Room Kyiv

CHILLVENTA

Chillventa CONGRESS 2024
Heat Pumping Technologies

IEA HPT Project 65 ´Heat pumps in a circular economy´

Presentation by Jakob Thomsen (jath@dti.dk)
Project leader of IEA HPT Project 65,
Business manager, Danish Technological Institute.

CONNECTING EXPERTS.

Agenda and introduction

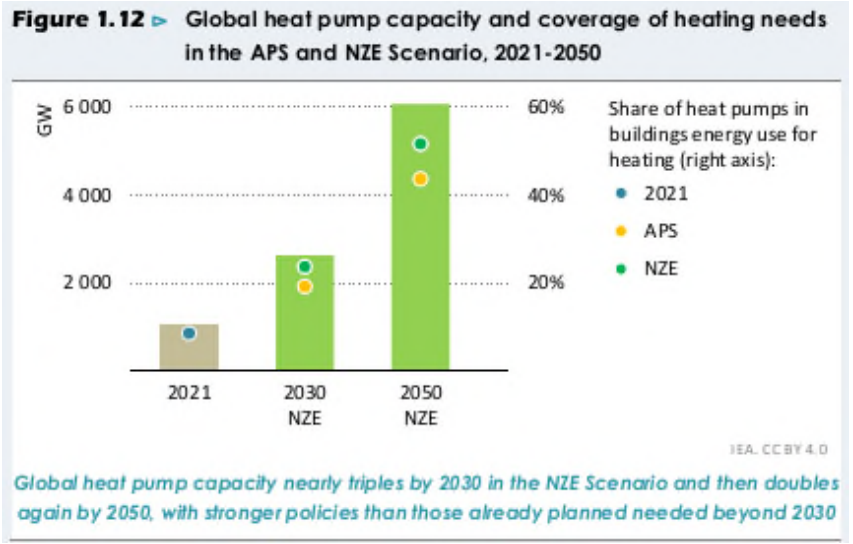
Agenda

- Why is the IEA HPT Project 65 relevant?
- How does the project match current trends?
- Scope and objectives for IEA HPT Project 65
- Potential benefits for industry and companies
- How is the project organized?
- Preliminary results
- How to learn more about the project

DANISH
TECHNOLOGICAL
INSTITUTE

Why is the project relevant?

- In the IEA Net Zero Scenario heat pump capacity will triple to 3,000 GW by 2030 and double again by 2050 to 6,000 GW.
- The increased deployment of heat pumps will also increase the material footprint and could influence supply chains of materials.
- Concurrently several large markets for heat pumps have strategies to switch to a circular economy with focus on:
  - Repairability,
  - Reused materials and components
  - Lifetime extension
  - New business models.



*"Residential hydronic heat pumps typically contain more **than twice as much aluminum and 15 times more copper and brass** than their condensing gas boiler equivalents"*

Source: IEA Future of heat pumps, 2022

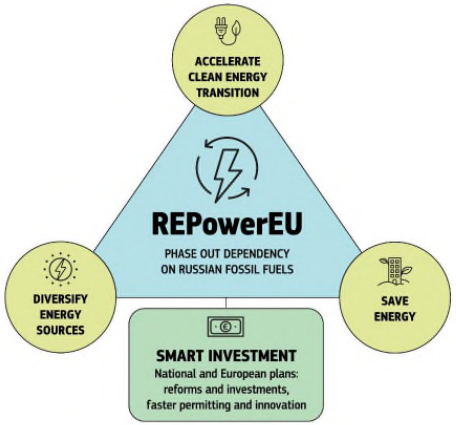
DANISH TECHNOLOGICAL INSTITUTE

How does the project match current trends?

Product regulation
- Material efficiency requirements ecodesign for heat pumps
- Development of a repairability score
- A digital product passport for heat pumps

The building sector
- Environmental product declaration (EPD's) for heat pumps to be used in buildings.

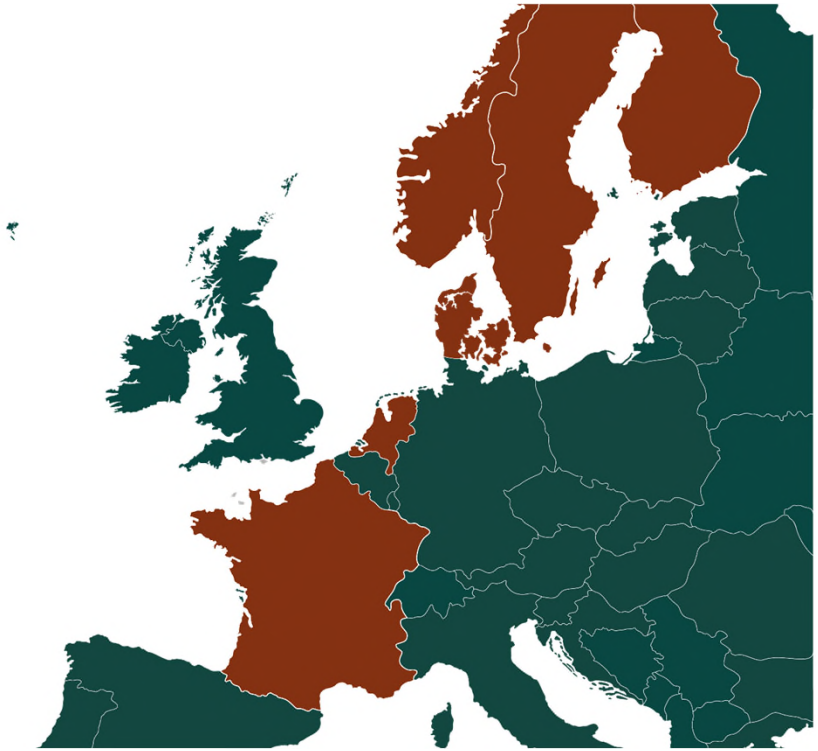
Product design
- Carbon footprint in LCA analysis are becoming a competitive parameter.
- Use of light and/or reused materials/components
- Focus critical raw materials
- Upgradeability in products



DANISH TECHNOLOGICAL INSTITUTE

Lifecycle Carbon requirements for buildings - Europe as a case

- 2012 - Netherlands: (LCA documentation requirements)
- 2018 - Netherlands: (LCA threshold value)
- 2021 - France: (LCA documentation requirements and threshold value)
- 2022 / Jan. - Sweden: (LCA documentation requirements)
- 2022 / End of the year - Norway: (LCA documentation requirements) (expected)
- 2023 / Jan - Denmark: (LCA documentation requirements and threshold value)
- Finland is in progress, official date pending



Red: European countries that have implemented or are in the process of implementing LCA requirements.

Source: Danish Authority of Social Services and Housing, primo 2023

DANISH TECHNOLOGICAL INSTITUTE

Scope and objectives for IEA HPT Project 65

Objectives

- To **provide analysis** and **share experiences** on circular economy aspects in domestic heat pumps.
- Provide an **overview of current circular economy initiatives** and to **improve the understanding** the circular economy framework for heat pump stakeholders.

Scope

- Focus on **air-to-air, air-to-water and ground source** heat pumps with a heating capacity (P_design) **below 30 kW**.

DANISH TECHNOLOGICAL INSTITUTE

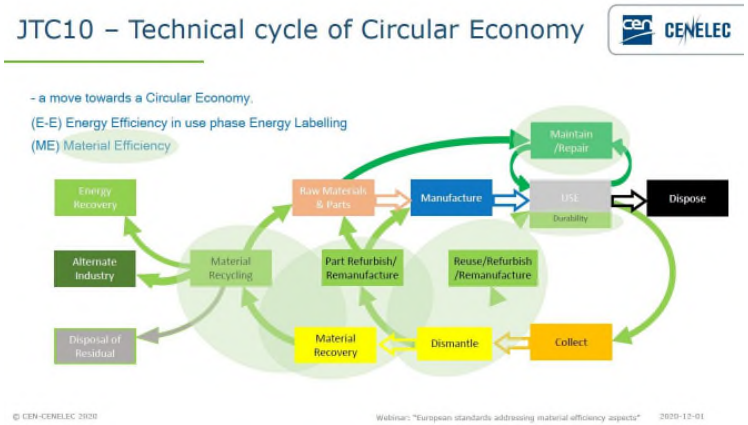
Potential benefits for industry and companies

Industry benefits in the project

- Establish a common understanding in industry.
- Platform for collecting and evaluating research before regulation or standards are developed/implemented.
- A platform for sharing and evaluating common barriers for the industry.

Company benefits

- Possibility to contribute to the research and discuss it with researchers.
- Gain design inputs for future products/services.
- Updated know-how on the regulation in various markets.
- Possibility to show-case state-of-the-art activities on circular economy.



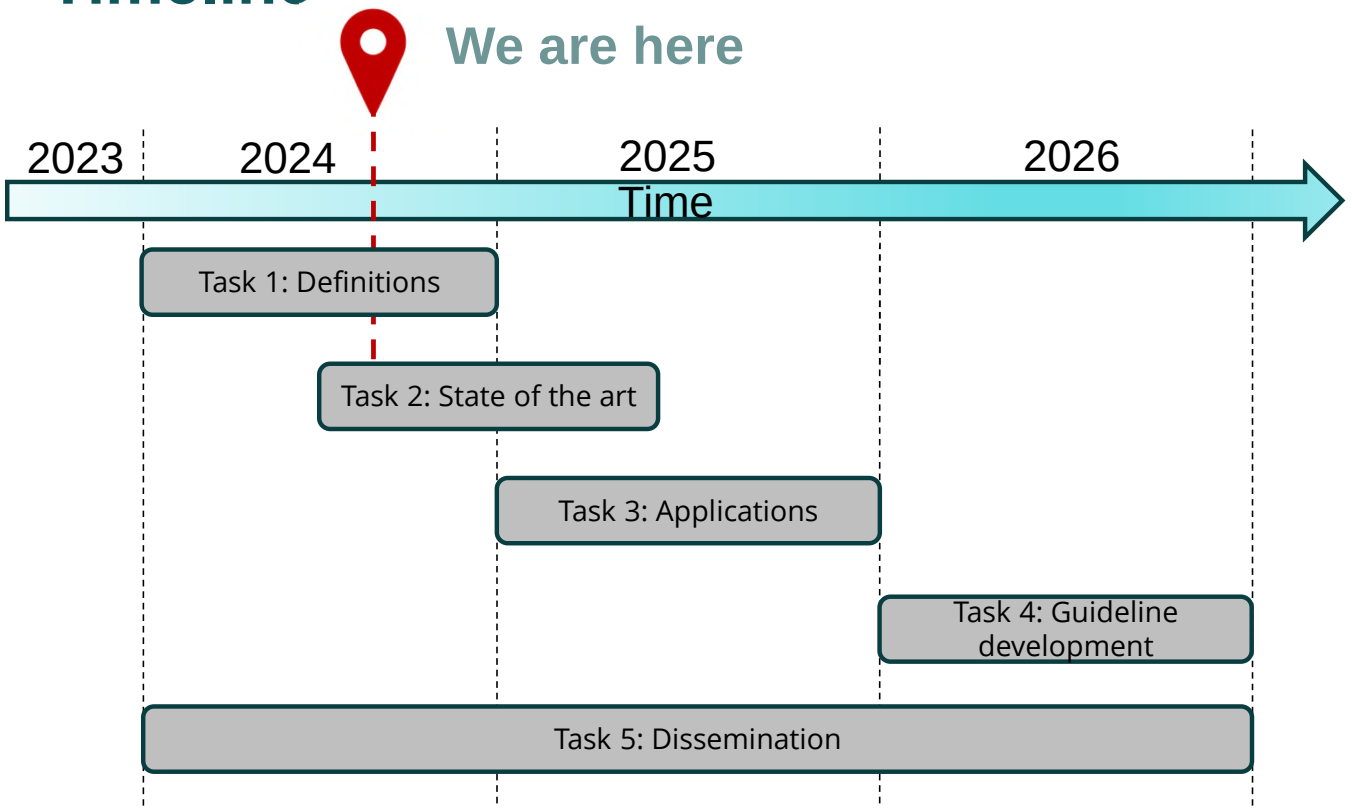
DANISH TECHNOLOGICAL INSTITUTE

How is the annex organized?

- **Task 1- Terminology and delimination:** Provide an overview of the terminology of material efficiency and circular economy literature study of relevant subjects related to circular economy.
- **Task 2 – State of the art:** Define the current state-of-the-art for circular economy for domestic heat pumps.
- **Task 3 – Potential and barriers:** Evaluate the potential for circular economy and potential obstacles for reusing and dismantling.
- **Task 4 – Develop best-practice:** Develop best-practice tools to achieve an improved material efficiency in domestic heat pump.
- **Task 5 - Dissemination:** Disseminate the findings with various stakeholders

DANISH
TECHNOLOGICAL
INSTITUTE

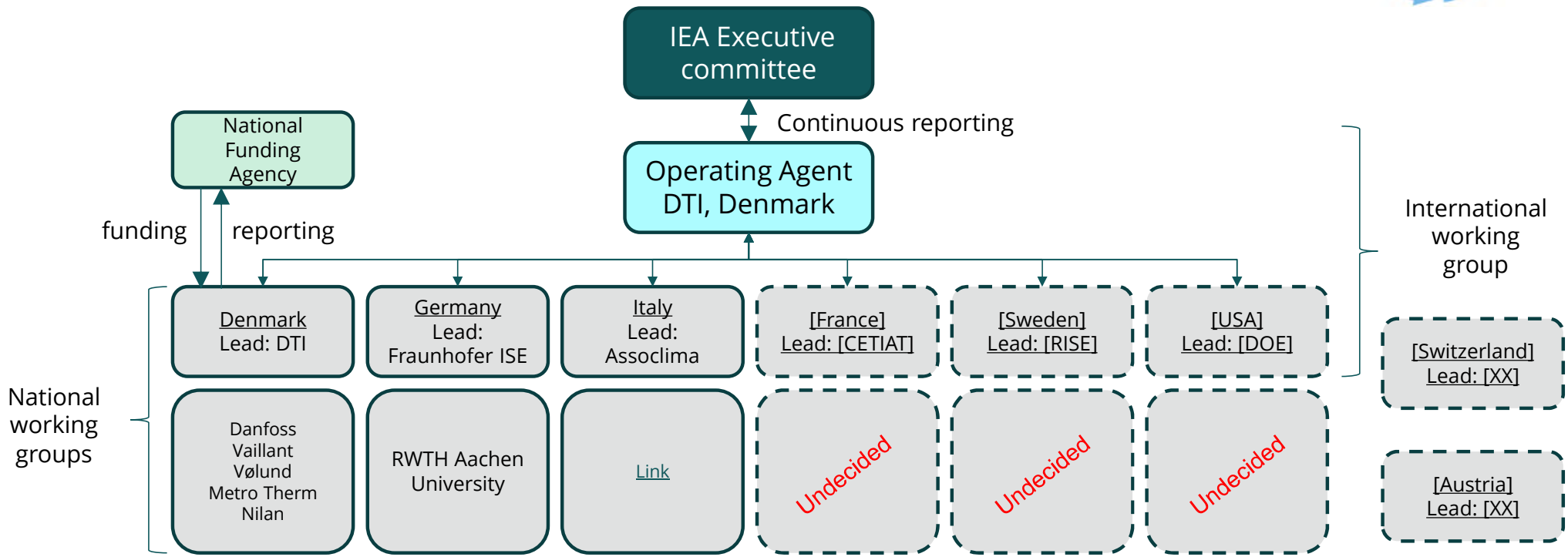
Timeline



- Still early in the annex period and it is on schedule.
- Still open for additional participants.

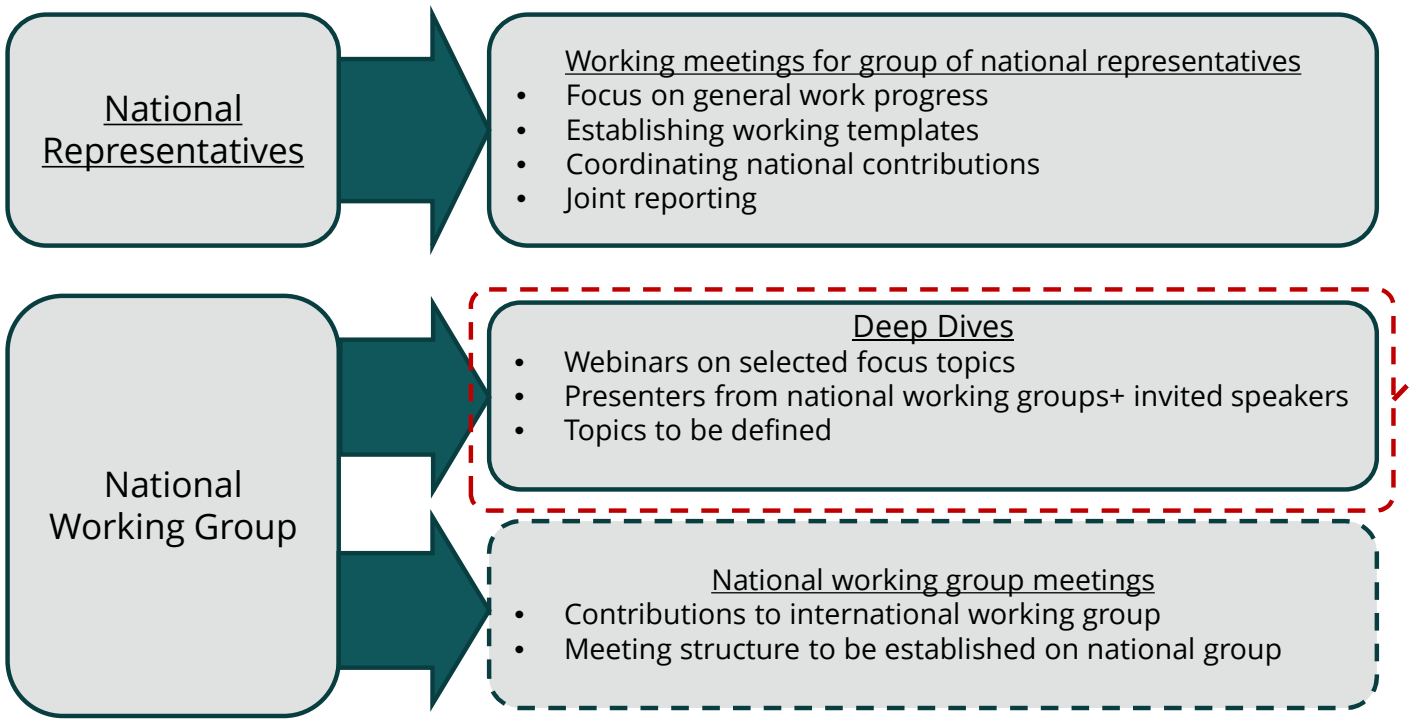
DANISH TECHNOLOGICAL INSTITUTE

Annex organization



DANISH TECHNOLOGICAL INSTITUTE

Meeting structure



Please reach out if you have ongoing activities to share or discuss in the project group.

DANISH TECHNOLOGICAL INSTITUTE

Deep dive overview

Structure

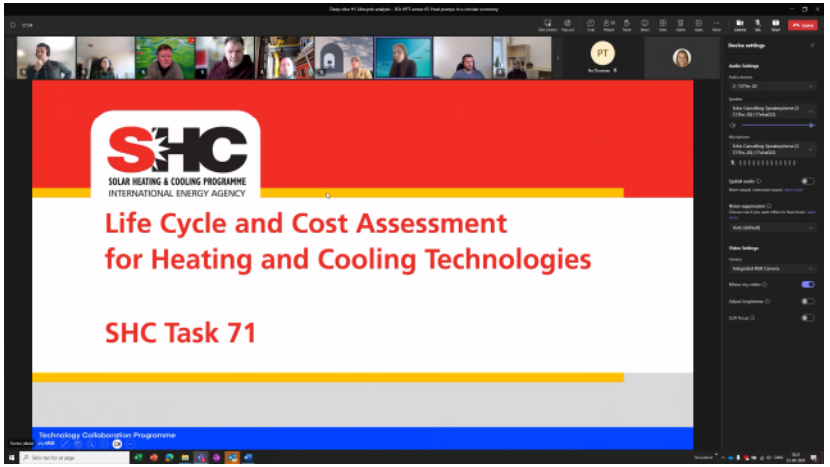
- Deep dive session usually 1-1,5 hours with 1-2 presentations.
- A company/researcher presents their topic for 30-45 minutes
- The project group including researchers and company representatives discuss the topic and what learnings can be made.

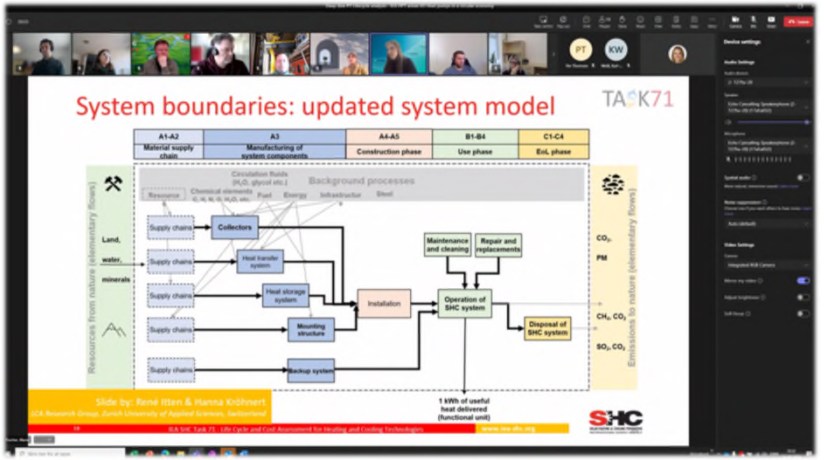
Completed topics

- ✓ **Lifecycle data collection to streamline data collection**
- ✓ **Presentation of LCA analysis of heat solutions (learnings from IEA SHC by Fraunhofer ISE)**
- ✓ **Towards integral assessment of heat pumps and refrigerants using LCA: A case study for the German building stock (RWTH Aachen University)**

Pipeline of Deep Dives

- Machine Learning Methods for Monitoring Heat Pumps (DTI and Metro Therm)
- CE-RISE project and Viessmann's participation (Viessmann)
- Heat pump supply chain environmental impact reduction to improve the UK energy sustainability, resiliency and security (link)





Preliminary results – Task 1 Report outline

Section

Task 1

1 - Definitions and delimitation

1.1 - Evaluation of standards for material efficiency in energy-related products

1.2 - Review of relevant regulations (e.g., WEEE, ROHS) for heat pump materials

1.3 - Literature review on lifecycle analyses conducted on domestic heat pumps

1.4 - Case study descriptions of previous common measures in heat pump design for domestic applications to lower the impact of materials.

Preliminary results - Data collection on lifecycle impact of heat pumps

Motivation

- Collect data and create database for lifecycle impact of heat pumps based on EDPs and Ecodesign data.

Outcome

- Template has been developed and reviewed by group members.
- National representatives in the project are encouraged to reach out to manufacturers to fill out the template.
- Data collection will continuously be published on the Task 1.

Template for Heat Pump Lifecycle Data collection

Heat pump and supplier name	***Model name:*** *[]* ***Manufacturer:*** *[]* ***Available in which countries:*** *[]*
EPD data	***Type of EPD:*** *[Type]*
Technical data	***Performance in design point:*** • ***Heat pump type:*** *[Air-air, Air-water, liquid-water etc.]* • ***Application:*** *[Space heating, combination heater, domestic hot water only]* • ***Refrigerant:*** *[R134a, R290, R407C, R32,..]* • ***Dimensions*** *[length, width, height]* • ***Heating capacity:*** *[E.g. 1 MW]* ***SCOP****$_{heating}$****:** *[E.g. 3.1. Please also state how this COP is determined]* ***Reference service lifetime:*** *[years]* ***Weight:*** *[NUMBER] kg*
Flow diagram	*[INSERT FLOW DIAGRAM]*

Material distribution

Material	*Weight-% of declared product*
[Steel]	*[NUMBER]*
[aluminum]	*[NUMBER]*
[Copper]	*[NUMBER]*
[Plastic]	*[NUMBER]*
[Other]	*[NUMBER]*

Lifecycle data about this heat pump from environmental product declaration

	Lifecycle indicators									
	A1-A3	A4	A5	B1	B2-B7	C1	C2	C3	C4	D
GWP [kg CO2 eq.]										
ODP [kg R11 eq.]										
Total use of non-renewable primary energy										

DANISH TECHNOLOGICAL INSTITUTE

Preliminary results - Data collection on previous initiatives

Motivation

- Collect a case database for previous initiatives to limit material impact of heat pumps.

Expected outcome

- Template has been developed and is in review and is expected to be filled out when adopted.
- National representatives in the project are encouraged to reach out to manufacturers to fill out the template.
- Data collection will continuously be published on the Task 1.

Template for case descriptions on previous initiatives to reduce material impact

Heat pump manufacturer/ supplier name	***Company:*** *[Company name]* ***Country of origin:*** *[country]*
Short description of the initiative	*[Describe the initiative in a simple descriptive way]*
Picture of product/component	*[Insert picture of the product or component]*
Motivation	*[Describe the motivation for the change (i.e. GHG reductions, reduce carbon impact, improve product functionality)]*
Category	***Type of measures:*** *(tick box)* *Take back* ☐ *Extend product life* ☐ *Limit use of materials* ☐ *Production changes* ☐ *Other (please describe):* ☐
Key Learnings	*[Describe if the ambitions were achieved and if there were there any obstacles or difficulties to succeed, and how did it affect the result?]*
Changes in market position	*[Describe what changes the initiative provide in the market situation]*

DANISH TECHNOLOGICAL INSTITUTE

Want to learn more or join the annex?

- The project work is continuously disseminated on https://heatpumpingtechnologies.org/annex65
- Reach out to me (jath@dti.dk) or your national representative if you would like to join the project work.
- Reach out to me (jath@dti.dk) if you would like to share topics of interest at a deep dive session.
- Presentations, deep dives, articles and task reports are published on the website

Room Kyiv

CHILLVENTA

Chillventa CONGRESS 2024
Heat Pumping Technologies

IEA HPT Project 65 ´Heat pumps in a circular economy´

Presentation by Jakob Thomsen (jath@dti.dk)
Project leader of IEA HPT Project 65,
Business manager, Danish Technological Institute

CONNECTING EXPERTS.