SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

SOLARCOOLING® SUNBELT REGIONS TASK65

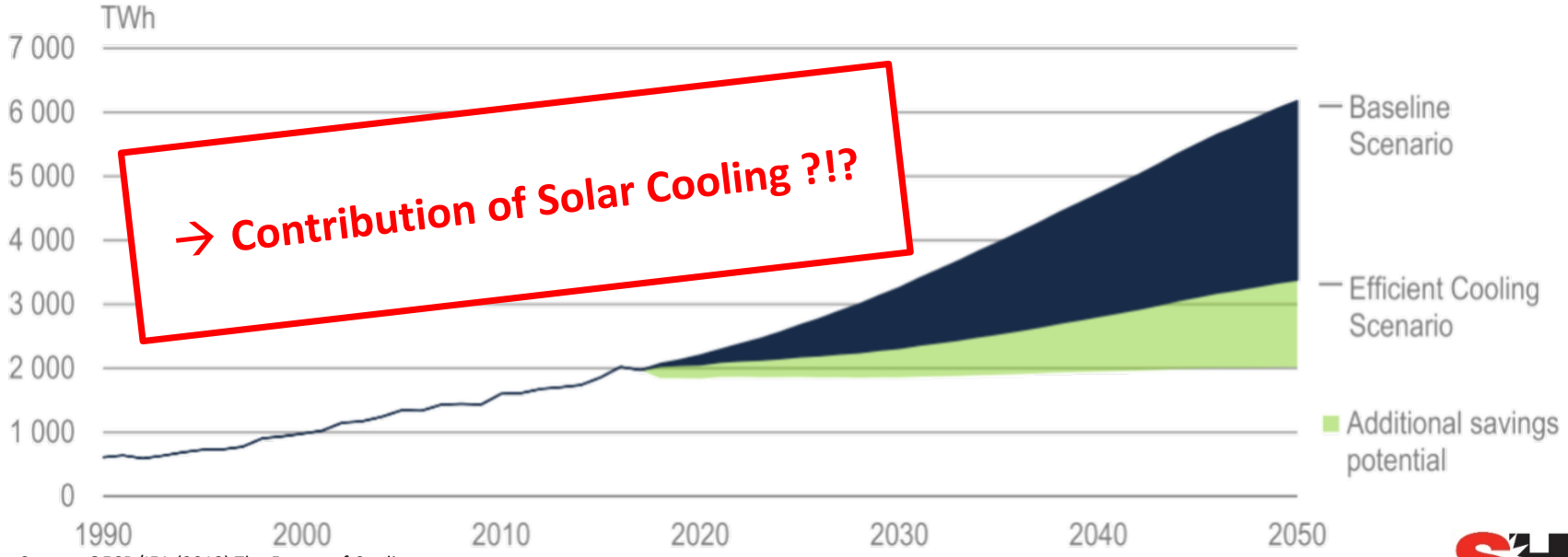
Solar Cooling for the Sunbelt Regions – IEA SHC Task 65

Introduction and cooperation possibilities

Daniel Neyer, NB / Uni Innsbruck & Uli Jakob, JER / Green Chiller
6th Yangzi River Delta International Conference on New Energy
Online, 5th December 2020

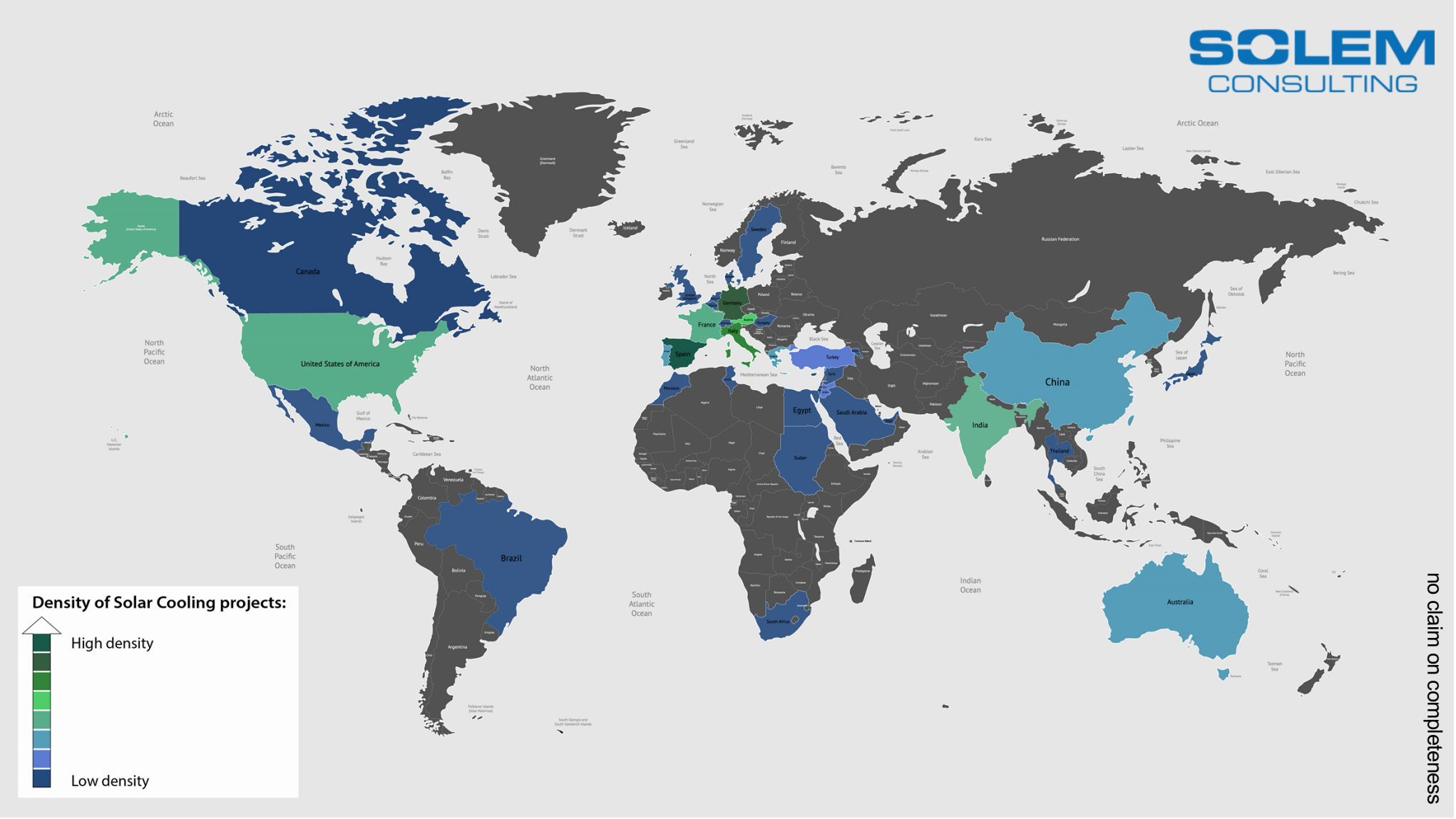
Future Trends

- On current trend, **energy needs for space cooling** – almost entirely in the form of electricity – will **more than triple between 2016 and 2050,** driven mainly by the residential sector (2,000 TWh => 6,000 TWh)
- Most of the **projected growth in energy use for cooling is set to come from India, China and other emerging economies**
- Space cooling is set to overtake appliances and plug loads **to become the single largest user of electricity in buildings** (2015: 10%; 2050: 30%)



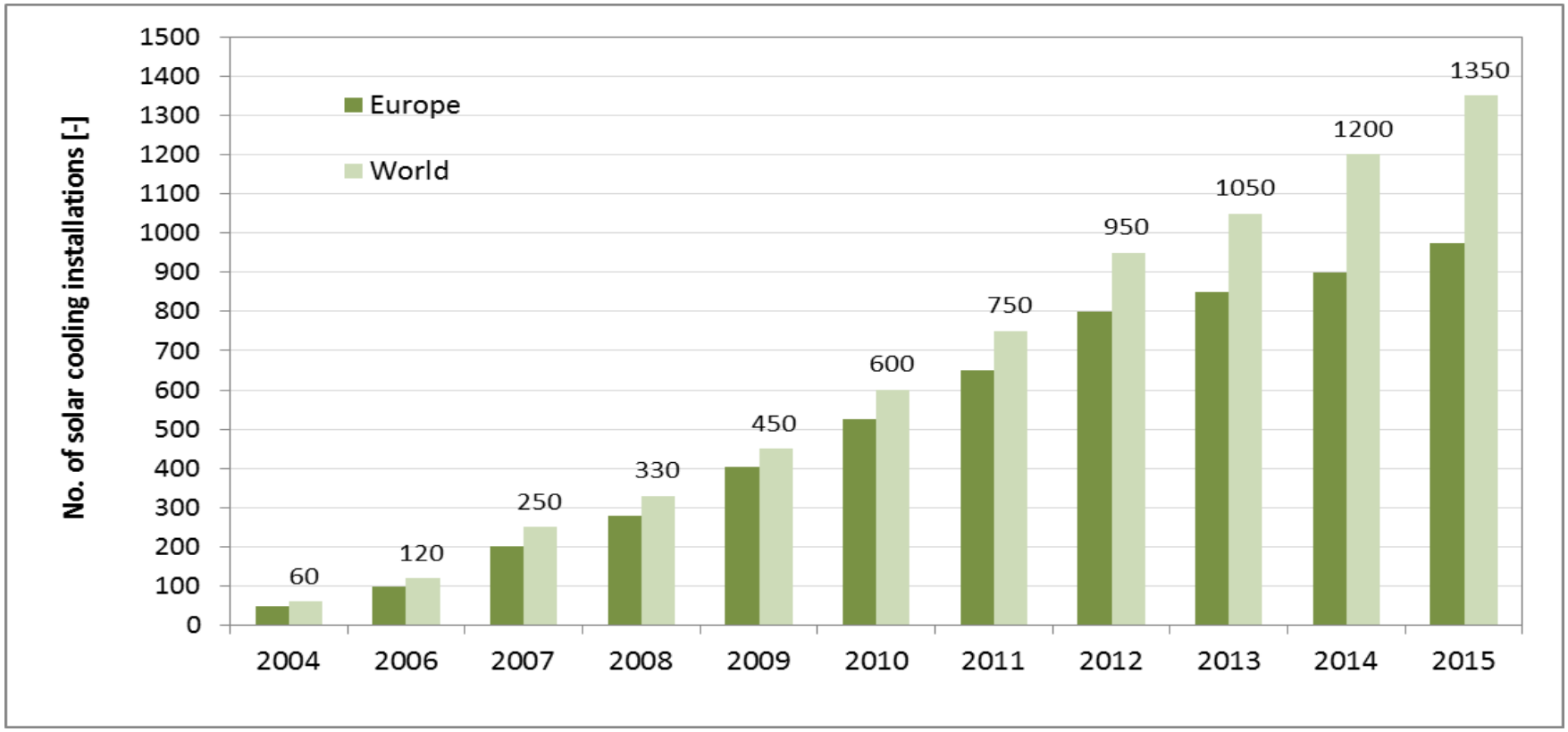
Source: OECD/IEA (2018) The Future of Cooling

Status of Solar Cooling (2015)



Source: SOLEM Consulting

No. of Solar Cooling installations

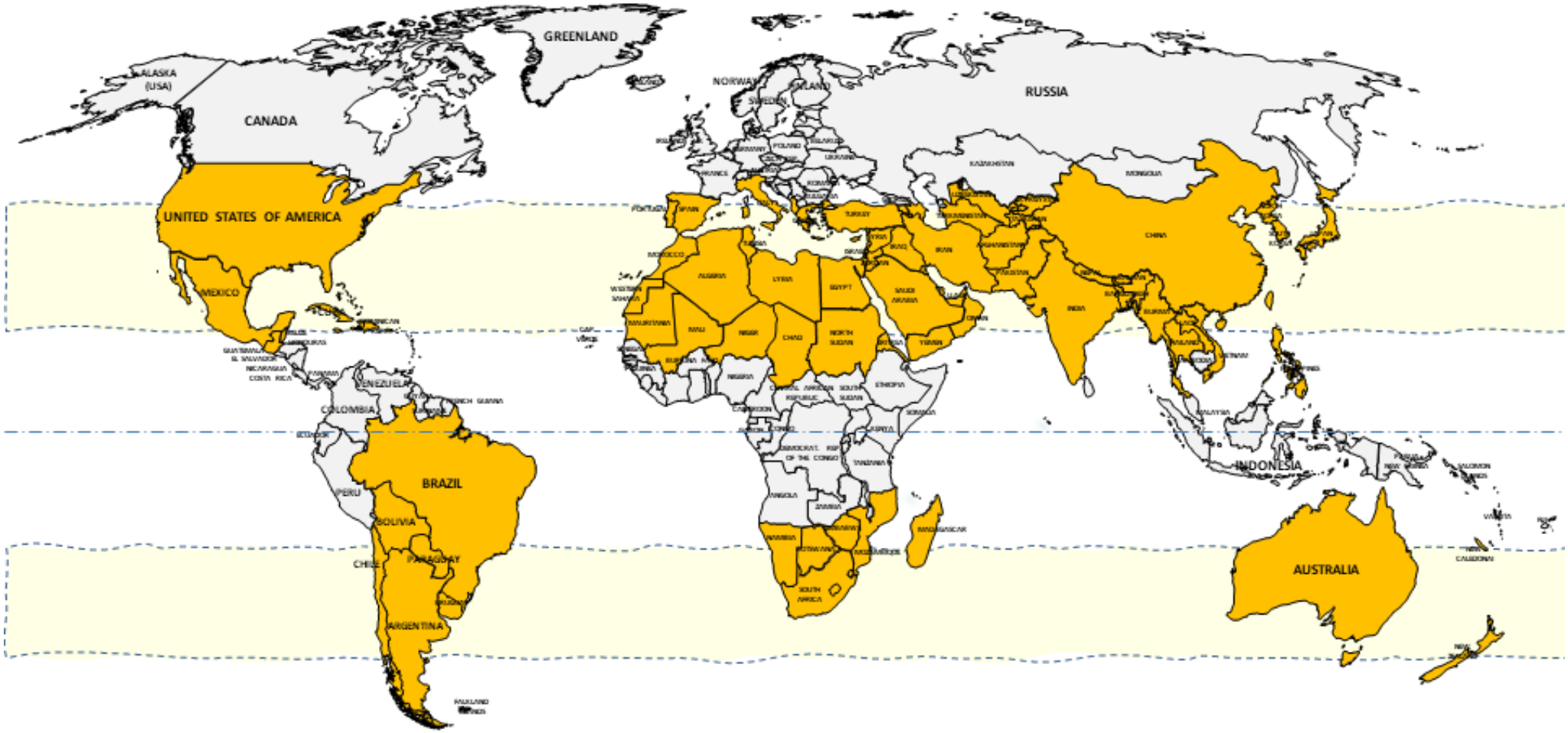


Source: SOLEM Consulting / TECSOL

Still a niche market :

≈ 1,800 systems installed worldwide (2020)

Sunbelt regions



Task 65 Objective & Scope

Objective

- Focus on innovations for **affordable, safe and reliable solar cooling systems for the sunbelt regions worldwide**
- Implementation/adaptation of components and systems for the different boundary conditions is **forced by cooperation with industry** and with support of target countries like UAE through Mission Innovation IC7
- The innovation driver and the **keyword is adaptation** of existing concepts/technologies to the sunbelt regions using solar energy either solar thermal (ST) or solar PV

Scope

- Build on previous tasks 25, 38, 48 and 53
- **Target size segment** on cooling and air conditioning between **2 kW and 5,000 kW** (PV and ST)
- Task duration: July 2020 – June 2024

Task 65 Subtasks and Leaders

Operating Agent
lead country: Germany
OA: Prof Dr. Uli Jakob, JER/Green Chiller

Subtask A: Adaptation
lead country: Italy
subtask leader: Dr. Salvatore Vasta, CNR-ITAE

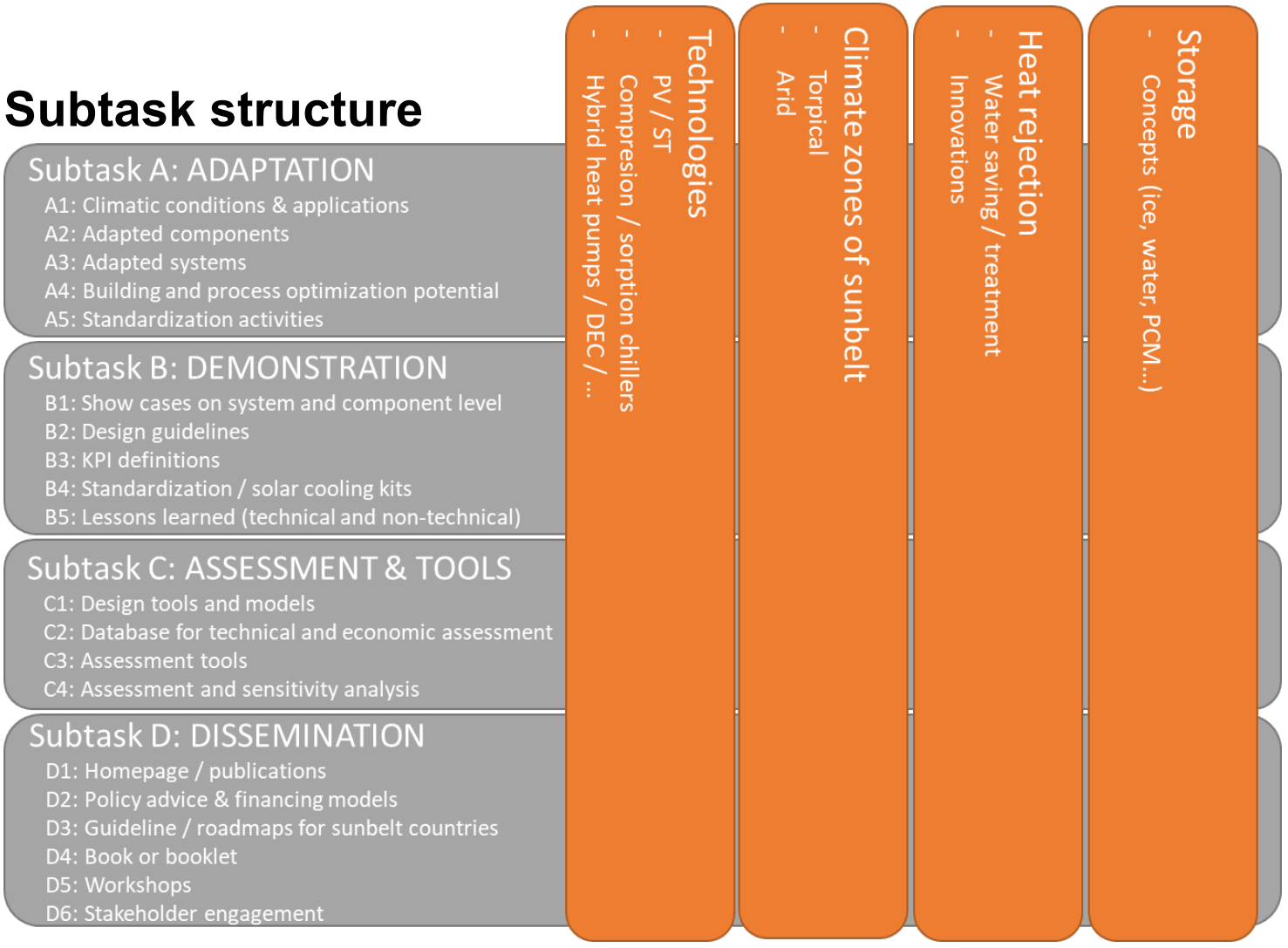
Subtask B: Demonstration
lead country: USA
subtask leader: Wolfgang Weiss, ergSol Inc. (Limited Sponsor)

Subtask C: Assessment and Tools
lead country: Austria
subtask leader: Dr. Daniel Neyer, Neyer Brainworks

Subtask D: Dissemination
lead country: Germany
subtask leader: Prof. Dr. Paul Kohlenbach, Beuth University of Applied Sciences Berlin

Task 65 Subtask Content

Subtask structure



Subtask A: ADAPTATION

General objectives

- Collection of **technical / climatic boundary conditions** for sunbelt
- Adaptation and documentation of specific **key components** (Sources, heat rejection, heat pumps/chillers, storage concepts, complete systems)
- Identify the technical and economic **potential of** building and process **optimization**
- Identify ongoing and future **standards** and **testing methods** and initiate updates

Subtask B: DEMONSTRATION

General Objectives

- **Show cases** on system and component level through existing projects & new **MI IC#7 activities**
- **Maximize solar fraction** of solar cooling under certain local technical & economic boundaries
- Force the work of **standardization** and **solar cooling kits** in all capacity ranges and different technologies
- Documentation of the **lessons learned** (technical & non-technical) and preparation for dissemination activities

Subtask C: ASSESSMENT and TOOLS

General Objectives

- Update / merging of **useful tools** for design & assessment
- Establishing / adapting of **assessment method** and benchmarking (incl. reference system in different locations)
- Create **common data base** for technical, environmental, economic (and social) assessment for the participating countries
- Analyses of **Subtask B results and benchmarking** against reference systems and different renewable and solar solutions
- **Sensitivity analyses** of high influencing parameters on the technical / economic / environmental assessment

Subtask D: DISSEMINATION

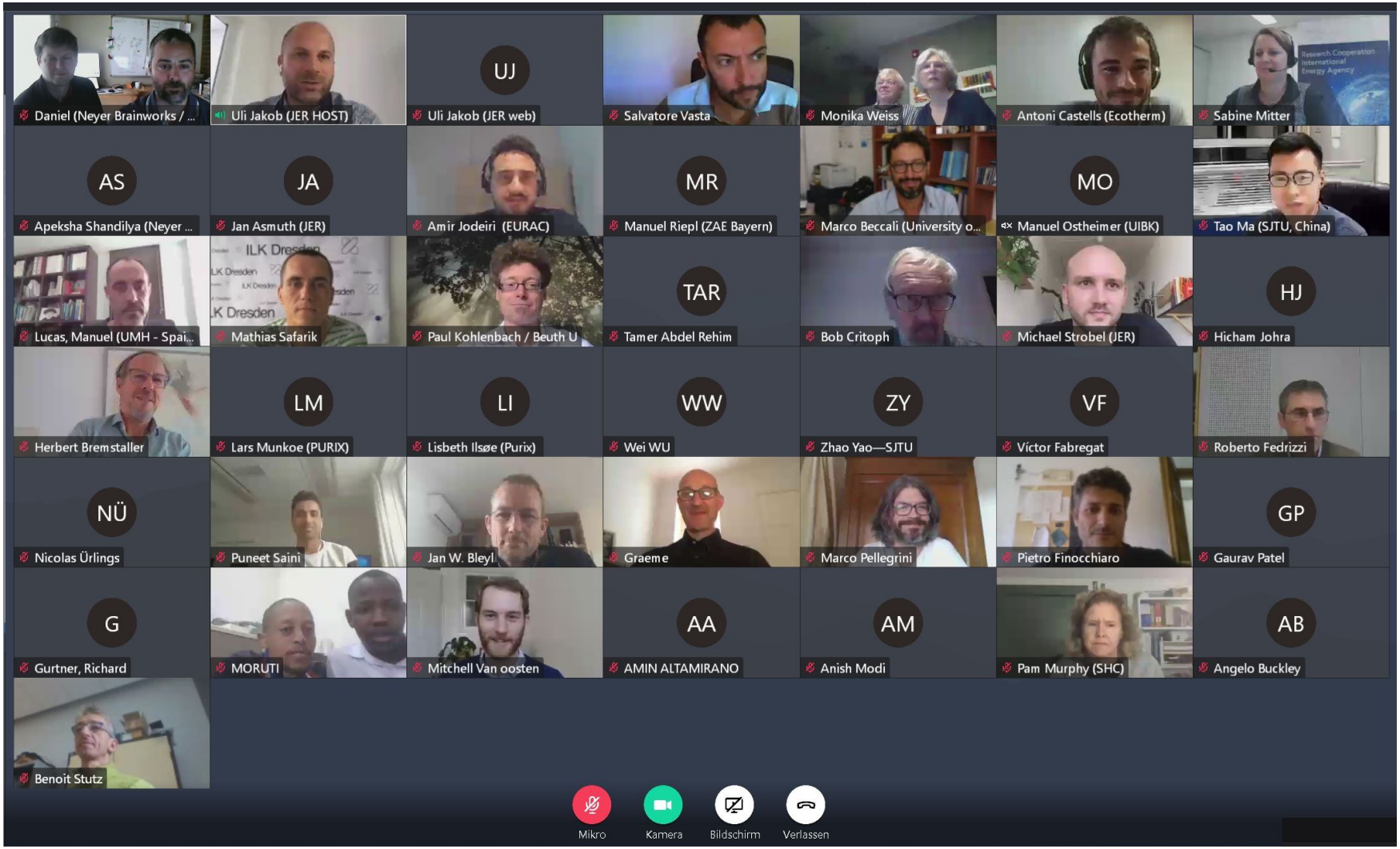
General Objectives

- **Communication of best practice** demo cases, successful installations and business models
- **Accelerate know how transfer** from scientists to industry & knowhow carrier to sunbelt regions
- Establish a network of scientists/consultants/companies to accelerate the **establishment of projects** in sunbelt regions
- Synchronize national/international **research & funding programs**
- **Financing & business models** for Solar Cooling
- Mapping of necessary R&D as base for a **roadmap** of solar cooling in sunbelt regions

Task 65 website

https://task65.iea-shc.org

Kick Off Meeting Day 1



- About 45-50 participants during the first day

Collaboration with other SHC Tasks, IEA TCPs, organizations/institutions

- IEA SHC Task 64 on Solar Process Heat
- **IEA HPT Annex 53 on Advanced Cooling/Refrigeration Technologies Development**
- IEA EBC Annex 80 on Resilient Cooling of Buildings
- **Mission Innovation IC7**

Mission Innovation @ kick off

Graeme Maidment – BEIS, UK (co-lead IC#7)

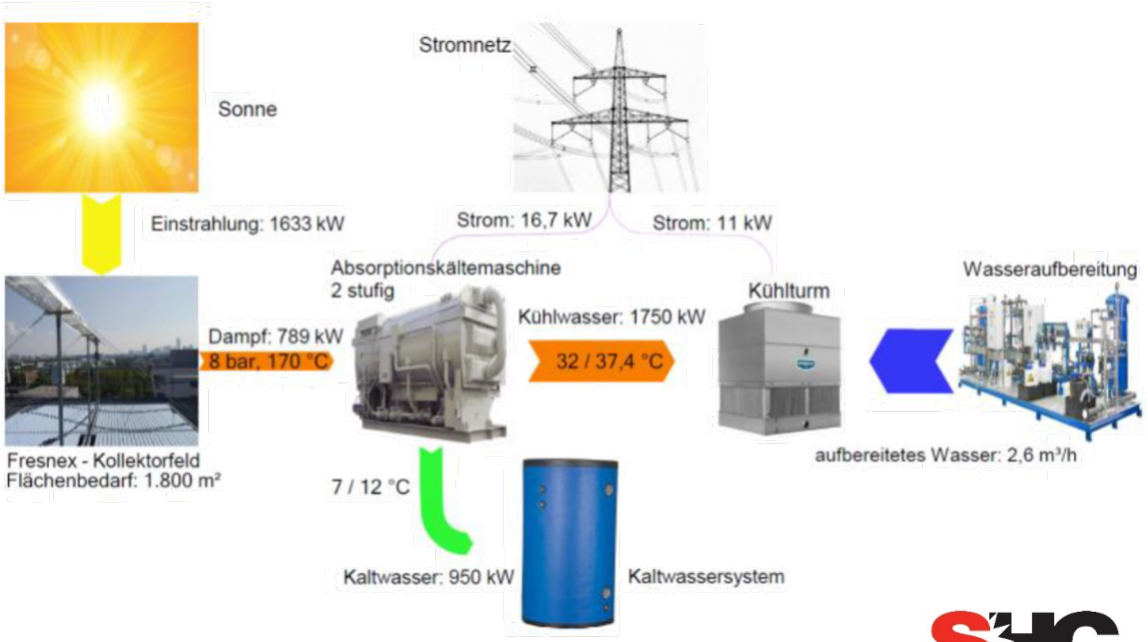
- Cooling demand is expected to grow 50x by 2100 adding 100 $GtCO_{2e}$ to 2050
- How IC7 can support Task 65 ?
  - → Publicity, profile and links to other projects
  - → Potential for IC7 to facilitate country funding

Sabine Mitter – BMK, Austria

- Austria participates in 21 technology collaboration programmes (TCPs) of the International Energy Agency (IEA)
- Member of the Mission Innovation
- Contribution to international standardisation
- Austria in SHC (e.g. Task 55, 59 and 64)
- New international markets for Austrian solar energy companies (Task 65)

Double effect concepts

- Example. „SolarCooling 2.0“
  - Fresnel collector, only direct radiation, 170°C outlet
  - 2-stage AbKM, COP_{th} = 1.2-1.4, steam
  - For the same cooling capacity compared to single-stage
    - approx. 50% of the generator power
    - approx. 70% of the heat rejection required.
    - here approx. 40% reduction of the investment costs

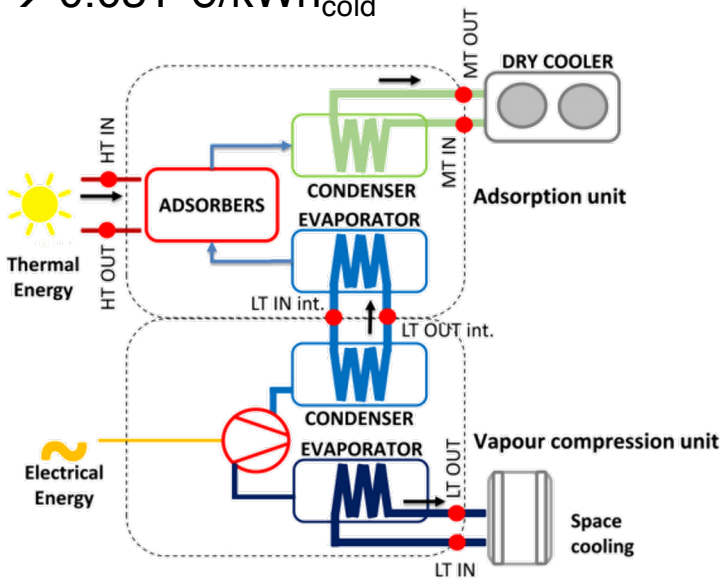


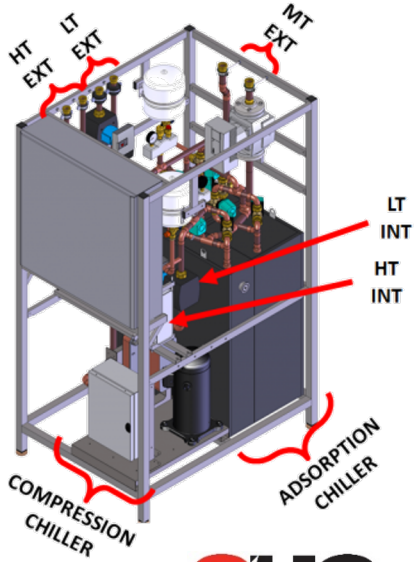
Source:
GET Güssing Energy Technologies
FHOOE – F&E GmbH; Forschungsgruppe ASiC

Hybrid e.g. HyCool

- T_{LT} = 5°C., Development target -10°C
- Integrated vapour compression modul (R290)
  - Redundancy and high energy efficiency
  - Peak and interim loads
- Sorption modul for cooling the condensator
  - Tcond VCC ~ 20°C → EER_{HHP} increases up to 7-8
  - E.g. Barcelona 4,748h → 0.031 €/kWh_{cold}

Source:
www.ecotherm.com
www.hycool-project.eu
www.fahrenheit.cool



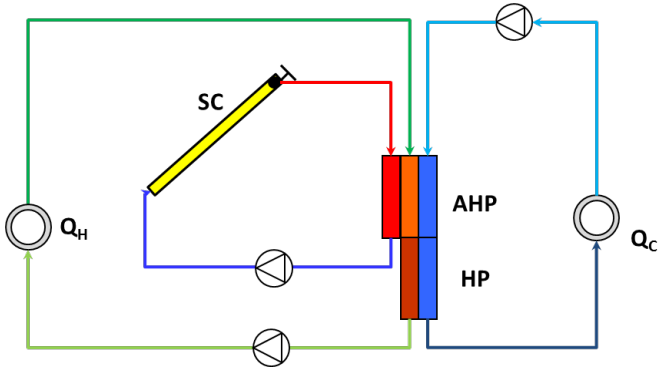


Hybrid concepts

- SolarHybrid by

universität innsbruck
Arbeitsbereich für Energieeffizientes Bauen

- Prototypes in Hardware-in-the-Loop (HiL) & simulation study
  - 20 kW NH_3/H_20 absorber (ACM)
  - 20 kW NH_3 vapor compression (VCC)



- Solar direct driven absorber + complementing compressor
  - No hot water storage
  - SPFel >15
  - Primary Energy Savings up to 80 %
  - CR < 1 possible

Hybrid concept in China sol.e.h.²

中国建筑 CHINA STATE CONSTRUCTION

中建（深圳）绿建投资有限公司 CHINA CONSTRUCTION (Shenzhen) GREEN BUILDING INVESTMENT CO., LTD. (CCGBI)

中建科技集团有限公司 CHINA CONSTRUCTION SCIENCE & TECHNOLOGY GROUP CO.,LTD. (CCSTG)

universität innsbruck
Arbeitsbereich für Energieeffizientes Bauen

dr. jakob energy research

TBSI 清华-伯克利深圳学院 Tsinghua-Berkeley Shenzhen Institute

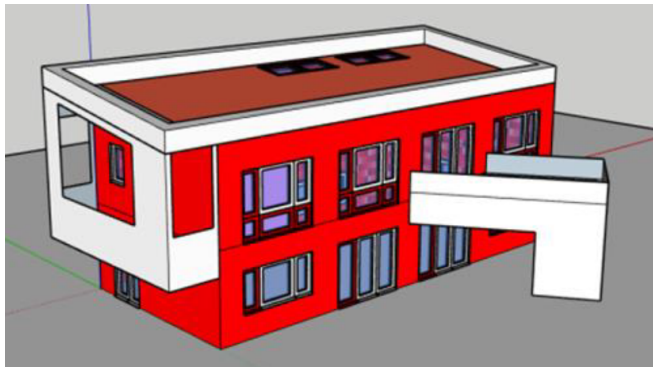
Passive House Institute

深圳大学 SHENZHEN UNIVERSITY

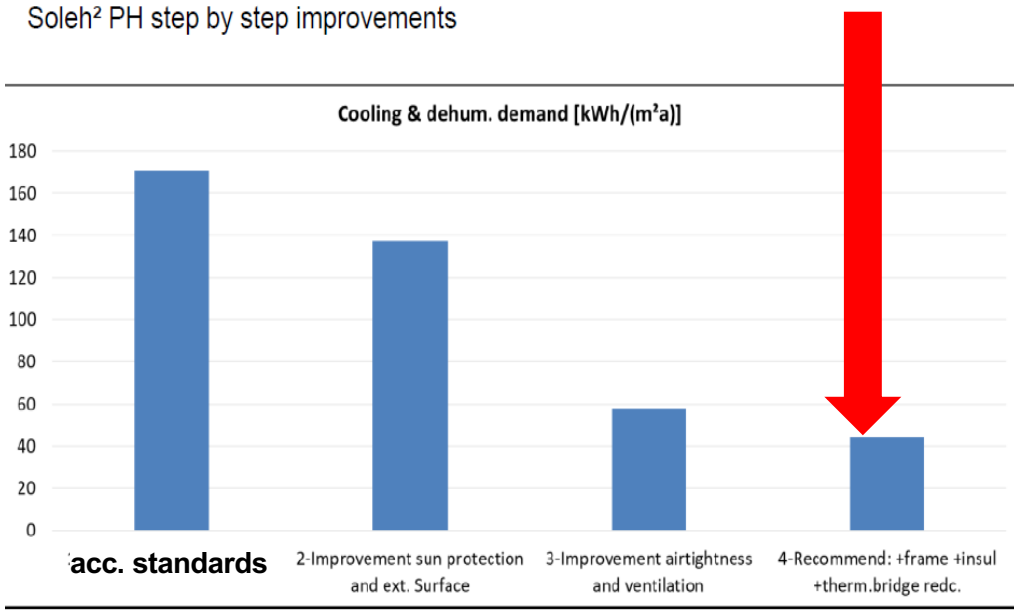
neyerbrainworks

Building optimization

- Application in hostel & office



Minus ~80%



Source: PHI

How to participate

- **National Participation Letters (NPL)**

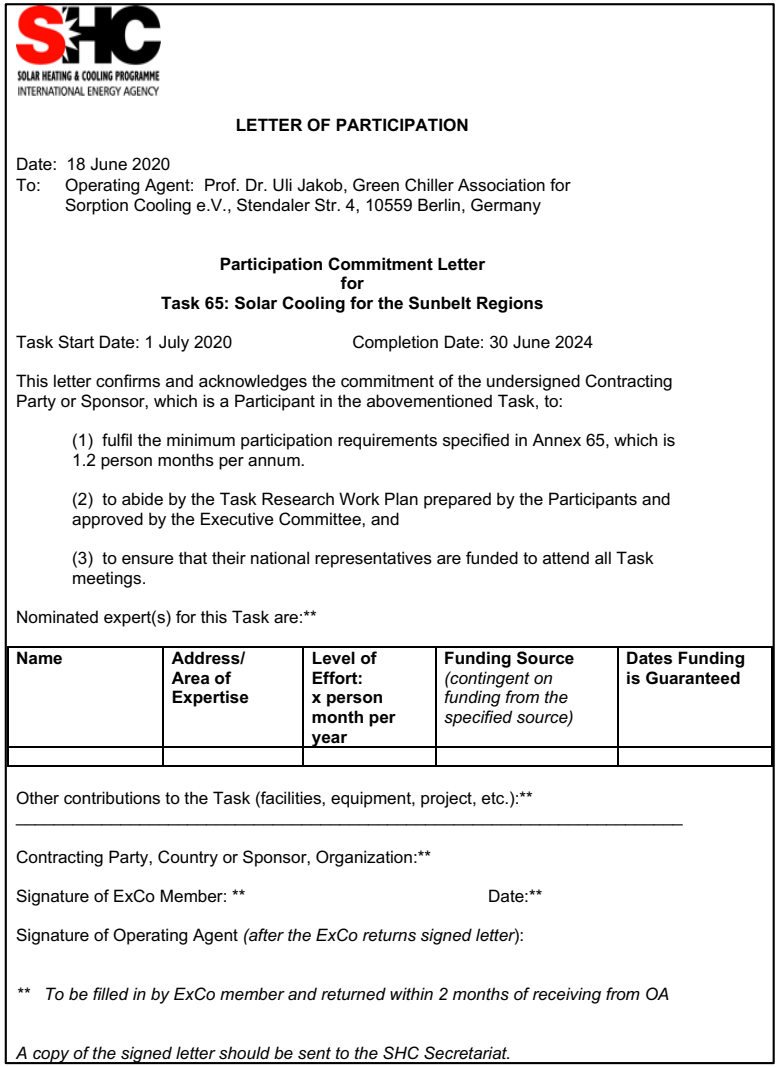
→ received from Austria, China, Denmark, France, Italy, Mozambique, The Netherlands, Spain, Sweden, Switzerland, Uganda, UK, USA, Zimbabwe

→ in progress by, Australia, Botswana, Egypt, Germany, India, Slovakia, South Africa

- Please contact your national **ExCo representative** (https://www.iea-shc.org/executive-committee)

or contact SHC secretary for **Limited sponsorship**

He Tao | Vice Chair
Deputy Director
Center for Quality Supervision and Testing of Solar Heating Systems
China Academy of Building Research (CABR)
30#, Beisanhuandonglu, Chaoyang District
Beijing 100013, hina
iac@vip.sina.com; www.cabr.com.cn



SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

LETTER OF PARTICIPATION

Date: 18 June 2020
To: Operating Agent: Prof. Dr. Uli Jakob, Green Chiller Association for Sorption Cooling e.V., Stendaler Str. 4, 10559 Berlin, Germany

Participation Commitment Letter for Task 65: Solar Cooling for the Sunbelt Regions

Task Start Date: 1 July 2020 Completion Date: 30 June 2024

This letter confirms and acknowledges the commitment of the undersigned Contracting Party or Sponsor, which is a Participant in the abovementioned Task, to:

(1) fulfil the minimum participation requirements specified in Annex 65, which is 1.2 person months per annum.

(2) to abide by the Task Research Work Plan prepared by the Participants and approved by the Executive Committee, and

(3) to ensure that their national representatives are funded to attend all Task meetings.

Nominated expert(s) for this Task are:**

Name	**Address/ Area of Expertise**	**Level of Effort: x person month per year**	**Funding Source** *(contingent on funding from the specified source)*	**Dates Funding is Guaranteed**

Other contributions to the Task (facilities, equipment, project, etc.):**

Contracting Party, Country or Sponsor, Organization:**

Signature of ExCo Member: ** Date:**

Signature of Operating Agent *(after the ExCo returns signed letter)*:

** *To be filled in by ExCo member and returned within 2 months of receiving from OA*

A copy of the signed letter should be sent to the SHC Secretariat.

Drivers to push forward Solar Cooling

Future growth of Solar Cooling markets could be stimulated by the following technical and economic aspects … :

- Focus on innovations for affordable, safe and reliable Solar Cooling systems
- Focus on energy conservation and use of renewables
- Shortfalls in electricity supply and rising electricity costs
- European F-gas regulation (natural refrigerants)
- Standards for sorption chillers (e.g. DIN V 18599-7, VDMA 24247-9)

… but much more on trust and political issues:

- Best practice online database to build trust in the technology
- Policy advice to provide relevant information for energy policy decision-makers including the current state of the art
- Roadmaps including policy measures to promote Solar Cooling

www.iea-shc.org

SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

SOLARCOOLING®
SUNBELT REGIONS
TASK65

Contact: Dr. Daniel Neyer, Subtask C leader
Prof. Dr. Uli Jakob, OA IEA-SHC Task 65

Neyer Brainworks GmbH, Austria / daniel@neyer-brainworks.at

Dr. Jakob energy research GmbH & Co. KG, Germany / uli.jakob@drjakobenergyresarch.de