An aerial photograph of a large crowd of people standing on a white surface, arranged to form the outline of the map of Austria. The people are densely packed within the map's boundaries and more sparsely distributed around the perimeter.

# EXAMINATION OF THE SUITABILITY OF INDUSTRIES FOR THE INTEGRATION OF GEOTHERMAL ENERGY AND CASCADING UTILISATION OF HEAT USING THE EXAMPLE OF GMUNDEN

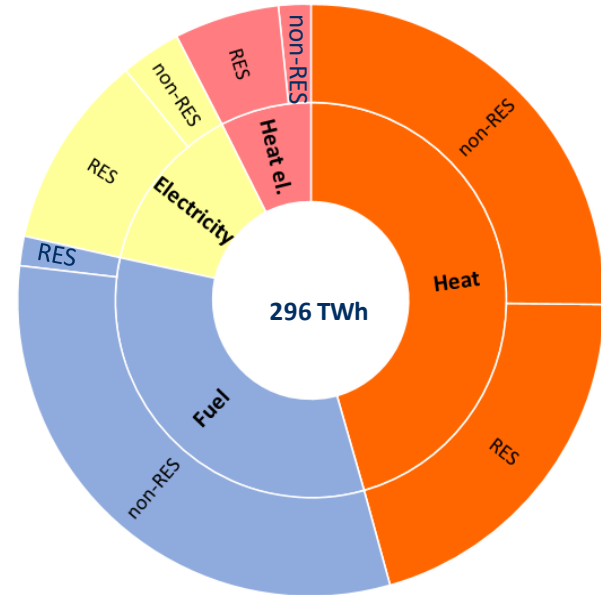
NEFI CONFERENCE 2024, VIENNA

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# INTRODUCTION AND CURRENT SITUATION

- Industrial energy: ~ **29 %** of the **final energy** use
- **Heat** accounts for more than **50 %** of final energy
- A successful transformation needs a **focus** on the **heat sector**
- **low temperature heat <100 °C** accounts for **64 %** (space heating, water, low temperature processes in industry)
- **geothermal energy** is suitable for a lot a industrial processes
- **kaskading** energy use of excess heat is essential



# CASCADE

GEOTHERMALLY POWERED CASCADE HEATING AND COOLING FOR INDUSTRIAL, COMMERCIAL AND HOUSING USE

- Part of NEFI – New Energy for Industry Innovation Network

## MAIN GOALS

- **Evaluation of deep and near-surface geothermal resources** in Steyr, Gmunden and St. Martin im Mühlkreis
- **Decarbonisation of industry** by **cascading** the use of **geothermal energy** and creating regional synergies
- **Feasibility study** and **preparation for implementation** of the **heat supply for industry**, as well as the heating networks of the two municipalities of Steyr and Gmunden

### Key Facts

Duration: 10/22 – 09/25

Project Volume: € 1,053,261



# DAIRY OF GMUNDEN - GMUNDNER MOLKEREI

## ABOUT THE COMPANY

- founded 1931
- 2022 Takeover by Milchwerk Jäger GmbH (Haag, Germany)
- Annual processing volume 2023: 291 Mio. litre of milk
- 380 employees
- Export share: 50 %
- Energy carrier: natural gas, electricity

## QUESTIONS

- Can geothermal energy supply the processes
- How much excess heat for cascading energy use is available



# TYPES OF HEAT TREATMENT OF MILK

	Type of heating up	Heat holding time	Temperature	Effect on germ killing	Purpose of use
	Thermisation	15 – 30 s	57 – 68 °C	95 %	Cheesemaking
Pasteurisation	Low temperature long time pasteurisation (LTLT)	up to 30 min	63 – 65 °C	99 %	Micro-entities
	High-temperature short-time processing (HTST)	15 – 30 s	72 – 75 °C	99 %	Freshmilk (up to 10 days chilled shelf life)
	Extended shelf-life (ESL) or ultra-pasteurised milk	Mostly in a flow process if temperature is reached	85 – 120 °C	99 %	ESL milk (up to 3 weeks chilled shelf life)
	Ultra-high-temperature processing	1 – 2 s	135 – 140 °C	up to 100 %	UHT milk (unchilled shelf life up to 3 months)
	Sterilisation	5 – 15 min	120 – 135 °C	up to 100 %	Unchilled shelf life up to 1 year

# METHODOLOGY

## DATA COLLECTION

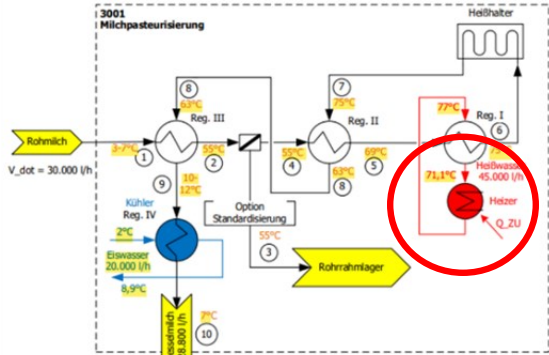
- Data analysis
- Volume flow measurement
- Temperature measurement
- Electrical power measurement
- Energy and mass balances
- Consideration of condensation in the flue gas
- Assumption of ideal compression

## BOUNDARY CONDITIONS OF GEOHERMAL ENERGY IN GMUNDEN

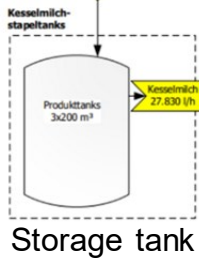
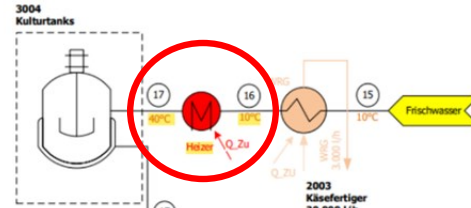
- depth of geothermal energy: ~ 4500 m
- Temperature at head of drilling probe: 110 °C
- max. temperature: 130 °C
- expected output: 19 MW

# BASIC FLOW CHART OF CHEESE PRODUCTION

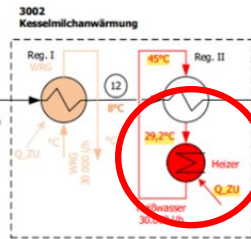
## Pasteurisation



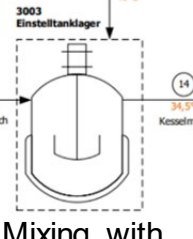
## Bacteria cultivation



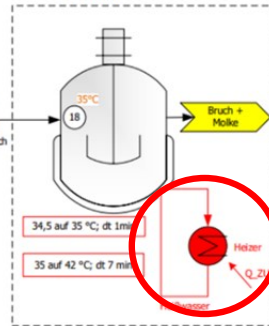
## Thermisation



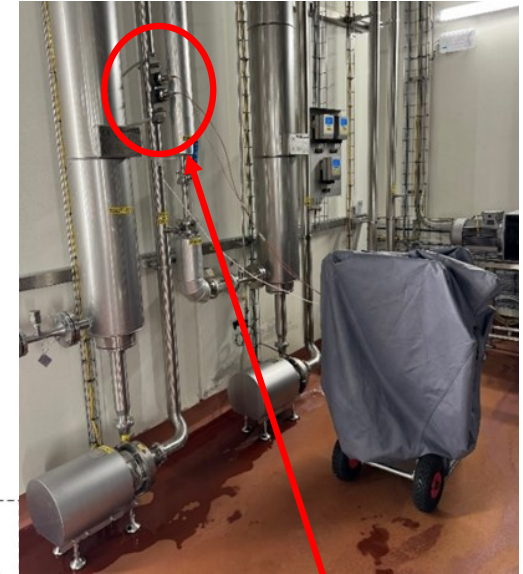
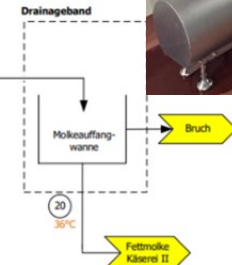
## Mixing with bacteria



## Cheesemaking vessel



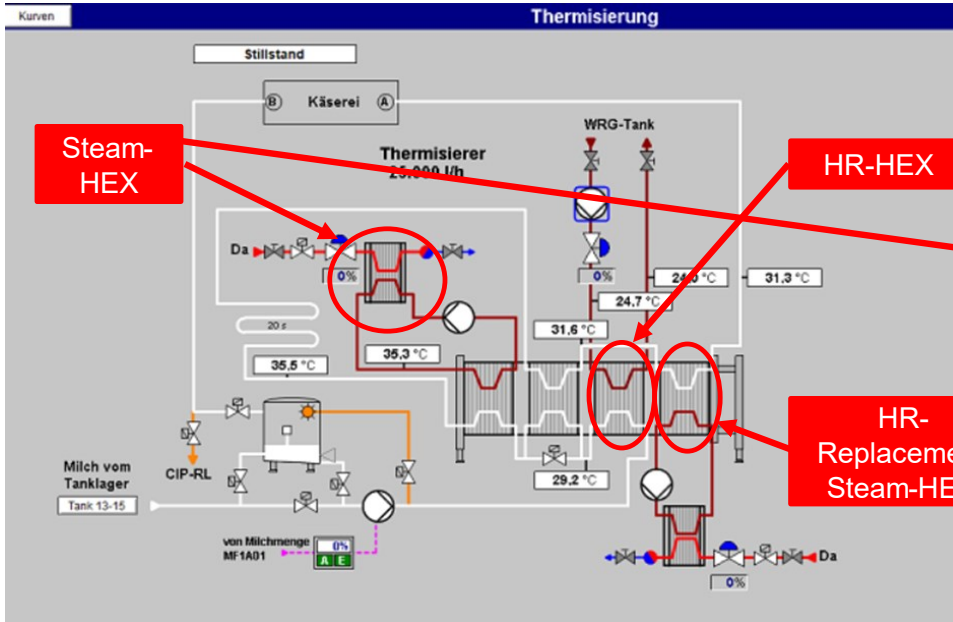
## Whey separation



Measurement

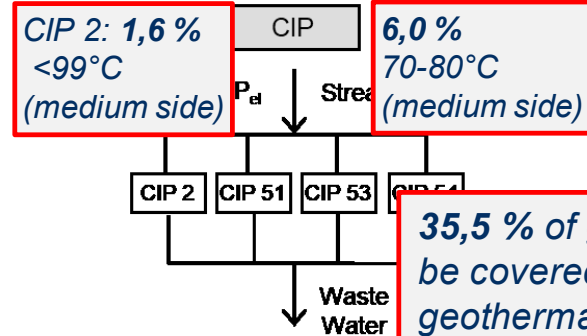
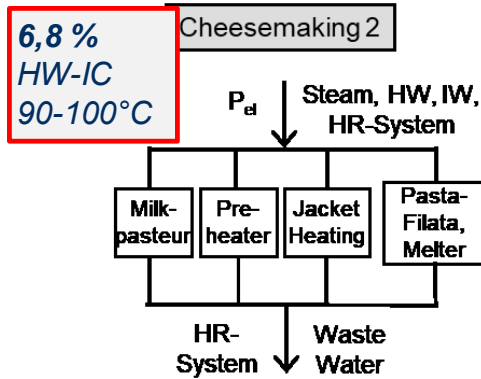
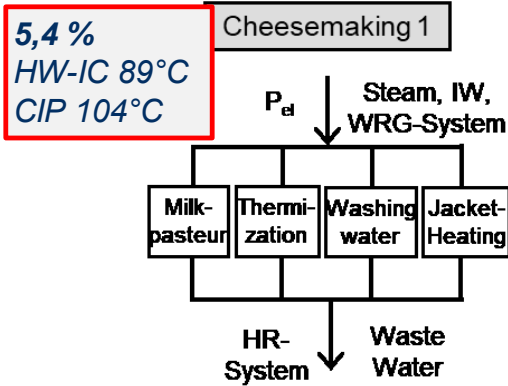
# CHEESEMAKING 1

## VISUALISATION OF THERMIZATION

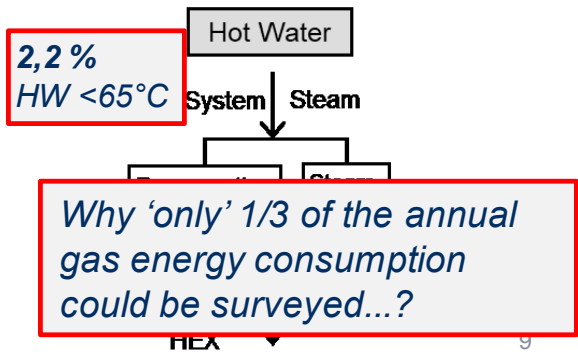
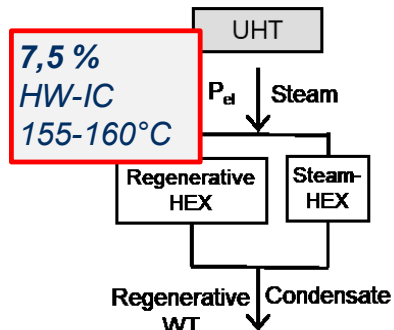
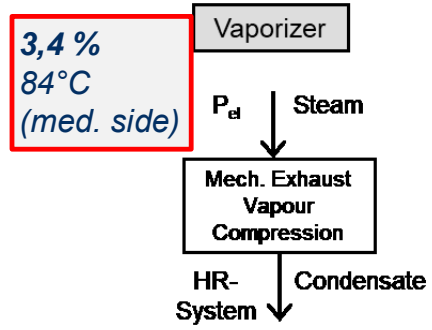
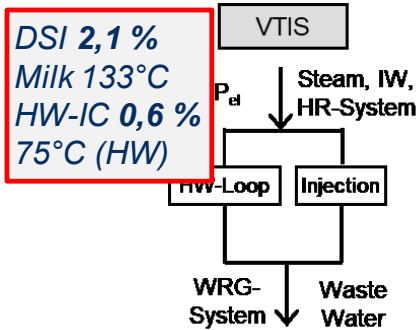




# RESULTS: SUITABLE SYSTEMS FOR SUPPLY WITH GEOTHERMAL ENERGY

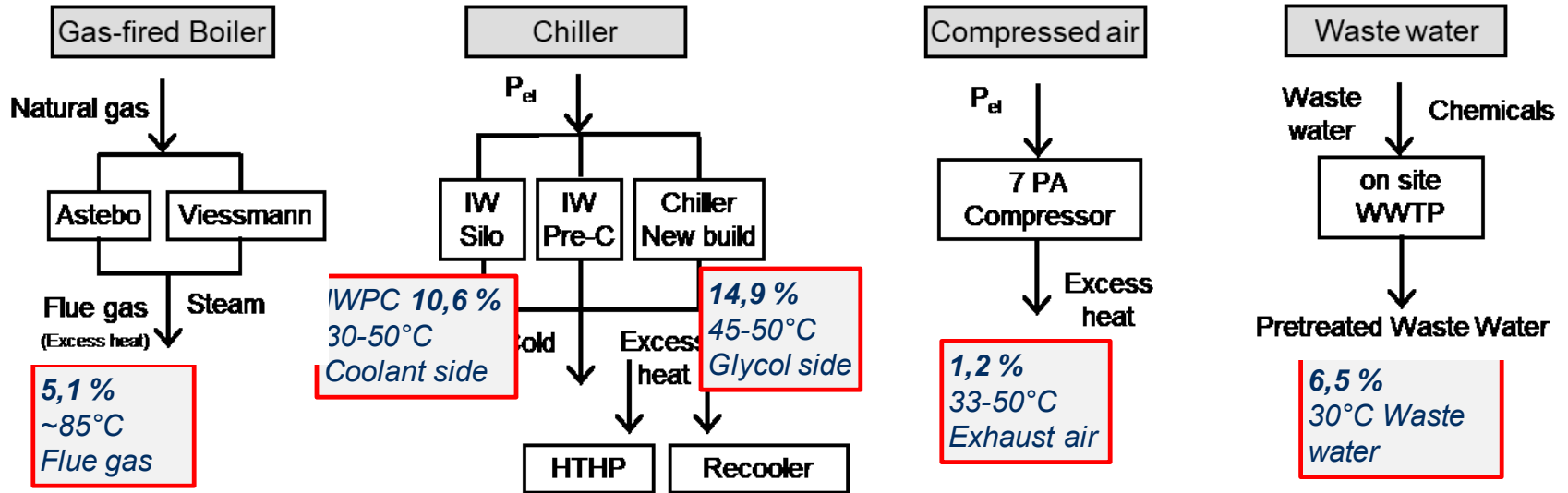


**35,5 % of gas could be covered by deep geothermal energy**  
25,9 % directly  
9,6 % by HT-HP



**Why 'only' 1/3 of the annual gas energy consumption could be surveyed...?**

# RESULTS: SOURCES OF EXCESS HEAT



**38,3 % of total energy consumption was identified as excess heat**

## SUMMARY AND OUTLOOK

- **35,5 % of thermal Input** (gas) could be covered by geothermal energy
- Theoretical potential of **excess heat: 38,2 %** of total energy input (gas and electricity)
- Limitations of the work: temperature difference, theoretical potential, ongoing modification works
- Next step is to match the excess heat with the available heat sinks
- Discussion in which processes steam can be replaced by hot water



NEW ENERGY  
FOR INDUSTRY

THANK YOU!