Dish Stirling Activities at Schlaich Bergermann und Partner

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Schlaich Bergermann und Partner is engaged in several fields of civil and structural engineering:

The scope of work includes all planning phases and ranges from feasibility studies, conceptual design through detailed structural design to the supervision of workshop and site construction.

Our close contact to teaching and research work at the Stuttgart University places readily at our disposal the latest "state of the art" as well as the know-how of new construction methods and materials.

This easily enables us to include any type of experimental work (such as material testing, structural testing, wind-tunnel tests) in our project studies.

Bridges	Road Bridges Railroad Bridges Pedestrian Bridges
Buildings for Administration	Residence Universities Hospitals
Towers, Silos	Telecommunication Towers Water Towers Cement Silos
Sport Facilities	Stadiums Athletic and Swimming Arenas
Special Structures	Cable-net Structures Shell Structures Cooling Towers Aircraft Hangars Industrial Plants
Use of new Energy Sources	Solar Chimney Dish Stirling Paraboloic Trough Heliostats

Solar Thermal Power Plants for Electricity Generation

- point-concentrating
  - Dish/Stirling-System
  - Central Receiver Power Plant
- line-concentrating
  - Parabolic Trough Power Plant
- non-concentrating
  - Solar Chimney

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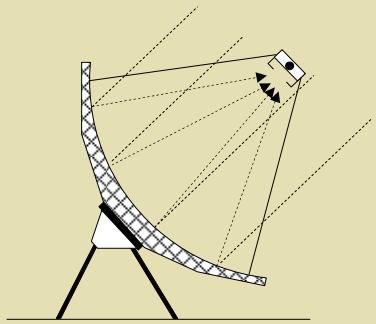
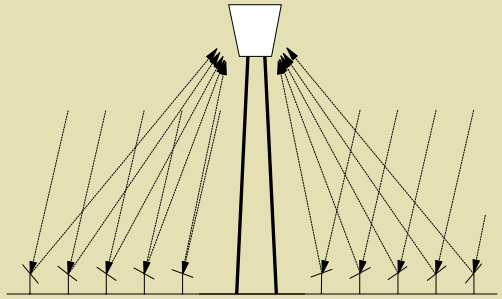
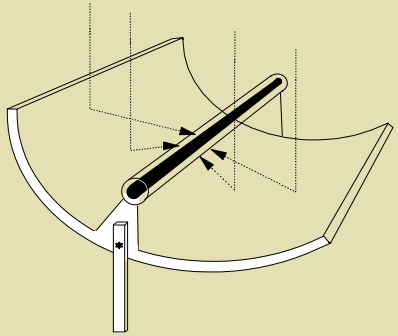
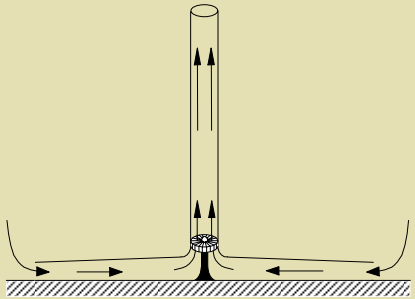
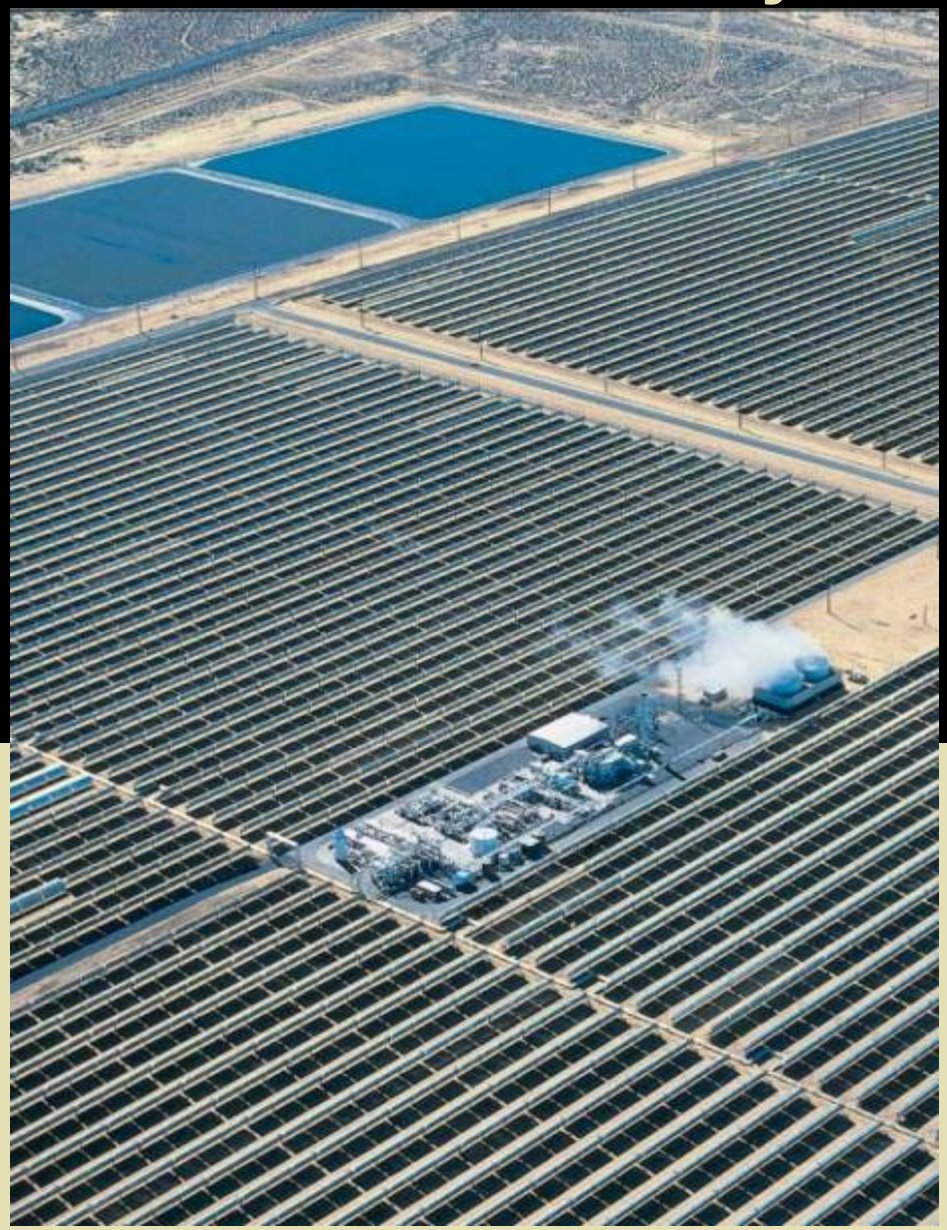






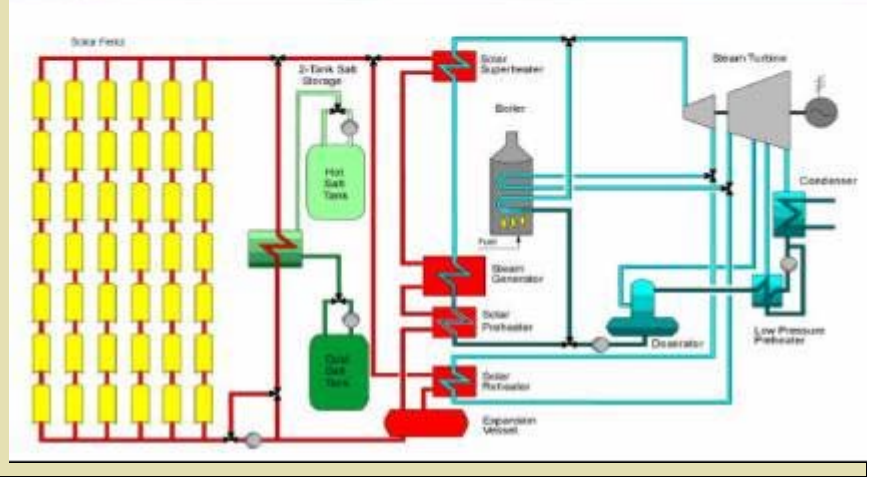


Structural engineer of the AndaSol-1 Project



- Nominal Power: 50 MW
- Storage: 6 h full load, Salt
- Plant size: 1.500 m x 1.300 m
- Aperture Area: 510. 200 m²
- No. of Collectors: 7.488
- Yearly Energy: 153 GWh/Jahr

Partner:
COBRA; SENER; FlagSol; sbp



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800 m sbp Loop at the Solar Trough Power Plant, Mojave-Desert, California

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30 MW Solar Power Plant in Spain (Concept Design)

Schlaich Bergermann
und Partner

Dish/Stirling-Systems

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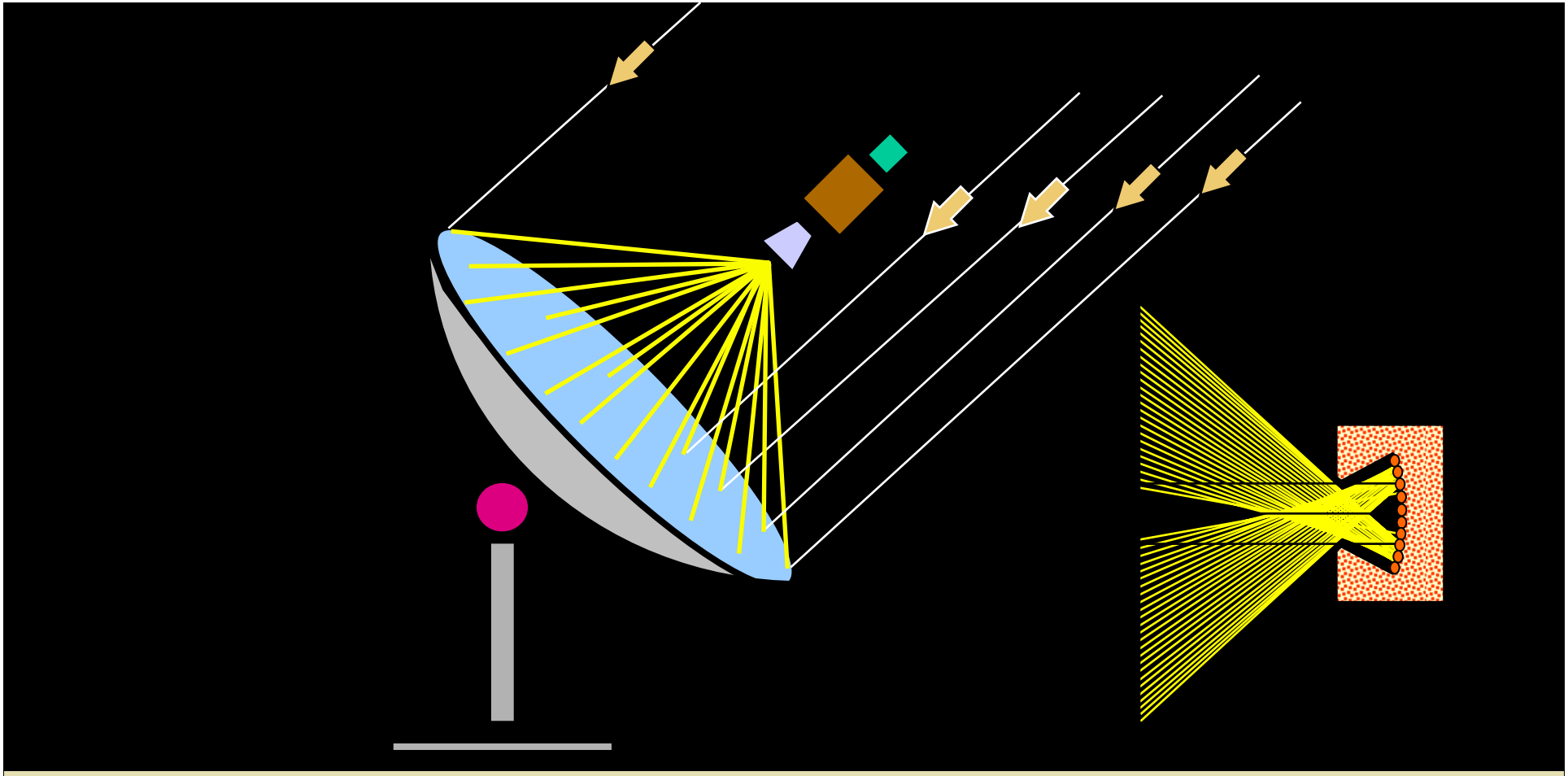

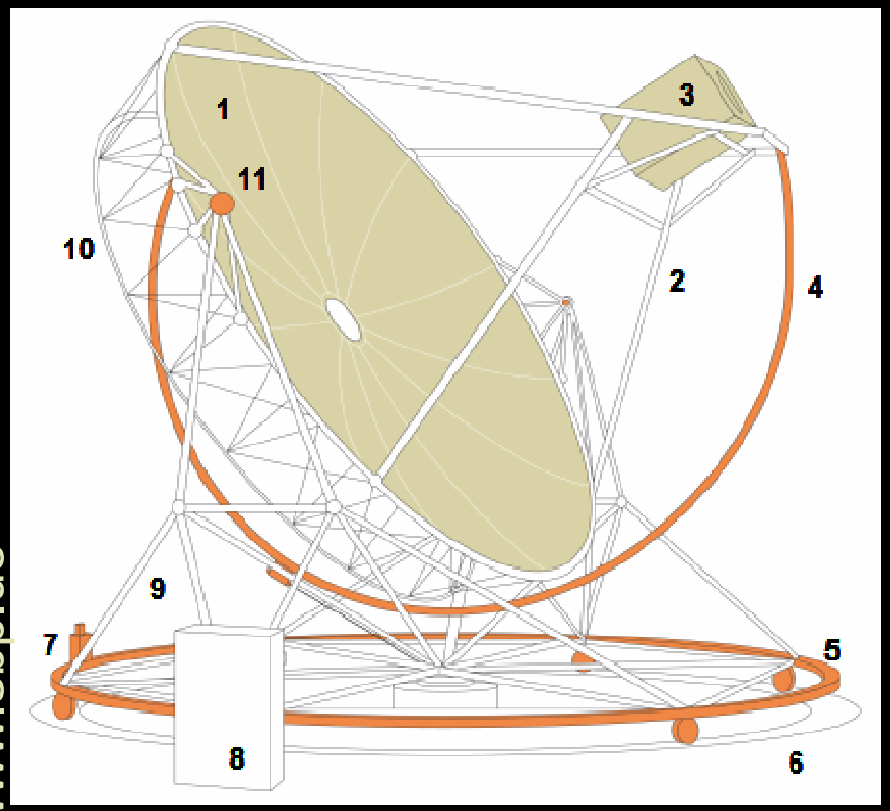

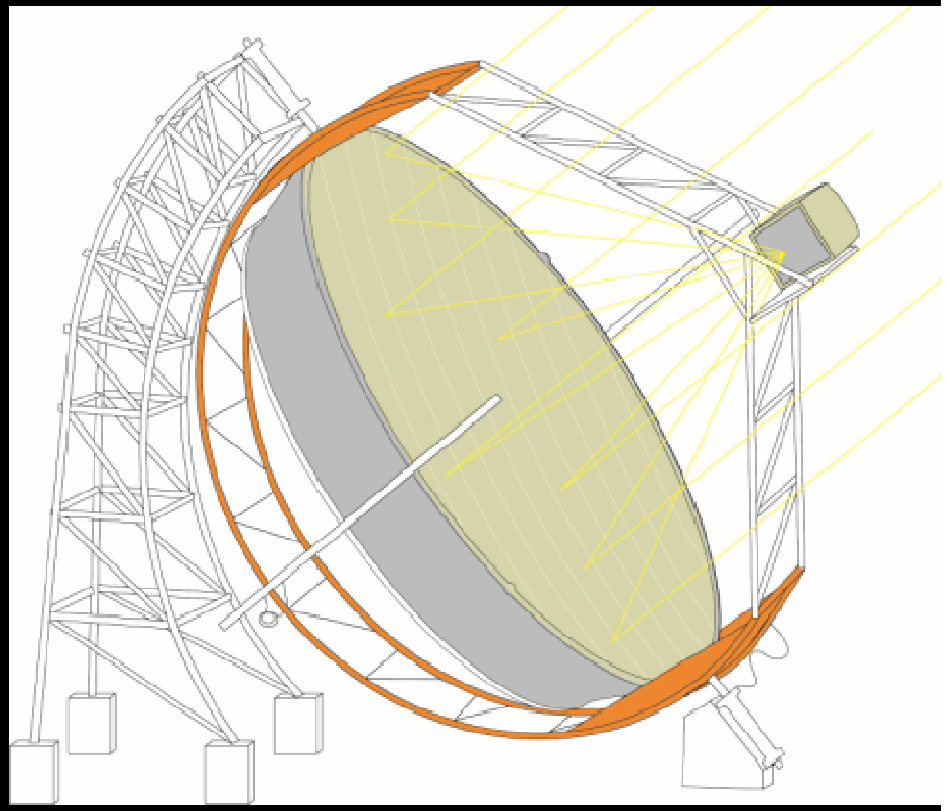

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Dish Stirling: Azimut and elevation drive system

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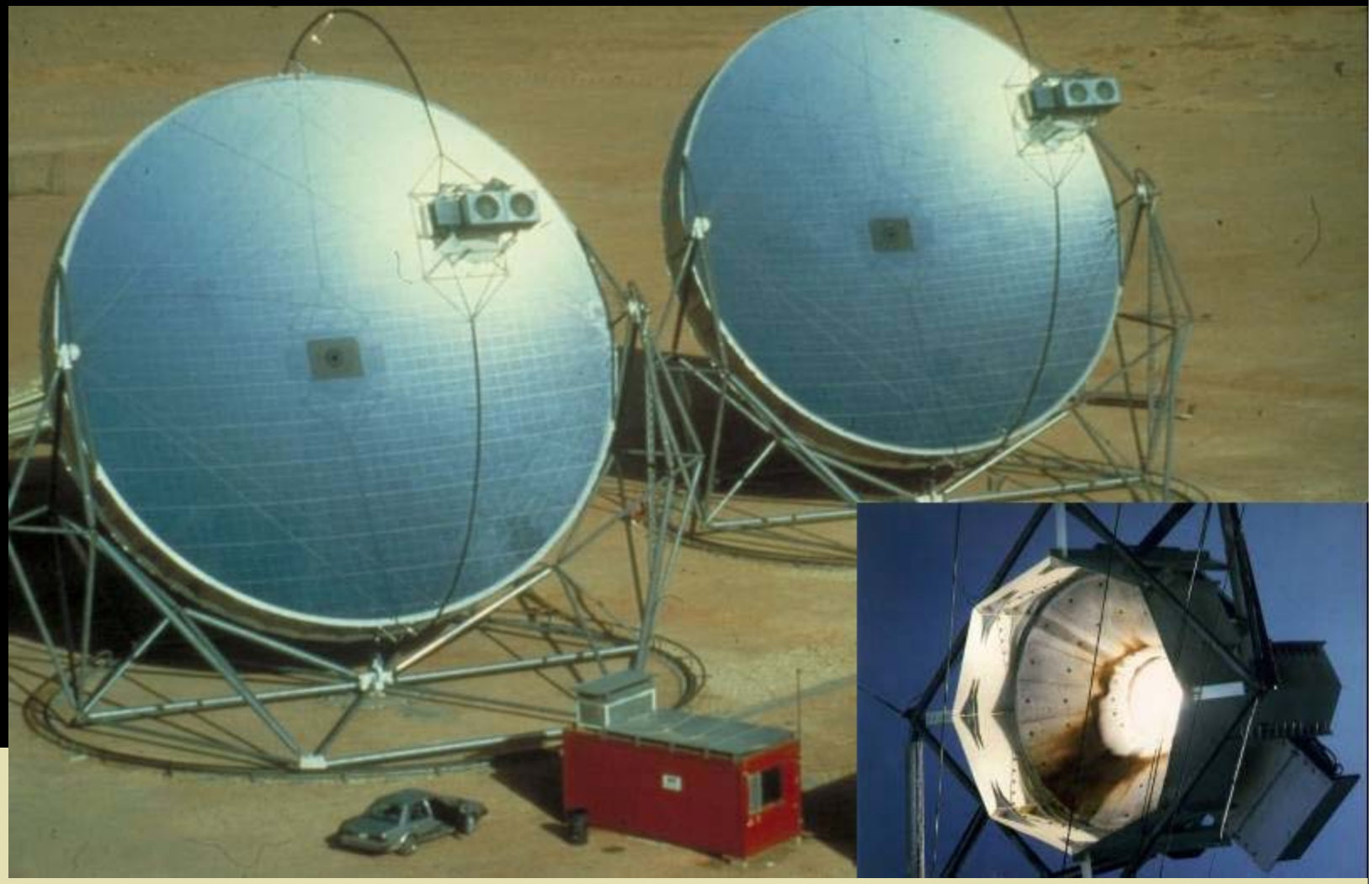

50 kW Dish-Stirling in Saudi Arabia (solar village) developed and built by sbp, (1983 / 1988), Dish diameter 17 m.
Stirling engine: 50 kW 4-275 Stirling engine from United Stirling AB

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9 kW Dish-Stirling Prototype. (a) Campus of the University, Stuttgart and Gardenshow in Pforzheim (1989 / 1991),
Stirling engine: V-160 Stirling engine from Stirling Power System, USA

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Dzúrability test of 6 Metal Membrane Dish/Stirling Systems, Almeria/Spain (1992 / 1996) Polar and Azimuth mounted.

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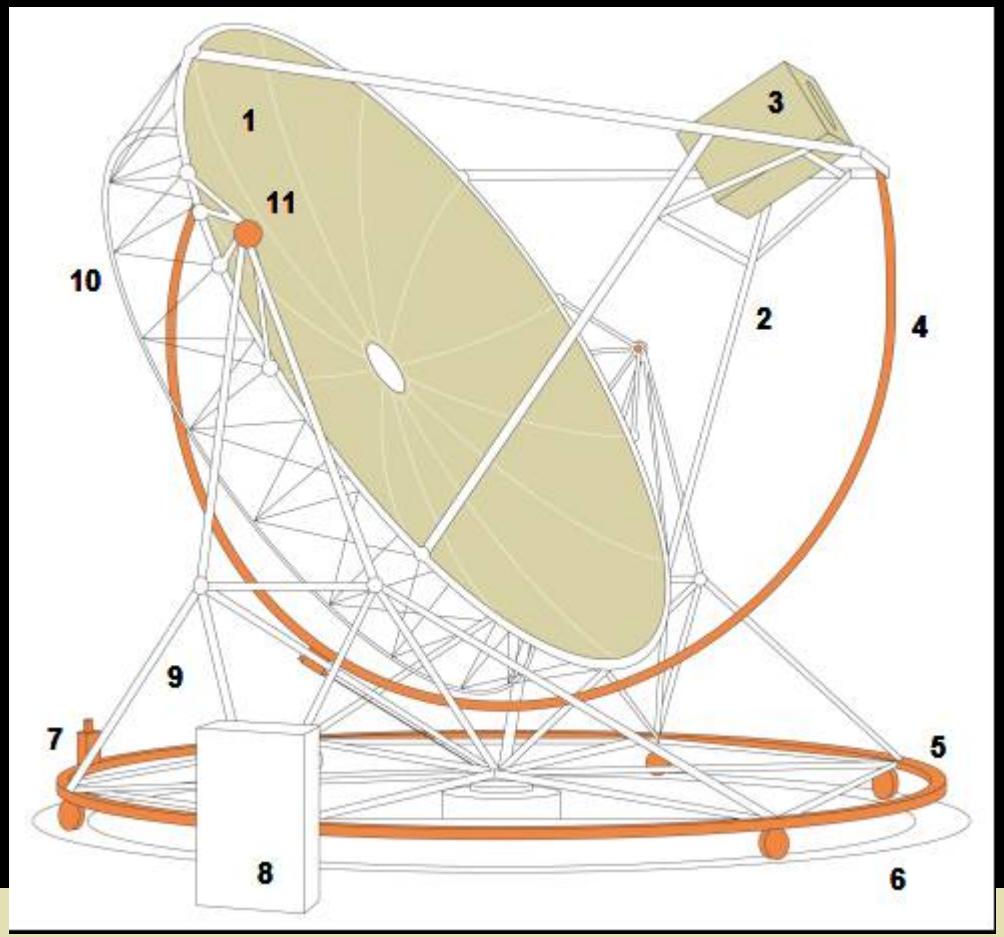

1 Concentrator shell
2 Stirling support
3 Stirling unit
4 Drive arch elevation
5 Drive arch azimuth
6 Foundation
7 Azimuth drive
8 Cabinet
9 Turn table
10 Ringtruss
11 Elevation bearing

Segmented Dish Stirling Design Components

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10 kW Dish/ Stirling Systems Almeria/Spain
(2001)

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Dish/Stirling System Euro/EnviroDish

EnviroDish system erection

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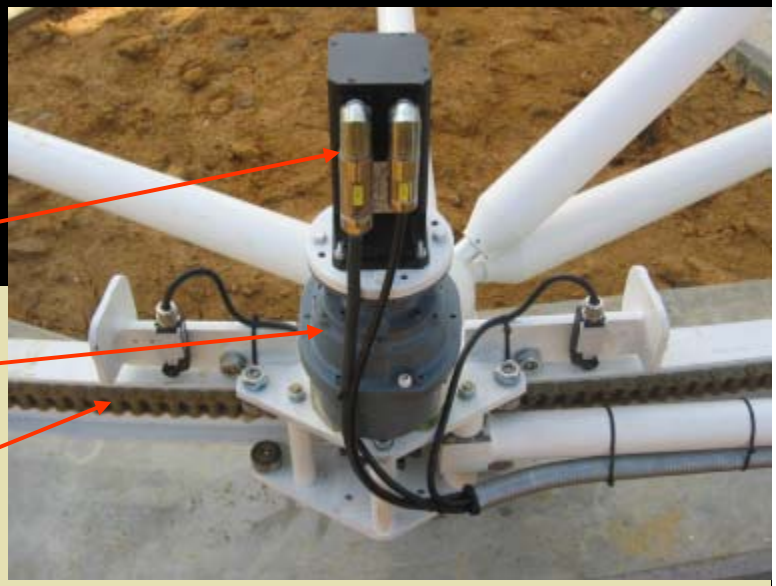
Assembly of concentrator

Elevation drive



EnviroDish details

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Drives and electrics

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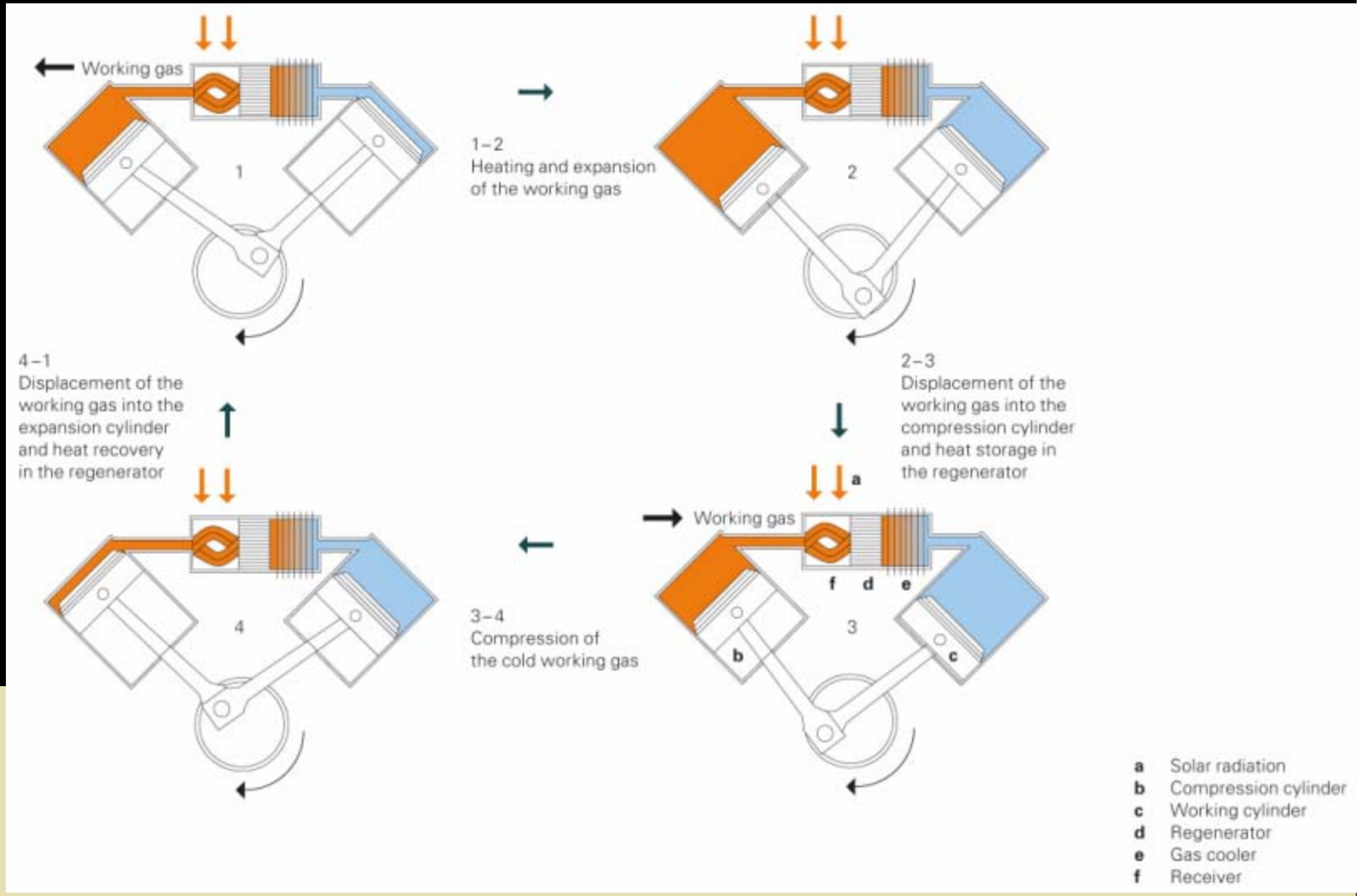


Stirling Principle

Solar Receiver

Expansion cylinder

Compression Cylinder

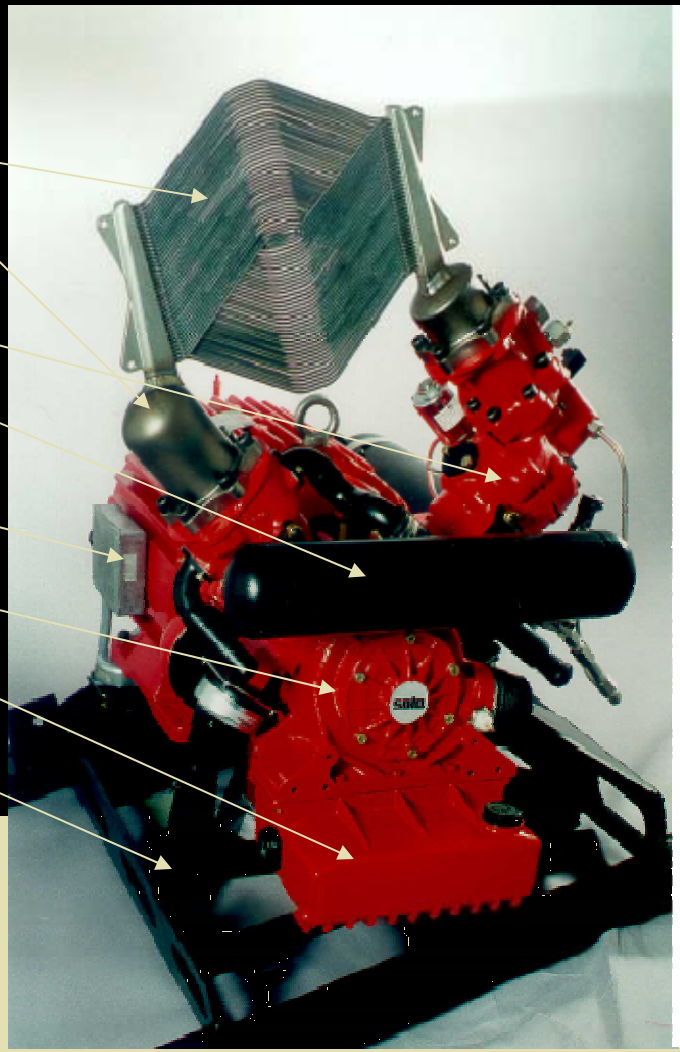
Buffer

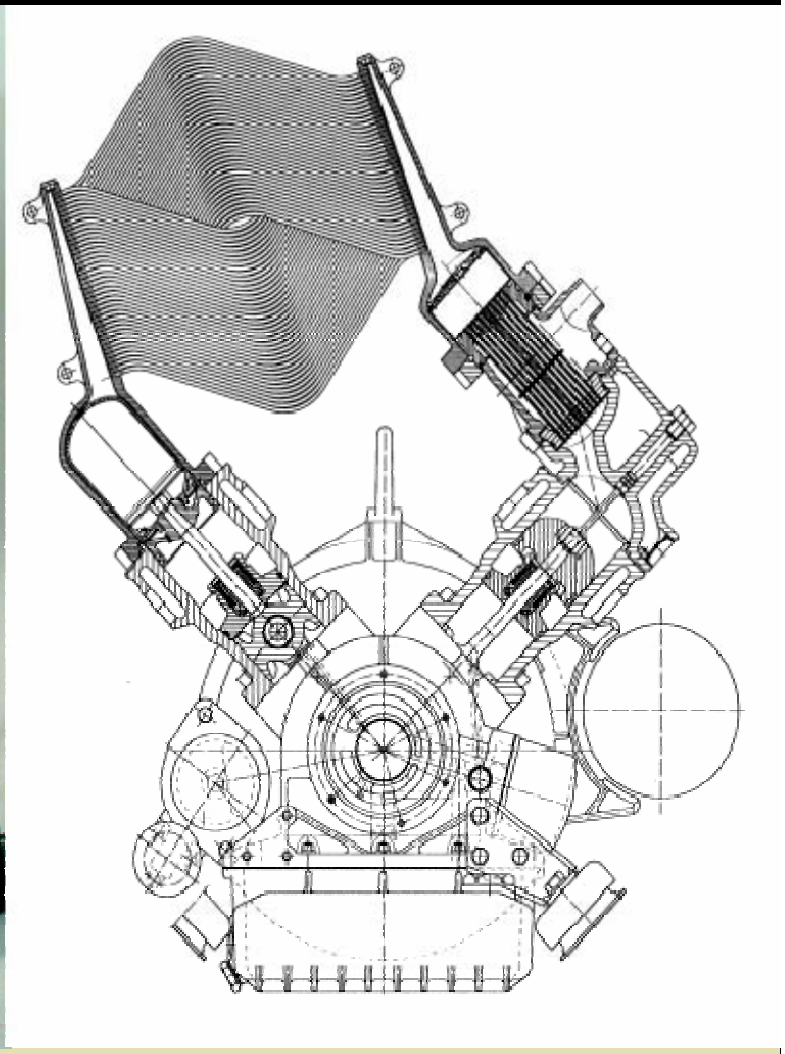
Generator

Drive

Oilsump

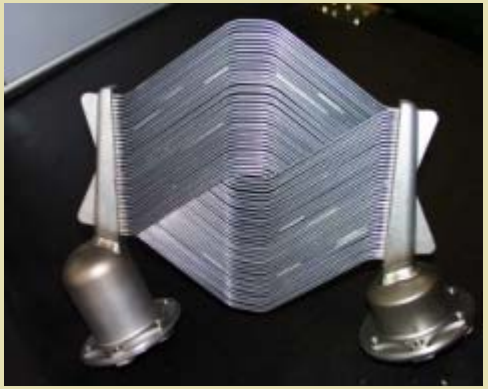
Support frame





The basic engine with drive unit and solar Receiver

SOLO Stirling 161 – Solar



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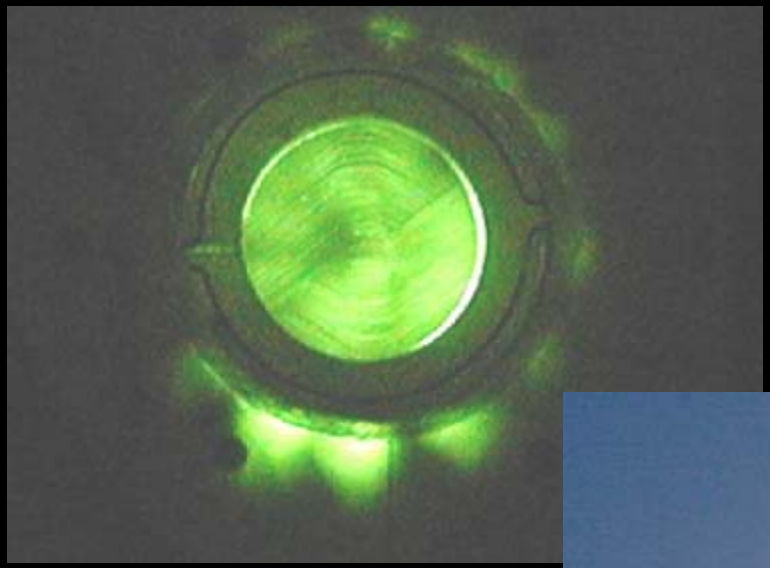
SOLO Stirling 161 – Solar in operation



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Reference systems built

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CRU Würzburg

CRU Milano

CRU Odeillo

CRU Seville

Test bed Almería

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10 kW Test Bed Concentrators on the Plataforma Solar de Almeria

Reference systems built

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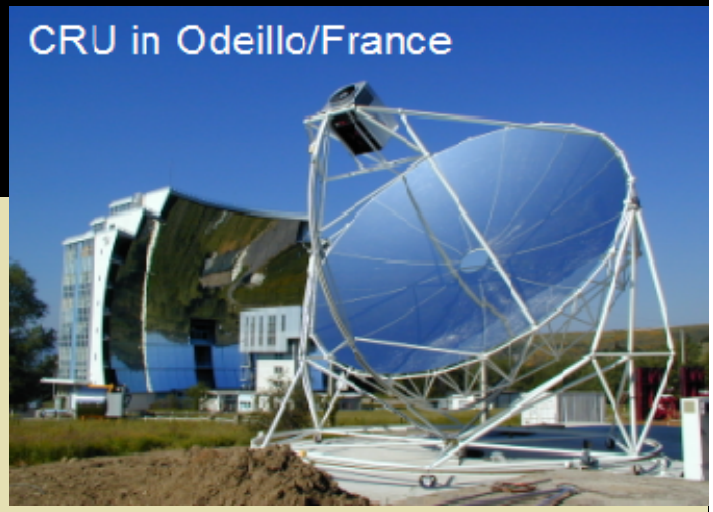

Country Reference Units built 2002-2004

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CRU/ Configuration	Dish	Stirling	Cavity *	Arbeits-gas	Access via Internet
Plataforma Solar Almería/Spain	Ø 8,5 m Segmented	SOLO 161 V1	Ceramic	Helium	yes
CESI Milan/Italy	Ø 8,5 m segmented	SOLO 161 V1	Water cooled	Helium	no
ESI/CENTER Sevilla/Spain	Ø 8,5 m segmented	SOLO 161 V2	Ceramic	Hydrogen	yes
Krick Würzburg/ Germany	Ø 8,5 m segmented	SOLO 161 V2	Water Cooled	Helium	yes
PROMES Odeillo/France	Ø 8,5 m segmented	SOLO 161 V2	Ceramic	Hydrogen	yes

System Configuration of Country Referenz units

* Cavity: insulating part of Stirling heat exchanger, systems equipped with water cooled cavity have less power output than systems with ceramic cavity

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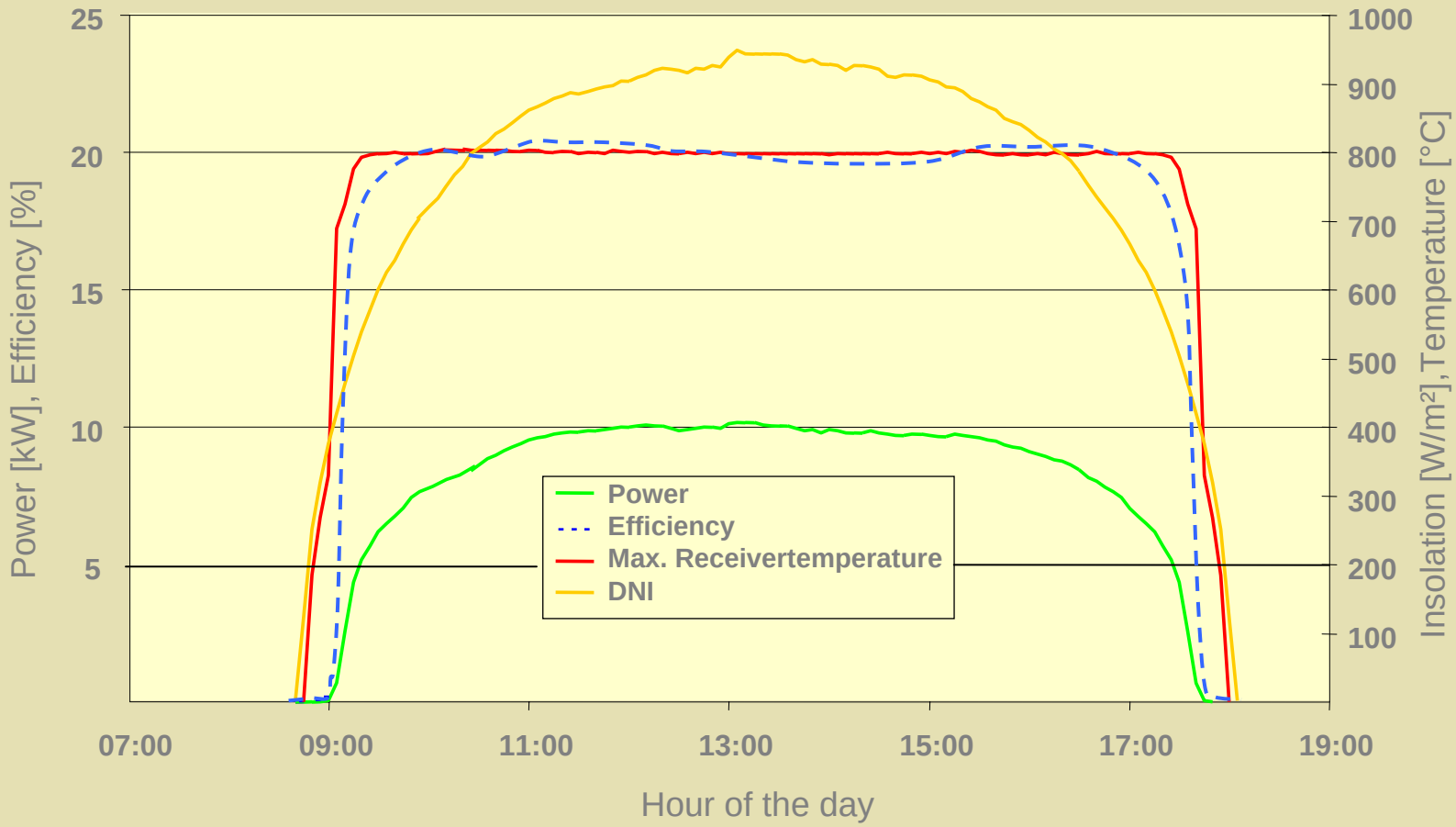

Typical operation day in Spring

* Measured on February 2005 in Seville

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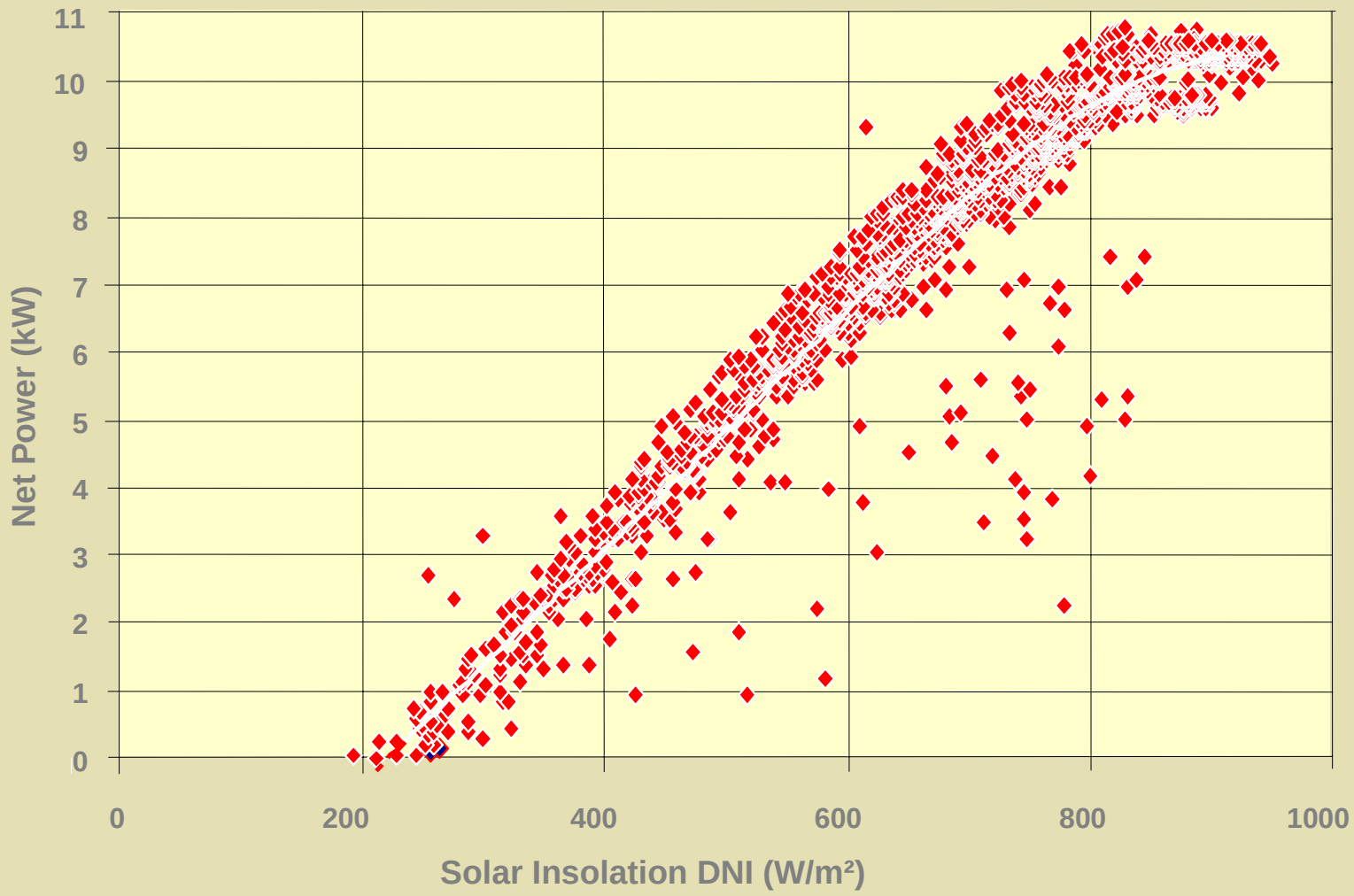

System I-O Diagramm

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Next Step: Dish/Stirling array

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