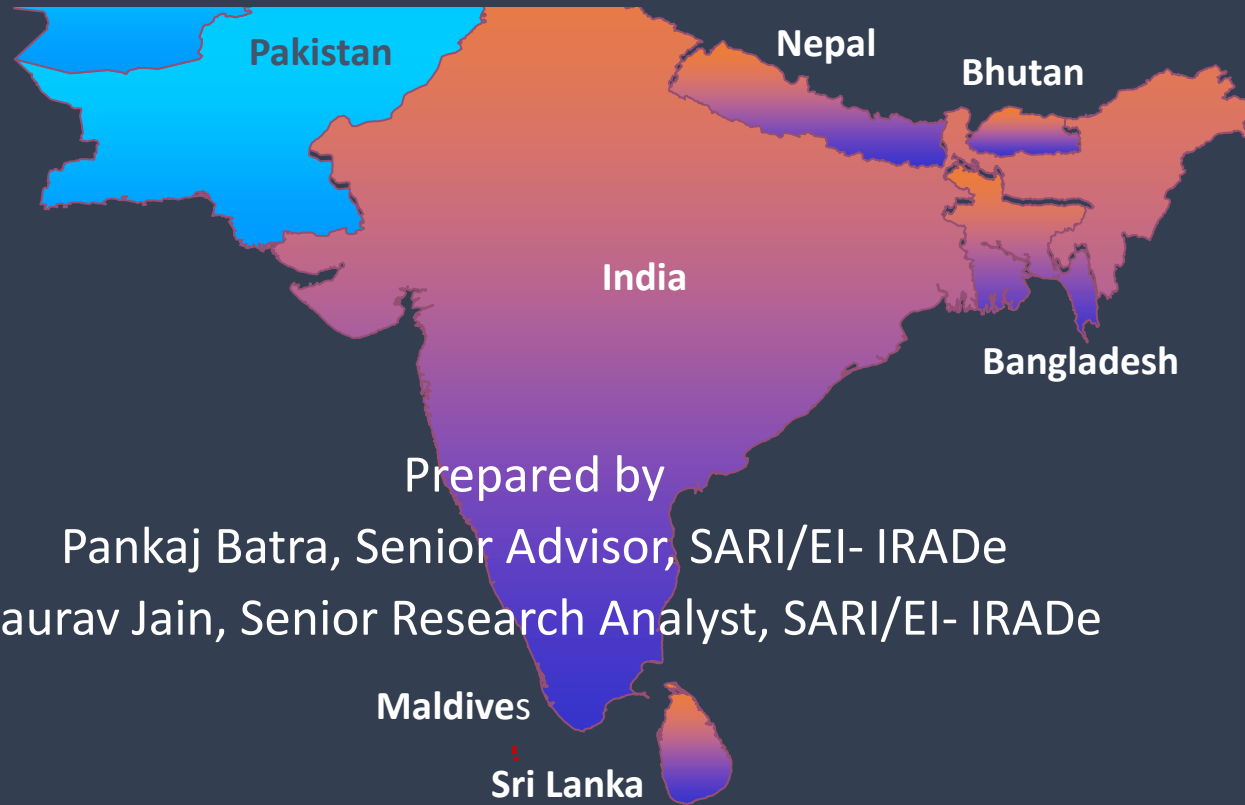


International Experiences on Power Pools and Markets



Prepared by
Pankaj Batra, Senior Advisor, SARI/EI- IRADe
Gaurav Jain, Senior Research Analyst, SARI/EI- IRADe



Content

- About IRADe and SARI/EI
- Existing power trade in South Asian region
- Global Practices- Regional Power Exchange
- Regional power trade- Exchange based trade
- South Asian Regional Power Exchange- Mock Exercise
- Way-forward



USAID
FROM THE AMERICAN PEOPLE

SARI/EI



Integrated Research and
IRADe Action for Development

About IRADe

- ❖ IRADe, a think tank set up in 2002
- ❖ Conducts multi disciplinary research and policy analysis
- ❖ Engages in national and international dialogue for consensus building

Thematic Areas

Urban
Infrastruct
ure &
Services

Energy &
Power
Systems

Agricultur
e & Food
Security

Climate
Change &
Environme
nt

Poverty
Alleviation
& Gender

Asia
Centre for
Sustainabl
e
Developm
ent



USAID
FROM THE AMERICAN PEOPLE

SARI/EI

IRADe Integrated Research and
Action for Development



सत्यमेव जयते

प्रधान मंत्री
Prime Minister
MESSAGE

I am glad to learn that a Regional Conference on “Enhancing Energy Integration in South Asia” is being organized at New Delhi on 30-31 August under the auspices of Integrated Research and Action for Development (IRADe).

There is lots to gain from enhanced regional energy integration. By matching the sources of energy production and its demand centres, it will synergize the economies of the region. India has a special role to play in helping the region to realize this shared destiny of prosperity.

I hope that the regional conference will be an occasion for energy experts and policy makers to deliberate on enhancing the energy integration in the region. I convey my best wishes for the successful conclusion of the conference.

(Narendra Modi)

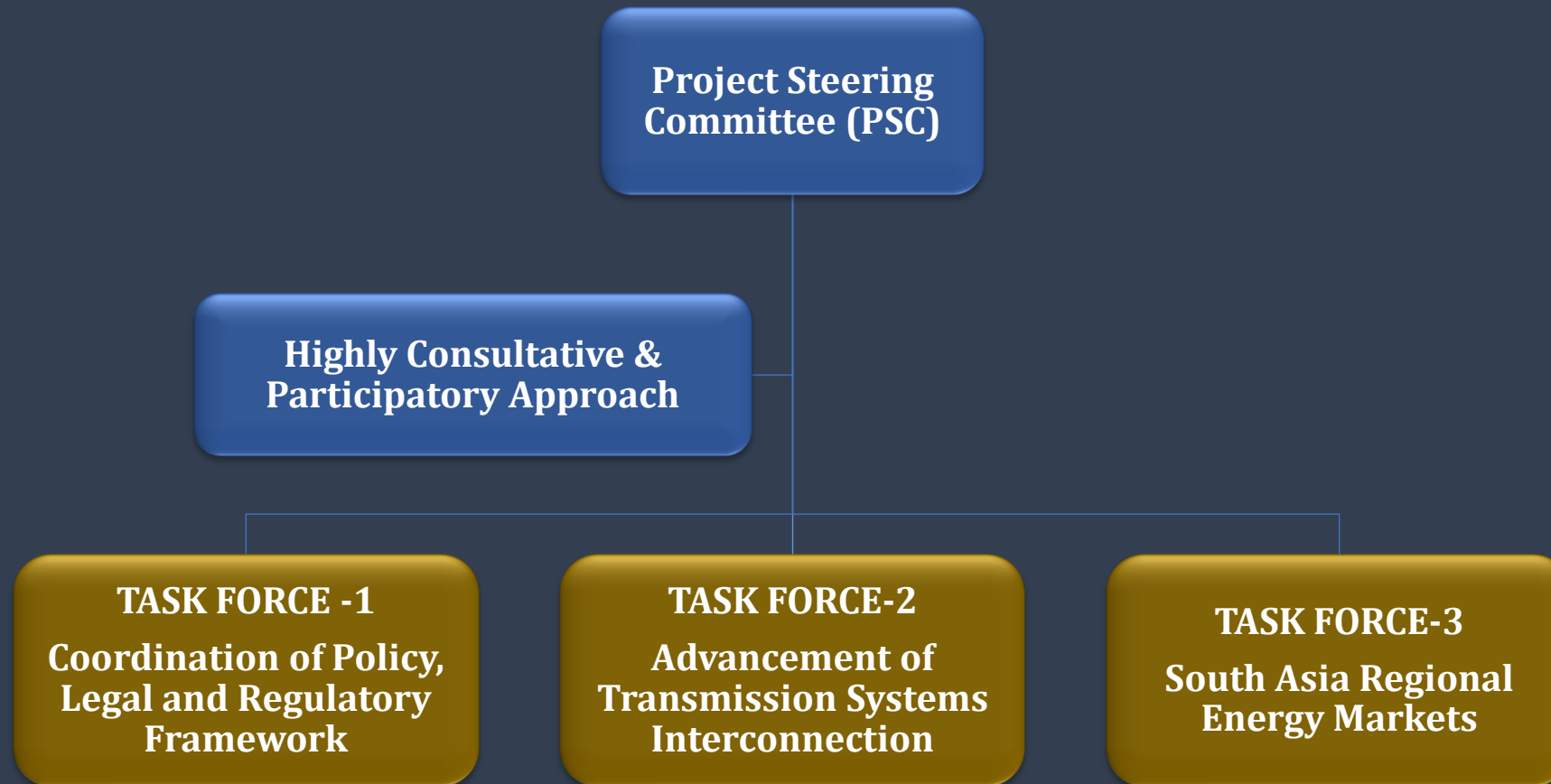
- ❖ SARI/EI promotes regional integration of Energy Systems.
- ❖ SARI/EI participating countries- Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka.

- ❖ IRADe is the implementing partner for the fourth phase (2012-2017) of SARI/EI program through a cooperative agreement with USAID.
- ❖ The SARI/EI program was recently extended to 2022 and is a key program under USAID’s Asia EDGE.

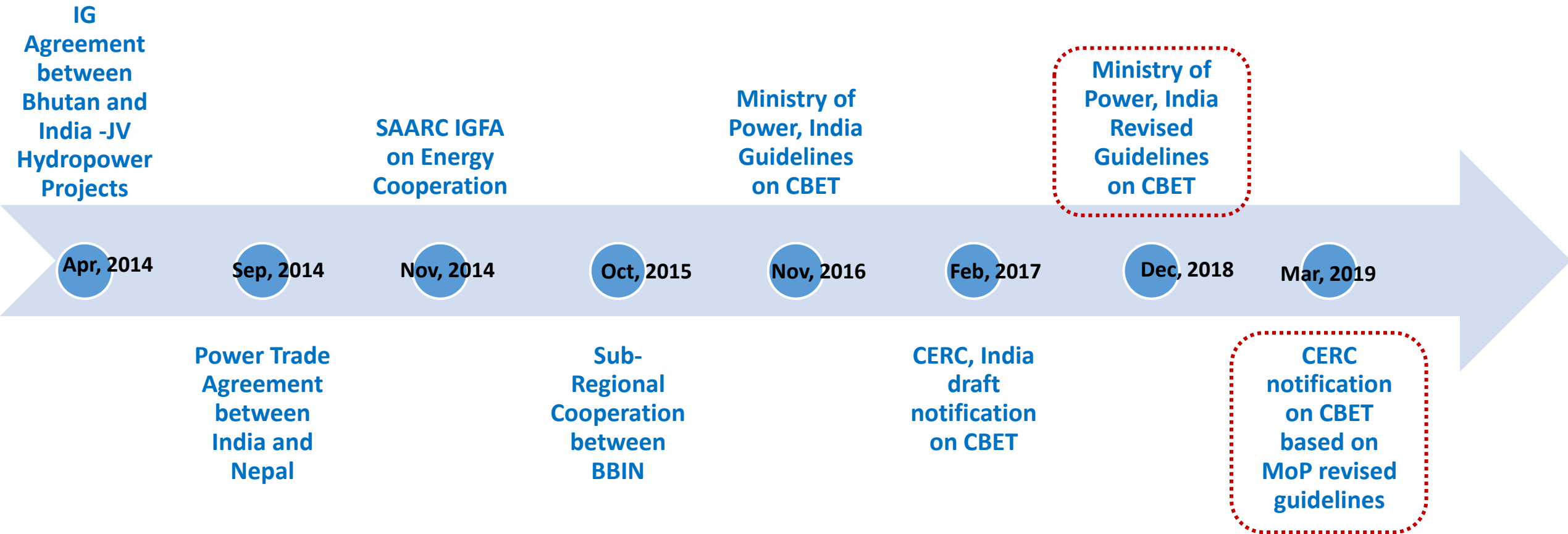
- ❖ Focus is on a demand driven “bottom up” development paradigm specific for cross-border power project development.



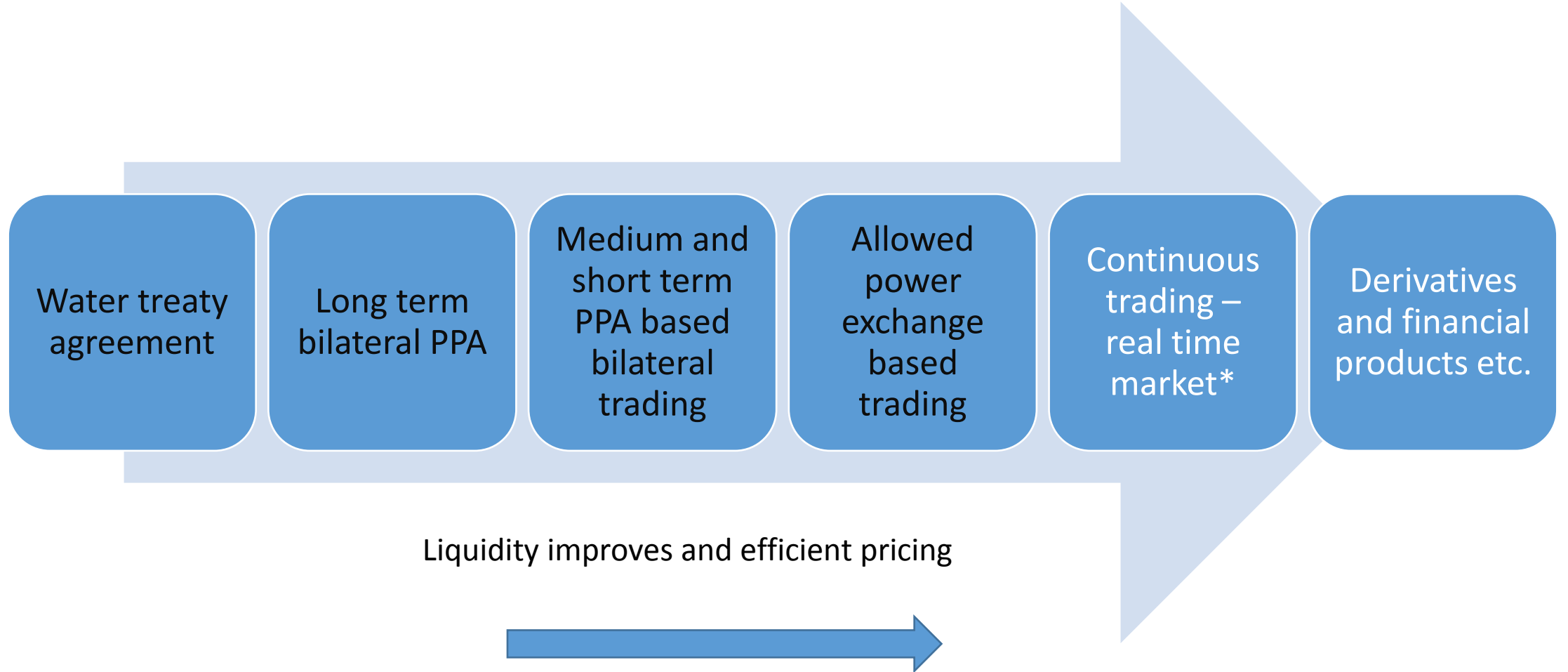
SARI/EI Framework



Key Policy developments in Cross Border Trading



South Asian Regional Power Market Development





USAID
FROM THE AMERICAN PEOPLE

SARI/EI

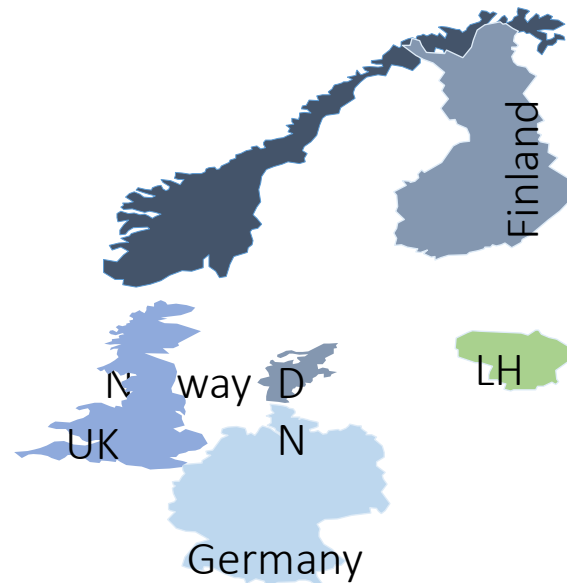


GLOBAL PRACTICES - REGIONAL POWER EXCHANGE

Evolution

- Norway was first amongst Nordics to deregulate power markets
- In 1996, Norway & Sweden established Nord Pool
- By 2000, Finland & Denmark joined the pool
- Germany (2006), UK (2010) & Baltic countries (2013) joined

Nord Pool



Products

- Elspot: Day-ahead market (DAM)
- Elbas: Intra-day market (IDM)

Currencies for settlement

- EUR, NOK, SEK & DKK for DAM
- EUR for IDM
- To trade in a specific currency, a pledged/non-pledged account in that currency is required

Ownership

- Nord Pool Spot AS is owned by Nordic & Baltic TSOs

Governance

- Governance includes Board of Directors and Customer Advisory Board.
- To detect possible breaches with the prohibition against market manipulation and insider trading.

Regulator

- Nord Pool Spot AS is licensed by Norwegian Water Resources and Energy Directorate (NVE) and by Norwegian Ministry of Petroleum and Energy

Structural features:

- TSOs of Norway and Sweden established Nord Pool
- Renaming of Nord Pool after all Nordic countries joined
- Separation of Energy & Derivatives markets; NPS to handle Energy market

Evolution of EPEX

- Inspired by experience by Nordic countries, France (2001) & Germany (2002) established their national PXs
- In 2008, French & German PXs merged to form EPEX Spot
- Subsequently, Switzerland and Austria joined

Salient features:

- Nord Pool Spot made active contributions in establishment of national PXs in France & Germany
- Powernext SA (France) and EEX AG (Germany) merged in 2008 to form EPEX Spot with 50% equity each
- In 2014, EPEX Spot also started operations in Hungarian power market on behalf of Hungarian PX (HUPX)

SARIEI

European Power Exchange (EPEX)



- In 2015, HGRT took-over 36.7% of shareholding of EEX
- In 2014, EPEX spot also started operating Hungarian PX

Products

- Day ahead auction (~DAM)
- Intra-day auction (~IDM)

Currencies for settlement

- EUR

Ownership

- 2015: Powernext (50%), EEX (13.3%) and HGRT (36.7%)

Governance

- Shareholders of EPEX spot appoint a Supervisory Board
- An Exchange Council comprising of 16 members & 5 permanent guests is the governing body
- A Market Surveillance Office reporting to board & council also set up. It monitors the market regularly

Evolution

- OMEL, national PX of Spain, operated day-ahead market since 1998
- In 2007, Portugal joined OMEL; renamed as OMIE

OMIE



Products

- Day ahead auction (~DAM)
- Intra-day auction (~IDM)

Currencies for settlement

- EUR

Salient features

- National Electricity Market Act of Spain ensured significant volume was traded on Spanish national PX – all power not traded bilaterally had to be sold through PX
- Portuguese market opened and joined OMEL in 2007 – resulting in restructuring of OMEL to OMIE
- Spanish Operator OMIE takes care of physical market operation; while Portuguese OMIP handles futures market

Ownership

- Spanish company OMEL (50%) & Portuguese company OMIP SGPS SA (50%)

Governance

- OMIE is regulated by the Santiago International Agreement between Spain & Portugal on implementation of an Iberian electricity market (MIBEL)

Regulator

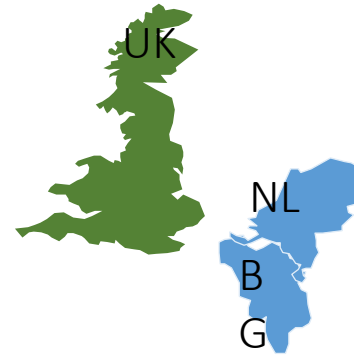
- CNE (Spain) & ERSE (Portugal)

OMIE – OMI-Polo Espanol S.A. (OMIE); CNE - Comision Nacional de la Energia (National Energy Commission); ERSE - Entidade Reguladora Dos Servicos Energeticos (Energy Services Regulatory Authority)

Evolution

- Amsterdam and UK launched national PXs in 1999 and 2000, respectively
- In 2001, UK launched APX-UK Spot later integrated with Amsterdam PX in 2003 to constitute APX
- National PXs were launched in the Netherlands (2005) and Belgium (2006)
- In 2008, APX-ENDEX company was formed after APX acquired energy derivatives exchange ENDEX
- In 2010, APX-ENDEX and Belgian PX got merged
- In 2013, APX-ENDEX got separated into two exchanges- APX (power) and ENDEX (gas)

APX



Salient features

- Concept of one European power exchange is next step of evolution with existing regional PX like APX being merged with others
- In 2015, APX got merged with EPEX Spot
- Next step is creation of Integrated Europe

Products

- Day ahead auction (~DAM)
- Intra-day auction (~IDM)
- UK Half-hour DAM

Currencies for settlement

- EUR & GBP

Ownership

- TenneT Holding BV (70.84%) & Elia System Operator NV (29.16%)

Governance

- Multi-layered governance structure comprising of Supervisory Board, Management Team & Market Development Advisory Board

Regulator

- ACM (the Netherlands), OFGEM (UK) & CREG (Belgium)

Integrated Europe – evolving market structure

European Commission aims to create a pan-European market with closer connection of power markets to improve efficient use of energy across national borders :

• Creation of ENTSO

- In 2011, 41 TSOs from **34 countries** came together to develop network codes to facilitate integration and harmonisation of European electricity market
- It will include system connection codes, market codes and system operations codes
- Each code will be submitted to European Commission for approval
- Subsequently, it will be voted into EU Law and implemented across member states

• Cross-border Intra-day (XBID) Market

- PXs and TSOs from 12 European countries (*Austria, Denmark, Germany, Belgium, Finland, France, UK, Italy, Luxembourg, Norway, Switzerland and Netherland*) initiated XBID project to cater to Intra-Day cross-zonal market
- This initiative will assist members to trade imbalances not only through available intra-day liquidity in national market but also from available liquidity in other areas

• Price coupling of regions (PCR)

- In 2009, 7 European PXs (APX, Belpex, EPEX SPOT, GME, Nord Pool Spot, OMIE and OTE) launched PCR initiative to calculate electricity prices across Europe and allocate cross-border capacity on a day-ahead basis
- PCR Cooperation and PCR Co-ownership Agreements were signed in June 2012
- In Feb 2014, TSOs & PXs in North-Western Europe (NWE) launched PCR.

Evolution

- Inter-Governmental MoU signed in 1994 established SAPP
- In 1995, 2 network links set-up via Botswana
- SAPP started short term market in 2001
- 2009: Launched competitive electricity market - DAM
- 2010: Operating guidelines finalized; SAPP fully operational

South African Power Pool



Products

- DAM, IDM & FPM (Forward Physical Market)

Settlement currency

- USD or ZAR

Governance

- Presently comprises of 16 utilities, independent transmission companies and IPPs from Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe
- Each member contributes an amount annually as agreed in Inter-Governmental MoU

Salient features:

- Inter-Governmental MoU gathered all national power utilities throughout region and defined the management & operating interactions
- Agreement between members defines operating rules and pricing

ZAR- South African Rand (Currency)

Key takeaways

Evolution history

- Initially, PXs may start operations in one or two countries. Subsequently, they may be expanded to other countries as RPX through merger & demerger or through acquisition of equity stake in national PXs

Ownership

- RPXs may have TSOs, national PXs, market operators and private parties as owners

Governance Structures

- RPXs should have robust, multi-level governance structures including supervisory boards, management team/board and advisory committees

Products

- Day Ahead Market (DAM) and Intra Day Market (IDM), a variant of Term Ahead Market (TAM), are the main products offered on all national and RPXs around the world

Settlement

- Popular practice of commercial settlement is through advance margins and **collaterals** as per the governing rules of the PX concerned

Market Surveillance

- To monitor trading activity with the aim to detect possible breaches with the prohibition against market manipulation and insider trading.



SARI/EI



South Asian Regional Power Trade through Power Exchange

Hourly complementarities- DAM may reap this opportunity

Demand Profile of South Asian countries

Demand In MWhr	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Bhutan	220	276																								
Nepal	589	1065																								
Bangladesh	5269	6884																								
Indian-Px's	4242	7872																								
			Very High	High	Medium	Low	Very Low																			

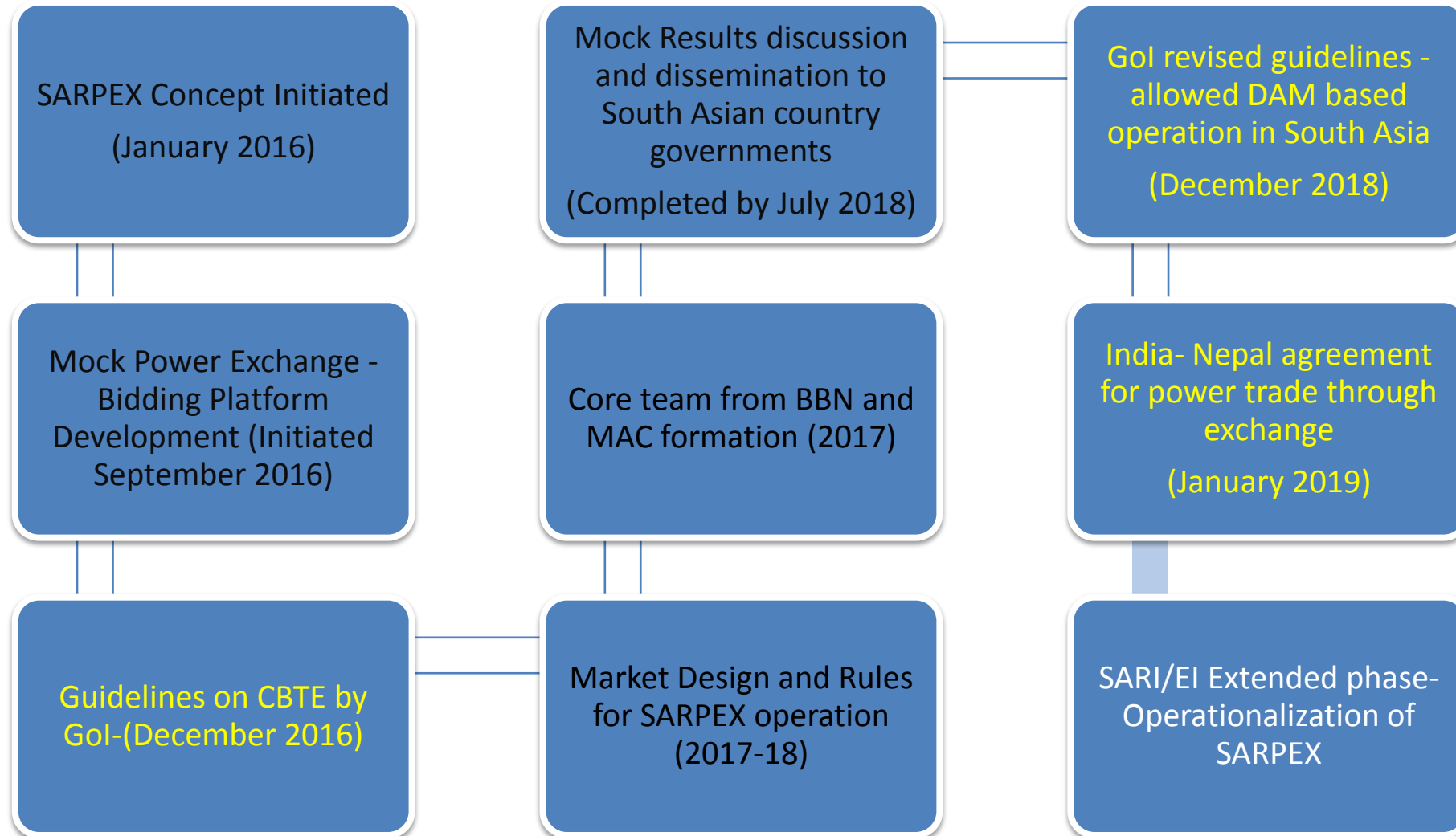
Based on 1st April 2015 Electricity Demand Met no's and IEX Market Clearing Volume

Country	% Variation in Average Monthly Demand
Bangladesh	45 - 50%
Bhutan	20 - 25%
India	8 - 10%
Nepal	10 - 15%

- The percentage variation of Average demand represents the increase in % over the minimum average monthly demand in an year.

Based on FY 2015 Electricity Demand Met no's.

Key Development- South Asian Regional Power Exchange (SARPEX)



SARPEX Mock Exercise

- Mock Day Ahead Market (DAM) created and run for 2015-2016.
- Participation of Nepal, Bhutan, Bangladesh and Indian (BBIN) Nations.
- Results generated and analyzed.
- Ascertain the desirability and feasibility of DAM in Cross Border Power Market
- Capacity building of BBN officials for handling exchange based trading.
- SARPEX web portal created for bidding and running of matching engine.

Capacity Building Programs

Capacity Building Program-1st (BBN)

- Session-1: Need of regional power exchange
- Session-2: Power Sector Overview of South Asian Countries
- Session-3: Cross Border Electricity Trade
- Session-4: Introduction to Power Exchanges
- Session-4: Key Processes in Power Exchange
- Session-5: Market Design and Rules for SARPEX
- Session-6: Proposed features of SARPEX
- Session-7: Bidding Strategy for Day-Ahead Market- Key Considerations for Bidding
- Session-8: Guidelines for Bid Preparation for SARPEX

Capacity Building Program- 2nd (BBN)

- SARPEX Mock exercise: Overview and Key results
 - Review of Bids submitted by participants
 - Results analysis
 - Social welfare for each country and South Asian region
- Impact of Capacity Building Workshops
- Way forward for SARPEX



USAID SARI/EI IRADe Integrated Research and Action for Development

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

Session Background:
Capacity Building Program on
South Asian Regional Power Exchange
(SARPEX) Mock Exercise
7th -9th February 2017
New Delhi, India



Impact of DAM based trade in South Asian Region

- Complementarities' justifying DAM in SA region.
- Social Welfare Maximization (10 Billion INR- SARPEX result).
- Price signals for investment growth in generation and transmission.
- Reduction in underutilized generation assets in power surplus nations.
- Reduction in power shortages in power deficit nations.
- Improve load- generation balancing nearer to real time.



USAID
FROM THE AMERICAN PEOPLE

SARI/EI



Way Forward- Operational Mechanism

- A Designated Trading Licensee to facilitate transaction/ Direct participation by Cross border entity
- If trading through Indian Trading Licensee, TL to
 - Register as client
 - Client should have a back-to-back agreement with a supplier.
- Delivery Point: Initially, Delivery point for all cross border transactions to be the Indian Periphery, the point of connection with the Indian Grid.
- NLDC to provide Available Transfer Capability for cross border capacity
- Transmission Curtailment – In accordance with Open Access Regulations as done for the current participant
- Deviation settlement through Indian Trading Licensee

REPORTS

Regional Power Exchange and Regional Power Market

