

California Solar Energy Collaborative Concentrated Solar and Storage



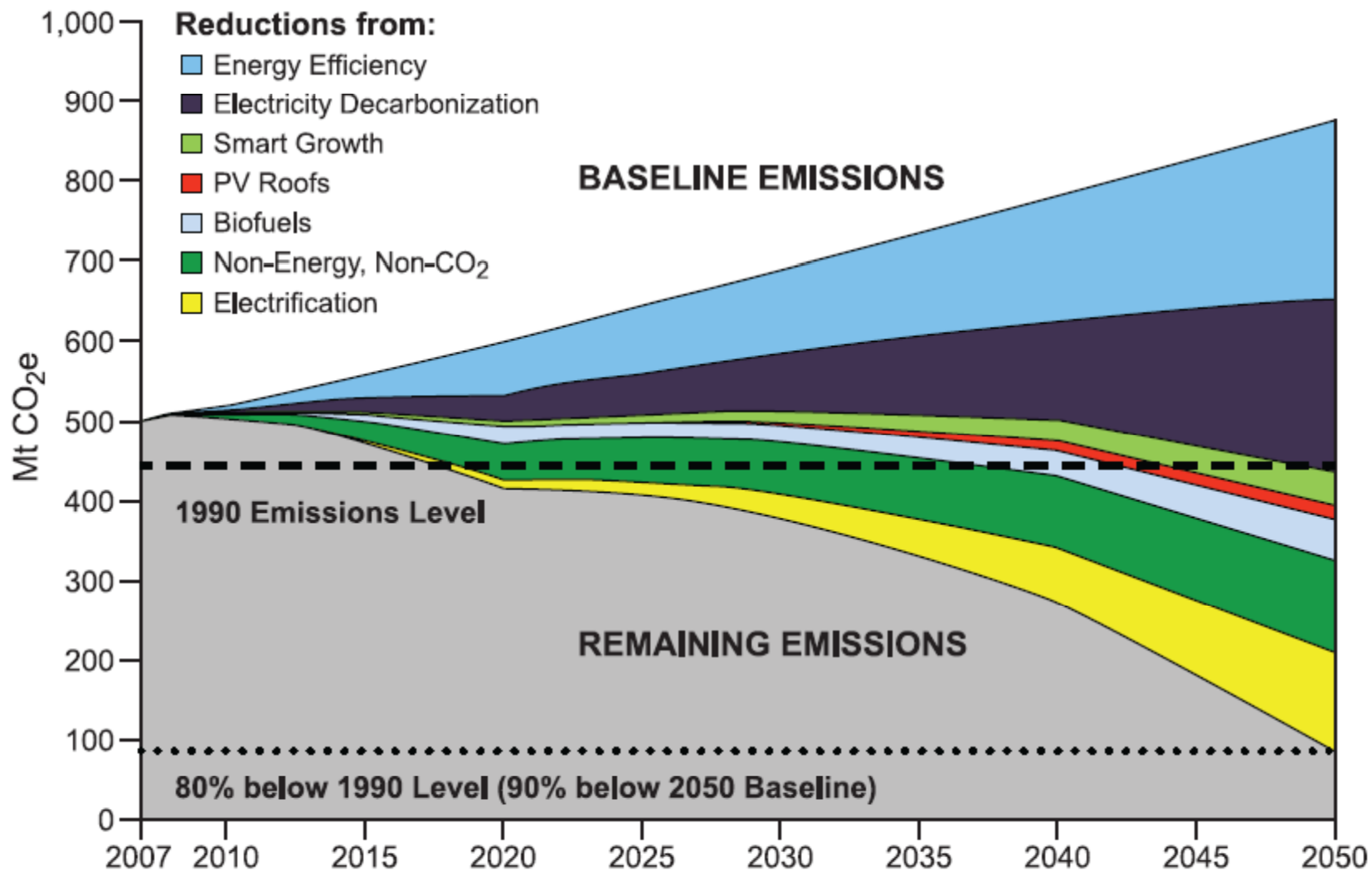
Mission Statement

The mission of the California Solar Energy Collaborative (CSEC) is to assist the State, key stakeholders, and the Energy Commission in developing and expanding the utilization of solar power in California, consistent with the California Solar Initiative (CSI) which has set a target of installing 3000 MW of solar power generation capacity in California by 2017, and with California's overall renewable energy goals, as articulated in the Renewables Portfolio Standard (RPS), and greenhouse gas reduction targets, as articulated in Assembly Bill 32.

Upcoming Events / Updates

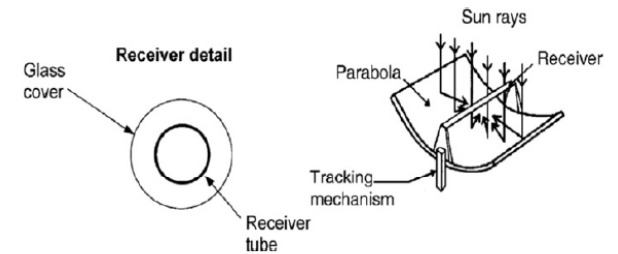
- [2011 UC Davis Energy Week information available.](#)
- White paper posted: Report to California Energy Commission on route to scale-up of polymer based PV: Funding suggestions for research and technology. [View.](#)
- Engineers Help Power Solar Use by 'Mapping' the Sun. [View.](#)
 - [See May 24, 2010 Press Release](#)

Path to 80% Emissions Reduction

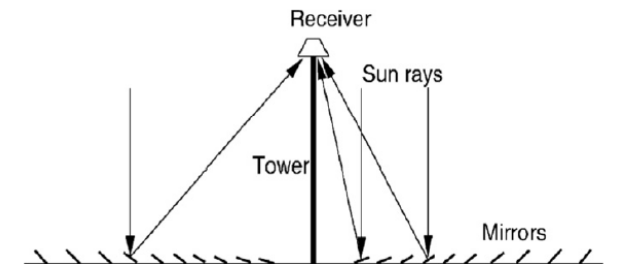


Concentrated Solar Assessment

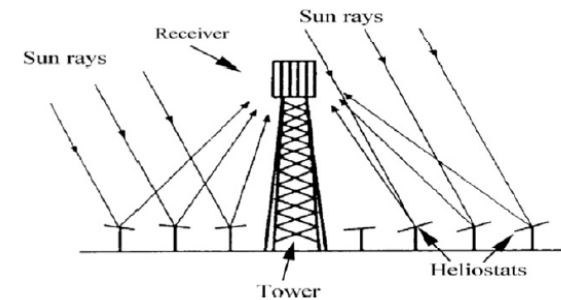
Parabolic Trough Collector



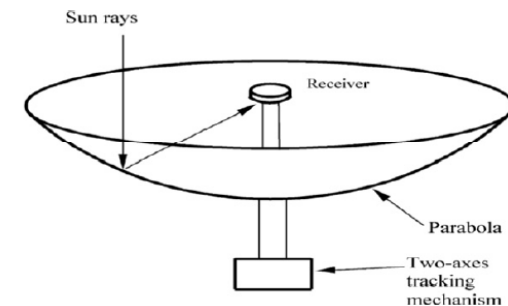
Linear Fresnel Reflector



Heliostat Field Collector



Parabolic Dish Reflector



Heat vs. Electricity

- Heat
 - Advantages – smoother power, high efficiency, midterm storage (12 hrs) possible
 - Disadvantages – must have huge installation, need high temp to “turn on”
- Electricity
 - Advantages – high efficiency, smaller installations, can collect low temp heat as waste product, fast turn on
 - Disadvantages – storage more difficult, power very sensitive to intermittency

Applications of Concentrated Solar

- Electricity
- Water Desalination or Disinfection
- Heating/cooling
- Hydrogen production (stored energy)
- Zinc smelting (1000-1300C)
- Food Dehydration/Drying

Electricity Storage Assessment

- Pumped Hydroelectric – location dependent
- Compressed Air Storage – location dependent
- Flywheels
- Batteries + Fuel cells
- Superconducting Magnetic Energy Storage
- Capacitors
- Concentration + nanoporous membranes

Thermal Energy Storage

- Direct heat storage
- Phase-Change-Material storage
- Sorption storage
- Solar Fuels

Major Themes

- 1) All new solar or wind installations should have energy storage included
- 2) The state of CA needs to incentivize energy storage – better rate of return on generated power.
- 3) Rooftop, community, and commercial PV and solar thermal systems will all be necessary to meet AB32 goals. Most Californians will only directly invest in rooftop.
- 4) The combined use of a load controller, smartgrid, and accessible storage will reduce sensitivity to intermittency.

Concept: Distributed Solar Smoothing or Signal Conditioning



Charge Controller
(maintains battery)

Inverter

Charge Controller

DC

DC

AC

DC

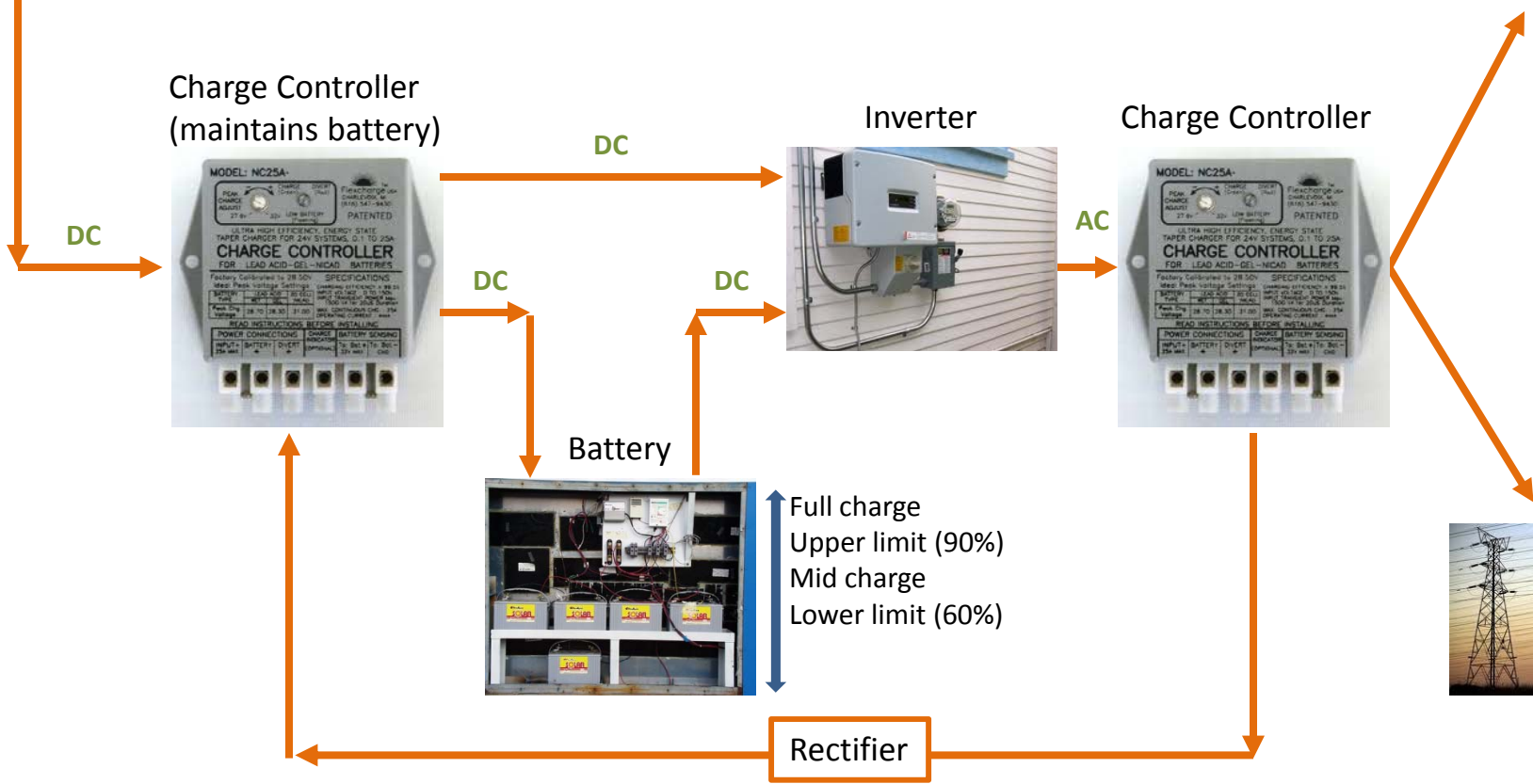
DC

Battery

Full charge
Upper limit (90%)
Mid charge
Lower limit (60%)

Rectifier

Grid



Concept: Targeted solar applications



Solar generates electricity to run pump



Pump waters field

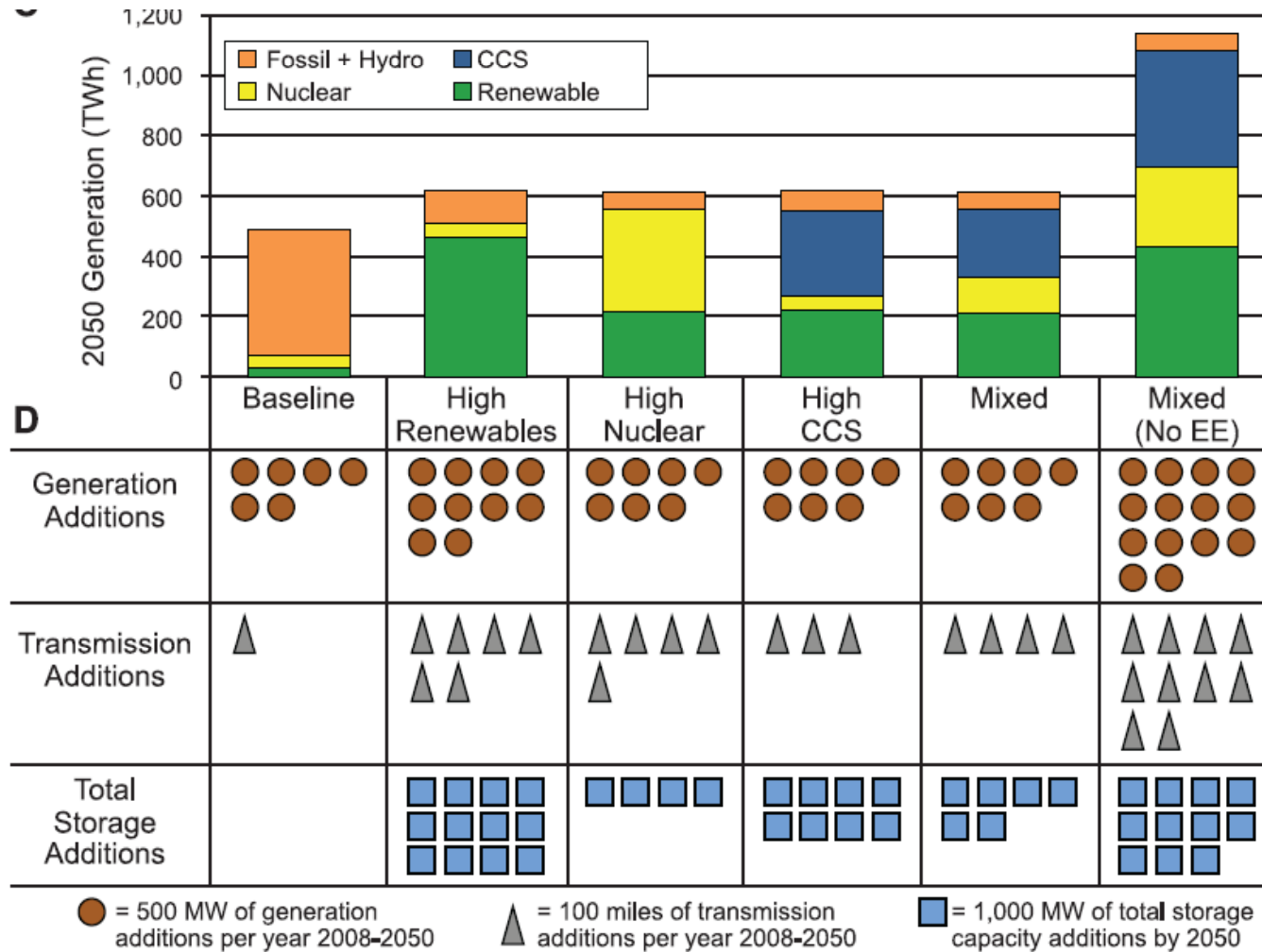


Pump stores water at elevation during day to water at night



With big tower – water runs generator to produce electricity on demand

Storage is always important!



Heat Storage Materials

