

**Submission  
No 13**

## **INQUIRY INTO BENEFICIAL AND PRODUCTIVE POST- MINING LAND USE**

**Organisation:** Gravitricity Ltd

**Date Received:** 25 June 2024

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The Director  
Standing Committee on State Development  
Parliament House  
Macquarie Street  
Sydney NSW 2000

**Submission into the Inquiry into beneficial and productive post-mining land use**

Gravitricity appreciates the opportunity to provide a submission into the Inquiry into beneficial and productive post-mining land use.

We are a UK based technology company, that is developing innovative, long-life underground energy storage systems that help solve the problem of intermittent renewable energy by storing excess energy during periods of low demand and releasing it back when required.

Our patented gravity energy storage system, known as GraviStore, uses heavy weights suspended in a deep shaft by cables attached to winches. We believe that the solution offers a viable alternative future to end of life mine shafts, which would otherwise face costly infilling and mine decommissioning costs.

We welcome the opportunity to share details about how the technology can enable the repurposing of existing mine sites, help maintain surrounding communities and provide opportunities to reskill current workforces.

In addition, we would be happy to provide further information if this would assist the Committee and are happy for our submission to be published, alongside our company name.

Yours sincerely

Gravitricity Ltd

## Beneficial and productive post-mining land use

Submission by Gravitricity Ltd

24 June 2024

### 1. THE NSW MINING LANDSCAPE

The recent [announcement of a \\$37.7 million investment](#) in the 2024-25 budget by the NSW Government to support mining communities, ensure rehabilitation of mines and support health and safety for mine workers in NSW, demonstrates the huge importance of the mining sector in the state.

The funding package will ensure compliance with rehabilitation requirements and provide support for local communities, which will be particularly important at the state's 39 coal mines, with 32 of them expected to close by 2040.

Finding a productive change in land use for these mining assets, that also supports the decarbonised economy and provides opportunities for investment and growth in training and skills will be vital in the coming years.

At [Gravitricity](#) we believe there exists a significant opportunity to transform these assets into grid-scale clean energy storage solutions. This would support the [NSW Government's stated aims for the increase of energy storage](#) to ensure a steady and reliable supply of energy around the clock and help to play a role in the transition to renewable energy, delivering reliable and affordable power to households and businesses at the same time as driving down emissions to meet net zero targets.

Energy storage will be required to provide fast-response frequency regulating services, as well as longer-duration applications such as peak shaving and renewables smoothing. As a result, numerous alternative technologies are under development and it is our view that multiple different energy storage technologies will be deployed on electricity grids of the future, including proven technologies like Pumped Hydro Storage (PHS) and lithium-ion chemical battery energy storage systems (BESS); but also, alternative options such as flywheels, compressed-air storage, and solid-weight gravitational energy storage.

In order to support this growing need for energy storage, Gravitricity have developed a novel gravity energy storage system (GESS) which enables the repurposing of an existing mine and the use/reuse of some of the existing infrastructure (including mine shaft and grid connection) for the system's deployment and operation.

### 2. HOW GRAVITY ENERGY STORAGE SYSTEMS WORK

Gravity energy storage systems are based on a simple principle: raising and lowering a heavy weight to store and release energy. Electricity is stored in the form of potential energy by raising the weight. Power is then generated by lowering the weights to turn a generator.

Our single weight [GraviStore](#) system is ideally suited to mine shafts in the range of 300-1200m+ and designed to use weight configurations totalling 1,000+ tonnes. We are developing full-scale

single weight systems with a power output of 1-8MW, with a typical duration of 30 mins (depending on shaft depth) providing 1-4MWh energy. Future multi-weight systems could have a much greater capacity (power 1-8MW, duration up to 12 hours).

We have already [built and tested a 250kW Concept Demonstrator](#) in the UK during 2021. This above-ground facility confirmed that the system will operate as expected and that a full-scale system will provide high round-trip-efficiency (up to 80%), rapid response times (<1s) and the capability to continuously vary output or input power.

We are now ready to deploy the system in projects across Europe and have identified a number of closed or soon to close coal mining assets suitable for installation. We also envisage the system being installed in deep mine shafts all over the world and have established a project development database of 300+ sites and established a network of worldwide partners, including in Australia, where we have been engaged in partnership discussions with established engineering companies.

### 3. GRAVITY ENERGY STORAGE SYSTEM BENEFITS

Once installed gravity energy storage systems can help to:

- **Reduce the carbon intensity of the power network:** By contributing to an increased reliance on intermittent forms of renewable energy such as wind and solar PV in electricity grids.
- **Offset CO2 associated with traditional forms of backup power:** Such as coal-fired plants, diesel engines and natural gas turbines, that are typically used for providing frequency response services.
- **Increase the reliability of the power network:** By demonstrating the provision of frequency control ancillary services (FCAS) and participating in wholesale energy markets.
- **Repurpose existing mining sites:** The system can enable circular economic benefits by repurposing an existing mine and the use/reuse of some of the existing infrastructure (including mine shaft and grid connection).
- **Retain local skilled employment:** Installation of the innovative technology can enable high-value jobs and associated economic benefits to be retained in communities where mining activities are coming to an end. It can positively contribute to the local economy, employment, and the environment, offer a major opportunity to support a positive local transformation and provide a positive social impact by offering skilled jobs, and strong PR associated with the implementation of innovative technology.
- **Provide a long-term energy storage asset:** Utility-scale lithium-ion BESS projects are well established, and the technology's costs have benefitted from large reductions, largely owing to economies of scale. However, their limitations are also increasingly well understood; with concerns primarily centring around durability, as the battery cells suffer from performance degradation, alongside having a relatively short lifetime of around 3,000 – 10,000 cycles. These drawbacks are particularly important for infrastructure projects where the energy storage system is required to last for 25 years or more: a BESS will require full-system replacement at least once during that time. By contrast, GESS are designed to have a 50 year+ design life with no cycle limit or

degradation, can provide a grid-scale asset that does not require rare materials during construction, and are built using components that can be locally sourced and recycled or re-used at the end of life.

#### **4. ALTERNATIVE LAND USE - UNDERGROUND HYDROGEN STORAGE**

In addition to our gravity energy storage systems, Gravitricity are also developing an innovative underground lined rock shaft system called H<sub>2</sub>FlexiStore, similar to the lined rock cavern method. This high-pressure hydrogen storage method uses the surrounding rock mass to support the gas pressure, minimising the amount of containment material required and maximising location flexibility.

Intended storage capacity is between 15 to 100 tonnes, with the ability to co-locate multiple shafts to give larger storage volumes. A 6m x 365m shaft at 200 bar would provide storage for 3.3GWh of raw energy (enough to refuel 3,125 FCEV buses) or 1.6GWh of electricity storage.

We believe widespread adoption of large-scale hydrogen storage infrastructure will be needed to support the uptake of renewable and low-carbon hydrogen, to help decarbonise the energy system; heavy transport and hard to abate industries like oil refining and ammonia production; as well as providing high grade heat for steel and petrochemical manufacturing.

Post-mining land could be a suitable location for siting this hydrogen storage technology, with the added benefit of the ability to re-use existing on-site mining skills and technology, to help optimise the process for sinking the deep shafts required.

#### **5. SUMMARY**

We believe there exists a significant opportunity to transform post-mining land throughout NSW, by installing innovative energy storage technology that can;

- 1) Reuse existing infrastructure,
- 2) Support the development of clean energy,
- 3) Provide commercial opportunities for both mine operators and mining communities, and,
- 4) Enable the existing workforce to benefit from training and skills, ensuring mining communities across the state have a vibrant economic future, with secure, well-paid, local jobs.

We hope that our input will benefit the work of the Standing Committee and would like to say thank you again for the opportunity to provide a submission into the Inquiry.

Yours sincerely

Ruth Apps  
Commercial Lead Manager  
Gravitricity Ltd