

# Bangladesh Presentation

For SAARC Training Workshop on Power System Study  
for Synchronization of Multiple System



***Jointly Presented By:***

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# Bangladesh's Power Sector : At a Glance

*August, 2014*

|                                                         |   |          |
|---------------------------------------------------------|---|----------|
| Installed Capacity (MW)                                 | : | 10,618   |
| De-rated Capacity (MW)                                  | : | 10,023   |
| Maximum Generation (MW)                                 | : | 7,418    |
| Total Consumers (in Million)                            | : | 14.2     |
| Transmission Lines (ckt. km)                            | : | 9,425    |
| Distribution Lines (km)                                 | : | 2,88,787 |
| Per Capita Generation (including Captive)               | : | 321      |
| Access to Electricity<br>(including Off-Grid Renewable) | : | 62%      |

# Present Structure of Power Sector

## *Apex Institution*

- Power Division, Ministry of Power, Energy & Mineral Resources (MPEMR)

## *Regulator*

- Bangladesh Energy Regulatory Commission (BERC)

## *Generation*

- Bangladesh Power Development Board (BPDB)
- Ashuganj Power Station Company Ltd. (APSCL)
- Electricity Generation Company of Bangladesh (EGCB)
- Rural Power Company Ltd. (RPCL)
- North West Power Generation Company Ltd. (NWPGL)
- Independent Power Producers (IPPs)

## *Transmission*

- Power Grid Company of Bangladesh Ltd (PGCL)

## *Distribution*

- Bangladesh Power Development Board (BPDB)
- Dhaka Power Distribution Company (DPDC)
- Dhaka Electric Supply Company Ltd (DESCO)
- West Zone Power Distribution Co. Ltd (WZPDCL)
- Rural Electrification Board (REB) through Rural Co-operatives
- North West Zone Power Distribution Co. Ltd (NWZPDCL)

# **Electricity Demand and Challenges**

**With sustained GDP Growth, Electricity demand is increasing at a rate of 9 -12 %**

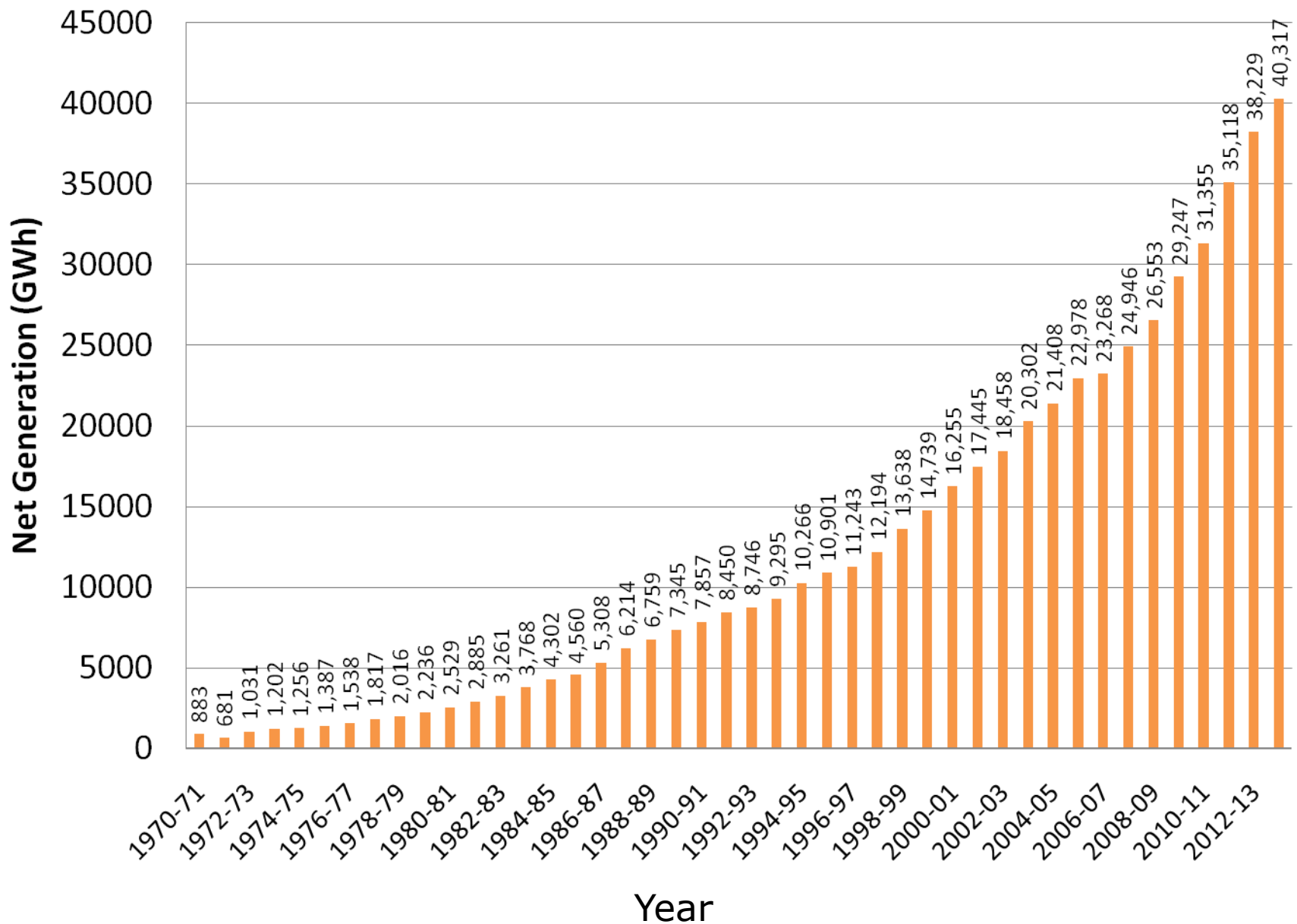
**Power sector are facing following challenges to meet this demand growth :**

- **Shortage of primary fuel supply from indigenous resources**
- **Financing capital intensive power projects**

# Strategic Policy on Power

- ✓ Fuel Diversity And Sustainable Supply of Primary Fuel
- ✓ Private Sector Participation in Power Generation
- ✓ Harnessing Renewable Energy Resources
- ✓ Demand Side Management (DSM) and Energy Efficiency Improvement Program
- ✓ Regional Co-operation on Cross Border Power Trade

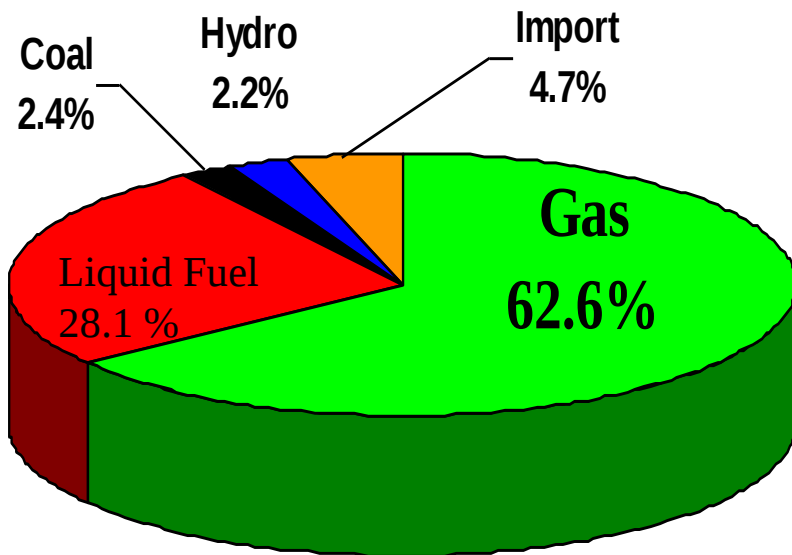
# Historical Energy Net Generation (GWh) in Bangladesh



# Generation: Fuel Wise & Owner (Installed Capacity' Aug 14)

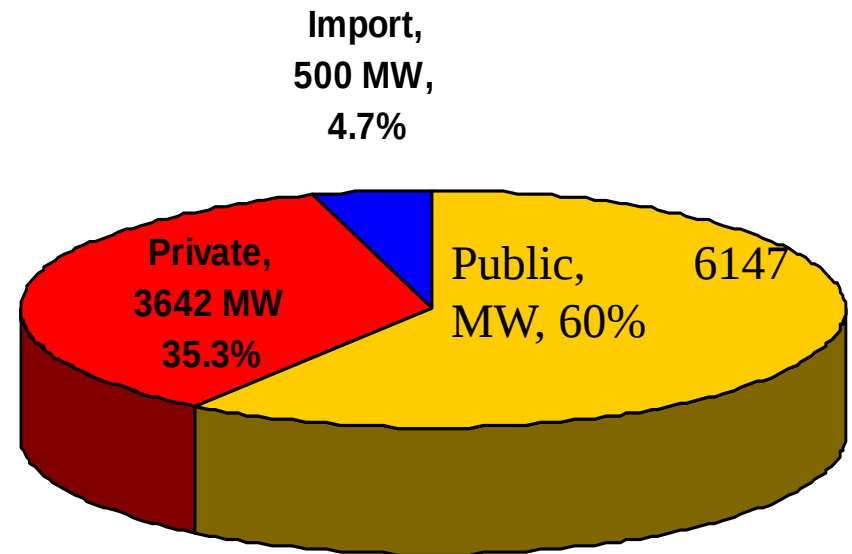
| Gas  | HFO  | HSD | FO | Coal | Hydro | Import | Total |
|------|------|-----|----|------|-------|--------|-------|
| 6651 | 2133 | 854 | 0  | 250  | 230   | 500    | 10618 |

## Fuel Wise Installed Capacity



■ Gas ■ Liquid Fuel ■ Coal ■ Hydro ■ Import

## Generation Owner (Installed Capacity)



■ Government ■ Private ■ Import



**Electricity Transmission in Bangladesh  
Managed by Power Grid Company of Bangladesh Ltd.**

# Bangladesh Grid Network

Year 2003

## Grid Infrastructure:

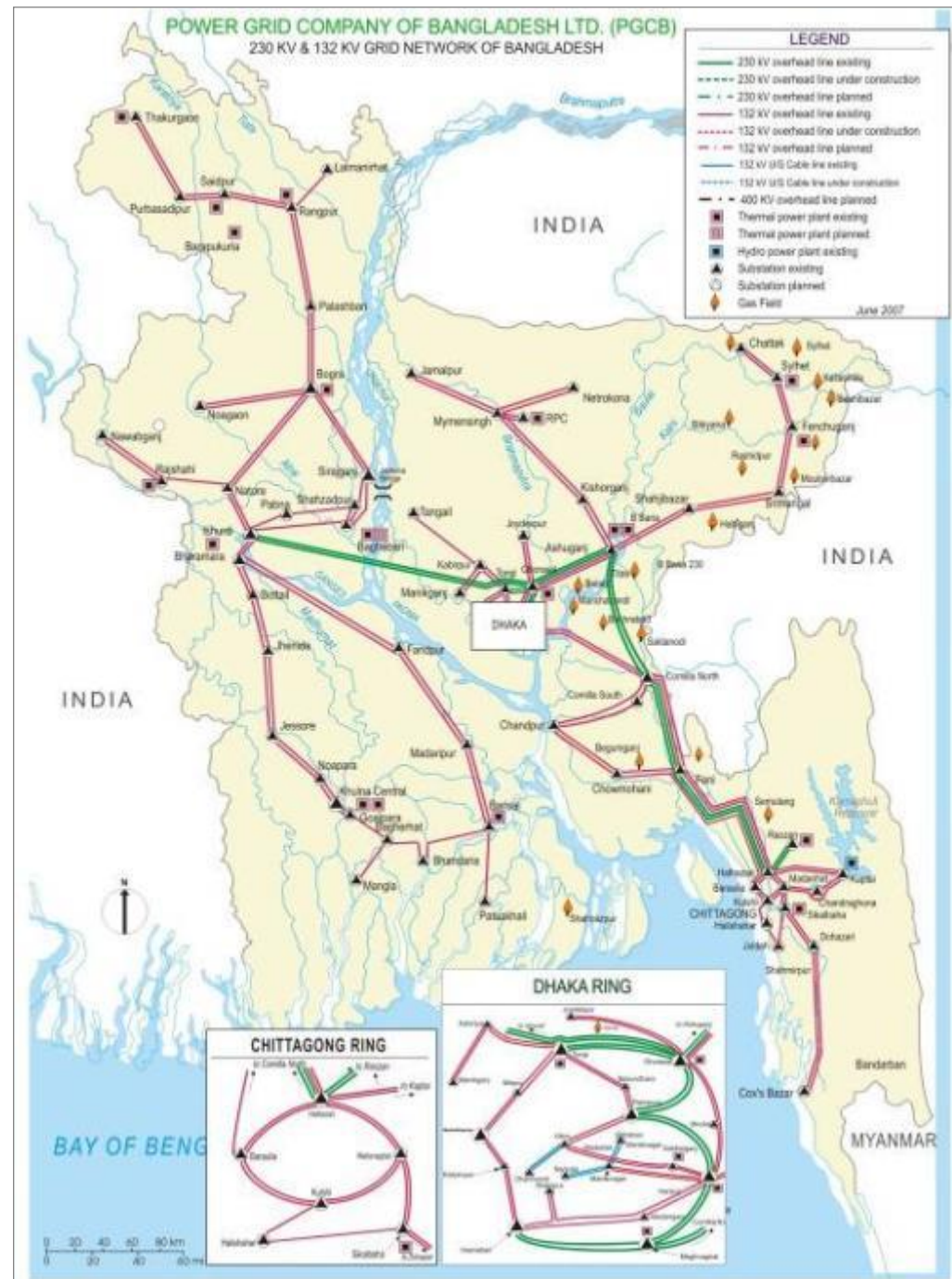
230kV Line: 1365 ckt. km

132kV Line: 4961 ckt. km

230/132kV SS: 7 (3150 MVA)

132/33kV SS: 63 (5507 MVA)

**Tr. Line added since 1972**  
**>1655 ckt.km 230 kV**  
**>3375 ckt.km 132kV**



# Bangladesh Grid Network

Year 2014

## Grid Infrastructure:

400kV Line: 164.7 ckt. km

230kV Line: 3066 ckt. km

132kV Line: 6195 ckt. km

HVDC Station: 1 (500MW)

230/132kV SS: 18 (8775 MVA)

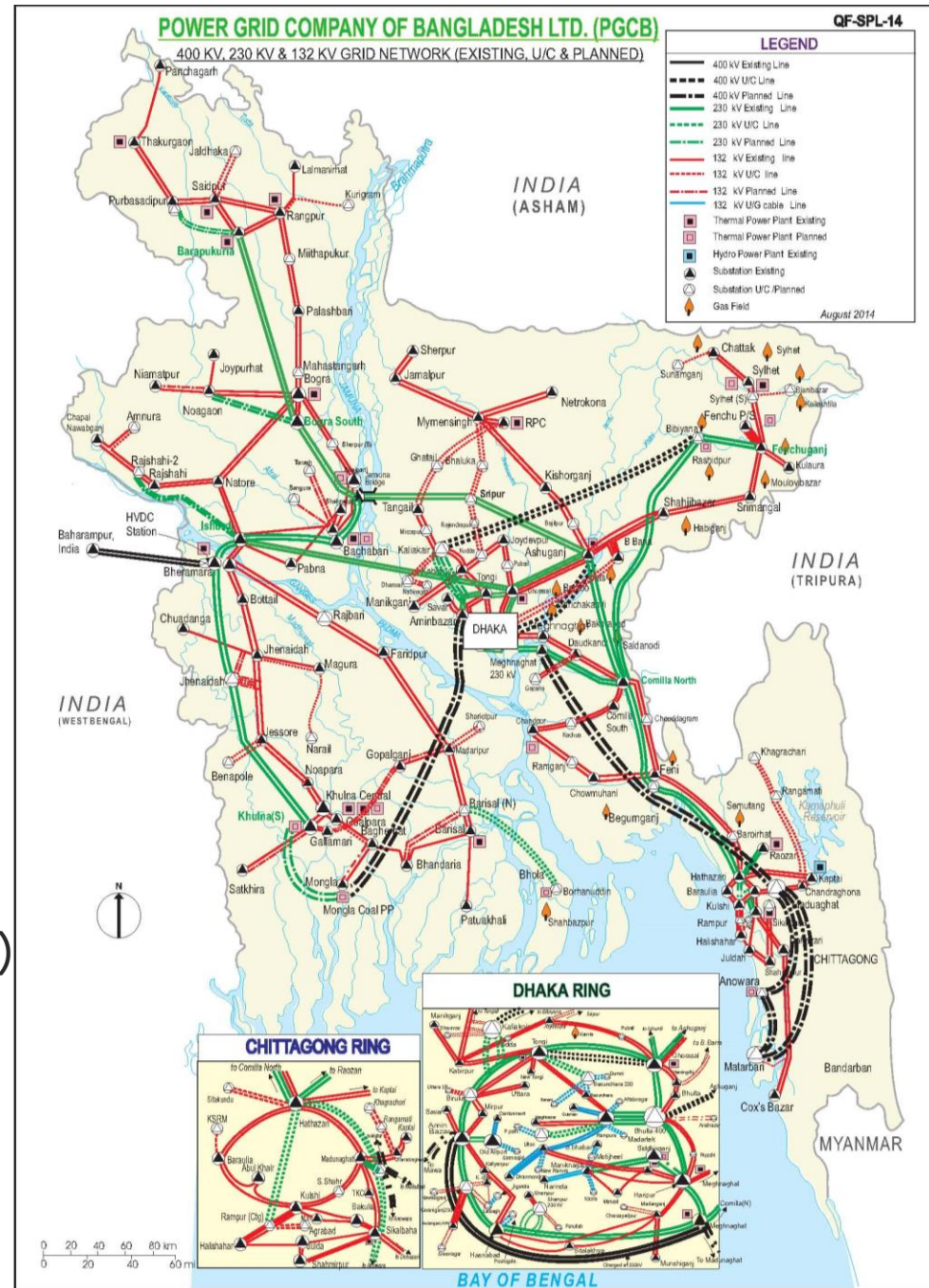
132/33kV SS: 105 (12796.3 MVA)

**Tr. Line added since 2003**

**>164.7 ckt.km 400 kV**

**>1701 ckt.km 230 kV**

**>1234 ckt.km 132kV**



# PGCB AT A GLANCE

|                                |                          |
|--------------------------------|--------------------------|
| Status                         | : Public Limited Company |
| Business                       | : Power Transmission     |
| Year of Incorporation          | : 1996                   |
| Authorized Capital             | : Tk. 10 Billion         |
| Present Paid-up Capital        | : Tk. 4190.13 Million    |
| Turnover (2012-13)             | : Tk. 8742.78 Million    |
| Net profit after tax (2012-13) | : Tk. 1010.18 Million    |

## Transmission Line as of April, 2014

|                                  |                         |
|----------------------------------|-------------------------|
| 400kV                            | : 164.7 Circuit Km      |
| 230 kV                           | : 3066 Circuit Km       |
| 132 kV                           | : 6125 Circuit Km       |
| <i>132 kV (DPDC &amp; DESCO)</i> | : <i>70 Circuit km.</i> |

## Substations as of April, 2014

|                                                   |                                    |
|---------------------------------------------------|------------------------------------|
| HVDC BtB                                          | : 01 (500MW)                       |
| 230/132 kV                                        | : 16 (8775 MVA) + 2 Nos. Switching |
| <i>230/132 kV (BPDB &amp; APSCL)</i>              | : <i>2 (550 MVA)</i>               |
| 132/33 kV                                         | : 88 (10846 MVA)                   |
| <i>132/33 kV (BPDB, DPDC, DESCO &amp; Others)</i> | : <i>19 (2269 MVA)</i>             |

# Government Vision

- To make electricity available for All by the year 2021.
- To ensure Reliable and Quality supply of Electricity.
- To provide Electricity at a Reasonable and Affordable Price.

## PGCB Vision

To Achieve Government Vision for “Economic upliftment of the country by reaching electricity to all through reliable transmission.”

## PGCB Mission

Efficient and effective management of national power grid for reliable and quality transmission of electricity as well as economic dispatch throughout the country.

# Performance of PGCB

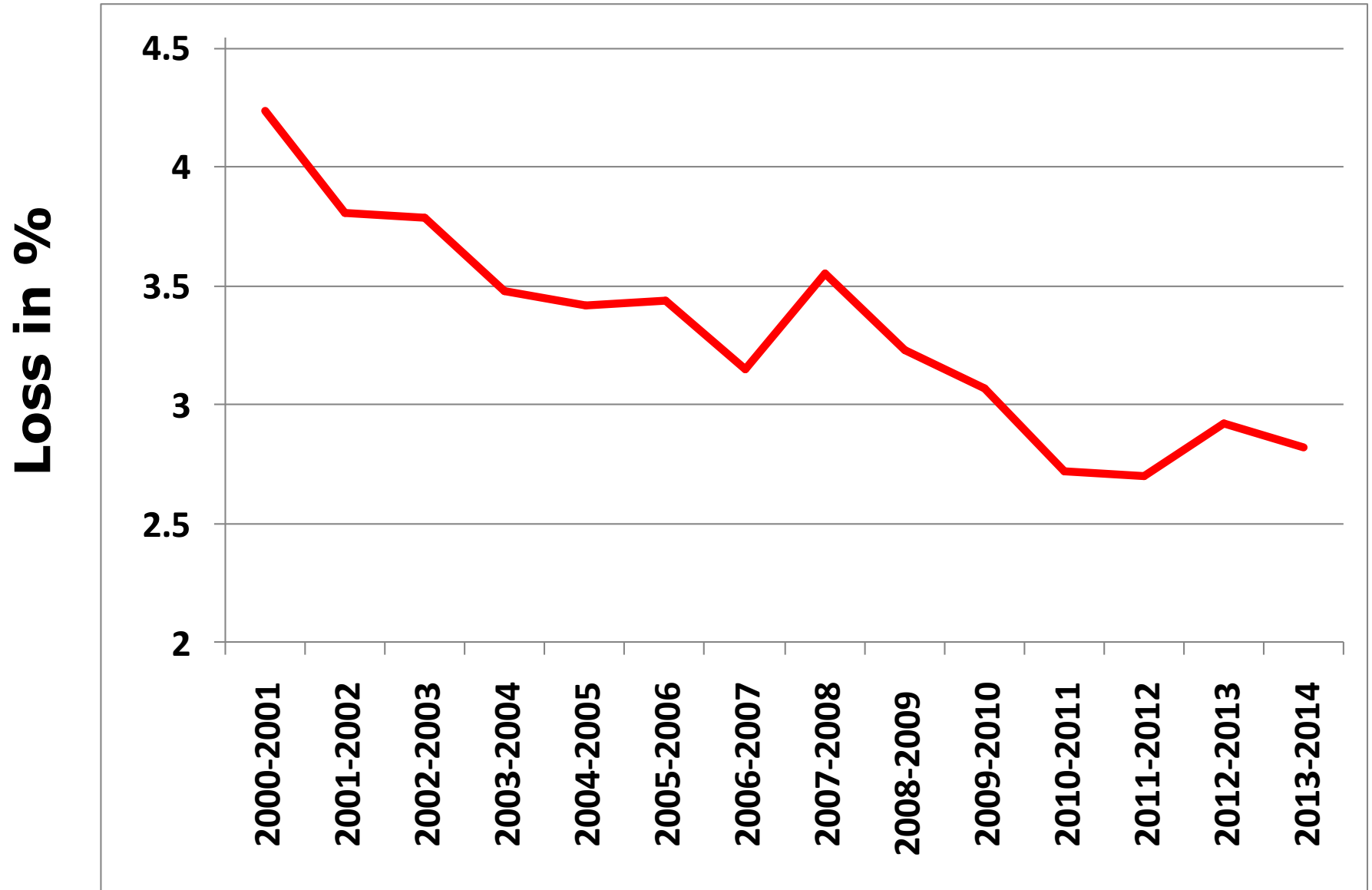
## Availability of Transmission Network

| Fiscal Year | Availability          |                |
|-------------|-----------------------|----------------|
|             | Transmission line (%) | Substation (%) |
| 2006-07     | 99.991                | 99.991         |
| 2007-08     | 99.986                | 99.992         |
| 2008-09     | 99.976                | 99.983         |
| 2009-10     | 99.978                | 99.973         |
| 2010-11     | 99.978                | 99.978         |
| 2011-12     | 99.958                | 99.969         |
| 2012-13     | 99.962                | 99.983         |
| 2013-14     | 99.982                | 99.993         |

# Transmission Loss Profile

| <b>Fiscal Year</b> | <b>Transmission Loss (%)</b> |
|--------------------|------------------------------|
| <b>2000-2001</b>   | <b>4.24</b>                  |
| <b>2001-2002</b>   | <b>3.81</b>                  |
| <b>2002-2003</b>   | <b>3.79</b>                  |
| <b>2003-2004</b>   | <b>3.48</b>                  |
| <b>2004-2005</b>   | <b>3.42</b>                  |
| <b>2005-2006</b>   | <b>3.44</b>                  |
| <b>2006-2007</b>   | <b>3.15</b>                  |
| <b>2007-2008</b>   | <b>3.55</b>                  |
| <b>2008-2009</b>   | <b>3.23</b>                  |
| <b>2009-2010</b>   | <b>3.07</b>                  |
| <b>2010-2011</b>   | <b>2.72</b>                  |
| <b>2011-2012</b>   | <b>2.70</b>                  |
| <b>2012-2013</b>   | <b>2.92</b>                  |
| <b>2013-2014</b>   | <b>2.82</b>                  |

## Transmission Loss Profile in Graph



## **Development Activities of PGCB**

# Power System Master Plan (up to 2030)

**Updates of PSMP 2006:** Due to change of planning perspective

**PSMP 2010 :** Long term planning up to 2030

**Study Conducted by:** TEPCO, Japan

**Study completion:** February 2011

## **Findings:**

- Generation capacity requirement by 2021: 24,000 MW
- Generation capacity requirement by 2030: 39,000 MW
- Coal based generation capacity by 2030: 20,000 MW

# Summery of Demand & Generation Forecast Master Plan-2010

## *Demand forecast*

## *Generation Plan*

|      | Government<br>Policy | Considering<br>GDP: 06% | Considering<br>GDP: 07% | Gen. Capacity<br>Present<br>Proposition |
|------|----------------------|-------------------------|-------------------------|-----------------------------------------|
| 2015 | 10 GW                | 8 GW                    | 9 GW                    | 18.2 GW                                 |
| 2020 | 18 GW                | 10 GW                   | 13 GW                   | 22.5 GW                                 |
| 2025 | 25 GW                | 14 GW                   | 19 GW                   | 29.3 GW                                 |
| 2030 | 33 GW                | 18 GW                   | 28 GW                   | 38.3 GW                                 |

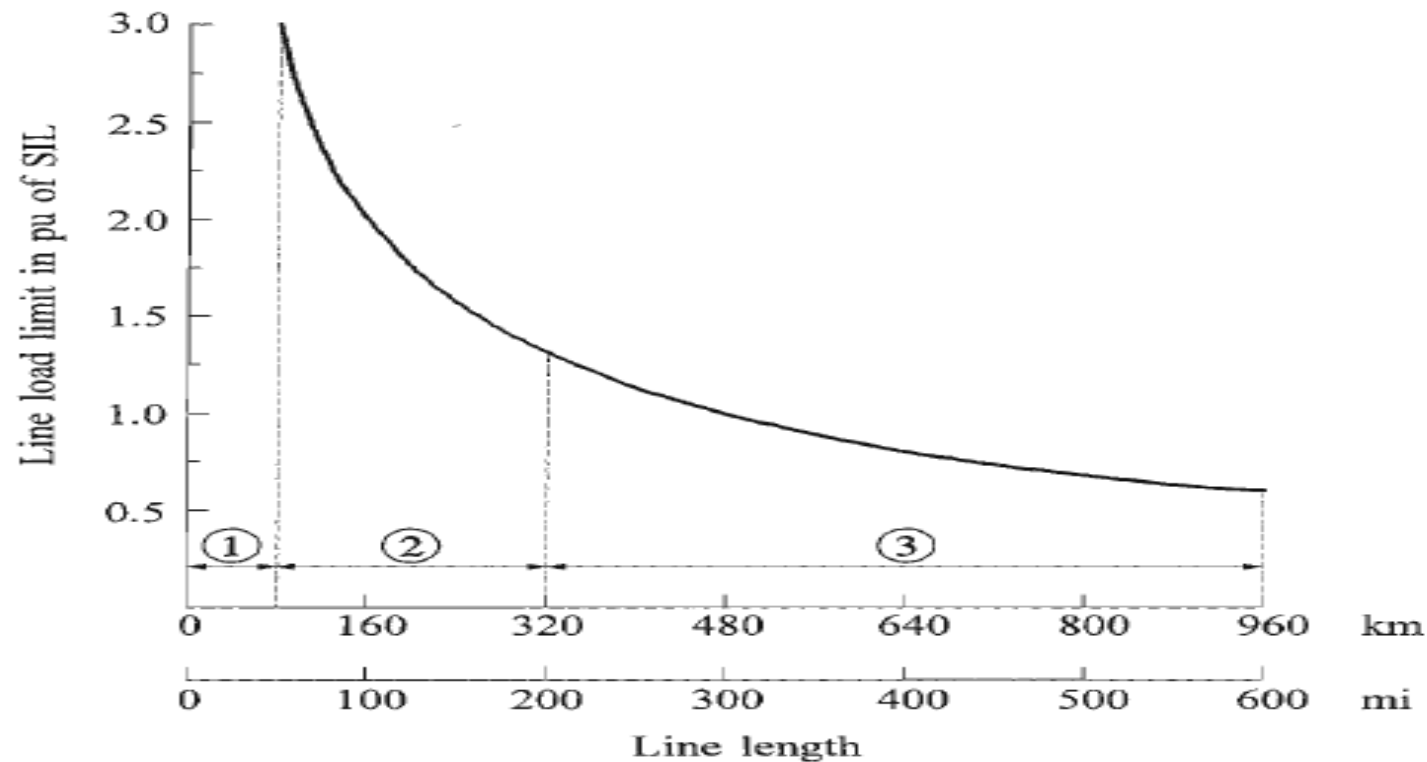
# Network Expansion Criteria

(Substation)

| Area  | 230/132kV S/S | 132/33kV S/S | Key Factors                    |
|-------|---------------|--------------|--------------------------------|
| Urban | 500MW         | 150MW        | Fault Current & RoW limitation |
| Rural | 300MW         | 80-120MW     | 33kV line loss & Voltage Drop  |

# Network Expansion Criteria

## (Transmission line)



- ① 0–80 km: Region of thermal limitation
- ② 80–320 km: Region of voltage drop limitation
- ③ 320–960 km: Region of small-signal (steady-state) stability limitation

# Network Expansion Criteria

(Transmission Line)

| Line Length (km) | Loading Limit (SIL)    | Key Factors                                      |
|------------------|------------------------|--------------------------------------------------|
| 0-80             | Up to thermal Capacity | Thermal Limitation                               |
| 80-320           | 1.5 -3.0               | Voltage Drop Limitation                          |
| 320-960          | 0.75-1.50              | Small Single (Steady-State) Stability Limitation |

# Stability Criteria

## ❖ Stability criteria in normal conditions and outage contingencies of facilities:

|                                                 |                                                                    |
|-------------------------------------------------|--------------------------------------------------------------------|
| Normal conditions of facilities                 | Facilities loading $< 100\%$                                       |
|                                                 | Steady-state voltage range: $\pm 5\%$                              |
| Single outage contingencies of facilities (N-1) | Facilities loading $< 100\%$                                       |
|                                                 | Steady-state voltage range: $\pm 10\%$                             |
|                                                 | Transiently stable to 3-phase to ground fault with normal clearing |

Completed Projects (Last 5 Years)

| SN | Project Name                                                     | Infrastructure Add                                     | Date of Completion |
|----|------------------------------------------------------------------|--------------------------------------------------------|--------------------|
| 1  | Aminbazar-Savar 132kV Transmission Line & Savar 132kV Substation | 132/33kV S/S : 1 (150MVA)<br>132 kV T/L : 30 ckt. km   | June, 2010         |
| 2  | Naogaon-Niamatpur 132kV Transmission Line                        | 132/33kV S/S : 1 (100MVA)<br>132 kV T/L : 45 ckt. km   | June, 2010         |
| 3  | Ashuganj-Shahajibazar 132kV Single Circuit Transmission Line     | 132 kV T/L : 56 ckt. km                                | June, 2010         |
| 4  | Ishurdi-Baghabari-Sirajganj-Bogra 230kV Transmission Line        | 230/132 kV S/S : 2(675MVA)<br>230 kV T/L : 328 ckt. km | June, 2009         |
| 5  | Shunt Compensation at Substation by Capacitor Bank (132kV level) | No' of S/S : 08<br>Capacity : 450MVAR                  | June, 2010         |
| 6  | National Load Dispatch Centre                                    | NLDC : 01                                              | June, 2010         |
| 7  | Three Transmission Line Projects                                 | 132/33kV S/S : 4 (328 MVA)<br>132 kV T/L : 149 ckt. km | June, 2011         |
| 8  | Bibiyana-Comilla (North) 230 kV Transmission Line                | 230 kV T/L : 320 ckt. km                               | June, 2013         |

Completed Projects (Last 5 Years)

| SN | Project Name                                                                                                                          | Infrastructure Add                                                                 | Date of Completion |
|----|---------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|--------------------|
| 9  | Construction & Extension of Grid Sub-Stations including Transmission Line facilities (Phase-I)                                        | 132/33kV S/S : 5 (655MVA)<br>132 kV T/L : 197 ckt. km                              | June, 2014         |
| 10 | Meghnaghat-Aminbazar 400 kV Transmission Line (Phase-I)                                                                               | 400 kV T/L : 110 ckt. km                                                           | June, 2014         |
| 11 | Transmission Efficiency Improvement Through Reactive Power Compensation at Grid Sub-Stations and Reinforcement of Goalpara Substation | No' of S/S : 26 (33 kV Level)<br>Capacity : 600 MVAR                               | June, 2014         |
| 12 | Siddhirganj-Maniknagar 230 KV Transmission Line                                                                                       | 230/132 kV S/S : 2(1200 MVA)<br>230 kV T/L : 22 ckt. km                            | June, 2014         |
| 13 | Construction of Haripur 360 MW Combined Cycle Power Plant & Associated Substation (PGCB part in EGCB's project)                       | 132/33kV S/S : 1 (240 MVA)                                                         | June, 2014         |
| 14 | Grid Interconnection between Bangladesh (Bheramara) and India (Bahrampur)                                                             | HVDC BtB Station: 1 (500MW)<br>400 kV T/L : 54.7 ckt. km<br>230 kV T/L : 9 ckt. km | June, 2014         |

## Infrastructure added after implementation of Completed Projects

| Transformer Capacity added (MVA) |       |        | Capacitor Bank (MVAR) |      | Transmission Line added (ckt km) |       |       |
|----------------------------------|-------|--------|-----------------------|------|----------------------------------|-------|-------|
| 132kV                            | 230kV | 400kV  | 132 kV                | 33kV | 132kV                            | 230kV | 400kV |
| 1867                             | 1125  | 500 MW | 450                   | 600  | 527                              | 864   | 164.7 |

## **Ongoing Transmission Projects**

| <b>SN</b> | <b>Project title</b>                                                                                                   | <b>Physical Progress</b> | <b>Date of completion as per DPP</b> |
|-----------|------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------------|
| 1         | Aminbazar-Old Airport 230 kV Transmission Line and associated Substations                                              | 98.88%                   | Dec' 2014                            |
| 2         | Bibiyana-Kaliakoir 400 KV & Fenchuganj-Bibiyana 230 KV Transmission Line (Fenchuganj-Bibiyana 230kV line is completed) | 49.60%                   | Dec' 2014                            |
| 3         | 132 kV Grid Network Development Project in Eastern Region.                                                             | 3.00%                    | June' 2015                           |
| 4         | National Power Transmission Network Development Project                                                                | 2.00%                    | June, 2016                           |
| 5         | 400/230/132 Network Development project                                                                                | 4.00%                    | June, 2017                           |

## **Ongoing Transmission Projects**

| <b>SN</b> | <b>Project title</b>                                                         | <b>Physical Progress</b> | <b>Date of completion as per DPP</b> |
|-----------|------------------------------------------------------------------------------|--------------------------|--------------------------------------|
| 6         | Enhancement of Capacity of Grid Substations and Transmission Line (Phase-I)  | 4.00%                    | June, 2017                           |
| 7         | Two New 132/33 kV Substations at Kulaura & Sherpur with Interconnecting Line | 95.00%                   | Dec, 2014                            |
| 8         | Barisal-Bhola-Borhanuddin 230kV Transmission Line Project                    | 68.00%                   | Dec' 2014                            |
| 9         | Goalpara-Bagerhat 132kV transmission line                                    | 18.00%                   | June, 2015                           |

## Ongoing Projects Summary:

### Infrastructure addition after implementation of Ongoing Projects

| Substation Capacity addition (MVA) |       |       | Transmission Line addition (ckt km) |       |       |
|------------------------------------|-------|-------|-------------------------------------|-------|-------|
| 132kV                              | 230kV | 400kV | 132kV                               | 230kV | 400kV |
| 4,791                              | 5,700 | 1,020 | 1,670                               | 563   | 396   |

# Planned Projects of PGCB

| S<br>N | Projects Name                                                                                                 | Expected Donor                  | Target Completion |
|--------|---------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------|
| 1      | <a href="#"><u>Ashuganj-Bhulta 400 kV Transmission line</u></a>                                               | <i>GOB &amp; PGCB financing</i> | June, 16          |
| 2      | <a href="#"><u>Aminbazar-Maowa -Mongla 400 kV &amp; Mongla - Khulna(S) 230 kV Transmission line (NG3)</u></a> | <i>IFC/ADB</i>                  | June, 17          |
| 3      | <a href="#"><u>Madunaghat - Meghnaghat 400 kV Transmission line (NG4)</u></a>                                 | <i>JICA</i>                     | June, 17          |
| 4      | <a href="#"><u>Matarbari -Madunaghat 400kV Transmission line project</u></a>                                  | <i>JICA</i>                     | 2017-2021         |
| 5      | <a href="#"><u>Western Grid Network Development Project</u></a>                                               | <i>kfW</i>                      | June, 17          |
| 6      | <a href="#"><u>Rural Transmission Network Development &amp; Renovation Project</u></a>                        | <i>kfW .</i>                    | June, 17          |
| 7      | <a href="#"><u>Madunaghat - Moheskhali 400 kV Transmission line (Addl part NG4)</u></a>                       | <i>yet to be decided</i>        | June, 19          |

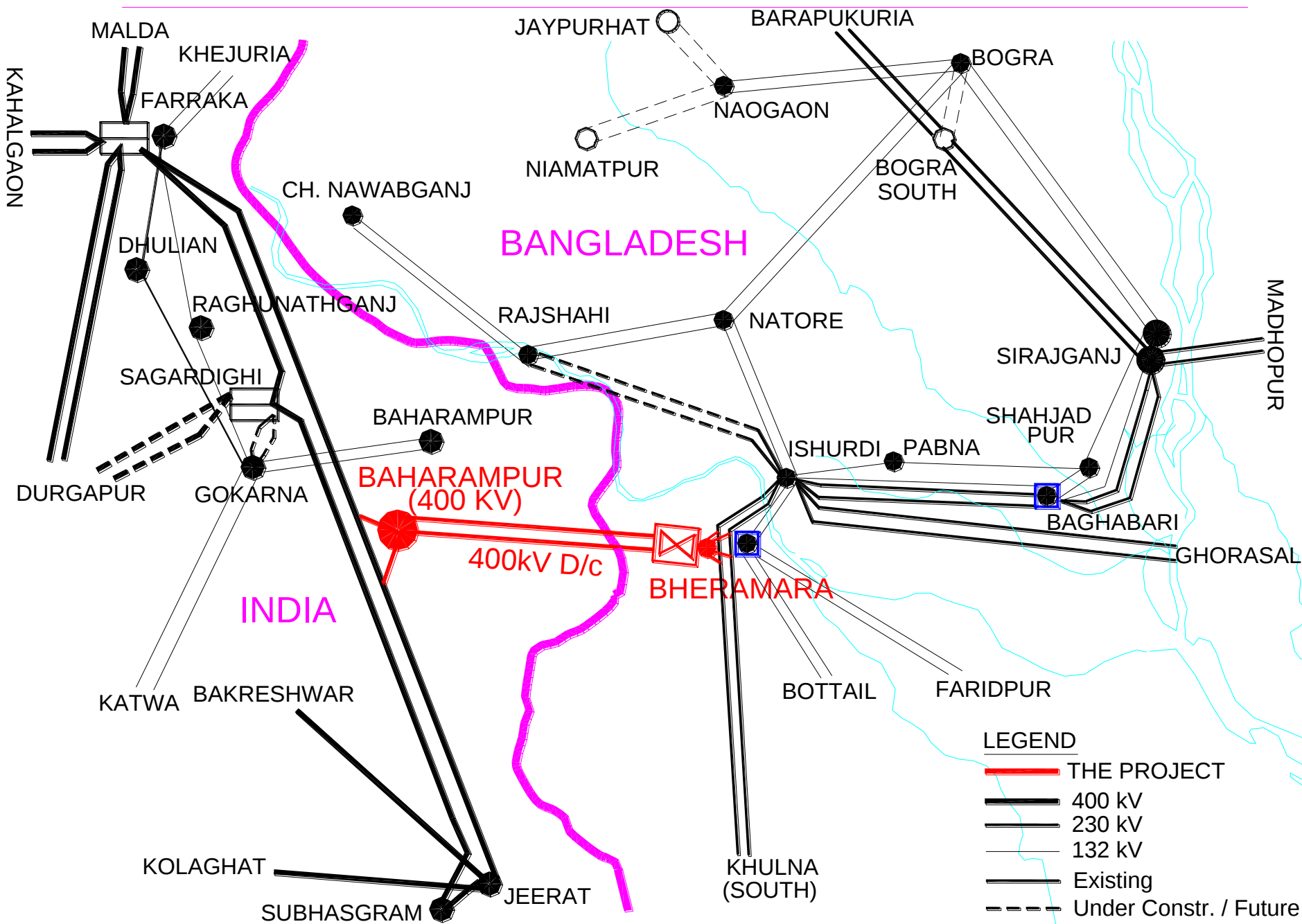
## Planned Projects Summary:

### Infrastructure to be added after implementation of Planned Projects

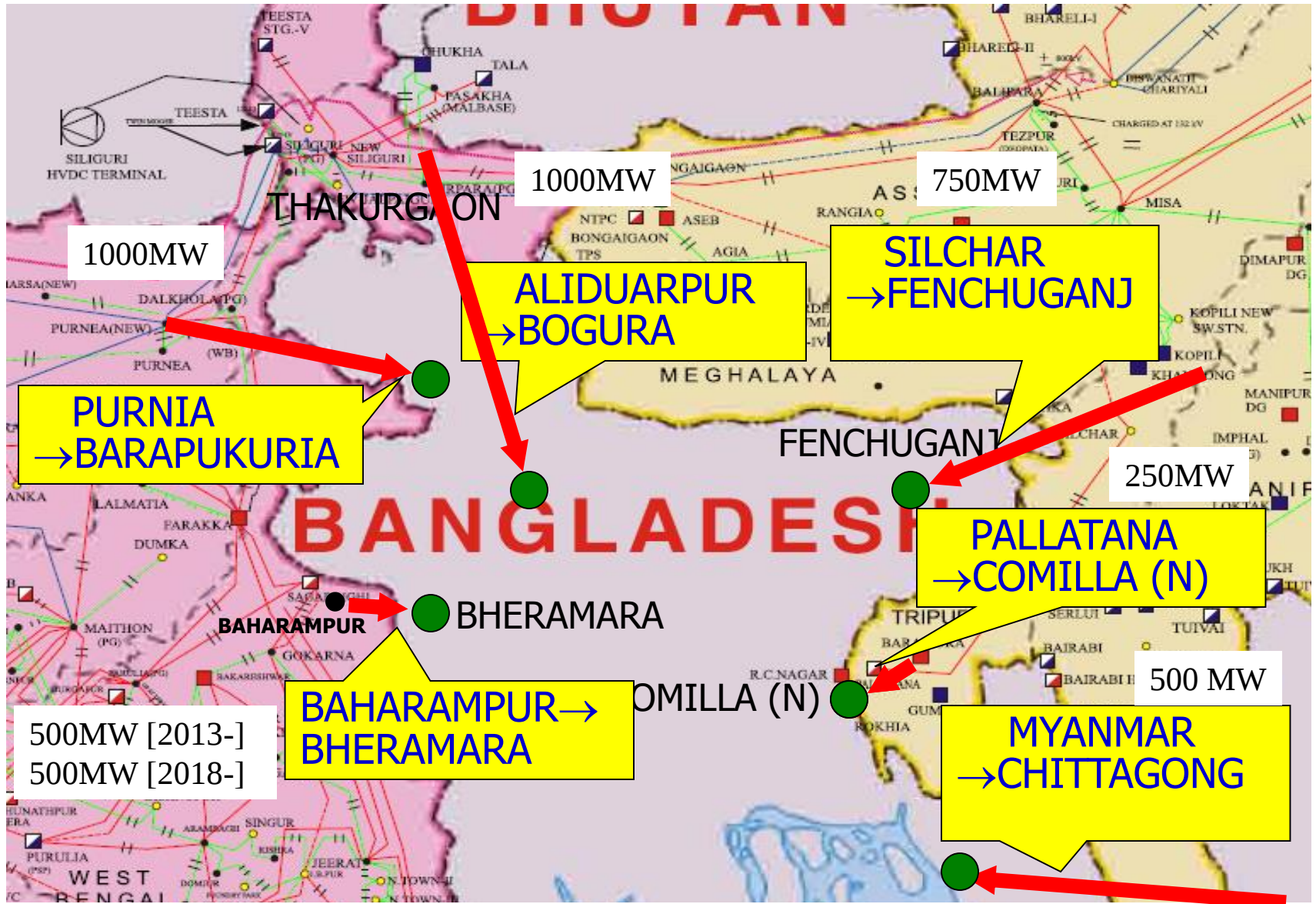
| Substation Capacity to be<br>added (MVA) |       |       | Transmission Line to be added<br>( ckt km) |       |       |
|------------------------------------------|-------|-------|--------------------------------------------|-------|-------|
| 132kV                                    | 230kV | 400kV | 132kV                                      | 230kV | 400kV |
| 1,725                                    | 5,100 | 5,720 | 689                                        | 466   | 1,316 |

# Regional Power Exchange/ Trading

# INTERCONNECTION BETWEEN INDIA AND BANGLADESH GRIDS



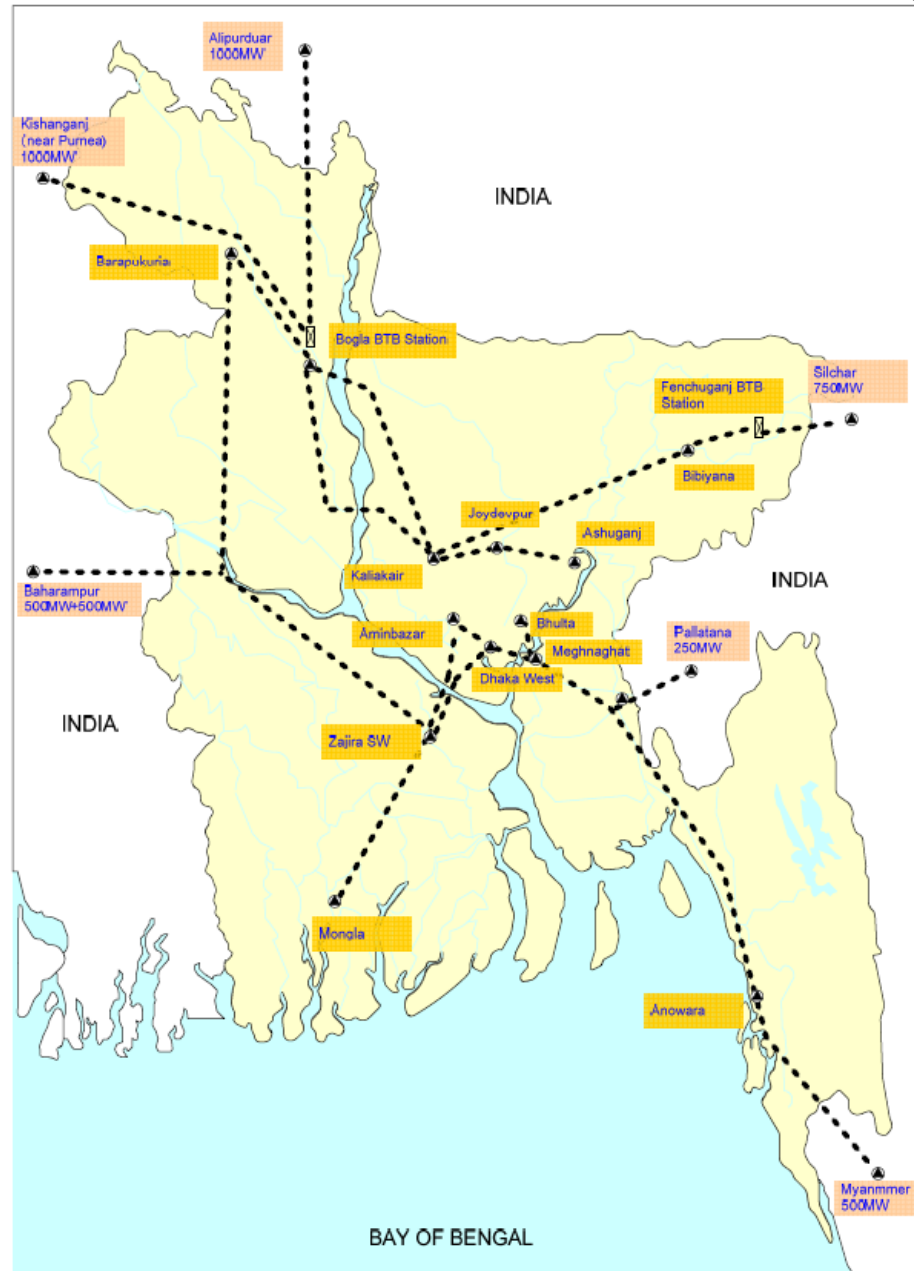
# Regional Power Exchange: Possibilities in PSMP



**As per PSMP 6 cross border interconnection lines are considered as follows:**

| <b>Name of Interconnection</b>                  | <b>Power Import (MW) by Year</b> |              |              |              |
|-------------------------------------------------|----------------------------------|--------------|--------------|--------------|
|                                                 | <b>2015</b>                      | <b>2020</b>  | <b>2025</b>  | <b>2030</b>  |
| Bheramara – Bahrapur                            | 500                              | 500          | 1,000        | 1,000        |
| Myanmar - Bangladesh                            | 0                                | 500          | 500          | 500          |
| Palatana - Comilla                              | 0                                | 0            | 250          | 250          |
| Shilchar - Fenchuganj                           | 0                                | 0            | 750          | 750          |
| Kishanganj - Bogra<br>(Hydro Power from Nepal)  | 0                                | 0            | 500          | 500          |
| Alipurduar - Bogra<br>(Hydro Power from Bhutan) | 0                                | 0            | 500          | 500          |
| <b>Total</b>                                    | <b>500</b>                       | <b>1,000</b> | <b>3,500</b> | <b>3,500</b> |

# 400 kV Power Transmission Routes for 2030 Bangladesh



Source: PSMP Study Team

**Fig. 9-16 Summary of potential interconnections (2030)**

# Bangladesh – India Co-operation

❑ Bangladesh-India signed an MOU to promote technical, bilateral co-operation in power sector development

❖ Salient Features of MOU signed on 11th January 2010

- ✓ Exchange of power
- ✓ Grid connectivity between the two countries

❑ NTPC & BPDB signed an MOU for mutual co-operation for development of Power Sector in Bangladesh

❖ Salient Features of MOU

- ✓ Setup of a 1320 MW coal based power plant in Bangladesh
- ✓ Human Resources Development and
- ✓ Enhancement of productivity and efficiency of their existing power stations.

# **1<sup>st</sup> Grid Interconnection between Bangladesh & India**

# Grid Interconnection Project

## **a) Objectives :**

- i) To establish a Grid Interconnection with India.
- ii) To minimize the power crisis in Bangladesh to some extent.

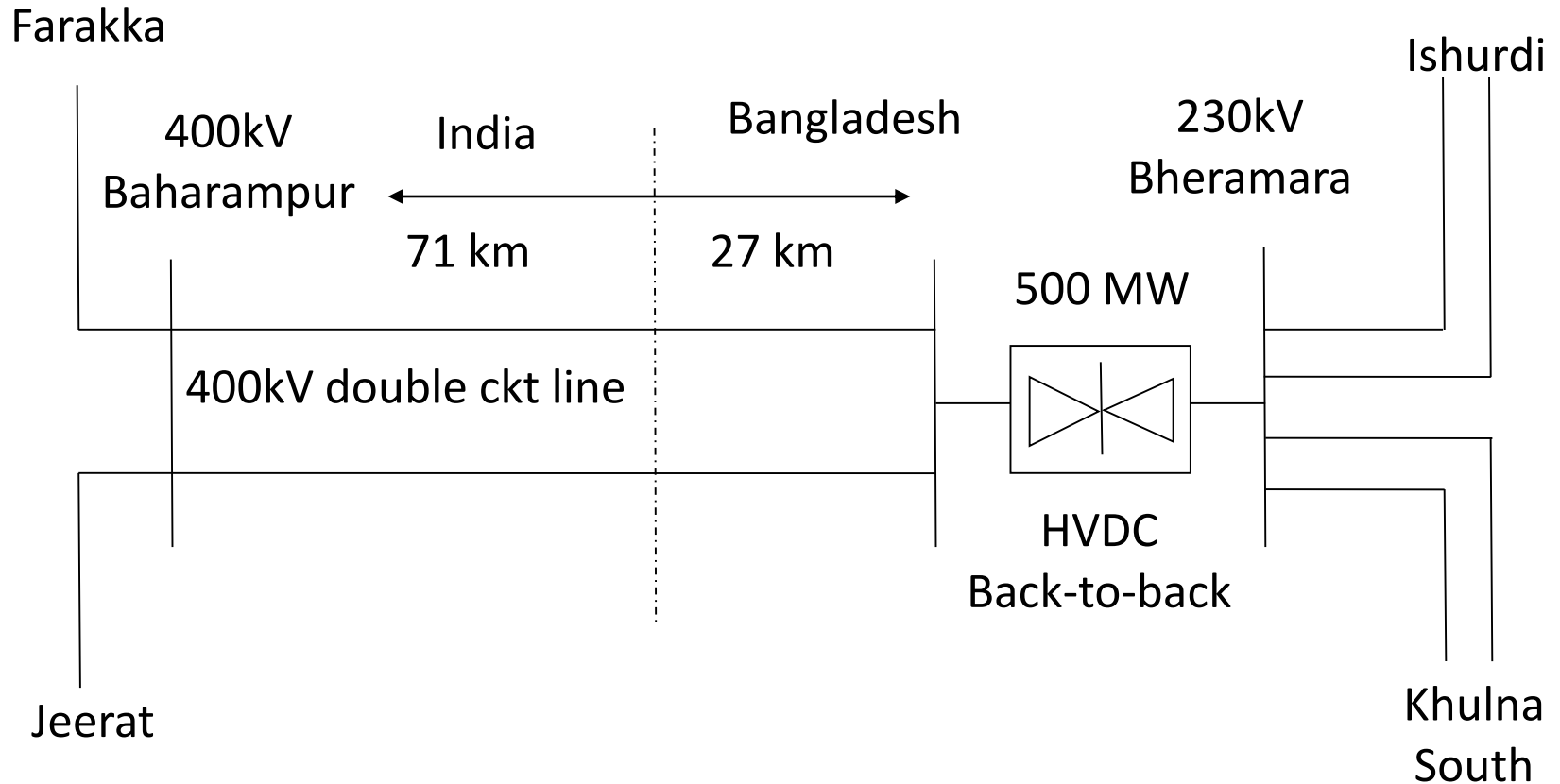
## **b) Main Components (BD part):**

- i) 27 km 400 kV double ckt transmission line
- ii) 400 kV Back-to-Back HVDC station at Bheramara.

## **c) Main Components (Indian part):**

- i) 72 km 400 kV double ckt transmission line
- ii) 400 kV switching station at Baharampur.

# 1<sup>st</sup> Grid Interconnection between Bangladesh & India



# Grid Interconnection Project

## Project Cost (BD Part) :

Total = Tk 1,078.69 Crore

F. E = Tk 700.00 Crore (ADB)

L. C = Tk 378.69 Crore (GOB+PGCB)

As per  
Approved DPP

Total = Tk 1,579.83 Crore

F. E = Tk 910.71 Crore (ADB)

L. C = Tk 669.12 Crore (GOB+PGCB)

As per RDPP  
approved on  
19.02.2013

Project Cost (Indian Part) : Total Cost 160.32 Crore Indian Rs.



19.03.2014 18:00

**400kV Switchyard**



**Valve Hall**



19.03.2014 17:59

**230kV Switchyard**



Photo: Control Room Building & Valve Hall

## **Control Room, Valve Hall and Converter Transformer**

## **Benefits found from this station**

- ❖ Socio-economic development of these region by energy cooperation.
- ❖ Ease power crisis.
- ❖ Power quality improvement.
- ❖ Milestone for further regional cooperation.

# **Potential Cross Border Interconnection Options**



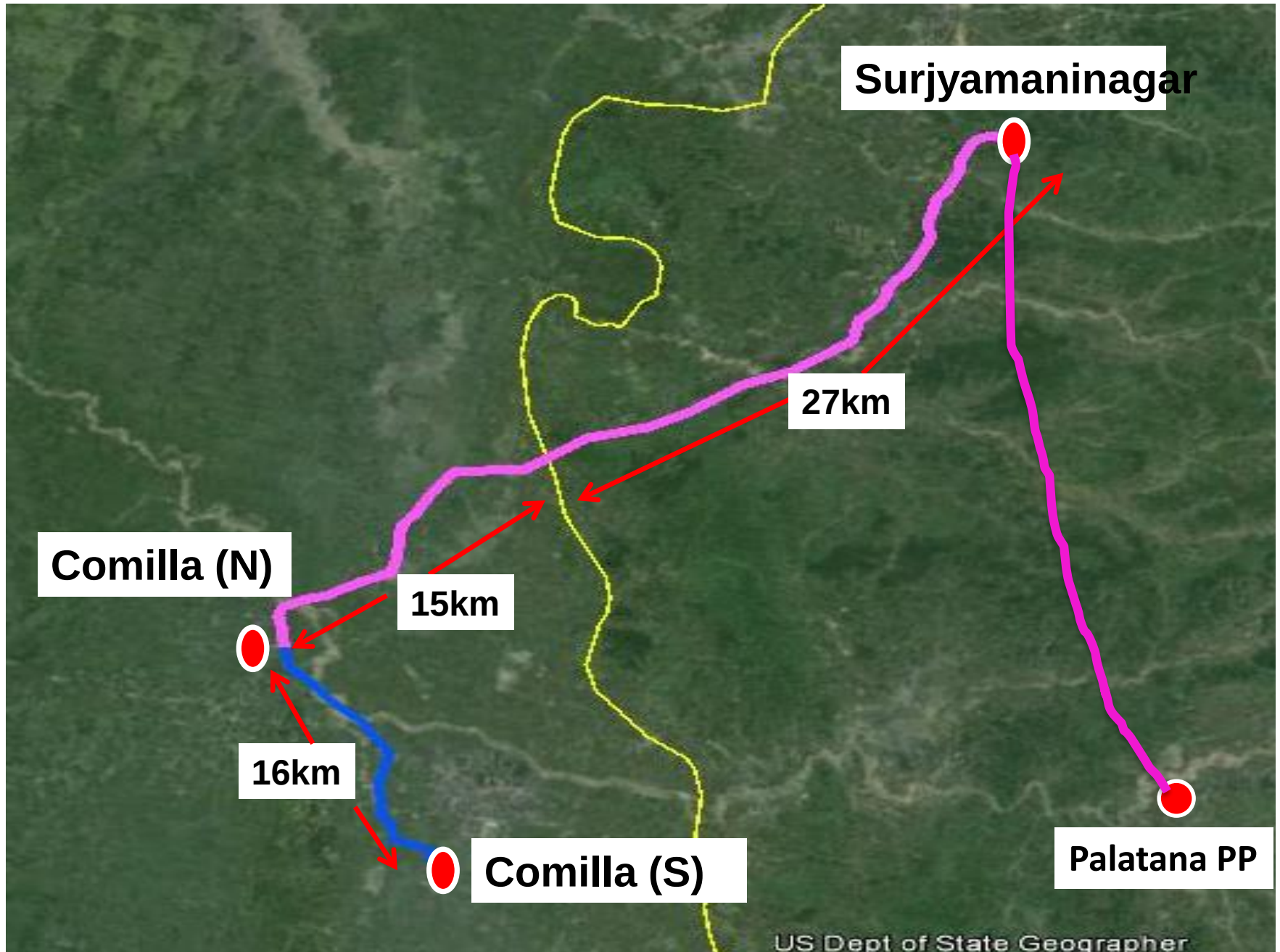
# Eastern Interconnection Project

As per the decision of seventh JWG/JSC meeting on power sector co-operation between Bangladesh and India a Joint Technical Committee (JTC) was formed to examine and recommend the system requirement/strengthening on the both sides of the border to import 100 MW power in radial mode from Palatana to Eastern Side of Bangladesh.

## **Main Objectives:**

- ❑ To import 100 MW power in radial mode from Palatana to Eastern Side of Bangladesh.
- ❑ To strengthening power exchange capacity on the both sides of the border.

# Patalana-Comilla Redial Connection



# Challenges of PGCB

- Lack of capacity charge provision in wheeling charge methodology.
- Fund arrangement to implement future development projects.
- Competency development to adopt advance technologies.

**Thank You**