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Pumped Storage Systems in Brazil

Why the time is now — and what needs to be done

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Brazil has the potential, the technology, and the legal framework.

What is lacking is the regulatory and economic framework to enable and unlock investments in Pumped Storage Systems (PSS).

The publication of CNPE Resolutions No. 7 and 8 in May 2026 represents a concrete step forward on the planning front, but four regulatory actions proposed here still require operationalisation.

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Strategic Context

With approximately 90% of its electricity matrix composed of renewable sources, Brazil has built, over decades, a robust, clean, and resilient system, strongly supported by the existing hydroelectric base.

This characteristic gives the country a significant comparative advantage in an international context marked by growing challenges of decarbonisation and energy security.

However, the accelerated expansion of variable renewable generation — especially distributed rooftop solar (micro and mini distributed generation), centralised solar, and wind — is structurally transforming the operation of the National Interconnected System (SIN).

This process has increased supply variability, raised the occurrence of spills and curtailment, and elevated the operational and commercial complexity of the sector. Recent studies estimate that losses associated with curtailment reached R$ 6 billion in 2025. [1]

In this context, a central challenge emerges: the absence of structural solutions to provide energy storage and operational flexibility at adequate scale, particularly to meet power ramps during peak hours.

Pumped Storage Systems, most widely known as reversible hydroelectric plants (RHP/PSH), represent a strategic response to this challenge. It is a mature, large-scale, long-life technology: over 50 years for electromechanical equipment and up to 100 years for civil works.

[1] VoltRobotics_AnáliseCurtailment_Balanço 2025_Janeiro 2026

Beyond short- and long-duration energy storage (from hours to days), PSS provide essential ancillary services to the system: frequency and voltage control, spinning reserve, inertia, reactive power control, and Black Start capability, in addition to operational flexibility and dispatchability.

Unlike other storage technologies, PSS do not depend on critical minerals or complex supply chains, and they benefit from a mature domestic industry with established suppliers, contractors, and project developers already active in Brazil.

Brazil's challenge is not one of natural resources or technical knowledge, it is one of creating the institutional, regulatory, and economic conditions that can allow this potential to be transformed into a reality.

Recent Regulatory Advances:

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CNPE Resolution No. 7

Directs the Energy Research Company (EPE) to carry out hydroelectric inventory studies focused on identifying projects with storage capacity, to structure a portfolio of priority projects for feasibility studies, and to coordinate with environmental agencies, the National Water Agency (ANA), and the Ministry of Indigenous Peoples.

CNPE Resolution No. 8

Establishes guidelines for contracting of PSS through auctions and other competitive mechanisms, providing for priority tendering for PSS projects, their inclusion in sector planning instruments, long-term contracts with revenue predictability, and remuneration linked to power availability and operational performance. Partially addresses Actions 3 and 4.

Remaining gaps: Although these resolutions represent high-level political momentum, they operate as guidelines. The sub-legal regulation of PSS regulatory identity and grid access rules (Action 1), support for the development phase (Action 2), operationalisation of long-term contracts (Action 3), and the proportionate licensing procedure (Action 4) remain as outstanding regulatory priorities.

The Four Central Challenges to Investment

The challenges to PSS development in Brazil are not technological, but institutional, regulatory, economic, and licensing-related.

1. Regulatory and Legal Uncertainty

Ambiguity persists regarding the legal nature of PSS: are they generation assets or system service providers? This lack of definition directly impacts the granting regime, grid access, tariffing, and market participation. Law No. 15,269/2025 formally recognised energy storage activity and assigned explicit powers to ANEEL, but the sub-legal regulation essential to enabling projects remains pending. The involvement of the Ministry of Mines and Energy (MME), as the Granting Authority, and the National System Operator (ONS), within their respective competences, is also indispensable for advancing the applicable rules.

2. Uncertainty Regarding the Conditions for PSS Project Development

The cost of developing a PSS is high and occurs entirely before any guarantee of return. There are no pre-tendering support mechanisms to allow interested parties or the current concessionaire to recover these costs if the project does not advance to auction. This gap discourages the initiation of feasibility studies, reduces the potential pipeline, and diminishes the chances of identifying sites and solutions of greatest systemic value.

3. Uncertainty in Contracting Conditions

PSS are capital-intensive, with construction periods of 5 to 10 years and lifespans exceeding 50 years. Short-term market energy arbitrage is insufficient to justify this investment profile. International experience demonstrates that long duration storage only becomes viable when supported by: (i) long-term capacity contracts (30 years or more); (ii) explicit remuneration for ancillary services and flexibility; and (iii) a multiple-revenue structure, with a capacity payment as the base, energy arbitrage as additional developer revenue, and revenue stacking from ancillary services and flexibility. None of these mechanisms is operational in Brazil for PSS, although CNPE Resolution No. 8 now provides the policy mandate for their development.

4. Risks of Environmental Licensing and Water Use Permitting

Brazil has extensive experience in conventional hydroelectric licensing, but PSS — particularly closed-loop systems — have characteristics of lower constructive and operational complexity. There are no specific terms of reference for these typologies, making licensing timelines unpredictable and inflating the risk premiums embedded in project capital costs. The integration between environmental licensing, water use permitting, and energy planning also remains incipient. Advances are warranted under the special environmental licensing regime provided for in Law 15,269/2020, which may be accompanied by objective criteria and procedures that reflect the low environmental impact of these solutions.

Four Priority Actions to Unlock Investment

The implementation of Law No. 15,269/2025 and the publication of CNPE Resolutions No. 7 and 8 open a window of opportunity that must be seized with urgency. The Brazilian hydroelectric sector awaits four coordinated actions:

ACTION 1

Define the Regulatory Identity of PSS

Regulate, at the sub-legal level, the typology, granting regime, and grid access conditions for PSS, distinguishing closed-loop systems (without continuous interference with natural water bodies) from open-loop systems.

This distinction is decisive for the applicable licensing procedure, the water use granting regime, and the rules for connection to the SIN. It is also necessary to eliminate double billing for grid use: Law 15,269/2025 created the autonomous figure of the energy storage operator, removing the obligation to classify PSS as a generator.

Notwithstanding the significant advances made in the first cycle of ANEEL Public Consultation 39/2023, sub-legal regulation must continue to develop so as to translate this legislative advance into clear and enforceable tariff rules.

Responsibilities:
ANEEL (lead, suggested timeframe of 6 months); ANA, IBAMA, MME and ONS for regulations within their competence.

Regulatory references:
CNPE Res. No. 8, Art. 5; closing deliberation of the first cycle of ANEEL Public Consultation No. 39/2023; and MME Ordinance No. 136 of 1 June 2026.

ACTION 2

Secure the Conditions for PSS Project Development

The preferred model is project-by-project competition: each agent develops and registers its own project in the auction, analogously to the LRCap mechanism, internalising study costs into the bid.

For this model to function, three conditions are essential: (i) a structured and predictable PSS auction pipeline, with clear signals on volumes and contracting timelines; (ii) a clear locational signal indicating priority regions based on SIN needs (EPE and ONS); and (iii) specification of the required storage duration, so that projects are dimensioned according to the real needs of the system.

EPE's strategic role is focused on formulating contracting guidelines, defining the locational signal, and providing technical validation (qualification) of registered projects. EPE may develop projects pursuant to the mandate of CNPE Res. No. 7, but without exclusivity.

Responsibilities:
EPE and ONS (locational signal, technical specifications); MME/CNPE (auction pipeline); ANEEL (qualification).

Regulatory references:
CNPE Res. No. 7, Arts. 3 and 5; CNPE Res. No. 8, Arts. 4 and 6.

Four Priority Actions continued...

ACTION 3

Operationalise Long-Term Capacity Contracts

The non-negotiable pillar is a capacity and flexibility contract with a minimum term of 30 years, remunerating available MW regardless of dispatch.

Law No. 15,269/2025 and CNPE Res. No. 8 already provide for capacity reservation in the modalities of power and flexibility. Complementarily, the admissibility of energy arbitrage and the valuation of Ancillary Services in contracting mechanisms — including through competitiveness criteria or bonuses (locational/functional scoring) in auctions — must be progressively incorporated.

This anticipates the differentiated value of PSS without requiring prior formal valuation by ONS and ANEEL.

Responsibilities:
ANEEL (contractual structure, rules for closed and open cycle); MME/CNPE (auction calendar); EPE and ONS (ancillary service requirements, storage duration).

References:
CNPE Res. No. 8, Art. 6 §1; Law No. 15,269/2025.

International references:
MACSE (Italy), cap-and-floor (UK), two-part capacity tariff (China).

ACTION 4

Create an Environmental Licensing and Water Use Permitting Procedure Proportionate to Impact

Establish specific procedures for PSS in environmental licensing and water use permitting, differentiated by project typology. Closed-loop systems and projects adding reversible units to existing hydroelectric plants must have a simplified procedure, proportionate to their actual environmental and hydrological impact.

For PSS associated with already-licensed hydroelectric assets: the installation of reversible systems in existing plants must not be characterised as a reopening of the original environmental licence.

It must be treated as an addition or operational improvement, restricted to areas directly affected by the new intervention, and must not imply a revision of previously fulfilled conditions or a reassessment of already-licensed impacts.

This principle is essential for the legal certainty of projects and to unlock the near-term retrofit pipeline, one of the highest-potential categories in Brazil.

Integrate the following agencies:
ANEEL, MME, EPE, ONS, ANA, IBAMA, and other competent environmental authorities.

Conclusion: The Opportunity is Now

Pumped Storage Systems offer a unique combination of attributes: longevity, scale, dispatchability, and the ability to provide multiple services to the electricity system.

A useful life three to four times longer than other mature storage technologies, without dependence on complex supply chains, positions PSS as a long-term pillar of Brazilian energy security. Brazil has the natural resources, technical knowledge, industrial base, and — since 2025 — the legal framework. With CNPE Resolutions No. 7 and 8, the political signal has been given at the highest level of energy governance. What is required now is coordinated regulatory action, with defined deadlines and clear responsibilities among MME, ANEEL, EPE, ONS, ANA, CCEE, and environmental agencies.

The cost of inaction is concrete and growing: each year without hydraulic storage means more renewable curtailment, greater reliance on peak thermal generation, and operational vulnerability for the SIN. The opportunity cost of not acting is high and increases with every cycle of renewable expansion that is not matched by corresponding advances in flexibility and storage.

The time to act is now.

Key References:

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