ZAE BAYERN
IMPLEMENTING ENERGY RESEARCH

Energy Storage for Industrial Process Heat

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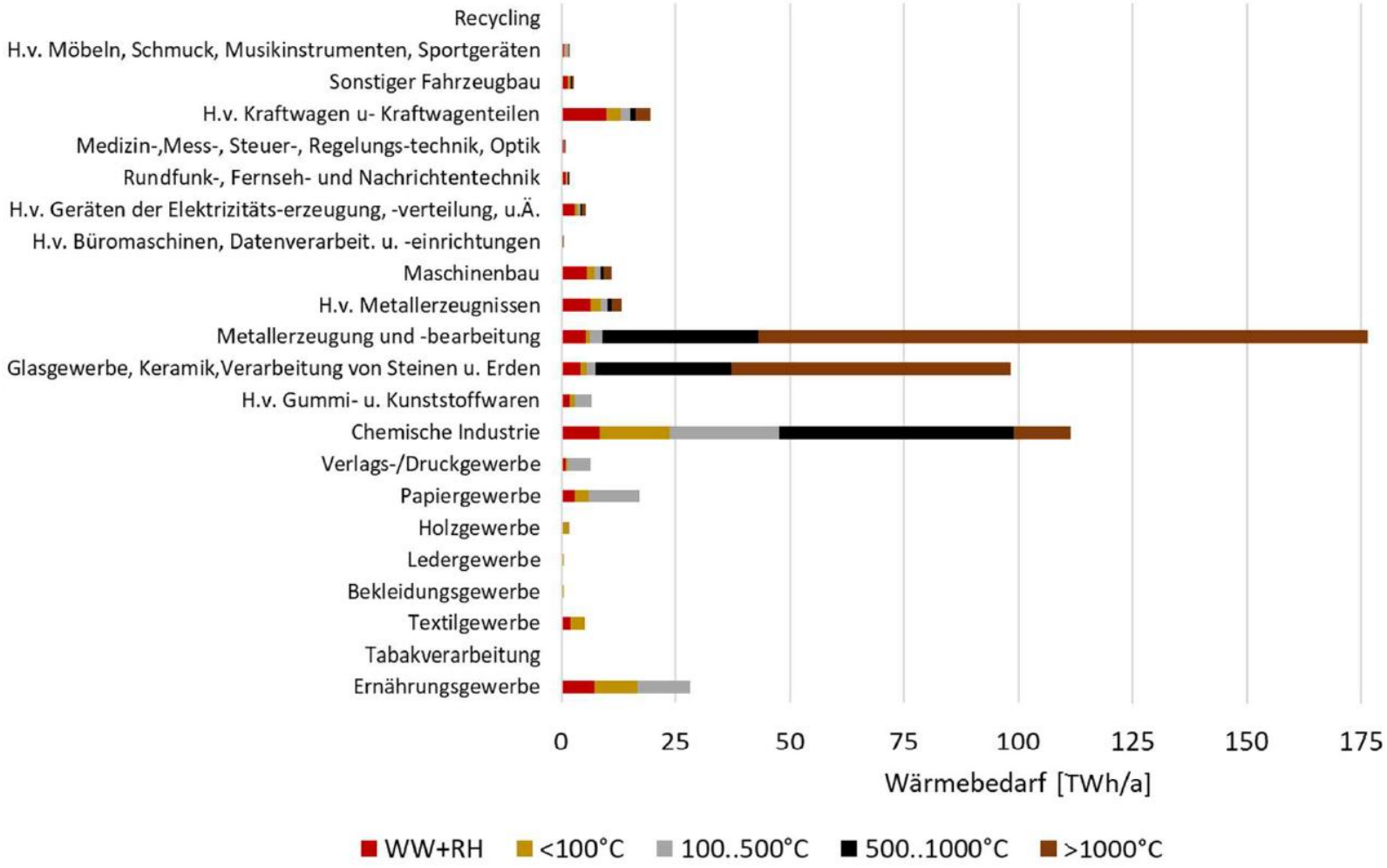
ZAE BAYERN

Energy Storage for Industrial Process Heat

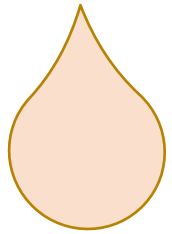
What is needed?

- Provision of heat / cold
- Recovery of waste heat
- Increase efficiency

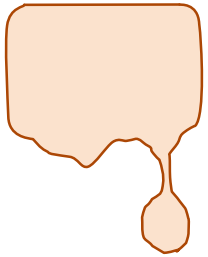


Thermal Energy Storage Technologies

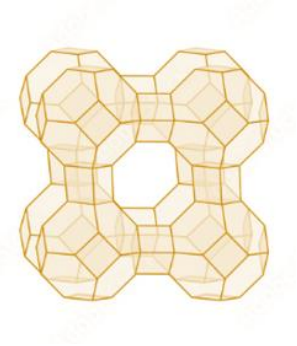
How can be stored?



Sensible



Latent



Thermochemical

Thermal Energy Storage: sensible

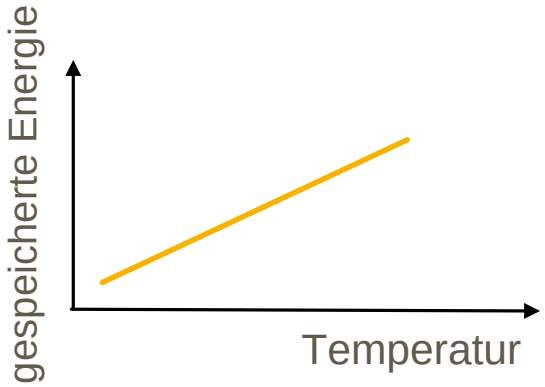
Principle: heat capacity over temperature range

Advantages:

▲ cheap & durable technology (water),
▲ high discharge power (liquid)
▲ high storage temperature (solid)

Challenges:

▼ low storage capacity
▼ long-term stability
▼ Thermo-mechanical aspects



Thermal Energy Storage: sensible

Industry example 1: waste heat recovery

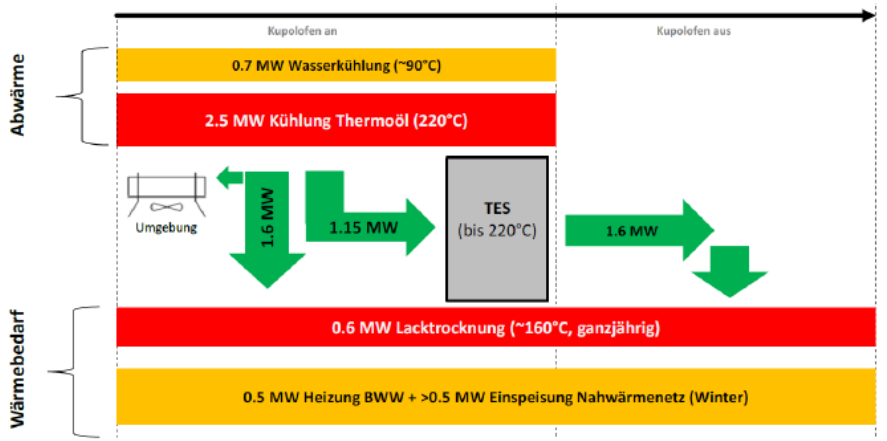
Source: waste incinerator Renergia
TES: warm water storage, 5 Million litre
End-use: district heating

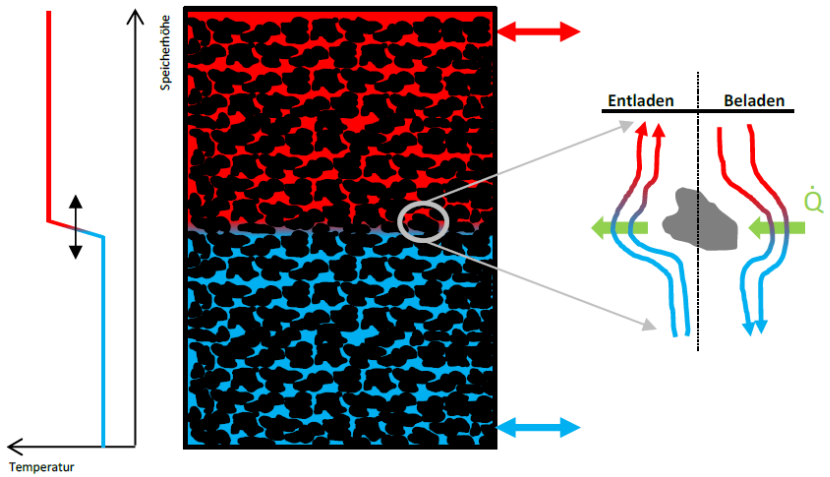
https://www.renergia.ch/

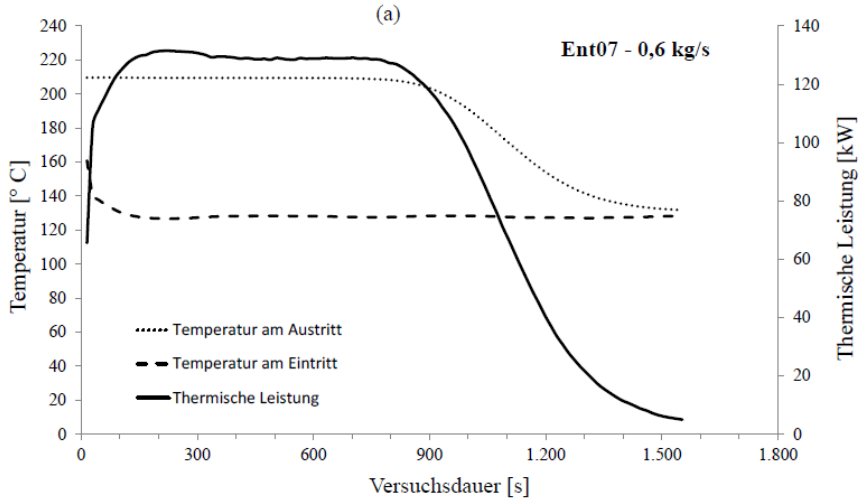
Thermal Energy Storage: sensible

Industry example 2: waste heat recovery

Source: foundry produced waste heat at furnace
TES: solid liquid mix (thermal oil + quartz filling)
End-use: paint drying





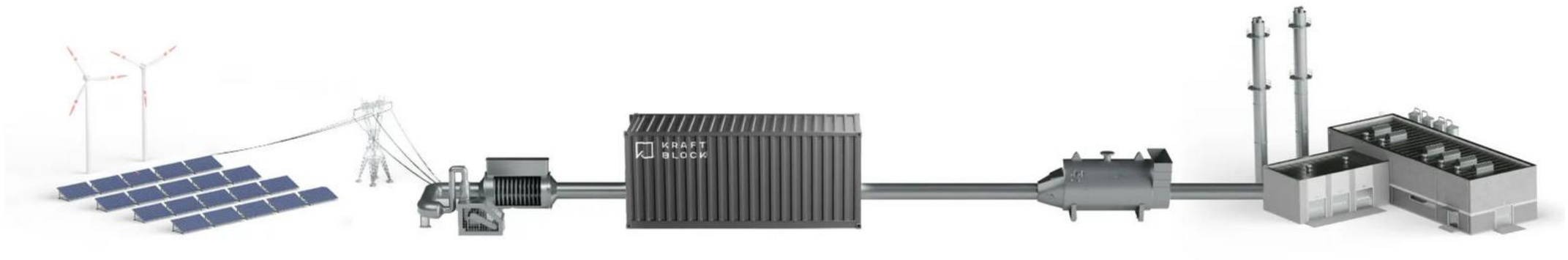


iAST FKZ: 03ESP370A-C

Thermal Energy Storage: sensible

Industry example 3: Net-Zero heat system

Source: electricity (Power-2-Heat)
TES: solid storage material, temperature 800°C
End-use: food processing (deep-frying)



https://www.kraftblock.com/de/volt-heat-project

Thermal Energy Storage: latent

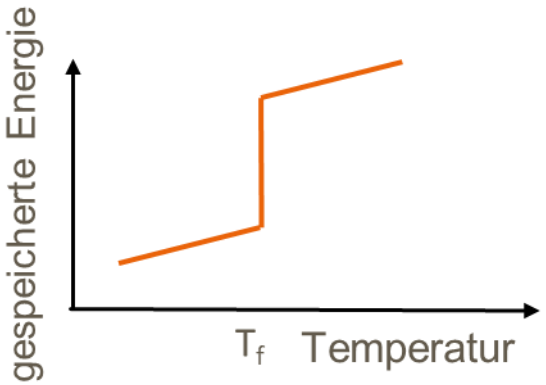
Principle: Phase change enthalpy

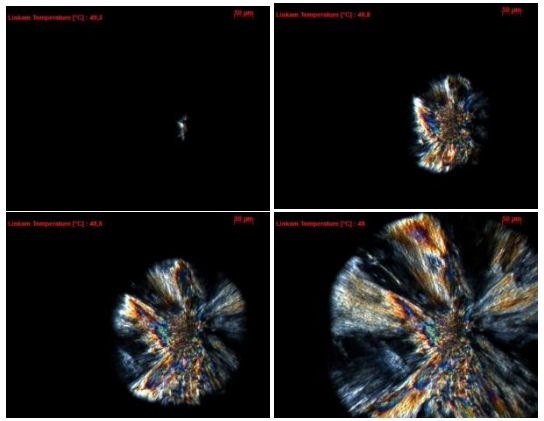
Advantages:

- ▲ high specific storage capacity (latent heat)
- ▲ „fixed temperature“
- ▲ passive temperature control

Challenges:

- ▼ „Complex“ heat transfer
- ▼ long time stability
- ▼ high costs
- ▼ low discharge power





Thermal Energy Storage: latent

Industry example 1: process steam supply for brewery (ISSDEMO)

Source: electrically / grid-serving

TES: metal alloy, phase change temperature 250 – 500°C

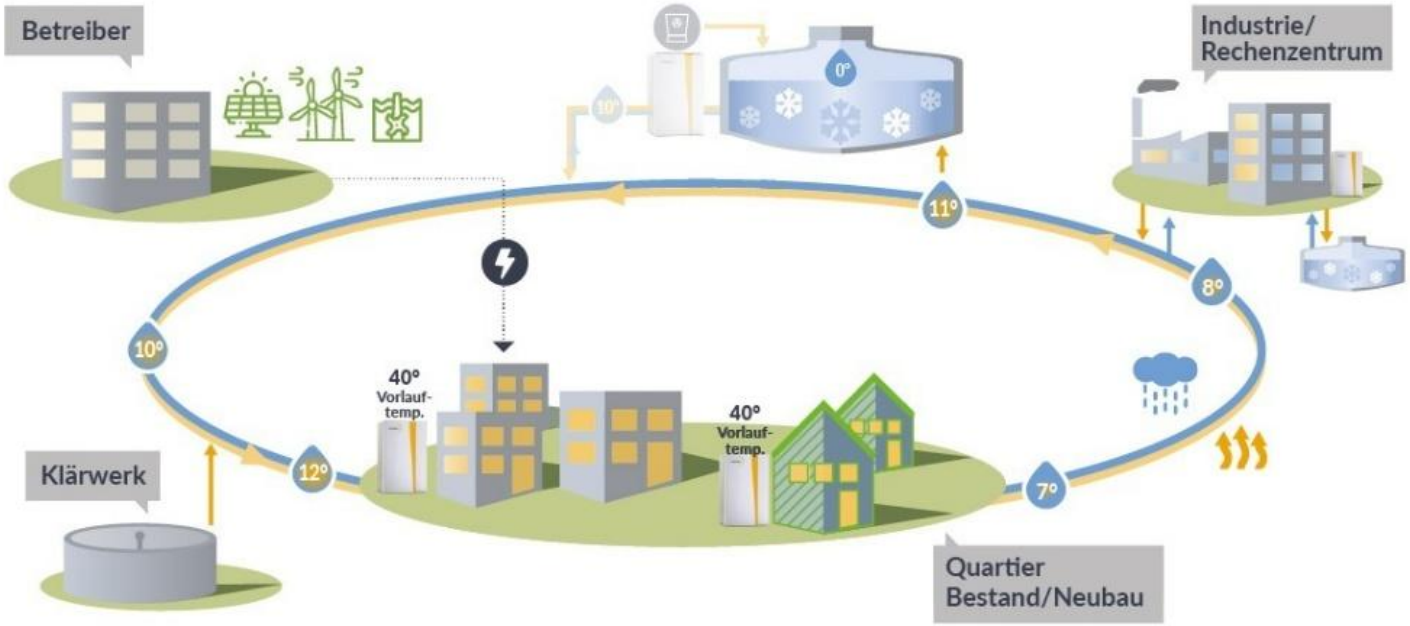
End-use: dynamic steam supply

https://www.umsicht-suro.fraunhofer.de/de/presse/pressemitteilungen/2024/Projekt-ISSDEMO.html

Thermal Energy Storage: latent

Industry example 2: Cooling of data center

Source: Recooling heat pump
TES: water, phase change temperature 0°C
End-use: cooling (heating) of data centre



Quelle: Caldoa; https://caldoa.de/leistungen/eisspeicher/

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Thermal Energy Storage: thermo chemical (sorption)

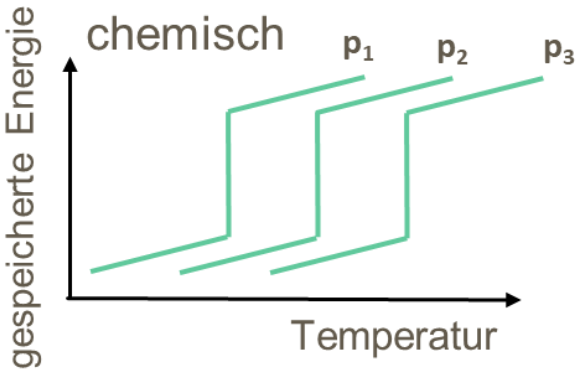
Principle: thermos chemical reaction & sorptive transitions

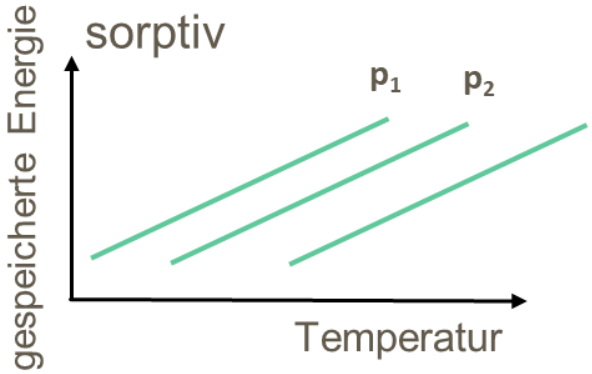
Advantages:

- ▲ high specific storage capacity
- ▲ no sensible loss
- ▲ temperature depending on p “heat pump effect”
- ▲ high efficiency

Challenges:

- ▼ Complex Technology
- ▼ hydro thermal stability
- ▼ Strong dependency on environmental conditions
- ▼ low discharge power





Thermal Energy Storage: thermochemical (sorption)

Industrie example: waste heat recovery (MoBS)

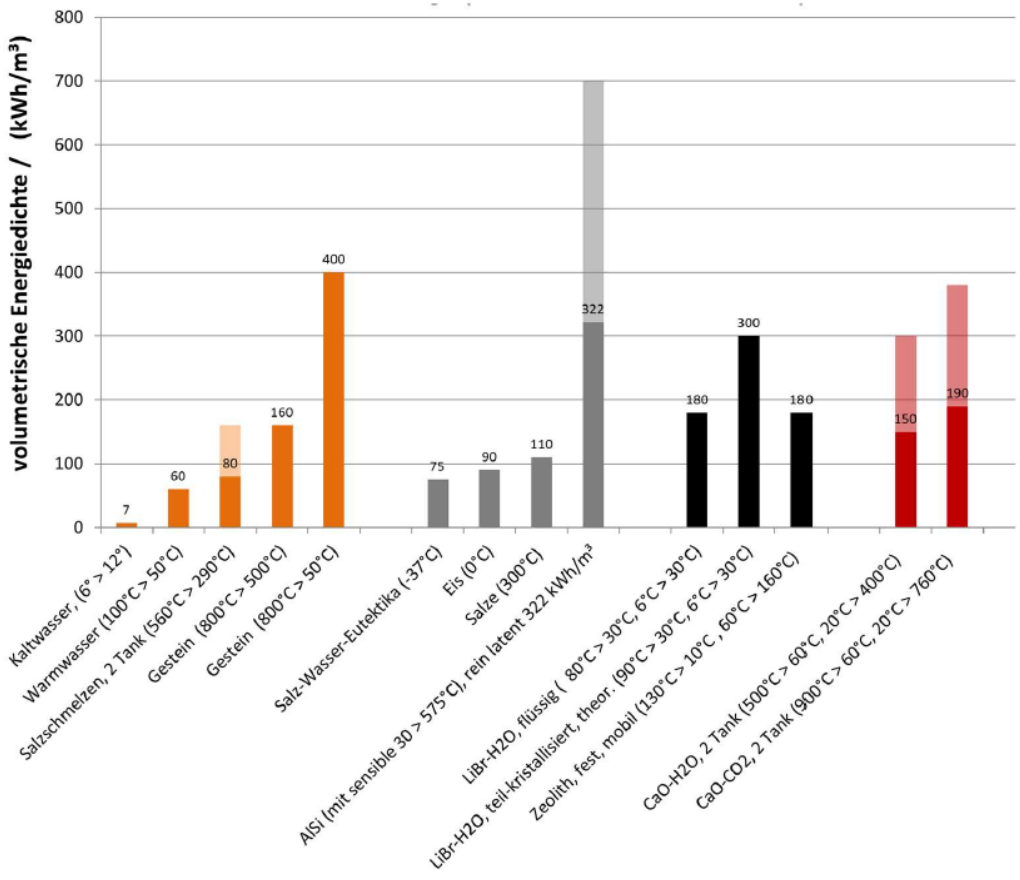
Source: waste incinerator Hamm
TES: mobile zeolite storage
End-use: drying process at wheat-starch factory

Thermal Energy Storage Technologies: comparison

No „one-size-fits-all“, BUT variety on different technologies give opportunity for different needs

Storage choice depending on application needs: temperatures, storage duration, capacity etc.

TES as a game Changer, BUT demonstration projects needed



Thank you for your attention!

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