



Overview of Bhutan-India Cooperation In the Power Sector

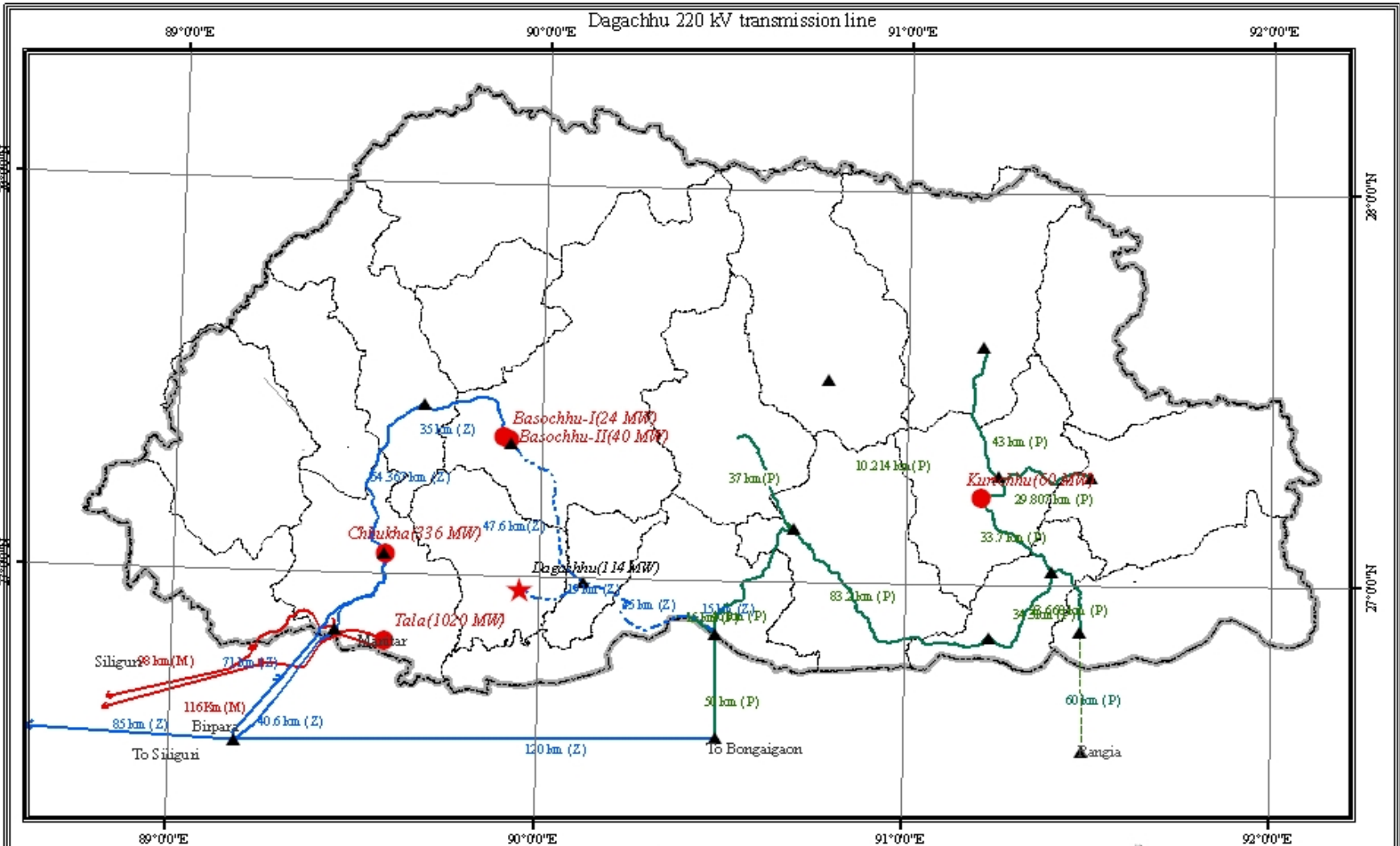
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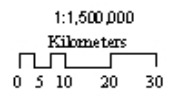
Outline of the Presentation

- **PAST**
- Jaldhaka Agreement of 1961
- 1st Five Year Plan Development Projects
- Power connections from West Bengal and Assam in 1970-80s
- Chhukha Agreement 1974
- Kurichhu Agreement 1994
- Tala Agreement 1996
- **PRESENT**
- 2006 Umbrella Agreement on Hydro power development cooperation and power trade.
- Punatsangchhu-I Project Agreement
- Anticipated JV agreements on Mangdechhu and Punatsangchhu-II.
- **FUTURE COOPERATION**
- Hydropower Policy and Future plans
- Mutual benefits – summary.
- Conclusion - Enabling environments for accelerated development and bilateral cooperation !

Dagachhu 220 kV transmission line



- ▲ Major_substation
- Generation Plant
- Proposed 220 kVline
- 220 kVline
- ★ Dagachhu HPP
- 132 kVnot sure
- 132 kVline
- 400 kVLine



Prepared by: Department of Energy

Jaldhaka Agreement 1961

- The first bilateral agreement (13 September 1961) that enabled construction of the barrage in the Bhutanese territory and 27 MW power plant in West Bengal, India with a provision of royalty payment @ Rs 8 per kW year per annum to Bhutan, 250 kW free power (or 1.314 GWh free annual energy) and import of power to Sibsoo, Chamurchi and Phuntsholing (the gateway to Bhutan) from India.
- Plant was commissioned in 1968 by WBSEB.

Mini/Micro Hydels under 1st FYP

Development assistance

- Under grant assistance from Gol, the first hydroelectric plant of 360 kW capacity (Joshina) was commissioned in 1967 during the 1st FYP to supply electricity to the capital. The plant is now synchronized with the Grid after its rehabilitation in 1992-93.
- Other mini hydels like Paro hydel (400 kW) built in 1968 and decommissioned in 1986,
- Chenari (750 kW) in 1972, Hesothanka/Wangdue (300 kW) were built after 1972

Power connections from West Bengal and Assam in 1970s.

- To electrify bordering villages/towns in Bhutan, power import connections were established at 3 places in South West Bhutan (Sibsoo, Chamurchi/Samtse, Phuntsholing) from WB and 4 places (Daifarm, Bhangtar, Darranga/SJ, Gelephu/Hatisar) in South and South-East from Assam through 11 kV and 33 kV systems.
- When the construction of Chukha Hydel and Penden project started, 66 kV lines were also drawn from Birpara/WB for construction power.
- Power tariff were in the range of Rs 0.30 to 0.80 per unit for this imported supply in 1972-1982.
- “Bilateral connections” – Small border tie lines are basic start-up connections. People at the village/district levels initiated for these neighbourly support and connections!

Chukha Agreement 1974

- Chukha agreement signed on 23 March 1974 for the development of 336 MW, 466.34 metres head run-of the river plant. Mean annual generation of 2024 GWh.
- Major construction works started from 1978 onwards and first unit of 84 installed capacity commissioned in Sept. 1986. Fully commissioned in 1988.
- 60% Grant, Loan 40% at 5% interest payable in 15 years, Capital cost (IPL 1974) was Rs 83 crores (Rs 830 million).
- Completion cost in 1988 was Rs 246 crores (2460 million). Starting export tariff was 27 paisa for firm and 13.5 paisa for secondary seasonal energy. First PPA signed on 29 April 1992 with NHPC by the DoP, RGoB.
- Present status: Loan shall be fully repaid/liquidated by end Dec. 2007 and the present export tariff is Rs 2.0 per unit, PPA with PTC. Surplus energy is exported and more than 85% of the total energy is planned for export in the years to come. In the past, export went down to as low as 70% when Bashochhus, Kurichu and Tala were not operational!
- So far only 1957 MU maximum generated by Chukha, machines can be overloaded to 360 MW. Chukha contributes about Nu 2.8 billion per annum.

Kurichhu Agreement 1994

- Agreement was signed on 18 February 1994 for the construction of the Kurichu 45 MW plant (toe of the dam power plant) to be upgraded to 60 MW later
- Capital cost was Rs 256 crores (1994), 60% grant, 40% loan at 10.75% interest rate repayable in 12 years
- Completion cost in 2001-2002 was 5637.5 million and debt servicing started from July 2004 and the tariff is Rs 1.75 per unit.
- Present PPA with PTC, Kurichhu could generate maximum of 366 GWh per annum maximum against the 400 GWh designed energy !
- Being Social Project - expensive and debt sustainability problem is arising as the internal demand is increasing and export is decreasing !

Tala Agreement 1996

- Signed on 5 March 1996 for development of 860 metres head 1020 MW, 4865 GWh mean annual energy plant at a cost of Rs 1408 crores (1993 price level). Perhaps the largest high head plant in the region!
- 60% grant, 40% loan at 9% interest rate repayable in 12 years from the date of commercial operation
- Present tariff is Rs 1.80 per unit, increase by 10% every 5 years till loan repayment and 5% increase every 5 yrs thereafter.
- Completion capital cost of the Project is around Rs 41,855.23612 million (2007) and IDC is around Rs 7,000 million
- First Unit commissioned in 31 July 2006 and last of the 6 units in 31 March 2007, Generated as high as 1122 MW (on water and machine availability) first time on 26 Sept 2007. Some stabilization problems being solved.
- More than 85% of design energy (3962 MU) shall be exported as surplus energy.
- Debt serving planned from 2008 onwards! Approximately Nu/Rs 2 to 2.5 billion per annum net revenue income (tax + dividend) expected from Tala.

2006 Framework Agreement on Hydropower development & Trade

- This umbrella agreement was signed on 28th July 2006 between RGoB and Gol
- Both countries to cooperate and facilitate hydropower development and trade through both public and private sector participation
- Market opportunity for export of a minimum of 5000 MW by 2020
- Renewable energy through CDM using India's baseline
- Agreement provides the framework for accelerated hydropower development !

Hydropower potential, development Plan and Policy

- Total potential – 30,000 MW (estimated)
- Identified technically feasible ~ 24000 MW (from 77 sites > 10 MW)
- Developed so far 5 sites: Chukha = 336 MW, Basochhu-I&II = 24+40 MW, Kurichhu 60 MW and Tala 1020 MW, Total 1480 MW installed (Generation capacity =1606 MW) from large plants
- Small/mini/micro =~ 8.098 MW installed/ 6.634 MW generation capacity from 22 other plants.
- Present Bhutan's demand = 157 MW in 2006/07 => 200 MW anticipated in Dec 2007/08!

Hydropower potential, development Plan and Policy (Cont.)

- Development Plan in the next 13 years (by 2020) is 5000 MW additional
- Status – Punatsangchhu-I of 1095 MW and Dagachhu CDM 114 MW started pre-construction/infrastructures development !
- Puna-II (992 MW) and Mangdechhu (700 MW) under DPR study to start construction from 2009/10 as JV Projects between Gol companies and Druk Green Power Corporation (merger of Gencos of Bhutan from 1st Jan. 2008 !)
- Others 2,000 MW through PPP models - JVs and IPPs models planned (Nikachhu, Chamkharchhus, Kholongchu, Amochhu)
- Hydropower policy (BOOT, FDI, IPP) is being formulated, draft ready, public consultation and road show in December 2007, Bidding/tendering/solicitation from 2008 onwards !
- A storage scheme on bilateral cooperation model being proposed and promoted during 10th Plan (eg. the Sankosh HEP of 4000 MW)

Hydropower development benefits to the two countries - summary

- During construction phase - India benefits from export of goods and services to the project (Trade volume increase, employment opportunities increase), Bhutan benefits from creation of employment opportunities, Other spin-off benefits/socio-economic developments in the project area and sale of domestic products and services to the project (Construction sector GDP increases and there is boom in economy !)
- During operation phase – India benefits from inexpensive and clean hydropower supply (for peaking) to meet part of the its growing demand, Bhutan benefits in revenue earnings from 85% export of surplus power and 15% domestic supply to fuel the engine of domestic growth (socio-economic development needs fulfilled!)

Enabling environments for accelerated development cooperation – *conclusion*

- Political will of our Leaders and their Far-sighted Wisdom and Vision ! (India-Bhutan Friendship model is time tested)
- “Good will” among people growing stronger as we become more and more dependent upon each other as the economic ties increase!
- Realization of hydropower projects as mutually beneficial and environmentally sustainable for energy security of both countries (win-win situation!)
- Political stability, Security and Peace in Bhutan
- Bilateral Financing terms very favorable and convenient to both sides.
- Trust, faith and confidence in development partners (risk perception!)
- Other Enabling environments (realized peace to prosper, safe work place, less bureaucratic hurdles/barriers, timely and quick decisions by Project Authorities, timely environment clearance, no taxes and duties, timely facilitation by immigration & customs and less malpractices)



Thank you
and
Tashi Delek!