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Global Trends in Women's Employment in Renewable Energy: Continuities, Disruptions, Contradictions

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4 Global trends in women's employment in renewable energy

Continuities, disruptions,
and contradictions

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Introduction

As evidenced by its inclusion as a standalone Sustainable Development Goal (SDG 5), gender equality is not only a fundamental human right but also a necessary foundation for a peaceful, prosperous, and sustainable world. There has been significant progress made globally to achieve gender equality over the last few decades: in education, employment, political participation, leadership, and legal reform. When the SDGs were framed in 2015, ensuring access to affordable, reliable, sustainable, and modern energy for all was also deemed an objective important enough to warrant a standalone Sustainable Development Goal (SDG 7). Achieving SDG 7 can, in turn, contribute toward meeting SDG 5 and other SDGs aimed at alleviating poverty (SDG 1), improving health and well-being (SDG 3), promoting quality education (SDG 4), improving access to decent work (SDG 8), and building sustainable communities (SDG 11) (IEA et al., 2020).

The International Renewable Energy Agency (IRENA) is an intergovernmental organization founded in 2009 to support countries in their transition to a sustainable energy future, and to serve as the principal platform for international cooperation, a center of excellence, and a repository of policy, technology, resource, and financial knowledge on renewable energy (RE hereafter). IRENA promotes the widespread adoption and sustainable use of all forms of RE, 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. Membership in IRENA is open to states that are members of the United Nations, and to regional intergovernmental economic-integration organizations. At present, IRENA has 162 member states, with another 21 states in various stages of accession. IRENA encourages governments to adopt enabling policies for RE investments, provides practical tools and policy advice to accelerate RE deployment, and facilitates knowledge sharing and technology transfer to provide clean, sustainable energy for the world's growing population.

One of the duties IRENA has performed since its inception is to produce an annual global review of employment in the RE sector. In 2020, the review estimated that the number of jobs in the RE sector could increase from 11.5 million in

2019 to nearly 42 million in 2050, provided appropriate policies are put in place (IRENA, 2020a, 2020b). To enable a sustainable and equitable global transition to renewables, the industry must engage the skills and abilities of women since they constitute half of the human population. Globally, women currently represent 32% of the RE workforce – a much higher share than women in the conventional oil and gas sector (22%), but well below the 48% in the overall economy (IRENA, 2019). As in many other sectors, women are particularly underrepresented in the RE sector in jobs that require STEM training (28%) compared to non-STEM technical jobs (35%) and administrative positions (45%) (ibid.). A later survey conducted by IRENA, with responses from 920 individuals and organizations, found that women's talents and insights are even more under-utilized in the wind energy sector, where women represent only 21% of the workforce (IRENA, 2020c). The global shift to renewables is creating demand for a growing array of technical, business, administrative, economic, and legal skills, and acute skill and labor shortages are being reported globally in the RE sector (Baruah and Gaudet, 2018; IRENA, 2020c). Widening the RE talent pool is thus an instrumental reason for improving the participation of women, in addition to intrinsic reasons of gender equity and fairness. Despite clear evidence of the importance of both SDG 5 and SDG 7, as well as the interdependencies and synergies between them, empirical data and detailed information on the status and trends related to gender equality in the RE sector remain sparse.

In this chapter, we share findings from an online survey carried out by IRENA in 2018 to collect empirical data to understand global trends, opportunities, and constraints for women's employment in RE. The survey analyzes the status of women's employment in the RE sector in two distinct deployment settings – the modern context (in which universal energy access already exists but renewables are displacing or complementing fossil fuels) and the energy access context (areas where access to modern energy services, including electricity and clean cooking fuels, is presently limited or does not exist, but characterized by efforts to introduce and expand access to modern energy services). With some exceptions in Eastern and Central Europe, where energy access is still a challenge for certain segments of the population (Clancy and Feenstra, 2019), the energy context in most industrialized Organisation for Economic Cooperation and Development (OECD) member countries can be considered modern. The energy context in emerging economies and developing countries in Asia, Africa, Latin America, and the Caribbean is often much more complicated and tends to include both modern and access contexts within the same countries. The survey was designed to glean information about modern and access contexts because of the distinct obstacles due to the different nature of the challenges that women face in each of the contexts.

The survey elicited a total of 1,440 responses from 144 countries (see Figure 4.1 for geographical distribution of survey respondents).

Respondents included 1,155 individuals (808 women and 347 men) working in highly specialized technical roles, as well as in policy, legal and commercial functions, and from 285 organizations (private companies, government agencies,



Figure 4.1 Geographical distribution of survey respondents

Source: IRENA, 2019

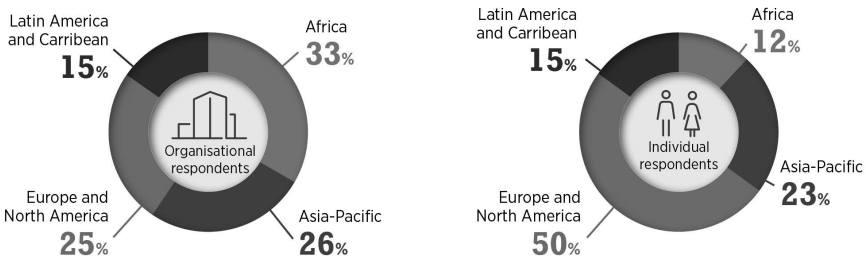


Figure 4.2 Distribution of survey respondents by region

Source: IRENA, 2019

non-governmental organizations, academic institutions, and other entities) working in the RE sector (see Figure 4.2 for distribution of survey respondents by region).

These responses provided estimates about the total share of women in the RE workforce as well as their representation in managerial and decision-making positions. The individual and institutional responses generated by the global survey also provided quantitative and qualitative insights about barriers and opportunities for women’s entry, retention, and advancement in the RE sector in both modern and energy access contexts. The findings from the 2018 IRENA survey currently constitute the largest global data set on women’s employment in RE.

In order to provide conceptual anchors for this research, as well as a framework of analysis for understanding survey responses, we reviewed the existing scholarly and practitioner literature on women’s employment in the energy sector (both fossil fuel-based and renewable). We also reviewed research on topics such as

women and technical occupations, women and part-time work, gender and care-giving, and gender and institutional sexism, which were identified in the existing literature on women's employment in the energy sector as important for understanding the broader underpinnings of women's underrepresentation in energy sector employment. We selectively present some of this literature in this chapter in order to frame and contextualize our findings about global patterns of women's employment in RE. This chapter focuses specifically on sharing findings from IRENA's 2018 survey, although we may at various points also share findings and perspectives from our previous research projects and publications. We provide references to other relevant research throughout the chapter so that those interested in learning more about gender issues in energy employment can also seek out these other resources. We hope that the issues identified by this research will provide the grounding and detail against which other related issues and research, perhaps using very different methodologies as well as broader conceptualizations of gender equality (including racial and ethnic identities, workers with disabilities, and gender-diverse LGBTQ persons) and intersectional gender analysis, can be tested, verified, and advanced.

Survey details and limitations

The survey was conducted online from October 8, 2018, to November 25, 2018. To reach a broad audience and generate a sufficiently large sample of participants, it was advertised widely through various distribution channels of IRENA and its partners, including mailing lists, newsletters, online fora and news sites, social media, e-mails from staff, and messages at national and international RE events.

The primary objective of the survey was to gather quantitative and qualitative information about women's formal employment in the RE sector, the challenges and opportunities 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 organizations. It was an open survey, that is, anyone who could access the online link would be able to complete it.

From individuals, information was collected about their perceptions of the main barriers and opportunities to attracting and retaining women in the RE workforce, as well as suggestions for potential solutions to increase women's participation.

From representatives of organizations (e.g., human resources staff with knowledge of relevant organizational statistics), the survey asked for quantitative information about the gender distribution in the organization'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 and asked respondents to identify which context they worked in. The survey was made available in five languages, namely, Arabic, Chinese, English, French, and Spanish. Participation in the survey was worldwide – with respondents from 144 countries. The response rate from China was generally low, even though the country is a major player in the Asian and global RE sectors. Responses from organizations were quite evenly distributed across the main

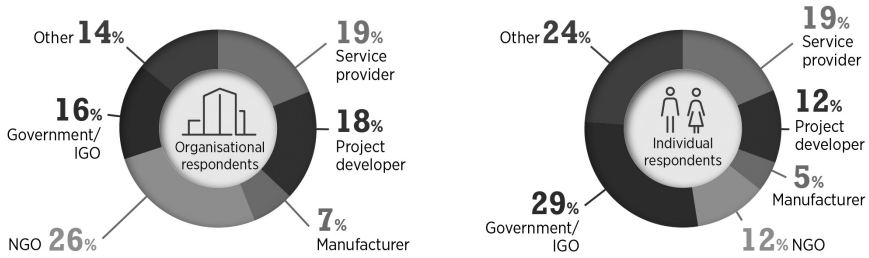


Figure 4.3 Distribution of survey respondents by type of organization

Source: IRENA, 2019

regions of the world, with many responses from organizations located in Africa. By contrast, half of the responses from individuals came from Europe and North America.

With respect to the organizations for which respondents work, the survey generated fewer responses from private sector organizations than from governmental, inter-governmental, and non-governmental organizations (see Figure 4.3).

In emerging economies and developing countries, the informal sector is a major driver of the economy. For example, in India, 88.2% of the employed population are informal workers, 82.7% in Kenya and 92.9% in Nigeria (ILO, 2018). Women often constitute the majority of informal sector workers in these countries (ibid). Since the IRENA survey was designed to study formal employment in the RE sector, it did not provide specific insights into challenges faced by women in informal RE activities, such as fuel collection and biomass production and processing. Efforts made by other researchers and intergovernmental organizations to provide estimates of informal employment in RE have been documented elsewhere (Baruah, 2015, 2017) and suggest that millions of women are engaged informally in RE. Future research aimed at collecting empirical data on informal employment in RE is crucial.

Major findings and discussion

The IRENA survey revealed that women represent 32% of the full-time employees of responding RE organizations, which is substantially higher than the 22% average in the global oil and gas industry (see Figure 4.4).

The share of women in the worldwide oil and gas workforce is much lower than in manufacturing, finance, education, health, and social work, and lower than the average in the overall global workforce (Rick et al., 2017). While women hold 27% of entry-level jobs in the oil-and-gas sector that require a college degree, and 25% of midcareer-level jobs, their share is only 17% in senior and executive roles. Only one in a hundred CEOs in the fossil fuel sector is a woman (ibid.). As a young and more dynamic sector, RE may be open to diversity and change in ways that are harder to effect in the older and more mature fossil fuel sector.

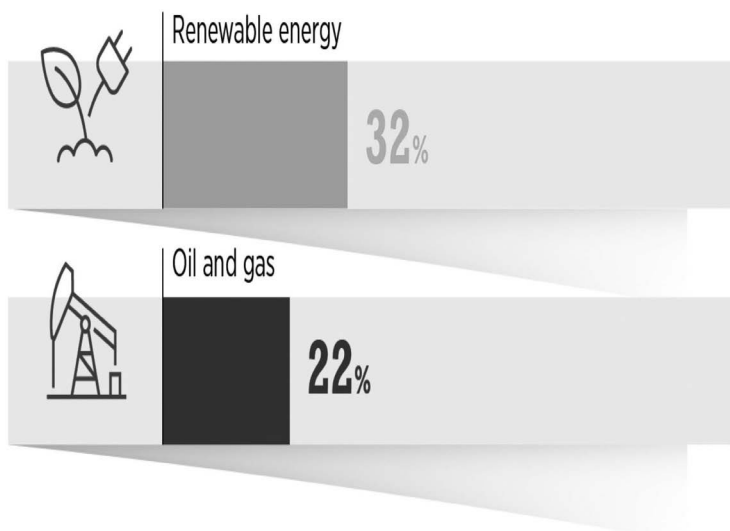


Figure 4.4 Share of women in RE and Fossil Fuels

Source: IRENA, 2019

This is borne out by findings from an earlier survey carried out by IRENA in 2016 of 90 RE companies in 40 countries, which revealed that women held 28% of technical positions and 32% of senior management positions in the RE industry. However, the findings from the 2018 IRENA survey reveal that although women are better represented at all levels of the RE sector than they are in the oil-and-gas sector, women continue to be underrepresented in the RE sector in jobs that require science, technology, engineering, and math (STEM) training (28%) compared to non-STEM technical jobs (35%) and administrative positions (45%) (see Figure 4.5).

Although renewables employ more women than fossil fuels, our findings suggest that women face persistent barriers to entry, retention, and to advance to senior executive and leadership positions. Removing these barriers is essential to meet the growing demand for skills in an expanding RE industry.

The fact that women face specific barriers to retention and advancement in the RE sector is also evident from the finding that male and female respondents to the 2018 IRENA survey had similar levels of education. Almost three-quarters of respondents (71%) reported having a university degree in a STEM subject, with most of the rest holding postsecondary degrees in non-STEM subjects, and 4% having high-school or diploma qualifications. The highest degree attained by respondents was a master's degree.

As mentioned previously, the survey was designed to shed light on both the modern energy and energy access realms. A small number of individual (11%)

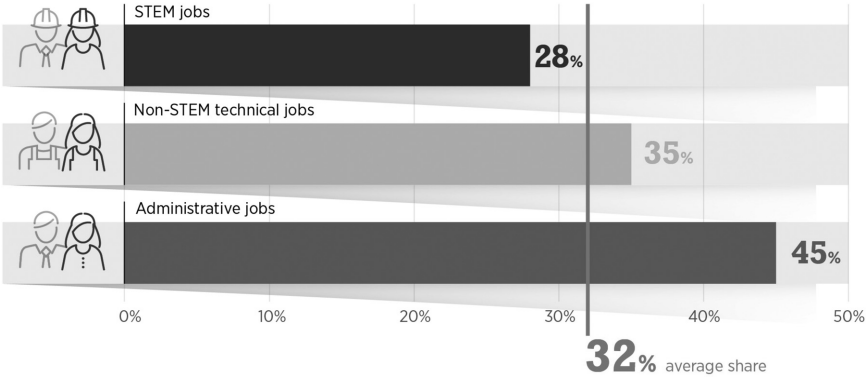


Figure 4.5 Shares of women in STEM, non-STEM and administrative jobs in RE
Source: IRENA, 2019

and organizational respondents (16%) indicated that they were working exclusively in the access context. A larger share – a quarter of all participating organizations and almost half of all individual participants – operated exclusively in the modern context. The largest share of respondents (57% of organizational respondents and 42% of individual respondents) indicated working in both modern and access contexts.

Social perception of gender roles

Regardless of whether they worked in the modern or energy access contexts, respondents identified societal perception of gender roles, cultural and social norms surrounding women’s employment, and male-biased hiring practices in the energy sector as the top three barriers for women’s entry into the RE sector (see Figure 4.6). These findings resonate with other recent research conducted to understand women’s underrepresentation in the RE sector in various industrialized, emerging, and developing economy contexts. For example, Baruah (2017) emphasizes how societal misperceptions of women’s incompetence in technical occupations present an impediment for women’s optimal participation in RE. Women in technical occupations are deemed less competent than men, even when they have more education and experience than their male counterparts (ibid).

Barriers to advancement

When asked to identify barriers to advancement in the RE sector, survey respondents unanimously emphasized the existence of a glass ceiling (i.e., unacknowledged or invisible barriers to advancement) in the RE sector. They cited cultural and social norms, lack of flexibility in the workplace, and lack of mentors as the

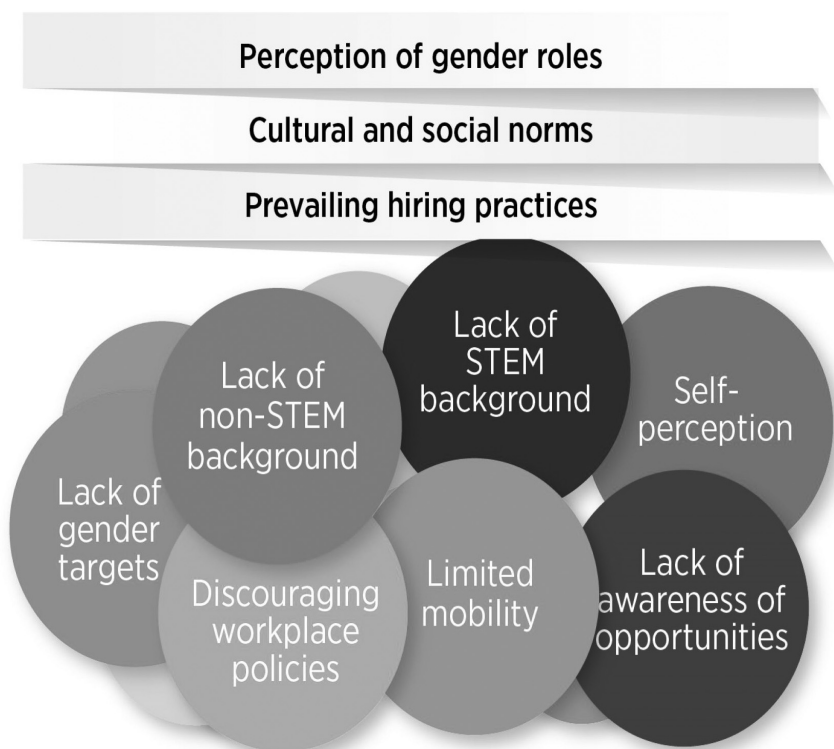


Figure 4.6 Barriers to entry for women in the RE sector

Source: IRENA, 2019

top three barriers for women's advancement in careers in RE (Figure 4.7). The barriers to advancement revealed by this survey have been emphasized elsewhere. For example, in a study about women, gender equality, and the energy transition in the European Union, Clancy and Feenstra (2019) identify male-biased hiring and promotion practices and lack of flexibility in work hours as major barriers to women's advancement in the RE sector. Also, as noted by Baruah (2019), women encounter both "sticky floors and glass ceilings" in the RE sector. In other words, careers may never get off the ground because of persistent and confining stereotypes of feminized roles. And the absence of role models and gender-balanced initiatives makes moving up the ranks more challenging for women (ibid).

Barriers to participation by geography

The regional distribution of perceived barriers to women's participation in the RE sector provided interesting results. Although cultural and social norms were

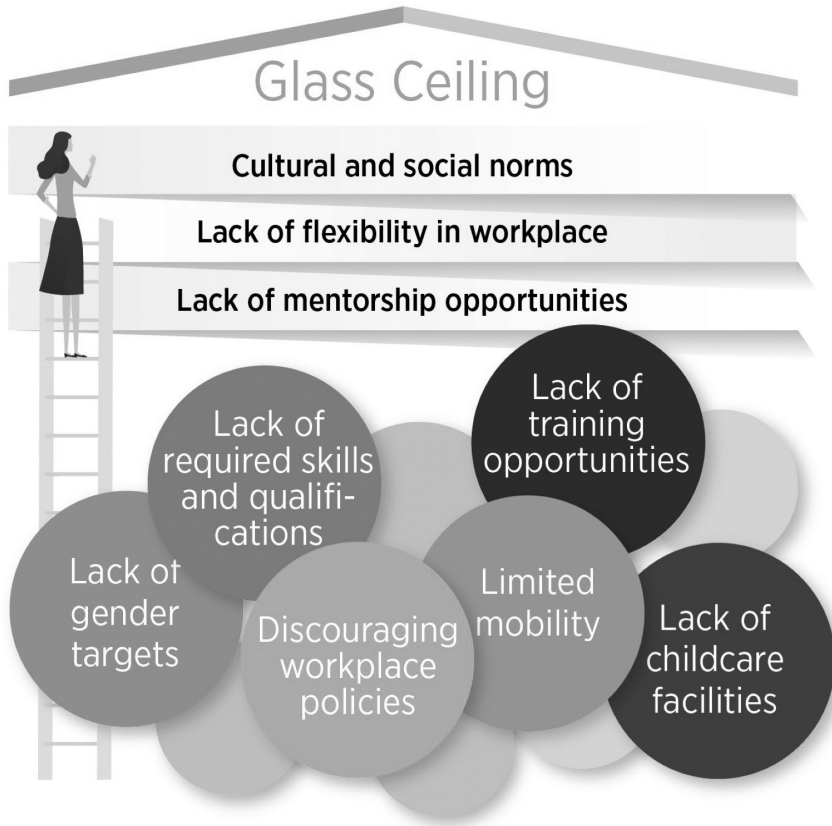


Figure 4.7 Barriers to women's advancement in the RE sector

Source: IRENA, 2019

identified as barriers for women's participation in the RE sector by respondents in all geographical settings, respondents from Europe and North America identified them as a bigger barrier than respondents from Latin America and the Caribbean, Asia, and Africa (see Figure 4.8). Respondents from Europe, North America, and the Asia-Pacific regions also identified unequal asset ownership as bigger barriers than respondents from Africa, Latin America, and the Caribbean. Respondents from Africa and the Asia-Pacific region identified lack of skills as the biggest barrier to women's entry into the RE sector. These findings are unique to the 2018 IRENA survey. They have not been written about elsewhere in the existing literature on women's employment in the energy sector. Of course, the fact that respondents from countries in Africa, Asia, Latin America, and the Caribbean did not identify cultural and social norms as the biggest barrier does not mean that such barriers do not exist in these contexts. It may just speak to the fact that lack of

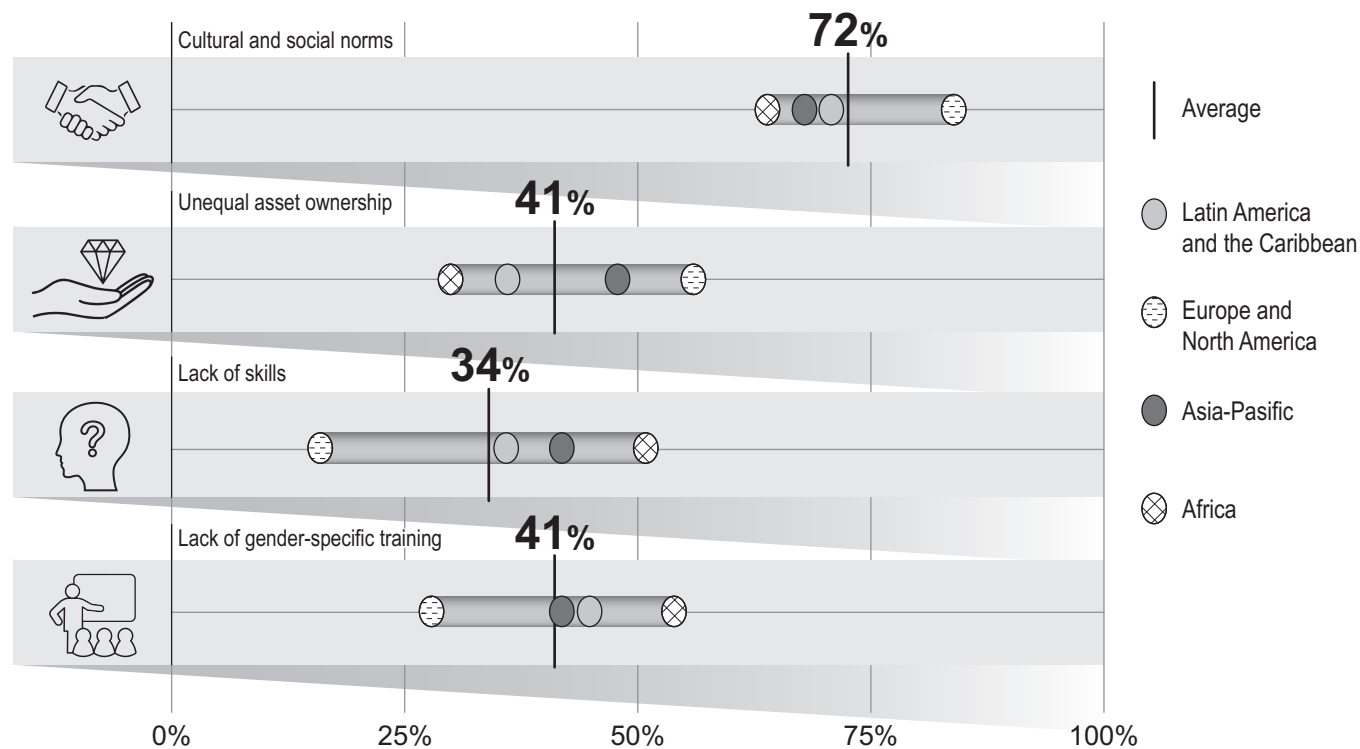


Figure 4.8 Regional distribution of barriers to women's employment in RE

Source: IRENA, 2019

access to training and skills is perceived as a more immediate and practical barrier than cultural and social norms. Indeed, the existing research on the topic emphasizes that although large numbers of middle-class women study STEM subjects in many Asian and African countries, and have no difficulty accessing entry-level technical jobs in the RE sector, much more needs to be done to make such training accessible and affordable to women from poorer socio-economic backgrounds in the same countries (Baruah, 2015; UNESCO, 2015).

Measures to address barriers: skills and training

Other regional differences emerged when survey respondents were asked to identify measures that would enable more women to access employment in RE (Figure 4.9).

Overall, 71% of respondents across all geographical settings identified skills and training as the most important priority for improving women's participation in the RE sector (Figure 4.10). More specifically, 40% of the respondents highlighted the importance of training opportunities that are tailored to meet the needs and circumstances of women's lives. An equivalent number of respondents (41%) emphasized the absence at the present time of training programs that are sensitive to women's needs and circumstances as a barrier to women's participation in the RE sector. African respondents valued training the most and gave other related measures (interning and volunteering) higher priority. The skills identified by survey respondents as critical for women to acquire 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, were also deemed crucial. These survey findings are echoed in the broader literature on women's employment in RE in developing countries and emerging economies (see, for example, Baruah, 2015, 2017; Clancy and Feenstra, 2019).

Measures to address barriers: networking and mentoring

Networking, mentoring, and gender-sensitive policies were regarded as important for women's recruitment and advancement in the RE sector across all regions of the world, although respondents in the Asia-Pacific region were less likely to view networking as critical as compared to counterparts elsewhere. Respondents in Latin America and the Caribbean emphasized mentoring less than others.

Measures to address barriers: flexible work policies

We asked respondents to indicate whether the availability of alternative work arrangements such as remote work, flexible work, part-time work, and job sharing would increase the participation of women in the RE sector. We found that the availability of the part-time work option only slightly increased the share of women in the RE workforce. Thus, whereas 32% of female survey respondents

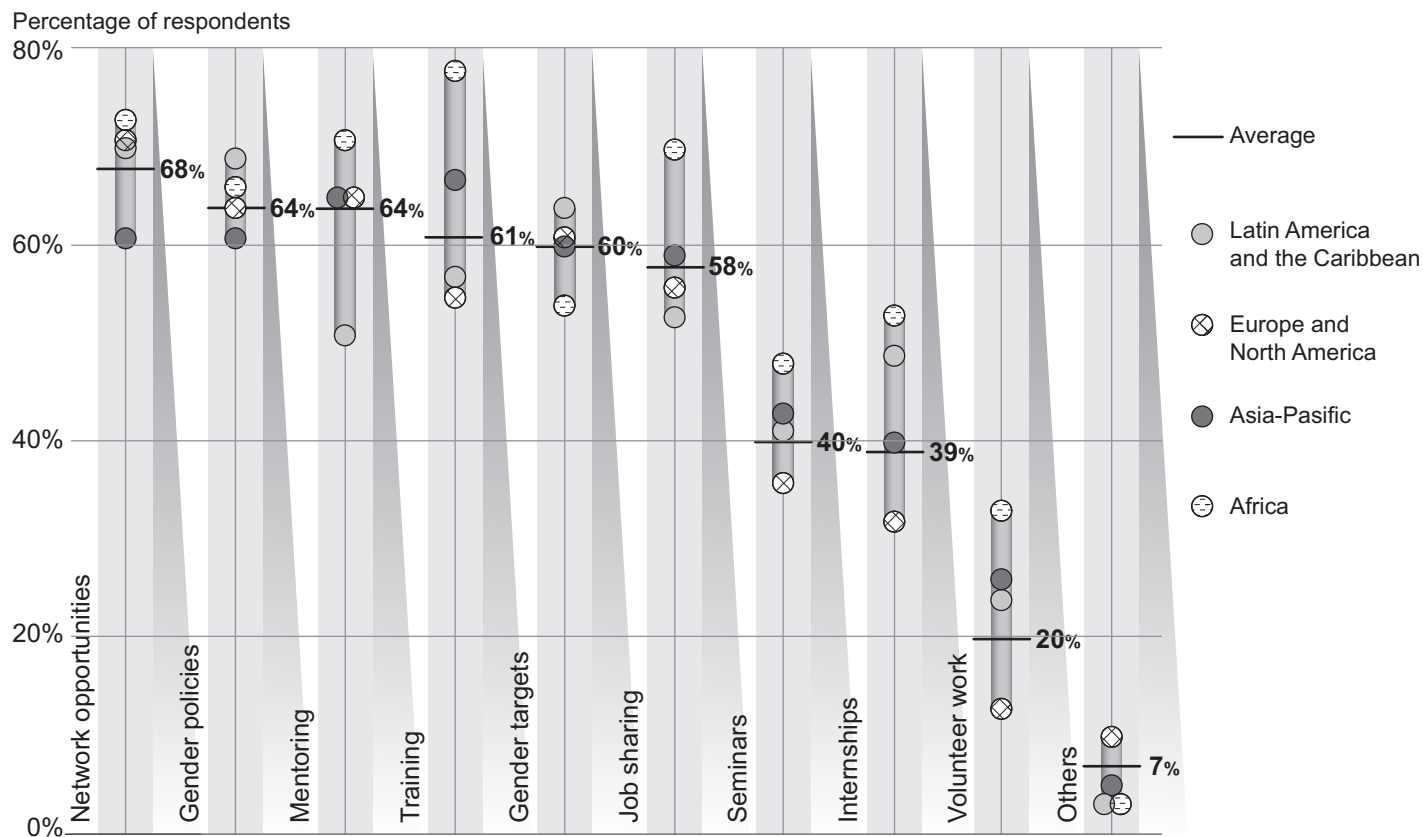


Figure 4.9 Suggested measures to enable more women to access employment in RE

Source: IRENA, 2019

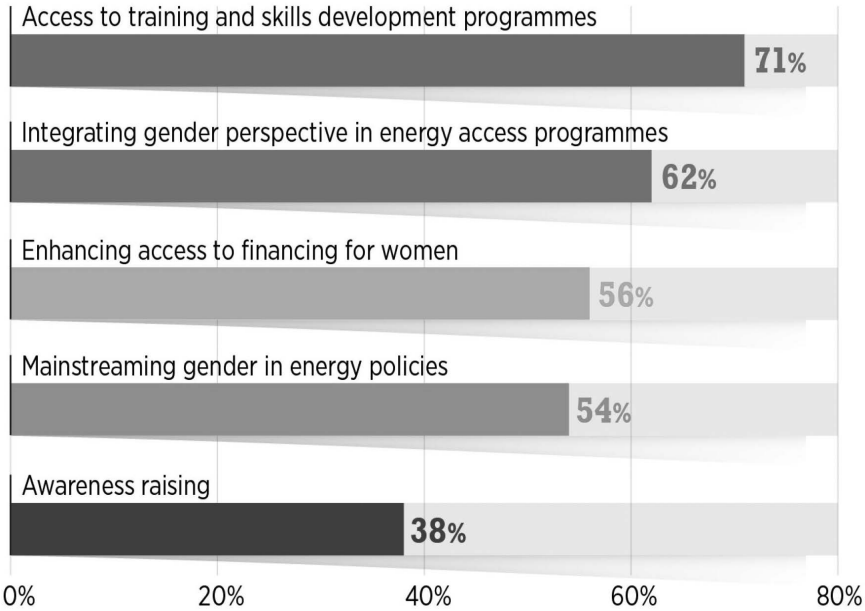


Figure 4.10 Suggested measures to improve women’s employment in RE

Source: IRENA, 2019

worked full-time, 36% worked part-time. A majority (75%) of individual female respondents considered full-time work with benefits and some flexibility in working hours and work location to be their ideal employment scenario. Sixty-nine percent of female survey respondents indicated that they could avail themselves of paid maternity leave, but only 34% of part-time workers said the same. We found that part-time workers were far less likely to be eligible for benefits such as employer-sponsored pensions, health care, dental services, and professional development when compared to full-time workers, which may explain why full-time work with full benefits is what most workers aspire to.

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 organizations 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 professional development and on-the-job training opportunities (7%). The availability of paternity leave and childcare facilities also had a significant positive impact on the

perception of barriers to female employment, although relatively few employers offered these benefits.

Awareness of gender issues

One of the most insightful findings from the survey was the gender difference in the response rates and the perception of barriers in the RE sector. Both men and women were invited to respond to the 2018 IRENA survey, but almost 70% of respondents were women. This may serve as an indication that awareness of gender issues in the RE sector is itself driven significantly by gender. Along the same lines, although 75% of female respondents identified gender as a barrier in the RE sector, only 40% of male respondents did so. Similar gender differences emerge regarding perceptions of pay equity in the RE sector. Sixty percent of male respondents and only 29% of female respondents agreed with the statement that women and men were paid equally for the same work in the RE sector. Most men working in the RE sector, presumably including those with responsibilities for making policy decisions, are unaware that women face specific barriers entering the sector and advancing within it. This is borne out by findings from the survey about the gender composition of boards of directors of organizations in the RE sector. Women are underrepresented on boards of private sector companies, governmental agencies, and intergovernmental organizations (IGOs), and NGOs that work on energy issues (see Figure 4.11). Women are most poorly represented on the boards of private sector companies, government agencies, and IGOs. Men represent at least 75% of board members for private sector organizations that responded to the survey. One survey respondent summed up why gender equality does not receive much attention within the RE sector succinctly: "If you don't even know you have a problem, you're certainly not going to fix it."

Benefits of gender diversity in the workplace

Research conducted all over the world confirms that gender diversity in organizations, and wage equity between women and men, results in higher profits and better returns on investment. In its study of almost 22,000 firms across the globe, the Peterson Institute for International Economics discovered that a company with 30% women leaders can add up to 6% points to its net margin, compared to other companies in the same industry. Across the economy, the percentage of women corporate officers is positively linked to better financial performance (Noland et al., 2016). Another study found that companies with more women board members, on average, outperform those with fewer women by 53% on return on investment, 42% on return on sales, and 66% on return on invested capital (Joy, 2008). Similar findings have emerged for women in executive positions – companies with higher percentages of women decision makers financially outperform their industry peers. Across all sectors of the economy, the percentage of women corporate officers is positively linked to better financial performance. A 30% critical mass of women as executive officers and board members has

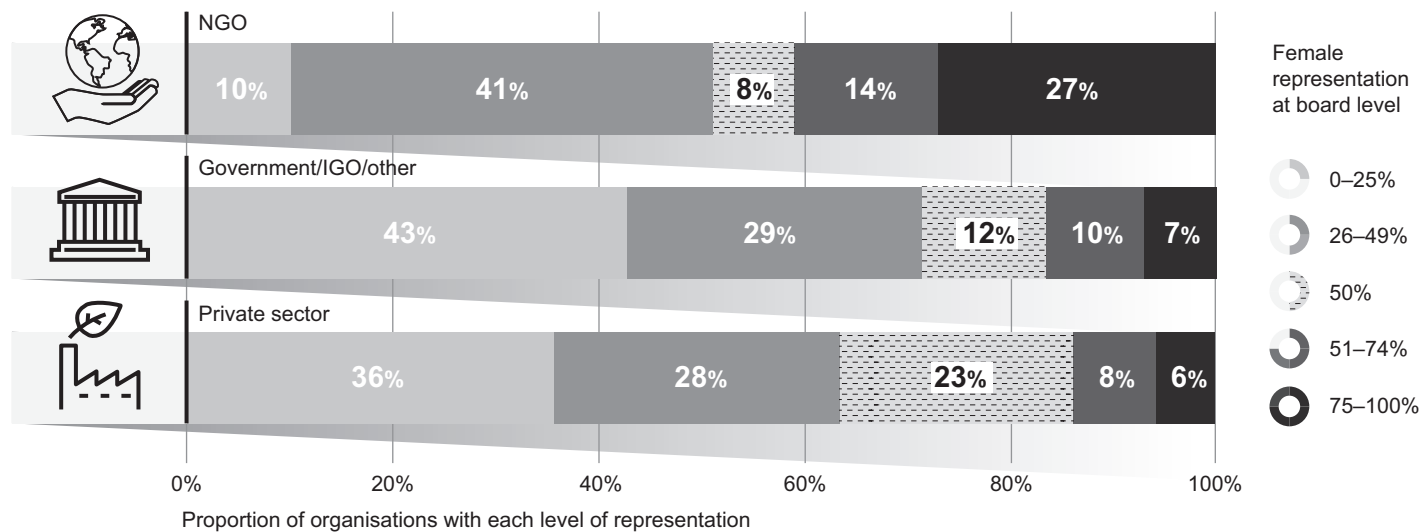


Figure 4.11 Gender composition of boards of directors in the RE sector

Source: IRENA, 2019

been demonstrated to have the most positive impact on company performance (Wagner, 2011). Gender balance in male-dominated professions contributes to the improvement in working conditions for both men and women, with positive effects on well-being, work culture, and productivity (WISE, 2017).

The business case – stronger economic outcomes if more women are employed – is often the most powerful rationale for more companies to institute gender diversity and wage equity policies (Baruah, 2018). Therefore, collecting gender-disaggregated data on employment in the RE sector and documenting and publicizing the economic benefits of gender diversity and inclusion is a useful strategy for convincing RE companies to recruit, retain, and promote more women.

The broad lesson that emerged from IRENA's 2018 online survey is that while progress has been made in building gender diversity and inclusion in RE employment, much remains to be done to ensure that women derive optimal benefits from employment in the sector, and concurrently that the RE sector is able to draw upon a larger workforce than it currently benefits from.

Conclusions and policy recommendations

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

The findings from IRENA's 2018 survey of 1,440 respondents working in the RE sector in 144 countries worldwide revealed that women represent 32% of full-time employees of responding organizations, 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 RE sector and from the energy transition more broadly. At the same time, the RE sector needs to be able to draw upon a larger talent pool. Responses to the survey revealed that although women represent 45% of general administrative jobs within participating organizations, they hold a lower number (28%) of the positions that require STEM training. Boosting women's participation in STEM education and employment is an action area that the RE sector must prioritize. 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% of 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 RE sector's need for skills.

Several policy recommendations and action areas emerge from the survey and the existing literature. These include the need to proactively plan and implement (i.e., mainstream) gender equity in energy sector frameworks; to tailor training and skills development programs to women's specific needs; to work to both attract and retain talent in the RE sector; 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. We elaborate briefly below on each.

Mainstreaming gender in energy sector frameworks

Almost half (49%) of the survey respondents identified the lack of gender-sensitive policies in the energy sector as a key barrier for women's employment and advancement in the RE sector. Yet, few countries have introduced meaningful policies to promote gender equity in the sector (Rojas et al., 2015).

A United States Agency for International Development (USAID) and International Network on Gender and Sustainable Energy (ENERGIA) study of RE 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 programs – 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, to avoid risking reinforcing the gender gap between men and women in both the modern and energy access contexts.

Gender mainstreaming is the process of analyzing legislation, regulations, taxation, and specific projects for their effect on the status of women in society (Swirski, 2002). The basic assumption of gender mainstreaming is that public policy affects men and women differentially, stemming from the different roles women and men play within their families, communities, and the economy at large. 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 (IRENA, 2013).

In the access context, greater efforts are needed to engage women along different segments of the off-grid RE value chain. A gender equality perspective needs to be integrated from the very beginning in the design, implementation, and monitoring of energy access programs. For example, Zambia's National Energy Policy identifies measures to mainstream gender considerations in all energy access programs and highlights the role of women not only as beneficiaries but as also

active energy providers and entrepreneurs within the sector (Clancy et al., 2017; ENERGIA, 2011). This is a good example of a gender-transformative approach that views women not simply as primary end users and beneficiaries, but as actors in the design and delivery of energy solutions.

Tailoring training and skills development programs

A lack of appropriate skills and training for employment in the RE sector remains a key barrier for women in both the modern and access context. This affects women seeking entry into the RE sector, as well as those who are already employed. Low enrollment rates in STEM courses translate into continued under-representation of women in technical roles in the RE 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 can play an important role in such efforts, including governments, educational institutions, the private sector, and advocacy organizations.

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 programs (covering both renewables and non-renewables), building cross-disciplinary and connected labs, adding courses to respond to digitization 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 potential areas of recruitment (ibid.).

Professional networks and personal connections play a big role in access to career information in the RE sector. 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 programs is critical. Many of the skills needed in the off-grid renewables' value chain can be developed locally. Organizations like Solar Sister, Grameen Shakti, Barefoot College, Hivos, ENERGIA, and the Self-Employed Women's Association (SEWA) have demonstrated that customized solutions for training and opportunities for cross mentorship can substantially increase women's participation in the sector (Baruah, 2015).

Attracting and retaining talent

Women want to work in the RE sector for similar reasons as men: 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, making it difficult for them to remain employed and advance at par with their male counterparts in careers in RE. The survey revealed significant

differences among employers in accommodating employees' caregiving needs and multiple responsibilities.

More RE 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.

An important distinction must be made between women's *representation* and *participation* in the RE sector. At lower than 15% female representation, it is not uncommon for women, because of their minority status, to be made to feel marginal and "invisible" in decision-making processes. Establishing critical mass is important 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). Toward this end, RE 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.

Challenging cultural and social norms

Prevalent cultural and social norms strongly influence the success of gender goals in the RE sector. 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 may be one way to challenge entrenched social and cultural norms.

In the access context, there are examples emerging from countries such as India and Indonesia about renewables enabling some women not just to forge a path out of poverty but also to become agents of social and economic transformation in their communities. The "solar mama" program at the Barefoot College in India is a well-documented case study of the democratizing power of off-grid RE solutions and the transformative potential of training women in rural areas. The program 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 non-literate 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 mentors for other women in their communities (Deshpande, 2017). Participating in the RE 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 (IRENA, 2018). In Indonesia, the Wonder Women program, an initiative of the non-profit Kopernik, trains women to expand last-mile electricity access through off-grid solutions. Since 2013, the program 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 program 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. A survey conducted after 12 months of program implementation found that 21% of participants felt 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% felt more empowered within the community. Wonder women often become a pillar of support and inspiration for other women in the village, encouraging them to join the program or take up other economic activities (IRENA, 2018). As gender-sensitive training, education, apprenticeships, employment placement, and financial tools are adopted more widely, more women may be able to step into such roles and, in turn, contribute directly to the accomplishment of SDG 5 and SDG 7, and indirectly to the other Sustainable Development Goals.

Future research

The scarcity of gender-disaggregated empirical data is a major barrier in the effort to enhance awareness of the challenges and to improve the gender balance in RE employment. Without data, there is no visibility. And without visibility, there is no policy priority. Efforts to improve quantitative and qualitative data gathering are thus essential. This is true for both the modern energy and energy access contexts and across all regions.

Although organizational responses to IRENA’s 2018 survey were evenly distributed across the main regions of the world, half of the individual responses came from Europe and North America. Also, the survey generated fewer responses from private sector organizations than from governmental, inter-governmental, and non-governmental organizations. Future data collection efforts should strive for a more comprehensive representation of the RE sector from private sector organizations, utilities, manufacturers, and large companies operating under power purchase agreements. They should also strive for better geographical coverage, especially from countries such as India and China that are key players in the global RE industry.

Government statistics will generally need to capture employment in the sector much better than is the case today, building gender disaggregation into these efforts from the beginning. A wide range of actors, including academic and non-academic researchers, advocacy groups, professional associations, international

organizations, NGOs, policy institutes, and think-tanks, can contribute to building a gender-disaggregated evidence base in RE.

Context matters greatly for understanding both gender barriers and solutions; this requires more detailed examination of gender dimensions in different regions and countries, for different types of RE technologies, and for different scales of deployment. For instance, gender equity issues in large-scale grid-connected RE 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 RE initiatives have generated significant new economic opportunities for women in the access context. However, available evidence of successes, remaining challenges, and long-term sustainability of such initiatives is currently largely anecdotal.

A better understanding is also required of wider social and economic policies that are necessary to optimize 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 cook stoves, or other RE solutions. More women can gain optimal traction from RE initiatives if there are other supportive gender-sensitive social and economic policies. Since women's ability to take advantage of new RE-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 (Baruah, 2015). 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 necessary to address the gender dimension adequately.

There have been significant advancements globally in expanding and strengthening social protection policies in recent years, as more countries transition toward developing welfare systems. Some strategies that are being tried in African, Asian, and Latin American countries include basic income schemes, as well as conditional and unconditional cash transfer programs that enable poor women to make priority decisions for themselves and their dependents. Programs like Brazil's Bolsa Familia, Mexico's Prospera, Mali's Social Cash Transfer initiative, and India's basic income pilot are hopeful developments given that structural inequality constrains an individual's ability to exercise rights and demand entitlements, such as decent employment (Campello and Neri, 2014; Davala et al., 2015; Mary Robinson Foundation, 2016). In the interest of enhancing the economic benefits and social outcomes of growing employment opportunities, the RE sector may find it necessary in the future to engage in research and policy aimed at understanding how to strengthen and expand social protection infrastructure in both the modern and energy access contexts in the pursuit of a just and equitable energy transition. Strengthening social protection policies around the world will lead to the advancement and optimization of both SDG 5 and SDG 7, and the synergies and interdependencies between the two goals.

There is growing recognition that universal energy access is unlikely to be achieved without addressing the need for gender equality (IEA, 2019; IEA et al.,

2020). Future research and evidence building at the intersections of SDG 5 and SDG 7 is therefore critical.

References

- Agarwal, B. (2010) 'Does Women's Proportional Strength Affect Their Participation? Governing Local Forests in South Asia', *World Development*, 38(1), pp. 98–112.
- Baruah, B. (2015) 'Creating Opportunities for Women in the Renewable Energy Sector: Findings from India', *Feminist Economics*, 21(2), pp. 53–76.
- Baruah, B. (2017) 'Renewable Inequity? Women's Employment in Clean Energy in Industrialized, Emerging and Developing Economies', *Natural Resources Forum*, 41(1), pp. 18–29.
- Baruah, B. (2018) *Barriers and Opportunities for Women's Employment in Natural Resources Industries in Canada*. Ottawa: Natural Resources Canada.
- Baruah, B. (2019) 'Addressing the Diversity Challenge in Energy Sector Recruitment', *Modern Diplomacy*, 6 July [online]. Available at: <https://moderndiplomacy.eu/2019/07/05/addressing-the-diversity-challenge-in-energy-sector-recruitment/> (Accessed: 16 November 2020).
- Baruah, B. and Gaudet, C. (2018) 'Creating and Optimizing Employment Opportunities for Women in the Clean Energy Sector in Canada', *Smart Prosperity Institute*, 18 May [online]. Available at: <https://institute.smartprosperity.ca/library/research/creating-and-optimizing-employment-opportunities-women-clean-energy-sector-canada> (Accessed: 16 November 2020).
- Campello, T. and Neri, M. (2014) *Bolsa Familia Program: A Decade of Social Inclusion in Brazil*. Brasília: Institute for Applied Economic Research.
- Clancy, J., Daskalova, V., Feenstra, M., Franceschelli, N., and Sanz, M. (2017) *Gender Perspective on Access to Energy in the EU*. Brussels: European Union.
- Clancy, J. and Feenstra, M. (2019) *Women, Gender Equality and the Energy Transition in the EU*. Brussels: European Union.
- Davala, S., Jhabvala, R., Standing, G., and Mehta, S. (2015) *Basic Income: A Transformative Policy for India*. New Delhi: Bloomsbury.
- Deshpande, V. (2017) 'Inside Barefoot College: Where Women from across the World become Solar Engineers', *The Economic Times*, 18 June [online]. Available at: <https://economictimes.indiatimes.com/industry/energy/power/inside-barefoot-college-where-women-from-across-the-world-become-solar-engineers/articleshow/59195677.cms> (Accessed: 3 February 2021).
- ENERGIA (2011) *Zambia Gender and Energy Mainstreaming Strategy 2011–2013*. The Hague: ENERGIA.
- IEA. (2019) 'Status Report on Gender Equality in the Energy Sector', *C3E International*, 17 June [online]. Available at: www.cleanenergyministerial.org/sites/default/files/2019-06/Status%20Report%20on%20Gender%20Equality%20in%20the%20Energy%20Sector_0.pdf (Accessed: 3 February 2021).
- IEA, IRENA, UNSD, World Bank, and WHO. (2020) *Tracking SDG 7: The Energy Progress Report*. Washington, DC: World Bank.
- ILO (2018) *Women and Men in the Informal Economy: A Statistical Picture* (third edition). Geneva: International Labour Office.
- IRENA (2013) *Renewable Energy and Jobs: Annual Review*. Abu Dhabi: IRENA.
- IRENA (2016) *Renewable Energy and Jobs: Annual Review*. Abu Dhabi: IRENA.
- IRENA (2018) 'Indonesia's "Superheroines" Empowered with Renewables', *IRENA Articles*, 22 April [online]. Available at: <http://irena.org/newsroom/articles/2018/Apr/>

- Indonesias-Superheroines-Empowered-with-Renewables (Accessed: 14 November 2018).
- IRENA (2019) *Renewable Energy: A Gender Perspective*. Abu Dhabi: IRENA.
- IRENA (2020a) *Renewable Energy and Jobs: Annual Review*. Abu Dhabi: IRENA.
- IRENA (2020b) *Global Renewables Outlook: Energy Transformation 2050*. Abu Dhabi: IRENA.
- IRENA (2020c) *Wind Energy: A Gender Perspective*. Abu Dhabi: IRENA.
- Joy, L. (2008) ‘Advancing Women Leaders: The Connection between Women Board Directors and Women Corporate Officers’, *Catalyst*, 15 July [online] Available at: www.catalyst.org/research/advancing-women-leaders-the-connection-between-women-board-directors-and-women-corporate-officers/ (Accessed: 1 October 2020).
- Mary Robinson Foundation (2016) *The Role of Social Protection in Ending Energy Poverty Making Zero Carbon, Zero Poverty the Climate Justice Way a Reality*. Dublin: MRF.
- Noland, M., Moran, T., and Kotschwar, B. (2016) *Is Gender Diversity Profitable? Evidence from a Global Survey*. Washington, DC: Peterson Institute for International Economics.
- Pearl-Martinez, R. (2014) *Women at the Forefront of the Clean Energy Future*. Washington, DC: IUCN-USAID.
- Pearl-Martinez, R. and Stephens, J. (2016) ‘Toward a Gender Diverse Workforce in the Renewable Energy Transition’, *Sustainability: Science, Practice and Policy*, 12(1), pp. 8–15.
- Rick, K., Martén, I., and Von Lonski, U. (2017) ‘Untapped Reserves: Promoting Gender Balance in Oil and Gas’, *Boston Consulting Group*, 12 July [online] Available at: www.bcg.com/en-ca/publications/2017/energy-environment-people-organization-untapped-reserves (Accessed: 16 November 2020).
- Rojas, A., Prebble, M., and Siles, J. (2015) ‘Flipping the Switch: Ensuring the Energy Sector Is Sustainable and Gender-Responsive’, in Aguilar, L., Granat, M., and Owren, C. (eds.) *Roots for the Future: The Landscape and Way Forward on Gender and Climate Change*. Washington, DC: IUCN & GGC, pp. 203–288.
- Swirski, B. (2002) *What is a Gender Audit*. Israel: Adva Center. Tel Aviv-Yafo.
- UNESCO (2015) *UNESCO Science Report: Towards 2030*. Paris: UNESCO.
- Wagner, H.M. (2011) ‘The Bottom Line: Corporate Performance and Women’s Representation on Boards (2004–2008)’, *Catalyst*, 1 March [online]. Available at: www.catalyst.org/research/the-bottom-line-corporate-performance-and-womens-representation-on-boards-2004-2008/ (Accessed: 1 October 2020).
- WISE (2017) *Women Employment in Urban Public Sector* [online]. Available at: www.wiseproject.net/download/final_wise_project_report.pdf (Accessed: 1 October 2020).