Compact Linear Fresnel Arrays –

Solar Thermal power generation ready to take off

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Presentation held at Clean Energy Power 2004, Berlin 22nd of January 2004

Our Commitment :

Utilizing the power of the sun
to offer a cost effective and CO_2 emission free method
of feed-water heating and steam production
as add-on to fossil fired power plants
or even for the stand-alone electricity generation

Solar Heat & Power Europe GmbH / Mülheim
is a Start-Up company acting in close cooperation with
Solar Heat and Power Pty. Ltd. Sydney / Australia.

Our task is the project development and marketing of
solar thermal electricity generation technologies for and within
Europa, Northern Africa and Near and Middle East.

Base for the commercialisation is the use of various patents
developed at the University of Sydney / NSW University for :

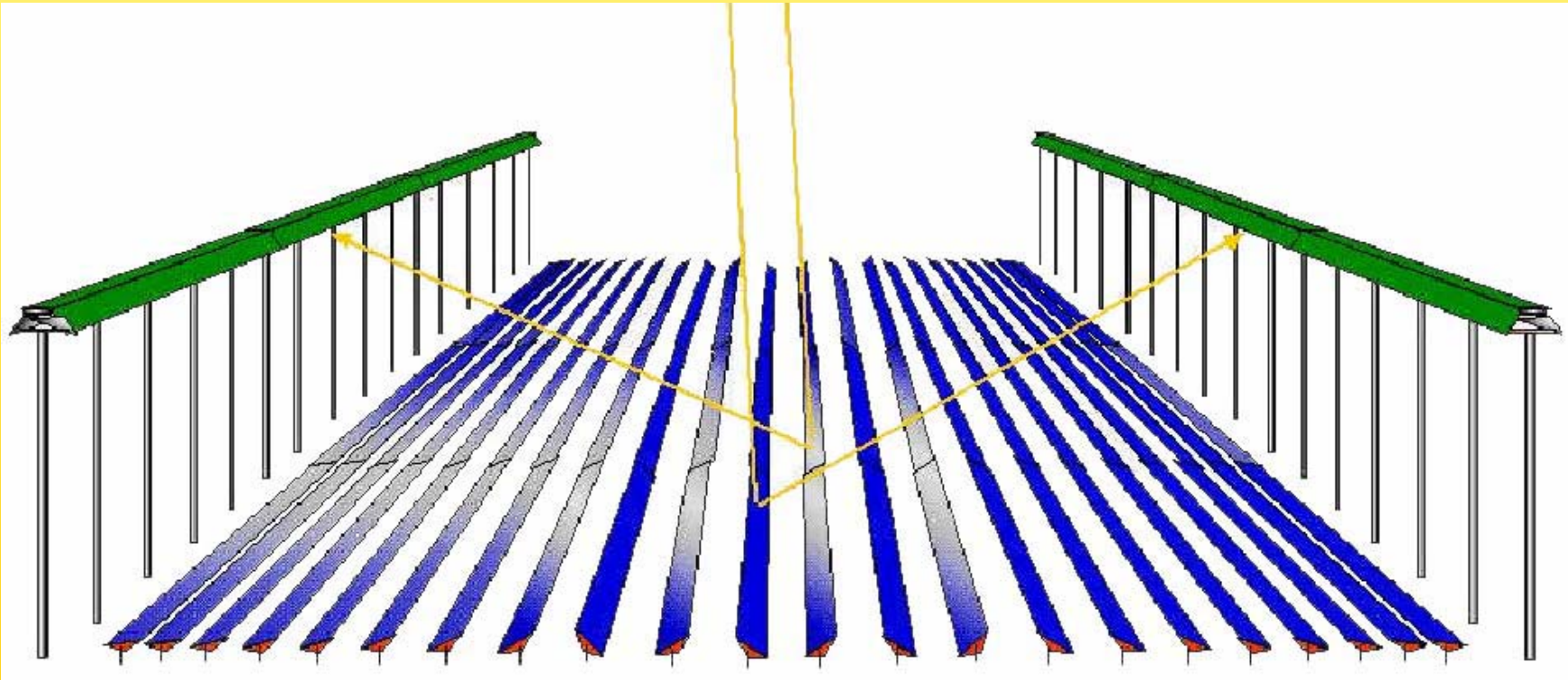
- CLFR = Compact Linear Fresnel Reflectors
- MTSA = Multi Tower Solar Arrays

The development and employment of solar energy plants in Europe is dominated by pure solar power plant units (stand-alone). The option to integrate such technologies into existing or planed new fossil power plants had only been looked at with little enthusiasm.

However, this approach offers a cost effective methology to reduce CO_2 emissions within the power generation industry and points towards a huge application area due to the large number of existing coal and oil fired power plant units.

This technology has it‘s origin in Australia, as only the most cost effective renewable energy form can compete with the low price power generation Down Under in the absence of favourable feed-in tariffs.

Principle of Compact Linear Fresnel Reflector Technology :



Collector Mirrors Collector

Impression of SHP CFLR Collector field :

The roll-out of this technology in Australia has begun :

- June 2003 : Order of the first collector array for demonstration use (purely privately funded by customer):
  Capacity : 1 MWth
  Location : Coal fired power plant Liddell / NSW
  Purpose : proof of array thermal performance
- Obligation under supply contract to extend array and connect to existing power block (if trial prooves successful) :
  Capacity : 7 MWel
  Purpose : solar feed-water heating
- Further extensions to 25 MWel under discussion

Project Data for Liddell :

- thermal output of collector field about 70 MWth
  → correlates to about 25 MWel within the existing current power plant thermal process layout
- input to IP-feed water system at 265 C level and 50 bar
  → minimal additional investment, no exergy losses, power block capacity increase possible
- Total cost of only approx. 220 €/kWel through utilization of existing power plant infrastructure
  → most cost effective CO_2 mitigation

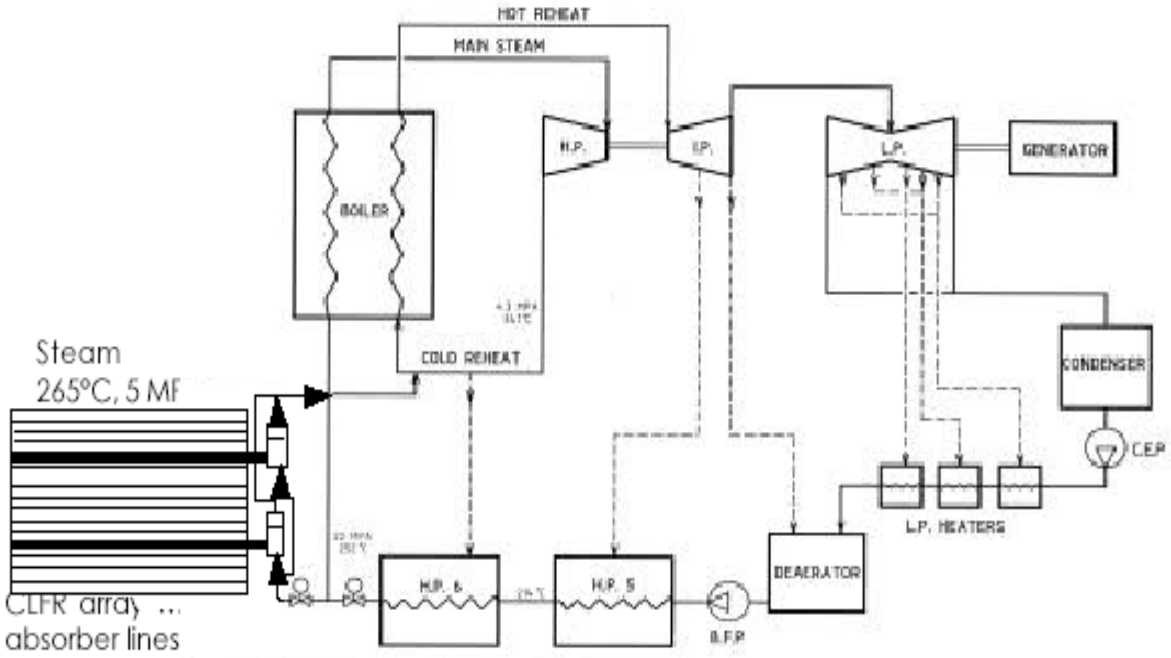


Fig. 6: Power station cycle with solar steam injection to the cold reheat line (stage 2).

Process Diagramme of CLFR integration into exiting power plant

The first project : Liddell Power Station / NSW Australia

Planned SHP CLFR Solar field (final size)

The first project : Liddell Power Station / NSW Australia

First manufactured mirror
(delivered to site 26.06.2003)

The first project : Liddell Power Station / NSW Australia

September 2003 : Erection of reflector rows

The first project : Liddell Power Station / NSW Australia

September 2003 : First installed reflector rows

The first project : Liddell Power Station / NSW Australia

December 2003 : First absorber modul installed

Advantages of SHP CLFR-Technology :

- Operating media water respectively water steam
  → no need for expensive and hazardous thermal oil and no extra cost for oil/water heat exchangers
- Outlet –Temperature 250 - 330°C
  → corresponding to feed water pre-heating temperature up to IP steam temperature level
- high optical efficiency by application of Fresnel-principle
  → Area demand halve of requirement for usual parabolic through collectors

Advantages of SHP CLFR-Technology :

- fixed, non-moving absorber pipe with no flexible joints illuminated from below
  - → no leakages / no losses
  - → effective energy transfer into pipe without danger of local superheating (energy input below water level in pipe)
- easy access to moving parts and to surfaces in need of regular cleaning through surface mounting of mirror arrays
  - → limited O&M costs

Advantages of SHP CLFR-Technology :

- optimized concept for mirrors / tracking, absorber pipe mounting and I&C system
  → lowest investment cost per installed capacity as well as per annual output
- Improvements to existing power plant water steam cycle due to the closing of bleed steam extractions
  → lower $C0_2$ emissions per generated kWh
  → increased power output for summer peaking

Advantages of SHP CLFR-Technology :

- Easy and cost effective option to store energy in form of latent heat as saturated steam
  - → better use of turbine portion of plant
  - → intermediate or base load production possible
- Future Option : Production of superheated HP steam
  - → generation of live steam or provision of IP process steam for e.g. sea water desalination

Example : Estimation on Cost of Avoided CO_2 Emissions for an add-on CLFR plant in southern Spain :

Capacity :	40	MWth
Investment Cost (no subsidies considered) :	14,5	Mio. €
Area demand :	100.000	m²
Annual Solar Electricity Production :	18,0	GWhel
Annual Operating Cost :	0,5	Mio. €
Income from Sale of “Grey” Power :	0,55	Mio. €

Required Bonus for Solar Input (IRR=10%) :< 0,10 €/kWh

Example : Estimation of IRR for a stand-alone CLFR plant in southern Spain :

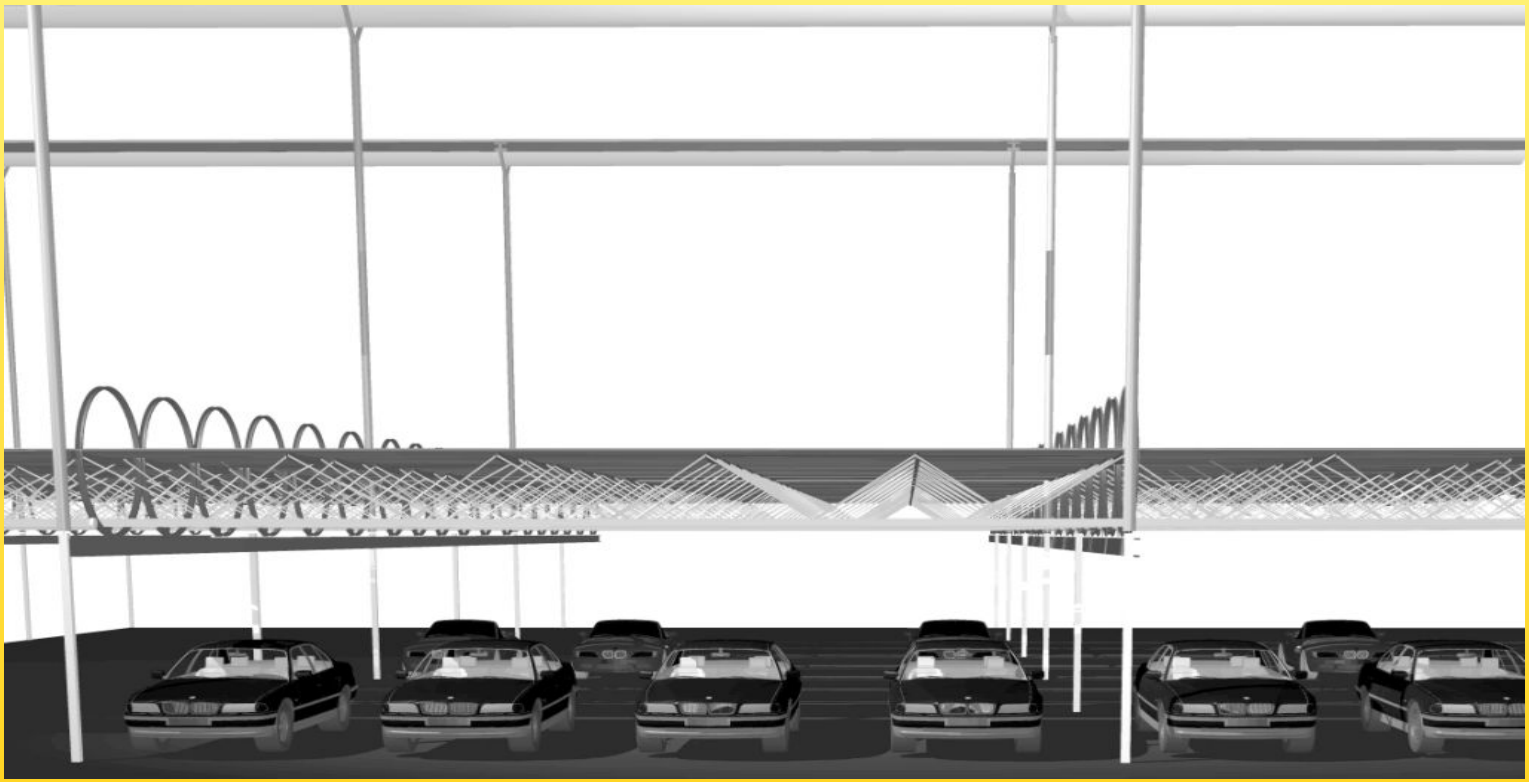
Capacity :	50	MWel
Investmest Cost (no subsidies considered) :	63	Mio. €
Area demand :	400.000	m²
Annual Production :	64	GWhel
Annual Operating Cost :	1,3	Mio. €
Income from Sale of Solar Electricity :	9,6	Mio. €
IRR for Investor :	**> 10**	**%**

Option : Introduction of Storage is raising IRR considerable !

German Opportunity :

Under the recently announced new feed-in tariff law for solar energy such stand-alone plants are also viable in Germany !

SHP Europe is seeking investors for such plants.



Vision : Car park shading solar thermal power plant

Conclusion :

Coal and other fossil fired power plants would gain improved acceptance through the symbiosis with solar energy.

Furthermore such existing power plant assets could continue to operate also after the introduction of obligatory CO_2-Certificate requirements.

Under the European context stand-alone plants are very attractive for investors too.

This is a vast and immediate pipeline of opportunities !

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