Molten Salt-based Thermal Battery to Decarbonize Process Heat

Molten Salt-based Thermal Battery to Decarbonize Process Heat

COMPANY NAME
Kyoto Group AS

TECHNOLOGY
-

TYPE OF OWNERSHIP
Public company

YEAR FOUNDED
2016

HEADQUARTERS
Lysaker, Norway

KEY MARKETS
Europe

INVESTMENT STAGE
Equity Finance

TOTAL FUNDING
$23.8 M (€22.1 M)

TOTAL REVENUE
-

EMPLOYEES
11-50

ABOUT THE COMPANY
Kyoto Group AS is a Norwegian clean energy technology company that develops industrial decarbonization solutions. The company has developed a molten salt-based thermal energy storage (TES) solution specifically for energy-intensive industries.

KEY CONTACT

NAME
-

PHONE
-

EMAIL
-

URL
https://www.kyotogroup.no/

Technology Snapshot

The company has developed the Heatcube, a thermal energy-storing battery that uses proprietary ternary molten salt as heat storage medium. This energy storage has a capacity of 16–96 megawatt hours and a charging capacity of 10–30 megawatts and can provide steam between temperatures of 170 and 400 degrees Celsius.

What Problem does the Technology solve?

Energy-intensive industries require huge amounts of process heat in manufacturing, which is provided by burning fossil fuels. As per International Energy Agency estimates, industries account for nearly 50% of global heat demand. Excessive use of fossil fuels in heat generation results in carbon dioxide emissions and the release of other harmful gases that contribute to climate change. The company's thermal battery provides a solution to this problem.

Attributes

High Heat Conversion Efficiency and Reduced Emissions

The product has a high electricity-to-heat conversion efficiency of > 90%. The Heatcube also eliminates CO2 emissions from process heat generation by replacing fossil fuels as the energy source.

Low Storage Footprint and Heat Loss

The Heatcube has a low storage footprint of 250 kilowatt-hours/m2, enabling more energy generation without the need for high footprint. The product has a low heat loss rate of <1% per day, providing long storage durations for thermal energy.

Long Operating Life

The molten salt-based thermal battery has a long operating life of more than 25 years.

Source: Frost & Sullivan

Kyoto Group AS - Value Proposition

Technology Assessment

The heatcube is a plug-and-play design and includes a series of tanks that heats the molten salt via renewable energy. The key advantage provided by the system is, during high renewable generation & low prices, thermal battery is charged i.e., Electricity is converted to heat and stored. Whenever the industry needs heat or during hours with high electricity prices, stored heat can be used for steam production for process heat or electricity generation. The company has 2 business models. With the Heat-as-a-Service model, the company enters into heat purchase agreements with customers and Heatcube is operated by Kyoto or its designated partners. With the Heat-as-a-Product model, the company sells the Heatcube directly to the customers while providing services and support for the product.

Key Competitors

- Alumina Energy, the United States
- Rondo Energy, Inc., the United States
- Hyme Energy ApS, Denmark
- Polar Night Energy, Finland
- Brenmiller Energy, Israel

Strategic Analysis

S – Strengths

- The plug-and-play design makes connecting with the heat generation network easier.
- Minimal moving parts result in lower losses.
- It can be charged whenever low-cost renewable energy is available.

W – Weaknesses

- The Heatcube technology does not have any significant weakness because it can provide high-quality steam as well as high efficiency heat conversion.

O – Opportunities

- The industrial sector is increasingly focusing on reducing carbon emissions and enhancing sustainability, which will provide ample opportunities for technology deployment.

T – Threats

- A strong decline in fossil fuel prices and improvements in point source emission reduction technologies may act as a threat.

IP/ Patent Activity

The company has filed for 3 patents pertaining to its thermal energy storage, circulation of molten salts and melting of ternary salts.

Future Focus Areas

In April 2023, the company signed memorandum of understanding (MoU) with one of the leading European renewable energy provider for industrial heat decarbonization.

In January 2023, Kaura Coproducts and Kyoto Group signed a letter of intent for the supply of its thermal battery technology. The Heatcube will replace nearly 40% of fossil fuel at Kaura Coproducts' production sites.

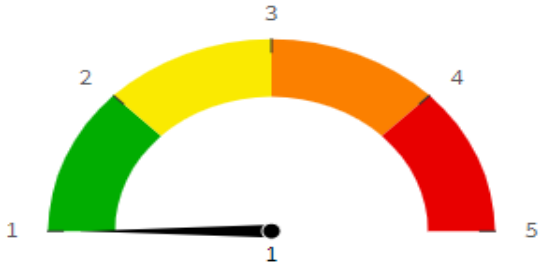
In January 2023, the company signed a letter of intent with Alfa Laval AB for the R&D of heat exchangers for molten salt-based thermal energy storage technologies. The company also signed a letter of intent with Kyotherm SAS to finance its Heatcube commercial projects.

Source: Frost & Sullivan

Kyoto Group AS - Investor Dashboard

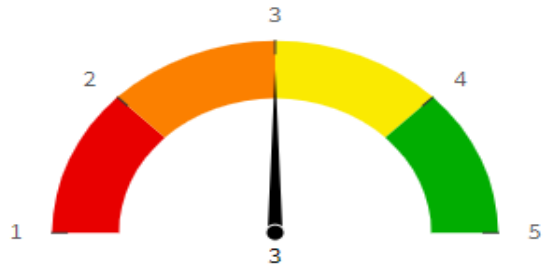
GROWTH INDEX

Risk Analysis



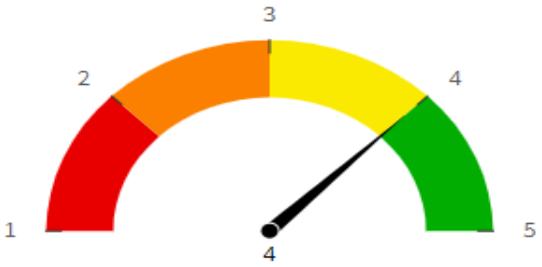
- The company has very strong project pipeline in various stages of completion. An 18 MWh storage capacity project is under construction while pipeline with 1000 MWh storage in assessment stage. Its total storage pipeline currently stands over 40 projects. Due to strong project pipeline, its risk related to future growth is low.

Revenue Magnitude Potential



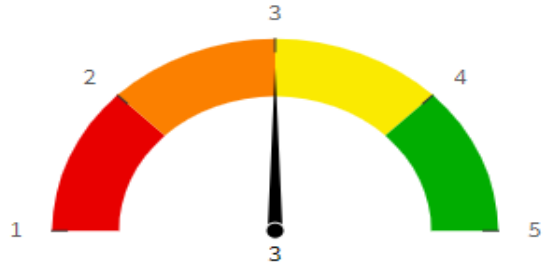
- The company is expected to achieve the EBITDA break-even by 2025. In addition, its strong project pipeline and well thought out funding strategy will significantly contribute towards company's revenue magnitude potential.

Buzz Worthiness



- In April 2023 the company joined The United Nations Global Compact which aims to promote responsible business practices. Kyoto's solution also meets two of the Sustainable Development Goal agendas.

Investor Lens



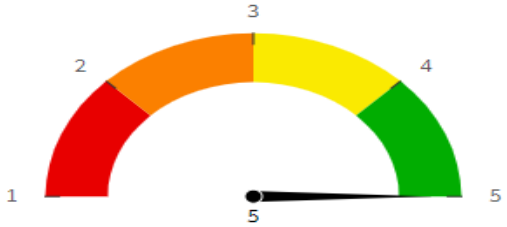
- In 2021, the company raised approximately $17.1 million via new equity to fund its R&D and growth. The company has also received debt financing approval from Nefco. The total financing can go as high as $4.4 million (EUR 4 million).
- The cumulative funding generated by the company as of 2023 is USD 23.8M (EUR 21.1M)

Source: Frost & Sullivan

Kyoto Group AS - Investor Dashboard

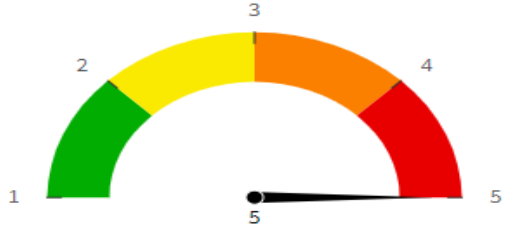
INNOVATION INDEX

Commercialization Readiness Level



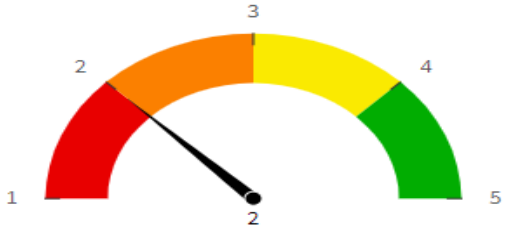
- Kyoto Group AS conducted its 1st pilot-scale demonstration of the product in 2020 and launched its 1st commercial Heatcube installation in 2022. The company launched the technology's 2nd generation in the last quarter of 2022 for commercial deployment. The Heatcube's commercialization readiness level is high.

Technology Competition Level



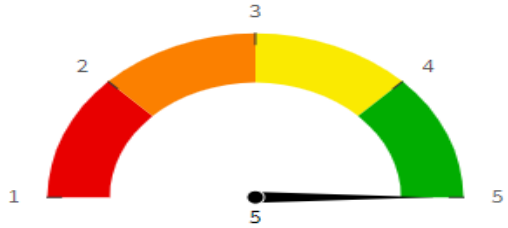
- The Heatcube will compete with other thermal energy storage solutions including solid state TES offered by other competitors. TES solution will also compete with Li-ion battery storage technologies.

Regional Impact



- The company primarily operates in Europe

Application Potential



- Reliable and low-cost heat for key industries such as iron & steel, food processing, pulp and paper, petrochemicals, CHP systems and metals & minerals production.

Analyst's Insights

With the announcement of net-zero emission goals, the industrial sector is increasingly coming under scrutiny because of its high fossil fuel use, process-heat generation, and subsequent carbon emissions. As a result, consumer awareness and policies supporting industrial decarbonization are growing. The Heatcube's thermal battery can meet the industry's need for energy security and sustainability and can play a vital role in electrifying and decarbonizing process heat. It can also provide grid balancing services and minimize investment needs for Transmission System Operators (TSO) and Distribution System Operators (DSO). The company is also on track to achieve low CAPEX of $44/kWh and levelized cost of storage of $16.5/kWh by 2025.

Source: Frost & Sullivan