Hybrid Solar System

ARPA-E FOCUS PROJECT | DE-AR0000464

TECHNOLOGY

- Transforms concentrating solar power parabolic trough into spectrum splitting receiver
- Integrates high temperature thermal transfer and storage
- Generates variable electricity and up to 600°C dispatchable heat

Metric	State-of-the-Art	Estimated
Electricity Cost	>>$1/$W_e$	$2-3/$W_e$
Collector Cost	-	$0.4-0.7/$W_e$
Energy Efficiency	38%	42-45%
Cogenerated Heat	<200°C	≥600°C

TEAM

gti

UNIVERSITY OF CALIFORNIA
UCMERCED

MicroLink Devices, Inc.

Thermal Storage Design

- Heat transfer/transport
- Particle laden gas
- Store and recover heat at >600°C

Hybrid Solar Collector Design

- Non-imaging optics
- Deliver electricity from PV cells
- Deliver thermal energy at 600°C

High Temperature PV Cell

- Spectral splitter concentrator
- Selective thermal receiver (200°C)
- Electric receiver (GaInP or GaInP/GaAs Cell)

ADVANTAGE

Hybrid Solar Collector

- Significantly upgrade the value of parabolic troughs
- Non-imaging optics
- Novel thin film GaInP or GaInP/GaAs cells
- Straightforward and low cost retrofit procedure

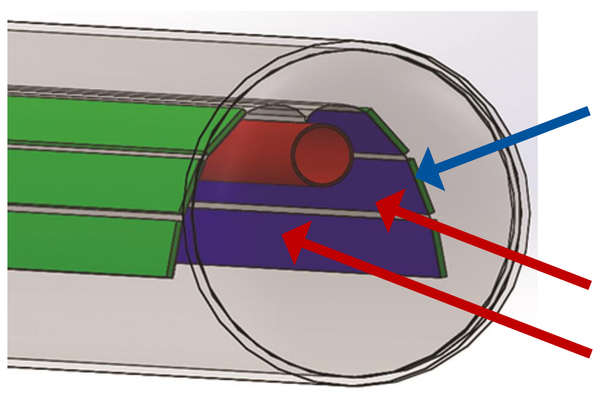
Thermal Storage

- Inert particles as combined heat transfer and storage media
- Low cost (16 $/kWhth)
- Potential to achieve T>1000°C

Power Block

- Air turbine cycle
- Thermal efficiency 32%
- Capital cost <$1M for 1MWe power plant

Integrated Spectrum-Splitting Solar Collector

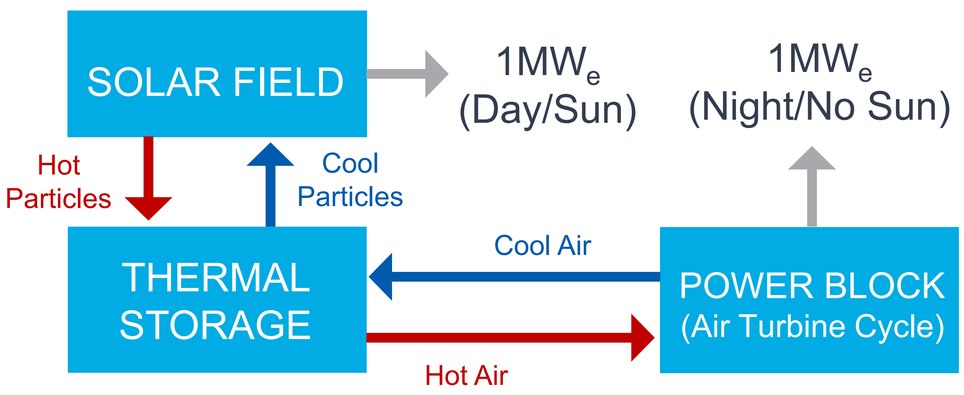


Dual Junction GaInP/GaAs as secondary reflector provides ~1.13X additional concentration on absorber

~60X concentration of photons below GaAs bandgap (compare 22X for today's trough)

Light from primary parabolic reflector to secondary at ~52X

Continuous Electric Power



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