



ausra™

## Solar Steam Generation For Existing Coal-Fired Power Plants



### MARKET READY SOLUTION

In today's evolving carbon market, power producers are looking for energy solutions to decrease emissions while enhancing their competitive advantage. Ausra's innovative solar generator design can be deployed at existing coal-fired power stations to deliver emission-free steam. Customers can increase plant output while lowering carbon emissions. Ausra's solar system can replace the extraction steam used for feedwater heating in a coal station with solar steam from a reliable, land-efficient solar field. The steam that is not extracted can continue expanding through the steam turbine and produce more electricity without increasing plant emissions.

### ENGINEERED FOR POWERFUL PERFORMANCE

The Ausra system delivers more energy per acre than any other solar technology. Generating steam from the sun, Ausra's solar field can lead to improvement in overall plant performance. Additional thermal energy from steam leads to an increase in plant output. For mid- to large-scale coal-fired power stations, the installation of an Ausra solar field can increase electrical output by approximately 5 percent during times of peak demand. Ausra is the first solar steam power boiler manufacturer to receive the American Society of Mechanical Engineers' (ASME) "S" Stamp Certificate of Authorization. Ausra has also received the National Board Certificate of Authorization "NB" to register its solar boilers.

### REDUCED EMISSIONS

Our system provides real value – from avoided carbon costs to the generation of emission reduction credits. Adding steam from the sun provides more carbon-free electricity at peak periods. Ausra's solar field can also improve a plant's environmental profile. The daily operational profile of Ausra's solar field reduces air emissions when air quality improvements are needed most – during peak summer demand hours.

### THE AUSRA™ ADVANTAGE

#### SIMPLE, DURABLE DESIGN

- Low wind profile
- Direct steam generation
- Steel-backed mirrors for long life

#### RELIABLE AND ROBUST

- Commercially proven technology
- Engineered for toughest environmental conditions
- (UV, rain, wind, hail, seismic)

#### RAPID DEPLOYMENT AND INSTALLATION

- High-volume automated production and standard materials help reduce supply chain constraints
- Rapid field installation (6 - 18 months)

#### OPTIMIZED SITING

- Ease of permitting
- Maximum energy per acre
- 8,200 MMBtu/acre/yr<sup>(1)</sup>

### AUSRA

#### YOUR SOLAR STEAM SOLUTION

Ausra's solar thermal technology can deploy quickly to provide solar generated steam to your operations reliably and cost effectively. Ausra's space-efficient, reliable, direct solar steam generators integrate simply with conventional power generation systems.

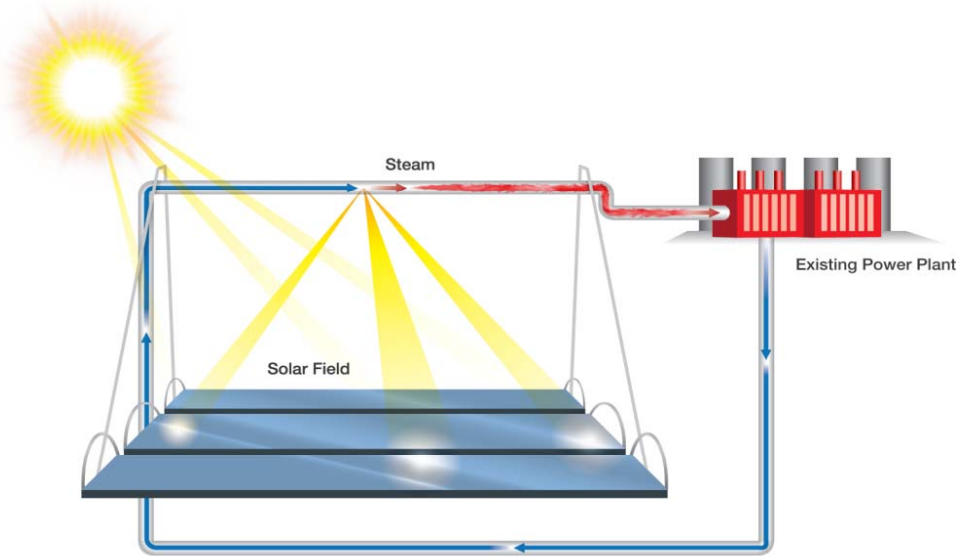
Our technology is a hedge against rising fuel and emissions costs and can provide an added financial benefit in upcoming carbon market scenarios. It's part of an integrated sustainability strategy for fuel and carbon market risk reduction.

<sup>(1)</sup> Annual energy yield is based on typical annual sunshine in Phoenix, AZ (NREL TMY2 data), 120F/50C feedwater.

Average additional hourly gross electrical production from host coal-fired plant (in MW of electricity)

		Hour													
		7	8	9	10	11	12	13	14	15	16	17	18	19	20
Month	1	0	0	0	1	5	7	6	6	6	5	1	0	0	0
	2	0	0	0	2	8	10	9	9	9	6	1	0	0	0
	3	0	0	1	7	11	12	12	12	12	9	2	0	0	0
	4	0	0	5	14	17	17	17	17	16	16	12	5	0	0
	5	0	2	10	15	17	17	18	18	17	17	13	8	1	0
	6	0	2	10	14	17	17	18	18	18	17	14	9	1	0
	7	0	1	7	11	13	14	14	14	14	13	11	7	1	0
	8	0	0	4	11	13	13	13	13	13	13	10	5	1	0
	9	0	0	3	10	12	11	12	12	12	11	8	2	0	0
	10	0	0	1	7	10	10	10	10	10	9	4	0	0	0
	11	0	0	0	2	7	7	7	7	7	6	1	0	0	0
	12	0	0	0	0	4	5	5	5	5	5	4	0	0	0

Note: From 50 acres assuming 33% conversion efficiency



**THE LIDDELL COAL-FIRED POWER STATION**

Located in New South Wales, Ausra has deployed and is expanding the world’s first solar thermal power collector system to augment steam production. Ausra began testing operations at the company’s Liddell Solar Thermal Station in 2004, initially generating 4.5 megawatts (MWt) of thermal energy. The solar thermal facility is located adjacent to the company’s steam host, Macquarie Generation’s coal-fired power station.

Ausra’s Phase II, 9-MWt solar steam system incorporates land-efficient, high durability solar collectors to supply solar-generated steam to Macquarie Generation’s Liddell Power Station, adding additional carbon-free electrical power. The expansion is currently in its start-up and testing phase.

**EXAMPLE OF COAL-FIRED PERFORMANCE <sup>(2)</sup>**  
 (#6 HP Feedwater Heater; 50-Acre Footprint)

Name plate Rating	450	MWe
Steam Supply Pressure	725	psia
Steam Supply Temperature	698	F
Steam Supply Enthalpy	1,342	Btu/lb
Annual Thermal Energy	326,750	MMBtu
Gross Annual Electrical Energy	31,600	MWhe
Peak Gross Electricity Boost	23.5	MWe
Annual Avoided CO <sub>2</sub> Emissions	29,500 - 1,725,000 <sup>(3)</sup>	Tons

<sup>(2)</sup> 250F feedwater, Phoenix TMY2 weather and radiation data, 33% gross conversion efficiency

<sup>(3)</sup> Assumes original plant output maintained by reducing fuel input.

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