CSP Gen3 Liquid Pathway to SunShot 34209

Liquid Pathway defines benefits and risks of sodium receivers with molten-chloride-salt storage.

1. Impact

Future high-renewable grids require dispatchable energy systems for stability and resilience. CSP can provide these attributes, but costs must be competitive with alternative sources.

2. Project Goal

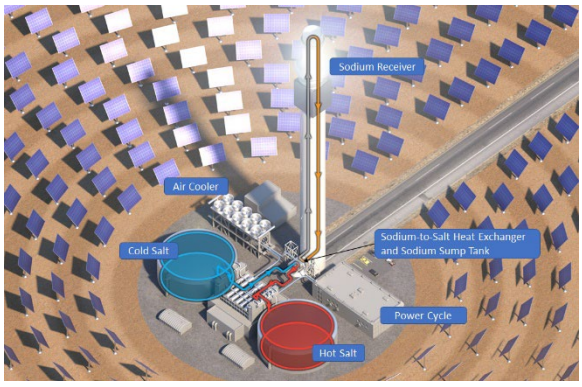
To utilize the superior heat-transfer attributes of liquids to demonstrate CSP technology capable of reliable operation at costs less than $60/MWh.

3. Method(s)

The Liquid Pathway proposes the use of low-cost molten chloride salts for energy storage, mated with a solar receiver that employs liquid-metal sodium for heat capture and transfer to the storage salt. This approach leverages molten-salt technology from the current power towers and builds on the knowledge gained in decades of use of sodium as a high-temperature heat transfer fluid in solar tests and nuclear-power applications.

4. Outcome(s)

- Control salt chemistry to minimize corrosion
- Design an insulating liner to protect salt tanks
- Validate the efficiency and performance of the solar receiver and primary heat exchanger
- Map path to commercialization through system simulation and industry collaboration

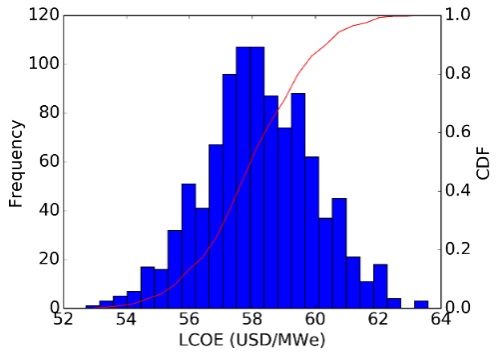


5. Conclusion/Risks

Analysis of system performance and cost indicated a mean LCOE of $58/MWh, meeting the project goal; however, risks remain high. Salt corrosion control methods were demonstrated at lab scale, but a non-negligible salt vapor presented unforeseen challenges. Key risks to overcome include demonstrating robust operation of the tank liner and salt handling at pilot scale.

6. Team

NREL	Team Lead
Sandia National Labs	System and controls
Savannah River National Lab	Salt chemistry
Bridgers & Paxton Engineers	System integration
JT Thorpe & Son	Refractory liner
Job Industrial Services	Tanks
ICL-IP America	Salts
Electric Power Research Inst.	Advisors
Nooter/Eriksen	Receivers
Australian National Univ.	Sodium, Technoeconomics
University of South Australia	Materials
Queensland Technical Univ.	Materials
Commonwealth Scientific & Industrial Research Org.	Sodium subsystem
Flinders University	Materials



(Left) System design uses liquid sodium in the receiver for excellent heat transfer coupled with molten-chloride salt thermal energy storage. Sensitivity analysis yields a mean LCOE of $58/MWh