As on 28-02-2023

STATUS OF PUMPED STORAGE DEVELOPMENT IN INDIA
(Installed Capacity above 25 MW)

S.No.	SCHEMES	STATE	INSTALLED CAPACITY		REMARKS
			No. of units x Unit size(MW)	MW	
A. SCHEMES CONSTRUCTED					
a) Working in Pumping Mode					
1	Nagarjuna Sagar	Telangana	7x100.80	705.60	
2	Srisailam LBPH	Telangana	6x150	900	
3	Kadamparai	Tamil Nadu	4x100	400	
4	Bhira	Maharashtra	1x150	150	
5	Ghatgar	Maharashtra	2x125	250	
6	Purulia	West Bengal	4x225	900	
			Sub Total	**3305.60**	
b) Presently not working in Pumping Mode					
1	Kadana	Gujarat	4x60	240	#
2	Sardar Sarovar Project	Gujarat	6x200	1200	##
			Sub total	**1440**	
8			**Grand Total**	**4745.60**	
B. SCHEMES UNDER CONSTRUCTION					
a) Under Active Construction					
1	Tehri St.-II	Uttarakhand	4x250	1000	Likely commissioning by 2023-24 (Oct.'23)**
2	Kundah (Stage I,II,III&IV)	Tamil Nadu	4x125	500	Likely commissioning by 2024-25 (Dec. 2024)
3	Pinnapuram	Andhra Pradesh	4x240+2x120	1200	Likely commissioning by 2024-25 (Mar.'25)
			Total	**2700**	
b) On which Construction is held up					
1	Koyna Left Bank	Maharashtra	2x40	80	Likely commissioning by 2027-28
			Total	**80**	
4			**Grand Total**	**2780**	
C. DPR CONCURRED BY CEA					
1	Turga	West Bengal	4x250	1000	EC & FC-I obtained. FC-II is awaited.
1			**Total**	**1000**	
D. UNDER EXAMINATION					
1	Upper Sileru	Andhra Pradesh	9x150	1350	Month of Receipt-Dec'22
1			**Total**	**1350**	
E. SCHEMES UNDER SURVEY & INVESTIGATION					
	I. One Reservoir Existing & One to be constructed				
1	Upper Indravati	Odisha	4x150	600	•Upper Reservoir is existing on Upper Indravati HEP reservoir (Exisiting Hydro Project) and Lower Reservoir is to be constructed. •Target date for preparation of DPR – 09/2023 •Agency-OHPCL
2	Saundatti	Karnataka	4x252+2x126	1260	•Upper Reservoir is to be constructed and Lower Reservoir is on RenukaSagar which is existing on Malaprabha river (Existing Irrigation Project) •Target date for preparation of DPR – 06/2023 •Agency-Greenko

S.No.	SCHEMES	STATE	INSTALLED CAPACITY		REMARKS
			No. of units x Unit size(MW)	MW	
3	MP30 Gandhi Sagar	Madhya Pradesh	5x240+2x120	1440	•Upper Reservoir is proposed off the river and Lower Reservoir is exisiting on Gandhi Sagar which is on Chambal river(Existing Hydro Project) •Target date for preparation of DPR – 03/2023 •Agency-Greenko
4	Gandikota	Andhra Pradesh	4x250	1000	•Upper Reservoir is proposed Off Stream and Lower Reservoir is exisiting on Gandikota reservoir which is on Penna river (Existing Irrigation Project). •Target date of Preparation of DPR- 6/23 •Agency- NREDCAP
5	OWK	Andhra Pradesh	4x200	800	•Upper Reservoir is proposed Off Stream and Lower Reservoir is exisiting on Owk reservoir which is on Penna river (Existing Irrigation Project) •Target date of Preparation of DPR- 12/23 •Agency- Aurobindo Realty & Infrastructure Pvt. Ltd.
6	Chitravathi	Andhra Pradesh	2x250	500	•Upper Reservoir is proposed Off Stream and Lower Reservoir is exisiting on Chitravathi reservoir (Existing Irrigation Project) •Target date of Preparation of DPR- 06/23 •Agency-NREDCAP
6	**Sub-Total**			**5600**	
	II. Both Reservoirs to be constructed				
1	Warasgaon	Maharashtra	4x300	1200	•Upper Reservoir is proposed on Mose river and Lower Reservoir is proposed on Kal river •Target date for preparation of DPR – 07/2023 •Agency-WRD, Maharashtra
2	Bhavali	Maharashtra	6x250	1500	UR-downstream of Bhavali Dam, LR-Ulhas Target date of Preparation of DPR- 12/23 Agency-JSW Energy
3	Kurukutti	Andhra Pradesh	5x240	1200	•Upper Reservoir is proposed on Minor nallah draining into Boduru Gedda river and Lower Reservoir is proposed on Boduru Gedda river •Target date of Preparation of DPR- 12/23 •Agency-NREDCAP
4	Karrivalasa	Andhra Pradesh	4x250	1000	•Upper Reservoir is proposed on Minor nallah draining into Boduru Gedda river and Lower Reservoir is proposed on Boduru Gedda river •Target date of Preparation of DPR- 12/23 •Agency-NREDCAP
5	Somasila	Andhra Pradesh	4x225	900	•Both Upper & Lower Reservoirs are proposed off stream • Target date of Preparation of DPR- 12/23 •Agency- Shirdi Sai Electricals Ltd.
6	Yerravaram	Andhra Pradesh	3x400	1200	Agency-Shirdi Sai Electricals Ltd. •Target date of Preparation of DPR- 12/23
7	Paidipalem East	Andhra Pradesh		1200	•UR- new proposed Off Stream , LR - new proposed draws water Paidipalem Balancing reservoir •Date of MOA– 12/09/2022 •Agency-Indosol Solar Power Pvt. Ltd.
8	Singanamala	Andhra Pradesh		800	•UR- Off Stream, LR- Off Stream. •Date of MOA– 12/09/2022 •Agency- Aurobindo Realty & Infrastructure Pvt. Ltd.
9	Sukhpura Off-Stream	Rajasthan	7x320 + 2x160	2560	•Both Upper Reservoir & Lower Reservoirs are to be contructed. •Target date for preparation of DPR – 06/2024 •Agency- Greenco
10	Paidipalem North	Andhra Pradesh	5 x 200	1000	•UR- new proposed Off Stream , LR - new proposed draws water Paidipalem Balancing reservoir •Date of MOA– 12/09/2022 •Agency-Indosol Solar Power Pvt. Ltd.
11	Shahpur	Rajasthan	5x300 +2x150	1800	•Offstream closed loop, UR &LR -off stream •Target date of preparation of DPR- 06/2024 •Agency-Greenko
11	**Sub-Total**			**14360**	
17	**TOTAL**			**19960**	

S.No.	SCHEMES	STATE	INSTALLED CAPACITY		REMARKS
			No. of units x Unit size(MW)	MW	
F. SCHEMES UNDER SURVEY & INVESTIGATION HELD UP					
	I. Both Reservoirs Existing				
1	Kodayar	Tamil Nadu	6x250	1500	•Both Reservoirs are existing. Upper Reservoir is on Kodayar Reservoir and Lower Reservoir is on PWD's Pechiparai reservoir(Existing Hydro Project) •Agency-TANGEDCO •Pre-DPR Chapters returned after there is no progress in the S&I activities by the developer
2	Sharavathy	Karnataka	8x250	2000	•Both Reservoirs are existing. Upper Reservoir is on Talakalale reservoir and Lower Reservoir is on Gerusappa reservoir(Existing Hydro Project) •Agency-KPCL •Pre-DPR Chapters returned after there is no progress in the S&I activities by the developer
2	**Sub-Total**			**3500**	
	II. One Reservoir Existing & One to be constructed				
3	Upper Kolab	Odisha	2x160	320	•Upper Reservoir is existing on Upper Kolab HEP reservoir (Exisiting Hydro Project) and Lower Reservoir is to be constructed. •Agency-OHPCL •Pre-DPR Chapters returned after there is no progress in the S&I activities by the developer
4	Balimela	Odisha	2x250	500	•Upper Reservoir is existing on Balimela HEP reservoir (Exisiting Hydro Project) and Lower Reservoir is to be constructed. •Agency-OHPCL •Pre-DPR Chapters returned after there is no progress in the S&I activities by the developer
2	**Sub-Total**			**820**	
	III. Both Reservoirs to be constructed				
5	Sillahalla St.-I	Tamil Nadu	4x250	1000	•Both Reservoirs are to be constructed •Agency-TANGEDCO •Pre-DPR Chapters returned after there is no progress in the S&I activities by the developer
1	**Sub-Total**			**1000**	
5	**TOTAL**			**5320**	
30	**GRAND TOTAL**			**33805.60**	

**** 1 unit (250 MW) likely during 2022-23 & 3 units (750 MW) during 2023-24**

Kadana Pumped storage project is located on river Mahi in Santarampur taluka of District Panchmahals in Gujarat State. An existing reservoir with 1300 Mm^3 live storage and 1700 Mm^3 gross storage capacity has already been created over this river by providing a 58.2 m high and 2225 m long masonary-cum-earth dam. This reservoir is proposed to serve as upper reservoir for this pumped storage project. The FRL & MDDL for this reservoir are 127.7 m and 114.3 m respectively. The lower reservoir for this project would be formed near the power house by creating a tail pool with FRL & MDDL 96 m & 78.7 m respectively.

It was proposed to install four reversible pump/turbine units of 60 MW each, operating under an average gross head of 43.5 m with rated discharge of 168.7 cumecs and at rated speed of 142.86 r.p.m. Each unit of this project would consume 65 MW of power to carry water with rated discharge of 126.2 cumecs for 47 m head, while operating in pumping mode.

Two units of 60 MW each of the project were commissioned during 1990 & two units of 60 MW each of the project were commissioned during 1998. Machines operated in generation mode till 2004 and trial for pump mode operation was done during 2004-05. However, operation in pumping mode was not taken up subsequently due to vibration problem in the machines. CKD Blanksko (OEM) was contacted by the project authorities and they submitted their offer for rectification of the problem.

This offer was discussed in a meeting by GSECL and its management decided to rectify the problem on its own (through in house expertise) as the offer of CKD Blanksko was costlier.

The Kadana unit no 3 was identified as the pilot unit for revival of Pump Mode Operation of KHEP. As per the report of vibration analysis of unit no 3 (carried out through Ex-BHEL expert to diagnose the root cause of vibrations observed during previous trial of unit under pump mode), necessary corrections like replacement of both the bearings, alignment and centering of turbine shaft is completed recently. The stop log gates of Kadana Unit no 3 are removed. The protection testing of Kadana Unit no 3 is completed and found OK.

At present, after attending the bearings, the unit no 3 was run in generation mode. The vibration analysis was carried out by Ex BHEL expert in generation mode and found to be working properly. Now the matter will be taken up with Irrigation Department to take permission for reversible mode trial. Along with it, the systems/control loops for reversible mode operations will be checked for healthiness and further actions will be planned accordingly.

As per meeting organized by CEA on 16.08.2021 through video conference to discuss operation of Kadana Pumped Storage Project not working in pumping mode, it was discussed that there are 4 units in Kadana PSP & Rs. 108 Crores /unit has been quoted by OEM for rectification, a total expenditure of about Rs. 450 Crores is required. CE (Hydro), GSECL requested that this fund may be provided by Central Government through some scheme like PSDF, etc.

On successful trial of unit no 3 under pump mode, similar corrections/rectification activities will be replicated in other units also.

The matter for revival of one unit through the OEM is also being explored in parallel by GSECL. As per discussion during the Meeting regarding PSP storage held on 12.11.21, the work of exploring the feasibility & timeline for revival of Pump Mode Operation of Kadana HEP is awarded to IIT, Roorkee by GSECL. A team from IIT Roorkee visited Kadana HEP & necessary information was collected by them .The discussion on observations is made with IIT Team during the month of March, 2022. The draft feasibility study report from IIT Roorkee was received & as suggested in the report, the RLA study of the civil structures & CFD study is being planned. During the last week of August 2022, an introductory meeting with the OEM was conducted to identify the alternatives available for replacement of entire units within the existing civil infrastructure without impacting the dam structures. The company has invited bids for retrofitting/replacement of existing turbines by similar/higher capacity reversible turbines as an EPC contract and the appointment of consultants for retrofitting/uprating of existing 4×60 MW units is under progress

Sardar Sarovar Pumped Storage Hydro Electric Project (1200 MW) was commissioned during 2004-06. The project has 6 nos of reversible motor / generator and pump / turbine each of 200 MW installed capacity means total capacity of 1200 MW. The Generation of SSHEP is shared between Gujarat (16%), Maharashtra (27%) & Madhya Pradesh (57%) States, as per the NWDT Award.

The entire operations of the Project are based on the directives by Narmada Control Authority, Indore and as per Narmada Water Disputes Tribunal (NWDT) award. There was no mention of pump storage operation of the project in NWDT award.

The project was not operating in Pumping mode as the lower reservoir at Garudeshwar weir was not operational and the equipments required to operate it in pumping mode were also not installed. Further, Narmada Control Authority (NCA) has to take decision to operate the project in pumping mode in consultation with the states of Maharashtra, M.P. and Gujarat.

Now, the lower reservoir at Garudeshwar weir has been made operational by Gujarat.

Govt. of M.P. and Maharashtra are of the opinion that pumping in the project is not as per NWDT award. Both the states are ready to participate if water sharing, cost apportionment, power distribution, O&M issues, operational methodology and Legal issues are resolved by NCA taking into consideration the NWDT award in the new scenario of pumping mode operation of the project.

- The following equipments are required to be installed for pumping mode operation:-

Items Description	Quantity
Isolated Phase Bus Ducts or 13/8 KV, 400 KV Cables	For Six Units
Phase Reversal Switches	Six nos for Six Units
Static Frequency Converter	Six nos for Six Units

In the meeting held on 31st August, 2021 via video conferencing organised by CEA, representative of SSNNL stated that for operationalization of pumping mode of 6 units of 200 MW of River Bed Power House (RBPH) of Sardar Sarovar Project, an expenditure of Rs. 294/- crore (Rupees Two hundred ninety-four crores only) is required which should be shared among the partner States.

❖ 92nd meeting of NCA held on 24.08.2021

Out of three partner states of M.P. Gujarat and Maharashtra, only M.P. Govt. is not agreeable to pumping mode operation of project. The issue was discussed in its 92nd meeting held on 24.8.2021 and Chairman, NCA has directed Member (Power), NCA to thoroughly examine the matter, taking into consideration all the correspondences that have been made between Govt. of Gujarat, Govt. of M.P. and NCA and prepare a detailed report.

❖ 93rd meeting of NCA held on 12.04.2022

In the 93rd meeting of NCA held on 12th April 2022 at 11 AM, CEA representative informed that they had carried out the study from incremental investment point of view and as per their study if GoMP go for PSP model, then over a period of 20 years their share will be Rs. 1,726 crore only, where as if they procure power from the market it will be around Rs. 3,300 crore. So CEA's final view is that the project is beneficial for GoMP and considering the long term benefits, they should go for PSP model at SSP

The Vice Chairman, NVDA, GoMP stated that their Narmada Control Board (NCB) had already taken a decision with regard to sharing of cost for construction of Garudeshwar Weir and pumping mode of RBPH operation and their stand is still the same, i.e., since the Pumped Storage Project (PSP) is not provided in the NWDT Award, hence GoMP will not participate in it. He further stated that as per recent Govt. instruction there is no change in the stand of State of Madhya Pradesh

MD SSNNL, in response stated that there may be views/stands of either of Government of MP or Govt. of Gujarat but NCA is the deciding body in this matter and this body (NCA) has been given mandate to take the decisions by NWDT Award, considering the views expressed by all the members.

Secretary (Power), GoI, has taken up this issue with Power Secretaries of States and has convened various meetings to address this issue and clearly spelled out that this pump storage operation is the solution and can fulfill the peak demand. He then requested Chairman NCA to take a decision for taking this project ahead taking into account the need of the hour as this is a very important subject for all the beneficiary States and the Country.

The GoM representative stated that they have already conveyed their consent for sharing the cost of Garudeshwar Weir except sharing the cost of construction of new structures of bridges/culverts as it was not the part of Garudeshwar Weir.

GoG representative stated that the cost incurred towards the construction of new structure of bridges/ culverts is an integral part of the scheme as with the construction of pond to facilitate the reversible operation this old Gora Bridge became submersible and was required to be demolished and replaced with an elevated one.

The Chairman, NCA requested GoM to consider sharing the cost in totality as they are already convinced with the scheme and agreed to share the cost of Garudeshwar Weir and requested all the concerned party States to review their respective stand so that this project can move forward with their willing consent.

❖ Meeting taken by Hon'ble Minister of Power & NRE on 26.10.2022

A Meeting under the Chairmanship of Hon'ble Union Minister of Power & NRE was held on 26.10.2022 at 3.30 P.M. to discuss the issues related to operationalization of Sardar Sarovar PSP in the pumping mode. Hon'ble Minister pointed out that the peak hour tariff in the power exchange should justify the need for the PSP. The Partner states can make a healthy profit if they incur the small additional expenditure to operationalize the PSP. Secretary, Ministry of Jal Shakti, informed that the issue was also discussed in the 93rd NCA meeting. Maharashtra and Gujarat have agreed to incur this additional expenditure but Madhya Pradesh is still reluctant.

Principal Secretary, Energy, GoMP stated that as far as power aspect is concerned, operationalizing the PSP seems an attractive proposition. The storage cost of the project would only be 60 paisa. However, GoMP has certain concerns regarding sharing of water since the PSP was not envisaged as part of the NWDT award. Further operation of the reservoir, especially during pre-monsoon, may not be optimum if PSP is operationalized. He informed that a decision has been taken in 2017 at the level of Hon'ble CM of Madhya Pradesh not to participate in the project.

Hon'ble Minister directed that a Committee may be constituted under the Chairmanship of Chairperson, CEA with representatives from CWC, NCA, NVDA and Grid-India, which would examine the concerns raised by GoMP and come up with a detailed plan to operationalize the project in pumping mode. The Committee shall so structure the scheme as to ensure that there is no loss of existing irrigation and power share of any of the Partner States.

❖ Constitution of the Committee to suggest possible Measures to operationalize the SSPSP

As per the direction of Hon'ble Minister of Power, MoP vide Order dated 13.12.2022, has constituted a Committee to suggest possible Measures to operationalize the Sardar Sarovar Pumped Storage Project under the Chairmanship of Chairperson, CEA with representatives from Govt. of MP, Gujrat and Maharashtra, CWC, Narmada Control Authority, Grid-India & CEA. In this regard, two meetings of the committee have been held on 20.01.2023 and 14.03.2023 and action plan for operationalization of Sardar Sarovar Project in pumping mode is under preparation.