



Mobile Heat Storage Concepts

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- Study programme „Mobile thermische Energiespeicher“ as supported by BWPLUS
- Basic data of available Mobile Heat Storage systems
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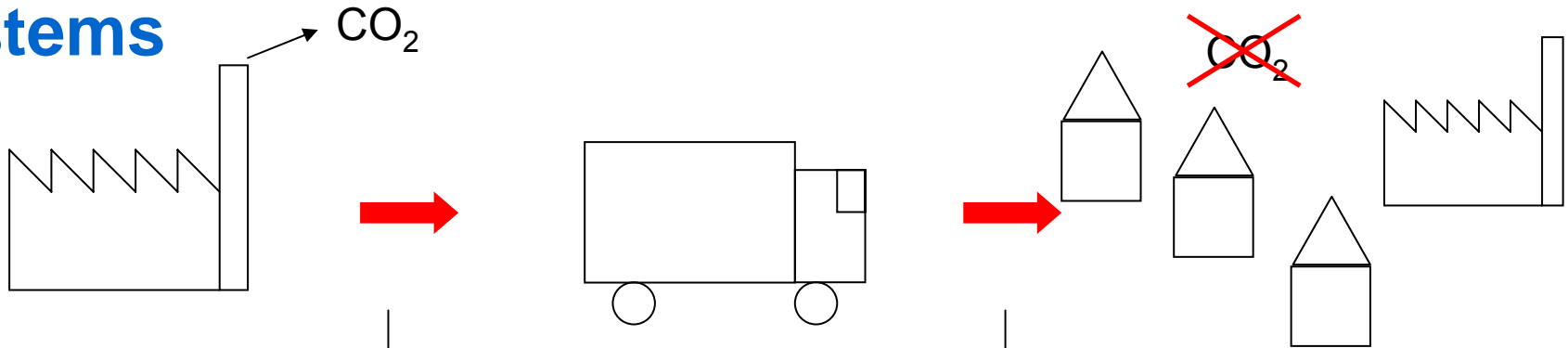


Project Data and Targets

- Project period: 07/2008-06/2010
- Covered storage materials: thermal oils, PCMs, zeolite materials
- Technical aspects: equipment requirements
- Economical aspects: investment costs, operational costs
- Ecological aspects: parameterised life cycle analysis (LCA) of each system, estimation of total CO₂-reductions (direct+indirect) for exemplary applications and potentials
- Potential analysis for Baden-Württemberg: identification of attractive heat source branches in industry, estimation of heat amount available in Baden-Württemberg
- Identification of potentially suitable heat sinks for each technology
- Identification of potential demonstration plant partnerships



Waste Heat Utilisation by Mobile Heat Transport Systems



Waste Heat Sources

e. g. industrial plants
combustion plants
power stations

Requirements

high temperature
permanent operation
large heat quantities
high thermal performance

Heat Transport

truck
railway

Requirements

favourable distance source-user
permanent reachability

Heat Utilisation

e. g. industry and commerce
hospitals, swimming pools
district heating systems

Requirements

low temperature
permanent operation
large heat quantities
high thermal performance



Heat Storage Concepts: PCM

Temperature Range	max. storage temperature 180-200 °C
Storage Density	100 kWh _{th} /t
Advantages	easy to apply, little capacities available
Disadvantages	restricted application spectrum due to small temperature range, high transport costs due to little storage density



Heat Storage Concepts: Zeolites

Temperature Range	max. storage temperature 140 °C
Storage Density	280 kWh _{th} /t
Advantages	highest storage capacity of all materials covered
Disadvantages	restricted application spectrum due to small temperature range



Heat Storage Concepts: Thermal Oil

Temperature Range	max. storage temperature 320-350 °C
Storage Density	200 kWh _{th} /t
Advantages	relatively large application spectrum due to wide temperature range, pressure-free transport and storage, high storage density
Disadvantages	complex apparative structure, difficult for steam production application, too expensive for seasonal operation (room heating applications), large capacities (>3 MW _{th}) required for competitiveness

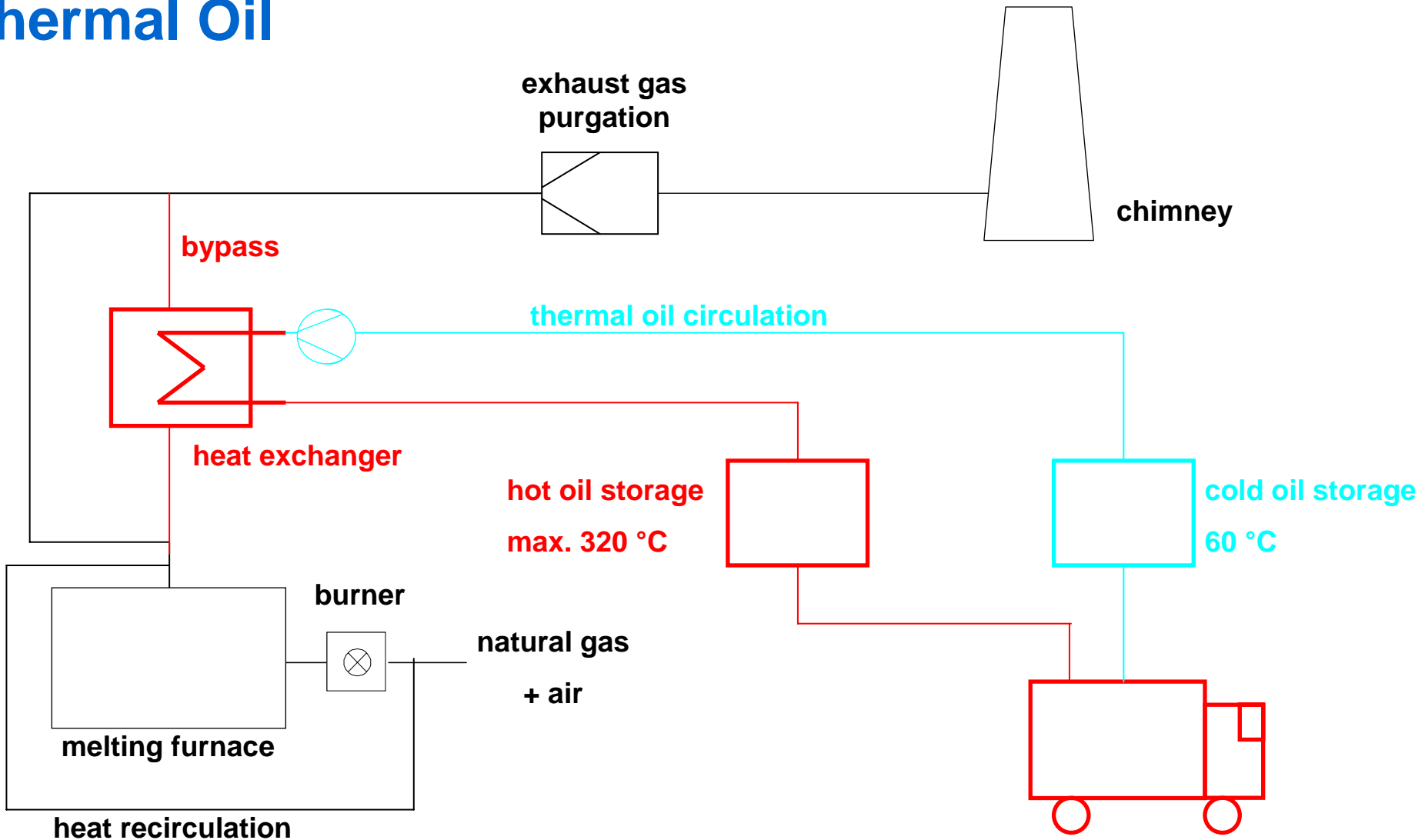


Heat Storage by Thermal Oil

- Storage containers for hot and cold oil required
- Easy integration into user`s heat supply system
- No contact with oxygen – patented technology provided by project partner
- Operational experience: two projects in the 1980s (glassmill - hospital and steel plant - tyre factory), discontinued due to plunging energy prices then
- Technology re-discovered during recent soar in energy prices



Glassmill Waste Heat Utilisation by **Mobile Heat** with Thermal Oil





Ecological Balancing

- Ecological impact of Mobile Heat systems to be examined through life-cycle balancing by software tool BALANCE
- Construction, operation and dismantling of Mobile Heat system components and services to be highlighted
- Comparison to conventional heat supply systems, e. g. based on the use of natural gas
- Link-up of economical and ecological balancing in order to estimate CO₂-abatement costs for each storage concept



Summary

- With thermal oils, PCM and zeolites there are three storage materials with different concepts available
- On-going examinations of the different storage concepts comprise technical, economical and ecological matters plus estimation of potentials for Baden-Württemberg
- For competitiveness high full load hours both for heat sources and heat sinks plus short distances required
- Probable lowering of potentials due to unfavourable temperature ranges for storage materials and heat utilisation systems, esp. when using steam supply systems
- High economical impact of transport costs, limiting the range of each Mobile Heat concept



**Thank you very much for your
attention!**