enerMENA

Towards a Sustainable Implementation of Solar Thermal Power Plants Technology in the MENA

The Regional Conference on:

-Renewable Energy and Sustainable Development in Rural Areas of the ESCWA Region-

Rabat, November 26th – 28th, 2013

enerMENA Project: Sustainable Implementation of Concentrating Solar Power Technologies in the MENA Region

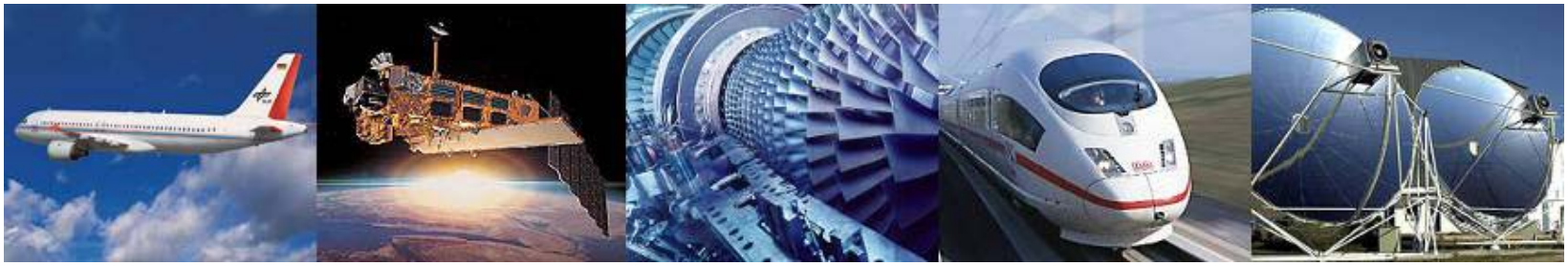
Dr. –Ing. Louy Qoaider, DLR

DLR Deutsches Zentrum für Luft- und Raumfahrt e.V. in der Helmholtz-Gemeinschaft

Content

- German Aerospace Center, DLR
- Overview of CSP Technologies
- enerMENA Project Structure
- enerMENA Capacity Building Program

DLR
German Aerospace Center



- Research Institution
- Space Agency
- Project Management Agency

Mission

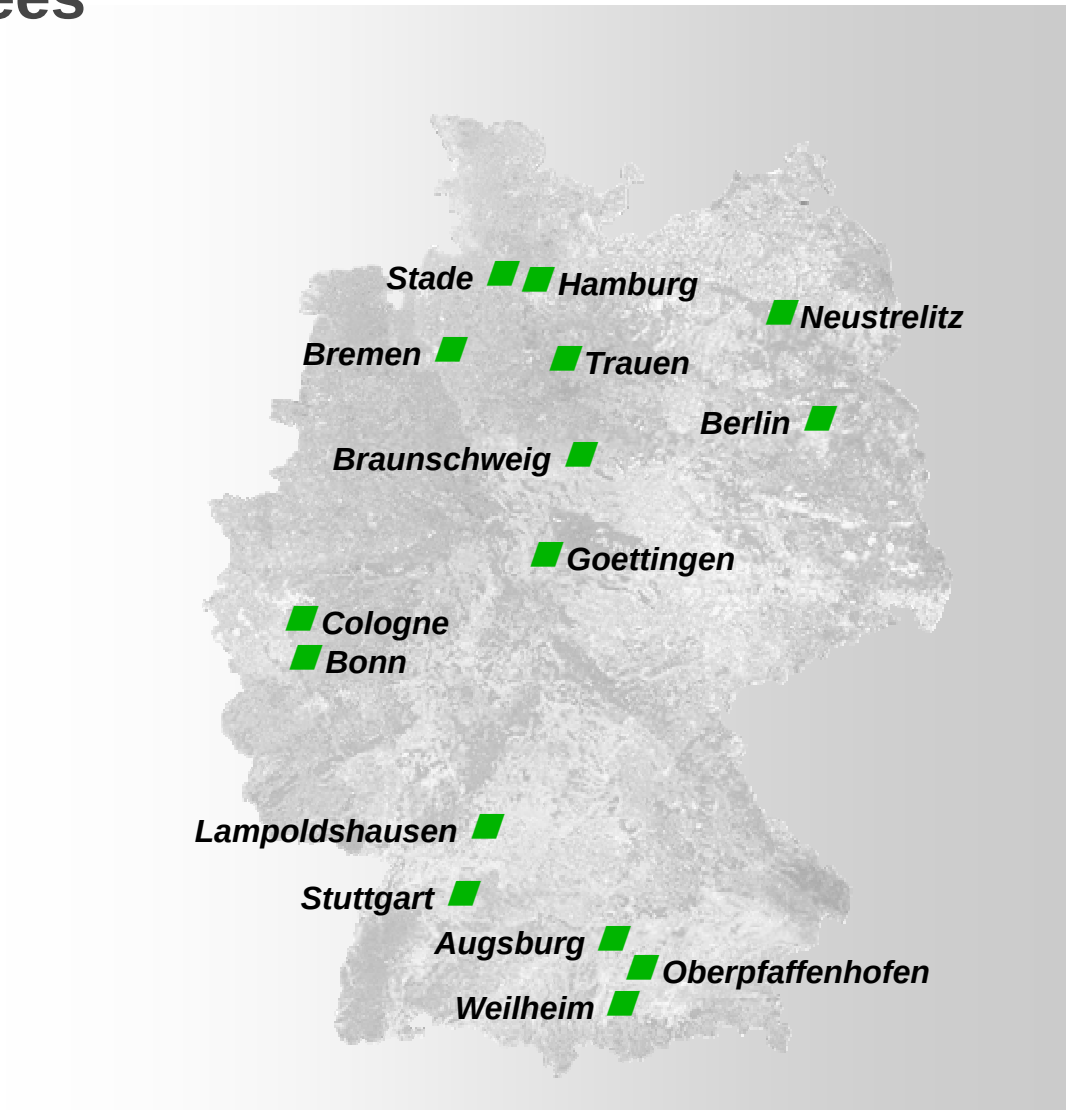
- Exploration of earth and solar system
- Research to protect environment
- Develop environment-friendly technologies

Locations and employees

6900 employees across
34 institutes and facilities at

- 15 sites.

Offices in Brussels,
Paris and Washington and
Almería.



Guiding Principles – Vision

- DLR – one of Europe's leading public research institutions, setting trends in its aeronautics, space, transport and energy business areas
- DLR – in its space agency function, a force that shapes European space activities
- DLR – the umbrella organisation for the most effective and efficient project management agencies and offices

Goal of DLR Institute of Solar Research

„Global Leader in System Competence of Concentrating Solar Technologies “

Product

First address for research and industry

Unique R&D Infrastructure

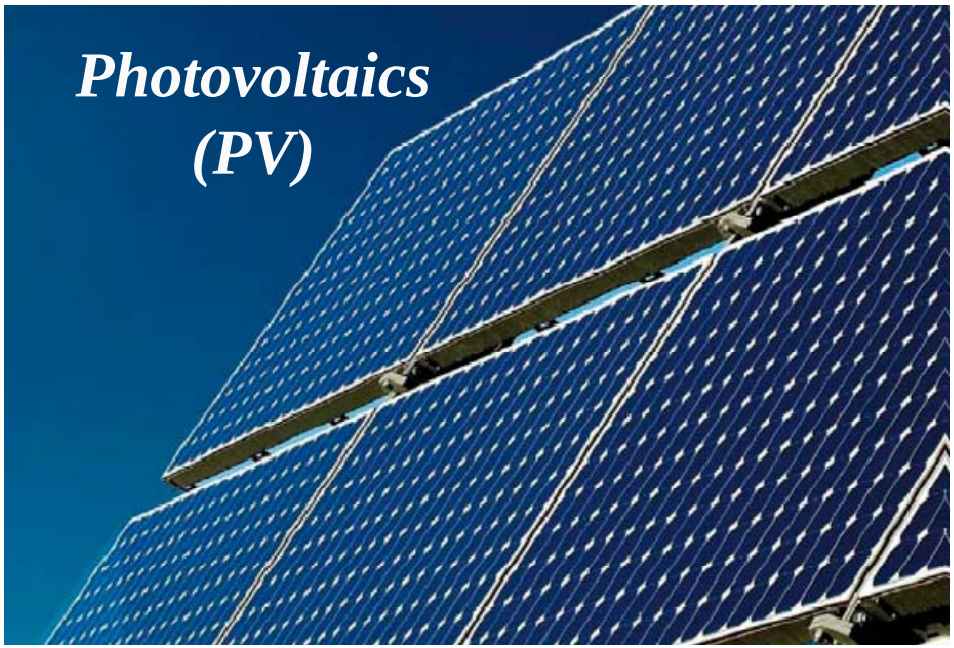
Excellent Research

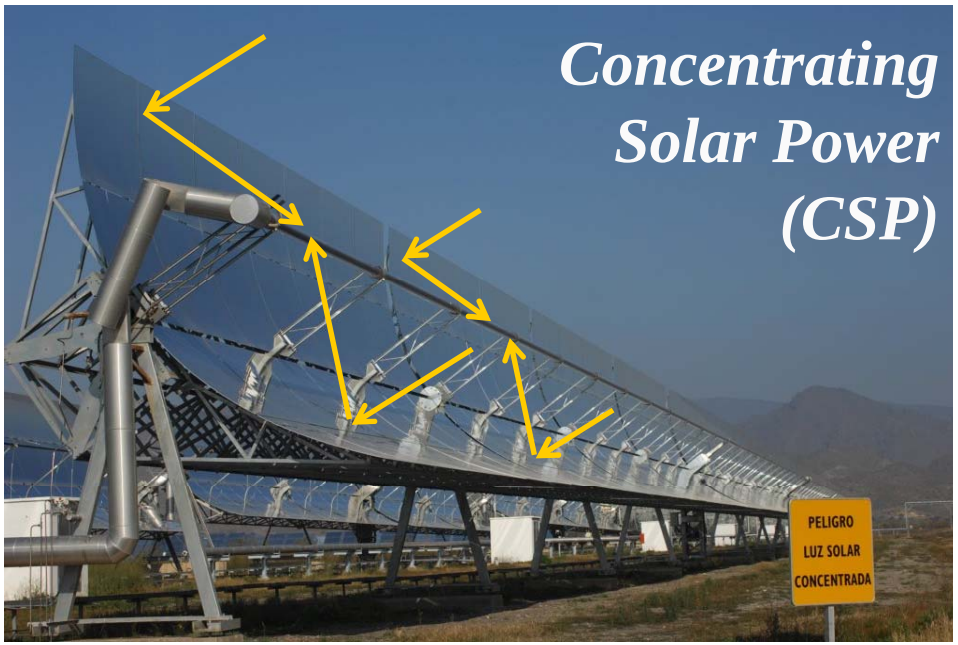
Idea

What is CSP?
Why CSP?

Solar Technologies: CSP and PV

SolEs





Solar energy

↓

Power

Solar energy

↓

Concentration

Heat ⟷ Thermal Energy Storage

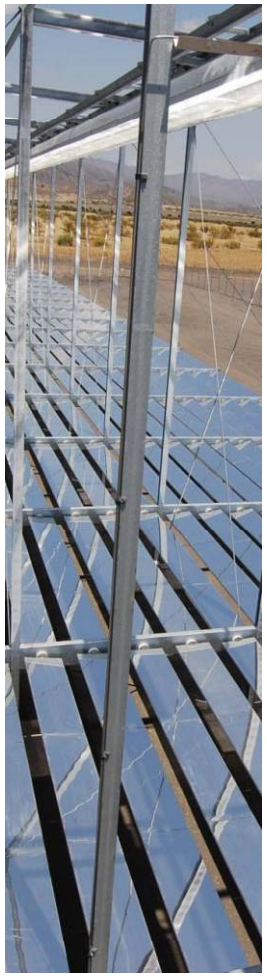
↓

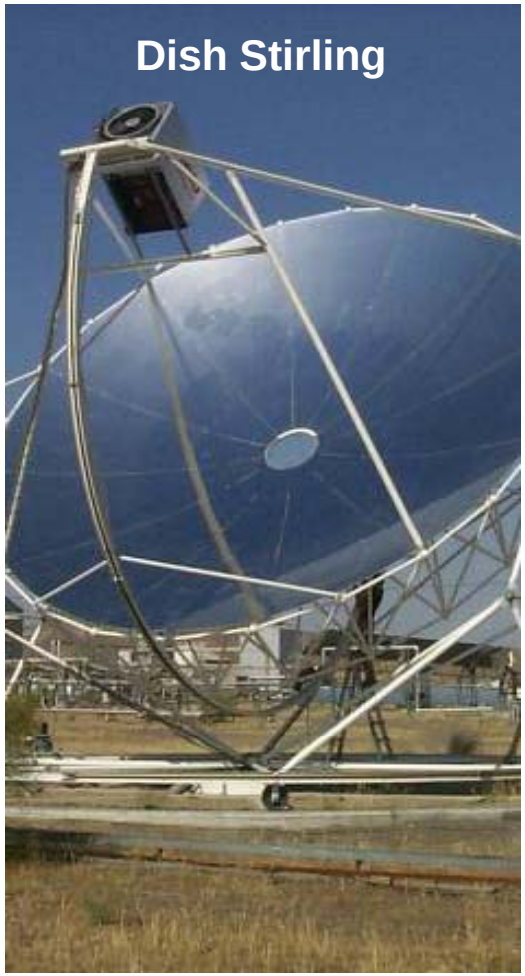
Turbine

Power

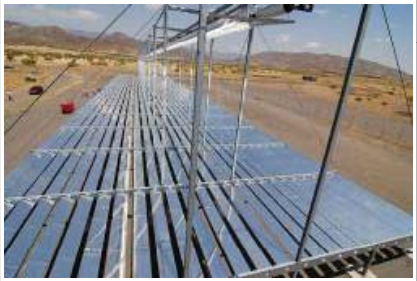
DLR

Concentrating Solar Power Technology Options

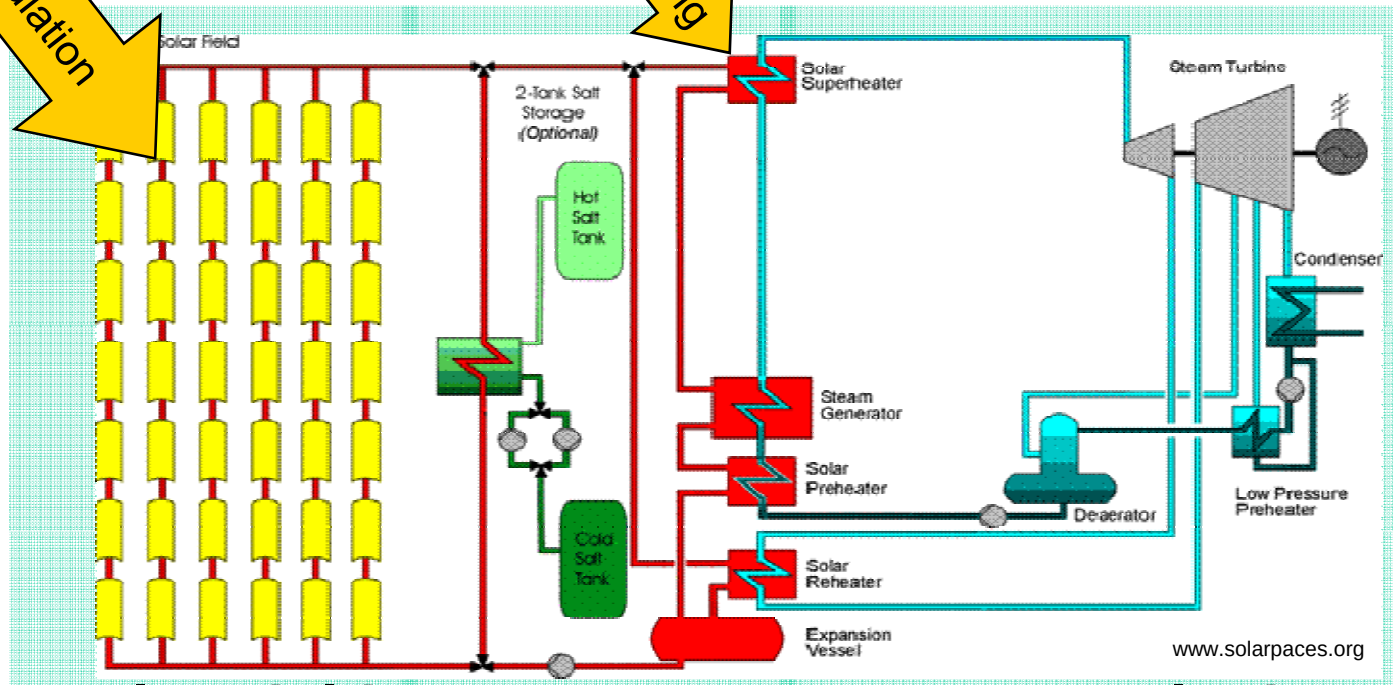




CSP Technologies
Overview

Type	*Parabolic Trough*	*Linear Fresnel*	*Solar Tower*	*Dish Systems*
				
	Line Focus	*Line Focus*	*Point Focus*	*Point Focus*
Tracking	1-axis	1-axis	2-axis	2-axis
Conc.	C ~ 80	C ~ <80	C ~ 200 - 1000	C >1000
Temp.	200°C – 400 / 500°C	200°C – 400 °C	600°C – 1100°C	700°C
Power	50 - 280 MW_{el}	50 - 280 MW_{el}	10 –some 100 MW_{el}	0.003 – 0.025 MW_{el}

Parabolic Trough Plant Scheme



Solar Field
parabolic trough collectors
300-500'000 m²

Heat Transfer & Buffer
0.5 - 6 hours capacity

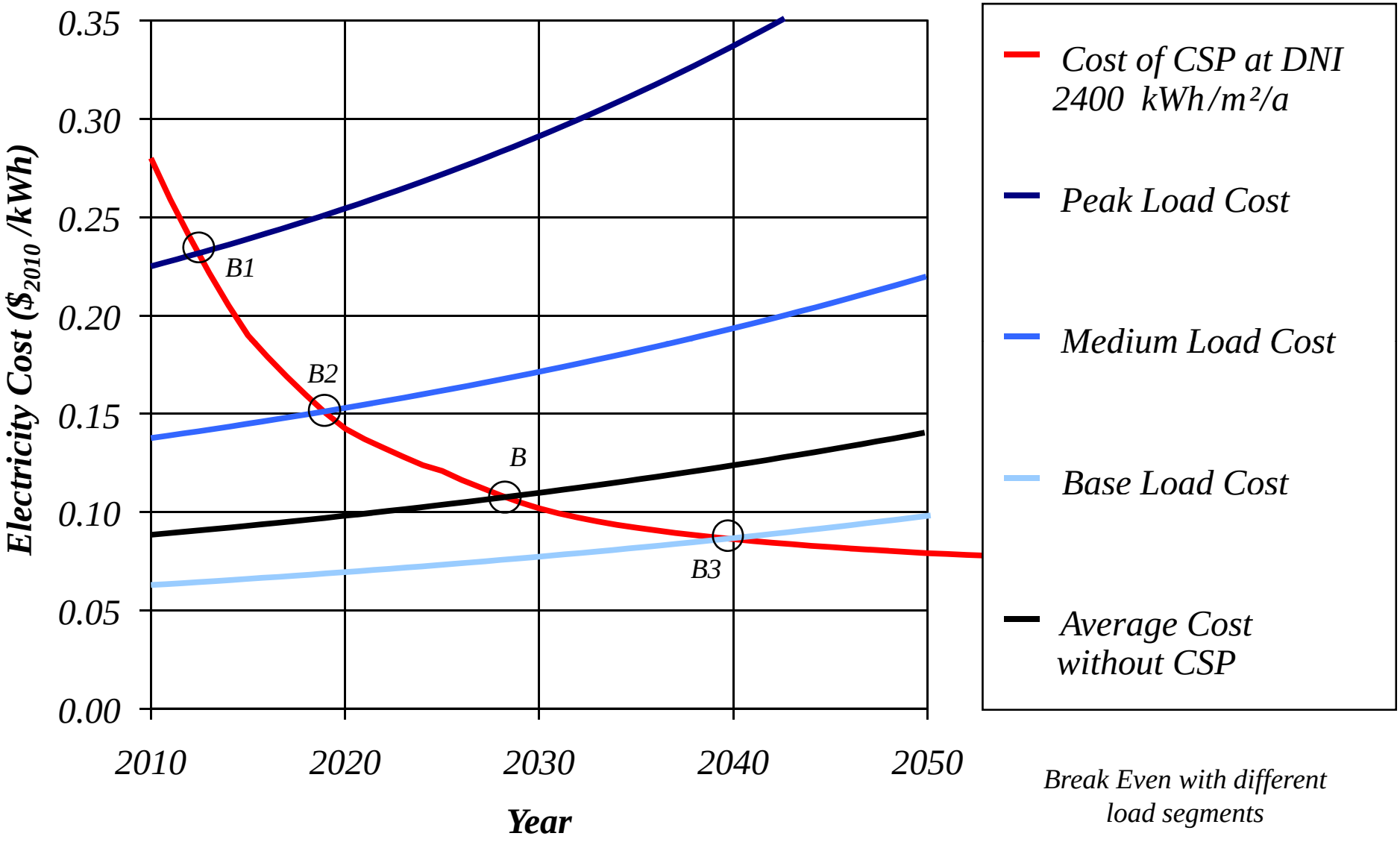
Power Block
steam cycle turbine, condenser
30-80 MW

Configuration of CSP Plants

CSP is a power plant plus „fuel“ for 40 years operation

Qualities of CSP Plants:

- Operating as peak, mid-merit or base load power plant
- Firm & flexible capacity Power on demand (dispatchable technology)
- Up to 8000 solar full load hours
- Combined generation of process heat for industry, cooling, desalination, etc.



Break Even with different load segments

Journal of Energy Policy 39 (2011) 307 - 317

Characteristics of CSP:

- Fully flexible power
- Low fuel consumption
- Higher investment cost
- Constant electricity cost
- Low emissions
- Low land transformation

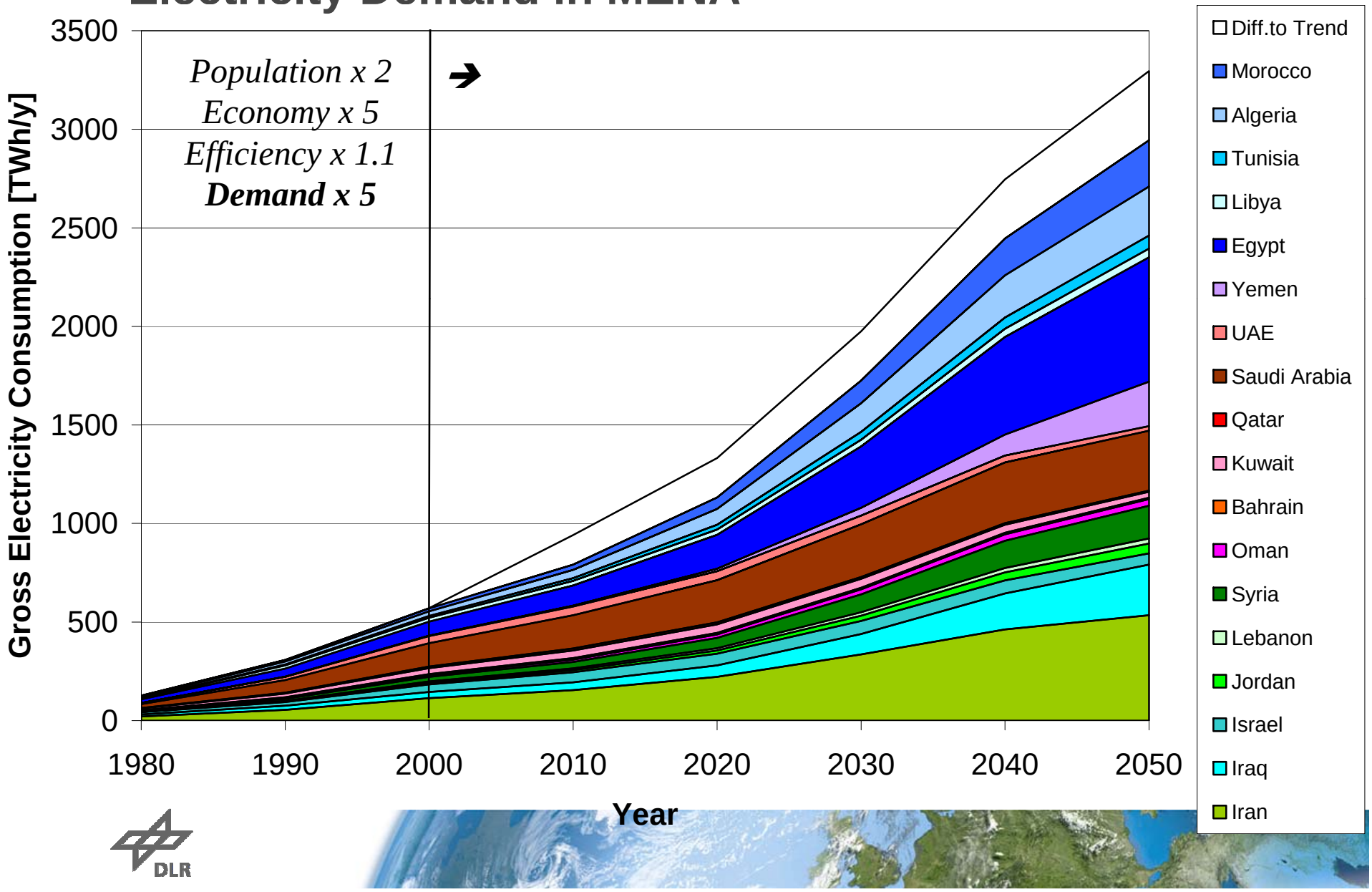
Scenario for sustainable energy supply for the MENA Region.

Sustainable Electricity Supply:

- ✓ **Inexpensive**
  - low cost
  - no long term subsidies
- ✓ **Secure**
  - diversified and redundant supply
  - power on demand
  - inexhaustible resources
  - available technology
- ✓ **Compatible**
  - low pollution
  - climate protection
  - low risks for health and environment
  - fair access

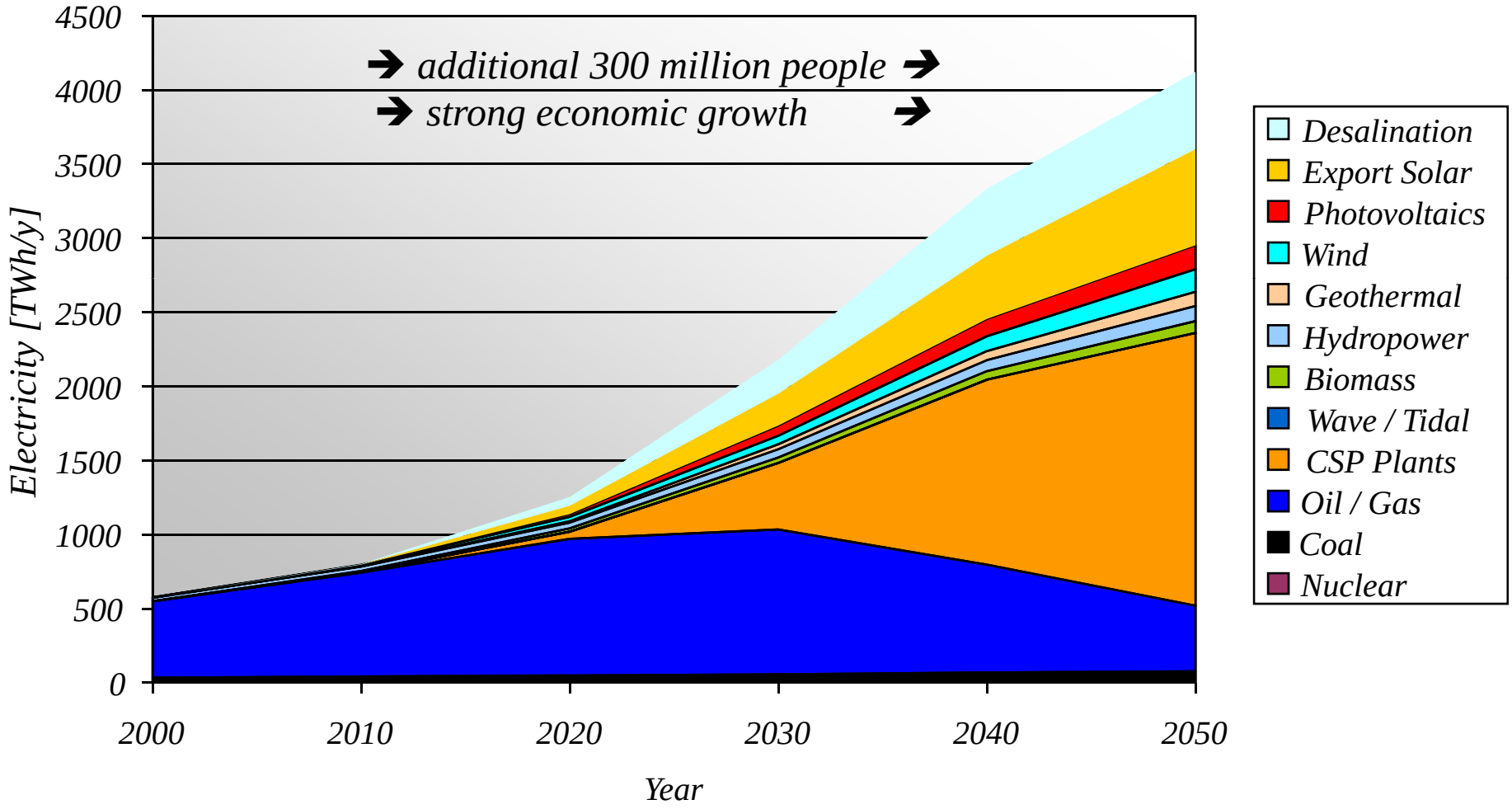
Electricity Demand in MENA

www.dlr.de/tt/med-csp



DLR

Electricity Supply in the Middle East & North Africa



www.dlr.de/tt/med-csp

enerMENA Project:

Towards a Sustainable Implementation of Solar Thermal Power Plants Technology in the MENA

Background

Towards a Sustainable Implementation of Solar Thermal Power Plants Technology in the MENA

DLR initiative, supported by the German Federal Foreign Office

enerMENA (since 2009) follows the DESERTEC concept and supports the *sustainable implementation of concentrating solar power plant technology in Europe and MENA*

by

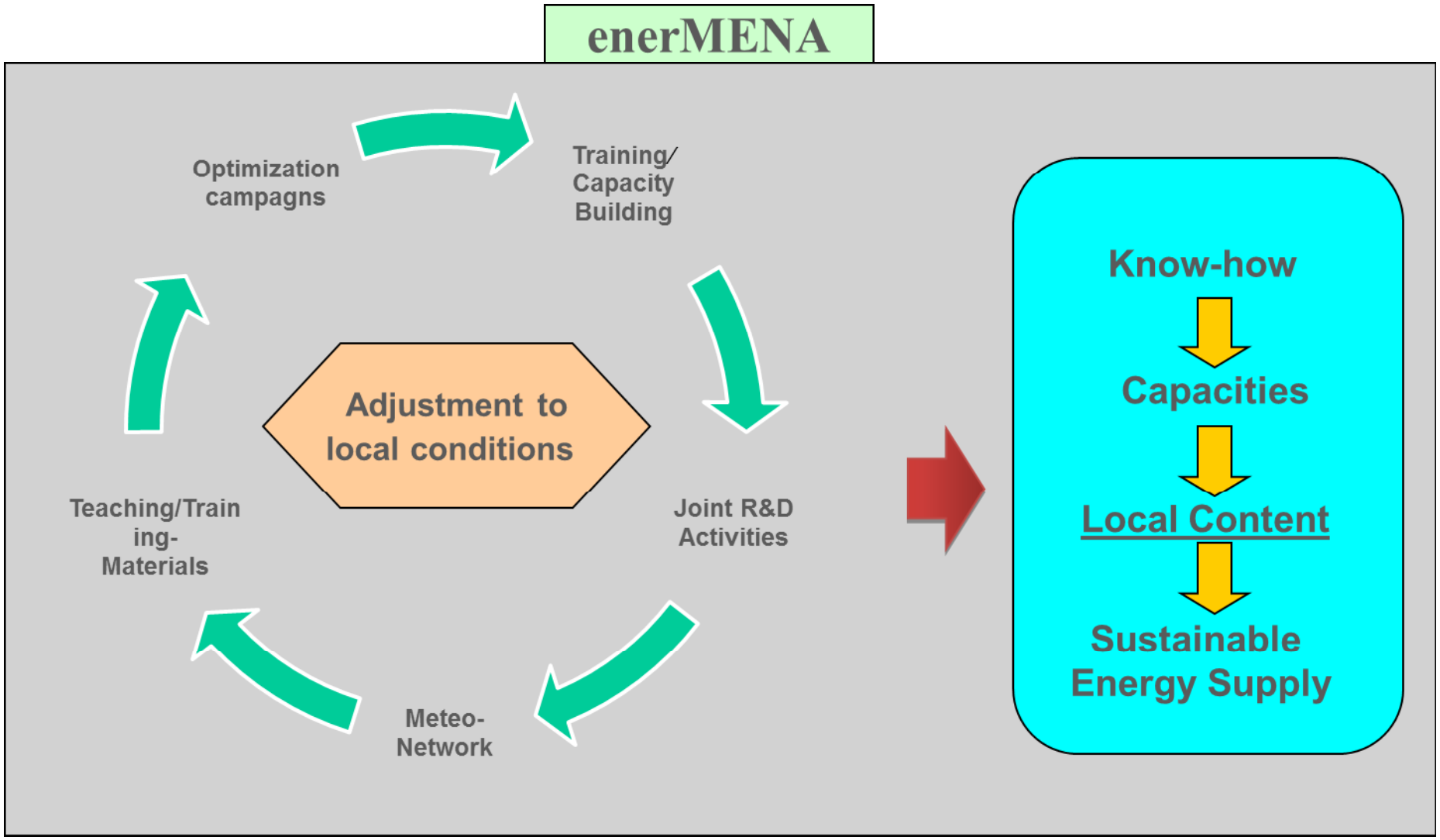
- Improvement of Technology
- Development of PEOPLE capacities
- Support of PROJECT DEVELOPMENT activities

Graphics: Desertec Foundation

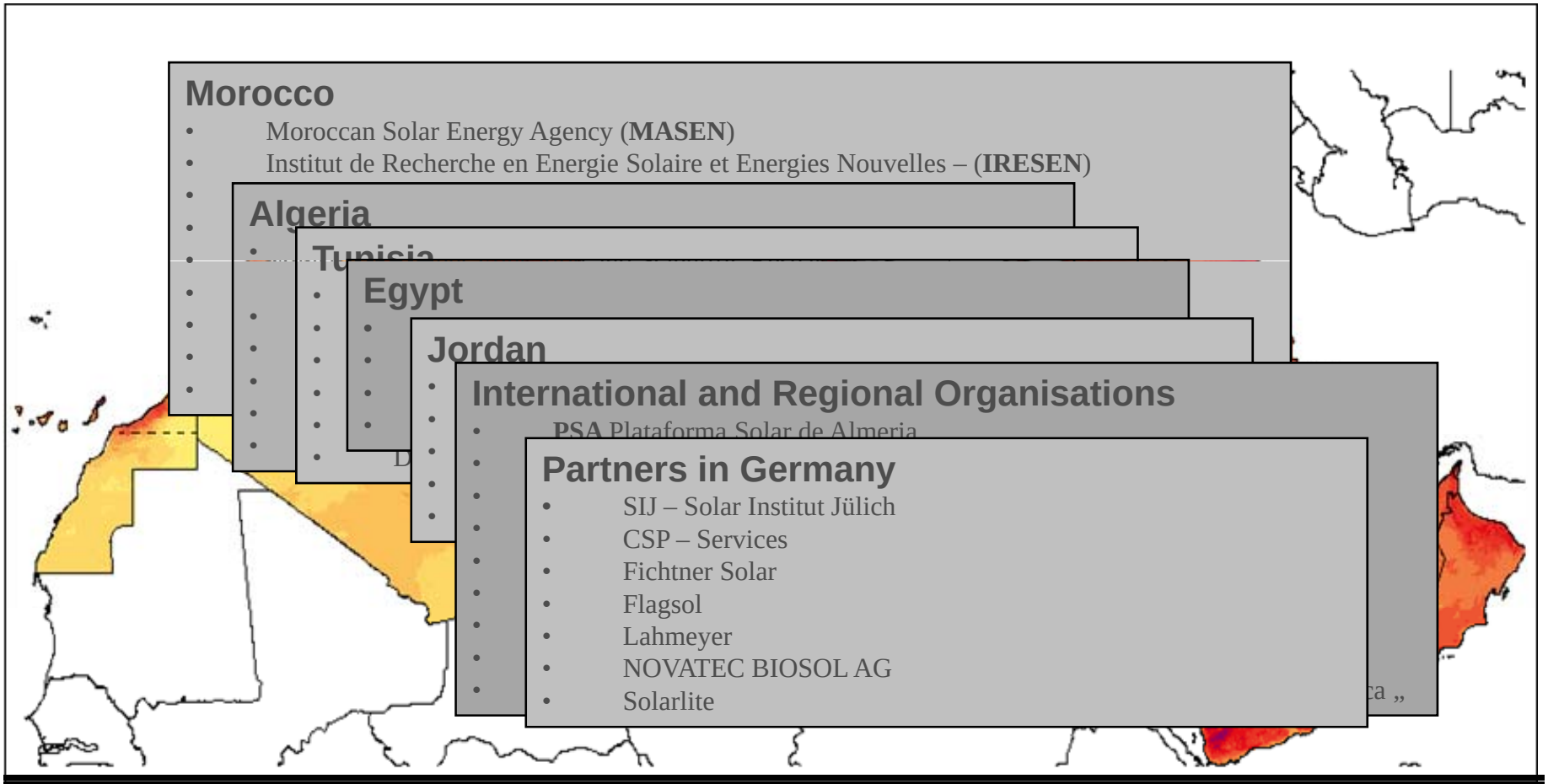
Methodology:

- Engagement of MENA Partner to achieve the project objectives through constructive cooperation
- Development and implementation of an integrated high quality training program. “Train the Trainers”
- Widen the dissemination (> 45 Partner)
- Know-how-Transfer EU-MENA
- Implementation of joint R&D activities
- Long term cooperation

Training course at the PSA, Spain


enerMENA
Optimization campagns
Training/ Capacity Building
Adjustment to local conditions
Joint R&D Activities
Meteo-Network
Teaching/Training-Materials
Know-how
Capacities
Local Content
Sustainable Energy Supply

enerMENA Network



enerMENA: Network with over 50 Partners from 5 MENA Countries, Germany and EU

enerMENA structure: three pillars

Module I: Technology

Overall objective: Support the **improvement** of the **efficiency** of CSP plants in MENA.

- Development of **mobile measurement equipment** to qualify CSP plants and components.
- Running of joint **measurement Campaigns** at CSP plants to optimization their operation
- Supporting the creation of **local test and R&D infrastructure**

Module II: People (Capacity Building)

A - Training program for **field engineers and technicians**

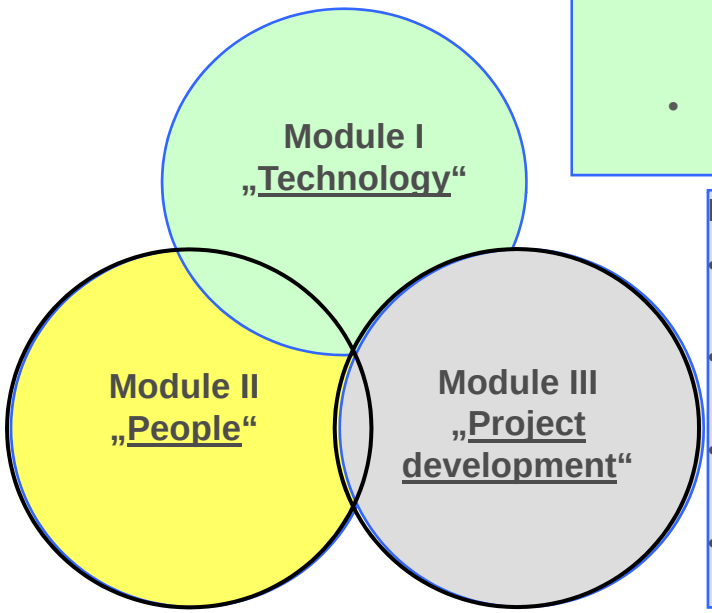
B- Preparing qualified **engineers at the academia**

- Theoretical: **CSP Teaching materials**
- Practical: MENA Students **Internship**

C- Training program for local **project planners and managers**

- Preparation of professional training materials.

D- **Expert Training** Courses



Module III: Project Development

- **enerMENA Meteo-Network** for reliable data
- **Know-how transfer** of CSP technologies
- Supporting a successful **project planning**
- **Joint R&D Activities** with partners

Project management and coordination

enerMENA

DLR

enerMENA Capacity Building Program

- Why -

- Rapid growth of the CSP market during the last years,
- Projections indicate a strong near-term demand on local capacities, knowledge, and local content.
- Good preparation of local capacities is highly requested to make the required CSP boom.
- The enerMENA project supports its partner organizations to achieve this target.

enerMENA Capacity Building Program

Module A - Training Program for *Field Engineers* and *Technicians*

Need: Establish CSP technical expert teams in the partner countries.

Teams mainly responsible for

- the **technical optimization** of the existing and planned power plants
- the organization of **training courses for technical staffs** in their countries (Train-the-Trainers).

Actions

- Each Country team provided with a mobile laboratory.
- Technical training courses organized at PSA and CSP plants
- Long term support by DLR experts.

30 expert lectures available as video tutorials !

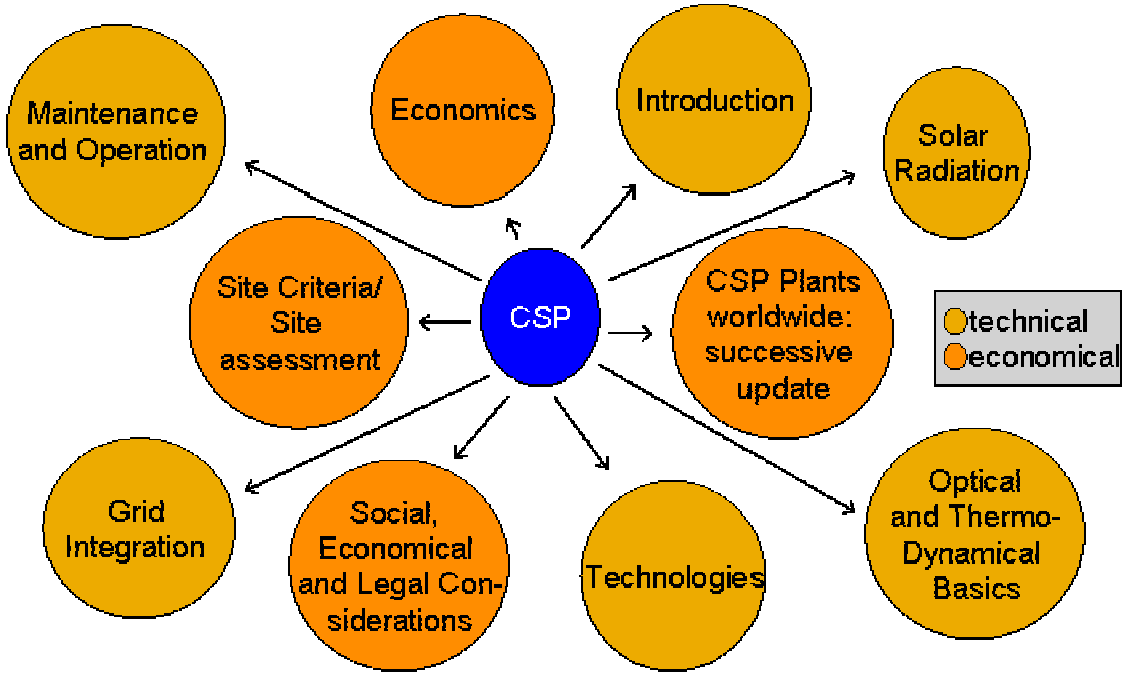
DLR

enerMENA Capacity Building Program

Module B - Educating *higher level university students* and *lecturers*

Need: Tailored education and creating CSP related ecological and economical consciousness

- CSP module developed for technical Master Degree programs
- two-stage review within EU-MENA university network
- Wide spectrum of topics covered including economics



Partners: Aachen University of Applies Sciences (SIJ), Kassel University, Cairo University (EG), GUC (EG), Jordan University (JO), JUST (JO), ENIT University (TN), CRTEn (TN), CDER (DZ), ENIT University (MA), UMP (MA)

enerMENA Capacity Building Program

Module B - Educating *higher level university students* and *lecturers*

Need: Tailored education and creating CSP related ecological and economical consciousness

- CSP module developed for technical Master Degree programs
- two-stage review within EU-MENA university network
- Wide spectrum of topics covered including economics
- Numerous implementation workshops organized

enerMENA Capacity Building Program

Module B - Educating *higher level university students* and *lecturers*

Need: Tailored education and creating CSP related ecological and economical consciousness

- CSP module developed for technical Master Degree programs
- two-stage review within EU-MENA university network
- Wide spectrum of topics covered including economics
- Numerous implementation workshops organized
- Practical component included by hosting DLR-internships

enerMENA Capacity Building Program

Module C - Training of local *project planners and managers*

Need: coaching of local responsibles in project planning and yield analysis of CSP plants.

enerMENA project planning courses include

- description of typical CSP project developments
- summarization of the different phases of the project development process and definition of required expertise
- presentation of CSP plant yield analysis tools as instruments for a proper assessment of the economic viability of possible CSP projects

5 expert lectures available as video tutorials !

enerMENA Capacity Building Program

Module D – **Expert** Training courses for *professionals*

Need: dissemination of CSP expert knowledge among utilities, IPP and public institutions

- Standard three-days course includes:
  - Introduction to all CSP technologies
  - Optimization of CSP plants
  - Solar resource assessment
  - CSP Projects planning and implementation
  - Overview of the world market and projects.
- The organization takes place in cooperation with regional stakeholders, e.g. AUE, GIZ, AFREC, RCREEE, ONEE, STEG, NEPCO, etc

19 expert lectures available as video tutorials !



Thank you for your attention!

enerMENA




Dr.-Ing. Louy Qoaider, German Aerospace Center, Institute of Solar Research, Plataforma Solar de Almeria, Spain, (louy.qoaider@dlr.de) +34-950-278817, www.dlr.de/enermena

DLR