GSHPA

GROUND SOURCE HEAT PUMP ASSOCIATION

“Flow Temperatures and Heat Pump Performance”

Heat Pump Calculator.

Importance of Flow and Return Temps on COP.

Solid energy a/s

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GROUND SOURCE HEAT PUMP ASSOCIATION

Sub-titled :

Back to basics. Press the reset button

Fabric first

Low water temperatures

Solid energy a/s

Audience – General Practice M&E Consultants

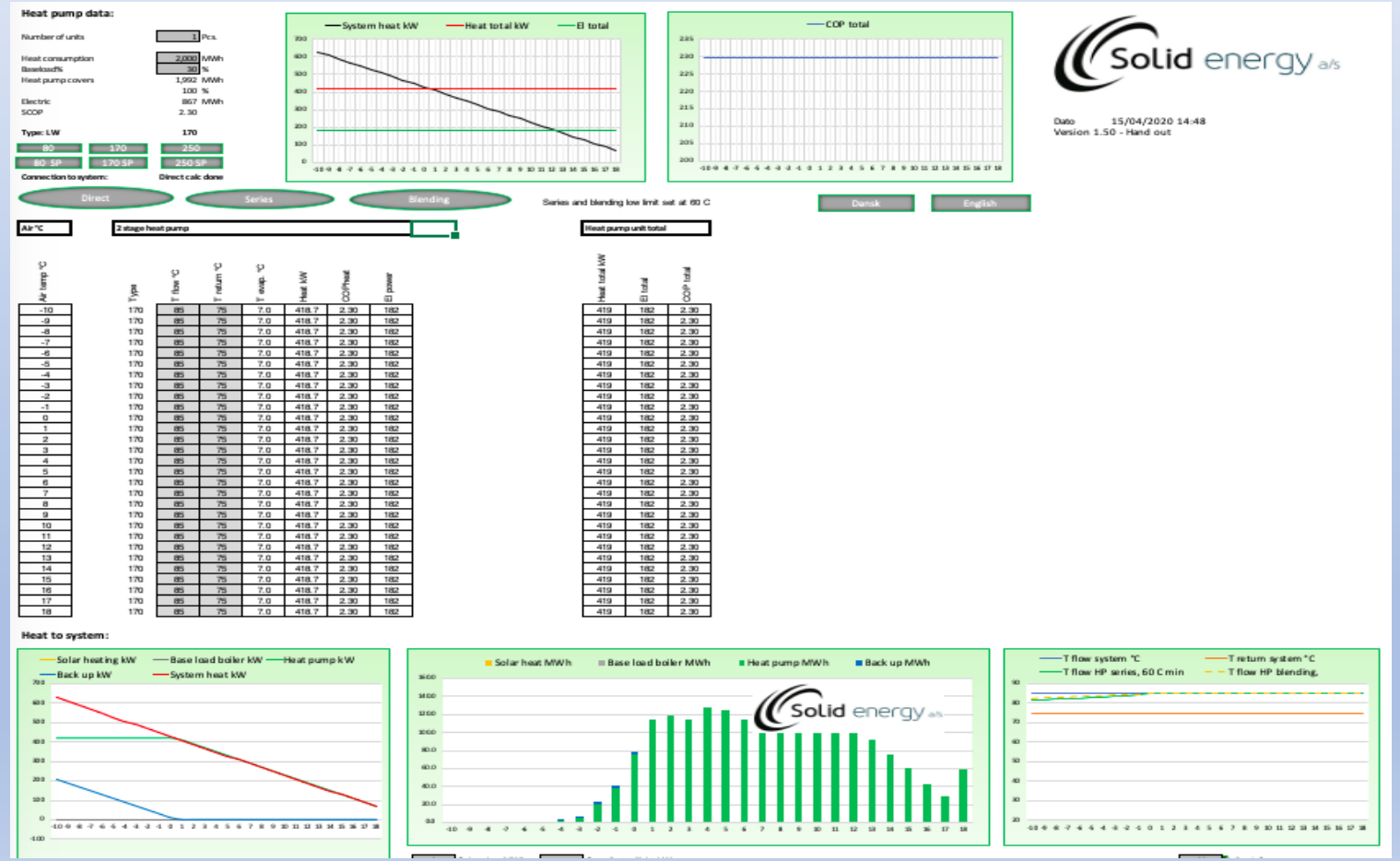
- As manufacturers of large heat pumps have been collaborating with Minibems with their series of lockdown webinars on dynamic flow controls on district heating systems to minimize flow and return temperatures to ensure that the heat pumps would be working at best possible efficiency levels.
- We are working under an NDA with the UK Coal Authority on their schemes to utilise mine water as a source of thermal energy. On some sites the mine water is at a consistent temperature of 20℃.
- Although this water temperature can be a great benefit, unless the heating system is designed correctly the advantage can easily be lost, with severe impact of the lifetime costs of the scheme if high flow temperatures are needed.

Heat Pump Selector

- The Solid Energy Heat Pump Selector has been designed to assist with large (>220kW) heat pump projects at an early feasibility stage.
- It can provide basic data on dimensions, electrical power requirements and an SCOP figure when anticipated flow and return temperatures are disclosed.
- It can very easily give SCOP figures for set parameters and the impact of both good ground water temperatures and poor flow and return can be demonstrated.
- The Heat Pump Selector has been well received and it is now assisting many designers throughout the UK and Ireland.

Heat Pump Calculator

"How does dynamic flow control impact on the viability of heat pumps"

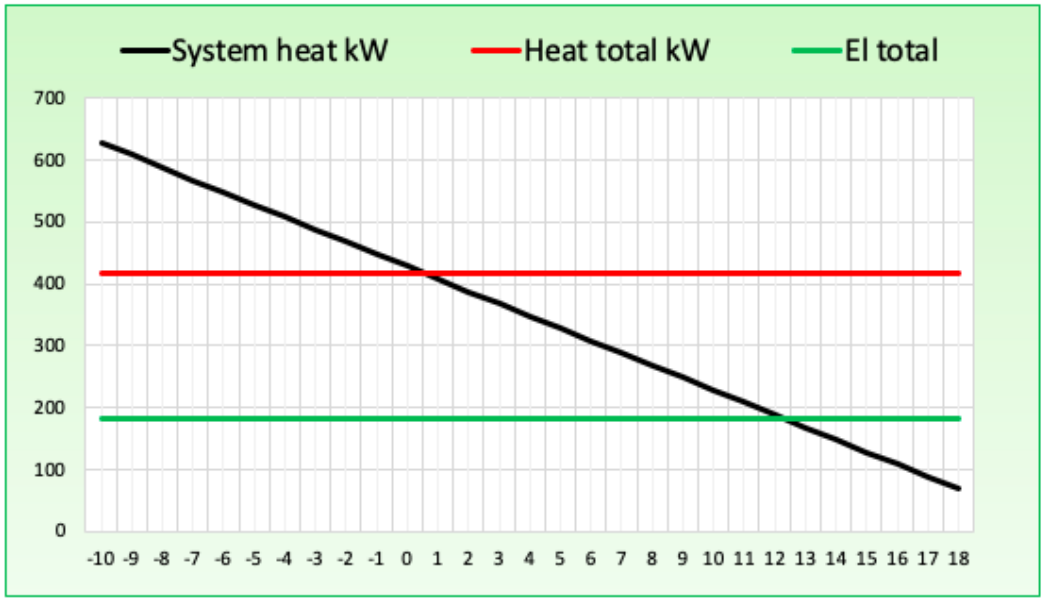


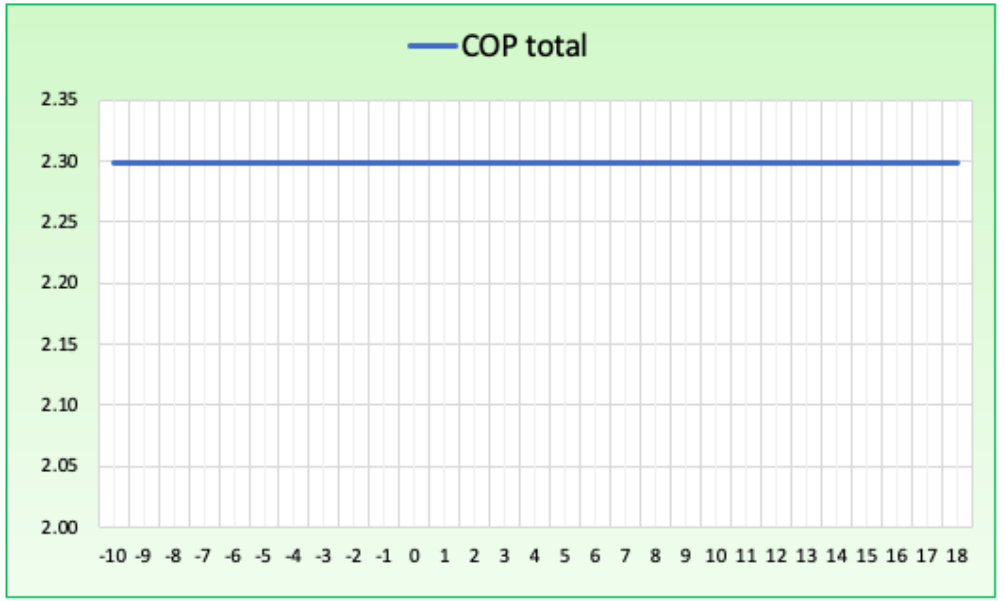
We have fixed the heat pump as a LW170 (nominal output 500kW) with the water source temperature at 10℃. We have varied only the flow and return temperatures to demonstrate the impact on the COP and similar scenarios with water source at 20℃ (mine water?)

Water Temp 10°C Flow85°C Return75°C COP 2.3

1	Pcs.
2,000	MWh
30	%
1,992	MWh
100	%
867	MWh
2.30	
170	
250	
250 SP	

Direct calc done





Series Blending

Series and blending low limit set at 60 C

Dansk English

at pump

T flow °C	T return °C	T evap. °C	Heat kW	COPheat	El power
85	75	7.0	418.7	2.30	182
85	75	7.0	418.7	2.30	182

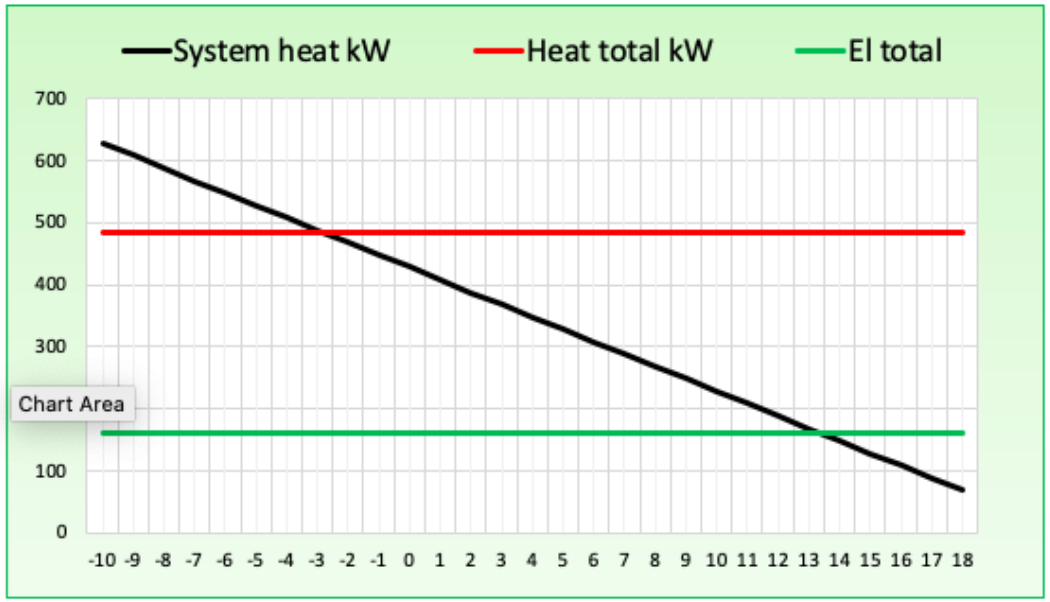
Heat pump unit total

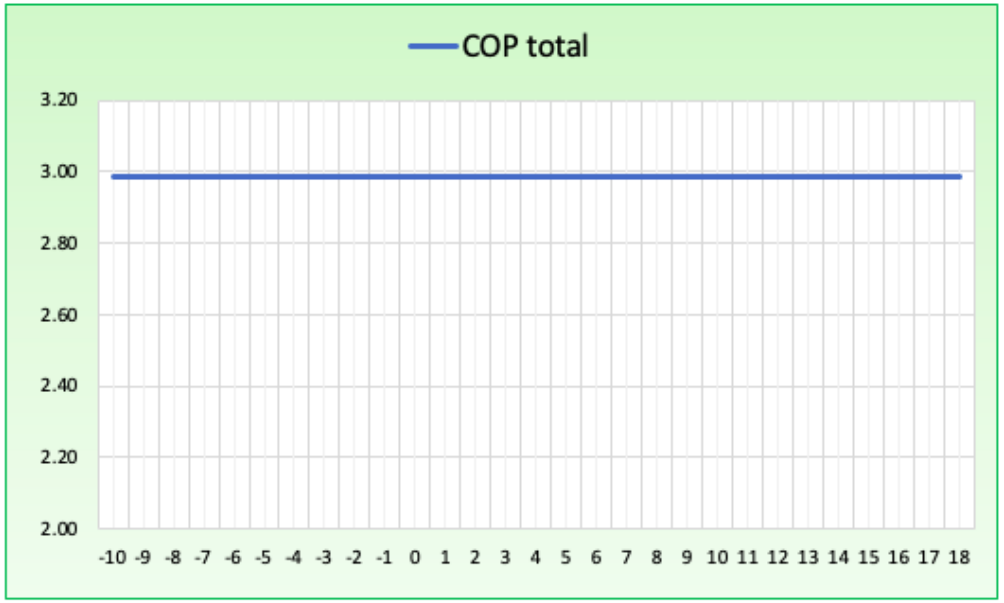
Heat total kW	El total	COP total
419	182	2.30
419	182	2.30

Water Temp 10°C F70°C R60°C COP 3.00

1	Pcs.
2,000	MWh
30	%
2,000	MWh
100	%
670	MWh
2.98	
170	
250	
250 SP	

Direct calc done





Series | Blending

Series and blending low limit set at 60 C

Dansk | English

at pump

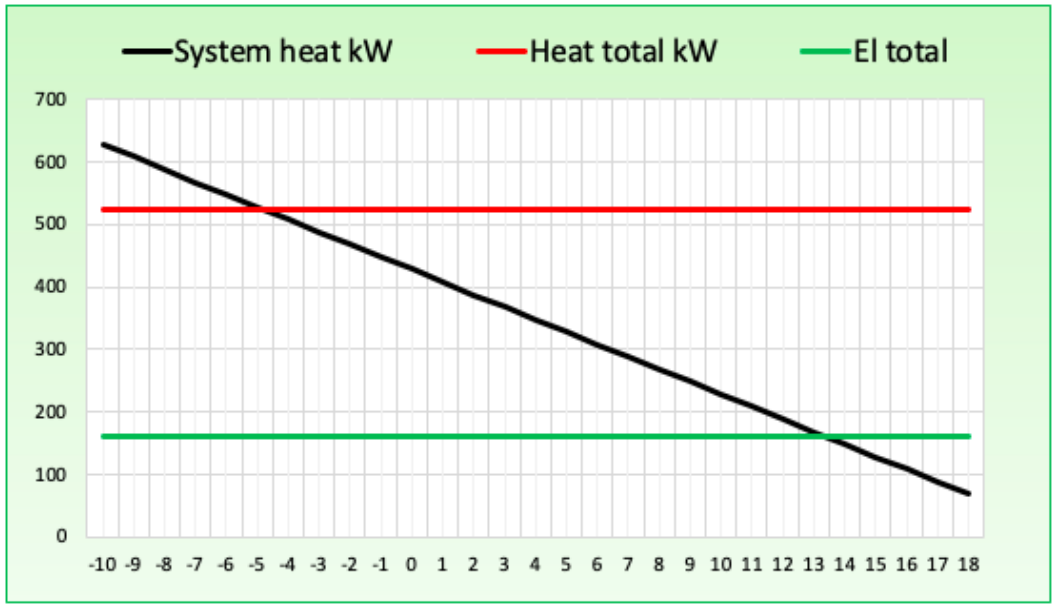
T flow °C	T return °C	T evap. °C	Heat kW	COPheat	El power
70	60	7.0	483.4	2.98	162
70	60	7.0	483.4	2.98	162

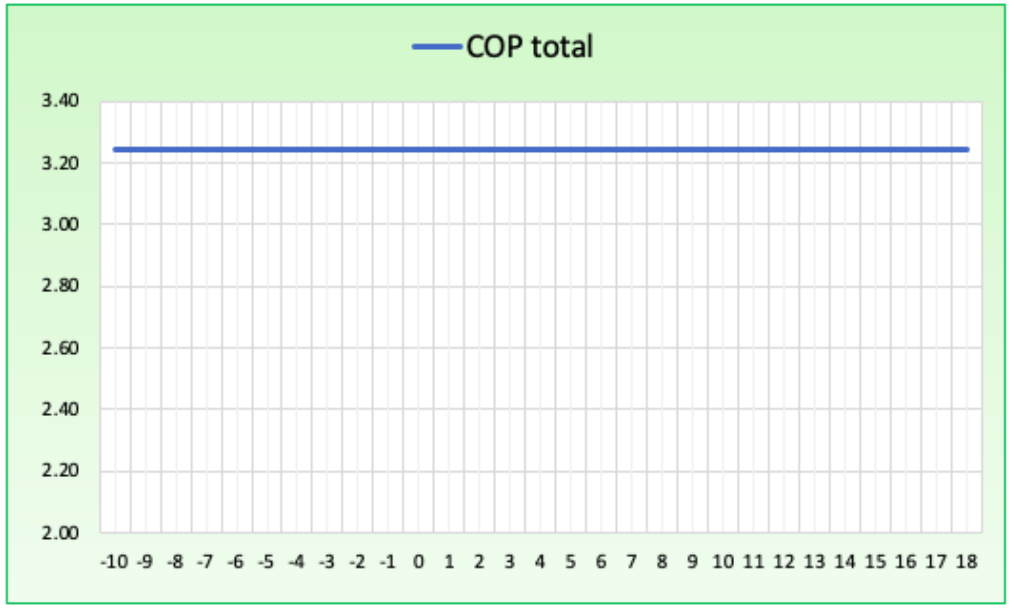
Heat pump unit total

Heat total kW	El total	COP total
483	162	2.98
483	162	2.98

Water Temp 10°C F70°C R50°C COP 3.25

1	Pcs.
2,000	MWh
30	%
2,000	MWh
100	%
616	MWh
3.24	
170	
250	
250 SP	
Direct calc done	





Series

Blending

Series and blending low limit set at 60 C

Dansk

English

eat pump

T flow °C	T return °C	T evap. °C	Heat kW	COPheat	El power
70	50	7.0	525.5	3.24	162

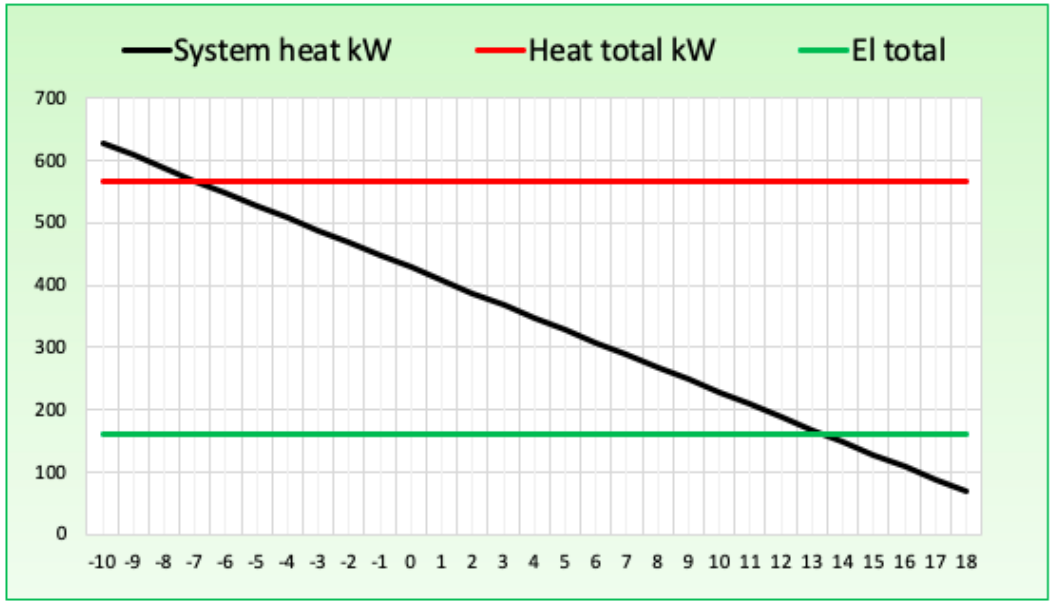
Heat pump unit total

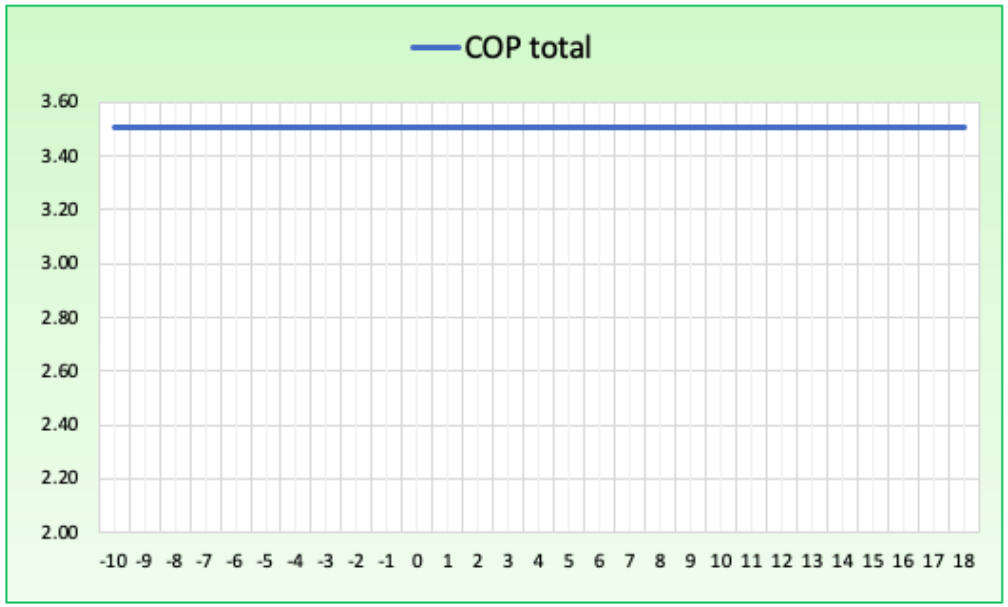
Heat total kW	El total	COP total
525	162	3.24

Water Temp 10°C F70°C R40°C COP 3.50

1	Pcs.
2,000	MWh
30	%
2,000	MWh
100	%
571	MWh
3.50	
170	
250	
250 SP	

Direct calc done





Series | Blending

Series and blending low limit set at 60 C

Dansk | English

eat pump

T flow °C	T return °C	T evap. °C	Heat kW	COPheat	El power
70	40	7.0	567.5	3.50	162
70	40	7.0	567.5	3.50	162

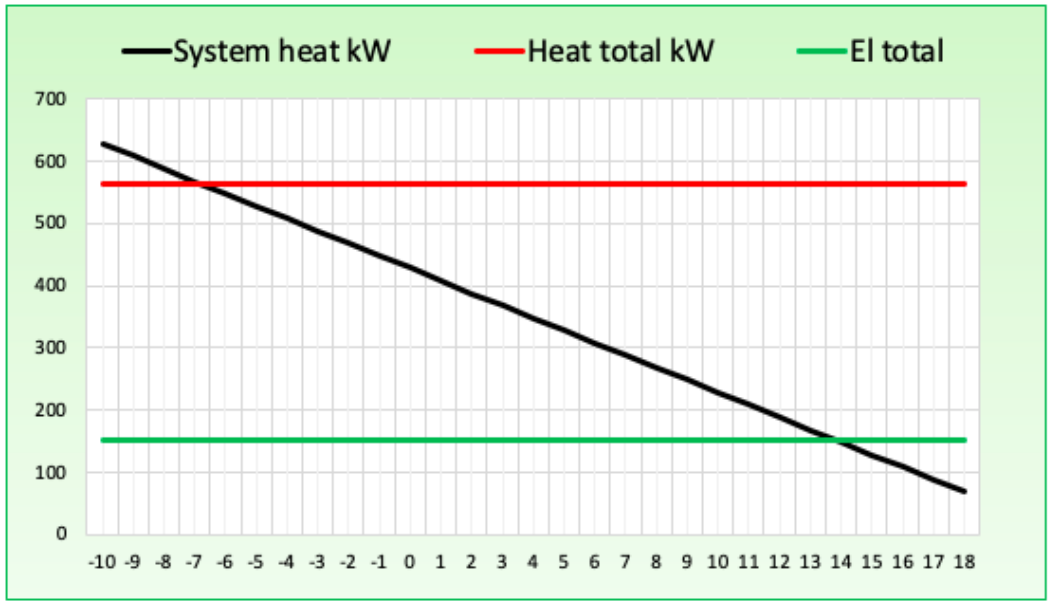
Heat pump unit total

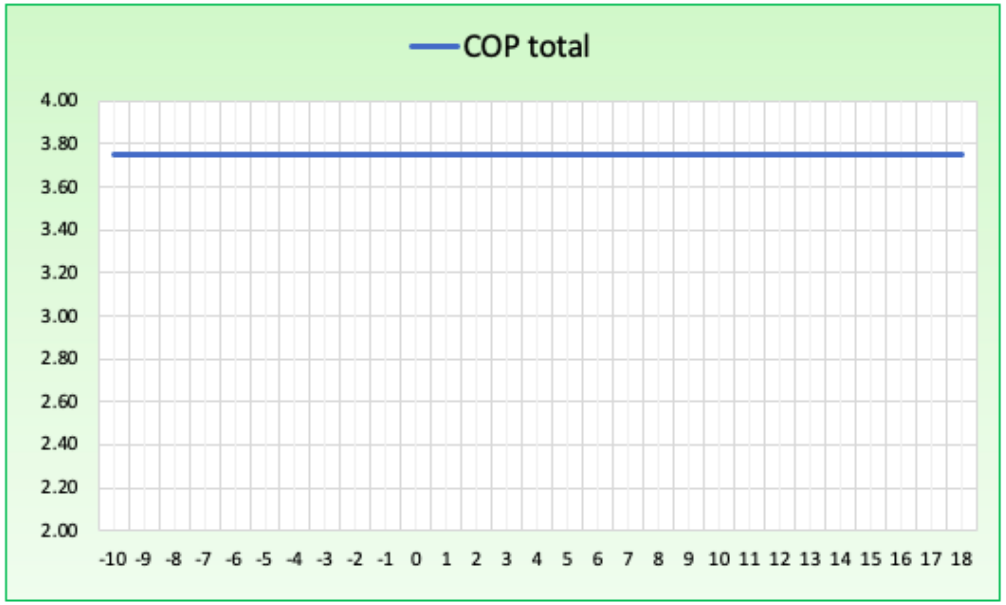
Heat total kW	El total	COP total
568	162	3.50
568	162	3.50

Water Temp 10°C F60°C R40°C COP 3.75

1	Pcs.
2,000	MWh
30	%
2,000	MWh
100	%
533	MWh
3.75	
170	
250	
250 SP	

Direct calc done





Series | Blending

Series and blending low limit set at 60 C

Dansk | English

at pump

T flow °C	T return °C	T evap. °C	Heat kW	COPheat	El power
60	40	7.0	564.1	3.75	150
60	40	7.0	564.1	3.75	150

Heat pump unit total

Heat total kW	El total	COP total
564	150	3.75
564	150	3.75

10℃ SUMMARY-F/R temps-COP-Fuel Cost Reduction

Water Temp ℃	Flow Temp ℃	Return Temp℃	COP	Electricity 15p/kW	Fuel saving over COP 2.3
10	85	75	2.30	6.52	0.0%
10	85	60	2.64	5.68	12%
10	70	60	3.00	5.00	23%
10	70	50	3.25	4.61	29%
10	70	40	3.50	4.28	34%
10	60	40	3.75	4.00	38%

Water Temp 20°C F70°C R40°C COP 3.64

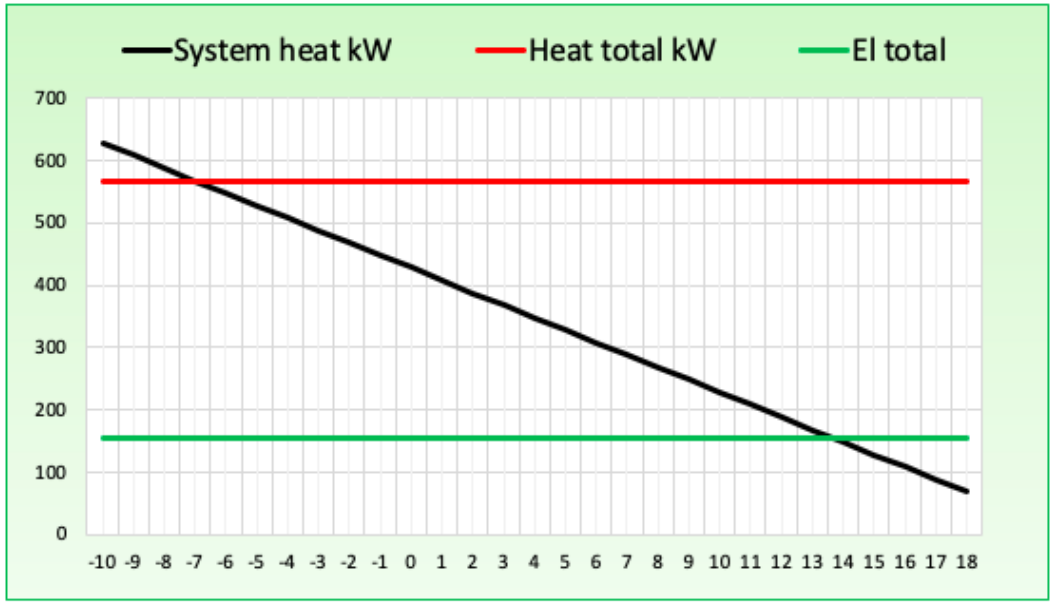
1	Pcs.
2,000	MWh
30	%
2,000	MWh
100	%
550	MWh
3.64	

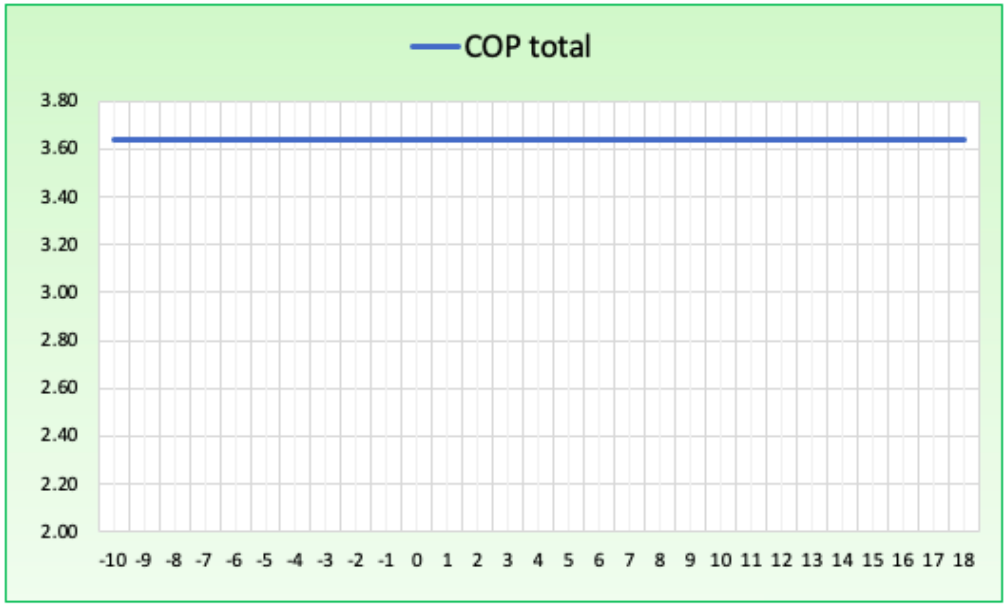
170

250

250 SP

Direct calc done





Series

Blending

Series and blending low limit set at 60 C

Dansk

English

heat pump

T flow °C	T return °C	T evap. °C	Heat kW	COPheat	El power
70	40	17.0	567.5	3.64	156
70	40	17.0	567.5	3.64	156

Heat pump unit total

Heat total kW	El total	COP total
568	156	3.64
568	156	3.64

20℃ SUMMARY – Possible savings

Water Temp ℃	Flow Temp ℃	Return Temp℃	COP	Electricity 15p/kW	Fuel saving over COP 2.3
20	85	75	2.33	6.48	0.6%
20	70	40	3.64	4.12	36%
20	60	40	3.94	3.8	42%

10℃ & 20℃ SUMMARY – Possible savings

Water Temp ℃	Flow Temp ℃	Return Temp℃	COP	Electricity 15p/kW	Fuel saving over COP 2.3
10	85	75	2.30	6.52	0.0%
20	85	75	2.33	6.48	0.6%
10	85	60	2.64	5.68	12%
10	70	60	3.00	5.00	23%
10	70	50	3.25	4.61	29%
10	70	40	3.50	4.28	34%
20	70	40	3.64	4.12	36%
10	60	40	3.75	4.00	38%
20	60	40	3.94	3.8	42%

Air Source – seasonal variation in COP

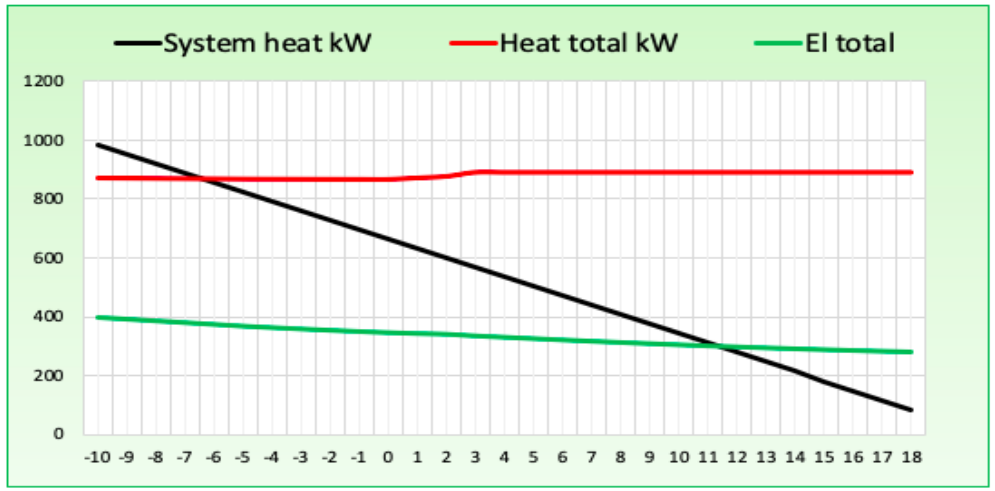
1	Pcs.
3,000	MWh
25	%
3,000	MWh
100	%
1,067	MWh
2.81	

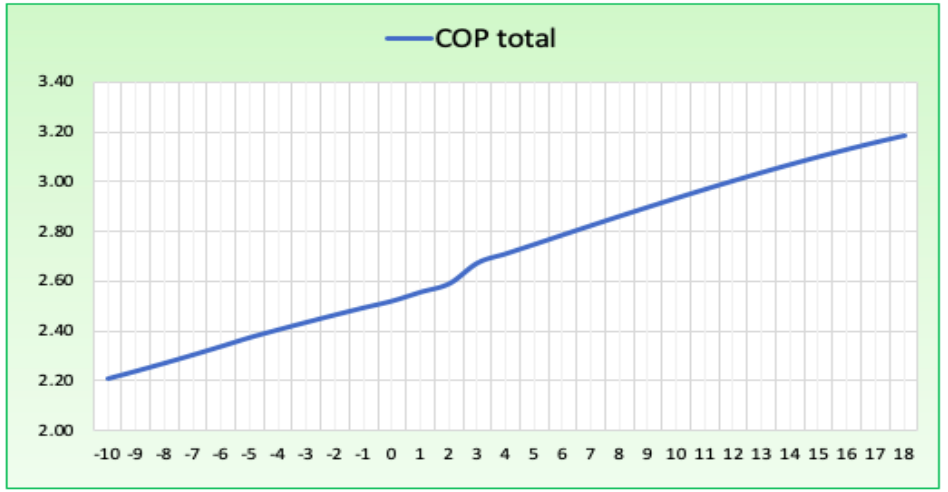
250

250

250 SP

Series calc done





Series | Blending

Series and blending low limit set at 60 C

Dansk | English

eat pump

T flow °C	T return °C	T evap. °C	Heat kW	COPheat	El power
60.0	40	-22.4	887.7	2.35	379
60.0	40	-21.4	887.7	2.38	373
60.0	40	-20.4	887.7	2.42	367

Heat pump unit total

Ventilator kW	Pump kW	Defrost kW	Heat total kW	El total	COP total
11.2	5.5	13.9	874	395	2.21
11.2	5.5	14.6	873	390	2.24
11.2	5.5	15.3	872	384	2.27

2020 Version. HP Calculator 220kW – 2.6MW

Initial setup temperature values for flow and return

Version isued 09072020

For SP models- max 60 C		For all other models - max 90 C		LW models
Tflow °C	Treturn °C	Tflow °C	Treturn °C	Cooling °C
60	40	70	40	5
60	40	70	40	5
60	40	70	40	5
60	40	70	40	5

Language:	English
Area:	London

If changes are done to temprature settings, then press calculate and wait for "Calculation Done" text below button
After initial setup is done, then SCOP calculations for all models can be done.

Calculate

Calculation Done

Solid energy a/s

3 Compressor sizes
80, 170 , 250 kWe

Single, twin and triple cascade heat pumps

Propane and isobutane

Water and air source

Compact units for limited space.

Calculator contains data for 72 heat pump options.

Thermal Store – size calculator

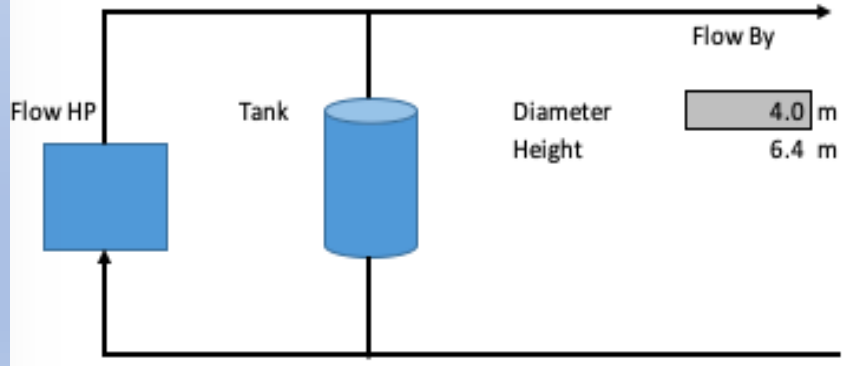
Solid energy a/s

Background data :

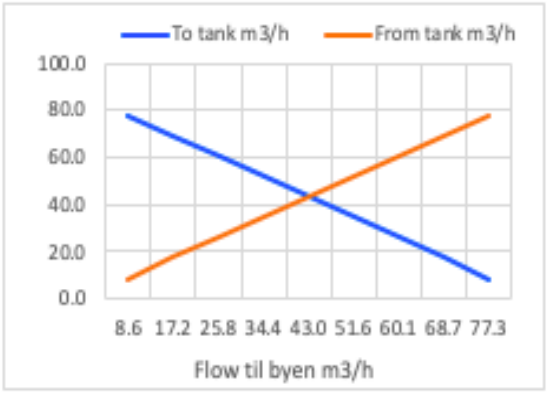
Heat power	2,000	kW
Flow temp.	70	C
Return temp.	50	C
Tank volume	80	m3

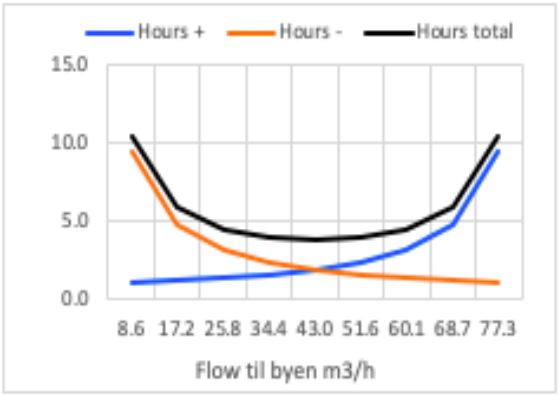
Results:

Flow HP	23.9	kg/sek
	86	m3/h



Anlæg data			Charging		De charging		Cycle
Tank	Flow HP	Flow Town	To tank	Hours +	From tank	Hours -	Hours total
m3	m3/h	m3/h	m3/h	Hours	m3/h	Hours	Hours
80	86	8.6	77.3	1.0	8.6	9.3	10.3
80	86	17.2	68.7	1.2	17.2	4.7	5.8
80	86	25.8	60.1	1.3	25.8	3.1	4.4
80	86	34.4	51.6	1.6	34.4	2.3	3.9
80	86	43.0	43.0	1.9	43.0	1.9	3.7
80	86	51.6	34.4	2.3	51.6	1.6	3.9
80	86	60.1	25.8	3.1	60.1	1.3	4.4
80	86	68.7	17.2	4.7	68.7	1.2	5.8
80	86	77.3	8.6	9.3	77.3	1.0	10.3





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Any questions

Solid energy a/s