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DESERTEC – Clean Power from Deserts

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Presentation to ITER
Cadarache, 14 November 2012

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Agenda

- DESERTEC: A global concept
- DESERTEC Initiatives – Update
- Technology Update
- Some example countries

Challenges of the 21st century

- Energy supply AND climate protection

How can 10 billion people
live in a sustainable way
on this planet
that's already
overburdened
by 5 billion people?

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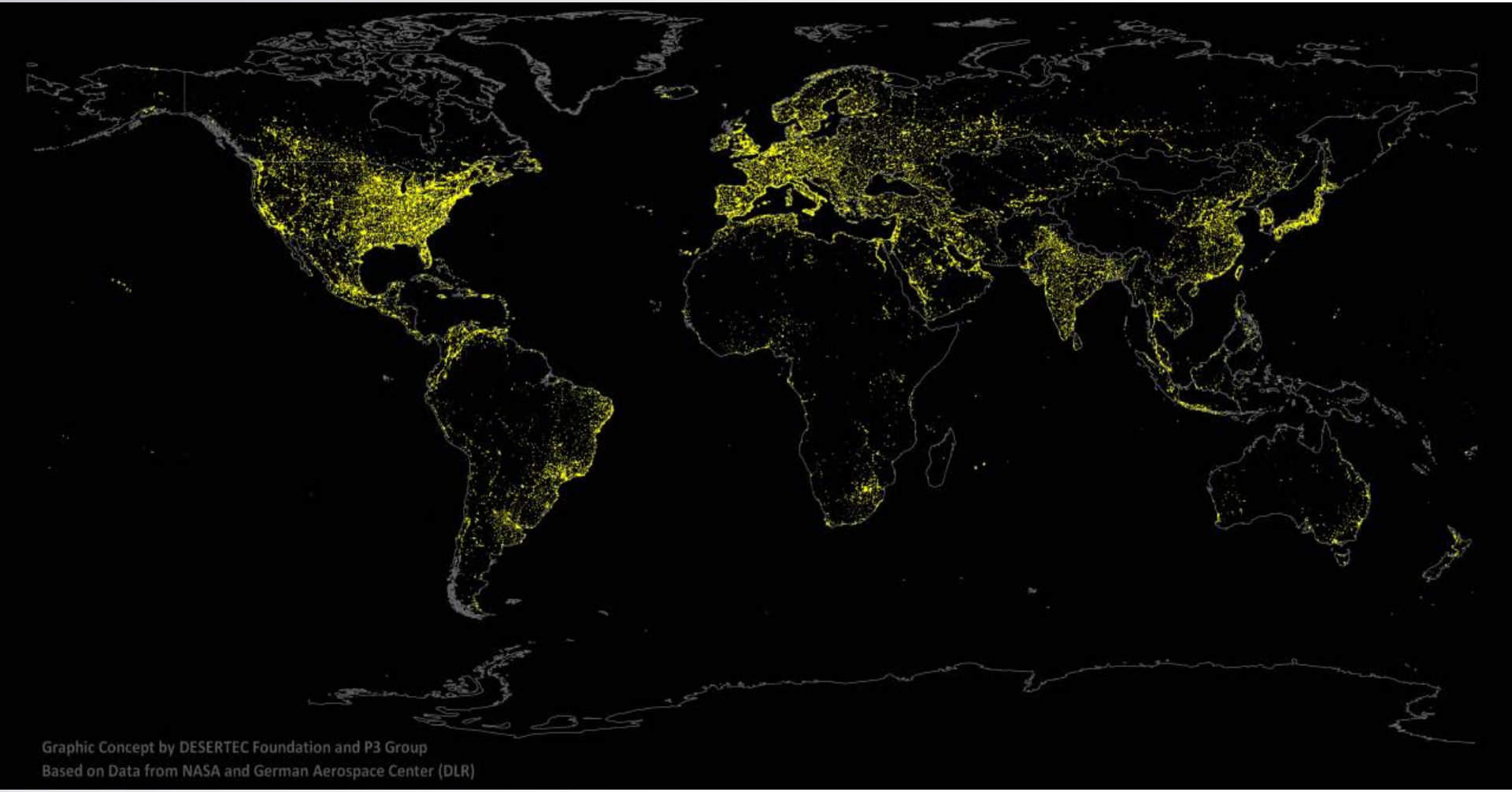
Energy Consumption Regions



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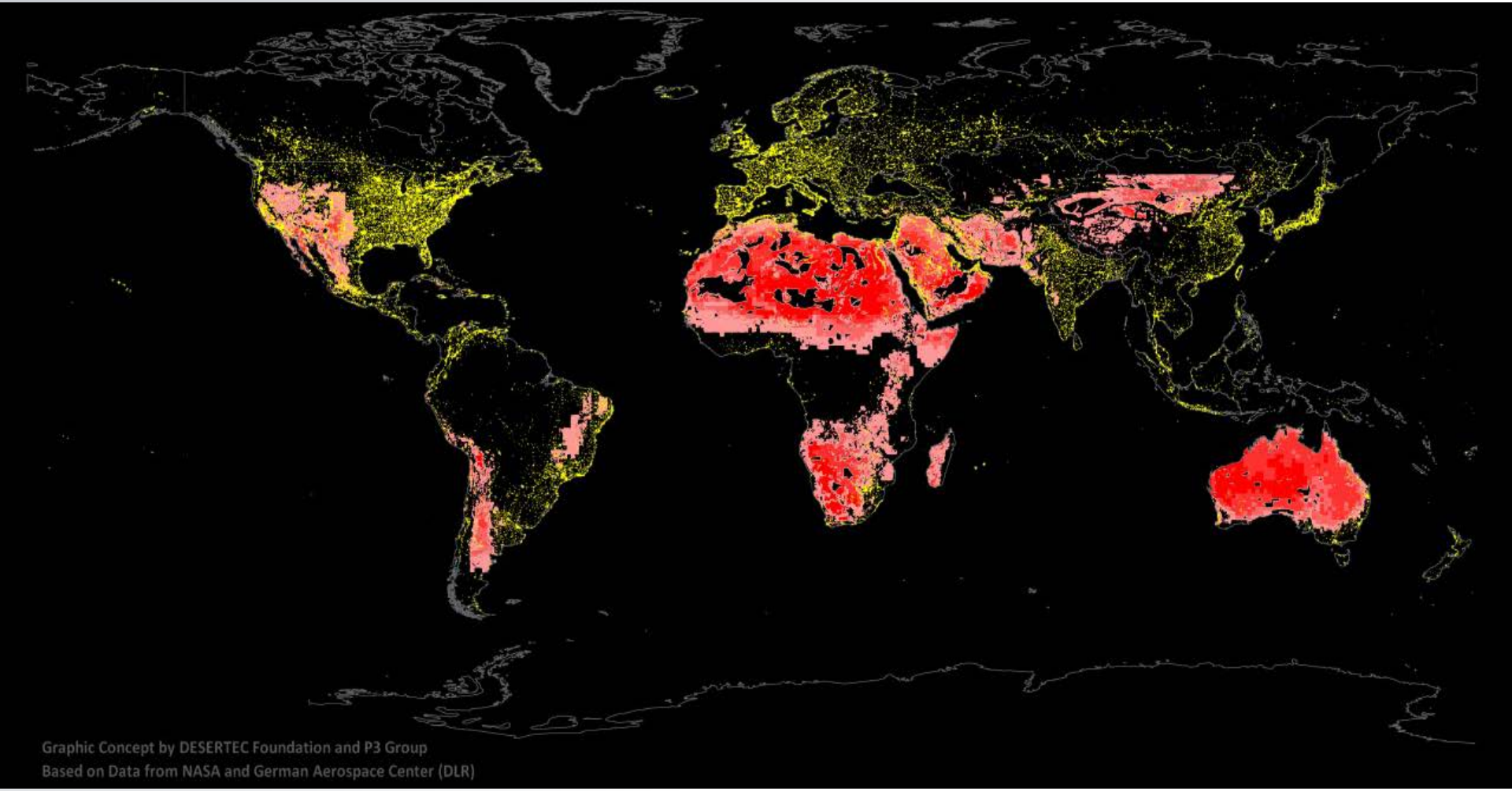
Energy Consumption vs. Supply Regions (Deserts)



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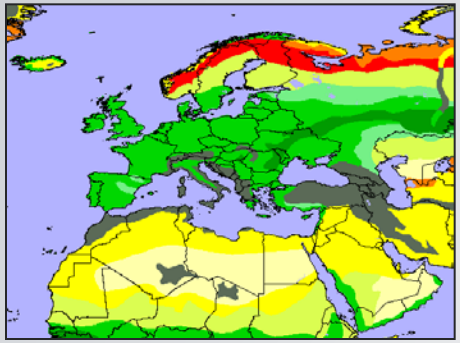
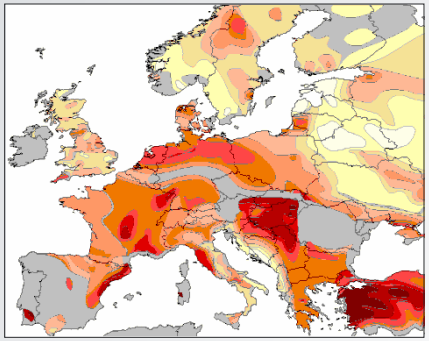
Solar energy has the largest potential

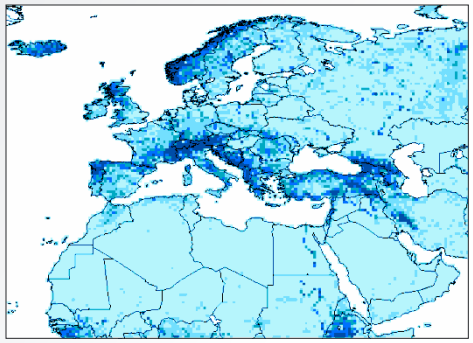
Electricity yield and potential in EU-MENA



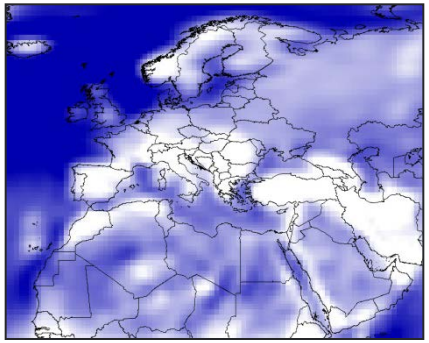
Biomass
0-1 GWh/km²y
1,350 TWh/y



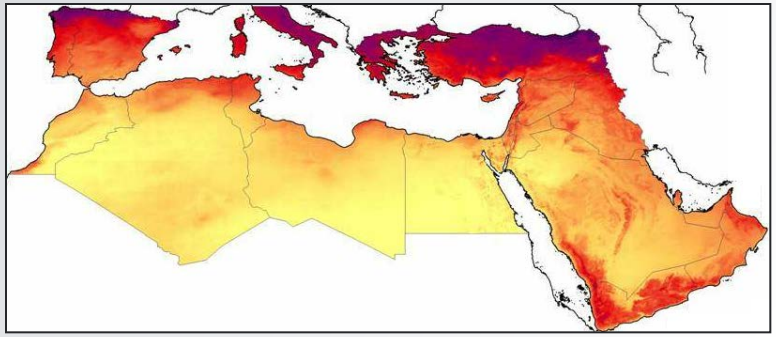
Geothermal
0-1 GWh/km²y
1,100 TWh/y



Hydropower
0-50 GWh/km²y
1,350 TWh/y



Wind power
5-50 GWh/km²y
1,950 TWh/y
(off-shore excluded)



Solar power
10-250 GWh/km²y
630,000 TWh/y

NB: Electricity demand
EU-25: 3,200 TWh/y
MENA: 600 TWh/y
Data for 2005

EU-MENA = Europe - Middle East & North Africa
Source: DLR • MED-CSP • Concentrating Solar Power for the Mediterranean Region • Stuttgart 2005 • www.dlr.de/tt/med-csp

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Solar power generation

Basic idea behind DESERTEC

Within 6 hours deserts receive more energy from the sun than humankind consumes within a year.

Dr. Gerhard Knies

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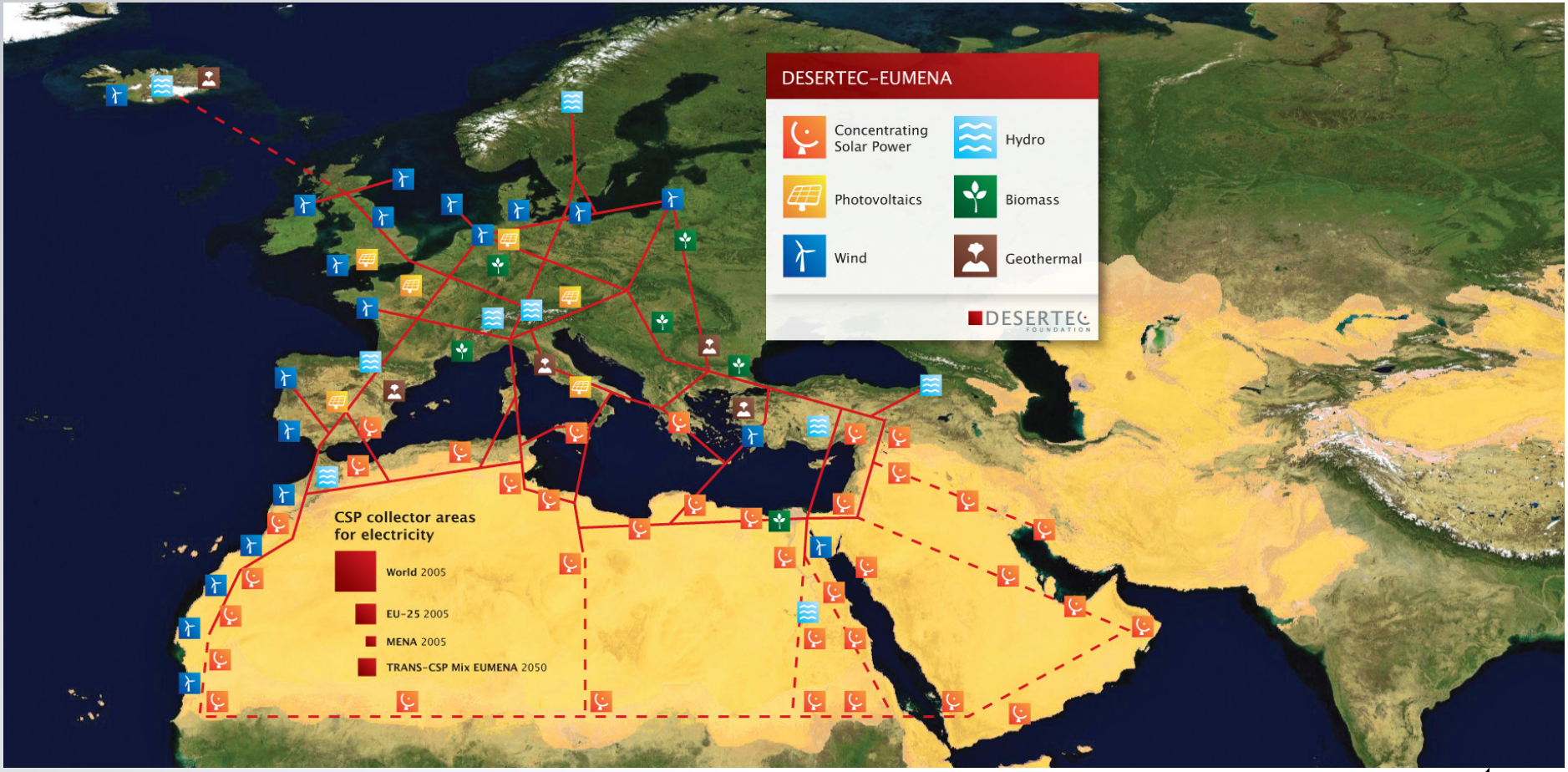
The DESERTEC Concept integrates CSP with other renewables and HVDC



EU-MENA = Europe - Middle East & North Africa • CSP = Concentrated Solar Power • HVDC = High-Voltage Direct Current
The symbols for power sources are only indicators of potential locations.
Sources: Clean Power from Deserts • White Book 4th Edition • DESERTEC Foundation • February 2009 • www.desertec.org • www.dlr.de

DLR

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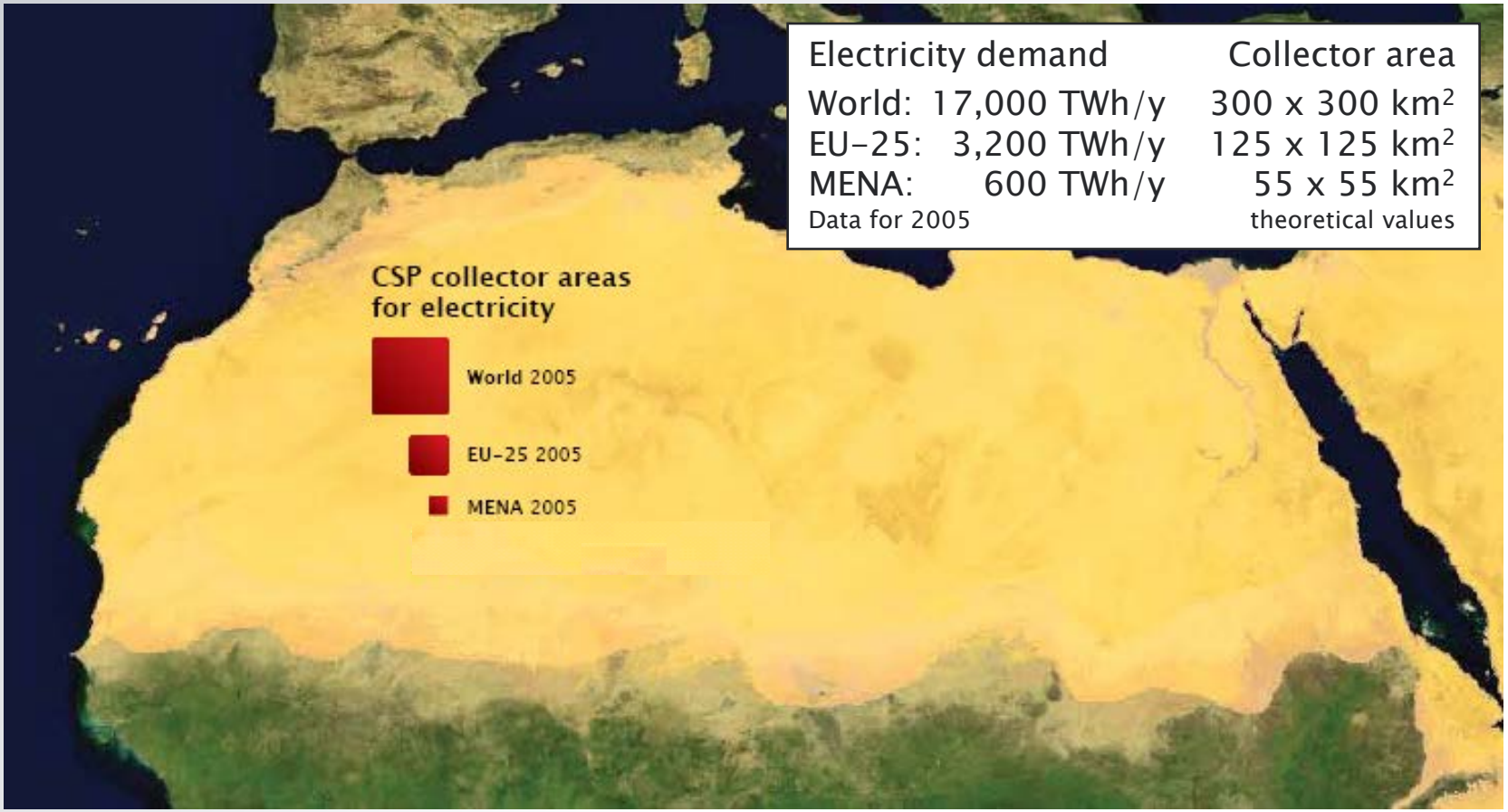
Summation for numerous individual units with concentrated solar power

Collector areas for solar power plants



EU-25 = 25 European Countries • MENA = Middle East & North Africa • CSP = Concentrated Solar Power
Source: Clean Power from Deserts • White Book 4th Edition • DESERTEC Foundation • February 2009 • www.desertec.org

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Rough estimate for DESERTEC

Power for 10 billion people in 2050

Demand

Average power per person in 2050:

~ 6 MWh/y

Data for 2006 in MWh/y

World	3.1
OECD	8.6
USA	12.2
India	0.9
Germany	6.4

Supply

Power for 10 billion people in 2050:

~ 60,000 TWh/y

18,000 TWh/y in 2007

Power

3,000 hours per year from sun, wind etc.

~ 20,000 GW

renewable power plants

2009: ~ 1.230 GW*

Construction

40 Years ≈
14,600 Days

~ 1.4 GW/Day

→ 7…10 billion people
2009: ~ 0,21 GW/Day*

Comparison with China:
174 coal fired plants of
~ 500 MW new in 2006

~ 0.24 GW/Day
→ 1.2 billion Chinese

0.24/1.2 = 1.4/7 ✓

*REN21 • Renewables 2010 Global Status Report • Press Release July 15, 2010 • www.ren21.net

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Latest Progress DESERTEC Foundation & Dii

- DESERTEC Foundation
  - New additional Director: Dr. Ignacio Campino
  - DESERTEC as a quality label for RE projects – Stakeholder Dialogue
    - First Evaluation done on the TuNUR project (Tunisia–Italy)
  - Academic Partner Network
    - First agreement signed with REUNET (Morocco) – DUN as a pioneer in MENA
  - DESERTEC Atlas published
  - MoU with JREF (Japan)
- Dii – DESERTEC's Industrial Initiative
  - Study "Desert Power Perspectives 2050" published
  - Mandate extended by >50 companies until 2014

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Dii – l'iniziativa industriale di DESERTEC
55 partner provenienti da oltre 12 paesi

Dii
Renewable energy bridging continents

20 Shareholders

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Enel Green Power
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OMV
Rexroth Bosch Group
SCHOELLER
SMA
TERNA ENERGY SA
TÜV SÜD
DOW CORNING
INTESA SANPAOLO
LuK INA FAG
SCHAEFFLER GRUPPE

Cooperating with institutions, associations and other initiatives :
MSP, UfM, IRENA, RECREE, ENTSO-E, ESTELA, OME, MEDRING, MEDGRID, etc.

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MedGrid / Transgreen – Concept Sketch

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DESERTEC-World
Clean Power from Deserts for a World of 10 bn people

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The next Challenge for DESERTEC Implementation

- Technical feasibility has been proven
- Now we must prove the financial viability
  - Bring the cost / kWh further down by
    - Large-scale industrial manufacturing
    - Professional and innovative financing
      - Concessional Loans from World Bank, EIB, AFD etc.
      - Crowdsourcing, philanthropy investors etc.
  - "Cherry-picking" pioneer projects

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CSP Plant with Thermal (Salt) Storage
➔ solar power day & night

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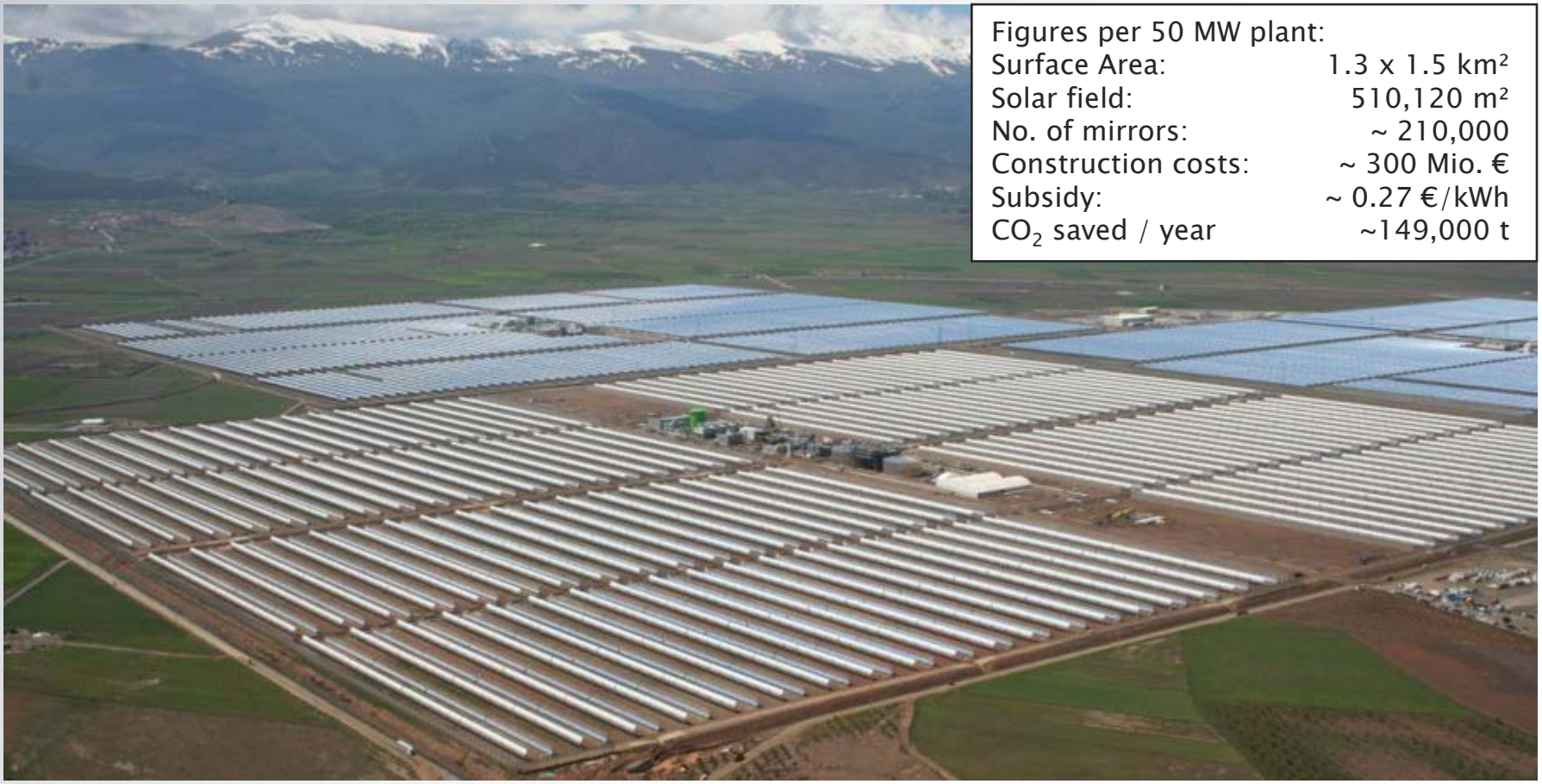

Figures per 50 MW plant:	
Surface Area:	1.3 x 1.5 km²
Solar field:	510,120 m²
No. of mirrors:	~ 210,000
Construction costs:	~ 300 Mio. €
Subsidy:	~ 0.27 €/kWh
CO_2 saved / year	~149,000 t

Andasol 1-3 • Guadix (Granada, Andalusia) • Spain • 3 * 50 MW • 2009-2011

Subsidy 2008 acc. to Orden ITC/3860/2007 as of 28 Dec. 2007 • CO_2 savings compared to a modern coal-fired power plant

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First Tower Design with Thermal (Salt) Storage
➔ solar power day & night

Torresol GEMASOLAR • Fuentes de Andalucía (Sevilla), Spain • 20 MW • 2011

2 650 heliostats = 304,750 m^2, diameter : 1.5 km • Heat Storage ~15 h (Molten Salt) • Steam: 565 °C • Turbine Efficiency 38,9 %

Annual Production = 110 GWh = 25,000 households = 30,000 tons of CO_2 / year mitigated • Autonomous Water Supply

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Linear Fresnel design
➔ very little water consumption ➔ desert-ready

Puerto Errado 2 • Calasparra (Murcia) • Spain • 30 MW • 2012

Mirrors: 28 lines of 980 x 16 m = 302,000 m², surface area 700,000 m² • Steam: 270 °C, 55 bar dry • Dry Cooling • Cleaning Robots

Annual Production = 50 GWh = 12,000 households = 16,000 tons of CO2 / year mitigated

Sources: Novatec / Tubo Sol • www.novatecsolar.com • National Renewable Energy Laboratory, USA • Nokraschy Engineering

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What do some countries do? Morocco

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- 94% dependency on external energy (like Jordan)
- Solution: Solar Plan: 2 GW by 2020, 9 bn $
- The King wants it …
- First Call for Tender (160 MW CSP) finished 2012
  - Winner: ACWA (Saudi) + Aries IS (Spain) + TSK EE (Spain)
  - kWh = 1.62 MAD = 0.146 € = 0.190 US$ = 0.134 JOD
- The 2 GW will save 1 mn tons Oil Equivalent (toe) = 3.7 mn tons of CO_2 / year

What do some countries do?
Saudi Arabia

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- In danger of becoming a net oil importer by 2030!
- Fossil water reserves (aquifers) close to the end
- Solution: Solar Plan: 41 GW by 2032 (25 GW CSP), ~100 bn $
- First Call for Tender (900 MW CSP) in early 2013
- Water desalination alone requires 1.5 mn barrels of crude oil / day!

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Why Nuclear Energy? We can use Fusion Today!

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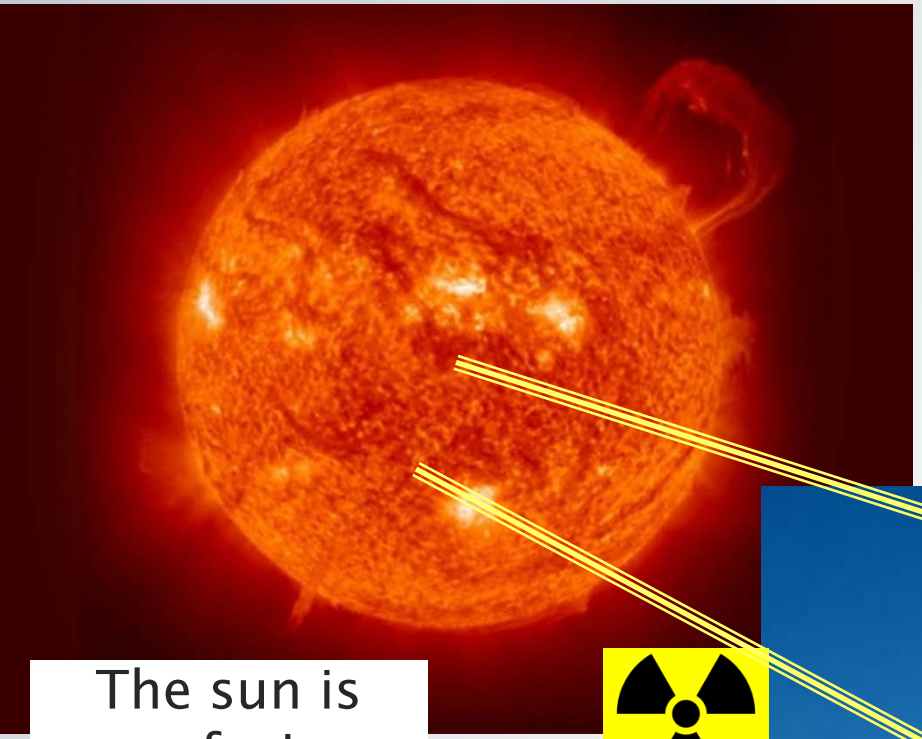
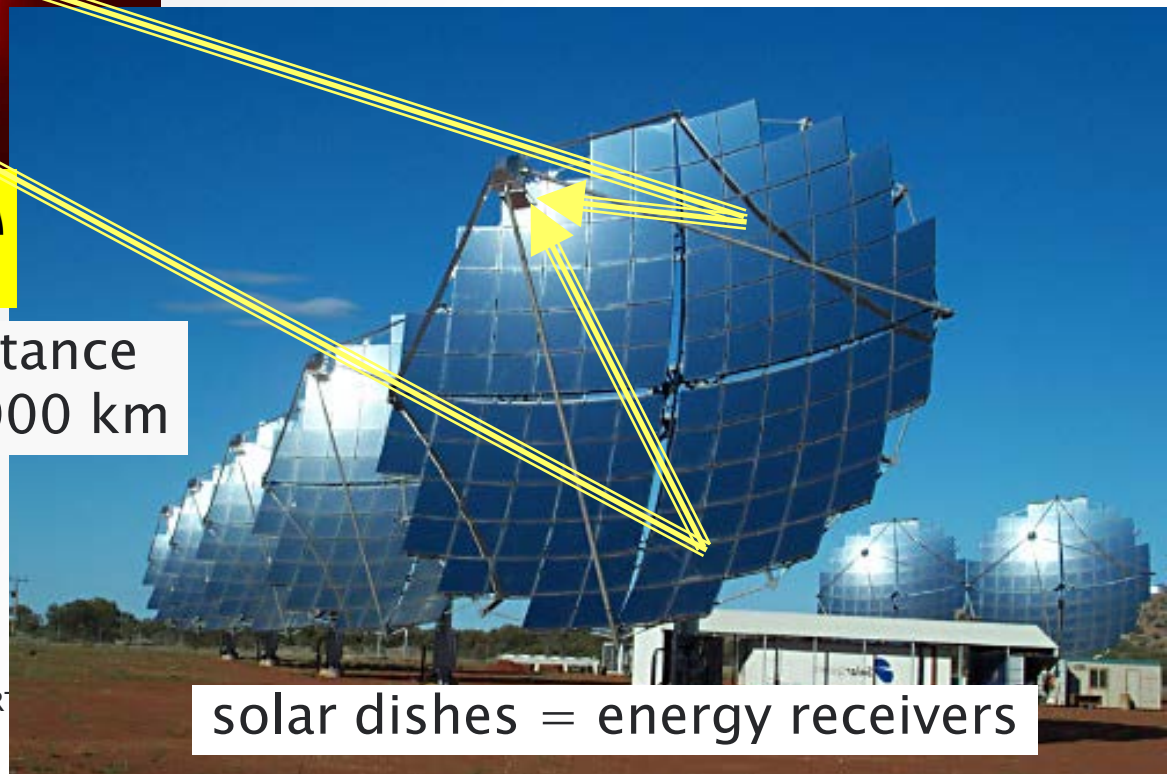


The sun is our fusion reactor!

… and no need to wait for ITER …

Safety distance 150 000 000 km



solar dishes = energy receivers

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"Clean Power from Deserts"

"The ultimate test of human intelligence"

www.DESERTEC.org
www.youtube.com/desertecchannel
www.facebook.com/DESERTEC
www.twitter.com/DESERTEC

Oliver.Steinmetz@DESERTEC.org

Charitable Foundation – Volunteers & Donations Welcome

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