Key components to getting Hydropower Planning Right

Hydropower Development in Myanmar

Workshop January 19, 2015

PRAVIN KARKI
Senior Hydropower Specialist, World Bank

WORLD BANK GROUP

TABLE OF CONTENTS

HYDROPOWER PLANNING PERSPECTIVE

From a planning perspective hydropower has advantages and disadvantages

Advantages	Disadvantages (relative to thermal)
Renewable	Long gestation (long wait for returns)
Very low operating costs	High capital costs (when combined with long wait, the returns are small)
Long term assets (>100 years)	Multipurpose use of water
Base load and flexible generation	Hydrological risks
Helps meet peaking demands	Construction risks (cost overruns are a fact of life – how to fund it ?)
Synergy with other renewables	Difficulty in signing take-or-pay PPAs
Dams provide irrigation, flood control, navigation etc.	Environmental & Resettlement Issues (private sector not always well equipped to deal with it)

CONTEXT OF POWER SYSTEM EXPANSION PLANNING

Power system planning depends on the type of resource base and country context

HYDRO ONLY SYSTEMS	
Non-landlocked	**Landlocked**
Brazil, Canada, Norway	Bhutan, Lao PDR, Kyrgyz, Nepal, Tajik

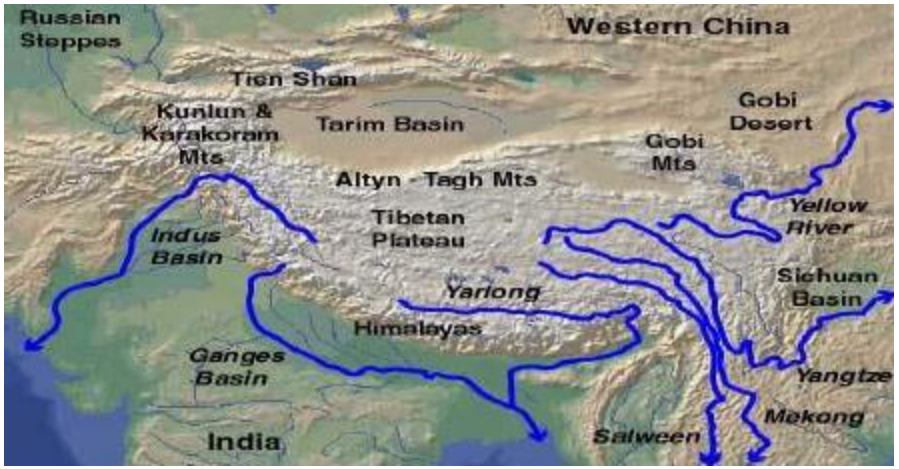
MULTI RESOURCE COUNTRIES
Myanmar, Turkey

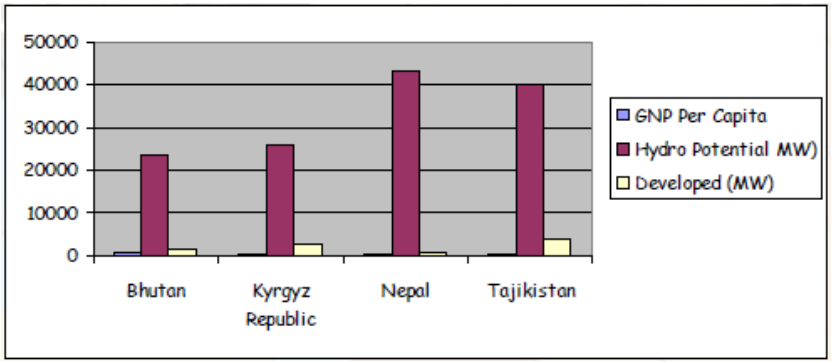
SMALL COUNTRIES WITH BIG POTENTIALS

Weak economies

- Cannot mobilize resources
- Lack technical & managerial capacity

Many rivers are international and lack cooperation





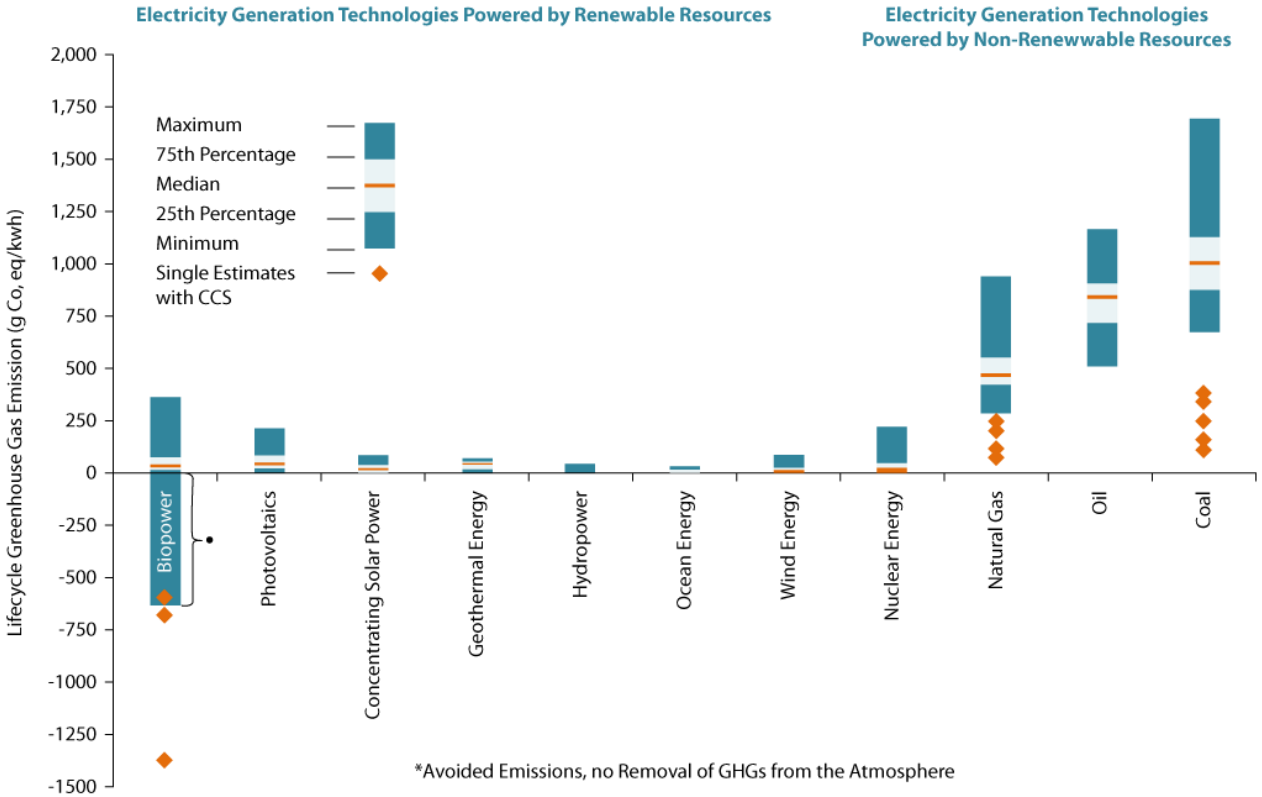
Policy challenges

- Pricing issues
- Env. & Social challenges
- Weak Private sector
- Energy trade missing

ADDITIONAL CONSIDERATIONS IN POWER SYSTEM PLANNING

- Climate Change considerations - generally positive
- Environmental and social considerations - generally negative
- Riparian considerations - depends on the location of the resource upstream (more difficult) or downstream (a bit easier)

MITIGATING CLIMATE CHANGE

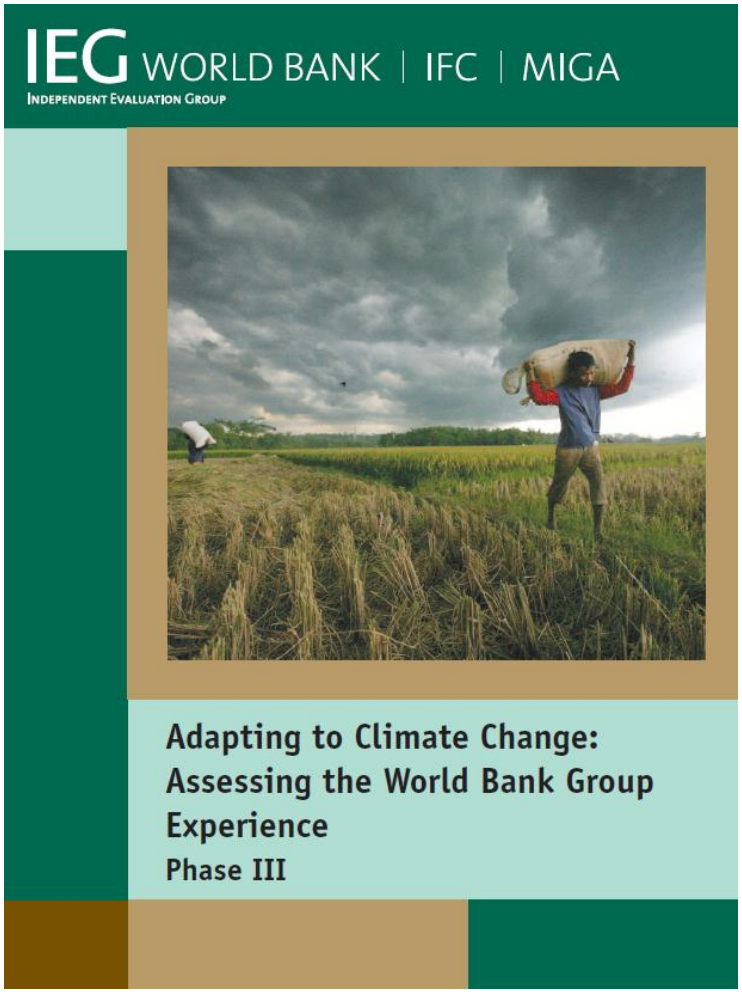


Count of Estimates	222(+4)	124	42	8	28	10	126	125	83(+7)	24	169(+12)
Count of References	52(+0)	26	13	6	11	5	49	32	36(+4)	10	50(+10)

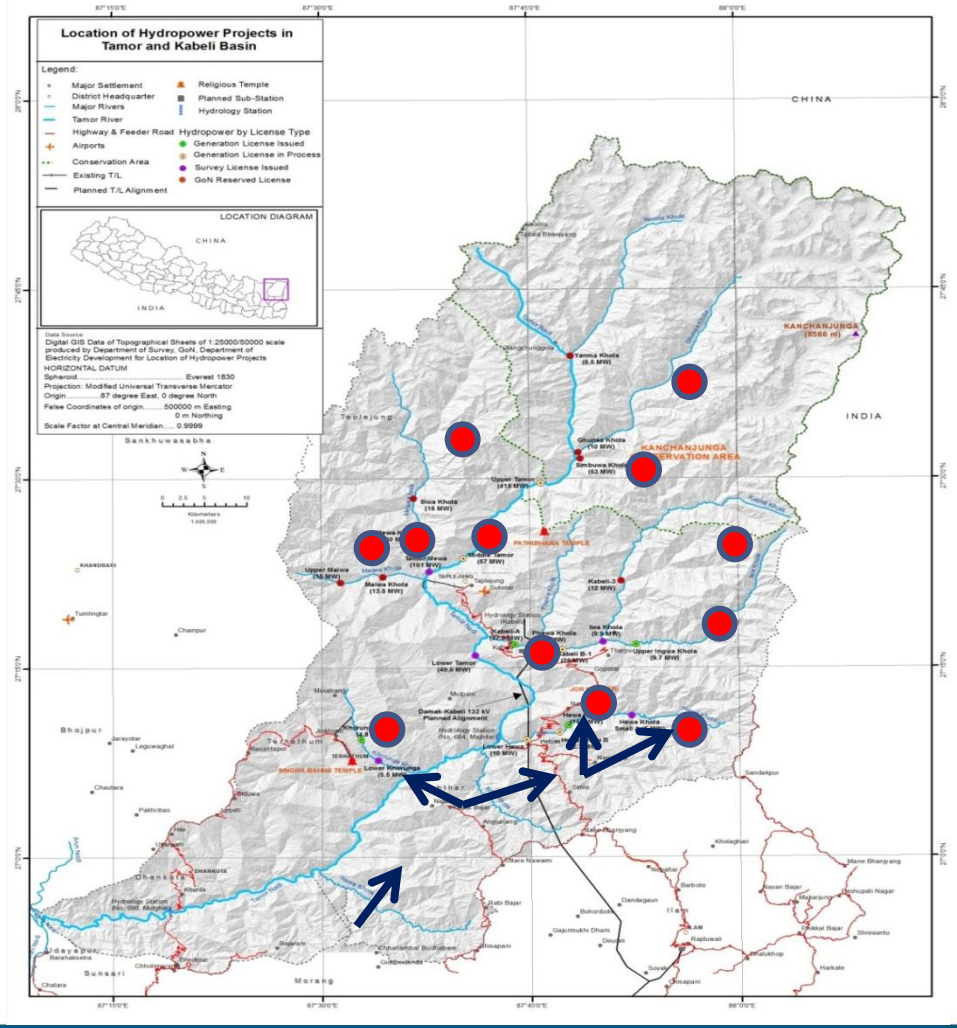
Majority of lifecycle GHG emission estimates for hydropower cluster between ***about 4 and 14 g CO_2eq/kWh,*** *But under certain scenarios there is the potential for much larger quantities of GHG emissions- source: IPCC 2011 SRREN- SPM*

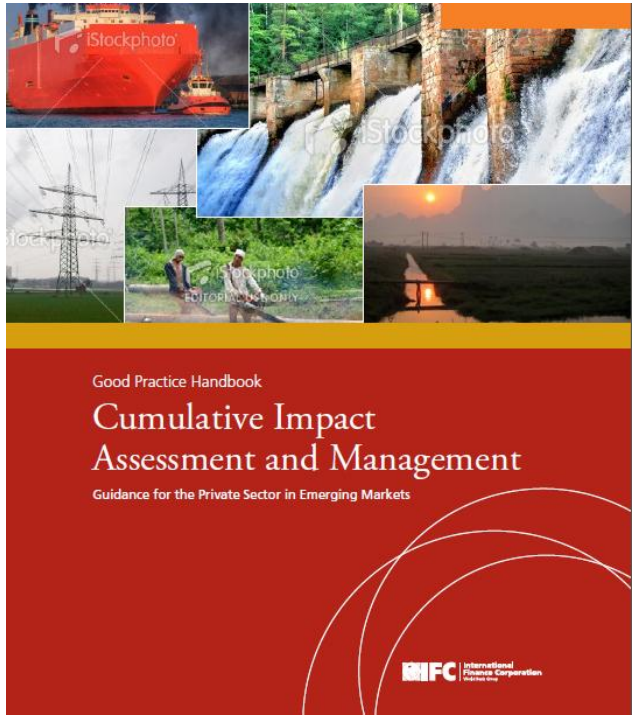
WORLD BANK GROUP

SCREENING FOR CLIMATE RISKS



ENVIRONMENTAL & SOCIAL



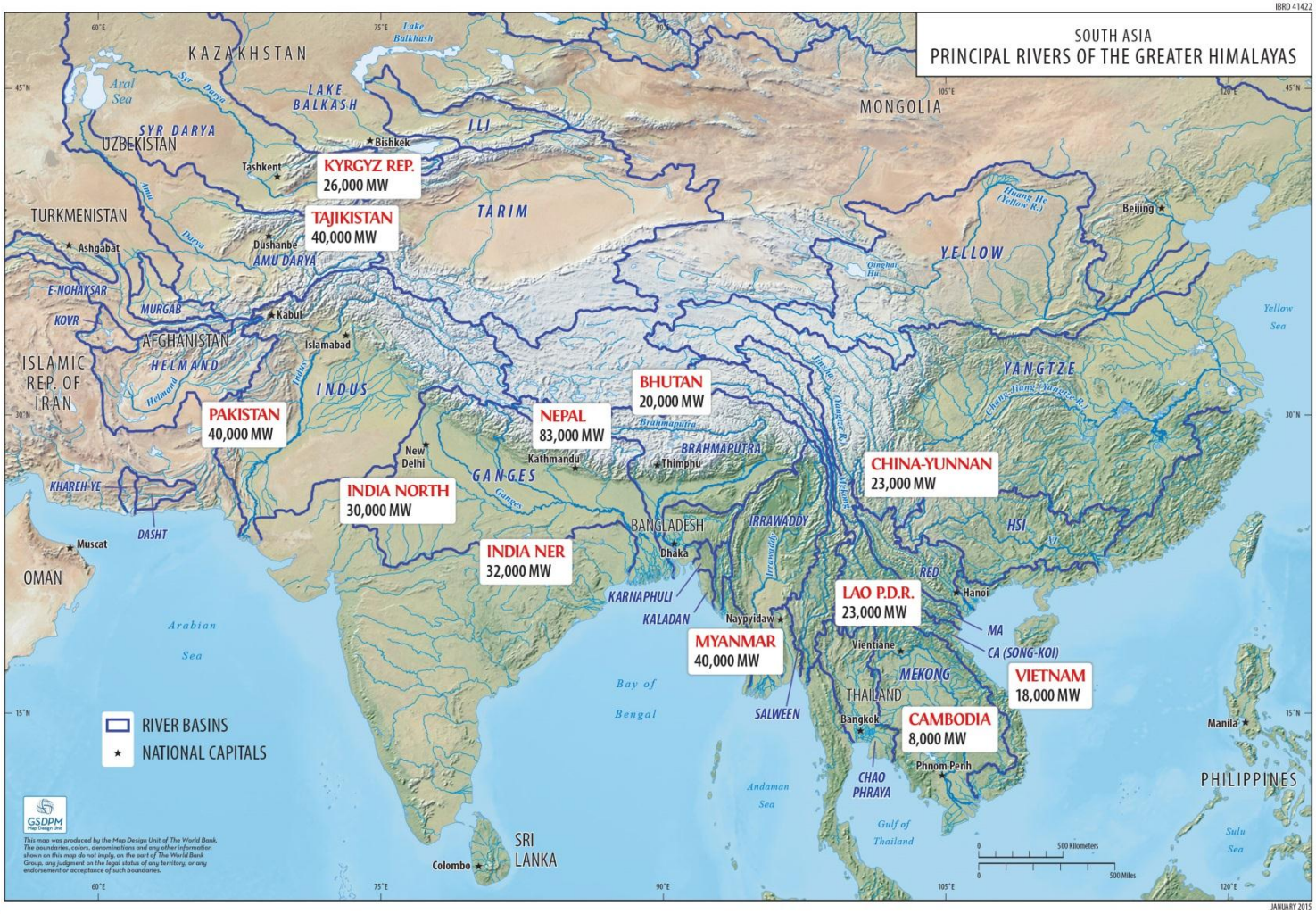


Proposed Small Hydro

Fish migration route

WORLD BANK GROUP

RIPARIAN ISSUES



NEPAL OVERVIEW

- Tech. feasible potential: 44,000 MW
- Installed capacity: 706 MW (1.6%)
- Significant population suffer from 16 Hours of Load shedding.
- Petroleum import : USD 0.75 billion per year.
- Major source of energy : traditional fire wood and petroleum products
- Per capita energy consumption : <100 kWh
- Neighboring India requires 45GW of clean energy in the next 10 years
- Bangladesh, Pakistan are also short of energy countries

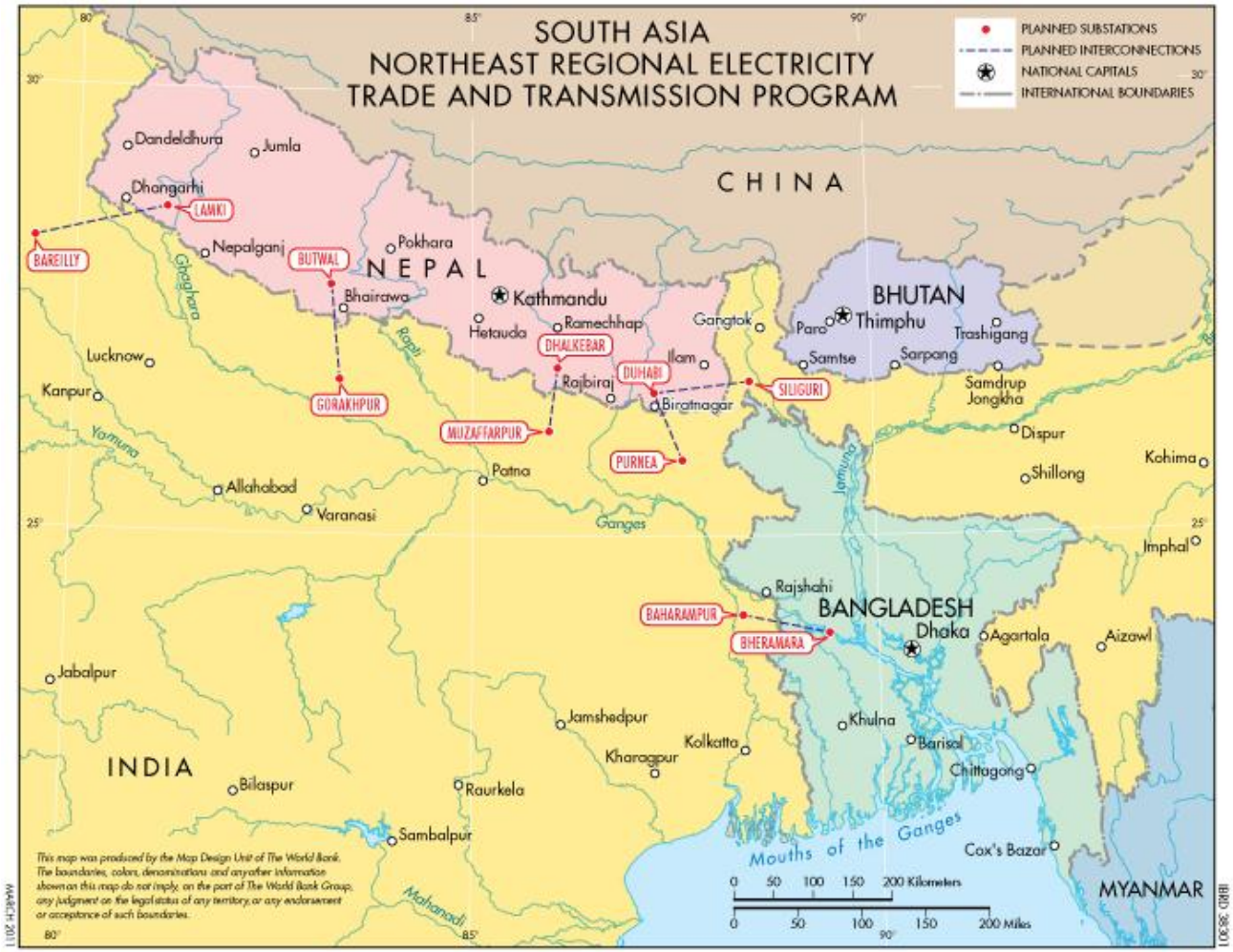
NEPAL'S ONLY SOLUTION

- Hydro is the only solution (no competition from other resources)
- Has good prospects in the context of a regional market

900 MW Arun 3 Project

- Aborted in the 90s, revived in 2014 after possibility of export
- SJVNL will provide 22 % free energy, which is worth USD 1.6 billion and USD 11 billion in royalty.
- SJVNL will allot USD 16 million worth of shares to the locals.
- Start energy generation by 2020.

TRANSMISSION BOTTLENECKS



NEPAL HYDROPOWER SCENARIO – FUNDING REQUIREMENT

- ***Generation:*** Financing of about USD 15 billion (assuming USD 1.5 million/ MW) to develop the exploitable generation capacity of 10000 MW.
- ***Transmission & distribution:*** Additional funding USD 5 Billion would be required for building the transmission infrastructure for sale within state and to the export market i.e. India / regional
- Total debt and equity required for funding these projects would be around USD 20 Billion.

SOME SOLUTIONS

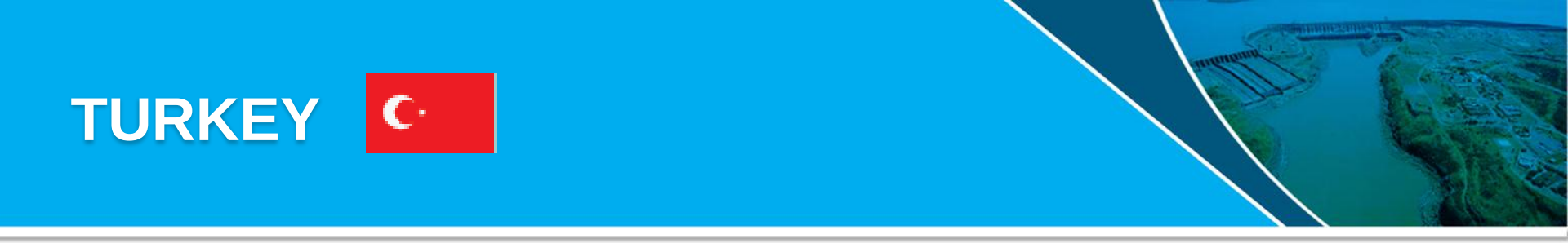
- Public sector/Government involvement and leadership is crucial
  - For addressing E&S issues locally (land)
    - Also for Cumulative Impact Assessment at basin level
  - For addressing riparian issues on transboundary rivers
- Bring in private sector
  - For resources, managerial capacity, commercial focus etc.
- PPP is ideal for hydropower (infrastructure by governments)
- Consider cross border trade of hydropower
  - Better economics, financeability, and easier to attract private investment
  - Absolute necessity for land locked high potential countries

TURKEY

TURKEY is a country with mixed energy system with a market economy.

- Installed hydro capacity: 20,069 MW (26% hydro)
- Considerable variation in runoff in terms of seasons, years and regions – necessity for the major rivers to have water storage facilities.
- Peak load is covered by hydros (126 TWh/year), dwindling lignite (105 TWh/year) and hard coal (16 billion kWh/year) resources, with a total annual average of 248 TWh.
- About 60% hydro potential remains to be developed in Turkey.
- 1923 only 3 cities were electrified; Until 1950s most RoR projects were being developed. In 1950s World Bank assisted with the first hydros. 500 MW
- An interconnected system now extends throughout the whole country

TURKEY



- DSI was founded in 1954 under Suleyman Demeral, dams engineer who later became the President.
- DSI under the Ministry of Energy and Natural Resources, is the major organization responsible for the development and management of hydropower and water resources.
- DSI built dams under central planning with transmission interconnections. Whole of Turkey is today interconnected.
- The energy policy is determined by 5-year development plans
- In 2000, privatization of the energy sector was done. By that time large hydro sites were developed.
- Currently there are over 1700 license applications for hydro IPPs, 800-900 are granted.
- Small hydros have potential in Turkey, about 57 TWh
- Turkey became an importer of electricity after 1997.

Thank You