SOLSTICE Proposers Day

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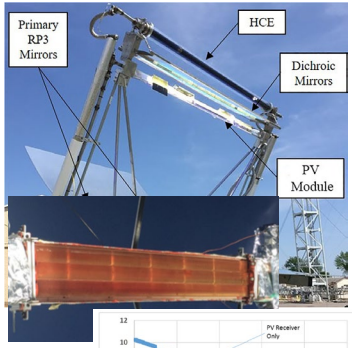
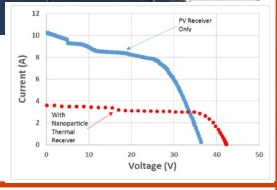
Our Prior Work

Spectral Splitting Hybrids

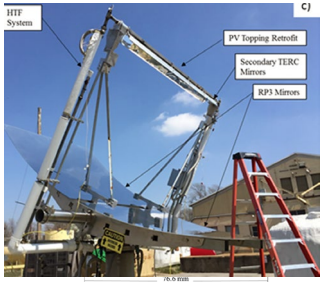
- Led 2 ARPA-E projects on spectral splitting and spectral absorbing hybrid PV-thermal collectors
- Culminated in large scale experimental demonstrations in first-of-kind collectors
- Developed novel optical, thermal, and hybrid simulations
- Participated in Energy i-Corps

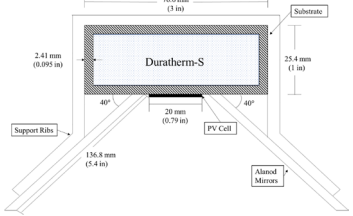




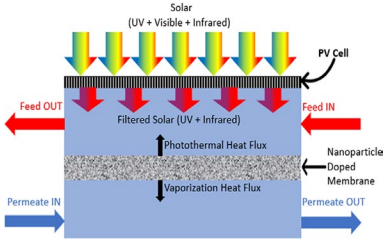
PV Topping Retrofit

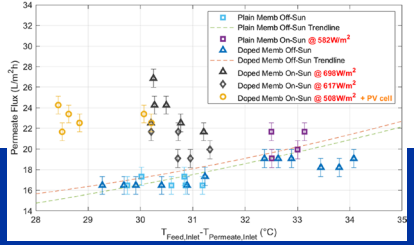
- ARPA-E and industry supported project to integrate multi-junction PV into existing linear concentrators
- Design custom topping CPV receiver to increase flux and cool cells
- Demonstrated 2x increase in flux to PV cells.
- Demonstrated potential for <$0.03/kWh for multijunction cells in terrestrial application





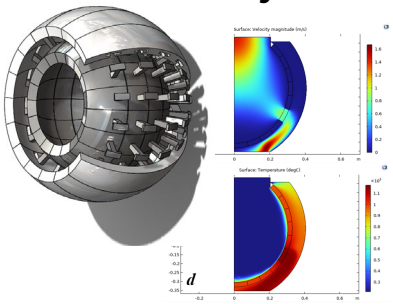
Hybrid PV + Desalination





- Only known PV + desalination system tested on sun
- Synthesized and characterized nanoparticle doped absorbing membranes
- Demonstrated increased permeate flux and simultaneous electrical energy production.

Porous Cavity Receiver



- Designed cavity receiver to achieve >1000 C outlet air temperature.
- Synthesized porous additively manufactured receiver surface to maximize heat transfer and minimize weight.
- Developed transient thermomechanical simulation for startup and shutdown

1. Wingert et al., Solar Energy, 2020
2. Otanicar et al., Applied Energy, 2018
3. Otanicar et al., Applied Energy, 2020
4. Sanchez et al., Applied Energy, 2021

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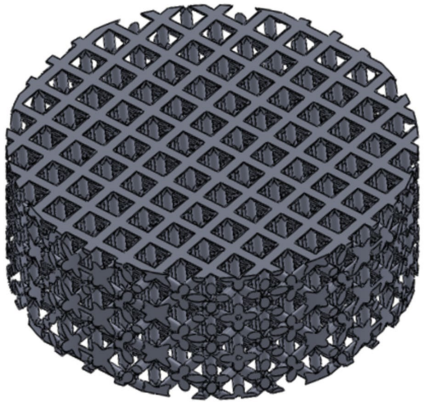
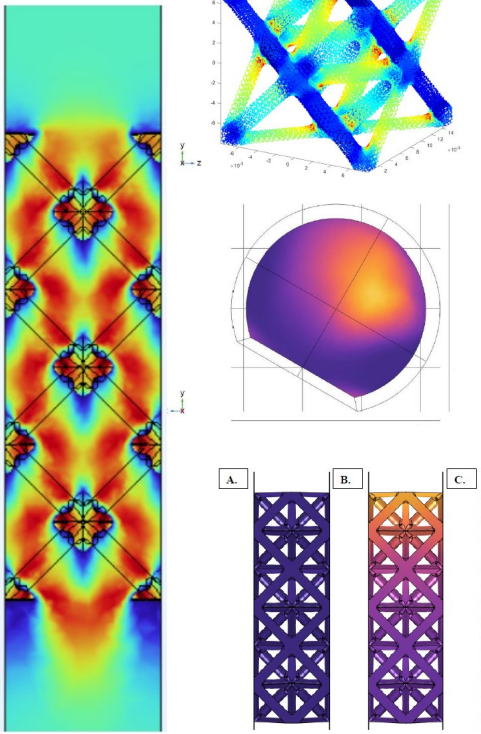
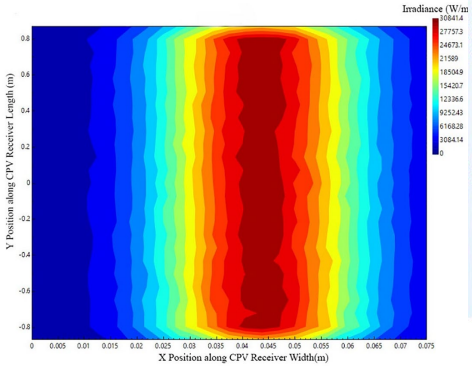
Todd Otanicar, Boise State University

Our Capabilities – Computational Modeling

- Multiscale and Multiphysics modeling
  - Thermal transport
  - CFD
  - Structural
  - Transient and steady state
  - Ray tracing
- Custom built multiple novel solar hybrid techno-economic analyses
- Focused on manufacturability, weight, and mechanical lifetime







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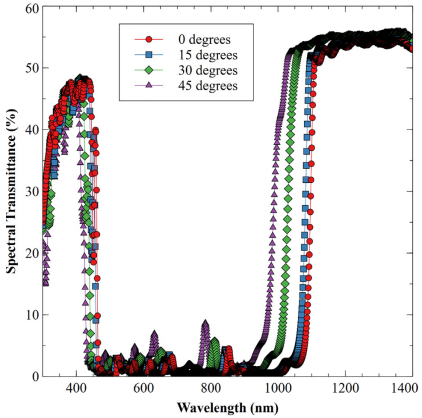
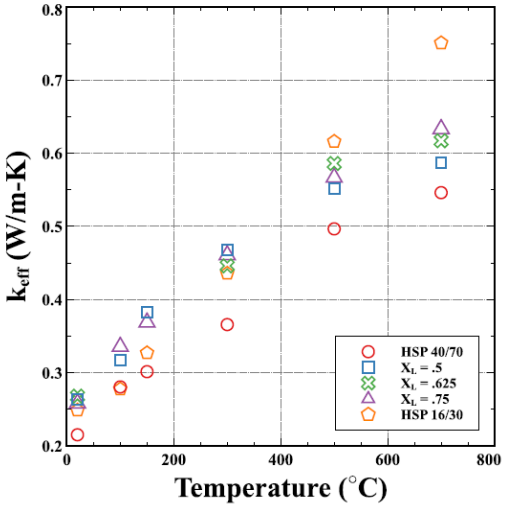
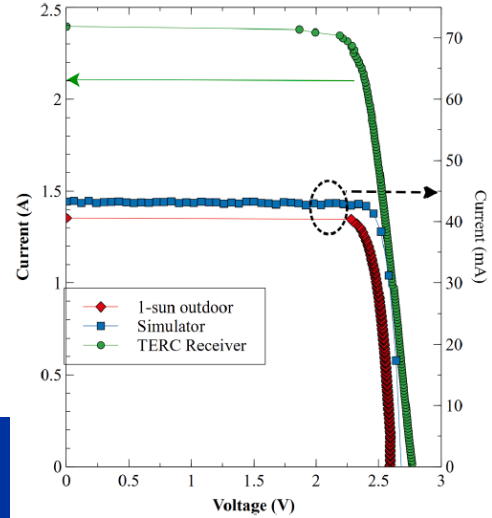
Our Capabilities – Fabrication & Characterization

- UV-VIS-NIR + FTIR spectrophotometers for optical properties
- Transient plane source thermal conductivity (up to 800 C)
- I-V Tracers
- Muffle and Tube Furnaces for high temperatures and different gas pressures
- Spin, Dip, and Blade coaters
- OpenAdditive Panda Metal 3D printer
- Outdoor dish concentrator (3 m^2 aperture area)
- Dataloggers, thermocouples, etc.

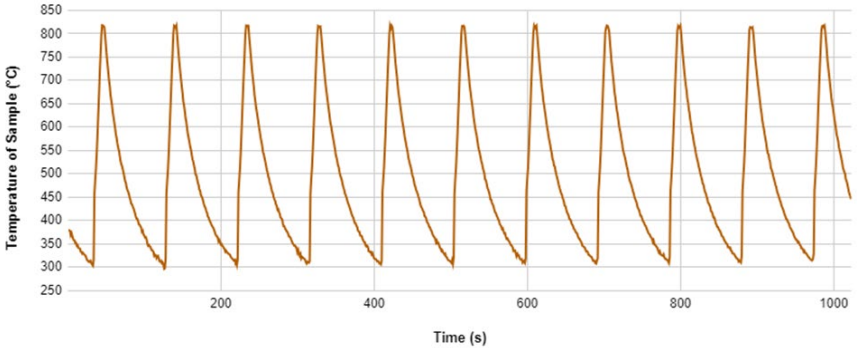


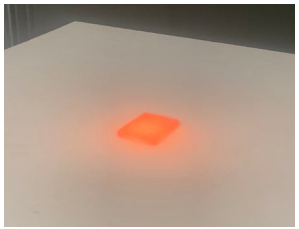


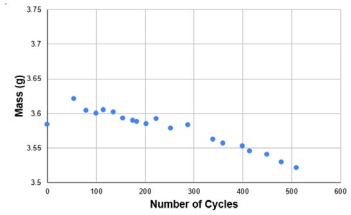


Our Capabilities – High Flux Simulator

- Highly concentrated UV/Visible/IR radiation, >600 kW/m^2 on ~50 cm^2 spot.
- Shutter to simulate thermal cycling







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