

ENVIRONMENTAL RISKS OF REPURPOSING HISTORIC MINE SITES FOR PUMPED HYDRO STORAGE



PUMPED HYDRO FACILITIES ON HISTORIC MINE SITES



Researchers found 37 mine sites in Australia that could be converted into renewable energy storage. So what are we waiting for?



Written by: [Timothy Weber](#)

28 Feb 2024



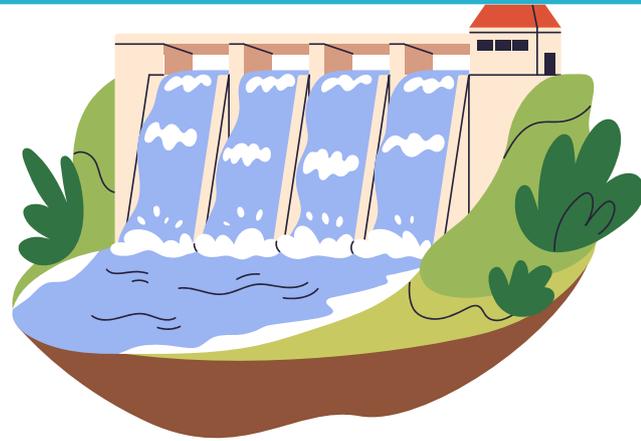
[ANU Research Identifies 37 Former Australian Mine Sites with Potential for Renewable Energy Storage](https://re100.eng.anu.edu.au/2024/02/28/Researchers-found-37-mine-sites-in-Australia-that-could-be-converted-into-renewable-energy-storage/)

<https://re100.eng.anu.edu.au/2024/02/28/Researchers-found-37-mine-sites-in-Australia-that-could-be-converted-into-renewable-energy-storage/>

PUMPED HYDRO FACILITIES ON HISTORIC MINE SITES: INTRODUCTION TO PUMPED HYDRO



Pumped hydro facilities are a type of energy storage system being promoted by Global Governments and Corporate Agencies to support Green Energy Compliance targets, by offering alternatives to Coal, Nuclear and Gas, and supply the demand for electricity for industrial, commercial & domestic use.



The basic concept behind these facilities involves two water reservoirs located at different elevations. Here's a step-by-step explanation of how they work:

- **Energy Storage (Pumping Phase):** When there is excess electricity on the grid (often during times of low demand or when renewable sources like wind and solar are generating more electricity than needed), this surplus energy is used to pump water from the lower reservoir to the upper reservoir. This process converts electrical energy into potential energy stored in the elevated water.
- **Energy Release (Generating Phase):** When there is a higher demand for electricity, or during peak usage times, the stored water in the upper reservoir is released back down to the lower reservoir through turbines. As the water flows downhill, it spins the turbines, which then generate electricity. This process converts the potential energy of the water back into electrical energy, which can be fed into the grid.

Advantages of Pumped Hydro Facilities

- **Energy Storage Efficiency:** Pumped hydro is one of the most efficient large-scale green energy storage methods, with an efficiency rate of around 70-80%.



PUMPED HYDRO FACILITIES ON CONTAMINATED HISTORIC GOLD & COPPER MINE SITES



Advantages of Pumped Hydro Facilities (continued)

- **Grid Stability:** These facilities help stabilize the electrical grid by balancing supply and demand, which is especially important as more intermittent renewable energy sources are integrated.'
- **Long Lifespan:** Pumped hydro facilities have a long operational life, often exceeding 50 years, making them a durable investment in energy infrastructure.
- **Large-Scale Storage:** They are capable of storing large amounts of energy, which is crucial for meeting high demand periods.

Challenges of Pumped Hydro

- **Geographic Limitations:** The construction of pumped hydro facilities requires specific geographic conditions, such as suitable elevation differences and water availability, which can limit their locations.
- **Environmental Impact:** Creating large reservoirs and altering natural waterways can have significant environmental impacts, including effects on local ecosystems and wildlife.
- **High Initial Costs:** The construction of these facilities requires significant upfront investment, although the long-term benefits can outweigh these initial costs.



Pumped hydro facilities are a proposed alternative by those in opposition to traditional coal and gas mining practices; in supporting the integration of renewable energy sources and attempting to achieve a more stable and resilient power grid than has been historically possible with Green Energy Systems and Renewables.

PUMPED HYDRO CRITICISMS: HABITAT DESTRUCTION & RELIANCE ON FINANCIAL SUBSIDIES



Environmental Impacts

Ecosystem Disruption:

Land Use: These projects often require large areas of land for reservoirs, which can lead to the flooding of natural areas and displacement of communities as well as lost habitat for native fauna and flora, including threatened and endangered species.



- **The construction of pumped hydro facilities can disrupt local ecosystems, affecting wildlife habitats, water quality, and river systems.**
- **Flooding habitats and altering water flows, which affects wildlife and plant life.**
- **Water Quality:** Stagnant water in reservoirs can lead to issues such as algal blooms, impacting local water quality.

Geographical Limitations

- **Site Specificity:** PHS requires specific geographic features, such as elevation differences and access to water sources. Suitable locations are often limited, especially in densely populated or developed areas.
- **Transport and Infrastructure:** If located far from power demand centers, extensive infrastructure may be needed to connect to the grid, increasing costs and complexity.

PUMPED HYDRO CRITICISMS: HABITAT DESTRUCTION & RELIANCE ON FINANCIAL SUBSIDIES



High Capital Costs

- **Initial Investment:** The construction of PHS facilities involves high upfront capital costs, making it less attractive compared to other energy storage options.
- **Long Development Time:** The permitting and construction process can take several years, delaying the benefits of energy storage.
- **Reliance on Government Subsidies (Support for Renewables):** As part of broader climate and energy goals, governments may provide subsidies to promote renewable energy integration and reduce greenhouse gas emissions.



PUMPED HYDRO CRITICISMS: EFFICIENCY CONCERNS, SOCIO-ECONOMIC & POLITICAL ISSUES



Efficiency Concerns

- **Energy Loss:** PHS typically has an efficiency rate of around 70-80%, meaning some energy is lost during the pumping and generation processes.

Maintenance Needs: Ongoing maintenance of infrastructure and equipment can incur additional costs and downtime.



Social and Political Issues

- **Community Opposition:** Local communities may resist new projects due to environmental concerns or potential displacement, leading to conflicts and delays.
- **Regulatory Hurdles:** Navigating the regulatory landscape can be complex and time-consuming, often requiring extensive environmental assessments.



Seasonal and Weather Dependency

- **Water Availability:** The effectiveness of PHS can be limited by seasonal variations in water availability, particularly in regions experiencing drought.
- **Climate Change Impacts:** Changing weather patterns can affect water levels and the reliability of PHS operations.



PUMPED HYDRO CRITICISMS: COMPETITION & ALTERNATIVES



Technological Alternatives

- **Competition from Other Technologies:** The rise of alternative storage solutions, such as lithium-ion batteries and emerging technologies like hydrogen storage, can make PHS less favorable in some contexts.
- **Flexibility Issues:** PHS systems may not respond as quickly as battery systems, which can limit their effectiveness for rapid demand response.

While pumped hydro storage plays a critical role in many energy systems, these challenges highlight the need for careful planning, consideration of alternatives, and a holistic approach to energy storage solutions.



PUMPED HYDRO FACILITIES ON HISTORIC MINE SITES: KIDSTON MINE



Queensland Government Evaluation Report – Kidston Pumped Storage Hydro Project (K2-Hydro).

<https://eisdocs.dsdp.qld.gov.au/Kidston%20Pumped%20Storage%20Hydro%20Project/Coordinator-General%27s%20evaluation%20report/Coordinator-General%20evaluation%20report%20for%20K2H%20project.pdf>

PUMPED HYDRO FACILITIES ON HISTORIC MINE SITES: KIDSTON MINE



The Kidston Mine Plan is coined by proponents as an “innovative approach aimed at transforming old, toxic mine sites into sources of green energy through the use of hydro pumping technology.”

The plan involves repurposing the abandoned Kidston Gold Mine in Queensland, Australia, into a pumped hydro energy storage facility.

Here's a detailed breakdown of how the plan works:

Site Selection and Preparation:

- The Kidston Gold Mine, which ceased operations in the early 2000s, features two large open-cut pits that have naturally filled with water over time. These pits are ideal for a pumped hydro energy storage system due to their existing depth and volume.

Pumped Hydro Energy Storage (PHES) System

- The PHES system operates by moving water between two reservoirs at different elevations.
- During times of low electricity demand (and thus lower energy prices), water is pumped from the lower reservoir to the upper reservoir using excess renewable energy from sources like solar or wind.
- When there is high electricity demand (and higher energy prices), the stored water is released back to the lower reservoir, passing through turbines to generate electricity.

Integration with Renewable Energy

- The Kidston project is to integrate with renewable energy sources. The site has an existing 50 MW solar farm, and there are plans to expand this capacity and potentially add wind power. By leveraging these renewable sources, the hydro pump system is suggested to be ‘sustainable, ensuring a green and efficient cycle.’

PUMPED HYDRO FACILITIES ON HISTORIC MINE SITES: KIDSTON MINE – POTENTIAL BENEFITS



Environmental Benefits

- Transforming the old mine site into ‘a green energy hub’ offers several environmental benefits:
 - **Toxic Remediation:** By repurposing the mine pits for energy storage, the plan helps mitigate the environmental hazards associated with abandoned mines, such as acid drainage and heavy metal contamination.
 - **Reduction of Greenhouse Gases:** Utilizing renewable energy to pump water and generate electricity reduces reliance on fossil fuels, thereby cutting greenhouse gas emissions.
 - **Sustainable Land Use:** The project exemplifies how degraded land can be reclaimed for productive and environmentally friendly purposes.

Economic and Social Impact

- Proponents of the Kidston Mine Plan suggest it has the potential to bring significant economic and social advantages:
 - **Job Creation:** The construction and operation of the PHES system and associated renewable energy projects create jobs and stimulate local economies.
 - **Energy Security:** The ability to store and dispatch renewable energy on demand enhances grid stability and energy security, particularly in remote regions.
 - **Innovation and Leadership:** The project positions Australia as a leader in innovative green energy solutions, demonstrating how other regions with similar abandoned mine sites can follow suit.

The Kidston Mine Plan is an attempt to convert a toxic former mining site into a pumped hydro energy storage facility. The plan underpins a Global effort to transition to a ‘sustainable and resilient energy future.’

KIDSTON MINE PUMPED HYDRO: CRITICISMS OF THE PROJECT



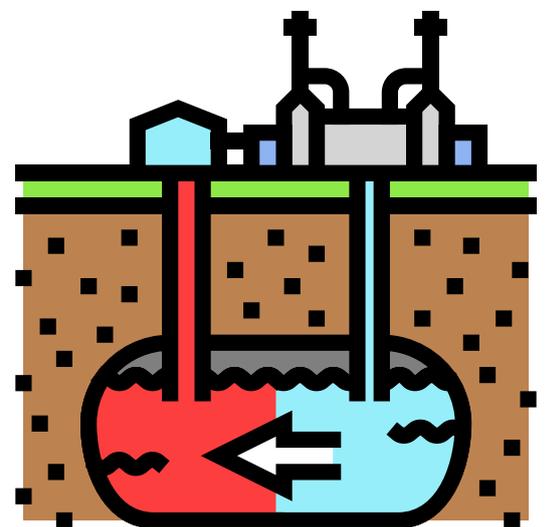
Acid Mine Drainage Potential Still Relevant

- **Historical Mining Impacts:** Given that the site was previously used for gold mining, there is a risk of acid mine drainage (AMD) from exposed sulfide minerals, which can lead to further leaching of existing heavy metals and acidity into surrounding water sources, the atmosphere etc.



Water Quality Contamination

- **Chemical Leaching:** The construction and operation of the facility could lead to the leaching of chemicals from construction materials or disturbed soils into water bodies, impacting local ecosystems.
- **Runoff from Construction Activities:** During construction, sediment and contaminants could wash into nearby water sources, affecting water quality.
- **Reservoir Contaminants:** If reservoirs are not properly managed, there is a risk of stagnation and the growth of harmful algal blooms, which can produce toxins.

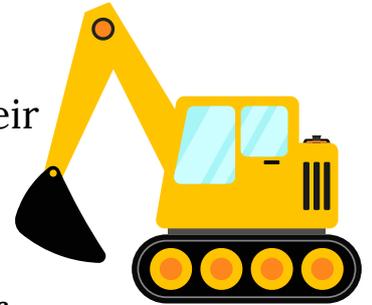


PUMPED HYDRO FACILITIES ON HISTORIC MINE SITES: KIDSTON MINE CRITICISMS



Potential for Soil Contamination

- **Construction Activities:** Soil disturbances during construction could expose contaminants and lead to their mobilization.
- **Chemical Use:** Use of chemicals for maintenance or construction could introduce contaminants to the soil if not managed properly.



Further Erosion and Sedimentation

- **Runoff Contamination:** Increased sediment can also facilitate the transport of contaminants already present in the soil into waterways.

Operational Risks

- **Water Management Failures:** Inadequate management of water levels or chemical treatments could lead to spills or overflows, causing contamination of nearby land and water resources.
- **Infrastructure Integrity:** Aging or poorly maintained infrastructure, such as pipes or dams, could lead to leaks or failures that result in contamination.

Ongoing Monitoring Needs: Monitoring contamination of water and soil quality over the long term can be resource-intensive and may face regulatory and logistical challenges.

Effective planning, monitoring, and management strategies are essential to mitigate these contamination risks at the Kidston Pumped Hydro Project. This includes implementing robust environmental management plans, conducting regular assessments, and engaging with local communities to ensure transparency and responsiveness to potential concerns.

PUMPED HYDRO FACILITIES ON HISTORIC MINE SITES: FINAL CONCLUSION



Is Green Energy Truly Green?

- **The suggestion that a highly toxic and contaminated, abandoned Copper/Gold Mine can be relabelled “Green and Environmentally Friendly” is quite contrary to the reality of the site and its unique issues.**
- **Labels of ‘Green Energy’ and ‘Renewables’ are common social buzz words that suggest positive connotations. This is a rather convenient ‘sleight of hand’ which is contrary to the reality of the harmful toxic water contamination found on this mine site, whether it be repurposed or not.**
- Although it is true that utilising the site in alternative ways is indeed ‘innovative’ - it is still a harmful and ecologically significant area of concern.
- Ongoing contamination issues will continue to exist and are relevant on this mine site - including the use of it as a Hydro Pump Station Facility.
- The Community should be made aware of the potential impacts and risks associated with projects that re-purpose toxic and contaminated, abandoned sites such as the Kidstone Mine Site to ensure that adequate transparency exists and that the public are informed as well as protected.
- **The environmental protection authorities charged with the responsibility of overseeing these projects ought to be independent, and free from any associated bias to ensure:**
 - **Objective Decision Making; Public Trust; Transparency and Accountability; Avoiding Regulatory Capture; Public Health and Safety**
 - **Evidence-Based Policy:** Independent agencies can promote regulations based on scientific evidence and expert recommendations, rather than political or economic interests.