Thermomechanical Behavior of Advanced Manufactured Parts, Subcomponents, and their Weldments for Gen3 CSP—36334

Advanced Manufacturing to Improve Gen3 CSP Plant Reliability and Reduce Cost

1. Impact

This project will reduce the cost of manufacturing CSP components toward SETO's 2030 cost targets by reducing capital and operation and maintenance costs, and loss of revenue by increasing plant reliability and availability.

2. Project Goal

The goal is to thermomechanically validate advanced manufacturing processes (additive manufacturing and cladding) and their welding to lower the capital cost of Gen3 CSP plants to advance commercialization and deployment using agile U.S.-based manufacturing sectors.

3. Method(s)

Methods include: (a) alloy selection for advanced manufacturing of pipes, primary heat exchanger (PHX), and solar receiver (Fig. 1); (b) sample fabrication, metallurgical characterization, and thermomechanical evaluation; and (c) techno-economic analysis of selected technologies for additive manufacturing of PHX and cladded pipes.

4. Outcome(s)

- The top candidate alloys for pipes in the cold section of Gen3 CSP plants are Ni201, Hastelloy C-22, and Hastelloy C-276 as cladders, and steels such as P91 class 2 and SS304H as backers.

- The top candidates for additive manufacturing of solar receiver parts and the PHX are Haynes 230, Haynes 282, and Inconel 740H.

5. Conclusion/Risks

Gen3 CSP cost reduction and reliability improvement were preliminarily demonstrated by cost analyses, microstructure characterization, and mechanical and corrosion evaluations performed on selected top candidate alloys.

6. Team

Lead organization:
National Renewable Energy Laboratory

Partners: Colorado School of Mines, Ohio State University, NobelClad, Elementum 3D, Advanced Material Solutions, Sciaky, and Haynes International (cost share partner).

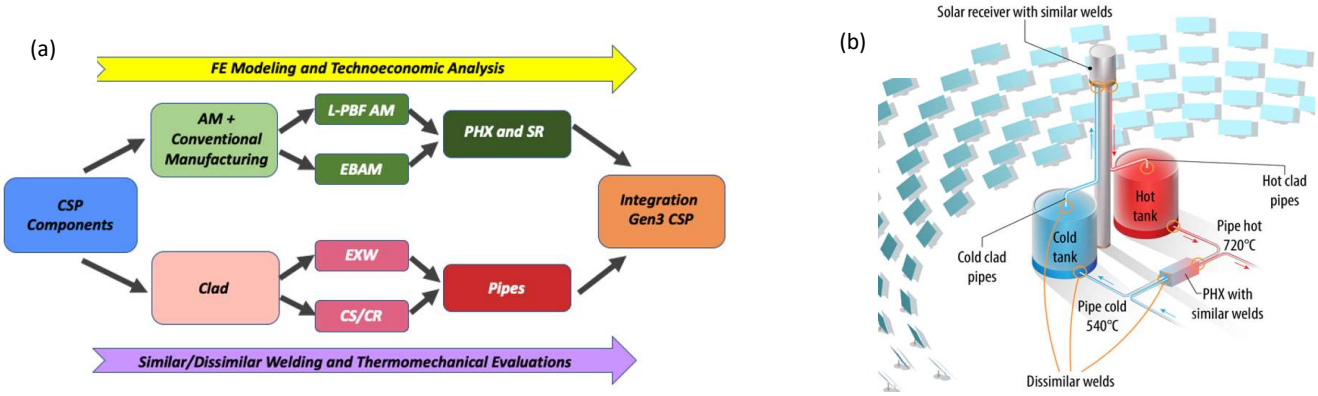

Fig. 1. *(a) Flow diagram of advanced manufacturing for Gen3 CSP components, (b) conceptual Gen3 CSP sections and subcomponents using proposed advanced manufacturing and similar/dissimilar welding.*