

Malta Pumped Heat Energy Storage

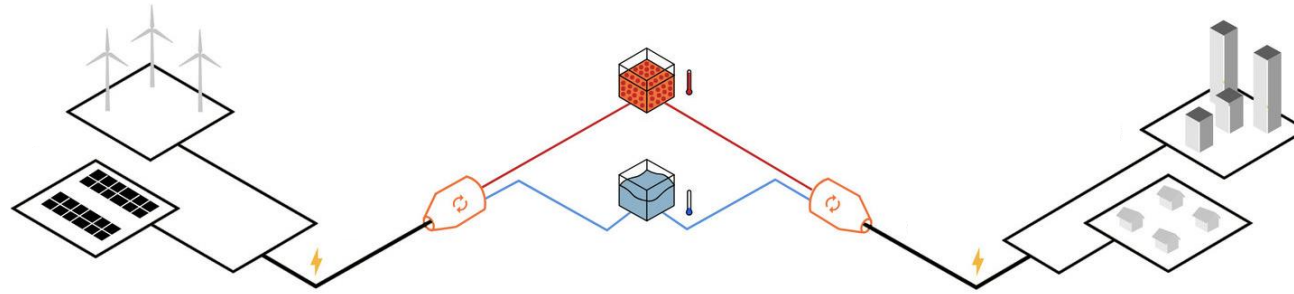
Ben Bollinger

3rd Thermal-Mechanical-Chemical Energy Storage Workshop

2021-08-10



Malta is Long-Duration Energy Storage



Malta's grid-scale pumped heat energy storage system (PHES) is a low-cost, long-duration solution which will enable the global energy transition



Long-Duration

10 – 200 Hours



Grid-Scale

10 – 100 MW+

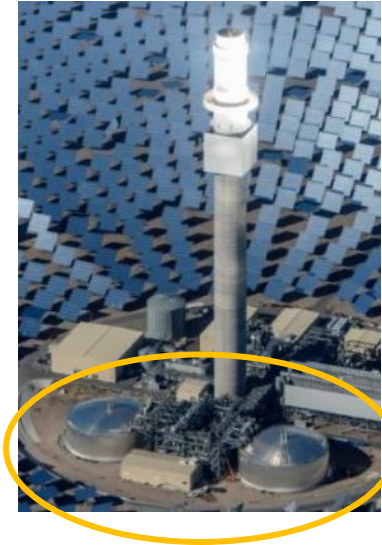
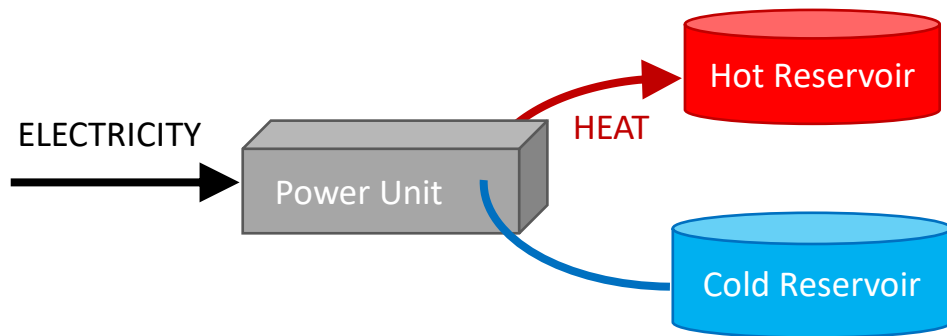


Low-Cost

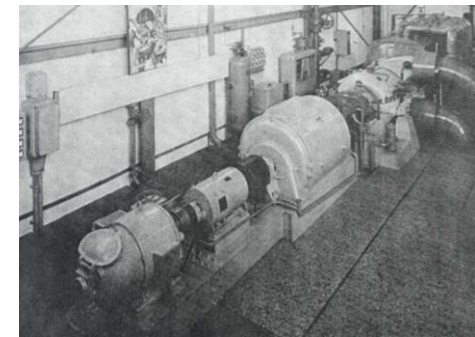
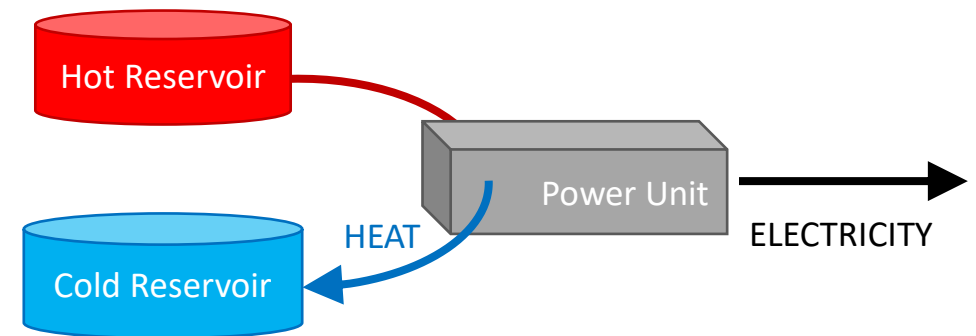
<\$100/kWh at 10h

How it works

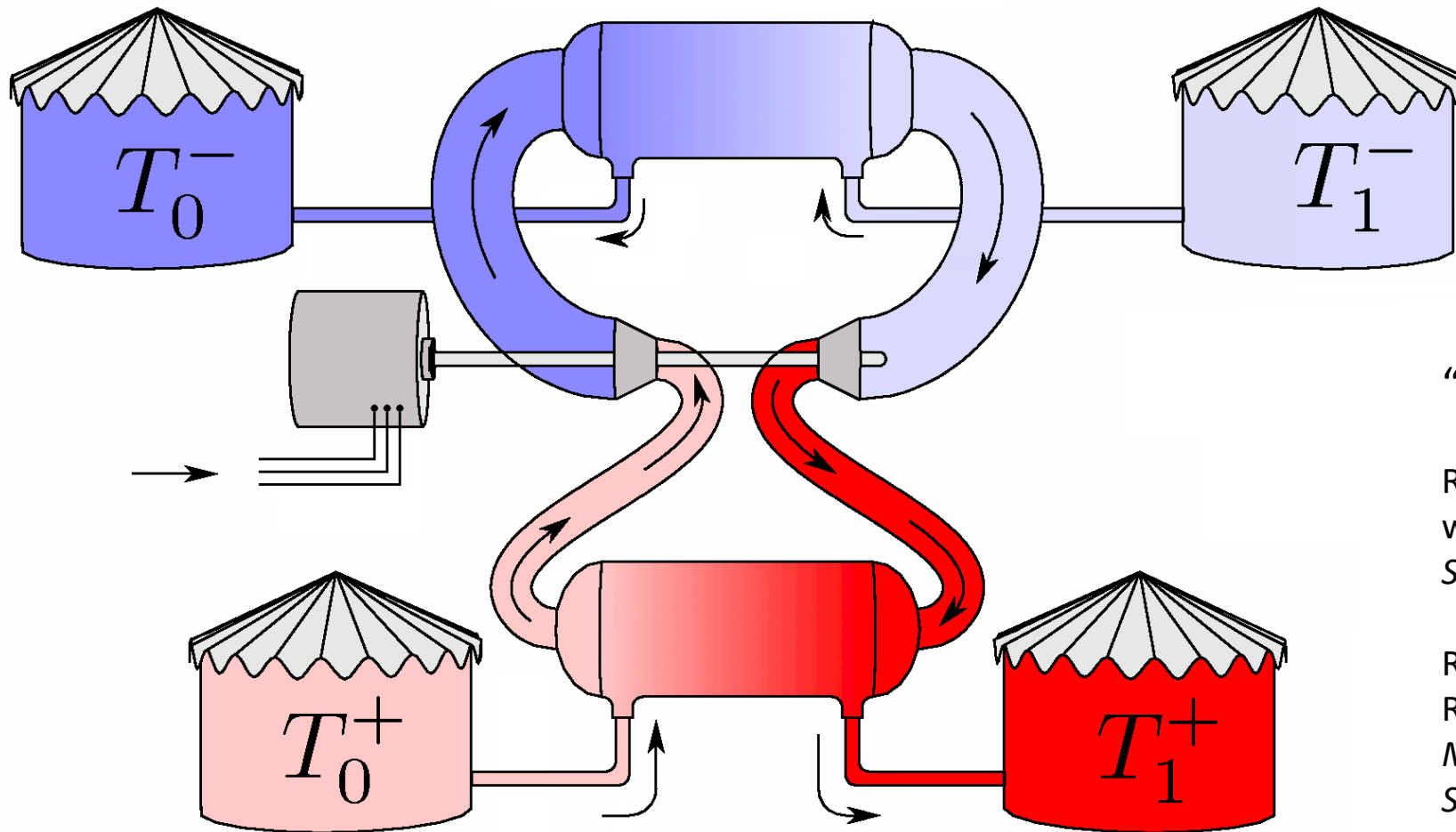
Charge: HEAT PUMP



Generation (Discharge): HEAT ENGINE



Malta PHES: Recuperated Air-loop Brayton-cycle Heat Pump/Heat Engine



“Necessary, Sufficient, and Doable”

R.B. Laughlin, “Pumped thermal grid storage with heat exchange,” *Journal of Renewable and Sustainable Energy* 9, 044103 (2017)

R. B. Laughlin, “Mass Grid Storage With Reversible Brayton Engines,” in *Thermal, Mechanical, and Hybrid Chemical Energy Storage Systems*, ed. by K. Brun, R. Dennis and T. Allison. London UK, Elsevier, 2021.

Technical Team Focused on Execution



Erhan Karaca
VP Engineering

25+ years in power gen
13 years with GE USA



Janina Hippler-Nettlau
Sr. Project Engineer

13 years in power gen
CSP construction, maint.



Mert Geveci, Ph.D.
Director, Control Systems Eng

16 years controls at Cummins,
GE Energy, GE Renewables



Kurt Waldner
Product Manager

25 years with GE USA
Services, Storage, LTSA



Samar Shah
Technical Lead, System Integration

12 years mech & process
6 years energy storage



Tom LeRoy
Technical Lead, Plant Sys Integr

35 years at GE USA
Led several CCS NPI efforts



Elyse Doyle, PMP
Project Manager

5 years at DNV
6 years in energy industry



Pravallika Vinnakota
Lead Engineer, Modeling & Sim

10 years appl. & simulation
8 years at The Mathworks



Escarlata Muñoz
Project Engineer

7+ years power plant design
CCGT and CSP electrical sys



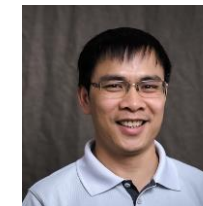
Harsh Oke
Technical Lead, Turbomachinery

21 years at GE USA
CCGT Design, Testing, Cost



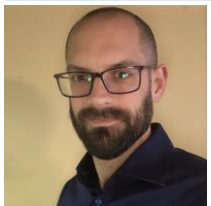
Finn Runkel
Sr Engineer, Performance

13 years in power gen
CSP plant performance



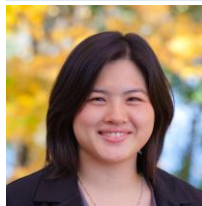
Bao Truong, Ph.D. PE
Technical Lead, Strategic Initiatives

10 years power industry
8 years nuclear reactor design



Benjamin Bollinger, Ph.D.
VP Strategic Initiatives

14 years startup experience
10 years CAES and TES



Tian J. Ong
Lead Engineer, Process

10 years process engineering
Chemical, process, thermal



Michael Geyer, Ph.D.
Managing Dir., Malta Europe

Developed 6 CSP projects
450 MW CSP scratch to close

Heat Exchanger Partner & Investor



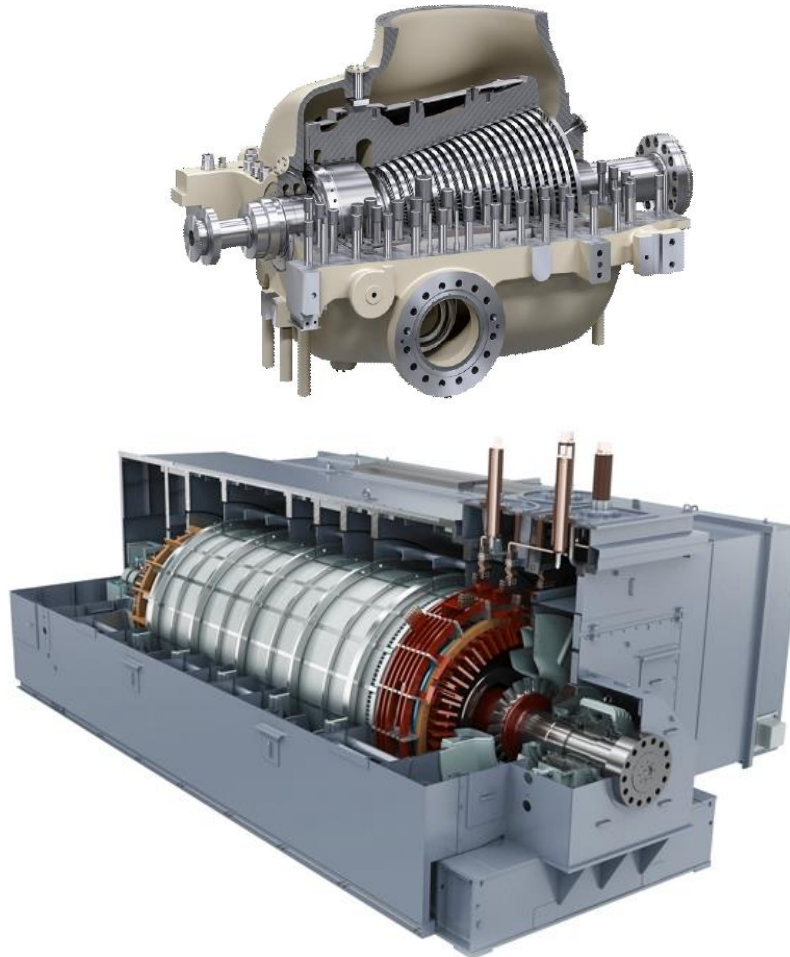
The world's leading heat
exchanger company



100 MW Turbomachinery & Powertrain Partner

SIEMENS
energy

One of the world's
largest turbomachinery
manufacturers



Engineering Partner & Investor



One of the world's largest
methanol producers





MALTA