TREASURE

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Task 45 Webinar

Planning, Regulatory, Societal, and Financial Dimensions of Large-Scale Thermal Energy Storage Implementation. PTES

Presenter PlanEnergi

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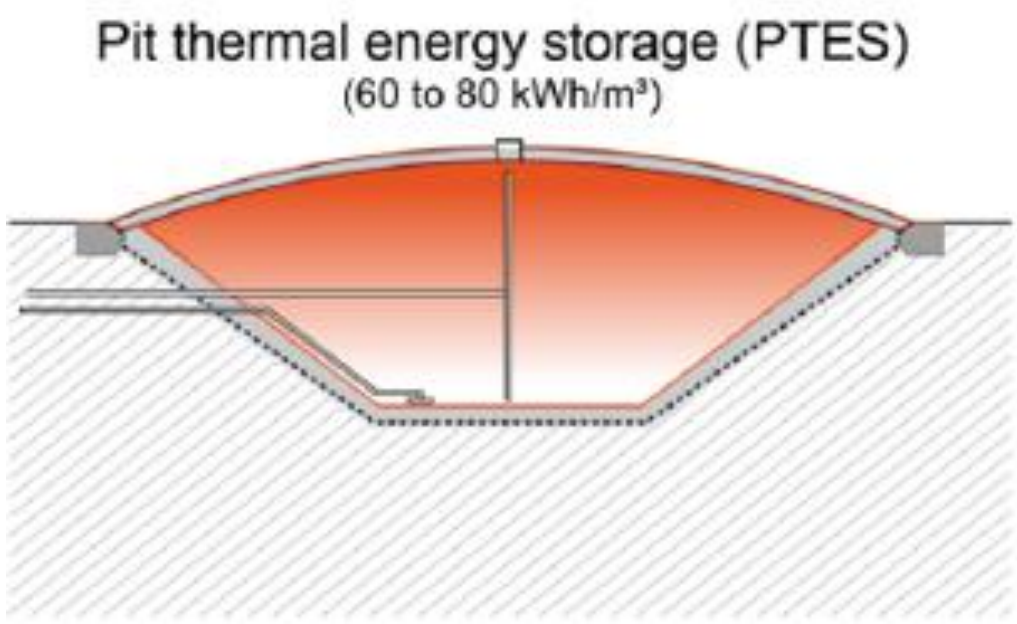
Content

1. Do we need a PTES storage?
2. Will it be economically feasible?
3. How to get permission

Do we need a PTES storage

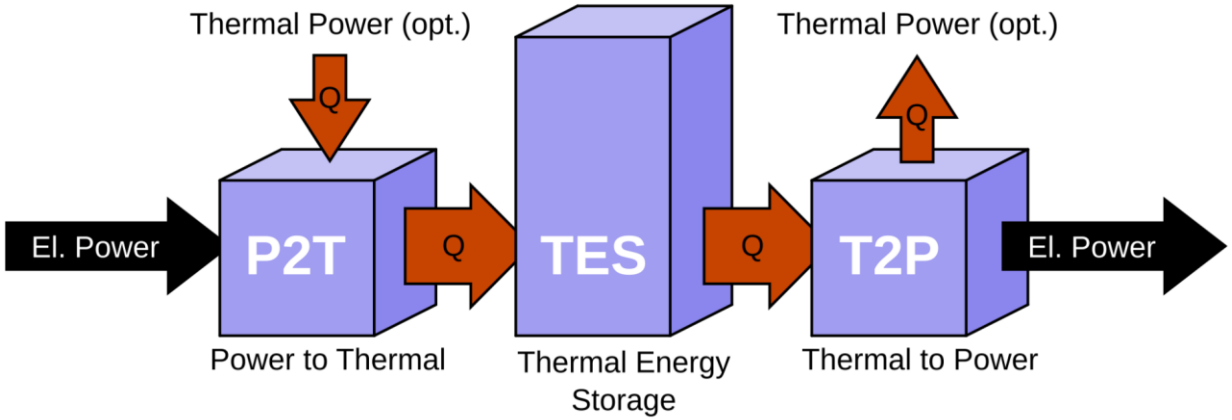
The price for storing 1 kWh of heat in a PTES storage with one yearly storage cycle is app. 3-4 €$_{cents}$

1. Storage for solar heating (adds flexibility in relation to variable solar radiation)
2. Storage for surplus heat from e.g. waste incineration and industries
3. Storage for cogeneration (adds flexibility in relation to the electricity market)
4. Storage for heat from heat pumps(adds flexibility to the electricity market)
5. Storage for electric boilers (adds flexibility in relation to the electricity market)
6. Reduction of peak load in district heating systems in winter and replacement of fossil peak load



Do we need a PTES storage II

7. Long-term heat storage of heat from PtX plants (Production of hydrogen, methane, methanol, ammonia)
8. Long-term heat storage of geothermal heat
9. Long-term heat storage of cheap summer heat from heat pumps (e.g. from data centers, cold stores, compressors..)
10. As a cold storage and supplier of district cooling (if there is a heat pump connected to the storage)
11. As a heat source for a Carnot Battery.



Will it be economically feasible?

We prefer to use energyPRO for feasibility calculations

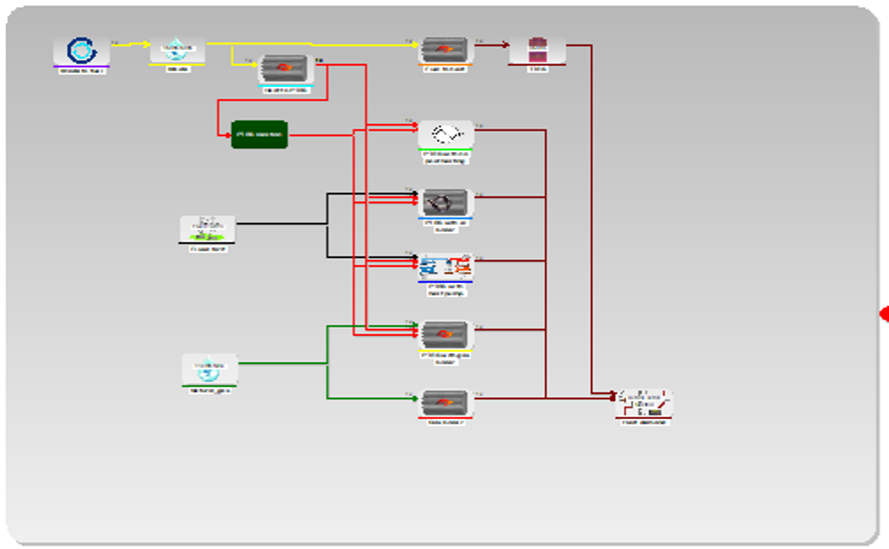
- energyPRO is developed by EMD International A/S, DK (https://www.emd-international.com/energypro/).
- energyPRO is the leading software for modelling, analyzing, and simulating complex energy projects with cross sectional optimization including electricity, PtX, hybrid and thermal energy (such as process heat, hot water and cooling).
- energyPRO is used for detailed technical and financial analysis of both existing and new energy projects in a very user-friendly interface providing the user with a clear overview of the project. The software offers a long range of technical and economic reports including graphical presentation of the simulated operation which provides an overview and in-depth understanding of the dynamics in a complex energy system.
- The calculations are made under due consideration to any conditions specified in the project offering precise results in a printable format accepted by the World Bank and international investment banks. With its flexible and generic structure, energyPRO can be used to model virtually any type of energy plant. The possibilities are almost endless. The list below provides some examples of which analyses can be performed with the software.

energyPRO • Selected PROS and CONS

- PROS – Why use energyPRO to simulate PTES ?
  - Powerful software to model and simulate energy systems.
  - Easy to learn – Much more accessible than e.g. TRNSYS.
  - User-friendly interface.

- CONS – What are the limitations when using energyPRO to simulate PTES ?
  - All relevant temperatures must be specified before starting the simulation.
  - Energy content in thermal storages are based on MWh, not temperatures.

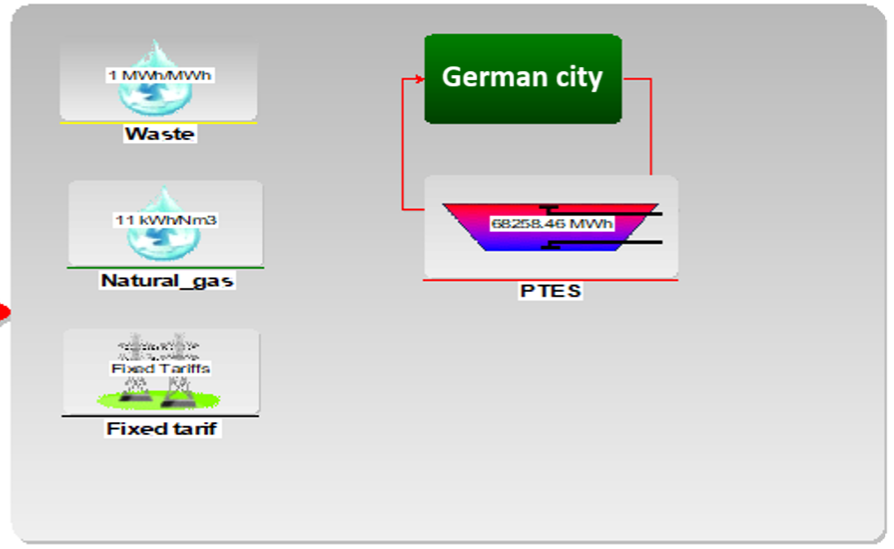
Example: German city with waste incineration CHP – 1/3



German city

f x

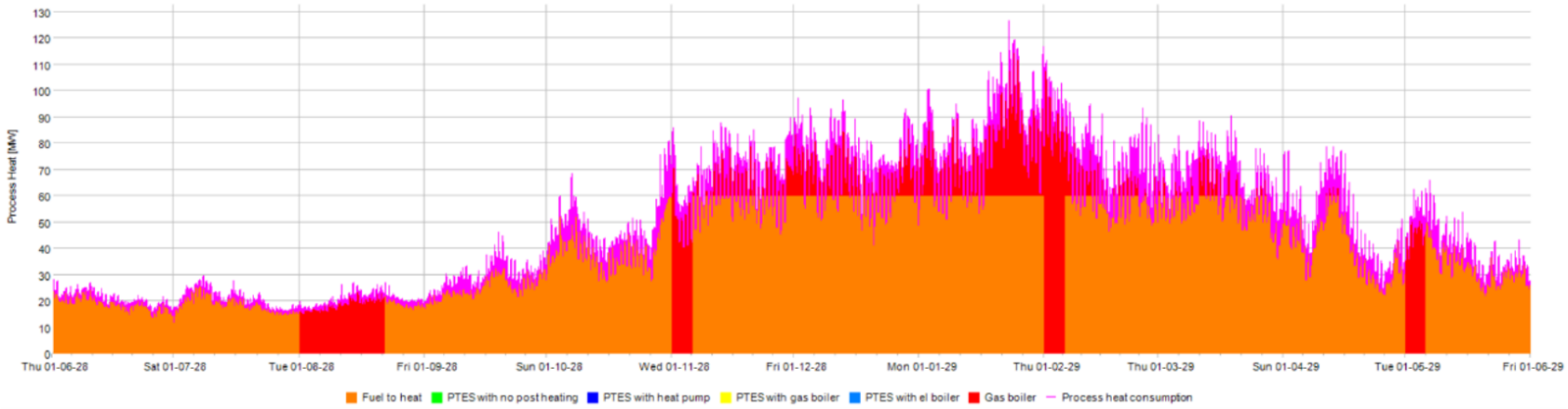
f x



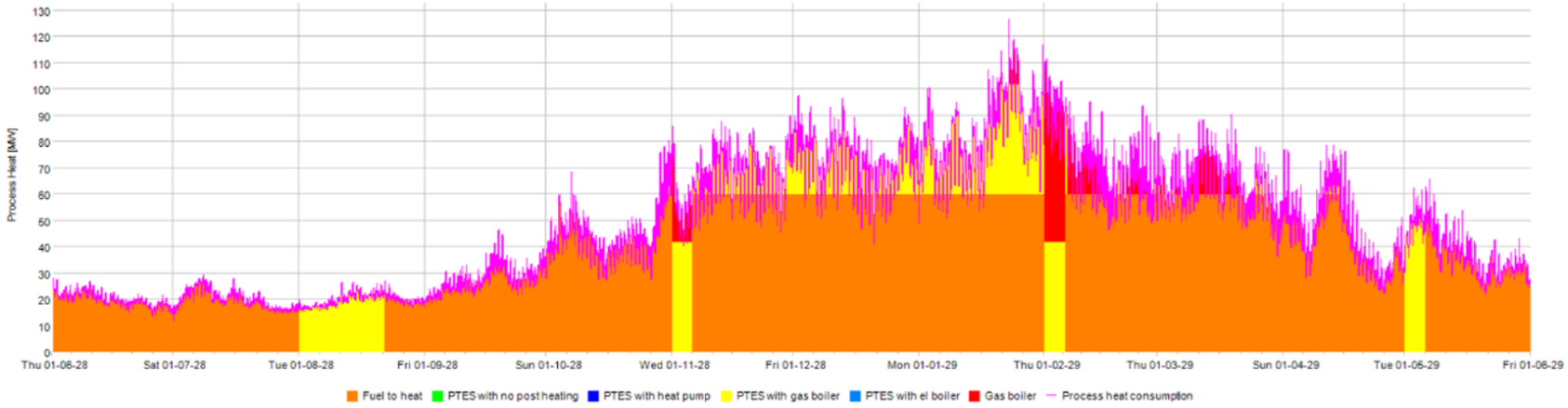
PTES location

Example 2: German city with waste incineration CHP – 2/3

- Heat load and heat production
- Without PTES

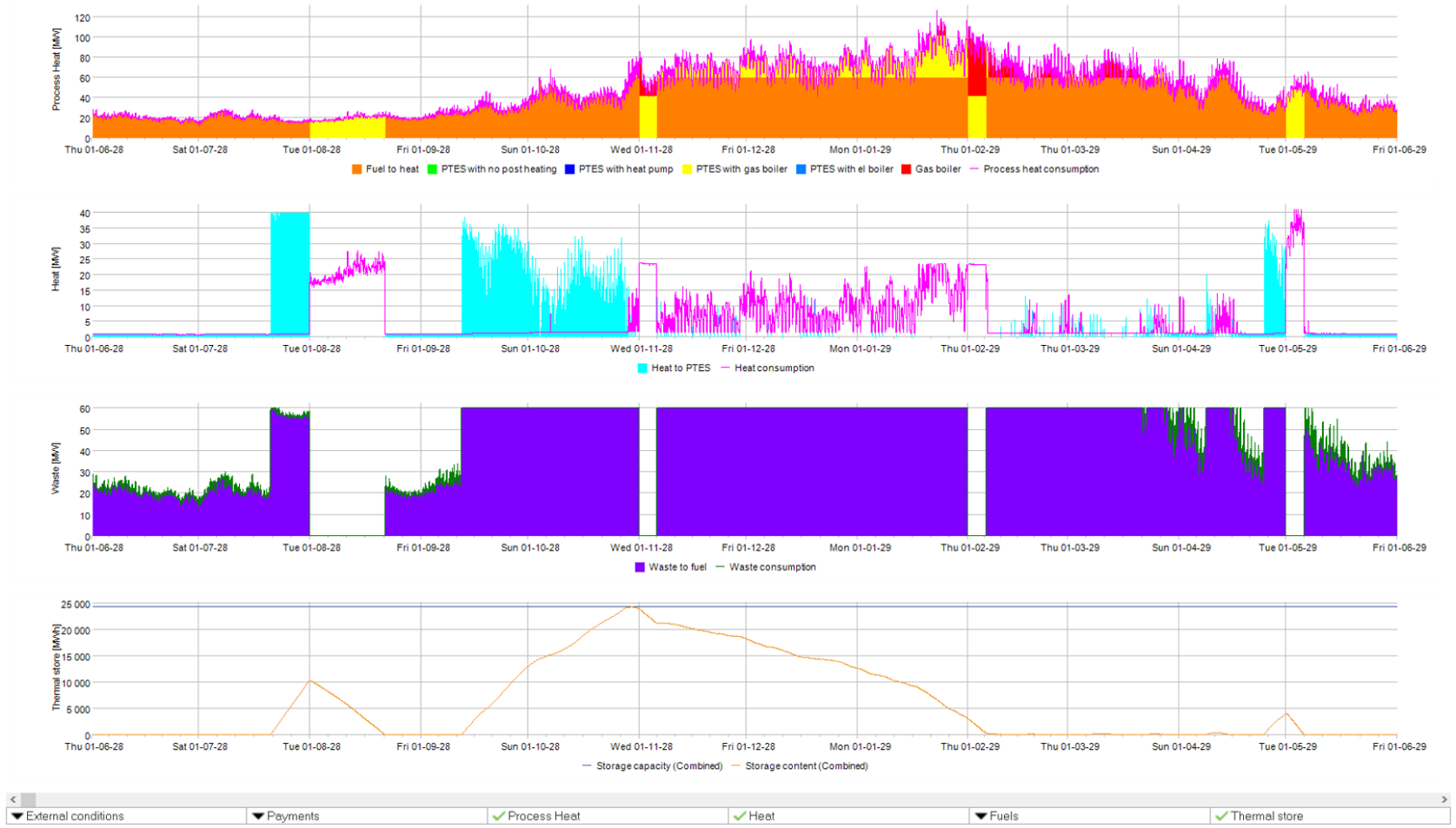


- Heat load and heat production
- With PTES



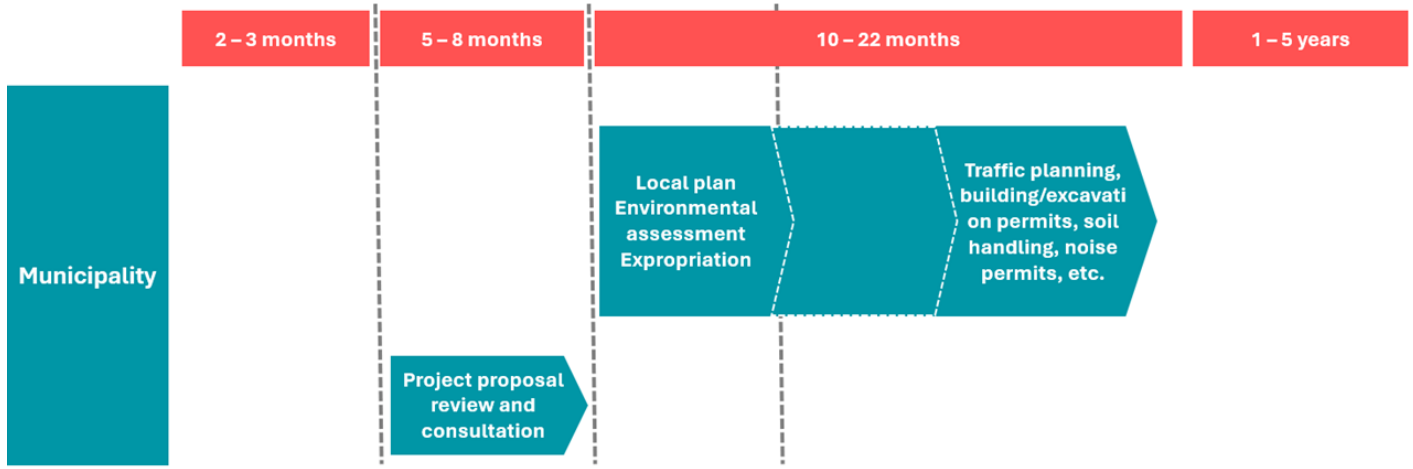
Example 2: German city with waste incineration CHP – 3/3

- Heat load and heat production
- Charging and discharging of PTES
- Load on waste incineration plant
- PTES SoC



How to get permission in DK: Heat Supply Act

- The municipality has the **authority** to approve projects
- Consumer economy has to be positive, socio economy has to be positive, greenhouse gas emissions have to be reduced
- The Danish Energy Agency issues a **manual for calculations** including electricity and fuel prices the next 20 years, rules for depriciation periods and emissions from fuels. Investment and operation costs has as principle to be taken from Danish Energy Agency (DEAs) Technology Catalogue
- The plant owner must elaborate a **project proposal for approval.** A public phase of 4 weeks can be part of the process



Law of Planning

- Regulates **area utilization** (where to situate new city parts, industrial areas, new infrastructure etc.).
- Every municipality makes a **Municipal plan** and revise it every 4 years. A public phase of 8 weeks is part of the process.
- To the municipal plan can be added **Thema plans** for instance for situation of wind power plants.

- When an energy plant is built, a planning permission is needed. Normally a **Local plan** is elaborated. In the local plan the new energy plant is visualized and all consequences for landscape and environment are described. A public phase of 8 weeks is part of the process.
- As part of the local plan a **screening of environmental consequences** has to be elaborated
- If the environmental impact is estimated as significant an **Environmental Impact Assessment (EIA)** report is needed

Environmental Impact Assessment

Background: Municipal plan and other planning and legislation
Content in EIA: Comparison PTES with present situation for

- Landscape
- Biodiversity
- Climate conditions
- Groundwater
- Surface water and waste water
- Human helth
- Cultural heritageRisk of accidents
- Traffic

Case 1: Dronninglund

Supported by EUDP (Danish national support sceme)

37 573 m^2 solar collectors

60 000 m^3 pit heat storage

2.1 $MW_{cooling}$ absorption heat pump

Bio oil boilers

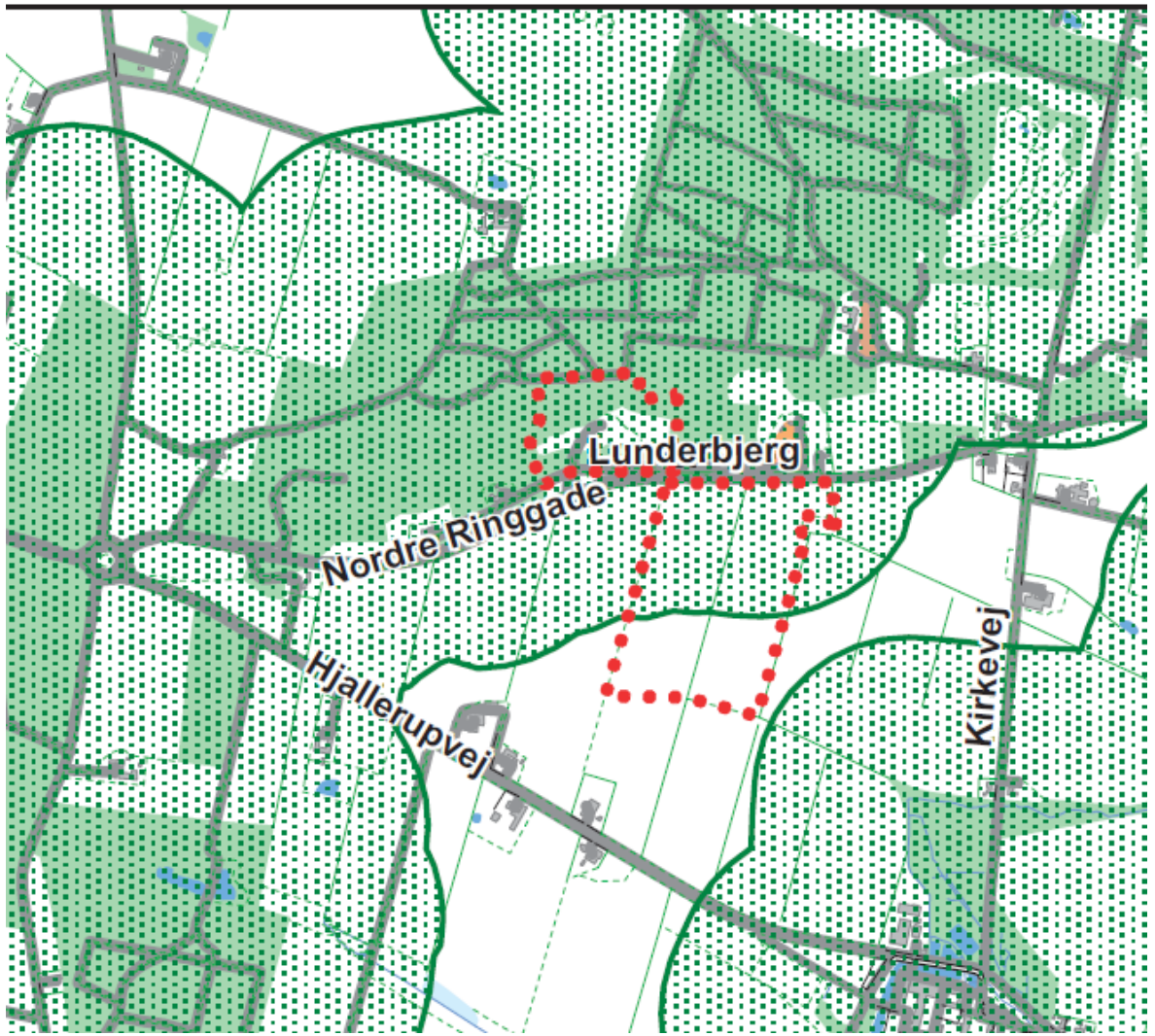
Gas engines

Permission procedure - Dronninglund

- First decision: No need for Environmental Impact Assessment Report
- Complain resulted in demand for an Environmental Impact Assessment report since consequenses of use of ground water for filling the storage was not described
- Local plan elaborated including permissions according to Law of Heat Planning, Law of Nature Protection, Law of Environmental Protection and the Municipal Plan
- Environmental Impact Assessment Report elaborated

EIA Dronninglund: Landscape 1

- No buildings 300 m from forest, but OK because banks of the storage will be with trees and buildings will not be visible



EIA Dronninglund: Landscape 2

Level for the storage top must be decided to avoid too high banks.

Plants must be placed at the storage banks.

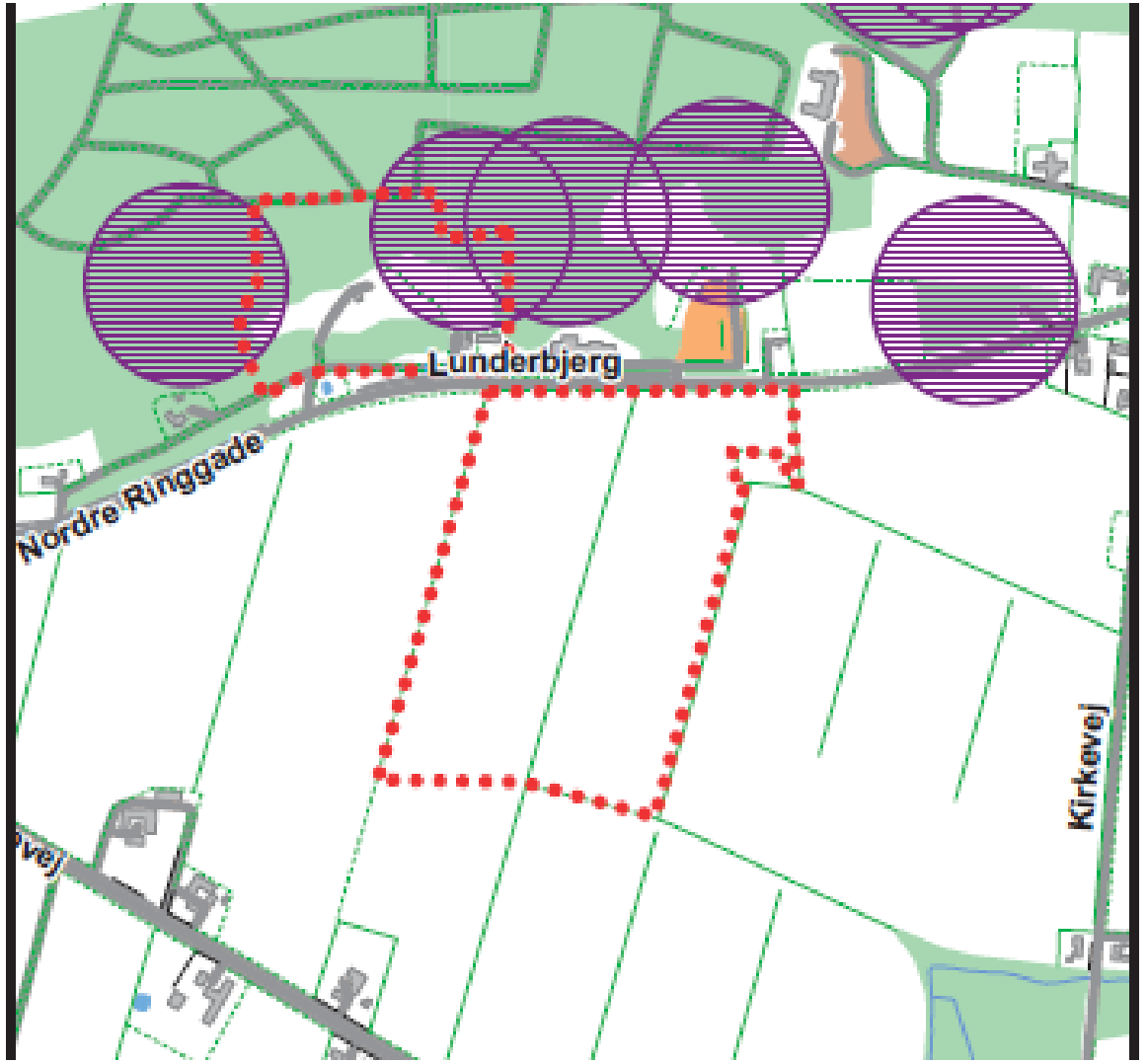
EIA Dronninglund: Cultural heritage

No buildings within 100 m

from memories, but OK because no changes in insight to

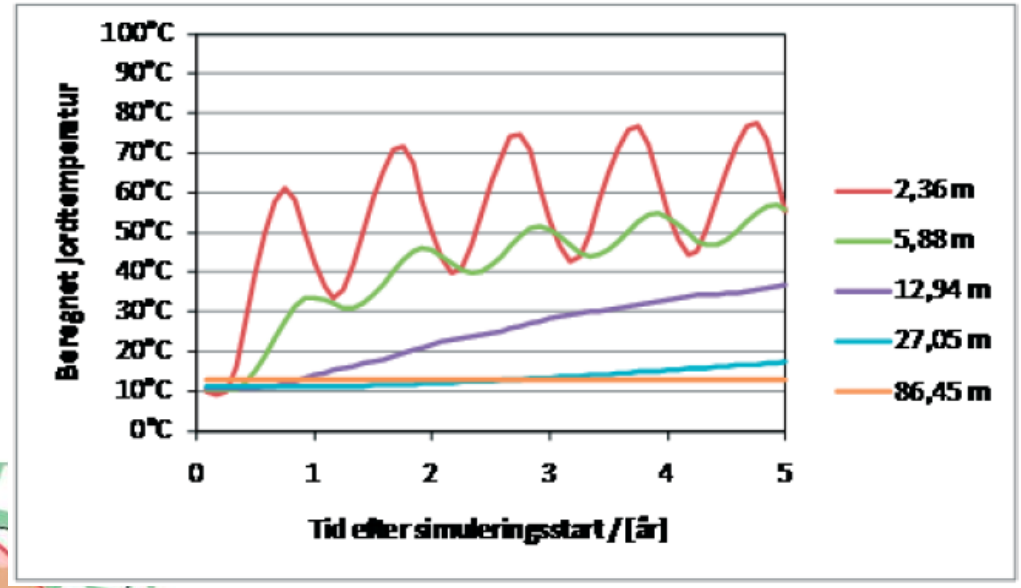
memories and no changes in sight from

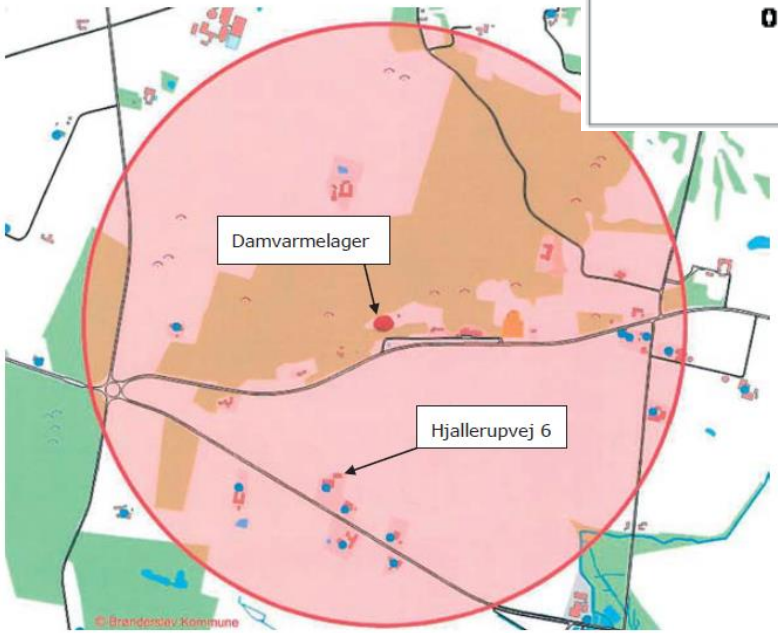
memories



EIA Dronninglund: Ground water

If doubts arise according to ground water temperature drilling and temperature monitoring can be required.





Case 2: Høje Taastrup

- Supportet by EUDP (Danish national program)
- 70.000 m^2 pit heat storage
- 90^oC constant
- 30 MW in- and outlet
- New PP-liner
- New generation of insulation material in lid

Screening of environmental impact, Høje Taastrup

- Protected areas? Natura 2000 or other protected areas
- Protected fauna
- Historical and cultural landscapes
- Utilization of ground water (report of district heating waters influence on ground water was annexed)
- Needs for getting rid of waste/water
- Changes in traffic
- People affected
- Is the area environmental vulnerable

Serious environmental consequenses?

Are consequenses reversible?

Result: The project can be implemented without Environmental Impact Assessment Report

WEBSITE

www.treasure-project.eu

PRESENTER

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Thank you for your attention!

Contact us if you have any questions.

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