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Pumped-Storage Hydropower

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Pumped-Storage Hydropower

Practice: 8 MCQs

At a glance

Pumped storage keeps electricity as water held at height

01 **How it works**Water is pumped uphill to charge. It runs down through a turbine to discharge.
02 **Why it matters**It saves surplus green power for non-solar hours.
03 **India today**The CEA sheet of 10 Jul 2026 shows 10 operating PSPs with 7,425.60 MW.
04 **Policy**The PIB reports a 100% ISTS waiver for 25 years for awards by 30 June 2028.

- New plants return around 80% of the energy used to pump (DOE).
- Eleven PSPs with 15,870 MW are being built (PIB, Jul 2026).
- The potential figure changes with the source and the date.
- Viability Gap Funding exists for batteries, not for PSPs.
- UPSC asked about pumped-storage hydropower in 2024.

PSPA pumped storage project.
Round-trip efficiency How much energy a plant returns; the DOE gives about 80% for new plants.
Closed-loopA plant not joined to a natural stream.
ISTSThe Inter-State Transmission System.

Pumped-storage hydropower stores electricity as water held at height. This lesson covers how a plant works, why the grid needs it, and where India stands. It lists India’s ten operating plants and the projects being built. It also covers policy, environmental trade-offs and the exam questions. Figures are dated snapshots. Where sources differ, both numbers are shown with dates.

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What is pumped-storage hydropower and how does it work?

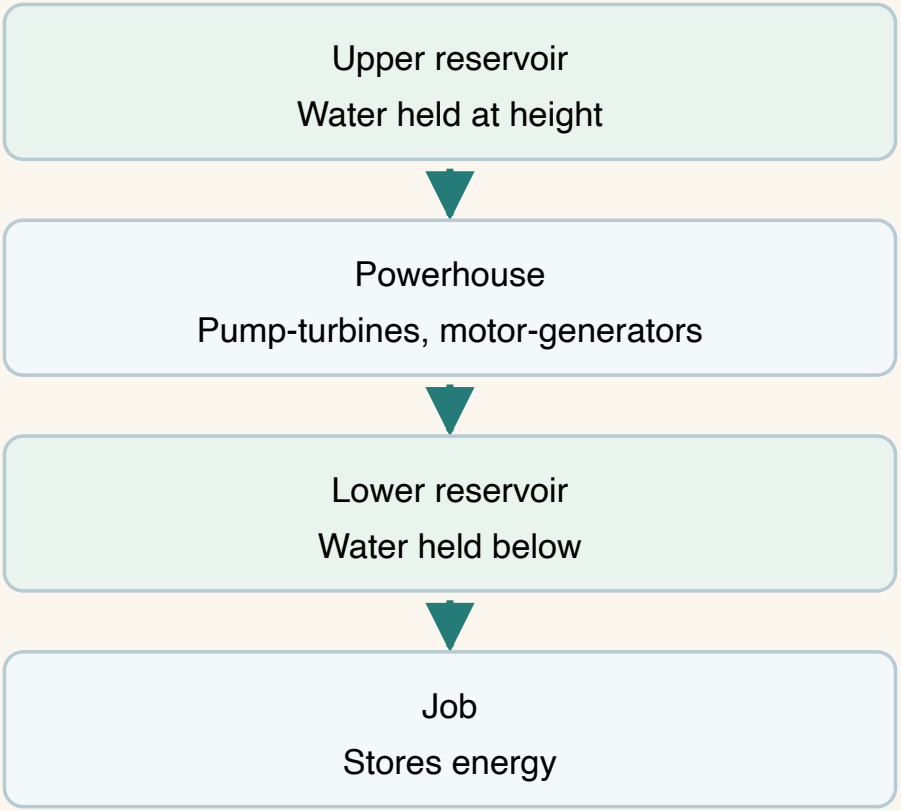
Think of two tanks at different heights joined by a pipe. Water moves between them to store and release power.

1. What is pumped-storage hydropower (PSH or PSP)?

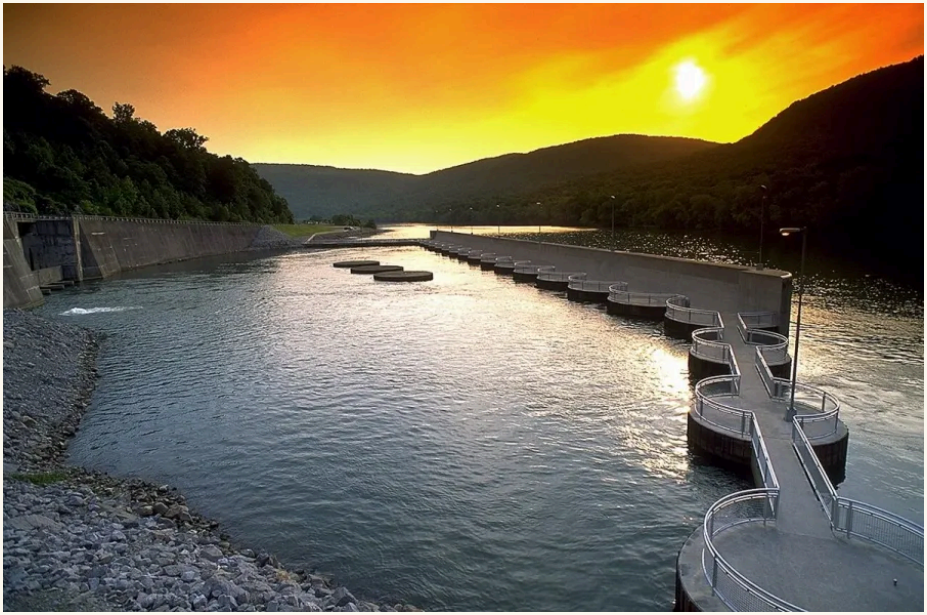
The US Department of Energy calls pumped-storage hydropower a **proven energy storage technology**. A plant has an upper reservoir and a lower reservoir. Water conveyances such as penstocks and tunnels join them.

Indian official papers use PSP for “pumped storage project”. The Ministry of Power says PSPs provide long-duration energy storage and balancing power.

- An upper reservoir and a lower reservoir.
- Water moves between them through tunnels and a powerhouse.



Four facts to hold on to.



Raccoon Mountain Pumped-Storage Plant, Tennessee. Photo: Tennessee Valley Authority, public domain, via Wikimedia Commons. File page.

Source: US DOE, Pumped Storage Hydropower Technology Strategy Assessment, July 2023, item 1

Source: PIB Ministry of Power, Status on Pumped Storage Projects, 20 Jul 2026, item 1

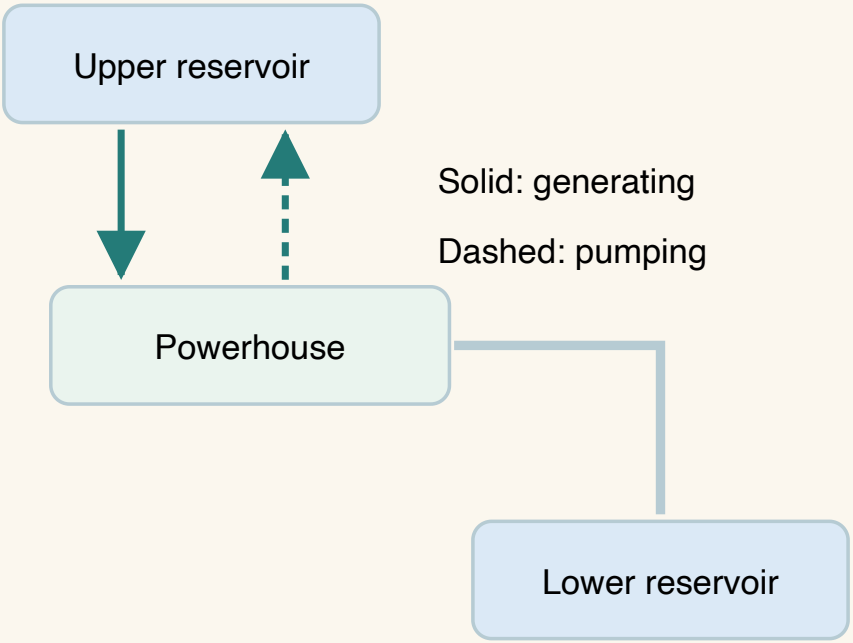
2. What happens in pumping mode and generating mode?

A plant has two modes. In pumping mode it charges. In generating mode it discharges.

The DOE says water is pumped from the lower to the upper reservoir when net demand is low. It is also pumped when supply is higher than demand. To generate power, water is released to a powerhouse that holds the pump-turbines and motor-generators. The water spins a turbine near the lower reservoir. The turbine drives a generator.

The DOE says most plants use **reversible pump-turbines**. Some designs use separate pumps and turbines.

- Pumping (charging): lower reservoir to upper reservoir.
- Generating (discharging): upper reservoir to lower reservoir, through the turbine.
- Reversible unit: one machine does both jobs.



Pumping charges the plant. Generating discharges it.

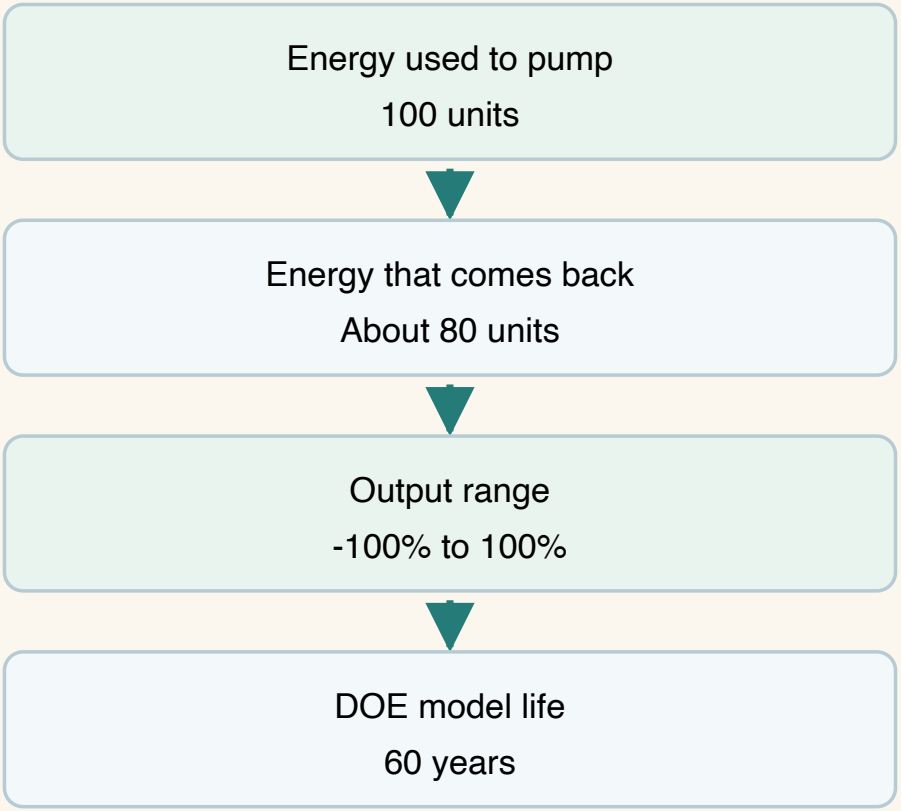
True or False: In pumping mode, water moves from the upper reservoir down to the lower reservoir.
Source: US DOE, Pumped Storage Hydropower Technology Strategy Assessment, July 2023, item 2

3. What is round-trip efficiency, and what is it for PSH?

Round-trip efficiency is how much energy a plant returns. The DOE gives **around 80%** for new plants.

The DOE says the typical round-trip efficiency of new PSH plants is currently around 80%. So about 80 units come back for every 100 units used to pump. Its cost table for a 100 MW plant with 10 hours of storage uses 80% and a 60-year project life.

The DOE says ternary and quaternary plants, running in hydraulic short-circuit mode, have practically a full operating range, **from -100% to 100%** of capacity.



True or False: The DOE puts the round-trip efficiency of new PSH plants at around 80%.
Source: US DOE, Pumped Storage Hydropower Technology Strategy Assessment, July 2023, item 3

4. What is the difference between open-loop and closed-loop PSH?

The DOE says open-loop systems are continuously connected to a naturally flowing body of water. Closed-loop systems are not.

The DOE says closed-loop plants typically have fewer environmental impacts. They also face a shorter licensing timeline in the US. The DOE gives 2 years, under an expedited FERC route for closed-loop projects at abandoned mine sites. Open-loop plants are typically cheaper because **only one reservoir is built**. But they face more environmental hurdles.

- Open-loop: linked to a naturally flowing body of water.
- Closed-loop: not continuously connected to a naturally flowing body of water.

Open-loop	Closed-loop
Flowing-water link	No water link
Often cheaper	Fewer impacts
	US licence: 2 yrs

The licensing time is the DOE figure for the US.



Bath County Pumped Storage Station. The upper reservoir lies behind the mountain top. Photo: Z22, CC BY-SA 4.0, via Wikimedia Commons. File page. Licence: CC BY-SA 4.0.

True or False: Closed-loop plants are typically cheaper than open-loop plants because they build only one reservoir.
Source: US DOE, Pumped Storage Hydropower Technology Strategy Assessment, July 2023, item 4

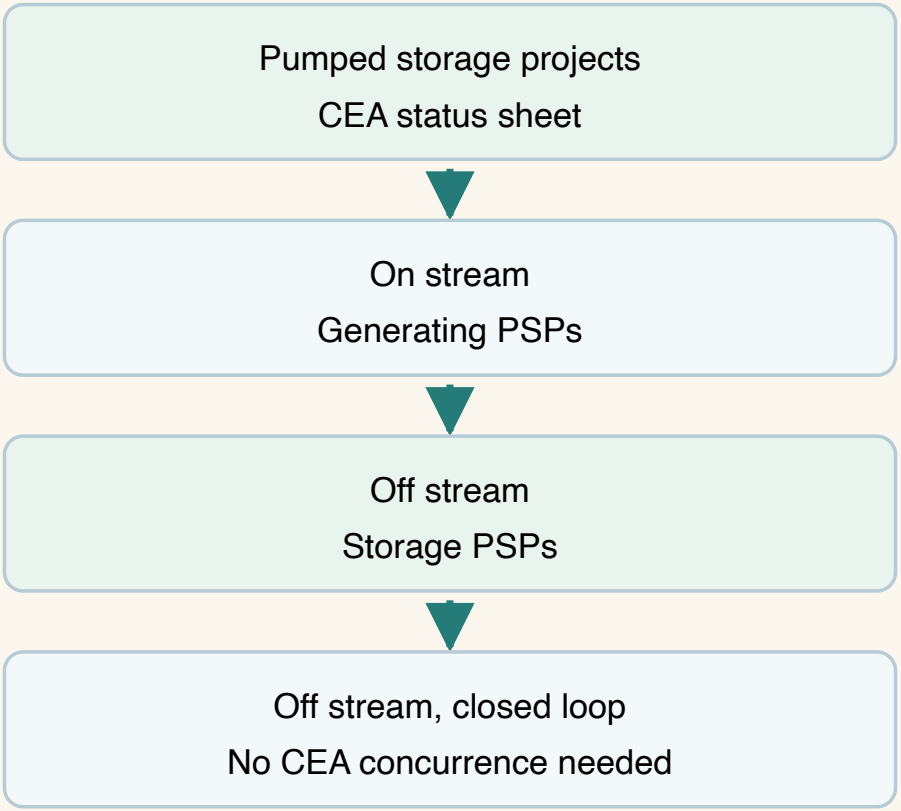
Source: US DOE PNNL, open-loop and closed-loop effects, item 4

5. How does India's Central Electricity Authority (CEA) classify plants as on-stream or off-stream?

The CEA status sheet splits PSPs into “on stream” and “off stream”. On-stream plants are labelled ‘Generating PSPs’ and off-stream plants ‘Storage PSPs’ on the CEA sheet.

The CEA then marks off-stream plants as “open loop” or “closed loop”. The PIB (July 2026) says closed-loop off-stream schemes are **exempt from CEA concurrence**.

The sheet lists state, district, units, MW, developer and commissioning dates.



Off-stream plants are marked open or closed loop.

Source: CEA, Status of Pumped Storage Development in India (PDF created 10 Jul 2026), item 5

Source: PIB Ministry of Power, 20 Jul 2026, item 5

Why does the grid need pumped storage?

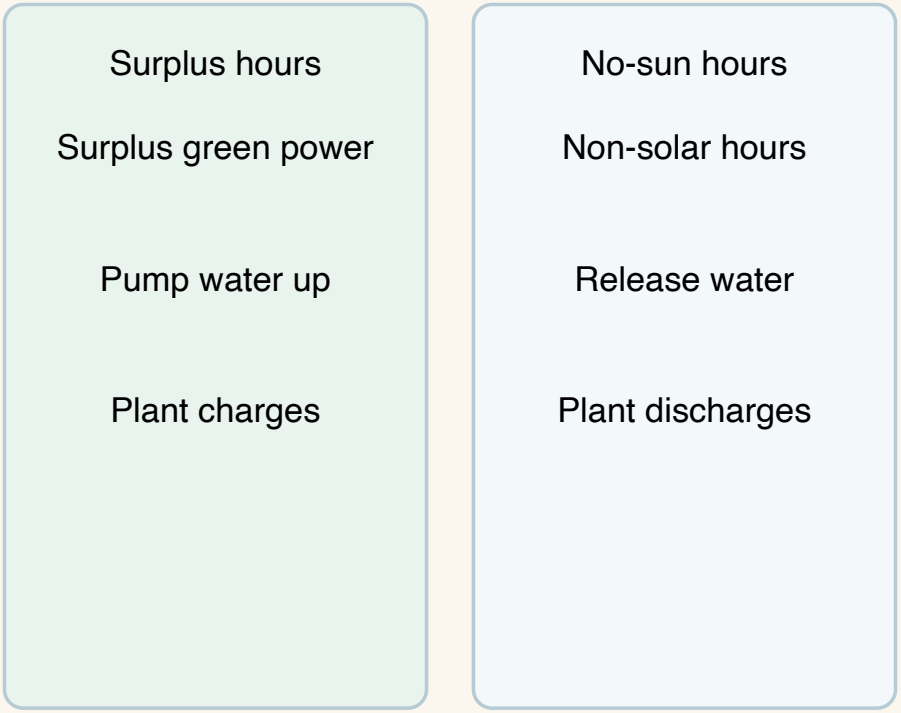
Solar and wind output is intermittent (PIB). Storage helps.

6. Why does a grid with more solar and wind need storage?

The PIB (17 Nov 2025) quotes Power Minister Manohar Lal. PSPs can store surplus green power. They can then meet demand in **non-solar hours**.

The PIB (July 2026) says PSPs support renewable integration. They store surplus energy off-peak and supply power at peak demand.

The PIB (9 Mar 2026) says the transmission system is planned to integrate **over 500 GW of non-fossil capacity by 2030**. It says the Government promotes storage and hybrid solutions to address intermittency.



The PIB links PSPs to non-solar hours.

Source: PIB Ministry of Power, 17 Nov 2025, item 6

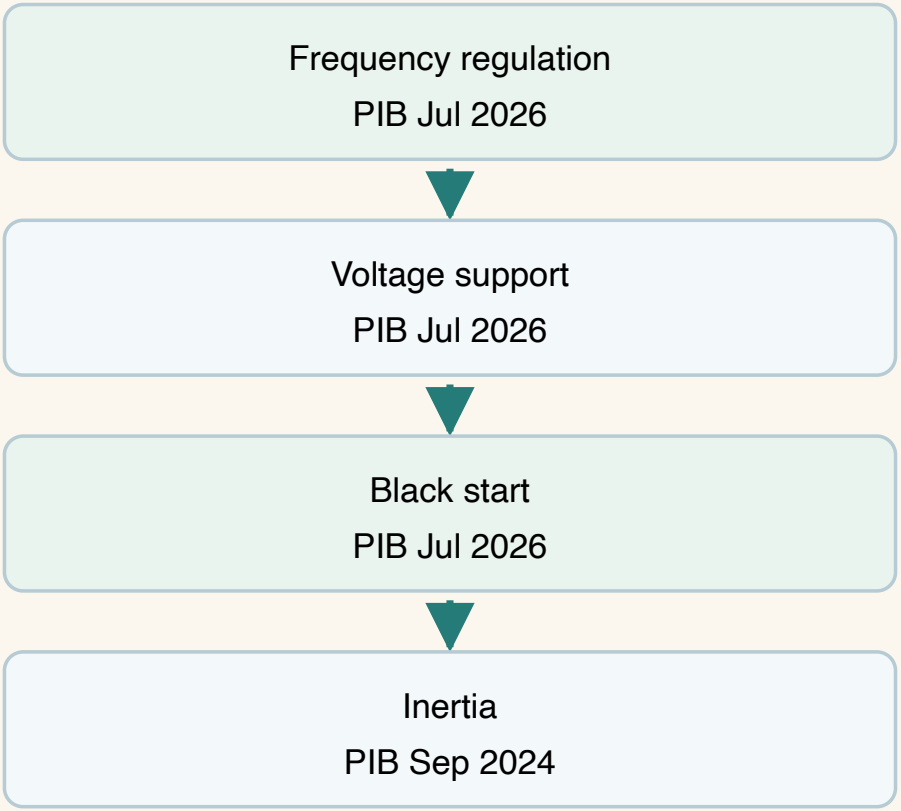
Source: PIB Ministry of Power, 20 Jul 2026, item 6

Source: PIB Ministry of Power, Renewable Energy Integration, 9 Mar 2026, item 6

7. What grid services does a PSP provide beyond storing energy?

The PIB (July 2026) names balancing power and ancillary services. These include frequency regulation, voltage support and **black start capability**.

The PIB (Sep 2024) says the two PSPs it concurred will help meet peak demand in non-solar hours and give “inertia” to the grid.





Powerhouse of the Raccoon Mountain Pumped-Storage Facility, showing four pump-generators. Photo: Mark Rankin, public domain, via Wikimedia Commons. File page.

Source: PIB Ministry of Power, 20 Jul 2026, item 7

Source: PIB Ministry of Power, CEA concurs two more PSPs, 22 Sep 2024, item 7

8. How does PSP compare with battery storage?

The two are planned side by side in India. The PIB (9 Mar 2026) says the National Electricity Plan transmission volume covers **35.6 GW of PSPs up to 2031-32**. It also considers **about 47 GW** of battery energy storage systems (BESS) by 2031-32.

The Government backs batteries with two Viability Gap Funding schemes for about **43.8 GWh** of BESS. They were launched in March 2024 and June 2025.

The PIB (Dec 2023) says the levelised cost of storage of PSPs is viable. So there are no plans for Viability Gap Funding for PSPs.

The DOE uses a 60-year life for a PSH plant. The DOE paper models 10 hours of storage. No official source checked gives a like-for-like battery life or cost. So no numeric battery comparison is made here.

Point	PSP	BESS
In NEP by 2031-32	35.6 GW (transmission planned)	about 47 GW
Central funding in India	Budgetary support for enabling infrastructure	Two VGF schemes, about 43.8 GWh
Model project life (DOE)	60 years	not sourced here

PSP

35.6 GW planned

No VGF plan (2023)

60-year model life

BESS

47 GW considered

Two VGF schemes

About 43.8 GWh

The model life is the DOE figure, not an Indian one.

Source: PIB Ministry of Power, 9 Mar 2026, item 8

Source: PIB Ministry of Power, No plans for VGF for PSPs, 23 Dec 2023, item 8

Source: US DOE, Pumped Storage Hydropower Technology Strategy Assessment, July 2023, item 8

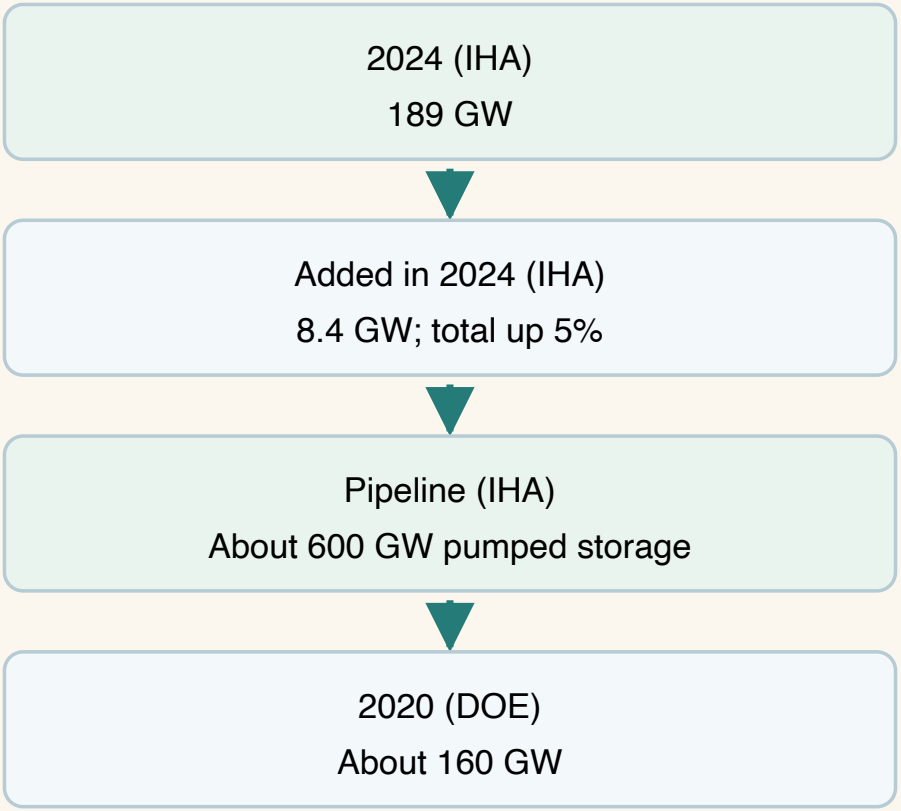
How much pumped storage does the world have?

9. What is the global PSH capacity, and how fast is it growing?

The International Hydropower Association (IHA) says global pumped storage reached **189 GW** in 2024. It says **8.4 GW** was added in 2024. Global capacity rose 5%.

The IHA says the global hydropower pipeline now exceeds **1,075 GW**. About 600 GW of it is pumped storage and 475 GW is conventional hydropower. The report was released on 25 June 2025.

The DOE gives an older snapshot. It says global PSH capacity was approximately 160 GW in 2020.



Do not mix the dates.

Source: IHA, 2025 World Hydropower Outlook, item 9

Source: US DOE, Pumped Storage Hydropower Technology Strategy Assessment, July 2023, item 9

10. How much PSH does the United States have?

The DOE (July 2023) says the US has **43 plants with 21.9 GW** installed. It says 42 are open-loop and one is a 40 MW closed-loop plant. The earliest US operation was the Rocky River project in Connecticut, **commissioned in 1929**.

The DOE says that in 2019 this was about 93% of US utility-scale energy storage power capacity. It was about 99% of US energy storage capability.

Source: US DOE, Pumped Storage Hydropower Technology Strategy Assessment, July 2023, item 10

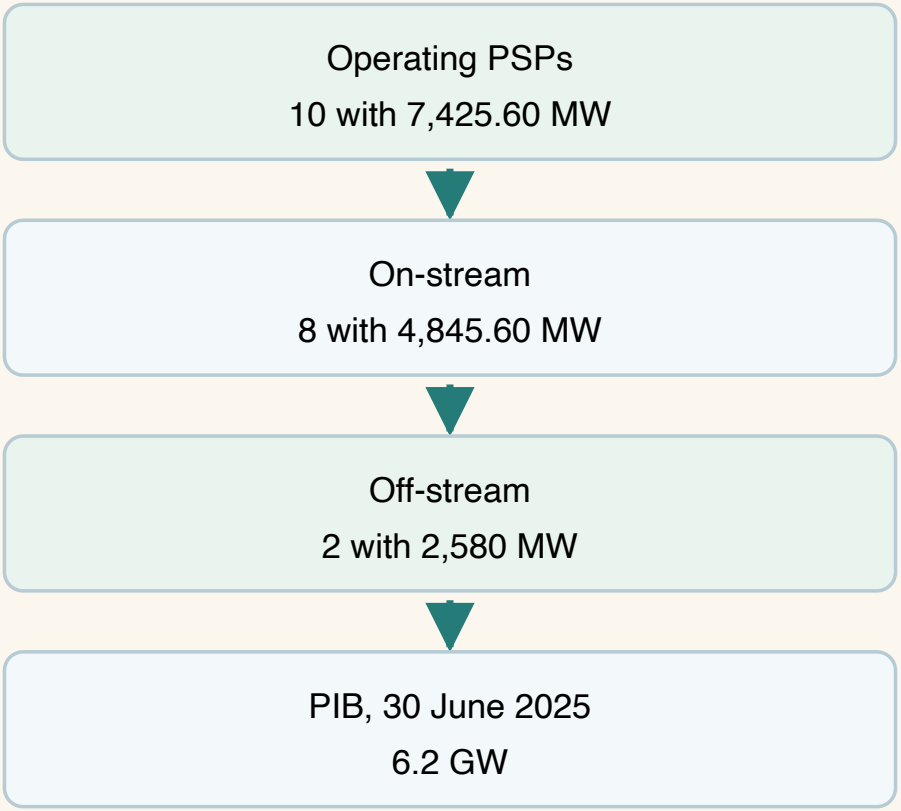
What pumped storage does India have today?

11. How much PSP capacity does India have in operation?

The CEA status sheets show **10 operating PSPs with 7,425.60 MW**. Eight are on-stream with **4,845.60 MW**. Two are off-stream with 2,580 MW. The same total appears in the CEA files of 8 May 2026 and 10 Jul 2026.

This is above the PIB (28 Jul 2025) figure of **6.2 GW** at 30 June 2025. The CEA sheet gives unit dates after the PIB date. Pinnapuram units run from June to October 2025. Tehri units run from June 2025 to April 2026.

The PIB (17 Nov 2025) says **about 224 GW** of PSP potential has been identified. The potential figure depends on the source and the date. The PIB gave **about 119 GW** in June 2023 (see item 18). The CEA survey total in its file of 10 Jul 2026 is 310,104.6 MW. The May sheet showed 290,195.6 MW and the July sheet 310,104.6 MW.



Pinnapuram and Tehri units came on line after the PIB figure.

Source: CEA, Status of PSP Development in India (PDF created 10 Jul 2026), item 11

Source: CEA, Status of PSP Development (sheet as on 30.04.2026; PDF created 8 May 2026), item 11

Source: PIB Ministry of Power, 28 Jul 2025, item 11

Source: PIB Ministry of Power, 17 Nov 2025, item 11

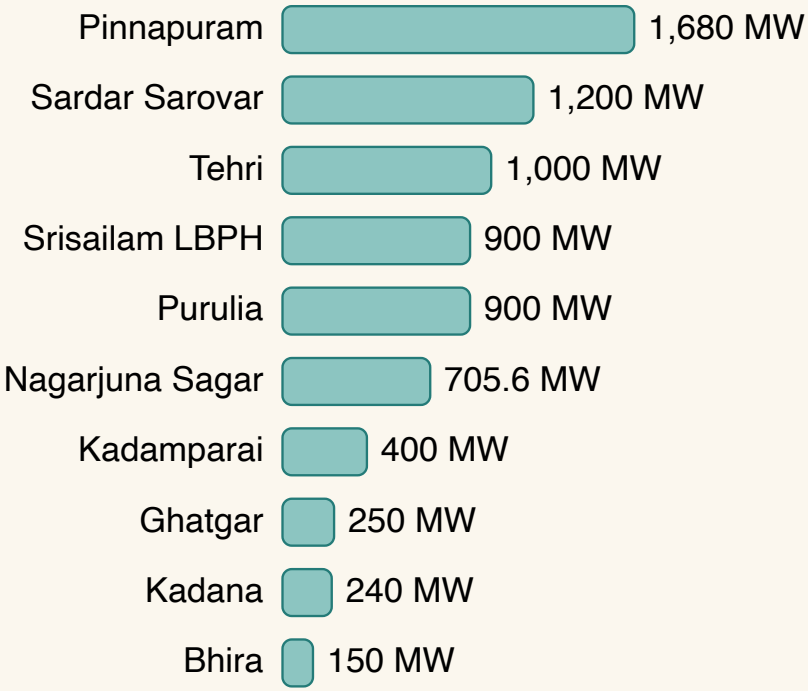
12. Which are India's operating pumped-storage plants?

This is the CEA list of PSPs above 25 MW, as in its file of 10 Jul 2026. States follow the CEA 2026 sheet.

- Kadana: Gujarat, 4×60 = 240 MW, GSECL.
- **Sardar Sarovar: Gujarat, 6×200 = 1,200 MW**, SSNNL.
- Ghatgar: Maharashtra, 2×125 = 250 MW, MAHAGENCO, commissioned 2008.
- Bhira: Maharashtra, 1×150 = 150 MW, Tata Power, units from 1927 and 1949.
- Tehri: Uttarakhand, 4×250 = 1,000 MW, THDC, units from June 2025 to April 2026.
- Srisailam LBPH: Telangana, 6×150 = 900 MW, TSGENCO, 2001 to 2003.
- Kadamparai: Tamil Nadu, 4×100 = 400 MW, TANGEDCO, 1987 to 1989.
- Nagarjuna Sagar: Telangana, 7 units totalling 705.6 MW, TSGENCO, 1980 to 1985.
- **Pinnapuram: Andhra Pradesh, 1,680 MW**, Greenko, off-stream closed loop, units from June to October 2025.
- Purulia: West Bengal, 4×225 = 900 MW, WBSEDCL, 2007, off-stream closed loop.

The first eight add to 4,845.6 MW. All ten add to 7,425.6 MW.

The PIB of 23 Dec 2023 listed Srisailam LBPH and Nagarjuna Sagar under Andhra Pradesh. The CEA 2026 sheet shows Telangana.



CEA list of 10 Jul 2026.



Srisailam Dam on the Krishna River. The CEA lists its pumped-storage plant, Srisailam LBPH, at 900 MW. Photo: iMahesh / Wikimedia Commons, CC BY-SA 4.0.

Source: CEA, Status of PSP Development in India (PDF created 10 Jul 2026), item 12

Source: PIB Ministry of Power, 23 Dec 2023, item 12

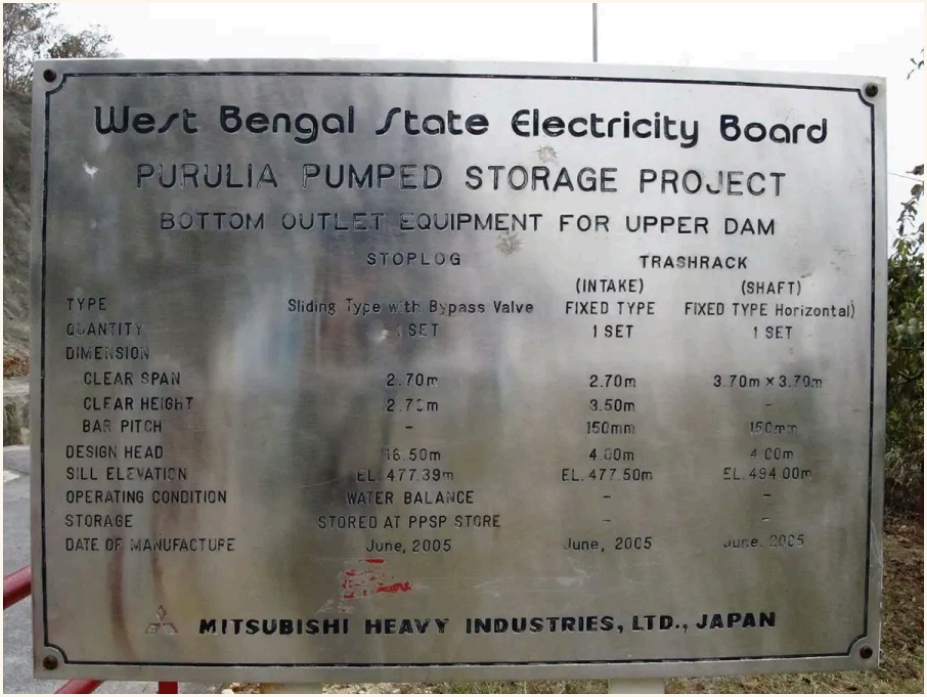
13. What is special about Pinnapuram and Tehri?

Pinnapuram, in Kurnool district of Andhra Pradesh, is off-stream and closed-loop.

The PIB (17 Nov 2025) says all eight units of the 1,680 MW Pinnapuram PSP were commissioned in 2025-26. It also names the 500 MW Tehri PSP among the 2025-26 commissionings. The CEA lists all four Tehri units, 1,000 MW. The PIB of 23 Dec 2023 gave Pinnapuram as 1,200 MW. Later sources give 1,680 MW, so this lesson uses 1,680 MW. The CEA shows all four Tehri units, 1,000 MW, running by April 2026.

Pinnapuram	Tehri
Kurnool district	Uttarakhand
Off-stream	4 units
Closed loop	1,000 MW
1,680 MW	Jun 2025 to Apr 2026

The CEA gives the unit dates.



Purulia Pumped Storage Project near the Ayodhya hills. Photo: Ayan Mukherjee, CC BY 3.0, via Wikimedia Commons. File page. Licence: CC BY 3.0.

Source: CEA, Status of PSP Development in India (PDF created 10 Jul 2026), item 13

Source: PIB Ministry of Power, 17 Nov 2025, item 13

14. Do Kadana and Sardar Sarovar run in pumping mode?

The PIB (23 Dec 2023) says Kadana and Sardar Sarovar RBPH were then **not operational in pumping mode**.

We found no later official line on this. The 2026 CEA sheet still counts them as operating PSPs.

True or False: In December 2023 the PIB said Kadana and Sardar Sarovar were not operating in pumping mode.

Source: PIB Ministry of Power, 23 Dec 2023, item 14

Source: CEA, Status of PSP Development in India (PDF created 10 Jul 2026), item 14

15. Are Kundah and Panchet Hill operating PSPs?

Kundah is not yet operating as a PSP. The CEA lists Kundah Stages I, II and III, 500 MW, in Tamil Nadu as under construction. The PIB (July 2026) gives its target as Feb 2027.

Panchet Hill does not appear in any CEA PSP list checked. So it is not counted as a PSP.

True or False: The CEA lists Kundah as an operating PSP.
Source: PIB Ministry of Power, 20 Jul 2026, item 15

Source: CEA, Status of PSP Development in India (PDF created 10 Jul 2026), item 15

What is being built and planned?

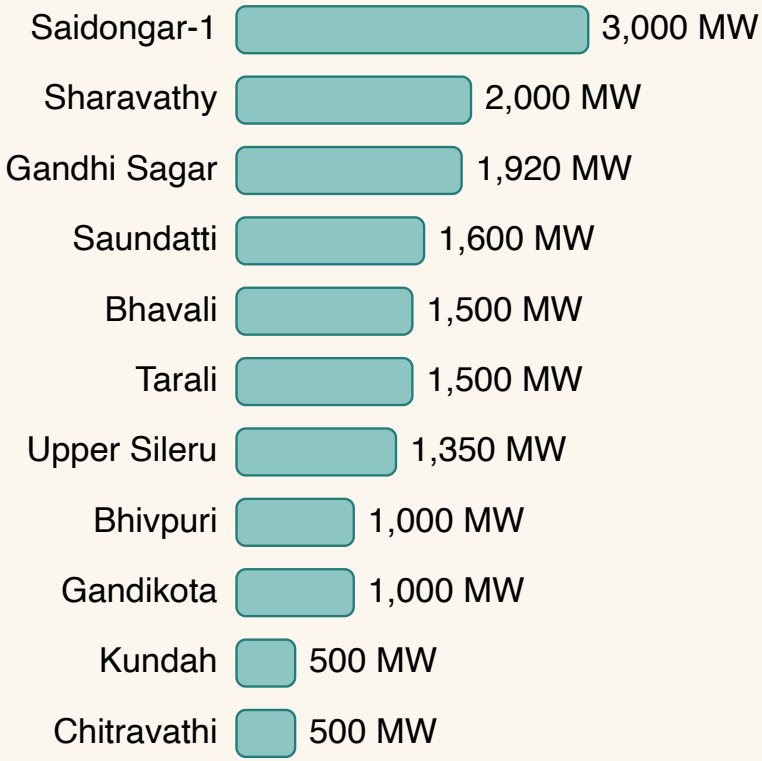
16. Which pumped-storage projects are under construction?

The PIB (20 Jul 2026) says **11 PSPs with 15,870 MW** are under construction. The dates are targets given by the Ministry.

- Upper Sileru, Andhra Pradesh: 1,350 MW, Feb 2029.
- Sharavathy, Karnataka: 2,000 MW, May 2032.
- Kundah, Tamil Nadu: 500 MW, Feb 2027.
- MP30 Gandhi Sagar, Madhya Pradesh: 1,920 MW, Dec 2026.
- Chitravathi, Andhra Pradesh: 500 MW, Feb 2027.
- Bhivpuri, Maharashtra: 1,000 MW, Feb 2029.

- Saundatti, Karnataka: 1,600 MW, Dec 2027.
- Bhavali, Maharashtra: 1,500 MW, Dec 2028.
- Gandikota, Andhra Pradesh: 1,000 MW, Mar 2029.
- Tarali, Maharashtra: 1,500 MW, Jun 2029.
- **Saidongar-1 Karjat, Maharashtra: 3,000 MW**, Dec 2029.

The PIB (23 Dec 2023) listed Koyna Left Bank, 80 MW, with work stalled. It is not in the 2026 list.



Targets run from Dec 2026 to May 2032.

Source: PIB Ministry of Power, 20 Jul 2026, item 16

Source: PIB Ministry of Power, 23 Dec 2023, item 16

17. Which projects are cleared but not yet under construction?

The PIB (20 Jul 2026) says **6 PSPs with 8,140 MW** are concurred or appraised by the CEA. They are yet to be taken up for construction.

- Chichlik, Uttar Pradesh: 1,560 MW, appraised on 8 Jul 2026 (PIB). The CEA sheet gives an authority meeting on 16 Jun 2026.
- Pane, Maharashtra: 1,500 MW.
- Shirawta, Maharashtra: 1,800 MW.
- Kandhaura, Uttar Pradesh: 1,680 MW, 13 Jun 2025.
- Upper Indravati, Odisha: 600 MW, 19 Aug 2024.
- Turga, West Bengal: 1,000 MW, concurred 5 Oct 2016.

The CEA file of 10 Jul 2026 also lists projects under survey and investigation. It shows **66 projects with 93,490 MW**. The same file counts 84 PSPs, 118,140 MW, outside operation (94 with the 10 operating plants).

Source: PIB Ministry of Power, 20 Jul 2026, item 17

Source: CEA, Status of PSP Development in India (PDF created 10 Jul 2026), item 17

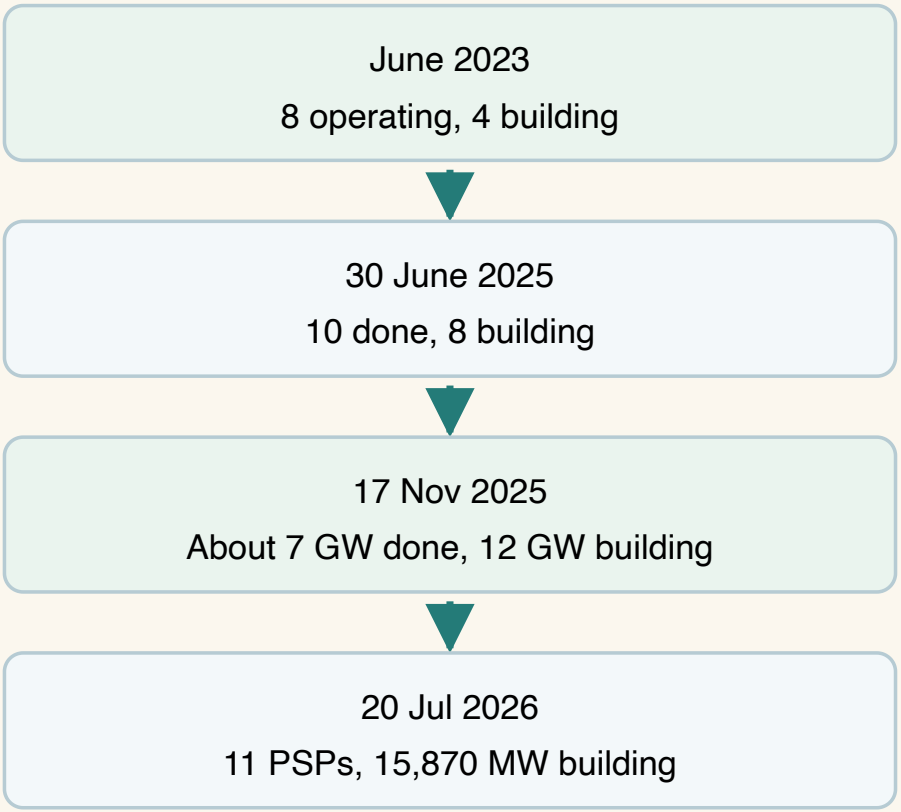
18. How has the pipeline grown over time?

These are dated snapshots from PIB. They count projects at different dates.

- June 2023: identified potential about 119 GW. 8 projects (4.7 GW) operating and 4 (2.8 GW) under construction.
- 30 Jun 2025: 10 PSPs (6.2 GW) commissioned and 8 (8.5 GW) under construction.

- 17 Nov 2025: about 7 GW commissioned and about 12 GW under construction.
- 20 Jul 2026: 11 PSPs (15,870 MW) under construction.

These are not a growth rate. The PIB counts and the CEA counts do not use the same cut-off dates.



Counts differ by date and source.

Source: PIB Ministry of Power, 8 Jun 2023, item 18

Source: PIB Ministry of Power, 28 Jul 2025, item 18

Source: PIB Ministry of Power, 17 Nov 2025, item 18

Source: PIB Ministry of Power, 20 Jul 2026, item 18

What is India's policy for pumped storage?

19. What did the 2019 and 2023 Government measures do?

In March 2019 the Government approved measures to promote hydropower. These declared **large hydro (over 25 MW) a renewable energy source**. They also set a Hydro Purchase Obligation and budgetary support for enabling infrastructure.

The Ministry of Power notified Guidelines to promote PSPs on **10 April 2023**. The PIB (28 Jul 2025) says they provide ways to allot sites. They also exempt PSPs from free power and Local Area Development Fund obligations. They rationalise environmental clearance and allow use of exhausted coal mines.

The budgetary support guidelines were notified on **28 September 2021**.

Source: PIB Ministry of New and Renewable Energy, 23 Dec 2023, item 19

Source: PIB Ministry of Power, 28 Jul 2025, item 19

20. What is the ISTS charge waiver for PSPs?

ISTS means Inter-State Transmission System. The PIB (20 Jul 2026) says CERC's notification of 26 June 2025 gives a **100% ISTS waiver**. It lasts 25 years from the commercial operation date. It applies where construction is awarded on or before **30 June 2028**. The PIB of 23 Dec 2023 described a part waiver in steps of 25%. The later notification is used here, as the PIB reports it.

An earlier order was dated 23 Nov 2021. The PIB (8 Dec 2022) says it covered PSPs and BESS commissioned up to 30 June 2025. The period was 25 years for PSPs and 12 years for BESS.

Order 2021	CERC 2025
PSPs and BESS	100% waiver
Up to 30 Jun 2025	25 years from COD
25 yrs PSP, 12 BESS	Award by 30 Jun 2028

COD means commercial operation date.

True or False: The PIB of July 2026 reports a 100% ISTS waiver for 25 years for PSPs awarded by 30 June 2028.
Source: PIB Ministry of Power, 20 Jul 2026, item 20

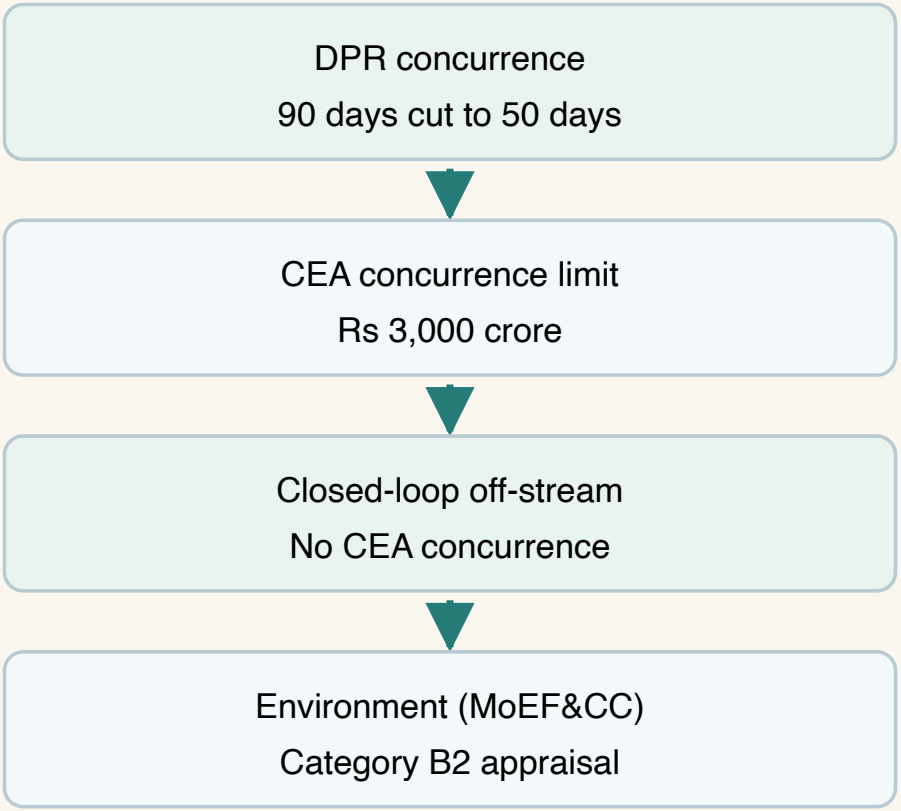
Source: PIB Ministry of Power, Energy Storage Technology, 8 Dec 2022, item 20

Source: PIB, 25% part waiver of ISTS charges, Dec 2023, item 20

21. How has approval of a PSP been made faster?

The PIB (20 Jul 2026) lists these steps.

- The CEA cut DPR concurrence time **from 90 days to 50 days** for all PSPs.
- Inter-State aspects need no clearance for PSPs.
- A Gazette notification of 1 Aug 2025 set the capital-expenditure limit for CEA concurrence of hydro generating station schemes at **Rs 3,000 crore**.
- Off-stream closed-loop schemes need no CEA concurrence, whatever their cost.
- MoEF&CC notified on 18 May 2023 that PSPs can be appraised in **category B2**, subject to certain conditions.
- Terms of reference of 14 Aug 2023 set baseline data for one season other than monsoon (closed-loop) or two seasons, pre-monsoon and post-monsoon (open-loop).
- MoP notified tariff-based competitive bidding guidelines for storage on 6 Feb 2025.



Inter-State aspects need no clearance.

Source: PIB Ministry of Power, 20 Jul 2026, item 21

22. Is there Viability Gap Funding, an obligation for storage, or a national plan for PSPs?

The PIB (23 Dec 2023) says there are **no plans to provide Viability Gap Funding** for PSPs. The PIB (23 Dec 2023) says their levelised cost of storage is viable. The Government also gives budgetary support for enabling infrastructure such as roads, ropeways and transmission lines.

The PIB (8 Dec 2022) says the Ministry of Power notified an Energy Storage Obligation trajectory up to 2029-30 on **22 July 2022**. The PIB (17 Nov 2025) says Renewable Consumption Obligations for energy storage systems have been notified. The yearly percentages were not found on an official page.

The PIB (9 Mar 2026) says the National Electricity Plan has transmission planned for 35.6 GW of PSPs up to 2031-32. It says transmission is identified for **100 GW of PSPs** from 2025-26 to 2035-36.

True or False: India gives Viability Gap Funding to pumped-storage projects.
Source: PIB Ministry of Power, 23 Dec 2023, item 22

Source: PIB Ministry of Power, 8 Dec 2022, item 22

Source: PIB Ministry of Power, 17 Nov 2025, item 22

Source: PIB Ministry of Power, 9 Mar 2026, item 22

Source: PIB Ministry of Power, 28 Jul 2025, item 22

What are the environmental and social costs?

23. How do the environmental effects of open-loop and closed-loop plants differ?

The Pacific Northwest National Laboratory (PNNL), for the US DOE (April 2020), concludes closed-loop effects are generally lower. They are more localised and shorter in duration. The reasons are that closed-loop plants sit off-stream and often have more siting flexibility.

Aquatic impacts are typically lower for closed-loop plants. They are not continuously connected to a flowing water body. Their main aquatic effect is the initial withdrawal of surface water to fill the reservoir.

But the report says closed-loop plants that use groundwater could have **higher impacts on geology, soils and groundwater**. All 43 US plants were open-loop then. So closed-loop effects were not well documented.

Closed-loop	Open-loop
Off-stream	Flowing water link
Lower aquatic impact	Always connected
Initial fill	More hurdles
Groundwater: a risk	All 43 US plants

Closed-loop effects were not well documented.

Source: PNNL for US DOE, A Comparison of the Environmental Effects of Open-Loop and Closed-Loop PSH, April 2020, item 23

24. What about water use and evaporation in India?

Reservoirs lose water to evaporation. The PIB (17 Nov 2025) says the Power Minister suggested **floating solar** on PSP reservoirs as a solution.

The same release says the Consultative Committee noted PSPs' relatively lower environmental impact. It also quotes the Minister on the role of State Governments in timely site allocation, water allocation and clearances. The MoEF&CC steps in item 21 cover baseline surveys for off-stream sites.

No page checked here gives figures on land take or displaced families for PSPs. So this lesson gives none.

Source: PIB Ministry of Power, 17 Nov 2025, item 24

Source: PIB Ministry of Power, 20 Jul 2026, item 24

What has the exam asked?

25. What did UPSC ask on pumped-storage hydropower in 2024?

The stem below is from the UPSC question paper, Civil Services (Preliminary) Examination 2024, General Studies Paper I, Set A, **Question 38**. The text was read from the scanned page.

"Recently, the term "pumped-storage hydropower" is actually and appropriately discussed in the context of which one of the following?"

- (a) Irrigation of terraced crop fields
- (b) Lift irrigation of cereal crops
- (c) Long duration energy storage
- (d) Rainwater harvesting system

Answer: (c), from the PIB line on long-duration energy storage and the DOE line on energy storage. Official key (Series A): (c).

Source: UPSC, CSP 2024 General Studies Paper I question paper, item 25

Source: US DOE, Pumped Storage Hydropower Technology Strategy Assessment, July 2023, item 25

Source: UPSC, official answer key CSP 2024 GS Paper I, item 25

26. Has UPSC asked about related energy topics in the same paper?

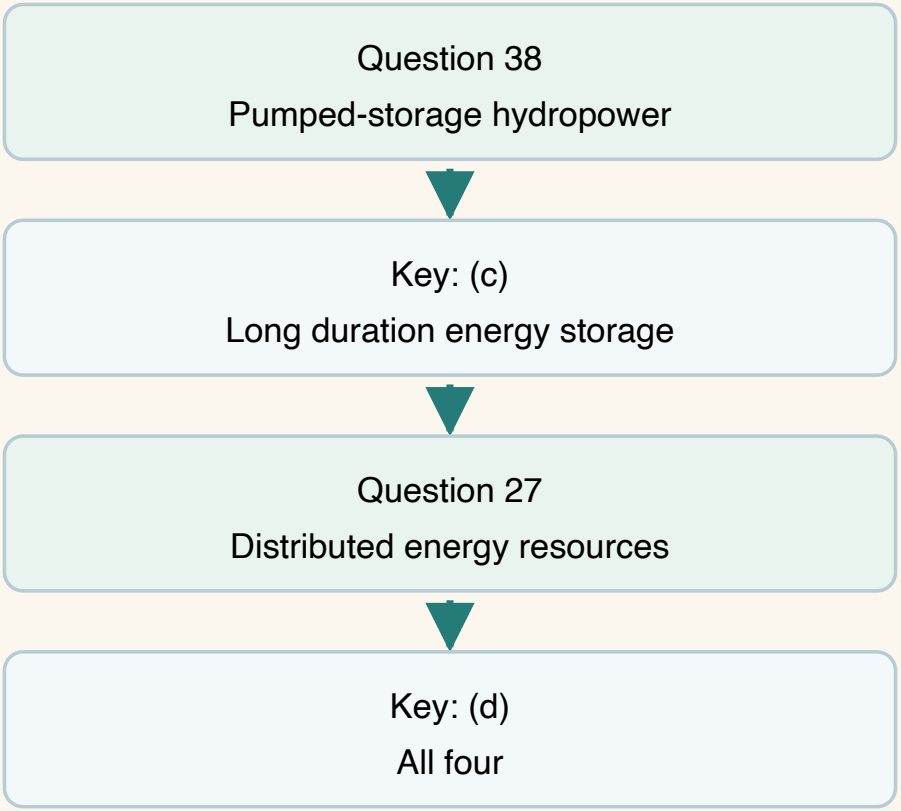
Yes. **Question 27** of the same paper (Set A) asked about distributed energy resources.

“Consider the following: 1. Battery storage 2. Biomass generators 3. Fuel cells 4. Rooftop solar photovoltaic units. How many of the above are considered “Distributed Energy Resources”?”

- (a) Only one
- (b) Only two
- (c) Only three
- (d) All four

Official key (Series A): (d) All four. Question 37 of the same paper asked about the exhaust of Fuel Cell Electric Vehicles. See the sibling lesson on FCEVs.

The 2025 and 2026 Prelims papers were not scanned for energy storage items.



Keys are from Series A.

Source: UPSC, CSP 2024 General Studies Paper I question paper, item 26

Four questions to think through

Why does a plant give back only about 80 units for every 100 units it uses?

About 20 of every 100 units are not returned. The DOE puts new plants at around 80%. So storage is a trade: you give up some energy to move it to a better hour.

Why do India's potential figures for PSPs differ so much between sources?

Each figure has its own source and date. The PIB gave about 119 GW in June 2023 and about 224 GW in November 2025. The CEA survey total was 310,104.6 MW in its file of 10 Jul 2026. The CEA total moved from 290,195.6 MW in May to 310,104.6 MW in July.

Why might a closed-loop plant still harm the environment?

A closed-loop plant is off-stream, so its aquatic impact is typically lower. But PNNL warns about groundwater. A plant that draws on groundwater could have higher impacts on geology, soils and groundwater. Closed-loop effects were also not well documented, because all 43 US plants were open-loop.

Why can the same plant show a different state or size in two official papers?

The papers have different dates and listings. The PIB of December 2023 put Srisailam LBPH and Nagarjuna Sagar in Andhra Pradesh. The 2026 CEA sheet lists them in Telangana. The PIB of December 2023 gave Pinnapuram as 1,200 MW. Later sources give 1,680 MW.

Check your understanding

Your 7 quick checks Answered 0 of · Correct
This score resets when the page reloads.

Continue to the 8 MCQs

✅ Test Yourself

Try 8 practice questions on pumped-storage hydropower.

Practice MCQs

1. In what context is the term pumped-storage hydropower appropriately and currently discussed?

A. Irrigation of terraced crop fields

B. Lift irrigation of cereal crops

C. Long duration energy storage

D. Rainwater harvesting systems

See answer ↓

2. Which feature separates a closed-loop pumped-storage plant from an open-loop one?

A. It is built with only one reservoir

B. It is not continuously connected to a naturally flowing body of water

C. It never needs water to fill its reservoirs

D. It is always built on an existing river dam

See answer ↓

3. The CEA status sheets of mid-2026 list India's operating pumped-storage projects above 25 MW. What do they show?

A. 6 projects with 8,140 MW

B. 11 projects with 15,870 MW

C. 8 projects with 4,845.60 MW

D. 10 projects with 7,425.60 MW

See answer ↓

4. According to the PIB report of 20 July 2026, what ISTS charge waiver applies to PSPs awarded by 30 June 2028?

A. Waiver in steps of 25% from July 2025

B. 50% waiver for 12 years

C. 100% waiver for 25 years from commercial operation

D. 100% waiver for 12 years

See answer ↓

5. Which statement about Viability Gap Funding (VGF) in India's storage policy is correct, as reported by the PIB?

A. VGF schemes support PSPs, but none exists for batteries

B. Both PSPs and batteries receive VGF

C. Neither PSPs nor batteries receive VGF

D. VGF schemes support battery storage; the PIB said in Dec 2023 there were no plans for PSPs

See answer ↓

6. What is the status of Kundah in Tamil Nadu, as per the PIB of July 2026 and the CEA?

A. An operating PSP of 400 MW

B. An off-stream closed-loop PSP commissioned in 2025

C. A 500 MW PSP under construction, targeted for Feb 2027

D. A cleared 1,000 MW PSP where work has not started

See answer ↓

7. According to the International Hydropower Association, how much pumped-storage capacity existed worldwide in 2024?

A. 189 GW

B. 600 GW

C. 160 GW

D. 1,075 GW

See answer ↓

8. Which of these is named by the PIB (July 2026) as a grid service from PSPs?

A. Coal blending

B. Net metering

C. Inertia

D. Black start

See answer ↓

Answer Key

1. **C.** The answer is long duration energy storage. The US DOE calls pumped-storage hydropower a proven energy storage technology. The Ministry of Power links PSPs to long-duration energy storage and balancing power. UPSC asked this in Question 38 of its 2024 General Studies Paper I, Set A. The UPSC key for Series A gives (c). ↑ Q1
2. **B.** A closed-loop plant is not continuously connected to a naturally flowing body of water. The DOE says open-loop plants are typically cheaper because only one reservoir is built. PNNL finds closed-loop effects are generally lower. Their main aquatic effect is an initial draw of surface water to fill the reservoirs. ↑ Q2
3. **D.** The CEA files of 8 May and 10 Jul 2026 show 10 operating PSPs with 7,425.60 MW. Eight on-stream plants account for 4,845.60 MW. The PIB figure of 15,870 MW is for 11 PSPs under construction in July 2026. The figure of 8,140 MW is for 6 concurred PSPs. ↑ Q3
4. **C.** The PIB of 20 Jul 2026 reports a 100% ISTS waiver for 25 years. It comes from a CERC notification of 26 June 2025. An earlier order of 23 Nov 2021 gave 25 years for PSPs and 12 years for BESS. The PIB of 23 Dec 2023 had described a part waiver in steps of 25%. The later notification is the one to use. ↑ Q4
5. **D.** The PIB of 9 Mar 2026 describes two VGF schemes for about 43.8 GWh of BESS. The PIB of 23 Dec 2023 says the levelised cost of storage of PSPs is viable. So there were no plans for VGF for PSPs. PSPs get budgetary support for enabling infrastructure such as roads, ropeways and transmission lines. ↑ Q5
6. **C.** Kundah Stages I, II and III total 500 MW and are under construction. The PIB gives the target as Feb 2027. The 400 MW operating plant in Tamil Nadu is Kadamparai. Pinnapuram is the off-stream closed-loop plant commissioned in 2025-26 (CEA unit dates June to October 2025). ↑ Q6
7. **A.** The IHA says global pumped storage reached 189 GW in 2024. It added 8.4 GW in 2024, and total capacity rose 5%. The figure of 600 GW is the pumped-storage share of the hydropower pipeline. The DOE gave about 160 GW for 2020, which is an older snapshot. ↑ Q7

8. **D.** Black start is one of the ancillary services the PIB of July 2026 names for PSPs. The same release names frequency regulation and voltage support. The PIB of September 2024 names inertia. ↑ Q8

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https://mcqquestion.com/articles/scitech0147-pumped-storage-hydropower/