BELGIUM: PUTTING THINGS ON A PERSPECTIVE

• Capital: Brussels
• Official languages: Dutch, French and German
• Area: 30 528 km² (136th)
• Population: 11 584 008 (82nd)
  ➢ 376/km² (22nd)
• GDP (nominal): 50 598 $/capita (17th)

Well known for: “complex system of governance, and an incredible variety of beers, waffles, and chocolates.”
Mayekawa, with head office in Japan, is an OEM of amongst others industrial compressors. **Mayekawa Europe** (Brussels) is one of the leading companies for refrigeration and gas compressors in the European market.

**Compressor types:**

<table>
<thead>
<tr>
<th>Compressor type of the heat pump</th>
<th>Refrigerant</th>
<th>Maximum supply temperature [°C]</th>
<th>Compressor type</th>
<th>TRL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS-compressor</td>
<td>Butane (R-600)</td>
<td>120 (pressurized water)</td>
<td>Piston</td>
<td>7</td>
</tr>
<tr>
<td>FC-compressor</td>
<td>Pentane (R-601)</td>
<td>145 (steam)</td>
<td>Screw</td>
<td>6/7</td>
</tr>
</tbody>
</table>

Furthermore, Mayekawa is investigating the possibility of using a standard ammonia refrigeration screw compressor (SCV-compressor) for the use of iso-butane (R-600a) or butane (R-600) to cover the temperature range of 90-120 °C. For lower temperatures, ammonia is the standard, while for higher temperatures the FC screw compressor can be used. This compressor unit has a shorter lead time and lower cost compared to the FC compressor.

*Note: These slides were made by Elias Vieren based on information received from Mayekawa Europe. For more information contact: koen.verplancke@mayekawa-europe.com*
NATIONAL HTHP INDUSTRY - QPINCH

- Belgian manufacturer of heat transformers (heat driven heat pump).
- Focus on (petro)chemical industries, but also food industry, carbon capture and recycling.

*Note: These slides were made by Elias Vieren based on information received Qpinch and information on their website.*
3 operation units on MW scale:

**Borealis – Antwerp**
- 1.3 MW
- Steam output: 165 °C – 184 °C
- 2 t/h steam; 3 to 10 bar G
- LDPE reactor cooling, 3 sources

**Kuraray – Eval – Antwerp**
- 1.3 MW
- Steam output: 155 °C
- 2 t/h steam at 4.5 bar G
- 2 distillation column overhead condensers

**Qpinch (Sabic) – Antwerp**
- 2 MW
- Demonstrate tech capabilities: COP, delta T
- Converting low pressure steam in medium pressure steam (up to 18 bar G)

*Note: These slides were provided by QPinch*
OVERVIEW OF NATIONAL HTHP MARKET

• Historically low gas prices and high electricity prices:
  → Unfavorable for HTHP integration (both electrically- and heat-driven).
  → However, due to the energy crisis and rising carbon prices, trends are changing.
• The ambition of the federal (national) government is to supply 80% of the total
  demand of the energy-intensive industries (chemical, petrochemical and steel) from
  CO2 neutral/sustainable energy in an economic cost-effective way by 2040.
  → Ambitious climate goals, but overall a lack of a good climate policy.
OVERVIEW OF NATIONAL HTHP MARKET

Industrial final energy use [2]:

Chemical industry [3]:

Port of Antwerp. Biggest petrochemical cluster in EU.

Belgium

KEY FACTS

Turnover
€74 billion

Number of companies
> 720

Capital Spending
€2.7 billion

R&D Investment
€5.5 billion

Direct Employees
97,400
OVERVIEW OF NATIONAL HTHP MARKET

Study of Kosmadakis [4]:

* Heat from renewables and derived heat is not included

12,15 TWh in the temperature range of 100-200 °C

2000-4000 MW of heating capacity

Assumption: 3000-6000 operating hours per year
SELECTED RD&D PROJECTS: CHESTER

CHESTER (Compressed Heat Energy Storage for Energy from Renewable sources):

- **Budget**: 5 Mio. € (Horizon Europe)
- **Date**: 01/04/18-31/03/23

➢ **Conclusion**: Successful demonstration of the CHEST concept.
SELECTED RD&D PROJECTS: UPHEAT-INES 2


- **Consortium:** Ghent University and KU Leuven
- **Budget:** 2 Mio. € (National project: Catalisti - Moonshot)
- **Date:** 01/01/23-01/07/25
- **Main scope:** Development, optimal control, testing and inspection of a lab-scale vapour compression high temperature heat pump, supplying heat up to 200 °C, making use of a novel water-ammonia zeotropic mixture. The compressor is a water lubricated oil-free twin-screw compressor able to handle two-phase compression and liquid injection.
  - Follow-up project of Upheat-INES 1, which focused on the technology potential and thermodynamic and financial models.

Contact:
Ghent University (project coordinator): Steven.lecompte@ugent.be
KU Leuven: alessia.arteconi@kuleuven.be
Main scope is to demonstrate 3 full-scale HTHPs:

<table>
<thead>
<tr>
<th>Knowledge and innovation centre</th>
<th>Technology supplier</th>
<th>End user</th>
<th>Information</th>
</tr>
</thead>
</table>
| TNO                             | Mayekawa            | Stella Polaris (Food) | Heating capacity: 1.3 MW
|                                 |                     |           | Supply temperature: 143 °C (steam)
|                                 |                     |           | Heat recovery from existing cooling system |
| DTI                             | GEA                 | Tiense suiker (Food) | Heating capacity: 4 MW
|                                 |                     |           | Supply temperature: 139 °C (steam) |
| DLR                             | Spilling            | Smurfit kappa (Paper) | Development of a standard steam compressor |

*Note: These slides were made by Elias Vieren based on information found online.*
REFERENCES

https://ec.europa.eu/eurostat/web/energy/data/energy-balances, 2019
Presenter:
Elias Vieren

E-mail: Elias.Vieren@ugent.be