

Integration of a Steam-Generating Heat Pump in a Swiss meat factory

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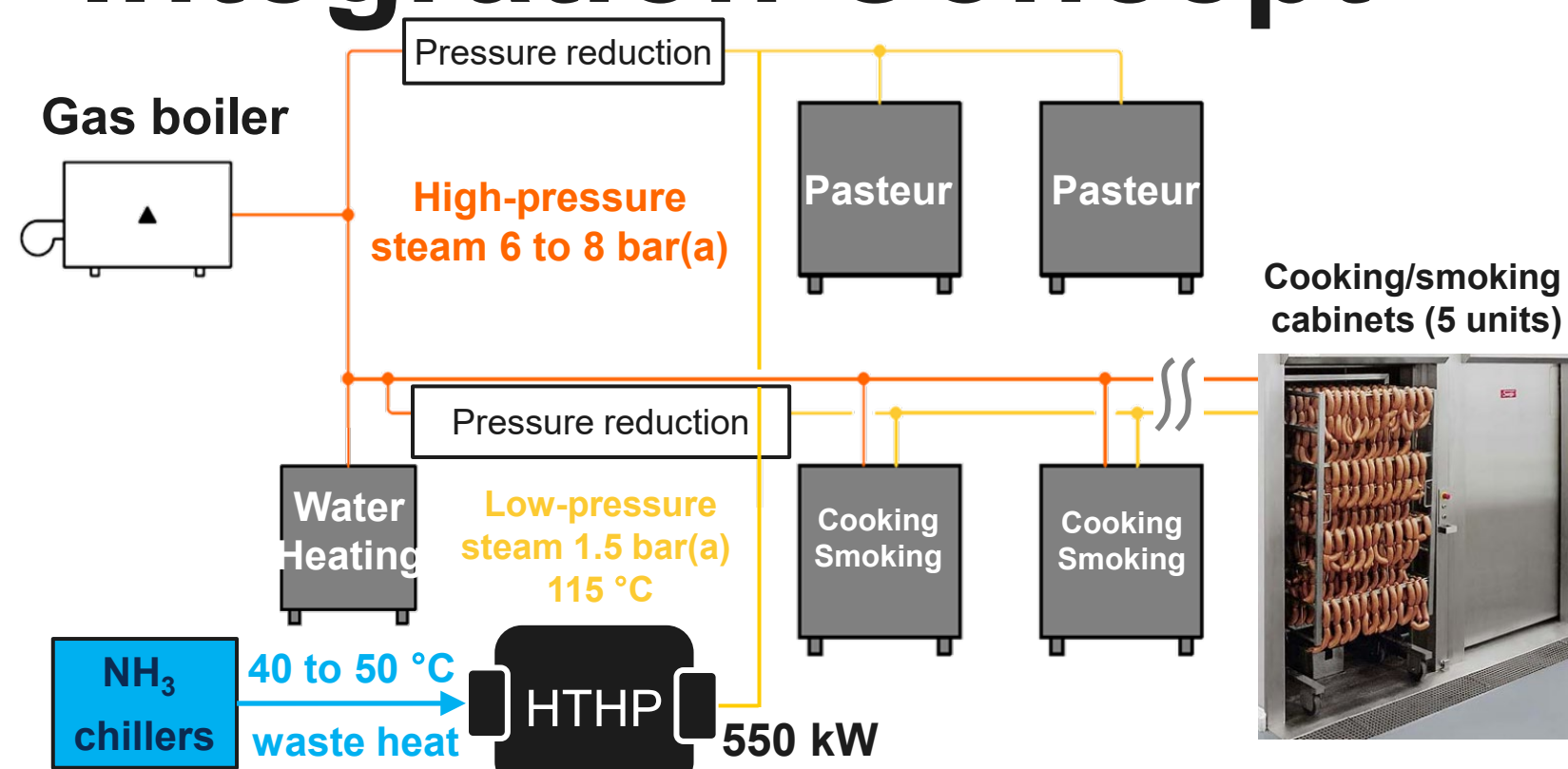
Introduction

- **Gustav Spiess AG** produces meat products such as sausages, ham, and bacon.
- Today, a **gas/oil boiler** provides 6 to 8 bar(a) steam to heat the pasteurization and cooking/smoking cabinets
- The steam pressure is reduced to **1.5 bara (115°C)** to achieve cabinet temperatures of 85 to 90 °C and a sausage core temperature of about 72 °C
- **5 cooking/smoking units: 840 kg/h steam**

Goals

- The company committed the **SBTi (Science-based Targets Initiative)** to reducing its Scope 1 (direct, electricity) and Scope 2 (indirect) greenhouse gas emissions by 50% by 2030 (2018 base) and to reducing its Scope 3 emissions.
- **Goal: Integrating a 550 kWth steam-generating heat pump (SGHP) into sausage cooking/ smoking processes** by using the **waste heat from the NH₃ chillers** and as a possible **heat source at 40 to 50 °C**
- Operating time: ~ 3'000 h/a (12 h/d, 250 d/a)

Integration Concept

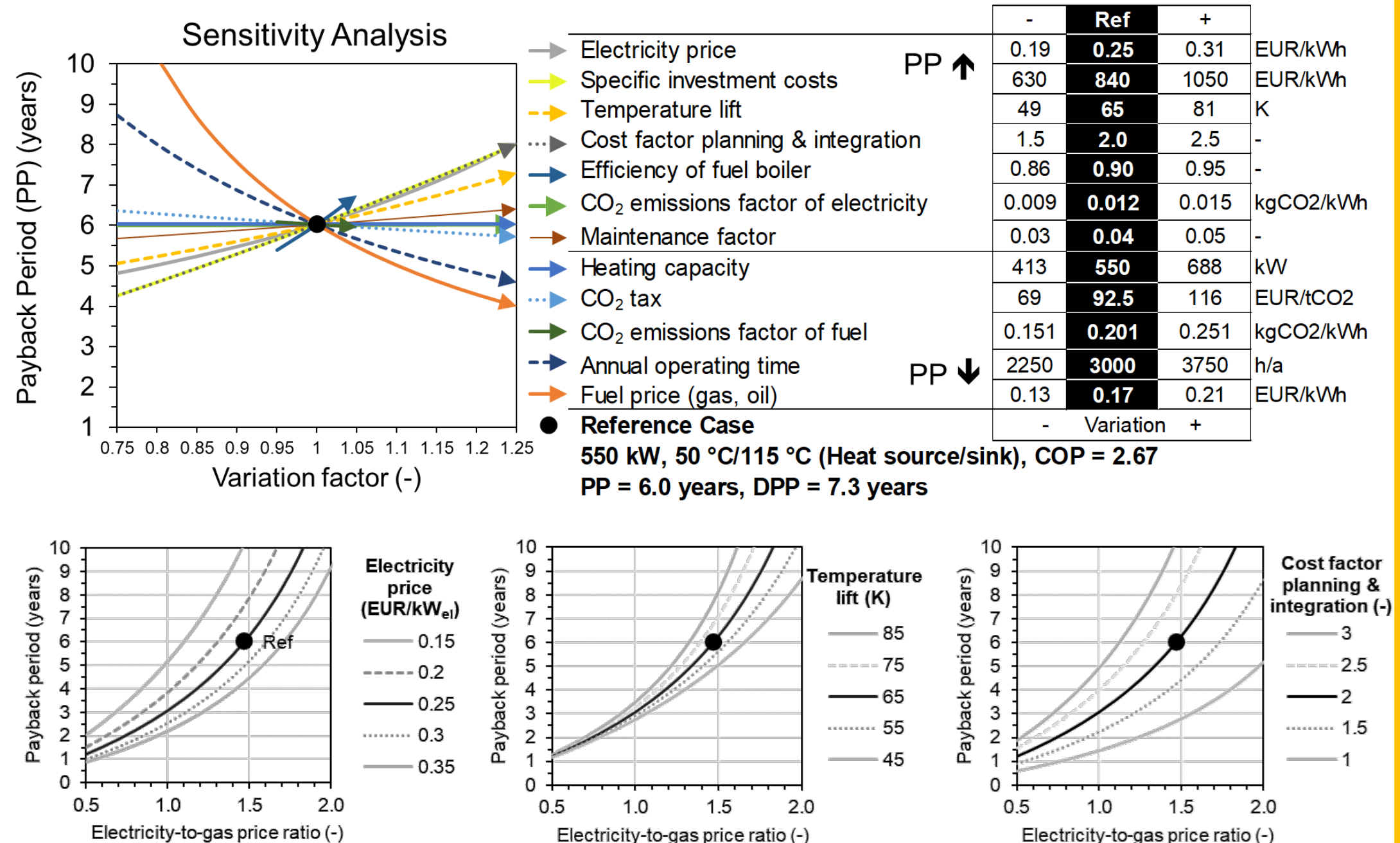


Energy costs & economic calculation

Input parameters		
Heat sink inlet/outlet temperature	°C	20/115 (1.5 bara steam)
Heat source inlet/outlet temperature	°C	50/45
Temperature lift	K	65
Heating capacity	kW	550
Fuel (gas, oil) price	EUR/kWh	0.17
Electricity price	EUR/kWh	0.25
Electricity-to-fuel price ratio	-	1.47
CO ₂ tax (or subsidies)	EUR/tCO ₂	92.5
Electricity CO ₂ emissions factor	kgCO ₂ /kWh	0.012
Fuel CO ₂ emissions factor	kgCO ₂ /kWh	0.201
Annual operating time (12 h/d, 250 d/a)	h/a	3'000
Efficiency of fuel boiler	-	0.90
Maintenance factor (on capital costs)	-	0.04
Cost factor for planning & integration	-	2.0
COP ($COP = 52.94 \cdot \Delta T_{lift}^{-0.716}$)	-	2.67
Specific investment costs (HTHP)	EUR/kW	840

Method

Payback period and sensitivity analysis



Results

Reference conditions

Total investment costs	kEUR	924
Annual CO ₂ emissions reduction	tCO ₂ /a (%)	361 (98%)
Annual energy savings	MWh/a (%)	1'214 (66%)
Annual fuel cost savings	kEUR/a	312
Annual electricity costs	kEUR/a	155
Annual heat pump maintenance costs	kEUR/a	37
Annual CO ₂ tax compensation	kEUR/a	33
Annual cost savings	kEUR/a	153
Discount rate	%	5
Payback period	a	6.0
Discounted payback period	a	7.3

Conclusions

- The estimated **payback period of 6 years** is influenced by the **electricity and fuel prices, temperature lift** (i.e., COP, application), **investment costs**, and **planning/integration**
- **Multiplication potential in other food processes**
- **Technical support is needed for HTHP integration** (e.g. refrigerant selection, combination with gas boiler, cost transparency regarding investment, maintenance, energy costs, reduction of CO₂ emissions)

Core partners



Associate partners



Cooperative partners:

