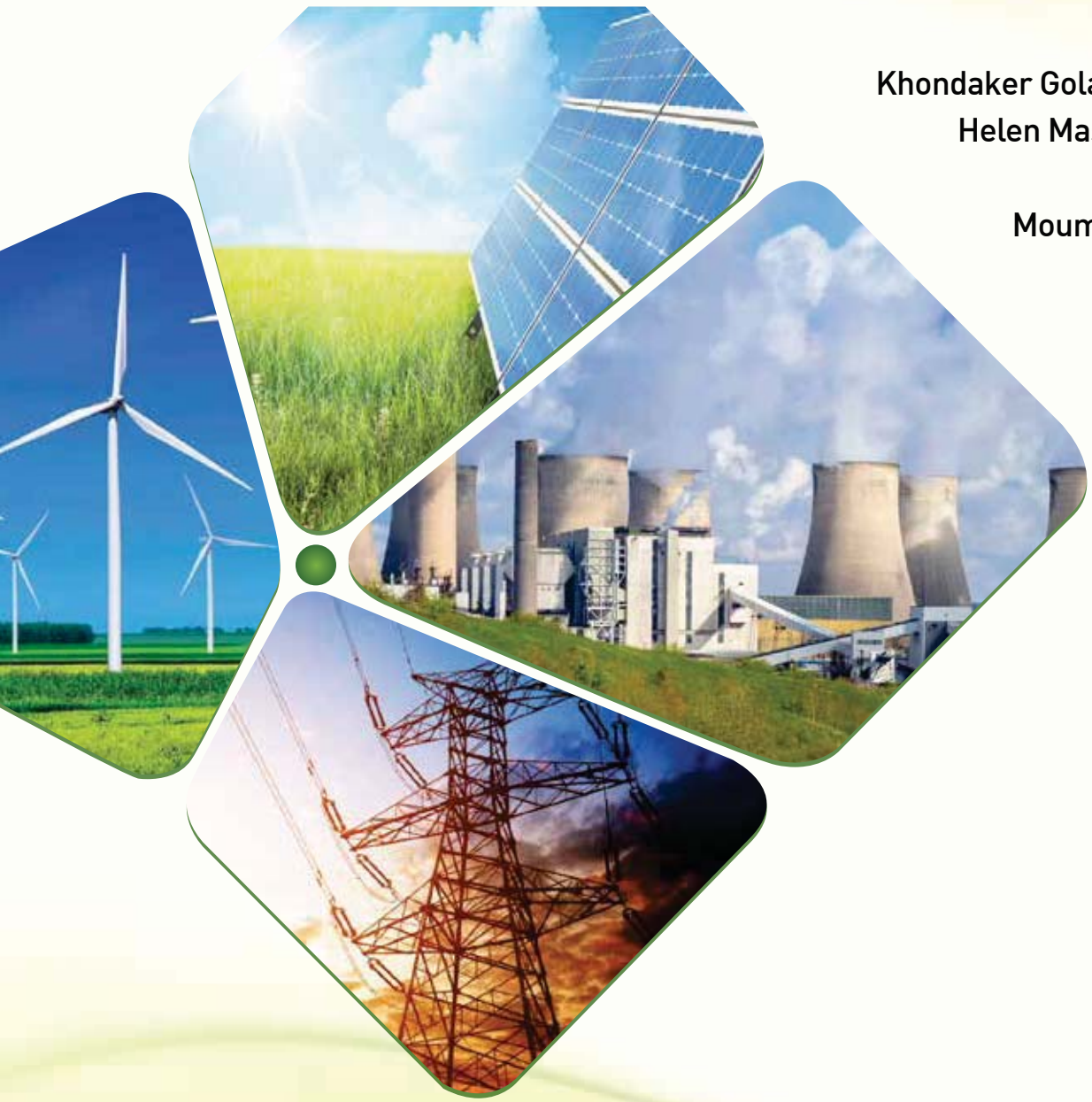
DRAFT INTEGRATED ENERGY AND POWER MASTER PLAN (IEPMP)

Can it address the clean energy targets?



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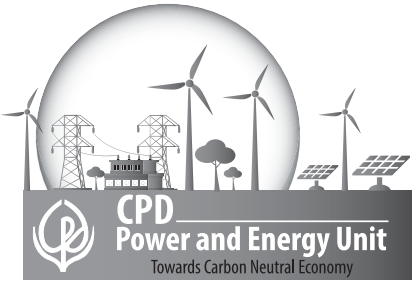

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Abstract

The Intregrated Energy and Power Master Plan (IEPMP) 2021 formulation process is found to be distinctive on several counts such as a comprehensive plan which accommodates energy and power-related issues, a specialised research organisation has been involved to provide technical support, and a consultative process has been followed. But there are still some preferential biases found to be in the power demand estimation method. The draft plan still has little room for renewable energy- based power generation which continues to promote fossil fuel- based power generation system and high- tech fossil fuels as the major source of energy in the coming decade. A rational demand projection for power and attaining the renewable energy target based on the demand projection will be accurate. An alternative scenario called '*40 per cent renewable energy by 2041*' should be introduced in the IEPMP instead of promoting technology driven fossil fuel-based (especially coal and LNG- based) power generation.

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The study is authored by *Dr Khondaker Golam Moazzem*, Research Director, CPD, *Ms Helen Mashiyat Preoty*, Research Associate, CPD, *Mr Shiyan Sadik*, Former Research Associate, CPD, and *Ms Moumita A Mallick*, Programme Associate, CPD.

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Acronyms

ATS	Advanced Technology Scenario
BAU	Business as Usual
BERB	Bangladesh Rural Electrification Board
BERC	Bangladesh Energy Regulatory Commission
BPC	Bangladesh Petroleum Corporation
CAF	Central Asian Flyway
CCS	Carbon Capture Storage
CCT	Carbon Capture Technology
CO_2	Carbon dioxide
DESCO	Dhaka Electric Supply Company Limited
DPDC	Dhaka Power Distribution Company
EAAF	East Asian Australasian Flyway
EECMP	Energy Efficiency and Conservation Master Plan
EV	Electric Vehicle
FSRU	Floating Storage Regasification Unit
GDP	Gross Domestic Products
GoB	Government of Bangladesh
GW	Gigawatt
IEEJ	Institute of Energy and Economics of Japan
IEPMP	Integrated Energy and Power Master Plan
JCC	Joint Coordination Committee
JICA	Japan International Cooperation Agency
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MW	Megawatt
NDC	Nationally Determined Contributions
NZS	Net-zero Scenario
PSMP	Power System Master Plan
PV	Photovoltaics

QRR	Quick Rental Power Plants
RE	Renewable Energy
REF	Reference Scenario
SEA	Strategic Environmental Assessment
SHM3	3rd Stakeholder Meeting
TnD	Transmission and Distribution

1. Introduction and Objective

In view of broader energy security and energy sustainability, the Ministry of Power, Energy and Mineral Resources (MoPEMR) has been formulating and implementing Power Sector Master Plans (PSMPs) since the 1990s. In continuation of this process, the MoPEMP has prepared a draft master plan for the Energy and Power sector titled *Integrated Energy and Power Master Plan (IEPMP)*. This is for the first time the energy and power sector has been brought under a single pathway plan.

It was initiated in March 2021, under the technical cooperation of JICA. As part of this process, several developments and interim reports have been published by the IEEJ, which is the responsible academic institution for this assignment. A draft interim report (July 2022), an updated version of the draft report at the third stakeholders meeting (November 2022) and a draft final report (December 2022) have already been made public. The final master plan is likely to come out by the end of this year. This study aims to review the IEPMP, taking into account the achievement of the clean energy goals set in the national policies.

The plan was developed with the technical and financial support of JICA, which has been the constant development partner of MoPEMR in the formulation of successive PSMPs. For the first time, JICA has officially appointed a technical/ academic institute — the Institute of Energy Economics of Japan (IEEJ) — to provide technical support in formulating the plan. The IEEJ has revised and assessed and thereby developed important policy-related issues such as energy and power development plan, long-term policy outlooks, demand methodologies, SEA and other critical issues. A committee known as the Joint Coordination Committee (JCC) was formed to carry out the research. Two steering committees (SCs) — the Steering Committee for Balance of Primary Energy Supply/Demand and the Steering Committee for Power System Development — have been designated under the JCC to oversee sector-specific studies. Four technical working groups (TWG) under the SCs are involved in investigating different related matters. Research on energy use, data collection for designing the power system, and strategic environmental consequences were done by local consultants. While local experts were involved in the primary data collection process, experts mainly from Japan were engaged to deal with the technical issues.

It is expected that the new IEPMP will highlight the contemporary issues of power and energy sector with way forwards to fulfil clean energy commitments and achieve affordable alternative non-fossil fuel energy through government measures. In this regard, the government of Bangladesh has taken various measures to unlock the global goal of clean energy for achieving net zero commitments by 2050. The prime minister of Bangladesh has announced a target of 40 per cent of renewable energy production by 2041 when Bangladesh aspires to become a high-income country. Not long after the announcement, a modified version of this commitment is now circulating as a renewable and clean energy target. The present clean energy target is up to 40 per cent clean energy by 2040. Replacement of the jargon **'renewable'** by **'clean'** has weakened the stance and global commitments to reduce carbon footprint and transit towards a sustainable energy sector.

Reviewing the draft IEPMP is essential to understanding how it will meet the clean energy goals despite current obstacles. In the upcoming years, strategies should be established for the power and energy sectors while keeping the energy security problem in mind. This study aims to investigate how draft IEPMP can meet the country's renewable energy targets, and put forward an alternative solution from a more resource-efficient clean energy perspective.

2. Analytical Frame for Reviewing Draft IEPMP

A plan is a predetermined course of action that specifies the procedures to accomplish a particular aim or purpose. It is a thorough description of

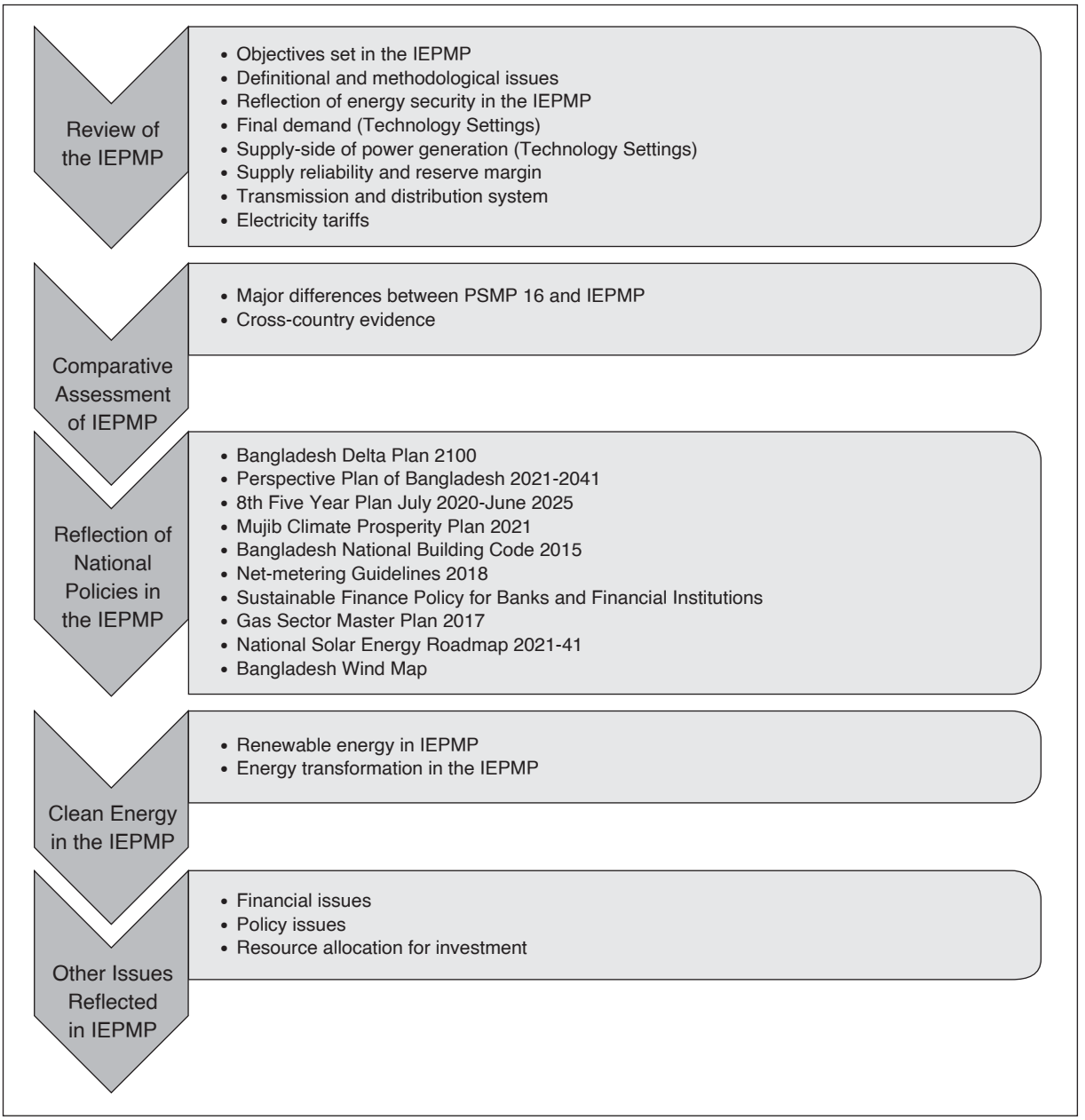
how the goals of an organisation or group will be achieved, outlining the resources needed and the timetable for its accomplishment. In conclusion, a plan is a precise course of action produced within the policies' limits, whereas a policy is a comprehensive declaration of principles that guide decision-making.

The framework commonly used to evaluate energy policies includes identifying the policy's specific goals and objectives, the policy instruments employed to achieve those goals, the process of implementing the policy, including the actors involved, analysis of the policy's impact on various stakeholders, comparison with similar policies in other countries, and an assessment of prospects for the policy. Siyambalapitiya (2002), Kanellakis et al. (2013), Sokołowski (2019), and IEA (2019) each followed a similar structure and sequence to review energy policies which includes energy access, energy efficiency, energy security, energy consumption, energy market structure, the optimum mix of energy sources, institutional governance of energy-efficient policies, renewable energy, climate change, and transmission infrastructure. Considering the outline broadly followed in global literature, this study attempts to review the draft IEPMP using the analytical outline provided in Figure 1.

This paper followed a review-based methodology that involved analysing and synthesising existing research studies and literature on the power and energy sector of Bangladesh to draw conclusions and make recommendations for the draft IEPMP.

This paper provides a review of the draft IEPMP, focusing on the current state of the power and energy sector, a review of this draft plan, particularly its methodological issues, reflection of energy security, comparative assessment, reflection of energy policies, clean energy including renewable energy and energy transformation, other issues reflected in the plan, adequacy of the objectives in the overall master plan, and summary observations, and recommendations.

Figure 1: Analytical Outline Used to Review Draft IEPMP



Source: Authors' Illustration.

3. Review of Draft IEPMP

3.1 Objectives Set in the Draft IEPMP

In energy policy analysis, integrated assessment models (IAMs) are widely used. Even though IAMs can effectively manage uncertainty concerning energy planning problems, they produce multiple variables as modelling outputs. Therefore, a variety of energy development scenarios and objectives must be considered by policymakers. Different criteria linked to conflicting goals represent technical, environmental, and economic aspects (Baležentisa & Streimikieneb, 2017). But in the context of IEPMP, adequate data was missing to enlighten and apply such rankings.

Table 1: Adequacy of the Objective in the Overall Draft IEPMP

Objective	Scope of the policy	Feasibility study	Way forward guidelines	Timeframe
A long-term energy plan covering every sector and energy source	**Average** • The targeted goals of each section have been well-defined. • Some specialised sectors regarding the transition to renewable energy were not adequately addressed.	**Average** • Feasibility studies along with the proposed plans are mostly in process or completed. • Evaluation of the feasibility policy doesn't seem appropriate.	**Below average** • Separate 'way forward' guidelines in each chapter is missing.	**Average** • A well-defined long-term goal, but lacks the short and medium-term benchmarks.
The global momenta towards low-carbonisation and/ or decarbonisation	**Below average** • Fewer goals regarding the pathway of decarbonisation have been addressed.	**Poor** • Very few feasibility studies targeting technological advancement.	**Poor** • Renewable energy-focused way forward is missing in the document.	**Below average** • No significant short- or medium-term benchmark has been addressed.

Source: Authors' Illustration.

A framework for improving the objectivity of Nigerian renewable energy policy decisions was formulated. It is made up of an expert ranking of resource abundance, resource efficiency, and the environmental comfort in selecting renewable energy options for large-scale power generation. The rankings are converted to a more objective function known as the Resource Appraisal Function (RAF) using dependence operators derived from logical relationships between the various criteria (Nwofor & Dike, 2016). But draft IEPMP does not solely discuss renewable energy policies; rather, it focuses on macro perspectives of objectives.

Based on the information, the focus has been given to two of the general objectives based on the scope of the policy in future, the record of proposed and completed feasibility studies, the way forward guidelines for each section and the timeframe for achieving the objectives. Qualitative terms like poor, below average, moderate, etc. have been used to rank them.

3.2 Definitional and Methodological Issues

The draft IEPMP uses a technological assessment model including a bottom-up approach, econometric modelling, regression analysis, and micro-level demand forecasting. Based on the main assumptions, the energy model is used as the core model in this study's econometric model to perform analysis by combining the economic model, price model, etc. According to the energy model, the industry, transport (road and other), buildings (residential and commercial), agriculture, and non-energy sectors consume maximum of the total energy produced. The energy model also divides transformation into the power generation, other transformation sectors, and own use/transmission and distribution (TnD) loss sectors to estimate the primary energy supply and energy-related CO_2 emissions. In theory, the secondary industrial GDP and the electricity/non-electricity price in that sector are used as the explanatory variables

for the income and price effects, respectively, to endogenously estimate the demand for electricity and non-electricity in the industry sector.

The last component of the framework for review is clean energy. The terminology 'clean energy' used in this paper is different from how it has been used in the IEPMP draft documents. The IEPMP draft final report defines 'clean energy' as a source of power that does not emit CO_2 including renewable energy, nuclear power, ammonia-fired and hydrogen-fired thermal power. NCSEA defines clean energy as energy derived from renewable, zero-emissions sources ('renewables'), as well as energy saved through energy efficiency ('EE') measures. Other sources define nuclear and hydrogen-fired power as clean, but ammonia and ultra-carbon capture unit technologies have not been found to be labelled as clean. This study attempts to define renewable energy sources (solar, wind, hydro, biogas) as clean energy.

3.2.1 Methodical Approaches in Draft IEPMP

The demand forecast in the new IEPMP follows a bottom-up approach using a sectoral regression model. The power demand forecast in draft IEPMP is not entirely based on the GDP growth rate, but it includes several variables: GDP, population, energy prices, previous demand, exchange rates and international trade. It was strongly advised that projections based solely on GDP are flawed; rather, variables such as household income, population, historical load data, weather, or temperature can be incorporated into the projection model. The annual maximum electricity demand (MW) estimation is obtained using the electricity energy demand (GWh) estimation, it can be subtracted from the final electricity consumption supplied from captive power and rooftop solar power, because grid-connected generators will not supply these. Power consumption of captive power should be excluded from the national demand. The energy consumption of these sectors has been segregated into electricity and non-electricity criteria such as industry, transport, residential, commercial, agriculture and non-energy sectors.

This makes the new plan different from the previous PSMPs from the methodological point of view. It is necessary to follow a bottom-up approach for demand forecast. A simple forecast was not enough and so it followed an inclusive regression model rather than using correlation analysis, electricity intensity method, and GDP elasticity method.

However, the forecasted demand of 90,000 MW under the plan seems unrealistic, and the reason behind this unrealistic demand is the consideration of perspective plan as the main GDP case. The plan discusses the sectoral demand projection but the draft plan has not reflected on the micro-level sectoral demand projection.

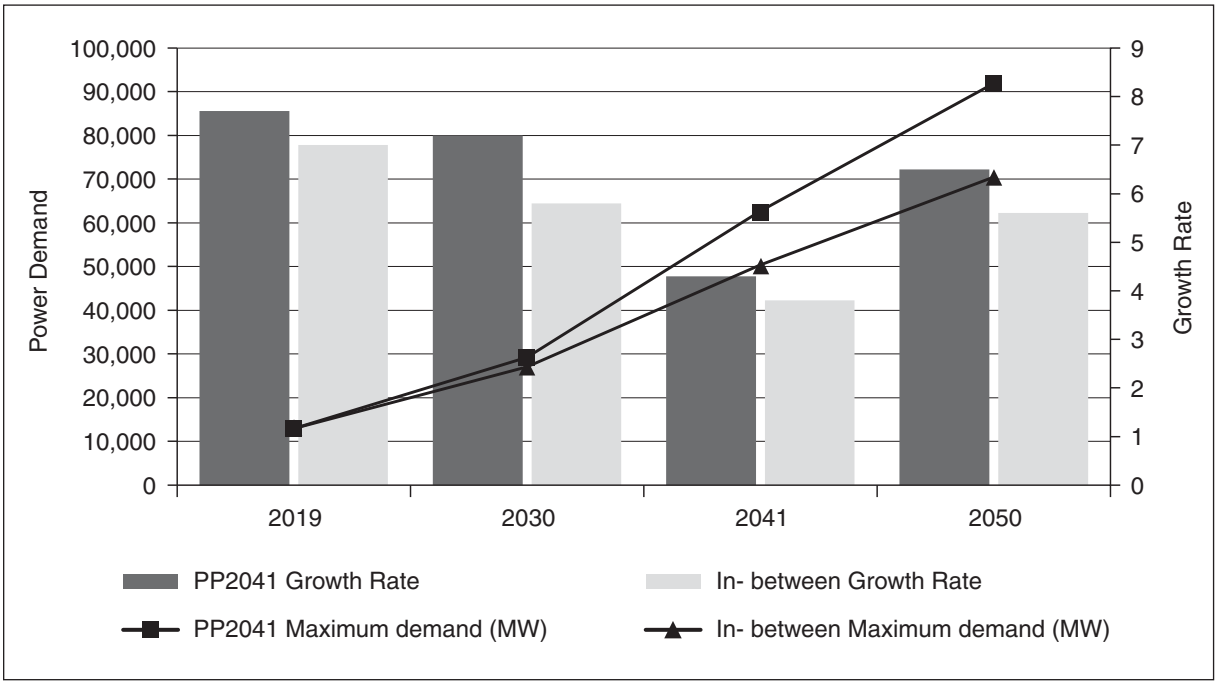
3.2.2 Power Development Plan in Draft IEPMP

The new IEPMP traditionally emphasises the power development plan as it is one of the key components of the power and energy sector. The power development plan highlights installation capacity, fuel mix, public to private sector ratio in power generation, renewable energy generation, reserve capacity, and many other issues. The new plan has improved and is more comprehensive than the previous one, but it is far from being robust.

GDP setting: The darft IEPMP is based on three GDP case settings; Perspective Plan 2041, in-between case and IMF Ext Case. Although the PP2041 case serves as the study's primary case, the JICA Study Team suggested including the IMF Ext Case as one of the GDP assumption exercise cases to see the impact of the global average GDP on energy and power demand, or at the very least to see the COVID-19 prolonged impact.

The in-between case has been set according to the deviation rates between planned and actual growth rates during the 6th and the 7th five-year plan periods. The average annual deviation rate is -1.1 per cent in the in-between case. The discussion between Planning Commission and JICA Study Team led to the development of this estimation method. The PP2041 will be the study's main case, which is not a viable option due to its overestimation

Figure 2: Electricity Demand Forecast



Source: Authors' Illustration from JICA-IEPMP.

of achieving more than USD 12,500 income per capita by 2050. Rather, the exercise case of IMF projections can be a plausible alternative to have a proper estimate.

Power Demand Forecast: As the PP2041 case has been considered the main case at 7.2 per cent GDP growth rate, the maximum demand for electricity will be 29,257 MW by 2030. This seems overly ambitious as the highest demand in 2022 was 14,792 MW (as of 16 April 2022). The demand needs to rise about 200 per cent in 8 years. It is forecasted that in 2050, maximum power demand will be 90,000 MW.

3.3 Reflection of Energy Security in the Draft IEPMP

Among the two main objectives, the first objective of draft IEPMP is to provide a long-term energy plan to ensure energy security. During this crisis, energy security is more crucial than at any other time. The draft IEPMP highlights creating and strengthening energy security. However, it intends to do so by depending on fuel imports. Unless energy generation is dependent mostly on domestic sources, it is only natural to be doubtful about energy security.

3.3.1 Energy Mix

There are three energy mix scenarios prescript in the new plan: Reference Scenario (REF), Advanced Technology Scenario (ATS), and Net Zero Scenario (NZS). In the REF scenario, which is the business-as-usual case, gas remains a major fuel in the mix along with oil and coal. Nuclear power will also be a part of the mix. It is predicted that imported fuel will increase by 2050.

The fuel mix in ATS scenario is similar to the REF scenario. But notably, after 2030, solar, hydro, and clean energy will be a part of the energy mix. Ammonia will also be adopted in ATS, but it will be much more moderate than in NZS, which is a significant change. Finally, in the NZS scenario, coal-fired power will shift to ammonia after its introduction as co-firing fuel. After its introduction, gas-fired power will be replaced by hydrogen-fired power.

The REF scenario will be mostly dominated by Gas (Grid) until 2050, while the NZS includes a balanced mix of nuclear, solar, hydrogen, gas (CCS), ammonia, etc. None of the ATS and NZS scenarios are pragmatic for Bangladesh. CPD proposes a new scenario called '*40 per cent power generation from renewable energy by 2041*'.

3.3.2 Scenario Analysis of Energy Mix in Draft IEPMP

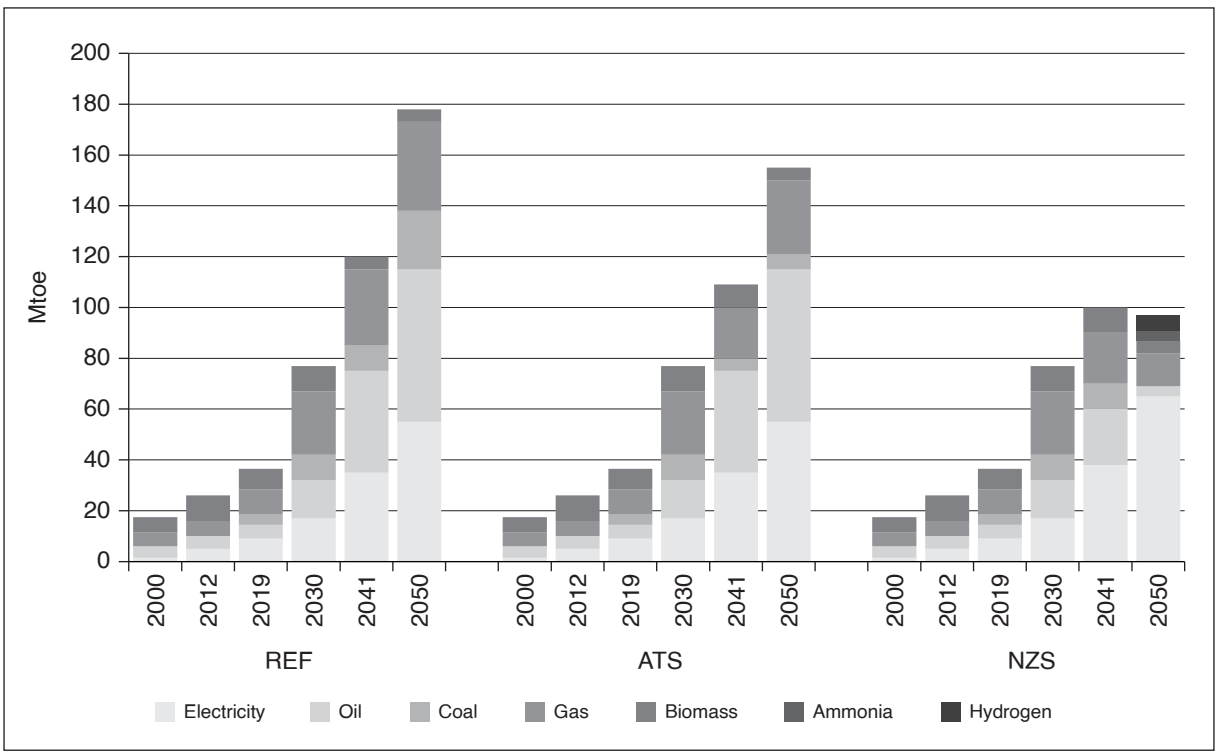
The REF scenario depicts the projected 2050 based on coal, oil and gas while ATS slightly changed the mix for coal. The NZS includes ammonia and hydrogen as alternatives to coal. JICA opined that the NZS scenario is almost impossible for Bangladesh and suggested not to opt for it.

a. Coal as a Fuel Mix in Draft IEPMP

The updated version of the IEPMP tries to promote coal-based energy as a form of cleaner energy source. Bangladesh's total coal reserves are 7.8 billion tonnes, which equates to 200 Tcf of natural gas (even with a 10 per cent recovery rate, this still amounts to 20 Tcf or 2,730 million cf/d for 20 years). Coal is expected to be used in the industry and power sectors, and utilisation of domestic resources will play a role in meeting the demand. Imported coal is used for power generation; however, this master plan expects that coal consumption for power generation will reduce during the 2040s shifting to ammonia-cofiring. As per the draft IEPMP, a feasibility study has been completed—Expansion plan of Barapukuria Coal Mine (BCMCL), Development plan for Dighipara coalfield, CBM at Jamalganj.

As discussed in table 2, the six development projects, including planned and proposed projects by BCMCL, are considered in the period of this master plan. Required investments for the coal sector will increase in order to meet the demand increase during 2020s and 2030s. The estimated investments in the Barapukuria expansion and Dighipara are based on the feasibility study results;

Figure 3: Fuel Mix Scenario Based on Draft IEPMP



Source: IEPMP Interim Report.

Table 2: Coal Reserve (as discussed in the draft IEPMP)

Coal Field	Area (sq. km)	Depth (m)	Reserve (mil. tonne)	Status
Barapukuria U/G	6.68	118-509	390	In operation
Barapukuria O/C				F/S Ongoing
Dighipara U/G	24	328-455	706	F/S Completed
Jamalganj U/G	11.5	640-1158	5,450	F/S Completed
Phulbari O/C	16	150-240	572	F/S Completed
Kalaspir U/G	7.5	222-516	685	F/S Not Yet
Total			7,803	

Source: The Draft IEPMP Interim Report.

however, the required investment will be subject to change depending on the results of the feasibility study for other projects.

The government strongly believes that the new development of domestic coal should be avoided due to the problems faced by residents as well as for its environmental impacts. Therefore, no expansion of coal import facilities is assumed except for a coal transhipment terminal in Matarbari, and the development of domestic coal mines is expected to increase instead of importing coal. The dependency on imported coal needs to be reduced and substituted by alternative renewable energy sources to achieve the goal of clean energy. The policy must adhere to the global 'Just Transition' coal phasing out momentum to have a sustainable and clean energy supply. The early retirement plans for Operational Coal Based Power plants can be expeditated through an abandonment policy including a compensation package for both public and private power plants.

b. Natural Gas & LNG as a Fuel Mix in Draft IEPMP

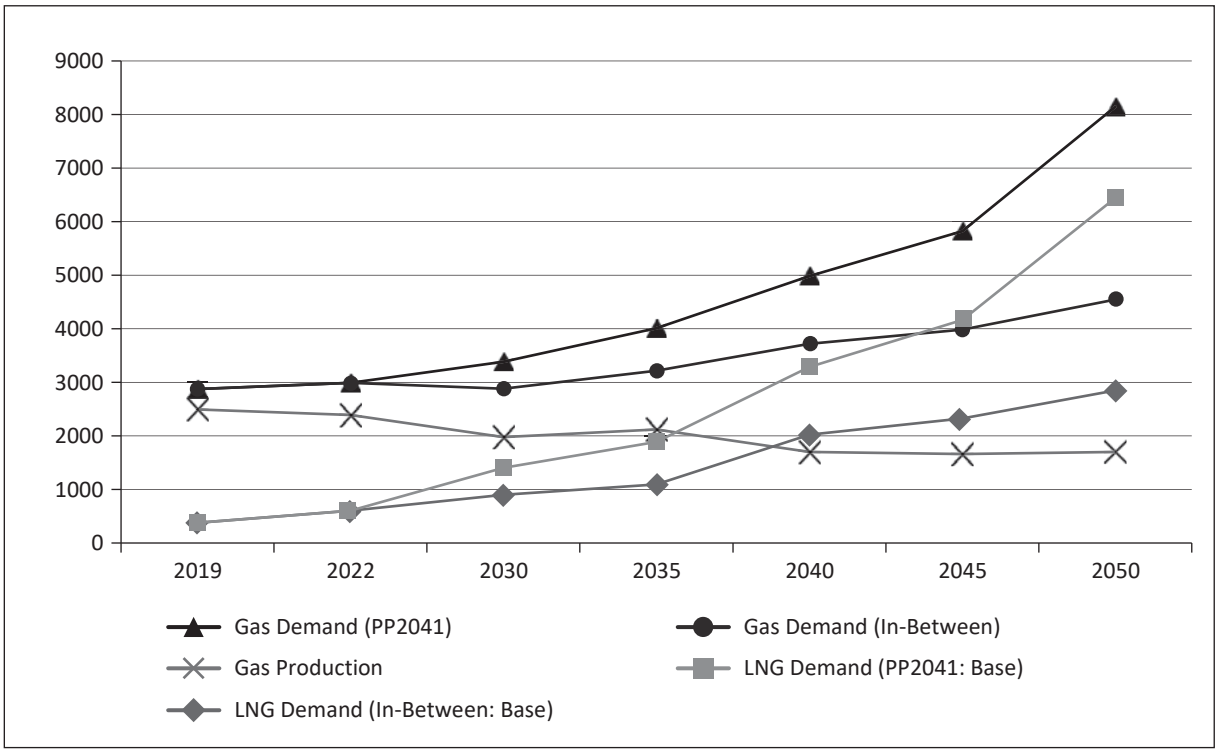
The draft IEPMP focuses on the natural gas demand, but in the form of promoting imported LNG. The gas demand for 2050 has been projected at 8,142 mmcfd according to PP2041 and 4,545 mmcfd according to the in-between scenario. Based on the demand, the projected low-risk potential (onshore) production will be 470 mmcfd in 2050.

The projected production from high-risk potential (offshore) is 1,230 mmcfd, totalling 1,700 mmcfd. Onshore and offshore production from new sources is anticipated to increase existing production. In fact, the production attained by the current drilling programme is one of these new sources. Despite unexplored domestic sources of gas reserves, there is a tendency to depend on imported gas (LNG).

As mentioned previously, draft IEPMP promotes LNG through emphasising demand projections and the necessity of LNG in Bangladesh. The demand for LNG projected from the PP 2041 for the year 2050 is 7,672 mmcfd (without high-risk potential). The demand for LNG projected from the in-between case for the year 2050 is 4,075 mmcfd (without high-risk potential). The shallow topography of Bangladesh restricts the options for locations for LNG receiving terminals.

Following the completion of the Matarbari onshore LNG terminal, more pipeline connections to Dhaka will be required as LNG import is predicted to rise. Due to this, a total of 1,000 mmcfd of LNG gas has been delivered to the pipeline by two offshore LNG receiving terminals using FSRUs. Import of LNG alongside the required investment for the LNG-based infrastructure will push the economy of Bangladesh from the top of the debt mountain. LNG-based energy development needs to be substituted by domestic gas not only to be economically resourceful and efficient but also to ensure energy security.

Figure 4: Domestic Natural Gas Supply Balance as Projected in the Draft IEPMP



Source: Authors' Illustration from Draft IEPMP Interim Report.

The updated draft plan also includes the investment plan for the draft IEPMP, segregating the allocation for domestic gas exploration and construction of gasification and regasification of liquid natural gas. Similar to the fuel mix plan, the investment plan for gas is also actually the LNG import investment plan and the investment in domestic gas exploration is negligible. Most of the investment is allocated for FSRUs (60 per cent), 18 per cent is allocated for domestic pipeline construction and the rest of the allocation is kept for onshore terminals and compressors. Despite focusing on the investment of LNG import and terminal and FSRUs, investment in domestic gas exploration should get focus.

The total required investment for domestic gas and LNG import will increase from 2030 (table 3). The accelerated growth of the natural gas

Table 3: Required Investment for Natural Gas and LNG Supply as per the IEPMP Draft Final Report

	2022-30	2031-41	2042-50	Total	
	Million dollar	Million dollar	Million dollar	Million dollar	Per cent
FSRU for LNG	344	688	1,376	2,408	60.4%
Onshore terminal	-	750	-	750	18.8%
Domestic pipeline (Natural gas)	660	94	-	754	18.9%
Compressors	25	-	-	50	1.3%
Terminals	25	-	25	25	0.6%
Total	1,053	1,532	1401	3,987	100%

Source: IEPMP Final Draft.

demand is due to the high economic growth will increase the need for investment in natural gas exploration and import. The demand forecasted is rational and justified, but the fact that the majority of the demand being forecasted would be met through expensive imported LNG and investment plan is also being designed to this end does not justify the current reserve situation. The projected investment for domestic pipeline is as low as only 19 per cent of the total allocated investment in natural gas and LNG.

c. Oil as a Fuel Mix in Draft IEPMP

The draft IEPMP contains several major planned oil projects, including distillation unit 2 at the ERL U2, new SPM, one LPG import terminal and petroleum products import pipeline from India. The draft IEPMP assumes the additional supply capacity projects until 2050. The projects are an additional crude distillation unit, new SPM, and additional LPG terminals. The supply capacity projects lack proper monitoring and evaluation module.

As per the draft interim report of draft IEPMP petroleum products, it will expand its role in Bangladesh's total primary energy supply. Hence the total liquid fuel demand is projected to be 43.1 million tonnes per year in FY2050. Majority of these will be imported oil and LPG. Required investments for the petroleum sector will increase in the earlier period of the new plan due to the rapid growth of oil demand in this period. As described in version 4 of draft IEPMP, the average growth rate of oil demand is much higher in the period of 2019-2030 compared with other periods. In the new draft, expansion of the domestic refining capacity is assumed relatively low, while a larger part of the demand increase will depend on petroleum product import. The expansion of its supply infrastructure will be limited to a certain area; however, it will also require huge investments.

Oil is heavily import based on imports which need to be replaced by clean energy sources. A huge investment is required for setting up relevant infrastructure. Feasibility studies of renewable energy replacing oil should be conducted in terms of efficiency, affordability, and sustainability.

3.4 Final Demand (Technology Settings)

As discussed above, three scenarios are set in the draft IEPMP; and three technological settings are considered under each scenario — a) Net Zero Scenario (NZS), b) Advanced Technology Scenario (ATS) and c) Business as Usual (BAU). Based on the discussions in the consultation meetings in May and June 2022, some changes in technological settings have been proposed from the draft interim report.

3.4.1 Final Demand under Net Zero Scenario

There has been no change to the position on energy conservation in the industry sector, hydrogen in the industry sector, electric vehicles (EVs) in the road sector, hydrogen in the road sector, energy conservation in the residential sector, electrification in the residential sector, energy conservation in the commercial sector, and electrification in the commercial sector. Positions on electrification in the industry sector and electrification in the commercial sector have deteriorated.

The stance on energy conservation in the industry sector remains constant at -43.2 per cent (-2.0 per cent/year) in 2050 from the REF level without price effect, whereas the electrification in the industry sector has been decreased by -5 per cent points in 2050 from the REF level, holding other conditions. In the industrial sector, the non-electricity energy will shift to hydrogen by 2050.

In the road sector, the fuel economy has been reduced from IMF Ext: +149 per cent to IMF Ext: +130 per cent in 2050 from the 2019 level, in-between: +170 per cent, PP2041: +200 per cent. The target is to shift 100 per cent of passenger light-duty vehicles (PLDVs) and 90 per cent of trucks and buses (TRBSs) to EVs in 2050. Among these 10 per cent of TRBSs will become fuel-cell vehicles (FCVs) in 2050.

In the residential and commercial sector, 100 per cent electrification is targeted with -34.5 per cent (-1.5 per cent/year) energy conservation in 2050 from the REF level without price effect in the residential sector and -43.2 per cent (-2.0 per cent/

year) in 2050 from the REF level without price effect in the commercial sector, as per the recent version of the plan.

The position on most cases remained the same, while in some cases it has rather deteriorated. The demand for electrification in the industry sector and electrification in the commercial sector under net-zero scenario focuses more on expensive new technologies. In the industrial sector, non-electricity energy is mentioned to shift to hydrogen by 2050, which is, then again, a new and costly technology.

Across the world, technological advancement is mostly done and seen in renewable and clean energy. As a result, solar is now the cheapest source of energy in any part of the world. Even under the net zero scenario, the plan should have focused on the enhancement of renewable and clean energy and explored ways to integrate solar-based energy in every sector.

3.4.2 Final Demand under Advanced Technology Scenario

Positions on electrification in the industry sector, EVs in the road sector, hydrogen in the road sector, energy conservation in the residential sector, electrification in the residential sector, and energy conservation in the commercial sector have not changed. Positions on hydrogen in the industry sector, fuel economy in the road sector, and electrification in the commercial sector have deteriorated.

The situation regarding energy conservation in the industry sector remains constant throughout the development of the plan from June to December standing at -24.5 per cent (-1.0 per cent/year) in 2050 from the REF level without price effect. Whereas electrification in this sector has been assumed to be increased from +10 per cent to +10 per cent points (+5 per cent) in 2050 from the REF level, ceteris paribus.

In case of the road sector, fuel consumption has been slightly revised downward from IMF Ext. +6 per cent to IMF Ext. +5 per cent in 2050 from the 2019 level, in-between: +35 per cent, PP2041: +65 per cent. The forecasted numbers of EVs remain the same at about 40 per cent of PLDVs and 10 per cent of TRBSs will shift to EVs in 2050. Similar to the industrial sector, no hydrogen will be introduced in the road sector.

Energy conservation in the residential sector remains unchanged with an upward revision in the electrification in the residential sector from +15 per cent to +15 per cent points (+7.5 per cent) in 2050 from the REF level, holding other conditions constant.

The decline in the use of hydrogen in the industrial sector and the no use of hydrogen in the road sector is a positive sign. Hydrogen is an untested expensive technology and can cause a financial burden on the economy as a whole. The assumption that with time residential sector will require more electricity than now has caused an upward revision in the electrification in the residential sector. One thing to remember is that demand-side management can play an important role in balancing the energy requirement for the increased electrification in the residential sector.

In every sector, the fuel economy or requirement should be further revised as this much fuel may not be required with technological advancement. Hydrogen and ammonia as a fuel should be replaced by the renewables and clean energy for the betterment and economic viability.

3.5 Supply-side of Power Generation (Technology Settings)

3.5.1 Supply under Net Zero Scenario

The updated version spontaneously introduced Solar PV (solar parks and irrigation). Even with land restrictions, it is forecasted to be 16 GW in 2050, which is impressive. On the other hand, the target for solar PV (rooftop) has been halved from 25.7 GW to 12 GW in 2050. Similarly, the target for onshore wind has been increased but that for offshore wind has been drastically reduced.

The plan includes eight units of nuclear power by 2050. The initial two units have already been constructed in the Rooppur Nuclear Power Plant to start production before July 2024. The stance on coal firing remains the same at 50 per cent ammonia co-firing around 2030, and 100 per cent ammonia single-firing around 2042. In case of gas, 100 per cent hydrogen single-firing will start around 2035 and replace 70 per cent of gas-fired power through 2050. Gas-fired with CCS will start around 2036 and achieve 30 per cent of the gas-fired power in 2050. Conventional captive power will be zero in 2050 and 15 per cent of total electricity demand through 2050.

The positions on renewables under NZS have improved from the draft interim report. Solar PVs (solar park and irrigation) have been added to the status of solar PV (rooftop) simultaneously, and onshore wind has been downgraded. On the bright side, the position on offshore wind has improved. There has been no change in the position of nuclear, coal-fired, gas-fired, oil-fired, and captive power.

The plan heavily promotes coal in the form of ammonia co-firing around 2030 and ammonia single-firing, which is contrary to the international commitments made by the government of Bangladesh. The CCS technology used to make gas-fired power plants clean which is not so great an option as well. These technologies are again costly and can increase the financial burden.

Renewable energy should be more focused on the final plan exploring the maximum potential of solar and wind energy sources. The plan should not promote coal and nuclear using high-end technologies. The allocation for these fancy technologies should rather be used to expand and enhance renewable energy in Bangladesh. Fifteen per cent of the electricity to be traded should be renewable energy from India, Nepal and Bhutan.

3.5.2 Supply under Advanced Technology Scenario

Solar PV (Solar Park, Irrigation) is estimated to be 6 GW in 2050 with land use restrictions, whereas the target from rooftop solar PV has been decreased from 18 GW to 12 GW in 2050. Onshore wind mainly in the coasts has been set at 5 GW in 2050 which was 10 TWh in 2050 (0.6 GW considering 20 per cent LoE) previously. Under ATS, 6 units of nuclear have been targeted instead of 8 in the NZS. The target for coal-fired power plants is set at 20 per cent ammonia co-firing around 2030 (2035*) and 50 per cent ammonia co-firing around 2035 (2040*) from the interim report's 50 per cent ammonia co-firing around 2030 and 100 per cent ammonia single-firing around 2049. Similarly, the gas-fired power plant is set at 20 per cent hydrogen co-firing which will start around 2035 (2037*), and 50 per cent hydrogen co-firing which will start around 2040 (2045*). Gas-fired with CCS will start around 2036 (2040*) and achieve 77 TWh (38 TWh**) in 2050. In 2050, there will be little conventional captive power, while high-efficiency co-gen system will be introduced from 2031 and reach 300 MW (app. 30 MW*10 towns) in 2050 nationally. The power import target is 12 per cent of the total demand.

Surprisingly, position on renewables under ATS has significantly decayed. Solar PVs (solar park and irrigation) have been added, solar PV (rooftop) deteriorated, and onshore and offshore wind deteriorated. However, the position for nuclear, oil-fired, and captive from the interim report to the SHM3 remains unchanged.

The overall target for RE seems to have downgraded significantly under ATS as the target for solar PV (rooftop), onshore and offshore wind has been decreased significantly. Only the new target of 6 GW from solar PV is satisfactory. The ATS scenario should have an ambitious target for renewable energy given that these are to be achieved by 2050.

Similar to the net zero scenario, renewable energy should be more focused on the final plan exploring maximum potential of solar and wind energy sources. The updated version put less emphasis on hydrogen-based power generation. The plan should not promote coal and nuclear using high end technologies. The allocation for these fancy technologies should rather be used to expand and enhance renewable energy in Bangladesh.

3.6 Supply Reliability and Reserve Margin

Due to overcapacity, the power sector's current reserve margin is as high as 40-45 per cent. The draft plan still promotes a high reserve margin of 30 per cent for 2030, and 25 per cent for 2040. In the draft interim report, the target was 22 per cent for 2030 and 11 per cent by 2050. The upward revision of the reserve capacity from the interim report to the document shared in the SHM3 is not encouraged while we bear the burden of excess installed capacity.

Table 4: Supply Reliability and Reserve Margin

	SHM3 (November 2022) and Draft Final Report Ver. 4		
	2030	**2040**	**2050**
Reserve capacity rate	30%	25%	20%
LOLE target (hours/year)	24	24	24
Unplanned outage rate	12% or less	11% or less	10% or less

Source: Prepared by authors.

The excess reserve capacity ratio will further add to the financial burden of the power sector. The targeted unplanned outage has been forecast to reduce slowly. The target should be lowered, and technical measures should be taken accordingly to limit the power outage.

3.7 Transmission and Distribution System

3.7.1 Transmission

Until recently, there was little need for long-distance power transmission, which made it possible to deal with it by configuring it in a network with 230kV and 132kV power transmission lines and substations. As a result, there was no tendency to be inferior to those of other countries for the supply reliability of the transmission system and transmission loss (about 2.3 per cent in the 2025 plan). Since the latter half of the 2010s, domestically-produced natural gas fuel alone cannot meet the growth in electricity demand due to economic growth, and large-scale power plants that run on imported coal and LNG fuel will be newly constructed.

Since it is located intensively in the coastal area of the Bay of Bengal in the south, it was necessary to transmit a large volume of electricity from the south to the north towards Dhaka, which is the centre of demand, over a relatively long distance.

To meet this need, the construction of 400kV transmission lines is underway, and plans for construction of 765kV transmission lines are also underway. Plans have also been made to import fuel and electricity generated by neighbouring countries. Unlike large-scale imported fuel power plants located on the coast of the Bay of Bengal, these receive power inland across national borders, thus correcting the above-mentioned bias in transmitting large volumes of power from the south to the north. On the other hand, there are also concerns about being heavily dependent on electricity imports from the energy security perspective.

The above are the characteristics and future trends of the transmission system described in the master plan so far, but the important change in this master plan is the power source composition and regional distribution change due to the efforts for decarbonisation, which has become a global trend.

Increase of South to North Power Flow: The future electricity demand growth shall be for the industrial demand of economic zones mostly outside Dhaka. Crossing the Padma Bridge and narrow Feni region are constraints in constructing the transmission lines. Since this is the issue of long-distance transmission from large-capacity power sources, draft IEPMP plans to construct transmission lines precisely simulating on the dynamic characteristics of the generators mainly on the large-capacity power sources.

Reliability improvement of supply network to Capital Dhaka: Securing the underground transmission line route from 400kV transmission

ring to the centre of Dhaka has been prioritised in draft IEPMP. It is important to simplify the relationship between demand points and underground transmission line routes through a radial system, and to maintain close cooperation between power generation, transmission and distribution utilities and share a common concept.

Interconnection: The interconnectivity lines to be introduced will be decided as a result of coordination with neighbouring countries from the aspect of energy security and the aspect of securing the amount of renewable energy to be introduced.

3.7.2 Distribution

All three aspects of the transmission system plan are important and should be emphasised, but there is still a lack of a strong, digital and smart national grid system. The draft IEPMP team recommended establishing a smart grid with GIS and SCADA as components to reduce distribution system losses, theft, and leakage.

As for Distribution Management System (DMS) or Smart Grid, each company will be on the stage to consider full-scale introduction in the future. Dhaka Power Distribution Company Ltd (DPDC) and Dhaka Electric Supply Company Ltd (DESCO) are preparing to introduce DMS together with the smart grid project. Other distribution companies are also planning to introduce it. Bangladesh Rural Electrification Board (BERB) has completed a feasibility study.

The initiatives taken so far to introduce and implement the smart grid system are praiseworthy but insufficient. A more aggressive, active and planned approach is required to introduce the smart grid and smart metering system nationwide.

3.7.3 Transmission and Distribution (TnD) loss

In the 'Perspective Plan 2041', Bangladesh has set a target to become a high-income country by 2041. So, the country needs to achieve the transmission and distribution loss ratio of high-income countries or lower the current transmission and distribution loss ratio by 2050. Based on this, the 2050 targets for each of the three scenarios covered in this project are Reference Scenario (RES): Global average (8.5 per cent), Advanced Technology Scenario (ATS): High-income country average (6.1 per cent) and Net Zero Scenario (NZS): Japan (4.3 per cent).

In the PP 2041 case, which is currently the first candidate for the GDP assumption based on discussions with the Bangladesh power sector, the maximum electricity demand is assumed to be approximately 31.1 GW in FY2030 and 62.7 GW in FY2041, which is almost the same level as the Base Case assumption in the Revisiting PSMP 2016. In FY2050, it reaches about 106.6 GW, which is about 7.3 times the current electricity demand. The annual growth rate will be about 8-10 per cent until FY2030, corresponding to the rate of electricity demand, but after FY2030, the growth rate will diminish to about 5-7 per cent.

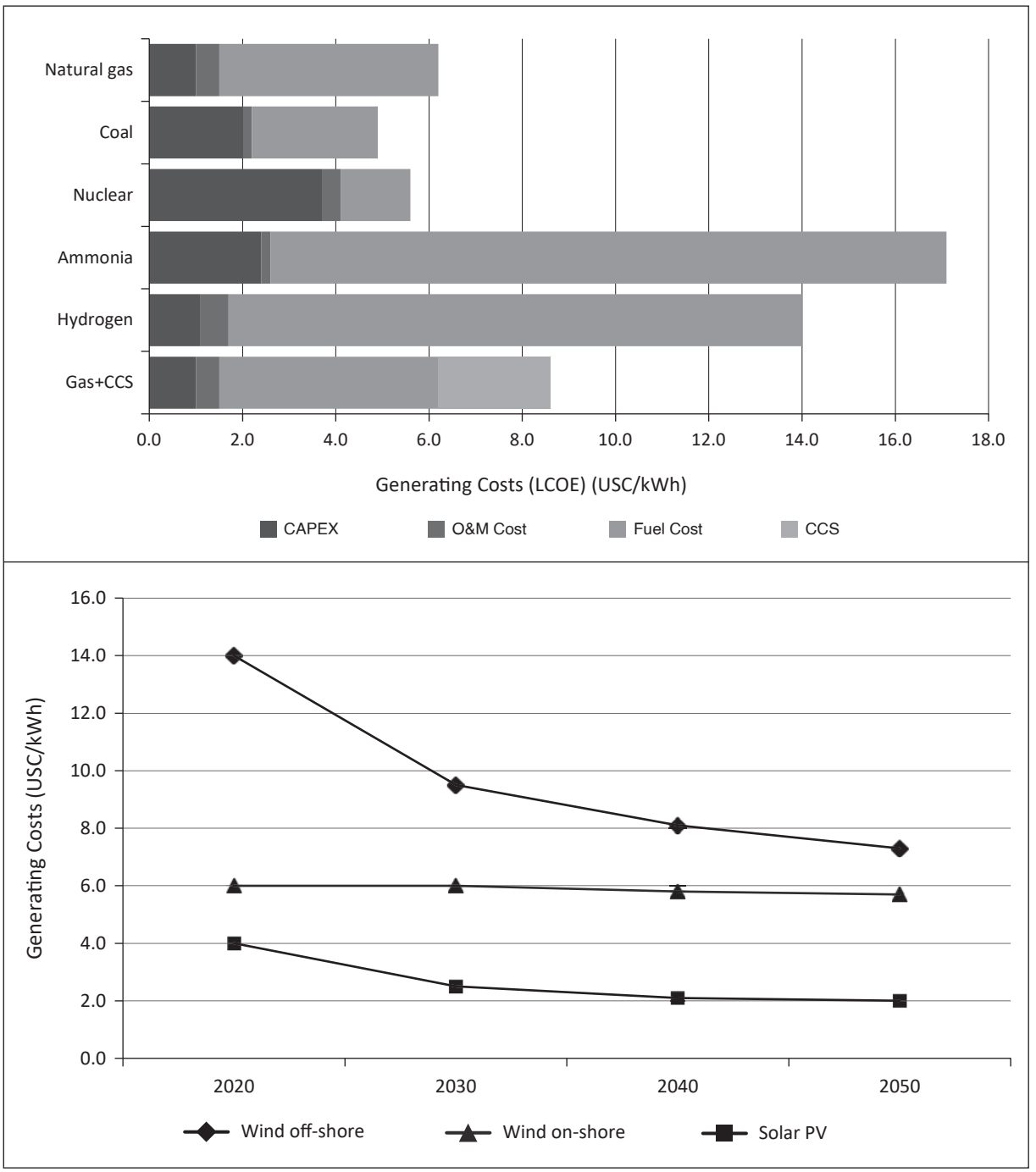
3.8 Electricity Tariffs

Under ATS, the Draft IEPMP interim report decided to operate 50 per cent ammonia co-firing around 2030 and 100 per cent ammonia single-firing around 2049. Later on, the plan was further developed, and it has been decided to operate 20 per cent ammonia co-firing around 2030 (2035*) and 50 per cent ammonia co-firing around 2035 (2040*).

Whereas, under NZS, 50 per cent ammonia co-firing around 2030 and 100 per cent ammonia single- firing around 2042 have been decided. Findings by the JICA study team demonstrate that production cost of ammonia and hydrogen-based power plants is more than double that of natural gas-based power plants.

On the other hand, production cost of electricity from RE-based sources is lower than that of thermal energy; it even predicts a further decreasing trend in the future. So, there is no logical reason to obtain the costly thermal energy-based power generation over the cheaper RE ones.

Figure 5: Production Costs of Thermal and RE Power Plants



Source: JICA-IEPMP Third Stakeholders Meeting.

4. Comparative Assessment of Draft IEPMP

4.1 Major Differences between PSMP 16 and Draft IEPMP

A resource that lists the country's all available energy-producing projects and is updated roughly every five to six years is the PSMP-2016 of Bangladesh. According to the report, 10 per cent of the country's grid should be made up of renewable energy (RE) by 2020 and 20 per cent by 2030. These goals are established in accordance with the country's supply of RE resources. Nevertheless, the proposed grid demands for electricity are not met by any of these RE sources taken together (Dulal, et al., 2021). VISION 2041, the government's recently unveiled development strategy, has been ingrained in PSMP 2016. To achieve its goal of becoming a high-income nation by 2041, it has set the following goals: reducing fuel intensity from 3.42 to 2.56 tonne of oil equivalent (ToE) / million BDT, increasing imported LNG supply from 0 to 4,000 mmcfd, increasing domestic and imported coal supply in electricity generation from 0.7 to 11 and 60 million tonnes per year, respectively, increasing oil import from 5 to 30 million tonnes per year, increasing biogas supply from 4 to 62 mmcfd, raising imported power from 500 to 9,000 MW, and increasing nuclear power generation capacity from 0 MW to 7,200 MW (Rahman & Rao, 2020).

In several counts, the draft IEPMP formulation process is found to be unique compared to the previous models. Technical assistance was given by a specialised research organisation, which was then followed by consultation. However, it has not yet reached the point where all parties involved are partners. An in-depth difference between PSMP 16 and draft IEPMP has been outlined in this section to portray changes and required improvements.

Table 5: Major Differences between PSMP 16 and Draft IEPMP

Key issues	PSMP 16	Draft IEPMP	Remarks
Structure	Not a holistic approach like draft IEPMP as PSMP 16 only included the scenarios of the power sector.	The draft IEPMP consists of both power sector master plan and primary energy supply plan.	The structure has **improved**.
Contribution	Several policies were referred briefly, and were not adequately reflected in the PSMP 16. Also, it lacked a proper linkage between the referred plans and policies which was further strengthened while preparing the final draft of draft IEPMP.	Bangladesh Delta Plan 2100, Mujib Climate Prosperity Plan (MCPP) 2021, National Energy Policy 1996 (updated in 2005), Nationally Determined Contribution (NDC), Perspective Plan 2041; and 8th Five Year Plan were analysed and referred in the draft IEPMP. The linkage was further modified to initiate a clear picture from a holistic perspective.	Reflection of different policies has been **enough**.
Policy vision	A properly-stated policy vision has been facilitated.	A well-defined policy vision has not been added.	The inclusion of policy vision has remained **unchanged**.
Detailed alignments of contributions	The alignments of contributions have been less prioritised.	Some alignments are mentioned but were not enough to develop a clear scenario.	It did not show a remarkable change in terms of alignments. Rather it remained **constant** in both the plans.

(Table 5 contd.)

(Table 5 contd.)

Key issues	PSMP 16	Draft IEPMP	Remarks
Methodological approach used	Correlation analysis, Electricity Intensity Method, GDP Elasticity Method methodologies were used to analyse the plan.	The draft IEMPMP uses a different and more comprehensive methodological approach for demand projection. It follows both top-down and bottom-up approaches for demand projection with an econometrical regression.	The draft IEPMP included a much more **upgraded** methodological approach. Still some cases need to be revised based upon this.
Range of variables	It did not follow a rigorous quantitative method. So, use of variables was limited.	A more realistic GDP growth rate and a wide range of variables for forecasting.	The range of variables had been **upgraded** based on the rigorous quantitative methodology.
Scenario analysis	PSMP 16 did not have any proper scenario setting to project and evaluate the plan.	There are 3 scenarios under draft IEPMP: The Reference Scenario (REF), Advanced Technology Scenario (ATS), & Net-Zero Scenario (NZS).	The analysis of scenario was **elaborated** and **segregated** to a better and more specific version.
Transmission and distribution system	Although it had been mentioned in the plan, it had been significantly less discussed than the IEPMP.	The new IEPMP emphasises on the expansion and strengthening of the transmission and distribution system.	Systems for transmission and distribution received **proper attention**.
Construction of smart grid system	PSMP 16 did not mention the inclusion of smart grid system at all.	The draft IEPMP discussed and illustrated the steps of constructing and utilising smart grid systems from different aspects.	The inclusion of the construction of the smart grid system can be viewed positively and marked as a necessary **upgradation** from the last plan.
Energy data management and collection	PSMP 16 did not guide through the steps of collecting and managing database for the power sector.	The draft IEPMP included separate chapters for energy data management and collection.	The clarity provided on energy data management and collection can be marked as **progress**.
SEA	PSMP 16 lacked the fundamental framing and concepts of SEA guidelines.	The draft IEPMP introduced the concept of SEA with a rigorous analysis in a separate chapter.	The expansion of strategic environmental objectives and the comparison between national regulations and JICA guidelines can be deemed as **positive efforts** in preparing SEA.
Energy transition policy	PSMP 16 ignored the policies focused on the energy transition.	The draft IEPMP also failed to introduce the necessary policy for the energy transition.	The introduction of an energy transition policy is a must, which has been **ignored** in both plans.
Renewable energy policy	PSMP 16 did not discuss the necessary policies for renewable energy.	Although policies were referred to, targets or roadmaps are not adequately mentioned in the draft IEPMP.	More importance has been attached to the draft IEPMP, but it is still **inadequate**.

Source: Author's Compilation.

4.2 Cross-Country Evidence

The global shift towards renewable and clean energy has been adopted by most countries; this has been reflected in the masterplans, policies, targets and methodologies. This section aims to analyse and compare the masterplans of five neighbouring countries based on their energy efficiency, timeframe, energy mix, technological advancement, etc. with Bangladesh. These five countries (India, Thailand, Vietnam, Japan and Sri Lanka) were selected based on the timing of the decision for reforming energy masterplans as it is aligned with the timing of Bangladesh. Furthermore, the economic background along with technological advancements in the energy mix was taken into consideration for selecting the countries.

India

The Draft National Energy Policy of India (2017) has set certain targets for reducing emissions intensity by 33-35 per cent by 2030 over 2005, achieving 175 GW of renewable energy capacity by 2022, and increasing the share of non-fossil fuel-based capacity in the electricity mix to over 40 per cent by 2030. The policy aims to promote sustainability and security by focusing on de-carbonisation through energy efficiency and renewable energy. The National Mission for Enhanced Energy Efficiency (NMEEE), launched under the National Action Plan on Climate Change (NAPCC), failed to achieve its goals due to poor inter-sectoral linkages. The proposed initiatives to enhance energy efficiencies, such as tradable energy-saving certificates, innovative financing mechanisms, and fiscal instruments, have not been effectively implemented. A new and improved National Mission for Enhanced Energy Efficiency will be launched, which will have better linkages between related sectors and a strong supervisory and review mechanism.

Thailand

Thailand's Power Development Plan (PDP), which runs from 2018 to 2037, aims to increase energy security and efficiency. The 10-Year Alternative Energy Development Plan 2012–2021 aims to replace fossil fuels with 25 per cent more renewable and alternative energy sources over the course of the following 10 years (ADB Law and Policy Reform Program-Asian Development Bank, 2012). In addition, the 20-Year Energy Efficiency Development Plan 2011–2030 aims to reduce the country's energy intensity (the ratio of energy consumption to GDP) by 25 per cent in that time frame (Thailand Energy Efficiency Development Plan, 2016). The MoEN targeted to increase the proportion of renewable energy for Thailand's electricity generation by not less than 5 per cent from that of the previous PDP2010: Revision 2 within 2030 by considering the 10-Year Alternative Energy Development Plan 2012–2021 (Sutabutr, 2012). Followed by the just transition movement globally, Thailand's first CCT project will be put into operation by 2026.

Vietnam

The National Power Development Plan (PDP) VIII from 2021 to 2030 with a vision until 2045 has been tasked to Vietnam's Ministry of Industry and Trade (MoIT), with a focus on reducing coal-based power (Vietnam's power plan VIII, 2022). With a 40 per cent share in the production of electricity, renewable energy currently dominates the power sector. Through 2030, the Vietnam Energy Efficiency Programme (VNEEP 3) aims to reduce power loss by 6 per cent and save 8–10 per cent of the country's energy consumption (VIETNAM ENERGY EFFICIENCY, 2022). Vietnam has not yet embraced CCT.

Japan

In the 6th Strategic Energy Plan (SEP), the key theme is to realise carbon neutrality by 2050 and reduce greenhouse gas emissions by 46 per cent in FY 2030 from its FY 2013 levels (Japan's Nationally Determined Contribution (NDC), 2021). The 6th of SEP increased the country's RE generation target from the previous 22–24 per cent to 36–38 per cent by 2030. The goal is to improve energy efficiency by about 40 per cent between 2012 and 2030 (YamaguchiI, 2022). Japan's

industry ministry plans to create a legal framework for CCT to enable companies to start storing CO_2 underground or under the seabed by 2030.

Sri Lanka

Sri Lanka's Energy Sector Development Plan for Knowledge–based Economy, 2015-2025, places a strong emphasis on energy security from both national and individual perspectives (Ministry of Power & Energy, 2015). Renewable energy is to make up 20 per cent of energy generation in 2023. A 10 per cent reduction in total energy demand were to be realised by 2020 through EEC, but failed to do so. Techno-economic feasibility studies of implementing CCT are being carried out.

Compared to other nations, Bangladesh's draft IEPMP timeline is suitable. Bangladesh lags in the renewable energy or clean energy scenario of the timeline because the nation's energy mix is heavily reliant on fossil fuels, while other nations strive to become less reliant on fossil fuels and move towards renewable energy. The goals for Bangladesh's energy efficiency and conservation are comparable to those of other nations, but Bangladesh is having trouble meeting these goals because of insufficient rules. Thailand, Vietnam, and Japan are far ahead of other nations in implementing CCT in their power and energy sectors by conducting feasibility studies, analysing the impacts, and establishing a legal framework for CCT. Bangladesh has not taken any action in this regard, and the idea of CCT is not widely known or accepted either.

5. Reflection of National Policies in the Draft IEPMP

Despite predictions that the global energy market would remain unstable over time, the Bangladesh Power Development Board drafted an Integrated Energy and Power Master Plan (IEPMP) in 2022 without adhering to the energy justice approach, which once again prioritises natural energy import for the following five years. The draft IEPMP ignored the need to explore domestic gas resources, phase out expensive oil-fired power plants, and expand renewable energy sources. It also lacked plans for reducing system losses in the power sector. It was based on multiple policies, but the goals and milestones of several policies were not appropriately reflected. As a result, it cannot be stated that draft IEPMP has addressed enough policy guidelines of previous plans.

This report addresses the goals of all the policies that had been mentioned in the draft IEPMP and tries to investigate the alignment and reflection level of each policy. Furthermore, it offers some recommendations from the policies which can be incorporated in draft IEPMP in the comments section.

Bangladesh Delta Plan 2100: The primary goal was to develop long-term renewable energy policies as well as strategies and formulate a master plan for at least 50 years to harness the potential of renewable energy resources in the country involving public and private sector investments. It also promotes research on the development of technology in the field of renewable energy at universities and research institutions as well as build capacity for its application. Moreover, enhancing green growth through research and development of renewable technologies, including clean development mechanism (CDM), has been a significant initiative. The plan devises innovative financing packages for grant funding and low-interest financing to address affordability for both grid and off-grid renewable energy projects. The target has been set for at least 30 per cent energy production from renewable sources by 2041 in the context of being a prosperous country (Bangladesh Delta Plan 2100, 2018).

The reflection of the policy in draft IEPMP is low. It does include individual chapter based on fuels for technological advancement. Also, inadequate focus on research and development of renewable energy technologies can be identified. The plan even lacks a detailed investment plan for the feasibility studies and research and development for renewable energy.

Perspective Plan of Bangladesh 2021-2041: Adopting a least-cost power generation expansion path and promoting supply of low-cost primary energy are the major objectives of the plan. It also highlights the development of the required infrastructure for primary fuel. It discusses goals like ensuring investment balance between generation, transmission, and distribution; promoting the efficient use of installed capacity and private energy investment, expanding power trade, ensuring proper energy pricing policy and strengthening power and energy institutions (Perspective Plan of Bangladesh 2021-2041, 2020).

The reflection of the policy in draft IEPMP is high. However, it needs to have separate chapters based on the types of fuel.

8th Five-Year Plan July 2020-June 2025: For electricity, the nation will continue to expand its electricity supply capacity and diversify its fuel supply, as has successfully been done in the Sixth and Seventh Five-Year Plans. In addition to reviewing the Power Sector Master Plan 2016, the nation will expand the use of renewable energy by rationalising fuel oil prices (raising the price to cost reflective level). Furthermore, the plan seeks to secure funds by reviewing the energy tariff system, and improve energy efficiency by appropriate capital investment and price mechanisms (8th Five Year Plan July 2020-June 2025, 2020). Reflection of the policy in draft IEPMP is medium.

Mujib Climate Prosperity Plan, 2021: Mujib Climate Prosperity Plan (MCCP) sets a target for renewable energy in the energy mix of Bangladesh for 2030 and 2041. A plan outlined 30 per cent renewable energy by 2030 and 40 per cent renewable energy by 2041 under the scenario MCCP-Maximised (subject to international and other investment support). Under MCCP scenario described as realistic climate prosperity scenario, the target is 10 per cent by 2030 (Mujib Climate Prosperity Plan, 2021).

Reflection of the MCCP in draft IEPMP is low. Feasibility roadmaps for SEA have not been discussed, and no plans for different RE pathways in the draft IEPMP have been mentioned.

Bangladesh National Building Code, 2015: Bangladesh National Building Code now consists of regulation that requires buildings to supply a portion of their electric load from renewable electricity. According to the regulation, residential building should supply 3 per cent of the total electric load of the building from solar or other renewable sources, for non-residential buildings, it is 5 per cent of the total electric load.

Reflection of the policy in draft IEPMP is very low as there is no concrete guidelines and policy discussion for the supply chain of RE in buildings.

Net-metering Guidelines, 2018: It includes a detailed guideline on eligibility criteria, consumer categories, capacity and energy export limits, energy accounting and settlement, tariff structure, metering arrangement, and detailed application procedure. NEM guidlines also include feeding method of RE system, equipment standards, connection types, general interconnection requirements, voltage functions and unbalance, RE generator power factor, reactive power compensation, short circuit level, protection guidelines & schemes, and safety requirements.

Reflection of the policy in draft IEPMP is moderately low. Eligibility criteria, consumer categories, capacity and energy export limits, energy accounting and settlement, tariff structure, and metering arrangement are not discussed for different transmission modules.

Sustainable Finance Policy for Banks and Financial Institution: Bangladesh Bank (BB) Refinance Scheme's of 2020 supports to participating Financial Institutions (PFIs) (Banks/ FIs) against their financing of renewable energy generation and other environmentally harmless projects. The size of the fund has been increased from BDT 2 billion to BDT 4 billion due to the growing demand for financing of environment-friendly products/projects/initiatives. The scheme

includes 55 green products/projects/initiatives under 09 categories.

Reflection of the policy in draft IEPMP is very low as no financing sources and investments are included in IEPMP.

Gas Sector Master Plan 2017: It is a roadmap for steering the gas sector into a direction where domestic production is maximised, infrastructure is developed, and import is facilitated. The first priority here is to initiate the required programmes within E&P. The second priority is to initiate the technical and economic studies of the optimal solution for bringing additional gas from Moheshkhali to Dhaka region. This will minimise the risk of bottlenecks in the system

The third priority is the approach to LNG pricing and inclusion into the gas market (Gas Sector Masterplan 2017). Reflection of the policy in draft IEPMP is low. A separate chapter discussing the roadmap is required. It needs to revise the infrastructural and transmission pathway outline in IEPMP. The proper detailing of future resourcing from local sources needs to be addressed separately.

National Solar Energy Roadmap 2021-41: It includes the narrative of increasing the share of renewable energy in the total energy mix. It also ensures energy security and sustainability and attracts private investment in RE projects. It aims to achieve global and national RE generation targets; and reduces the rate of GHG emission (National Solar Energy Roadmap 2021-41, 2020)

The reflection of the policy in draft IEPMP is NIL. It needs to incorporate a separate chapter on this.

Bangladesh Wind Map: Identifying possibilities for further feasibility studies generating wind-based energy in smart grid is the fundamental objective of the plan (Bangladesh Wind Map, 2021). The reflection of the policy in draft IEPMP is NIL. It needs to incorporate a separate chapter on research and feasibility study.

6. Clean Energy in the Draft IEPMP

The draft IEPMP so far acknowledges the GoB's global goals towards clean energy for achieving net zero commitments by 2050. The acknowledgement has not much influenced renewable energy's position in the draft IEPMP as renewable energy has not received the deserving spotlight in draft IEPMP yet. Rather, the goal set in the draft IEPMP seems to be degraded from the previous global commitment. Initially, the target was to generate 40 per cent of power from RE by 2041. Later, the target was revised to ***'Up to 40 per cent of power from cleaner energy by 2041'***. Such a shift in narratives weakens the government's stance and creates confusion among the masses regarding renewable energy.

6.1 Renewable Energy in Draft IEPMP

The updated version of the draft IEPMP interim report shared on the SHM3 sets a much more positive tone for renewable and clean energy. Significantly moderate targets have been determined for solar, wind and biogas. Even though it is more comprehensive than the previous interim report, it does not detail out the plan for the implementation and transition. Investment plans, details regarding feasibility tests, technological advancements and other macro-micro issues are yet to be included in the final plan.

The final draft plan is updated from the previous SHM3 version as it lays out the segregation between renewable energy and clean energy. The plan provides contradictory data on the target for renewable energy throughout the document. The share of these clean energies will reach 20 per cent by 2041 and 30 per cent by 2050. In another chapter, the draft IEPMP draft plan states the share of clean energy will be as high as 55.4 per cent of the total share, but the actual share of RE will stand at only 12.2 per cent by 2050. The definition of RE and clean energy and their targets need to be made clear for better planning.

Initially, the draft IEPMP report did not seem to give enough importance on RE; the discussion is focused more on the challenges and limitations rather than on the expansion. But following up in the next stages (SHM3 and Draft Ver. 4) the tone started to be more assertive. Both the updated documents include the possible scopes to explore existing solar, wind and waste energy based on Solar Energy Roadmap, Wind Energy Plan and other RE-based research. It particularly defines that the targeted power generation from RE sources is possible but does not indicate how and when that will be possible.

The draft IEPMP rightfully mentioned the importance of solar PV in Bangladesh, but it is necessary to promote the introduction of solar parks as aggressively as possible. The draft IEPMP discusses the limitations of expanding the use of solar PV in Bangladesh, which is constraint of land. The position regarding solar remains the same in the successive versions as well.

There has been progress regarding Rooftop PV, wind, hydro, and biogas energy in the later versions of draft IEPMP. The interim report of the draft recommended following the measures to promote the introduction of Rooftop PV be considered Public Sector Mandatory introduction of Rooftop PV. The two updated documents mentioned targets to increase the rooftop PVs to 2,000 MW by 2030 and 12,000 MW by 2050. Currently, the installed rooftop solar PV is 400 MW. Data collection of wind power has been emphasised in the interim report of IEPMP, as there is a lack of progress in wind energy generation in Bangladesh. The draft IEPMP 3rd and 4th versions acknowledge that the forecasted value of 5,000 MW of onshore wind power by 2050 is not excessive. The draft IEPMP defines the usefulness of Waste to Power from the perspective of 3R (Reduce, Reuse, Recycle), and is expected to expand the introduction of several MW classes in rural areas, in addition to the introduction of power plants of the same scale in metropolitan.

The draft IEPMP highlights the scopes and possibilities for renewable energy in the landscape of Bangladesh but lacks a specific work plan with a timeline for the transition to sustainable energy. There is no detailed plan for the necessary financial estimates for investment and maintenance of RE technologies that could be used to attain the goal of low- carbonisation. Additionally, there is no accurate policy framework for renewable and clean energy subsidies yet. The decision of phasing out diesel-based power plants does not seem to be reflected in the draft IEPMP yet. Similarly, the GoB's plans to phase out diesel and furnace oil-based power plants have not been considered, and the resources that could be saved from implementing this decision and used to subsidise the RE sector were not raised in draft IEPMP. Medium-term plans for installing solar PVs in sectors like agriculture, irrigation, and primary schools are not mentioned. No feasibility study was discussed on RE-related implementation in various spheres of the economy.

Although it intends to move towards low carbonisation, draft IEPMP lacks substantial and adequate policy pathways to address the possible energy mix focused on RE. Referring the carbon capture storage (CCS) as 'clean energy' is unjustifiable and unacceptable. Contrary to popular belief of opting low-cost energy option, the study team revealed their interest in adopting costly hydrogen and green ammonia in the SHM3. Investment plans that need to be made in expensive technologies such as CCS, hydrogen and green ammonia are missing in the draft paper so far.

6.2 Energy Transformation in the Draft IEPMP

The draft IEPMP recognises the need to reduce energy intensity by 20 per cent by 2030 compared to the 2015 levels. This goal is in line with the United Nations Sustainable Development Goal 7, which aims to ensure access to affordable, reliable, sustainable, and modern energy for all. The measures proposed in the draft IEPMP to achieve this goal include the promotion of energy-efficient technologies and practices in different sectors, such as industry, transport, construction, and agriculture.

From a clean energy perspective, the emphasis on energy efficiency and conservation in the draft IEPMP is a positive development. Energy efficiency and conservation can reduce the demand for fossil fuels and therefore help to lower greenhouse gas emissions. However, no specific guidelines on how to achieve the Nationally Determined Contributions (NDCs) target for energy transformation have been formulated.

Priority should be given to energy efficiency measures such as building codes, energy-efficient appliances, and industrial energy audits. Energy conservation must be encouraged through public education campaigns, energy-efficient lighting, and energy-efficient building design to reduce energy demand. Collaboration must take place among government, industry, and civil society through public-private partnerships, stakeholder engagement, and knowledge-sharing platforms to identify and implement effective energy efficiency and conservation measures.

6.2.1 Energy Efficiency

The draft IEPMP has a chapter dedicated to 'Improving Energy Efficiency'. The government intends to reduce energy intensity (national primary energy consumption per unit of GDP) by 20 per cent from 2013 levels in 2030 as part of the Energy Efficiency and Conservation Master Plan (EECMP 2016). This goal is to be achieved through the many energy management programmes outlined in the EECMP 2016.

The draft IEPMP has placed significant emphasis on expanding the country's production capacity in the power sector. However, there seems to be a lack of emphasis on energy efficiency and conservation measures. This is particularly concerning given the country's high energy demand growth rate. There is a significant potential for energy conservation in Bangladesh. For example, a significant amount of energy get wasted due to inefficient constructions, transport systems, and industrial processes.

Several revisions were made to the draft IEPMP's final draft regarding energy efficiency. The introduction of imported energy-efficient used vehicles and management strategies for them were considered. The final energy consumption of the agricultural sector and suggestions for increasing efficiency in the sector were included. Two significant initiatives have been identified as ways to speed up energy efficiency and conservation activities and regulations: a) re-examining the proposals from the EECMP 2016, and b) creating energy efficiency and conservation goals and policies for 2050. However, it is unlikely that these updates are enough to address energy efficiency in a country for a medium to long-term energy plan.

The draft IEPMP covered the existing energy efficiency regulations in commercial, residential, and industrial sectors. However, it fell short in the discussion of sector-specific goals or its strategy for achieving low energy intensity by 2030. Moreover, no guidelines were suggested to assist the industrial sector in overcoming the barriers to implementing EEC policy. The EECMP 2016's goals for overall use of energy in construction and residential sectors were emphasised. Although the EECMP 2016's reflection in the draft IEPMP is positive, a suitable structure or set of instructions for achieving those goals should have been developed.

The draft IEPMP needs to prioritise energy efficiency and conservation measures, with a focus on construction, transport, and industry sectors. The plan should outline specific goals and strategies for achieving low-energy intensity by 2030 in each sector. To achieve its energy efficiency and conservation goals, the draft IEPMP should develop implementation strategies such as a sector-specific roadmap, identifying funding sources, and partnering with the private sector to promote investment in energy efficiency and conservation measures.

To assist the industry sector in implementing energy efficiency and conservation policies, the draft IEPMP should provide guidelines, technical assistance, training programmes, and financial incentives. For buildings, the draft IEPMP should establish energy efficiency standards and encourage use of energy-efficient designs and materials. Financial incentives should be provided to builders and developers who invest in energy-

efficient buildings. To promote energy conservation measures across all sectors, the draft IEPMP should develop a comprehensive programme that includes public awareness campaigns, technical assistance, and financial incentives.

6.2.2 Low Carbonisation & Decarbonisation

The draft IEPMP acknowledges the importance of the low carbonisation/decarbonisation in the country's energy sector. The plan recognises that the country needs to reduce its greenhouse gas emissions and contribute to global efforts to mitigate the impacts of climate change.

To achieve low carbonisation/decarbonisation, the plan emphasises the promotion of energy efficiency and conservation measures in all sectors of the economy. The plan includes specific targets for renewable energy, such as increasing the share of renewable energy in the power sector to 10 per cent by 2021 and 20 per cent by 2030.

The draft IEPMP aims to achieve 40 per cent of the country's energy from clean sources by 2041 through low carbonisation and/or decarbonisation. However, the draft considers energy from coal and technology-based hydrocarbons as 'clean'. Instead, renewable energy (RE) should be the primary source of clean energy. The power industry is expected to expand clean energy, including nuclear, renewable energy, and decarbonisation technologies such as ammonia co-firing, hydrogen single-firing, and gas-fired power with CCS.

The Scenario Setting for Energy Demand Forecast notes that the REF scenario does not anticipate significant changes in energy efficiency and low carbonisation initiatives. The ATS and NZS scenarios, however, are expected to produce lesser CO_2 emissions from energy compared to the REF scenario. By 2050, CO_2 emissions will have increased to 401 million tonnes. The Decarbonisation Index will evolve differently in each of the three scenarios, requiring a significant reduction in the NZS scenario and an increase in the REF and ATS scenarios to achieve net-zero emissions by 2050.

In the final draft of the IEPMP, important changes were made, such as the inclusion of low-carbonisation hydroelectric power imports from Bhutan, Nepal, and Myanmar via India; procedures and policies such as emissions trading systems, feed-in tariffs, carbon taxes, etc. to achieve a clean energy society; and policy actions to address the difficulties in achieving a clean energy society. The update emphasises decarbonisation principles while taking constructive initiatives towards low carbonisation. However, the rising CO_2 emissions in the REF scenario suggest that further measures will be necessary to achieve low carbonisation. In the medium to long run, the existing policies and efforts may not be enough to achieve low carbonisation.

The draft IEPMP should consider revising its definition of clean energy to exclude coal and technology-based hydrocarbons, which are not considered sustainable and can contribute to greenhouse gas emissions. The emphasis should instead be placed on increasing the use of renewable energy sources, such as wind, solar, and hydroelectric power, which have a much smaller carbon footprint and can be harnessed without depleting finite resources.

Given the rising CO_2 emissions in the REF scenario, it is clear that existing policies and efforts may not be sufficient to achieve low carbonisation. Therefore, the draft IEPMP should consider additional measures such as implementing stronger regulations, increasing funding for research and development of clean energy technologies, and encouraging public-private partnerships to accelerate the transition towards a sustainable and low-carbon economy.

6.2.3 Technological Advancement, Research and Development

The inclusion of a new chapter on data management in the draft IEPMP is a significant recognition of the importance of technological advancement data management, research, and development in the power sector. The power sector is a critical component of any country's economy,

and its sustainable development is a key factor in achieving the economic and social goals of a nation. With the increasing demand for electricity and the need to reduce carbon emissions, it is becoming more important than ever to develop clean energy solutions that are reliable, efficient, and affordable.

Accurate data collection and analysis are essential to achieving these goals. By highlighting the government bodies responsible for energy statistics and their roles in data management, the draft IEPMP recognises the importance of using accurate data to inform policy decisions and identify areas for improvement. This is particularly important in the context of clean energy, where investment decisions must be based on accurate data on energy demand, resource availability, and technological feasibility.

The draft IEPMP's focus on data management also reflects a growing recognition of the importance of using technology to improve the efficiency and effectiveness of the power sector. With advances in data analytics, machine learning, and artificial intelligence, it is becoming increasingly easy to analyse large datasets and identify patterns and trends that would be difficult to detect using traditional methods. This, in turn, can help policymakers make better-informed decisions about energy policy and investment priorities.

From a 'clean energy' perspective, the inclusion of data management in the draft IEPMP is particularly important as it enables accurate tracking of progress towards the goal of achieving 40 per cent of the country's energy from clean sources by 2041. Accurate data collection and analysis can help identify areas where the use of renewable energy sources can be increased and where further investment in clean energy technologies is necessary.

The draft IEPMP could establish a dedicated research and development unit with a specific focus on clean energy technologies. This unit could collaborate with academic and research institutions to develop innovative solutions for clean energy.

The draft IEPMP could suggest partnerships with potential international organisations that specialise in clean energy research and development. This could provide access to expertise, funding, and technology transfer opportunities.

The draft IEPMP could promote collaboration among government, industry, and academic institutions to foster innovation and speed up the development of clean energy technologies. The plan could encourage collaboration through workshops, conferences, and research grants.
The draft IEPMP could invest in training and education programmes to develop a workforce with the necessary skills to support the growth of clean energy. This could include programmes for technicians, engineers, and other professionals focused on clean energy.

6.2.4 Strategic Environmental Assessment (SEA)

The SEA process is an important tool for identifying and assessing potential environmental and social impacts of policies, strategies, or programmes. It aims to manage negative outcomes and minimise their impact while maximising positive outcomes. The draft IEPMP has mentioned sector-wise SEA, but it lacks concrete acknowledgement of policy guidelines, feasibility studies, and legal frameworks. Less information has been provided concerning the expert team performing the SEA, no technological element with proper planning has been specified, and the costing burden has also not been shared.

It is important to consider the effects of the natural gas-fired power plants' construction on ecosystems, water quality, air quality, and ecosystems, as well as the potential for accidents and resettlement.

In the SEA, the evaluation should consider the development of port facilities, construction of coal-fired power plants, and construction of power transmission and distribution networks. Particular attention should be paid to the climate change impacts and air pollution associated with coal-fired power generation. There was no inclusion of Carbon Capture Technology (CCT) in the methodology such as post-combustion carbon

capture (the primary method used in existing power plants), and pre-combustion carbon capture (largely used in industrial processes). Further feasibility plans need to be incorporated for CCTs.

Climate change, air and water pollution, ecosystems, land acquisition and resettlement, accidents, etc. should be considered for the monitoring of SEA, but no specific timeframe and monitoring unit has been outlined in the draft IEPMP. The government should invest more in building capacity by giving workers at government environmental institutions the required training and facilities, and the legal authority they need to carry out their duties. Comparative studies between technologies also need to be commissioned.

The impacts of wind farms on migratory birds should be looked into because Bangladesh is located on the East Asian Australasian Flyway (EAAF) and the Central Asian Flyway (CAF). The effects on inland and marine fisheries, as well as aquaculture and other enterprises in coastal regions, should be considered from the standpoint of livelihood. Ecology specialists are not included in the multidisciplinary approach and there is a gap in the baseline research for gathering the essential data.

Nuclear power generation produces lesser greenhouse emissions in SEA than coal-fired power generation, etc., but the assessment should scrutinise the safety factors, particularly accidents that occur while operating nuclear power plants and the handling of radioactive waste (waste, exhaust gas, wastewater, etc.). There has been historical evidence of hazardous accidents of nuclear-based power plants worldwide which is detrimental to the environment and the people residing there. The aftermath of such accidents is immense both for the locality and the biodiversity. Keeping this in mind, no technology has been specified for a hazardous breakout or disaster, and no adequate steps are stated for SEA. There is also no mention of an extreme safety precaution plan.

SEA should incorporate the environmental effects of hydrogen manufacturing, storage, transportation, and deployment. Even though hydrogen is deemed clean as a fuel, its production is an energy-intensive process. Hydrogen-based energy systems are an appealing option for replacing the existing fossil fuel-based systems. However, releasing hydrogen into the atmosphere can disrupt the methane and ozone levels, which are the second and third most significant greenhouse gases after carbon dioxide. Consequently, hydrogen has the potential to contribute to global warming as an indirect greenhouse gas.

From a ‘clean energy’ perspective, the changes made in the documents are encouraging. The inclusion of a work schedule and plan demonstrates a commitment to action, which is essential in addressing environmental challenges. The segregation on four levels (policy, plan, programme, and project) allows for a more targeted approach to achieving environmental objectives.

The incorporation of three scenarios (REF, ATS, and NZS) that take into account the characteristics, policy, and technology provides a more balanced approach that is essential in achieving a sustainable energy system. The inclusion of alternatives that address financial accessibility, environmental sustainability, and the security of the energy supply also shows a commitment to achieving a sustainable energy system that is accessible to all.

The addition of dimensions such as biodiversity, fauna, and flora, air and climatic elements, labour, and land acquisition to the list of strategic environmental objectives shows a recognition of the interconnected nature of environmental challenges. The broadening of the strategic environmental objectives to cover topics such as soil, water, natural hazards, and waste management is also a positive development.

Finally, the comparison conducted between national regulations and JICA guidelines and the summary of environmental interactions on cumulative impacts by type of energy and power development provides a comprehensive understanding of the potential environmental impacts of the project. This information is essential in identifying and mitigating potential environmental risks.

For SEA practitioners/consultants and policymakers, training and capacity-building sessions on SEA statements and monitoring should be made available. This would improve existing procedures and encourage proactive and useful monitoring commitments. There are several areas where training could be beneficial:

1. *SEA Statement Preparation:* Training should be provided to policymakers and practitioners on how to prepare SEA statements that are clear, concise, and easily understood. This training should cover the basic principles of SEA and the key components of an SEA statement, including the screening process, scoping, assessment and reporting.
2. *Monitoring and Reporting:* Policymakers and practitioners must understand the importance of monitoring and reporting. Training should be provided on how to develop effective monitoring programmes that identify and track environmental impacts and outcomes. This training should also cover the key elements of reporting, including how to effectively communicate monitoring results to stakeholders.
3. *Integration with Planning Processes:* SEA practitioners and policymakers should understand how to integrate SEA with planning processes. This includes identifying key decision points and ensuring that environmental considerations are integrated into the decision-making process at each stage.
4. *Legal Requirements:* SEA practitioners and policymakers should have a strong understanding of the legal requirements surrounding SEA. This includes knowledge of relevant legislation, regulations and guidelines, as well as how to ensure compliance with these requirements.

The current SEA Process Checklist needs to be revised. Once updated to meet the process and reporting requirements, this checklist might be utilised as a framework for quality checks. The checklist should be designed to ensure that all necessary steps in the SEA process are completed, and that the resulting reports are of high quality.

The publication of monitoring findings must be promoted and made publicly available on the websites of the policymakers with the plan/ programme and SEA relevant paperwork to guarantee that monitoring is properly conducted and monitoring reports are generated. This will ensure that stakeholders are aware of the results of monitoring activities, and that these results can be used to inform decision-making processes.

A national monitoring organisation or forum can be established to guarantee that the advantages of monitoring are realised. This would cooperate with local government and other plan-making agencies to facilitate monitoring. The monitoring organisation or forum would be responsible for overseeing the implementation of monitoring programmes, ensuring that they are conducted in a consistent and effective manner. The organisation or forum could also provide guidance and support to policymakers and practitioners, as well as sharing best practices and lessons learned.

Monitoring activities that go above and beyond the minimal legislative criteria should be rewarded, for example, through awards given at relevant national planning conferences conducted by the Ministry of Environment. This will incentivise policymakers and practitioners to conduct monitoring activities that are more extensive and thorough, and will recognise those who go above and beyond the legal requirements. By recognising and rewarding excellence in monitoring, we can encourage better environmental outcomes and ensure that SEA remains a valuable tool for sustainable development.

7. Other Issues reflected in Draft IEPMP

The draft IEPMP has not included several important issues related to Bangladesh's power and energy sector, such as tariffs, subsidies, capacity payment, investment in technology, R&D, etc. These issues can be segregated into financial, policies and investment issues. The final IEPMP must incorporate these issues as they are as important, if not more.

7.1 Financial Issues

7.1.1 Power Tariff

A discussion has been going on to raise the power tariff by 19.92 per cent to BDT 6.20 per unit (1 kilowatt-hour) from the previous BDT 5.17 per unit from December 2022. The distribution companies demanded to hike retail level electricity tariff by around 25 per cent on average. Bangladesh Energy Regulatory Commission (BERC) arranged a two-day public hearing starting from 8 January 2023, to justify power tariff hike proposals at retail level by different state-run power distribution companies.

The upward adjustment of power tariffs at this moment of consumer inflationary pressure may add more burden. The hike could have been avoided by exploring other options. If expensive oil-based power plants are phased out as per the plan, there will be no need for subsidising electricity for easing consumers' burden. In that case, substantial tariff rationalisation at this situation is not required.

7.1.2 Subsidy

The full additional subsidy demanded for power, petroleum and LNG will not be required. On the one hand, BPC is currently going through a profitable phase. On the other hand, it is demanding a subsidy of BDT 19,358 crore. BPC should rather cross-subsidise Petrobangla for an efficient allocation of resources. The upcoming 978 MW power generation from RE can substitute for imported LNG-based power generation. This will also help in reducing the subsidy in the current fiscal year.

7.2 Policy Issues

7.2.1 Retirement of the QRRs

Fossil fuel-based power plants in retirement should not be extended further under the Quick Enhancement of Electricity and Energy Supply (Special Provision) Act 2010. A total of 8 IPPs will retire this FY2022–23 as per plan and another 5 IPPs will retire in FY2023-24. None of the contracts of these 13 fossil fuel-based IPPs should be extended further under any circumstances, nor should any new IPPs be signed.

7.2.2 No further extension of the Quick Enhancement of Electricity and Energy Supply (Special Provision) Act 2010

Last September, the special act was extended for the third time till 2026. This special provision does not ensure a competitive market for procurement; it rather causes market failures through externalities. The act should not be extended again; in fact, it should be abolished at the earliest possible time.

7.2.3 Amendment to the BERC Ordinance 2022

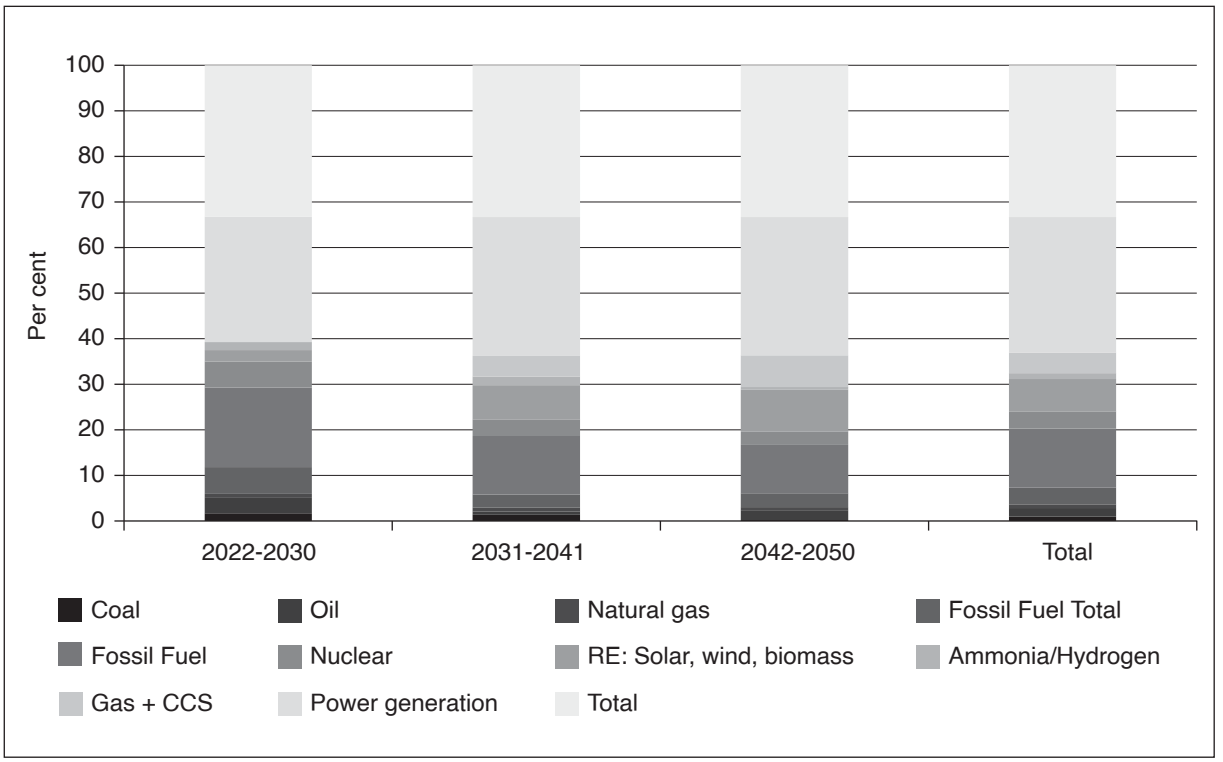
The BERC will now consult with the government before any move towards holding a public hearing on retail power tariff hike proposals. The GoB has amended the BERC Act 2003 to create a scope for the government to take arbitrary decisions on raising retail, bulk power, and energy prices. This decision will weaken the institutional capability of BERC even more.

7.3 Resource Allocation for Investment

The draft IEPMP broadly emphasises the ATS scenario which will introduce technologies with a high cost. But the allocation for investing in this high technology seems to be overlooked. The R&D allocation for technologies such as green ammonia and hydrogen has also not been made clear. A huge fiscal burden or investment would be created in adopting advanced technology which is not discussed. However, the updated version 4 sheds light on the priority areas and investment planning for the next three decades.

As per the final draft IEPMP, more than USD 176 billion of investment will be necessary in the next three decades through 2050 to construct the necessary energy infrastructure (Figure 6). This estimation does not include the investment plan of some important items such as upstream activities for exploration, development and production, and electricity transmission and distribution activities.
As shown in figure 6, the required amount

Figure 6: Investment Plan as per the Draft IEPMP



Source: Authors' illustration from IEPMP 4th draft.

will increase in the later periods as proactive investment will become necessary to promote low carbonisation of the energy structure. Intensive investments in cleaner energies will occur mainly in the electricity sector. An overwhelming amount of investment is required in the electricity sector; the dominance of the sector will be even greater if the investment for transmission and distribution system is included. The electricity sector investment schedules adoption of innovative technologies such as co-firing with ammonia and hydrogen as well as CCS. In this regard, a dedicated study is needed to assess the potential of CCS utilisation in Bangladesh as these technologies are still in the preliminary stage of socio-economic application worldwide. As demonstrated, there is no detailed required investment in energy infrastructure including investment in RE. A source and project-wise detailed RE investment plan should be included in this chapter. To incorporate RE in the fuel mix and generate power from RE sources, short-term plant investment will also be required. Without a proper investment plan and work plan, achieving 40 per cent of clean energy is impractical.

8. Summary Observations and Recommendations

The draft IEPMP 2021 formulation process is found to be distinctive in several counts such as a comprehensive plan which accommodates energy and power-related issues, a specialised research organisation has been involved to provide technical support, and a consultative process has been followed. However, it has not reached to the level of partnership.

The plan considers a carbon-neutral economic perspective though it is not fully reflected in operational issues. The new plan still has no room for renewable energy-based power generation which continue to promote fossil fuel-based power generation system as the major source of energy in

the coming decades. The preferential biases found to be in the methodology for demand estimation will ultimately make it unrealistic to achieve 40 per cent of the power demand from clean energy. A rational demand projection for power and attaining the renewable energy target will be reasonable.

The draft IEPMP still promotes fossil fuels in the form of LNG, coal and coal-based energy. The energy scenario settings still lack the inclusion of clean energy. The newly introduced technologies are yet to be tested and proven to be economically efficient and environmentally harmless. A hefty investment is kept for the LNG import and LNG regasification infrastructure, indicating LNG being the most used energy in the fuel mix. This ultimately overlooks and undermines the importance of natural gas exploration from domestic sources.

The plan has been revised since the first draft was available in May/June 2022; a revised version was available in November 2022. Findings have been presented to different stakeholder groups. A number of issues — some positive and some negative – were taken into consideration. Considering the current power and energy sector scenario, the final plan must be more robust and rigorous.

a. ***The draft IEPMP must overcome the preferential biases:*** The draft plan, though found to be relatively rigorous, cannot overcome several biases. Over-reliance on GDP estimates, reliance on coal and LNG as the important fuel mix, and passing over RE are some key prejudices observed in the IEPMP. GDP estimate based on PP2041 made the whole exercise unreliable and to make it more reliable, an alternative 'in-between' scenario is proposed where GDP growth also seems high. A more realistic assumption on GDP estimates is highly important.
b. ***An alternative scenario called '40 per cent RE by 2040' needs to be set:*** The commitment of 40 per cent of RE has been shifted to 40 per cent of clean energy. This seems "logical". This, however, includes coal and other hydrocarbon-based energy mixed with advanced technologies as 'clean', which is unacceptable. It is expected that an alternative scenario called '40 per cent RE by 2040' needs to be set. An implementation plan for rooftop solar in primary schools and solar irrigation systems is required.
c. ***Necessary modelling and exercise need to be undertaken:*** The IEPMP, directly and indirectly, promotes coal and coal-based energy that should not be accepted. Before adopting any untested or less-tested technology, proper modelling and testing is required.
d. ***Financial aspects of the power and energy sector should be reflected more in the final plan:*** The Plan does not take into account the fiscal burden due to the use of fossil fuel and excess reserve margin. The IEPMP does not properly discuss the impact and implications of energy tariff, and hence the proposed technological choice would raise energy prices significantly. Amid this crisis a clean energy scenario in the power and energy sector can be resource-efficient, can generate more power and save subsidy allocation.
e. ***LNG-based power generation should not be encouraged further:*** The draft IEPMP should further emphasise on gas exploration in domestic gas fields. Dependency on long-term LNG contracts should also be reduced. It should not be opted for LNG purchases from the spot market as this is a high-price situation. BPDB/SREDA/IDCOL should aggressively look for foreign financiers and investors in RE sector.
f. ***Fossil fuel-based power plants in the process of retirement should not be extended:*** Fossil fuel-based power plants in the process of retirement should not be extended further under the Quick Enhancement of Electricity and Energy Supply (Special Provision) Act 2010. This will save resources in terms of capacity payment and subsidy. Additionally, it will save the USD required for importing fuels. BPDB must revisit the existing IPP contracts yet to retire after July 2023. Especially, the capacity payment paid and the tariff at which PDB is buying power from IPPs should be reviewed.

g. Establishing proper implementation of the existing SEA guidelines is required: The implementation of the existing SEA guidelines is badly needed. To ensure enough budgeting and costing for numerous technologies and to conduct a complete feasibility analysis, impact evaluation, and reporting, the system must abide by the SEA guidelines.

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For broader energy security and sustainability, the Ministry of Power, Energy and Mineral Resources (MoPEMR) of the government made a draft master plan for the Energy and Power sector titled *'Integrated Energy and Power Master Plan'* (also known as IEPMP) which has brought the energy and power sector under a single pathway plan.

Initiated in March 2021, the plan underwent several developments and updates, while the final master plan is likely to be released by the end of this year.

It is expected the final version will highlight the contemporary power and energy sector issues with way forwards to accomplish clean energy commitments and achieve affordable alternative clean and renewable energy through government measures.

The study aims to analyse the draft IEPMP from a clean energy perspective considering how it will meet the clean energy goals despite current obstacles.

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