IEA TECHNOLOGY COLLABORATION PROGRAMME ON

HEAT PUMPING TECHNOLOGIES (HPT TCP)

Research, Development, Demonstration and Promotion
of Heat Pumping Technologies

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 organised 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.

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CONTENT

- Heat pumping technologies
- The HPT TCP
- How do we work
- The expected development
- Strategic plan
- The Annexes

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HEAT PUMPING TECHNOLOGIES

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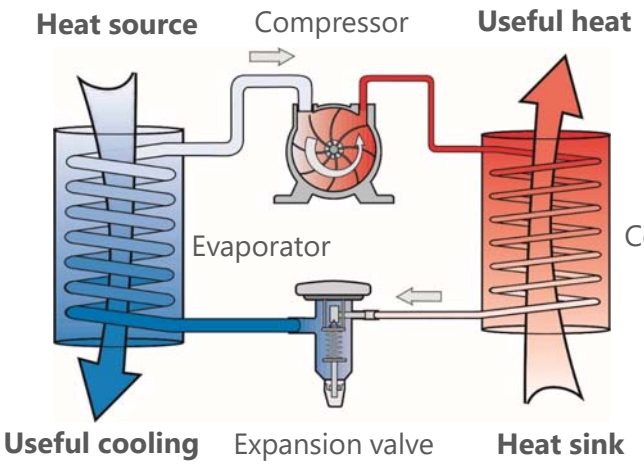
WHAT IS HEAT PUMPING TECHNOLOGIES?

The vapour compression cycle



…and other cycles

- Absorption heat pump
- Thermo-acoustic heat pump
- Electro-magnetic heat pump
- Mechanical vapor recompression
- …

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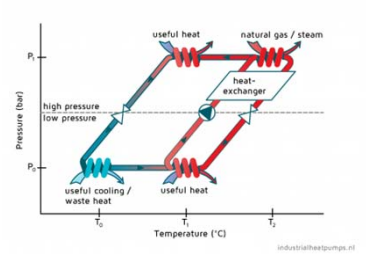
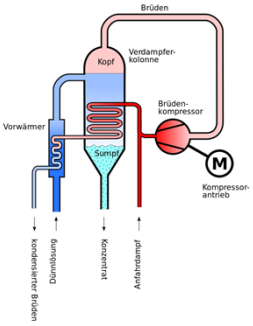
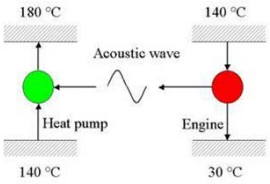
OTHER HEAT PUMP CYCLES



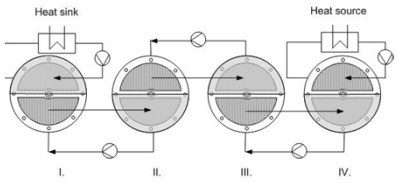
Absorption heat pump cycle



Mechanical vapor recompression



Thermo-acoustic heat pump cycle



Electro-magnetic heat pump cycle

HEAT PUMPING TECHNOLOGIES IN A SUSTAINABLE WORLD

https://www.youtube.com/watch?time_continue=1&v=XWrm8wg1GjE

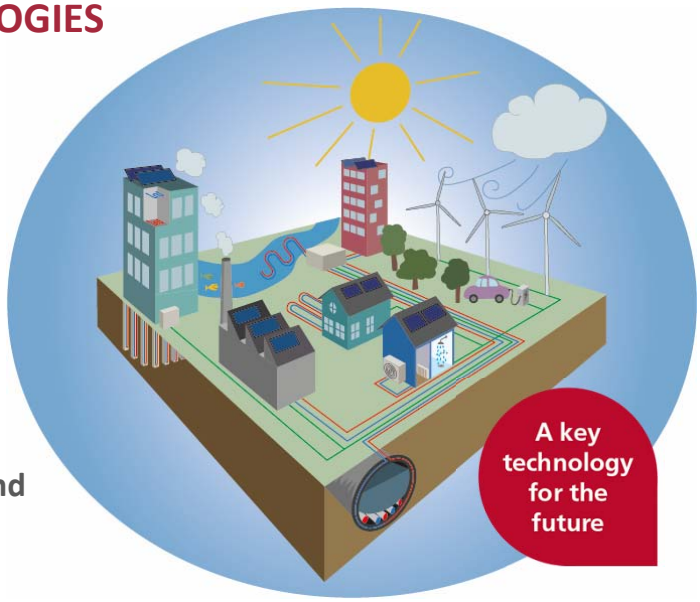
HEAT PUMPING TECHNOLOGIES

Includes

- **Heating and cooling**
- **Air conditioning**
- **Refrigeration**

Covers applications in

- **Residential and commercial buildings**
- **Industries**
- **Thermal grids in cities and communities**
- **Other applications**



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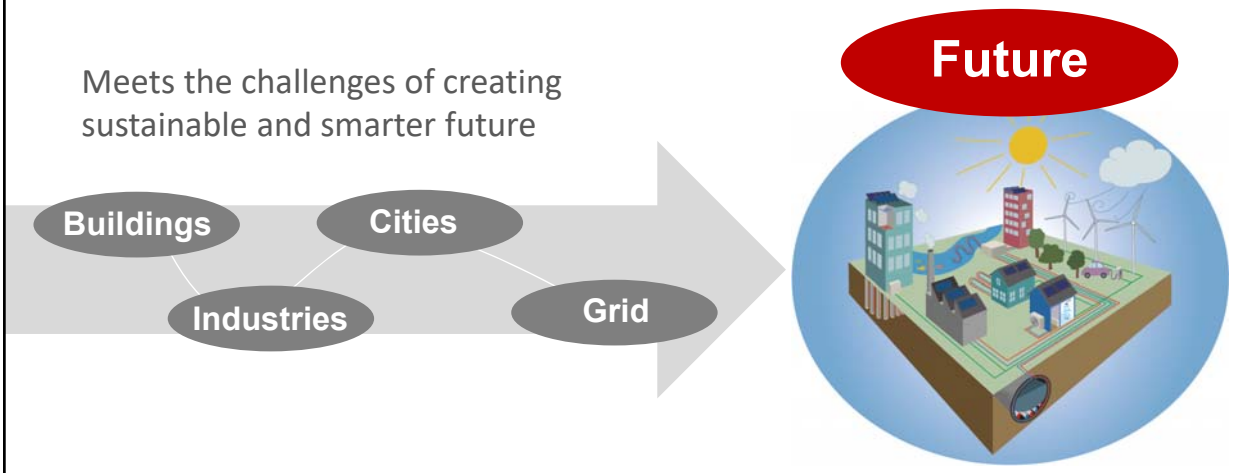
HEAT PUMPS ARE ENERGY EFFICIENT AND RENEWABLE!

Meets the challenges of creating sustainable and smarter future



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HEAT PUMPING TECHNOLOGIES IN THE FUTURE

- Heat pumping technologies can significantly contribute to **reduction of CO_2-emissions**
- The **future green electricity grid** must be able to handle **intermittent production** – heat pumping technlogies are an excellent electricity sink in order to balance the grid
- Greening the grid makes heat pumping technologies even greener!

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THE HPT TCP

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WHAT IS THE HPT TCP?

A Technology Collaboration Programme (TCP) within **the IEA** since 1978

An international framework of **cooperation** and **networking** for different HPT actors

A forum to exchange **knowledge** and **experience**

A contributor to **technology improvements** by RDD&D projects

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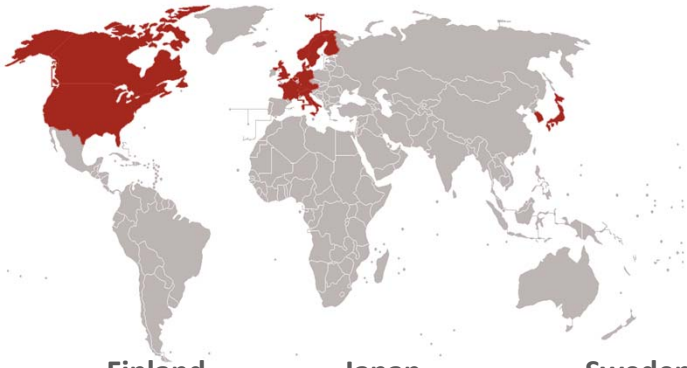
CURRENT PARTICIPATING COUNTRIES



Austria	Finland	Japan	Sweden
Belgium	France	Netherlands	Switzerland
Canada	Germany	Norway	United Kingdom
Denmark	Italy	South Korea	United States

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THE HPT TCP - WHO WE ARE

The worldwide key player in generating and communicating independent knowledge on heat pumping technologies

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HPT TCP AND OTHER TCPS

More about TCPs:
http://bit.ly/TCPvideo

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THE ROLE OF HPT TCP

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AS A MEMBER COUNTRY YOU WILL

- Participate in an **international network** on Heat Pumping Technologies
- **Exchange knowledge** with other countries
- Participate in **international projects** (HPT TCP Annexes) to increase national knowledge
- **Influence** the work of the HPT TCP
- Access the **worldwide network** for independent information and knowledge of heat pumping technologies
- Be a part of the **meeting place** for researchers, academia, policy and industry in the field of heat pumping technologies

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HOW DO WE WORK?

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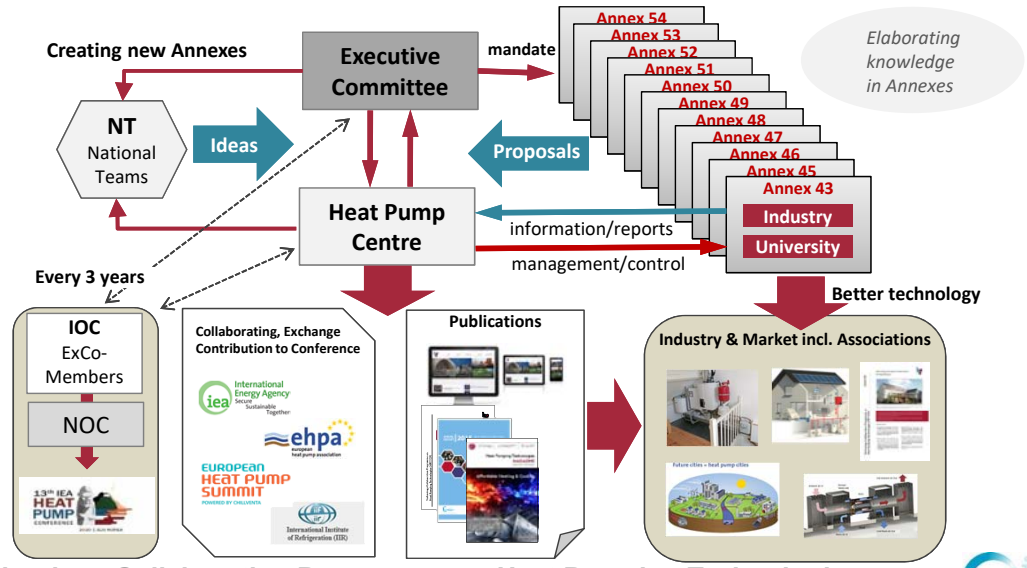
HPT TCP - ORGANISATION AND MANAGEMENT



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HOW DO WE WORK?

Executive Committee | National teams | National experts meeting | Heat Pump Centre | Annexes

Executive Committee: The board of HPT TCP - one vote per member country

National Teams: Organisations representing national HPT activities. A forum for discussion networking and creation of new ideas. Meet at joint **National Experts meetings.**

The Heat Pump Centre: The central communication activity of HPT TCP

Annexes: Elaborating new knowledge through collaborative RDD&D work

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THE HEAT PUMP CENTRE

Information dissemination

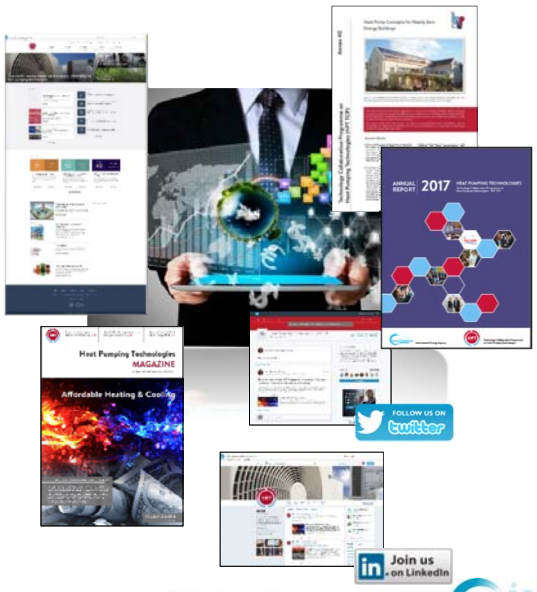
- Publications (e.g. project reports)
- HPT Magazine and Newsletter(digital)
- Website www.heatpumpingtechnologies.org
- Social media: LinkedIn and Twitter @heatpumpingtech

Program Support

- to ExCo, NTs and Project leaders (OAs)

And

- Generation of new activities
- National Experts meetings
- Support to IEA publications
- Outreach activities



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COMMUNICATION DISSIMINATION OF RESULTS

- Website
  - Publication database
  - **Annex subsites**
- Annex reports and summaries
- HPT Magazine and Newsletter (electronic)
- Printed material, fact sheets
- Social media
- Outreach activities with other countries and organisations
- Workshops
- Triennal IEA HP Conference

EXAMPLES OF OTHER ACTIVITIES OF HPT TCP

Position Papers and support to IEA publications
Placing heat pumping technologies higher on the political agenda.

Workshops and symposium
For example in conjunction with conferences, fairs, ExCo or Annex meetings.

Coordination with other bodies
E.g. ASHRAE, EHPA, IIR other TCPs, UNEP, AHRI, IRENA etc

Participation at special events
Promotion of HPT TCP.

THE IEA HEAT PUMP CONFERENCE

Every third year the IEA Heat Pump Conference is arranged. The purpose is to **Increase the awareness the heat pumping technologies** but also to establish a **meeting place** for different actors working in the field of heat pumping technologies. It is also an opportunity to strengthen the collaboration with other TCPs.

The next conference will be held in Jeju, Korea 2020.

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13th IEA HEAT PUMP CONFERENCE 2020

13th IEA HEAT PUMP CONFERENCE 2020 | JEJU KOREA

"Heat Pumps – Mission for the Green World"

May 11-14, 2020, at Jeju, South Korea

Organizing Committee of HPC2020
The Society of Air-conditioning and Refrigerating Engineers of Korea (SAREK)
Prof. Min Soo KIM (Seoul National University)

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THE EXPECTED DEVELOPMENT

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EXPECTED ENERGY DEVELOPMENTS TO 2023

Heat pumps are one of the prioritized areas within the Mission Innovation

Challenge #7:

Affordable Heating and Cooling of Buildings Innovation to low-carbon heating and cooling affordable for everyone

Heat pumps have been selected because….

- They heat and cool so widely applicable across countries
- Low-carbon technology and key enabler of decarbonisation
- Heat pumps are very efficient
- Heat pumps can be integrated into div. solutions

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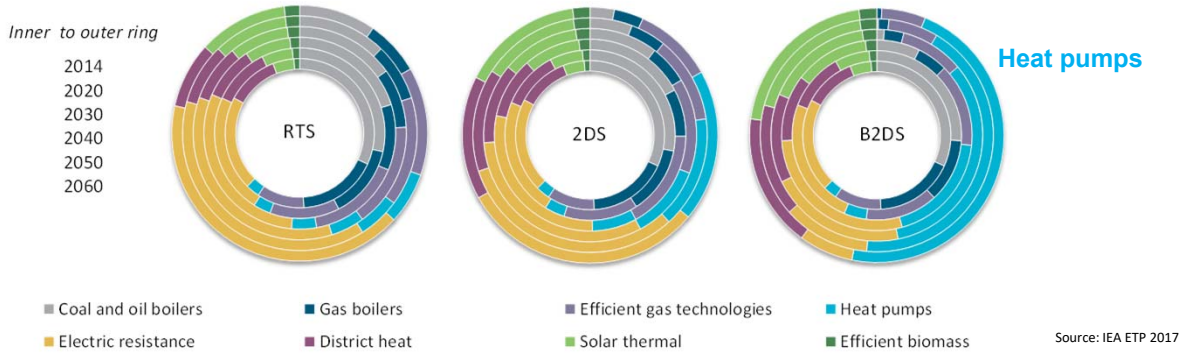
EXPECTED ENERGY DEVELOPMENTS (1)

IEA ETP 2017 shows that heat pumping technologies are a **critical enabler** to reach **climatic ambitions** and their **deployment** needs to be **increased** more than tenfold

Evolution of heating equipment in buildings to 2060



Source: IEA ETP 2017

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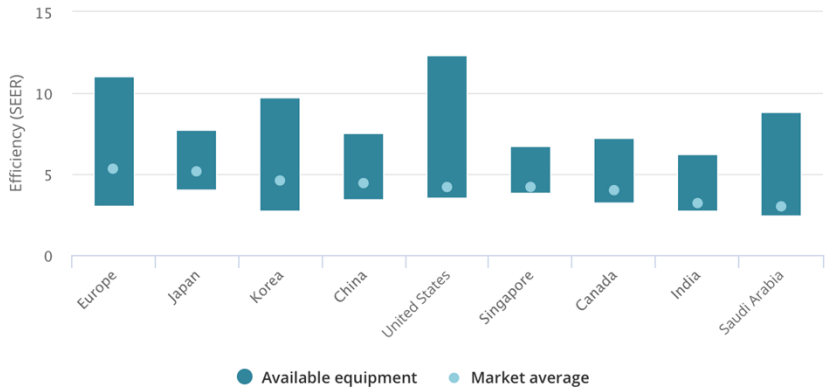
EXPECTED ENERGY DEVELOPMENTS (2)

Global demand for **cooling** and **refrigeration** is **growing** quickly - in rapidly emerging economies, developing countries, IEA member countries

Energy performance of air conditioners available today



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STRATEGIC PLAN

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STRATEGIC PLAN 2018-2023 - VISION

Heat pumping technologies play a vital role in achieving the ambitions for a **secure, affordable, high-efficiency and low-carbon energy system** for heating, cooling and refrigeration across multiple applications and contexts.

The Programme is a **key worldwide player** in this process by communicating and generating independent information, expertise and knowledge related to this technology as well as enhancing international collaboration.

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STRATEGIC PLAN – OBJECTIVES UP TO 2023

In 2023…

Energy security

… HPT are frequently **demonstrated** and **deployed** in appropriate applications

… HPT is a **key element** in **new cross-cutting, affordable** solutions for heating and cooling

Environmental Awareness

… **more policy makers** are aware of the potential of the technology **to fulfil the IEAs mission**

Economic Development

… the **innovation rate** for HPT is increased

- **capacity building** is improved
- **cost-effective** solutions identified, demonstrated and **accepted by end users**

Engagement Worldwide

… **HPT TCP** has more **member countries**

… **HPT TCP** is an **active player** in, or partner to, other **international initiatives and organisations**

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STRATEGIC PLAN 2018-2023

Perform RDD&D activities within the areas of **heating**, **cooling** and **refrigeration** for **the building, community, transport and industrial sectors** while widening the scope to include to a larger extent:

a. Affordable and competitive technologies for **heating**

b. More efficient cooling and air-conditioning, especially in warm and humid climates

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STRATEGIC PLAN 2018-2023

c. Flexible, sustainable and clean system solutions (e.g. in urban areas) using combinations of heat pumping technologies with **energy storage**, **smart grid**, **solar** and **wind** energy, **thermal networks**, **energy prosumers**, etc

d. Possibilities offered by the developments in the area of **digitalisation and Internet of Things**

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STRATEGIC PLAN 2018-2023

e. New or special markets and applications, including automotive, industry and consumer products
(e.g. white goods)

f. New, alternative or natural refrigerants with **lower global warming potential**, high thermodynamic potential and low toxicity for both new and existing applications

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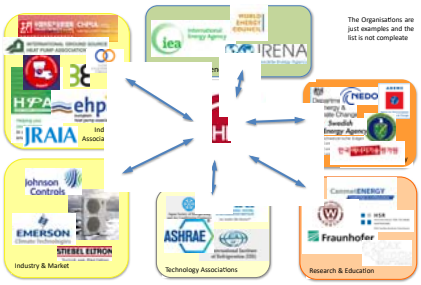
STRATEGIC PLAN 2018-2023

Advance the RDD&D of heat pumping technologies through

- creation of research opportunities
- networking possibilities and meeting places for academia, industry, private sector
- markets and policy makers to collaborate under new Annexes (projects) and activities within the HPT TCP.



Contribute to **advanced and/or disruptive innovations** through cross-cutting networking and collaboration with other TCPs and relevant organisations

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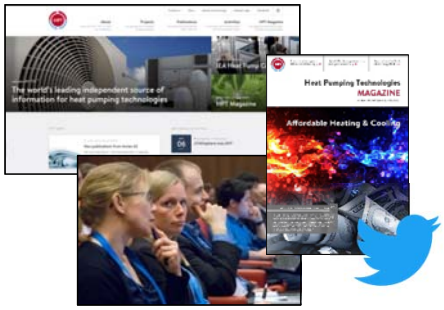
STRATEGIC PLAN 2018-2023

Communicate the results and impact from the RDD&D work, tailor the messages using appropriate channels to reach target groups

Provide IEA and standardisation organisations with **reliable and independent guidance, data and knowledge** about heat pumping technologies

Increase activities to **attract new members**, including IEA key partner and association countries.



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THE ANNEXES

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ANNEX 55 COMFORT AND CLIMATE BOX

A joint project between the two Technology Collaboration Programmes, Heat Pumping Technologies (HPT) and the Energy Storage (ECES). The Annex will be ran in the ECES context under Annex number 34 and in cooperation with Mission Innovation Challenge #7 Affordable Heating and Cooling for Buildings.

The issue
How to accelerate market development of Climate and Comfort Box solutions.

Work to do
Specialists from various fields of technology will cooperate in order to accelerate product development and market introduction of combined heat pump/storage packages.

Results & benefits
The goal is to develop nearly market ready systems, including, as a minimum, a heat pump and a storage system.

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ANNEX 54 HEAT PUMP SYSTEMS WITH LOW GWP REFRIGERANTS

The issue
How to promote low-GWP refrigerant applications to accelerate phase down of high-GWP HFCs?

Work to do
Develop design guidelines of optimized heat pump components and system for low-GWP refrigerants through the review of available low-GWP refrigerants.

Results & benefits
Replacing current high-GWP working fluid of vapor compression technology to low-GWP ones while keeping and/or improving its efficiency so that the environmental impacts by the building's cooling and heating systems are minimized.

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ANNEX 53 ADVANCED COOLING/REFRIGERATION TECHNOLOGIES

The issue
Global demand for space cooling, dehumidification, and refrigeration is projected to see huge increases in the coming decades, especially in the developing world.

Work to do
Investigate technology solutions for higher efficiency air-conditioning/refrigeration systems focusing on two principal paths: advanced vapor compression with low or ultra-low GWP refrigerants and non-traditional technologies (zero-GWP).

Results & benefits
Propose candidate technology solutions to help minimize expected energy demand growth.

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ANNEX 52 LONG TERM PERFORMANCE MEASUREMENT OF GSHP SYSTEMS SERVING COMMERCIAL, INSTITUTIONAL AND MULTI-FAMILY BUILDINGS

The issue
What is the long-term performance of larger GSHP systems and how should we measure and express it?

Work to do
Identify and compile existing larger GSHP long-term performance measurements, evaluate new monitoring projects

Results & benefits
Formulate guidelines for instrumentation, measurements, analysis and key parameters for long-term performance of larger GSHP systems. This will improve the possibilities to increase knowledge and system efficiency of GSHP systems, and to develop system design, best practice and components.

Source: Geotec, Sweden.

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ANNEX 51 ACOUSTIC SIGNATURE OF HEAT PUMPS

The issue
How can we reduce acoustic emissions to minimize noise annoyance and increase the acceptance of heat pumps.

Work to do
Different reasons to reduce sound emissions depending on countries (legislation), locations and applications have to be gathered and understood.

Results & benefits
Research results on the different implementation levels → directions for improved components, units and control strategies including guidelines, training, and inputs to future standards.

Image source: RISE Research Institutes of Sweden

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ANNEX 50 HEAT PUMPS IN MULTI-FAMILY BUILDINGS FOR SPACE HEATING AND DHW

The issue
How can we increase the use of heat pumps in multi-family buildings?

Work to do
Identify barriers for heat pumps on these markets and how to overcome them. Enhancement of heat pump systems and/or heat pump components for their adaptation in multi-family buildings.

Results & benefits
Demonstration of possible energy savings and the utilisation of renewable energy by means of heat pumps in buildings retrofitted with heat pumps without improving the building envelope.

Image source: RISE Research Institutes of Sweden

Annex 50 MFB IEA HPT

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ANNEX 49 DESIGN AND INTEGRATION OF HEAT PUMPS FOR NZEB

The issue
Find criteria for further developments of current marketable heat pump systems to exploit specific performance opportunities in nZEB.

Work to do
Investigation of heat pump integration options for nZEBs and nZE neighbourhoods. Design and control for heat pumps in nZEB and the integration into energy systems.

Results & benefits
Groups of buildings open up opportunities for load balancing between different use patterns and energy needs.

The Annex 49 *is a follow-on of the work in Annex 40 on heat pump concepts for nZEB, with an* ***extended scope****, e.g. regarding the balance of single buildings and groups of buildings/ neighbourhoods.*

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ANNEX 48 INDUSTRIAL HEAT PUMP, SECOND PHASE

The issue
How can we overcome existing difficulties and barriers for the larger scale market deployment of industrial heat pumps?

Work to do
Analyze case studies with large saving potentials and develop a simplified model for integration of heat pumps into a process.

Results & benefits
Condensed information material for policy makers, associations, industries and training courses showing the potential of IHP.

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ANNEX 47 HEAT PUMPS IN DISTRICT HEATING AND COOLING SYSTEMS

The issue
How can heat pumps in DHC systems be implemented in the best way?

Work to do
Mapping existing solutions, develop new ones, and study market and energy reduction potential and implementation barriers.

Results & benefits
Suggest how heat pumps can be implemented in both new and old district heating systems in the best way and describe the different types of integration.

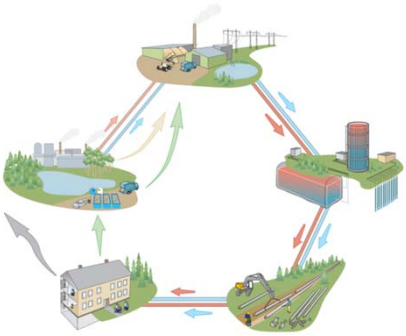

Image source: RISE Research Institutes of Sweden

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ANNEX 46 DOMESTIC HOT WATER HEAT PUMPS

The issue
How can information on the technologies be developed and targeted to end users, consultants, building constructors and policy makers?

Work to do
Mapping and comparing available technologies and system concepts and development of standardized procedures and comparison models.

Results & benefits
Better understanding of how well implemented DHW HPs reduce the energy use and CO2-emissions.

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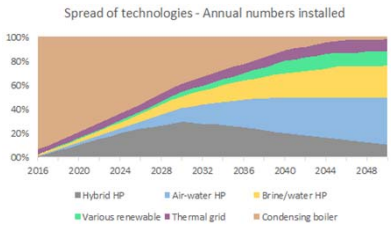
ANNEX 45 HYBRID HEAT PUMPS

The issue
How to increase implementation of hybrid heat pumps in order to reduce energy use and emissions of greenhouse gasses.

Work to do
Overview of markets, barriers and system classification. Quantification of key performance factors in a range of climates, countries and building types and building standards.

Results & benefits
Identification of applications with the greatest environmental benefit & market potential, most suitable system configuration & control strategy and highest importance in future energy systems.



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ANNEX 43 FUEL-DRIVEN SORPTION HEAT PUMPS

The issue
To save the environment, solar thermal cooling and fuel driven heat pumps need measures for a wider market penetration.

Work to do
Development, evaluation and classification of different solutions through e.g. field tests.

Results & benefits
Two new gas driven heat pumps on sale, two more to start summer 2016.

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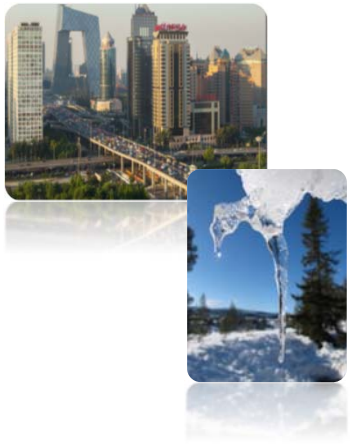
OUTCOMES, SUCCESSES AND BEST PRACTICES (1)

- **Policy decision** in China to **prioritize heat pumps** in the "coal to electricity programme" in Beijing to **improve the air quality** of the city – 160 000 installed ASHP in 2016, 300 000 ASHP expected in 2017

- **Two prototypes** of **cold climate ASHP** have been developed. Field tests demonstrated **energy savings** of more than 40 % in comparison to a conventional ASHP



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OUTCOMES, SUCCESSES AND BEST PRACTICES (2)

- Research and demonstrations work proved that heat pumps are an **energy-efficient and cost-effective system solution in NZEB** buildings. New systems are available on the **market**

- **A roadmap** for further deployment of smart **heat pumps in smart grids**, containing (policy) recommendations for several different market stakeholders

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OUTCOMES, SUCCESSES AND BEST PRACTICES (3)

- **Tools** for sizing and calculation of energy and economic performances for **industrial heat pumps** and a **reference guide** describing presently available systems with their applications.

- **Revisions** of **operation and maintenance design/installation standards** for heat pump systems, with **improved guidance** to designers, installers, and maintenance personnel

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AND STILL MORE TO COME:

The following ideas are under discussion:

Proposals:

- Affordable heating and cooling for buildings for the 21st century – Comfort and Climate Box.
- Internet of things for Heat Pumps
- Heat pumps in multi vector energy system, second phase

Ideas:

- How to improve the channel between manufacturer and end-user, to extend the good use of heat pumps

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WELCOME TO CONTACT US

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