PTES
Development
In Denmark

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## Pit Thermal Energy Storages (PTES) in DK

<table>
<thead>
<tr>
<th>Project</th>
<th>Size $[m^3]$</th>
<th>Heat capacity $[MWh]$</th>
<th>Year of finalizing</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTU</td>
<td>500</td>
<td>43.5</td>
<td>1983</td>
</tr>
<tr>
<td>Ottrupgaard</td>
<td>1.500</td>
<td>638</td>
<td>2003</td>
</tr>
<tr>
<td>Marstal Sunstore 2</td>
<td>10.000</td>
<td>6.960</td>
<td>2012</td>
</tr>
<tr>
<td>Marstal Sunstore 4</td>
<td>75.000</td>
<td>5.500</td>
<td>2014</td>
</tr>
<tr>
<td>Dronninglund</td>
<td>60.000</td>
<td>11.300</td>
<td>2015</td>
</tr>
<tr>
<td>Gram:</td>
<td>122.000</td>
<td>18.800</td>
<td>2015</td>
</tr>
<tr>
<td>Vojens:</td>
<td>205.000</td>
<td>6.500</td>
<td>2017</td>
</tr>
<tr>
<td>Toftlund:</td>
<td>85.000</td>
<td>1.000</td>
<td>2018</td>
</tr>
<tr>
<td>(Langkazi, Tibet)</td>
<td>15.000</td>
<td>3.300</td>
<td>2022</td>
</tr>
<tr>
<td>Høje Tåstrup</td>
<td>70.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Dronninglund 2013-14 – 60,000 m³

Supported by EUDP (Danish national support scheme)

- 37,573 m² solar collectors
- 60,000 m³ pit heat storage
- 2.1 MW cooling absorption heat pump *
- Bio oil boilers
- Gas engines

* originally, now combined with an air-water heat pump of 5.5 MWth heating capacity
Dronninglund
Høje Taastrup 2019-22 - 70,000 m$^3$

Supportet by EUDP (Danish national program)

70,000 m$^2$ pit heat storage 90°C constant 30 MW in- and outlet
New PP-liner
New generation of insulation material in lid
Høje Taastrup

Storage content (MWh)
Integrate 2 supported by EUDP

- In Integrate 2 next generation of Pit Thermal Energy Storages is developed
- VEKS (DH municipality owned transmission utility) and Hjørring-Hirtshals (utilization of excess heat from Hirtshals Harbour) are cases.
Integrate 2 - Test of materials

Tests

- Test of membranes at high temperatures in laboratory
- Test of membranes under real conditions
- Test of foams for insulation in the lid
- Test of material for weight pipes
- Test of fiber glass for in- and outlet
- Design solutions

Test of foams in heating chambers

Heating chamber - exposure in dry and damp heat
Thank you for attention
Questions?

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For further information