Environmentally Sustainable Energy Storage

Enercon Engineering Group (Team E3)

UCI Samueli School of Engineering | Department of Civil and Environmental Engineering

Enercon Engineering Group

Winter Design Review 2018

General Team Information

Team Members	Mark Doss (Project Manager), Pooyan Farshidfard, Elizabeth Njuguna, Pauline Nguyen, Tuong Nguyen, Aiqian Shen
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Preliminary Design Results

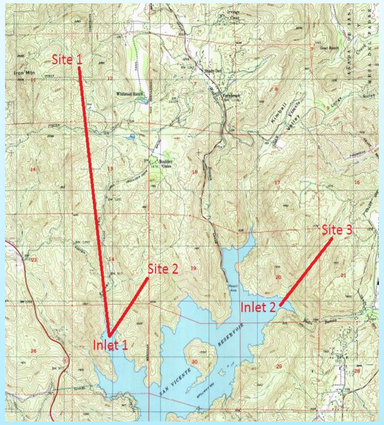
Red Color in the table indicates the least qualified candidate site because it does not contain sufficient volume to accommodate the reservoir. Green Color refers to the most ideal pipe size and acceptable head loss. Yellow Color represents an alternative site that is also qualified, but not the best in terms of pipe size.

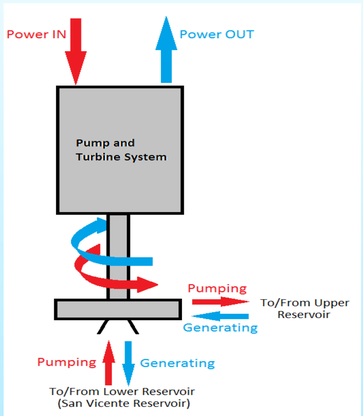
Calculations are based on a maximum penstock velocity of 30 cfs (Mays, L. W., section 8.21).

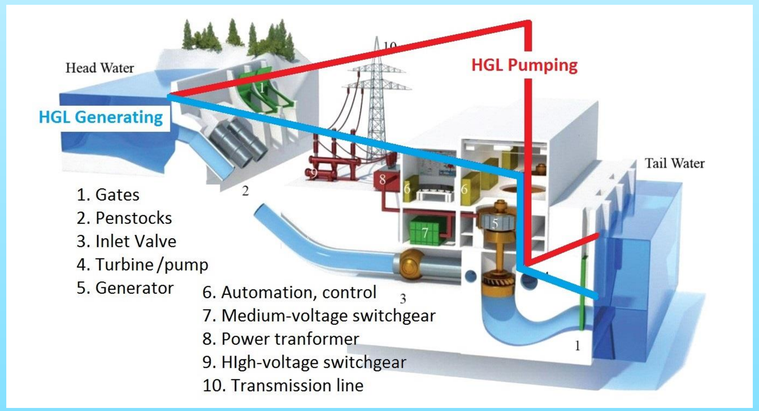
							v = 20 ft/s		v = 25 ft/s		v= 30 ft/s	
	Elevation (ft)	ΔH (ft)	Conduit Length (ft)	Q (gpm)	V required (acre ft)	V actual (acre ft)	D pipe (ft)	Head Loss (ft)	D pipe (ft)	Head Loss (ft)	D pipe (ft)	Head Loss (ft)
Site 1	1400	636	3333	6.62E+06	9758	6506	-	-	-	-	-	-
Site 2	1600	836	7083	5.04E+06	7416	9629	321	12.8	287	21.9	262	34.2
Site 3	2000	1236	17750	3.41E+06	5028	11957	264	40.1	236	69	215	107.6

Project Description

The objective is to generate 500 MW of power for 8 hour periods. This would be enough to supply 325,000 homes annually in the San Diego area. A new upper reservoir will be constructed above the existing San Vicente Reservoir and connected by an underground pipe containing a reversible pump-turbine system. Energy produced by the system will be stored during off-peak hours and sold during peak hours.







Design Constraints and Parameters

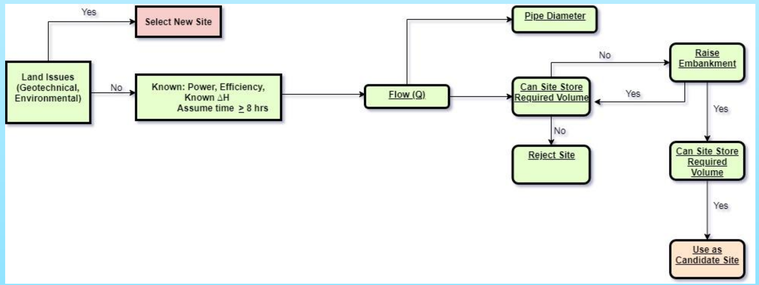
Design Parameters	Pipe diameter, pipe length, upper reservoir volume, head loss, elevation difference
Design Constraints	Biological preservation constraints, environmental constraints

Cost Estimation

Category	Category Total
Embankment and Upper Reservoir	$280,000,000
Pressure Tunnel	$120,000,000
Powerhouse Structure	$40,000,000
Pump/ Turbine Motor/ Generator	$300,000,000
Access Tunnel	$30,000,000
Tailrace Tunnel	$40,000,000
Inlet/Outlet Lower Reservoir	$40,000,000
Electrical Transmission	$20,000,000
Roads and Site Work	$20,000,000
Contingency (10%)	$89,000,000
Construction Total Cost	$979,000,000
Engineering	$146,850,000
Total Project Cost	**$1,125,850,000**

Design Approach

As shown in the flow chart below, the first main step of the design is to select various candidate sites that would be capable of providing 500 MW of energy for 8 hours to the surrounding area of San Diego County.



Plan for Next Phase

Tasks Completed	Project research and analysis Determination of criteria for upper reservoir Selection of candidate sites using topography Calculation of upper reservoir volume
Tasks to be Completed Next	Cost analysis for upper reservoir selection Selection of upper reservoir Design upper reservoir, tunnel, and pipe