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NEPAL INFRASTRUCTURE SUMMIT 2024

Driving Sustainable Development through Strategic Investment

Built and Trust with SHIVAM CEMENT

12 - 13 September 2024

The Soaltee Kathmandu

Water Resources Development in Nepal

Keshab Dhoj Adhikari

Presentation Outline

- Water availability
- Hydropower: global, Nepal's current and planned use and potential
- Irrigation: current status and future
- Domestic water
- Issues
- Ways forward

How much water does Nepal have?

- Assessment basis – 474/579 pptn. & >103 GD stations
- Annually renewable freshwater in Nepal

Reference doc:	PPtn. (mm)	Runoff (BCM	GW (BCM)
WRS, 2002	1530	220	5.8
RBP Study,2024	1609	226.5	5 to 8
WB stats, 2020		198	

- **Nepal ranks 36th (overall) and 59th (per capita) availability**
- **Annual withdrawal 9.5 BCM (<5%); water stress, if >25%**

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Installed Hydropower Currently in Nepal and World

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Installed hydro in some major countries and Nepal in GW (as of 2023)						
#	**Country**	**Capacity**	**#**	**Country**	**Capacity**	
1	China	421	6	India	52	
2	Brazil	110	7	Japan	50	
3	USA	102	8	Norway	34	
4	Canada	83	9	Turkey	33	
5	Russia	56	10	France	26	
11	Nepal	3	12	World	1416	

Electricity Consumption Currently in Nepal and World (2021)

#	Country	Total/year (GWhr)	KWhr/capita/year	Per capita rank	Total rank
1	Iceland	19,000	51,304	1	73
2	Norway	131,931	24,182	2	29
3	Bahrain	31,000	21,185	3	65
4	USA	3,979,000	11,267	12	2
5	RoK	568,000	10,959	13	7
6	China	7,806,000	5,474	53	1
7	Bhutan	3,300	4,244	74	134
8	Maldives	600	1,151	144	173
9	India	1,443,000	1,025	150	3
10	Bangladesh	78,000	461	173	39
11	Nepal	7,200	240	186*	115
12	Afghanistan	5,500	137	195	126

Nepal's per capita per year figure as of FY 2023/24 is **380 kWhr, which is targeted to increase to **700** kWhr in 2028/29 – **16th Plan***

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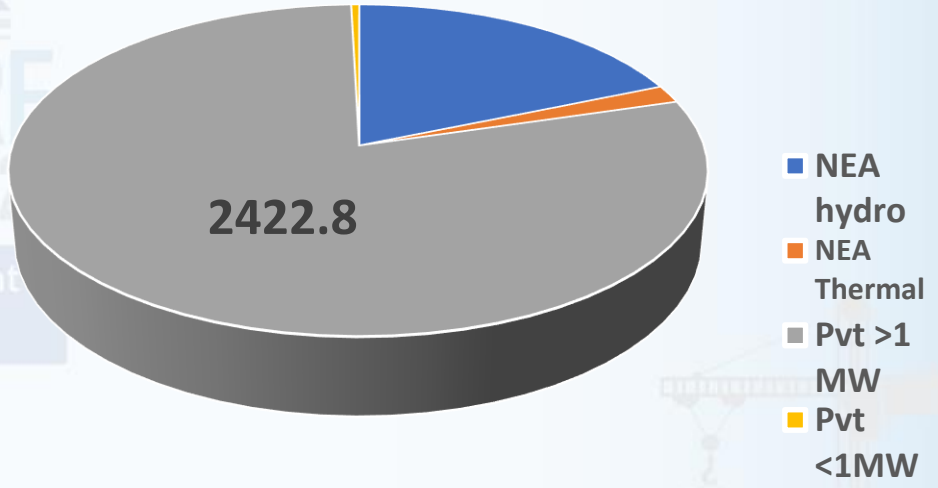
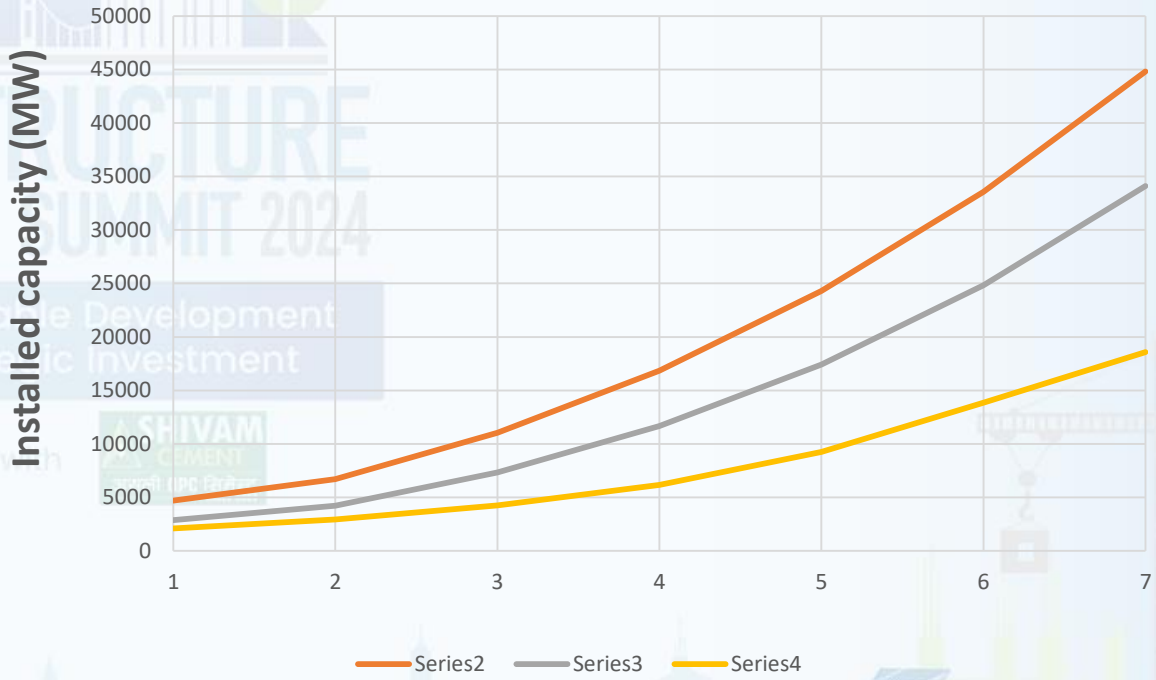
Current Installed Capacity of INPS (MW)

Current installed capacity of INPS (MW), (as of July, 2024)			
#	Particulars	Capacity	%
1	NEA hydro	573.6	
2	NEA thermal	53.0	
	NEA total	**626.6**	**20.5**
3	Private < 1 MW	13.2	
4	Private > 1 MW	2422.8	
	Private sector total	2436.0	79.5
	Grand total	**3062.6**	**100**



Projected Electricity Demand Up To 2050

Year	Installed Capacity, hydro (MW)		
	Base case	Scenario-1	Scenario-2
2022	4717	2882	2092
2025	6697	4234	2930
2030	11041	7331	4249
2035	16850	11660	6161
2040	24302	17428	9241
2045	33567	24845	13862
2050	44812	34119	18591



Hydro Development Plan Up To 2050 (HDMP, 2024, WECS)

Project class	Installed Capacity, hydro (MW)		
	Base case	Scenario-1	Scenario-2*
Under operation as of April, 2023	2188	2188	2188
Projects with gen. licenses	8667	7072	4722
Inter-basin or IMP projects	768	768	768
Large government projects	11327	8355	5835
Greenfield projects	25000	18500	7500
Total	47950	36833	21013

Base case: 15th Plan; Scenario-1: ADB projected (Paper no. 73, Aug, 2020)

Scenario-2: NEA's forecast; 5% added as reserve in all; * Recommended

Irrigable land in Nepal (IMP, 2019)

S. No.	Ecological zones	Irrigable land (ha)	%
1	Terai	1,499,176	59
2	Hill	836,617	33
3	Mountain	200,526	08
	Total irrigable	2,536,319	100
	Total agricultural land	**3,557,764 ha**	

Existing & Planned (16th Plan)

S. No.	Particulars	Coverage at the end of FY 2023/24 (ha)	Coverage at the end of FY 2028/29 (ha)
1	Surface	1,022,735	1,122,735
2	GW	530,654	643,154
3	Lift/storage	2,119	27,119
	Total	1,555,508	1,793,008
	Year-round	25%	50%

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Selected Large Projects in IMP, 2019

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S. No.	Particulars	New irrigation area (ha)	Rehab irrigation area (ha)	Total irrigation area (ha)	Remarks
1	Tamor-Morang	43743	70000	113743	With Tamor-3 storage dry season area can be 113700 ha
2	Sunkoshi-Marin & Sunkoshi-Kamala	171500	169889	341389	Sunkoshi-Marin under construction. With Sunkoshi-3 storage combined area=352300 ha
3	Kaligandaki-Tinau with Andhi Khola Storage	0	41953	41953	Kaligandaki-1 storage needed for hectareage enhancement
4	Naumure Dam, Rapti-Kapilvastu	51526	15226	66752	Not much economically attractive, but may be required for flow enhancement
5	Karnali transfer to Kailali	32996	7632	40628	Serves area in between that of Rani Jamara and Mahakali-3
6	Bheri-Babai + Nalsingad storage	2644	42467	45111	Power potential 46 MW
7	Chatra Barrage	18489	47993	66482	Provides reliable water supply to this area of Saptari in addition to existing 68,000 ha of Sunsari-Morang
	Total	**320898**	**395160**	**716058**	

WASH Status

- Article 35(4) of Constitution: WASH is a fundamental right
- By 2022/23, 95% has access to basic WS and 96% basic sanitary services
- Only 25% have well treated water supply and 2.34 % have sewage treatment
- Open defecation free in 2019, first in South Asia, but raw sewage disposal
- 16th Plan target: Basic sanitation-99%, sewage treatment – 30%
- Besides, SDG-6 has set ideal WASH targets
- WASH Policy, 2023 has set the main two of them for the next 2 decades

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Basin-wide Annual Irrigation and Domestic Demands in BCM (2050)

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#	River Basin	Irrigation	Domestic	Irrig +Dom.
1	Mahakali	1.522	0.024	1.546
2	Karnali	3.920	0.096	4.016
3	Gandaki	2.701	0.201	2.902
4	Koshi	9.070	0.380	9.450
5	Babai	1.767	0.056	1.823
6	West Rapti	2.601	0.032	2.633
7	Kamala	1.153	0.024	1.177
8	Kankai	1.446	0.039	1.485
9	Mechi	0.372	0.013	0.385
10	Bagmati	1.601	0.548	2.149
11	Southern rivers	28.291	0.593	28.884
Total		**54.444**	**2.006**	**(water stress 28%) 56.450**

Issues in Water Sector

- **Natural constraints:** variability, topography, etc.
- **Policy issues:** WRP, 2020; no multi-purpose, emotion and global wave based, land policies –hinderance to commercialization, decision reversals
- **Legislation related:** no or too less laws, e.g., No custodian of waterbodies
- **Institutional:** overlapping and confusing, too many institutions (e.g. in WS), brain-drain
- **Environmental:** climate change effects, even resilience solution has impacts
- **Bilateral/International:** non-acknowledgement of d/s benefits, agreement compliance issues, inundation related issues

Ways Forward

- Work from whole to part
- Align sub-sector policies with the WRP
- Restructure NWRDC, WEC(S) RBOs for consensus building and W. allocation and whole of the water related institutions
- Legislate elaborately for: demarcating rights & responsibilities; making RBP & MPs legally enforceable effects; authorizing regulating insts., *viz* NWRDC, WEC(S), RBOs; conserving work sites, command areas; preventing encroachments; authorizing custodian institutions; etc.

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