

Concentrated Solar Power

American Clean Skies Foundation CERF III

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imagination at work

Overview

- GE & eSolar
- Current Offerings
- Differentiation
- ISCC Benefits
- ISCC in the US



imagination at work

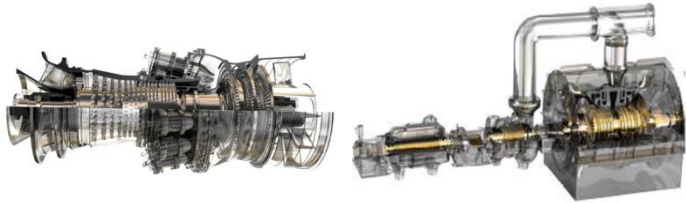
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GE alliance with eSolar

Integrated solar combined cycle and concentrated solar plants



- Leading-edge GT technology
- 100+ year ST experience
- Strategic equity investment



- Proven solar technology
- Unique modular, scalable design
- Rapid installation
- Advanced control/ optimization software

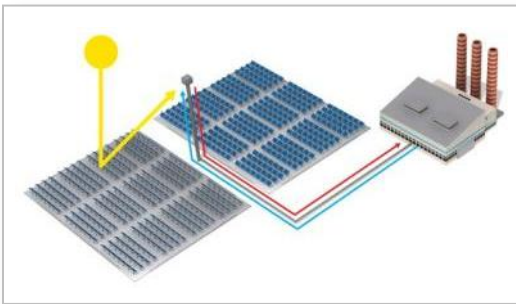
Working to deliver integrated technology solutions

Modular CSP offering ... application flexibility



ISCC

- 10%-15% of plant rating optimal
- Fuel efficiency > 70%
(~8% increase with ISCC vs. CC)

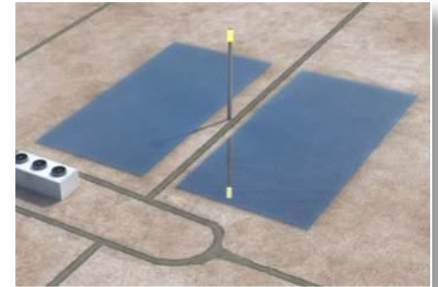


Hybrid Fossil

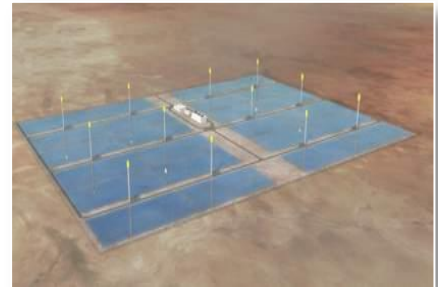
- 10%-15% of plant rating optimal
- Solar integrated into feedwater heating
- ~8% increase in fuel efficiency

Stand Alone

- Direct steam without storage
- Molten Salt with storage
- 100MWe maximum per power block



5MWe Module



50MW plant

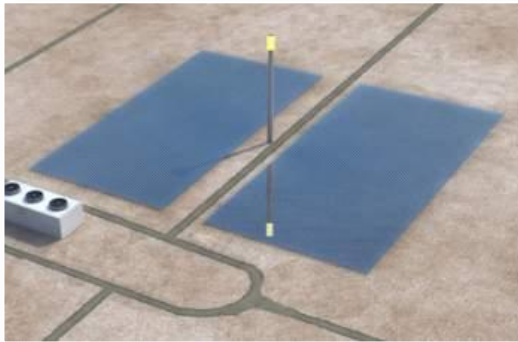


Multi-plant CSP Farm

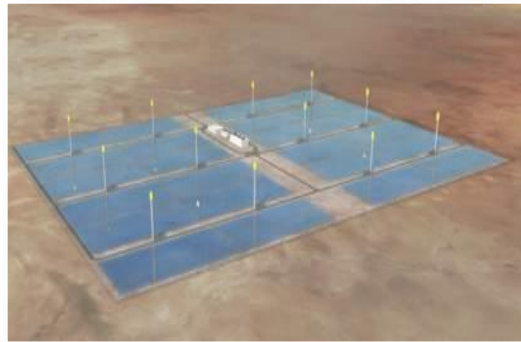
Differentiating features

Scalable direct steam technology

- **Scalability** ... single module size for multiple configurations
 - Capacity factor (20 - 30%)
 - Solar multiple (1.0 - 1.3)
 - Overall plant size (up to ~100MW)
- **Lower tower heights** (versus single tower plants)
- **Fault tolerance** (no single point tower failure)
- **Standardized design** ... reduces project specific engineering cost/risk



Direct Steam
Generation Module
(one tower and receiver)



12 Modules
100 Hectares



Multi-Unit Plant

ISCC the best of both worlds

Advantages

- Steam Turbine already deployed – increase utilization & LCOE savings
- No need for thermal storage – dispatchable and renewable
- Off-set gas turbine's hot day lapse to meet peak summer demand
- Flexible control at the plant level, not the grid level
- Higher efficiency increases plant dispatch position

Leveraging a global footprint

- GE Announced Dervish ISCC plant in Turkey (2011)
- Since 2009, major Gas Turbine OEMs have entered into CSP
 - ISCC is a growing trend in CSP
- Global market is over 5 GW of CSP to date
 - Solar is one the fastest growing energy sources for electrical generation
- GE's scalable, modular approach is designed for cost-out
 - Software over hardware
 - Design for scale
 - Reduce one-time engineering through modularity



ISCC in the United States

Opportunities

- Aggressive RPS targets
- Strong DNI in Southwest
- 360° renewable energy leadership
- Leverage global scale with modular offering

Challenges

- Low gas prices due to shale
- Over capacity in US market
- Installed costs need to lower with scale
- Permitting restrictions and red tape

US CSP to date

- 530 MW operational
- Over 4 GW operational, under construction, or in development

State	RPS	Target
Arizona	15%	2025
California	33%	2020
Nevada	25%	2020
New Mexico	20%	2025
Utah*	20%	2025

* RPS Goal, not mandatory requirement



* Source: NREL and EPA



Summary

- A growing demand for solar generation in the world
- Many developing countries can benefit from tapping their solar resources
- GE & eSolar bring scalable, modular solution to the CSP industry
- Hybrid solar plants ... a catalyst for the CSP deployment



Thank - You



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