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Integrated Research and Action for Development IRADe

Analytical Studies in Macro Economic Framework: What to expect from them and how to carry them out?

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

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Dr. Jyoti Parikh

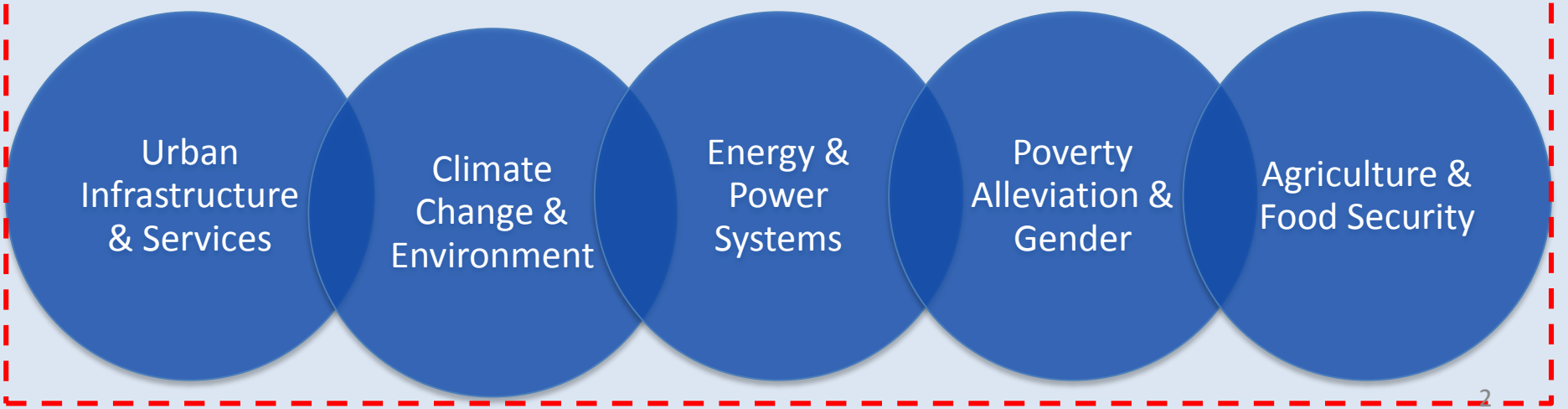
Executive Director

Integrated Research and Action for Development (IRADe)

About IRADe

- IRADe , a think tank set up in 2002
- Conducts multi disciplinary research and policy analysis
- Multi stakeholders problems and approaches involving government, non-governmental organizations, corporations, academia and financial institutions.
- Engages in national and international dialogue for consensus building

Key Thematic Areas



PSC meeting suggestions 2013-14

- Identification of analytical studies and exercises to support the task force activities and meet the program deliverables.

- IRADe will carry out economic studies to demonstrate benefits of trade during daily, monthly and annual demand supply curve for three years or more

- PSC members suggested media to get involved in creating awareness about the benefits of CBET

SAARC Framework Agreement for Energy Cooperation –

Article 7: Planning of Cross-Border Interconnections

Transmission planning agencies of the Government to plan the cross-border grid interconnections through bilateral/trilateral/mutual agreements between the concerned states based on the needs of the trade in the foreseeable future through studies and sharing technical information required for the same.

Article 11: System Operation and Settlement Mechanism

Member states shall enable the national grid operators to jointly develop coordinated procedures for the secure and reliable operation of the inter-connected grids and to prepare scheduling, dispatch, energy accounting and settlement procedures for cross border trade.

Article 14: Knowledge Sharing and Joint Research in Electricity Sector

Member states may enable and encourage knowledge sharing and joint research including exchange of experts and professionals related to, inter alia, power generation, transmission, distribution, energy efficiency, reduction of transmission and distribution losses, and development and grid integration of renewable energy sources.

Recent Updates

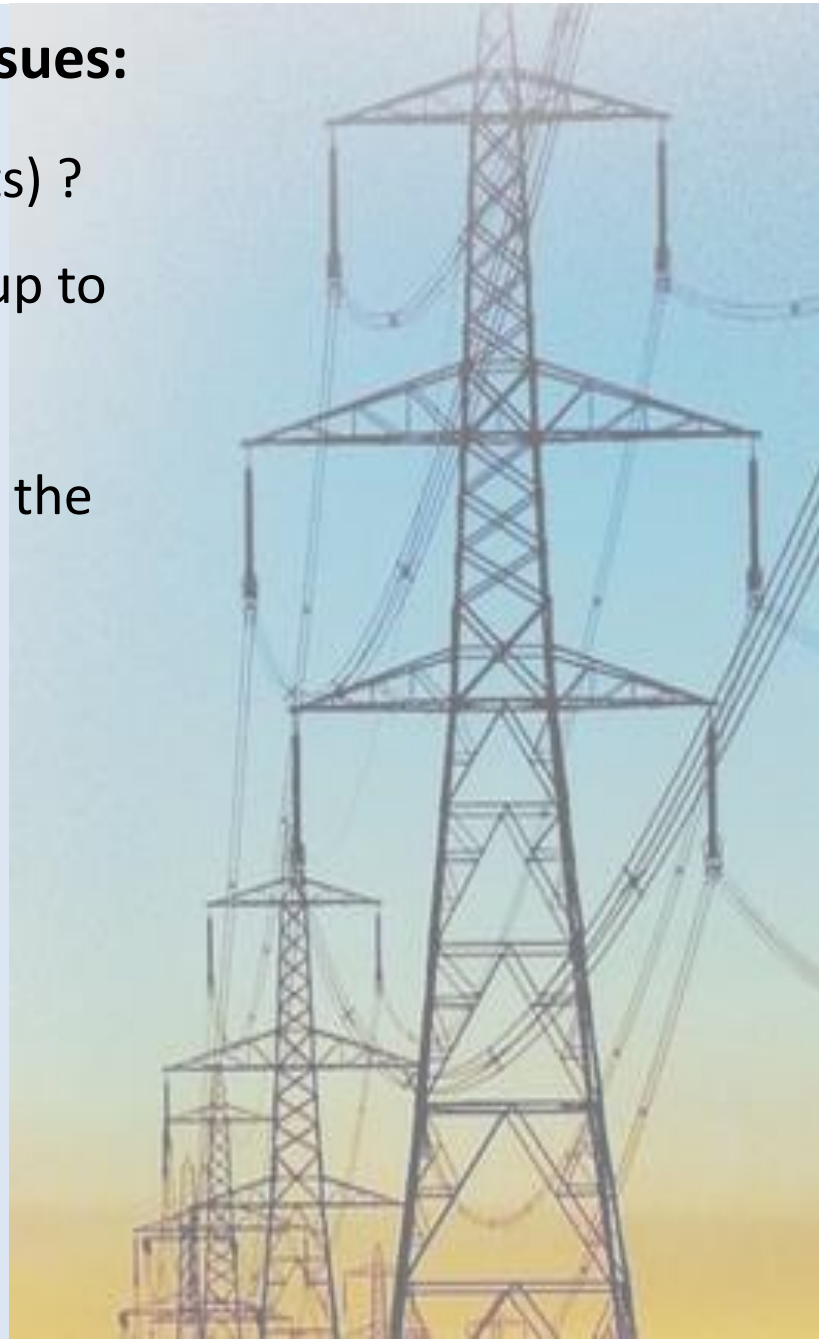
"SAARC Framework Agreement for Energy Cooperation (Electricity) **signed on 27th November 2014 at 18th SAARC Summit, Kathmandu"**

Still, a lot more to be done!

- The Agreement is an **umbrella agreement**, therefore huge work needs to be done at country level
- Efforts needed to bring all the stakeholders together to:
  - ❑ Inform **Civil Society of gains**
  - ❑ ***Easy and faster execution*** *of underlying policies and procedures*
- Channelizing CBET benefits realization by the stakeholders including Power, Finance, Energy and Trade ministries etc.
- Development of Country level and Regional Level Agreements

Power Sector Issues:

- How high CBET can go over time (in units) ?
- What factors are needed to build CBET up to maximum level ?
- What Economic Challenges will obstruct the way ?



Financial/ Economic Issues:

- How does CBET kick growth in other sectors such as domestic Power, transport, construction and services etc ?
- What preparations are required so that CBET support other sectors development ?
- How can CBET lead to diversified economies beyond power sector ?

Political and Diplomatic Challenges:

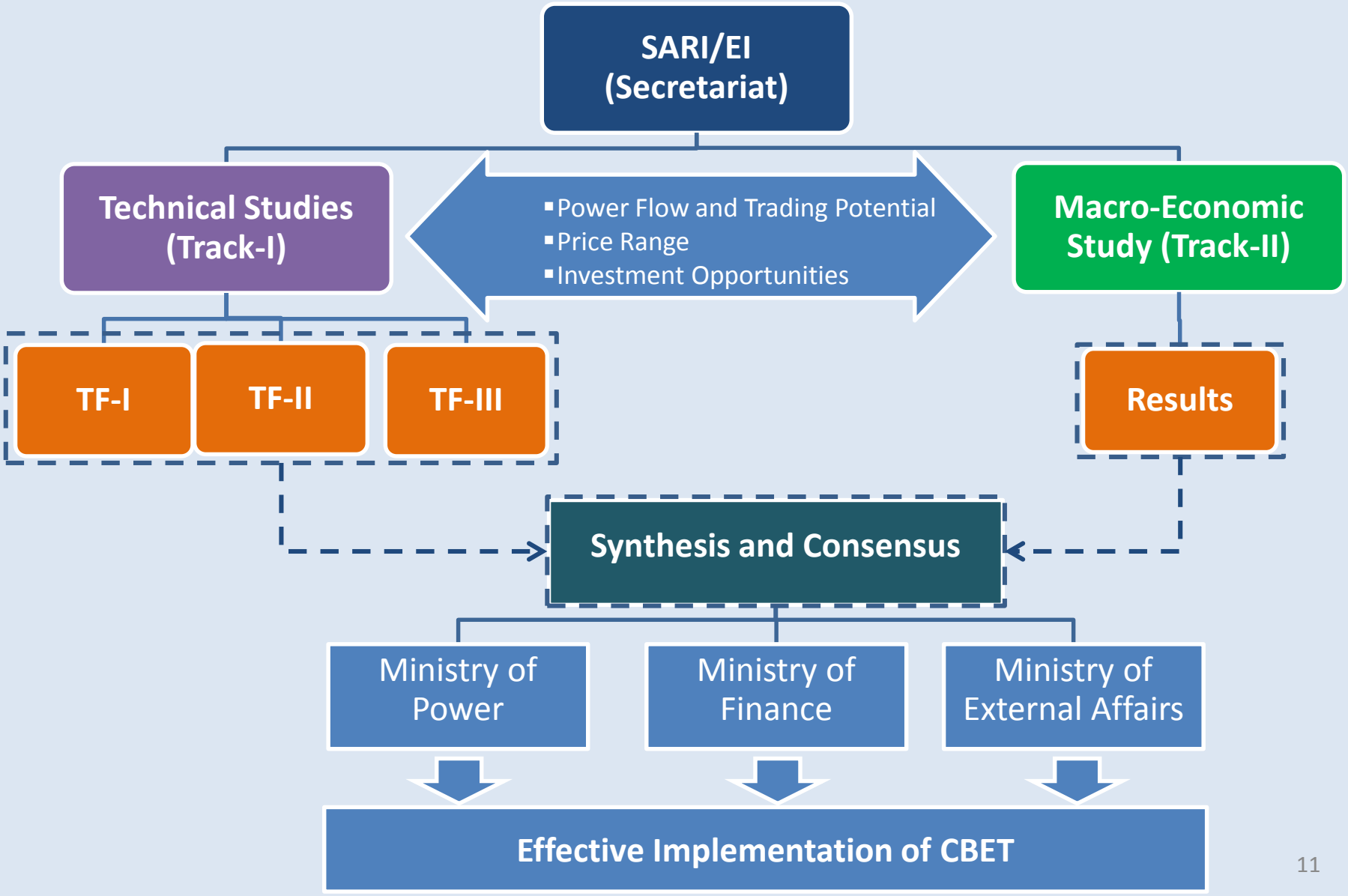
- How can we facilitate process and solve problems of CBET ?
- What are the interdependencies among the countries ?
- what role is expected by and for each country to get maximum benefits ?

Interdependency brings peace and dividends.

Purpose & Scope of the Analytical Studies in the SAARC Region

- To adopt an interdisciplinary research and a long term vision by considering the technological, economic, environmental and social aspects.
- To build the evidence for the decision makers for consensus building between countries and within countries through informed dialogues and negotiations to support creation and implementation of the CBET.
- Cover a wide range of **demand growth, renewable development, interconnection scenarios and delayed scenarios to properly assess the scenarios of economic impact of CBET**.
- **Provide a basis to discuss with the beneficiaries from CBET both in terms of power received (i.e., importing countries) and export revenue generated**.

Synthesis of Track I & II Studies



A Glimpse to Our Work Done So Far

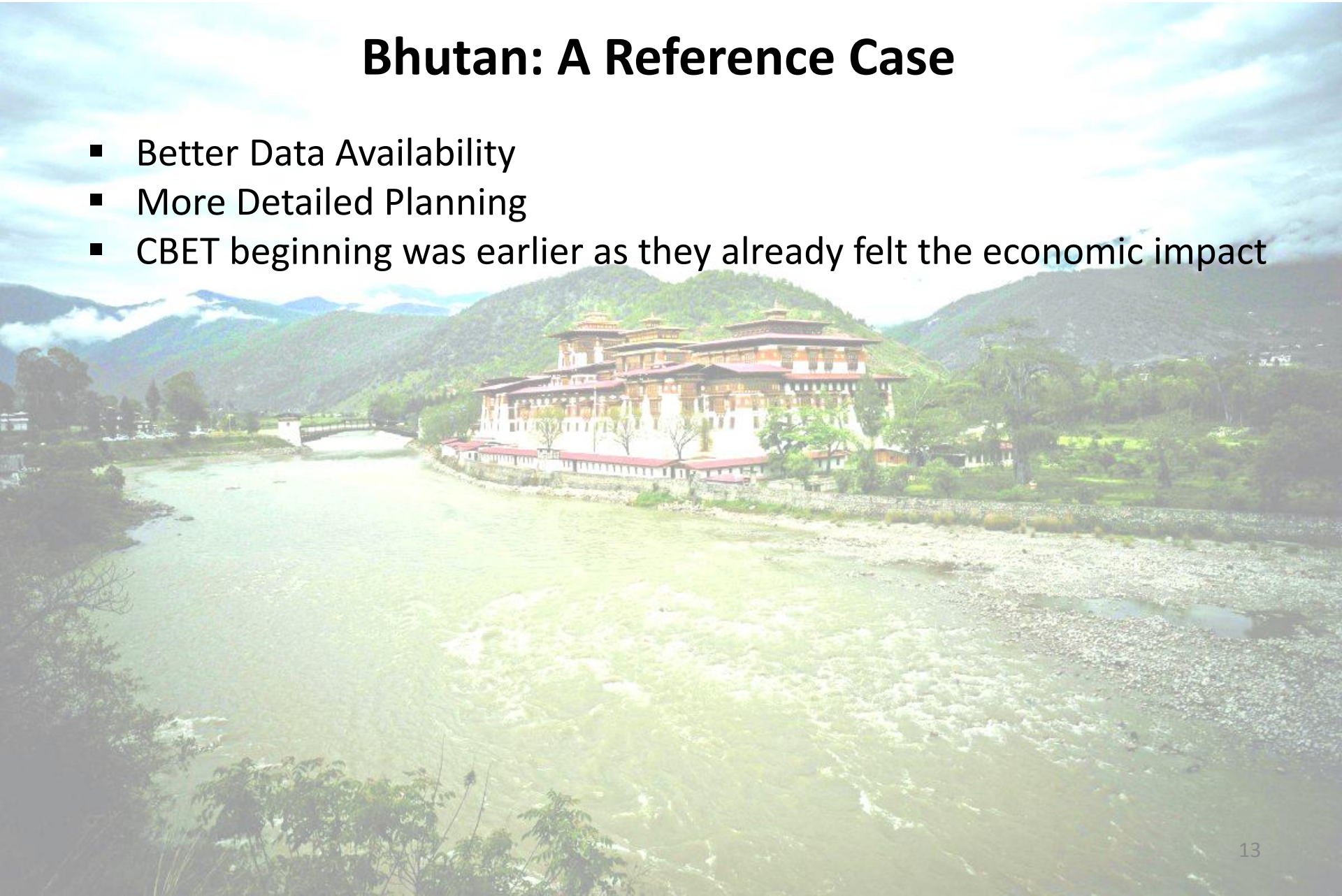
- Preliminary assessment of Bhutan and Nepal **electricity demand-supply up to 2050**
- Assessment of e**lectricity surplus** available with Bhutan and Nepal
- Assessment of economic **Gains** to Nepal and Bhutan from **power exports**
- Assessment of **Loss** due to **delay in implementation of CBET**
- **Revision of IRADe's India Activity Model** to incorporate power import and export options
- Assessment of **Gains to India** from CBET
- Scenarios and their results from preliminary assessment on Bhutan and Nepal were presented at ***SARI/EI Investor workshop held on 24 and 25 September 2014***

Important Note:

- *Results shared in forthcoming slides are only for illustration*
- *Results are at preliminary stage of assessment and will be modified later*
- *Limitation in data availability in various segments has restricted the study outcomes*

Bhutan: A Reference Case

- Better Data Availability
- More Detailed Planning
- CBET beginning was earlier as they already felt the economic impact



Electricity Demand Supply Situation- Bhutan

Hydro Potential:

- Techno economic viable potential = **23,500 MW**

Current Installation:

- Hydro Generation Capacity = **1,488 MW**

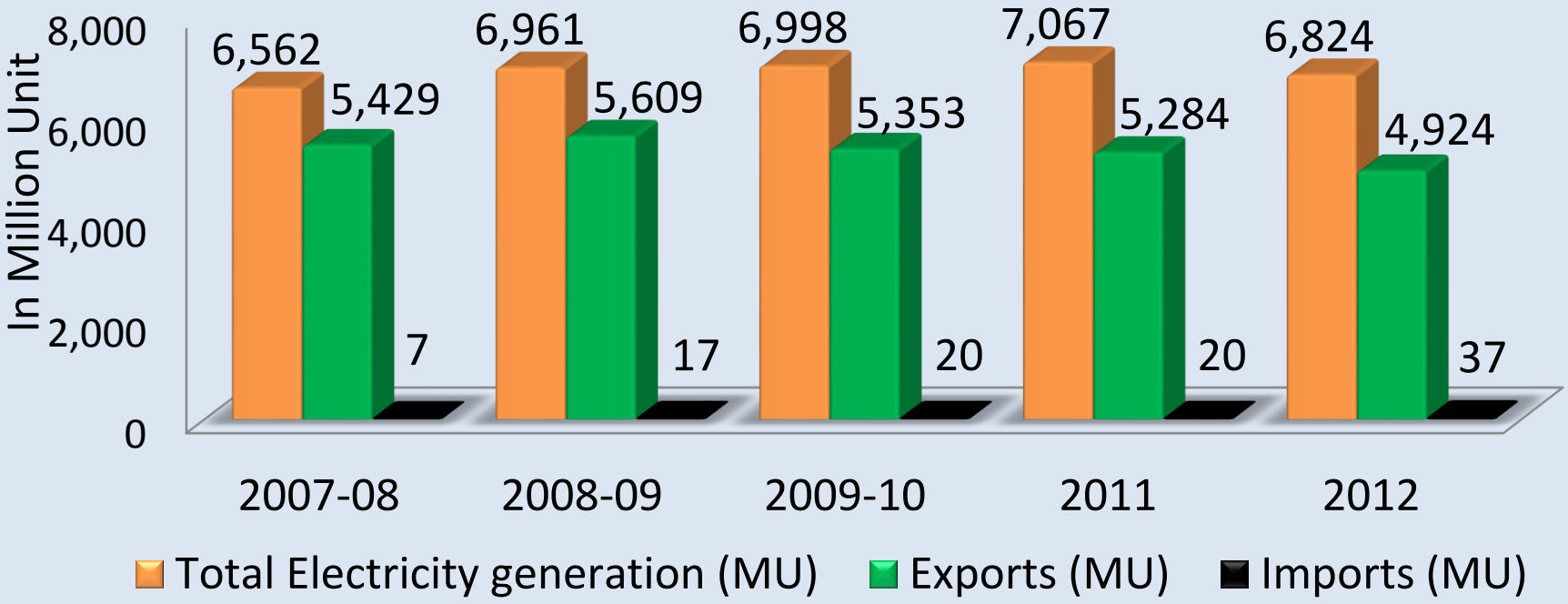
	2005-06	2012-13
Peak Demand	128 MW	314 MW
Electricity Generation	2,648 MU	7,550 MU
Domestic Consumption*	738 MU	2,105 MU
Imports from India	34 MU	112 MU
Exports to India	1,943 MU	5,557 MU
Domestic T&D losses	-	4.30%

** Including Losses*
Source: BPC Annual Report and Statistical Year Book of Bhutan

Electricity Exports- Bhutan

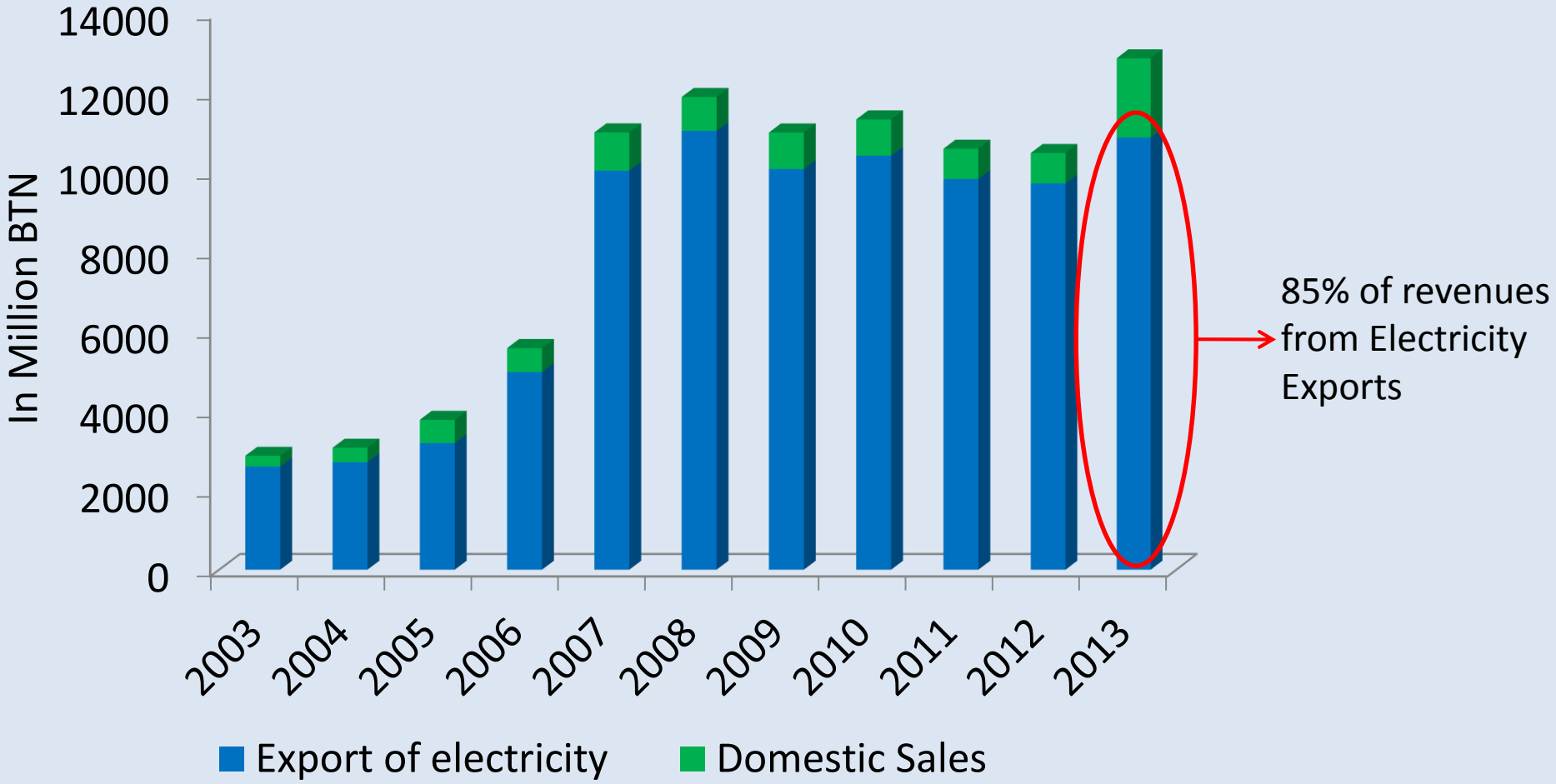
- Interconnection for sharing electricity between Bhutan and India started in 1968
- With the commissioning of Chukha HEP in 1986 Bhutan became net Exporter of electricity

Bhutan Electricity Generation, Export and Import



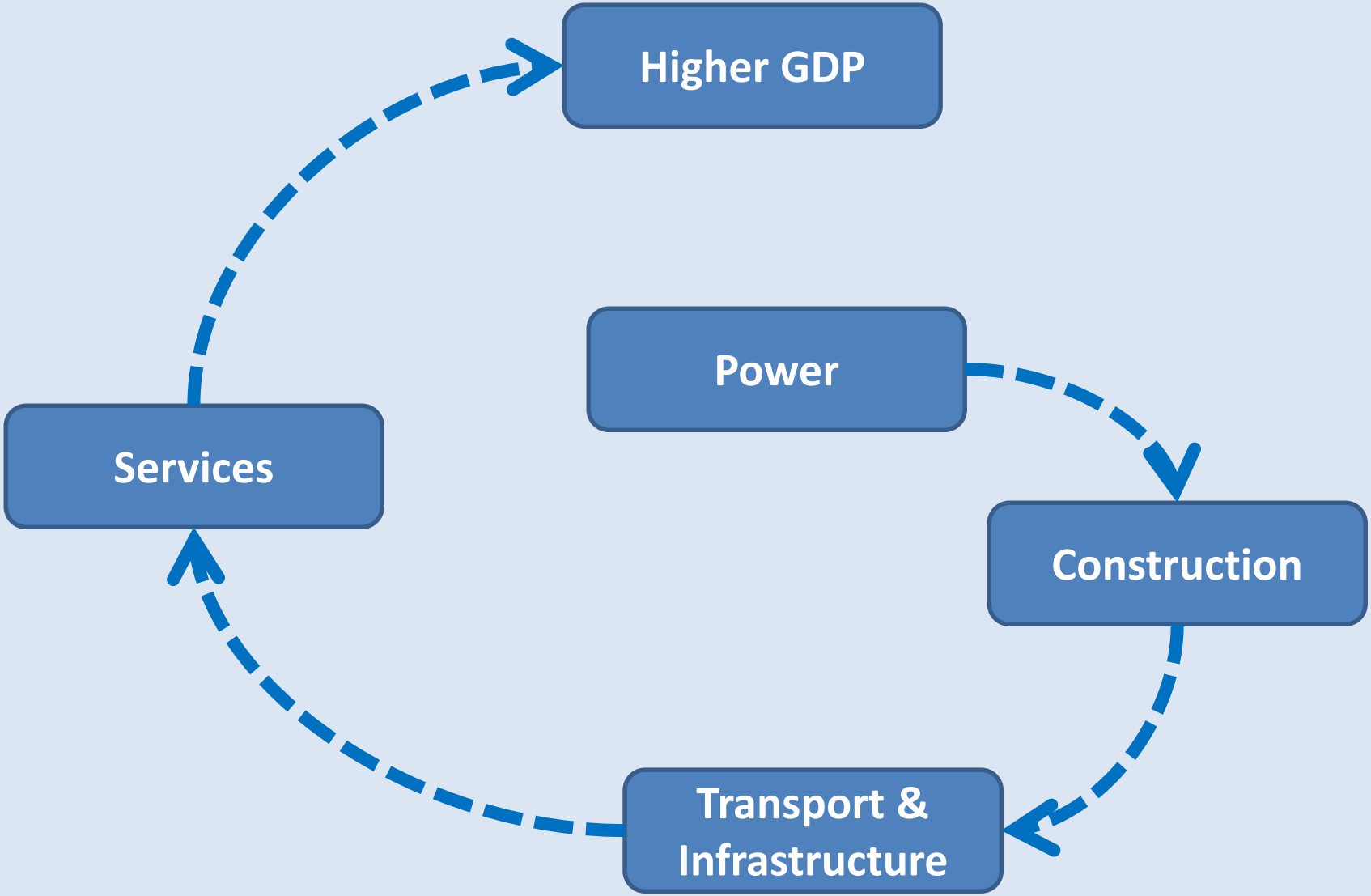
Source: Statistical Year Book of Bhutan 2013

Bhutan's Revenue from Electricity: Exports Vs Domestic Sales



Source: Bhutan Statistical Year Book 2012-13)

Impact of Power Sector Revenues



Electricity Surplus- Bhutan

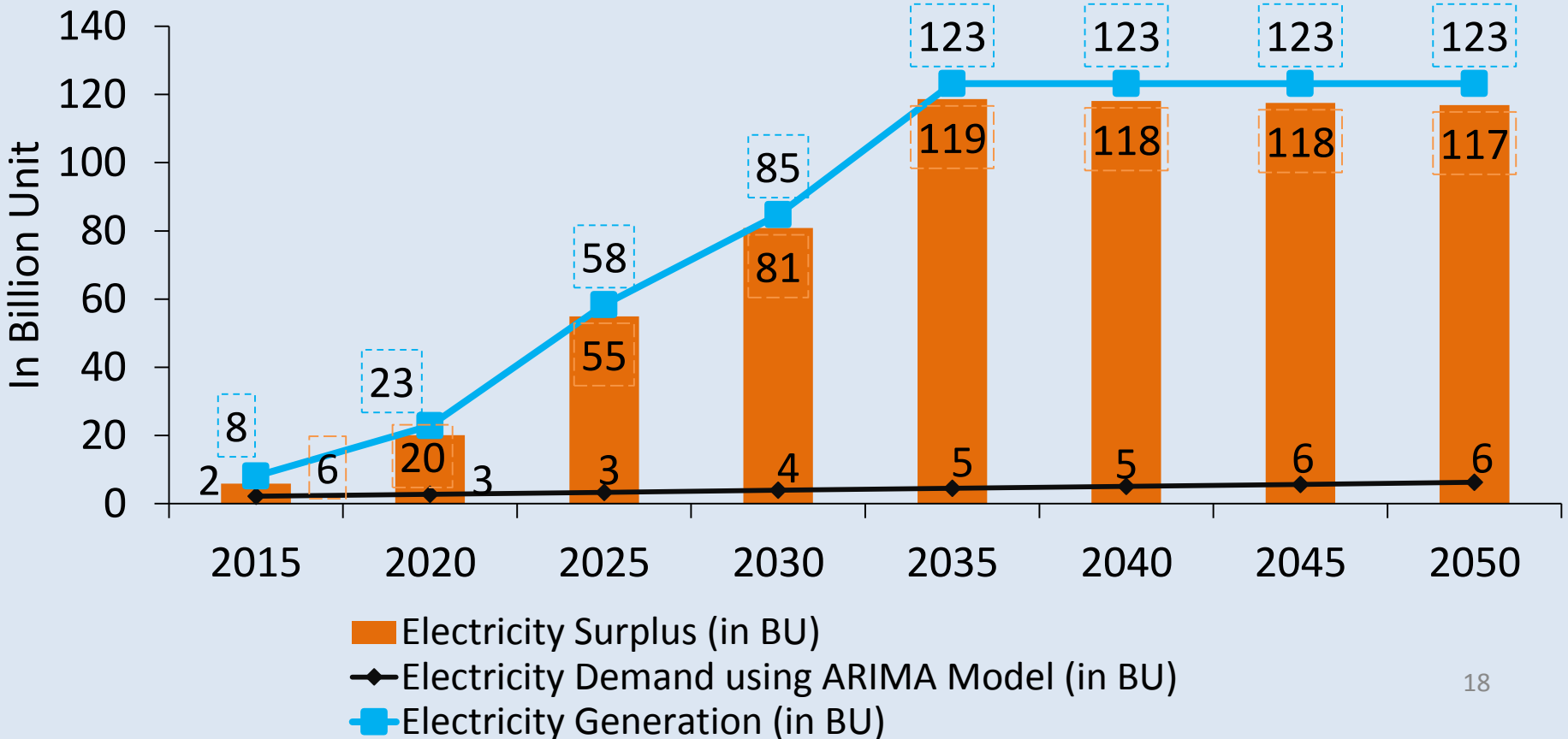
Key Assumption:

Supply Side

- **PLF** for Hydro power generation assumed to be **53%**
- NTGMP target of installed hydro capacity of **26,534 MW to be achieved by 2035**

Demand Side

- Demand Projection through ARIMA time series model

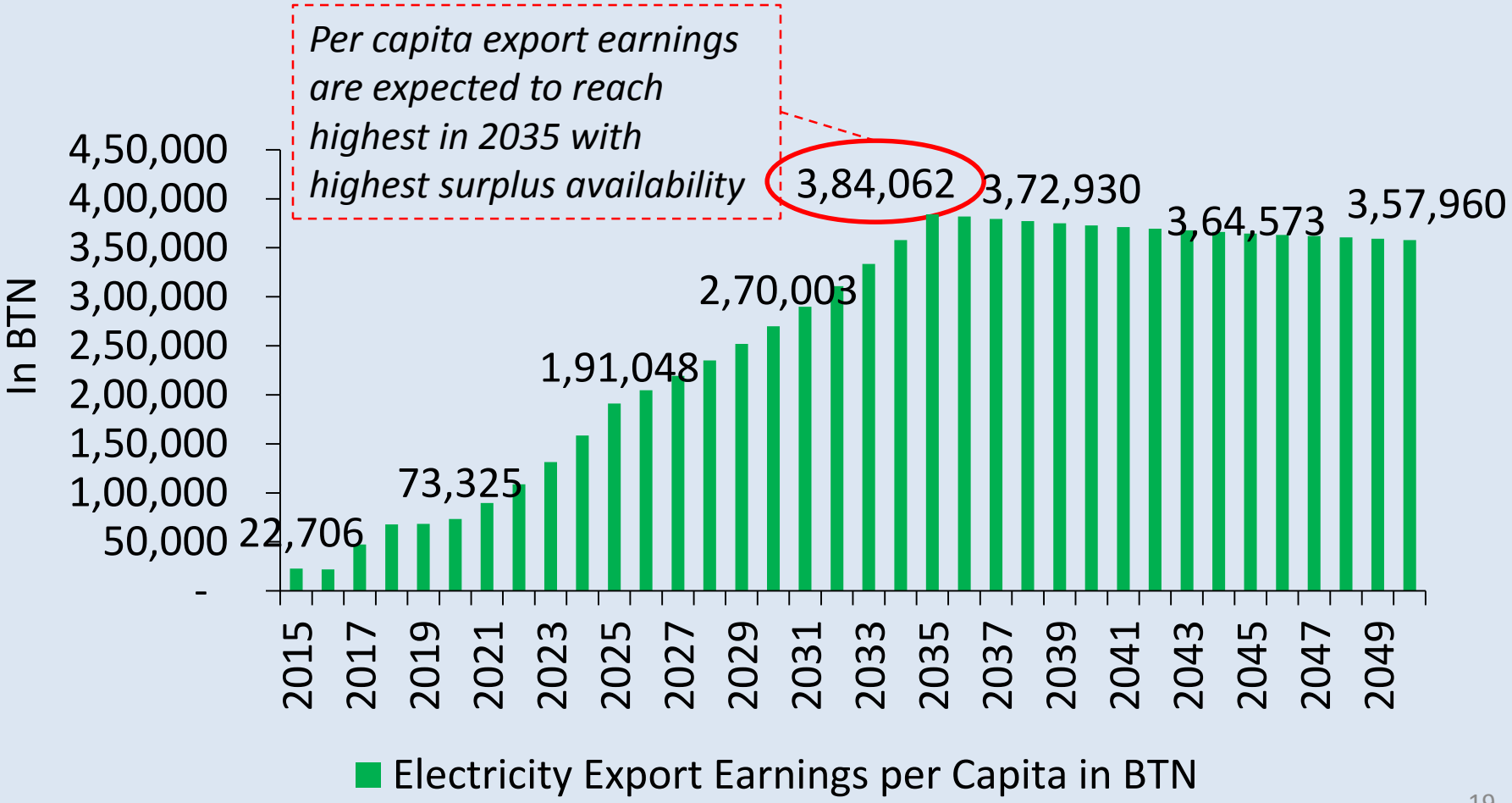


Expected Annual Electricity Export Earnings per Capita- Bhutan

Key Assumption:

1 INR = 1 BTN

- Export of electricity to India at BTN 3 per kWh.
- Population growth as per UN World Population Prospects

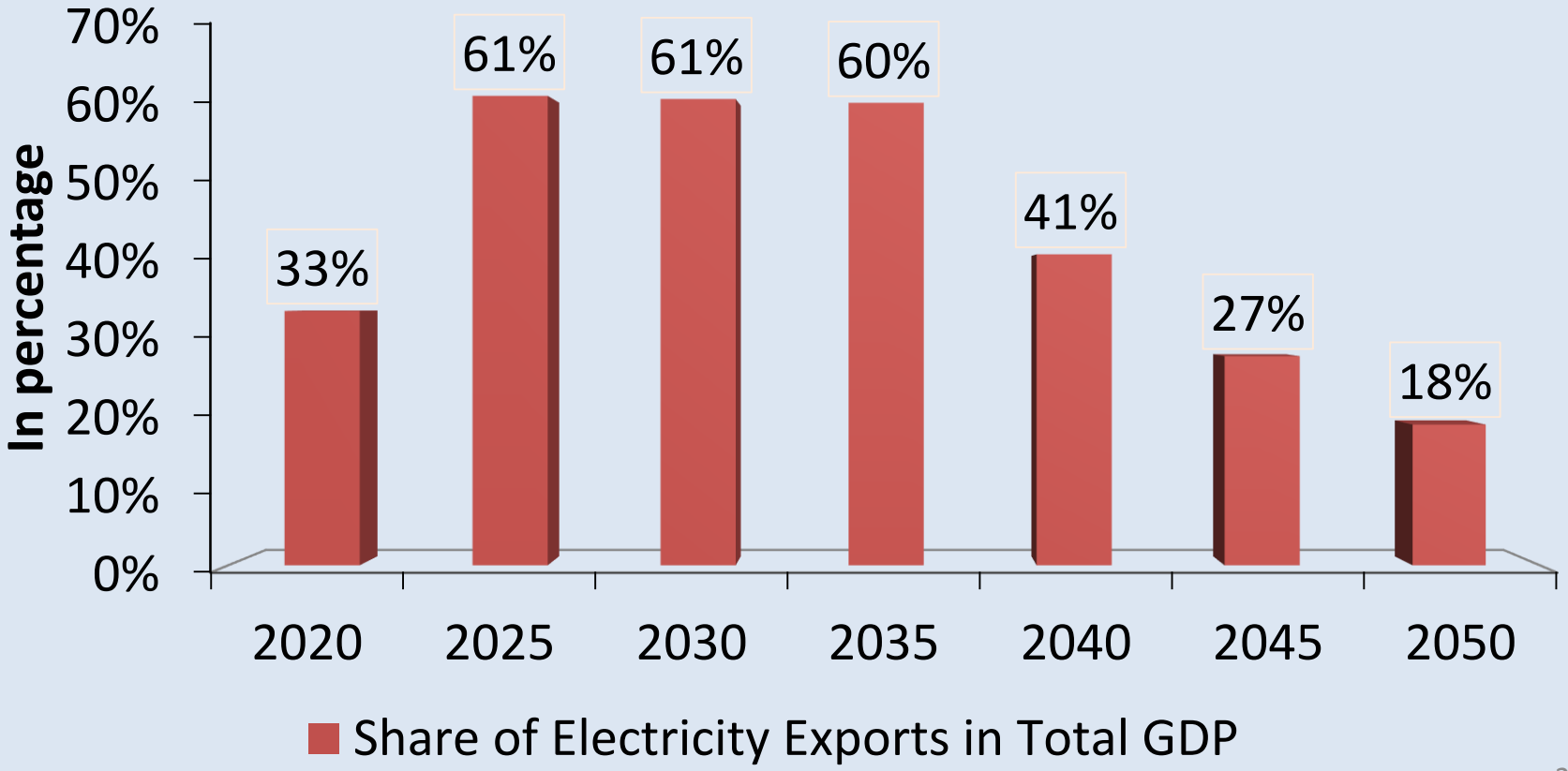


*Data values given for each five years between 2015 to 2050.

Bhutan's Electricity Export Revenue share in GDP (at 2005 price)

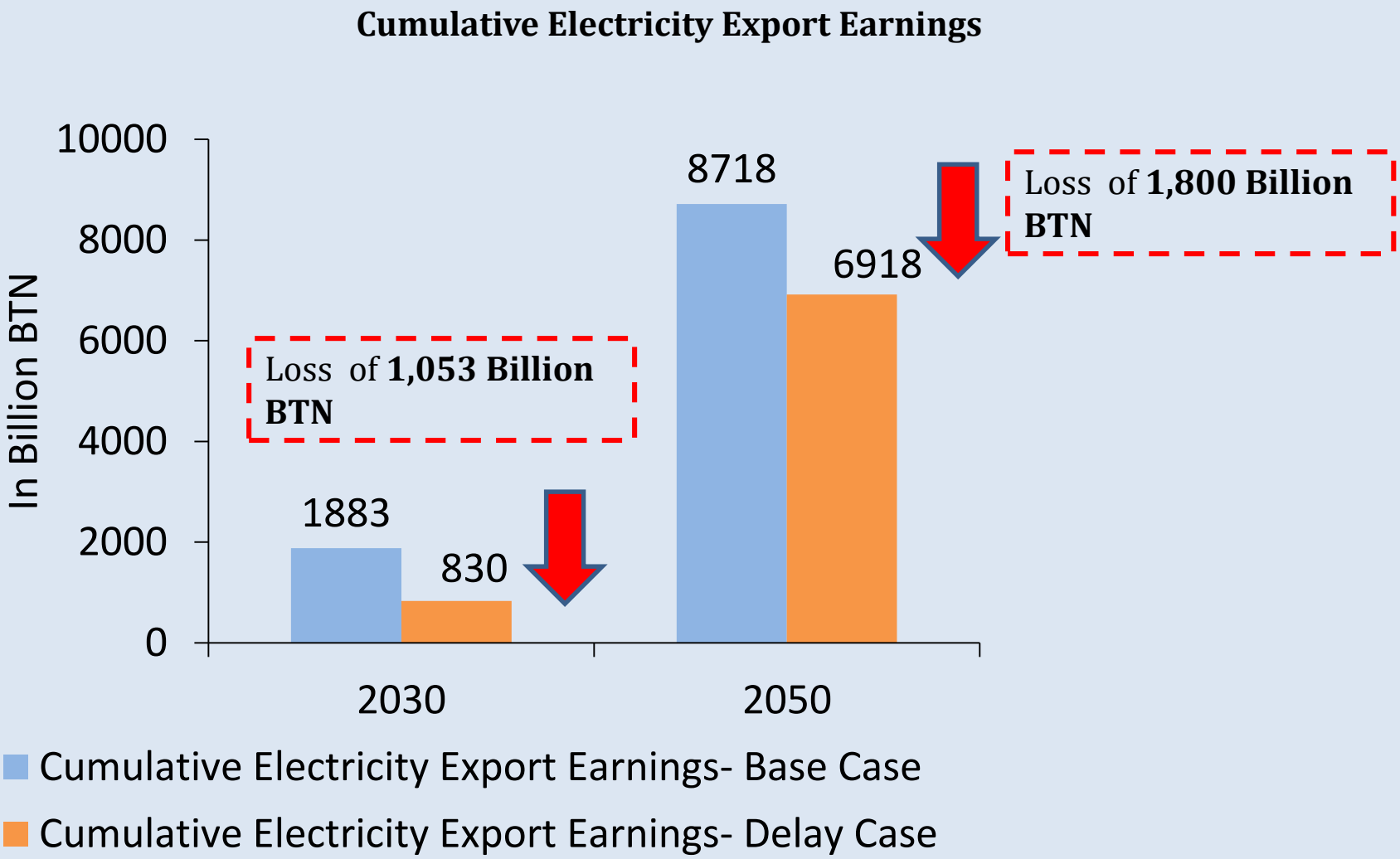
Key Assumption:

- Growth rate for Projecting GDP: 8.2% (as observed during 2003-12)
- Average electricity export price for year 2005: BTN 2 per kWh



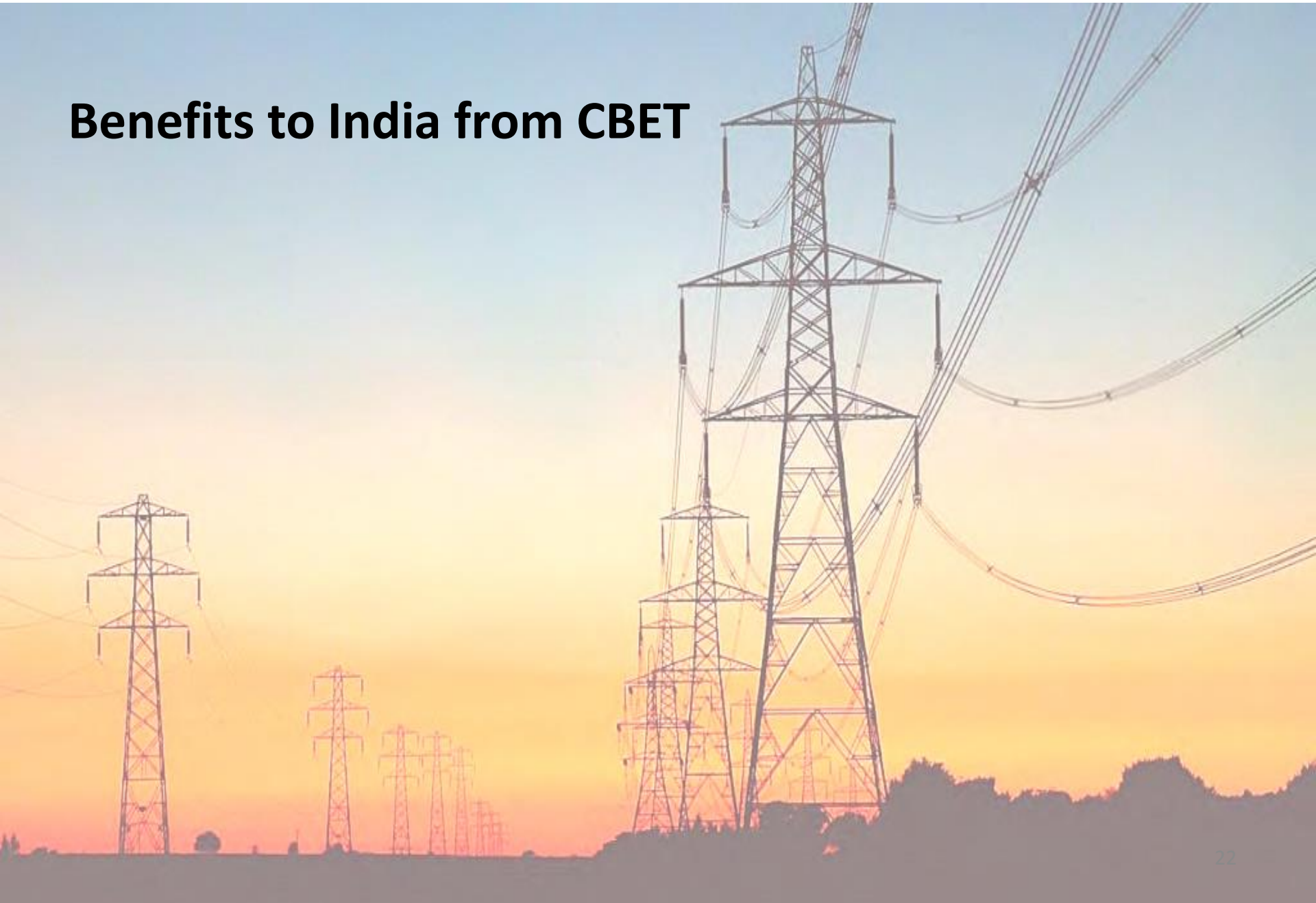
1 INR = 1 BTN

Impact of Delay in CBET- 5 Year Delay Scenario for Bhutan



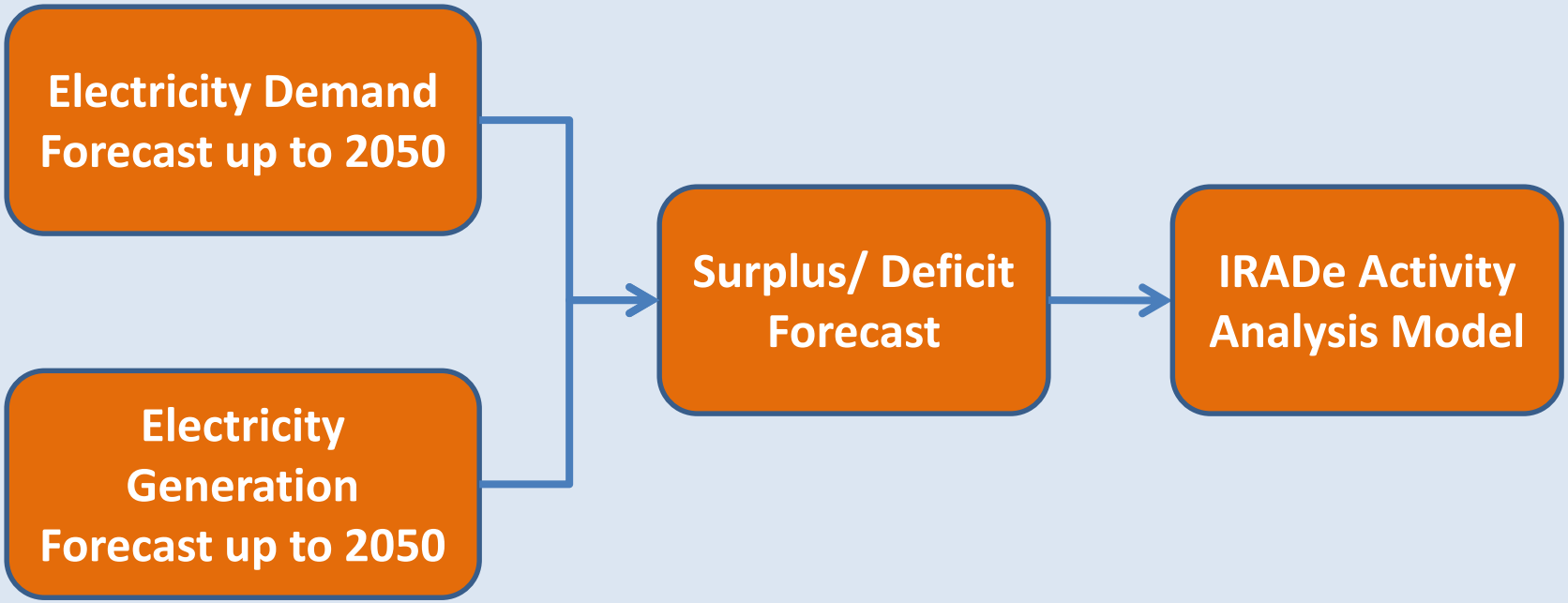
1 INR = 1 BTN

Benefits to India from CBET



IRADe's India Activity Model

IRADe's India Activity Model assesses economic benefit from Cross Border Electricity Trade between India and Bhutan, and India and Nepal.



- In the current work we only consider **one way input from Nepal & Bhutan to India** through higher importable surplus generation, thus this is still **a partial analysis**.

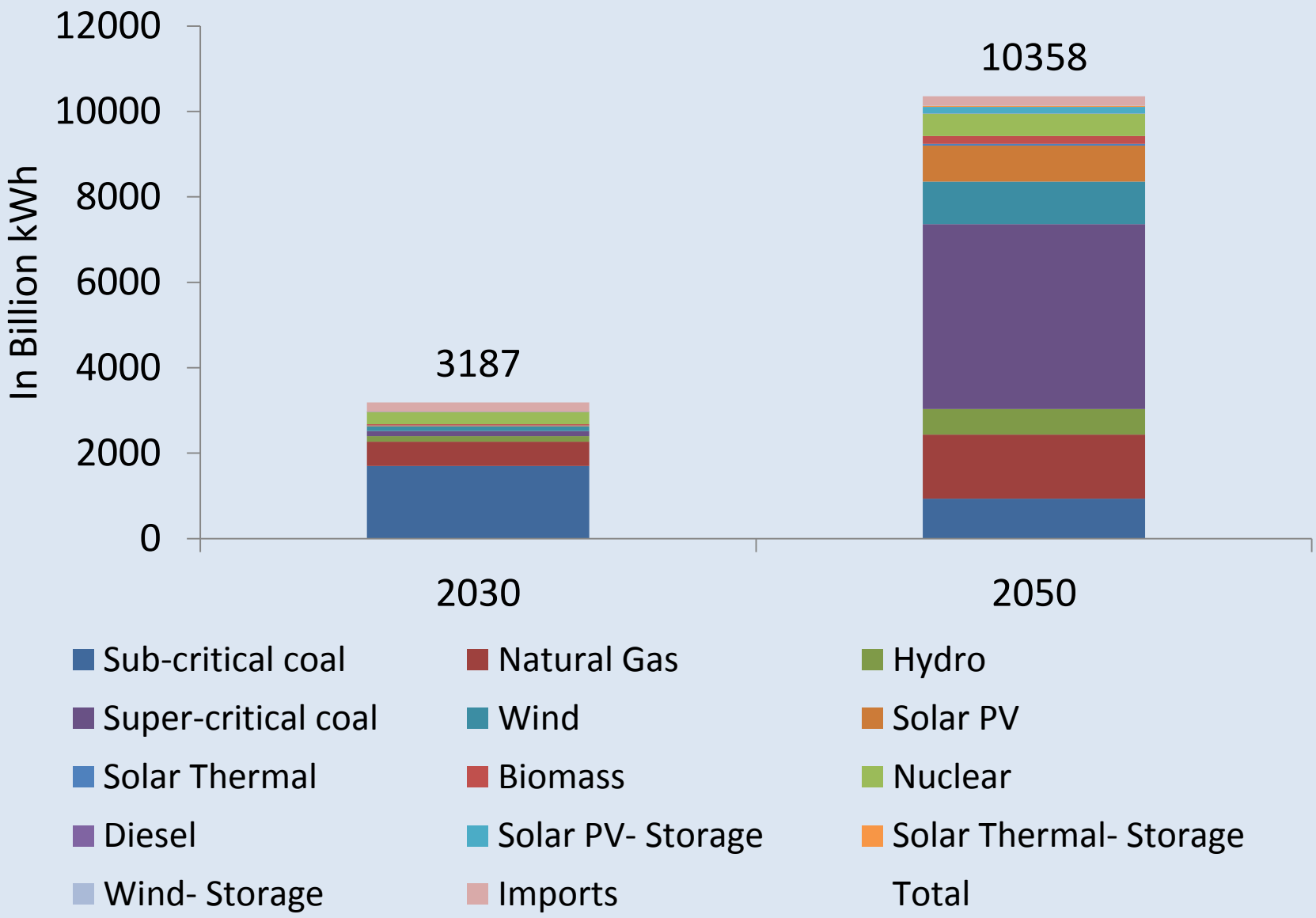
Revision of IRADe's India Activity Model for CBET

- The India model was revised to incorporate power import and export options as additional sources of power supply options apart from coal, gas, hydro, solar, wind, biomass and nuclear
- The model has been updated to simulate up to 2050. The current version is an annual version of the IRADe model instead of a 5 year model for 2050 as was the case earlier
- The model takes electricity surplus from Bhutan and Nepal as input

Scenario Assumption

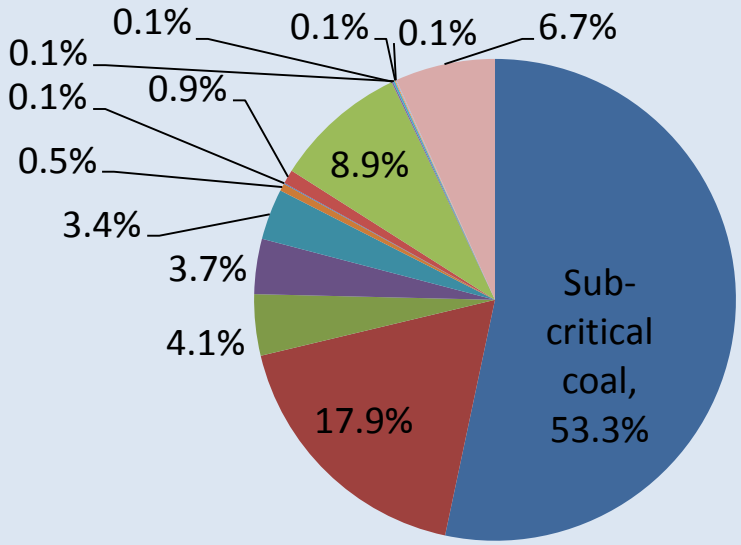
Scenarios	Description
CBET	Electricity imports from Nepal & Bhutan are assumed in addition to DAU50 assumptions
CC-CBET	Electricity imports from Nepal & Bhutan are assumed in addition to Carbon Constraint scenario (In Carbon Constraint (CC) Scenario a CC of 85 GT on cumulative emissions from electricity sector is imposed on the dynamic as usual scenario)

Electricity Supply- under CC-CBET Scenario

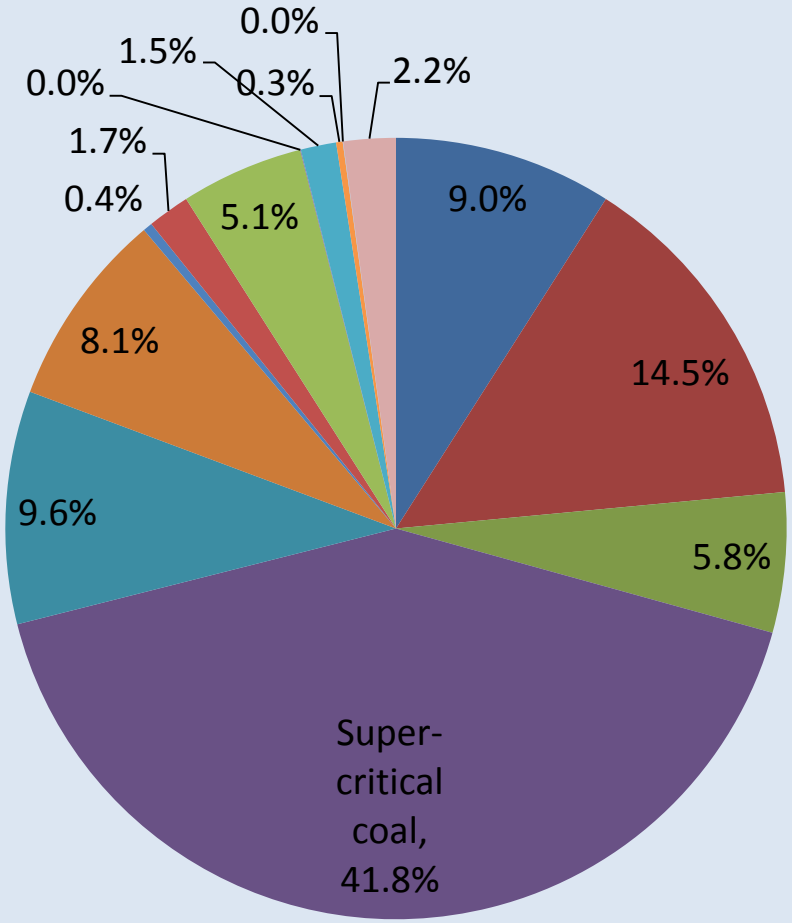


Electricity Generation- under CC-CBET Scenario

In 2030



In 2050



- Sub-critical coal
- Natural Gas
- Hydro
- Super-critical coal
- Wind
- Solar PV
- Solar Thermal
- Biomass
- Nuclear
- Diesel
- Solar PV- Storage
- Solar Thermal- Storage
- Wind- Storage
- Imports

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Proposed Macro-Economic Studies for CBET

Proposed Macro-Economic Studies

Phase-I
Oct 2014 - Sept 2015

Macro- Economic study focusing on Gains to Nepal and India from CBET

Tasks

- Review of existing models
- Deciding modelling strategies for Nepal
- Incorporate both export and import of power between Nepal and India and assessment of economic impact using:
  - ❑ Information on seasonal and daily load curves
  - ❑ Seasonal power transfers

Outputs

- **Macro model based**: Long term electricity demand-supply scenarios for Nepal and India
- Demand-supply gap on annual basis, with seasonal gaps increasing gross power transfers
- Prioritization of transmission lines
- Macro economic feed back on the economy

Phase-I continued on next slide

Activities to be Undertaken in 2014 – 15 (Nepal-India CBET) - 1

- Review of power generating potential in Nepal
- Review of NEA's exiting master plans for power systems
- Review of studies carried by JICA and other multilateral agencies in hydropower generation and storage
- Consultations with Nepal's MoP, NEA, and other agencies responsible for power systems planning to estimate power generation capacity addition till 2050 & hydropower storage

Activities to be Undertaken in 2014 – 15 (Nepal-India CBET) - 2

- Review of power demand in the end use economic sectors (agriculture, residential, commercial, industry, transport, etc.)
- Review of Government of Nepal's plans for development of various economic sectors and energy sector
- Review of the economic performance of the various economic sectors and input-output studies carried out by ADB and other multilateral agencies; including historical past data for at least 15 years
- Demand estimations of electricity & other forms of energy in end use sectors using econometric methods till 2050 for both Nepal and India

Activities to be Undertaken in 2014 – 15 (Nepal-India CBET) - 3

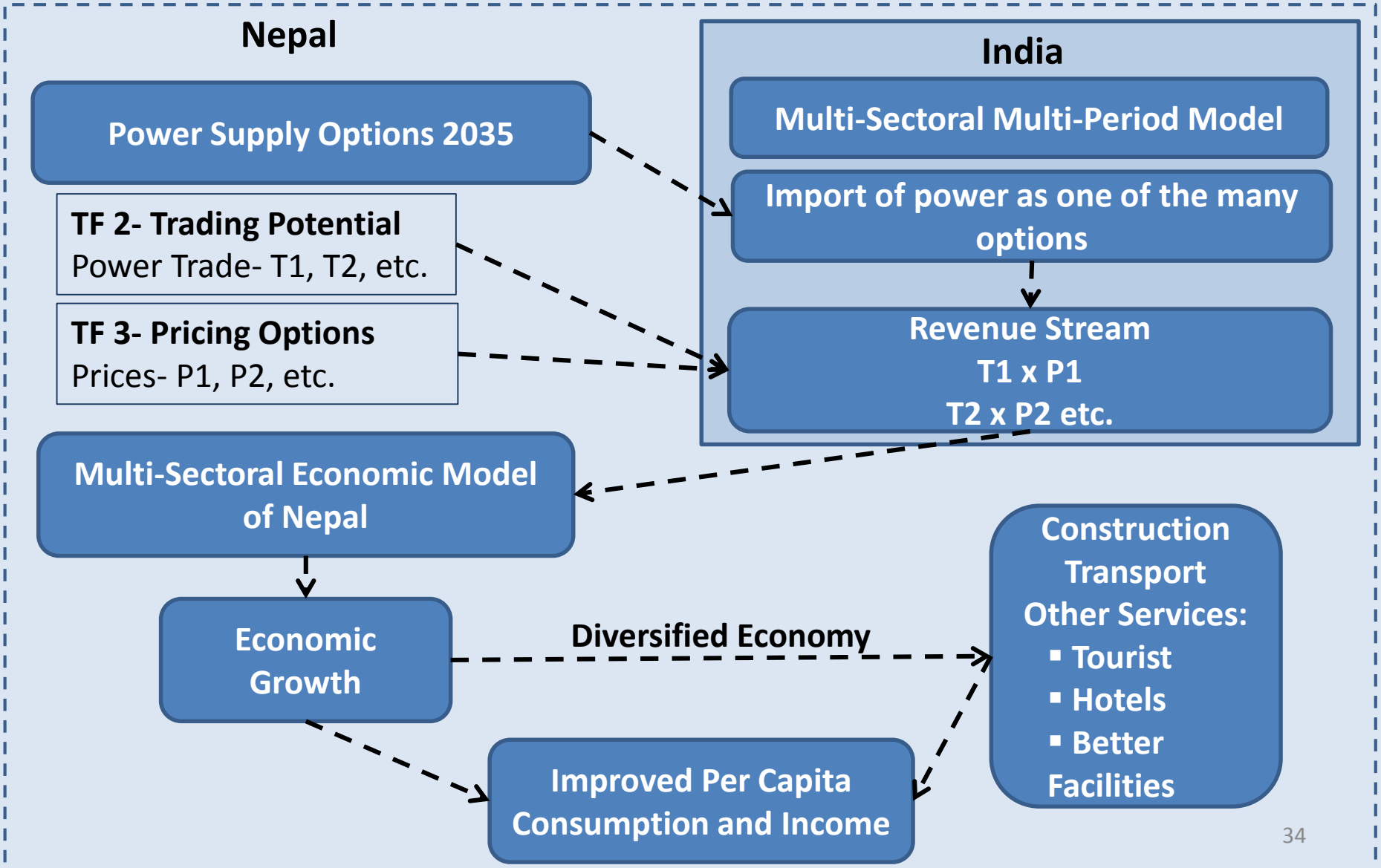
- The model has been updated to simulate up to 2050. The current version is a annual version of the IRADe model instead of a 5 year model for 2050 as was the case earlier.
- The India model was revised to incorporate Power import and export options as additional sources of power supply options apart from coal, gas, hydro, solar, wind, biomass and nuclear.
- Building of Nepal's and India's energy systems model using Markal or other models like LEAP – long term integrated energy models till 2050
- Building a Social Accounting Matrix (SAM) based Macro model for Nepal
- Running and validating the energy systems model and economic model for both Nepal and India – and arriving at macro-economic impacts
- Integrating the energy systems and SAM together for Nepal and India and arriving at the broad impacts of CBET for Nepal & India

Activities to be Undertaken in 2014 – 15 (Nepal-India CBET) - 4

- Identification and selection of Think Tanks and other NGOs in Nepal
- Holding stakeholder consultations in Nepal to discuss Nepal results of the energy and SAM models – Workshop 1
- Holding stakeholder consultations in India to discuss India results of the two models – Workshop 2
- Workshop 3 to discuss results of the integrated modelling exercise taking India and Nepal together bringing out the economic benefits
- Presentation of the results at regional workshops at Secretarial level of the MoP, MEA & MoF
- Presentation of the results at Ministerial level

Nepal-India Model- Basic Characteristics/process

(To be developed)



Proposed Macro-Economic Studies

Phase-I
Oct 2014 - Sept 2015

Outputs of Phase- I

Consensus Building Activities

- ***Stakeholder Consultations***
- ***Developing country level policy briefs***
- ***High level bilateral workshops***

Phase-II
Oct 2015 - Sept 2016

Macro-Economic study focusing on Gains to Bangladesh and India from CBET

- Methodology will be same as adopted in Phase-I analytical studies
- Results/Outputs of the Phase-II would feed the task forces in building consensus among key stakeholders including diplomatic community with support from the SARI/EI Secretariat

Proposed Macro-Economic Studies

Phase-III
Oct 2016 - March 2017

Macro-Economic Study Gains to the Region (Nepal, Bangladesh, Bhutan and India) Integration and Consensus Building

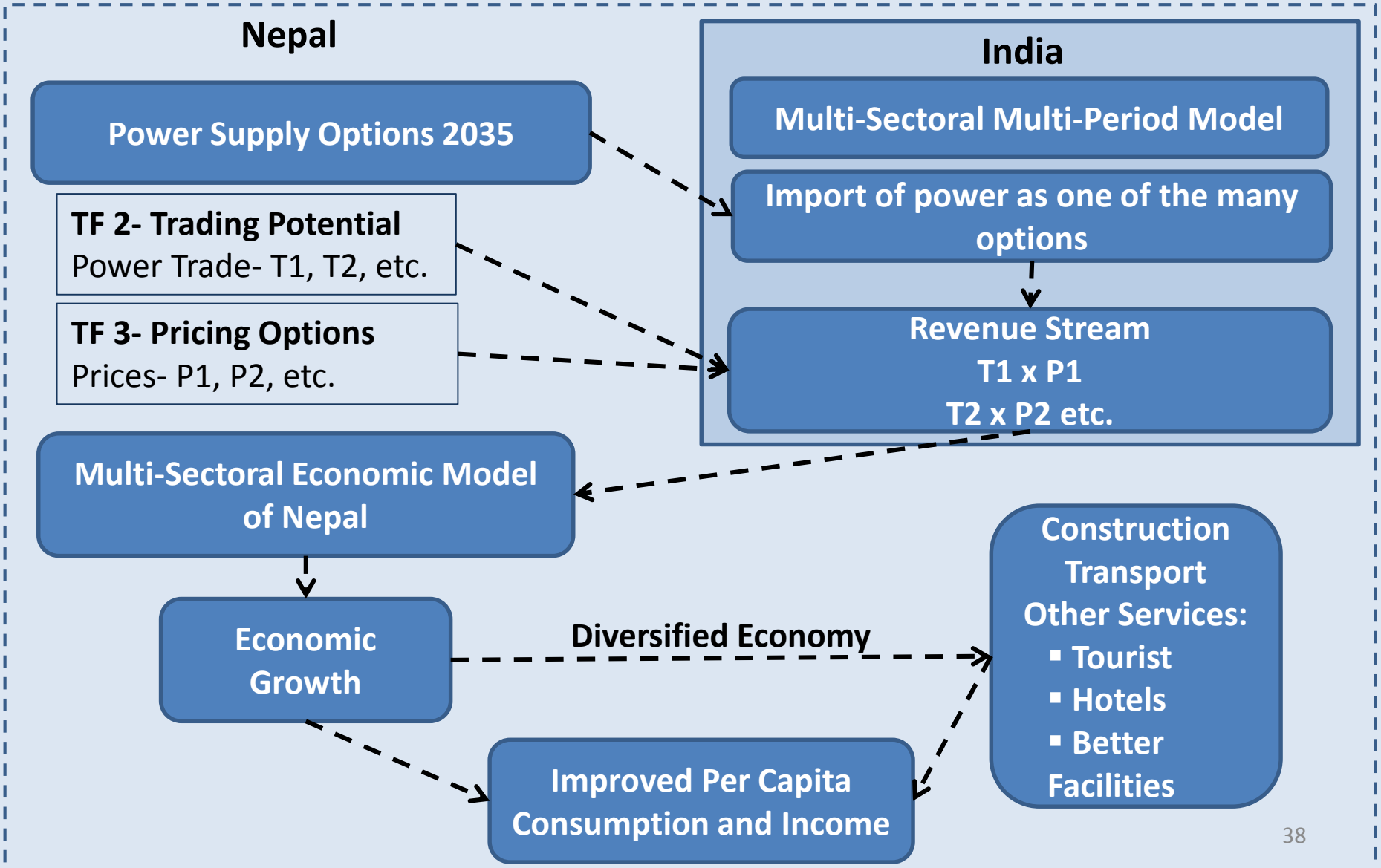
- Integration of Analytical Study outputs to assess the impact of CBET on the countries that participate in trade
- Analysis from regional perspective:
  - ❑ Regional Integration
  - ❑ Optimization of Infrastructure

THANK YOU



Nepal-India Model- Basic Characteristics/process

(To be developed)



Proposed Analytical Studies

Phase-III
Oct 2016 - March 2017

Analytical study Gains to the Region (Nepal, Bangladesh, Bhutan and India) Integration and Consensus Building

- Integration of Analytical Study outputs to assess the impact of CBET on the countries that participate in trade
- Final Report Preparation that includes Multi-Country Analysis
- Nepal, Bangladesh detailed models
- Results for consensus building beyond power sector:
- Conducting multi-county workshops
- Technical Studies: For Power, Technical and Finance Departments, etc.
- Macro-Economic Studies: Finance, Civil Society and Other departments