RAPIDH Case Example

Data Collection → Reference Scenario → Project Scenarios → Evaluation

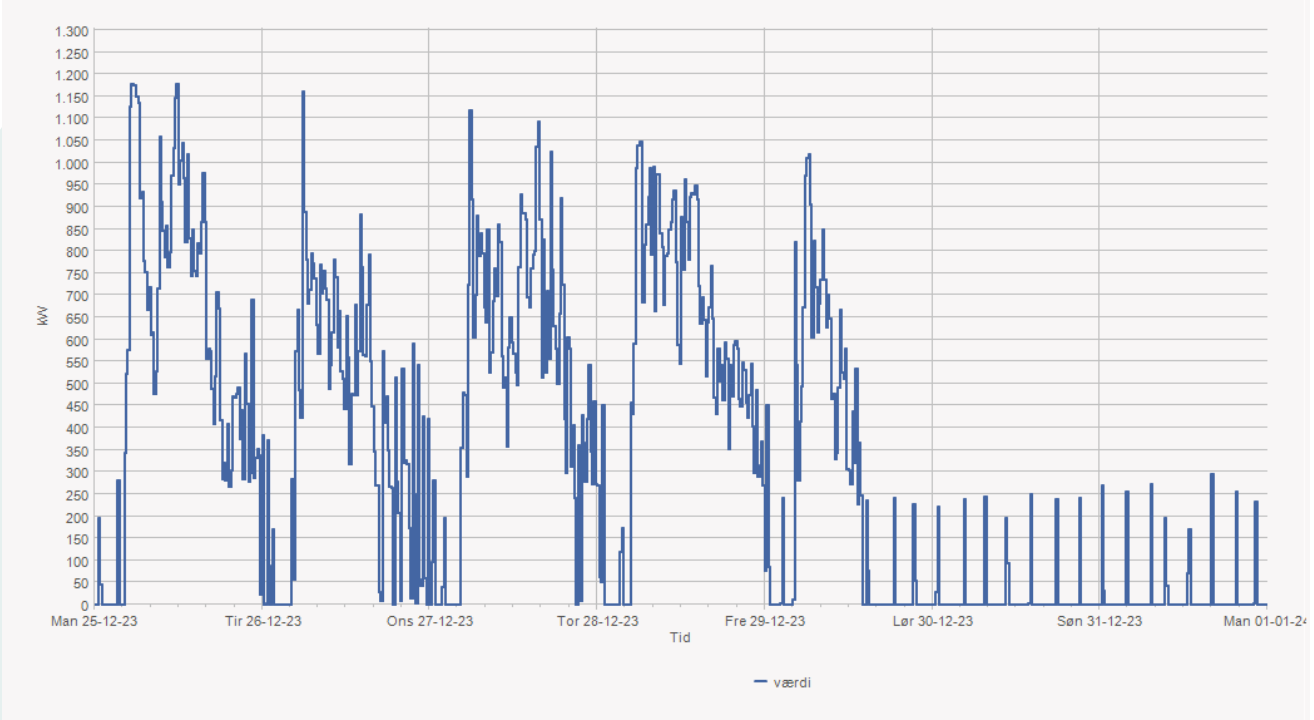
RAPIDH Case Example

Data Collection → Reference Scenario → Project Scenarios → Evaluation

Data Collection

- Demand profiles
  - Electricity, heating, cooling…
  - Balancing the level of detail
  - Accurate results vs. use of resources

- Production units
  - Capacities and efficiencies
  - Internal connections and storage access
  - Operational limitations



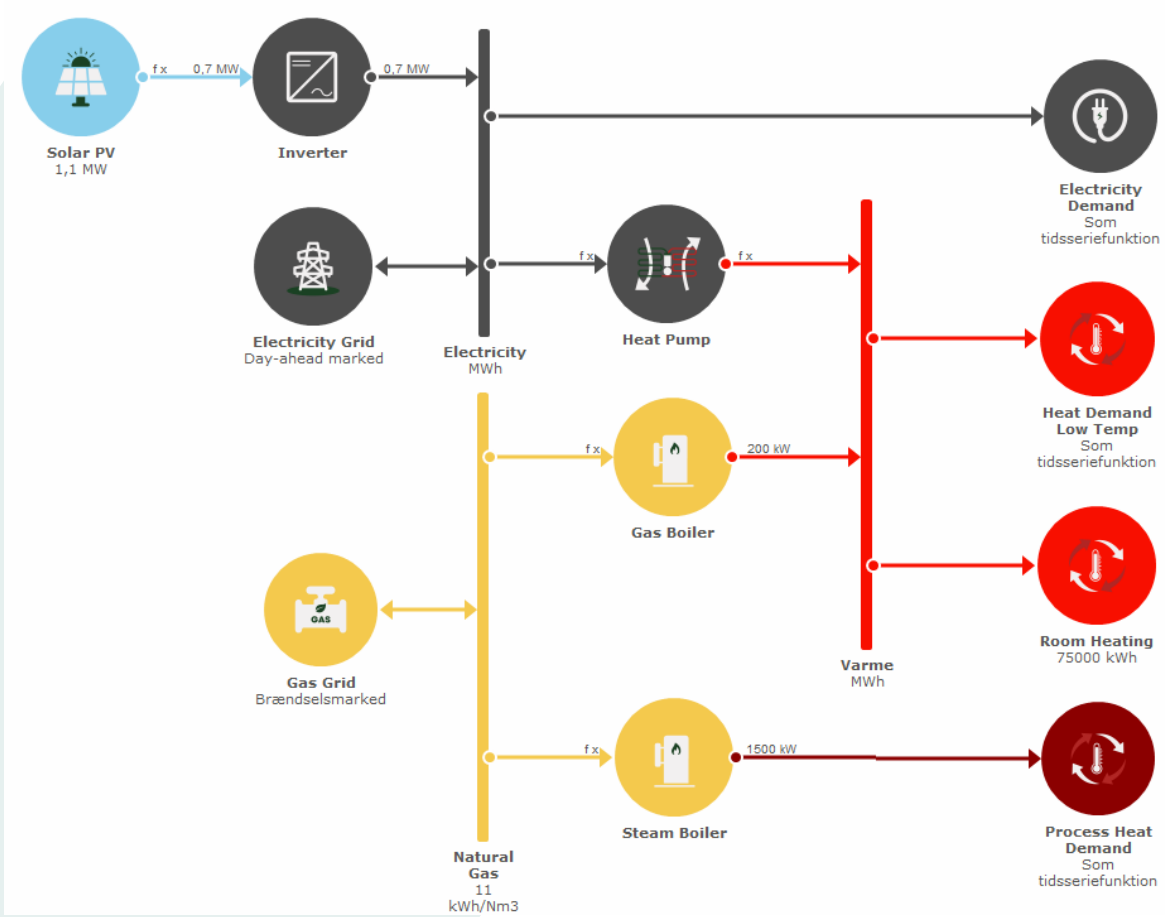
RAPIDH Case Example

Reference Scenario

- Simplified example - not a complete mapping of the factory

- Demand
  - Electricity demand = 2.047 MWh/year
  - Heat demand = 426 MWh/year
  - Process heat demand = 2.906 MWh/year
    - Higher temperature

- Production units
  - Solar PV + inverter 700 kW
  - 160 kW heat pump (not in operation)
  - 200 kW gas boiler
  - 1.500 kW steam boiler

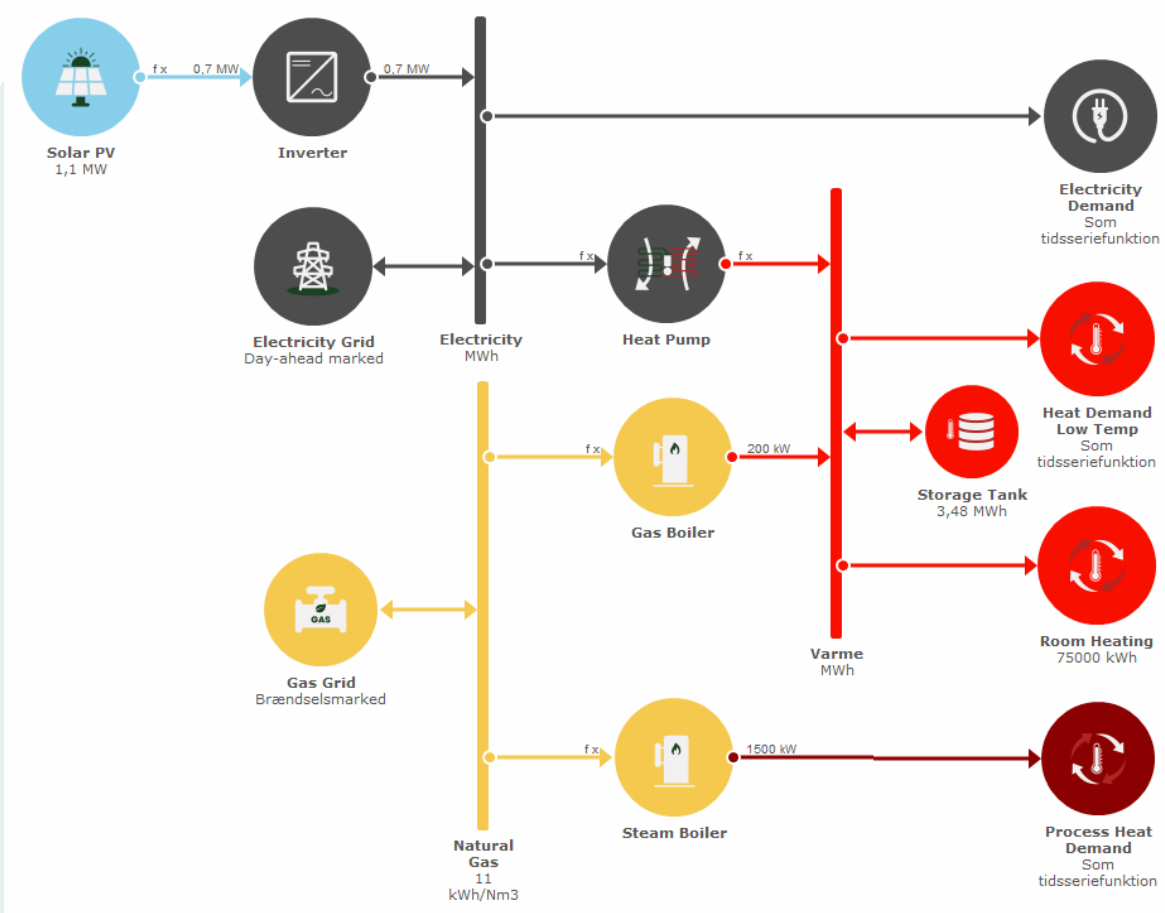


RAPIDH Case Example

Scenario 1

150 m³ Heat Storage Tank

- Heat pump in operation
- Use of own electricity production during weekends
- May be a bit oversized
- Used storage tank = 450.000 DKK



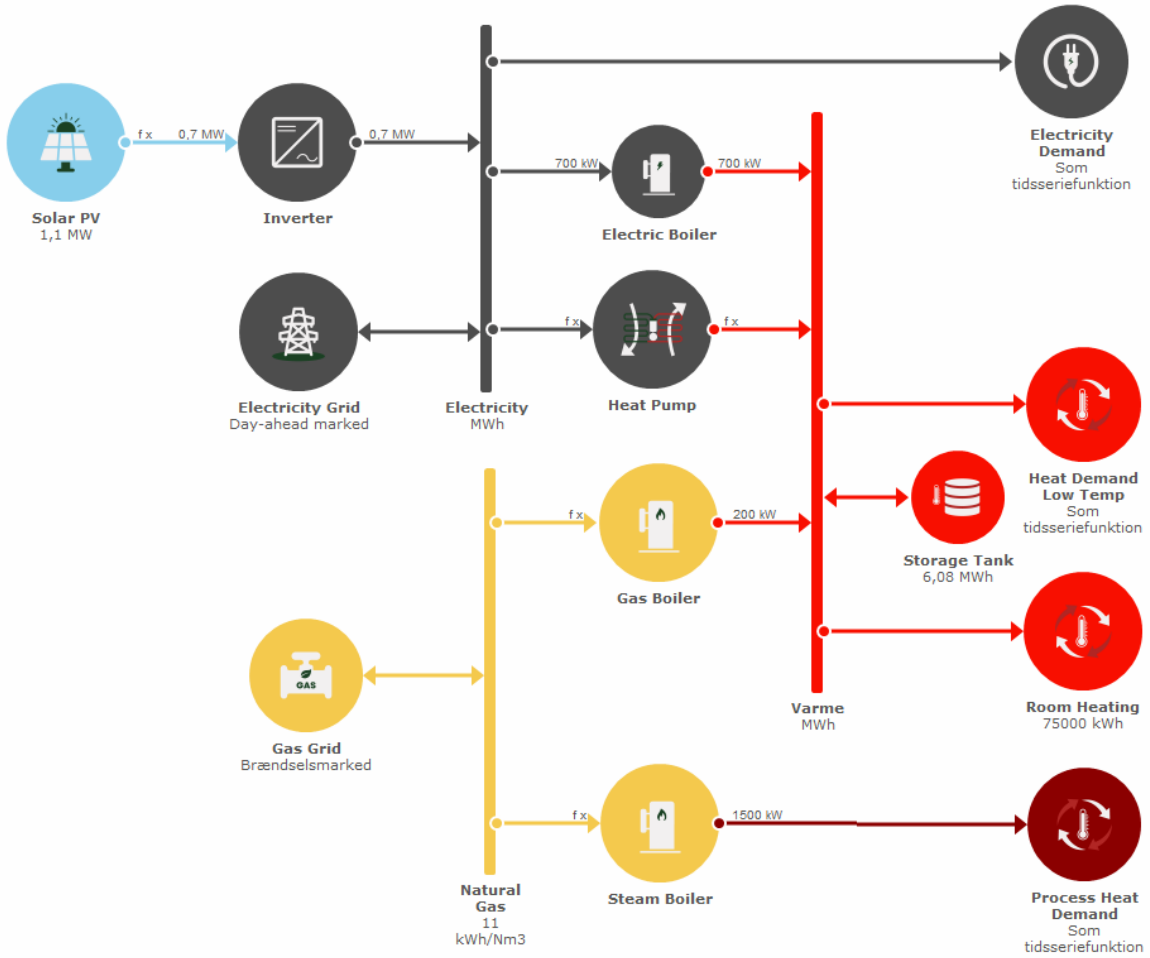
Scenario 2

150 m³ Heat Storage Tank + 700 kW Electric Boiler

- More capacity to utilise low electricity prices
- Increased storage capacity due to higher temperature

- A battery solution was also analysed
  - The price is high but decreasing

- Used storage tank = 450.000 DKK
- Electric boiler + grid connection = 2.600.000 DKK



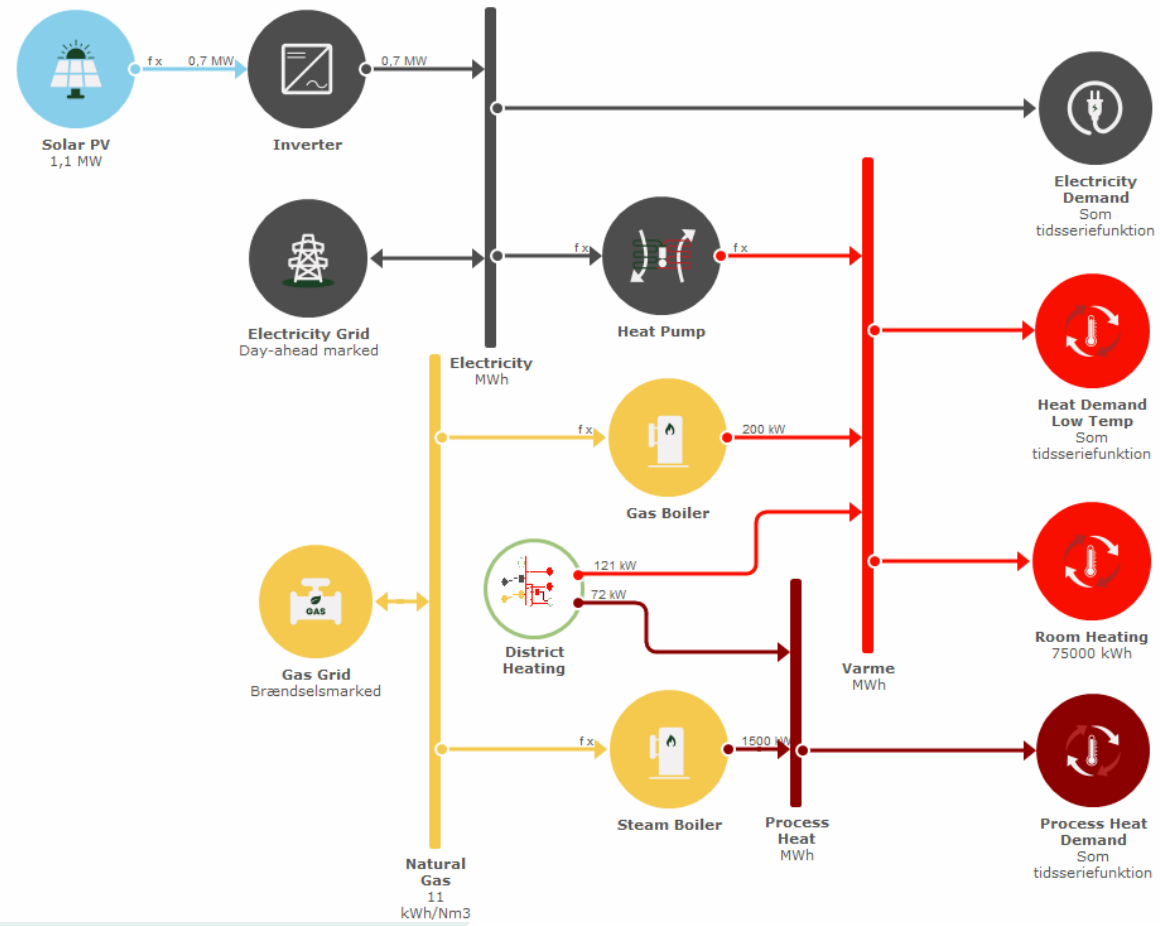
Scenario 3
District Heating

- Reduced gas consumption

- Supply temperature is a limitation
- Pre-heating the feed water for the steam boiler = 72 kW

- District heating = 1.280.000 DKK
- Variable payment = 495 DKK/MWh

District Heating for the Factory			
	Heat Production [MWh/year]	Costs of Operation [DDK/year]	Production Price [DDK/MWh]
Solar Heat	32	227	7
Excess Heat	0	0	Ingen øget produktion
Electric Boiler	804	290.660	362
Gas Boiler	24	16.513	685
TOTAL	**860**	**307.400**	**357**

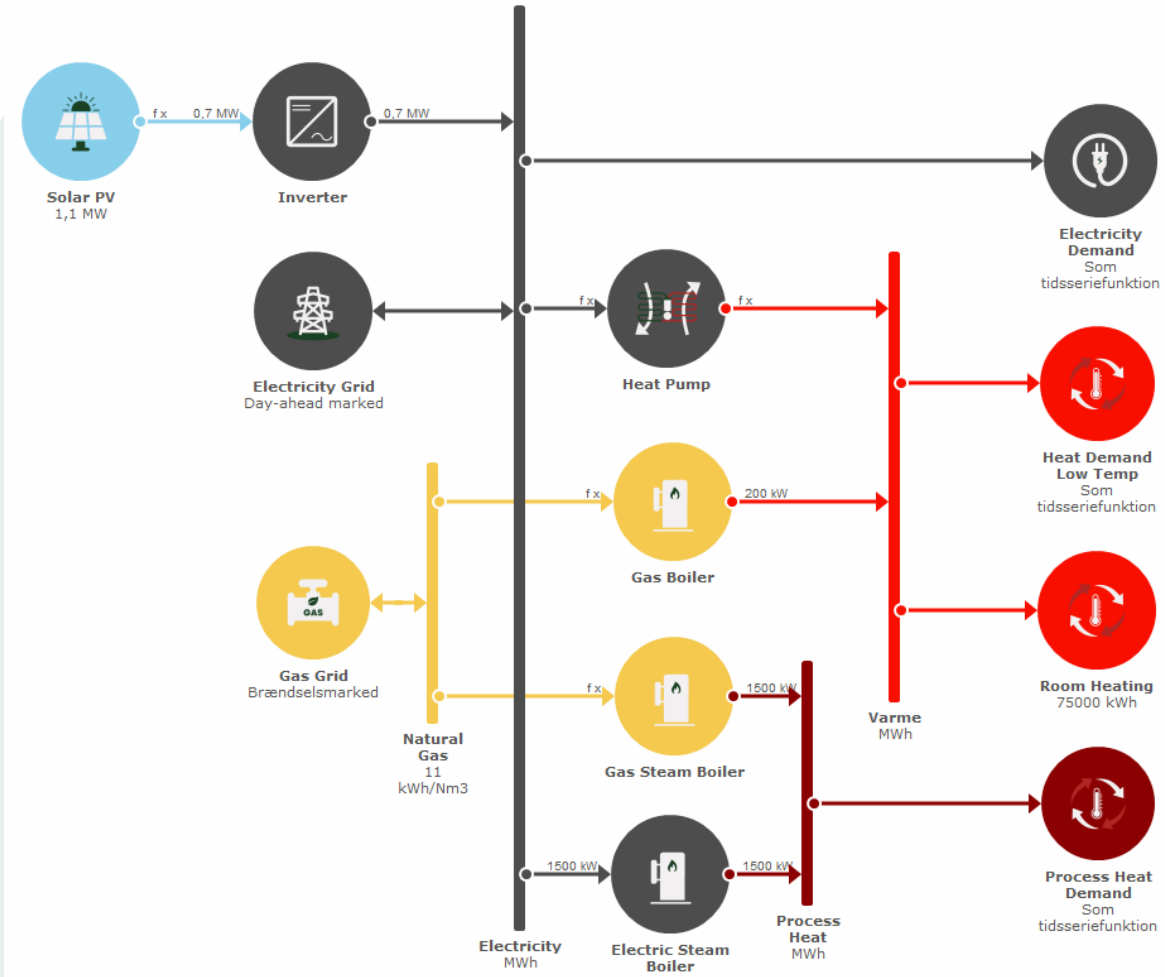


Scenario 4

Electric Steam Boiler

- Installation of an electric steam boiler
- Reduced heat production from the gas-fired steam boiler

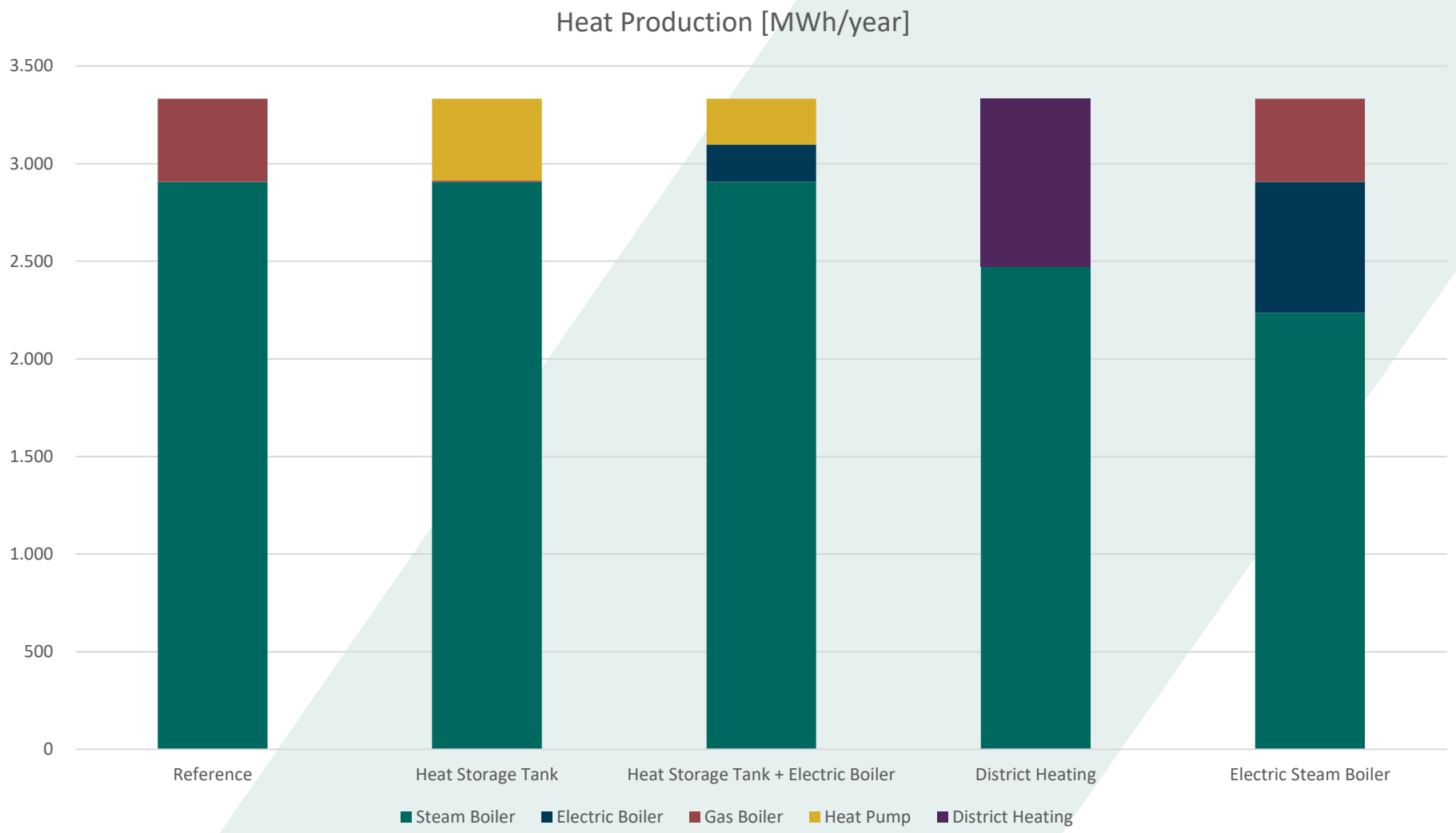
- Electric steam boiler + grid connection = 4.900.000 DKK



RAPIDH Case Example

Evaluation

Distribution of Heat Production



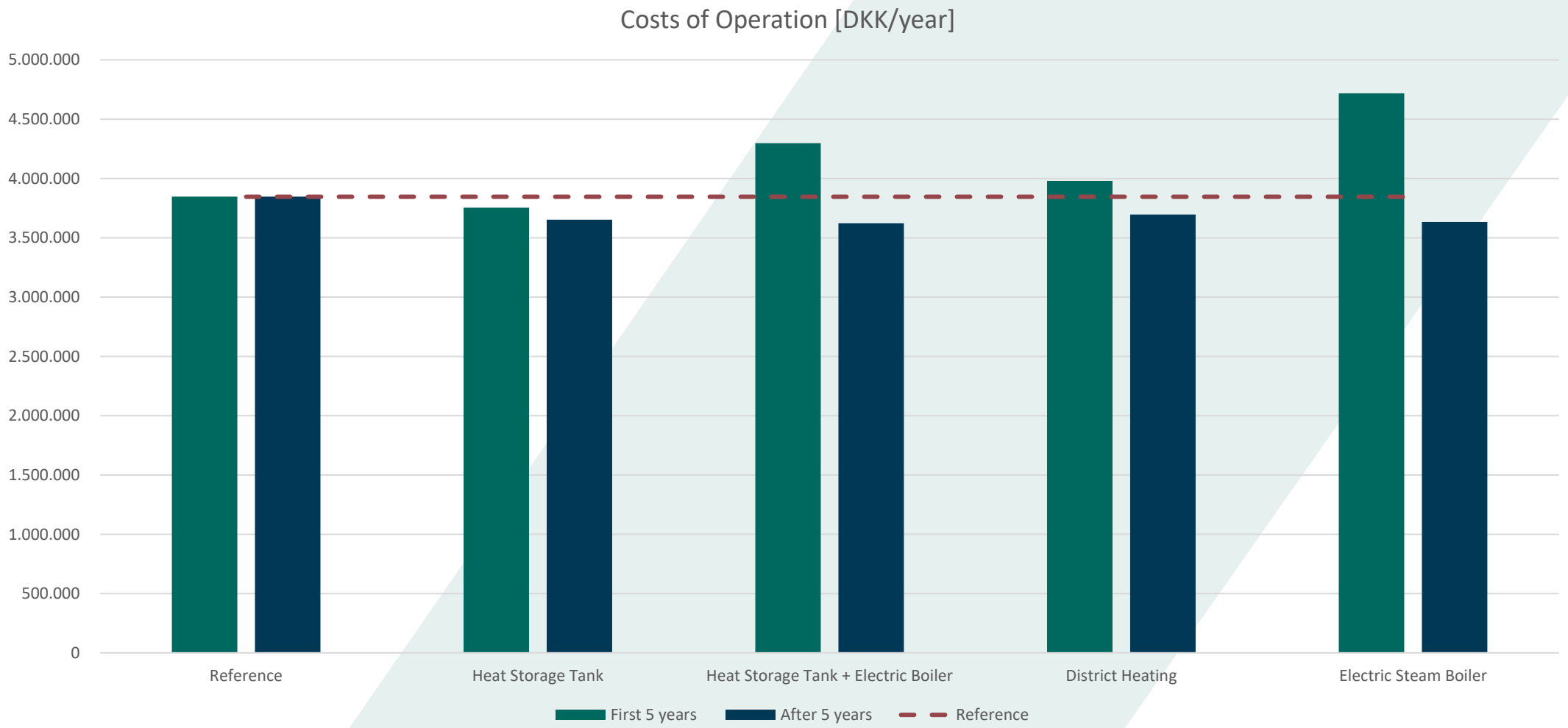
Evaluation
Costs of Operation

Loan Repayment					
	Reference	Heat Storage Tank	Heat Storage Tank + Electric Boiler	District Heating	Electric Steam Boiler
Investment [DKK]	0	450.000	3.050.000	1.280.000	4.900.000
Interest Rate	3,5%	3,5%	3,5%	3,5%	3,5%
Loan Period [years]	5	5	5	5	5
Loan Repayment [DKK/year]	**0**	**99.667**	**675.518**	**283.496**	**1.085.259**

Costs of Operation [DKK/year]					
	Reference	Heat Storage Tank	Heat Storage Tank + Electric Boiler	District Heating	Electric Steam Boiler
Electricity Sale	-68.302	-58.695	-67.228	-68.302	-50.536
Electricity Purchase	1.650.273	1.713.311	1.698.222	1.650.273	1.891.256
Gas Purchase	2.237.313	1.966.731	1.962.224	1.669.161	1.784.005
Operation and Maintenance	26.656	31.677	29.469	19.776	8.771
District Heating	0	0	0	425.651	0
Loan Repayment	0	99.667	675.518	283.496	1.085.259
TOTAL	**3.845.940**	**3.752.691**	**4.298.205**	**3.980.055**	**4.718.755**
Annual Benefit (first 5 years)		**93.249**	**-452.265**	**-134.115**	**-872.815**
Annual Benefit (after 5 years)		**192.916**	**223.253**	**149.382**	**212.444**

Evaluation

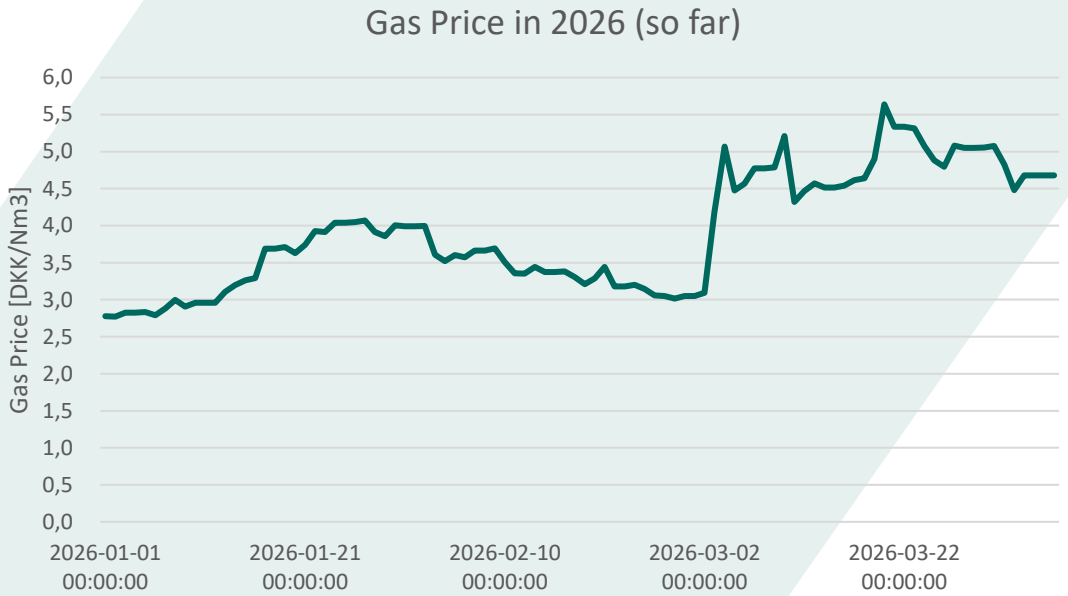
Overview



Evaluation

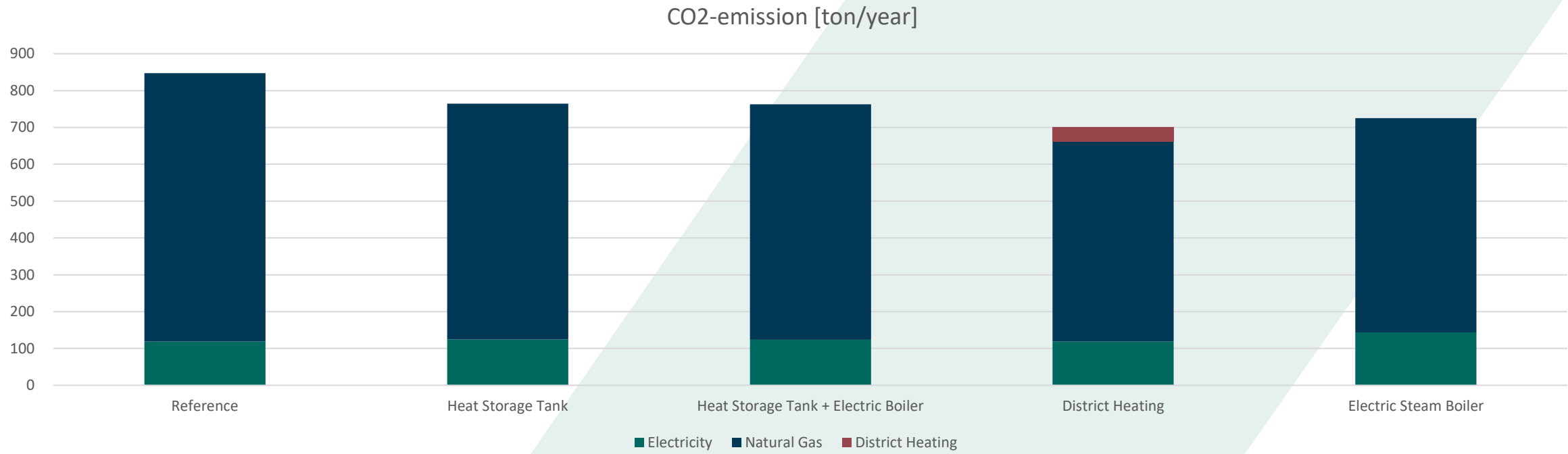
Sensitivity towards the Gas Price in Scenario 4 (Electric Steam Boiler)

- Average gas price in 2025 = 3,44 DKK/Nm^3
- Sensitivity with a fixed gas price of 4,75 DKK/Nm^3
- Reference costs increase by 420.000 DKK/year
- Project costs increase by 320.000 DKK/year
- = The benefit increases by 100.000 DKK/year



Costs of Operation [DKK/year]				
	Reference	Electric Steam Boiler	Reference + High Gas Price	Electric Steam Boiler + High Gas Price
Electricity Sale	-68.302	-50.536	-68.302	-45.917
Electricity Purchase	1.650.273	1.891.256	1.650.273	2.029.970
Gas Purchase	2.237.313	1.784.005	2.655.788	1.960.919
Operation and Maintenance	26.656	8.771	26.656	10.345
District Heating	0	0	0	0
Loan Repayment	0	1.085.259	0	1.085.259
TOTAL	**3.845.940**	**4.718.755**	**4.264.415**	**5.040.576**
Annual Benefit (first 5 years)		**-872.815**		**-776.161**
Annual Benefit (after 5 years)		**212.444**		**309.098**

Evaluation
CO2-emission



- At some companies, a CO2-reduction can justify that the annual benefit of the project is negative
  - In Scenario 3 (District Heating) the benefit is -134.000 DKK/year during the first 5 years, and the CO2-reduction is 146 ton/year
  - This means that the CO2-reduction costs 917 DKK/ton