

District Heating Conference Lithuania

Denmarks history up to 2015, Cost Effective Pit Heat Storage

29-30 September 2015, Vilnius

[→]

Special Featured Projects:

Vojens 195,000 m³

Marstal 75,000 m³

Gram 122,000 m³

Dronninglund 69,000 m³



[DURABILITY RUNS DEEP]

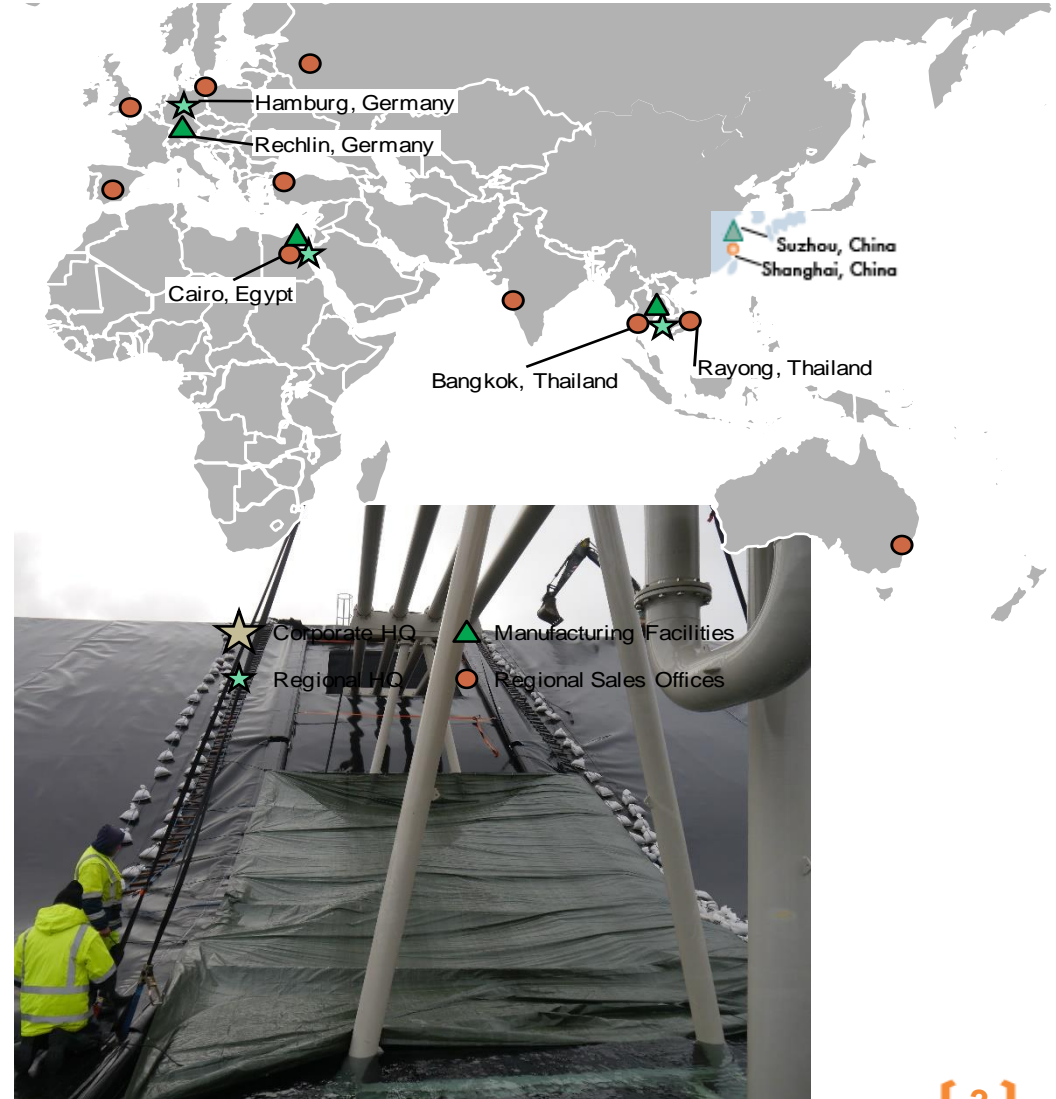
Content

- What is GSE?
- General history with heat storage in Denmark
- Our GSE heat storage projects since 2012
- Alternatives in design and future progress, developments since 2012, discussion.....?



GSE—Shaping an industry

- Worldwide presence
- Environmental focus
- High technical competence, worldwide engineering staff
- Able to custom design specific solutions based on experience
- Experience in all fields of geotechnical solutions
- Tested and certified proven solutions
- Specific and relevant experience in heat storage



History of heat storage in Denmark



- Developed since 1980....
- Different techniques used, steel tanks, groundwater (Aquifer), bored holes, concrete tanks.
- One of the most efficient are PTES; Pit Thermal Heat Storage
- Comes originally out of government spend for re-newable energy development
- Gram and Vojens are commercially self bearing as per 2014-15

Existing GSE heat storages

- Sunstore 4, **75 000 m³** **2012**
- Sunstore 3, **69 000 m³** **2013**
- Vojens, **195 000 m³** **2015**
- Gram, **122 000 m³** **2015**



Sunstore 3

Dronninglund Fjernvarme

anno 2013

Project: Sunstore 3 Dronninglund
Owner: Dronninglund Fjernvarme
Installer: PBJ Miljø aps
Volume: 69 000 m³
Depth: 16 meters
Size of cover: 91 x 91 meter
Finished: September 2013
Time to fill up: 9 Weeks



Products used

Baseliner: 13-04-04-HP-HD-250-PSD-E / GSE 2,5 mm HD Black Liner
Bottom float: 13-04-04-HP-HD-200-PSD-E / GSE 2 mm HD Black Liner
Separation layer: Geonet / GSE 5 mm Hypernet CN-E
Insulation: Encapsulated Polyethylene Foam / 240 mm
Separation layer: Geonet / GSE 5 mm Hypernet CN-E
Upper Liner: HDS-150AM-UBB-V-00 / GSE 1,5 mm HD Grey Liner
Fastening system wind up lift:
Vacuum vents

Special installation features:

- Length of rolls adapted to size of pond
- EFT Test performed before filling pond, (in other words control of 100% leak free functions)
- Special upper liner color (in GREY) formulated to adapt to local environmental permits



Vojens (commercial project)

Vojens Fjernvarme

anno 2015

Project: Vojens (a commercial project)
Owner: Vojens Fjernvarme
Installer: GSE Lining Technology GmbH
Volume: 195 000 m³
Finished: Summer 2015
Time to fill up: approx. 5 months

Products used

Baseliner: GSE 2,5 mm High Temperature Liner
Bottom float: GSE 2 mm High Temperature Liner
Separation layers: GSE Fabrinet
Insulation: Leca balls, up to 700 mm.
Separation in insulation layer: Geonet
Upper Liner: GSE 1,5 mm HD Grey Liner

Fastening system wind up lift:

Vacuum vents

Special installation features:

- UV system for dewatering
- 4 m in diameter opening over diffuser tower
- Prefabricated vents to floating liner to evacuate trapped air



Gram (commercial project)

Gram Fjernvarme

anno 2015

Project: Gram (a commercial project)
Owner: Gram Fjernvarme
Installer: GSE Lining Technology GmbH
Volume: 122 000 m³
Finished: Summer 2015
Time to fill up: approx. 4 months

Products used

Baseliner: GSE 2,5 mm High Temperature Liner
Bottom float: GSE 2 mm High Temperature Liner
Separation layers: GSE Fabrinet
Insulation: Leca balls, up to 700 mm.
Separation in insulation layer: Geonet
Upper Liner: GSE 1,5 mm HD Grey Liner

Fastening system wind up lift:

Vacuum vents

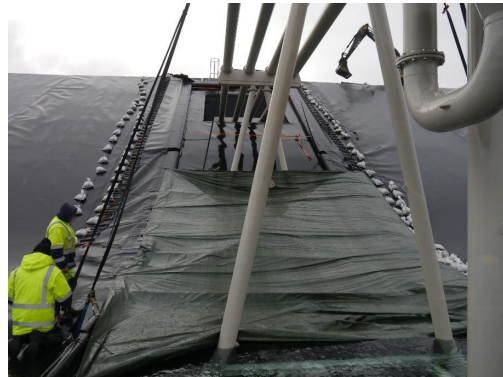
Special installation features:

- UV system for dewatering
- 4 m in diameter opening over diffuser tower
- Prefabricated vents to floating liner to evacuate trapped air



Alternatives in design and future progress since 2012

- Liner development
- Insulation
- Filling with water
- After care
- Leak control
- Floating liner installment options
- Known issues after heating
- ***State of the art at 2015 is with GSE***



Costs for Danish Market:

Conventional tech cost; insulated steel tanks + 150€ per m³ 2105

Cost for same storage function PTES

- at Sunstore 4 39€ per m³ 2012
- at Sunstore 3 25€ per m³ 2013
- at Vojens 21€ per m³ 2015



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Thank you!

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Questions...?



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