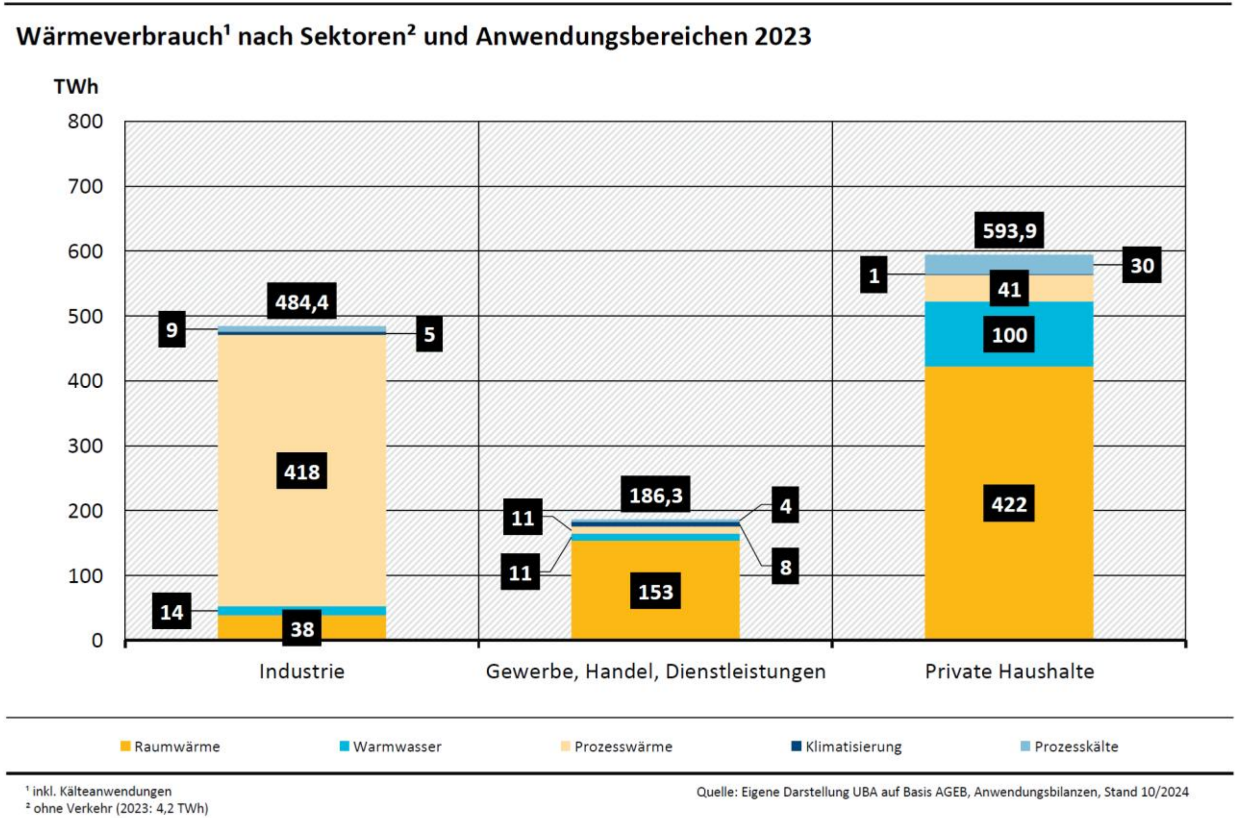
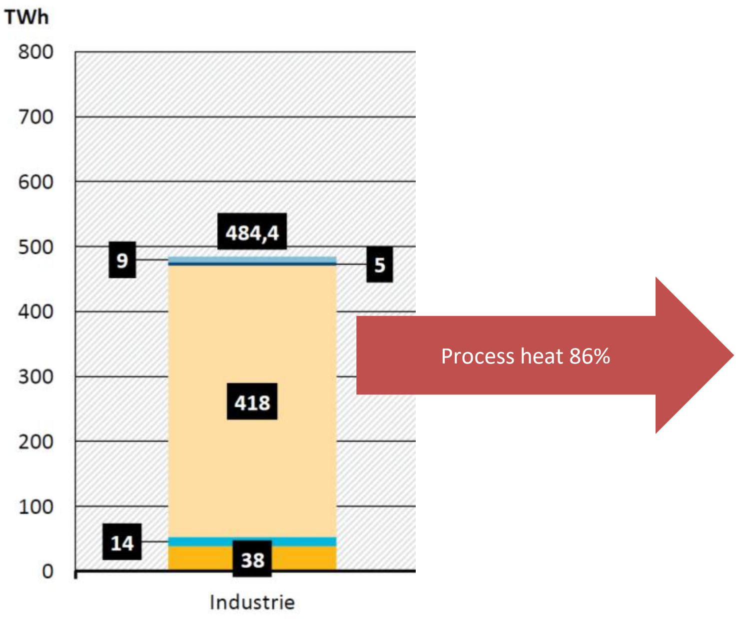
Level-2 systems as a prerequisite for recording and monitoring the energy efficiency of industrial furnaces

Gesellschaft für industrielle Wärme,
Energie- und Prozeßtechnik m.b.H.



Source: Energieverbrauch für fossile und erneuerbare Wärme. Information des Umweltbundesamtes (https://www.umweltbundesamt.de/daten/energie/energieverbrauch-fuer-fossile-erneuerbare-waerme). Dessau-Roßlau, 2025



Significantly attributed to fuel fired re-heating and heat treatment plants in the metals industry

Systematic and accurate monitoring of energy consumption is essential!

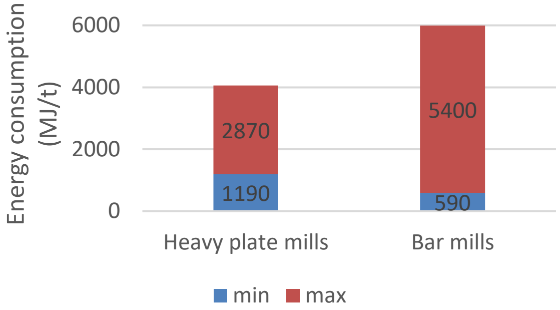
Systematic and accurate monitoring of energy consumption is essential!

Optimization of plant condition and production organization	→	Avoiding unneccessary energy cost
Allocation of energy cost to specific production orders	→	Proper cost accounting
Attribution of CO_2-emissions to the final product	→	Disclosure to end customer
Recording of waste heat	→	According to legal requirements

Furnaces are designed as one-of-a-kind units

Wide range of specific energy consumption reported*

Range of 1:2,5 for heavy plate mills
1:9 for bar mills



Tailored to the intended purpose **but…** energy consumption not comparable

A furnace can only be compared to itself

* Source: Aries, Eric; Gómez, Jorge; Mavromatis, Stilianos; Klein, Gabriele; Chronopoulos, Georgios; Roudier, Serge: Best Available Techniques (BAT) Reference Document for the Ferrous Metals Processing Industry. European IPCC Bureau, Sevilla, 2022

Energy monitoring is based on monthly consumption figures

Monthly consumption report by energy supplier → Specific energy consumption calculated by monthly tonnage

Far too long recording period to systematically investigate consumption fluctuations!

Impossibile to determine if rising energy consumption is caused by:

- Plant condition
- Changed heating target
- Changed production conditions

→ Deduction of possible and necessary measures is not possible

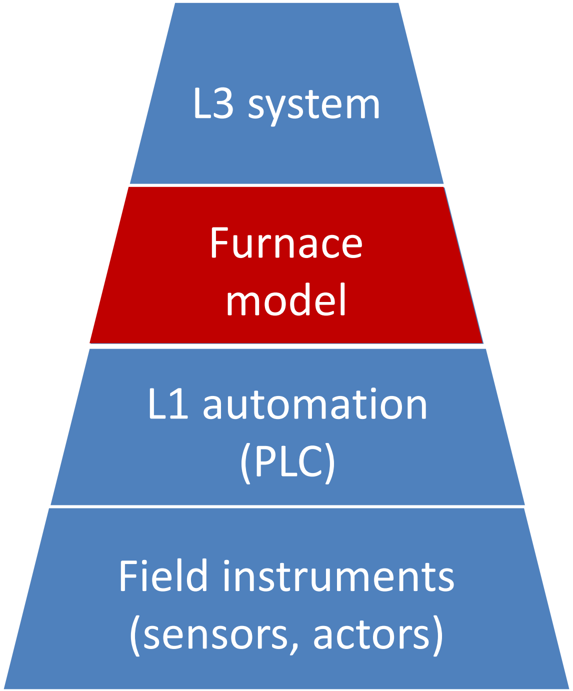
Significant potential for energy-saving is being wasted

A furnace can only be compared to itself

Significant potential for energy-saving is being wasted

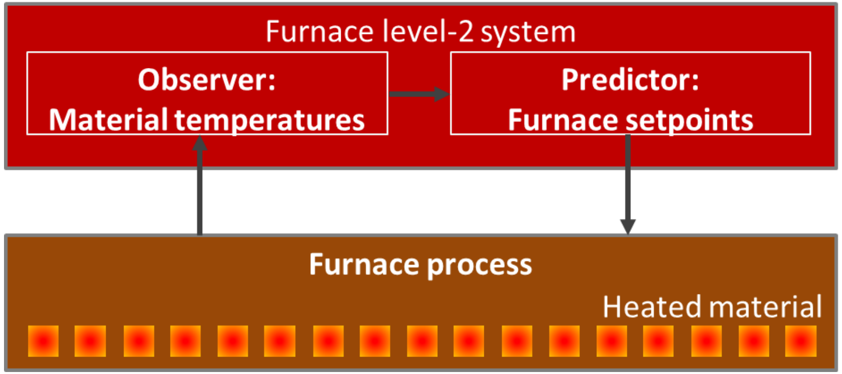
Energy consumption and –efficiency recording and monitoring system

- Breakdown of fuel consumption to individual heated pieces of material
- Providing consumption data to check the impact of the production cycle on energy consumption
- Assessment of the energy consumption compared to the optimal energy consumption
- Continuous calculation of an energy balance for the furnace with key balance items
- Archiving of the generated data for further reference and deeper investigation



Furnace level-2 systems are used for

- Automatic process control
- Process optimization



Material data

Furnace level-2 system

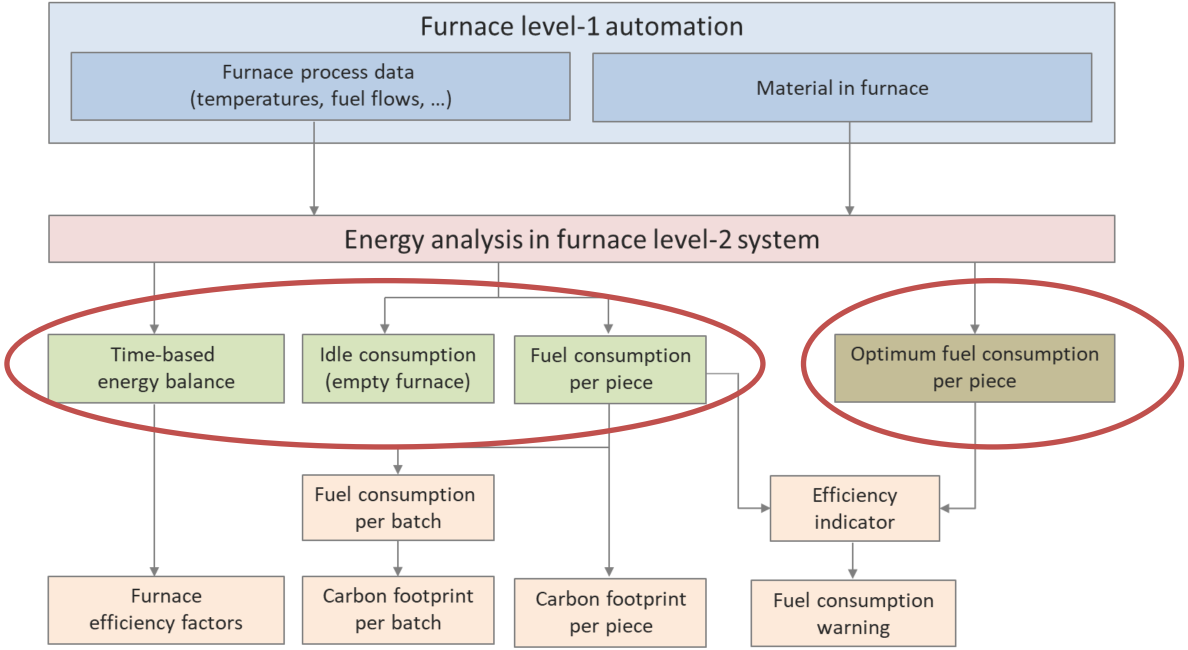
Process data

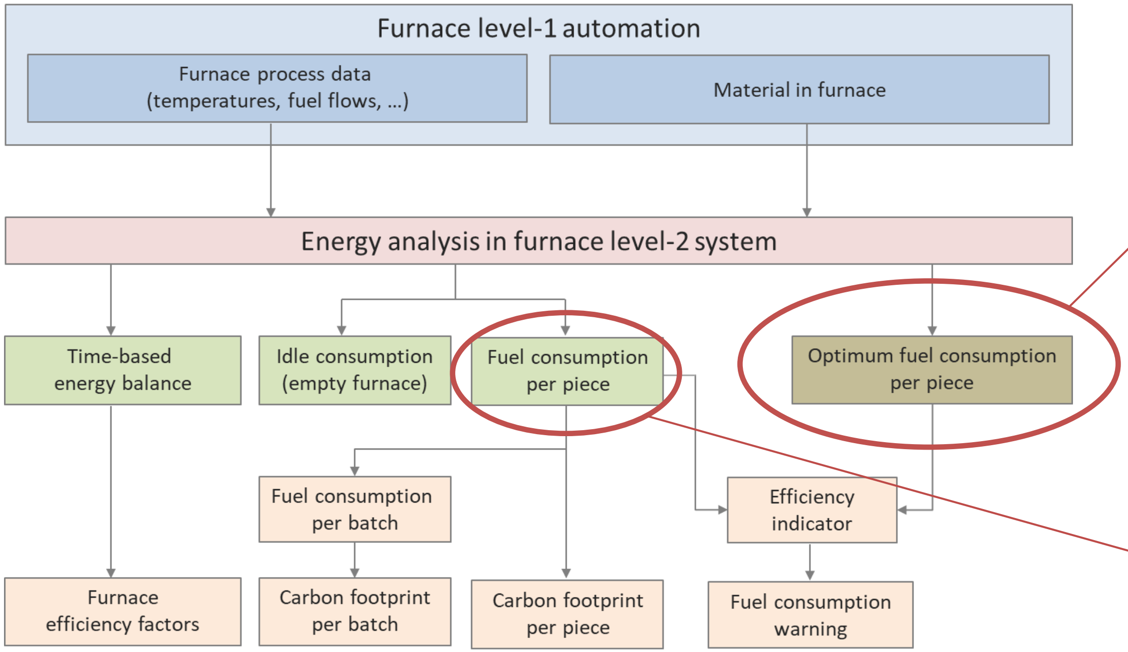
- Weight
- Size
- Quality
- Heating targets

- Chamber Temperatures
- Media flows
- Furnace atmosphere
- Waste gas temperatures

Ideal platform for
energy consumption and energy efficiency recording and monitoring

Solution


Furnace level-1 automation
Furnace process data
(temperatures, fuel flows, ...)
Material in furnace
Energy analysis in furnace level-2 system
Time-based
energy balance
Idle consumption
(empty furnace)
Fuel consumption
per piece
Optimum fuel consumption
per piece
Fuel consumption
per batch
Efficiency
indicator
Furnace
efficiency factors
Carbon footprint
per batch
Carbon footprint
per piece
Fuel consumption
warning

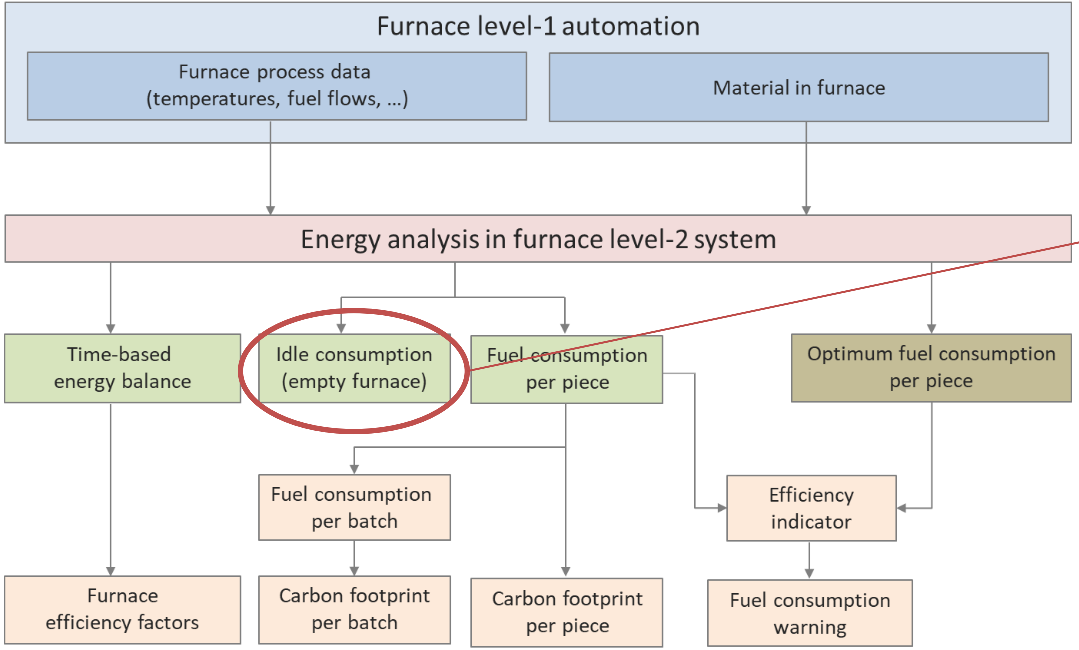


Calculated based on furnace design data

Indicator for the current batch efficiency

Calculated based on process data

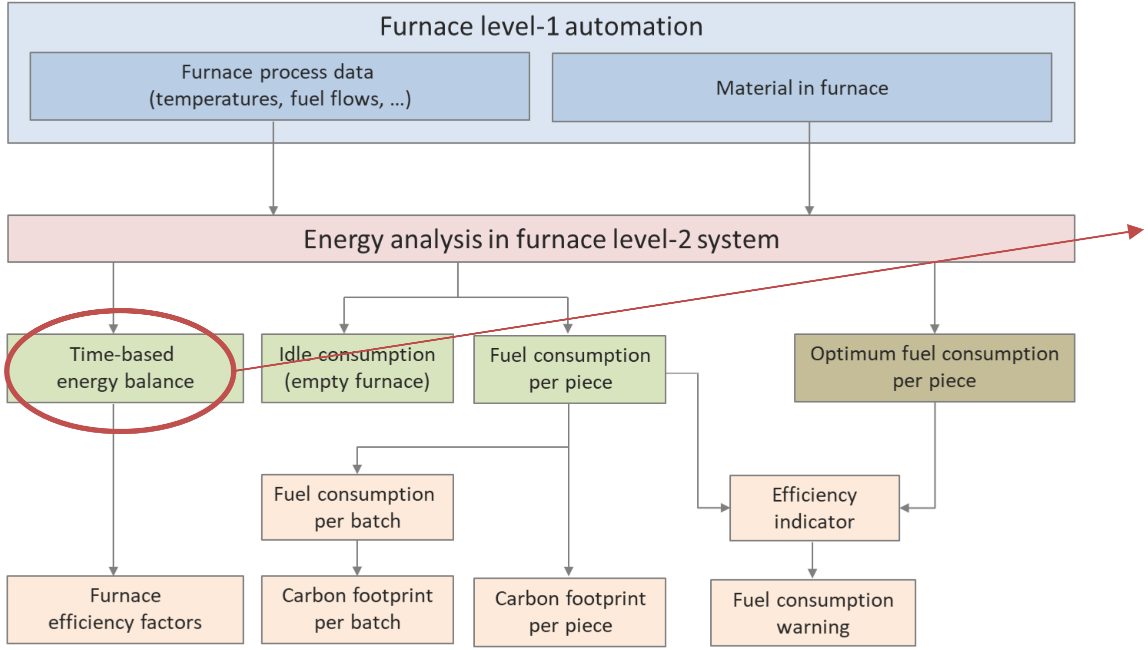
Solution



Energy consumption while the furnace is empty

Indicator of production cycle

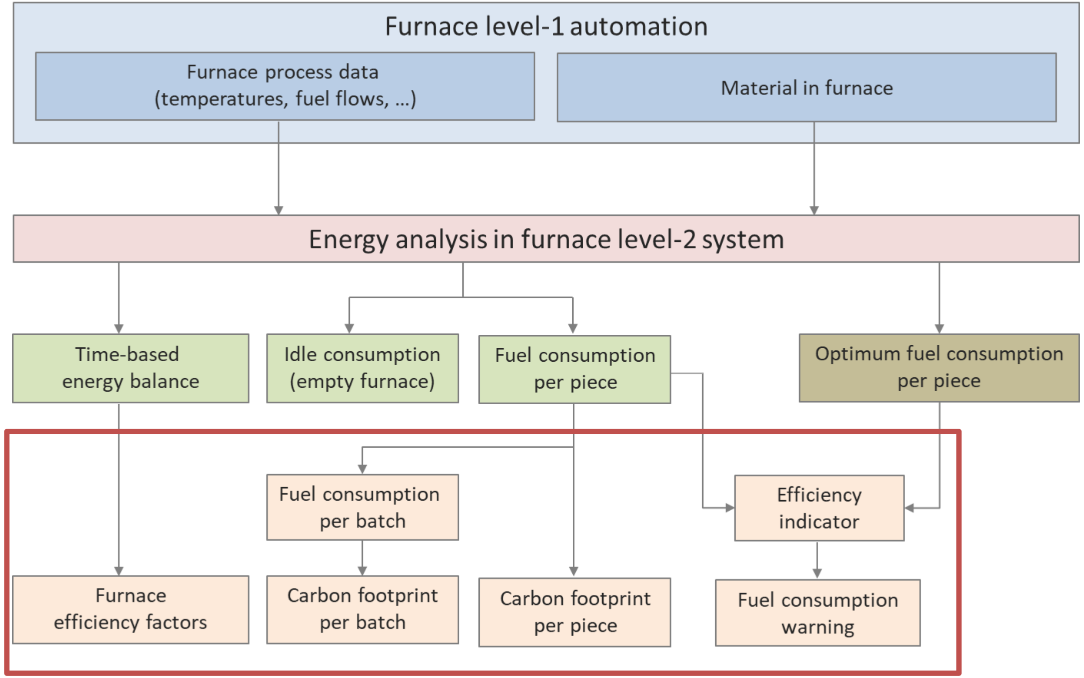
Solution

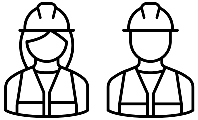


Current energy balance of the furnace

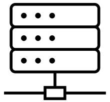
Indicator for current furnace efficiency

Solution



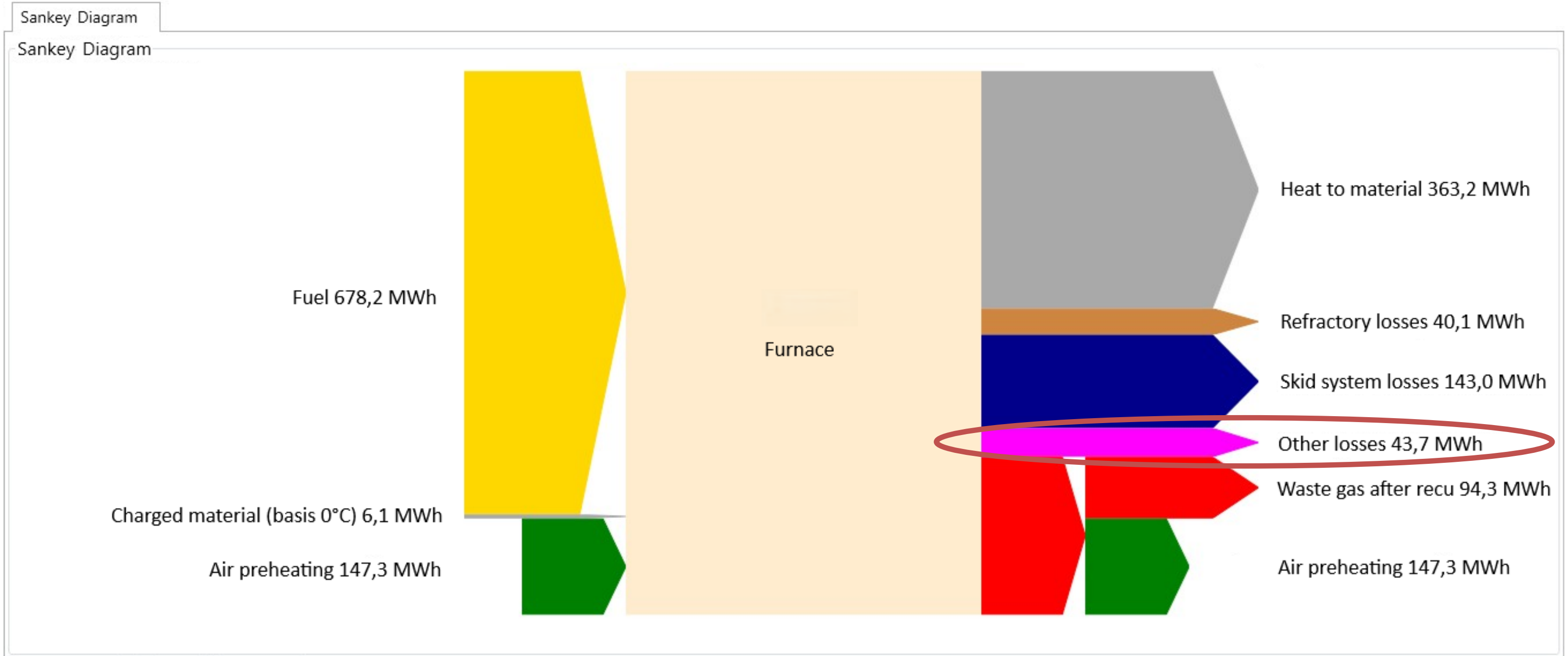


All calculated data is made available to operating and technical staff



Data is stored in a standard database for easy use in external systems

Examples: Sankey diagram

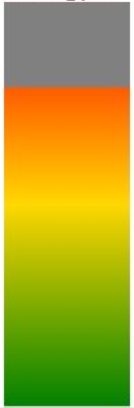


combustion efficiency CE:	0,861
furnace efficiency FE:	0,622
total efficiency (CE * FE):	**0,536**

Examples: Batch related efficiency

Rolling Batch no.: 83576

Energy consumption

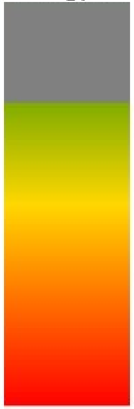


Batch specific consumption = 326 kWh/t

Optimum spec. consumption = 245 kWh/t

Batch overconsumption = 33,0 %

Energy efficiency

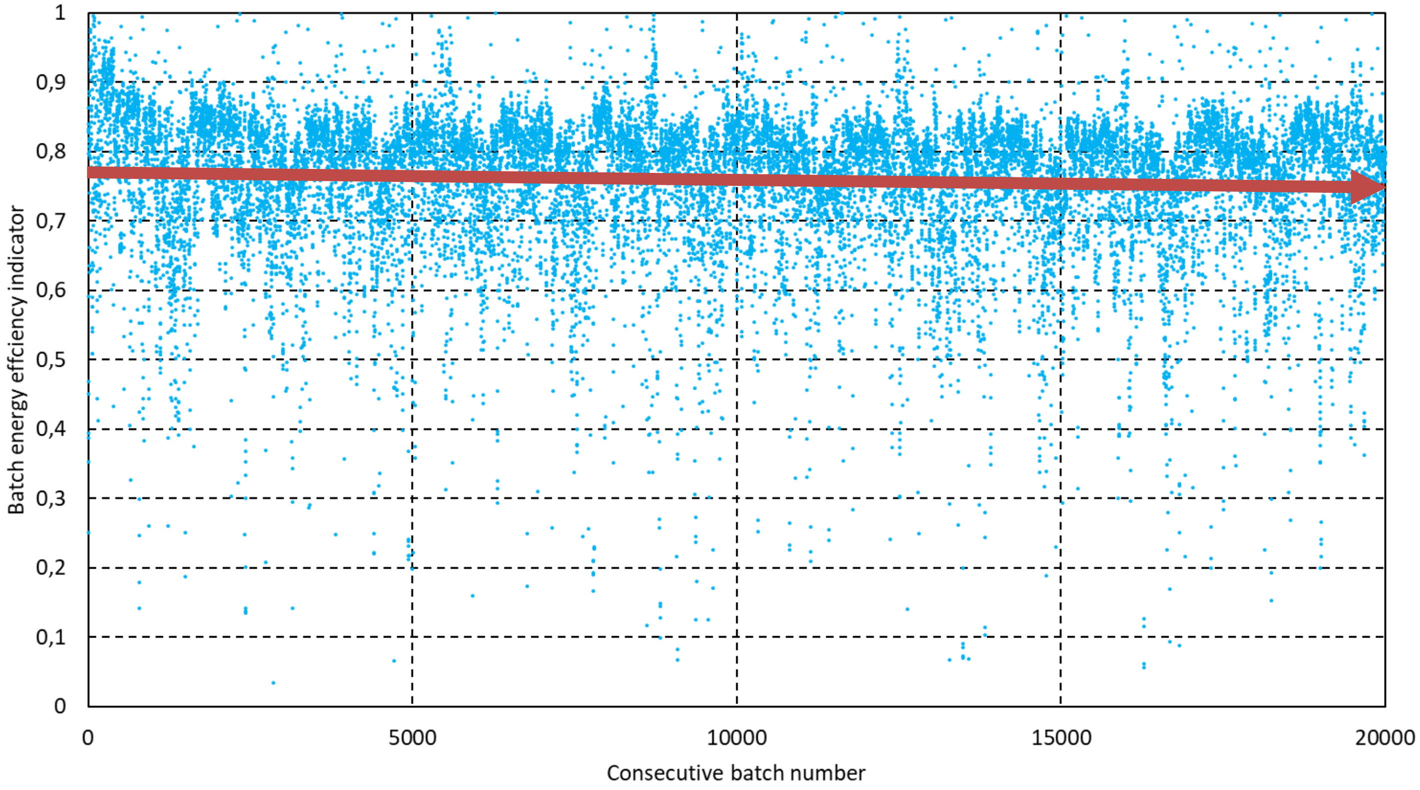


Batch energy efficiency = 75,2 %

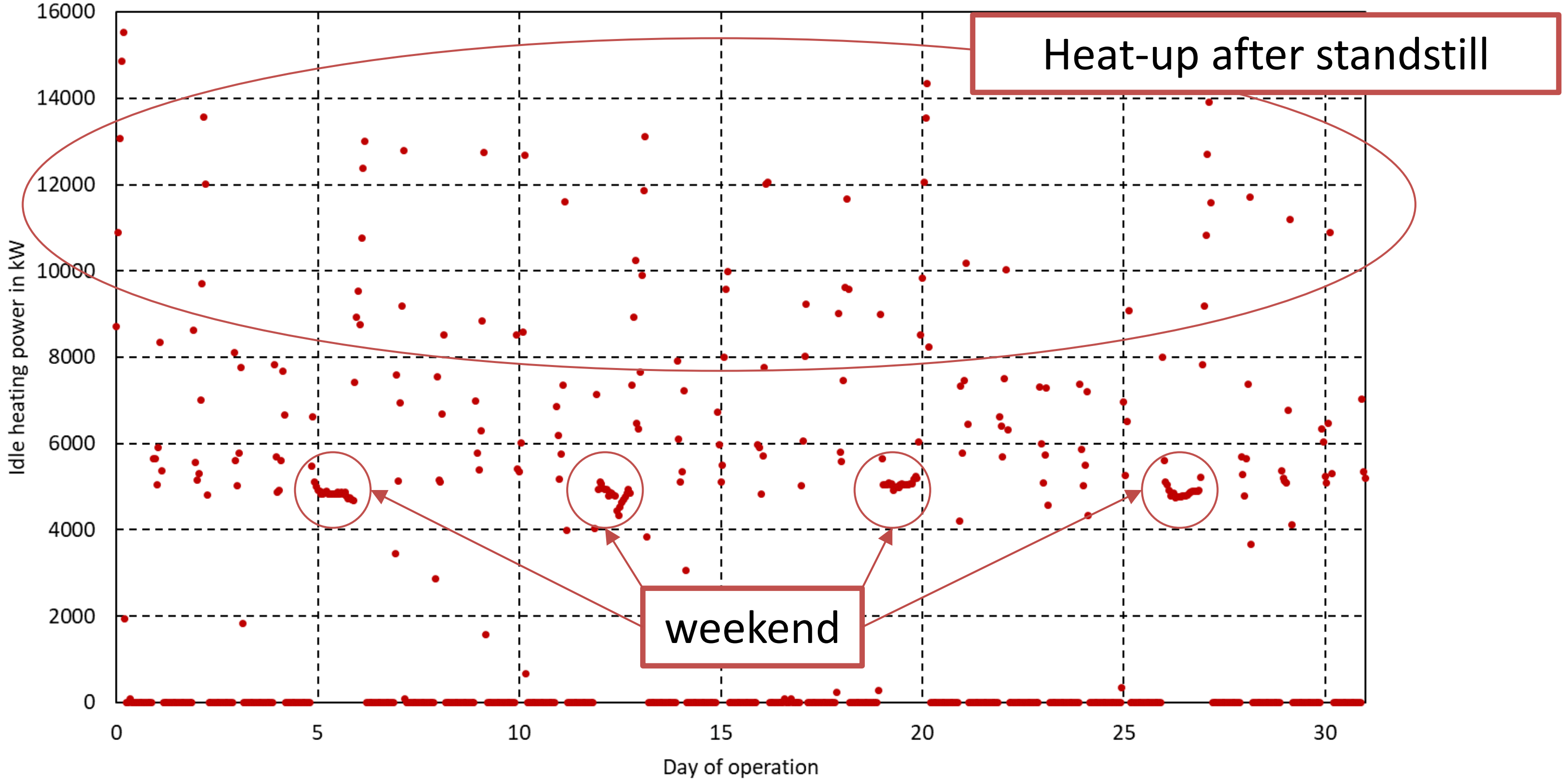
Possible sources of overconsumption

Discharging temperature exceeds target
Furnace operated with elevated excess air
Skid cooling losses beyond design

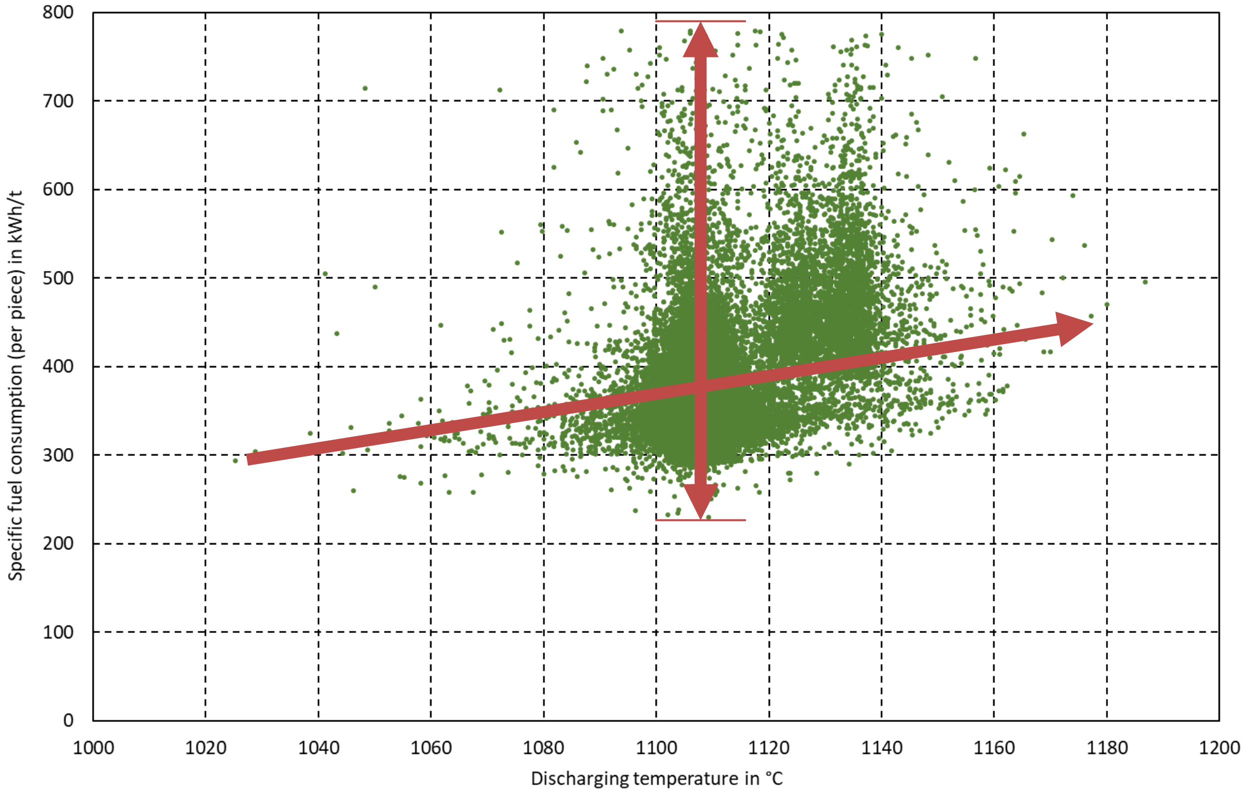
Examples: Long-term evaluation of energy efficiency



Examples: Long-term evaluation of idle consumption



Examples: Long-term evaluation of specific energy consumption



Energy consumption and –efficiency recording and monitoring system

Individually set up for each plant → Easily expandable with additional key figures

Possible features and use cases:

- What-if analysis of extended waste heat usage for investment decisions
- Consideration of fuel quality fluctuation due to H_2-addition
- Integration of ML-tools to quicker detect significant changes in efficiency
- …

Energy consumption and –efficiency recording and monitoring system

Provides insights for

- maintenance procedures
- production optimization

Automates required documentation of

- energy consumption
- CO_2 emissions
- Waste gas losses

Indespensable tool for evaluating and monitoring the energy state of the furnace!

Our work is driven by an intensive dialogue with our customers.

If you've got questions, suggestions or requests concerning our services and products or you need further information, please feel free to contact us at any time.

We are glad to hear from you

GIWEP
Gesellschaft für industrielle Wärme, Energie- und Prozeßtechnik m.b.H.
Saarner Straße 277
45479 Mülheim an der Ruhr
Germany

Phone: +49 208 439 253 - 0
Fax: +49 208 439 253 - 90
E-Mail: info@giwep.de
Internet: www.giwep.de - www.giwep.com