Enables more efficient utilization of renewable sources, reducing dependence on fossil fuels and improving the reliability of power generation

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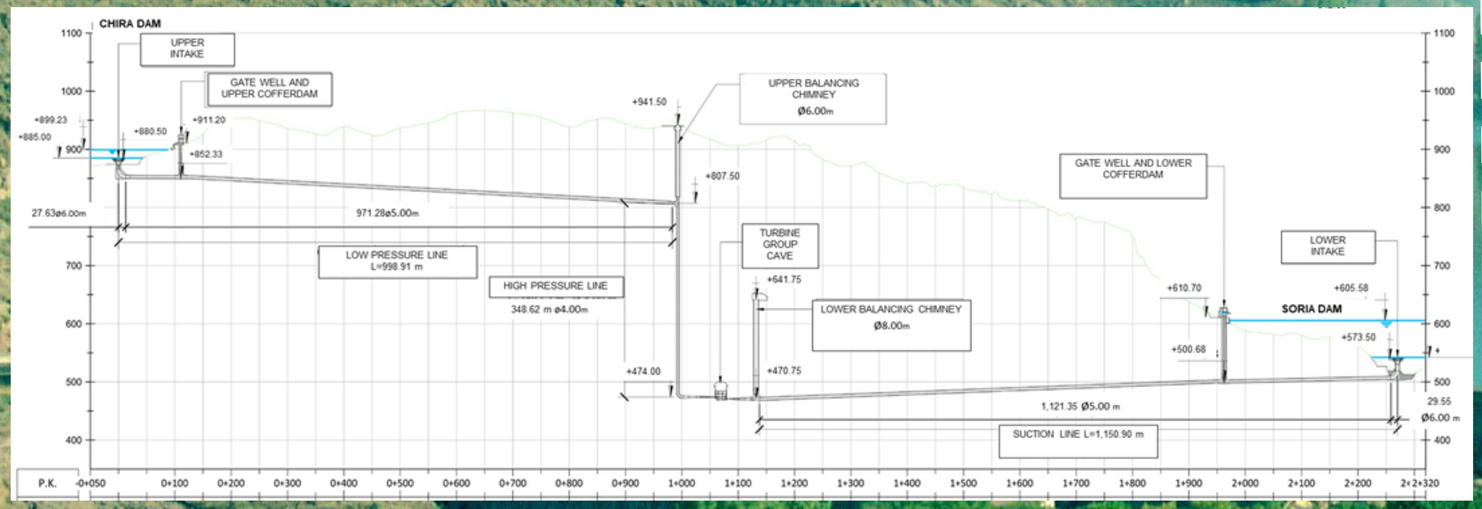
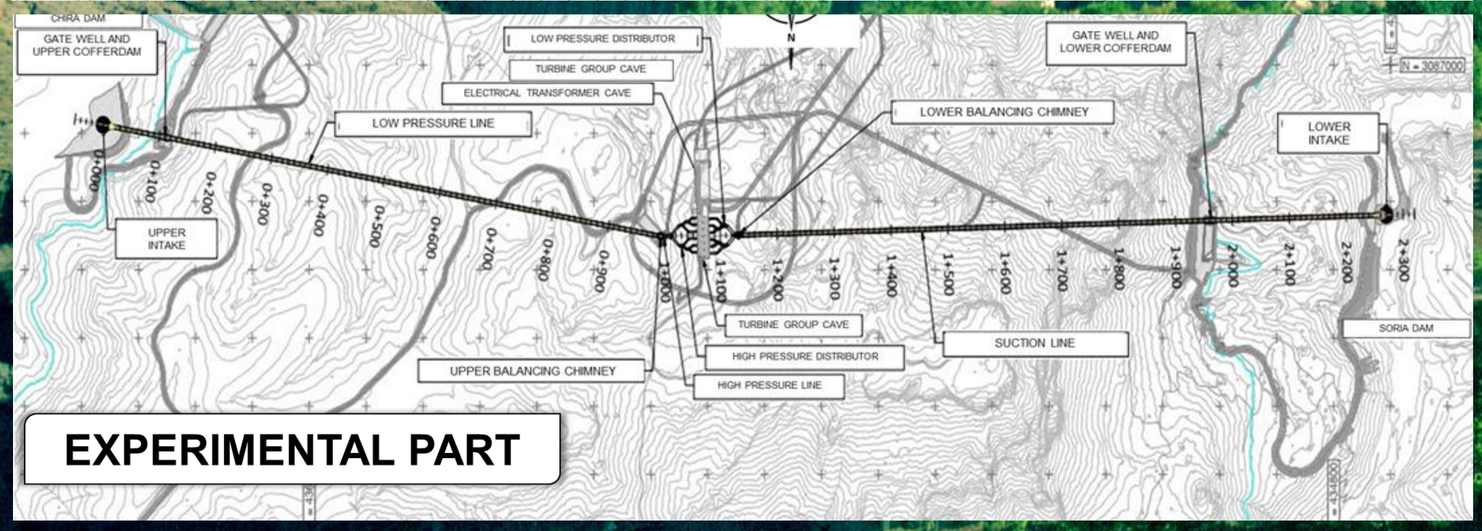
ABSTRACT

Gran Canaria, as an island, operates within an isolated energy system (IES), making it entirely dependent on its own generation capacity. Currently, its electricity production is composed of approximately 19% renewable sources (mainly wind and solar) and 81% from fossil fuel–based thermal power plants. This configuration, largely dependent on aging and partially obsolete infrastructure, requires urgent modernization to prevent the risk of an “Energy Zero” scenario — a total supply disruption due to system failure.A major step toward this transition is the planned integration of the Chira-Soria Pumped Hydroelectric Energy Storage Plant into Gran Canaria’s electrical system. The facility, stabilized hydraulically through a seawater desalination system, enables large-scale energy storage by pumping water to a high-altitude reservoir, to be released and turbined when needed.This study analyzes the implications of incorporating the Chira-Soria plant into the island’s energy network, evaluating its potential for integrated operation within the existing generation structure and its contribution to enhancing system reliability, renewable integration, and sustainability.





EXPERIMENTAL PART

CONCLUSIONS

- The operation of turbohydraulic machines in pumping mode presents lower efficiency, as they demand higher power input for reduced hydraulic output, resulting in a net power deficit of approximately 20 MW.
- Under maximum operating conditions —a continuous turbine phase of 16 h 34 min producing 3,313.84 MWh— compensation requires a pumping phase of 21 h 15 min, consuming 4,669.16 MWh. This leads to an energy deficit of 1,355.32 MWh.
- Achieving the plant’s maximum annual production would require around 231.8 complete renewals of the reservoir’s total transfer volume.
- Despite this imbalance, Pumped Energy Hydrosystems (PEHs) significantly enhance renewable energy integration, prevent curtailments (energy spills), and increase the reliability and security of the island’s electricity supply, reinforcing the stability of Gran Canaria’s isolated energy system.h/day) turbined and 8.08 (h/day) pumped.