



The SAARC Power Grid Nepal's Perspective



Anil Rajbhandary

Director, Power Trade Department, NEA

Medium Term Vision for Energy Connectivity in the SAARC Region

10 March, 2015; Islamabad

Energy Resources of the SAARC Region



India

- ❧ Oil - significant
- ❧ Coal - significant but of low quality
 - ❧ high ash content & low calorific value
- ❧ Natural gas – significant
- ❧ Hydropower potential - significant
- ❧ Inadequate to meet rapidly growing energy requirement

Pakistan

- ❧ Oil – significant
- ❧ Coal – significant
- ❧ Natural gas – significant
- ❧ Hydropower potential - significant
- ❧ Inadequate to meet rapidly growing energy requirement

Energy Resources of the SAARC Region



Nepal

- ⌘ Coal – negligible
- ⌘ Hydropower potential – significant
 - ⌘ far exceeds the likely demand due to smaller power system and economy

Bhutan

- ⌘ Hydropower potential – significant
 - ⌘ far exceeds the likely demand due to smaller power system and economy

Bangladesh

- ⌘ Oil – insignificant
- ⌘ Coal – insignificant
- ⌘ Natural gas – significant
- ⌘ Hydropower potential – insignificant

Prospect for Grid Connectivity in the SAARC Region



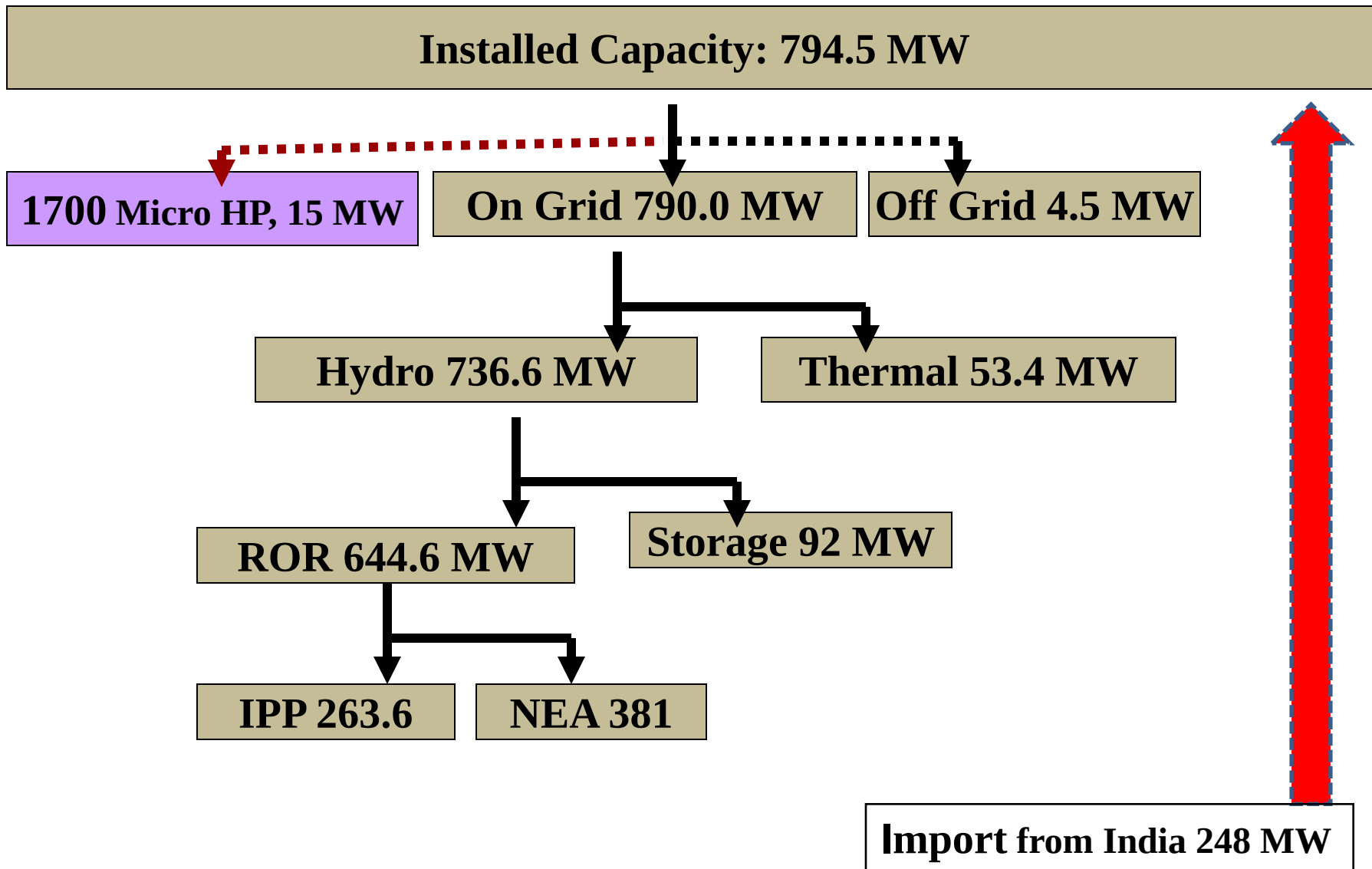
- ❧ Region endowed with coal, gas and water resources
- ❧ Seasonal characteristics of supply from hydro dominated power system:
 - ❧ Reduced generation capability during the winter (dry) season
 - ❧ Increased generation capability during the summer (wet) season
- ❧ Seasonal characteristics of power demand :
 - ❧ System Peak during winter and lower demand during summer in Nepal
 - ❧ System Peak during summer and lower demand during winter in India
- ❧ Geographical proximity of the load centers

Benefits of Grid Connectivity in the SAARC Region



- ☛ Diversity in energy resources and seasonality in power supply/demand could complement the power system of one country by the other
- ☛ Improve reliability of the power system
- ☛ Lower reserve margin and therefore lower capital investment
- ☛ Lower operating cost by operating the power system in the most optimum way
- ☛ Capture economy of scale by constructing large hydropower projects for the larger integrated power system
- ☛ The end result is the supply of electricity to the consumer that is adequate, reliable and affordable

Nepal Power System



NEA Power System Status

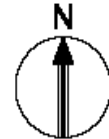
On Grid Installed Capacity	790.0	MW
Transmission Line 132 kV	2,130	Circuit Km
Substation 132 kV : 28	1,722	MVA
Transmission line 66 kV	511	Circuit Km
Substation 66 kV : 13	438	MVA
Number of consumers	2.7	Million

POWER DEVELOPMENT MAP OF NEPAL

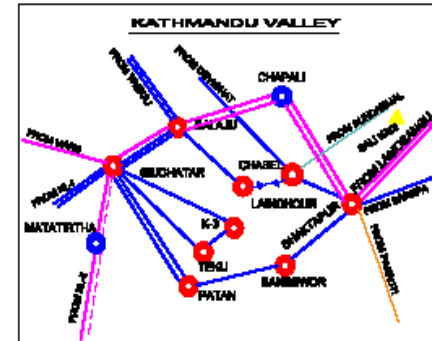
EXISTING / UNDER CONSTRUCTION / FUNDING SECURED POWER STATIONS & TRANSMISSION LINES / SUBSTATIONS

(Revised Date: JULY 2014)

(NOT TO SCALE)



CHINA



LEGENDS

EXISTING	UNDER-CONSTR.	
		400 KV TRANSMISSION LINE PROPOSED
		220KV TRANSMISSION LINE
		132KV TRANSMISSION LINE
		66KV TRANSMISSION LINE
		GRID SUB-STATION
		HYDRO-POWER STATION
		IPP's HYDRO-POWER STATION
		DIESEL-GEN-SET POWER STATION

INDIA

NEPAL ELECTRICITY AUTHORITY
TRANSMISSION DIRECTORATE
GRID DEVELOPMENT DEPARTMENT

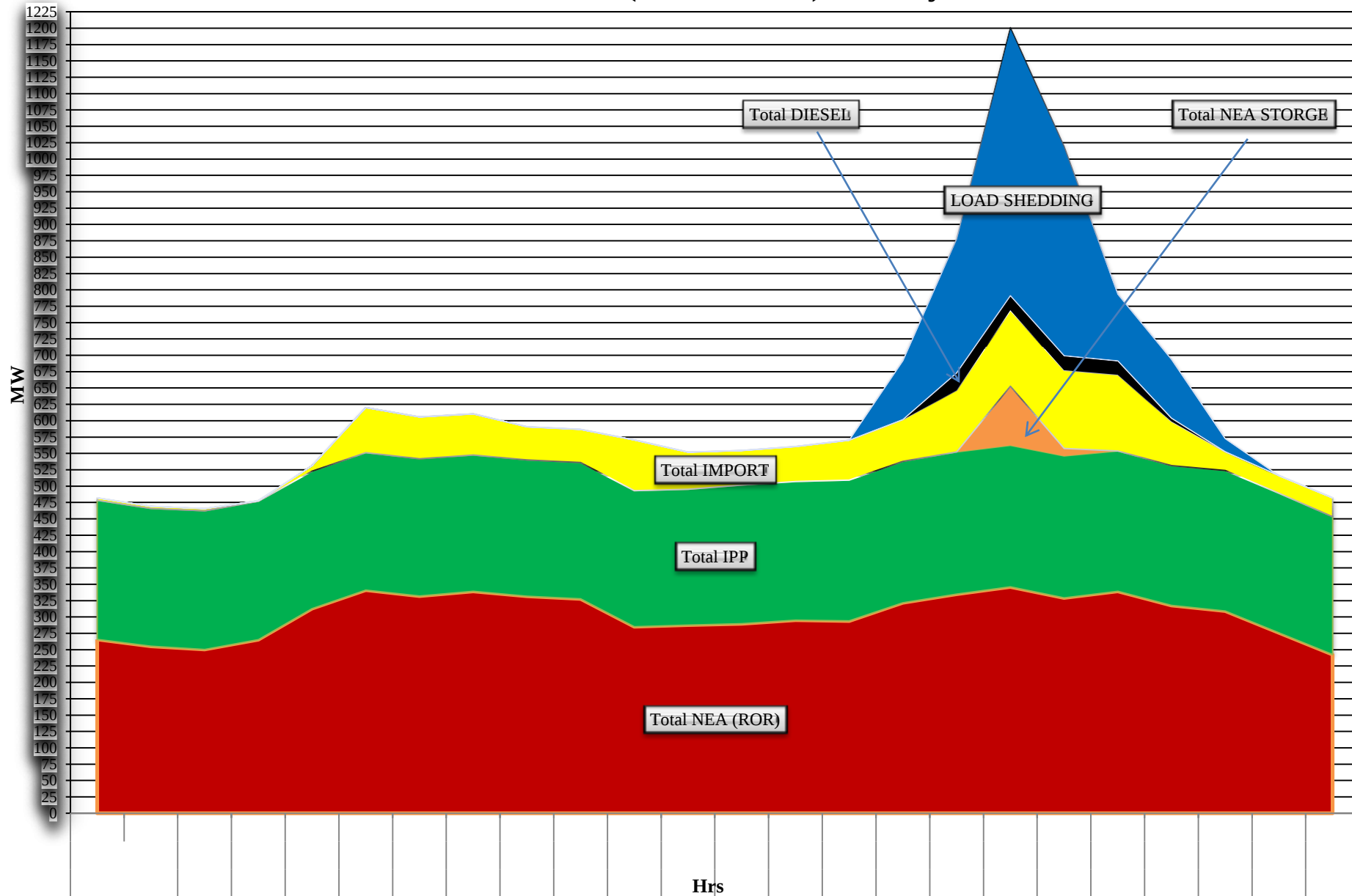
Prepared by : Manager Ogden Menzies

Total Energy Available and Peak Demand

Particulars	FY	2009/10	2010/11	2011/12	2012/13	2013/14*
Peak Demand (MW)		885.28	946.10	1,026.65	1,094.62	1,200.98
NEA Hydro Generation		2,108.65	2,122.08	2,357.43	2,273.11	2,290.78
NEA Thermal Generation		13.01	3.40	1.56	18.85	9.56
NEA Generation Total (GWh)		2,121.66	2,125.48	2,358.99	2,291.96	2,300.34
Power Purchase from India		638.68	694.05	746.07	790.14	1,072.23
Power Purchase from IPPs		591.43	1,038.84	1,073.57	1,175.98	1,258.94
Power Purchase Total (GWh)		1,230.11	1,732.89	1,819.64	1,966.12	2,331.17
Available Energy (GWh)		3,351.77	3,858.37	4,178.63	4,258.08	4,631.51

System Load Curve of Peak Load Day Kartik 17, 2070 (Nov 3, 2013) Sunday

Peak Load 1200.98 MW at 18:25 hr





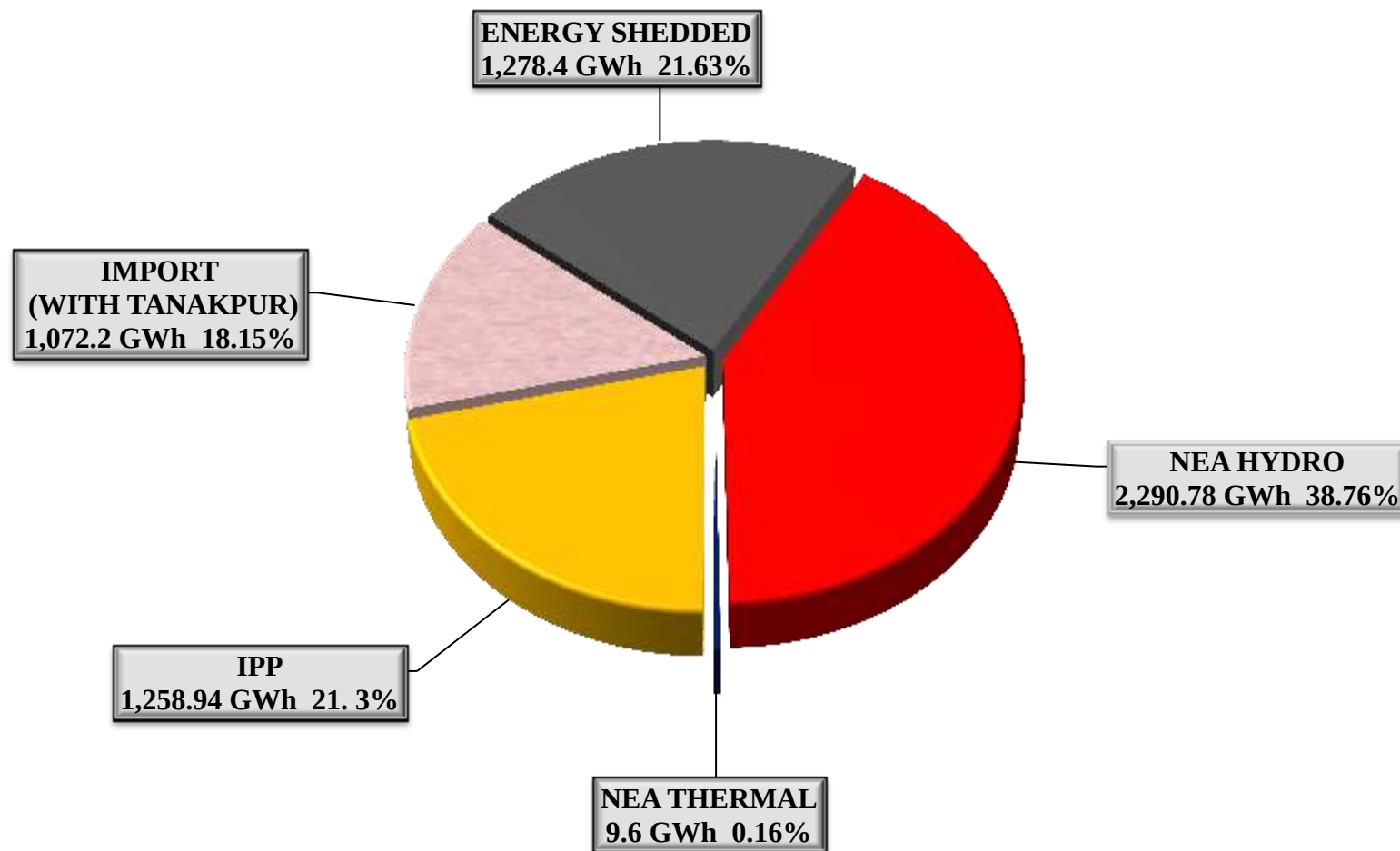
Breakdown of Supply Option in Meeting the System Peak

Supply Option	Contribution (MW)
NEA – Hydro	436.4
NEA – Diesel Plants	22
IPP - Hydro	216.4
Import	116.2
Total	791
Peak System Demand	1201
Deficit	410

Percentage Energy Share of Different Supply Options

Fiscal Year - 2013/2014

(Total : 5,910.0 GWh)

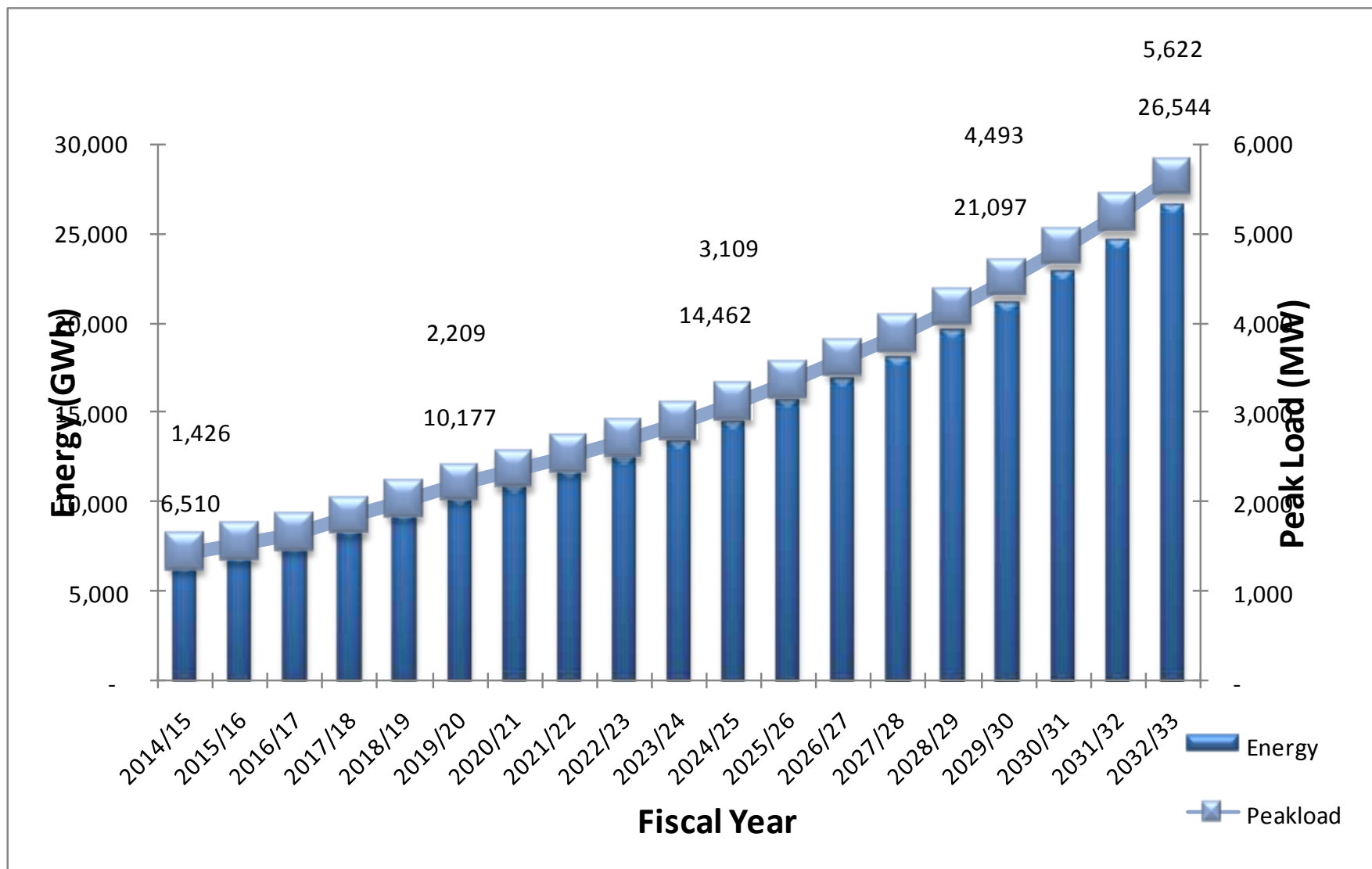


Market for Electricity



- Peak Electricity Demand of Nepal has crossed 1200 MW
- Prolonged Load Shedding has been enforced to cope with Supply – Demand Imbalance since last few years
- Being a Developing Country and with more than half of the population still without access to electricity, electricity demand is projected to grow on an average by 8.5 percent annually based on target GDP growth rate of 6 percent
- India, Nepal's immediate neighbour to the south, has presently a power shortfall in excess of 12,000 MW

Load Forecast



Power Exchange between Nepal & India



- ❧ Started with the signing of Koshi River Treaty in 1954.
 - ❧ Nepal's entitlement 10 MW
- ❧ Power Exchange Agreement concluded in 1971 for a 5 MW power exchange
 - ❧ at present it stands at 50 MW level.
- ❧ Other River Treaties:
 - ❧ Gandak Treaty: 15 MW Gandak Power Station Built
 - ❧ Mahakali Treaty: 12 – 16 MW (70 GWh per annum) being drawn from the Tanakpur Power Station
- ❧ Import beyond the 50 MW level under commercial terms with PTC India
- ❧ Import of power by India from Nepal is lately on decline
 - ❧ Extension of Indian Grid to rural areas adjoining Nepal Border

Existing Import Interconnections



Interconnections	Voltage Level (kV)	Import Power (MW)
Kataiya - Kusaha	132	125
Kataiya - Rajbiraj	33	10
Sitamadi-Jaleshwor	33	12
Kataiya-Inaruwa	33	5
Raxaul-Birgunj	33	12
Ramnagar-Gandak	132	25
Jaynagar-Siraha	33	7
Nanpara-Nepalgunj	33	12
Tanakpur-Mahendranagar	132	40
Total		248



New Interconnections

- ❧ Kataiya - Kusaha 132 kV single circuit
 - ❧ 15 km
 - ❧ 50 MW
- ❧ Raxaul - Parwanipur 132 kV single circuit
 - ❧ 17 km
 - ❧ 50 MW
- ❧ Both transmission lines are being implemented under Government of India Grant Assistance and are expected to be completed by August, 2015
- ❧ Dhalkebar – Muzzaffarpur 400 kV double circuit cross-border transmission line being implemented under PPP Model



D – M 400 kV Cross Border Line

- ❧ Implemented under commercial mode i.e. PPP Model
- ❧ A Joint Venture (JV) company in Nepal called Power Transmission Company Nepal (PTCN) was formed with following share structure:
 - NEA: 50%
 - Power Grid India: 26%
 - HIDC: 14%
 - IEDCL India: 10%
- ❧ A JV company in India called Cross Border Power Transmission Company India (CPTC) was formed with following share structure:
 - IL&FS India: 38%
 - Power Grid India: 26%
 - SJVNL: 26%
 - NEA: 10%



D – M 400 kV Cross Border Line

- ❧ The JV companies will develop, own, operate and maintain the transmission line in their respective territory.
- ❧ Share Holder's Agreement of both companies were signed on 9 July, 2012
- ❧ Implementation & Transmission Service Agreements (ITSA) were signed on 13 December, 2011 between NEA & PTCN and between NEA & CPTC
 - ❧ whole transmission capacity allocated to NEA
 - ❧ NEA to pay Transmission Service Charge (TSC) to PTCN & CPTC
- ❧ PTC India signed Power Sales Agreement (PSA) with NEA on 12 December, 2011 for the bulk sale of 150 MW of power to NEA
- ❧ With the commissioning of mega hydro projects in Nepal, this high capacity interconnection will facilitate in exporting surplus power from Nepal to India

D – M Line Project Features



- ⌘ Voltage: 400 kV (initially charged at 220 kV) and will be operated in synchronous mode with the Indian grid
- ⌘ Line length: 40 Km in Nepal and 86 km in India
- ⌘ Transmission Capacity: ~ 1,000 MW
- ⌘ The Project is expected to be commissioned by December, 2015

Issues in Cross Border Interconnections



- ✚ NEA to bear all major risks as an off-taker and developer
- ✚ Synchronization between Nepal and India power systems
- ✚ Loop flows
- ✚ Grid code harmonization
- ✚ Security standards and operational protocols
- ✚ Adequacy of load dispatch and communication facilities to handle commercial trade of power



PTA Between Nepal and India

- ❧ On 21 October, 2014; Nepal and India signed an Agreement on Electric Power Trade, Cross-border Transmission Interconnection and Grid Connectivity
 - ❧ non-discriminatory access to the cross-border interconnections
 - ❧ speed up interconnection planning and construction
 - ❧ policy harmonization for the realization of cross-border interconnections, grid connectivity and power trade
 - ❧ Joint Working Group Set Up
 - ❧ planning and identification of cross-border interconnections
 - ❧ preparation and finalization of operation and maintenance guidelines

PTA Between Nepal and India....



- ❧ The Joint Working Group convened a meeting on 20 November, 2014 in New Delhi and decided on:
 - ❧ preparation of long term integrated transmission plan by May, 2015
 - ❧ power evacuation from planned hydro power projects in Nepal
 - ❧ requirement of related cross border interconnections
 - ❧ time frame till 2035 with detailed action plan up to 2025
- ❧ For the synchronized operation of the Nepal and India Power Systems, a Joint Operation Committee was formed:
 - ❧ identify operational issues
 - ❧ necessary actions to be taken for smooth operation of the Grid when the Nepal and India power systems are Integrated

SAARC Framework Agreement



- ❧ The SAARC member states, on 27 November, 2014; signed the SAARC Framework Agreement for Energy Cooperation (Electricity):
 - ❧ enable cross-border trade of electricity on voluntary basis
 - ❧ plan cross-border grid interconnections
 - ❧ non-discriminatory access to the respective transmission grids



Concluding Remarks

- ❖ The cumulative excess power available in NEA grid in FY 2019/20 during the off peak period on the basis of number of small to medium sized IPP projects seeking access to NEA Grid has crossed 2000 MW.
- ❖ Arun – III (900 MW), Tamakoshi – 3 (650 MW), Upper Marsyangdi – 2 (600 MW) and Upper Karnali (900 MW) are being developed for the purpose of bulk sale of power to India
 - ❖ Project Development Agreements (PDA) for Arun – III (900 MW) & Upper Karnali (900 MW) have already been concluded
 - ❖ PDA negotiations for Tamakoshi – 3 (650 MW) & Upper Marsyangdi – 2 (600 MW) are on-going



Concluding Remarks ...

- ❖ Need for additional Cross Border Interconnections is therefore imminent.
- ❖ Power Trade Agreement between Nepal and India is already in place
- ❖ SAARC Framework Agreement for Energy Cooperation (Electricity) is also already in place



In Conclusion, Realization of the SAARC Power Grid from Nepal's Perspective is not that far.

Thank You !

anil_rajbhandary@hotmail.com