

## DOCKETED

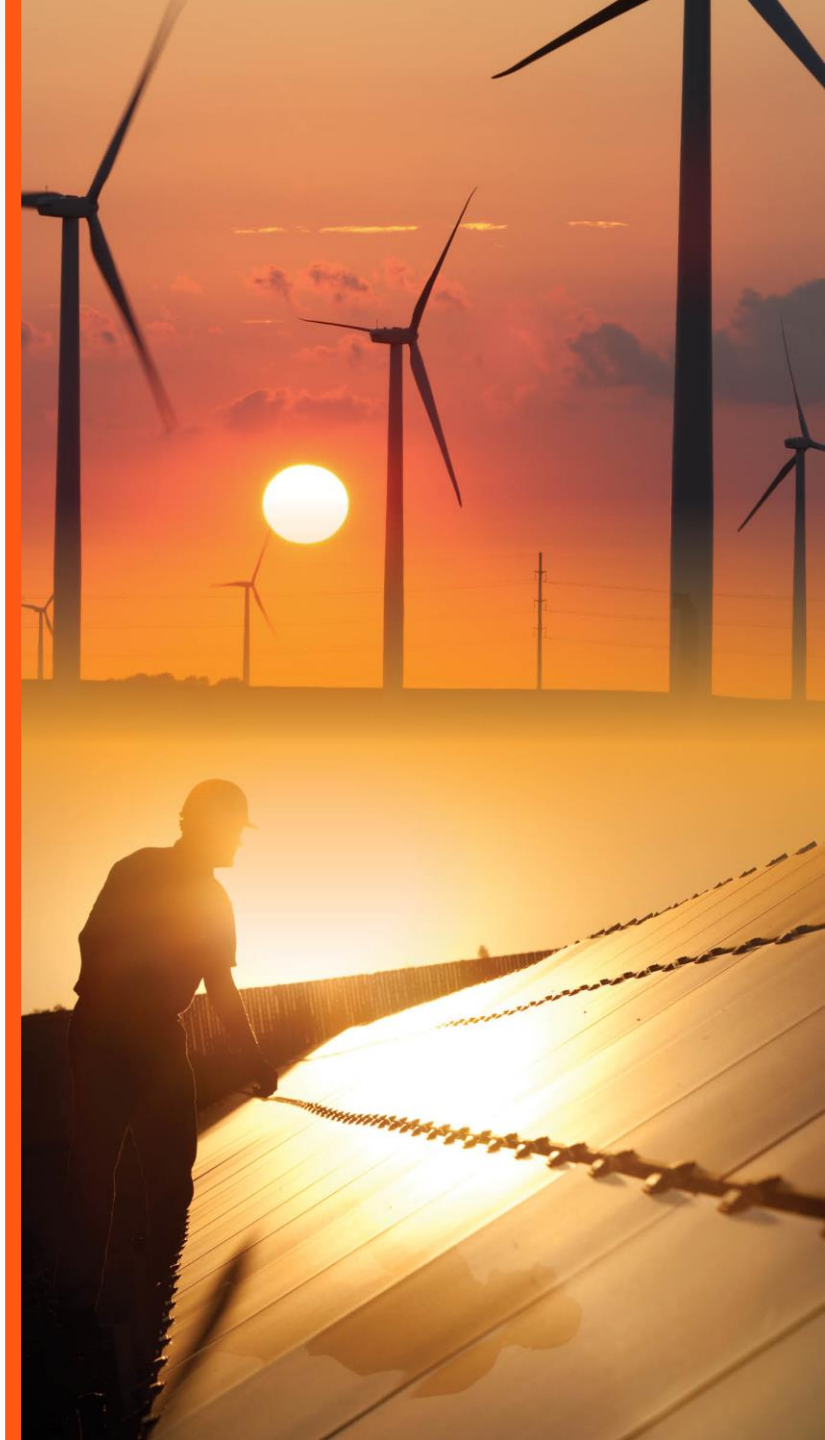
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# **PATHWAY TO DELIVERING NEW PUMPED STORAGE TO CALIFORNIA**

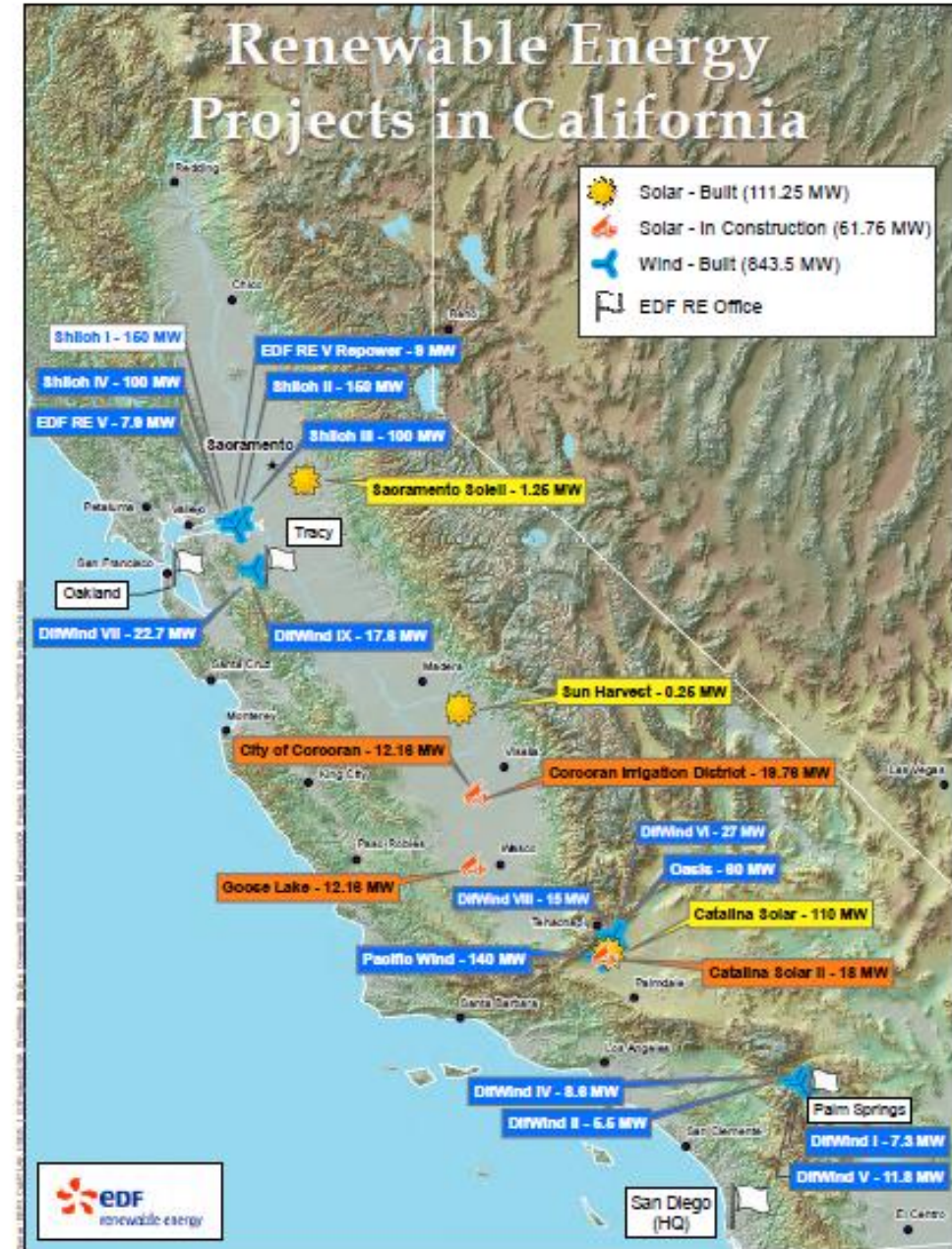
***CPUC/CEC Bulk Storage Hearing  
November 20, 2015  
Sacramento***

Swan Lake North



# EDF in California

- Leading North American developer and operator of renewable projects
- Born in California and headquartered in San Diego, with offices in Palm Springs, Oakland, and Tracy
- 396 employees in California plus many vendors and contractors
- Over 1,000 MW of wind and solar developed in California
  - San Joaquin Delta wind
  - Central Valley solar
  - Tehachapi wind and solar
  - San Geronio solar





# EDF Group Pumped Storage Hydropower Experience

- ✿ Developed 23,000MW of pumped storage hydro projects globally
- ✿ 1,000 employees at our Hydropower Center for Excellence
  - Over 600 engineers devoted to hydro development specialties and operations
  - Headquartered in Chambéry, France
- ✿ Developed and constructed 2 "sister" projects in the last 5 years (Morocco and Israel) with the same engineering characteristics as the proposed Swan Lake North project here in the WECC
- ✿ Experience with most up-to-date technology
  - Including variable-speed turbines
  - Optimal conveyance systems
  - Currently, retrofitting older fixed speed units in France with new variable-speed turbines
- ✿ Developing one of the most advanced pumped storage hydro projects in the USA as Swan Lake North



**SWAN LAKE NORTH**  
pumped storage hydro 

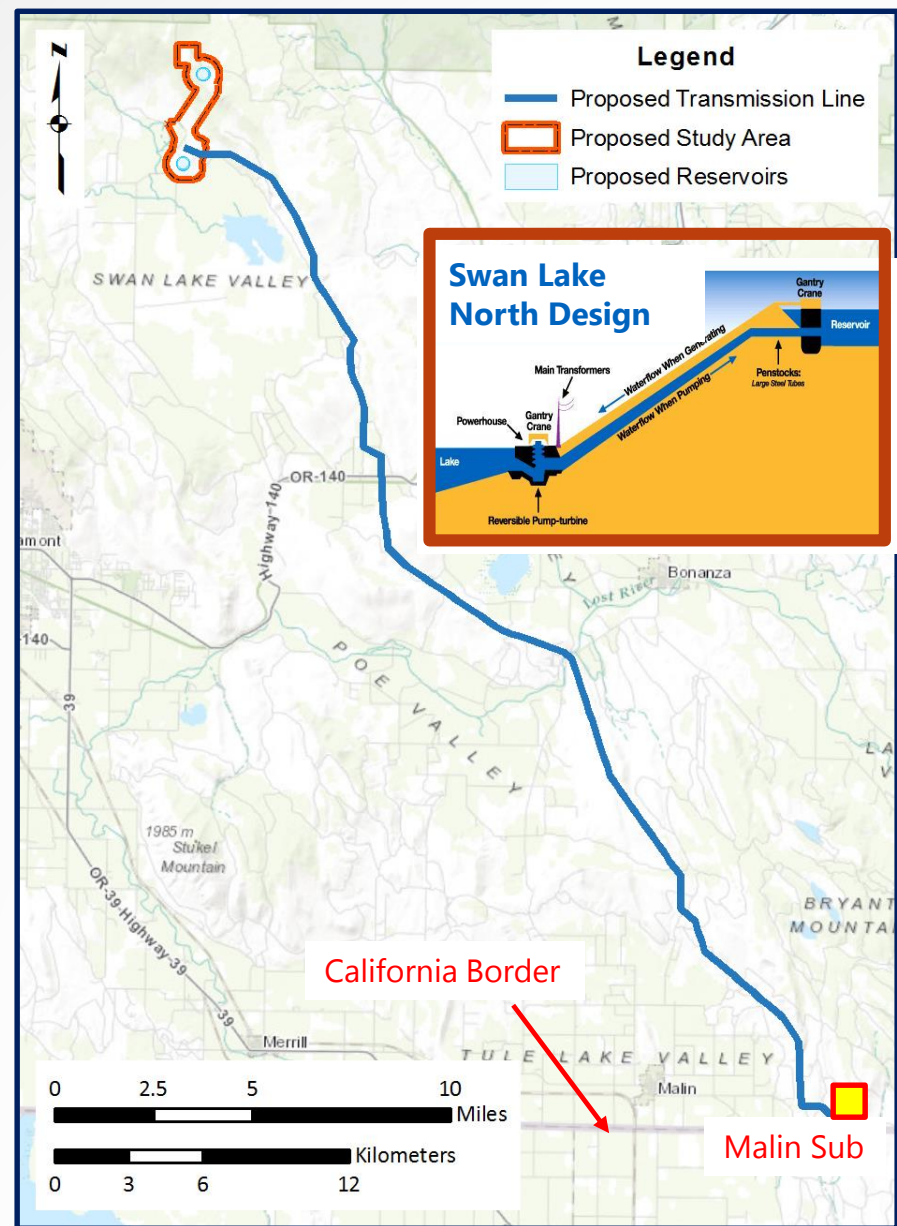


# SWAN LAKE NORTH

pumped storage hydro

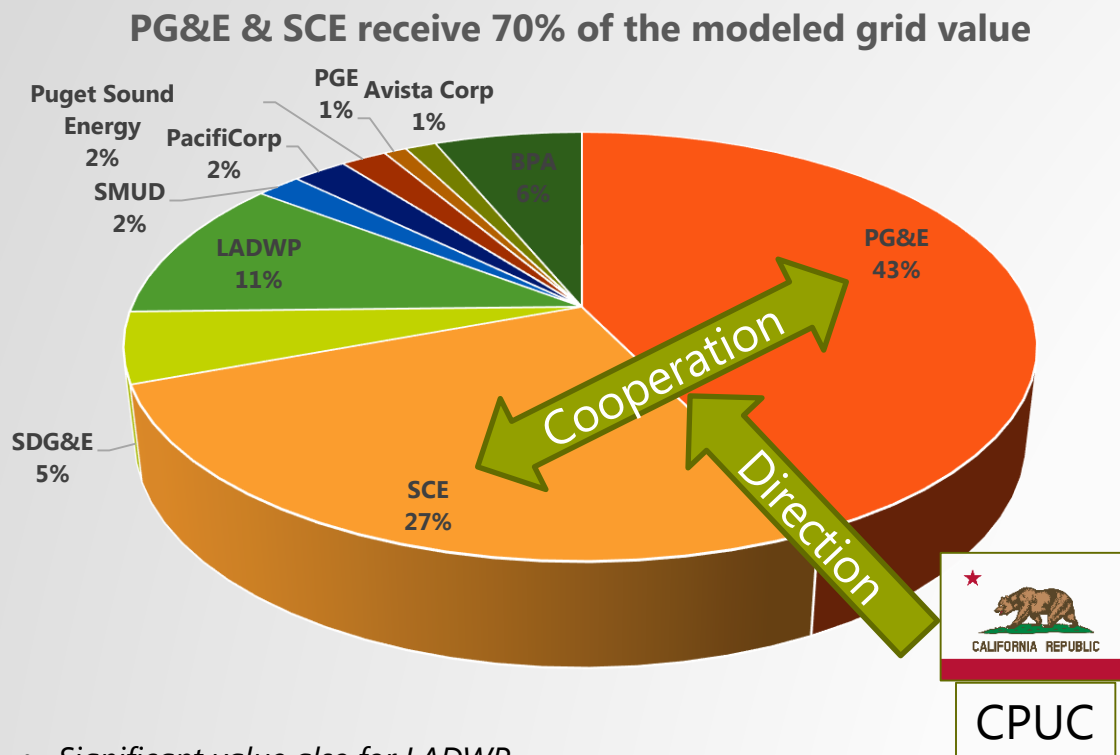
## project characteristics

LOCATION	Approx 11 miles NE of Klamath Falls
CAPACITY	393.3 megawatts (MW) Generation Mode 415.8 MW Pumping Mode
PROJECT HEAD	1,680 feet
PROPERTY	Private & BLM
WATER AVAILABILITY	Leased groundwater rights, preliminary OWRD approval
TRANSMISSION ACCESS	At Malin Substation; near COB market; PacifiCorp or BPA with access to CAISO
CLOSED-LOOP SYSTEM	New upper and lower reservoirs No impact to existing water ways Initial fill and evaporation makeup from existing ground water wells
FACILITY DESIGN	Above ground powerhouse and penstock



# Value for many, procurement by \_\_\_\_\_?

**Any LSE not involved  
in procurement  
is a potential Free Rider.**



- Significant value also for LADWP
- Top 3 benefactors receive 81% of the value for Swan Lake North.
- This is a project for California.

## **Key assumptions of economic modeling using PLEXOS**

- Pie chart represents both LSE specific intrinsic and extrinsic benefits
- Production cost modeling software for year 2022 (first year of operations after COD)
- Same planning dispatch model used by CAISO and major LSEs
- Includes linear track to the 50% CA-RPS as per SB350 (~36.4% installed in 2022)
- Includes 1,325 MW of mandated CA storage

**Installed cost of \$1,775/kW**

**PSH economics cannot support large Free Riders.  
Joint cooperation and procurement is necessary  
with direction by CPUC.**

# Procurement Pathways for Bulk Storage

- ✿ LTPP analysis of primary bulk storage technologies as part of low-carbon, high-reliability, low-rate portfolio (i.e., as a part of “the other 50%”)
  - Role for longer-duration storage?
  - Acknowledgement and quantification of multiple reliability and system attributes in making determination for authorization – i.e., do not wait for individual markets for each attribute to materialize given high complexity
  - Valuation of GHG value relative to other flexible resources
- ✿ If deemed prudent, then authorization from CPUC to IOUs to procure based on proportional benefits
  - Joint investment and joint operation
- ✿ Competitive procurement based on price, net of GHGs, and viability
  - Viability controls important for long lead-time projects
  - Viability in light of technology maturity, project-specific risk, and developer-related risk





# SWAN LAKE NORTH

pumped storage hydro 

[www.SwanLakeNorth.com](http://www.SwanLakeNorth.com)

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