SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Solar Energy Buildings

Integrated solar energy supply concepts for climate-neutral buildings and communities for the "City of the Future”

Task 66

Status Report, 92. ExCo Meeting, December 6*, 2022, Cape Town (SA) and Web*

Task Duration: 1 July 2021 – 30 June 2024

Harald Drück, IGTE, University of Stuttgart, Germany

Task 66 (Solar Energy Buildings) – Status Report Dec 2022

Agenda

- Scope
- Meetings and Workshops
- Information / Dissemination
- Work already done
- Subtasks and work performed
- Formal Issues - NPLs
- Past and future Meetings
- Industry Workshops
- Issues for the ExCo
- Questions and Discussion

Task 66 (Solar Energy Buildings) – Status Report Dec 2022

Scope

- **IEA SHC Task 66 focuses on the development of economic and ecologic energy supply concepts for buildings with high solar fractions of at least 85% of the heat demand, 100% of the cooling demand and at least 60% of the electricity requirements for central European climate conditions**
- Target: Households and e-mobility of multi-storey residential buildings, single buildings and building blocks or distinguished parts of a city (communities) for both, new buildings and the comprehensive refurbishment of existing buildings
- Key aspect:
  - focus on the overall energy supply of the building: This means heat, cold and power
  - synergetic consideration of the interaction with grid infrastructures (electricity and heat) in the sense of bidirectional flexibility

Meetings / Workshops already performed (1/2)

- Task preparation Workshop on
  Mach 30, 2021 (virtual approx.
  45 participants from 15 different countries)

https://www.chanty.com/blog/perfect-virtual-meeting/

- Task Meeting No 1 (kick-off meeting)
  July 1+2, 2021 virtual, with 37 par-
  ticipants from 14 different countries)
- Task Meeting No 2
  Nov 4+5, 2021, virtual with 37 participants from 14 different countries
- Task Meeting No 3
  March 23+24, 2022, virtual with 29 participants from 12 different countries
- Industry Workshop No 1
  March 23, 2022, virtual with 56 participants from 14 different countries

Meetings / Workshops already performed (2/2)

- Task Meeting No 4
  September, 29+30, 2022, Kassel, Germany,
  with 17 participants from 8 different countries

- Industry Workshop No 2
  September, 29, 2022, Kassel, Germany,
  with 31 participants from 9 different countries

- **First physical meetings of Task 66**

Task 66 (Solar Energy Buildings) – Status Dec 2022

Industry Workshop No 2, September 29, 2022

IEA SHC Task 66
Solar Energy Buildings

Integrated solar energy supply concepts for climate-neutral buildings and communities for the "City of the Future"

Industry Workshop No 2

"Solar thermal and/or PVT combined with heat pumps as an innovative energy supply solution"

29th September 2022, Kassel, Germany

in context with the EuroSun 2022 conference

14:00 – 17:30 h Building WISO B / Room 0109, Nora-Platiel-Straße 5, Kassel

About IEA SHC Task 66 Solar Energy Buildings:
The objective of Task 66 is the development of economic and ecologic feasible energy supply concepts with high solar fractions. Task 66 addresses single-family buildings, multi-story residential buildings as well as building blocks and communities, with regard to new and existing buildings.

Program

14:00 – 14:10	**Welcome, Introduction and Presentation of Task 66** Dr. Harald Drück, Task Manager of Task 66 Institute for Building Energetics, Thermotechnology and Energy Storage (IGTE), University of Stuttgart, Germany
14:10 – 14:30	**PVT heat pump collector as innovative energy supply solution** Andreas Siegemund, Managing Partner Consolar Solare Energiesysteme, Germany
14:30 – 14:50	**VirtuPVT: evacuated-tube technology for commercial and industrial applications** Maria Zagorulko, Development and Operations Engineer Naked Energy Ltd., UK
14:50 – 15:10	**Design and optimization of CCHP for microgrids and solar energy buildings** Dr. Arun Kumar Vaiyapuri, Project Manager / R&D and Renewable Energy STEAG Energy Services (India) Pvt. Ltd., India

INVOLVED COUNTRIES: ALBANIA • AUSTRALIA • AUSTRIA • CHINA • DENMARK • FRANCE • GERMANY • GREECE • INDIA ITALY • MACEDONIA • MEXICO • POLAND • PORTUGAL • SLOVAKIA • SLOVENIA • SWITZERLAND • UNITED KINGDOM • USA

15:10 – 15:30	**Manufacturing of innovative pvt-collectors (tbc)** Robbert van Diemen, Managing Director at HRsolar Group HRsolar Group / Qsilence, Netherlands
15:30 – 16:00	*Coffee Break*
16:00 – 16:20	**Intelligent heat pump solutions in combination with photovoltaics** Marcel Macke, Key Account Manager iDM Energiesysteme GmbH, Austria

Presentation of latest Task 66 Subtasks results

16:20 – 16:30	**Introduction: Task66 Video** Moderation: Dr. Harald Drück
16:30 – 16:45	**Highlights of the activities in Subtask A** *Boundary Conditions, KPIs, Definitions and Dissemination* Prof. Frank Späte, Leader Subtask A of Task 66 OTH Amberg-Weiden, Germany
16:45 – 17:00	**Highlights of the activities in Subtask B** *Thermal stand alone Buildings and Building Blocks / Communities represented by:* Elsabet Nomonde Noma Nielsen, Leader Subtask C of Task 66, Technical University of Denmark (DTU), Denmark
16:45 – 17:00	**Highlights of the activities in Subtask C** *Thermal grid connected Buildings and Building Blocks / Communities* Elsabet Nomonde Noma Nielsen, Leader Subtask C of Task 66 Technical University of Denmark (DTU), Denmark
17:00 – 17:15	**Highlights of the activities in Subtask D** *Current and future technologies and components* Thomas Ramschak, Leader Subtask D of Task 66 AEE - Institut für Nachhaltige Technologien, Austria
17:15 – 17:30	**Discussion and Closing:** Dr. Harald Drück, Task Manager Task 66, IGTE, University of Stuttgart, Germany

Registration is required! Please send an E-Mail **at latest until 18.09.2022** to:
Claudia Scholl-Haaf (Task administrator) claudia.haaf@igte.uni-stuttgart.de

Task Manager: Dr. Harald Drück; E-Mail: harald.drueck@igte.uni-Stuttgart.de

Contact us, join us, share your ideas with us!
E-Mail: task66.info@iea-shc.org Website: https://task66.iea-shc.org

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Version 05.09.2022

31 participants from 9 different countries, Kassel, Germany

Task 66 (Solar Energy Buildings) – Status Dec 2022

Information / dissemination - already done (1/4)

Publications related to Task 66 (in English)

02 MAY 2021

How to design an 85 % solar-heated and 100 % solar air-conditioned house

During an online meeting from 1 to 2 July, the IEA Solar Heating and Cooling programme will launch a new global research platform called Task 66 Solar...

read more >

24 APR 2021

Solar-heated multi-family buildings gain popularity in Germany

Many new largely solar-heated houses in Germany are multi-family buildings, and their number is growing, according to Sonnenhaus-Institut (Solar House...

read more >

24 APR 2021

Solar houses: above 95 % solar fraction is possible

Between 2014 and 2019, the Austrian Climate and Energy Fund supported the construction of over 100 solar-heated houses, 19 of which were monitored by the...

read more >

20 FEB 2020

Solar Energy Buildings to make cities fit for the future

Buildings account for around 40 % of the world's primary energy consumption. Hence, they are the number one cause of resource consumption on earth.

read more >

Task 66 (Solar Energy Buildings) – Status Dec 2022

Information / dissemination - already done (2/4)

Publications related to Task 66 (in German)

SCHWERPUNKT Gebäudekonzepte

Wohnanlage in Weinstadt: Eine Sole-Wasser-Wärmepumpe, ein Eisspeicher und PVT-Kollektoren nutzen effizient Solarstrahlung und Umweltwärme.

Mit Eis und Sonne heizen

SOLARE KONZEPTE FÜR KLIMANEUTRALE GEBÄUDE Klimaschutz braucht echte Klimaneutralität, keine virtuelle oder bilanzielle. Worin sich die drei Formen der Ökobilanzierung unterscheiden und wie sich mit einem solaren Eisspeicher-Konzept der CO_2-Ausstoß vor Ort mindern lässt, erläutert der folgende Beitrag. Dr. Harald Drück

IEA Task 66 „Solar Energy Buildings"

Die Entwicklung von Konzepten und Technologien zur weitgehend solaren Energieversorgung von Gebäuden ist von globalem Interesse. Aus diesem Grund wurde im Solar Heating und Cooling Programm (SHC) der Internationalen Energieagentur (IEA) auch die Arbeitsgruppe bzw. Task 66 zum Thema "Solar Energy Buildings – Integrierte solare Energieversorgungskonzepte für klimaneutrale Gebäude und Quartiere für die Stadt der Zukunft" etabliert. Die Task 66 wird von Dr. Harald Drück vom IGTE der Universität Stuttgart als Operating Agent geleitet und wird offiziell zum 01.07.2021 beginnen.

Eisspeicher im Außenlabor am IGTE

Visualisierung der Neubau-Wohnanlage Weinstadt Smart-Living
GRAFIK: KOP

Solare Konzepte für klimaneutrale Gebäude

Im Projekt Sol4City arbeiten deutsche und österreichische Partner aus Forschung und Industrie zusammen, um solare Energieversorgungskonzepte für klimaneutrale Gebäude der „Stadt der Zukunft" zu entwickeln.

Task 66 (Solar Energy Buildings) – Status Dec 2022

Information / dissemination - already done (3/4)

Publications related to Industry-Workshop No 1 on Solarthermalworld. org

How to get renewable energy to buildings in dense urban areas

Wed, 13 April 2022

Publications (and presentation) related aspects of climate neutrality (in German)

32. Symposium Solarthermie und innovative Wärmesysteme, 03.–05. Mai 2022, Bad Staffelstein

Die Definition von Klimaneutralität und ihre Relevanz für die Solarthermie

Harald Drück[1,2], Dominik Bestenlehner[1,2]

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1. Einleitung

Das Adjektiv „klimaneutral" ist heute fest in unserem Sprachgebrauch etabliert. Doch was bedeutet klimaneutral eigentlich?

In dem Beitrag werden drei Ansätze für das Erreichen von Klimaneutralität detailliert beschreiben und zusätzlich auch auf Basis von ökologischen und ökonomischen Aspekten am Beispiel unterschiedlicher Konzepte für die Wärme- und Stromversorgung eines Einfamilienhauses verglichen und bewertet.
Ergänzend wird dargestellt, dass die thermische Nutzung der Solarenergie in Kombination mit saisonaler Wärmespeicherung eine Schlüsseltechnologie für das Erreichen einer reellen Klimaneutralität ist.

Task 66 (Solar Energy Buildings) – Status Dec 2022

Information / dissemination - already done (4/4)

Publications related to Industry-Workshop No 2 on Solarthermalworld. org

26 OCT

Optimised PVT and heat pump combinations for heating and cooling of buildings

In combination with the Eurosun 2022 conference, the second IEA SHC Task 66 industry workshop entitled "Solar thermal and/or PVT combined with heat pumps...

read more ›

6 contributions at EuroSun conference Sept. 22-29, 2022 Kassel, Germany

- Definitions for Climate Neutrality and their Relevance for the Assessment of Solar Energy; Harald Drück, Dominik Bestenlehner (Germany)
- Theoretical investigations for electric heating concepts for residential buildings; Dominik Bestenlehner, Harald Drück (Germany)
- Solar energy buildings with high degree of independence of energy supply from grids: Elsabet Nielsen, Simon Furbo (Denmark)
- Participation potentials for energy active facades in future flexibility markets; Thomas Ramschak, et. al. (Austria)
- Development of a commbined model predictive and adaptive control strategy for the operation of a cold district heating network; Jens Ullmann, Harald Drück, Bernd Hafner (GER)
- Quasi-Dynamic Testing of Thermal Sun-Air-Collectors and Numerical Simulations of a Cold; Stefanie Lott, Stephan, Fischer, Harald Drück, Bernd Hafner (Germany)

Subtasks of Task 66

Subtask A: Boundary Conditions, KPIs, Definitions and Dissemination
Lead: **Frank Späte,** OTH-AW, Germany

Subtask B: Thermal stand alone Single Buildings and Building Blocks (New and Existing) – Not connected to a thermal grid
Lead: **Xinyu Zhang**, China Academy of Building Research, Beijing, China

Subtask C: Thermal grid connected Buildings and Building Blocks / Communities (New and Existing) – Connected to thermal grid
Lead**: Elsabet Nielsen,** DTU, Denmark

Subtask D: Current and future technologies and components
Lead: **Thomas Ramschak,** AEE INTEC, Austria

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Work already performed since last ExCo-Meeting by:

Subtask A: Boundary Conditions, KPIs, Definitions and Dissemination

- In addition to the fourth task meeting subtask A conducted **one virtual meeting** on 17.07.2022 plus several meetings in sub-working-groups on specific topics
- A **final draft** of the list with **KPIs for the technical, energetical, economical, ecological and sociological evaluation of Solar Energy Buildings** (Deliverable D.A2) was prepared and discussed during the 4th task meeting
- A **final draft** of a document with **definitions for reference buildings, building blocks and/or communities** (Deliverable D.A4) was prepared and discussed at the 4th task meeting
- A task poster was prepared for the EuroSun 2022 conference held from September 22 to 29, 2022 at Kassel Germany

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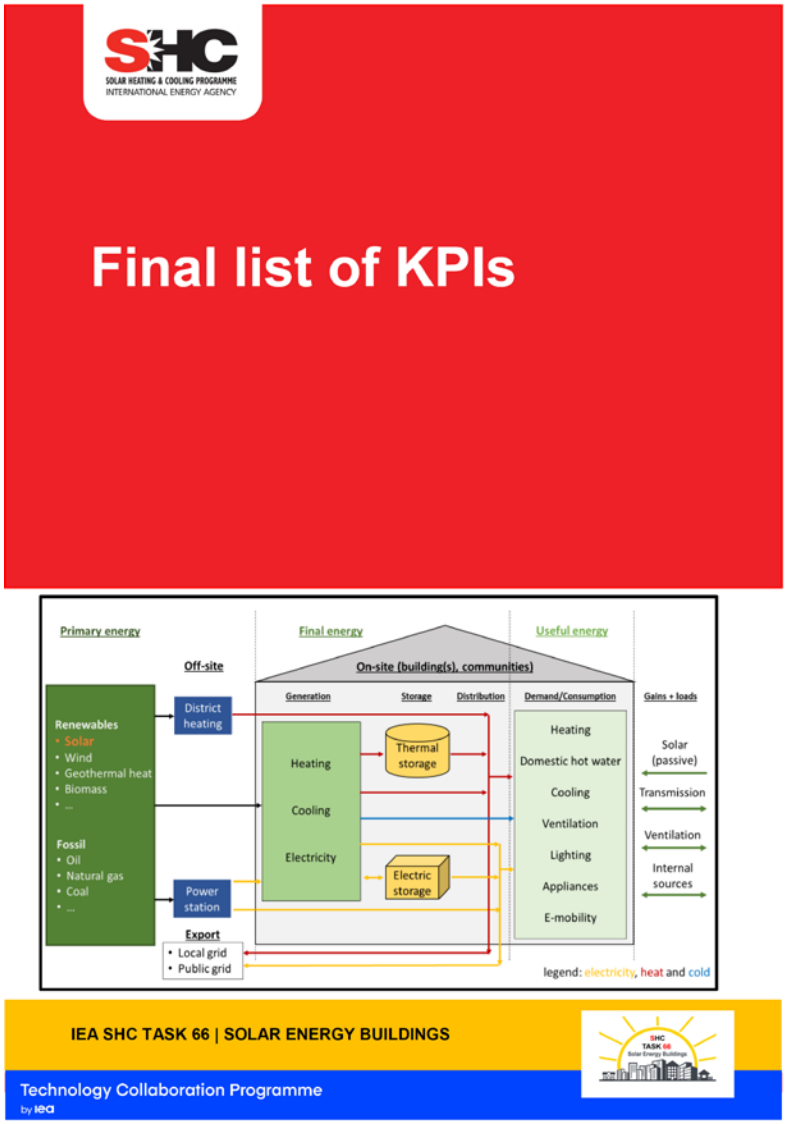
Final list of KPIs
→ Deliverable D.A2

- Energetic and technical KPIs
- Ecological KPIs
- Economic KPIs
- Sociological Evaluation

KPI: Key Performance Indicators



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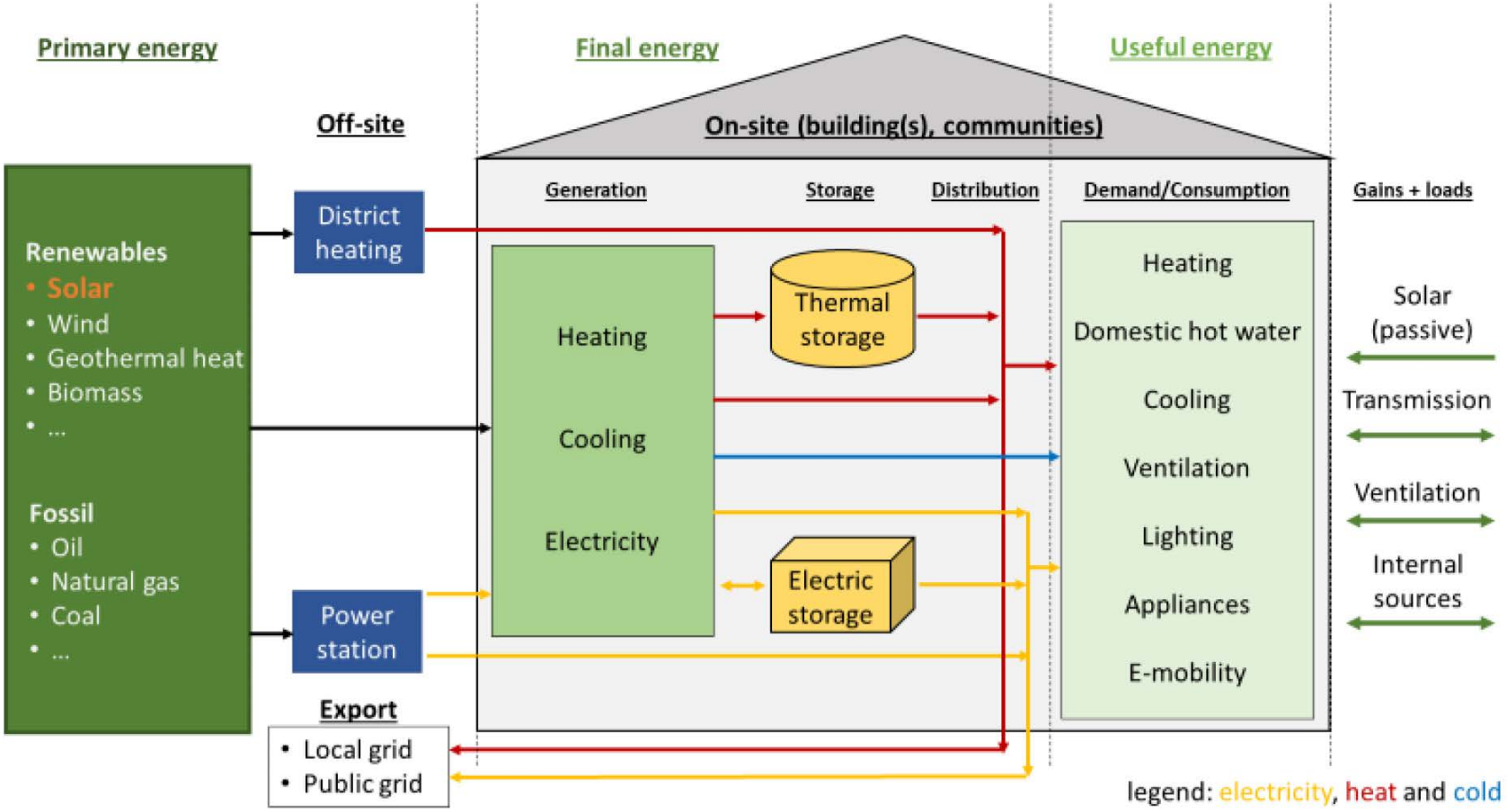
Final list of KPIs – Deliverable D.A2 **– Energy Flow Diagram**



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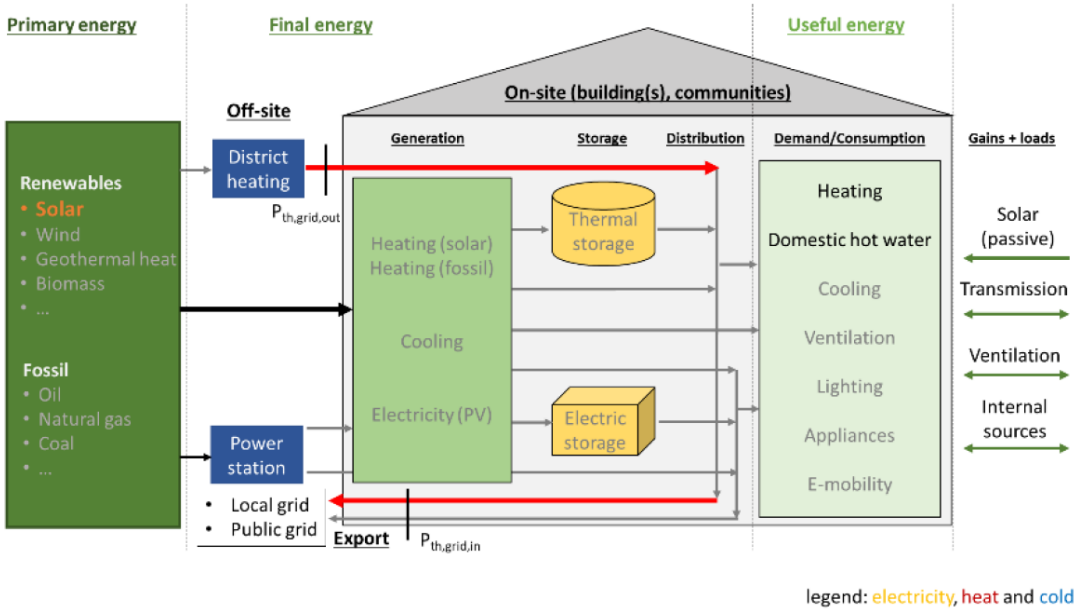
Final list of KPIs – Deliverable D.A2 **– *Example:* Energetic KPI**
Peak power export / import

Peak power export/import thermal max. $P_{th,grid}$ [kW_{th}]	$max.P_{th,grid,in}$ and $max.P_{th,grid,out}$ Maximal power which is feed into the thermal grid or extracted from the thermal grid.



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Final list of KPIs – Deliverable D.A2 **– *Example:* Economical KPI Cost of produced kWh of electrical and thermal energy**

Levelized cost of electricity (LCOE)	$$LCOE = \frac{\text{Total annual cost for electricity production}}{\text{Total annual electrical energy production } (E_{tot,g})}$$ Calculation method for determining the electricity production costs (electricity price); depending on total costs.	
Levelized cost of heat/cold (LCOH)	$$LCOH = \frac{\text{Total annual cost for heat production}}{\text{Total annual thermal energy production } (Q_{tot,g})}$$ Calculation method for determining the heat production costs (heat price); depending on total costs.	

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Final list of KPIs – Deliverable D.A2

Example: **Sociological Evaluation**

User Influence Range (UIR)

User Influence Range = UIR [kWh]	UIR The User Influence Range describes the influence on energy consumption (heating, cooling, domestic hot water, electricity) through the user behaviour, e.g. room temperature, number and kind of electrical appliances.	The User Influence Range UIR can only be determined through a simulation. In principle, this can be done by simulating the same building under the same boundary conditions with different load profiles (user behaviours). One should be a user who saves energy wherever possible and the extreme one consumes a lot of energy. The difference in the results is then the UIR.

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Work already performed since last ExCo-Meeting by:

Subtask B: Thermal stand alone Single Buildings and Building Blocks (New and Existing) – Not connected to a thermal grid

- In addition to the fourth task meetings subtask B conducted on **06.07.22 and 11.08.22 online meetings**.
- Members of Subtask B participated online in meeting of **joined Subtask B and C working group** on 07.11.22
- Note: The work of Subtask B is extremely challenging due to the strong Covid 19 restrictions in China and hence behind schedule. This is also one reason why a merge of Subtask B and C is proposed; *see also "Issues for the ExCo" on page 26*

Task 66 (Solar Energy Buildings) – Status Report Dec 2022

Work already performed since last ExCo-Meeting by:

Subtask C: Thermal grid connected Buildings and Building Blocks / Communities (New and Existing) – Connected to thermal grid

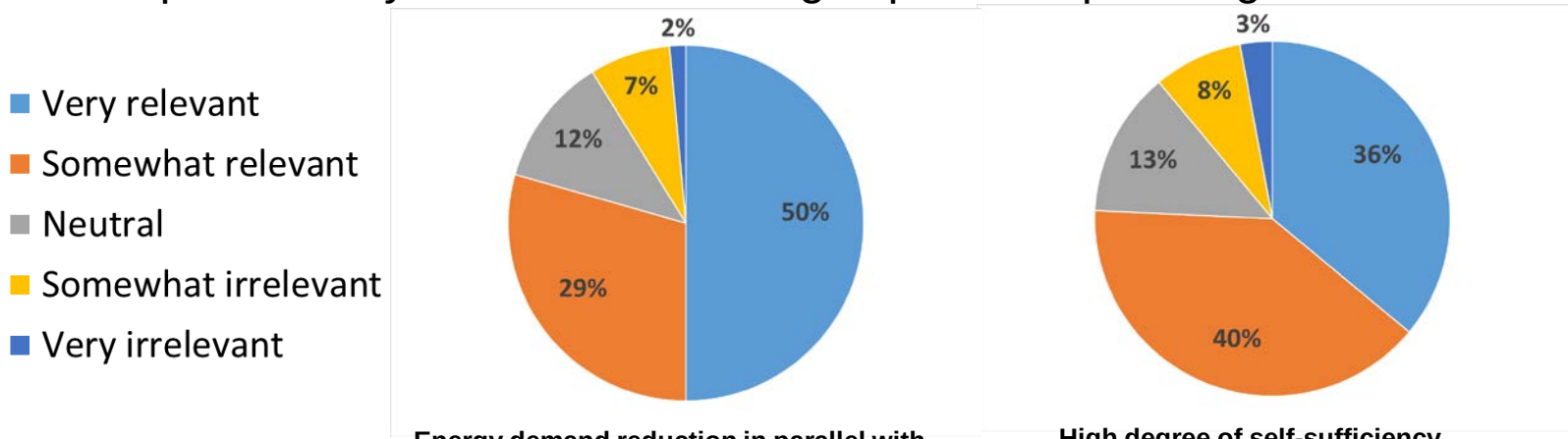
- In addition to the fourth task meeting subtask C conducted 3 **virtual meetings**: 10.06. / 06.07. and 11.08.2022
- Members of Subtask C participated online in meeting of **joined Subtask B and C working group** on 07.11.22
- A draft version of **"Summary of demonstration cases"** (deliverable C1) was prepared and discussed during 4th task meeting; Deliverable slightly delayed.
- It is proposed to **merge deliverable C2** (description of process and tools currently used to design new SEB and SEB communities) **and deliverable C3** (description of process and tools currently used) to convert existing building stock into SEB to one new deliverable;
  see also "Issues for the ExCo" on page 26

Task 66 (Solar Energy Buildings) – Status Report Dec 2022

Work already performed since last ExCo-Meeting by:

Subtask C: Thermal grid connected Buildings and Building Blocks / Communities (New and Existing) – Connected to thermal grid

- A **questionnaire** related to **planning, project development and performance a well as financial and environmental aspects** of Solar Energy Buildings was elaborated and send out to a large number of persons. Until September 2022 around 140 answer were received and evaluated.
- Some exemplarily results:
  How important do you find the following aspects for planning SEBs?



Energy demand reduction in parallel with installation of solar energy systems

High degree of self-sufficiency

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Work already performed since last ExCo-Meeting by:

Subtask D: Current and future technologies and components

- In addition to the fourth task meetings subtask D conducted one **virtual meeting on 23.08.22**
- A final draft version of the **deliverable D.D1 (description of the available technology portfolio)** was elaborated and discussed during the 4th task meeting.
- Deliverable D1 was due in month 9, corresponding to March 2022
  → delayed; expected to be available in Dec 2022.
- Deliverable D2 (description of promising future technologies) was discussed during the 4th task meeting. A draft version of the deliverable will be available by the end of 2022.

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Formal issues – National participation letters (NPLs)

Source: https://www.cartoonstock.com/w/de/l/legal.asp

Already received

- Austria
- Denmark
- Slovakia
- China (one for CABR and one for BUT and one for HUST)
  CABR: China Academy of Building Research
  BUT: Beijing University of Technology
  HUST: Huazhong University of Science and Technology
- Portugal
- Germany

Still missing

- Australia
- United Kingdom

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Past and future Meetings

Note: Future Meetings are printed in *italic*

Meeting #	Date	Location	Number of participants &
0	30.03.2021	Virtual task preparation workshop	45 participants from 15 countries
1	01.-02.07.2021	Virtual meeting	37 participants from 14 countries
2	04.-05.11.2021	Virtual meeting	37 participants from 14 countries
3	23.-24.03.2022	Virtual meeting	29 participants from 12 countries
4	29.-30.09.2022	Kassel, Germany	17 participants from 7 countries
5	*06.-07.02.2023*	*Virtual meeting*	*? participants from ? countries*

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Industry Workshops

Note: Future Workshops are printed in *italic*

Workshop #	Date	Location	Number of participants
3	*07.02.2023*	*Virtual*	*? participants from ? countries*
2	29.09.2022	Kassel, Germany	31 participants from 9 countries
1	23.03.2022	Virtual	56 participants from 14 countries

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Participating Countries

- Austria
- Germany -
- *India*
- *USA*
- Australia
- China
- Belgium
- UK
- *Albania*
- Portugal
- Switzerland
- Poland
- Denmark
- *Mexico*
- Slovakia

Note: - For the USA and Mexico a “minimum collaboration level” between IEA SHC Task 66 and the PVPS TCP might be an option
- India will hopefully soon join the SHC
- Albania might to be kicked out

Alternatively:
Experts from USA, Mexico, India and Albania might participate as ISES members?

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Issues for the ExCo

Issues for participating ExCo Members

- Please sign NPLs and help the experts with funding, if possible

Issues for full ExCo

- Please motivate additional experts and representatives from industry to participate in Task 66.
- Do you agree to merge
  Subtask B (Thermal stand- alone buildings and building blocks)
  and
  Subtask C (Thermal grid connected buildings and building blocks)

- Do you agree to merge
  Deliverable C2 (description of process and tools currently used to design new SEB and SEB communities)
  and
  Deliverable C3 (description of process and tools currently used to convert existing building stock into SEB)

Questions and Discussion

Thanks for listening!

www.iea-shc.org

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INTERNATIONAL ENERGY AGENCY

A common activity of:

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