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TMCES 2023 Panel Presentation

August 2023

Daniel Mark Mikkelson

Changing the World's Energy Future

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IES
Integrated Energy Systems

Energy Storage Projects at Idaho National Laboratory

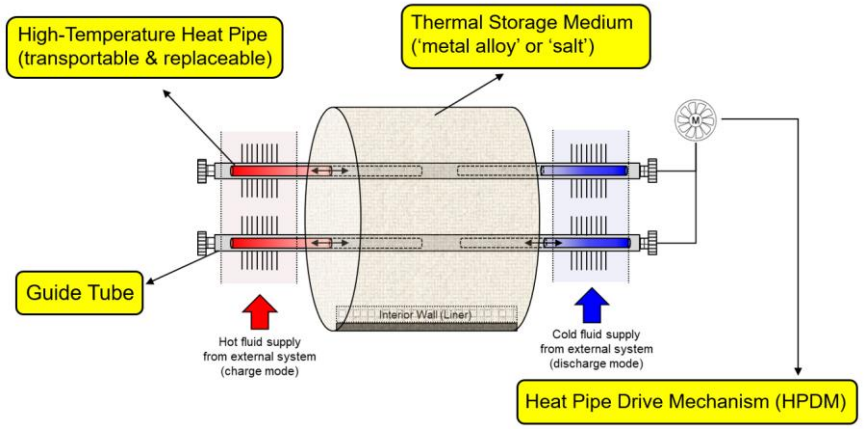
TMCES Workshop
August 2-3, 2023

Presented by:
Daniel Mikkelson, Ph.D.

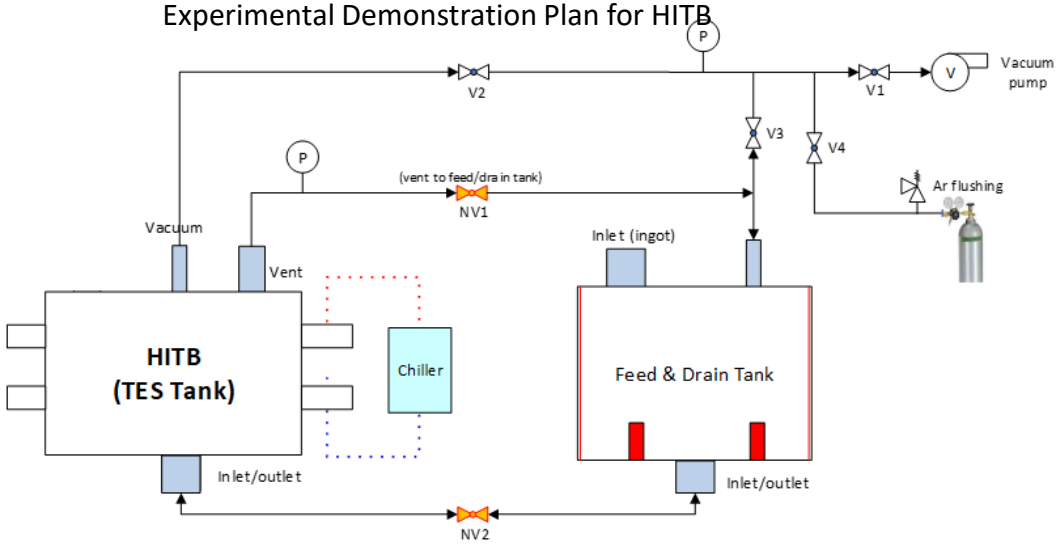
Heat Pipe-Integrated Thermal Battery (HITB) for Versatile Integration with Emerging Microreactors

INL Laboratory Directed Research Development Program

Heat pipe-Integrated Thermal Battery (HITB)



Experimental Demonstration Plan for HITB



- HITB is a high-temperature latent-heat thermal energy storage (TES) that allows for versatile integration with various thermal systems, including nuclear microreactors.
- Alkali-metal heat pipes, designed to be displaceable using a driving mechanism, are introduced for dynamic control of TES operation at high temperatures.
- Easy to scale up to multiple modules and can be interfaced with any thermal systems with minimal safety issues.
- Detailed design of experimental demonstration facility has been completed through small-scale experimental demonstrations and modeling-informed optimization efforts.
- Experimental facility will be built at INL this year for demonstration and associated validation research.

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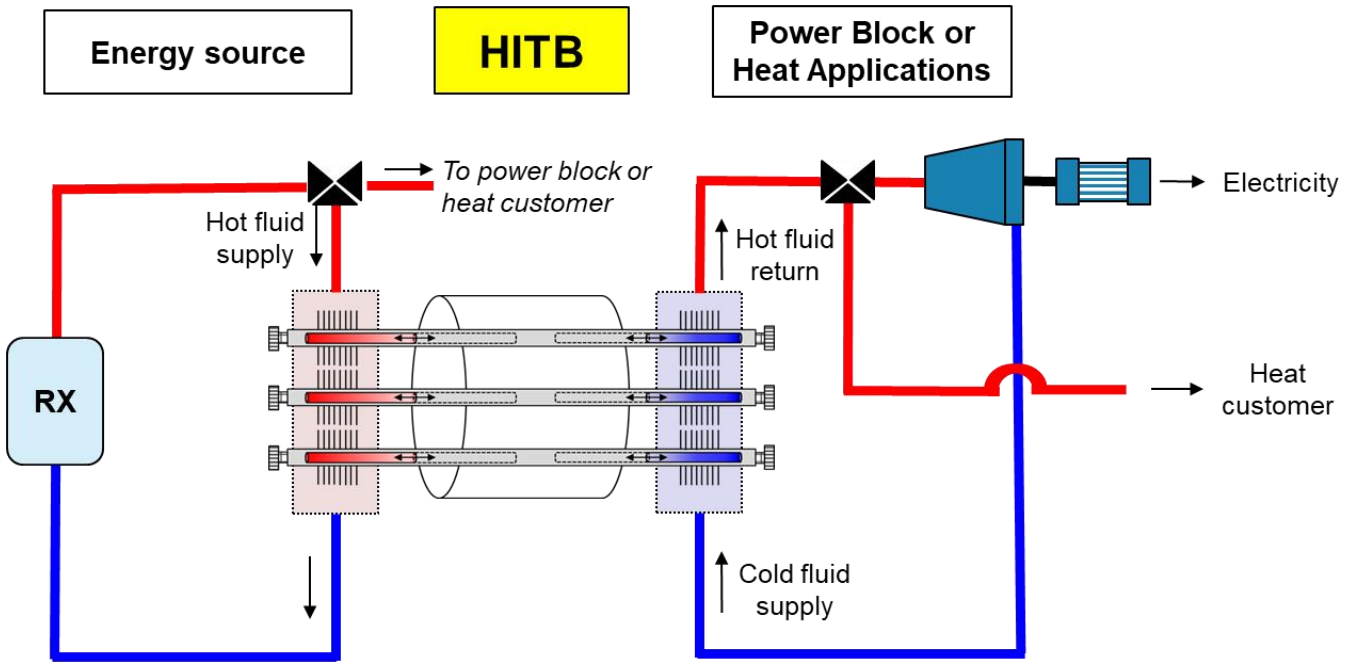
Heat Pipe-Integrated Thermal Battery (HITB) for Versatile Integration with Emerging Microreactors



- ✓ Easy coupling
- ✓ No additional pump or heat exchanger
- ✓ Low cost for integration and maintenance
- ✓ High temperature application
- ✓ Easy to install and operate (like battery)

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Heat Pipe-Integrated Thermal Battery (HITB) for Versatile Integration with Emerging Microreactors

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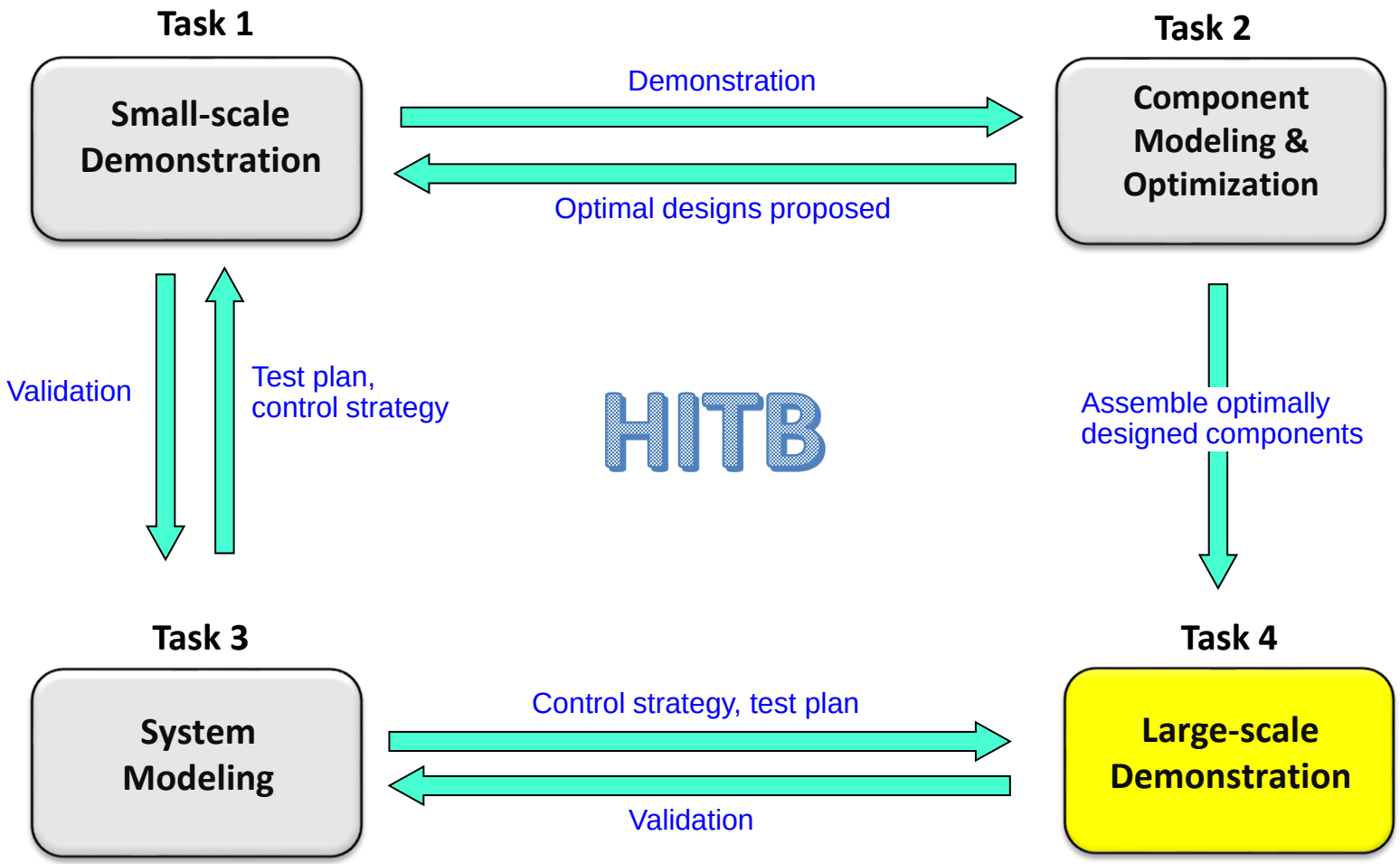

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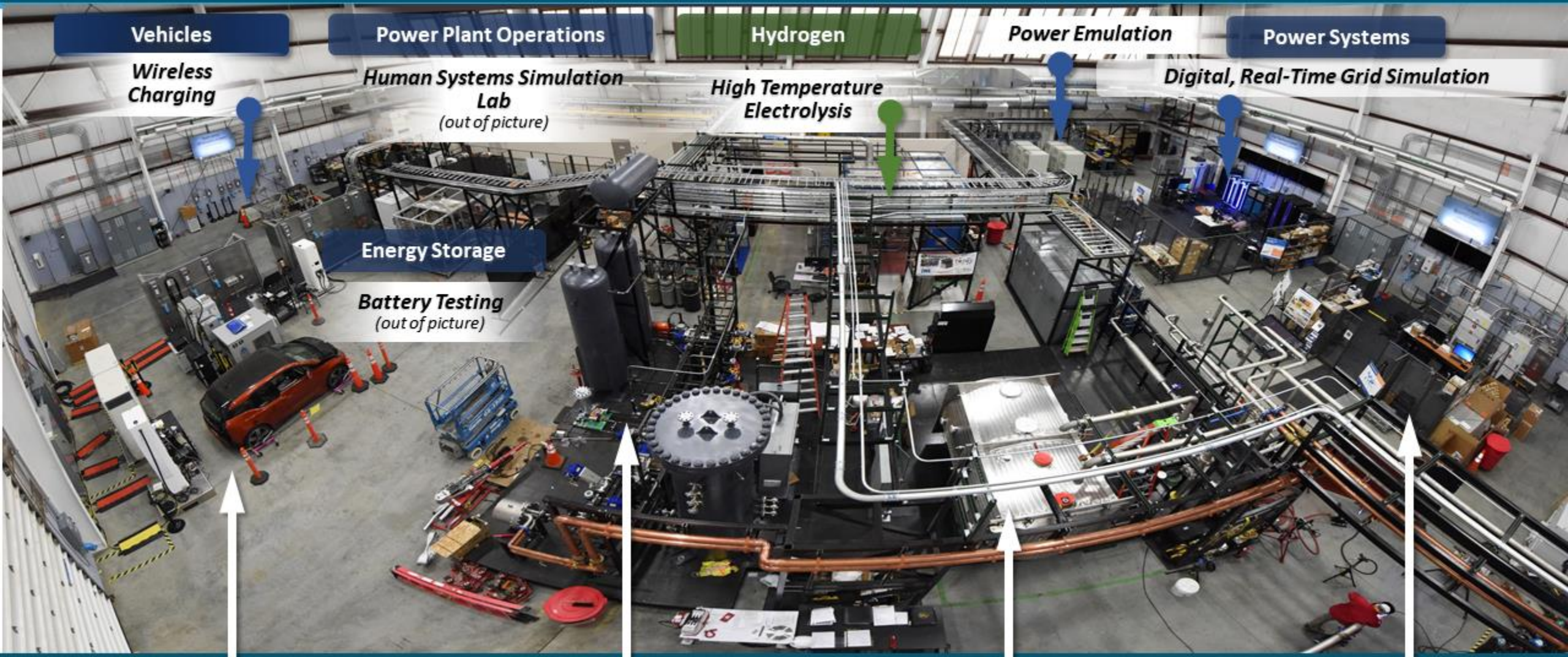
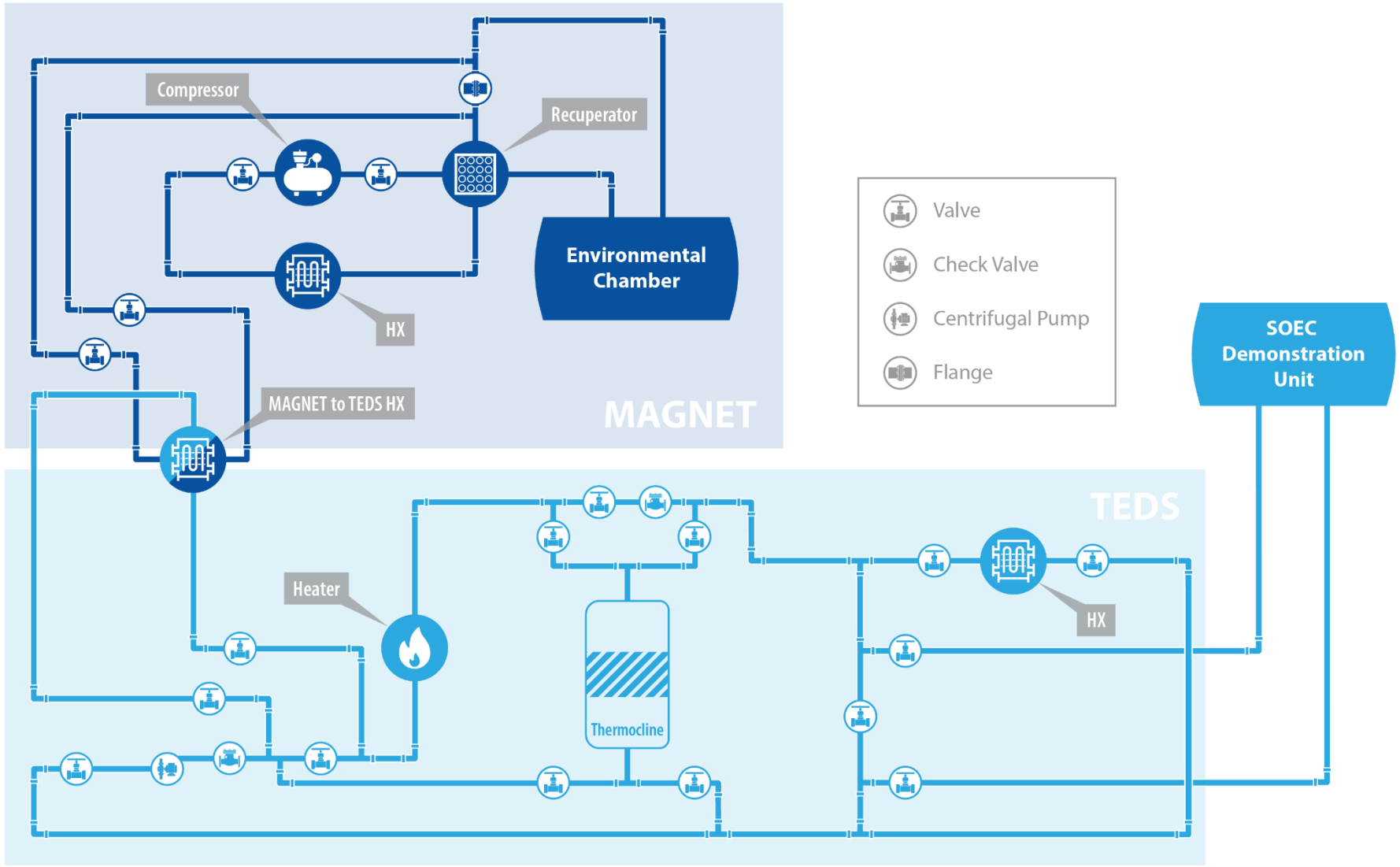
Systems Integration Laboratory



DETAIL Flow Diagram



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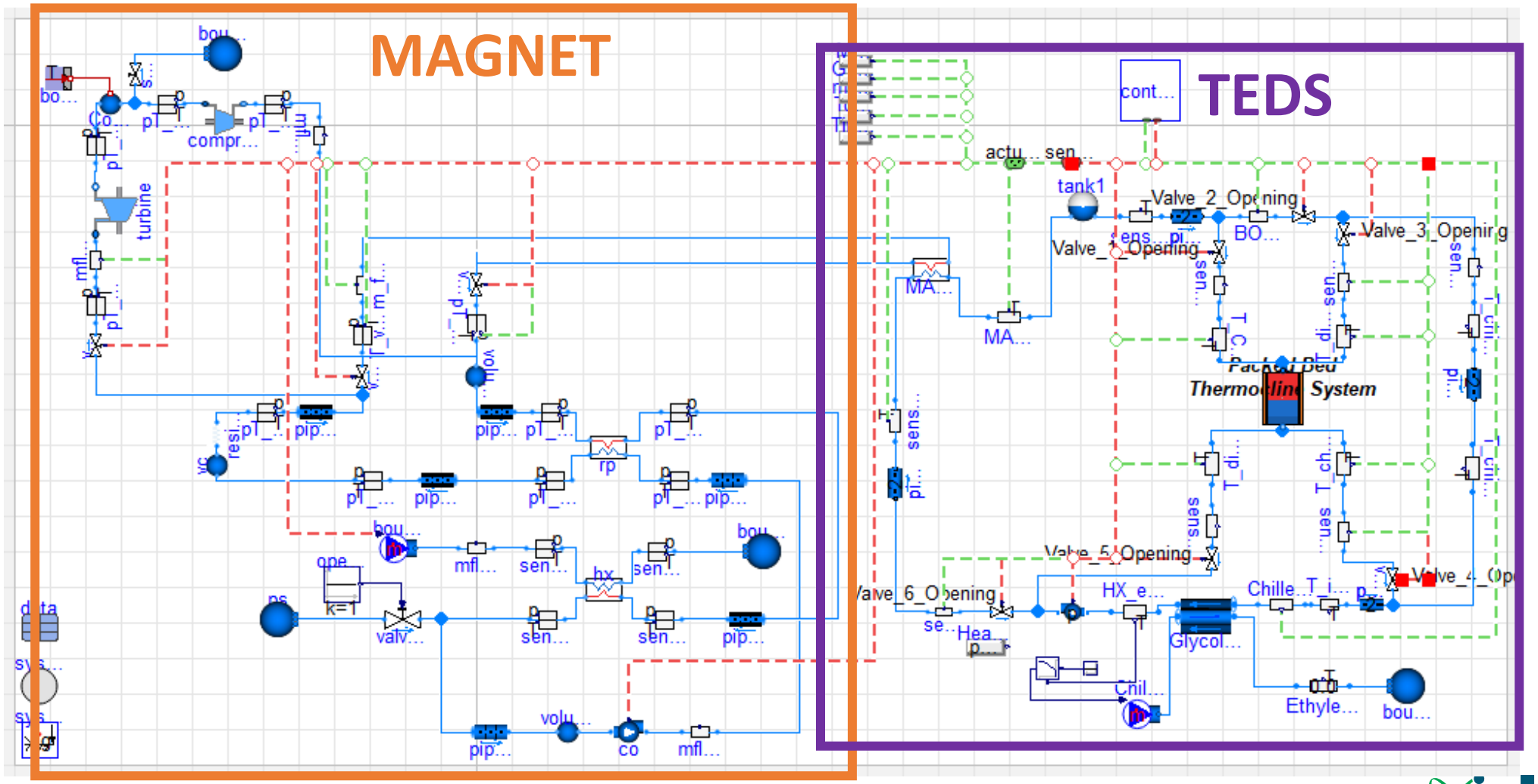
DETAIL Model for V&V



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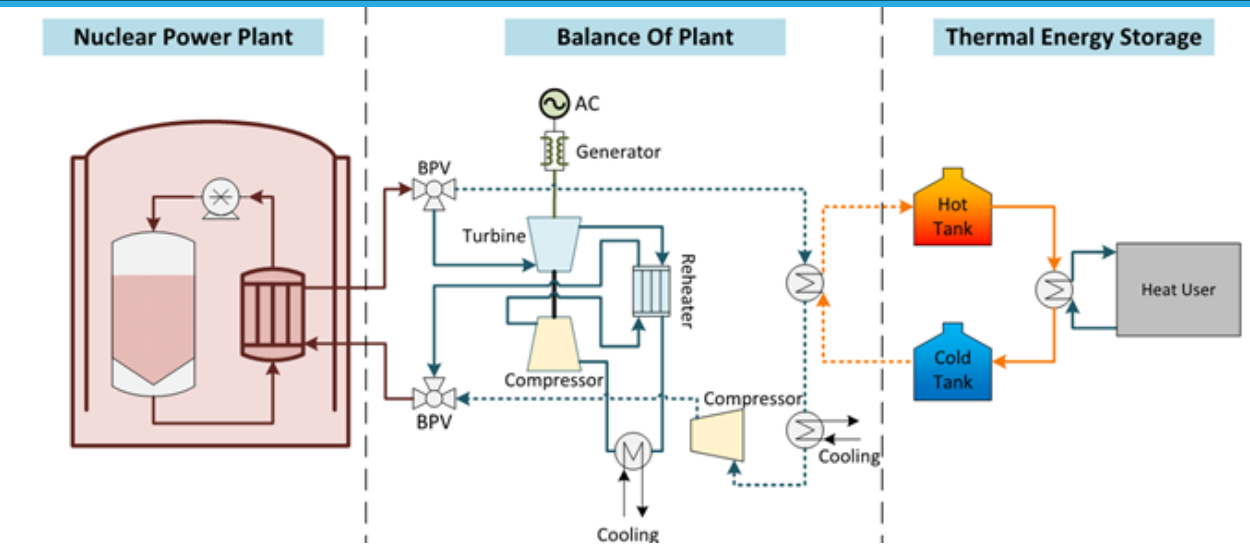
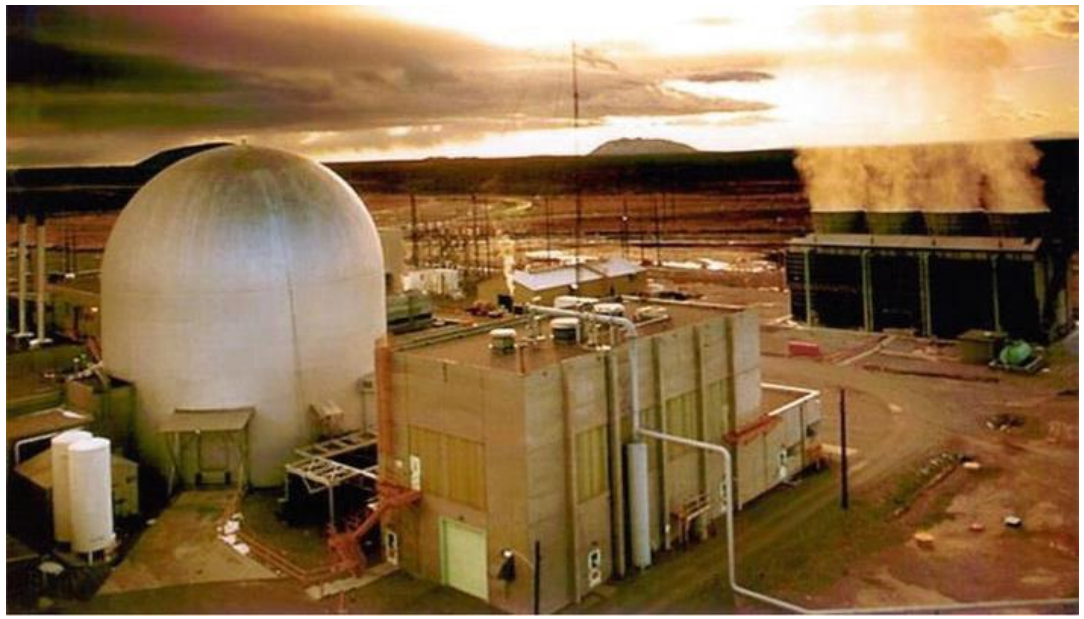
Advanced Reactor Integrated Energy System (AR-IES)





Overall objectives:

- In collaboration with National Reactor Innovation Center (NRIC), design and construct an advanced reactor integrated energy system (AR-IES) demonstration
- Incorporate a TES study/facility to enable understanding and coupling with various thermal loads/users

Background:

- Location: EBR-II Dome Testbed
- Demonstration platform to couple the thermal output from an advanced reactor to a controllable load and TES system.

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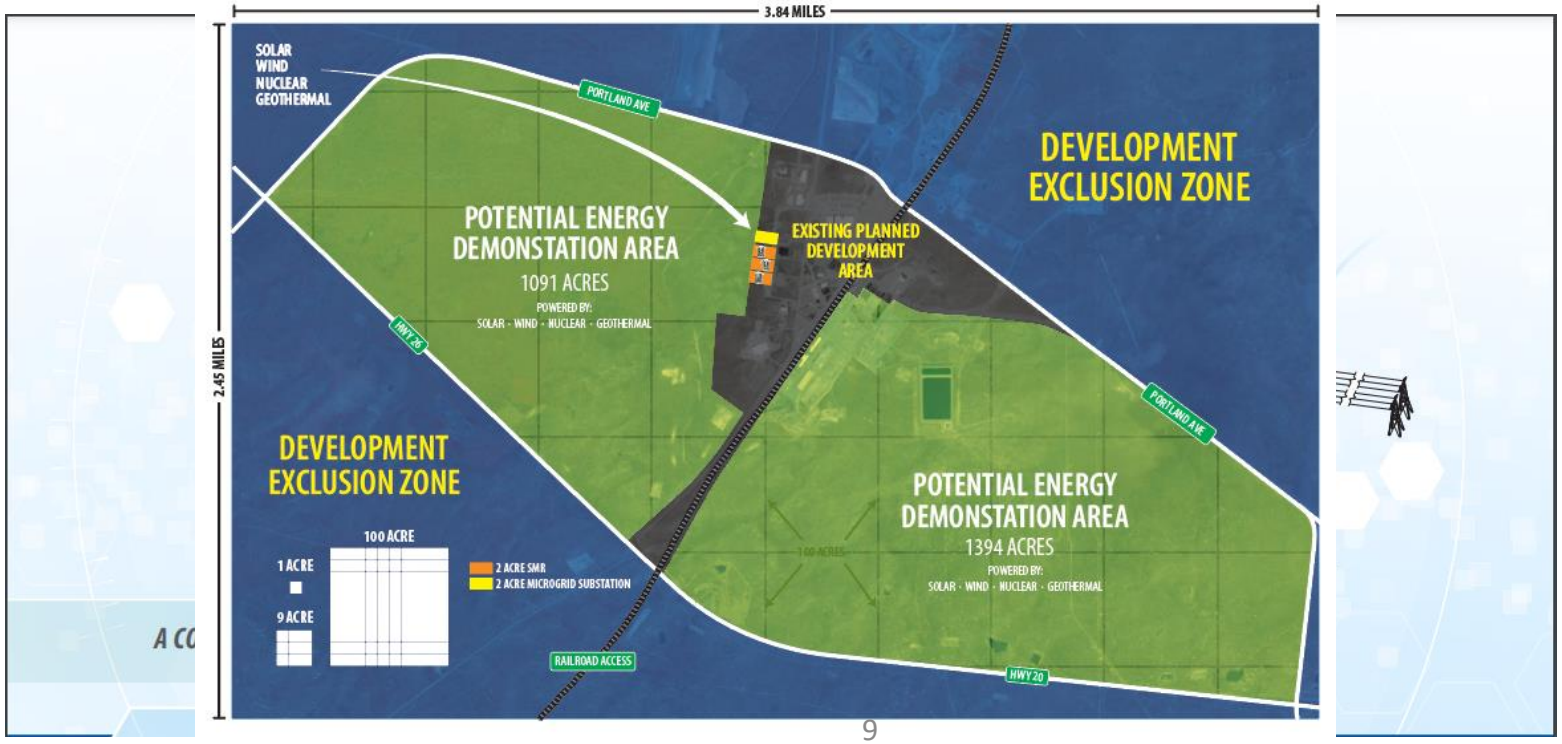
Net-Zero IES at CFA

- IES program involved with Net-Zero planning
- System size plan 15MWe
- Installation by 2031
- Supports thermal islands for integration and distribution of heat to multiple users, with TES and conditioning



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