

RENEWABLE ENERGY:  
**A GENDER  
PERSPECTIVE**

**gender** /'dʒɛndə/

*noun* 1. euphemism for the sex of a human being, often intended to emphasize the social and cultural, as opposed to the biological, distinctions between the sexes.

Unless otherwise stated, material in this publication may be freely used, shared, copied, reproduced, printed and/or stored, provided that appropriate acknowledgement is given of IRENA as the source and copyright holder. Material in this publication that is attributed to third parties may be subject to separate terms of use and restrictions, and appropriate permissions from these third parties may need to be secured before any use of such material.

**ISBN 978-92-9260-098-3**

This publication should be cited as: IRENA (2019), Renewable Energy: A Gender Perspective. IRENA, Abu Dhabi.

## ABOUT IRENA

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future and serves as the principal platform for international co-operation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.

[www.irena.org](http://www.irena.org)

## ACKNOWLEDGEMENTS

This report was developed under the guidance of Rabia Ferroukhi (IRENA) and authored by Rabia Ferroukhi, Michael Renner, Divyam Nagpal, and Celia García-Baños (IRENA), and Bipasha Barua (University of Western Ontario), with valuable contributions from Adrian Whiteman, Anindya Bhagirath (IRENA), and Christine Lins (GWNET).

The report benefited from valuable comments and feedback provided by Elizabeth Press, Mirjam Reiner, Sadia Afreen, Ahmed Abdel-Latif, Diala Hawila, Emanuele Bianco, Abdullah Abou Ali, Saba AlDefi, Ali Yasir, Salvatore Vinci (IRENA), Soma Dutta and Sheila Oparaocha (ENERGIA: International Network on Sustainable Energy), Eco Matser (Hivos), Rana Ghoneim (UNIDO), Suhela Khan (UN Women), and Henning Wuester (ICAT).

The dissemination of the survey benefited from the support of GWNET, REN21, WiRE, ISES, GIZ, Clean Energy Council, Factor, Regions20, Deloitte Advisory S.L., EnRupt, and FSR Lights on Women Initiative.

## DISCLAIMER

This publication and the material herein are provided “as is”. All reasonable precautions have been taken by IRENA to verify the reliability of the material in this publication. However, neither IRENA nor any of its officials, agents, data or other third-party content providers provides a warranty of any kind, either expressed or implied, and they accept no responsibility or liability for any consequence of use of the publication or material herein.

The information contained herein does not necessarily represent the views of the Members of IRENA. The mention of specific companies or certain projects or products does not imply that they are endorsed or recommended by IRENA in preference to others of a similar nature that are not mentioned. The designations employed and the presentation of material herein do not imply the expression of any opinion on the part of IRENA concerning the legal status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

## Foreword

The ongoing energy transformation, driven by renewables, is bringing far-reaching, systemic change to our societies. This offers important opportunities for greater inclusion and equality.

Accelerating the deployment of renewables can alleviate poverty, create jobs, improve welfare and strengthen gender equality. Still, to fully realise this potential, the renewables industry has to tap a wider pool of talent – notably that of women, who have been largely underrepresented, depriving the energy transition of critical capacities.

*Renewable Energy: A Gender Perspective* provides new insights on women's role in renewable energy employment and decision-making globally. This key report by the International Renewable Energy Agency (IRENA) aims to help fill the knowledge gap in this field. Based on a ground-breaking, first-of-its-kind online survey combined with in-depth research, the study highlights the importance of women's contributions in the energy transformation, the barriers and challenges they face, and measures that governments and companies can take to address these.

IRENA's online survey gathered responses from around 1 500 men, women and organisations working in the renewable energy sector, from highly specialised technical roles to policy, legal and commercial functions. Their answers illuminate both facts and perceptions about gender equality, as well as solutions to overcome challenges facing it.

The study finds that women represent 32% of the renewable energy workforce. This compares favourably to the broader, conventional energy sector. Still significant imbalances remain, both in highly developed markets and in communities where renewables are only now extending energy access. The decentralised nature of renewable applications, however, brings energy choices to the household and community level, where women tend to have a greater voice.

As the report illustrates, gender equality, along with a wider sharing of the benefits from the global energy transformation, is not only a question of fundamental fairness. It is also essential to shaping positive social and economic development outcomes. Women provide valuable perspectives on key decisions, from investment priorities to project design.

The renewable energy industry needs to engage and retain more women – and promote them – to fill its growing needs for skills. Their leadership and contributions will be crucial to ensuring that the energy systems of the future address the needs of modern societies and leave no one behind.

Promoting gender equality and including gender considerations on all levels should be a high priority in both the public and private sectors. *Renewable Energy: A Gender Perspective* reflects IRENA's commitment to advancing gender equality in the energy transition. It provides a basis for further research that can inform evidence-based policy-making, and I hope it also adds to the momentum for closing the gender gap in renewable energy and beyond.



**Adnan Z. Amin**

*Director-General*  
IRENA



# RE Renewable Energy: **A Gender Perspective**

# Contents

<b>Foreword</b> .....	3
<b>Message from IRENA Gender Focal Point</b> .....	7
<b>Executive summary</b> .....	8

<b>1 Renewable energy and gender</b> .....	16
1.1. Background .....	17
1.2. Rationale .....	19
1.3. Narrowing the knowledge gap on gender and renewable energy: IRENA's survey .....	21

<b>2 Women in renewable energy: Modern energy context</b> .....	26
2.1. Status and trends .....	27
2.1.1. Employment in renewable energy, gender-related findings in the literature and IRENA's work on the issue .....	28
2.1.2. Gender composition of the workforce in the conventional energy sector .....	29
2.1.3. Gender composition of the workforce in the renewable energy sector .....	29
2.2. Barriers and challenges .....	32
2.2.1. Barriers to entry .....	32
2.2.2. Retention and career advancement challenges .....	37
2.3. Policies and solutions .....	43
2.3.1. Mainstreaming gender perspectives .....	44
2.3.2. Creating networks and supporting mentorship ..	44
2.3.3. Access to education and training .....	48
2.3.4. Gender targets and quotas .....	49
2.3.5. Workplace practices, policies and regulations ...	50
2.3.6. Work-life balance .....	52
2.4. Conclusions .....	55

Annex .....	82
References .....	86
Photo Credits .....	91

<b>3 Women in renewable energy: Access context</b> .....	56
3.1. Background .....	57
3.2. Barriers and challenges .....	59
3.2.1. Cultural and social norms .....	60
3.2.2. Lack of gender-sensitive programmes and policies .....	62
3.2.3. Lack of skills and gender-specific training opportunities .....	62
3.3. Policies and solutions .....	63
3.3.1. Improving access to training and skills-development programmes .....	64
3.3.2. Integrating gender in energy access programmes .....	67
3.3.3. Fostering women entrepreneurs and improving access to finance .....	70
3.3.4. Improving the collection of gender-disaggregated data .....	74
3.4. Conclusions .....	75

<b>4 Conclusions and way forward</b> .....	76
4.1. Way forward to improve gender diversity in the renewables sector .....	78
4.2. Future work .....	81



## List of Boxes

<b>Box 1.1</b>	Key definitions .....	18
<b>Box 1.2</b>	Gender equality and gender equity .....	19
<b>Box 2.1</b>	Female participation in the US solar sector .....	30
<b>Box 2.2</b>	GWNET: Offering online mentoring .....	46
<b>Box 2.3</b>	The Pink to Green Toolkit: Wider Opportunities for Women .....	46
<b>Box 2.4</b>	C3E and WiRE Women of Distinction Awards .....	47
<b>Box 2.5</b>	Definitions of part-time work, flexi-time, and job-sharing .....	52
<b>Box 3.1</b>	Training solar grandmothers: The case of Barefoot College .....	65
<b>Box 3.2</b>	Empowering women through training: The case of Wonder Women in Indonesia .....	66
<b>Box 3.3</b>	Policy on gender mainstreaming in energy access: The case of ECOWAS .....	67
<b>Box 3.4</b>	Gender mainstreaming at the programme level: The case of Hivos' domestic biogas programme and Sumba Island Initiative .....	68
<b>Box 3.5</b>	Empowering women brewers in Burkina Faso through energy- efficient cookstoves .....	70
<b>Box 3.6</b>	Empowering women entrepreneurs to deliver off-grid renewable energy solutions: The case of Solar Sister .....	71
<b>Box 3.7</b>	Establishing women's cooperatives to deliver stand-alone solar systems .....	72
<b>Box 3.8</b>	Regional Renewable Energy Entrepreneurship Support Facility .....	73
<b>Box 3.9</b>	Gathering gender-disaggregated data through household surveys .....	74
<b>Box 3.10</b>	Gender considerations in grid-based rural electrification programmes .....	75

## Message from the IRENA Gender Focal Point

The idea for this report dates back more than five years, to the publication of IRENA's first Renewable Energy and Jobs study. The report included a full chapter dedicated to gender to contextualise this vital dimension of renewable energy employment. Since, IRENA's annual reviews on jobs have featured updates on gender data, providing a glimpse into the promising interplay between renewable energy and gender.

To bring a greater understanding of this interplay, the present report introduces a comprehensive gender perspective into the analysis of the renewable energy sector and the ongoing energy transformation. Supported by a global survey and literature review, the study explores the role of women, their opportunities for employment in the sector and the challenges they face.

Across the globe, the findings confirm, women are increasingly attracted to renewables. This multi-disciplinary sector employs a larger share of women compared to the conventional energy field. But like in other fields of work, women still encounter numerous obstacles, from the lack of equal access to education, training, mentoring, professional networks and finance, to the glass-ceiling in companies or institutions.

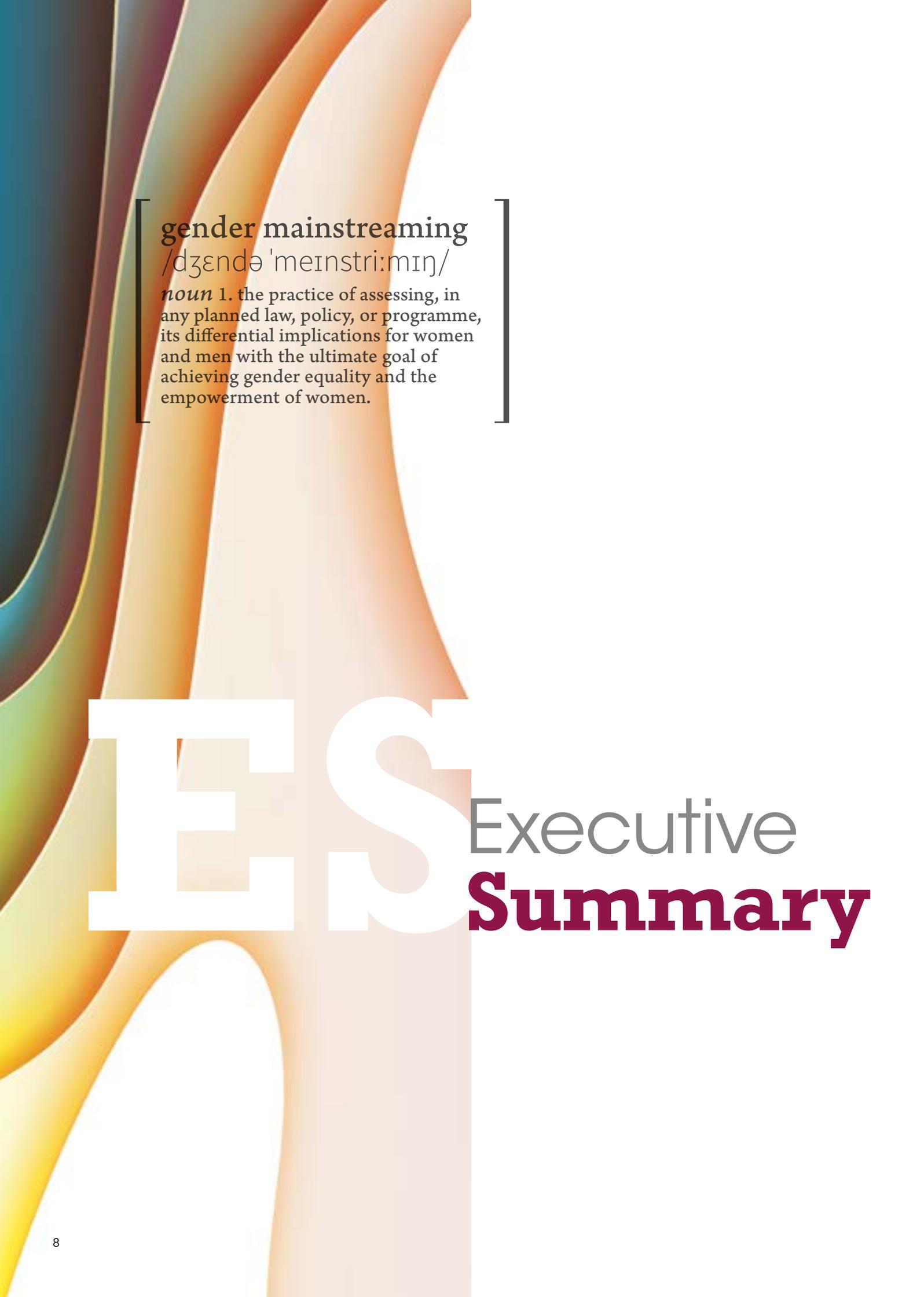
When I first began my career in the energy sector, very few of my fellow researchers or analysts were women. At the time, this seemed to be the norm in energy-related jobs. Some two decades later, this pattern has started to change, in part thanks to the emergence of renewables and the more holistic, democratised energy future they represent. If the global energy transformation is to drive sustainable growth and development, it needs to be inclusive in every sense. And women have to be part of it.



**Rabia Ferroukhi**

*Acting Director  
Knowledge, Policy  
and Finance*

IRENA



**gender mainstreaming**

/dʒɛndə 'meɪnstri:mɪŋ/

*noun* 1. the practice of assessing, in any planned law, policy, or programme, its differential implications for women and men with the ultimate goal of achieving gender equality and the empowerment of women.

# IES

Executive  
**Summary**



The global energy transition offers an unprecedented opportunity to transform the energy sector in all aspects. The transition towards a renewable, distributed, decarbonised energy system is creating an array of social and economic benefits, including growing employment. IRENA estimates that the number of jobs in the sector could increase from 10.3 million in 2017 to nearly 29 million in 2050. The sector offers diverse opportunities along the value chain, requiring different skill sets and talents. A key pillar of the energy transition should be to ensure that the opportunities it creates are equally accessible, and the benefits it bestows, equitably distributed.

Adopting a gender<sup>a</sup> perspective to renewable energy development is critically important to ensure that

women's contributions – their skills and views – represent an integral part of the growing industry. Increased women's engagement expands the talent pool for the renewables sector. Meanwhile, greater gender diversity also brings substantial co-benefits. Studies suggest that women bring new perspectives to the workplace and improve collaboration, while increasing the number of qualified women in an organisation's leadership yields better performance overall. In the context of energy access, engaging women as active agents in deploying off-grid renewable energy solutions is known to improve sustainability and gender outcomes.

In recognition of these opportunities, the 2030 Agenda for Sustainable Development adopted in 2015 introduced a dedicated goal on gender

equality, noting that the “systematic mainstreaming of a gender perspective in the implementation of the Agenda is crucial”. Yet, detailed information on the status and trends related to gender equality in the renewable energy sector remains sparse.

## ES.1 Renewable Energy and Gender

IRENA's *Renewable Energy: A Gender Perspective* aims to address this knowledge gap. It analyses the status of women's participation in the sector in two distinct deployment settings – the modern context (in which renewables displace or complement conventional energy) and the energy access context (which is characterised by efforts to expand access to modern energy services).

<sup>a</sup> For the purposes of this report, gender refers to men and women.



**32%**

share of women in the renewable energy workforce

**22%**

share of women in oil and gas industry

Underpinning the report are quantitative and qualitative insights from a global online survey conducted by IRENA in 2018, complemented by findings from the literature. The multi-stakeholder survey attracted close to 1500 respondents from 144 countries working for private companies, government agencies, non-governmental organisations, academic institutions, and other entities. The findings from the survey offer a glimpse into the current status of women’s participation in the sector and provide insights on what measures are needed, and by whom, to “engender” the energy transition.

### ES.2 Women in Renewable Energy: Modern Energy Context

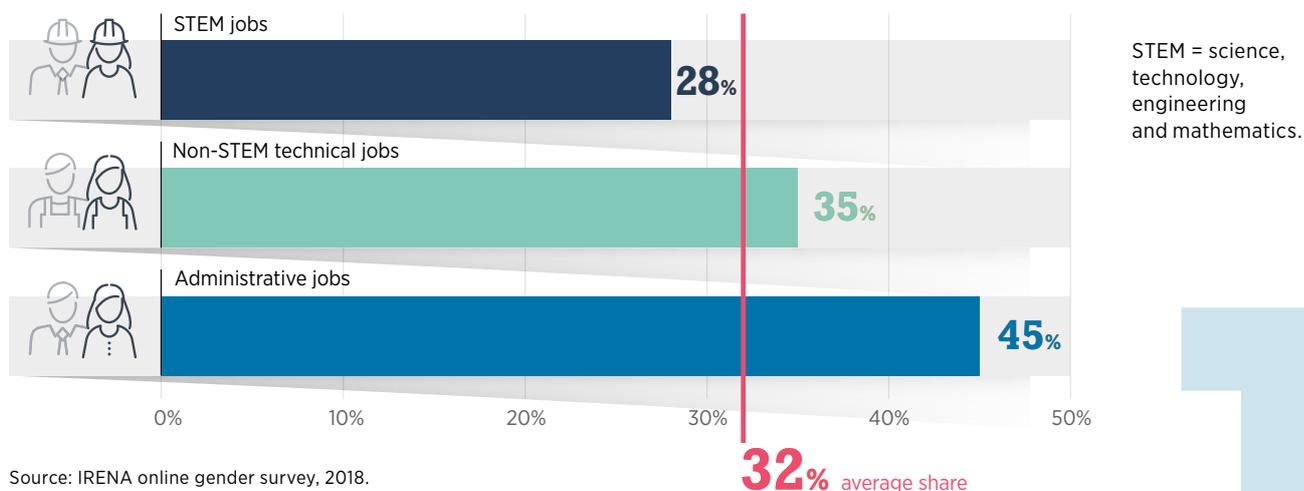
Renewable energy offers a range of unprecedented opportunities. With public policy support, women can garner a growing share of expanding employment in this young and dynamic sector.

Because of its multi-disciplinary dimension, the renewable energy field exerts an appeal on women that the fossil fuel industry has lacked. The survey revealed that women represent 32% of the full-time employees of responding organisations – substantially higher

than the 22% average in the global oil and gas industry. Still, in renewables, women’s participation is much lower in science, technology, engineering and mathematics (STEM) jobs than in administrative jobs (see Figure ES.1).

The appeal of the sector notwithstanding, women face persistent barriers to entry (see Figure ES.2) and advancement (see Figure ES.3). Moreover, the survey reveals that most men working in the sector, presumably including those with responsibilities for making policy

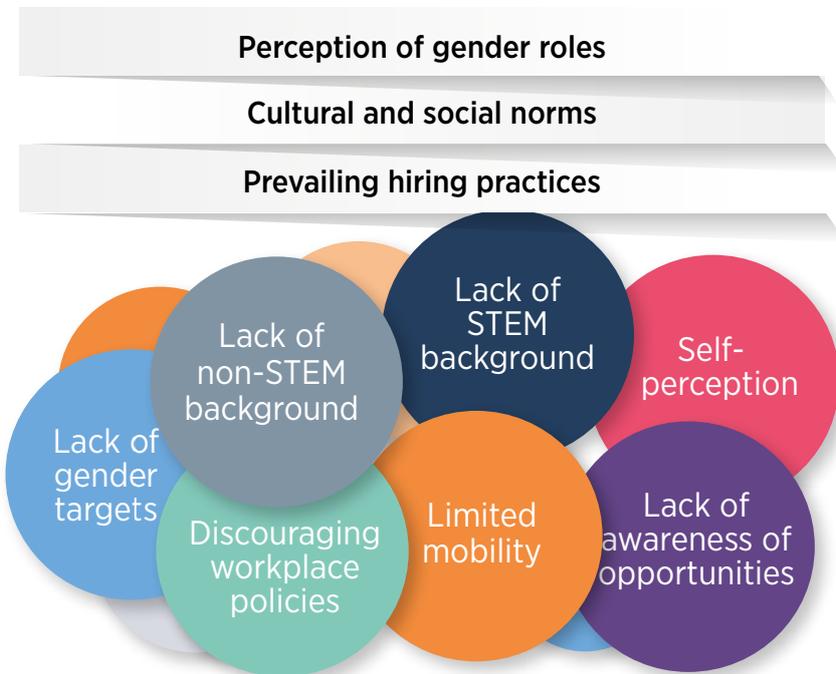
**Figure ES.1** Shares of women in STEM, non-STEM and administrative jobs in renewable energy



Source: IRENA online gender survey, 2018.

Note: The vertical line indicates the average share of women in renewable energy jobs among survey respondents.



**Figure ES.2** Barriers to entry for women in the renewable energy sector

decisions, are unaware of this fact. Responses show that just 40% of men, as opposed to 75% of women perceive the existence of gender-related barriers.

Survey respondents who affirmed the existence of such barriers indicated which are most important for entry into employment, and for the ability of women to remain in the workforce and to advance.

Source: IRENA online gender survey, 2018.

Note: STEM = science, technology, engineering and mathematics.

### Barriers to entry

**Perceptions of gender roles** are seen as the most important barrier to entry into the sector. These are driven by cultural and social norms that influence many of the fundamental decisions people make.

STEM skills are critical to many career paths in renewables, but because of prevailing views of women's abilities, women continue to have a limited presence in these fields. For example, in New Zealand, women represent 80% of graduates in health-related studies, but less than 30% in engineering. In Malaysia, 36% of students enrolled in engineering in 2012 were women, just half the female rate in pharmacy. In Mongolia,

the share of women enrolled in computer science was 30% and 24% in engineering in 2013, compared with 73% in biology courses.

The views about gender roles also translate into a lack of access to career information and to relevant networks for women. And they shape hiring practices as well as the degree to which women have access to such employment entry points as internships and apprenticeships. In Canada, for instance, women make up 14% of all apprentices – and only 4% of female-dominated trades are excluded.

**Figure ES.3** Barriers to retention and advancement for women in the renewable energy sector



Source: IRENA online gender survey, 2018.

**Barriers to retention and career advancement**

The ability to stay in a given job and opportunities for professional growth are shaped by a number of factors. Survey respondents saw the glass ceiling as the most important of these, a reality confirmed by the fact that in close to half of all participating private sector firms, men represent at least 75% of board members.

Women frequently face the double burden of balancing work and family, especially during the childbearing years. Mobility requirements and difficult work schedules are demanding for women shouldering family and household duties. Wage inequities are also an issue. Close to two-thirds of IRENA survey

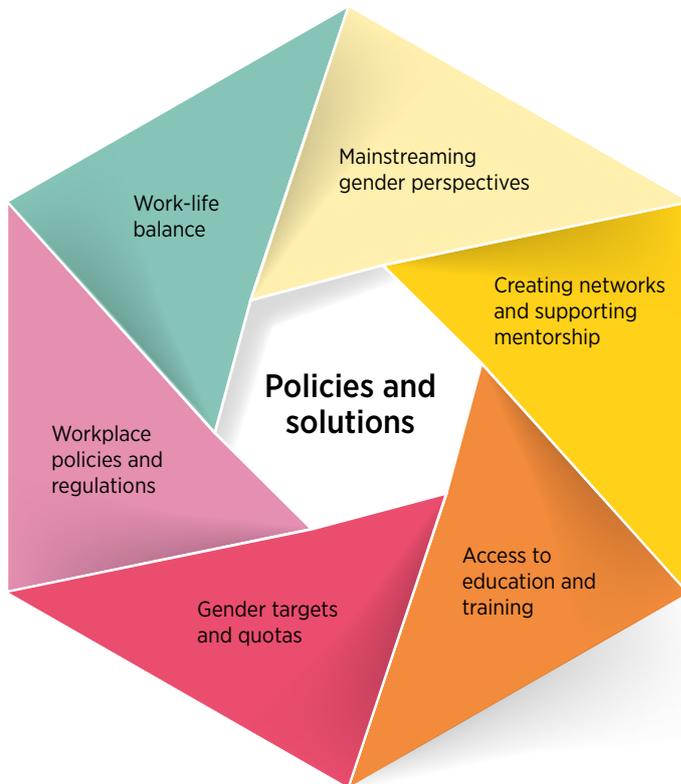
respondents believe that women in renewable energy earn less than men in the same position. The existing literature also suggests the lack of a supportive environment in the form of flexible work hours, family-friendly measures, mentoring and networking, training opportunities, and gender equity targets

**Policies and solutions**

Measures to improve gender balance depend on specific circumstances, but the literature and IRENA’s survey results suggest a range of generally promising solutions.

**Mainstreaming gender perspectives** through audits and awareness training can change broad perceptions as well as specific workplace practices. Leveling the playing field for the genders could be achieved by creating **supportive networks and mentorship** arrangements for women, such as an online programme developed by GWNET, or by recognising women’s accomplishments through awards such as “WiRE Woman of the Year” in Canada. Both GWNET and WiRE, as well as many of the programmes mentioned below, are described in Chapter 2.





Access to **adequate education and training** opportunities can be enhanced through adjustments in curricula, targeted scholarships and internships, and vocational training opportunities for women. For instance, adapting university curricula helps boost women's enrolment, as demonstrated by MIT's pioneering work within its mechanical and electrical engineering departments. At King's College London, the "Women in Science Scholarships" in mathematics, physics, computer science and chemistry helped reduce gender imbalances in STEM fields.

Workplace imbalances can be addressed through **gender targets and quotas**. Engineers Canada adopted a "30-by-30" programme in 2011 to raise the number of newly licensed female engineers in the country to 30% by 2030. Countries with mandatory quotas for corporate boardrooms, such as France, Germany and Norway, have made considerable progress, but national energy policies still rarely include such gender diversity targets. Whether it is quotas or workplace policies and practices such as fair and transparent decision-making, mentoring, performance appraisals, and equal pay, top leadership commitment is indispensable. In Iceland, public utility Reykjavik Energy adopted policies to eliminate the gender pay gap. Similarly, Energy

Australia raised women's salaries in 2018 to achieve pay parity with men.

Meanwhile, measures to ensure a **better work-life balance** allow a larger proportion of women to remain in the sector. Part-time employment and flexi-time arrangements were among the most-favoured options among survey respondents. Adequate paid parental leave policies are another important measure. Among survey respondents, 69% indicated that paid maternity leave was available for full-time employees, but only 37% said the same was true for part-time workers.

Survey respondents who have access to benefits such as maternity leave and **training opportunities** and who are subject to fair and transparent **workplace practices** were far less likely to perceive gender barriers than respondents who do not enjoy similar benefits.

### ES.3 Women in Renewable Energy: Access Context

Energy access and gender are deeply entwined components of the global development agenda. The transformative effect on women of access to affordable, reliable and sustainable modern energy is well-known. Energy access frees up time for women who otherwise may spend an average of 100 hours a year collecting fuel wood and gives them more flexibility in sequencing tasks, since lighting allows them to do more at night. It also improves access to public services and opens new opportunities for part-time work and income-generating activities.

The distributed nature of off-grid renewable energy solutions offers tremendous opportunities for women’s engagement along multiple segments of the value chain. Many of the skills needed to take advantage of those opportunities can be developed locally and women are ideally placed to lead and support the delivery of

energy solutions, especially in view of their role as primary energy users and their social networks.

Organisations have found it difficult to ignore the value of involving women in the renewable energy supply chain. SELCO India, for instance, trained female solar technicians in the early 2000s simply (at least initially) as a means to accomplish its business goals: technicians were needed to enter the homes of customers to repair solar lanterns and cookstoves. As women become engaged in **delivering energy solutions**, they take on more active roles in their communities and consequently facilitate a gradual shift in the **social and cultural norms** that previously acted as barriers to their agency.

#### Barriers to engagement

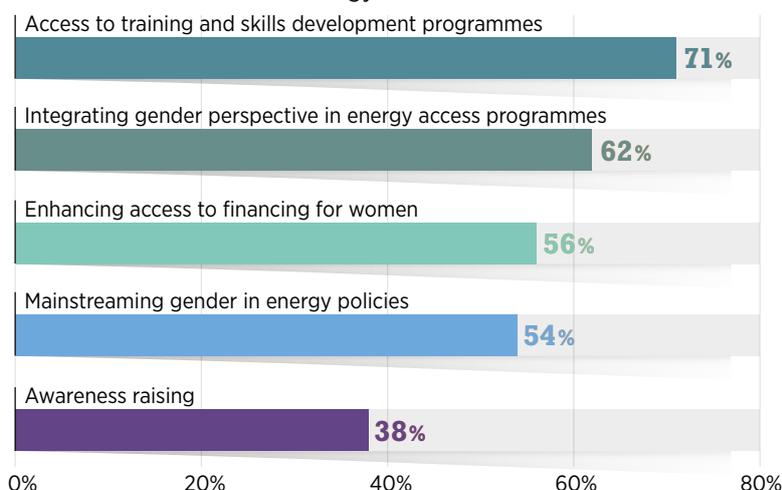
Over two-thirds of survey respondents noted that women face barriers to participation in the renewables-based energy access

sector. **Cultural and social norms** were cited by respondents as the most common barrier, followed by lack of **gender-sensitive policies** and **training opportunities** and **inequity in ownership of assets** (see Figure 3.3). Security and the remoteness of field locations were also mentioned as other barriers to participation. Interestingly, cultural and social norms was the barrier selected more often by respondents in Europe and North America, while respondents from other regions were much more likely to select the lack of skills and training as important barriers in the access context.

#### Policies and solutions

In identifying solutions, respondents highlighted first the importance of **access to education and training** (see Figure ES.4). Training is often an integral part of energy access programmes, but greater efforts are needed to make them more accessible to women. Training sessions must be tailored and scheduled around women’s childcare responsibilities and be sensitive to mobility constraints, security concerns and social restrictions that may prohibit women from participating. Hivos, for instance, adapted training approaches used in its cooking energy programmes in Africa and Southeast Asia to ensure that women and men were equally engaged. In all cases, the proportion

**Figure ES.4** Measures to improve women’s engagement in deploying renewables for energy access



Source: IRENA online gender survey, 2018.

Note: The respondents were asked to select three key measures to improve women’s engagement in deploying renewables for energy access. The percentages represent the share of respondents who selected a specific measure as one of their top three.

**71%**  
of respondents highlighted that access to training and skills development should be a top priority

of women trainees has gone up significantly, with positive outcomes for long-term sustainability and socio-economic benefits.

Over half of the respondents also cited **improving access to finance** and mainstreaming gender in access programmes as measures to support women's engagement in the sector. Dedicated financing schemes are particularly important if women are to play an active role in the off-grid renewables value chain (e.g., as technology distributors) and tap into the entire spectrum of opportunities created by modern energy access (e.g., investments in productive appliances). The Self-Employed Women's Association in India, for instance, connects women to financing options through the Thrift and Credit Cooperative, providing affordable payment options so that women can invest in livelihood options, family education and

household safety. SEWA also provides a special energy loan product and has set up a company that employs women to market, sell, install and service solar home lighting solutions that benefit over 20 000 people.

Opportunities and gaps will become evident if **gender is mainstreamed** at the level of energy access policies, programmes and projects. In 2013, the Economic Community of West African States established a programme to mainstream gender in the formulation of energy access policy and in the design and implementation of energy projects and programmes. A dedicated policy for mainstreaming gender in energy access, endorsed in 2015, aims to ensure that women are part of the solution and leverage their role as energy users, community members, business owners and policy makers.

**Gender audits**, as tools, can ensure due consideration of the known gender differences in household decision-making, preferences and priorities. These have been used in Botswana, India and Senegal, among other countries, to support the integration of gender into energy access projects. The socio-economic dividends of gender mainstreaming are immense; several examples covered in the report suggest improvements in women's self-perception and empowerment within the community. In Indonesia, for instance, over 500 "wonder women" have been trained as social entrepreneurs, selling clean energy technologies that have reached over 250 000 people. It is estimated that around 20% of women became more empowered within their families – taking on a greater role in household decision making – and almost half of them perceived an improvement in their status.

## ES.4 Engendering the Energy Transition: The Way Forward

The survey and literature suggest several ways to advance gender equality in the renewable energy sector.

Advancing equality and diversity in the energy sector is a compelling proposition rather than a zero-sum game. Establishing gender as a pillar of energy strategies at the national and global levels will produce a swifter and more-inclusive transition to renewable energy while accelerating the attainment of multiple Sustainable Development Goals.

→ **Mainstreaming gender in energy sector frameworks** at all levels, including policy making, programme design and project implementation. Gathering and reporting of gender-disaggregated data is crucial to set baseline and monitor progress.

→ **Tailoring training and skills development** in technical and non-technical subjects, and in broad business and leadership skills. Governments, educational institutions, industry associations, and other actors need to adapt curricula and strengthen mentoring opportunities for women.

→ **Attracting and retaining talent in the sector** through policies, such as parental leave, part-time positions, flexible work hours and equal opportunities for professional development. In the access context, efforts beyond skills and training are also needed to unlock new livelihood opportunities focusing on access to financing and markets.

→ **Challenging cultural and social norms.** Strengthening the visibility of the diverse roles women are playing in the energy transition and helping women become agents of social and economic transformation in their communities can exert a strong influence on perceptions of gender roles.



**inclusiveness**

/in'klu:sivnəs/

*noun* 1. the practice or policy of including many different types of people, all of whom who are treated fairly and equally.

# 1

# Renewable Energy and Gender

## 1.1. Background

Renewable energy is imperative to ensure security of energy supplies, reduce health effects of conventional energy use, and mitigate climate change. The transition from fossil fuels to renewables also facilitates economic development and alleviates poverty. This path of opportunity will be most effective if it is socially inclusive. The gender dimension, in particular, carries great importance: women must participate on par with men.

A dynamic sector, renewable energy offers a range of exciting opportunities, especially with public policies in place to ensure that women can benefit equally much as men. As the global energy transition gathers pace, it will generate jobs and livelihoods in renewables. Employment in the renewable energy sector has already grown from 7.1

million jobs in 2012 to 10.3 million in 2017, a number that is expected to almost triple by 2050 under the International Renewable Energy Agency's (IRENA's) REmap roadmap (IRENA, 2018a; IRENA, 2018b). The strongest expansion to date has taken place in the solar photovoltaics (PV) industry, which now accounts for about 3.4 million jobs. But other renewable energy sectors, particularly bioenergy, hydropower, wind power, and solar heating and cooling, are also significant employers.

Job opportunities exist 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, marketing, knowledge, legal,

business development, etc.). These activities require expertise across a broad array of occupations, involving both technical and non-technical skills. As the transition takes hold, countries can benefit from moves to make educational and training programmes equally accessible to both genders.

More is known about employment and livelihood effects in the “modern” energy context in areas that already enjoy universal or near-universal access to modern energy than in the “energy access” context where large-scale access is yet to be achieved (see Box 1.1 for definitions), but there is a growing body of evidence of the income and livelihood benefits of decentralised applications of renewable energy.



### Box 1.1 Key definitions

For the purposes of this report, the “**modern**” context refers to the deployment of renewables to displace or complement the use of conventional modern energy (e.g., in urban areas).

The “**access**” context refers to the deployment of renewables in areas presently without access to modern energy services including electricity and clean cooking fuels (e.g., unelectrified rural areas).

Achieving greater gender diversity in the rapidly expanding renewables sector is crucial for several reasons. First, greater participation of women allows the sector to draw on **additional talent**. Second, workforce diversity at all levels, including in senior management, brings substantial **co-benefits for organisations** in terms of growth, culture and sustainability. Third, in ensuring a just energy transition, the **equity** dimension of its benefits is considered across social and economic groups. Finally, the transition to renewables needs to actively engage **women and children because they are disproportionately affected** by the use of traditional energy sources in the energy access context.

Women have traditionally been under-represented in the energy industry. It was estimated in 2012 that female employment in the electricity, gas and steam, and water sectors is half the level of male employment (World Development Report, 2012). The same appears true for renewable energy, although the sector fares better than the conventional energy sector.

Available estimates suggest that men in renewables outnumber women in most workplaces, especially in technical, managerial and policy-making positions. To ensure that the

energy transition is inclusive, gender-disaggregated data and information are needed to set targets, monitor progress and guide decision making.

This report aims to contribute to the knowledge base by analysing women’s engagement in the sector in both the modern and access contexts. Building on the literature and IRENA’s growing body of work on renewable energy jobs, measuring the socio-economic benefits of renewables deployment and energy access, the report brings to bear quantitative and qualitative insights on women’s participation in the sector, the problems they face and potential solutions to those problems.

Central to the report is a global survey conducted by IRENA over two months in 2018. The survey gathered insights from nearly 1 500 respondents –

organisations and individuals – active in the sector.

The report is structured as four chapters. This chapter briefly presents the rationale for pursuing greater diversity in the renewables sector, followed by an overview of the survey that IRENA carried out to strengthen the knowledge base on the gender dimension of renewable energy and the ongoing energy transition. Chapter 2 discusses the gender dimension of renewable energy deployment in the context, while Chapter 3 tackles the same question in contexts where access to clean, modern, and sustainable forms of energy is still lacking. Based on the analysis, Chapter 4 highlights key conclusions and proposes next steps to advance gender equality in the sector and further improve the knowledge on the topic.





## 1.2. Rationale

The Sustainable Development Goals (SDGs) relating to access to modern, clean, and sustainable energy (SDG 7), to gender equality and empowerment (SDG 5), and to inclusive growth and decent work (SDG 8) are mutually reinforcing. Sustainable energy is the golden thread that connects economic well-being, increased social equity and a natural environment in which humanity can survive and thrive. Achieving SDG 7, therefore, is indispensable to reaching all other SDGs, but the manner in which it is attained matters. Energy is useful not in itself, but for providing goods, services and goods, services and derived outcomes, including employment and sustainable livelihoods. Those goods, services and outcomes can be furnished in more or less inclusive ways.

**Gender inequality** is a fact in all countries, both industrialised and emerging/developing (Myers, 2017). **Gender imbalances** in the workplace are largely an outcome of educational pathways and recruitment pipelines that remain male-dominated. The existing evidence suggests that women are generally more attracted to renewable energy than to the conventional energy industry (Lucas *et al.*, 2018). However, since energy is widely perceived as a technical subject, it attracts more interest from boys and young men than from girls and young women, even in the early years of schooling.

Gender inequality generally is most evident at decision-making levels. Across the economy, women are under-represented on company boards and

senior management positions, as well as in policy making and governance. Under-representation and the absence of female role models is even more acute in energy-related fields. The few women who do manage to secure top positions are often less well-connected with their peers than with their male colleagues. Notwithstanding some changes over the last few decades, underlying cultural and social norms still shape the perceptions of men and women's abilities, needs and prerogatives.

Moving towards **greater gender equality** can be viewed as a tremendous opportunity. In the first place, it is a matter of basic fairness to adopt policies, programmes and rules for equal job and career opportunities (see Box 1.2). Giving

### Box 1.2 Gender equality and gender equity

**Gender equality.** Gender equality is achieved when men and women have equal rights, freedom, conditions, and access to endowments and social and economic opportunities for realising their capabilities and for contributing to and benefiting from economic, social, cultural and political development.

**Gender equity.** Related to gender equality, gender equity is the process of being fair to women and men. To ensure equity, measures must often be taken to compensate (or reduce disparity) for historical and social disadvantages that prevent women and men from otherwise operating on an equitable basis.

Source: Lallement, 2013.



women a stronger voice will ensure that women’s needs and perspectives are taken into account in decisions on energy technology, market design, scale of projects, community involvement and other questions that shape how energy is produced and used, and that therefore shape the socio-economic benefits of the energy transition.

It bears repeating that **greater participation** by women allows the renewable energy sector to draw from a wider and deeper pool of talent. The size of the talent pool will be increasingly important as the renewable energy sector expands, demanding growing numbers of people with adequate technical, business, administrative, economic, legal and other skills. Indications are that the sector may soon confront growing shortages of well-trained and experienced individuals.

Eliminating the barriers that dissuade or prevent women from entering the sector and from succeeding in it have never been more important.

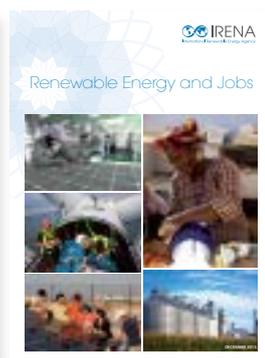
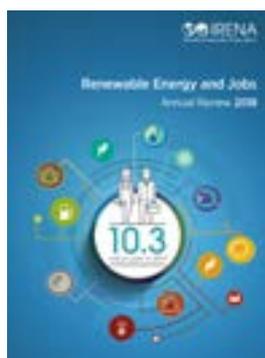
Women face a different set of challenges and opportunities in the energy access context. Off-grid

renewable energy solutions promise substantial improvements in women’s quality of life through reduced indoor air pollution, better lighting to enable girls to study, less day-to-day drudgery and more opportunities to earn income from productive uses of energy or from the jobs that modern energy induces in rural economies. Given women’s role as primary energy users in the household, their participation in planning and implementing a sustainable renewable energy system is essential if their priorities and preferences are to be reflected in the system.

IRENA produces annual updates of its global employment estimates along the value chain. However, gender-disaggregated data on employment remain extremely sparse. To improve knowledge of these matters, IRENA conducted an initial survey in 2016. The responses from 90 participating companies indicated that women

made up roughly 35% of the workforce in the renewable energy industry, compared to 20–25% in the traditional energy industry (IRENA, 2016a). In 2017, IRENA, in collaboration with the Clean Energy Business Council and Bloomberg New Energy Finance, conducted a regional survey to analyse women’s participation in the renewable energy sector in the Middle East and North Africa (BNEF, CEBC and IRENA, 2017).

The present report marks another step in IRENA’s efforts to improve knowledge and awareness of the gender dimension in the renewable energy sector. Along with insights from the relevant literature, it presents results of a new global multi-stakeholder survey undertaken in partnership with the Global Women’s Network for the Energy Transition (GWNEN) and the Renewable Energy Policy Network for the 21st Century (REN21).



### 1.3. Narrowing the knowledge gap on gender and renewable energy: IRENA's survey

The survey was carried out online in October and November 2018. To reach a wide audience and generate a sufficiently large sample of participants, it was advertised widely through varied distribution channels of IRENA and its partners. Those channels included mailing lists, newsletters, online fora and news sites, e-mails from staff and messages at renewable energy events. Over 1500 responses were received; 285 respondents completed the survey on behalf of organisations, whereas 1155 replied in their individual capacity.

The objective was to gather quantitative and qualitative information about women's participation in the renewable energy sector, the challenges faced by women in the sector, and suggestions to improve gender diversity. Respondents could complete the survey either as individuals or on behalf of their employers as organisations.

- **From individuals**, information was collected about their perceptions of the main barriers and challenges to attracting and retaining women in the workforce, as well as suggestions for potential solutions.
- **From representatives of organisations** (individuals with sufficient knowledge of relevant staff

statistics), the survey asked for quantitative information about the gender distribution in the organisation's workforce and the policies and measures used to support greater gender diversity.

- Survey questions also distinguished between the modern energy and energy access contexts.

The survey was made available in Arabic, Chinese, English, French and Spanish. Participation was worldwide – with respondents from 144 countries and areas, as illustrated in Figure 1.1. The map also indicates that participation was generally low in China, even though the country is a major force in the renewable energy sector, and more broadly in the Asia-Pacific region. Responses from organisations were quite evenly distributed across the main regions of the world, with many responses from organisations located in Africa. By contrast, half of the responses from individuals came from Europe and North America (see Figure 1.2).

The survey also asked participants to provide information about the following:

- their gender, family status, educational attainment and background in technical or non-technical fields;

- the type and size of organisation they are affiliated with;
- whether they operate in the modern energy or energy access context, or both; and
- the type of renewable energy technology they work with.

The composition of respondents according to these various characteristics can influence survey results, as personal backgrounds and work experiences will colour perceptions of both problems and solutions.

**Gender.** Both men and women were invited to respond to the survey, but the fact that almost 70% of respondents were women may serve as an indication that awareness of gender issues in renewables is still driven by gender itself. As Figure 1.3 shows, women without children represent the single largest group (36%) among all respondents, followed by women with children (25%) and men with children (16%).

**Education.** The distribution of educational status is similar for male and female respondents. Almost three-quarters of respondents (71%) reported having a university degree in a science, technology, engineering or mathematics (STEM) subject, with most of the rest holding post-secondary degrees in non-STEM subjects, and 4% having high-school



**1 440**

respondents to the IRENA Gender Survey

**1 155**

responses from individuals

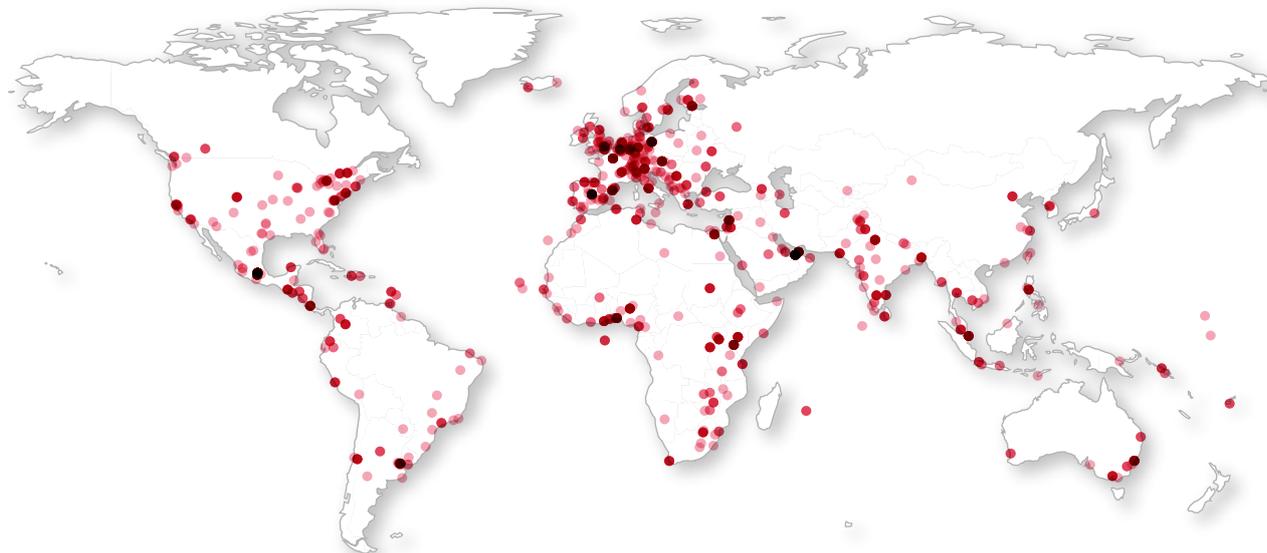
**285**

responses from organisations

**144**

countries represented in the responses

**Figure 1.1** Geographical distribution of survey respondents



Source: IRENA online gender survey, 2018.  
 Note: Baseline map data ©2018 Google, overlaid with data points from the survey.



or diploma qualifications. Figure 1.4 shows the highest degree level reached by respondents, which in most cases is a master's degree.

**Type of organisation.** With respect to participants replying on behalf of an organisation, close to half of the responses were received from private sector companies – mostly service providers and project developers, but few manufacturers (see

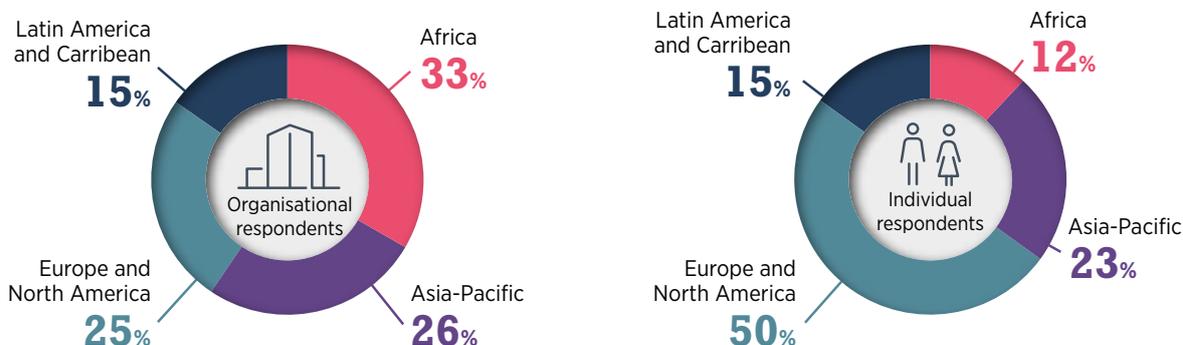
Figure 1.5). Twenty-six percent came from non-governmental organisations; 16% from government agencies (including inter-governmental organisations), and the remaining 14% from academic and research institutes and financial institutions.

**Type of employer.** Among individual responses, by contrast, people working in the private sector accounted for only about one-third

(36%), while governments and inter-governmental organisations represented 29%. Non-governmental organisations accounted for 12%, while other affiliations – principally academic and research institutes and industry associations and public utilities – were represented more prominently at 24%.<sup>1</sup>

**Size of employing entities.** The survey sample is weighted toward

**Figure 1.2** Distribution of survey respondents by region

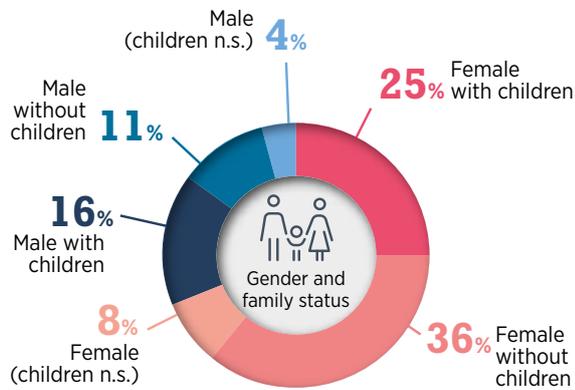


Source: IRENA online gender survey, 2018.



<sup>1</sup> Percentages do not add up to 100 due to rounding.

**Figure 1.3** Distribution of survey respondents by gender and family status

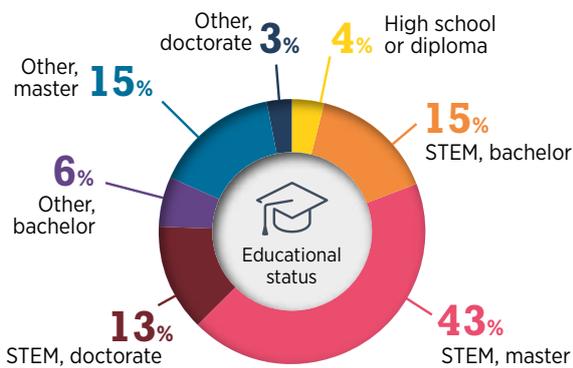


Source: IRENA online gender survey, 2018.

**69%**

of survey participants were women

**Figure 1.4** Distribution of survey respondents by educational achievement

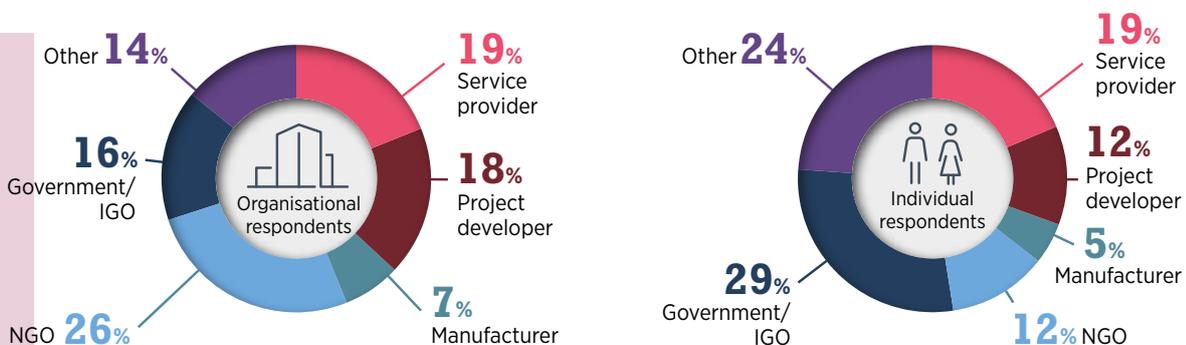


Source: IRENA online gender survey, 2018.

small- and medium-sized organisations (see Figure 1.6). Three-quarters of the participating organisations employ 100 people or less; those employing 20 or fewer represent almost half of all respondents. By contrast, only 10% of responses came from companies employing more than 1000 people. Given that organisations of different size may have varying capacities to address gender issues, the composition of survey participants could affect the balance of survey responses received. The distribution is much more balanced, however, among individual participants.

As already mentioned, the survey was designed to shed light on both the modern energy and energy access realms. A small number of individual and organisational respondents indicated that they were working exclusively on access (see Figure 1.7). A larger share – a quarter of all participating organisations and almost half of all individual participants – are focused exclusively on the modern context. But the largest numbers are present in both areas.

**Figure 1.5** Distribution of survey respondents by type of organisation



Source: IRENA online gender survey, 2018.

Note: IGO = inter-governmental organisation; NGO = non-governmental organisation.

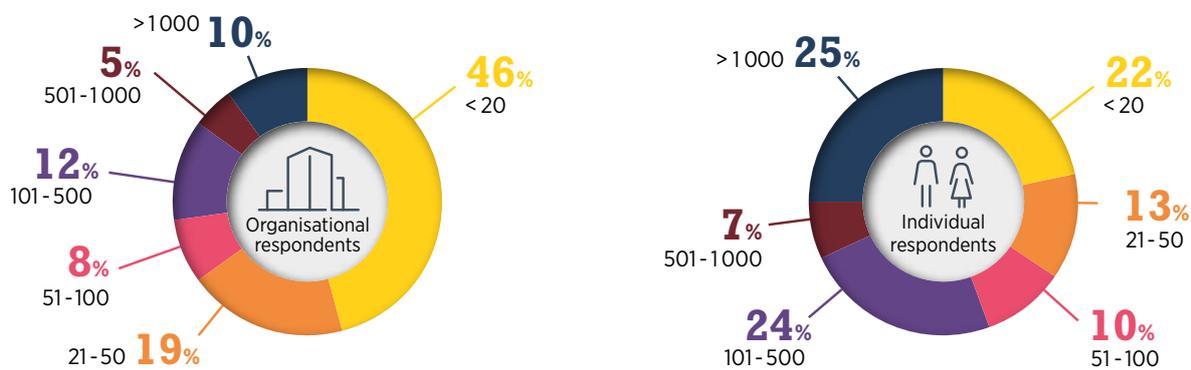
**Technology focus.** All renewable energy technologies are represented, but some are more prominent. Respondents could specify multiple technologies as relevant for their work. On average, each respondent listed two to three technologies. Solar energy is the most mentioned technology (listed by 80% of all respondents), frequently in combination with other types of renewable energy (see Figures 1.8 and 1.9). The next three most prominent technologies were bioenergy, wind energy and hydropower, with slightly more organisational respondents working

on bioenergy and slightly more individual respondents working on wind energy. For other technologies, most respondents reported working in science- and technology-related areas, although quite a few individual respondents said they were focused on social sciences or general management and administration.

As noted, IRENA reached out to a broad cross-section of organisations and individuals working in the renewable energy sector to assemble a meaningful survey sample. However, an online survey, while convenient, may unintentionally exclude part of the population of interest, especially

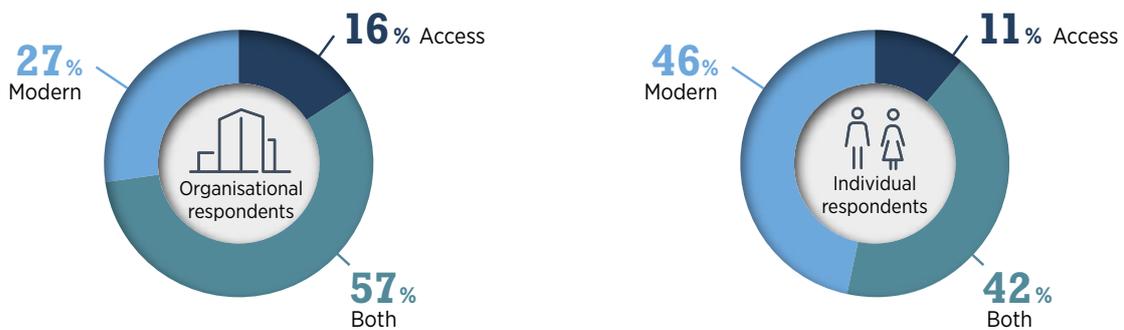
in the access context.<sup>2</sup> Further, the self-selected nature of participation in the survey may influence results in favour of people with a proactive interest in the topic and access to the online platform. The sample of respondents may thus differ from the true composition of the global renewable energy sector in terms of the characteristics discussed above, as well as others such as the geographical and technological distribution of production and the types of employment created. The Annex offers further discussion of some limitations of the survey results.

**Figure 1.6** Distribution of survey respondents by size of organisation



Source: IRENA online gender survey, 2018.

**Figure 1.7** Distribution of survey respondents by main area of work



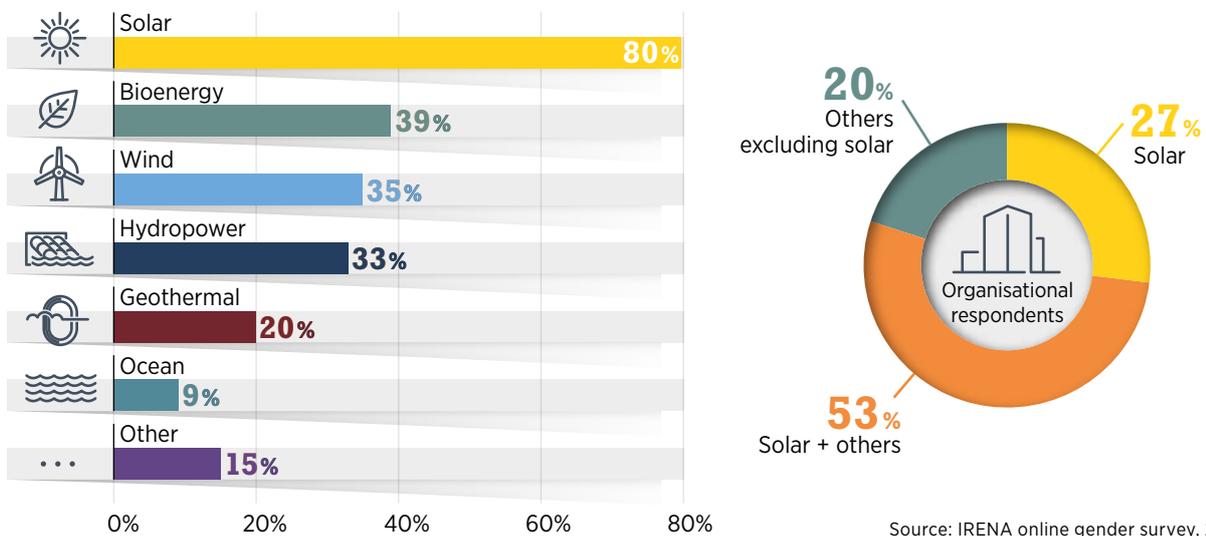
Source: IRENA online gender survey, 2018.

<sup>2</sup> In this context, it is easier to reach and involve respondents who work for organisations and practitioners dedicated to improving energy access than it is to reach those who contend with access issues on the ground such as renewable energy end-users or village-level enterprises. The views and perceptions among them may vary.

Notwithstanding these caveats, the survey represents the largest sample of responses on renewable energy and gender that IRENA has yet collected. It confirms several findings from earlier studies and analyses and offers new insights. These are discussed in the following

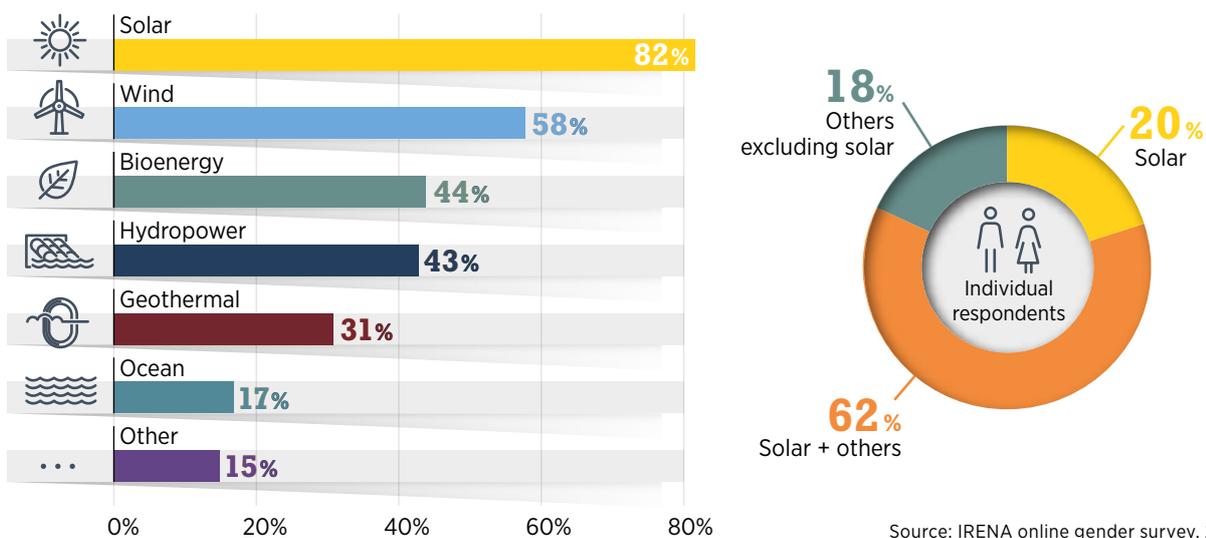
two chapters, which focus first on the modern energy situation (Chapter 2) and then on the energy access context (Chapter 3). Chapter 4 then highlights the most important findings and contrasts the two contexts.

**Figure 1.8** Types of renewable energy technology relevant to organisations responding to the survey

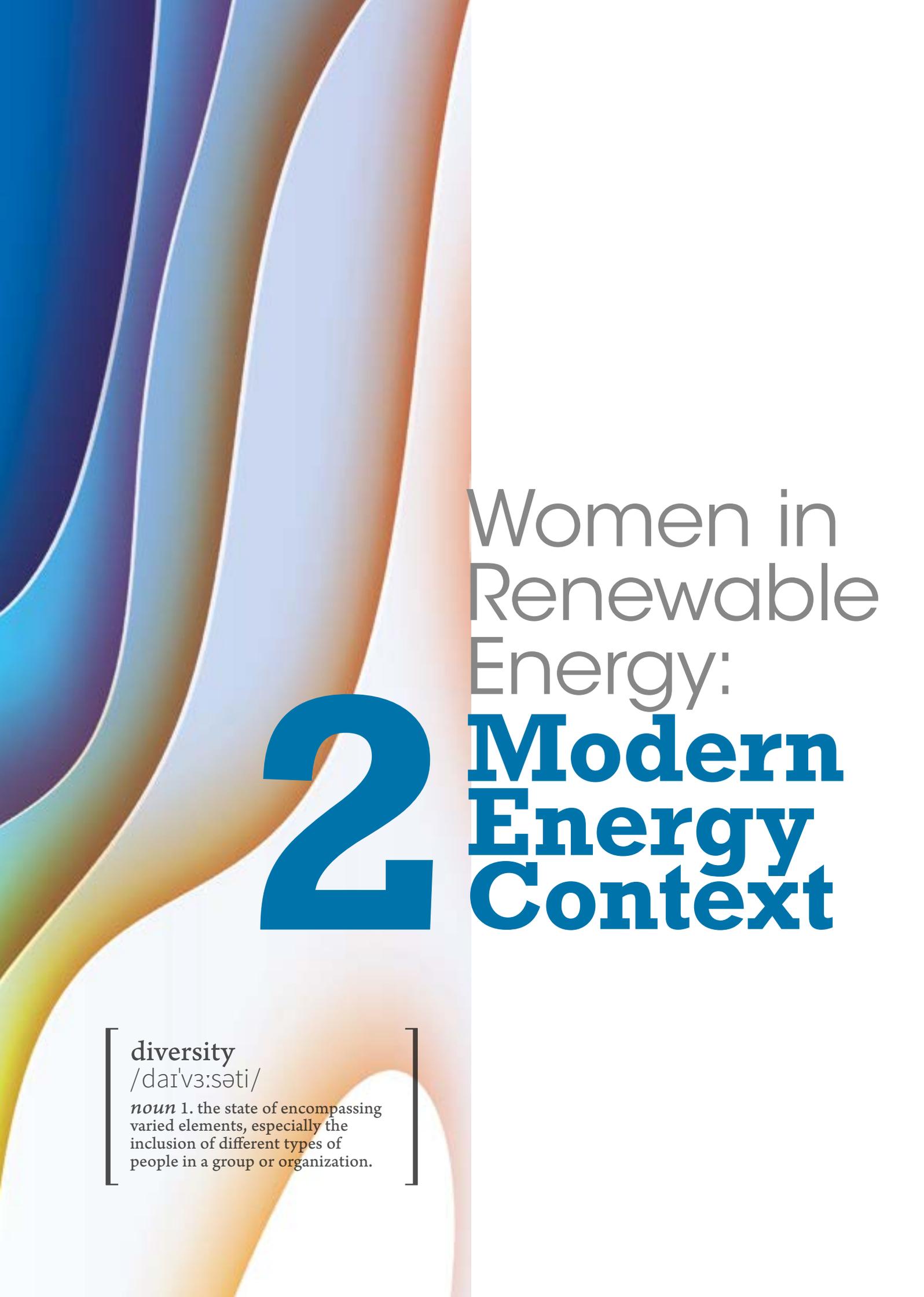


Source: IRENA online gender survey, 2018.

**Figure 1.9** Types of renewable energy technology relevant to the work of individuals responding to the survey



Source: IRENA online gender survey, 2018.



# 2

## Women in Renewable Energy: **Modern Energy Context**

**diversity**

/daɪˈvɜːsəti/

*noun* 1. the state of encompassing varied elements, especially the inclusion of different types of people in a group or organization.

## 2.1. Status and trends

Although detailed information remains sparse, both the general literature and IRENA's survey indicate the presence of gender imbalances in the conventional energy sector. A variety of structural realities, perceptions and biases that help explain this imbalance constitute barriers to swift change. Yet change is imperative, and the rise of renewables offers a unique opportunity to bring it about.

While it is true that renewable energy is subject to some of the same limitations and barriers that prevail in the energy sector at large, this report shows that women already have a stronger presence in renewable energy than is the case in fossil fuels. Furthermore, renewable energy offers a range of unprecedented opportunities. As a young and dynamic sector, it is open to change



in ways that are harder to effect in an industry as set in its ways as the relatively mature fossil fuel sector. In the unfolding energy transition, women will have the chance to garner a growing share of employment. Although some technical fields are still male dominated, younger generations of women are increasingly being educated and prepared for the emerging opportunities. The right kinds of public policies can help ensure that women benefit fully from these opportunities.

Beyond issues of basic fairness to women with regard to job entry, workplace conditions, work-life balance and career advancement, gender imbalances pose a threat to the growth of the renewable energy sector. Reports from around the world warn of a looming skills gap, as industrialised and emerging

economies transform their energy industries (IRENA, 2013). Those skills shortages could be minimised or avoided entirely by training and recruiting women into the sector. In other words, the renewable energy industry has a material interest in addressing its gender imbalance.

A better gender balance is not a zero-sum game in which women stand to gain while men lose. Studies have shown that an increase in the number of qualified women in an organisation's leadership yields better performance overall (Noland *et al.*, 2016). Women are also likely to bring new perspectives into their work, are more likely to act collaboratively in the workplace and may contribute to greater fairness (Moodley *et al.*, 2016). A better gender balance in male-dominated professions has been shown to contribute to the



improvement of working conditions for both men and women, with positive effects on well-being, work culture and productivity (WISE, 2017).

However, given the relatively slow progress to date in removing barriers to entry and career advancement, there is a risk that women will remain under represented – and the sector deprived of a large share of its potential talent pool – unless and until effective, proactive gender-equity policies and programmes are put in place (Baruah, 2017). This first section briefly provides some background concerning overall employment in renewable energy, discusses gender-related findings in the literature and introduces IRENA’s work on the issue and findings from its new survey.

The remainder of the chapter analyses key challenges and barriers, and possible policy solutions in the modern energy context. Section 2.2 examines barriers faced by women in hiring (Section 2.2.1), and with regard to retention and career advancement (Section 2.2.2). Barriers to retention and career advancement overlap to some extent. Their examination is followed by a discussion of promising policies, practices and initiatives to remedy present-day imbalances (Section 2.3). Interspersed in this

discussion are relevant findings from IRENA’s survey.

### 2.1.1. Employment in renewable energy, gender-related findings in the literature and IRENA’s work on the issue

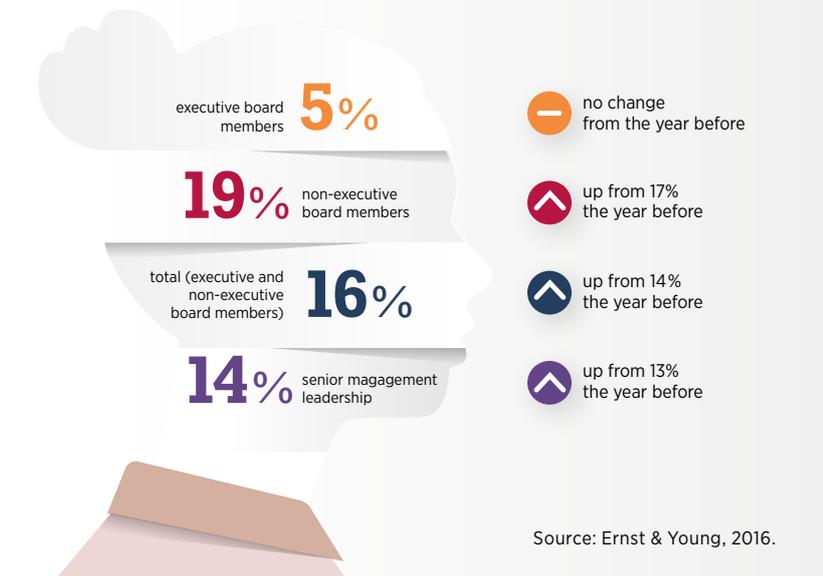
The renewable energy sector is comprised of a wide range of actors. It encompasses not only well-established companies, such as regulated utilities and old-line engineering firms, but also new independent power producers and a variety of start-ups, as well as policy-making ministries and regulatory bodies, research and academic establishments, communities and many others. They all have different operating cultures, philosophies and norms that influence how they perceive gender issues and act on them.

Because the value chain of renewable energy is more labour intensive than that of fossil fuels (Wei *et al.*, 2010), the transformation promises net employment gains. Directly and indirectly, renewable energy already provided jobs for an estimated 10.3 million people worldwide in 2017 (IRENA, 2018a). Employment in the sector is expected to continue to

expand as the global energy transition gathers momentum.

Yet the employment dimensions of renewable energy are seldom captured in national economic statistics. Gender-disaggregated data are especially hard to find. The energy value chain is largely gender-blind and as such does not recognise the contributions of women (Pearl-Martinez, 2014).

Owing to the relative scarcity of gender-related studies in the renewable energy sector itself, this section discusses some relevant findings within the broader context of the “green economy” of which renewable energy forms a key part. It also draws broadly on trends in the science, technology, engineering, and mathematics (STEM) fields, since a significant portion of renewable energy jobs – and particularly of the well-paid jobs – require a STEM background (Antoni *et al.*, 2015). Also, the barriers women face in the renewables sector are similar to those they face in other non-traditional occupations (NTO), in terms of broader structural issues that influence women’s ability to enter and succeed in their careers. Non-traditional occupations are defined as any occupation in which women, or men, comprise less than 25% of the total workforce. Thus, nursing and

**Figure 2.1** Female board members at 200 of the world's largest utilities, 2016

# 22%

Share of women  
in the oil and gas workforce



primary education, for example, are typically non-traditional occupations for men whereas mining, energy, construction and transportation are non-traditional occupations for women.<sup>3</sup>

The literature is quite clear that women continue to face a series of barriers that make them less likely than men to take up a career in renewable energy. And when women do join, they confront a number of attitudes, perceptions and structural obstacles that can make it difficult for them to stay in the workforce and to advance in their career paths. Those barriers are discussed in Section 2.2.

### 2.1.2. Gender composition of the workforce in the conventional energy sector

Available information strongly indicates that employment in the conventional energy industry is male dominated:

- A 2017 study by the World Petroleum Council and Boston Consulting Group put the share of women in the worldwide oil and gas workforce at 22% – much lower than in manufacturing, finance, education, health and social work, and lower than the average in the overall workforce. While women fill 27% of entry-level jobs in the oil-and-gas sector that require a college degree and 25% of mid-career-level jobs, their share is only 17% in senior and executive roles. Only one in a hundred CEOs in the sector is a woman (Rick *et al.*, 2017).

- In 2015, the electricity, gas and water supply sector was found to have women in 22% of senior management roles, roughly half the share in the educational and social services sector (McCarthy, 2016).

- A study of the world's 200 largest utilities found only 25 female board members, representing 16% of board members, and only 5% of executive board members (Ernst & Young, 2016) (see Figure 2.1).

### 2.1.3. Gender composition of the workforce in the renewable energy sector

Studies to date confirm that women are also under-represented in the renewable energy sector. Reports from countries such as Canada, Germany, Italy, Spain and the United States (see Box 2.1) suggest that typically less than 30% of jobs in the renewable energy sector are

<sup>3</sup> The US Bureau of Labor Statistics defines non-traditional occupations in this way and offers detailed statistics on NTO in terms of numbers of workers, share of women, and median earnings of men and women (BLS, n.d.).



**Box 2.1 Female participation in the US solar sector**

The National Solar Jobs Census finds that in 2017, women accounted for 27% of 250 000 solar-industry jobs (including solar photovoltaics, concentrated solar power, and solar heating/cooling), up significantly from 19% in 2013 (Solar Foundation, 2018). The share of women has expanded in all parts of the country’s solar value chain, but is particularly high in sales and distribution, and particularly low in installation (see Table 2.1).

**Table 2.1** Share of women in the US solar workforce, 2013–2017

	Total solar jobs (thousands)	Solar jobs held by women	Women as share of:					
			All solar workers	Installers	Manufacturing workers	Sales and distribution workers	Project development staff	Other
			(percent)					
2013	142.7	26.7	18.7	14.8	22.4	18.6	19.6	na
2014	173.8	37.5	21.6	17.7	24.4	24.0	24.2	43.7
2015	208.9	49.8	23.9	21.1	28.5	23.5	24.9	38.9
2016	260.1	72.8	28.0	25.2	30.9	33.8	25.3	37.7
2017	250.3	67.3	26.9	24.7	29.5	32.9	25.1	35.4

Source: Solar Foundation (2018) and earlier editions.

While the Census’ overall job numbers paint an encouraging picture, a closer look reveals a less comforting situation. Among survey respondents, white males are significantly more likely to earn hourly wages in the highest wage bracket (USD 75 or more) – 36% compared to 28% among men of color, 21% of white women, but only 4% of women of color. Women of color are also least likely to be “very satisfied” with their current wage and position (19%), compared to a high of 60% among white male respondents, and 45% of white females. In terms of career advancement, the Census reports that women perceive greater barriers than men in moving up the career ladder (Solar Foundation, 2017).



Women account for

**32%**

of full-time employment in the organisations covered by the survey

held by women. Women are more likely to be employed in lower-paid, non-technical, administrative and public relations positions than in technical, managerial or policy-making positions (IRENA, 2013). This contrasts sharply with the fact that women represent more than 50% of university students, and almost half the labour force in these countries (Pearl-Martinez, 2015).

Beyond headline statistics, the scarcity of detailed data and time series makes it difficult to understand the structures and patterns in renewables that may constitute either barriers to or opportunities for greater gender equity.

IRENA has sought to address this situation. The agency provided a first gender analysis in its report *Renewable Energy and Jobs* (IRENA, 2013). It followed up with a survey of nearly 90 private clean-energy companies from more than 40 countries (IRENA, 2016a), which found that women represent an average of 35% of the sample's workforce. That survey provided insight into the occupational roles women fill. On average, women were found to represent 46% of the administrative workforce of the respondent companies, 28% of the

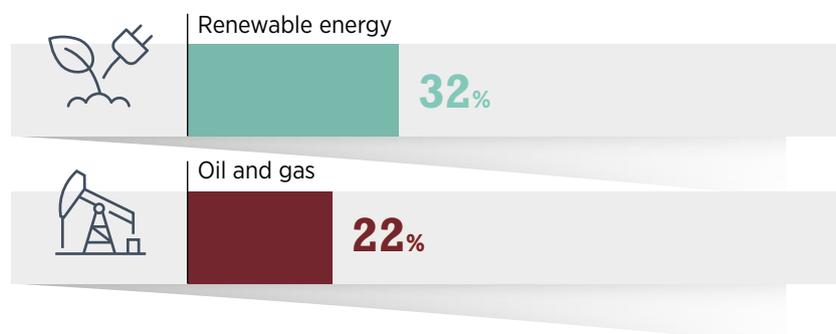
technical staff and 32% of senior management posts.

In 2017, IRENA, in collaboration with the Clean Energy Business Council and Bloomberg New Energy Finance, conducted a survey of the Middle East and North Africa (MENA) region to assess the gender situation and identify ideas on how the clean-energy industry in the region might attract more women (BNEF, CEBC and IRENA, 2017). In line with global findings, the results showed imbalances in overall employment,

especially in management and technical positions, as well as pay discrimination.

IRENA's 2018 online survey, reported here, is based on a significantly larger sample of respondents working in the renewable energy sector worldwide. Survey results show that women represent 32% of full-time jobs in the sample, in line with the finding from IRENA's previous survey. Women thus have a much stronger presence in the renewable energy sector than in oil and gas (see Figure 2.2).

**Figure 2.2** Share of female full-time workforce in renewable energy and oil and gas



Sources: IRENA online gender survey, 2018; Rick *et al.* (2017).





**75% | 40%**

**Shares of women and men who perceive that women face barriers.**

## 2.2. Barriers and challenges

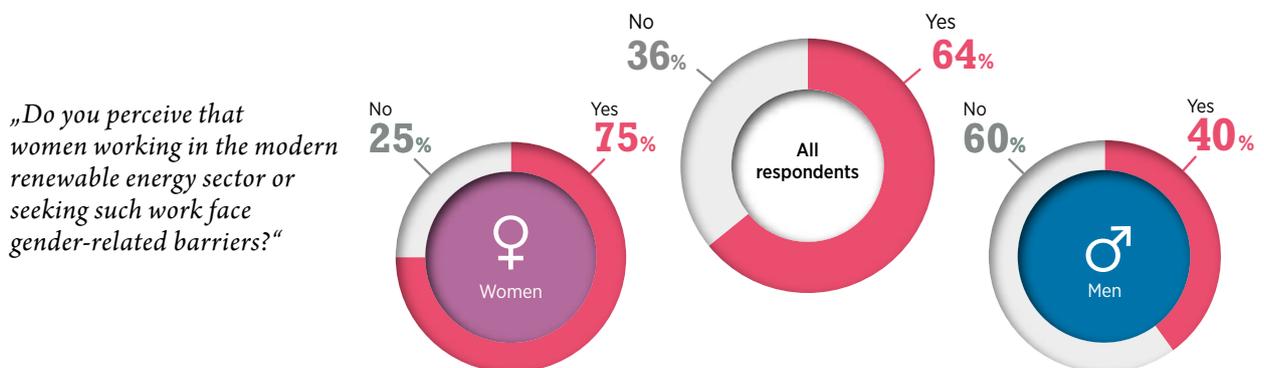
A fundamental issue in addressing barriers to women’s advancement is whether people are sufficiently aware of the existence of the impediments. IRENA’s survey asked: *“In your experience, do you perceive that women working in the modern renewable energy sector or seeking such work face gender-related barriers?”* Almost two-thirds of all respondents answered yes. However, this result is strongly driven by female respondents, three quarters of whom answered in the affirmative. By contrast, only 40% of male survey participants agreed (see Figure 2.3).

### 2.2.1. Barriers to entry

The survey then sought to assess the importance of barriers that are specific to job entry. A survey question asked individual respondents to rank a number of specific barriers to entry according to their importance (see Figure 2.4). The perception of gender roles ranks highest, followed by cultural and social norms. Both have similar origins and implications and may in fact reinforce each other. The third-ranked barrier, prevalent hiring practices, may be seen as an expression of male-biased cultural and social norms and are thus in some ways a variation of the top two barriers.

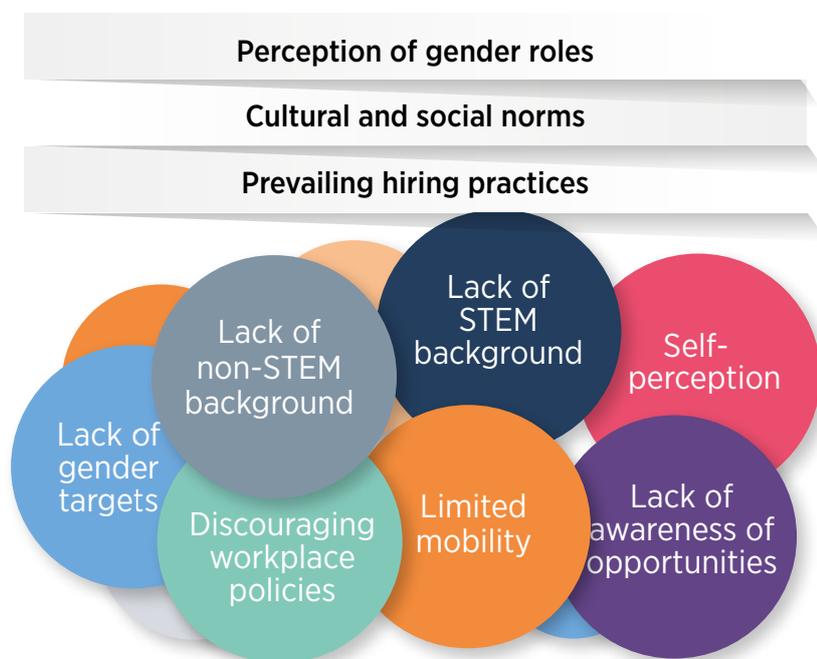
The text that follows discusses four categories of barriers: 1) perceptions of gender roles and the nature of work in the sector; 2) participation of women in STEM and non-STEM jobs; 3) the lack of adequate information, and thus awareness, about career opportunities in renewable energy; and 4) prevalent hiring practices, as well as unequal access to employment entry points, such as apprenticeships. The survey did not explicitly ask respondents about the last point, but the literature suggests that entry points are important with respect to vocational jobs, especially in view of women’s disproportionate lack of access to job information and networking opportunities.

**Figure 2.3** Perceptions of gender barriers in the modern renewable energy sector



Source: IRENA online gender survey, 2018.

**Figure 2.4** Barriers to entry for women in modern renewable energy, ranked by respondents in order of importance



Source: IRENA online gender survey, 2018.

Note: STEM = science, technology, engineering and mathematics.

### 1. Perceptions of gender roles

Perceptions about what women can or should be expected to do, and about what they can accomplish, are deeply ingrained in society, with restrictive views of gender roles prevailing across generations. Changing such views, along with the structures that reinforce them, is a slow process. It is not surprising, therefore, that perceptions continue to affect women's ability to participate fully and equally in many parts of the economy.

The problem is in part a self-perception by women themselves and in part a set of assumptions among men about women's ability to

succeed. Both are well-recognised in the literature as key impediments to women's hiring and advancement in certain careers in the energy industry and other sectors (Huyer and Hafkin, 2013; MacKenzie and Wajcman, 1999; Rosser, 2005).

In the energy sector, nowhere do the misperceptions appear more pronounced than in technical jobs. One pervasive assumption is that such jobs require more physical strength than most women possess. However, the importance of physical strength has been much reduced by the mechanisation and automation of many tasks. Other misperceptions are based on doubts about women's

technical competencies. The inherent bias is that women are deemed less competent to hold technical jobs than their male counterparts, even with the same or superior qualifications and work experience (Baruah, 2017).

Women's and girls' comparative lack of awareness and information about employment opportunities in renewable energy appear to interact with broader male-biased social attitudes based on misunderstandings and misperceptions about gender. The result is women's systematic under-representation in the sector, especially in technical roles.

In a review of technical education for women in 120 countries, **social, cultural and gender norms and misperceptions** were identified as factors that erode girls' confidence, interest and willingness to engage in STEM subjects (UNESCO, 2017). Girls are often brought up to believe that STEM subjects are "masculine" topics and that women's ability is innately inferior to that of men.

Field-specific beliefs about what it takes to succeed in STEM drive career trajectories and may play an important role in making women feel welcomed or excluded (Bian *et al.*, 2017). Despite concerted efforts over



# 28% | 45%

Shares of women in  
**STEM-related positions (left)**  
 and **administrative**  
 positions (right).

many years to address the gender imbalance in these fields, only 12% of engineers in the United Kingdom are women, compared with 47% of the overall workforce. Between 2015 and 2016, just 16% of those who started an engineering or technology degree in the United Kingdom were women, and only 25% of girls aged 16–19 said in a survey they would ever consider a career in engineering (Engineering UK, 2018). Similar barriers of perception or interest have been identified in Australia, Belgium, Finland, Poland, Spain and Sweden (OECD Higher Education Programme, 2014).

**Women's self-perceptions** can have distorting effects as well. Women may be less likely to choose occupations in engineering and technology because those fields may not appear as socially useful as other disciplines such as the medical and biological sciences.



## 2. Women's participation in STEM fields and misperceptions of career pathways

Driven by perceptions and misperceptions, only a **low percentage of female students choose the STEM fields**. The latest edition of the UNESCO Science Report, entitled *Towards 2030* (UNESCO, 2015), offers the most recent statistics on women's participation in STEM fields. The share of women graduating in the fields of engineering, physics, mathematics and computer science is low in many industrialised countries. The roughly 20% share of women among engineering graduates in Canada, Finland, Germany and the United States is rather typical. In Japan and the Republic of Korea, women represent an even lower proportion – just 5% and 10% of engineers, respectively. There are some bright spots, however. In Cyprus and in the United Arab Emirates (UAE) women represent 50% of engineering graduates, in Denmark 38%, and in the Russian Federation 36%.

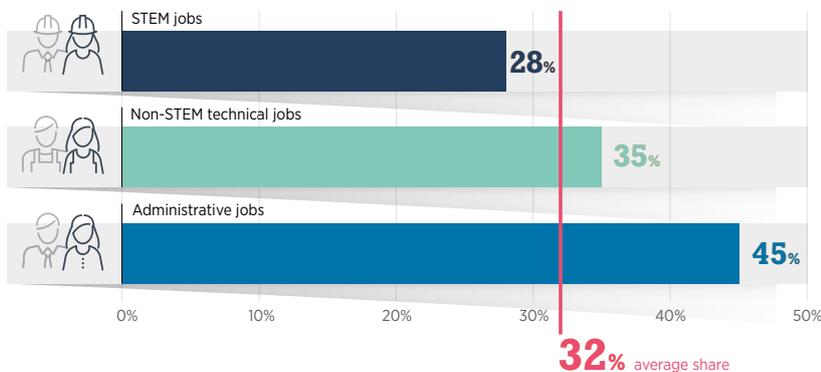
The contrast with other fields – notably education, health and social sciences – is stark. In New Zealand, the share of female graduates remained

around 80% in health between 2000 and 2012 but fell in science (43% to 39%) and engineering (33% to 27%), even as it rose from 39% to 70% in agricultural science.

Information from India presents a picture similar to that in industrialised countries with regard to low percentages of women in engineering courses (about 30%) and STEM careers (MHRD, 2018; Dasgupta, 2018). In Malaysia, 36% of students enrolled in engineering in 2012 were women, just half the female rate in pharmacy. In Mongolia, the share of women enrolled in computer science was 30% and 24% in engineering in 2013, compared with 73% in biology courses (UNESCO, 2015).

Gender imbalances among STEM students carry through to gender imbalances in STEM jobs – in the renewable energy sector as elsewhere. IRENA's survey finds that women occupy 28% of STEM positions. While these percentages are close to the average share of 32% across the entire workforce, they are much lower than in administrative jobs (see Figure 2.5).

**Figure 2.5** Shares of women in STEM, non-STEM and administrative jobs in renewable energy



Source: IRENA online gender survey, 2018.

Notes: STEM = science, technology, engineering and mathematics.

The vertical line indicates the average share of women in renewable energy jobs among survey participants.



The **lack of a STEM background** ranked highly in survey respondents' perception of barriers. However, even though technical and engineering roles tend to be highly visible in the renewable energy sector, contributing to the impression that would-be job applicants have to be of the sector, individuals with non-STEM backgrounds nonetheless have plenty of opportunities to pursue a career in renewable energy.

In fact, the skills and occupations required across the value chain are highly diverse, as illustrated by the example of large-scale solar PV (see Table 2.2). Female recruitment into the renewable energy sector could thus be encouraged by raising awareness of the varied career opportunities available for people with a broad range of educational backgrounds and experiences, including law, finance, economics, environmental studies and governance, among many others.

### 3. Lack of career information

An enduring disadvantage that women and girls face in comparison to their male counterparts is the lack of readily accessible information about employment in non-traditional occupations, including those in the energy sector. Personal networks are critical for entering and succeeding in many professions. But women have more difficulty accessing such networks on par with men in non-traditional occupations and thus are at a disadvantage in receiving timely information about job openings (MiHR, 2016; UNESCO, 2015).

**Careers in renewables are generally still not promoted through formal channels** such as career counsellors, student employment advisors, job centres, recruitment sessions and career fairs. Many women who now work in the sector emphasise that they had not been informed of careers in renewable energy in high school or even in the early years of college or university (Baruah, 2018).

Because technical fields of study have been dominated by men for so long, a significant amount of information about job opportunities continues to travel through familial and **professional networks that often are inaccessible to women**. There is an urgent need to level the playing field. The necessity for more institutionalised information systems about employment in renewable energy has been noted in various contexts in North America and Europe (EHRC, 2017).

Human resources experts have emphasised that far larger numbers of women are employed in renewables than in the conventional energy sector, where most people find employment through their personal connections and professional networks. Professional networks in the conventional oil and gas industry were established a long time ago, are dominated by men and are often intentionally or unintentionally exclusionary toward women. Since professional networks in renewable

**Table 2.2** Selected occupations in segments of the solar PV value chain



Type of human resources	Planning	Manufacturing and procurement	Transport	Installation and grid connection	O&M	De-commission
Construction workers and technicians				☺☺	☺☺	☺☺
Factory workers		☺☺				
Engineers	☺☺	☺☺		☺☺	☺☺	☺☺
Quality health and safety experts	☺☺	☺☺	☺☺	☺☺	☺☺	☺☺
Operators					☺☺	
Technical personnel					☺☺	
Truck drivers			☺☺			☺☺
Administrative personnel		☺☺	☺☺			
Logistic experts	☺☺	☺☺	☺☺			☺☺
Marketing and sales personnel		☺☺				
Legal, energy regulation, real estate and taxation experts	☺☺				☺☺	
Regulation and standardisation experts		☺☺				
Loading staff			☺☺			
Environmental experts	☺☺			☺☺		☺☺
Management					☺☺	
Financial analysts	☺☺					
Shipping agents			☺☺			

Source: IRENA, (2017).

Note: O&M = operation and maintenance.

energy have been built much more recently, they tend to be more open; women who participate in these networks may attract more women to the sector (Lucas *et al.*, 2018). This is an advantage that employers in the renewable energy sector should leverage in order to build a gender-balanced workforce.

#### 4. Prevailing hiring practices and unequal access to career entry points

Respondents to IRENA's 2018 survey identified prevailing hiring practices as the third most significant barrier to women's recruitment and retention in the renewable energy sector. The literature on employment in the conventional energy sector and other non-traditional occupations such as mining and transportation confirms that men tend to apply for jobs even when they meet only some of the requirements, but women tend not to apply for jobs unless they meet all requirements (Asia-Pacific Gateway Skills Table, 2015). Women are also less likely to negotiate salaries and benefits. They must often outperform men in male-dominated industries just to fit in and certainly to progress.

Female employees in male-dominated sectors have frequently emphasised a disconnect between company rhetoric about recruiting and retaining women and the reality of entrenched male preference (Baruah, 2018). The **preference for male recruits** in these sectors is very much a "chicken and egg" problem – women often lack the necessary training and skills for many jobs, but these jobs had traditionally not been designed with women in mind and are

therefore not particularly attractive to them, resulting in a smaller pool. Thus, when it comes to selection, managers, who are much more likely to be men, are less likely to regard women as suitable candidates (Turnbull, 2013).

For vocational jobs, apprenticeships enable people to gain the skills and knowledge they need to become skilled tradespeople. They are thus an essential entry point into the renewable energy sector (EHRC, 2017; Baruah, 2018). However, **apprenticeships are often marked by extreme gender imbalance.**

In Canada, for example, women make up just 14% of apprentices, and just 4% of female-dominated trades are excluded (Frank and Jovic, 2015). Similar figures are reported in other countries of the Organisation for Economic Co-operation and Development (OECD), such as the United Kingdom, where women comprise 94% of childcare apprentices but under 4% of engineering trainees (Young Women's Trust, 2016). Trades associated with energy industry occupations (wind turbine technician, solar energy system installer, electrician, energy auditor, energy retrofitter, etc.) remain heavily male-dominated (McFarland, 2015). In Ireland, just 1% of apprentices in engineering and construction were women (O'Brien, 2018).

In most countries, securing a trade apprenticeship remains an unregulated process, with informal networking still the norm. This often translates into a barrier to women's entry into and advancement in these fields. Research conducted in North America has repeatedly identified the inability to access informal and familial apprenticeship networks on



par with men as a major impediment to women in gaining full-time employment in the trades (National Women's Law Center, 2014).

#### 2.2.2. Retention and career advancement challenges

Women tend to drop out of the workforce at key phases in their life and career, especially around the childbearing years when the double burden of balancing work and family is particularly strong. IRENA survey respondents identified the glass ceiling as the most important barrier to women's career development in the modern renewable energy sector (see Figure 2.6). Cultural and social norms, the lack of workplace flexibility and the lack of mentorship opportunities ranked next. Given the double burden they shoulder, women can benefit from flexibility measures to remain in the workforce. Yet options such as maternity and family leave often are inadequate or simply not available.

The nature of specific jobs and the demands of particular workplaces may place practical limits on how much flexibility in working hours can be offered. Generally speaking, however, survey respondents ranked

**Figure 2.6** Barriers to career advancement for women in modern renewable energy



Source: IRENA online gender survey, 2018.

flexi-time (full-time work with flexible beginning and end times during the workday) highest, followed by part-time work and work from home. By comparison, job sharing is seen as a less important or effective way of circumventing retention barriers. (Section 2.3 expands on these topics, notably the pros and cons of part-time and flexi-time.)

Replies to IRENA’s survey also indicate that the lack of child- and family-friendly measures is an important barrier. The unavailability of maternity leave notably ranks higher than the lack of paternity leave. But both are seen as more important than the option of on-

site childcare, which can be helpful but does not remove women’s double burden.

Women face a double standard with respect to parental leave in that they are more likely than men to find their commitment to work implicitly or explicitly questioned (UNESCO, 2015). This appears especially true for women who take multiple parental leaves. And it may explain why women who do not bear caregiving responsibilities and those who enter work at a later stage in their lives, after completing parenting roles, are more likely to remain in the sector.

Career-cycle assessments suggest that most departures (resignations and dismissals) of women in non-traditional occupations occur within the first five years of employment, and that initial experiences with regard to support and promotion are critical. A gender-based demographic analysis of women employed in science and technology, including the fossil-fuel and renewable energy sectors, revealed that women in secure permanent positions (often obtained after 4–5 years of employment) were no more or less likely to leave than men. Even women in non-permanent positions at the senior level depart from their positions at rates equal to those of men. However, at the junior and middle levels, women depart in greater numbers than their male colleagues (Byveldts, 2016).

An additional set of barriers is found in the lack of mentorship and training opportunities for women. These are of great importance with regard to improved career prospects for women. Solutions are discussed in Section 2.3.

Finally, the lack of fair internal policies and the absence of gender equity targets are factors in retention and, ultimately, career advancement. Gender targets actually do not rank highly in the survey results. But where some sort of target is already in place, fewer respondents perceived barriers to women.<sup>4</sup>



<sup>4</sup> In interpreting the survey results, it is important to distinguish between “revealed preferences” and “stated preferences”. Statisticians experienced in the evaluation of surveys know that sensitive questions may elicit inaccurate replies. In this case, respondents may not wish to imply that a lack of gender targets was a barrier to their success, even though they may be willing, in a different context, to propose them as a useful measure to reduce or overcome barriers.

**glass ceiling**

/glɑ:s 'si:lɪŋ/

**noun** 1. an unacknowledged barrier to advancement in a profession, especially affecting women and members of minorities.



Because of the importance of social and cultural norms as a deeply ingrained – and thus difficult-to-change – barrier, the effectiveness of lowering other barriers by providing more benefits and support measures is bound to be somewhat limited. Nonetheless, survey respondents who work for organisations that provide maternity leave or have fair and transparent internal processes and gender targets were significantly less likely to state that barriers existed than respondents who do not have these benefits.

The key issues that condition and limit women's renewable energy and careers include: 1) the glass ceiling; 2) mobility-related challenges and difficult work schedules; and 3) wage inequities. Section 2.3 addresses a number of solutions to these challenges.

### 1. Glass ceiling blocking ascent to leadership positions

All along the renewable energy value chain one finds persistent barriers to improving women's representation in senior executive positions and on boards of directors. The **lack of equal representation of women in decision-making roles** is described as the “glass ceiling”, where invisible barriers keep women from rising to influential positions, regardless of their qualifications.

A recent McKinsey survey in the United States, for example, shows that the higher up the corporate ladder one moves, the fewer women one finds. For entry-level positions, women accounted for 48% of jobs. Among managers and senior managers, the share declined to 39% and 34%, respectively; for vice presidents, it was 30%, but for senior vice presidents and executive-suite positions, it was only 23% (Krivkovich *et al.*, 2018).

IRENA's survey provides evidence for different types of organisations working in the renewable energy sector. Survey responses indicate that men account for a majority of board members at 65% of participating private sector firms. In close to half of all firms, men represent at least

three-quarters of directors. The distribution is also heavily male biased among national agencies and inter-governmental organisations in the sample, although almost a quarter of them have equal representation between the genders. In comparison, non-governmental organisations have a much better gender balance (see Figure 2.7).

From a pragmatic perspective, gender diversity is good for business. Across the economy, companies with higher percentages of female decision-makers financially outperform their industry peers. Documenting and publicising the economic benefits of diversifying boards and senior leadership is a useful strategy, though, regrettably, it is usually this fact – rather than equity considerations in their own right – that motivates private corporations to support gender equality at senior executive levels (Baruah, 2018).

An important distinction must be made between women's representation and participation. A share of 15% female representation appears to be a critical lower threshold. Below this level, women commonly feel marginal and “invisible” in decision-making processes (Westermann *et al.*, 2005). Establishing critical mass is

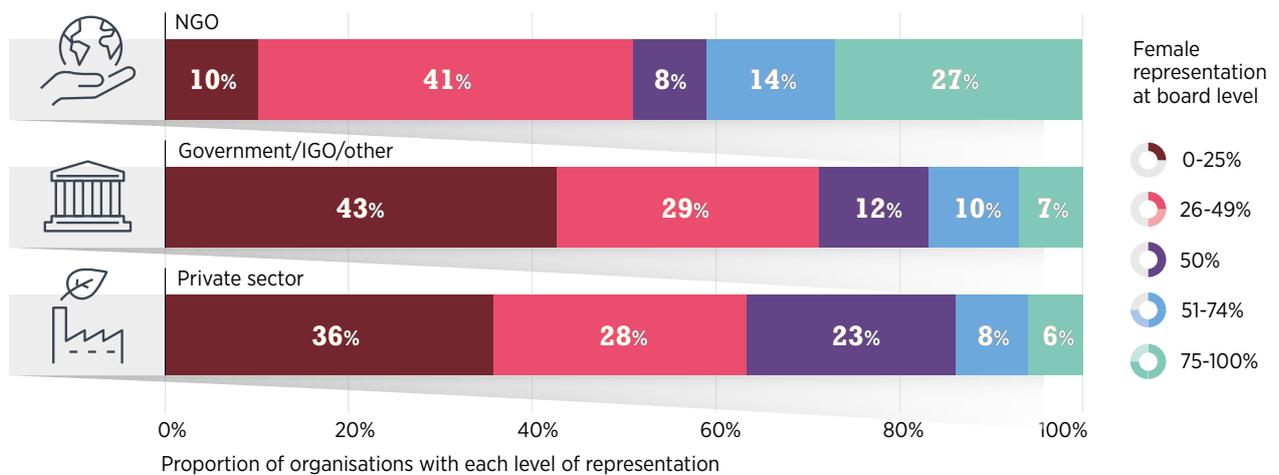


essential for creating more supportive institutional environments in which women can overcome potential reticence and speak out on issues and concerns in the presence of colleagues (Agarwal, 2010).

Additionally, a 30% “critical mass” threshold of women as executive officers and board members has been found to have a positive effect on company performance (Catalyst, 2011). In its study of almost 22 000 firms across the globe, the Peterson

Institute for International Economics discovered that a company meeting the 30% threshold could add up to 6 percentage points to its net margin (Noland *et al.*, 2016). Another study found that, on average, companies with more women board members outperform those with fewer women by 53% on return on investment, 42% on return on sales and 66% on return on invested capital (Catalyst, 2008).

**Figure 2.7** Gender composition of board of directors in the renewable energy sector



Source: IRENA online gender survey, 2018.

Note: IGO = inter-governmental organisation; NGO = non-governmental organisation.



## 2. Work schedules and mobility requirements

**Rigid work schedules** were identified by survey respondents as one of the key barriers women face, given that, in many societies, they are expected not only to excel at work but also to reliably perform many tasks outside of work, including child rearing, other care-giving responsibilities and various household chores. “Having it all” is especially difficult when there is little flexibility at work.

Personal circumstances vary, of course, and women who do not have children are likely to face less of a challenge. Similarly, higher-paid women may be better equipped than those in less well-remunerated positions to secure paid help to meet certain family responsibilities, but the fulfilment of certain roles generally falls on women in ways it does not on men. This situation is not limited to the energy sector by any means. Broad societal change is needed.

An added burden is found in **mobility requirements**, particularly among those in the renewable energy sector who hold field jobs (project planners, installers, operators) and may thus be subject to frequent travel requirements, relocation and long periods of time away from home and family. While this can be challenging for men and women alike, women with care-giving responsibilities, especially for young children, face a particular disadvantage.

Project locations are largely determined by the availability of natural resources (such as wind speed or solar irradiance) and may thus be remote from population centres. The scale of wind and solar farms, hydropower facilities and bioenergy plantations can also be a factor influencing location. For example, while household rooftop solar is principally deployed in urban areas, utility-scale solar may be in remote locations. Construction and installation of renewable energy projects may require many months of working in difficult-to-access places. The nature of the job implies shifting among different far-flung locations. Jobs in the maintenance of wind turbines also require extensive travel among different installations.

However, one must not assume that women would prefer not to hold such jobs. Many women already work in less-than-optimal environments, and for much less pay than they could make in renewables. Given the option, some women may prefer work in renewable energy simply because of the potential to earn higher wages. Because of persistent male-biased norms (often unintended or unconscious), even women who are able and willing to work may not be given the option to choose between difficult or dangerous working conditions with low pay and similar conditions with higher pay (Carpenter *et al.*, 2015; McKee, 2014). Instead, women are tracked into feminised occupations in administrative and support services within the sector.

Assumptions about women’s willingness or ability to work in certain occupations or working conditions can thus themselves become barriers to women’s employment (Baruah and Biskupski-Mujanovic, 2017).



**60% | 29%**

shares of men (left) and women (right) in sample who believe the genders are paid equally

### 3. Wage inequities

Existing research on women’s employment in renewable energy in OECD countries reveals that although average wages in the industry may be higher than in other sectors, women continue to earn less than men across occupational categories (see Antoni *et al.* [2015] for findings from Germany).

Close to two-thirds of IRENA survey respondents believe that women in renewable energy earn less than men for the same position, while one-third believe they earn the same, and just 1% believe women are paid more (see Figure 2.8). But the survey also

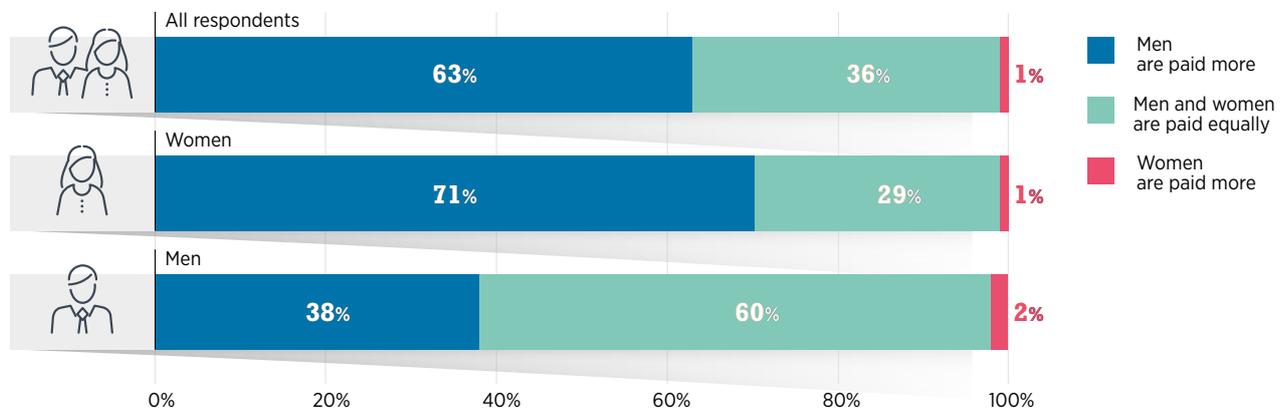
indicates that perceptions about wage equity are strongly shaped by a gender bias. Among male respondents, just 37% say they think men are paid more, as opposed to 70% of female respondents. Some 60% of men have the perception that both genders are paid equally.

As in other sectors, the causes of the gender wage gap in renewable energy appear to be multifaceted. They include women’s **greater concentration in lower-paying, non-technical and administrative jobs** and in junior positions; women’s **comparatively weaker negotiating positions**; their greater likelihood of **taking time off from their careers for**

**parenting and care-giving**; and the **attitudes and values of employers**. In addition, differences may in some cases be the result of pay discrimination.

There are no simple or straightforward solutions for addressing the gender wage gap in renewable energy. However, as will be discussed in the next section, greater transparency about pay scales and information about career trajectories are important first steps toward levelling the playing field in negotiations for starting salaries, raises, bonuses and promotions.

**Figure 2.8** Beliefs about pay equity among men and women



Source: IRENA online gender survey, 2018.

### 2.3. Policies and solutions

The survey results highlight that ingrained social and cultural norms play a central role in the barriers to greater gender balance. Therefore, the more these norms change – a process that inevitably takes time – the more effective other measures will be. The previous section discussed a range of measures that survey respondents felt would be helpful in overcoming barriers. Most (60-80%) expressed a preference for measures to promote training, gender-sensitive policies, diversity targets, networking and mentoring. The survey suggests that governments and inter-governmental organisations offer these measures more frequently than most other organisations.

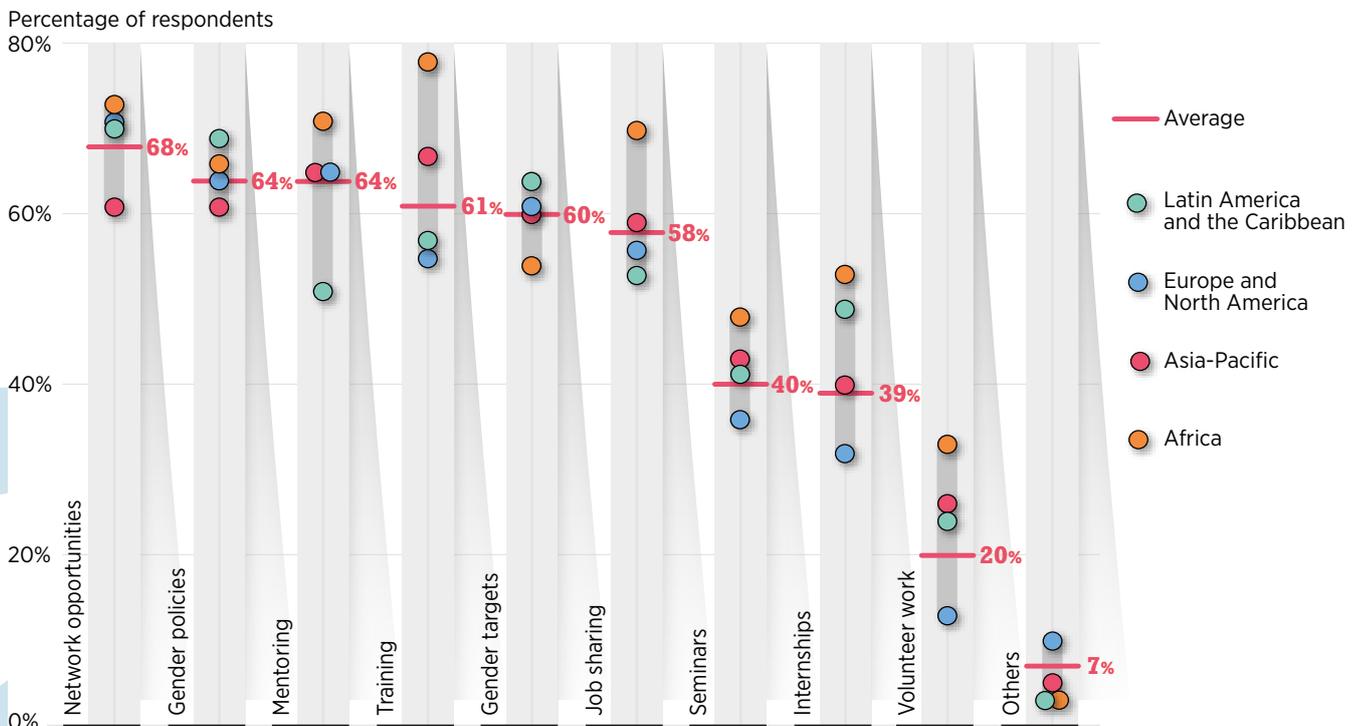
There is some regional variation in these views (see Figure 2.9). Networking, mentoring and gender-sensitive policies are regarded as most important across all regions of the world, although respondents in the Asia-Pacific region were less likely to view networking as critical than counterparts elsewhere. Similarly, respondents in Latin America and the Caribbean emphasised mentoring less than others.

On the other hand, African respondents valued training the most and also gave other measures (interning, volunteering, and job sharing) higher marks. Seminars, job sharing and other types of work arrangements tended to receive more

support from respondents outside Europe and North America.

This section discusses a range of solutions grouped into the following categories: 1) mainstreaming gender; 2) creating supportive networks and mentorship programmes for women; 3) improving access to education and training; 4) establishing gender targets and quotas; 5) developing appropriate workplace policies and practices; and 6) pursuing measures to favour a better work-life balance.

**Figure 2.9** Suggested measures in support of women in modern renewable energy, by respondents region



Source: IRENA online gender survey, 2018.

## sisterhood

/ˈsɪstəhʊd/

**noun** 3. the solidarity of women based on shared conditions, experiences, or concerns.



### 2.3.1. Mainstreaming gender perspectives

To promote gender equality in renewable energy employment, it is important to assess whether gender perspectives enter into decision-making. Gender audits can help answer this question in the context of public policy measures such as legislation and regulations, and in the private sector.

A **gender audit** is one aspect of what is referred to as “mainstreaming”: analysing legislation, regulations, taxation and specific projects for their effect on the status of women in society (Swirski, 2002). The basic assumption of gender audits is that public policy affects men and women differentially, stemming from the different roles women and men in the family and their status in the economy. They are essential for constructing more gender-sensitive policy frameworks, for providing support services and other incentives to increase gender equity, and ultimately for increasing gender equality (IRENA, 2013). Gender audits of energy sector policy have been implemented in several developing countries, mainly with support from ENERGIA, the International Network on Gender and Sustainable Energy (Clancy, 2011).

Mainstreaming efforts challenge the misperceptions and stereotypes discussed earlier. Part of the mainstreaming effort is to provide **training in gender awareness**, the goal being to make the work environment more inviting with regard to career pathways, professional development and performance reviews by mitigating conscious or unconscious biases (Solar Foundation, 2017).

Training of this type was included in the Gender Action Plan created for Uzbekistan’s Talimarjan Power Project, for example. Staff were shown how to set up mechanisms to induce awareness of gender, how to adapt hiring policy so as to add more women employees and managers, and how to collect and analyse data on gender and women’s working conditions (Mohideen and Tanaka, 2012).

Without doubt, men can be strong champions of gender equality. But perhaps the best way to mainstream gender is by hiring women. Asked about the frequently voiced argument that the pool

of trained women is not large enough, Indian businessman Anand Mahindra responded that **“when you have a woman CEO in the company, miraculously, that pool emerges, and you get more women. Women hire other women. [...] I think just having the awareness of the aspiration and existence of these women is going to change the rules of the game”** (Alves, 2018).

### 2.3.2. Creating networks and supporting mentorship

Women are often effectively excluded from access to familial and professional networks that provide information about job openings and career opportunities. Many of these networks have traditionally catered to the interests of men. There is an urgent need to level the playing field by improving women’s access to such information and peer support. A measure the renewable energy industry could undertake is to “simulate” valuable personal connections through practices such as mentoring programmes, outreach efforts, site tours and temporary work placements.

Organisations advocating for greater gender equity in the renewable energy sector are already pursuing such strategies. They share information; create networks among representatives of government, industry, academia and non-profit

**Gender mainstreaming is also a matter of language – rendering the spoken and written word more inclusive (e.g., the use of “humanity” in place of “mankind”).**

**One survey respondent wrote that at her company, “we use the female form in our job announcements ... in order to attract more female engineers.”**

groups; and offer mentoring, coaching and consulting services (see Table 2.3). These organisations (two of which are profiled in Boxes 2.2 and 2.3) play an important role in creating awareness

and advocating for the need for gender equity in renewable energy. In their early years of operation, most have prioritised public education, professional development and networking activities. Over

time, and with support from governments, industry associations and private corporations, some have been able to step into important research and policy roles.

**Table 2.3** Selected organisations advocating for gender equity in renewable energy



Name	Year founded	Location of activity	Activities
<b>ENERGIA</b> (International Network on Gender and Sustainable Energy)	1996	22 African and Asian countries	Gender mainstreaming, strengthening women-led energy enterprises, advocacy
<b>WRISE</b> (Women of Renewable Industries and Sustainable Energy)	2005 <sup>a</sup>	United States	Fellowships, awards, webinars, networking, training retreats, in-person and online mentoring
<b>Hypatia</b>	2010	Germany	Networking, events
<b>WISE</b> (Women in Solar Energy)	2011	United States	Education, capacity building, advocacy, strategic partnerships, networking, events
<b>WICS</b> (Women in Cleantech and Sustainability)	2011	United States	Fostering networks of professionals to advance women's role in the green economy (energy and other sectors)
<b>WiRE</b> (Women in Renewable Energy)	2013	Worldwide	Capacity-building field trips, networking, awards recognition programmes, student bursaries, speed mentoring
<b>Women in Sustainability, Environment and Renewable Energy</b> (WiSER)	2015	United Arab Emirates	Advocacy, education and training opportunities for women, platforms for dialogue, showcasing of women's contributions to sustainability
<b>Renewable energy and energy efficiency Women's Network</b> (REDMERE)	2016	Mexico	Networking, capacity building, training and events
<b>Women in Sustainability</b> (WiS)	2017	India	Advocacy, networking
<b>GWNET</b> (Global Women's Network for the Energy Transition)	2017	Worldwide	Interdisciplinary networking, advocacy, training, coaching and mentoring, and services related to projects and financing
<b>Nordic Energy Equality Network</b> (NEEN)	2017	Nordic and Baltic countries	Bringing together people who are interested in improving gender balance and promoting diversity in energy-related matters

Source: Websites of profiled organisations.

a. WRISE was founded as Women of Wind Energy in 2005; it was rebranded as WRISE in 2017.



### Box 2.2 GWNET: Offering online mentoring

The Global Women's Network for the Energy Transition (GWNET) began in early 2018 to offer a global online mentoring programme for women in junior and middle-management positions. The 12-month cycle emphasises suitable match-ups between mentors and mentees. Participants in the 2018 cycle – mentees and mentors – hail from Africa, China, Europe and the Middle East, as well as North and Latin America. The programme is set up to run remotely; however, several mentees have managed to meet with their mentors in person. Each duo establishes an agreement on the frequency of interactions and the mode of communication. Beside the bilateral interaction, mentees have access to tailored knowledge webinars to assist in personal and professional growth. Webinars focus on the development of the energy sector, women's entrepreneurship and personal development. The programme concludes with an interactive web-based graduation meeting.

Source: GWNET, n.d.

### Box 2.3 The Pink to Green Toolkit: Wider Opportunities for Women

Wider Opportunities for Women advocates for gender equity in employment in the United States. Its Pink to Green Toolkit includes presentations, trainings, webinars, curriculum guides and modules, briefs, templates, tip sheets, and planning documents designed to maximise capacity building in recruiting, assessing, placing and retaining women in green occupations.

The toolkit is organised into five categories: outreach and recruitment of women, assessment and case management for women, building critical skills of job readiness, gender-inclusive and gender-focused training design, and sexual harassment. The resources in the toolkit include a myths-and-facts worksheet about common stereotypes, presentations about the benefits of green jobs for women, an assessment of a company's or organisation's capacity to serve and recruit women, a tip sheet to plan a career fair, a module on building skill and confidence of women to perform well in interviews, modules addressing communication and learning styles of women, and many more.

The toolkit can be a valuable resource for organisations working on equity in renewable energy and the broader green economy in other countries.

Source: Wider Opportunities for Women, n.d.

A range of measures can help create **greater awareness of career opportunities**, including: 1) ensuring that information about renewable energy jobs and careers is publicly available through online bulletin boards and other measures; 2) supporting the **establishment of mentorship programmes**; and 3) working with educational institutions to reach out to women by **publicising training opportunities, including apprenticeships**.

More female students could be provided with an entry into the renewable energy sector if co-op programmes and internships in related fields which tend to draw more

significant numbers of female students – such as public policy and administration, economics, law, business and health – were better aligned with the renewable energy sector. Better alignment requires collaboration among governments, skill development and employment organisations, educational institutions, renewable energy companies and industry associations.

New job entrants can be inspired by, and learn from, those women who already have established a career in the sector. Showcasing their accomplishments not only recognises their trail-blazing work,

but also highlights opportunities for women joining the renewable energy workforce. Several dedicated awards have been instituted to recognise women's accomplishments in the renewable energy sector. For example, the US Clean Energy Education & Empowerment (C3E) Awards celebrate the outstanding leadership and extraordinary achievements of mid-career women working to advance clean energy. Another example is the Women in Renewable Energy (WiRE) Women of Distinction Awards (see Box 2.4).

#### Box 2.4 C3E and WiRE Women of Distinction Awards

The Clean Energy Education & Empowerment (C3E) Initiative was launched in 2010 by the Clean Energy Ministerial, a global consortium with representation from 24 countries. The C3E initiative seeks to increase women's participation and leadership in clean energy, especially in the STEM fields. The US C3E programme, initiated in 2012, is led by the US Department of Energy and three university partners: the MIT Energy Initiative, the Stanford Precourt Institute for Energy, and the Texas A&M Energy Institute. Among its pillars of activity are an annual symposium that provides networking opportunities for professional women, students and government representatives, and awards for outstanding mid-career women in education, research, business, entrepreneurship, advocacy, government, law and finance, among others.

Women in Renewable Energy (WiRE) was launched in 2013 in Canada and is now active internationally. To advance the role and recognition of women in the renewable energy sector, it offers mentoring, provides networking opportunities in partnership with government agencies and renewable energy associations, and organises capacity-building field trips. WiRE supports the Leadership Accord for Gender Diversity in Canada's Electricity Sector, a 2017 commitment by employers, educators, unions and governments to increase the representation of women in the electricity and renewable energy sectors. WiRE also supports the Equal by 30 Campaign for equal pay, equal leadership and equal opportunities for women by 2030. The organisation presents a "WiRE Woman of the Year" award, plus "Woman of Distinction" awards in the solar, wind and hydropower sectors. The awards recognise accomplishments in a variety of areas, including leadership, policy and advocacy, technical advancement and R&D, project development, community adoption of renewable energy technologies, and contributing to the advancement of women in the energy sector by volunteering or serving as a role model.

Source: C3E, 2018; WiRE, 2018.



### 2.3.3. Access to education and training

Access to adequate education and training opportunities is essential if women are to develop their skills and seize employment opportunities in renewable energy. This sub-section discusses curriculum change, targeted scholarships and internships, and vocational training opportunities for women.

Governments can encourage and incentivise educational institutions to work with companies, industry associations and organisations advocating gender equality to better align their educational offerings with employment in the renewable energy sector. Fields such as environmental science and policy, biology, geography, public policy and administration, law, business and health, which tend to enrol large numbers of female students, can become important avenues of recruitment for the renewable energy industry.

But efforts to attract more women into technical and engineering studies remains a critical goal, one to which several organisations and networks are dedicated. Some, like WiRE (see Box 2.4), are specifically focused on the renewable energy

sector. Others, like WiTEC (the European Association for Women in Science, Technology, Engineering and Mathematics, formed in 1988) have a broader mission (WiTEC, n.d.). The European Center for Women and Technology (ECWT) is a more recent partnership of more than 130 organisations, bringing together expertise from government, business, academia and the non-profit sector (ECWT, n.d.).

**University curricula** can be adapted to be more open to women. At the University of California, Berkeley, 2014 was the first year that more women than men enrolled in an introductory computer science course. An important factor was that the curriculum had begun to emphasise group projects and creative thinking in addition to programming (Finley, 2014).

At the Massachusetts Institute of Technology, female enrolment in the Department of Electrical Engineering and Computer Science doubled between 2011 and 2017 and the share of female majors rose from 30% to 38%. In parallel, the institution's Department of Mechanical Engineering has seen sustained female major enrolment rates of more than 40% over the past five years. In both de-

partments the number of female students increased markedly following changes in the curriculum, content and pedagogy. The most rapid period of growth in female students also coincided with the department being headed for the first time by a woman (Huang *et al.*, 2017).

**Scholarships, internships and enrolment targets** can attract women into clean energy careers. Supported by several governments, the C3E initiative provides opportunities for scholarships, internships and academic and industry research appointments. Another example is the Women in Science Initiative established at King's College London in 2013 to address the imbalance of women working and studying in in STEM fields. The initiative established Women in Science Scholarships for undergraduates in mathematics, physics, computer science and chemistry. Further, a gender equality student fund was established to support innovative projects, activities and events that promote gender equality in STEM (Kings' College London, n.d.).

Another approach is to establish minimum enrolment rates. In India, the government decided to mandate that all 23 of the country's premier

engineering institutes, the Indian Institutes of Technology, increase enrolments of girls to 14% in 2018; results have been encouraging (Ibrar, 2018).

It is also important to widen opportunities for women in **vocational training**. An application scorecard developed by the South African Renewable Energy Technology Centre, for example, allocates double points for female applicants. In Kenya, the Strathmore Energy Research Centre (SERC) has conducted training courses for solar PV technicians with the express purpose of enlarging the pool of female solar PV technicians. A five-day course in 2015 included not only training for technicians and trainers, but also educational workshops for policy makers. Gender awareness was integrated into the curriculum to promote women's access to and participation in vocational education related to renewable energy technologies (Strathmore University, 2015).

#### 2.3.4. Gender targets and quotas

Improving gender diversity in the workplace is, most immediately, an issue for individual companies and other organisations to address, but governments have an important role to play where progress is lacking.

**Numerical goals for gender diversity and equity** can be an important indicator of progress. They include targets for recruitment of new staff, as well as greater gender balance in the overall workforce.

For example, Engineers Canada adopted its “30-by-30” programme in 2011 to raise the number of newly licensed female engineers in Canada to 30% by 2030 (Engineers Canada, 2018). In 2017, Engineers Australia announced a target to have women make up 30% of its 100 000 member organisation by 2020 (Engineers Australia, 2017). A McKinsey review of 118 US companies and 30 000 employees found that companies with gender targets made the most tangible progress toward gender balance and equity, while those without targets lost ground (McKinsey & Company and LeanIn.org, 2015).

The best demonstration effect occurs when women are able to climb the internal ladder to leadership positions. But even if one must recruit from the outside until an adequate pool of senior female talent is established, hiring women from the outside sends an important signal that gender equity is a serious commitment.

Voluntary measures do not necessarily translate into sufficient progress, as shown in a joint survey of US workplaces by McKinsey and LeanIn.org based on data from 279 US com-

panies that employ more than 13 million people (Krivkovich *et al.*, 2018). Governments may thus need to take action to widen opportunities for women's participation in the economy and in the renewable energy sector.

Several OECD countries have adopted nationwide goals or targets to increase the number of women in engineering and technical fields. Countries that have instituted mandatory quotas have achieved a higher level of representation of women in the boardroom, and done so more rapidly, than countries that have opted instead to encourage gender diversity via a “comply or explain” approach, which requires them to adopt mechanisms that consider the representation of women or explain the reason for not doing so.

In France, for example, women held 37.6% of the board seats at companies surveyed in 2016 by Morgan Stanley Capital International, representing substantial progress toward the country's mandatory 40% quota to be met by 2017. In Germany, which has implemented a quota of 30% by 2017, women held 26.7% of board seats in 2016, and in Norway, which requires that women make up 40% of the board, 39% of the board seats were held by women (MacDougall *et al.*, 2017).

To date, national energy policies rarely include any gender equity targets (Rojas *et al.*, 2015). Conversely, national gender equity policies rarely include any targets specific to equity in access to energy services, or employment in the energy sector (Pearl-Martinez, 2014). But government action can either **encourage or mandate renewable**

**energy companies to establish targets for the share of women in their overall workforce** and in certain categories such as technical, engineering and management staff. Such targets can most obviously be introduced where public policy support generates an enabling environment such as through feed-in tariffs, auctions, or where companies benefit from financial incentives.

Some countries have adopted measures to correct for historical imbalances or injustices. In South Africa, for example, the Renewable Energy Independent Power Producers Procurement Programme has sought to enhance the role of women. Gender metrics exist for top management, preferential procurement of inputs from women-owned vendors and overall job creation.

Namibia's Equitable Economic Empowerment Policy seeks to include "previously disadvantaged Namibians" - a group that includes blacks, women and people living with disabilities- in tender processes for renewables. Scoring elements include, among others, ownership or shareholding, with particular emphasis on women and disabled individuals, and management or board positions held by the previously disadvantaged (IRENA, forthcoming 2019).

### 2.3.5. Workplace practices, policies and regulations

Another critical area concerns policies and regulations that help foster more gender-sensitive and non-discriminatory workplace practices. For instance, a European Parliament resolution on jobs in a sustainable economy calls on governments to "create work environments that attract and retain women, promote work-life balance through adequate, high-quality child-care 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).

This sub-section discusses measures directly affecting workplace practices - top leadership commitment, mentoring, and pay equity.

Measures to improve workplace gender equity could be mandated by national law or adopted voluntarily by individual companies and organisations as a key performance indicator. But declaring a lofty goal is not enough. To actually achieve a better gender balance in the workplace requires careful implementation: **fair and transparent internal processes** governing employee appraisal and promotion, and establishment of **appropriate systems to measure and track progress**.

Experience across many industries yields a consistent conclusion that will also need to be taken to heart in the renewable energy sector: The proactive commitment of senior leadership, such as the

CEO or president of a company, is indispensable (Orser, 2001). People in leadership positions need to specify gender equity as a priority, formulate clear plans and goals for its implementation and establish effective mechanisms and processes to ensure that day-to-day practices change accordingly.

Mentorship programmes can help make the workplace more welcoming to women and supportive of their career development by helping them to overcome hesitations in the face of traditional perceptions and stereotypes and, once hired, allowing them to thrive with the support of experienced colleagues and peers. Mentorship comes in many forms, some of which were explored in Section 2.3.2. It can take place in a low-key fashion in day-to-day work situations, but it can also entail supporting women's participation in conferences, workshops, councils and training opportunities to assist in personal development, as well as encouraging people to participate in networking activities.

**Understanding and addressing wage gaps** is another important issue. This chapter has already pointed to the perception of inequities. To some extent, wage differentials reflect the



general gender bias in the workforce structure, *i.e.*, women predominantly occupying non-technical and lower-paid positions. However, there is also a need to ensure that equal work receives equal pay.

Efforts in this direction have begun. “Equal by 30” is a public commitment by public and private sector organizations to work towards equal pay, equal leadership and equal opportunities for women in the clean energy sector by 2030. The initiative asks organizations, companies and governments to endorse a set of principles, undertake specific, measurable commitments and report on progress by May 2019 (Equal by 30, 2018).

The European Union issued an equal pay directive, though enforcement has been ineffective, with the gender pay gap remaining at an average of 16.4% across the EU member states (European Parliament, 2018). In Iceland, public utility Reykjavik Energy adopted policies to eliminate the gender pay gap. With the help of software developed by Pay Analytics, the company was able to show in real time the effects of each pay decision on the gender wage gap. This helped the company to drastically shrink

its wage gap from 8.4% in 2008 to just 0.3% by the end of 2017. The company also succeeded in its target of filling half of all management positions with women (USAID, 2018).

Another encouraging recent example is found at Energy Australia, an electric and gas utility. The firm announced in March 2018 that women would be paid the same amount as men for doing the same job and that it was spending USD 0.85 million (AUD 1.2 million) immediately to boost the pay of 350 women. The utility, led by a female CEO, also announced that it would conduct a review in five years to ensure continued pay equality (Morgan, 2018).

Closing gender gaps can be difficult, even for companies that are committed to this goal. Good Energy, a UK company that buys and distributes 100% renewable electricity from independent generators and is led by a female founder-CEO, reports a mean gender pay gap of 8% – comparing favourably to the UK energy sector and national economy. But the rate rises to 23% if median earnings rather than averages are compared. The disparity exists because there are fewer women than

men in middle management. Women make up 52% of total staff, but 61% of those in the lowest pay quartile and just 42% in the highest quartile (Good Energy, 2018).

All publicly and privately held renewable energy employers should be encouraged to adopt policies to make wage information more transparent. Even anonymised salary data grouped by qualifications, skills and years of experience would enable applicants to understand what fair salaries are like at specific career stages. All entry-level workers should be able to understand the career trajectories and possibilities for advancement specific to their sector. This would help level the playing field for women who, as explained earlier, are more likely to lack the familial and social connections that often provide men with information about career and salary trajectories.

Making pay scales more transparent can make an even bigger difference in addressing gender-wage equity over the course of women’s careers, especially if it is coupled with institutional mechanisms for reporting and correcting wage differences.

### 2.3.6. Work-life balance

Various means of reducing working hours or adding flexibility can help to balance the mix of social, household and professional roles and responsibilities that women often face. This section discusses such arrangements – part-time, flexi-time, and job sharing – and related findings from the IRENA survey.

Other important measures to improve work-life balance are paid leave (specifically paid maternity/paternity leave), on-site childcare facilities and stipends or subsidies for childcare services. Almost all organisations participating in IRENA's survey – 96% – provide at least one of the above-mentioned benefits for full-time employees.

Holding a full-time job can be difficult for women who carry a double burden of working while also raising children or providing other care or household services.



**Part-time employment, flexi-time and job-sharing arrangements** (see Box 2.5) can, in principle, provide a degree of “time sovereignty” to female workers, making it easier for them to enter and remain in the labour force. Both part-time and flexi-time arrangements are among the most-favoured options among survey respondents. By contrast, job sharing was ranked low among options already offered in workplaces

and in the list of measures desired by respondents.

The survey shows that 63% of all organisations participating in the survey offer part-time work and survey participants indicated that this can be important in reducing gender barriers. Availability varies. While NGOs score highest at 84%, only 40% of governments and IGOs allow part-time work (or similar measures such as working from

#### Box 2.5 Definitions of part-time work, flexi-time, and job-sharing

**Part-time work** is usually defined as a specific number of work hours that make up less than a full work week, but the threshold varies among countries. The specific distribution of work hours across a week, month or year can vary strongly. The share of part-time workers in overall employment has generally increased in developed countries but remains low in most developing countries. Women are believed to represent close to 60% of all part-time workers, a much higher portion than their share of the total workforce.

**Flexi-time** (also called flex-time) is a system in which people work a set number of hours within a given period, but the starting and finishing times are chosen by the employee within agreed limits (e.g., core working hours are not subject to flexi-time arrangements). Pay and benefits should in principle be unaffected, since there is no net reduction of working hours.

**Job sharing** is an arrangement under which two people voluntarily share the responsibilities of one full time job. The individuals involved work as a team to complete a given task and share responsibility for the overall workload. Job sharing may involve people working half days, alternate days or alternate weeks. Total working hours are typically divided equally among job sharers, who receive salary and benefits on pro-rata basis.

Sources: ILO, 2004, n.d.; Business Dictionary, n.d.

# 63%

of organisations participating in the survey offer part-time work

home and flexi-time). Private sector companies perform better than public sector entities, with an average of 62%. Survey results confirm that the availability of part-time slightly increases the share of women in the workforce. Compared with their 32% share of full-time employment,

women account for 36% of part-time workers.

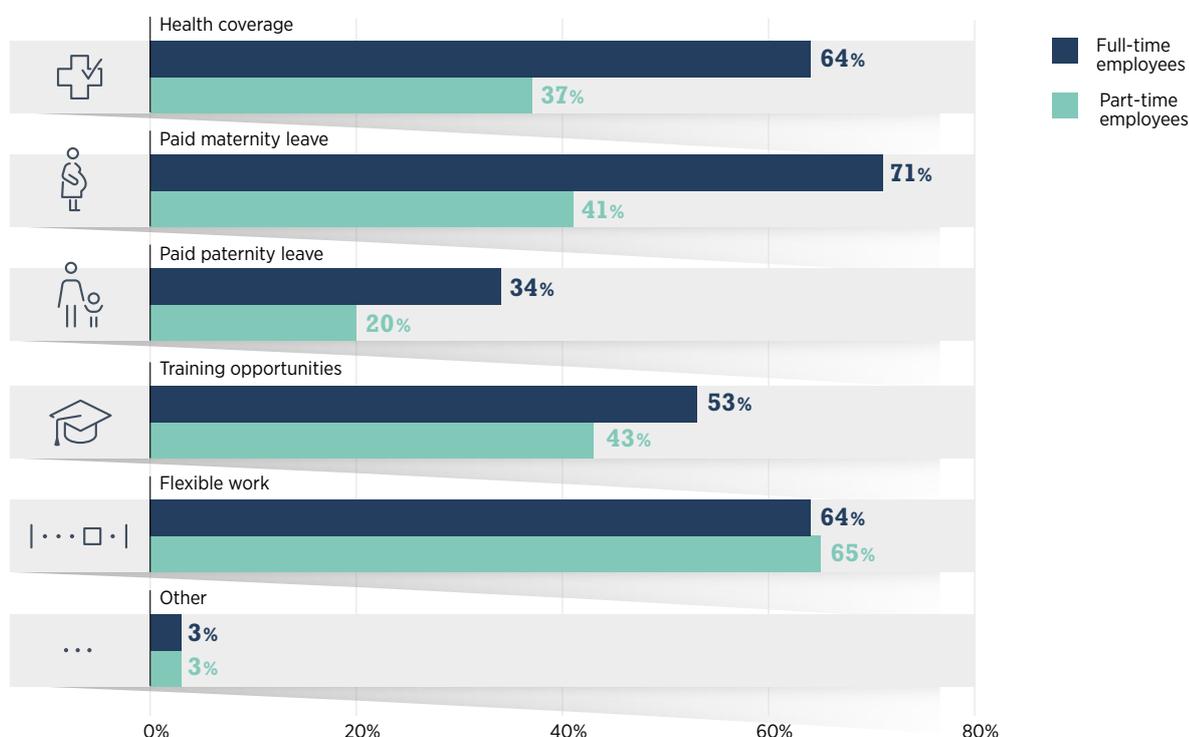
Arrangements may be voluntary or involuntary, and opportunities to switch between part-time and full-time status may not be available (ILO, n.d.). Part-time work implies lower total earnings owing to fewer work hours; it typically offers reduced benefits (such as vacation days, paid sick leave, health insurance, social security benefits, etc.) compared with full-time jobs or no benefits at all.

Close to two-thirds of full-time employees responding to the survey have health insurance through their employers, while only 37% of part-time employees do (see Figure 2.10). The difference is similarly pronounced for maternity and

paternity leave. But there is less of a gap when it comes to training opportunities. With regard to the availability of flexible working hours, no difference is discernible.

Part-time workers run the risk of reduced status in the workplace and greater likelihood of layoffs. Other potential disadvantages include limited career progression and training opportunities, “work intensification” (part-time hours with a full-time workload) or irregular working hours (including “on-call work” that lacks predictable hours and offers flexibility to the employer at the expense of the worker). There may also be gender discrimination in the sense of poorer terms and conditions for women than for men (ILO, n.d.).

**Figure 2.10** Comparison of benefits among full- and part-time employees



Source: IRENA online gender survey, 2018.

Although flexible work schedules and job sharing can give an employee a greater degree of personal control over work and life schedules and an ability to better meet family needs, the delineation between work and leisure times may become indistinct (Heathfield, 2018). In a world where home computers, mobile phones and tablets, instant messaging and cloud computing have become ubiquitous, the line is increasingly blurred irrespective of formal worktime arrangements.

An important task is to ensure that women do not incur unfair disadvantages from childbirth and child-rearing. **Adequate paid parental leave** policies can help in this regard. Such leave should not be limited to women; paternal leave can help parents share the burden of child rearing. But such policies need to be coupled with public policy measures or corporate undertakings to allow women (and men) to resume the positions they held previously without sidelining their career prospects. In addition, on-site childcare facilities can provide a good transition back to the workplace after a period of parental leave.



**69% | 37%**  
 share of full-time and part-time respondents with maternity leave benefits

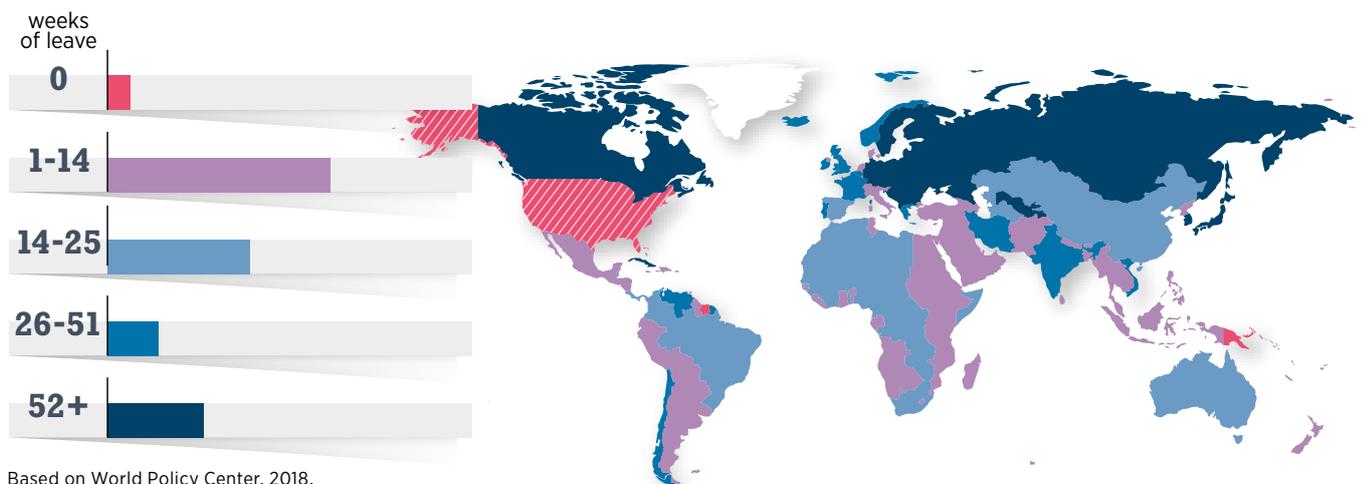
Policies vary widely among different countries and regions. Corporate practices may in many cases merely reflect local legal requirements. As of 2014, a total of 83 countries offer paid maternity leave of up to 14 weeks; another 53 provide 14-25 weeks, 18 offer 26-51 weeks, while 36 offer 52 weeks or more (see Figure 2.11). Some 70 countries worldwide also offer paid paternity leave.

By sharp contrast, the United States is one of just nine countries worldwide that have no legal requirement of paid maternity leave at all (Etehad and Lin, 2016). In those countries, private executives decide how hospitable their workplace will be to women.

Where there is no legal requirement, companies may still decide to offer the benefit voluntarily, an option enjoyed by 12% of workers in the United States (Covert, 2014).

Among respondents to IRENA's survey, 69% indicated that paid maternity leave is available for full-time employees. But for part-time workers, the share drops to 37%. There is also a marked difference between full-time and part-time employees when it comes to paternity leave. But the percentages are much lower than for maternity leave (see Figure 2.12). This suggests that childcare continues to be primarily the responsibility of women.

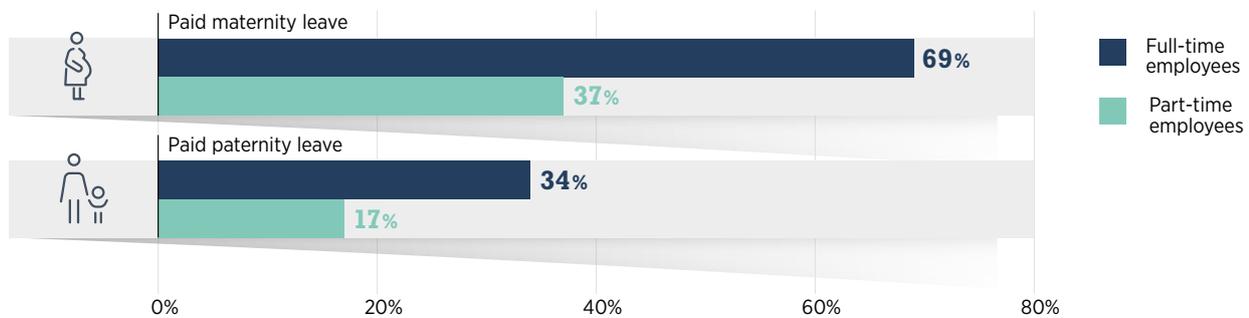
**Figure 2.11** Paid maternal leave, in weeks



Based on World Policy Center, 2018.

Note: The striped area across the United States indicates that while there is no stipulated maternity leave on the national level, companies with over 50 employees have obligations to offer up to 12 weeks of unpaid leave for 'expanding family' reasons under the Family and Medical Leave Act (FMLA). Some independent states follow varied forms of maternity leave entitlement, including California, New Jersey, New York, and Rhode Island, who offer partially paid leave (NCSL, 2016; U.S. Department of Labor, n.d.).

**Figure 2.12** Availability of paid maternity and paternity leave for full-time and part-time employees in renewable energy



Source: IRENA online gender survey, 2018.

## 2.4. Conclusions

IRENA's survey confirms that women represent a higher share of the workforce in the renewable energy sector compared to conventional energy. However, they remain under-represented. The reasons are relatively well understood. They range from persistent and confining stereotypes about gender roles, to gender imbalances in the STEM fields and lack of adequate awareness about non-STEM career trajectories in the renewable energy sector, to a strong inertia embedded in institutions and networks in both the private and public sectors.

These barriers are not exclusive to the energy sector, but rather are encountered in the economy and society at large. Although there are promising examples of governmental, corporate and non-profit initiatives and practices to improve the situation, change has been slow.

Underlying social and cultural norms are typically slow to change, which obviously affects how effective

overt gender-related measures can be. But the conclusion is not to discard such measures, but rather to think of them as the tools that can accelerate normative change. This is underlined by an important fact: survey respondents who have access to benefits such as maternity leave or training opportunities and who can rely on gender diversity targets and on fair and transparent decision-making processes in the workplace are far less likely to perceive gender barriers than those respondents who do not enjoy similar benefits.

Individuals from organisations that have fair policies in place reported 10% lower levels of perceived barriers to female employment. Reported perceptions of barriers were also lower for people entitled to paid maternity leave (9%), those who benefit from gender targets (8%), and those with access to training opportunities (7%). The availability of paternity leave and child care facilities also had a significant positive impact on the perception of barriers to female employment,

although relatively few employers offered these benefits.

This chapter provided actionable policy recommendations that can level the playing field for women in the renewable energy sector. The recommendations include: mainstreaming gender perspectives into organisational decision-making; enforcing equal pay legislation; supporting networking, mentoring and other forms of professional development for female employees; adopting and enforcing policies to accommodate caregiving responsibilities and provide better work-life balance for all employees; improving access to education and training programmes through post-secondary courses, internships, scholarships and apprenticeships; and enforcing gender targets and quotas to ensure a critical mass of female employees at all levels of management, as well as in technical and operational roles.

**empowerment**

/ɛm'paʊəmə(ə)nt/

*noun* 1. the power, right, authority or ability to do something.

# 3

## Women in Renewable Energy: **Access Context**

### 3.1. Background

Globally, the number of people without access to electricity fell below 1 billion for the first time in 2016. The number without access to clean cooking facilities has been gradually declining, but still accounted for nearly 3 billion globally in 2016 (World Bank, 2018).

The lack of access to modern energy affects women and children disproportionately. A large amount of their time and labour is spent on unpaid care work, subsistence and productive tasks (e.g., gathering fuelwood for cooking, fetching water, manually processing grain or other food) (World Bank, 2017).

Indoor air pollution resulting from the use of traditional fuels for cooking and limitations on the delivery of healthcare, education, water and other basic public services owing to the lack of modern energy also has a far greater impact on women and children than on men.

Access to affordable, reliable and sustainable modern energy can have a transformative impact on productivity, incomes and overall well-being. It frees up time for women collecting fuelwood and enables time-shifting of tasks with access to lighting, opening new opportunities for leisure, part-time work and income-generating activities. There are also strong cross-cutting links to other sectors, including improved education opportunities for girls, safety, and access to media (IRENA, 2016b; World Bank, 2011).

Yet sustainable, modern energy infrastructure and technology tend to reach women last (UN Women, 2018). To ensure equitable and inclusive outcomes of efforts to improve energy access, the gender perspective needs to be mainstreamed in access programmes. Women, who often are the primary energy users in households, have different energy

needs from men and use energy differently, with varying preferences and priorities.

Those differences should be addressed in policy and programme design. Women should be involved from start to finish in energy access programmes and empowered to become more involved in providing modern energy services. They can take on different roles, including as engaged end-users, community mobilisers, technicians, and part-time and full-time employees and entrepreneurs. Women also bring to the table different social networks from men and tend to have access to hard-to-reach households to deploy modern energy solutions (SEforAll, 2017).

This chapter focuses on the gender dimension in the deployment of off-grid renewable energy solutions for improving access to modern energy.<sup>5</sup>



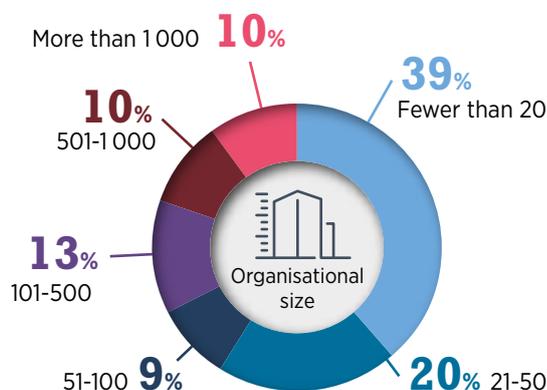
<sup>5</sup> This chapter focuses exclusively on modern energy access through off-grid renewable energy solutions. Gender considerations for grid-based electrification is briefly discussed in Box 3.10.

Off-grid solutions, including stand-alone systems and mini-grids, are now recognised as vital for achieving universal modern energy access by 2030 – one of the targets of Sustainable Development Goal 7 on energy. The decentralised and modular nature of these solutions offers **greater opportunities – compared to grid-based solutions – for engaging women** in design, delivery and operations and in realising co-benefits related to gender equality and empowerment.

The chapter analyses the key challenges faced by women in participating in this segment of the renewable energy sector (Section 3.2.), as well as potential solutions to address those challenges (Section 3.3.). In so doing, the chapter draws insights from the literature, case studies and the global online survey conducted by IRENA, which included a dedicated set of questions for organisations and individuals working in projects or programmes to expand energy access.

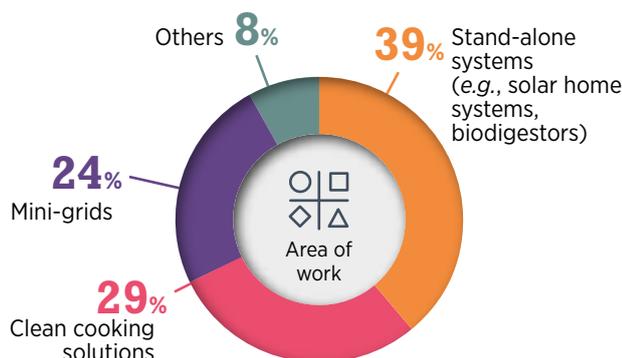
Over 835 respondents active in the energy access context filled out the survey. Of these, 180 answered questions pertaining solely to that context, while the others also responded to questions relating to

**Figure 3.1** Organisational size reported by respondents to the energy access survey



Source: IRENA online gender survey, 2018.

**Figure 3.2** Area of work of organisations responding to the energy access survey



Source: IRENA online gender survey, 2018.

the modern context (which was the subject of the previous chapter).

Compared to the overall sample, respondents to the energy access portion of the survey belonged to small organisations. As seen in Figure 3.1, the majority of responding organisations employed fewer than 50 people (59%). This represents the engagement of small- and medium-sized institutions in the renewables-based energy access sector.

The organisations filling out the survey tend to specialise in stand-alone systems (38%; e.g., solar home systems, household biodigestors), clean cooking solutions (29%) and mini-grids (24%) (see Figure 3.2). Several organisations (8%) represented in the survey were also engaged in policy making, planning, technical standards setting and capacity building.

# 66%

of respondents believe that women face barriers in the renewables-based energy access sector



## 3.2. Barriers and challenges

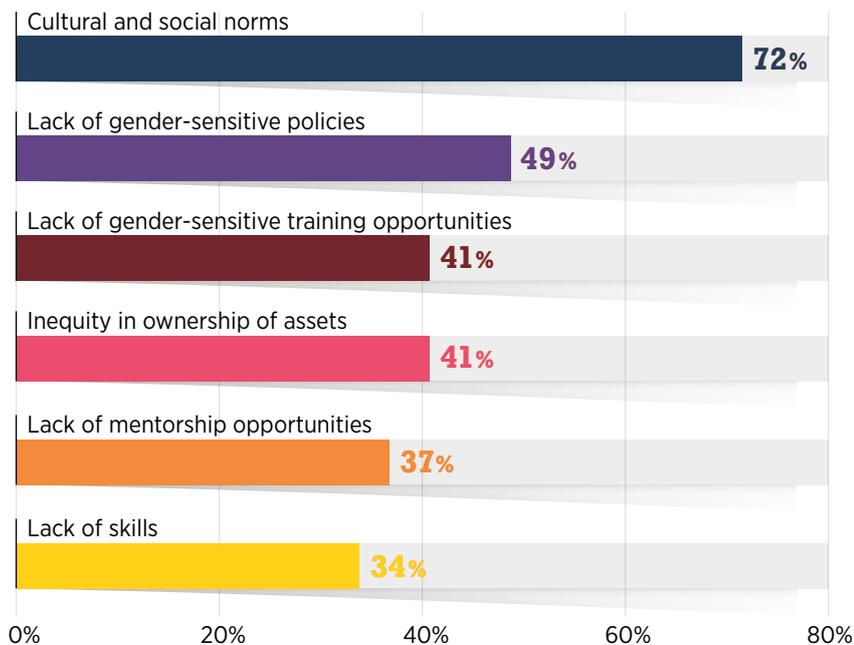
Over two-thirds (66%) of survey respondents stated their belief that women working or seeking work in expanding access through renewable energy faced barriers. The responses did not differ significantly by region, type of organisation, organisation

size or level of female employment in the organisation.

The barriers were associated with several factors. **Cultural and social norms** were cited by respondents as the most common barrier to women's participation in the access sector,

followed by **lack of gender-sensitive policies** and **training opportunities and inequity in ownership of assets** (see Figure 3.3). Security and the remoteness of field locations were also mentioned as other barriers to women's participation.

**Figure 3.3** Barriers to women's participation in deploying renewables to expand energy access



Source: IRENA online gender survey, 2018.

Note: Respondents were asked to select three barriers to women's engagement in deploying renewables to expand energy access. The percentages represent the share of respondents who selected a specific measure as one of their top three.



Cultural and social norms was also the barrier selected most often in all regions, but much more often by respondents in Europe and North America (see Figure 3.4). For the other three barriers, respondents from Europe and North America emphasised the importance of unequal asset ownership, while respondents from other regions were much more likely to select the lack of skills and training as important barriers.

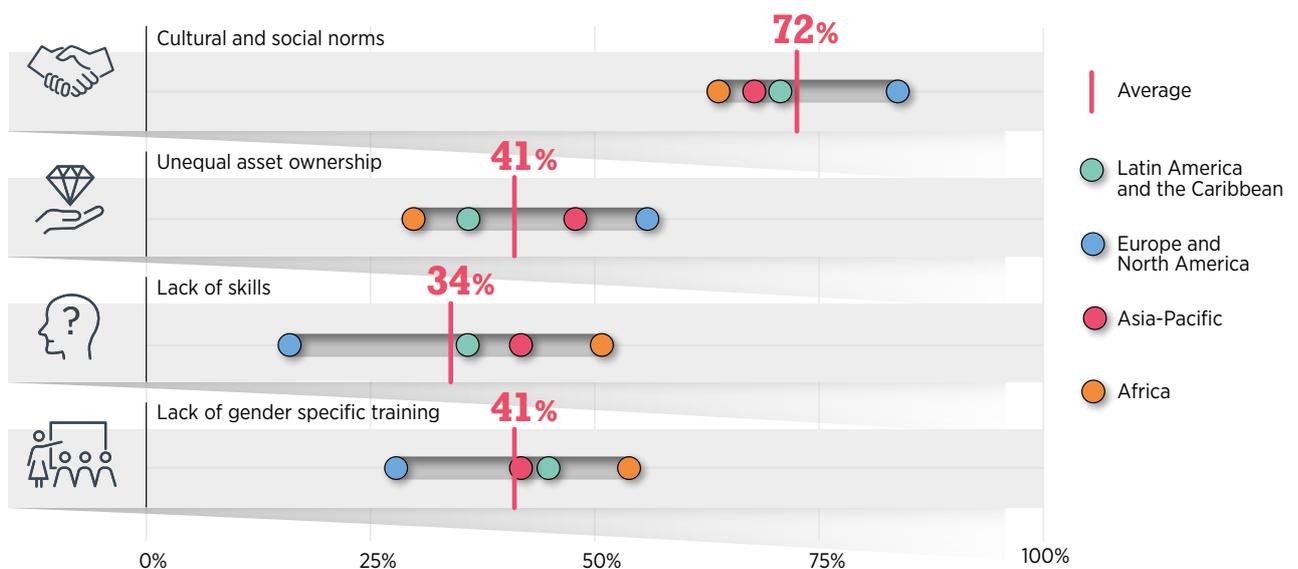
### 3.2.1. Cultural and social norms

Cultural and social norms often make it difficult for women to engage fully in the economic and political spheres. The gender division of labour results in women allotting a **significant amount of their time to household work and childcare (and elderly care) responsibilities**, and consequently having limited skills and time to engage in formal, paid activities that predominantly

employ men (SEforAll, 2018). In some cases, women (and children) spend on average 1.4 hours a day collecting solid fuels and several hours cooking with inefficient stoves, leaving them less time to pursue other economic, family or leisure activities (UN Women, 2018).

Women also tend to have **less access to information, skills, training and labour markets**, while facing greater risks of violence. This influences their decision-making power and

**Figure 3.4** Regional distribution of responses on barriers to women’s participation in the energy access context



Source: IRENA online gender survey, 2018.



# 72%

of respondents cited cultural and social norms as one of the top three barriers

exercise of voice and agency, and constrains their access to land and productive resources, technology and information, and education and health services.

Cultural and social norms and power hierarchies strongly influence **women's ability to participate in energy access programmes**. As an example, women are often disadvantaged in gaining access to energy by the fact that men typically make the purchasing decisions within the household. Since kerosene, diesel and other fossil fuels tend to be expensive, men are often more willing to purchase or seek financing for technologies such as solar lighting systems that can save money (and are perceived to be beneficial for the entire family) than technologies such as clean cookstoves that reduce women's drudgery and "time poverty" (Baruah, 2015).



Understanding how **intra-household gender hierarchies influence technology access** is crucial for designing effective responses to address them. Women may also use different communication and information channels than men, as they have lower literacy rates, less access to television and radio, and less time to attend public meetings. They may even be reluctant to express their views at meetings (United Nations, 2018).

As **primary users of energy** in the household, women's direct engagement in renewable energy projects is critical to ensuring that the projects have a positive impact and are widely used and accepted by their intended beneficiaries. Because women are typically responsible for cooking, they often have a **comparative advantage in reaching out to other end-users** of clean cookstoves.

In Kenya, customers who bought clean cookstoves from women were more likely to use them efficiently and reported preferring them to their traditional cookstoves because women were more knowledgeable about the cookstoves than men. Consequently, evidence suggests that

involving women as entrepreneurs in the clean cooking value chain can result in women selling three times as many cookstoves as men (Clean Cooking Alliance, 2015).

The fact that large numbers of women in the energy access context are engaged in selling and promoting clean cookstoves has led to a tendency within the energy sector to classify household needs for clean cooking technologies as "women's needs".

Categorising goods and services that all families need to survive – water, sanitation and childcare are other examples – as "women's needs" only serves to maintain the sexual division of labour and to reinforce entrenched gender inequalities.

Making normative assumptions about women's nurturing roles perpetuates and deepens gender divides through a feminisation of certain responsibilities and obligations. Organisations in the renewable energy sector should avoid the rhetoric of cooking technologies as women's needs. They should describe and promote them as general human needs.



# 49%

of respondents cited lack of gender-sensitive policies as a key barrier

### 3.2.2. Lack of gender-sensitive programmes and policies

Gender-blind energy sector policies and programmes fail to integrate women's experiences, expertise and capacities, and risk further exacerbating the gender gap between men and women in the energy access context. An examination of renewable energy policies in 33 countries by the United States Agency for International Development (USAID) and ENERGIA found that only 6 policies (18%) included gender keywords and considerations.

Moreover, when referring to themes on energy access and women's engagement in the sector, the policies often referred to gender issues through terms such as "vulnerable", "recipients" and "beneficiaries". The acknowledgement of women as passive beneficiaries does not make these programmes gender sensitive, although progress is being made to address such concerns (Clancy *et al.*, 2017; Glemarec *et al.*, 2016).

For example, Zambia's National Energy Policy (2008) identifies measures to mainstream gender considerations in all energy access programmes and highlights the role of women not only as beneficiaries, but also active energy providers and entrepreneurs within the sector (Clancy *et al.*, 2017; ENERGIA, 2011).

For energy projects to have an effective gender-sensitive approach, it is essential that they **highlight the participatory and active role of women in programme implementation** and adequate budgetary provisions are in place within relevant ministries, programmes and schemes to support gender-related activities. Social impact assessments, consultations and policy development often do not adequately address women as stakeholders and often exclude them from the planning of energy programmes along with other marginalised groups such as youth, ethnic or religious minorities and people with disabilities (UNDG, 2014).

### 3.2.3. Lack of skills and gender-specific training opportunities

The lack of skills is a key barrier faced by women seeking to participate in efforts to expand modern energy access through off-grid renewable energy solutions. To overcome it, over 40% of the respondents highlighted the importance of tailored training opportunities for women.

Capacity building along the off-grid renewable energy value chain is vital for long-term operation and sustainability of the systems, and project proponents often recognise the value of engaging local capacity and investing in skills development. These skills range from the technical (involving installation, operation and maintenance) to business-related (including accounting, bookkeeping, product design and pricing, and business plan design).

Non-energy-related skills, such as leadership training and digital literacy, are also becoming crucial. Mobile payment services in Kenya, for instance, have opened new opportunities, and have been shown to reduce poverty among female-headed households and to stimulate an occupational shift from farming to business (Suri and Jack, 2016).

# 41%

of respondents cited lack of gender-specific training opportunities as a barrier

**Training opportunities are often not equally accessible by men and women.** There are several reasons for this. One relates to cultural and social norms, especially where such norms are deeply entrenched. Even if women have the enthusiasm and motivation to be engaged in the off-grid renewables supply chain (e.g., as distributors), they may be discouraged by others in the household from attending/continuing the training, or from working after completing the training (EEP, 2017).

**Social norms often also broaden the gender gap** in measures of human capital such as financial literacy and entrepreneurial management. As such, women are more likely to partake in minor income-generating activities in informal sectors related to cooking and sewing, and less likely to participate in more technical sectors such as renewable energy. The low profitability of these women-led businesses in the informal sector results in a lower likelihood that households will invest in women's education and training. This creates a vicious cycle that relegates women to informal and unpaid work (ENERGIA, 2016).

In the instances where women are offered training opportunities, time constraints linked to domestic responsibilities, travel constraints and the self-perception that they lack the prerequisite knowledge or skills to benefit from trainings and workshops leads to lower attendance (Inter-American Development Bank, 2014; Buvinic and O'Donnell, 2016).



### 3.3. Policies and solutions

The link between gender inclusion and energy access is now well established (UN Women, 2016). Accordingly, stakeholders are paying more attention to the gender dimension in energy access and within the wider development agenda.

The declaration “Transforming Our World: The 2030 Agenda for Sustainable Development” adopted in 2015 by the UN General Assembly introduced a dedicated goal on gender equality, noting that “*gender equality and the empowerment of women and girls will make a contribution to progress across all the Goals and targets*”. The declaration further recognised that the “*systematic mainstreaming of a gender perspective in the implementation of the Agenda is crucial*” (United Nations, 2015).

In the context of SDG 7 on energy, a number of tools are now available to policy makers, development practitioners and financing institutions to support gender mainstreaming and encourage women's participation in the sector.<sup>6</sup>

Despite encouraging progress in the discourse on gender and energy access, substantial efforts are still needed, especially in enabling women's participation in the sector

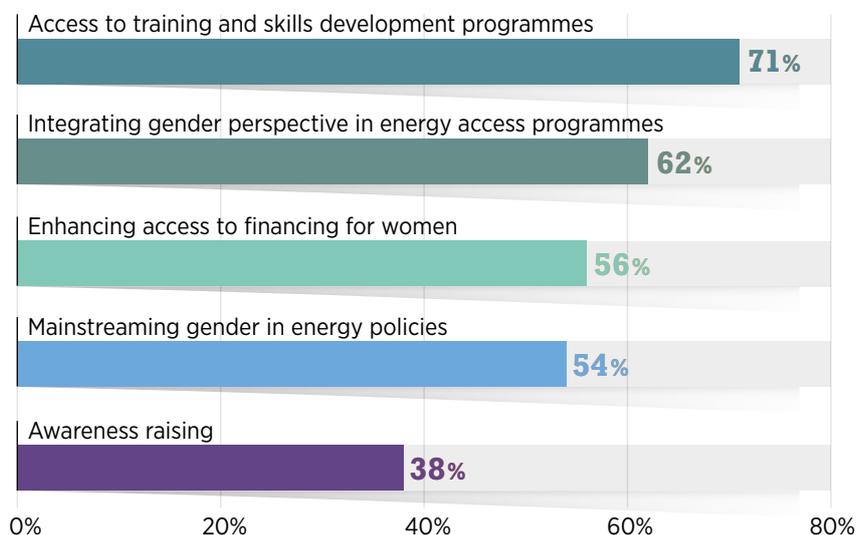
in different roles, including as energy entrepreneurs and in leadership positions. While the gender differentiated effect on women of poor access to modern energy is well understood and increasingly recognised, women's role as agents of change to scale up the adoption of off-grid renewable energy solutions has not yet been mainstreamed (UN Women, 2016).

In seeking solutions to improve women's engagement in the renewables sector for energy access, survey respondents highlighted first the importance of **access to training and skills-development programmes**. Over half the respondents also cited improving **access to finance** and **mainstreaming the gender perspective in energy access programmes** as important to improve women's engagement (see Figure 3.5).

Interestingly, there were some significant differences between regions, with respondents from Africa much more likely to suggest training and access to finance as measures and respondents from Europe and North America less likely to suggest a need for training. Selected measures are discussed in greater detail below.

<sup>6</sup> Some examples include ENERGIA's Mainstreaming Gender in Energy Projects: A Practical Handbook, UN Women's Guide on gender mainstreaming: Energy and climate change projects, ESMAP's Gender and Energy Online Toolkit for Practitioners, the World Bank's Mainstreaming Gender in Energy Projects - A Practical Handbook, and Asian Development Bank's Gender Tool Kit: Energy Going Beyond the Meter.

**Figure 3.5** Measures to improve women’s engagement in deploying renewables for energy access



Source: IRENA online gender survey, 2018.

Note: The respondents were asked to select three key measures to improve women’s engagement in deploying renewables for energy access. The percentages represent the share of respondents who selected a specific measure as one of their top three.

### 3.3.1. Improving access to training and skills-development programmes

Women’s participation in the energy sector cannot be enabled without adequate capacity building and training conducted at all levels of entry into the industry (ADB, 2018). A key prerequisite, if women are to play an active role in the deployment of off-grid renewable energy solutions, is **awareness of opportunities and access to necessary technical, business or leadership skills** (SNV, 2015).

The skills needed to take advantage of opportunities vary quite significantly. Some skills needed to install, operate and maintain off-grid solutions require little past education or prior experience and can be developed locally (IRENA, 2012) (see Box 3.1). For many technologies, training can be done on-site or on the job.

**71%**  
of respondents highlight that access to training and skills development should be a top priority

### Box 3.1 Training solar grandmothers: The case of Barefoot College

The “solar mama” programme at the Barefoot College is a well-documented example of the democratising power of off-grid renewable energy solutions and the transformative potential of training women in rural areas. The programme has trained over 1 000 women from more than 80 countries, leading to the deployment of at least 18 000 solar systems.

The trainees are often illiterate or semi-literate women who maintain strong roots in their rural villages and have the potential to play a key role in bringing off-grid solar solutions to remote, inaccessible villages. The initiative works to demystify the technology and place it in the hands of local communities. Over a period of six months, trainees receive instruction on assembly, installation, operation and maintenance of solar lanterns, lamps, parabolic cookers, water heaters and other devices. The women return to their villages with equipment to deliver sustainable electricity to their community and become role models for other women in the village.



Source: Deshpande, 2017; Barefoot College, n.d.; WIPO, 2009.

Several factors limit women’s access to training. A survey conducted among more than 6 000 women across 100 villages in four states of India found that the gaps identified in accessing training for renewables were related to quality, distance and cost (Khan, 2018).

Other factors cited in the literature are tied closely to **cultural and social norms, and to the traditional roles fulfilled by women in rural communities**. For instance, training sessions must be scheduled around women’s childcare responsibilities and be sensitive to mobility constraints and security concerns; programmes must consider social restrictions that may prohibit women

from participating actively (UN Women, 2016). Training and coaching programmes need to be customised to local contexts, the needs of women and informal businesses, and the communication medium most suitable for women (World Bank, 2017; Deloitte University Press, 2014; SEforAll, 2018).

**Broader training is needed in business, financing and leadership skills, product standards, and quality control**, among other areas (see Box 3.2). Marketing skills are especially needed for renewable energy technologies such as solar home systems and solar lanterns that are sold to households (IRENA, 2012). Training for women entrepreneurs

that combines finance and business training is more effective than either finance or business training alone, as will be discussed further on in this section.

The Energy Change Lab Tanzania has run a series of leadership courses named ‘Energy Safaris’ which lead participants, both men and women, through a problem-solving cycle related to an identified energy case. A young woman engineer who attended the first Energy Safari is now running a company doing consultancy, research and technical support in the wind and solar sector (Bavo, 2017; Malaki, 2018; Malaki & Mshare, 2018).

### Box 3.2 Empowering women through training: The case of Wonder Women in Indonesia

The Wonder Women programme, an initiative of the non-profit Kopernik, empowers women to expand last-mile electricity access through off-grid solutions. Since 2013, the programme has recruited more than 500 “wonder women”, who have sold more than 55 000 clean energy technologies (e.g., solar lighting solutions) reaching more than 250 000 people in some of Indonesia’s poorest and most remote areas. The programme provides training to female social entrepreneurs to develop their capacity to build and sustain businesses. The training focuses on technology use and maintenance, sales and marketing, bookkeeping and financial management, and public speaking. The entrepreneurs sell from home, through their networks, at market stalls and small shops, or at community events.

Surveys conducted after 12 months found that 21% become more empowered within their families – taking on a greater role in household decision making. Almost half of the survey’s respondents perceived an improvement in their status and 19% have increased their empowerment within the community. Wonder women often become a pillar of support and inspiration for other women in the village, encouraging them to join the programme or support other economic activities.

Source: IRENA, 2018c.



# 62%

of respondents cited gender-sensitive programmes as one of their top three measures

Training and skills development are important catalysts of gender equality in efforts to expand access to energy. **Certification programmes** standardise competencies for specific roles support delivery of quality training, increase employability and enhance market sustainability.

IRENA is presently supporting the ECOWAS Centre for Renewable Energy and Energy Efficiency in establishing a regional certification scheme for solar PV installers. The scheme will be implemented in partnership with national examination experts, guided by the ISO 17024 standard and its

requirements for off-grid solar PV installers. Twenty-one training institutes from eight countries are expected to benefit from the project.

While skills development is important, training alone is unlikely to address all existing barriers women face in engaging in the sector. Future initiatives to engender market transformation efforts should aim at **removing all key barriers and associated risks in an integrated manner** (Glemarec *et al.*, 2016).

### 3.3.2. Integrating gender in energy access programmes

The decentralised nature of off-grid renewable energy solutions provides greater opportunities for tailoring energy services to gender-differentiated needs and for engaging women in the development and management of energy infrastructure.

Advocating for strategies and planning approaches that include women at every stage of the design, implementation, delivery and monitoring of energy services is critical if those services are to respond to women's needs and priorities. This means that gender mainstreaming needs to occur at different levels, beginning with regional and national policy making and planning, through to the design of programmes and delivery models, and continuing during project implementation and monitoring.

### National energy access strategies and plans

are only beginning to consider off-grid renewable energy solutions as a mainstream option to accelerate the rate of expansion in access to energy. A stable and dedicated policy and regulatory environment for off-grid solutions is a crucial first step in supporting the long-term development of the sector.

In the renewable energy mini-grid sub-sector, for instance, a growing number of countries are introducing dedicated regulations that tackle key investment risks such as licensing and legal provisions, tariff setting and the timing of the arrival of the main grid (IRENA, 2018d). Related efforts are being made to integrate gender at the regional (see Box 3.3) and national levels. However, gender considerations are not widely integrated or highlighted in national energy access plans and emerging

policies and regulations for off-grid renewables.

A survey of 65 countries conducted in 2014 found that less than a third of the countries had appointed a gender focal point in the ministry of energy (IUCN, 2015). Where focal points are appointed, they often lack specific expertise on the linkages between energy and gender, as well as resources and mechanisms for integration (Ceasay and Gassama, 2015).

Gender audits, as tools to identify and analyse the factors that hinder efforts to mainstream gender in energy policy, can assess the capacities or potential to mainstream gender within public sector ministries, energy policies, implementation frameworks and budgets. Gender audits in Botswana, India and Senegal, among other developing countries, have been

#### Box 3.3 Policy on gender mainstreaming in energy access: The case of ECOWAS

In 2013, the Economic Community of West African States established its Programme on Gender Mainstreaming in Energy Access to mainstream gender in the formulation of policy and the design and implementation of energy projects and programmes across West Africa. A dedicated policy for mainstreaming gender in energy access aims to ensure that the 2030 objective of universal modern energy access is met by making women part of the solution, leveraging the role of women as energy users, community members, business owners and policy makers.

The policy was endorsed in 2015; implementation is now in progress. A legal directive mandating gender assessments in energy projects was validated by energy regulators in 2017, although the directive provides flexibility for each member state to determine how to integrate the provisions into existing legislation.

The progress in West Africa has been used as a blueprint for others, with the East African regional centre publishing its Gender and Sustainable Energy Situation Analysis in 2018. This baseline study on gender and women's empowerment in East Africa identifies barriers and achievements to gender equality, and examines the policies and regulatory frameworks that support gender mainstreaming and the mobilisation of support for women's engagement in the energy sector.

Source: ECREEE, 2015; Clancy *et al.*, 2016; ; EACREEE, 2018.

used to support the integration of gender sensitive energy policies into development programmes such as energy access projects (Glemarec *et al.*, 2016). **Promoting interaction between different sectors, such as primary health, education and water, is key for women’s economic empowerment and advancement and can help formulate solutions that look at the entire ecosystem and maximise the benefits.**

**Development financing institutions and agencies** that often design, manage, implement and finance energy access programmes strongly influence practices related to gender mainstreaming in the sector. Several such institutions and agencies have taken steps to integrate gender within their respective energy access programmes. The World Bank, African Development Bank, Asian Development Bank and Inter-American Development Bank, among others,

have introduced several guidelines to integrate gender in energy projects, as well as other infrastructure projects (World Bank, n.d.).

Conducting gender audits of energy access programmes (at the design stage and during monitoring and evaluation) can reveal new opportunities for improving gender outcomes (see Box 3.4 for the case of Hivos). ENERGIA’s energy and environment activities with

### Box 3.4 Gender mainstreaming at the programme level: The case of Hivos’ domestic biogas programme and Sumba Island Initiative

In 2011, Hivos, a Dutch development aid organisation, was engaged in eight domestic biogas and two improved cookstove programmes in Africa and Asia. After assessing gender mainstreaming in policy and practice, it concluded that core issues of gender inequality were not always being addressed sufficiently. It called for a better understanding of gender issues in all programmes and identified concrete opportunities for mainstreaming.

The cooking energy programmes, including the African Biogas Partnership Programme and Program Biogas Rumah in Indonesia, had not all defined gender goals from their inception. Gender equality was integrated in the programme’s planning, implementation, monitoring and institutional set-up from 2011 onwards. For instance, training approaches within biogas programmes have been adapted to address gender issues more effectively to ensure that women and men are equally engaged. In all countries, the proportion of women trainees has gone up significantly, with positive outcomes for long-term sustainability and socio-economic benefits.

As part of its Sumba Island Initiative in Indonesia, Hivos is working with the local and national government to devise approaches to integrate gender in the renewable energy sector. Hivos has capacitated four local civil society organisations who coach or mentor local entrepreneurs and users of renewable energy systems on identifying gender gaps and ways to address them including building shared-vision between husband and wife from the energy access they have for better a livelihood. At the national level, Hivos has engaged Ministry of Women Empowerment and Child Protection, to together identify potential gender integration models in the sector with two test locations: Sumba and Salatiga, Central Java.



Source: Hivos, 2013, 2018.

the United Nations Development Programme in Cambodia suggested that gender mainstreaming was most successful when integrated into the design phase because it positively affected the hiring of project staff with gender-sensitivity skills and training, and ensured that gender components were factored into planning documents, budgets, and monitoring and evaluation reports (Clancy *et al.*, 2016).

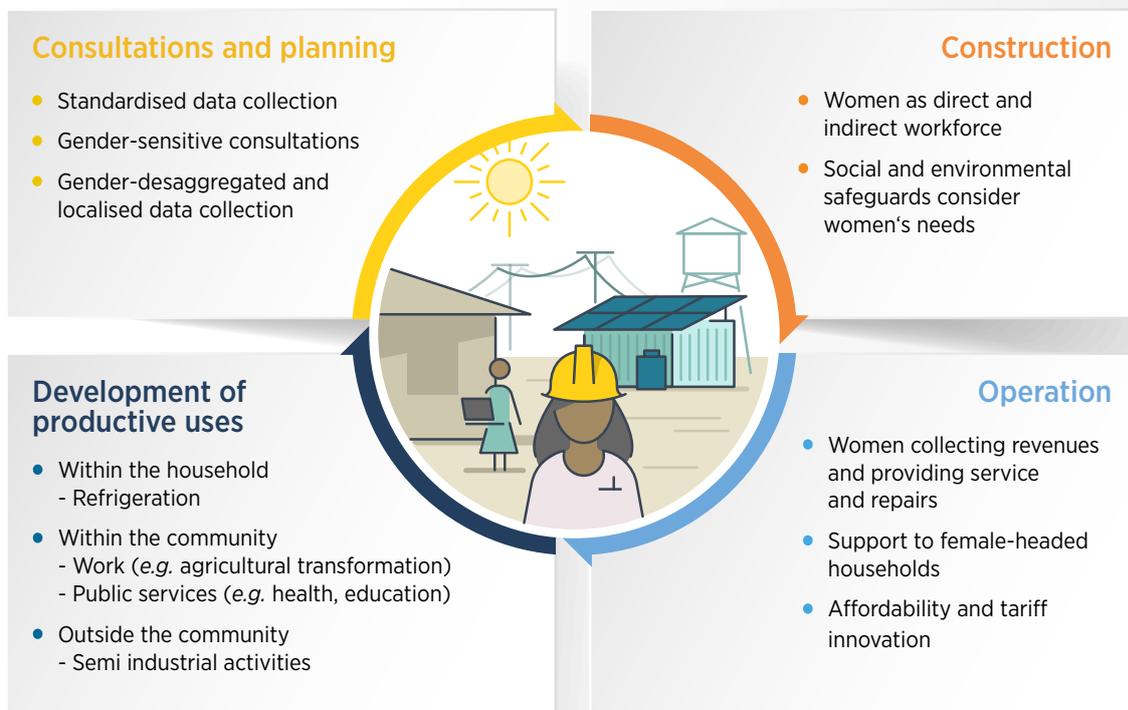
**At the project level,** gender can be mainstreamed along every phase from planning and design to operation and management and monitoring. During the planning phase, the gender perspective should be considered when assessing demand (including the potential for productive end uses), the nature of energy services desired and the ability and willingness of end users to pay.

Gender-disaggregated data are key to identifying the differential needs of men and women, and the balance of household decision making, among other considerations. Environmental and social impact assessments

address the effects and risks of the energy infrastructure development, but mitigation plans are not always funded, monitored or disaggregated by gender (United Nations, 2018).

As discussed earlier, training and skills-building are also effective means of engaging women in the construction and maintenance of off-grid renewable energy technologies, as well as in promoting productive end-uses that support local socio-economic development. Figure 3.6 illustrates the different entry points for women's engagement in the development of a renewable energy mini-grid.

**Figure 3.6** Illustrating gender entry points in the development of renewable energy mini-grids



Based on Bogle and Rodriguez (2017).

### 3.3.3. Fostering women entrepreneurs and improving access to finance

Women's entrepreneurship within the energy sector has the potential to significantly enhance economic growth and promote their social inclusion and empowerment. Women-led enterprises tend to have a stronger emphasis on social value (Shankar *et al.*, 2018).

Women are also more easily able to reach out to and interact with female end-users, especially in situations where women are primary users and also in areas where cultural and social norms inhibit public engagement with women (SNV, 2015).

Even organisations that do not have any specific aspirations to promote

gender equality have found it difficult to ignore the instrumental value of involving women in the renewable energy supply chain. As an example, SELCO India's decision to train female solar technicians in the early 2000s was (at least initially) simply a means to accomplish its business goals. Technicians needed to enter the homes of customers to repair solar lanterns and cookstoves. Since it was considered inappropriate for male technicians to enter the homes of customers while male family members were away, female technicians became the most practical solution (Baruah, 2015).

As women become engaged in delivering energy solutions, they take on more leadership in their communities and consequently facilitate a gradual paradigm shift



in the social and cultural norms that traditionally acted as barriers to their agency. Active engagement further contributes to women's economic and financial independence by increasing income-generating opportunities and enhancing women's social and political status (ARE and ENERGIA, 2017) (see Box 3.5).

#### Box 3.5 Empowering women brewers in Burkina Faso through energy-efficient cookstoves

Burkina Faso's traditional small-scale beer-brewing sector is predominantly led by women and is an important source of income for rural women. But poorly designed, inefficient cookstoves cause health problems and require longer cooking times and higher fuel consumption.

In 2012, a programme to install over 500 energy-efficient cookstoves reached an estimated 800 women by helping them build clusters that identify and promote their business development priorities including financial management, technology upgrading and improving the hygiene of the production. The women were grouped together in associations and encouraged to use self-help groups to finance the purchase of improved cook stoves. The programme also establishes a credit risk guarantee mechanism to help women access additional financing. They were also trained on how to operate and maintain the energy-efficient cookstoves. The women were also motivated to initiate the formation of a nationwide federation for beer brewers to pursue the common interests of women working in the sector.

Following the implementation of the project, women's profits and income increased and they had more social standing within their communities. The high efficiency of the cookstoves also reduced the amount of firewood required by over 40%, thus also reducing the health risks and physical or sexual assault risks to women collecting firewood.

Source: UNIDO, 2013.



# 56%

of respondents noted the importance of access to financing for women

Energy projects can facilitate social change in the balance of decision-making power within households. In the communities of Kutui and Homa Bay in rural Kenya, for instance, women began to engage in solar jobs that related to small-scale portable systems with low subscription fees. This changed the social and cultural perceptions of women's roles, and resulted in greater interest among women for jobs in the sector.

In order to scale up women's **engagement in entrepreneurship, training and mentoring programmes** focusing on technical, financial and leadership skills are essential for developing stable energy businesses (Pradhan, 2018) (see Box 3.6). Such programmes enable women to identify viable business opportunities, form useful networks to expand their business activities and devise effective market strategies to run successful businesses. Mentorship and training opportunities ease women's inhibitions about taking on

leadership roles and bridge the gap between women and the formal, more-male-dominated sector of the economy (SEforAll, 2017).

**Access to finance** is another binding constraint women face in setting up small and medium-sized enterprises. Although 48% of business owners in Kenya are women, only 7% have access to formal credit. Women are also less likely to have bank accounts than men, particularly due to the lack of bank branches in rural areas (SEforAll, 2017).

### Box 3.6 Empowering women entrepreneurs to deliver off-grid renewable energy solutions: The case of Solar Sister

Solar Sister is a training and job creation initiative for women that distributes portable solar lights in rural Sub-Saharan Africa through female entrepreneurs. Entrepreneurs are trained to sell solar lanterns and are given the opportunity to build sales and a cash flow by earning a commission, which they then re-invest in new inventory.

Solar Sister equips women to build their own technology-driven businesses and provides a holistic package of inputs (including business and technical training, a quality brand, access to world class products and service, marketing support and ongoing coaching).

As of 2018, it has benefitted 3 554 entrepreneurs, of whom 83% are women.

Source: World Bank, 2017.



Other factors inhibiting access to financing for women include limited awareness of the financial schemes, lack of banker's confidence in renewables and/or women-owned enterprises and confidence issues among rural women to conduct financial transactions. There is a need for inclusive financing channels that are accessible by women-led enterprises.

Various solutions are emerging, including dedicated credit lines, crowdfunding and local community organisations and cooperatives (see Box 3.7). In Kenya, for instance, women-led enterprises unable to access funding from traditional financing institutions have raised

financing through crowdfunding platforms that utilise mobile payments (Farouky and Wanzala, 2018). Despite the success enjoyed by some such innovations, inadequate access to affordable financing remains a major impediment for women setting up small businesses in the energy access context.

**Mentoring programmes** are essential in guiding women who are interested in the energy sector and encouraging them to overcome hesitations and barriers associated with traditional socio-cultural perceptions and stereotypes.

Women's Integration into Renewable Energy Value Chains, a programme by the non-profit Energy 4 Impact,

has supported over 450 women entrepreneurs, while the Women's Economic Empowerment project in rural Senegal has supported 160 women small and medium entrepreneurs engaged in expanding energy access (CIO East Africa, 2017). This was done through community-level mentoring and training programmes that expanded business skills (such as the ability to use financial services and access credit), communication skills and decision making. An evaluation of the project indicates that the mentoring and training programmes significantly increased participants' entrepreneurial capacities and overall confidence as business owners in energy access (see Box 3.8).

### Box 3.7 Establishing women's cooperatives to deliver stand-alone solar systems

Since 2013, the Self-Employed Women's Association (SEWA) has provided a special energy loan product for communities with limited access to electricity. The SEWA Bharat programme began by providing basic lighting services through solar home lighting systems in rural households. SEWA then established a cooperative livelihood opportunity for women based on energy access, establishing a company that employs women to market, sell, install and service home lighting systems. SEWA also connects women to financing options through the Thrift and Credit Cooperative, providing affordable payment options so that women can invest in their livelihood options, family education and household safety. Through the programme, over 83 000 litres of kerosene have been saved annually by 20 000 beneficiaries. Additionally, over 232 600 kilograms of carbon emissions have been reduced annually.

The Women of Deir Kanoun Ras el Ain, a cooperative in South Lebanon, produce food products such as rosewater, jams and sauces. Intermittent power supply and expensive, polluting diesel generators prevented these women from maximising their productions and revenue. To address this, the women launched a crowdfunding project in 2017 to install solar power systems to heat water and power machines that increase efficiency and reduce production costs. The cooperative's renewable energy supply has also driven local environmentally friendly food markets to approach these women as potential suppliers.



Source: SEWA Bharat, n.d.; Fayad, 2017.

The **private sector** also has an important role to play in supporting women-led enterprises. Partnering with women entrepreneurs is a mutually beneficial option, as women often have extensive local networks, specialised skills and an in-depth understanding of local markets that can help the private sector address market barriers.

IFC's Lighting Asia programme in India, for example, has facilitated partnerships and networking between Indian solar distributors and women entrepreneurs in rural areas. Through the development of these networks and partnerships, distributors have been able to overcome cost and market barriers in last-mile communities and increase sales of solar lighting products by approximately 30% (IFC, 2017).

It is important to provide the right type of support for women-led enterprises, but it is also important to remember that entrepreneurship is often not a realistic livelihood

strategy for some women, and even well-intentioned and well-designed interventions by governments, private sector organisations and social enterprises may fail to convince them to become entrepreneurs.

Women from the poorest households are generally averse to entrepreneurship, often because they have no capital to invest and no collateral against which to borrow. They are much more likely to pursue employment opportunities in renewable energy if they can earn incomes without becoming indebted. Acquiring new skills – such as learning to build and repair renewable energy technologies – is often better suited to their economic realities and limitations.

**Social enterprises and non-governmental organisations** (NGOs) that disseminate renewable energy technologies to low-income populations are aware of this fact and some have started to offer training in such skills. For example, the India-based

organisation Technology Informatics Design Endeavour has successfully trained women who formerly worked for daily wages as manual labourers to build smokeless stoves from locally available materials. This has enabled women, who often lack basic literacy skills, to earn two or three times their previous incomes, while relieving them of more physically strenuous and unsafe work (Baruah, 2015).

Many private sector organisations, social enterprises and NGOs in the energy sector have created opportunities for women to earn incomes through activities outside the entrepreneurial sphere. For example, Envirofit, a social enterprise that operates in many other Asian and African countries, employs men and women from poor urban and rural communities to demonstrate the use of energy technologies (through street plays, theatre and village fairs) and pays commissions for each unit sold.

### Box 3.8 Regional Renewable Energy Entrepreneurship Support Facility

In 2015, IRENA and the ECOWAS Centre for Renewable Energy and Energy Efficiency established the ECOWAS Renewable Energy Entrepreneurship Support Facility, which provides mentorship support and advisory assistance to small and medium enterprises on technical aspects (system sizing, installation guidelines), business management and operations, and refinement of project proposals. Since its inception, over 80 small businesses have benefited from training courses, facilitation of partnerships and networking opportunities with financing institutions. Following the successful implementation of the facility in the ECOWAS region, the Southern African Development Community launched its Renewable Energy Entrepreneurship Support Facility in 2018.

Note: ECOWAS = Economic Community of West African States.

Opportunities have also been created by the private sector for women to earn incomes or commissions from activities such as educating people about the health risks of smoke inhalation and the environmental dangers of emissions, creating awareness about the benefits of using clean technologies, conducting energy audits of homes and businesses to demonstrate opportunities for reducing energy consumption and waste, and connecting potential customers of clean technologies with financing opportunities available through banks and NGOs.

### 3.3.4. Improving the collection of gender-disaggregated data

The lack of gender-disaggregated data exacerbates the gender gap within the energy access field because it distorts perceptions of the level of gender inequality within the sector. This hinders **baseline evaluations of gender inequality** which underpin the development of gender-sensitive targets and indicators, the same targets and

indicators that subsequently inform gender-sensitive programmes and policies. The result is a decrease in the effectiveness and accuracy of gender-responsive strategies. Without gender-disaggregated data, policy makers cannot begin to fully understand and effectively address women's needs and abilities to be active agents in the success of energy programmes (AFI Global, 2017).

**Data-informed policies** are therefore critical to the achievement of gender equality. For women to be effectively included in the decision-making and entrepreneurial aspects of energy access, comprehensive data and statistics regarding the gender division of labour, women's access to resources in relation to men, and the disproportionate benefits of energy for women are required (UNIDO, 2014).

For the differences between men and women across social, economic, environmental, political and cultural dimensions to be fully grasped, both **qualitative and quantitative data collection** and analyses are necessary. Progress is being made and a greater attention is being paid to the

collection and reporting of gender-disaggregated data (see Box 3.9).

In 2015, ENERGIA and the Asian Development Bank conducted a project on improving gender-inclusive access to clean and renewable energy in Bhutan, Nepal and Sri Lanka. The project included gender reviews of the energy sector, implemented direct gender-inclusive interventions that facilitated access to renewable energy, and monitored the project's implementation and outputs from a gender perspective (ADB and ENERGIA, 2015).

The data collected through the project's gender approach generated comprehensive gender statistics that provided insight on how training and capacity building for community energy programmes can empower women across different dimensions, different dimensions. It also showed the form this empowerment can take, such as the form this empowerment can take, such as changes in women's decision-making abilities in relation to men and the amount of time spent on unremunerated domestic work (Clancy *et al.*, 2016).

#### Box 3.9 Gathering gender-disaggregated data through household surveys

Household survey data provide a better picture of energy access than data from service providers. By capturing more indicators, such surveys enable analysis of access trends across socio-economic segments (e.g., urban vs. rural, male- vs. female-headed households). The World Bank's Global Poverty Working Group Database analyses datasets of household-level data, including household electrification status and gender of head of household, allowing valuable insights on how (and where) access varies.

Gender-disaggregated data show that electricity access for male- and female-headed households differs only slightly overall – 33% and 31%, respectively. Disparities emerge for some countries, however. In some countries (Ethiopia, Mali, Nigeria), access rates for female-headed households are two percentage points higher; in others (Angola, Bangladesh, Chad, Sudan, Zambia), male-headed households enjoy substantially higher access rates.

Source: World Bank, 2018.

### 3.4. Conclusions

Energy access and gender are deeply entwined components of the global development agenda. Treating them in isolation will undermine efforts to expand access to modern energy, achieve socio-economic development objectives and advance gender equality. There is ample evidence of the differential effects on the genders of access – and lack of access – to modern energy services.

The known gender differences in household decision-making about energy and the disproportionate impacts of energy choices, preferences and priorities reveal the importance of **integrating the gender perspective at every stage of the process** of delivering and managing energy solutions.

The opportunities and entry points for integrating gender in efforts to expand energy access can vary depending on the solutions being adopted (see Box 3.10 for the example of gender in the context of grid-based solutions). The distributed nature of off-grid renewable energy solutions offers tremendous opportunities for women's **active engagement along several segments of the value chain**, offering substantial co-benefits for gender equality and empowerment.

**Energy access policies and programmes** represent an important first step in recognising women as active participants in the sector. That step should be accompanied by awareness raising, gender-specific training and skills-development programmes, and schemes to

expand access to finance for female-owned businesses and female-headed households.

As seen from the survey results, **cultural and social norms** strongly influence women's engagement in the sector. Even as these norms evolve, several cases presented in this chapter have shown that engaging women in the off-grid energy value chain also contribute to changing **women's self-perception** and empower them within the community.

**Monitoring gender-disaggregated outcomes** from energy access programmes are, therefore, critical for ensuring equity not only in access to energy, but also in access to its benefits and the opportunities it unleashes.

#### Box 3.10 Gender considerations in grid-based rural electrification programmes

Gender is a key consideration to meet the objectives of equitable connections and universal access in grid-based rural electrification programmes. Key differences in the needs and preferences of men and women (e.g., choice of areas within and outside the household to be electrified first) and in the ability of female-headed households to afford connection fees affects equitable access to electricity. Furthermore, cultural and social norms, as well as accompanying limitations on women's access to education, political participation, credit and land, affect the distribution between men and women of the effects of electrification. Beyond the household, it has been found that women-headed enterprises face more barriers to access to grid electricity than enterprises headed by men.

"Gender entry points" have been identified at various project stages:

1. **Planning, monitoring and evaluation:** Feasibility and baseline studies; environmental impact assessments; monitoring and evaluation frameworks;
2. **Construction:** Compensation for taking of land and its impact on women's access to land; women's access to local employment in rural electrification;
3. **Operations:** Tailored promotion of rural electrification to female- and male-headed households; addressing access to and affordability of electricity connections and house wiring for women-headed households (e.g., earmarked subsidies for single-parent households); support for women-owned firms to benefit from electricity access.

Source: ENERGIA, n.d.; Cecelski, 2004; Dutta, 2003; AfDB, 2016.

## Engendering

/in-'jen-d(ə-)riŋ /

*verb* to endow with gender; to create gender or enhance the importance of gender. Ensuring women's empowerment within society and the energy transition, supporting women as active agents, instead of as passive beneficiaries.

# 4

## Conclusions and **Way Forward**



The global transition to renewable energy is creating many benefits for the economy and the environment, including new sources of employment. Women's contributions – their talents, skills and views – are critically important in supporting this growing industry during a momentous transition towards a more sustainable energy system benefiting all of humanity.

IRENA's survey with about 1500 respondents working in the renewable energy sector in 144 countries worldwide revealed that women represent 32% of full-time employees of responding organisations, and a slightly lower number (about 31%) of female respondents are in mid-level management positions. These numbers are significantly more promising than in the global oil and gas industry, where women make up an estimated 22% of the workforce and represent 25% of mid-career level jobs.

A broad variety of policies and measures can ensure that women derive equal access and benefits from participation in the renewable energy sector and from the energy transition more broadly. At the same time, the renewable energy sector needs to be able to draw upon a larger talent pool.

For example, responses to the survey revealed that although women represent 43% of general administrative jobs within participating organisations, they hold a lower number (31%) of the positions that require science, technology, engineering and math (STEM) training. Boosting women's participation in STEM education and employment is an action area that the renewable energy sector must prioritise. At the same time, non-technical career paths – of which there are many – need to be given greater visibility and stature.

In regions of the world where large segments of the population lack reliable or affordable access to modern energy services, new entrepreneurial and livelihood opportunities arise for women. Globally, 70% the world's poorest people are women and children, which means that gender equity must be an integral part of efforts to expand modern energy access and reduce gender inequality and poverty (Pearl-Martinez and Stephens, 2016).

Thus, enabling more women to engage in the sector in both the access and the modern contexts can simultaneously advance gender equality and empowerment objectives as well as the renewable energy sector's need for skills.

## 4.1. Way forward to improve gender diversity in the renewables sector

Boosting gender awareness and equity is a win-win proposition rather than a zero-sum game among the genders. Understanding patterns, barriers and opportunities for women's employment in renewable energy is challenging because of the dearth of gender-disaggregated data on the topic. Research confirms that gender diversity in organizations and wage equity between women and men results in an improved quality of workplace interactions, which contributes to companies' better financial performance.

Therefore, collecting gender-disaggregated data on employment in the renewable energy sector and documenting and publicizing the economic benefits of gender diversity is an indispensable and useful strategy for convincing renewable energy companies to recruit, retain and promote more women.

Many men working in the sector, presumably including those with responsibilities for making policy decisions, are unaware that women face specific barriers in entering the sector and advancing within it. The survey results showed a large difference in the numbers of men (40%) and women (75%) who perceive the existence of such barriers. The survey revealed a similar gap about perceptions of wage equity along gender lines: 60% of male respondents assumed pay equity between women and men versus only 29% of female respondents.

Perceptions matter. As one survey respondent put it, *"If you don't even think you have a problem, you're certainly not going to fix it."*

A number of main common action areas emerge from the survey and the existing literature. These include the need to mainstream gender in energy sector frameworks; to tailor training and skills development programmes; to work to attract and retain talent; and to challenge cultural and social norms. These action areas point to commonalities in both the modern energy and energy access contexts, despite considerable differences between them.

### a. Mainstreaming gender in energy sector frameworks

Almost half (49%) of the respondents to the survey identified the lack of gender-sensitive policies in the energy sector as a key barrier for women's employment and advancement in the renewable energy sector. Yet, few countries have introduced meaningful policies to promote gender equity in the sector.

A USAID and ENERGIA study of renewable energy policies found that only six of 33 examined countries (18%) included gender keywords and considerations. Conversely, national gender equity policies rarely include any targets specific to equity in access to energy services, or employment in the energy sector (Pearl-Martinez, 2014).

Energy policies and programmes - regardless of whether they are driven by governments, civil society, private corporations or international aid agencies - should **integrate women's experiences, expertise, capacities and preferences**, and avoid risking reinforcing the gender gap between men and women in both the modern and energy access contexts.

For women to enjoy equal opportunities, mainstreaming gender equity concerns and solutions into national energy sector frameworks is critical. **Gender audits** can be an effective instrument in identifying gender gaps across the energy sector landscape and setting a baseline for future gender mainstreaming efforts at the policy and institutional-level.

In the access context, greater efforts are needed to **engage women along different segments of the off-grid renewable energy value chain**. A gender perspective needs to be integrated from the very beginning in the design, implementation, and monitoring of energy access programmes. A holistic approach views women not simply as primary end-users and beneficiaries of such programmes, but as actors in the delivery of energy solutions.



### b. Tailoring training and skills development programs

A lack of appropriate skills and training for employment in the renewable energy sector remains a key barrier for women in both the modern and access context. This affects women seeking entry into the renewable energy sector as well as those who are already employed. Low enrolment rates in STEM courses translates into continued under-representation of women in technical roles in the renewable energy industry.

**Raising awareness of career opportunities, adapting curricula and training as well as creating entry points**, such as internships, co-op programs and apprenticeships, is likely to attract more women into relevant fields. A wide range of actors play an important role, including governments, educational institutions, the private sector and advocacy organisations.

In responding to the changing landscape of the energy sector, universities, colleges and other educational institutions should make **technical training programs more versatile** to enable cross-sectoral transition within the energy sector. Universities should consider integrated programmes (covering both renewables and non-renewables), building cross-disciplinary and connected labs; adding courses to respond to digitisation trends; and, offering more courses such as business and project management to help students increase their employability (Baruah, 2018).

Non-STEM fields, such as environmental studies, public policy and administration, law, business and health, which tend to enroll large numbers of female students, are also important areas of recruitment. Professional networks and personal connections play a big role in access to career information. **Strengthening mentoring, outreach presentations and visits**, student networks, and temporary work placements can help level the playing field for women.

In the energy access context, women's participation in training and skills development programmes is critical. Many of the **skills needed** in the off-grid renewables value chain can be **developed locally**. Organisations like Solar Sister, Grameen Shakti, Barefoot College, Hivos, ENERGIA and the Self-Employed Women's Association (SEWA), have demonstrated that **customised solutions for training and opportunities for cross-mentorship**, can substantially lift women's participation in the sector.

Co-benefits relate to changing self-perception, empowerment and improved livelihoods. In addition, **providing adequate funding** and putting in place follow-on programmes (e.g., capacity building for **productive end-uses**) can enhance the benefits and sustainability of energy access initiatives.



### c. Attracting and retaining talent

Women want to work in the renewable energy sector for the same reasons that men do: for decent incomes, good benefits, company reputation, availability of work, and opportunities to build careers. Yet, female employees often face the double burden of work and family responsibilities that makes it difficult for them to remain employed and advance at par with their male counterparts in careers in renewable energy. The survey revealed significant differences among employers in accommodating employees' caregiving needs.

More renewable energy companies should institute **policies such as parental leave, flexible work hours, telecommuting, and working part time**. Such policies in combination with **gender equity in wages, support for childcare, and equal opportunities for professional advancement**, will ensure that more early and midcareer women find it worthwhile not just to remain in their jobs, but also possible to move up the professional ladder.

At lower than 15% female representation, it is not uncommon for women, because of their minority status, to feel marginal and “invisible” in decision-making processes. A critical mass of female employees at all levels can help to generate more supportive institutional environments and to address subtle or unconscious male-biased workplace dynamics.

Toward this end, renewable energy employers should set gender diversity targets in junior, mid-level and senior positions in all occupations in which they are currently underrepresented, namely, trades, production, and technical and management positions.

### d. Challenging cultural and social norms

Prevalent cultural and social norms strongly influence the success of gender goals in the renewable energy sector. Even as these norms naturally evolve, concrete actions must be taken to reduce barriers to entry for women, establish an enabling environment for retention and advancement, and level the playing field through equal pay and workplace policies. **Strengthening the visibility of the diverse roles** women are already playing in the energy sector will be critical.

In the access context, as the experiences of “solar mamas” trained in India and “wonder women” in Indonesia suggest, engaging in the renewable energy sector has enabled some women not just to forge a path out of poverty but also to become **agents of social and economic transformation** in their communities. Participating in the renewable energy sector has provided some women with a meaningful platform for questioning and subverting oppressive social norms and practices such as dowry, child marriage and domestic violence.

As gender-sensitive training, education, apprenticeships, employment placement, financial tools are adopted more widely, more women may be able to step into such roles, in turn contributing to the accomplishment of global development agendas such as the Sustainable Development Goals.



## 4.2. Future work

The scarcity of **gender-disaggregated data** is a major handicap in the effort to enhance awareness of the challenges and to improve the actual gender balance in renewable energy. Without data, there is no visibility. And without visibility, it is difficult to establish policy priorities. Efforts to improve quantitative and qualitative information are thus essential. This is true for both the modern energy and energy access contexts and across all regions.

Government statistics will generally need to capture employment in the sector much better than is the case today and build the gender dimension into these efforts from the get-go. A wide range of actors, including academic and non-academic researchers, advocacy groups, professional associations, international organisations, non-governmental organisations (NGOs), policy institutes and think-tanks, can contribute to building a gender-disaggregated evidence base.

**Context matters** greatly for understanding both gender barriers and solutions, and this requires more detailed examinations of gender dimensions in different regions and countries, for different types of renewable energy technologies, and for different scales of deployment. For instance, gender equity issues in large-scale grid-connected renewable energy projects (utility-scale solar, wind, geothermal or hydropower, for example) have not yet been researched extensively. Future research should identify guidelines and strategies in this context.

Off-grid renewable energy initiatives have generated significant new economic opportunities for women in the access context. However, available evidence of successes and remaining challenges is largely anecdotal. A better understanding of the **dynamics of productive use of energy** is required to design suitable policies for livelihood initiatives in the renewables sector. In particular, the creation of permanent and stable sources of income often remains a challenge for women who have been trained to build, install, repair and sell solar systems, improved cookstoves, or other renewable energy solutions.

More women can gain optimal traction from renewable energy initiatives and become change agents in their communities if there are gender-sensitive social and economic policies. Since women's ability to take advantage of new renewable energy-related employment options is, to begin with, often constrained by legal or social barriers that limit their education, property rights, land tenure, and access to credit, it is crucial that social and economic policies go beyond energy sector planning to enhance economic opportunities for women. Therefore, in both the access and modern energy contexts, **analytical efforts and policy initiatives that go beyond the confines of the energy sector** itself may become increasingly relevant to address the gender dimension adequately.

---

## Response statistics

**Total respondents:** 1 440

**Responding as individuals:** 1 155

**Responding on behalf of an organisation:** 285

---

# Annex

## A.1. IRENA 2018 online survey on gender and renewable energy

The International Renewable Energy Agency (IRENA) conducted an online Gender and Renewable Energy Survey ([www.irena.org/gendersurvey](http://www.irena.org/gendersurvey)) from 8 October 2018 to 25 November 2018. Its objective was to gather quantitative and qualitative information about women's participation in the renewable energy sector, the challenges they faced and their suggestions for improving gender diversity. It was an open survey – that is, anyone accessing the online link would be able to complete it.

Respondents could complete the survey either as individuals or as representatives of their employers

(organisations). From those speaking as individuals, the survey collected information about their perceptions of the main barriers and challenges to attracting and retaining women in the workforce and asked for suggestions about how to solve some of these problems.

From those responding as representatives of organisations, the survey asked for more quantitative information about the gender distribution in the organisation's workforce and the policies and measures used to support greater gender diversity. Answering these questions required some knowledge of the relevant staff statistics, so respondents were encouraged to ask for help from their human resources department to complete this part of the questionnaire.

The survey also asked a different set of questions depending on whether the organisation or individual worked primarily on energy access issues or more generally on the development of renewable energy, including in settings characterized by universal or near-universal access to modern forms of energy. Respondents could reply that they worked in both areas, in which case they were invited to complete the full set of questions.

The two work contexts with which respondents were invited to self-identify are referred to below as the “modern” context (near-universal access to modern energy) and the “access” context, wherein access to modern energy is not an accomplished fact but is still being built.

**A.2. Modern context**

The modern context was defined as settings in which the deployment of renewables displaces or complements the use of conventional modern energy (e.g., in urban areas). Individual respondents were asked: “In your experience, do you perceive that women working in the modern renewable energy sector or seeking such work face gender-related barriers”? If they answered yes to this question, they were asked three follow-up questions about the main barriers to women’s entry, advancement and retention in the renewable energy sector. Each of these questions asked respondents to rank a list of barriers in order of importance (see Table A1).

Individual respondents were also asked to rank what measures would attract women to the renewable energy sector (or facilitate their retention within it) and which of those were offered by the organisation for which they worked. The options were part-time work, flexi-time, parental leave, job sharing, on-site childcare, training and mentorship opportunities, fairness and transparency policies, and gender diversity targets.

The respondents were also asked what other organisations (industry associations, governments, non governmental and inter-governmental organisations) should do to support women in renewable energy. Respondents were invited to select any number of the following possible choices: networking, mentoring,

training, sharing work experiences and advocating for gender sensitive policies and diversity targets.

The respondents expressed a clear preference for some measures rather than others, with opportunities for networking and mentoring, gender-sensitive policies and diversity targets, and training suggested by 70–80% of them. Seminars, job sharing and other types of work in the sector were suggested less frequently, although respondents outside Europe and North America highlighted these measures significantly more often. The variation in responses between regions did not alter the overall ranking of suggestions (except for the case of the very high number of respondents from Africa suggesting the need for training), but it did indicate a more general interest in

**Table A.1** Main barriers to women’s entry and advancement in the modern renewables context

<b>Barriers to entry</b>	<b>Barriers to advancement</b>
<ul style="list-style-type: none"> <li>• Lack of STEM background</li> <li>• Lack of non-STEM background</li> <li>• Lack of awareness of opportunities</li> <li>• Perception of gender roles</li> <li>• Self-perception</li> <li>• Limited mobility (e.g., due to family support expectations)</li> <li>• Cultural and social norms</li> <li>• Prevalent hiring practices</li> <li>• Lack of gender diversity targets</li> <li>• Discouraging workplace policies</li> <li>• Other</li> </ul>	<ul style="list-style-type: none"> <li>• Glass ceiling</li> <li>• Lack of required skills and qualifications</li> <li>• Lack of training opportunities</li> <li>• Lack of mentorship opportunities</li> <li>• Lack of flexibility in workplace</li> <li>• Lack of childcare facilities</li> <li>• Cultural and social norms</li> <li>• Limited mobility (e.g., due to family support expectations)</li> <li>• Lack of gender diversity targets</li> <li>• Discouraging workplace practices</li> <li>• Other</li> </ul>

opportunities for women to engage in the sector in countries outside Europe and North America.

Those responding on behalf of organisations were asked a different set of questions pertaining mostly to the current state of women's participation in the workforce and measures being taken to improve gender diversity. Information was gathered on the share of women in total full-time employment; in mid-level management; in technical jobs in so-called STEM fields (science, technology, engineering or mathematics) or in other technical fields; in administrative roles; and in board positions. Additional information on benefits offered to employees was sought, including on health coverage, training funds, maternity/paternity leave and flexible work.

### A.3. Access context

In the access context, individuals and organisations were asked whether they perceived that women working to expand access to renewable energy or seeking such work faced gender-related barriers (yes/no answer). Those who answered yes were then asked to select the top three barriers to women's participation. This was followed by a question asking them to select the top three measures needed to improve women's engagement (see Table A2).

Those responding on behalf of organisations were asked about their area of work in the access context. Options included clean cooking solutions, stand-alone systems, mini-grids and others (open field). Compared to the version of the survey administered to respondents working in the modern energy context, fewer questions were asked about the share of women in the workforce, focusing instead on full-time and part-time employment. Given the nature of

the off-grid renewables value chain, information on the share of women in part-time commercial, sales and marketing positions was also sought.

Again, unlike the survey administered to respondents working in the modern energy context, where organisational respondents filled out questions related to the share of women in the workplace (but not questions about women's own perceptions of workplace challenges and solutions), in the access context, organisations also answered questions related to barriers and solutions for women participating in efforts to expand access. In essence, organisations (and indeed individual respondents) striving to expand access are proxies for women engaged (or seeking to engage) in different segments of the off-grid renewables value chain in rural areas, whether as part-time employees of distributors of technologies or as technicians or local entrepreneurs.

**Table A.2** Main barriers and solutions to women's participation in the renewable energy sector in the access context

<b>Barriers</b>	<b>Solutions</b>
<ul style="list-style-type: none"> <li>● Cultural and social norms</li> <li>● Inequity in ownership of assets</li> <li>● Lack of skills</li> <li>● Lack of gender-sensitive policies</li> <li>● Lack of gender-specific training opportunities</li> <li>● Lack of mentorship opportunities</li> </ul>	<ul style="list-style-type: none"> <li>● Mainstreaming gender in energy policies</li> <li>● Integrating gender perspectives in energy access programmes</li> <li>● Enhancing access to financing for women</li> <li>● Access to training and skills development programmes</li> <li>● Awareness raising</li> </ul>

#### A.4. Limitations of the survey

Surveys as a research methodology offer valuable quantitative and qualitative contemporary insights, especially when the area of interest is fast evolving and covered by little published data. Gender in renewable energy is one such area, where gender-disaggregated data are limited and the dynamism in the sector demands an analytical approach founded on existing academic and literature, and draws on research methods, such as surveys and interviews, that involve contemporary quantitative and qualitative elements.

The survey as conducted has limitations stemming from the design itself, as well as from the sample of responses received. Some of these are discussed below as part of a reflective exercise with the aim of informing the design and conduct of such surveys in the future.

##### Sampling

Participants responding on behalf of organisations were quite evenly spread across the different dimensions recorded in the survey (location, type and size of organisation, main focus of work and types of renewable technologies). Among the individual respondents, the sample contains many responses from Europe and North America (particularly Europe), but the Asia-Pacific region is under-represented

compared to the likely numbers of people working in the sector there. With respect to the organisations for which respondents work, the private sector is under-represented in the sample and, in this case, the sample is biased toward respondents from governmental, inter-governmental and similar types of organisations. Future samples could provide a more comprehensive representation of the renewable energy sector by including more data from utilities, manufacturers and large companies operating under power purchase agreements. They could also have more geographical coverage, especially in key countries such as India and China.

##### Question validity

The questions posed in the survey vary in their specificity. Those probing the gender pay gap are general, whereas those probing barriers ask about the renewable energy sector; others specifically target barriers and practices within the respondent's organisation. These differences have an impact on the accuracy with which data and results can be interpreted. Additionally, some of the barriers discussed may be too similar to one another for respondents to accurately distinguish among them. It is also challenging to control for respondents' understanding of targets and policies addressed in the survey, and what exactly the survey questions are attempting to address.

##### Question precision

In the future, data on location of current place of work and nationality should be collected so that the results will accurately distinguish between the perceptions of people originating from a certain place vs. those working in that place.

##### Question format

The use of a Likert Scale instead of a ranking procedure would enhance the statistical power of the tests that could be used to analyse the data. In addition, the order of answers for the multiple-choice questions in the survey could have been randomised to control for response bias and order effects bias.

##### Analysis

A more comprehensive and multi-dimensional analysis could produce more in-depth results, such as multiple correspondence analyses or multiple logistic regressions. This would require a more robust statistical sampling procedure.

# References

- ADB (Asian Development Bank)** (2018), *Energy technology innovation in South Asia: Implications for gender equality and social inclusion*, ADB South Asia Working Paper Series, <https://www.adb.org/sites/default/files/publication/463296/swp-061-energy-technology-innovation-south-asia.pdf>, accessed 7 November 2018.
- ADB** (2012), *Gender Tool Kit: Energy Going beyond the Meter*, <https://www.adb.org/documents/gender-tool-kit-energy-going-beyond-meter>.
- ADB and ENERGIA** (2015), *Improving Gender Inclusive Access to Clean and Renewable Energy in Bhutan, Nepal and Sri Lanka*, <https://www.adb.org/sites/default/files/project-document/182303/44135-012-dpta-01.pdf>, accessed 16 October 2018.
- AfDB (African Development Bank)** (2016), *Empowering women and girls in the quest for universal energy access for all*, 25 April, <https://www.afdb.org/en/blogs/investing-in-gender-equality-for-africa%E2%80%99s-transformation/post/empowering-women-and-girls-in-the-quest-for-universal-energy-access-for-all-15625/>, accessed 22 November 2018.
- AFI (Alliance for Financial Inclusion) Global** (2017), *Sex-Disaggregated Data Toolkit: How to Leverage Sex-Disaggregated Financial Inclusion Data to Accelerate Women's Financial Inclusion*, [https://www.afi-global.org/sites/default/files/publications/2017-03/GuidelineNote-26%20FID%20Gender%20Data%20Toolkit\\_digital.pdf](https://www.afi-global.org/sites/default/files/publications/2017-03/GuidelineNote-26%20FID%20Gender%20Data%20Toolkit_digital.pdf), accessed 3 November 2018.
- Agarwal, B.** (2010), *Does women's proportional strength affect their participation? Governing local forests in South Asia*, *World Development*, Vol. 38/1, pp. 98 112.
- Alves, G.** (2018), *Anand Mahindra bats for more women in boardrooms; says 10 pc hike in girls' education can up GDP by 3 pc*, 7 November, <https://economictimes.indiatimes.com/magazines/panache/anand-mahindra-bats-for-more-women-in-boardrooms-says-10-pc-hike-in-girls-education-can-up-gdp-by-3-pc/articleshow/66525064.cms>.
- Antoni, M., M. Janser, and F. Lehmer** (2015), *The hidden winners of renewable energy promotion: Insights into sector-specific wage differentials*, *Energy Policy*, Vol. 86, pp. 595 613.
- ARE (Alliance for Rural Electrification) and ENERGIA** (2017), *ARE-ENERGIA position paper: Women and sustainable energy*, [https://www.ruralelec.org/sites/default/files/2017-04-24\\_-are-energia\\_position\\_paper\\_-\\_women\\_and\\_sustainable\\_energy\\_final.pdf](https://www.ruralelec.org/sites/default/files/2017-04-24_-are-energia_position_paper_-_women_and_sustainable_energy_final.pdf), accessed 11 November 2018.
- Asia-Pacific Gateway Skills Table** (2015), *Women in Transportation Careers: Understanding Participation in Canada*
- Barefoot College** (n.d.), <https://www.barefootcollege.org/solution/solar/#stats>, accessed 8 November 2018.
- Baruah, B.** (2018), *Barriers and Opportunities for Women's Employment in Natural Resources Industries in Canada*, *Natural Resources Canada*, Ottawa.
- Baruah, B.** (2017), *Renewable inequity? Women's employment in clean energy in industrialized, emerging and developing economies*, *Natural Resources Forum*, Vol. 41/1, pp. 18 29.
- Baruah, B.** (2015), *Creating opportunities for women in the renewable energy sector: Findings from India*, *Feminist Economics*, Vol. 21/2, pp. 53 76.
- Baruah, B. and S. Biskupski-Mujanovic** (2017), *Identifying Promising Policies and Practices for Promoting Gender Equity in Global Green Employment*, Smart Prosperity Institute, Ottawa.
- Bian, L., S.-J. Leslie, and A. Cimpian** (2017), *Gender stereotypes about intellectual ability emerge early and influence children's interests*, *Science*, Vol. 355/6323, pp. 389 391.
- BLS (Bureau of Labor Statistics, US Department of Labor)** (n.d.), *Nontraditional occupations*, <https://www.dol.gov/wb/stats/Nontraditional%20Occupations.pdf>.
- BNEF (Bloomberg New Energy Finance), CEBC (Clean Energy Business Council), and IRENA (International Renewable Energy Agency)** (2017), *Women in clean energy, Middle East and North Africa survey 2017*, <https://data.bloomberglp.com/professional/sites/24/2017/05/2017-05-03-BNEF-CEBC-IRENA-MENA-Women-in-Clean-Energy-Final.pdf>.
- Bogle, S. and S. Rodriguez** (2017), *Standardized process for productive uses & gender integration*, ESMAP, [https://esmap.org/sites/default/files/Myanmar\\_Standardized%20Process%20for%20Productive%20Uses%20Gender%20Integration\\_Web.pdf](https://esmap.org/sites/default/files/Myanmar_Standardized%20Process%20for%20Productive%20Uses%20Gender%20Integration_Web.pdf), accessed 23 October 2018.
- Business Dictionary** (n.d.), *Job sharing*, <http://www.businessdictionary.com/definition/job-sharing.html>.
- Byvelds, C.** (2016), *Women in Science and Technology at Natural Resources Canada: A Gender-Based Demographic Analysis*, Natural Resources Canada, Ottawa.
- C3E (Clean Energy Education & Empowerment Initiative)** (2018), *Recognizing outstanding women leaders and accomplishments in clean energy*, <https://www.c3eawards.org>.
- Carpenter, J. P., P. H. Matthews, and A. Robbett** (2015), *Compensating differentials in experimental labor markets*, IZA Discussion Papers 8820, Institute for the Study of Labor (IZA), Bonn.
- Catalyst** (2011), *The Bottom Line: Corporate Performance and Women's Representation on Boards* (2004 2008), Catalyst, <https://www.catalyst.org/knowledge/bottom-line-corporate-performance-and-womens-representation-boards-20042008>.
- Catalyst** (2008), *Advancing Women Leaders: The Connection between Women Board Directors and Women Corporate Officers*, Catalyst, <https://www.catalyst.org/knowledge/advancing-women-leaders-connection-between-women-board-directors-and-women-corporate>.
- Cecelski, E.** (2004), *Re-thinking gender and energy: Old and new directions*, *Energy, Environment and Development Discussion Paper*, ENERGIA/EASE, Netherlands.

- Ceesay, K. and A. Gassama (2015), *Status of gender mainstreaming in energy access in the Gambia*, ECREEE, [http://www.ecreee.org/sites/default/files/documents/news/gambia\\_country\\_presentation.pdf](http://www.ecreee.org/sites/default/files/documents/news/gambia_country_presentation.pdf), accessed 18 November 2018.
- CIO East Africa (2017), *Energy 4 Impact, M-Changa launch crowdfunding community to support women micro-entrepreneurs*, <https://www.cio.co.ke/energy-4-impact-m-changa-launch-crowdfunding-community-support-women-micro-entrepreneurs/>, accessed 1 October 2018.
- Clancy, J. (2011), *Integrating gender awareness into energy policies*, ENERGIA.
- Clancy, J., N. Mohlakoana, and Y. Gueye (2016), *Mainstreaming Gender in Energy Sector Practice and Policy: Lessons from the ENERGIA International Network*, UK Department for International Development, [https://www.energia.org/cm2/wp-content/uploads/2016/12/Mainstreaming-gender-in-energy-sector-policy-and-practice\\_FULL-REPORT.pdf](https://www.energia.org/cm2/wp-content/uploads/2016/12/Mainstreaming-gender-in-energy-sector-policy-and-practice_FULL-REPORT.pdf), accessed 25 November 2018.
- Clancy, J. S., V. I. Daskalova, M. H. Feenstra, and N. Franceschelli (2017), *Gender Perspective on Access to Energy in the EU*, European Union, [https://ris.utwente.nl/ws/portalfiles/portal/22449255/Final\\_Report\\_Gender\\_perspective\\_on\\_access\\_to\\_energy\\_2017.pdf](https://ris.utwente.nl/ws/portalfiles/portal/22449255/Final_Report_Gender_perspective_on_access_to_energy_2017.pdf), accessed 20 November 2018.
- Clean Cooking Alliance (2015), *Study shows women cookstove sellers outsell men 3 to 1*, 4 May, <http://cleancookstoves.org/about/news/05-04-2015-study-shows-women-cookstove-sellers-outsell-men-3-to-1.html>, accessed 16 November 2018.
- Covert, B. (2014), *U.S. paid family leave versus the rest of the world, in 2 disturbing charts*, ThinkProgress, 30 July, <https://thinkprogress.org/u-s-paid-family-leave-versus-the-rest-of-the-world-in-2-disturbing-charts-365324eeba45/>.
- Dasgupta, B. (2018), *Women less likely to pursue STEM careers, says survey*, The Economic Times, 10 February, <https://economictimes.indiatimes.com/jobs/women-less-likely-to-pursue-stem-careers-says-survey/articleshow/62858006.cms>.
- Deloitte University Press (2014), *Women, energy and economic empowerment: Applying a gender lens to amplify the impact of energy access*, [https://www2.deloitte.com/content/dam/insights/us/articles/women-empowerment-energy-access/DUP\\_950-Women-Energy-and-Economic-Empowerment\\_MASTER1.pdf](https://www2.deloitte.com/content/dam/insights/us/articles/women-empowerment-energy-access/DUP_950-Women-Energy-and-Economic-Empowerment_MASTER1.pdf), accessed 14 November 2018.
- Deshpande, V. (2017), *Inside Barefoot College where women from across the world become 'solar engineers'*, The Economic Times, 18 June, <https://economictimes.indiatimes.com/industry/energy/power/inside-barefoot-college-where-women-from-across-the-world-become-solar-engineers/articleshow/59195677.cms>, accessed 13 November 2018.
- Dutta, S. (2003), *Mainstreaming gender in energy planning and policy*, UNESCAP, Bangkok.
- EACREEE (East African Centre of Excellence for Renewable Energy and Efficiency) (2018), *Situation Analysis of Gender and Sustainable Energy in the East African Community*, <https://cdn2.b2match.io/event/2901/assets/8478585390-c9af64a444.pdf>, accessed 17 October 2018.
- ECREEE (ECOWAS Centre for Renewable Energy and Energy Efficiency) (2015), *Situation analysis of energy and gender issues in ECOWAS member states*, <https://www.seforall.org/sites/default/files/Situation-Analysis-of-Energy-and-Gender-Issues.pdf>, accessed 4 November 2018.
- ECWT (European Center for Women and Technology) (n.d.), *Who we are*, <http://www.ecwt.eu/en/our-story>.
- EEP (Energy and Environment Partnership) (2017), *Understanding the Role of Women and Girls in Renewable and Energy-Efficiency Projects: An In-Depth Study of Gender in the EEP Portfolio*, [https://eepafrica.org/wp-content/uploads/GendeStudy\\_final\\_full.pdf](https://eepafrica.org/wp-content/uploads/GendeStudy_final_full.pdf), accessed 20 October 2018.
- EHRC (Electricity Human Resources Canada) (2017), *Profile of Women Working in the Clean Energy Sector in Canada*, EHRC, Ottawa.
- ENERGIA (2016), *Mainstreaming Gender in Energy Sector Practice and Policy. Lessons from the Energia International Network*, ENERGIA, The Hague.
- ENERGIA (2011), *Zambia Gender and Energy Mainstreaming Strategy 2011–2013*, [http://zgfoffce.org:8080/jspui/bitstream/123456789/206/2/Ministry%20of%20Energy\\_gender%20mainstreaming%20energy%20sector\\_Part%201\\_2011.pdf](http://zgfoffce.org:8080/jspui/bitstream/123456789/206/2/Ministry%20of%20Energy_gender%20mainstreaming%20energy%20sector_Part%201_2011.pdf), accessed 16 October 2018.
- ENERGIA (n.d.), *Gender mainstreaming in rural electrification programmes*, [https://genderinsite.net/sites/default/files/03.-GENDER\\_MAINSTREAMING\\_IN\\_RURAL\\_ELECTRIFICATION\\_PROGRAMMES1.pdf](https://genderinsite.net/sites/default/files/03.-GENDER_MAINSTREAMING_IN_RURAL_ELECTRIFICATION_PROGRAMMES1.pdf), accessed 23 October 2018.
- Engineers Australia (2017), *Addressing the shortage of women engineers*, <https://www.engineersaustralia.org.au/News/addressing-shortage-women-engineers>.
- Engineers Canada (2018), *"30 by 30"*, <https://engineerscanada.ca/diversity/women-in-engineering/30-by-30>.
- Engineering UK (2018), *Gender Disparity in Engineering Report*, <https://www.engineeringuk.com/media/1691/gender-disparity-in-engineering.pdf>.
- Equal by 30 (2018), *About the campaign*, <https://www.equalby30.org/en/content/about-campaign>.
- Ernst & Young (2016), *Women in Power and Utilities: Index 2016*, <http://www.ey.com/Publication/vwLUAssets/ey-talent-at-the-table-women-in-power-and-utilities-index-2016/%24FILE/ey-talent-at-the-table-women-in-power-and-utilities-index-2016.pdf>.
- ESMAP (Energy Sector Management Assistance Program) (n.d.), *Gender and Energy Online Toolkit for Practitioners*, <https://www.esmap.org/node/2757>.
- Etehad, M. and J. C. F. Lin (2016), *The world is getting better at paid maternity leave. The U.S. is not*, Washington Post, 13 August, <https://www.washingtonpost.com/news/worldviews/wp/2016/08/13/the-world-is-getting-better-at-paid-maternity-leave-the-u-s-is-not/>.
- European Parliament (2018), *A new directive on work-life balance*, EU Legislation in Progress Briefing, European Parliamentary Research Service, September, [http://www.europarl.europa.eu/RegData/etudes/BRIE/2018/614708/EPRS\\_BRI\(2018\)614708\\_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2018/614708/EPRS_BRI(2018)614708_EN.pdf).
- European Parliament (2010), *Report on developing the job potential of a new sustainable economy*, P7\_TA(2010)0299, Official Journal of the European Union, [www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+REPORT+A7-2010-0234+0+DOC+PDF+VO//EN](http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+REPORT+A7-2010-0234+0+DOC+PDF+VO//EN).

- Farouky, J. and J. Wanzala** (2018), *Failed by banks, Kenyan women in clean energy embrace crowdfunding*, News Deeply, 3 April, <https://www.newsdeeply.com/womensadvancement/articles/2018/04/03/failed-by-banks-kenyan-women-in-clean-energy-embrace-crowdfunding>, accessed 22 November 2018.
- Fayad, G.** (2017), *How women are expanding horizons with solar power*, Greenpeace blog, <https://www.greenpeace.org/archive-international/en/news/Blogs/makingwaves/women-expanding-horizons-solar-power/blog/58897/>, accessed 10 October 2018.
- Finley, K.** (2014), *In a first, women outnumber men in Berkeley computer science course*, Wired, 21 February, <https://www.wired.com/2014/02/berkeley-women/>.
- Frank, K. and E. Jovic** (2015), *National Apprenticeship Survey: Canada Overview Report, 2015*, Statistics Canada, Ottawa.
- Glemarec, Y., F. Bayat-Renoux, and O. Waissbein** (2016), *Removing barriers to women entrepreneurs' engagement in decentralized sustainable energy solutions for the poor*, AIMS Energy, <http://www.wocan.org/sites/default/files/Women%20entrepreneurs-energy-04-00136.pdf>, accessed 5 November 2018.
- Good Energy** (2018), *Gender Pay Report 2017*, <https://www.goodenergy.co.uk/media/15372/good-energy-gender-pay-gap-report-29032018.pdf>.
- GWNET (Global Women's Network for the Energy Transition)** (n.d.), *GWNET mentoring programme for women in the energy sector*, <http://www.globalwomennet.org/2018/05/22/gwnet-mentoring-programme-for-women-in-the-energy-sector/>.
- Heathfield, S. M.** (2018), *The advantages and disadvantages of flexible work schedules*, The Balance Careers, 20 September, <https://www.thebalancecareers.com/advantages-and-disadvantages-of-flexible-work-schedules-1917964>.
- Hivos** (2018), *Gender mainstreaming in renewable energy sector: Lessons from Sumba Iconic Island*, <https://d2oc0ihd6a5bt.cloudfront.net/wp-content/uploads/sites/837/2018/06/Henriette-Imelda-Gender-Mainstreaming-in-Renewable-Energy-Sector-Lessons-from-Sumba-Iconic-Island.pdf>, accessed 11 November 2018.
- Hivos** (2013), *Gender mainstreaming in Hivos' domestic biogas and improved cook stoves programmes*, [https://knowledge.hivos.org/sites/default/files/gender\\_mainstreaming\\_in\\_hivos\\_domestic\\_biogas\\_and\\_improved\\_cook\\_stoves\\_programmes.pdf](https://knowledge.hivos.org/sites/default/files/gender_mainstreaming_in_hivos_domestic_biogas_and_improved_cook_stoves_programmes.pdf), accessed 23 October 2018.
- Huang, L., E. Qian, and K. Willcox** (2017), *Gender diversity the past two decades at the Massachusetts Institute of Technology*, <http://kiwi.ices.utexas.edu/mit-gender-diversity.php>.
- Huyer and Hafkin** (2013), *Brazilian women lead in science, technology and innovation, study shows*, Elsevier Connect
- Ibrar, M.** (2018), *IIT-Delhi tops MHRD mandate, enrolls 16% girls in all its courses*, Times of India, 5 July, <https://timesofindia.indiatimes.com/city/delhi/iit-delhi-tops-mhrd-mandate-enrolls-16-girls-in-all-its-courses/articleshow/64862109.cms>
- IFC (International Finance Corporation)** (2017), *Women entrepreneurs light the way for solar products in India*, International Finance Corporation, [https://www.ifc.org/wps/wcm/connect/efc71c24-b75d-45fd-8d6c-73a4d2a6d04b/10953\\_Gender\\_Case\\_Study\\_LightingAsia.pdf?MOD=AJPERES](https://www.ifc.org/wps/wcm/connect/efc71c24-b75d-45fd-8d6c-73a4d2a6d04b/10953_Gender_Case_Study_LightingAsia.pdf?MOD=AJPERES), accessed 5 November 2018.
- Inter-American Development Bank** (2014), *Mainstreaming gender in rural development projects in Latin America and the Caribbean*, <https://publications.iadb.org/bitstream/handle/11319/6863/Rural%20Development%20Technical%20Note.pdf?sequence=1>, accessed 2 November 2018.
- ILO (International Labour Organization)** (2004), *Part-time work, Conditions of Work and Employment Programme, Information Sheet No. WT-4*, June, Geneva, [https://www.ilo.org/wcmsp5/groups/public/---ed\\_protect/---protrav/---travail/documents/publication/wcms\\_170717.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---travail/documents/publication/wcms_170717.pdf).
- ILO** (n.d.), *What are part-time and on-call work?*, [https://www.ilo.org/global/topics/non-standard-employment/WCMS\\_534825/lang-en/index.htm](https://www.ilo.org/global/topics/non-standard-employment/WCMS_534825/lang-en/index.htm).
- IRENA** (2019 forthcoming), *Community Benefits of Large-Scale Solar and Wind Projects: Insights from sub-Saharan Africa*, IRENA, Abu Dhabi.
- IRENA** (2018a), *Renewable Energy and Jobs: Annual Review 2018*, IRENA, Abu Dhabi.
- IRENA** (2018b), *Global Energy Transformation: A Roadmap to 2050*, IRENA, Abu Dhabi.
- IRENA** (2018c), *Indonesia's 'superheroines' empowered with renewables*, <http://irena.org/newsroom/articles/2018/Apr/Indonesias-Superheroines-Empowered-with-Renewables>, accessed 4 November 2018.
- IRENA** (2018d), *Policies and Regulations for Renewable Energy Mini-Grids*, IRENA, Abu Dhabi.
- IRENA** (2017), *Renewable Energy Benefits: Leveraging Local Capacity for Solar PV*, IRENA, Abu Dhabi.
- IRENA** (2016a), *Renewable Energy and Jobs: Annual Review*, IRENA, Abu Dhabi.
- IRENA** (2016b), *Renewable Energy Benefits: Decentralised solutions in the agri-food chain*, IRENA, Abu Dhabi.
- IRENA** (2013), *Renewable Energy and Jobs*, IRENA, Abu Dhabi.
- IRENA** (2012), *Renewable Energy Jobs & Access*, IRENA, Abu Dhabi.
- IUCN (International Union for Conservation of Nature)** (2015), *Gender focal points and policies in national environmental ministries*, EGI Brief, [http://www.wocan.org/sites/default/files/EGI\\_focal\\_point\\_brief\\_sept15\\_0.pdf](http://www.wocan.org/sites/default/files/EGI_focal_point_brief_sept15_0.pdf), accessed 16 October 2018.
- Khan, S.** (2018), *Take five: 'The opportunity for sustainable energy entrepreneurship is significant for women'*, UN Women, <http://www.unwomen.org/en/news/stories/2018/4/take-five--suhela-khan>, accessed 27 October 2018.

- Kings' College London** (n.d.), *NMS women in science initiative*, <https://www.kcl.ac.uk/nms/WomeninScience/initiative.aspx>.
- Krivkovich, A., M.-C. Nadeau, K. Robinson, N. Robinson, I. Starikova, and L. Yee** (2018), *Women in the Workplace 2018*, McKinsey & Company, October, <https://www.mckinsey.com/featured-insights/gender-equality/women-in-the-workplace-2018>.
- Lallement, D.** (2013), "Infrastructure and gender equality", Chapter 9, In: DM Figart, TL Warnecke (Eds.) *Handbook of Research on Gender and Economic Life*, pp. 592.
- Lucas, H., S. Pinnington, and L. F. Cabeza** (2018), *Education and training gaps in the renewable energy sector*, *Solar Energy*, Vol. 173, pp. 449-455.
- MacDougall, A., J. M. Valley, R. Aziz, C. Bettel, M. Dick, A. Kim, B. Lastman, and T. Traore** (2017), *Diversity Disclosure Practices: Women in Leadership Roles at TSX-Listed Companies*, Hoskin & Harcourt LLP, Osler.
- MacKenzie, D. and J. Wajcman** (1999), *The Social Shaping of Technology*, Open University Press, Buckingham.
- McCarthy, N.** (2016), *Which industries have the most women in senior management?*, *Forbes*, 8 March, <https://www.forbes.com/sites/niallmccarthy/2016/03/08/which-industries-have-the-most-women-in-senior-management-infographic>.
- McFarland, J.** (2015), *Are there jobs for women in green job creation?*, *Women & Environments International*, Vol. 94/95, pp. 22-25.
- McKee, L.** (2014), *Women in American energy: De-feminizing poverty in the oil and gas industries*, *Journal of International Women's Studies*, Vol. 15/1, pp. 167-178.
- McKinsey & Company and LeanIn.Org.** (2015), *Women in the Workplace*, McKinsey & Company and LeanIn.Org.
- MHRD (Ministry of Human Resource Development, India)** (2018), *All India survey on higher education 2017-18*, <http://aishe.nic.in/aishe/reports>.
- MiHR (Mining Industry Human Resources Council)** (2016), *Strengthening Mining's Talent Alloy: Exploring Gender Inclusion*, Mining Industry Human Resources Council, Ontario.
- Mkenda-Mugittu, V.** (2003), *Measuring the invisibles: Gender mainstreaming and monitoring experience from a dairy development project in Tanzania*, *Development in Practice*, Vol. 13/5, pp. 459-473.
- Mohideen, R. and S. Tanaka** (2012), *Gender Tool Kit: Energy Going Beyond the Meter*, Asian Development Bank, Manila, <http://www.climateinvestmentfunds.org/sites/default/files/knowledge-documents/gender-toolkit-energy.pdf>.
- Moodley, L., T. Holt, A. Leke, and G. Desvaux** (2016, August), *Women Matter Africa*, McKinsey & Company, <https://www.mckinsey.com/-/media/McKinsey/Global%20Themes/Women%20matter/Women%20matter%20Africa/Women%20Matter%20Africa%20August%202016.ashx>.
- Morgan, E.** (2018), *Energy Australia closes gender pay gap overnight, literally*, *ABC News*, 7 March, <https://www.abc.net.au/news/2018-03-07/energy-australia-closes-gender-pay-gap-overnight/9524770>.
- Myers, J.** (2017), *These are the world's most gender-equal countries*, *World Economic Forum*, 2 November, <https://www.weforum.org/agenda/2017/11/these-are-the-world-s-most-gender-equal-countries/>.
- National Women's Law Center** (2014), *Women in Construction: Still Breaking Ground*, NWLC, Washington, DC.
- NCSL (National Conference of State Legislatures)** (2016), *State Family and Medical Leaves Law*.
- Noland, M., T. Moran, and B. Kotschwar** (2016), *Is gender diversity profitable? Evidence from a global survey*, Peterson Institute for International Economics, Washington, DC.
- O'Brien, C.** (2018), *Apprenticeships: A welcome growth in numbers*, *The Irish Times*, 23 March.
- OECD (Organisation for Economic Co-operation and Development) Higher Education Programme** (2014), *Fostering equity in higher education: Compendium of practical case studies*, <http://www.oecd.org/education/imhe/Promoting-female-participation-in-STEM.pdf>.
- Orser, B.** (2001), *Chief Executive Commitment: The Key to Enhancing Women's Advancement*, Conference Board of Canada, Ottawa.
- Pearl-Martinez, R.** (2015), *All Hands on Deck: Who's Missing in the Clean Energy Workforce*, Renewable Equity Project, Tufts University, Massachusetts.
- Pearl-Martinez, R.** (2014), *Women at the forefront of the clean energy future*, IUCN-USAID, Washington, DC, <http://genderandenvironment.org/resource/women-at-the-forefront-of-the-clean-energy-future/>.
- Pearl-Martinez, R. and J. Stephens** (2016), *Toward a Gender Diverse Workforce in the Renewable Energy Transition*, *Sustainability: Science, Practice and Policy* 12(1).
- Pradhan, A.** (2018), *Women energy entrepreneurs need financing to reach vulnerable populations*, SE4ALL <https://www.seforall.org/content/women-energy-entrepreneurs-need-financing-reach-vulnerable-populations>, accessed 19 November 2018.
- Rick, K., I. Martén, and U. Von Lonski** (2017), *Untapped Reserves: Promoting Gender Balance in Oil and Gas*, *World Petroleum Council and The Boston Consulting Group*, 12 July, <https://www.bcg.com/publications/2017/energy-environment-people-organization-untapped-reserves.aspx>.
- Rojas, A., M. Prebble, and J. Siles** (2015), *Flipping the switch: Ensuring the energy sector is sustainable and gender-responsive*, in L. Aguilar, M. Granat, and C. Owren (eds.), *Roots for the Future: The Landscape and Way Forward on Gender and Climate Change*, IUCN and GGCA (Global Gender and Climate Alliance), Washington, DC.
- Rosser, S.** (2005), *Women and technology through the lens of feminist theories*, *Frontiers*, Vol. 26/1, pp. 1-23.

- SE4ALL** (2018), *Levers of Change: How Global Trends Impact Gender Equality and Social Inclusion in Access to Sustainable Energy*, Sustainable Energy for All, [https://www.seforall.org/sites/default/files/18\\_SEforall\\_SEtrendsReport\\_0.pdf](https://www.seforall.org/sites/default/files/18_SEforall_SEtrendsReport_0.pdf), accessed 11 November 2018.
- SE4ALL** (2017), *Scaling sustainable access pathways for the most vulnerable and hardest to reach people*, <https://www.seforall.org/sites/default/files/ScalingSustainableAccessPathwaysfortheMostVulnerableandHardesttoReachPeople.pdf>, accessed 15 November 2018.
- SEWA (Self Employed Women's Association Bharat)** (n.d.), *Solar and renewable energy*, <http://sewabharat.org/program-themes/solar-and-renewable-energy/>, accessed 19 October 2018.
- Shankar, A., A. Elam, and A. Glinks** (2018), *Building the evidence base for women's entrepreneurship in the energy sector*, ENERGIA, <https://www.energia.org/cm2/wp-content/uploads/2018/07/RA-7-Womens-Entrepreneurship-Jun-27webv3.pdf>, accessed 15 October 2018.
- Solar Foundation** (2018), *National Solar Jobs Census 2017. A Review of the U.S. Solar Workforce*, Solar Foundation, Washington, DC, February.
- Solar Foundation** (2017), *2017 U.S. Solar Industry Diversity Study: Current Trends, Best Practices, and Recommendations*, Solar Foundation, Washington, DC, September.
- Strathmore University** (2015), *Strathmore Energy Research Centre hosts the 2nd female solar PV training*, <http://www.strathmore.edu/news/strathmore-energy-research-centre-hosts-the-2nd-female-solar-pv-training/>.
- Suri, T. and W. Jack** (2016), *The long-run poverty and gender impacts of mobile money*, *Science*, Vol. 354/6317, pp. 1288–1292, <http://science.sciencemag.org/content/354/6317/1288>, accessed 27 October 2018.
- Swirski, B.** (2002), *What is a gender audit*, Adva Center.
- Turnbull, P.** (2013), *Promoting the Employment of Women in the Transport Sector: Obstacles and Policy Options*, International Labour Office, Geneva.
- United Nations (UN)** (2018), *Accelerating SDG7 achievement: Policy briefs in support of the first SDG 7 review at the UN high-level political forum 2018*, [https://sustainabledevelopment.un.org/content/documents/18041SDG7\\_Policy\\_Brief.pdf](https://sustainabledevelopment.un.org/content/documents/18041SDG7_Policy_Brief.pdf), accessed 5 December 2018.
- United Nations** (2015), *Transforming our world: The 2030 agenda for sustainable development*, <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf>, accessed 4 October 2018.
- UN Women** (2018), *Turning Promises into Action: Gender Equality in the 2030 Agenda for Sustainable Development*, United Nations Entity for Gender Equality and the Empowerment of Women, <http://www.unwomen.org/en/digital-library/publications/2018/2/gender-equality-in-the-2030-agenda-for-sustainable-development-2018>, accessed 27 October 2018.
- UN Women** (2016), *Leveraging Co-Benefits between Gender Equality and Climate Action for Sustainable Development: Mainstreaming Gender Considerations in Climate Change Projects*, UN Women, New York.
- UN Women** (2014), *Guide on Gender Mainstreaming: Energy and Climate Change Projects*, <http://www.unwomen.org/en/docs/2014/1/gender-mainstreaming-energy-climate-change>.
- UNESCO (United Nations Educational, Scientific and Cultural Organization)** (2017) *Cracking the code: girls' and women's education in science, technology, engineering and mathematics (STEM)*.
- UNESCO** (2015), *UNESCO Science Report: Towards 2030*, UNESCO, Paris.
- UNIDO (United Nations Industrial Development Organization)** (2014), *Sustainable energy for all: The gender dimensions*, [https://www.unido.org/sites/default/files/2014-02/GUIDANCENOTE\\_FINAL\\_WEB\\_s\\_0.pdf](https://www.unido.org/sites/default/files/2014-02/GUIDANCENOTE_FINAL_WEB_s_0.pdf), accessed 27 October 2018.
- UNIDO** (2013), *Burkina Faso empowering women beer brewers*, [https://www.unido.org/sites/default/files/2014-02/Factsheet\\_BKF\\_women\\_2013\\_0.pdf](https://www.unido.org/sites/default/files/2014-02/Factsheet_BKF_women_2013_0.pdf), accessed 14 November 2018.
- USAID (United Nations Industrial Development Organization)** (2018), *Practical Guide to Women in Energy Regulation*, USAID, Washington, DC.
- U.S. Department of Labor** (n.d.), *Family and Medical Leave Act*. Retrieved from Wage and Hour Division (WHD), <https://www.dol.gov/whd/fmla/>
- Wei, M., S. Patadia, and D. Kammen** (2010), *Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US?*, *Energy Policy*, Vol. 38/2, pp. 919–931.
- Westermann, O., J. Ashby, and J. Pretty** (2005), *Gender and social capital: The importance of gender differences for the maturity and effectiveness of natural resource management groups*, *World Development*, Vol. 33/11, pp. 1783–1799.
- Wider Opportunities for Women** (n.d.), *Pink to Green Toolkit: Building Cultural Competency and Respect for Diversity*, <http://womensequityinitiative.org/portfolio/pink-to-green-toolkit/>.
- WIPO (World Intellectual Property Organization)** (2009), *Barefoot College, teaching grandmothers to be solar engineers*, *WIPO Magazine*, [https://www.wipo.int/wipo\\_magazine/en/2009/03/article\\_0002.html](https://www.wipo.int/wipo_magazine/en/2009/03/article_0002.html), accessed 12 November 2018.
- WiRE (Women in Renewable Energy)** (2018), *Women of distinction awards*, <https://www.womeninrenewableenergy.ca/awards>.
- WISE (Women in Solar Energy)** (2017), *Women employment in urban public sector*, [http://www.wiseproject.net/download/final\\_wise\\_project\\_report.pdf](http://www.wiseproject.net/download/final_wise_project_report.pdf).
- WiTEC (European Association for Women in Science, Technology, Engineering and Mathematics)** (n.d.), *About WiTEC*, <https://www.witeceu.com/about-us/about-us-38888907>.

**World Bank** (2018), *Tracking SDG7: The Energy Progress Report 2018*, [https://trackingsdg7.esmap.org/data/files/download-documents/tracking\\_sdg7-the\\_energy\\_progress\\_report\\_full\\_report.pdf](https://trackingsdg7.esmap.org/data/files/download-documents/tracking_sdg7-the_energy_progress_report_full_report.pdf), accessed 10 October 2018.

**World Bank** (2017), *Energy access and gender: Getting the right balance*, ENERGIA, <http://documents.worldbank.org/curated/en/463071494925985630/pdf/115066-BRI-P148200-PUBLIC-FINALSEARSGenderweb.pdf>, accessed 25 November 2018.

**World Bank** (2012), *World Development Report 2012: Gender and Development*, World Bank, Washington, DC.

**World Bank** (2011), *Mainstreaming Gender in Energy Projects—A Practical Handbook*, <https://ppp.worldbank.org/public-private-partnership/library/mainstreaming-gender-energy-projects-%E2%80%93-practical-handbook>.

**World Bank** (n.d.), *Applying a Gender Lens throughout the Project Cycle*, <https://ppp.worldbank.org/public-private-partnership/ppp-sector/gender-impacts-ppps/gender-lens-project-cycle/applying-gender-lens-throughout-project-cyc>, accessed 7 October 2018.

**World Policy Center** (2018), *Is paid leave available for mothers of infants?* Retrieved from <https://www.worldpolicycenter.org/policies/is-paid-leave-available-for-mothers-of-infants>

**Young Women's Trust** (2016), *Making Apprenticeships Work for Young Women*, [https://www.youngwomenstrust.org/apprenticeshipcampaign/making\\_apprenticeships\\_work\\_for\\_young\\_women](https://www.youngwomenstrust.org/apprenticeshipcampaign/making_apprenticeships_work_for_young_women).

## Photo Credits

- page 17 © KeepWatch; shutterstock  
 page 18 © crazystocker; shutterstock  
 page 20 © only\_kim; shutterstock  
 page 27 © wavebreakmedia; shutterstock  
 page 28 © goodluz; shutterstock  
 page 28 © Delpixel; shutterstock  
 page 29 © DW2630; shutterstock  
 page 30 © only\_kim; shutterstock  
 page 31 © only\_kim; shutterstock  
 page 32 © Roman Samborskyi; shutterstock  
 page 34 © Gorodenkoff; shutterstock  
 page 34 © FlyingFifeStudio; shutterstock  
 page 37 © Monkey Business Images; shutterstock  
 page 38 © Roman Samborskyi; shutterstock  
 page 39 © gyn9037; shutterstock  
 page 40 © sirastock; shutterstock  
 page 40 © KeepWatch; shutterstock  
 page 41 © Syda Productions; shutterstock  
 page 42 © Hyejin Kang; shutterstock  
 page 44 © Yuttana Jaowattana; shutterstock  
 page 46 © fizkes; shutterstock  
 page 48 © Monkey Business Images; shutterstock  
 page 48 © CRS PHOTO; shutterstock  
 page 51 © Pressmaster; shutterstock  
 page 52 © Zivica Kerkez; shutterstock  
 page 52 © Khakimullin Aleksandr; shutterstock  
 page 54 © pikselstock; shutterstock  
 page 57 © Russell Watkins; Department for International Development  
 page 59 © Mooshny; shutterstock  
 page 60 Opuwo, Namibia; © Beate Wolter; shutterstock  
 page 60 Yangon, Burma; © Anirut Thailand; shutterstock  
 page 61 Marsabit, Kenya; © Adriana Mahdalova; shutterstock  
 page 61 © Practical Action  
 page 62 © Zurich Insurance Company Ltd Elisabeth Real  
 page 63 © LeoPatrizi; iStock  
 page 65 © Sandeep Saxena  
 page 66 © Kopernik  
 page 68 © Hivos  
 page 70 Barefoot, India © Abbie Trayler-Smith / Panus Pictures / Department for International Development  
 page 71 © Natee Meepian; shutterstock  
 page 71 © Solar Sister  
 page 72 © SEWA  
 page 77 © Prashanth Vishwanathan (IWMI)  
 page 79 © Franziska & Tom Werner; iStock  
 page 80 © PeopleImages.com; iStock  
 page 81 © rawpixel.com; unsplash

# RENEWABLE ENERGY: **A GENDER PERSPECTIVE**

## **diversity**

/daɪˈvɜːsəti/

*noun* 1. the state of encompassing varied elements, especially the inclusion of different types of people in a group or organization.

Copyright © IRENA 2019

### **IRENA HEADQUARTERS**

P.O. Box 236, Abu Dhabi  
United Arab Emirates

[www.irena.org](http://www.irena.org)