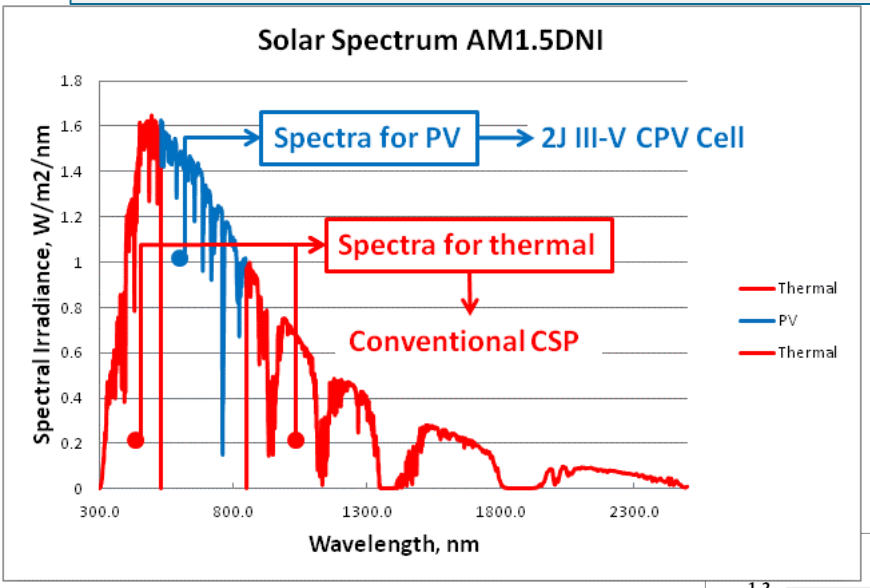
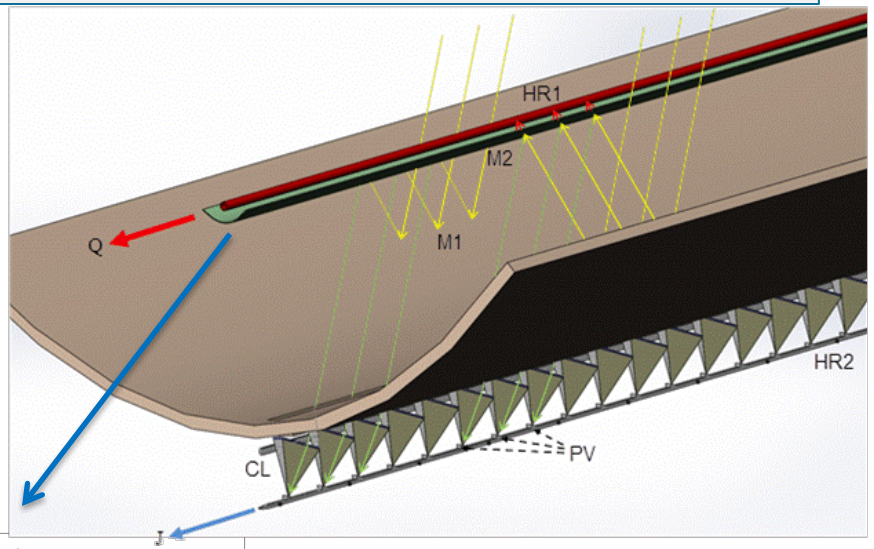
Wei Pan, Sharp Labs of America, Inc.

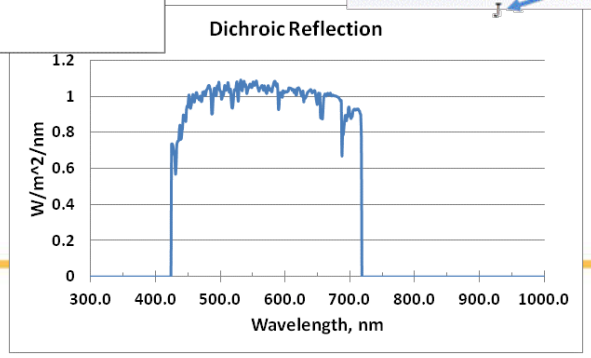
A CSP/CPV Hybrid Solar Energy Conversion System with Full Use of Solar Spectrum

What is the technology?

- *The hybrid CPV/CSP technology splits solar rays into PV and thermal bands using a hyperbolic dichroic mirror placed near the primary heat collector.*
- *PV light is reflected by the dichroic and concentrated onto CPV cells with optimal conversion efficiency, while the rest of sun light is transmitted and collected by the heat collector..*







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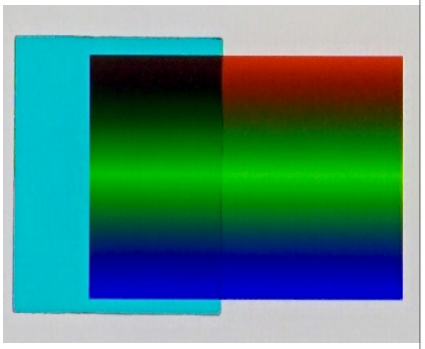
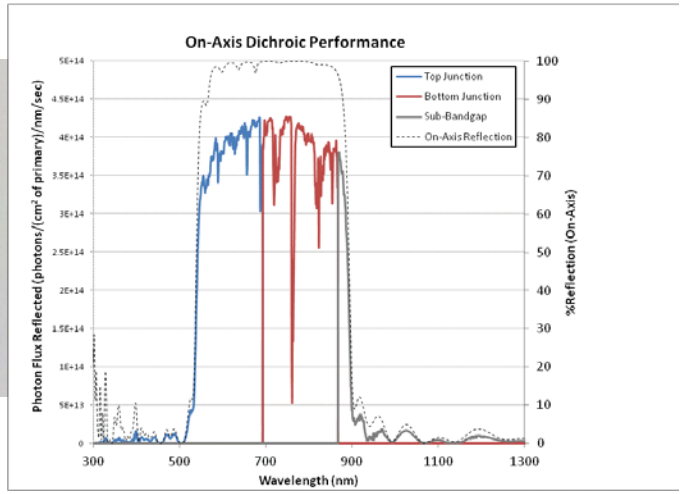
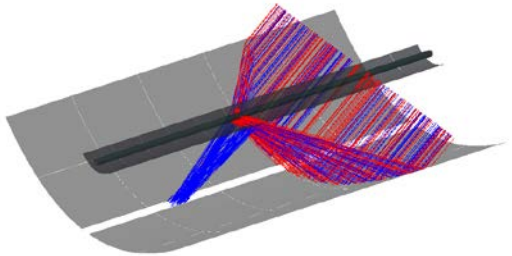
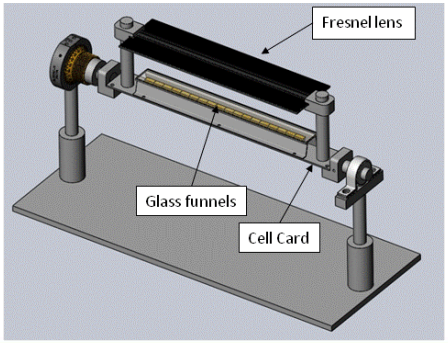
How does it improve the state-of-the-art?

- *This hybrid CPV/CSP collector utilizes the whole solar spectrum effectively by splitting solar energy into PV and thermal bands for variable electricity generation and low cost dispatchable thermal storage.*
- *Combines advantages of CPV and CSP technologies to achieve not only more electricity output but also balanced variable / dispatchable output*
- *Innovative core technologies: Novel dichroic design with small blue shift; Secondary optics to track and re-focus light; 2J CPV cell; and New collector design to adopt add-on optics*









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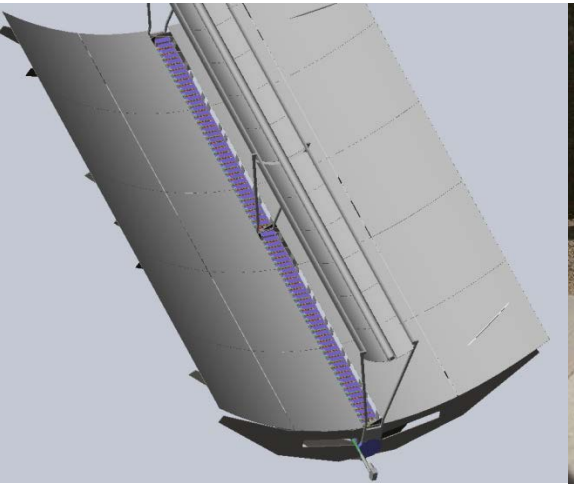
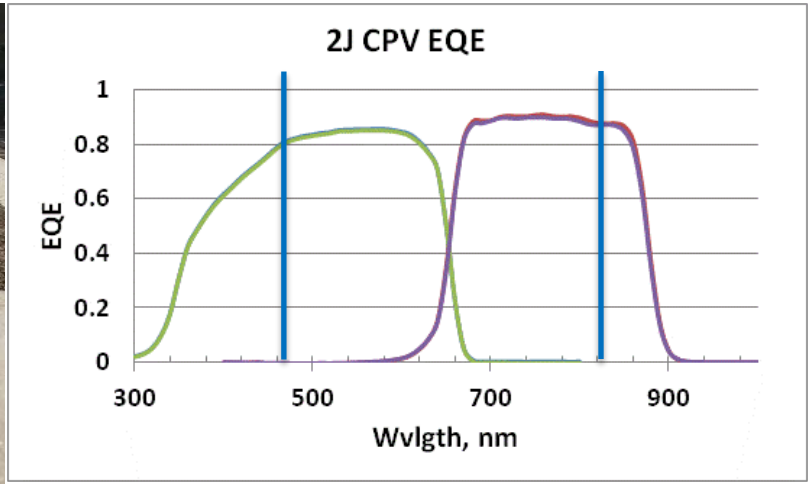
Status and achievements of the project to date

- *A full hybrid collector is designed with add-on dichroic mirror and secondary optical module that passes FEA stress tests. System specifications determined.*
- *A secondary optic design and prototype shows 90% transmittance efficiency.*
- *A 2J CPV cell designed and tested. Demonstrated annual efficiency >50% in dichroic band selected.*
- *A hyperbolic glass slump process developed to shape dichroic mirror substrate.*
- *A dichroic film is being designed intended to minimize skew angle induced blue shift effect.*
- *A detailed annualized energy output model is established for electricity and exergy of hybrid system.*



FEA Stress test finished

90% Transmittance



2J CPV cell designed and tested

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Challenges that the team has encountered

- *An invariant dichroic design with solar energy weighted angle of incidence on M2 is progressing.*
- *A low cost field reliable passive thermal management design still needs fine tune.*
- *A simplified low cost secondary optical module design posses challenge.*