

FEASIBILITY STUDY SCOPE

Archimedes Screw Seawater Pumped-Hydro Program — Terms of Reference for a staged feasibility study

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DRAFT — FOR DISCUSSION

1. PURPOSE

This document defines the study the concept brief calls for. It scopes a staged, gated feasibility program to determine whether seawater-fed pumped-hydro storage with saline-lake restoration and point-of-use desalination is technically feasible, economically viable, environmentally permissible, and financeable in the Great Basin. Each phase ends in a formal go/no-go gate; later phases are funded only if earlier gates pass.

2. STUDY PHASING

Phase	Duration	Budget (order-of-magnitude)	Estimate accuracy	Gate decision
Phase 0 — Desktop pre-feasibility & fatal-flaw screen	3–4 months	\$1–3M	AACE Class 4 (±30–50%)	Any fatal flaw? Ranked alternatives; proceed to field work?
Phase 1 — Targeted pre-feasibility (first sites + conveyance)	6–9 months	\$5–12M	AACE Class 3 (±10–30%)	First phase technically viable? Proceed to bankable study?
Phase 2 — Bankable feasibility (first construction phase)	12–18 months	\$25–60M	AACE Class 2 (±5–15%)	Ready for final investment decision?

Note: Phase 0 screens the full program; Phases 1–2 go to bankable depth on the first construction phase only (intake + conveyance + first 1–2 storage sites + first lake deliveries). Later sites repeat a lighter Phase 1/2 cycle reusing program-level work.

3. BUDGET GROUNDING

Single-site pumped-hydro feasibility studies provide the anchor points. The Cultana seawater pumped-hydro study in South Australia (225 MW / 1,770 MWh) cost \$1.1 million in total, led by EnergyAustralia with Arup and the Melbourne Energy Institute (ARENA grant \$453K)^[1]. The Shoalhaven expansion full feasibility (235 MW underground power station) cost \$6.8 million (ARENA \$2M)^[2]. ARENA committed \$4 million toward the Kidston 330 MW feasibility^[3]. This program is an order of magnitude larger in scope — program-level conveyance plus multiple sites plus desalination plus lake restoration — hence the higher ranges above.

CAUTIONARY LESSON: FRONT-LOAD GEOTECHNICAL INVESTIGATION

Australia's Snowy 2.0 (2 GW / 350 GWh) was found technically and financially feasible in its 2017 study at \$3.8–4.5 billion; costs have since escalated past \$12 billion, with the Auditor-General finding Snowy Hydro failed to properly assess geological conditions — a major driver of tunnel delays^[4]. A trans-Sierra conveyance must not repeat that mistake: deep geotechnical investigation belongs in Phase 1, not Phase 2.

4. WORK PACKAGES (1 OF 2)

WP	Scope & key questions
WP1 — Ocean intake & marine works	Intake siting on the California coast; screen/velocity-cap design, biofouling and corrosion strategy, marine survey. Key question: where can a large seawater intake be permitted?
WP2 — Conveyance	I-80 corridor alignment alternatives; hydraulics and pump-station staging (Archimedes screw pumps at required scale vs. largest built); tunnel-vs-pipeline; seismic design across active faults; deep geotechnical program.
WP3 — Pumped-hydro powerhouses	Reversible pump-turbines in seawater service; materials selection (Okinawa Yanbaru precedent: corrosion-resistant alloys, lined storage, FRP penstocks); powerhouse siting and construction method.
WP4 — Upper reservoirs	Siting, lining and seepage control in desert geology, evaporation losses, dam safety under seismic loading.
WP5 — Lake restoration hydrology & salt balance	Per-lake coupled water/salt mass-balance models (Great Salt Lake south-arm dilution toward 12–16%, Owens Lake dust-mitigation synergy, other terminal lakes); long-term salt accumulation and equilibrium.
WP6 — Point-of-use desalination	Side-stream only — the main conveyance stays unchanged seawater throughout. Technology selection (reverse osmosis baseline), energy demand verification, brine return logistics to hypersaline lakes, product-water delivery to users.

4. WORK PACKAGES (2 OF 2)

WP	Scope & key questions
WP7 — Inland marine aquaculture	Candidate species, biosecurity, reservoir-level fluctuation constraints, market and economic analysis. Phase-two industry; screened in Phase 0, detailed in Phase 1.
WP8 — Grid integration & revenue	Interconnection and queue position, capacity accreditation, arbitrage and ancillary-service revenue modeling, offtake/contract structures.
WP9 — Environmental, permitting & consultation	NEPA/CEQA pathway, Endangered Species Act, tribal consultation, Coastal Commission / State Lands, programmatic vs. project-level review strategy.
WP10 — Economics & finance	CAPEX/OPEX build-up per phase, levelized cost of storage vs. alternatives, water value, job modeling, financing structures (federal loan programs, state bonds, private capital).
WP11 — Program structuring	Buildout sequencing of the multi-site program, procurement and delivery model, governance, program risk register.

Coverage: WP1–WP6 and WP8–WP10 run in all phases at increasing depth; WP7 and WP11 are screened in Phase 0 and detailed from Phase 1.

5. TEAM & PROCUREMENT

Competitive RFP for an owner's engineer — a lead firm with pumped-storage *and* large conveyance/tunneling experience — plus specialist subconsultants (marine, geotechnical, environmental, energy markets). An independent technical review panel sits at each gate. This document forms the basis of the Phase 0 RFP.

6. WHAT THIS STUDY IS NOT

- **Not final design.** It produces study-grade definition sufficient for investment and permitting decisions — not construction drawings.
- **Not a permitting decision.** It maps the permitting pathway and its risks; agencies decide.
- **Not a financing commitment.** It builds the bankable case; capital is raised on the back of Phase 2.
- **Cost estimates are study-grade, not construction bids.** Accuracy classes are stated explicitly at every phase (AACE Class 4 → 2).

7. IMMEDIATE NEXT STEP

Issue the Phase 0 RFP on the basis of this scope. Three to four months to the first go/no-go gate; total Phase 0 → 2 timeline roughly 2.5–3.5 years for the first construction phase.

Contact: Zachary Moses — zachmoses.com. Companion to *The Archimedes Screw — Concept Brief* (October 2026).

SOURCES & NOTES

[1] Cultana seawater pumped-hydro study, South Australia (225 MW / 1,770 MWh): \$1.1M total, led by EnergyAustralia with Arup and the Melbourne Energy Institute; ARENA grant \$453K. arena.gov.au/blog/can-pumped-hydro-energy-storage-work-lets-sea/

[2] Shoalhaven expansion full feasibility (235 MW underground power station): \$6.8M total, ARENA \$2M. pumpindustry.com.au

[3] Kidston 330 MW pumped-hydro feasibility: ARENA committed \$4M toward the study.

[4] Snowy 2.0 (2 GW / 350 GWh): 2017 feasibility at \$3.8–4.5B; costs since escalated past \$12B; Auditor-General finding on geological assessment failures and tunnel delays. reneweconomy.com.au

Budget ranges in Section 2 are order-of-magnitude estimates for scoping purposes. AACE estimate classes: Class 4 (± 30 –50%), Class 3 (± 10 –30%), Class 2 (± 5 –15%). This document is a draft for discussion, not a procurement solicitation.