حـــوار أبوظبـــي بيـن الـــدول الآسيويـــة المرسلـــة و المستقبلـــة للعمالـــة
Abu Dhabi Dialogue among the Asian Labor-Sending and Receiving Countries

Current and Potential Demand for Women Workers in the Renewable Energy sector in India and the UAE

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Executive Summary[1]

The dynamic transition to renewable energy (RE) in India and the United Arab Emirates (UAE), is marked by commitments to international human rights frameworks, sustainable development and national development ambitions. It promises, among other benefits, cleaner environments, access to sustainable energy, more jobs including for women, because of its multi-disciplinarity, its long, diverse supply chains, higher labor intensity and profit margins - compared to the traditional energy sector. The modern RE and decentralized RE (DRE) sectors also provide women greater opportunities to play leadership roles and to own companies, than the conventional energy sector because of the latter's large scale of investment and top-heavy system. DRE allows women to be situated and create value anywhere along the clean energy value chain - as aggregators, as trading businesses, as data analytics platforms that help aggregate demand, or build consumer awareness/demand for clean energy products in a company or by creating companies.

Optimizing opportunities for the emerging RE sector and women, partly depends on reform that is intentional about gender equality and women's rights, as research shows that women's expertise enhances growth, productivity, returns and organizational culture. This is especially relevant to RE, where women in their socially prescribed roles as nurturers, providers, managers and consumers of natural resources, develop their own knowledge, consciousness, skills, attitudes and behaviors on environmental protection and sustainability. Moreover, gender equality in the RE sector is a woman's human right and labor right.

Framed within the sustainable development paradigm, this policy paper stems from the preceding context and an ADD member states' decision to focus on women's skilled employment in the technology sector. The paper explores current and potential demand for women as employees in the RE sector, particularly solar energy, in India and the UAE, while also drawing on global data. It analyzes the gender-based structural opportunities and constraints mediating women's employment, career decision-making and advancement. It also preliminarily explores the status of migrant women professionals in UAE's RE sector, to initialize conversations on potential areas of job demand - given the significance of the sector in the UAE and of the country as a migrant destination site. Drawing on this analysis and relevant national, regional and global good practice, the paper makes recommendations to enhance decent employment for women, including Emirati and Indian women in the RE sectors of their respective countries, and for migrant women in the RE sector, including in the UAE.

This is a qualitative paper that draws on published data from diverse sources. A key constraint is the lack of available national labor force data (disaggregated) in the young RE sectors of these countries. The paper therefore draws on available studies, published RE company data and 23 key informant interviews across multiple sectors, that highlight gender considerations in the RE sector, the nature of RE job demand for women, and ways to enhance women's real access to decent RE employment.

These are the paper's highlights on women's RE employment globally, in India and the UAE:

1. **(a) Women's global share of** fulltime RE jobs in the overall RE sector globally is 32 percent; 40 percent in solar PV (27 percent of these are full time off grid jobs) and 21 percent in wind energy. Their global share of the oil and gas workforce is 22 percent. Smaller studies on rooftop solar, and the solar powered DRE sector in **India,** place their presence at 11per cent and 21 per cent

[1] The Executive Summary excludes in-text citations in view of space constraints. These are detailed in the paper.

respectively. Based on analysis of annual reports of Indian RE-focused companies, the International Solar Alliance (ISA) showed that **women's share in the total work force of key public sector companies - SECI was 19 per cent, NTPC, 7 per cent and NHPC 11 percent. [2] It was 5 per cent in private companies like Suzlon Energy and 8 per cent in Tata Power, and 45 per cent of UNIQUS Consult Tech.[3] Per UAE data from ADNOC, DEWA[4] and Masdar - major state-owned companies also focused on RE, women's share of the total workforce was 12 per cent, 18 per cent and 33 per cent respectively. Their share of the total workforce in private companies -Yellow Door Energy (YDE) was 56 per cent and Alcazar Energy 38 per cent. Women are 59 per cent and 53 percent of UAE's Ministries of Energy and Infrastructure and Climate Change and Environment, each**

(b) Women's RE employment across its diverse value chains is marked by gendered skill and occupational segmentation. The reasonable presence of women with STEM and non-STEM technical skills in some non-traditional segments of the value chain and jobs (although based mostly in corporate offices), holds promise for gender equality in the RE sector. However, their presence in on-site business deployment segments of the value chain is poor.

(i) Globally, women hold 28 per cent of STEM jobs, 35 per cent of non-STEM technical jobs and 45 per cent of administrative jobs. Global solar PV value chains have over 35 percent of women in all segments, but notably in core segments - equipment manufacturing (47 per cent), project development (37 per cent).

(ii) Senior RE company officials in **India and UAE confirm women's strong technical expertise in non-STEM and STEM fields (engineering, data/computer sciences), in strategy, project design, business development and sustainability, (commercial intelligence, site assessment, marketing, external customer relations), data analytics, finance and accounting, administration. human resources, communications, legal affairs/tax compliance, and increasingly in office-based engineering teams.**

(iii) In **India**, grid-connected rooftop solar has 18 per cent women in project design and pre-construction and 34 per cent in corporate support functions. In many rooftop solar companies, women engineers opted for corporate support roles. In solar DRE women account for 25 percent of the skilled work force in commercial &industrial DRE and 20 percent in mini-grids – mostly in office jobs. They also serve as sales agents/distributors, including last-mile distributors to rural communities, when conditions permit. Women in the feminized textiles, handicrafts, food processing sectors that use clean energy products and services, perform typically male functions e.g., operations and marketing, in enabling environs.

(iv) Women's presence in on-site business deployment segments of RE value chains is poor **globally, in India and the UAE -** 12 percent in installation in **global** solar PV and 12 percent in on-site business deployment of rooftop solar in India (3 percent in construction/commissioning and 1 percent in operations/ maintenance). Half the surveyed rooftop solar companies in India had no women in both these segments. Per **India and UAE interviews, women in corporate strategy, data analytics and engineering teams made periodic on-site visits to assess sites, provide technical demonstrations to clients, monitor plant operations and maintenance. Low skilled construction/installation work on-site is done by males.**

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[2] SECI, NTPC, NHPC. See expanded forms in paper

[3] UNIQUS Consult Tech (300 staff), also provides ESG and RE consulting services

[4] ADNOC, DEWA. See expanded forms in paper

(v) This paper does not focus on women's RE entrepreneurship, but globally women lead only 10.6 per cent of energy start-ups, relative to some 19.1 per cent of non-energy start-ups. In India's DRE sector, women tend to be founders/co-founders of small and medium RE start-ups in the pico-solar or solar home appliance sector that provide RE products and services for household/business use across sectors such as textiles and handicrafts, agriculture and allied activities, e-mobility and others such as waste management. Women lead about 30 percent of SMEs in the UAE, but it is not clear how many of these are RE focused.

©Women's share of **leadership** positions varies across the three sites. It is low globally and in India and higher in the UAE – per available data.

(i) Women's share of **leadership** positions in the **global** RE sector is low at 10.8 per cent (2019), relative to oil and gas (12.1 per cent), and non-energy industries (15.5 per cent). In **India**, women's share of senior management in energy industries is 8.4 women. In rooftop solar, women are12 per cent and 17 per cent of senior and middle management respectively, mostly leading teams or departments in support function related divisions - human resources, accounting/finance, and institutional relations. Women rarely head engineering/sales teams. More generally, women in the **UAE** hold 30 per cent of leadership roles in the public sector workforce and 15 per cent on the Board of the UAE Chambers of Commerce and Industry. **UAE's 3 state-owned RE companies have from 18 to 23 per cent women in leadership positions.**

(ii) The **glass ceiling is most difficult to break at senior- most levels** of the energy sector. Globally women held 5 per cent of these positions in 2019. The IRENA 2018 RE survey showed that men were 65 per cent of boards in participating private firms and three fourths of the directors in half of all the firms. In India, only one third of rooftop solar businesses surveyed had a female board member. None had more than one woman. This **ceiling can be broken with enabling conditions**. **In India, Tata Power has 20 per cent women on the board of directors. One of three CEOs in UNIQUS Consult Tech is a woman**. **UAE's**, **ADNOC had three senior VPs across the group in 2019, one was VP Operations. In YDE women hold 20 percent (two out of ten) C-Suite positions. At Alcazar Energy one out of four partners is a woman.**

(d) Gender gaps in wages and other work conditions

(i) Women earn about 20 per cent less than men in the RE sector globally. In **India,** where women's average wages in general are one-fifth of men's (WEF, 2021), solar rooftop businesses show persistent gender wage gaps (IEA and CEEW, 2019) Gender-based wage data for the **UAE's** RE sector was inaccessible, but the UAE has a gender equal pay policy for the same kind of work and ranks eighth worldwide on wage equality for similar work (WEF, 2022). However, a 2020 survey of 11,000 students (52 per cent Emirati, 31 per cent Saudi, and 17 per cent UAE residents from other countries) in sixteen universities in Dubai (with 43 percent women respondents), showed that 50 percent of women expected to be paid AED 5000, while only 40 per cent men would accept salaries at this level. According to an Institute of Management Accountants (IMA) 2014 survey of 131 IMA members in the UAE, average base salaries for women in the UAE ($53,222) were found to be 97 per of those for men ($54, 938).

(ii) Women entrepreneurs find it more difficult than men to set up RE businesses, especially with respect to access to capital. **Per interviews in India**, **other nuanced gender biases in access to capital and company ownership, include how much capital women get for the same dilution in ownership compared to a male-led company or how women negotiate the terms of the equity they bring in.**

(iii) Other **key gender concerns in the RE sector globally, in India and the UAE** to different degrees include the poor retention of women and poorer opportunities for career progression compared to men. About 50 per cent of **Indian** women drop out of the corporate employment pipeline at junior and mid-levels, compared to 29 per cent of women across Asia. Women often tend to be taken less seriously by clients or even within organizations and must work twice harder than men to succeed.

2. With the **UAE's** dynamic transition to RE and a high-powered knowledge economy **highly skilled migrant women professionals** are in demand for their skill, knowledge and labor in private RE and RE-related firms **in the UAE** that continue to have a lower proportion of Emirati women**.**

(a) Data from this study shows that most non-Emirati women work in the private sector, while most Emirati women work in the public sector. B**oth private sector RE companies in the UAE had employees of different nationalities, in one case 15. Migrant women were 0.56 per cent vs 99.4 per cent Emirati women in the Ministry of Energy and Infrastructure, and 9 percent vs 91 per cent Emirati women in the Ministry of Climate Change and Environment. Emirati women were 81.8 per cent and 61 percent of the female workforce in two state-owned companies in the study.** These patterns match overall available employment data that says that migrant women dominate the private sector but are a small proportion of public sector employees, while Emirati women are 66 -71 percent of the public sector work force and 11 percent of private sector employees.

(b) Many migrant women professionals in UAE's RE sector work in firms that develop RE assets at utility scale, in sustainable infrastructure funding companies, in Engineering-Procurement-Construction turn-key companies, in consultancy firms providing business, legal, RE technical services to RE companies or to others to help them decarbonize.

(c) **These women are high-skilled professionals with non-STEM/STEM expertise, working in middle/ senior management positions in non-technical/technical roles. They are partners, regional/ country heads, division/team leads, senior technical advisers or mid/junior technical specialists**.

(d) Most are in corporate settings, engaged in overall corporate strategy development or business development - commercial intelligence, site assessment, marketing, external customer relations finance, HR, legal, sales and marketing, communications departments, and in administration. They are far less involved in project execution – construction, installation, operations/maintenance. However, women from engineering or business development teams who have engineering backgrounds undertake periodic on-site visits with engineering functions as part of their jobs.

(e) The majority of blue-collar workers who set up RE infrastructure on-site in the UAE are male migrants, especially those employed in semi-skilled technical work or low-skilled construction. However, some companies are looking at increasing the number of women in on-site project execution through policies and agreements with their supply chain partners.

(f) Migrant women professionals in RE-related government ministries tend to be researchers, technical specialists such as on air quality and green-house gas emissions in the department of Green Development and Environment Affairs (MoCCAE) or in international relations departments (MoEI), handling bilateral documentation between countries of a more administrative nature. Depending on the nature of the work contracts would be short term to longer term.

3. **There are several challenges to women's recruitment, retention and upward mobility in the RE sector, which are being systematically eroded. (a) The challenges to women's recruitment include:**

(i) Gendered and other limited perceptions about the sector and its work (e.g., technology-based infrastructure sector, with heavy physical work). However, the sector has growing proportions of women with technical competencies and many heavy manual tasks are being automated.

(ii) Gendered perceptions and practice about women's location in RE value chains and related infrastructure and protections. Women's presence mostly in administrative, non-STEM technical and then STEM technical jobs in corporate offices is partly because enabling and administrative functions are seen as more appropriate for women versus core technical business functions or on-site roles. Office-based roles offer routine and stability conducive to family life, while on-site roles involve long, tedious travel, and prolonged onsite-stationing often in hard-to-reach sites that disrupt family life; and involve challenges in working with male vendors, supply chain partners, contractors/laborers and communities in which solar projects are being developed. Some contexts have very poor on-site infrastructure, safety and security. **(iii) Gender biases in employment, recruitment policies/practices, and in application processes.** The constitutions of both countries enshrine gender equality, including in employment, but there are variations between them in employment and recruitment policies/ practices. **India** has a history of implementing quotas for various groups of disadvantaged people, and legally mandated job quotas for women in certain sectors. **UAE** has quotas for women in public sector jobs, and targets for women's presence on boards of federal entities/institutions, which while not specific to the private sector can extend to all institutions. There is need for more granular data on these policy impacts, especially in the UAE. Further, private sector RE companies tend to adopt either gender neutral approaches, or soft or hard targets for women's recruitment. Lack of intentional recruitment of women contributes to poor presence of women, because conscious/unconscious biases drive recruiters to pursue male candidates; men tend to apply even if they are not a perfect fit for the job and women tend to self-select. Contrary to pervasive views that quotas and other affirmative actions for women are discriminatory, CEDAW deems it a gender equality measure that compensates for women's historical disadvantages.

(iv) Gender disparities in tertiary education and TVET for RE jobs. Despite a robust share of STEM graduates in both sites, this does not necessarily translate into RE jobs, due to gendered social norms/ practices, combined with more nuanced gender biases in STEM study streams. A 2021 UNESCO study showed that women are overrepresented in sciences like medical/health sciences (**India**:61.6 percent; **UAE**:81.1 percent) and natural sciences (**India**:51.4 percent; **UAE**:85.9 percent) – not directly related to RE jobs. **India** has a range of RE skills development programs e.g., *Suryamitra*, *Vayumitra*, *Varunmitra*, but there is a lack of sex-disaggregated data on enrolments, placements, types of courses pursued and sector-specific participation in the workforce post-training in these programs. Programs tend to be largely focused on skills relevant to the execution phase of RE projects, which involves fewer women workers, and are likely to have less women enrolled in them. Moreover, the operational elements of access to these programs need to be women-friendly. Sex-disaggregated data on TVET for the RE sector in the **UAE** was not accessible**,** but overall enrolment in these at the upper-secondary level is about 2.5 per cent. TVET generally draws in males, and Emirati women are about 37 per cent of enrollees. Low levels of TVET enrolment in the UAE and other GCC states reflect a lack of preference for TVET relative to academic education, despite state investments in TVET.

(v) Inadequate embedment of RE programmes in core educational curriculum, thin alignment between education and RE industry demands, and a scarcity of RE job skills, despite progress in both sites. A World Bank study on women in energy sector jobs in the **MENA region** says that STEM study fields are "often theoretical and or related to more traditional types of occupations such as medicine,

engineering and research. Anecdotal evidence indicates that early education and training in newer areas of technology are nascent and not necessarily integrated into educational curriculums, leaving critical gaps in skills development for youth competing in future markets. "A study on engineering programs in public/private universities in the **UAE** says that the integration of RE fundamentals and applications into the engineering curricula is still modest and requires strategic decisions by university officials to advance this change. **In India**, integrating RE pervasively into the core engineering syllabus is still developing.

(vi) Women's unequal access to entry points for RE jobs (e.g., internships, apprenticeships) that help acquire required skills and jobs. A Government of **India** study (2019) showed that women were only 11 per cent of apprentices clustered in a few women-oriented trades in Industrial Technical Institutes (ITIs).

(vii) Women's greater lack of access to adequate information on RE job opportunities as they are excluded from the 'all-boys' social/professional networks and other formal channels of communication (industry conferences, exhibitions, job fairs and events organized by government, industry, financiers and international organizations). These events feature research and development, innovation, good RE policy/ programs and provide a range of RE job opportunities. Also, not all universities have dedicated information, mentoring/counselling programs on RE job prospects targeting women.

(b) Challenges to women's retention and career progression into senior leadership roles include:

(i) Marriage, childbearing and unpaid care work which often entails relocation, childbearing/child-care breaks in service, family pressures and socio-cultural expectations for women to conform to socially prescribed family roles.

(ii) Gender-based work-related protection deficits for women

In **India** few rooftop solar companies surveyed had gone beyond basic government-mandated policies (e.g. maternity/paternity leave, sexual harassment prohibitions) to provide a more enabling work environment, partly because they were young. Child-care support after initial years of birth was an expressed need. Also like many sectors in India, most rooftop solar companies had no equal pay for equal work policy but claimed that the wage structure was based on educational qualifications, work experience and previous salary. This has disproportionate adverse impacts on women as they start from an unequal playing field, tend to negotiate wages less than men, and are more likely to take maternity and care-work breaks disrupting careers. Despite equal pay for similar work in the **UAE**, studies show that there are gender wage gaps, and that women underestimate their skills and need to negotiate to ensure they are paid the same as men. Also, in **both sites,** research shows employer/recruiter gender biases in performance evaluations/ promotions that view men as better managers than women who are deemed primary caregivers, and as disinterested in career progression. Women are presumed to be unable to work late, participate in important business/government meetings/networking events, engage with more critical business partners, enrol in strategic mentorship/training programs, take on more critical business functions or more demanding projects, or enjoy more strategic travel, travel perks relative to male managers. They are thus passed over for promotions. At times, this happens without consulting with them about their career goals, and/or not providing enabling support that could address these 'perceived or lived realities.' Women are also reticent to discuss a justified promotion or highlight their achievements that puts them in the line of vision of employers/sponsors for a promotion.

(iii) The leaking pipeline and the glass ceiling partly stems from there being too few women in the job pipeline, reflecting the lack of intentionality in targeting women at the hiring phase through all levels of employment. There is a consequent lack of role models for women in senior leadership positions.

4. **Recommendations for action drawing on good practice from the selected sites and beyond.** Promoting and protecting women's access to decent/productive RE employment in line with ILO and CEDAW labour and human rights standards is a moral imperative, promotes efficiency and must underscore all responses. Policies/programs must adopt a whole-of-government and whole-of-society approach across RE and related policy fields and ensure women's full and effective representation from all sectors.

Governments

(a) Generate national labour force data on women-owned RE businesses and on employees in the RE sector by sub-sector, occupation, education, skill and wage levels – disaggregated by sex, age, nationality and migration status – at minimum.

(b) Undertake comprehensive gender-responsive analyses on the strengths and constraints underpinning the employment of national and migrant women in various job categories and levels in RE sub-sectors/ DRE and women's RE businesses; and on government schemes for women's RE businesses and employment.

© Use data, analyses, workable good practices and recommendations generated in research to inform the design, implementation, monitoring and evaluation of policies, plans and programs for national and migrant women in the RE sector, backed by gender-responsive targets, indicators and budgets.

(d) Enhance investments in gender-responsive budgeting to ensure that fiscal policies advance gender equality via legislation that enshrines it in the design of fiscal policy and in budgetary and financial management processes in energy/RE and related government ministries and departments.

(e) Build capacities of government/quasi-government staff to design and implement gender-responsive RE policies, plans, programs and budgets.

Government policies, plans and programs backed by social norm change and temporary special measures (TSMs) should ensure women's equal opportunity and real access to:

(i) Non-discriminatory enrolment, retention and graduation from RE-related TVET and tertiary STEM education aligned with current and potential RE job demand for women, backed by job grooming/ matching, first-work placements as needed, quality on-job mentoring for both sexes; and operational provisions that enhance access;

(ii) **Non-discriminatory recruitment of women, including into non-traditional RE STEM jobs**, with mechanisms to give effect to this;

(iii) Decent and productive RE employment, including provisions for: **minimum wages** for those in low-skilled jobs; **equal wages and benefits** for work of equal value; **paid maternity/paternity and/or parental leave** of reasonable duration; **work-life balance measures** for female/male employees to undertake post-partum childcare; support for parenting/other care responsibilities **without compromising career tracks** (flexi-hours, remote work, child-care subsidies/facilities); **workplace incentives that place an equal and tangible value on 'productive' and 'unpaid care work' for male and female employees; equal opportunities and access to promotions; repeal of laws and regulations banning women from working night shifts; transport and worksite; general and occupational health, safety and well-being** including annual, casual and sick leave; provision of appropriate personal protective equipment, and safety standards at work, compensation for occupational injuries and death;

prevention of and protection against sexual harassment at work; post-retirement health insurance and pension benefits; **the right to association and collective bargaining**;
(iv) Customized support for women's RE businesses, such as encouragement to financial institutions to develop innovative gender-responsive financing policies/regulations, practices products and mechanisms tailored to different categories women RE entrepreneurs with robust gender benchmarks, monitoring and accountability mechanisms; business mentoring, including on policy/legal frameworks; technical and financial assistance and training on financial inclusion; support for market linkages; tax rebates for SMEs;

In addition to the above, Government measures for migrant women professionals and low-skilled migrant women workers who may be employed in the RE sector should ensure:
(i) Non-discriminatory labour law coverage and programmes such as comprehensive information on rights, wage protection, portable social security with robust enforcement and accountability mechanisms;
(ii) Harmonization of labour laws with migration and other legal regimes, and **more legal migration pathways for low-skilled women migrant workers;**
(iii) Harmonized worker-employer skills matching and skills-based mobility for migrant women aligned with labour market demand that includes developing national and regional occupation-based competency standards with commensurate wages and benefits; developing, assessing and recognizing workers' skills against these standards; and promoting mobility tied to these standards;
(iv) **Skills development and women's recruitment in non-traditional segments of the RE value-chain;**
(v) F**air and accountable recruitment processes** that are accessible to and protect low-skilled migrant women workers;
(v) **Effective bilateral labour agreements/MOUs** with robust protections for migrant women workers backed by strong monitoring and enforcement mechanisms;

RE Companies
1. Ensure that corporate mandates, standard operating procedures, programs and budgets espouse gender equality and women's empowerment and have robust monitoring/enforcement mechanisms and ensure that these principles and provisions are incorporated in contracts with vendors.
2. Generate company-and industry-wide data on women-led RE businesses and women's and men's representation as employees in the RE sector by sub-sector, occupation, education, skill and wage levels - disaggregated by sex, age, nationality and migration status at minimum.
3. Ensure gender equality performance incentives that tie employee performance assessments, compensation, etc., to the company's and/or industry's gender equality mandate.
4. Ensure regular, transparent and broadly disseminated communication on the company's gender equality mandates and its implementation of related work plans with targets and indicators.

RE company/industry policies, plans and programmes backed by social norm change and temporary special measures should ensure women's equal opportunity and real access to:
(i) Targeted information reach to women on the RE sector through diverse strategies including special measures for women to participate in industry events, job fairs etc;
(ii)Intentional recruitment of women at all levels and in all segments of the RE value chain to ensure gender parity and **a pipeline of women for leadership** positions. Recruitment should include **diversified strategies** beyond traditional head-hunters;

(iii) Decent and productive RE employment provisions in line with all afore-mentioned recommendations to government (see iii under details of recommendations to government);
(iv) Retention and career progression through inclusive workplace cultures that create a sense of belonging, protection, safety and security. This should include: **onboarding** that introduces women (and men) to the organization – its culture, benefits and social-physical infrastructure that addresses women's specific needs and access to women's informal groups as a support mechanism; **clear communication on career pathways** to all employees in the organization; **equal opportunities and real access to up-skilling and professional development that takes account of women's needs and priorities**; **women's equal opportunities, conditions and on-going access to gender-sensitive mentors and sponsors with similar levels of competence, seniority and influence as those for men; fair and comprehensive performance assessment feedback to female employees from supervisors that takes account of women's concerns, with avenues for women to express disagreement on feedback**; **public endorsement of women's** achievements that inform upward career mobility; **periodic anonymous feedback mechanisms or walk-in sessions** with senior managers, mentors, coaches, counsellors on workplace policies, individual/group concerns, and career progression goals and concerns; **training on conscious and unconscious biases for employees at all levels and celebration of diversity of all kinds**; and **policies that prevent and protect employees against workplace harassment and abuse**, including sexual harassment and abuse, backed by effective enforcement mechanisms.
(v) Support to women RE microentrepreneurs (MEs) by procuring from them; **building their and other suppliers' capacities** including on gender issues; **supporting them directly or via partners on sales/ service of products** of larger RE companies; **acting as aggregators of loan demand for financial institutions to finance** women MEs who use RE-driven appliances for income-generation, purchased from RE enterprises/their partners; **providing margin money assistance or financing through a revolving funds supported by profits or by philanthropic capital** – that builds financiers' confidence to formalize lending to first-time women borrowers for MEs;
(v) Client/community engagement by soliciting and incorporating female customer feedback into product/service design and training employees in client-facing roles on relevant gender equality themes; ensuring gender-responsive CSR initiatives, especially in DRE that enhances women's DRE employment, livelihood initiatives and access to RE household and business appliances;

Energy Transition in the UAE and India

Energy drives global socioeconomic activity. The dynamic transition from non-renewable, carbon-emitting fossil fuels to clean renewable energy (RE) in India and the United Arab Emirates (UAE), is marked by commitments to international human rights frameworks,[5]sustainable development and national development ambitions. The transition promises more jobs, reduced carbon emission levels, access to sustainable energy and other benefits including for women, based on how reform pathways play out.

India, the world's third-largest energy consumer, doubled its energy use since 2000. Fossil fuels which dominate its installed energy capacity (Arasu, 2022), are largely imported and vulnerable to price volatilities and supply bottlenecks. Its dynamic transition to RE includes commitments to reach net zero emissions by 2070 and short-term targets for 2030:- meeting 50 per cent of energy needs from RE, raising RE capacity to 500 gigawatts (GW), reducing cumulative emissions by one billion tons, and lowering emissions intensity of GDP by 45 per cent (MEA, Government of India, 2021).

The 2023 national budget earmarks INR 350 billion ($ 4.3 billion) for energy security and green growth as development priorities (Sharma and Singh, 2023). This transition is driven by India's resolve to combat climate change, achieve sustainable green living and development (MEA, Government of India, 2021), ensure energy self-sufficiency and security, alleviate poverty and unemployment and secure sustainable growth (MEA, Government of India, 2021; Power for All, 2022a). The development of green energy and the green economy mark India's aspirations to become a developed nation by 2047 (ET Government, 2022).

Despite bottlenecks (Bhattacharya, 2022; Birol and Kant, 2022; Nandi, 2023), by October 2022 India had a total RE capacity of 172.72 GW (42.26 per cent) of the total installed generation capacity of 408.71 GW) and ranked fourth globally in RE installed capacity, including large hydro, wind and solar power (MNRE, Government of India, 2022).

The **UAE** has the seventh largest oil and natural gas reserves globally, that now account for only 30 percent of its economic activity (Embassy of the UAE, Washington DC, n.d). Its ground-breaking investments in RE is likely to reach AED 600 billion (about $160 million) by 2050 (Government of UAE, 2023). This two-decade-old shift (Government of UAE, 2022) reflects commitments to address climate threats in line with key international human rights frameworks. (Embassy of the UAE, Washington DC, n.d; Government of UAE, 2022), and the UAE's development agenda. This includes diversification of its economy to reduce dependence on finite crude oil, cushion against cyclical oil crises, meet rising energy demands, and ensure sustainable economic growth. (Government of UAE, 2023; Crowther, 2018). It is also aligned to its vision to become a premier global knowledge and technological hub especially on the green economy (Embassy of the UAE, Washington DC, n.d), and help it also address youth unemployment (World Bank, 2022j).

The UAE's "Energy Strategy 2050," aims to raise the proportion of clean energy in total energy production from 25 to 50 per cent, and reduce the carbon footprint of power generation by 70 per cent, thereby saving AED 700 billion, and increasing energy consumption efficiency by 40 per cent.by 2050

[5] The United Nations Framework Convention on Climate Change, 1992 (UNFCCC), the Kyoto Protocol 1997, Agenda 2030, the Sustainable Development Goals (SDGs) and the Paris Agreement 2015.

(Government of UAE, 2023). The UAE's 2021 "Net Zero by 2050 Strategic Initiative," a regional first (Embassy of the UAE, Washington DC, n.d), sets a net zero emissions target by 2050.

The Socioeconomic and Job Dividends of RE: The Case for Gender Equality and Women's Rights

The transition to RE will potentially create multiple direct and indirect jobs of a STEM and non-STEM technical and non-technical nature, including for women. RE's positive job creation effect stems, among other things, from its multi-disciplinarity, its longer, more diverse supply chains, and higher labor intensity and profit margins compared to the traditional energy sector (ILO, 2014).

"Moreover, the modern RE and DRE sectors provide greater opportunity for women to play leadership roles and to own companies than in conventional fossil fuel-based energy sector because of the latter's large scale of investment and top-heavy system. DRE allows women to be situated and create value anywhere along the clean energy value chain as aggregators, as trading businesses, as data analytics platforms that help aggregate demand, or build consumer awareness and demand for clean energy products – roles that can be built around thematic areas within the company or by creating companies based on these themes and functions." (Patnaik, KII 2023)

India and the UAE have a huge pool of female STEM graduates estimated at estimated at 42.7 percent in India (2018) and 41.5 percent in the UAE (2017) (World Bank, 2019). Moreover, women in their roles as nurturers, low emissions subsistence farmers, small livestock owners and raisers, natural resource managers especially in rural and urban households and communities develop local knowledge, consciousness, attitudes and behaviours, technological, social, emotional and leadership skills and networks on the natural environment and its sustainability (D'Cunha, 2023). Deploying such female expertise from India's and UAE's female population will optimize opportunities for emerging clean RE markets (Belghiti-Mahut et al., 2016; Hunt et al., 2015), as research has established that gender equality at work brings women's expertise to bear positively on growth, productivity, returns and organizational culture (Chastain et al., 2014; Dabla-Norris & Kocchar, 2019; Khera, 2018; Lagarde and Ostry, 2018; McKinsey & Company, 2010; OECD, 2017). Drawing women into RE employment, and access to RE will empower women, families, communities, economies and help achieve sustainable development (Power for All, 2022b).

Ensuring gender equality and women's rights in RE employment is also a moral imperative aligned with international human rights standards and national agendas. Achieving this entails addressing the different priorities of women and men (and of different groups of women). Policy and program responses must be tailored to the specific priorities of women and men, and of different groups of women to ensure de facto equality and sustainable development.

Scope, Focus, Justification and Contribution

Framed within the sustainable development paradigm, this policy paper stems from the preceding context and an ADD member states decision to focus on women's skilled employment in the technology sector. The paper explores current and potential demand for women as employees in the RE sector, particularly solar energy, in India and the UAE, while also drawing on global data. It analyzes the gender-based structural opportunities and constraints mediating women's employment, career decision-making and development. It also preliminarily explores the status of migrant women professionals in UAE's RE sector, to initialize conversations on potential areas of job demand - given the significance of the sector

in the UAE, and of the country as a migrant destination site. Drawing on this analysis and relevant national, regional and global good practice, the paper makes recommendations to enhance decent employment for women, including Emirati and Indian women in the RE sectors of their respective countries, and for migrant women in the RE sector, including in the UAE.

The selection of RE among technology sectors and the choice to locate the research in India and the UAEwas partly based on the dynamic transition to RE globally and in India and the UAE; the countries' robust political commitment to the RE transition; their commitment to enhancing gender equality and women's empowerment in the economy and society; the RE sector's the multiple co-benefits and its positive job creation effect (especially for rural Indian women via DRE); and the significance of UAE as a migrant destination with potential RE job opportunities for migrant women professionals.

Literature Review

Global, regional, and national country-based studies on women's employment in RE – many of which are cited in this paper - largely address their representation in the traditional energy and RE sector overall and in technology-based RE sub-sectors. They are focused on women's participation rates as workers and entrepreneurs in the modern RE and DRE sectors, their location in value chains and decision-making, and work-conditions, and on women's access to RE.

Research on women's employment in the RE sector is still evolving. The gender-based employment dimensions of the RE sector are not always sufficiently captured in national statistics, leading to a lack of granular national employment data in RE overall and its varied technology-based sub-sectors. The paucity of data makes it difficult to analyze trends in transition to RE, gauge progress, identify gaps and make employment projections for women mediated by changes in technology, the RE market/s, related changes in job and skill demand and other factors. Further, data deficits conceal women's contribution to the RE sector, hinder the ability to assess and compare performance on the RE gender scorecard between countries, glean lessons learned, or develop context-specific policy and program responses to enhance women's representation and decent work as employees and entrepreneurs in the RE sector/ sub-sectors, and their access to RE.

The paper therefore draws on available studies and key informant interviews to get granular data and insights on issues it addresses.

Methodology: Framework and Techniques

Underscored by the sustainable development paradigm, this qualitative policy paper highlights gender considerations and makes recommendations to enhance women's decent RE-based employment overall and in two national contexts. It does not seek to measure the different indicators of women's role and status in the RE sector at scale. It is based on a desk review of secondary sources, complemented by 23 key informant interviews (KIIs) in India and the UAE in particular, for deeper insights.

The desk review included policy and strategy documents, review reports, research publications, white papers, journal and press articles, press releases, opinion pieces, and case studies. These materials included works by national governments, regional inter-governmental mechanisms, the private sector, academia, think tanks, international/national non-governmental organizations (NGOs), the media, multilateral banks and the United Nations (UN).

Key informant interviews (KIIs) were held with stakeholders from different sectors in India and the UAE. Interviewees included female and male government officials from ministries related to climate change, the environment, energy and infrastructure; representatives of intergovernmental organizations; RE business owners and entrepreneurs; senior and mid-level decision-makers and employees in private-sector RE companies and public utilities; sustainable infrastructure funds and grant-making institutions; environment, sustainability governance (ESG) advisory and consulting services; social enterprises focused on enhancing women's employment; NGOs, leadership coaching organizations; academic and research institutions, policy think tanks; and UN agencies.

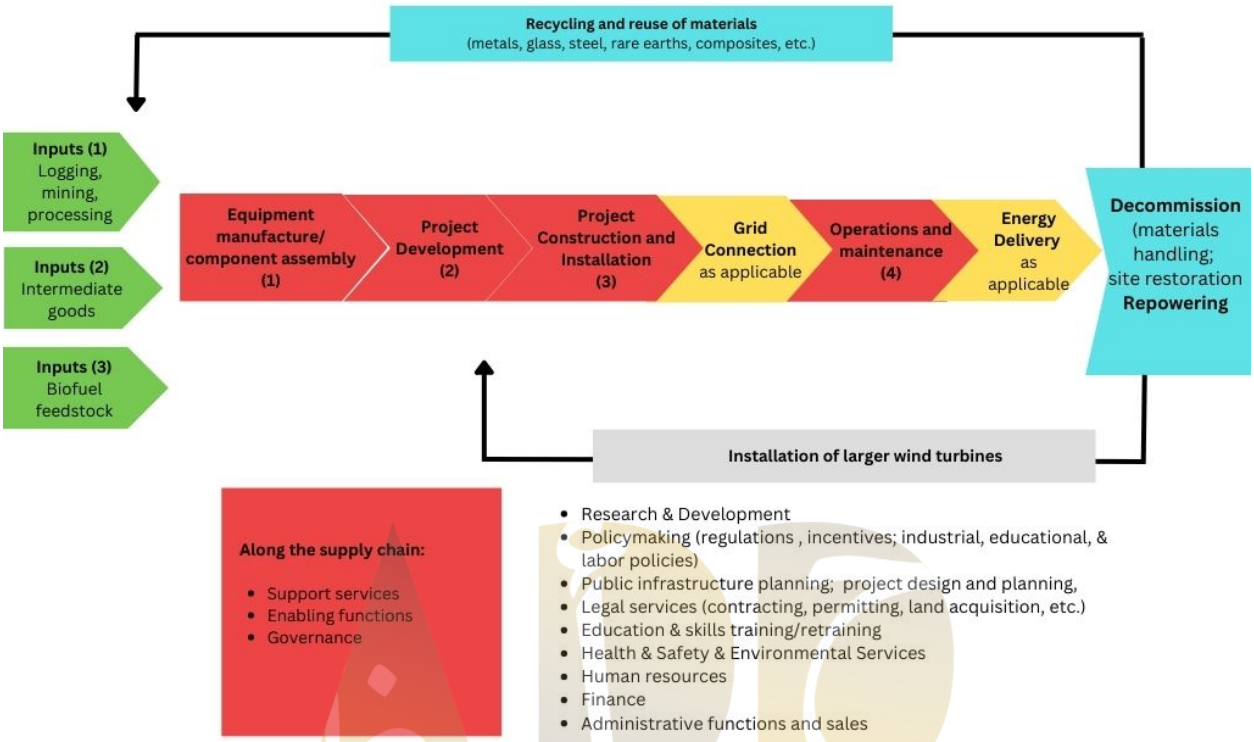
2. The Job-creation Effect in the RE Sector: A General Overview

The Extended RE Supply Chain: Core Jobs and Related Skills

RE's positive job creation effect stems from longer, more diverse supply chains and its multi-disciplinarity. RE projects can also offset job losses in the traditional energy sector and create a net employment gain (ILO, 2014.).

Figure 1 shows the extended RE supply chain along which jobs are generated. The supply chain consists of the four core elements of the RE value chain and the extended elements of the value chain**.** The four core elements of the value chain are **equipment manufacture and components assembly, business development and project design, construction and installation, and operations and maintenance.** These core elements require **support services and enabling functions** which are provided across the entire value chain. Connection to the grid and energy delivery are also parts of the value chain. The extended segments of the value chain consist of two elements **input readiness** preceding equipment manufacture (including mining and processing of metals and other raw materials essential to RE equipment) and **decommissioning and repowering** past the life of the technology. (IRENA & ILO, 2022).

Figure 1: The Extended RE Supply Chain



Source: Adapted from IRENA cited in IRENA and ILO 2022, and TERI., 2019

Many of these jobs require backgrounds in engineering and related technical and vocational education, non-STEM technical backgrounds,[6] and more routine clerical and administrative skills in these fields. Demand for low-skilled jobs are largely in construction, transportation and related areas. **(See Table 1, Annex 1: Core Jobs and Skill Levels in RE Sub-sectors across Four Key Supply Chain segments).**

3. RE Employment in India and the UAE within the Global Landscape: A Snapshot

Current Estimates and Projected Increases in RE Jobs: India, UAE, Global **(See Table 2 Annex 1)**

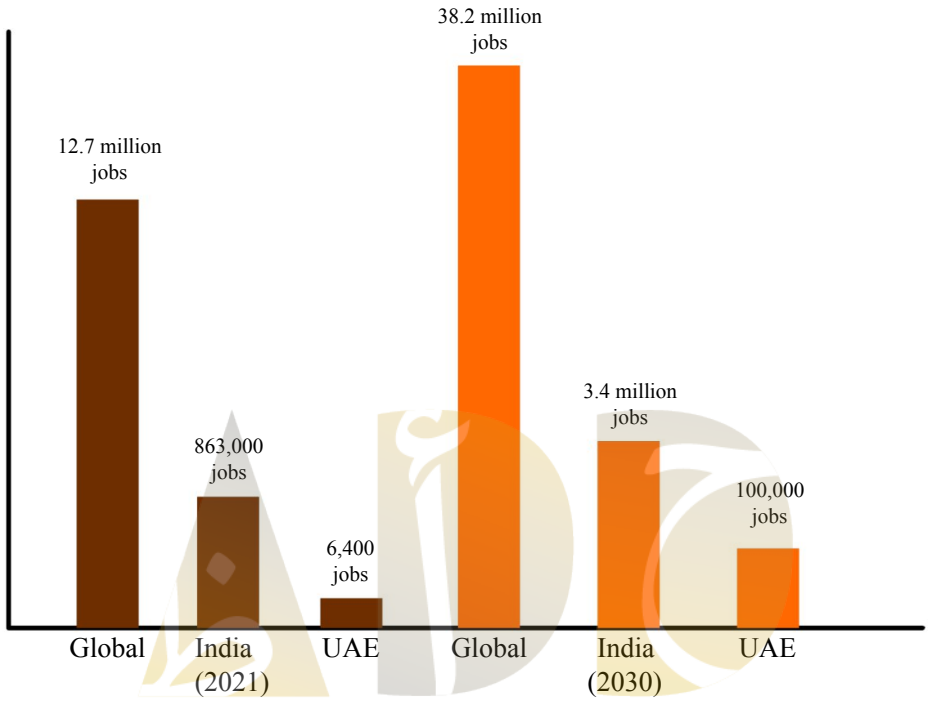
Out of 12.7 million global RE jobs in 2021, India accounted for 863,000 (7 per cent) of the jobs and the UAE accounted for 6,400 (0.05 per cent) of the jobs (IRENA & ILO, 2022). By 2030 global RE jobs are projected to reach 38.2 million. **India is projected to create .4 million**[7] (8.9 percent) of the total jobs **and**

[6] Interviews with RE professionals in both sites indicate STEM and non STEM technical jobs that tend to have demand in the solar, hydro, wind and bio-energy sub-sectors, albeit with some differences between countries: research and development specialists, data analysts, project developers, design, operations and maintenance engineers, service technicians, management and logistics experts, architects, sales/marketing professionals, building inspectors, human resource and sustainability specialists, lawyers, finance specialists, educators/trainers.

[7] These would be new short and long term RE jobs (about 1 million full-time equivalents) (Tyagi et al., 2022).

the UAE is projected to create 100,000 (0.26 percent) of these global RE jobs (IRENA & ILO, 2022**) (See Figure 2 below).**

Figure 2: Estimates (2021) and Projected Increases (2030) in RE Jobs: Global, India and the UAE



Source: Adapted from IRENA & ILO 2022

Figure 3 below and Table 2 in Annex 1 show that **most RE jobs globally and in India are in bioenergy, hydropower and solar PV. Solar PV and concentrated solar power (CSP) account for the majority of RE jobs in the UAE.** Data for bioenergy, hydropower and wind energy are not available for the UAE.

Bioenergy has 20.63 percent of the RE jobs in **India** or 5.2 percent of global bioenergy jobs.[8] India has an established **hydropower** sector that accounts for 48 percent of its overall RE jobs or 17.5 per cent of the global hydro power jobs.[9] Two-thirds of these jobs are in manufacturing, 30 percent in construction and installations and 6 percent in operations and maintenance (IRENA & ILO 2022). **Solar PV is India's** fastest growing RE sector constituting 25.1 percent of the country's RE jobs, and 5.05 percent of global solar PV jobs (IRENA and ILO, 2022). Many solar PV jobs - about 342,000, are off-grid in South Asia and parts of Africa out of the global total of 4 million solar PV jobs in 2020 (IRENA and ILO, 2021). India had 137,000 grid-connected solar PV jobs in 2021, up 47 percent from 2020. There are another 80,600 jobs in off-grid settings for a total of 217,000 jobs (IRENA & ILO 2022). Tyagi et al. 2022 find that many grid-connected direct Solar PV jobs in India are in construction/commissioning, O&M and

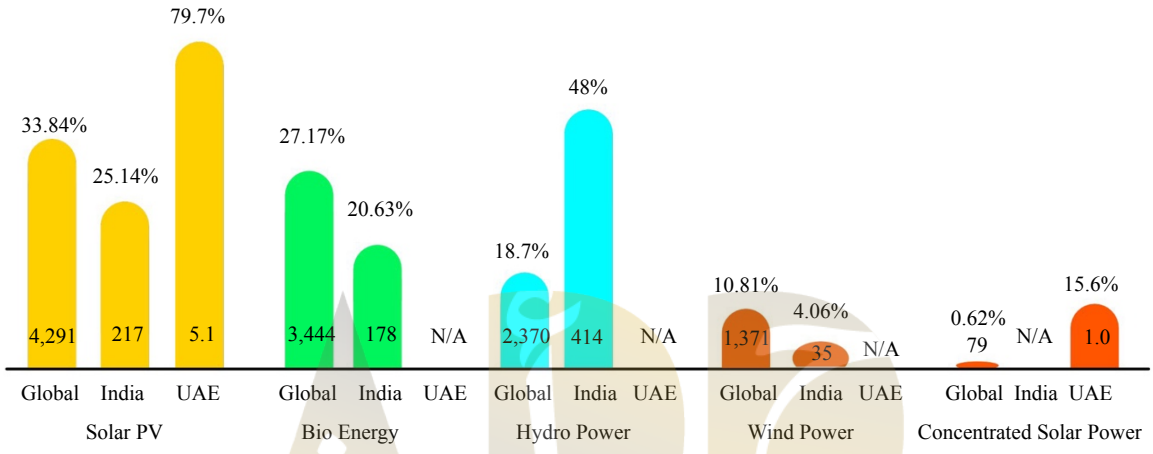
[8] Calculations by UN Women based on IRENA Jobs Database cited in IRENA & ILO 2022

[9] Calculations by UN Women based on IRENA Jobs Database cited in IRENA & ILO 2022

business development/design. **Wind energy** has 4.06 percent of RE jobs in **India,** 2.6 percent of global wind power jobs.[10]

In the UAE, solar PV and concentrated solar power jobs comprise 79.7 per cent and 15.6 per cent of all RE employment in the country, and 0.12 per cent and 1.3 per cent of global solar PV and concentrated solar power jobs, respectively (IRENA & ILO 2022).[11]

Figure 3: Estimates (2021) of Jobs in Key RE Sub-sectors: Global, India and UAE (in thousand)



Source: Adapted from IRENA & ILO 2022

4. Women's Role and Status in the RE sector in India and UAE

Overall Status Indicators on Gender Equality and on Women's Economic Participation in these Sites

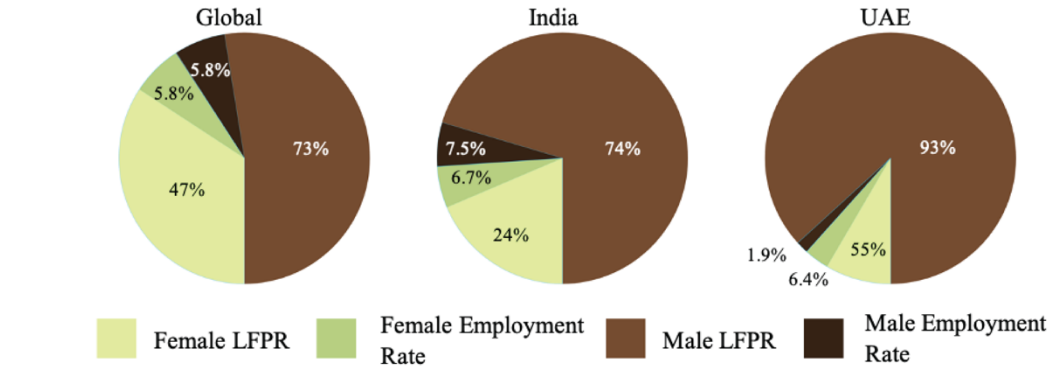
Women are about 48.4 per cent (World Bank, 2022d) of India's estimated 1.4 billion people (World Bank, 2022e). The country ranked 135th and the UAE 68th out of 146 countries on the Global Gender Gap (GGG) Index 2022, scoring 0.629 (WEF, 2022). Emirati women are about 30.6 per cent (World Bank, 2022d) of UAE's estimated population of 9.4 million people (World Bank, 2022e), and the country ranked 68th out of 146 countries on the GGG Index 2022, scoring 0.716 (WEF, 2022).

Globally, women's labor force participation rate (LFPR) is about 47 per cent, the gender gap in LFPRs is about 26 percentage points, and women's unemployment rate is about 5.8 per cent. By contrast, women's LFPR in India is about 24 per cent – among the lowest worldwide - the gender gap in LFPRs is about 50 percentage points, and women's unemployment rate is about 6.4 per cent. In UAE, women's LFPR is about 55 per cent, its gender gap is about 38 percentage points, and women's unemployment rate is about 6.4 per cent **(See Figure 4 below and Table 3, Annex 1 Male and Female Labour Force Participation and Unemployment Rates: Global, India and UAE for 2022 for further information).**

Figure 4: Male and Female Labor Force Participation and Unemployment Rates: Global, India and UAE for 2022

[10] Calculations by UN Women based on IRENA Jobs Database cited in IRENA & ILO 2022

[11] Calculations by UN Women based on IRENA Jobs Database cited in IRENA & ILO 2022



Source: World Bank 2022b, 2022c, 2022g and 2022h

Women's Labor Force Participation in the RE Sector/sub-sectors: Globally, in India and the UAE

Globally, in India and UAE, women's LFPR in the traditional energy and RE sectors is far lower than their overall LFPR. Globally, women's share of the RE workforce is 32 per cent of fulltime jobs, which is 10 percentage points higher than their share of the global oil and natural gas workforce (IRENA, 2019a). Globally, women hold 40 per cent of full-time jobs in the solar PV sector - the largest RE employer per 2021 data (IRENA, 2022). About 27 per cent of these are full time off-grid jobs held by women (Power for All, 2022b). Women's share in solar PV is about double their global share in wind energy (21 per cent) and compares well with their 32 per cent participation across the global RE sector (IRENA, 2022). As entrepreneurs, globally women lead only 10.6 per cent of energy start-ups, relative to some 19.1 per cent of non-energy start-ups. About a fourth of energy patents named one or more women inventors. (IEA, 2022a).

In India, women are poorly represented in the physical infrastructure and manufacturing sectors. The male to female ratio is four times higher in core industries such as construction, machinery and manufacturing, compared to IT or the software industry where women are robustly present (IEA and CEEW, 2019). Although there is a paucity of comprehensive sex-disaggregated employment data for the RE sector in India smaller sub-sector studies provide useful insights.For example, one study found that women constituted 11 per cent of the workforce of the eight rooftop solar companies that it surveyed (IEA and CEEW, 2019). Another study placed women's representation in DRE at 21 percent of over 80,000 workers in 2022 (Power for All, 2022a).

Women's share of the DRE (21 per cent) and the grid-connected rooftop solar (11 per cent) workforces in India is much higher than their share of the workforce in coal, oil and gas and electricity utilities, where women's share is less than 10 per cent of the labor force. However, both DRE and rooftop solar fall short of intra-sector gender parity and are each below women's national average labor force participation rates (24 percent) (World Bank, 2022b). Women's representation in these sectors is also much lower than in the IT sector where women are 35 per cent of the workforce (Confederation of Indian Industry et al., 2017; NASSCOM, 2018).

Based on analysis of annual reports, the International Solar Alliance (ISA) showed that women's share in the total work force of key RE-focused public sector companies – Solar Energy Corporation of India, Ltd

(SECI) was 19 per cent, National Thermal Power Corporation (NTPC) was 7 per cent and National Hydroelectric Power Corporation (NHPC) was 11 per cent. Women's share in the total work force of key RE-focused private companies such as Suzlon Energy was 5 per cent and in Tatat Power it was 8 per cent (Jyotsna ISA, Written KII 2023).

Interviews with CEOs of RE companies and companies providing RE-related services complement the forementioned research findings:

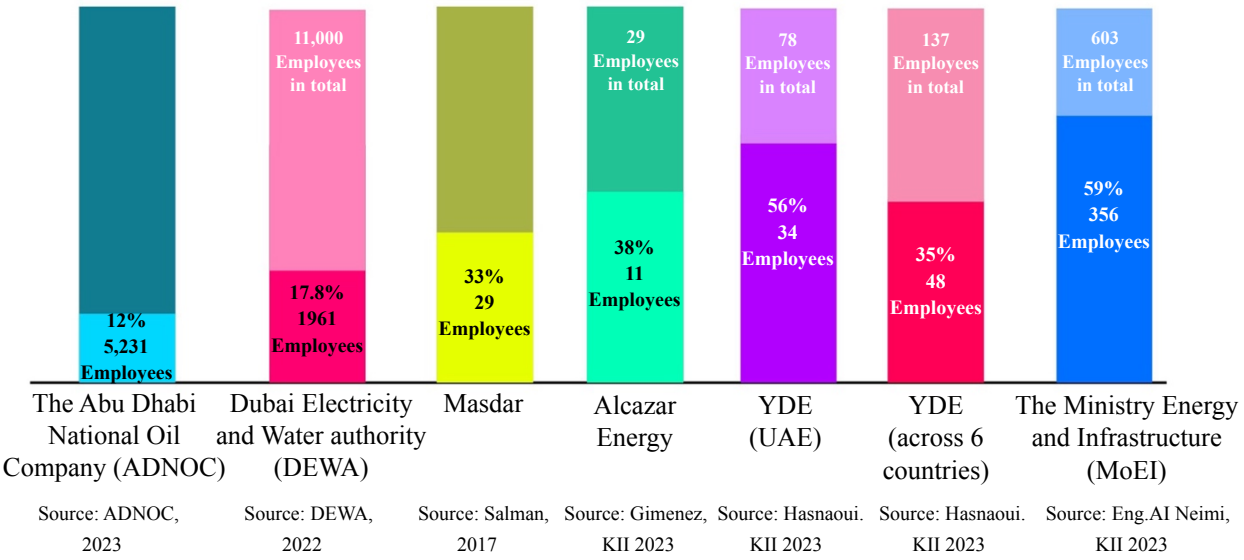
> ***"Women constitute 45 per cent of UNIQUS Consult Tech's 300 staff. Women work as analysts, consultants, managers, senior managers, directors and partners. I am the global head, and one of three on the leadership team. As the company expands to increase its workforce to 400 employees in the near future, the proportion of women is targeted to reach about 50 per cent". (Chaudhary, KII 2023).***

According to a World Bank study of 18 countries in the **MENA region**, women's presence in energy jobs in many MENA countries is below 15 percent, although it varies by country (World Bank, 2022f). Countries such as Egypt, Iraq and Jordan that had labor force data on women's share in RE, showed that their participation varied between 7-10 percent (World Bank, 2022). No data was publicly available for the UAE that was also part of the study (World Bank, 2022f), although available data shows a high share of Emirati women in tertiary (Government of UAE, 2019) and overall STEM education (World Bank, 2019).

However, data from public and private sector companies solely or also focused on RE, and from UAE's Ministries of Energy and Infrastructure (MOEI) and Climate Change and Environment (MOCCAE) provide some indication of women's presence in the RE sector.

> ***The Abu Dhabi National Oil Company's* (ADNOC)** has ***5231 women employees that comprise 12 per cent) of its workforce (ADNOC n.d.b). Dubai Electricity and Water Authority's (DEWA) has 1961 women employees that make up 17.8 per cent (DEWA, 2022) of its 11,000 employees across all its divisions.*** (DEWA, n.d). ***Women are about 33 percent of Masdar employees (Salman, 2017)***
>
> ***"Women constitute 38 percent of Alcazar Energy's employees."(Gimenez, KII 2023). "In Yellow Door Energy's UAE office, women constitute 56 percent or 34 of its total staff of 78. Women make up 35 percent or number 48 out of all 137 YDE employees across 6 countries." (Hasnaoui, KII 2023)***
>
> ***"The Ministry of Energy and Infrastructure (MoEI), Government of UAE has a total of 603 staff, of which the majority 356 or 59 percent are women and 247 or 41 percent are men." (Eng.Al Neimi, KII, 2023).*** 53 per cent of all employees in the Ministry of Climate Change and Environment (MOCCAE), Government of UAE are women."(Eng. Al Abdooli, KII 2023).

Figure 5: Women's Share of Total Workforce in Public and Private Energy Companies and Ministry of Energy and Infrastructure UAE (numbers in lower half of bar graph are women employees)



Women make up about 66 per cent of the **overall** public sector workforce, with a substantial concentration in education, health and social affairs (Gender Balance Council, 2020). Key informant interviewees in the UAE confirmed that Emirati women are more likely to be employed in state-owned RE companies and the government sector than in private sector RE companies.

> ***"Younger women are exploring and joining the RE private sector. They are encouraged with incentives provided by the government's overall nationalization policy for more nationals in the private sector. But working in the private sector is still a new experience for them." (Ajaj, KII, 2023).***

> ***"Emirati women tend to prefer jobs with public sector companies and the government because these jobs are highly valued, secure, well paid and allow women to combine domestic roles and paid jobs with flexibly negotiated work hours. Work cultures are in line with national culture and families support women's work in this sector. Moreover, our government ministries offer women many opportunities to learn and grow, including training and capacity building, opportunities to participate in international conferences, sharing our good practices, and learning what others are doing in the field. But in the future younger women may join private sector jobs." (Eng. Al Abdooli Eng. Al Neimi, KIIs 2023)***

> ***"Many Emirati women want to work in ministries like climate change and environment because protecting and saving the environment for our children is close to our hearts. Also, our federal ministries have policy and standard-setting mandates, so we feel we are leaving a great legacy for the future by contributing to environmental protection." (Eng. Al Abdooli, KII 2023)***

Women's Location in RE Value Chains

Women's RE employment varies across its value chains and is marked by gendered skill and occupational segmentation. However, a reasonable presence of women with STEM skills in some non-traditional jobs in non-traditional value chain segments holds promise for closing gender gaps in RE employment. Available global, India and UAE data on solar PV, roof top solar, solar DRE and wind energy shows that: (a) Women in the global RE sector have a reasonable presence in high-skilled STEM jobs (28 per cent), a far stronger presence in high-skilled non-STEM technical jobs (35 per cent), and the strongest presence in mid-skilled administrative jobs (45 per cent) (IRENA, 2019a) **(See Figure 6 below). I**n global solar PV,

women's share of STEM jobs is 32 per cent, non-STEM technical jobs (38 per cent), administrative jobs (58 percent), and other non-technical jobs such as marketing, sales, product assembly etc, (35 percent), driven partly by off-grid solar deployments (IRENA, 2022). Similar patterns prevail in the global wind energy sector (IRENA, 2020) and in rooftop solar in India **(**IEA and CEEW, 2019). Many women employees in rooftop hold an engineering and/or an MBA degree with relevant work experience and match male colleagues in qualifications (IEA and CEEW, 2019). In solar DRE women account for 25 percent of the skilled work force in commercial and industrial DRE, 20 percent in mini-grids, mostly office-based jobs (Power for All, 2022a).

(b) Global solar PV value chains have a robust over 35 percent representation of women in all value-chain segments, but notably in core segments such as equipment manufacturing (47 per cent), and project development (37 per cent). Women are strongly present in 'other categories' (40 per cent), service provision (39 per cent) (IRENA, 2022). Grid-connected roof top solar in India has some presence of women in project design and pre-construction phases (18 per cent) – a core business segment, that involves designing and managing rooftop solar projects. They are also engaged in corporate support functions (34 per cent) such as human resources, finance and accounting, legal affairs and compliance and public relations that demand a high level of expertise. In several companies women engineers opted for corporate support functions (IEA and CEEW, 2019). In solar DRE women are largely concentrated in skilled office-based jobs, but also serve as sales agents and distributors, including last-mile distributors to rural communities. This was frequently when the locations were close to their homes, when travel and other arrangements were provided by companies or when they had family support. Women in feminized sectors such as textiles and handicrafts or food processing that used clean energy products and services, undertook typically male-dominated functions such as operations and marketing showing that women can undertake these jobs if provided an enabling environment (Patnaik et al., 2021).

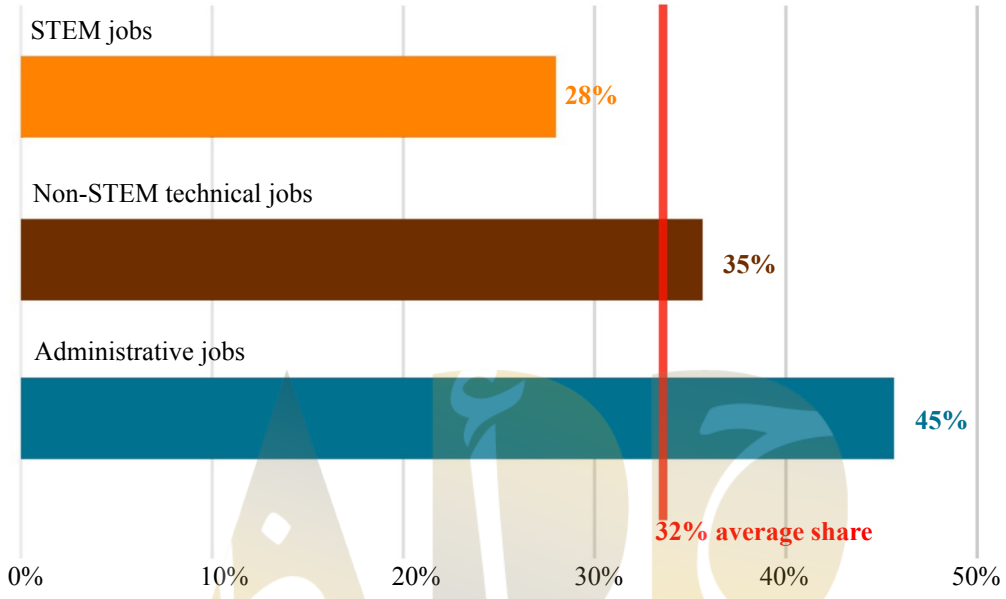
© Global wind energy value chains also have some presence of women in non-traditional value chain segments such as project development (27 per cent) and manufacturing (17 percent). Women are also present in 'other categories' (27 percent), operations (26 per cent) and service functions (24 percent) (IRENA, 2020)

(d) Women are poorly represented in on-site segments of RE value chains. Global solar PV had 12 percent women in installation (IRENA, 2022). India roof top solar had 12 percent of women workers in the on-site business deployment phase – 3 percent in construction and commissioning, and 1 percent in operations and maintenance. Half of the surveyed companies had no women employees in both these segments (IEA and CEEW, 2019). In the DRE sector, women are poorly represented on-site in high and low-skilled construction and installation work, where men dominate (Power for All, 2022a, 2022b).

(e) As women's RE entrepreneurship is not the focus of this paper, it would suffice to say that available data in India, for instance, shows that women-led RE businesses tend to be concentrated in micro-small-medium enterprises and start-ups producing and supplying clean energy products to end users, rather than as large developers or owners of EPC companies. The rooftop solar study did not show many project development and EPC companies that were women-owned and led ((IEA and CEEW, 2019). In India's DRE sector, women tend to be founders or co-founders of small and medium clean energy start-ups in the pico-solar or solar home appliance sector that provide clean-energy products and services for household or business use across various sectors such as textiles and handicrafts, agriculture and allied activities, e-mobility and others such as waste management (Patnaik et al., 2021). Further women tend to be under-represented as business-owners and founders of large developer and EPC companies in the commercial and industrialized (C & I) DRE sector and in mini and micro grid technologies in the DRE terrain. Women led about 24,000 enterprises in the country and about 30 per cent of SMEs, with investments of

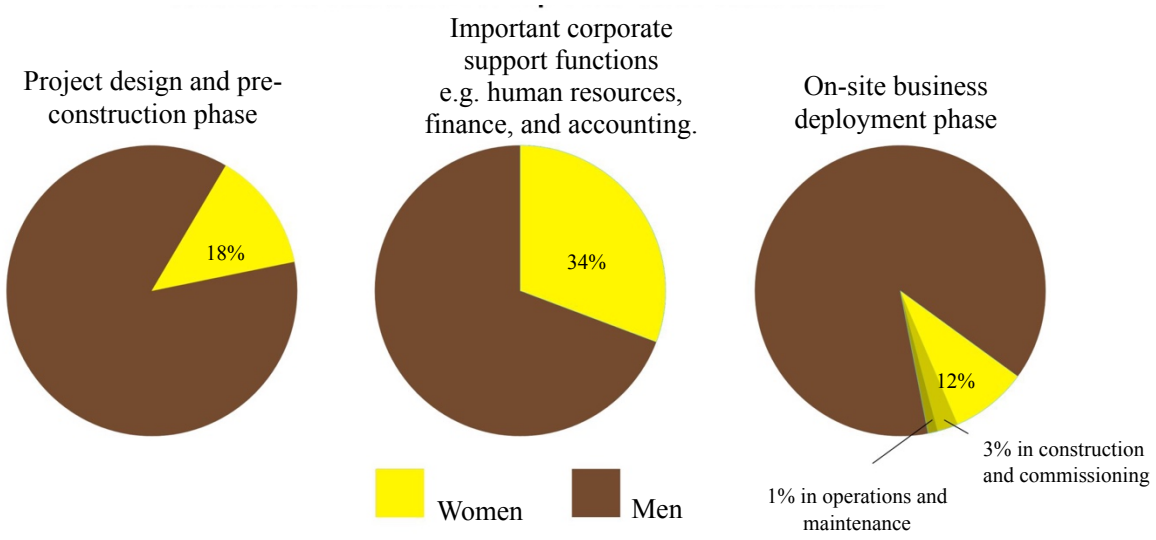
about 45-50 billion AED (Government of UAE, 2019), but, it is unclear how many of these were RE businesses.

Figure 6: Shares of Women in STEM, Non-STEM and Administrative Jobs in Renewable Energy



Source: IRENA Online Gender Survey, 2018

Figure 7: Women's Location in Roof Top Solar Value Chain in India



Source: Adapted from IEA and CEEW 2019

Interviews with C-suite and senior managers of solar developing companies and ESG consulting services in India and the UAE and data from state-owned companies and government ministries in the UAE aligned with the aforementioned research findings on women's skill levels and location in value chains.

> ***Most female employees in Solar Arise and Fenice Energy Pvt. Ltd were strongly represented in strategy, project design, marketing, data analytics, finance, human resources, communications, legal and tax compliance teams, and increasingly in office-based engineering teams. These women have strong technical expertise in non-STEM and STEM fields (engineering, data and computer sciences), and despite being based in corporate offices, some of those based in strategy, data analytics and engineering teams made periodic on-site visits to assess sites, monitor plant operations and management, as required. However, women are under-represented in project execution segments of the value chain on-site, which is often outsourced to EPC companies (Singhal; Saji, KIIs, 2023).***
>
> ***Of the two verticals that anchor UNIQUS Consult Tech, women constitute 40 per cent of staff in the accounting, reporting and consulting services, and about 55 per cent of ESG advisory services (Chaudhary, KII 2023).***
>
> ***12 percent of female employees out of 5231 employees in ADNOC are women in technical roles, marking progress towards doubling women's representation in specialized technical roles to reach 25 percent by 2030. (ADNOC, n.d.b). In Dewa, 737 of 1961 female employees are in the technical and engineering sectors.*** (DEWA, 2022).

Women's Location in RE Value Chains

Interview with Shilpa Urhekar,

Business Head Sterling and Wilson, RE Ltd. India

"Sterling and Wilson, RE Ltd. India, a turnkey EPC company, implements onsite projects that vary in size, complexity and duration and could employ 100 to 3000 workers at peak with project durations ranging from three to seven months to two to three years. These are often on expansive tracts of land in remote sites, as is the case with solar projects. Women are well represented in engineering (largely in electrical design and engineering, or electronics and communication design and engineering) and in supply chains – two of our four core business functions. Women are also well represented in our commercial and accounts, human resources, personal relations management, and communications teams. All these women have strong STEM and non-STEM expertise. These are 99 per cent corporate office-based jobs".

"By contrast, professional women are far less represented in construction and installation or in operations and maintenance which require site presence; their numbers vary at different points from one or two women engineers stationed long-term on-site to none."

"We sub-contract construction work to labor contractors, and sometimes women may be hired as construction workers, especially on long-duration projects of about two years. In this situation, it makes business sense and fits timelines to invest in constructing women- and child-friendly infrastructure at residential colonies for workers. This also provides women and their young children a sense of longer -term stability in terms of residence close to the worksite, which is the nature of RE projects. Short-term projects have also hired women construction workers when project sites have been close to villages, and workers could be transported back and forth to work."

Women construction workers are involved in low-skilled manual work that includes grass cutting to prepare the land and physically depositing it at designated sites, shoveling stones, concrete and sand into containers and passing it down the chain to be deposited at proximal sites, sorting

Women's Location in RE-related Government Ministries in the UAE

Interview with Eng. Moza Al Neimi,
Director of Productivity and Demand, Ministry of Energy and Infrastructure

"Women comprise 59 per cent of the Ministry's workforce across all its thematic pillars - oil and gas; infrastructure, buildings, and transportation; and housing and maritime. Women are mainly engaged in jobs related to research (technical, base-line assessments, perception surveys), data management, strategic visioning and planning, project design and management, standard setting, monitoring and evaluation, HR, finance, IT, communications, legal affairs, customer relations and international relations, all of which demand high and mid-level STEM and non-STEM expertise. In each pillar, women hold senior, mid-management, technical and administrative positions.

"Among the female STEM graduates in the Ministry, many are civil, mechanical, and electrical engineers, architects, data and computer scientists. Before joining the energy sector, I was a chief electrical engineer and worked in buildings and housing infrastructure, including on-site. MoEI also has sustainability experts who cover its STEM and non-STEM-related aspects. But STEM expertise alone is not enough. Women in strategy and standard setting must have a good understanding of the technical, governmental and community needs to know what and how to integrate priorities into UAE's strategies on energy, water, hydrogen, and other energy sources.

"While most of these jobs are office-based, women employees also make on-site visits to assess parameters for project design, inspect and monitor projects, undertake energy audits, raise awareness among students, communities, and employees in utility companies on efficient energy and water use, and to provide practical support on implementing and maintaining efficient practice to achieve sustainability."

Interview with Sophia Hasnaoui,
Senior Business Development Manager, Yellow Door Energy, UAE

"As a solar developer that entrusts the construction of our solar plants to EPC companies, under our strict supervision, Yellow Door Energy ("YDE") team members in the UAE are based in its corporate office in Dubai. Women are well represented across all divisions, except for the technical (engineering) division, which has fewer women. Women are well represented in the legal department, which has an all-female team, in HR which has all but one man, and in finance and accounting, business development (commercial intelligence, site assessment, marketing, external customer relations) and administration. They are also present in corporate development and

A 2019 study placed women's share in senior management in the RE sector at only10.8 per cent, well below that found in non-energy industries (15.5 per cent), in a composite of energy utilities (13.9 percent), all other energy-related business lines excluding utilities (12.1 per cent), oil and gas (12.1 per cent), and marginally higher than coal (10.6 percent) (Pilgrim et al., 2021). IRENA studies on RE sub-sectors show that globally women are 13 per cent of management and 8 per cent of senior management in wind energy (IRENA, 2020) and 30 per cent of management and 17 percent of senior management in solar PV (IRENA, 2022).

The glass ceiling is most difficult to break at the senior-most levels in the energy sector where women hold less than 5 percent of these positions (IEA, 2019a). IRENA's 2018 RE sector survey says that men

hold 65 percent of board positions in participating private sector firms. About three-fourths are directors in about half of all firms. Most national agencies and inter-governmental organizations have similar patterns of male leadership, but about one-fourth have gender parity. NGOs have a much better gender balance in leadership (IRENA, 2019a).

In **India** and **the UAE**, available data on women's share of management and senior management roles in RE[12] broadly mirror global trends, although the shares are getting impressive in the UAE. I**n India**, the share of women in senior management roles in energy industries is 8.4 per cent (IEA, 2019). In rooftop solar women hold 17 percent of middle-management and 12 percent of senior management roles. Women in senior and mid-level management mostly lead a team or department that address support. Women seldom head engineering or sales teams. Only one-third of rooftop solar companies had a female board member. None had more than one woman. The remaining had all-male executive boards (IEA and CEEW, 2019). Public sector companies in India like NTPC have no female board members, but 3 per cent of women in top/senior management, 5 per cent in middle management, and 8 percent women in lower management, while private sector companies like Tata Power have 20 per cent women on the board of directors and 10 percent women in leadership positions. Both companies also focus on renewable energy (Jyotsna ISA, Email Communication 2023).

More generally, women in UAE constitute 30 percent of leadership roles in the public sector workforce and 15 percent of positions on the Board of the UAE Chamber of Commerce and Industry (UAE Gender Balance Council, 2020).

Data from UAE's state-owned and private sector RE companies and from its federal ministries of energy and infrastructure and climate change and environment, show that:

ADNOC had three female CEOs across the ADNOC group, a female Vice President of Operations and a female Vice President of Operations), and 20 percent women in leadership positions by 2019. (ADNOC, n.d.b). According to DEWA 364 (18 percent) of its 1961 female employees occupy leadership positions (DEWA, 2022), while women accounted for 23.3 percent of Masdar employees in supervisory roles in 2022 (Masdar, n.d.).

"In YDE, women hold 20 percent or 2 out of 10 C-Suite positions. The heads of the legal, HR, health and safety department are women. The senior design manager in the technical division is a woman with all male supervisees, although the technical division overall is headed by a man." (Hasnaoui, KII 2023). 1 out of 4 partners at Alcazar Energy is a woman (Gimenez, KII 2023)

Of the two UAE ministries directly related to RE, a woman holds the ministerial portfolio for the ministry of climate change and environment, while the ministry of energy and infrastructure rests with a male.

*"**Women in UAE's Ministry of Energy and Infrastructure constitute a significant proportion of senior and middle management as Directors and Heads of Sections, respectively, across the thematic divisions of oil and gas; construction, building and transportation, and housing and maritime."*** (Eng. Al Neimi, KII 2023)

[12] This data is gleaned from studies on RE industries and private businesses in RE sub-sectors in India, and from data for both countries from private and state-owned individual energy companies, energy and energy-related national government ministries and departments, and KIIs undertaken by this research.

Although the data accessed for both countries on women's share of leadership roles in the RE sector is limited, both countries have a number of individual women in prominent leadership roles in the RE sector, [13] and efforts to raise the proportion of women in leadership in RE are underway.

All stakeholders interviewed for this research recognized that women in senior management roles strengthens organizations' 'gender equality culture.' Organizations with women in such positions increased their recruitment of women, expanded gender-responsive policies, and fostered work environments that provide women with more opportunities for growth.

Having more women in senior management roles also has a positive impact on business growth and performance, and in turn national economic growth and development. Seventy-four per cent of ILO surveyed companies that track the impacts of gender diversity in management reported that profits increased by five to twenty per cent. These gains have yet to lead to a major shift in the gender composition of senior leadership and decision-making roles in companies (ILO, 2019).

This is a lesson for the RE sector and all industries across the globe. There must be a critical mass of women at all levels of management, especially at the top-most levels for greater gender equality and other impacts.

Gender Gaps in Wages and other Conditions of Work in the RE Sector

Echoing the state of other sectors, women earn about 20 per cent less than men do in the RE sector (IEA, 2022b). Other critical gender concerns in the RE sector at the global levels include, women's exit from the workforce at key points in their careers, especially at childbearing age when the demands of balancing work and family are strong; the lack of flexible work-cultures, lack of access to mentoring and training and the glass ceiling that obstructs women's career advancement. The lack of enabling policies reinforces these concerns (IRENA, 2019).

India reflects similar concerns. The rooftop solar businesses show persistent gender wage gaps (IEA and CEEW, 2019), in a country where on average women are paid one-fifth of men's incomes (WEF, 2022). Retention of women and their representation in senior management roles is poor. Only a few surveyed companies went beyond very basic government mandated work site protections such as six months of maternity leave, about seven days of paternity leave and the prevention of sexual harassment at work (IEA and CEEW, 2019). India's DRE sector offers wages that are slightly better than the national average. Women in the DRE sector in India earn 22 per cent less than their male counterparts overall. Unskilled and skilled women workers earn 33 per cent and 13 per cent less than their male counterparts, respectively (Power for All, 2022a). However, the average retention rate for direct full time formal employment in the DRE sector in India is 21 months and 12 months in informal employment (Power for All, 2022b)

Gender-based wage data for the **UAE's** RE sector was inaccessible, but the UAE has a gender equal pay policy for men and women doing the same kind of work ***(H.E. Dr. Nawal Al Hosany, KII May 2023.***

[13] In India these include a number of women CEOs of solar companies, energy and ESG consulting services, women leading the e-mobility transition, energy/RE research and public policy institutions such as The Energy and Research Institute (TERI), Indian women in senior and top management positions in inter-governmental organizations such as the India-based International Solar Alliance (ISA) and the UAE-based IRENA (Walawalkar, 2023), and in senior energy-related government portfolios at cabinet and state ministerial level. Likewise in the UAE, these include CEOs and Vice Presidents of state owned energy companies, the Permanent representative of UAE to IRENA.

The country also ranks eighth worldwide on wage equality for similar work (WEF, 2022). However, a 2020 survey of 11,000 students (52 per cent Emirati, 31 per cent Saudi, and 17 per cent UAE residents from other countries) at sixteen universities in Dubai (with 43 percent women respondents), showed that 50 percent of women expected to be paid AED 5000, while only 40 per cent men would accept salaries at this level. (Rizvi, 2020) According to another study in 2014 covering 131 IMA members in the UAE, average base salaries for women in the UAE ($53,222) were found to be 97 per of those for men ($54, 938). (Dubai Media, 2015)

Most interviewees across the stakeholder spectrum in India and UAE pointed to gender inequalities beyond numerical representation at all levels of management in and beyond the RE sector.

(a) While some in India asserted gender equality in equity shares of CEOs and CFOs, salaries and wages of employees, others pointed out gender pay gaps. ***In some companies co-founded by men and women, the latter's share of equity is lower because of the perceived lack of value women bring relative to men."***

(b)" Women entrepreneurs find it more difficult than men to set up RE businesses, especially with respect to access to capital. All things being equal in applications for loans, it is often gendered perceptions of finance decision-makers that privilege men as loan recipients." (Saji, KII 2023). But there are other nuanced manifestations of gender biases in access to capital and company ownership, such as how much capital women get for the same dilution in ownership compared to a male-led company or how women negotiate the terms of the equity they bring in. However, women do benefit as clients of a 'gender lens investor' or from targeted investments in women-led and women-owned businesses, where 50 per cent or majority ownership is a criterion for investment in a company — which in India is so few." (Patnaik, KII 2023).

© Beyond financials, interviewees reported the tendency to assign women managers portfolios related to enabling functions rather than core RE business functions. Stemming partly from the portfolio being handled, male managers in RE and other industries on average tend to participate in more important business and government meetings, engage with more critical business partners, enjoy more travel, travel perks and networking opportunities, access more strategic work-related trainings, and often tend to be taken more seriously by clients or even within organizations. Women must work twice harder than men to succeed (H.E. AlAbdooli; Hasnaoui; Osawe; Saji; Singhal; Urhekar, KIIs 2023)

5. Migrant Women Professionals in UAE's RE sector

Key Gender-based Labor Migration Trends into the UAE

The UAE is among the most important migrant destination sites, ranking sixth globally and second in the Arab region. International migrants (of which about 26 per cent are women) comprise 88 per cent (8.7) of UAE's total population (UNDESA, 2020). The country's economic magnetism, relative political stability and modern facilities have since the oil boom of 1973 drawn highly skilled migrants from countries of the global North and South as well mid and low-skilled migrant workers largely from Asia, other Arab States and now Africa, in search of jobs. While the former plug skill and labor deficits in the oil and gas, education, finance and investment sectors, the latter do so in lower-end or drudge jobs in oil, construction, infrastructure development, hospitality, wholesale/retail trade, domestic work, that economically and socially secure UAE nationals do not engage in.

Migrant women workers dominate the feminized segments of the private sector, but make up a small proportion of the public sector workforce . They are largely clustered in low skilled informal jobs, but also work to some extent in medium and high skilled formal jobs – mostly in social and community services (health work, social work, education, hotels and restaurants domestic work), business and financial services (insurance, real estate), and basic, whole-sale and retail trade. These are woman-oriented work sectors marked by women's nurturing, house-keeping 'proclivities,' or client-facing sales or service roles, or routine, repetitive administrative tasks that for economic or cultural reasons run short of national skill and labor. Migrant women workers are less represented that their male counterparts in transport and storage, mining and quarrying, manufacturing, construction, oil and gas, and agriculture and fishing (D'Cunha, 2021). Emirati women dominate the public sector in traditional portfolios for women such as the health, education and financial services, but also work in non-traditional sectors such as energy and infrastructure, and climate change and environment (Eng, Al Abdooli & Eng Al Nueimi, KII, 2023). Moreover, about 23,000, own and lead business (Government of the UAE, 2019).

Migrant Women Professionals in the UAE's RE sector

The country's dynamic transition to RE and a high-powered knowledge economy has opened a spectrum of jobs for highly skilled women. This is especially so for professional migrant women in private RE and RE-related firms who contribute their skill, knowledge and labor to segments of the RE space that continue to have a lower proportion of national women.

National labour force data on migrant and Emirati women's representation in the RE sector was not accessible. However, national data on migrant and Emirati women's overall employment in the UAE, and research conducted for this study shows a greater concentration of migrant women in private RE firms than in the public sector. Emirati women dominate the public sector workforce (state owned RE companies and related ministries), than the private sector, although these proportions may change in the future.

"Alcazar Energy currently has 29 employees, 28 of whom are based in the UAE and represent 15 different nationalities. The company aims to continue promoting diversity in employment as its team grows."(Gimenez, KII 2023).

Emirati women form 81.8 percent of the 1961 female employees at DEWA (DEWA, n.d) and 61 percent of Masdar's female workforce (Salman, 2017).

"Migrant women professionals are 0.56 percent or 2 of the Ministry of Energy and Infrastructure work force, while Emirati women constitute 99.4 percent of the Ministry's 354 women employees" (Eng Al Nueimi, KII 2023).

"Non-local women comprise 9 per cent of the female work force in the Ministry of Climate Change and Environment t, while Emirati women are 91 per cent of this workforce" (Eng Al Abdooli, KII 2023)

Many migrant professionals in the RE sector work in firms that develop RE assets at utility scale, or in sustainable infrastructure funding companies, in EPC turn-key companies, in consultancy firms providing critical business, legal or RE technical services to RE companies or to other companies to help them decarbonize.

These women are high-skilled professionals with non-STEM and STEM expertise, who work in middle or senior management positions in non-technical and technical roles. They serve as partners, regional or

country heads, division and team leads, senior technical advisers or mid to junior-level technical specialists.

Most tend to be in corporate settings and are engaged in overall corporate strategy development or business development namely, commercial intelligence, site assessment, marketing, external customer relations finance, HR, legal, sales and marketing, communications and administration. They are far less involved in project execution – construction, installation, operations and maintenance (Garcia; Hasnaoui, KIIs 2023). However, women in engineering teams, and women in other segments such as business development who sometimes tend to have engineering backgrounds undertake periodic on-site visits with engineering functions as part of their jobs (Hasnaoui, KII 2023).

The majority of blue-collar workers who set up RE infrastructure on-site in the UAE are male migrant workers – especially those employed in low-skilled construction or semi-skilled technical work (Hasnaoui, KII 2023). However, some companies are looking at increasing the number of women in on-site project execution through policies and agreements with their supply chain partners (Gimenez; Hasnaoui, KIIs 2023).

Some migrant women professionals in the UAE also hold leadership (often voluntary) positions such as Vice Chairs or Chapter leads in non-profit organizations such as the Clean Energy Business Council (CEBC) and Women in Renewable Energy (WiRE), focused on providing services to women to enhance their recruitment, retention and upward mobility in clean RE jobs (Darwish; Garcia; Osawe, KIIs 2023)

Migrant women professionals in government ministries tend to be researchers, technical specialists such as on air quality and green-house gas emissions in the department of **Green Development and Environment Affairs (MOCCAE) or in** international relations departments (MoEI) handling bilateral documentation between countries of a more administrative nature. Depending on the nature of the work contracts would be short term to longer term **(**Eng. Al Abdooli; Eng Al Nueimi, KIIs 2023)

Backgrounds of Migrant Women Professionals in UAE's RE sector and Pull Factors to the UAE

KIIs in the UAE revealed the following broad-based information on the regional and nationality profiles of migrant women professionals, and factors that draw them to UAE's RE sector. Migrant women professionals in UAE's RE sector hail from various countries in Europe, North and South America, Oceania, the MENA region, Southeast and South Asia, including India, and others (Eng. Al Abdooli; Eng Al Neimi, KIIs 2023). Some Indian women RE professionals in the UAE were born and/or raised and educated in the UAE. Others have migrated from India on work visas or are of Indian origin but have other nationalities and are on work visas in the UAE (Eng Al Nueimi, KII 2023).

Migrant women professionals are attracted to working in the UAE and its RE sector because it is an economically prosperous, modern, high-income country. In addition, the country's more liberal environs, its legal and social endorsement of gender equality, its efforts to enhance women's potential and their LFPR (including at senior levels of decision-making), attractive salaries and work entitlements make living and working in the UAE attractive to women who migrate more out of choice than force of circumstance.

Working women with families and young children are especially drawn to the UAE because of its political stability, the experience of personal safety and security in public spaces backed by security infrastructure and stringent law enforcement. Moreover, the UAE's high-end physical infrastructure and travel and communication connectivity with the rest of the world, its hospitable culture and the ability

to forge strong work and social relationships with UAE nationals are important priorities for these women. Finally quality education and health care services, availability of migrant domestic workers and a care infrastructure governed by legal protections are magnets for migrant women professionals to move for work to the UAE.

6. Basis for Gender Gaps in RE Employment and Good Practices for Advancement

Challenges in Women's Recruitment and their Location in the RE Value Chain

Available literature and key informant interviews highlight several challenges to women's recruitment into the RE sector:

(a) Gendered and other limited perceptions about the overall nature of the sector and its work;
(b) Gendered perceptions about women's location in value chains and about work protections;
(c) Conscious and/or unconscious gender biases in recruitment practices coupled with family pressures and women's self-selection;
(d) Gender biases in tertiary education and technical and vocational education and training;
(e) Lack of adequate alignment between education and RE industry demands
(f) Women's unequal access to entry points for RE jobs (internships, apprenticeships);
(g) Inadequate information and awareness about RE job and career opportunities.

(a) Gendered and other limited perceptions about the overall nature of the sector and its work

The recruitment of women into the RE sector tends to lose sight of its potential appeal to women who in their socially-determined roles as nurturers, child raisers, and managers of natural resources, are more likely to resonate with RE's game-changing contributions to planetary sustainability and sustainable living. RE is overridingly perceived as a male-oriented STEM-based hard infrastructure sector. It is speciously deemed unsuitable for women who are not considered technology-oriented, and are deemed incapable of performing and enduring physical on-site roles.

> ***"When I studied and graduated as a chemical engineer in the 1980s, the university would post a list of companies advertising summer or longer-term jobs. A good many companies would say 'female trainees or jobseekers need not apply.' So top women did not get the most coveted jobs. While the situation has since changed, traditional attitudes still prevail." (Venkataraman, KII 2023).***

It is wrong to presume that women cannot do technological jobs. A growing number of women with impressive technical competencies are gradually entering the sector in non-traditional roles. Moreover, many on-site jobs are now mechanized and automated, reducing heavy labor intensity (Eng. Abdooli ; Eng; Al Neimi; Gimenez; Hasnaoui; Singhal; Urhekar, KIIs 2023).

Breaking Gender Stereotypes in Employment

Excerpt of the Interview with Eng. Al Abdooli, Director of Green Development and Climate Affairs, Ministry of Climate Change, UAE

"I have a bachelor's degree in chemical engineering. Before my transition to the Ministry of Climate Change and Environment in the UAE, I worked in various private-sector jobs. My first was that of an operations engineer in a sewage treatment plant in Dubai Municipality. I was the first Emirati female to hold such a position. I would wear my uniform in the field and do the same tasks as men, side by side with them, and some of this was messy and smelly –like checking tanks with sludge, and checking filters. I would go to mechanical and electrical workshops to check, calibrate and repair pumps and blowers etc. In my next job as an technical manager in a Belgian-owned company, I managed a public-private partnership project on sewage treatment and waste management – the first and only Emirati female in that company holding that position. My third job was that of an environment manager in the aluminum industry. My responsibility which I ably discharged was to ensure via monitoring and maintenance that all operations adhered to prescribed environmental guidelines and standards. This entailed regular field visits and technical work. Women can do any job with external support and inner confidence."

SEWA:

Off-season Solar Park for Women Salt Pan Worker: Full Employment, Green Livelihoods, Self-Reliant Solar Entrepreneurship

The Self -Employed Women's Association (SEWA) established in 1972 is a national union of poor, self-employed women workers in the informal economy. SEWA has supported 30,000 women salt pan workers negotiate bureaucratic processes to establish an off-season solar park in the *Little Rann of Kutch*, Gujarat, India. The solar park enables the sale of electricity from the women's solar systems to the Ministry of Energy and Petrochemicals.

This is a value chain addition in the use of solar energy for full employment, green livelihoods and self-reliant solar entrepreneurship. The initiative builds on SEWA's ongoing support to women salt pan workers by helping them set up the Grassroots Trading Network for Women (GTNfW) to help women transition from producing edible salt to more lucrative industrial salt, raising incomes from Rs 8000-10,000 to 25,000-30,000, during the six-month salt production season, and replace the polluting use of diesel which comprised 70 percent of the salt production cost. (Reema Nanavaty, KII, July 2023).

UN Women:

Dismantling Barriers to Women's Entrepreneurship and Access to Clean Energy: UN Women

Between 2017-2020, UN Women, India partnered with Madhya Pradesh Urja Vikas Nigam (Department of RE), Government of Madhya Pradesh on a co-financed government pilot that helped 63 off-grid women-run *aanganwadi*s (rural child-care centers) to access decentralized solar energy systems. UN Women also partnered with S4S Technologies to build a cadre of women solar entrepreneurs in the states of Odisha and Maharashtra to produce and market dehydrated food products in niche markets. A total of 245 women consequently accessed, operated, managed and maintained rooftop solar systems and solar dryers enabling their access to clean energy technologies, including for productive use. This improved household nutrition and women's incomes, raising it by up to 250 percent in some cases.

Solar powered *aanganwadi*s resulted in enhanced lighting, cooling, mobile charging and hence the comfort, safety, security and retention of children in these centers. Moreover, the access to solar technology also resulted in the centers being used as safe spaces, hubs for women's livelihood and other community-based activities in the evenings. These promising impacts on women's lives led the Department of Women and Child Development in Madhya Pradesh to replicate the initiative in select *bal shiksha*

(b) Gendered perceptions about women's location in value chains and about work-site infrastructure and protections

Women's location in the core segments of the RE value chain is determined by gendered perceptions about RE as a male-oriented technology-driven infrastructure sector, and by the levels of women-responsive work-site infrastructure, protections and entitlements. Women are often relegated to or opt for roles perceived as stable, routine, locally-situated and conducive to balancing paid work and unpaid care work.

However, RE project sites are generally located close to available natural resources, which often means they are in remote, desolate locales. The construction, operation and maintenance of RE projects frequently require long spans of working in and shifting between different hard-to-reach sites.

In **India,** this often involves enduring lengthy and strenuous journeys on poorly maintained roads coupled with inadequate transportation, water quality and sanitation facilities. Additionally, many routes lack food and other essential services (Singhal; Urhekar, KIIs 2023). Some companies in India permit women to travel by air to reachable project sites, even if the benefit is beyond their grade. This facilitates safer, quicker and easier travel and encourages women to visit project sites (Urhekar, KII, 2023). In the **UAE,** distances are shorter, and all interviewees noted that the infrastructure to access project sites is of a high quality. Women in UAE travel in their own cars or access suitable transport whose expense is reimbursed.

Interviewees in India highlighted a key concern: interactions with male co-workers, contractors and local communities. Because they are completely unaccustomed to seeing a woman on-site, let alone having

women undertake on-site technical work and supervisory roles, reactions range from shocked silence to confrontational insubordination.

> ***"But nothing is insurmountable. You must be confident. I own my space, demonstrate my technical and supervisory capacity, inspect the plant under the same conditions as everyone else, and temper my professionalism with kindness. I always detail the benefits of the plant to local communities — energy access, jobs and many other improvements in their lives. I emphasize the good work opportunities with a prestigious company to contractors and labourers. They realize this, and soon you see acceptance. Also, I always ensure accompaniment by trusted male colleagues on site." (Singhal, KII 2023).***

> ***"I have encountered difficult situations with contractors on site in my various roles within the industry, even prior to my job with Sterling Wilson. I just rolled up my sleeves, demonstrated confidence in the face of threats of a work stoppage (and 'self-immolation' in one case), showed technical and managerial capacity via an approach to negotiations marked by a no-nonsense attitude and a willingness to discuss with leaders who were prepared to discuss rationally and on the basis of hard evidence. I demonstrated fairness, flexibility as needed, sincerity and seriousness about reaching an agreeable solution — without compromising the continuance and quality of work during negotiations. Finally, all turns out well — with experience and training" (Urhekar, KII 2023).***

Emirati and non-Emirati women professionals in the UAE echoed similar on-site experiences:

> ***"You can only imagine what it would be for an Emirati lady to work in a technical and managerial job on-site in the UAE alongside men. Some were supportive, but many took me lightly, made jokes about me and thought I was a spoilt young lady trying to do something different for the fun of it, but not actually with any real intention or capacity to deliver. I had to work doubly hard and do the same things as the men did on my own (taking occasional help from my boss or supportive colleagues to learn when I needed it). I had to prove my expertise, be patient, humble and non-threatening, build trust and reach out to peers when they needed help. At all times I was focused on learning as much as I could and even worked overtime. I gradually earned the trust and respect of male peers and supervisees. I had the strong support of my supervisors and family, but it is also about your perseverance, social skills and competence." (Eng. Al Abdooli, KII 2023).***

> ***"As a non-Emirati woman in the UAE based in our corporate office, I would receive a warm, hospitable welcome when I visited our project sites. However, there were occasions where, once the initial greetings were done and I changed into my full PPE to scale rooftops, I saw a visible change in the expressions of the men, marked by surprise. Nevertheless, I pretended not to notice, continued to demonstrate my technical competence, and moved on. Gradually, they got used to it and came around. It is encouraging to see the positive change." (Hasnaoui, KII 2023)***

All Indian RE professionals interviewed confirmed that field infrastructure is less than ideal for women. Personal protective equipment is often tailored for men and unusable. Women on short visits often have difficulty identifying a suitable hotel that is close to the project site. Sites themselves often lack separate and clean toilets, changing rooms and toiletry items for women - a particular concern during menstruation, which compromises women's safety, comfort and privacy. From a company perspective, the

cost of investing in separate woman-responsive on-site infrastructure is an important determinant of women securing employment, the total number employed and the tenure of their employment. Some RE developers espousing gender diversity may have targets for women's on-site employment, but these are often soft targets and involve some level of agreement with sub-contracted EPC companies to hire women. (Singhal, Urhekar, KII 2023).

All interviewees in the UAE stated that sites generally have quality, woman-friendly infrastructure and safe, separate overnight accommodation. However, it is rare to see women living and working on site for long periods of time, especially as medium-skilled or low-skilled workers. Most of these workers are male migrants recruited as part of all-male cohorts. Gendered perceptions of these jobs as male jobs, the culture of 'modesty and protection' for women, the need for more consultations with women on their concerns, and the costs involved in providing sex-segregated infrastructure are factors that lead to women's exclusion.

> ***"I was once requested by the CEO of an energy company to help them address the reluctance of female engineers to go on site. I entered a room of mainly men (when the issue was a women's issue), who said they were there to listen actively to effectively solve this concern. This insight and the commitment of the CEO impressed me. After talking with women, we realized that they wanted to wear their abayas on site for cultural reasons and, because their uniforms were ill-fitting and uncomfortable. However, wearing an abaya was a health and safety risk. The company then invested in fire-resistant material for modest and well-fitting uniforms and shoes that encouraged women's on-site presence." (H.E. Dr. Nawal Al-Hosany, KII May 2023).***

Personal safety concerns also account for women's poorer on-site work roles in both countries, although UAE interviewees reported the existence of strong measures to guarantee women's on-site safety and security.

(c) Gender biases in employment, recruitment policies and practices and in application processes

Employment and recruitment policies and practice play an important role in increasing or limiting

Policies to Promote Women in RE Employment

Government Policies on Women's Employment Promotion in India and the UAE

Both countries' constitutions enshrine equality between men and women, including in matters of public employment. Both have a slew of laws protecting women's varied rights at work (Agarwal, 2018; Fletcher et al., 2017; UAE Gender Balance Council, 2020). India has a long history of implementing affirmative action quotas for different categories of disadvantaged peoples. In the realm of women's economic empowerment, there are for instance legally mandated job quotas for women in select contexts, on boards of publicly listed companies (Agarwal, 2018), and in skills training programs, some of which incentivize post-training placement and retention in a first job (Fletcher et al., 2017).

The UAE has personal status laws that give women the right to work (UAE Gender Balance Council, 2020). The UAE has quotas for women in public sector jobs (Smith, 2020). and targets for women's representation on the boards of federal entities and institutions (UAE Gender Balance Council, 2020). The government of UAE has lifted 'all restrictions on women working at night, or in a broad and subjective category of jobs deemed hazardous, arduous, or morally and socially inappropriate, as well as on women working in mining, construction, manufacturing, energy, water, agriculture and transportation, to give them the right to work in these industries' (UAE

women's employment. Literature and interviews show some variations across the two sites in overall government and company approaches, including affirmative action measures.

However, there is a general lack of data and analysis on the impacts of these policies, especially in the UAE.

In both geographies private sector RE companies had mixed approaches to women's recruitment including gender neutrality, adopting soft or hard targets in line with the organizations' evolving diversity policies. Intentional targeted recruitment of women enhanced their employment, reportedly without compromising competence. This required championing at the highest levels of decision-making, monitoring and accountability. persistent and patient search and clear instructions to recruiters who because of conscious and unconscious biases often pursue potential male candidates in recruitments.

Gender-responsive Recruitment Policy and Practice

SolarArise :
Women-Targeted Recruitment

"The lack of deliberate policies that ensure women's recruitment based on qualifications and merit, is a sure way of never finding women for the job. In my experience as a woman founder and CEO of companies, if you take the quick path to recruitment, the first candidate is likely to be a male, and so you can never build an organization with the right gender ratio, and frustrates gender diversity efforts. Men tend to take a shot at applications even if they do not fulfil all the job requirements perfectly. By contrast many well-qualified women candidates simply self-select and do not apply for many reasons because of lack of confidence, a perception that they are not a perfect fit for the job, or a lack of familiarity with the company culture."

"Although SolarArise did not have written targets, as a female co-founder and director, we did have soft quotas and targets for women in each team. I very deliberately told headhunters that I would not accept male CVs unless there were also good CVs of women in the mix and we did not hire unless we had suitable women candidates for certain roles. In some, we forward-hired for women. Patience paid and we met our soft targets, and got very competent women on board."

"We also ensured that companies to whom we out-sourced project execution hired women through the contractors that they engaged. We ensured the implementation of these policies and agreements through update reports, site visits etc. All these provisions meant increased costs for us. But corporate leaders must be prepared to make that investment to ensure that gender diversity works, because it does yield dividends. From my experience and observations, women CEOs, leaders, and hiring managers are more likely than men to adopt an intentional approach to ensuring women's enhanced employment, especially in non-traditional sectors." (Singhal, KII 2023)

ADNOC:
Gender Balance Committee, an Institutional Mechanism to Ensure Gender Balance

ADNOC has established a Gender Balance Committee and has made significant progress on women's economic empowerment and gender diversity in the energy sector, as highlighted earlier. (Government of UAE, 2019). Moreover, it asserts that its women-hires and 'appointments, to leadership positions including at CEO level were based on achievement, actual performance, merit and maturity.' (ADNOC, n.d.b).

Alcazar Energy:
Accountability to Women's Recruitment

"Alcazar Energy has an internal target of maintaining a 30 per cent representation of female employees across its organization. Alcazar Energy works with its contractors to promote the recruitment of women on-site. Additionally, Alcazar Energy sets targets for female employment in the construction and operation of its assets. These targets are set on a project-by-project basis for higher skilled roles, such as engineers, and for support services as the likelihood of female recruits is more typical for these, than for lower-skilled roles."

"We are optimistic about meeting these targets because we employ Tier 1 contractors who have high environmental, social, health and safety standards. Besides, our contracts with them incorporate the conditions and standards they need to meet upfront, and we closely monitor project construction and operations including employment numbers and decent work standards." (Gimenez, KII 2023).

The lack of policies that deliberately target the recruitment of women is related to the pervasive belief that a 'gender-neutral' approach based on merit and qualifications is non-discriminatory. However, years of past discrimination against women in every sphere of life have created an unequal playing field between men and women. Women thus begin from an unequal starting point relative to men. According to the Convention on the Elimination of all Forms of Discrimination against Women (CEDAW) 1979, a 'gender-neutral' approach does not address this situation and reinforces gender-based discrimination and inequality against women. The Convention recommends Temporary Special Measures (TSMs) paired with training, mentoring and other enablers as measures that compensate from women's cumulative disadvantage and promote gender equality in women's employment.

Discussions with RE and engineering professionals also showed that the recruitment strategies tended to be limited to contracting recruiters and head-hunters, and could be enhanced by going beyond these channels, such as talent scouting in universities, well-organized placement seasons for graduating students, and others.

Finally, it is critical to have higher-order accountability to guaranteeing women's defacto access to RE and other jobs.

"A very effective accountability policy in the UAE is reports of companies to the cabinet on the proportion of women employed, or for instance the number of hours of staff development and training for women and men" (H.E. Dr. Nawal Al Hosany, KII May 2023)

(d) Gender disparities in tertiary and technical and vocational education and training for RE jobs

Women enjoy high levels of tertiary education in both countries (Gohain, 2021; Government of UAE, 2019). They also constitute a high proportion of STEM graduates estimated at 42.7 per cent in India (2018) and 41.5 per cent in the UAE (2017) (World Bank, 2019). According to the UAE government, women comprised 56 percent of STEM graduates from public universities and 60 percent of graduates from the Masdar Institute for Science and Technology in Abu Dhabi (Government of UAE, 2019). However, in both countries this does not always translate into STEM-related, including RE jobs.[14] This is attributable to social factors, that also includes more nuanced gender biases in STEM study streams.

In India, while the proportion of female students in undergraduate STEM fields ranges from 30-50 percent in engineering colleges in Indian States, at the premier IITs this proportion was about 9 percent till 2017. Social norms favoring the arts or medical streams for girls, parental inability or unwillingness to spend on preparatory tutorials for girls to appear for highly competitive IIT entrance exams, without guaranteed success, partly underscore this reality. For greater gender inclusion, following a directive from the Ministry of Human Resource Development,[15] IITs have increased female enrollment on a supernumerary basis, to 20 percent by 2021." (Venkataraman, KII, 2023).

According to a 2021 UNESCO report, further levels of disaggregated data (Bello et al., 2021) in both India and the UAE show that women are over-represented in some STEM fields such as the medical and health sciences and the natural sciences that are not directly related to RE jobs. In the medical and health sciences, the share female tertiary graduates in India was 61.6 per cent, while the share of female tertiary graduates in the UAE was 81.1 per cent. In the natural sciences, the share of female tertiary graduates in India and the UAE was 51.4 per cent and 85.9 per cent respectively. The same study showed that the share of female tertiary engineering graduates in India was 30.8 per cent, while in the UAE it was 33.3 per cent (Bello et al., 2021).

India has a range of institutional skills development programs to build a competent RE workforce. From 2015 to mid-2021, over 78,000 trainees have been certified under the *Suryamitra* training program launched by MNRE, Government of India. *Suryamitra* creates skilled technicians for solar installation, commissioning, operations and maintenance. Other training programs like MNRE-affiliated *Vayumitra (wind energy installers) and Varunmitra (solar pumping installers)* have been launched, to meet the growing demand for skilled workers in these sectors (Tyagi et al., 2022). The Skills Council for Green Jobs (SCGJ), an autonomous body of the Ministry of Skills Development and Entrepreneurship has developed national occupational standards (NOS) and qualification packs (QPs) in the solar, wind, and bio-energy sub-sectors aimed at capacitating 1,320 trainers and certifying 1,000,320 trainees between 2017-2025

[14] Women in India are just 14 percent of scientists, engineers, and technologists in research development institutions and universities (Kalra, 2023), while the female share of science and engineering jobs in the UAE was only 7 percent in 2018 (World Bank, 2022f).

[15] See https://www.education.gov.in/technical-education-2#:~:text=It%20has%20been%20decided%20to,%2C%2018%25%26%2019.8%20respectively.

(UNDP, 2021). *Industrial Training Institutes* (it is), Ministry of Skill Development and Entrepreneurship, India that anchor TVET also offer RE programs as a result of MNRE facilitation (UNDP, 2021).

However, there is a lack of available sex-disaggregated data on enrollments, placement, type of course pursued and sector-specific participation in the workforce post-training (UNDP, 2021). The *Suryamitra*, *Vayumitra* and *Varunmitra* programs and the national occupational standards and qualification packs tend to be largely focused on skills relevant to the execution phase of RE projects. This is a dire need but is also a segment of the value chain that involves fewer women workers. It is likely that few women have enrolled in these programs, unless there were targeted and other supportive measures to ensure their enrollment and job placement.

A 2019 study by the Ministry of Skills Development and Entrepreneurship on women's participation in ITIs and National Skills Training Institutes (NSTIs) in India showed that while female enrollment including in 'women-only' ITIs had increased over the past five years, women were only 21 per cent of enrollees with a dominant 60 per cent presence in non-engineering trades. Average dropout rates were about 23 per cent across different types of ITIs. Key institutional challenges to women's access and retention in these institutions included inadequate access to accurate official channels of information, a common perception that TVET was more for men, remote locations, lack of transportation, safety concerns, poor on-site sanitation infrastructure in ITIs, challenges in enrolling online, the expense of repeated visits to cyber cafes, and high fees. Gendered attitudes and behavior of faculty to women students that reinforced gender stereotypes on trades, marriage and related relocation, lack of support in balancing training and domestic work, the lack of on-site or other childcare support, lack of in-house career counselling, and post training support in transitioning to jobs also inhibited access, retention and post-training employment (Ministry of Skills Development and Entrepreneurship, 2019).

حوار أبوظبي بين الدول الآسيوية المرسلة و المستقبلة للعمالة
Abu Dhabi Dialogue among the Asian Labor-Sending and Receiving Countries

While it was not possible to access sex-disaggregated data on TVET for the RE sector in the **UAE,** overall enrolment in vocational programs at the upper secondary level in the UAE is about 2.5 per cent. TVET options generally tend to be limited to males, such that Emirati women are under-represented in TVET (Hojeij, and Al-Marzouqi, 2023; UNESCO-UNEVEC, 2022; constituting about 37 per cent of students in these programs (Assi, and Marcati 2020). The low levels of TVET enrollment in the UAE, and in other GCC countries reflect a less favorable attitude towards TVET, relative to academic education. This is despite government investments in TVET to help realize their economic vision and plans. (Khan et al.,2017).

(e) Lack of relevant RE job expertise, inadequate embedment of RE programs in core educational curriculum, and thin alignment between education and RE industry demands

Despite the growth of technological and socioeconomic research on RE, and the growing introduction of RE programs into research, academic, technology and skills development institutions in the two countries, RE education and training needs to be pervasively embedded in mainstream STEM education in order to ensure the optimum match between the desired levels of RE expertise and available or expected RE jobs.

Innovative Models of Non-Traditional Skills Development for Women

Aspire for Her:

Harnessing the Power of Communities, Networks and Life-time Learning

Aspire for Her (AfH) based in Mumbai, India, is a platform that harnesses the power of communities and networks, and life-time learning to create a generation of financially independent women. It motivates, educates and trains women to enter and stay in the workforce as employees and entrepreneurs. "Our vision is to add 1 million women to the workforce by 2025 and 10 million by 2030 via mentors and role models; courses, cohorts and learning; career previews and resources, and peer communities, with a focus on developing hard technology and soft skills," says Madhura Dasgupta Sinha, Founder and CEO.

AfH's revenue model is a business-to-business model where over 60 premium business clients/partners pay for identifying and creating communities of women that constitute the talent pool for their markets and for job recruitments from this pool. AfH women community members benefit from pro-bono mentoring, coaching, skilling and other services provided by business partners.

Says Dasgupta, "Our parameters of success are member acquisition, member engagement, and the more than 60 business partners. Of the over 225,000 women members, about 50, 000 engage on the AfH platform daily – speaking on social media, taking courses, participating in webinars, getting certified or collectively finding solutions, especially on common concerns such as childcare and family restraints on paid public work. About 20,000 women have started businesses, and another 20,000-25,000 are in jobs, including with reputed companies. Many of these are technology companies. AfH women members who move forward give back as mentors and serve as leaders among other women members. This give and take between us, our members and business partners, as opposed to transactional one-off

"The overall pool of applicants for solar jobs tends to be small and often lacking in relevant solar-related technical expertise. This holds for men and women job applicants with STEM backgrounds, although more pronounced for women. This is partly because the entire solar sector and related education and training are relatively new, although this situation will improve with time Saji; Singhal, KIIs 2023).

A World Bank study on women in energy sector jobs in the **MENA region** says, that STEM study fields are "often theoretical and or related to more traditional types of occupations such as in medicine, engineering and research. Anecdotal evidence indicates that early education and training in newer areas of technology are nascent and not necessarily integrated into educational curriculums leaving critical gaps in skills development for youth competing in future markets" (World Bank, 2022f).

"A course in environmental science is mandated in the second year in every undergraduate science and engineering college in India, to better understand its relevance. But education in India follows traditional disciplinary silos. Engineering is divided into mechanical and civil engineering..., although we do have elective courses on environment or sustainability. There are initiatives introducing sustainability and environmental concepts into core undergraduate courses, such as introductory courses in mass and energy balance in chemical engineering. Mainstreaming RE pervasively into the core engineering syllabus is still nascent in India." (Ventkataraman, KII 2023)

University research productivity on RE has been on the rise in the UAE. However, not all universities have been able to integrate RE into their core curricula although some have courses at higher levels of postgraduate education– often in the form of technical electives or senior design projects. Decision-making at the highest levels of institutional leadership and resources, including for research and partnerships with government-industry can help widen the base of RE mainstreaming at all levels of our education system (Ajaj; Shahin, KIIs 2023).

A study on engineering programs in public and private universities in the UAE says that "the integration of RE fundamentals and applications into the engineering curricula is still modest and requires strategic decisions by university officials to advance this change. Most courses are of a general nature, introducing students to the different sources of RE and applications. The next most popular courses are related to solar energy which is abundant in the Arabian Peninsula. Twelve universities with engineering programs did not offer RE courses. (Kaaki et al., 2015).

By contrast, seventeen universities with engineering programs offered RE courses of which some, notably the University of Sharjah, had 18 courses; the Amity University Dubai had 11 courses, including a complete bachelors degree program on RE; and Masdar Institute of Science and Technology in Abu Dhabi which had 7 courses at the graduate level (Kaaki et al., 2015).

(f) Women's unequal access to entry points for RE jobs (internships, apprenticeships)

Internships and apprenticeships are important entry points into the RE sector because they help individuals acquire the skills and expertise they need for jobs in the sector. However, research in different countries shows that women form a small proportion of apprentices in male-dominated trades, such as those related to the RE sector (McFarland, 2015). For example, a Government of India study, showed that women comprise only 11 percent of apprentices clustered in a few women-oriented trades in ITIs in India. (Ministry of Skills Development and Entrepreneurship, 2019).

(g) Women's greater lack of access to adequate information on RE job opportunities

Women lack quick, timely, easy and strategic access to information on RE job opportunities compared to men. They are excluded from the 'all-boys' social and professional networks, and other formal channels of communication such as industry conferences, exhibitions, job fairs and events organized by government, industry, financiers and international organizations. These events feature research and development, innovation labs, good RE policy and program practices, start-up pitches for investment. They provide an opportunity to demonstrate leadership trends in the sector, enhance market intelligence and opportunity for job-related networking. Further, not all universities have dedicated mentoring and counselling programs on RE job opportunities, with focused objectives to improve women's access to RE-related information.

"Personal, social and professional networks have been a primary conduit for information transmission and successful job recruitment, especially in male-monopolized job sectors like the traditional energy sector and others. Much of this networking happens after office hours in spaces such as clubs, restaurants, bars or cafes, or over sports and other recreational activities that are typically male. Women's discomfort in these spaces, their domestic responsibilities at these times or the expectation for them to be home by a certain time, effectively excludes them from these closed, all-boy networks, and, hence from information and job possibilities." (Manacha, KII 2023)

"Women tend to be excluded from formal avenues of communication including a range of RE industry events because they often do not have the connections to be invited or sponsored, or the financial resources for registration fees, travel and accommodation to participate in these events. Consequently, many women who have important research to share and innovations to feature are excluded. This inhibits their career progression and opportunities to attract investments, as these are venues to network, demonstrate talent, secure jobs and other resources." (Osawe, KII 2023)

"Women also miss out on information because RE industry personnel or recruiters do not routinely visit our universities for woman-targeted job searches and recruitment. Nor do all universities have dedicated counselling or mentoring programs that target women's higher enrolment in STEM fields of study or facilitate their employment in the RE sector. This is perhaps related to the newness of the sector and budgetary constraints of many universities. Also, women are not always aware of recruiters who can provide valuable information and guidance on available jobs in the sector and how to avail themselves of their services." (Ajaj, KII 2023).

Facilitating Women's Access to Information and Networking in the RE sector

WiRE:

The Connector Par Excellence between Women and the Network of RE Industry Players

"Women in Renewable Energy (WiRE) grew out of my job of setting up commercial wind farms and the marginalization I felt in an all-male work environment – so common to women," says Joanna Osawe WiRE's Founder and CEO. "Our mission is to enhance women's employability and career progression in the energy sector and to create a diverse and inclusive RE sector through a robust network of key industry players in Canada its headquarters, and in over 25 WiRE chapters around the world including in the UAE."

With an on-line community of over 26,000 and counting, WiRE provides a platform for young women professions and other under-represented groups to enhance their technical knowledge of the RE sector, its skill demands and job opportunities, to feature their work and expertise, and to network and connect with industry players for collaborative incubation and project partnerships and jobs. The platform's varied programs customized to different locations include spotlights/blogs on the WiRE website, webinars, workshops, seminars, trainings, conferences, field trips to important energy sites, industry events, and trade/job fairs. It also includes information on opportunities to participate in these through student bursaries and scholarships as needed (Osawe, KII 2023)

In the **UAE,** a young chapter, WiRE has conducted webinars with key women CEOs and professionals from RE companies as role models for young women professionals (Darwish, KII April 2023), and as awareness-raisers on women's contributions, challenges and forward-looking strategies in the sector. It has facilitated trainings and women's participation in conferences where they present their research on RE with the potential for funding (Ajaj, KII 2023; Shahin, KII 2023)

Challenges to Retention and Career Progression into Senior Leadership Roles

Literature and most interviewees across both countries maintained that key barriers to women's retention and career advancement in the RE and other non-traditional sectors of work include:

(a) Marriage, childbearing and unpaid care work;

(b) Gender-based protection deficits for women employees, senior managers and entrepreneurs;

(c) The leaking job pipeline and the glass ceiling.

Conscious and unconscious gender biases at work at home and society underpin these specific challenges.

(a)Marriage, child-bearing, and unpaid care work

Catalyst's[16] First Step: India Overview Tool says that about 50 per cent of Indian women drop out of the corporate employment pipeline at junior and mid-levels, compared to 29 per cent of women across all of Asia (Bhalla, 2015). Key reasons for this include marriage which in many cases entails relocation, childbearing and child-care which causes career breaks, family pressures (ETHRWorld, 2022), and sociocultural expectations for women to conform to socially prescribed family roles.

In India, as in other contexts, giving up employment or taking a career break at a crucial juncture at junior or mid-levels set back a woman's career track. Many women are unable to return to work as they fall short of the most updated skills, knowledge and developments in the sector and lack the confidence to deliver. Others who return find themselves on a slow career path, often in more routine support roles. Many women lack opportunities to retrain and upgrade their skills (ETHRWorld, 2022).

(b)Gender-based protection deficits at work

Gender-based and other work-place deficits generate tensions in work-life balance, stress, frustration, and erode women's self-esteem. Often women lack the nerve to speak up and claim their entitlements. At times institutional mechanisms to redress grievances may be inadequate. This can cumulatively trigger women to drop out of the work force or a change jobs ***(Manacha, KII 2023).***

In the UAE, there is little accessible data on the de facto enforcement of RE policies on employment and work-related protections, but all UAE interviewees claimed strong enforcement of women's workplace rights. RE sub-sectors in **India** are at varied stages of growth and consolidation. Few companies in the rooftop solar study had gone beyond basic government-mandated policies (e.g., maternity/paternity leave, sexual harassment prohibitions) to provide a more enabling work environment. This can deter women from joining and staying in the sector. Moreover, childcare support after initial years of birth was an expressed need. (IEA and CEEW, 2019).

In **India,** as in many other countries, key drivers of gender wage gaps include women's higher concentration in junior positions and in lower-paying non-technical and administrative jobs (IEA and CEEW, 2019; IRENA, 2019; Patnaik, KII, 2023; Power for All, 2022a). Further, current wages in the RE and other sectors tend to be linked to wages received in the previous job. So, if a woman's last salary was low or unfairly low, that would adversely impact the new salary level (Patnaik, KII, 2023). Some companies in rooftop solar for instance, have introduced pay brackets delinked from an employee's prior

[16] A global non-profit headquartered in the USA working for progress for women through workplace inclusion.

compensation. This helps job mobility between sectors and could reduce pay gaps between employees in general (IEA and CEEW, 2019).

Also, like many sectors in India, most companies in the rooftop solar sector have no policy to ensure equal pay for equal work. Often, gender-neutral policies that offer similar benefits to men and women, without addressing women's specific realities, reinforce existing gender inequalities. For example, most surveyed companies in the rooftop solar study in India claimed that they did not discriminate between men and women on compensation, and that the wage structure was based on educational qualifications, work experience and previous salary. In the absence of policies on equal wages for equal work in each set of roles, company assessments of financial compensation to employees become subjective and adhoc. This has disproportionate adverse impacts on women due to factors such as conscious and unconscious employer gender biases, women's start from an unequal playing field, their poorer negotiating positions and skills relative to men and because women are more likely to take maternity and care-work breaks which impact career paths and wages (IEA and CEEW, 2019; Patnaik, KII, 2023).

> ***"Moreover, women tend to prioritize company culture, especially work-life balance, and company branding over wages. The absence of government-mandated annual reporting on issues such as gender-equal wage policies and practices by publicly listed companies partly inhibits closing this gap." (Patnaik, KII 2023).***

In both **India and the UAE,** pervasive conscious and unconscious of employers and headhunters in promotions and performance evaluations are that men make better managers than women who are considered primary caregivers (Bhalla, 2015; Malhotra, 2016; Nayeem, 2021), and that women seek slower career tracks (Malhotra, 2016). Supervisors therefore assume that because of family commitments, women are unable to work late, attend events including networking events, enroll in mentorship programs and training, travel, or take on demanding projects. As a result, women are often passed over for promotions (Bhalla, 2015). This is often with or without consulting with them about their career aspirations, and/or often without providing enabling support that could address these 'perceived or lived realities.'

> ***Women often tend to wait patiently. They tend to be unaware of unwritten rules, are often reticent to express a justified entitlement to a promotion, or are often unable to speak about their achievements that could put them in the line of vision of employers and sponsors for a promotion. By contrast, men tend to demonstrate 'seeking' behavior. They tend to be more comfortable speaking openly about their achievements, and negotiating and claiming benefits (Manacha; Osawe, KIIs 2023)***

The leaking pipeline and the glass ceiling

Women often hit a glass ceiling with respect to senior management positions, especially C-suite positions in India and the UAE.[17] This is partly because there are very few women in the pipeline. This

[17] Although this is improving in the UAE, it hits the 30 percent benchmark in senior positions in the public sector (UAE Gender Balance Council, 2020)

Enhancing Women's Retention and Promotion in the RE Sector

Women in Clean Energy (WICE), a Clean Energy Business Council (CEBC) Program

The Clean Energy Business Council (CEBC), a non-profit established in the UAE, promotes the deployment of clean energy across the MENA region, and in other sites globally," says, Mhairi Main Garcia in her role as Vice Chair of CEBC. "Its Women in Clen Energy (WICE) working group is one of the key pillars of the CEBC, which also include energy efficiency, future mobility, clean energy and climate finance and clean hydrogen and storage. WICE recently established a mentorship program to enhance the retention and promotion of women in the clean energy sector through mentorship. At this stage, the program is aimed at women who already have at least three to five years of professional experience."

The WICE mentorship program is unique in that it mentors women across the whole clean energy value chain on issues such as market trends, job opportunities and on what it takes for their retention and career progression. Mentors and mentees are from the public and private clean energy sector, although not from the same organization and not necessarily working in the same type of position. Mentees come to the program with diverse needs related to retention and promotion. The mentor-mentee relationship tends to continue informally beyond the year-long program time-frame. A reporting requirement over the formal timeframe captures mentor-mentee satisfaction levels which, based on the progress so far, appears to be working well." (Garcia, KII 2023).

reflects the lack of intentional efforts at inclusion from the onset of hiring through all levels of employment, and critically impacts women's presence in senior decision-making roles.

'Because women are often evaluated against a 'masculine' standard of leadership, they are left with limited and unfavorable options, no matter how they behave and perform as leaders." Biases that often undermine their leadership and career advancement include 'extreme perceptions (women are perceived as too soft or too tough but never just right), the high competence threshold (female leaders face higher standards and lower rewards than male leaders); and competent but disliked (female leaders are perceived as competent or liked, but rarely both (Catalyst, 2007).

Innovative Models of Leadership Coaching for Women

Physis:
A Journey to Powering Women as Influential Corporate Leaders

Physis located in Bengaluru, India sits at the cusp of gender, psychology and leadership practice, readying women for expansive leadership roles at work to plug the ailing leadership pipeline for women in India. This happens through a personalized, sustained leadership journey rather than one-off interventions, through practical inner-self explorations rather than much-deployed conceptual learning and leadership models; through tailored approaches to men and women rather than generic approaches that invisibilize the different leadership-related needs and priorities of men and women; and through modelling leadership on feminine principles – emotional agility, connection, empathy, collaboration, instead of the alpha male principle.

Sailaja Manacha, the founder of Physis, says, "when women understand their early socialization and inner landscape, their psychological blocks, normative and belief systems that limit them, when they tune into their real drives and motivations personally and professionally, I notice that they are willing and able to step up and leap forward. So, my strategies are anchored in building self-awareness, dismantling inner blocks and designing activities in ways that align individual leadership growth plans and actions with individual proclivities, values and capacities. I combine behavioral interventions, cognitive reflections and concepts and somatic interventions, to help women find voice, claim space and act with creative power and presence even when they are the only women in the room."

"Although I desire to work with men, in the same way as I do with women, it has been difficult to identify a male-co-facilitator to take this conversation forward with men. So, I do workshops on unconscious biases and some one-on-one coaching with men to support their journeys to be better leaders and balance the feminine and masculine energies in themselves. But the needle needs to be moved a long way on this."

Even companies' investments in mentoring and developing their best female talent did not necessarily translate into promotions for women, as they did for men (Carter & Silva, 2010). One reason is that women's mentors are less senior and have less organizational clout than men's mentors, constraining their pace of career growth. Also, men's bosses and informal mentors helped them plan their moves, take charge in new roles, in addition to endorsing their authority publicly. (Ibarra et al., 2010).

Finally, women's notable underrepresentation in senior management and C-Suite positions, presents few role models for other women to emulate. This situation is compounded by their limited access to informal networks and sponsorship relationships where key talent decisions are often made. This tends to reinforce exclusion when new 'premium job' opportunities arise perpetuating the vicious cycle of continued exclusion from leadership positions at various levels (Malhotra, 2016).

WiRE's CEO, Joanna Osawe, says, "WiRE facilitates speed mentoring and speed interviewing with key decision makers in the industry, looking to meet and potentially hire students and emerging professionals. It also provides participants with opportunities to gain insights, career advice and

potentially jobs. Women's retention and leadership within the sector are equally critical, and the industry must champion this. WiRE supports this through awards that celebrate women's contributions, while also drawing them into the line of vision of key decision-makers, and by facilitating sponsorships within the industry because sponsors take you to the next level, provide you with recommendations and champion you through your career."

7. Recommendations for Action Drawing on Good Practice Worldwide

Principles of Engagement

Promoting and protecting women's access to decent and productive RE employment in line with ILO and CEDAW labor and human rights standards is a moral imperative that helps enhance sustainable business performance, economic growth and development. These human and labor rights standards must underscore all responses.

Policy and programmatic action in the RE sector must adopt a whole of government and whole of society approach, including across related policy fields and disciplines for coherent and amplified impact. Moreover, decision-making and action in the sector must ensure women's full and effective representation in the design, implementation, monitoring and evaluation of RE policies, plans, programs and budgets in the the state, market, community and household. More specifically these processes must include women as government officials in ministries/departments addressing RE and related issues as financiers, business owners, entrepreneurs, employees and workers in the RE and related sectors; as academics, researchers, NGOs and CBOs on RE; and as users and consumers of RE household appliances.

Recommendations for Action beyond Countries Addressed in this Paper

Governments

1. Generate national labor force data on women-owned RE businesses and national and migrant representation as employees/workers in the RE sector by sub-sector, occupation, education, skill and wage levels - disaggregated by sex, age, nationality and migration status, at minimum.

2. Undertake comprehensive gender-responsive analyses on the strengths and constraints underpinning women-owned RE businesses; the employment of national and migrant women in various job categories and job levels in RE sectors and DRE; and on government schemes for women's RE entrepreneurship and employment

3. Use data, analyses, workable good practices and recommendations generated from such research to inform the design, implementation, monitoring and evaluation of policies, plans, and programs for national and migrant women in the RE sector, backed by gender-responsive targets, indicators and budgets.

4. Enhance investments in gender-responsive budgeting to ensure that fiscal policies advance gender equality via legislation that enshrines it in the design of fiscal policy and in budgetary and financial management processes, in energy/RE and related government ministries and departments.

5. **Build the capacities of government and quasi-government staff to design and implement gender-responsive RE policies, plans, programs and budgets.**

Government policies, plans and programs backed by targeted and general social norm change on traditional gender stereotypes, and by the provision of temporary special measures should ensure women's equal opportunity and real access to:

- **Non-discriminatory enrollment, retention, and graduation from RE-related TVET and tertiary STEM education**, including in non-traditional streams, with specific attention to mentoring on-job opportunities, job grooming and matching, and first-work placements at minimum, where needed; and operational provisions that enhance women's access (information reach, simplified registration processes, affordability, transport, gender-responsive institutional infrastructure etc);
- **Non-discriminatory recruitment of women into RE jobs including non-traditional STEM jobs** through an array of strategies (recruiters, university tie-ups, industry events etc);
- **Decent and productive RE employment** including provisions for :
    - Minimum wages for those in low-skilled jobs;
    - Equal representation of women with men at all levels of organizations and in all segments of RE value chains;
    - Equal wages and benefits for work of equal value;
    - Paid maternity/paternity and/or parental leave of reasonable duration;
    - Work-life balance measures for female and male employees to undertake post-partum childcare,
    - Support for parenting and other care responsibilities without compromising career tracks (e.g., flexi-hours, remote working, child-care facilities, etc);
    - Equal opportunities and access to promotions;
    - Repeal of laws and regulations banning women from working night shifts;
    - Transport and worksite safety;
    - General and occupational health, safety and well-being including annual, casual and sick leave; provision of appropriate personal protective equipment, and safety standards at work, compensation for occupational injuries and death; prevention of and protection against sexual harassment at work; post-retirement health insurance and pension benefits;
    - The right to associate and collective bargaining.
- **Customized support for women-owned RE businesses,** such as encouragement to financial institutions to develop innovative gender-responsive financing policies/regulations, practices

products and mechanisms tailored to different categories women RE entrepreneurs,[18] with robust gender benchmarks, monitoring and accountability mechanisms; business mentoring, including on policy/legal frameworks; technical and financial assistance and training on financial inclusion; support for market linkages; tax rebates for SMEs;

In addition to the above, targeted government measures for migrant women professional and low-skilled migrant women workers who may be employed in the RE sector, should ensure:

- **Non-discriminatory labor law coverage and programs** such as comprehensive information on rights, wage protection and portable social security, backed by robust enforcement and accountability mechanisms;
- **Harmonization of labor laws with migration and other legal regimes;**
- **More legal migration pathways for women migrant workers;**
- **Harmonized worker-employer skills matching and skills-based mobility for migrant women aligned with labor market demand (as highlighted in the paper)** by developing national and regional occupation-based competency standards with commensurate wages and benefits; developing, assessing and recognizing workers' skills against these standards; and promoting mobility tied to these standards, including via Mutual Recognition Agreements (MRAs);
- **Encourage skills development and recruitment of women in non-traditional segments of the RE value chain** such as engineering, procurement and construction;
- **Fair and accountable recruitment processes that are accessible to and protect low skilled migrant women workers, especially where online recruitment is increasing; and**
- **Effective bilateral labor agreements and MOUs that have robust protections for migrant women workers,** backed by strong monitoring and enforcement mechanisms.

RE Companies

1. **Ensure that corporate mandates, standard operating procedures, programs and budgets espouse gender equality and women's empowerment** and are backed by robust monitoring and enforcement, and ensure that these principles are incorporated in contracts with vendors;

2. **Generate company-and industry-wide sex-disaggregated data on women-led RE businesses and national and migrant representation as employees/workers in the RE sector** by sub-sector,

[18] Such innovation could include: alternate credit assessment methods; investments in financial institutions that lend to women and/or to women in partnership with women's organizations, donors, larger RE enterprises, to meet women's asset acquisition needs; provision of special entrepreneurship loan windows to women for asset acquisition via MFIs, that are larger than usual MFI loans; alignment of repayment plans with cash flows and improve credit conditions for women- owned microenterprises; Deployment of mobile banking agents to enhance women's awareness of customized financial products/procedures, mobile savings, and to assist women avail of these services (Patnaik et al., 2021).

occupation, education, skill and wage levels - disaggregated by sex, age, nationality and migration status at minimum;

3. **Ensure gender equality performance incentives** that tie an employee's performance assessment, compensation, etc., to the company's and/or industry's gender equality mandate; and
4. **Ensure regular, transparent, widely disseminated communication on the company's gender equality mandates and its implementation of related workplans with targets and indicators,** with the executive team, all employees, on websites and in sustainability reports;

RE company/industry policies, plans and programs backed by social norm change on traditional gender stereotypes, and by the provision temporary special measures should ensure women's equal opportunity and real access to:

- **Recruitment of women at all levels and in all segments of the RE value chain** to ensure gender parity in representation, including in senior management positions and to ensure a pipeline of women for leadership positions. The recruitment of women must be intentional and have diversified strategies, beyond traditional headhunters, non-discriminatory language in advertisements and a candidate pool includes competent women, among others;
- **Decent and productive RE employment that includes:**
  - Gender equality in wages and compensation for work of the same value with periodic assessments by neutral third parties, with results shared with management and employees;
  - Paid maternity/paternity and/or parental leave of reasonable duration, and other work-life balance and care initiatives without compromising career tracks, in line with afore-mentioned recommendations made to governments;
  - Workplace incentives that place an equal and tangible value on 'productive' and 'unpaid care work', for male and female employees;
  - General and occupational health, safety and well-being including annual, casual and sick leave; provision of appropriate personal protective equipment, and safety standards at work and appropriate on-site infrastructure like sanitation, safe accomodation, transport particularly to project sites, women-sensitive infrastructure at project sites (accommodation, sanitation etc), compensation for occupational injuries and death; post-retirement health insurance and pension benefits;
- **Retention and career progression through inclusive workplace cultures that create a sense of belonging, protection, safety and security, including:**
  - Onboarding that introduces women and men to the organization, and its culture, benefits, and, social-physical infrastructure that addresses women's specific needs, and fosters access to women's informal groups as a support mechanism;
  - Clear communication on career pathways to all employees in the organization;
  - Equal opportunities and real access to up-skilling and professional development that takes account of women's care work, mobility, time constraints and other concerns;

- Women's equal opportunities, conditions and access to mentors and sponsors with similar levels of competence, seniority and influence as those for men, and with an understanding of women's psyches, mindsets and behavior. Mentorships and leadership coaching need to be mid-to-long-term and not one-off events;
- Fair and comprehensive performance assessment feedback to female employees from supervisors that takes account of women's concerns, backed by avenues for women to express disagreement on feedback;
- Public endorsement of women's achievements that inform upward career mobility;
- Periodic anonymous feedback mechanisms or walk-in sessions with senior managers, mentors, coaches, counsellors on workplace policies, individual/group concerns, career progression goals and concerns;
- Training on conscious and unconscious biases for employees at all levels and celebration of diversity of all kinds; and
- Policies that prevent and protect employees against workplace harassment and abuse including sexual harassment and abuse, backed by effective enforcement mechanisms

- **Gender-responsive procurement, support to RE microentrepreneurs, engagement with clients and communities**
  - Procure from women-owned businesses and/or male-owned businesses with proven records of gender-responsiveness;
  - Build the capacities of women-owned businesses and other suppliers, including on gender issues;
  - Support women microentrepreneurs directly or through partners on sales and service of products of larger RE enterprises;
  - Act as aggregators of loan demand for financial institutions to enable financing for women micro-entrepreneurs who are end users of clean energy driven appliances for income-generation, purchased from RE enterprises and their partners (Patnaik et al., 2021).
  - Provide margin money assistance or financing through a revolving funds supported by profits or by philanthropic capital – thus building financier's confidence to formalize lending to first time women borrowers for their own microenterprises (Patnaik et al., 2021). .
  - Solicit and incorporate female customer feedback into product/service design and train employees in client-facing roles on relevant gender equality issues; and
  - Ensure gender-responsive CSR initiatives, especially in the DRE sector that enhances women's DRE employment, livelihood initiatives and access to RE household and business appliances.

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Annex 1

List of Key Informant Interviews (KIIs): April 2023 –August 2023

India			
Name	**Designation/Organization**	**City/Country**	**Interview date**

Anu Chaudhary	Partner & Global Head ESG, Uniqus Consultech	Mumbai/India	24 April 2023
Suhela Khan	Country Programme Manager, Women's Economic Empowerment · UN Women	New Delhi/India	10 May 2023
Sailaja Manacha	Founder, Physis	Bengaluru/India	12 April 2023
Reema Nanavaty	Director, Economic and Rural Development, Self Employed Women's Association, SEWA	Ahmedabad/India	24 July 2023
Poulomi Pal	Program Specialist, Ending Violence against Women, UN Women	New Delhi/India	10 May 2023
Sasmitaa Patnaik	Programme Associate, Council on Energy, Environment and Water (CEEW)	New Delhi/India	18 July 2023
Selna Saji	Founder & CEO, Zircle	Gurgaon/India	25 July 2023
Madhura Dasgupta Sinha	Founder & CEO, Aspire for Her	Mumbai/India	16 April 2023
Tanya Singhal	Founder & Director, SolarArise and Mynzo Carbon	Gurgaon/ India	19 April 2023
Shilpa Urhekar	Business Head, Sterling and Wilson, Renewable Energy Ltd.,India	New Delhi/India	10 May 2023
Dr. Chandra Venkataraman	Prof. Climate Studies, Indian Institute of Technology (IIT)	Mumbai/India	15 May 2023
Jyotsna	Policy Specialist, Knowledge Management and Capacity Building, International Solar Alliance (ISA)	Gurgaon/India	23 May 2023
The UAE			
Name	**Designation/Organization**	**City/Country**	**Interview date**
HE. Dr. Nawal Al Hosany	Permanent Representative of the UAE to IRENA & Spokesperson for Masdar	Dubai/UAE	20 May 2023
Eng. Aisha Mohamad Abdullah Al Abdooli.	Director, Green Development & Environment Affairs, Ministry of Climate Change, UAE	Dubai/UAE	15 June 2023

Eng. Moza Al Neimi	Director of Productivity & Demand, Ministry of Energy & Infrastructure, UAE.	Dubai/UAE	23 June 2023
Dr. Rahaf Ajaj	Chapter Lead, Women in Renewable Energy (WiRE) Canada, UAE Chapter & Asst. Prof. Environmental Health and Safety, Abu Dhabi University	Abu Dhabi/UAE	30 April, 2023
Dana Darwish	Chapter Lead, Women in Renewable Energy (WiRE) Canada, UAE Chapter	Dubai/UAE	3 April 2023,
Mhairi Main Garcia	Partner, Watson, Farley & Williams (Middle East) LLP &Vice Chair Clean Energy Business Council (CEBC)	Dubai/UAE	18 May 2023
Patricia Gimenez	Environment & Social Manager, Alcazar Energy	Dubai/UAE	15 May, 2023
Sophia Hasnaoui	Senior Business Development Manager, Yellow Door Energy	Dubai/UAE	11 May 2023
Dr Suzan Shahin	Chapter Lead Women in Renewable Energy (WiRE) Canada, UAE Chapter, & Asst. Prof. in the General Education Department, College of Arts & Science. Head of Innovation & Entrepreneurship Center, Umm Al Quwain University. IUCN (International Union for Conservation of Nature) member in Species Survival Commission.	Umm Al Quwain/ UAE	9 May 2023
Canada			
Dr. Joanna Osawe	President & CEO, Women in Renewable Energy (WiRE).	Toronto/Canada	12 April 2023
USA			
Shaily Jha	Sed Fund	USA	23 August 2023

Table 1: Core jobs and skill levels in RE sub-sectors across four key supply chain segments

.1. Equipment Manufacture & Distribution: Wind Energy	**2. Project Development: Solar Energy**	**3. Construction & Installation: Hydro Power**	**4. Operation & Maintenance: Geothermal Energy**

R & D Engineers (computer, electrical, environmental, mechanical, wind power design): **H** :	Project designers (Engineers): **H**	Engineers (civil, mechanical, electrical): **H**	Plant Managers: **H**
Software engineers: **H, M**	Architects (small projects): **H**	Project Managers: **H**	Measurement & Control Operators: **H**
Modellers prototype testing: **H, M**	Atmospheric scientists & meteorologists: **H**	Skilled Construction Workers (Heavy machine operators, welders, pipe fitters etc): **H, M**	Welders: **M** Pipe-fitters: **M** Plumbers: **M**
Industrial Mechanics: **M**	Resource assessment specialists & site evaluators: **H**	Construction laborers: **L**	Machinists: **M**
Manufacturing Engineers: **H**	Environmental Consultant: **H**	Business developers: **H**	Electricians: **M**
Manufacturing Technicians: **M**	Lawyers: **H**	Commissioning engineer (electrical): **H**	Construction equipment operator: **M**
Manufacturing Operators: **L**	Debt Financier Representatives: **H**	Transportation workers: **L**	HVAC technicians: **M**
Manufacturing Quality Assurance Experts: **H, M**	Developers/ Facilitators: **H, M**		
Certifiers: **H**	Land development Advisor: H		
Logistics Professionals: **H, M**	Land use negotiator: **H**		
Logistics Operators: **L**	Lobbyist/mediator: **H**		
Equipment Transporters: **L**	Environmental & social NGO reps: **H**		
Procurement Professionals: **H, M**	Public Relations Officer: **H**		
Marketing Specialists: **H, M**	Procurement Professionals: **H, M**		
Sales Professionals: **H, M**			
5. Support Services, Enabling Functions, Governance across all Segments of the Value Chain : Solar			
Policy makers, government. staff: **H, M**	Administration: **H, M, L**	HR Professionals: **H**	Sales & Marketing specialists : **H, M**
Trade association, professional society staff: **H, M & L**	Insurer Representatives: **H, M**	Finance Professionals: Accountants, auditors, financers: **H**	Clients: **H, M. L**
Educators & Trainers: **H**	Communications Specialists: **H, M**	ESG consultants: **H, M**	

Management: **H, M, L**	IT Professionals: **H, M**	Health/Safety Consultants: **H**	

H:High Skilled- Professional/managerial; **M**: Medium skilled – Technician/skilled crafts/supervisory
L:Low, Semi & unskilled

Source: Adapted from ILO, 2011

Table 2 Estimated number & %age of direct and indirect RE jobs globally, in India and the UAE, by industry, 2020-2021(in thousand)

RE Industry	**Global**	**India**			**UAE**		
	Global total & global sub-sector share of overall global RE jobs	**India total & India sub-sector share of overall India RE jobs**	**India RE sub-sector share of global RE sub-sector**	**India RE sector/sub-sector share of overall global RE jobs**	**UAE Total & sub-sector share of overall UAE RE jobs**	**UAE RE sub-sector share of global RE sub-sector**	**UAE RE sector/sub-sector share of overall global RE jobs**
RE Overall	**12677**[f]	**863**		6.81%	**6.4**		0.05 %
Solar PV	**4291**[g] (33.84 %)	**217** (25.14 %)	5.05 %	1.71 %	**5.1** (79.7%)	0.12 %	0.04%
Bio Energy [a]	**3444** (27.17 %)	**178** (20.63 %)	5.2 %	1.40 %			
Liquid biofuel	**2421** (70.30 %)	**35** (19.06 %)	1.44 %	0.27 %			
Solid Biomass[b,c]	**716** (20.79 %)	**58** (32.58 %)	8.1 %	0.46 %			
Bio gas	**307** (8.91 %)	**85** (47.75 %)	27.7 %	0.67 %			
Hydropower [d]	**2370** (18.70 %)	**414** (48.00 %)	17.5 %	3.26 %			
Wind power	**1371** (10.81%)	**35** (4.06 %)	2.6 %	0.28 %			
Solar Heating and cooling	**769** (6.07 %)	**19** (2.20)	2.5 %	0.15 %			

Geo Thermal Energy [b,c]	**196** (1.55 %)	NA	NA	NA			
Concentrated Solar Power	**79** (0.62 %)	NA	NA	NA	**1.0** (15.6 %)	1.3 %	0.008 %
Other Technologies	**125**	NA			**0.3** (4.7 %)	0.24 %	0.002 %
New RE Jobs by 2030	**38200**	**3400**			**100**		

Source: Adapted from IRENA Jobs Database cited in IRENA & ILO. (2022). *Renewable energy and jobs: Annual review 2022*. International Renewable Energy Agency, Abu Dhabi and International Labour Organization, Geneva. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_856649.pdf

Note: a: bioenergy includes liquid biofuels, solid biomass and biogas; **b**: power & heat applications; **c**:traditional biomass excluded; **d**: direct jobs only; **e**. includes 7400 jobs for ground-based heat pumps in EU countries; **f:** includes 39,000 jobs in waste to energy; **g**:includes an estimate of 342,000 jobs in off-grid solar PV in South Asia, & in East, West & Central Africa; **h**: includes 137,000 jobs in grid connected and 80,400 off grid jobs in solar PV. Also see note g;

Table 3: Male and Female Labor Force Participation Rate (% of male papulation and % of female population ages 15+) (modeled ILO estimate) and Male and Female Unemployment Rate (% of male labor force and % of female labor force) (modeled ILO estimate): Global, India and UAE for 2022

Country	Male LFPR (%)	Female LFPR (%)	Male Unemployment Rate %	Female Unemployment Rate %
Global	73	47	5.8	5.8
India	74	24	7.5	6.7
UAE	93	55	1.9	6.4

Source: World Bank 2022b, 2022c, 2022g, 2022h

1. Introduction