Pumped Storage Hydropower Projects in Vietnam Opportunities and Challenges

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Overview

Pumped storage hydropower is widely recognized as an efficient and long-term electricity storage solution to balance power systems. It stores energy by using surplus electricity or electricity generated during off-peak periods to pump water to an upper reservoir (energy storage phase) and then releasing water from the upper reservoir to a lower reservoir to drive turbines and generate electricity (energy generation phase).

The water is then pumped back to the upper reservoir, and this closed-loop cycle is repeated. The process both generates and stores electricity. The electricity generated is supplied to the grid during peak demand periods or when there is a shortage of power. Due to its primary function to store electricity, pumped storage hydropower is also referred to as a "water battery."

In addition to energy storage, pumped storage projects can serve other purposes, including:

- stormwater regulation (acting as reservoirs during flooding, particularly in underground systems);
- wastewater storage and treatment;
- water storage for domestic or industrial use; and
- repurposing depleted oil wells or mines as reservoirs for water storage and electricity generation.

Given these advantages, pumped storage hydropower is increasingly being adopted. It has become an integral part of national energy development strategies, particularly for energy storage. Its development is governed by various legal instruments, including the Law on Electricity, Law on Investment, Law on Land, Law on Geology and Minerals, Law on Natural Resources Tax, Law on Environmental Protection, and Law on Planning. This article discusses the policies and legal framework for developing pumped storage hydropower in Vietnam.

Drivers for the Development of Pumped Storage Hydropower

Several factors support the development of Vietnam's pumped storage projects.

First, Vietnam's geographical and topographical conditions are favorable for such projects. That is, high mountainous terrain, abundant natural water resources, sea water and a long coastline.

Second, Vietnam's economic development and power market are divided into three main regions: North, Central, and South. The North relies heavily on hydropower and often faces electricity shortages during the dry season when reservoirs are depleted, while experiencing surplus electricity during the rainy season. Meanwhile, the Central and Southern regions frequently experience excess electricity from solar and wind power during off-peak hours (typically in the morning), but face shortages during peak hours in the evening when solar generation is unavailable.

Third, technological advancements are reducing development costs and enabling investors to integrate floating solar systems on reservoirs to lower input costs.

In addition to energy storage, certain projects also have positive environmental and social impacts. For example, underground pumped storage projects can create subterranean reservoirs for flood control. Similarly, underground projects combined with offshore wind power and production of green hydrogen offer advantages that may attract green financing and facilitate project approvals.

Vietnam's General Policy on Pumped Storage Hydropower

General policies governing pumped storage hydropower are set out in the Law on Electricity and Decision No. 768 dated April 15, 2025, issued by the Prime Minister ("Decision 768").

Under this framework, Vietnam plans to develop 22 pumped storage projects between 2025 and 2035. The total installed capacity is expected to reach 6,000 MW by 2030 and 21,000 MW by 2050. Bac Ai (in Ninh Thuan Provice) is the first pumped storage project (with capacity of 1,200 MW). It is in the construction stage, and it is classified as an important energy project under Decision 768. The project is expected to be completed in 2030 or 2031.

Electricity Supply Sources

Pumped storage projects function both as electricity producers and consumers (consuming electricity to pump water). The electricity supply for pumping is flexible.

Projects may purchase electricity from EVN, whose tariff structure is time-based (off-peak and peak pricing). This allows pumped storage operators to buy electricity at lower prices during off-peak hours and sell it at higher prices during peak hours. The speed of capital recovery depends largely on this price differential.

Additionally, current regulations allow pumped storage projects to purchase electricity directly from private renewable energy projects through direct power purchase agreements (DPPAs). Prices under such agreements are negotiated between parties but are subject to a ceiling price set annually by the Ministry of Industry and Trade.

Investors may also develop their own renewable energy sources under the "self-generation, self-consumption" model. Regardless of the chosen supply source, investors can estimate input electricity costs and determine the minimum revenue required to recover investment within the expected timeframe.

Conventional vs. Underground Pumped Storage

Vietnam's mountainous terrain and abundant natural water resources are well suited for conventional pumped storage projects. However, these projects may have negative environmental and social impacts, such as deforestation, large land use requirements, displacement of local communities, and potential ecological disruption due to dam construction. These problems will need to be addressed.

Underground pumped storage projects can significantly mitigate these impacts, as reservoirs are constructed below ground. Modern drilling technology allows depths of 700–800 meters. Due to the high elevation difference, underground reservoirs do not require large volumes or extensive land surface. Moreover, underground projects can be developed in flat or coastal areas where renewable energy sources (such as wind power) are available, and seawater can be used instead of the need to dam rivers.

Conditions to Develop Pumped Hydro Storage Projects

In addition to other requirements (such as capital and investor selection through bidding), pumped storage projects must be included on the national master plan and appear on the approved project list. Approved projects are listed in Appendix 9 of Decision 768.

Power Purchase Agreements (PPA)

Under Circular 58, EVN (as the buyer) and pumped storage plants (as sellers) must enter into PPAs based on standard terms and conditions set out in the regulations.

Key provisions include 20 articles covering: definitions, contract term, provision of services, obligations, grid connection, dispatch, billing, termination, compensation, dispute resolution, confidentiality, governing law, and others.

However, given the large capital investment and long project lifespan, these provisions may not fully protect investors. Key concerns include exchange rate risks (as revenues are in VND while loans are often in foreign currencies), changes in law, termination compensation, tariff adjustment mechanisms, payment guarantees, and dispute resolution.

Foreign Ownership Limits

Current laws impose foreign ownership restrictions only on offshore wind and nuclear power projects. There are no such restrictions on pumped storage hydropower.

However, projects located in coastal, island, border, or sensitive national security areas require additional approvals from various authorities (eg, Ministry of National Defense, Ministry of Public Security, Ministry of Foreign Affairs).

Offtake Obligations

Vietnamese law requires EVN to offtake electricity from certain energy sources (eg, wind, solar, waste-to-energy, biomass, LNG). However, there is no mandatory offtake obligation for pumped storage projects.

Instead, pumped storage operators must compensate EVN if they fail to supply committed electricity, ensuring system stability and reliability.

Key Licenses and Approvals

Both investors and project companies must obtain various licenses and approvals before construction and operation:

Pre-construction phase:

- Inclusion in the national master plan
- Investment registration certificate
- Enterprise registration certificate
- Approval of pre-feasibility study (for major or PPP projects)
- Approval of technical-economic study
- Construction permit
- Environmental impact assessment approval
- Environmental license
- Fire safety approval

Post-construction phase:

- Construction completion approval
- Fire safety certificate
- Water use license (surface/groundwater)
- Electricity generation license
- Reservoir operation approval
- Resource extraction license (if applicable)

Financial Obligations

Subject to the nature of each project, applicable taxes and fees may include:

- Water resource tax
- Royalty to explore minerals
- Forest environmental service fee
- Environmental protection fee

- Land/water surface rental fees
- Natural resource tax (if applicable)
- VAT
- Export tax (if exporting extracted resources)

Investment Incentives

Pumped storage projects are classified as encouraged investments and are eligible for incentives such as:

- **Corporate income tax:** Preferential rate of 10%, with up to 4 years of tax holidays and 9 years with a reduction of 50%.
- **Import duty exemption:** For imported equipment not available domestically.
- **Land/water rent exemptions or reductions.**

Conclusion

Pumped storage hydropower is a relatively new sector in Vietnam. To attract both domestic and foreign investment and to achieve the targets set in Decision 768, more transparent and robust incentive policies are needed.

For example, licensing procedures should be streamlined; exchange rate compensation mechanisms should be clearly defined in PPAs; the current tariff cap (VND 3,457/kWh) should be removed or increased to reflect high investment costs and rising input electricity prices; and the current maximum IRR (internal rate of return) of 12% should be raised to enhance project attractiveness. In return, Vietnam would benefit from a stable, long-term electricity storage solution that enhances grid stability and ensures sustainable energy security.