



Modular Solar Electric Power (MSEP) Systems



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Purpose and Objectives

- Discuss development and deployment of Modular Solar Electric Power (MSEP) systems
- Feasibility of application of existing binary power cycles to solar trough technology
- Identification of next action items

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Modular Solar Electric Power (MSEP) Systems

- Concept Description
 - MSEP combines field proven technologies of ORC power unit and the CSP troughs
 - ORC power units have been successfully used for resource temperatures up to 400 °F

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Modular Solar Electric Power (MSEP) Systems, cont'd.

- Concept description cont'd.
 - CSP troughs have been deployed and used to provide heat resources up to 735 °F
 - Combination of these technologies may provide great opportunities for modular electrification

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MSEP's Unique Aspects and Advantages

- Links proven technologies such as ORC power cycle with trough solar technology
- Makes trough technology available to higher value distributed and remote power markets

MSEP's Unique Aspects and Advantages

- Allows lower operating temperatures (450 °F - 580 °F):
 - Means that lower-cost non-evacuated receiver tubes may be used
 - Efficient cost effective thermal storage
 - Smaller solar field

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MSEP's Unique Aspects and Advantages

- Reduces water utilization (ORC air-cooled)
- Standalone and automated operation with minimal operator involvement

MSEP's Past Experiences

- Coolidge Solar Irrigation Project (Arizona Solar Irrigation Facility)
 - 150-200 kW Solar Powered
 - 23040 ft² collector area
 - Caloria HT-43, at 550 °F in and 392 °F out
 - 50,000 gal thermal storage

MSEP's Past Experiences, cont'd.

- ORC with Toluene and $\eta=20\%$
- O&M required 4 hrs/day (2/3 of which was devoted to collector system)
- Plant operated automatically with no incidents during 1981-1982

MSEP's Past Issues

- Diminished collector reflectivity over time
- Equipment failure(pump seals, flexhose rupture), solar side piping, collector tracking, collector no-flow overheating, condenser freezing, tracker photodiodes cracking
- Environmental issue: rainfall, storms, dust, wind
- High O&M: cooling tower, collector system

MSEP's Challenges and Issues

- Issues with operation of ORC's at temperatures 450 °F to 580 °F (choice of appropriate working fluid)
- Availability of components for ORC's
- Development of new cycles

MSEP's Challenges and Issues

- Development of modular solar plants
- Standalone operation of solar plant (O&M costs)
- Balance between cost and efficiency
- Identification of potential markets
- Identification of next action items