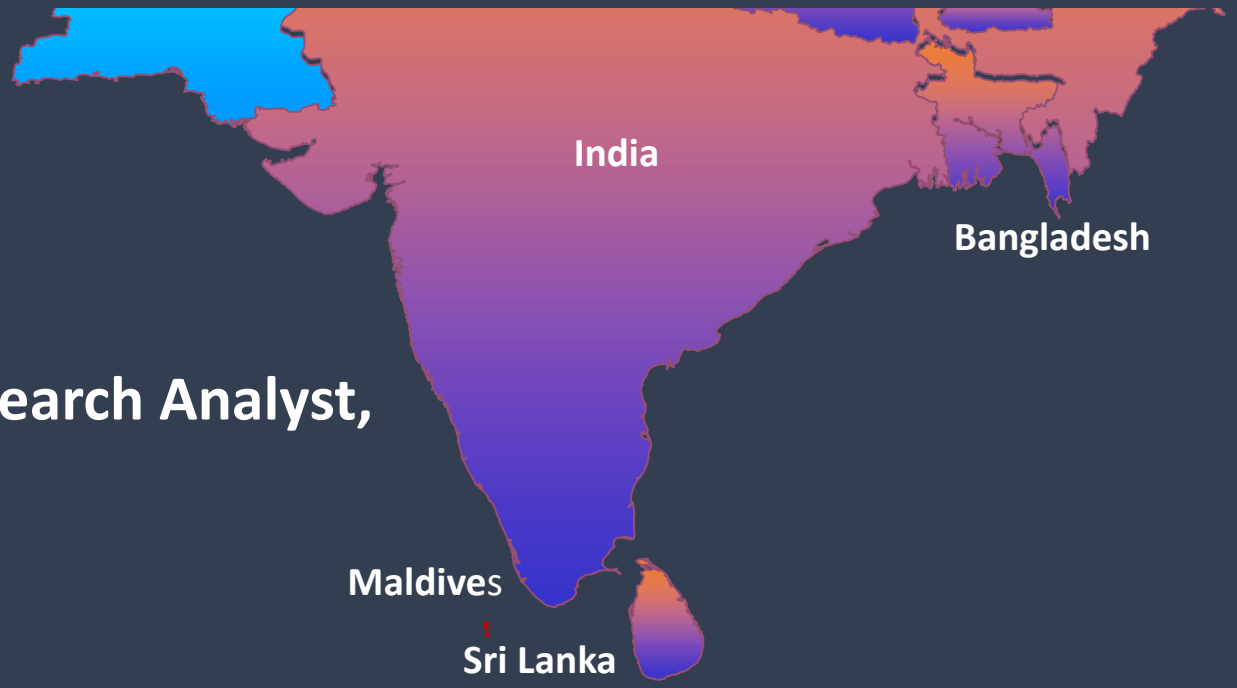
South Asian Regional Power Exchange- Mock Exercise
SARPEX Workshop- Sri Lanka
17th January 2018



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- Regional Complementarities
- Power market development phases- Expected in South Asia
- Need of Power Exchange
- Possible market design for Power Exchange
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Aspiration Behind the Regional Integration

Technical and Operational Benefits:

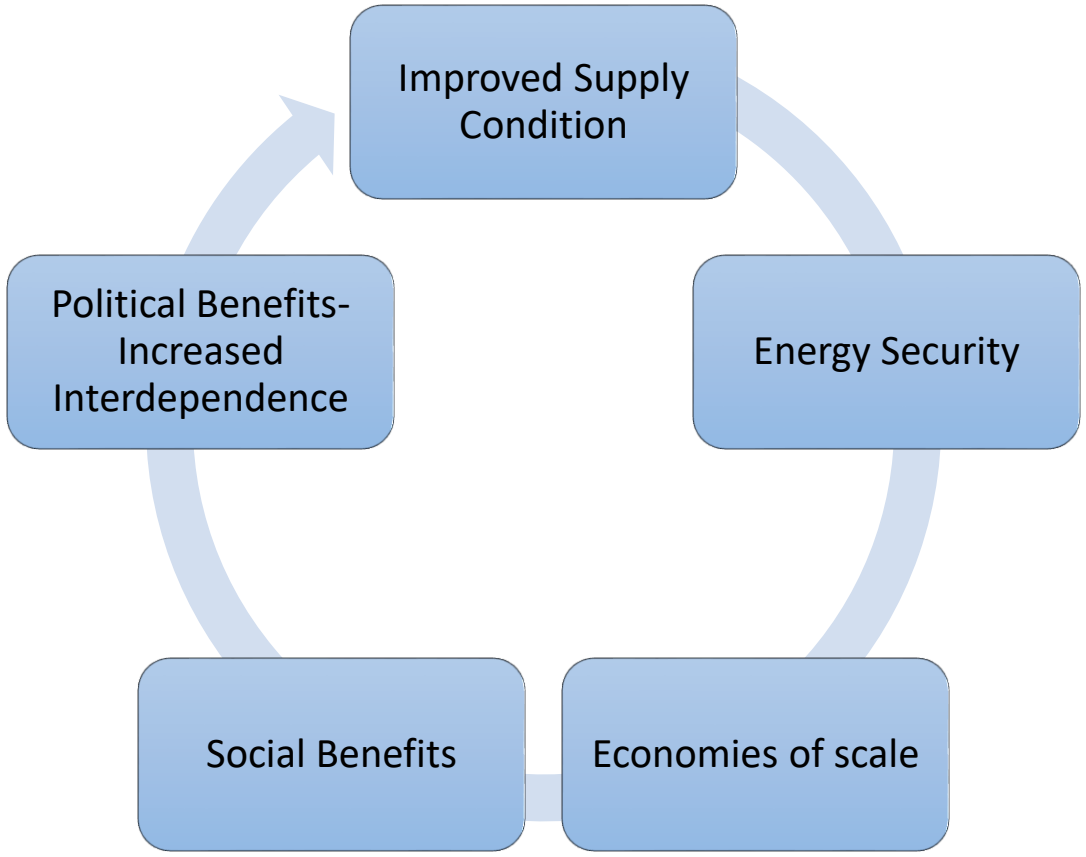
- Optimal Use of Regional Resources and System Operation
- Economies of scale in the development of regional resources
- Improved energy security and reliability of respective power systems
- Optimized transmission network
- Reduce environmental impact
- Reduce fossil fuel imports

Economic and Financial Benefits:

- Cost effective power system
- Better return to investors in generation assets
- Improvement in industrial productivity and competitiveness
- Less exposure to volatile international energy prices
- Economic Growth
- High export income

Environmental Benefits:

- Less Impact on Local and Global environment
- Reduce Adverse Impact of Indoor Air Pollution
- Improvement in Social Indicators
- Renewable Energy Development



SOUTH ASIA- BRIEF OVERVIEW

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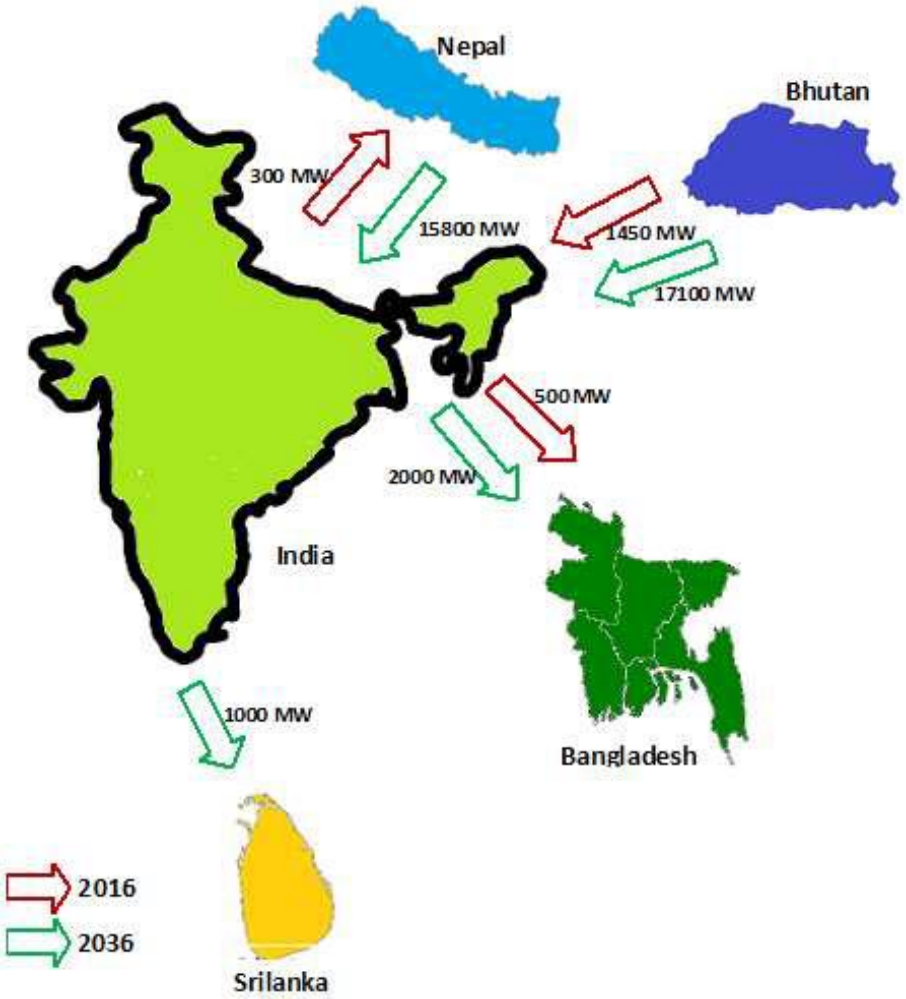
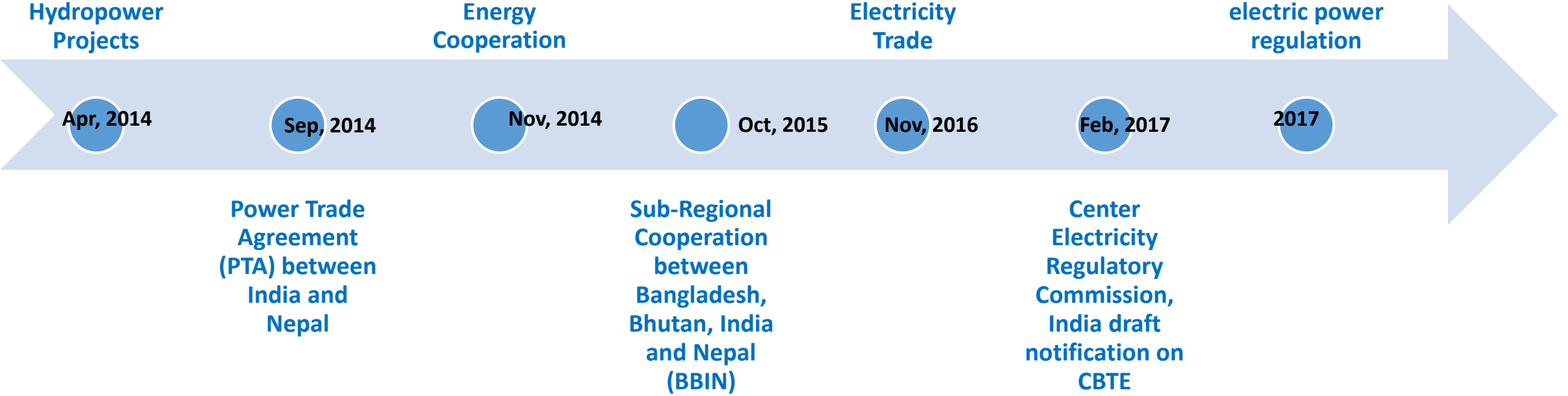
Existing and Future envisaged Power trade in South

Country	Contracts quantum and duration	Type
Bhutan → India (1450 MW)	Contract with PTC for Chukka (336 MW), Kurichhu (60 MW) Hydro Projects (Long Term)	G to G
	Contract with PTC for Tala (1040 MW) Hydro Project (Long Term)	G to G
	Contract with TPTCL for Dagachhu (126 MW) Hydro Project (Long Term)	Commercial
India → Bangladesh (660 MW)	BPDB Long-term contract with NVVNL for 250 MW	G to G
	BPDB Medium-term contract with PTC for 250 MW	Commercial
	Tripura – Comilla 160 MW contract	G to G
India→ Nepal (420 MW)	NEA Bilateral contracts / Treaties to the tune of 420-440 MW	G to G
	NEA Past contracts with PTC (2011-2015) during December-April months for ~20-30 MW	Commercial



Commercial Mechanisms of Price Discovery in Power Trading is well established now in all the BBIN countries

Key Policy developments in Cross Border Trading



WHY POWER EXCHANGES IN SOUTH ASIA??

Regional Complementarities

- **Resource Complementarities:** The degree to which two countries symmetrically contribute dissimilar resources, in terms of both resource type and quantity, to an alliance.

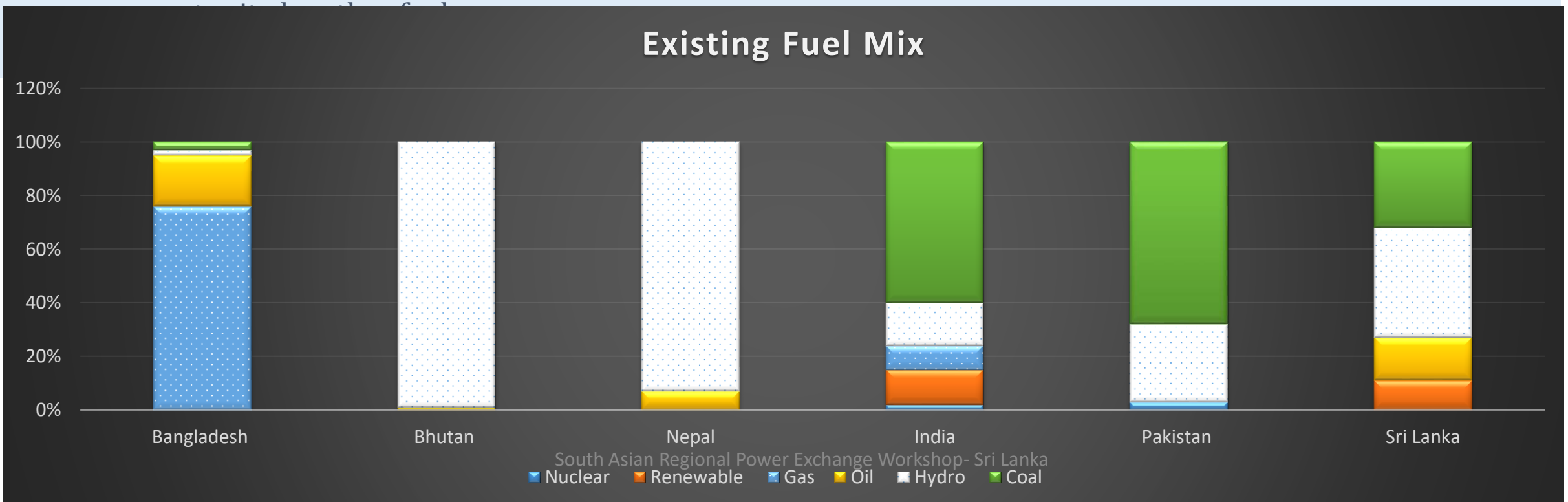
- The region is blessed with diverse natural resources ranging from the most conventional forms (i.e. coal) to hydro and non-conventional forms (i.e. solar and wind).

Country	Coal (Million tons)	Oil (Million barrels)	Natural Gas (Trillion cubic feet)	Biomass (Million tons)	Hydropower (GW)	Wind (MW)	Solar Power (Kwh/Sq m per day)
Bangladesh	884	12	8	0.08	0.33	Limited	3.8-6.5
Bhutan	2	-	-	26.6	30	4,825	2.5-5
Nepal	-	-	-	27.04	83	3,000	4.0-7.0
India	90,085	5700	39	139	150	151,918	3.6-6.2
Pakistan	17,550	324	33	-	59	24,000	5
Sri Lanka	-	150	-	12	2	25,000	NA

Regional Complementarities

- **Existing Fuel Mix:** Countries are having an skewed fuel mix in the region. By regional power trade, the countries will able to increase the energy security and reduce the dependency in a particular form of energy.

- Key Point:
  - ✓ Bangladesh's generation is mainly gas based and hence provides a contrast with Bhutan and Nepal which are majorly hydro based electricity generation.
  - ✓ Provide an opportunity to harness the renewable energy by extending an market and provide an balancing



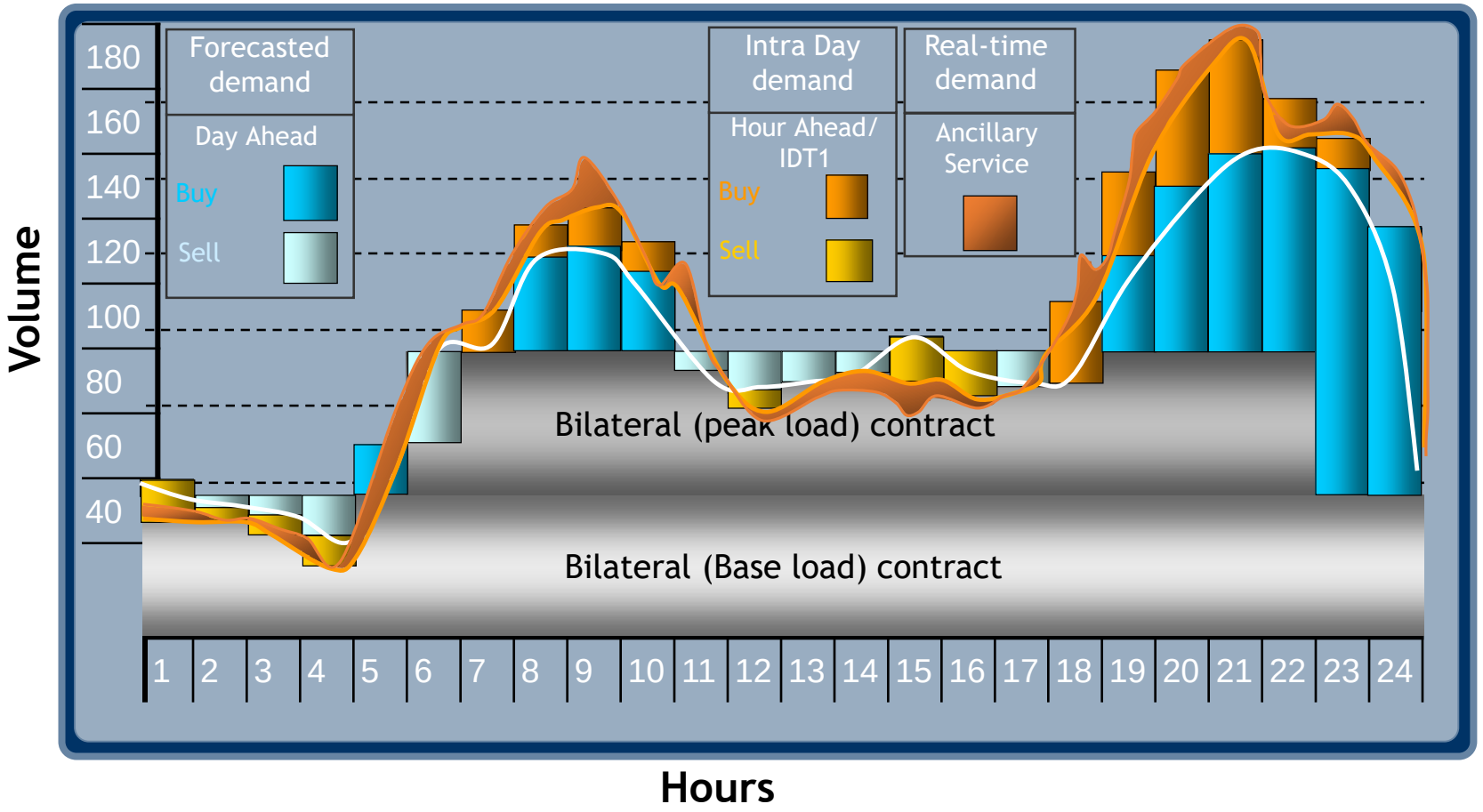
Regional Complementarities- Monthly and Hourly

	January	February	March	April	May	June	July	August	September	October	November	December
Bangladesh												
India - North East												
Bhutan												
India - East												
Nepal												
India - North												
India - West												
Pakistan												
India - South												
				Low	Medium	High						

Countries	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Bangladesh- April																								
Bhutan - April																								
India- April																								
Nepal- April																								
Pakistan-April																								
Sri Lanka- April																								

Color Coding	Range	
	Min	Min+ (Max-Min)*20%
	Min+ (Max-Min)*20%	Min+ (Max-Min)*40%
	Min+ (Max-Min)*40%	Min+ (Max-Min)*60%
	Min+ (Max-Min)*60%	Min+ (Max-Min)*80%
	Min+ (Max-Min)*80%	Max

Optimal Management of daily Demand Supply Position



- The DAM spot with 15-minute dispatch is inherently more compatible than bilateral for closer to the real time needs for balancing the demand supply gaps
- Optimal management of daily / seasonal variations in demand or supply - buy/sell the surplus / deficits

Need and Evolution of Power Exchanges in India

Long & Medium Term Market

- Long term power markets do not meet the full requirements of the market participants:
  - Projecting hourly consumption over long term without forecasting errors is difficult
  - Long term contracts for peak load requirement may be economically inefficient

Short Term Market

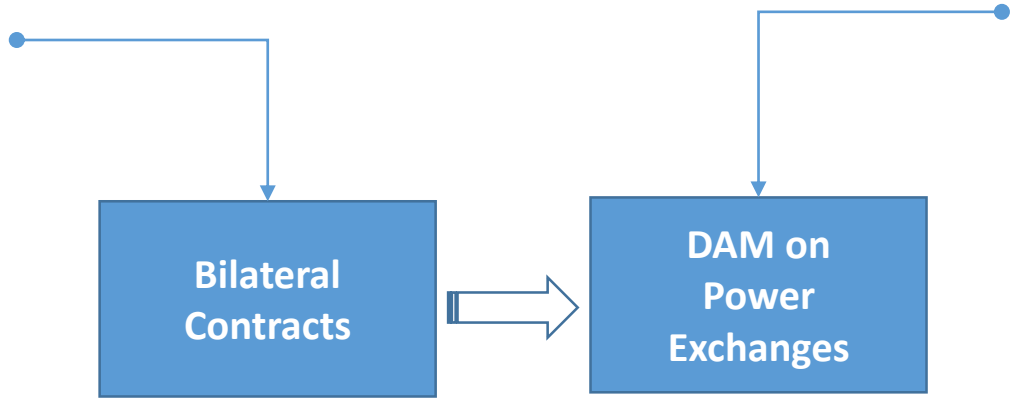
- Similarly, Short-term Markets have the following limitations:
  - Don’t permit correction of positions taken by players in long and short term market closer to real time
  - Non-standard and firm nature of contracts
  - Arrangement of separate transmission access – explicit transmission allocation / auction
  - Insufficient price signals for investment growth in requisite generation type

Power Exchange

- Power Exchanges provide a neutral, fair and an efficient platform to mitigate some of these challenges
  - Balancing the buy and sell position near to real time
  - Standardized contracts
  - Counterparty risk is taken care of
  - Competitive and widely acceptable future price signals
  - Signals for Generation and Transmission addition

Benefits of a DAM through a Power Exchange

- Trading parties specify the contractual terms
  - Negotiating & customization of contracts may take weeks, months to years
  - Assessing the creditworthiness of Counterparty involves risk & costs
- Not suitable for closer to real time operations



- Standardized contract structures
  - Centralized trading with easier & faster access to operate closer to real time
  - Low transaction costs, safe counterparty with clearing and settlement service
- More suitable for closer to real time operations

While Bilateral PPAs provide certainty to buyers and seller, Power Exchanges allow countries to manage the daily variations in load requirements on a 15-minute basis

SARPEX would enable closer to real-time balancing and Social Welfare Maximization in the Region

- A cross border exchange will provide a fair, neutral and robust price discovery platform and create an orderly marketplace for all the buyers and sellers in BBIN
  - Market-determined prices - Price transparency, competition and efficient price signals
  - Greater flexibility since trades are on a short-term requirements and production capability basis – better suits the resource type of the countries
  - Allows for absolving the counterparty risk
  - Enhanced grid stability through real-time balancing and better coordination between all operating markets and dispatch schedules
  - Economic dispatch
- Apart from the other benefits of Exchange, it will not only supplement the existing bilateral trade in BBIN but also encourage more choice and investments in the sector

Implementation of a Regional Exchange Market has been delayed on account of multiple factors

Perceived Challenges

- Provisions w.r.t. institutional, legal, policy, market and regulatory framework essential for a Regional Spot Market development
  - Provisions with respect to institutional and legal jurisdiction of x-border trades in respective countries
  - Regulatory framework for access to respective grids, x-border capacity allocation & congestion management, trading licenses etc.
  - Commercial mechanism relating to tx charge & loss allocation, imbalance and payment security mechanisms
  - Coordinated policy development for transmission infrastructure and related grid codes
  - Acceptable & neutral Dispute Settlement Mechanisms
- Apprehensions about price increase in the Spot Market
- Impact on Transmission Charges & Losses due to cross-border power flows
- Agreement on redistribution of benefits or losses accrued by the various participants –*"Consumer & Producer Surplus"*

Key issues and apprehension??

- Market Design and Rules for a Regional Day Ahead Spot Market?
- Price convergence and impact on the prices in each country?
- Social Welfare of each country?
- Impact on the DA contingency market, bilateral market?
- Market power - behavior of consumers & producers changing their bidding behavior in the respective countries?
- Capacity Building of BBN countries for initiating DAM transactions through Exchanges

Existing proposed provision: Trading through the Power Exchanges

- The following products are permitted
  - Term Ahead Contracts (Upto 11 days ahead)
  - Intra Day Contracts / Contingency Contracts
- Subject to
  - Approval from the Designated Authority
  - traded volumes to be regulated and reviewed from time-to-time by the Designated Authority
- Cross border trade to be extended to other categories of contracts based on review by MoP and CERC, India

Primary or the core Product of Power Exchanges i.e. the Day Ahead Market (DAM)
Spot is still not in the list of products to be offered through Exchanges

Regional Power Exchange- Mock Exercise

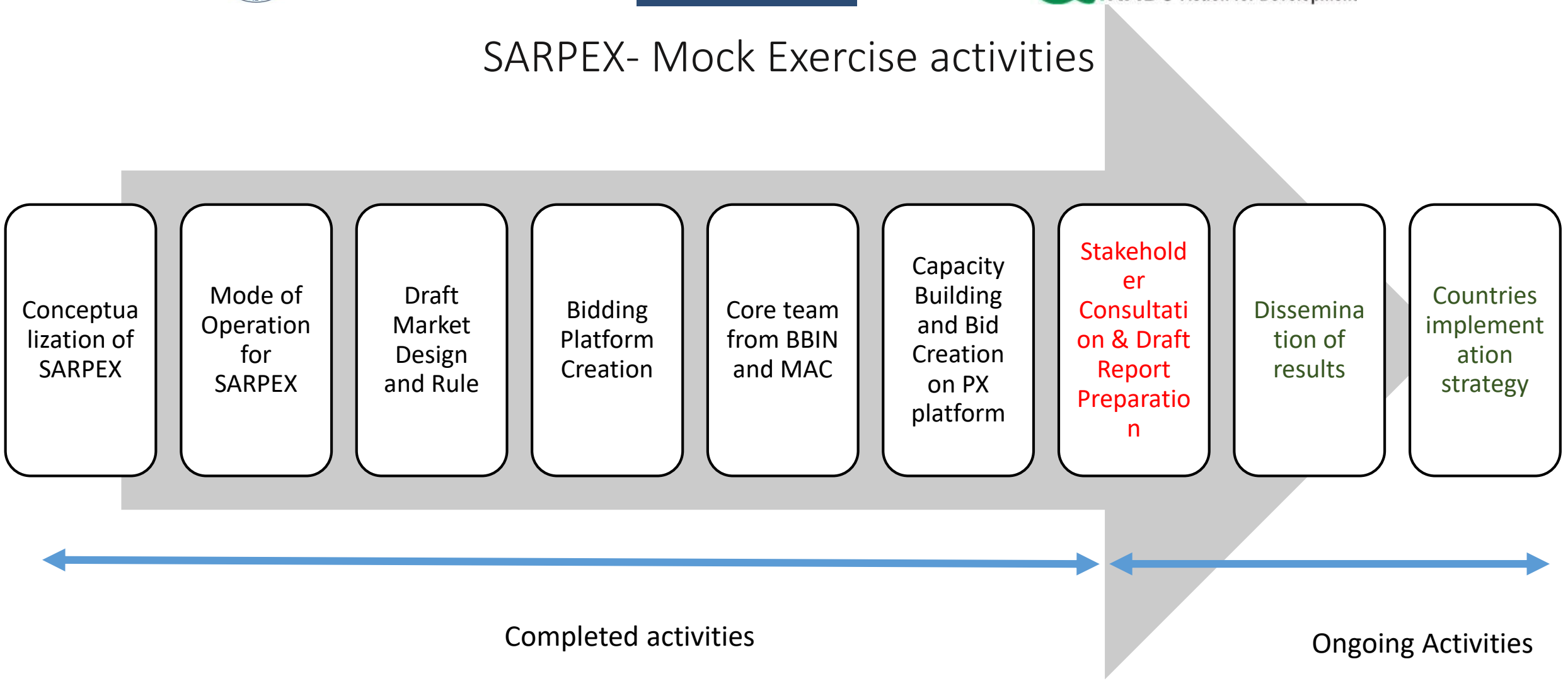
- A trading platform mimicking a regional Energy Exchange for the SA Region.

- The mock exchange will provide an answer to various key questions, related to feasibility and desirability and possible volume in the regional market, the impact of regional market on domestic energy markets.

- The mock exercise results will provide the desired inputs for the decision makers in selecting a suitable option for market design. This will also give clarity about the identity of the buyers and sellers in such a Regional Exchange.

- Additionally, the mock exercise will also develop/provide:
  - Develop a draft set of market design and rules of a SA regional electricity market.
  - Prepare a detailed report based on the analysis of the pilot market data to ascertain the desirability and the feasibility of a SARPEX, and
  - To build the capacity of relevant officials from the SA countries on the functions of a power exchange which is critical irrespective to the option finally selected.

SARPEX- Mock Exercise activities



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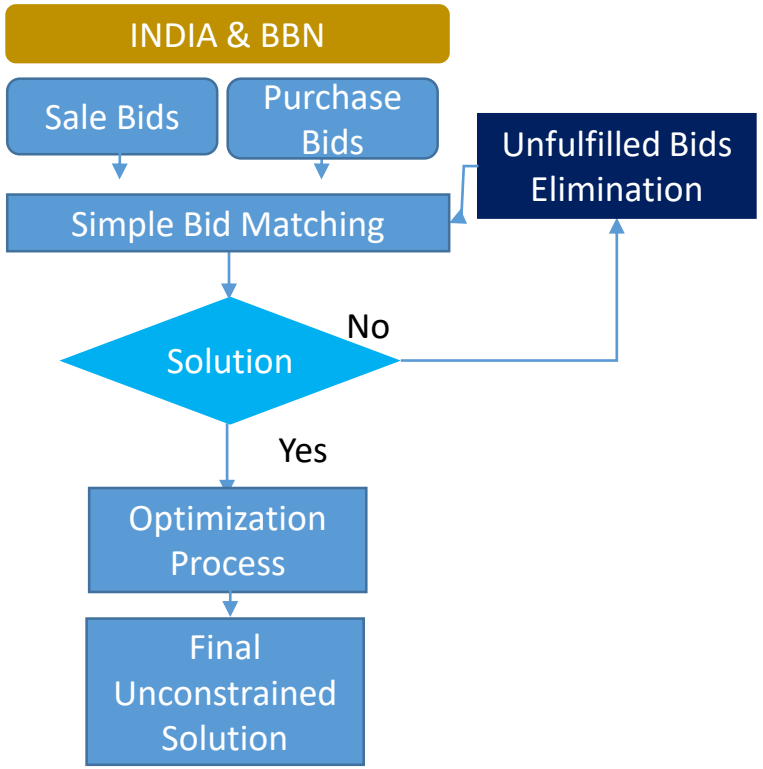
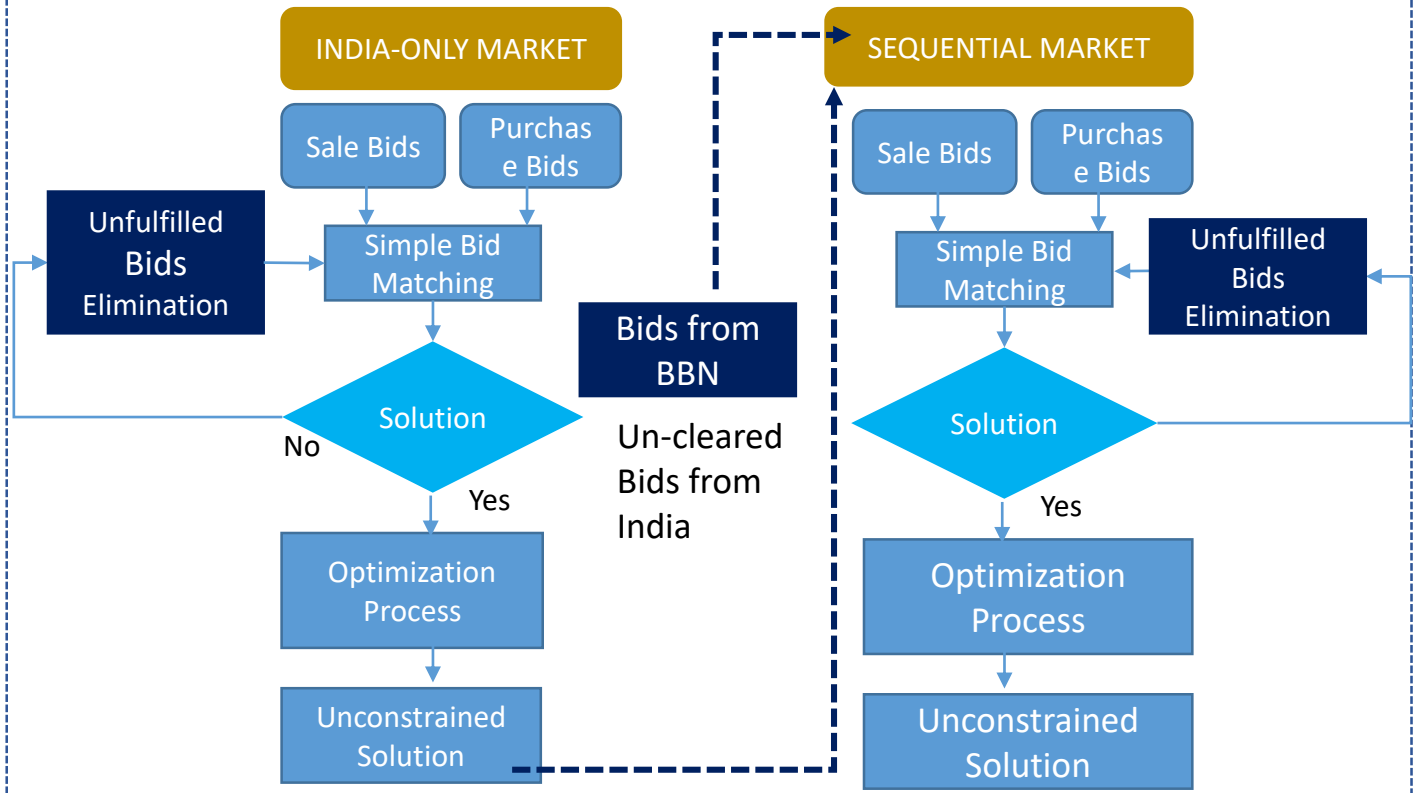
SARPEX's CLEARING ALGORITHM

SEQUENTIAL MODE

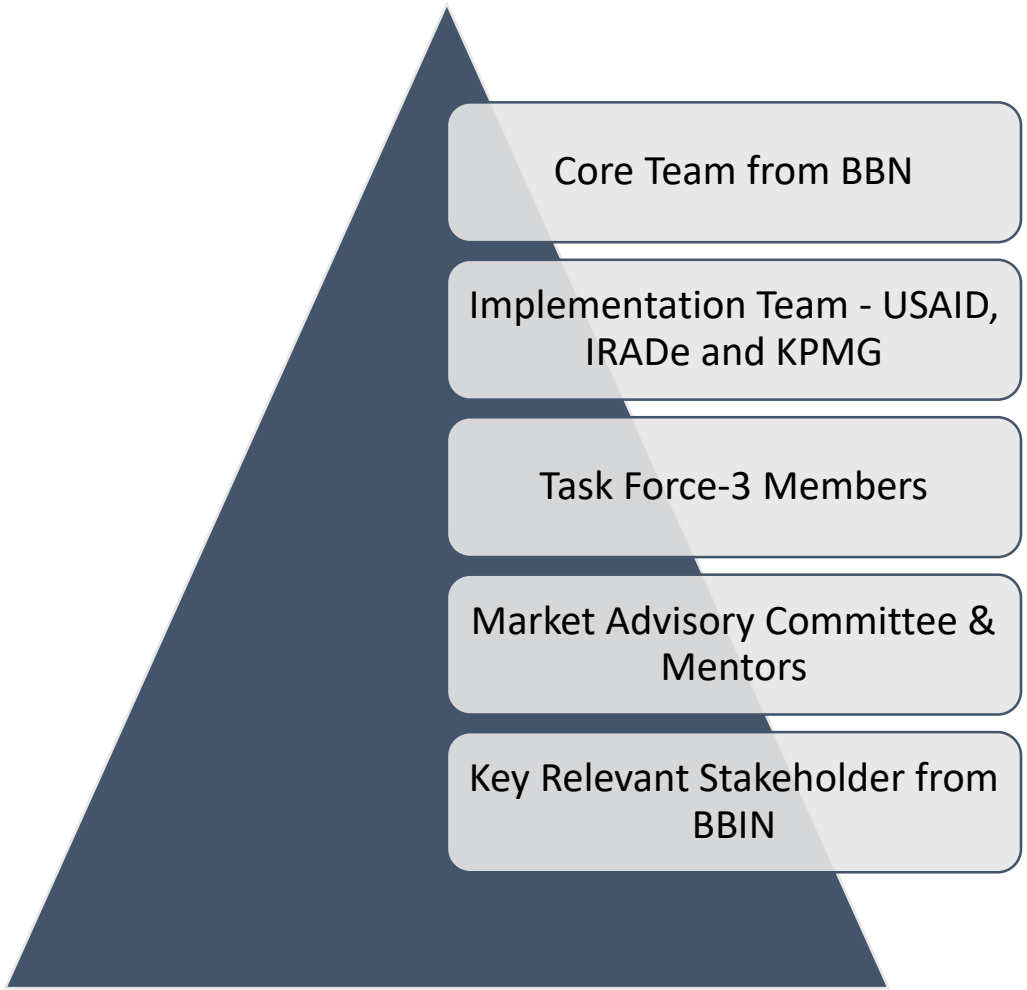
UNIFIED MODE – 15 MINUTE DAM INTERVAL



SEQUENTIAL MODE – 15 MINUTE INTERVAL DAM



SARPEX TEAM



Market Advisory Committee

Name	Country	Designation	Organisation
Mr Anil Razdan	India	Ex- Secretary Power	Ministry of Power
Mr. Hans-Arild Bredesen	Norway	CEO	Nord Pool Consulting
Mr Peter Jogersen	Denmark	Vice President	Energinet, Denmark
Mr Musara Beta	South Africa	Chief Analysts	South African Power Pool

- Core Team Members are Government nominated members for bidding purpose and capacity building.
- Task Force-3 members are the senior level SA countries government representative to provide the directional inputs.
- The Market Advisory Committee (MAC) and Mentors formed to include suitable international experts who can provide guidance to the team for conducting the mock exercise.
- The implementation team members ensure all activities related to mock exercise are implemented and are responsible for following activities

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South Asian Regional Power Exchange – Mock Exercise


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LEARNINGS FROM NORD POOL REGION:
Transmission Service Agreement
for Cross-Border Electricity Trade
SOUTH ASIA REGIONAL INITIATIVE FOR ENERGY INTEGRATION (SARI/EI)
Working Paper:
Impact of Cross-Border Electricity Trade on Bhutan (Country Series)
September, 2016
Roadmap fo
South Asian Reg
Power Exchan
(SARPEX)
POWER PURCHASE AGREEMENT
for Cross-Border Electricity Trade (CBET)
Between Seller (New Hydro Generator) & Procurer
SOUTH ASIA REGIONAL INITIATIVE FOR ENERGY INTEGRATION (SARI/EI)
Task Force-3 Report
South Asian Countries
Power Pricing Mechanism &
Recommendation for CBET

Thanks

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For further information related to SARPEX you may visit web portal.

http://mocksarpex.eu.ai