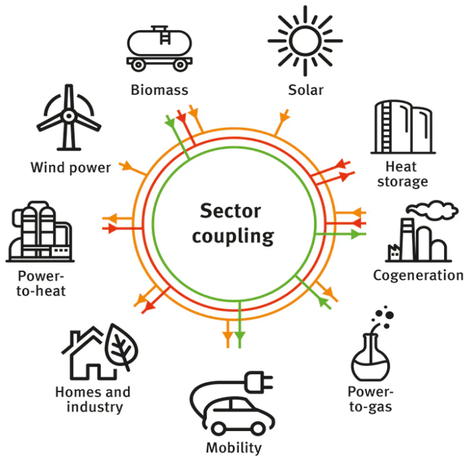
ENERGY EFFICIENCY IN THE DISTRICT HEATING PERSPECTIVE

EXPERIENCE FROM DENMARK

CHISINAU, MOLDOVA

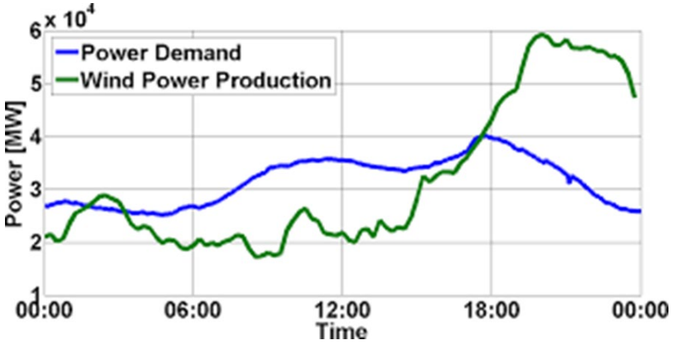
DBDH – 19 NOVEMBER 2025



LOOKING INTO THE FUTURE

- In the future – tomorrow - we are looking into an energy system with far more power production from wind and solar cells (PV) and less heat and power production from CHP plants.

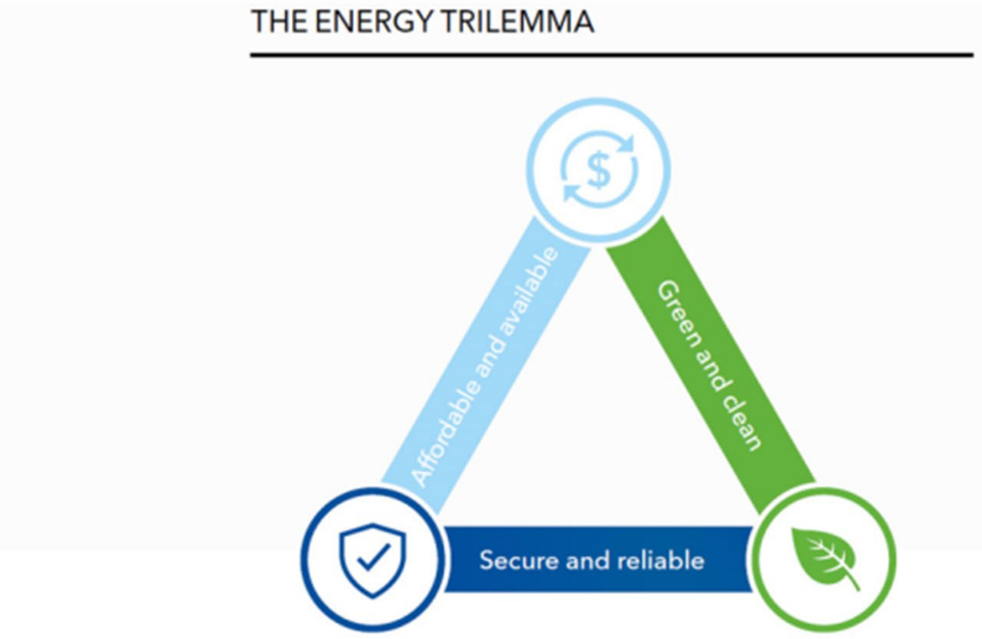
- A system that must be fossil -free but also an energy system which can accommodate more of this fluctuating energy from wind and PV.



- A flexible and integrated sectoral linked energy system is essential – "**System Integration**".

THE GREEN TRANSITION - CHALLENGES

- The so-called energy trilemma describes the devilish choice that DH companies, politicians and authorities face when planning the energy supply:
  - Everyone agrees on wanting cheap, sustainable and stable energy - but, says the energy trilemma, you can only choose two.
  - It is associated with real challenges when we go from a really well -functioning fossil energy system to a new and less climate -damaging alternative.



POWER SYSTEM

“YESTERDAY” AND “TOMORROW”

- Central power production
- Fossil fuels
- Demand driver for power production
- Cars based on fossil fuels
- No need for energy storage
- Limited need for System Integration

- Decentralised power production
- Wind, solar (and hydro+nuclear)
- Wind and solar driver for power production
- Cars based on electricity (EV)
- Need for energy storage
- System Integration needed (DE, EV,HP)

DISTRICT HEATING SYSTEM

"YESTERDAY" AND "TOMORROW"

- Central heat production
- Fossil fuels
- Heat demand driver for heat production
- No need for energy storage
- Limited need for System Integration

- Decentralised heat production
- Wind, solar, excess heat, heat pumps
- Electricity price driver for heat production
- Need for energy storage (tanks, PTES)
- **System Integration** needed (DH, Power)

SYSTEM INTEGRATION

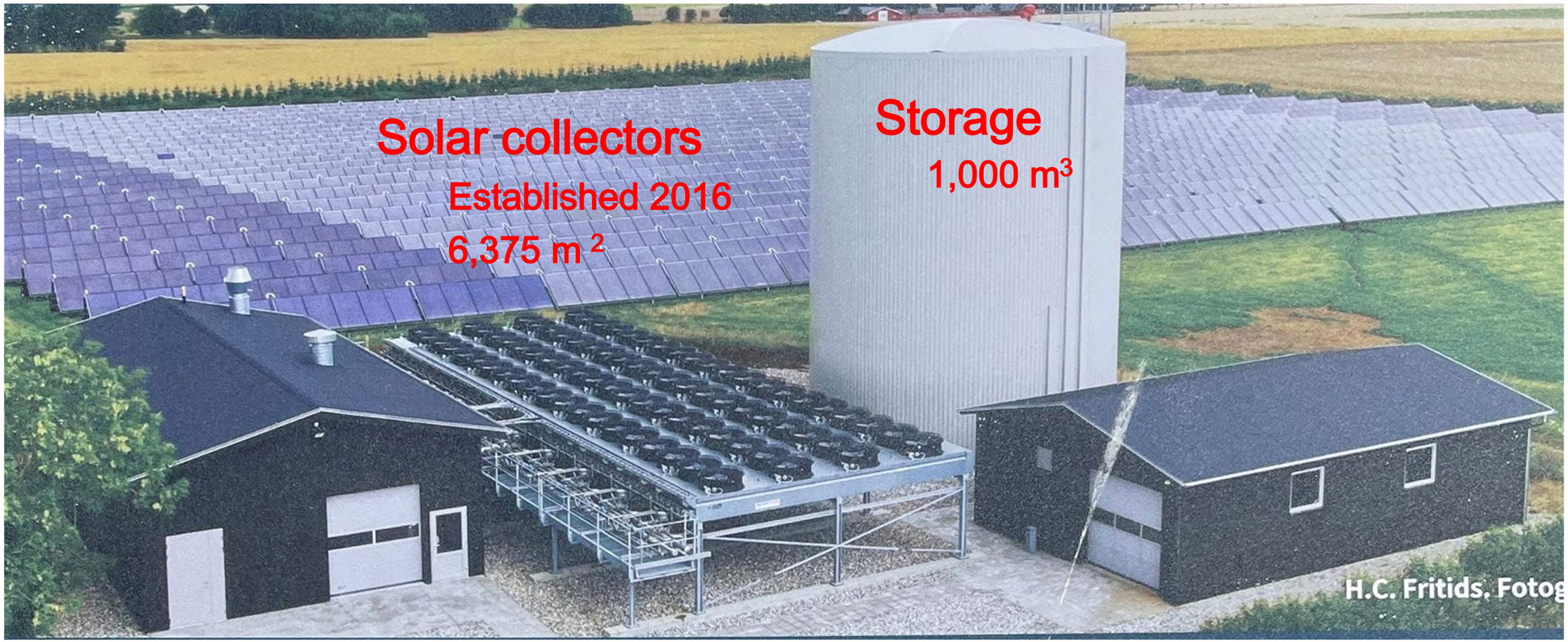
No need to worry - we've been there before and have the experience.

IMPACT POINT

Air-water heat pump, solar collectors and storage

ØRUM DISTRICT HEATING COMPANY, DK

720 CUSTOMERS (13,000 MWh/year)



Air-water heat pump

Established 2020

ØRUM DISTRICT HEATING COMPANY

Integration of technologies

- The heat pump (HP) is intelligently integrated with the solar collectors from 2016.

- HP is designed to primarily taking heat from the outside air but can also take heat in the form of lukewarm water from the storage tank - thereby increasing the efficiency of the solar heating system.

- Before the establishment of the HP, solar heating accounted for approx. 20% of the heat production - today the HP accounts for 70% of the annual heat production (9,000 MWh) and thus solar and HP cover approx. 90% of the customers' heating demand.

IMPACT POINT

Air-water heat pump, electric boiler, natural gas engine and storage

STØVRING CHP COMPANY

54 GWh heat + 14 GWh power (2024)

- Three combined heat and power units - each 3 MW power and 3.8 MW heat (2024).
- Two natural gas boilers - 7 MW and 11.5 MW (emergency and reserve load)
- Two storage tanks - each 3,700 m ^{3} (?, 2024)

STØVRING CHP COMPANY

54 GWh heat + 14 GWh power (2024)

- Electric air -to-water heat pump (ammonia) with a heating capacity of 7.3 MW (2019)
- Electric boiler, with a heating capacity of 10 MW (2023).
- Electric air -to-water heat pump, with a heating capacity of 3.6 MW (2024).

STØVRING CHP COMPANY

WHY INVEST IN ELECTRIC BOILER?

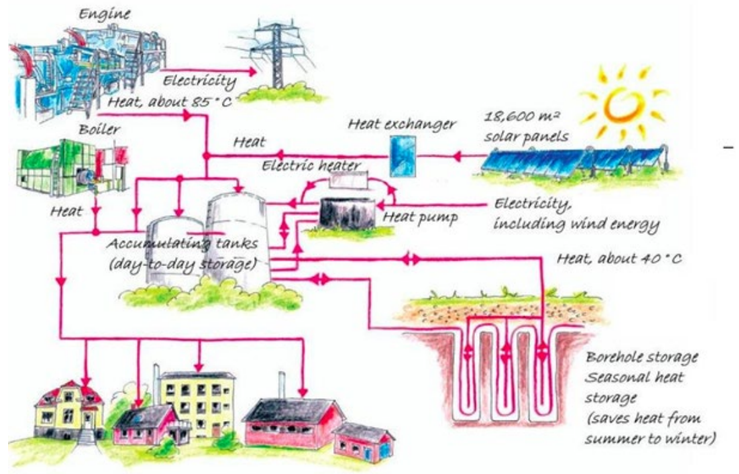
- Operating of electric boilers:
  - Low electricity prices
  - Services to the power grid.
  - Difficult to budget the number of annual operating hours.

- 01-25-09.25 – more than 31% of the heat production covered with heat from the electric boiler (primarily services to the power grid).

Type	Short	Response	Delivery	Earnings
Fast Frequency Reserve	FFR	1,3 s	●	$
Frequency Containment Reserve for Disturbance Frequency Containment Reserve	FCR-D FCR	7,5 s 5 – 30 s	●	$
Frequency Containment Reserve for Normal Operations	FCR-N	60	●	$
Automatic Frequency Restoration Reserve	aFFR	300s	●	$
Manual frequency restoration reserve	mFFR	15 min	●	$

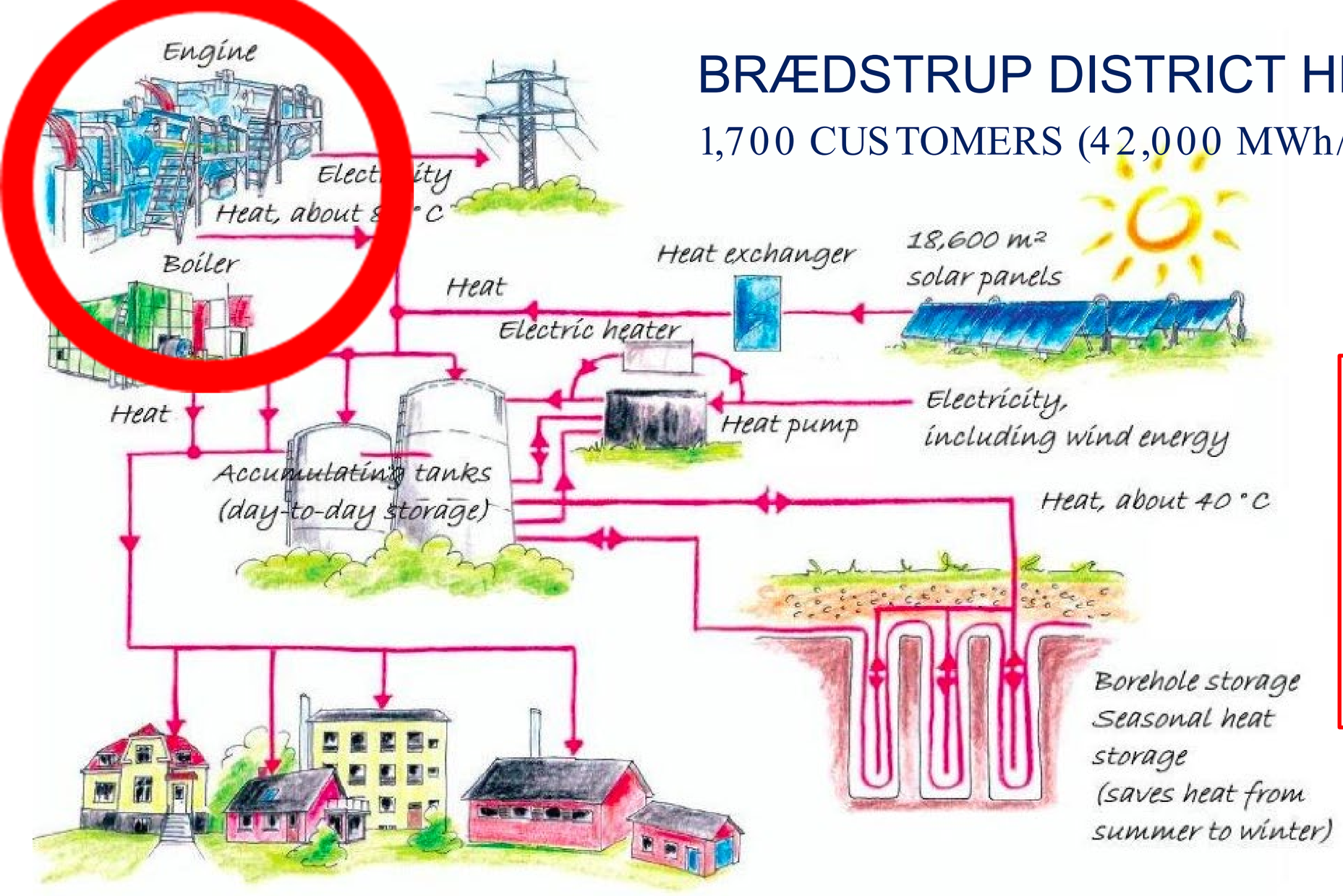
IMPACT POINT

CHP engine, electric boiler, gas boiler, air - water heat pump, solar collectors, day -to- day storage and seasonal storage



BRÆDSTRUP DISTRICT HEATING COMPANY

1,700 CUSTOMERS (42,000 MWh/Year – 75% green)

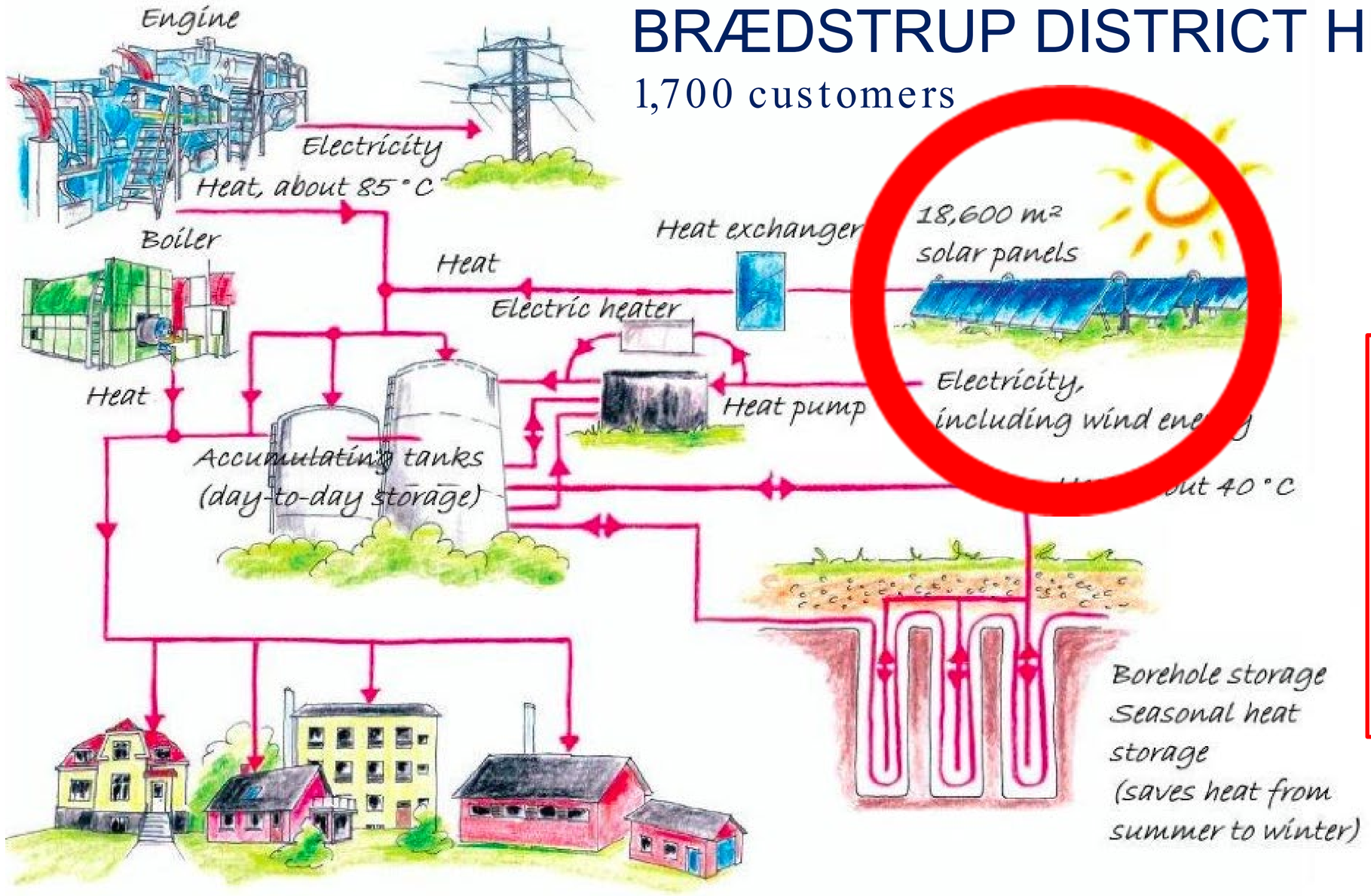


High electricity prices:
Heat produced at the gas engine and power sold to the grid.

If heat demand is lower than production -> storage.

BRÆDSTRUP DISTRICT HEATING COMPANY

1,700 customers



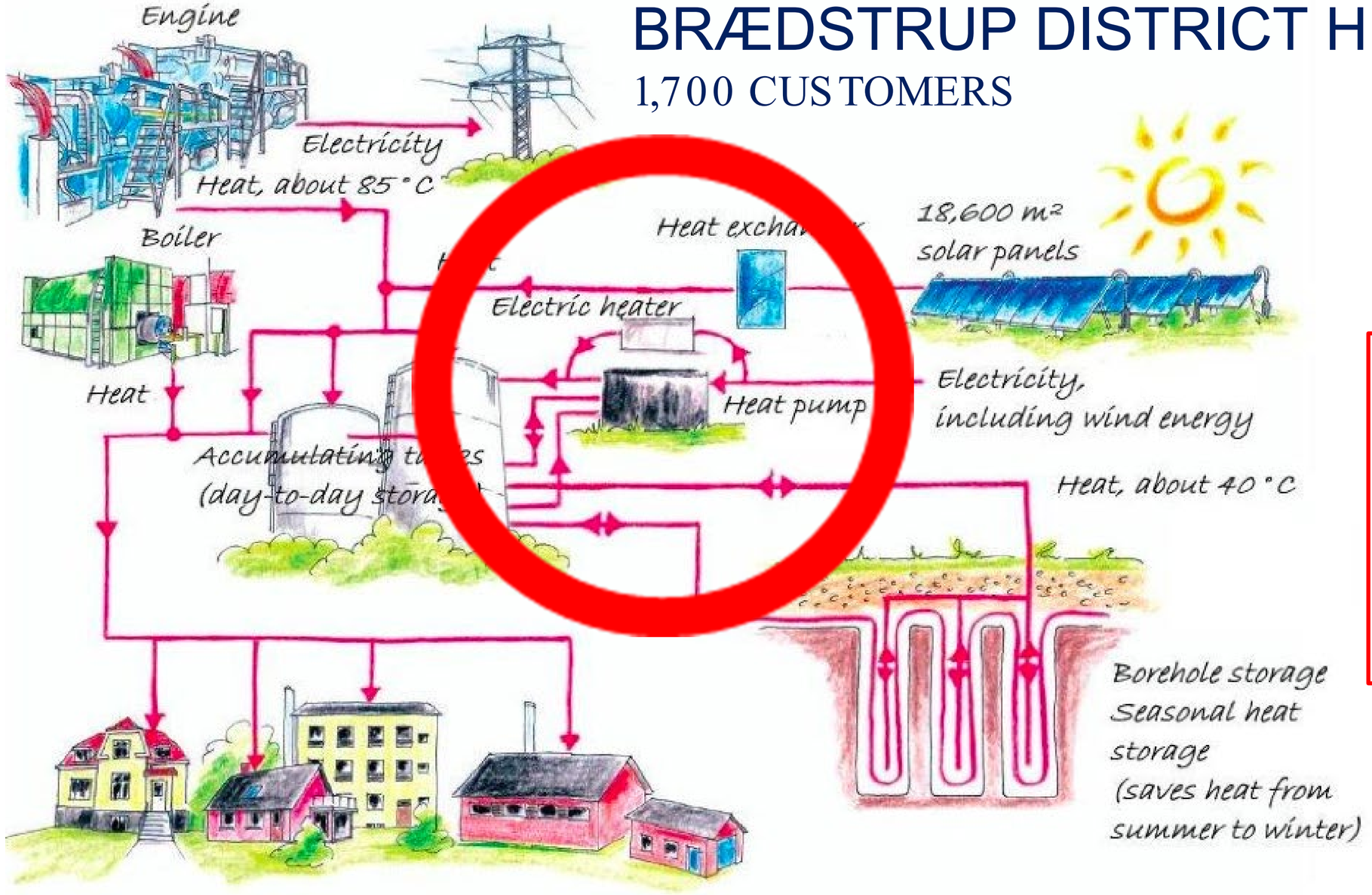
When the sun is shining:

Heat produced at the solar panels.

If heat demand is lower than production -> storage.

BRÆDSTRUP DISTRICT HEATING COMPANY

1,700 CUSTOMERS

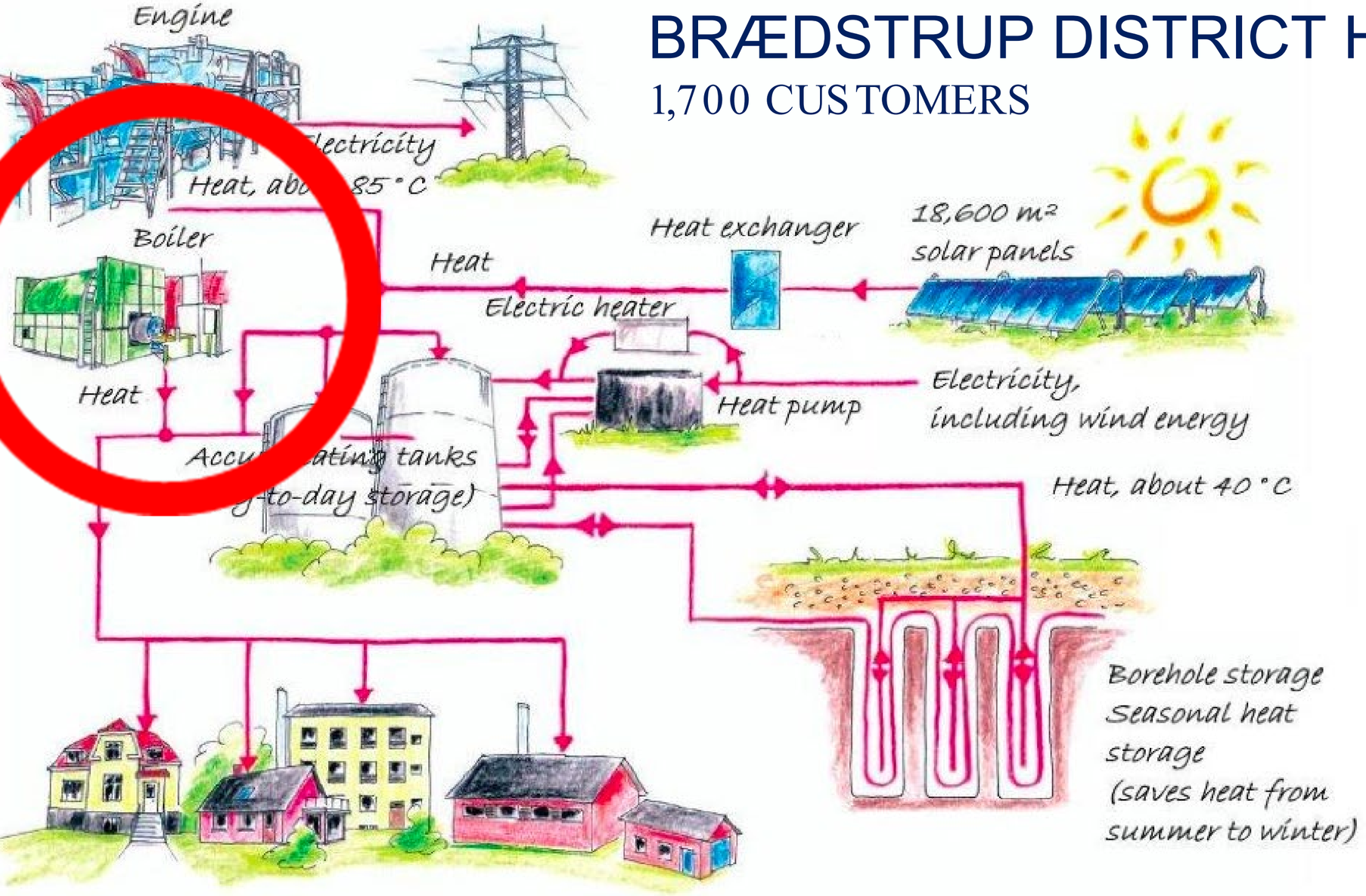


Low electricity prices:
Heat produced at electric boiler.

If heat demand is lower than production -> storage.

BRÆDSTRUP DISTRICT HEATING COMPANY

1,700 CUSTOMERS

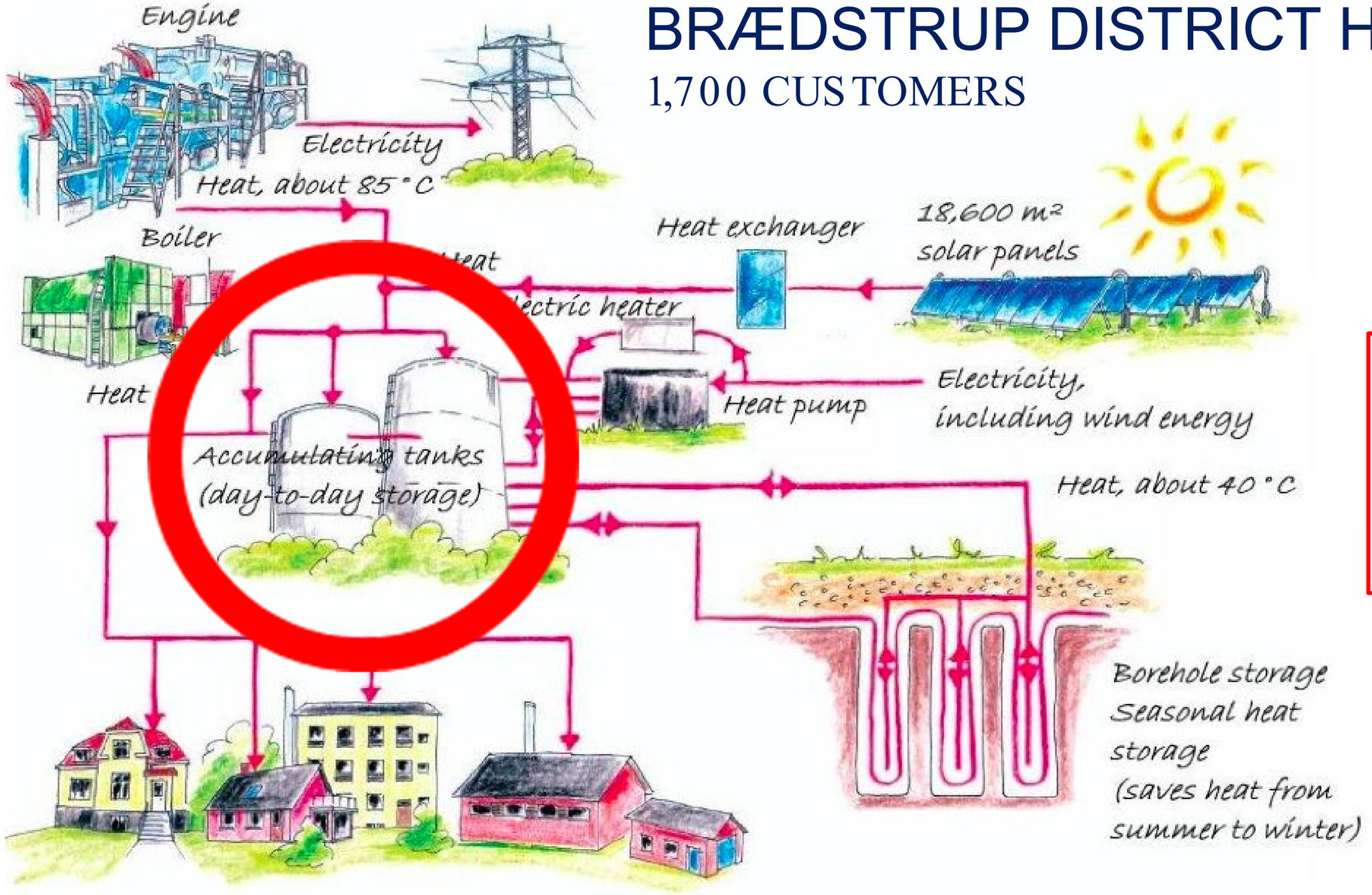


Medium electricity prices:

Heat produced at natural gas fired boiler.

BRÆDSTRUP DISTRICT HEATING COMPANY

1,700 CUSTOMERS

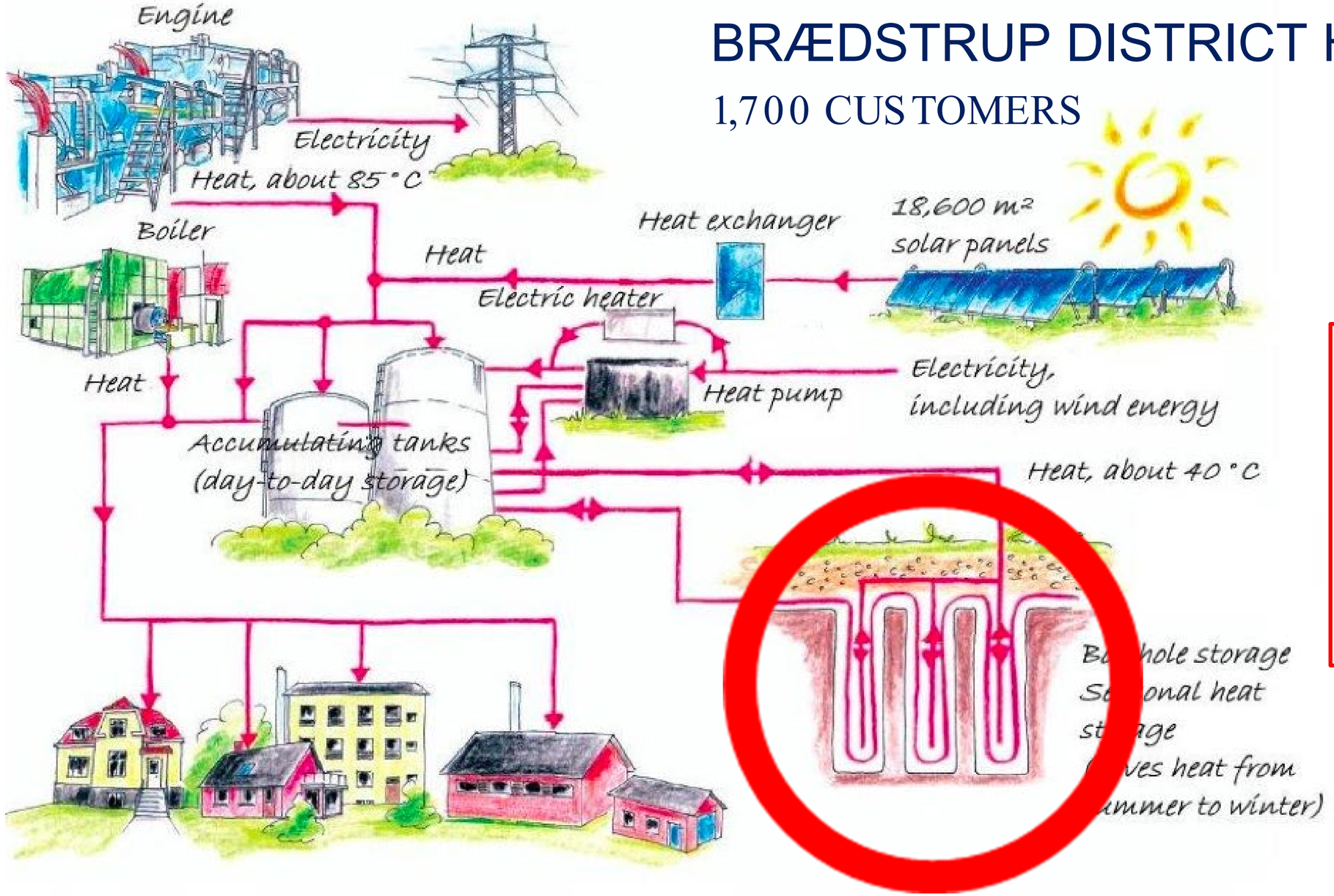


Heat production higher than heat demand:

Heat is stored at day-to-day tanks or borehole storage.

BRÆDSTRUP DISTRICT HEATING COMPANY

1,700 CUSTOMERS

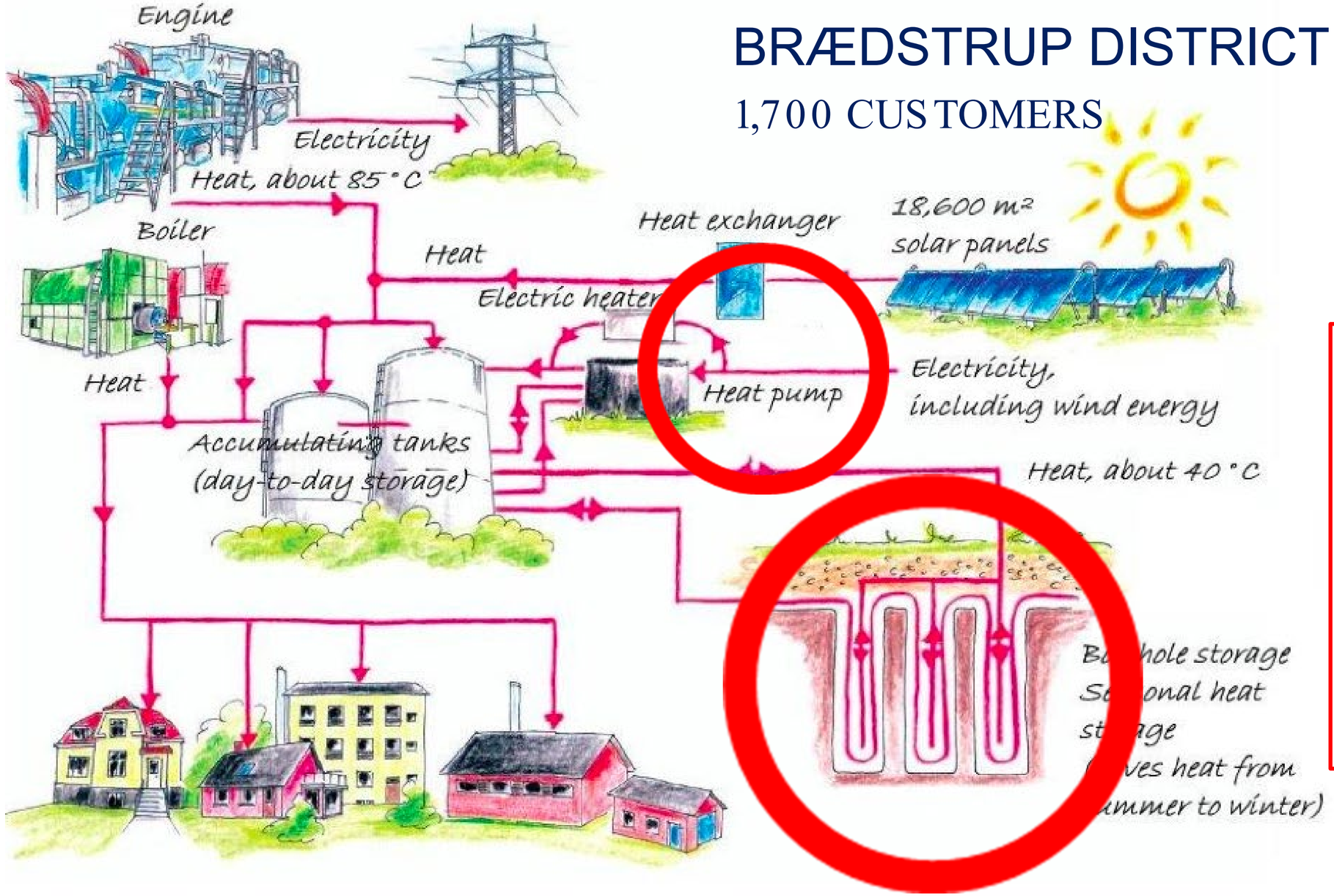


Heat production higher than heat demand:

Heat is stored at borehole storage if the need is for seasonal storage from summer to winter.

BRÆDSTRUP DISTRICT HEATING COMPANY

1,700 CUSTOMERS



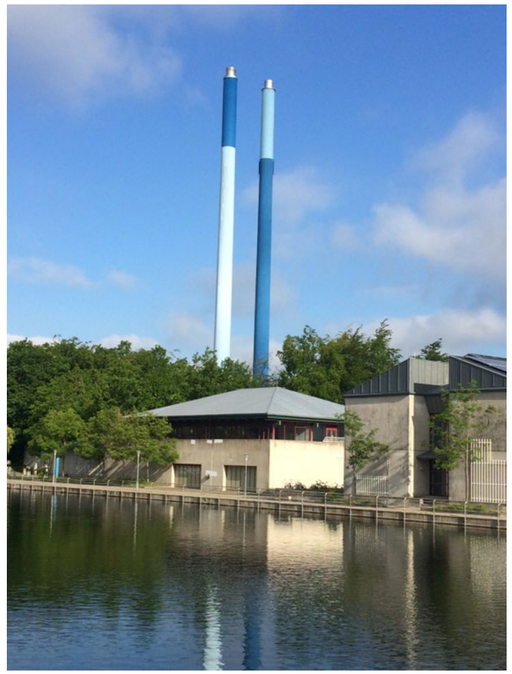
Heat production covered with heat from borehole storage:

Heat pump (HP) is used for boosting the flow temperature from 40^0C to needed flow-temperature $70\text{-}80^0$C.

IMPACT POINT

Low temperature district heating (LTDH)

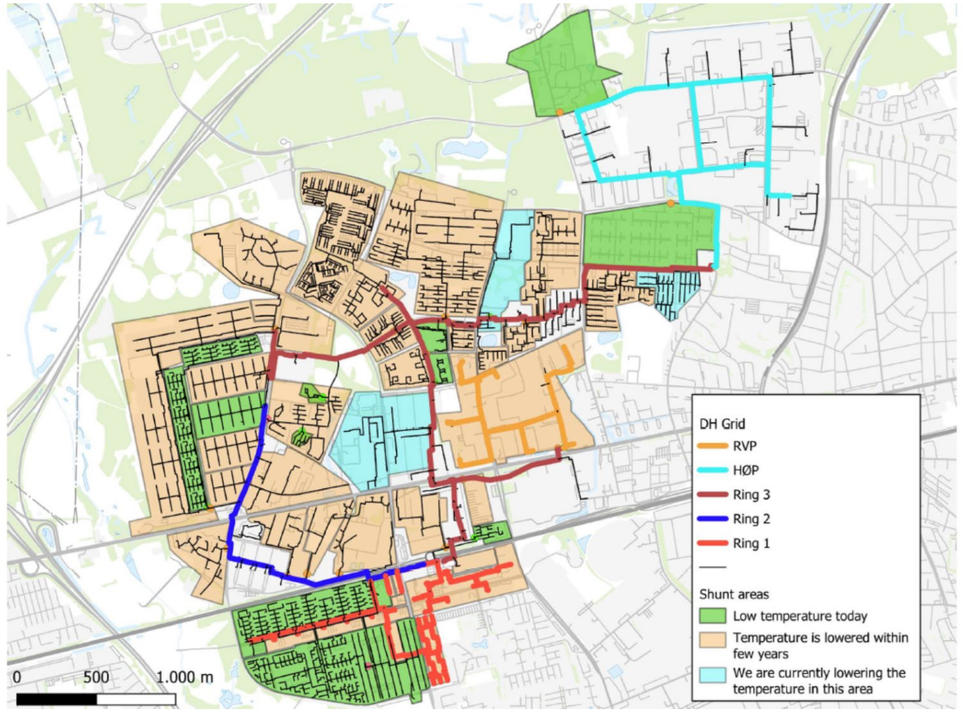
Albertslund District heating Company



ALBERTSLUND DH COMPANY

FACTS ABOUT NETWORK ETC .

- Established from 1963 - since 1987 connected to VEKS DH transmission company.
- Covers above 99% of the heat demand in Albertslund .
- +400 km DH pipes.
- +8.000 customers.
- 9 peak load oil and natural gas boilers with a total effect of 132.5 MW.



MUNICIPALITY OF ALBERTSLUND

DH IS CENTRAL IN THE FUTURE (2016 - >2026)

- DH will be a central element in the energy system in the future - Green Energy, not least from wind turbines, takes over.

- In line with this, Albertslund's Vision and Strategy (2016) states:

  - We set the target of having a CO_2-neutral electricity and heat supply in 2025.

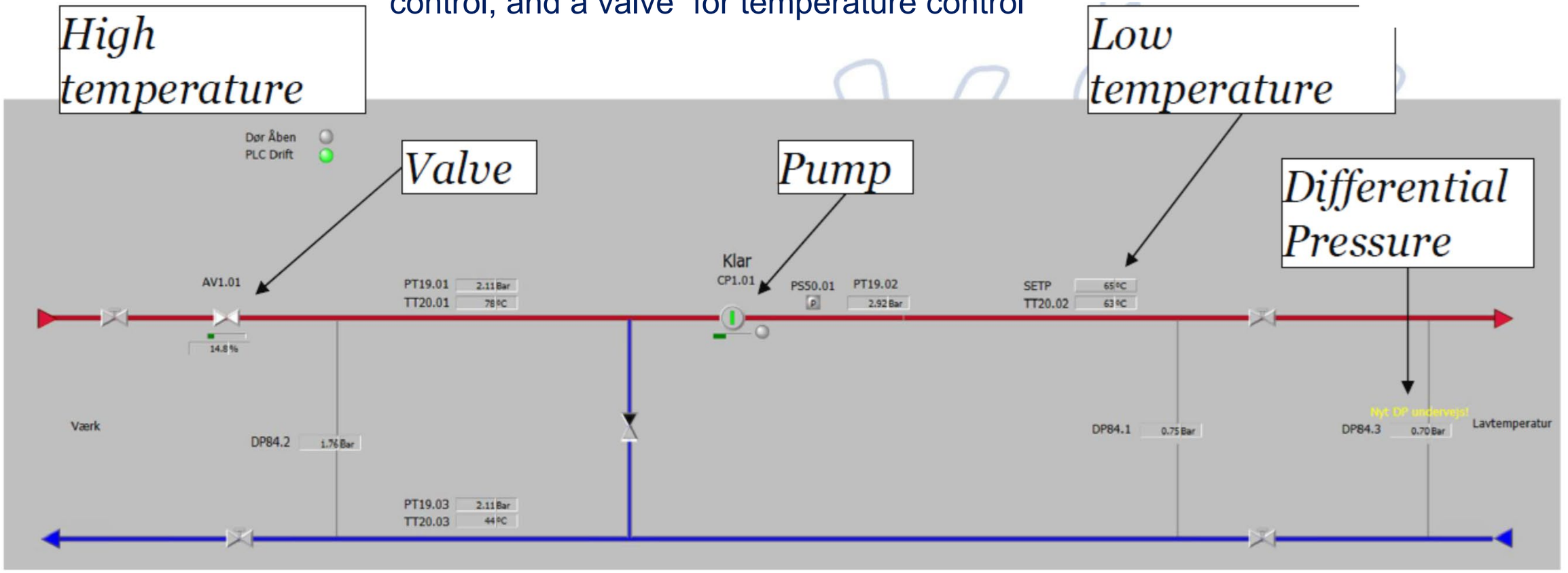
  - We want to ensure that Albertslund District Heating only supplies low-temperature district heating (LTDH with flow temperature 60^0C).

  - We will work with strategic energy planning and continuously uncover the possibilities for local renewable energy production.

LOW TEMPERATURE DISTRICT HEATING

SHUNT WORKING PRINCIPLE

Current generation is with a pump for pressure control, and a valve for temperature control



ALBERTSLUND DH COMPANY

Pilot project - 104 villas from the 1960's

Demo-type of buried shunt

ALBERTSLUND DH COMPANY

OUTCOME OF THE PILOT PROJECT (T_F 85 ^{0}C - > 60 ^{0}C)

- When lowering the temperature:
  - Three houses had some difficulties, which could be fixed by a better regulation/tuning of the heating system.
  - One house needed replacement of a broken component.
  - One house needed a new substation/DH unit.
  - Then all 104 houses were on LTDH on a frosty day in February 2021.

ALBERTSLUND DH COMPANY

FIRST GENERATION ABOVEGROUND SHUNT

ALBERTSLUND DH COMPANY

LATEST SHUNT

Bottom of building

Front of building

ALBERTSLUND DH COMPANY

LATEST SHUNT DESIGN

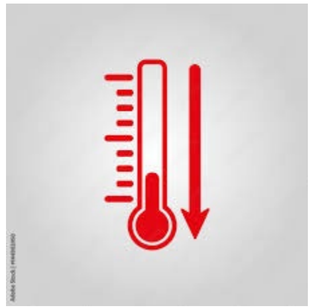
Shunt building in the local environment

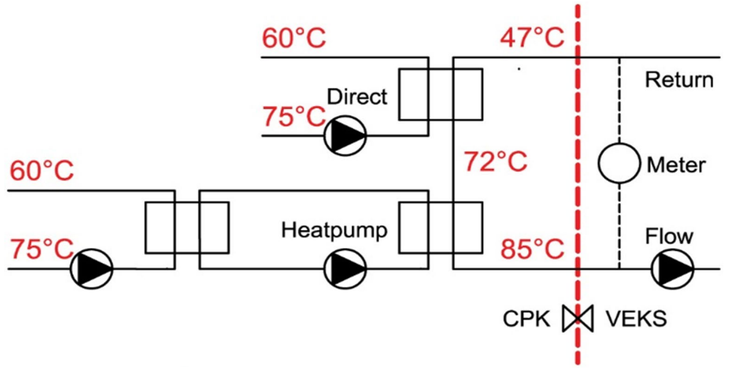
Shelter at the bus stop

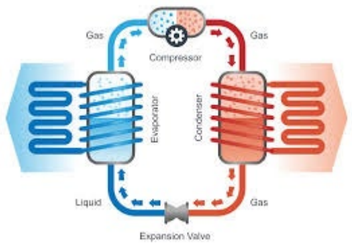
SUMMARY

WHY LOWER TEMPERATURE?

- Lower heat losses - less difference in temperature between the district heating water and the surrounding ground.
- Improves opportunities to use new supply sources (renewable energy).
- Provides better COP when using heat pumps (excess heat).
- Lower operating costs.

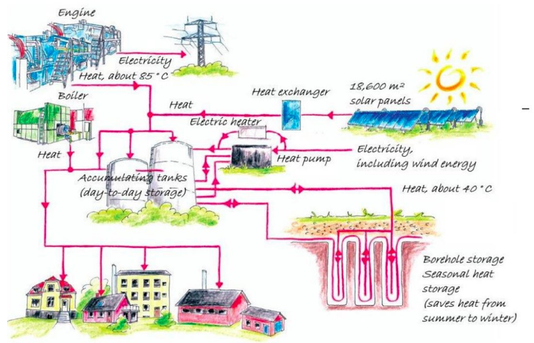






SUMMARY – SYSTEM INTEGRATION

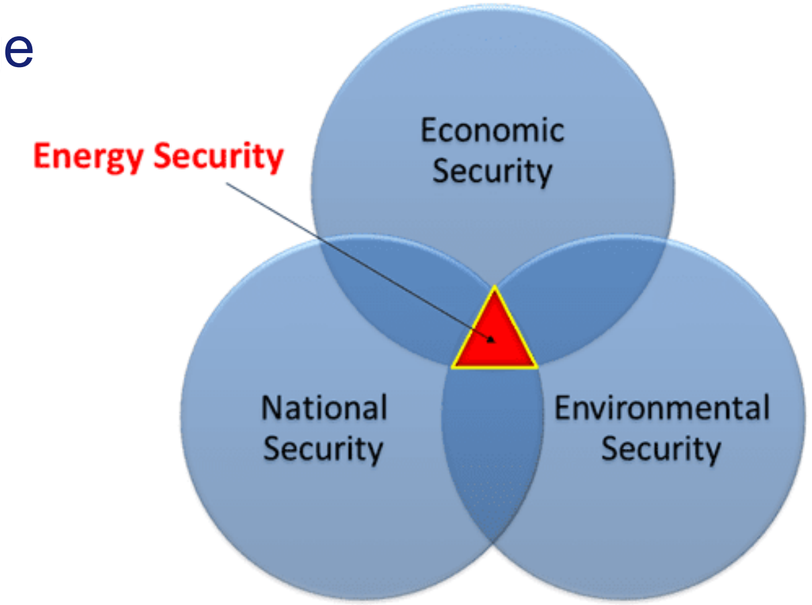
- By integration power -system and DH -system the following advantages can be achieved:
  - Cheap electricity can be used for production of DH at electric - boiler.
  - With high electricity prices DH can be produced by gas -engine and DH production can be put to the storage – if demand is low.
  - High share of renewable energy (solar) can be utilised in the DH system – covering heat demand or stored.
  - High energy efficiency as no energy is lost and heat supply is reliable.



SUMMARY - FLEXIBILITY

In both small and large district heating companies, fossil fuels are being phased out in favor of heat production based on:

- Heat pumps (air/water)
- Heat pumps (seawater, industrial, data centers, sewage water, carbon capture, P2X)
- Electricity (PV and wind)
- Solar collectors
- Geothermal energy
- Biomass
- Excess heat from waste incineration



GULLEV ADVISORY

Thank you!

NAVIGATING GREEN TRANSITION

FURTHER INFORMATION: LARSGULLEV55@OUTLOOK.COM