

INTEGRATION OF LOCAL RENEWABLE ENERGY PRODUCTION WITH ENERGY STORAGE SYSTEMS FOR SUPPLYING ELECTRICITY TO INDUSTRIAL CONSUMERS

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PUMPED HYDRO STORAGE

ADVANTAGES:

- Large-scale storage
- Wind and PV generation
- Long lifespan
- Efficiency
- Flexibility
- Stability

DRAWBACKS:

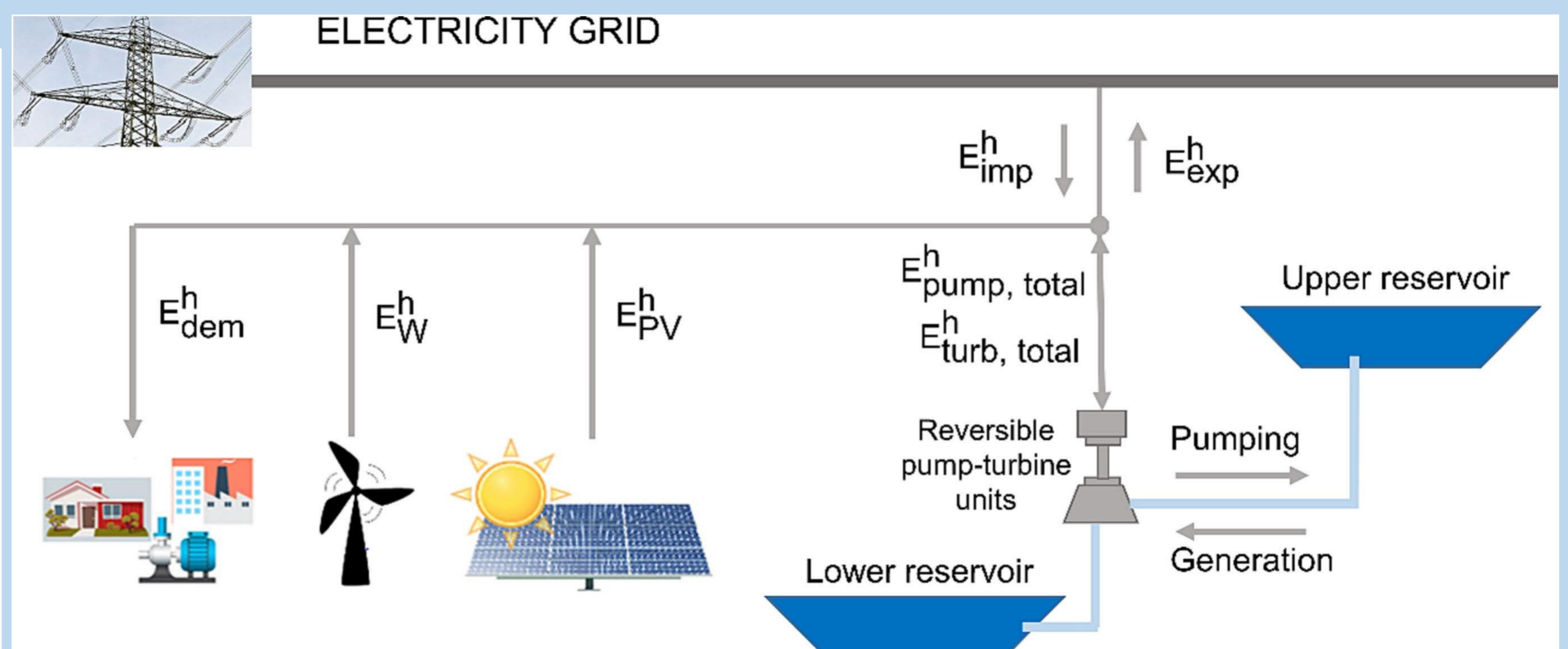
- High investment costs
- Construction time
- Environmental impact
- Specific orographic conditions



CLOSED-LOOP PHS

MATHEMATICAL MODEL

- Characterization of the operation of PHS – variable speed reversible units
- Optimal hourly scheduling model for closed-loop reversible PHS plants
- Maximize operating profit in liberalized electricity market environments
- Hybridization with renewable wind and solar photovoltaic generation
- Start-up costs of reversible units
- Economic feasibility
- Mixed-integer programming

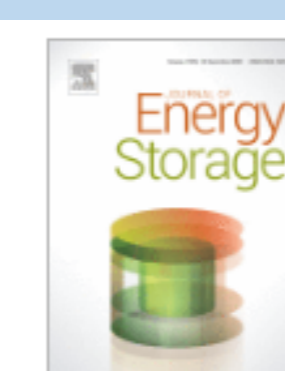


RESEARCH AREAS

- ✓ Techno-economic optimal operation of energy systems
- ✓ Techno-economic analysis of hydrogen electrolysis systems
- ✓ Energy markets
- ✓ Water-Energy integrated management



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Research Papers

Optimal scheduling and management of pumped hydro storage integrated with grid-connected renewable power plants

Natalia Naval ^a, Jose M. Yusta ^a, Raul Sánchez ^b, Fernando Sebastián ^b

RESULTS

Renewable Energy
Volume 246, 15 June 2025, 122939



An optimal dispatch model of renewable generation and pumped hydro energy storage for green hydrogen production

Lizbeth Tipán-Salazar, Natalia Naval ^a, Jose M. Yusta

