

F. No. 15-14/9/2022-H-II(Part)  
भारत सरकार / Government of India  
विद्युत मंत्रालय / Ministry of Power  
Shram Shakti Bhawan, Rafi Marg  
New Delhi - 110001, Tel: 011-23705841

Dated: 10<sup>th</sup> April, 2023

To

1. The Secretaries of all the Ministries / Departments of Government of India
2. The Chief Secretaries of the State Governments & Union Territories
3. Principal Secretaries (Energy / Power) - All the State Governments & UTs
4. CMDs - PGCIL, NTPC, NHPC, SJVN, THDC, NEEPCO, Grid India, PFC, REC
5. The Chairman - BBMB, DVC

**Sub: Guidelines to promote development of Pump Storage Projects (PSP) - reg.**

Sir / Madam,

This has reference to Ministry of Power's letter of even number dated 15<sup>th</sup> February, 2023 vide which the draft PSP Guidelines were circulated for comments / suggestions. Subsequently, a webinar was held on 23<sup>rd</sup> February 2023 on the topic of "Green Growth", wherein, inter alia, suggestions were also received on the framework for Pumped Storage Projects in the country.

2. Based on the comments / suggestions received from the stakeholders, the Guidelines to promote development of Pump Storage Projects in the country have been finalized. A copy of the PSP guidelines is enclosed herewith for information and necessary action.

This issues with the approval of Hon'ble Minister of Power and New & Renewable Energy.

Yours sincerely,

(Mohd. Afzal)  
Joint Secretary

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Tel.: 011-23714000

**Copy to:-**

1. CEO, NITI Aayog
2. Secretary, CERC / All SERCs
3. Chairperson, CEA
4. Chairperson, CWC

**Copy also to:**

**In-charge, NIC Cell, MoP:** with request to upload the Guidelines on the website of the Ministry of Power.

# **Guidelines on Pumped Storage Projects**

## **1. Introduction**

Energy Transition entails increasing presence of variable and intermittent Renewable Energy Sources (VREs) like solar & wind in the energy mix. This presents a grid-level challenge for stability and a need for addressing the temporal considerations in power availability. Storage and ancillary services would be the attributes that require incentivization in the power system to ensure appropriate capacity. Comprehensive storage guidelines are required to set the direction of developments in this regard. Amongst the various technologies available for addressing this requirement of storage and ancillary services, Pumped Storage Projects (PSPs) are clean, MW scale, domestically available, time tested and internationally accepted.

The positive aspects of PSPs are not limited to the attributes of storage and ancillary services. PSPs are clean, green and safe. They don't produce any poisonous/ harmful by-products or pose problems of disposal. The advantages of promoting PSPs are not only based on their usefulness in maintaining grid stability and facilitating VRE integration but also their other positive attributes when compared to other available energy storage systems.

### **1.1 Perspectives**

Flexible Energy Generation Assets that can supply both Base Load & Peaking Power efficiently and economically are the need of the future and necessary to address the dynamically evolving energy needs of India. At present, Variable Renewable Energy Sources (VRE) such as wind and solar are being connected to the grid at a rapid pace owing to their low cost of installation and the thrust on sustainable & green energy. The energy supply from VREs can't be regulated since they are dependent on the time of the day, seasons, and the vagaries of weather. Hence, there is an ever-increasing demand for Energy Storage Assets. PSPs are best suited in the present scenario for addressing this demand. PSPs are also known as 'the Water Battery', which is an ideal complement to modern clean energy systems.

PSPs provide the necessary scale of storage and have a long service life of more than 40-50 years. This is much more than any other energy storage technology presently available. This also results in a low cost of delivered energy over the life of the projects. PSPs are also non-polluting and are more environmentally friendly. Pumped Storage Projects account for over 95 percent of installed global energy storage capacity. It is estimated that pumped hydro projects worldwide store up to 9,000 gigawatt hours (GWh) of electricity worldwide.

### **(a) Energy Transition Considerations**

India is on the path towards a clean energy transition, guided by the Nationally Determined Contribution (NDC) targets, to reduce the emission intensity of its Gross Domestic Product (GDP) by 45% by 2030, get to 50% of installed capacity from non-fossil fuel sources by 2030 and achieve net zero carbon emissions by 2070. Given the ongoing energy transitions in the country, the development of PSPs is of paramount importance for providing greater inertia and balancing power to the grid as battery storage solutions are still being scaled up and are required for short duration storage needs in grid management, PSPs are a natural enabler for integrating greater amounts of wind and solar power. With its ability to store a large amount of energy, frequent starts/stops, and faster ramp-ups/ramp-downs, PSPs are ideally suited to address the dynamic supply and demand. PSPs can also be used for peaking operation and improve the reliability of the power system.

### **(b) Ancillary Services Considerations**

Wind and Solar power have become one of the lowest-cost sources of renewable energy. However, their inherent variable, uncertain and intermittent nature presents a huge challenge for integrating large quantities of renewables, while maintaining grid stability. Curtailment of wind and solar power is already being witnessed in some areas although they presently constitute only around 25% of total energy capacity. With the increasing presence of VREs, the need for curtailment will be more acute if there is insufficient storage in the grid. PSPs present a viable solution to the integration issues of large RE capacities. They are best equipped for peak load requirements. PSPs can store a large amount of energy during off-peak hours and discharge over longer period. Thus, PSPs would help reduce RE curtailment and improve the plant load factor of VREs.

### **(c) Temporal Considerations**

It is anticipated that with the increasing presence of VRE in the energy mix, the generation of wind and solar energy may be at its peak where the energy demand is the lowest. If the energy from these sources is not stored during off-peak hours in times to come, there will be an increasing need for large operating reserves from thermal power plants (typically high carbon coal and gas) to meet the peak demands of the country. PSPs provide an economical solution by off taking a large amount of energy from the grid during off-peak hours, increasing the load factor of other systems, and also providing additional capacity to meet the peak loads. Pumped hydro storage provides a dynamic response and offers critical backup during periods of excess demand along with maintaining grid stability. Without PSPs, full decarbonisation of the electricity sector will not be achievable at reasonable costs. Thus, PSPs provide 'green storage' and make VREs dispatchable by firming up the capacities.