

# Varmepumper i fjernvarmen

## Praktiske eksempler

Niels From, PlanEnergi

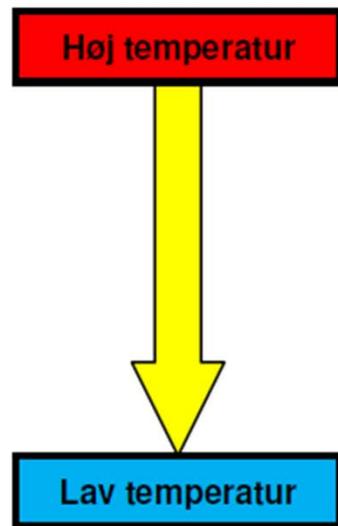
# PlanEnergi

- Rådgivende ingeniørfirma
- 30 år med VE
- 26 ansatte
- Kontorer i
  - Skørping
  - Aarhus
  - Roskilde
- Energiplanlægning
- Vindmølle VVM
- Biogas
- Fjernvarme
  - Solvarme
  - Sæsonlagre
  - Varmepumper

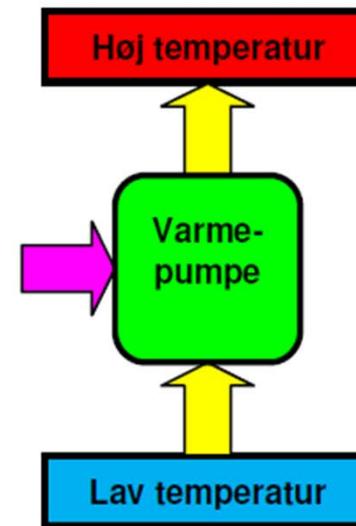
# Forløb

- Varmekilde
- Feasibility
- Projektering
- Myndighedsbehandling
- Udbud og kontrakter
- Etablering
- Indkøring, garanti-tests, aflevering

# Teori - 1

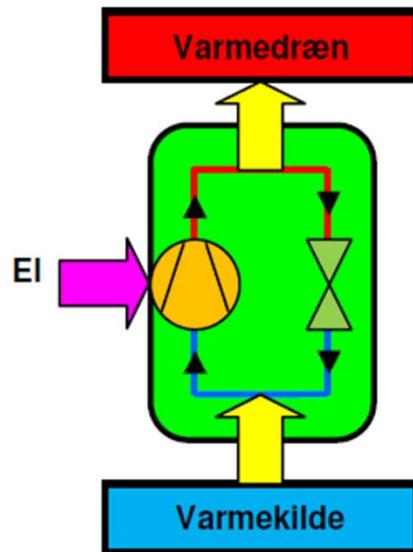


**Figur 1:** Naturlig varmetransport.

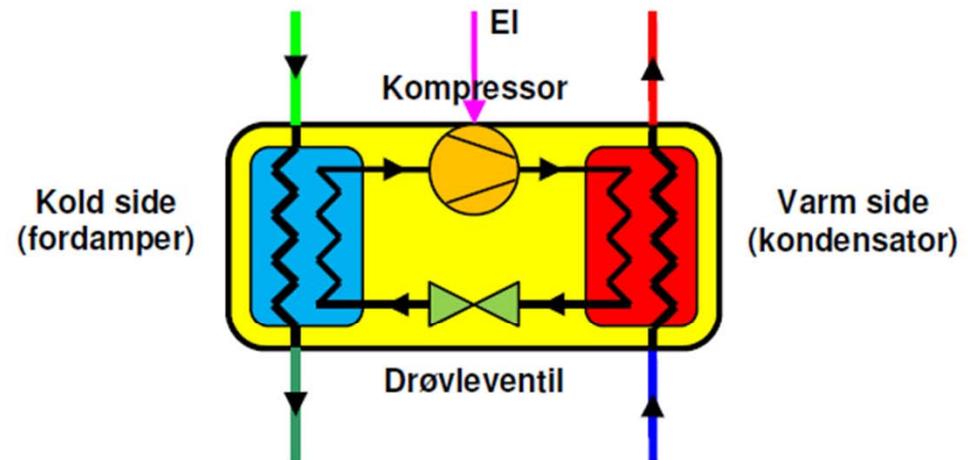


**Figur 2:** "Omvendt" varmetransport.

## Teori - 2



**Figur 3:** "Indmaden" i varmepumpen på figur 2.



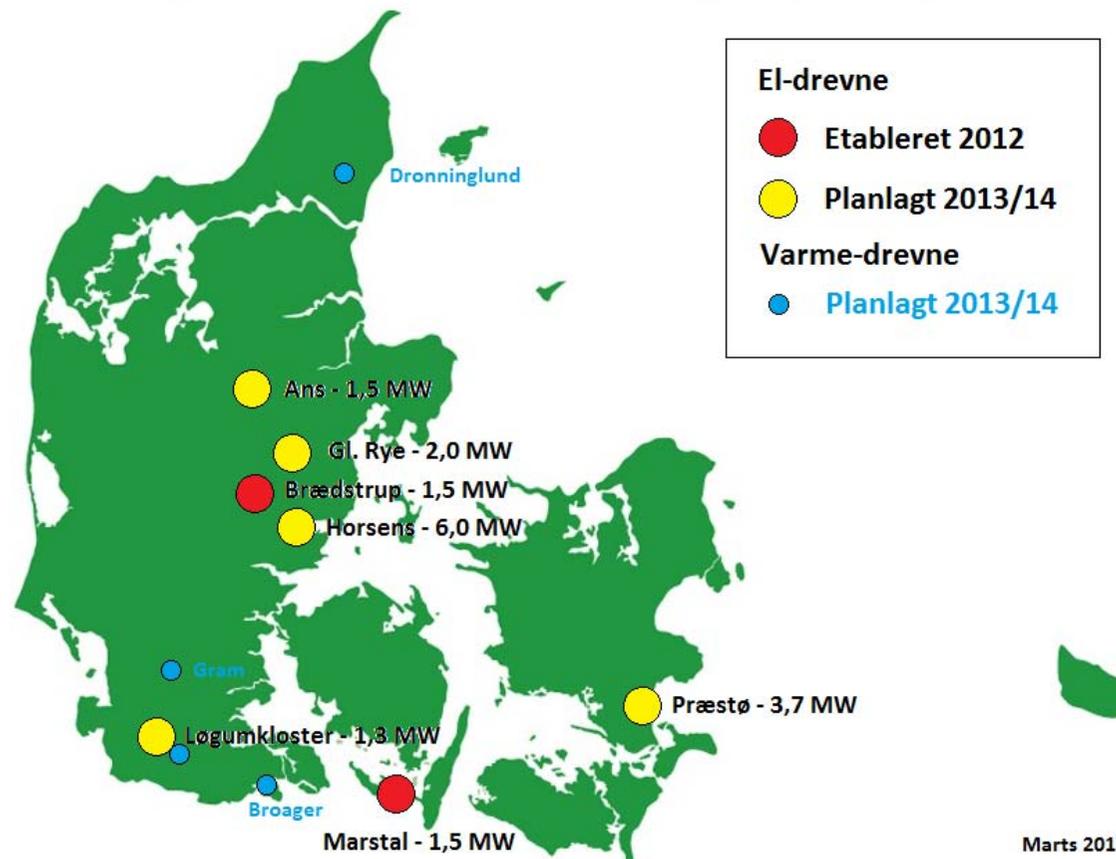
**Figur 4:** "Indmaden" i varmepumpen på figuren fra orienteringen.

# Varmekilder

- Overskudsvarme fra industri
- Spildevand
- Røggas
- Geotermi
- Grundvand
- Å, sø, fjord, hav
- Luft
- Jord

# Praktiske eksempler

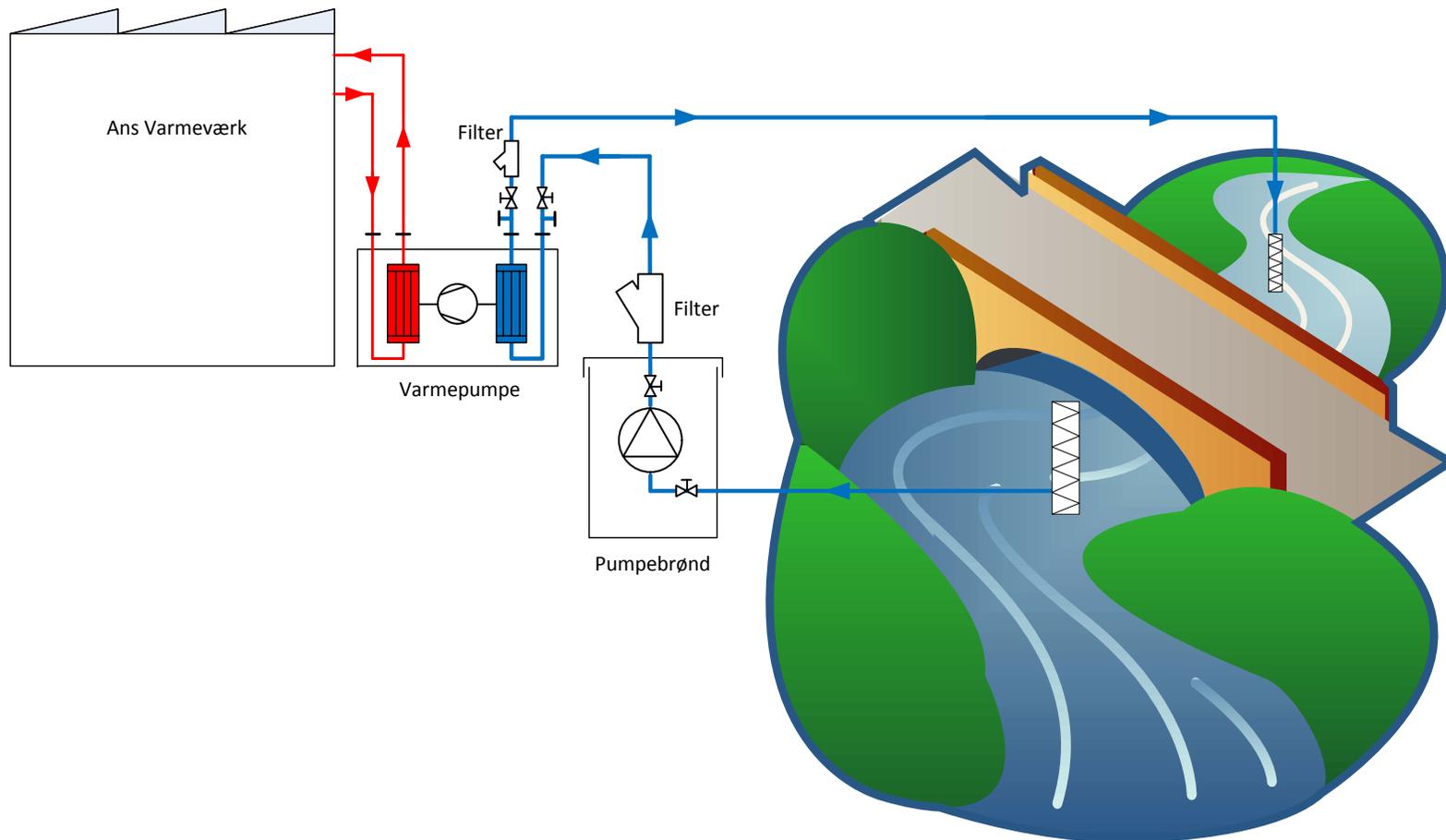
## PlanEnergis referenceliste over varmepumper til fjernvarme



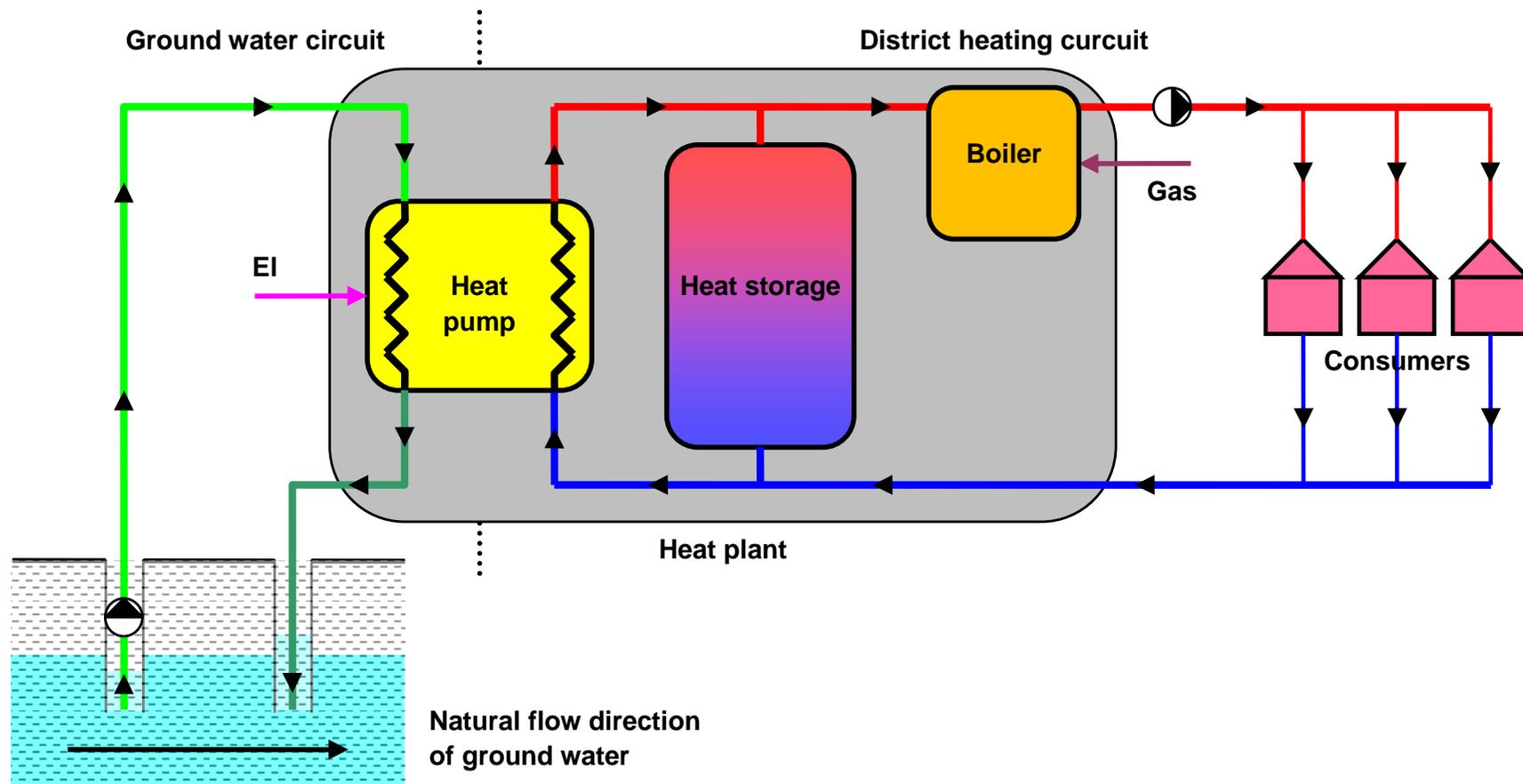
# Horsens

- Varmekilde
  - Renset spildevand fra Horsens Centralrenseanlæg
  - Renholdelse af spildevandvekslere
- Driv-energi
  - El fra egen biogas-motor
  - Naturgas-motor: El eller?
  - El fra nettet?

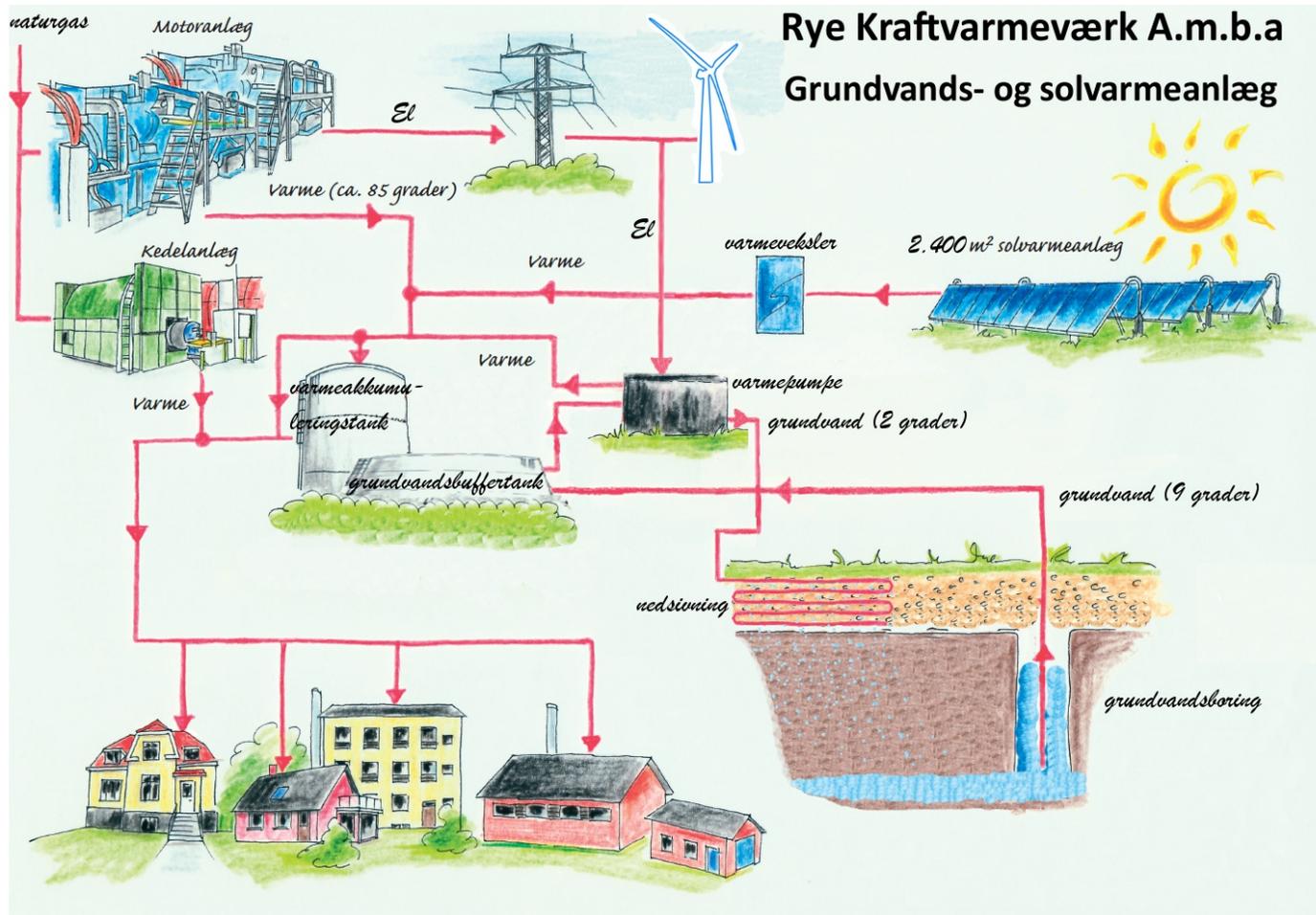
# Ans



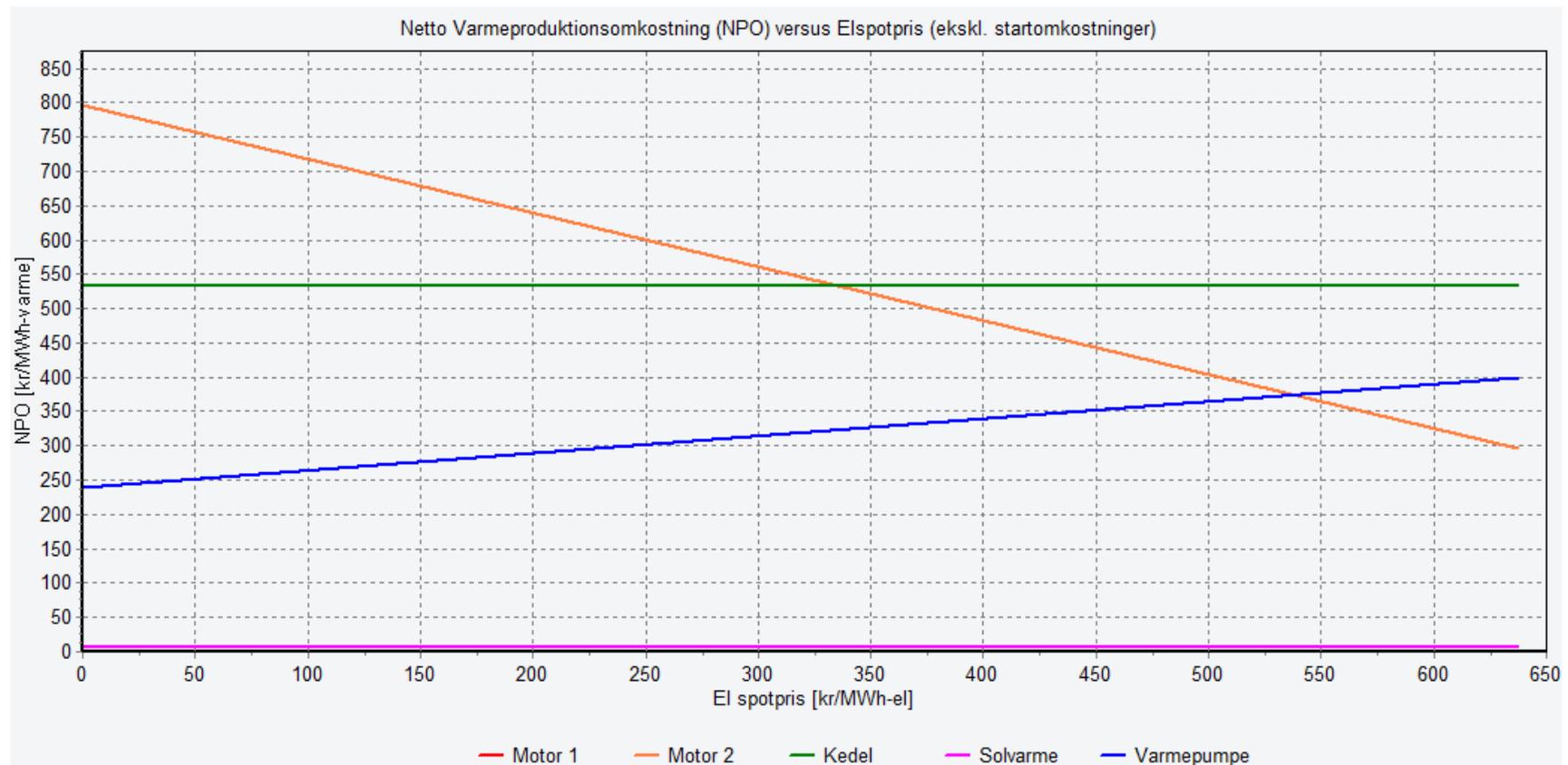
# Præstø



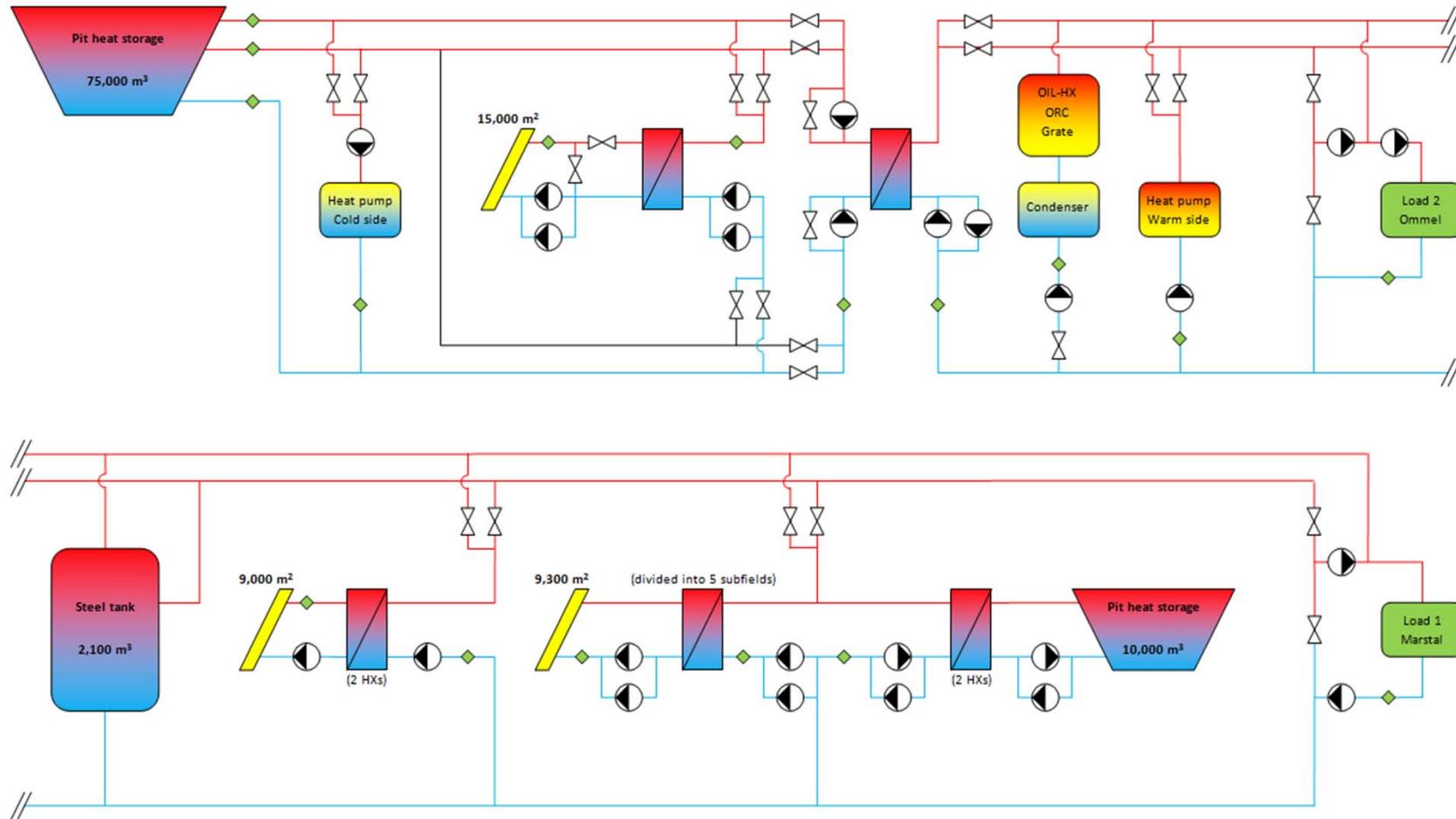
# Gl. Rye - 1



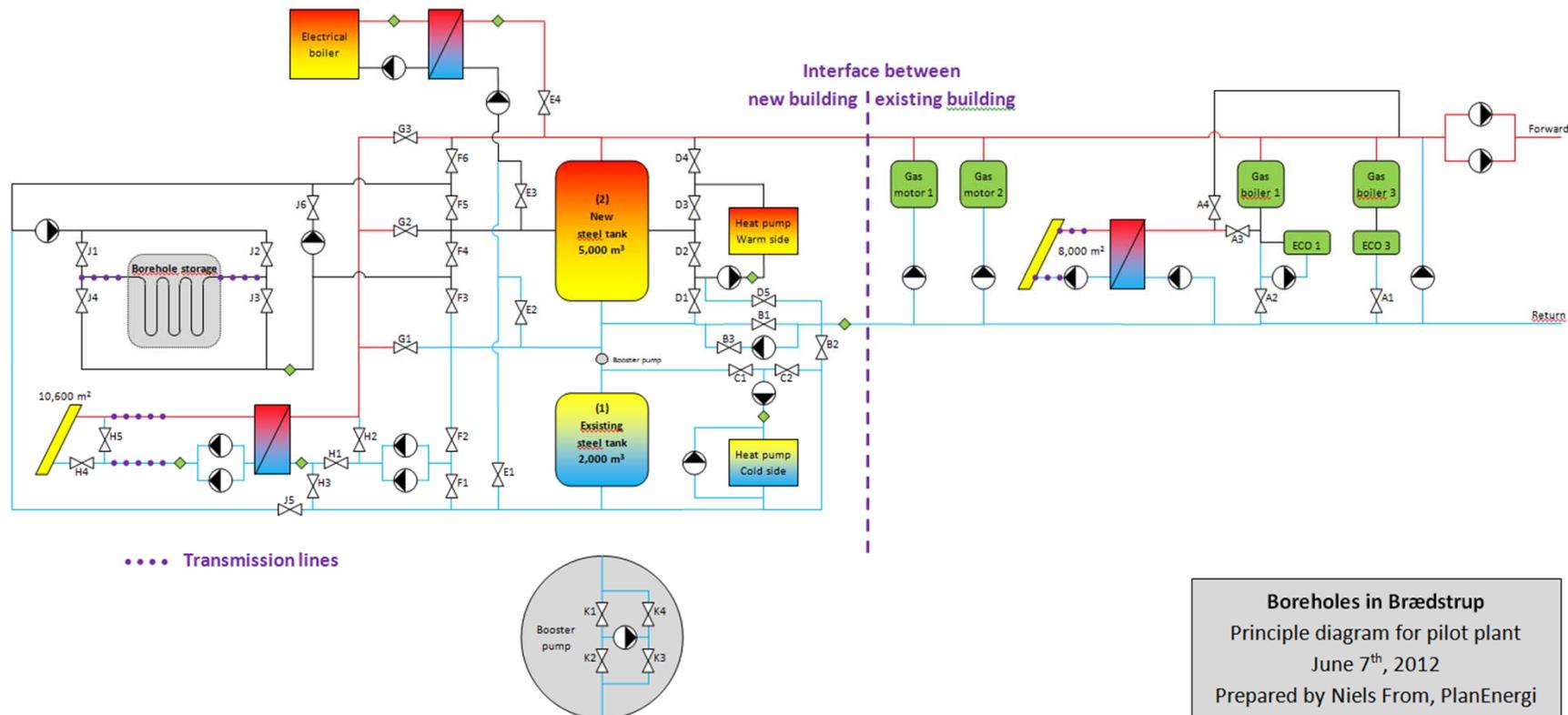
# Gl. Rye - 2



# Marstal - Principdiagram



# Brædstrup - Principdiagram

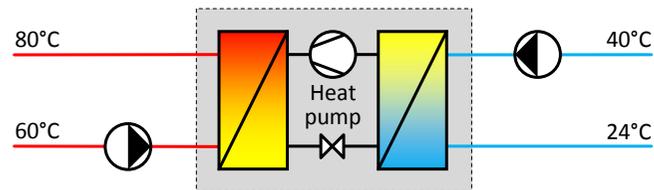


**Boreholes in Brædstrup**  
 Principle diagram for pilot plant  
 June 7<sup>th</sup>, 2012  
 Prepared by Niels From, PlanEnergi

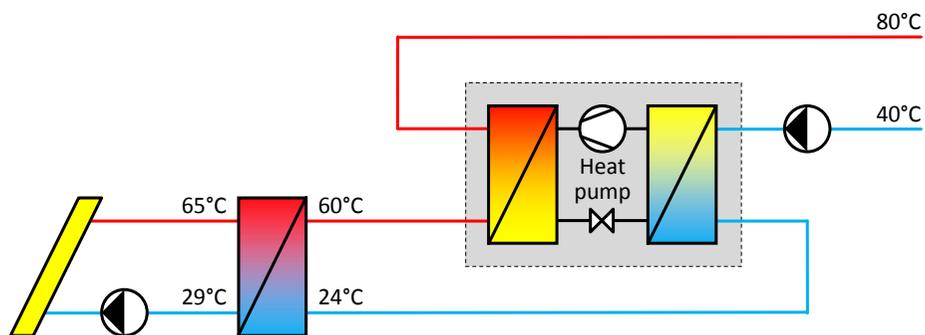
# Solvarme og varmepumper - 1



$$q_{coll} = \eta_0 \cdot G - a_1 \cdot \Delta T_{coll} - a_2 \cdot \Delta T_{coll}^2$$

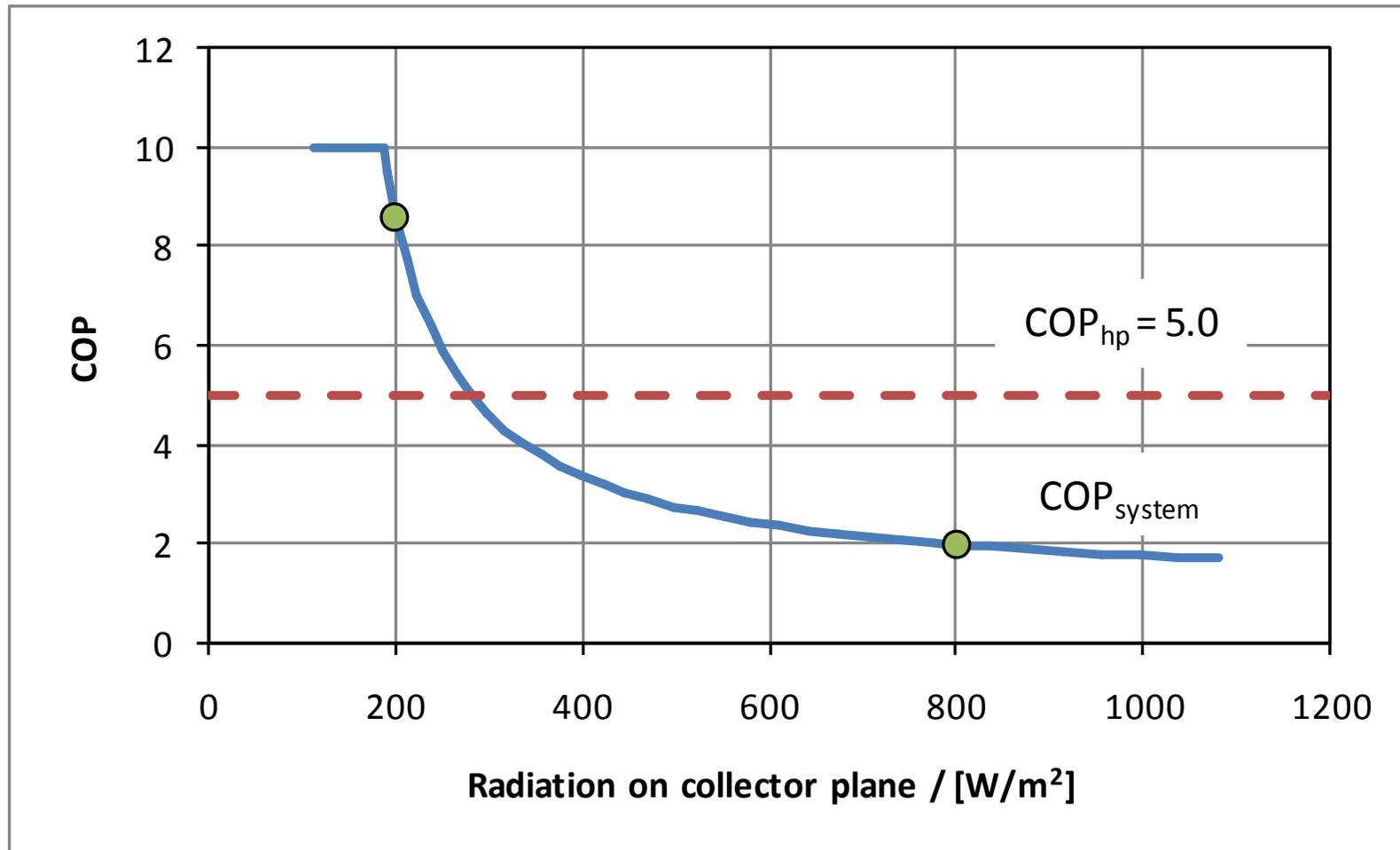


$$COP_{hp} \equiv \frac{q_c}{P_{hp}}$$



$$COP_{system} \equiv \frac{\Delta q_{system}}{P_{hp}}$$

## Solvarme og varmepumper - 2



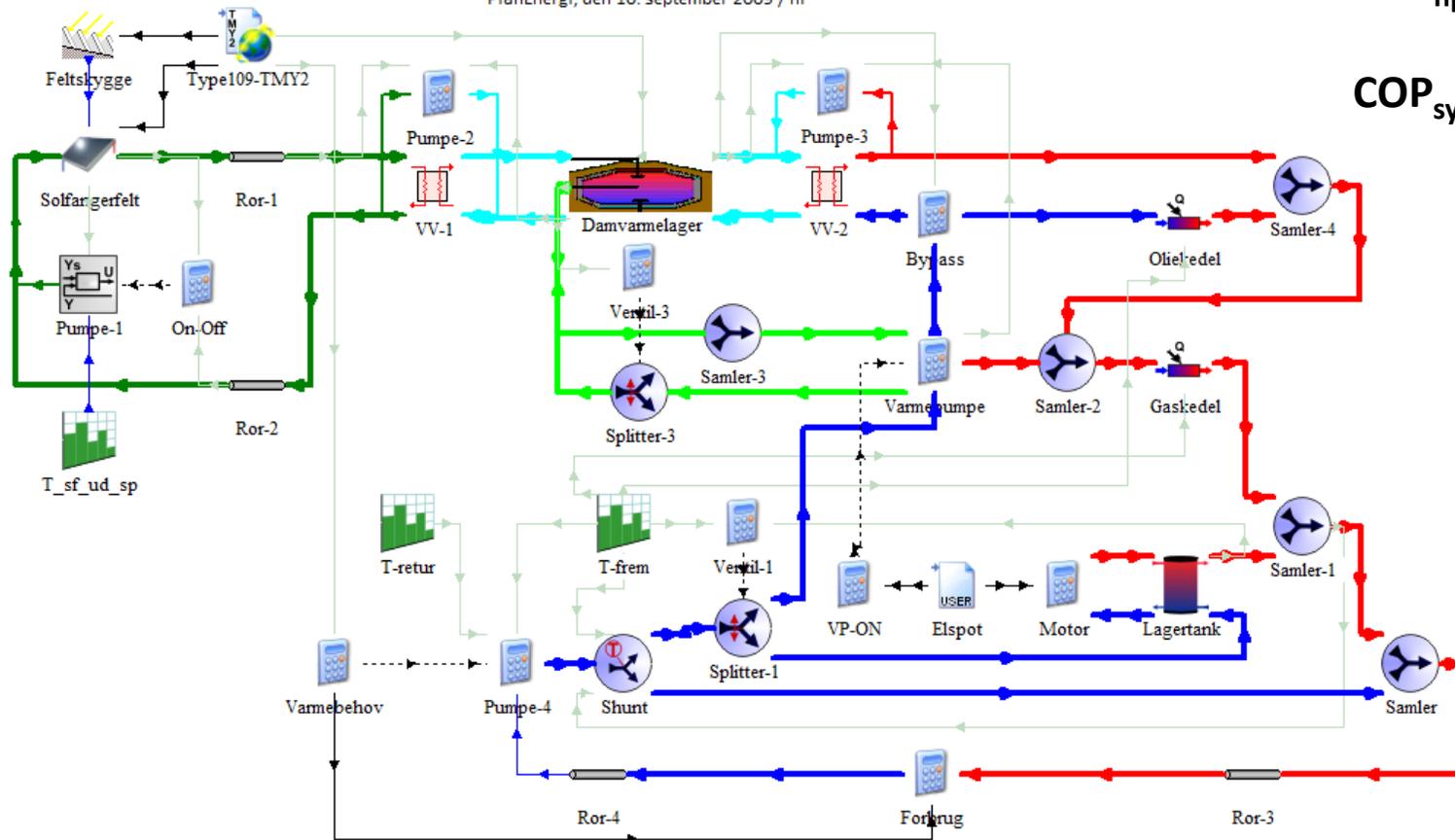
# Dronninglund - 1

## Sunstore 3

PlanEnergi, den 10. september 2009 / nf

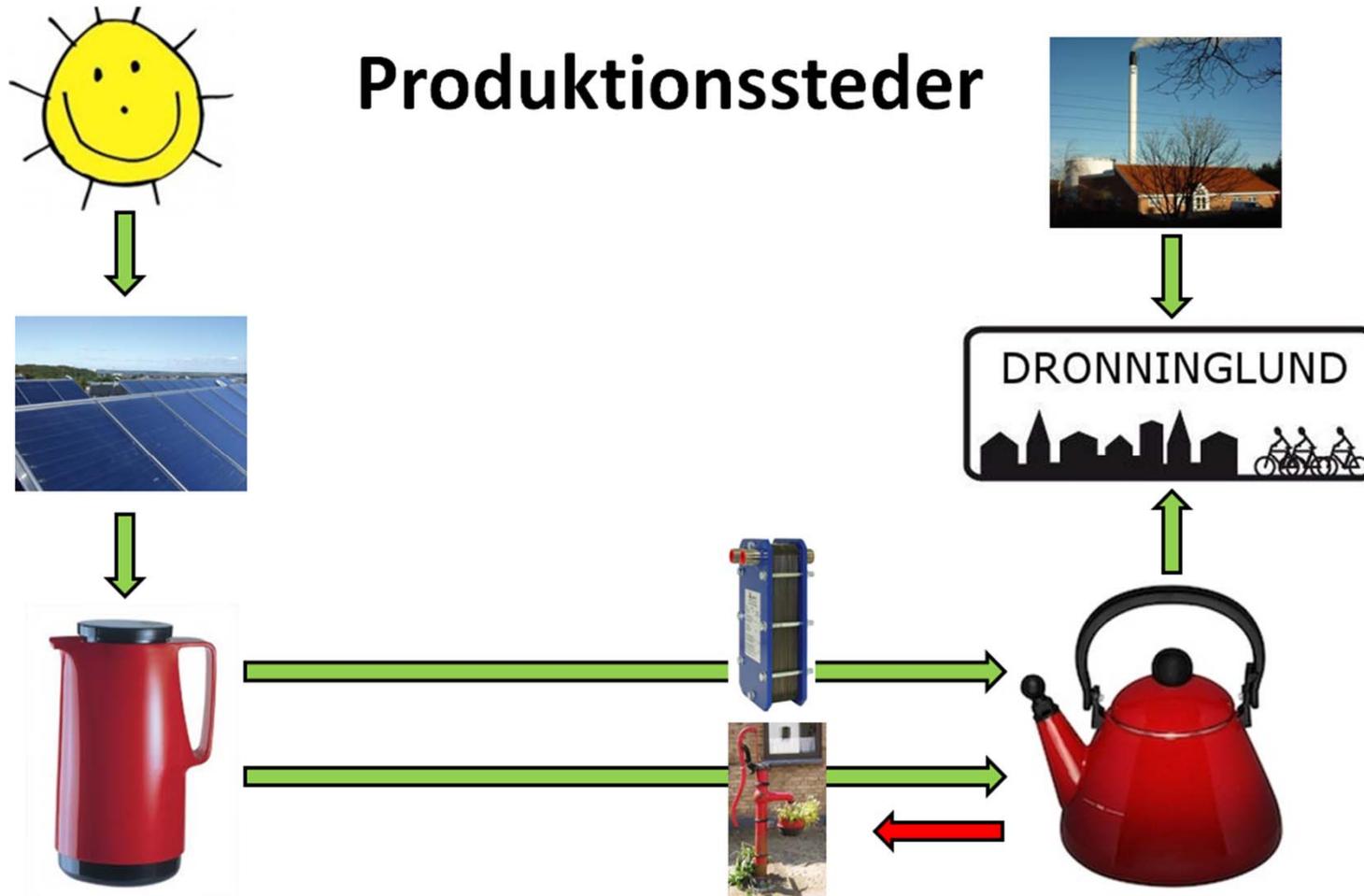
$COP_{hp} = 2,96$

$COP_{system} = 1,44$

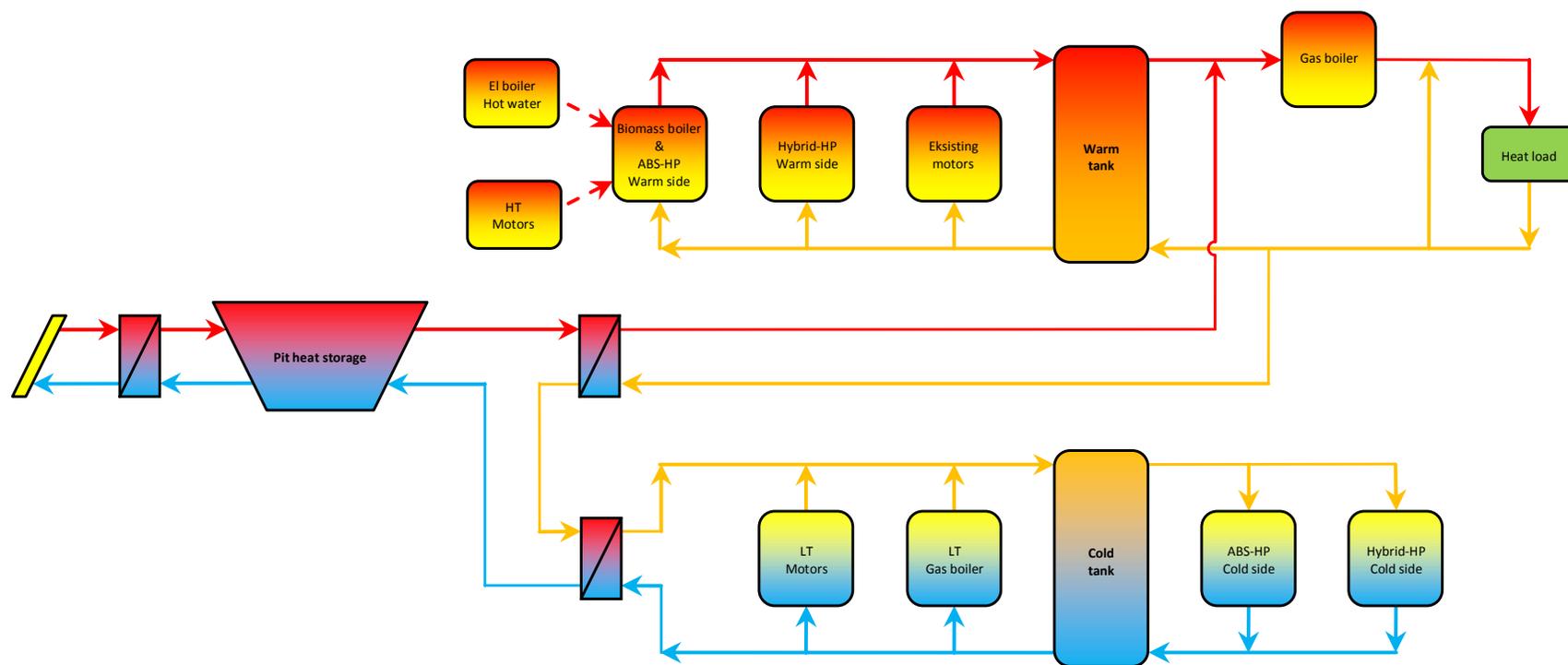


# Dronninglund - 2

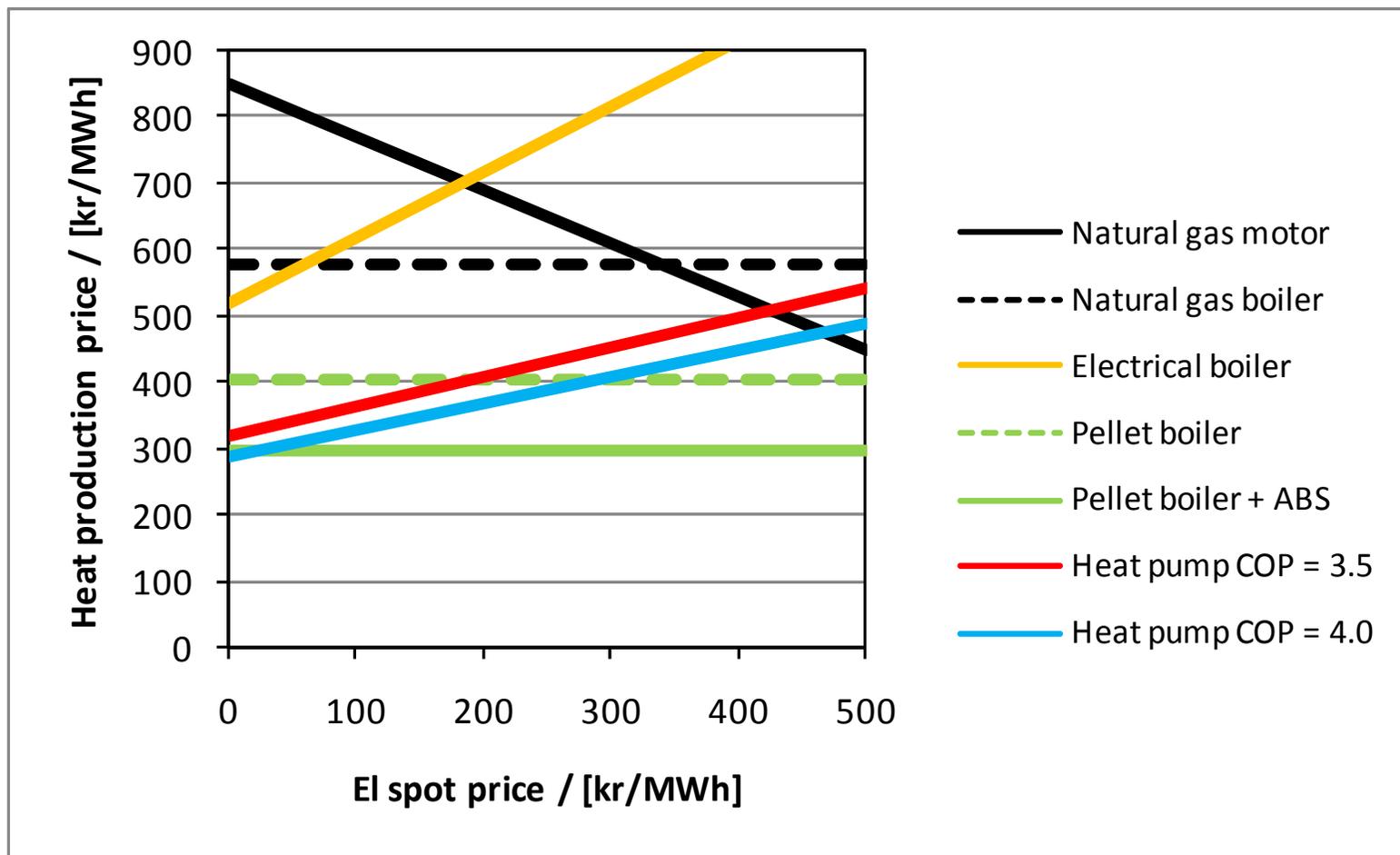
## Produktionssteder



# Løgumkloster - 1



## Løgumkloster - 2



# Tak for opmærksomheden