Standards solarer Großanlagen
IEA SHC TASK 45

IEA Vernetzungstreffen
Wien, 2015-10-29, Sabine Putz
s.putz@solid.at

Potential Renewable Heating

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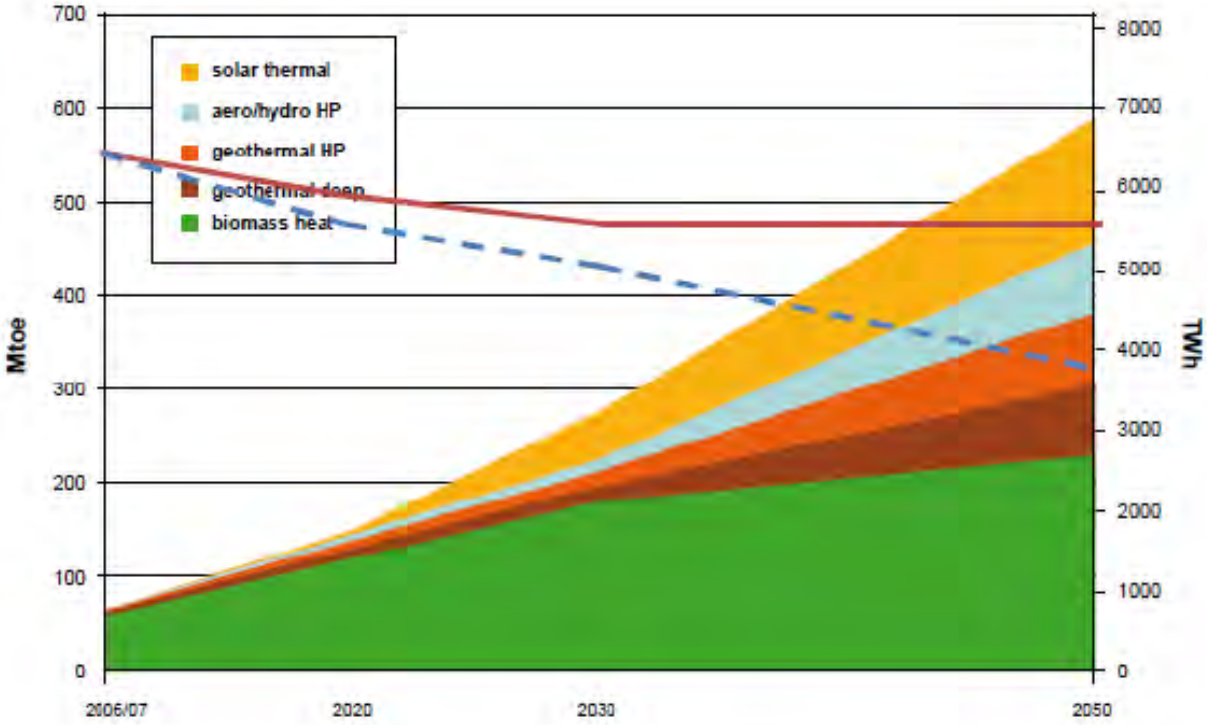
Potential for "Renewable Heating" (2011)

RHC Renewable Heating & Cooling
European Technology Platform



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

Heat load scenarios:

- ❑ Business as usual
- ❑ Reduced demand

Denmark Activities

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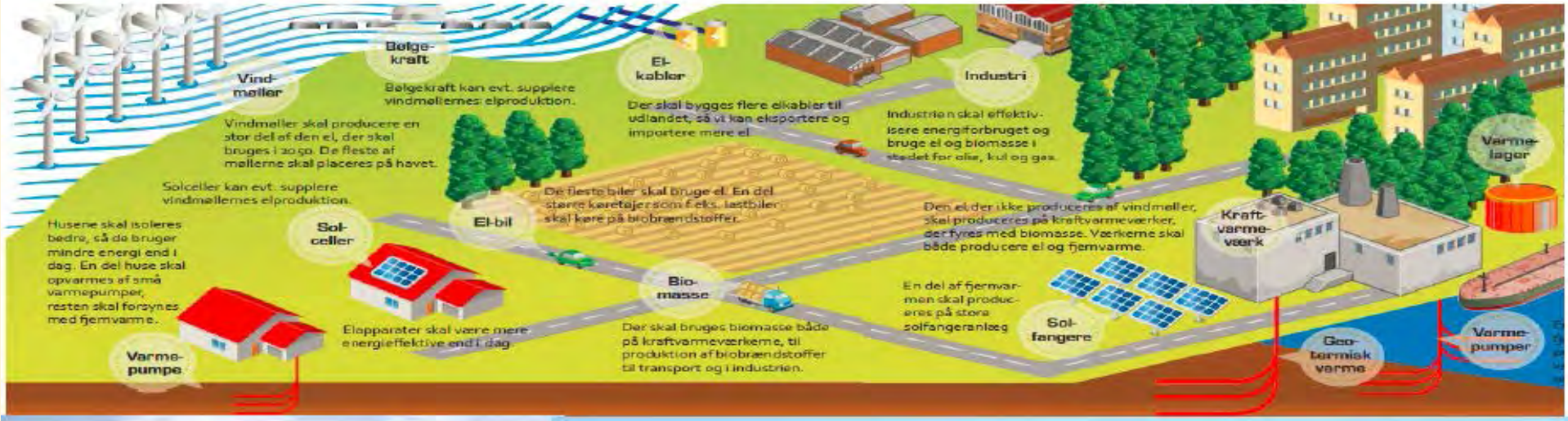
Denmark: Phase out all fossil fuels before 2050



Source: J.E. Nielsen, PlanEnergie

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

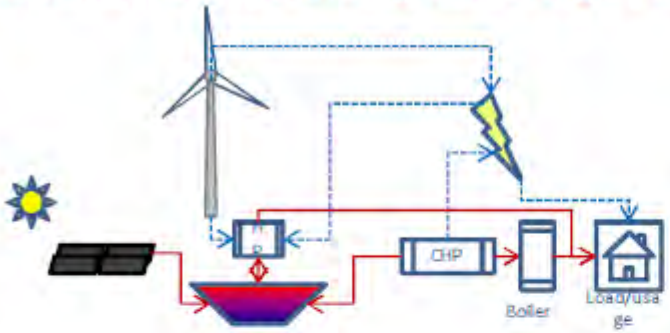
Solar heating:
2030: 15% of decreased heating demand
2050: 40% of decreased heating demand – 80% of this by district heating

	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 district heating

DENMARK – SDH Concept

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

SDH Milestone in Denmark

World Largest Solar District Heating Plant
Vojens, DK, 70,000 m² (49 MW), 200,000 m²
Source: http://www.vojensfjernvarme.dk

SHC - IEA Task 45 Objectives

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

Operating Agent: Jan-Erik Nielsen, PlanEnergi, DK

Austrian Participation: AEE INTEC, SOLID, IWT

Objectives:

- Sustainable market developement through standards for large systems
- MW size: Collector field > 0.5 MW ≈ > 700 m²
- Focus on district heating applications

Time Schedule

- 3 years + 1 year extension 2011 - 2014

IEA Task 45 Participation

Country	Number of Research Institutes	Number of Universities	Number of Companies	Number of associations	Number of test labs
Austria	1(1)		1(1)		
Canada	1(2)				1(1)
China	1(2)		1(1)		
Denmark		1(1)	1(2)	1(1)	
France	1(2)				
Germany		2(2)	2(2)		
Italy		1(1)			
Spain	1(2)	2(4)			

IEA Task 45 Workplan

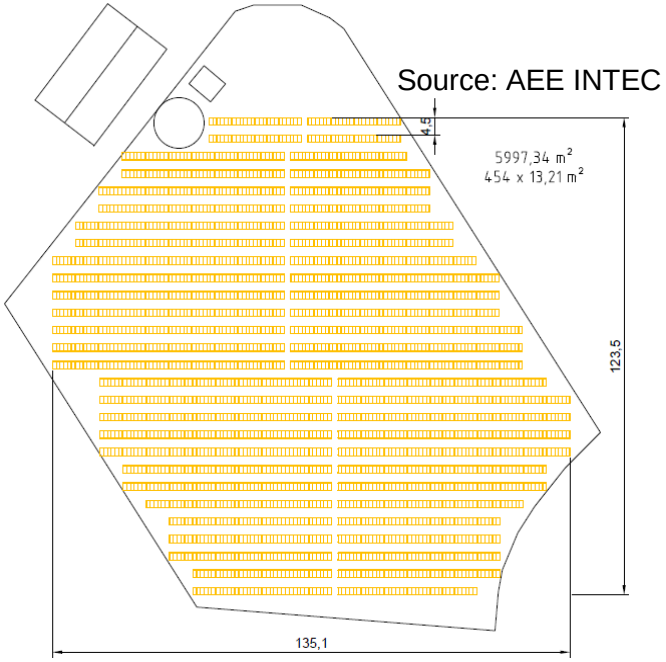
- **SUBTASK A: Collectors and Collector loops** (Efficiency, installation guidelines, performance guarantees, simulations)
- **SUBTASK B: Seasonal Storages** (State of the art, identification R&D potential, economics, simulations, characteristics and design guidelines)
- **SUBTASK C: Systems** (system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

SUBTASK A - Results

ReportNo.	Report Title	Publication Date	Access (PUblic, REstricted)	Web or Print
INFO sheet 45.0	IEA SHC Task 45 FACT SHEETS - overview	May 2015	PU	Web
INFO sheet 45.A.1	Correction of collector efficiency parameters depending on variations in collector type, fluid type, collector flow rate and collector tilt.	February 2015	PU	Web
TECH sheet 45.A.1	Correction of collector efficiency parameters depending on variations in collector type, fluid type, collector flow rate and collector tilt.	December 2014	PU	Web
INFO sheet 45.A.2	Requirements & guidelines for collector loop installation	December 2014	PU	Web
TECH sheet 45.A.2	Requirements & guidelines for collector loop installation	December 2014	PU	Web
INFO sheet 45.A.3.1	Performance guarantee - Collector field power output	April 2014	PU	Web
TECH sheet 45.A.3.1	Performance guarantee - Collector field power output	April 2014	PU	Web
INFO sheet 45.A.3.2	Performance guarantee - Collector field annual output	July 2014	PU	Web
TECH sheet 45.A.3.2	Performance guarantee - Collector field annual output	April 2014	PU	Web
INFO sheet 45.A.4	Simulation of large collector fields	December 2014	PU	Web
TECH sheet 45.A.4	Simulation of large collector fields	December 2014	PU	Web

Characteristic key figures to evaluate and optimise the hydraulic of large/complex collector fields were developed by AEE INTEC

1) Stagnation distance
2) Maximum flow velocity
3) Absorber tube Reynolds numbers
4) Specific metal mass of field piping
5) Piping network length
6) Specific copper mass in solar collector
7) Thermal capacity of the collector array
8) Ratio of hydraulic to thermal power
9) Total pressure loss
10) Efficiency loss due to uneven flow distribution
11) Overall emptying behavior



Source: AEE INTEC


Source: AEE INTEC

Measures to prevent or control Stagnation in large scale solar systems were developed by AEE INTEC

	Stagnation control	Stagnation prevention
Passive measures	large expansion vessels (small systems only <25 m²)	
	air cooler – e.g. finned tubes (small systems only <50 m²)	drain back systems
	evaporative cooler	
	passive heat sink in solar loop e.g. water storage	
Active measures	uninterruptible Power Supply (UPS) e.g. battery backup	uninterruptible Power Supply (UPS) e.g. battery backup
	active re-cooler in solar loop e.g. • water cooler • electrical re-cooling devices	active re-cooler in solar loop e.g. • water cooler • electrical re-cooling devices
		night cooling
safety valve characteristics	(usually) high opening pressure	(usually) low opening pressure
expansion vessels characteristics	large volume (water expansion + steam)	small volume (water expansion only)

Source: AEE INTEC

SUBTASK B - Results

ReportNo.	Report Title	Publication Date	Access (PUblic, REstricted)	Web or Print
INFO sheet 45.B.1	Seasonal storages - Best practise examples	Delayed	NA	NA
TECH sheet 45.B.1	Seasonal storages - Best practise examples	Delayed	NA	NA
INFO sheet 45.B.2	Seasonal storages - Monitoring	Delayed	NA	NA
TECH sheet 45.B.2	Seasonal storages - Monitoring	Delayed	NA	NA
INFO sheet 45.B.3.1	Seasonal storages – Bore hole heat storage – Guidelines for materials & construction	February 2015	PU	Web
TECH sheet 45. B.3.1	Seasonal storages – Bore hole heat storage – Guidelines for materials & construction	October 2014	PU	Web
INFO sheet 45. B.3.2	Seasonal storages – Water pit heat storage – Guidelines for materials & construction	December 2014	PU	Web
TECH sheet 45. B.3.2	Seasonal storages – Water pit heat storage – Guidelines for materials & construction	December 2014	PU	Web

http://www.sdh-online.solites.de/

SUBTASK C - Results

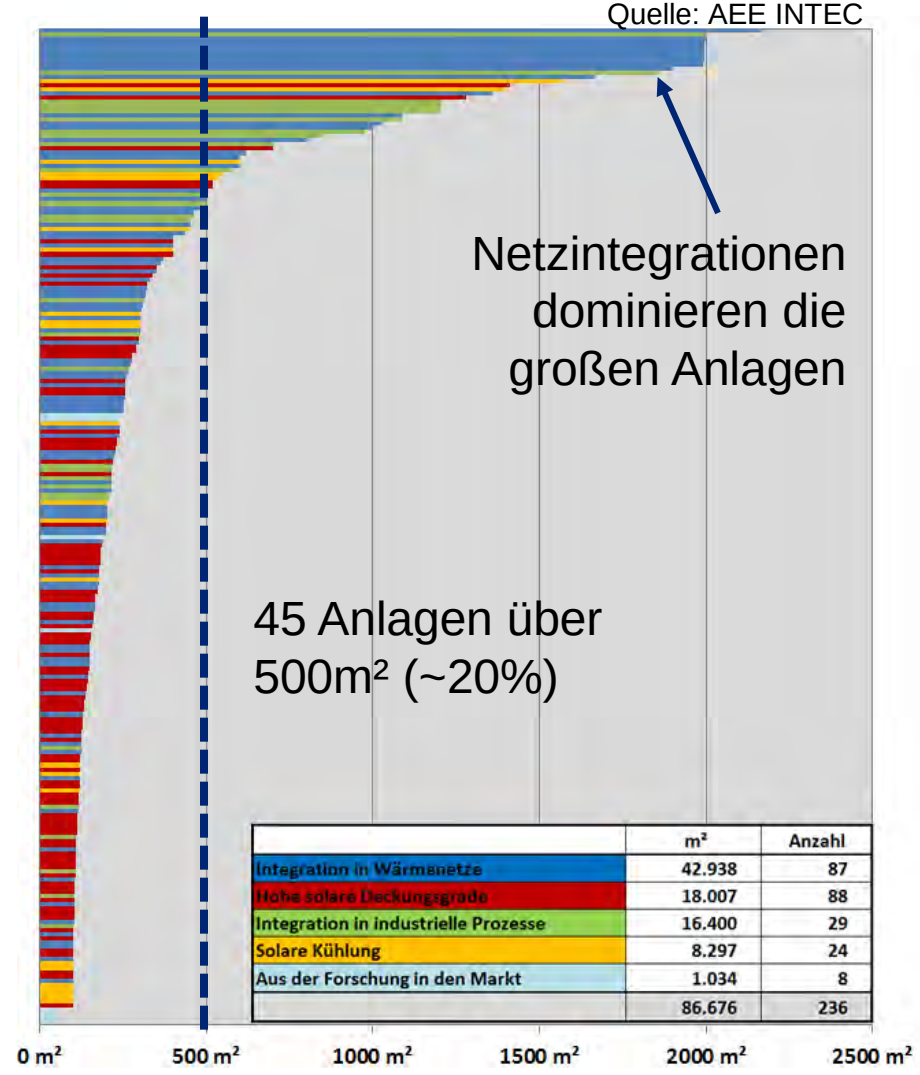
ReportNo.	Report Title	Publication Date	Access (PUblic, REstricted)	Web or Print
INFO sheet 45.C.1	Categorization of large solar heating and cooling systems	December 2014	PU	Web
TECH sheet 45.C.1	Categorization of large solar heating and cooling systems	December 2014	PU	Web
INFO sheet 45.C.2.1	ESCo models - General description	April 2015	PU	Web
TECH sheet 45.C.2.1	ESCo models - General description	April 2015	PU	Web
TECH sheet 45.C.2.2A	ESCo models - Best practice ex: Lisbon	April 2015	PU	Web
TECH sheet 45.C.2.2B	ESCo models - Best practice ex: Graz	April 2015	PU	Web
INFO sheet 45.C.3	ESCo models - Energy performance contracts - Simple model	December 2014	PU	Web
TECH sheet 45.C.3	ESCo models - general description	December 2014	PU	Web

Förderung von solaren Großanlagen in Österreich - das seit 2010 aufgelegte Programm basiert auf zwei Säulen

1. Investitionsförderung mit bis zu 50% der umweltrelevanten Mehrinvestitionskosten in vier (fünf) gewerblichen Anwendungskategorien
2. Wissenschaftliche Begleitung durch AEE INTEC (Leitung), AIT und ASIC
   - Verpflichtende Beratungsgespräche mit allen Förderwerbern (vor Einreichung)
   - Messtechnische Begleitung ausgewählter Projekte über zumindest ein Jahr
     - Diskussion des finalen Hydraulik- und Regelungskonzeptes
     - Erstellung eines spezifischen Monitoringkonzeptes nach den Vorgaben des Monitoring-Leitfadens (Input-Output-Analyse)
     - Inbetriebnahme des Monitoringsystems
     - Detaillierte Anlagenanalyse und ggf. Kommunikation von Verbesserungspotenzialen (intensiviert in den ersten 3 bis 5 Monaten)
     - Analyse von etwaigen durchgeführten Verbesserungsmaßnahmen
     - Routineanlagenüberwachung bis Ende des Messjahres
     - Durchführung einer Jahresauswertung und einer Anlagendokumentation
   - Rückkopplung zum Programmmanagement des Klima- und Energiefonds
   - Rückkopplung zur Branche (Technologieentwicklung, Forschungsfragen, etc.)

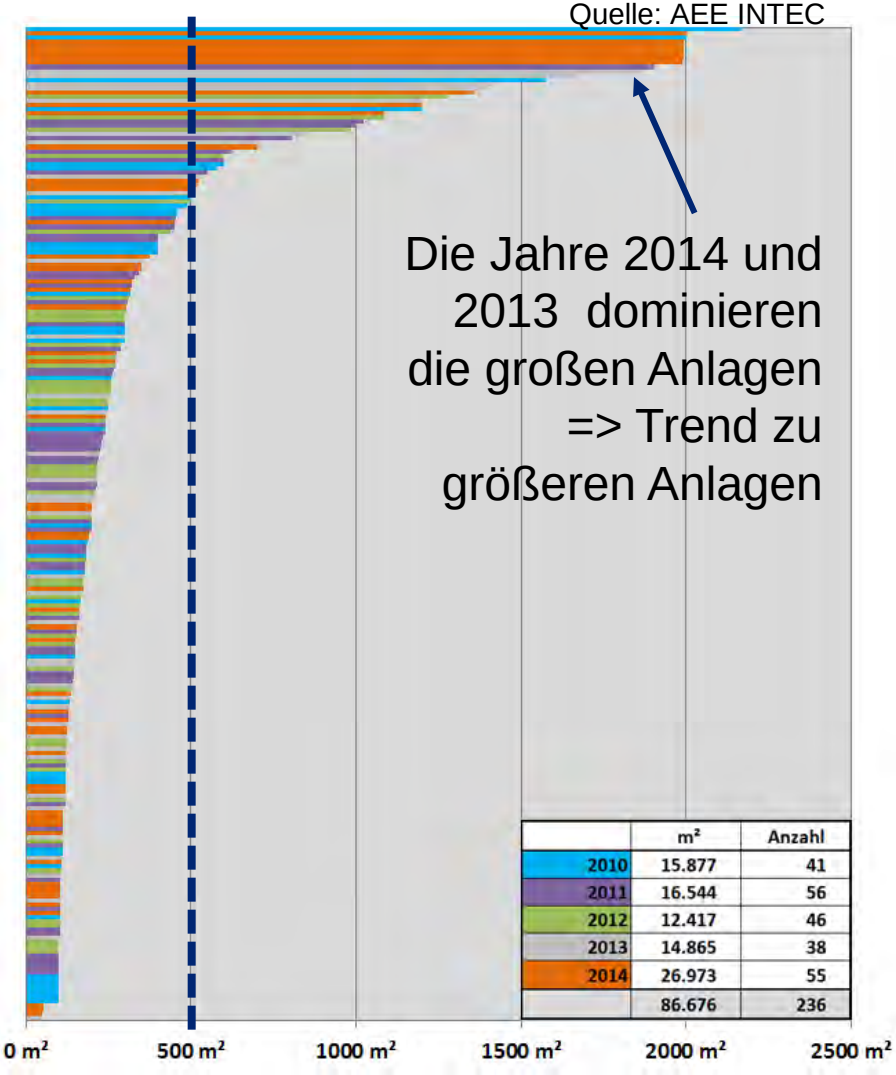
236 Beratungsgespräche in fünf Jahren dargestellt nach Anwendung und Einreichjahr

Quelle: AEE INTEC



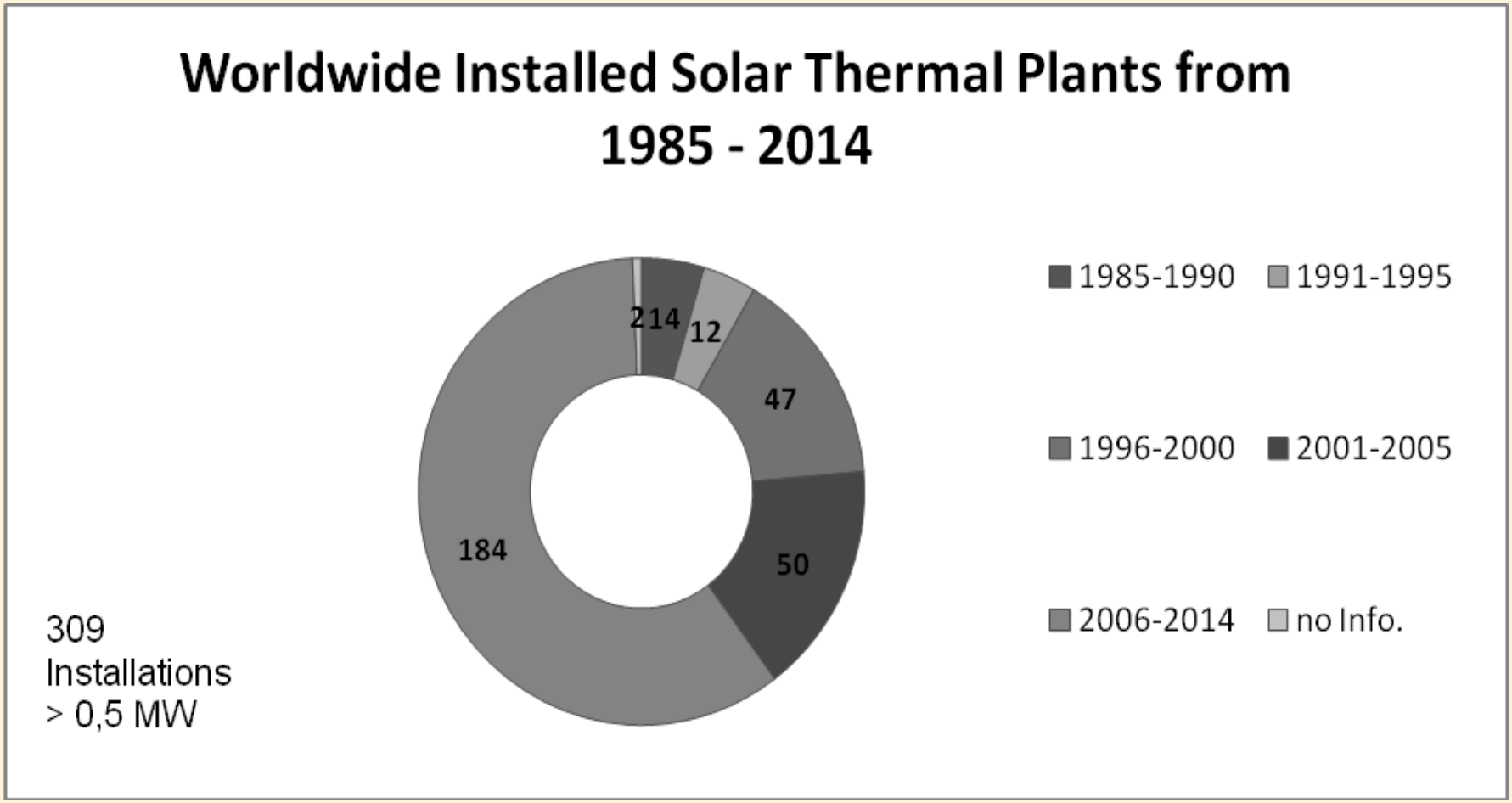
	m²	Anzahl
Integration in Wärmenetze	42.938	87
Hohe solare Deckungsgrade	18.007	88
Integration in industrielle Prozesse	16.400	29
Solare Kühlung	8.297	24
Aus der Forschung in den Markt	1.034	8
	86.676	236

Quelle: AEE INTEC

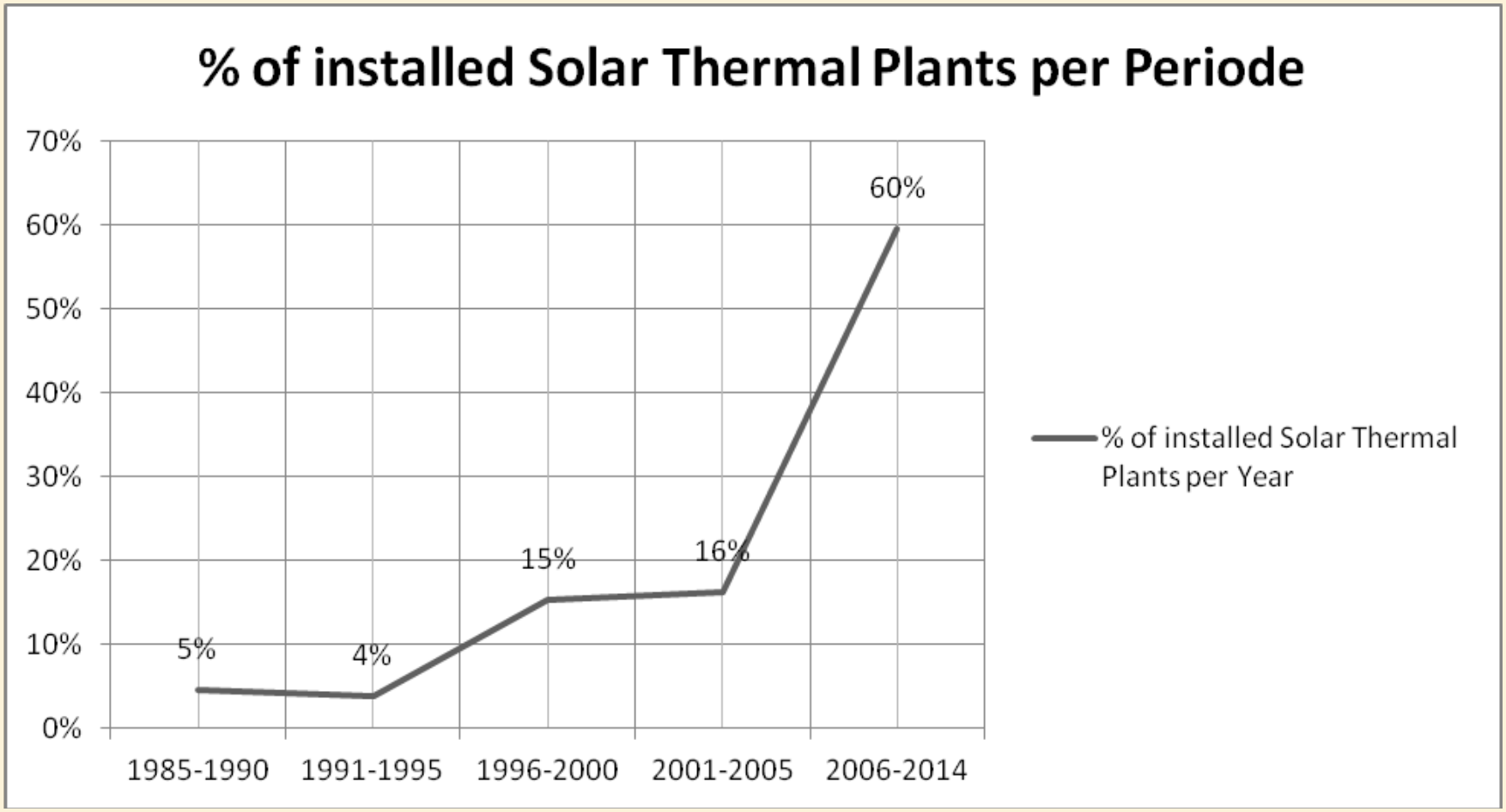


	m²	Anzahl
2010	15.877	41
2011	16.544	56
2012	12.417	46
2013	14.865	38
2014	26.973	55
	86.676	236

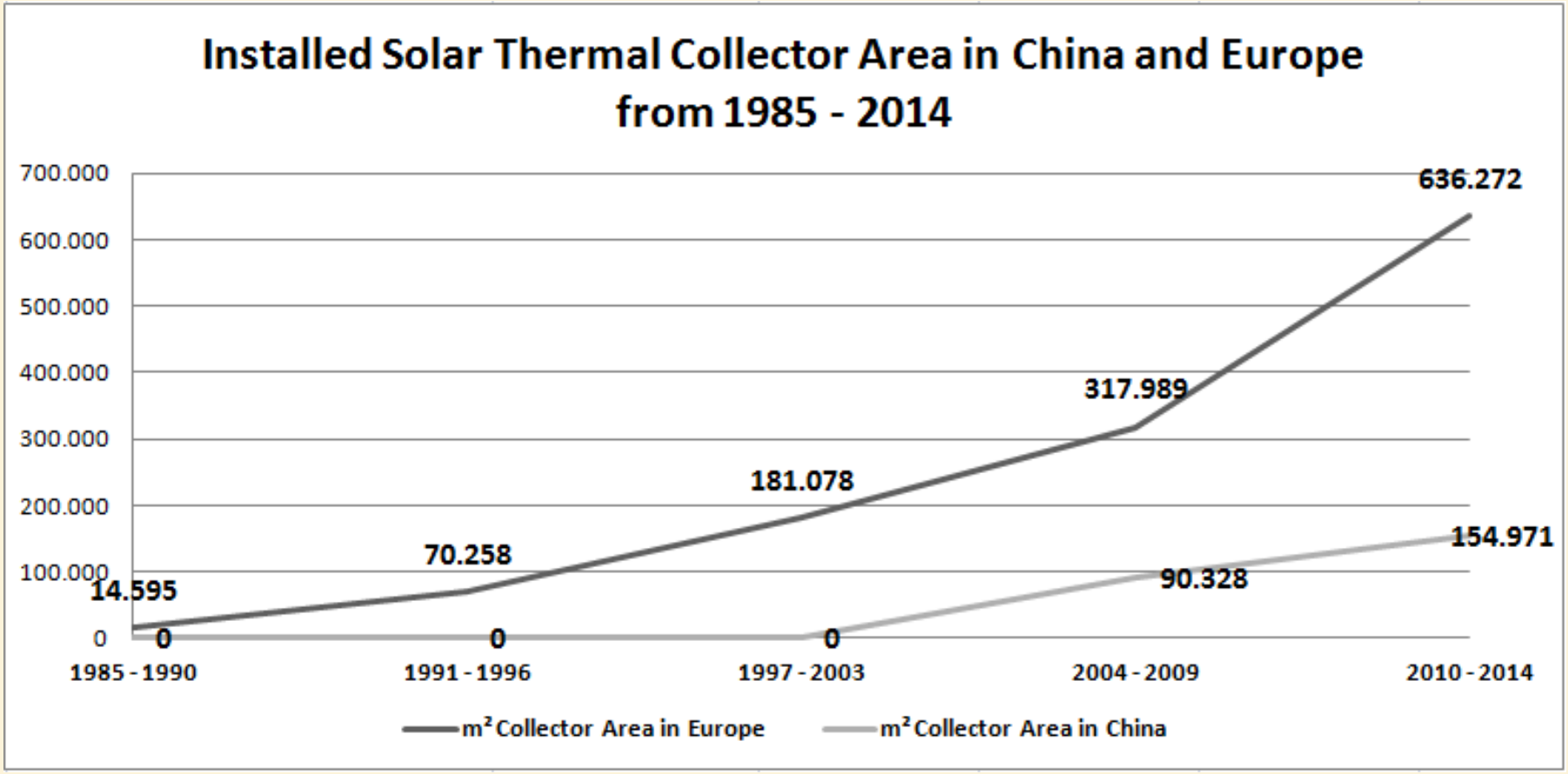
SUBTASK C Results – Systems > 0,5 MW



309 Installations per Periods



Solar Thermal [m²] CHINA - EUROPE



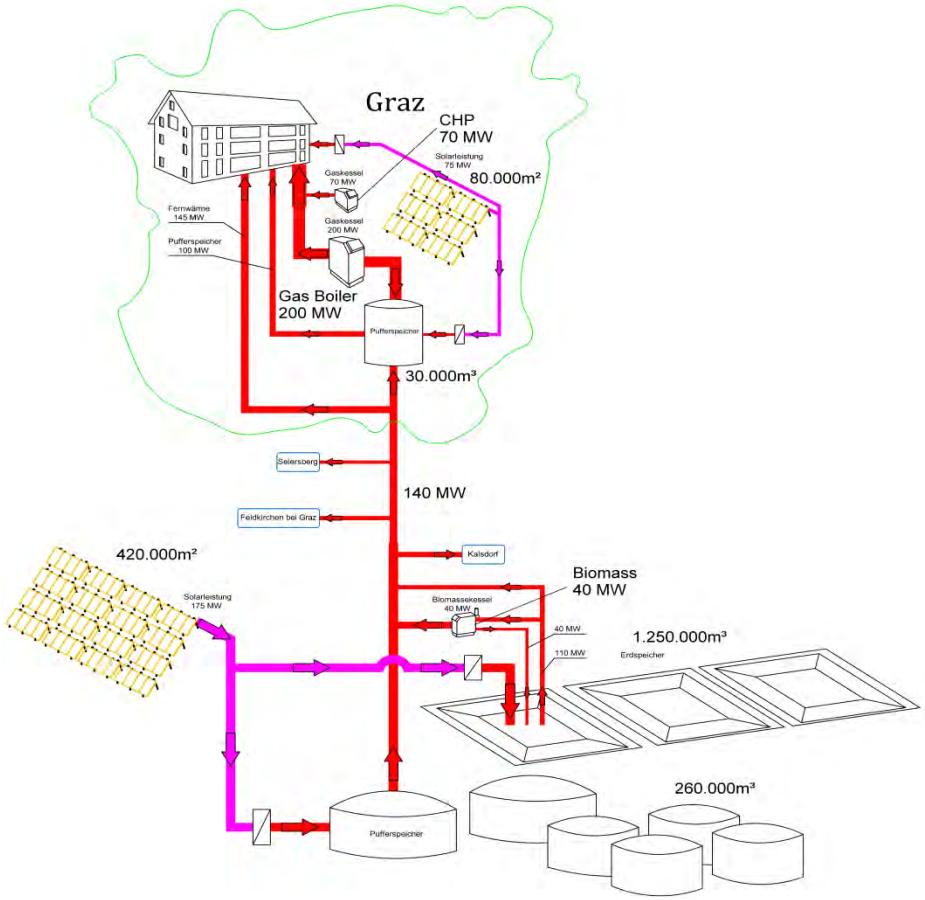
Ausblick neuer IEA TASK

“Large Scale Solar District Heating and Cooling Systems”

Definition Workshop, 05-11-2015, Graz

PlanEnergi ARCON SUNMARK

Vojens, DK, 70,000 m² (49 MW), 200,000 m³



http://task45.iea-shc.org/

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Besten Dank für die Aufmerksamkeit!