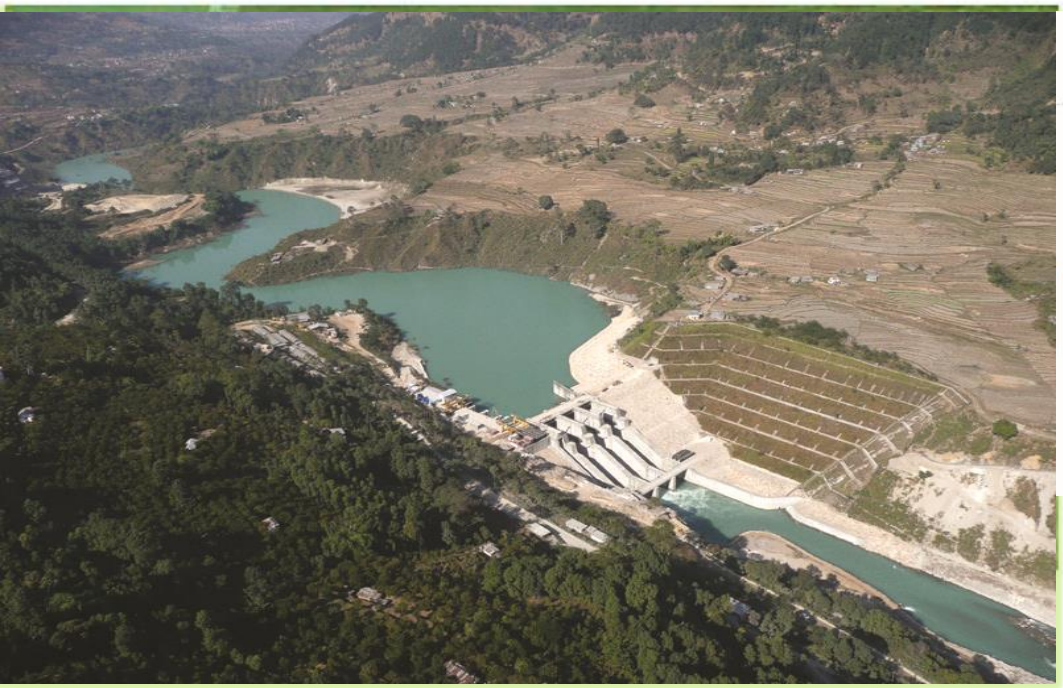
South Asia's Water, Energy & Climate Change Challenges: Nepal's Opportunity



Hydro Solutions
empowering hydropower

Er. Gyanendra Lal Pradhan. (*Chairperson*)

Energy Committee, FNCCI

CACCI Asian Council on Water, Energy and Environment, Taiwan

SAARC CCI Council on Climate Change, Energy & Water Resources

Member Electricity Tariff Fixation Committee

Ex Member : Prime Minister's Economic Advisor Council

Comparing the world's energy resources*:

Where should we invest
For the long haul?

finite

2010 World Energy Use

Natural Gas

Petroleum

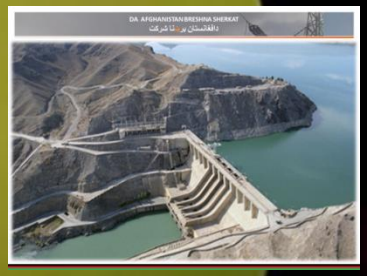
Uranium

COAL

WIND

SOLAR

HYDRO



Waves

Biomass

OTEC

TIDES

Geothermal

S. No.	Name of P/S	Installed Capacity (MW)	Generation Rs/Unit
1.	*Sundarijal*	0.64	1.50
2.	*Kaligandaki 'A'*	144	2.97
3.	*Marsyangdi*	70	2.17
4.	*Kulekhani-I*	60	1.98
5.	*Trishuli*	24	1.71
6.	*Multifuel (Thermal)*	53	29.40

Yearly potential is shown for the renewable resources. Total "use it lose it" reserve is shown for the finite fossil and nuclear resources. World energy use is annual

Energy Situation of South Asia (Reserve)

Coal

- 63,036 Million tonnes, proved recoverable

Natural Gas

- 2,308 Billion cubic meters, proved recoverable

Oil

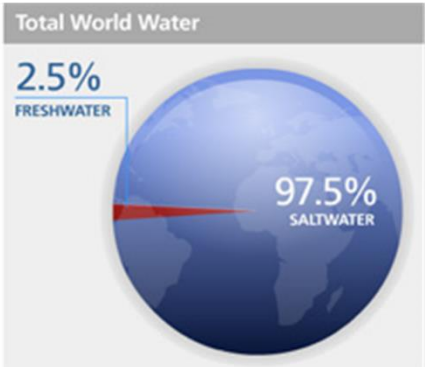
- 785 Million tonnes, proved recoverable

Hydropower

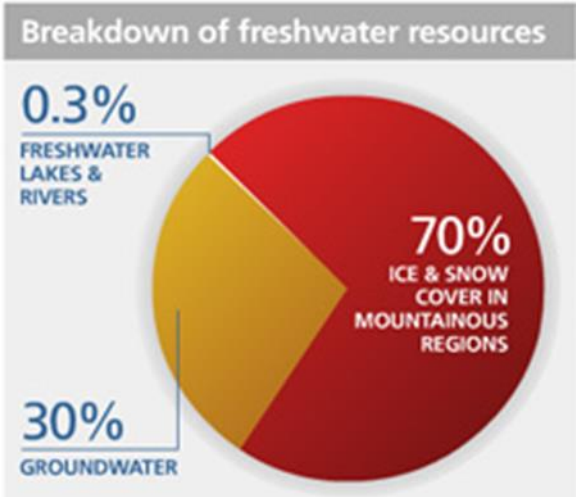
- 4,528,000 GWh/year, gross theoretical capability

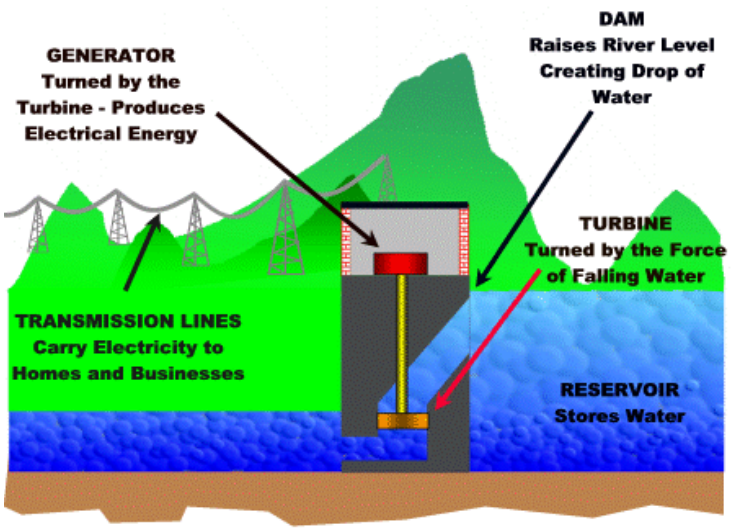
W A T E R

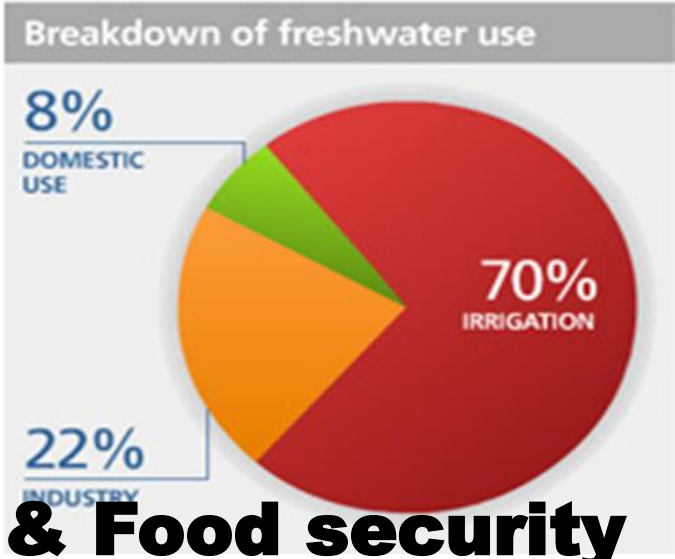
Water Resource & Consumptions



- Water is life-line for all living beings, foundation for the overall development of human society.
- **Hydropower makes water use cheaper and efficient**







Hydropower for Water, Energy & Food security

1350 litres water

1 kg wheat

16000 litres water

1 kg beef

140 litres water

1 cup of coffee

900 litres water

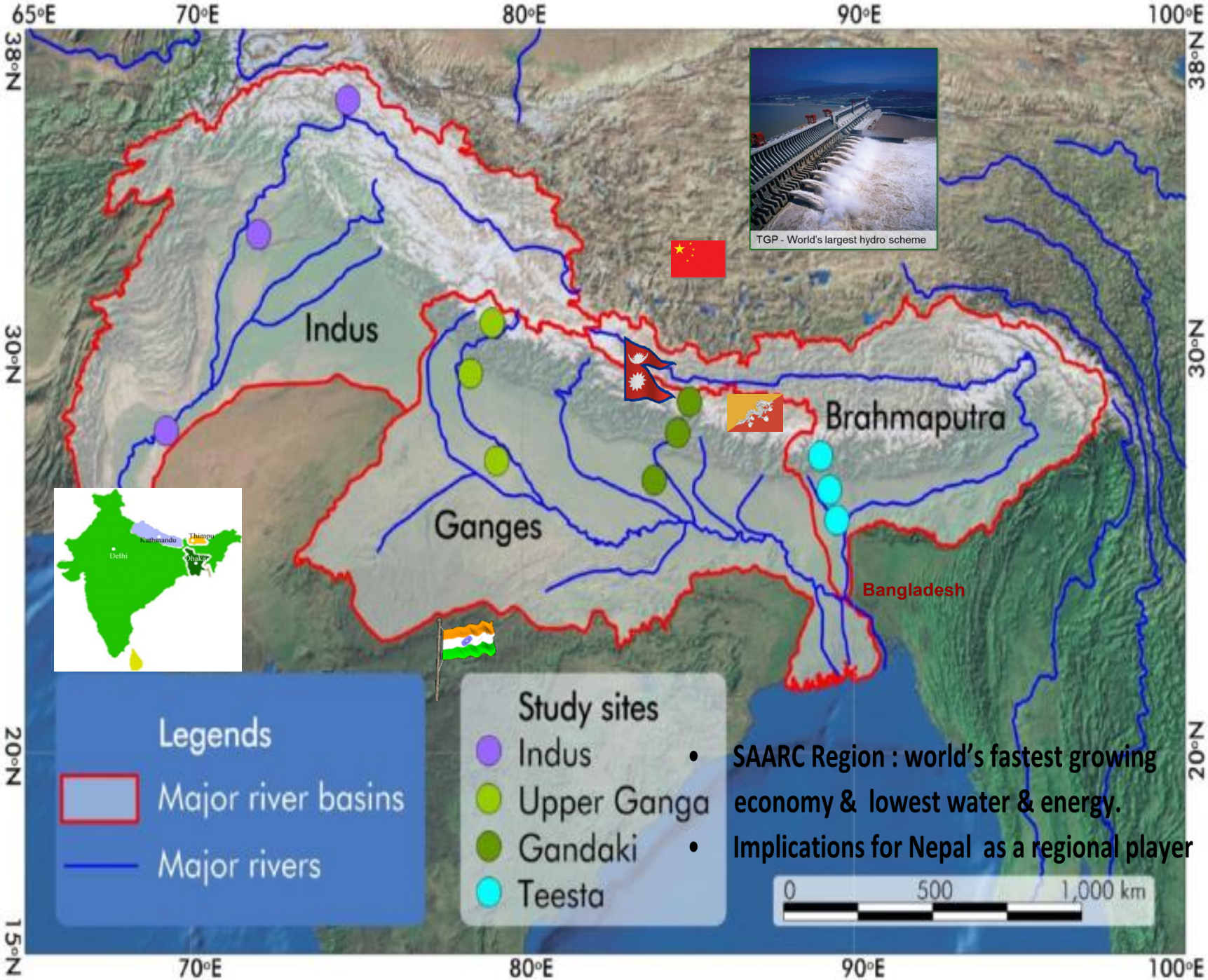
1 kg maize

1000 litres water

1 litre milk

3000 litres water

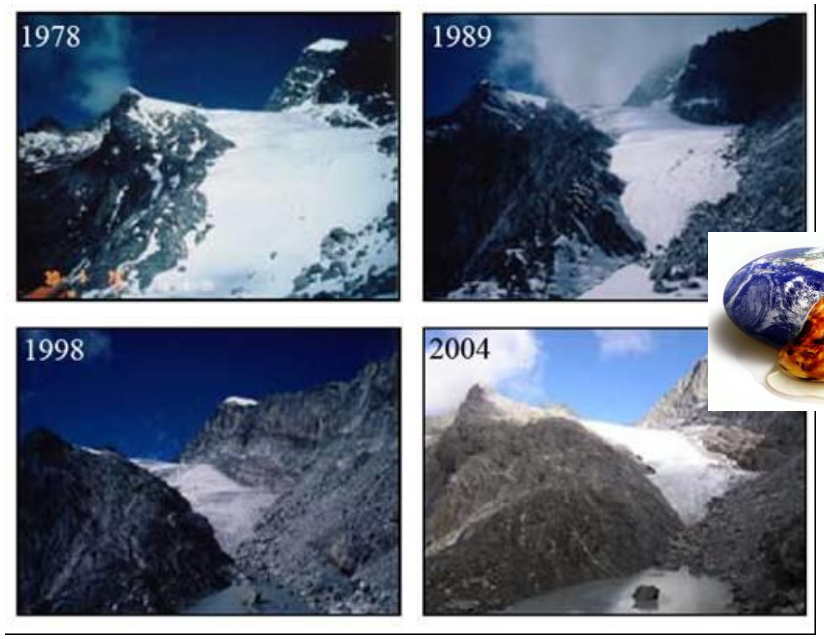
1 kg rice



- SAARC Region : world's fastest growing economy & lowest water & energy.
- Implications for Nepal as a regional player

People residing in Ganges basin are highly vulnerable to

climate change



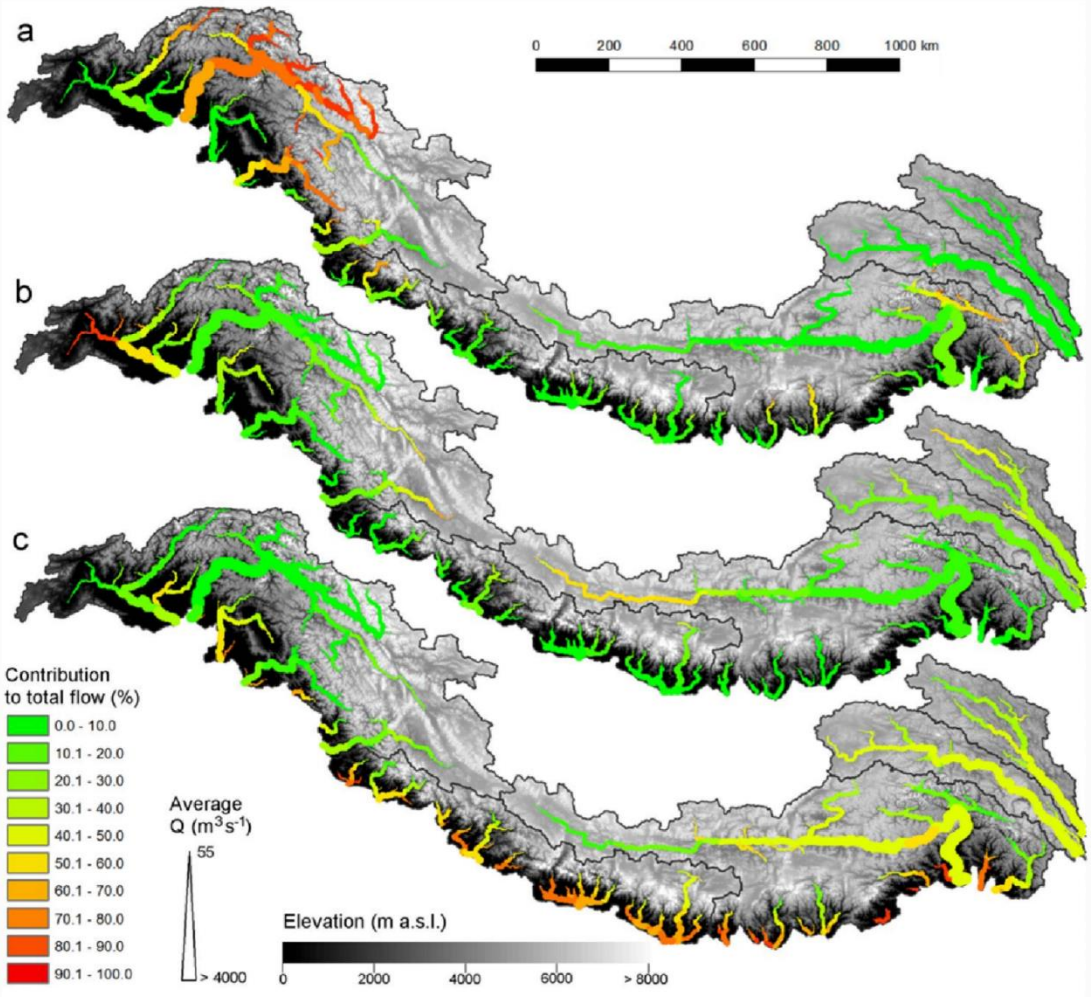
"If Himalayas live we can live"

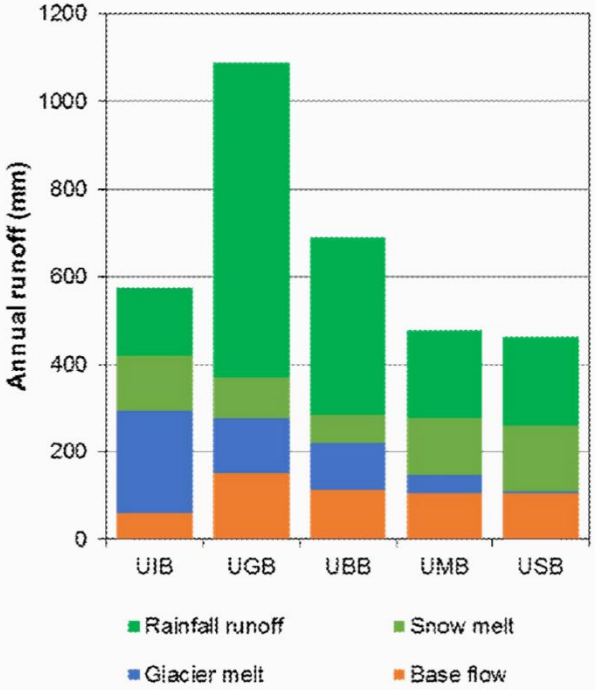
- **The Indo-Gangetic Plain –**
- 255 million hectare fertile land. **Ganges provides water to 600 million people, largest in the world.**
- **The seasonal distribution of flow is extremely variable.**
  - **Snow fed : 1.5 - 2.4 % of the total runoff (Jan-March) & as high as 20 - 27 % in July & August.**
  - **Purely rain fed rivers : 0.5 - 3 % (March – May) & 19 - 30 % in July & August.**

Understanding the Water Tower

From averages to extremes

Uttarakhand floods, India, June 2013

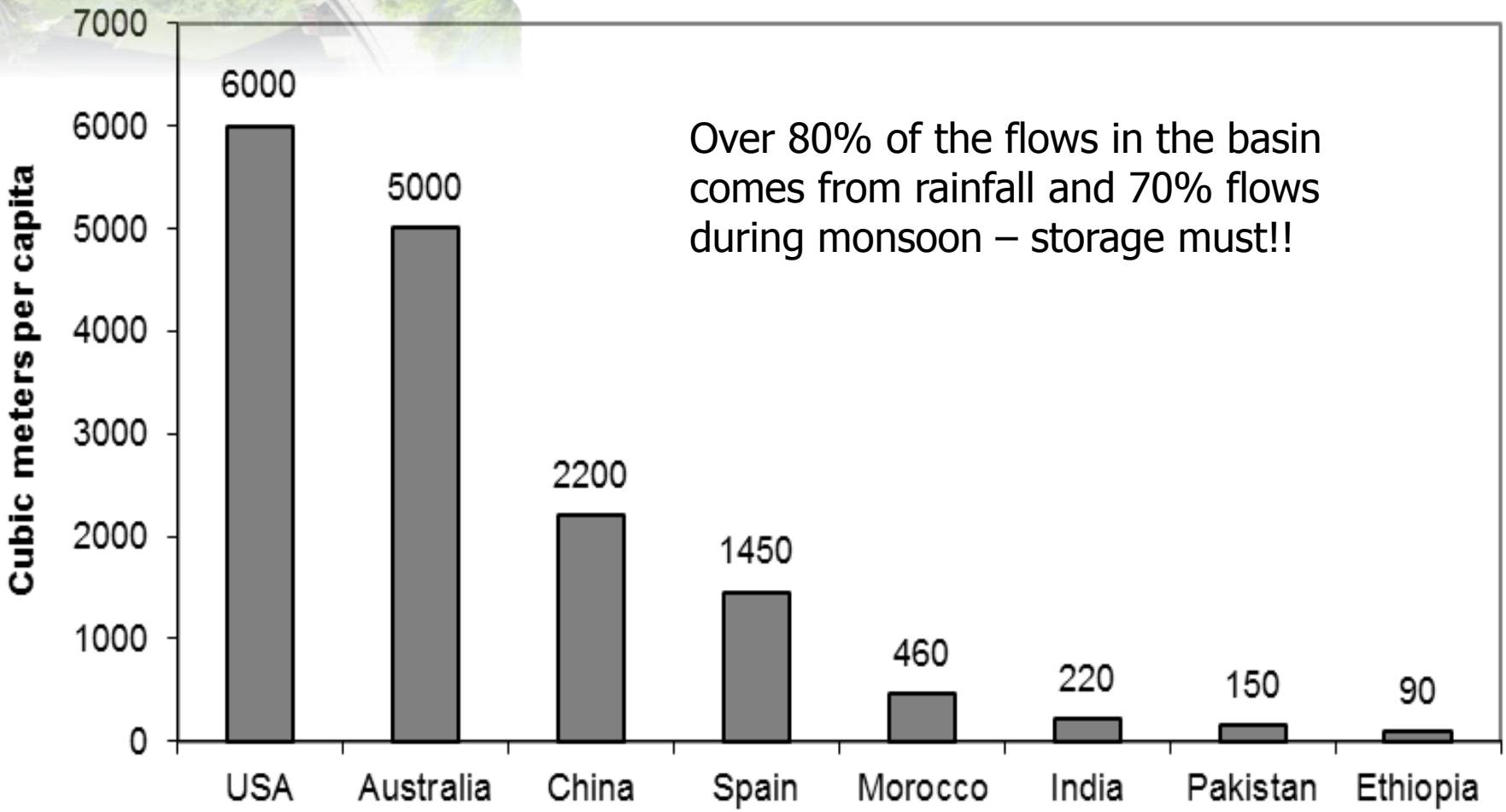




Lutz, Immerzeel, Shrestha, Bierkens, Nature Climate Change, 2014

Increase storage capacity

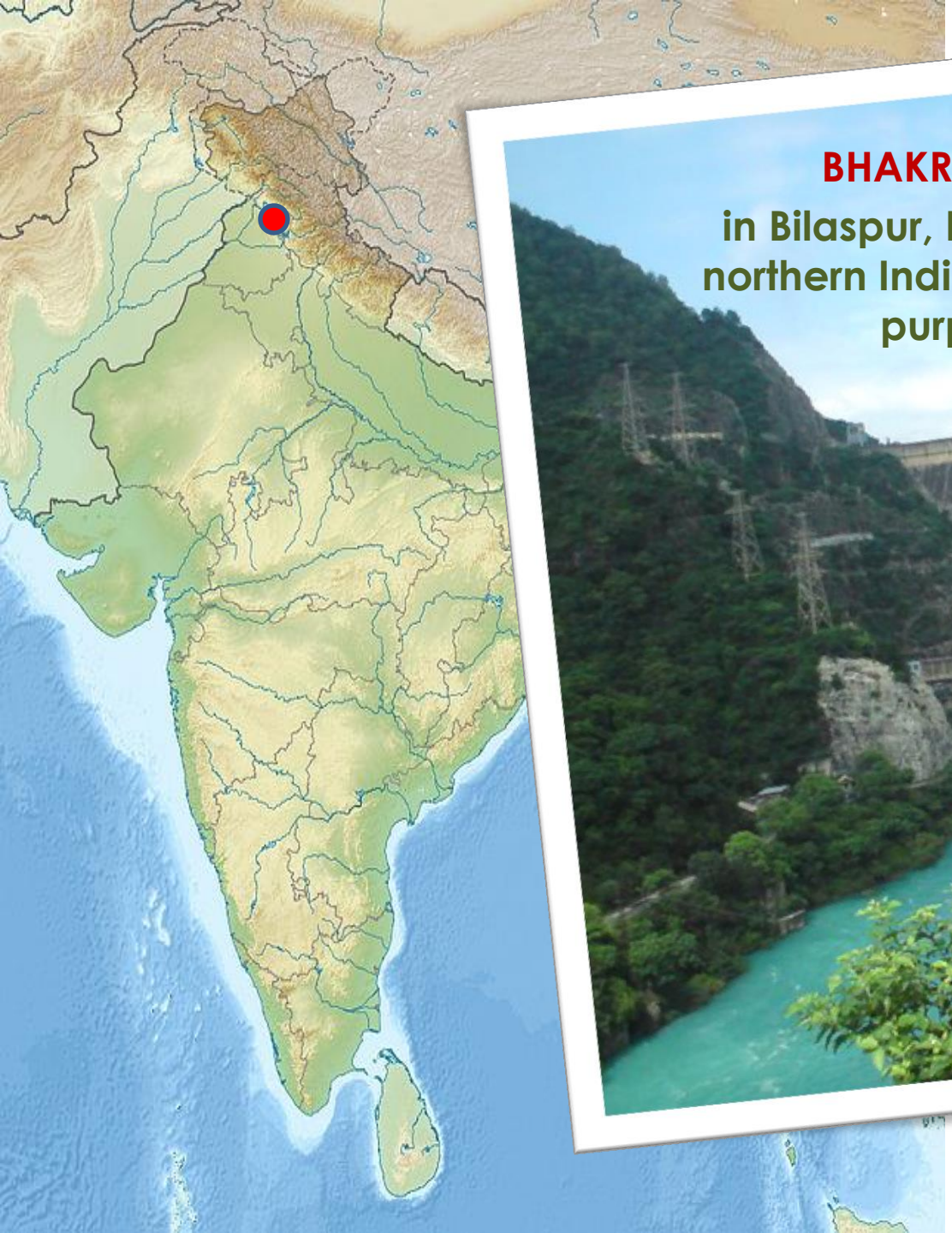
(30% of the river flow for 8 months- over 20% will be lost by 2025)

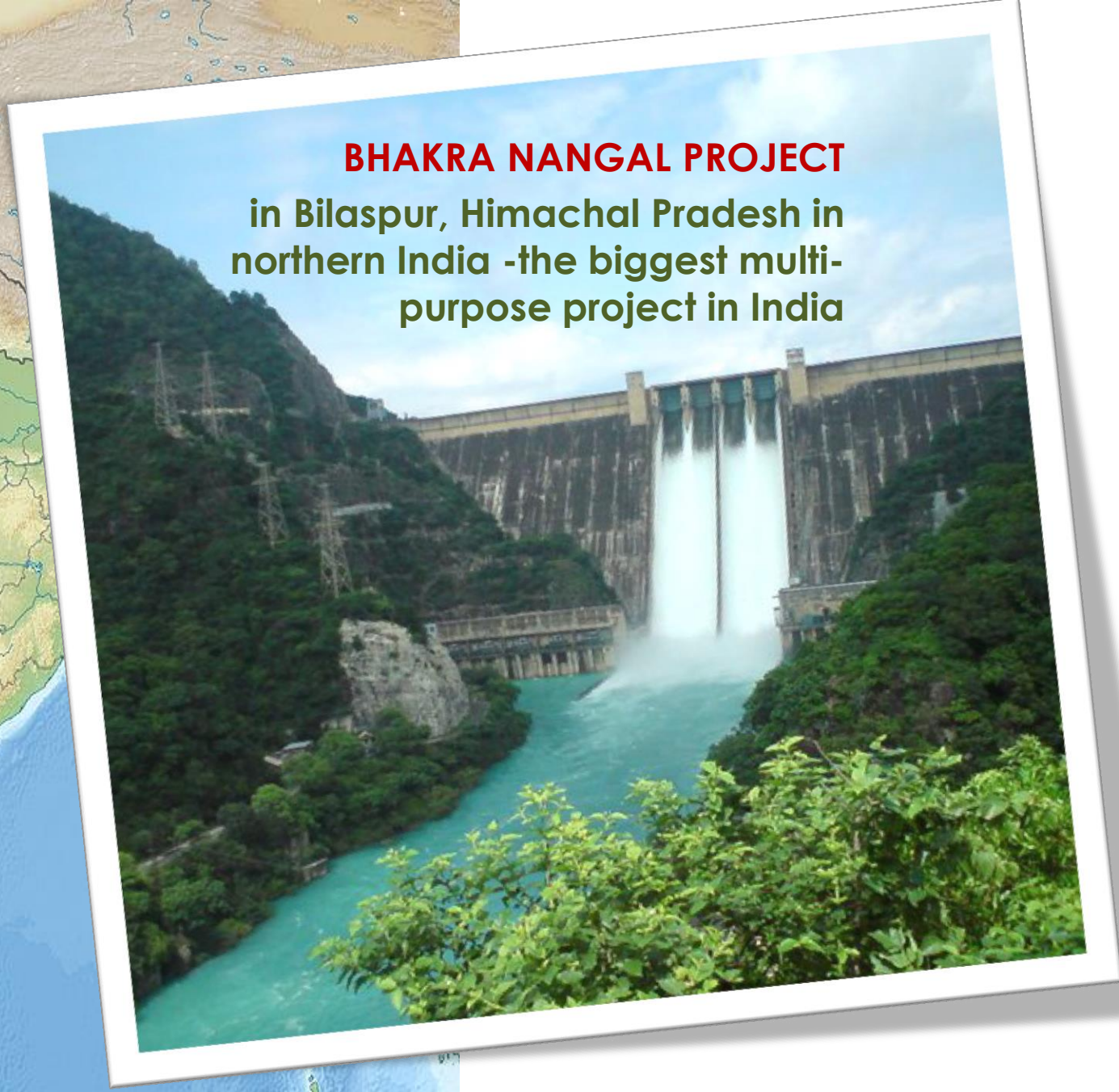


Over 80% of the flows in the basin comes from rainfall and 70% flows during monsoon – storage must!!

STORAGE VS. ROR

Projects	Storage			ROR		
	Q20			Q ?		
	Cap. (MW)	Dry (GWh)	Wet (GWh)	Cap. (MW)	Dry (GWh)	Wet (GWh)
Kali Gandaki-Kowan	374	624	1283	330	164	1110
Kaligandaki Gorge	298	457	968	298	145	968
Upper Kaligandaki	31	41	105	31	15	105
Lower Kali Gandaki	99	113	345	99	48	345
Kaligandaki Upper	81	88	283	81	39	283
Beni Kaligandaki	111	106	394	111	55	394
Phalebas Kaligandaki	241	95	772	241	63	772
Kaligandaki "A"	637	231	2016	637	156	2016
Kaligandaki B	878	647	2846	317	96	1018
Kali Sapta Gandaki	369	271	1192	369	111	1192
Total	3120	2673	10204	2514	892	8203





BHAKRA NANGAL PROJECT

in Bilaspur, Himachal Pradesh in northern India -the biggest multi-purpose project in India

Straßenansicht
Mehr...
Karte
Jaynagar
Bhaptiahi
Pratapganj
Forbesganj
Supaul
Madhipura
Saharsa
Bakhtiarpur
Purnea
Katihar
Khagaria
Munger
Jamalpur
Sultanganj
Bhagalpur
Naugachhia
Bhagalpur
Rusera
Bariarpur
Bogusarai
Bartiyar
20 km
©2008 Google - Grafiken ©2008 TerraMetrics, Kartendaten ©2008 AND, Europa Technologies

KOSHI Barrage

Triveni Road
NEPAL
Tribeni Gandak Barrage
© 2013 Google
US Dept of State Geographer
Image © 2013 DigitalGlobe
Imagery Date: 11/2

Budhi Gandaki - 1200 MW

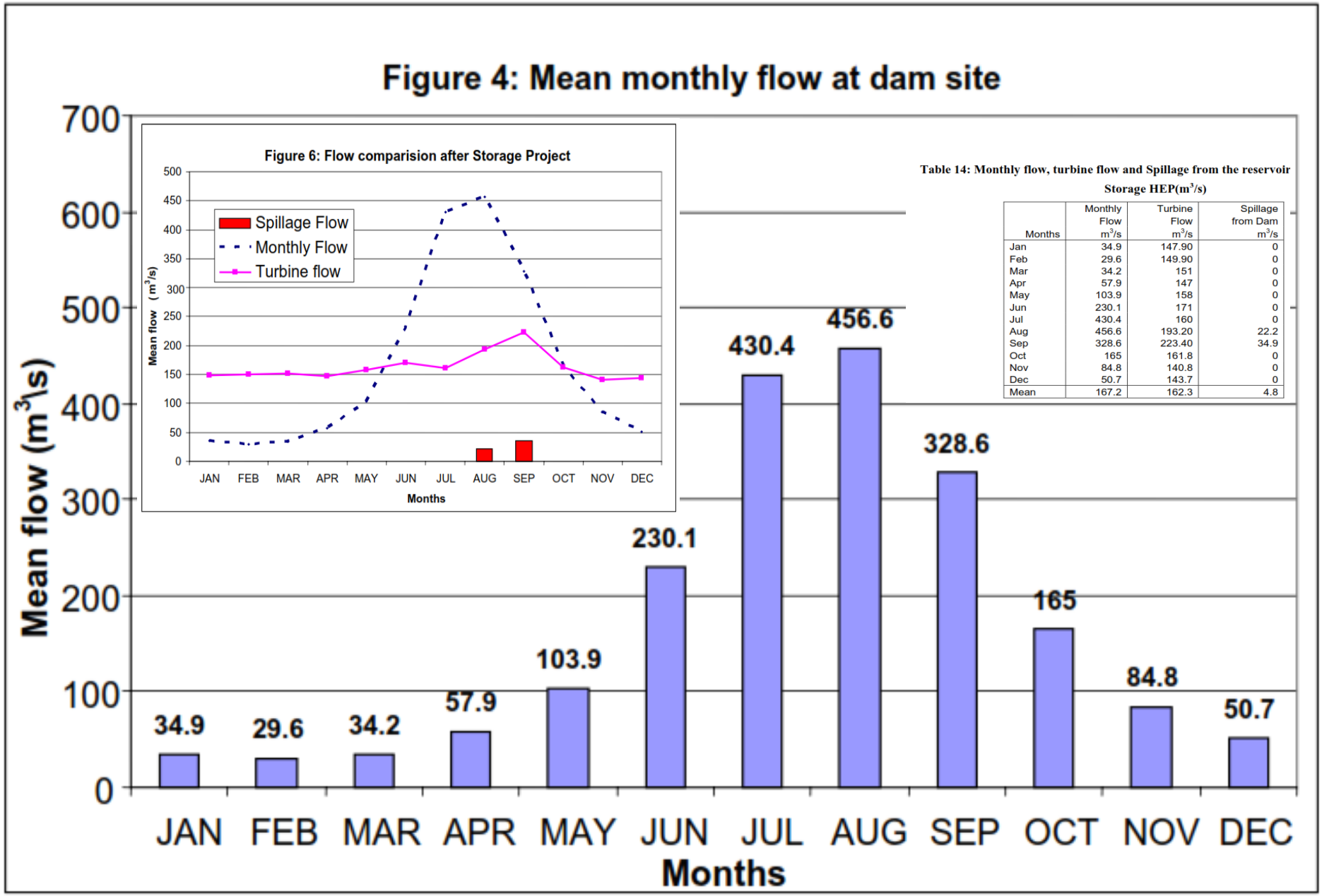
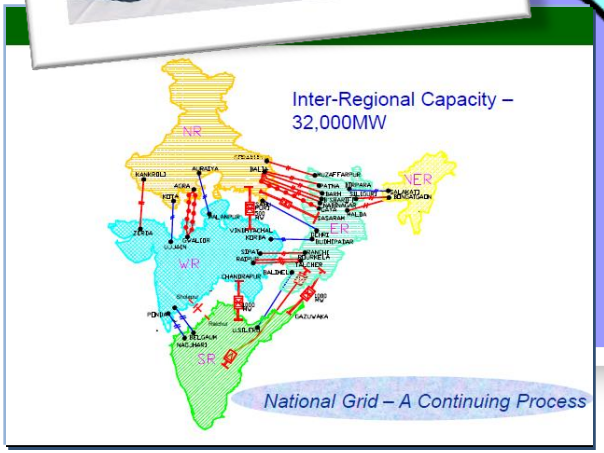
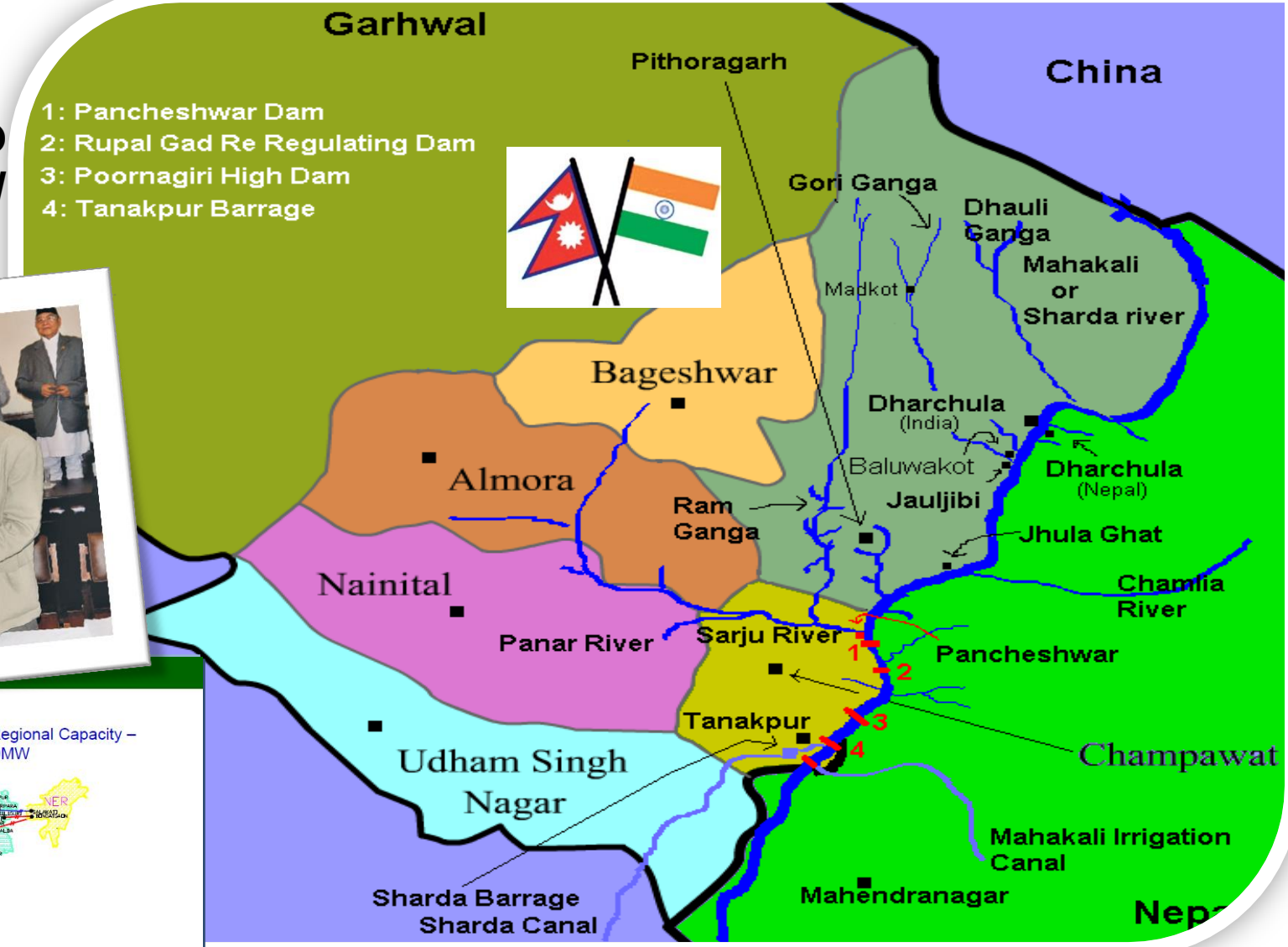


Table 14: Monthly flow, turbine flow and Spillage from the reservoir Storage HEP(m^3/s)

Months	Monthly Flow m^3/s	Turbine Flow m^3/s	Spillage from Dam m^3/s
Jan	34.9	147.90	0
Feb	29.6	149.90	0
Mar	34.2	151	0
Apr	57.9	147	0
May	103.9	158	0
Jun	230.1	171	0
Jul	430.4	160	0
Aug	456.6	193.20	22.2
Sep	328.6	223.40	34.9
Oct	165	161.8	0
Nov	84.8	140.8	0
Dec	50.7	143.7	0
Mean	167.2	162.3	4.8

PDA SIGNED FOR 1800 MW PROJECTS





Pancheswar Multipurpose Project – 5,000 MW

Table 7

Existing and Proposed Dams in the Ganges Basin over 100m High, with Global Comparators

Dam	River	Total height (m)	Gross Storage Capacity (BC
Existing			
Tehri	Bhagirathi	261	3.5
Marsyangdi	Marsyangdi	240	6
Lakhwar *(Under construction)*	Yamuna	204	0.6
Utyasu *(Under construction)*	Alaknanda	175	3.7
Kalagadh	Ramganga	128	0.3
Kulekhani	Bagmati	107	0.1
Proposed			
Budhi Gandaki	Budhi Gandaki	300	3.2
Upper Karnali	Karnali	260	7
Bheri 4	Bheri	260	15.8
Kali Gandaki A	Kali Gandaki	260	6.9
Pancheshwar	Sarda	250	6.8
West Seti (Seti 6)	West Seti	240	3.1
Chisapani	Karnali	240	28.2
Sapta Koshi High	Koshi	220	13.5
Seti 1	West Seti	195	1.5
Sun Khosi	Sunkoshi	180	1.5
Kali Gandaki 2	Kaligandaki	160	5.1
Purnagiri	Sarda	150	3.4
Tamur Mewa	Tamur	150	1.9
Seti	Seti	145	4
Trisuli	Trisuli	140	11.0
Andhi Khola	Kali Gandaki	110	0.9

Nepal Agriculture Water Need – At a glance

Particulars	Area in ha
Total area of nation	14,718,100
Cultivable Area	2,641,000 – 18%
IRRIGABLE AREA	1,766,000 – 12%
IRRIGATED AREA	1,331,521 – 75%
Surface irrigation	734440
Underground irrigation	359556
Farmer managed irrigation	237525

Water & Irrigation status of northern India

Uttarakhand

- The major irrigation are tube wells 58% canals 28%.

Uttar Pradesh

Net cultivated area: 167.50 lakh hectares. Poorly irrigated

Bihar

- 47.98 lakh hectares 54 % area is irrigated mainly through private tube wells

Delhi – Water Supply :

- Requirement of water in Delhi is nearly 11 million MGD, availability not more than 700 MGD per day.

River Ganga Cleaning Project

- Has earmarked Rs 20,000 crore for the project.

Households in every 1,000 do not have drinking water available throughout the year in India

Source: (Census 2011)

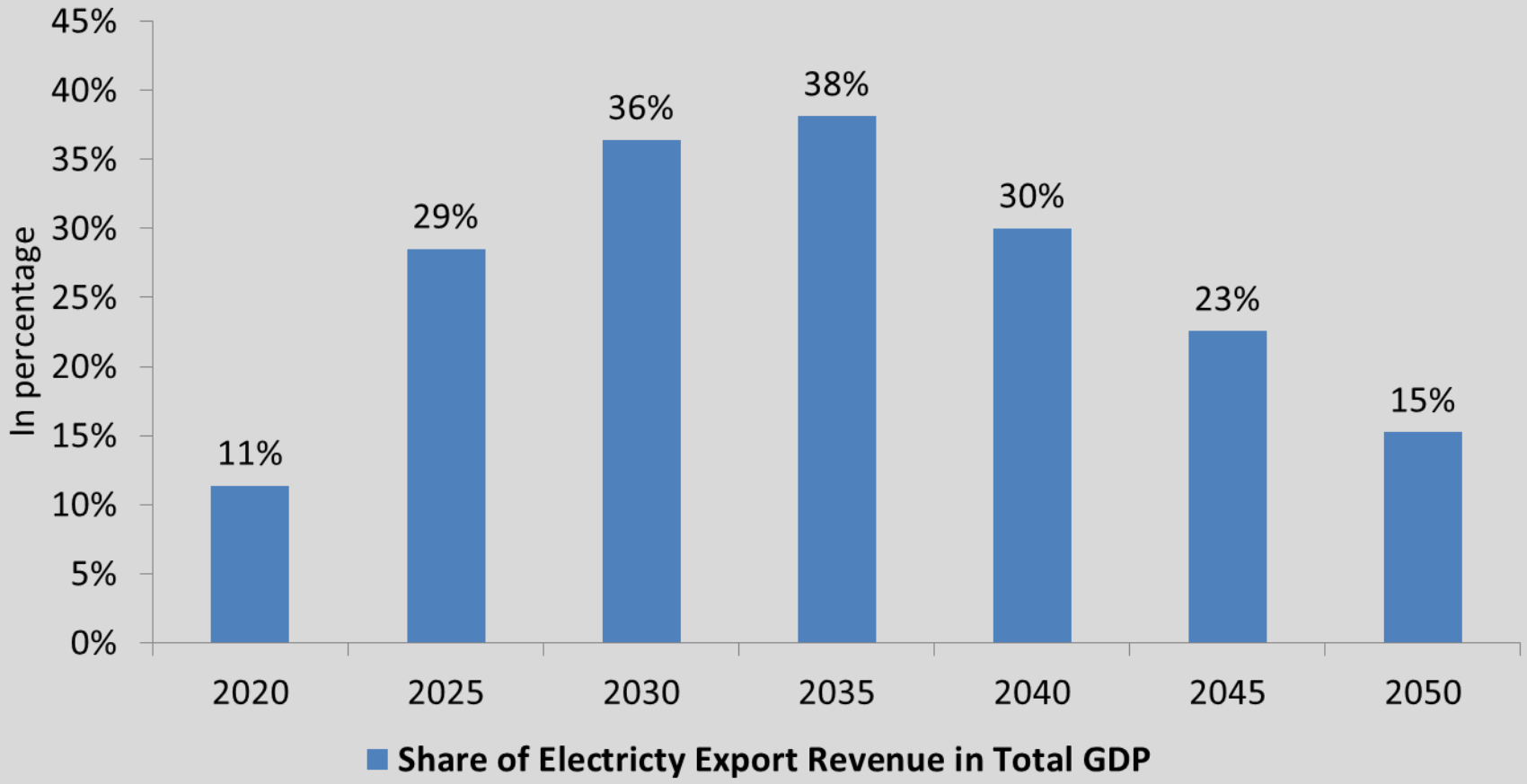
State	Rural	Urban	% of NOT getting sufficient drinking water
Uttarakhand	877	900	88.85
Punjab	931	908	91.95
Uttar Pradesh	971	966	96.85
West Bengal	880	935	90.75
Sikkim	730	951	84.05
Bihar	924	952	93.8
Himachal Pradesh	768	959	86.35
Jharkhand	703	793	74.8
Haryana	958	913	93.55
Andhra Pradesh	865	876	87.05
Arunachal Pradesh	803	783	79.3
Assam	961	945	95.3
Chhattisgarh	804	841	82.25
Delhi	703	844	77.35
Goa	917	950	93.35
Gujarat	863	961	91.2
Jammu & Kashmir	744	848	79.6
Karnataka	750	795	77.25
Kerala	860	916	88.8
Madhya Pradesh	762	762	76.2
Maharashtra	735	931	83.3
Tripura	834	987	91.05

Electricity Export Revenue share in GDP (at 2005 constant price)- Nepal

1 INR = 1.60 NPR

Assumptions:

- Growth rate for GDP: 8.2% (observed during period: 2003-12)
- Average electricity export price for year 2005: NPR 5.21 per kWh

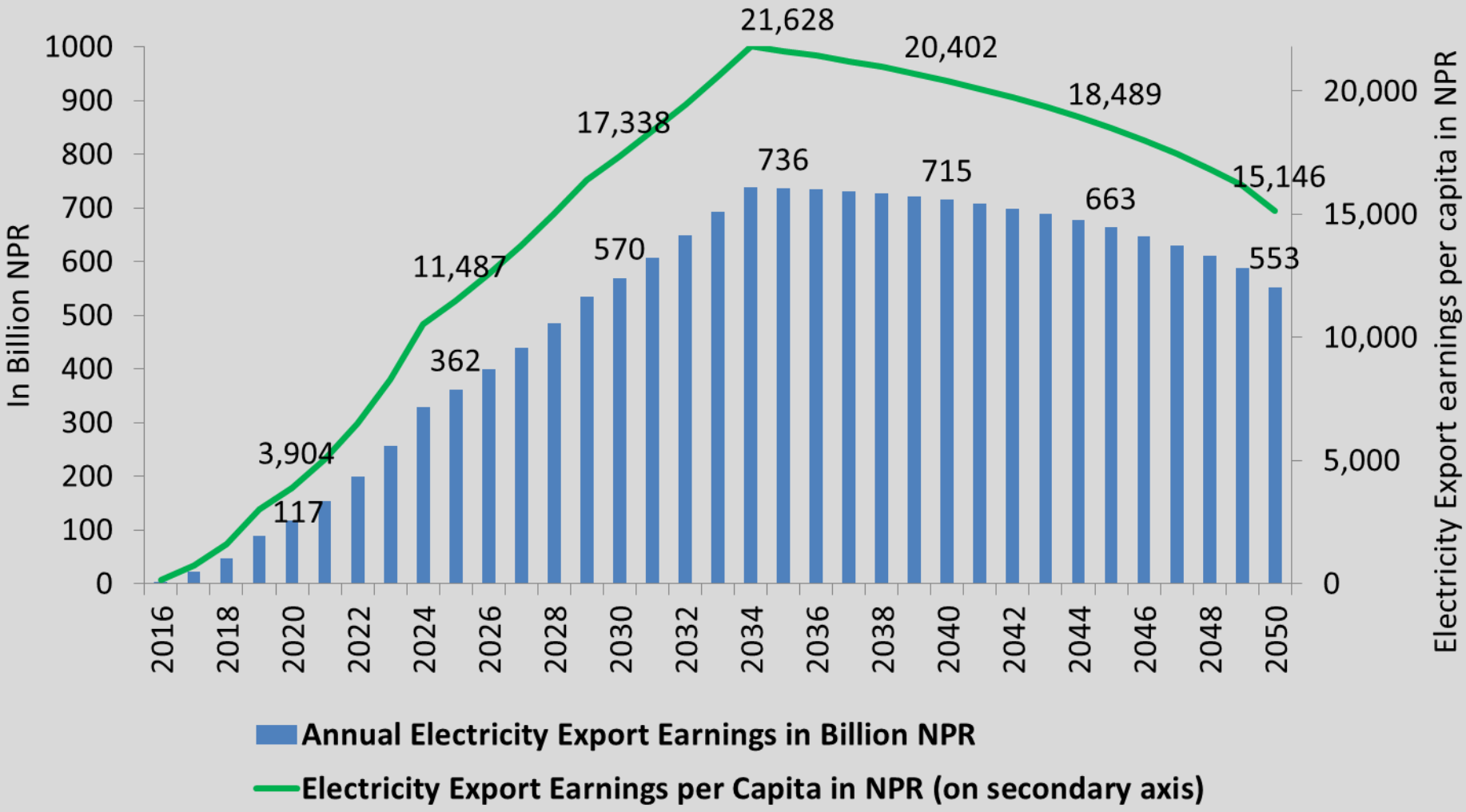


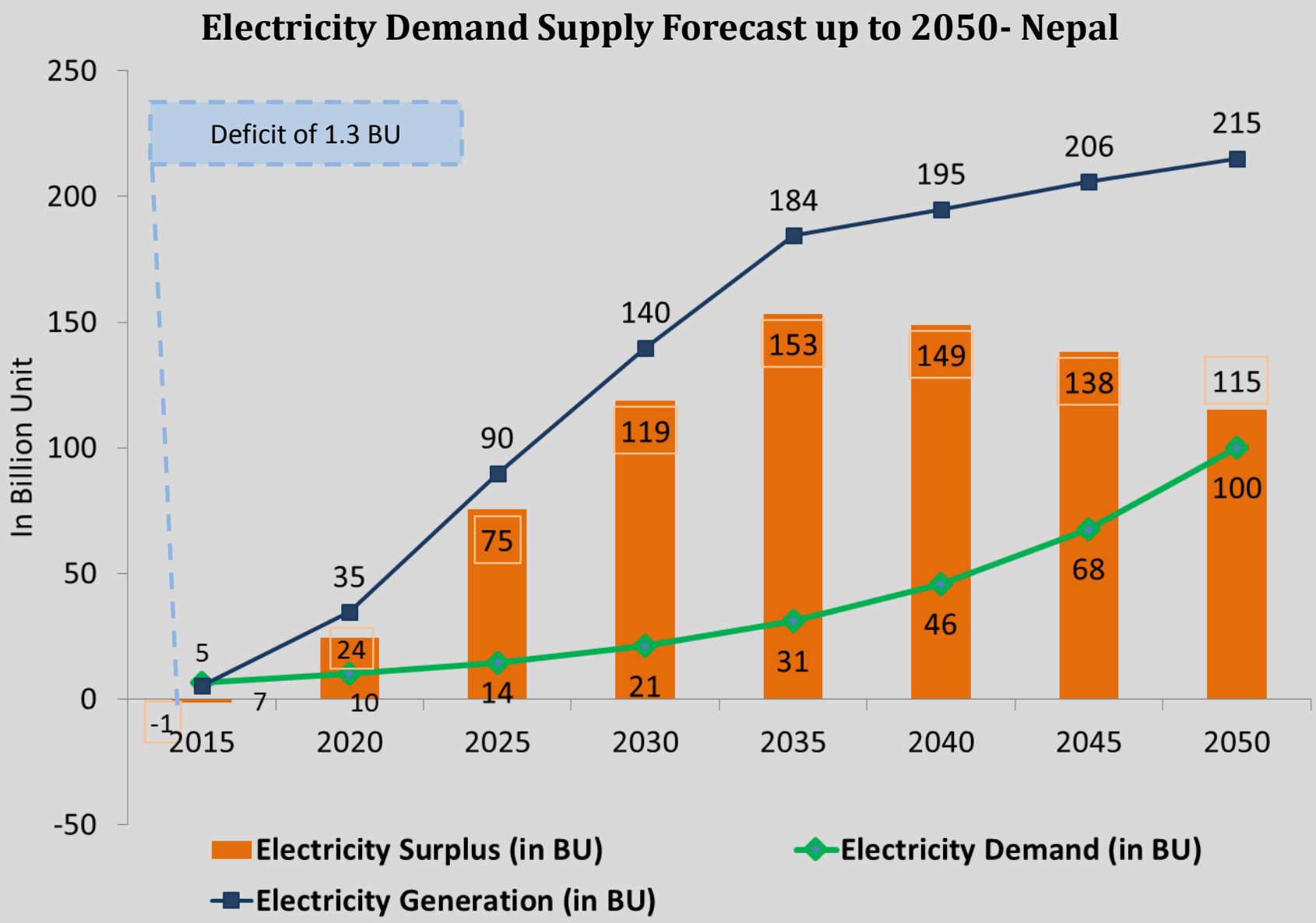
Annual Gains from Electricity Export- Nepal

1 INR = 1.60 NPR

Assumption:

- Export of electricity to India at NPR 4.8 per kWh (INR 3 per kWh).

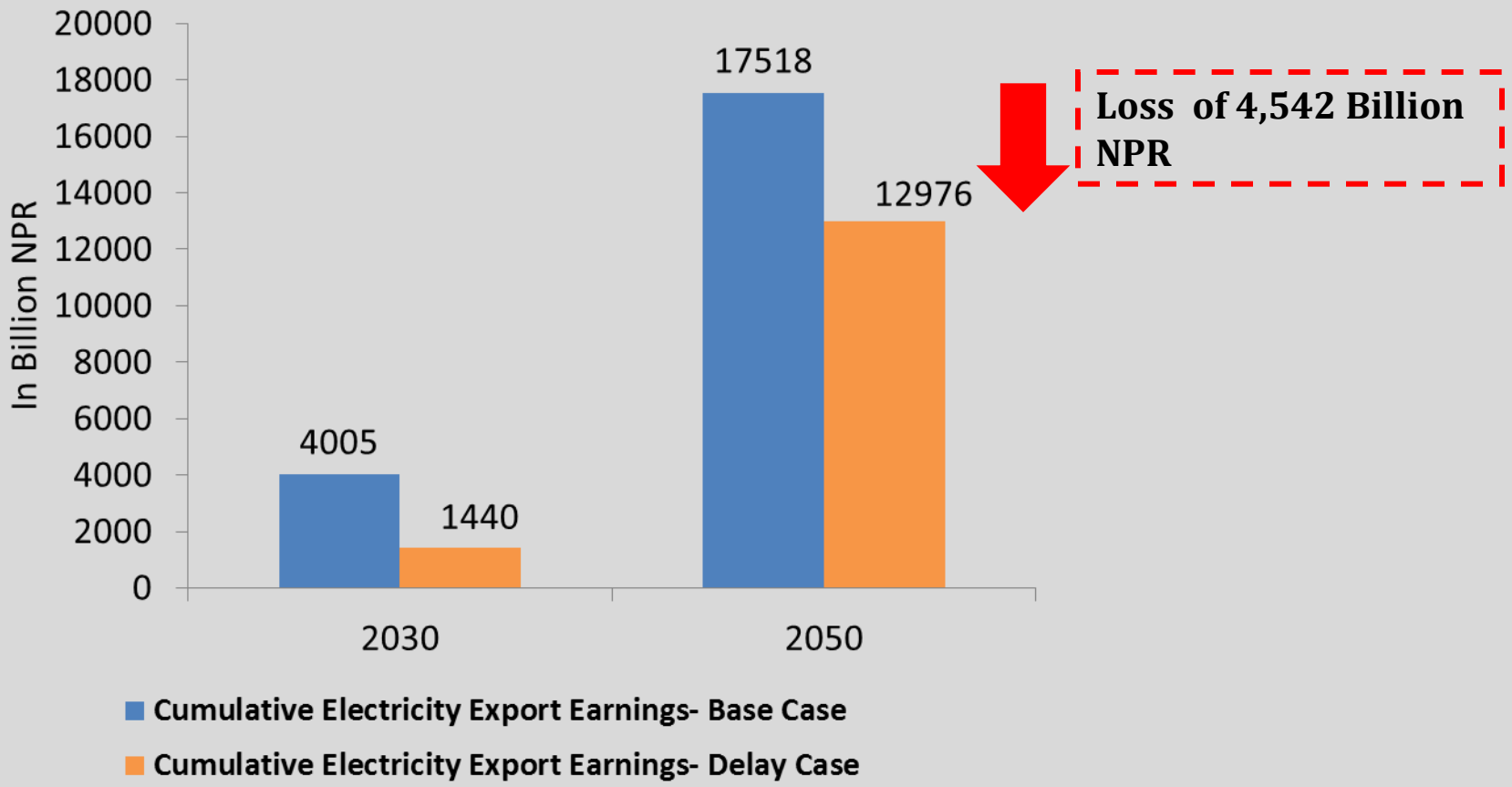



Electricity Demand Supply Forecast up to 2050- Nepal
Deficit of 1.3 BU
In Billion Unit
250
200
150
100
50
0
-50
2015
2020
2025
2030
2035
2040
2045
2050
5
35
90
140
184
195
206
215
-1
24
75
119
153
149
138
115
7
10
14
21
31
46
68
100
Electricity Surplus (in BU)
Electricity Demand (in BU)
Electricity Generation (in BU)

Impact of Delay in CBET- 5 Year Delay Scenario for Nepal

1 INR = 1.60 NPR

Cumulative Electricity Export Earnings



What is Stopping us…..????

Thank You