Sector Summaries

Implementing Intended Nationally Determined Contributions (INDCs) and Low Emission Development Strategies (LEDS) through Mobilising Private Investments

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List of Acronyms

BB	Bangladesh Bank
BIFFL	Bangladesh Infrastructure Finance Fund Limited
BPDB	Bangladesh Power Development Board
BRTA	Bangladesh Road Transport Authority
BSCIC	Bangladesh Small and Cottage Industries Corporation
CDKN	Climate Development and Knowledge Network
CNG	Converted Natural Gas/ Converted Natural Gas driven Vehicles
CSEB	Compressed Stabilized Earth Blocks
EE	Energy Efficiency
EE&C	Energy Efficiency and Conservation
ESCO	Energy Services Company
ESI	Energy Savings Insurance
FDR	Fixed Deposit Receipt
FI Act	Financial Institution Act
FMO	Netherlands Development Finance Company
GCF	Green Climate Fund
GCPF	Global Climate Partnership Fund
GHG	Green House Gas
GoB	Government of Bangladesh
ICT	Information and Communication Technology
IDCOL	Infrastructure Development Company Limited
IFC	International Finance Corporation
IKI	German International Climate Initiative
INDC	Intended Nationally Determined Contributions
JICA	Japan International Cooperation Agency
IPP	Independent Power Producer
KW	Kilowatt
KWP	Kilowatt Peak
LTFF	Long Term Financing Facility
LED	Light Emitting Diode
LEDS	Low Emission Development Strategies
LPG	Liquefied petroleum gas
MFO.	Mutual Fund Organization
MPI	Mobilizing Private Investment
MRT	Mass Rapid Transit System
MRV	Measurement Reporting and Verification
MtCO2	Metric tons of carbon dioxide equivalent
MW	Megawatt
NACOM	Nature Conservation Management
NBFI	Non -Bank Financial Institution
NGO	Non-governmental organization
NDCs	Nationally Determined Contributions
PPP	Public Private Partnership
PSMP	Power Sector Master Plan
RE	Renewable Energy
SHS	Solar Home System
SME	Small and Medium-sized Enterprise
SREDA	Sustainable and Renewable Energy Development Authority
UNFCCC	United Nation Framework Convention on Climate Change
US	United State of America
USAID	The United States Agency for International Development
VAT	Value Added Tax

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1. Introduction

Mobilising Private Investment for Nationally Determined Contributions is a two-year project funded by the German International Climate Initiative (IKI). An initial scoping was conducted between June and August 2017. The objective of the project was to support public actors and the private sector to create favourable conditions for private investment in implementing Nationally Determined Contributions' (NDCs) by de-risking investments and increasing the scale of demand. In the initial scoping study, five sub-sectors were identified including improved crop production (agriculture), Energy Efficiency (EE) in industry, Renewable Energy (RE) (power), modal shift in transport; and electric vehicles (transport). As part of the process CDKN assigned NACOM to undertake a detailed scoping study targeting further assessment on the potential to invest in the economic sub sectors based on market maturity, willingness of private sector to invest, and the enabling policy environment.

The objective of this report is to short-list sub-sectors that are most eligible for private sector investment. Their eligibility has been assessed on the ease of implementing and financing them, the existence of proven technology, mature markets in-country and the prevalence of prior investments in the sub-sectors.

To this end, the following pages map the most relevant stakeholders in the context of private investment mobilization in Bangladesh, identify incentives that support finance mobilisations in the priority sectors, list key potential sources of finance for investment in the selected priority NDC sectors, explore which current policies are effective in encouraging investment, and understand barriers to mobilising finance in the priority sectors. The analysis is anchored as much as possible in evidence from the interviews conducted by the project team with private and public sector stakeholders in early 2018.

2. Sector Summary on Power, Industry and Transport for NDC Implementation

Criteria for assessing sectoral readiness

While developing this sector summary, a rigorous assessment was undertaken based on the following criteria to understand the sectors' readiness in terms of mobilizing private investment to the climate change mitigation projects. The following criteria were considered:

a. *Ease of project implementation*: Whether favourable and enabling Government policies and regulatory supports are in place to promote investment in this sector.
b. *Ease of Finance*: Whether suitable financial packages are available with the right level of financial and fiscal incentives for the private sector to implement projects.
c. *Market Maturity*: Whether a significant demand-supply situation for such projects is available in the country
d. *Available proven Technologies*: Whether proven technologies are available for the private investors to implement the mitigation projects with confidence and be able to meet their return on investment expectation.
e. *Scale of Investment*: Whether there is already significant investment in this sector and potentials are there to scale up those low carbon project measures in a significant scale.

The study attempted to assess the three sectors (Power, industry and Transport) identified in the Intended Nationally Determined Contribution (INDC) by Bangladesh in terms of the above criteria.

The summary of each sector has been developed with brief introduction followed by the existing policy and financial landscape, a list of projects implemented successfully along with project pipe-line. The summary also discusses the key barriers of implementation along with the recommendations provided by the sectoral stakeholders during their interviews and sub-sequent discussion, which took place in presence of high level Government policymakers. A round table meeting was organized at the Ministry of Environment and Forests (MoEF) following the conclusion of this phase, where main findings of the phase 1 and next steps have been discussed.

2.1 Power Sector

2.1.1 Sectoral assessment: Power including Renewable Energy

Bangladesh is in transition from a least developed country towards having middle income country status. To achieve this vision, Bangladesh needs affordable as well as sufficient electricity to meet the power requirements of industrialization and other income generating activities by ensuring access to electricity for all by the year 2021. Accordingly, the Government of Bangladesh has revised its Power Sector Master Plan (PSMP) in 2016 to meet the ever-increasing power requirement considering the "Vision of 2041" to becoming a developed country.

The total power generation capacity of Bangladesh is now 16,290 MW, including 2.91% of Renewable Energy (RE) (474 MW) (SREDA, 2018). According to the PSMP, 2016, the GoB intends to install 60,000 MW[1] of additional electricity generation capacities by 2040, including at least 10% of total capacity from RE (Power Division, 2017). The graphic on the power generation mix [2](fig. 1) shows that gas has the largest share and gas-based captive generation (around 2200 MW) in the private sector industries makes a significant contribution to the overall electricity generation mix. The level of average efficiency of captive generators (<25%) is low compared to large scale integrated power plant and not a suitable and fuel-efficient option from the perspective of demand side management. To increase the overall efficiency of captive generation, private investment in the areas of co/tri-generation and integration with the onsite RE at the industrial facilities can help mitigate this problem and attain a sustainable energy mix in the country's overall electricity generation portfolios.

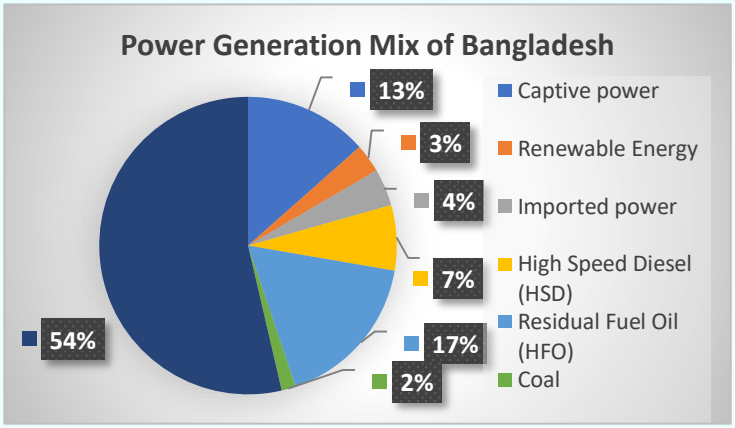

Fig-1: Power generation mix of Bangladesh

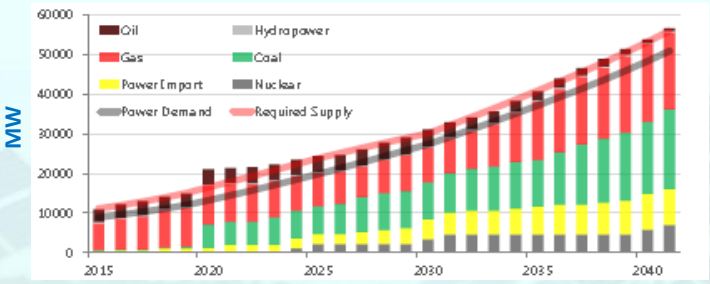

Fig-2: Power Demand Supply Pathway
Source: JICA PSMP 2015 Team Estimate

[1] Revised Power Sector Master Plan of Bangladesh Government
[2] SREDA, 2017

Due to rapid depletion of the country's primary fuel, natural gas, the revised master plan has put significant emphasis on the diversification of the current electricity generation mix with clean coal technology, introduction of nuclear power plants and electricity imports from the neighbouring countries like India, Nepal and Bhutan. According to PSMP, the Power sector is expected to follow the above demand-supply pathway (fig.2) till the year 2041 to achieve the overall PSMP target. The projected demand-supply profile[3] shows the growing trend of coal and imported power along with other conventional power options in the future mix. But despite reflecting minor RE incremental growth in the hydro power generations from small scale hydropower plants in the range of, 30 kW～5MW from the technologies like, small run of river, pumped storage hydro along with hydro power imports from Bhutan and Nepal, this projection does not include the year-wise RE additions from the other RE sources like solar, wind and bio-gas and bio-mass energy in the future demand-supply scenario.

The renewable energy share in Bangladesh (fig. 3) illustrates that, out of different RE options, solar has the largest share in terms of generation (apart from the country's only hydro energy installations by Government back in the year 1962). The rapid cost decline of solar technology associated with proven results and workable business models of private sector, set this RE technology apart from the other RE options available in the market. The private sector has already made significant investment in solar energy and is predicted to mobilize more investment in this sector provided that an enabling policy direction and incentives are available by the GoB. To a lesser extent, this is applicable for other RE options like wind, bio-gas and bio-mass, to which private investment could be attracted.

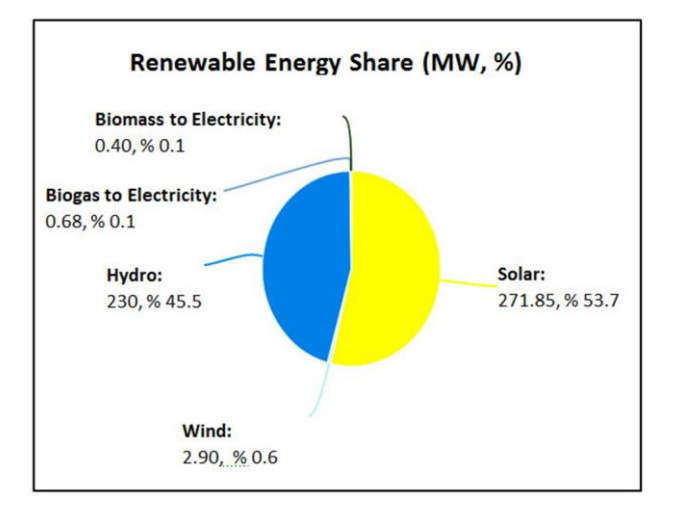

Fig. 3: Renewable Energy Share in Bangladesh (March 2018)

2.1.2 Sectoral Policy/incentives

The GoB has formulated several policies, a masterplan, guidelines and programme to provide policy and fiscal incentive support to encourage both domestic private investors as well as foreign investors to invest in the power sector projects. The core objective of these policies is to strengthen the power sector by mobilising financial resources and create a competitive environment to encourage innovation.

[3] Power Sector Master Plan (2016)

Policy or incentive	Views on effectiveness
Renewable Energy Policy of Bangladesh: A dedicated policy on Renewable Energy was adopted in 2008 which requires utilities to have at least 5% power from RE sources in their energy mix by 2015 and 10% by 2020 with the following incentives for private sector • Renewable energy equipment and related raw materials and energy equipment are exempted from charging 15% VAT • Several fiscal incentives have been declared for RE project developers and investors. Dedicated funding support has also been extended through government financial institutions like Bangladesh Bank and IDCOL as well as through private commercial banks. Moreover, government has extended fiscal incentives including duty exemption on certain renewable energy products e.g. solar panel, solar panel manufacturing accessories, LED light, solar operated light and wind power projects. • Renewable energy project investors both in public and private sectors shall be exempted from corporate income tax for a period of 5 years • An incentive tariff may be considered for electricity generated from renewable energy sources which may be 10% higher than the highest purchase price of electricity by the utility from private generators	In the stakeholders' interview with the private sector and financial institutions, few suggestions/requests were made to make the policy more effective and purpose serving • Rationalization and reduction of import duty from the RE equipment and accessories. • The horizon of current financial packages under IDCOL and BIFFL needs to be extended further for promoting market-based financing solar and Bangladesh bank re-financing scheme needs further review and adjustment in the existing capital buy-down propositions to match the current market dynamics esp. for solar irrigation, solar mini-grid, bio-mass, industrial solar and wind power projects. • From central bank, more policy supports are needed to expand and extend market-based financing from commercial banks and NBFIs. • To bring down the cost of re-financing in BDT from central bank, the bank rate (rate for lending from central bank to commercial banks currently ~5% since 2003) needs to be reduced immediately. That will eventually increase the financing RE and EE. • Market interest rate for RE and EE varies from 10%-12% (variable depending largely on money market liquidity condition) where rate under BB refinancing in BDT is 9% and in USD is 5%. Interest rate from IDCOL ranges from 6%-10% and from BIFFL ranges from 4%-12%. • Under the support funding actions of central bank, currently there is no risk sharing/risk support mechanism for commercial banks and NBFIs. Central bank should actively consider establishing a Credit Guarantee Fund/Scheme for RE/EE viz-a-viz green financing. • Under the support funding actions of central bank, currently there is no risk sharing/risk support mechanism for commercial banks and NBFIs. Central bank should actively consider establishing a Credit Guarantee Fund/Scheme for RE/EE viz-a-viz green financing • The lending tenure of RE financing needs to be extended from the existing practice and it has to be benchmarked for specific RE technologies like Solar, Wind, Bio-gas and Bio-mass etc..
Power Sector Master Plan (Revised), 2016: The revised plan: The PSMP (2016) envisaged to be less dependent on any single primary energy resource by 2030. Therefore, it aims to adopt an energy mix which comprises of domestic and imported coal, domestic natural gas and imported LNG, and maximizing	• The revised PSMP emphasized on small scale hydro power generation as a priority and further talks on maximizing the share of RE in the overall generation mix. But it did not include any year-wise RE implementation plan. SREDA has adopted an year wise RE implementation plan and , it can be good starting point for the private sector to prioritize their future RE

renewable energy potentials under a limited land scenario.	investment outlook.
NDC roadmap and NDC Power Action Plan, 2017: NDC envisaged RE as one of the main off-set measures in line with both conditional and unconditional country target to reduce GHG emissions. In the power sector action plan, it lists up all possible RE measures with a special focus on Solar and Wind technologies that can be implemented in the country context.	• NDC is a relatively new policy direction of the GoB and its understanding of the private sector and know-how on the country GHG reduction target is not up to the mark. In the stakeholders' meeting, this was mentioned by the private sector esp. on the requirement of awareness and capacity building of private sector so that they can participate in the NDC implementation of Bangladesh. The capacity and awareness support are also required so that private sector could access international development funds and tie up with impact investors to implement sustainable energy projects.
Solar Guidebook: It is the functional landscape of Renewable Energy Policy especially for development of solar power generation. It has provided comprehensive guidelines to private sector investors with technical, financial and commercial & contractual aspects of solar power project implementation.	• It was enacted in October 2013 and is serving as a reference guideline for solar project implementation. Issues like land management and evacuation of power to the grid system is still a challenge for the private sector. Some stakeholders commented to include these issues at length in the existing version of the document.
500 MW Solar Programme: It was aimed to promote RE in Bangladesh with a special focus to implement commercial scale and grid-connected solar projects under the incentive structure of RE policy.	• It was adopted as a priority government target to promote RE and engage privates sector in the implementation of commercial as well as solar projects with social interest. The opinion we received from the private sector is that government should dedicate a funding line with long term financing arrangement to implement more RE projects in the targeted RE options like grid scale solar, community electrification and solar irrigation and pumping solutions etc.
Policy Guidelines for Enhancement of Private Participation in the Power Sector, 2008: Given the fast depleting condition of domestic natural gas, the policy aimed to involve the private sector in the implementation of new power plants preferably reliant on coal, imported gas, liquid fuel, or renewable energy sources like solar, wind, hydro, biomass, municipal waste, and others, as natural gas.	• The general expression of the stakeholders on this policy is that there should a dedicated PPP enhancing policy on the RE and EE sector, otherwise it is too general to serve the purpose of private investment mobilization.

2.1.3 Sectoral financing landscape

In Bangladesh, credit/loan is the major instrument of financing RE apart from Government incentives and capital-buy down support. Commercial banks and NBFIs are the intermediaries in this respect. Among them, two government owned Specialized NBFIs, IDCOL and BIFFL have significant focus on RE. There are two main stream of credit line established to finance the broader range of RE activities and projects in the country (Fig 4). Bangladesh Bank (BB) led Green Fund to support RE and EE

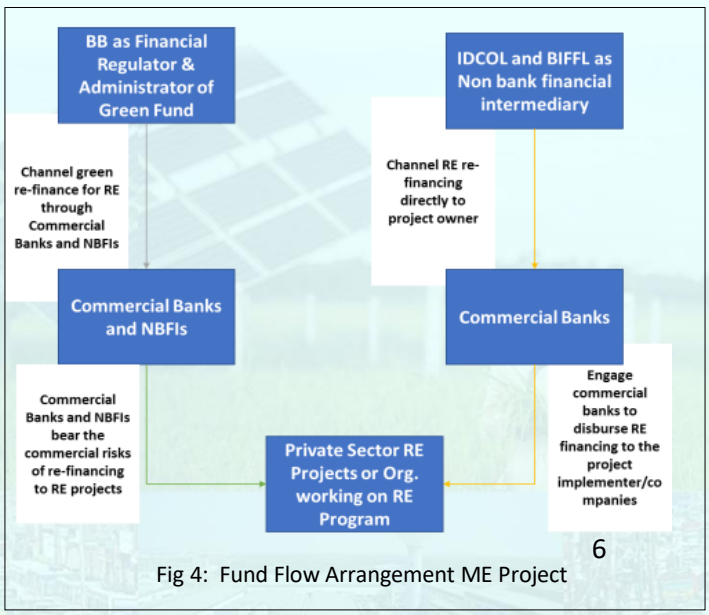

Fig 4: Fund Flow Arrangement ME Project

measures and Infrastructure Development Company Ltd. (IDCOL) and Bangladesh Infrastructure Financing Fund Ltd. (BIFFL) arranged credit facilities for RE and EE project activities.

Bangladesh Bank's (BB) green funding provides soft financing support to RE and EE projects utilizing the channel of public and private commercial banks and specialized NBFIs. So far, the credit facility has listed 61 products and equipment as worthy of receiving re-finance support from this facility. The portfolio ranges from a panel manufacturing facility to implementing solar projects, bio-gas plants, roof-top solutions at the factory etc.

The fund flowing arrangement from BB green fund to the end RE project developer is shown in Table-1. In both arrangements, commercial banks are involved to either re-finance the projects or disburse the loan (in the case of IDCOL and BIFFL) on behalf of the lending financial institutions. A total amount of BDT 548.6 billion was disbursed during FY 17 by 50 banks and NBFIs involved in green finance, sector-wise contribution of the total green finance shows that PCBs played the main role (77.7 %) followed by FCBs (18.5%), product wise and direct and indirect green finance by banks are given in the following tables (Table 2,3 and 4)

Table 1: Financing Framework of Bangladesh Bank (Green Fund)

Refinancing (On-lending) schemes for Renewable Energy and Energy Efficiency				
Title	Size	Interest Rate	Repayment Tenor	Coverage
Refinance Scheme for Green Initiatives	BDT 2.00 bn	8%-9%	4-10 Years	18 types of Initiatives/ products
Islami Refinance Scheme for Green Initiatives		8%-9%	4-10 Years	
Green Transformation Fund	USD 200.00 mn	5%	5-10 Years	REs in Export oriented Textile, Leather and Jute Sector

Table 2: Green finance of different products (in million BDT)

Category of Green Finance	SCBs	DFIs	PCBs	FCBs	FIs	Total
Renewable energy	47.9	4.3	2202.5	330.1	1859	4443.8
Energy efficiency	0	2.1	3118.8	0	277.4	3398.3
Solid waste management	0	0	7.3	0	0	7.3
Liquid waste management	101.3	0	8678.2	15.3	282.4	9077.2
Alternative energy	0	0	1432.7	0	0	132.7
Fire burnt brick	441.1	11.9	4646.6	0	1085.7	6185.3
Non fire block brick	1	0	192.6	0	0	193.6
Recycling & recyclable product	283.2	0	5813	0	180.2	6276.4
Green industry	481.8	0	4212.2	152.6	900.2	5746.8
Safety and security of factory	40	0	1438	53.3	46.5	1577.8
Misc.	9.7	0.6	10.3	0	0	20.6
Others	1478.4	0	126.3	0	1.2	1605.9
Total	2884.4	18.9	30578.5	551.3	4632.6	38665.7

Source: sustainable Finance Department, BB, chapter 6.

Table 3: Direct and indirect green finance in FY 17 (in million BDT)

Types of Banks	Direct green finance	Indirect green finance	Total green finance	Sector-wise contribution (%)
SCBs	2884.4	4336.2	7220.6	1.3
DFIs	18.9	0	18.9	0.0
PCBs	30578.5	395366	425944.5	77.7
FCBS	551.3	100973.6	101524.9	18.5
FIs	4632.6	9275.1	13907.7	2.5
Total	38665.7	509950.9	548616.6	100

Source: Bangladesh Bank Annual report 2016-2018, chapter6.

Table 4: Utilization of green fund (in million BDT)

Type of Banks/FI	Green Finance	Climate risk fund	Marketing Training & capacity building	Total
SCBs	7.220.6	2.5	4.5	7,227.5
DFIs	18.9	00	0.0	18.9
PCBs	425,944.4	823.7	43.7	4426,811.9
FCBS	101,524.8	49.9	0.0	101,574.7

FIs	13,907.7	3.5	2.0	13913.2
Total	548,616.3	879.6	50.2	549,546.1
Source: Bangladesh Bank Annual report 2016-2018, chapter 6.				

State owned financial intermediary IDCOL (non -bank financial institution, NBFI) have financed the world largest solar home system program for the rural off-grid population of Bangladesh. On top of their grant and soft financing support, IDCOL acts as the program operator and successfully disseminated about 5.18 million solar home systems (SHS) with the help of 49 private NGOs under their off-grid electrification program. Following the successful dissemination of SHSs business model and due to market maturity, IDCOL has now phased out grant from the system sizes beyond 20 Wp and it is limited to only 10 and 20 Wp system only. The financing model of IDCOL for a typical 20 Wp home system is shown in Fig. 5.

In parallel of SHSs dissemination, IDCOL has had an instrumental role arranging financing facilities with incentives like grant and capital buy-down support to promote solar home systems, solar irrigation, solar mini and micro—grid, cookstoves, bio-mass, bio-gas and grid scale solar projects. IDCOL is extending up to 50% capital buy-down grant on the total project capital cost of solar irrigation and solar mini-grid.

Interesting opinions and observation emerged from the stakeholders meeting on the current financing arrangement for RE. The following table depicts the observation and suggestions we received during the stakeholders meeting.

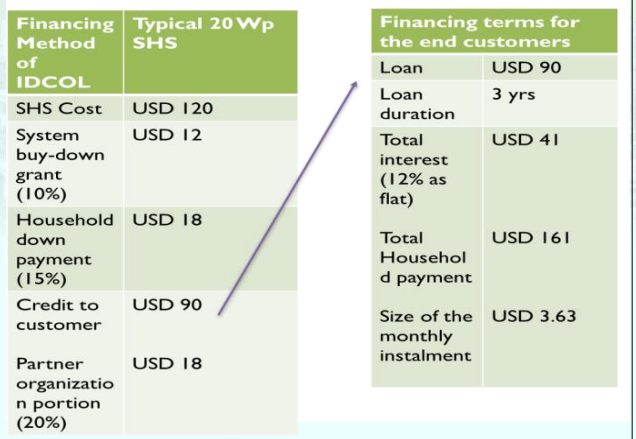

Fig 5: Financing model of IDCOL for a typical 20 Wp home system

Table-5: Opinion and Observation from stakeholders meeting on current financing arrangement.

Stockholders	Observation	Suggestions
Private Sector	The existing RE financing facilities need more diversification in terms of lending, cost of capital not favourable to RE projects. The collateral requirement for RE projects is still high and the due-diligence and loan approval process is still complicated.	• Interest rate for RE projects has to be in the range of 5~6% • Collateral requirement and loan due diligence for small scale RE projects has to be simplified.
NBFI, IDCOL/Public investor	Lack of tax incentives, refinancing incentive from central bank and development partners. Lengthy approval procedures from government offices and lack of technology and infrastructure are the prevailing barriers for RE implementation.	Finance required by the private sector investing in this sector includes • Debt • Equity • Mezzanine finance • Bonds • Insurance • Credit guarantee fund
Banks		They want market-based rate of re-financing, plus Domestic Certification Process in endorsing technology Capacity building of borrowers for improving 'bankability More GoB fiscal incentives to promote the RE investment in the private sector

Capital Market Regulator (Security and Exchange Comission)		Development of long-term financial market to support RE projects

The following barriers specific to RE financing have been identified in talking to private sector and financing institutions:

- Cost of capital, still too high to support the scaling up proven RE technologies like solar irrigation, grid connected power plant and solar mini and micro grids.
- Re-lending premium of Bangladesh Bank,IDCOL and BIFFL needs to be rationalized especially when coming to the end of commercial banks, otherwise cost of lending cannot be lowered to an expected range of 5~6%
- Inadequate funding support to roll-out pilots: This is one of the major impediments for the commercial banks to test and try-out new RE project idea like solar vehicles, optimization of SHSs esp. selling surplus power, solar boating solutions, solar dryer and cold storage etc.
- Lack of capacities: It is another barrier for commercial banks to overcome and finance RE projects of new nature.
- Tenure mismatch: The way commercial banks operate especially the tenure of Fixed Deposit Receipts FDR by the private investors, are in the range of 1-3 years and RE projects require tenure of 10 years and more. If there is not adequate re-fining credit extended by BB or Government to them, it is very difficult for them to package up lending offer suitable to RE project developer.

2.1.4 Project Pipeline

RE Projects/measures Implemented:

- As of May 2017, about 5.18 million SHSs have been installed under the program in the remote rural areas of Bangladesh.
- Till December 2017, IDCOL has financed construction of over 47,200 biogas plants all over the country.
- IDCOL has so far financed 9 biogas-based power plants, the largest one with a capacity of 400kW.
- The 3MW utility scale solar plant recently constructed on a “build, own and operate” basis on eight acres of land at Sharishabari in Jamalpur by a local company, Engreen Sharishabari Solar Plant Ltd.
- The Bangladesh Power Development Board (BPDB) recently installed the biggest off-grid solar power plant of the country at the haor areas of Sunamganj to provide electricity to about 900 families. The plant has a 650 kilowatt peak (kwp) capacity.

Pipeline:

- IDCOL has a target to finance 6 million additional SHSs by 2021 with an estimated generation capacity of 220 MW of electricity.
- So far IDCOL have approved 18 Solar Mini-Grid Projects, among which 7 are operational while the rest are under construction. The mini-grid projects have successfully created access to low-

emission electricity for almost 5000 rural households in Bangladesh. IDCOL further targets to install 50 solar mini-grid by 2018

- IDCOL has approved 629 solar irrigation pumps of which 607 are already in operation. The remaining pumps are expected to come into operation shortly. IDCOL has a target to finance 1500 solar irrigation pumps by 2018
- IDCOL has a target to finance 140 such projects with an average capacity of 50 kW by 2018.
- The government is currently working to install solar panel-based power projects connected with the national grid, which will have a 572MW capacity.
- AR Group is implementing the country's largest Bio-mass (rice husk) fired renewable IPP power plant at Pabna BSCIC

2.1.5 Barriers and opportunities for Power sector

Details of the barriers and opportunities are mentioned in the following table and highlighted where MPI phase 2 and 3 can be involved and private sector can be come forward for NDC implementation.

Barrier or gap	Rationale for barrier or gap	Relevant sub-sectors	Recommendations	Specific opportunities for technical assistance to address barrier
Market for off-grid not established due to lack of data and information on RE feasibility and proven business models on the specific RE technologies and solutions in Bangladesh	RE technology like solar irrigation and pumping solution etc. need proven business models for wide scale dissemination	Off-grid systems like Solar irrigation, pumping solution, solar boats and on-grid option like solar-diesel hybrid solution, grid connected bio-mass plants etc.	The interviewees suggested more pilots to take place and result of those pilots need to be shared with the policy maker and financiers to ensure appropriate finance is on offer to support these technologies. During consultation with SREDA, the team of consultants received their similar observation esp. the lack of robust business case to upscale the solar irrigation and solar boat technology.	Technical assistance can assess the pros and cons of the existing business models of solar irrigation system with a view to identify the business challenges, appropriate financing mechanism and the need of appropriate policy to address the current barriers and challenge. It can support developing business model for solar boats, which is still a nascent sector with huge market potentials.
Affordability of renewable energy for end-users	The benchmark tariff per KWh of electricity from solar mini-grids set by IDCOL customers is in the range of 29~35 US Cents, which is very high in comparison to the conventional price of electricity. Grid expansion poses a huge challenge to the mini-grid investors in terms of their investment recovery and future fate of the installed systems.	Solar Mini and Micro-grid	During the interview, the private sector expressed favour for increasing Government grant and financial support for RE so that the cost of electricity remains in the affordability limit of the end user. They also suggested that Government as part of its electrification obligation to remote rural people could allocate more concessional funding along with grant support to address this barrier. They also think, private sector need to work more on the innovation of the RE	TA support can be extended to assess the existing barriers and challenges that off-grid solutions like solar mini-grid, and micro-grid are facing in market and help developing robust business models identifying gaps in the existing technology, financing and business landscape taking grid expansion in to the account. In-depth analysis of business models for solar mini-grids from

			technologies esp. to reduce the cost of storage technology. In this case, GoB can rationalize the import duty of highly efficient and durable imported Lithium Ion Phosphate batteries to address this barrier. Even with 50% capital buy-down financing support from IDCOL seems not adequate to keep the cost of electricity from solar mini-grid for users close to conventional power prices. It is still 3 to 4 times higher than the cost of grid power. So, further assessment on the existing business model will help identifying real challenges exists in the technology as well as financing side of the project. Senior policymakers from Power Division and SREDA echoed in the similar ways and expressed in favour of developing robust business cases on solar mini-grid.	the perspective of the project developer needing to sell the electricity generated will also help to examine how incentives could be targeted to make energy from mini-grids affordable and thus generate reliable revenue streams.
Limited land available for solar grid connected power plant development. Even where land is available, it may experience seasonal flooding, requiring different technical solutions, such as wet land use and additional land development etc.	Government has received so far 600 MW project proposal from private sector to implement grid connected power plant, only the 3 MW Sarishabari power plant has so far been able to deliver power to national grid	Grid connected solar power plant	Land and Land development has become a huge issue for this type of power plant and the private sector want government intervention to address this barrier esp. Easing access to this land could make it easier for developers to implement projects.	
Grid integration of RE maintaining grid stability is still a challenge for utility scale as well as roof-top solar projects.	The national grid is sensitive, making it difficult to stabilize instantaneously changing electricity like Solar power.	Both grid connected and roof-top power plant supplying power to distribution grid system	Having a clear plan for grid integration could help utilities and grid operator to integrrate solar power reliably through the national grid system.	A grid integration study of the solar power system could address those barriers and help utilities to go for planned

				evacuation of the solar power without hampering the stability of the national as well as distribution grid system. This will equally address the investors current technical limitations to evacuate solar power to grid system and address the implementation challenge of the utility scale solar power plant.
No feed-in tariffs for solar-RE generation No standardized process for procuring power from RE-IPPS Lack of Low cost financing arrangement for small-scale projects: RE projects require considerable concessionary support as many projects are not viable in pure commercial terms. Commercial interest rates typically ranges between 11 percent and 14 percent for RE projects, though government sometimes provides loans at lower rates for the purchase of capital equipment of bio-gas, bio-mass power plant etc.	Limited access to low cost finance from in country sources for large-scale projects: Apart from a range of financing programs for off-grid solar home system, solar irrigation, mini-grids, biogas, and biomass projects, the country does not have specific incentives for larger utility scale RE projects. A draft feed-in tariff for wind and solar projects has stalled since 2015. However, in the current scenario, Bangladesh government is trying to introduce net meeting policy to popularize industrial and commercial building roof-top solar power generation in the on-grid areas.	Grid connected Power Plants	The private sector expressed for more soft funding support along with regulatory framework and incentive so that they could invest in this area with confidence. Government needs to either benchmark tariff based on the market reality or introduce any suitable off-take modality so that private sector can invest in RE sector with confidence.	TA support can support SREDA and Power Division to assess the true scope of such financing requirement and develop financing plan to scale up RE measures like solar roof-top and solar irrigation system.
No bond market to support RE projects	There is no bond in the capital market to support the large scale RE projects. Long payback period	For large scale RE projects mainly Solar and Wind.	Support needed to make actors aware of the advanced concept of green bonds and further support will be required to issue	Capacity building workshops on the advanced concept of market based green bonds could help

	and limited off-take guarantee are the two major impediments as expressed by private sector and capital market regulator.		bonds to support large scale RE projects	stakeholders and market regulator to develop general understanding on this subject matter. Inviting experienced professionals from mature bond markets to facilitate knowledge exchange with Bangladesh could also be beneficial.
Lack of awareness and capacity gaps regarding technical know-how and technology transfers on RE. The same capacity and awareness gaps exists for NDC.	Probably the most crucial requirement of all to aware and sensitize stakeholders and align them towards implementation of NDC	Power Sector	Most of the stakeholder expressed that they need technical and management capacity support to fully understand the NDC implementation target on Power sector.	To build general awareness and capacities on the overall technical and management aspect of NDC target implementation in the Power sector, capacity building support in the form of workshop, focus group discussion, orientation on the necessary MRV system can be targeted.

2.2 Industry Sector

2.2.1 Sectoral Assessment

The market for EE investments in the industrial sector is nascent in Bangladesh but promising: According to IFC (2016), the investment potential for EE could reach USD 600 million by 2020 according to conservative valuations (IFC, 2016). The NDC Industrial Sector Action Plan reflects that standard technology and equipment are available in the market for most measures.[4]

Why not outright set energy efficiency standards for the garment and cement sector and make them mandatory? What hinders progress on reducing the sector's water use will likely also be a barrier to improvements in terms of energy efficiency: Khan (2017) finds that "given the political clout of the textiles industrialists and the intensely competitive nature of international textiles market, any measure for greening the growth of the sector that exerts excessive financial burden on the industry owners will not be accepted". Still, the financial cost of greening the sector should be split between all concerned stakeholders, including government, trade organisations, and the industry owners themselves.

The business case for energy efficiency investments make this undertaking promising and eligible for financing by the private sector arms of development banks and commercial banks, provided barriers are addressed. What must be borne in mind throughout as far as the business case is concerned is: if energy used by these industries is cheap or unduly subsidized it reduces the incentives for energy

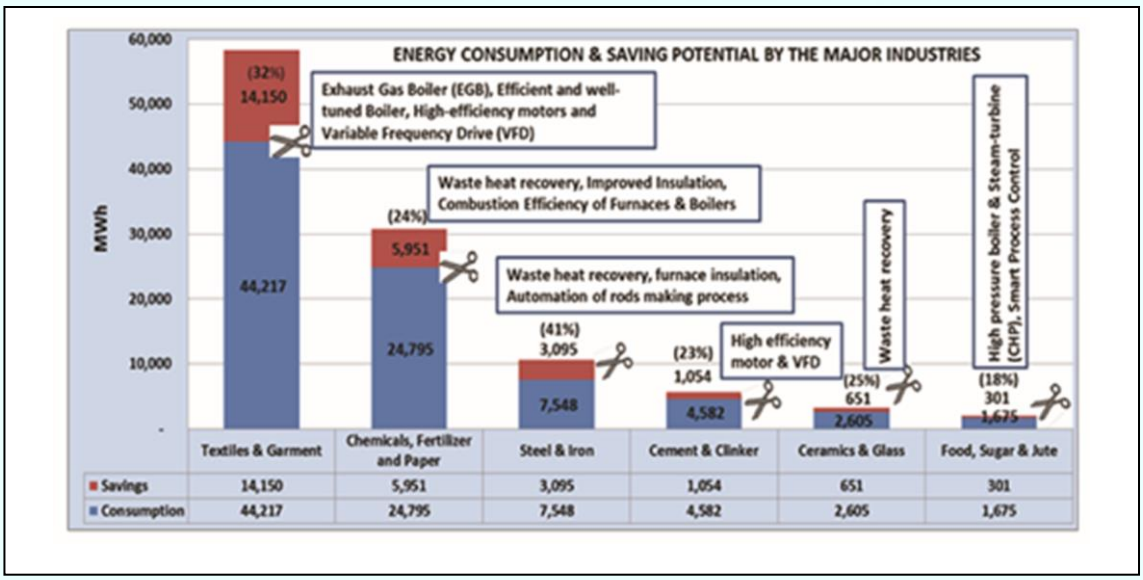

Fig 6: Energy Consumption & Saving Potential by the Major Industries in Bangladesh

efficiency investments. It follows that the gains from energy efficiency investments must in the medium to long term outweigh the cost of these investments. The Danish funded study, "2017-state of industrial energy efficiency in Bangladesh" identified the energy saving potential in the major industries (Fig: 6), which was being estimated up to an average of 30% savings in some major industries

[4] Scoping study identifies Cogeneration, Waste heat recovery (mainly from captive generators/boilers), Condensate recovery, Heat recovery from the cooling system of generator, Implementation of EE measures like leak sealing of steam and air flow systems, Efficient chillers, boilers, and motors.

Bangladesh's industrial sector contributed 11.09% to GDP in 2016[5]. Energy demand by this sector has continued to rise - showing an increase of around 8% in the past few years[6]. Bangladesh is facing an impending energy crisis. At the same time, the scope for improving industrial efficiency is significant. Efficient use of energy is thus a key solution to support and meet the increasing demand of energy in the industrial sector, if it can be cost effective.

2.2.2 Sectoral policy/ incentives landscape

Policy or incentive	Views on effectiveness
NDC roadmap and NDC Industry Action Plan, 2017 The NDC roadmap and NDC Industry Action Plan, 2017 reflects upon energy efficiency measures and what is required in terms of resources and time to implement. It identified the key energy efficiency measures suitable for specific industry along with the barriers and gaps exists. It proposes an MRV framework to monitor the progress of NDC GHG reduction target set for industry sector.	The document is yet to be approved by the government and thus , so the private sector stakeholders are not fully aware of this roadmap and action plan. They urged more awareness raising on this national document.
Energy Efficiency and Conservation (EE&C) Master Plan up to 2030 Provides ongoing energy management programme and energy audit roll-out plan across industry up to 2030. It is set out in the Energy Efficiency and Conservation Master Plan (EECMP) that Bangladesh aims to achieve a reduction in primary energy consumption per GDP for all sectors of 15% and 21% reduction by 2021 and 2030 respectively.	It was mentioned by one financial institution as a document with potential to reduce GHGs because it identified industrial sectors like textile, steels, cement and ready made garment in terms of their energy saving potential. It is referenced in the roadmap and other documents.
2016 National Industrial Policy The industry policy 2016 was enacted with a special focus to promote resource efficient and environment friendly technology dispersion for industrial production in the country. It encourages mitigation measures in the industry to reduce energy consumption and impact of climate change and elaborated on tax and other fiscal and non-fiscal benefits for the industrial owner to implement green measures at their factories.	The Industries NDC Roadmap mentions the policy, one of the aims of which is to promote an energy efficient industrial sector. However, industrialization and investment are the main goals.
Fiscal Incentive available	Corporate income tax rate is 10% for export-oriented knit & woven manufacturers that have internationally certified green factories while the usual rate is 12%.

[5] Bangladesh Bureau of Statistics, Asian Development Bank

6 https://www.researchgate.net/figure/270831290_fig6_Fig-6-Final-energy-consumption-in-Bangladesh-by-fuel-type-2

	Supplementary duty is 0% for energy efficient bulbs and parts of energy efficient bulbs; different solar powered instruments and bio-gas instruments Customs duty is much less (10%) for parts of energy efficient bulbs. The investors are encouraged by fiscal incentives and appreciate the government's initiatives.
Green finance policies Bangladesh's government has established green banking through three policies: a green banking and finance framework, a monetary policy facility for cheaper loan refinancing, and a green lending target. The policy envisioned to promote greening of industrial development with the support of low cost re-financing.	Stakeholders mentioned this policy as relevant in the effort to reduce GHG emissions. The private stakeholders think that green loans make up quite a small, but increasing, share of Bangladesh banks' total loan portfolios.[7] At the institutional level, the green banking framework appears to be encouraging. Especially among commercial banks, there is wide awareness of these green banking policies and use of them. The stakeholders also urged simplification of loan approval procedures.
Environmental Risk Management Guidelines for banks and financial institutions, 2011 The guidelines provide detailed technical guidance, including sector-specific environmental due diligence checklists including on energy efficiency. Secondly, monetary policy incentives, easier refinancing by BB, are used to lead commercial bank lending to priority sectors including energy efficiency investments in the garment sector.	Private sectors are less aware about the guidelines with exception.

2.2.3 Sectoral Financing landscape

The EE financing landscape is emerging in Bangladesh. Bangladesh Bank finances EE measures led by private sector. In collaboration with IFC, BRAC Bank has also recently developed a product called - Planet Solution an Energy Efficiency Financing Loan to assist readymade garments and textile industries to invest in energy efficiency technology. These include audit and EE equipment for borrowers at the rate of 6%. This is an unsecured loan (no collateral) offered to manufacturers and exporters in textile.[8] Government-owned financial intermediaries (IDCOL and BIFFL[9]) also have funding available for the private sector to invest in the area. This includes efficient brick kiln, furnace efficiency improvements and EE equipment for the SME sector, alongside efficient household electronics.

Among the development partners, many finance energy efficiencies in industry. The Japan International Cooperation Agency (JICA) provides concessional funding to the Sustainable and RE Development Authority (SREDA) to finance EE measures in the cement and textile industries, with IDCOL acting as a fund manager of this scheme. However, the volume is to limited to finance all measures suggested by SREDA to receive soft financing support. IDCOL, being fund manager of this

[7] https://seekingalpha.com/article/4088192-sustainable-banking-initiatives-investors-need-regulator-support-halt-deforestation
[8] MPI Scoping study
[9] Mr. MD. Saddam Hossain, Senior Officer, Bangladesh Infrastructure Finance Fund Limited. Date: February 13, 2018, Time: 3.00 pm

scheme, has arranged financing for Meghna Cement Mills Ltd, a concern of Bashundhara Group, to introduce energy-efficient equipment. Meghna Cement Mills has received BDT. 127 crore (1.27 billion) at 4 percent interest rate for its Vertical Roller Mill (VRM) plant in Mongla. Bangladesh Export Import Company Ltd, Pretty Eco Village Ltd, and Tithi Textile Mills (Pvt) Ltd. also received BDT. 110 crore, BDT. 84.4 crore and BDT. 57.76 crore respectively from the SREDA financing scheme. JICA also undertakes an Energy Efficiency and Conservation Promotion Financing project which aims to promote efficient use of energy in Bangladesh by introducing and disseminating energy efficient equipment through concessional loan, technical support thereby incorporating the latest technical trends of Energy Efficiency and creating awareness, contributing to balance energy demand-supply and mitigating climate change.

JICA also provides financing to financial intermediaries. Similarly, the Global Climate Partnership Fund (GCPF) is currently working with City Bank and Southeast Bank to finance EE measures in the ready-made garment sector including financing equipment. There is also the IFC's Partnership for Cleaner Textiles. Under USAID's Catalysing Clean Energy in Bangladesh projects, which ended in 2017, as much as 30% of total project cost could be finance through grants for any particular textile/RMG factory interested in implementing energy efficiency interventions recommended through an Energy Audit by Certified Energy Auditors. Almost 150 factories accessed the free energy audit service and nearly USD 2 Million grants for EE implementations were given within their factories. They also built capacity in the financial sector for energy efficiency financing.[10]

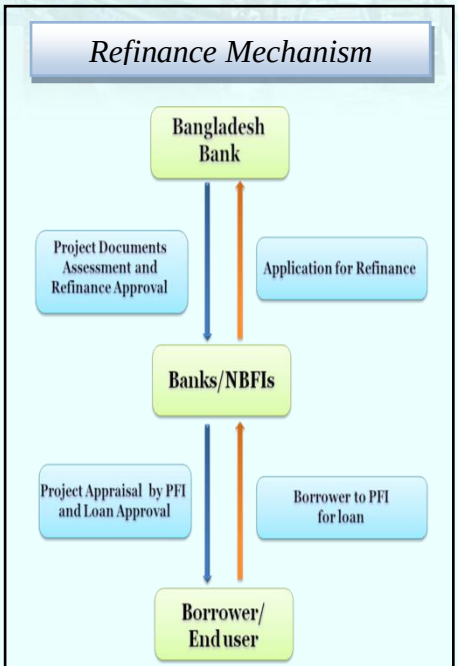

Fig 7: Refinance Mechanism of Bangladesh Bank

There are various sources of finance from development banks and Bangladesh Bank operating through the commercial sector. BB has been specially committed to supply green finance in the economy including US$25 million refinance scheme for Renewable Energy and Environmentally Friendly Financeable Sectors [11], and a US$ 200 million Green Transformation Fund for Export Oriented Textile and Leather Sectors[12]. Besides that, funds like LTFF (Long Term Financing Facility [13]) also exists that support investment in priority sectors (https://www.bb.org.bd/mediaroom/circulars/fepd/oct272015fepd18e.pdf)[15]. The Bangladesh Bank re-finance mechanism to promote energy efficiency measures is furnished in the figure-7.

[10] Mr. Shahriar Rahman, Assistant Manager, Sustainable Finance Unit, IDLC Finance Limited. Date: February 15, 2018, Time: 4.00 pm
[11] This scheme is not exclusive to the industry sector but available to others as well.
[12] This scheme is not exclusive to the industry sector but available to other as well
[13] LTFF (Long Term Financing Facility) is under Financial Sector Support Project (FSSP) with an objective of the project is to improve financial market infrastructure of the country, regulatory and oversight capacity of Bangladesh Bank and access to long term financing mainly for manufacturing firms in Bangladesh.
[14] Mr. Saiful Islam, SAVP, Eastern Bank Limited. Date: February 14, 2018, Time: 3.00 pm
[15] Mr. Saiful Islam, SAVP, Eastern Bank Limited. Date: February 14, 2018, Time: 3.00 pm

The Bangladesh Bank further requires every commercial bank and financial institutions under its jurisdiction to disburse 5% of its total loaned amount to green projects. [16] [17]

BRAC Bank is also one to enjoy BB support in the form of refinancing schemes, policy and capacity development initiatives. Through the BB refinancing scheme, they offer on lending facility to green and low carbon projects. Degrees of concessionality vary from 3%-4% in interest rate. They avail concessional on-lending financing from IFC and FMO as well as Bangladesh Bank.

During the interviewed with commercial banks that drew on BB lending for financing green and low carbon projects – Eastern Bank Limited, for example, provides a range of interest rate for corporate customers around 9%–11% and finances working capital requirement or short term financing as well as long term financing with tenor up to 5 years. [18] [19]

IIDFC is a Non-Bank Financial Institution (NBFI), licensed and operated under the FI Act. Amongst others, IIDFC supported an energy audit program by ADB in 120 industries of the country to find out bankable energy efficiency improvement scopes. They also work to develop new renewable energy and energy efficiency programmes.

2.2.4 Project Pipeline

The Global Climate Partnership Fund (GCPF) works with City Bank and Southeast Bank to finance EE measures in the ready-made garment sector, financing equipment such as label weaving machines, dryers, irons and washing machines.

Ongoing and earlier Energy Efficiency programme and projects:

- Compact Florence Lamp (CFL), T- 5 tube light, electronic ballast
- Free CFL Distribution program
- Energy Star Labeling Program (fan, AC, refrigerator, CFL bulb, ballast and electric motors)
- Efficient Rice husk Parboiling Program
- Improved Cook Stove Program
- Improving Kiln Efficiency in the Brick Manufacturing Industry
- Energy audits by Energy Audit Cell under Electrical Advisor and Chief Electrical Inspector
- SREDA's focus includes – amongst others - to promote LED lighting in the garment industry under the ESCO (Energy Services Company) model. The objective of introducing ESCO is to develop and test a self-sustaining business model in efficient lighting sector.[20]

Potential for energy efficiency in Bangladesh

Energy saving techniques and replacing some outdated and inefficient industrial products, machinery and process can lower the consumption and save significant amount of energy as well as reduction of GHG emissions. Some of project potential is explained below:

In the SREDA Master Plan, following energy efficiency potential have been identified:

[16] Adam Smith (2017) Governance for Green Growth in Bangladesh: Policies, Institutions, and Political Economy p.13
[17] Qazi Mutmainna Tahmida, Joint Director, Bangladesh Bank. Date: 07/02/2018, Time: 3.00 pm
[18] Mr. Saiful Islam, SAVP, Eastern Bank Limited. Date: February 14, 2018, Time: 3.00 pm
[19] Adam Smith (2017) Governance for Green Growth in Bangladesh: Policies, Institutions, and Political Economy p.27
[20] NDC Industries Sector

- Textile and garment: Adoption/improvement of: spinning machine, air Jet Loom (Weaving machine), sewing machine, efficient lighting (HF TFL and LED lamp), gas engine waste heat recovery, gas turbine cogeneration, steam boiler waste heat recovery, steam boiler combustion control, once-through steam boiler, high efficient stenters, etc.
- Chemical fertilizer: Replacement of old plants with 3rd generation technology plants
- Waste heat recovery technology and rehabilitation in 4 plants
- Steel-making & re-rolling ν Reheating furnace: re-generative burner, combustion control unit, waste heat recovery, heat insulation with ceramic fiber sub sector and items.
- Replacement of induction furnace with arc furnaces
- Cement grinding Replacement with vertical roller mill
- Cold storage ν Renewal of gas compressor

Successful mobilization for broad energy efficiency improvements across different industries will likely require a combination of both instruments and measures. From a donor perspective, in addition to the instruments and channels mentioned above, it might be useful to contemplate the introduction of instruments such as Energy Savings Insurance (ESI).

Originally introduced by the Danish Energy Agency and rolled out by the Inter-American Development Bank, this was a successful initiative in mobilizing private finance in Mexico and Colombia. Now, rollout is being prepared in multiple other countries (GCF, 2017). The ESI provides an insurance underwriting minimum savings for energy efficiency investments. The model has been reviewed and endorsed by the Global Innovation Lab for Climate Finance with estimated capacity to mobilize USD 10–100 billion in investment with annual emissions reductions of 2 234 MtCO2 by 2030 (State of Green, 2016). The ESI approach allows simultaneously addressing technical and financial risks and building confidence among SMEs, technology providers and local banks.

2.2.5 Barriers and Opportunities for Industry Sector

Barrier or gap	Rationale for barrier or gap	Relevant sub-sectors	Recommendations	Specific opportunities for technical assistance to address barrier
Lack of awareness regarding the business case of specific EE measures	NDC Industries roadmap identifies this but it also adds that the business case depends on energy prices.	Most prominently across industries for Condensate recovery systems, Heat recovery from the cooling system of generators Leak sealing of steam and air flow systems	Develop/roll out an awareness-raising campaign on EE savings/benefits in the cement and textile/garment industries. Identify those technologies which have a strong business case: For each technology/sub-sector, the business case should be broken down (if possible). It will be important to consider awareness raising campaigns that target the relevant constituencies (garment, textiles, cement industry associations, trade fairs, etc.).	A set of cost-benefit analyses could be undertaken for the various technologies/ sub-sectors. Based on this study, the sub-sectors for which there is a business case could be shortlisted so they can be targeted in a potential awareness raising campaign. It would be important to focus on the business case of the most easily implementable and finance-able improvements. Key questions could include: Does this business model pay off at the factory level given current and projected energy prices? Prior program experience from JICA and SREDA could be used.
Limited promotion of energy savings/audits as energy savings are not always easily measured	Industries NDC roadmap reflects the plan "In 2017, a programme of certifying energy auditors will be started. A forthcoming energy audit regulation is expected to set out those rules and laws." However audits not yet widespread.	Across industries	Provision of energy efficiency audits at a wider scale and promotion of the business case for efficiency improvements would be helpful. Free consultancy services and Capacity development initiatives were proposed for green industries. Moreover, grants/rewards for the front runners or pioneers of such projects were proposed. [21] This could be the particular realm for development partners to conduct activities. An initial screening of ongoing projects suggest that donor efforts are centred around the garment and textiles sectors (rather than the cement sector).	Financing energy audits is a long-term effort that donors have been engaged in selectively with relatively large financing facilities. Instead of this, TA could focus on one input to this end. Training of energy audit consultants will be required.[22] A partially grant-financed training and certification program could be proposed (European Commission foremost[23]) as an area of work. The first step for this would be preparation of a Concept Note for the programme, to seek funding.

[21] Mr. Shahriar Rahman, Assistant Manager, Sustainable Finance Unit, IDLC Finance Limited. Date: February 15, 2018, Time: 4.00 pm
[22] Scoping Study
[23] Their own research champions this. https://ec.europa.eu/jrc/en/energy-efficiency/eed-support/energy-service-companies.

Upfront capital investments requirements to implement EE measures	Lack of low cost finance for these investments was widely cited (among development partners, banks and other financial institutions) as a barrier.	The size of the upfront investment required differs from technology to technology (see table below and NDC industries roadmap). The capital cost of conducting a baseline data and energy audit, staff awareness on energy efficiency, leak detection, etc. is low.[24]	Concessional lending is an obvious enabler. Furthermore, preferential taxation on the purchase of high efficiency equipment could improve cash flow at the factory level in the year of implementation. Low interest loans and preferential taxation vehicles are stated parts of the EE&C Finance Incentive Programme under the EECMP.[25] Points (iii) and (iv) are addressed through providing financing at reasonable, possibly concessional rates. Development banks as well as commercial banks may pilot innovative and open-end financial products for sector specific green financing by addressing the funding gaps & needs in the energy efficiency space. Efficiency investments in many areas include an upfront investment to undertake (possibly the audit and) energy efficiency improvements followed by decreased costs resulting from the improvements. In the garment sector, they may be combined with water efficiency improvements. This can be combined with certifications.	Future research & consultation could include GCPF, IDCOL, BIFFL, BB and SREDA as well as energy audits consultants and a group of industrial units. GoB, led by SREDA, will carry out a review in 2017 and 2018 of additional data needed to track progress. Further TA could examine the findings of this review and support identification of this additional data. Such initiatives should liaise with the Industry sector working group of under the NDC NAPO coordination committee and the Ministry of Industries. Also, Ministry of textiles.
Production interruption	Interruption of production operations when installing new EE measures, leading to extra costs to private companies. Depending on volume, this could be financed through working capital or external financing	Across industries that implement energy efficient technology.		

[24] For more experience from Cambodia, please see https://betterwork.org/cambodia/wp-content/uploads/2013/05/Generic-Guidelinel1.pdf

[25] NDC Industries Roadmap p.10. The Roadmap also foresees some tax incentives: *Low Duties (2%) for all imported EE industrial machineries; Duty free for solar panels & materials, LED and raw materials; Add energy efficient (EE) products to the list of "Renewable Energy (RE) Products" for tax benefits; Submit proposals to NBR by mid-May Income tax reductions for EE product manufacturers*

2.3 Transport Sector

2.3.1 Sector Assessment

The transport sector has a key role to play in Bangladesh's ambitions to become a middle-income country by the year 2021 by providing a cost-effective and robust transport infrastructure, which is surely vital for economic growth of the country. The Seventh Five-Year Plan aimed at a sustainable economic development pathway. It follows that transportation will need to become more efficient and environmentally friendly. Benefits could include GHG emission reductions from transport improving the country's GHG balance along with its air quality.

In the INDC, "Bangladesh committed to reduce GHG emissions in the power, industry and transport sectors by 5% below 'business-as-usual' GHG emissions by 2030, or by 15% below 'business-as-usual' GHG emissions by 2030 if sufficient and appropriate support is received from developed countries. To deliver the overall targets, the INDC anticipated that the transport sector would contribute GHG emissions reductions of 9% below 'business-as-usual' by 2030, or 24% below 'business-as-usual' by 2030, conditional on support from developed countries"

The government of Bangladesh recognizes in the policy and strategic transportation plan that the development of transport infrastructure is a major challenge. Earlier, many transport sector projects were initiated but the rate of completion has been slow due to factors like constraints of resources, lack of coordination among the agencies etc. Similarly, anticipated investments in railways and inland water transport have lagged in terms of execution. Urban transport issues like congestion and traffic management remain enormous especially in the major cities: Dhaka and Chittagong. The Five-Year Plan has special emphases on these issues. To reduce traffic congestion on the road network, a specific focus is also put on the improvement of the multimodal transport network, aimed to increase significantly the share of rail and waterways traffic in overall transport. Also, urban traffic management and the maintenance of road transport infrastructure are seen to be a key focus area, as already highlighted in earlier policy documents and strategies. Private sector investment is essential to support the government's vision on transport sector development, which is still limited to only vehicles and other support services. Collaboration between public and private actors for transport infrastructure development so far has been limited. Realizing the importance of private sector participation for the development of transport sector, government has adopted Public-Private partnership law and guidelines to promote private investment in this sector.

The INDC envisaged that the transport sector in Bangladesh will contribute to GHG emissions reductions in several ways and those are grouped according to the 'Avoid-Shift-Improve' framework26:

- *Avoid* – reducing the demand and need for transport.
- *Shift* – encouraging people to switch to lower-emitting modes of transport.
- *Improve* – increasing fuel and vehicle efficiency.

This has opened vast opportunities for the private sector to bring forward appropriate technology along with skills to invest more in vehicles diversification and in the shift to low-emitting modes.

[26] http://www.sutp.org/files/contents/documents/resources/E_Fact-Sheets-and-Policy-Briefs/SUTP_GIZ_FS_Avoid-Shift-Improve_EN.pdf

A number of measures are also already being taken to improve the fuel efficiency of the vehicles used in Bangladesh. GoB encourages the use of clean fuel like Compressed Natural gas (CNG) for both private and public vehicles. As a result, around 90 percent of vehicles in Dhaka converted to CNG ensuring co-benefits like air quality improvement. The two-stroke baby-taxi was banned officially back in 2003 and 65 Ministerial cars are now hybrid. Even without GoB policy support, more than a 1000 hybrid cars are being imported by private sector and more than 50,000 battery chargeable e-bikes and rickshaws are running in the urban, peri-urban and rural areas of Bangladesh and meeting the transport need of the underprivileged people of the country. During the stakeholder interviews, private sector representatives expressed their interest in the areas of e-vehicles coupled with solar charging facilities and other type of low carbon vehicles, provided there are suitable government policies and financial support in place. It follow that the right policy intervention along with incentive support, like tax incentives and rationalized import duties on low carbon vehicles along long-term low-cost financing support can open many avenues for the private sector.

2.3.2 Sectoral policy/incentives landscape

To ensure a speedier development of transport sector, GoB has formulated several policies and strategies for transport sector. Below mentioned table is highlighted the policy incentives and views on effectiveness by the private sectors and other relevant stakeholders.

Policy or incentive	Views on effectiveness
The transport priorities listed in the National Sustainable Development Strategy 2010-21 (2013): It provisioned an expansion and renewal of the railway network, increased focus on upgrading and maintaining the existing road infrastructure and the development of rural transport infrastructure by integrating road and inland water transport and improving channel and waterway conditions. Concerning urban transport, especially pedestrian traffic is to be prioritised. Also, public transport means are to be developed, especially with regards to the bus system (i.e. increase of the network and capacities; introduction of Bus Rapid Transit Systems) and the rail system (i.e. development of a rail-based mass transit systems in the Dhaka Metropolitan Area). The "how" part of these targeted development measures are best integrated in the **Multi Modal Transport Policy (2018)** and it has become the key policy document in this sector**.**	Private sector investment opportunity in this sector is limited to large international players in the market, as it requires multimillion dollar investment to implement projects in infrastructure. The private stakeholders mentioned that Government could provide long term concessional contracts to the project developers.
The Perspective Plan of Bangladesh 2010-2021 of 2012132012-13 includes the following strategies: • Expand and improve the railway system with the goal of increasing the market share of freight and passenger transport of rail; • Establish a modern Mass Rapid Transit System (MRTS) in Dhaka and increase the number of modern high-capacity • With the help of JICA, Bangladesh is implementing the first MRT project in Dhaka city, "MRT:6" and it has adopted **The Railway Master Plan (2013)** to promote rail as the	Most of these projects require huge investment and private investors lack financial as well as management capacity to implement those projects utilizing their own resources.

cost effective and safe way of transportation. These are mega scale projects and their pace is slow.buses.	
The 2nd National Communication of 2012 identifies the following potential mitigation measures in the transportation sector: • Urban transport planning and traffic management to decrease congestion; • Urban MRTS; • Vehicle maintenance and eco-driving; • Expansion and modernization of railways and a mode shift from road to rail and from road to waterways.	This is the national communication of Bangladesh to the United Nation Framework Convention on Climate Change (UNFCCC). The response of the stakeholders on issues like vehicle maintenance and eco-driving was that enabling policy support of government can encourage private sector participation in these sectors. The private sector is interested to receive more incentives to implement these measures.
The National Land Transport Policy established in 2004 and Concerning GHG reduction measures, the policy commits to encouraging the use of environmentally-friendly rail and water transport by supporting the development of a transport system that integrates rail, bus, taxi and water services to ensure efficient transport flows and ease of modal interchange. Concerning road transport specifically, the policy commits to the introduction of mandatory emission testing as part of the vehicle fitness test and to progressively raise initially adopted standards to reflect international norms. The policy further encourages the use of clean fuel like CNG.	Measures like Fuel switch to CNG has demonstrated a significant positive impact in the urban emission reduction from vehicles. There was an initiative to engage private sector actors to develop and operate vehicle fitness testing facilities but it did not materialize.
The Railway Master Plan (2013) It gives attention to the main corridors, where 90% of traffic takes place and focuses on the infrastructure requirements to be implemented during the period 2010 to 2030. The national climate change policies, development strategies and the relevant transport strategies all point to the importance of developing further rail transport.	It was expected that the private sector would be encouraged to participate in infrastructure development where it brings finance, efficient operating techniques and technological innovation. However the private sector requires appropriate guidelines from government and promotion.
The Multi Modal Transport Policy (2018) is envisaged to promote an environment efficient transportation based on the following measures • Better Integration with Inland Water Transport Policy • Physical integration between water, road, and rail modes will be encouraged where there are benefits to users, costs reductions or environmental improvements. • A high diversity of vehicles and technologies will be encouraged through removing inappropriate regulations. Transport and rural development policies will be more closely linked so as to improve economic conditions through improved local markets, • To involve the private sector more in infrastructure, services and maintenance • The Government will provide the appropriate legal framework so that private investors can run their business operation smoothly. • Construction of bypass roads with private investment will be encouraged along with other components of a potential toll road network. • In order to discourage use of cars, innovative measure like	This is the most complete policy for addressing *shift-avoid and improve* measures holistically. The policy is very new and not yet been disseminated among all sorts of stakeholders for their support and participation. However, this policy needs alignment with the INDC/NDC target to mainstream the country commitment for the development of low carbon and sustainable transportation system.

allowing more private franchisee to investment in the public transportation for bus services so that they are cleaner, more comfortable, more reliable, and hence they are considered as an attractive alternative to cars; • Innovative measures will be encouraged so that bus routes can be franchised to private sector operators in a transparent way that meet environmental objectives; • Encouraging CNG driven vehicles; • Solar powered refrigeration units for trucks carrying perishable items will be encouraged; • Environmental standards for road transport will be established including rigorous emission standards in Motor Vehicle Act;	
NDC Roadmap Transportation: The government set target and plan to improve the transport sector in the low carbon and efficiency pathway is mentioned in the section 1 and it has identified the following key sub-sectors for immediate intervention: • Modal shift (transport); and, • Electric vehicles (transport).	NDC is a relatively a new policy direction of government and private sector understanding and know-how on this country target is not up to mark. They have expressed to receive capacity support to understand the NDC policy document and action plan.

2.3.3 Sectoral financing landscape

Lack of access to finance continues to be an impediment to private sector to invest in the transport sector. Since the beginning of the 2000s, good progress has been made in deregulating interest rates, strengthening prudential regulations, enhancing the capacity of the central bank, and allowing more competition through the entry of more private banks. To engage private sector in the development of large infrastructure projects that includes transport sector through different arrangement of Public Private Partnership (PPP), the GoB enacted a PPP law, and has extended the following financial support to private sector in different stages of infrastructure PPP project life cycle.

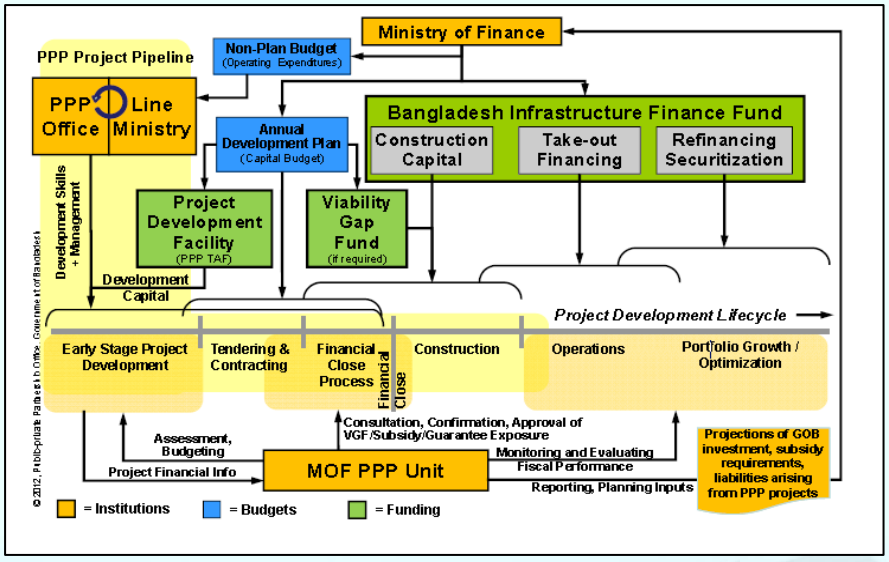

Fig 9 : PPP Projects financing arrangement

- Technical Assistance Financing
- Viability Gap Financing
- Financing against Equity and Loan
- Financing against Linked Component

An overview on the financing PPP project in the context of life cycle is shown in the following figure 9.

It is expected that GoB will seek new opportunities for private sector involvement (including Private Sector Operations) in transport infrastructure, energy, natural resources, and finance. Private sector operations are expected to play an increasingly important financial and catalytic role as progress is made in.

There are opinions and observation came out from the stakeholders meeting on the current financing arrangement available for the transport sector. The following table depicts the observation and suggestions we received during the stakeholders meet.

Stakeholders	**Observation**	**Suggestions**
Public agencies	The existing financing available for transport sector needs diversification. The capacity of the commercial banks finance large scale transport projects is limited. There is no policy regulation in place to support private sector to raise equity on the green field projects.	-Interest rate for infrastructure projects is not market reflective and the tenure of financing in many cases do not match with the return profile of the large-scale transport infrastructure projects. -Present financing facilities are highly focused to provide loan to purchase fossil fuel vehicles by the private owner. It needs to be extended to alternative types of low carbon and alternative energy-based vehicles. -Government incentives make it still challenging to undertake mega scale infrastructure projects where income from the operation is uncertain. -They want more relaxed policy on the off-shore financing to support mega scale transport projects.
	They have expressed their eagerness to engage private sector in the development of transport sector, but they need proper understanding on the modalities esp. how to engage private sector in the development, operation and maintenance of the transport sector assets.	They expressed favour for the bond market to raise capital for large transport projects.
Banks/Non-bank Financial Institutions (NBFIs)		Need more GoB fiscal and budgetary support to provide extended financing facilities to private sector.
Financial /capital market Regulator	They have limited capacity, especially in terms of developing understanding and how to utilize capital market to address the financial need of transport sector.	They need proper authority and capacity support to devise the right instrument to open the market.

The following barriers specific to Transport sector financing have been identified while talking to private sector and financing institutions

- Cost of capital, still high to support the large-scale transport projects, it needs to come down to single digit (preferable in the range of 6~7%) to encourage more private investment in this sector.
- Off-shore financing needs more relaxed government policy to get promoted as a convenient means to private sector.
- Central bank should relax the SLR (statutory liquidity ratio) while financing large transport sector projects with single credit exposure or under syndicated financing.
- Lack of capacities: It is another barrier for commercial banks to overcome to finance transport projects of new nature.
- Tenure mismatch: The way commercial banks operate especially the tenure of FDR by the private investor, is in the range of 1~3 years and transport sector projects require a tenure of 10 years and more. If there is not adequate re-fining credit extended by BB or Government, it is very difficult for them to package up appropriate lending offer suitable to transport sector project developer with longer operational life.

2.3.4 Project pipeline

Transport Projects/measures implemented or under implementation:

Following are the implemented/or under implementation projects for improving vehicle movement in the road sector.

- A number of measures are also already being taken to improve the fuel efficiency of the vehicles used in Bangladesh. CNG fuel is often used for both private and public vehicles, 65 Ministerial cars are now hybrid, and zero tailpipe emission battery-powered vehicles are used widely in most urban areas as public transport.
- Fuel switch to CNG by private and public owned vehicles has addressed emission and air quality.
- The construction work of the Dhaka Elevated Expressway PPP project from the airport to Palashi, has started.
- Bangladesh Government has enacted ride sharing guidelines and as a result two reputed company Uber and Pathao are expanding their operation network especially in the Dhaka city areas.

Pipeline:

- There are also plans for construction of a BRT (Bus Rapid Transit) line from Gazipur to old Dhaka. As this will use a new fleet of modern buses, it will improve the fuel efficiency of the bus stock
- Dhaka is constructing metro rail 6 and another two-metro rail (1&5) area in the feasibility stage, it is an opportune time to apply transit-oriented development (TOD) measures along those metro corridors.
- To reduce traffic congestion and faster communication, Government of Bangladesh is implementing Dhaka-Chittagong 4 lane highway project.
- Procurement of new locomotives, coaches etc for the Replacement of old locomotives, fuel efficiency increase, track electrification, introduction of HSR etc. Bangladesh Railway (BR) is expected to complete this by 2030
- Scoping study on reverse logistics options by Bangladesh Road Transport Authority (*BRTA),* Roads and Highway Department *(RHD)* with in July 2017 to July 2018.
- Scoping study on emissions graduated tolls by RHD, Dhaka Transport Coordination Authority (DTCA), BRTA from July 2017 to July 2018.
- Study to assess potential scope for a car scrappage scheme and the likely costs and benefits BRTA, DTCA, RHD from Jan 2018 to Jan 2019.
- Build traffic modelling capacity in GoB. agencies like BRTA, DTCA, Bangladesh Police & City Corporations from July 2017 to July 2019.

2.3.5 Barriers and opportunities for Transport Sector

The following table also shows the result of such assessment and it indicates the most promising measures and sub-sectors identified to have the highest potential for private sector investment, provided the right GoB policy. The key barriers of implementation are further explained in the remark column. In terms of market maturity and scale of investment, E-vehicles (battery charged) and fuel switch measures appear to have be the most promising areas for investment. LPG vessels and hybrid vehicles are further sub-sectors that may grow in future if facilitated by policy.

Barrier or gap	Rationale for barrier or gap	Relevant sub-sectors	Recommendations	Specific opportunities for technical assistance to address barrier
Lack of robust data on GHG emissions	There is need to build a robust Measurement Reporting and Verification (MRV) system to track the NDC emission reduction target as well as attract more concessionary financing from the donors and development partners. A particularly important data set that is lacking is vehicle km, passenger km and freight km. Another key data set that is lacking is on vehicle fuel efficiency.	Public and Private owned vehicles	The Bangladesh Road Transport Authority (BRTA) could play a role in collecting such data. Also freight transport statistics can be established this way, All the data on vehicle km could then be shared with Bangladesh Bureau of Statistics for them to publish on a regular basis. BRTA vows in favour of improvement of fuel and improvement of fuel efficiency of the road sector.	Collecting such data requires detailed knowledge on the overall vehicle stock in a country and emission values of the respective vehicles. A GHG inventory on the transport sector could be attempted to set up emission base line on this sector. This will help policy maker to introduce relevant policies on emission control from this sector
Banning years old vehicles to address emission and transport efficiency	Many old and out of service life vehicles are still running on the road and attributing GHG emission and fuel in-efficiency in the transport sector.	Public and Private owned vehicles	Private sector owns most of the road vessels and water vessels in the country. During the interview they expressed to receive necessary financial incentive and soft financing support to withdraw the old vehicles from the operation. Low cost and long tenure financing facility to promote low carbon vehicles can play important role in this regard. Emissions graduated tolls, car scrappage, reduction of road roughness; and Information and communication technology (ICT) support, e.g. real-time information on public transport; and, Euro 4 engine could address the issue.	Awareness and capacity building support along with business case development support along with investment grade feasibility study on the low carbon vehicles like solar powered bike and three wheelers etc. could help policy maker and financial institutions to address this barrier.

Lack of finance	Cost of finance especially for large scale transport project is not market reflective. Moreover, there is no credit line established to promote low carbon vehicles	Private sector transportation and infrastructure	-The private sector urged for dedicated government budgetary and funding support in this regard. -They also want relax policy to facilitate off-shore financing so that private sector can invest in this sector. -Cost of fund needs to be in range of 6~7% so that private sector will be encouraged to take more transport projects.	TA support can help policy maker to understand the impact of cost of finance for the development of business model in this sector.
Non-existent bond market to support mobilization of private financing in this sector	There is no bond market to support the large scale transport projects . Long payback period and limited off-take guarantee of Government, are the two major issues as expressed by private sector and capital market regulator.	private sector transport projects	The stakeholders in their opinion expressed that transport sector issues are to be addressed in a holistic manner with an integrated policy approach rather than piece-meal sub-sectoral approach that has been adopted so far. Different modes of transport will have to fit into the transport chain by their quality and competitiveness of service. Implementation of multimodal practices would require an integrated policy approach to guide transport investment decisions on the basis of appropriate assessments of impacts of all modes of transport to ensure that investment meets the policy objective of sustainable development.	TA can assess the impact of different modes of transport in line with multi-modal policy and see whether the scope extension of multimodal policy is required or not. Also facilitate workshops with experienced professionals from overseas bond market to discuss how projects in Bangladesh could be floated on bond markets.
Lack of Policies	Government of Bangladesh has enacted many policies for transport sector. To boost up transportation sector and address the modal shift issue, Government has adopted integrated multimodal transport policy. This is comparatively a comprehensive policy and less known to private sector. Also, it may need to update the transport policies in light of INDC/NDC to address the innovative measures like e-vehicles, solar charging facilities for vehicles in the current policy	Transport sector	The interviewee expressed to gain more understanding on the aspects of this integrated policy and keen to know the areas of private sector engagement in the areas of modal shift. The Government stakeholders expressed to update or adopt new policy document to accommodate low carbon measures like e-vehicles, hybrid cars and buses and solar charging facilities for the small un-registered e-vehicles getting operated in the rural areas of Bangladesh.	TA can extend support to Ministry to address the policy issues.

	document.			
Lack of awareness/ capacity gaps on technical know-how on the low carbon and low mileage transport technologies	The same capacity and awareness gaps exists for NDC. Probably the most crucial requirement of all to aware and sensitize stakeholders and align them towards implementation of NDC	All relevant transport sub-sectors	Continuous capacity and awareness support can address this matter.	TA could conduct workshop for all sorts of stakeholders regarding NDC implementation focusing transport sector priority like low carbon vehicles, solar charging system for e-vehicles etc.

3. Barriers and Opportunities Analysis of Power Industry and Transport Sectors

Considering the key barriers and opportunities of Power, Industry and Transport Sectors, a matrix has been developed for the better understanding of barriers and opportunities. The matrix is given below:

Barrier	***Proposed activity in the next phase***	***Type of action recommended***				***Applicable subsector***
		Policy reform	*Specific technical Studies*	*Financial instruments*	*Awareness raising and Capacity development*	
Power Sector						
High cost of energy produced from RE for end users	Comprehensive assessment to rationalize the high costs of RE technology and accessories; innovation from Private sector and financing support to cover high cost of technology		√			Grid connected solar projects
Unstable grid integration of RE	Grid integration study studying current technical limitations and recommendations for government and utilities		√			
Limited access to low cost financing	Soft funding support along with regulatory framework and incentive needed from govt. such as market suitable benchmarked tariffs.	√	√	√		
Lack of proven business models hampering RE market development	A comprehensive study exploring business models of off-grid technologies, suitable financing mechanisms and policies for further uptake on solar mini grid and solar irrigation.	√	√	√		Off-grid solar projects
Lack of awareness on technology transfer and bond market	Raising awareness of bonds and technical and management aspects of NDC implementation, and capacity support on MRV systems				√	Overall RE sector

Industry Sector						
Lack of awareness on business case for EE technologies	Cost-benefit analysis for the various technologies/ sub-sectors. Potential awareness raising campaign for technologies with a business case targeting relevant constituencies (garment, textiles, cement industry associations, trade fairs, etc.)		√		√	***EE technology*** (ies) across industry(ies)
Lack of energy audits	Training of energy auditors and developing case for grant financed training and certification program		√		√	
Inadequate financing for EE technologies	Developing innovative financial products with banks		√	√	√	
Transport sector						
Lack of business case on low carbon vehicles	Awareness and capacity building support along with business case development with investment grade feasibility study on the low carbon vehicles like solar powered bike, three wheelers and **solar power boat**.	√		√	√	Road transport – Low carbon vehicles
Lack of finance for low carbon vehicles	Study to assess impact of finance on vehicle uptake, development of business models and relaxed policies for financing	√	√	√		
Lack of GHG data	Collect data and develop GHG inventory		√			Entire transport sector

4. Recommendations for future action

Proposed Sub-sector next phase actions

The summary findings of the phase 1 activities of the IKI project have been developed and shared in a round table meeting with the high level government policy makers at the Ministry of Environment and Forests where representatives of Power Division, Ministry of Industries, Road Transport and Highway Division, SREDA and Department of Environment were present. During the discussions in the round table meeting and considering the government priority, market maturity and readiness of the private sectors, the following sector/areas can be considered for next phase by the MPI Project. A preference was shown for demonstrating viable business model for off-grid energy and to move projects closer to implementation, and providing evidence for redesign of financial incentives and support packages.

Off-grid Solar (solar mini-grids, solar irrigation, potentially solar boats)

To address the issues, a study exploring business models of off-grid technologies and measures to mobilise investment towards the sector will be undertaken. This will include cost-benefit analysis of off-grid projects with finance support under different scenarios for business case development.

Relevance of Off-grid Solar to NDC mitigation sectors:

1. Energy: Off-grid solar is a key renewable energy technology which investors are interested in

2. Industry: Solar mini-grids have high potential to provide power for commercial uses (e.g. cottage industries)

3. Transport: Solar boats a nascent technology with potential to reduce transport sector emissions

Cover Photo credit:

Top: The Daily Sun, "Solar Energy: The Green Source of Power", October 06, 2017 , Shariful Islam, Accessed on December 21, 2017, https://goo.gl/qAm3t2

Bottom Left: Nasir Group of Industries, "Nasir Glass industries limited (Float Glass)", Accessed on December 21, 2017 https://goo.gl/LNpCic

Bottom Right: First News (Vol: 7, No: 42), Loads on the Roads, Manik Chowdhury, Accessed on December 21, 2017 <https://goo.gl/3yUwZ1>

Annex-1: Details assessment of the power sector including renewable sector

Sub-sectors (Renewables)		Ease of project implementation	Ease of Finance	Market Maturity	Scale of Investment	Available Technology	Remark
Supply side (on-grid)	*Grid connected RE Plants*	Low	Low to medium	Low	Low	High	The key barriers are land and scale of land development., proximity to power evacuation facility and low-cost finance
	Solar Roof-top	High	High	High	Low to medium	High	Absence of FIT/Net-meeting is still a hindrance. GoB is working on that. The draft net-metering scheme is awaiting final approval.
	Wind power plant	Low	Low	Low	Low	Medium to high	True potentials are not identified yet. The comprehensive wind mapping is on-going. Low cost financing can break the chain. Need more pilot projects to take place.
Demand side (on-grid)	*Solar-diesel hybrid solutions*	High	Low to medium	Low	Low	High	Low cost financing especially low interest rates in the range of 5~6% is essential to scale up this potential. Need more pilot projects to take place.
	Commercial Bio-gas plant	Low to medium	Low to medium	Low	Low	High	Low cost financing and priority access to grid is essential to scale up this potential.
	Bio-mass (rice, sugar bagasse plant)	Low	Low	Low	Low	Medium to high	Technology proven, but the availability of bio-mass for year-round operation is a challenge. Most of the financiers are hesitant to finance this type of project based on this reason. Few pilots are being attempted to demonstrate technology.
Demand side (off-grid)	*Solar Home System*	High	High	High	High	High	It is the most successful off-grid RE solution in Bangladesh
	Solar Mini and Micro grid	Low to medium	Medium to high	Low	Low	High	High cost is a problem, otherwise it can provide a handy rural electrification solution esp. in the off-grid region
	Solar Irrigation	Low	High	Low to medium	Low	High	Ease of implementation is still a challenge associated with the right business model to scale up this technology to save imported and subsidized diesel
	Household bio-gas plants	Low to medium	High	Low to medium	Low to medium	high	Ease of implementation and maintenance and feed-stock collection for the plant is a major challenge

Annex-2: Details assessment result of the Industry sector

Sector: Industry		Ease of implementation	Ease of Finance	Market Maturity	Scale of Investment	Available Technology	Remark
Demand Side-measure (at factory) across industries	*Waste Heat Recovery from Boilers*	High to medium	High to medium	High	High	High	Established technology and market maturity given for this type of investment. Small/medium scale upfront investment by factory owner required.
	Vapor Absorption Chillers	High	High	High	High	High	This is a popular technology to textiles mills owner and a great number of VAC systems are already installed in that industry.
	Condensate recovery systems	High	High	Low to medium	Low	High	Soft financing and awareness support can help this measure to gets disseminated at a wider scale. Small/medium scale upfront investment by factory owner required.
	Heat recovery from the cooling system of generators	High to medium	High to medium	Low	Low	High	Technology is proven. Need to raise industry's awareness about the business case. Pilot demonstration (of the profitability of small to medium upfront investments) is essential.
	Leak sealing of steam and air flow systems	High	High	Low	Low	High	Technology is proven; only small upfront investment required. Need to aware industry owner about the potentials. Pilot demonstration is essential.
	Efficient boilers	Low	Low to medium	Medium to high	Medium to high	High	Soft financing can help to change the mind set of the industrialists towards more energy efficient new boilers.
	Speed drive enables efficient motors	High	High	High	High	High	
	LED lightning	High	Low to medium	Low to medium	Low to medium	High	Low cost financing and incentive support (like SREDA's promotion of Energy Services Company model) can help more dissemination in the industry.
Demand side specific to Textiles	*Efficient Air Jet Looms in the textiles*	High	Low to medium	Low	Low	high	Low cost financing can help more dissemination.
	Co/tri-generation (textile and garment)	Low	Low	Low	Low	High	Low cost financing can help wider dissemination. Need for more pilot projects.

	Demand side specific to Cement	*Process change from wet to dry*	Low	Low	Low	Low	High	Low cost financing can help dissemination. Demonstration through donor-financed private sector projects (e.g. IFC ESG standards).
	Demand side: Steel Re-rolling Ind.	*Furnace efficiency improvement, mainly in re-rolling mills*	Low	Low	Low	Low	High	Low cost financing can help more dissemination. Need for more pilot projects.
	Demand side: Brick making Ind.	*Efficient Brick-kilns, Mainly Hoffman and tunnel kiln*	Low	Low	Low	Low	High	Low cost financing can help dissemination. Alternative brick models (Compressed Stabilized Earth Blocks).

Annex-3: Details assessment of the Transport sector

Sector: Transport		Ease of implementation	Ease of Finance	Market Maturity	Scale of Investment	Available Technology	Remark
Diversification of vehicles	*Introduction of E Vehicles*	Medium to High	Low	Low	Low	Medium to High	Highly policy driven. GoB Incentive can facilitate the market
	Hybrid vehicles	High	Low to medium	Low	Low	High	Demand exists in the market, need GoB policy and duty waiver on the imported vehicles
	Solar vehicles	Low to medium	Low	Low	Low	Low to medium	Soft financing and GoB incentive can help wide scale dissemination. Need more pilots.
	E-vehicles (Battery chargeable)	**High**	**High**	**High**	**High**	**High**	Technology is proven. Need to aware private sector vehicle owner about the potentials. Pilot demonstration is essential.
	Fuel switch-to CNG and LPG	**Medium to high**	**High**	**Medium to high**	**High**	**High**	Market is quite mature, and technology is available. Awareness and soft financing support can sustain the growth of CNG/LPG conversion.
Modal Shift	*Road to River*	Low	Low	Low	Low	High	GoB fiscal and financial incentive support needed in light of multi-modal transport policy
	Road to Rail	Low	Low	Low	Low	High	Soft funding support of GoB can encourage private investment in this area.
	Energy Efficient Water Transportation	Low	Low	Low	Low	High	GoB policy and incentive support needed.
	LPG vessels	Medium to high	Low	Low	Low	high	GoB policy and funding support needed.