



# 2

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

**diversity**

/daɪˈvɜːsəti/

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



## 2.1. Status and trends

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

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

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

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

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

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



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

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

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

discussion are relevant findings from IRENA's survey.

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

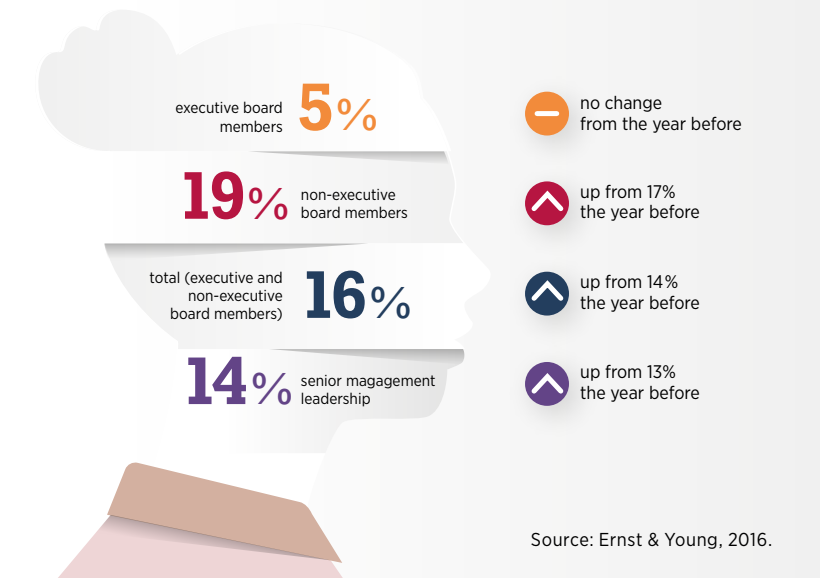
The renewable energy sector is comprised of a wide range of actors. It encompasses not only well-established companies, such as regulated utilities and old-line engineering firms, but also new independent power producers and a variety of start-ups, as well as policy-making ministries and regulatory bodies,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

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

expand as the global energy transition gathers momentum.

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

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

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

# 22%

Share of women  
in the oil and gas workforce



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

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

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

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

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

- In 2015, the electricity, gas and water supply sector was found to have women in 22% of senior management roles, roughly half the share in the educational and social services sector (McCarthy, 2016).
- A study of the world's 200 largest utilities found only 25 female board members, representing 16% of board members, and only 5% of executive board members (Ernst & Young, 2016) (see Figure 2.1).

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

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

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



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

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

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

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

Source: Solar Foundation (2018) and earlier editions.

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





Women account for

**32%**

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

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

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

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

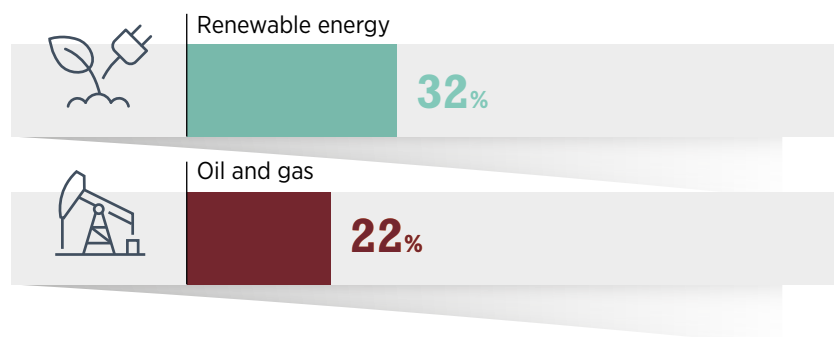
technical staff and 32% of senior management posts.

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

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

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

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



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





# 75% | 40%

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

## 2.2. Barriers and challenges

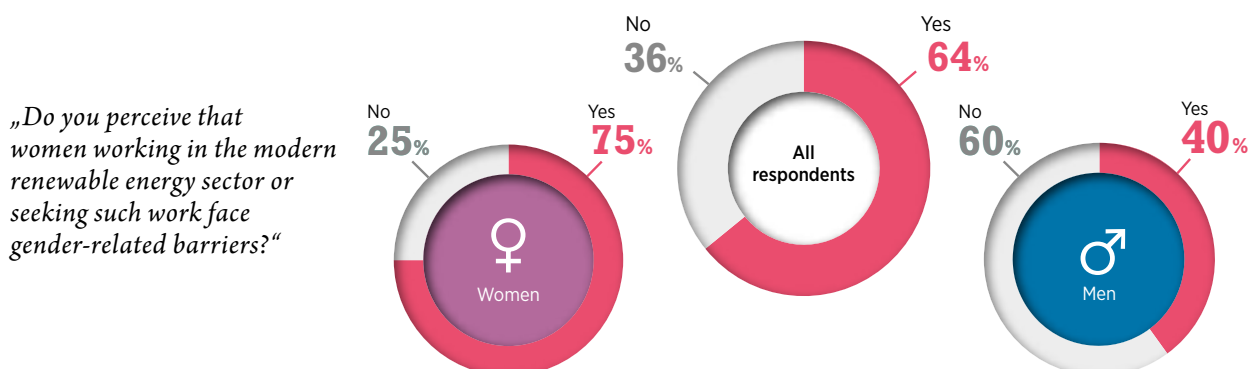
A fundamental issue in addressing barriers to women's advancement is whether people are sufficiently aware of the existence of the impediments. IRENA's survey asked: *"In your experience, do you perceive that women working in the modern renewable energy sector or seeking such work face gender-related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

### 2.2.1. Barriers to entry

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

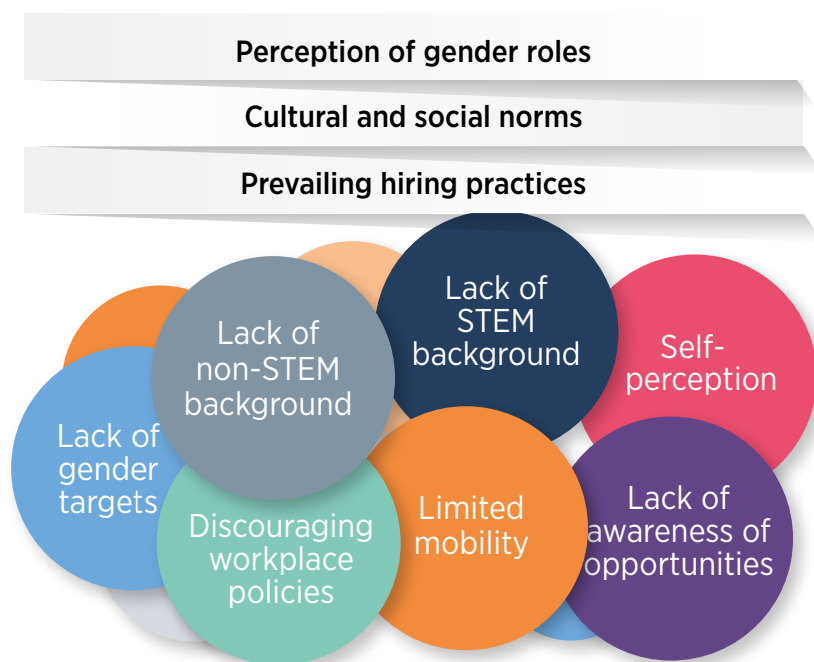
The text that follows discusses four categories of barriers: 1) perceptions of gender roles and the nature of work in the sector; 2) participation of women in STEM and non-STEM jobs; 3) the lack of adequate information, and thus awareness, about career opportunities in renewable energy; and 4) prevalent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

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



Source: IRENA online gender survey, 2018.

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



Source: IRENA online gender survey, 2018.

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

### 1. Perceptions of gender roles

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

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

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

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

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

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

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

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





# 28% | 45%

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

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

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



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

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

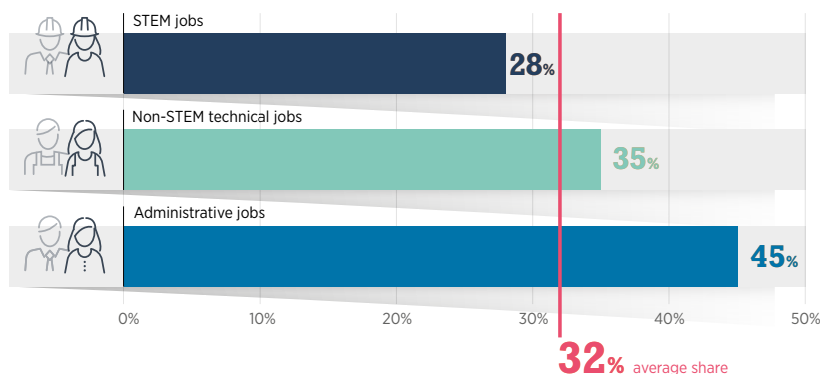
The contrast with other fields – notably education, health and social sciences – is stark. In New Zealand, the share of female graduates remained

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

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

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

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



Source: IRENA online gender survey, 2018.

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

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



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

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

### 3. Lack of career information

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

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

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

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

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

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

Source: IRENA, (2017).

Note: O&amp;M = operation and maintenance.