



University Panel Discussion

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**UW -Thermal Hydraulics
Laboratory**



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**Gigawatt-Hour Heat
Storage with Assured
Peak Electric Generating
Capacity**



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**On Computational Tools to
Model Thermal and
Thermochemical Energy
Storage Systems**



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**Solar thermochemical energy
storage overview for high-
temperature applications**



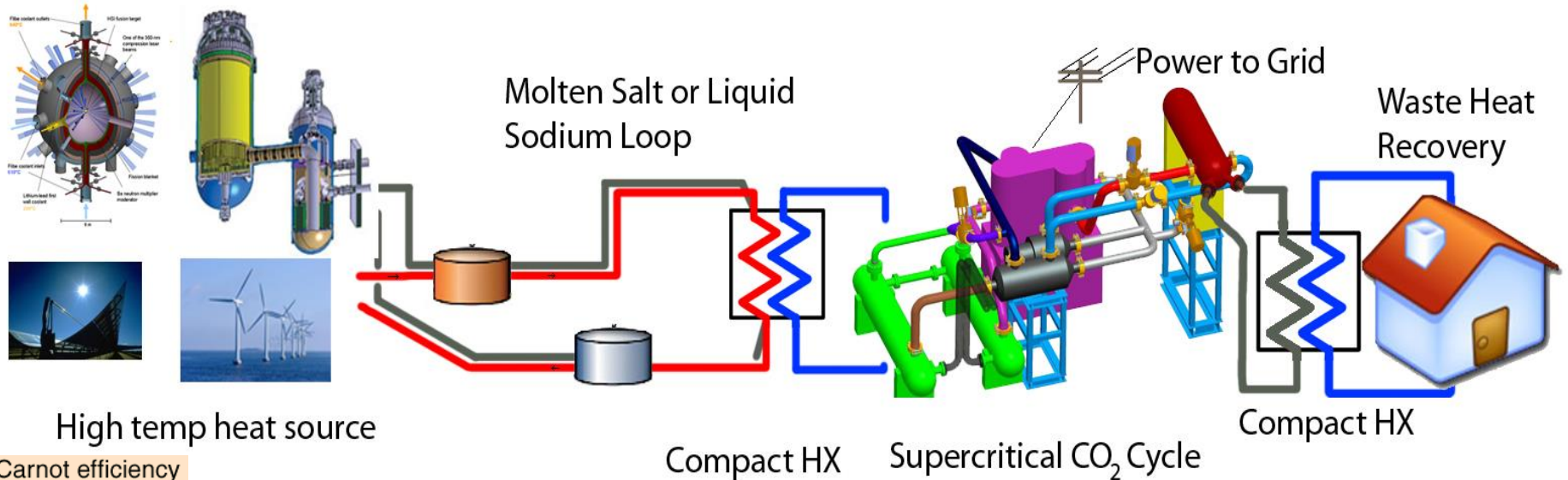
Eric Severson

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**Next Generation Electric
Machinery**



Effective Energy utilization



Carnot efficiency

$$\frac{T_H - T_C}{T_H} \times 100\%$$

Study advance energy sources to increase efficiency and power output

- Fission-VHTR, FHR, SFR
- Fusion
- Concentrated solar
- Biomass
- Clean coal

Use or store energy to make use in different applications

- Electrical power generation
- Chemical processes
- Advanced oil recovery
- Grid power stabilization and utilization

Develop new power conversion cycles

- Improved efficiency
- Lower cost
- Smaller components
- Higher temperatures
- lower water usage

Reduce waste heat

- Use low quality waste heat
- Recycle heat from chemical process
- Backup Power conversion

What 800° C Looks Like



- Designing a storage system to withstand this temperature for 20 yrs isn't trivial.
- Heat storage and heat transfer fluids need to be evaluated.
- High temperature sensors, valves and components need to be engineered and tested.



(a)

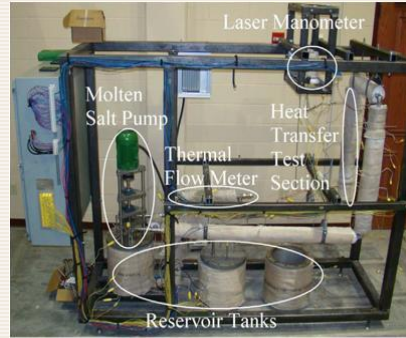


(b)





Salt flow corrosion loop



MgCl-KCl loop



MgCl-NaCl - PCM test

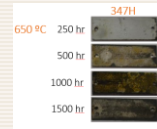


Natural circulation Flibe loop

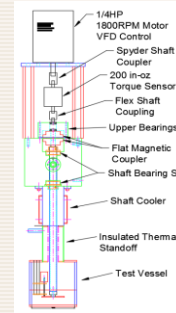
Moderate scale liquid salt flow loops for component testing



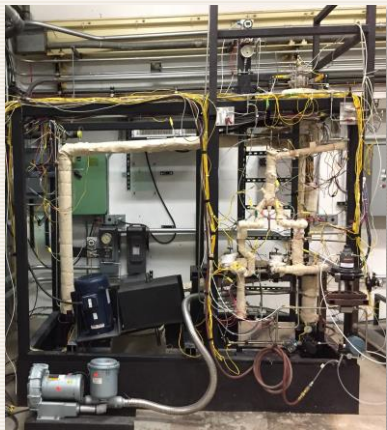
Static corrosion testing, nitrates, chlorides, fluorides, carbonates



Under salt pin on disk



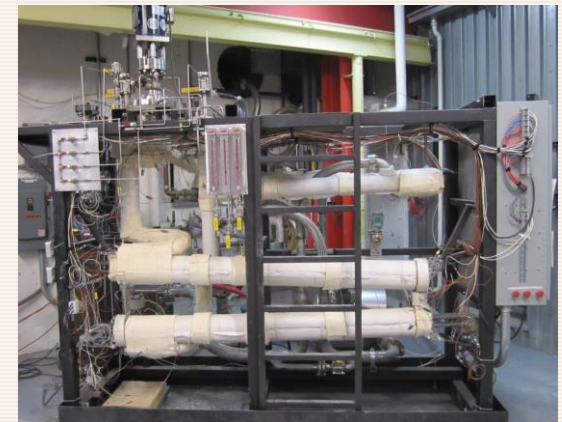
Salt Joint and component testing



Sodium test loops



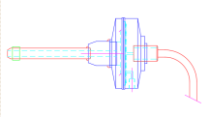
HTF purification and manufacturing system



Forced circulation flibe loop



6 inch molten salt valve tests



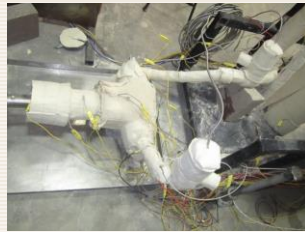
NaK filled high temperature pressure sensors



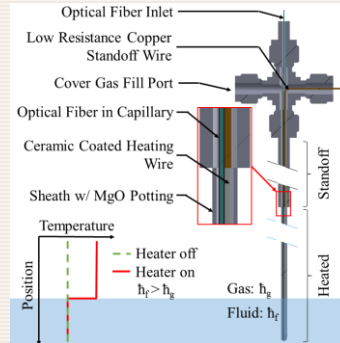
Molten salt heat exchanger development and testing



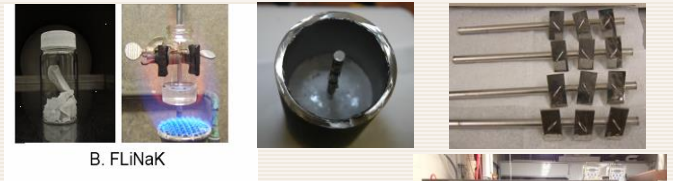
High temp molten salt Venturi flow meters



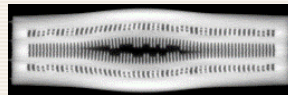
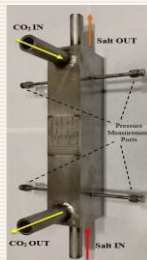
Valve and Pressure transducer testing



High temperature high resolution level detection and temperature measurement with optical fibers



Glovebox salt redox and corrosion testing

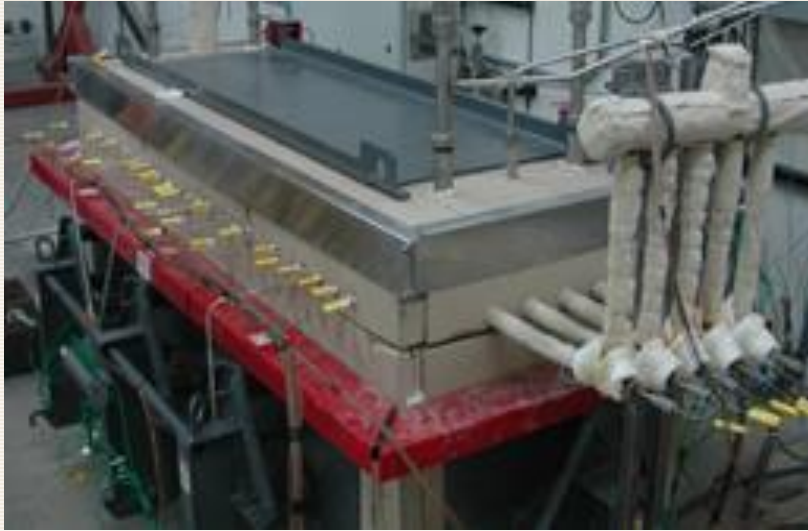


sCO₂ Testing

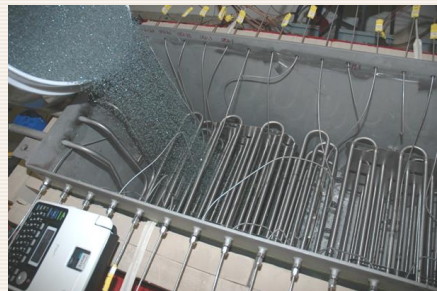
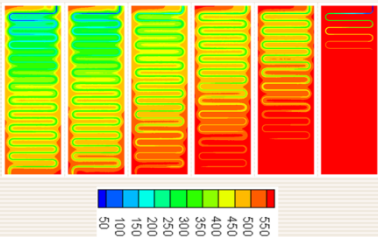
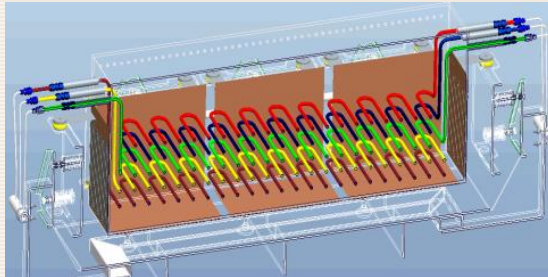
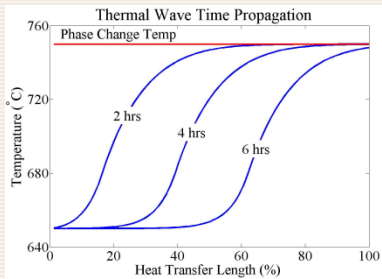


Reaction of HTFs with hydrocarbons, concrete

Electric to thermal to electric (latent heat)



Thermal battery is filled with SiC Granules (used to increase the thermal conductivity of salt when solid) – box is then sealed purged with N₂ gas and then filled with purified NaClMgCl salt from melt tank. Makes use of both sensible liquid -> latent heat -> sensible solid. Flexible charge/discharge cycle.



Success Metric

Low Cost

High Energy Density & Exergetic Efficiency

Strategy

Designed for High Volume Manufacturing

Latent Heat Storage (Salt)

Enabling Innovation

Modular, Design-for-Manufacturing

Sharp Thermal Wave via embedded HX

Controlled, Anisotropic Thermal Conductivity

Thermal Ratcheting Controlled