



Current Status of Solar Thermal Application Worldwide

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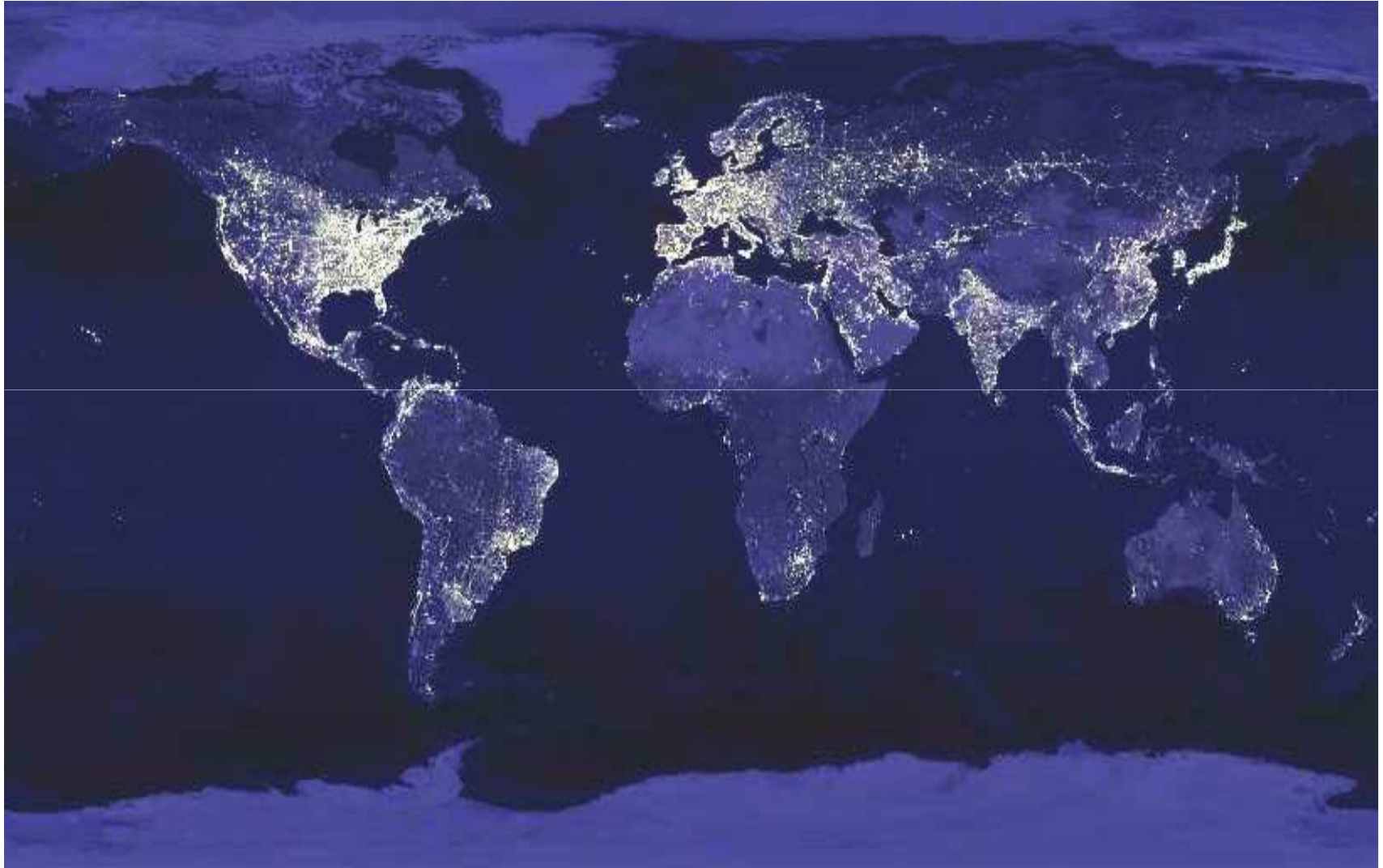
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A sustainable energy future

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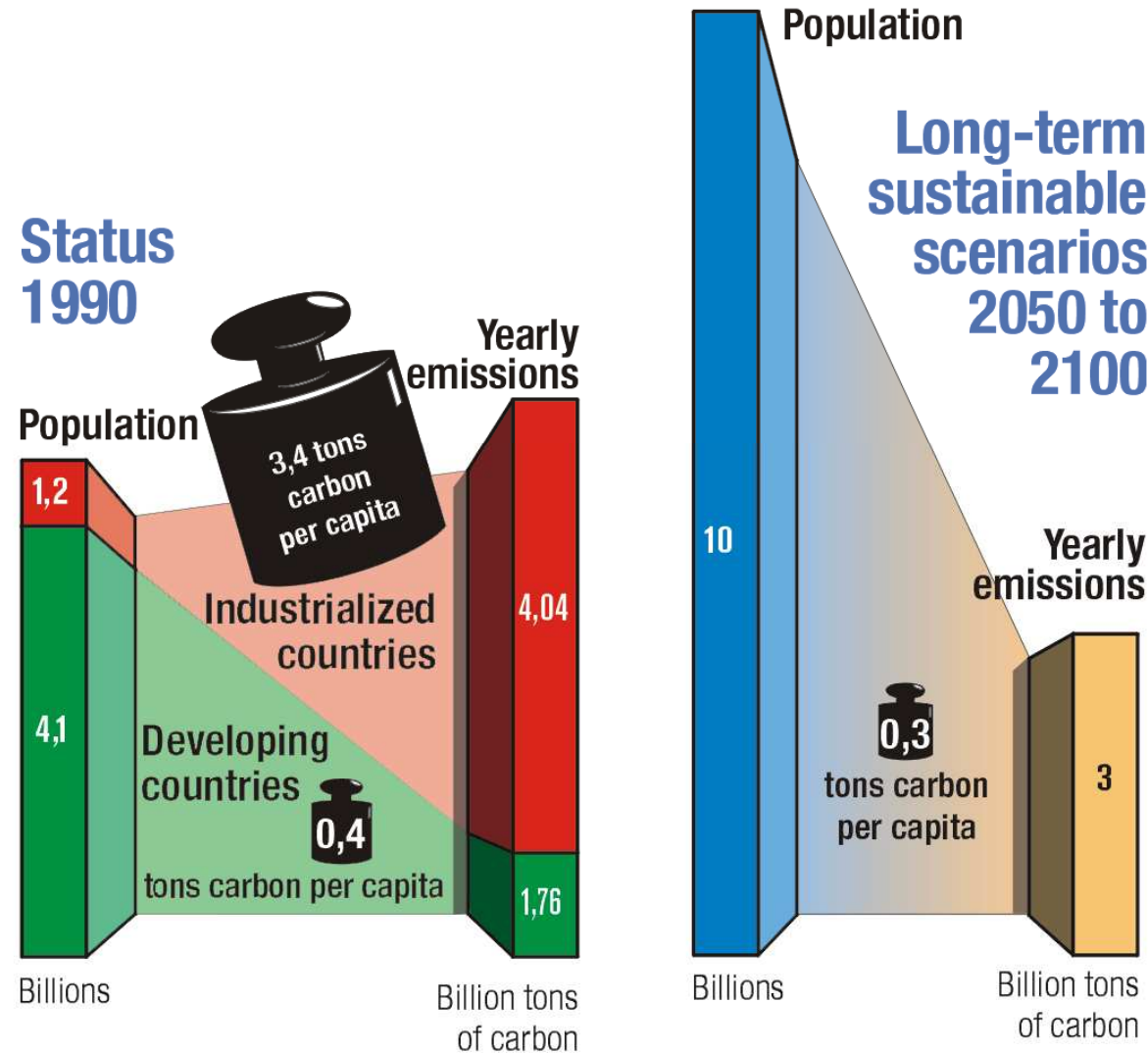
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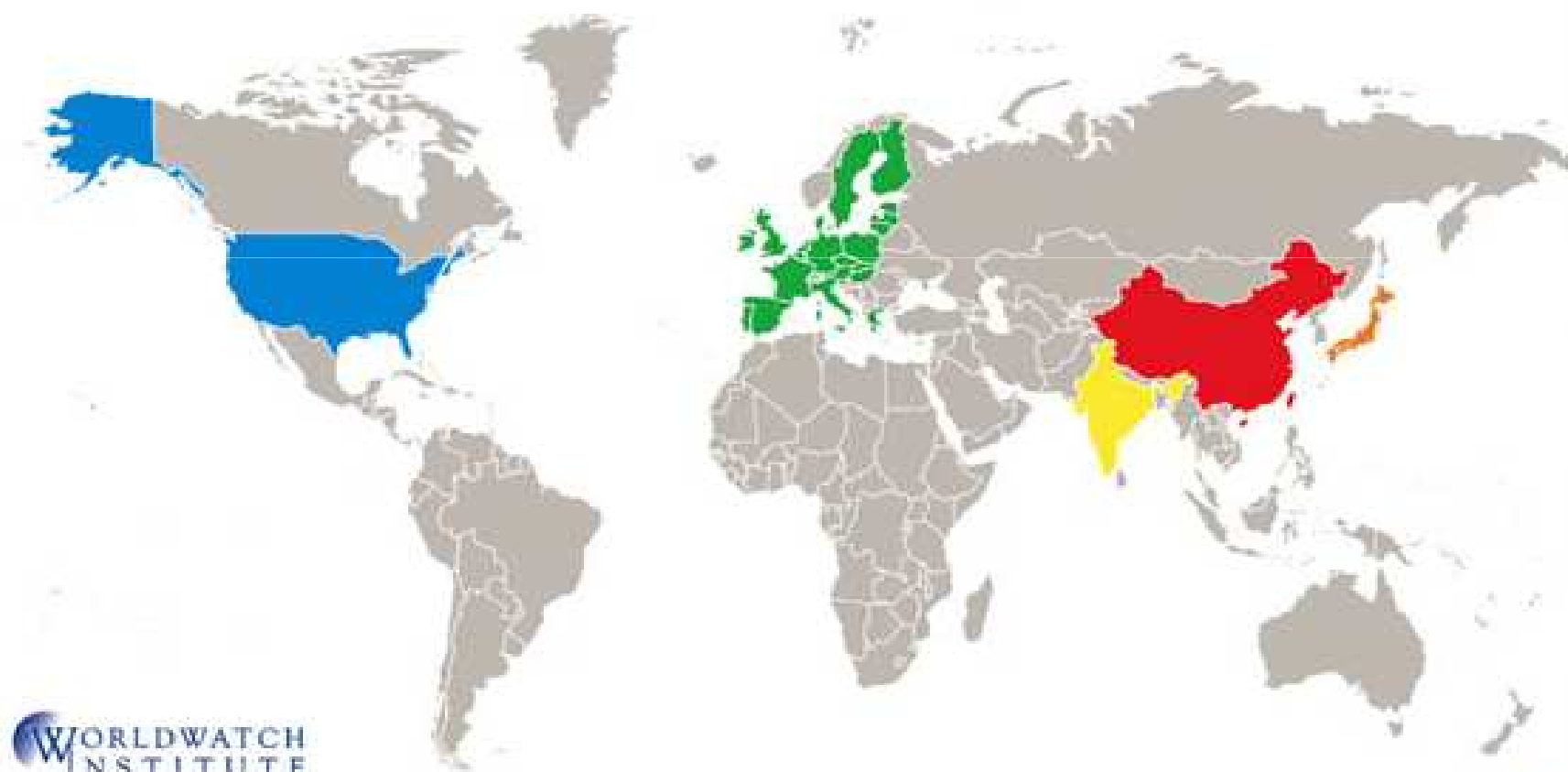
Source: NASA / NOAA

A sustainable energy future



World by Geography

>> Size indicates land mass



WORLDWATCH
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Map created by Mapping Worlds 

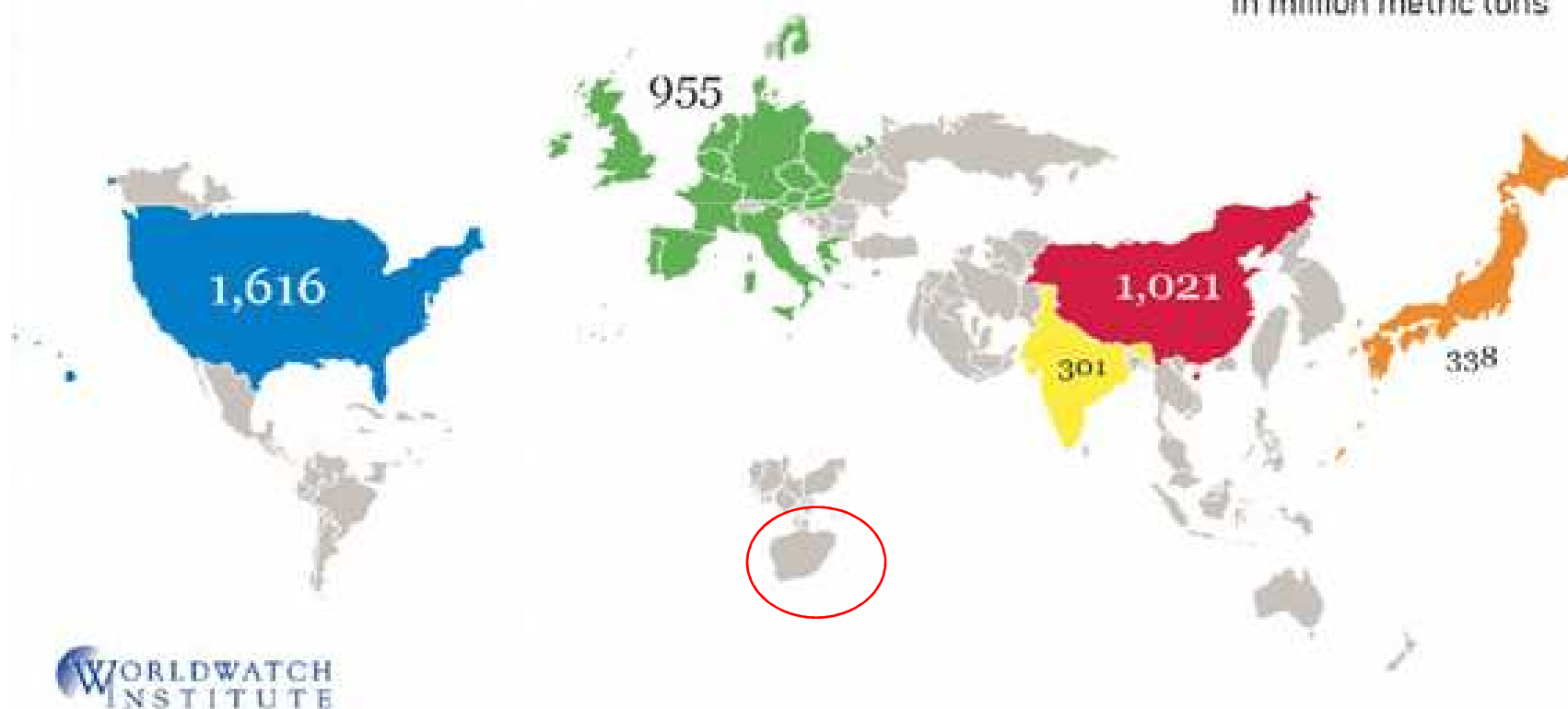
World by Population

>> Size equals inhabitants in millions



World by Carbon Emissions

>> Size of a country equals emissions in million metric tons

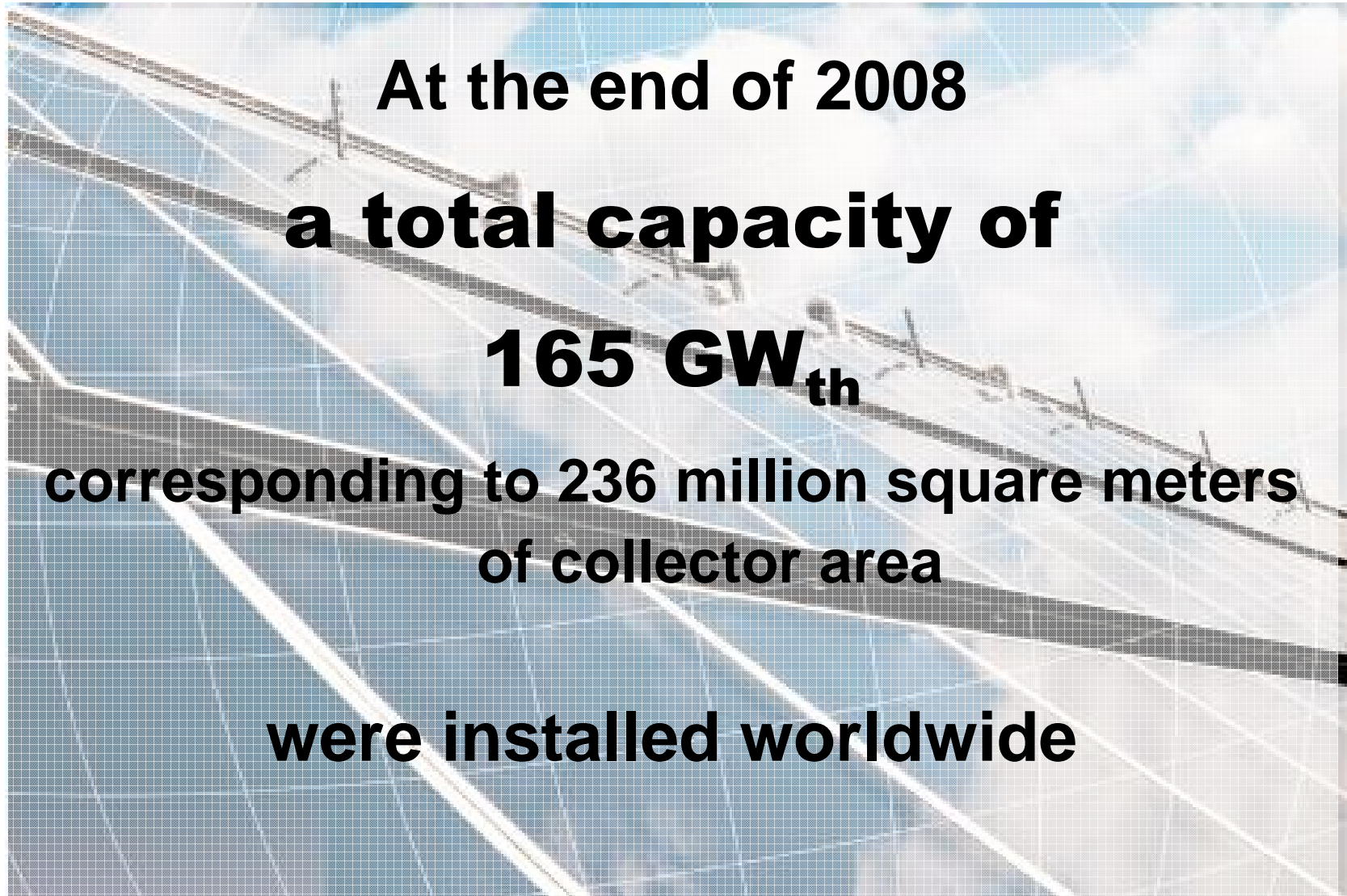


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Display data US Department of Energy

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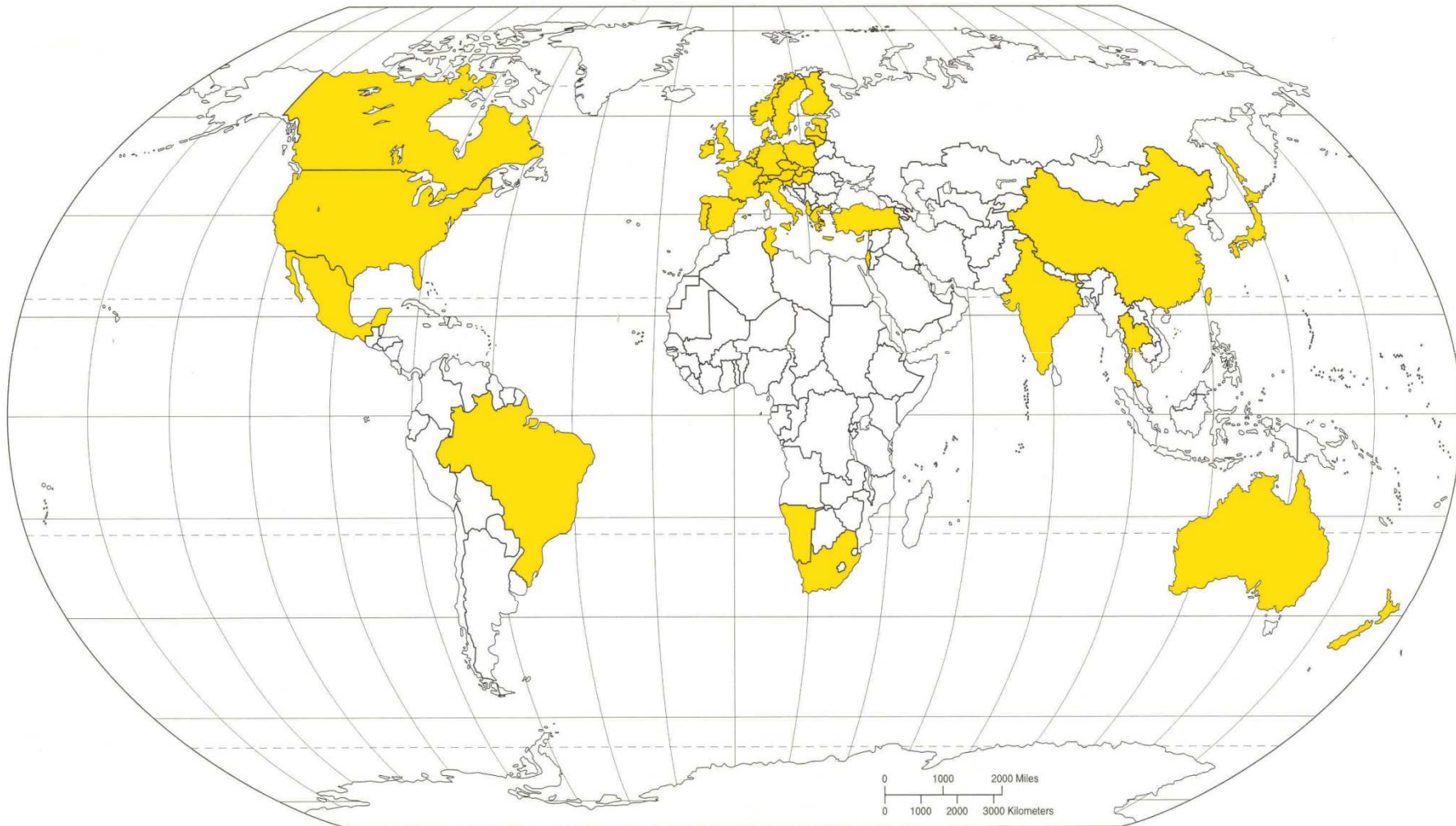


Solar Heat Worldwide

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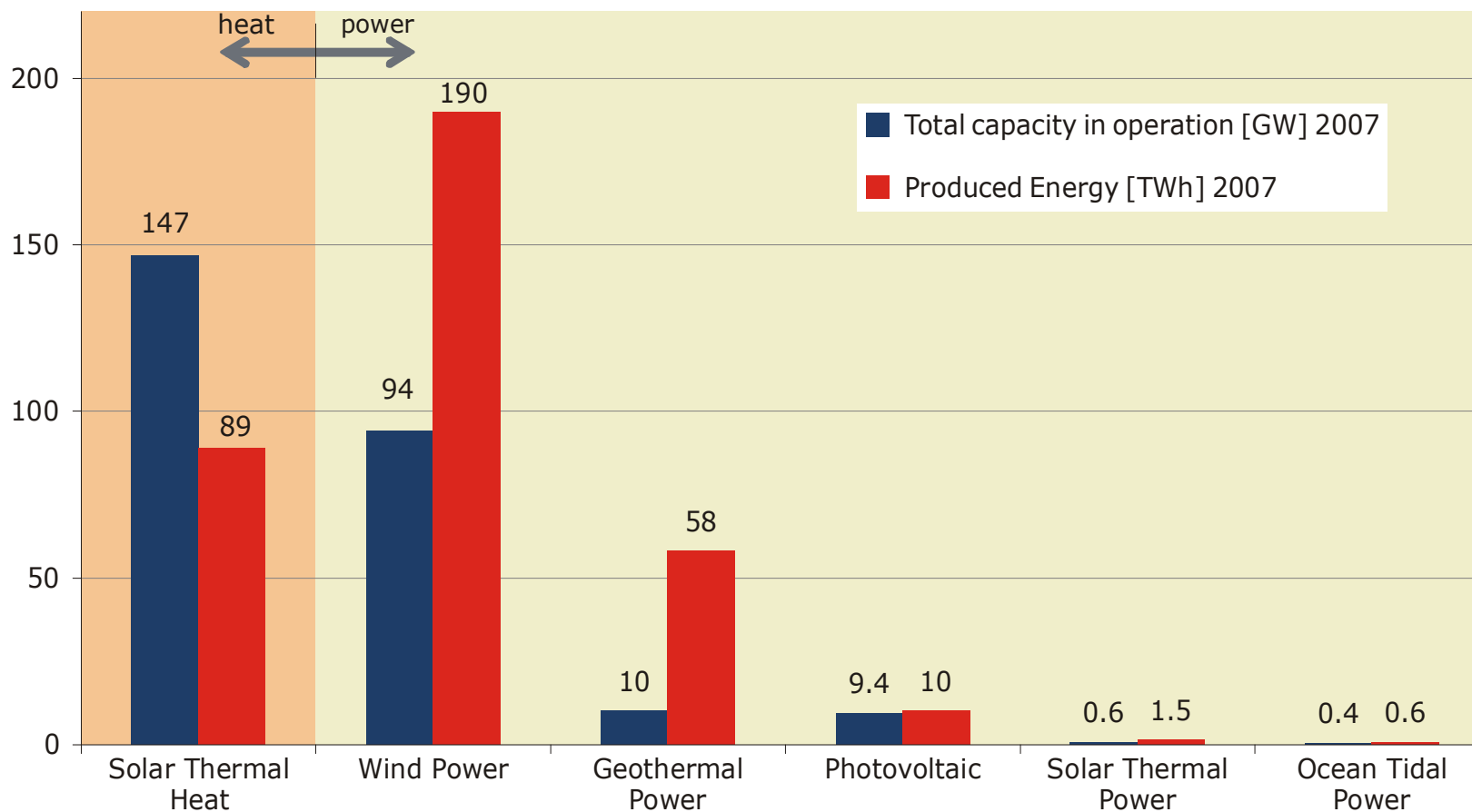
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Achievements - 2007

Total Capacity in Operation [GW_{el}], [GW_{th}] and Produced Energy [TWh_{el}], [TWh_{th}], 2007



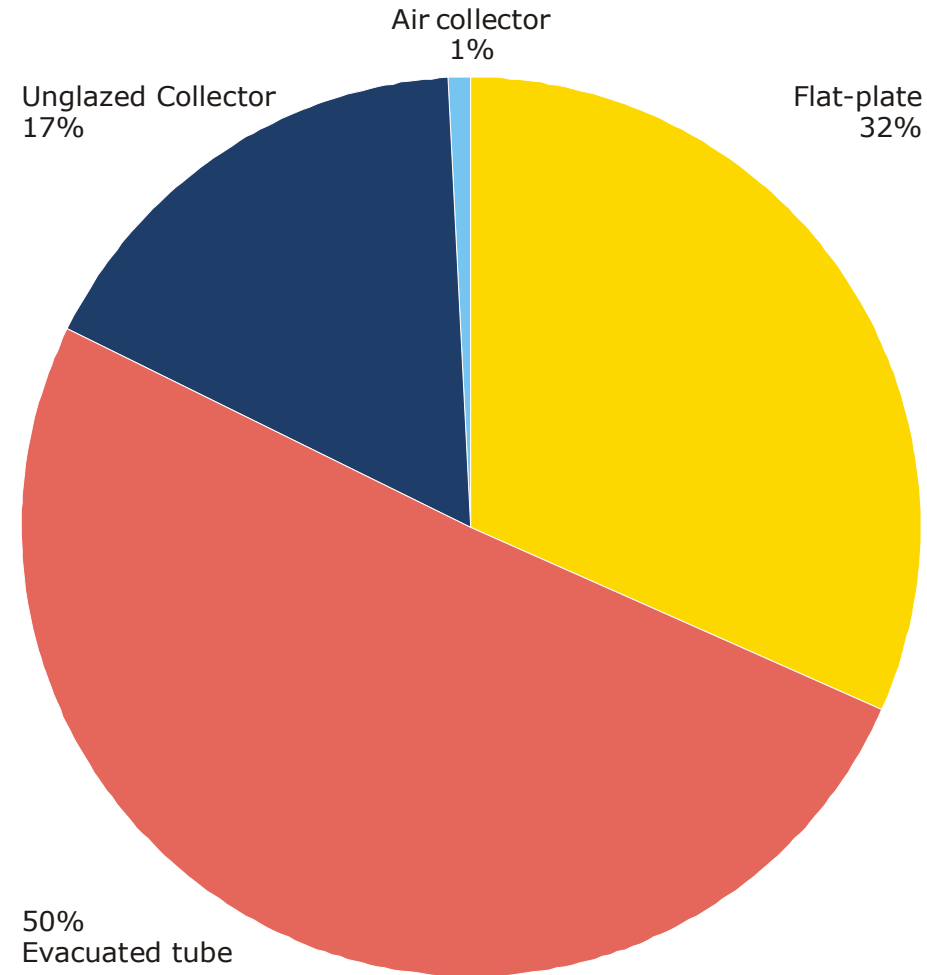


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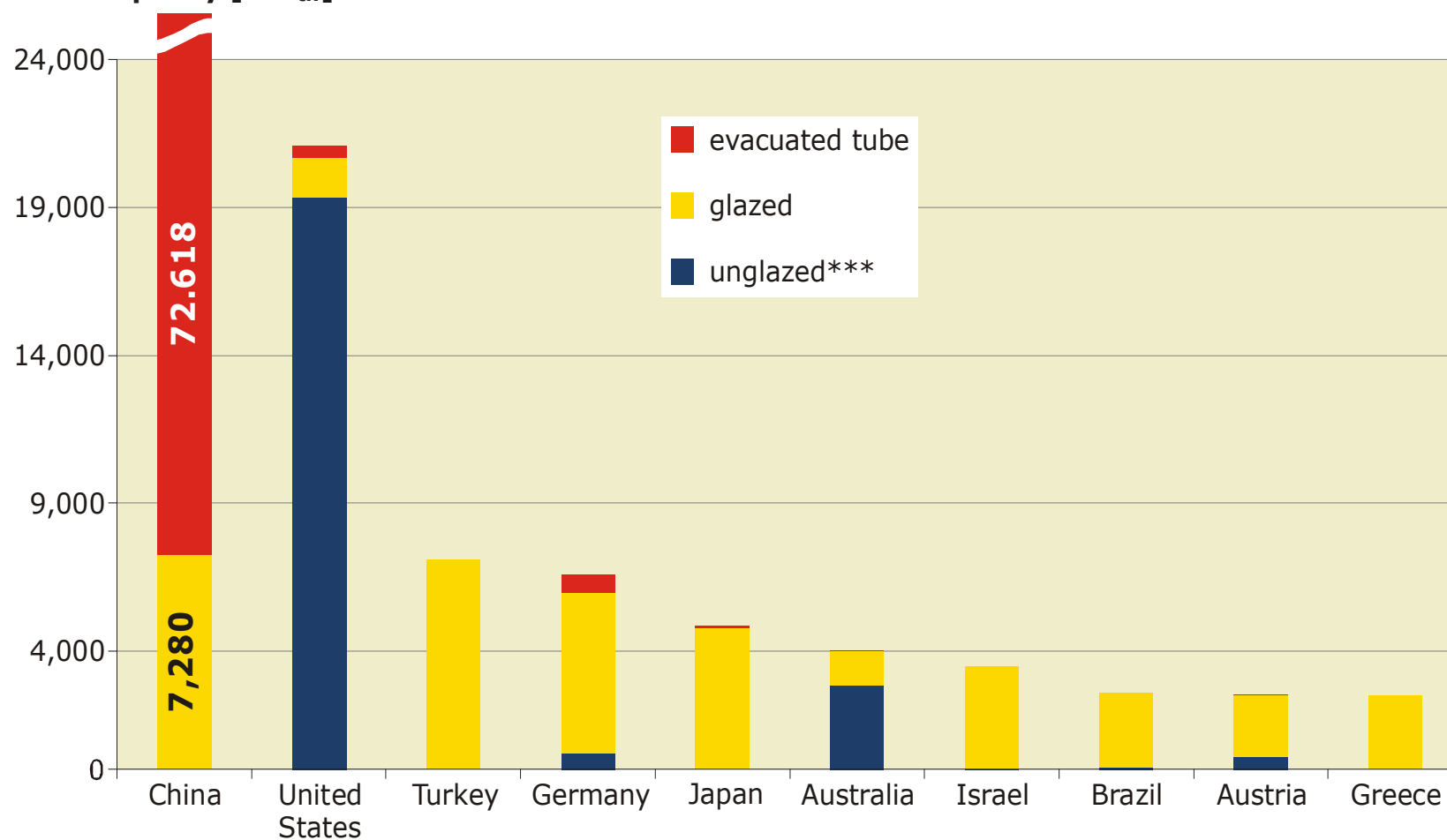
Solar Heat Worldwide - 2007

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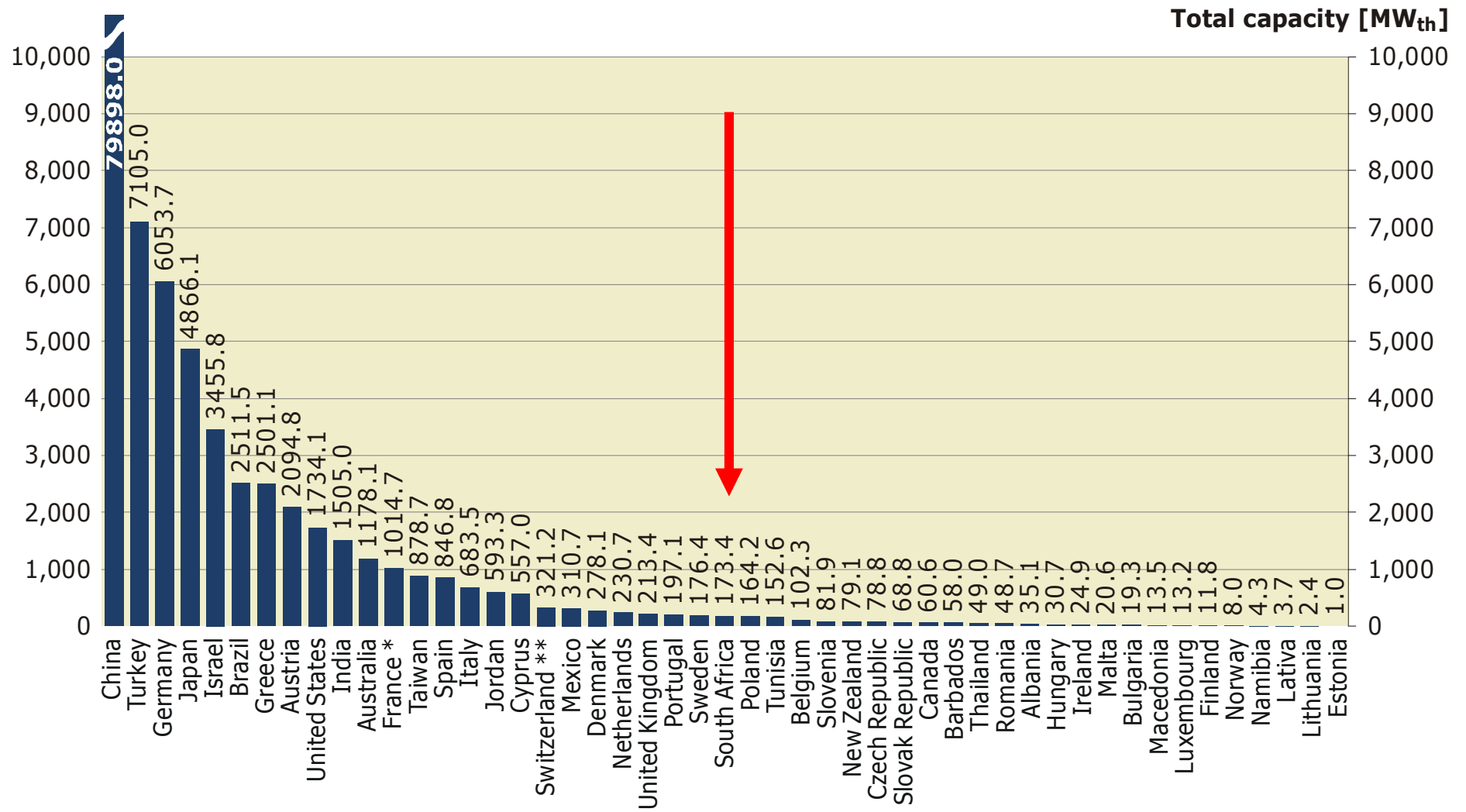
Total Capacity [MW_{th}]



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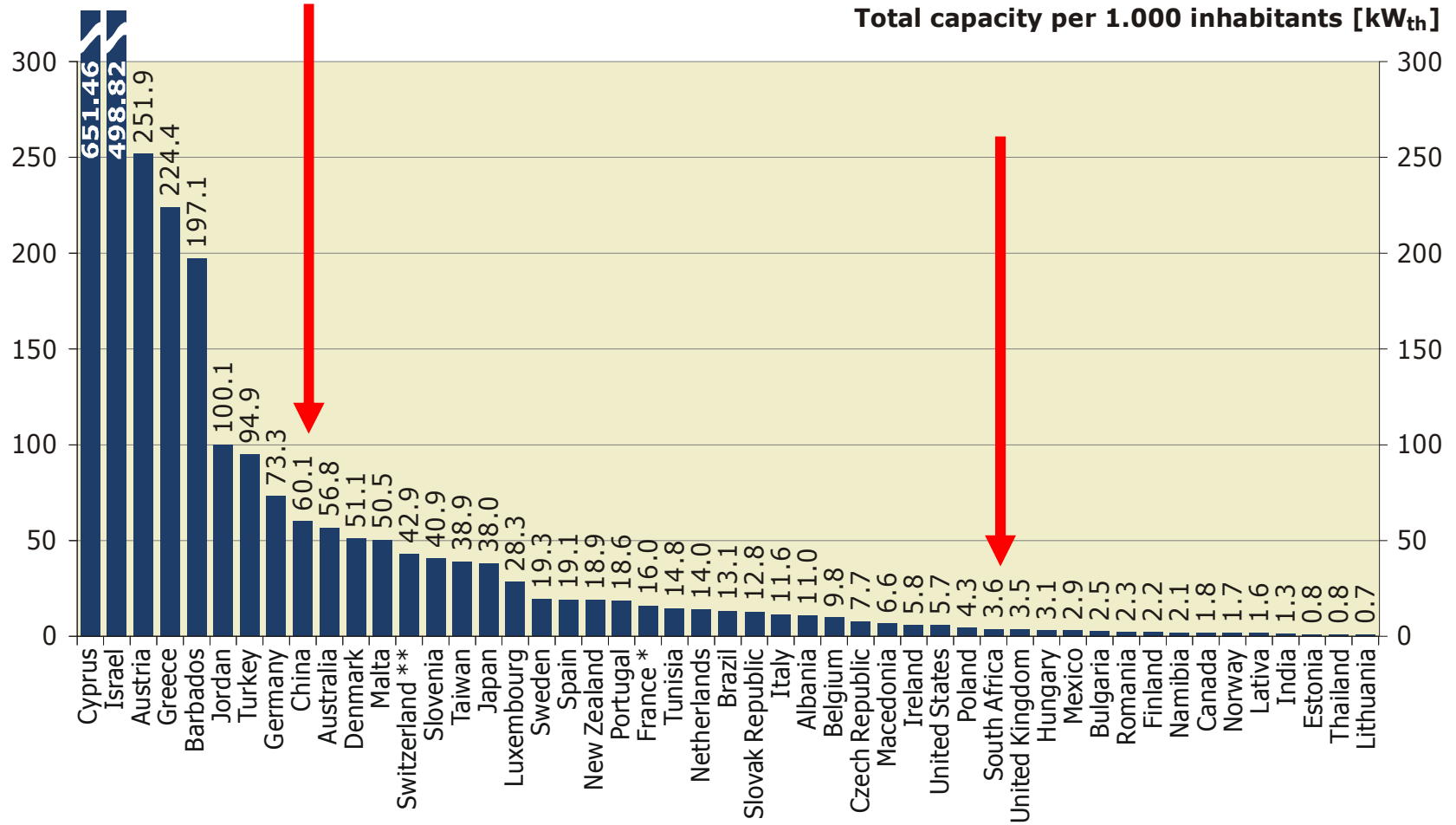

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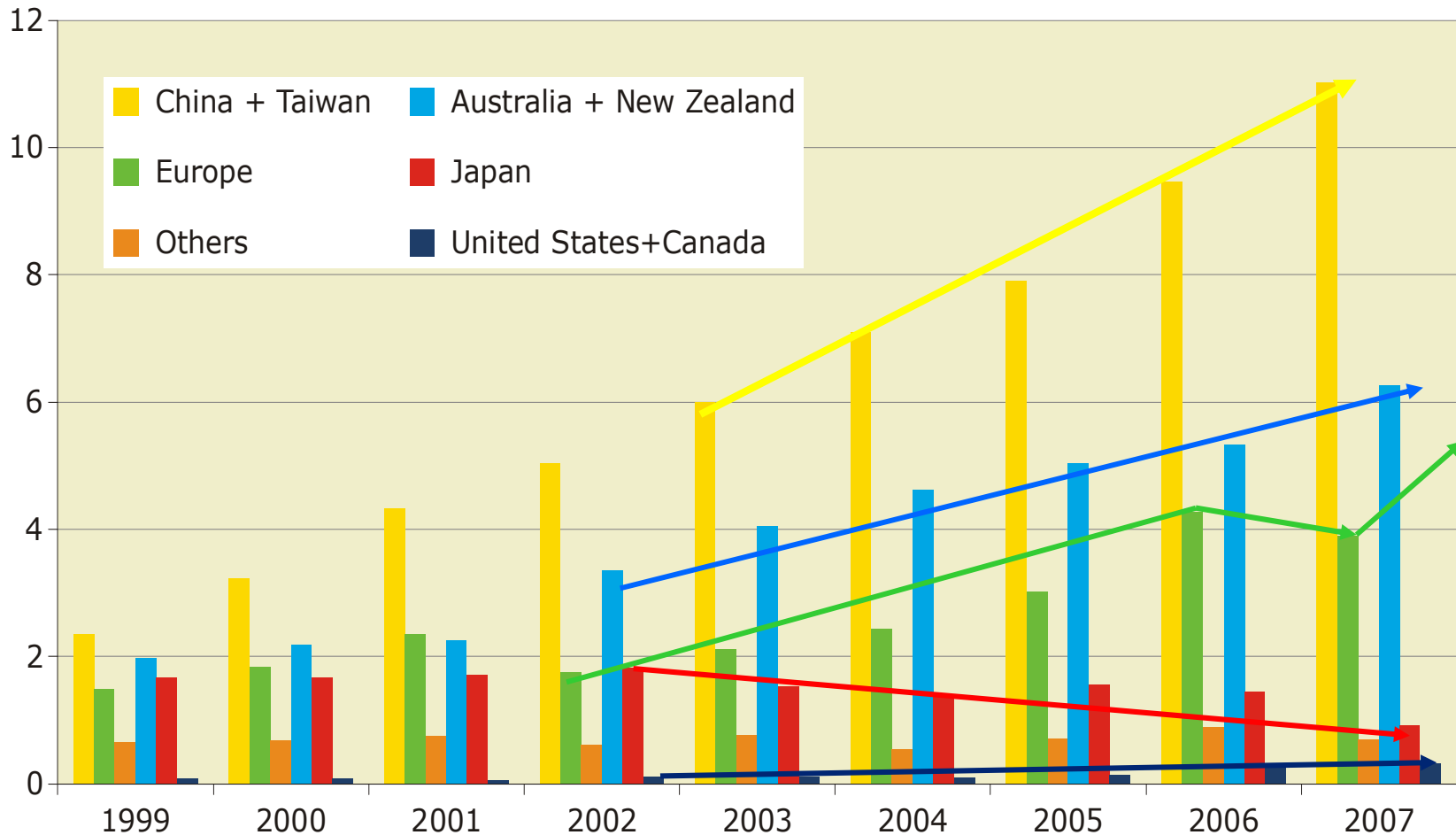


Market Development 1999 - 2007

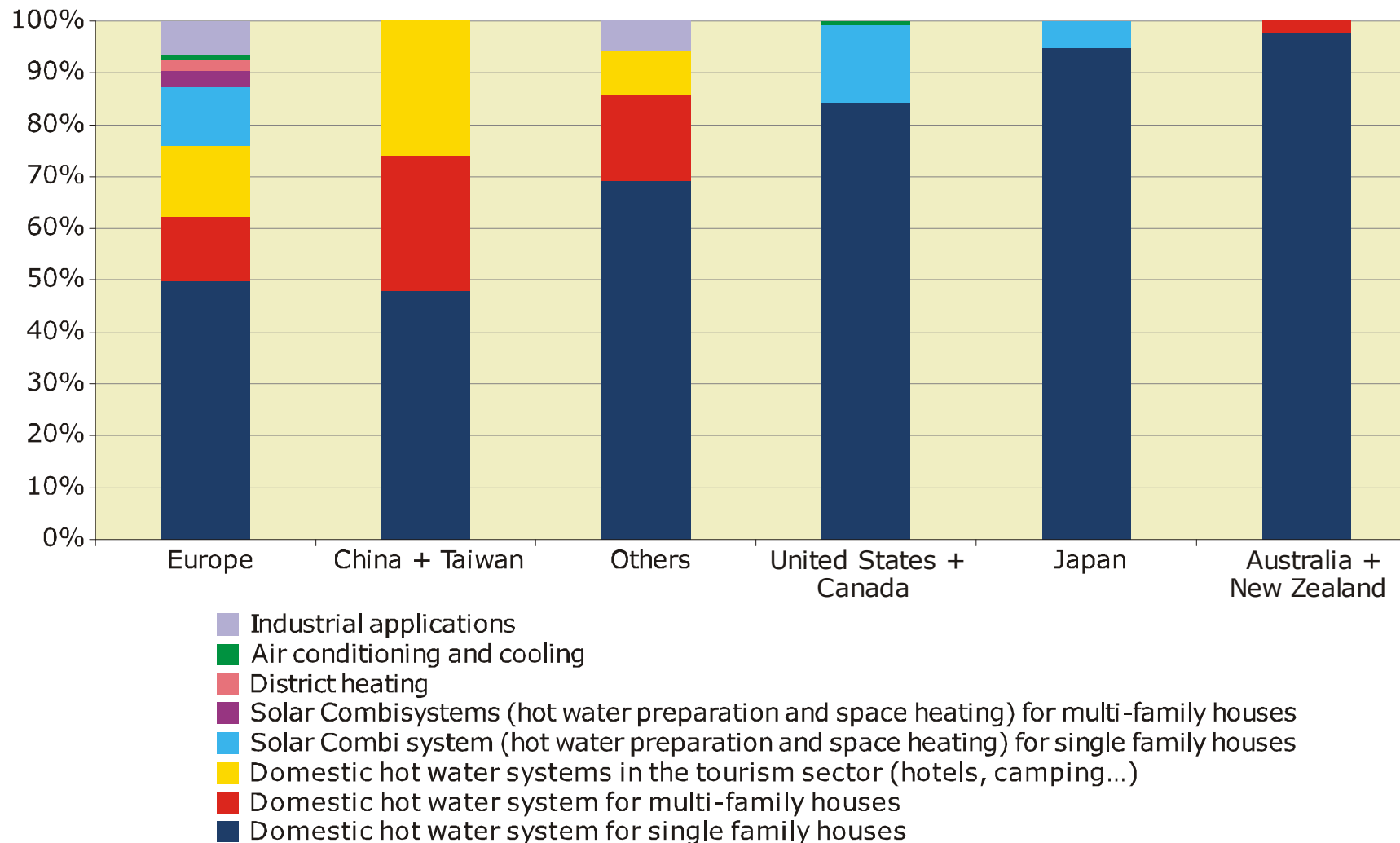
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Installed capacity per 1,000 inhabitants [kWth/a]



Diversification of the Global Market - 2007



Employment

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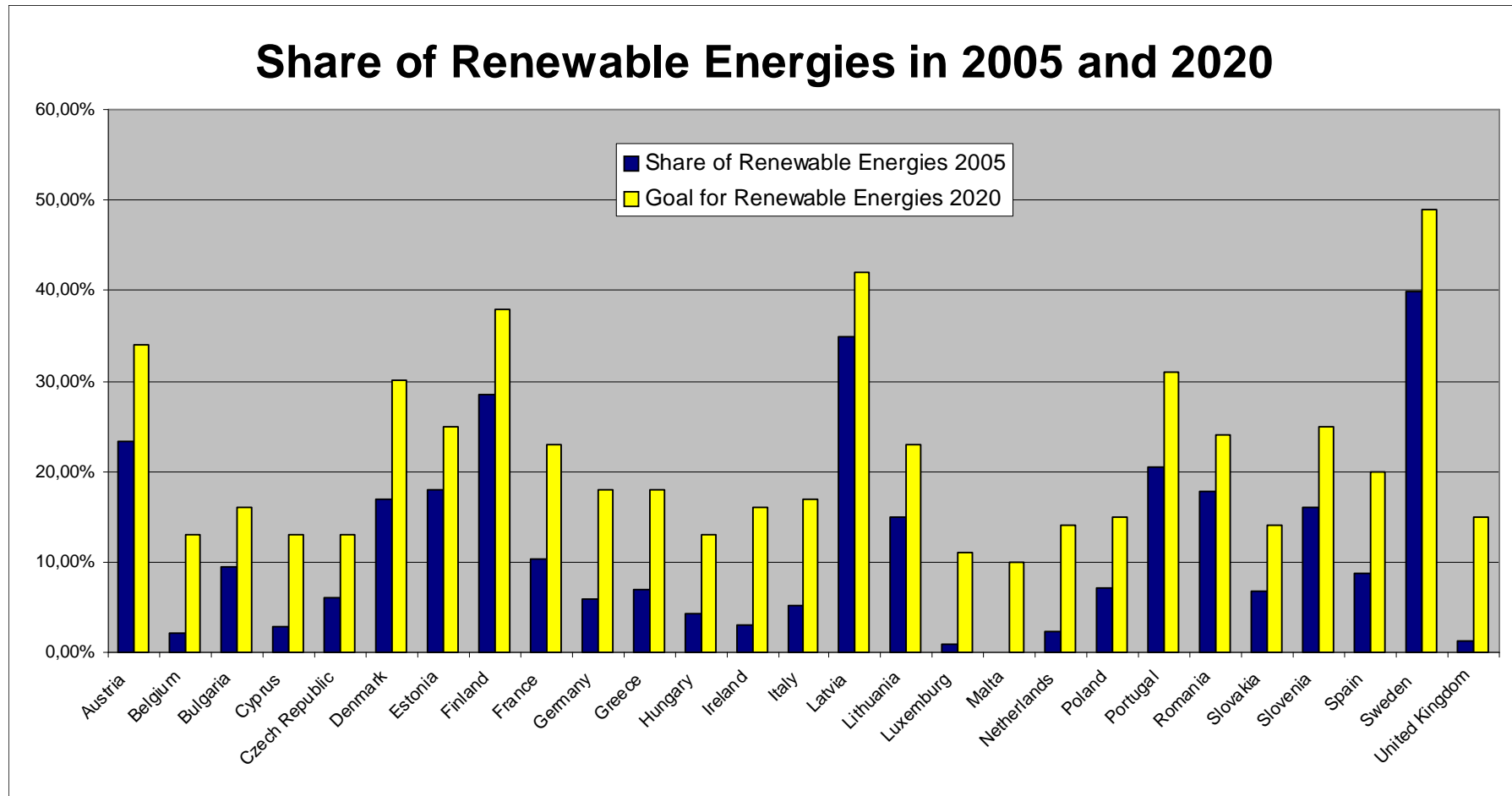
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Share of Renewables 2005 and target 2020

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Contribution of Solar Thermal to the EU 20% RES Target

Renewable Heating and Cooling

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Solar thermal



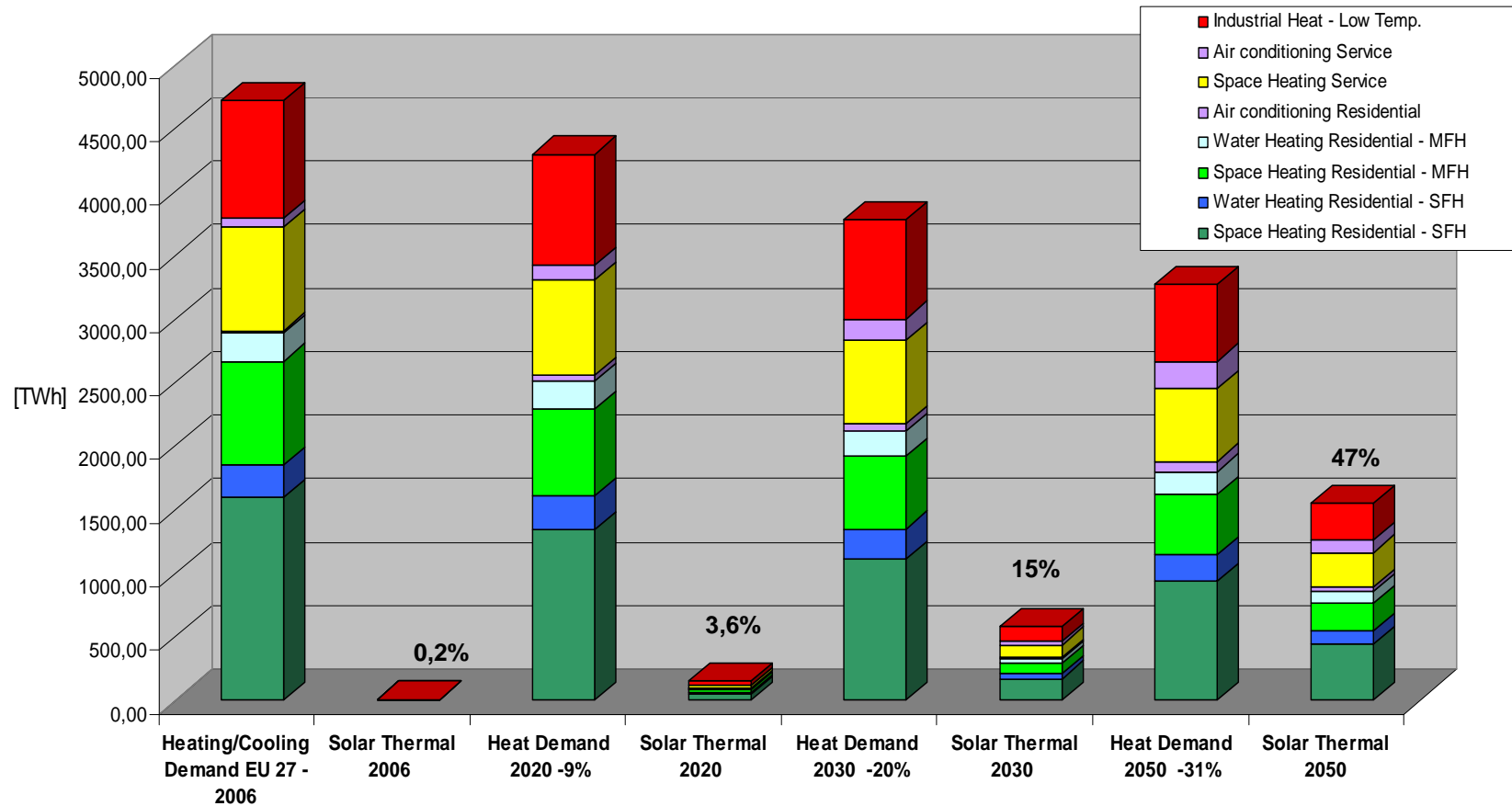
Biomass



Geothermal

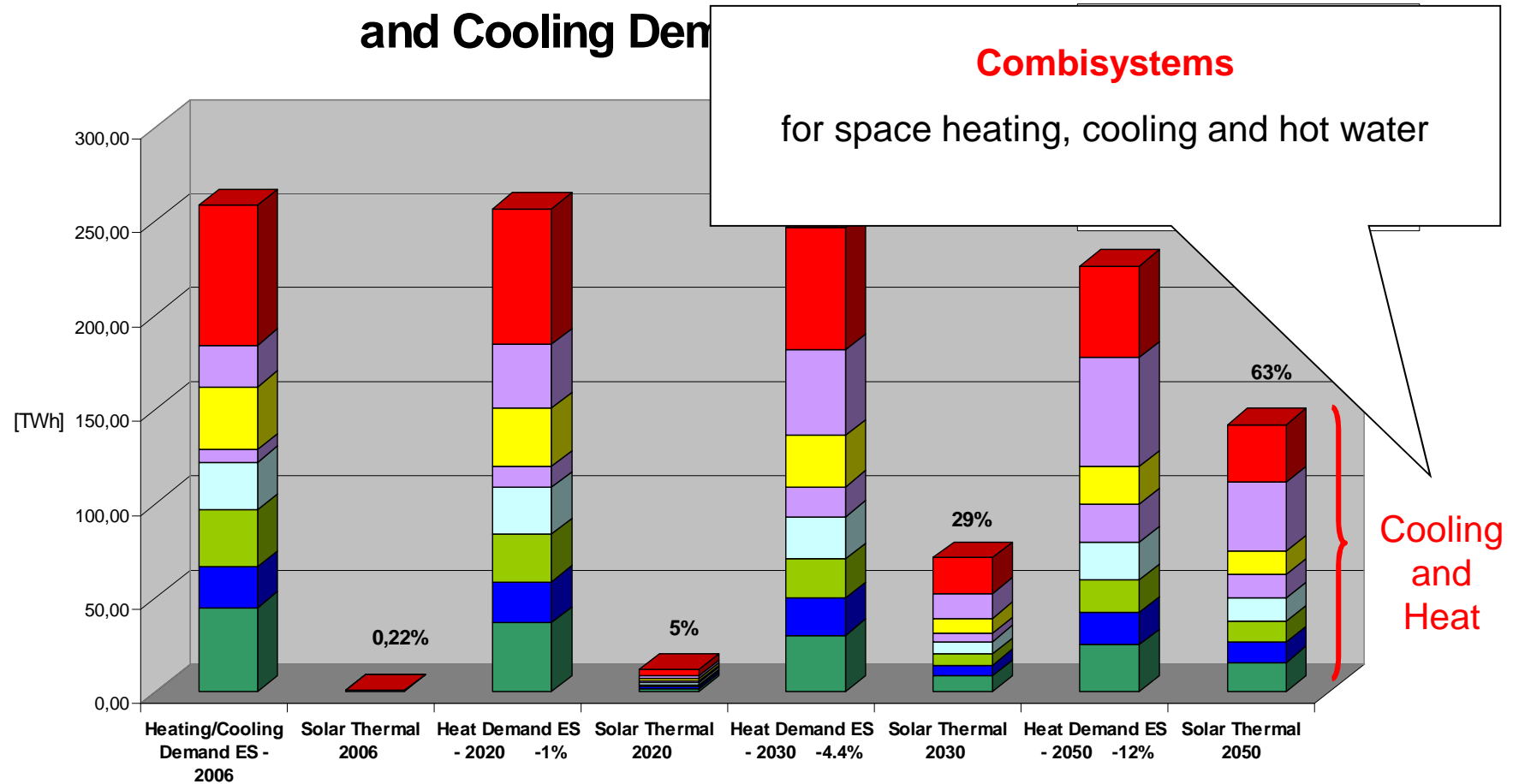


Contribution of Solar Thermal to the EU 27 Heating and Cooling Demand by Sector



Solar Thermal Potential Spain

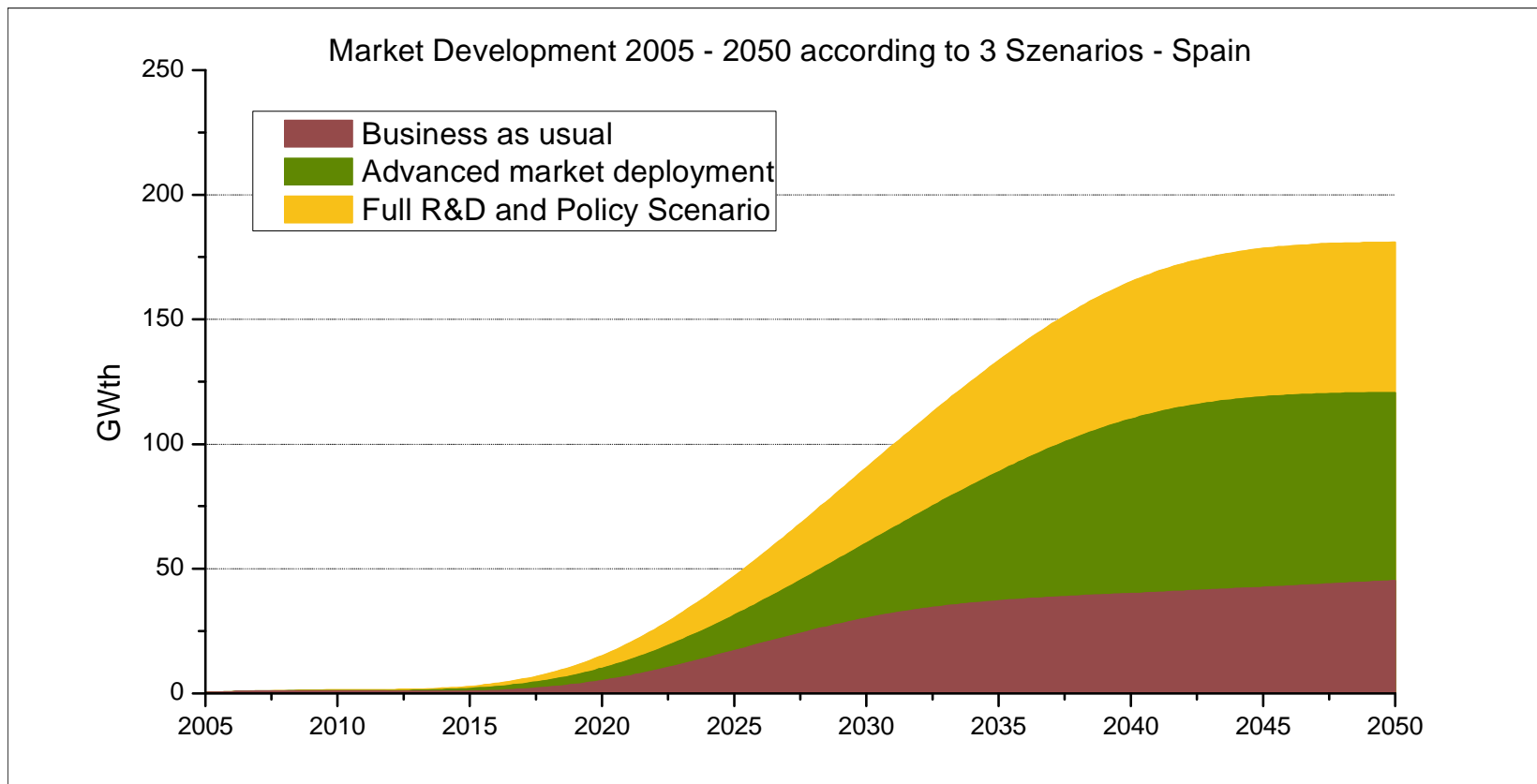
Contribution of Solar Thermal to the Spanish Heating and Cooling Demand

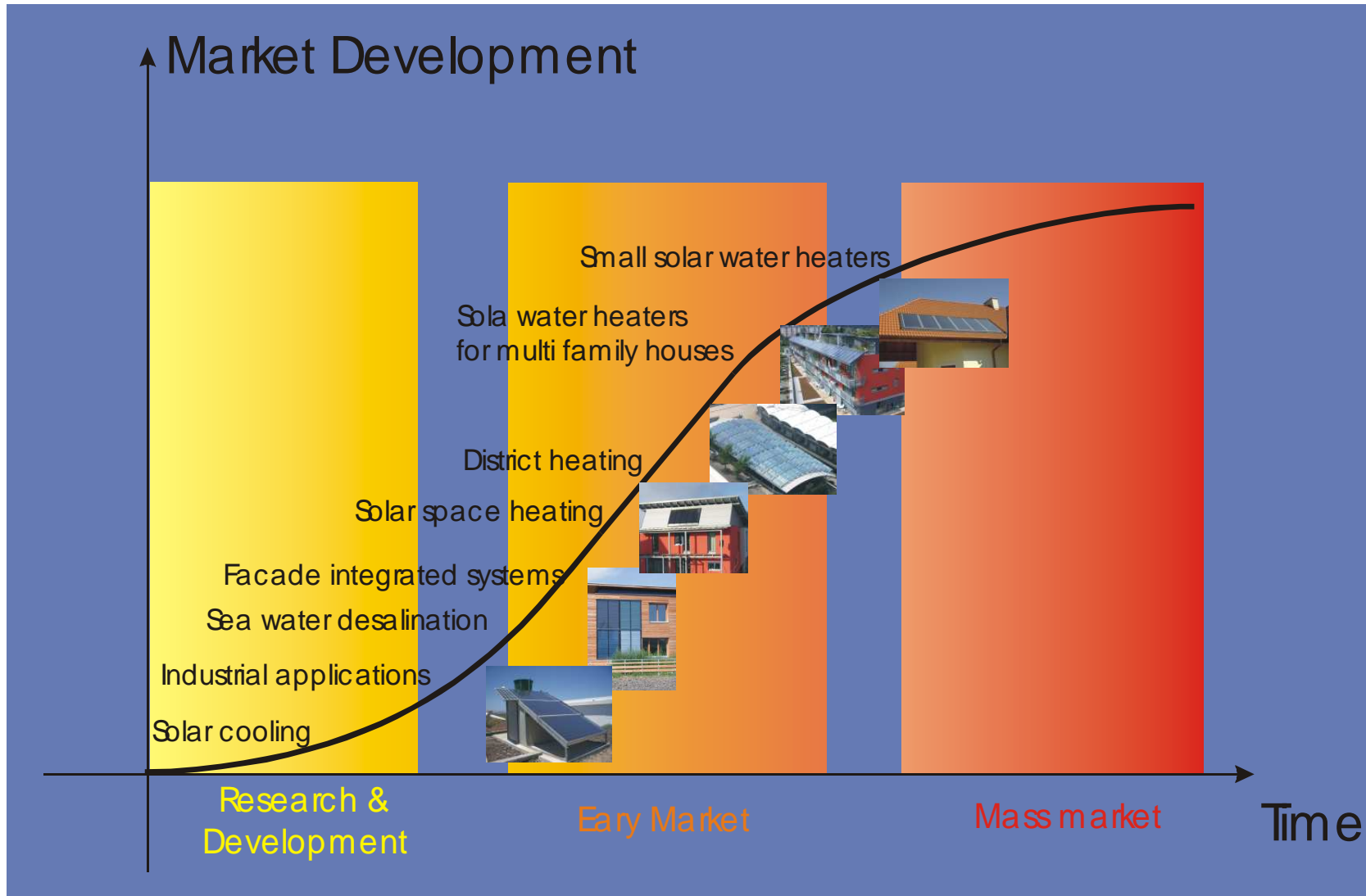


Solar Thermal Potential Spain

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Established Applications

Solar Water Heating Systems

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Further Developments:

- Compactness
- Building integration
- Medium sized systems





Solar Water Heating Systems

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Solar Water Heating Systems

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Three different types of evacuated tube collectors:

all-glass
U-tube
heat-pipe



Small-scale Systems for Hot Water Preparation

$$f_{\text{sol}} = 50 - 70\%$$

$$500 - 650 \text{ kWh/kW}_{\text{th}}$$



Solar Water Heating for Hotels

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Source: TiSun

Combined Pool Heating and SWH

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Combined SWH and Cooling

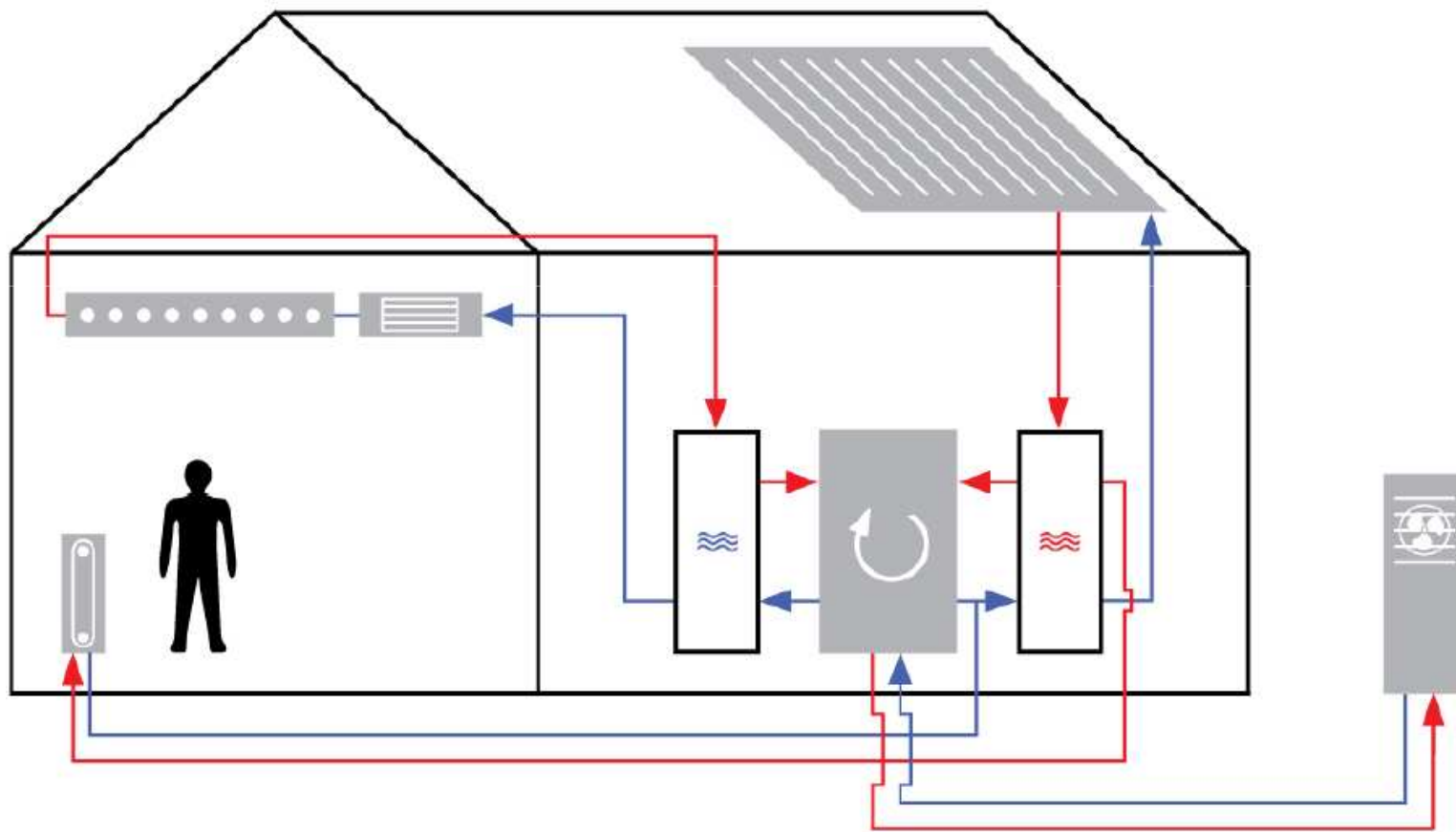
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Solar Air Conditioning and Cooling



Solar Cooling System for the German BMWBW



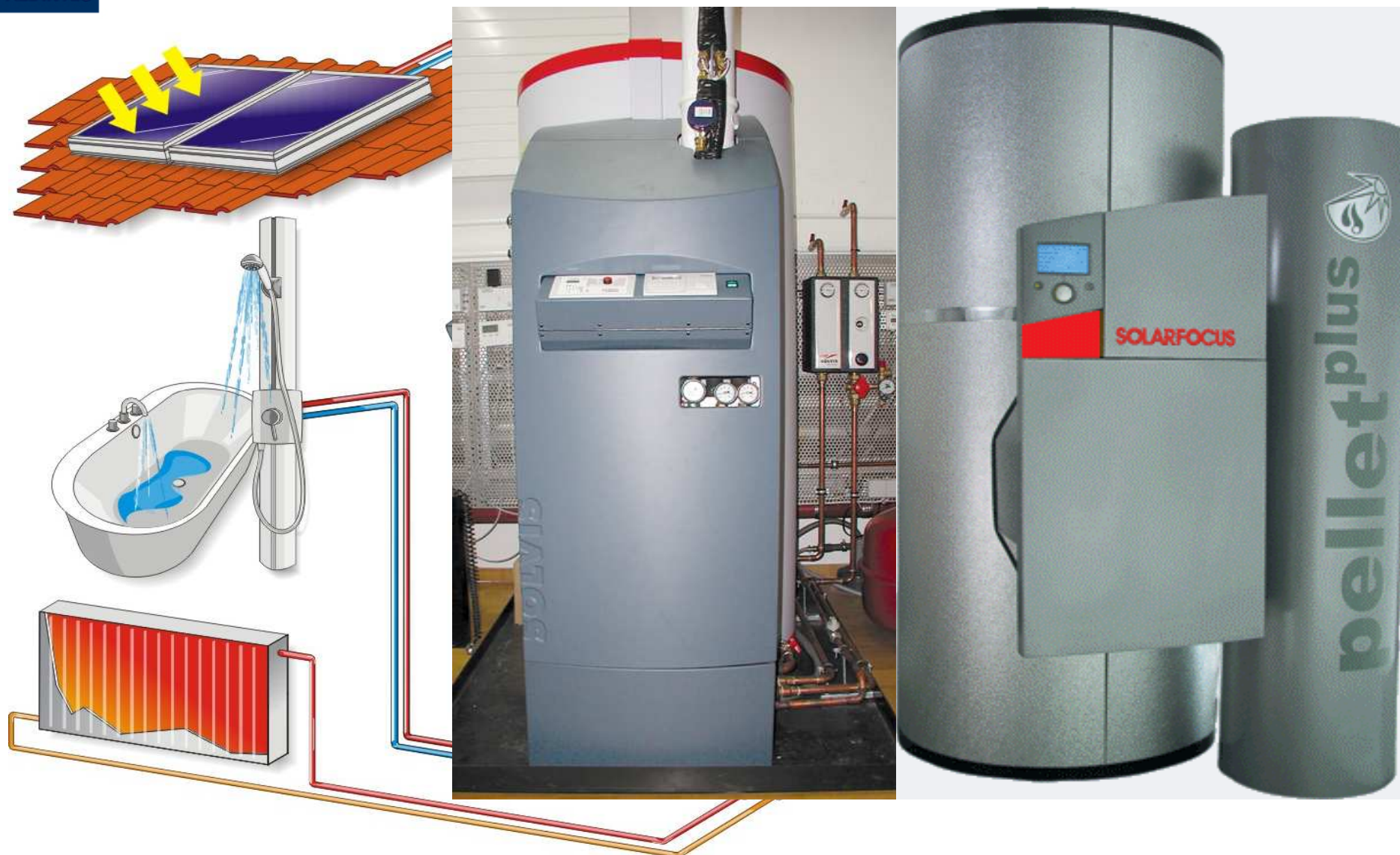
Source: Jan Albers, IMBE, TU Berlin

Solar Combi Systems for SFH

$$f_{\text{sol}} = 20 - 50\%$$

$$450 - 550 \text{ kWh/kW}_{\text{th}}$$



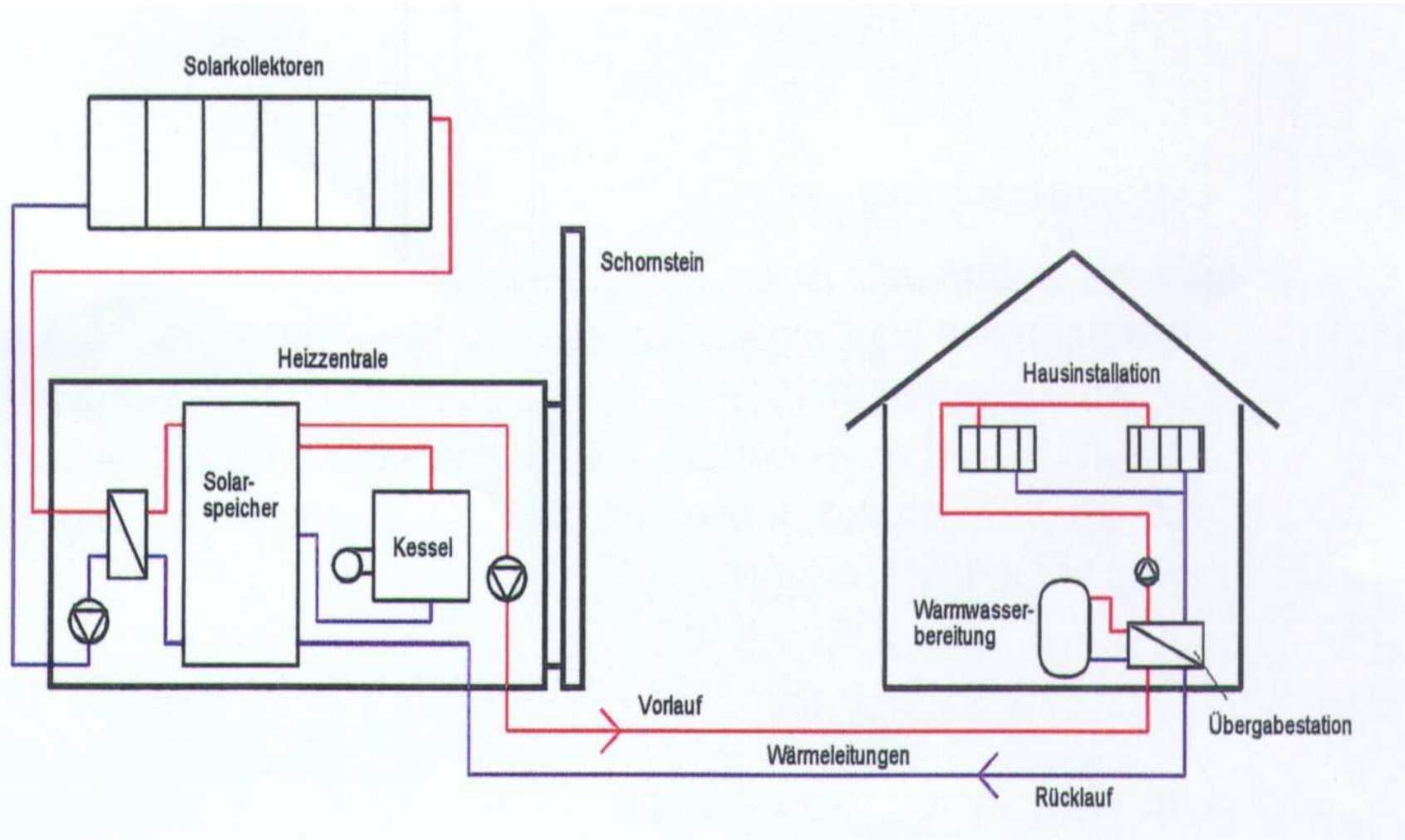




Large-scale solar heating systems



System with short-term storage – Müllheim, D



System with seasonal storage, SE

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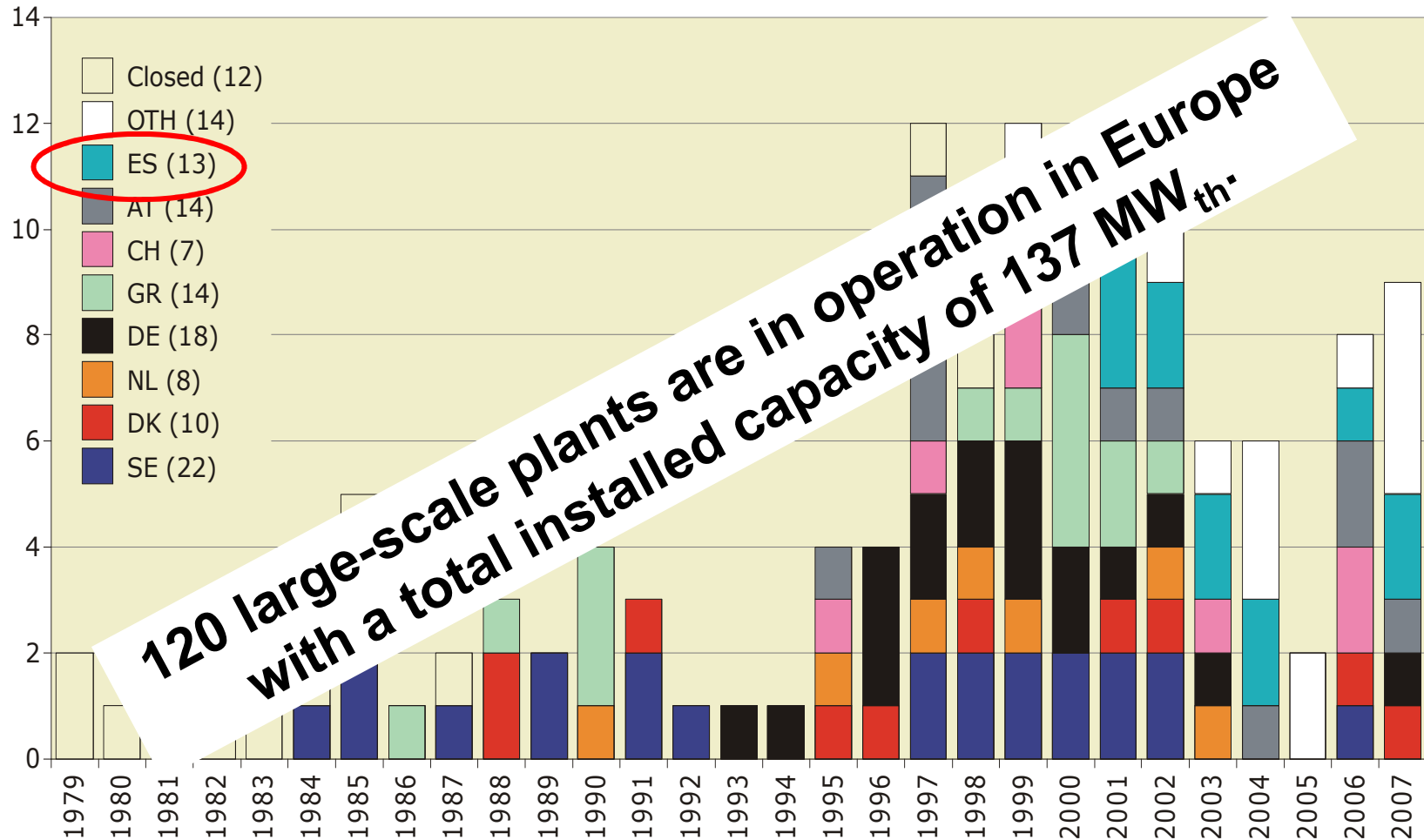


Project	Heat Storage	Project -Size			
		Collector area (m ²)	Storage Volume (m ³)	fsol (%)	Nb. of Flats
Anneberg-Danderyd	seasonal	2.400 m ²	60.000 m ³	70%	50



Large-scale Plants in Europe

No of plants



Source: Jan-Olof Dalenbäck, 2008

Local District Heating – Hamburg, Germany



Source: ITW, University Stuttgart



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District Heating – 3MW_{th}, AEVG, Graz, Austria



Source: S.O.L.I.D.

Solar District Heating

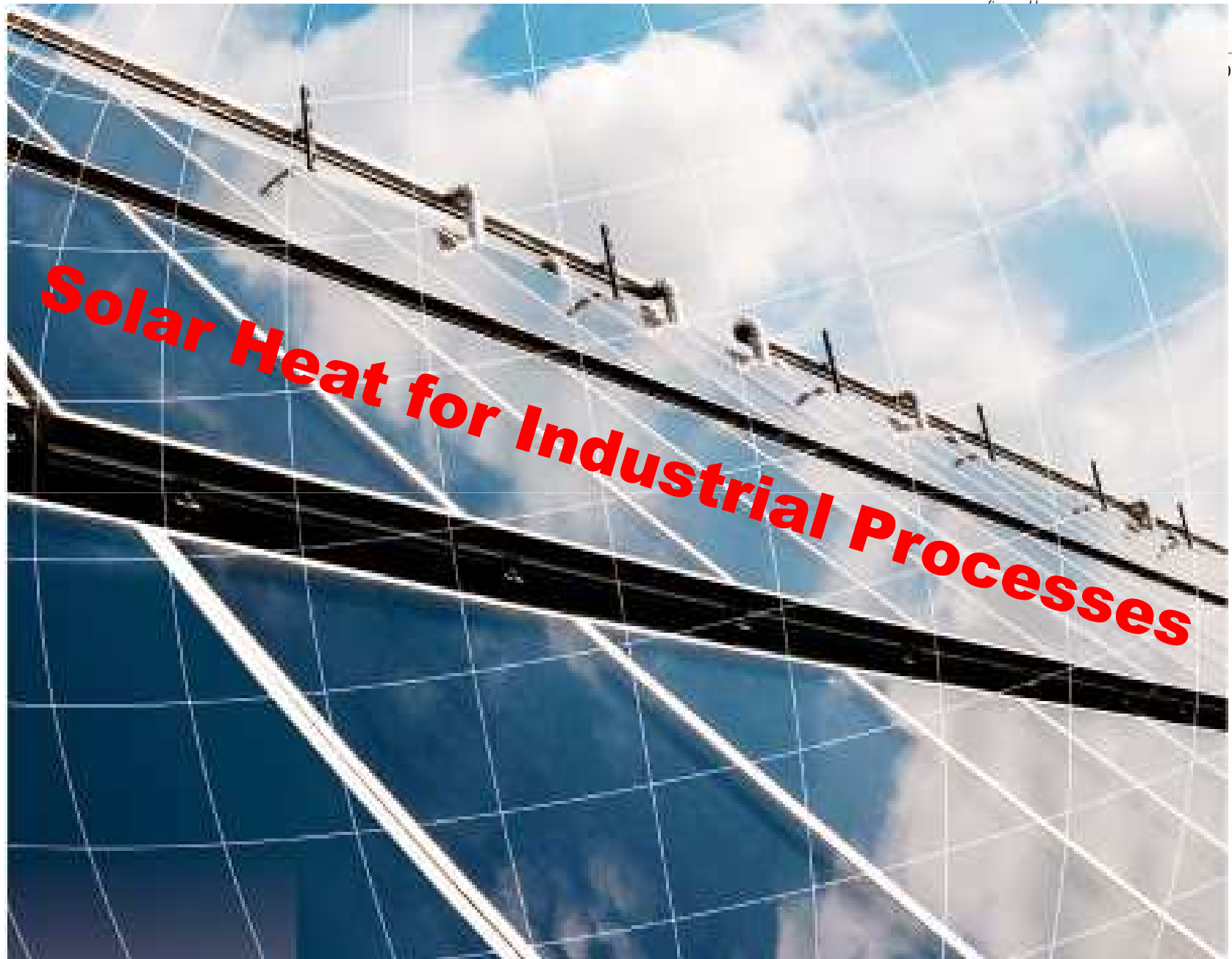
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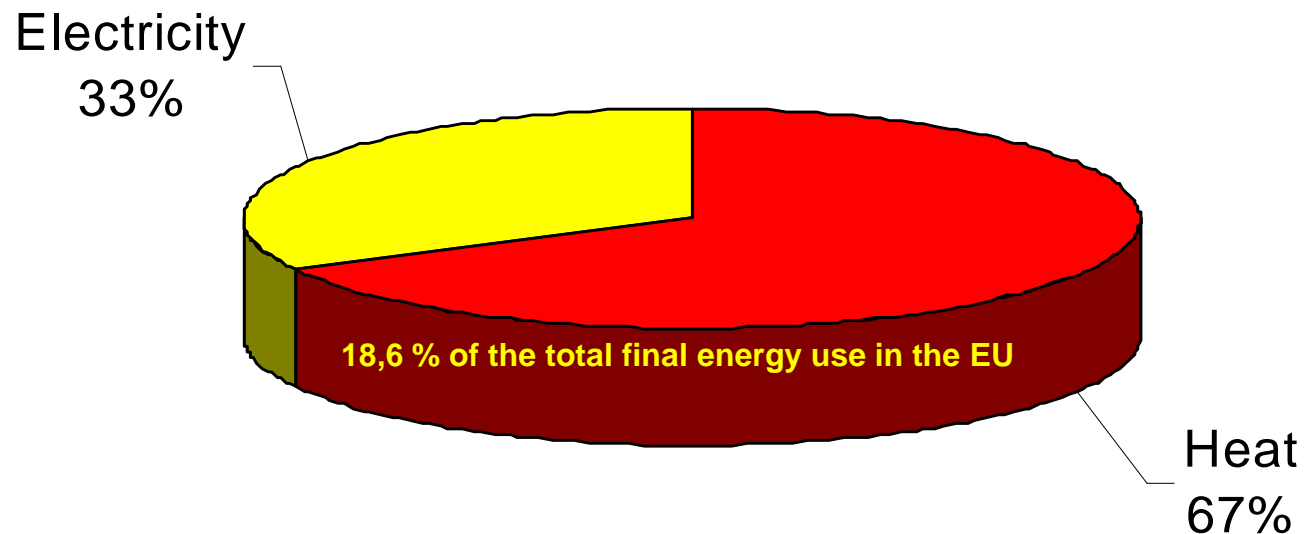


Solar yields: 400 – 460 kWh/m².a

Marstal, Denmark 12.8 MW_{th} (18.365m²)



Final Energy Use of the EU - Industry share of heat and electricity



Source: GREEN PAPER – TOWARDS A EUROPEAN STRATEGY FOR THE SECURITY OF ENERGY SUPPLY, Brussels, 2001

Space Heating of Factory Buildings





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LARGE-SCALE INDUSTRIAL APPLICATIONS





Tyras Dairy, Trikala, Greece

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Textile Industry Hangzhou China 13000m² (9 MW_{th})





Solar Drying in Guatemala

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SEA WATER DESALINATION

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Pilot System Spain, CIEMAT, INETI
252 CPC AO SOL (499 m²)



Seawater Desalination – Gran Canaria, Spain

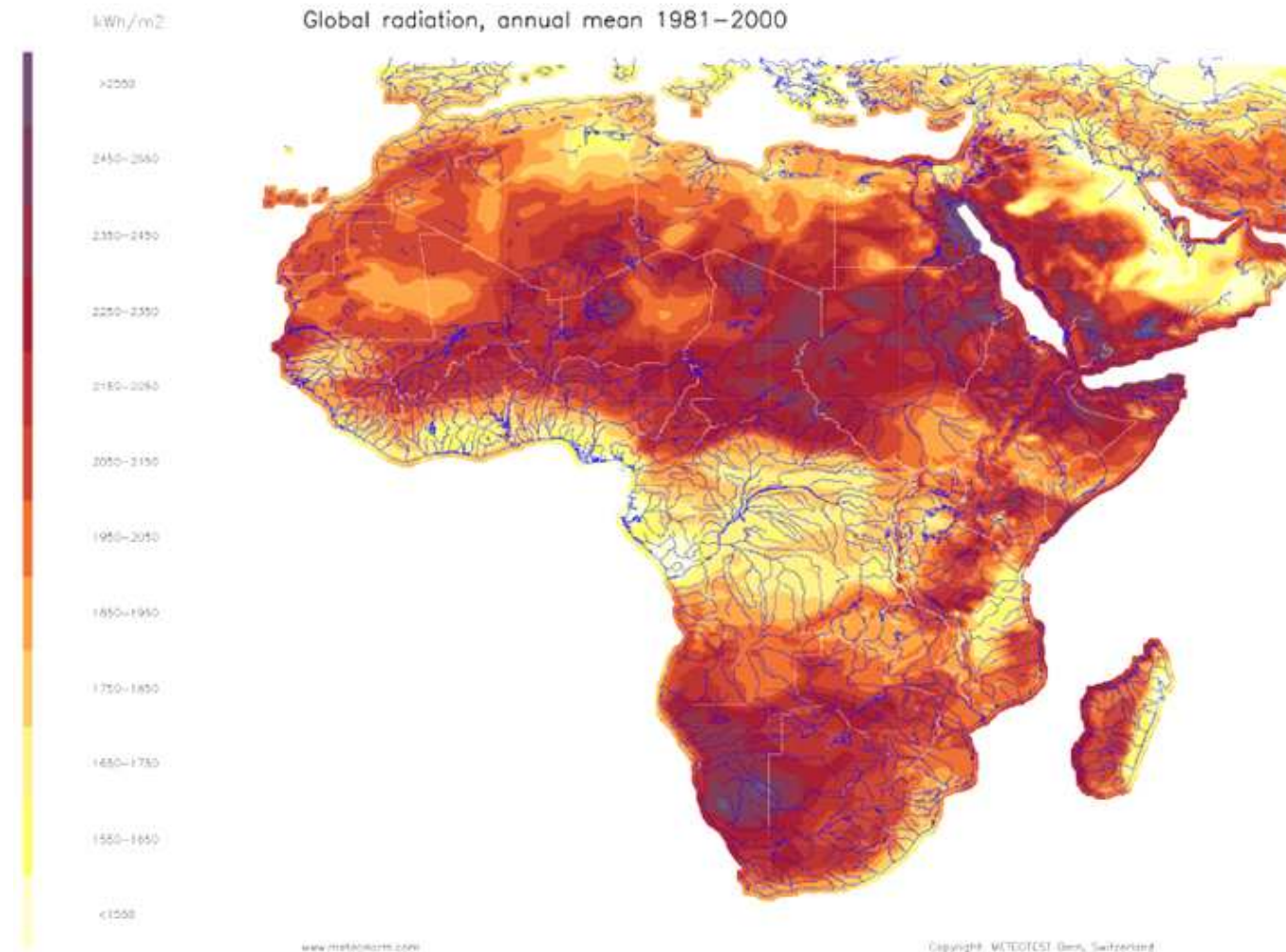
Fraunhofer ISE, Germany



The Solar Ressource in Africa

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Thank you for your attention

