

Mercury's Use of Geography for Renewable Energy

By Shando Naini

A Brief History Lesson

- Creation from deregulation
- Only renewable energy
- Formed in 1994
- State control reduced from 100% to 51% in April 2011, leads to IPO
- Logo Transformation in 2016



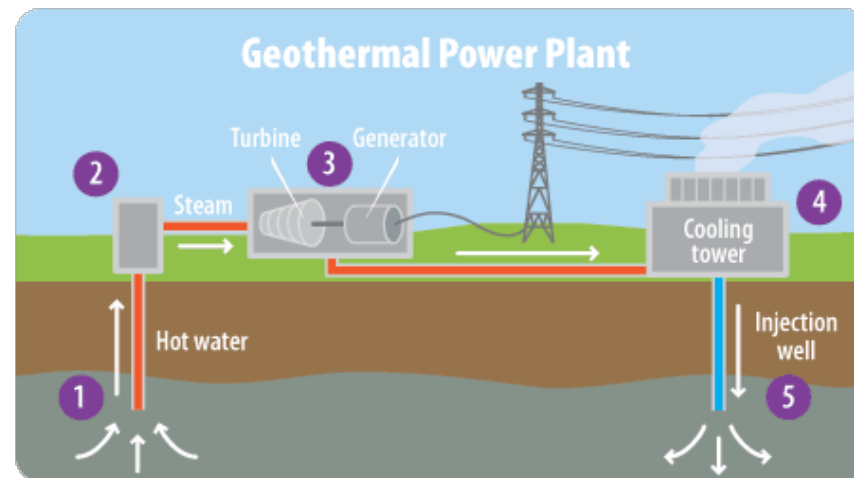
Foothold in Wind Energy

- Acquisitions from Tilt Renewables in August 2021
- 5 Wind Farms, including NZ's largest Tararua (1729 acres)
- Further investments planned



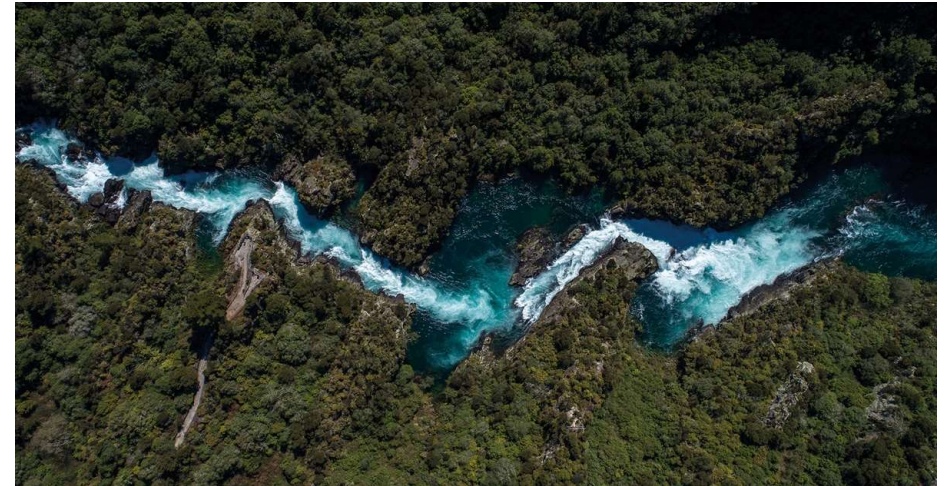
Energy From Underground

- Incorporation of geothermal energy, not dependent on weather
- 4/5 Geothermal Stations concentrated around Taupo
- Partnership with native Maori landowners
- Stations run 24/7, and produce enough energy to supply 330,000 NZ homes



The Waikato River's Potential

- NZ's longest river
- Only drainage source for Lake Taupo
- 8 Dams and 9 Hydroelectric Stations
- 4000 GWH Annually; 12% of NZ total Electricity



Whakamura Dam

Riverside Homes Create New Challenges

- Steep catchments and low-lying floodplains
- Many homes and farms right along the riverfront
- Land instability creates slips during heavy rains
- Worst cases require home evacuations
- Dams help mitigate flood risk



Beauty and Ferocity of Huka Falls

- Flow rate can reach 220,000 L/s
- Comparable to American Falls (283,905 L/s), despite significant gorge differences
- River constriction mainly responsible for this flow, 100 m to 15 m
- NZ's #1 visited natural attraction



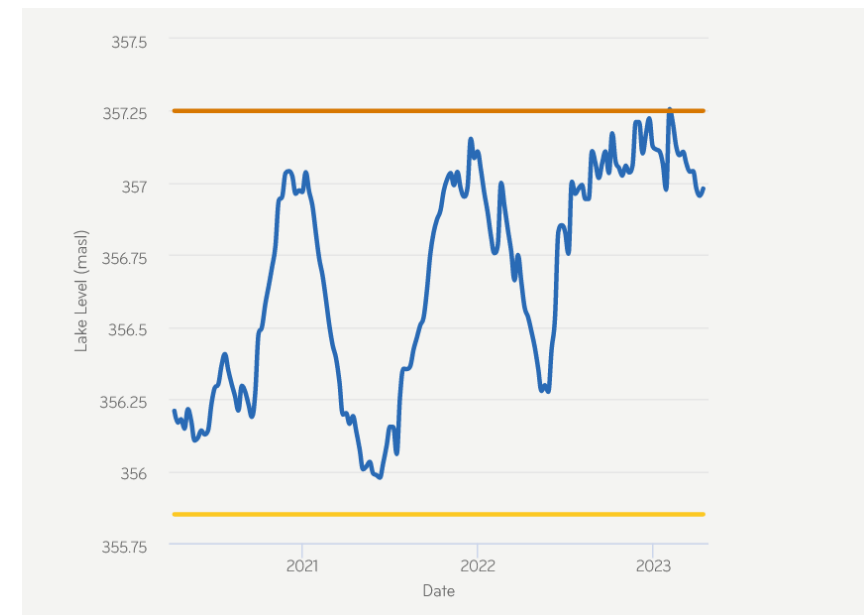
Recreation at a Cost

- River trails, boating, swimming
- Contaminants due to outflows from farms, meatpacking, pulp/paper mills
- Approx. 50/1000 of those who swim fall ill
- High Nitrogen/Phosphorous levels exacerbate toxic algae growth
- Drowning's major concern, especially after “point of no return”



Meticulous Control of Lake Taupo Level

- Winter of 2022 pushes Lake Taupo to a maximum of operating range
- 1167 ft to 1172 ft above sea level (1% of total lake volume)
- High lake levels caused a greater flow rate on Waikato
- Creates more power, but drives up flooding/drowning risk
- Levels are constantly monitored, updated every 30 minutes
- Controlled through Taupo Gates



Taupo Control Gates

- Built in 1940-41 underneath Waikato River bridge, as hydropower grows
- Close during periods of drought, open during periods of flooding
- 100% open during late 2022 Winter
- 1st “checkpoint” in Mercury Hydropower system
- Relieves excess water to diversion channel
- Trees/Other obstacles require immediate attention



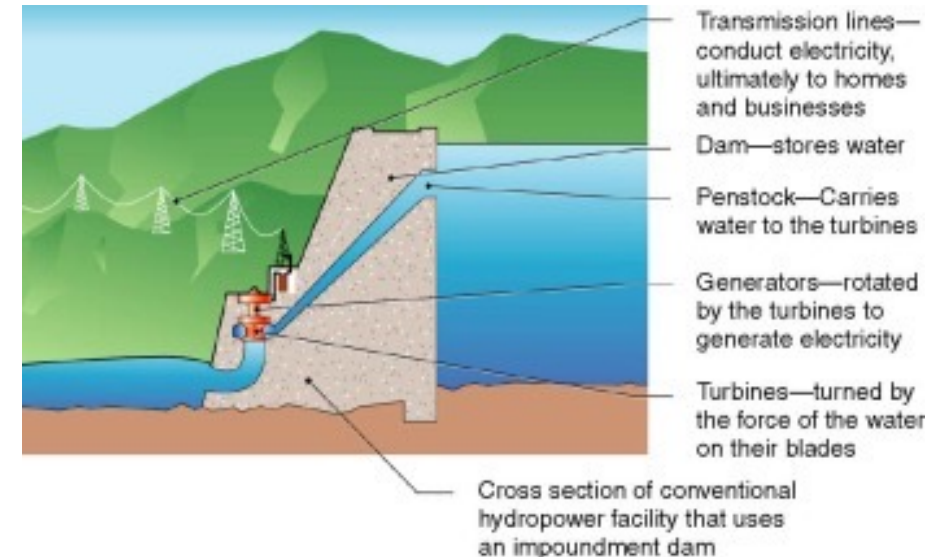
Hydropower: The True Moneymaker

- Mercury's highest production of electricity comes from hydropower system
- Water takes 18 hours to go from Lake Taupo to last stop, Karapiro
- Uses gravity of water from upstream to downstream for energy

Hydropower Generation Formula

$$P = \rho_w g Q \Delta H \epsilon$$

- Hydropower can easily controlled, unlike wind



The Most Valuable Station

- Arapuni Dam constructed in 1929
- Largest power capacity in hydro system, despite being oldest station
- Continuous renovations and repairs
- Annual generation of 805 GWh
- 8 Turbines



Thank You!