US Department of Energy Kickoff Meeting Illinois Compressed Air Energy Storage DE-FE0032019

PI

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Budget Period

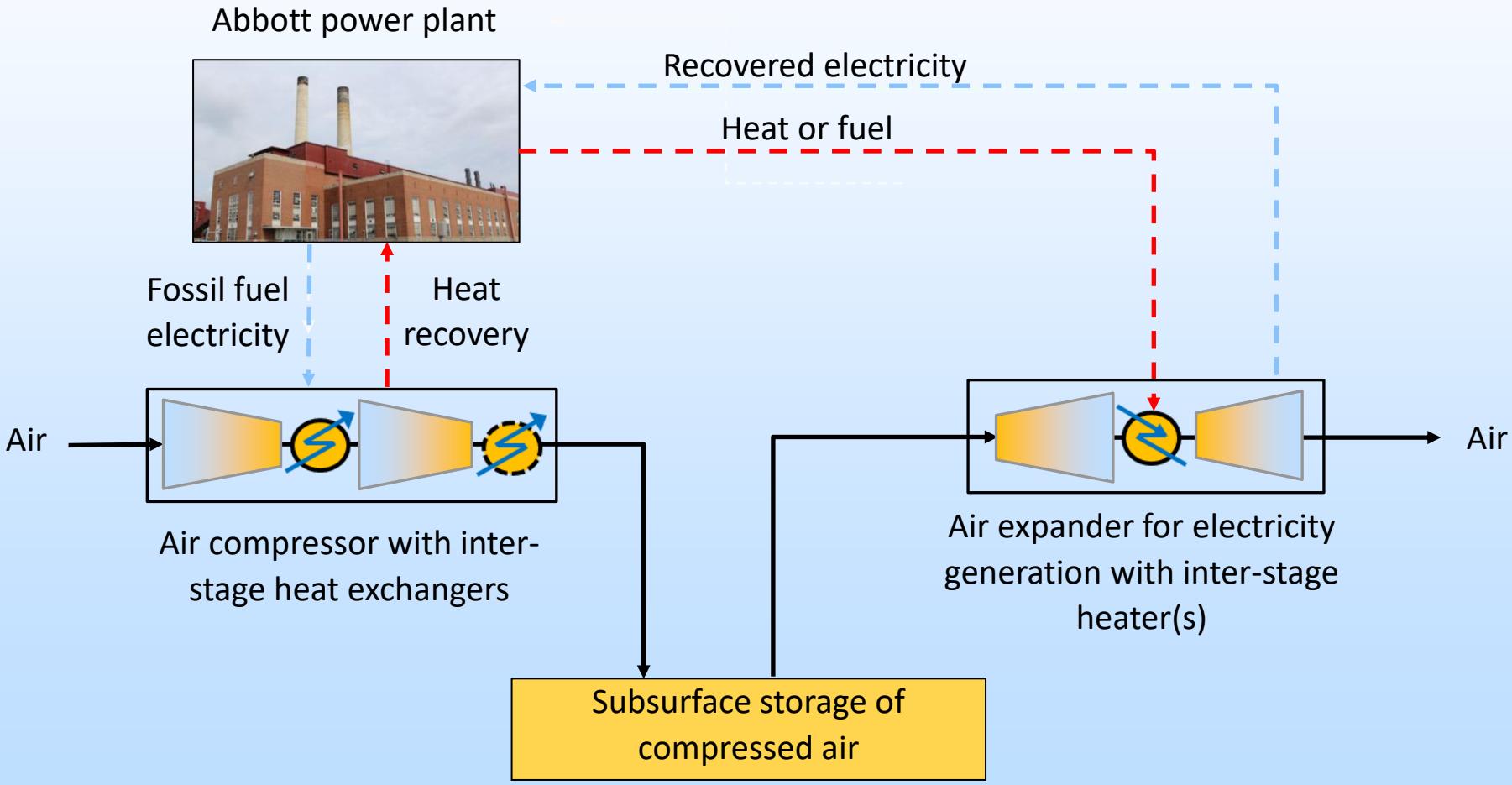
03/01/2021 - 02/28/2022

Budget

DOE: $200,000
Non-DOE: $50,022

Total: $250,022

Conceptual Diagram of Surface Infrastructure: Primary Case



Lessons Learned
Why Compressed Air Energy Storage?

- To store generated energy during off-peak times for use during peak times.
- In the winters of 2021 and 2011 an extremely cold winter freeze caused supply disruptions with natural gas and, in 2021, also with wind and coal generated electricity.
- The challenge is in dealing with day-to-day variability in net load, rather than hourly intermittency.
- CAES will help build resilience in the electric grid to increase its reliability by building one of the few long duration backup sources of energy.

The Illinois CAES Project Objectives **Design an Integrated System** to:

- Integrate energy storage technologies “within the fence” of a power plant or other fossil asset
- Capture surplus electrical energy from fossil-fuel and renewable sources at the Abbott Power Plant using a CAES system
- Store both the compressed air and the thermal heat generated by compression in the subsurface as part of an adiabatic system
- Model the storage of air and heat in the subsurface

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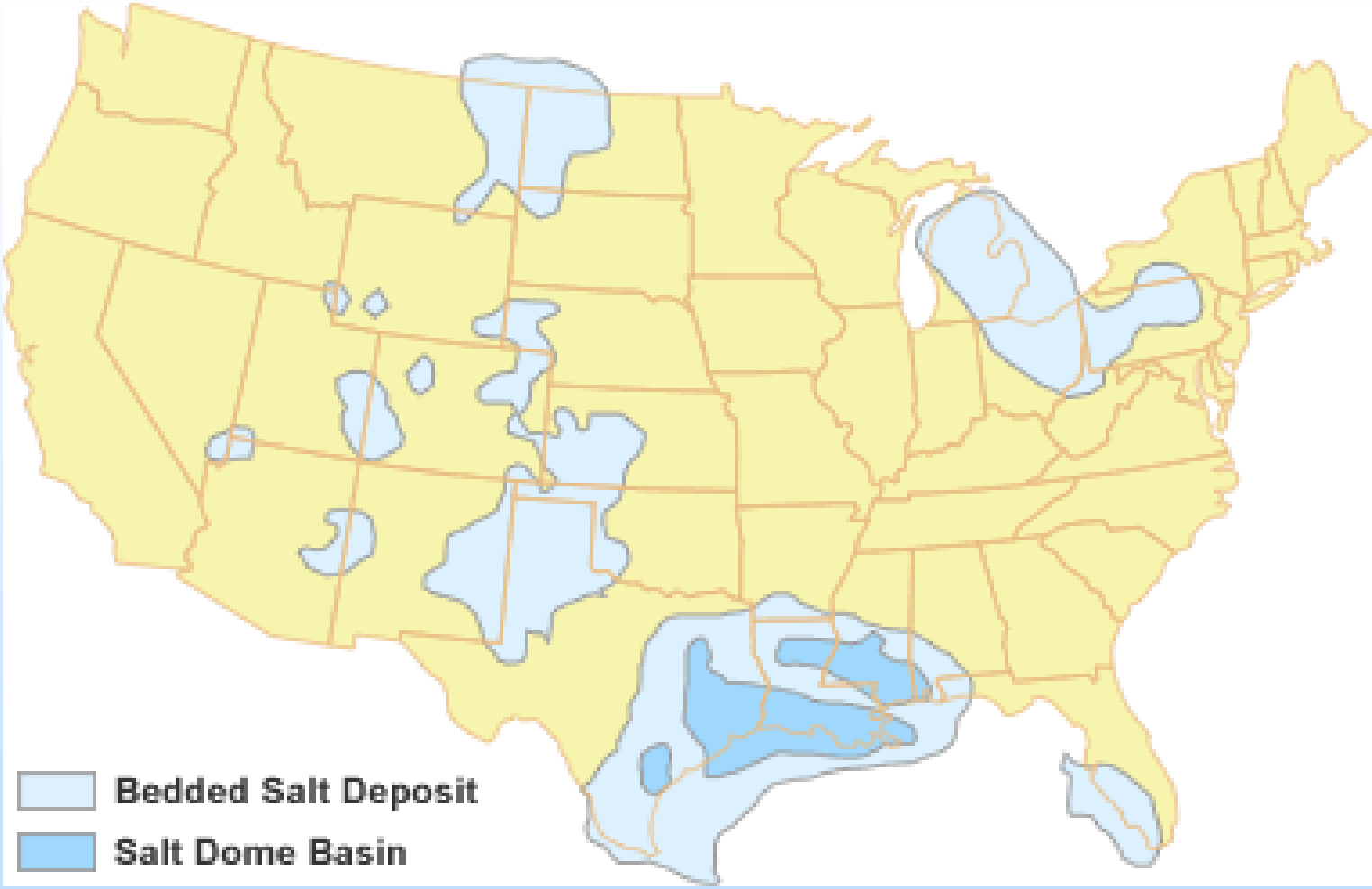
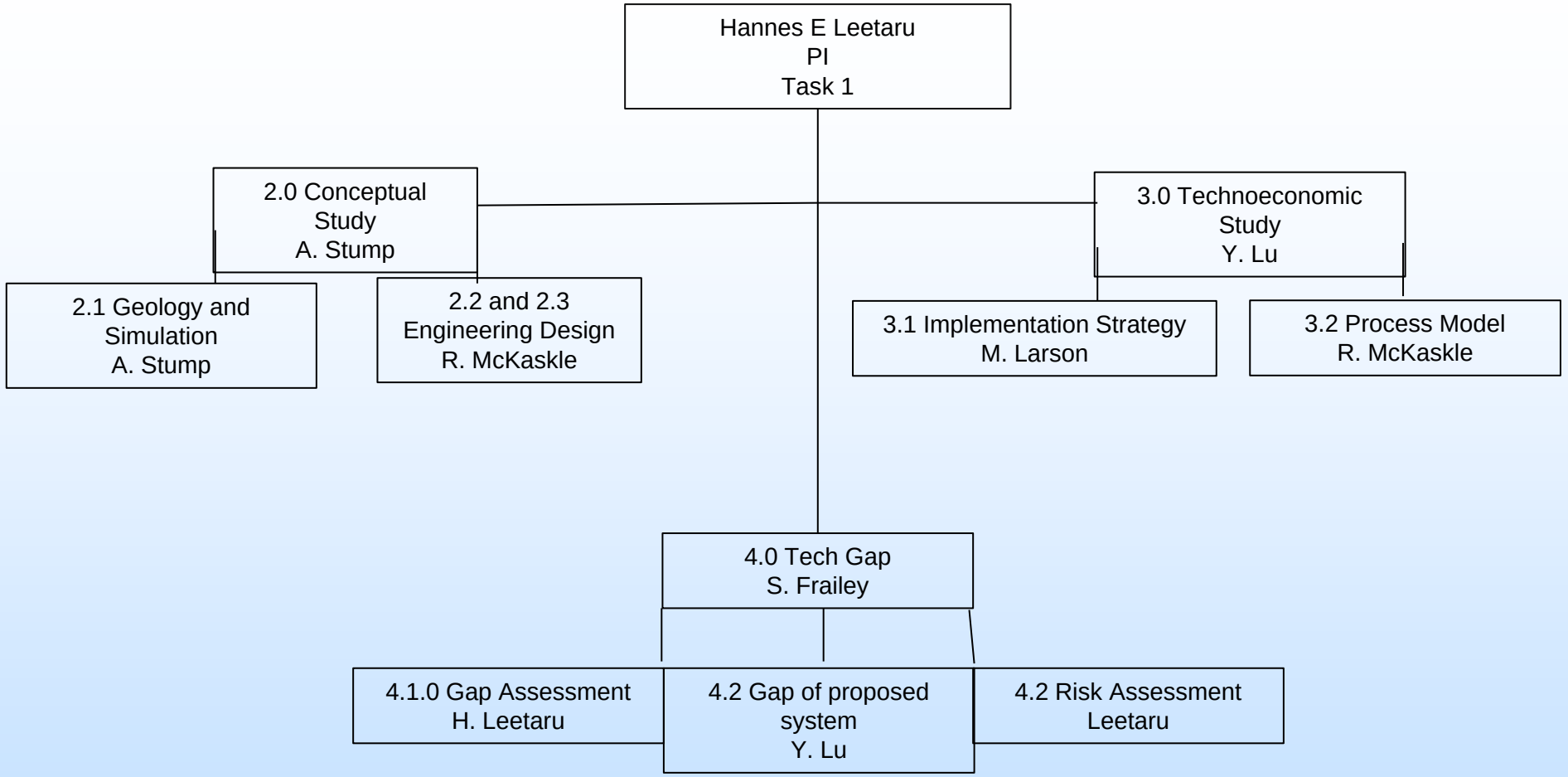
- Illinois CAES project will be evaluating using subsurface porous reservoirs without the need for salt caverns.
- Model the storage of air and heat in the subsurface
- co-location has the potential to allow load to go “within-the-fence” (i.e., to decouple from the electricity grid in an effort to save on transmission and distribution costs by serving their own demand).

Issues and Benefits

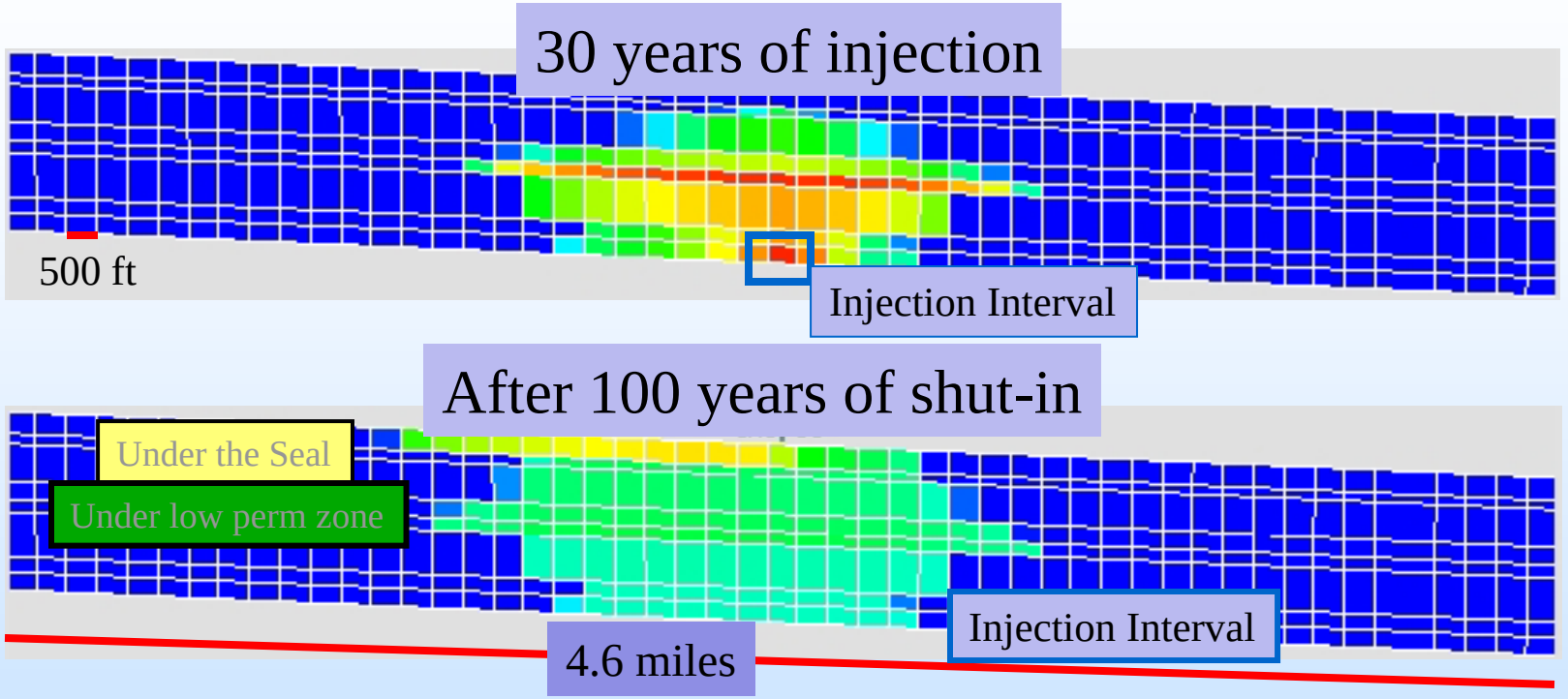
- CAES has only been evaluated in Salt Domes which are geographically limited
- **Benefit:** CAES system can be use in strata from any porous and permeable reservoirs

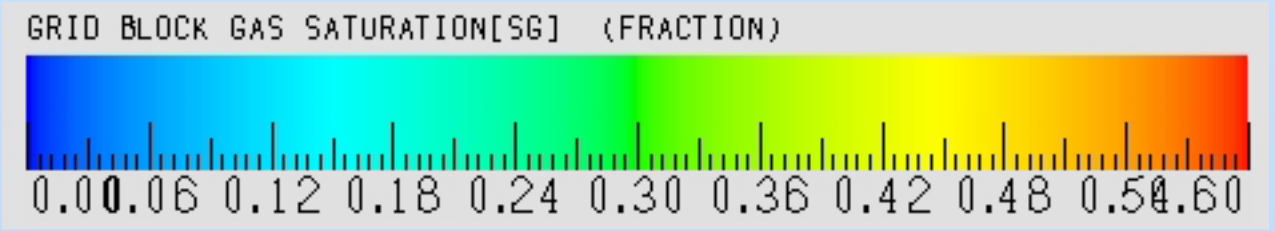


https://geology.com/stories/13/salt-domes/

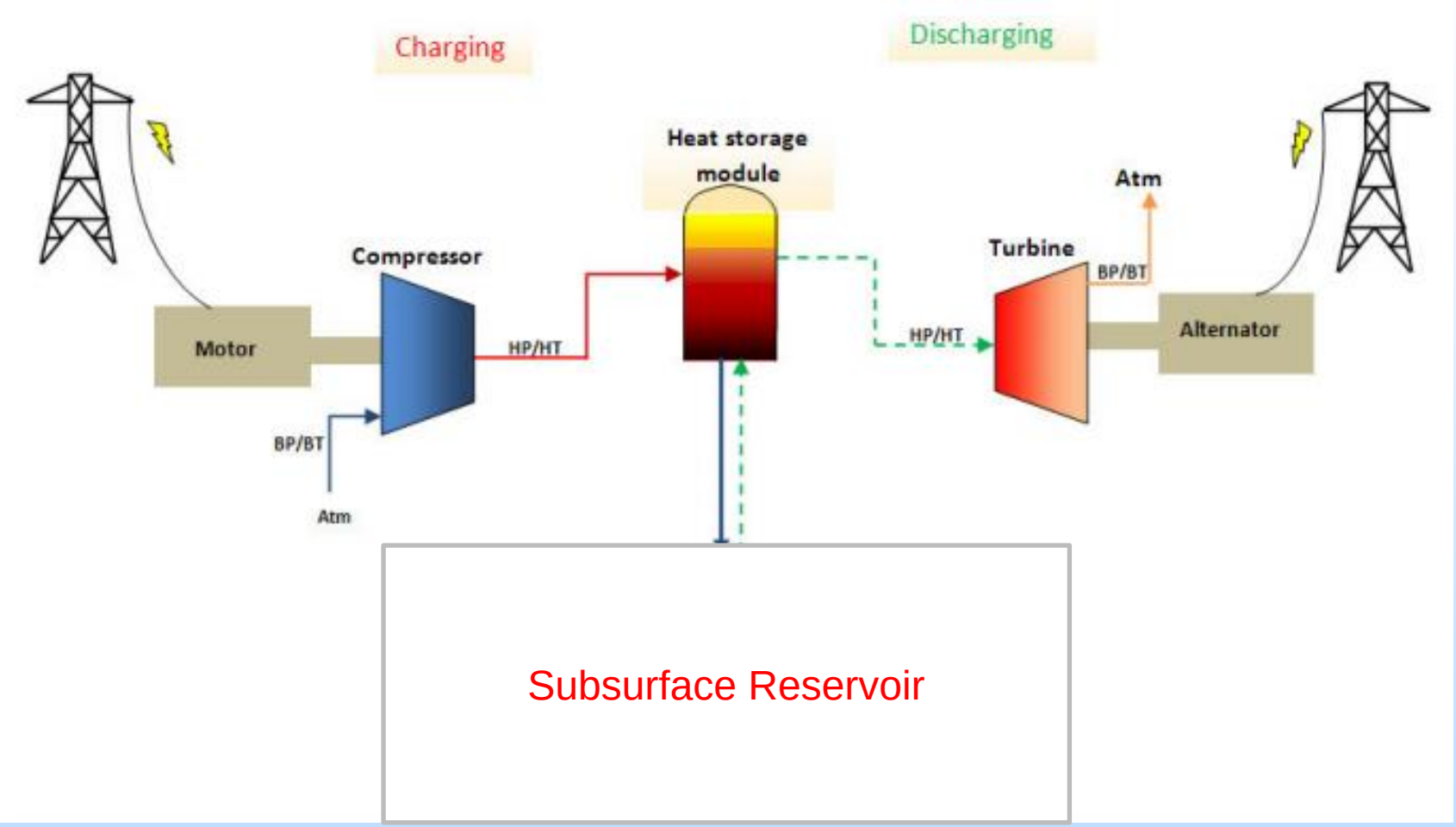

Hannes E Leetaru
PI
Task 1
2.0 Conceptual Study
A. Stump
3.0 Technoeconomic Study
Y. Lu
2.1 Geology and Simulation
A. Stump
2.2 and 2.3 Engineering Design
R. McKaskle
3.1 Implementation Strategy
M. Larson
3.2 Process Model
R. McKaskle
4.0 Tech Gap
S. Frailey
4.1.0 Gap Assessment
H. Leetaru
4.2 Gap of proposed system
Y. Lu
4.2 Risk Assessment
Leetaru

Injection into Reservoir with 1 degree dipping beds



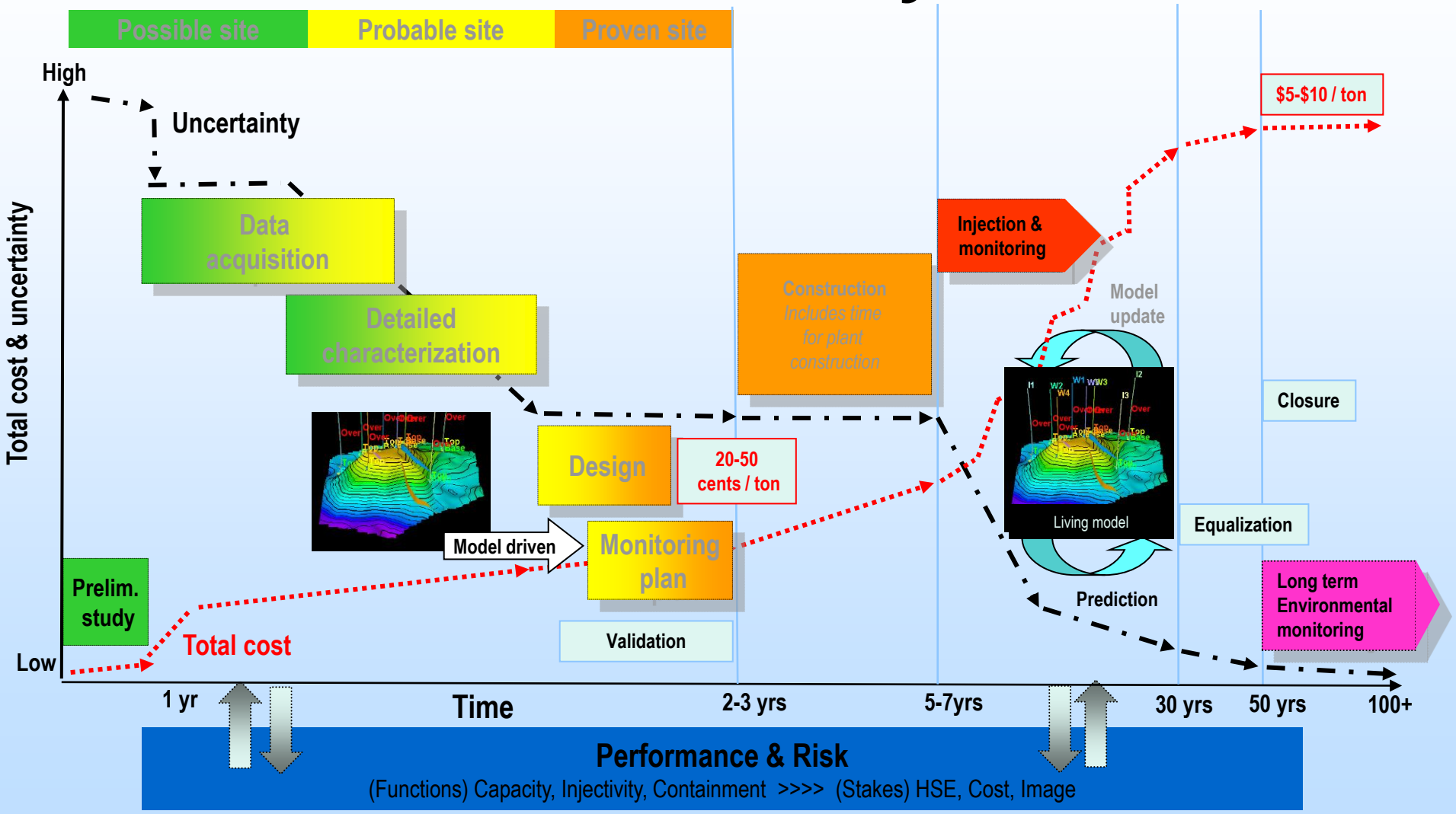


Scheme of adiabatic compressed air energy storage (A CAES)



Kere, A., V. Goetz, X. Py, R. Olives, N. Sadiki, and E. Mercier, 2014, Dynamic behavior of a sensible-heat based thermal energy storage: Energy Procedia, v. 49, p. 830-839.

Storage Timeline with Cost and Uncertainty



Courtesy of Schlumberger

Illinois Compressed Air Energy Storage (CAES)

- **Award Number** DE-FE0032019

Suggested information for discussion:

1) CAES captures air during non-peak times from variable energy sources and injects the air into subsurface reservoirs. The heat of compression is also injected into the reservoir to create an artificial geothermal reservoir. During peak electric usage the air and heat are used to generate electricity.
2) CAES is one of the longest duration energy system available and could potentially store days of energy for electric generation
3) CAES has to be integrated into a vertical integrated system of fossil and renewable energy sources.

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Choose any number of these topics to discuss. You may simply pose the question(s) and discuss or you may utilize text/tables/figures to support your comments.

1) What is needed to be able to pilot a demo plant by 2025?
    1) **For CAES you need acquire minimum 2D reflection seismic across the area being used of storage.**
    2) **For CAES you need to drill a well an measure properties such a permeability, porosity, and thermal properties**
    3) **Complete reservoir modeling based on this properties**
    4) **Reevaluate the design parameters with the new data and begin building the plant**

Thank You!!

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