Standards solarer Großanlagen IEA SHC TASK 45

2014-06-11
Highlights der Energieforschung
Wien

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SHC SOLAR HEATING & COOLING PROGRAMME INTERNATIONAL ENERGY AGENCY

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Potential Renewable Heating

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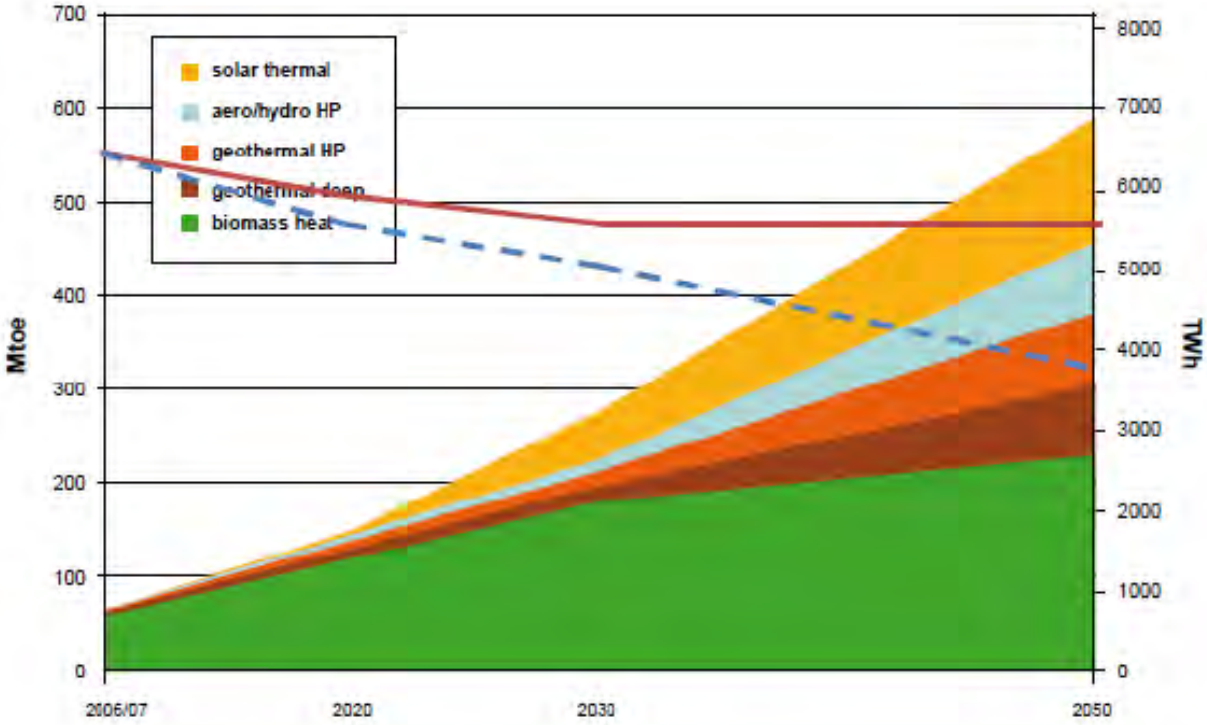
Potential for "Renewable Heating" (2011)

RHC Renewable Heating & Cooling
European Technology Platform



http://www.rhc-platform.org/publications/

Heat load scenarios:

- ❑ Business as usual
- ❑ Reduced demand

SHC - IEA Task 45 Objectives

"Large scale solar heating/cooling systems, seasonal storages, heat pumps"

Operating Agent: Jan-Erik Nielsen, PlanEnergi, DK

Overall Objectives

- Assist in a strong and sustainable market development of large solar heating and cooling systems

Scope

"MW size": Collector field > 0.5 MW ≈ > 700 m²

- Focus on district heating applications, including seasonal storage and heat pumps (chillers)

Time Schedule

- 3 years + 1 year extension 2011 - 2014

IEA Task 45 Workplan

- **SUBTASK A: Collectors and Collector loops** (Efficiency, installation guidelines, performance guarantees, simulations)
- **SUBTASK B: Seasonal Storages** (State of the art, identification R&D potential, simulations, characteristics and design guidelines)
- **SUBTASK C: Systems** (system categorisation down to component level, guidelines for financing and installation)

IEA Task 45 Workplan

- **Austrian participation:**

  AEE INTEC, S.O.L.I.D.

- **“Official” international participation:**

  Austria, Canada, China, Denmark, France, Germany, Italy, Spain

- **Numerous Observer** in broader sense > 15 countries

SUBTASKS Status

Subtask A lead by DTU, DK:

- Advancing in general according to plan with some minor delays
- Work on simulation models and operation strategies put on stand by due to lack of funding (Austria´s contribution partially depending on progress of Subtask A)

Subtask B lead by SOLITES, DE:

- Subtask B is in general behind original schedule due to late start of subtask leader
- Important deliverables pending (design guidelines, simulations)

Subtask C lead by SOLID, AT:

- No delays, but minor changes in workplan due to lack of funding of Spanish partners

SUBTASK C Results

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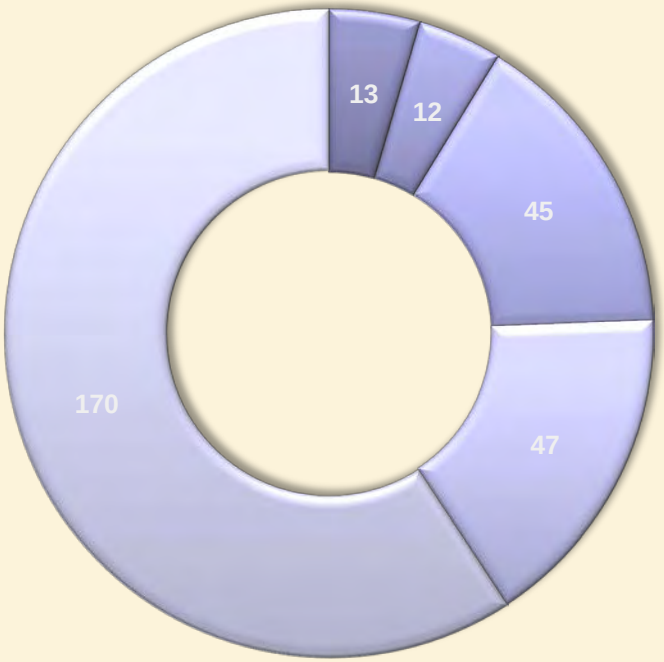
Worldwide Installed Solar Thermal Plants from 1985 - 2014



290
Installations
> 0,5MW

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Solar Thermal Technologies

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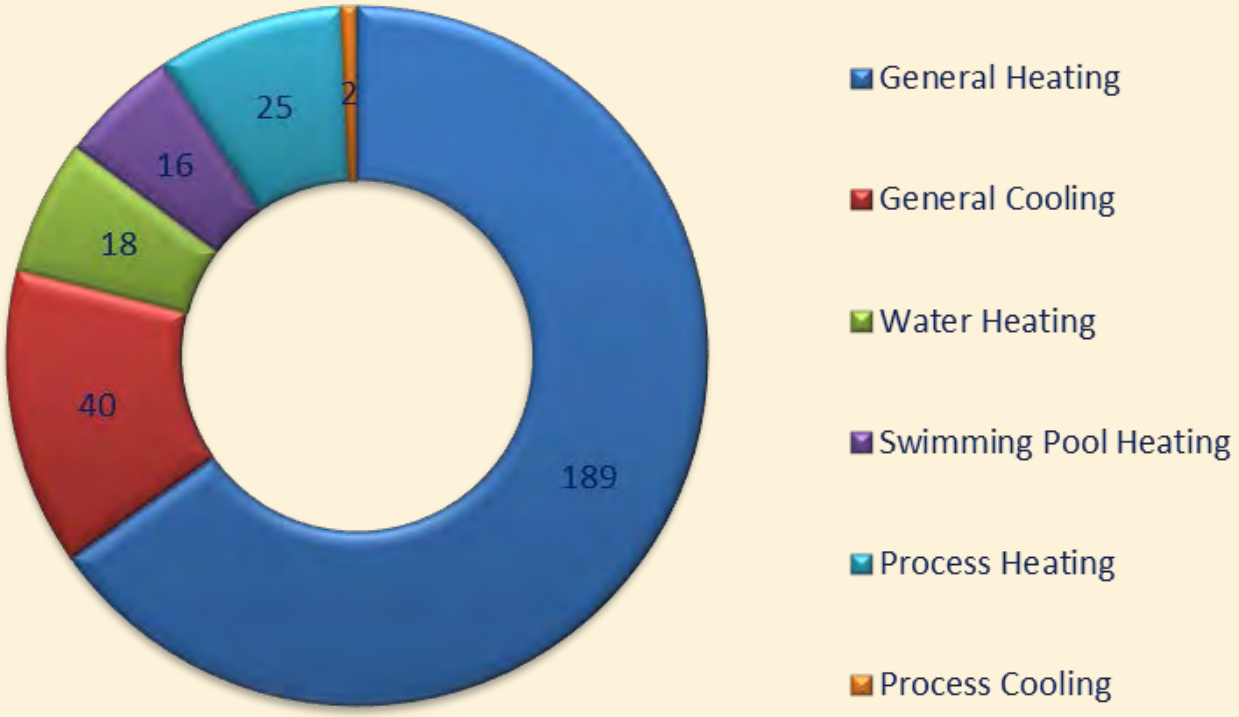
Technology Segmentation 2014



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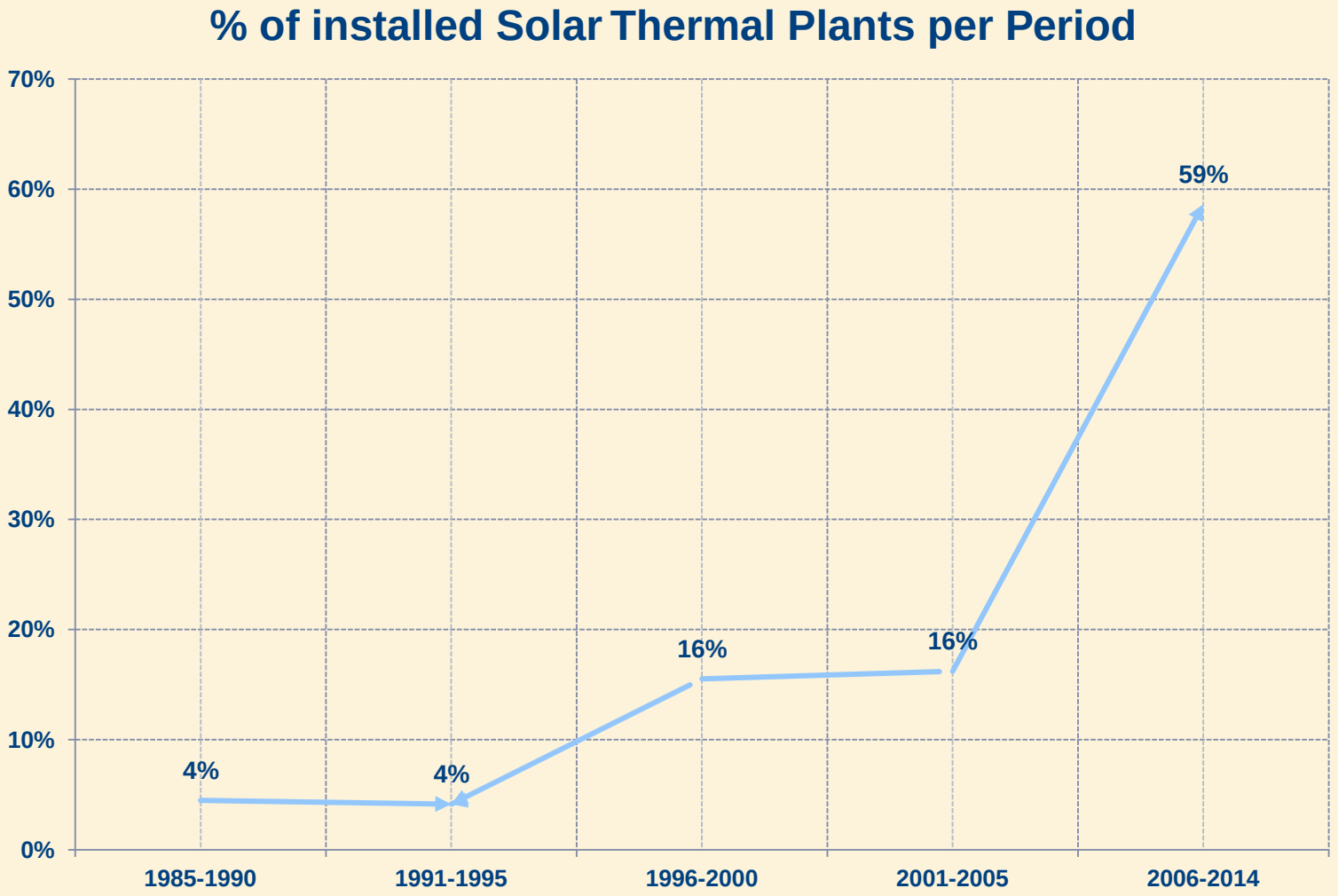
290 Installation per Periods



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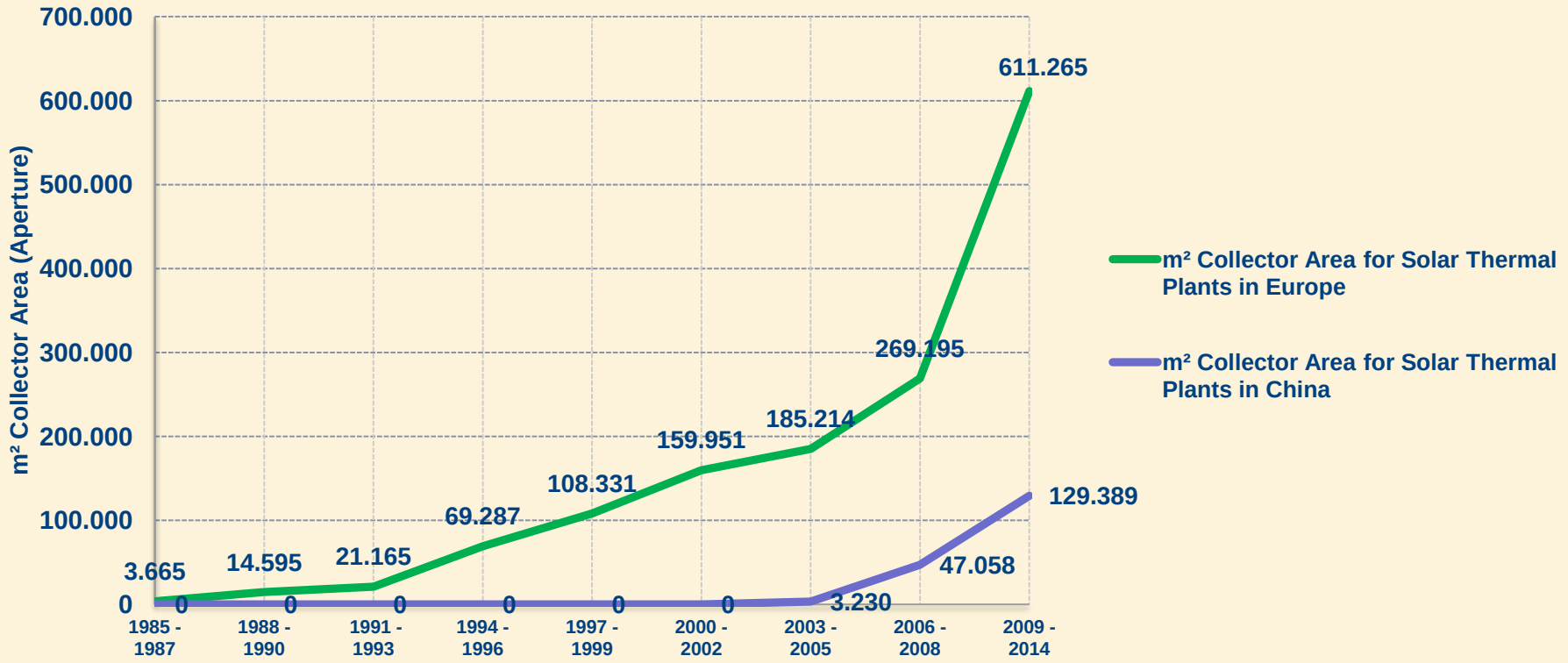
Solar Thermal Collector Area

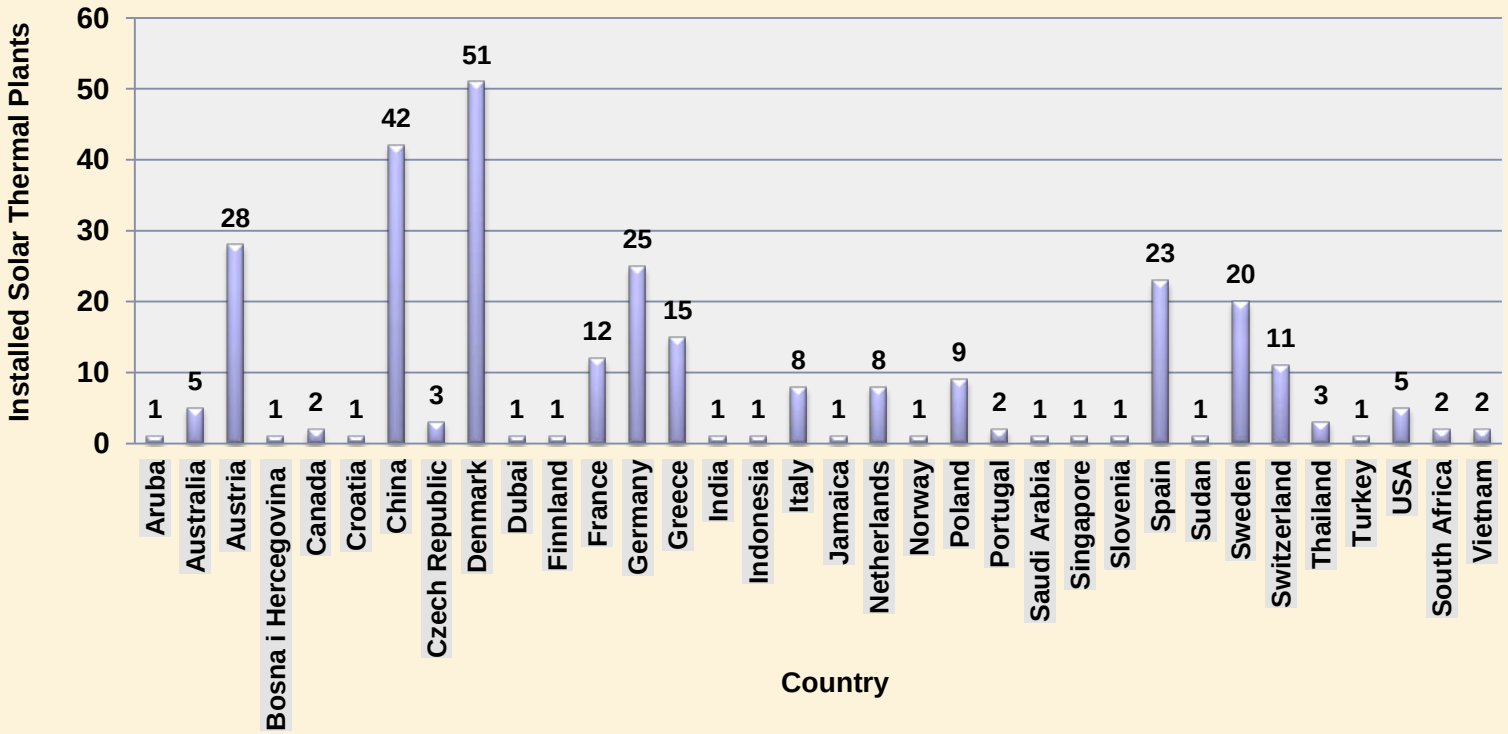
Installed Solar Thermal Collector Area in China and Europe from 1985 – 2014



Large Scale Solarthermal per Country

SOLID solarinstallation+design

Installed Solar Thermal Plants per Country



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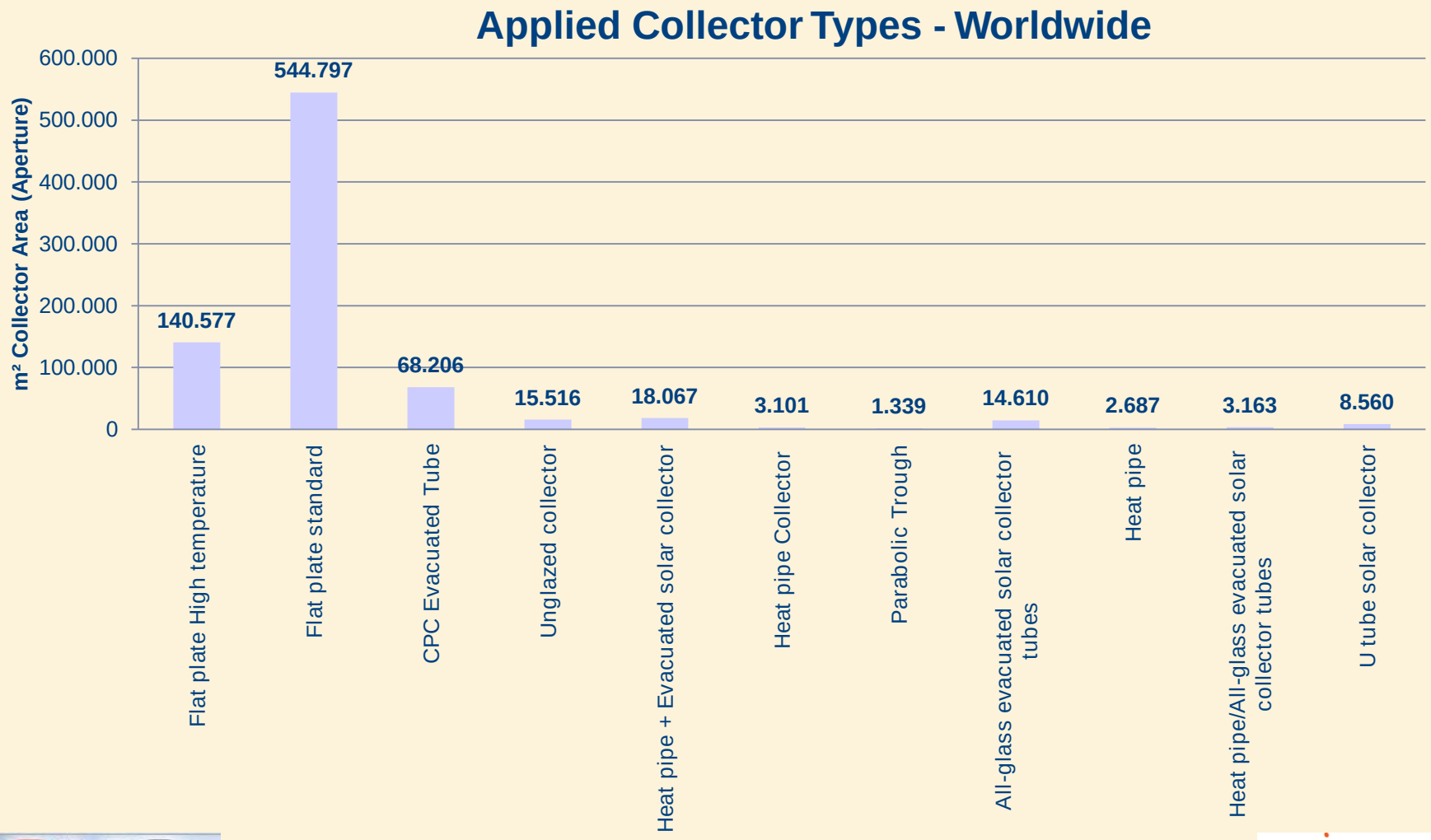
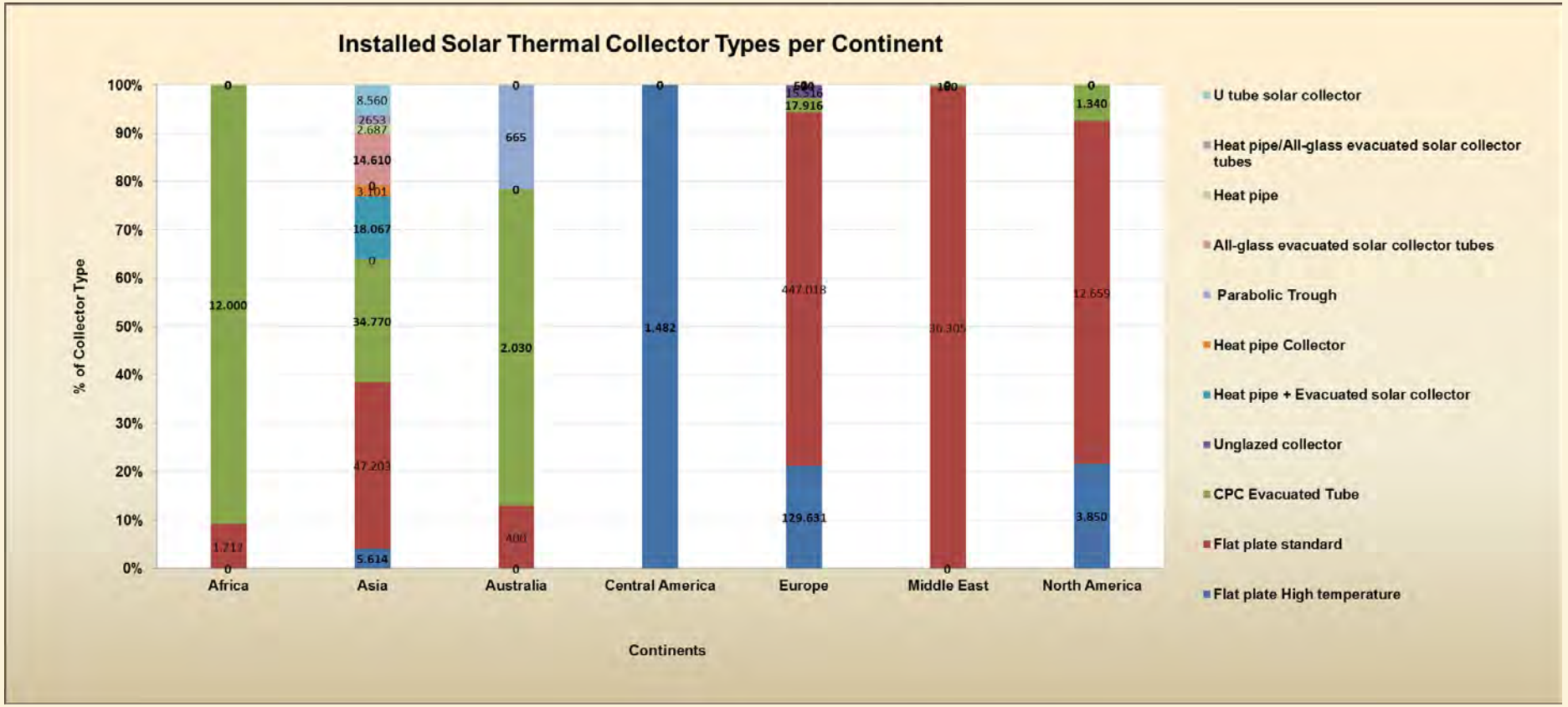
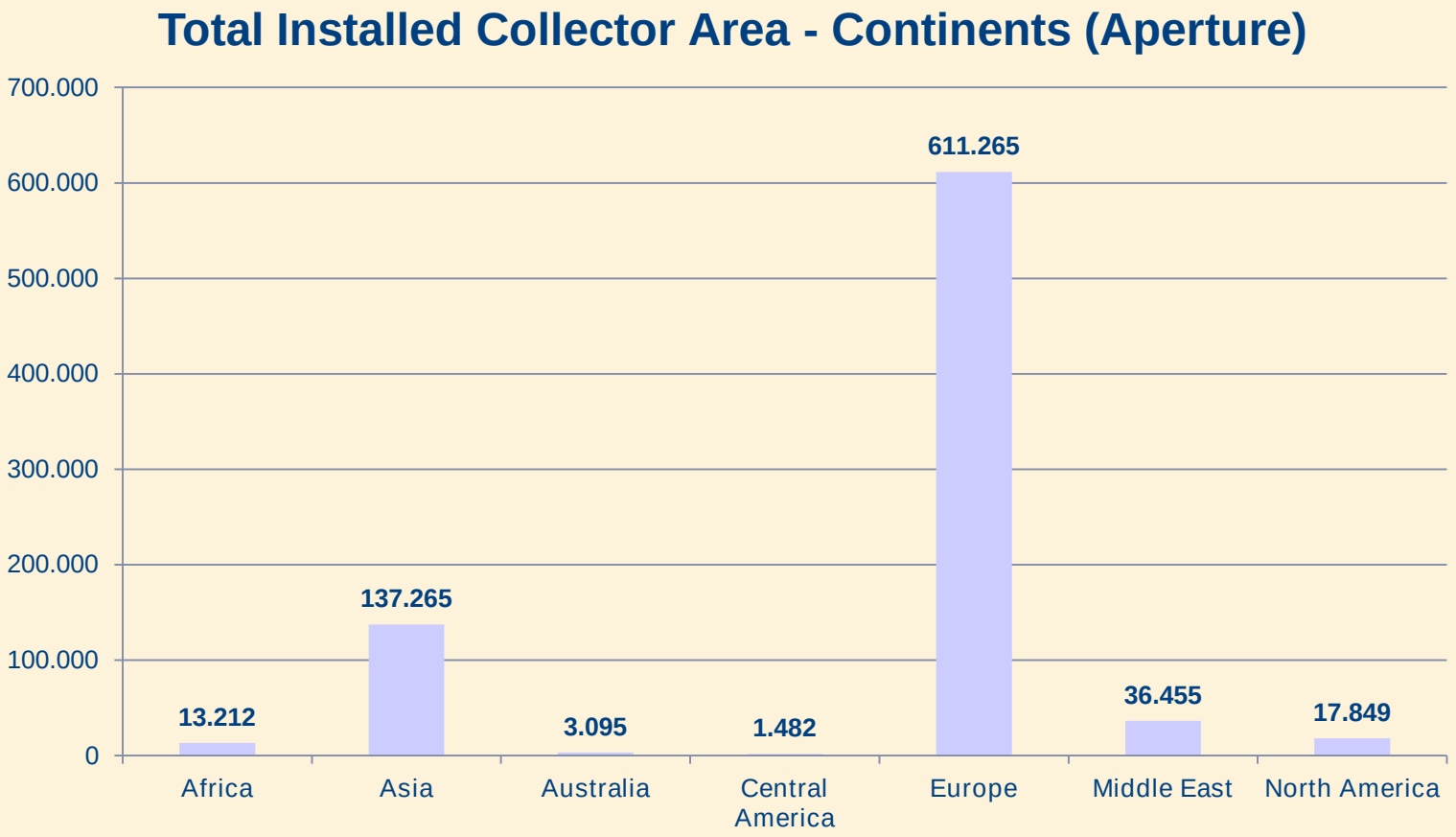
Collector Types Worldwide



Collector Types per Continent



Worldwide installed Collector Area



Denmark Activities

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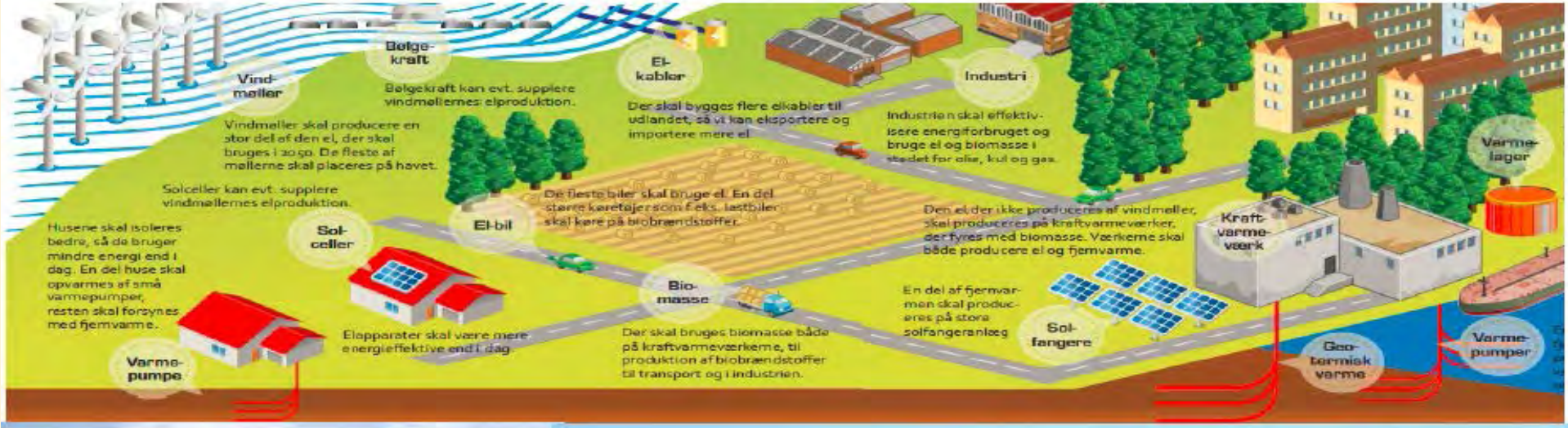
Denmark: Phase out all fossil fuels before 2050



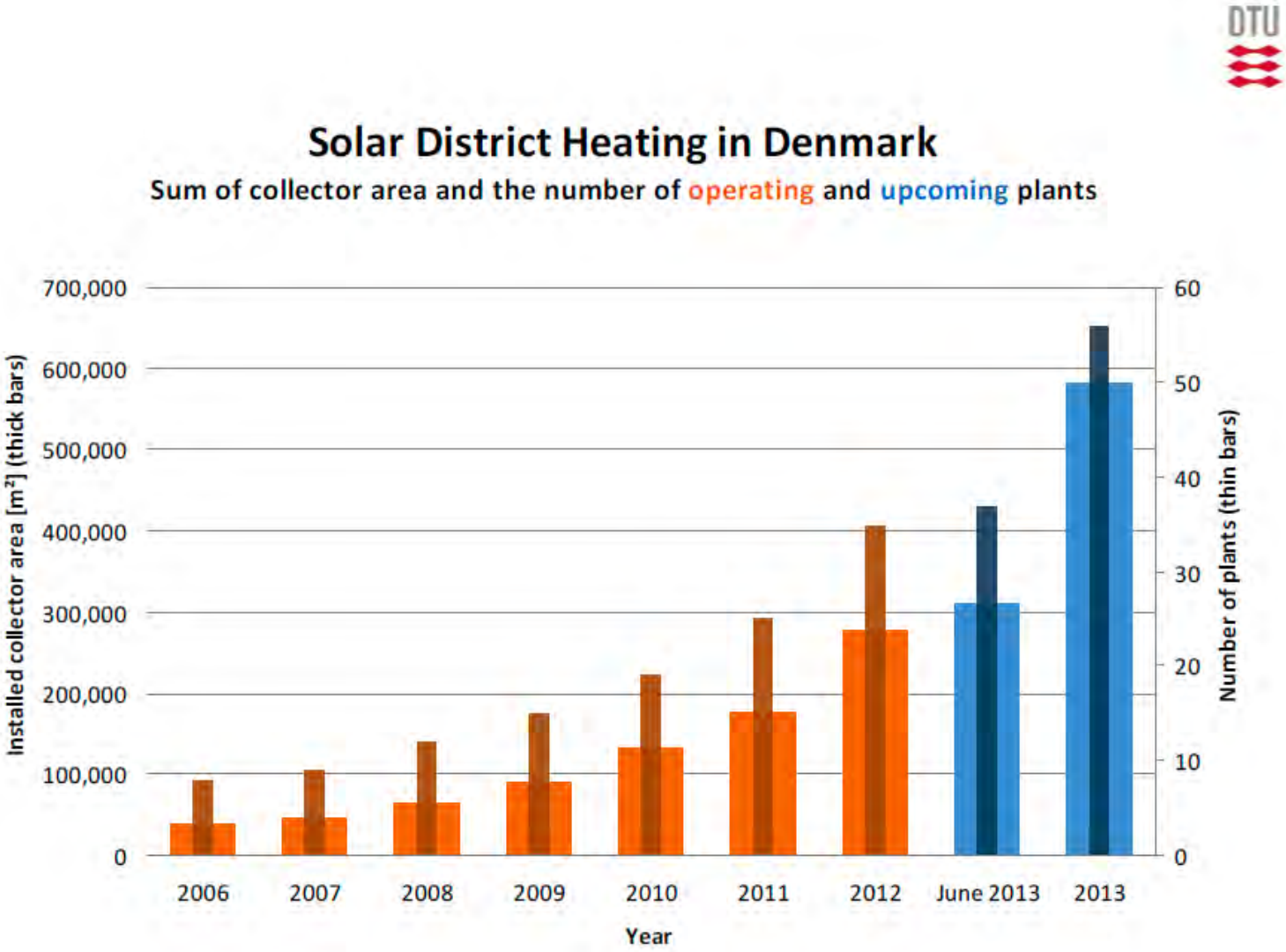
Wind energy:
2012: 30% of electricity
2020 → 50 % of increased electricity consumption (incl. transport, heat pumps, ...)

Solar heating:
2030: 15% of decreased heating demand

	District heating total	Solar district heating	
2011	133 PJ	0.3 PJ	0.2%
2012	150 PJ	0.5 PJ	0.3%
2013	140 PJ	1.0 PJ	0.7%

Today: 50% of heat demand covered by district heating
Best future solution: 70% of heat demand covered by

Solar District Heating in Denmark



Source: J.E. Nielsen, PlanEnergie

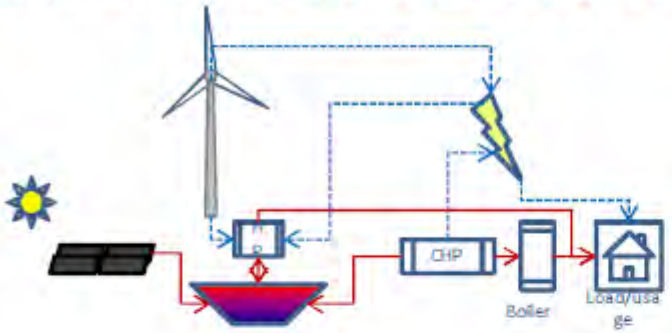
SDH Milestone in Denmark

DENMARK versus Rest of the World

- Long time tradition for district heating
- Good price / performance of ground mounted collectors
- High tax on natural gas
- Benefits from combining technologies like solarthermal, CHPs (biomass, gas) & seasonal storages
- Competitive heat production price
- Interaction with liberal electricity market
- Strong R&D activities and demonstration plants
- 2 Competition partners pushing each other

DENMARK – Rest of the World

Benefits from combining technologies and using heat storage



Solar:
- ✓ Produce free heat

CHP:
- ✓ Produce valuable electricity → earn money
- ✓ Fast capacity regulation (prod.) → earn money

Heat pump:
- ✓ Produce cheap heat
- ✓ Fast capacity regulation (load) → earn money
- ✓ Reduce storage volume

Storage:
- ✓ Gives the flexibility
- ✓ Makes the combinations of technologies possible

Source: J.E. Nielsen, PlanEnergie

DENMARK – Rest of the World

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Good price of installations

- Prices down to 190 €/m² collector ≈ 270 €/kW (system in operation)
- Average around 250 €/m² ≈ 360 €/kW
- Large modules - fast installation
- 2 companies competing rather hard:

ARCON SOLAR

SUNMARK SUSTAINABLE SOLAR SOLUTIONS

Good performance

- Max. collector field output > 530 kWh/m²; max. efficiency > 50 %
- Average output: 440 kWh/m²; average efficiency: 40 %

Source: J.E. Nielsen, PlanEnergie

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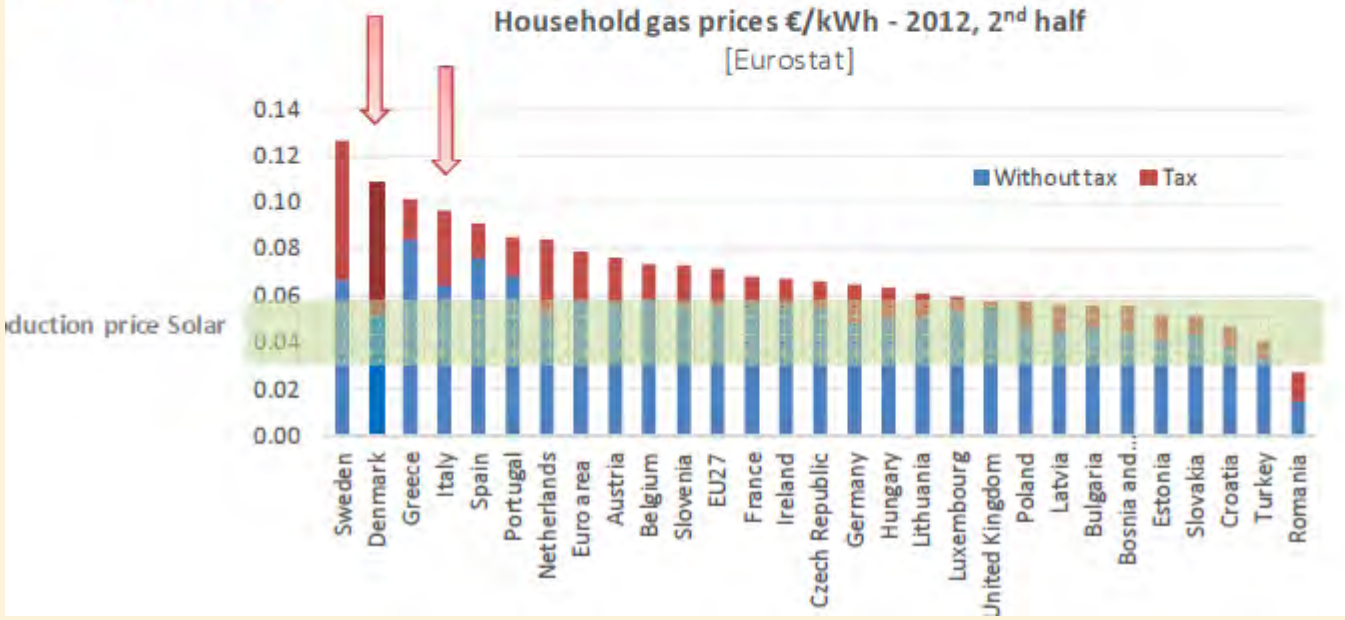
DENMARK – Rest of the World

Good heat production price

- Prices down to 30 €/MWh (0.03 €/kWh)
- Average around 45 €/MWh (0.045 €/kWh)

Gas price (with/without tax)



Source: J.E. Nielsen, PlanEnergie

SDH AUSTRIA in Graz & Wels

13.000m²

3.400m²

36.000 m² Riad

Source: AEE INTEC

1,5 MW Cooling, Singapore

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1 MW Cooling, China

Demo biggest Austrian SDH Plant

PITAGORAS — Sustainable urban planning with innovative and low energy thermal and power generation from residual and renewable sources

SEVENTH FRAMEWORK PROGRAMME

Austrian Demo in Upper Austria

- 10,000 m² of solar collectors
- Approx. 60,000 m³ heat storage
- CHP combination
- Solar District Heating

Funding: FP7-ENERGY-SMARCITIES-2012
„Large scale systems for urban area heating and/or cooling supply“

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SZDLC- Al AIN Exhibition Center

Sheik Zayed Desert Learning Center

Planning:
iC Consultants; SOLID

Location:
Al Ain, UAE

Exhibition area, theatre/cinema, café, office area; RES

Peak visitor numbers:
1,600 visitors per hour

Building certification levels:
•LEED TM (Platinum)
•Estidama (5 Pearls)

SZDLC- Al Ain Key Data Solarthermal

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Solar Cooling via concrete core activation of a desert museum

Cooling capacity:

352 kW

Collector area:

1.134 m²

Heat storage tank:

2 x 13 m³

Cold water storage tank:

5 m³

Cooling tower:

wet cooling tower shared with conventional cooling

Expected Solar yield:

825 kWh/ m²/ year

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Thank you!

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http://www.iea-shc.org/task45
http://www.nachhaltigwirtschaften.at/iea/results.html/id7598f