BEL - Brabant Energy Leaders

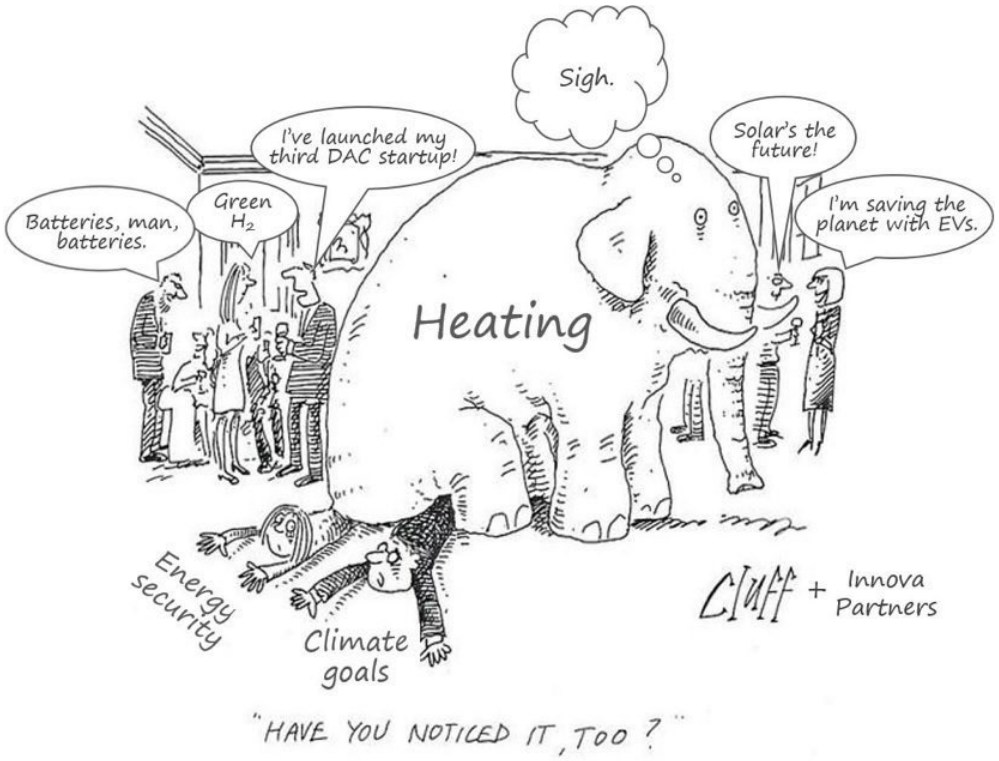
July 11 2024

KRAFT BLOCK

Green Heat For Industries

Unveiling Kraftblock's groundbreaking high-temperature energy storage solutions, enabling a sustainable transition towards a decarbonized future.

Process Heat – how to tackle that elephant



Overview Heat

- Process heat is responsible for 40% of the global emissions
- 75% of the energy in the industry is process heat
- Process heat is mainly produces by fossil fuels
- Kraftblock has developed alternative solution for green process heat

- Ceramic industry – pilot in 2019
- Collecting over the week
- Preheating the batch process
- 330t of CO_2/a reduced

About Kraftblock

2014

Foundation

Chemist Dr. Martin Schichtel and economist Dr. Susanne König founded Kraftblock to develop a sustainable storage for industrial purposes.

2018

Seed-Investment

First investor, Seed round with German VC Freigeist, a leading deeptech VC from Germany.

2020

Series A

Dutch Cleantech investor Koolen industries joins with a multi-million Series A. Kees Koolen (booking.com) is invested in multiple technologies to tackle the energy transition.

2023

Series B

Kraftblock closes a €20 million Series B round, led by Shell Ventures and with participation from Finindus (ArcelorMittal), Tech Energy Ventures (Techint Group), Future Industry Ventures (Redstone), Moore Strategic Ventures, A&G

Maturity Timeline

2014

Technology development

Establishment of the company, R&D of material, development of first pilots.

2019

Full-scale pilot stationary

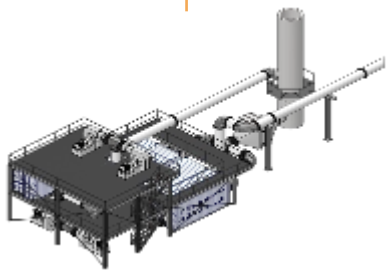
Installing the first commercial pilot with 4.2 MWh capacity at a German ceramic manufacturer.

2021

First of its kind mobile storage

Proving the first mobile appliaction with a CHP operator in Germany to replace gas with waste heat.

2023



Heat-to-Heat: 20 MWh in Steel

Commercial project in Indian Steel industry to improve efficiency in a sinter plant. Record payback time.

Finished 2024

Power-to-heat: 70 MWh in food

Replacing natural gas completely at a PepsiCo food factory leveraging negative energy prices for attractive business case.

Trusted partners and customers

Customers

PEPSICO

TATA STEEL

Eneco

COMET
Made for Perfection

buhck GRUPPE

Feasability Studies

agl

iqony

Verbund

Partners & Suppliers

SIEMENS

MAN

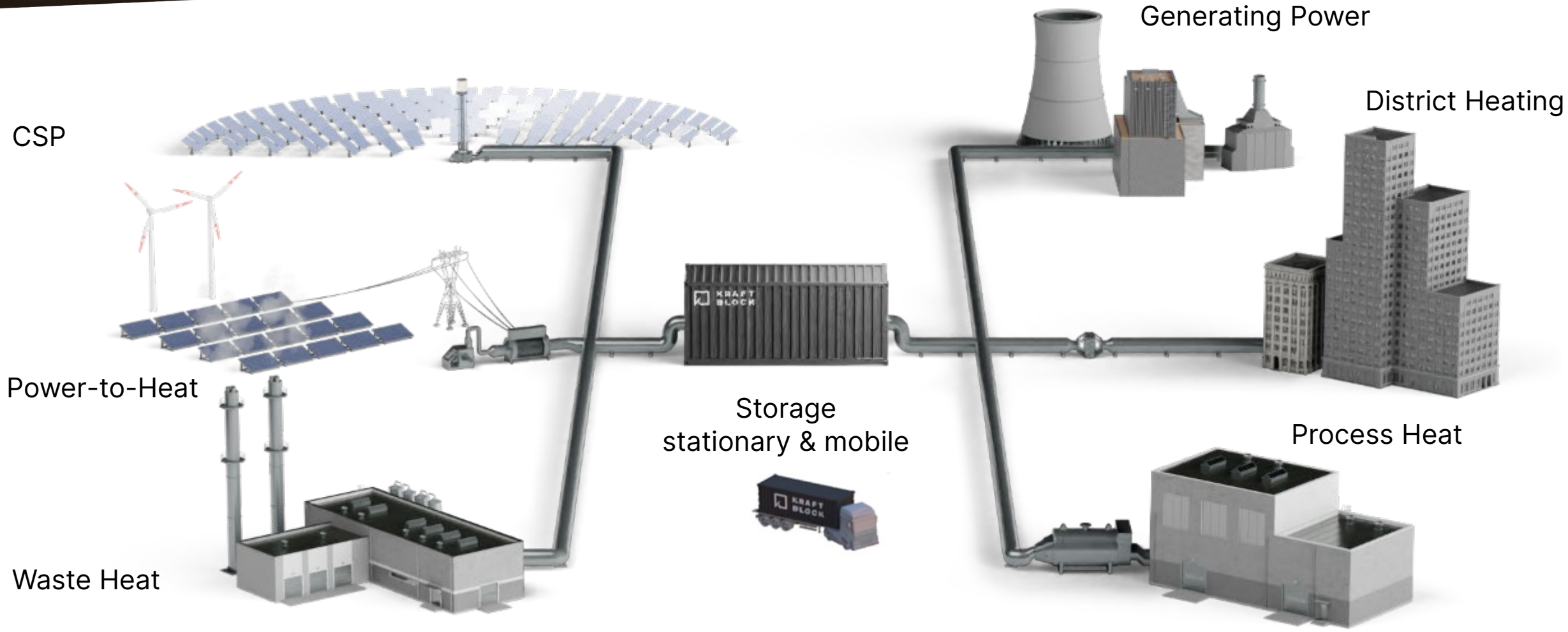
OTTOJUNKER

eit Climate-KIC

Climate-KIC is supported by the EIT, a body of the European Union

Storage innovation Kraftblock

Overview of Applications - multifunctional



Kraftblock‘s storage

Highly economic, multifunctional high-temperature energy storage

From **350°C** to **1,300°C** **(2400°F)**

Modular and multipliable

Scalable storage **to GWhs**

Patented Systems

Capacity of up to **1.2 MWh/m³**

High durability of 40+ years

95% **round-trip efficiency**

Unique material

Upcycled up to 85% (slags)

Tested for **15,000 cycles**

Lowest carbon footprint

Sustainable energy storage material without rare earths

Patented Material

Individual mixtures possible

Different forms, easy production

The storage cycle

Charging

- Hot air blown in
- Material is heated up
- 300kw – xx MW.

Storing

- Energy stored between hours and days, possible up to 2 weeks
- Flexible discharching
- Minimal daily losses

Discharging

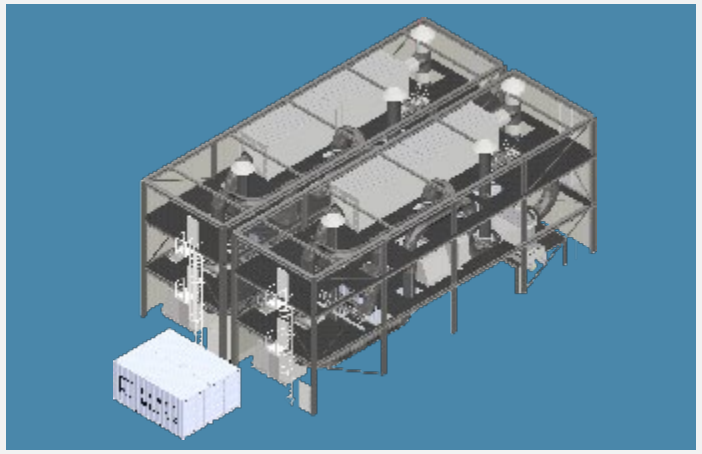
- Ambient air blown in
- Heats up on material
- Hot air to serve downstream process equipment like boiler, heat exchanger or mixing chamber

Product portfolio

Size S

Capacity:	up to 12MWh
Charge:	up to 10MW
Discharge:	up to 5MW

Size M

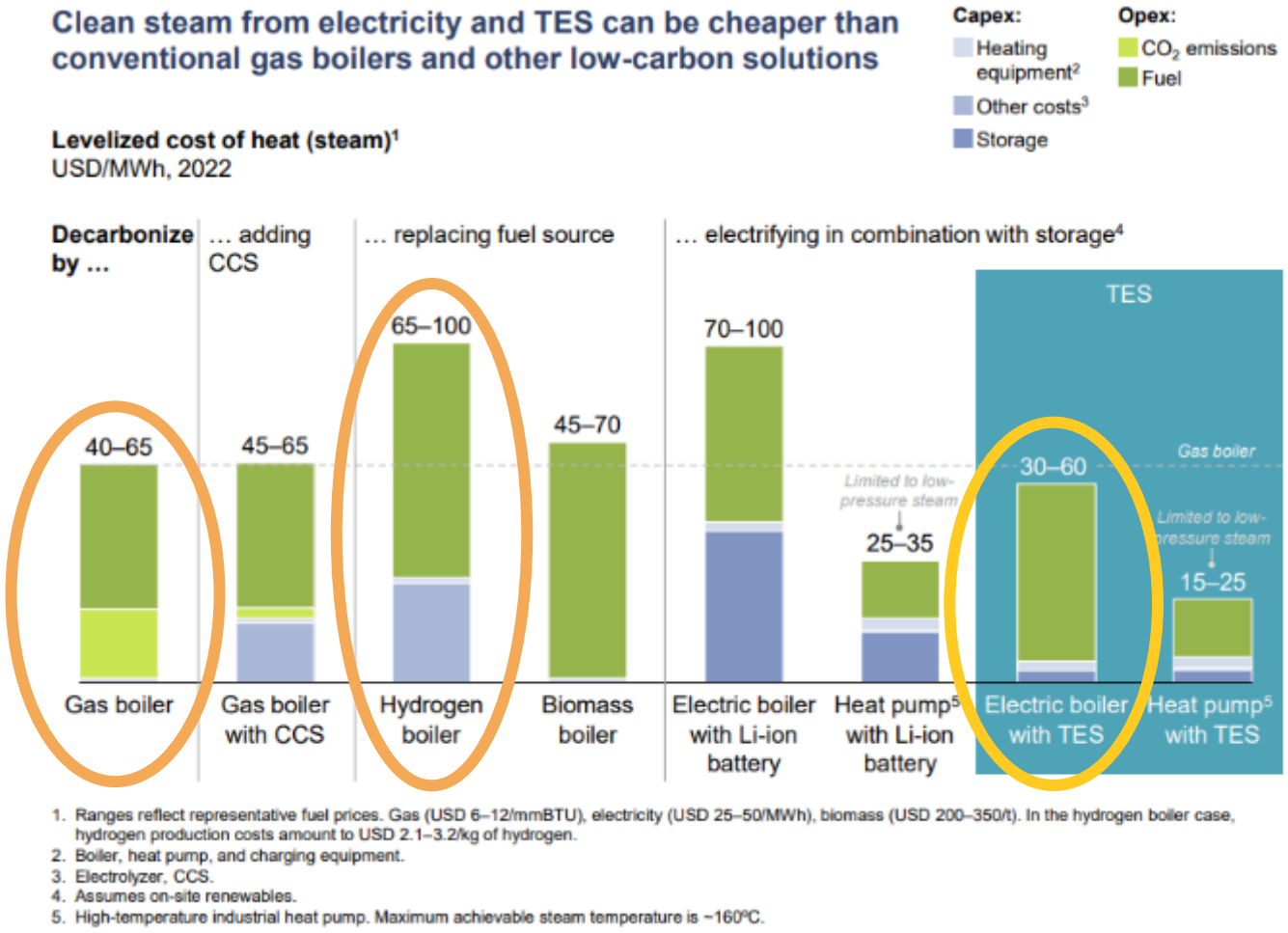


Capacity:	up to 150MWh
Charge:	up to 50MW
Discharge:	up to 25MW

Size X

Capacity:	up to 300MWh
Charge:	up to 150MW
Discharge:	up to 50MW

Business Case of Thermal Energy Storage



1. Ranges reflect representative fuel prices. Gas (USD 6–12/mmBTU), electricity (USD 25–50/MWh), biomass (USD 200–350/t). In the hydrogen boiler case, hydrogen production costs amount to USD 2.1–3.2/kg of hydrogen.
2. Boiler, heat pump, and charging equipment.
3. Electrolyzer, CCS.
4. Assumes on-site renewables.
5. High-temperature industrial heat pump. Maximum achievable steam temperature is ~160°C.

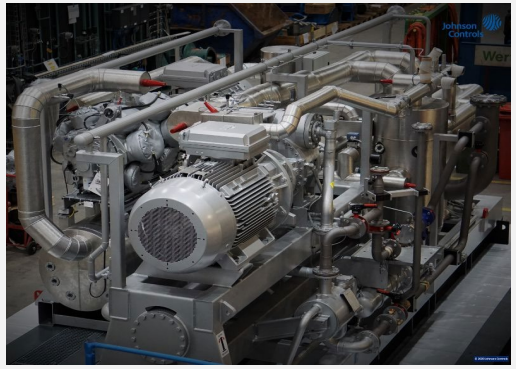
Steam production

- Study with various technologies and providers
- Levelized cost of heat (steam)
- Electricity with TES best high-temperature solution
- Even better OPEX via privat wire

Source: LDES Council 2023. Systemiq 2024

Technologies in comparision

Heatpump



- Very high efficiency - COP 3
- Cost efficient
- Temperature limited
- Technical demanding
- For steam just in starting stage

E-boiler

- High efficient
- Can not benefit from fluctuating power prices
- Size and steam parameters limted

Hot Water storage

- Cheap
- simple
- Temperature limited
- huge space demand

KRAFTBLOCK

- compact
  (factor 4 - 6 smaller than hot water storage)
- Serves temperature 80 - 1000°C
- High efficient
- High flexibility
- Broad range of applications

... and please don‘t wait for hydrogen as process heat alternative

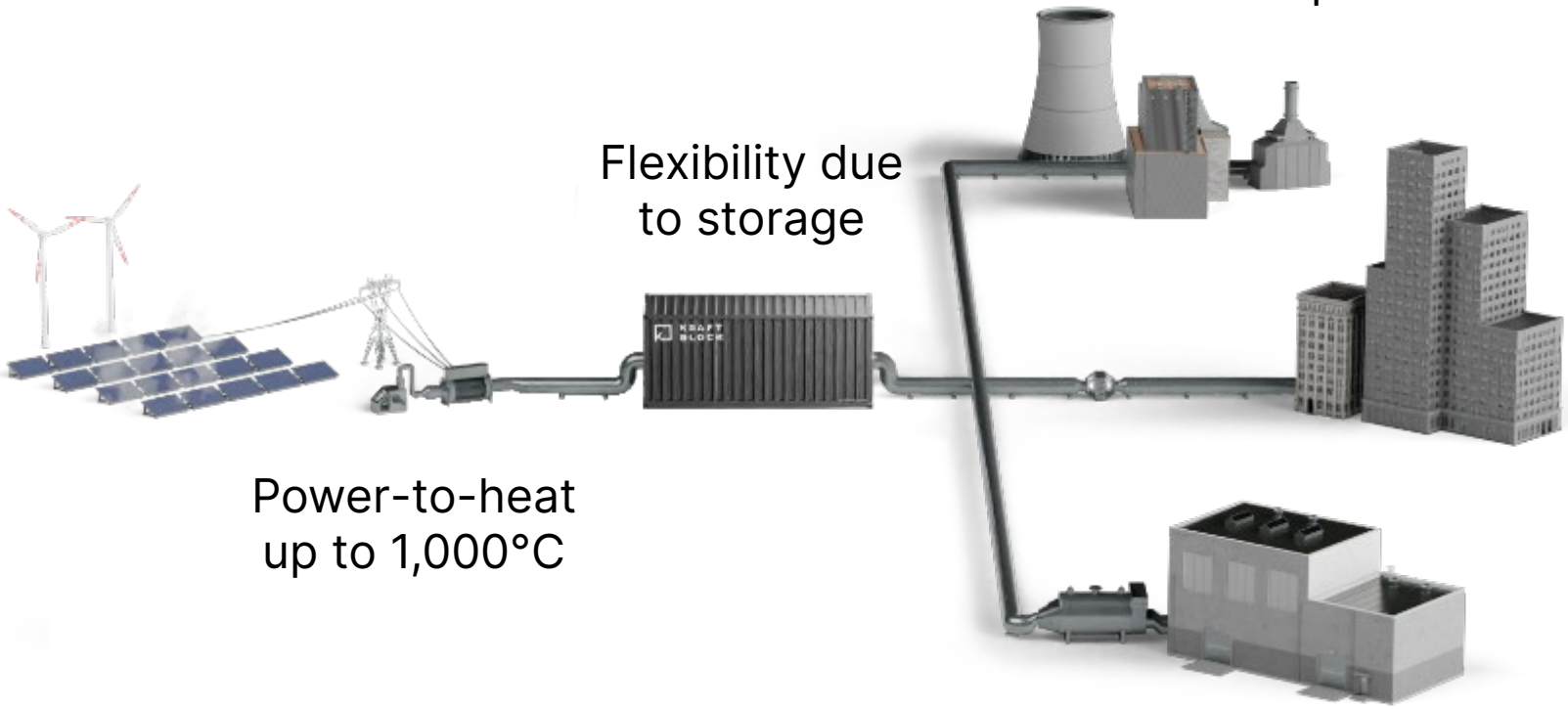
Net-Zero-Heat System

Net-Zero Heat System

Renewable Power

Application in any form and temperature

Flexibility due to storage



Power-to-heat up to 1,000°C

Advantages

- Prevent curtailment
- Relieve grid
- Use low power prices
- Replace fossil fuels

Industries

Volt project

PEPSICO

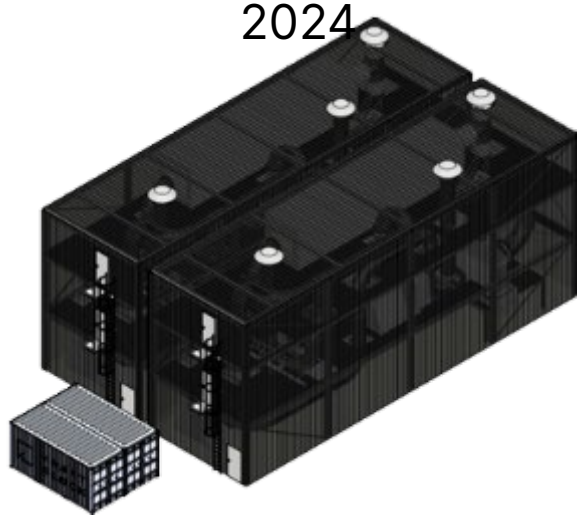
- Broek op Langedijk, NL
- 1 million bags of chips everyday
- For eight European countries
- Almost every emission in Scope 1 is burning gas for frying 24/7

Volt project

Scope

- Green power from **Eneco** is converted to 800°C heat.
- Kraftblock system cares for conversion, storage and heat transfer to thermal oil.
- Existing infrastructure is used, no disruption in operation.
- Only gas-fired boiler is replaced and can serve as backup.

2 out of 5 modules in operation by end of 2024



With five modules it will be the largest high temperature heatstorage with 150 MWh

PEPSICO

Eneco

- 25 MW boiler is replaced
- 9 million m^3 natural gas saved
- 16,000t of CO_2 avoided
- 98% of emissions are avoided when project is finished

Replicability for the food industry

Dairy

- Pasteurizing
- Sterilizing
- Constant Heat
- Cheese vat
- UHT

Sweets

- Baking ovens
- Tempering
- Cooking
- Preheating
- Sugar factories

Meat

- Saturated steam
- Air drying
- Cooking
- Processing

Coffee & tea

- Roasting
- Drying
- Brewing

Alcohol

- Drying
- Mashing
- Destilling
- Wort boiling
- Malt making

Processed

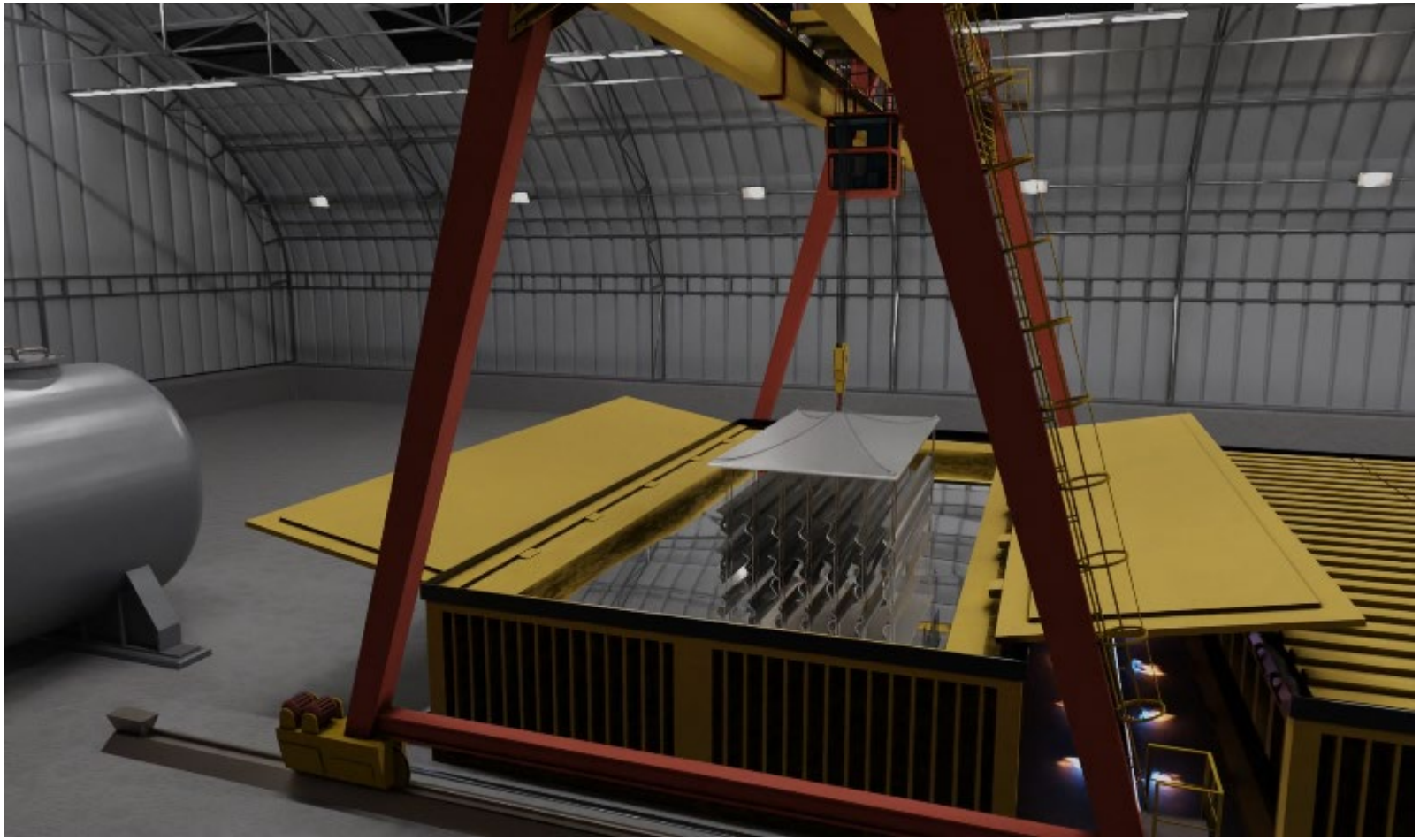
- Frying
- Cooking
- UHT
- Pasteurizing
- Pet food

Use case: paper

Drying

- Pulp & paper plans have complex energy infrastructure
- Central use case is calander drying with green steam
- Perfect example for integration in steps (Kraftblock/boiler/direct electrification mix)
- More concepts in pulp and power

Use case: zinc coating



Zinc bath

- Protective coating for steel parts
- Permanent heating at melting point (600°C)
- Thus energy intensive application
- Natural gas is standard, but has disadvantages (burning through)

Industries and target markets

Building materials

- Insulation material
- Stone wools
- Wood heat treatment
- Asphalt aggregate drying

Chemical sector

- Steam generation
- Fertilizer production, Drying
- Petrochemical (Rectification)
- Distilling

Pulp & paper

- Digesters
- Evaporation
- Limestone
- Optimisation power plant

Steel & metals

- Dozens of use cases in Steel
- Refining of Copper
- Aluminium (Bayer, Smelting)
- Metal processing (tempering, hot bending, foundries etc.)

Glass & ceramics

- Technical Ceramics
- Partial Furnace Electrification
- Recycling and scrap processes
- Drying processes

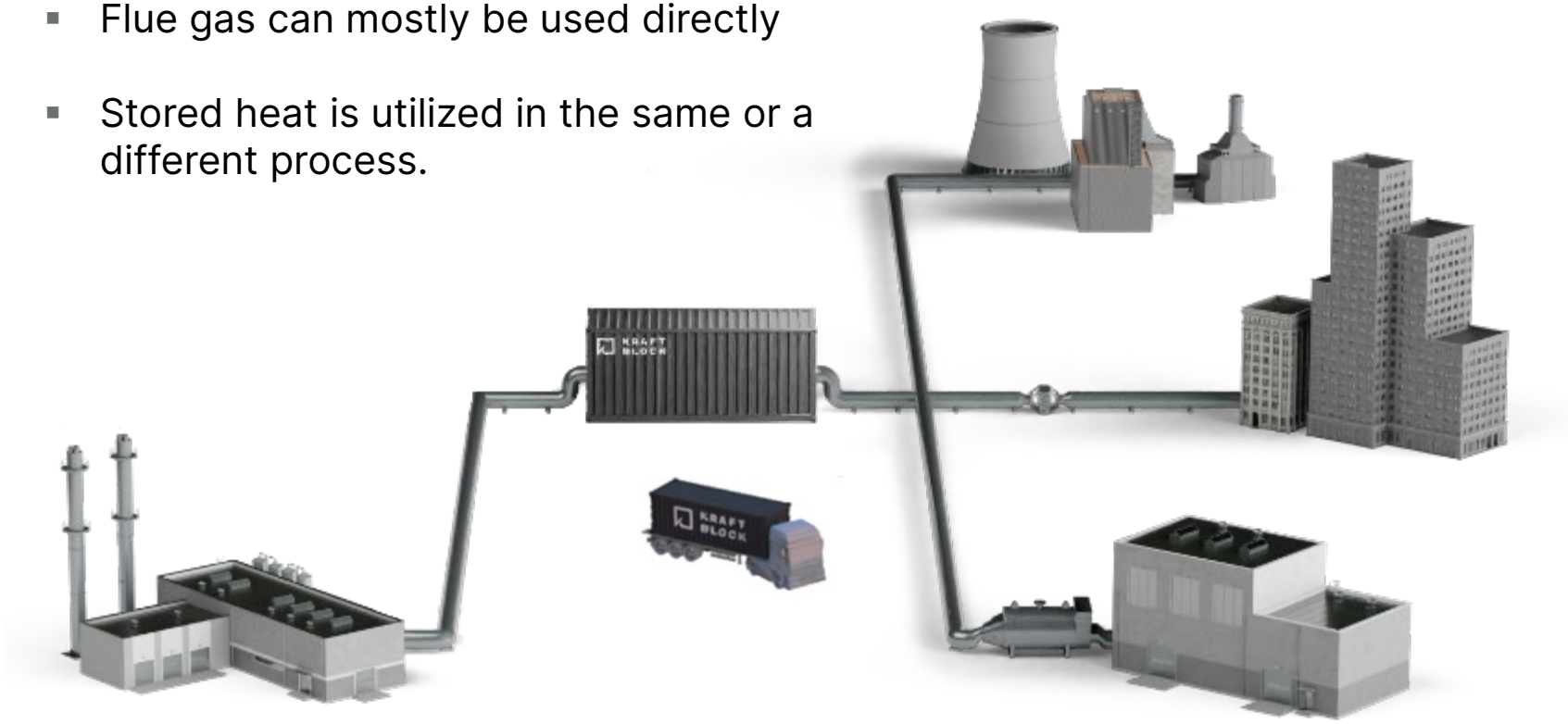
Energy in general

- District heating
- Power plant optimization (also H_2)
- Power plant retrofitting
- Oil & Gas (Flare gas)

Waste Heat Recycling System

Waste Heat Recycling System

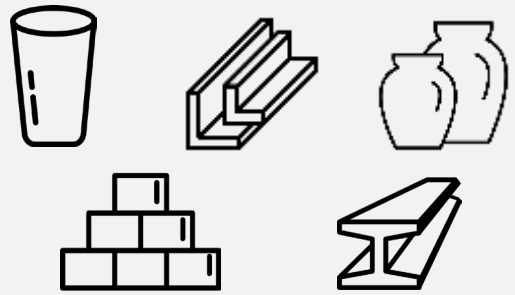
- Waste heat from 300°C upwards
- Flue gas can mostly be used directly
- Stored heat is utilized in the same or a different process.



Advantages

- Less primary energy needed
- Additional emissions avoided
- Cost savings
- No new energy source needed

Industries



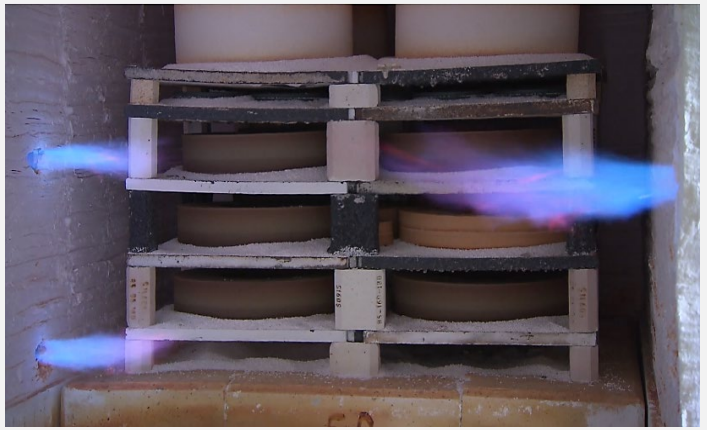
Pilot project: Comet

COMET
Made for Perfection

Manufacturer of technical Ceramics (abrasive disks)

- Installed: 2019
- Capacity: 4.2 MWh
- Charging/Discharging: max. 300kw
- Location: St. Ingbert, Germany
- Savings: 330t CO_2/year

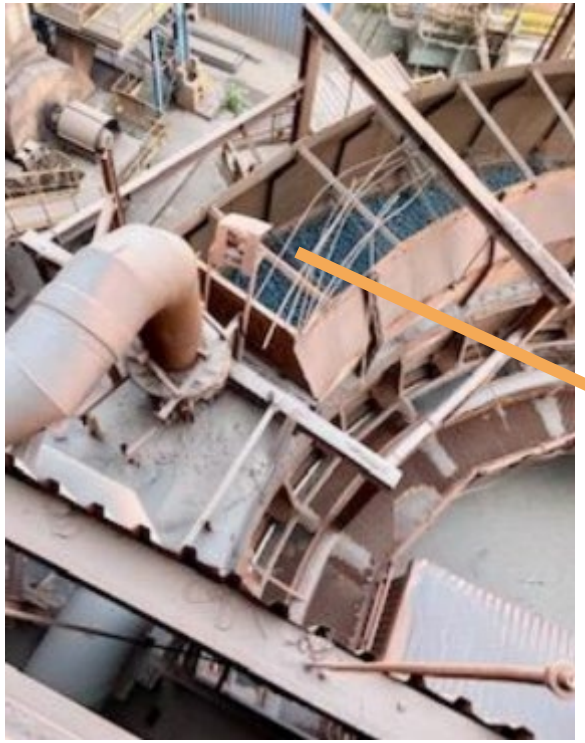
About the project



- Collecting waste heat from a gas-fired kiln and preheating the kiln on various occasions
- Replicable in many batch processes

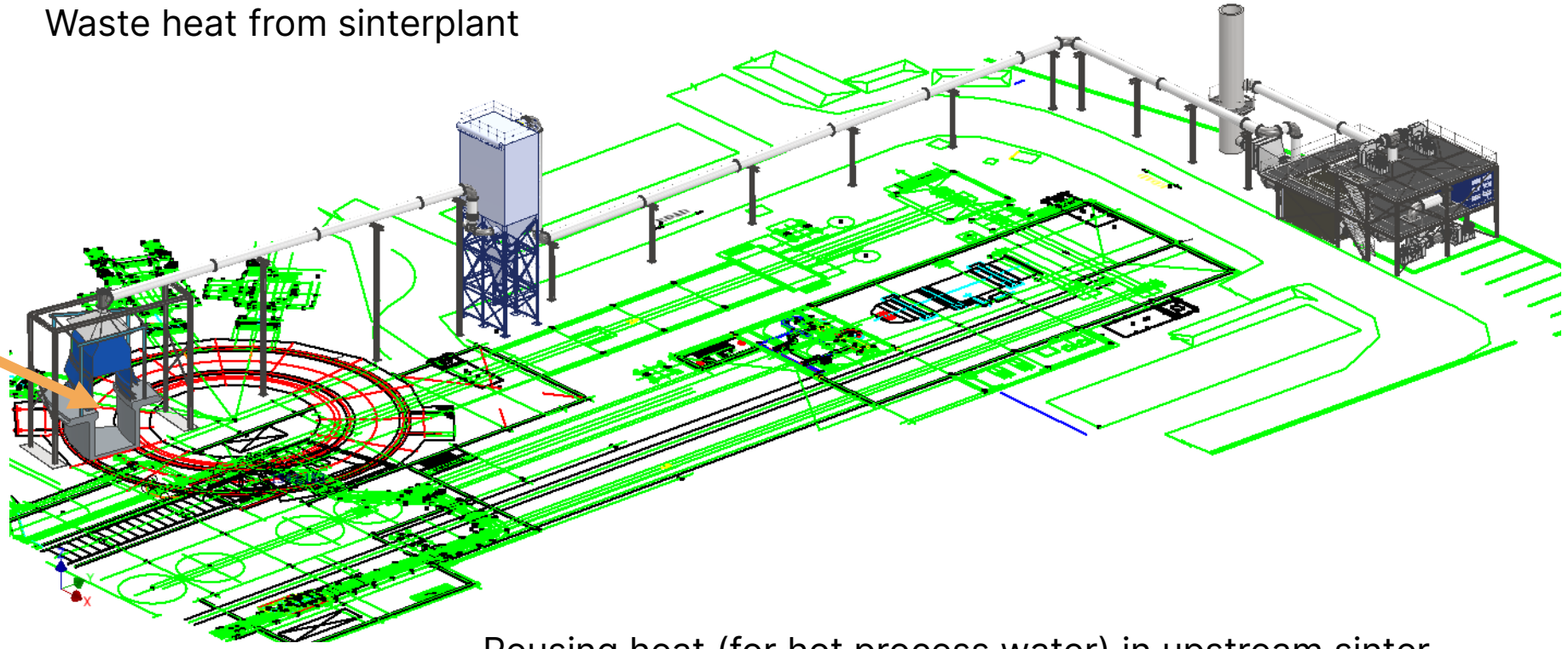
Commercial project: Sinterplant retrofitting

Steel Industry



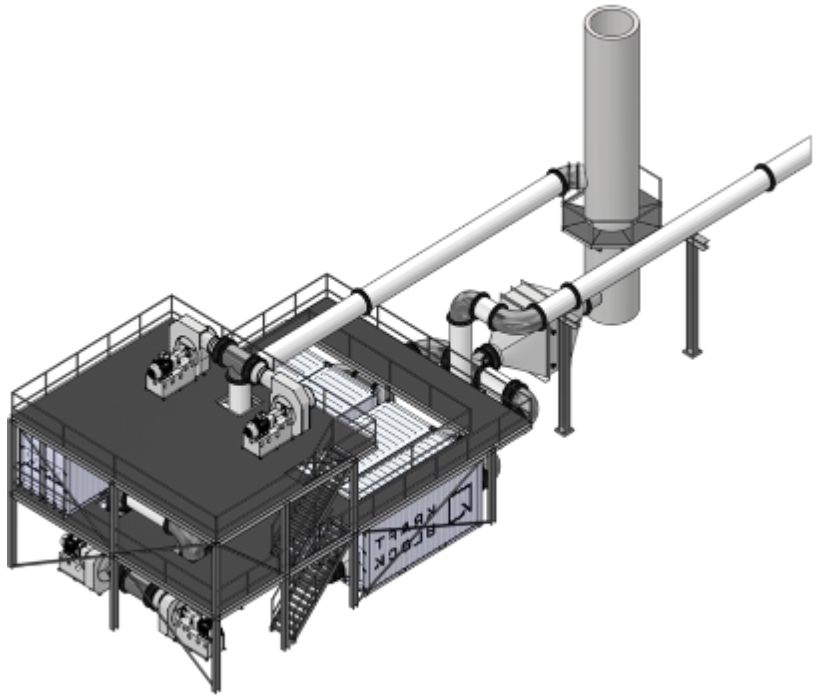
Waste heat from sinterplant

Storing waste heat



Reusing heat (for hot process water) in upstream sinter mixing process

Commercial project: Steel industry



Indian Steel producer

- Installing: 2024 (Autumn)
- Capacity: 20 MWh
- Very fast payback
- Location: India

About the project

- Collecting waste heat from the sinter plant
- Operation: Sintering
- Application: Hot water for the sinter mixting to save coke later in blast furnace
- 20,000t of CO_2 per year reduced

Research project: testing flare gas

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European Innovation Council

Using waste heat from Dillinger

- Installing: 2024 (Summer)
- Capacity: 12 MWh
- Charging/Discharging: 1 MW / 1 MW
- Location: Saarbrücken, Germany

About the Project

- Collecting waste heat from steel flare gases
- Operation: Batch process
- Application: Testing and replacing fossil space heating
- also as mobile one

Commercial project: Making heat mobile

buhck GRUPPE

Waste recycler

- Installing: 2021 (Summer)
- Capacity: 1.5 MWh
- Charging/Discharging: <300kW
- Location: Hamburg, Germany

About the Project

- Recovering waste heat from a CHP in Hamburg
- Operation: Batch process
- Application: Substituting fossil fuels in industries, for construction drying, and more

Contact

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