



STATUS OF NEPAL CROSS-BORDER INTERCONNECTION WITH INDIA AND EXPECTED BENEFITS

SOUTH ASIA REGIONAL WORKSHOP ON COMPETITIVE
ELECTRICITY MARKETS – DESIGN, IMPLEMENTATION
AND BENEFITS
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Outline of the Presentation

- Cross-border Nepal-India – existing transmission lines
- Nepalese power sector- proliferation of Private sector pushing towards operational modality of a Market
- Seasonal Surplus of Power in Nepal – necessitating power trade
- Recent Initiative by NEA – Purchasing Winter energy from Export Projects
- Understanding Indian Market for Power Export
- Nepal-India 400 kV transmission line – current status
- Long term Vision – Energy sufficiency and security for the region

NEPAL-INDIA EXISTING INTERCONNECTIONS

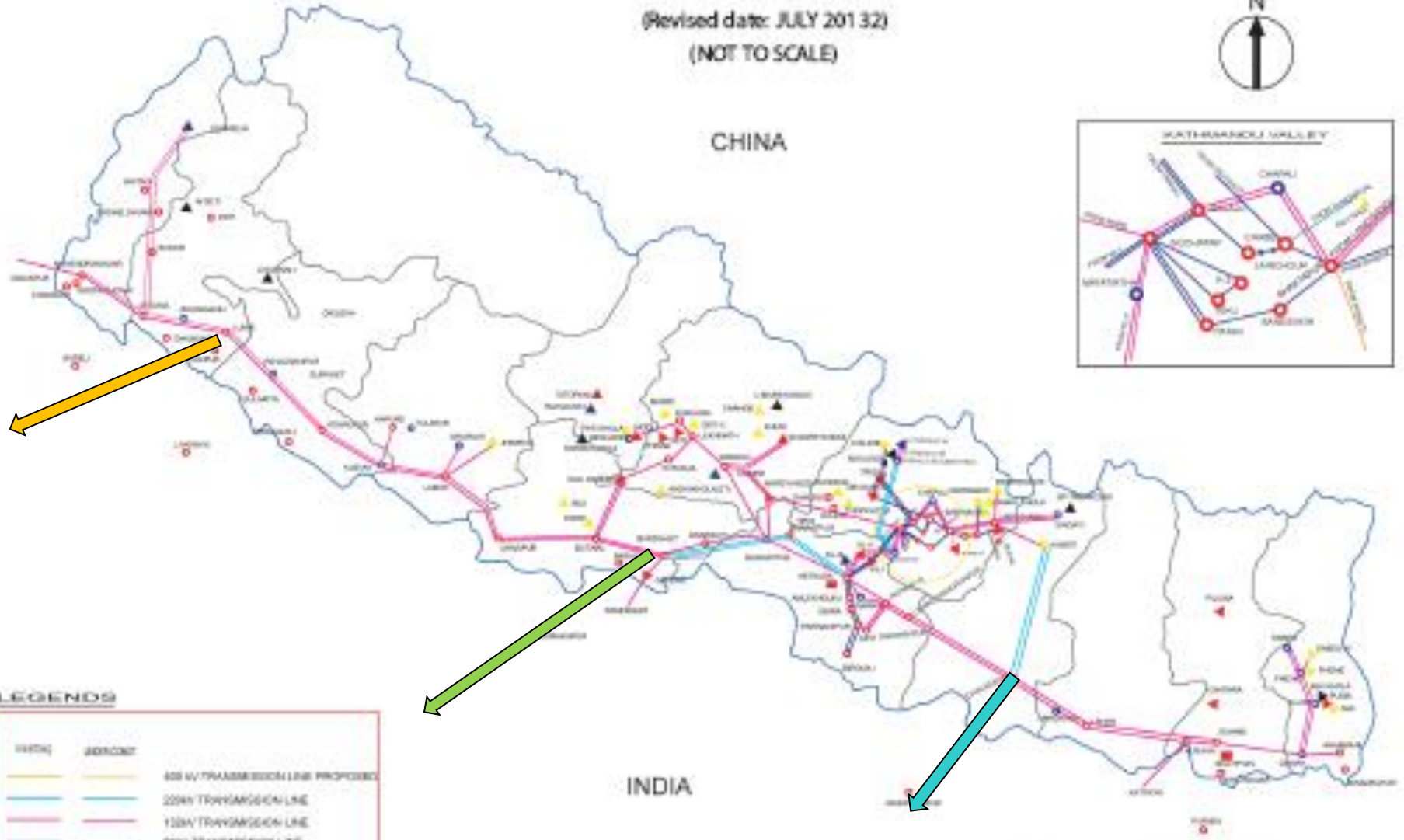
- 33 kV level – Radial connections at 14 points along the southern border districts of Nepal
 - Supplied by state electricity companies (holding companies) – appx. 50 MW
- 132 kV level – Radial connections at 3 points at East (Duhabi), Middle (Gandak) and West (Tanakpur)
 - Supply by State electricity companies and Power Trading Company (PTC) – appx. 130 MW

POWER DEVELOPMENT MAP OF NEPAL

EXISTING/UNDER CONSTRUCTION POWER STATIONS & TRANSMISSION LINES/ SUBSTATIONS

(Revised date: JULY 2013/2)

(NOT TO SCALE)



LEGENDS

LINE	STATION

NEPAL ELECTRICITY AUTHORITY
 GRID DEVELOPMENT
 TRANSMISSION LINE CONSTRUCTION DEPARTMENT
 Prepared by: Dr. Manoj Dagar (Internship)

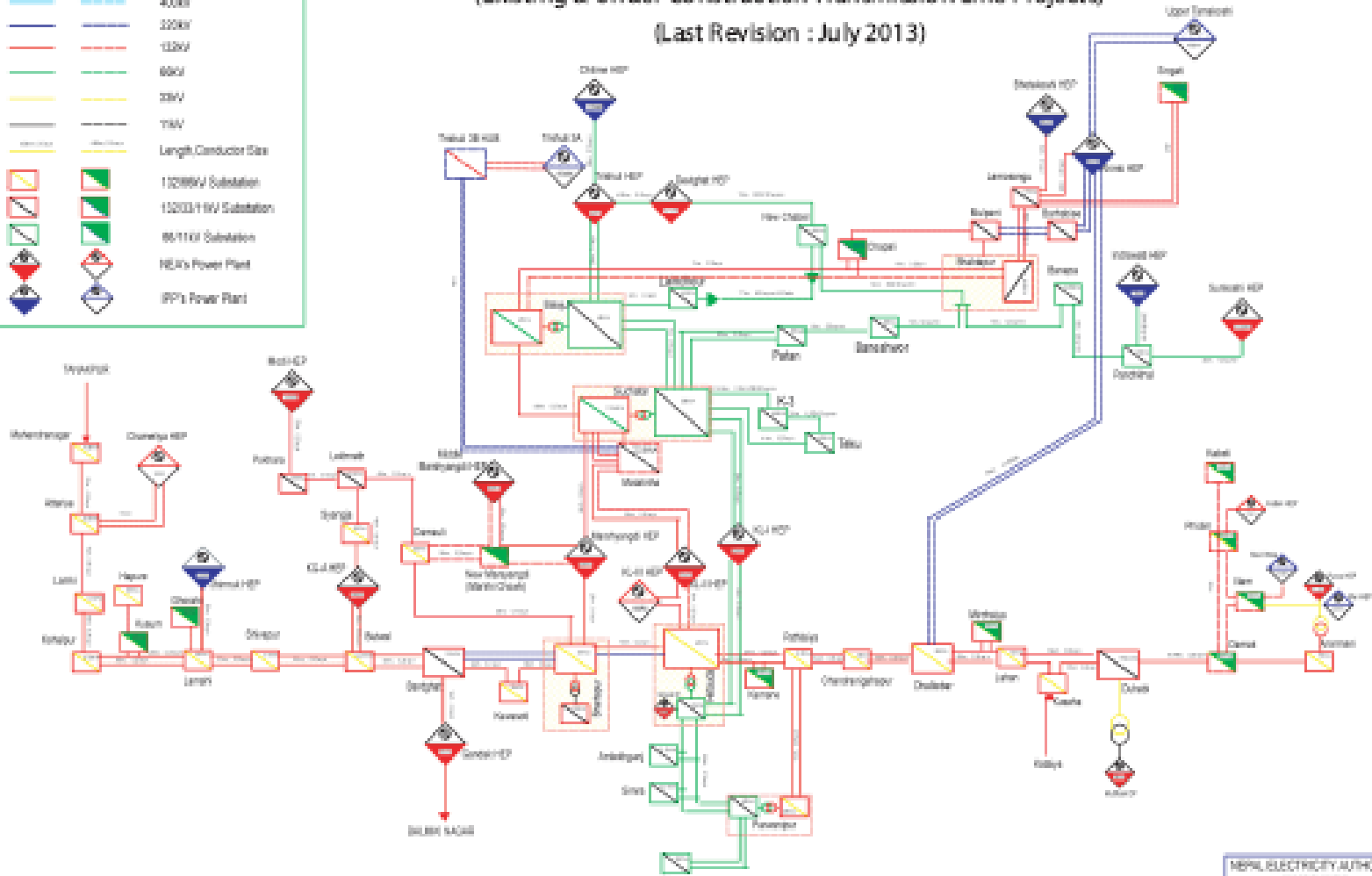
INTEGRETED NEPAL POWER SYSTEM

(Existing & Under Construction Transmission Line Projects)

(Last Revision : July 2013)

Legend:

Existing	Under Construction	Voltage Level
		400kV
		220kV
		132kV
		66kV
		33kV
		7.6kV
		Length, Conductor Size
		132/66kV Substation
		132/33kV Substation
		66/11kV Substation
		NEA's Power Plant
		IPP's Power Plant



One third of the Capacity is Private-owned,
More power plants in Private (35 nos.) than NEA (public utility)

Proliferation of Private Sector in Hydro Power Generation in Nepal

- 1999 till 2006 – 12 IPPs with total capacity of 168.5 MW
 - Major contribution by 2 IPPs with International investors totalling 104 MW
- After 2006 till 2009 (3years)- 9 IPPs with total 13.1 MW capacity
 - All are small IPPs with national equity and lending sources
- From 2010-2013 (4years) - 14 IPPs with total 64.8 MW capacity
 - All are small IPPs with national equity and lending sources

Proliferation of Private Sector in Hydro Power Generation in Nepal

- In **2014** - 44 nos of IPPs with total capacity of **221** MW are slated to come online
 - Some may be aborted, some may be delayed by a year. But there is definite acceleration in generation.
- In **2015** – 27 nos. of IPPs with total of **268** MW capacity planned for commercial operation –
 - Many may be delayed due to transmission line delays
- In **2016** – 15 nos. of IPPS with total of **691.3** MW capacity lined up for commercial operation
 - Possible Delays – financial closure and not enough equity
- In **2017** – 18 nos of IPPs with **346** MW- More PPAs are in line. The total capacity-on-line will increase.
- **Scenario – Private sector capacity is increasing – Larger projects but lesser number of developers**

Private sector in hydropower generation

- Hopes
 - Sufficient maturity and understanding of the sector by the Investors
 - Financial processes consolidated
 - Various instruments of capital available – Bonds, Debentures, Special Funds created for investment.
 - Special Purpose banks for long-term loans - HIDCL
 - High Public trust – Recent hydropower company IPO --90 times oversubscribed
 - Technical maturity
 - Manageable Local/ community issues

Private sector in hydropower generation

○ Despairs

- Tariff not in step with Inflation, Rate of return is low, Most projects have cost overruns and time overruns
- No pass-through of costs to consumers – So Purchase tariff by NEA is also tethered
- PPA in dollar/convertible currency – poses the USUAL problems – Who bears Risks?
- Regulations need to be simplified– Different govt. entities – forestry, environment, tax office, customs, licensing and PDA etc.

Next Issue - Seasonal Surplus of **Clean Energy** from Private Sector

- By 2016 end –
 - New IPPs with 1200 MW are slated for operation
 - If 25% casualty is assumed, still **900** MW will be available.
 - Nepal Electricity Authority will add **104** MW
 - Existing capacity of **720** (hydro) MW
 - Total Nepal System capacity in Wet season (Peak Generating capacity) – **1720** MW
 - Change of status by 2016 end/ 2017 wet season *allowing 1 year delay* (FY 2016/17)
 - – from net Deficit to Surplus in Wet season (**>500 MW**)

Capacity scenario – Post 2015

Wet season – (May – November)

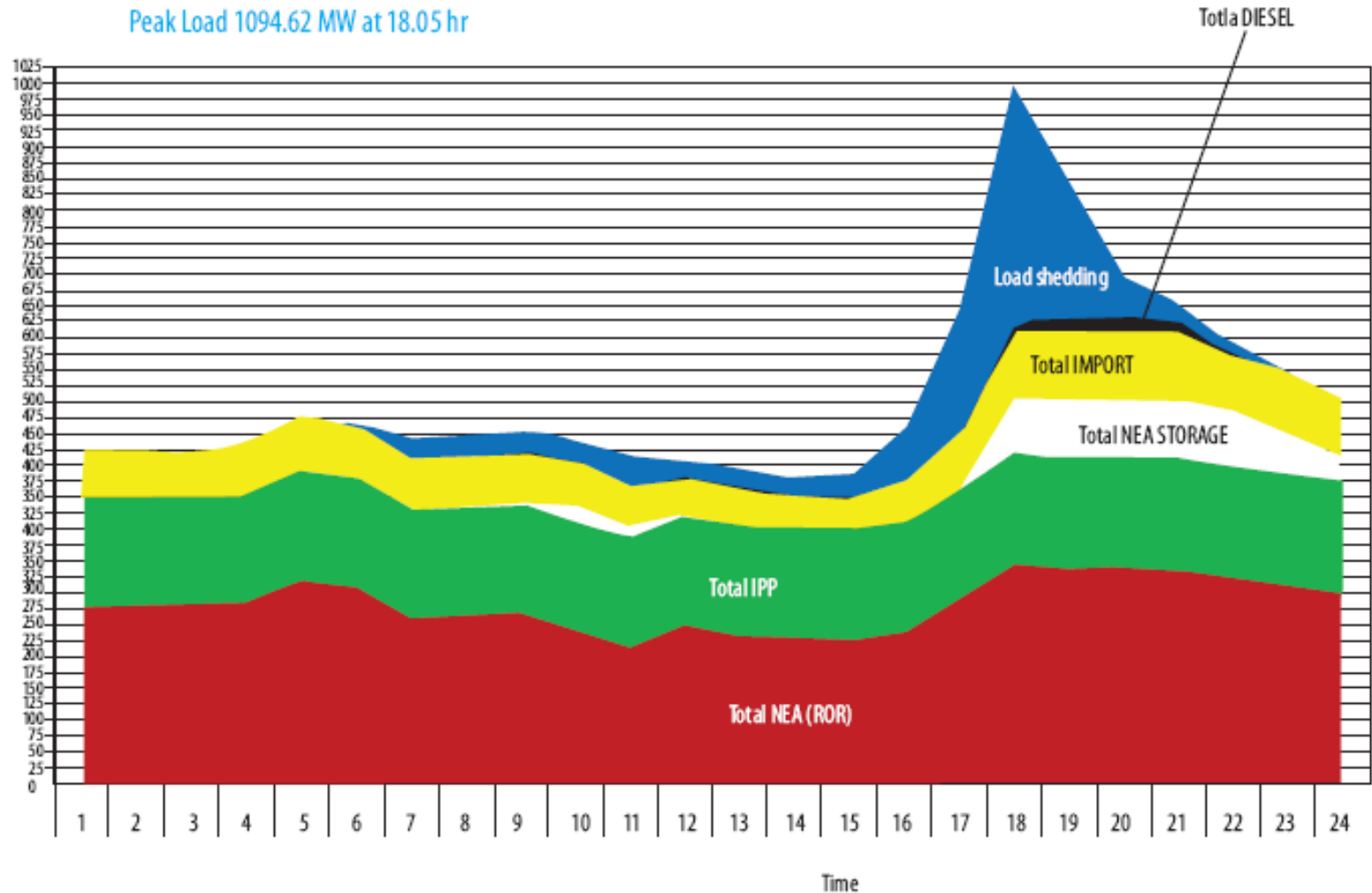
Nepal Energy			Wet Peak		Wet Off-Peak	
FY	Generation (MW)	Import from India (MW)	Load (MW) w/o trans loss	Surplus Power (MW)	Load (MW)	Surplus Power (MW)
2015-16	1278	150 (Peak)	1400	0	700	530
2016-17	1710	None	1530	129	800	900
2017-18	1926	None	1748	116	900	1000

Daily Load Curve – Peak and Base Load variation

System Load Curve of Peak Load Day

November 13, 2012 Tuesday

Peak Load 1094.62 MW at 18.05 hr



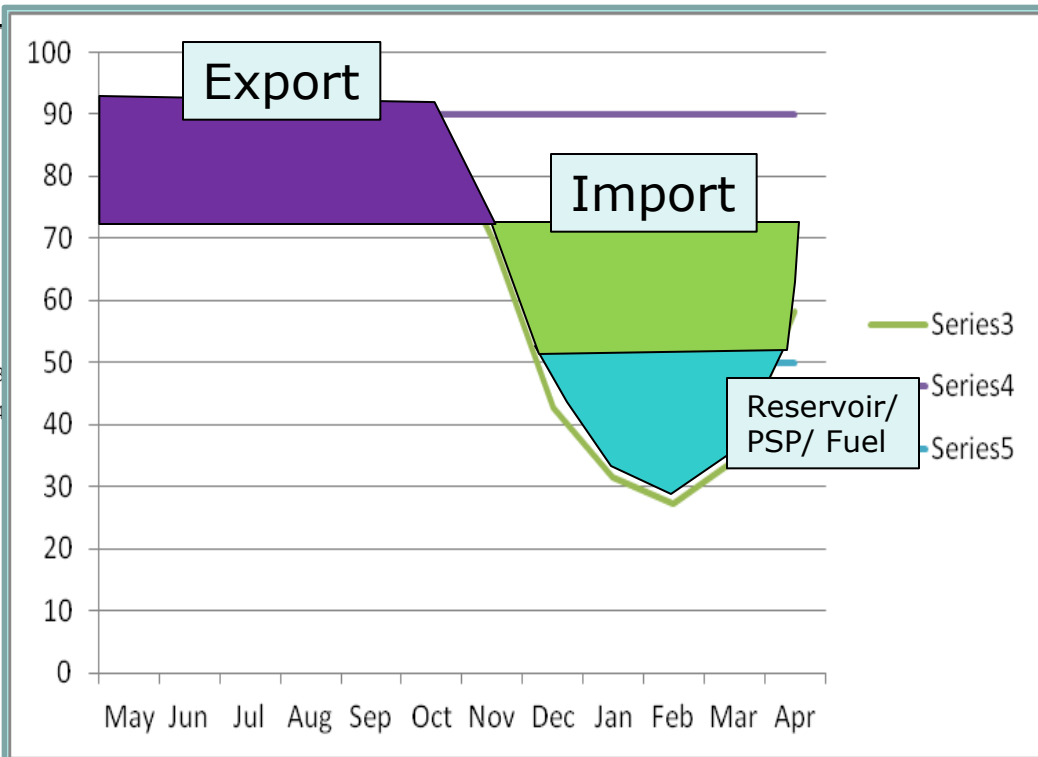
Capacity scenario – Post 2015

Dry season – (December – April)

Dry Season			Dry Peak		Dry Off Peak	
FY	Generation (MW)	Import from India (MW)	Load (MW) w/o trans. Loss	Load Shedding (MW)	Load (MW) w/o Trans loss	Surplus
2015-16	<970	150 (Peak 6 hours)	1398	300	700	250
2016-17	<1418	150 (Peak 6 hours)	1531	60	800	550
2017-18	<1594	150 (Peak 6 hours)	1702	100	920	600

Access to Market and Trading will remove Load Shedding, and contribute to Clean Energy for the Region

Himalayan River based ROR/PROR type projects and Need for Electricity Market integration



Capacity curve for Projects designed at Q40 exceedence

Recent Initiative by NEA – Purchasing Dry/ Winter Energy from Export projects

- Bidding notice was published (February 2014) for supplying energy for only 5 months (mid Dec – mid May)
- Energy to be delivered from 2020.
- Ceiling price NRs 10.60/unit (INR 6.625) without any escalation.
- No contract period specified.
- No convertible currency, currency risk born by the seller
- Wet energy (7 months) – no obligations of NEA, the Project to evacuate power to India/Region on its own
- Support the system as a Virtual annual Reservoir₁₅

Recent Initiative by NEA – Purchasing Dry / Winter Energy from Export projects

- **5** projects offered their energy – total capacity **1680 MW**
- Total Energy in 5 months – apx. **1975 GWH** (averaging 550MW dry capacity)
- **2** projects in the **West** of Nepal – connecting to Kohalpur s/s at 400 kV
- **2** projects in the **central** Nepal – connecting to the 220 kV Marsyangdi corridor s/s
- **1** project in the **eastern** Nepal connecting to the Dhalkebar s/s 220kV
- All project offering to complete within **2020** and prices within **NRs 10.60/unit**
- Further negotiation and discussions regarding project feasibility, reliability , terms of sale going on.

WHAT IT ALL MEANS -> REGIONAL MARKET FOR ELECTRICITY

- Long term PPA with IPPs – required by Banks
- Creates for NEA an obligation to pay due to Take-or-Pay conditions
- Differential tariff
 - Dry season - Rs 8.40 with 3% x 5 times escalation till Rs 9.66 / unit
 - Wet season - Rs 4.80 till Rs 5.52
 - = > IRs. 3.00 till IRs.3.45
- Wet season energy export at lower rate is paid for by higher tariff of domestic dry season energy
- Still the Indian Market is priced low for export
- Long term contract for Seasonal energy blocks– 6 months Firm power – Instrument to be designed? Explore Indian Market ??
- Alternative for Nepal summer energy – Isolate certain systems and supply to Tibet/China – **Not feasible**, load centers are distant (>300-500km tr line for seasonal energy – not economic)

Understanding Indian Energy Market for Export potential

- Short Term Energy Market
 - - Exchanges markets – day-ahead and short-term prices
 - - Licensed Traders – PTC , Global Energy etc.
 - - Unscheduled Interchange (UI) as a balancing market
 - - Bilateral power transactions directly with DISCOMS/ Producers
- Volume of trade is about 11% of total load and increasing.
- Traders and Exchanges – more than 60% of that pie.

Understanding Indian Energy Market for Export potential – Short Term

- Short Term Energy Market
 - Not suitable for off-loading seasonal energy from Long term PPAs
 - Not suitable for Export-oriented IPPs, as the Project will not be Bankable
- IPPs can not build upon this market - Banks not yet ready for Merchant Projects.

- Short Term Prices decreased from 2008-2011
- Then stabilised at around INR 4.3 for Traders and INR 3.6 for Exchanges
- (reference Report on Short term power markets in India 2012- 2013)

Understanding Energy Market for Export potential – Long Term

- Long term – via Traders and Bilateral transactions
- Case I and II bidding by central/state electricity companies
 - Prices varied according to source
 - Average INR 1.19 to 4.28 / kwh for lignite/coal based stations
 - Average between **INR 0.77 to INR 5.9** / kwh for hydro stations
 - Long term prices – INR 2.345 – INR 3.324
 - Medium term – INR 4.1 – INR 4.85
- Medium term prices normally higher
- Medium term Bilateral Transactions with neighboring State companies and through PTC to rest of the market – **is it the way to go?**
- **Welcome Signals** - Recent removal of Restriction of Import upon electricity
- **More signals sought** – participating in the market eg. In the bidding for Long term energy.

Energy markets of India and Nepal – made for each other

- Indian market – 25% Hydro, 5% nuclear, 10% gas, predominantly coal (total 170,000MW installed, about 120,000MW delivered)
 - Coal prices are rising, coal is getting deeper, low quality, causing more imports. Not sufficient coal mining
 - Thermal power plants down-time is high, requiring longer period of maintenance shutdowns
- Indian peak load in summer appx.112,000 MW in 2013 in summer and appx.102,000 MW in winter, with a difference of 10,000 MW
 - Indian Hydro-power stations –lower productions during winter.
 - Still room for shutting down more thermal stations in summer using neighbor's hydropower.
 - Export from Nepal will allow that much thermal stations – for maintenance shutdowns .
- **Medium Term contracts** may be best suited for this exchange arrangement ?
- Helps to **bring down the higher prices of energy in India in summer**

Nepal-India Cross-border transmission line - necessary step towards a regional electricity market

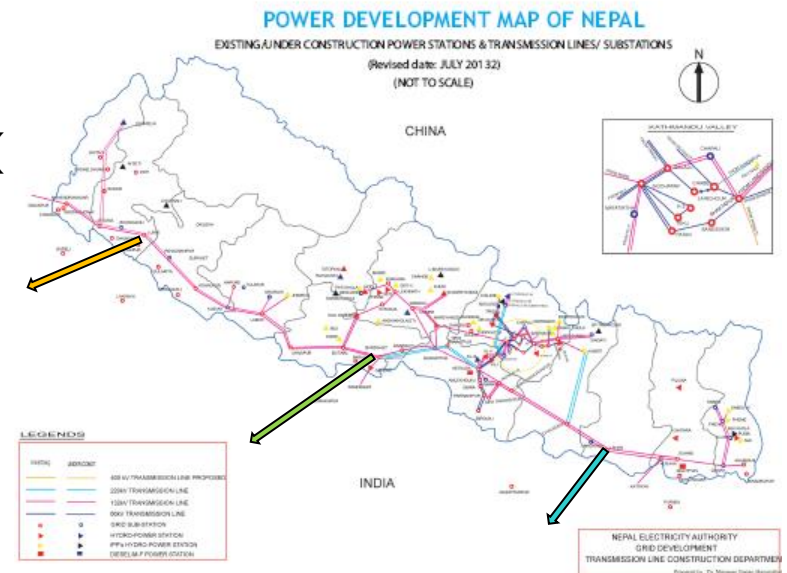
Three CBTL are under consideration –

- 400 kV DC Dhalkebar – Muzaffarpur
- 400 kV DC (Butwal / Bardghat) – southwards (Gorakhpur)
- 400 kV DC (Kohalpur) – southwards (Bareilly)
- Two more lines in the East / planned
- 400 kV DC trunk line East-West under construction

○ One CBTL is under construction

- 400 kV DC from Dhalkebar (Nepal) to Muzaffarpur (India)
- Features – 40 km in Nepal, 100 km in India
- Double Circuit Twin-conductor, Moose
- Initially to be charged at 220 kV

○ Further CBTL as transaction increases



Dhalkebar-Muzaffarpur 400kV CBTL

- Two JVC created for two sides of the line
- Power Transmission Company Nepal PTCN – **Nepal Side.**
- Crossborder Power Transmission Company (CPTC) – **India side**
- The JV companies shall develop, own, operate and maintain the CBTL of respective sides.

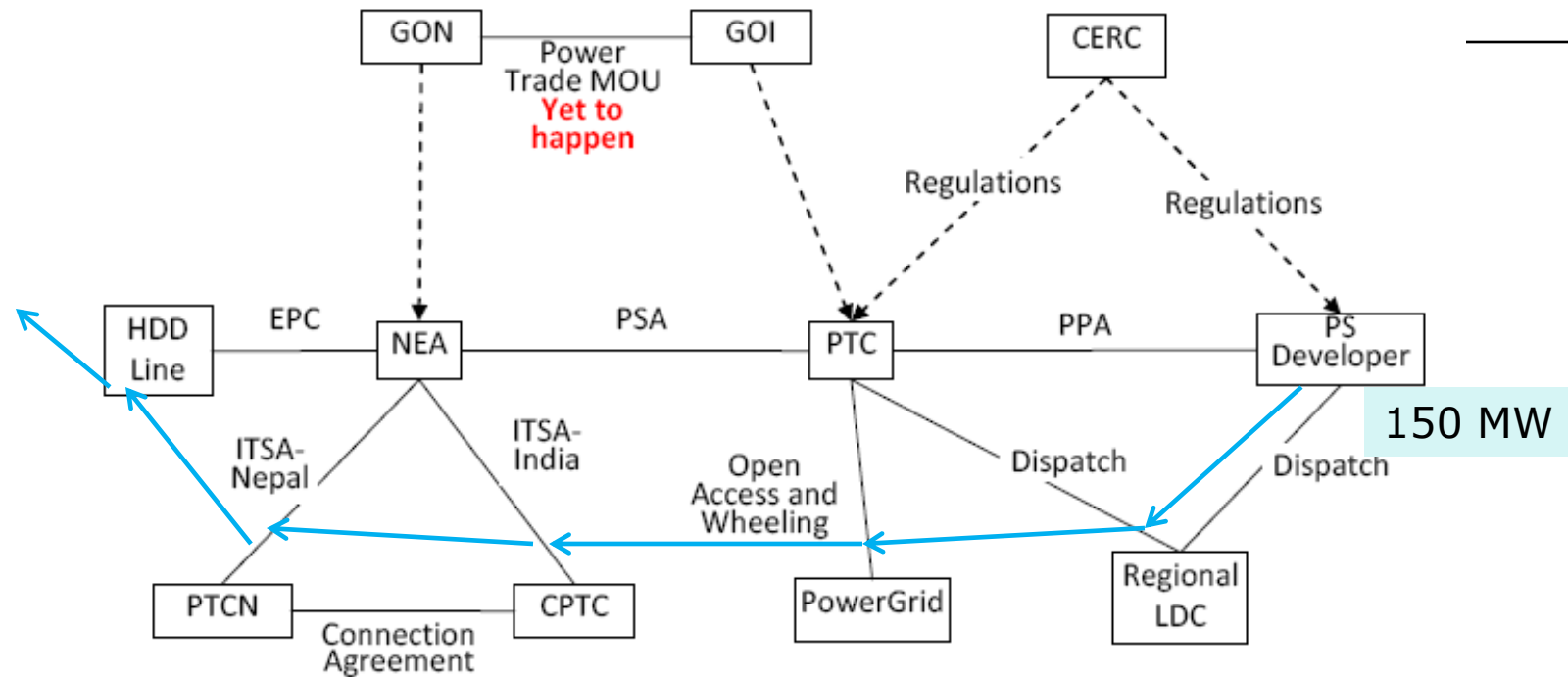
PTCN shareholding

- NEA: 50%
- Power Grid India: 26%
- HIDCL 14%
- IEDCL India: 10%

CPTC shareholding

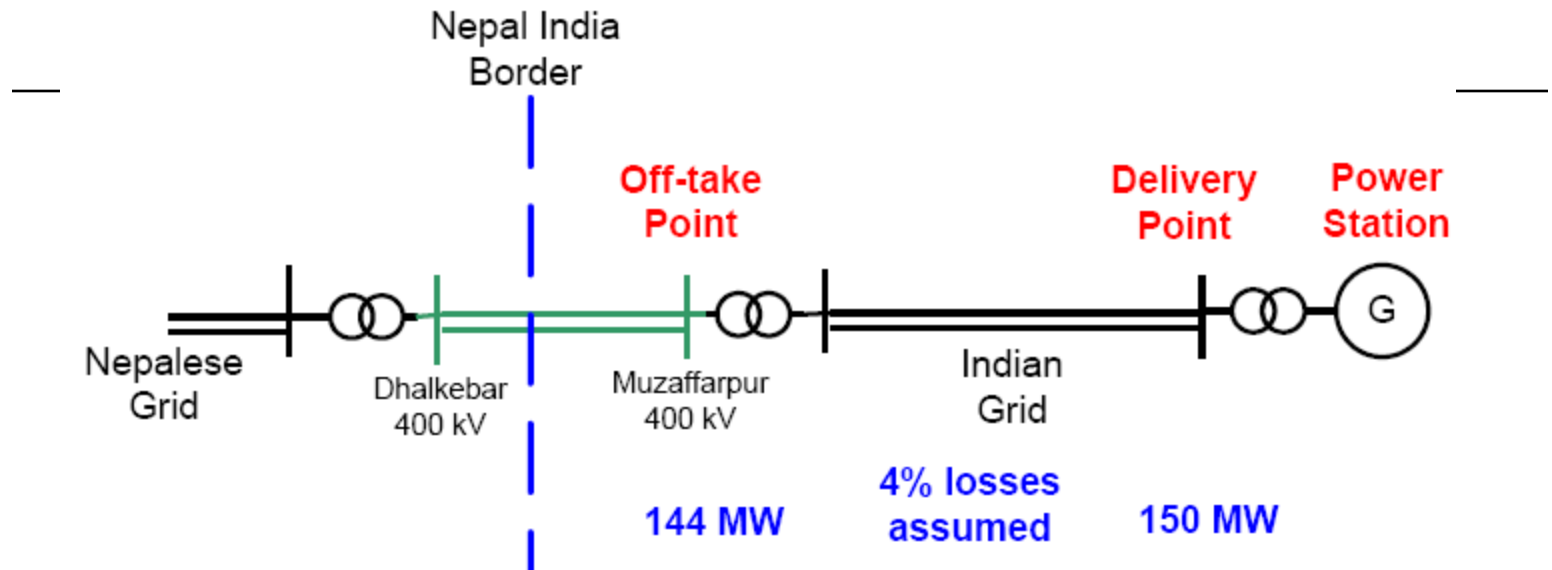
- Power Grid India: 26%
- SJVNL: 26%
- NEA: 10%
- IL&FS India: 38%

Dhalkebar-Muzaffarpur 400kV CBTL



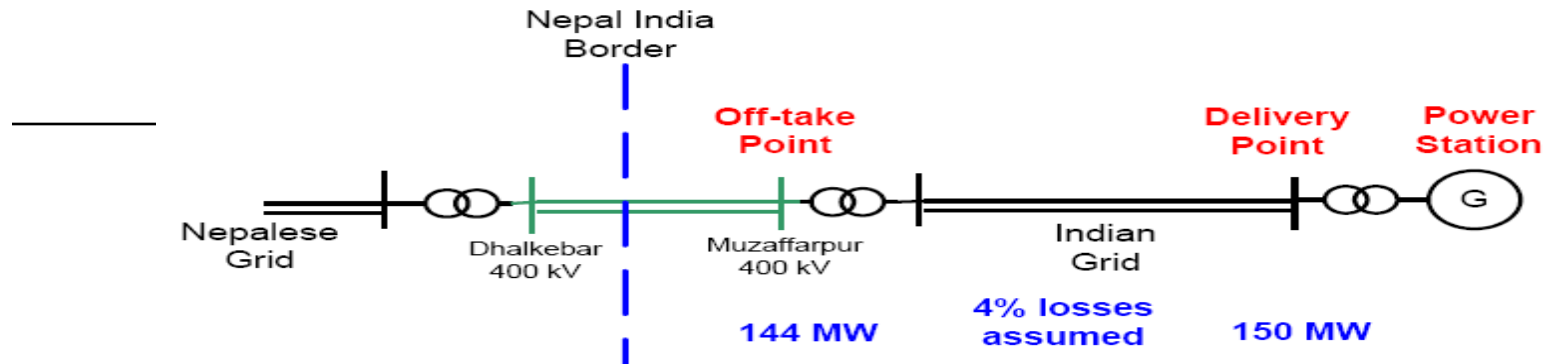
- NEA signed PSA with PTC (India) for **150 MW for 25 years** – that made the CBTL financial closure (*December 2011*)
- NEA signed ITSA with both PTCN and CPTC (*December 2011*)
- NEA has booked full transmission capacity of the lines, and shall pay the TSC
- NEA can contract with IPPs in Nepal / India and PTC for export/import using the transmission capacity

Dhalkebar-Muzaffarpur 400kV CBTL



- Under PSA, the Delivery Date – 2015 June 12th (Not later) take or pay or resell
- The Nepalese grid – substation, and transmission lines should be ready
- The Indian side (Muzaffarpur line bays are assumed as ready)
- The Line will be initially charged at 220 kV.
- At Dhalkebar (Nepal) , 220/132/33 kV substation is under construction to evacuate the power to rest of national grid.

Dhalkebar-Muzaffarpur 400kV CBTL

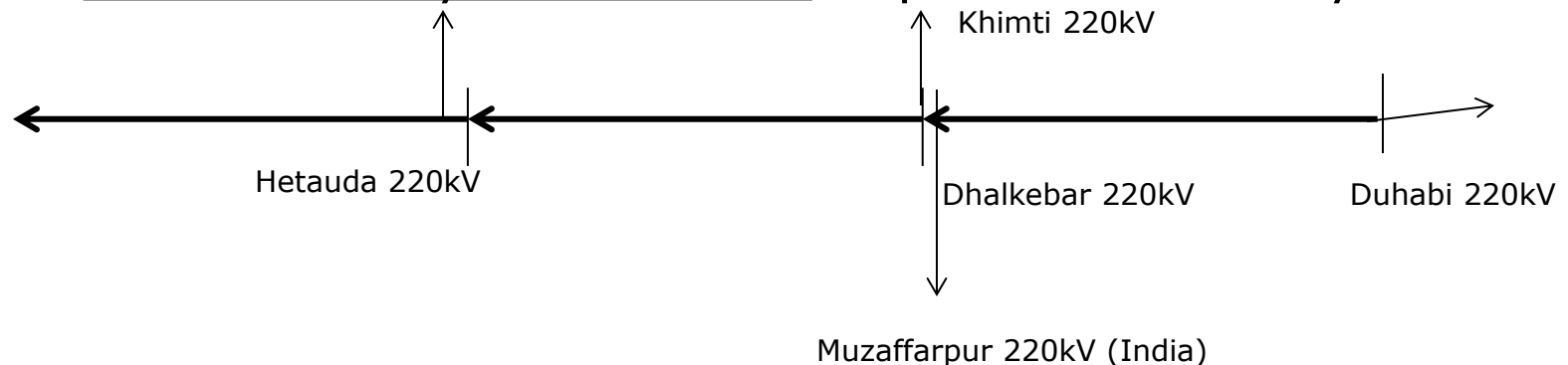
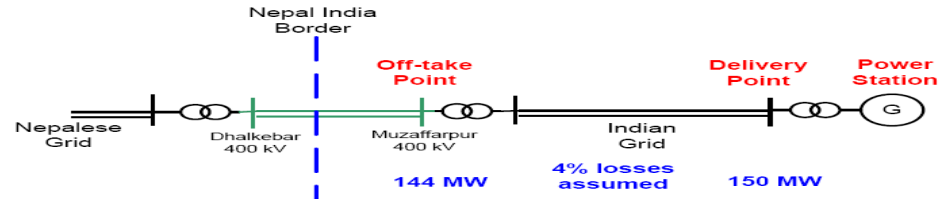


- PTCN – contract signed for transmission lines (40 km) – 19 December 2013 - Completion Period – 16 months
 - Contractor - Tata Projects Limited
- Probable Operational date - **May 2015**
- CPTC – contract signed (100 km) – 4 February 2014
- Completion period 16 months
- Probable Operational date – **May 2015**

Dhalkebar-Muzaffarpur 400kV CBTL

Progress

- **Route survey** completed
- **EIA** of the line completed
- Consultant – approved Tower profile, Check Survey of the line
- **Land Acquisition** – 11 hectares- planned to complete this FY
- If no community disturbance – operational in May 2015



- Necessary work in Nepal for evacuation -
- Duhabi-Dhalkebar-Hetauda 220 kv line and substation project
- Substation with 220/132/33 kV transformer at Dhalkebar

Duhabi -Dhalkebar- Hetauda 220 kV Nepal Grid

- Project finance from World Bank
- Survey, EIA, Design completed
- Tr Line Tender floated, under evaluation.
- Completion Period 19 months. (by 2015 end)
- Substation project need to be completed earlier
- 220/132/33 kV Transformer tender floated

- Khimti-Dhalke 220 kV line – almost complete, but charge at 132 kV
- 220/132 kV substation – probable delays

- All of above works must be in place by 2015 end for full utilization of the CBTL

Nepal Experiences with Indian power grid / market

- Exchanges – From State Electricity companies (Bihar) (Kataiya and Balmikinagar)
- Bulk Consumer (Bihar, UP) w/o capacity charges
- RTC trading contracts (from PTC) - Tanakpur
- PSA (from PTC) – Muzaffarpur/Dhalkebar, also from Tanakpur if required.
And from other points along border if Open access / deregulation reaches to State / distribution levels
- **NEXT**
- Reverse roles at CBTL – Export to India (still as two grids with a Tie-line)
- Interspersion of the Grid – feeding some area from Nepal, and some area in Nepal from India as usual avoiding Loop flows.
- Nepalese grid supplying to border areas using existing 132 kV lines –
 - Define transmission charges within NEA Grid – need for regulations
 - To Operate as a single market, through a distribution company ?
 - **When Retail sale of power through the market is realized in India, Nepalese and Indian power system may be truly integrated in one market.**

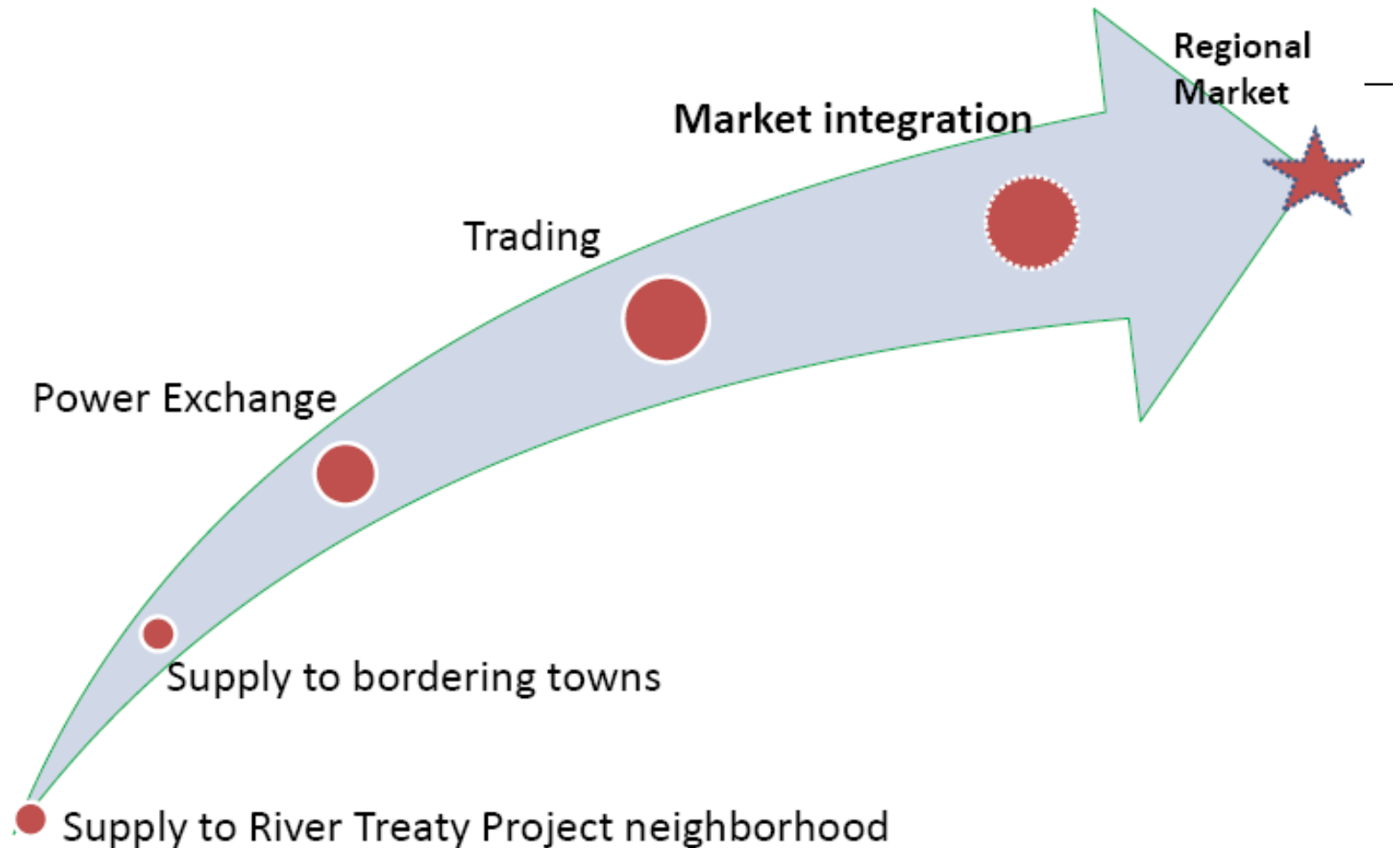
LONG TERM VISION – ENERGY SUFFICIENCY AND SECURITY for THE REGION

- The Key – Regional Electricity Market and access to the Market
- G-to-G Power Trade agreements, and Regional (SAARC) Power Trade Agreements
- Uniformity of Grid Code – harmonization for synchronous operation – single Grid
- Policy in Transmission charges for export to third country - Transmission pricing, Point of connection or Nodal pricing?

LONG TERM VISION – ENERGY SUFFICIENCY AND SECURITY for THE REGION

- Nepal power sector – ready for unbundling
- Legislation to that effect (unbundling and a regulatory commission) is waiting in the parliament, and its passage has been promised by the parties to the government.
- Indian CEA, CERC and PGC should take lead to formulate Regional Grid operation, Grid code, Pool operation, and fill in regulatory gaps in the nations,
- Lead the region towards a Market Formation, market clearing and financial arrangements – and ***allow a mix of the regional energy sources to ensure energy sufficiency for the region, efficient energy economy, and thereby, Sustainable Energy Security for itself and South Asia***
- *(All roads lead to Rome, so they said then. Here and now in electricity, it leads to Delhi)*

Towards a Regional Electricity Market



**Every Journey began with a single step !
Good bye! See you in the Market!!**