

Harvesting energy
FROM THE SUN

PTES the next generation of storing energy

Heat storage and monitoring results October 28th 2020

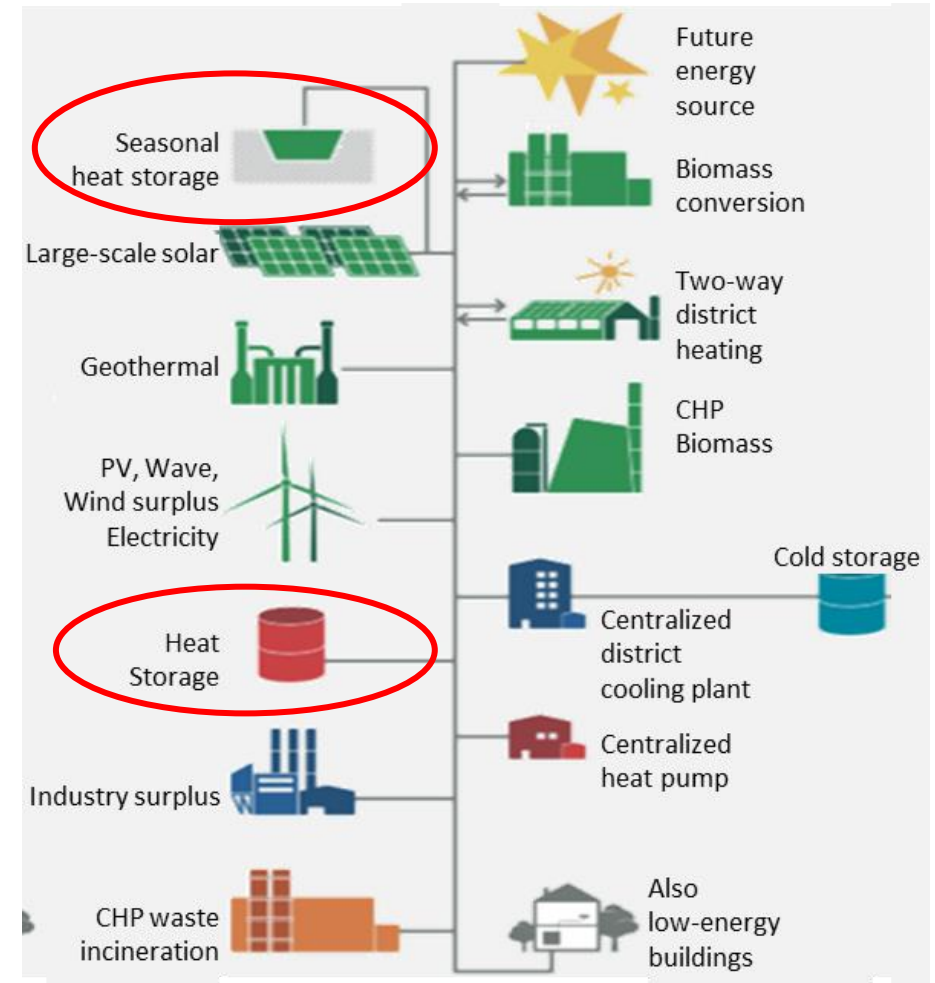
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The technology and functionality of PTES

Features of Aalborg CSP PTES technology

- The lifetime of the PTES is at least 25 years.
- The efficiency of the PTES is at least 90 %.
- The PTES is capable of storing heat up to maximum 90 °C.
- Reliability: Service and maintenance can be carried out without interfering with normal operation. This gives an availability factor of 100 %.
- Charging and discharging power is minimum 90 MW but can be customized.
- Once installed and operating the PTES requires a minimum of operational resources.
- At least 90 % of the components of the PTES are recyclable.
- The maximum yearly required amount of make-up water is 1,5‰ of the total volume of the PTES.

* All numbers based on 1.000.000 m³ PTES



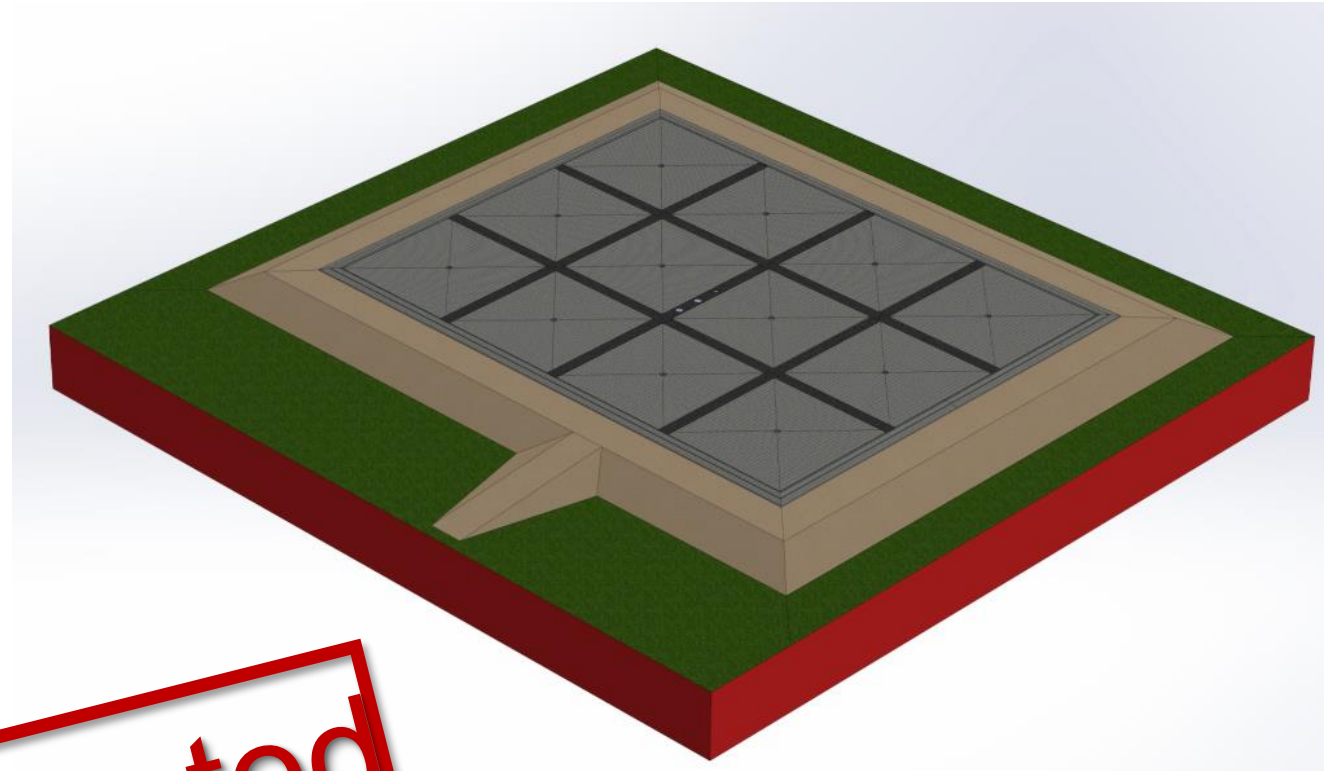
The technology and functionality of PTES

Patented solution

Patent 1- Diffusion open top cover construction to avoid water accumulation inside insulation material

Patent 2- Top cover surfaced is build in sections, each with own drain system for surface water

Size of PTES is easy scalable due to section design



Patented

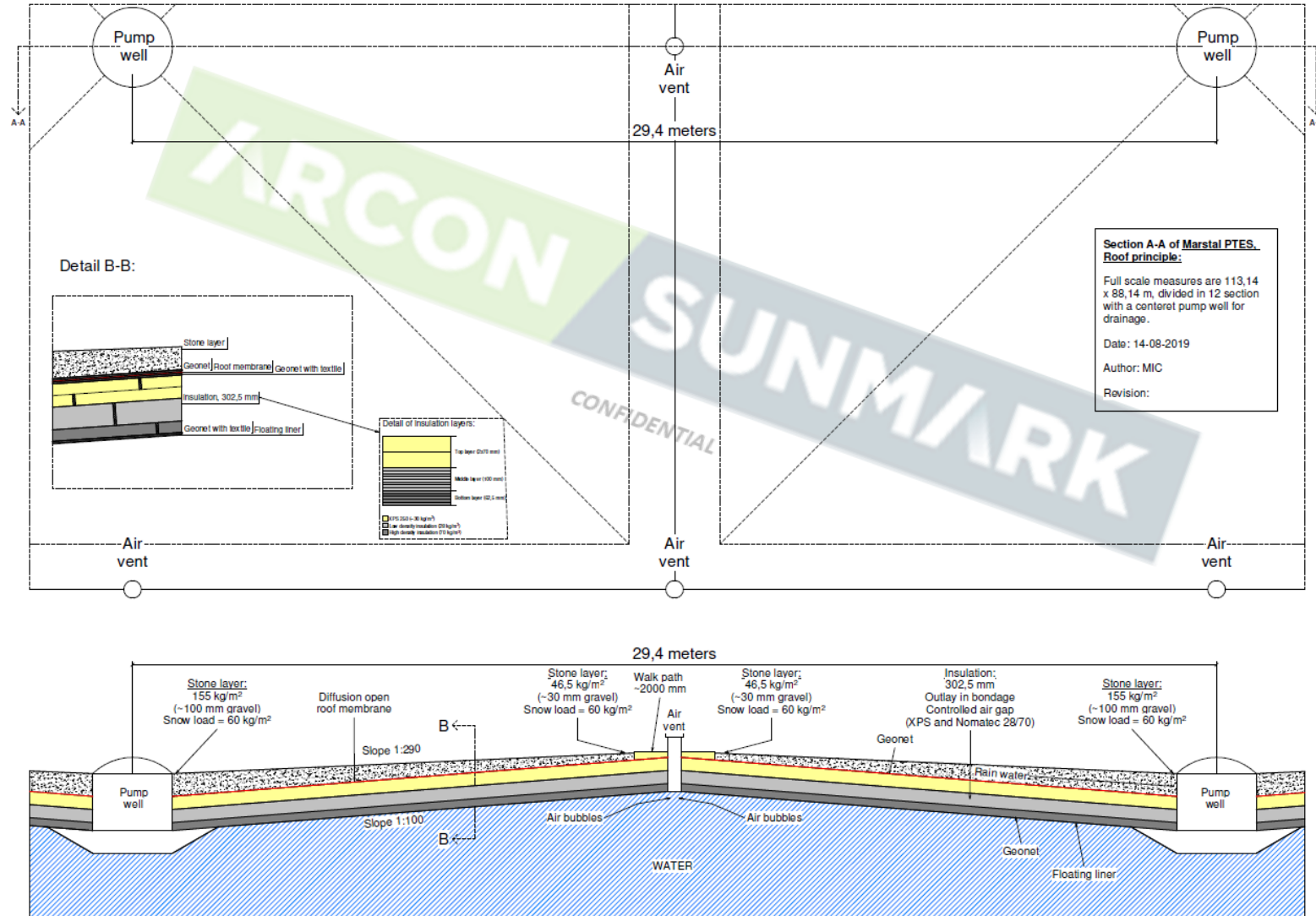
The technology and functionality of PTES

Draining of water and venting of air

The wedge shaped gravel layer on top of the top cover creates a slope pointing towards the centre of each section.

The water from the surface will run to the pump wells in each section

Under the surface, air bubbles will raise to the air vents, placed on the highest points on the section borders

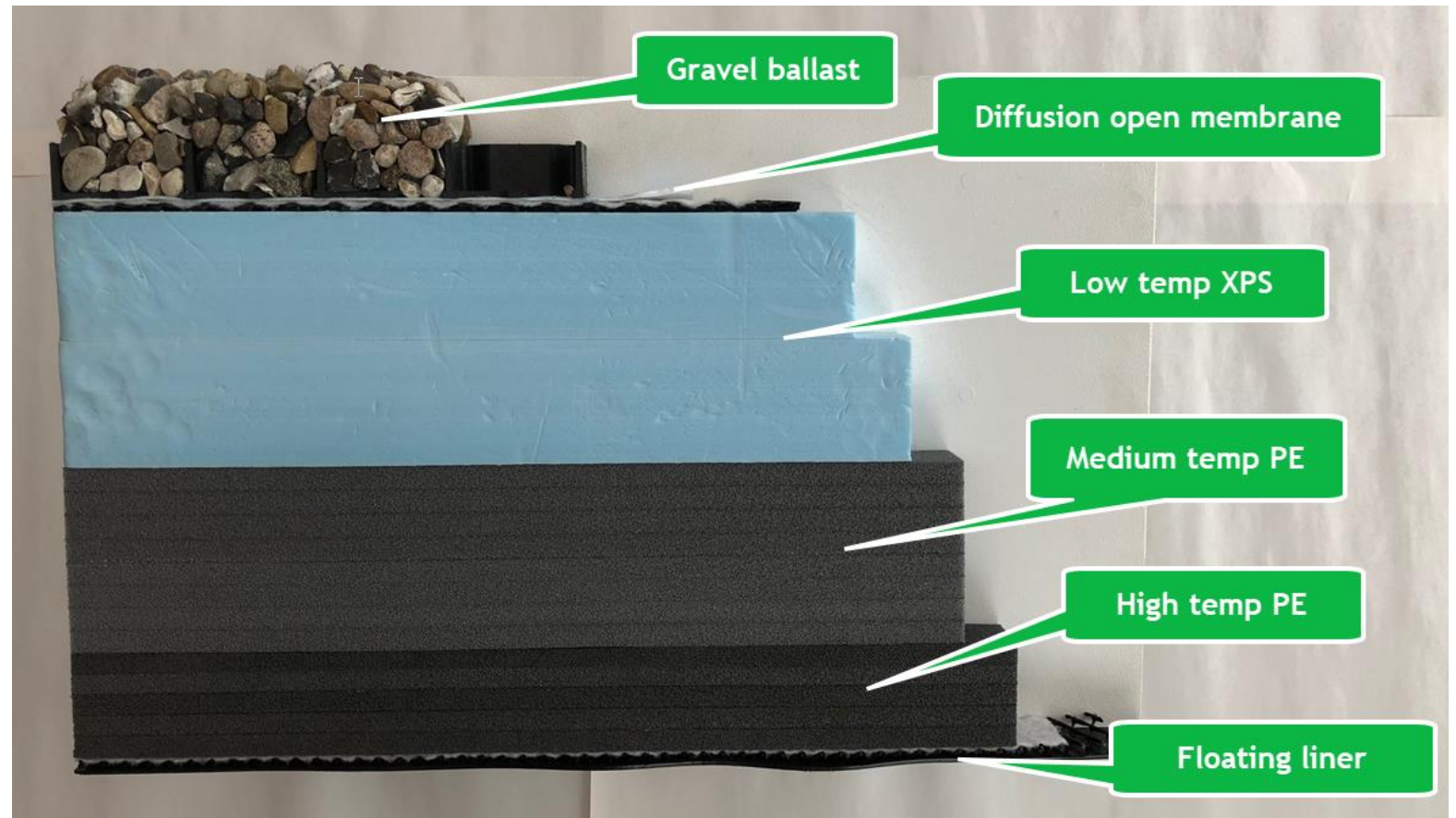


The technology and functionality of PTES

Build up of layers in lid

The top cover design consist of 11 layers of specialized materials

All materials has been tested and approved for 25 years lifetime at the relevant temperature profile



The technology and functionality of PTES

Technology appraisal
report from Lloyd's
pending



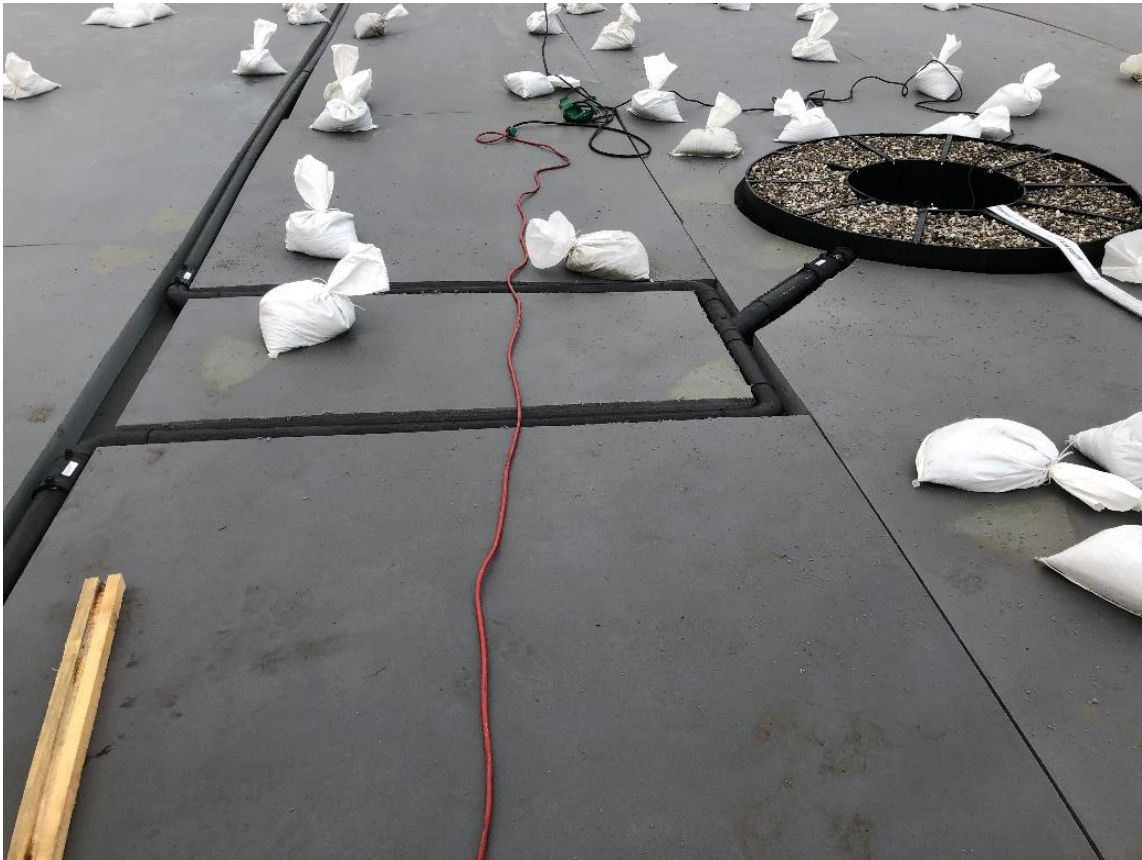
Pictures from Marstal installation



Pictures from Marstal installation



Pictures from Marstal installation



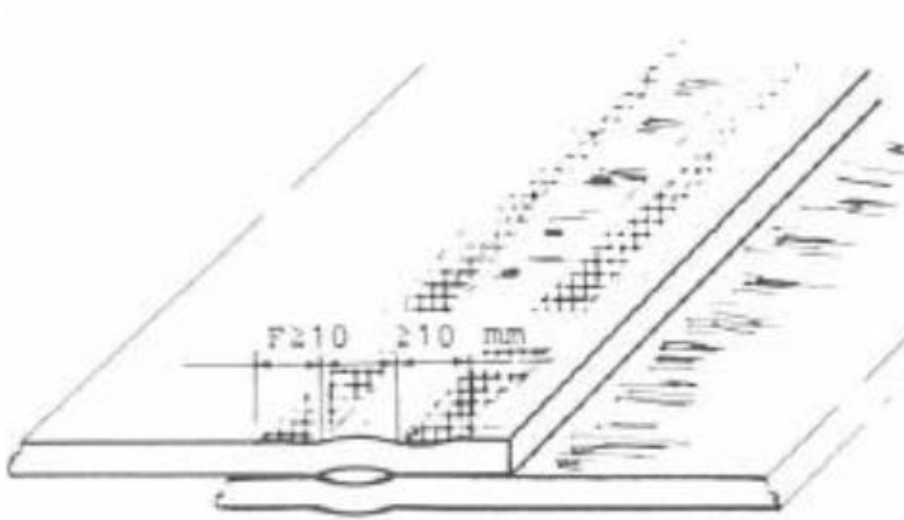
Pictures from Marstal installation



Validation of technology

Connections between rolls of liner material are connected via double weld seams.

Weld seams are 100 % tested by static pressure



Validation of technology

Water vapour diffusion through 2.5 mm
HDPE-liner: 3 to 5 g/m²/day @ 90°C

Development and validation of inverted roof
solution: Bunch Byggningsfysik and test facility
at Arcon-Sunmark

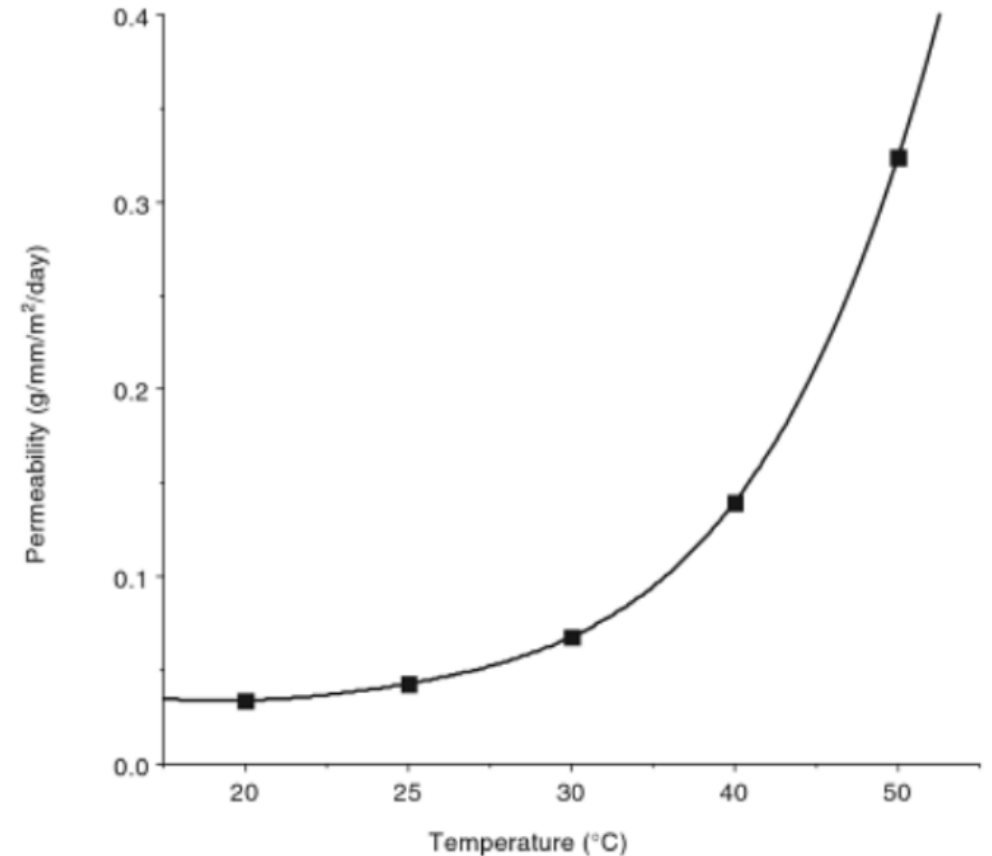


Arcon-Sunmark A/S

Report on cover for pit heat storage

KON17277-R004

2018-08-24



Water vapour permeability as a function of temperature for a typical HDPE liner [3]

Validation of technology



| | Probe 1 - Reference | Probe 2 - Rockwool | Probe 3 - Rockwool + 100 g H ₂ O | Probe 4 - Nomatec | Probe 5 - Nomatec + 100 g H ₂ O |
|------------|---------------------|--------------------|---|-------------------|--|
| Test 1 | | | | | |
| Test 2 | | | | | |
| Test 3 | | | | | |
| Test setup | | | | | |

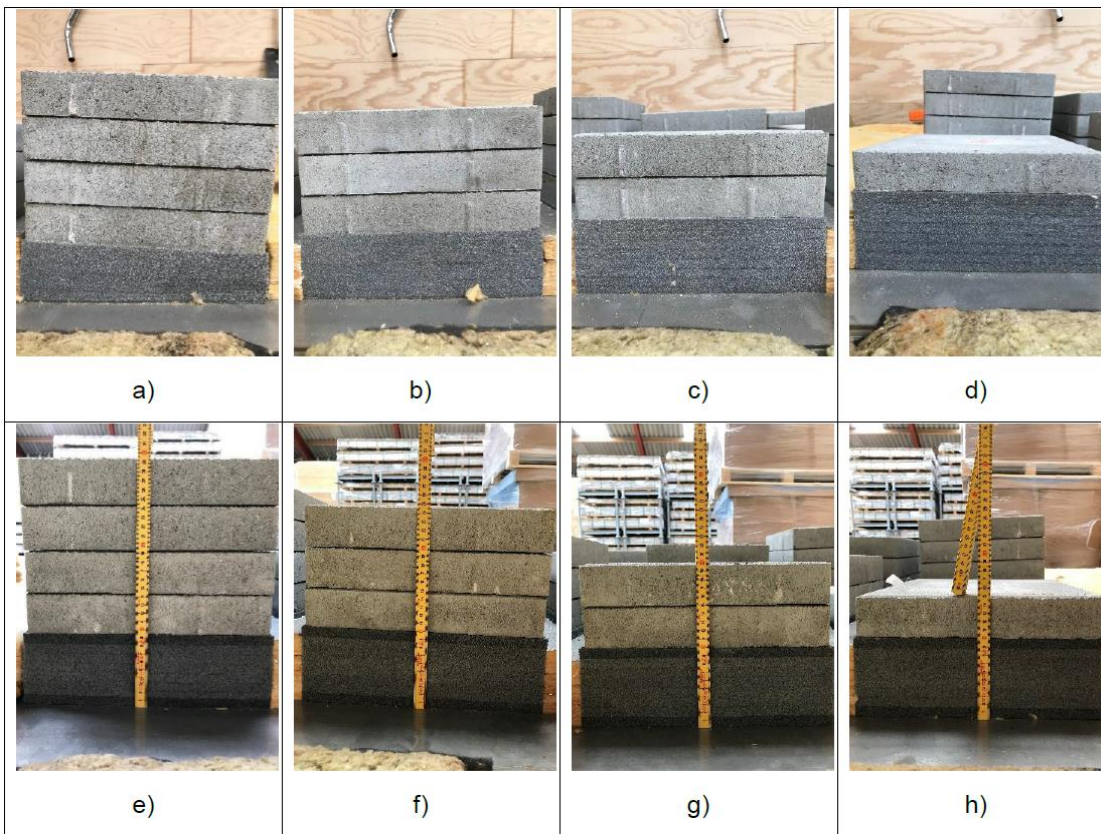
320009 - Diffusion test. Probes:
Probes and test setup description.

Date: 06-08-2019

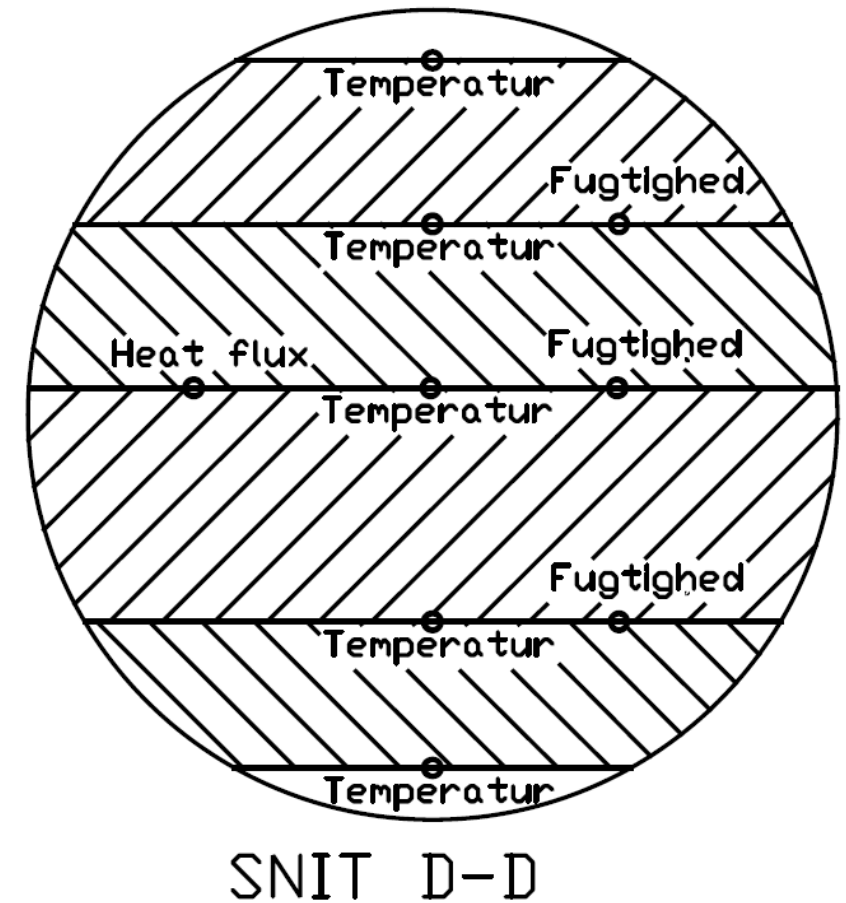
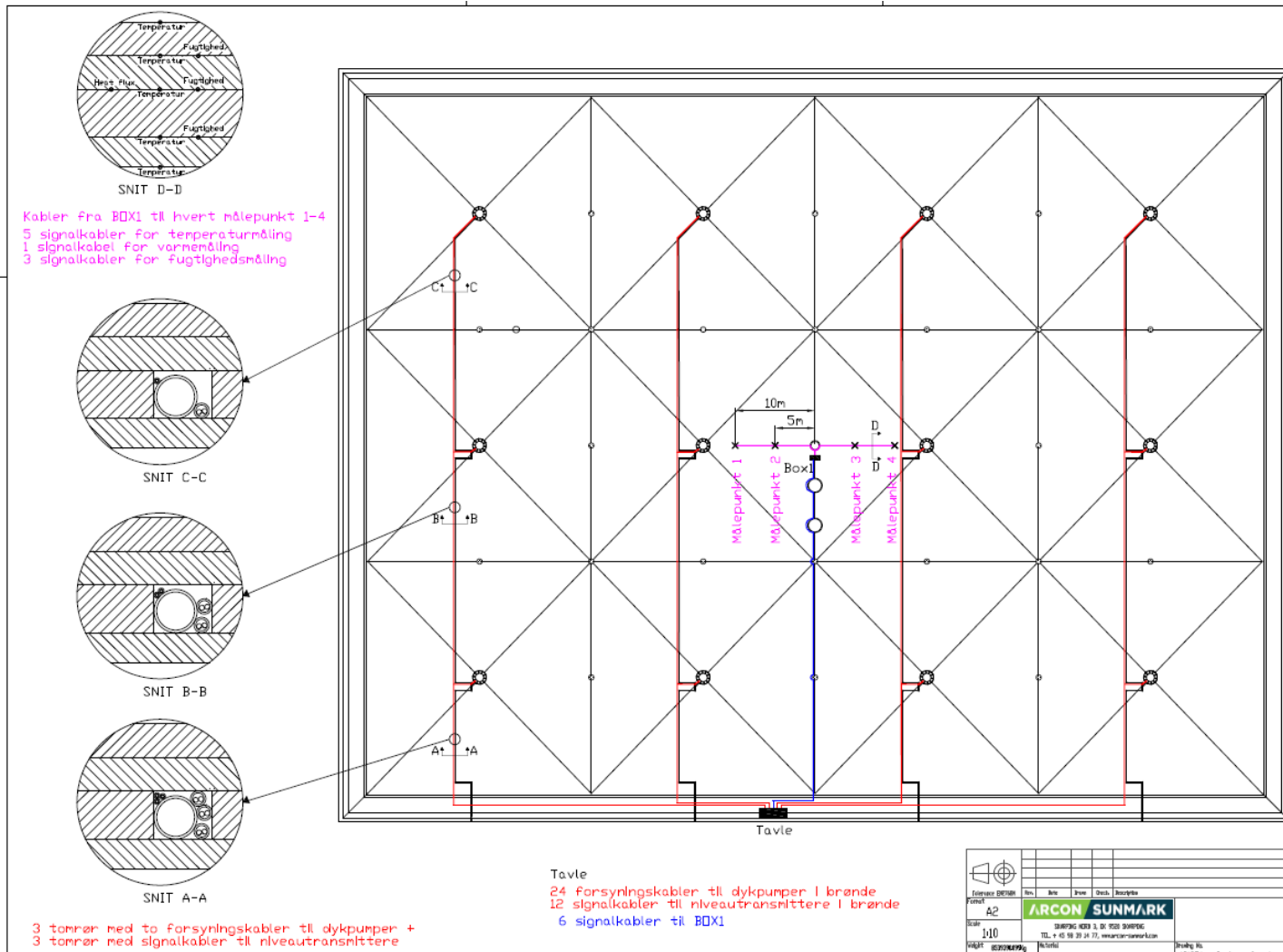
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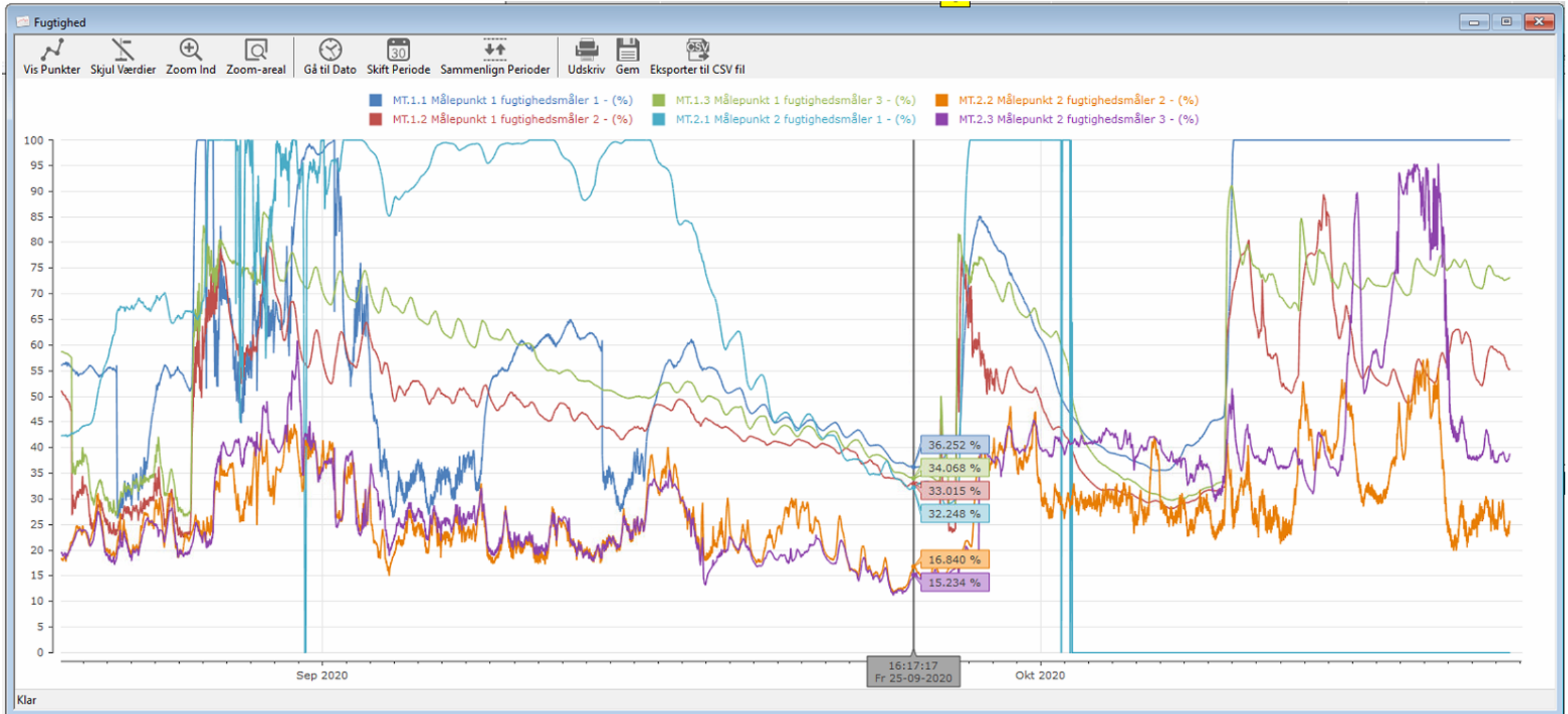
Validation of technology



Measurements from Marstal



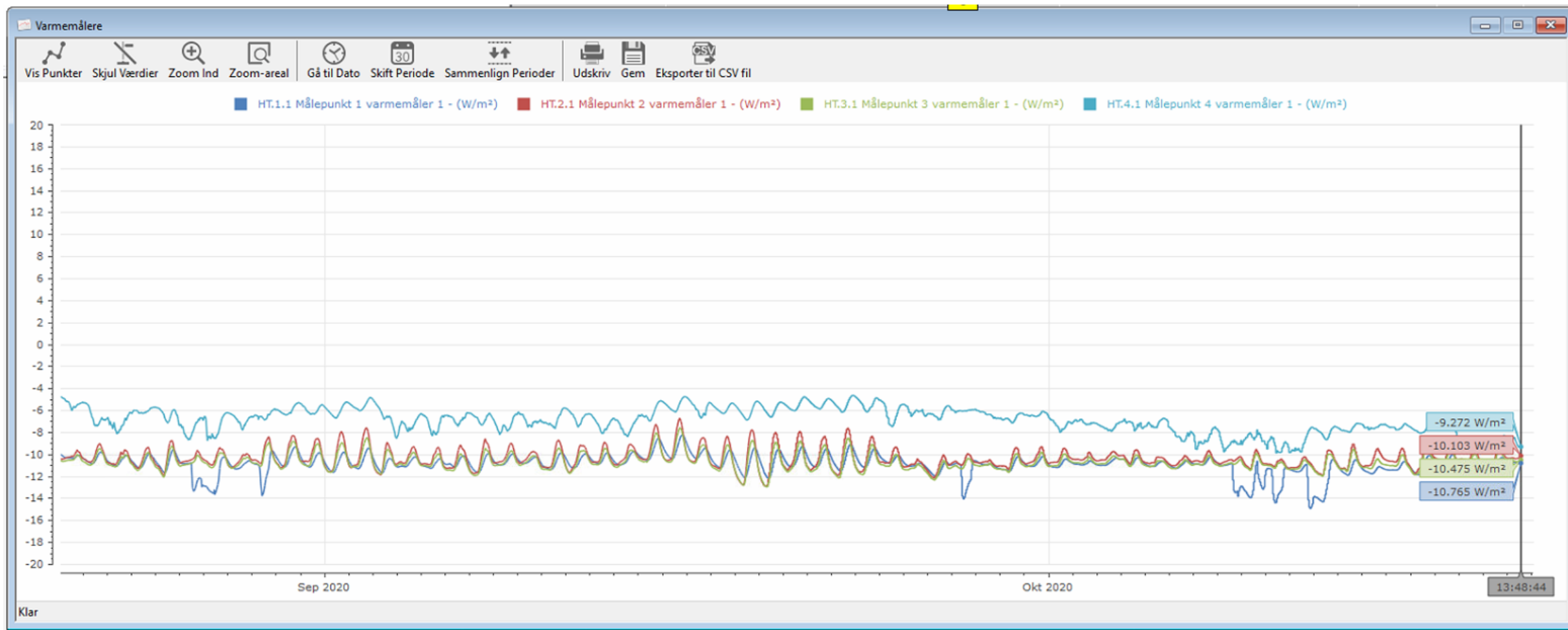
Measurements from Marstal



Measurements from Marstal



Measurements from Marstal



THANK YOU FOR YOUR ATTENTION

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