Solar Receiver with Integrated Thermal Energy Storage for a Supercritical Carbon Dioxide Power Cycle 07118

Metal Hydrides Provide Compact Thermal Energy Storage.

1. Impact

Integrating metal hydrides that can operate at temperatures compatible with sCO_2 cycle temperatures into a CSP plant can reduce the LCOE to below the DOE goal of 10₵/kWh for a peaker plant.

2. Project Goal

Develop a fully integrated CSP plant design for peaker duty. Employ metal hydrides as thermochemical storage media. Demonstrate technical feasibility of system.

3. Method(s)

Develop, test, and optimize metal hydrides that can operate at up to 760°C. Design and test a solar receiver and discharge heat exchanger for the system. Create a whole system model for LCOE prediction.

4. Outcome(s)

Metal hydride developed capable of operating at temperature of 760°C at a projected cost of 9.2₵/kWh_{th}. A CSP Plant with integrated metal hydride storage was developed which obtained an LCOE of 8.25₵/kWh and capacity factor of 38%.

5. Conclusion/Risks

Metal hydrides offer a significant improvement the in density of thermal energy storage. Heat transfer into and out of metal hydride is expensive because of large volumes required and poor metal hydride conductivity.

6. Team

Savanah River National Laboratory

GreenWay Energy

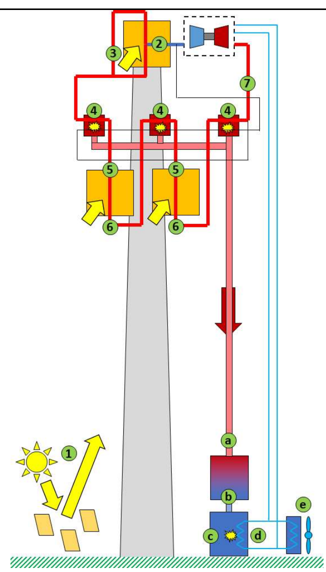

Figure 1. Layout of integrated CSP system showing flow path for discharging.

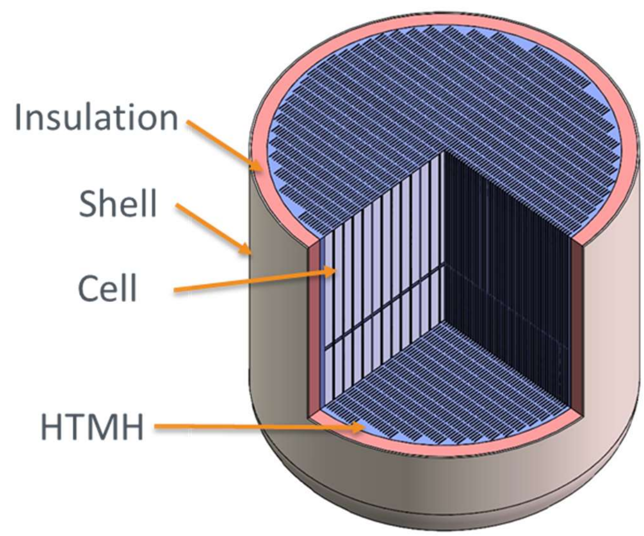

Figure 2. Hypothetical layout of high temperature metal hydride heat exchanger.