



Solar Energy Buildings

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

Task 66

Joint Workshop IEA HPT Annex 61, EBC Annex 83, SHC Task 66

Task Duration: 1 July 2021 – 30 June 2024

Lukas Oppelt, Harald Drück, Frank Späte, Elsabet Nielsen, Xinyu Zhang, Thomas Ramschak et al.

Task 66 (Solar Energy Buildings)

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



Task 66 (Solar Energy Buildings)

Subtasks of Task 66

Subtask A:

Boundary Conditions, KPIs, Definitions and Dissemination

Lead: **Frank Späte**, OTH-AW, Germany

Subtask B/C:

Thermal stand alone Single Buildings and Building Blocks

Not connected to a thermal grid (B) Connected to thermal grid (C)

Lead: **Elsabet Nielsen**, DTU, Denmark

Co-Lead: **Xinyu Zhang**, China Academy of Building Research, Beijing, China

Subtask D:

Current and future technologies and components

Lead: **Thomas Ramschak**, AEE INTEC, Austria

Task 66 (Solar Energy Buildings)

Task 66 brochure / Task 66 flyer

Task 66 video

Task 66: Solar Energy Buildings

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




OBJECTIVE: Development of economic and ecologic feasible energy supply concepts with high solar fractions

Areas of Work

The task addresses single-family buildings, multi-story residential buildings and building blocks and communities, for both, new and existing buildings. The separation between (single) buildings and building blocks or communities is based on the aspect whether the buildings are connected to a thermal grid or not. While single buildings have their individual heating system, building blocks and communities are connected to a thermal grid.

Subtask A: Boundary Conditions, KPIs, Definitions and Dissemination
 Leader: Frank Späte (OTH Amberg-Weiden, Germany, f spaete@oth-aw.de)
 • Define performance assessment methodology for SEBs* incl. KPIs**
 • Assessment of SEBs of Subtask B and C
 • Organization of Industry Workshops
 • Preparation of guidelines for policy makers, municipalities, energy related companies

Subtask B: Thermal stand alone Buildings and Building Blocks / Communities
 Leader: Xinyu Zhang (China Academy of Building Research, China, zxyhit@163.com)
 • Development and definition of sample cases
 • Identification of demonstration Projects
 • Planning and implementation methodology
 • Modelling, simulation and optimization tools

Subtask C: Thermal grid connected Buildings and Building Blocks / Communities
 Leader: Elsebet Nielsen (Technical University of Denmark, Denmark, ean@byg.dtu.dk)
 • Development and definition of sample cases
 • Identification of demonstration projects
 • Planning and implementation methodology
 • Modelling, simulation and optimization tools

Subtask D: Current and future technologies and components
 Leader: Thomas Ramschak (AEE - Institute for Sustainable Technologies, Austria, t.ramschak@aee.at)
 • Documentation and analysis of current and future technologies
 • Classification and techno-economic technology assessment
 • Development SEB* solution sets and guidelines

* SEB = Solar Energy Building
 ** KPI = Key Performance Indicator

Outcomes

Summary of KPIs, Definition of Reference Buildings, SEB promotion documents, Demonstration cases (Case studies), Processes and tools currently used to design new SEBs and convert existing buildings into SEBs, Catalogue describing optimized solutions of SEBs and communities, Description of available technology portfolio, future technologies and components

Duration: July 2021 – June 2024

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<https://task66.iea-shc.org/>
task66.info@iea-shc.org
www.iea-shc.org

Participating Countries

Australia
Austria
China
Denmark
France
Germany
Italy
Mexico
Portugal
Slovakia
Switzerland
United Kingdom




SHC TASK 66

[ABOUT PROJECT](#)
[MEETINGS / EVENTS](#)

Task Introduction Video



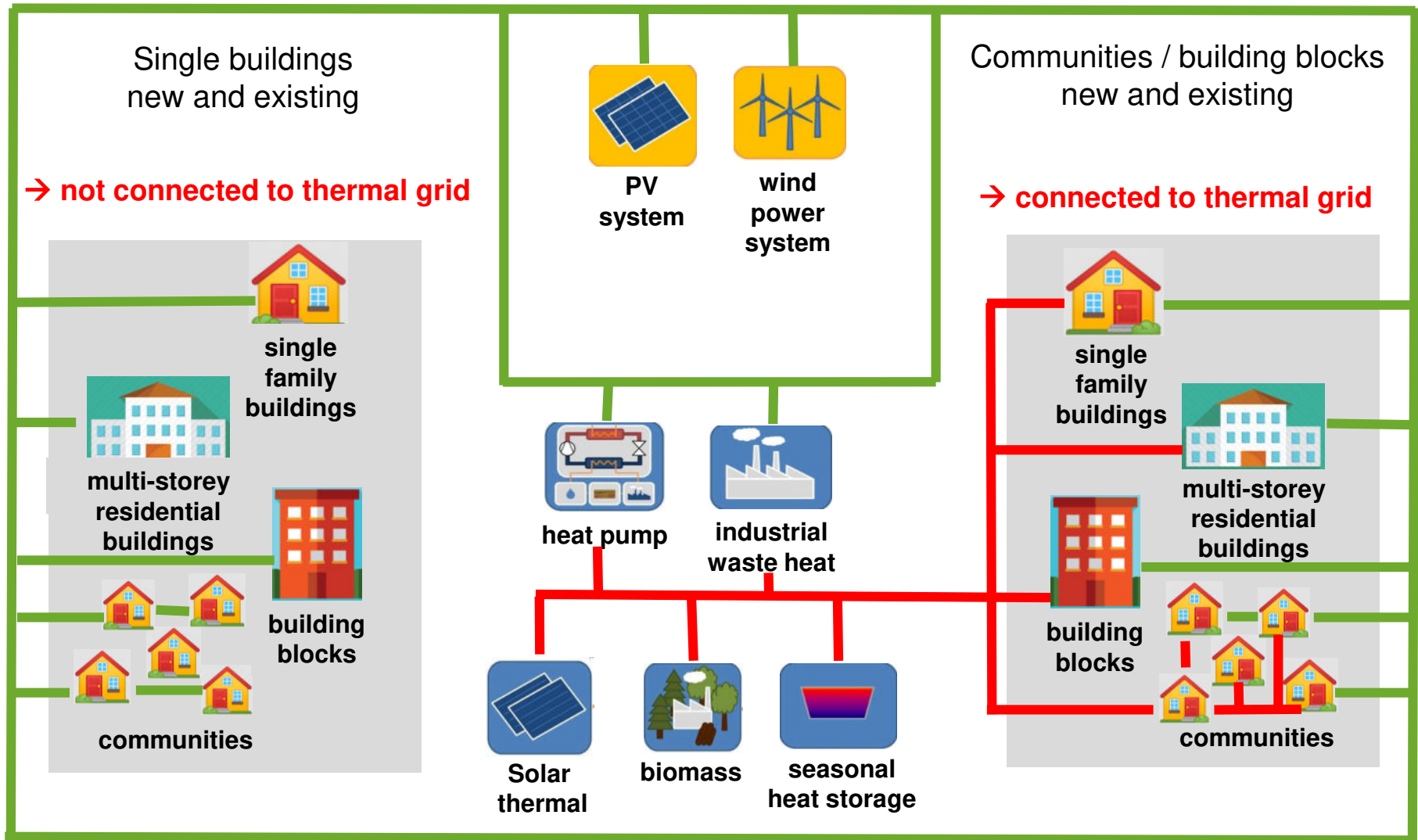
SHC Task 66 - Solar Energy Buildings
 IEA SHC Task 66 - Solar Energy Buildings
 SHC SOLAR HEATING & COOLING PROGRAMME INTERNATIONAL ENERGY AGENCY
 Solar Energy Buildings
 Integrated solar energy supply concepts for climate-neutral buildings and communities
 Task 66 General Information
 Task Duration: 1 July 2021 – June 2024
 Ansehen auf YouTube

Task 66 (Solar Energy Buildings)

Participating Countries

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

Task 66 (Solar Energy Buildings)



— electrical grid

— thermal grid

Task 66 (Solar Energy Buildings) – Subtask A

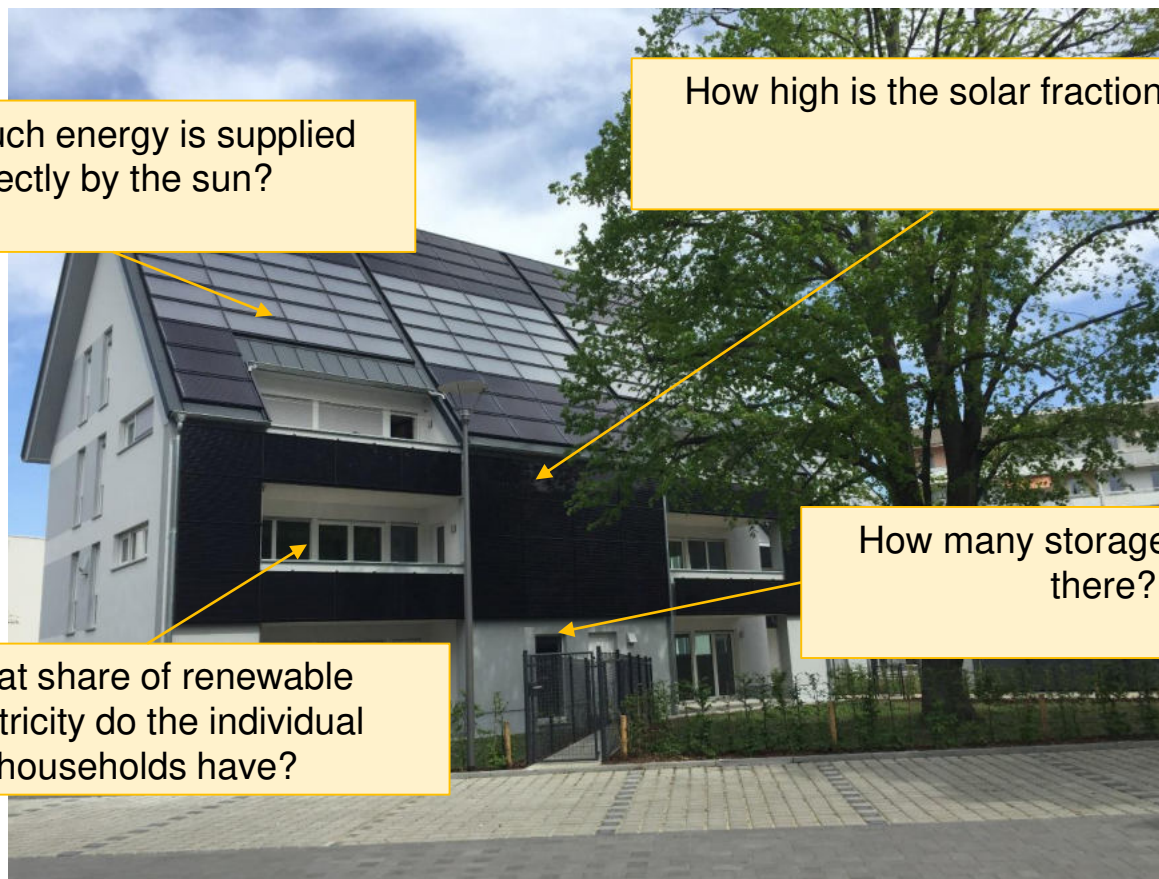
KPIs

How much energy is supplied directly by the sun?

How high is the solar fraction?

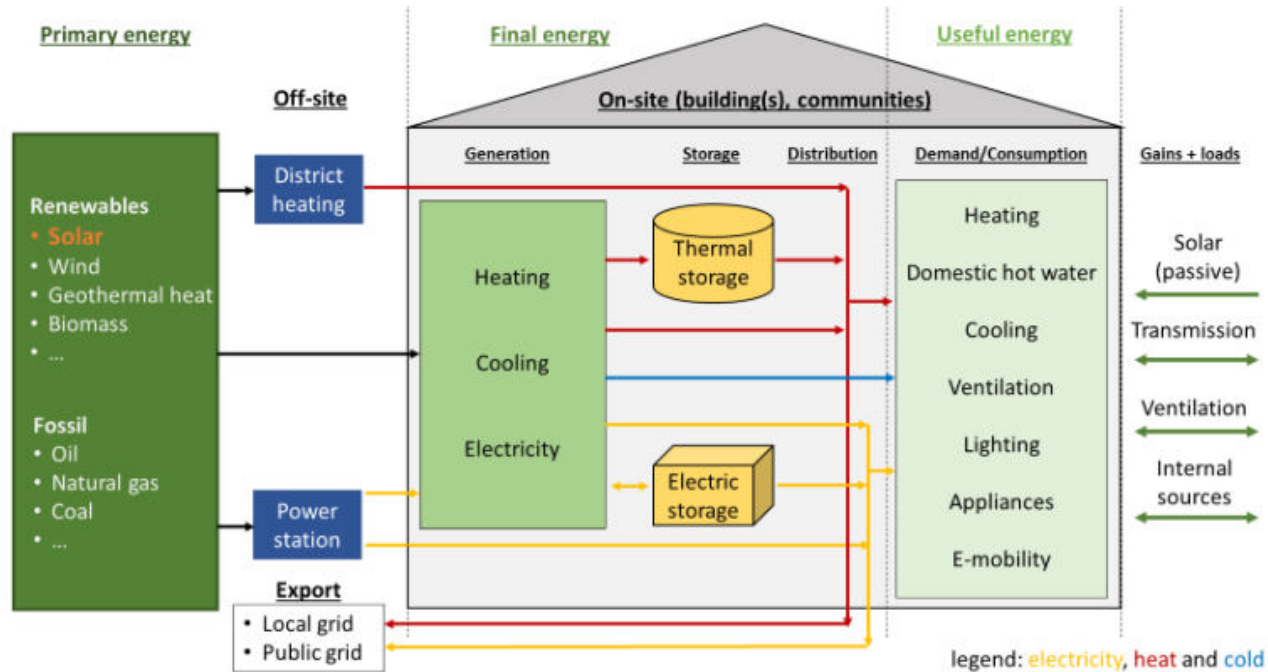
How many storage losses are there?

What share of renewable electricity do the individual households have?



Task 66 (Solar Energy Buildings) – Subtask A

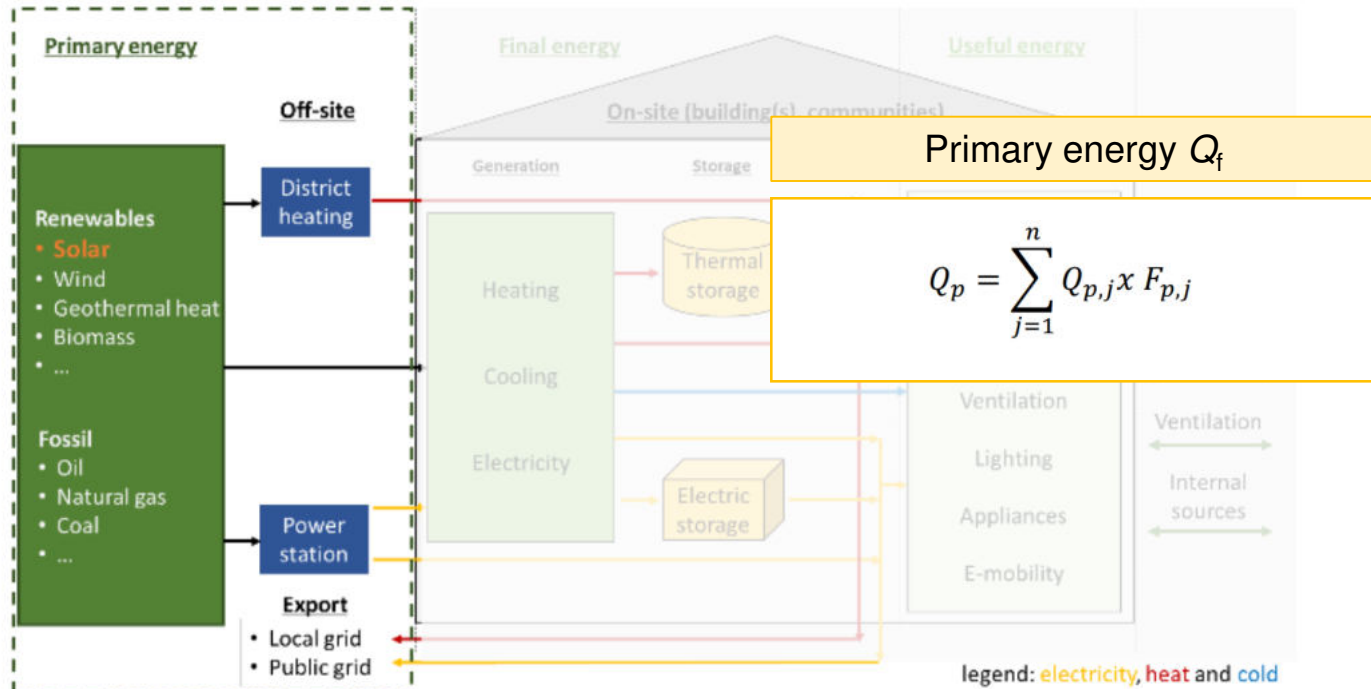
Final list of KPIs Deliverable D.A2 (sneak preview)



→ Franziska Bockelmann, Tillman Gauer, Frank Späte: „Final list of KPIs“, report from SHC Task 66

Task 66 (Solar Energy Buildings) – Subtask A

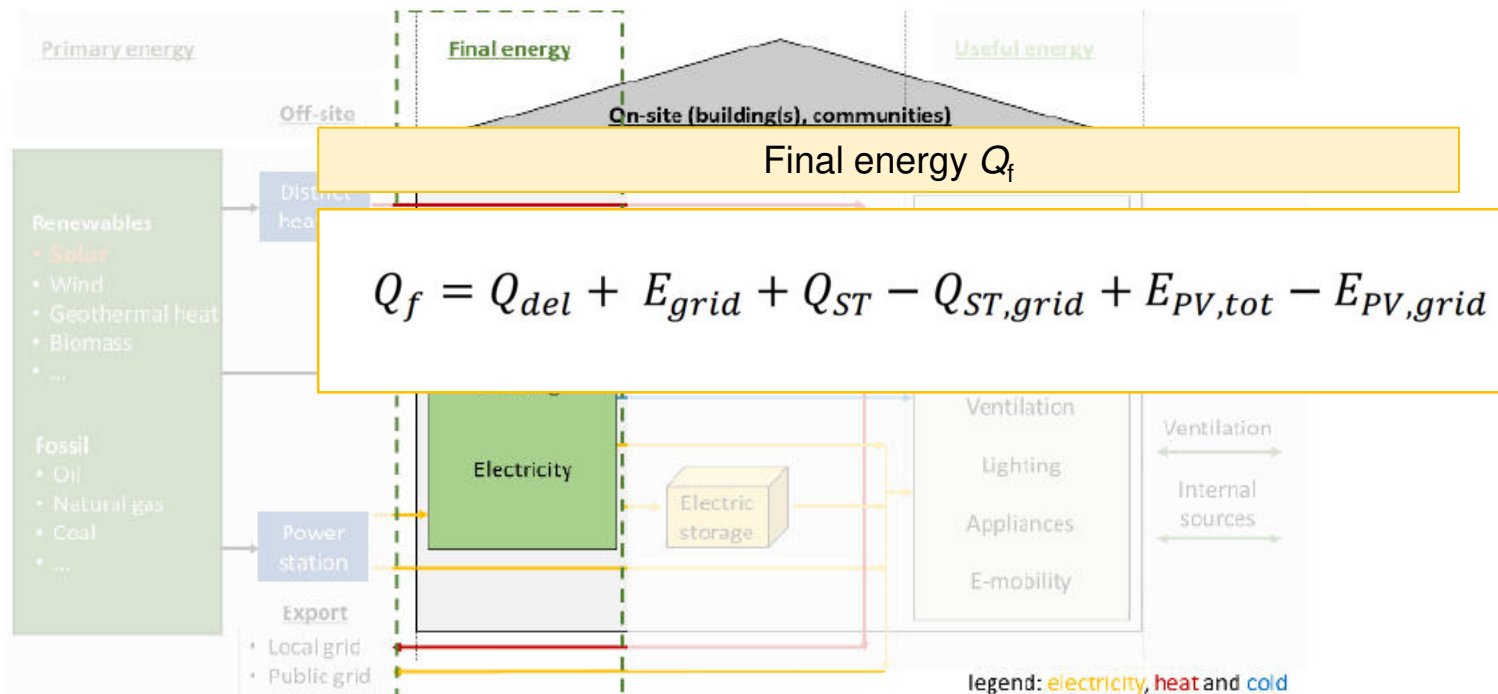
Final list of KPIs Deliverable D.A2



→ Franziska Bockelmann, Tillman Gauer, Frank Späte: „Final list of KPIs“, report from SHC Task 66

Task 66 (Solar Energy Buildings) – Subtask A

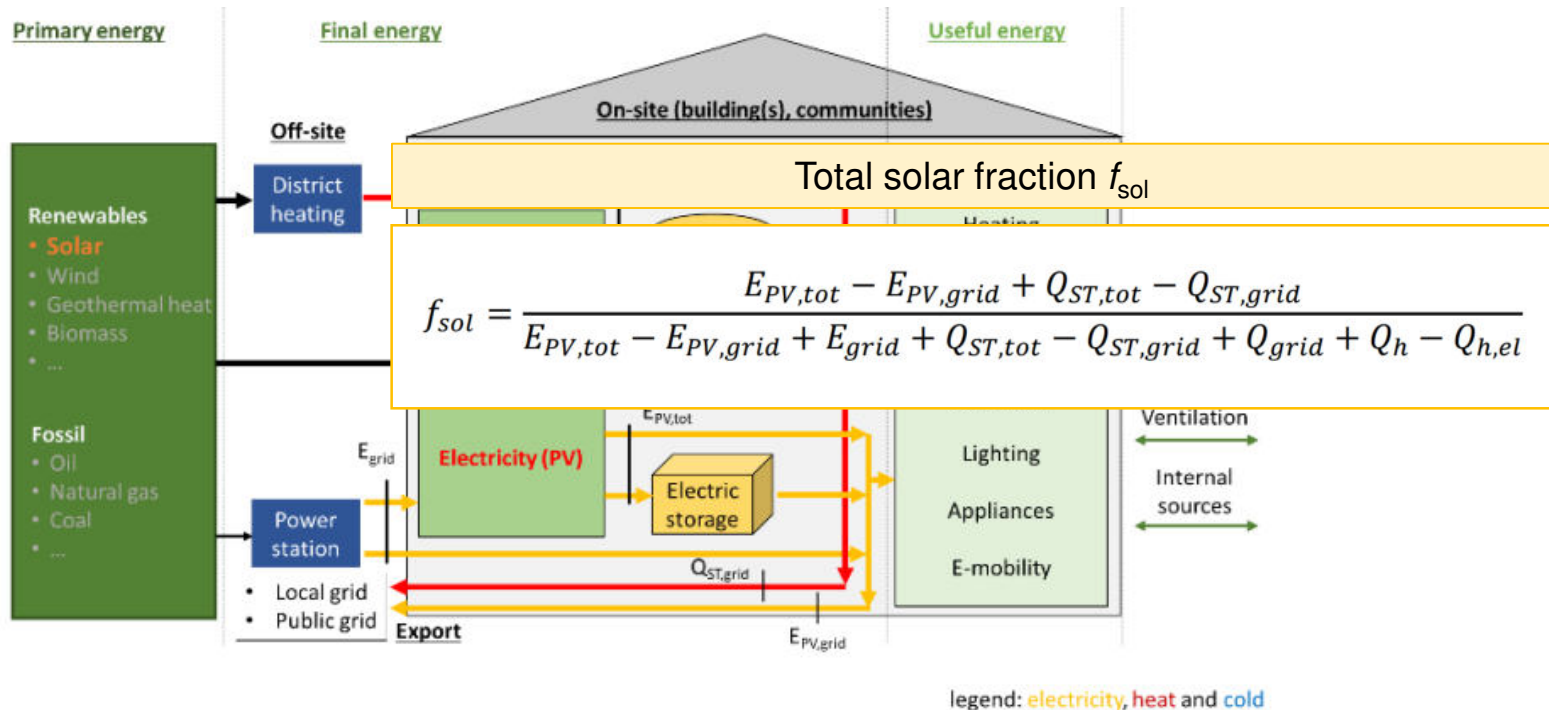
Final list of KPIs Deliverable D.A2



→ Franziska Bockelmann, Tillman Gauer, Frank Späte: „Final list of KPIs“, report from SHC Task 66

Task 66 (Solar Energy Buildings) – Subtask A

Final list of KPIs Deliverable D.A2



→ Franziska Bockelmann, Tillman Gauer, Frank Späte: „Final list of KPIs“, report from SHC Task 66

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

Subtasks of Task 66

Subtask A:

Boundary Conditions, KPIs, Definitions and Dissemination

Lead: **Frank Späte**, OTH-AW, Germany

Ongoing/future work:

- **Define reference buildings**
- **Other deliverables, e.g:**
 - SEB promotion document for investors
 - Policy oriented guidelines for the promotion of SEB

Task 66 (Solar Energy Buildings) – Subtask BC

Demonstration cases Deliverable D.A2



Campagne-Reichenau, Austria
 No data - monitoring started October 2022



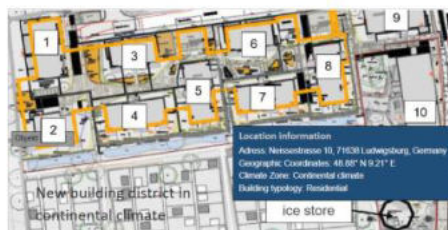
Neue Heimat Tirol, Austria
 Simulated data



East Beisanhuan Road, Beijing, China
 Simulated and measured data (2022)



READY, Denmark
 Simulated and measured data (2020)



Ludwigsburg, Germany
 Simulated data - monitoring not started yet



Weinstadt, Germany
 Simulated data – monitoring started

→ Elisabet Nielsen et al.: D.BC1 „Demonstration cases“, report from SHC Task 66

Task 66 (Solar Energy Buildings) – Subtask BC

Demonstration cases Deliverable D.A2



Cottbus, Germany
Simulated and measured data
(2020/2021)



Konstanz, Germany
Simulated and measured data (2017
– 2019)



Riedberg, Germany
Simulated and measured data (2016 –
2019)



Freiberg, Germany
Measured data (2014-2017)



Delhi, India
Measured data – Not yet available



Kochi, India
Measured data – Not yet available

→ Elisabet Nielsen et al.: D.BC1 „Demonstration cases“, report from SHC Task 66

Task 66 (Solar Energy Buildings) – Subtask BC

Demonstration cases Deliverable D.A2



Kochi, India

Measured data – Not yet available



Haryana, India

Measured data – Not yet available



Reference building, Graz,
Austria

Multifamily house in Graz – simulated
data (MFH-10 and MFH-35)

→ Elisabet Nielsen et al.: D.BC1 „Demonstration cases“, report from SHC Task 66

Task 66 (Solar Energy Buildings) – Subtask BC

Demonstration cases Stakeholder viewpoint

Subtask B/C:

Thermal stand alone Single Buildings and Building Blocks

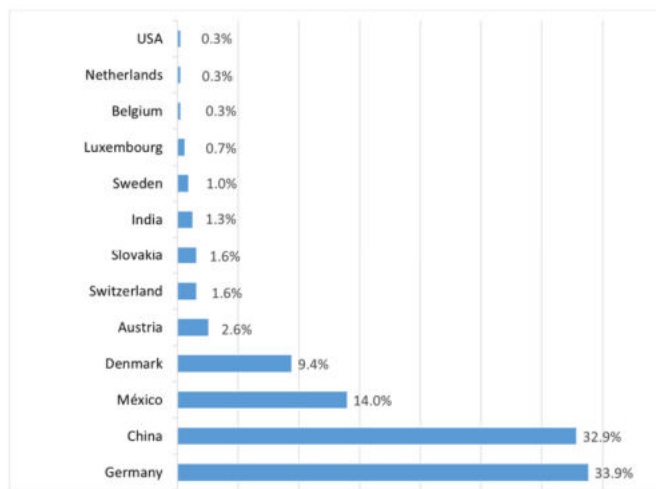
Not connected to a thermal grid (B) Connected to thermal grid (C)

Lead: **Elsabet Nielsen**, DTU, Denmark

Co-Lead: **Xinyu Zhang**, China Academy of Building Research, Beijing, China

General questions on:

- Planning aspects
- Project development aspects
- Performance aspects
- Financial aspects
- Environmental aspects



Distribution of answers from all countries.

Germany: 104

China: 101

México: 43

Denmark: 29

Austria: 8

Switzerland: 5

Slovakia: 5

India: 4

Sweden: 3

Luxembourg: 2

Belgium: 1

Netherlands: 1

USA: 1

Task 66 (Solar Energy Buildings) – Subtask BC

Demonstration cases Stakeholder viewpoint

Subtask B/C:

Thermal stand alone Single Buildings and Building Blocks

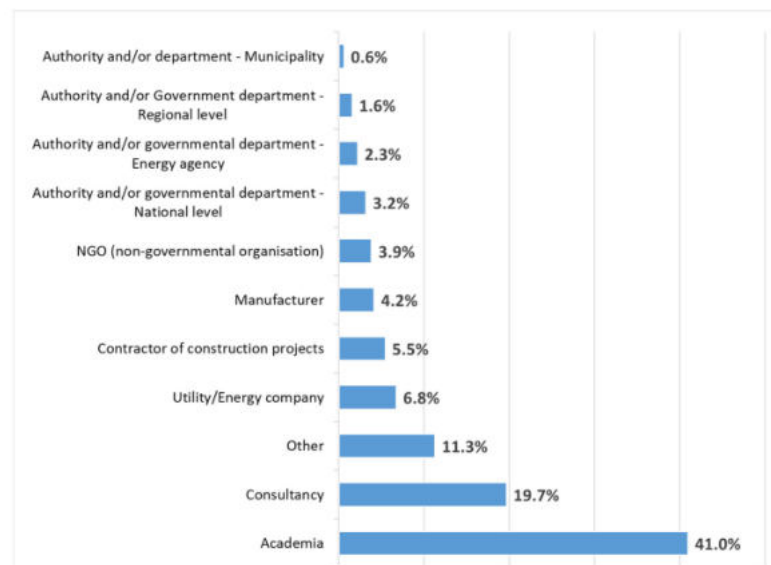
Not connected to a thermal grid (B) Connected to thermal grid (C)

Lead: **Elsabet Nielsen**, DTU, Denmark

Co-Lead: **Xinyu Zhang**, China Academy of Building Research, Beijing, China

It is concluded that

- Changes of national legislations and regulations on renewable energy technologies are most needed
 - Also country-dependent, e.g. the Chinese are satisfied with current regulations
- The rules on selling are stable
 - Is that still the current view?
- CO₂-emission reduction related to operation of the buildings are achieved
- The energy demand of the buildings are reduced in parallel with installation of the solar energy system



Distribution of organizations from all countries.

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

Subtasks of Task 66

Subtask B/C:

Thermal stand alone Single Buildings and Building Blocks

Not connected to a thermal grid (B) Connected to thermal grid (C)

Lead: **Elsabet Nielsen**, DTU, Denmark

Co-Lead: **Xinyu Zhang**, China Academy of Building Research, Beijing, China

Ongoing/future work:

→ Working group “Planning and implementation methodology”

→ design

→ construction and verification

→ operation and maintenance

→ renovation, end of life

→ Other deliverables, e.g:

→ Description of processes and tools currently used to design new Solar Energy Buildings

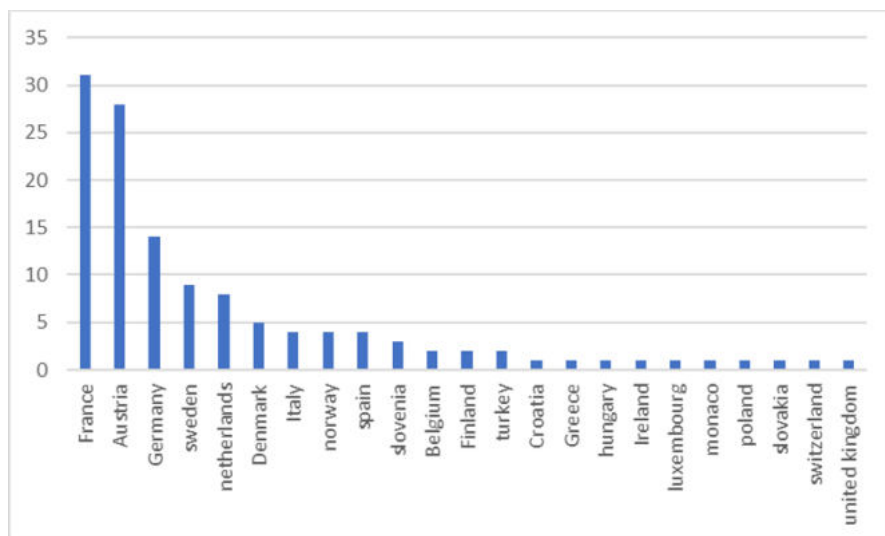
→ Catalogue describing optimized solutions of Solar Energy Buildings

Task 66 (Solar Energy Buildings) – Subtask D

Description of available technology portfolio

- Stocktaking of Solar energy buildings across Europe
- SEB distribution across four climate zones (HDD)














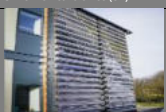







→ Thomas Ramschak, Elisa Venturi, Lukas Oppelt et al.
D1: Documenting and analyzing current and future technologies applied in SEB's.



Task 66 (Solar Energy Buildings) – Subtask D

Case studies

SEB N°	SEB Technologies																		
	Energy Generation							Energy storage				DH	Other Energy Features						
	Photovoltaics	Solar Thermal Collectors	PVT-Collectors	Groundwater and Heat Pumps	Ice-Storage and Heat Pumps	PVT and Heat Pumps	Geothermal and Heat Pumps	Mix-Source Heat Pumps	Biomass Combustion	Batteries	Mobile Batteries (E-mobility)	Sensible Energy Storage	Thermochemical Storage	Ice-Storage	Thermal Mass Activation	District Heating Network	Retrofit	Thermo-regulatable well	Energy Management System
SEB No.1	1			1						1	1	1			1	1	1		1
SEB No.2	1			1					1			1			1				
SEB No.3		1													1				
SEB No.4		1												1					
SEB No.5	1	1								1	1	1							
SEB No.6																		1	
SEB No.7		1										1	1						
SEB No.8	1						1			1									
SEB No.9	1	1	1				1			1	1	1			1				1
SEB No.10	1				1					1									
SEB No.11	1									1									
SEB No.12	1	1		1															
SEB No.13	1			1				1											
SEB No.14	1			1						1	1								
SEB No.15	1			1				1		1									
SEB No.16	1																		
SEB No.17	1																		
SEB No.18	1									1									
SEB No.19	1																		
SEB No.20	1	1			1	1				1	1	1							
SEB No.21			1		1	1								1	1	1			
SEB No.22	1	1			1	1								1		1			

MIXED USE by AEE INTEC Former Industrial complex (AT)  SEB No. 1	COMMERCIAL by DTU Ramboll Head Office (DK)  SEB No. 2	RESIDENTIAL by Simply Solar Kurja Guesthouse in Leh/Ladakh  SEB No. 3	RESIDENTIAL by IGTE SolSpace (DE)  SEB No. 4
RESIDENTIAL by TU Freibg Apartment Buildings (GER)  SEB No. 5	TEST CHAMBERS by LNGE LNGE Campus (PT)  SEB No. 6	COMMERCIAL by AEE INTEC Orphanage (PL)  SEB No. 7	RESIDENTIAL by SIZ energieplus Multi-family houses (GER)  SEB No. 8
RESIDENTIAL by AEE INTEC Sol4City-Simulation Study (AT)  SEB No. 9	RESIDENTIAL by SIZ energieplus Multi-family house GER)  SEB No. 10	MIXED USE by (UIBK) An der Lan (AT)  SEB No. 11	RESIDENTIAL by (UIBK) Vögeleibichl (AT)  SEB No. 12
MIXED USE by (UIBK) Campagne Reichenau (AT)  SEB No. 13	RESIDENTIAL by (UIBK) Apartment Buildings in Rum (AT)  SEB No. 14	COMMERCIAL by Naked Energy SPECIFIC Active Office (UK)  SEB No. 15	RESIDENTIAL by (STEAG) Rajagiri College (IND);  SEB No. 16
MIXED USE by (STEAG) Rajagiri Valley Campus (IND)  SEB No. 17	MIXED USE by (STEAG) St. Mary School and Hostel (IND)  SEB No. 18	HOSPITAL by (STEAG) Holy Family Hospital (IND);  SEB No. 19	RESIDENTIAL by TU Freibg Single family home (GER)  SEB No. 20
MIXED USE by IGTE/Viessmann New residential and service complex (GER)  SEB No. 21	MIXED USE by IGTE/Viessmann New building district (GER)  SEB No. 22		

Task 66 (Solar Energy Buildings) – Subtask D

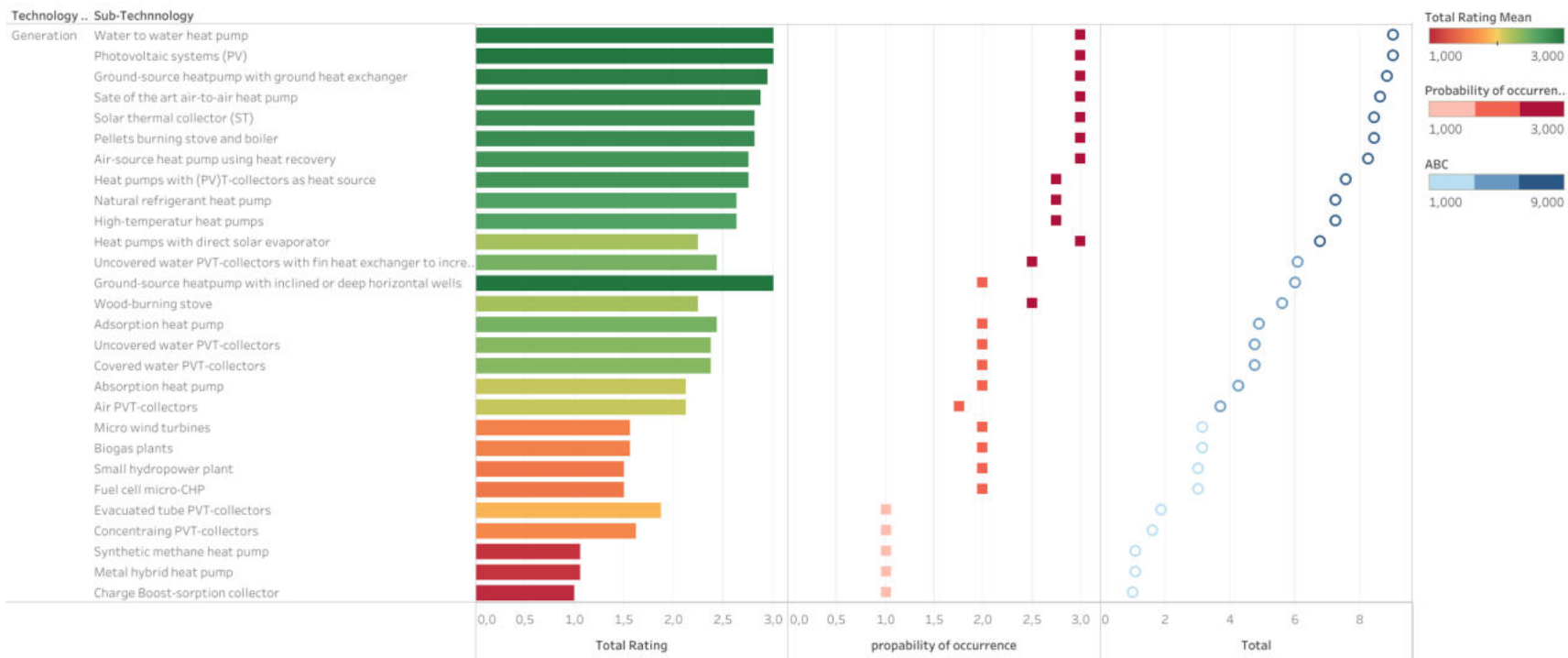
Description of available technology portfolio

Generation Technologies

Storage Technologies

Thermal Grids

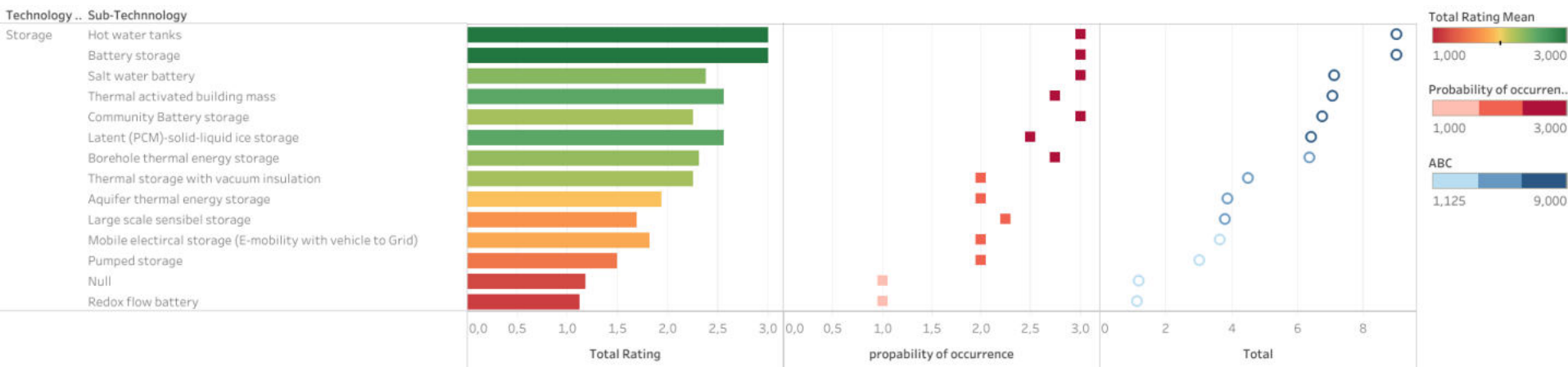
Buildings/Communities



- best rated generation technologies → solar technologies (solar heat and power), heat pumps
- hybrid technologies (PVT) → high potential but a need to change external and internal environment

Task 66 (Solar Energy Buildings) – Subtask D

Description of available technology portfolio



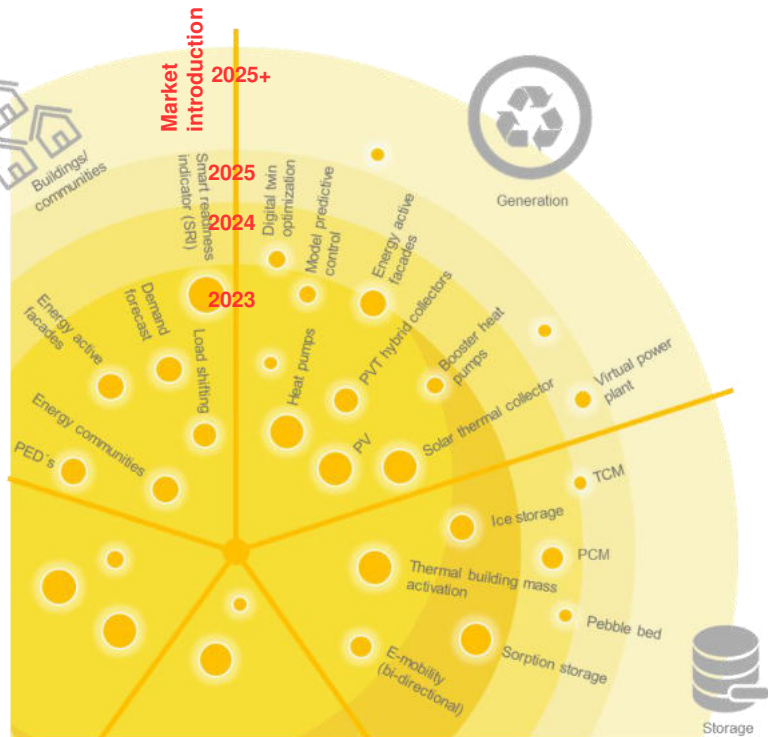
- Heat production is becoming increasingly electrified and impacting on electricity network (V2G, Community Batteries, ...)
- The decision in favour of a technology is often also made dependent on funding programmes
 → Denmark: solar district heating systems with seasonal pit thermal energy storage

Task 66 (Solar Energy Buildings) – Subtask D

Description of available technology portfolio

➔ Activity D2: Comparison of technologies with respect to technical and economical considerations .

Generation technologies	Storage technologies	Thermal Grids	Buildings/Communities
GenTech1	StoreTech1	GridTech1	Tech1
Methods	Methods	Methods	Methods
Actions	Actions	Actions	Actions



Marked potential



Probability of occurrence



Thanks for your attention!

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A common activity of:

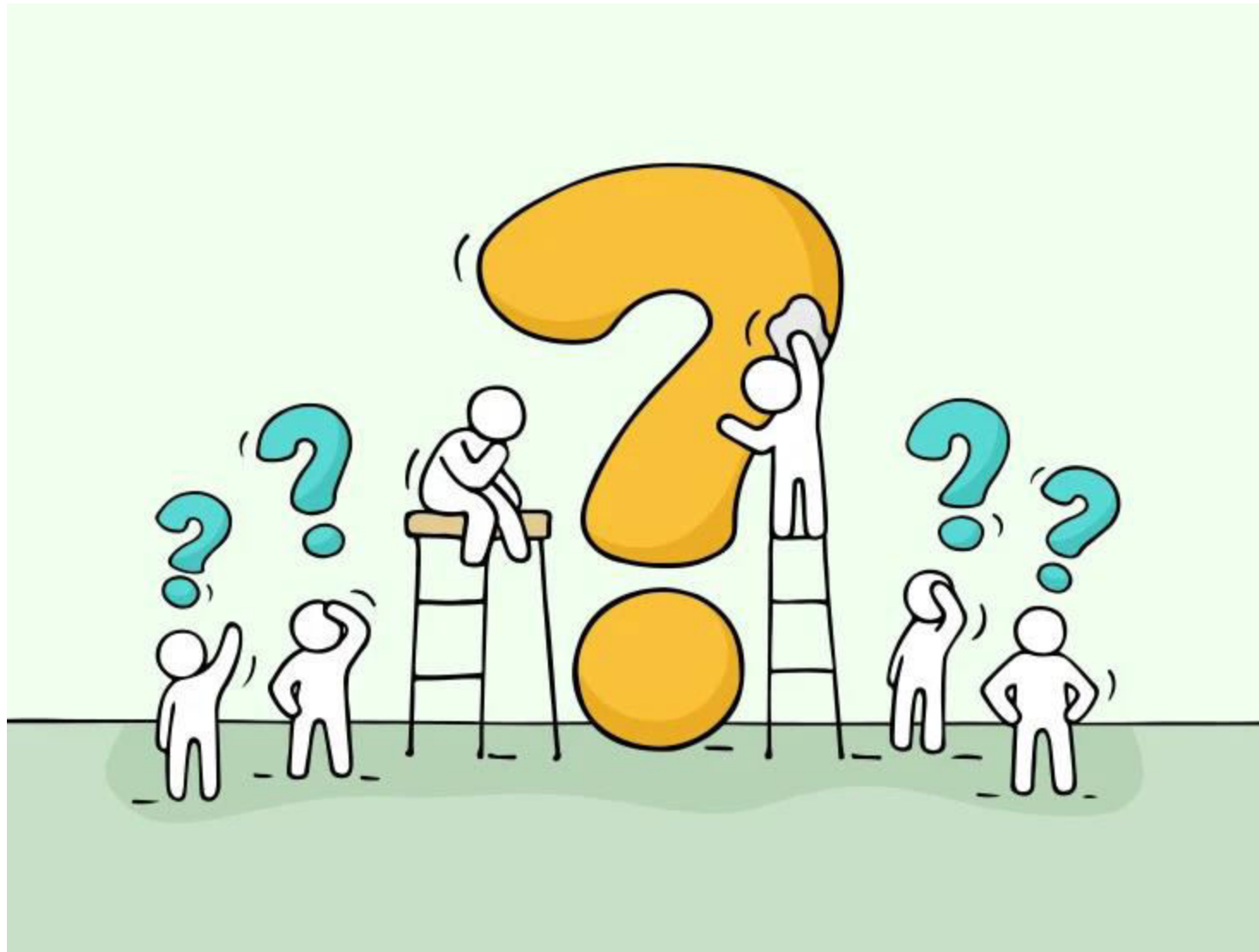
Harald Drück, IGTE, University of Stuttgart - Stuttgart, Germany

Email: harald.drueck@igte.uni-stuttgart.de

Christian Fink, Thomas Ramschak, AEE INTEC, Gleisdorf, Austria

Email: c.fink@aee.at

Questions and Discussion



Thanks!

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Christian Fink, Thomas Ramschak, AEE INTEC, Gleisdorf, Austria

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