

14. System-based PSH selection and engineering design



Technology brief - *Not a new technology, but a new methodology using existing and extended models to support PSH planning and implementation.*

- An **iterative process** comprised of a **top-down** analysis that evaluates the needs of a power system for energy storage, flexibility and ancillary services, using an Integrated Resource Planning model
- And a **bottom-up** analysis that screens for individual projects with geoprocessing and optimization algorithms, engineering design, cost estimates, and assessment of socio-environmental impacts.
- **R&D project** under development between PSR and the Brazilian subsidiaries of EDF, CTG and Brookfield and the power utility of Rio de Janeiro, supported by the power regulatory authority (ANEEL).

Costs & economics

- **Competitive PSH projects** and other technologies (hydropower, solar PV, wind power, biomass, cogeneration, nuclear, natural gas, etc.) are considered by an IRP model to minimize investment and O&M costs to affordably and to reliably supply system requirements (OPTGEN model)
- PSH projects tend to support the **increase in the amount of variable renewable sources** and may **displace gas-fired plants** to firm up system capacity to supply peak demand and to provide operating reserves.

Challenges and Opportunities

- **Top-down** analysis requires **preparing general candidates** from different technologies, including a detailed modelling of their actual operation, constraints, and investment costs.
- The **bottom-up** step requires original PSH project identification and engineering for many candidates; there are no PSH inventories, unlike conventional hydropower.
- There is a need for coarse level **socio-environmental screening tools for Early-Stage Planning**.
- The **bottom-up** step can take advantage of **computational tool HERA*** that plans hydropower cascades to maximize economic value while minimizing socioeconomic impacts.

* <https://www.psr-inc.com/software-en/hera>

Potential Beneficiaries and Use Cases

- Integrated methodologies of this type are essential for **Early Stage planning** and evaluation.
- A specialized module for PSH screening and modelling is now being added to HERA as part of the R&D project.
- The level of detail is equivalent to **pre-feasibility planning studies** executed by **project developers** and **energy planning agencies**.