sustainable energy TRANSFORMATION

SHC SOLAR HEATING & COOLING PROGRAMME INTERNATIONAL ENERGY AGENCY

International Energy Agency Solar Heating and Cooling Program

Ken Guthrie

Deputy Chair - IEA SHC Executive Committee

27 March 2014

AUSTRALIAN PV INSTITUTE

Overview

- What are IEA Implementing agreements?
- An overview of the IEA SHC program
- Some highlights of the SHC program
- Participating on IEA Tasks
- The Australian contracting party APVI

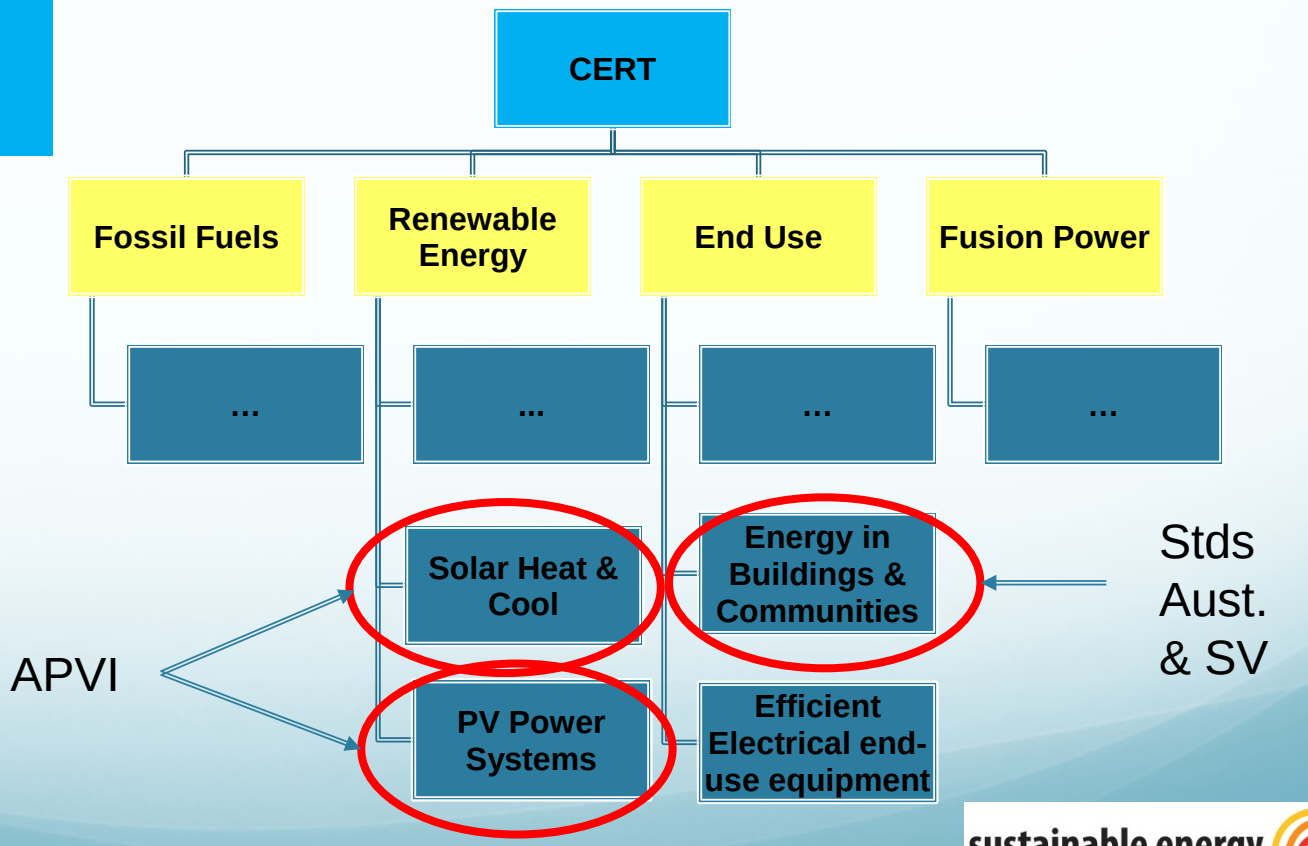
Energy Technology Co-operation

The primary mechanism for collaboration on technology matters are the co-operative Research, Development and Demonstration programs carried out in the Implementing Agreements (also called Multilateral Technology Initiatives)

IEA Committee on Energy Research and Technology

Working Parties

45 Implementing Agreements (IA) (Examples)



Research Tasks

- International collaborative research tasks are managed by the Executive Committees (ExCo) of each Agreement
- Tasks (called Annexes in EBC) are Managed by an Operating Agent and Sub Task leaders.
- Tasks typically run 3-5 years.
- Tasks need at least 5 countries participating.

IEA SHC - Member Countries

SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY


Australia


Austria


Belgium

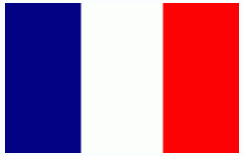

Canada


China


Denmark


EC


Finland

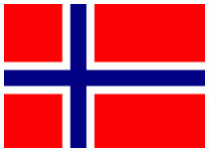

France


Germany


Italy


Mexico


Netherlands


Norway


Portugal


Singapore


South Africa


Spain


Sweden


Switzerland


United States

What do we mean by Solar Heating and Cooling?

Solar energy technologies and architectural designs that include active **solar thermal heating** and **cooling**, **photovoltaics for heating** and **cooling**, **passive solar** and **daylighting** are essential components of a sustainable energy future.

These technologies and design techniques can be applied to providing comfort, light and sanitary hot water in the built environment and heating, cooling and drying in industrial and agricultural processes.

Also essential to the development of markets are improved **solar resource data,** worldwide harmonization of **test standards** and **certification programs** and the regular publication of **worldwide market data** on solar thermal heating and cooling

VISION

By 2050 a worldwide capacity of 5kW$_{th}$ per capita of solar thermal energy systems installed and significant reductions in energy consumption achieved by using passive solar and daylighting: thus solar thermal energy meeting 50% of low temperature heating and cooling demand

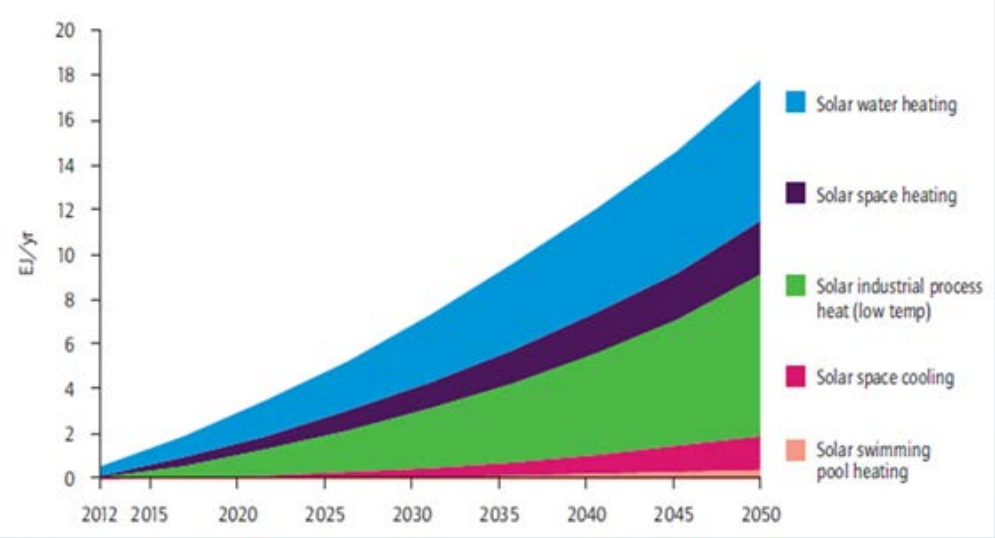
MISSION

To enhance collective knowledge and application of solar heating and cooling through international collaboration in order to fulfill the vision

Key Technologies and Applications

In the near future, the most important solar heating and cooling applications in the member countries of the Solar Heating and Cooling Implementing Agreement are expected to be:

- Solar water heating
- Solar space heating by district heating and combi systems (domestic hot water and space heating) with a high solar fraction
- Solar heat for industrial processes and agriculture
- Solar cooling, air conditioning and refrigeration
- Solar water treatment



Conferences

SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

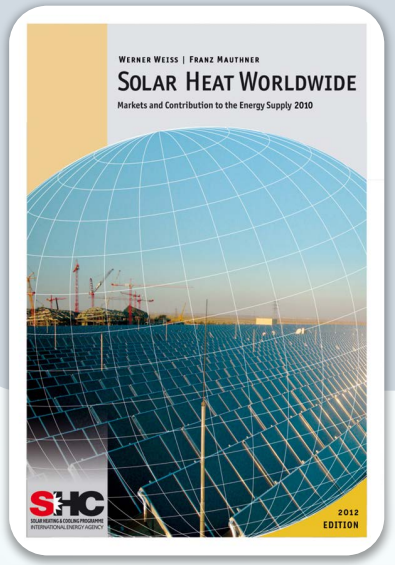
SHC 2014

13 -15 0CTOBER

BEIJING CHINA

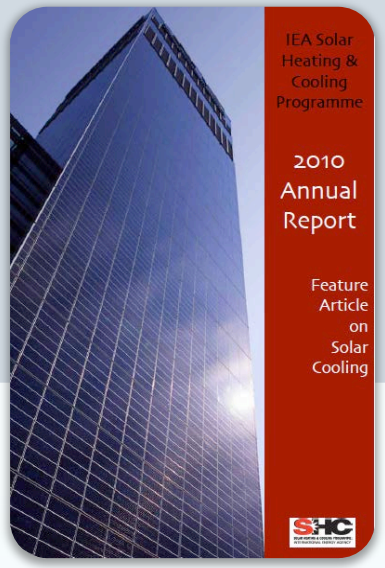
SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Publications

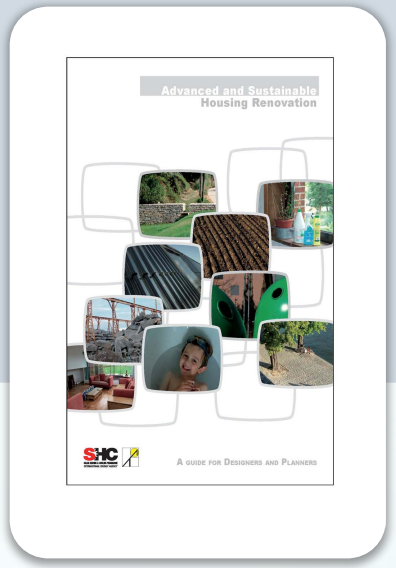


Solar Heat Worldwide

Solar Update



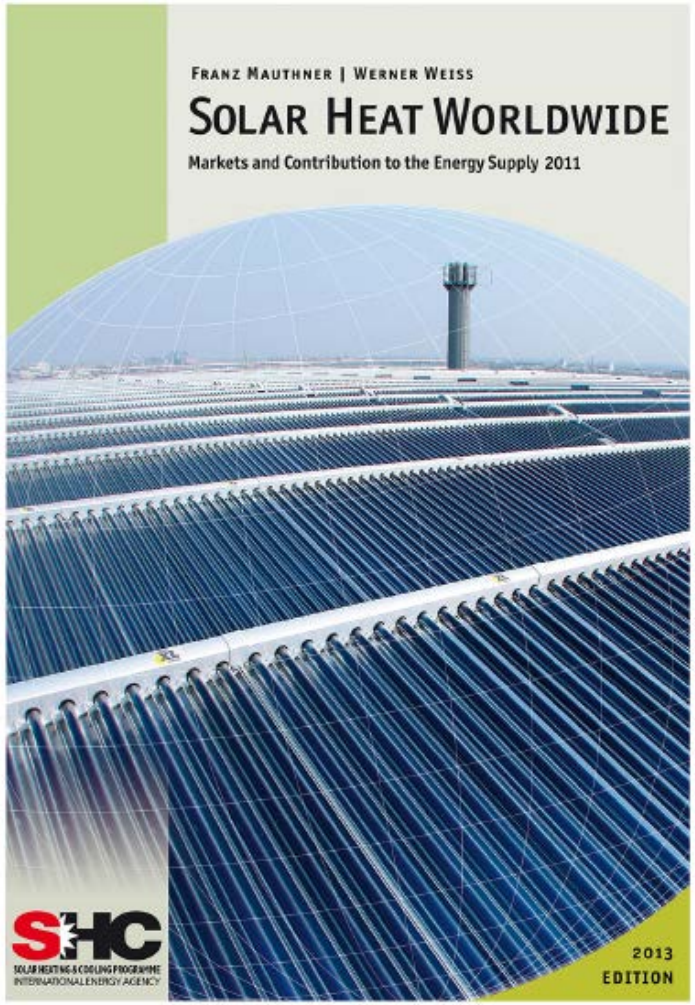
Annual Report



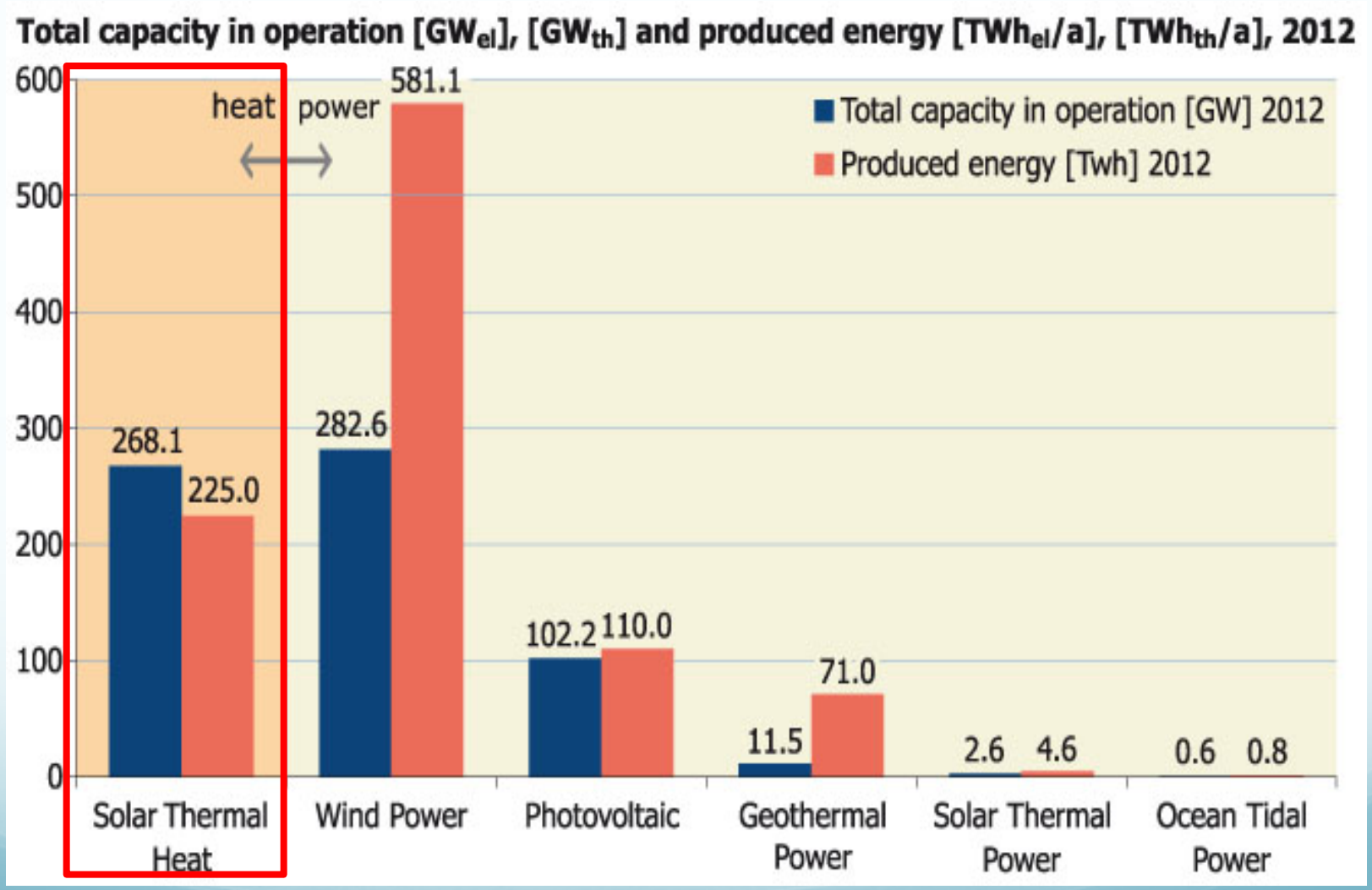
Task Reports

Solar Heat Worldwide 2011

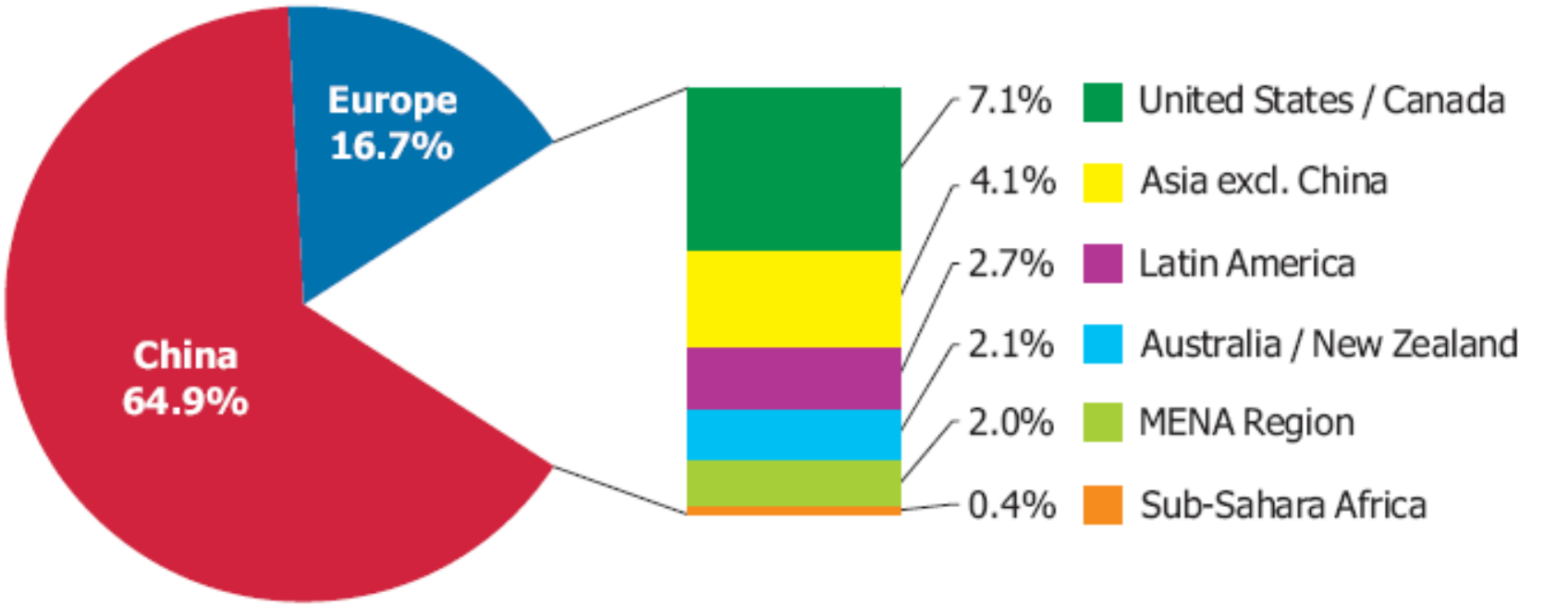
Edition 2013



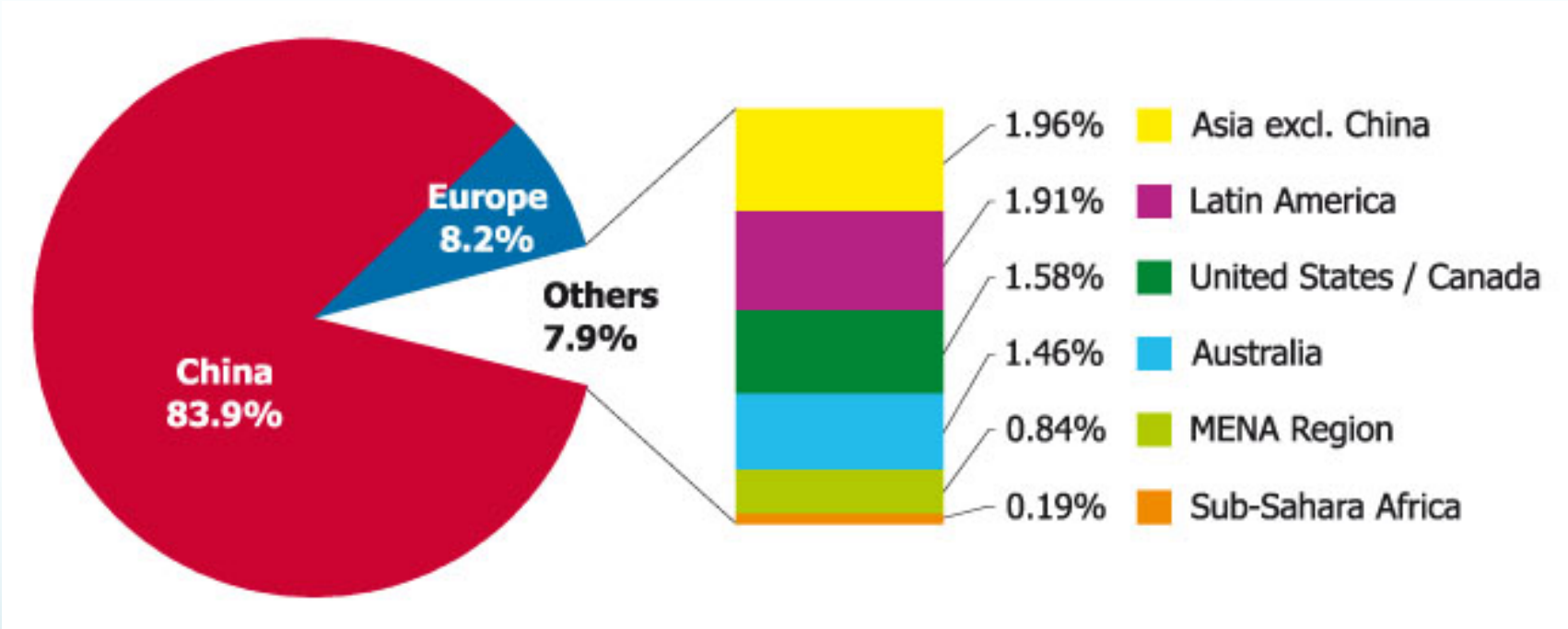
Installed Capacity - 2012



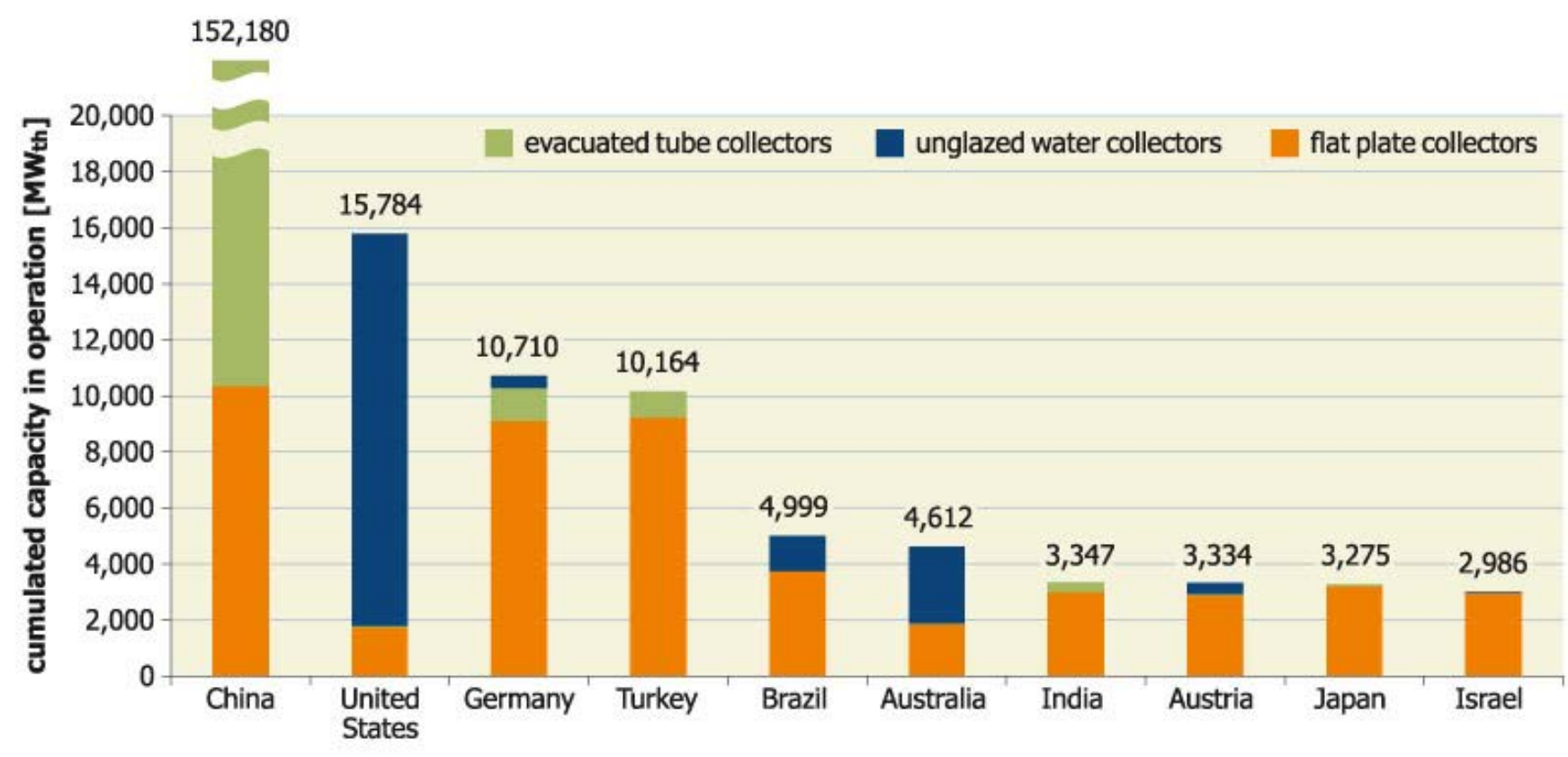
Total installed capacity in operation by economic regions at the end of 2011



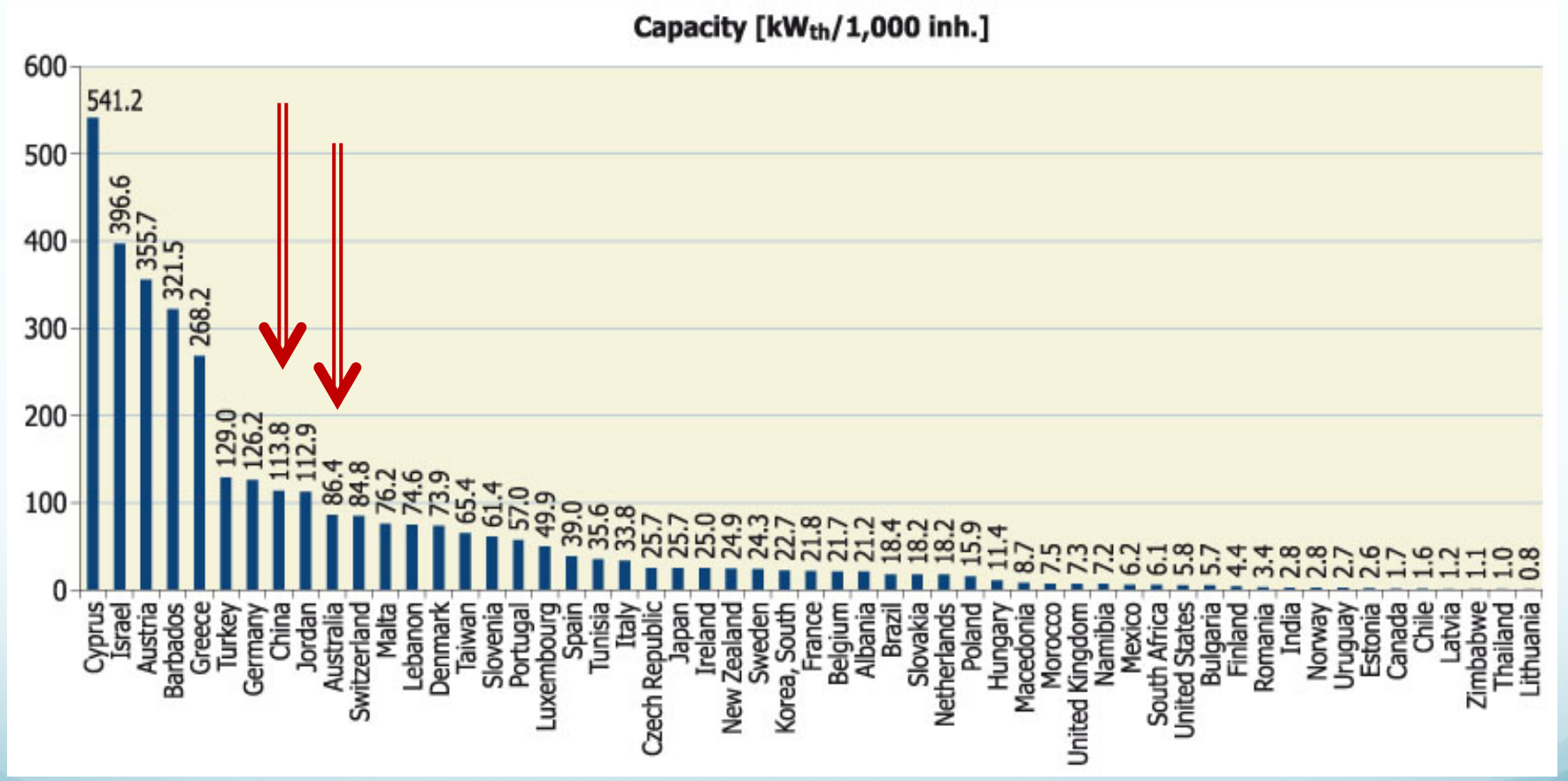
Share of the newly installed capacity (glazed and unglazed water and air collectors) by economic regions in 2011



Total installed capacity of unglazed and glazed water collectors in operation in the 10 leading countries by the end of 2011



Total capacity of glazed flat plate and evacuated tube collectors in operation in kW_{th} per 1,000 inhabitants by the end of 2011



Current SHCTasks

Task		Capacity Building	Buildings Precincts	Systems	Materials
39	Polymeric Materials for Solar Thermal				X
40	Net Zero Energy Solar Buildings		X		
41	Solar Energy and Architecture		X		
42	Compact Thermal Energy Storage				X
43	Rating and Certification Procedures	X			
44	Solar and Heat Pump Systems			X	
45	Large Solar Systems			X	
46	Resource Assessment & Forecasting	X			
47	Solar Renovation of Non-Residential Buildings		X		
48	Quality Assurance & Support Measures for Solar Cooling			X	
49	Solar Heat Integration in Industrial Processes			X	
50	Advanced Lighting Solutions for Retrofitting Buildings		X		
51	Solar Energy and Urban Planning		X		
52	Solar Heat and Energy Economics		X		
53	New Generation Solar Cooling Systems			X	

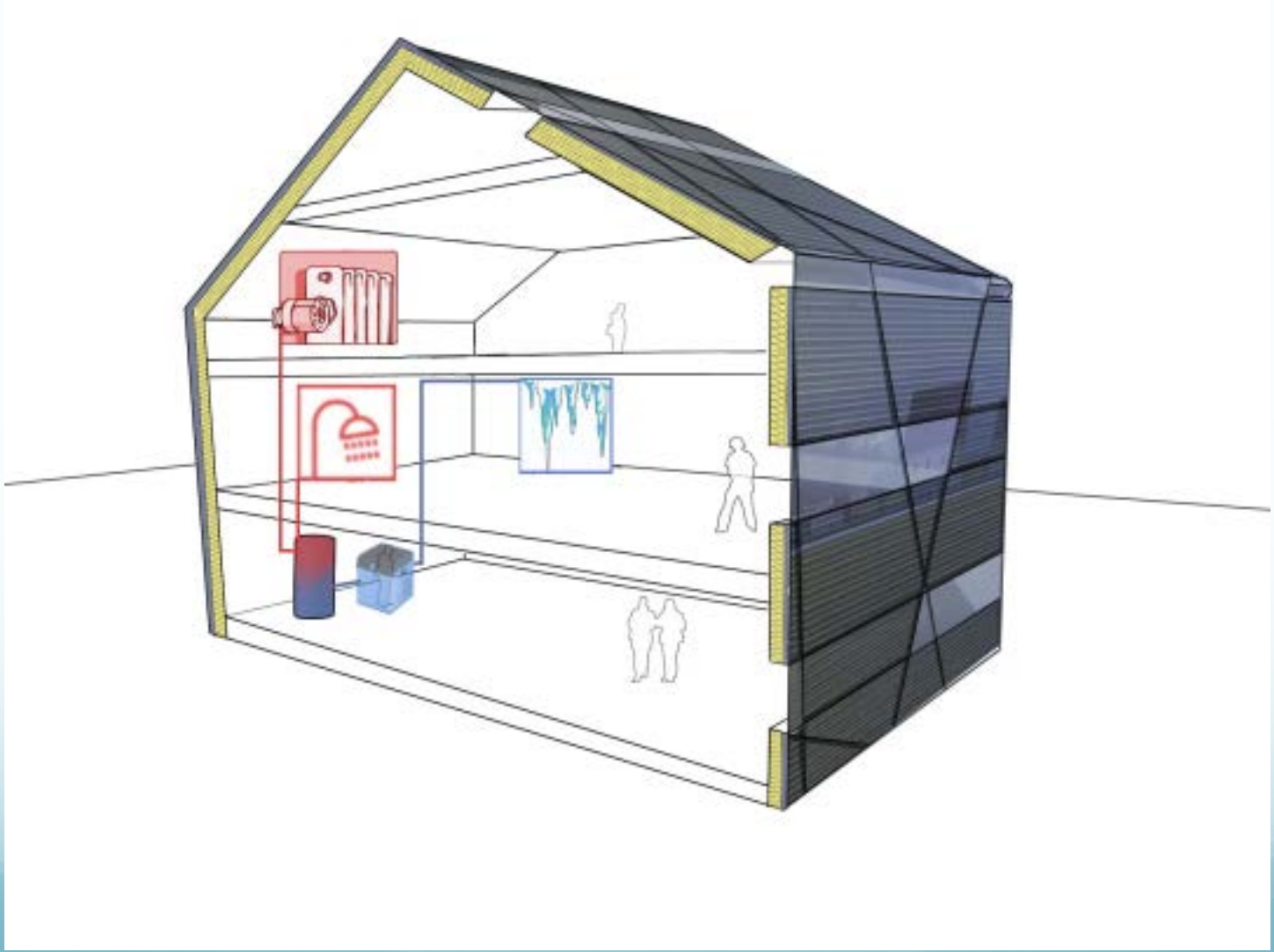
SHC Highlights

Material related Tasks

ENERGY STORAGE – THE KEY ISSUE

Task 42/24

Joint Task between Solar Heating and Cooling (SHC) and Energy Conservation through Energy Storage (ECES)




Highlights
System related Tasks

Task 25 'Solar Assisted Air Conditioning of Buildings'

The main objective of the Task was to improve conditions for the market entry of solar assisted cooling systems.

Technologies covered were:

- Absorption chillers
- Desiccant cooling techniques with solid desiccants, powered by solar collectors for air or water heating
- New desiccant cooling cycles with liquid sorbents
- Closed cycle solid sorption (mainly adsorption)
- Advanced combined systems (e.g. solar dehumidification with conventional temperature control)

The results of task work were directed toward air-conditioning industries, planners, architects, facility managers and building owners.

Task 25 Publications

The following were publications developed by Task 25:

- Checklist for Solar Cooling
- Decision Scheme for the Selection of the Appropriate Technology Using Solar Thermal Air-Conditioning
- Ongoing Research Relevant for Solar Assisted Air Conditioning Systems
- Survey of Solar Assisted Cooling
- Solar-Assisted Air-Conditioning in Buildings - A Handbook for Planners
- Ongoing Research Relevant for Solar Assisted Air Conditioning Systems Appendix

Task 38

- accelerate market introduction of solar air conditioning and refrigeration
- focus on improved components and system concepts.
- residential and small commercial sector;
- pre-engineered system for small and medium size systems and custom made systems;
- reports on pilot and demonstration plants
- comparison of simulation tools and applicability for planning and system analysis;

Task 38
Solar Air Conditioning and Refrigeration

Main achievements:

- Development of small capacity thermally driven chillers (<35 kW_{cold})
- Optimization of the heat rejection subsystem

Sortech AG

EAW

Pink GmbH

Task 38 Publications

The following were publications developed by Task 38:

- Solar Cooling Position Paper
- Overview of World Wide Installed Solar Cooling Systems
- Checklist Method for the Selection and the Success in the Integration of a Solar Cooling System in Buildings

Subtask A: Pre-engineered Systems for Residential and Small Commercial Applications

- Monitoring Procedure for Solar Cooling Systems
- Installation, Operation and Maintenance Guidelines for Pre-Engineered Systems
- Market Available Components for Systems for Solar Heating and Cooling with a Cooling Capacity < 20 kW
- Collection of Selected Systems Schemes “Generic Systems”

Task 38 Publications

Subtask B: Custom-made Systems for Large Non-residential Buildings and Industrial Applications

- Commissioning.
- State of the Art on Existing Solar Heating and Cooling Systems

Subtask D: Market Transfer Activities

- Life Cycle Assessment of Solar Cooling Systems

.

Task 38 Publications

Subtask C: Modelling and Fundamental Analysis

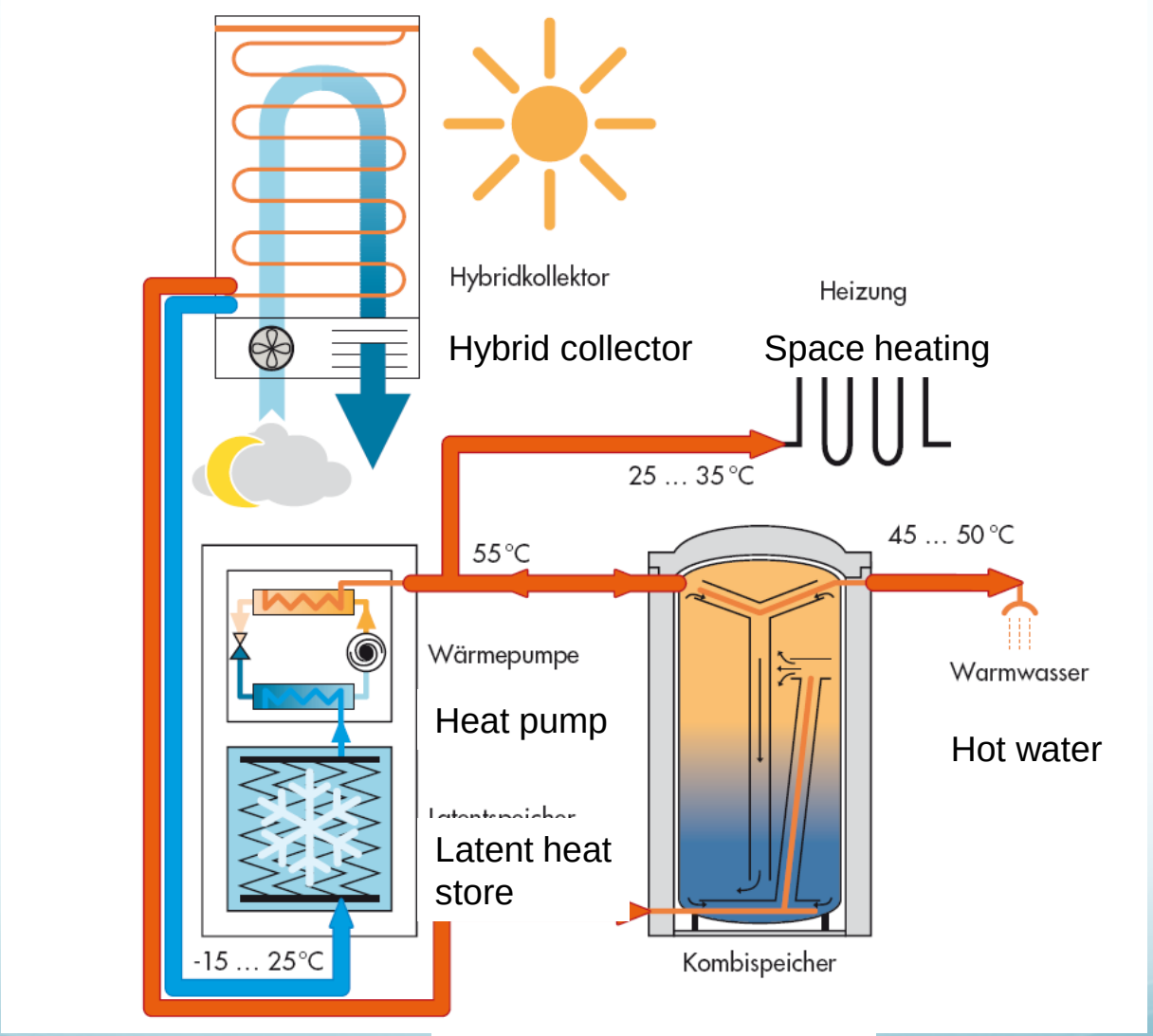
- Benchmarks for Comparison of System Simulation Tools – Solid Desiccant Simulation Comparison
- Heat Rejection
- State of the Art - Survey on New Solar Cooling Developments
- Exergy Analysis of Solar Cooling Systems
- Hygienic Aspect of Small Wet Cooling Towers
- Description of Simulation Tools Used in Solar Cooling
- Benchmarks for Comparison of System Simulation Tools – Absorption Chiller Simulation Comparison
- Description of Simulation Tools Used in Solar Cooling

.

Task 38 / Task 48
Solar Air Conditioning and Refrigeration

SHC SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Solar and Heat Pump Systems – Task 44



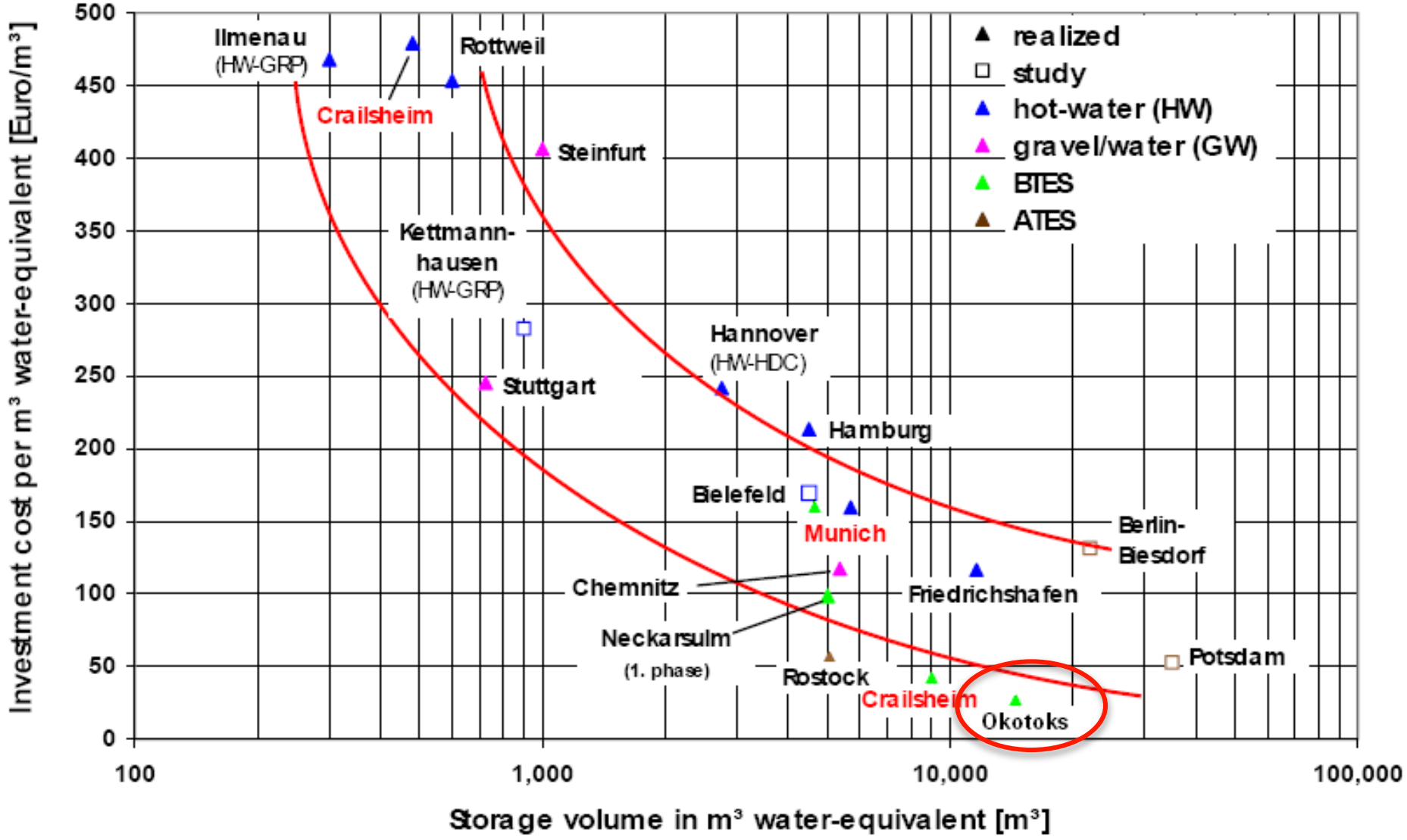
Source: Consolar

Solar Space Heating with High Solar Fraction

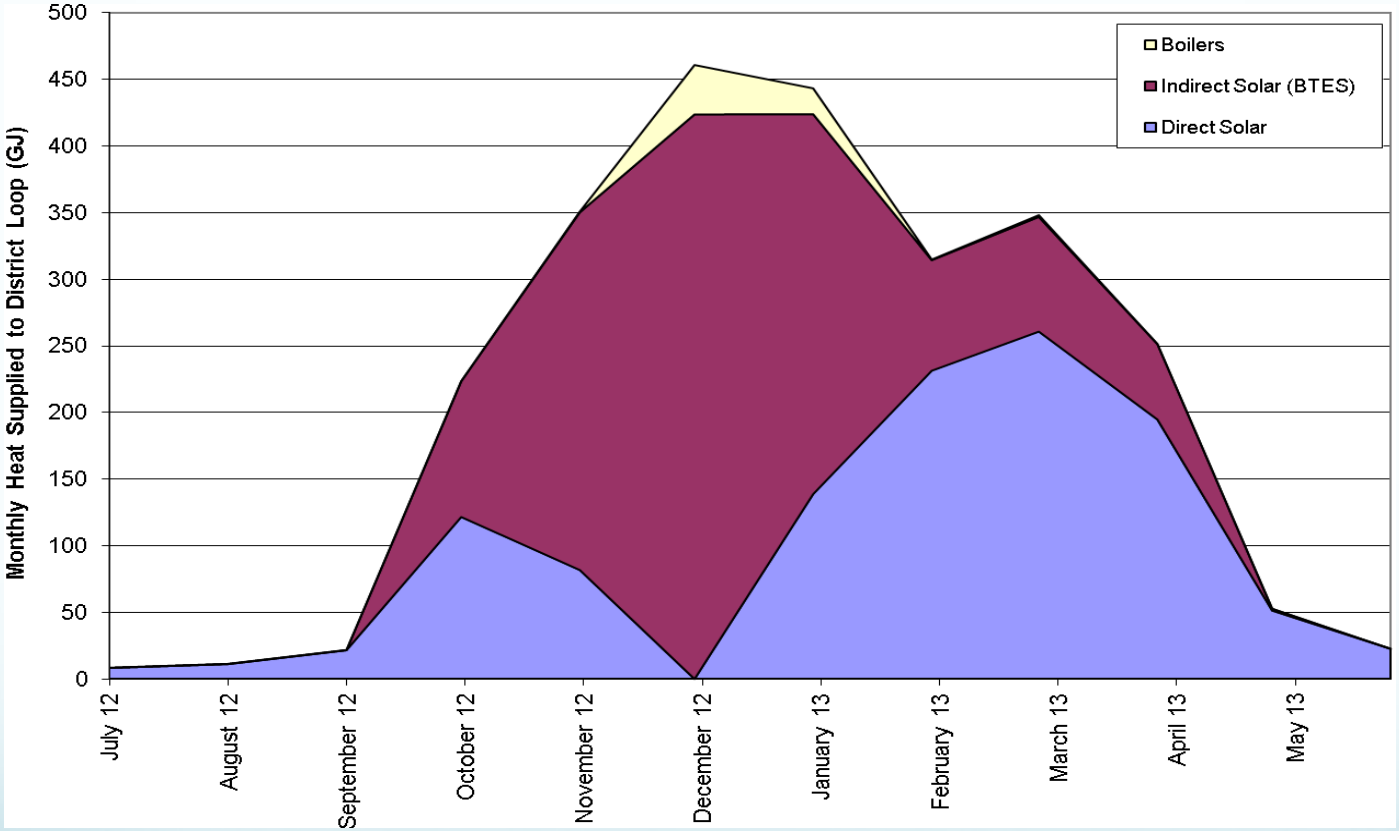
Drake Landing Solar Community, Canada

SHC
SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

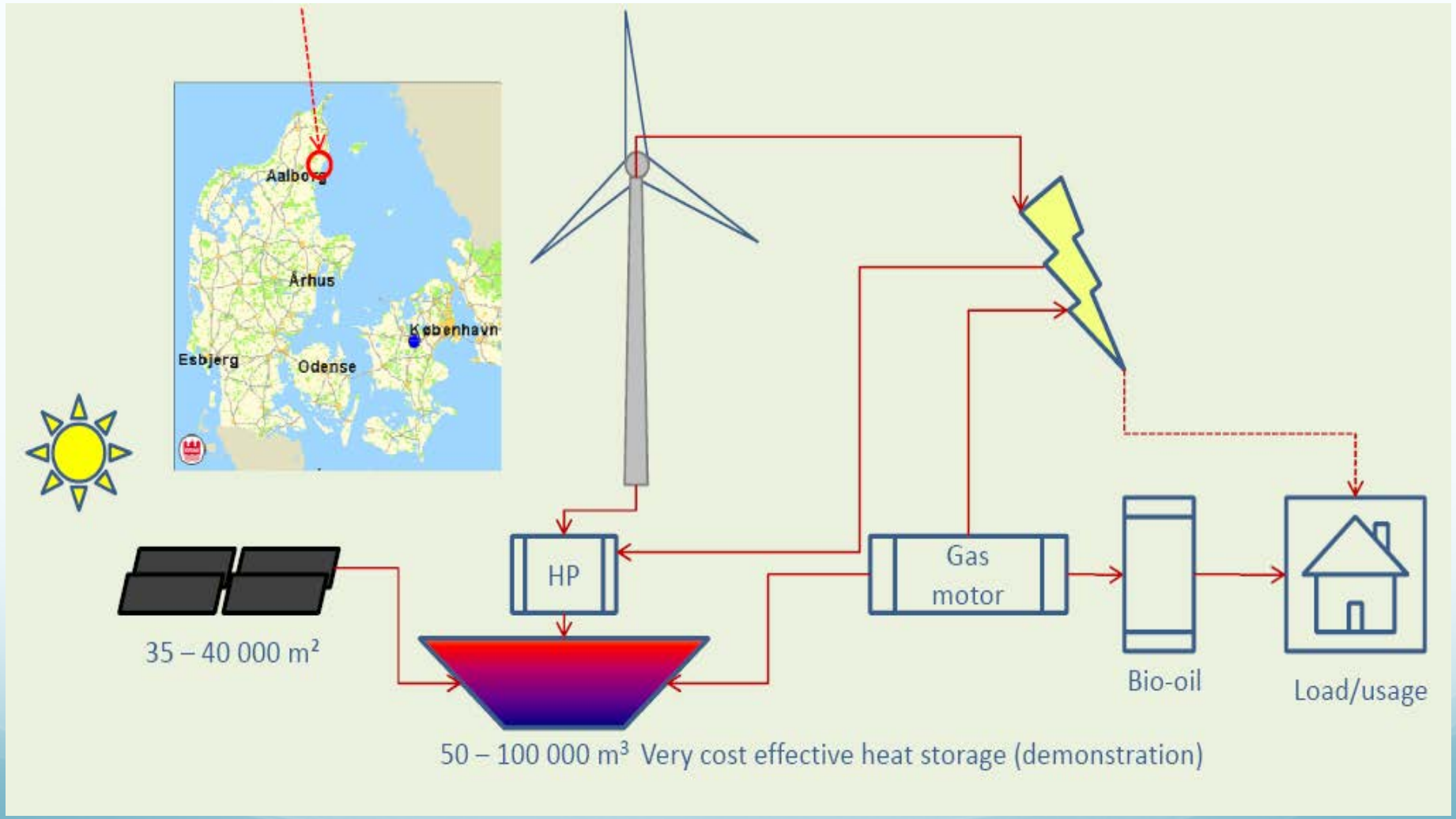
Investment cost for seasonal heat storage



Drake Landing - Monthly District Energy Distribution by Source

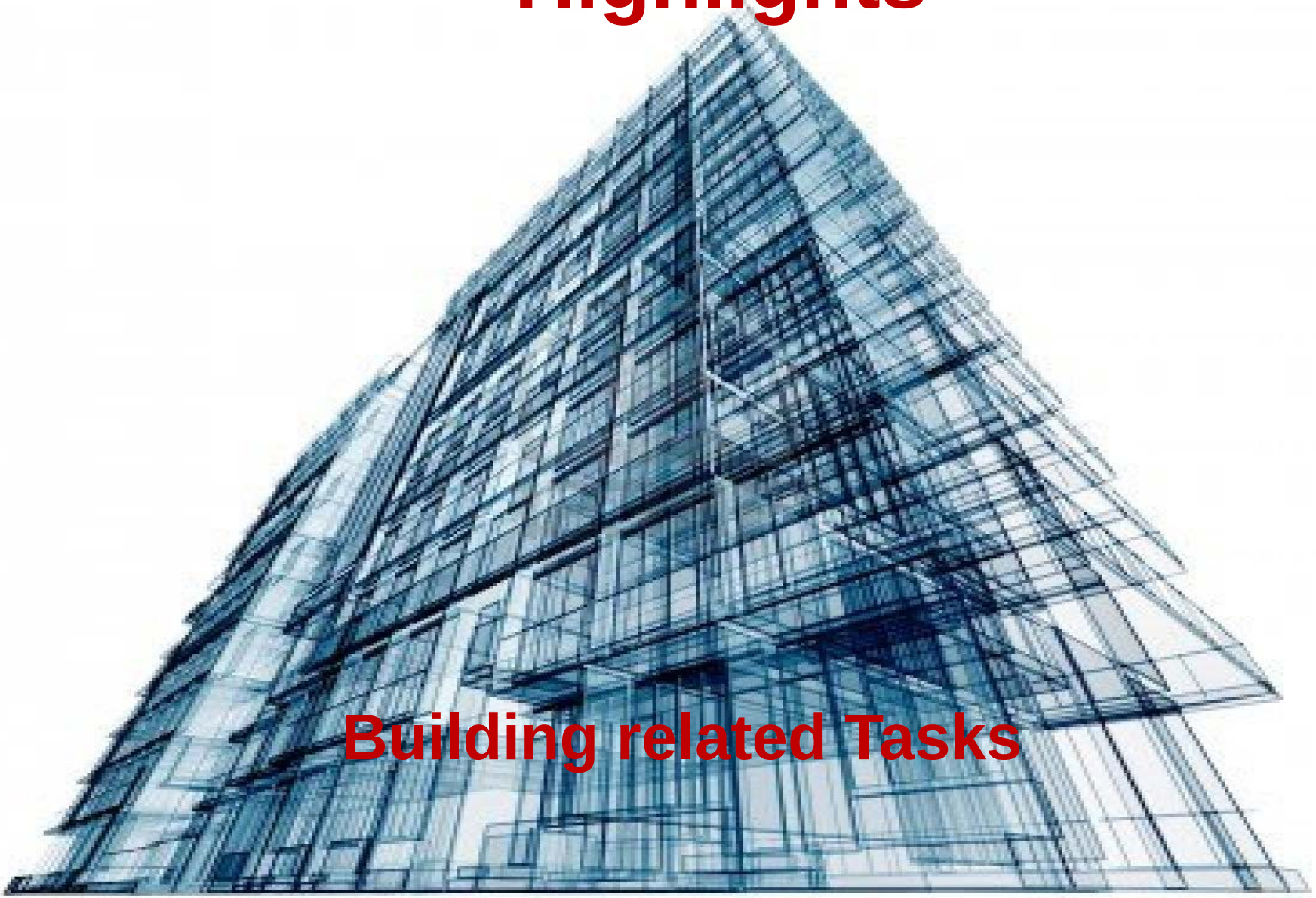


Smart District Heating Systems
Integration of heat and electrical grids



Source: Jan-Erik Nielsen, PlanEnergi, Cost source: SDH, Report „success factors in district heating, Dec 2010

Highlights



Building related Tasks

Task 41: Solar Energy and Architecture

Task Accomplishments

9 main reports
2 websites
CAAD objects
List of product developments and dissemination activities

Workshops/confe

See [rg/publications]

ReportNo.	Report Title	Publication Date	Access (PUblic, REst	Web or rint
T.41.A.1	Building Integration of Solar Thermal and Photovoltaics – Barriers, Needs and Strategies	June 201		
T.41.A.2	Solar Energy systems in Archite integration criteria and s			Web
T.41.A.3/1	Designing sol archit		PU	Web
T	riteria and oduct and system developers	Feb/March 2013	PU	Web
	ive solar products for architectural integration	July 2012	PU	Web
st of activities	IEA SHC Task 41 Product developments and dissemination activities	July 2012	PU	Web
T.41.B.1	State-of-the-art of digital tools used by architects for solar design	July 2010	PU	Web
T.41.B.2	International survey about digital tools used by architects for solar design	August 2011	PU	Web
CAAD objects	Solar components 3D parametric CAAD objects	November 2011	PU	Web
T.41.B.3	Solar Design of Buildings for Architects: Review of Solar Design Tools	June 2012	PU	Web
T.41.B.4	Needs of architects regarding digital tools for solar building design	June 2012	PU	Web
T.41.C.1	Communication Guideline	July 2012	PU	Web
Website	Collection of Case Studies of architecturally attractive solar buildings	Feb/March 2013	PU	Web

Solar Energy and Architecture

Task 51: Solar Energy in Urban Planning
May 2013 – April 2017

SHC SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Main objectives

- Provide support to urban planners, authorities and archi… urban areas and eventually whole cities with archit… solar energy solutions (active and passive) … to cities with a large fraction of renewable en…
- Develop processes, ma… pable of assisting cities in developing a long … strategy. Heritage and aesthetic issues will … nt.
- … strengthen education at universities on solar energy in … ing, by testing and developing teaching material. The material … also be useful for post graduate courses and continuing professional development (CPD).

Solar Energy in Urban Planning

Net Zero Energy Buildings
Task 40/Annex 52

Solar Renovation of Non Residential Buildings - Task 47

SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Brochures describing exemplary renovation projects in participating countries on the public web-site.

Expecting appr. 20 renovation examples

RENOVATION EXAMPLES

Kindergarten Vejtoften - Denmark
October 2012 - PDF 1.3MB - Posted: 10/19/2012
By: Jørgen Rose and Kirsten Engelund Thomsen
Built in 1971 with minimal insulation standard. One of 27 kidergartens in the municipality that will undergo and extensive energy renovation. The method developed in this project will be applied in all the other kindergartens.

NVE Building - Norway
October 2012 - PDF 1.23MB - Posted: 10/19/2012
By: Anders Johan Almas, Michael Klinski, Niels Lassen
The office building was constructed through 1962 -64 fir the Norwegian Water Resources and Energy Directorate. Protected elements both internal and external. The first protected buiilding in Norway to be renovated to energy level B or better.

School Renovation - Cesena, Italy
June 2012 - PDF 0.79MB - Posted: 7/2/2012
By: Task 47
Presentation that outlines a major renovation of a primary school built in the 1960s. Includes building envelope, heating system, renewable energy system and lighting.

Norwegian Tax Authority Building Renovation - Oslo, Norway
June 2012 - PDF 1.17MB - Posted: 7/2/2012
By: Task 47
Presentation that outlines the renovation of the high-rise Norwegian Tax Authority building in Oslo, Norway. The renovation includes high insulated building facade, increased air tightness, energy recovery, and high efficiency technical systems.

Solar Heat and Energy Economics

- Focuses on the analysis of the future role of solar thermal in energy supply systems in urban environments.
- Based on energy economic analysis - reflecting future changes in the whole energy system
- Strategies, technical solutions and tools will be developed.
- Good examples of integration of solar thermal systems in urban energy systems will be developed and documented.

Covers

- Buildings
- Districts
- Energy supply system

Subtasks

- *Energy Scenarios,*
- *Methodologies, Tools & Case studies for Urban Energy concepts, Technology and Demonstrators*

Why participate in SHC Tasks

The Programme's work is accomplished through the international collaborative effort of experts from Member Countries.

The benefits:

- accelerates the pace of technology development
- promotes standardization
- enhances national R&D programmes
- permits national specialization
- saves time and money

How to participate in SHC Tasks

- Understand new tasks being developed.
  - APVI newsletters etc, SHC website
- Contact ExCo member and Operating Agent (Task Manager)
- Participate in Task Definition phase
- Agree your deliverables
- Ensure funding to attend meetings and produce deliverables.
- National Participation Letter through APVI/ExCO

Australian PV Institute

- The APVI is an association of companies, government agencies, individuals, universities and research institutions with an interest in solar photovoltaic electricity.
- Provides the structure for Australian participation in the International Energy Agency (IEA) PVPS (Photovoltaic Power Systems) and SHC (Solar Heating and Cooling) programmes,
- Further information is available from www.apvi.org.au.

What We Do

Events

- Ideas competition
- Annual Report launch
- Annual Research Conference
- Workshops

Reports

- State-of-the-Industry Reports
- Industry Directories
- Submissions
- Research reports

Information

- Webinars
- Technical workshops
- Conference
- Support materials for training and certification programs

Resources

- Information, data, materials, reports
- Technical resources (Map)
- Guidelines, standards

Services

- Specialised analyses
- Training
- Research projects

2014 Solar Research Conference

AUSTRALIAN PV INSTITUTE

- 8-10 Dec 2014, UNSW
- APVI Research Review
  - expanded into a general solar research conference
  - with refereed papers
  - Student presentations & networking
- Combined with:
  - ACAP
  - ASTI & Austella
  - 9th international DSC & OPV Conference
  - CRC for Low Carbon Living

Thank You

SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

ken.guthrie@setransformation.com.au

www.apvi.org.au. www.iea-shc.org