Energy7
13-17 August 2017
Manchester, UK

THEORETICAL ANALYSIS OF STEAM GENERATION METHODS – THE CASE OF HIGH TEMPERATURE HEAT PUMP

Frédéric Bless, Cordin Arpagaus, Stefan S. Bertsch, Jürg Schiffmann

NTB
Interstaatliche Hochschule für Technik Buchs
FHO Fachhochschule Ostschweiz

EPFL
ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

1 NTB University of Applied Sciences of Technology Buchs, 9471 Buchs, SWITZERLAND.

2 Ecole Polytechnique Fédérale de Lausanne, Laboratory for Applied Mechanical Design, 2002 Neuchâtel, SWITZERLAND.

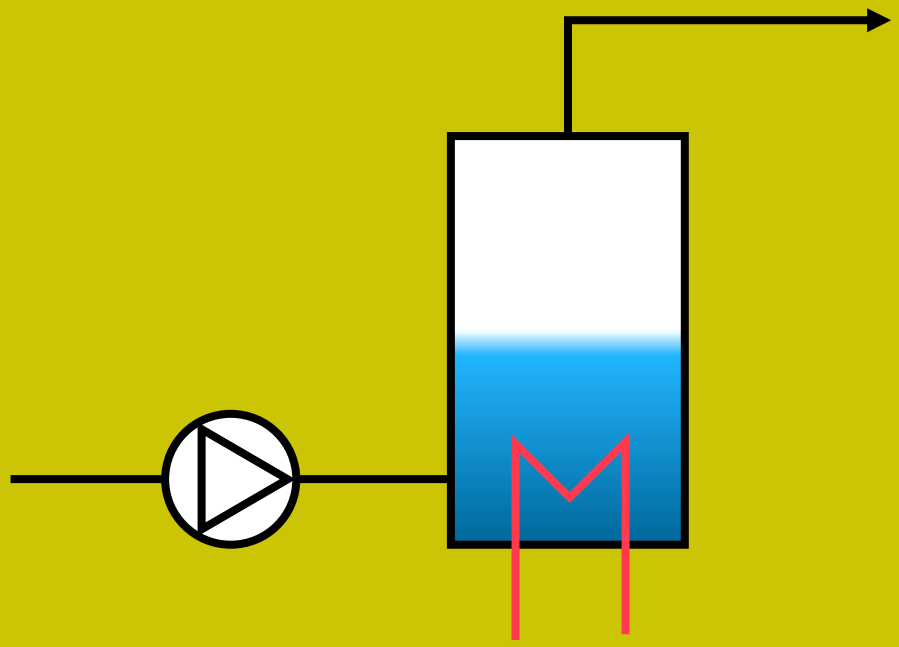

STEAM

USAGE

- Heating
- Distillation
- Food drying
- Carbon activation
- …

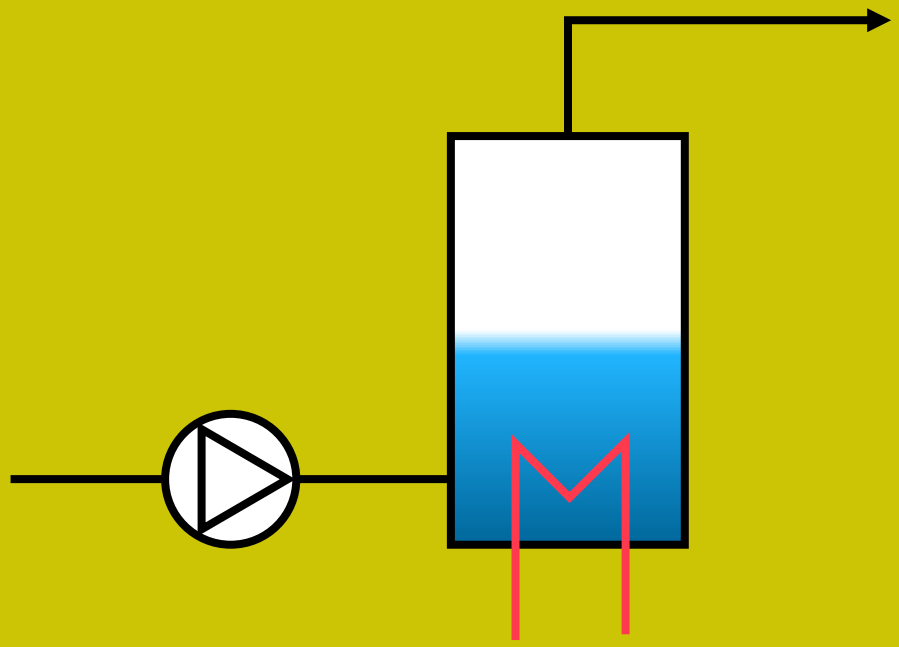
BOILER

- Gas, oil, electricity
- Efficient



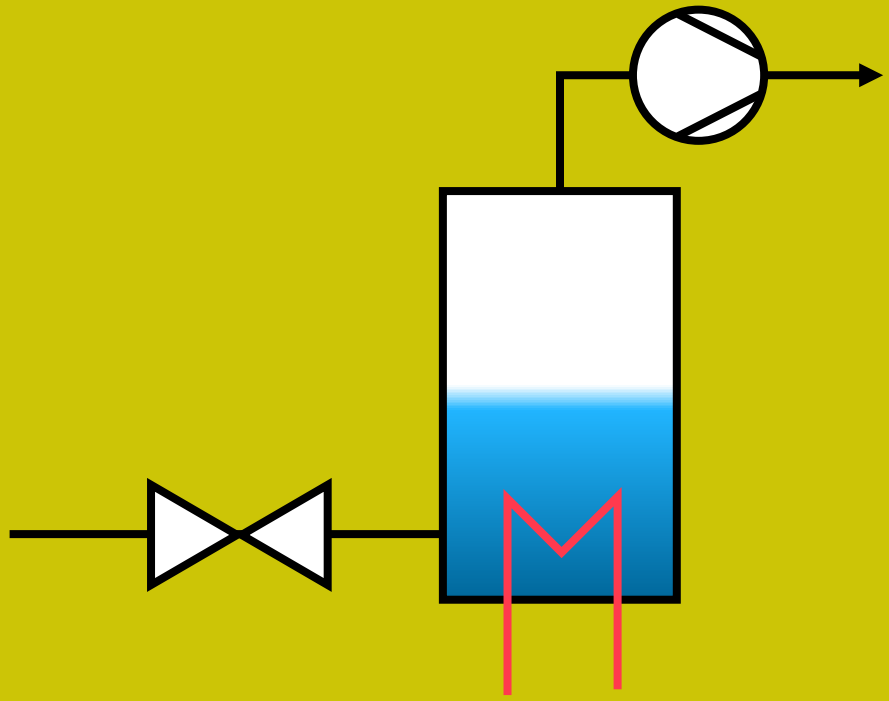
HIGH - TEMPERATURE HEAT PUMP

- COP ~1.4



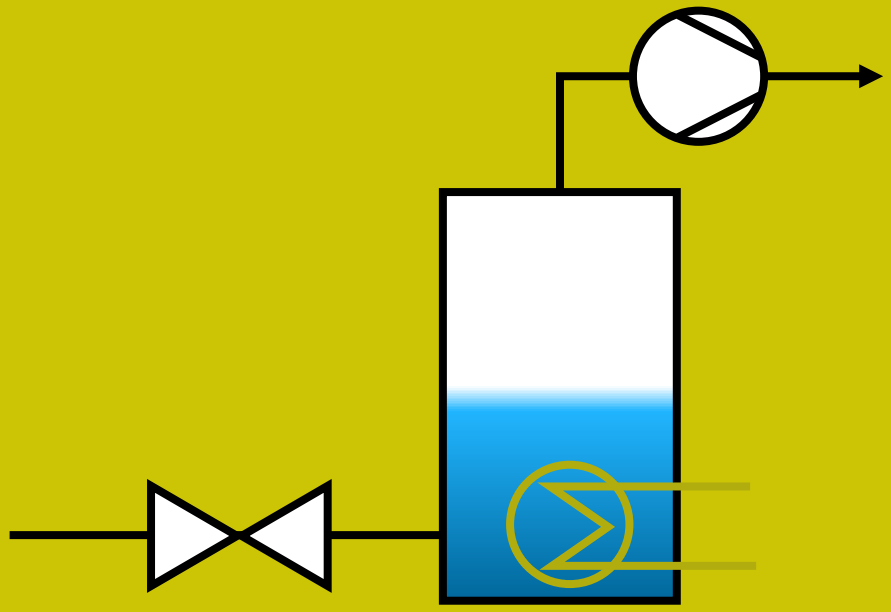
STANDARD HEAT PUMP

- Low-pressure

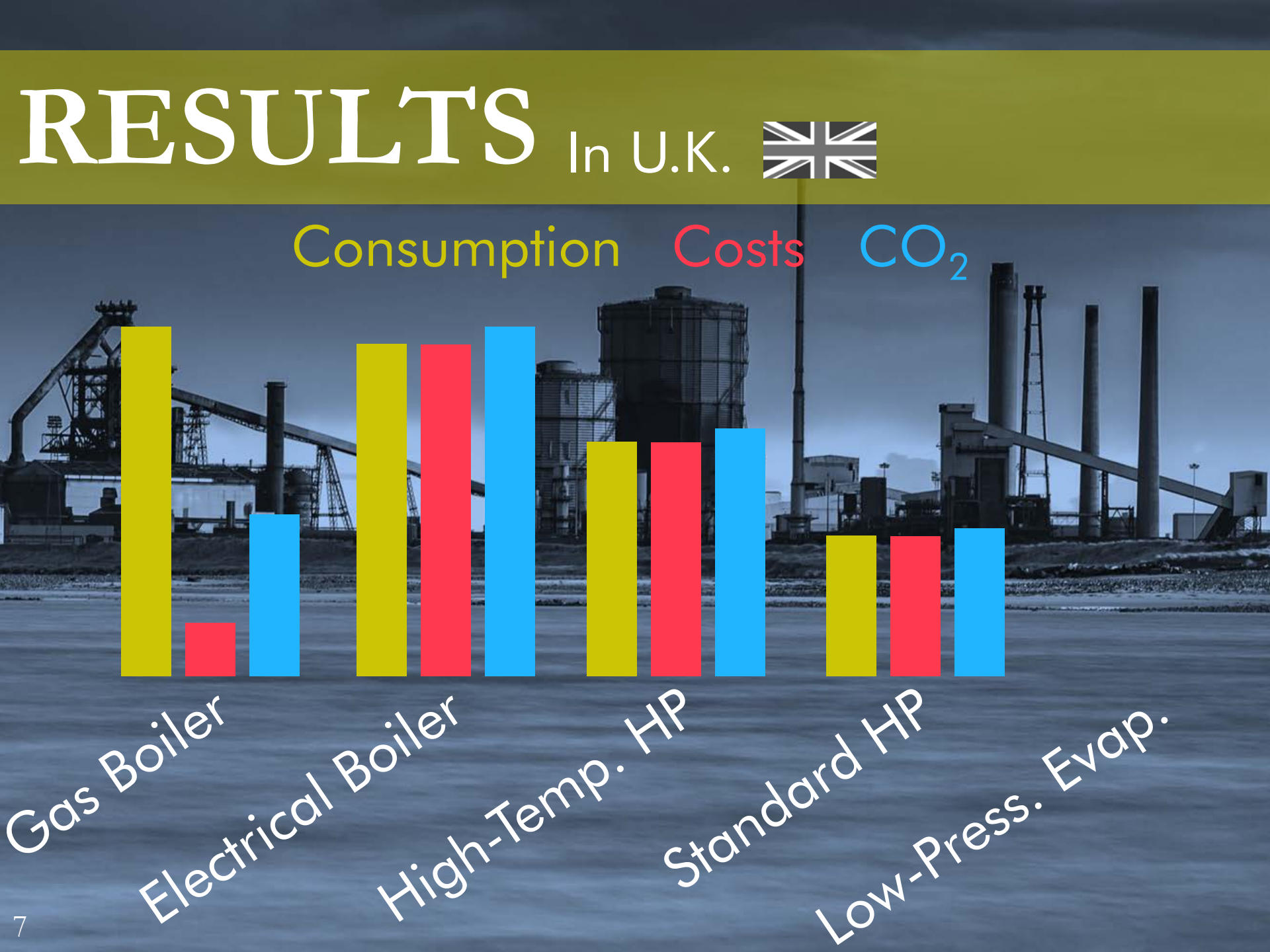


LOW-PRESSURE EVAPORATION

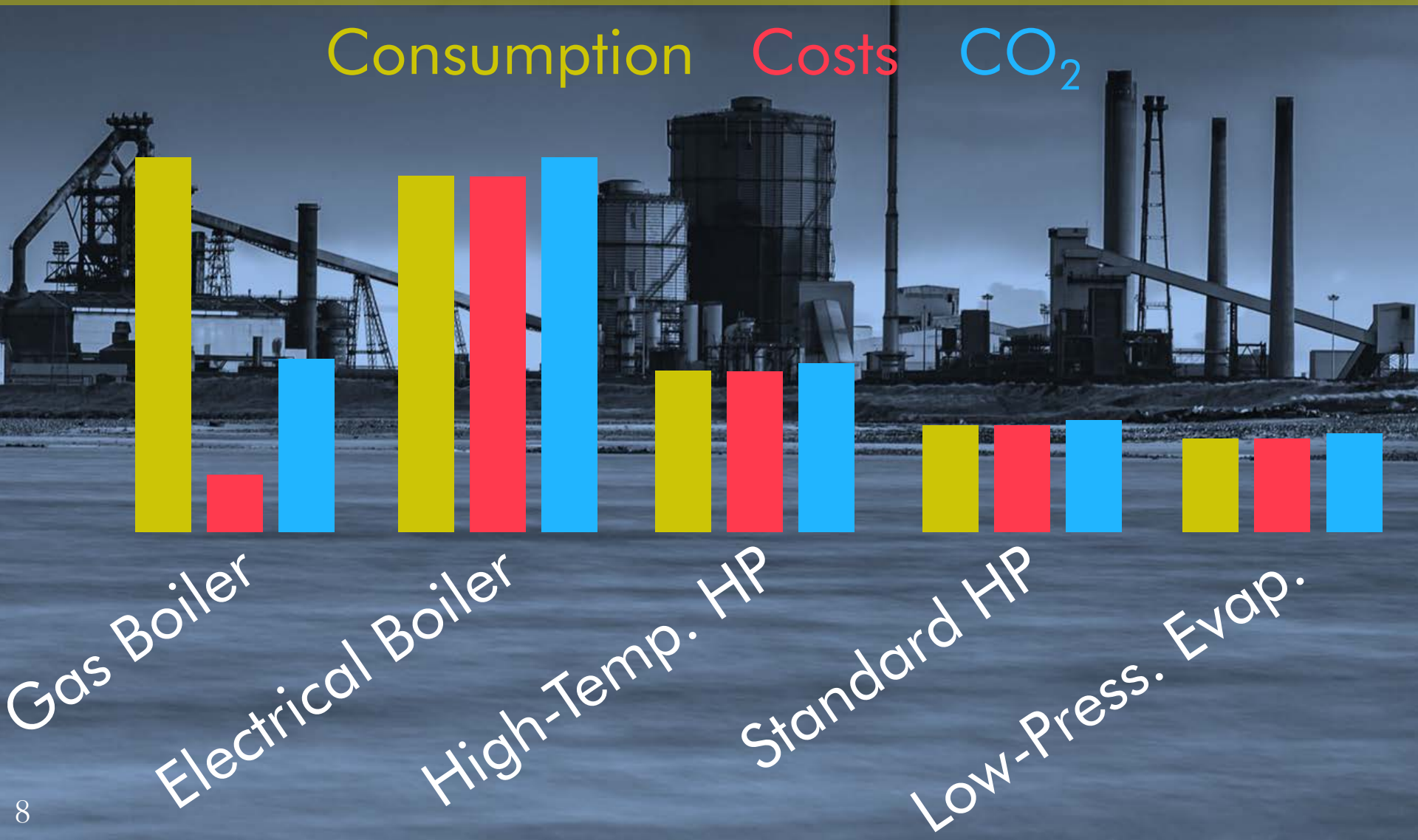
- Low-pressure
- Waste heat



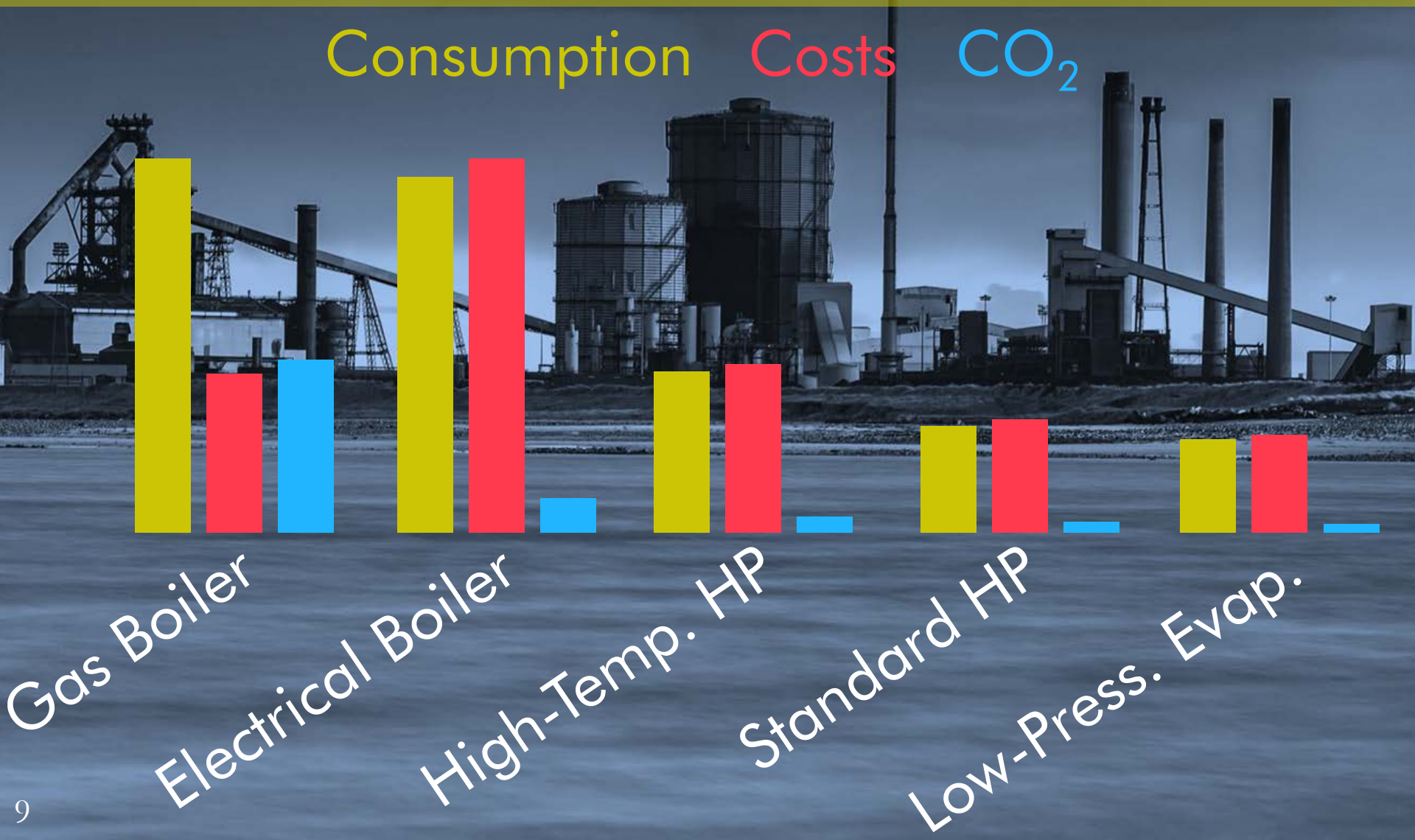
RESULTS In U.K.



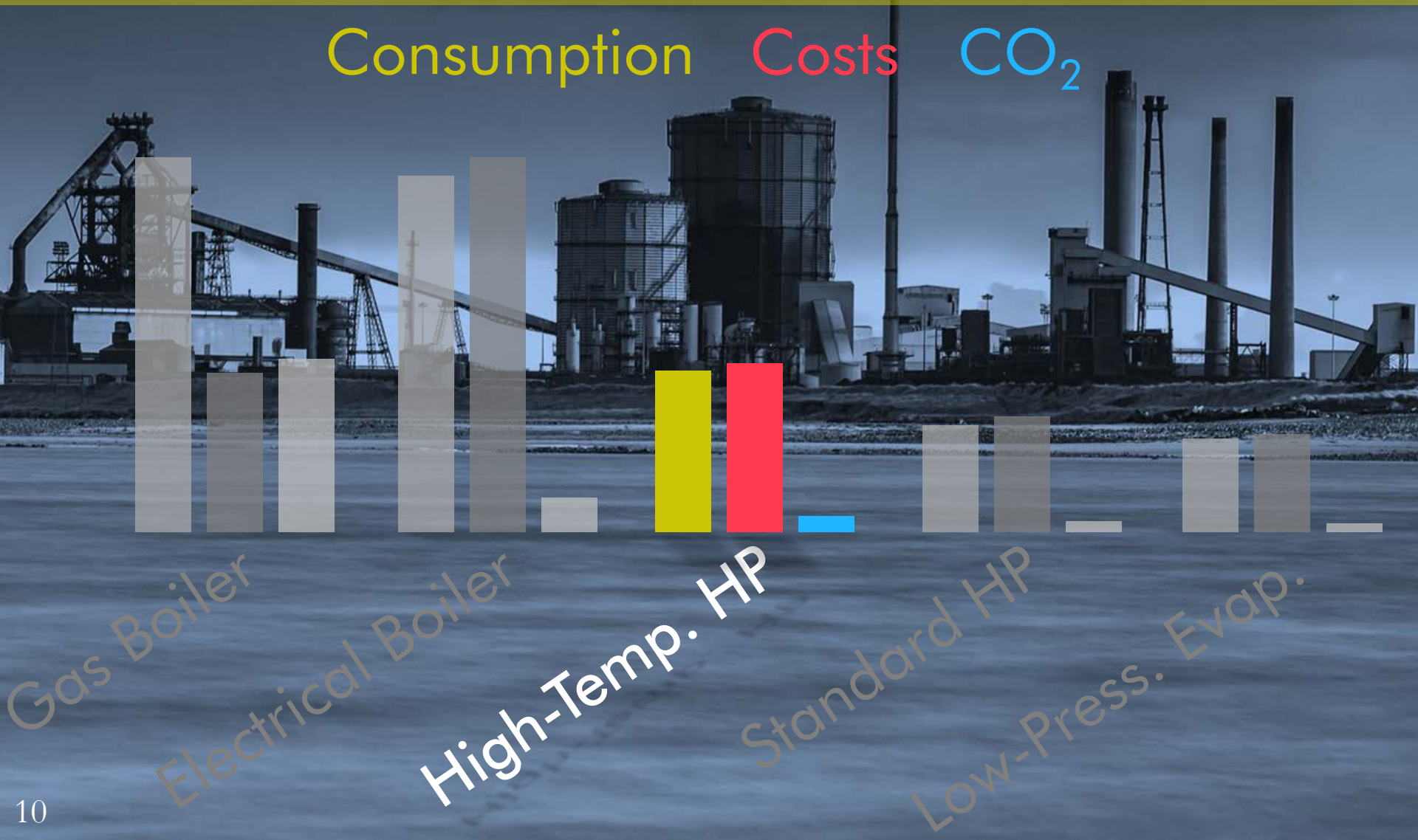
RESULTS In U.K with 55°C waste heat

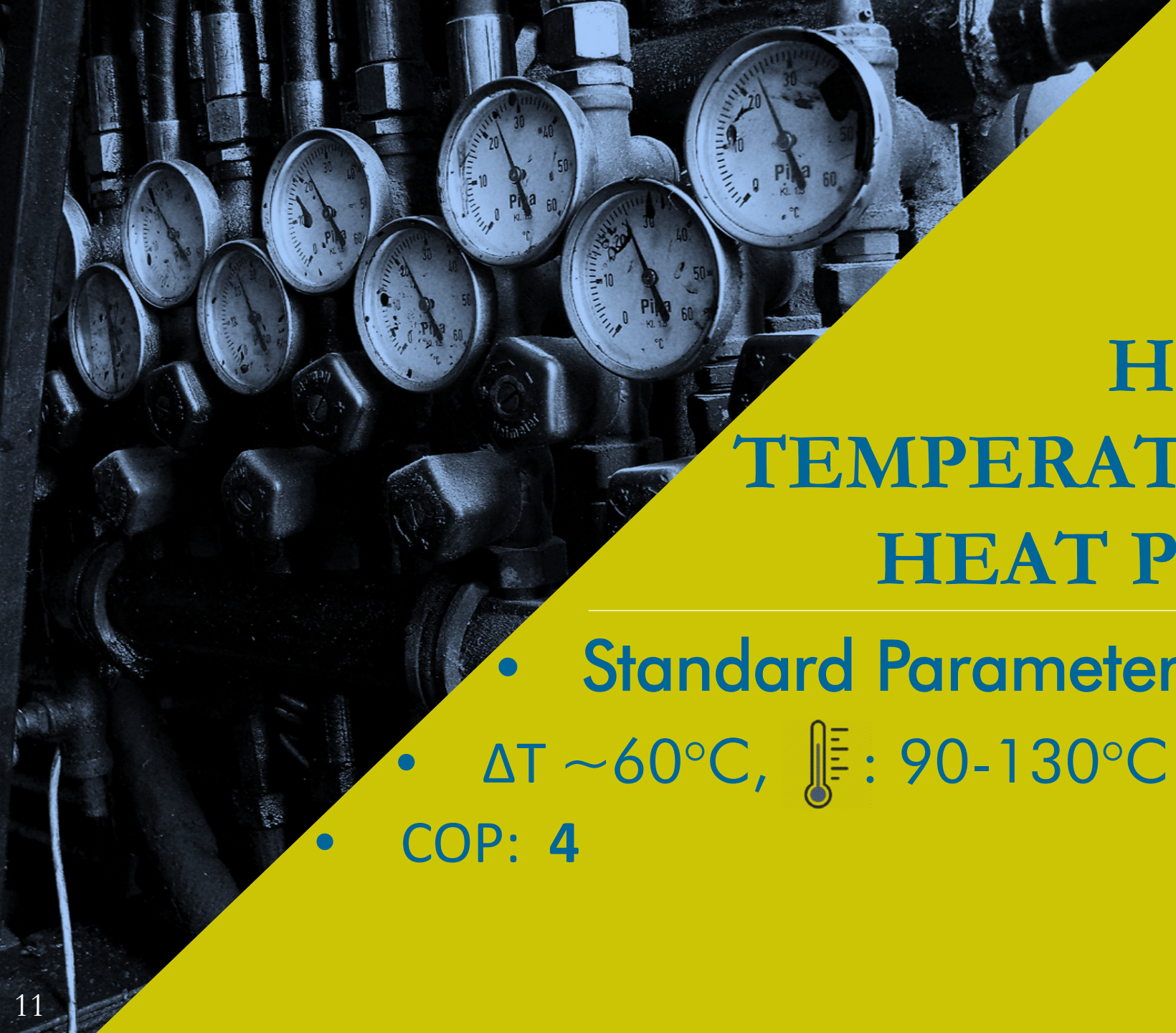


RESULTS In Switzerland with 55°C WH



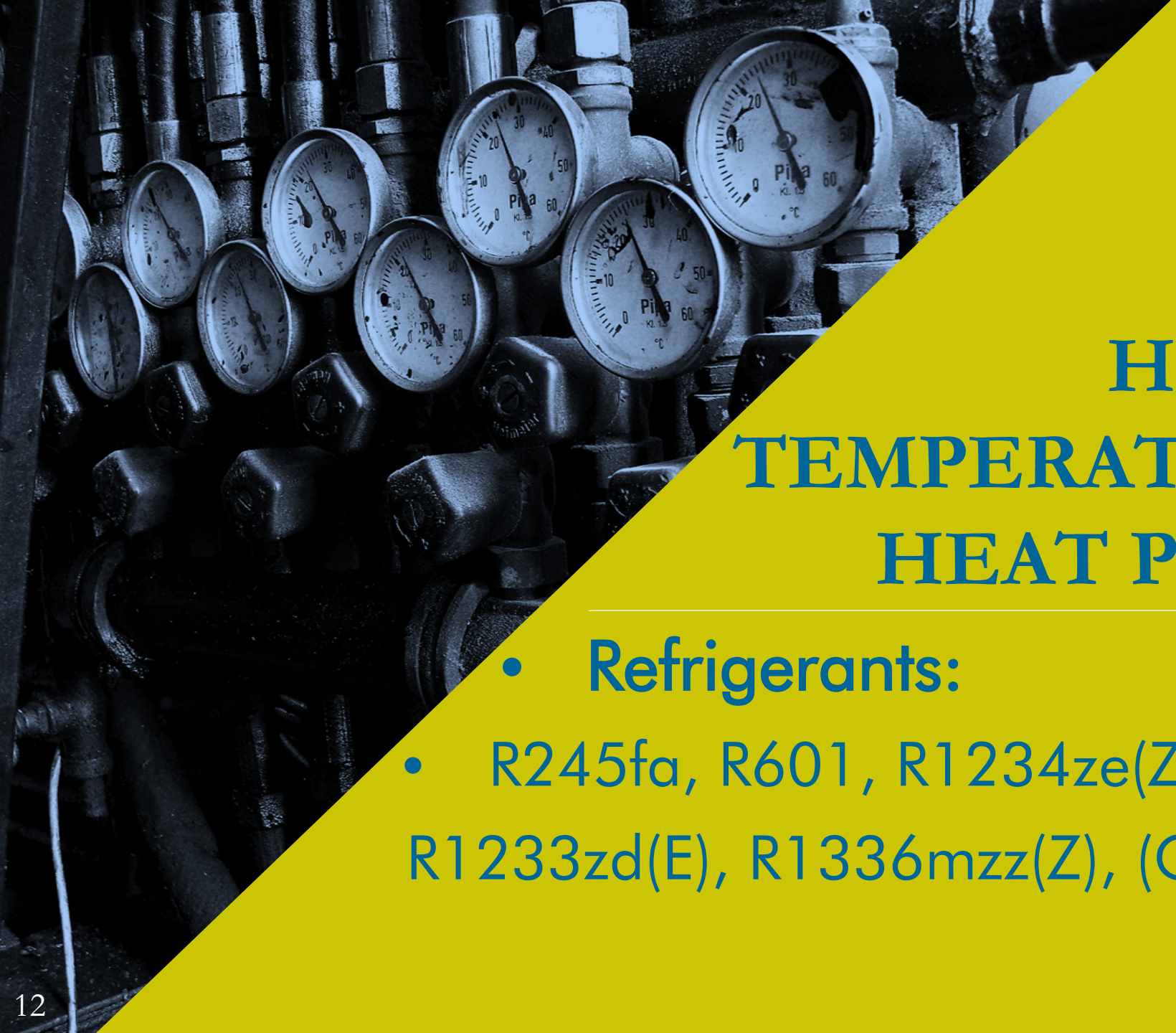
RESULTS In Switzerland with 55°C WH





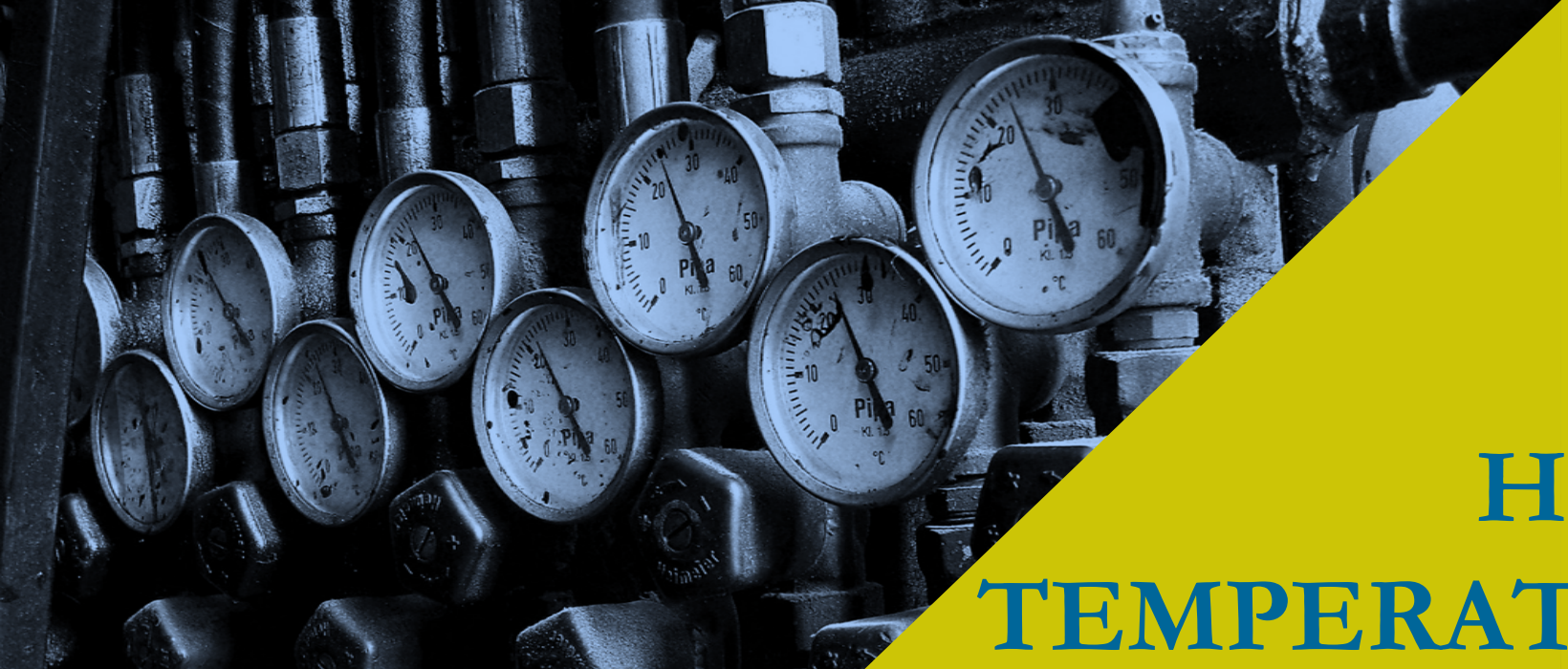
HIGH-TEMPERATURE HEAT PUMP

- Standard Parameters:
- ΔT ~60°C, : 90-130°C
- COP: 4



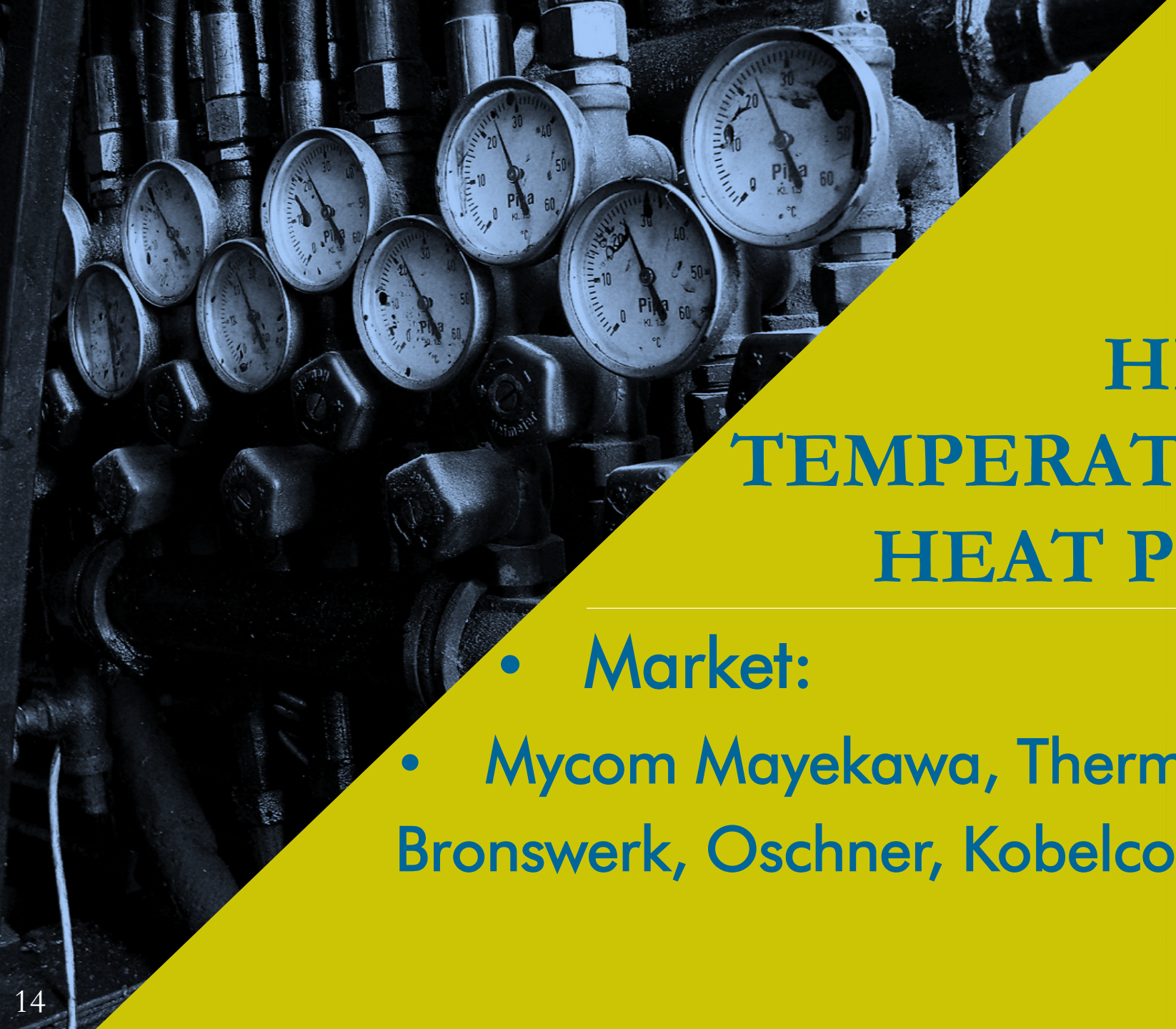
HIGH-TEMPERATURE HEAT PUMP

- **Refrigerants:**
- R245fa, R601, R1234ze(Z), R1233zd(E), R1336mzz(Z), (CO_2)



HIGH-TEMPERATURE HEAT PUMP

- Research:
- 7 groups with >100°C
- 



HIGH-TEMPERATURE HEAT PUMP

- Market:
- Mycom Mayekawa, Thermeco2, Bronswerk, Oschner, Kobelco

THANKS

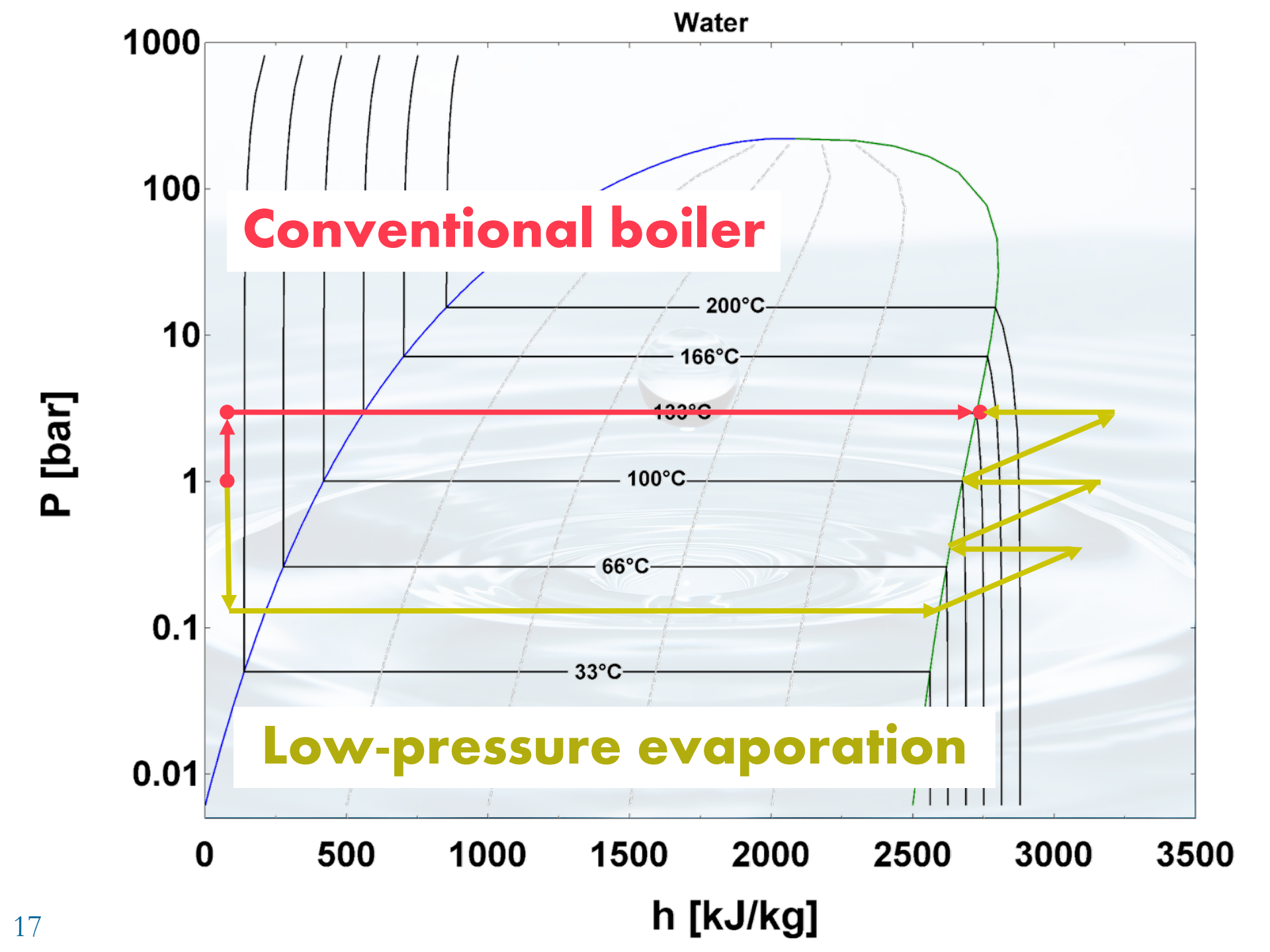
Frédéric Bless
NTB Buchs
Switzerland

frederic.bless@ntb.ch

Frédéric Bless, et al., *Theoretical analysis of steam generation methods - Energy, CO2 emission, and cost analysis, Energy,* Volume 129, 15 June 2017, Pages 114-121, ISSN 0360-5442

All images from pixabay (CC0 Public Domain)

Additional slides


Water
Conventional boiler
Low-pressure evaporation
200°C
166°C
133°C
100°C
66°C
33°C
P [bar]
1000
100
10
1
0.1
0.01
0
500
1000
1500
2000
2500
3000
3500
h [kJ/kg]

RESULTS In Switzerland