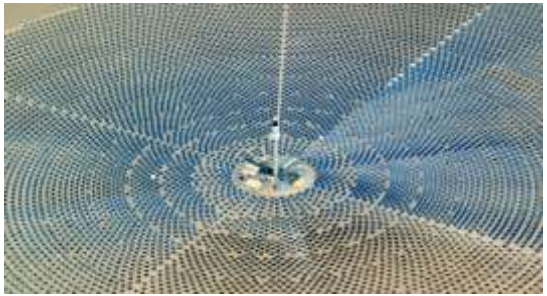
U.S. DEPARTMENT OF ENERGY | Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

SOLAR ENERGY TECHNOLOGIES OFFICE

SETO CSP Program Summit 2019



energy.gov/solar-office

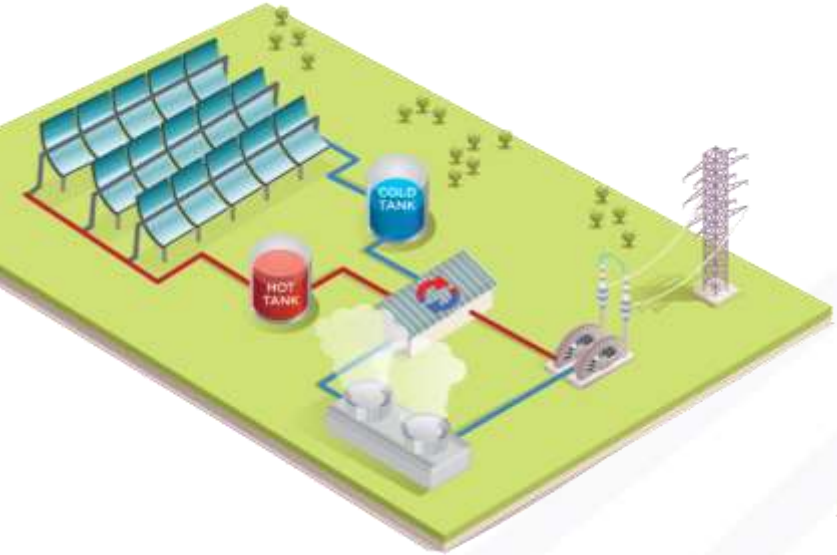
Concentrating Solar Thermal Power Technology Overview

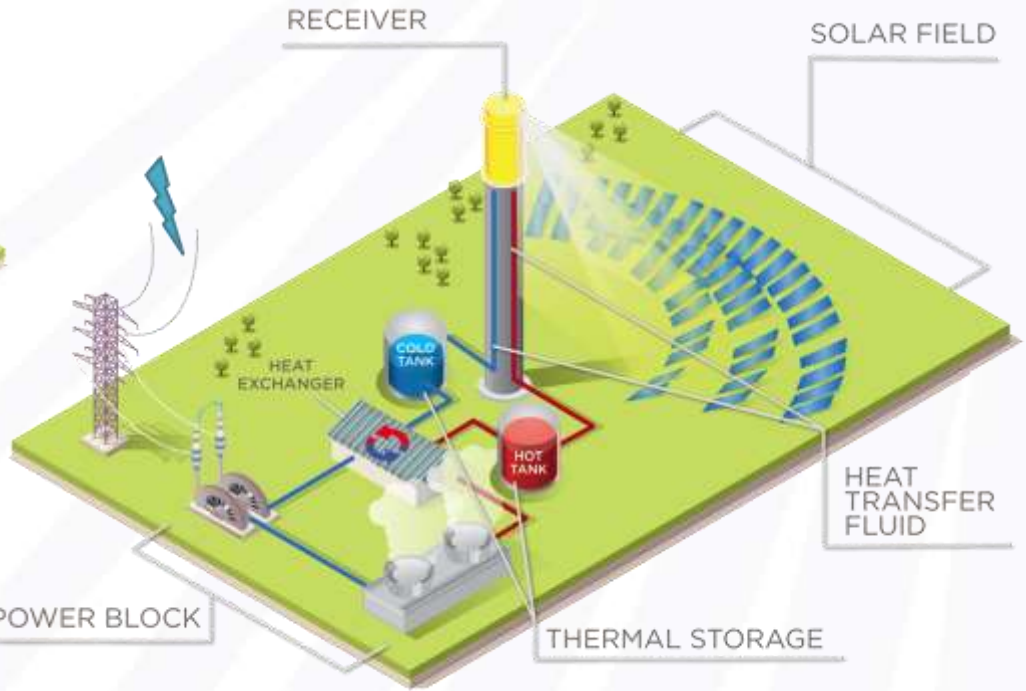
SETO CSP Program Summit 2019

March 18, 2019

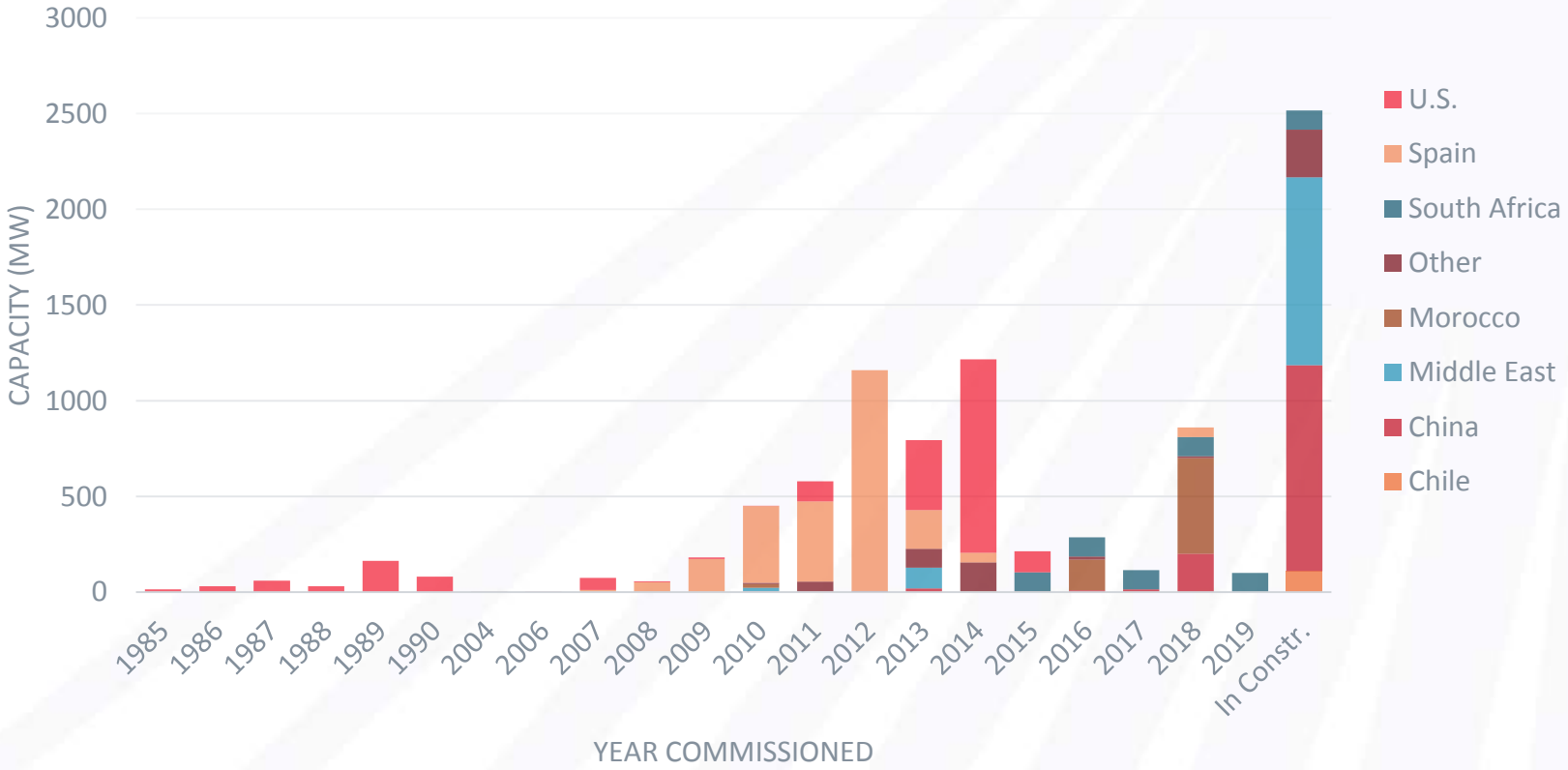
Dr. Avi Shultz, Program Manager

CSP with Storage is Solar Energy On-Demand

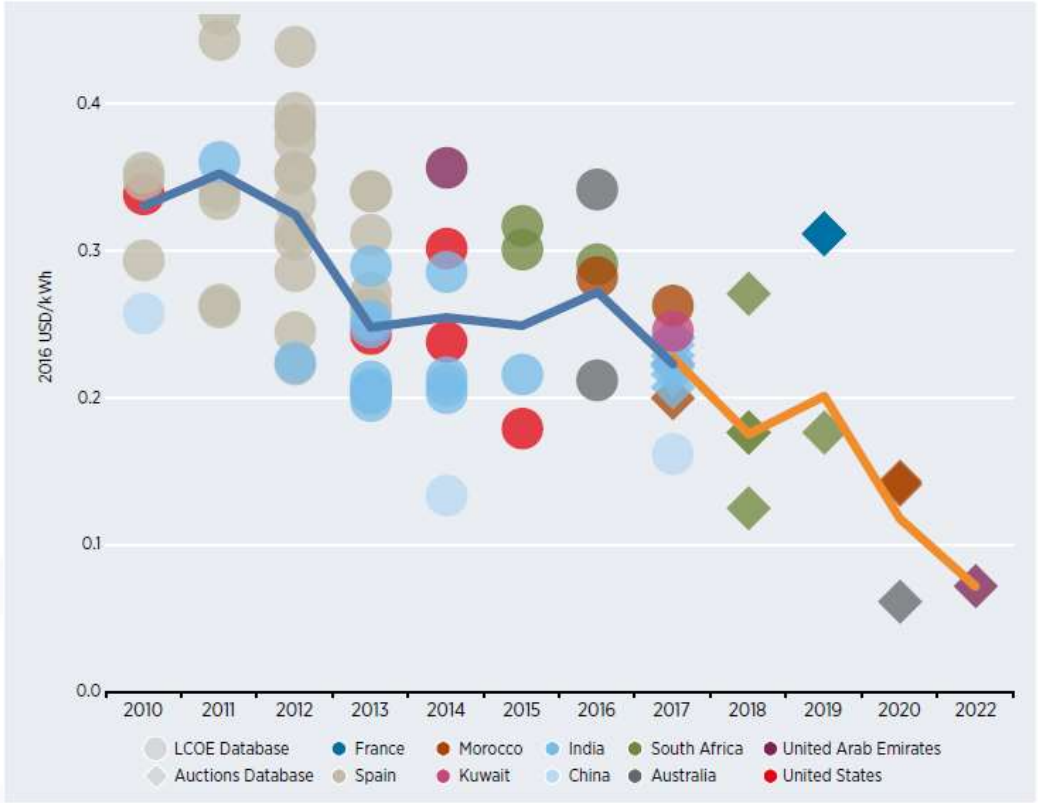




CSP is Being Deployed Worldwide



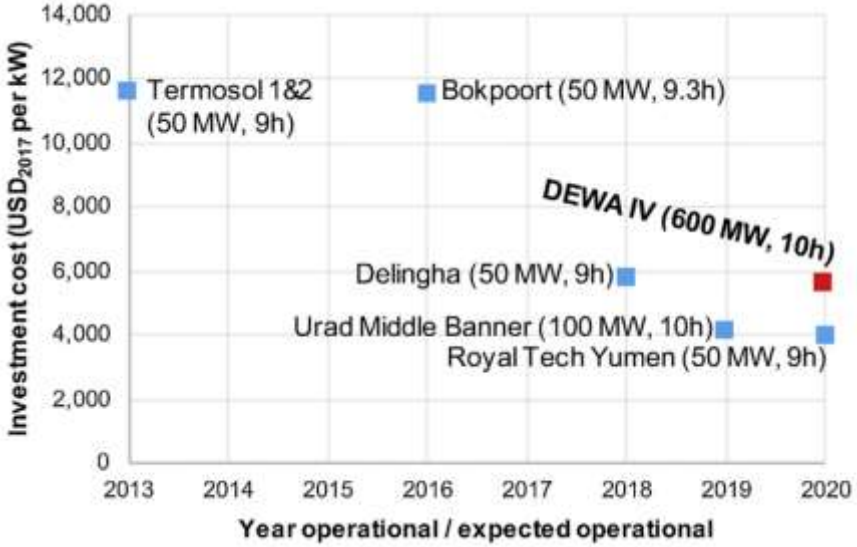
Global CSP PPAs are Decreasing



IRENA, 2018

CSP Capital Costs are Decreasing

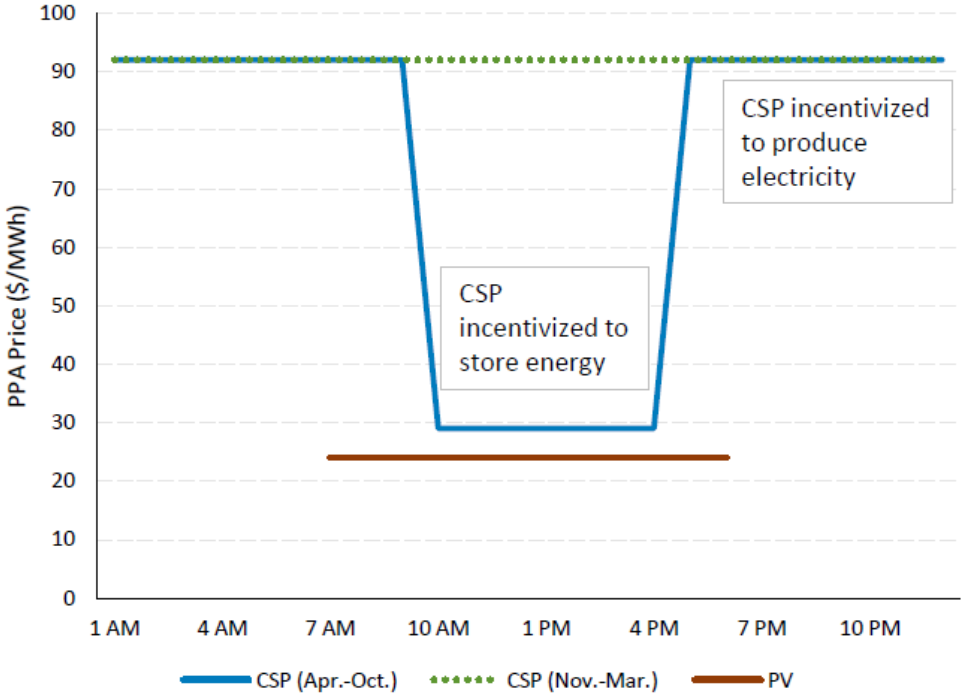
Troughs



Towers

Lilliestam, Pitz-Paal, *Renewable Energy Focus*, 26, **2018**, 17

CSP is under construction globally – Particularly as CSP/PV Hybrid



DEWA IV – Dubai

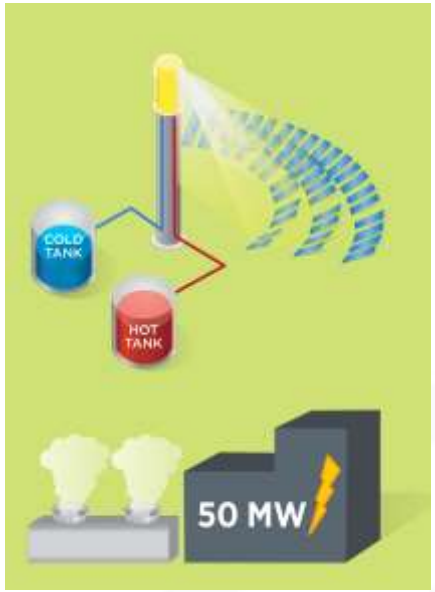
- Developer: ACWA Power
- PPA signed at $73/MWh
- DNI: ~2000 kWh/m^2/year
- 950 MW total capacity
  - 200 MW x3 Troughs with 10 hours storage
  - 100 MW Tower with 15 hours storage
  - 250 MW PV

Aurora – Port Augusta, South Australia

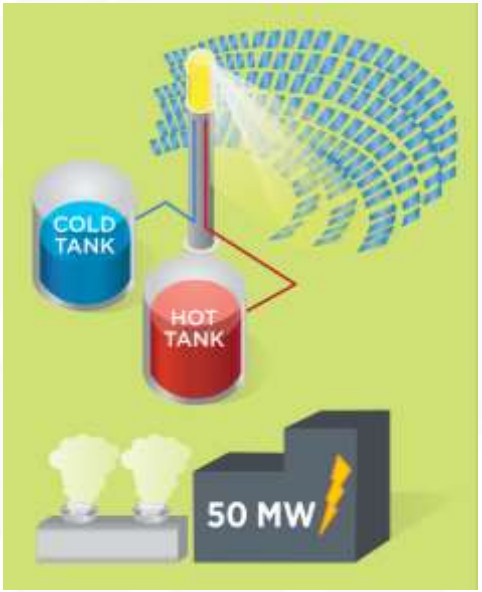
- Developer: SolarReserve
- PPA signed at $61/MWh
- DNI: ~2400 kWh/m^2/year
- 150 MW Tower with 8 hours storage

CSP: Flexible Designs for an Evolving Grid

'Peaker'
(≤6 hours of storage)

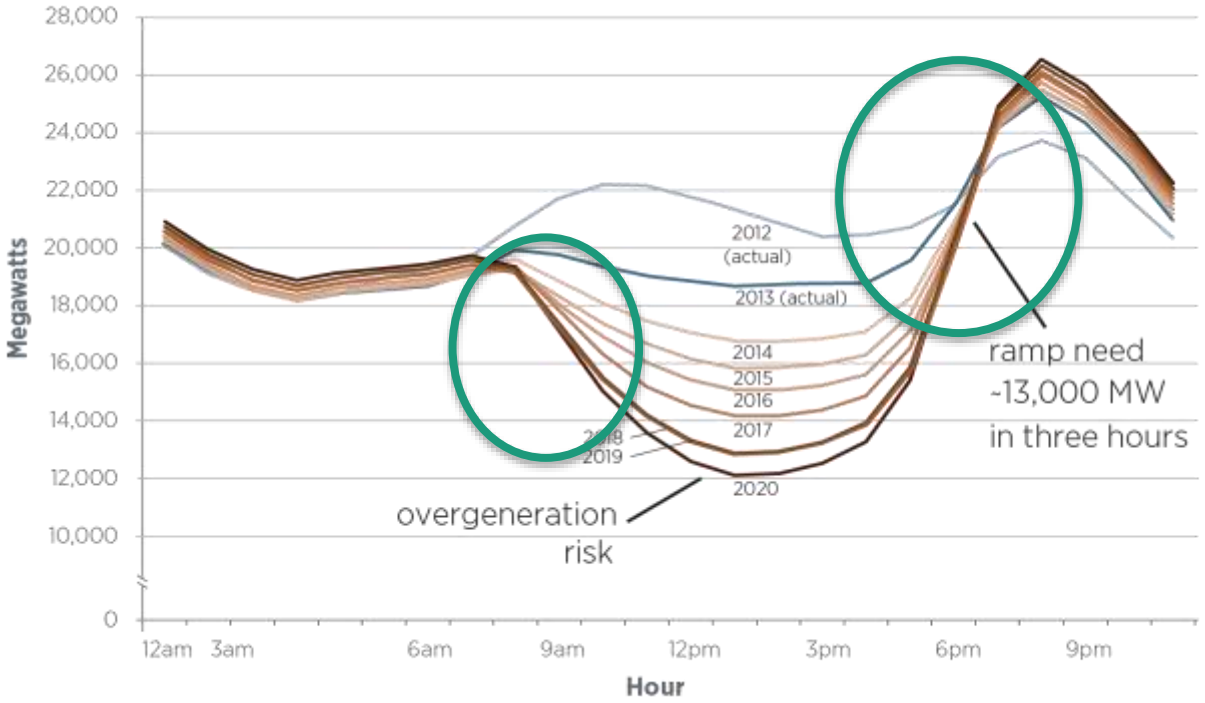


'Baseload'
(≥12 hours of storage)

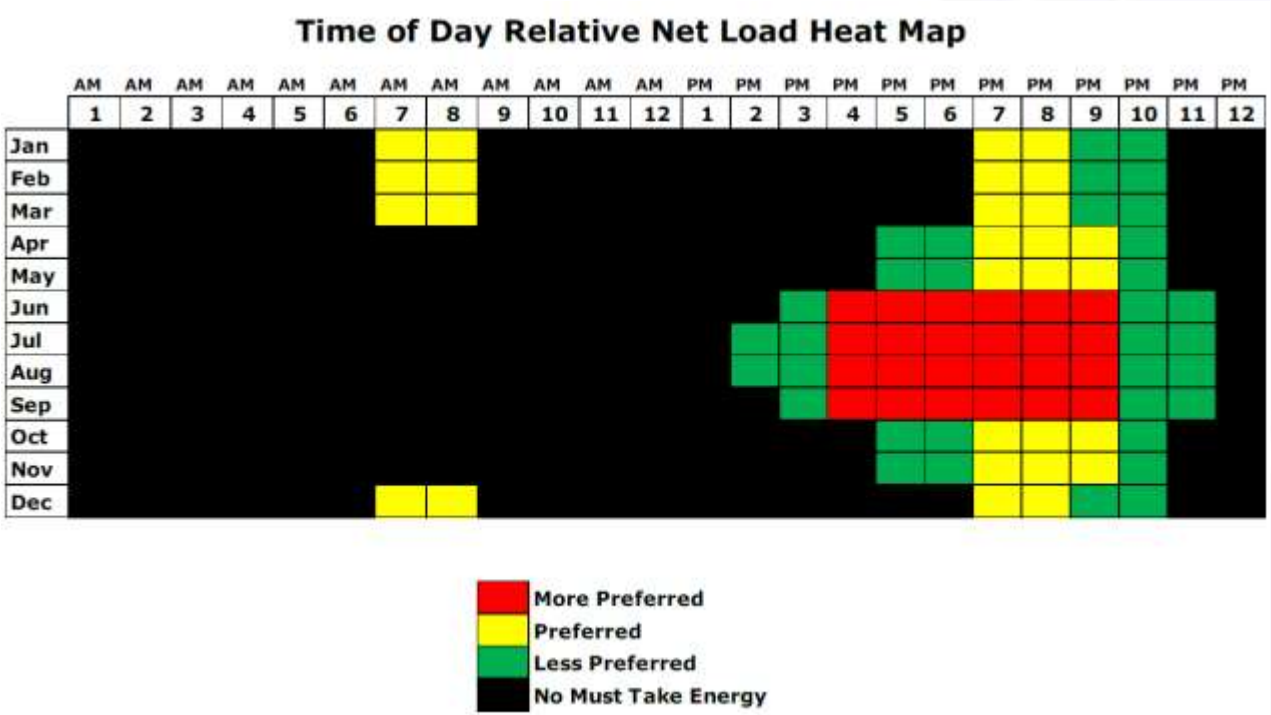


By choosing the size of the solar field and thermal energy storage, the same CSP technology can be configured to meet evolving demands of the grid

Challenge in the US – the 'Duck' Curve

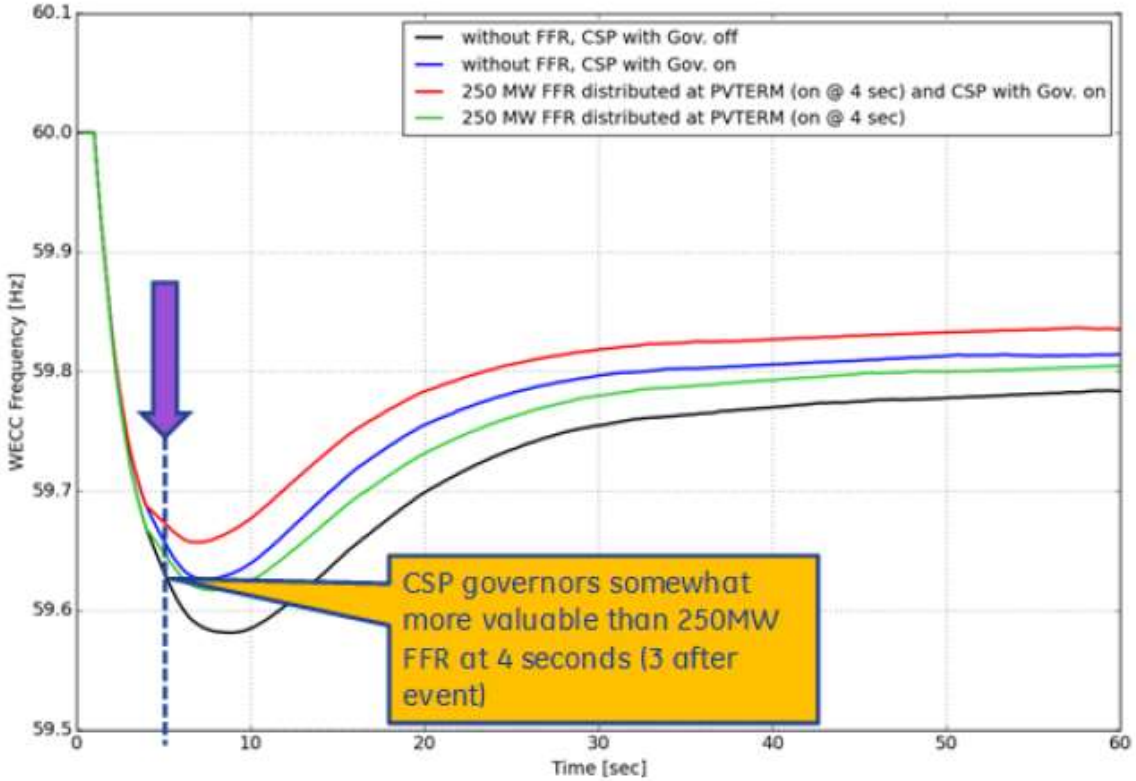


CSP Can Provide Energy When It's Needed



Recent RFP from Arizona Public Service

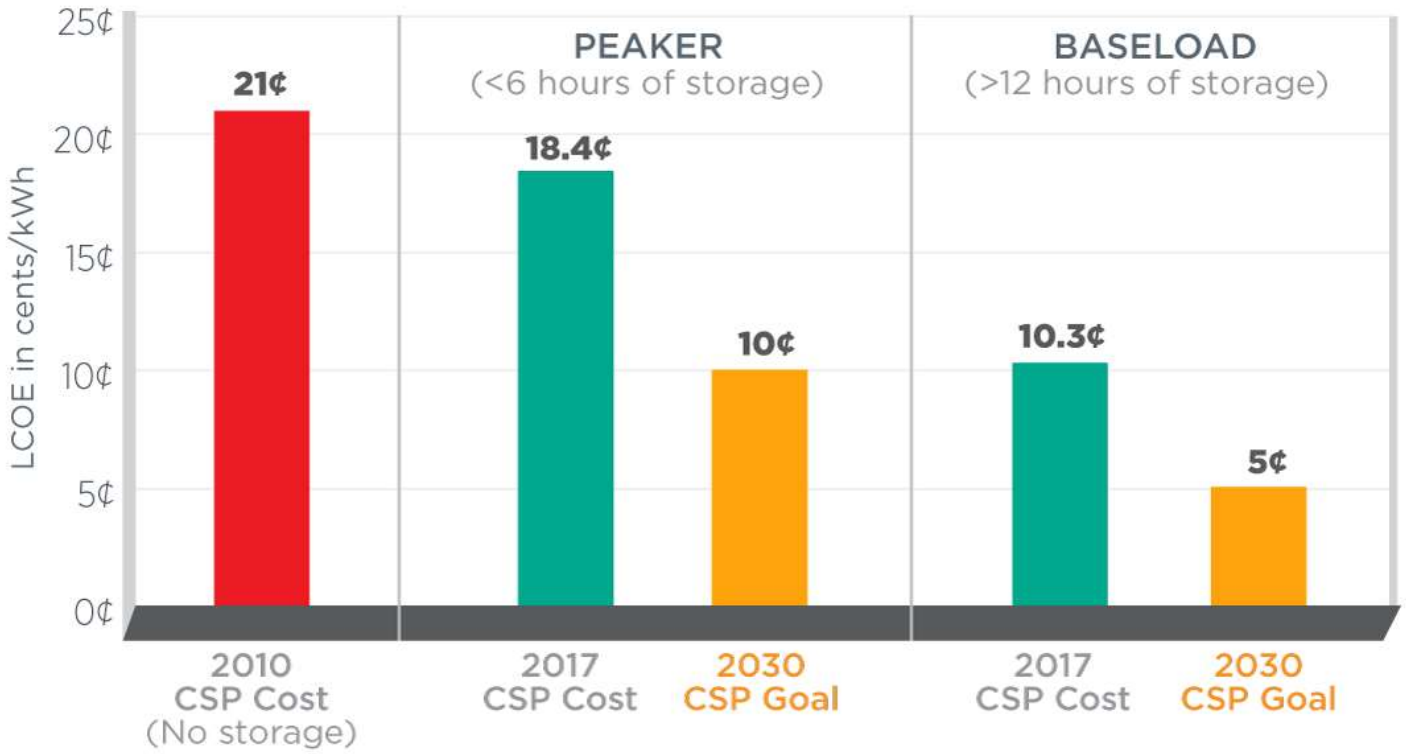
CSP Provides Conventional Grid System Inertia



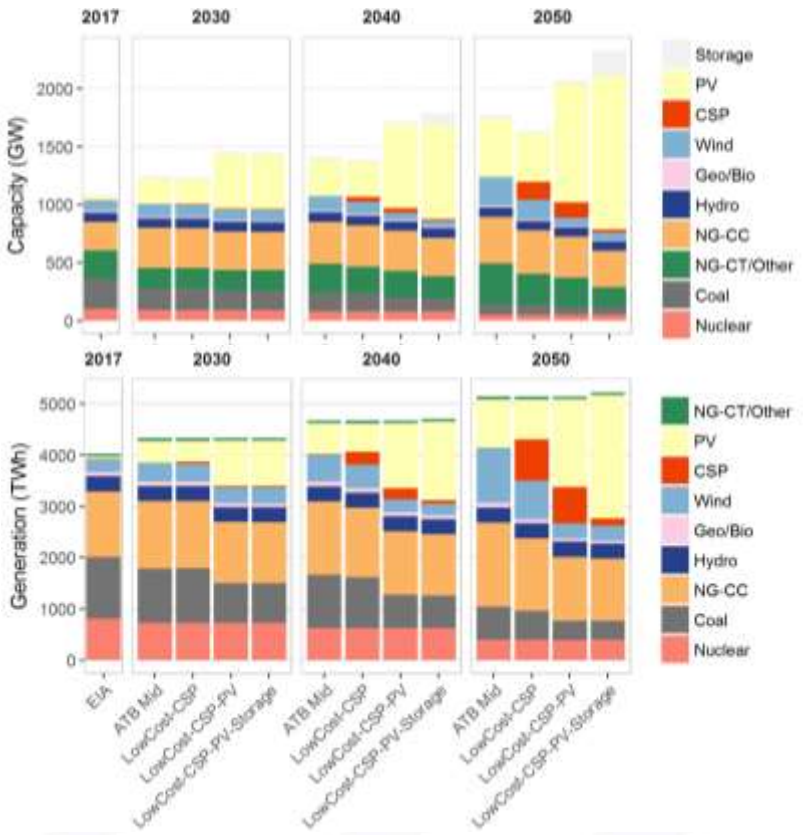
"The Benefits of Frequency Response from Concentrating Solar Power During Sunset Can Be Substantial and Might Represent Valuable Options During the Neck of the Duck Curve"

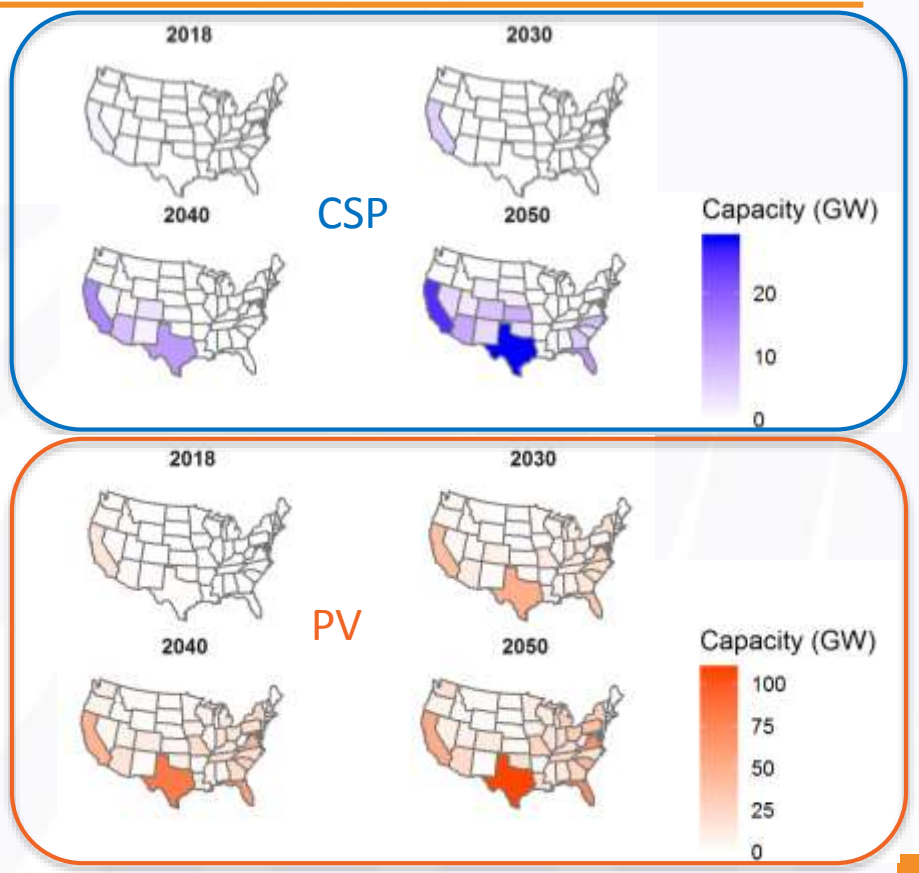
Miller, Pajic, Clark, **2018**, NREL/TP-5D00-70782

2030 Levelized Cost of Electricity Targets



Potential CSP Deployment in the US if DOE CSP and PV 2030 Cost Targets are Achieved





Murphy, et al. **2019**, NREL/TP-6A20-71912

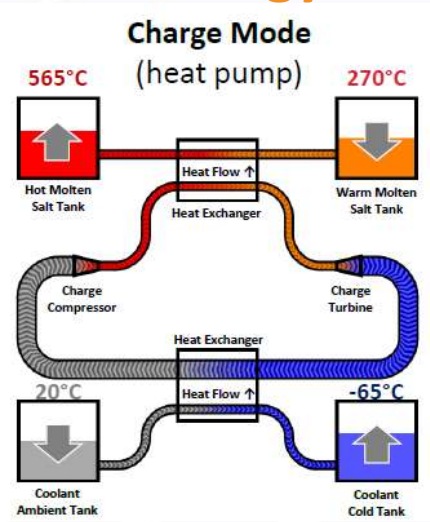
Related (Solar) Thermal Technologies

Solar Industrial Process Heat

GlassPoint

Awarded 1 GW_t (Oman) and 850 MW_t (California) projects for Enhanced Oil Recovery

Electric-to-Thermal-to-Electric Energy Storage



MALTA

CSP Summit – Day 1 Panels

- 9:00AM-10:30AM – **CSP in the Evolving Grid and Energy Market**
  - **Paul Denholm**, NREL; **Caitlin Murphy**, NREL; **Jimmy Nelson**, E3; **Logan Goldie-Scot**, Bloomberg NEF; **Cara Libby**, EPRI (Moderator)
- 11:00AM-12:30PM – **The Potential U.S. Market for CSP**
  - **Ric O'Connell**, Gridlab; **Jenifer Hedrick**, SCE; **Clyde Loutan**, CAISO; **Byron Woertz**, WECC; **Heather Curlee**, Wilson Sonsini (Moderator)
- 1:30PM-3:00PM – **CSP Development Around the World**
  - **Hicham Bouzekri**, MASEN; **Zhifeng Wang**, CAS; **Wes Stein**, CSIRO; **Ana Maria Ruz**, CORFO; **Mercedes Sierra**, SENER; **David Kearney**, K&A (Moderator)

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