Solutions for a sustainable future

Mohamed Aly El-Hamamsy

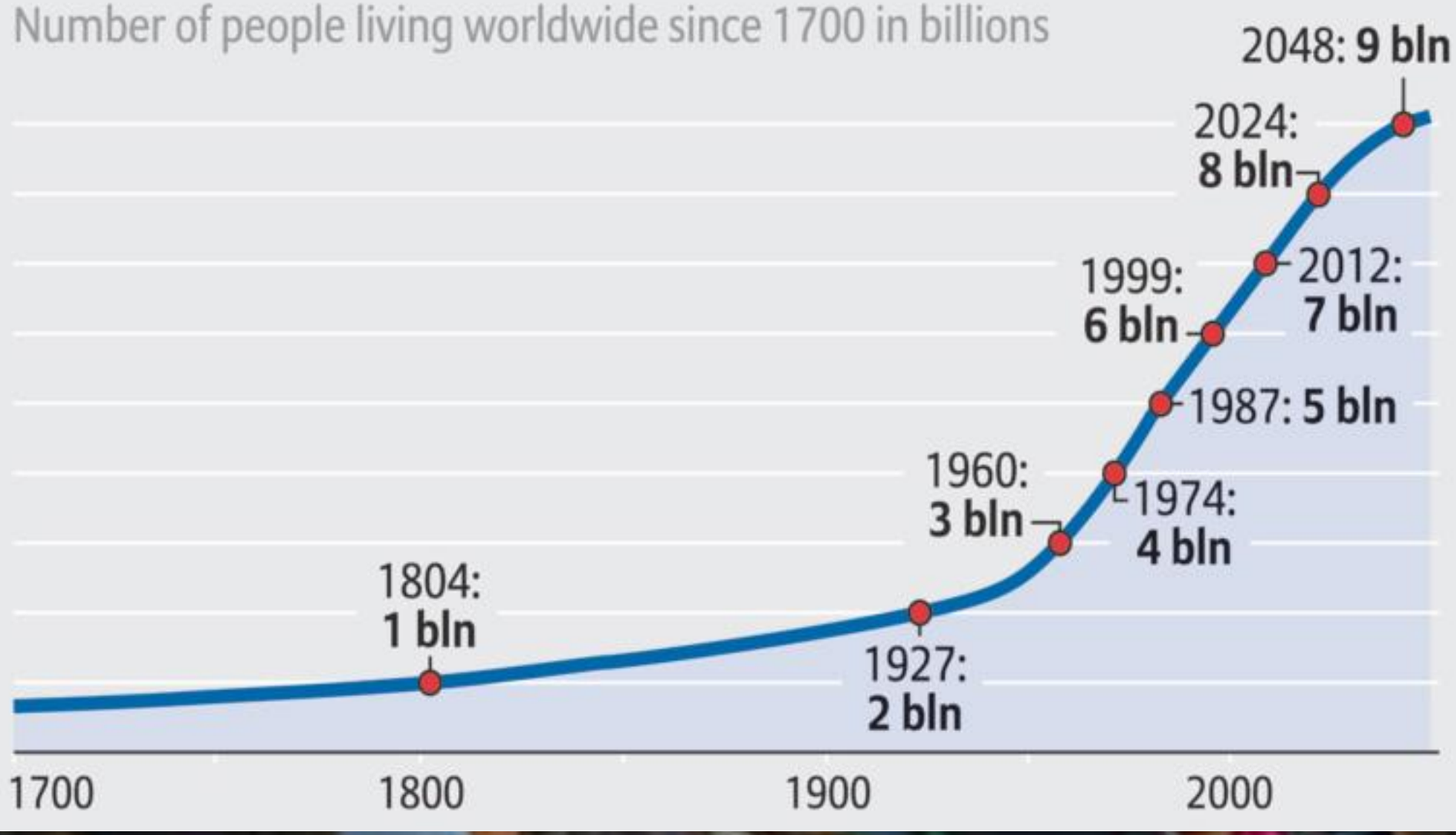
BioVision Alexandria

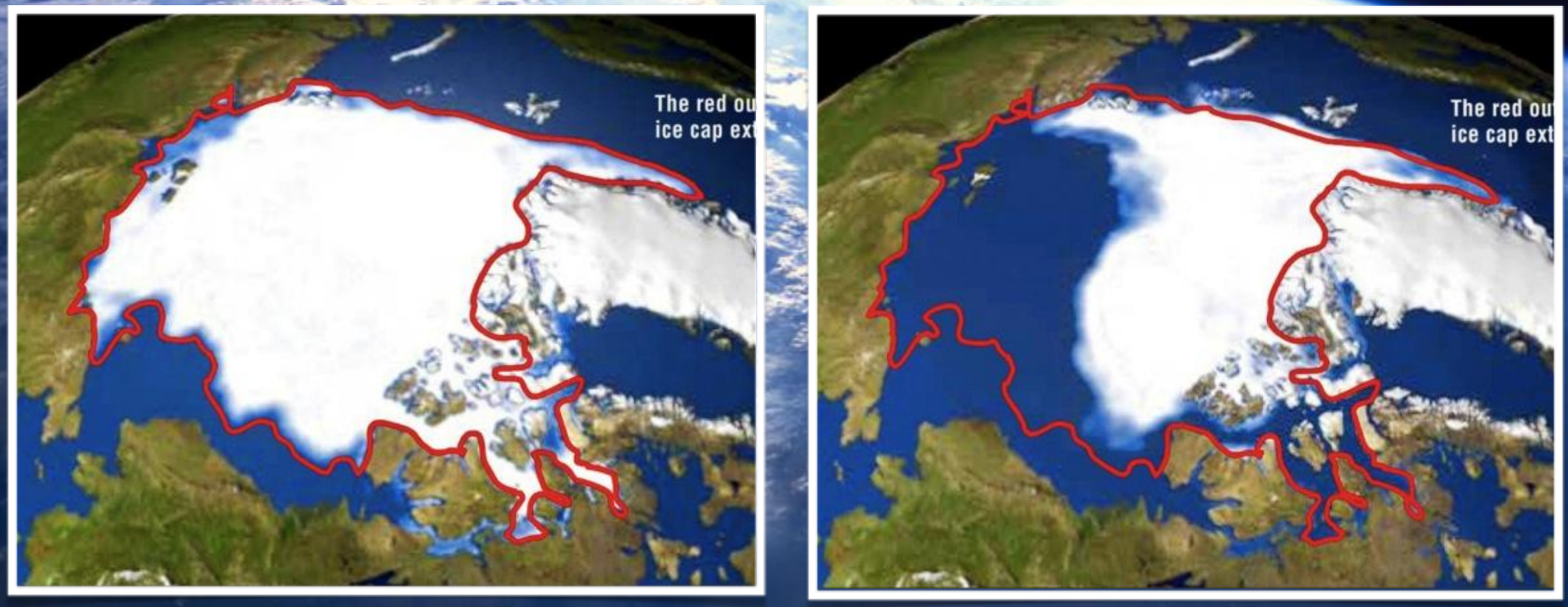
8th April 2014

www.DESERTEC.org

POPULATION OF THE EARTH

Number of people living worldwide since 1700 in billions





1979

2007

DESERTEC FOUNDATION

Challenges of the 21th Century

Melting of frozen ground in Siberia releases Methane gas

Source: Polygon on the ground.

DESERTEC FOUNDATION

Challenges of the 21th Century

Hurricane Isabel (2003) as seen from orbit during Expedition 7 of the International Space Station. The eye, eyewall and surrounding rainbands that are characteristics of tropical cyclones are clearly visible in this view from space.

Source: Image courtesy of Mike Trenchard, Earth Sciences & Image Analysis Laboratory, Johnson Space Center.

Challenges of the 21th Century

Floods in Bangladesh 2009

Source: Rezowan at en.wikipedia

DESERTEC FOUNDATION

Challenges of the 21th Century

The destroyed reactor of Chernobyl with its sarcophagus, April 2003

Source: Elena Filatova,www.elenafilatova.com

DESERTEC FOUNDATION

Challenges of the 21th Century

Fukushima: Satellite photograph of reactor blocks 1 to 4 on 16th March 2011 after several explosions.

Source: Digital Globe Quelle: Digital Globe

DESERTEC FOUNDATION

Challenges of the 21th Century

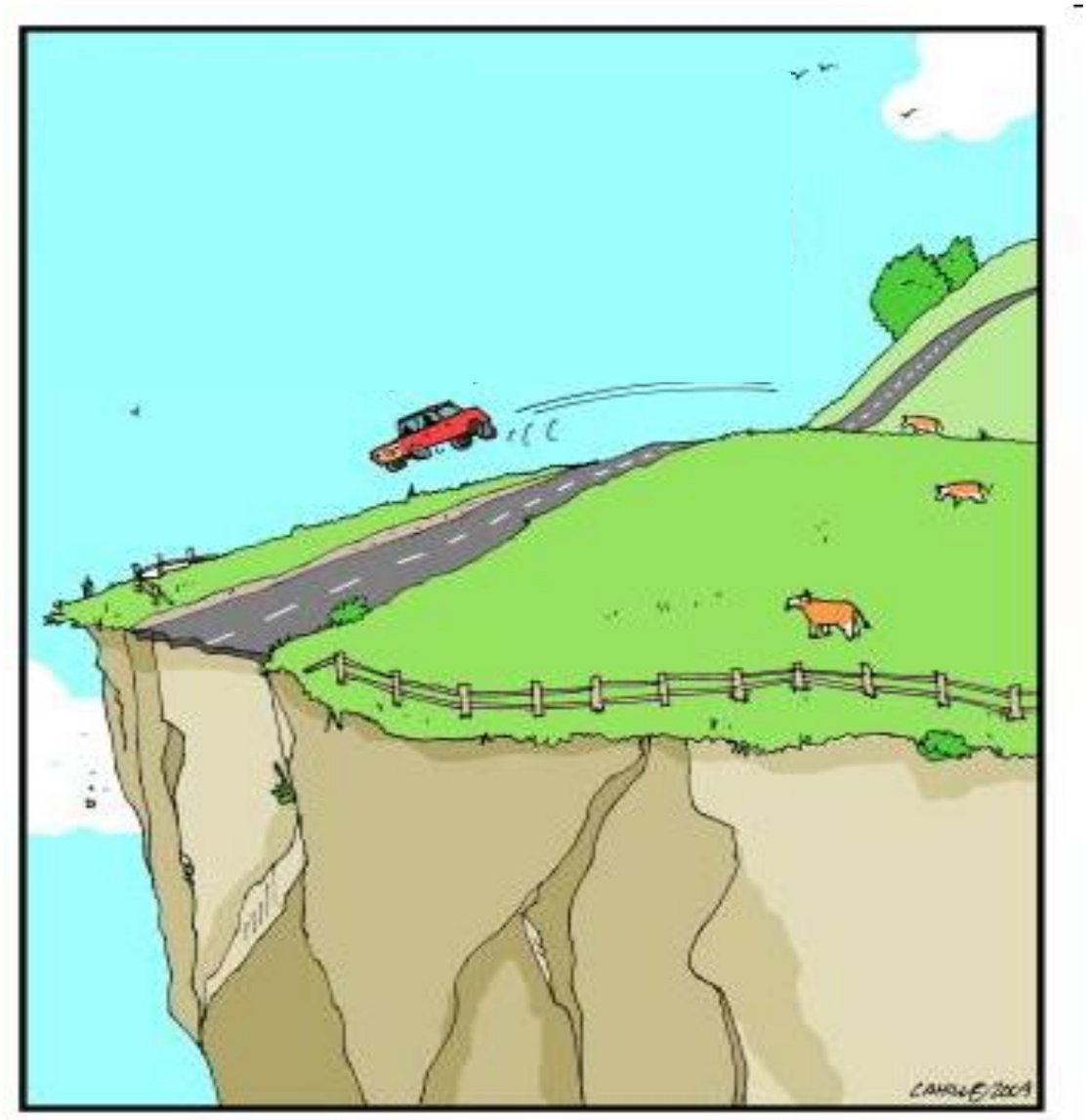
To get drinking water will be a challenge in the near future

Source: Africa Research Central

DESERTEC FOUNDATION

Challenges of the 21th Century

- Food security
- Supply of drinking water
- Energy security
- Migration
- War for resources
- Climate change
  - Extreme weather conditions
  - Rise of sea level
  - Floods
  - Droughts
  - …



DESERTEC FOUNDATION

How can we create sustainable living conditions...

...in view of a world population of ~10 billion people in 2050?

We cannot afford 3 planets ……

DESERTEC FOUNDATION

All these challenges are affecting Egypt severely ….

… can we suggest a solution for 2050 ?

- Population 85 Millions, expected in 2050 to be 120+ Millions
- Water requirement 120+ bln m³ yearly - available are only 60 Bln m³
- Need to grow food without exhausting the available limited land.
- Installed electricity now 30 GW, needed are 110+ GW

- ➢ New settlements outside the Nile valley, along the coasts
- ➢ Use renewable energy for electricty and desalination
- ➢ Industrial sites at the new settlements.
- ➢ Improving education, health services and infra-structure.

DESERTEC FOUNDATION

The Egyptian constitution asks for sustainability ….

… it mentions Renewable Energy as an essential component

so let us have a look at the resources

- Limitation of water can be overcome only by large scale seawater desalination, which needs **ENERGY**

- What are the resources for 110 GW?

  - **Hydro power** from Nile dams … potential 2.8 GW, are already deployed

  - **Wind energy** … potential 22 GW, however, in limited places & fluctuating

  - **Solar photovoltaic** …. potential 14 GW, everywhere but fluctuating.

  - **Concentrating solar thermal power** … potential 8500 GW, everywhere.

➢ Initial costs are still high → **need a strategy to reduce costs …**

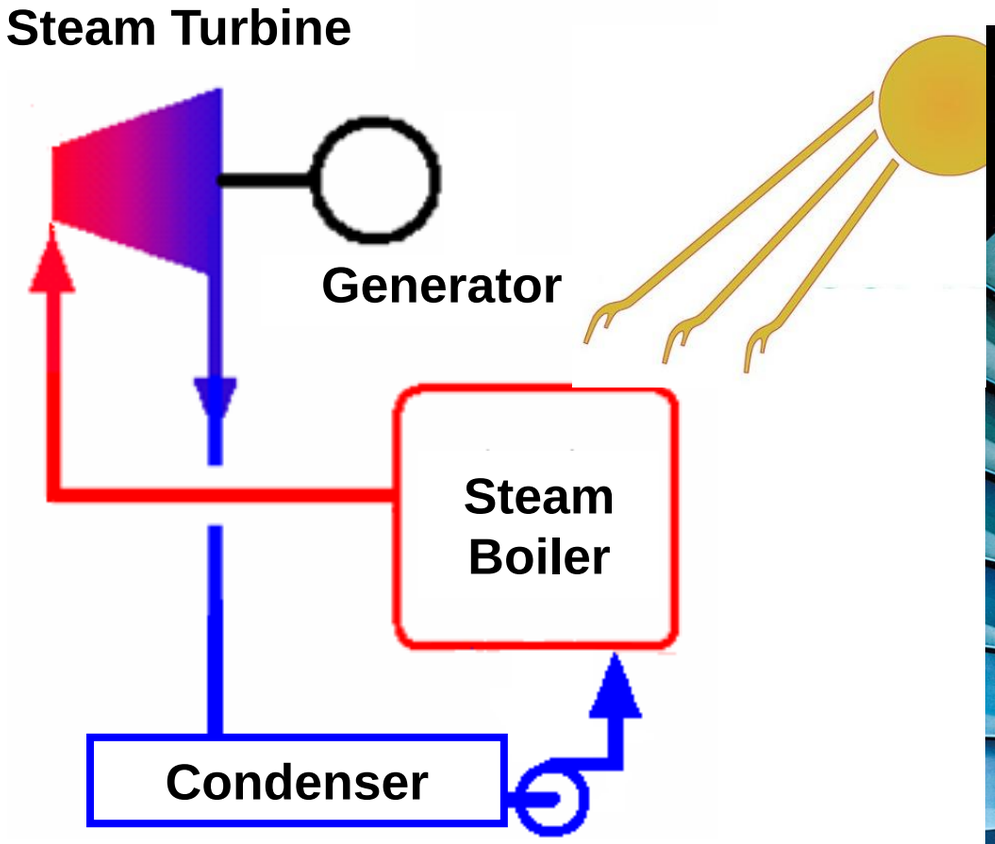
… although already now cheaper than nuclear power … **!**

DESERTEC FOUNDATION

How Concentrating Solar Thermal Power works?

Like a conventional steam power station; however …

… boiler is heated by concentrating direct sunrays



Standardization is a step to mass production

a frame work for standardizing Solar Thermal Power Stations

- Starting with only 2 sizes, 20 and 50 MW nominal unit capacity with 16 hours storage and emergency heating device → large number of units …
  … thus enabling local manufacture of components and jobs creation.

- Steam turbine with air cooled condenser, 80°C exhaust steam temp. to allow placing the power station anywhere without restrictions due to water unavailability - and to protect water resources.
  Place it near new settlements … avoid long distance transmission.

- Live steam temp. up to 550°C to compensate the reduced efficiency.
  Get maximum possible electricity from the sun rays

- Option to replace condenser with a desalination unit using waste heat.
  Get desalted water almost for free

DESERTEC Standard

NOKRASCHY ENGINEERING
Mechanical Vibrations and Infrasound under Control
Solar Power for Sustainable and Everlasting Energy

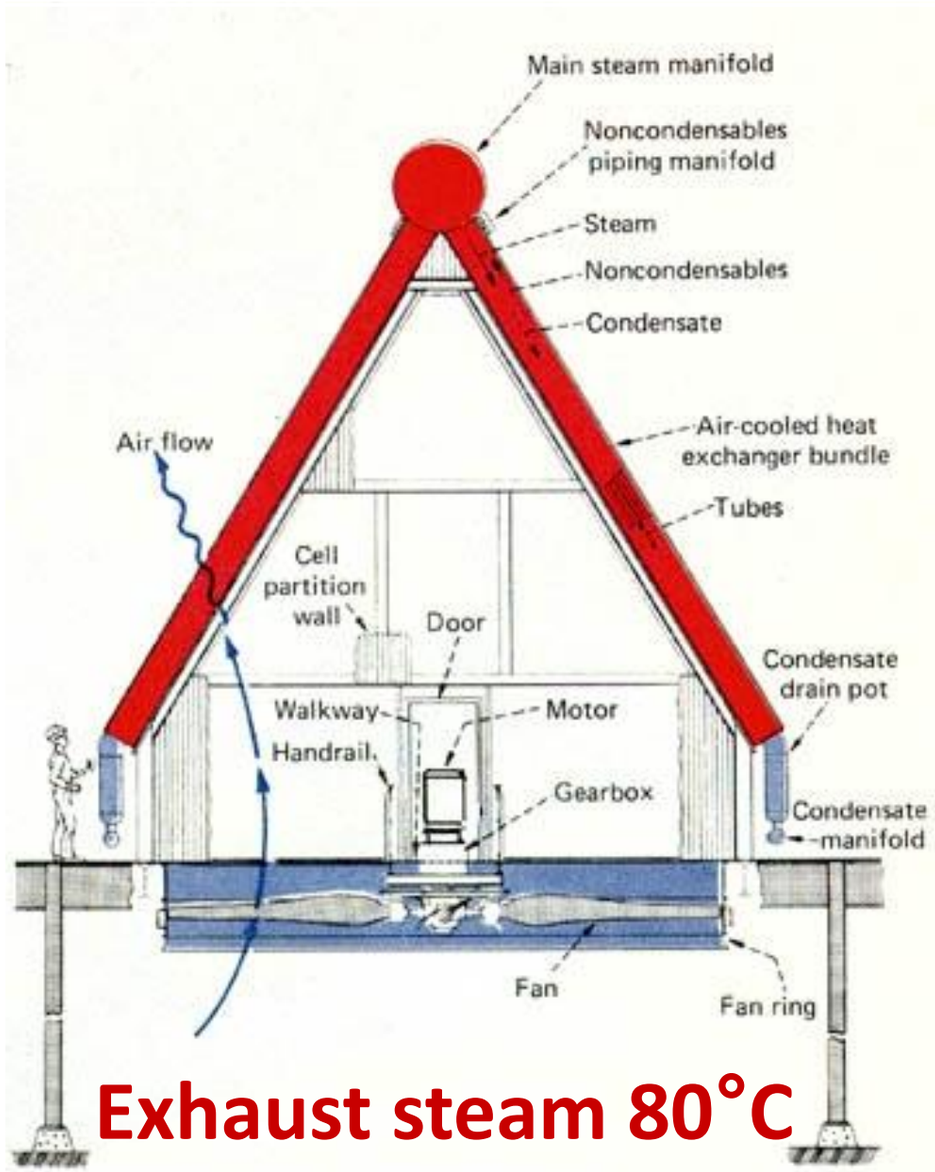
DESERTEC FOUNDATION

A good example

Gemasolar in Spain

20 MW, 15 hours storage

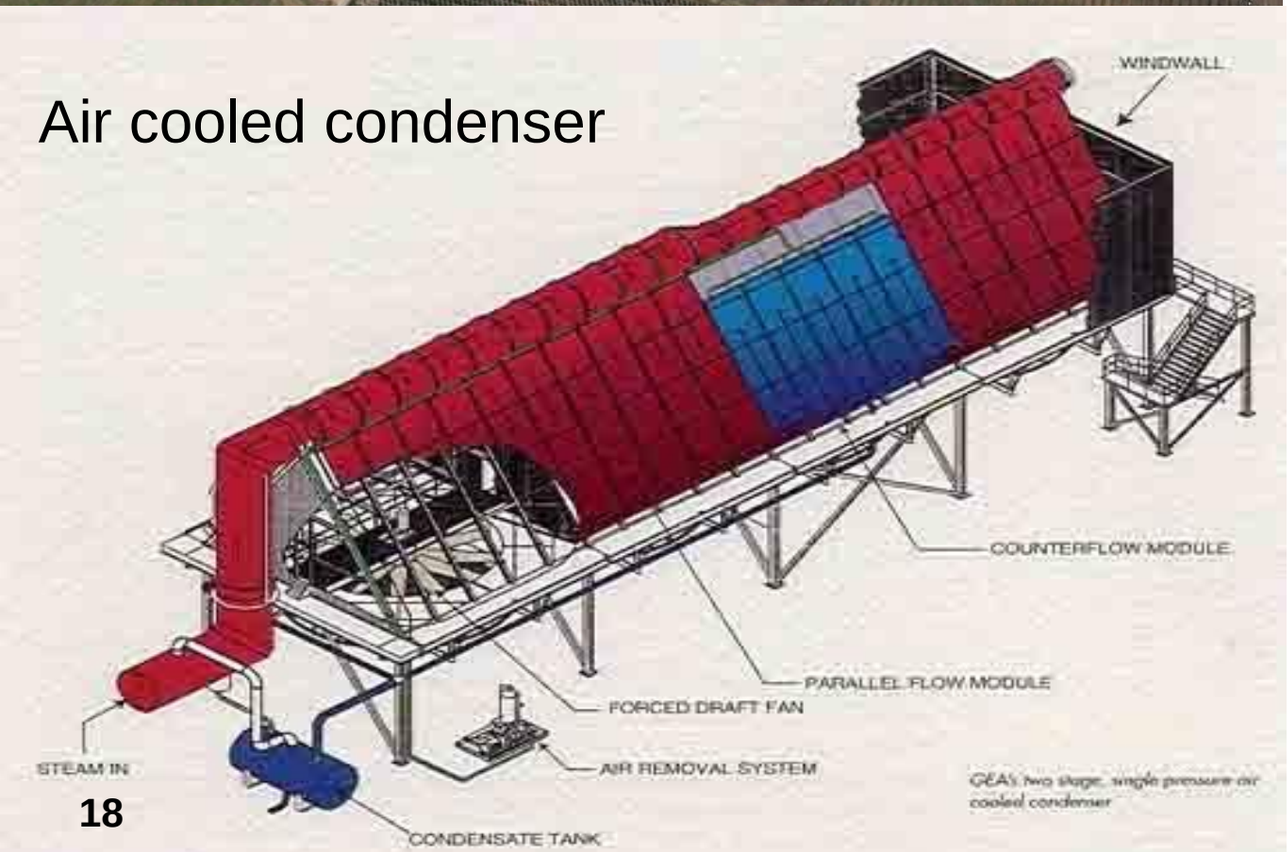
In Egypt 18 hours storage



Exhaust steam 80°C

(also suitable for desalination)

Air cooled condenser



DESERTEC FOUNDATION

The DESERTEC Criteria - Ensure Quality and Sustainability

(for Concentrating Solar Thermal Power Station evaluation)

Principle 1
Secure supply of clean electricity on demand

Criteria

- **Dispatchability of electricity**
- **Minimized down-time**
- **Local and national benefit**
- **Maximize renewable energy share**
- **Interconnectivity and grid stability**

Principle 2
Social responsibility and economic sustainability

Criteria

- **Profound consideration of socio-economic impacts**
- **Participation**
- **Maximized involvement of local / regional economy**

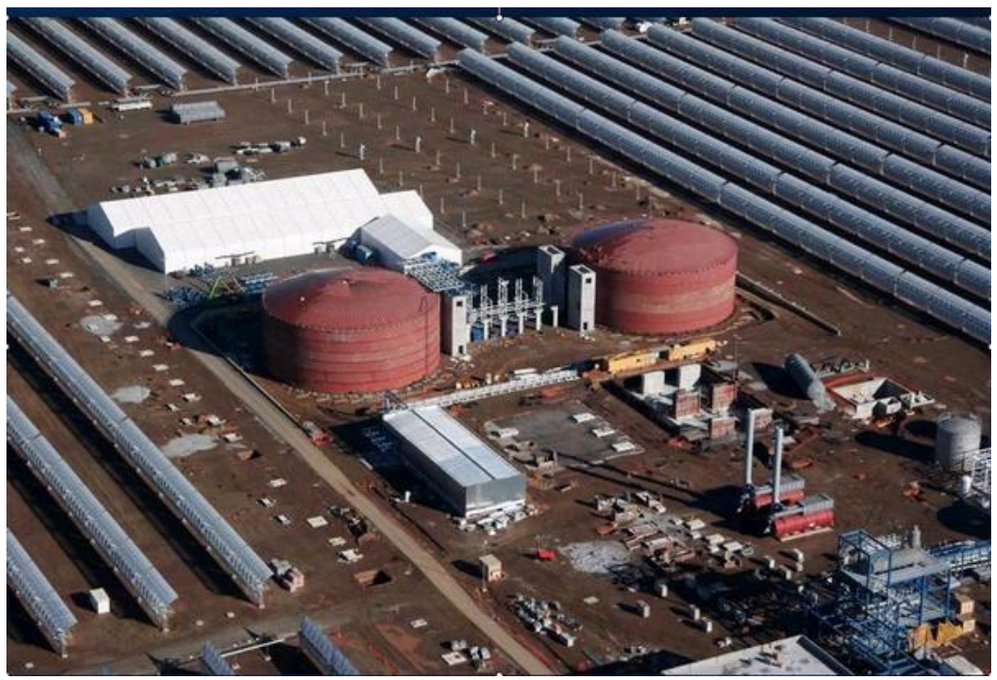
Principle 3
Environmental responsibility

Criteria

- **Profound consideration of environmental impacts**
- **Conservation of rare, threatened or endangered species and habitats**
- **Minimized waste production.**
- **Minimized use of water / optimum: neutral water balance**

DESERTEC FOUNDATION

Solar Thermal Power Stations nominated for the DESERTEC Award 2014



Andasol: 3 x 50 MW 7.5 h storage, Spain

Shams 1: 100 MW no storage, Abu Dhabi

Puerto Errado: 30 MW 0.5 h storage, Spain

Gemasolar: 20 MW 15 h storage, Spain

Solar Energy for Egypt

3000 km² = 55 x 55 km can cover Egypt's demand

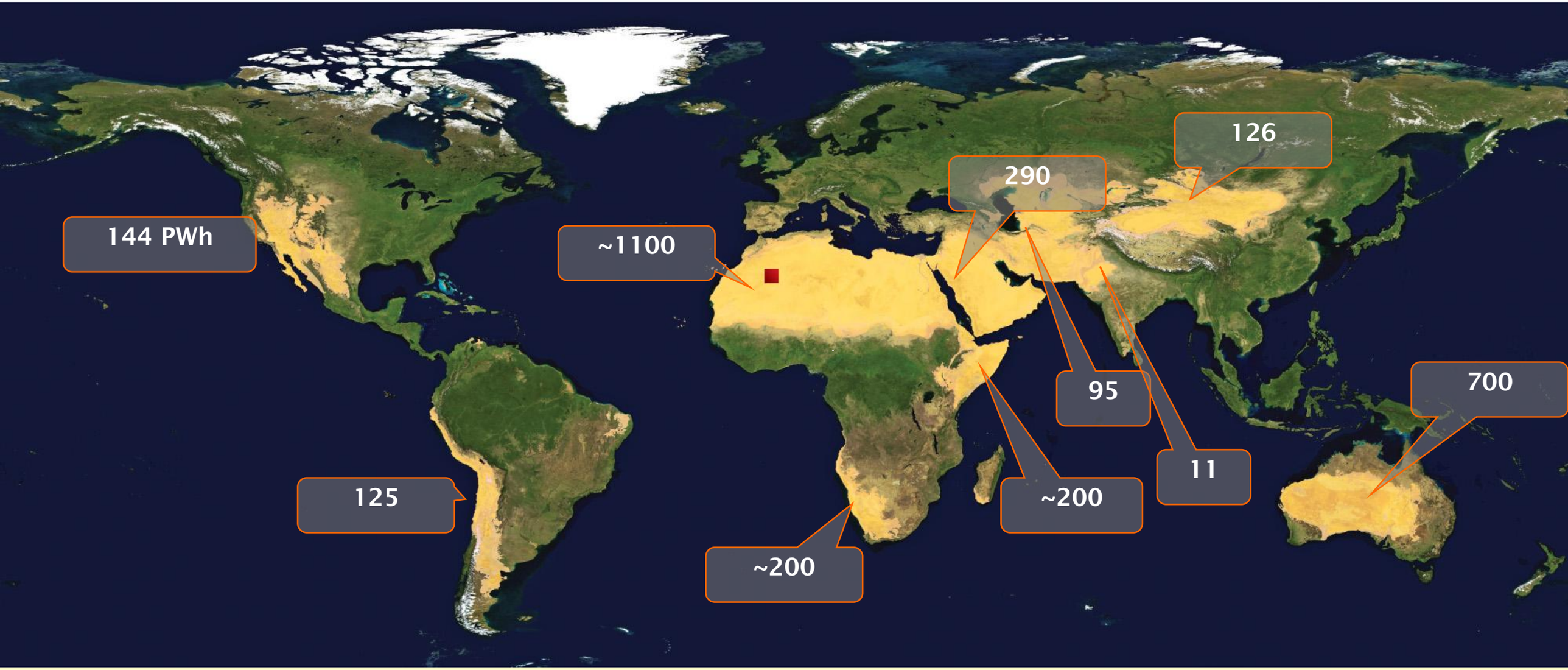
Air cooled condenser

Seawater desalination using waste heat

NOKRASCHY ENGINEERING
Mechanical Vibrations and Infrasound under Control
Solar Power for Sustainable and Everlasting Energy

Energy is abundant

Deserts Potential: 3000 PWh/y



Annual economic potential, in PWh (= 1000 TWh)

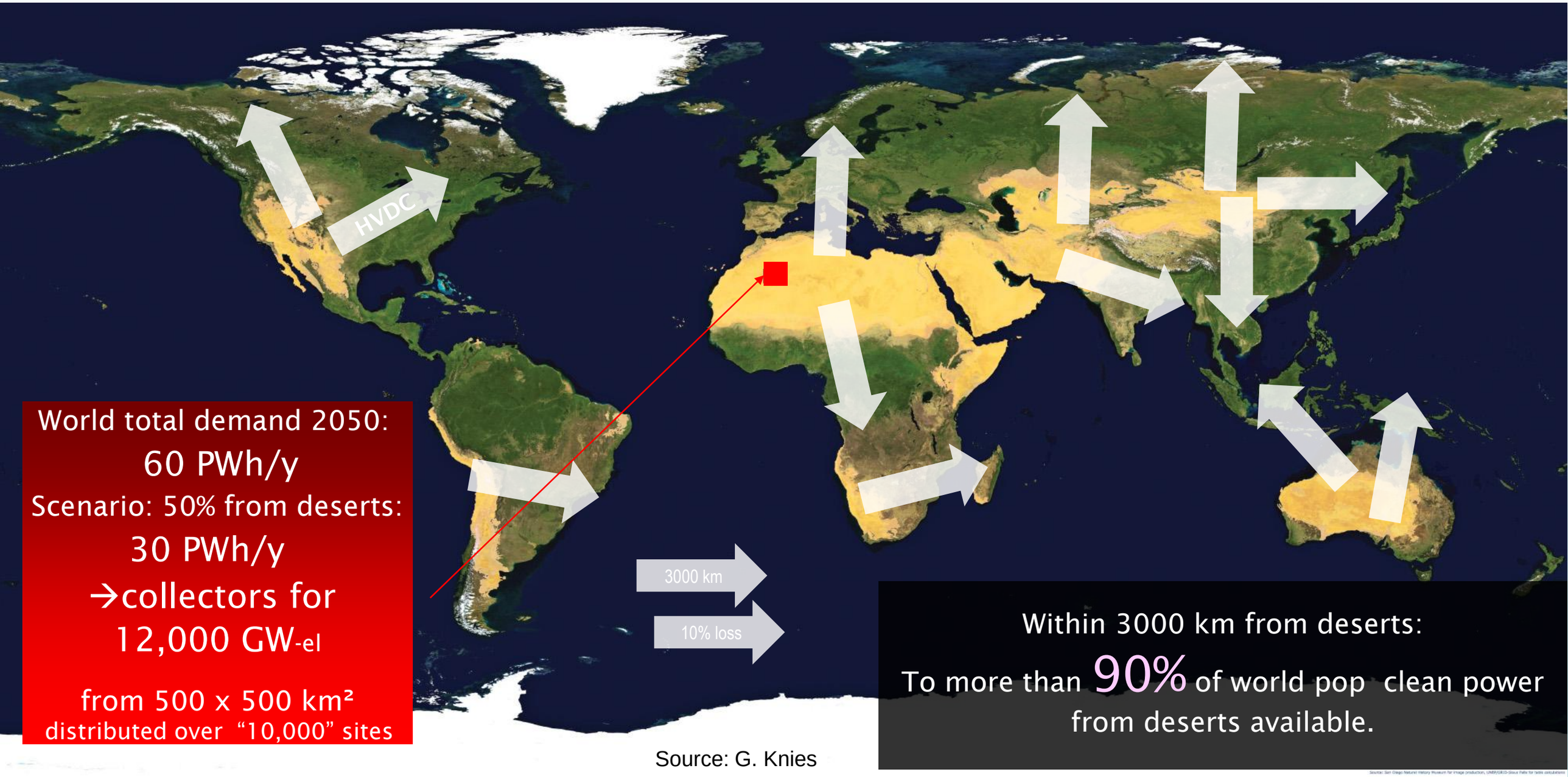
Global demand (2008): 18 PWh/y

Source: Trieb et.al.,DLR, 2009

DESERTEC-WORLD

12,000 solar GigaWatt from Deserts

via HVDC super grid to a World with 10 billion People



World total demand 2050:
60 PWh/y
Scenario: 50% from deserts:
30 PWh/y
→collectors for
12,000 GW-el

from 500 x 500 km²
distributed over "10,000" sites

Source: G. Knies

Within 3000 km from deserts:
To more than 90% of world pop clean power from deserts available.

DESERTEC FOUNDATION

DESERTEC FOUNDATION

DESERTEC - Become part of the solution!

http://www.desertec.org/en/concept/criteria/

DESERTEC FOUNDATION