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EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM
SMART NETWORKS FOR ENERGY TRANSITION

Storage Technolgies and Sector Interfaces

StoreITup-IF

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AUSTRIAN INSTITUTE OF TECHNOLOGY
TOMORROW TODAY

StoreITup-IF Overview

Consortium

AIT Austrian Institute of Technology – Tomorrow Today
geba Group
Montan Universität Leoben
CTB Automation
University of Applied Sciences Upper Austria – Oberösterreich
technosert electronic

Budget

2.4 M€

Timeline

1.4.2015 – 31.3.2019

Co-Funding of the SmiLES Method

developed within the EU project SmiLES applied within StoreITup-IF use cases
(grant agreement No 730936)

SmiLES Shared Data and Information Platform

Overarching objectives

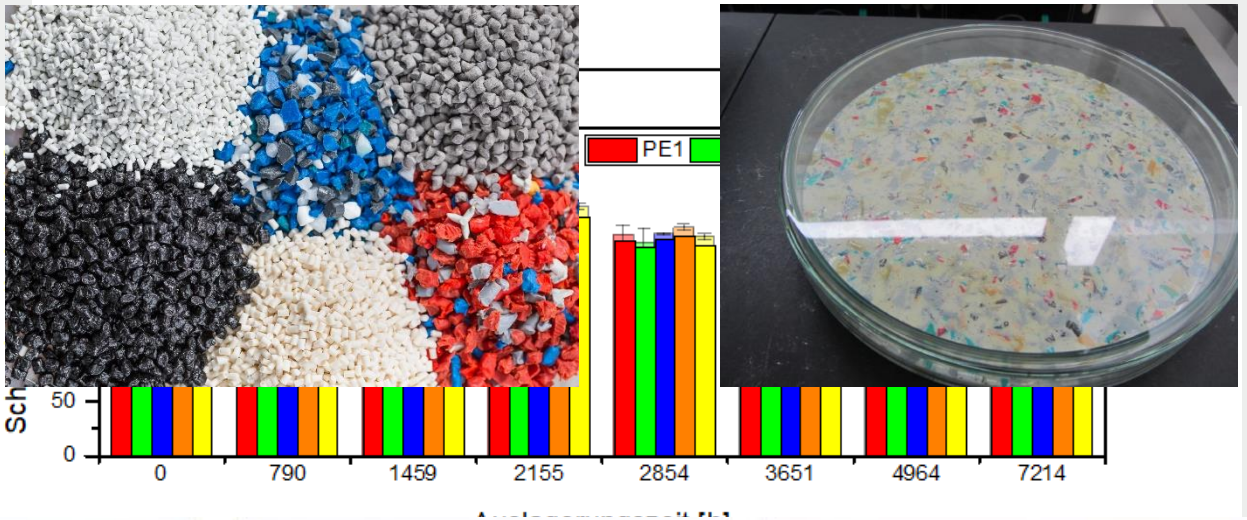
Development of Thermal Energy Storages for

- Short term energy storage (hours, days, weekend)
- Up to 400 °C
- Application in Industry, Solar Energy, District Heating and Power Plants
- Flexible energy capacity: kWh - MWh
- Flexible charging and discharging power: kW - MW

StoreITup-IF Results

Latent Heat Storage using Polymers as Phase Change Material

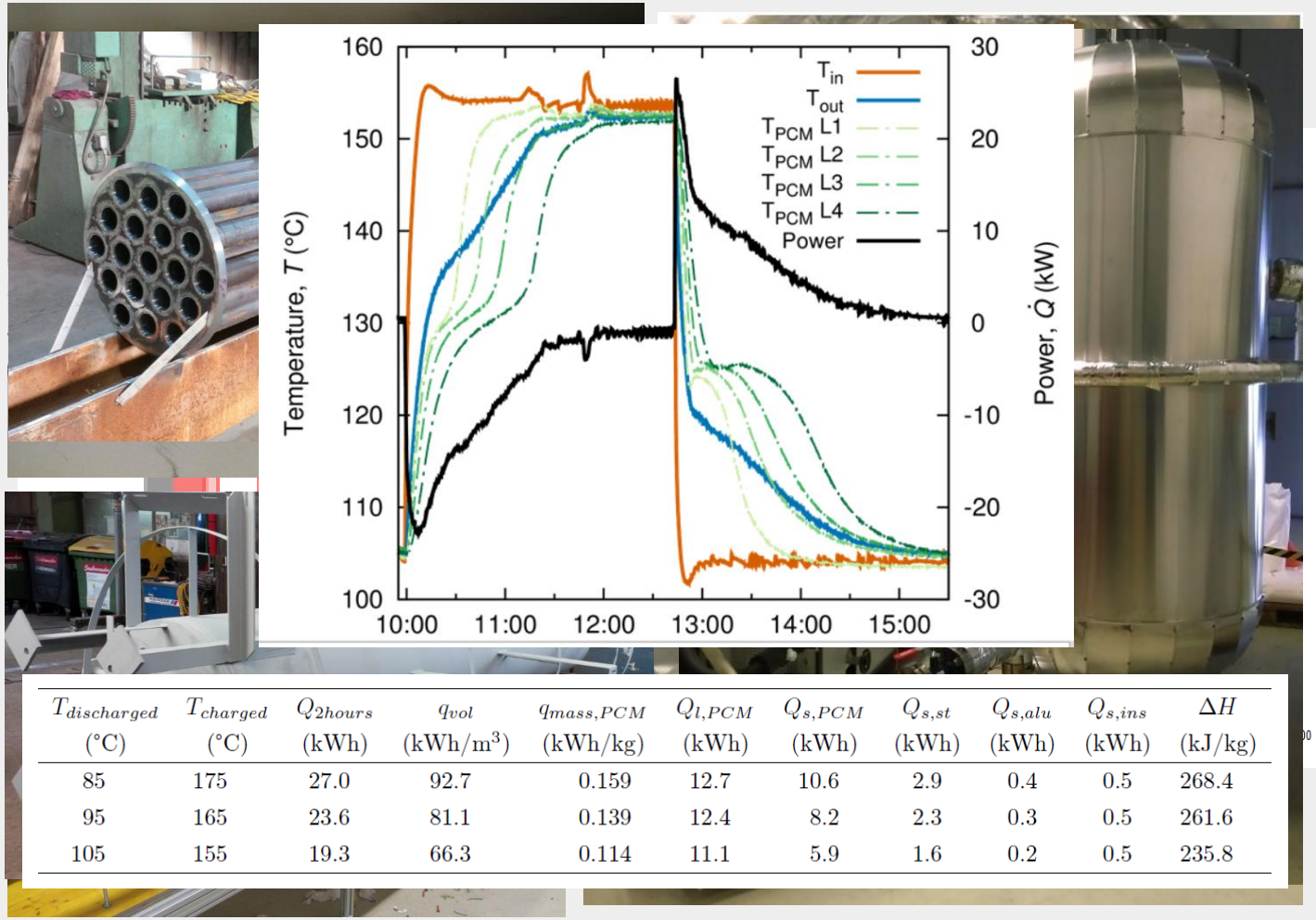
- Worldwide large scale production
- More than 100 polymers tested
- Compounds
- Recycling
- Polymers from bio-feedstock
- Against all predictions:
  Polymers are suitable as PCM!



StoreITup-IF Results

Polymer PCM Storage – Lab Scale

- Fast and accurate design models
- Six storages designed and built
  (10-100 kWh, 10-100 kW, 100-500 kg PCM)
- Industrial production incl. standards
- Different heat exchangers
- Modular design (capacity, power)
- Fully characterized on lab test rig
- Economically viable 30 – 300 €/kWh
  (power dependent)



$T_{discharged}$ (°C)	$T_{charged}$ (°C)	Q_{2hours} (kWh)	q_{vol} (kWh/m³)	$q_{mass,PCM}$ (kWh/kg)	$Q_{l,PCM}$ (kWh)	$Q_{s,PCM}$ (kWh)	$Q_{s,st}$ (kWh)	$Q_{s,alu}$ (kWh)	$Q_{s,ins}$ (kWh)	ΔH (kJ/kg)
85	175	27.0	92.7	0.159	12.7	10.6	2.9	0.4	0.5	268.4
95	165	23.6	81.1	0.139	12.4	8.2	2.3	0.3	0.5	261.6
105	155	19.3	66.3	0.114	11.1	5.9	1.6	0.2	0.5	235.8

StoreITup-IF Results

Polymer PCM Storage – Application in Polymer Extrusion

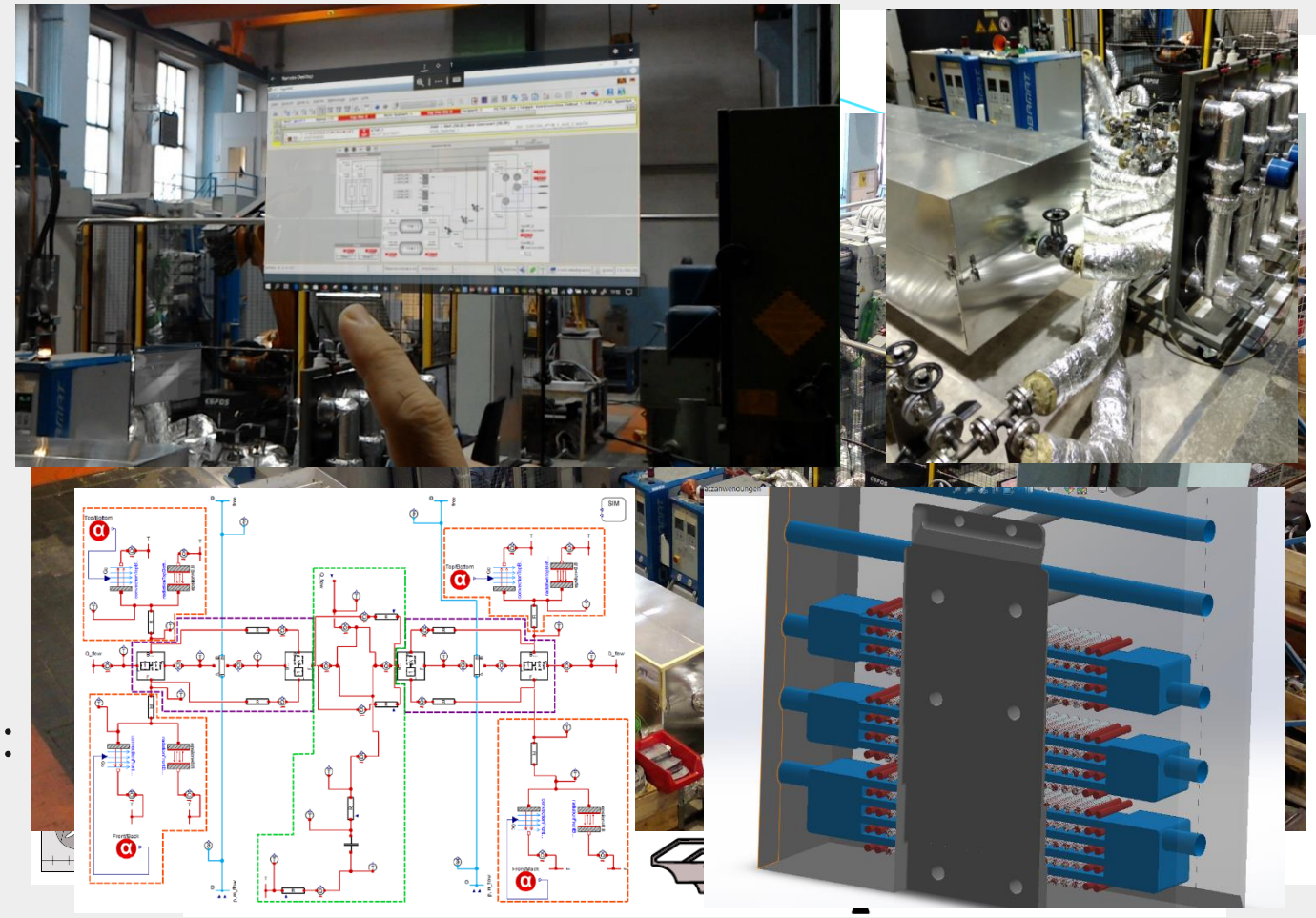
- Almost no PCM storages demonstrated in real applications
- Extrusion is a wide spread process in polymer, food, chemical industries
- State of the art Extrusion Factory: no waste heat recovery possible
- Development of Efficient Extrusion Factory: extensive waste heat recovery and usage
- Demo system tested at real Factory (geba)

Investment Costs for Energy Efficient Extrusion Factory	654.5 kEUR
Annual Savings Austria	257.8 kEUR
Annual Savings Germany	351.8 kEUR

StoreITup-IF Results

Polymer PCM Storage – Application in Aluminum Die Casting

- Die Casting is a wide spread process: automotive, consumer, machines
- State of the art Casting Factory: no energy, no information exchange
  → *no efficient factory possible*
- Development of Green Foundry 4.0: Industry 4.0 enables energy efficiency
- Demonstrated at industrial scale at AIT: up to 30 % energy efficiency increase
- Best concepts are being implemented in new factories



StoreITup-IF Lessons learned

Lessons learned from the project

- Polymer PCM Storages work well

- Energy efficiency in industry requires a holistic approach
- including modern Information Technology (Industry 4.0 enables energy efficiency)

Barriers

- Energy is still cheap compared to e.g. labor, equipment, tax
- ROI of less than 3 years (as usually required in industry) are difficult to achieve
- Incentives help, if not needed to reach climate goals:
  e.g. CO2 tax, efficiency bonus, Best Available Technologies as standard

StoreITup-IF Deployment

Deployment of the most promising solutions, replication and scaling

- More than 20 peer publications and conference talks issued
- 6 master thesis, 2 PhD thesis completed (publicly available)

- 3 related patents granted (PCM enhanced Ruth steam storage)
  some more in preparation

- More than 15 individual workshops with potential users/customers held - ongoing

- Project portfolio of side-projects developed (completed and ongoing projects):
  Tes4SeT, SmiLES, INPATH-TES, envIoTcast, HyCool, HySteps, bPCM, ISOlar, Guss4.0, …

- First steps towards industrial production developed (start-up, partners)

StoreITup-IF Future R&I

Future R&I, interoperability and inter-regional cooperation

The transition to a truly sustainable society is enormously complicated and diverse!

Thus, many ***more Best Practice Examples*** have to be developed and demonstrated:

- for different applications, e.g.
  - Solar Energy (within EU project HyCool currently food and chemical industry, including steam PCM storage are being investigated)
  - Power-to-Heat (electrification of the energy system)
- for different industrial sectors
  - Employing a holistic approach combining Information and Energy Technology
- In many different countries
  - Due to different preconditions and requirements