International Energy Agency
Solar Heating and Cooling Program

Ken Guthrie
Deputy Chair - IEA SHC Executive Committee

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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)

Fossil Fuels
Renewable Energy
End Use
Fusion Power

Solar Heat & Cool
Energy in Buildings & Communities
PV Power Systems
Efficient Electrical end-use equipment

APVI

Stds Aust. & SV

Australian PV Institute
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.
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 $5\text{kW}_{\text{th}}$ 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
Installed Capacity - 2012

Total capacity in operation [GWel], [GWth] and produced energy [TWhel/a], [TWhth/a], 2012

- Total capacity in operation [GW] 2012
- Produced energy [Twh] 2012

- Solar Thermal Heat: 268.1, 225.0
- Wind Power: 581.1, 282.6
- Photovoltaic: 102.2, 110.0
- Geothermal Power: 11.5, 71.0
- Solar Thermal Power: 2.6, 4.6
- Ocean Tidal Power: 0.6, 0.8
Total installed capacity in operation by economic regions at the end of 2011

- China: 64.9%
- Europe: 16.7%
- United States / Canada: 7.1%
- Asia excl. China: 4.1%
- Latin America: 2.7%
- Australia / New Zealand: 2.1%
- MENA Region: 2.0%
- Sub-Sahara Africa: 0.4%
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

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<td>Advanced Lighting Solutions for Retrofitting Buildings</td>
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<td>Solar Energy and Urban Planning</td>
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<td>New Generation Solar Cooling Systems</td>
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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
- Ongoing Research Relevant for Solar Assisted Air Conditioning Systems Appendix

www.iea-shc.org
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;

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Task 38
Solar Air Conditioning and Refrigeration

Main achievements:

• Development of small capacity thermally driven chillers (<35 kW\text{\textit{cold}})
• Optimization of the heat rejection subsystem
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

Collector area: 1,579 m²
Absorption cooling: 545 kW

Source: SOLID, Graz
Solar and Heat Pump Systems – Task 44

Hybrid collector
Latent heat store
Heat pump

Hot water
Space heating

Source: Consolar
Solar Space Heating with High Solar Fraction
Drake Landing Solar Community, Canada
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/conferences
See: [http://task41.iea-shc.org/publications](http://task41.iea-shc.org/publications)

### Listed products

<table>
<thead>
<tr>
<th>ReportNo.</th>
<th>Report Title</th>
<th>Publication Date</th>
<th>Access (Public, Restricted)</th>
<th>Web or Print</th>
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<tbody>
<tr>
<td>T.41.A.1</td>
<td>Building Integration of Solar Thermal and Photovoltaics – Barriers, Needs and Strategies</td>
<td>June 2012</td>
<td>PU</td>
<td>Web</td>
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<tr>
<td>T.41.A.2</td>
<td>Solar Energy systems in Architecture: integration criteria and guidelines</td>
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<td>T.41.A.3/1</td>
<td>Designing solar thermal systems for architectural integration: Criteria and guidelines for product and system developers</td>
<td>Feb/March 2013</td>
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<td>T.41.A.3/2</td>
<td>Designing photovoltaic systems for architectural integration: Criteria and guidelines for product and system developers</td>
<td>Feb/March 2013</td>
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<td>T.41.B.1</td>
<td>IEA SHC Task 41 Product developments and dissemination activities</td>
<td>July 2012</td>
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<td>T.41.B.2</td>
<td>State-of-the-art of digital tools used by architects for solar design</td>
<td>July 2010</td>
<td>PU</td>
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<td>T.41.B.3</td>
<td>International survey about digital tools used by architects for solar design</td>
<td>August 2011</td>
<td>PU</td>
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<td>CAAD objects</td>
<td>Solar components 3D parametric CAAD objects</td>
<td>November 2011</td>
<td>PU</td>
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<td>T.41.C.1</td>
<td>Needs of architects regarding digital tools for solar building design</td>
<td>June 2012</td>
<td>PU</td>
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<tr>
<td>Website</td>
<td>Collection of Case Studies of architecturally attractive solar buildings</td>
<td>Feb/March 2013</td>
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</table>
Main objectives

- Provide support to urban planners, authorities and architects to achieve urban areas and eventually whole cities with architecturally integrated solar energy solutions (active and passive), contributing to cities with a large fraction of renewable energy supply.

- Develop processes, methods and tools capable of assisting cities in developing a long-term urban energy strategy. Heritage and aesthetic issues will be taken into account.

- Prepare for and strengthen education at universities on solar energy in urban planning, by testing and developing teaching material. The material will also be useful for post graduate courses and continuing professional development (CPD).
Brochures describing exemplary renovation projects in participating countries on the public web-site.

Expecting appr. 20 renovation examples
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

- 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

www.iea-shc.org

ken.guthrie@setransformation.com.au

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