



ABENGOA SOLAR

The Truth About Concentrating Solar Power:
Affordable, Abundant, Reliable and
American-Made

EESI-ACEG Briefing, 22 May 2012



Parabolic trough



Power tower



Linear fresnel

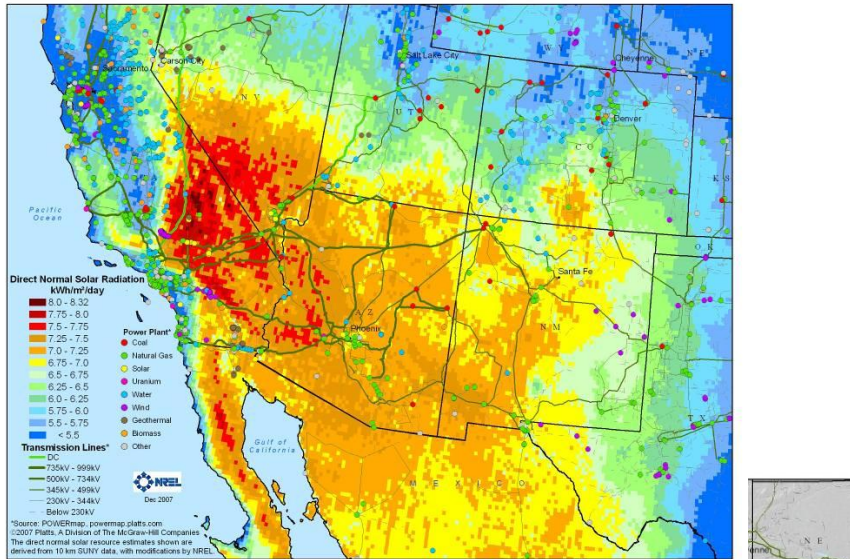


Dish engine

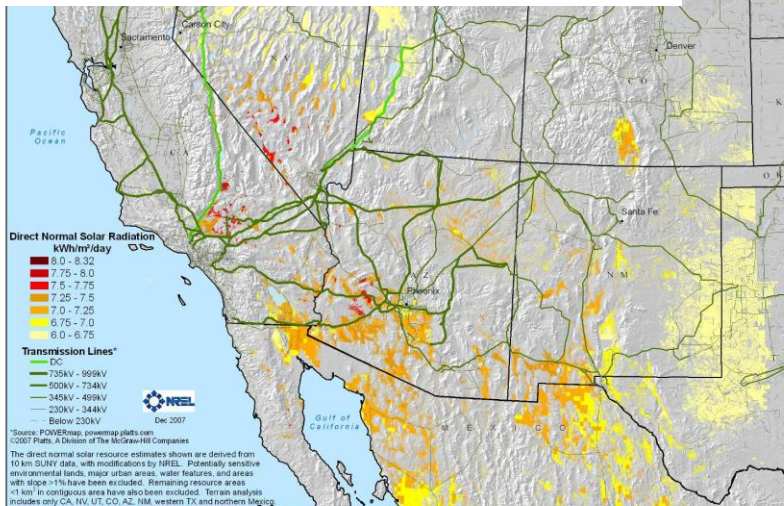


Concentrating PV

Abundant



- In America, beam or direct solar energy is greatest in the southwest states – AZ, CA, CO, NM, NV, TX and UT.
- This map shows the areas (over 87,000 sq miles) in those states where the land is relatively flat and relatively “empty”.
- The generation potential of those areas is six times what the US needs today.
- So this energy resource is abundant.



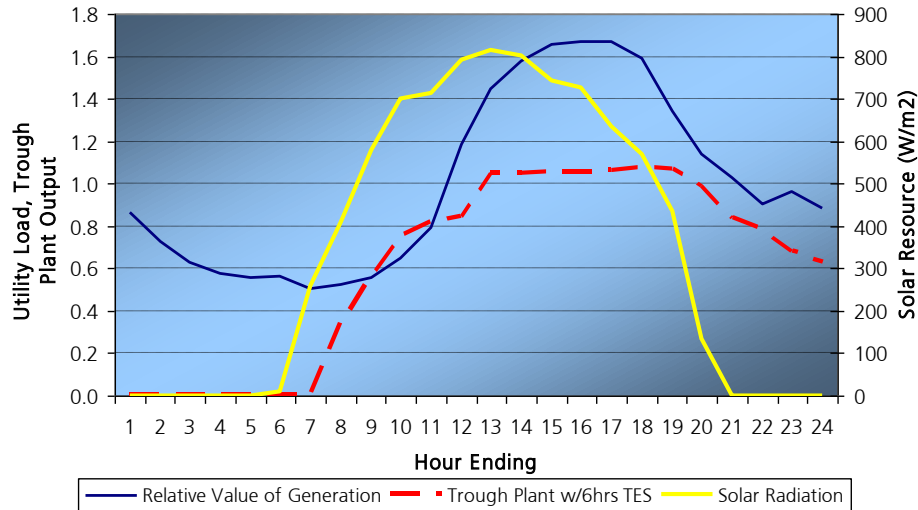
CSP works when needed not only when electricity is generated

- Because the sun's energy is collected in the form of heat, that heat can be stored efficiently and economically in large tanks, similar to thermos bottles
- The tanks hold a fluid, called a molten salt
- In the daytime, heat from the solar field is collected in these large tanks, and at night or during long cloudy periods, the heat is transferred from the tanks to make steam to allow the turbine to continue to run and generate electricity
- That is now being done on a very large scale by CSP plants

Generation from a CSP plant with thermal energy storage can be shifted to match the utility system load profile

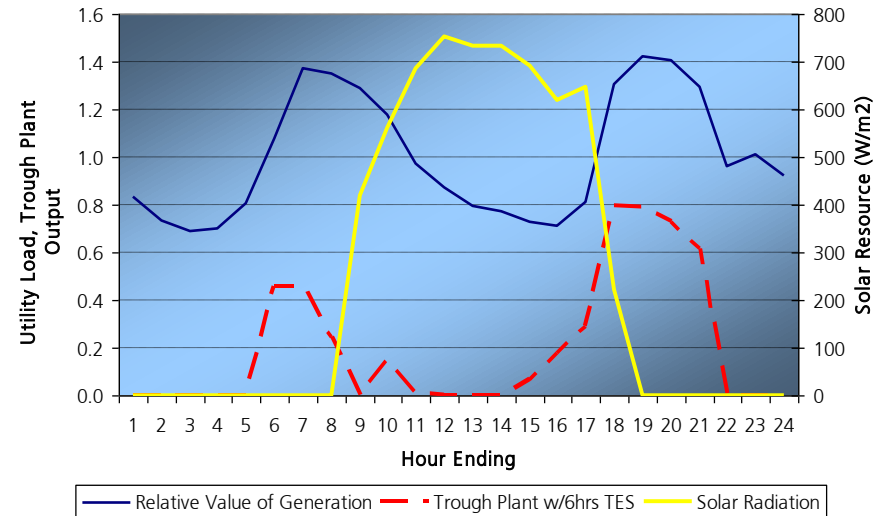
Summer

Solar Plant With Storage vs. Utility System Load
July



Winter

Solar Plant With Storage vs. Utility System Load
January



- Key:
- Solar
 - Demand
 - Generation

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Operating CSP plants in the US



Name or location*	Utility	State	Size	Technology	Begin operation	Company
SEGS	SCE	California	354 MW	Parabolic trough	1985 - 1991	FPL Energy
Saguaro	APS	Arizona	1 MW	Parabolic trough	2006	Acciona
Nevada Solar One	NVEnergy	Nevada	64 MW	Parabolic trough	2007	Acciona
Kimberlina power plant	PG&E	California	5 MW	Linear Fresnel	2008	Ausra/AREVA
Sierra Sun tower	SCE	California	5 MW	Power tower	2009	eSolar
Keahole Solar demo	HELCO	Hawaii	7 MW	Parabolic trough	2009/2011	Sopogy
Maricopa Solar demo	SRP	Arizona	1 MW	Dish/engine	2010	SES / Tessera Solar
Cameo hybrid	Xcel	Colorado	2 MW*	Trough add-on to coal	2010*	Abengoa
Martin Solar Energy Ctr.	FPL	Florida	75 MW	Trough add-on to IGCC	2010	NextEra Energy
Operation Total -----			512 MW			

* Cameo project completed its testing and is no longer operating

CSP plants under construction in the US



Name	Ivanpah	Genesis	Solana	Crescent Dunes	Mojave
Utility	SCE + PG&E	PG&E	APS	NVE	PG&E
State	California	California	Arizona	Nevada	California
Size	392 MW	250 MW	280 MW	110 MW	280 MW
Technology	Power Tower	Trough	Trough	Power Tower	Trough
COD	2012	2012	2013	2013	2014
Company	Brightsource	NextEra	Abengoa	SolarReserve	Abengoa
Total CSP under construction: 1,321 MW					



Image provided by BrightSource



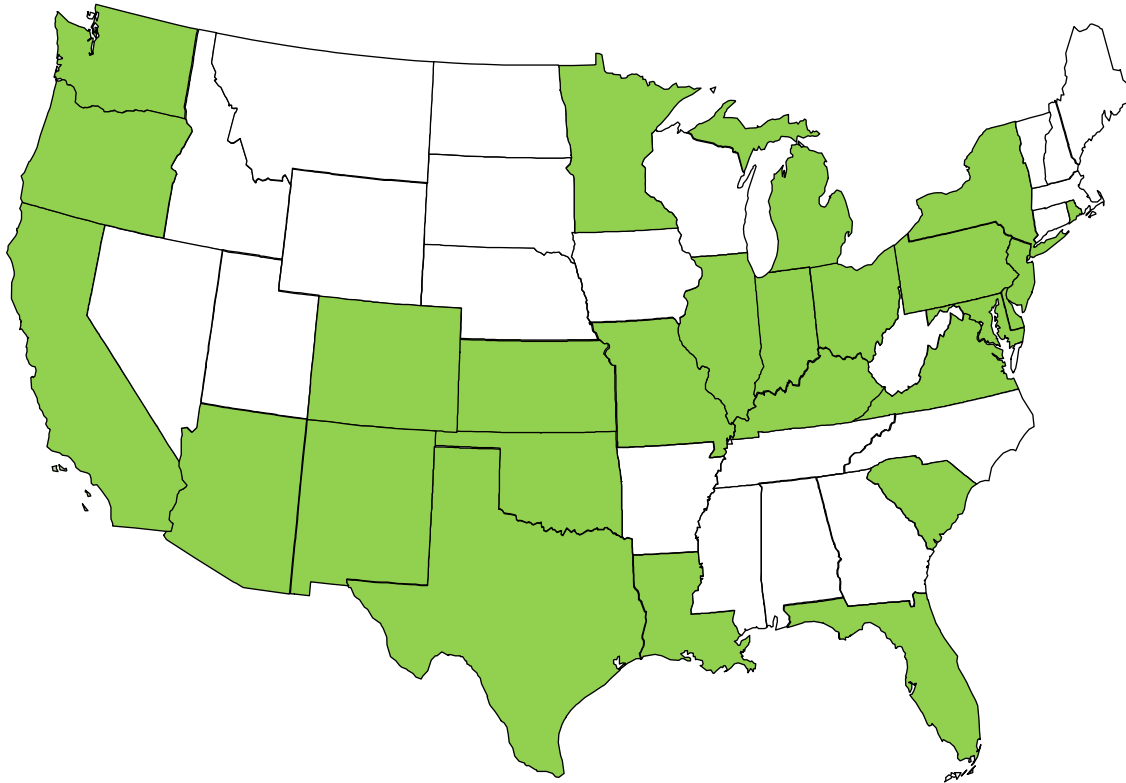


Artist's rendering of Solana (3 sq. miles)

Power block May 2012



Solana supply chain spans the country



Components

Mirrors, collector assembly
Perimeter fence/grading, pond
Thermal Storage foundation
Steel tanks
Substation/transmission lines
IT controls
Feed water vessels
Pump motors
Heat Transfer Fluid and pumps
Pressure heaters
Thermal Storage Equipment
Receiver tubes
Ball joint assemblies
Water treatment equipment
Collector foundations
Cooling / condensing system
Night HTF pumps
Hydraulic drives
Piping/insulation

Rio Glass advanced manufacturing of mirrors



America wins

- There are numerous benefits from harvesting the sun's energy with CSP plants
 - Energy security – we use our own domestic energy
 - Enhances reliability – by adding another resource to the generation mix
 - Environmental – generates electricity free of GHG emissions and other harmful emissions
 - Economic benefits – creates more jobs per MW than conventional sources and supports economic growth
 - ▶ Jobs – 5,200 jobs during construction of these five CSP projects – mainly local jobs
 - ▶ 313 jobs to operate and maintain those plants – mainly local jobs
 - ▶ Several thousand jobs to manufacture the components for those plants in factories across America
 - American-Made – Solana is over 70% American-Made while Mojave, our second plant is over 90% American-Made.

Affordable

- CSP is abundant, reliable (and dispatchable) and American-Made. But is it affordable?
 - Thanks to the federal and state incentives, CSP is affordable today.
 - If those policies are continued for about 10 more years (many fewer than what was done to support coal, oil and gas), the cost will come down due to improved performance and the learning curve effect, those incentives will no longer be needed and CSP will be a low cost clean energy option.
- Conventional sources of electricity generation started out at very high cost and have achieved cost reduction with economies of scale
 - Coal, natural gas, and nuclear have required massive increases in scale in order to achieve current favorable costs
- Solar PV and wind, by contrast, are continuing to experience significant improvements in their costs with relatively small increases in scale
 - The rapid reductions in clean energy's costs are projected to continue and will bring these technologies to parity in a relatively short time
- CSP is even earlier on the learning curve and therefore still requires federal support until adequate scale is reached

Conclusion

- As we are talking today about wind power, I claim that we cannot afford not to develop CSP because CSP with TES will back up the intermittent wind and PV, allowing the country to use larger amounts of both.
- With continued policy support, the outlook for CSP is very strong and positive and America will have another competitive resource to meet its energy needs.



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