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ADVANCING HP CIRCULARITY: BUSINESS POTENTIALS AND TECHNOLOGICAL REQUIREMENTS/NEEDS/CHALLENGES

HPT TCP National Experts Meeting



FOLLOW-UP PROJECT PROPOSAL





BACKGROUND

- IEA HPT Project 65 “Heat Pumps in a Circular Economy” proved the technical feasibility of dismantling, repairing, and refurbishing heat pump components.
- Circular Economy (CE) frameworks for heat pumps present unique and complex challenges due to the presence of refrigerants, PFAS and the refrigerant phase out plans.
- IEA HPT Project 65 highlighted the lacking business incentives for circularity for heat pumps.





ADVANCING HP CIRCULARITY: BUSINESS POTENTIALS AND TECHNOLOGICAL REQUIREMENTS/NEEDS/CHALLENGES

Money talks! How can circularity become the right choice – not only from an environmental perspective but from a business perspective?

The HPT TCP is part of a network of autonomous collaborative partnerships focused on a wide range of energy technologies known as Technology Collaboration Programmes or TCPs. The TCPs are organized under the auspices of the International Energy Agency (IEA), but the TCPs are functionally and legally autonomous. Views, findings, and publications of the HPT TCP do not necessarily represent the views or policies of the IEA Secretariat or its individual member countries.



LEGAL TEXT FOR PROJECT 65 FOLLOW-UP



PROJECT IDEA

1 (1)

IEA Technology Collaboration Programme on Heat Pumping Technologies

Date: 13th of May, 2026

Name of proponent: Esben Vendelbo Foged

Title

Advancing HP circularity: business potentials and technological requirements/needs/challenges

Background

Summary of research topic and/or problem to be handled, framework, regulatory situations etc. The rapid electrification of residential heating has led to an exponential increase in heat pump installations globally. Consequently, big amounts of materials are invested in Heat Pumps and a massive wave of heat pumps will reach their end-of-life (EoL) in the coming decades. While current policies heavily incentivize installation, frameworks for extending the product lifetime and efficient EoL treatment are severely underdeveloped. Key regulatory drivers, such as the EU's F-Gas Regulation and the Ecodesign Directive, necessitate strict handling of phased-out refrigerants and push for greater material sustainability. Money talks! How can circularity become the right choice – not only from an environmental perspective but from a business perspective.

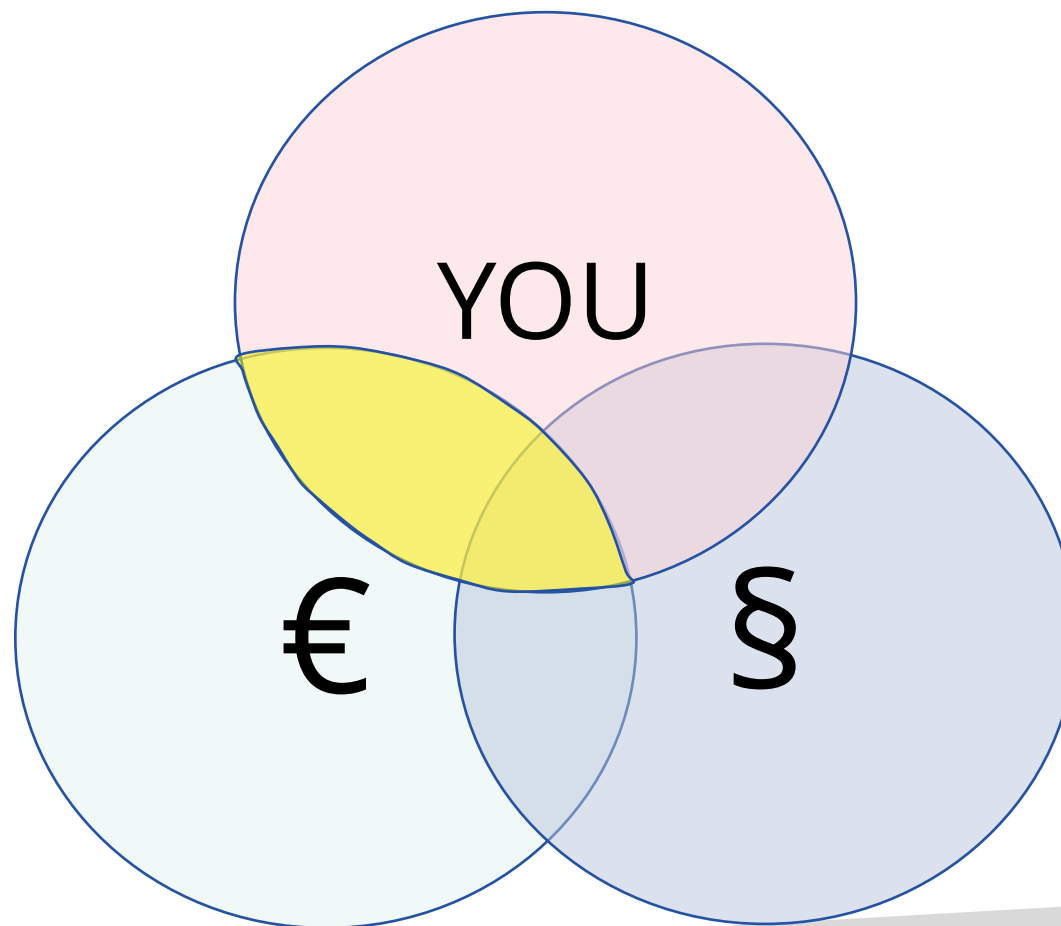
State any previous and relevant work done in the field (own, international) This project directly builds upon IEA HPT Project 65, which proved the technical feasibility of dismantling, repairing, and refurbishing heat pump components. Other relevant work

Presented for the IEA TCP EXCO committee



WHY THIS PROJECT?

IEA HPT Project 65 Follow-Up



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WHY THIS PROJECT?



Source: Federal Office for the Environment (FOEN)



FROM FEASIBILITY TO BUSINESS REALITY

IEA HPT Project 65 Follow-Up



- **Impending EoL Wave:** Rapid electrification is creating a massive installed base rich in critical raw materials, with underdeveloped end-of-life frameworks.
- **Beyond Environmental Necessity:** Strict EU regulations (F-Gas, ESPR, PFAS) force action, but scalable adoption requires viable business cases and positive ROI.
- **Building on Project 65:** Project 65 proved *technical feasibility*; this follow-up solves the *market, business, and reverse-logistics realities*.
- **Key Business Models:**
 - "Certified pre-owned" secondary markets (the automotive model).
 - Heating-as-a-Service (HaaS) driving systematic unit redeployment.
 - Certified component reuse and reverse supply chains.
- **Strategic Timing Dilemma:** Extend the lifetime of the legacy synthetic/PFAS fleet now vs. build circular infrastructure for incoming natural refrigerant units.
- **IEA HPT Strategic Impact:** Lowers embodied carbon, secures critical raw materials, enforces refrigerant recovery, and improves heating affordability.





QUESTIONS TO BE ANSWERED

This new project investigates the market, business, end-of-life realities and necessary developments to address the circular economy potentials.

Main focus is small- and medium-size heat pumps (up to 70 kW), with inspiration from large heat pumps.

- It asks unprecedented questions like:
 - Where is the money in circularity?
 - What can we learn from larger heat pumps and used for household heat pumps?
 - How can we sell used heat pumps like used cars?
 - How can we monetize on end-of-life R-strategies?
 - How can “circularity” become an integrated part of alternative business models like “heat/cooling as a service”?
 - How can heat pumps be kept alive safely using second-hand components?
 - How to transition to circular oriented design?





TIMING FOR CIRCULARITY

Official Journal
of the European Union

EN
L series

2024/573

20.2.2024

REGULATION (EU) 2024/573 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 7 February 2024
on fluorinated greenhouse gases, amending Directive (EU) 2019/1937 and repealing Regulation (EU)
No 517/2014

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 192(1) thereof,

Having regard to the proposal from the European Commission,

After transmission of the draft legislative act to the national parliaments,

Having regard to the opinion of the European Economic and Social Committee^(*),

After consulting the Committee of the Regions,

Acting in accordance with the ordinary legislative procedure^(*),

F-Gas regulation

REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT
AND OF THE COUNCIL

of 18 December 2006

concerning the Registration, Evaluation, Authorisation and
Restriction of Chemicals (REACH), establishing a European Chemicals Agency,
amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93
and Commission Regulation (EC) No 1488/94 as well as
Council Directive 76/769/EEC and Commission Directives 91/155/EEC,
93/67/EEC, 93/105/EC and 2000/21/EC

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

REACH regulation

The project explores a critical twofold issue:

1. **NOW** dedicatedly pursue circularity for HPs already installed and optimize EoL strategies!
2. Build up circularity plans for a **FUTURE** dominated by CE-optimized HPs using natural refrigerants!

SEVERAL GREENHOUSE GASES BELONG TO THE GROUP OF GREENHOUSE GAS EMISSIONS COVERED BY THE PARIS AGREEMENT ADOPTED UNDER THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC) (THE 'PARIS AGREEMENT')^(*). TODAY, FLUORINATED GREENHOUSE GAS EMISSIONS AMOUNT TO 2,5 % OF TOTAL GREENHOUSE GAS EMISSIONS IN THE UNION, AND HAVE DOUBLED FROM 1990 TO 2014 IN CONTRAST TO OTHER GREENHOUSE GAS EMISSIONS, WHICH HAVE FALLEN.

Acting in accordance with the procedure laid down in Article 251 of the Treaty¹,





LEGAL TEXT FOR PROJECT 65 FOLLOW-UP

What will be included in the Project?

- Residential and light commercial heat pumps
- Efficient reverse logistics and supply chain processes
- End-of-life handling procedures and R-strategies
- Market analysis for second-hand heat pumps and refurbished parts

Hopefully you find some of these topics interesting!

- Circular business models (HaaS/CaaS)
- Refrigerant management, carbon economics, and CO2 certificates
- Strategic timing dilemma (F-gas and PFAS phase-outs vs. natural refrigerants)

What will not be included? (set frame of the Project idea)

- Large-scale industrial heat pumps and district heating systems
- Deep material science





LEGAL TEXT FOR PROJECT 65 FOLLOW-UP TASKS

- **Task 1: Design-for-Circular-Economy**
- **Task 2: Refrigerant Management and CO2 Economics**
- **Task 3: Circular Business Models**
- **Task 4: End-of-(first Service)-Life (EoL) and Handling**
- **Task 5: The timing dilemma for Circular Economy
roll-out for heat pumps**
- **Task 6: Dissemination and Knowledge Sharing**



TARGET AUDIENCE AND BENEFITS



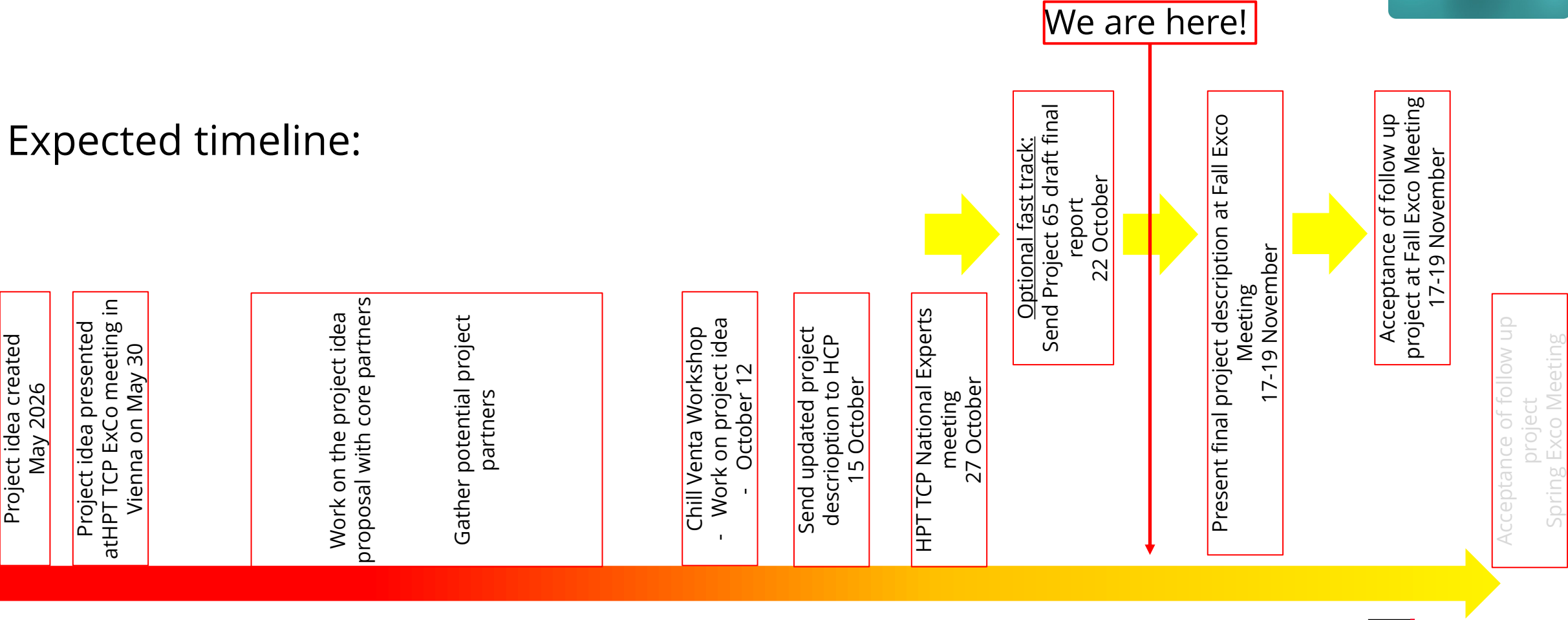
- **Manufacturers (OEMs) and Component Suppliers**
- **Policy Makers & Regulators**
- **Installers and Service Technicians**
- **Consumers and Building Owners**
- **Recycling and Waste Management Facilities**
- **Anybody else?**



LEGAL TEXT FOR PROJECT 65 FOLLOWUP



Expected timeline:



WHAT WE NEED YOU TO DO!

- Scan QR and sign up to be informed about the status of the follow up project
- Get in contact with your national IEA HPT TCP Exco Delegate – support the proposal in November!

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IEA HPT Project 65 Follow-Up

