



“Utility scale long duration synchronous pumped heat electricity storage for the energy transition“

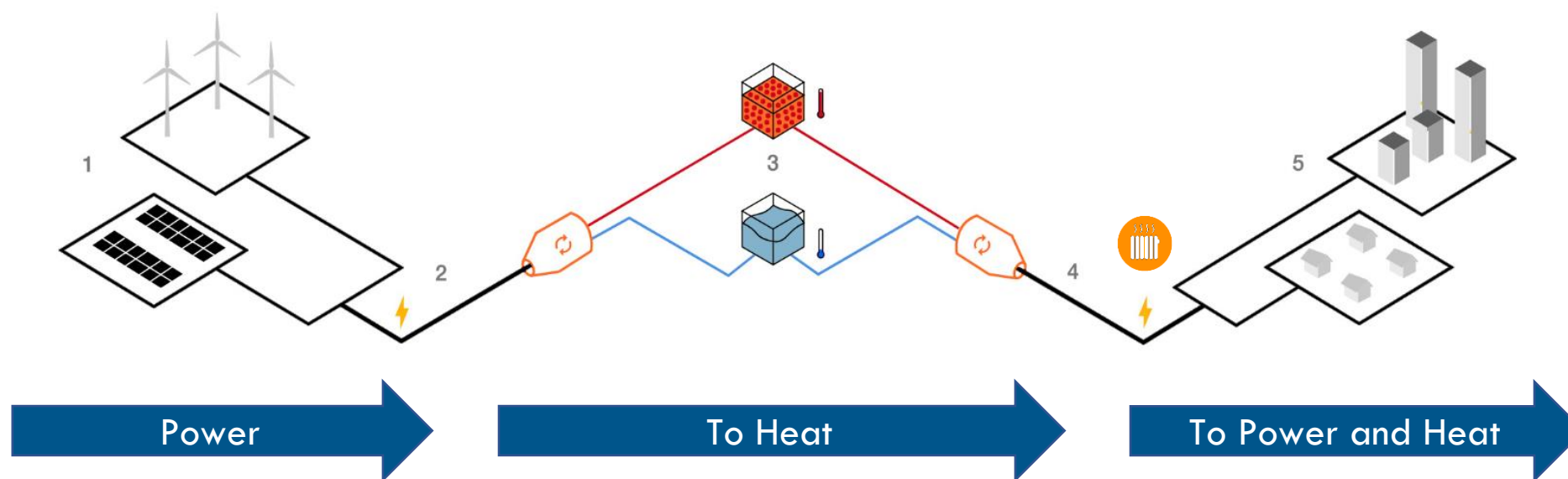
Michael Geyer, Malta Inc.



*MEDIUM-DURATION ENERGY STORAGE, 16TH MARCH 2022,
INSTITUTE FOR MECHANICAL ENGINEERS (IMECHE), LONDON*

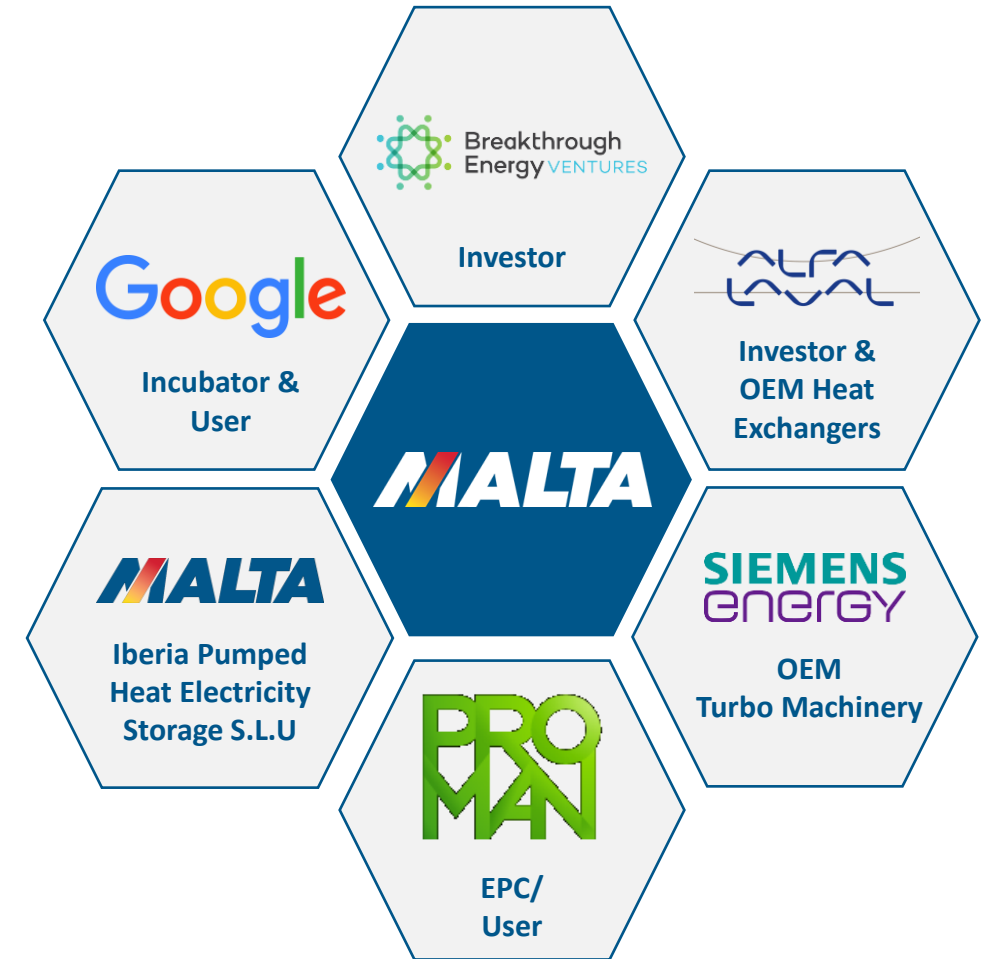
Breakthrough Grid-Scale Energy Storage

- Long Duration: 8 - 24+ hours
- Grid Scale: 100+ MW
- Mature technology: Molten salt storage
- Innovative breakthrough: Integration with high temperature heat pump technology boosts electrical roundtrip charge/discharge efficiency from currently <40% to up to 60%



Malta Partners

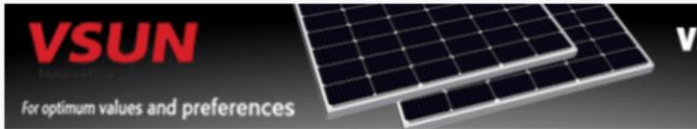
- Malta's ownership represents a unique balance of **bold visionaries** and **world-class execution experience**
 - Breakthrough Energy Ventures
 - Google
 - Proman
 - Chevron and Piva
- Strong commitment in Europe
 - Malta Iberia Pumped Heat Electricity Storage SLU
 - Malta Hochtemperatur Wärmepumpen Stromspeicher GmbH
- Selected strong Own Equipment Manufacturers
 - Heat Exchanger OEM – Alfa Laval
 - Turbomachinery OEM – Siemens Energy



Malta Inc and Siemens Energy progressing in TM development

pV magazine

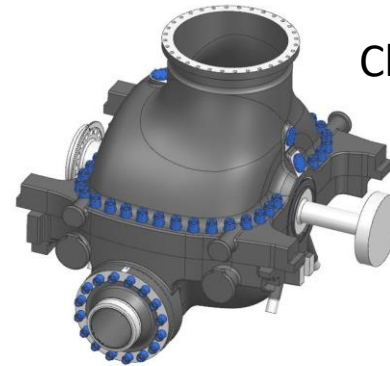
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Siemens and Malta team up to develop scalable energy storage technology

The two will design turbomachinery components to support long-duration energy storage systems that could scale over time to the gigawatt range.

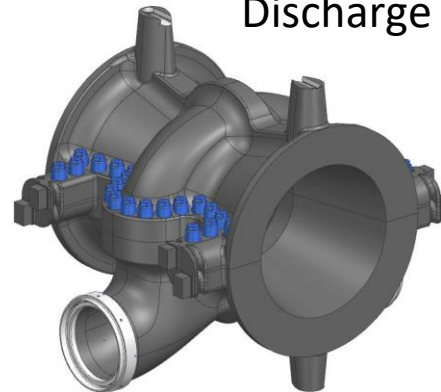
JULY 8, 2021 RYAN KENNEDY



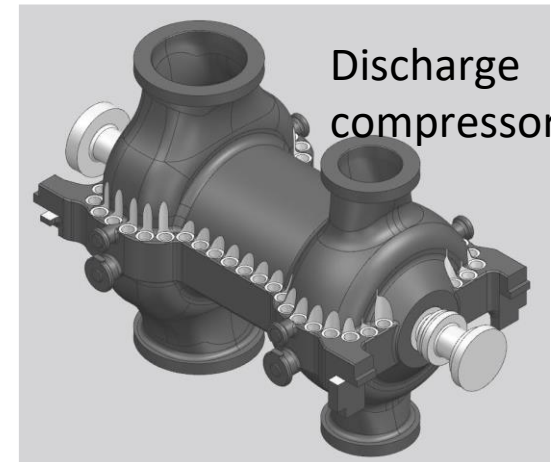
Charge turbine



Charge compressor



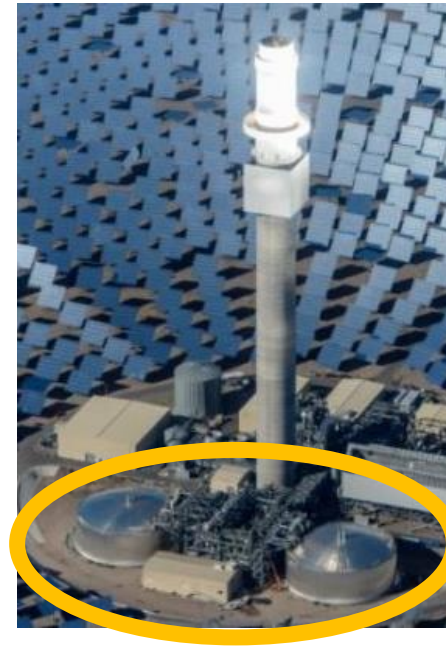
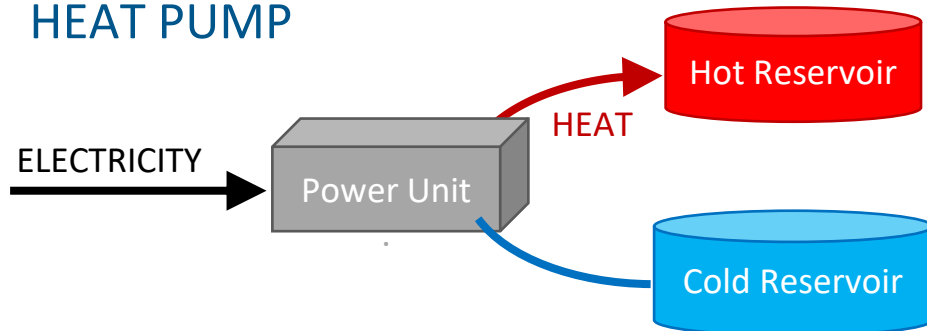
Discharge turbine



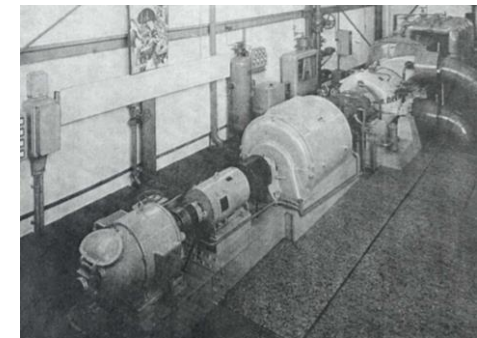
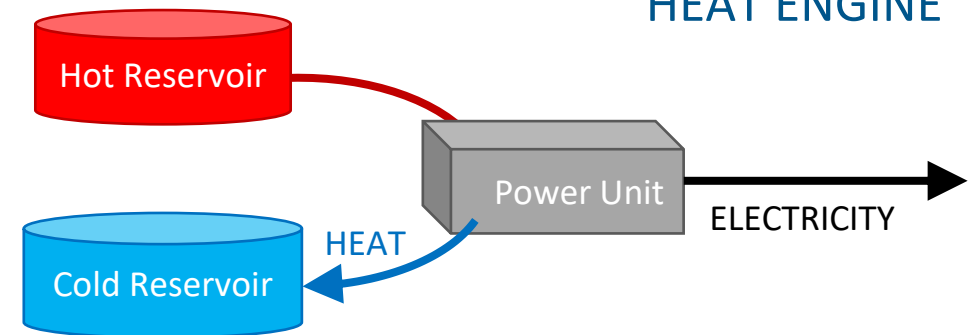
Discharge compressor

HOW IT WORKS

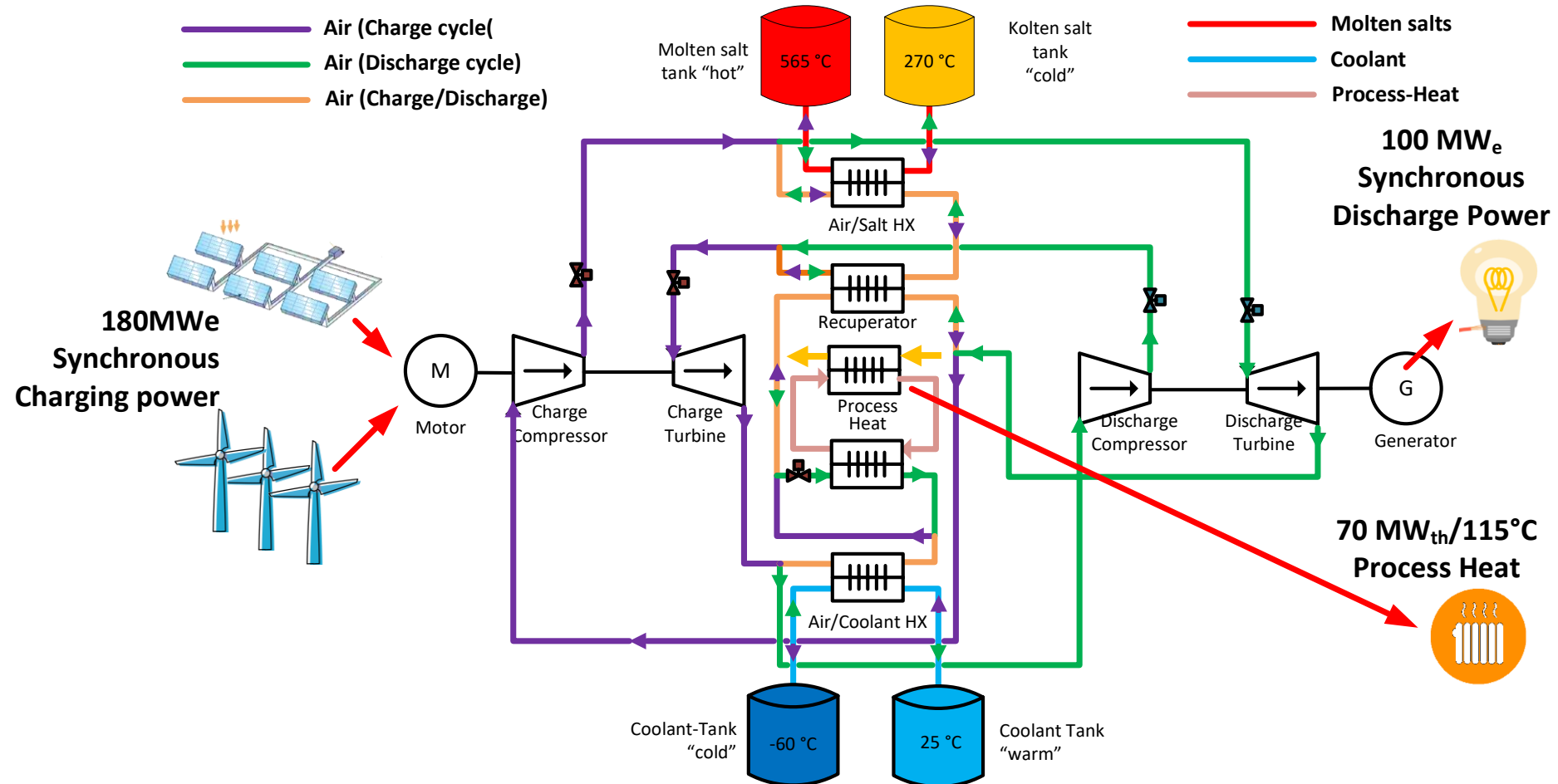
Consumption (Charge):
HEAT PUMP



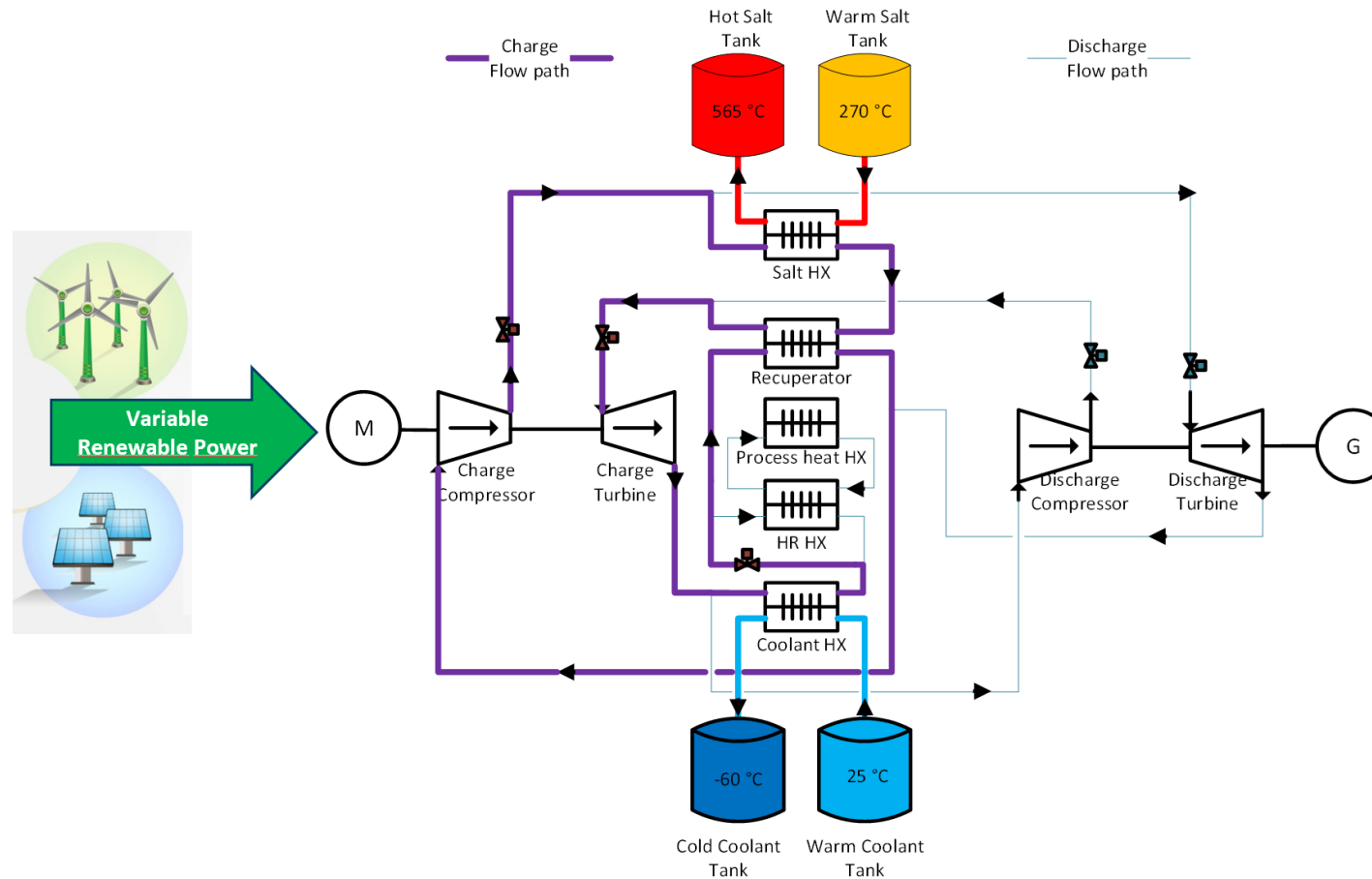
Generation (Discharge):
HEAT ENGINE



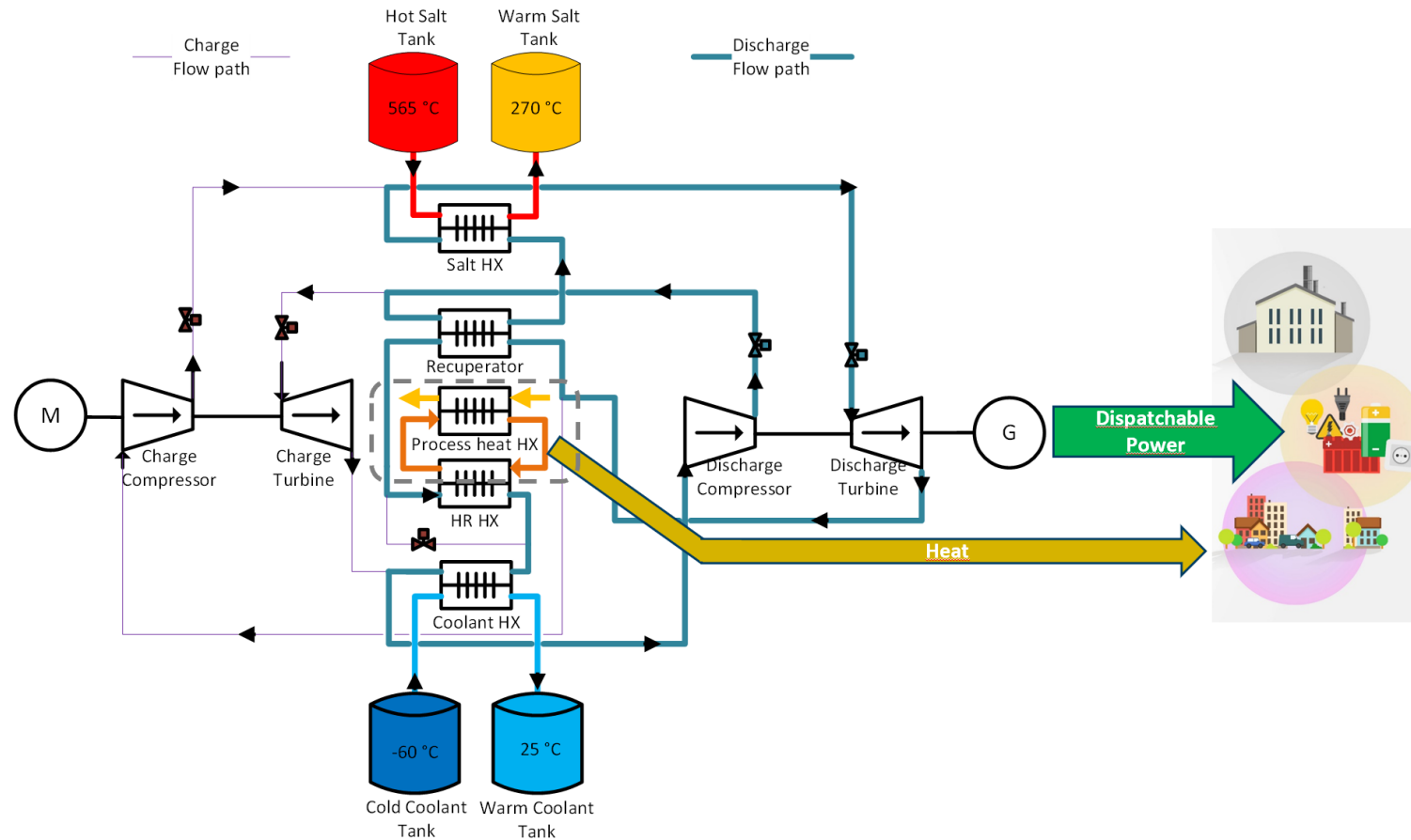
Malta with its technology partners is improving molten salt storage charge/discharge efficiency up to 60%



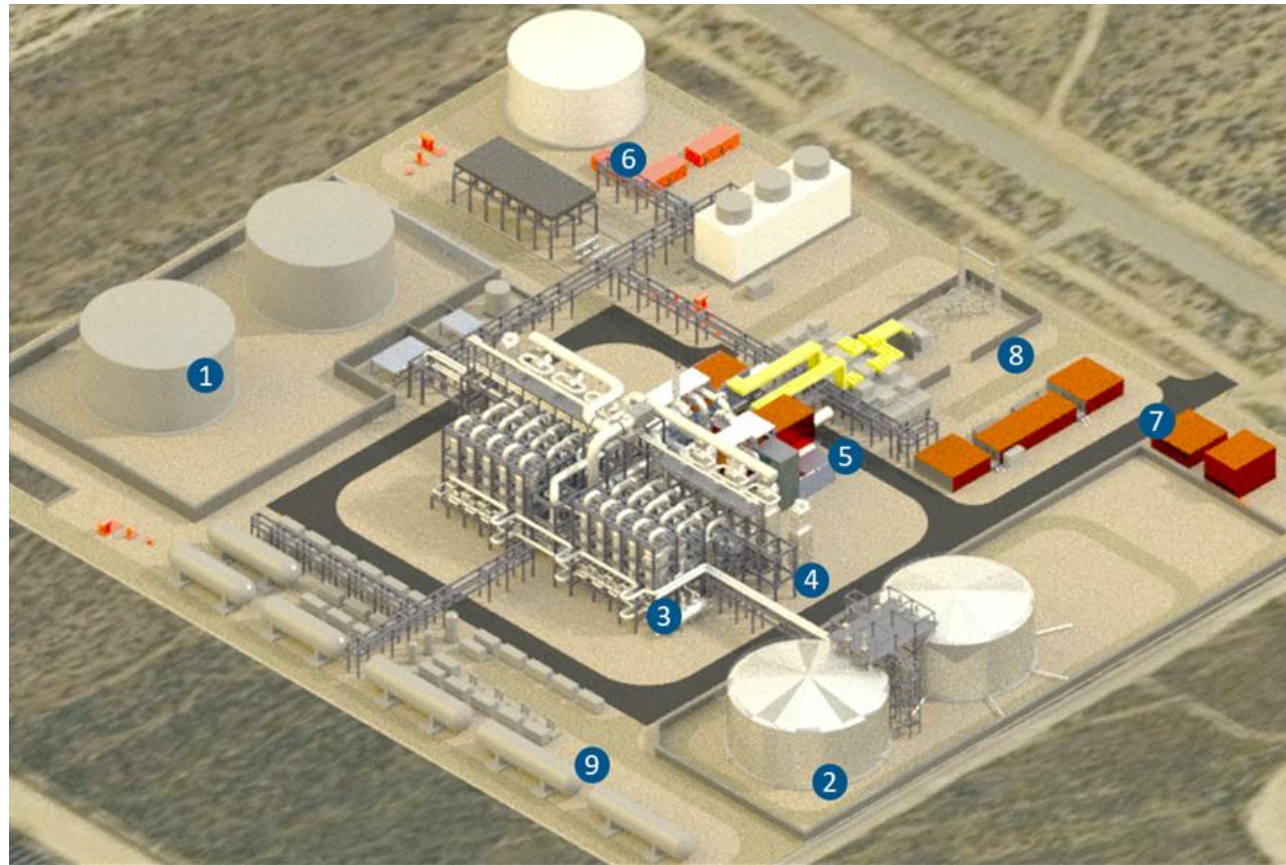
Malta PHES Charging Process



Malta PHES Discharging Process

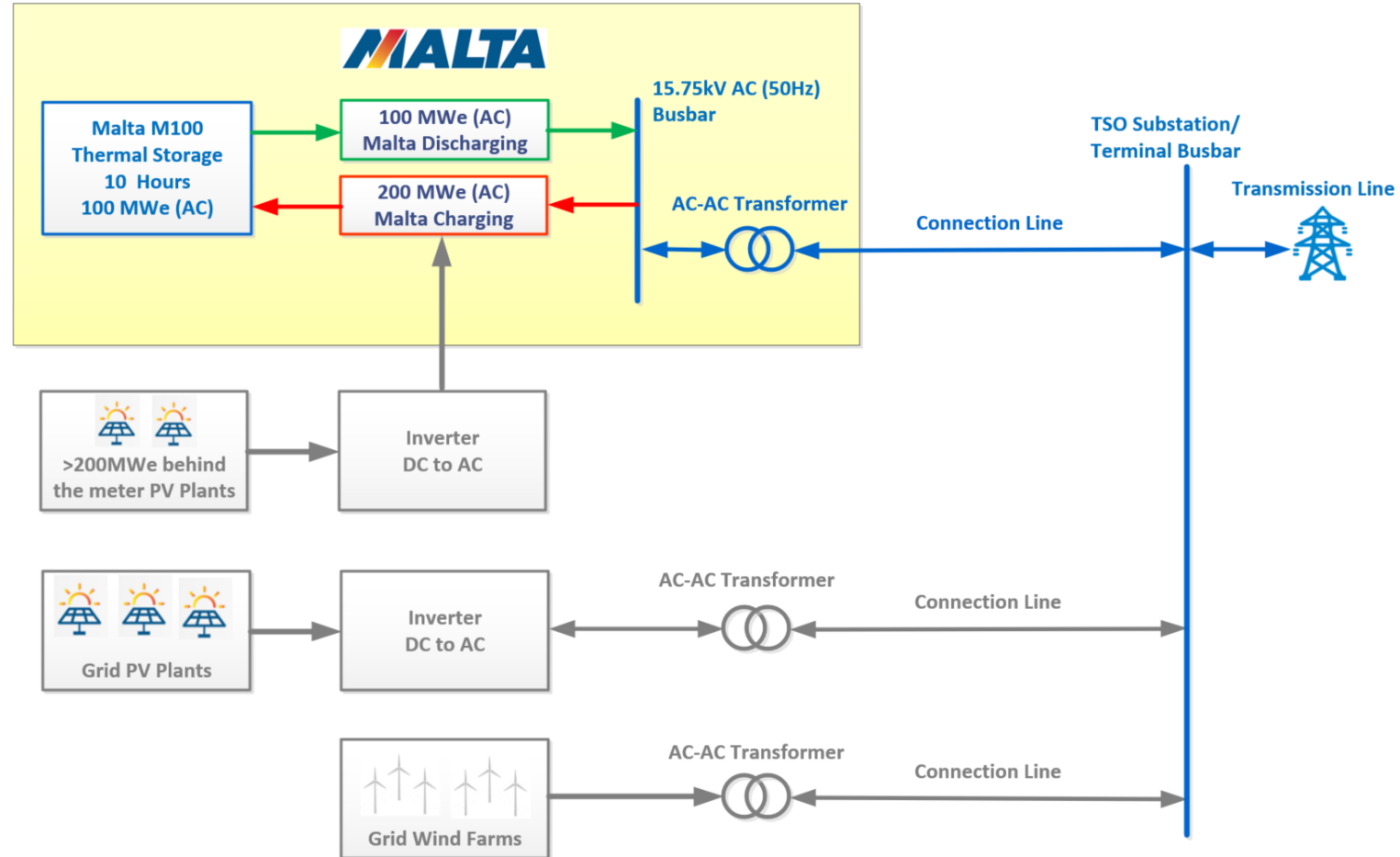


Malta M100 3D Layout



- | | | | | |
|-----------------|----------------|------------------|--------------|----------------------------|
| ① Coolant tanks | ③ High Temp HX | ⑤ Turbomachinery | ⑦ Controls | ⑨ Inventory Control System |
| ② Salt tanks | ④ Low Temp HX | ⑥ Fire Control | ⑧ Switchyard | |

Malta M100 Storage Interconnection Options



PHES Pilot System at South West Research Institute, USA



- Southwest Research Institute (SwRI) Pilot demonstration of shared hot, cold, and recuperator heat exchangers, liquid hot thermal storage and liquid cold thermal storage—and functions as a small-scale pilot system of the Malta technology
- Design and construction of a pumped heat energy storage system with the same basic architecture as the Malta system—charge heat pump powertrain and discharge heat engine powertrain

2021 Malta Teams Up with Duke Energy to Study Possibility of Converting Coal Units into Clean Energy Storage Facilities

May 19th, 2021: Malta Inc. is teaming up with Duke Energy to study the socioeconomic, environmental and operational benefits of converting retiring coal units into long-duration, zero-emissions energy storage systems by integrating Malta's 100-megawatt, 10-hour pumped heat energy storage system into existing infrastructure at a Duke Energy coal plant in North Carolina with the potential benefits including:

- Job retention
- Local economic impacts
- Environmental benefits
- Operational benefits

The goal is to scale technologies that are currently too expensive to compete with fossil-fuel-based incumbent technologies.

A U.S. Department of Energy grant is funding the year-long study of the emerging technology.

<https://news.duke-energy.com/releases/malta-teams-up-with-duke-energy-to-study-possibility-of-converting-coal-units-into-clean-energy-storage-facilities>

Malta teams up with Duke Energy to study possibility of converting coal units into clean energy storage facilities

Novel approach to turn coal plants into energy storage stations

MAY 24, 2021 TIM SYLVIA

UTILITY SCALE STORAGE UNITED STATES



Duke Energy coal-fired power plant

<https://www.pv-magazine.com/2021/05/24/novel-approach-to-turn-coal-plants-into-energy-storage-stations/>

Thank You



Long-Duration
10 - 24+ Hours



Grid-Scale
100 MW+



Low-Cost
<€200/kWh

