



Hydrogen Storage in Underground Lined Rock Shafts

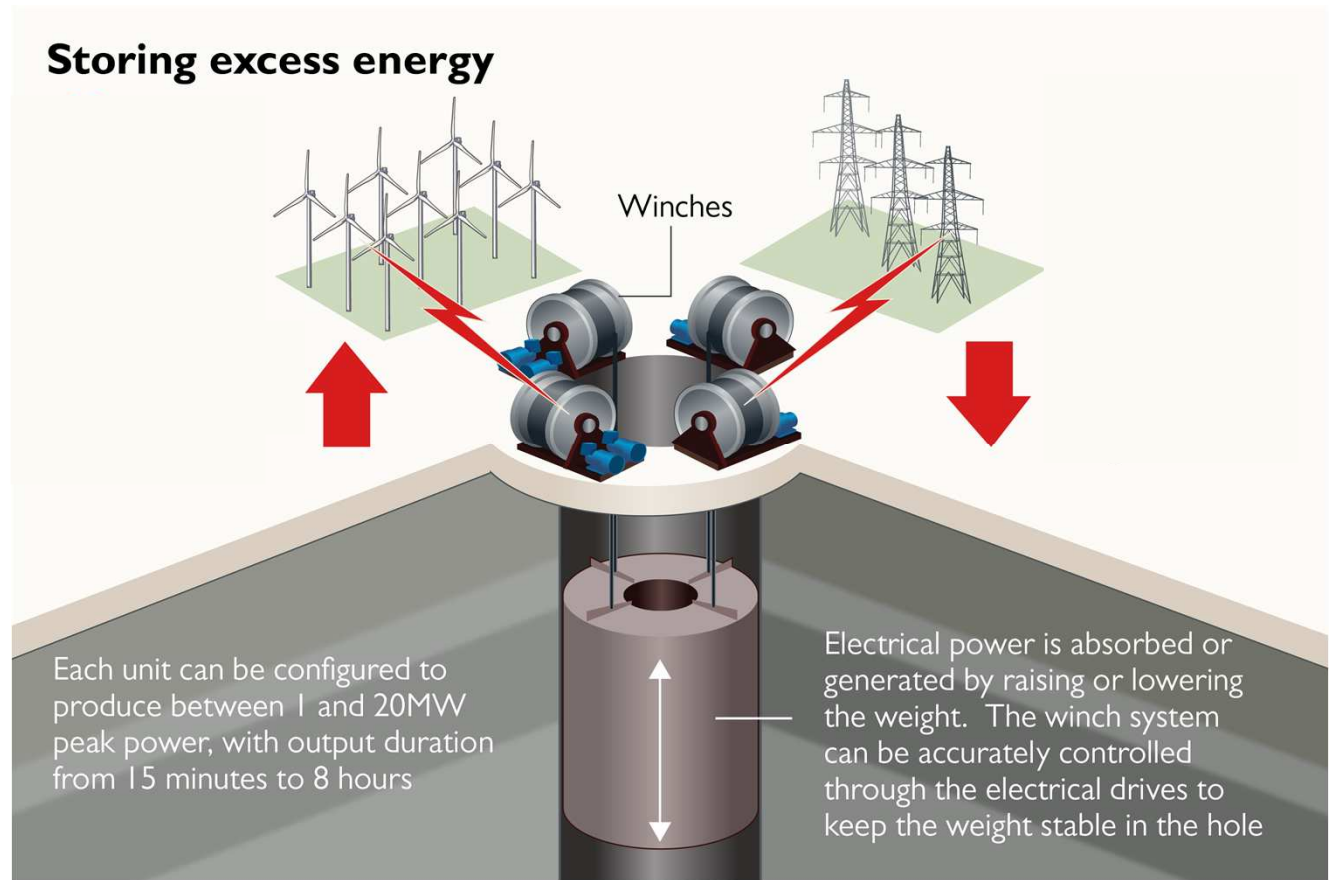
Hydrogen Storage in Caverns, 2022
14th March – Burlington House, London

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Gravitricity Ltd.

- Stores electricity by raising and lowering weights
- Flexible power output up to 20MW
- Allows energy to be stored and released whenever there is demand
- Rapid response time <1 second
- Longevity >25years



Our Technology – Why it matters

Technical Characteristics

Low levelized (lifetime) cost of storage.

Rapid response: full rated power <1s

Long cycle life with **no cyclical degradation**.
(75,000+ cycles)

High efficiency: >80%. As good or better than all alternatives

Versatile Power/Energy ratio: c-rate up to 8 or more.

Small footprint: <30mx30m for 8MW facility. Can be sunk below ground. **No locational constraint** at new-shaft sites

No parasitic loads, no standing losses, no depth-of-discharge limits. Nothing explosive.



Gravitricity Ltd. - Demonstrator

- Port of Leith, Edinburgh
- 250 KW Demonstrator
- 2 x 25 tonne weights
- Allowed the technology to be tested in real-life setting
- Prove concept above-ground
- Worked in partnership with Dutch partners winch specialists, Huisman
- Enabled team to develop and test control methods to optimize performance
- Standby to full power in <1 second
- Safely demonstrated concept reducing risk in delivering the first full-scale project



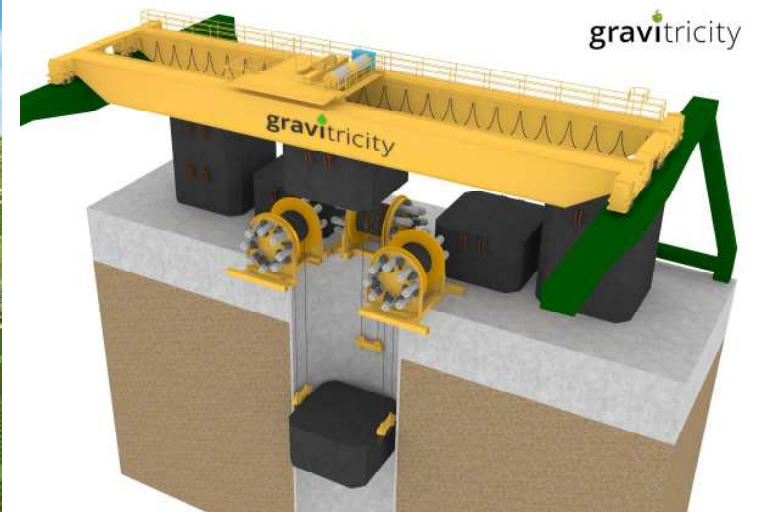
Gravitricity projects

Future projects will integrate the gravity-based system in underground shafts

Single weight



Multi-weight – N. England

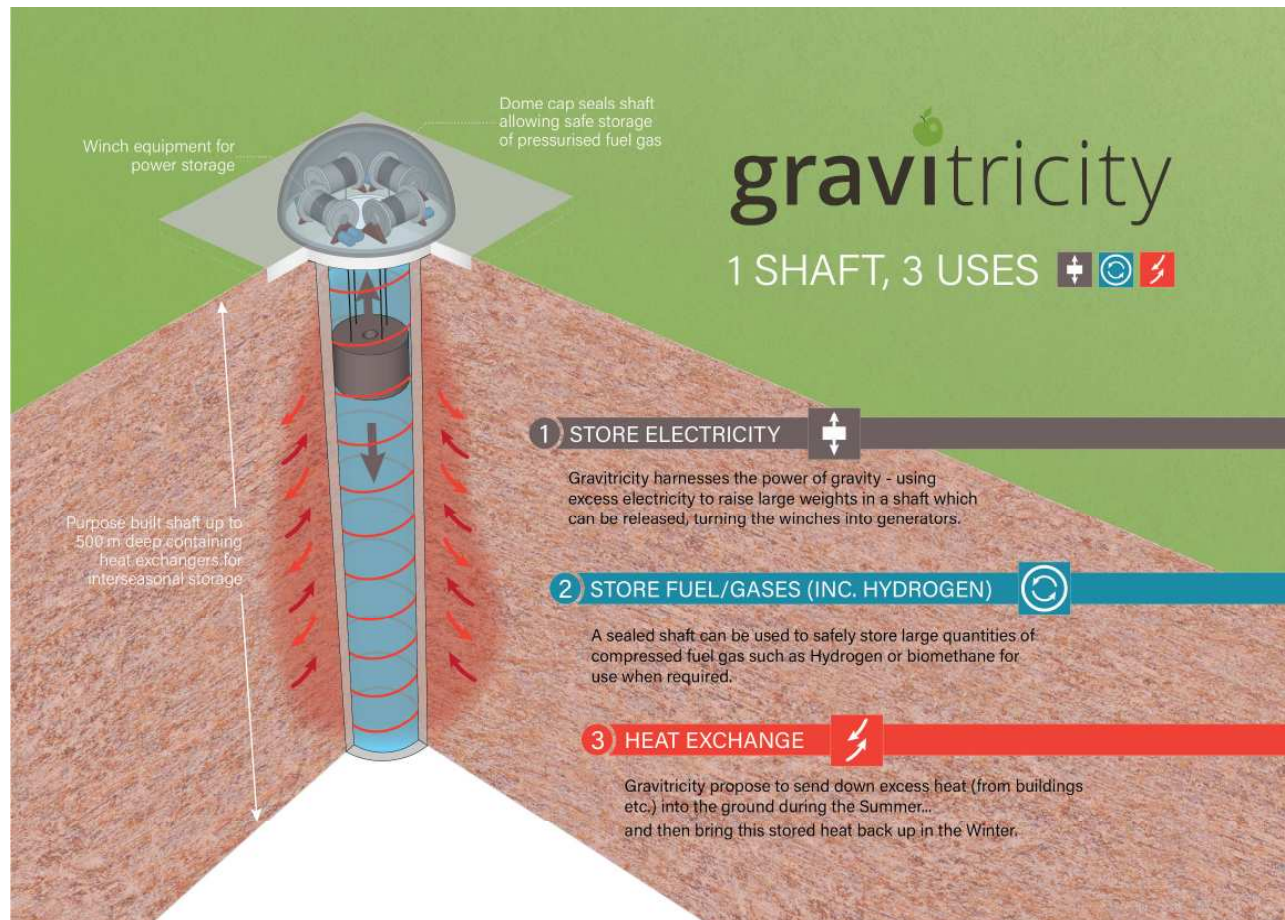


Commercial aspects

		Required performance characteristics	Description	Gravitricity product		
				Single weight	Multi weight	Combined w/ hydrogen
	1. Grid services	• High power • Fast response • Cyclability • Longevity	Power or energy for grid balancing & frequency regulation	✓	✓	✓
	2. Co-location	• Cyclability • High round trip efficiency	Coupling storage and large scale renewable generation at same site	✓	✓	
	3. Commercial & industrial	• Fast response • Longevity	Supporting industrials to decarbonise operations		✓	✓
	4. Energy Access	• 6-24 hrs • Longevity	Designed into mini grids delivering energy access to rural and off grid communities		✓	✓

Integration of H2 with Gravitricity technology

Integrated hydrogen storage - gravity-based energy, hydrogen and inter-seasonal heat storage within one shaft



Focus of feasibility study

Hydrogen will be stored at high pressures in an underground shaft, Gravitricity's ambition is to provide multi-sector storage capability, using one shaft to store electricity, hydrogen and inter-seasonal heat.

What are the benefits of having an integrated storage facility?

- Combine, electrical, heat and hydrogen storage in one shaft
- Location flexibility – not restricted to salt deposits
- Reduced above-ground footprint
- Uses surrounding ground pressure to resist bursting, reducing the material costs of lining
- Increases safety by limiting opportunities for oxygen ingress, and enables more hydrogen to be stored than in above-ground vessels
- Purity of hydrogen – unlike geological storage
- Can be scaled up or down depending on end-user

A 3D architectural rendering of the Gravity Research Accelerator facility. The facility consists of a wooden building with a blue roof and a concrete platform. On the platform, there are several large cylindrical tanks and a white van. A large red cylindrical tank is suspended in a deep, rocky shaft below the platform. The background shows a green field with trees and a road.

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Thanks for listening

Any Questions?