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Quartzite Thermal Battery for Circular Energy in Data Centres

Transforming waste heat into renewable power using high-temperature stone-based thermal storage.

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FUTURE CAST

Powering technological innovation in
Quarrying and Construction

Centre for Innovation, Education, and R&D in Construction, Manufacturing, and Quarrying

Based in **Manorhamilton, Co. Leitrim**, Future Cast is a national hub for industrial transformation.

Support companies across the **entire manufacturing supply chain** from materials to advanced systems.

Our mission: **accelerate the adoption of Industry 4.0 technologies** to drive sustainability, productivity, and competitiveness.

Executive summary

Data centres waste up to 40% of energy on cooling.

- Our solution: capture and store waste heat in quartzite at up to 1000 °C.
- Stored heat powers steam turbines to generate electricity for cooling systems.
- Creates a circular, low-carbon energy loop within the data centre.

The Problem

- Data centres are energy-intensive and growing rapidly.
- Cooling systems are inefficient and waste heat is lost.
- Current solutions don’t recover or reuse this thermal energy.
- Need for scalable, sustainable, and resilient energy systems.

Solution

- ✓ Quartzite-based Thermal Energy Storage (TES) system.
- ✓ Captures low-grade waste heat and stores it in insulated silos.
- ✓ Converts stored heat into electricity via steam turbines.
- ✓ Powers cooling systems, reducing grid dependency.

How It Works

1. **Heat Capture** – From data centre cooling loops.
2. **Thermal Storage** – Quartzite stones heated to 1000 °C.
3. **Power Generation** – Steam at 10 bar drives turbines.
4. **Circular Integration** – Electricity powers cooling; loop repeats.

Technical overview

- **Storage Capacity**: 5–50 MWh (scalable).
- **Efficiency**: 35–50% round-trip.
- **Lifetime**: 30+ years with minimal quartzite degradation.
- **Components**: Quartzite bed, heat exchangers, turbine, insulated silos, automation.

Implementation Roadmap

Phase 1 (Months 0-6): Feasibility study, modelling, business case.

Phase 2 (Months 06-24): Pilot plant (1–5 MWh), test cycles.

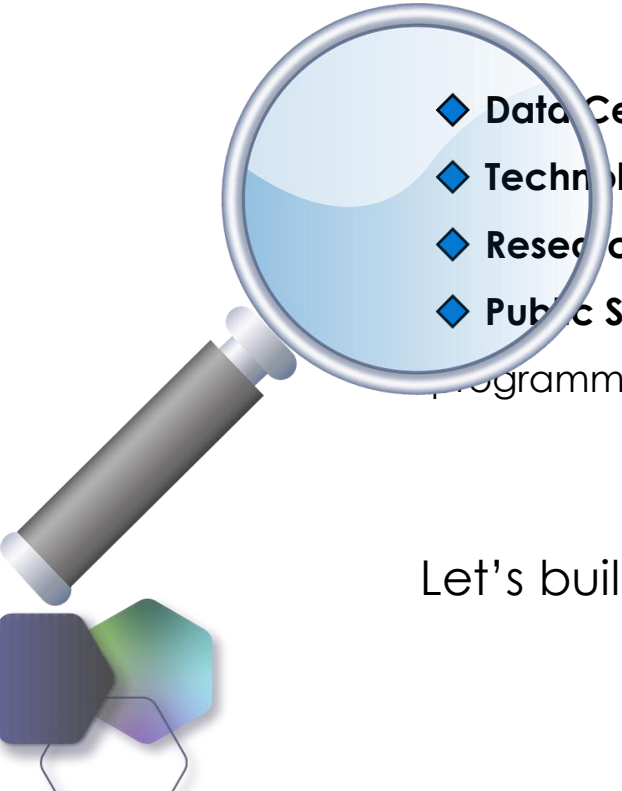
Phase 3 (Months 24-36): Commercial deployment (20–50 MWh).

Phase 4 (Months 36+): Replication across data centres and hybrid use cases.

Impact & Benefits

- ✓ **Environmental**: Reduces emissions, reuses waste heat.
- ✓ **Economic**: Cuts energy costs, potential grid revenue.
- ✓ **Resilience**: On-site backup power for critical systems.
- ✓ **Scalability**: Suitable for hyperscale and modular data centres

PARTNERS



- **Data Centre Operators** – Hyperscale and colocation firms for pilot sites.
- **Technology Providers** – Turbine, TES, and automation specialists.
- **Research Institutions** – Thermal modelling, materials testing.
- **Public Sector & Funders** – Climate innovation funds, energy agencies, EU programmes..

Let's build the future of circular energy—together.

To conclude

- ✓ A first-of-its-kind integration of quartzite TES in data centres.
- ✓ Turns waste into power, cost into savings, and heat into resilience.
- ✓ Strong alignment with EU Green Deal and global sustainability goals.
- ✓ Ready to pilot, scale, and replicate across Europe and beyond.

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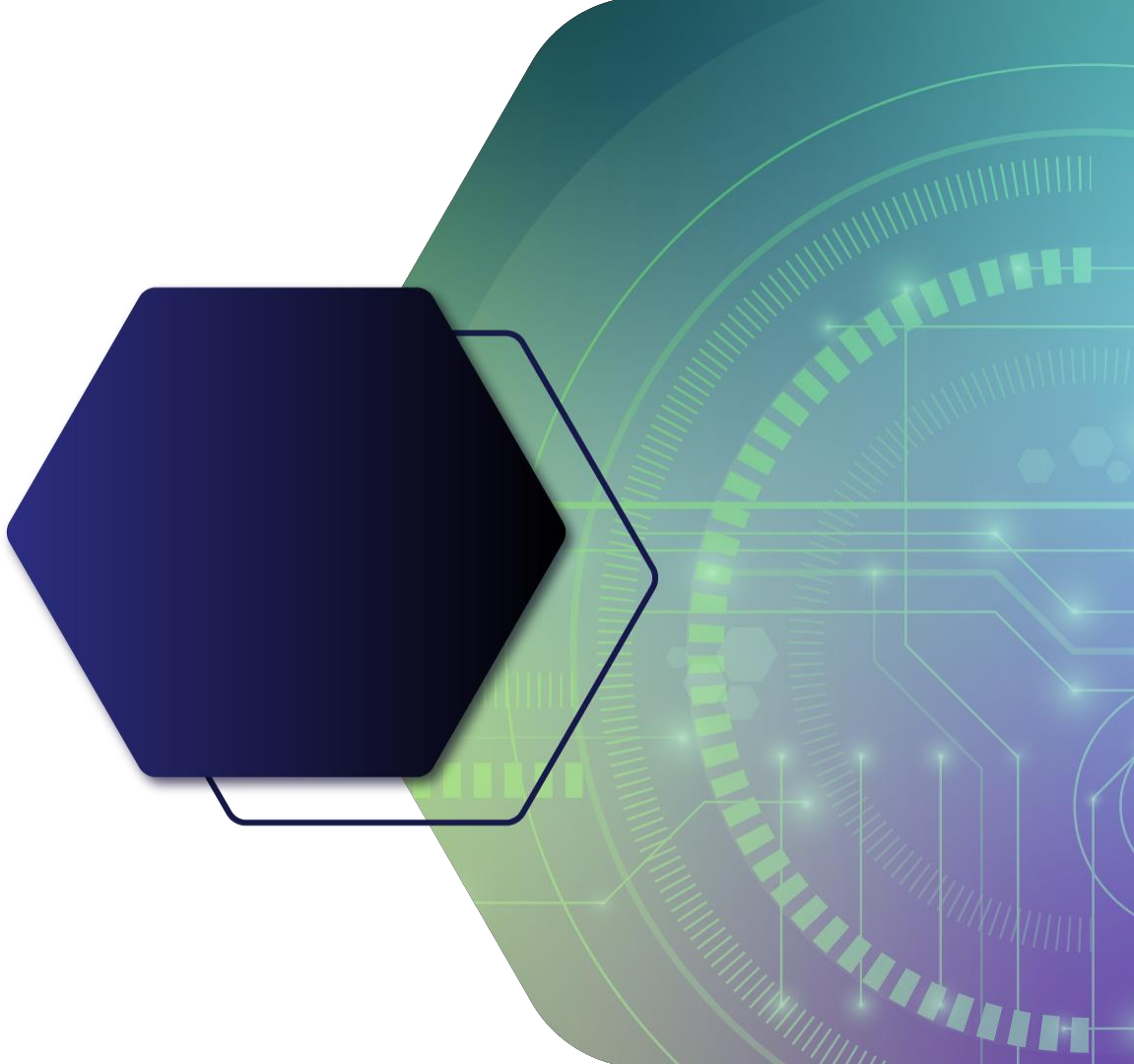

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