

WIND ENERGY:
**A GENDER
PERSPECTIVE**



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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 knowledge on policy, technology, resources and financing related to 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

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1 Wind energy and Gender



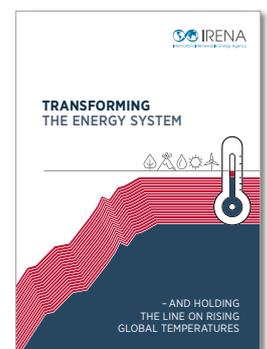
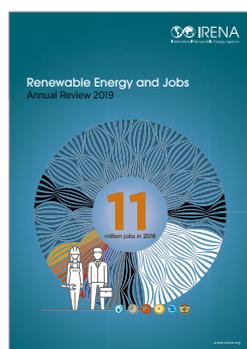
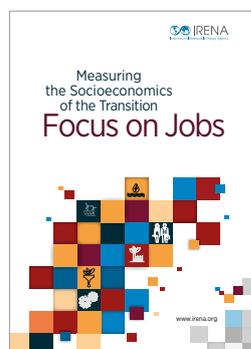
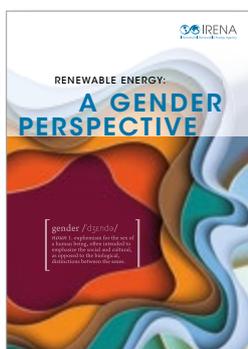
The expansion of renewable energy promises a broad array of benefits. That renewables are good for energy security, air quality and health, and the reduction of greenhouse gas emissions is well known. What many do not realise, however, is that the renewable energy transition can boost economic development and create jobs. Global employment in the renewable energy sector grew by nearly 4 million jobs in six years – from 7.1 million in 2012 to 11 million in 2018 (IRENA, 2019a). Renewable energy is creating jobs as fossil fuel industries are shedding them due to rising automation in extraction, overcapacity, consolidation, regional

shifts, and the substitution of coal by natural gas in the power sector. IRENA's socio-economic footprint analysis estimates that employment in renewables will almost triple to 42 million in 2050 (IRENA, 2020).

But to realise this success, and to ensure that everyone benefits from the socio-economic opportunities created by the energy transition, the sector must be accessible to women, youth, minorities, and others who are often left behind.

The present report looks more closely at the participation of women in the wind sector, one of the fastest-growing renewable energy industries. It follows an in-depth analysis of women's participation

in the renewable energy industry as a whole. *Renewable energy: A gender perspective* (IRENA, 2019b) was based on an extensive literature review and global survey of individuals and organisations. It found that women account for an estimated 32% of the renewable energy workforce. After identifying the barriers women face in attempting to enter and advance in the industry, it suggested policies and workplace measures to overcome these impediments in both the public and private sectors. The present report follows up with a specific focus on wind energy, one of the fastest-growing renewable energy industries. The number





of jobs generated in the sector worldwide has grown from about 750 000 in 2012 to 1.16 million (IRENA, 2019a).

To understand women's participation in wind, IRENA, together with its partner Women in Wind – a joint program managed by the Global Wind Energy Council (GWEC) and the Global Women's Network for the Energy Transition (GWNET) – surveyed women and men working in the wind industry. GWEC and GWNET are profiled in Box 1.1.

In publishing this report, we pay tribute to the late Steve Sawyer, a founder of GWEC who served as its Secretary General for more than a decade. Steve's consistent support for gender balance was a key factor in the decision by the three organisations to join forces in producing this survey and analysis.

Chapter 2 of this report details the findings of the survey.

The survey found that job opportunities for women exist across the wind energy value chain – in project planning and equipment manufacturing, construction and installation, and operations and maintenance of facilities. Those opportunities include a broad array of support services, such as finance, information technology, administration, marketing, knowledge, legal, and business development, among others. These activities require expertise in a diverse set of technical and non-technical occupations (IRENA, 2017; 2018).

Under IRENA's Transition pathway (ReMap), the number of wind jobs worldwide is projected to surpass six million in 2050 (IRENA, 2019c; 2019d; 2020). Appropriate policies can ensure that women are able to garner their fair share of those jobs. Policy areas include better access to education and training, mainstreaming efforts, networking and mentoring opportunities, workplace policies and regulations, and work-life balance.

In general, gender-sensitive policies belong as integral parts of a comprehensive set of policies designed to advance the energy transition and ensure that its benefits are broadly shared. This framework includes broad provisions expressing the political will to push ahead with the deployment of wind and other renewables; technical measures to facilitate the integration of variable sources such as wind into the grid; and a set of enabling policies in the areas of industrial policy, financial policy, education and training, labour market regulation, and social protection to strengthen the capacity of countries to carry out the transition while opening opportunities for all (IRENA, 2020).

Box 1.1 About IRENA's survey partners



The **Global Wind Energy Council (GWEC)** is the international trade association for the wind power industry. Its mission is to ensure that wind power establishes itself as the answer to today's energy challenges, providing substantial environmental and economic benefits. GWEC members represent over 1500 companies, organisations and institutions in more than 80 countries, including manufacturers, developers, component suppliers, research institutes, national wind and renewables associations, electricity providers, and finance and insurance companies. Working with the United Nations Framework Convention on Climate Change, REN21, the International Energy Agency, international financial institutions, the Intergovernmental Panel on Climate Change and IRENA, GWEC advocates policies to help wind power reach its full potential. GWEC leads the efforts of the sector to advance a gender-equitable energy transition.

GWEC and GWNET launched the **Women in Wind Global Leadership Program** in 2019 (see Box 2.1 for details).



The **Global Women's Network for the Energy Transition (GWNET)** aims to advance the global energy transition by empowering women in energy through interdisciplinary networking, advocacy, training, coaching and mentoring. GWNET seeks to address the current gender imbalances in the energy sector and to promote gender-sensitive action related to the global energy transition through:

- **Networking:** facilitating connections among women working in the fields of renewable energy and energy efficiency to advance the energy transition, through events and the Women in Energy Expert Platform.
- **Advocacy:** generating and disseminating information on the role of women in the energy transition as well as organising conferences, seminars, webinars, and workshops which foster discussions and promote gender-sensitive action related to the energy transition.
- **Mentoring:** leading the development of several women's mentoring programmes at the regional and global levels, with the goal of advancing the role of women as agents of change in society and promoting best practices within the sustainable energy sector.



1.1 The importance of gender equality

Women have long been under-represented in conventional energy industries such as coal, oil and gas, whether in exploration and extraction activities or in running power-generating plants. All available information suggests that men outnumber women in most of these workplaces, and especially in technical, managerial and policy-making positions (Catalyst, 2019). Energy is still often seen as a man's domain, where persistent cultural and social norms sway hiring decisions. More prosaically, workplace disparities reflect educational pathways and recruitment networks that remain heavily male-oriented. The widespread perception that the energy field requires technical skills

above all else, and that energy is a "dirty" business, reinforce these patterns (Paraskova, 2017). Another factor is the relative scarcity of female role models in the sector, and inadequate mentoring and peer networks for women.

Yet greater gender equality and equity is an issue of fundamental fairness: equal job and career opportunities should be available to all, irrespective of their gender or other distinguishing characteristics (see Box 1.2).

The benefits to companies are compelling. Studies in many sectors of the economy show that workforce diversity is good for an organisation's growth, culture and sustainability (World Economic Forum, 2019; Boston Consulting Group, 2018). Eliminating the barriers that dissuade or prevent

women from entering the wind sector (and remaining in it) offers several advantages to the industry. These include the ability to draw on a much wider and deeper pool of talent in technical, business and administrative occupations, and to gain from the fresh ideas and perspectives that women bring to the industry.

Society at large also benefits from a stronger female presence and voice in the energy sector. Women's perspectives and priorities may differ from those of men; having them reflected in decision-making on energy technology choices, market design, and scale and scope of specific projects can bring about more balanced outcomes for society as a whole. This is of great importance in the context of the Sustainable Development Goals (see Box 1.3).

Box 1.2 Gender equality and 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 permitting them to realise their capabilities and to contribute to and benefit from economic, social, cultural and political development.

Source: IRENA, 2019a.

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 for (or reduce disparity in) historical and social disadvantages that prevent women and men from otherwise operating on an equitable basis.

Box 1.3 Gender in the context of sustainable development

Renewable energy, including wind power, enables the achievement of key social, economic and environmental objectives expressed in the Sustainable Development Goals (SDGs). The triangle of sustainable energy, jobs and gender objectives finds expression in three of the 17 SDGs: SDG 7 (access to modern, clean, and sustainable energy), SDG 5 (gender equality and empowerment), and SDG 8 (inclusive growth and decent work).

They are closely interconnected. Achieving SDG 7 is indispensable to a vibrant, clean and inclusive economy. The close interaction between the energy system and the broader economy implies a symbiotic relationship between SDGs 7 and 8. The gender objectives expressed in SDG 5 shape the way the energy industry and the economy at large function, aiming to make them inclusive.

Different strands of IRENA's work address aspects critical to these three SDGs.

Over the years, IRENA has been providing empirical evidence on the socio-economic effects of renewable energy for member states and relevant stakeholders. To support informed policy-making, the agency has

published several reports that explore the transition's macroeconomic and social impact through indicators such as employment, GDP and welfare (IRENA, 2019c; 2019d; 2020).

In addition, the agency is leading an initiative – the Sustainable Energy Jobs Platform, formally established in January 2020 – that brings together a group of international partners to study the preconditions for and the implications of a just energy transition. A particular focus of the initiative is the interlinkages between SDGs 7 and 8, with special consideration of SDG 5.



1.2 Closing the knowledge gap on gender and the wind energy sector: IRENA's survey

Following up on its sector-wide gender report (IRENA, 2019b), IRENA has decided to shed light on individual industries, focusing first on wind energy. Mirroring

the survey approach of the earlier report, this study offers quantitative and qualitative insights on women's participation in the industry; analyses barriers to their entry, retention and advancement; and suggests solutions.

The survey was carried out online from mid-September to mid-November 2019. To reach a wide

audience and generate a sufficiently large sample of participants, it was advertised widely through the distribution channels of IRENA, GWEC, GWNET and other partners. Those channels included mailings, newsletters, online fora and news sites, e-mails from staff and messages at renewable energy events, especially those with a focus

921

responses

132

organisations

789

individuals

71

countries

on the wind energy sector. A total of 921 responses were received from 71 countries and areas; 132 respondents completed the survey on behalf of the organisations they work for, whereas 789 replied in their individual capacity.

- **From individuals**, qualitative information was collected about their *perceptions* of the main barriers and challenges to attracting and retaining women in the wind workforce, as well as suggestions for potential solutions to some of these problems.
- **From representatives of organisations**, the survey asked for *quantitative information* about the gender distribution in the organisation's workforce and the policies and measures in place to support greater gender diversity. Answering these questions

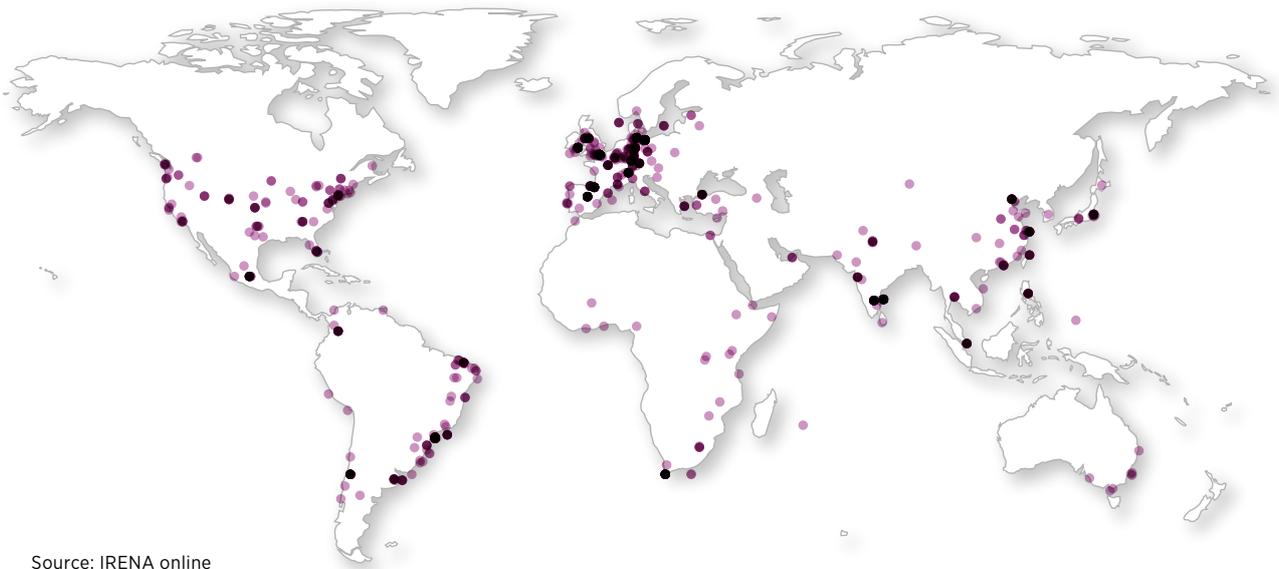
accurately requires knowledge of relevant staff statistics, so individuals with sufficient knowledge of such matters (principally staff from human resources departments) were targeted for completion of this part of the questionnaire.

The survey was made available in Chinese, English and Spanish. Participation was worldwide, as illustrated in Figure 1.1. The map also indicates that participation was higher in countries where wind energy is the dominant market (e.g., Brazil, China, Germany, Spain, and the United States).

Regional distribution. Figure 1.2 shows the regional distribution of responses by individuals and organisations. However, the regional pattern varies somewhat between them:

- Responses from *organisations* were quite evenly distributed across the main regions of the world, with the largest share of responses coming from the key markets of Europe and Northern America¹, followed by Latin America and the Caribbean and then Asia-Pacific.
- By contrast, over half of the responses from *individuals* came from Europe and North America (making the combined region somewhat over-represented), followed by Asia-Pacific and Latin America and the Caribbean. Africa's wind industry is taking off more slowly than in the rest of the world; the region's representation in the survey sample is lower for both sets of respondents (organisations and individuals).

Figure 1.1: Geographical distribution of survey respondents

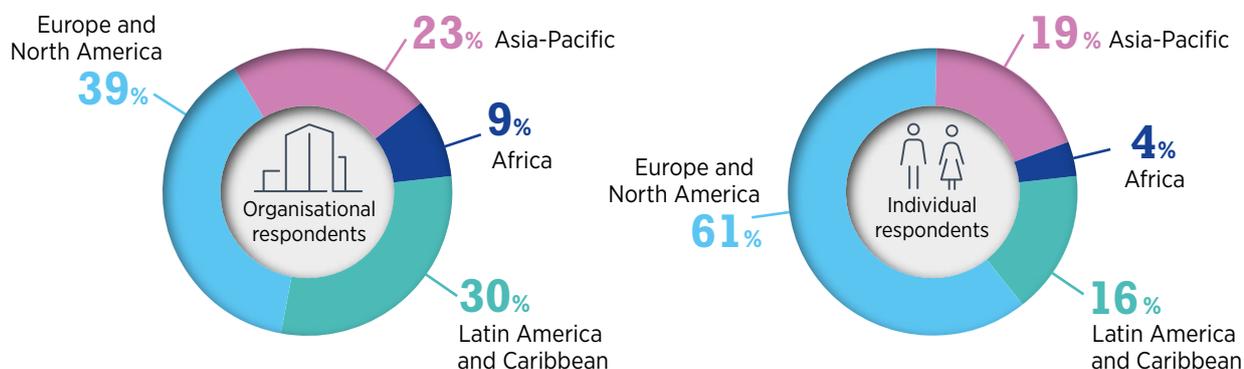


Source: IRENA online wind survey, 2019.

Note: Baseline map data ©2019 Google, overlaid with data points from the survey.

Disclaimer: This map does not imply any official endorsement of names, boundaries or territorial status.

¹ North America excludes Mexico. Respondents from Mexico are included in the Latin American region.

Figure 1.2: Distribution of survey respondents by region

Source: IRENA online wind survey, 2019.

The survey also asked participants to provide information about the segment of the value chain to which their activities belong, and the size of the organisation participating in the survey. Box 1.4 explains what is meant by segments of the value chain and defines two terms – “roles” and “activities” – used throughout this report.

Segment of the value chain. Among replies on behalf of an organisation, 23% of responses received were from developer companies, followed by manufacturing firms (19%), service providers (16%) and operators (15%). “Other”² was selected by 27% of the responders (see Figure 1.3).

Among individual responses, by contrast, people working for service providers accounted for 29%, while operators represented 24%. Developers accounted for

21%, and manufacturing companies were represented at 13%.

Given the relatively even distribution from respondents engaged in different activities across the segments of the value chain, the survey is likely to represent the views of a broad selection of organisations and individuals working in the sector.

Size of employing entities.

The survey sample is weighted toward large organisations (over 1 000 employees) in both the organisational and individual categories (37% and 54%, respectively) (see Figure 1.4). Mid-size companies (101 to 500 employees) are less well represented (11% of institutional replies, 19% of individual replies). However, among respondents who provided institutional replies, almost half (47%) came from organisations

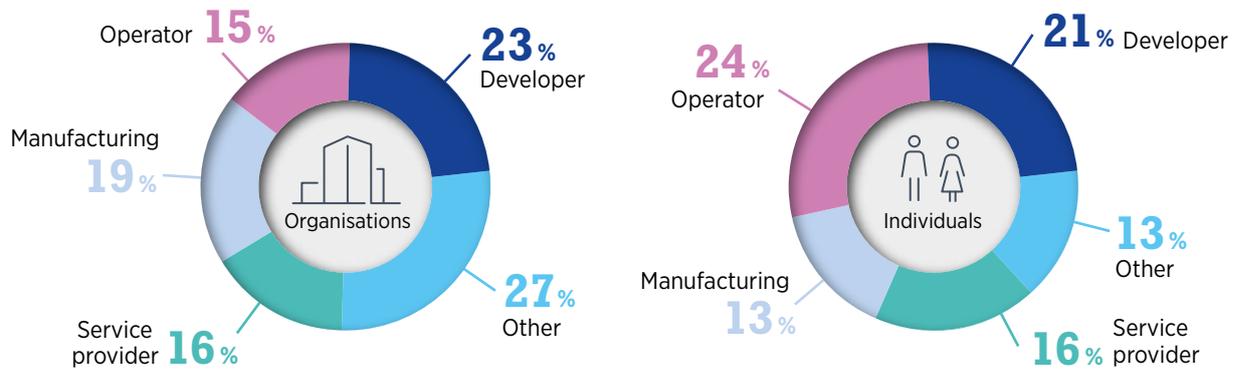
that employ 100 people or less, with those employing 20 or fewer representing almost a quarter of the total. By contrast, among individual respondents, roughly a quarter of the respondents work for companies with a workforce numbering fewer than 100 persons. The predominance of large organisations is in accord with current wind energy realities, in which the leading five manufacturing companies held a two-thirds market share of orders for onshore wind projects in 2018, and the top five firms in the offshore segment had a 94% share in the same year (Wood Mackenzie, 2019).

The size structure of the sample was used to generate weighted estimates of the share of women working in the wind sector. This was done to reflect the fact that respondents answering on behalf

² “Other” includes consultancy companies, think tanks, academic and research institutes, training and educational centres, financial institutions, governmental agencies or marketing companies among others.

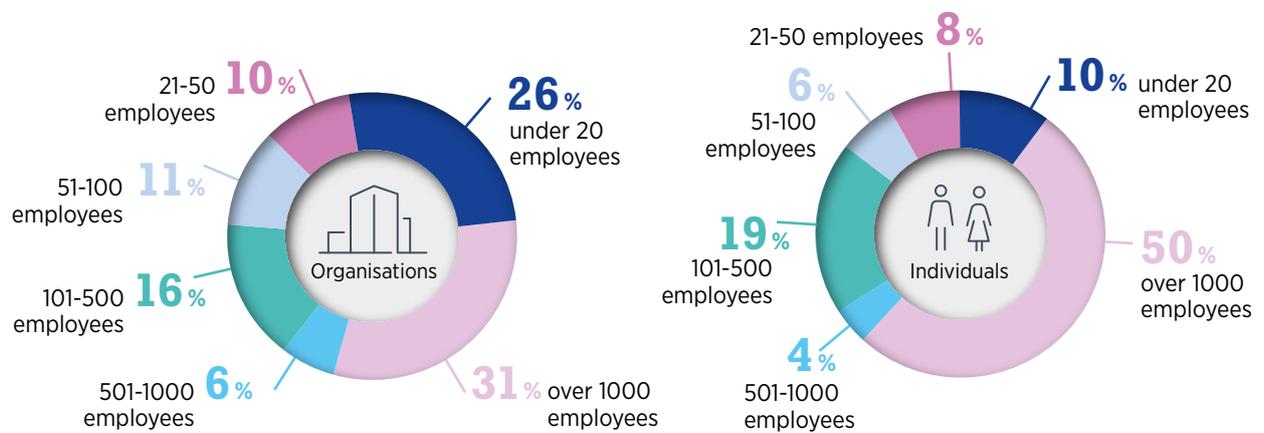


Figure 1.3: Distribution of survey respondents by segment of the value chain



Source: IRENA online wind survey, 2019.

Figure 1.4: Distribution of survey respondents by size of their organisation



Source: IRENA online wind survey, 2019.

70%

of survey participants were women

of the organisation they work for represent a workforce of varying size. Naturally, replies from representatives of large companies or other entities have a significant impact on the overall results. Notably, however, the distribution of total employment by organisation size is unknown; whether the distribution in the survey sample matches that of the wind industry as a whole is therefore also not known.

Survey participation by women and men. Both women and men were invited to respond to all survey questions, but around 70% of respondents were women. This disparity mirrors participation in IRENA's global renewable survey (IRENA, 2019b) and may serve as an indication that concern about gender issues in the wind sector is still driven by gender itself. The level of education of survey respondents was roughly the same for men and women.

Educational achievement. For individuals, additional questions enabled respondents to provide information about their gender and educational attainment and background, specifically in technical or non-technical fields. 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. As Figure 1.5 on the distribution of educational status shows, 93% of respondents had a university degree, with over half of the total holding a master's.

Non-degree holders are underrepresented in the sample compared with respondents with advanced degrees (see Box 1.5). Factory and construction workers are not well represented, although the wind energy sector requires



Box 1.4 Terms used in this report

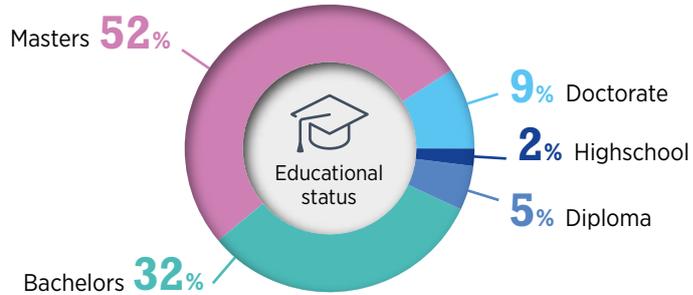
Segment of value chain: Segments include project planning, equipment manufacturing, construction, installation, operations and maintenance, in addition to a broad array of support services – such as finance, information technology, administration, marketing, consulting, legal advice, business development, and so on.

Roles: For the purpose of this report, the roles of wind sector employees fall into the following categories: low-qualified (unskilled), mid-qualified (require some type of certification that does not require higher education), administration, STEM (science, technology, engineering, and math), non-STEM, management and senior management. Some of the categories may overlap. A person with a STEM degree, for instance, can rise into a management or senior management role.

Activities: This refers to the functions of companies and other organisations that may relate to segments of the wind value chain. For this report, the activities broken out are: manufacturing, developer, service provider, operator, and other.

Gender: For the purpose of this report gender refers to women and men.

Figure 1.5: Distribution of survey individual respondents by educational achievement



Source: IRENA online wind survey, 2019.

large numbers of such workers with limited or less specialised qualifications.

The underrepresentation of lower-skilled employees can affect the analysis, both in the quantification of the share of women in the industry and in the qualitative analysis. In fact, parts of the workforce that are less well represented may have very different workplace experiences and could therefore hold views very different from those of the rest of the sample.



These considerations notwithstanding, the survey does represent the most significant sample of responses on wind energy and gender gathered to date. It confirms several findings from earlier studies and offers new insights. These are discussed in the sections that follow, which focus first on the quantitative analysis and the share of women in the wind energy sector (Section 2) and then on the most critical highlights on the qualitative analysis of the barriers and solutions that women face in the participation of the wind energy workforce (Section 3).



Box 1.5 Representation of lower-skilled employees in the survey

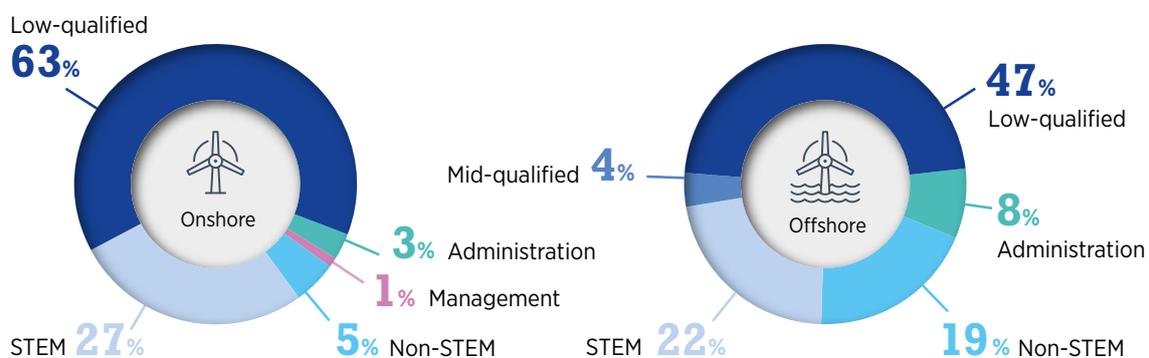
To assemble a meaningful sample, the survey captured a broad cross-section of organisations and individuals in the wind energy sector. However, the self-selected nature of participation in an online survey may influence results in favour of people with a proactive interest in the topic, in this case mostly women with higher levels of education. An online survey, while convenient, may therefore unintentionally limit or exclude part of the population of interest, especially the lower-qualified segment of the workforce. Manufacturing workers on a factory floor or construction workers are difficult to reach, especially in remote project locations, unless an online survey is paired with workplace interviews co-ordinated with employers or labour unions.

Derived from data on a large number of existing wind projects, IRENA's series on leveraging local capacity assesses the types of jobs created along the value chain. The series provides policymakers with an understanding of the human resources and skills required to produce, install and operate facilities for selected renewable technologies. The reports on onshore wind (IRENA, 2017) and offshore

wind (IRENA, 2018) shed light on broad functional and occupational distributions in these industries' workforces, with implications of required skill levels. As Figure 1.6 shows, personnel in management, STEM, and non-STEM functions (including engineers; technicians; experts in quality assurance, health, safety and environment; experts in law, regulation, standardisation and logistics; marketing personnel; financial analysts) account for about a third of the total labour required for a typical 50 MW onshore wind project. These are the types of employees who may be expected to participate most readily in an online survey. The remaining two-thirds of the labour required is in lower-skilled jobs (such as construction and factory workers). The views of people in these types of positions are far less likely to be reflected in the survey results. Similarly, for a typical 500 MW offshore wind farm, low-qualified individuals again represent the highest category (47%). STEM and non-STEM personnel together account for 41%.

Sources: IRENA, 2017; IRENA, 2018.

Figure 1.6: Roles and skill requirements in onshore and offshore wind



Note: Please see Box 1.4 for the definitions of roles of wind sector employees.

2

Employment
of women
in the
**wind
energy
sector**



This section opens with key findings from IRENA's wind survey. A series of figures sketch the sector's gender landscape by region, activity, and organisational size. The next topic is major barriers to women's entry, retention and advancement in the sector. The discussion of issues relating to pay inequities draws comparisons with IRENA's earlier survey of the renewable energy sector as a whole. The section then turns to possible solutions. These include networking and mentorship efforts; workplace practices, policies and regulations; and mainstreaming initiatives. It closes with examples of grassroots women's initiatives in the field.

32%

share of women in the overall renewable energy workforce

2.1 Key findings

In 2019, IRENA examined the question of gender equity throughout the renewable energy sector. *Renewable Energy: A Gender Perspective* (IRENA, 2019b) was based on an in-depth literature review and a ground-breaking survey of over 1 400 employees, companies and institutions. The analysis found that women make up, on average, 32% of the sector workforce. However, imbalances abound across different roles and occupations. At 28%, women's presence in jobs requiring knowledge in science, technology, engineering and mathematics (STEM) is still lower than in non-STEM positions (35%) and administrative jobs (45%).

Recognising that the situation varies for different types of renewables, IRENA followed up with a survey of the wind value chain in collaboration with GWEC and GWNET (see Box 1.1). This new survey finds that women represent 21% of the sector workforce, according to a statistical analysis that accounts for different sizes among participating firms and other organisations in the sector.

21%

share of women in the wind energy workforce

At first glance, this is substantially lower than the 32% share of women in the workforce for all renewables. Without doubt, this sobering finding underscores how far the industry has yet to go to reach meaningful gender equality. However, beyond headline statistics, there are also limits to the direct comparability of the two findings:

- First, the earlier survey included the entire range of renewable technologies and thus industries with diverging characteristics, supply chains, occupational patterns and skill requirements.
- Second, in addition to covering the "modern" renewable energy sector as a whole, the earlier study also included off-grid applications, particularly in rural areas. This is an area where women are playing major roles in improving energy access and in local productive

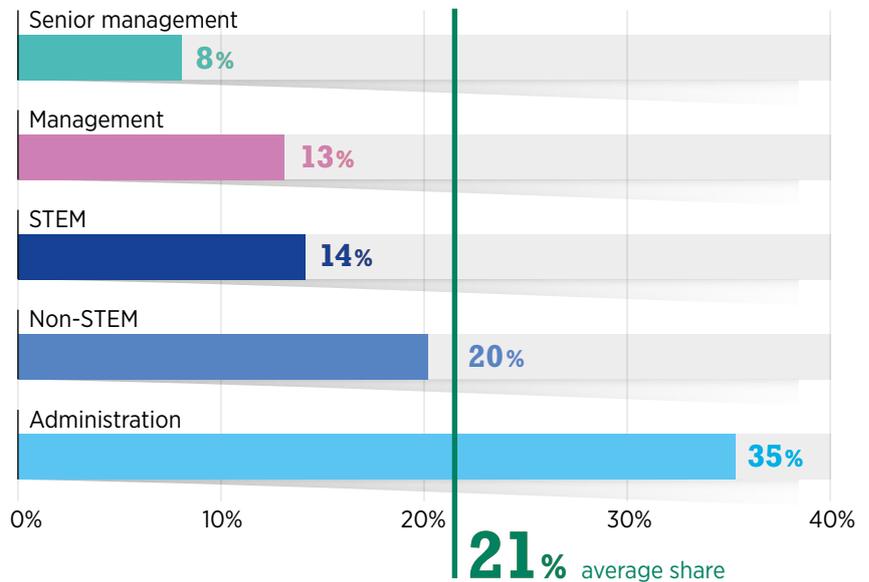
applications of electricity. Although small wind turbines do have a niche presence, wind technology is heavily focused on ever-larger scales of deployment, playing at most a limited role in efforts to expand access to energy.

Still, there are important similarities in findings from the two surveys. As is the case for the renewable energy sector as a whole, women are better represented in administrative functions (35%) than they are in the wind industry as a whole (21%), but less well represented in other roles (see Figure 2.1). The role with the lowest share of female employment (8%) was senior management (e.g., owners or members of the board of directors of an organisation).³

Beyond the global results, responses from survey participants can be analysed in three categories: geographically, based on four major regions of the world (Europe and North America; Latin America and the Caribbean; Asia-Pacific; and Africa); by activity; and by organisation size. In each case, findings emerge for all positions, and by major roles, including STEM jobs, other technical positions, management, senior management, and administration.

By region. There is some regional variation in the female share of the workforce, with the Africa and Asia-Pacific regions showing generally lower levels than the other two.

Figure 2.1: Shares of women by role in the wind energy sector



Source: IRENA online wind survey, 2019.

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

Note: Please see Box 1.4 for the definitions of STEM and Non-STEM.

At 26%, the Europe and North America region performs best (see Figure 2.2). A national report for the United States offers even more encouraging findings, indicating that women made up 32% of the country's wind industry workforce in 2017 (USDOE, 2017). Women are significantly more represented in administrative positions, a result that holds up across all regions (see Figure 2.3). This is a finding that confirms IRENA's earlier survey, and also parallels a broad reality across many sectors of the economy. The spread between women's shares

in administration and in all other roles is most pronounced in Latin America and the Caribbean and in Europe and North America. This finding suggests that these two regions fare better in comparisons of women's share of the global wind workforce, principally because of heavy representation of women in administration.

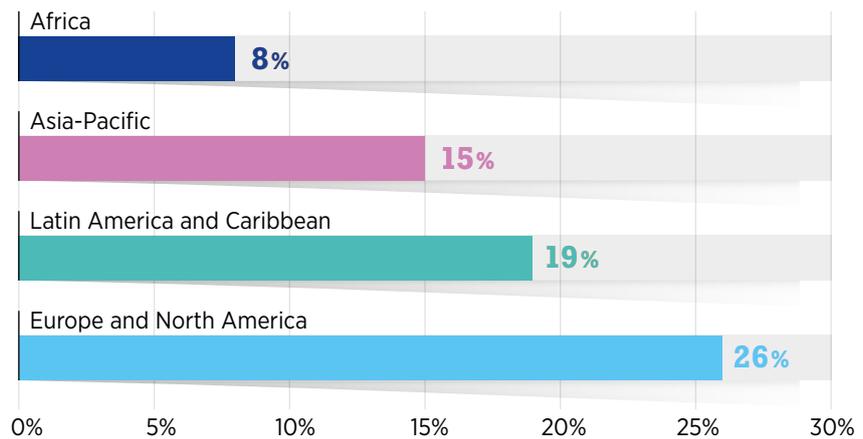
The fact that women are comparatively less well represented in non-administrative functions may attest to the existence of a variety of gender-specific barriers.

³ Throughout this analysis, statistical significance is measured against a null hypothesis of randomness (or no relationship) using a 5% probability level (i.e. randomness is rejected if its probability is less than 5%). A significance level of 5% or less can be assumed unless otherwise stated. Where a relationship is significant at a different probability level, the level is specified. These differences in employment shares in given roles (compared with the share for all roles) were significant in all cases except for the share of women employed in STEM roles. The share of women in a senior management position is up to a 14% compared to the 8% if the results are not weighted by organisation size. This could be assumed because the number of people serving on boards of directors is likely to be quite similar across all organisations regardless of their size.

Such obstacles will be discussed in Section 2.2. Even so, survey respondents undoubtedly saw the “glass ceiling” for women as the second most important barrier.⁴ Indeed, the share of women holding senior management positions is generally quite low across all regions.

By activity. Developers and “other” activities along the wind value chain perform best in employing women. By contrast, female employment in equipment manufacturing is below the 21% average for the wind energy sector (Figure 2.4). From the

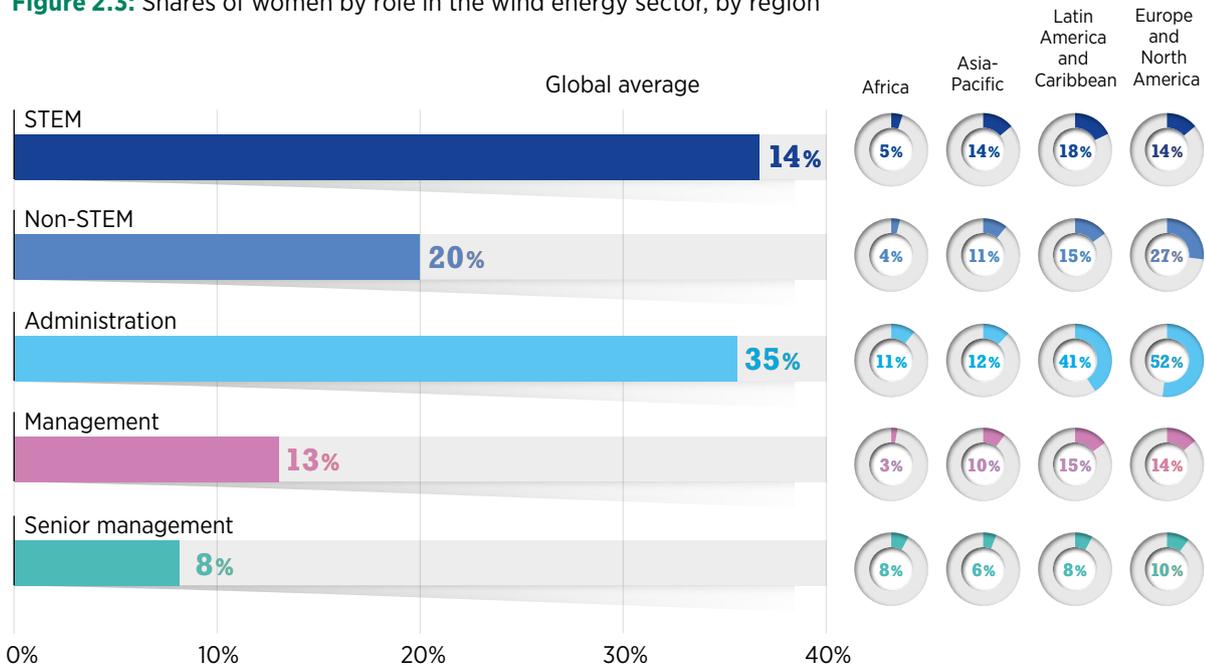
Figure 2.2: Shares of women in the wind energy sector, by region



Source: IRENA online wind survey, 2019.

Note: North America excludes Mexico. Respondents from Mexico are included in the Latin American region.

Figure 2.3: Shares of women by role in the wind energy sector, by region



Source: IRENA online wind survey, 2019.

Note: Please see Box 1.4 for the definitions of STEM and Non-STEM.

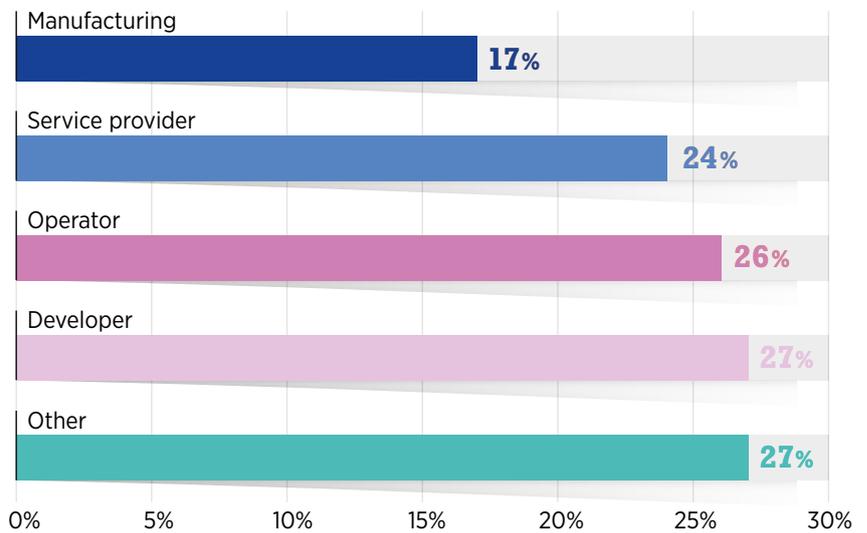
⁴ “Glass ceiling” refers to an unstated barrier to advancement in a profession, especially affecting women and members of minority groups.



perspective of assessing not just the number of jobs but also their quality, this represents a challenge, given that manufacturing typically offers better-paying jobs than other segments of an industry (Mishel, 2018).

Figure 2.5 disaggregates the findings presented in Figure 2.4. For each major activity, it shows the share of women broken down by STEM, non-STEM but professional, administrative and management roles. Once again, administrative positions are where much higher proportions of women find employment. This is particularly the case among developers and in the “other” category. Repeating findings from IRENA’s survey of the entire renewable energy sector, STEM-related positions also seem to have a significantly lower female presence than other professional jobs (IRENA, 2019b). Indicating an area where gender equality remains a remote ideal, the share of women is by far the lowest in senior management.

Figure 2.4: Shares of women in the wind energy sector, by activity



Source: IRENA online wind survey, 2019.

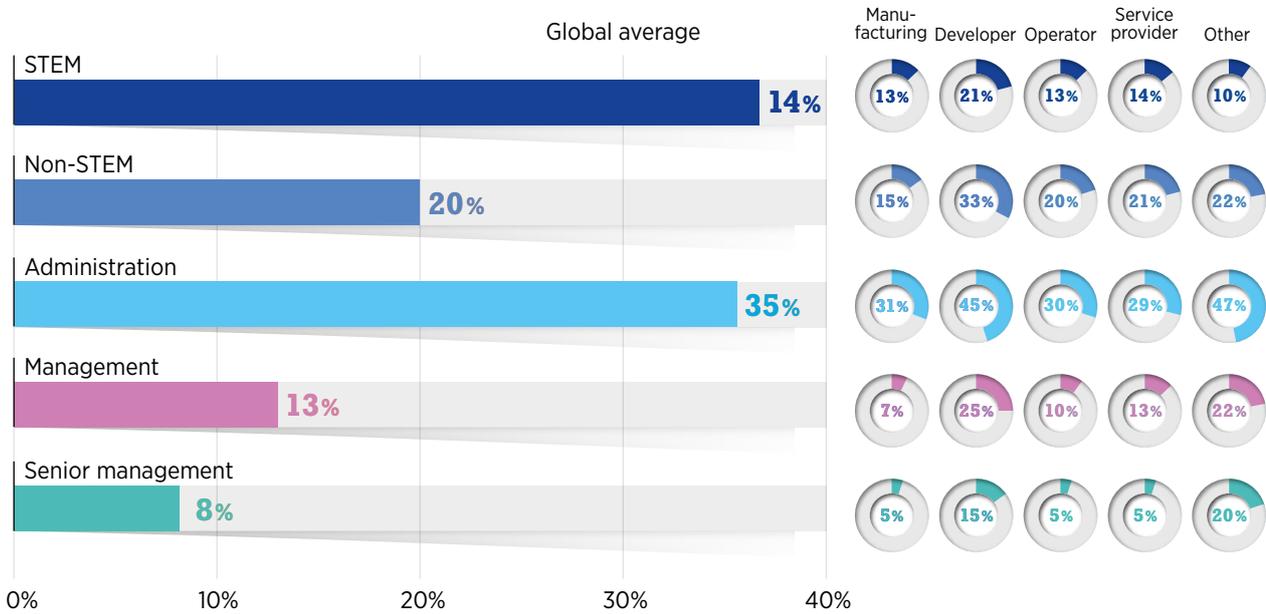
Note: Other includes consultancy companies, think tanks, academic and research institutes, training and educational centres, financial institutions, governmental agencies or marketing companies among others.

By organisation size. Interestingly, the female shares of the workforce varied significantly when assessed by the size of the participating organisation. The bulk of survey participants were those employed by organisations in the three largest categories (*i.e.* those with more than 100 employees). Organisations in the two largest categories (those with more than 500 employees) scored comparatively low in terms of the female proportion of their workforces. Because the weighted average of female employment is heavily influenced by the results from the largest organisations, the result from those largest entities matches the overall level of 21% reported for all participating organisations (see Figure 2.6). Thus, if large companies effectively fail



to acknowledge the advantages of employing women, the overall wind energy sector will be deprived of the fresh perspectives that women can bring.

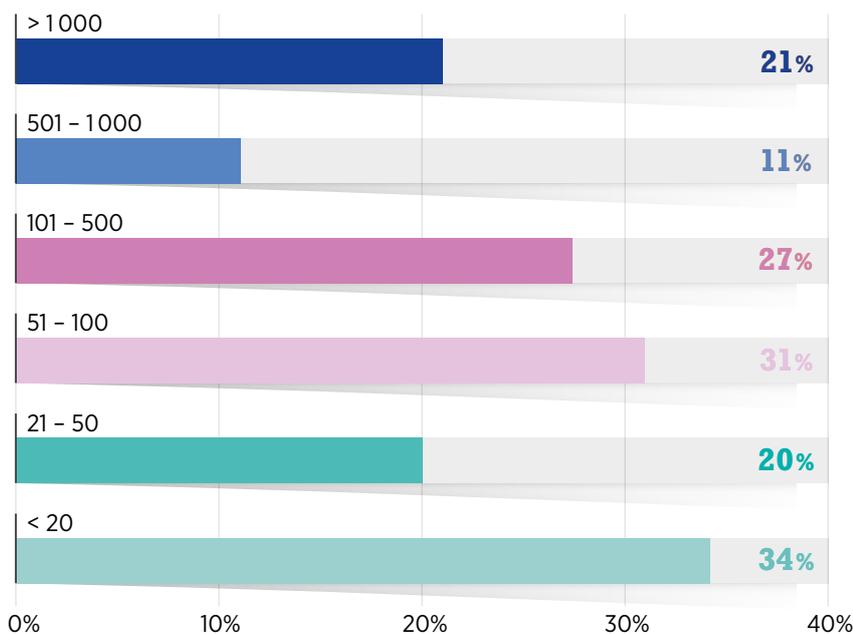
Figure 2.5: Shares of women by occupation in the wind energy sector, by activity



Source: IRENA online wind survey, 2019.

Note: Please see Box 1.4 for the definitions of STEM and Non-STEM.

Figure 2.6: Shares of women in the wind energy sector, by organisation size

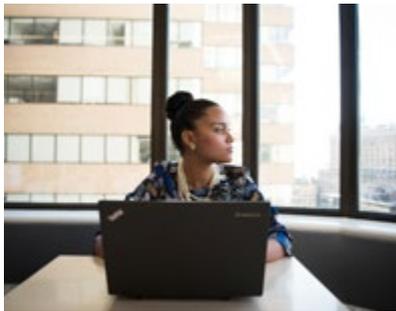


Source: IRENA online wind survey, 2019.

Note: Please see Box 1.4 for the definitions of STEM and Non-STEM.

Only a third of male respondents acknowledged the existence of gender-related barriers – compared with two-thirds of women

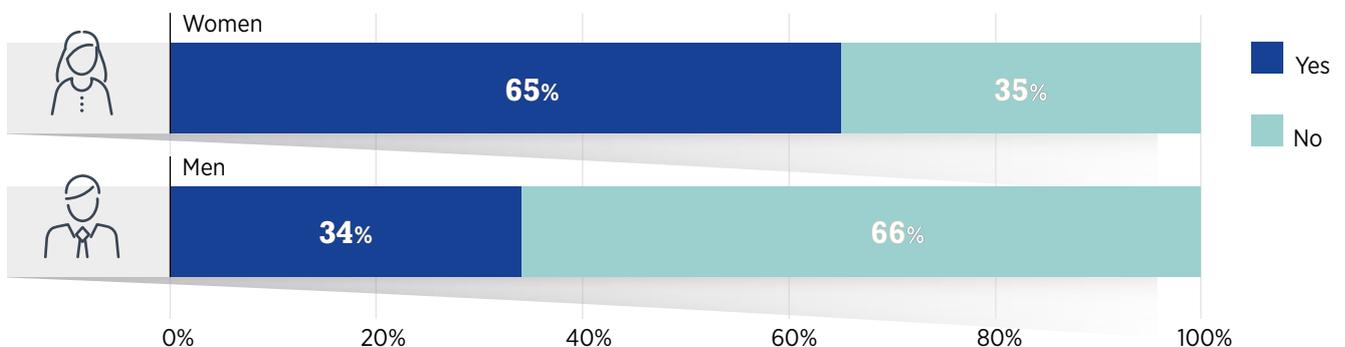
2.2 Barriers to female entry, retention and advancement in the wind workforce



Breaking down the barriers to women’s entry, retention and advancement in the wind workforce requires full awareness of the impediments. Overall, more than half (53%) of the respondents to IRENA’s wind sector survey stated that barriers do exist. But this average figure hides diverging answers. As was true when IRENA canvassed the entire renewable energy sector (IRENA, 2019b), men tended to see fewer gender-related barriers than women did.

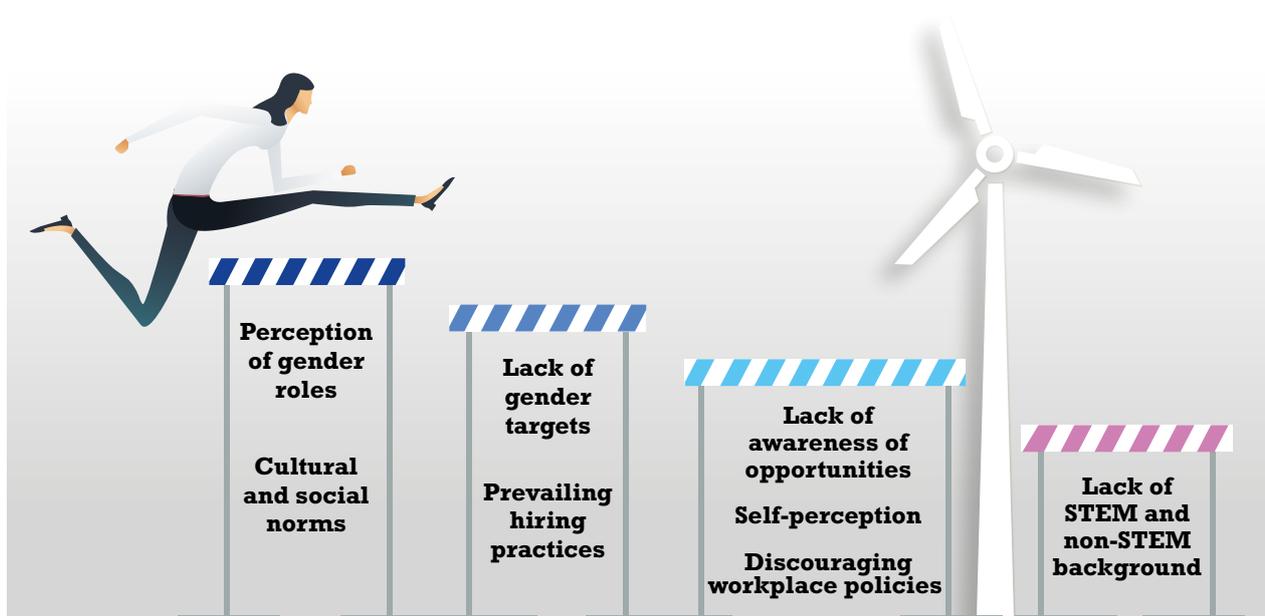
In fact, the replies were mirror opposites, with just one-third of men acknowledging the existence of barriers compared with two-thirds of women (Figure 2.7). On a regional basis, respondents from Africa, Latin America and Caribbean, and Europe and North America (in that order) recognised gender barriers in greater numbers than those from Asia-Pacific.

Figure 2.7: Perceptions of gender-related barriers in the wind sector among women and men



Source: IRENA online wind survey, 2019.

Figure 2.8: Barriers to entry for women in wind energy, ranked by respondents in order of importance



Source: IRENA online wind survey, 2019.

Note: Please see Box 1.4 for the definitions of STEM and Non-STEM.

Barriers to entry

The survey sought to assess the importance of barriers specific to job entry into the wind sector. Of individual respondents who replied that women do face barriers, a follow-up question was asked to rank specific impediments to entry according to their perceived importance (see Figure 2.8).

As in IRENA's previous survey (IRENA, 2019b), the two main barriers revolve around perceptions of gender roles and the persistence of certain cultural and social norms. Because they are so similar in origin, roles and norms may, in fact, reinforce each other. Many respondents also highlighted

the lack of gender targets and the prevalence of certain hiring practices as important. Both may be seen as an expression of male-biased norms, and thus to some extent a variation of the top two barriers. Other barriers were less relevant, particularly educational backgrounds (both STEM and non-STEM careers) and self-perceptions of women wanting to work in the sector. The lack of sector-specific background among women working in wind energy was not an issue for survey participants. Results suggest that respondents participating in the study are confident that women working in the field are properly prepared to enter the sector.





Barriers to retention and advancement

Once a woman is employed, her ability to stay in a given job and her opportunities for professional growth are shaped by several factors. Women face barriers to retention and advancement that men do not, especially during the childbearing years. Individuals participating in the survey raised several concerns related to the retention of women in the wind

workforce (see Figure 2.9). Fairness and transparency in internal policies and processes were identified as the most relevant concerns, followed by some specific policies and working practices that were felt to be lacking in many organisations.

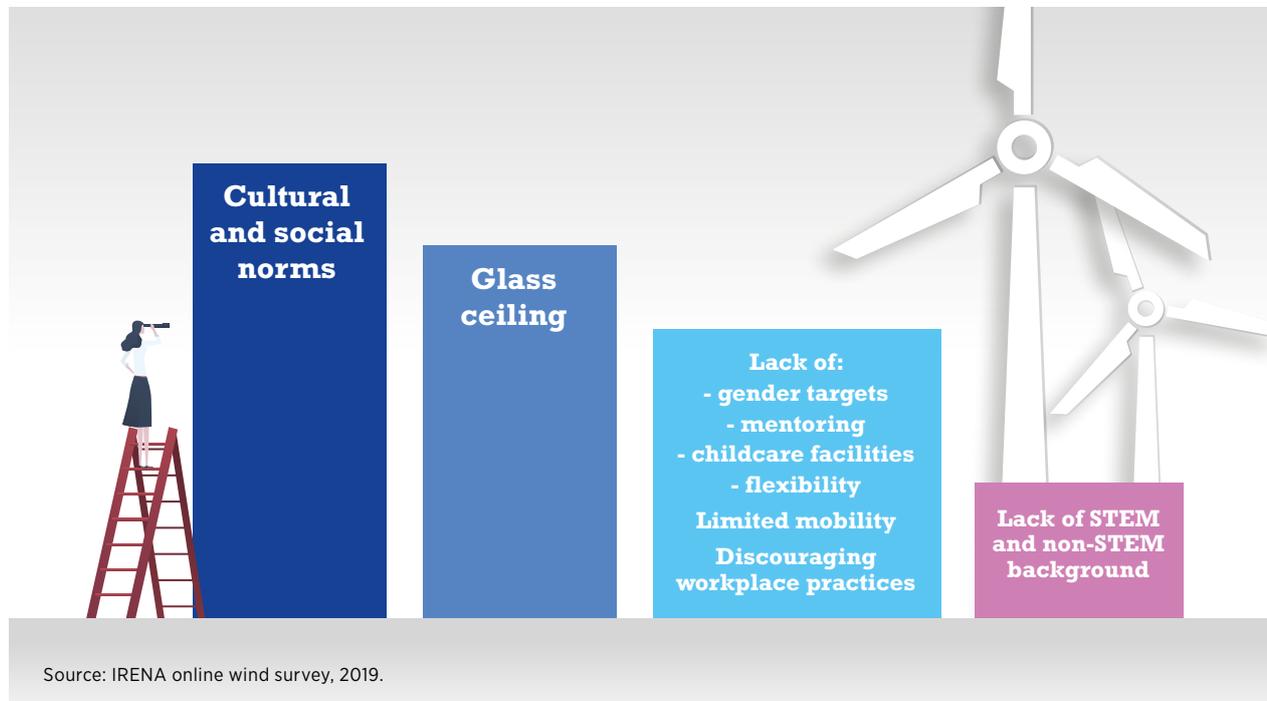
While respondents were more concerned about the challenges to retention, obstacles to professional advancement were also flagged as an issue. According to the survey, social and cultural norms

were once again seen as the most relevant barrier to advancement (see Figure 2.10). Second was the perception of a glass ceiling. (In IRENA’s global survey, the glass ceiling was the paramount barrier to advancement.) Yet the glass ceiling is not an isolated issue. It is, after all, reflective of cultural and social norms, which have tended to reinforce the misconception that women are not interested in high executive positions because

Figure 2.9: Barriers to retention for women in wind energy, ranked by respondents in order of importance



Figure 2.10: Barriers to advancement for women in wind energy, ranked by respondents in order of importance



of the difficulty of reconciling professional and personal duties. However, women have frequently proven themselves willing to tackle industry responsibilities even if doing so results in personal sacrifices (Gallup, 2016).

Apart from the glass ceiling, additional issues were flagged, including a lack of gender diversity targets and lack of mentoring opportunities. Mentoring is known to boost retention and advancement. Organisations that have formal mentoring programmes benefit not only from higher rates of retention, but also from better-prepared employees, while also having a better internal understanding and assessment of their staff capacities.

Barriers at the same level of concern were lack of childcare facilities, discouraging or inflexible workplace practices, and limited mobility (e.g. owing to family expectations). The lack of workplace flexibility is challenging for women, who frequently face the double burden of balancing work and family responsibilities, especially during childbearing years or while caring for elderly dependants. All of these issues can be addressed if employers are willing to make operational adjustments to accommodate employees with families.

As is the case for barriers to entry, the lack of training or skills was perceived to be the least

relevant of all the impediments to advancement. This suggests that women are generally perceived to possess the skills required to advance.

In summary, the survey results suggest that the most serious barriers to women obtaining a job in the wind energy sector are related to social and cultural norms. Once employed, there is relatively less concern about barriers to advancement, but barriers to retention are far higher than all other types of barriers. As many of these barriers are related to how organisations operate, it suggests that a focus on investing in the retention of female employees could be the most effective strategy

for improving the gender balance in employment in the sector (see Section 2.3).

Perceptions of barriers to entry, retention and advancement vary somewhat depending on the region and the educational level of respondents, whereas organisation size and main activity had little discernible influence.

By region. Perception of gender roles was a factor that received a relatively high score by respondents working in Africa, as was a lack of training and mentorship. Respondents from the Asia-Pacific region, by contrast, affixed higher relevance to lack of mobility, while in Latin America and the Caribbean, cultural and social norms were seen as a greater barrier to advancement than in other regions.

The **educational level** of respondents did appear to influence the scoring in many areas. Obviously, where possible personal weaknesses were suggested as barriers (background, skills, training), the scores for the relevance of these issues declined as the level of educational qualifications increased. However, for most of the other barriers to entry and advancement, there appeared to be a positive correlation between educational level and perception of barriers.

Wage inequities

Gender pay gaps for equivalent work are difficult to measure for a variety of reasons, but the perception of a persistent gap remains strong, fed by both analysis and anecdote. The literature and other surveys show that in the wider economy, pay gaps widen as women move up the career ladder, and therefore the biggest inequities exist for executive positions (PayScale, 2019). Pay discrepancies between men and women can weaken the appeal of an industry. Understandably, they may temper women's interest in joining an enterprise or other organisation, or their desire to remain for the long run. While IRENA's survey did not include any pay data, it reveals respondents' perceptions.

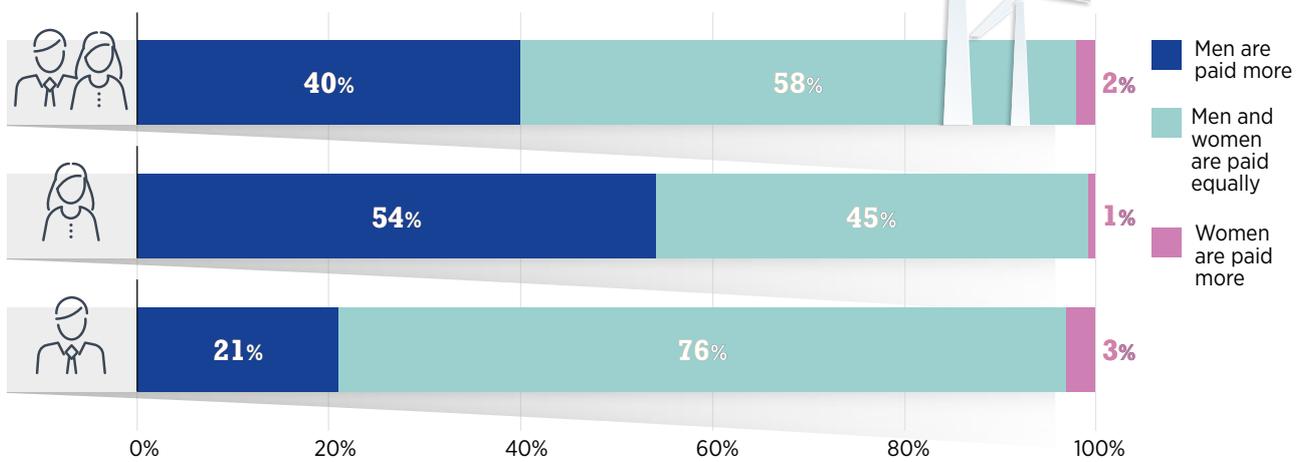
Individual respondents were asked whether they perceived that men and women were paid equally for equivalent work in their current place of employment (*i.e.* in the wind sector) and in general. Overall, 40% of all respondents believed that men were paid more for equivalent work, while 60% believed that pay was equal or higher for women for the wind sector. The replies indicate that respondents perceive less pay inequality in the wind sector than in the overall economy, where 68% of the respondents perceive that men are paid more (see Figure 2.11 and 2.12).

Survey responses did not indicate any significant differences by region, or by main activity of an employee's organisation. Organisation size, however had a significant impact on perceptions of pay equality, with employees in larger organisations being less likely to believe that men and women were paid equally. Similarly, there were disparities correlated with educational background. Individuals with no higher than a high school degree had a significantly lower perception of pay equality than other individuals.

Broken down by gender, 76% of male respondents indicated their perception of the existence of pay equality in the wind sector, compared with just 45% of female respondents. The perception gap was even greater for pay equality across the economy as a whole (see Figure 2.11 and 2.12).

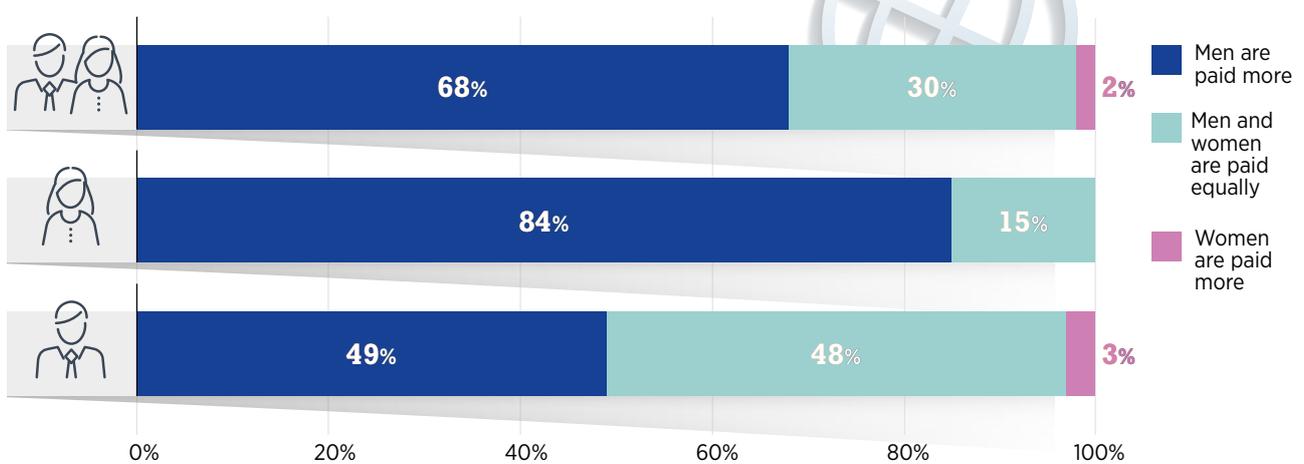


Figure 2.11: Pay gap perceptions: Who is paid more in wind?



Source: IRENA online wind survey, 2019.

Figure 2.12: Pay gap perceptions: Who is paid more in the overall economy?



Source: IRENA online wind survey, 2019.

2.3 Selected measures to address barriers

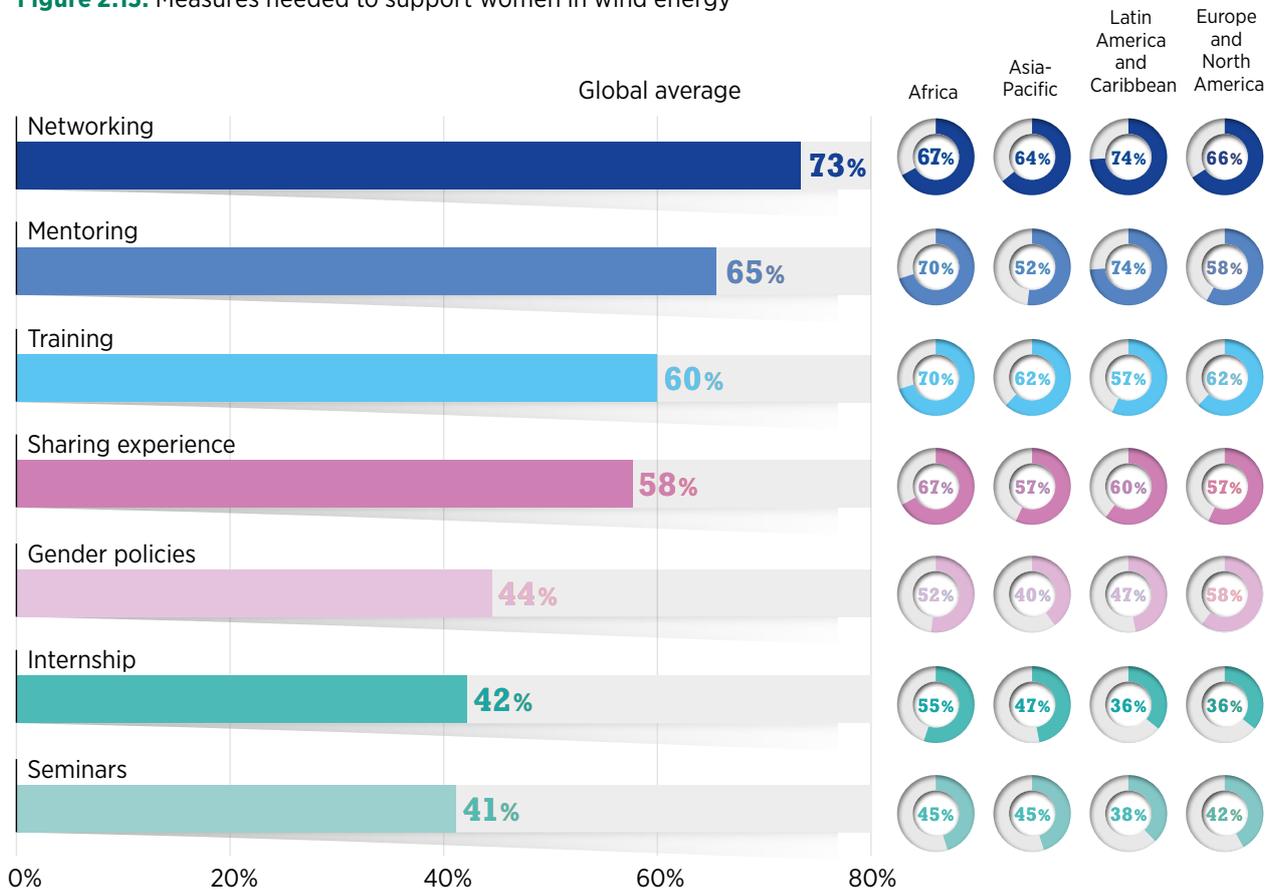
Measures to improve the gender balance depend on specific circumstances. Survey participants support the need to change the social and cultural norms that rule society. Attitudes generally do not change quickly. But organisations in the wind sector (whether enterprises, industry associations, governmental agencies, non- or intergovernmental organisations, or others) can take steps that

will accelerate change, including measures to ensure greater fairness and transparency in internal processes and policies to support a better work-life balance.

In addition, many survey participants highlighted the need to support networking, mentoring, training and opportunities for sharing work experiences (see Figure 2.13). Internships and seminars were seen as less important or effective. These responses echo the results of IRENA’s gender survey for the entirety of the renewable energy sector.

On a regional level, respondents from Africa saw each of these measures as helpful, while those from the Asia-Pacific region offered less frequent endorsement. There was general agreement about the importance of training and opportunities to share experiences, but views about the utility of networking and mentoring, and about dedicated gender policies, varied significantly among the regions. Internships and seminars were generally rated as the lowest priority in all regions.

Figure 2.13: Measures needed to support women in wind energy



Source: IRENA online wind survey, 2019.

Creating networks and systems for support and mentorship

Respondents highlighted the need for levelling the playing field so that everyone can participate equally in the wind energy workforce. The creation of supportive networks and mentorship arrangements for women is a critical element of such an endeavour. There are indeed many initiatives across the wider renewable energy sector (IRENA, 2019b), but some of them are specific to the wind sector. One example is the Women in Wind Global Leadership Program (see Box 2.1).

This programme is supra-national. However, there are also national-level initiatives to support women in

the sector in several countries. One is Women of Wind Energy Germany, which has been active since 2011, offering networking opportunities and mentorship programmes, as well as public advocacy. The organisation is working to significantly raise women's share of professional and management posts in wind energy; reach gender equity; improve the ability of women to reconcile professional and family demands faced by women; and achieve pay parity for equal work. The group intends to collaborate with similar networks in neighbouring countries, to build a European association, and to work with women in the sector worldwide (Women of Wind Energy Deutschland, 2019).



**Women of
Wind Energy**
Deutschland

Box 2.1 The Women in Wind Global Leadership Program

Launched in 2019 by the Global Wind Energy Council (GWEC) and Global Women's Network for the Energy Transition (GWNET), the programme's mission is to advance the role of women as agents of change in the global energy transition, in line with SDGs 5 and 7, and to contribute to a more just, innovative and prosperous society. As a multidimensional programme including mentorship, learning and development, webinars, a study tour and an online storytelling campaign, Women in Wind is designed to accelerate the careers of women in wind power, support their pathway to senior leadership and foster a global network of knowledge-sharing, inclusion and empowerment. Women in Wind represents the voice of women in the wind sector at international forums like the

United Nations Framework Convention on Climate Change and IRENA. In its inaugural year, it was supported by MHI Vestas, Mainstream Renewable Power and GE Renewable Energy. More information about the programme is available online.

Source: Women in Wind Global Leadership Program, 2019.



Improving workplace practices, policies and regulations

The global energy transition provides a unique opportunity not just to render energy supply and delivery systems more sustainable, but also to create a more diverse and inclusive workforce in the process (see Box 2.2).

Interestingly, the survey results imply that companies with more generous benefits available to

staff (such as parental leave above and beyond what is obligated by law, onsite childcare, and so on) employ fewer women than those who do not offer any benefit at all. This paradoxical finding may imply that family-friendly measures are necessary but insufficient for increasing the share of women in the workforce. While women may feel more encouraged to apply for positions with family-friendly companies, it does not follow that

they actually get the job. Hiring managers may prefer not hiring women to avoid having to provide the benefits that the organisation makes available in principle. Without additional measures such as quotas, prevailing hiring practices are unlikely to change to the needed degree.

Box 2.2 Good practices for a more inclusive workplace

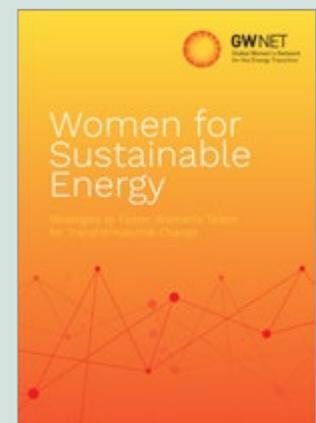
Based on interviews with women and men currently working in the sustainable energy sector, a structural/environmental analysis and a literature review, GWNET identified the following as good practices for greater inclusion of women in the wind sector's workforce:

- Seeking greater gender equality by promoting girls who have a demonstrable aptitude for STEM disciplines.
- Promoting the sustainable energy sector as a workplace of choice for women and men with families.
- Putting in place quotas for leadership roles to break unconscious biases and highlight women's leadership.
- Removing biases in recruitment, performance reviews; equal pay and promotions.
- Universalising equitable parental and career leave, childcare for parents, return-to-work programmes; flexible work; and mentoring.
- Adopting a zero-tolerance policy toward sexual harassment and discrimination in the workplace.

Transformative change is the responsibility of the most senior person in an organisation. It requires that objectives and initiatives be monitored and reported as a matter of priority to the organisation's board or leaders. Commitments of time, resources and personnel are essential to achieve diverse and gender-inclusive workplaces.

No single company, industry or sector has found the perfect formula for gender inclusion. Beyond change in a single organisation, coalitions of the like-minded may bring together governments, industry, labour representatives, women's networks and associations, and international organisations such as the United Nations and the International Labour Organization. In collaboration, they can bring about necessary change.

Source: GWNET, 2019a.



Mainstreaming gender perspectives

The wind energy industry, like other sectors, can promote women as leaders and innovators in the global energy transition. Beyond changes internal to the sector as discussed in earlier in this section, industry

conferences and workshops can serve as important platforms, showcasing pioneering practices, presenting role models, and establishing gender-inclusive norms in clean energy (see Box 2.3). These and other mainstreaming efforts will require great persistence, given that

many renewable energy events still exhibit a wide gap between male and female speakers and attendees, and that breakout sessions on diversity are often poorly attended.

Box 2.3 Good practices in promoting female leadership at industry events

The Women in Wind Global Leadership Program compiled a set of best practices for gender diversity at wind industry events. Though broadly applicable, cultural differences need to be properly reflected. As such, the practices identified here for planning, speaker selection and communications are intended as guidelines rather than hard rules.

Planning

- Integrate gender perspectives into topics such as project sustainability; stakeholder engagement and community relations; workforce development and skill-building; health and safety; and technology and innovation.
- Ensure audience draw by selecting prominent time slots and venue locations.
- Maximise network-building opportunities for women attendees through gender-inclusive and balanced business-to-business matchmaking opportunities.
- Consider adopting a code of conduct clarifying that sexist or discriminatory language/behaviour will not be tolerated.

Panels and speakers

- Ensure that an adequate presence of female panellists can translate into equality of thought leadership.
- Remind companies and other organisations about gender diversity when asking them to nominate speakers and panellists.

- Tap networks for suggestions of women speakers or use open directories such as the Switch List, the Women in Energy Expert Platform or Brussels Binder.
- Invite and take questions from a diverse range of audience members. Calling upon a woman to ask the first question may encourage other female audience members to raise their hands.

Communications

- Highlight gender diversity as a theme or priority for the event in marketing materials, communications and social media.
- Carefully consider the public face(s) of the event and ensure a strong gender balance and overall diversity in promotional materials, social media campaigns, and among spokespersons. Events should aim for a gender-diverse audience as well.
- Use gender-neutral titles, terminology, and pronouns. Use professional titles or neutral forms of addressing women; refer to “humanity” instead of “mankind”, or “spokesperson” instead of “spokesman”; use gender-neutral pronouns.
- Encourage post-event transparency of gender representation. A post-event survey including gender diversity aspects can be helpful in evaluating whether diversity measures had the intended effect.

Source: GWNET, 2019b.



Replicating women's initiatives in the field

Mainstreaming gender into policymaking, programme design and project implementation in the wind industry is a must to heighten awareness of restrictive cultural and social norms and to challenge persistent gender myths. Mainstreaming is best accomplished by presenting gender-disaggregated data and boosting the visibility of the diverse roles women are already playing in expanding the wind energy sector and in promoting the energy transition.

While changing men's perceptions is important, women themselves are the best agents of change in the quest for greater gender balance, whether as employees of companies or, as in the Windfang and Qvinnovindar cases (see Box 2.4), by setting up women-operated organisations. So far, such initiatives appear to exist principally (or perhaps only) in the Europe and North America region. But they will be equally important elsewhere as the geographic pattern of the wind energy industry diversifies.



Box 2.4 Women's wind co-operatives in Germany and Sweden

Windfang FrauenEnergieGemeinschaft is Germany's first (and thus far only) energy co-operative exclusively run by women. Windfang (literally "wind catch") was initiated in 1991 by a group of female engineering and natural sciences students. In March 1995, Windfang's first wind turbine was connected to the grid. Today, the co-operative owns and operates eleven wind turbines in four German federal states (along with three small solar rooftop installations). Since its inception, Windfang has generated more than 146 000 MWh of wind electricity; just in the last three years (2017-2019), annual generation increased by almost 60% to 16 523 MWh. Windfang supplies some 3 140 households with wind energy, avoiding 8 280 tonnes of CO₂ emissions annually.

The co-operative enables women to participate in male-dominated technical and strategic fields. Women run Windfang's technical and commercial management and its finances. A general assembly of 300 associates decides democratically on the further development of the co-operative and on how profits are used. The co-operative offers a return on investment of more than 4% to its members.

Qvinnovindar, a co-operative formed by 10 Swedish women, was inspired by the Swedish words for women (kvinnor) and wind (vind). It exists not only to support renewable energy, but to empower women in rural areas. Initiated in 2007, the group expanded to some 80 members with diverse professional backgrounds.

Qvinnovindar has invested more than 10 million krona (USD 1.5 million) in various wind projects. Individual members have invested various sums, some as much as USD 46 000. However, regardless of the amount, each member has an equal vote in how the company is run.



Sources: Women & Gender Constituency (2014); Windfang e.G. FrauenEnergieGemeinschaft (2019).

Source: Markham, 2013.



3 The path ahead

Advancing equality and diversity in the wind energy sector promises winners all around. It establishes greater fairness in an industry critical to making energy use – and thus all economic activities – more sustainable. Women, after all, account for half the human population. That very fact indicates how great a gain the wind industry can expect if it taps into the female pool of talent, skills, and perspectives more fully.

Gender is the keystone in the arch of building blocks of greater sustainability and more inclusive development. The better the role of gender is understood, the more readily the wind industry (and the renewable energy sector more broadly) will be able to contribute to an energy transition that supports progress toward the Sustainable Development Goals. IRENA is working with a range of international partners to improve knowledge about the interactions between the energy system and the economy at large; gender is an important aspect of these assessments (see Box 3.1).



Box 3.1 Gender and the Sustainable Energy Jobs Platform



In 2019, IRENA initiated efforts to create a Sustainable Energy Jobs Platform under the umbrella of the SDG 7 Technical Advisory Group (a group convened by the UN Department of Economic and Social Affairs). The idea for a platform arose out of deliberations surrounding multi-author policy briefs that IRENA and its partners contributed to the High-Level Political Forum process for the review of SDG 7 in 2018 and 2019. The platform was officially launched in Abu Dhabi in January 2020, with IRENA as co-ordinator and ten other organisations as inaugural members. Core members presently include: the Global Green Growth Institute, GOGLA, the Global Women's Network for the Energy Transition (GWNET), the Institute for Advanced Sustainability Studies (IASS Potsdam), the International Labour Organization (ILO), Power for All, SELCO Foundation, the United Nations Industrial Development Organization (UNIDO), and the World Bank in an affiliated role.

Substantive goals of the platform include:

- Improving knowledge about the forces shaping sustainable energy job creation.
- Studying education and training needs along the supply chain.
- Evaluating opportunities to leverage domestic capacities in support of renewable energy and energy efficiency.
- Analysing policies and approaches to ensure a just transition in light of job loss in conventional energy industries and the likelihood of structural misalignments.
- Assessing the employment and livelihood opportunities linked to energy access and productive use of energy, particularly with regard to decentralised applications of solar energy.

A better understanding of the gender dimension is critical in all of these contexts.

Annex

A.1. IRENA 2019 online survey on gender and wind energy

The International Renewable Energy Agency (IRENA) and Women in Wind – a joint program managed by the Global Wind Energy Council (GWEC) and the Global Women’s Network for the Energy Transition (GWNEN) – conducted an online Gender and Wind Energy Survey (www.irena.org/windsurvey) from mid-September 2019 to mid-November 2019. Its objective was to gather quantitative and qualitative information about women’s participation in the wind energy sector, the challenges they faced and their suggestions for improving gender diversity across the industry. It was an open survey – that is, anyone accessing the online link could complete it.

Respondents could complete the survey either as individuals or as representatives of their employer (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 the respondents who were targeted to complete this part of the questionnaire were, most likely, human resources staff.

Response statistics

Total respondents: 921

- **On behalf of an organisation: 132**
- **As individuals: 789**

An additional 246 respondents started the survey but did not complete it.



A.2. Limitations of the survey

As noted in IRENA's previous gender survey (IRENA, 2019b), online surveys can have several types of bias. However, as this survey was focused on one sector (wind), more is known about the population of interest (employees in the sector) than would be the case in a multi-sector study. Some of these biases were solved through weighting, by adjusting the responses to reflect the distribution of different characteristics in the underlying population.

The potential impact of different characteristics on the reliability of the survey results were as follows.

Location: The location of respondents was found to affect the responses to many questions in the survey, so this is a critical factor in the calculation of global averages.

Table A.1 shows the distribution of known employment in the wind sector (IRENA, 2019a) across locations and compares it to the survey responses. Africa and Latin America and the Caribbean were over-represented in the responses of both organisations and individuals, while the Asia-Pacific region was under-represented. The share of responses from Europe and North America almost matched the share of employment in the combined region in the case of organisations, but the region was over-represented in the sample of individuals. To adjust for these differences, weights were used

to calculate global averages so that they would more accurately reflect the regional distribution of employees in the sector.

Main activities: Information about the distribution of employment among different activities in segments of the wind sector is not consistently available at the global level. Fortunately, examination of this characteristic showed that it rarely had a significant impact on the responses to the questions asked in this survey. Thus, any bias introduced by possible over- or under-representation of different types of organisations in the sample is likely to be quite small.

In addition, a question was added to the survey asking both organisations and individuals to specify the proportion of their activities that are related to wind

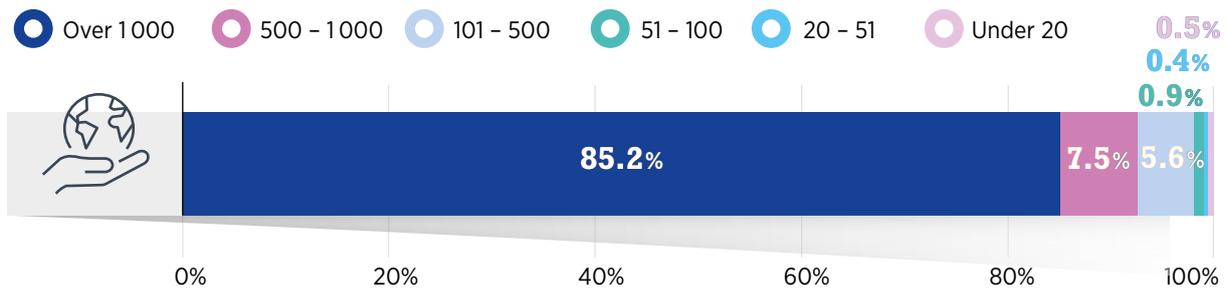
Table A.1: Location of survey respondents compared with employment in the wind sector

Region	Employment	Organisations		Individuals	
		Responses	Weight	Responses	Weight
Africa	2%	9%	0.22	4%	0.50
Asia-Pacific	54%	23%	2.35	19%	2.84
Europe and North America	38%	39%	0.97	61%	0.62
Latin America and Caribbean	5%	30%	0.17	16%	0.31

Source: IRENA, 2019a and IRENA online wind survey, 2019.

Note: North America excludes Mexico. Respondents from Mexico are included in the Latin American region.

Figure A.1: Distribution of wind sector employment across different-sized organisations, as inferred from the responses of organisations



Source: IRENA online wind survey, 2019.

energy. In the analysis, the answer to this question by each respondent was used as an additional weighting factor in the calculation of global averages.

Size of organisation: The size of an organisation is an important variable for the calculation of global averages for two reasons. First, as with any other variable, answers can differ significantly between respondents from different-sized organisations, as indeed appears to be the case for some questions. Secondly, and more importantly, size is a crucial variable for the interpretation of responses from organisations, where each reply must be treated as though it represents a number of employees in the sector. In the case of large companies, for example, such responses may represent the

workplace situation of hundreds or thousands of people.

For responses from organisations, each reply was treated as representing the number of employees in that organisation (where this was calculated as the mid-point of the applicable survey size category).⁵ This implicitly assumes that the sampling fraction (proportion of organisations surveyed in each size class) is the same. With the huge differences in number of employees, it also means that the responses from large organisations have a very large impact on the calculation of global averages.

Certainly, the replies from organisations cannot be treated with equal weight, but the weighting of replies by the number of employees in each respondent’s organisation may have introduced some bias toward calculating averages that over-represent large organisations. For individuals, the responses were not weighted by organisation size as the weight was not a factor affecting the responses. Adjustments for location and share of activities related to the wind sector were still applied.

⁵ For the largest size category, a mid-point of 2 100 employees was used. This was based on the total employment in several large firms mentioned in the survey, divided by the number of replies from those organisations. (Respondents from organisations had the option of stating who they worked for and several did so).



A.3. Overall representativeness of the survey

Gender and educational status of individuals: Women and degree holders were vastly over-represented in the individual responses to the survey. In the case of differences between the sexes, the results are presented for each group separately where they differ significantly. Indeed, presenting averages corrected for the shares of men and women working in the sector would be counter-productive, as identifying differences in their views is one of the main purposes of the survey. In terms of educational status, the under-representation of non-degree holders is a concern in a few cases where they held views significantly different from those of the rest of the sample.

Based on organisation size, the responses from organisations presented the current employment and benefits packages offered to 71 000 people working in those organisations, of whom 67 500 work in the wind energy sector. IRENA's latest estimate of total global employment in wind energy is 1.16 million people, so the latter figure represents 5.8% of the global wind workforce.

For the calculation of global averages, the replies from organisations were adjusted for location, the share of activities related to wind energy and organisation size. The first two adjustments were an improvement on previous surveys (that used unweighted responses), but the scaling up of sample results to the population based on organisation size reported in the survey may have led to some bias.

Similarly, for individuals, the first two adjustments were also applied to the survey results by using weights, but no adjustment was made for organisation size. This should have reduced bias in the sample. The one remaining issue is the distribution of responses by education level, which may have biased the calculation of global averages in some cases.



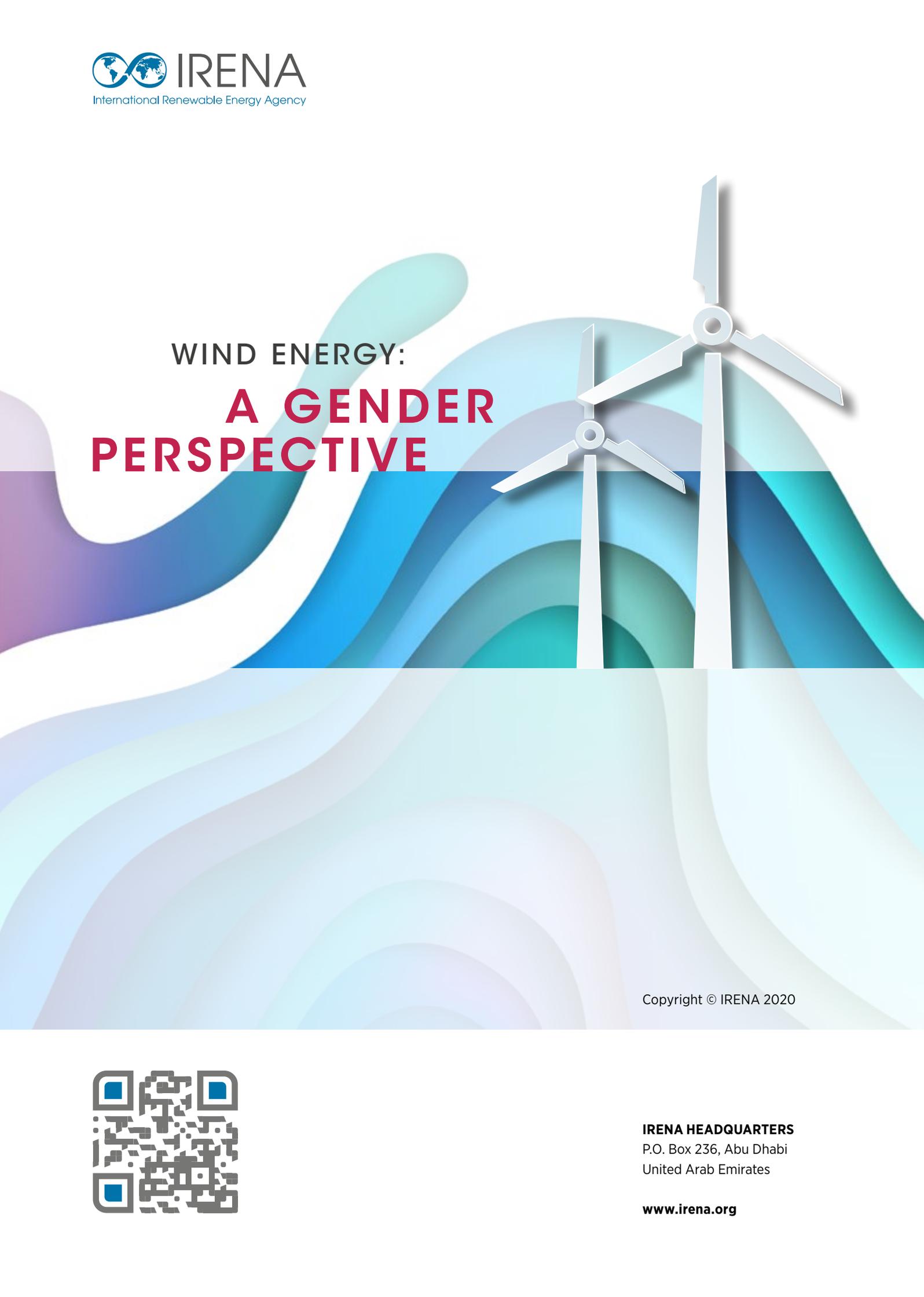
References

- Boston Consulting Group (2018)**, *How diverse leadership teams boost innovation*, <https://www.bcg.com/en-us/publications/2018/how-diverse-leadership-teams-boost-innovation.aspx>
- Catalyst (2019)**, *Women in energy – gas, mining, and oil: quick take*, <https://www.catalyst.org/research/women-in-energy-gas-mining-oil/>
- Gallup (2016)**, *Women in America: work and life well-lived*, https://www.in.gov/icw/files/2016%20Women_in_America_Work_and_Life_Well-Lived.pdf
- Global Women’s Network for the Energy Transition (GWNET), (2019a)**, *Women for Sustainable Energy: Strategies to Foster Women’s Talent for Transformational*.
- GWNET (2019b)**, *Best Practices for Gender Diversity at Industry Events*, <https://gwec.net/wp-content/uploads/2019/12/Best-Practices-for-Gender-Diversity-Final.pdf>
- International Renewable Energy Agency (IRENA) (2020)**, *Measuring the socioeconomics of the transition: A focus on jobs*, International Renewable Energy Agency, Abu Dhabi.
- IRENA (2019a)**, *Renewable energy and jobs – Annual review 2019*, International Renewable Energy Agency, Abu Dhabi.
- IRENA (2019b)**, *Renewable energy: A gender perspective*, International Renewable Energy Agency, Abu Dhabi.
- IRENA (2019c)**, *Global energy transformation. A roadmap to 2050*, International Renewable Energy Agency, Abu Dhabi.
- IRENA (2019d)**, *Transforming the energy system – and holding the line on the rise of global temperatures*, International Renewable Energy Agency, Abu Dhabi.
- IRENA (2018)**, *Renewable energy benefits: Leveraging local capacity for offshore wind*, International Renewable Energy Agency, Abu Dhabi.
- IRENA (2017)**, *Renewable energy benefits: Leveraging local capacity for onshore wind*, International Renewable Energy Agency, Abu Dhabi.
- Markham, D. (2013)**, “Swedish women-only cooperative invests in wind energy”, *Inspired Economist*, <https://inspiredeconomist.com/2013/10/14/swedish-women-cooperative-invests-wind-energy/>.
- Mishel, L. (2018)**, “Yes, manufacturing still provides a pay advantage, but staffing firm outsourcing is eroding it”, Economic Policy Institute, 12 March, <https://www.epi.org/publication/manufacturing-still-provides-a-pay-advantage-but-outsourcing-is-eroding-it/>.
- Paraskova T. (2017)**, “Dirty, Difficult, And Dangerous: Why Millennials Won’t Work In Oil”, *Oilprice*, <https://oilprice.com/Energy/Energy-General/Dirty-Difficult-And-Dangerous-Why-Millennials-Wont-Work-In-Oil.html>
- PayScale (2019)**, *The state of the gender pay gap 2019*, <https://www.payscale.com/data/gender-pay-gap#section02>
- USDOE (U.S. Department of Energy) (2017)**, *U.S. Energy and Employment Report*, Washington, DC, https://www.energy.gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.
- World Economic Forum (2019)**, *The business case for diversity in the workplace is now overwhelming*, <https://www.weforum.org/agenda/2019/04/business-case-for-diversity-in-the-workplace/>.
- Windfang e.G. FrauenEnergieGemeinschaft (2019)**, *Windenergieanlagen*, <http://s477174211.website-start.de>.
- Women & Gender Constituency (2014)**, *Windfang: A women’s cooperative that projects, builds and runs wind turbines*, http://womensgenderclimate.org/gjc_solutions/windfang-a-womens-cooperative-that-projects-builds-and-runs-wind-turbines/.
- Women in Wind Global Leadership Program (2019)**, “About”, <https://gwec.net/women-in-wind/about-the-program/>.
- Women of Wind Energy Deutschland (2019)**, *Unsere mission*, <https://womenofwindenergy.wildapricot.org>.
- Wood Mackenzie (2019)**, *Wind power market shares*, online dashboard, <https://power-and-renewables.woodmac.com>.

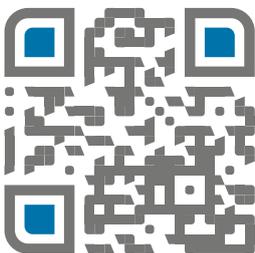
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