

# “South Asian Regional Electricity Markets” – Nepal’s Perspectives

1<sup>st</sup> meeting of task force 3

Mumbai

29<sup>th</sup> – 30<sup>th</sup> April 2014

Sanjeeb Baral

Ministry of Energy

Nepal

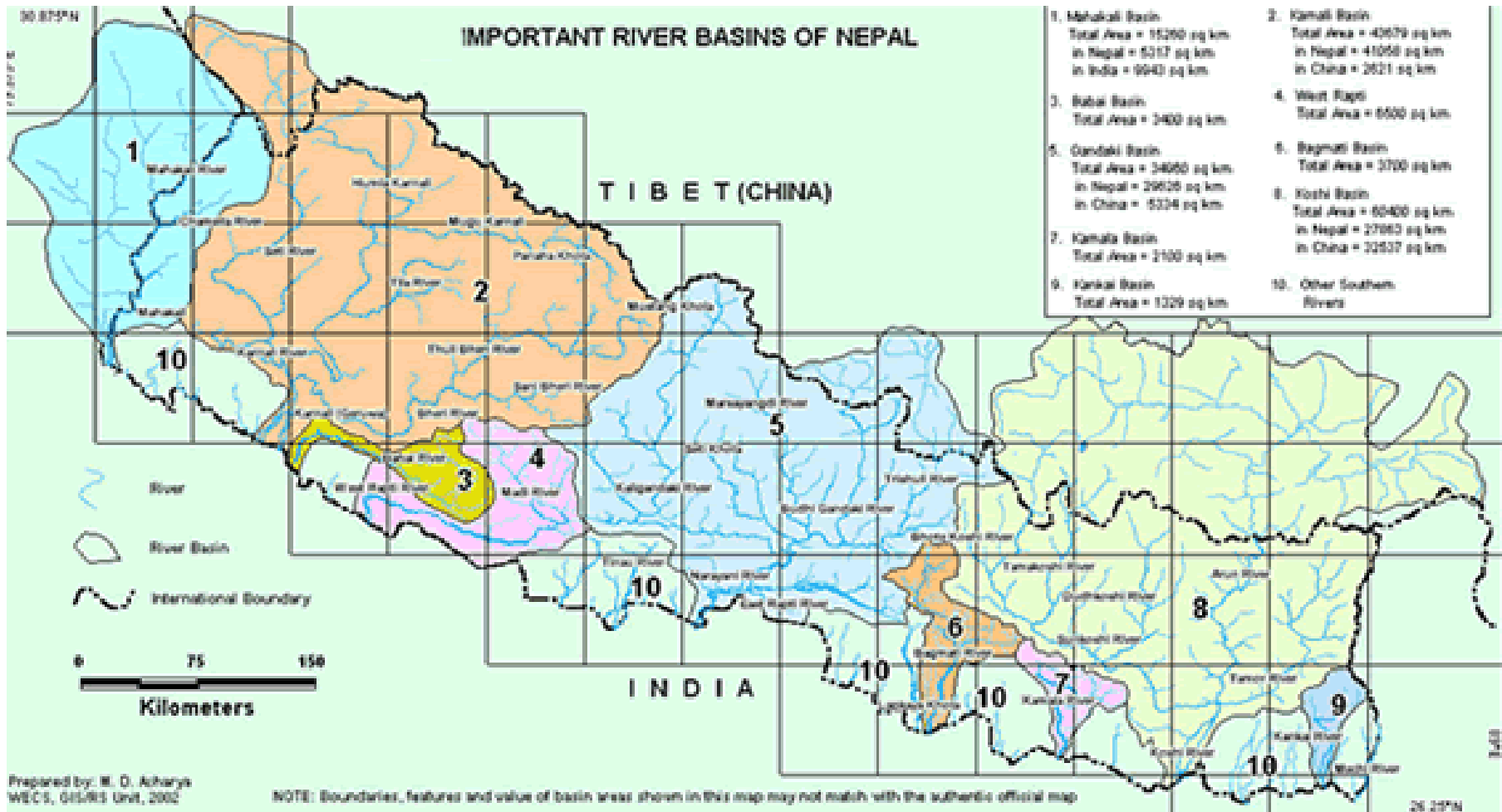


# Presentation Outline

- Hydropower Potential
- Present Scenario
- Potential Projects
- Demand and Supply Situation
- Present Modes of Import
- Internal and External Markets
- Key Issues : Nepal's Perspectives



# Hydropower Potential





# Hydropower Potential

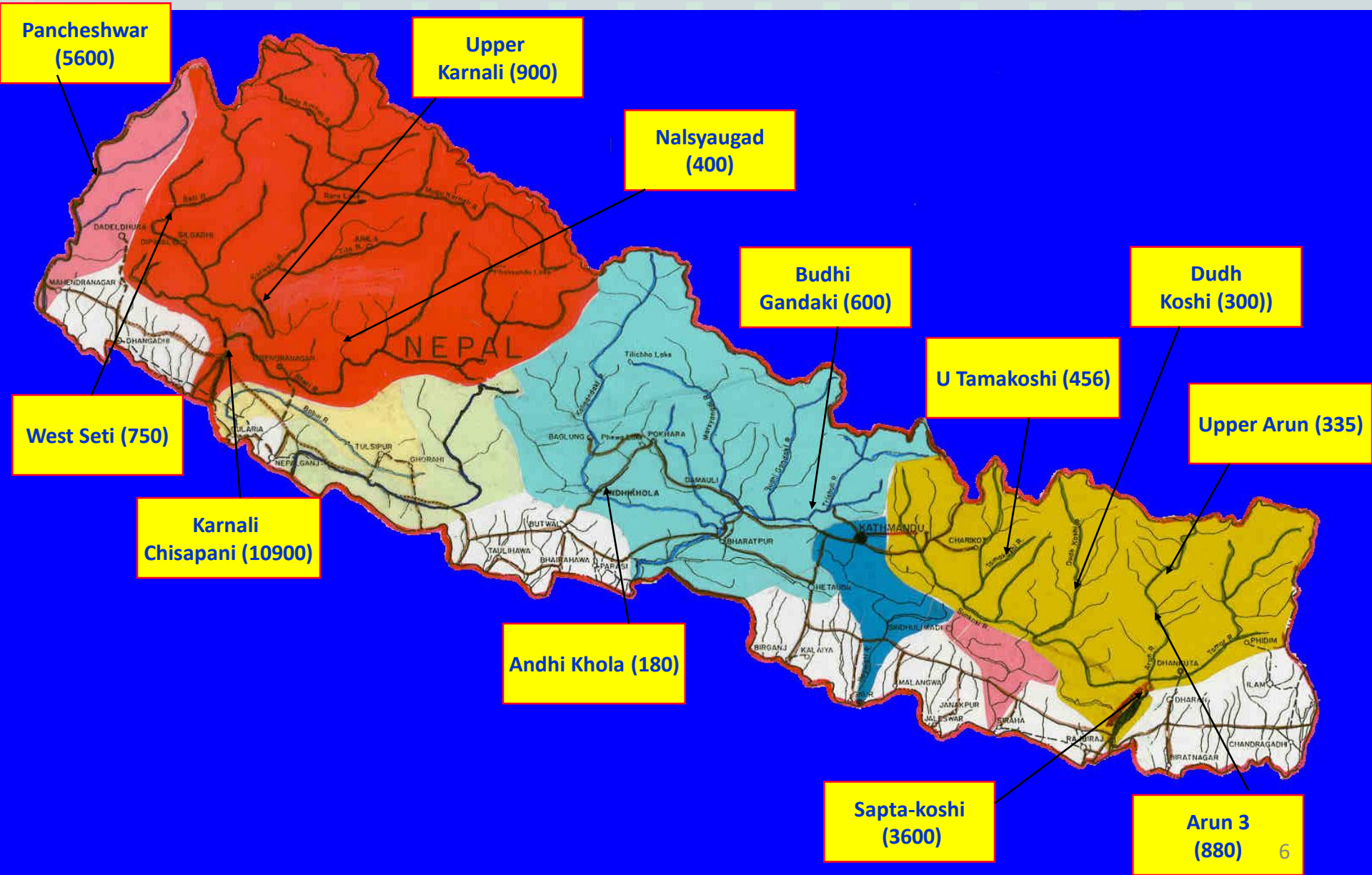
Name of basin	Theoretical Potential (MW)	Technically Feasible (MW)
Sapta Koshi	22,350	10,860
Sapta Gandaki	20,650	5,270
Karnali-Mahakali	36,180	25,100
Southern Rivers	4,110	880
<b>Total</b>	<b>83,290</b>	<b>42,130</b>



# Present Scenario

Status	NEA	IPP
Under Operation ( 718 MW)	<ul style="list-style-type: none"><li>• 478MW</li><li>• 66%</li></ul>	<ul style="list-style-type: none"><li>• 240 MW</li><li>• 34%</li><li>• 35 Projects</li></ul>
Under Construction (1220MW)	<ul style="list-style-type: none"><li>• 862 MW</li><li>• 9 projects</li></ul>	<ul style="list-style-type: none"><li>• 358MW</li><li>• 37 projects</li></ul>
PPA Concluded	IPP – 502 MW ( 67 projects)	
Issued survey license	9043 MW ( 326 nos)	
Large Projects in Pipeline	3,900 MW (including Arun III, Upper Karnali, Lower Arun, Tamakoshi III, Upper Tamor, Upper Marshyangdi, etc.	
Other Large projects	Karnali chisapani; Pancheshor; Koshi etc	

# Projects





# Projects for Domestic Demand

Projects with involvement of international investors for domestic market at advanced stage:

- Lower Solu HEP (82 MW)
- Marsyangdi HEP (50 MW)
- Kabeli HEP(37 MW)
- Likhu PRoR HEP (120 MW)
- Belephi HEP (50 MW)



# Project for Domestic Demand

Storage for seasonal and peaking needs:

- Upper Seti (Tanahu ) Reservoir Project (127 MW)
- Aandhi Khola Reservoir Project (180 MW)
- Budhigandaki Reservoir Project (600 MW)
- Nalsyaugad Reservoir Project (400 MW)
- Tamor Reservoir Project (400 MW)

Some Others:

- Upper Arun RoR Project (335 MW)
- West Seti (750 MW) MOU with Three Grazes China
- Dudhkoshi RoR Project (300 MW)
- Budhiganga RoR project (20 MW)
- Simbuwa RoR Project ( 80 MW)





# Projects for Export

- Export power projects to be developed by international developers (Concession agreements are underway) ;
  - Upper Karnali PProR project (900 MW): GMR (India)
  - Tamakoshi-3 PProR Project (800 MW): SN Power (Norway)
  - Arun III PProR Project (880 MW): Sutluj (India-public)
  - Himtal ROR Project (600 MW) ): GMR (India)
  - Lower Arun RoR Project (400MW): Engevix (Brazil)

# Current FY (2070/71 – 2013/14) : Demand and Supply



Month	Demand	Supply	Deficit (MW)
	MW	MW	
Paush (Dec- Jan)	1165	676	489
Magh (Jan- Feb)	1197	647	550
Falgun (Feb – Mar)	1197	600	597
Chaitra (Mar- Apr)	1159	614	545
Baisakh (Apr-May)	1159	664	495
Jestha (May- Jun)	1159	808	351

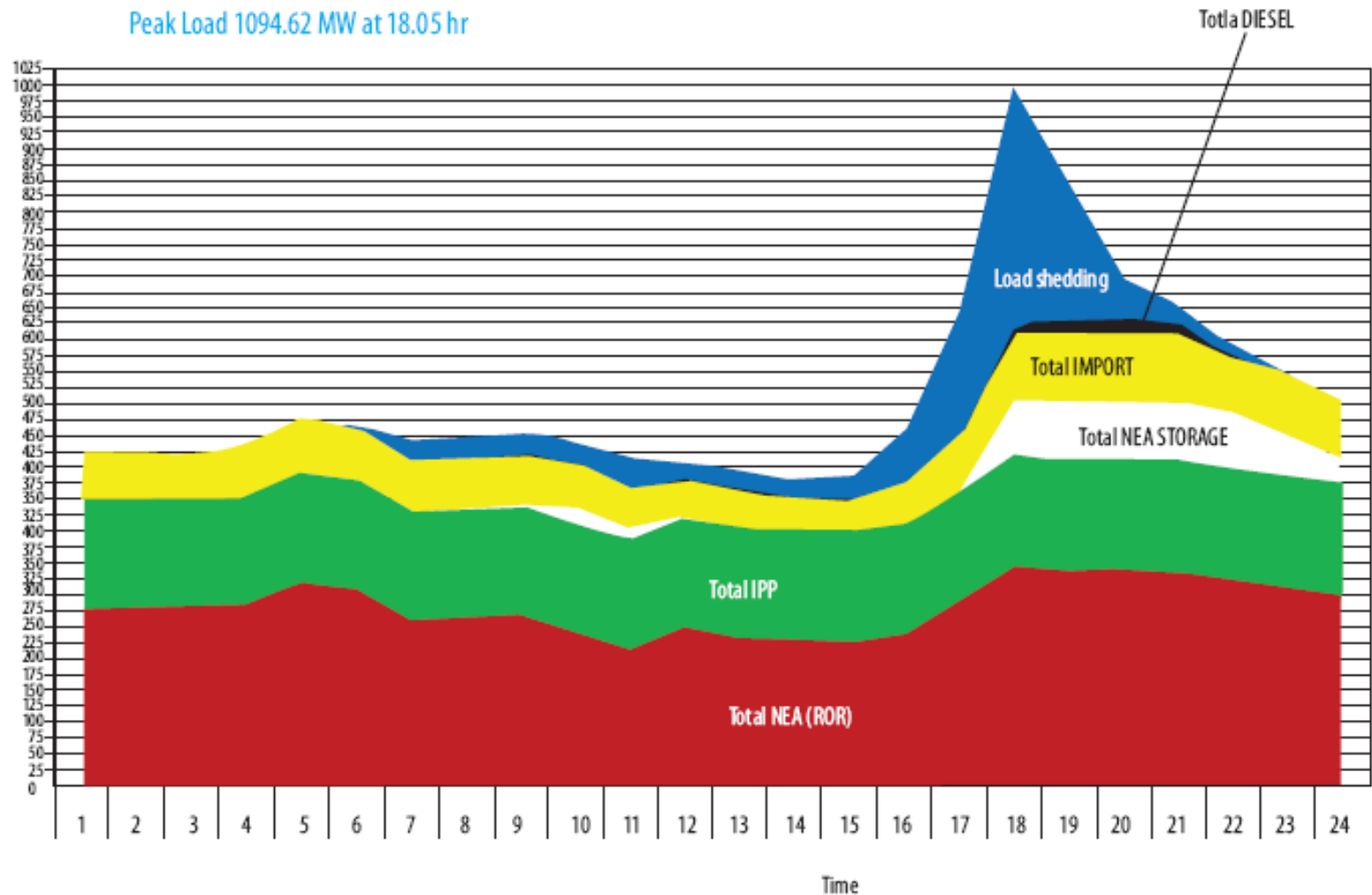
# Daily Load Curve



## System Load Curve of Peak Load Day

November 13, 2012 Tuesday

Peak Load 1094.62 MW at 18.05 hr



# 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	<b>0</b>	700	<b>530</b>
2016-17	1710	None	1530	<b>129</b>	800	<b>900</b>
2017-18	1926	None	1748	<b>116</b>	900	<b>1000</b>

# 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	<b>&lt;970</b>	<b>150</b> (Peak 6 hours)	<b>1398</b>	<b>300</b>	<b>700</b>	<b>250</b>
2016-17	<b>&lt;1418</b>	<b>150</b> (Peak 6 hours)	<b>1531</b>	<b>60</b>	<b>800</b>	<b>550</b>
2017-18	<b>&lt;1594</b>	<b>150</b> (Peak 6 hours)	<b>1702</b>	<b>100</b>	<b>920</b>	<b>600</b>



# Cross border: Current Modes

- Free Power under Major River Treaty
  - Mahakali Treaty 70 Million Units/year (30MW)
  - Koshi Treaty 10 MW
- Contiguous border Power Exchange (with state electricity companies )
  - 50 MW
- Commercial Power Trading (with PTC India)
  - No limit
  - Limited by transmission capacity



# Nepal – India Interconnection

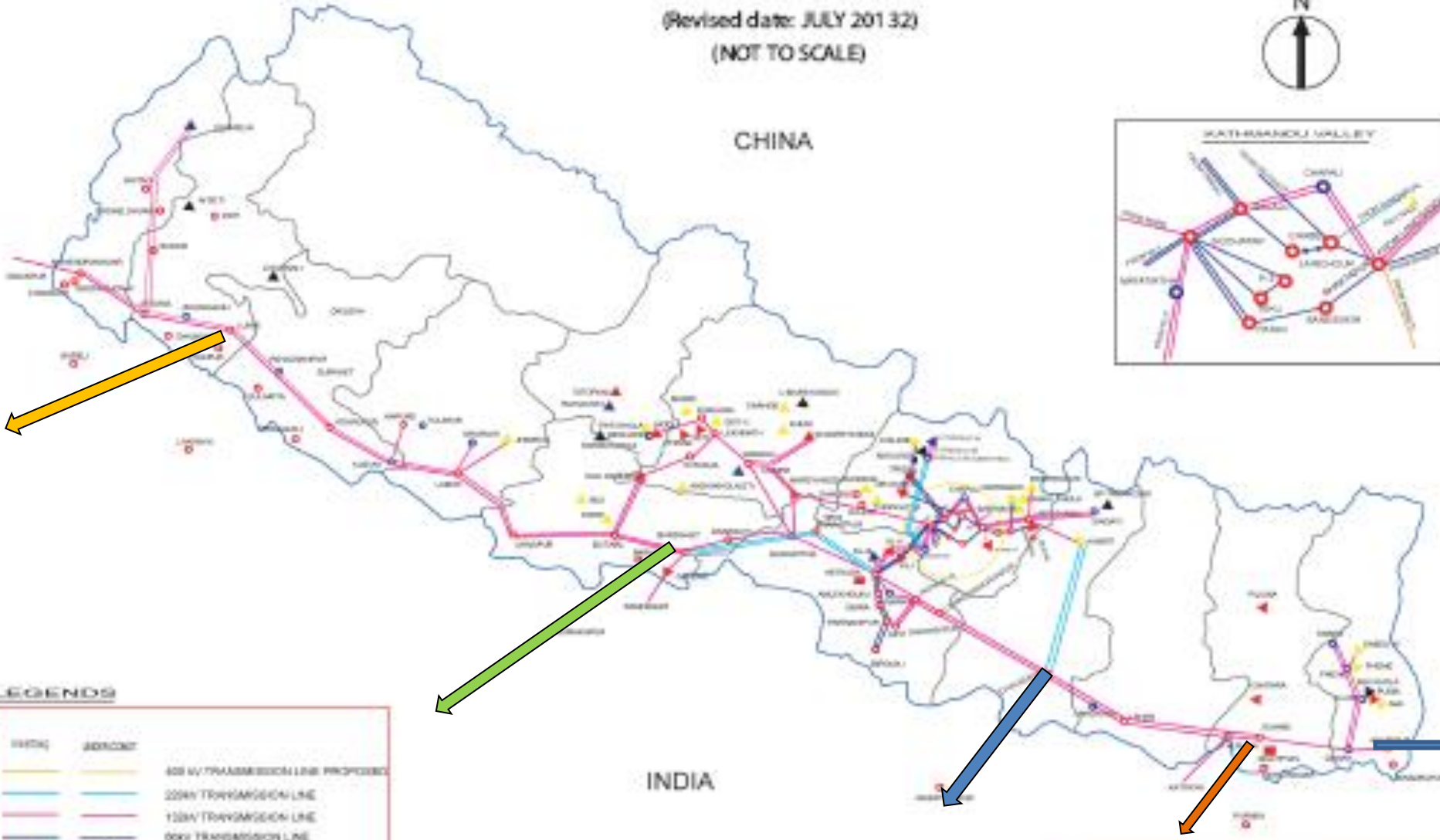
- Existing Links:
  - 132 kV: 3 numbers
    - Kushah – Katiya 132 kV TL
    - Gandak – Ramnagar 132 kV TL
    - Tanakpur – Mahendranagar 132 kV TL
  - 33 kV: 6 links
    - Rajbiraj
    - Jaleswor
    - Raxaul
    - Siraha
    - Nepalgunj
    - Bhairawa

# POWER DEVELOPMENT MAP OF NEPAL



EXISTING/UNDER CONSTRUCTION POWER STATIONS & TRANSMISSION LINES/ SUBSTATIONS

(Revised date: JULY 2013)  
(NOT TO SCALE)



**LEGENDS**

VOLTAGE	SYMBOL	DESCRIPTION
400kV	Yellow line	400 kV TRANSMISSION LINE (PROPOSED)
220kV	Cyan line	220kV TRANSMISSION LINE
132kV	Magenta line	132kV TRANSMISSION LINE
66kV	Blue line	66kV TRANSMISSION LINE
Grid Substation	Red square	GRID SUB-STATION
Hydro-Power Station	Black triangle	HYDRO-POWER STATION
IPP Hydro-Power Station	Yellow triangle	IPP HYDRO-POWER STATION
Geothermal Power Station	Black square	GEOTHERMAL POWER STATION

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





# Short Term Management

S.No	Connection Point	Present Import (MW)	Target (MW)	Additional
1	Katiya (132kV)	75	120	45
2	Ramnagar (132kV)	25	25	
3	Tanakpur (132kV)	30	40	10
4	Rajbiraj (33kV)	7	10	3
5	Jaleswor (33kV)	10	12	2
6	Raxaul (33kV)	10	10	
7	Siraha (33kV)	7	7	
8	Nepalgunj (33kV)	10	10	
9	Bhairawa (33kV)	0	10	10
	Total	174	244	70



# Long term Plan

- Three CBTL are under consideration –
  - Dhalkebar – Muzaffarpur (400 kV DC)
  - Butwal / Bardghat - Gorakhpur (400 kV DC)
  - Kohalpur – Bareilly (400 kV DC)
  - Duhabi – Purnea (400 kV DC)
  - Anarmani – Silguri (400 kV DC)
  - In Nepal Side 400 kV DC trunk line East-West under construction
- *One - under construction , two - study ongoing*

# Dhalkebar-Muzaffarpur 400kV CBTL



- 400 kV DC from Dhalkebar (Nepal ) to Muzaffarpur (India)
- 40 km in Nepal, 100 km in India
- Double Circuit Twin-conductor, Moose
- Initially to be charged at 220 kV
- Two JVC created for two sides
- Power Transmission Company Nepal PTCN – Nepal Side.
- Cross border Power Transmission Company (CPTC) – India side
- The JV companies shall develop, own, operate and maintain the CBTL of respective sides.

## PTCN shareholding

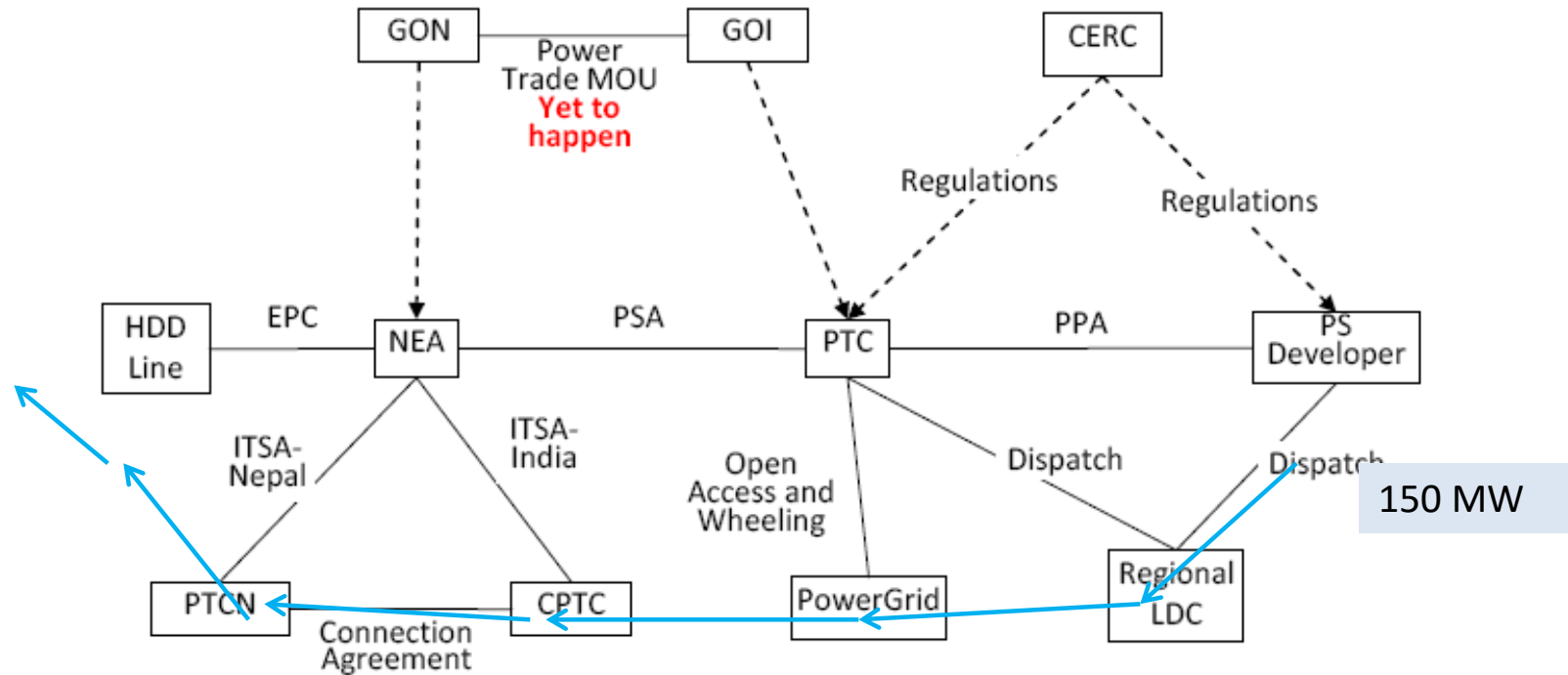
- NEA: 50%
- Power Grid India: 26%
- HIDCL 14%
- IEDCL India: 10%

## CPTC shareholding

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



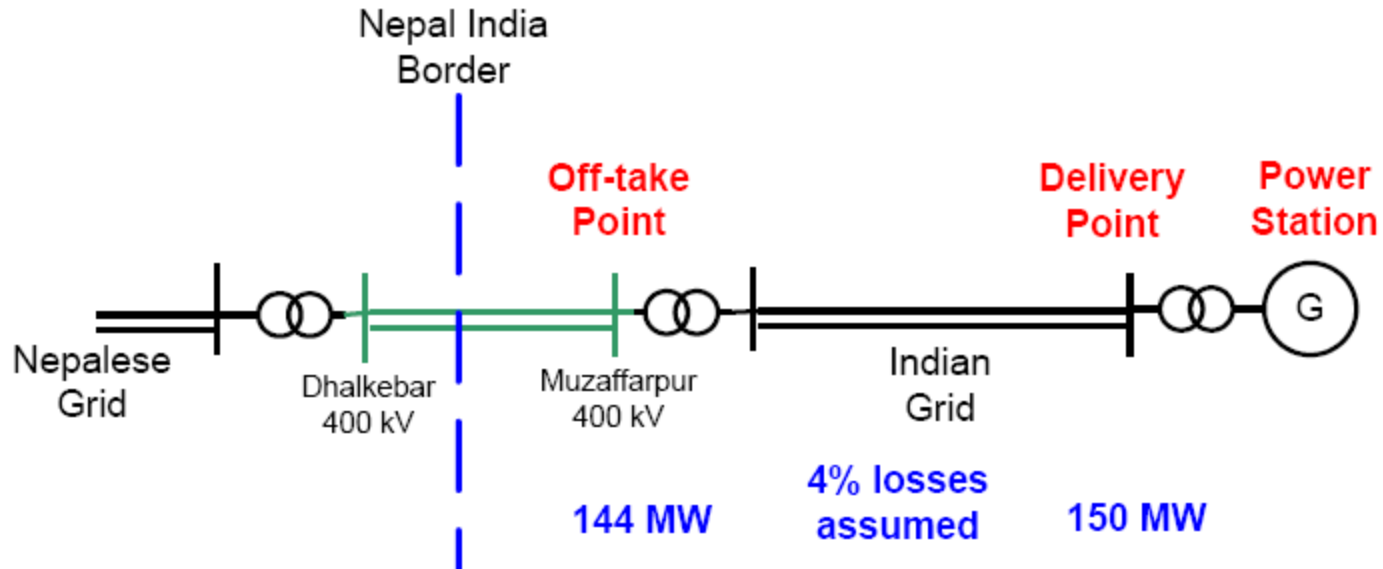
# Dhalkebar-Muzaffarpur 400kV CBTL



- 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



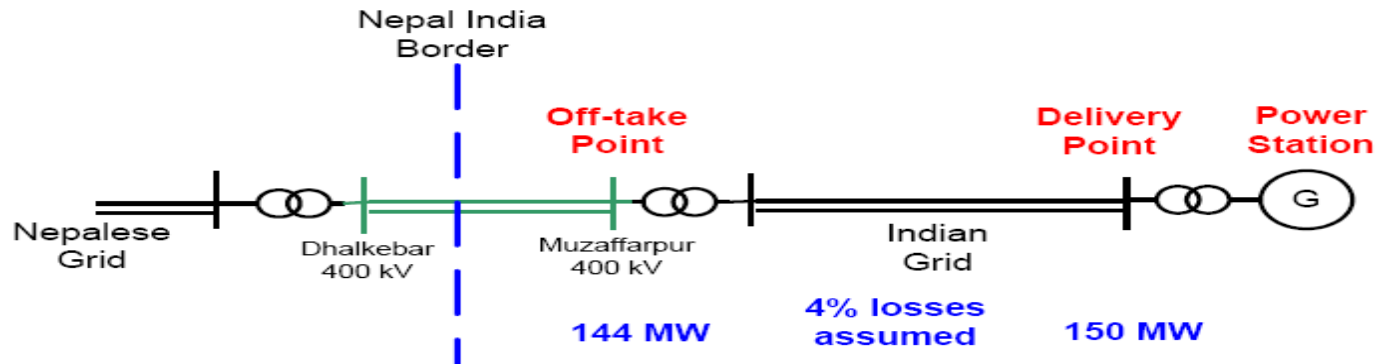
# Dhalkebar-Muzaffarpur 400kV CBTL



- 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)
- Initially charged at 220 kV.
- At Dhalkebar (Nepal) , 220/132/33 kV substation is under construction



# 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**

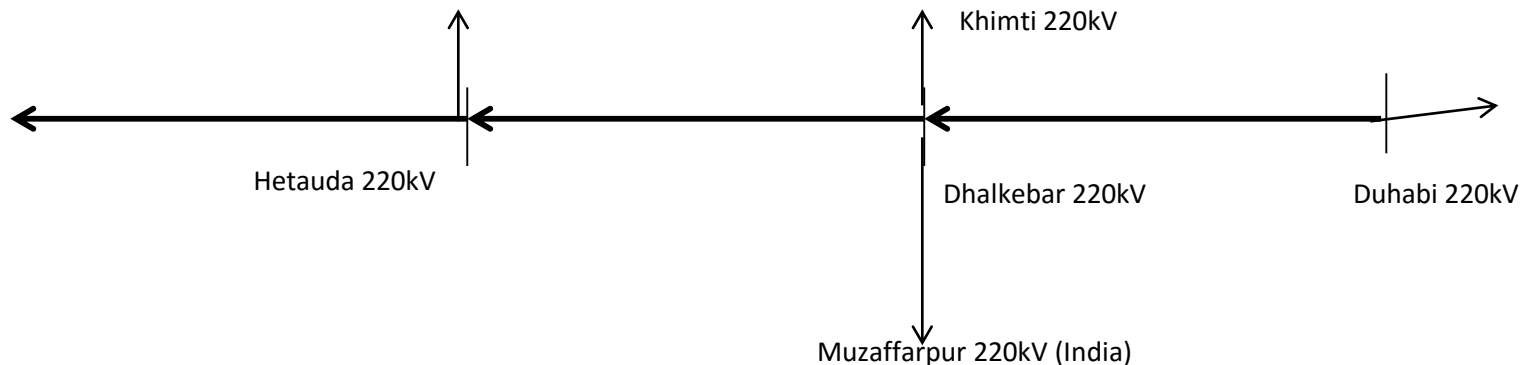
- CPTC – contract signed (100 km ) – 4 February 2014
- Completion period 16 months
- Probable Operational date – **May 2015**

# Dhalkebar-Muzaffarpur 400kV CBTL



## Progress

- **EIA , Route survey** 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



# Recent Initiative by NEA

Purchasing Dry/ Winter Energy from Export projects

- Bidding notice was published 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 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
- **5 projects offered– total capacity 1680 MW**





# Legal Regime

- Two bills are in parliamentary committee
  - Nepal Electricity Act
  - Nepal Electricity Regulatory Commission Act
- Hoped to through by the present government
- Licensing for generation and Transmission projects required
- NEA presently single buyer and Single Seller
- NEA Conduct PPA with private sector (NEA rejected to conduct PPA for wet season energy )
- Urgency of separate Power Trade Company has been discussed but not materialized yet
- Power Trade Agreement with India hasnot concluded (Nepal send the MoU to India- No Reply from Indian side)



# Nepal's system

- Hydro dominated system
- Large number RoR projects (Dry season generation is about 1/3<sup>rd</sup> to 1/4<sup>th</sup> of installed capacity)
- Annual demand variation @10%
- Seasonal and daily demand variation
- Importing from Indian market
- Large number of developer (international) has shown interest (Most of them are Indian Companies)
- NEA offered to purchase only dry season energy (mid Dec – mid May) from Export oriented projects



# External Market

- India is our export market in first stage
- China as our export market is not impossible but difficult.
- Bangladesh has also shown interest to purchase power from Nepal (4000 MW)
- With expansion of South Asia regional grid and enhanced level of cooperation among countries of South Asia, South Asia region is our potential market.
- In long term when Central Asia South Asia (CASA) interconnection is realized, even CA might be the market.



# Issues for south Asian grid

- What type of Market ? - **Pool Type or Exchange type**? Is it possible to have hybrid markets?
  - Nepal's system is hydropower based
  - Developing through private sectors
  - If market totally rely on the exchange system, the hydropower project shall not be bankable.
  - Long term PPA is essential to make the hydropower project bankable



# Issues for south Asian grid

- **Evolution of the Market operator** of India towards South Asian Market Operator? Or a new Entity with all national players forced into the market?
- **South Asian Grid Code** to be developed that allows slow improvement of national power stations and substations as necessary - sudden changes not possible.



# Issues for South Asian Grid

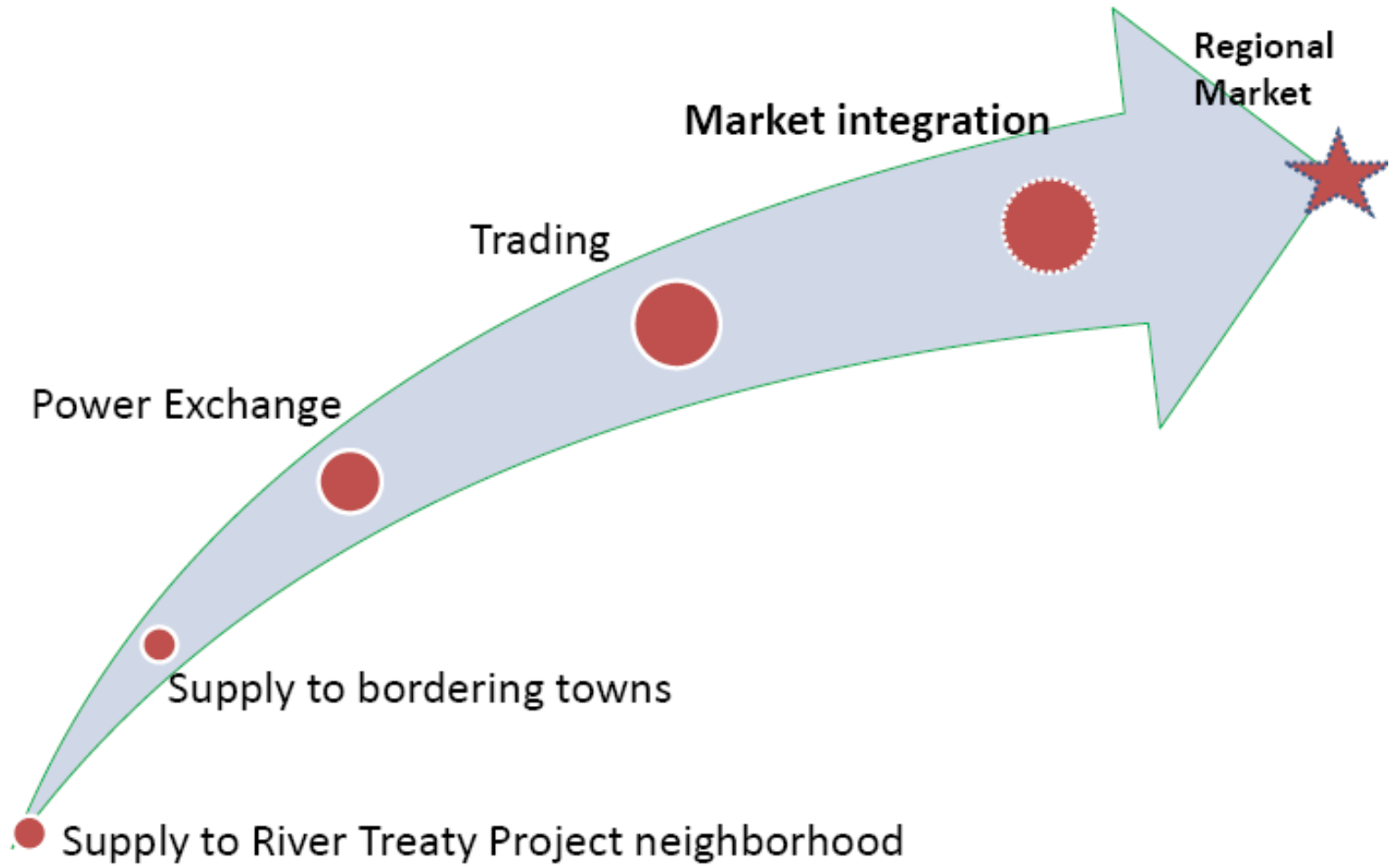
- **National Markets** to be first developed.
  - Independent Market Operator required for Nepal
  - Independent System Operator required for Nepal
  - Independent Grid Operator required for Nepal
  - This is due to proliferation of Export oriented projects having own transmission lines dedicated (as expected now).
- **All projects within Nepal whether directly connected to Indian grid or through Nepalese grid, shall be under the control of National Load Dispatching Center. ( as part of energy will be given to Nepal, and so connected to Nepalese Grid also)**



# Issues for South Asian Grid

- **Market efficiency and Optimization studies** has to be done for any number of alternatives that the players agree. The individual efficiency and optimization and regional efficiency and optimization. Evaluation of the gains for each participant and proportional investment participation necessary in the required infrastructure for a strong regional GRID is recommended.

# Towards a Regional Electricity Market



Let us have a wide discussion in TF3 and propose the best model of regional electricity markets....





**THANK YOU**