CPD

Working Paper 152

Energy Transition in Bangladesh

Its Implication on Employment and Skills in the Power and Energy Sector

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CENTRE FOR POLICY DIALOGUE

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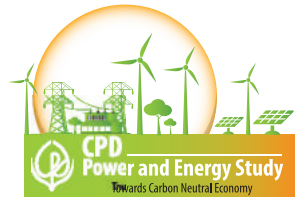

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A key area of CPD's activism is to organise dialogues to address developmental policy issues that are critical to national, regional and global interests, with a view to seeking constructive solutions from major stakeholders. The other key area of CPD's activities is to undertake research programmes on current and strategic issues.

CPD's research programmes are both serviced by and intended to serve, as inputs for particular dialogues organised by the Centre throughout the year. Major research themes are: macroeconomic performance analysis; poverty and inequality; agriculture; trade; regional cooperation and global integration; infrastructure; employment, and enterprise development; climate change and environment; development governance; policies and institutions; and the 2030 Agenda for Sustainable Development.

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The present paper titled ***Energy Transition in Bangladesh: Its Implication on Employment and Skills in the Power and Energy Sector*** has been prepared by *Dr Khondaker Golam Moazzem*, Research Director, CPD (moazzem@cpd.org.bd); *Mr Mashfiq Ahasan Hridoy*, Research Associate, CPD (mashfiq@cpd.org.bd); and *Mr Dr Rafat Alam*, Associate Professor, MacEwan University.

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Abstract

The global energy landscape is undergoing a pivotal transformation, driven by the dual imperatives of sustainable development and climate change mitigation. This transition from traditional fossil fuels to renewable energy sources presents a unique set of challenges and opportunities, particularly in the context of developing nations such as Bangladesh. With its dense population and burgeoning energy needs, Bangladesh stands at a critical juncture in its energy development trajectory. This paper explores the implications of Bangladesh's energy transition on employment and skill requirements within the power and energy sector. Through a comprehensive analysis, the study aims to project the net employment impact by 2030, taking into account the evolving energy mix and the potential for job creation versus job displacement. The study further delves into the skill shifts necessitated by this transition, identifying key areas where workforce development efforts should be concentrated. Based on the findings, a set of policy recommendations were proposed to optimize employment outcomes in the renewable energy sector, thus facilitating a more inclusive and sustainable energy transition for Bangladesh.

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Acronyms

BAU	Business as Usual
BLFS	Bangladesh Labour Force Survey
BPDB	Bangladesh Power Development Board
IEPMP	Integrated Energy and Power Master Plan
KII	Key Informant Interview
LNG	Liquefied Natural Gas
MCPP	Mujib Climate Prosperity Plan
MCPP-M	Mujib Climate Prosperity Plan-Maximised
RSF	Rural Services Foundation
SDGs	Sustainable Development Goals
TAA	Trade Adjustment Assistance

I. INTRODUCTION AND OBJECTIVES

The energy sector is currently experiencing a significant transformation as part of the worldwide efforts towards sustainable development and the mitigation of climate change (Grubler et al., 2018). Bangladesh, a densely populated developing country situated in South Asia, is among the countries following the path of this paradigm change. As countries confront the necessity of shifting away from fossil fuels towards cleaner and renewable energy sources, Bangladesh's endeavours and encounters offer valuable perspectives on the complex relationship between energy transition, employment dynamics, and skill enhancement within the power and energy industry.

In Bangladesh, the energy sector is overwhelmingly dominated by fossil-fuel which is accounted for 91 per cent of total energy supply. Specifically, natural gas constitutes 49 per cent, oil contributes 27 per cent, diesel accounts for 10 per cent, and coal makes up 5 per cent of the energy mix (Bangladesh Power Development Board, 2023). The share of renewable energy comprises only 4.5 per cent of the total energy supply. The energy sources incorporated in the energy mix will encompass local gas and renewable energy and imported liquefied natural gas (LNG), coal, oil, nuclear power and cross-border power. According to a report by the Institute for Energy Economics and Financial Analysis (2023), Bangladesh is projected to experience an increased reliance on imported energy sources by the year 2023. This shift towards imported energy is expected to impose significant economic pressure on the country. Hence, smooth energy transition as well as consequent employment transition in Bangladesh would not be so easy given the pre-dominance of the fossil fuel-based energy infrastructure, energy institutions, energy-related human resource base in the country.

While the employment transition owing to energy transition has been widely discussed in different countries, these issues are new in the context of Bangladesh. On the other part, the analysis of job implications resulting from the energy transition has received limited attention within the field of energy studies. The energy transition has resulted in a shift in focus, with increased emphasis on environmental sustainability and reduced attention on the job sector and the necessary skills. A persistent discourse exists over the potential impact of energy transition on global employment levels.

The global transition to clean energy is projected to result in the creation of around 10.3 million net new jobs by the year 2030, with an estimated 13.3 million jobs being generated in total. In contrast, it has been projected by the World Economic Forum in 2022 that a significant number of 3 million jobs will be negatively impacted. According to a recent study, there has been a notable rise of 12.7 million employment opportunities within the renewable energy industry in the year 2021 (Renewable Energy and Jobs, 2022). According to a report by Reuters (2022), it is projected that the number would experience a fourfold increase by the year 2050. The forthcoming change is expected to be driven by governmental policies and the capabilities of institutions.

Variations in employment rates are expected to occur among different countries. Employment opportunities in industries reliant on fossil fuels, bioenergy, and biofuels are anticipated to decline, while a corresponding increase in job prospects is expected in the construction and installation of solar photovoltaic panels, concentrating solar power plants (which utilise solar energy to generate electricity), wind turbines, geothermal facilities, as well as tidal and wave devices. The extraction sector in Russia, Canada, and certain regions of Africa is projected to experience job losses, but European countries are expected to witness a rise in employment opportunities (Charles, 2009).

The increasing need for energy and the negative environmental impacts associated with reliance on fossil fuels has motivated Bangladesh to pursue a sustainable diverse energy mix. The country's dedication to the United Nations Sustainable Development Goals (SDGs) and the Paris Agreement has prompted the establishment of ambitious objectives for the integration of renewable energy, development of energy efficiency, and reduction of greenhouse gas emissions. The phenomenon of evolution not only exhibits potential for alleviating the detrimental impacts of climate change but also initiates a cascade of consequences within the socio-economic structure of the country. Bangladesh plans to generate 40 per cent of its power from renewable energy sources; it aims to reach 4.1 GW of renewable capacity by 2030, including nearly 2.3 GW of solar capacity (Enerdata, 2023). Hence, a substantial upgradation of the human resource base will be required to ensure smooth transition of energy towards renewable energy use will be required.

This study focuses on possible changes in the overall employment scenario in the future because of projected energy transition in the country. The main objective of this study is to examine the impact of transition in the power sector on employment and skills. The specific objectives of this study are:

a) To identify the structure of employment in the power sector of Bangladesh;
b) To analyse the possible structure of energy transition and implications on employment and skills in the power sector;
c) To estimate the net employment position in the transformed power and energy sector; and
d) To recommend supportive policies to ensure an improved employment scenario in the power and energy sector.

2. METHODOLOGY OF THE STUDY

The study considers a possible short-term transition in the power sector—hence the year 2030 is considered as the target year for analysing the energy transition. In fact, the Mujib Climate Prosperity Plan (MCPP) 2023 has outlined the decade wise targets for energy transition for 2030 and 2040. The Plan outlines three different scenarios for decade-wise targets— 'Business as Usual (BAU)', 'higher than BAU: MCPP' and 'the highest level: MCPP-M'. Both the MCPP scenario and MCPP-M (Maximised) scenario have been considered and calculations for both have been done. It is to be noted that several targets on energy transition have been mentioned in different draft power and energy-related policies such as Integrated Energy and Power Master Plan (IEPMP) and Renewable Energy Policy 2023. However, those policy documents are still at draft stage and those have several concerning issues related to targeting related with energy transition. Hence, this study does not consider those targets.

The study has explored data on skills and employment in the power and energy sector of Bangladesh. Since Bangladesh Labour Force Survey (BLFS) is one of the important sources for national level employment data, the study uses data available on employment in the LFS 2017 for the purpose doing necessary analysis. However, the BLFS did not have adequate data and lacked segregated data on various employments in the power and energy sector. Hence, the study applied some thumb rules to estimate the projected employment requirement in different types of power plants by 2030. These thumb rules have been identified based on the discussion with key stakeholders. Thereby, the estimated projected employment in the power sector may not be representative of the power and energy sector of Bangladesh.

In keeping with both qualitative and quantitative nature of the study, three complementary approaches have been used: (i) desk research, (ii) key informant interviews (KII) and (iii) field visit in three different types of power plants—solar, wind and coal-based power plants. The KIIs were conducted with the representatives of the following power plants and energy-related institutions: (a) Teknaf Solartech Energy Limited; (b) Cox's Bazar Wind Power Plant; (c) Matarbari Coal Power Plant; (d) Infrastructure Development Company (IDCOL); (e) Bright Green Energy Foundation; (f) Summit Power Limited; and (g) Rural Services Foundation (RSF).

3. AN OVERVIEW OF ENERGY TRANSITION AND ITS IMPLICATIONS ON EMPLOYMENT TRANSITION

The energy transition entails a paradigm shift towards the utilisation of renewable energy sources, including solar, wind, hydroelectric, and biomass, while concurrently diminishing reliance on non-renewable sources such as coal, oil, and natural gas. The transition in question is not solely a technical alteration in energy production techniques; rather, it covers a broad range of economic, social, and environmental factors that must be considered (Oberthur, 2019).

3.1 Experience of Energy Transition on Employment and Skills

Generation: The power and energy sector of a country experiences substantial changes throughout and following an energy transition. This type of transition commonly involves a departure from conventional energy sources reliant on fossil fuels, towards cleaner and more sustainable alternatives such as renewable energy. Additionally, it involves the use of more efficient and advanced technology. The modifications give rise to a need for a fresh array of abilities and knowledge within the power and energy industry.

The shift towards more environmentally friendly energy sources such as wind, solar, hydro, and geothermal power has resulted in an increasing need for individuals possessing comprehensive knowledge and expertise in these technologies. There will be a strong demand for individuals with a comprehensive set of skills related to the design, installation, operation, and maintenance of renewable energy systems.

The integration of intermittent renewable energy sources necessitates the indispensability of energy storage technology, such as batteries. The demand for skills pertaining to the design, maintenance, and administration of energy storage systems is expected to be substantial in order to assure the stability of energy supply.

The implementation of large-scale renewable energy projects and system upgrades plays a crucial role in facilitating the transition process. The possession of proficient project administration abilities is crucial in order to guarantee the prompt and cost-efficient execution of these endeavours.

Community engagement and stakeholder management play a vital role in energy transition programmes by fostering support and promoting collaboration within communities and among stakeholders. Proficiency in effective communication and community engagement will play a crucial role in cultivating favourable interpersonal connections.

Transmission and Distribution: Smart grids and grid integration are crucial for addressing the challenges posed by the variability of renewable energy sources and improving the resilience

of the grid. Proficiency in grid management, data analytics, and cybersecurity will be essential requirements for effectively overseeing and safeguarding the dynamic energy infrastructure.

The energy transition is a complex undertaking that encompasses several players and technologies, necessitating interdisciplinary skills. Professionals possessing interdisciplinary competencies that encompass engineering, economics, environmental science, and politics will play a crucial role in effectively managing and facilitating successful transitions.

The increasing interconnectivity and digitisation of energy infrastructure have led to a heightened vulnerability to cyberattacks in the realm of cybersecurity. The presence of cybersecurity experts will be vital in safeguarding critical energy infrastructure against potential assaults.

Energy Use: The growing dependence of the power and energy sector on data needs a proficient understanding of data analytics and artificial intelligence (AI). The acquisition of these skills is crucial for the optimisation of energy production and consumption, the implementation of data-driven decision-making processes, and the effective management of energy resources.

Energy efficiency is frequently highlighted as a crucial aspect of the energy transition, with a focus on its significance in mitigating overall energy use. As a result, the acquisition of competencies related to energy audits, building retrofits, and the adoption of energy-efficient technology will progressively assume greater significance in the optimisation of energy utilisation.

Environmental and sustainability: The related skills have become increasingly important as sustainability issues have gained prominence. Proficiency in areas such as environmental impact assessments, carbon accounting, and the implementation of sustainable energy practises can greatly contribute to the promotion of eco-friendly energy solutions.

3.2 Successful Countries in Employment Transition after Energy Transition

Several countries have achieved notable advancements in effectively navigating employment transformations amidst energy transitions. Several countries have successfully developed laws and programmes aimed at providing support to workers and communities impacted by transitions within the energy sector.

Germany is frequently seen as an exemplary case in effectively navigating job shifts throughout its transition to renewable energy sources. The country has adopted the ‘Energiewende’ policy, which encompasses a specific emphasis on fostering employment opportunities within the renewable energy industry. The organisation has made investments in initiatives focused on enhancing worker training and development, as well as establishing regional innovation clusters aimed at providing support to clean energy sectors.

Denmark has emerged as a frontrunner in the field of wind energy, effectively fostering employment creation within the wind power sector. The government has implemented several incentives to support wind energy projects and has allocated resources towards research and development endeavours to stimulate innovation within the sector. Consequently, there has been a significant increase in employment opportunities within the renewable energy sector.

Sweden has implemented a comprehensive strategy to effectively tackle employment transitions. The primary objective of this initiative is to provide training and skill development opportunities

to people who are employed in industries experiencing a decline. Additionally, robust social safety nets have been put in place to offer substantial support to persons throughout the process of transitioning between occupations. The prioritisation of green innovation and sustainable practises in Sweden has resulted in the emergence of employment opportunities within the clean energy sector and other associated businesses.

Canada has successfully implemented just transition measures in provinces that significantly depend on fossil resources, such as Alberta. These initiatives entail the co-operation of governmental bodies, industrial sectors, and labour unions to provide assistance to workers through programmes focused on retraining, income support, and community development. Additionally, the country has made substantial investments in renewable energy initiatives, hence generating employment opportunities within the clean energy industry.

Spain has effectively undergone a change in its energy industry through strategic investments in renewable energy technologies such as solar and wind power. The government has facilitated this shift by implementing policies that promote the development of renewable energy sources and the generation of employment opportunities. The experience of Spain serves as a notable example showcasing the potential for substantial employment expansion within the renewable energy sectors.

The United States has witnessed the implementation of employment transition regulations in different states, including California and Texas. The policies encompass a range of measures aimed at promoting the adoption of renewable energy projects, fostering the development of a skilled workforce, and encouraging innovation in clean technology. Federal programmes such as the Trade Adjustment Assistance (TAA) programme also aid those who have been impacted by global economic changes.

South Korea has implemented a 'Green New Deal' initiative aimed at facilitating the transition towards a low-carbon economy. The government has made substantial investments in the study and development of green technologies, the implementation of renewable energy projects, and the establishment of job training programmes. The objective of this method is to generate employment possibilities within the green economy while concurrently mitigating carbon emissions.

Scotland has established high objectives for renewable energy and has generated employment opportunities in wind, wave, and tidal energy initiatives. The primary emphasis of this approach lies in the promotion of regional economic growth and the enhancement of community advantages linked to renewable energy initiatives, with a particular emphasis on ensuring that job benefits are extended to the regions impacted by such projects.

Australia has implemented various initiatives and allocated financial resources to facilitate the retraining and reskilling of people residing in areas that have been adversely impacted by the diminishing coal mining industry. Furthermore, the company has made investments in projects and activities related to renewable energy with the aim of fostering job growth within the clean energy industry.

3.3 Financing Issues in Case of Employment Transition

Securing funding for employment efforts following an energy transition presents a formidable challenge, yet it constitutes a pivotal element in ensuring the efficacy of the shift. Energy transitions

frequently result in the displacement of jobs in conventional energy sectors such as coal, oil, and gas, while concurrently generating prospects in renewable energy, energy efficiency, and other domains (Baker et al, 2013).

Initially, it is imperative to get adequate financing to address the financial requirements associated with retraining and reskilling the workforce. In order to facilitate a seamless shift for employees from industries experiencing decline to others that are developing, it is imperative to allocate significant resources towards retraining and reskilling initiatives. These programmes play a crucial role in providing people with the necessary skills required for employment in the ever-changing energy sector (Baker et al, 2013).

Additionally, the provision of income support is a crucial factor to be taken into account. During the process of transitioning, numerous employees in industries experiencing decline may see temporary periods of unemployment or a decrease in their salary. Income support programmes, such as unemployment benefits and salary subsidies, may be necessary to assist these individuals and their families in preserving financial stability during their transition to alternative work prospects (Baker et al, 2013).

Moreover, the provision of labour market matching services necessitates adequate financial resources. The process of facilitating the transition of workers into new employment frequently requires the allocation of resources towards labour market matching services. These services facilitate the connection between individuals seeking employment and the available job vacancies, and their effective operation necessitates financial support (Baker et al, 2013).

The role of incentives for employers is of utmost importance. Promoting the employment of workers from failing industries or the adoption of new green technology by enterprises may necessitate the provision of financial incentives or subsidies. These incentives can serve as means to mitigate the initial expenses associated with the recruitment and training of fresh staff, hence enhancing the appeal for businesses to engage in the transition process (Murshed et al, 2021).

Governments and organisations may also contemplate the issuance of green bonds or the utilisation of sustainable finance methods to procure funding for projects related to renewable energy and energy efficiency. These projects, in turn, have the potential to generate employment possibilities while also being in line with sustainability objectives (Azhgaliyeva, 2020).

4. ENERGY TRANSITION IN BANGLADESH

To examine the possible employment transition, it is important to understand the energy transition of Bangladesh. As per Bangladesh's different plans and policies, the energy transition is being targeted for the period of 2030, 2040 and 2050. The structure and composition of energy transition, however, are not the same in those policies and plans. Moreover, not all the policies and plans elaborate the year-wise targets of energy-mix till 2050.

According to annual energy reports of BPDB from the past two years, conventional fuels generate over 85 per cent of electricity, with natural gas contributing over 50 per cent each year. However, extensive usage of these fuels, especially natural gas, raises concerns about future gas reserves. Some recent surveys predict that these fuels' reserves would run out within decades. Despite having a reasonable coal reserve, high extraction costs, heavily inhabited regions, and other factors

force the government to buy a lot of coal to generate electricity. There is no major oil reserve in the country. War situations and natural disasters raise energy prices; thus, these fuels are not imported at required level with the limited foreign reserves. Currently, 2400 MW capacity nuclear fuel-based power generation plants is under construction which will be operational in 2025. Massive initial expense, technology adaptation hurdles, and energy market regulatory hazards are associated with this project.

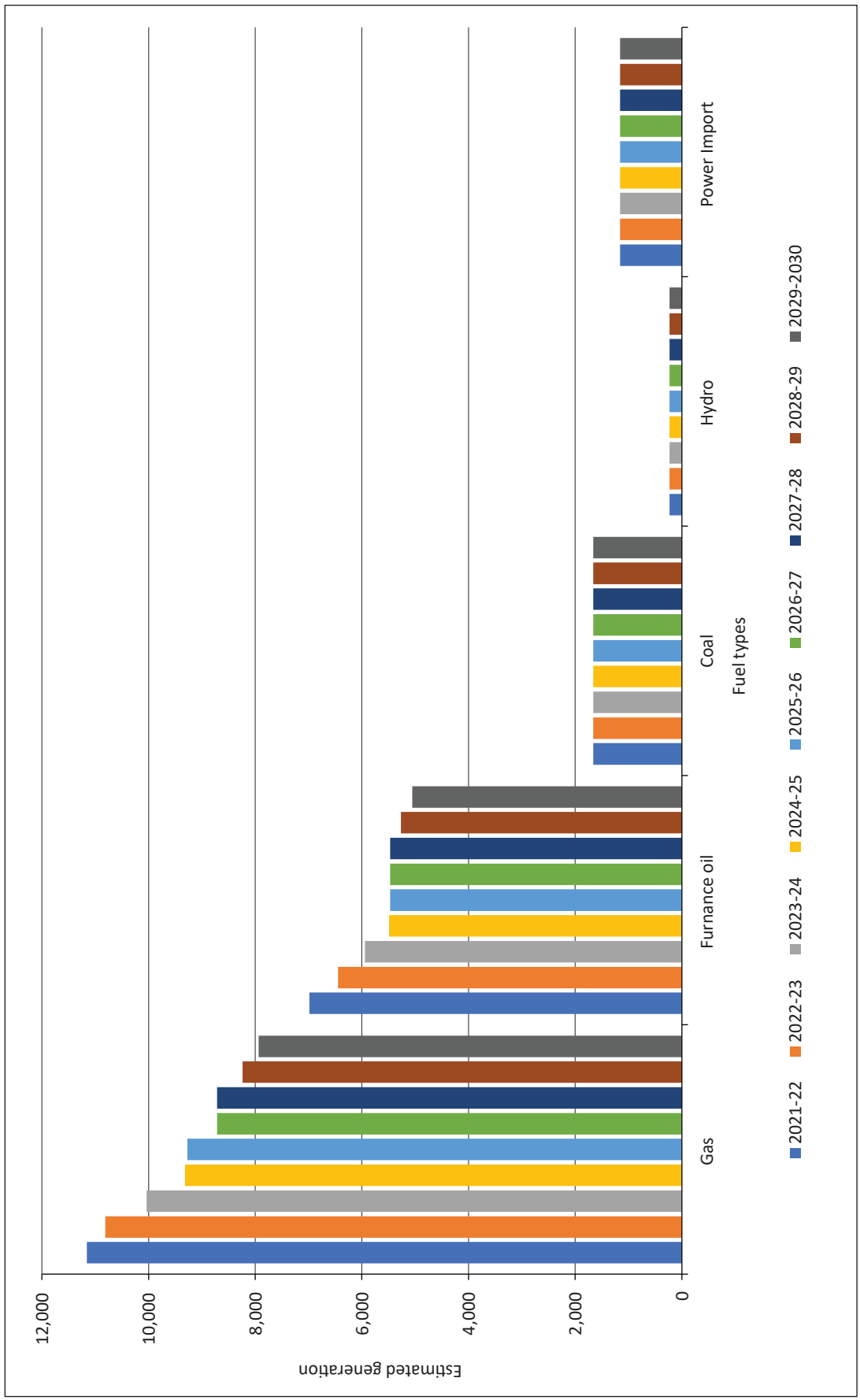
A possible alternative source of energy could be renewable energy. In recent years, renewable sources, mostly solar power, and hydro, have generated barely 4.5 per cent of electricity. This share is insufficient for the country's long-term electricity needs, especially as fossil fuel supplies from the local sources diminish. However, establishment of renewable energy-based power plants experienced many obstacles due to government's discriminatory policy support for the fossil fuel-based power plants over renewable energy-based power plants.

The detailed source-wise and year-wise energy projection has been made in the IEPMP. This study uses those projected energy-mix for 2030 to provide an indication on changing future energy composition as per government document. Figure 1 presents the year wise energy breakdown till 2030. It is noteworthy that the electricity generation from gas and furnace oil will be reduced over the years. Recent surveys indicate a decline in gas production of 286.4 mmcfd over the past two years. This downward trend is expected to continue, potentially leaving Bangladesh completely out of any gas use by 2030–2041. The decrease in gas output in Bangladesh emphasises the need for diversification and investment in alternate energy sources. The government should prioritise alternative energy initiatives like solar and wind power to lessen dependence on diminishing gas reserves.

Despite skyrocketing fuel oil prices amid the war in Ukraine, the administration has planned to increase fuel oil imports by about 15 million tonnes in 2023 (Hossain, 2023). The decline of power generation by this source is not as steep as gas. IEPMP, before it is approved, needs to be more stringent about this source since it has been creating pressure in the foreign exchange reserve for the last two fiscal years. The share of coal-generated power remains to be constant as per IEPMP. Due to the newly built coal-based power plants, these plants need to be run until their generation period is fulfilled. The total fuel-based transition shows a positive sign and room for generating power from the renewable energy source. However, the import issues of power, coal, LNG and furnace oil need to be looked after and rather than importing these fuels and losing the foreign reserve, that expenditure can be made in the renewable energy sector.

Overall, the structure and composition of energy-mix in the country is likely to be changed in the coming years. However, the energy transition would not be so fast as it is expected because of continuous reliance on fossil fuels, carbon lock-in and barriers in investment in renewable energy. Whether the pace of energy transition is slow or fast, such a transition is likely to cause a major transition to employment in the power and energy sector in the coming years. Following sections will review the structure of employment and skills in the power and energy sector of Bangladesh at present, will estimate the possible employment transition from fossil-fuel based power plants to solar-based power plants and possible changes in skills in the power sector by 2030.

Figure 1: Annual electricity generation breakdown by fuel sources



Source: IEPMP.

5. STRUCTURE OF EMPLOYMENT AND SKILLS IN THE POWER AND ENERGY SECTOR IN BANGLADESH

5.1 Structure of Employment

The Labour Force Survey of 2017 reported a total of 37 different categories of jobs in six different categories which are found in the power and energy sector. These jobs are mainly related to technical operation, management, financing, and IT. However, not all these jobs are related to the power sector. Table 1 presents the list of jobs that are observed in different segments of the power and energy value chain.

Table 1: Jobs in the power and energy sector of Bangladesh

Job Type	Jobs
A. Management	• Managing directors and chief executives • Business services and administration managers • Sales and marketing managers • Manufacturing managers • Construction managers
B. Finance	• Finance managers • Financial, bank, and insurance services • Accountants
C. Technical Personnel	• Mining supervisors • Manufacturing supervisors • Construction supervisors • Power production plant operators • Electrical engineering technicians • Electronics engineering technicians • Power production plant operators • Electrical engineers • Mechanical engineers • Chemical processing plant controllers
D. Field Personnel	• Miners and quarriers • Well drillers and borers • Metre readers
E. IT	• Information and communications technologists
F. Support Staff	• General office clerks • Accounting and bookkeeping clerks • Stock clerks • Cooks • Building caretakers 28. Blacksmiths and hammersmiths • Electrical and electronic equipment assistants • Drivers • Cleaners • Freight handlers • Garbage and recycling collectors • Security guards • Insulation workers • Plumbers and pipe fitters

Source: Labour Force Survey, 2017.

5.2 Structure of Occupation

The study identified occupations in power plants based on key informant interviews with the power plants. According to the respondents one set of occupations is related to small and medium scale power plants, while some additional occupations are identified in large scale power plants. Table 2 presents the occupational composition in all categories of power plants. These occupations are found in a power plant in five different categories including – (a) engineer, (b) manager, (c) field operators, (d) sales and (e) services. Each of these occupations have specific job responsibilities for which they need specific skills. In general, most of the occupations are highly technical and require specialised knowledge, skills and experience.

Table 2: Occupational composition in all categories of power plants

Occupation	Major tasks and required skills
Engineering	• Business case development • Architecting and structuring • Design development, approval, and plan submission • Cost estimation • Equipment and machinery sourcing • Innovative mindset
Manager	• Field operation management • Strategic business planning • Programme guide and regulation design and disbursement • Performance evaluation • Project design, development, and implementation • Field-office communication
Field operators and technicians	• Field office management • Administration and security of field office • Reporting and logistic support • Product installation • After sale service • Construction monitoring • Designing training activities • Task management and supervision • Field collection of money • Test and trial operation • Tech-savviness
Salesperson	• Selling product • Building up customer relation • Motivational skill
Service staff	• Day-to-day field activity • Solving customer problem • Assisting system installation • Assisting after sale service • Construction, wiring and connection • Regular field visits and monitoring • Tech-savviness

Source: Authors' compilation from literature review and KIIs.

It is important to note that large plants often operate using a department-based organisational structure, which distinguishes them from small and medium-sized firms and plants. The study identified three prevalent departments within major enterprises that exhibit a comparable or higher level of occupational composition in comparison with small and medium-sized power plants. Table 3 presents the additional occupations that are observed in large scale power plants. These power

generation-related occupations include design engineer, lead engineer, technician, and operator. Like other occupations in small and medium sized power plants, these occupations are also highly technical for which they need specialised skills and experience.

Table 3: Additional occupations requires in large power plants

Department	Occupation	Tasks and Skills
Customer Interaction	Design Engineer	• Facing customers • Customer inquiry and record data • Design and development • Cost estimation • Design validation • Equipment and machinery sourcing • Offer submission
Implementation	Lead Engineer	• Project mobilisation • Hiring contractors • Managing technicians
	Technician	• System installation • Running trial operation
Operation and Maintenance	Operator	• Guiding technicians • Machine operation • Maintenance
	Technician	• Operation and maintenance
	Sales and Service worker	• Selling of product • Service providers

Source: Authors' compilation from literature review and KIIs.

6. ESTIMATING TRANSITION IN EMPLOYMENT IN THE POWER SECTOR OF BANGLADESH BY 2030

This section estimates the overall transition of employment due to transition in the power sector by 2030. The impact on employment will depend on what level of energy transition is likely to take place by 2030. This study considers the energy transition as stipulated in the Mujib Climate Prosperity Plan. Two types of energy related transition will take place and likewise the employment related transition will occur by 2030—(a) Decrease in energy use in power generation from fossil fuels and likely decrease in employment in fossil-fuel based power plants; (b) Increase in renewable energy use in power plants and thereby increase in employment in renewable energy-based power plants. However, no change in energy efficiency is considered between 2023 and 2030 which is a limitation of the study.

The changes in energy use in the power generation plants between 2023 and 2030 have been reported in Table 4. The projection of power generation by 2030 is presented under two scenarios- (a) MCPP scenario; and (b) MCPP-M scenario. For details, please see the methodology section of the report.

As per MCPP scenario, overall projected generation of electricity will reach 28,975 MW in 2030 (from 26,017 MW in 2023). Of these, the major share of power generation will come from fossil fuel even after the transition in 2030 (82.6 per cent) which is lower than the current share of fossil fuel in power generation (95.4 per cent). On the other hand, use of renewable energy in power generation will reach 17.4 per cent by 2030 (which is only 4.6 per cent now). Overall reduction in

fossil fuel use in power generation will cut its share by 27.8 per cent; on the other hand, the share of renewable energy will rise by 80.1 per cent within a span of seven years.

As for MCPP-M scenario, projected generation of electricity will reach 53,334 MW in 2030. Fossil fuel will cover 37,334 MW (70 per cent) which is still lower than the current share of fossil fuel in power generation (95.4 per cent). On the other hand, use of renewable energy in power generation will reach 30 per cent by 2030 (which is only 4.6 per cent). Overall reduction in fossil fuel use in power generation will cut its share by 30 per cent; on the other hand, the share of renewable energy will rise by 1,240 per cent within a span of seven years. Following sub-sections have estimated the impact on employment because of changes in the energy-mix in power generation in Bangladesh by 2030.

Table 4: Power generation in 2023 and 2030

Year	2023	2030 (as per MCPP)	2030 (as per MCPP-M)
Total Projected Generation	26017 MW	28975 MW	53334 MW
Projected Generation from Fossil Fuel	24823 MW	17945 MW	37334 MW
Projected Generation from Renewable Energy	1194 MW	6000 MW	16000 MW
Decrease of generation through fossil fuel	-	27.8 per cent	30 per cent
Increase of generation through renewable energy	-	80.1 per cent	1240 per cent

Source: Authors' calculations.

6.1 Employment Impact on Renewable Energy-Based Power Plants (As per MCPP)

This paper just considers the direct employment impact of renewable energy expansion. Direct job impacts are jobs created in the design, manufacturing, delivery construction/installation, project management and operation and maintenance of the technology. Indirect employment refers to upstream and upstream and downstream suppliers. We use the direct job coefficients from a meta study done by Wei et. al. (2010). We consider 'two job function groupings: (1) construction, installation, and manufacturing (CIM) and (2) operations, maintenance and processing.' (Wei et al. 2010). The employment coefficients 'is normalised to total jobs per average megawatt (MW) by dividing per peak megawatt by the capacity factor, where the capacity factor is the fraction of a year that facility is in operation.' We also assume that the majority of the RE will be generated through Solar thermal plants (85 per cent), a smaller portion would come from large biomass plants (10 per cent) and wind (5 per cent). The table below shows the employment coefficients that are used following Wei et al. (2010). We take the average of the all the sources identified from the meta studies.

Table 5: Employment multiplier coefficients (total jobs created per MW of new RE)

Type of RE	Total Jobs/MWa (CM)	Total Jobs/MWa (O & M and Processing)
Biomass	0.19	1.61
Wind	0.80	0.09
Solar Thermal	0.69	1.34
Solar PV	5.10	2.48

Source: Fragkos and Paroussos, 2018.

Note that the CM job coefficients for three sources except solar PV are less than 1 whereas the O & M and processing job coefficients are greater than 1 for three sources except Wind. As wind energy has less potential in Bangladesh compared to solar PV, solar thermal and biomass energy—the employment impact will be highly positive. The solar PV, solar thermal and biomass RE jobs will also be more spatially diversified though with lower earnings.

The expansion of renewable energy-based power generation will take place in two forms— (a) off-grid based power generation; and (b) on-grid based power generation. At present, off-grid based power generation accounts for about 31 per cent of total renewable energy-based power generation. These off-grid REs are also mostly solar PVs. According to the industry experts, the off-grid based renewable energy-based power generation is less likely to grow in the future. In estimating the future growth or renewable energy in power generation, the absolute amount of off grid-based power generation has been kept constant. Therefore, the total amount of on-grid based power generation from renewable energy by 2030 is likely to be 4661 MW. The following calculation shows the estimated power generation (equation 1).

a) Existing Renewable Off grid is 368.77 MW (30.9 per cent of total renewable energy)
As per KII, renewable off-grid is less likely to expand further.
So, on-grid renewables in 2030 will be (6000-368.77) MW= 5631.23 MW ……. (1)

The projected composition of employment in renewable energy-based power plants by 2030 considering of the changing composition of electricity from off-grid and on-grid will be 2,796 and 10,982 respectively. The following equations (equations 1 and 2) present those calculations.

b) On-grid RE will be 5631.23 MW. We assume 85 per cent of this will be Solar Thermal – 4,786.55 MW, 10 per cent biomass – 563.12 MW and 5 per cent wind – 281.56 MW. We use the employment coefficients from table 5 to estimate the employment generation.
Solar Thermal: [(4786.55 X 0.69) + (4786.55 X 1.34)] = 9717 jobs.
Biomass: [(563.12 X 0.19) + (563.12 X 1.61)] = 1014 Jobs.
Wind: [(281.56 X 0.8) + (281.56 X 0.09)] = 251 jobs.
So, 5631.23 MW will employ 10,982 people by 2030……. (2)

c) Off-grid is assumed to be 368.77 coming from solar PVs.
So, 368.77 MW generation will employ [(368.77 X 5.1) + (368.77 X 2.48)] = 2,796 by 2030…. (3).

d) So, by 2030, renewable energy will generate in total [2] + [3] = 13,778 people ….. (4)

6.2 Employment Impact on Renewable Energy-Based Power Plants (As Per MCPP-M)

For the maximised scenario,

a) Existing Renewable Off grid is 368.77 MW
As per KII, renewable off-grid is less likely to expand further.
So, on-grid renewables in 2030 will be (16000-368.77) MW= 15631.23 MW ……. (5)

The projected composition of employment in renewable energy-based power plants by 2030 considering of the changing composition of electricity from off-grid and on-grid will be 154,515 and 15,631 respectively. The following equations (equations 6 and 7) present those calculations.

b) Within the on-grid, we assume 85 per cent from solar thermal (13,286.55 MW), 10 per cent from biomass (1,563.12 MW), and 5 per cent from wind (781.56).
Solar Thermal: [(13,286.55 X 0.69) + (13,286.55 X 1.34)] = 26,972 jobs.
Biomass: [(1563.2 X 0.19) + (1563.12 X 1.61)] = 2,814 Jobs.
Wind: [(781.56 X 0.8) + (781.56 X 0.09)] = 696 jobs.
So, 15631.23 MW will employ 30,302 people by 2030……. (6)

e) Off-grid is assumed to be 368.77 coming from solar PVs.
So, 368.77 MW generation will employ [(368.77 X 5.1) + (368.77 X 2.48)] = 2,796 by 2030…. (7)

c) So, by 2030, renewable energy will generate in total [6] + [7] = 33,098 people ….. (8)

There are a few limitations to this estimation. The most important one is that the energy efficiency related impacts are not taken into account which can significantly impact energy use and related employment. Government incentives, policies and on-grid connectivity may change the scenario too. We have assumed an 85 per cent solar thermal, 10 per cent biomass and 5 per cent wind and constant solar PV in the above estimation. Any changes in these percentages may change the employment scenario. But our estimation is the best possible estimation given the current data availability.

6.3 Employment Impact on the Fossil Fuel-Based Power Plants

The employment impact of fossil fuel-based power plants will depend on the type of power plant – small, medium, and large-scale power plants. These three types of fossil fuel-based power plants have been categorised based on the level of power generation capacity of these power plants. According to the key informant interviews, there is a thumb rule for minimum required employment in a fossil fuel-based power plant. Taking that into account, the employment of individual and total power plants of different categories have been calculated for the year 2023. At present, a total of 121 power plants are in operation of which majority are small sized (<50 MW) and medium sized (50-499 MW) power plants. Table 5 presents the estimated employment in fossil fuel-based power plants by 2023. The total employment in 2023 in fossil fuel-based power plants is 23,050.

Table 6: Number of people working on various types of power plants in 2023

Power plant type	Number of Power Plants	Production capacity	Average number of people required	Approximate number of people working in the power plant
Small	45	<50 MW	40	1,800
Medium	69	50-499 MW	150	10,350
Large	7	>500 MW	700	4,900
Total number of people				**17,050**

Source: Fragkos and Paroussos, 2018.

Considering the ratio of employment and power generation in fossil fuel-based power plants in 2023, a projection is made for the employment for 2030 in these power plants. According to Table 4, the total power generation from fossil fuel-based power plants will be reduced to 17,945MW in 2030 from the existing level of 24,823 MW. Hence, the proportionate number of employments by 2030 in fossil fuel-based power plants will be 16,663 as per MCPP and 25,644 as per MCPP-M.

6.4 Net Employment Impact

From the above discussion, it is evident that in the fossil fuel industry, there will be a few losses of jobs. However, the renewable energy sector will generate a significant number of new jobs and the overall net employment impact will be positive i.e., more new jobs will be created in both the scenarios. Table 7 presents the net employment impact due to energy transition in the country by 2030.

Table 7: Net employment in power generation by 2030

Types of plants	2023	2030 (MCPP)	2030 (MCPP-M)	Net employment in 2030 (as per MCPP)	Net employment in 2030 (as Per MCPP-M)
Renewable energy-based power plants	4472	13778	33098	8919	37220
Fossil fuel-based power Plants	17050	16663	25644		
Total employment	21522	30441	58742		

Source: Authors' calculations from KIIs.

According to Table 7 approximately 58,9q9 new jobs would be created after the energy transition in 2030 as per MCPP. However, the number of creating jobs would be significantly high (37,220 approx.) if the energy transition takes place at a significant level.

7. REQUIRED SKILLS SET AND NEWLY DEMANDED OCCUPATIONS IN THE PROCESS OF ENERGY TRANSITION

Table 8 presents a compilation of renewable energy occupations that are now experiencing significant levels of demand. The compilation of this list is derived from the findings obtained from KIIs and desk research. Jobs have been differentiated in three categories – (a) sector-wise; (b) skill-wise; and (c) occupation-wise. In case of sector-wise jobs, the solar sector holds a prominent position in Bangladesh, thereby resulting in a significant need for jobs within this sector.

Table 8: List of jobs with high demand

Type of RE	Total Jobs/MWa (CM)	Total Jobs/MWa (O & M and Processing)
Sector-wise	High Demand Medium Demand Low Demand	Solar Jobs Biogas and Hydropower Jobs Wind Jobs and others
Skill-wise	High Demand Medium Demand Low Demand	Jobs that require minimal training STEM Professionals Non-STEM and Administrative Professionals
Occupation-wise	High Demand Medium Demand Low Demand	Skilled Engineers Skilled Technicians Management, Sales, Service

Source: Authors' compilation from KIIs and Desk Research.

In the case of the skill-wise category, there is a significant demand for employment that necessitates less training. In case of occupation wise category, the scarcity of trained engineers in Bangladesh as a profession has resulted in a significant demand for individuals with engineering expertise. The demand for skilled technicians is moderate, yet it is somewhat easier to locate trained technicians compared to skilled engineers. As a result, skilled technicians fall within the medium demand group.

The shift from utilising energy sources derived from fossil fuels to those derived from renewable sources is anticipated to generate a diverse array of employment prospects spanning multiple industries. This transition encompasses not just the production of energy but also alterations in infrastructure, technology, and legislation. The energy shift to renewables has the potential to give rise to several novel career vocations including:

a) Renewable Energy Technicians: There will be a growing demand for technicians who possess specialised expertise in the installation of solar panels, maintenance of wind turbines, upkeep of hydroelectric systems, and operations of geothermal plants.
b) Energy Storage Specialists: The incorporation of renewable energy sources into the power grid necessitates the presence of proficient individuals specialising in energy storage technology, such as batteries and pumped hydro storage.
c) Smart Grid Engineers: Professionals engaged in the design, development, and management of smart grid technologies, which facilitate the seamless integration of renewable energy sources and enhance the stability of the grid.
d) Energy Analysts: These professionals specialise in the examination of energy markets, evaluation of the potential for renewable energy, and offer valuable insights into the economic and environmental consequences of transitioning to alternative energy sources.
e) Environmental Planners and Consultants: Professionals with expertise in evaluating the environmental consequences of renewable energy initiatives, who strive to adhere to regulatory requirements and mitigate ecological disturbances.
f) Energy Efficiency Experts: Professionals in the field collaborate with several sectors, including industries, buildings, and transportation, with the aim of optimising energy efficiency and mitigating overall energy consumption.
g) Green Building Designers and Architects: Architects and designers place their emphasis on the development of energy-efficient and sustainable building designs, which involve the integration of renewable energy systems.

8. PROBABLE INVALID JOBS IN THE TRANSFORMED POWER AND ENERGY SECTOR OF BANGLADESH

Renewable power plants, namely solar, wind, hydroelectric, and geothermal facilities, exhibit notable distinctions from fossil fuel-based power plants regarding their technological aspects, operational procedures, and environmental ramifications. Consequently, there exist specific occupational positions that are frequently present in power plants reliant on fossil fuels, which may not be necessary or may possess diminished importance in renewable power plants. Some of them are as follows:

a) ***Fuel Handling and Storage Personnel:*** Fossil fuel power plants necessitate the presence of personnel who are tasked with the responsibility of managing, transporting, and storing coal, oil, or natural gas. Renewable power plants operate without the requirement for fuel purchase or handling, as they derive their energy from natural sources such as sunshine, wind, or water flow.

b) ***Ash Disposal and Pollution Control Specialists:*** Fossil fuel power facilities generate byproducts such as coal ash and release harmful substances including sulphur dioxide and nitrogen oxides. Renewable facilities often exhibit reduced emissions and generate fewer waste byproducts, hence diminishing the significance of roles associated with pollution control and ash disposal.
c) ***Boiler Operators and Combustion Engineers:*** Boiler operators and combustion engineers play a crucial role in fossil fuel facilities by overseeing the combustion process and heat generation. The presence of these positions is seen as unnecessary in renewable power plants that employ non-combustion methods to generate electricity.
d) ***Flue Gas Desulfurisation (FGD) Technicians:*** FGD specialists have the primary responsibility of operating and maintaining equipment designed to mitigate Sulphur dioxide emissions originating from fossil fuel plants. In the context of renewable plants, the absence of combustion renders these tasks irrelevant.
e) ***Coal Yard Workers and Conveyor Operators:*** These responsibilities encompass the oversight of coal transportation and storage within fossil fuel power plants, which do not apply to renewable energy facilities.
f) ***Oil and Gas Refinery Workers:*** These individuals are responsible for the refinement and processing of fossil fuels, with the ultimate aim of utilising them in the generation of power. Renewable plants do not necessitate the process of fuel refinement.

Nevertheless, it is crucial to acknowledge that although these positions may have diminished significance in renewable power facilities, the shift toward renewable energy sources might also generate novel employment prospects. The renewable energy industry frequently necessitates the expertise of technicians, engineers, project managers, and maintenance personnel who possess specialised proficiencies in several domains, including but not limited to solar panel installation, wind turbine maintenance, grid integration, and energy storage systems.

As the energy sector transforms, employment positions have the potential to undergo modifications and adjustments in response to emerging technology and shifting environmental concerns. It is noteworthy to acknowledge that there may exist a degree of skill set overlap between fossil fuel and renewable power plants, given that numerous technological proficiencies can be used across various energy technologies.

9. POLICY RECOMMENDATIONS

This study finds that the energy transition by 2030 will create net positive employment. Even though the number of newly generated employment could be rather low, the number indicates that new employment sectors will also open up in the transformed power and energy sector.

It is evident that through the transition from fossil fuel-based power to renewable energy, several people will lose their jobs. However, a lot of new job opportunities will also open, and as per KIIs, a lot of people can just easily shift from one industry to the other through their prior working experiences. But it is also important to look after the fact that the current workforce is skilled enough to adjust in the transition so that their income generation is not hampered.

Considering all these, the following recommendations can be made:

a) Invest in Workforce Development

Designing and implementing comprehensive training and skill development initiatives that effectively equip the workforce with the requisite competencies for the renewable energy industry must be ensured. Engagement in collaborative efforts with educational institutions to develop curricula that are in line with the dynamic requirements of the industry must be made. Vocational training centres with a specific focus on renewable energy technologies must be established. Training should be provided on building green buildings and for renewable energy technicians to accelerate the development of renewable infrastructures.

b) Formulate Pragmatic Policies

Rather than making generalised policies for job transitions, the policies should fix achievable, practical goals. The policies should set a fixed time limit and the outcomes should be predictable which means, policies should indicate how the job transition will take place through fiscal and logistical supports and through what kind of institutional supports. In Southern Australia, the province has their own policy for those who are going through employment transition due to the energy transition in the country. They are collaborating among federal governments, communities, agencies and development bodies, the education sector, and the clean energy industry so that their formulated policy addresses all the relevant issues to smoothen the post-transition employment period.

c) Replication of Globally Successful Measures

Countries like Germany and Spain devised measures like 'Energiewende' and feed-in-tariff to promote energy transition in their countries. These policies also ensured the employment transition to face as few obstructions as possible. Globally successful and unique measures could be tailored as per the country's energy and employment landscape.

d) Redesigning Academic Courses

Industrial collaboration should be made with educational institutions like engineering schools while making curriculum. Universities like MIT regularly does this. Faculty members should be trained as well so that they are also aware of the job market demand for graduates. Courses like Industrial and Production Engineering should add the renewable dimension in their curriculum design in Bangladesh.

e) Promote Industry-Academia Collaboration

The establishment of strong partnerships between academic institutions, such as universities and colleges, and renewable energy firms is of utmost importance in fostering a mutually beneficial educational setting. By fostering these alliances, prospects for internships, co-operative research endeavours, and the dissemination of knowledge might thrive. In addition, the implementation of collaborative initiatives can offer students significant practical training and direct involvement in practical projects, giving them the necessary expertise and understanding to thrive in the ever-evolving field of renewable energy. Renewable energy related industries can collaborate with the

engineering schools of the country to inform about their incentives and the requirements for joining their industry after graduation.

f) Support Local Manufacturing

The establishment of a local renewable energy manufacturing industry is crucial in order to attain self-sufficiency and foster economic development. Countries can stimulate their industrial sector and enhance employment prospects by providing incentives for the domestic manufacture of crucial components such as solar panels, wind turbines, and related equipment. These incentives not only have the effect of decreasing dependence on imported goods but also promote the development of new technologies and innovations in the field of renewable energy. These measures not only enhance energy security but also enable nations to actively participate in the global transition towards sustainable energy alternatives. South Korea has been so successful in this regards that they export raw materials for renewable energy technology to China.

g) Create Green Jobs Reporting Mechanisms

The implementation of transparent reporting procedures can have a significant impact on assessing the transformative effects of renewable energy initiatives. Transparency is strengthened through the implementation of a requirement for enterprises to publish the number of green employments generated as a direct outcome of their efforts in the field of renewable energy. This enables a comprehensive comprehension of the precise employment contributions made by various efforts. Furthermore, via the regular monitoring and transparent dissemination of data on the growth of environmentally friendly employment opportunities, it becomes possible to accurately trace the progress of the shift towards sustainable energy. These indicators not only promote accountability but also offer vital insights into the sociological and economic changes brought about by the implementation of renewable energy technologies. Countries like Singapore and Netherlands are regularly using this mechanism to ensure the skilled personnel in the renewable energy sector are finding their suitable jobs. USA also maintains a national database through which anyone can access a personnel's profile and can hire or consult for their services.

h) Develop Transition Plans for Fossil Fuel Workers

The establishment of efficient transition programmes holds significant importance in allowing individuals employed in the fossil fuel industry to effectively navigate the transition toward renewable energy sources. Through the development and implementation of comprehensive projects, individuals can acquire the essential resources and skills required to smoothly navigate the move into various positions within the renewable energy sector. The provision of financial assistance additionally strengthens these endeavours, thereby permitting a more seamless and enduring transition for workers. Poland is currently providing financial assistance to those use used to work in the coal mines. They are also being trained to transit into the renewable energy sector. These programmes not only serve to protect and support individuals' means of living, but also play a role in cultivating a workforce that can adjust to change, displaying resilience, and aligning with the requirements of a more environmentally friendly and sustainable energy sector.

i) Future Scope of Research

Though the study does not highlight the backward linkage of employment in domestic production, that is still something to be considered for future research in the energy employment transition

sector. Existing public data completely ignored the number of people working in the renewable energy sector of the country. It is expected that HIES and LFS should acknowledge the future renewable energy value chain and thus reflect them in their reports. The lack of data disallowed the study to look at the gender dimension. However, existing reports showed that off-grid renewable energy sector is dominated by women. So, gender-wise data of skills should be reflected in the studies of Bangladesh Bureau of Statistics.

The purpose of these recommendations for policy is to effectively tackle the various issues and capitalise on the potential opportunities that arise from the energy transition within Bangladesh's power and energy industry' employment sector. The primary objectives of these initiatives are to promote long-term economic development, generate job prospects, and support a seamless shift towards sustainable and renewable energy alternatives.

REFERENCES

Alam, S. (2023). *Bangladesh should plan for energy security,* not just electricity access. IEEFA. https://ieefa.org/resources/bangladesh-should-plan-energy-security-not-just-electricity-access

Azhgaliyeva, D., Kapoor, A., & Liu, Y. (2019). Green bonds for financing renewable energy and energy efficiency in South-East Asia: a review of policies. *Journal of Sustainable Finance & Investment, 10*(2), 113–140. https://doi.org/10.1080/20430795.2019.1704160

Baker, D., & Bernstein, J. (2013). *Getting back to full employment: A Better Bargain for Working People*. Center for Economic & Policy Research.

Grübler, A., et al., (2018). A low energy demand scenario for meeting the 1.5 °C target and sustainable development goals without negative emission technologies. *Nature Energy*, 3(6), 515–527. https://doi.org/10.1038/s41560-018-0172-6

Hossain, M. A., Ferdous, N., & Ferdous, E. (2023). Crisis-Driven disruptions in global waste Management: impacts, challenges and policy responses amid COVID-19, Russia-Ukraine war, climate change, and colossal food waste. *Environmental Challenges, 14*, 100807. https://doi.org/10.1016/j.envc.2023.100807

Murshed, F., Sen, S., Savitskie, K., & Xu, H. (2021). CSR and job satisfaction: Role of CSR importance to employee and procedural justice. *Journal of Marketing Theory and Practice, 29*(4), 518–533. https://doi.org/10.1080/10696679.2021.1877156

Oberthür, S. (2019). Hard or soft governance? The EU's climate and energy Policy Framework for 2030. *Politics and Governance, 7*(1), 17–27. https://doi.org/10.17645/pag.v7i1.1796

Renewable Energy and Jobs. (2023). *Renewable Energy and Jobs - Annual Review 2022*. IRENA. https://www.irena.org/publications/2022/Sep/Renewable-Energy-and-Jobs-Annual-Review-2022

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