

Session-V

Context Setting Presentation on

“Electricity Trade in BBIN region- Long Term Trading Volumes and Prospects”

30th August 2018

New Delhi

Presentation By:

Dr. Probal Ghosh
(Head Modeling Group)

Mr. Vinay Saini
(Senior Research Analyst)



Objective and Approach

- Assessing benefits of technically feasible and economically viable electricity trade

- **Bilateral Electricity Trade between**
 - India- Nepal
 - **India- Bangladesh**

- Multilateral Electricity Trade within
 - **BBIN Region**

Approach

Interlinked Models

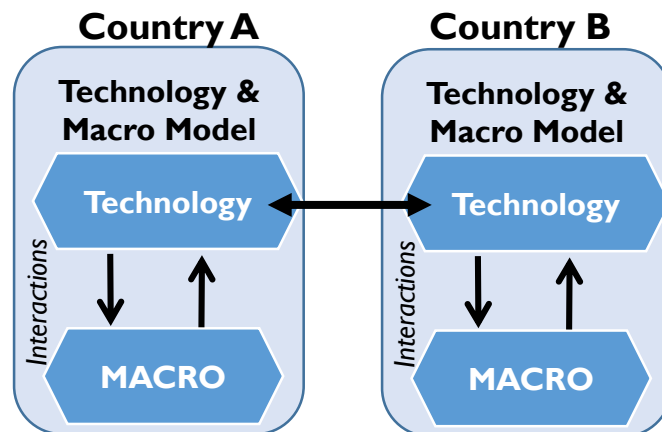
- Technology Models
(*Power System Model*)

- Hourly trade over 30 Years for given electricity demand
- Choices of different generation technologies

- Macroeconomic Model**

- Generation Technologies affect**
Investment → **GDP** → **Consumption**
Electricity Demand

Iteration between both the models were undertaken for technological and macro economical consistent results



Approach & Methodology- Bilateral Studies

Economic Benefits from Nepal- India Electricity Trade (Jan 2017)

- Scenarios- BASE, **APT**, DCA

Scenarios Considered

- **BASE Scenario** assumes no increase in interconnections across countries (2015 level)
- **Accelerated Power Trade (APT) Scenario** allows full potential of electricity trade.
- **Delayed Capacity Addition (DCA) Scenario** considers a delay in hydropower project implementation by five years in Nepal

Economic Benefits from Bangladesh-India Electricity Trade (Jan 2018)

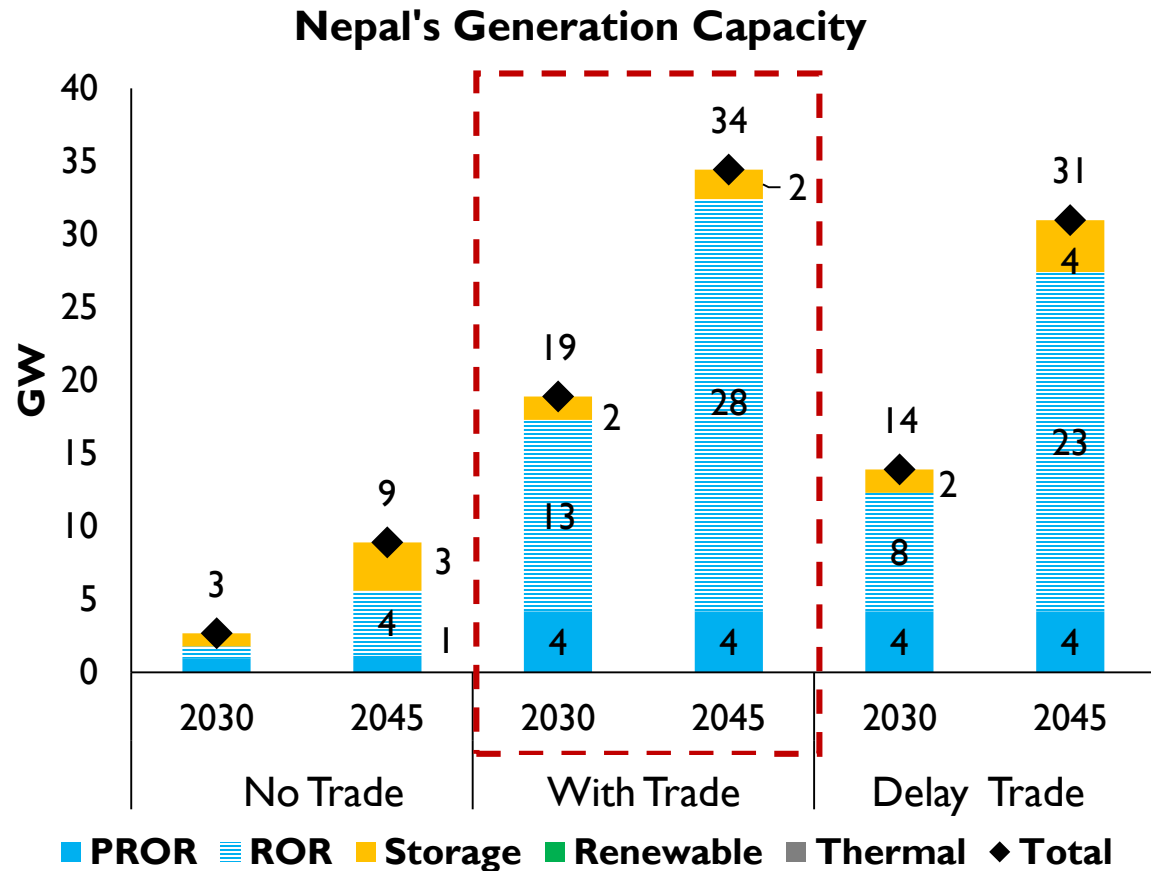
- Scenarios- REF, PSMP, **TRADE30**

Scenarios Considered

- **REF Scenario** electricity trade is restricted to 1.1 GW (upper limit)
- **Power System Master Plan (PSMP) Scenario** allows electricity mix coal-35%, Gas- 35%, Imports- 16%, Nuclear-12% by 2040 for Bangladesh
- **TRADE 30 Scenario** assumes only 30% imports bound for Bangladesh

Bilateral Study: Benefits of India-Nepal Trade to Nepal (1/2)

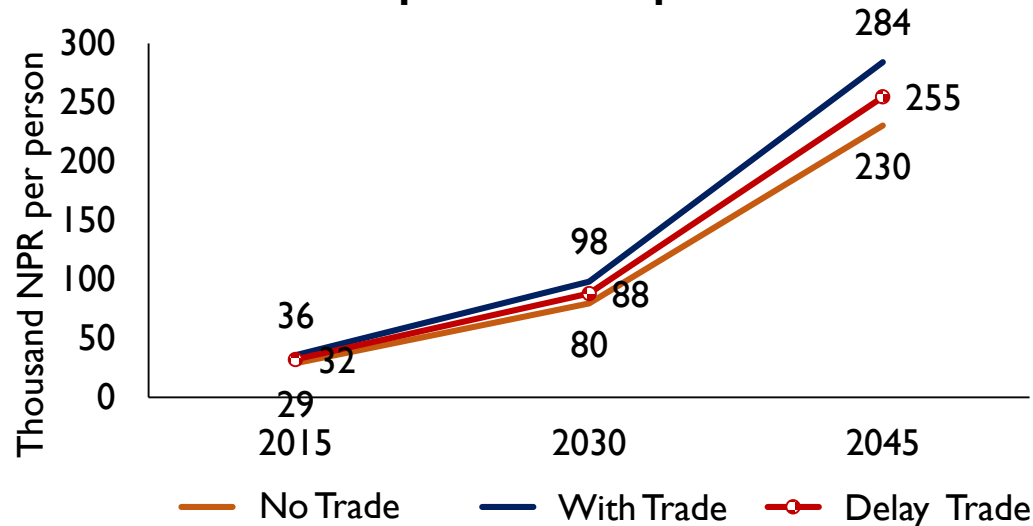
- Power cuts restricts growth. Initially Nepal imports and later exports
- Trade market develops Nepal's hydro potential sooner
- By 2045, with trade, 34.4 GW is exploited out of its total hydro potential of 43 GW compared to only 9 GW with out trade
- Even a delay of 5 years in Trade reduces the hydro potential exploited to 31 GW by 2045
- Without trade, Nepal needs to rely more on storage plants to meet the seasonal variability
- With trade, the bulk of the capacities is from ROR plants which are cheaper and have less environmental consequences



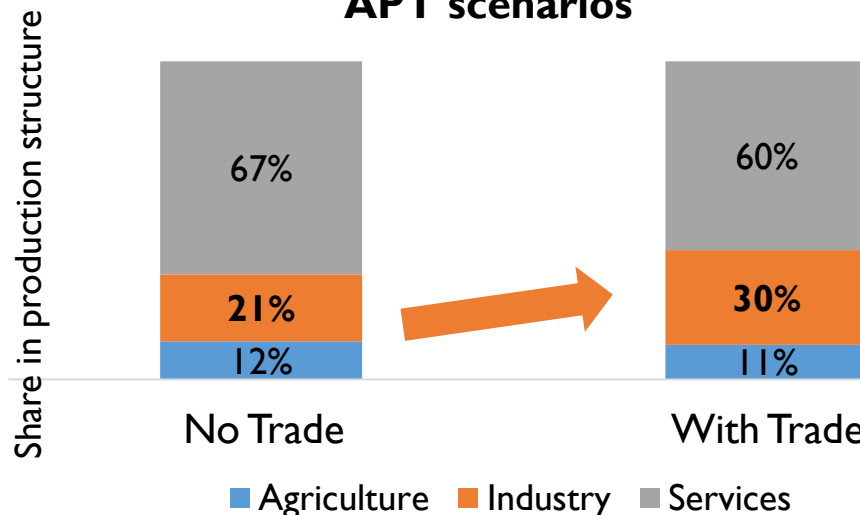
Bilateral Study: Benefits of India-Nepal Trade to Nepal (2/2)

- With trade Nepal increases its GDP by 40% and per capita household consumption by 23% by 2045
- Even a 5 year delay in trade will result in GDP gain only by 14% and per capita consumption by 13%
- In addition, with trade share of industry sector in GDP increases to 30% compared to 21% in BASE
- In absolute terms, with 40 per cent higher GDP, industrial GDP will be twice as large as without trade

Per capita Consumption



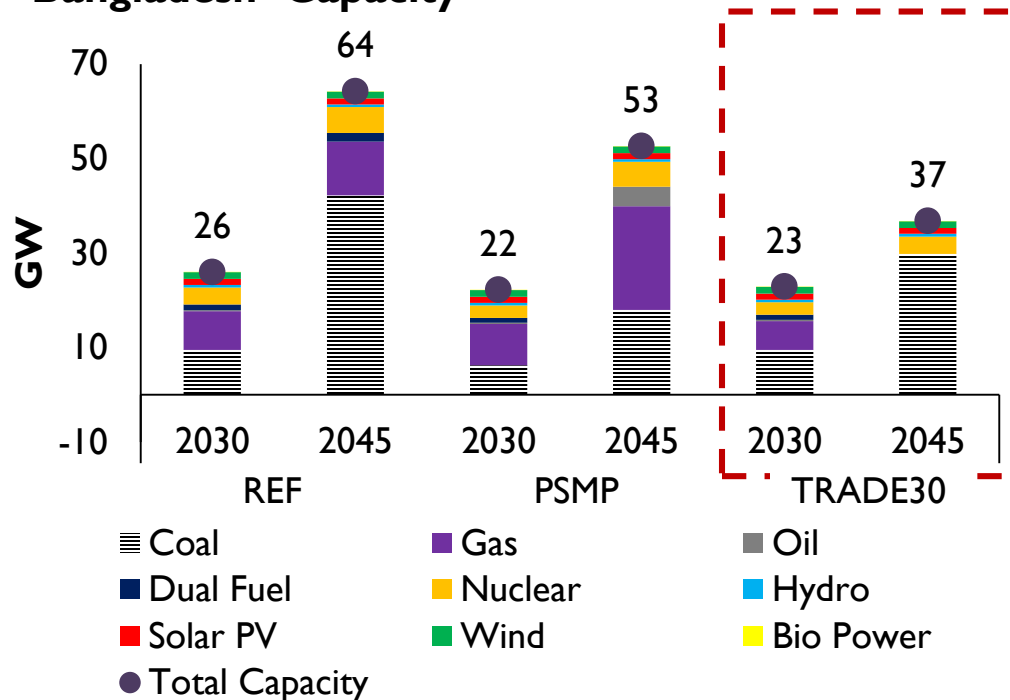
Structure of Nepal's Economy in BASE and APT scenarios



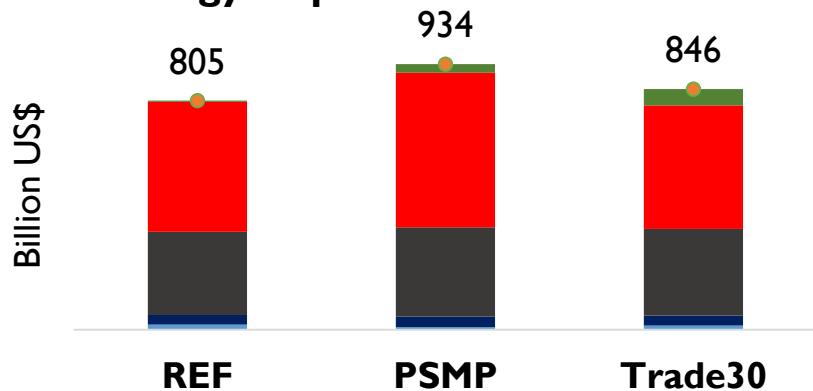
Benefits of Bangladesh-India Trade to Bangladesh (I/2)

- Bangladesh Short of energy resources
- PSMP restricts electricity imports to 15% and fixes share of fuels in generation
- TRADE30 limits imports to 30% and keeps generation mix free
- Electricity import from India is the cheapest option including generation from coal
- Capacity requirements reduce by 17% in PSMP and 42% in TRADE30 in 2045

Bangladesh- Capacity



Energy Import bill in 2045



- TRADE30 lowers power system cost and lower fuel bill to the economy
- PSMP increases the reliance on Gas imports which has a more volatile market
- How much reliance on foreign exchange is worth diversification of energy supply

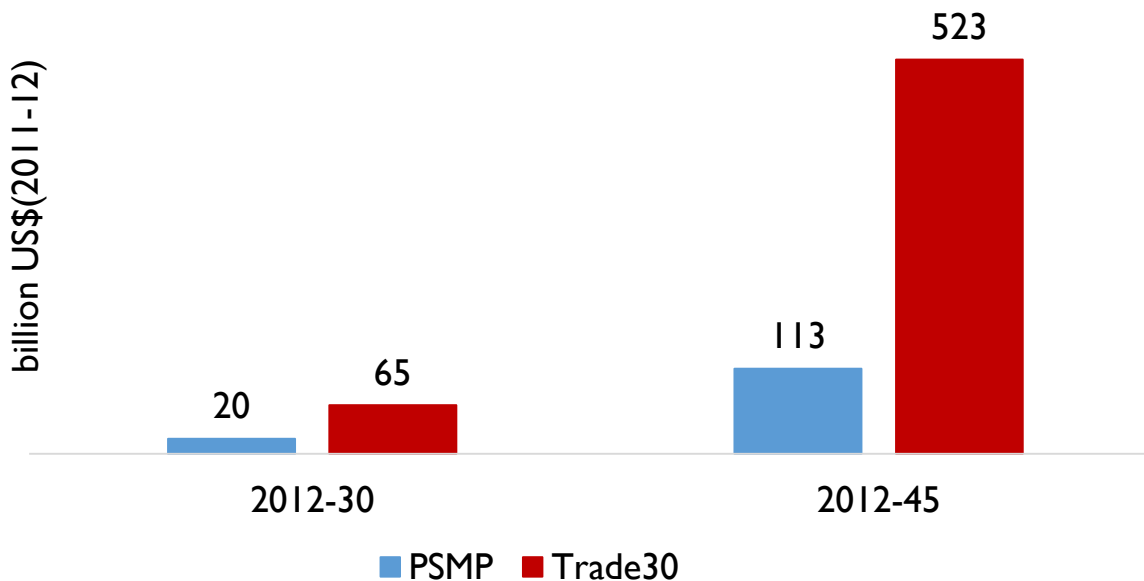
■ Coal
■ Petroleum Products
■ Electricity

■ Crude Oil
■ Gas
● Energy

Benefits of Bangladesh-India Trade to Bangladesh (2/2)

- Electricity imports requires less investment in capacity and infrastructure
- **PSMP results in higher GDP and lower household consumption whereas TRADE 30 results in lower GDP and higher household consumption**
- Aggregate household consumption and household consumption of electricity increase in TRADE30 is 5 times more than in PSMP

Cumulated Consumption increase compared to REF



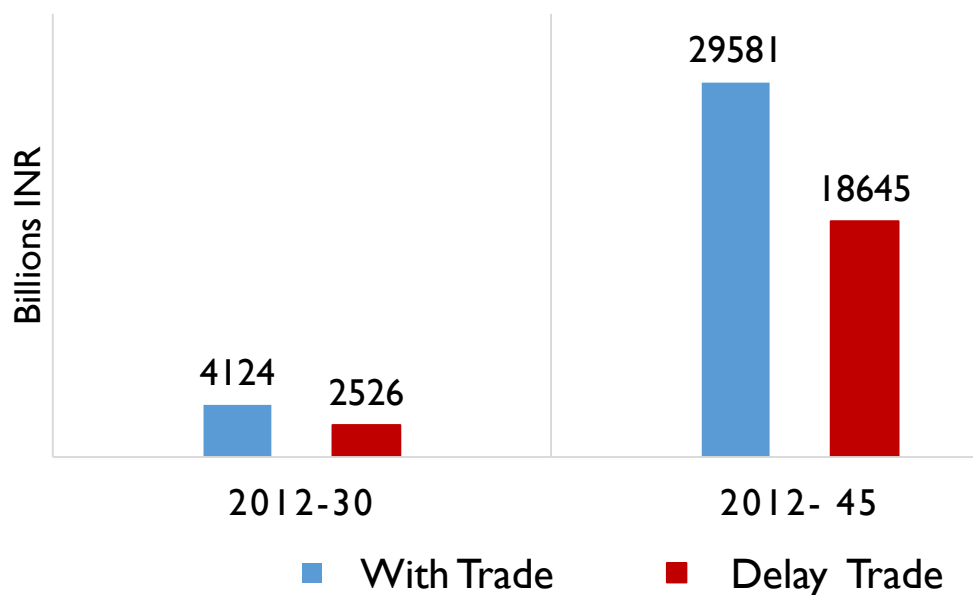
- **Cumulated emissions over 2012-45 reduces by 9 % in the PSMP scenario and by 6.4 % in the TRADE-30 scenario**

Bilateral Study: Benefits of Trade to India (1/2)

IND- NEP Bilateral Study

- With imports from Nepal, generation, capacity creation and investment in the power sector are reduced
- **Cumulated Investment cost over 2012-45 in Power sector decreases by 4%**
- Imports reduces fossil fuel consumption in general
- **CO2 emissions reduce by 572 Million tonnes in 2045**
- Electricity supply cost is lower as imported electricity is cheaper than domestically produced one
- **Trade with Nepal increases India's cumulated consumption by 1.43% in 2045**
- Investment requirement in India's economy decreases by 8.6% due to lower capacity requirement
- **Cumulated GDP decreases by 2.6% in 2045 due to future capacity requirement savings and shift of resources from power sector to non power sectors and household consumption**

Cumulated Consumption Gains



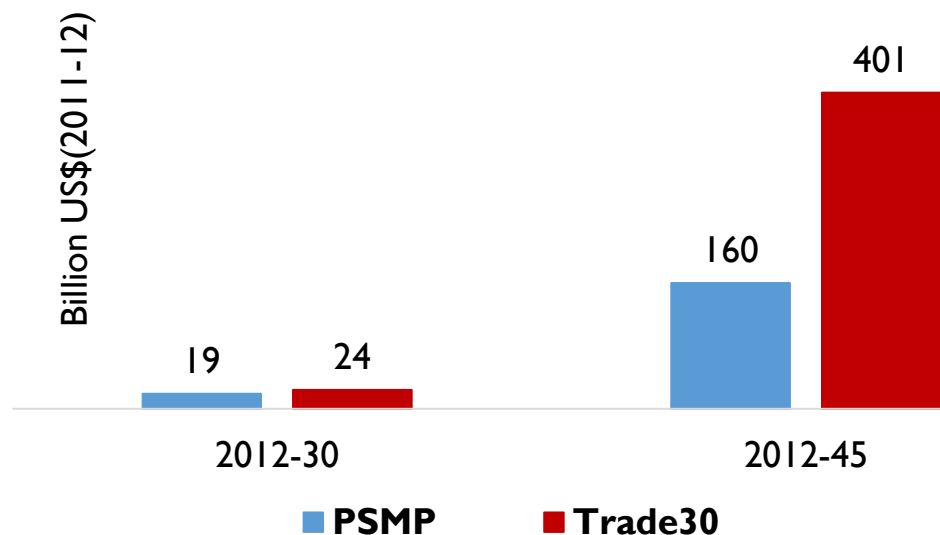
Bilateral Study: Benefits of Trade to India (2/2)

IND- BNG Bilateral Study

- No capacity increase required up to 2025 and only small 1- 1.5 % additional coal-based capacity by 2030 & 2045
- **Increases coal consumption and emissions in India**
- The additional investment requirement is less than 1 percent higher than in the No trade scenario
- **Earnings from exports increase India's GDP by 0.28% (636 billion US\$) in TRADE30 and 0.12% (266 billion US\$) in PSMP scenario**
- Investments increase in India's energy sector and the overall economy due to trade

- **Cumulated consumption gain is 0.42% in TRADE30 and 0.17% in PSMP scenario**

Cumulated Consumption Gain

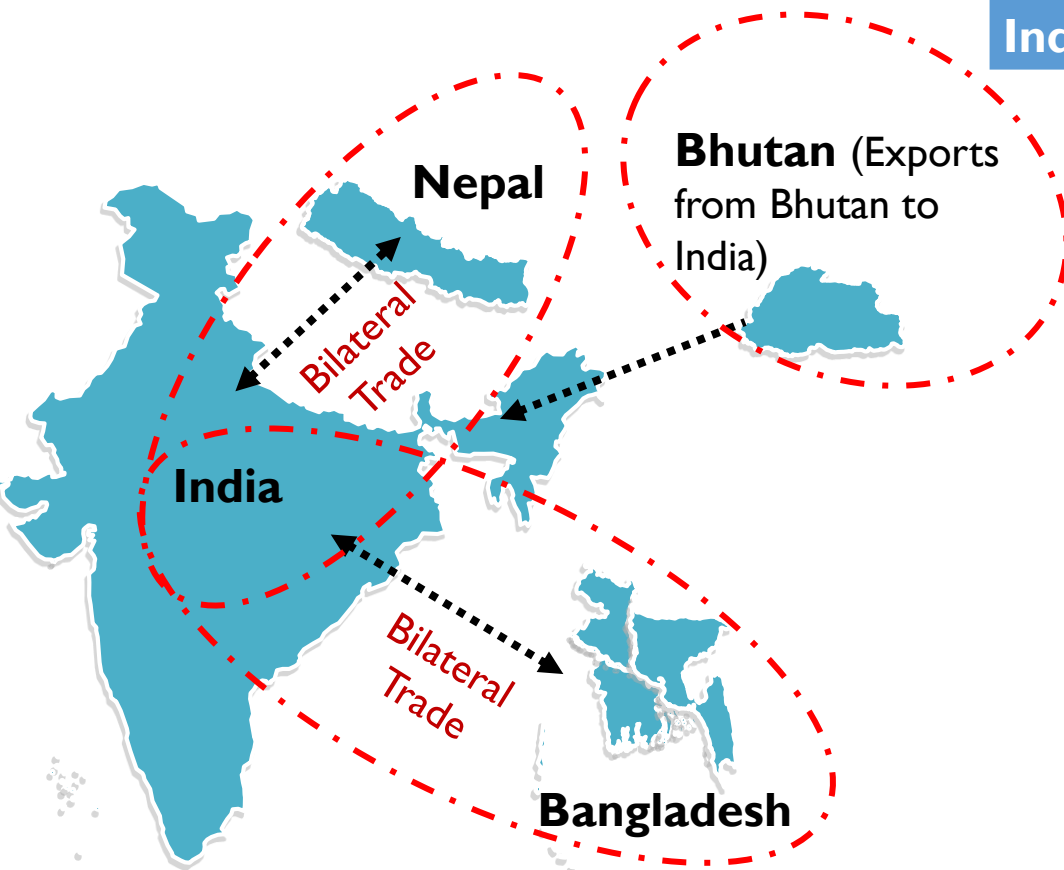


Benefits to India although not highly visible because of the size of the India's power system and its economy, but are comparable in absolute terms to benefits to Nepal and Bangladesh.

Approach & Methodology- Multilateral Study

Multilateral Trade Scenario (Aug 2018)

Country	Trade Scenario Parameters from Bilateral Study
Nepal	IND-NEP Study
Bangladesh	IND-BNG Study
India	IND-BNG Study



Multilateral Study- Key findings for the Region

Opportunities through Multilateral Trade

- Regional trade reaches to 197 BU by 2030 and 359 BU by 2045 from 12 BU (in 2017)
- Both Bhutan and Nepal (hydropower exporter) gain access to Bangladesh's and India's power market (net importers)
- Regional capacity reduces by 2 to 5% i.e. 12 to 36 GW compared to REF
- Power sector CO₂ emissions reduce by 4% (70 MT) in 2030 and by 3% (109 MT) in 2045 due to lower fossil fuel consumption

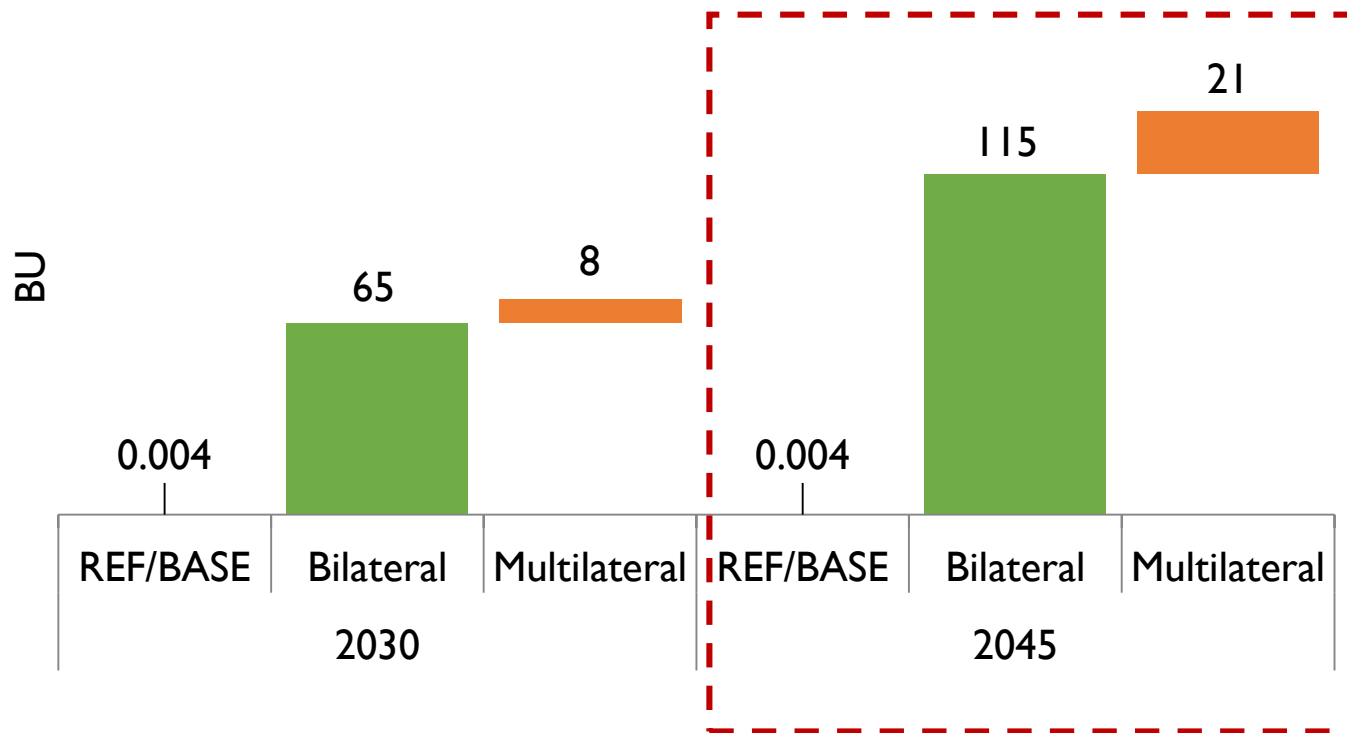
Multilateral Study- Key findings for Bangladesh

- With Multilateral Trade Bangladesh can diversify its power import sources such as Bhutan, India and Nepal

Multilateral Study- Key findings for Nepal

- Nepal's exports to India increases by 18% (21 BU) by 2045 compared to Bilateral
- Nepal's harness higher hydro potential of 37 GW compared to 34 GW in Bilateral and only 9 GW in REF/BASE

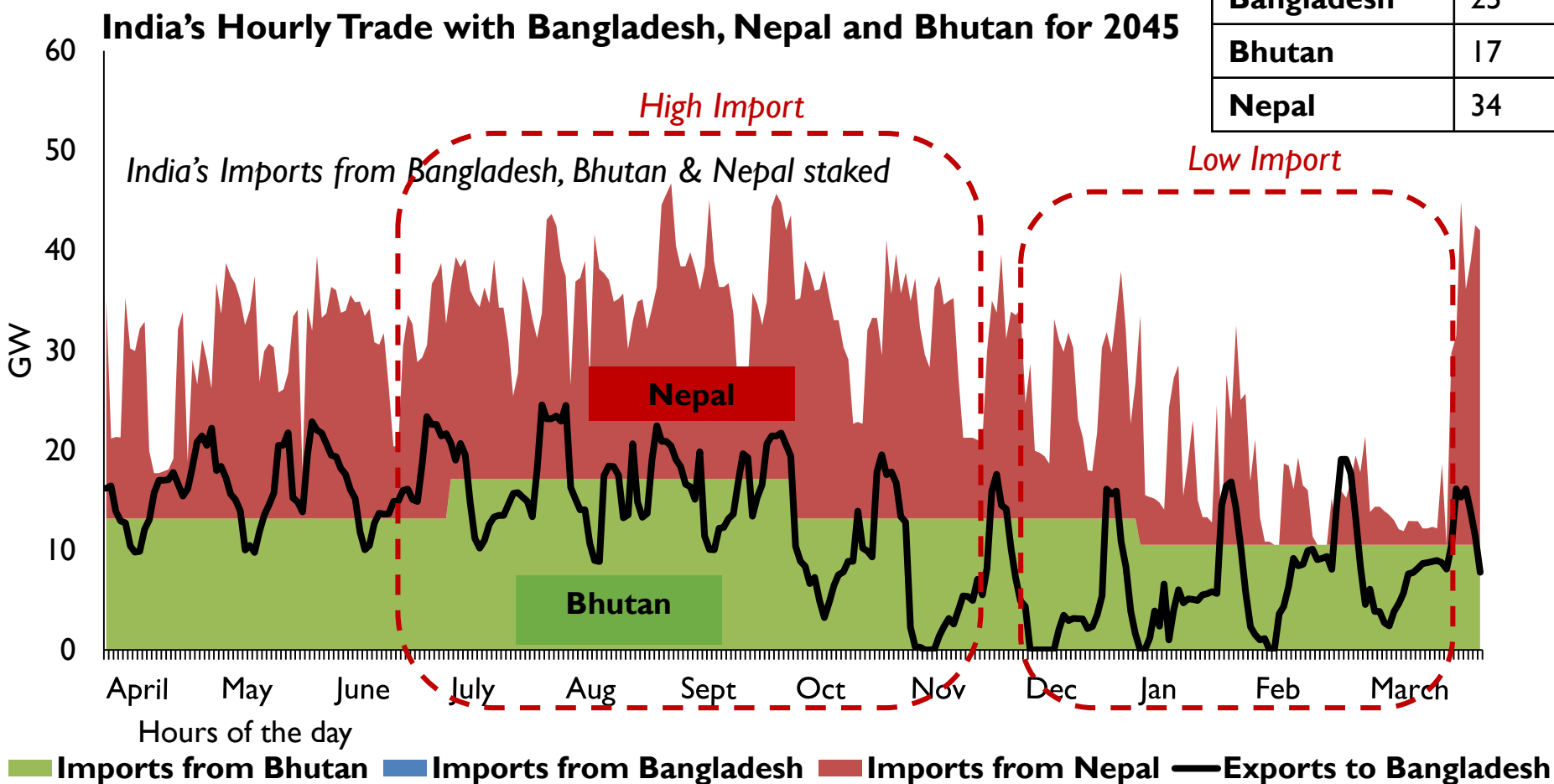
Nepal- Additional Electricity Exports



Multilateral Study- Key findings for India (1/2)

- India will be net importer of electricity and has potential to absorb electricity both from Bhutan and Nepal (even after exporting to Bangladesh)

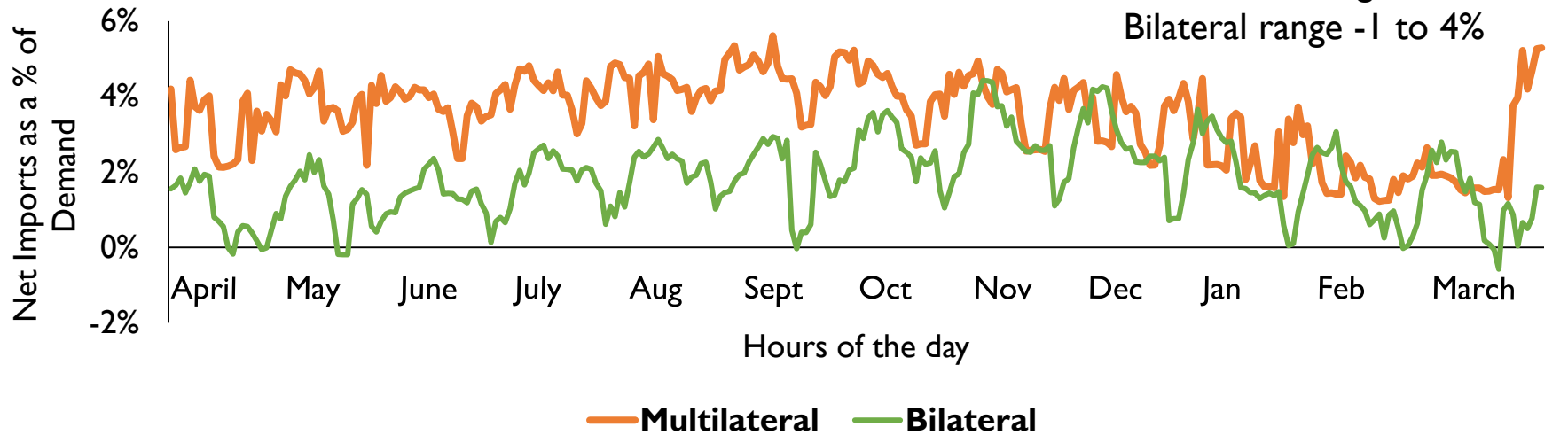
Maximum Hourly Electricity Trade (GW)	
Bangladesh	25
Bhutan	17
Nepal	34



Multilateral Study- Key findings for India (2/2)



- Net Imports for India are higher in the Multilateral trade compared to Bilateral trade

India's Net Import as a % of Demand -2045



- India can support Multilateral Trade without increasing its own generation
- India's power generation, capacity and capex requirements reduce in Multilateral Trade
- India's CO2 emission reduces due to hydro imports from Bhutan and Nepal and reduced fossil fuel consumption by power sector

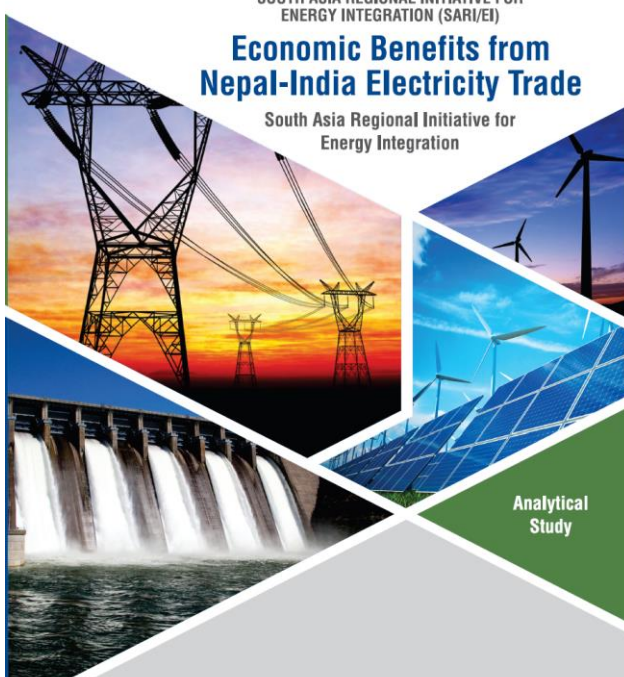
Our Publications on Long Term Trading Volumes and Prospects

 **SARI/EI**  Integrated Research and Action for Development


SOUTH ASIA REGIONAL INITIATIVE FOR ENERGY INTEGRATION (SARI/EI)



Economic Benefits from Nepal-India Electricity Trade

South Asia Regional Initiative for Energy Integration



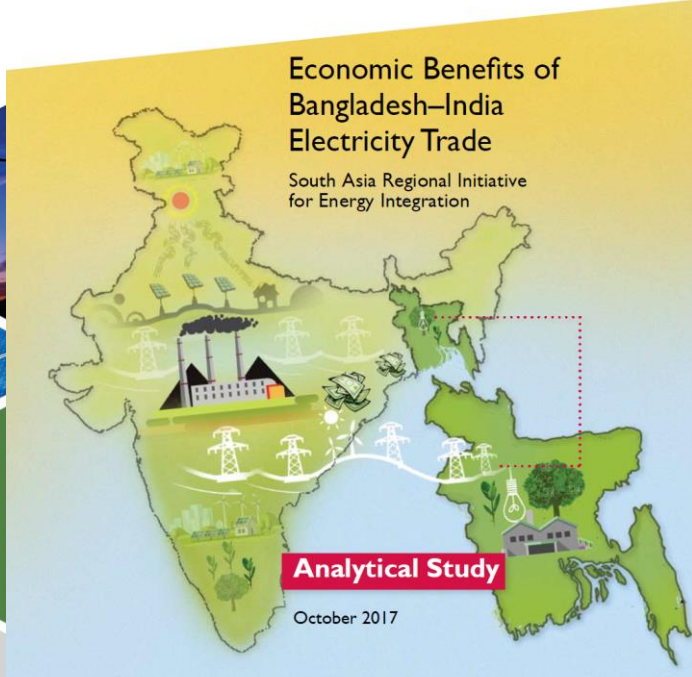
Analytical Study



 **SARI/EI**  Integrated Research and Action for Development


Economic Benefits of Bangladesh-India Electricity Trade



South Asia Regional Initiative for Energy Integration



Analytical Study

October 2017




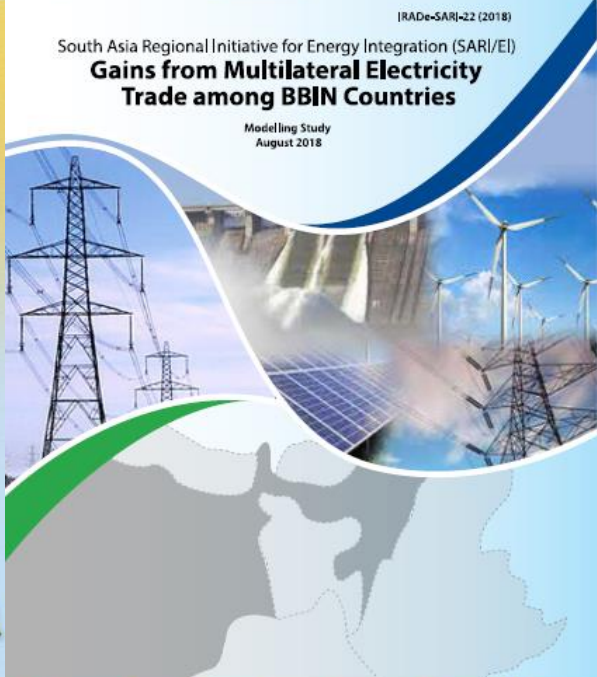
 **SARI/EI**  **15 YEARS** Integrated Research and Action for Development

[RADE-SARI]-22 (2018)

Gains from Multilateral Electricity Trade among BBIN Countries

South Asia Regional Initiative for Energy Integration (SARI/EI)

Modelling Study
August 2018



Thank You