



STORY

Added value of storage in distribution systems

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About STORY

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General project information

- 18 institutions from 8 countries
- Coordinator: VTT
- Technical coordinator: Th!nk E
- Horizon 2020 (LCE-08-2014)
- Start: May 1st, 2015 (Duration: 66 months)
- Budget: 15,8 million Euro



Project partners



Objectives

Show the added value of storage in the distribution grid

- To **demonstrate** and evaluate **innovative approaches** for energy storage systems
- To find **solutions**, which are **affordable, secure** and ensure an **increased percentage of self-supply of electricity**
- To accelerate **innovation and business models** for deployment of storage at local level.



Project demonstrations

1. Demonstration in residential building (Oud-Heverlee, Belgium)



Site contains 7 new and old buildings at the end of the electricity line

- Technologies (new or existing)
 - PV, PV-Thermal, vacuum collectors
 - Natural gas, oil, heat pumps
 - 2 electric vehicles
 - Load shifting
- Storage type (new)
 - Batteries
 - Small and large scale thermal water storage (low and high temperature)
 - Fuel cells
 - ICT at building level (interoperability)

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Project demonstrations

1. Demonstration in residential building (Oud-Heverlee, Belgium)



- Building 1
 - $U < 0.1 \text{ W/m}^2\text{K}$
 - LED
 - Smart 2-zone ventilation: continuous measuring of CO_2 , T and humidity
 - Smart household appliances
 - KNX home control
 - BTES + heat pump
 - Electric vehicle
 - PV-Thermal and vacuum collectors
 - Hot water tanks / cooling basins
 - 2 batteries



Project demonstrations

2. Demonstrating the roll out of a neighbourhood (Oud-Heverlee, Belgium)



Additional 7 buildings
compose last part of the
line with its specific
challenges

- Buildings from demo 1 are connected, combined with another 7 buildings -> microgrid
- ICT will integrate operation of thermal storages, heat pumps, fuel cell, PV and batteries and optimize it at the neighborhood scale
- Neighborhood battery

Project demonstrations

3. Demonstration of storage in factory (Navarra, Spain)

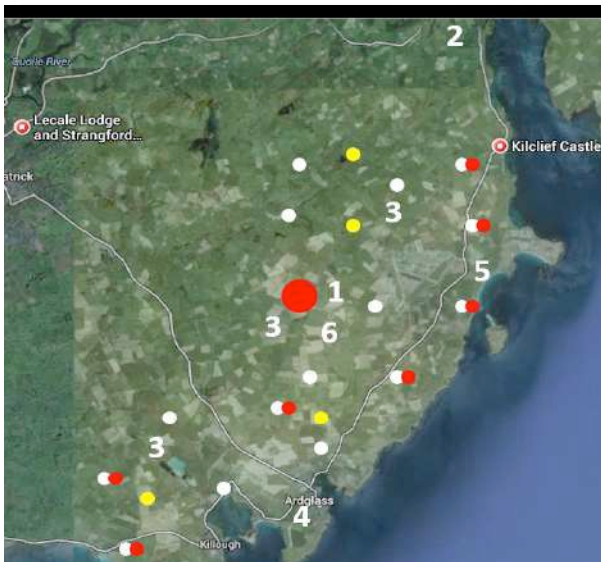


Site is located in an industrial zone in Navarra.

- Existing situation
 - Facility produces professional fridge rooms and requires high power peak values (280 kW)
 - Installed 113 kWp PV does not deliver expected cost savings
- Objectives and technologies
 - 50 kW, 200 kWh Li-Ion battery will be added to improve the business case
 - Reduction of peak power
 - Demand side management

Project demonstrations

4. Demonstration of storage in residential district (Lecale, Northern Ireland)



Site is under development to become a complete self-sufficient, greener, cheaper energy grid for the 300 residential buildings

- Existing situation
 - 250 kW of PV installed
 - 2 x 2,5 MW onshore wind turbines
 - 500 kW anaerobic digestion unit
 - 1.2 MW tidal energy test
- Objectives and technologies
 - Extension with a large scale, medium voltage 250 kW and 2 MWh Compressed Air Energy Storage (CAES)
 - To increase security of supply

Project demonstrations

5. Flexibility and robustness of large scale storage unit (Germany/Slovenia)



A village, where the battery will be installed at the Low Voltage (LV) substation

- Objectives and technologies
 - Flexible design of medium voltage battery: 800 kW, 660 kWh
- Location: Suha, Slovenia
 - 210 kW of PV already installed
 - Low Voltage (LV) network supplied by 400 kVA transformer
- Objectives
 - Demonstration of flexibility and robustness of the battery

Project demonstrations

6. Roll out of private multi-energy grid in industrial area (Olen, Belgium)

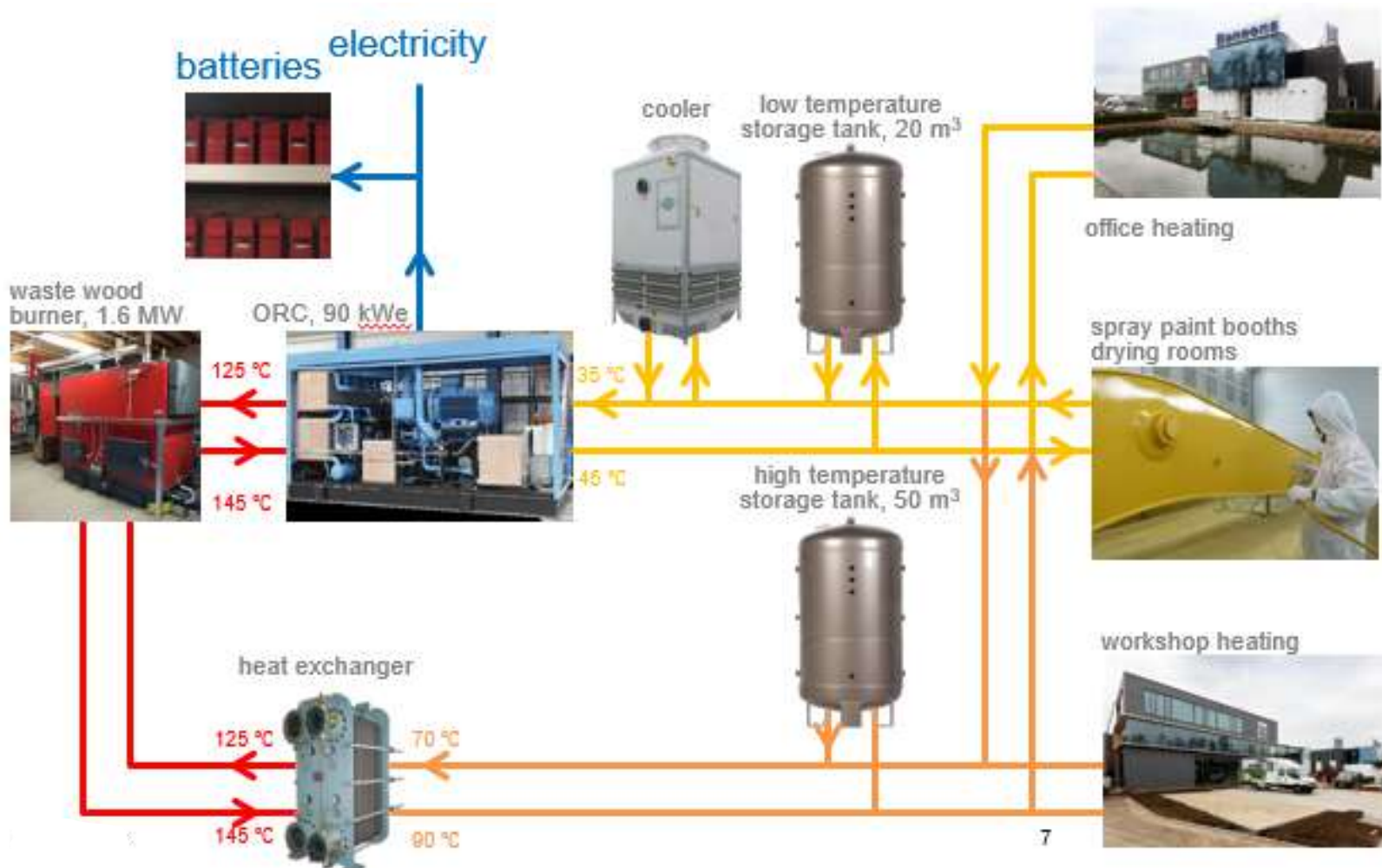


Site is located around a large joinery, which has a large amount of wood waste

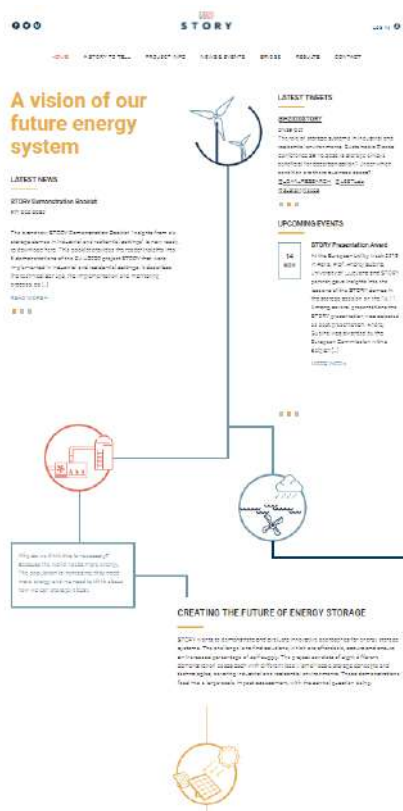
- Existing situation
 - Old wood-fired boiler
- Objectives and technologies
 - New highly-efficient wood-fired boiler
 - Organic Rankine Cycle (ORC)
 - Large scale thermal energy storage (low and high temperature)
 - Multi-temperature district heating
 - To increase efficiency of ORC
 - To reduce power peaks
 - To increase self-sufficiency

Project demonstrations

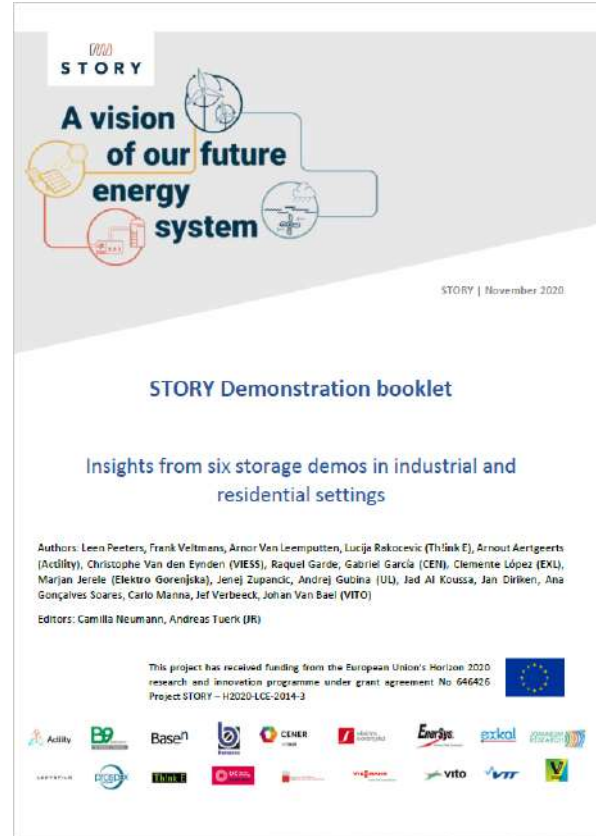
6. Roll out of private multi-energy grid in industrial area (Olen, Belgium)



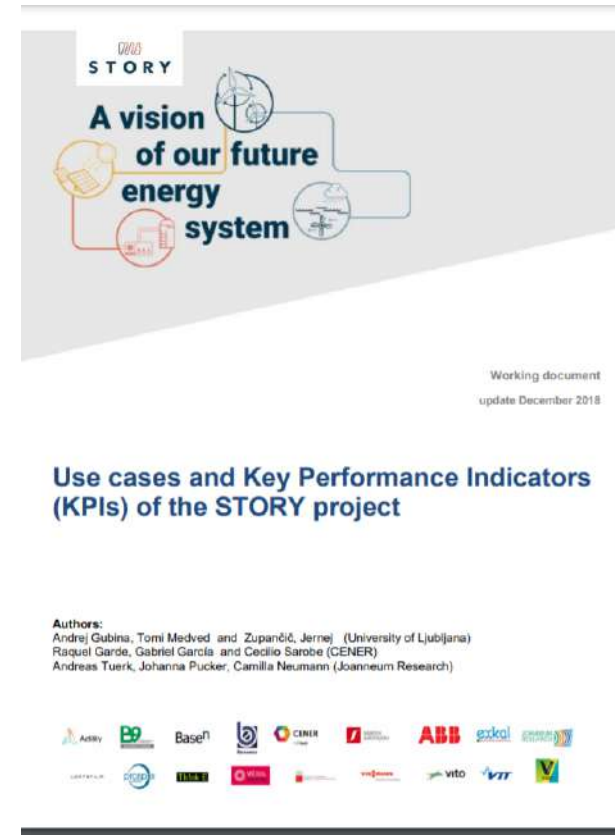
Project demonstrations



The screenshot shows the STORY website homepage. At the top, there is a navigation menu with links for HOME, ABOUT STORY, PROJECTS, NEWS, EVENTS, CONTACT, and PARTNERS. The main heading is "A vision of our future energy system". Below this, there is a "LATEST NEWS" section featuring an article titled "STORY Demonstration Booklet" dated 17.11.2018. To the right, there is a "LATEST EVENTS" section with a "STORY Presentation Aired" event on 14.11.2018. A large graphic on the left side of the page shows a wind turbine, a battery, and a power plug connected by lines, symbolizing energy storage and distribution. Below the graphic, there is a section titled "CREATING THE FUTURE OF ENERGY STORAGE" with a brief description of the project's goals.



The cover of the "STORY Demonstration booklet" features the title "A vision of our future energy system" at the top. Below the title, it says "STORY Demonstration booklet" and "Insights from six storage demos in industrial and residential settings". The authors listed are: Leen Peeters, Frank Veltmans, Arnor Van Leemputten, Lucije Rakocovic (Think E), Arnout Aertgeerts (Actility), Christophe Van den Eynden (VIESS), Raquel Garde, Gabriel Garcia (CEN), Clemente López (EXL), Marjan Jerele (Elektro Gorenjska), Jenej Zupancic, Andrej Gubina (UL), Jad Al Koussa, Jan Dirken, Ana Gonçalves Soares, Carlo Manns, Jef Verbeeck, Johan Van Bael (VITO). The editors are Camilla Neumann and Andreas Tuerk (IR). The cover also includes the text: "This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 646426. Project STORY – H2020-LCE-2014-3". At the bottom, there is a row of logos for the project partners: Actility, BP, Base1, CEMER, Enerjis, gskol, and VITO.



The cover of the "Use cases and Key Performance Indicators (KPIs) of the STORY project" features the title "A vision of our future energy system" at the top. Below the title, it says "Use cases and Key Performance Indicators (KPIs) of the STORY project". The authors listed are: Andrej Gubina, Tomi Medved and Zupančič, Jernej (University of Ljubljana), Raquel Garde, Gabriel Garcia and Cocilio Sarobe (GENER), and Andreas Tuerk, Johanna Pucker, Camilla Neumann (Joanneum Research). The cover also includes the text: "Working document update December 2018". At the bottom, there is a row of logos for the project partners: Actility, BP, Base1, CEMER, Enerjis, gskol, and VITO.

<http://horizon2020-story.eu/>

<http://horizon2020-story.eu/story-demonstration-booklet/>

<http://horizon2020-story.eu/wp-content/uploads/STORY-use-cases-and-KPIs.Publish1-1.pdf>

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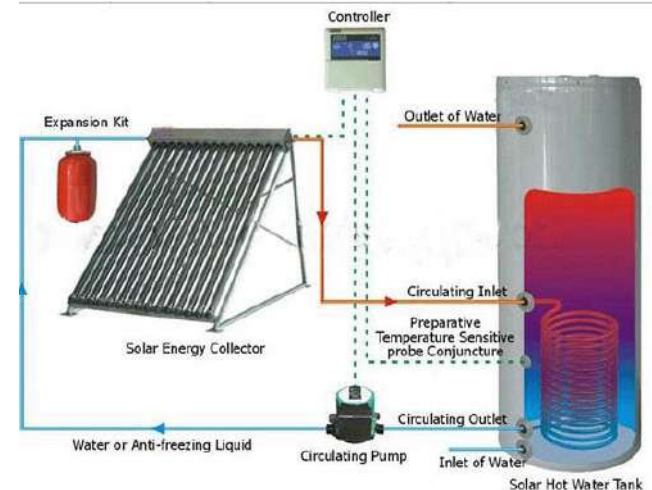
STORY

Description of technology : energy content of water tanks

Energy content of water storage tanks

Why needed?

- A lot of water storage tanks are equipped with only one temperature sensor
 - Electric hot water heaters
 - Tanks for solar collectors
 - Etc.
- Advantage:
 - Only one temperature sensor is needed
 - Works well for the application
 - Start full loading of the electric hot water heater if temperature is below certain value
 - Stop loading via solar collector if temperature is above certain level
- Disadvantage
 - No detailed information about the energy content of the tank, only information at one certain point
 - Difficult to be used for smart control



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Energy content of water storage tanks

Why needed?

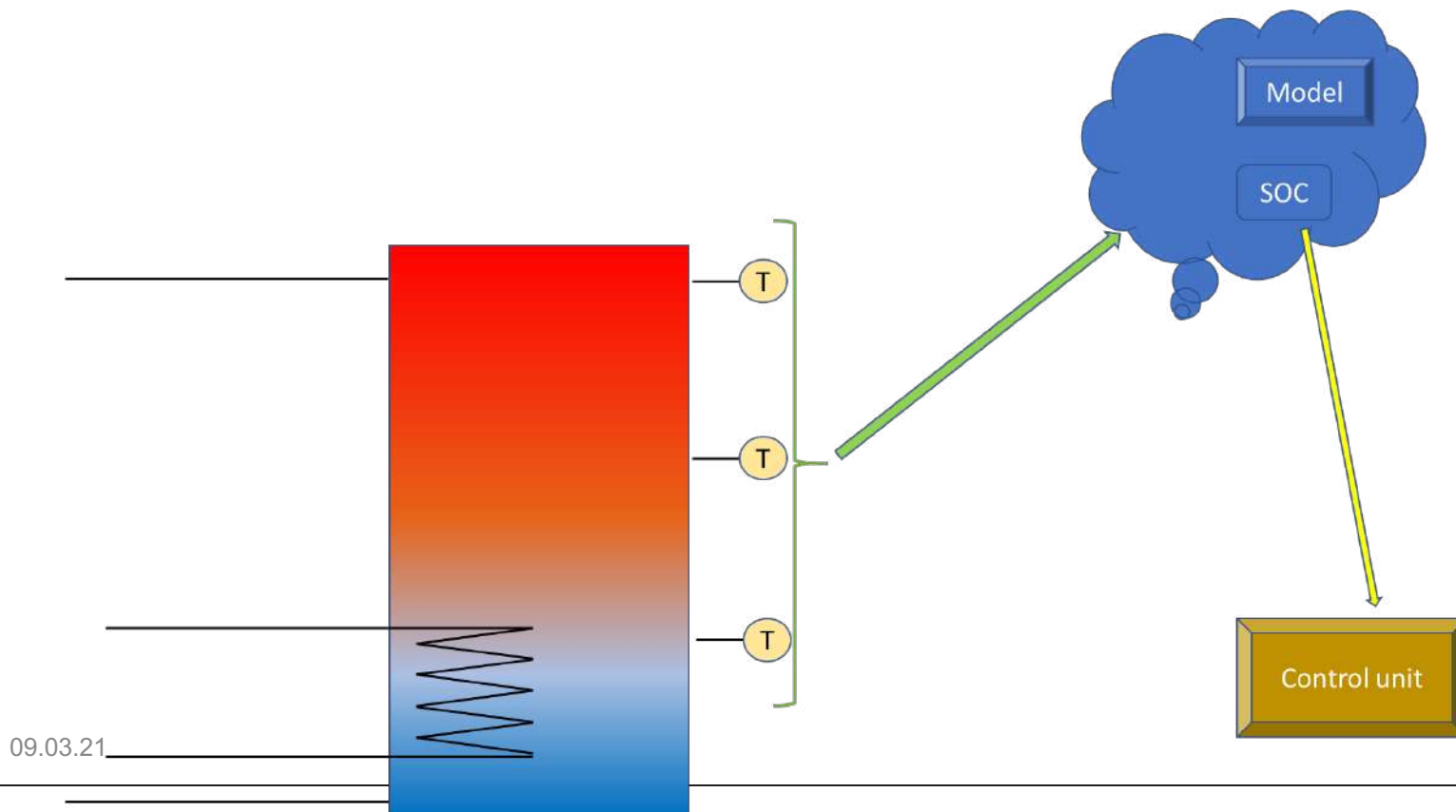
- Some applications use a lot of sensors
 - Large-scale water storage tanks for CHP in greenhouses
 - Etc.
- Advantage:
 - Multiple sensors give detailed overview of the temperature of each of the layers in the tank
 - Could be used for smart control
- Disadvantage
 - Higher investment cost for monitoring equipment
 - Higher cost for maintenance (multiple sensors)



Energy content of water storage tanks

VITO solution

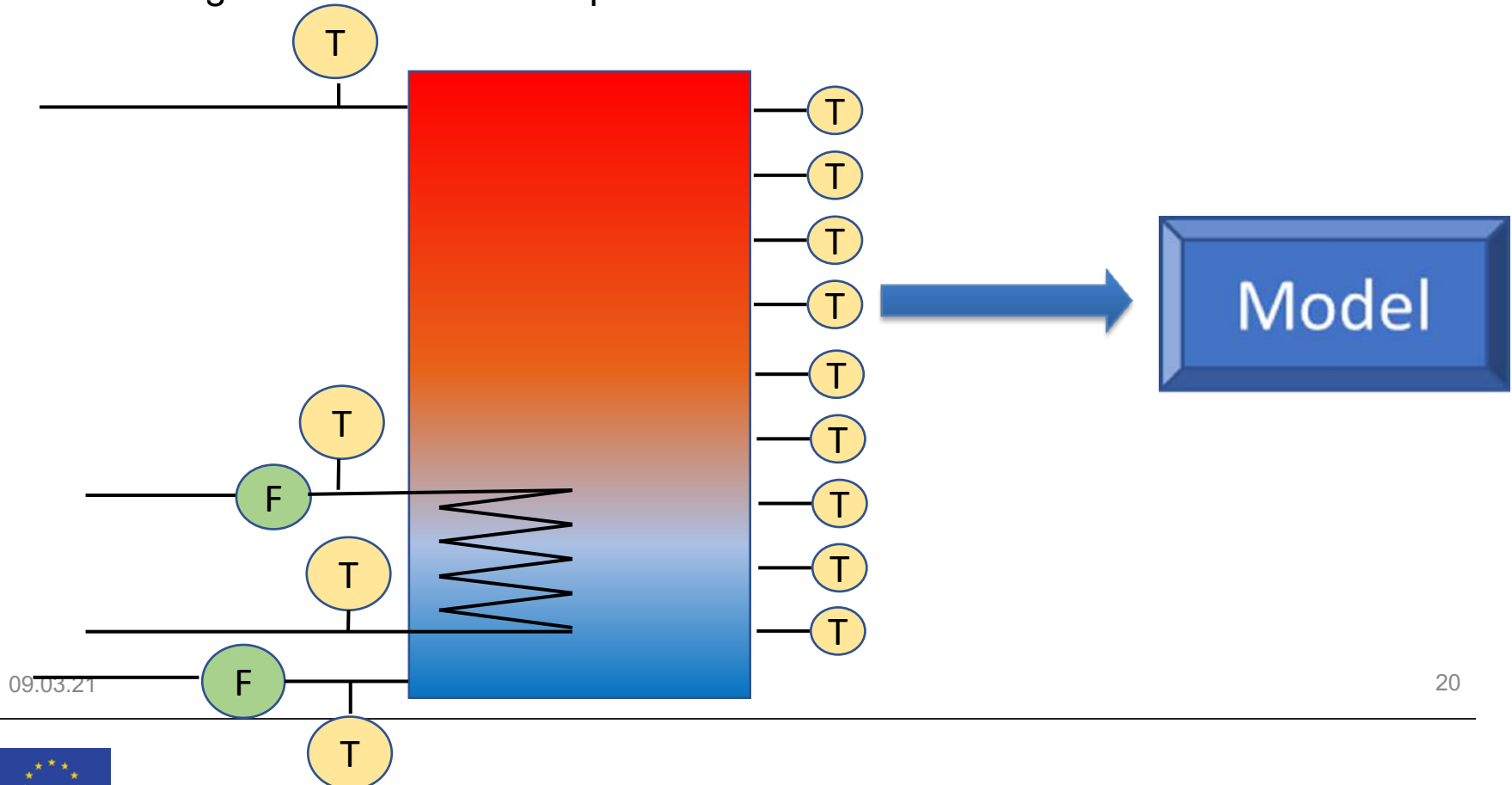
- Combination of a limited number of sensors and a model of the tank



Energy content of water storage tanks

VITO solution - procedure

- Starting with detailed testing of the storage tank
- Including flow meters and temperature sensors



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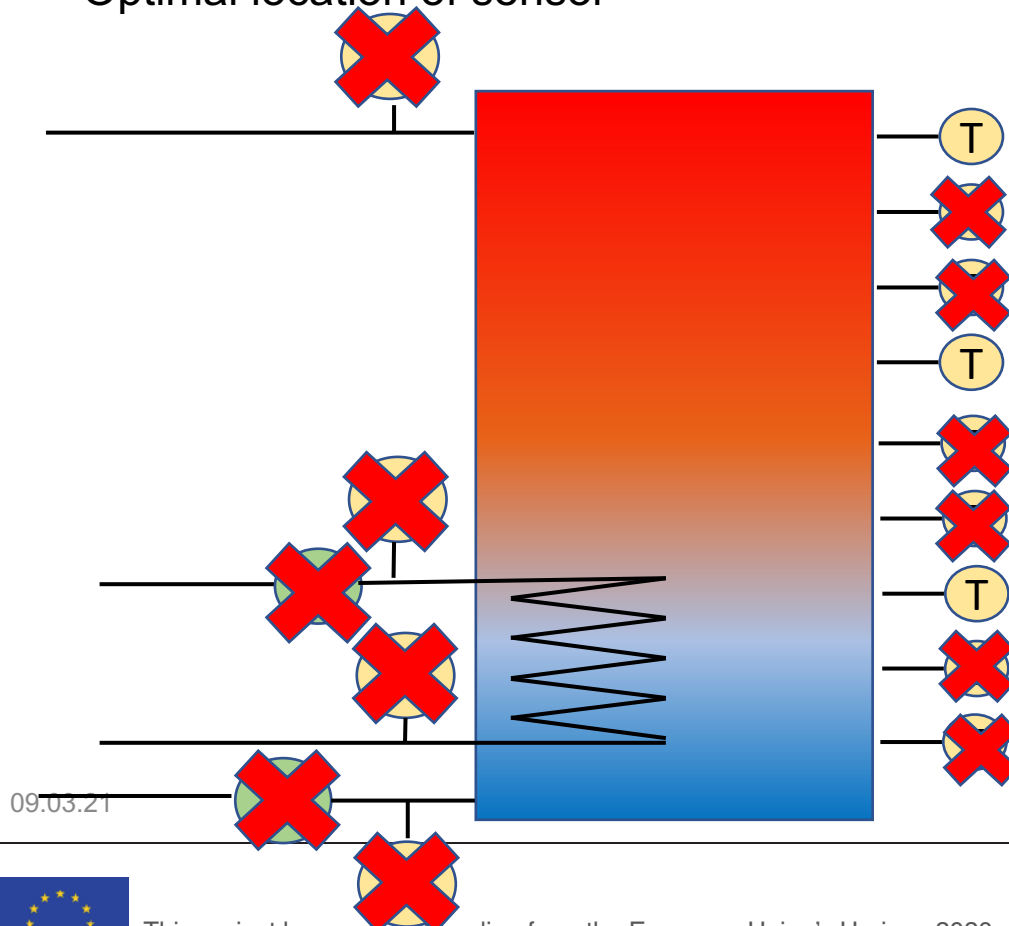
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Energy content of water storage tanks

VITO solution - procedure

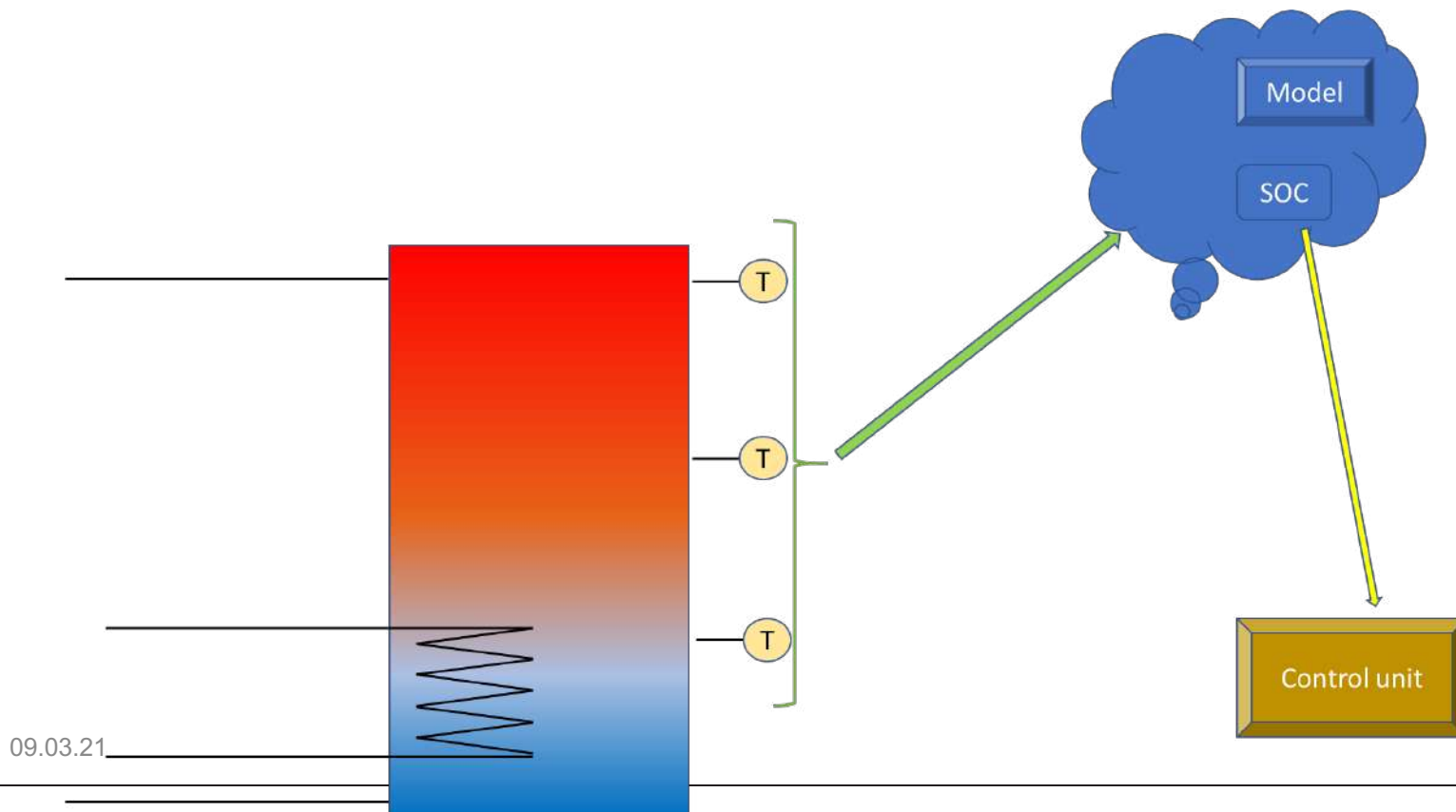
- Reducing number of sensors (no flow meters, only temperature sensors)
- Optimal location of sensor



Energy content of water storage tanks

VITO solution

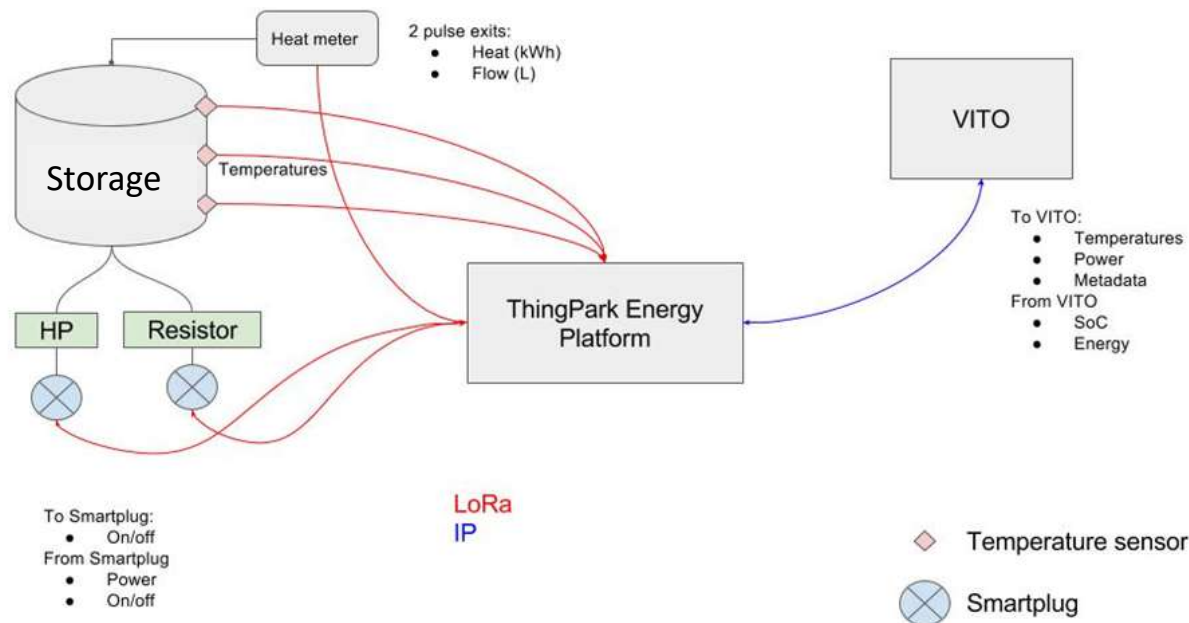
- Cloud application (API – Application Programming Interface)



Energy content of water storage tanks

VITO solution

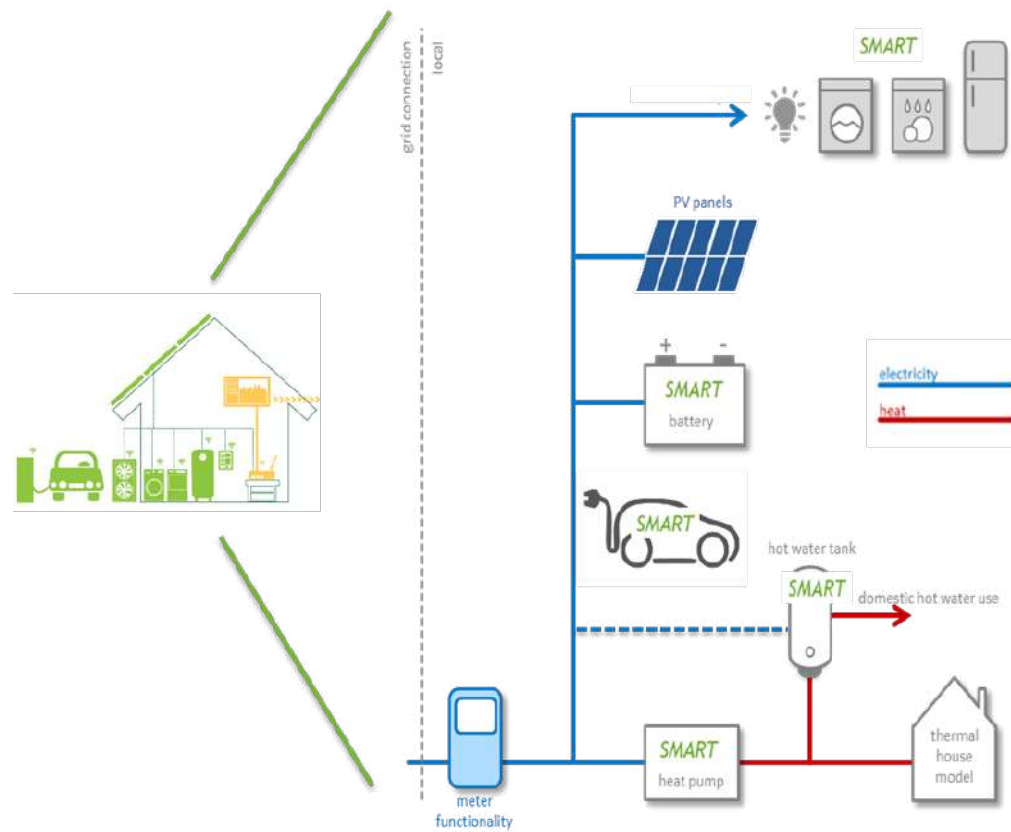
- Tested solution (Story-demonstration project in Oud-Heverlee)



Energy content of water storage tanks

VITO solution

- Used in our VITO-Building Energy Management System



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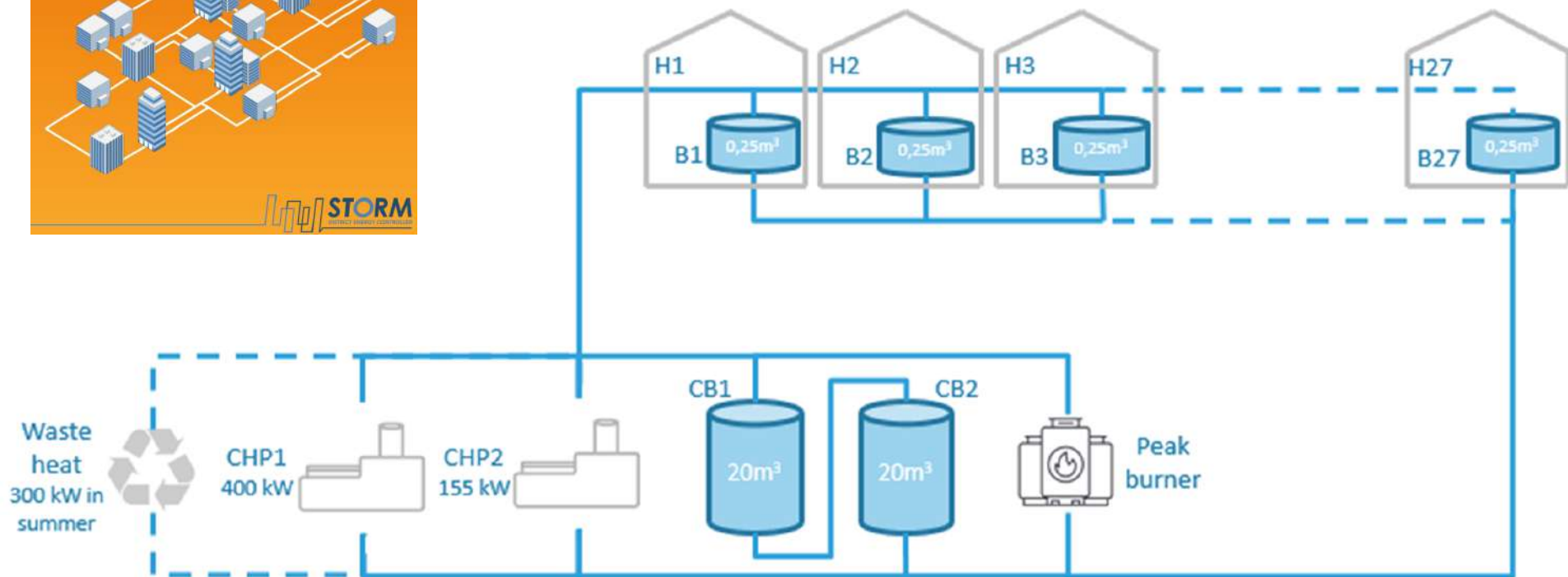
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Energy content of water storage tanks

VITO solution

- Implemented in our STORM district heating network controller



Energy content of water storage tanks

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THANK YOU!

