



SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Proposed Task

Life Cycle and Cost Assessment for Heating and Cooling Technologies

Karl-Anders Weiß
SHC ExCo Meeting, online, 05.12.2022

Global Objectives

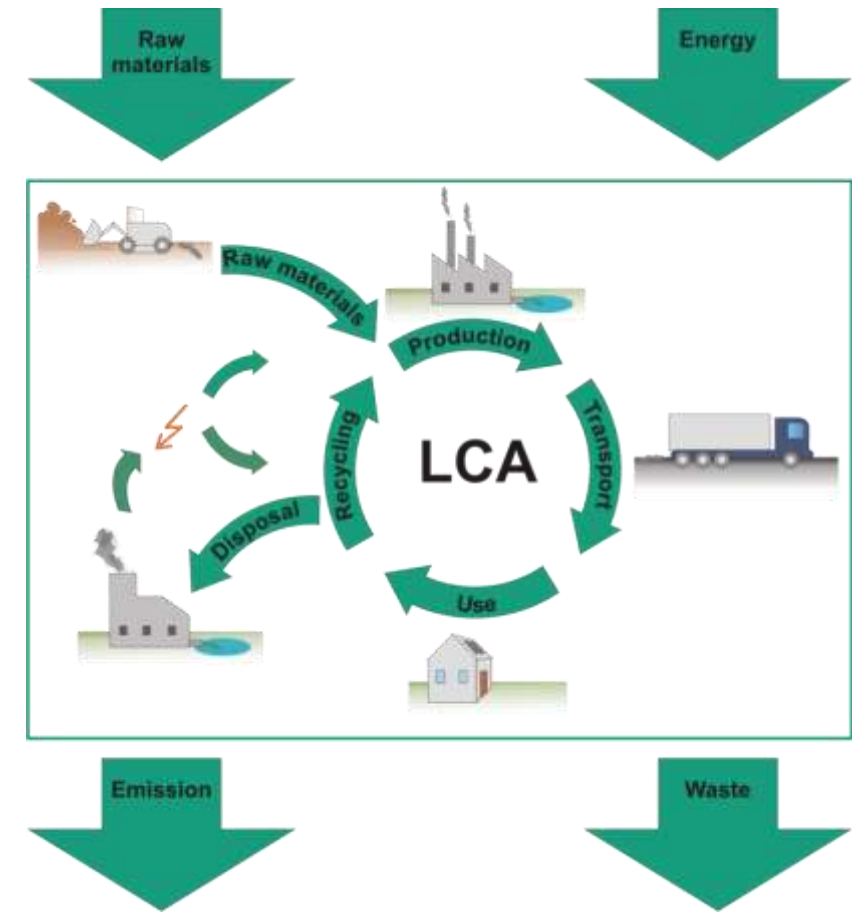
- Make heating costs and sustainability reliable comparable – **of different technologies**
- Identification, monitoring and influencing of existing and upcoming regulations and standards for environmental performance of SHC technologies
- Enhancing the eco-quality of products
- Supporting cost reduction measures
- Make impact of influences transparent
- Creating business opportunities for producers
- Customer trust is sustained by standardized and reliable analyses on costs and ecology



| | Reference system | General system | Heat pipe system |
|--------------------------|------------------|----------------|------------------|
| Solar investment [€] | 3 850 | 3 220 – 3 570 | 3 135 – 3 509 |
| Annual maintenance [€/a] | 100 | 42 – 52 | 34 – 46 |
| Annual yield [kWh/a] | 2 226 | 2 226 | 2 226 |
| LCoH solar [ct/kWh] | 13.9 | 9.9 – 11.1 | 9.3 – 10.7 |
| Cost reduction [%] | - | 21 – 30 | 24 – 34 |

Specific Objectives

- Improvement and extension of LCA and LCOH calculation methodology and database for SHC technologies
- Development of guidelines on methodologies, system boundaries (included components, lifetime, location of use, interest rate, etc.), impact categories/(CO₂-emissions, toxicity, energy-payback-time, etc.)
- Definition of the parameters for location and system specific LCA and cost assessment (climate, electricity mix ...)
- Close cooperation with ongoing or upcoming SHC-Tasks that want support



Objectives

Support for ongoing and upcoming Tasks

Close cooperation with related Tasks from other TCPs:

Methodological and technical knowledge shall be shared and possible synergies be explored and LCOH calculation and LCA for combined systems enabled

Proposed Structure

Subtask A: Cooperation with ongoing or upcoming SHC-Tasks and related Tasks from other programs

Subtask B: Methodology adaptation

Subtask C: Data of different technologies and components

Subtask D: Reference systems and their requirements, scenarios and optimization

Subtask E: Dissemination, networking and policy involvement

Subtask A: Cooperation with ongoing or upcoming SHC-Tasks and related Tasks from other programmes

Lead: Fraunhofer ISE, Germany

Outcomes

- Identification of relevant standards and regulations
- Updates of upcoming policy initiatives
- Establishing a close cooperation with ongoing related IEA activities
- Establishing a common understanding and approach on sustainability and cost assessments with in the renewable energy community
- Joint workshops with experts for energy technologies, cost and sustainability assessment (Subtask E)

Subtask A: Cooperation with ongoing or upcoming SHC-Tasks and related Tasks from other programmes

Activities

A 1: Cooperation with ongoing or upcoming IEA-Tasks and programs

A 2: Regulation Framework

| No. | Deliverable / Milestone | Month | Related to activity |
|-------|---|-------|---------------------|
| D A.1 | Summary of existing regulations | 12 | A 2 |
| M A.1 | Contact with all relevant Tasks / Annexes established | 6 | A 1 |
| M A.2 | Workshop with PVPS and EBC representatives on common understanding and approaches regarding ecological footprint assessment | 18 | A 1 |
| M A.3 | Draft for a white paper is ready | 24 | A 2 |

Subtask B: Methodology adaptation

Lead: ZHAW, Switzerland

Outcomes

- Improvement and extension of existing LCA and LCOH models and methodology
- Definition of guidelines for LCA and LCOH of components
- Definition of guidelines for LCA and LCOH of heating systems

Activities

B 1: Functional units and framework parameters

B 2: Ecological assessment

B 3: Economic assessment

B 4: Hybrid integral assessment

| No. | Deliverable / Milestone | Month | Related to activity |
|-------|---|-------|---------------------|
| D B.1 | First version of guidelines for LCA and LCoH calculation for components and systems | 18 | B 4 |
| D B.2 | Updated version for a proposal of guidelines for LCA and LCoH calculation of components and systems | 36 | B 4 |

Subtask C: Input data and data formats

Lead: DTU, Denmark

Outcomes

- Identification and compilation of existing inventory and other input data for LCA and LCOH assessment for SHC components and systems
- Data base with relevant and reliable data for LCA and LCOH assessment of SHC systems
- Identification of problems like limited interoperability of different formats and software
- Suggestion of solutions for improved data compatibility
- Definition of interfaces with cooperating IEA Tasks (EBC Annex 72, PVPS Task 12,...)

Activities

C 1: Data requirement

C 2: Data sources and collection

| No. | Deliverable / Milestone | Month | Related to activity |
|-------|--|-------|---------------------|
| D C.1 | Data base established | 12 | C 1 |
| D C.2 | Summary of available and accessible data sets for component and system inventories | 36 | C 2 |

Subtask D: Reference systems, scenarios and sensitivity analysis

Lead: IGTE, Germany

Outcomes

- Selection of reference systems suitable for LCA and LCOH and definition of the functional unit and of relevant parameters of the reference systems
 - Technical characteristics, life expectancy, performance, degradation
 - location of use, allocation, subsidies and taxes
 - optimized sector coupling
 - ...
- Assessment of different current technologies
- Investigation of prospective scenarios for LCA and LCOH
- Recycling scenarios

Subtask D: Reference systems, scenarios and sensitivity analysis

Activities

D 1: Reference data: Demand side

D 2: Reference data: Heating systems (Supply side)

| No. | Deliverable / Milestone | Month | Related to activity |
|---------|---|-------|---------------------|
| D D.1.1 | Reference systems (heat demand) defined | 12 | D 1 |
| D D.1.2 | Reference systems (heat supply) defined | 18 | D 2 |
| D D.2 | Reference systems calculated according to first version of guidelines | 30 | D 2 |
| M D.1 | Reference systems selected | 12 | D 1+2 |

Subtask E: Dissemination, networking and policy involvement

Lead: Inventasolar, Norway

Reporting

- Based on the Task 12 methodology guidelines for PV a similar reporting method must be implemented for heating systems:
Purpose of the study, Type of technology and system, Technical assumptions, Efficiencies, Degradation rates, Lifetime, Geographical constraints, Timeframe of data, Lifecycle stages, LCA tools and data sources used...

Outcomes

- Publication of results
- Workshops with interested stakeholders
- Definition of benchmarks and development goals
- Cooperation with industry and technology associations

Subtask E: Dissemination, networking and policy involvement

Activities

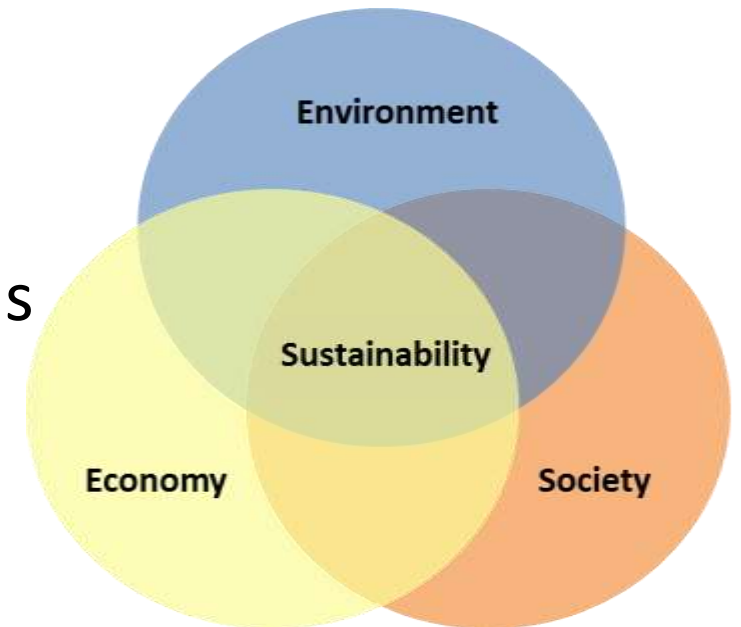
E 1: Stakeholder involvement

E 2: Reporting

| No. | Deliverable / Milestone | Month | Related to activity |
|-------|---|-------|---------------------|
| M E.1 | Stakeholder involvement workshop | 12 | E 1 |
| D E.1 | Info Sheets on input and output information for LCA and LCoH assessment | 24 | E 2 |
| D E.2 | Guidelines on Reporting of LCA and LCoH data | 30 | E 2 |

Prospects

- Future activities could also include further aspects of social and economic sustainability
- Prevent trade-offs from economic improvement to environmental burdens
- Support decision makers with data
- Estimate impact of external effects / regulations

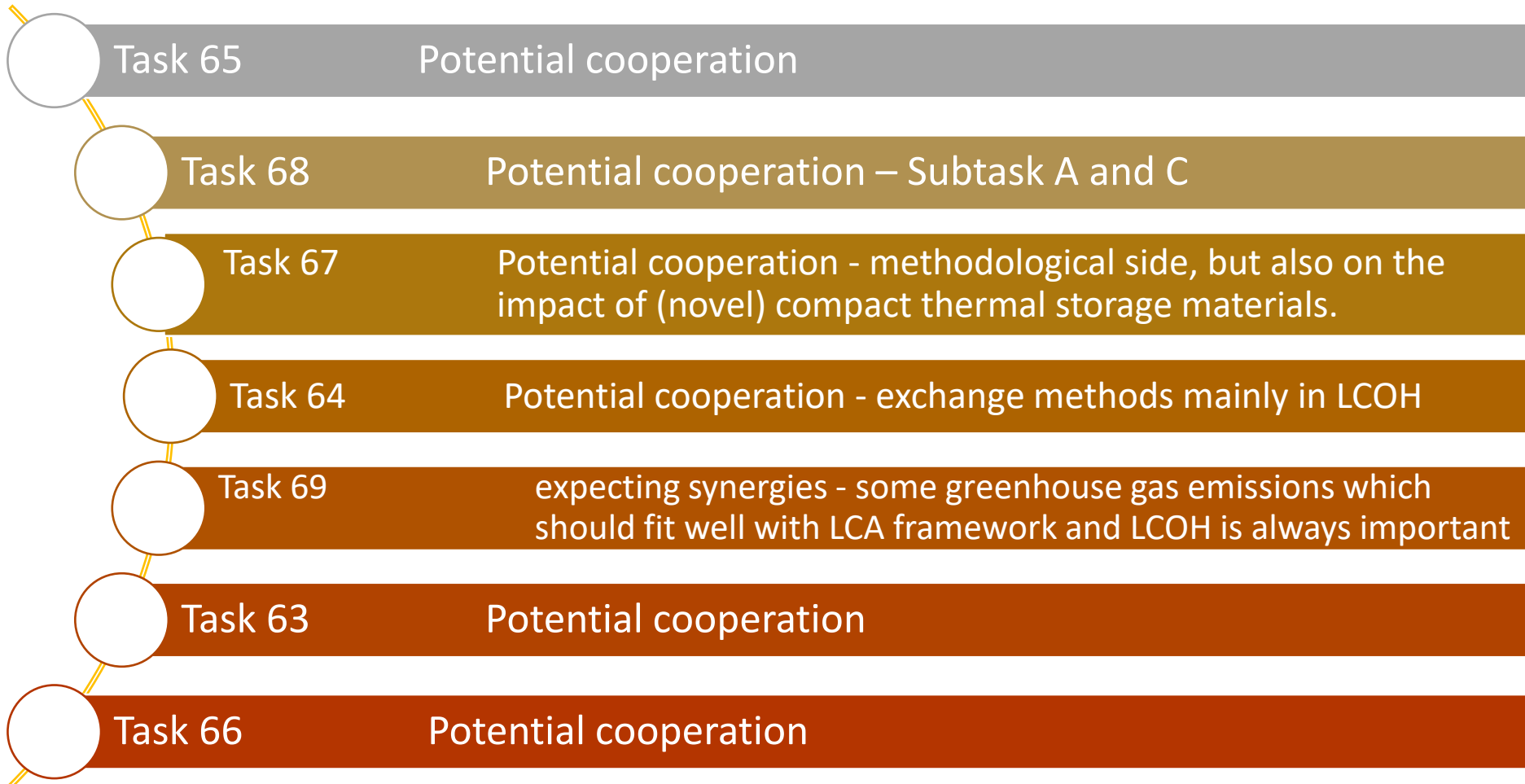


Status

- Industry very interested
- In contact with a few IEA programs
 - PVPS
 - Contact to ExCo and Task 12: open for cooperation
 - DHC
 - Presentation at ExCo - supporting proposal, DHC representative in task group, contact to USA
 - EBC
 - Contact to ExCo and Annex 72, planned Annex 89: open for cooperation, clarification Task addresses heating technologies not building features
 - HPT
 - Information of ExCo, planned Task on circular economy of HPs
 - ES
 - Task 39 interested in cooperation

Status

- Tasks interested in cooperation



Status

- currently available or approved: >100 PM from 6 countries

| Country | Partner / Institution in WP preparation |
|-------------|--|
| Austria | GreenOneTec, JKU, (AEE) |
| Australia | CISRO |
| Canada | contact with Exco to identify suitable participants |
| China | contact with Exco to identify suitable participants |
| Denmark | DTU |
| France | CEA, NewHeat |
| Germany | ISE, IGTE, Vaillant-Group, Universität Kassel, Viessmann, AGFW |
| Greece | International Hellenic University |
| Italy | Uni Palermo |
| Norway | Inventasolar |
| Sweden | Absolicon |
| Switzerland | ZHAW, SPF, (Treeze) |

Matters for the Exco

- Scope: open to small as well as to large scale technologies, system components are explicitly included
- Strong links to other research programmes:
 - Comparable models, parameters and scenarios
 - Modelling of combi-systems (sector coupling)

Proposal:

- Planned for longer duration: start with first 3 a phase to get topic and related projects installed. Major focus on cooperation and connection of players. Afterwards decision how to proceed.
- Start as soon as possible because of the advances of the other programs, the momentum and the importance
- **Goal: start of Activity Beginning of 2023**

Thank you for your attention!



www.iea-shc.org

 @IEASHC

 IEA Solar Heating and Cooling Programme
(group 4230381)

Information Plan

| Task Information Plan | | | | | | | | | | |
|----------------------------------|---|---|--|---|---|---|---------|---|----------------|--------------------------------|
| Task Duration: 01/2023 - 12/2025 | | | Target Audience | | | | | | | |
| | | | <div style="display: flex; justify-content: space-around; text-align: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Policy makers</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">R&D scientists</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Architects</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">LCALCoH industry</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Teaching</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">SHC ECo and IEA</div> </div> | | | | | | | |
| | | | | | | | # | Title/Proposed Title | Task Month | Format |
| Subtask A | x | x | | x | | x | D A.1 | Summary of existing regulations | 12 | SHC website |
| | | | | | | x | M A.1 | Draft for a white paper is ready | 24 | Internal document (not public) |
| | | | | | | x | M A.2 | Contact with all relevant Tasks / Annexes established | 6 | Internal document (not public) |
| | | x | | x | | x | M A.3 | Workshop with PVPS and ECB representatives on common understanding and approaches regarding ecological footprint assessment | 18 | Workshop |
| Subtask B | x | x | | x | x | | D B.1 | First version of guidelines for LCA and LCoH calculation of SHC for components and systems | 18 | SHC website |
| | x | x | | x | x | | D B.2 | Updated version for a proposal of guidelines for LCA and LCoH calculation of SHC for components and systems | 24 | SHC website |
| Subtask C | | | | | | x | D C.1 | Data base established | 12 | SHC website |
| | | x | x | x | x | | D C.2 | Summary of available and accessible data sets for component and system inventories | 24 | SHC website |
| Subtask D | | x | x | x | x | | D D.1.1 | Reference systems (heat supply) defined | 18 | SHC website |
| | | x | x | x | x | | D D.1.2 | Reference systems (heat demand) defined | 12 | SHC website |
| | x | | x | x | x | | D D.2 | Reference systems calculated according to first version | 30 | SHC website |
| | | | x | x | x | | M D.1 | Reference systems selected | 12 | SHC website |
| Subtask E | x | x | x | x | x | | M E.1 | Stakeholder involvement workshop | 12 | Workshop |
| | | | x | x | | | D E.1 | Info Sheets on input and output information for LCA and LCoH | 24 | SHC website |
| | | x | x | x | | | D E.2 | Guidelines on Reporting of LCA and LCoH data | 30 | SHC website |
| TCP/Other | x | x | x | x | x | x | | Task webpage | 6 | |
| | x | x | x | x | x | x | | Task brochure | 6 | |
| | x | x | x | x | x | x | | TCP Annual Report contribution (1 per year) | annually | |
| | x | x | x | x | x | x | | Task Highlight report (1 per year) | annually | |
| | x | x | x | x | x | x | | Solar Update articles (minimum during and end) | annually | |
| | | | | | | x | | Task Status report (2 per year) | twice per year | |
| | | | | | | x | | Final Management report | 36 | |
| | | | | | | x | | Mid-term Task evaluation | 18 | |
| | | | | | | x | | Final Task evaluation | 36 | |
| | x | x | x | x | x | x | | Solar Academy webinar | 33 | |

Gantt Chart

