Task 2 : Assessing heat pumps market in industry

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TREE Division – Technologies and Research for Energy Efficiency Division
Industrial waste heat in France 116 TWh per year

High temperature waste heat (>100°C) : 50%

Source : CEREN 2016
Low temperature waste heat (<100°C) : 50%

-> Heat source for heat pumps

Source: CEREN 2016
Aim of this study:
Understanding the heat pumps markets to improve their dissemination in the industry sectors
Objective: Improve EDF's Sales forces communication about Heat Pumps

- HP's benefits on energy and CO2 emissions reduction and costs savings are recognized
- EDF’s sales forces require innovative communication about Energy Efficiency
- HP's are considered as complex projects and Sales and Technical Forces need to be trained

Deliverable: Guide "how to implement Heat Pumps in industry sectors"

General methodology:

References of Heat Pumps in industry sectors

Heat Pumps Guide

Energy Databases
- Waste heat
- Heat needs

Knowledge about Industry processes
How to use "heat needs" and "waste heat" databases to assess HP's market
Example of the milk Industry

<table>
<thead>
<tr>
<th>Heat needs Vs. Temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;70°C</td>
</tr>
<tr>
<td>70-100°C</td>
</tr>
<tr>
<td>100-150°C</td>
</tr>
<tr>
<td>150-250°C</td>
</tr>
<tr>
<td>250-500°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaporation concentration</th>
<th>Drying of Solids and pastes</th>
<th>Drying of powders</th>
<th>Sterilisation Pasteurisation</th>
<th>Hot water for cleaning</th>
<th>Other heating (excluding steril. and pasteur.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;70°C</td>
<td>100°C to 150°C</td>
<td>150°C to 250°C</td>
<td>150°C to 250°C</td>
<td>70°C to 100°C</td>
<td></td>
</tr>
<tr>
<td>70°C to 100°C</td>
<td>100°C to 150°C</td>
<td></td>
<td>100°C to 150°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100°C to 150°C</td>
<td>150°C to 250°C</td>
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<td>150°C to 250°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>250-500°C</td>
<td></td>
<td></td>
<td>100°C to 150°C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example of the milk Industry:

<table>
<thead>
<tr>
<th>Temperature range</th>
<th>Example of the milk Industry</th>
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<tbody>
<tr>
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<td></td>
</tr>
<tr>
<td>70°C to 100°C</td>
<td></td>
</tr>
<tr>
<td>100°C to 150°C</td>
<td></td>
</tr>
<tr>
<td>150°C to 250°C</td>
<td></td>
</tr>
<tr>
<td>250°C to 500°C</td>
<td></td>
</tr>
</tbody>
</table>
Example in the Milk Industry

Waste heat Vs. Temperature range

- Air compressors
- Boilers
- Chillers compressors
- Cleaning water
- Chillers desurperheating
- Dryers
- Furnaces

Temperature ranges:
- >500°
- 400-499°
- 350-399°
- 300-349°
- 250-299°
- 200-249°
- 150-199°
- 100-149°
- 80-99°
- 60-79°
- 40-59°
- <40°
Assessing the heat pump potential

Example in the Brewery Industry
Heat Pumps segmentation for the study

Temperature

Waste heat

Heat needs

HP 3. Very High Temperature HP \( \geq 150^\circ C \)

HP 2. High Temperature HP \( \geq 100^\circ C \)

HP 1. Standard HP \( \geq 70^\circ C \)
Key points to assess the HP's opportunities in industry

Key point 1  Potential of Heat Pumps heat production in each industry sector
Key point 2  In each industry sector, competition between Heat Exchangers and HP's
Key point 1: Potential of energy that can be produced by a heat pump

The energy production of HP is limited by
• either the energy needs
• or the energy wasted of the industry sector

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

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

HP 1 = \( \min \) (Heat Waste \(<40^\circ C\); Heat Needs \([40-70^\circ C]\))
Key point 1

Overall Potential (France) for HP 1 (heat up to $70^\circ$C)
With Key point 2:

Taking into account the competition between Heat Exchangers and Heat Pumps.
Key point 2:
Taking into account the competition between Heat Exchangers and HP's

Top 10 sectors for HP n°1 (➔ 70°C)
Key point 1: HP1 Potential in the sector

Key point 2: HP1 potential considering competition with heat exchangers

Sectors with high temperature processes have disappeared:
base chemistry, plastic, mineral chemistry, paper, …
Different market sizes for HP1 (70°C), HP2 (100°C) and HP3 (150°C)

Example for 3 sectors: Paper, Starch, Fruits and Vegetables preserves and frozen products
Industrial Heat Pumps potential market in France

Total Potential HP potential: 32 TWh of heat

Total potential found with this methodology considering heat exchangers: 11 TWh of heat
This work could be extended to other countries

<table>
<thead>
<tr>
<th>Industry sectors</th>
<th>Milk</th>
<th>Malt</th>
<th>Meat</th>
<th>Car</th>
<th>Pet food</th>
<th>Paper</th>
<th>Chemistry</th>
<th>Sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size in France (random figures for example)</td>
<td>100</td>
<td>20</td>
<td>15</td>
<td>200</td>
<td>20</td>
<td>60</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>Size in other country (random figures for example)</td>
<td>80</td>
<td>60</td>
<td>30</td>
<td>...</td>
<td>...</td>
<td>....</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>HP market France</td>
<td>x TWh</td>
<td>y TWh</td>
<td>z TWh</td>
<td>...</td>
<td>....</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>HP market other country</td>
<td>x * 0.8</td>
<td>y * 3</td>
<td>z * 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
Thank you

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