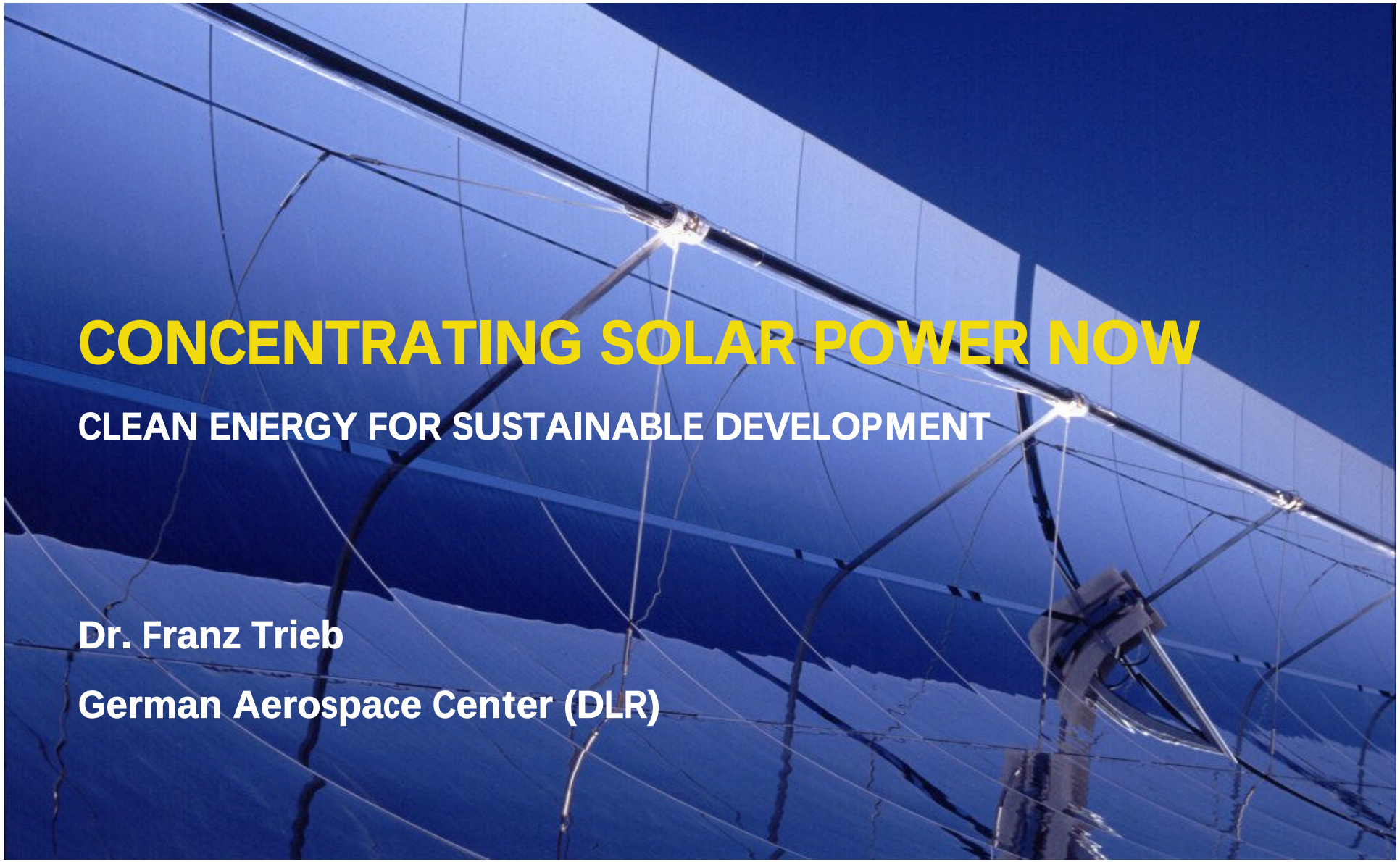


CONCENTRATING SOLAR POWER NOW

CLEAN ENERGY FOR SUSTAINABLE DEVELOPMENT

Dr. Franz Trieb

German Aerospace Center (DLR)

Deutsches Zentrum
für Luft- und Raumfahrt e.V.
German Aerospace Center

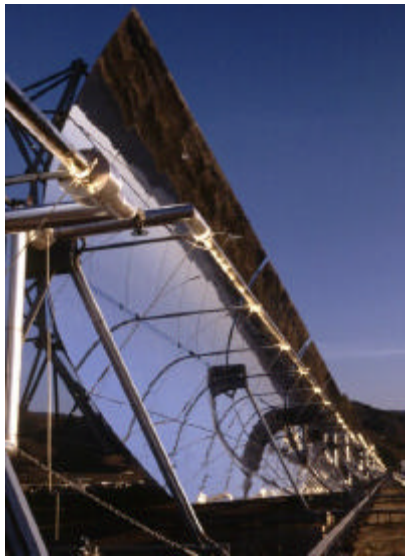
DLR

WORLD SUMMIT ON SUSTAINABLE DEVELOPMENT
JOHANNESBURG 2002

The Federal Ministry
for the Environment,
Nature Conservation
and Nuclear Safety

PRINCIPLE OF CONCENTRATING SOLAR POWER

Heat from concentrating solar thermal collectors drives steam turbines, gas turbines or piston engines, to deliver electricity or combined heat and power. E.g.:



concentrating
solar collector

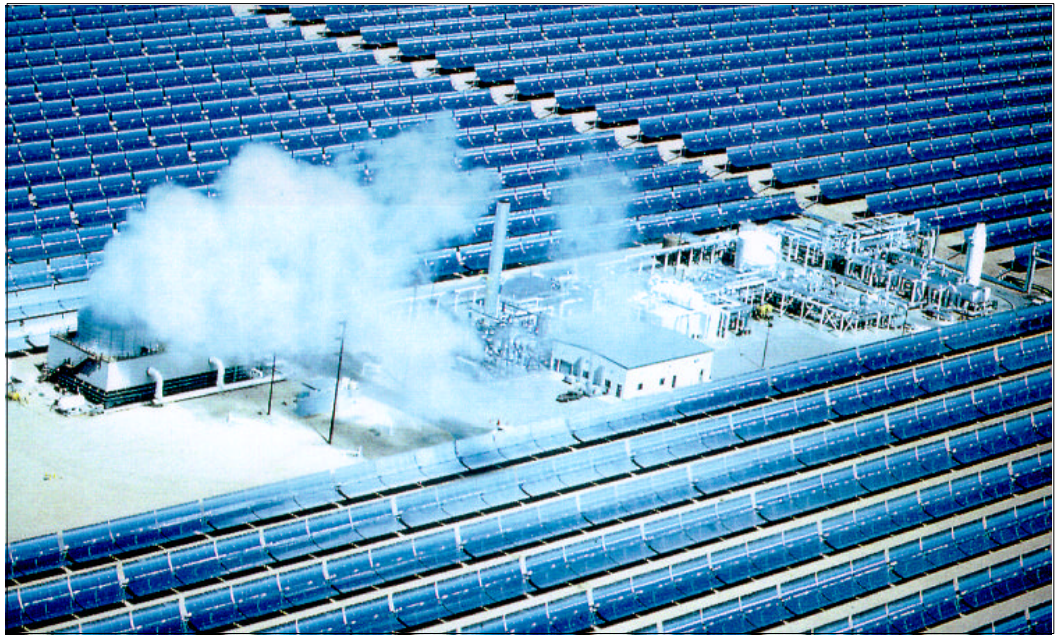
steam

steam turbine
& generator

power

utility grid

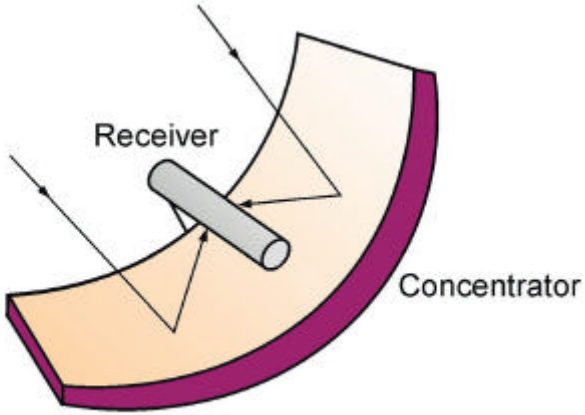
CSP TECHNOLOGIES - PARABOLIC TROUGH



cycle: steam turbine, CHP

status: commercial, 80 MW

projects ahead:
50 - 150 MW, Spain, India, Mexico, Egypt, Morocco, Crete, Jordan, USA, South Africa .....



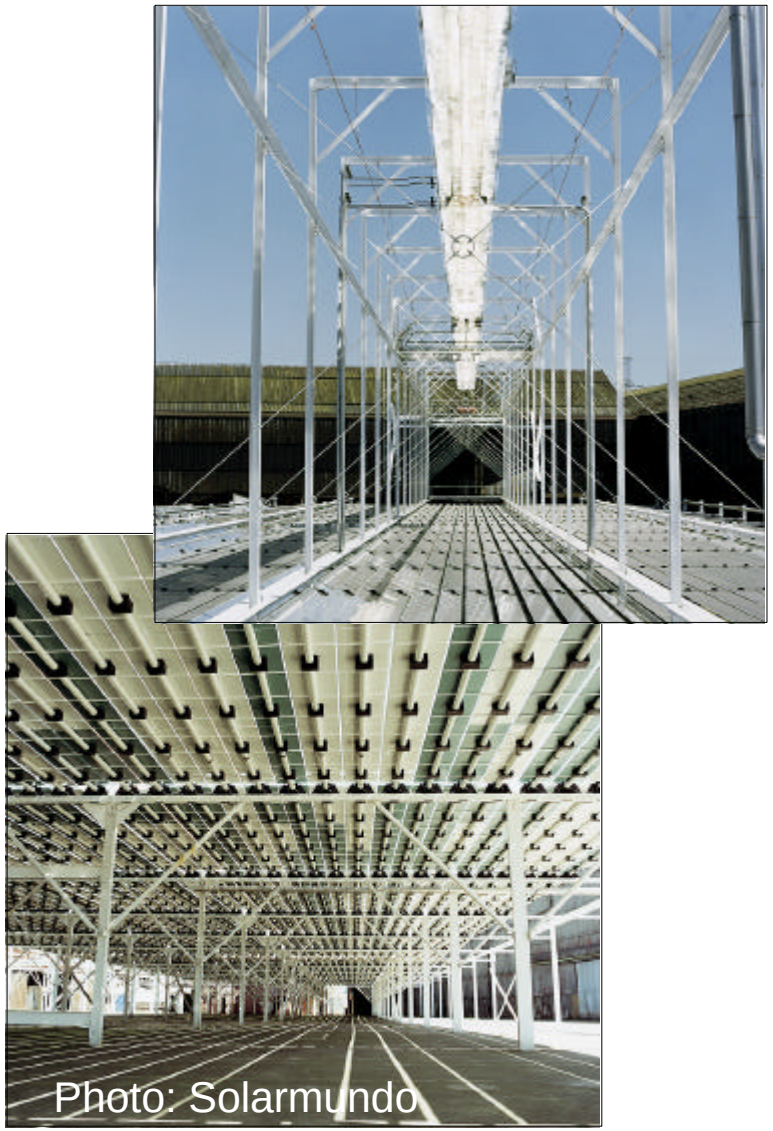
oil (1-3 bar / 390 °C)
steam (100 bar / 390 - 550 °C)

CSP TECHNOLOGIES - PARABOLIC TROUGH

Dagget, Harper Lake and Kramer Junction, California

Solar Electricity Generating System (SEGS)

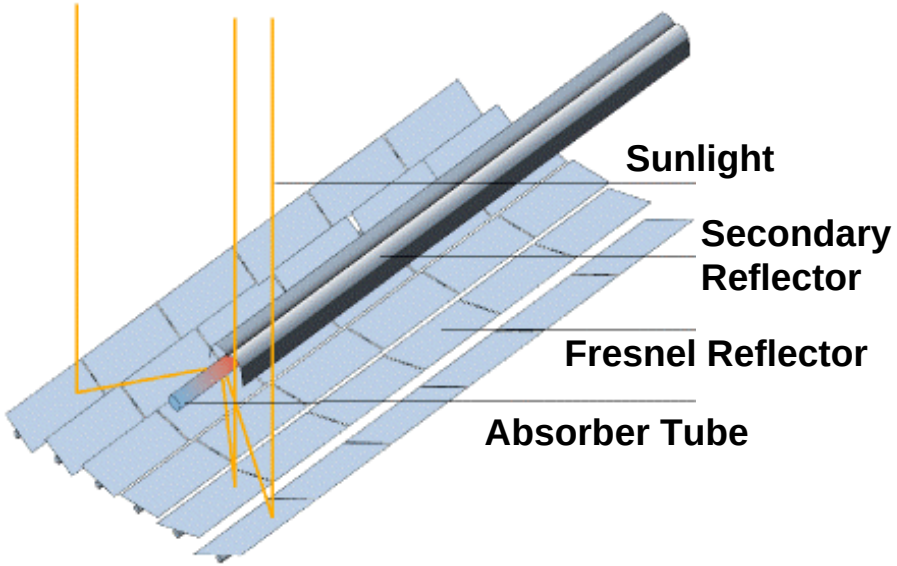
CSP TECHNOLOGIES - LINEAR FRESNEL



cycle: steam turbine, CHP

status: prototype

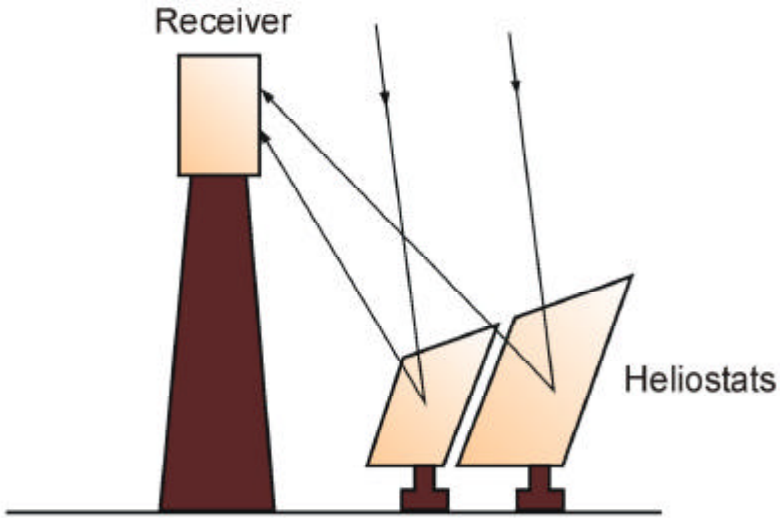
projects ahead:
1 - 5 MW pilot plant



steam (25 - 100 bar / 270 - 550 °C)

CSP TECHNOLOGIES - SOLAR POWER TOWER

air (1 - 15 bar / 800 - 1200 °C)

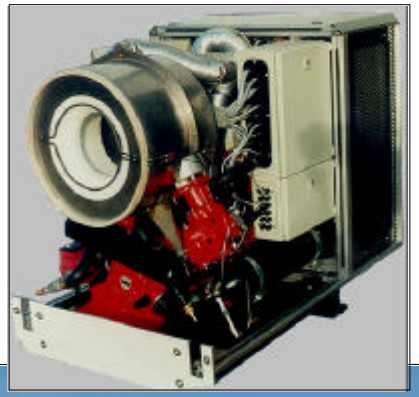


cycle: steam turbine, gas turbine, combined cycle, CHP

status: prototype, demonstration

projects ahead: Spain
PS10 (10 MW steam cycle)
SOLGATE (250 kW gas turbine)

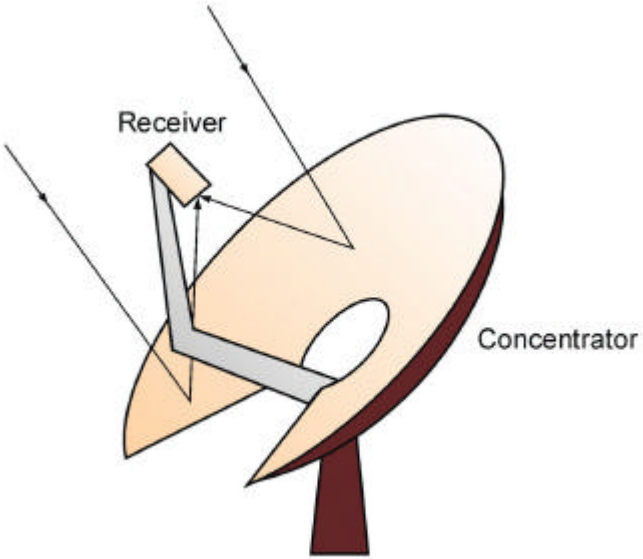
CSP TECHNOLOGIES - PARABOLIC DISH



cycle: Stirling engine

status: prototype, demonstration

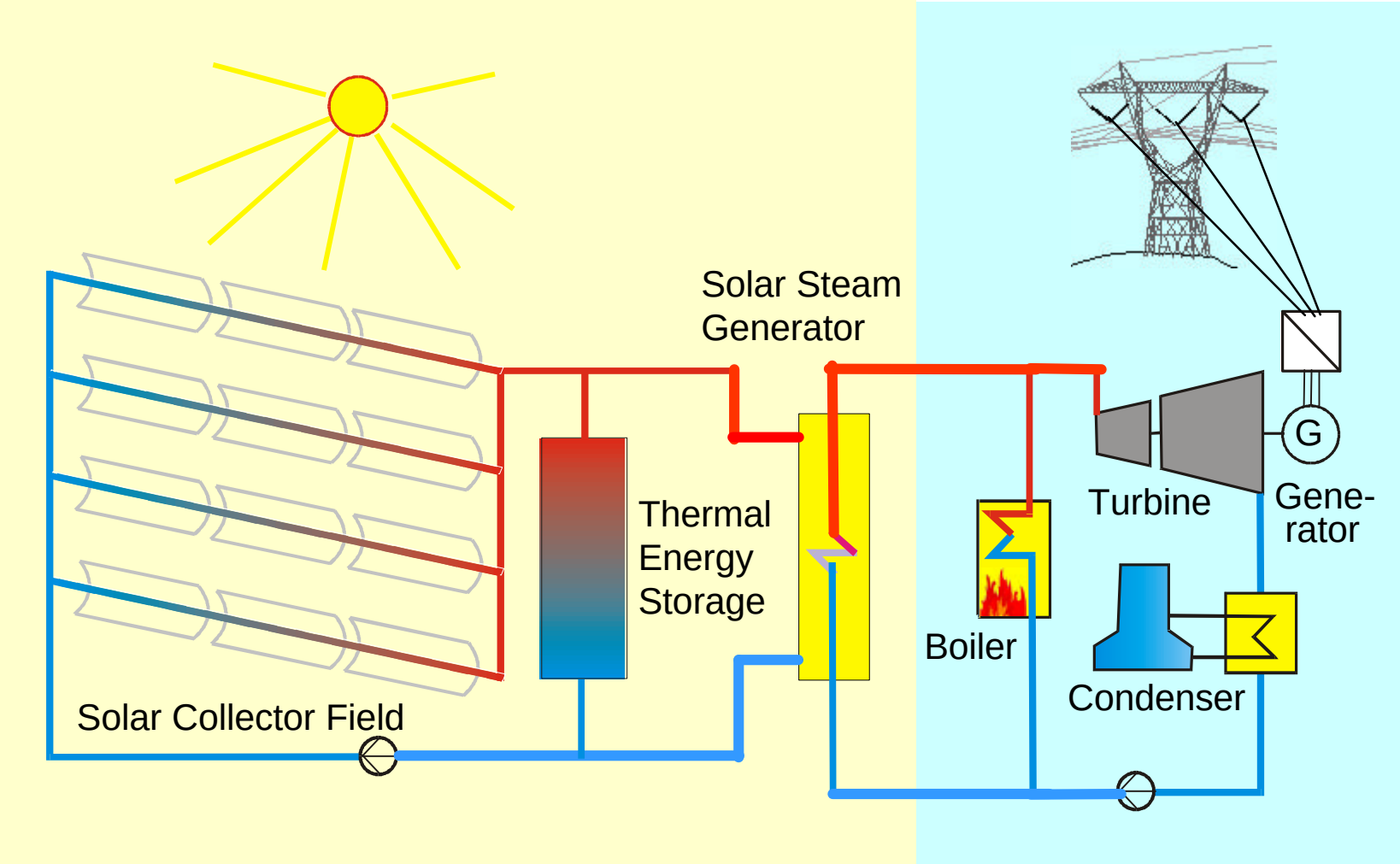
projects ahead:
EURO-DISH, 10 kW series



helium (50 - 200 bar / 600 - 1200 °C)

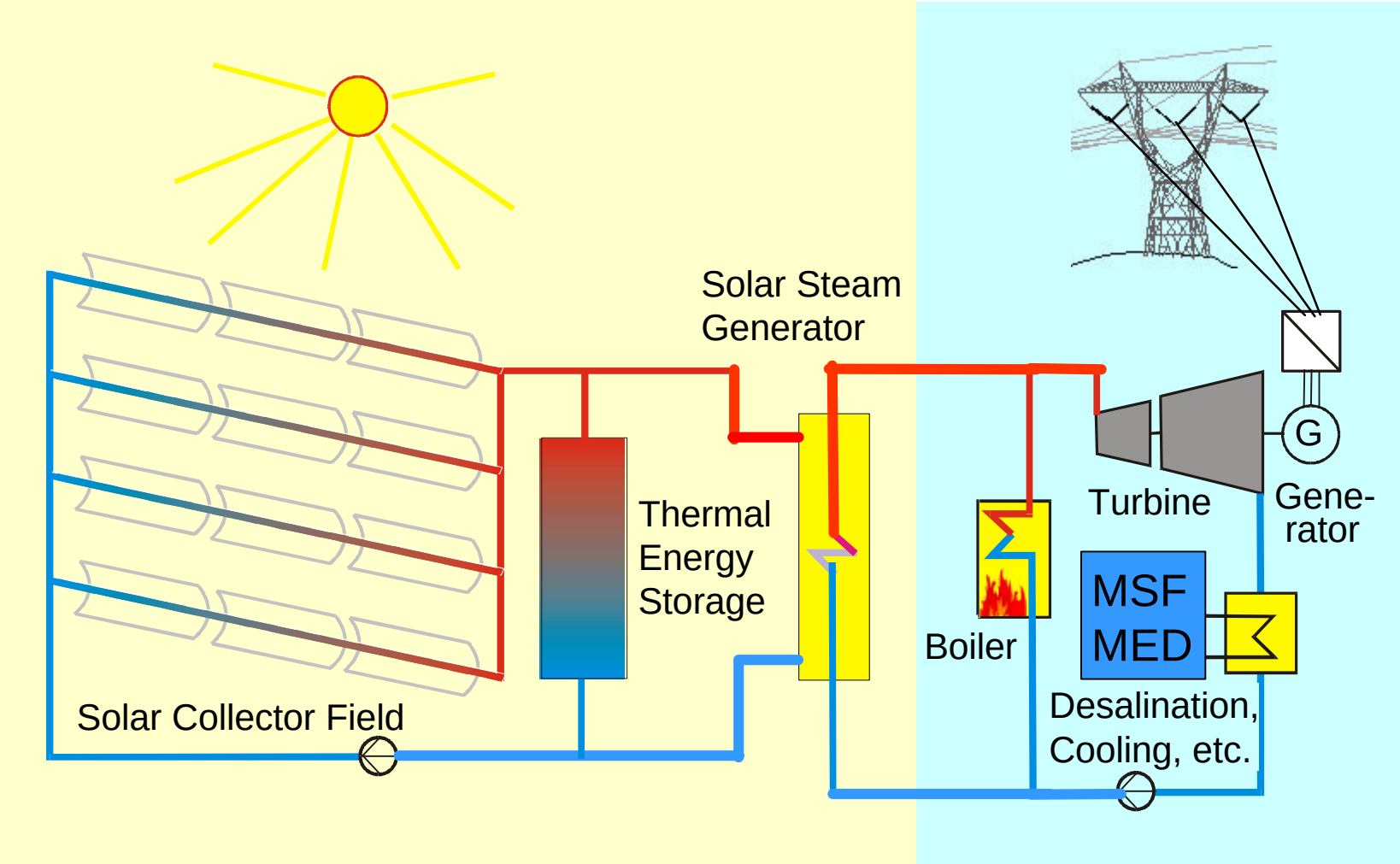
APPLICATIONS - POWER UTILITY

Power generation with steam turbines or gas turbines



APPLICATIONS - POWER & WATER

Combined heat and power multipurpose plant



APPLICATIONS - REMOTE POWER

Decentralised generation of electricity or combined heat and power for remote areas with Dish-Stirling engines

Photo: SBP

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für Umwelt, Naturschutz
und Reaktorsicherheit

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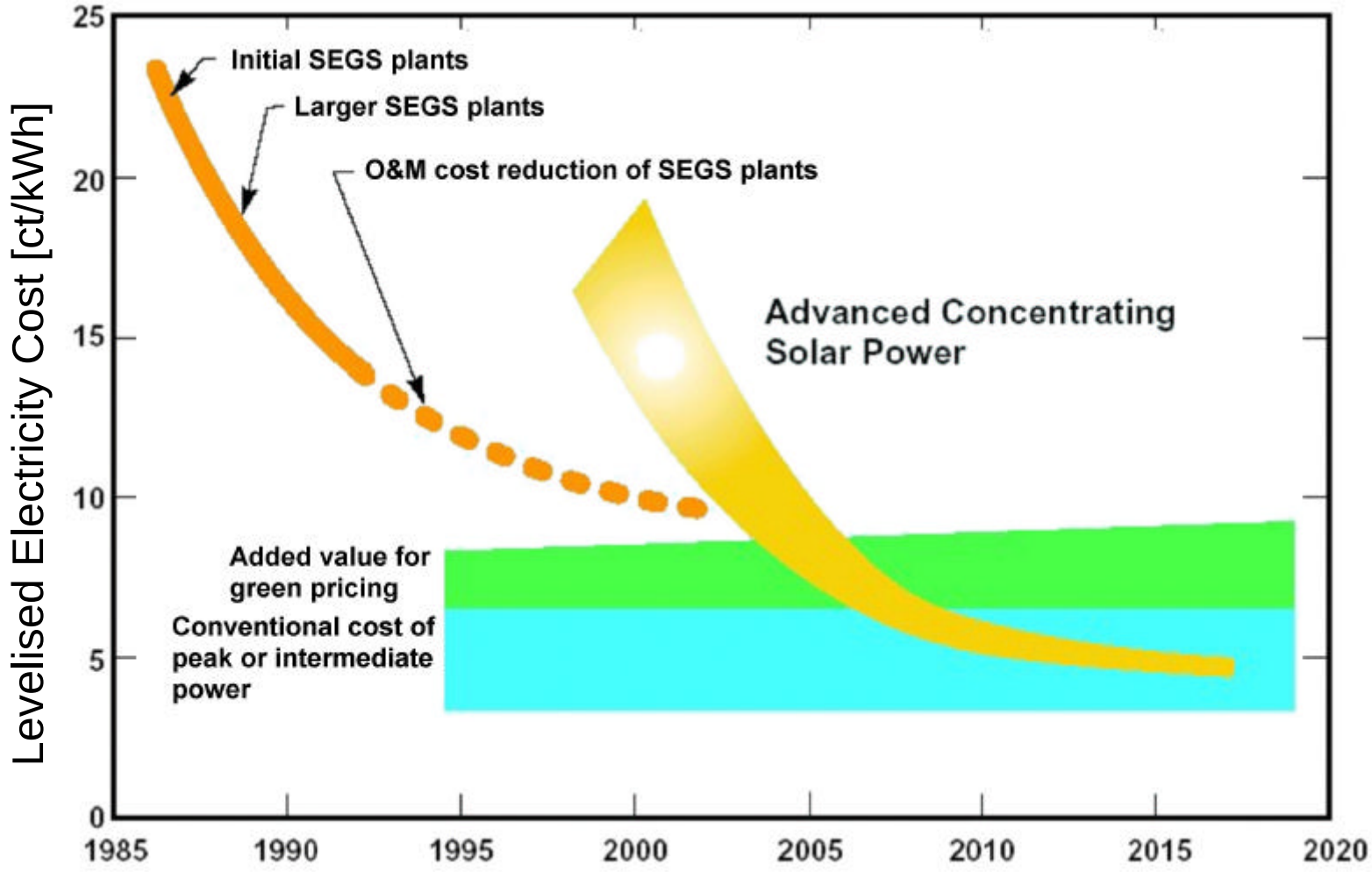
CONCENTRATING SOLAR POWER - JOBS AND ECONOMIC GROWTH FOR THE SUNBELT COUNTRIES

- one permanent job per megawatt during 25 year plant life
- ten temporary jobs per megawatt during two year construction
- high local content and added value in the solar collector field

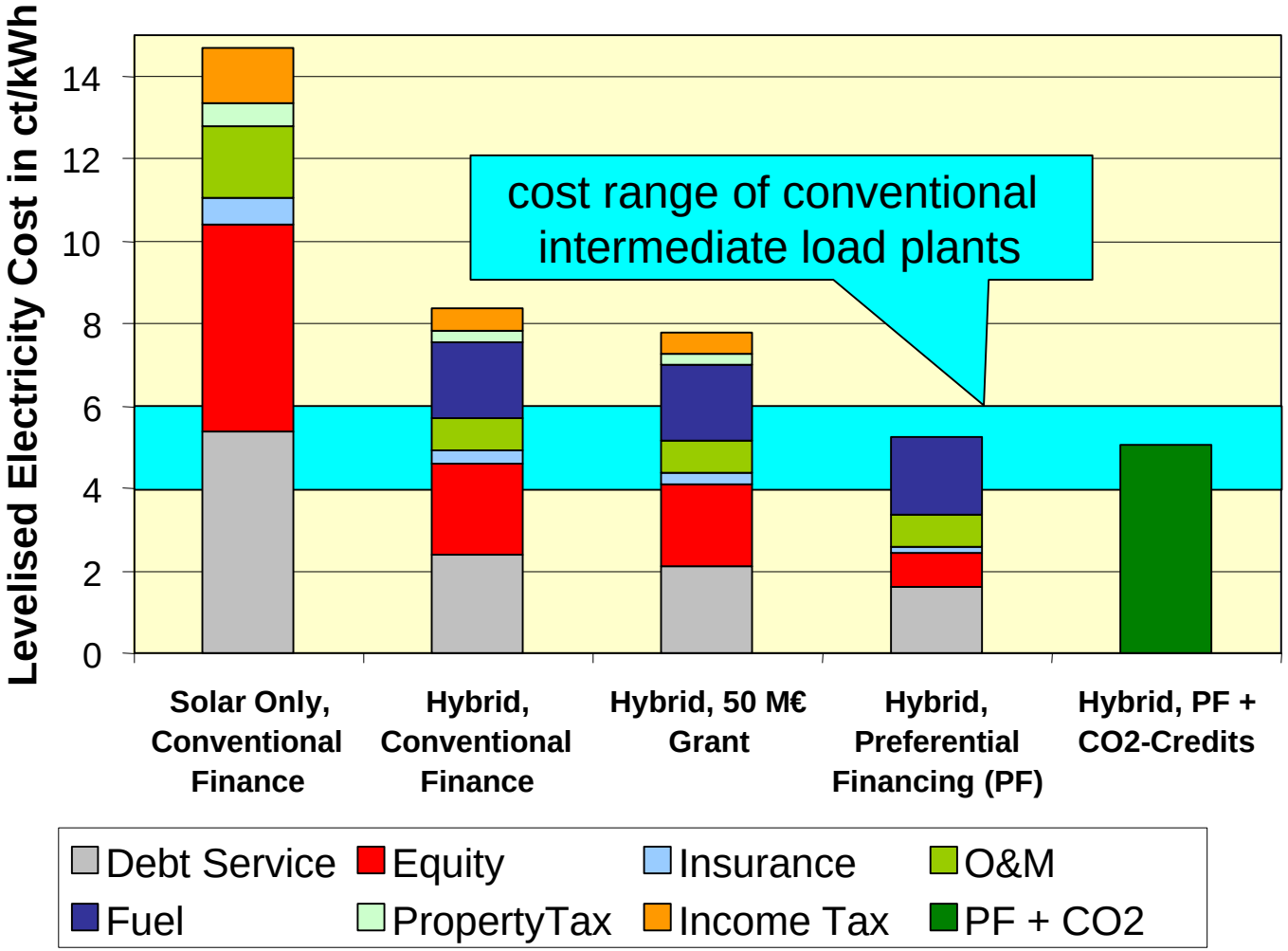
COST PERSPECTIVES

Impressive history and considerable cost reduction ahead



PERSPECTIVES OF PREFERENTIAL FINANCING

Sharing risks and burdens for start-up projects



General calculation parameters: 200 MW parabolic trough steam cycle, solar only plant yields 445 GWh/y, hybrid plant in medium load, solar share 45 %, annual electricity 1000 GWh/y, investment 425 M€, discount rate 3.5 % (real), economic life 25 years, fuel cost 12 €/MWh, avoided CO_2 310,000 t/y.

Parameters for conventional financing and (in brackets) ideal parameters for preferential start-up financing (PF): Debt interest rate 8 %/y (4 %/y), internal rate of return of equity 20 %/y (8 %/y), insurance rate 1% (0.5 %) of Inv./y, property tax 1.5 % (0 %) of Inv./y, income tax 38 % (0 %) of Inc./y, custom duty 5 % (0 %) of direct investment, production overhead 10 % (5 %), grant 0 M€ (50 M€), CO_2-Credit 0 €/t (5 €/t), risk management private (private & public).

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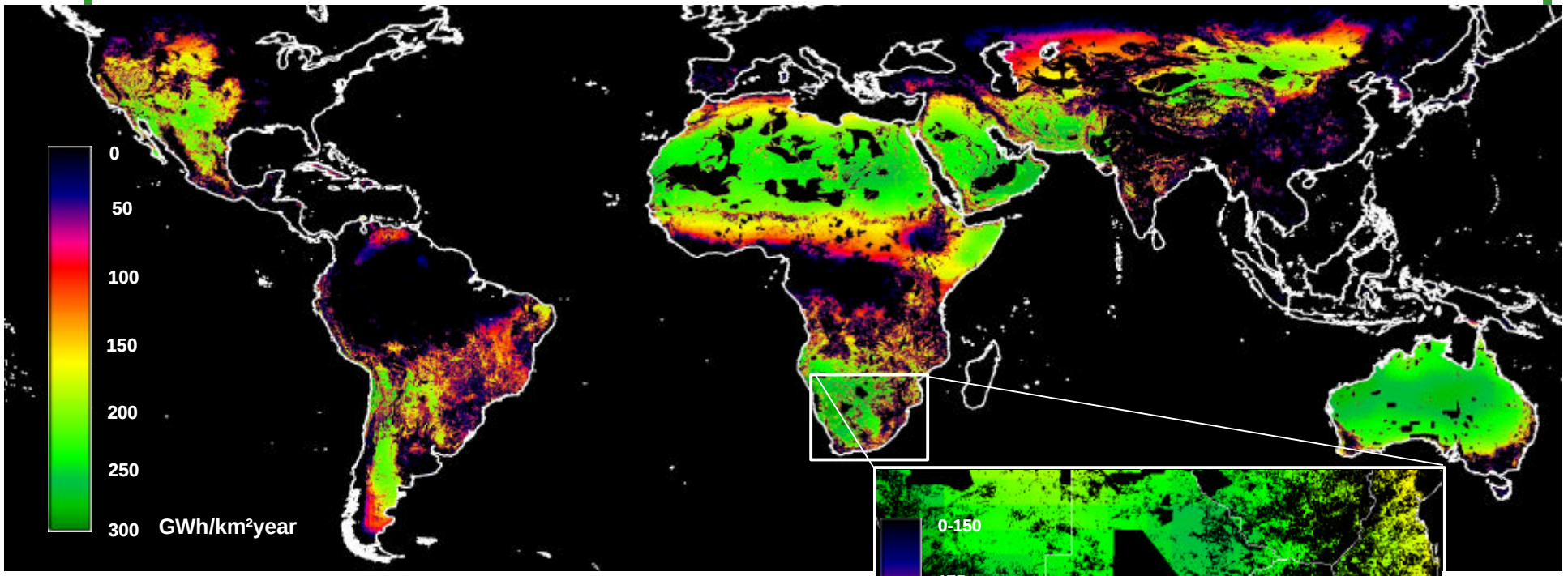
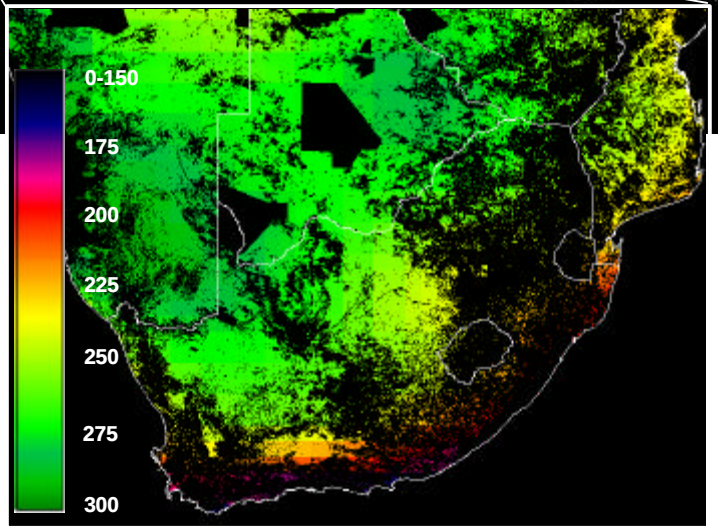
POTENTIAL OF CONCENTRATING SOLAR POWER





1 km² yields up to 200 - 300 GWh_e/year

1 km² equals 50 MW coal or gas plant

1 km² saves 500,000 bbl of oil / year

1 km² avoids 200,000 tons CO_2 / year

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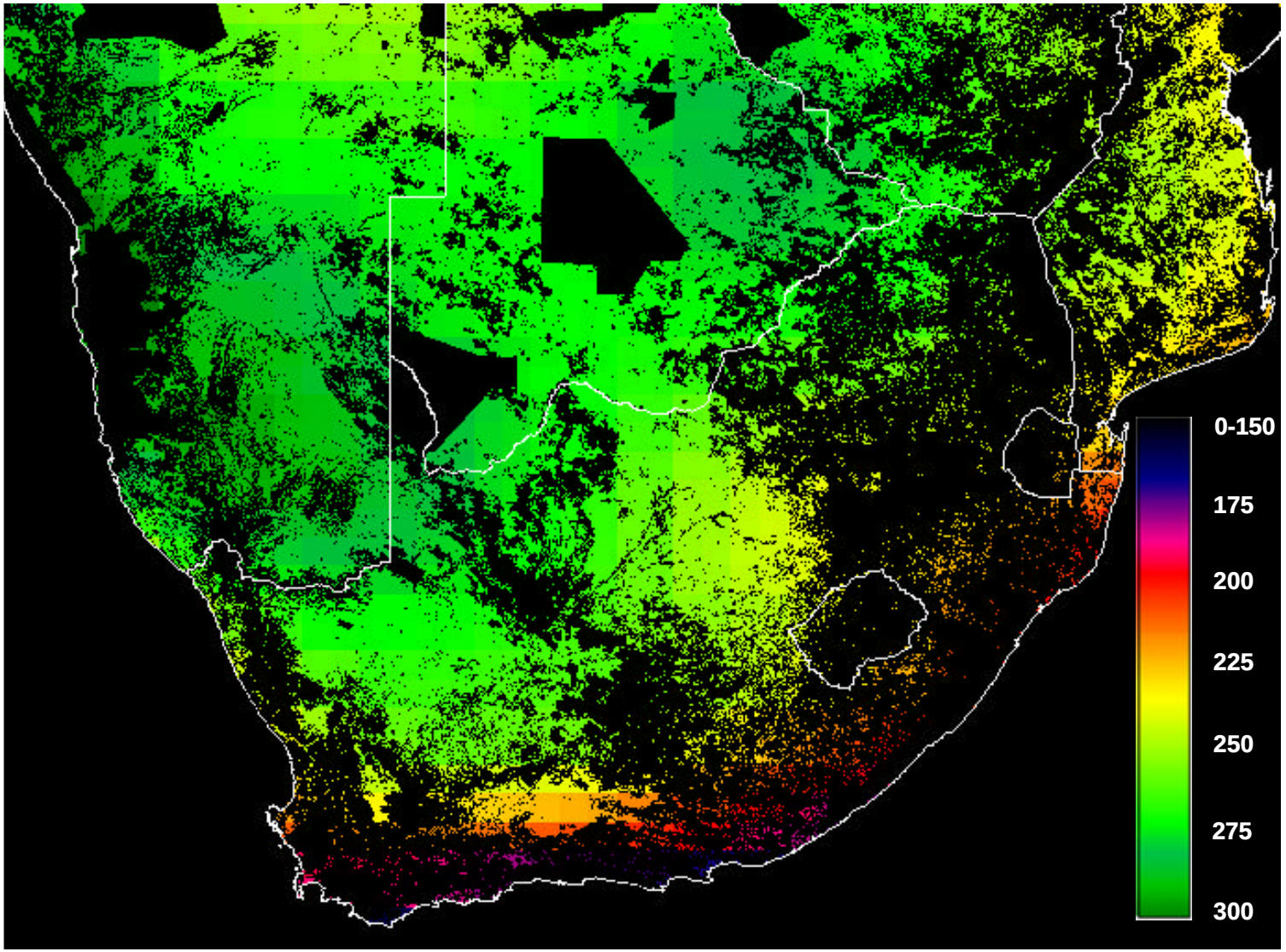
POTENTIAL OF CONCENTRATING SOLAR POWER



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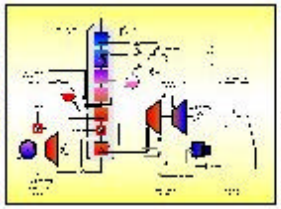
INITIATING A CSP PROJECT

From basic project outlines to large scale investment


	Project Development		Engineering, Procurement, Construction		Operation
		first year	second year	third year	25 - 30 years
Basic Project Information					
Project Assessment					
Project Definition					
Engineering					
Procurement					
Construction + Civil Works					
Commissioning					
Operation and Maintenance					

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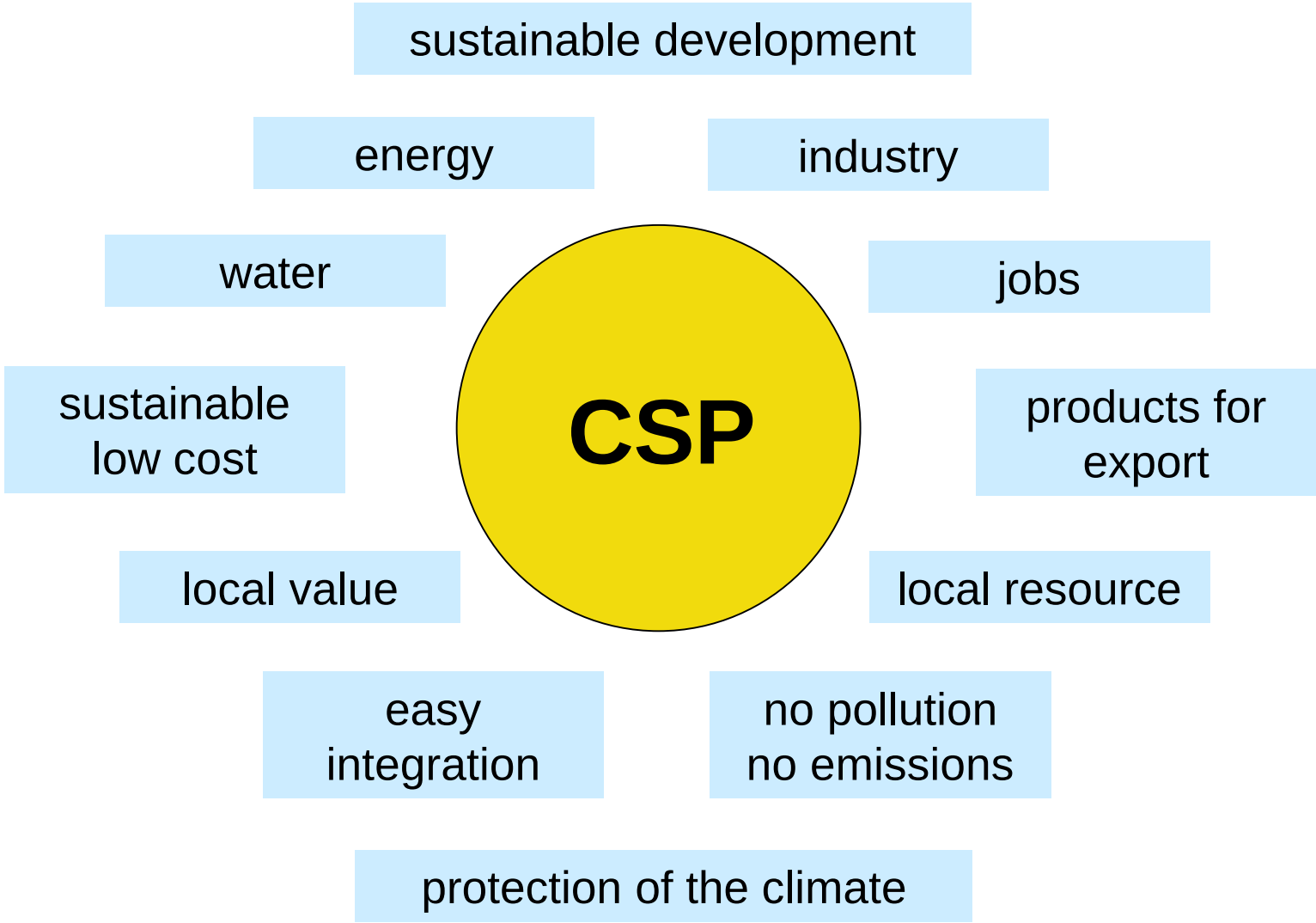
WHY CONCENTRATING SOLAR POWER?



Concentrating Solar Power may become a Development Machine for the Sunbelt Countries in the 21st Century

Brochure and more infos available here and at:

http://www.bmu.de
http://www.dlr.de/system

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