



**SOLAR THERMAL PARABOLIC TROUGH POWER PLANTS:
AN OVERVIEW OF EXISTING POWER PLANTS
& FUTURE TECHNOLOGICAL DEVELOPMENT**

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NEW ADVANCES IN CONCENTRATING SOLAR POWER



**SOLAR THERMAL PARABOLIC TROUGH POWER PLANTS
AN OVERVIEW OF EXISTING POWER PLANTS
& FUTURE TECHNOLOGICAL DEVELOPMENT**

1. History of the SEGS Plants
2. SEGS Plants Brief Description
3. SEGS Experience
4. Future Development of SEGS
5. Concluding Remarks

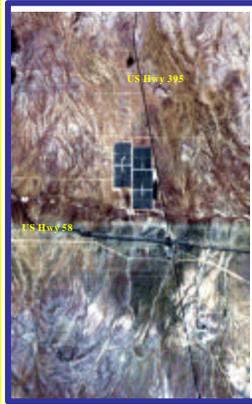


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THE SEGS HISTORY IN CALIFORNIA

SEGS I	1984	Daggett	14 MW
SEGS II	1985	Daggett	30 MW
SEGS III	1986	Kramer Junction	30 MW
SEGS IV	1986	Kramer Junction	30 MW
SEGS V	1987	Kramer Junction	30 MW
SEGS VI	1988	Kramer Junction	30 MW
SEGS VII	1988	Kramer Junction	30 MW
SEGS VIII	1989	Harper Lake	80 MW
SEGS IX	1990	Harper Lake	80 MW



Kramer Junction - California
Satellite view

TOTAL CAPACITY INSTALLED = 354 MW

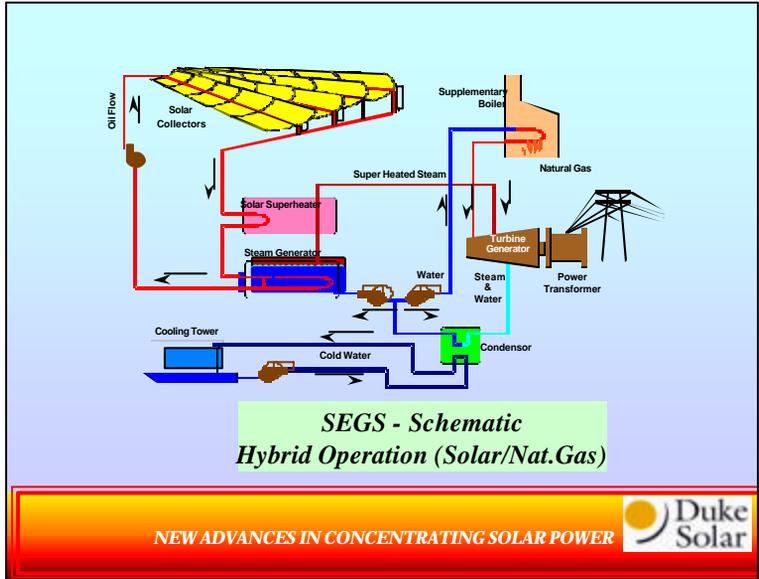
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AERIAL VIEW OF KRAMER JUNCTION

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SEGS: BRIEF DESCRIPTION	
 <p style="text-align: center;">Power Block</p>	<p>Turbine Generator Gross Output 33 MWe Net Output to Utility 30 MWe</p> <p>Solar Steam Conditions Inlet Pressure = 1450 psia Inlet Temperature = 700 Deg.F</p> <p>Gas Mode Steam Conditions Inlet Pressure = 1450 bars Inlet Temperature = 950 Deg.F</p>
<p>Electrical Conversion Efficiency Solar Mode = 37.5 % Gas Mode = 39.5 %</p>	

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Solar Collector Assembly LS-3 (545 M)

99 Meters

244 Reflector Panels

Aperture 5.76 Meter

Ball Joint Assembly

Drive System

Sun Sensor

Local Controller

24 Heat Collection Elements

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SEGS: BRIEF DESCRIPTION

Solar Field

Annual Efficiencies

Thermal = 43 %

Peak Optical = 73 %

SEGS V - Kramer Junction

Solar Collector Assemblies

LS2 (235 m ²)	980
Aperture Area (m ²)	5.0
Length (m)	47.1
Concentration Ratio	71
Optical Efficiency	0.737
# of Mirror Segments	117.600
Field Aperture (m ²)	230.300
Field Inlet Temp. (°C)	350
Field Outlet Temp. (°C)	395

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WEST EAST

Morning

Afternoon

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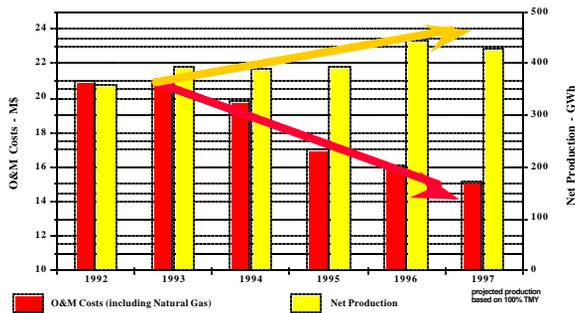
Operation and Maintenance

- Years of Data Available
- More than 100 years of Operating Experience
- High Reliability
- Mature Technology

Experience With Parabolic Trough Systems

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O&M COST DECREASE WHILE NET PRODUCTION INCREASE



Experience With Parabolic Trough Systems

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Solar-to-Electric Efficiency



Experience With Parabolic Trough Systems

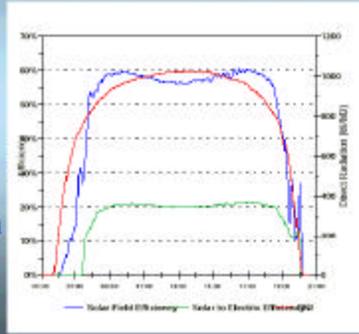
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Kramer Junction Operational Experience

EXCELLENT EFFICIENCY

- Plants operating well
- Performance records set in 1998 and 1999
- Improvements due to:
 - ▶ Better O&M practices
 - ▶ Technical innovations
- Achieved in parallel with reduced O&M costs
- Typical clear summer day shown here



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SEGS: BRIEF DESCRIPTION

SOLAR ELECTRIC GENERATING SYSTEMS SEGS I - IX - FACT SHEET

- 354 Mwe Installed and in Operation
- More than 7000 GWh produced
- \$ 1.25 Billion invested
- Matured O&M Procedures
- On-going Technical Innovations reducing costs
- Selected Technology for GEF Projects

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FUTURE DEVELOPMENT OF TROUGH AND Concentrator Solar Power (CSP) TECHNOLOGIES

1 *Potential Improvements in Trough Technology*

- Reduction in Trough Structure Cost
- Improved Receiver Performance, Reliability, & Maintainability
- Standardized Designs
- Lower Cost Reflectors

2 *Global Environment Facility*

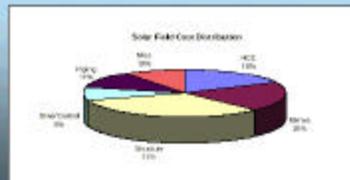
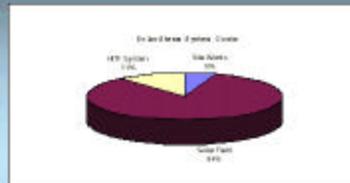
- Has identified CSP as a favored technology to help achieve objectives on reduction of global greenhouse gas production
- Recent assessment of CSP concluded that trough and power tower technologies promise long-term competitiveness
- Has tentatively approved approximately \$200M of grants for four projects
- Additional projects beyond these four are possible

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Nominal Trough Solar System Cost Distribution

- Total Direct Cost for Solar Field
 - 250 \$/m² +/- 20% depending on vendor, design, location, etc.
- 70% of cost made up of structure, reflectors, and receivers (HCE)



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CONCLUDING REMARKS

It is The Right Time To Look For a Better Environment For Us And For Future Generations All Key elements At Hand

- Abundant sources of Renewable Energy
- Strong Public Consciousness
- Technology readily available
- Global Energy companies involved

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