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IDENTIFY AND HARNESS HYDROPOWER POTENTIAL IN NORTH EASTERN REGION

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1. INTRODUCTION

Electricity is one of the key enablers for achieving socio-economic development of the country. The economic growth leads to growth in demand of power. Generation and capacity augmentation is the most vital for meeting the ever-increasing demand of power to achieve the targeted growth rate. Today, endeavor is being made to provide 24x7 adequate & reliable energy and reduce country's reliance on fossil-based energy by shifting to cleaner and renewable energy sources. Government has set an ambitious plan to have generation of about 175 GW by 2022 and 450 GW by 2030 (further increased to 500 GW as announced in the 26th Summit of the Conference of Parties (COP-26) at Glasgow, by the Hon'ble Prime Minister of India) from renewable energy sources. In addition, India also envisages to be Carbon Neutral by 2070.

The renewable energy sources of Solar and Wind power, however, generate intermittent and variant energy. As such, there would be growing need for energy storage plants for smooth integration of these renewables into the grid and to stabilize the electrical grid. Development of hydropower especially the pumped storage projects, in this regard, assume paramount importance since hydropower is a clean, green, sustainable, renewable, non-polluting and environmentally friendly source of power and promotes conservation of fossil fuel. It is blessed with numerous other advantages like its suitability for peaking and balancing operation due ability of these plants for instantaneous starting, stopping and load variation and improving reliability of power system. Hydro/ PSP projects also have very long life as compared to other energy storage sources and these are escalation free & cheapest energy in long run.

2. HYDRO POWER POTENTIAL - NORTH EASTERN REGION OF INDIA

North Eastern Region (NER) of the country has been endowed with enormous hydropower potential estimated to be of the order of 62000 MW, which is about 40% of the total hydropower potential identified in the country i.e. 145320 MW from large hydro projects above 25 MW capacity. The state-wise Hydro Power potential and development status in the North Eastern Region of the country is as under:

State	Exploitable Potential (MW)	Developed (MW)	Under Development (MW)	Under Planning (MW)	Balance (MW)
Ar. Pradesh	50,064	1115	2000	7271	39678 (79.25%)
Meghalaya	2,298	322	0	355	1,621 (70.54%)
Mizoram	2,131	60	0	0	2,071 (97.18%)
Manipur	1,761	105	0	66	1,590 (90.29%)
Nagaland	1,452	75	0	186	1,191 (82.02%)
Assam	650	350	120	0	180 (27.69%)
Sikkim	4,248	2,282	1,037	520	409 (9.69%)
Total	**62,604**	**4,309**	**3,157**	**8398**	**46740 (74.66%)**

3. HYDROPOWER DEVELOPMENT STATUS IN NORTH EASTERN REGION:

Description		Nos.	Installed Capacity (MW)
1	H.E. Projects in operation	22	4309
2	H.E. Projects under construction	7	3157
3	H.E. Projects concurred by CEA	17	15605
4	H.E. Projects under examination in CEA	0	NIL
5	H.E. Schemes under S&I	4	1610

3.1 Hydro Projects in Operation

Sl. No.	Name of the Project	Installed Capacity (MW)	Sector/ Agency	Year of Commissioning
	Sikkim			
1	Rangit-III	60	Central / NHPC	Feb, 2000
2	Teesta-V	510	Central / NHPC	Mar, 2008
3	Chujachen	110	Private/ GIPL	Apr, 2013
4	Jorethang Loop	96	Private/DEPL	Sept, 2015
5	Teesta-III	1200	State/TUL	Feb, 2017
6	Dikchu	96	Private/SKPPL	Apr,2017
7	Tashiding	97	Private/SEPL	Nov, 2017
8	Rongnichhu	113	Private/MBPCL	June, 2021
	Total (Sikkim)	**2282**		
	Assam			
9	Kopili	200	Central /NEEPCO	1988-2003
10	Khandong	50	Central /NEEPCO	Mar, 1984
11	Lower Borpani (Karbi Langpi)	100	State	Mar, 2007
	Total (Assam)	**350**		
	Manipur			
12	Loktak	105	Central / NHPC	May, 1983
	Meghalaya			
13	Umiam Umtru IV	60	State	Sept, 1992
14	Kyrdamkulai	60	State	Mar, 1997
15	Umiam St.- I	36	State	Sept, 1965
16	Myntdu St.-I	126	State	2012-13
17	New Umtru	40	State	June, 2017
	Total (Meghalaya)	**322**		
	Arunachal Pradesh			
18	Ranganadi Stage-I	405	Central /NEEPCO	Mar, 2002
19	Pare	110	Central /NEEPCO	May, 2018
20	Kameng	600	Central /NEEPCO	Feb, 2021
	Total (Ar. Pradesh)	**1115**		
	Nagaland			
21	Doyang	75	Central /NEEPCO	July, 2000
	Total (Nagaland)	75		
	Mizoram			
22	Tuirial	60	Central /NEEPCO	Nov, 2017
	Total (Mizoram)	**60**		
	Total (NER)	**2027**		
Grand Total (NER +Sikkim)		**4309**		

3.2 Hydro Projects under Construction

S. No.	Name of Project	I.C. (MW)	Implementing Agency	Likely Commissioning
Arunachal Pradesh				
1	Subansiri Lower	2000	M/s. NHPC	2023-24
Assam				
2	Lower Kopili	120	M/s. APGCL	2024-25
Sikkim				
3	Teesta- VI	500	M/s. NHPC	2023-24
4	Rangit-IV	120	M/s. NHPC	2025-26
5	Bhasmey	51	M/s. Gati Infrastructure Ltd.	2024-25
6	Rangit-II	66	M/s. Sikkim Hydro Power Ventures L	2024-25
7	Panan	300	M/s. Himgiri Hydro energy Pvt. Ltd.	2025-26
Total (NER+ Sikkim)		**3157**		

3.3 Hydro Projects concurred by CEA & yet to be taken up for construction

A total of 17 nos. of hydropower projects aggregating to 15605 MW have been accorded concurrence by CEA and are yet to be taken up for construction due to different reasons such as pending Environmental and Forest Clearances, etc. The details are as under:

Sl. No.	Name of Scheme	State	Sector	I.C. (MW)	Date of TEC Letter issued
1	Dibbin	Ar.Pr.	Private	120	04.12.2009
2	Demwe Lower	Ar.Pr.	Private	1750	20.11.2009
3	Lower Siang	Ar.Pr.	Private	2700	16.02.2010
4	Tawang-I	Ar.Pr.	Central	600	10.10.2011
5	Tawang-II	Ar.Pr.	Central	800	22.09.2011
6	Etalin	Ar.Pr.	Private	3097	12.07.2013
7	Loktak D/S	Manipur	Central	66	05.05.2017
8	Teesta St-IV	Sikkim	Central	520	13.05.2010
9	Talong (Londa)	Ar. Pr.	Private	225	16.08.2013
10	Kalai II	Ar. Pr.	Private	1200	27.03.2015
11	Dikhu	Nagaland	Private	186	31.03.2014
12	Kynshi-I	Meghalaya	Private	270	31.03.2015
13	Heo	Ar. Pr.	Private	240	28.07.2015
14	Tato-I	Ar. Pr.	Private	186	28.10.2015
15	Dibang	Ar. Pradesh	Central	2880	18.09.2017
16	Attunli	Ar. Pradesh	Private	680	02.07.2018
17	Wah Umiam St-III (Mawphu St-II)	Meghalaya	Central	85	10.06.2021
	Total			**15605**	

3.4 Hydro Projects under Survey and Investigation

A total of 04 no. of hydropower projects aggregating to 1610 MW are under Survey & Investigation in NER. The details are as under:

	Name of Scheme	State	Sector	I.C. (MW)	Likely DPR submission
1	Anjaw	Ar.Pr.	Private	270	06/22
2	Demwe Upper St-I	Ar.Pr.	Private	270	06/22
3	Niare	Ar.Pr.	Private	860	12/22
4	Myntdu Leshka Stage-II	Meghalaya	Private	210	12/22
	Total	1610			

3.5 Hydro Capacity addition during last five years:

A total 9 no. of hydropower projects aggregating to 2412 MW have only been commissioned during the last 5 years as per details below:

S. No.	Name of Project	I.C. (MW)	Implementing Agency	Commissioning
Arunachal Pradesh				
1 2	Kameng Pare	600 110	NEEPCO	2020-21 2018-19
	Total (Ar.Pr)	710		
Meghalaya				
3	New Umtru	40	MePGCL	2017-18
Mizoram				
4	Turial	60	NEEPCO	2017-18
Sikkim				
5	Rongnichhu	113	MB Pvt Ltd.	2021-22
6	Jorethang Loop	96	DANS Pvt. Ltd.	2015-16
7	Teesta-III	1200	Teesta Urja Ltd.	2016-17
8	Dikchu	96	Sneha Kinetic	2017-18
9	Tashiding	97	Shiga Energy	2017-18
	Total (Sikkim)	1602		
Total (NER+ Sikkim)		**2412**		

3.6 Hydro Capacity addition envisaged during next five years:

The likely capacity addition in NER including Sikkim during the next five years is as under:

S. No.	Name of Project	State	I.C. (MW)	Developer	Likely Comm.	Present Status
1	Subansiri Lower	Ar. Pr.	2000	NHPC	2022-24	Under-construction
2	Teesta- VI	Sikkim	500	NHPC	2023-24	Under-construction
3	Lower Kopili	Assam	120	APGCL	2024-25	Under-construction
4	Rangit-IV	Sikkim	120	NHPC	2024-25	Under-construction
5	Bhasmey	Sikkim	51	Gati Infra. Ltd.	2024-25	Under-construction
6	Rangit-II	Sikkim	66	Sikkim Hydro Power Ventures	2024-25	Under-construction
7	Panan	Sikkim	300	Himgiri Hydro Energy	2025-26	Under-construction
8	Wah Umiam Stage-III	Megh.	85	NEEPCO	2027-28	Concurred
9	Loktak Down Stream	Manipur	66	LDHCL	2027-28	Concurred
	Total (NER+ Sikkim)		**3308**			

3.7 Hydro Capacity Addition envisaged under 30000 MW Plan by 2030:

A total of 16 nos. of hydropower projects aggregating to 4905 MW have been envisaged under 30000 MW plan by 2030 in NER. The details are as under:

S. No.	Name of Project	State	I.C. (MW)	Developer	Likely Comm.	Present Status
1	Subansiri Lower	Ar. Pradesh	2000	NHPC	2022-24	Under-construction
2	Teesta- VI	Sikkim	500	NHPC	2023-24	Under-construction
3	Lower Kopili	Assam	120	APGCL	2024-25	Under-construction
4	Rangit-IV	Sikkim	120	NHPC	2024-25	Under-construction
5	Bhasmey	Sikkim	51	Gati Infra. Ltd.	2024-25	Under-construction
6	Rangit-II	Sikkim	66	Sikkim Hydro Power Ventures	2024-25	Under-construction
7	Panan	Sikkim	300	Himgiri Hydro Energy	2025-26	Under-construction
8	Wah Umiam Stage-III	Megh.	85	NEEPCO	2027-28	Concurred
9	Loktak Down Stream	Manipur	66	LDHCL	2027-28	Concurred
10	Talong Londa	Ar. Pradesh	225	GMR	2028-29	Concurred
11	Tato-I	Ar. Pradesh	186	Velcan/ Pvt.	2028-29	Concurred
12	Heo	Ar. Pradesh	240	Velcan/ Pvt.	2028-29	Concurred
13	Dibbin	Ar. Pradesh	120	KSK/ Pvt.	2028-29	Concurred
14	Nafra	Ar. Pradesh	120	SEW/ Pvt.	2028-29	Concurred
15	Dikhu	Nagaland	186	NMPPL/ Pvt.	2028-29	Concurred
16	Teesta-IV	Sikkim	520	NHPC/ C.S.	2029-30	Concurred
Total			**4905**			

4. CHALLENGES IN DEVELOPMENT OF HYDRO IN NE REGION

The growth of hydropower in North eastern Region of India has remained very sluggish, even though, the development of hydropower in India also started with the commissioning of a 130 KW plant in Darjeeling in 1897, the region adjoining North eastern region. As compared to overall exploited hydropower potential of about 28% in the country, the percentage exploitation of Hydropower potential in North eastern region is just about 6.9 %.

The key challenges in the development of hydropower in NER are as under:

Land Acquisition: Non-availability of proper land records is one of the prominent reasons leading to delays in completion of land acquisition. Further, methodology of Award calculation in Arunachal Pradesh

Environmental and Forest: Hydropower development often results in change in local environment including forest, land use, etc. Non availability of land for Compensatory Afforestation /creation of Land Banks for mitigation of environmental change is a major challenge before project developers.

Lack of adequate infrastructure/ roads and bridges: The infrastructure in the regions is very limited and often transportation of heavy, large sized equipment & machinery to the project site is difficult. Before, the development of hydropower is taken, necessary steps need to be taken for ramping the infrastructure development by the concerned State/ Agencies.

Rehabilitation and Resettlement: Hydropower development often results in displacement of families, loss of livelihood, etc. which in turn leads local agitation/ law & order problems.

Non-signing of PPAs for hydro projects: Deterrent for the developers undertaking new projects often resulting in non-tying up of funds (Financial Closure). GoI Guidelines of March, 2019 addresses the issue to some extent by lowering the project cost as well as project tariff during initial years.

Free Power: NE States may consider deferment and staggering of free power till repayment of loan period or 12 years. Improves financial viability & salability of the hydro projects- Already in practice in states like J&K and HP.

Power evacuation issues: Power demand of NER region is low and most of the Hydro power generated is required to be evacuated to other regions. At present there are constraints in Transmission System required for evacuation of Hydro power from NER. For evacuation of NER Hydro potential to load centers, the development of High-capacity power transmission corridor challenge in *'chicken neck'* region.

Transmission Projects /Sub-Transmission & Distribution Schemes: The cost of hydro power from NER is higher than other power sources, in the short run. This further increases with transmission charges leading to tepid response from prospective buyers. Further, land for Sub-stations/ compensation for land value diminution/Forest clearances/RoWs/ Approach Roads/ SGST, etc. are also the issues, which impede hydropower development in NER.

5. POLICY INITIATIVES/ REVIVAL OF HYDRO PROJECTS

The Government had taken several policy initiatives, from time to time, in the past for development of hydropower in the country. During March, 2019, the Government had approved a number of measures for promoting hydropower in the country which would be especially helpful for the projects under construction as well as the new hydro projects:

(a) Declaring Large Hydro Power (LHPs) (> 25 MW projects) as Renewable Energy source.

(b) Hydro Purchase Obligation (HPO) as a separate entity within Non-Solar Renewable Purchase Obligation (RPO).

(c) Tariff rationalization measures for bringing down hydro power tariff.

(d) Budgetary Support for Flood Moderation/Storage Hydro Electric Projects (HEPs).

(e) Budgetary Support to Cost of Enabling Infrastructure, i.e. roads/bridges.

  (i) Rs. 1.5 crore per MW for projects upto 200 MW.

  (ii) Rs. 1.0 crore per MW for projects above 200 MW.

These measures would be particularly beneficial for development of hydro projects in North Eastern Region, which are located in remote and far-flung areas and requires development of extensive associated infrastructure such as roads, bridges etc. for transportation of heavy, large sized equipment & machinery to the project site. The HPO trajectory, in this regard, has already been notified by the Govt. on 29.01.2021. In addition to this, guidelines for operationalizing Budgetary Support for Flood Moderation/Storage Hydro Electric Projects (HEPs) and Cost of Enabling Infrastructure, i.e. roads/bridges have also been issued on 28.09.2021.

A number of hydro projects which were stuck up for a long time have been revived during last few years, due to persistent efforts and policies of the Government. These include Lower Subansiri (2000 MW) project of NHPC, Teesta VI (500 MW) in Sikkim was but now has been revived through NHPC's bid in NCLT in 2019. Rangit IV (120 MW) in Sikkim, and revived through NHPC's bid in NCLT.

6. OTHER MEASURES BY THE GOVT. TO REVIVE HYDRO

The Govt. has been striving to revive stalled hydro projects and to attract new investments in the sector. With the persistent efforts of the Govt., some of the projects like Lower Subansiri (2000 MW) in Arunachal Pradesh which was stuck up since 2011, Teesta-VI (520 MW) stalled since 2012 and Rangit (120 MW) in Sikkim stalled since October, 2013, Pakaldul (1000 MW) and Ratle (850 MW) in J&K and Kutehr (240 MW) in H.P. by JSW have moved ahead towards their active construction. A number of new projects have also been taken up like Kiru (624 MW) in J&K by CVPPL, Luhri Stage-I (210 MW) in H.P. etc. In addition, Dibang project (2880 MW) in Arunachal Pradesh has also been revived where construction is now on the verge of take-off.

Certain other measures taken in the past few years to give a boost to the development of hydro power sector, are mentioned below:

(a) Waiver/ reduction in transmission charges for PSPs commissioned up to 30.06.2025 have been notified by Govt. vide MoP order dated 21.06.2021.

(b) Scheme for bundling of Hydro Power with Renewable Energy has been notified vide MoP order dated 15.11.2021.

(c) Ministry of Power on 22.12.2021 has identified hydropower projects for implementation by CPSUs like NEEPCO, NHPC, SJVN and THDC in Arunachal Pradesh, where most of the hydropower potential in NER is concentrated. A total of 29 hydropower projects aggregating to 32415 MW have been identified for allocation to aforesaid CPSUs. An evaluation committee for the same has also been constituted for faster allocation and henceforth, execution of these hydropower projects.

(d) Dispute Avoidance Mechanism through Independent Engineer has been introduced in CPSUs to minimize/ resolve issues in under construction projects at inception stage itself and a Panel of Independent Engineers issued.

(e) Issuance of Guidelines by MoP for reducing the incidence of Time and Cost Overrun

(f) On the advice of Central Government, some hydro rich State Governments have also made efforts to push the sector by deferment/ staggering the free power during the initial years in order to reduce the tariff during the initial years and other measures like allotting projects for longer period of 70 years, 50% reimbursement of State GST and booking of Local Area Development. Fund (LADF) to any head other than project cost to bring down Tariff etc.

(g) A Consultation Process has been evolved for Fast Tracking of S&I activities and preparation of Quality DPRs. DPRs of 12 nos. of HEPs with aggregate installed capacity of 5758 MW have so far been prepared in consultation with appraising agencies. In addition, Time bound appraisal norms have been evolved for examination of DPRs in CEA within a period of 150 working days.

7. IDENTIFICATION OF CPSUS FOR IMPLEMENTING HYDROPOWER PROJECTS IN NE REGION

Majority of hydropower potential within NER i.e. 80% (50,064 MW) lies in Arunachal Pradesh alone. Accordingly, a total of 29 hydropower projects aggregating to 32415 MW have been identified for allocation to aforesaid CPSUs like NEEPCO, NHPC, SJVN and THDC in Arunachal Pradesh. An evaluation committee for the same has also been constituted for faster allocation and henceforth, execution of these hydropower projects. The details are as under:

Sr. No.	Project	IC (MW)	Basin	Identified for CPSU	Likely Start date	Likely Commi. Date	Remarks
1.	Tawang-I	600	Tawang	NEEPCO	2026-27	2032-33	Concurred (CEA)
2.	Tawang-II	800	Tawang	NEEPCO	2024-25	2031-32	Concurred (CEA)
3.	Talong (Londa)	225	Kameng	NEEPCO	2023-24	2028-29	Concurred (CEA)
4.	Panchung (Pachi)	56	Kameng	NEEPCO	2024-25	2028-29	Concurred (State)
5.	Dibbin	120	Kameng	NEEPCO	2024-25	2028-29	Concurred (CEA)
6.	Nafra	120	Kameng	NEEPCO	2024-25	2028-29	Terminated by State
7.	Khuitum	66	Kameng	NEEPCO	2024-25	2028-29	Concurred (State)
8.	Saskarong	45	Kameng	NEEPCO	2024-25	2028-29	Terminated by State
9.	Par	52	Dikrong	NEEPCO	2024-25	2028-29	Concurred (State)
10.	Simang-I	67	Siang	NEEPCO	2024-25	2028-29	Concurred (State)
11.	Simang-II	66	Siang	NEEPCO	2024-25	2028-29	Concurred (State)
12.	Siang Lower	2700	Siang	JV (NHPC & NEEPCO)	2025-26	2035-36	Concurred (CEA)
13.	Upper Siang	10000	Siang	JV (NHPC & NEEPCO)	2026-27	2040-41	Proposed
14.	Pauk	145	Siang	NEEPCO	2027-28	2033-34	S&I held-up
15.	Heo	240	Siang	NEEPCO	2024-25	2028-29	Concurred (CEA)
16.	Tato-I	186	Siang	NEEPCO	2024-25	2028-29	Concurred (CEA)
17.	Tato-II	700	Siang	NEEPCO	2026-27	2033-34	Concurred (CEA)
18.	Hirong	500	Siang	NEEPCO	2026-27	2033-34	Terminated by State
19.	Naying	1000	Siang	NEEPCO	2026-27	2035-36	Concurred (CEA)
20.	Subansiri Middle (Kamala)	1800	Subansiri	NEEPCO	2027-28	2035-36	Terminated by State
21.	Subansiri Upper	2000	Subansiri	NEEPCO	2028-29	2037-38	Concurred (State)
22.	Etalin	3097	Dibang	SJVN	2026-27	2033-34	Concurred (CEA)
23.	Dibang	2880	Dibang	NHPC	2022-23	2032-33	Concurred (CEA)
24.	Attunli	680	Dibang	SJVN	2025-26	2030-31	Concurred (CEA)
25.	Emini	500	Dibang	SJVN	2029-30	2035-36	Terminated by State
26.	Mihumdon	400	Dibang	SJVN	2029-30	2035-36	Terminated by State
27.	Amulin	420	Dibang	SJVN	2029-30	2035-36	Terminated by State
28.	Kalai-II	1200	Lohit	THDC	2026-27	2033-34	Concurred (CEA)
29.	Demwe Lower	1750	Lohit	THDC	2025-26	2030-31	Concurred (CEA)
Grand Total		**32415**					

(b) Identification of PSP Potential:

In order to accelerate the development of Pumped Storage projects in NER, Govt. has identified about 10 Pumped Storage Projects aggregating to 16900 MW for assessing feasibility/ further implementation by CPSUs like NHPC, SJVN, THDC and NEEPCO in NE Region.

8. INVESTMENT POTENTIAL

During the period of 2022-32, 21 projects with aggregate capacity of 11285 MW are proposed to be taken up for construction in NER. As such, there exists an investment potential of almost Rs. One lakh Crore in hydropower sector which would not only benefit equipment manufacturers, cement and steel industries etc. but would also result in overall development of the region by way of development of infrastructure facilities, job creations, establishment of educational institutions, healthcare facilities, boost to tourism and fisheries sector, etc.

9. CONCLUSION AND WAY FORWARD

In light of huge capacity additions envisaged from variable renewable energy sources of Solar and the Wind, there is need for faster capacity additions from Hydro. In this regard, there has to be impetus on development of this potential in North-eastern region where huge potential has been identified with minimum of time and cost overruns. A number of other measures, outlined below, are also proposed to make the power saleable and economically viable in order to give a push to the sector:

(i) Free power waiver/ staggering and allocating risk and responsibility with States

(ii) Increasing involvement of CPSUs in development of Hydro & PSPs and allotment of delayed/ stalled hydro projects by the States to CPSUs on nomination basis in consultation with MOP

(iii) Involving States as Equity Partners in Hydro Projects

(iv) Reviving Private Investment through PPP route and VGF Support

(v) Availability of loans for longer duration of 18 to 25 years and reduction of interest rate during operational period

(vi) Feasibility of Support for preparation of DPRs to create shelf of projects

(vii) Explore possibility of Support for Transmission

(viii) Basin-wise approach to development of hydro potential