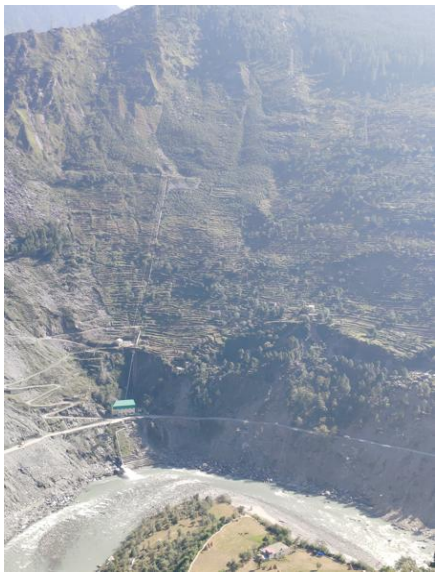
नवीन एवं नवीकरणीय ऊर्जा मंत्रालय
MINISTRY OF NEW AND RENEWABLE ENERGY
सत्यमेव जयते

SMALL HYDROPOWER CONCLAVE 2025

The Road Ahead for Small Hydropower

15th December, 2025



India International Centre, New Delhi

Scenario & Perspective

Department of Hydro and Renewable Energy
Indian Institute of Technology Roorkee

Federation of Indian Small Hydropower

Report on FISH Conclave 2025 held on 15th December, 2025 at India International Centre, New Delhi

Purpose and intent of the Conclave:

With the objective of bringing together the small hydropower fraternity from across India, the Federation of Indian Small Hydropower (FISH), in collaboration with the Hydro and Renewable Energy Department (HRED), IIT Roorkee, and with the support and guidance of the Ministry of New and Renewable Energy (MNRE), organised the "Small Hydropower Conclave 2025: The Road Ahead for Small Hydropower" in New Delhi on 15 December 2025.

The Conclave served as a unique national platform for stakeholders in the small hydropower (SHP) sector to deliberate on synergies, emerging technologies, opportunities, and challenges. It enabled participants from across the country to meet, network, and exchange best practices—thereby fostering collaboration, shared learning, and collective progress in the sector.

Invitees and Participation

A wide spectrum of stakeholders from the small hydropower (SHP) sector were invited to attend the Conclave. These included officials from State and Central Government agencies, SHP developers, equipment manufacturers, academicians, start-ups, and service providers. Participants actively engaged in the various sessions and deliberations, which were conducted throughout the day.

Despite major flight disruptions on 15 December 2025, the Conclave witnessed strong participation, with over 70 delegates in attendance.

The detailed list of participants is enclosed as ***Annexure 1*** to this report.

Conclave Structure

The Conclave was organised into the following structured sessions to ensure focused and meaningful deliberations:

- Inaugural Session
- Session on the Status of Small Hydropower (SHP), Policy and Challenges
- Session on Industry Perspectives
- Session on Technology
- Concluding Session

This structured format enabled comprehensive discussions covering policy, industry insights, technological advancements, and the future roadmap for the SHP sector.

Opening Session

Shri Bhupinder Singh Bhalla, IAS, Member, Appellate Tribunal for Electricity (APTEL) and Former Secretary MNRE graced the occasion as the Chief Guest.

Shri Minhas Alam, IAS and CMD Kerala State Electricity Board Ltd. kindly consented to be the Guest of Honour.

Sh. Arun Sharma, President, FISH, set the tone and agenda for the day through his address titled "Purpose Today." In his remarks, he briefly highlighted the critical role of small hydropower in India's renewable energy mix, while also outlining the key challenges confronting the sector. He emphasised the need for all stakeholders to work together with a common purpose and shared goals on a pan-India basis—an approach that lies at the very heart of the Conclave's purpose and intent. He also encouraged all participants to engage actively and communicate openly during the deliberations, to ensure meaningful and outcome-oriented discussions.

Prof. Arun Kumar, Emeritus Fellow, HRED, IIT Roorkee, and Vice President, FISH, spoke on the way forward for small hydropower, emphasising the growing importance of sound, well-advised design and engineering in the context of changing climatic conditions, where weather-related events are becoming both more frequent and more severe. He underscored the need for a country-wide platform to systematically assimilate and share best practices from different regions of India. Such a platform, he noted, would help promote greater uniformity in policy frameworks, adoption of appropriate technologies, and dissemination of proven practices across the SHP sector.

Shri S. K. Shahi, Director, Small Hydro Power and Biomass Division, MNRE, spoke on the support mechanisms being extended by MNRE to the small hydropower sector. He highlighted the various initiatives undertaken by the Ministry, including ongoing inter-ministerial consultations concerning the Central Financial Assistance (CFA) scheme, and appreciated the patience demonstrated by developers while awaiting its formal notification. He also emphasised the importance of adopting proven design and project implementation practices to ensure timely delivery of robust and reliable projects. Such an approach, he noted, is essential for building the confidence of lenders and other stakeholders in the SHP sector.

Shri Minhas Alam, IAS., emphasized the critical role of hydropower particularly in hydro-rich states like Kerala not only as a source of clean energy but also for its contribution to grid stability and asked to review the capital cost of SHP project. He cited the Kerala's SHP potential as well as experience in installing SHP projects, which could lead to strengthening of investment opportunities in the state.

Shri Bhupinder Singh Bhalla, highlighted the strategic importance of SHP in India's renewable energy mix, citing its multiple advantages. He urged all stakeholders to work towards an actionable roadmap to achieve 10 GW of SHP capacity in the next five years, and to identify additional potential from non-powered dams, canals, and industrial outflows, and hydro kinetic flows which could augment the currently identified 25 GW SHP potential by another 10+15 = 25 GW.

Session on Policy, Status of Small Hydropower (SHP) and Challenges:

The participants in this session were Shri S.K Shahi, Shri Arun Sharma and Shri Rajesh Sharma, President BHHDA.

The session, moderated by Prof. Arun Kumar, deliberated on the available potential of small hydropower in the country, which is estimated at around 25 GW, of which only about 20% has been harnessed so far. It was further noted that if the untapped potential in non-powered dams, canals, industrial outflows, and hydrokinetic flows is systematically mapped and accounted for, the total potential could exceed 50 GW.

Despite these significant prospects, the pace of SHP capacity addition has declined in recent years, even though SHPs generate reliable round-the-clock (RTC) power and offer inherent

technical and socio-economic advantages. From a technical standpoint, SHPs provide stable, dispatchable, and high-quality power, while also improving voltage and frequency stability at the remote ends of the grid where many such projects are located. Moreover, when properly designed, operated, and maintained, SHP projects can have operational lifespans exceeding 100 years, offering a distinct advantage in terms of long-term asset value.

On the socio-economic front, SHP projects contribute substantially to local economies, with a significant portion of capital investment flowing into the project area during construction. They promote local area development, generate direct and indirect employment over the long term, and help mitigate rural-to-urban migration. The presentation made by Prof. Arun Kumar is attached as ***Annexure 2.***

At the same time, it was strongly urged that the development of SHP projects must follow a systematic and technically sound approach, with a clear emphasis on timely project completion. The emerging impacts of climate change and increasingly frequent weather-related events, it was noted, can be effectively mitigated through comprehensive studies and the adoption of robust, climate-resilient plant designs.

Discussions on timely project completion led to a detailed deliberation on the forest clearance approval processes for SHP projects adopted by State agencies. It was noted that the repeated back-and-forth movement of files between State authorities and the Ministry of Environment, Forest and Climate Change (MoEFCC) often makes the approval process inordinately long and cumbersome.

Following a presentation by Sh. Rajesh Sharma, the participants discussed, with due justification, the need for simplification of these procedures. Key suggestions included exemption from Compensatory Afforestation (CA) Plan charges for projects up to 25 MW, exemption from River Basin Studies and Environmental Impact Assessment (EIA) requirements, exclusion of underground tunnels from compensatory afforestation obligations, and a re-examination of Right of Way (RoW) requirements for transmission lines in hilly terrain. Many participants also strongly advocated the adoption of a single-window clearance mechanism to streamline approvals and reduce delays.

The presentation made by Shri Rajesh Sharma is enclosed as ***Annexure 3***.

At the closure of the session, it was requested that all stakeholders provide case-specific submissions on the forest clearance approvals so that MNRE can support SHP community in discussions with MOEFCC.

Session on Industry Partners' perspective:

Shri. Swatantra Lodhi, Zonal Manager – Sales, M/s Hydac India Pvt Ltd., provided a brief of the company and presented an overview of the depth and breadth of hydraulic oil–powered systems used in the governing and operation of hydropower projects. The presentation highlighted their state-of-the-art technological offerings, developed in collaboration with their principals in Germany, and supported by a strong in-house design, engineering, manufacturing, and service infrastructure in India.

They emphasised the critical importance of robust hydraulic systems for reliable plant operation, as well as the need to maintain cleanliness and optimal condition of hydraulic oils and lubricants to ensure long equipment life and sustained performance. They gave an indepth coverage of the various products and systems the company offers, which can bring

sustained operational and cost benefits. The presentation also showcased Hydac's extensive reference list, covering a wide range of projects in India and abroad.

The presentation made by Shri Lodhi is enclosed as ***Annexure 4***.

Shri Pankaj K. Rajput, Managing Director, M/s Nelumbo Technologies Pvt Ltd., introduced the company and showcased its high-end power-plant automation solutions for hydro, solar, thermal and HFO projects. His presentation covered digital governing and excitation control systems, as well as comprehensive Balance-of-Plant (BOP) offerings for a wide range of project types.

Mr. Rajput described Nelumbo's end-to-end "wire-to-water" solutions and services for hydropower projects with unit sizes up to 40 MW, delivered in partnership with Gugler Water Turbines (Austria) — a firm with over 100 years' experience and more than 1,000 installations worldwide. With Nelumbo already active in 40+ hydropower plants across India, Nepal, Southeast Asia and beyond, this collaboration was presented as a significant opportunity to expand service and supply capabilities in India, Nepal and Bhutan.

The presentation by Shri Rajput is enclosed as ***Annexure 5.***

Shri Indranil Sarkar, General Manager, Business Development, from 50 Hertz presented "Opportunity for Power Sales".

He presented the various options such as Sale of Power to Nodal State Utility under preferential tariff, Sale of Power on Power Exchange, Sale of Power under Group Captive Model, Sale of Power Under 3rd Party Bilateral Contracts to C&I Contracts and Sale of Power under Tender floated by State Utilities. Various tenures associated with these options. The discussions generated much interest among the SHP Developers who will seek one-to-one meeting to understand and possible use of these options.

The presentation by Shri Sarkar is enclosed as ***Annexure 6.***

Technical Session 1- Silt in Himalayan Rivers- impacts and remedies:

The session featured Prof. Arun Kumar; Prof. Anant Kumar Rai, Department of Mechanical Engineering, NIT Warangal; Shri Girish Rao, Additional General Manager, Andritz Hydro Pvt Ltd.; and Shri Navneet Vij from M/s Dynavec AS.

The session was ably moderated by Prof. Sunil K. Singal, HRED, IIT Roorkee.

Himalayan rivers pose significant challenges due to their young and fragile geological formations. High suspended sediment loads lead to loss of reservoir storage and cause severe hydro-abrasive erosion of turbine components and hydraulic structures. Therefore, minimizing the passage of silt through hydropower plants—through appropriate layout planning and structural design—was emphasized as a critical necessity.

Key aspects discussed during the session included:

- Measurement of silt and its constituents, highlighting the importance of accurate assessment and various methods available for monitoring sediment characteristics.
- Preventive strategies, focusing on restricting sediment entry at the head regulator stage.
- Curative strategies, aimed at excluding sediment after it enters the water conveyance system, through the use of desilting devices such as settling basins, vortex tubes, sediment ejectors, and vortex settling basins.

In situations where complete exclusion of silt from the water passage is not feasible, Shri Girish Rao (Andritz Hydro) and Shri Navneet Vij (Dynavec AS) elaborated on mitigation measures such as advanced coatings, replaceable face plates, and the use of bolted structures to reduce wear and facilitate quicker maintenance.

The session generated keen interest, particularly as a large number of small hydropower projects in northern and north-eastern India operate under high-silt conditions, making the subject both relevant and timely.

The presentations by Prof. Singhal, Prof. Anant and sh. Vij are enclosed as ***Annexure 7a, 7b and 7c.***

Technical Session 2- Hydrokinetic technology and opportunities:

The session featured Ms Swati Maini, CEO, Maini Renewables and Shri Rishi Chopra GM, Jash Engineering. The Session was moderated by Prof. C.S Pant, HRED, IIT Roorkee.

Prof. Pant set the tone of the discussion on this relatively new Kinetic hydro Technologies by stating key difference from the conventional hydropower technologies, which have been already widely harnessed world-wide over the last century and more. He cited the key differentiators as:

- ✓ 100% renewable electricity
- ✓ Absence of bulk civil structures
- ✓ Good choice for off-grid electricity
- ✓ Works at zero-head applications

Though the technology yields less power output & has lower efficiency and currently and suffers from cost disadvantage when compared vis-à-vis their outputs, still the technology offers various advantages and with upscaling of production, better cost levels can be achieved.
Prof. Pant explained various technologies in the horizon in this area.

Smt. Maini, presented her Start-up, Maini Renewables, and the technology her firm is trying to develop in association with the utilities, the teething issues and the challenges.

Sh. Chopra explained about the possibilities of using screw turbines, the references of JASH in this area and the possibilities and advantages such technology offers.

The presentations by Prof. Pant, Smt. Maini and Shri. Chopra are enclosed as ***Annexure 8a, 8b and 8c.***

Concluding Session and key take-aways:

The session was chaired by Sh. Arun Sharma and Prof. Arun Kumar.

The Conclave provided an excellent platform for stakeholders to exchange views, ideas, and best practices. However, it is essential that the deliberations are followed up through systematic documentation and action on the following key issues:

1. Project timelines and forest clearances
2. Project developers shall submit detailed project timelines, including the status of forest clearance approval processes, to FISH. These details will be compiled and forwarded

to MNRE to facilitate structured engagement and enable the implementation of appropriate improvement measures.

3. Assessment of untapped SHP potential
4. A comprehensive mapping of kinetic hydropower potential and small hydropower (SHP) potential at non-powered dams, canals, and industrial outflows should be undertaken to assess the full SHP potential in India.
5. Key recommendations for the National SHP Policy

   a. All SHP projects should be governed solely under the prevailing Electricity Act, as SHP projects are non-consumptive users of water and should not be regulated under water resources legislation.

   b. Any additions or amendments introduced after the signing of the Power Purchase Agreement (PPA) shall apply only prospectively and not retrospectively.

   c. Any changes or amendments, including the imposition of additional taxes, duties, cess, or other costs after the signing of the PPA, must be allowed as a pass-through in tariff and approved by the relevant SERC/CERC before being enforced.
6. Strengthening sectoral capacity and collaboration
7. While SHP stakeholders keenly await the notification of the new CFA scheme, it is imperative for the SHP community to enhance peer interaction and adopt best practices, particularly in project design and operation & maintenance (O&M), especially in the context of emerging climate change challenges.
8. The SHP industry should set up stiff targets for achieving much needed capacity additions and work with MNRE and the state government agencies to make these implementable- say, achieving achieve 10 GW of SHP capacity in the next five years.

The Conclave concluded with a vote of thanks to all participants.

Annexure – 1: Conclave Programme

Annexure – 2: Participants attended the conclave

Annexure – 3: Photographs taken during conclave Dec 15, 2025

Annexure – 4: Draft Policy Recommendation SHP

Annexure – 5: Presentations

Annexure 1

Small hydropower Conclave

December 12, 2025
India International Centre, New Delhi

Sl. No	Topic	Time		Notes
		From	To	
1	Registration, Tea	09:30	10:00	Registration desk (manned by Santosh, Jiban, Neetu, Richa)
Opening Session				
2	Welcome & National Anthem	10:00	10:08	Shri Sumeet Mazumdar CEO FISH
3	Purpose Today	10:08	10:16	Shri Arun Sharma, President FISH
4	The way forward for SHP	10:16	10:24	Prof. Arun Kumar, Emeritus Fellow, HRED IIT Roorkee and Vice-president FISH
5	Support to SHP	10:24	10:32	Shri S.K Shahi, Director. Small Hydro Power and Biomass Division, MNRE
6	Address by guest of Honour	10:32	10:40	Shri Minhas Alam, IAS and CMD Kerala State Electricity Board Ltd.
7	Address by the Chief Guest	10:40	10:55	Shri Bhupinder Singh Bhalla, IAS, Member, Appellate Tribunal for Electricity (APTEL) and Former Secretary MNRE
8	Vote of thanks	10:55	11:00	Vote of thanks
9	Tea and networking	11:00	11:30	
Session on Policy				
10	Discussion on Policy	11:00	13:00	**Moderator**: Prof. Arun Kumar, **Participants -** Shri S.K Shahi, Shri Arun Sharma, Shri Rajesh Sharma
11	Lunch	13:00	13:45	

Sl. No	Topic	Time		Notes
		From	To	
Session on industry Partners' perspective + Technical Session				
12	Industry partners' perspective- 1	13:45	13:55	Hydac- Hydraulics for Hydropower- Shri Amish Lakhani
13	Industry partners' perspective- 2	13:55	14:05	Nelumbo-Water to Wire and Automation, Shri Pankaj K Rajput, CEO, Nelumbo technologies Pvt Ltd
14	Industry partners' perspective- 3	14:05	14:15	50 Hertz- "Opportunity for Power Sales" Shri Indranil Sarkar, General Manager, Business Development
15	Technical Session 1- Climate change- impacts and remedies	14:15	14:55	**Moderator**: Prof. Arun Kumar, IIT Roorkee **Participants -** Shri S.K Gangewar, CE, HSO CWC, Shri Rajneesh Aggarwal, ED, NHPC
16	Technical Session 2- Silt in Himalayan Rivers- impacts and remedies	14:55	15:50	**Moderator:** Prof. Sunil K Singal, HRED, IIT Roorkee **Participants –** Prof. Anant Kumar Rai, Department of Mechanical Engineering NIT, Warangal, Shri Girish Rao Addl. General Manager - Facility management, Andritz Hydro Pvt Ltd, Shri Navneet Vij, Dynavec
17	Tea and networking	15:50	16:10	
Technical Session + Closing Session				
18	Technical Session 3- Hydrokinetic technology and opportunities	16:10	17:05	**Moderator:** Prof. C.S Pant, HRED, IIT Roorkee **Participants –** Ms Swati Maini, CEO, Maini Renewables, Shri Rishi Chopra GM, Jash Engineering
19	Summing up of the day	17:05	17:15	Prof. Arun Kumar
20	Vote of thanks	17:15	17:25	Shri Auditya Yadlapati + Master of the Ceremony

Annexure 2

Participants attended the conclave

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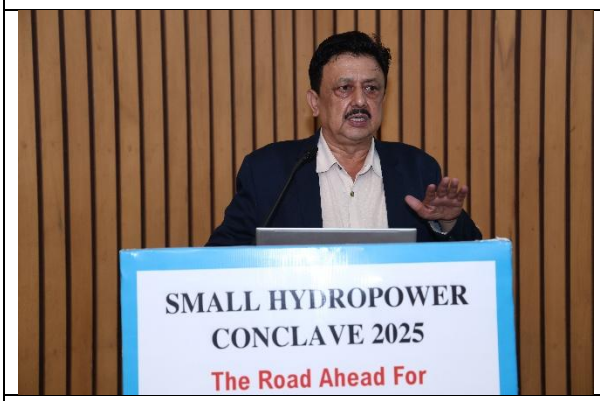
Annexure 3

Photographs




International Centre, New Delhi


SMALL HYDROPOWER
CONCLAVE 2025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FISH


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FISH

Annexure 4

PROPOSED DRAFT FRAMEWORK FOR NATIONAL SMALL HYDRO POWER POLICY 2025

राष्ट्रीय लघु जल विद्युत नीति **2025** के लिए प्रस्तावित प्रारूप रूपरेखा

CONTENTS

1. INTRODUCTION:

Hon'ble Prime Minister has outlined his vision on Energy Transition at the 26th session of the Conference of the Parties (COP-26) at Glasgow in 2021. The *"Panchamrit"* goals of India's climate action include the following:

i. Reach 500 GW Non-fossil energy capacity by 2030

ii. 50 per cent of its Electricity Installed Capacity from renewable energy by 2030

iii. Reduction of total projected carbon emissions by one billion tonnes from now to 2030

iv. Reduction of the carbon intensity of the economy by 45 per cent by 2030, over 2005 levels

v. Achieving the target of net zero emissions by 2070

In line with the Hon'ble Prime Minister's announcement at COP26, the Ministry of New and Renewable Energy is working towards achieving 500 GW of installed electricity capacity from non-fossil sources by 2030. So far, a total of 228.28 GW of non-fossil capacity has been installed in the country as of 31.03.2025 as follows:

Sector	Installed Capacity (in MW) (as on 31.03.2025)
Wind Power	50.04
Solar Power	105.65
Small Hydro Power	5.10
Large Hydro	47.73
Biomass (Bagasse) Power Generation	10.74
Waste to Energy	0.84
Nuclear Power	8.18
Total	228.28 MW

A decade back, RE was considered to supplement conventional sources, however, now it forms an important part of the energy mix. India achieved its commitment made at COP-21 Paris Summit by meeting 40% of its power capacity from non-fossil fuels nine years ahead of schedule in 2021. The share of solar and wind in India's energy mix has grown phenomenally. Owing to technological developments, steady policy support and a vibrant private sector, India has become a leading investment destination for global clean energy investors. As per the IRENA Statistics 2023[2], India stands 4th globally in Renewable Energy Installed Capacity.

2. Global Small Hydro Power SCENARIO:

- Hydro Power projects are classified as large and small hydro projects based on their sizes. The definition and classification of Small Hydro Power projects vary across countries. In India, Hydro Power plants with capacity of 25 MW or below are classified as Small Hydro. ISO has defined 30 MW capacity as small hydropower where as many countries define SHP as 10 MW installed capacity against the SHP definition in China and New Zealand as 50 MW capacity.

- As highlighted in the 2022 World Small Hydro Power Development Report by the United Nations Industrial Development Organization (UNIDO)[3], Small Hydro Power (SHP) plants with capacities of up to 10 MW currently have a global installed capacity of around

79 GW. Despite their benefits, about 64 percent of the SHP potential, which totals 221.7 GW, remains unexploited. This untapped potential is partly due to varying definitions and measurements, suggesting that actual capacities might be higher than reported.

- SHP plants, defined as those with a capacity of up to 10 MW, account for about 1 percent of the total electricity capacity and 6 percent of the hydropower capacity in the surveyed countries. Asia holds the lead in both installed capacity and potential for SHP, contributing 64 percent and 63 percent, respectively, to the global figures. Europe, particularly Western Europe, has developed 83 percent of its SHP potential, with Europe as a whole having the highest development rate at 52 percent.

- China is the frontrunner in SHP capacity with 81.3 GW, followed by Brazil at 6.324 GW, India at 4.8787 GW, and Canada at 4.504 GW. Significant undeveloped SHP potential is concentrated in Central Asia, Eastern Asia, and South-Eastern Asia. This data underscores the vast opportunities for expanding SHP infrastructure, particularly in regions with considerable yet untapped resources. Developing these projects can enhance energy security and support sustainable development initiatives.

3. Background of Small Hydro Power Sector IN INDIA:

- All capacities of Hydro Power projects were overseen after by the Ministry of Power prior to 1989. In 1989, Hydro Power Projects with a plant capacity up to 3 MW and below was transferred to the Department of Non-Conventional Energy Sources (DNES), now known as Ministry of New and Renewable Energy (MNRE). Thereafter, many initiatives were taken by the MNRE for the promotion of Small Hydro, including the implementation of a UNDP-GEF assisted Technical Assistance project entitled “Optimizing Development of Small Hydro Resources in Hilly Regions of India” and India-Renewable Resources Development Project with International Development Association (IDA) credit line having inter-alia Small Hydro development component with target of 100 MW canal based Small Hydro Power projects through private sector participation. Subsequently, in November 1999, Small Hydro Projects with a plant capacity up to 25 MW and below were entrusted with the MNRE[4].

- Small Hydro is unique since States have a critical role to play in its timely development. The earlier ecosystem, where Small Hydro potential could be seen as an opportunity to claim more free power for the States, are no longer present. Even though Small Hydropower is relatively immune to inflation after commissioning, construction constitutes a significant component of overall project cost and is subject to inflation impacts. Therefore, there is a need for timely attention to unlock the potential of Small Hydropower projects.

- Small hydro power projects may not be viewed solely from the perspective that their tariffs are higher compared to Solar and wind power projects. Small hydro projects may have a lifespan of up to 70 years, and tariff from these projects is found to be very competitive in terms of net present value. In addition, SHP projects offer other benefits such as grid stability, socio-economic development of remote areas and local employment generation, which needs to be factored in while framing policies.

- The Small Hydro Power (SHP) sector in India began to gain traction in the 1990s, driven by the need to diversify energy sources and promote sustainable development. Early initiatives focused on harnessing the abundant hydro potential available in the country, particularly in hilly and remote areas where other forms of energy were not feasible.

- The Government of India has been providing support to encourage setting up of SHP Projects since 1992**.** In order to further improve upon the whole ecosystem of SHP

development, a National Workshop on Small Hydro was held in 1993 at Shimla wherein several recommendations were made to scale up the deployment. Thereafter, the Government of India has been continuously supporting the SHP sector through different schemes till 2017.

4. Current Status of the Small Hydro Power Sector

India has identified SHP potential sites of over 21 GW with approximately 5 GW installed capacity. Additionally, about 10 GW of potential is estimated as hydro kinetic in flowing rivers and channels and about 5 GW on non- powered dams, outfall structures of water and waste water treatment. SHP projects are spread across various states, with significant developments in Himachal Pradesh, Uttarakhand, Karnataka, Arunachal Pradesh, Maharashtra, Kerala and Jammu & Kashmir. There is still a significant untapped potential, which needs to be harnessed at the earliest as the construction costs are expected to increase further in the future and may impact project viability. The State-wise potential and achievement of SHP is provided in **Annex I.**

5. Advantages of Small Hydro power:

- Small Hydro Power (SHP) is an important source of renewable energy that can contribute to the state's energy transition. It is a proven, mature, predictable and cost-competitive renewable energy source and has lower carbon footprint than large hydro projects. SHP projects have multiple advantages compared to large-scale projects such as lower carbon footprint, no requirement of large-scale land acquisition/deforestation, or displacement of human settlements. Moreover, the creation of water surfaces through SHP projects supports aquatic life and provides feeding sites for migratory birds and breeding habitats for resident species. These projects also improve the groundwater table, leading to enhanced greenery and compensatory afforestation, which acts as a carbon sink and mitigates CO_2 emissions.

- Being located in remote locations and at the tail end of the transmission network, they help in improving voltage levels and can also feed into the local grid in case of a major grid failure thereby avoiding a complete black out. In addition, SHP projects have the inherent ability to start and stop instantaneously and manage load variations, which helps improve the reliability of the power system.

- SHP projects also boost local economy development. A large chunk of the investment made in the projects feeds into the local economy as contracts for small civil works, transport of material, etc. are awarded to the local contractors. They also generate secondary employment, such as retail shops and services, etc. in and around the project area.

- A SHP project generally has a life time of 70 years. SHP is a technology where 50 to 60 percent of project cost goes into the local economy, benefiting not only the locals but also the entire chain of the activities and helping to arrest migration from remote hilly/rural areas. Further, they lead to creation of permanent jobs for operation and maintenance for at least 35 to 40 years. The construction and operation of a 1 MW small hydro plant employs 13.84 persons according to a 2019 study by IASS, TERI, CEEW and SCGJ[5]. This includes the creation of 13 jobs per MW for construction and commissioning and 0.84 per MW for the O&M phase. The development of hydropower projects also plays a critical role in the balanced regional development of states that have high SHP potential. With appropriate support and investment, SHP can contribute significantly to India's commitment to increase renewable energy capacity and combat climate change.

- The equipment for SHPs in India is domestically manufactured, aligning with the Government of India's *Atmanirbhar Bharat* initiative, which promotes self-reliance and local production.

- In view of the numerous benefits of Small Hydro, there is a need to promote Small Hydro projects by tapping into the existing potential in the country.

- A national small hydropower policy will help accelerate the pace of development of Small Hydro Power projects. This policy would be applicable for all hydro power projects up to 25 MW, including Pico-hydro/watermills (up to 5 kW) and Microhydel (>5 to 100 kW).

6. Government Support and Initiatives

The Government of India (GoI) and State Governments have been instrumental in the development of the SHP sector through various policies, schemes, and financial incentives. The major initiatives are outlined below:

- **Subsidy Schemes:** Financial assistance provided by the central government to offset the high initial costs for the construction of SHP projects. The Ministry of New and Renewable Energy (MNRE) has also been continuously supporting the SHP sector since the 1990s through different SHP Schemes. The last SHP Scheme lapsed in 2017.

- **Institutional Support:** The Alternate Hydro Energy Centre (AHEC) at IIT Roorkee was initially set up with the support of MNRE and which is now known as the Department of Hydro and Renewable Energy (HRED), IIT Roorkee. The department has been the focal point in providing technical support in the Smal Hydro Power sector across the country and has several state of art laboratories for conducting research in hydropower, performance evaluation at field and training to SHP personnel.

- **Small Hydro Power Policies:** The introduction of separate policies for Small Hydro Power by the State Governments have supported the development of SHP.

- **Hydro Purchase Obligation (HPO)[6]:** Mandates for distribution companies to purchase a certain percentage of their power from Hydro Power sources, including Small Hydro Power projects. A long-term trajectory for Hydro Purchase Obligations (HPOs) has been prescribed by the Ministry of Power. The notification specifies that the hydro renewable energy component shall be met only by energy produced from Hydro Power Projects [including Pump Storage Projects (PSPs) and Small Hydro Projects (SHPs)], commissioned after the 31st March, 2024

7. Challenges Faced by the Small Hydro Power Sector

Technical Challenges

- **Data:** Non-availability of reliable hydrological data impacts the accurate potential assessment of the sites.

- **Site-accessibility:** Many potential sites are in remote, inaccessible areas, which makes transportation of equipment and workforce challenging and increases the project cost.

- **Technology transfer:** Limited availability of advanced and efficient technology suitable for small-scale applications.

- **Maintenance:** Maintaining and operating plants is difficult due to the unavailability of trained manpower locally, at remote locations, and in harsh environmental conditions.

Financial Challenges

- **High initial costs:** Significant upfront investment is required for SHP projects. According to prevailing market conditions, the cost of developing hydro projects is around INR 10-12 crore/ MW, resulting in a levelized tariff of around Rs 5-6/unit as per the applicable norms. At present, discovered tariff for solar and wind projects are comparatively cheaper. Hence, DISCOMs are generally reluctant to sign PPAs with new hydro projects.

- **Financing:** Limited availability of long-tenure and low-interest financing options.

- **Taxation:** Higher GST rates are applicable on SHP projects as compared to Solar/ Wind projects.

- **Subsidy scheme:** No subsidy Scheme operational at present.

- **Revenue generation:** Inconsistent revenue due to seasonal variations in water flow, impacting the financial viability.

- **High insurance premium:** SHP projects are being clubbed in the same category as Large Hydropower projects, whereas, the risks involved in SHP projects are much less as compared to large hydro power projects. Hence, there is a need for customised insurance packages for SHP projects.

Regulatory and Policy Challenges

- **Clearances and approvals:** The application process for SHP is lengthy and complex requiring multiple clearances, including forest clearances. Hydro projects have long gestation periods and involve huge financial investments. The delay in processing of applications may impact the economic viability of the SHP projects and impact investors' confidence.

- **Policy implementation:** Variations in policies across different states leads to lower investor confidence. Lack of sufficient supportive policies of water resources/ irrigation departments in some states. Absence of National Policy on Small Hydro Power.

- Reluctance from Distribution Companies (DISCOMS) in signing of Power Purchase Agreements (PPAs) with SHP project developers.

8. OBJECTIVES OF THE SMALL HYDROPOWER POLICY

The objective of the policy is to promote the development of small hydro power projects in the country to:

i. Rationalise Small Hydro Power development across all the States.
ii. Increase the share of Small Hydropower in India’s electricity mix.
iii. Promote rural electrification and provide electricity to remote areas.
iv. Encourage private sector investments in the SHP sector.
v. Create local employment opportunities in SHP projects and arrest migration from remote areas.

vi. Boost the overall rural economy development in remote areas.

vii. Create an enabling environment for SHP development by providing suitable regulations, and support.

viii. Ensure SHP development in an environmentally sustainable manner.

ix. Increase awareness and understanding of the benefits of SHP.

9. FEATURES OF THE PROPOSED POLICY:

9.1 ALLOTMENT OF SHP PROJECTS

- State Governments may allot SHP sites through a transparent mechanism for bidding and allotment.
- State Governments may invite applications from independent power producers (IPPs) preferably every year or at lesser intervals for SHP development on the identified potential sites. The allotment may be completed within 6 months from the last date of submission of the application.
- The State Governments may provide reliable data related to the hydrology, geology and transmission infrastructure facility before allotment of the SHP site in the feasibility report made available to the developer about the actual site conditions.
- The sites not identified by the state government may also be allotted based on the self-identified proposals received from IPPs through transparent process.
- Bidding methods prevailing for factory produced energy technology such as wind and solar do not suite to SHP sector due to specific features and design of each project and lack of reliable cost estimates.
- For SHP, out of bidding options such as quantum of free power to state, concession period, tariff to state DISCOM and upfront fee, the fixed upfront fee to state government through the transparent bidding mechanism may be preferred.
- Beyond initial allotted concession period, further extension (say 25-30 years) of concession period be also notified along with term to ensure that IPP also carry out the required renovation and modernization of SHP plant for efficient operation and generation from plant for the extended concession period.
- **Timelines for Start of Construction work after award of Project:** State Governments may limit the time of start of construction to two years from the date of allotment of the project failing which, allotment of the project site may be cancelled by the State Government. However, relaxation may be considered where delay in the start of construction is not attributable to the project developer and primary data such as discharge data is to be collected for the ungauged streams.

9.2 SIMPLIFICATION OF CLEARANCES FOR HYDRO PROJECTS

- In order to reduce the time taken to get various clearances from different departments and ministries, a single window clearance system may be created at the State level to process all the required clearances. The timely undertaking of Small Hydro Power projects is essential to ensure that the viable capacity is developed at the earliest. The process for obtaining technical, administrative, forest and wildlife clearances associated with SHP projects has to be made simple, effective, and timely to achieve this end. A single window system with well- defined

timelines for obtaining the clearances at the Centre and the State Governments will help in achieving faster installation of SHP projects and tracking project status.

- Online portal be developed by state governments to minimize the human interface and all fee required be deposited online by the applicant.
- Forest Clearance: Decisions regarding the grant of Forest Clearance (FC) may be made promptly. The parameters considered for the grant of clearances and for timely processing of applications may be suitably reviewed. Issues of requirement of .kml digital images for all the hydro projects in the entire catchment, animal passes, harmonisation of land conversion unit, preparation of catchment area treatment plan, paying the compensatory charges for the land above the tunnels on similar lines on the lines of railway and road projects should be suitably reviewed. Harmonisation of right of way (ROW) requirement for transmission lines of small hydro projects (especially in hilly areas) be suitably reviewed on practical basis.
- SHP projects not having the diversion barrage of more than 10 m height be exempted from river basin studies being by MOEFCC and not be compared with large hydro projects involving in submergence and river fragmentation due to construction of large dams.
- State government may create and allot a pool of land to SHP developers for compensatory afforestation land on chargeable basis. Also river cross sections with normal and highest flood level note to be considered as forest land.
- The process of land use changes (for example tea gardens, abandoned pits of mineral / stone quarry) for setting of SHP or small pumped storage plants should be simplified and made time bound.
- SHP represents the renewable energy sector and is categorized as “white category” industry, and be given special status in granting clearances by respective state forest / environment or other departments.
- State governments may consider forming a specialised cell for allotments, timelines for providing clearances, and their monitoring. The cell would further function as a liaison between the Central and State governments on SHP-related projects and their reliable and authentic information.

9.3 FINANCIAL SUPPORT FROM CENTRAL GOVERNMENT

High initial capital investment required for SHP projects leads to higher tariffs for SHP high compared to other sources of renewable energy. Development of a scheme to provide financial assistance to SHP projects and reduce the discovered tariff rates would be helpful in this regard.

9.4 Supportive PROVISIONS BY STATES GOVERNMENTs

- **FREE POWER:** SHP developers are often mandated to provide to the respective State Government with free power. Since the royalty/free power is to be recovered through the sale of the remaining power, this results in a higher tariff which particularly impacts the viability of the project. Doing away with free power not only reduces the overall tariff but also has a compounding effect with a reduction of the risk premium of SHP projects and attracting competitive financing. Hence, the State Governments may consider abolishing the levy of free power on SHP

projects as there is no consumptive use of water in small hydro projects and development of SHP brings to the state several direct and indirect benefits enumerated at para 8

- **OTHER LEVIES AND CESS:** The powers to levy taxes / duties are specifically stated in the VII Schedule of the Constitution. List -II of the VII Schedule lists the powers of levying of taxes / duties by the States in entries-45 to 63. No taxes / duties which have not been specifically mentioned in this list can be levied by the State Governments under any guise. Since there is no consumptive use of water in the hydroelectric projects, no water cess may be levied on such projects. This shall also contribute in making the hydro projects commercially viable and reduce their overall tariff rate.

- Roads which are planned by the State Government (viz., Public Works Department) for future development but are not yet constructed, may be allowed to be constructed by the project developer in view of the urgency in transportation of man and material to the project site and consider to reimburse the cost in due course through suitable mechanism.

- Wherever required, in order to attain viability, the State Government may also consider reimbursement of SGST on project components. This will enable the State to reap the long-term benefits due to development of these SHP projects.

9.5 WHEELING/ TRANSMISSION CHARGES

- Power be evacuated by DISCOMs from the switchyard of SHP instead of DISCOMs / STU substations to rationalise the uniformity in the country.

- Wheeling/Transmission Charges need to be rationalized. In most of the projects, transmission systems of both Distribution Companies (DISCOMS) and State Transmission Utility, is being used which is resulting in levy of separate transmission charges by both which makes third party power sale non-viable. State Governments could rationalise these multiple wheeling charges.

- For captive use, such Wheeling/Transmission charges may not be levied to encourage the private sector investment and decarbonisation of industry. The power banking from SHP be rationalised in view of its availability preferably on annual basis.

- Transmission connectivity may be as per Central Electricity Regulatory Commission (CERC) norms as notified from time to time. 'Inter-connection Point' shall mean interface point of renewable energy generating facility with the transmission system or distribution system, as the case may be. In relation to small hydro power Inter-Connection Point shall be line isolator on outgoing feeder on HV side of generator transformer in accordance with Regulation 2 (o) (ii) of the CERC RE Regulations, 2024[7]. SHP project should also be eligible for concession on transmission of electricity (intra and interstate) on similar lines as for solar and wind energy projects in respective of capacity limitation.

- In case the developer is directed to construct the transmission line for evacuation of power from the project, where such line was required to be constructed by the State Government, applicable reimbursement of cost to the developer could be considered or could be suitably adjusted in the tariff of SHP project, as per State Government norms.

- The current DSM regulations provide liberalized treatment for Solar and Wind project whereas the provisions for SHP are similar to Thermal (which has peaking capacity and predictable generation pattern). Thus, leading to levy of Higher DSM charge placing limitation on interstate sale of power.

- In case state DISCOMs choose not to buy the power from IPP, the IPP may sell the power through open access or third-party sale within or outside the state for which rationalized wheeling / transmission charges, STU charges, IPS charges should be charged to prevent making the power expensive and difficult to sell.

9.6 POWER PURCHASE AGREEMENT (PPA)

- The power purchase agreement may be between 25 to 40 years. Tariffs may be calculated in accordance with the bench-mark specified by CERC from time to time.

- To ensure assured offtake and reduce risk premium, States may direct distribution companies to mandatorily purchase power from SHP projects up to 25 MW as per State Electricity Regulatory Commission (SERC) /CERC determined tariff for the year of commissioning of the project, in line with Regulation 10 (i) of CERC RE Regulations, 2024.

- DISCOMS may have the first right to purchase power through long-term PPAs, but if they choose not to, the developer may sell the power through open access or third-party sale within or outside the state with rationalized wheeling / transmission charges, STU charges, IPS charges for not making expensive power.

- The subsidy/CFA availed by the SHP project should be passed on to the consumers and reflected in the tariff. However, if any project is not availing the benefit of any Subsidy/CFA, tariff may be determined without considering the Subsidy/CFA.

- Any amendment including additional tax / duty / cess or any other kind of charges imposed on SHP projects by the state or central government after the signing of PPA must be pass though in the tariff and applicable after approval from SERC / CERC.

9.7 FINANCING:

- **EQUITY NORMS:** Most of the existing SHP projects have a Debt-to-Equity ratio of 70:30. Higher equity in the project entails a higher return on equity. A reduction in the proportion of equity would reduce the weighted average cost of capital, leading to a reduction of the levelised tariff. To make the projects more viable by reducing the tariff, a debt-to-equity ratio of 75:25 or 80:20 may also be considered.

- **LOWERING COST OF DEBT:** Long-term loans with a debt repayment period of 20 years or beyond are needed to improve viability. Additionally, refinancing of debt after commissioning to reduce the tariff should be encouraged. SHP projects can also seek green financing from multilateral agencies at low interest rates to make the projects more viable. Financial Institutions may consider facilitating long-tenure soft loans, given the renewable energy status granted to hydropower. The increase in financing duration will bring down the requirement of higher revenue generation required to meet repayment obligations, which in turn shall promote the reduction of small hydropower tariffs and increase the project viability.

- **PRIORITY SECTOR LENDING:** The existing RBI guidelines (2024)[8] provide Priority Sector Lending (PSL) status to micro-hydel plants and other non-conventional energy-based public utilities such as remote village electrification. All SHP projects may be considered for inclusion in Priority Sector Lending (PSL).

- **SEPARATE FUND FOR STRESSED SHP PROJECTS:** To help projects under financial stress, a separate fund may be created for refinancing by Financial Institutions such as IREDA, PFC and REC to provide low-cost funds with a longer tenure to reduce the annual outflow towards debt servicing, thus providing respite to such stressed projects.

- **INSURANCE:** A customised insurance package for SHP projects may be developed by insurance companies to ensure the SHP plants for risk against Cloud burst, Flood, Land slide and other act of God perils.

9.8 RENOVATION, MODERNIZATION AND UPGRADING (RM&U) OF OLD SMALL HYDRO POWER STATIONS

Renovation , Modernization and Upgrading (RM&U) of commissioned SHP projects (owned by State GENCOs and IPPs) may be ensured to enhance their capacity utilisation and economic viability. It is a cost-effective option to retain the operational capacity at the end of the useful life of the project as well as an opportunity of having an uprated capacity in certain projects. The life of SHP project can be extended even beyond its useful life through proper RM&U activities. Hence, RM&U activities may be taken up by the State Government proactively by identifying projects and carrying out the necessary works either by themselves or through standard option of leasing out to the private parties, joint sector or public sector collaboration through competitive bidding process options of (a) lease, rehabilitate, operation and transfer, (b) Joint venture, (c) outright sale.

9.9 Heritage Small Hydro Projects

India has few pre-independence small hydro projects in different states presenting the heritage of hydro projects in line with western world. SHP installations i.e. Shivasamundram in Mysore in Karnataka (2000 kW) and Raja Bhuri Singh in Chamba, HP (40 kW) in 1902, Mohra (450 kW) in 1905 in Baramulla J&K, Galogi in Mussoorie, Uttarakhand (3000 kW) in 1907, Jammu (800 kW) and Karteri (997 kW) in 1908, Pallivasal (400 kW) in Kerala in 1910 and Jubbal, Himachal Pradesh (50 kW) in 1911 and Chhaba, Shimla (1750 kW)

in 1913, Sonapani Meghalaya (1.5 MW) in 1922 are the known early HP stations and many of them still working with enhanced capacity. These plants were used primarily for lighting purposes in the important towns. An incentive scheme to develop and maintain these SHP sites for heritage and tourism may be planned by MNRE with liberal support to the plant owner and operated by state or private sector.

9.10 'MUST-RUN' STATUS FOR SHP

As per Ministry of Power's notification dated 22nd October 2021, "a wind, solar, wind-solar hybrid or hydro power plant (in case of excess water leading to spillage) or a power plant from any other sources, as may be notified by the Appropriate Government, which has entered into an agreement to sell the electricity to any person, shall be treated as a must-run power plant." Since SHP projects are built on a flowing stream or canal and they do not have any Dam or other storage systems, so any not generated by SHP projects will be wasted. Hence, SHP projects need to be treated as 'must-run' projects.

9.11MICRO HYDRO UP TO 100 KW AND WATERMILLS UP TO 5 KW

Micro Hydel Projects (MHPs) are generally located in remote & hilly areas. MHPs have a capacity of above 5 kW up to 100 kW. These projects are suitable to meet the energy requirements in remote locations and also support livelihood activities. In the case of Watermills, they harness the mechanical and electrical energy from running water (small streams/nallahs) in hilly locations and are suitable for livelihood-generating activities such as grinding grains, oil extraction, spinning textiles, etc. in remote areas. The development of MHPs and Watermills may also be focused and suitable policy measures may be developed.

9.12CAPACITY BUILDING

- **Training programs:** The Ministry of New and Renewable Energy is implementing the "Jal-Urja Mitra skill development programme" to provide a skilled workforce for SHP sector. The programme provides training to SHP technicians & operators and other roles related to Operations and Maintenance, supervisory and managerial tasks and entrepreneurship (Small units). States may also develop an ecosystem for training and capacity-building for stakeholders, including project developers, engineers, technicians and operators.
- **Knowledge sharing:** Central & State Governments may establish platforms for sharing knowledge and experiences among developers, policymakers and researchers to disseminate best practices.

9.13RESEARCH AND DEVELOPMENT

Research and Development (R&D) would drive innovations in technology, leading to more efficient turbines, better designs for small-scale installations, and improvements in overall performance. This can result in increased energy output, reduced maintenance costs, and enhanced reliability of SHP systems. Further, through R&D,

new materials, manufacturing techniques, and operational strategies can be developed that may lower the initial costs of setting up SHP plants. Hence, promotion of collaborative research initiatives between academia, industry, and government to address specific challenges in the SHP sector would be encouraged.

9.14INDUSTRY STATUS:

Small hydro power projects may be treated as an industry or infrastructure and all the benefits declared by the State Government for the industry or infrastructure from time to time in policies or schemes may also be applicable to these power projects.

10. CONCLUSIONS:

The promotion of small hydro power development is an important step towards achieving a sustainable pathway towards energy security and reducing greenhouse gas emissions. It offers a reliable electricity generation that complements other renewable energy sources like wind and solar. This policy framework document outlines the measures that may be implemented to promote the development of SHP projects in the country. The attributes of SHP need to be given due weightage and addressed with suitable incentives as applicable. Concerted actions in association with State Governments are required for prompt development of the SHP Sector. It would also help towards rationalising policies related to development of sector across all States and Union Territories of the country.

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Annex I.

The State-wise potential and achievement of SHP as on 30.06.2024

Sl. No.	State	Total Potential		Projects Installed						Projects under Implementation	
		Nos.	Total Capacity (MW)	Upto 2023-24		2024-25		Total		Nos.	Capacity (MW)
				Nos.	Capacity (MW)	Nos.	Capacity (MW)	Nos.	Capacity (MW)		
1	Andhra Pradesh	359	409.32	45	163.31	0	0	45	163.31	1	1.20
2	Arunachal Pradesh	800	2064.92	157	133.11	0	0	157	133.11	5	6.05
3	Assam	106	201.99	6	34.11	0	0	6	34.11	0	0
4	Bihar	139	526.98	29	70.70	0	0	29	70.70	0	0
5	Chhattisgarh	199	1098.2	10	76	0	0	10	76	0	0
6	Goa	7	4.7	1	0.05	0	0	1	0.05	0	0
7	Gujarat	292	201.97	22	91.64	0	0	22	91.64	2	21.66
8	Haryana	33	107.4	9	73.5	0	0	9	73.5	0	0
9	Himachal Pradesh	1049	3460.34	202	969.71	0	0	202	969.71	45	251.84
10	UT of Jammu & Kashmir	103	1311.79	24	169.93	0	0	24	169.93	5	29.65
11	UT of Laddakh	199	395.65	31	42.99	0	0	31	42.99	5	5.60
12	Jharkhand	121	227.96	6	4.05	0	0	6	4.05	0	0
13	Karnataka	618	3726.49	170	1280.73	0	0	170	1280.73	6	16.45
14	Kerala	238	647.15	41	276.52	0	0	41	276.52	4	32.85
15	Madhya Pradesh	299	820.44	14	123.71	0	0	14	123.71	3	7.7
16	Maharashtra	270	786.46	73	382.28	1	2.00	74	384.28	6	6.10
17	Manipur	110	99.95	8	5.45	0	0	8	5.45	0	0
18	Meghalaya	97	230.05	6	55.03	0	0	6	55.03	1	3.0
19	Mizoram	72	168.9	20	45.47	0	0	20	45.47	0	0
20	Nagaland	98	182.18	14	32.67	0	0	14	32.67	1	2.4
21	Odisha	220	286.22	13	115.63	0	0	13	115.63	3	56.5
22	Punjab	375	578.28	59	176.10	0	0	59	176.10	5	4.05
23	Rajasthan	64	51.67	10	23.85	0	0	10	23.85	0	0
24	Sikkim	88	266.64	18	55.11	0	0	18	55.11	0	0
25	Tamil Nadu	191	604.46	21	123.05	0	0	21	123.05	0	0
26	Telangana	94	102.25	30	90.87	0	0	30	90.87	0	0
27	Tripura	13	46.86	3	16.01	0	0	3	16.01	0	0
28	A&N Islands	7	7.27	1	5.25	0	0	1	5.25	0	0
29	Uttar Pradesh	251	460.75	10	49.1	0	0	10	49.1	1	1.5
30	Uttarakhand	442	1664.31	103	218.82	0	0	103	218.82	6	65.55
31	West Bengal	179	392.06	24	98.5	0	0	24	98.5	0	0
Total		**7133**	**21133.61**	**1180**	**5003.25**	**1**	**2.00**	**1181**	**5005.25**	**99**	**512.10**

Annexure 5

Presentations

1. Policy_Matters_ dec 15 2025 from ArK
2. Updated_SHP_Policy_Presentation_on_forest_matter_by_Rajesh_sharma_
3. Desilting management in hydropower plants
4. Anant_Desilting management in hydropower plants V01
5. DynaVec presentation - FISH
6. csp_10mins_FISH_15jan_2025
7. FISH_JASH Screw Turbine_15 Dec25
8. FISH Hydropower Maini Renewables
9. Nelumbo-Presentation_FISH 2025
10. Hydac Solutions for FISH_v1
11. PPT for Small Hydro Conclave