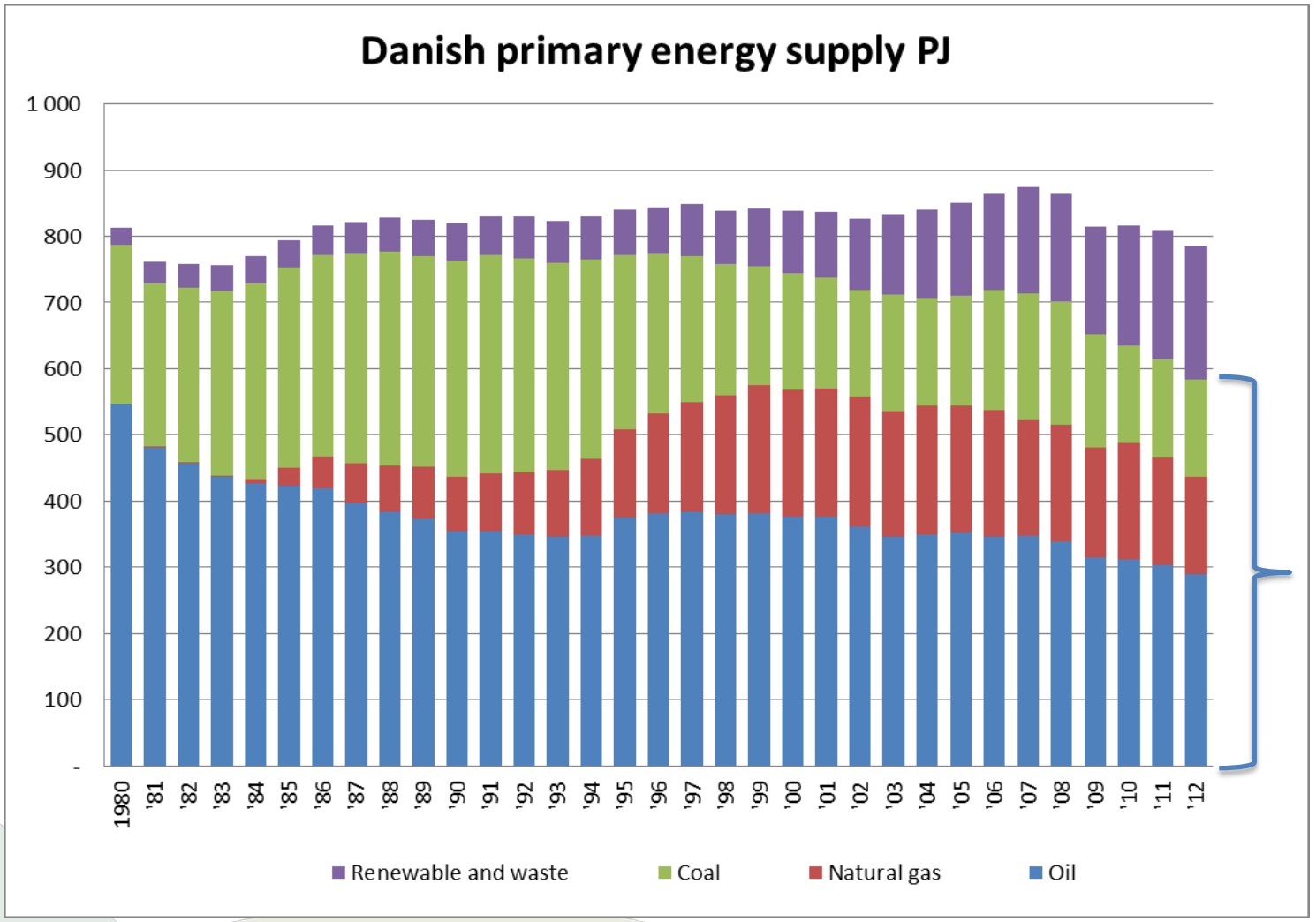
SMART ENERGY SYSTEMS

By Consultant John Tang

DANSK FJERNVARME

THE SITUATION



Removed
In 2050

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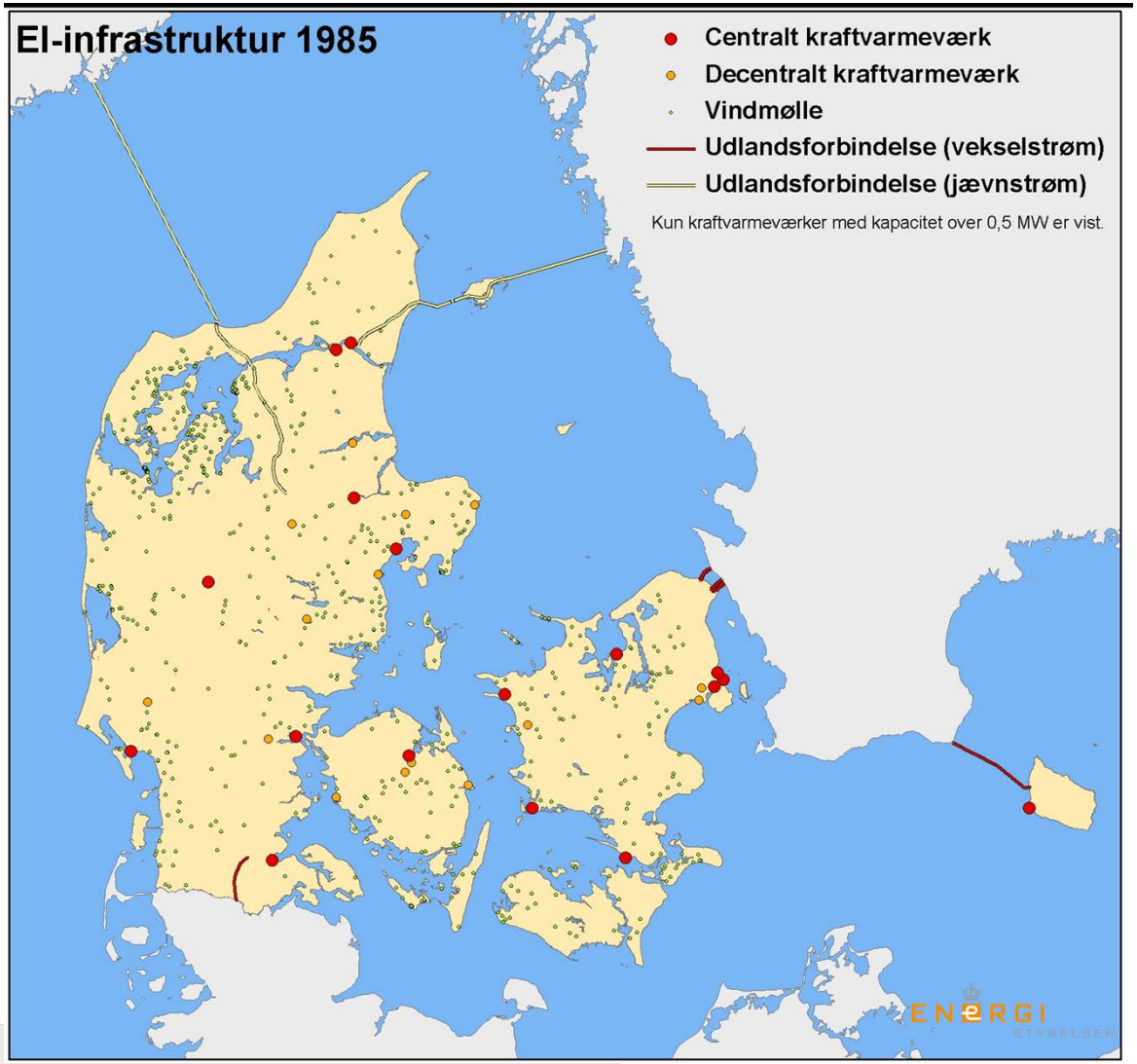
INFRASTRUCTURE 1985



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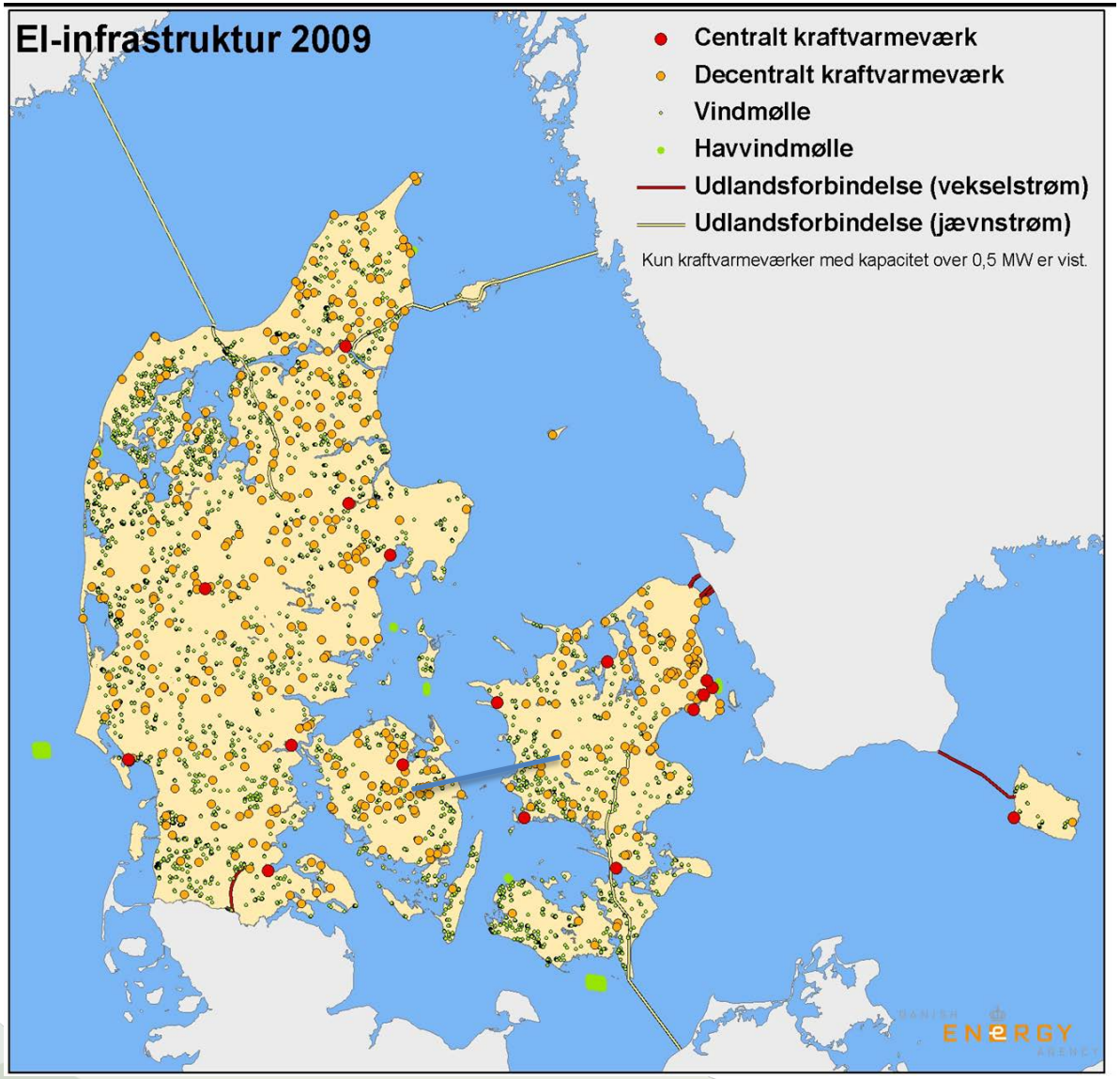
INFRASTRUCTURE 2009



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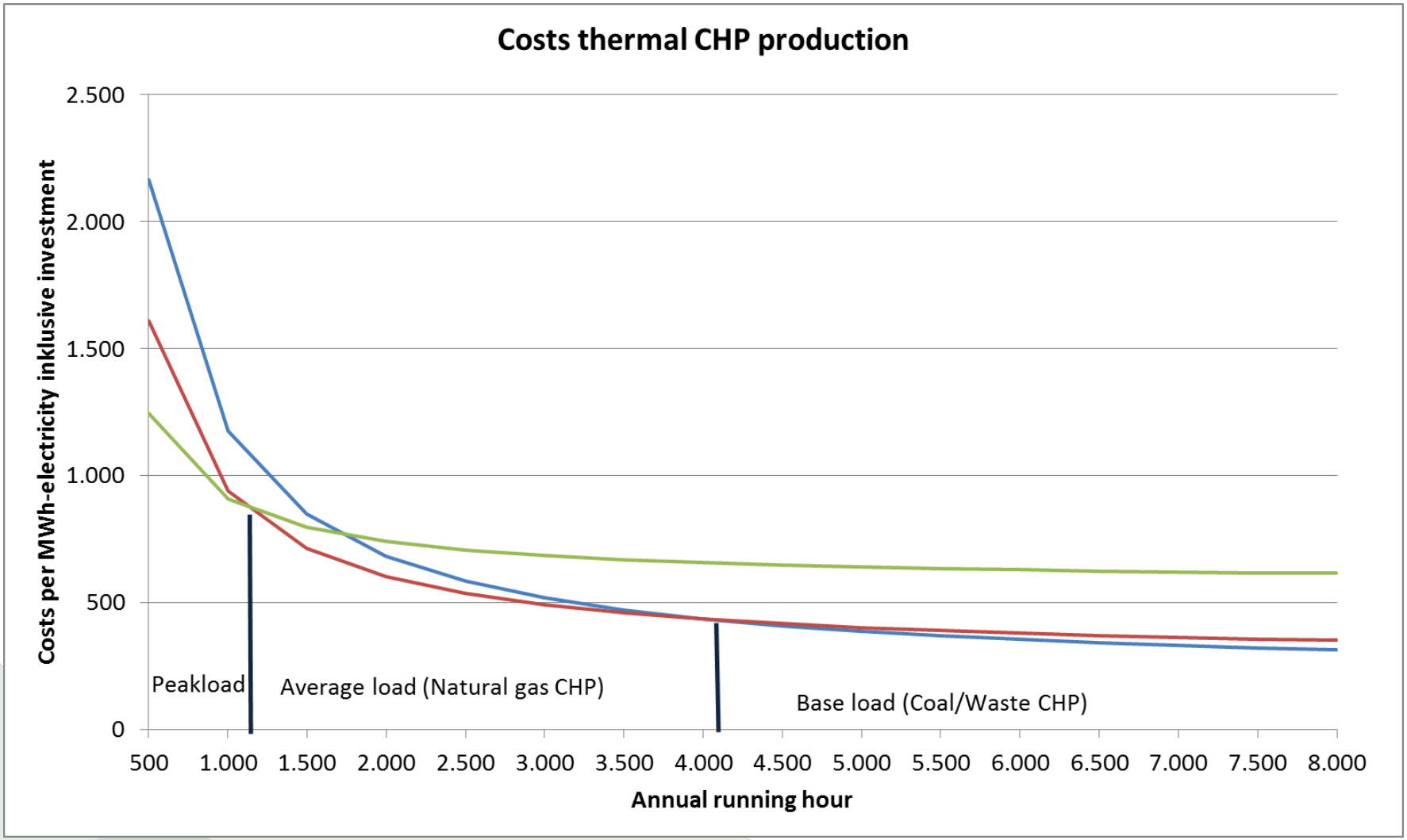
What is needed?



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The situation?

- Probably 2000 MW central production (Base load) has to shut down
- In short term to much peak load capacity – Needed in long term
- Cables East/Vest will help balancing wind power
- Balancing North = lower prices
- Balancing south = bottelnecks (Same wind profile in Germany)
- Electrical boilers (400 MW) and large heat pumps can balance the power system (10 MW) – but Norway is primary doing it.

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Electrification

- More heat on electricity
- Electrical boilers (400 MW): - perhaps 1000 MW
- Large heat pumps (10 MW): 400 – 600 MW-elec.
- Less CHP = More demand for energy storage capacity
- Better price signals – District heating demand both high and low prices
- Capacity market is not a good solution – will disturb price signals

Barriers:

Tariff system is not suited to battery function – pure cent/kWh payment

Tax system

Double capacity in district heating systems + storage = expensive

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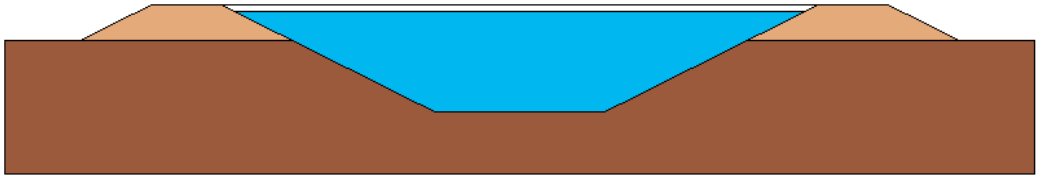
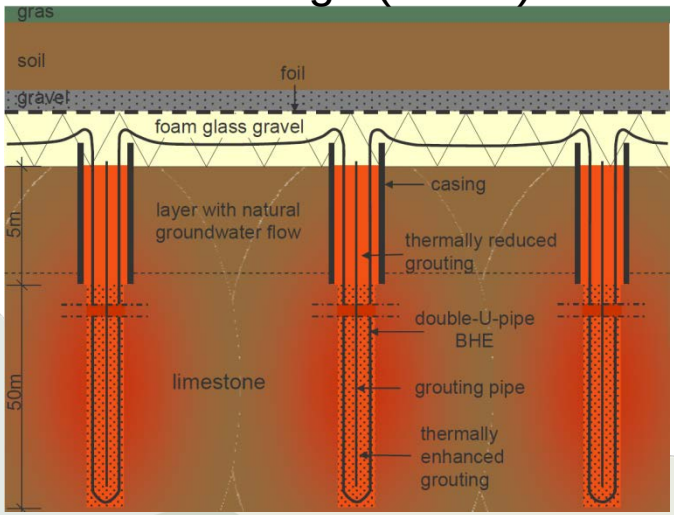
STORAGE SYSTEMS

Steeltank (TTES)

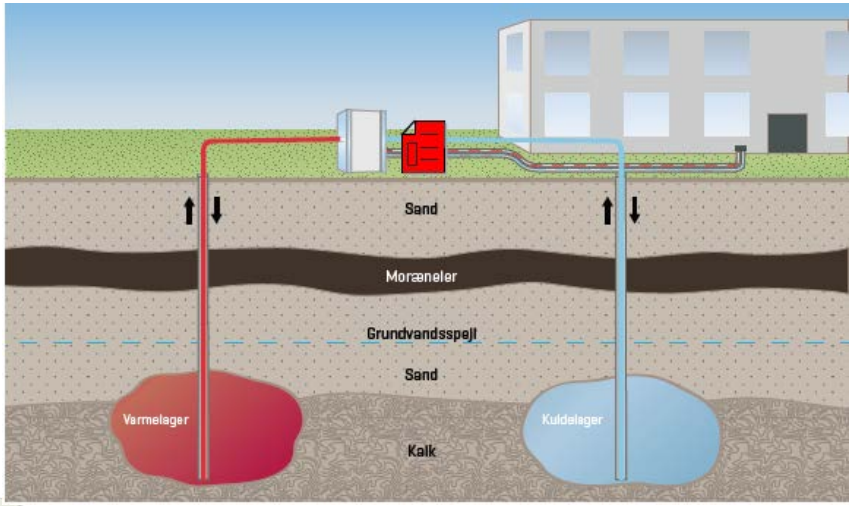


Pool storage (PTES)
Vojens 200.000 m^3 – 7.500 people

Borehol storage (BTES)



ATES (Aquifer)



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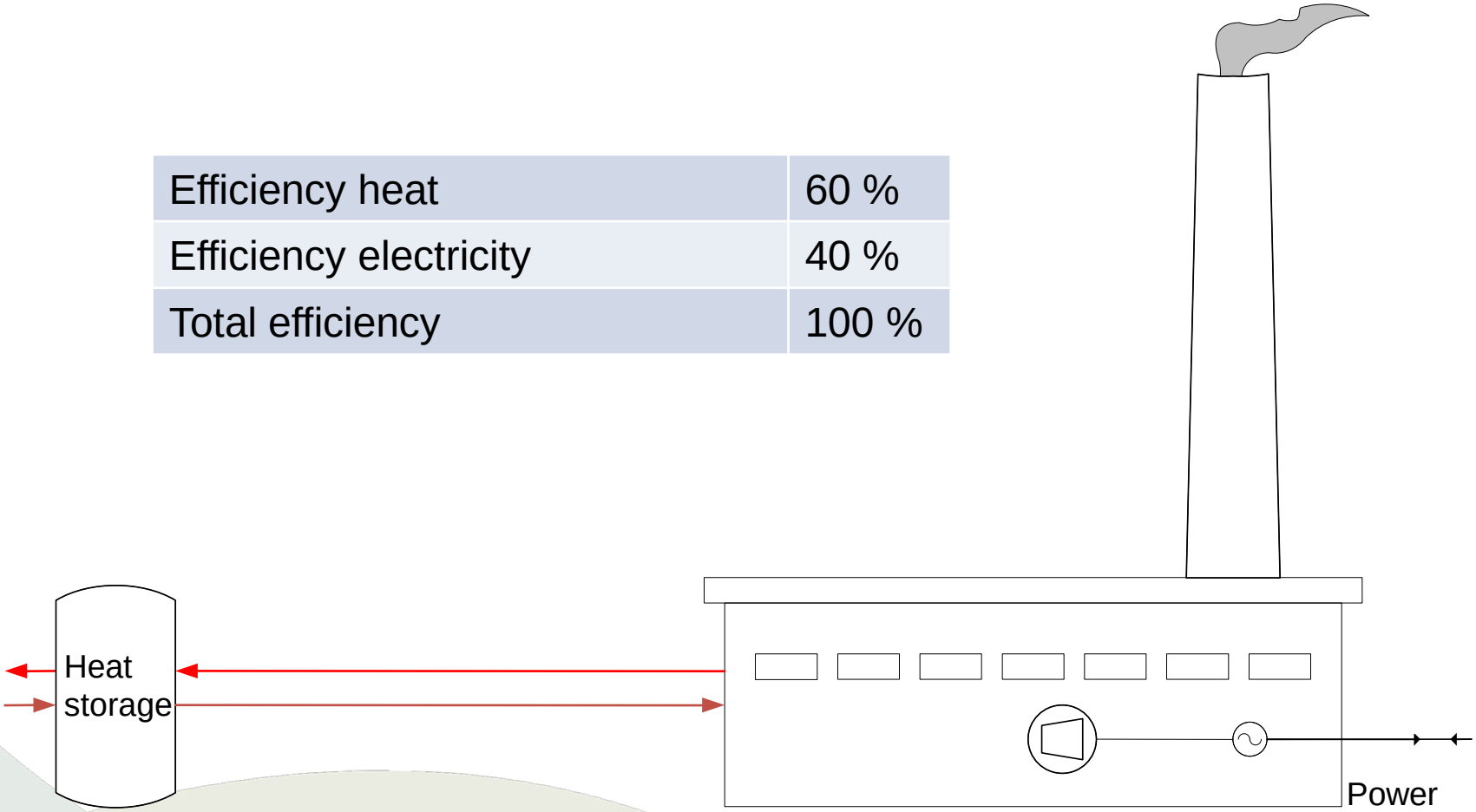
MARSTAL – LARGE STORAGE

CHP WITH HEAT STORAGE (TYPICAL SYSTEM 2014):

Efficiency heat	60 %
Efficiency electricity	40 %
Total efficiency	100 %



Dist. Heating system

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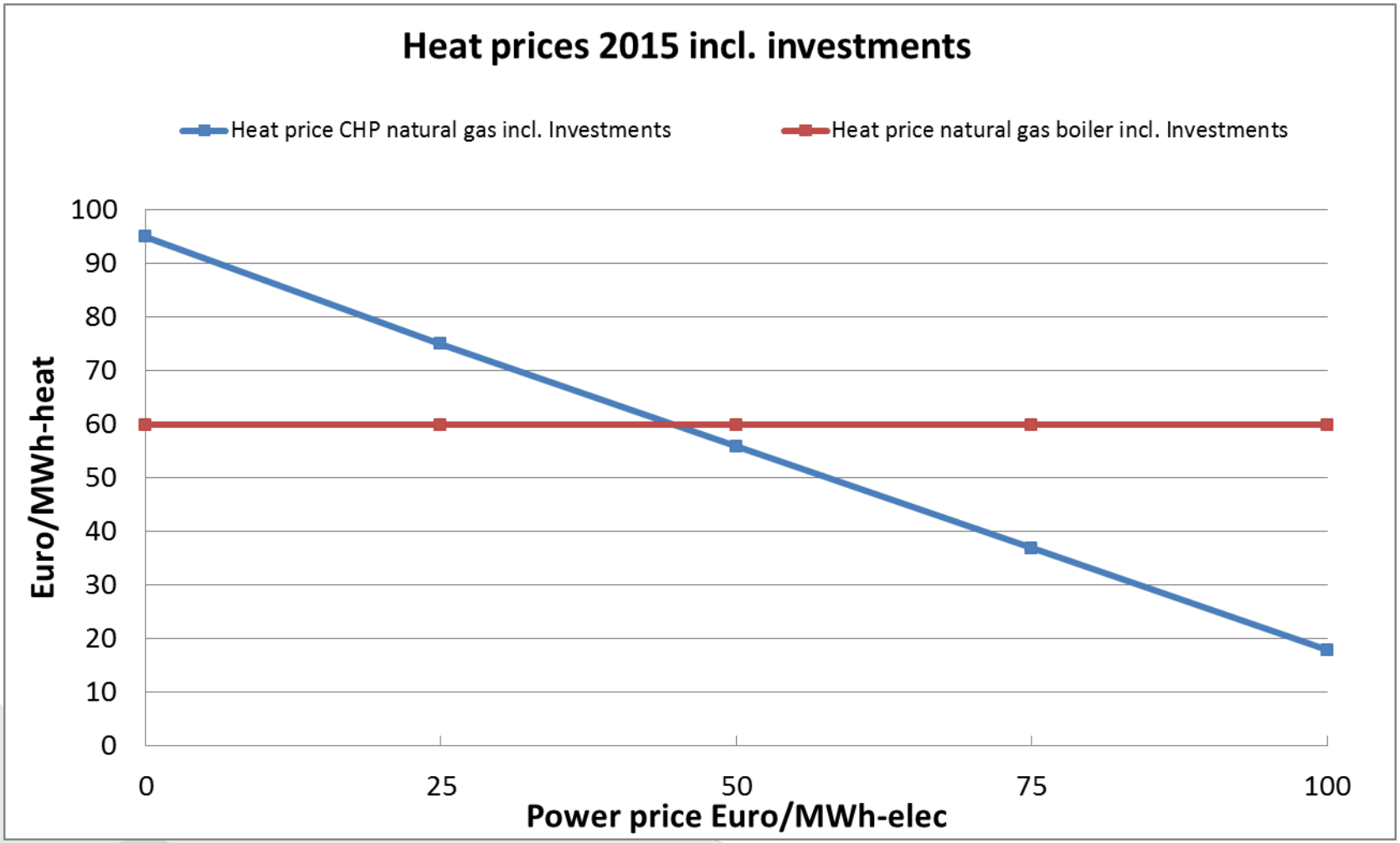
EXISTING PLANTS



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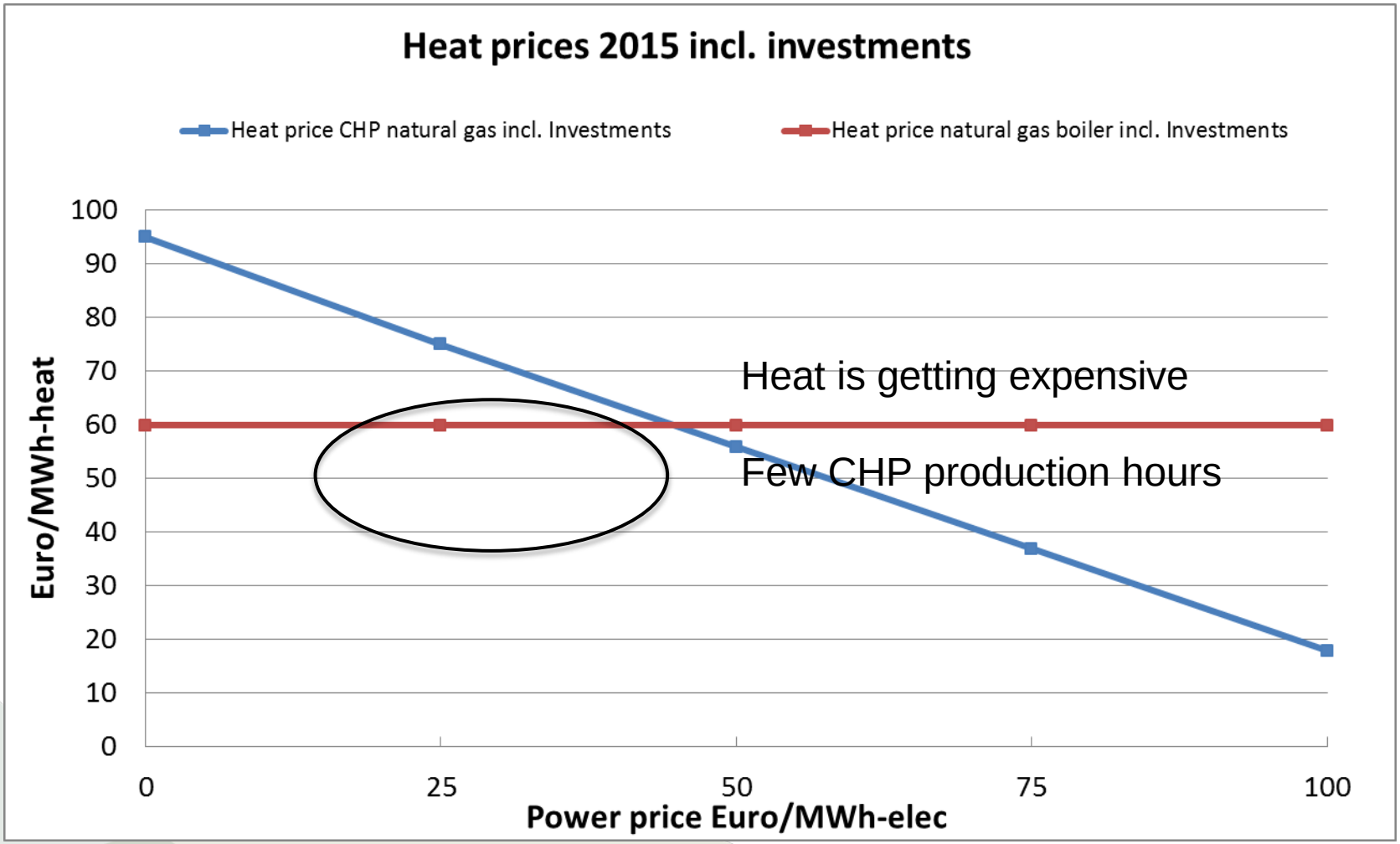
EXISTING PLANTS



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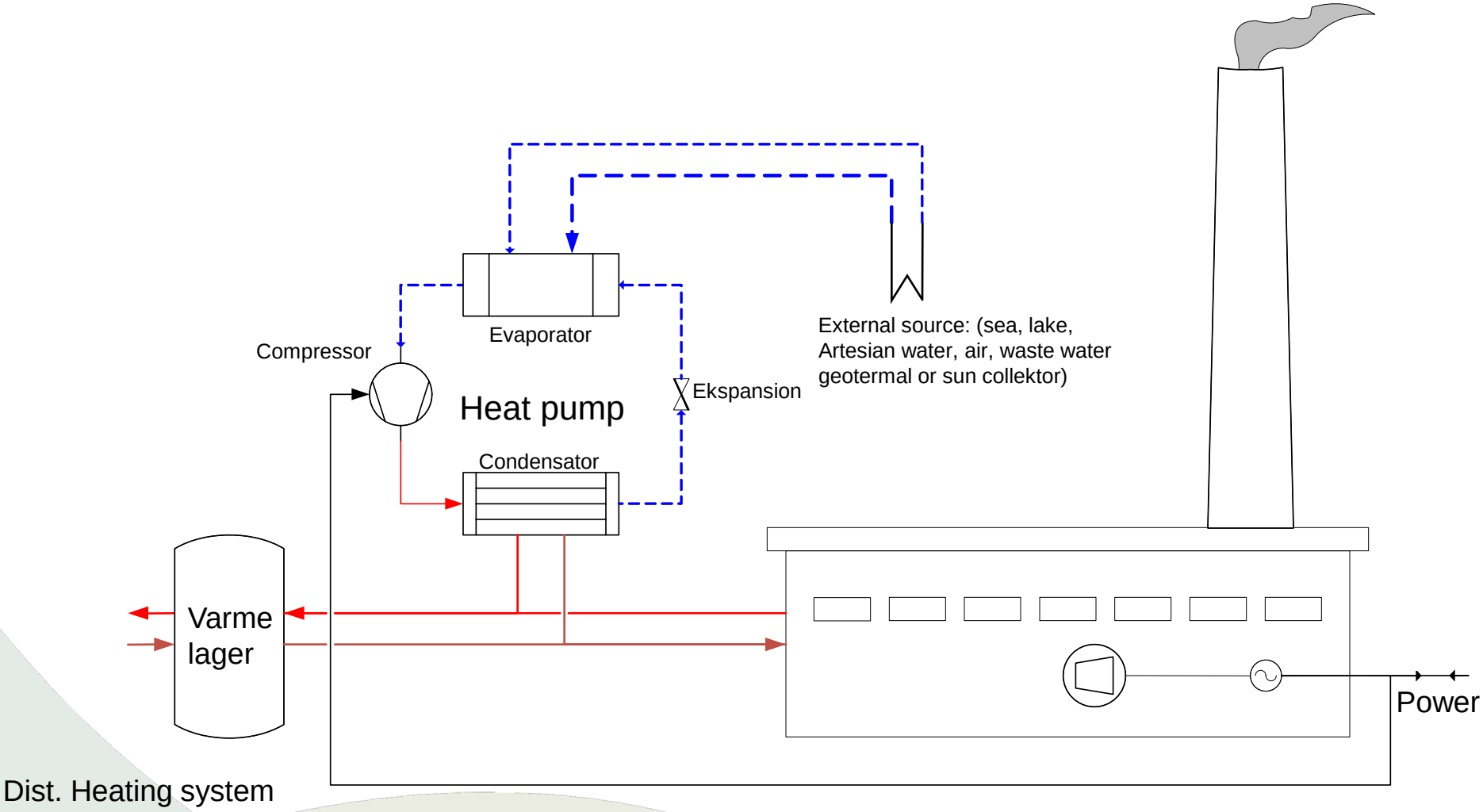
ONE SOLUTION



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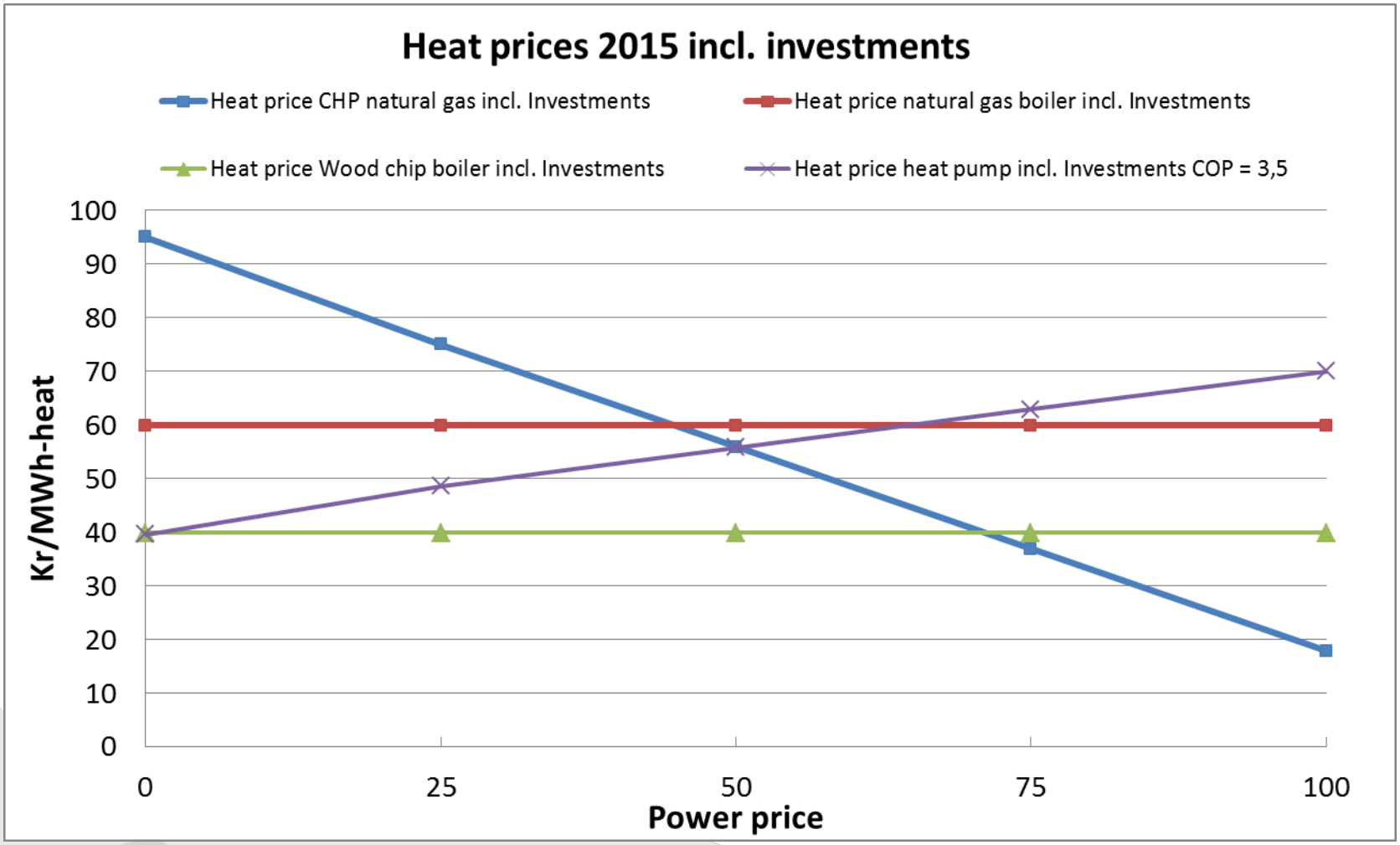

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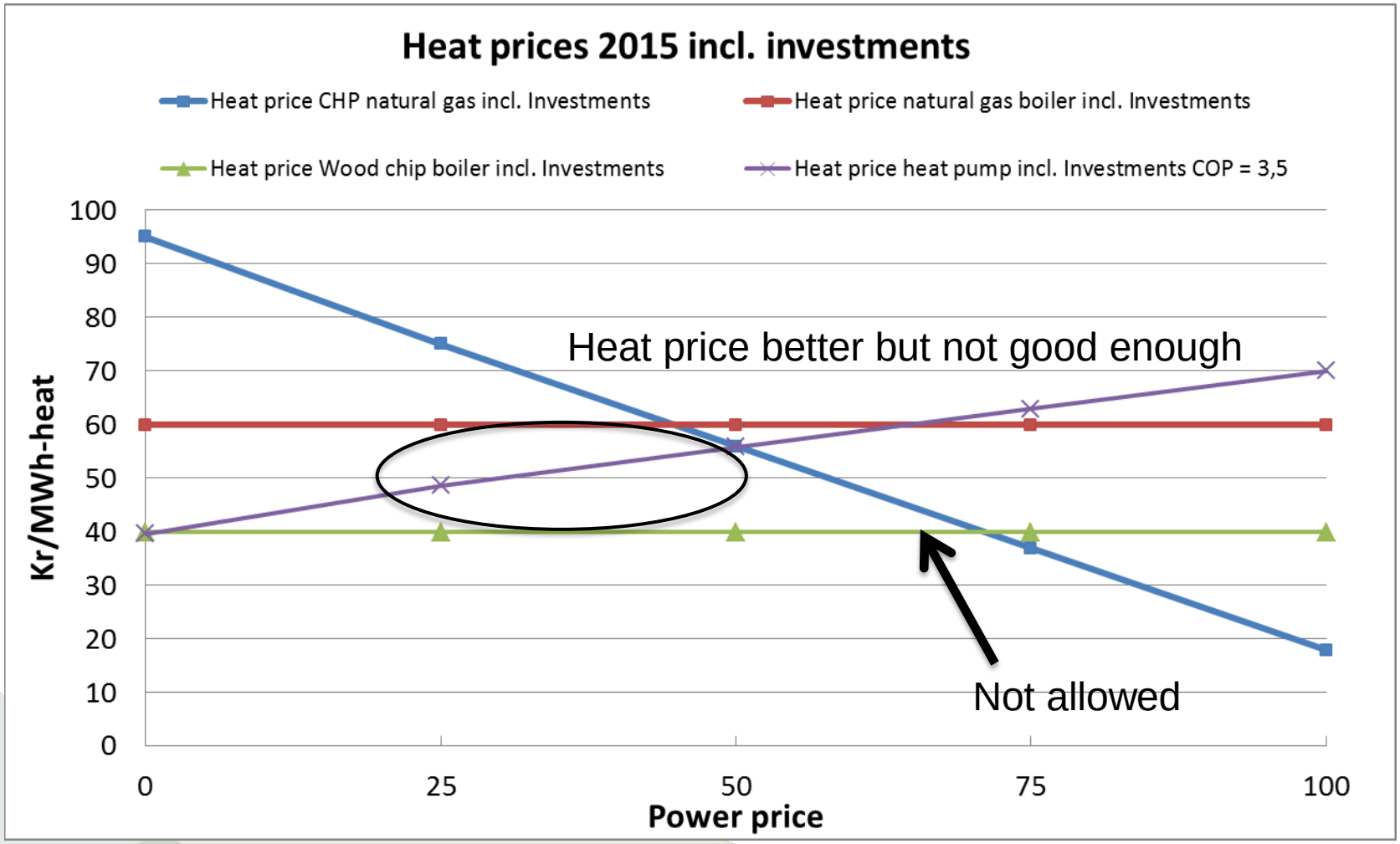
ONE SOLUTION



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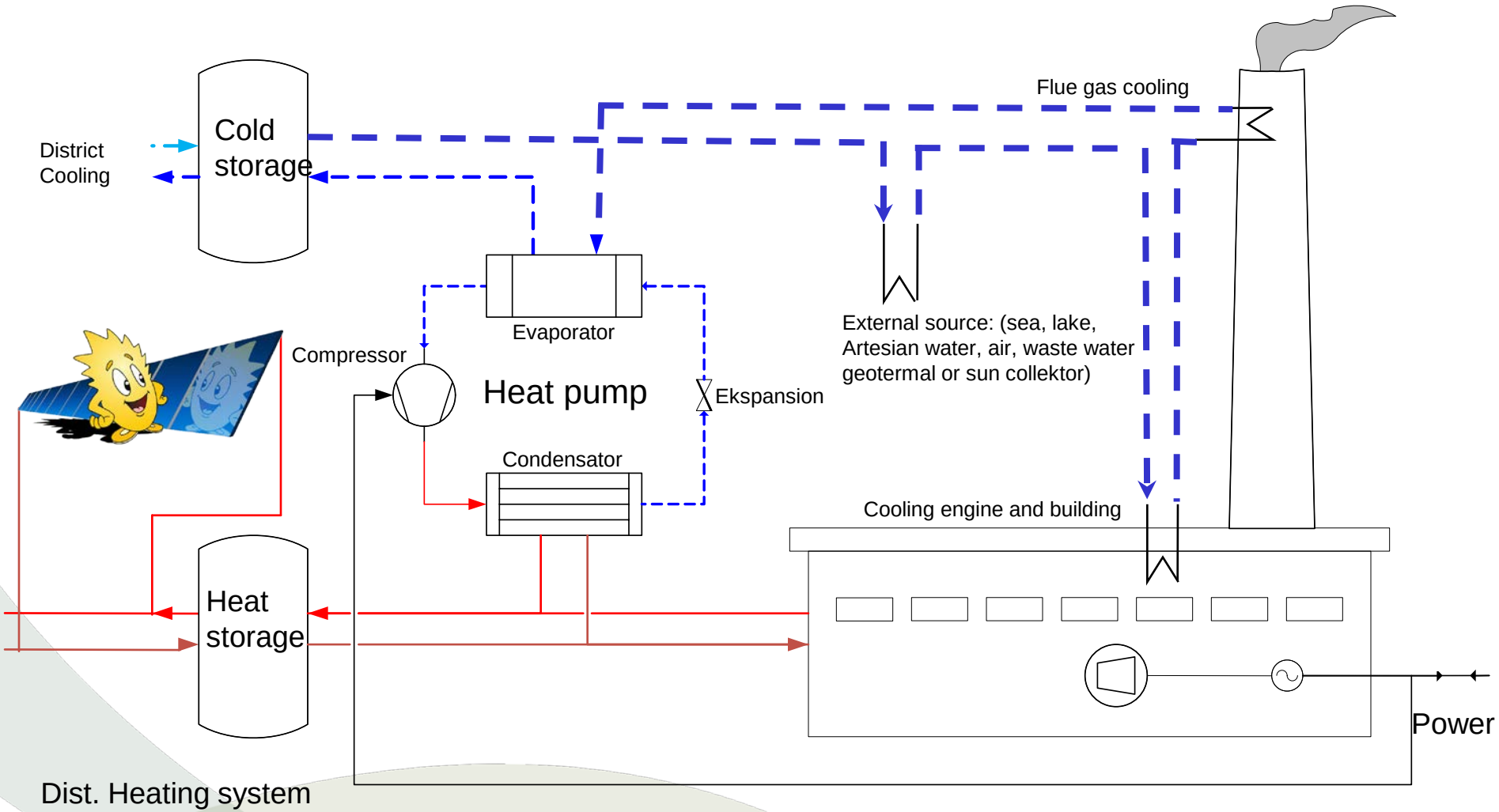
A BETTER SOLUTION



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