Capabilities, Costs & Innovation

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/softwares-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***.