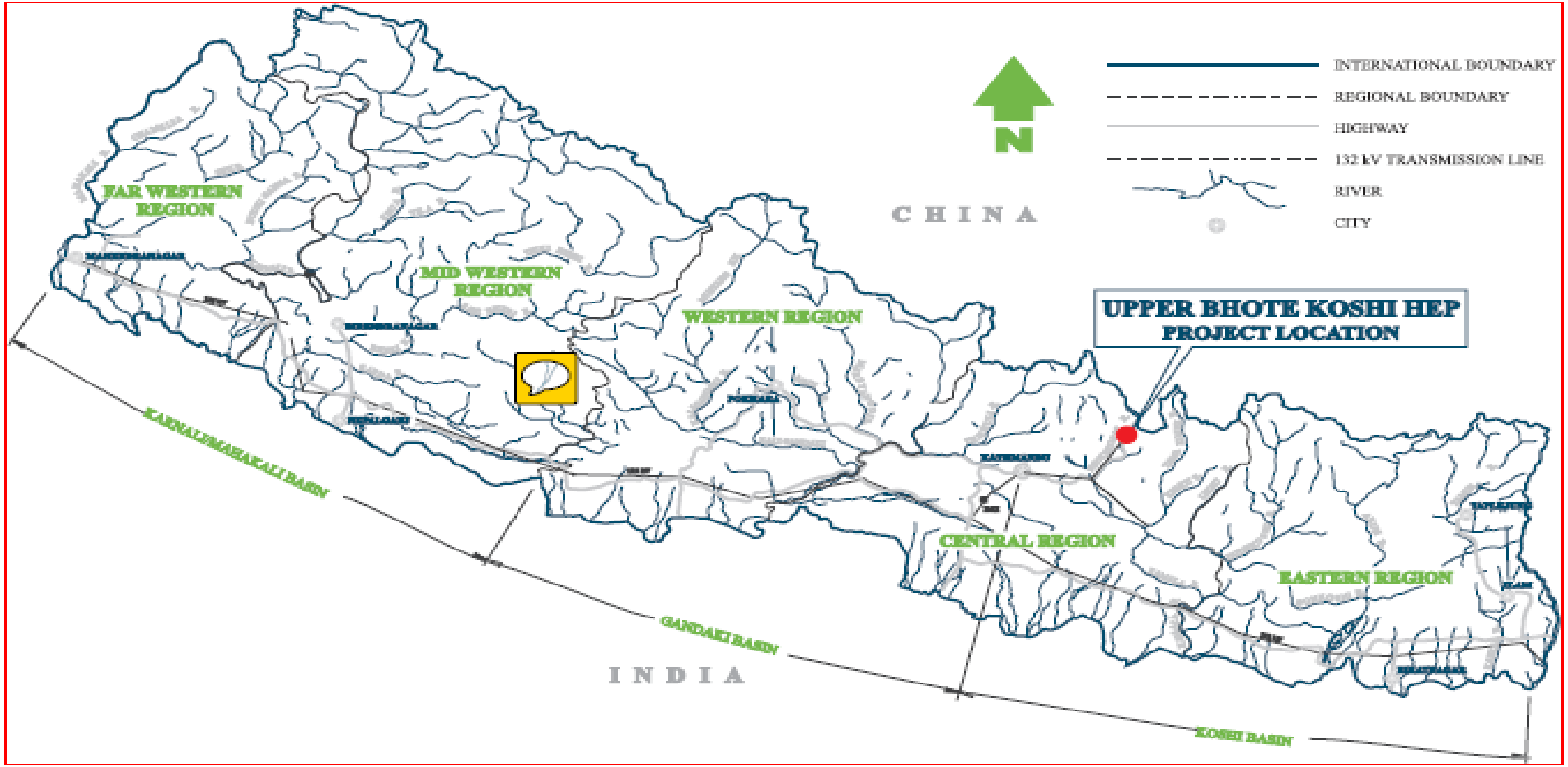
Unlocking Nepal's Large Hydropower Potential
and
Future Large Storage Hydropower Projects Planning

By :
S.C. Agarwal
CEO, SAPDC (Arun-3)

Scope of Presentation

- Introduction
- Hydro Potential of Nepal
- Indo- Nepal Cooperation
- Energy Scenario of Nepal
- Nepal as Investment in Large Hydro Electric Project
- Benefits likely to Nepal from Hydro Projects under Development by Indian Companies/ Indian Assistance
- Unlocking Nepal's Large Hydropower Potential-Development of Arun-3
- Way Forward for Developing Large Hydro Projects in Nepal

Introduction – River Map of Nepal



Major River Systems of Nepal

•Nepal has a dense network of rivers with steep topographic conditions.

•There are 6,000 rivers, including rivulets and tributaries, totaling about 45,000 km in length. The country contains approx. 2.2% of the world's water resources.

•The major river systems of Nepal, which originate in the Himalayas are Koshi, Gandaki, Karnali and Mahakali.

•The total average annual runoff from all these river systems is estimated at about 225 billion cubic metres (BCM).

•The Koshi river basin is the largest river basin in Nepal. It covers a total catchment area of 60,400 sq km,

•Nepal has 225 BCM of water available annually, only a small part of it (estimated at 15 BCM) has so far been utilized for economic and social purposes.

RIVER BASIN-WISE HYDRO POTENTIAL OF NEPAL

RIVER BASIN	POTENTIAL (MW)
	TOTAL
Kosi	22,350
Gandaki	20,650
Karnali	32,010
Mahakali	4,160
Southern rivers	4,110
Total:	83,280

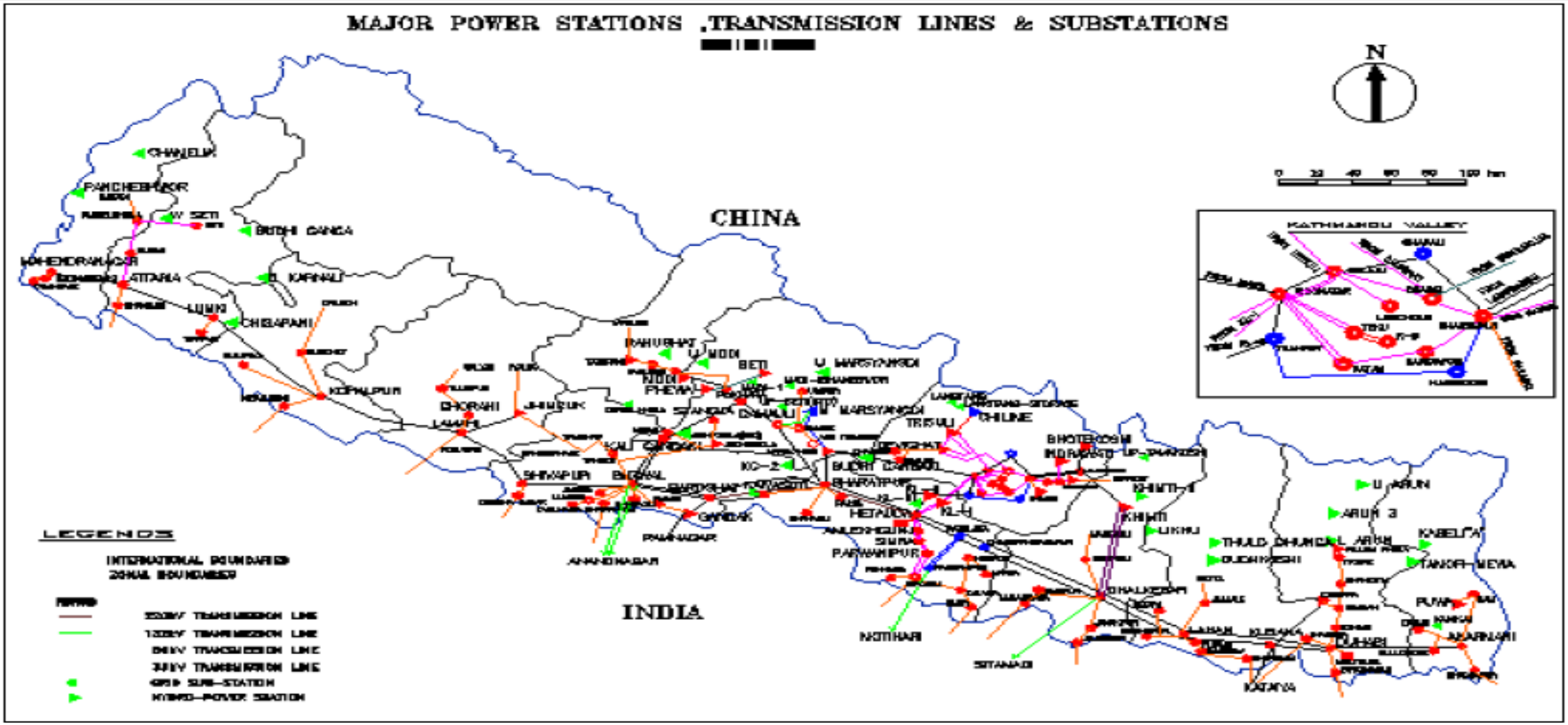
Hydro Potential of Nepal

Theoretical generation capacity	83280 MW
Economically feasible capacity	44000 MW from 66 feasible sites
Likely Annual Energy Potential (at 50% Load Factor)	190-195 Billion units
Present Hydro installed capacity	About 759 MW

Indo- Nepal Cooperation

- Multipurpose Projects in the border area :
  a) Koshi Project – Koshi Treaty signed in 1954
  b) Gandak Project – Gandak Treaty signed in 1959
  c) Pancheshwar Project – Mahakali Treaty signed in 1996
- Development of Hydro-projects under grant-aid program :
  a) Trishuli Hydroelectric Project
  b) Devighat Hydroelectric Project
  c) Fewatal Small Hydroelectric Project
- Border power exchange and power transmission line link
- Joint Technical Study for mega projects like:
  a) Chisapani (Karnali) Multipurpose Project
  b) Pancheshwar Multipurpose project & Tanakpur Project
  c) Koshi High Dam Multipurpose Project
- Electric Power Trade Agreement
- Project Development by Indian Companies – SJVN, GMR

Transmission Network and link with India



Indo- Nepal Cooperation

S. No.	Name of the Project	I.C (MW)	Status
Projects under advanced stage of implementation by Indian Cos. :			
1.	Arun-3 (*Arun River*)	900	Awarded to M/s. SJVNL. DPR appraised by CEA. Project development agreement (PDA) has been signed between SJVNL and Govt. of Nepal on 25.11.2014.
2.	Upper Karnali (*Karnali River*)	900	Nepal has awarded the project to a consortium consisting of GMR Group companies and Italian-Thai Development Project Co. Project development agreement (PDA) signed between on 19.09.2014.

Indo- Nepal Cooperation

S. No.	Name of the Project	I.C (MW)	Status
Mutual Interest Projects under Discussions:			
3.	Pancheshwar (*Mahakali River*)	5840 (U/Rev.)	India and Nepal had signed a Treaty known as Mahakali Treaty in February'1996. Implementation of Pancheshwar Multipurpose Project is the centerpiece of the Mahakali Treaty. The constitution of PDA finalized dated 7th August 2014. WAPCOS Ltd. has been awarded the work of preparation of revised DPR. DPR in advance stage.
4.	Sapta Kosi/ Sun Kosi (*Kosi River*)	3300	Under Survey & Investigation by Joint India-Nepal Project office. Field survey, investigation works and preparation of DPR for the project likely to be completed by Feb., 2017.

Indo- Nepal Cooperation

S. No.	Name of the Project	I.C (MW)	Status
Other Projects :			
5.	Upper Marsyangdi (Marsyangdi River)	600	Awarded to a consortium consisting of GMR Group companies & Italian-Thai Development Project Co of Thailand. Project development agreement (PDA) is yet to be signed.
6.	Tamakoshi-3 (Tamakosi River)	690	Awarded the project to Tata Power & SN Power, Norway. Project development agreement (PDA) is yet to be signed between Tata Power & SN Power, Norway and Govt. of Nepal. SN Power, Norway since opted out in Jan, 2016

Indo- Nepal Cooperation

PROJECTS IMPLEMENTED WITH INDIAN CO-OPERATION

Name of the Project	Installed Capacity (MW)
Pokhra	1
Trisuli	21
Western Gandak	15
Devighat	14.1

In addition, 70 MU of energy is also being supplied to Nepal, free of cost, from Tanakpur H.E. Project, as per the provisions of Mahakali Treaty- 1997.

Energy Scenario of Nepal

- Nepal’s theoretical capacity for producing power from hydropower projects is around 83,000 MW.

- As at 2014, installed capacity is only around 800 MW of electricity, despite the fact that demand is over 1,000 MW.

- Nepal remains one of the lowest energy consuming countries in the world.

- Demand for electricity is increasing at 7–9% per year, and according to the forecast from Nepal Electricity Authority, demand for electricity will reach 3,600 MW by 2027.

Impediments in Hydropower development

- Natural constraints
- Lack of infrastructure
- Transmission interconnections
- Lack of funds
- Market
- Cost of generation
- Institutional Arrangements
- Statutory Provisions
- Complicated Procedures

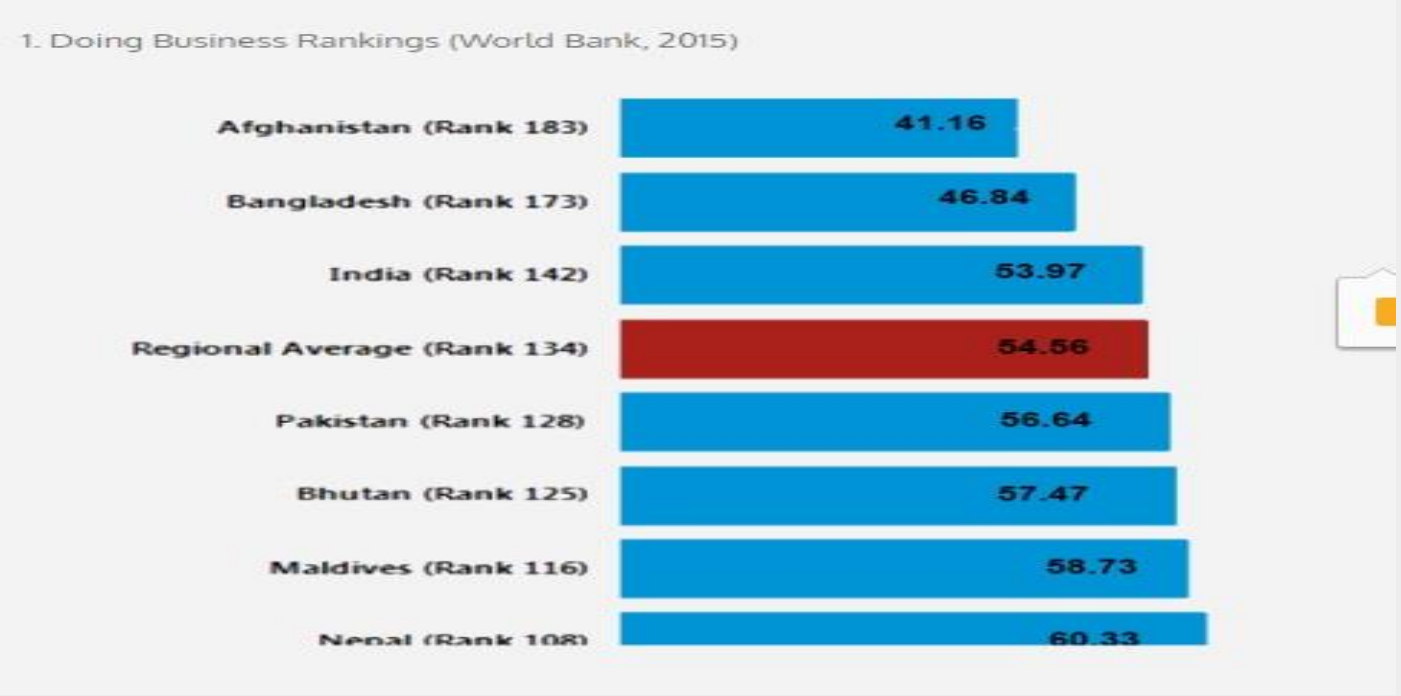
Nepal as Investment in Large Hydro Electric Project

- Nepal has realized that Hydropower has the potential to be the cornerstone of government finance, a key engine of Nepal's economy and a vital means of rural electrification .

- After Democracy setup in Nepal the atmosphere for investment is conducive

- Investment Board of Nepal (*IBN)*Single window clearance for Mega Hydro Projects. Hence safeguard from Bureaucracy Red- Tapism

- Being landlocked with India having Common Border with India Transmission of Energy from Nepal will be easy.



Benefits likely to Nepal from Hydro Projects under Development by Indian Companies/ Indian Assistance

FISCAL BENEFITS

Name of the project	Annual Design Energy (MU)	Estimated Cost. (INR Crs.)	Financial Benifits
Arun-3	3924	5724	INR 33,800 Crore (Approx. life time benefits)
Upper Karnali	3466	8750	INR 30,000 Crore (Approx. life time benefits)
Pancheshwar MPP	9117	30000 (approx.)	INR 2,280 Crores (Annual Revenue from sale of 50% of the

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OTHER BENEFITS

- **Power Banking** – Nepal can get more off – peak power from Indian Thermal Plants in exchange of peaking power from Nepal Hydro Projects.

- **Development of ancillary Industries** like cement and steel, conductor, insulator, tower, transformer, galvanizing and service industries associated with hydro power projects.

- **Development of infrastructure** on account of development of roads and bridges

Benefits likely to Nepal from Hydro Projects under Development by Indian Companies/ Indian Assistance

OTHER BENEFITS

- As per UNDP 2010 Report, only 21% of Nepal Land is cultivable , hence cultivable land needs to be fully exploited. However, only 33% of cultivable land has irrigation facility. Agriculture currently contributes about 1/3 rd GDP of Nepal. **Hence availability of irrigation facility is critical to the economy of Nepal.**

- **Drought and Flooding in Terai area** can be mitigated which will result in increased agriculture production apart from other benefits.

- **Other Multipurpose benefits** of drinking water supply and pisci-culture etc.

Benefits likely to Nepal from Hydro Projects under Development by Indian Companies/ Indian Assistance

OTHER BENEFITS

- **Electrification** of towns and villages in far flung areas.
- Large scale generation of **Employment** opportunities.
- Overall development of the areas and **economic upliftment** of the people.
- Development of **health care** facilities around project area.

Unlocking Nepal's Large Hydropower Potential-Development of Arun-3

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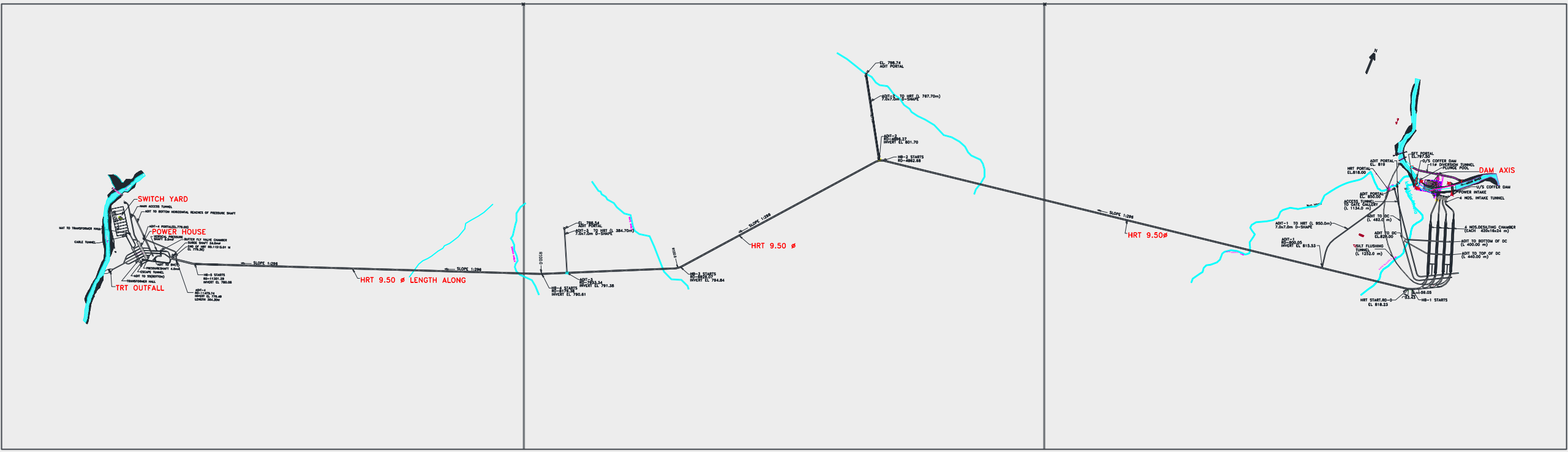

Unlocking Nepal's Large Hydropower Potential-Development of Arun-3

Salient Features of Arun-3

Dam Height	:	70 m
Type of Dam	:	Concrete Gravity dam
Head Race Tunnel (Length, Dia and shape)	:	11.779 km,9.5m dia, Circular
Pressure Shaft (No, Type and Size)	:	2 Nos,Circular,5.5 m dia
Power House(Type, Size)	:	Underground, 179.50m(L)X22.5 m (W) X49.5m (H)
Design Head	:	286.21 m
Design Discharge	:	344.68 m3 / sec
Transformer Hall(Type ,Size)	:	Underground, 153.94 m (L)X 16 m (W)x 22.50 m (H)
Tail Race Tunnel(No, Type, Size, Length)	:	1 No. Circular 10.00 m dia 192.00 m long
Energy Benefits	:	3924.03 MU

Benefits from Projects

•**Development of the region:** Project will generate employment for the locals, boost local industries, and foster entrepreneurship. Other Projects of this scale have generated over 3000 direct jobs during peak construction period.

•**Industrial Benefits:** Nepali suppliers will be given a fair opportunity to compete. Growth of local shops, traders, catering & hotel services, etc.

•**Rural Electrification & Local Shares:** Electrification of affected areas and option to purchase shares. 30 units of free electricity for directly affected.

•**Robust Community Infrastructure and Financial Support:** Construction of roads, bridges, schools, healthcare and community centers, etc. to provide a robust community infrastructure. Skills training and other programs will provide great financial support to the affected communities.

Unlocking Nepal's Large Hydropower Potential-Development of Arun-3

Present Status

- MOU was signed between GON and SJVN on 02.03.08
- PDA has been signed with IBN, GoN on 25.11.14
- Generation license applied on 14.07.13 & is under process.
- TEA accorded by CEA on 09.06.14.
- The MOU between SAPDC and Department of Roads, GoN for construction of roads & bridges signed on 05.01.16. Draft agreement under finalization in DoR, GoN.
- DPR (Transmission lines): CEA accorded the clearance for Transmission line

Unlocking Nepal's Large Hydropower Potential-Development of Arun-3

Why SJVN

- SJVN is a Govt of India Public Sector Unit
- Proven Track Record for Building ,Operating and Maintaining the large Hydro Plants in India: Construction, Operation and Maintenance of India’s Largest Nathpa Jhakri Hydro Power Station(1500 MW) and Rampur Hydro Power Station(412 MW).
- Planning for construction of more than 10 Hydro Electric Projects in India
- In - House Technical expertise in developing and designing Hydro Power Projects
- Robust Financials conditions
- Best Community development in and around the projects

Way Forward for Developing Large Hydro Projects in Nepal

- Giving the Projects in same river basin to single Promoter
- Single promoter in Single Basin shall help in best operation and Transmission aspects of the project.
- Single Window Clearances for the projects like being done by IBN.
- Transfer of project to GoN time shall be extended from present 25 years to 40 years

Thank You