Draft

CPD Dialogue on
Energy Transition in Bangladesh: Employment and Skills

Study on
Energy Transition in Bangladesh
Its Implication on Employment and Skills in the Power and Energy Sector

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1. Introduction

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- The global energy sector is undergoing a **significant transformation** to promote sustainability and combat climate change
  - Bangladesh is also part of this shift
- In Bangladesh, the energy sector is overwhelmingly dominated by fossil-fuel, accounted for **91 percent** of total energy supply
  - The share of renewable energy comprises only **4.5 per cent** of the total energy supply
- The smooth **energy transition** as well as consequent employment transition in Bangladesh **would not be so easy**
  - This is because of pre-dominance of the fossil fuel-based **energy infrastructure, energy institutions, energy related human resource base** in the country
- Different countries will **experience varying employment opportunities**, with growth in renewable energy sectors and job losses in fossil fuel industries
  - The global transition to clean energy is expected to create **millions of new jobs by 2030** while negatively impacting some traditional energy sectors
- **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**
  - A corresponding increase in job prospects is expected in the construction and installation of solar photovoltaic panels, concentrating solar power plants, wind turbines, geothermal facilities, as well as tidal and wave devices

1. Introduction

- The impact of energy transition on employment, especially in the context of **Bangladesh,** is relatively **unexplored**, with a focus on environmental sustainability over job sector considerations
- Bangladesh is committed to sustainable energy development, aiming to generate **40 percent** of its power from renewable sources by 2030
    - Meeting renewable energy goals will require **upgrading** the **country's human resource base**
- The main objective of this study is to examine the **impact of transition** in the power sector on employment and skills
    - **Identifying** the structure of employment in the power sector of Bangladesh
    - **Analyzing** the possible structure of energy transition and **implications on employment** and skills in the power sector
    - **Estimating** the net employment position in the transformed power and energy sector
    - **Recommending** supportive policies to ensure an improved employment scenario in the power and energy sector

2. Methodology

2. Methodology

- The study has explored **data on skills and employment** in the power and energy sector of Bangladesh
- The study focuses on the short-term transition in Bangladesh's power sector, primarily targeting the year 2030
  - The **Mujib Climate Prosperity Plan** (MCPP) 2023 sets **decade-wise targets** for this transition
  - The study specifically considers the **MCPP and MCPP-M** scenarios, excluding other draft policies due to concerns about their energy transition targets
- 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**
- The study estimates employment requirements for different types of power plants in 2030 using **approximations based on discussions** with key stakeholders
- The study was conducted using a combination of **qualitative and quantitative methods**, including desk research, key informant interviews (KII), and field visits to various power plants, such as solar, wind, and coal-based facilities
  - The study utilizes data from the Bangladesh **Labour Force Survey 2017**
  - Key informant interviews were conducted with representatives from relevant power plants and energy-related institutions, ensuring a comprehensive approach to the research

2. Methodology

- 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
  - Hence, the estimated projected employment in the power sector **may not be representative** of the power and energy sector of Bangladesh
- We consider **'two job function' groupings**:
  - Construction, installation, and manufacturing (CIM) and
  - Operations, maintenance and processing' (Wei et. al. 2010)
- The employment coefficients 'is **normalized** 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.'
- There are **differences in job coefficients** for various renewable energy sources in Bangladesh
  - The coefficients for construction, installation, and manufacturing (CM) are **less than 1** for all sources except solar PV
  - Coefficients for operations, maintenance, and processing (O&M) are **greater than 1** for all sources except wind

2. Methodology

- The expansion of renewable energy-based power generation in Bangladesh is expected to occur in two forms: **off-grid and on-grid**
  - Presently, off-grid power generation accounts for approximately 31% of total renewable energy-based power generation, primarily from solar PV
  - However, industry experts suggest that off-grid power generation is **unlikely to grow** significantly in the future
- To estimate future growth in renewable energy, the paper assumes that **off-grid power generation remains constant**, resulting in a total on-grid power generation from renewable energy of 4,661 MW by 2030.

3. An Overview of Energy Transition and Its Implications on Employment Transition

3.1 Experience of Energy Transition on Employment and Skills

- 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)
  - The energy transition involves various players and technologies, requiring **interdisciplinary skills** encompassing **engineering, economics, environmental science, and politics** for successful management
  - As energy infrastructure becomes more **interconnected and digitized**, the need for **cybersecurity experts** to protect against cyberattacks on critical energy systems becomes increasingly important

Generation

- The power and energy sector undergoes significant changes during an energy transition, moving from fossil fuels to more sustainable sources like renewables
  - This shift requires a new set of skills and knowledge in the industry. Expertise in technologies such as **wind, solar, hydro, and geothermal power** is increasingly vital, especially in the **design, installation, operation, and maintenance** of renewable energy systems
  - Energy **storage technology**, like batteries, is also essential, leading to a demand for **skills in their design and management**
  - **Proficient project administration** skills are crucial for the successful execution of **large-scale** renewable energy projects and system upgrades
  - **Effective communication and community** engagement are key in gaining support and fostering collaboration within communities and among stakeholders during energy transition programs

3.1 Experience of Energy Transition on Employment and Skills

Transmission and Distribution

- **Smart grids and grid integration** are vital for addressing the challenges of renewable energy variability and enhancing **grid resilience**
    - Skills in **grid management, data analytics, and cybersecurity** are necessary for effectively overseeing and safeguarding the dynamic energy

Energy Use

- The power and energy sector's increasing reliance on data necessitates expertise in **data analytics and artificial intelligence (AI) to optimize energy production**, consumption, and resource management through data-driven decision-making
- **Energy efficiency** is a key focus in the energy transition, emphasizing the importance of skills related to **energy audits, building retrofits**, and the adoption of energy-efficient technology to reduce overall energy consumption

Environmental and sustainability

- **Proficiency in environmental impact assessments, carbon accounting**, and the implementation of sustainable energy practices can greatly contribute to the promotion of eco-friendly energy solutions

3.2 Successful Countries in Employment Transition after Energy Transition

Germany

- Set example in effectively navigating job shifts throughout the transition
- The "**Energiewende" policy emphasizes** on fostering employments opportunities within the renewable energy industry
- Investments have been made in initiatives focusing on **increasing worker-training** and development, establishing **regional innovation clusters** for providing support to clean energy sector

Denmark

- Frontrunner in the field of **wind energy**, effectively fostering employment creation within the wind power sector
- The government's incentives to support wind energy projects and allocation of resources towards **research and development** endeavours have stimulated innovation within the sector
- Significant increase in employment opportunities within the renewable energy sector

Sweden

- Addresses employment transitions by providing **training and social safety nets**
- Prioritizing **green innovation** has created jobs in the clean energy sector

Canada

- Canada implements just transition measures, especially in fossil-dependent provinces like Alberta, with **governmental, industrial, and labor union cooperation**
- Investments in renewable energy contribute to clean energy employment

3.2 Successful Countries in Employment Transition after Energy Transition

Spain

- Spain promotes renewable energy through policies, creating employment opportunities in the renewable energy sector

The United States

- Different states, including California and Texas, implement **employment transition regulations,** supporting renewable energy, workforce development, and clean technology innovation.
- Federal programmes like **Trade Adjustment Assistance** aid those affected by global economic changes

South Korea

- "**Green New Deal**" initiative invests in green technologies, renewable energy projects, and job training to promote employment in the green economy while reducing carbon emissions

Scotland

- Focuses on regional economic growth and community benefits through **wind, wave, and tidal energy** initiatives, extending job benefits to impacted regions

Australia

- **Retraining initiatives and investments** in renewable energy projects aim to create jobs in the clean energy industry, particularly for areas affected by declining coal mining

3.3 Financing Issues in Case of Employment Transition

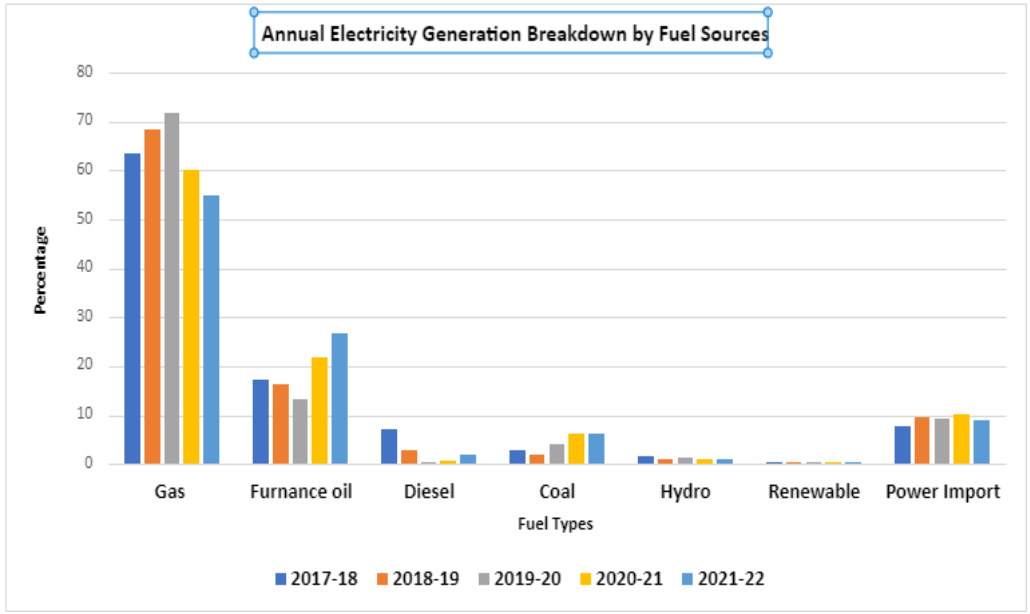
- **Retraining and Reskilling**: Adequate funding is essential for **retraining and reskilling** programs to equip the workforce with the necessary skills for employment in the evolving energy sector
  - It is imperative to allocate significant resources towards retraining and reskilling initiatives
- **Income Support**: Providing income support, including **unemployment benefits** and **salary subsidies**, is crucial to help workers experiencing temporary unemployment or reduced income during the transition
- **Labour Market Matching Services**: Financial resources are needed for labor market matching services that connect job seekers with **available vacancies, facilitating the transition** to new employment
- **Employer Incentives**: Financial incentives or **subsidies for employers** can promote the hiring of workers **from declining industries or the adoption of green technology**, making the transition more appealing for businesses
- **Green Finance Methods**: Governments and organizations can explore the use of **green bonds** and sustainable finance methods to fund renewable energy and **energy efficiency** projects
  - These projects have the potential to create employment opportunities while aligning with sustainability goals

4. Energy Transition in Bangladesh

4. Energy Transition in Bangladesh

- **Energy Transition Plans**: Bangladesh is targeting an energy transition for the periods of **2030, 2040, and 2050**, with varying structures and compositions in different policies and plans.
- **Current Energy Sources**: The majority of Bangladesh's electricity, over **85%**, is generated from conventional fuels, with natural gas contributing over **50% annually**
  - **Concerns** arise about **future gas reserves**, and the reliance on coal and limited **foreign reserves** for energy import.
- **Nuclear Power**: Bangladesh is constructing nuclear fuel-based power generation plants, but they come with high initial costs, **technological challenges**, and regulatory issues.
- **Renewable Energy**: Renewable energy sources, primarily solar and hydro, generate only about 4.5% of electricity
  - Despite their potential, the establishment of renewable **energy-based power plants faces obstacles** due to government policies favoring fossil fuel-based plants.

Figure 1: Annual electricity generation breakdown by fuel sources

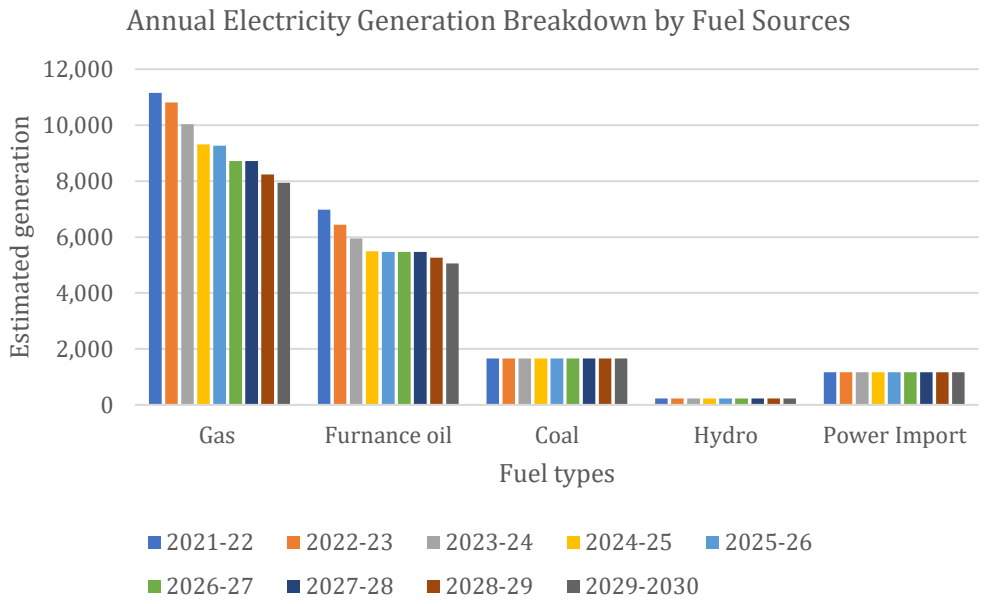


Source: IEPMP

4. Energy Transition in Bangladesh

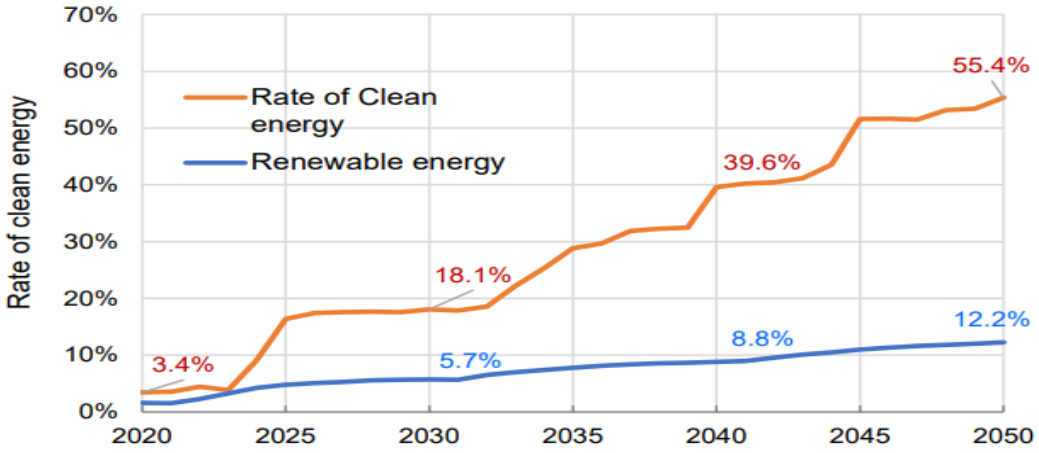
- **Energy Projection**: The Integrated Energy and Power Master Plan (IEPMP) outlines detailed energy projections for 2030
  - The data indicates a **shift away from gas and furnace** oil for electricity generation, emphasizing the need to **prioritize alternative energy** sources like solar and wind power due to the declining gas reserves
- The administration plans to increase fuel oil imports in 2023, despite soaring fuel prices due to the conflict in Ukraine
- While power generation from **fuel oil is declining**, it's not as steep as gas
  - More stringent measures are required regarding fuel oil imports, as it has been pressuring foreign exchange reserves in recent years
- **Coal-generated power** is expected to remain constant due to newly built coal-based plants

Figure 2: Projection of Annual Electricity Generation (2022-2030) breakdown by fuel sources



Source: IEPMP

Figure 3: Clean Energy Generation Plan in IEPMP in REF Scenario

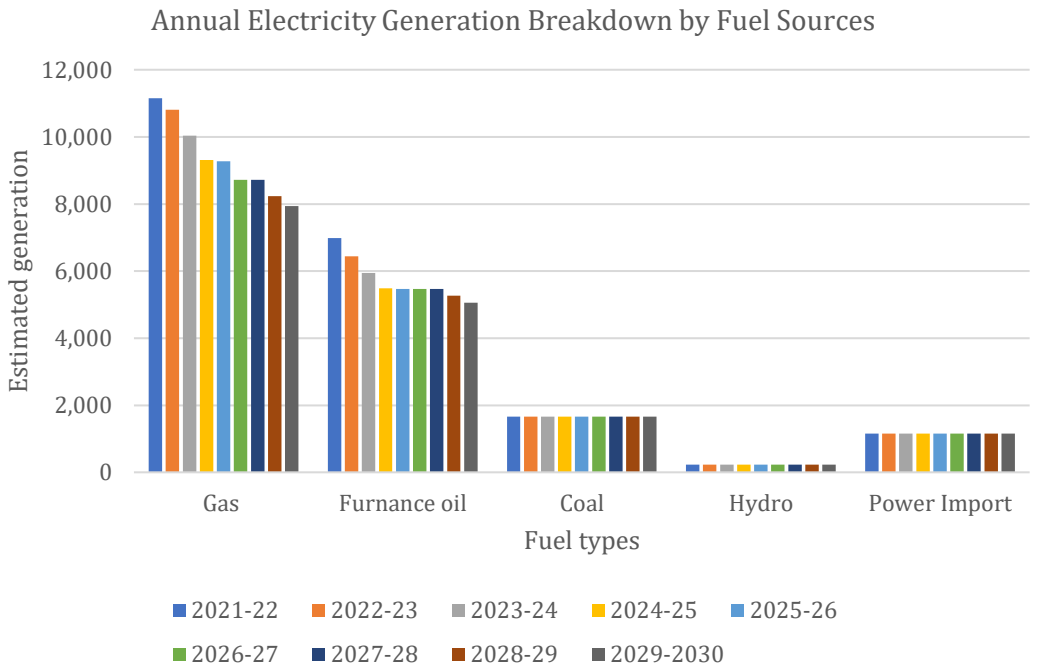


Source: IEPMP

4. Energy Transition in Bangladesh

- Overall, the structure and composition of **energy-mix** in the country is likely to be **changed** in the coming years
- The transition from fuel-based power shows potential for renewable energy
- However, challenges like **reliance on fossil fuels, carbon lock-in**, and barriers to renewable energy investment may slow down the energy transition
- This transition is **likely to impact employment** in the power and energy sector

Figure 4: Projection of Annual Electricity Generation (2022-2030) breakdown by fuel sources



Source: IEPMP

5. Structure of Employment and Skills in the Power and Energy Sector in Bangladesh

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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 with **technical operation, management, financing, and IT**
  - 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

5.1 Structure of Employment

Table 1: Jobs in the Power and Energy sector of Bangladesh

Management	Finance	Technical Personnel	Field Personnel	IT	Support Staff
1. Managing directors and chief executives	1. Finance managers	1. Mining supervisors	1. Miners and quarriers	1. Information and communications technologists	1. General office clerks
2. Business services and administration managers	2. Financial, bank, and insurance services	2. Manufacturing supervisors	2. Well drillers and borers		2. Accounting and bookkeeping clerks
3. Sales and marketing managers	3. Accountants	3. Construction supervisors	3. Meter readers		3. Stock clerks
4. Manufacturing managers		4. Power production plant operators			4. Cooks
5. Construction managers		5. Electrical engineering technicians			5. Building caretakers
		6. Electronics engineering technicians			6. Blacksmiths and hammersmiths
		7. Power production plant operators			7. Electrical and electronic equipment assistants
		8. Electrical engineers			8. Drivers
		9. Mechanical engineers			9. Cleaners
		10. Chemical processing plant controllers			10. Freight handlers
					11. Garbage and recycling collectors
					12. Security guards
					13. Insulation workers
					14. Plumbers and pipe fitters

Source: Labour Force Survey, 2017

5. Structure of Employment and Skills in the Power and Energy Sector in Bangladesh

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**
  - These occupations are found in a power plant in five different categories including – **(a) engineers, (b) manager, (c) field operators, (d) sales and (e) services**
  - Each of these occupations have specific job responsibilities for which they need specific skills
  - Most of the occupations are highly technical and require specialized knowledge, skills and experience

5.2 Structure of Occupation

Table 2: Occupational Composition and Skills Requirement in All Categories of Power Plants

Engineer	Manager	Field operator and technician	Salesperson	Service Staff
1. Business case development	1.Field operation management	1.Field office management	1.Selling product	1.Day-to-day field activity
2. Architecting and structuring	2.Strategic business planning	2.Administration and security of field office	2.Building up customer relation	2.Solving customer problem
3. Design development, approval, and plan submission	3.Program guide and regulation design and disbursement	3.Reporting and logistic support	3.Motivational skill	3.Assisting system installation
4. Cost estimation	4.Performance evaluation	4.Product installation		4.Assisting after sale service
5. Equipment and machinery sourcing	5.Project design, development, and implementation	5.After sale service		5.Construction, wiring and connection
6. Innovative mindset	6.Field-office communication	6.Construction monitoring		6.Regular field visits and monitoring
		7.Designing training activities		7.Tech-savviness
		8.Task management and supervision		
		9.Field collection of money		
		10.Test and trial operation		
		11.Tech-savviness		

Source: Authors' compilation from literature review and KIIs

5. Structure of Employment and Skills in the Power and Energy Sector in Bangladesh

5.2 Structure of Occupation

- **Large plants** often operate using a department-based organisational structure, which distinguishes them from small and medium-sized firms and plants
  - There are 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 occupations include **design engineer, lead engineer, technician, and operator**
  - These occupations are also highly technical for which they need specialized skills and experience

5.2 Structure of Occupation

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 mobilization • 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

6. Estimating Transition in Employment in the Power Sector of Bangladesh by 2030

- The actual impact on employment will depend on the level of energy transition by 2030, with reference to the Mujib Climate Prosperity Plan
  - There are **two key energy-related transitions** anticipated, leading to corresponding changes in employment
    - (a) A **decrease** in employment in fossil-fuel-based power plants due to reduced use of fossil fuels in power generation;
    - (b) An **increase** in employment in renewable energy-based power plants as renewable energy usage in power generation grows
- It's worth noting that this study **does not consider** changes in energy efficiency between 2023 and 2030, which is a limitation.

6. Estimating Transition in Employment in the Power Sector of Bangladesh by 2030

- Table 4 shows the changes in energy use in power generation plants between 2023 and 2030
- In the **MCPP** scenario, the projected electricity generation will reach **28,975** MW in 2030
  - Major portion still coming from fossil fuels (82.6%) but reduced from the current share (95.4%)
  - Renewable energy's share will increase to 17.4% by 2030 from the current 4.6%
  - This will result in a **27.8%** reduction in fossil fuel use and an **80.1%** increase in renewable energy use within seven years
- In the **MCPP-M** scenario, the projected electricity generation will reach **53,334 MW** in 2030
  - Fossil fuel will cover **70%** of this, still lower than the current share
  - Renewable energy's share will increase to **30%**, up from 4.6%
  - This represents a **30%** reduction in fossil fuel use and an astonishing **1,240%** increase in renewable energy use within the same seven-year period

Table 4: Projected Power Generation in 2023 and 2030 (as per MCPP)

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%	-30%
Increase of generation through renewable energy	-	+80.1%	+1240%

Source: Authors' calculations

6. Estimating Transition in Employment in the Power Sector of Bangladesh by 2030

6.1 Employment Impact on Renewable Energy Based Power Plants

- The paper focuses on examining the direct employment impact of renewable energy expansion, specifically in the areas of **design, manufacturing, delivery, construction/installation, project management**, and operation and maintenance of renewable energy technologies
    - It distinguishes between **direct and indirect employment**, where direct jobs pertain to those directly related to the renewable energy industry, and indirect jobs encompass the supply chain
- The study relies on data from a meta-study conducted by Wei et al. in 2010 to obtain **direct job coefficients**, which are then normalized to total jobs per average megawatt (MW) by considering the capacity factor, representing the fraction of a year that a facility operates

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	0.8	0.09
Solar Thermal	0.69	1.34
Solar PV	5.1	2.48

Source: Based on Wei et. al. (2010)

6. Estimating Transition in Employment in the Power Sector of Bangladesh by 2030

6.1 Employment Impact on Renewable Energy Based Power Plants

- The paper assumes that a significant portion of the renewable energy (**85%) will come from solar thermal** plants, with smaller contributions from large **biomass plants (10%) and wind (5%)** by 2030
    - The employment coefficients used in the analysis are averaged from various sources identified in the meta-studies, following Wei et al.'s approach
- 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

6. Estimating Transition in Employment in the Power Sector of Bangladesh by 2030

6.1 Employment Impact on Renewable Energy Based Power Plants

- 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**.
- Total amount of **on-grid b**ased power generation from renewable energy by 2030 is likely to be **5631** MW. The following calculation shows the estimated power generation.
  - Existing Renewable Off grid is 368.77 MW (30.9% 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**

6. Estimating Transition in Employment in the Power Sector of Bangladesh by 2030

6.1 Employment Impact on Renewable Energy Based Power Plants

- 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.
  - On-grid RE will be 5631.23 MW. We assume 85% of this will be Solar Thermal – 4,786.55 MW, 10% biomass – 563.12 MW and 5% wind – 281.56 MW.
  - We use the employment coefficients from table 5 to estimate the employment generation.
    - Solar Thermal: [(4786.55*0.69) + (4786.55*1.34)] = 9717 jobs.
    - Biomass: [(563.12*0.19) + (563.12*1.61)] = 1014 Jobs.
    - Wind: [(281.56*0.8) + (281.56*0.09)] = 251 jobs.
    - So, 5631.23 MW will employ 10,982 people by 2030…….. (2)
- Off-grid is assumed to be 368.77 coming from solar PVs.
- So, 368.77 MW generation will employ [(368.77*5.1) + (368.77*2.48)] = 2,796 by 2030…. (3)
  - So, by 2030, renewable energy will generate in total [2] + [3] = **13,778 people**

6. Estimating Transition in Employment in the Power Sector of Bangladesh by 2030

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

- For the maximized scenario, 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)
- Within the on-grid, we assume 85% from solar thermal (13,286.55 MW), 10% from biomass (1,563.12 MW), and 5% from wind (781.56).
  - Solar Thermal: [(13,286.55*0.69) + (13,286.55*1.34)] = 26,972 jobs.
  - Biomass: [(1563.2*0.19) + (1563.12*1.61)] = 2,814 Jobs.
  - Wind: [(781.56*0.8) + (781.56*0.09)] = 696 jobs.
  - So, 15631.23 MW will employ 30,302 people by 2030…….. (6)
  - Off-grid is assumed to be 368.77 coming from solar PVs.
  - So, 368.77 MW generation will employ [(368.77*5.1) + (368.77*2.48)] = 2,796 by 2030…. (7)
- So, by 2030, renewable energy will generate in total [6] + [7] = **33,098 people** ….. (8)

6. Estimating Transition in Employment in the Power Sector of Bangladesh by 2030

6.2 Employment Impact on Renewable Energy Based Power Plants (Limitations)

- There are several **limitations** in its estimation of employment impacts related to renewable energy expansion:
  - The analysis does not consider the potential employment effects of **energy efficiency** improvements, which can have a substantial influence on energy use and related job opportunities
  - The scenario outlined in the estimation may be influenced by **government incentives**, policies, and changes in on-grid connectivity These external factors can alter the employment landscape
  - It is based on the **assumption that 85% of renewable energy** will come from solar thermal, 10% from biomass, and 5% from wind, with constant solar PV
  - Any variations in these percentages may result in changes to the estimated employment impacts.
- Despite these limitations, the estimation is the best possible given the available data
  - Providing insights into the employment implications of renewable energy expansion, while acknowledging that real-world factors can influence the actual outcomes.

6. Estimating Transition in Employment in the Power Sector of Bangladesh by 2030

6.3 Employment Impact on the Fossil Fuel Based Power Plants

- The **employment impact of fossil fuel-based** power plants in 2023 varies based on **their size**, categorized as small, medium, and large-scale plants
  - Interviews with experts revealed a thumb rule for minimum employment requirement for such plants, and the total employment for each category was calculated accordingly
- In 2023, there are 121 operational power plants
  - Most of them falls into the small (<50 MW) and medium (50-499 MW) categories
- The estimated total employment in fossil fuel-based power plants in 2023 is **17050**
- Based on the employment-to-power generation ratio in fossil fuel-based power plants for 2023, a projection has been made for the employment in these plants for 2030
  - In 2030, the total power generation from these plants is expected to decrease to 17,945 MW from the current 24,823 MW
  - The projected employment by 2030 is estimated to be **16,663** based on MCPP and **25,644** based on MCPP-M.

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

Power Plant Type	Number of Power Plants	Production Capacity	Avg 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: Authors' calculations from KIIs

6. Estimating Transition in Employment in the Power Sector of Bangladesh by 2030

6.4 Net Employment Impact

- It is evident that in the fossil fuel industry, there will be a few losses of jobs
  - The renewable energy sector will generate a significant number of new jobs
  - The overall net employment impact will be positive i.e., more new jobs will be created in both the scenarios.
- Approximately **8,919 new jobs** would be created after the energy transition in 2030 as per MCPP
  - The number of creating jobs would be significantly high (**37,220 approx.**) if the energy transition takes place at a significant level.

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

7. Required Skills Set and Newly Demanded Occupations in the Process of Energy Transition

7. Required Skills Set and Newly Demanded Occupations in the Process of Energy Transition

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

Table 8: List of Jobs with High Demand

Distribution	Demand Category	Jobs
Sector-wise	High Demand	Solar Jobs
	Medium Demand	Biogas & Hydropower Jobs
	Low Demand	Wind Jobs & Others
Skill-wise	High Demand	Jobs that require minimal training
	Medium Demand	STEM Professionals
	Low Demand	Non-STEM & Administrative Professionals
Occupation-wise	High Demand	Skilled Engineers
	Medium Demand	Skilled Technicians
	Low Demand	Management, Sales, Service

Source: Authors' compilation from KIIs and Desk Research

7. Required Skills Set and Newly Demanded Occupations in the Process of Energy Transition

- 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
- **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
- **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**
- **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
- **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

7. Required Skills Set and Newly Demanded Occupations in the Process of Energy Transition

- **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
- **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
- **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 exhibit notable distinctions from fossil fuel-based power plants regarding their technological aspects, operational procedures, and environmental ramifications
    - There are specific occupational positions that are frequently present in power plants reliant on fossil fuels, which may not be necessary in renewable power plants. Some of them are as follows:
- **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
- **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**, diminishing the significance of roles associated with pollution control and ash disposal.

8. Probable Invalid Jobs in the Transformed Power and Energy Sector of Bangladesh

- **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 seems **unnecessary in renewable power** plants that employ non-combustion methods to generate electricity
- **Flue Gas Desulfurization (FGD) Technicians**
  - FGD specialists have the primary responsibility of **operating and maintaining equipment designed to mitigate sulphur dioxide** emissions originating from fossil fuel plant
  - In the renewable plants, the absence of combustion renders these tasks irrelevant.
- **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.

8. Probable Invalid Jobs in the Transformed Power and Energy Sector of Bangladesh

- **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.
- Although these positions may have diminished significance in renewable power facilities, the shift toward renewable energy sources might 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
- With the energy sector transformation, employment positions have the **potential to undergo modifications and adjustments** in response to emerging technology and shifting environmental concerns
- It is important to realize that there may exist a **degree of skill set overlap** between fossil fuel and renewable power plants, as numerous technological proficiencies can be used across various energy technologies.

9. Policy Recommendations

9. Policy Recommendations

- The study suggests the implication of the energy transition on employment will be net positive with lower number of newly generated employment within a limited period (by 2030)
  - The transition is **sure of creating unemployment, but new job opportunities will be created**
  - The **shift from one industry to the other would be easy** for people with experiences, according to the data collected from KIIs
- Current workforce should be skilled enough to adjust in the transition
- The recommendations aim to address the challenges and leverage the opportunities associated with the energy transition in Bangladesh's power and energy industry, with a focus on long-term economic development and the promotion of sustainable and renewable energy alternatives
- For smooth transition, following recommendations can be made:
  - **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

9. Policy Recommendations

- **Formulate Pragmatic Policies**
  - Rather than making generalized 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 **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
  - **'Energy Transition and Employment and Skills Policy'** needs to be formulated
- **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

9. Policy Recommendations

- **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
- **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, cooperative 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

9. Policy Recommendations

- **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**
- **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

9. Policy Recommendations

- 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

- **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

9. Policy Recommendations

- **Develop Transition Plans for Fossil Fuel Workers**
  - 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
- **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, LFS should acknowledge 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**

Thank you.