EUROPEAN HEAT PUMP SUMMIT
POWERED BY CHILLVENTA

CONGRESS + EXPO
NUREMBERG, 24–25.10.2017

Industrial | Commercial | Residential
Heating & Cooling | Components & Equipment

hp-summit.de
Heat Pumps opportunities in industry

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EDF Research & Development
EDF R&D aims and figures

**AIMS**

Improve the EDF Group's performance in all of its current ventures and enable customers to benefit.

Prepare for the energy scenarios of the future by working on disruptive technologies.

Carry out research for external bodies within the framework of partnerships or orders.

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More than 2000 employees

134 Ph.D. students

27 nationalities represented

14 joint laboratories

10 research centers in France and abroad

In contact with 2000 startups

1678 patents in use

€572 million budget in 2016

1/3 of which is used for anticipating the Group's future

2/3 of which is used to support the performance of the Group's business units
EDF R&D Labs for Heat Pumps

HIGH-TEMPERATURE HEAT PUMPS

This laboratory is for developing new high-temperature heat pump technologies to meet the needs of industrial and district heating customers.

CLIMATRON

This test facility is for assessing and developing heat pump technologies for private customers and buildings sector.
Improving the dissemination of heat pumps
Improving the dissemination of Heat Pumps

**Objective:** Improve EDF’s Sales forces communication about Heat Pumps

- EDF’s sales forces require innovative communication about Energy Efficiency
- HP’s benefits on energy and costs savings are recognized
- HP’s are considered as complex projects and Sales Forces need to be trained

**Deliverable:** Guide "how to implement Heat Pumps in industrial sectors"

**General methodology:**

- Energy Databases
  - Wasted heat
  - Heat needs
- References of Heat Pumps in industrial sectors
- Knowledge about Industrial processes
How to use heat needs and heat wastes databases
Example of Milk Industry

- Heating of liquids evap., concent., sterilisation
- Drying of Solids and pastes
- Drying of powders
- Sterilisation Pasteurisation
- Hot water for cleaning
- Other heating (excluding steril. and pasteur.)

Heat needs:
- <70°C
- 70-100°C
- 100-150°C
- 150-250°C
- 250-500°C
Example in the Milk Industry

- Air compressors
- Boilers
- Chillers compressors
- Cleaning water
- Chillers desuruperheating
- Wasted heat
- Dryers
- Furnaces

Temperature Categories:
- >500°
- 400-499°
- 350-399°
- 300-349°
- 250-299°
- 200-249°
- 150-199°
- 100-149°
- 80-99°
- 60-79°
- 40-59°
- <40°
Heat Pumps segmentation for the study

This segmentation have to fit with the temperature intervals of the energy databases

Question:
Which Heat Pump for which industrial sector?

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Heat wastes</th>
<th>Temperature</th>
<th>Heat needs</th>
</tr>
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<tbody>
<tr>
<td>160 (°C)</td>
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<tr>
<td>20 (°C)</td>
<td></td>
<td>20 (°C)</td>
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</tr>
</tbody>
</table>

HP n°3. Very High Temperature HP \(\rightarrow 150°C\)
HP n°2. High Temperature HP \(\rightarrow 100°C\)
HP n°1. Standard HP \(\rightarrow 70°C\)
3 criteria to target the HP's opportunities in industry

Criteria 1  Overall potential of heat pumps given by the industry sector

Criteria 2  In each industry sector, competition between Heat Exchangers and HP's

Criteria 3  Strategic nature of the heat temperature range for the Industry sector
Criteria 1: Overall Potential for HP's

We consider HP can valorize HEAT up to:
- either the energy needs
- or the energy wasted of the industry sector

HP 3 = min (Heat Waste [60-100°C]; Heat Needs [100-150°C])

HP 2 = min (Heat Waste [40-60°C]; Heat Needs [70-100°C])

HP 1 = min (Heat Waste [<40°C]; Heat Needs [40-70°C])
Criteria 1

Overall Potential (France) for HP n°1 (→ 70°C)

1 TWh

1 TWh

0,2 TWh
Criteria 2: Takes into account the competition between Heat Exchangers and Heat Pumps

\[
HP_1 = \frac{\text{Heat Wastes} < 40^\circ\text{C}}{\text{Heat Wastes} > 60^\circ\text{C}}
\]

Heat needs

Heat provided by Heat Exchangers

HP 1. Standard HP $\Rightarrow 70^\circ\text{C}$
Criteria 2: Takes into account the competition between Heat Exchangers and HP's

Top 10 sectors for HP n°1 (70°C)
Criteria 3: Strategic nature of the temperature range provided by the Heat Pump

for HP n°1 = \( \frac{\text{Heat Needs [40 – 70°C]}}{\text{Total Heat Needs}} \)

for HP n°1 = \( \frac{\text{Heat Needs [70 – 100°C]}}{\text{Total Heat Needs}} \)

for HP n°1 = \( \frac{\text{Heat Needs [100 – 150°C]}}{\text{Total Heat Needs}} \)

In this industry, the needs at “HP” delivery temperature is very low compared to high temperature needs.

This will result in a very low criteria 2
Results for HP n°1 (70°C): considering criteria 1, 2 and 3

Y axis: Criteria 2 + Criteria 3

HP potential 100 GWh (thermal)
Can we rely only on Energy databases?
Back to the general methodology:

Energy Databases
✓ Wasted heat
✓ Heat needs

References of Heat Pumps in industrial sectors

Heat Pumps Guide

Knowledge about Industrial processes

This analysis lead to:
- Definition of key sectors
- Size of the technical market
- Origin of waste and needs

This analysis is essential for:
- Timeline of wasted heat and needs
- Regulations, standards, …
- Prepare case study
  (energy audits are useful for that work)

These references are useful for information
- Fine description of real projects
- Heat exchangers
- Storages, time of operation, …
- Equipment Providers

Annexe 48
Example of malt kilning industry
Malt Industry

Understanding the process

Barley sourcing

Germination

Cooling

Waste heat: Condensers of chillers

Drying and Kilning

Barley drying at 60°C then Kilning at 85°C (Duration 20 h)

To the Brewery Industry

Waste heat: Exhaust humid air (mist)
Finding 2 references

Malt house SOUFFLET (Fr)
Heat pump: 10 MW

Malt house Malteurop (Fr)
Heat pump: 2 x 4.5MW
Toward the catalog of "HEAT PUMP OPPORTUNITIES"
Thank you