

# Desertec



# Outline

- What and who is Desertec?
- Power Plants Overview
- Solar irradiation in EUMENA
- Concentrating solar power (CSP) Power Plant
- Energy Transportation
- Advantages and Problems of Desertec

# What and who is Desertec?

- a global civil society initiative aiming to **shape a sustainable future**
- formed of scientists, politicians and economists



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## What do they do?

- inform society and politicians
- promote establishment of framework conditions
- support knowledge transfer
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## What is the concept?

- choosing the best locations for renewable energy production
- transport it to the places of demand

# European-Union-Middle-East-North-African (EUMENA) Concept



# Power Plants Overview

| Power Plant (renewable)         | Energy properties   |
|---------------------------------|---|
| Wind Power                      | <ul style="list-style-type: none"><li>• weather fluctuations</li></ul>  |
| Photovoltaic                    | <ul style="list-style-type: none"><li>• seasonal and weather fluctuations (just in Europe)</li><li>• expensive</li></ul>                            |
| Biomass                         | <ul style="list-style-type: none"><li>• seasonal fluctuations</li><li>• good storability</li><li>• high area demand</li></ul>                       |
| Geothermal                      | <ul style="list-style-type: none"><li>• no fluctuations</li><li>• expensive</li></ul>   |
| Hydropower                      | <ul style="list-style-type: none"><li>• seasonal fluctuations</li><li>• good storability</li><li>• exhausted</li></ul>                              |
| Concentrating Solar Power (CSP) | <ul style="list-style-type: none"><li>• seasonal and weather fluctuations (just in Europe)</li><li>• good storability</li><li>• expensive</li></ul> |

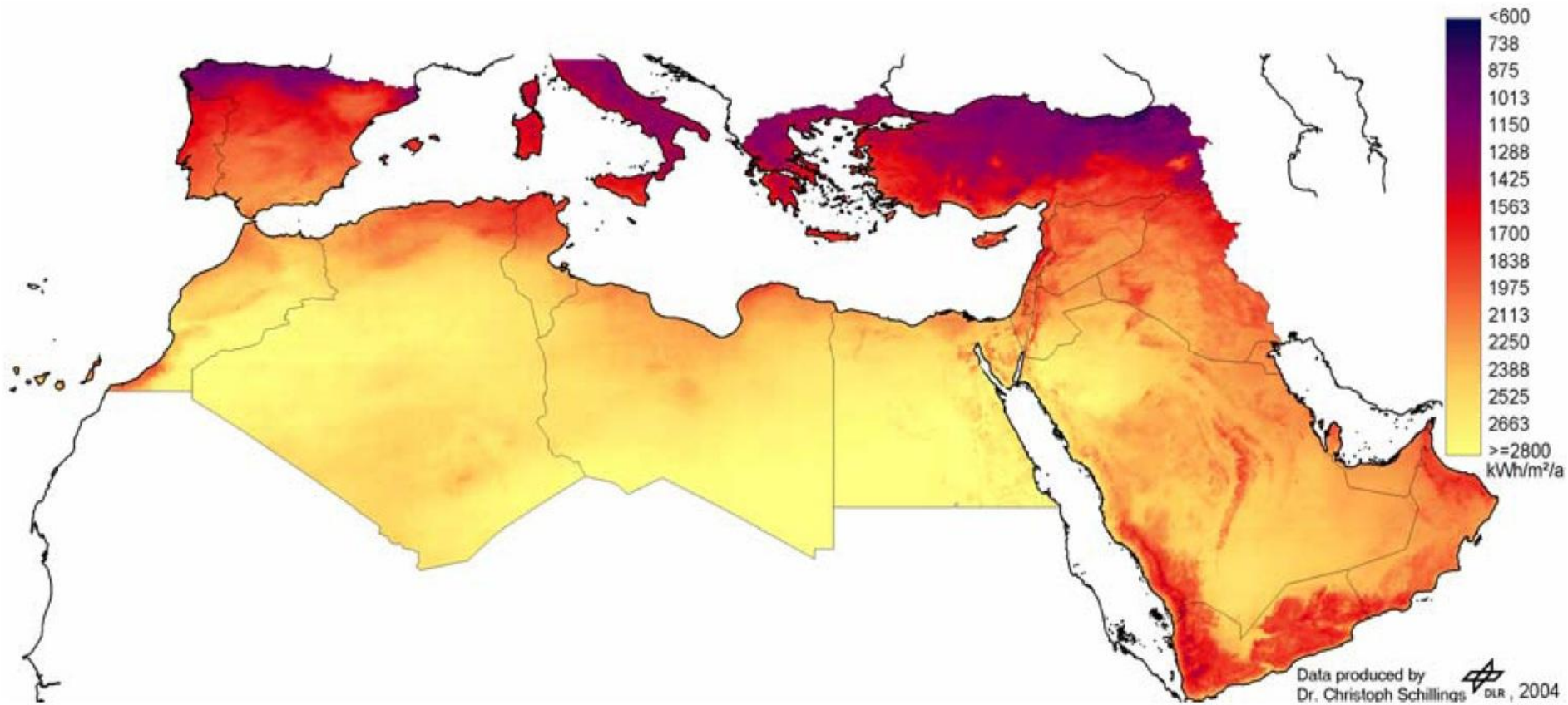
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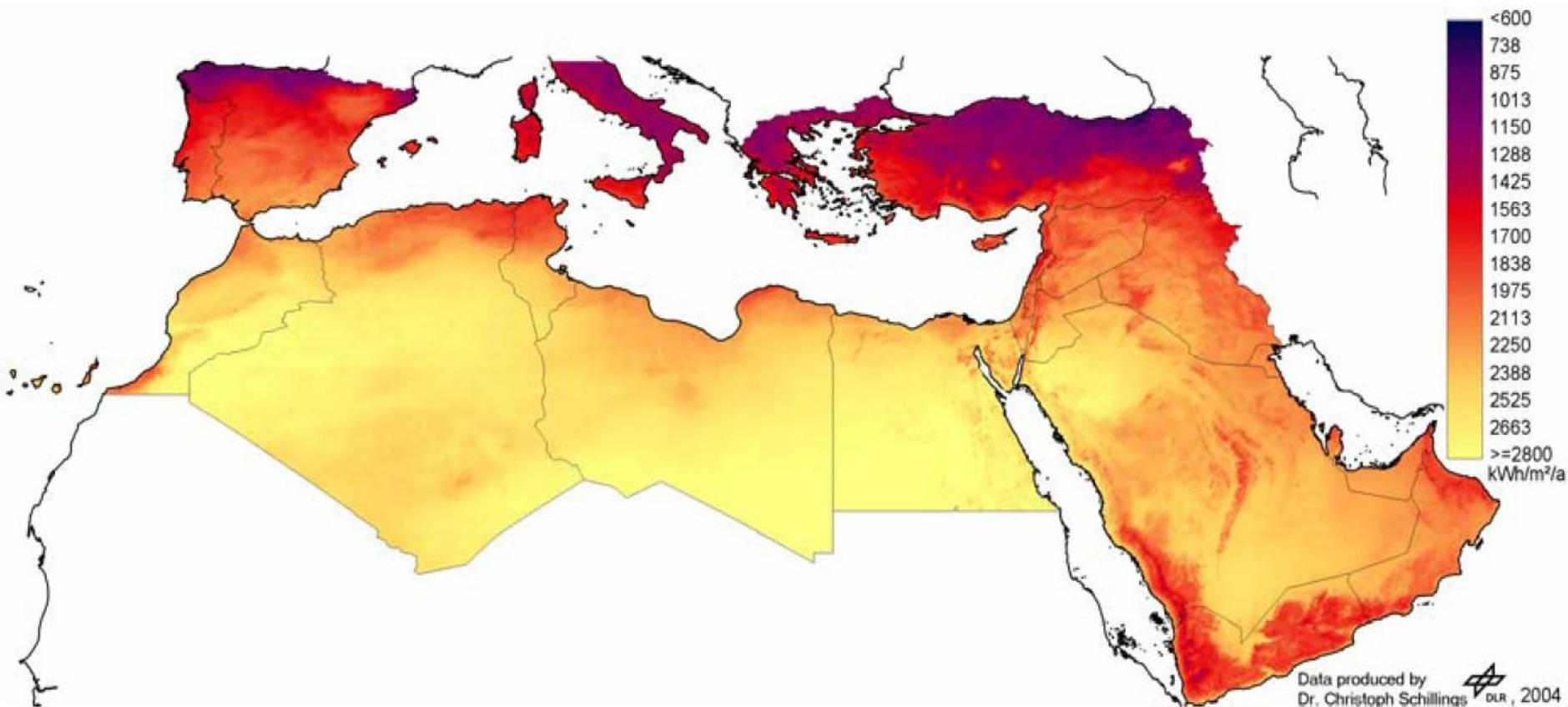
→ Concentrate on CSP Power Plants



# Solar irradiation in EUMENA

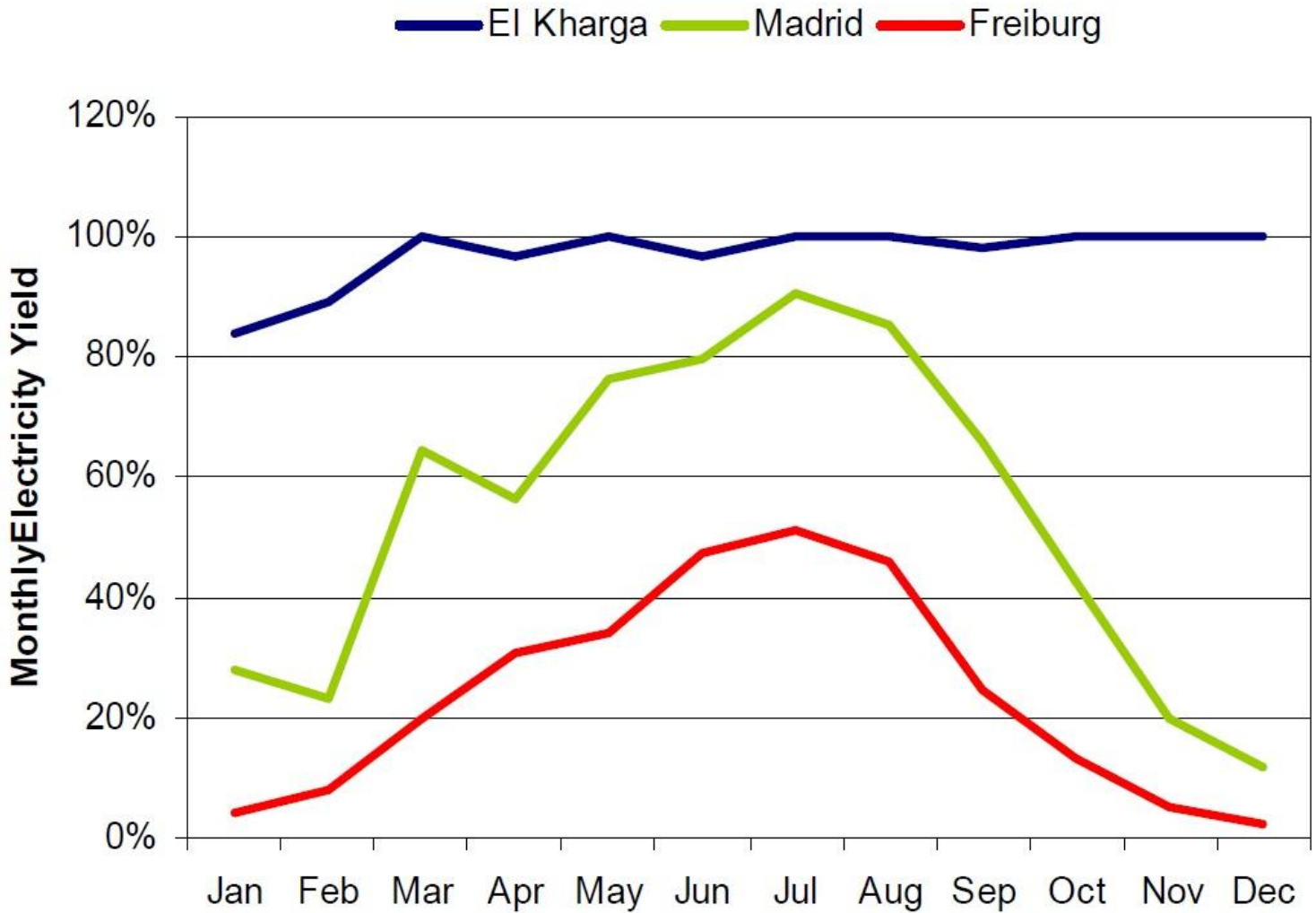


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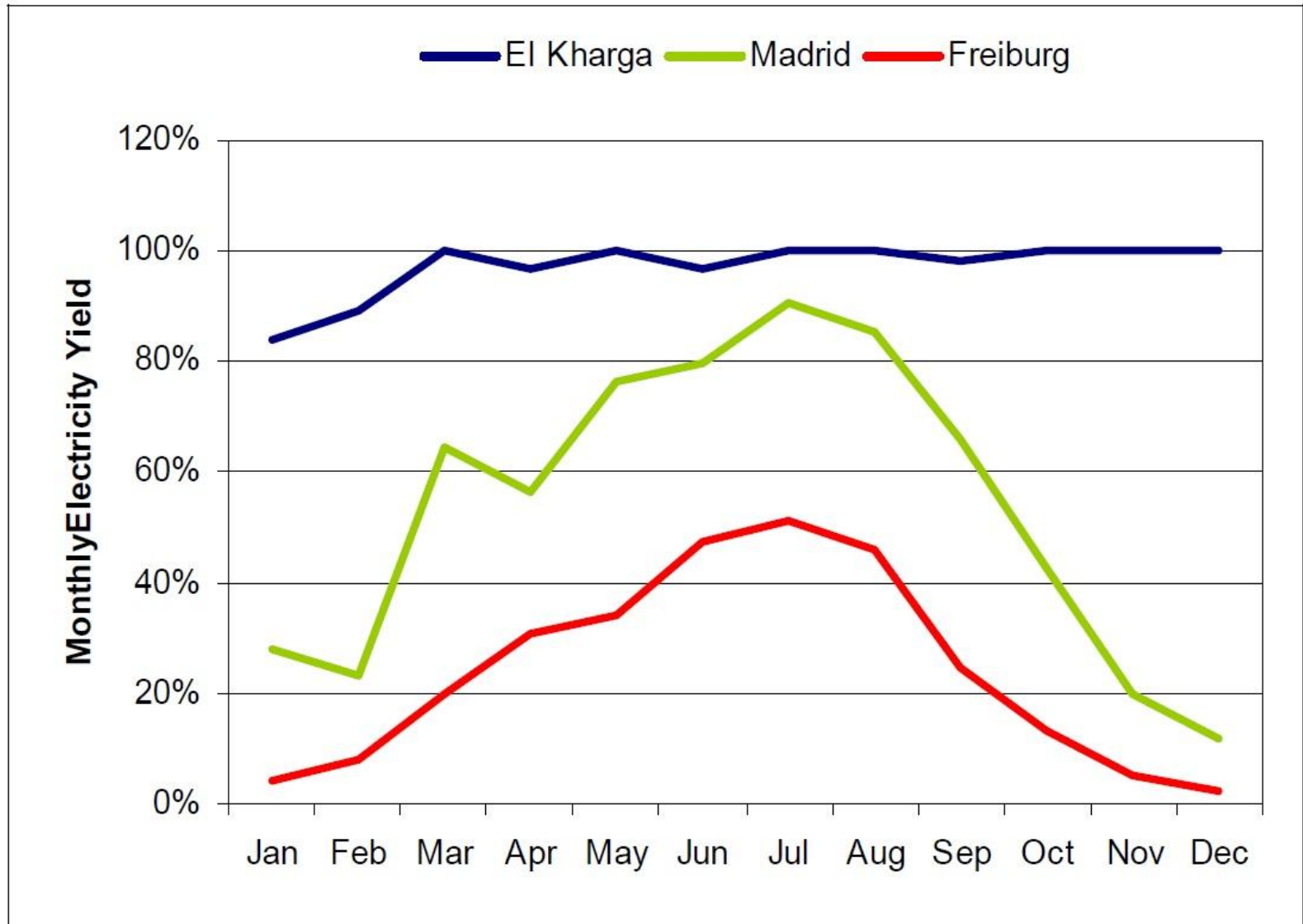


- large increase toward southern countries
- energy production a lot more efficient in North Africa

# Solar irradiation in EUMENA

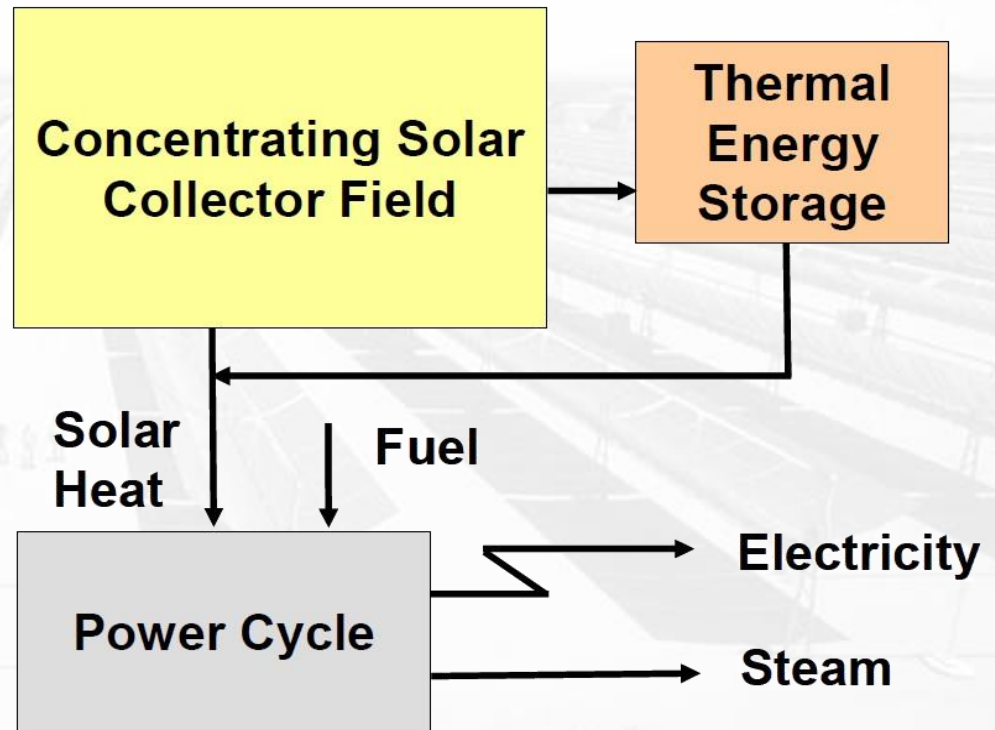
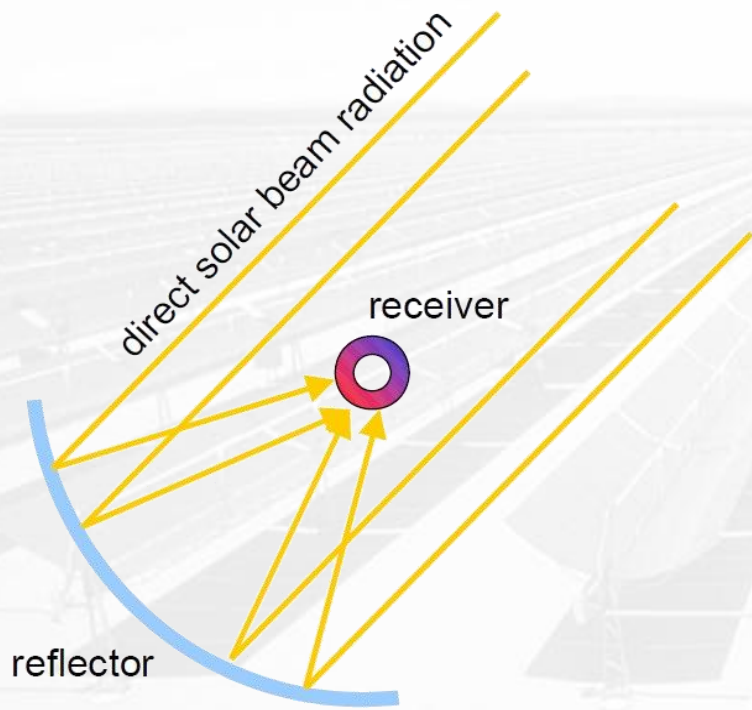


# Solar irradiation in EUMENA

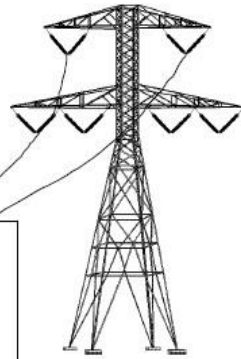


→ considerably less fluctuation in North Africa than in Europe

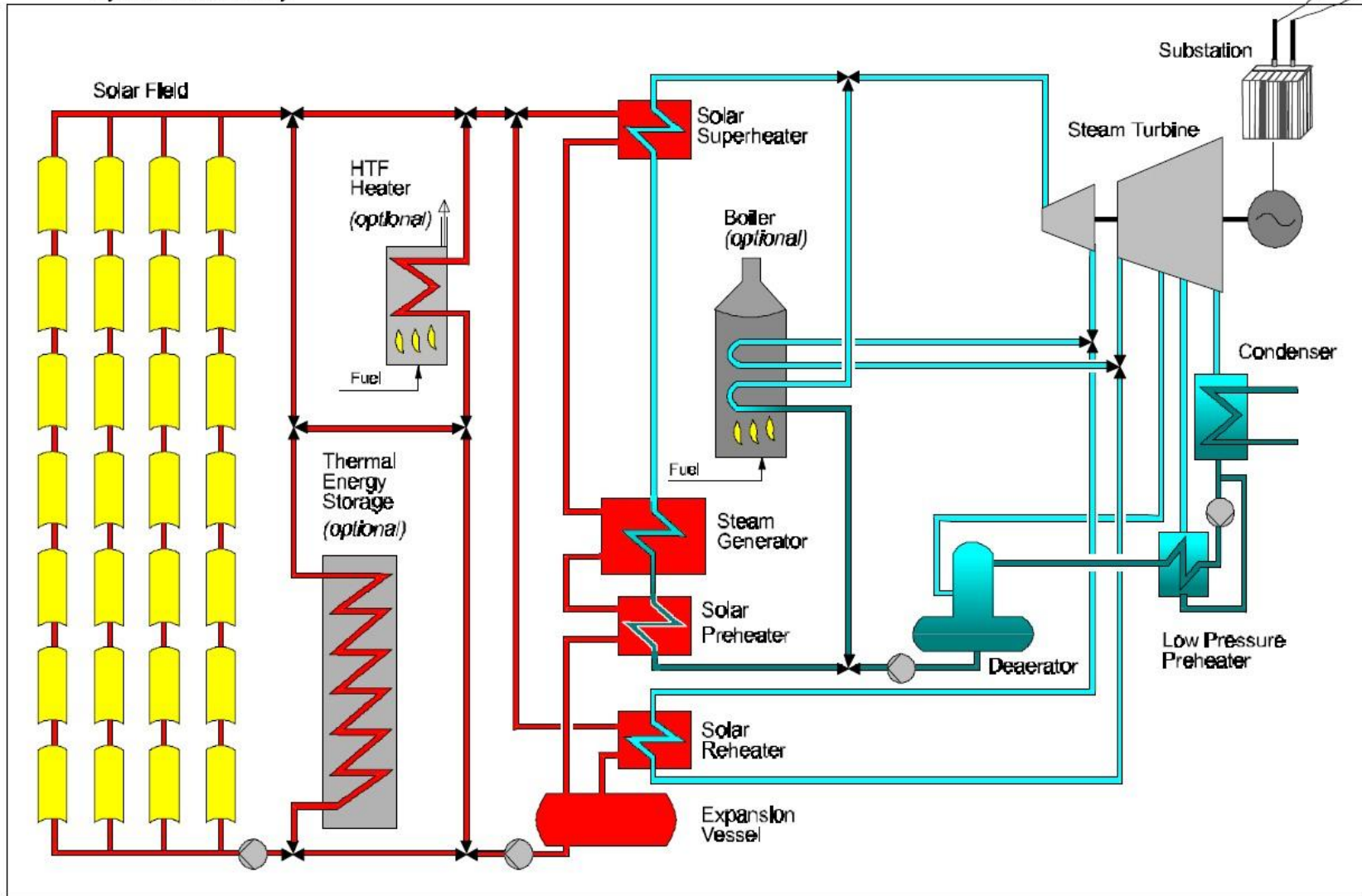
# Concentrating solar power (CSP) Power Plant



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System Boundary



# Concentrating solar power (CSP) Power Plant



Source: [http://upload.wikimedia.org/wikipedia/commons/0/01/Solar\\_troughs\\_in\\_the\\_Negev\\_desert\\_of\\_Israel.jpg](http://upload.wikimedia.org/wikipedia/commons/0/01/Solar_troughs_in_the_Negev_desert_of_Israel.jpg)

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Source: <http://upload.wikimedia.org/wikipedia/commons/4/40/Solarplant-050406-05.jpg>



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Source: <http://upload.wikimedia.org/wikipedia/commons/4/44/Solarplant-050406-04.jpg>

# Energy Transportation

| Parameter            | Unit      | HVAC |      | HVDC  |       |
|----------------------|-----------|------|------|-------|-------|
|                      |           | 750  | 1150 | ± 600 | ± 800 |
| Operation Voltage    | kV        | 750  | 1150 | ± 600 | ± 800 |
| overhead line losses | %/1000 km | 8%   | 6%   | 5%    | 2.5%  |
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Values for transportation of 5 GW



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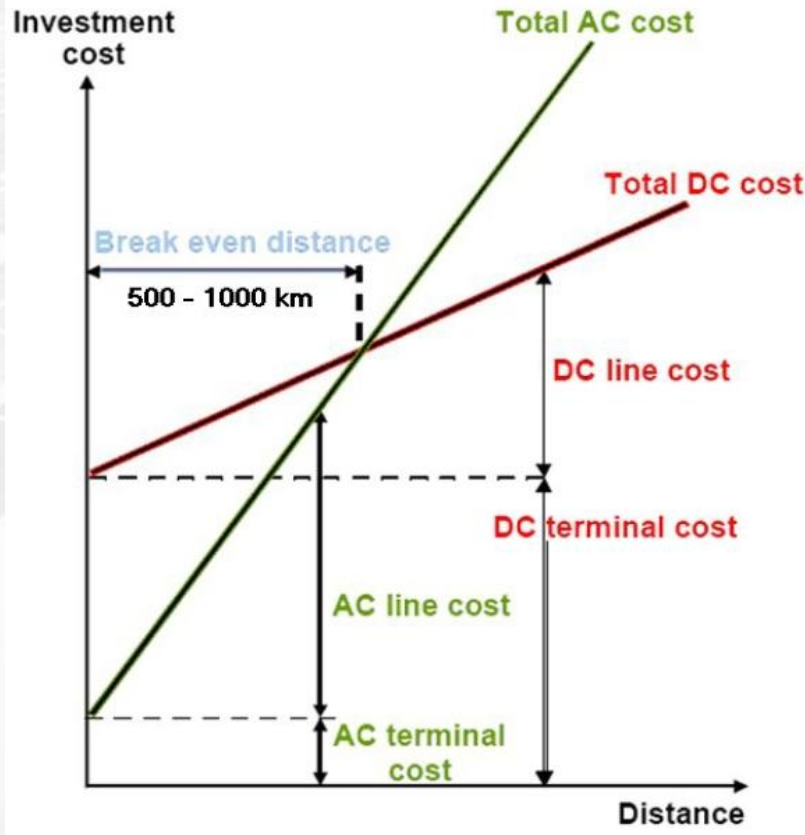
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Values for transportation of 5 GW



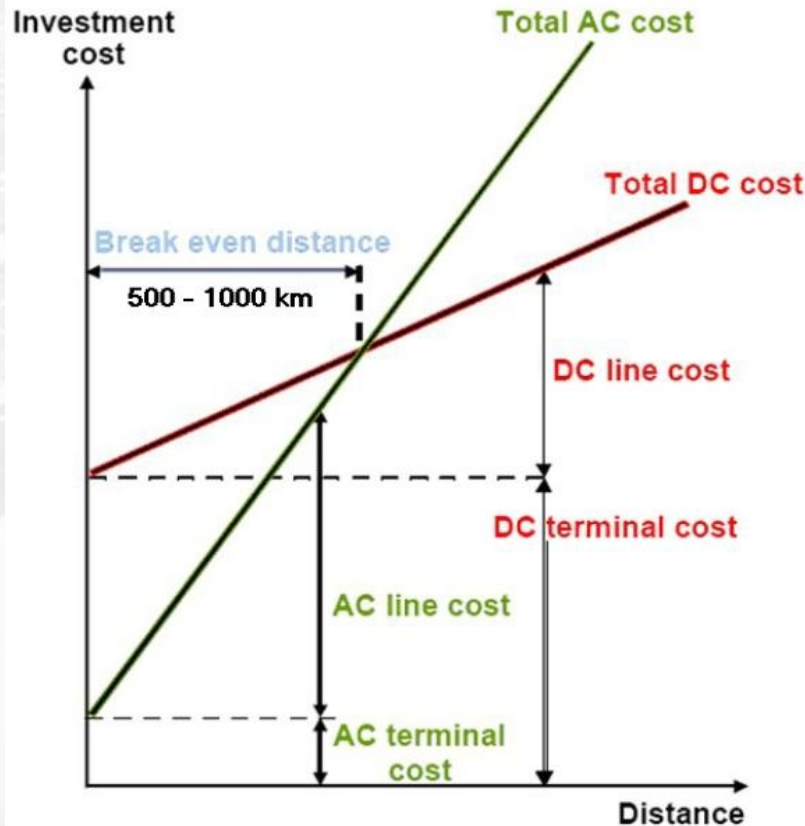
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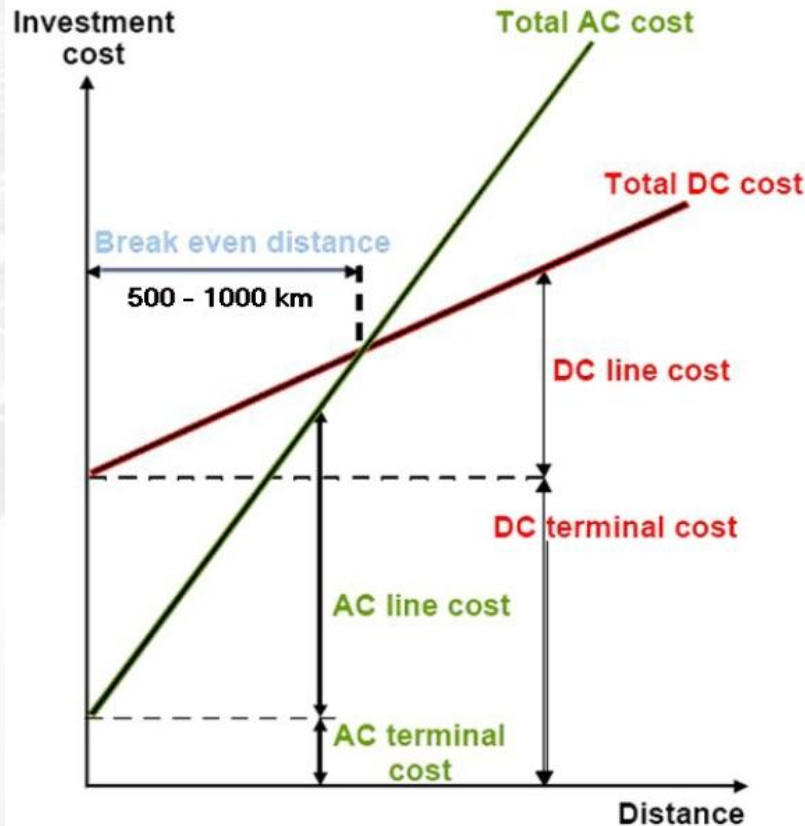
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→ HVDC better adapted for transporting energy over more than 1000 km

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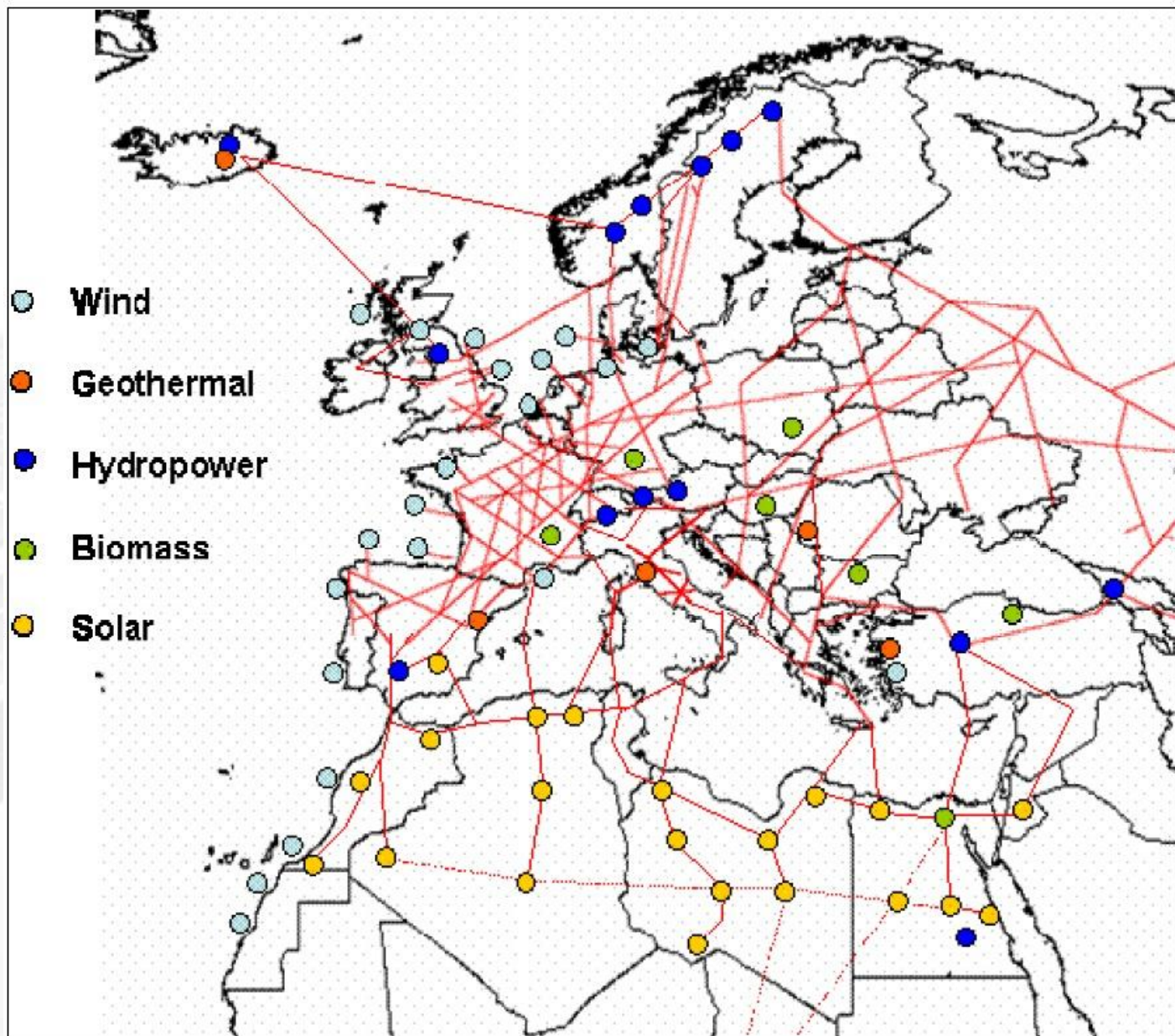
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→ Summarized we get an energy loss of about 3% per 1000 km for HVDC

# Vision of the HVDC electricity grid



# Advantages and Problems of Desertec

The background image shows a vast solar power plant in a desert. In the center, a tall tower (heliostats) is visible, surrounded by numerous rows of solar collectors (heliostats) that reflect light onto it. The landscape is flat and arid, with a hazy sky. The overall scene is brightly lit, with a strong sense of perspective from the rows of solar panels receding into the distance.



# Advantages

- Reducing Emission of CO<sub>2</sub>
- Sustainable production of energy
- Assuring electrical power supply for Europe
- Advantages in MENA:
  - Creating jobs and improving infrastructure
  - Thermal desalination of sea water (CO<sub>2</sub>-free)

# Technical problems

## Problem:

- Conditions for the mirrors of the CSPs are very hard, they have to resist UV-radiation, storms etc.

## Solution:

- There is a safety position for the mirrors

## Example:

- Mirrors in the Mojave desert (California) resist already for over 20 years different kinds of storms, breaking only 0,4% per year

# Economical problems

## **Problem:**

- The big companies involved in Desertec want to extend their monopolies
- Small companies cannot afford to join in Desertec

## **Counter-argument:**

- Generating only 17% of the necessary energy is no monopoly

# Economical problems

## **Problem:**

- Instead of investing the money in MENA there can be achieved much more in Europe

## **Counter-argument:**

- The Energy that can be generated in Europe isn't enough to cover the consumption
- Especially to compensate the seasonal fluctuations

# Economical problems

## Problem:

- Who pays for it?
- Generating power with CSPs is not profitable in comparison to conventional possibilities
- Not many investors are interested at the moment
- The involved companies are able to afford only about 30% of the costs
- It is not possible to schedule such a big project properly or to estimate the costs correctly

# Political problems

## Problem:

- There are too many involved parties
- Every state will try to take advantage, so there will be much resistance in MENA
- Ruling parties primarily want to keep their power (especially family clans)
- They don't care for the progress of the economy
- Due to the Arab Spring the situation may have changed in a good or bad way

# Political problems

## **Problem:**

- Importing too much energy will create political dependencies

## **Counter-argument:**

- Since the energy will be supplied from many states the problem of political dependencies will decrease
- Europe is already dependent (Russian-Ukrainian gas conflict)
- Europe is already importing oil and gas from Algeria and Libya

# Risk of terroristic assaults

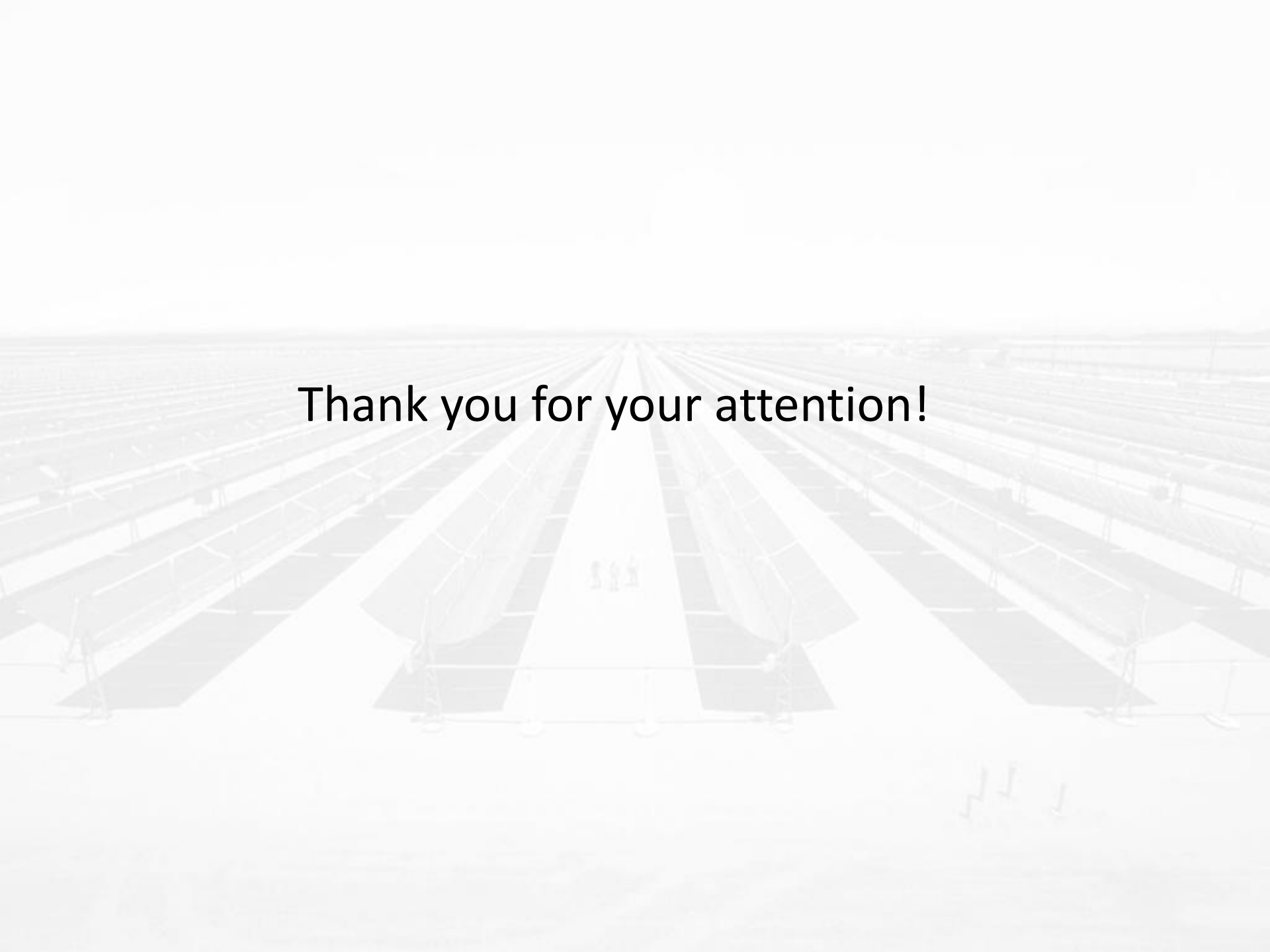
## Solution:

- Only 17% of the necessary energy will be imported
- There will still exist back-up power plants for compensating the fluctuations of renewable energy sources
- So it will be possible to compensate the missing energy for a while
- Economic progress and better education decrease this risk



# Summary

- Desertec is a concept to solve the energy problem in the world
- It concentrates on the production of energy in the most efficient places (mostly deserts)
- CSP power plants in North Africa are very suitable to produce a large part (app. 17 %) of the European energy demand in the future
- The transportation takes place via HVDC, which has a loss rate of about 3% over 1000 km
- Investment costs for an EUMENA HVDC energy grid are high
- From the technical point of view there are no big problems
- Political situation in MENA very unclear and not predictable
- Not profitable yet, not enough Investors

An aerial, high-angle photograph of a large stadium, showing numerous rows of empty bleachers stretching far into the distance. The perspective is from a high vantage point, looking down the center aisle. The bleachers are arranged in a symmetrical pattern on either side of a central walkway. The overall scene is brightly lit, and the colors are somewhat muted, giving it a clean, architectural feel. In the center of the image, there is a group of small figures, likely people, standing on the central aisle, which provides a sense of scale to the vastness of the stadium.

**Thank you for your attention!**

## Sources

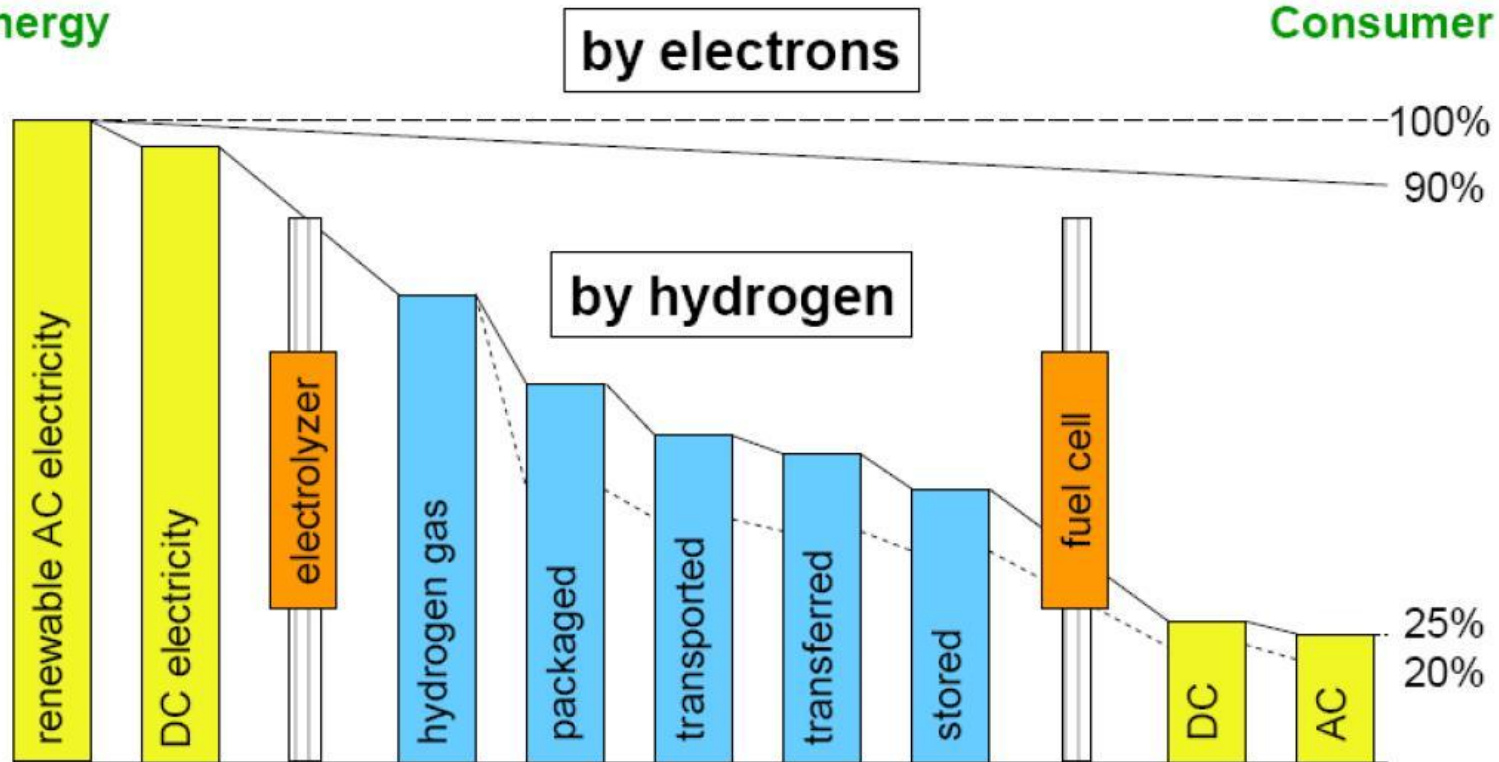
1. Trans-CSP study:  
[http://www.dlr.de/tt/Portaldata/41/Resources/dokumente/institut/system/projects/TRANS-CSP\\_Full\\_Report\\_Final.pdf](http://www.dlr.de/tt/Portaldata/41/Resources/dokumente/institut/system/projects/TRANS-CSP_Full_Report_Final.pdf)
2. Desertec Foundation: <http://www.desertec.org/>
3. SolarPaces: <http://www.solarpaces.org/inicio.php>
4. <http://www.welt.de/print/wams/vermishtes/article13726066/Stromoase-in-der-Sahara.html>
5. <http://www.manager-magazin.de/unternehmen/energie/0,2828,635955,00.html>
6. <http://www.dw-world.de/dw/article/0,,15538574,00.html>
7. <http://www.stern.de/wissen/natur/desertec-startschuss-fuer-wuestenstrom-projekt-706083.html>
8. <http://de.wikipedia.org/wiki/Desertec>

# Why not use hydrogen to transport energy?

## Electricity Transport

Renewable  
Source  
Energy

Consumer



— gaseous hydrogen  
- - - liquid hydrogen