



## Is CHC the New CHP?

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# EMD International

An independent software and consulting company, operating worldwide. Owned by the EMD Foundation with the purpose to ensure the transition to a renewable energy system

Since 1986  
Aalborg

windPRO >4000 Users  
energyPRO > 250 Customers

~40 employees

- Sales
- Research
- Software
- Consultancy

Foundation owned



Per Nielsen  
CEO  
M.Sc. (eng)  
35+ years of experience



Christian Ingerslev Sørensen  
Vice CEO  
M. Sc. E. E. , eMBA  
20+ years of experience



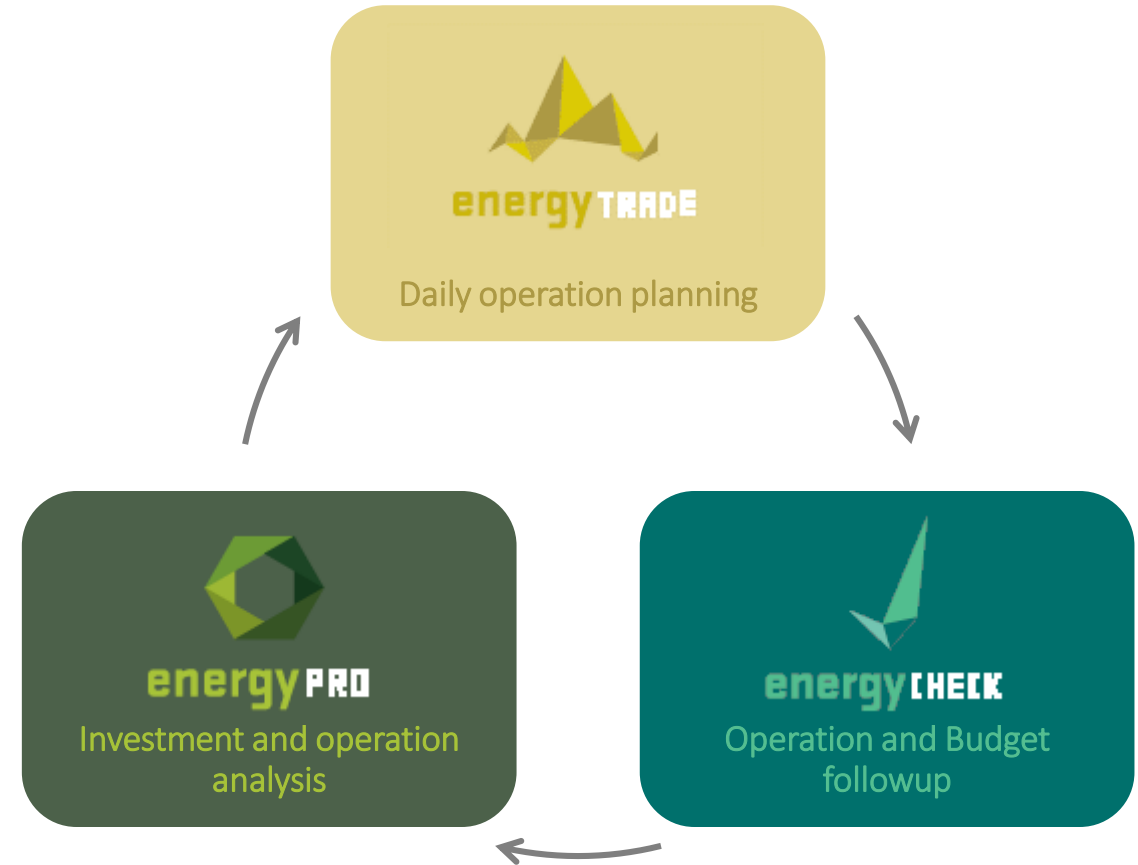
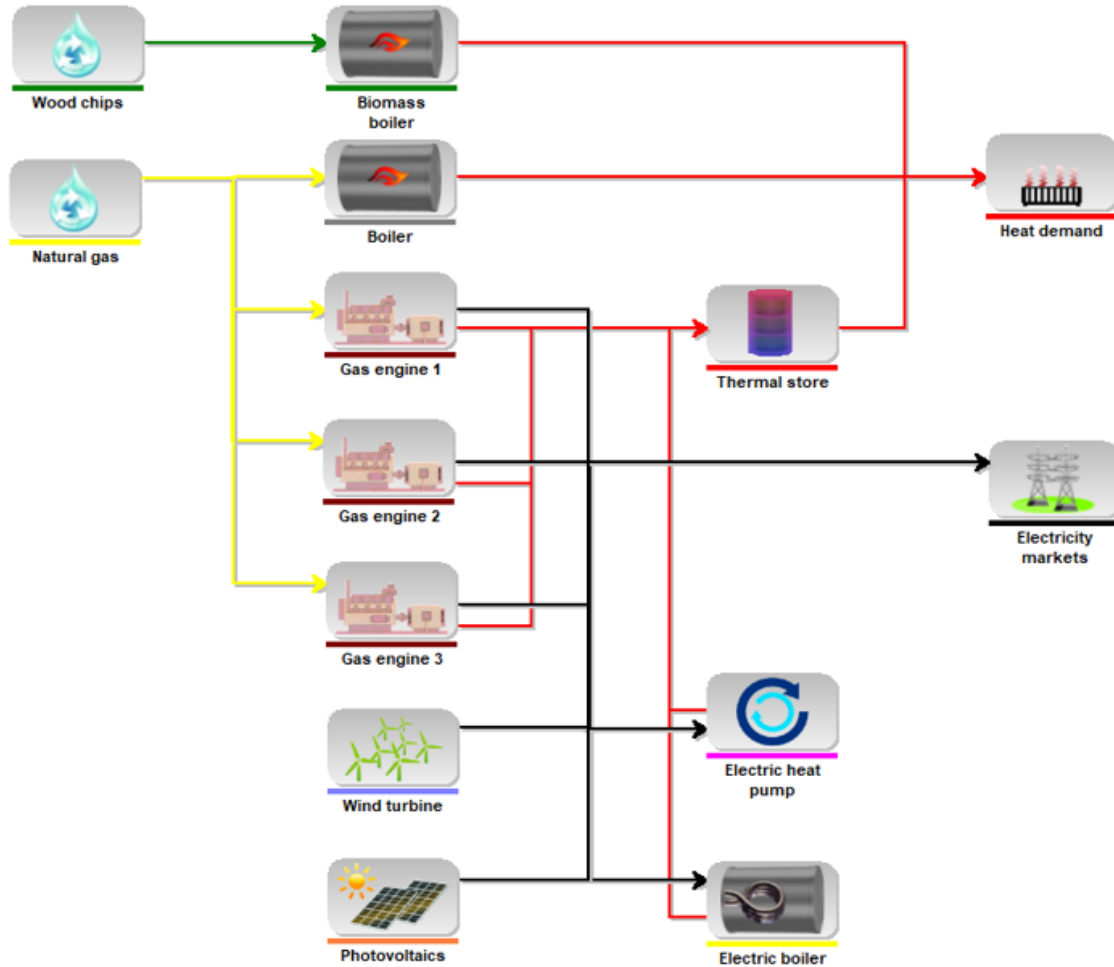
Anders N. Andersen  
Head of R&D  
PhD., M.Sc. & B.Com. (org.)  
35+ years of experience



Leif Holm Tambjerg  
Energy System Consultant  
M.Sc. (eng)  
25+ years of experience

Staff: 30+ people with M. Sc. (eng). 6 with PhD.  
Average experience from EMD 15+ years

# energyPRO



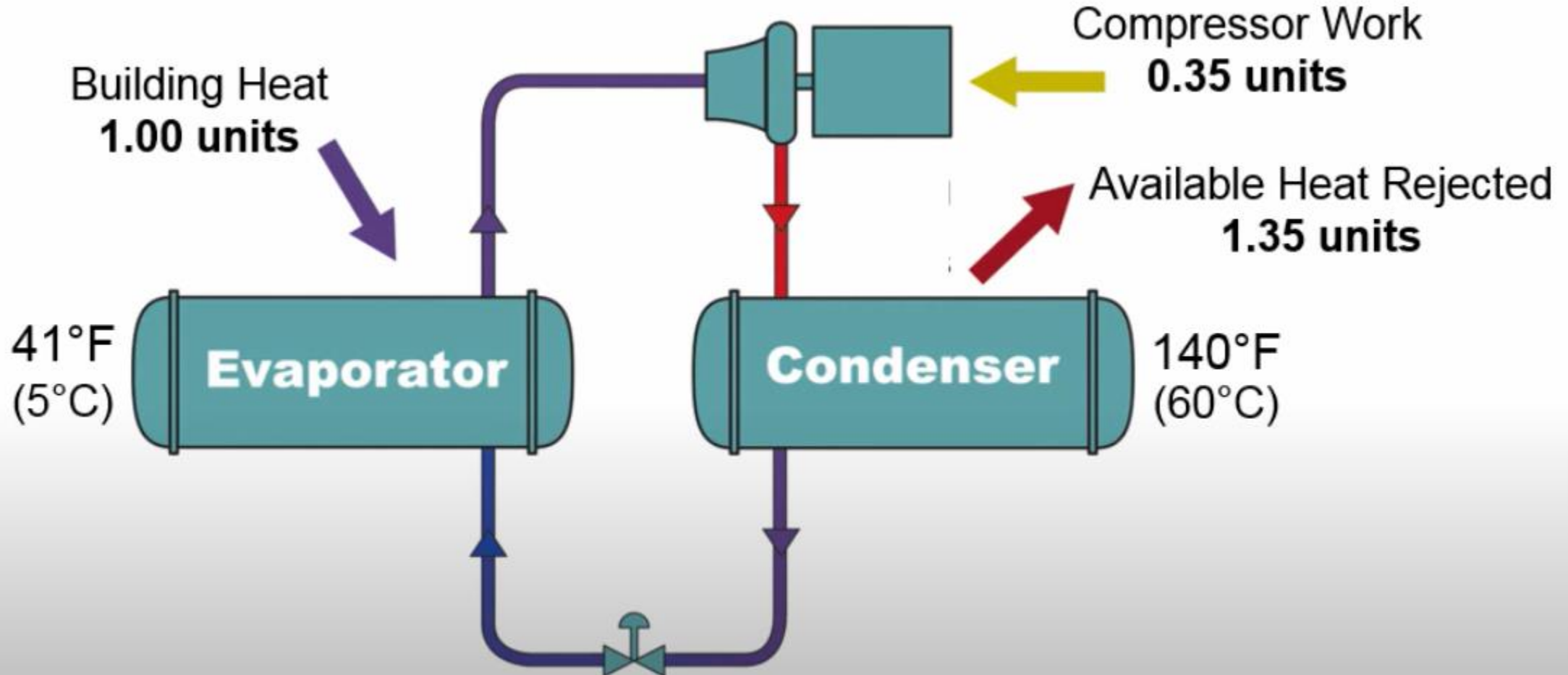
# CHC Modelling Projects over last year

- Islington New River – 6MWth
- Reading Uni -1.1MWth
- Edinburgh Uni – 850kWth
- West Midlands - 3MWth
- London – 40MWth
- London – 30MWth
- Bristol – 600kWth
- Glasgow - ?

It certainly feels like... CHC is the new CHP!

*5 years ago all of these projects would have been gas CHP*

# Combined Heating and Cooling Heat Pump



For every unit of heat I produce, the cooling produced = heat out - the compressor power

# The UK: Historically(!) Cheap Gas & Expensive Electricity

Chart 5.4 Industrial gas prices

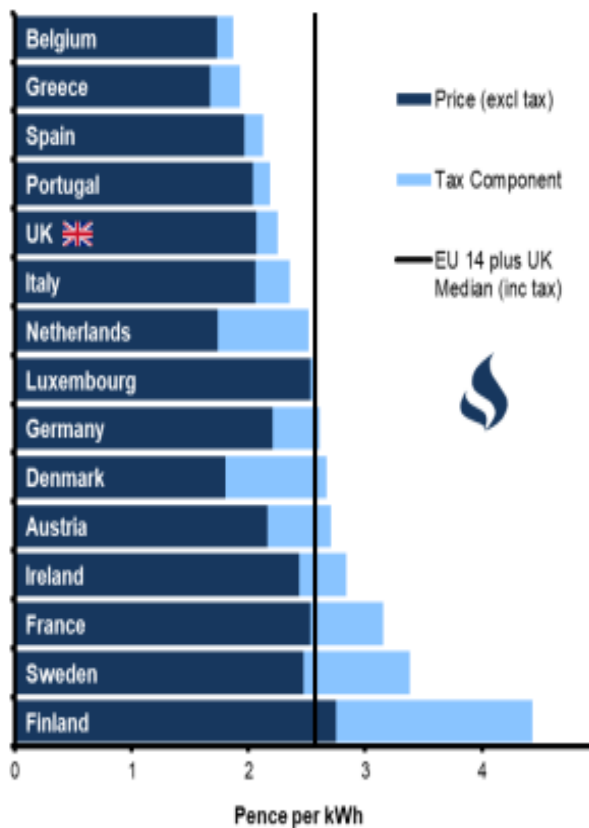
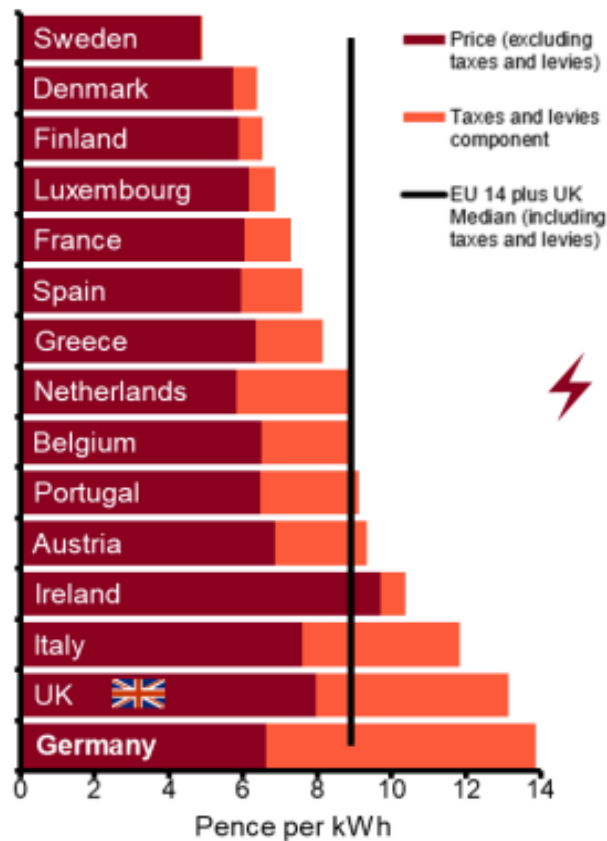
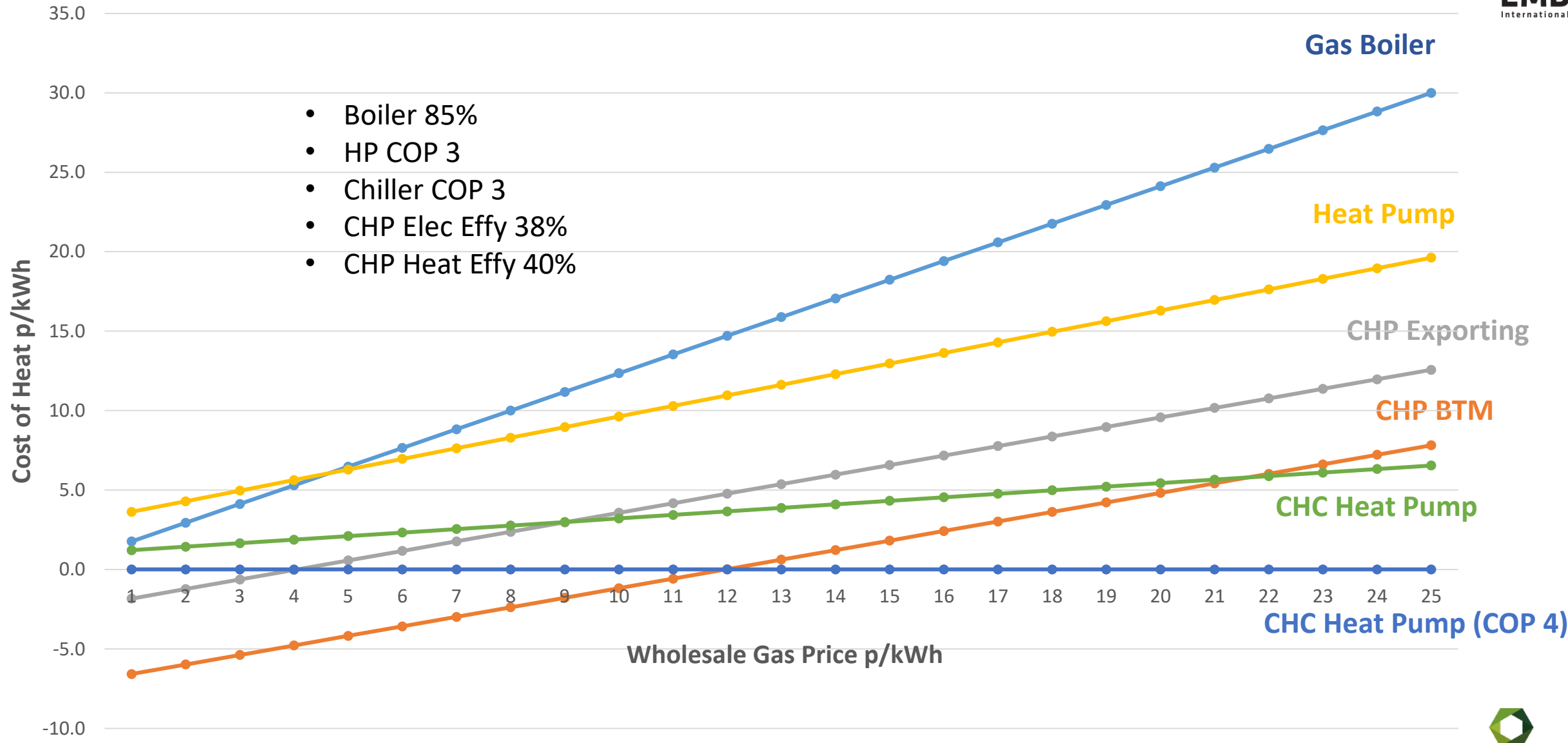


Chart 5.3 Industrial electricity prices



- Good for CHP
- Bad for heat pumps
- Can CHC overcome this?

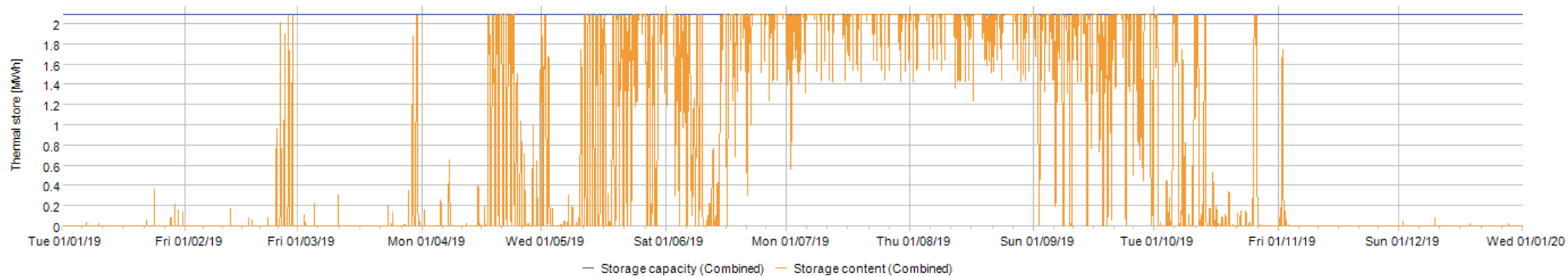
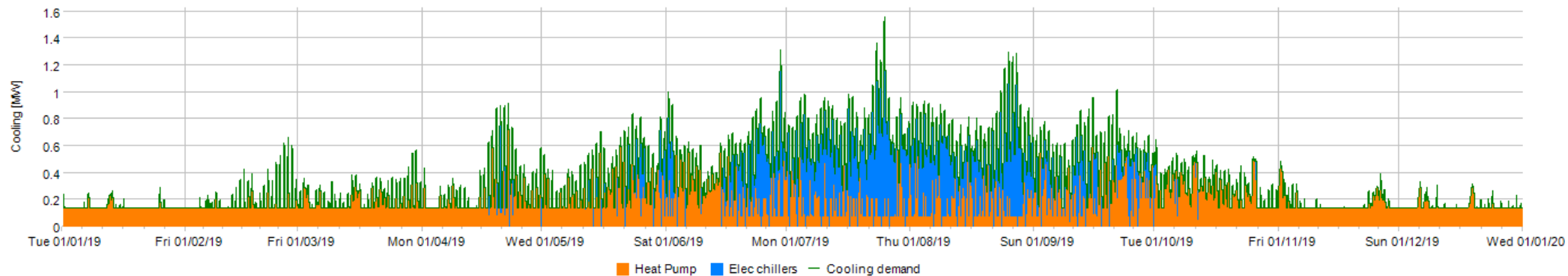
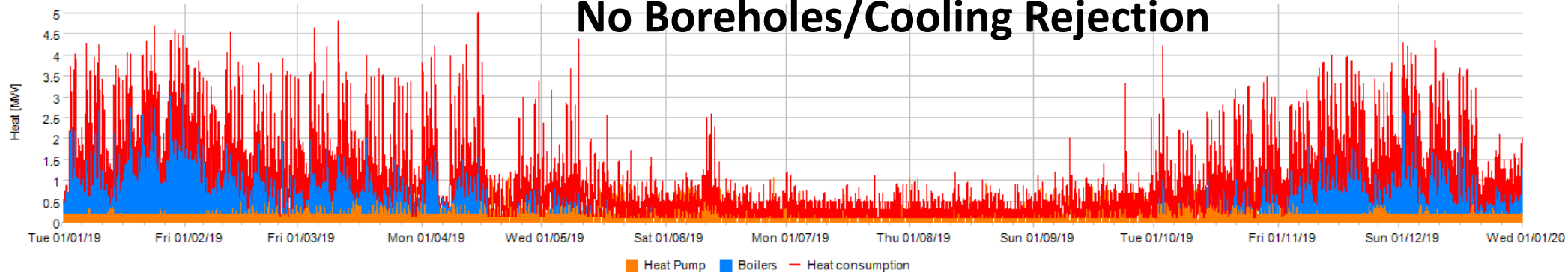
## OPEX Cost of Heat Compared p/kWh vs Wholesale Gas Price p/kWh



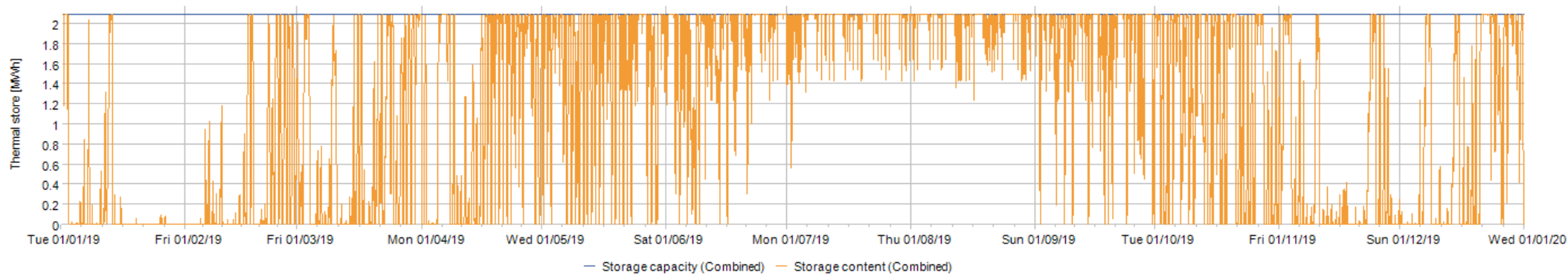
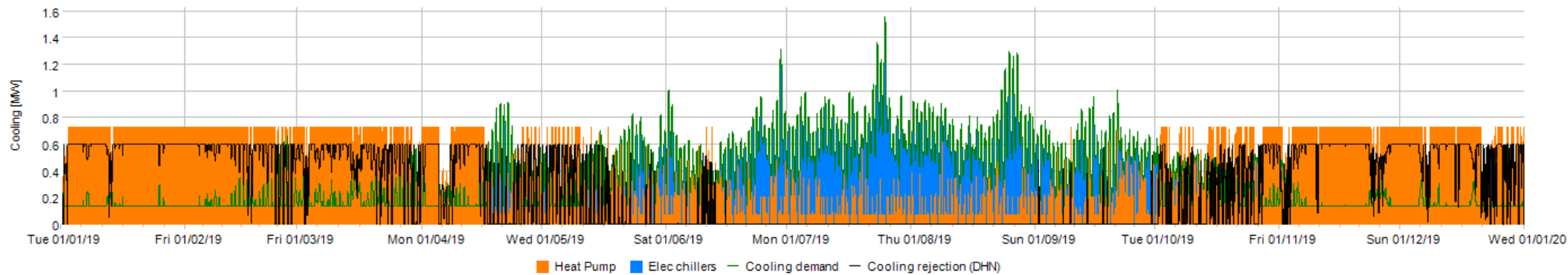
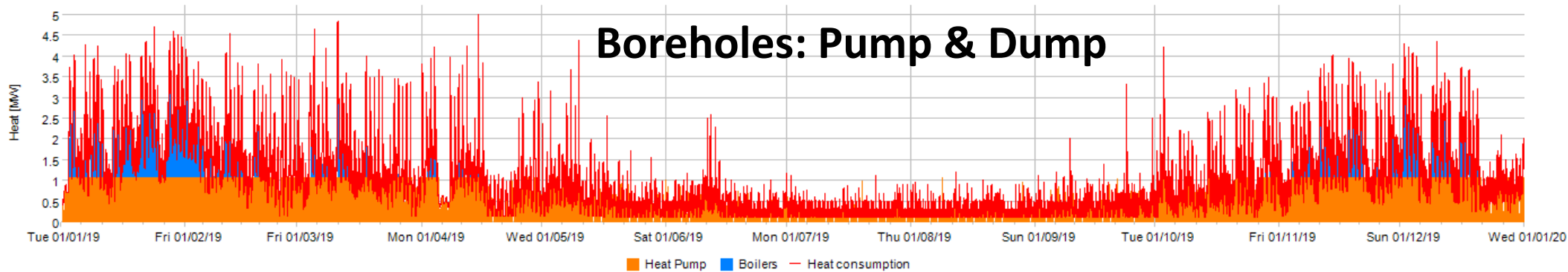
## Not as simple as this (fortunately for me)...

- Electricity prices vary with time of day/year (DUoS, CM Levy and/or Spot)
- Heat Pump COP varies with time – weather compensated
- Chiller COP varies – plus free cooling
- Demand for heating and cooling not simultaneous
- Increasingly renewables will break link between gas and elec prices
- Capital & maintenance costs

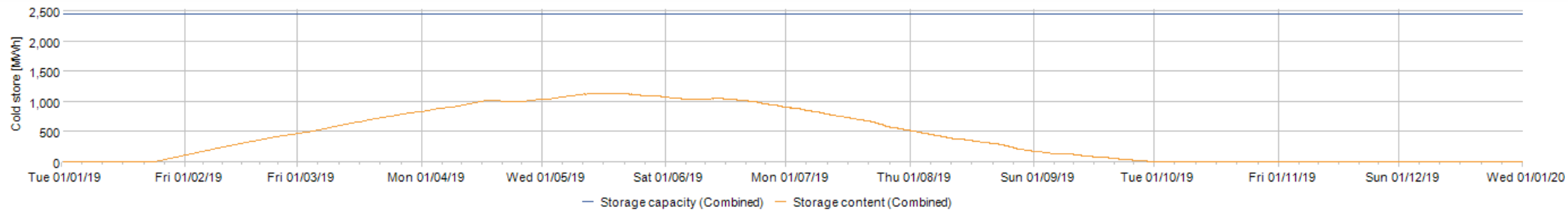
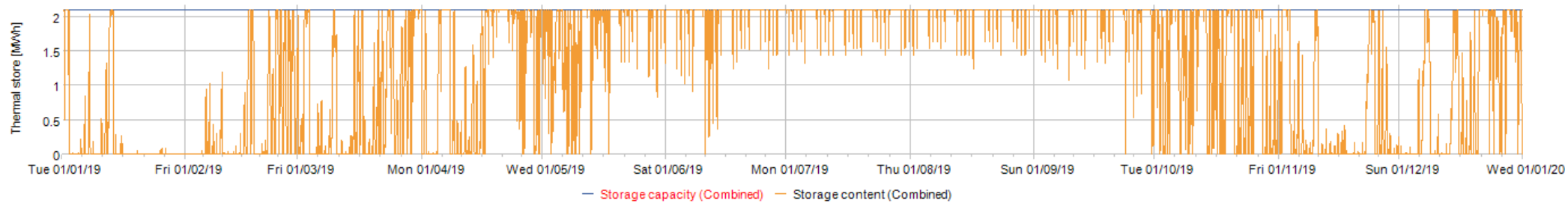
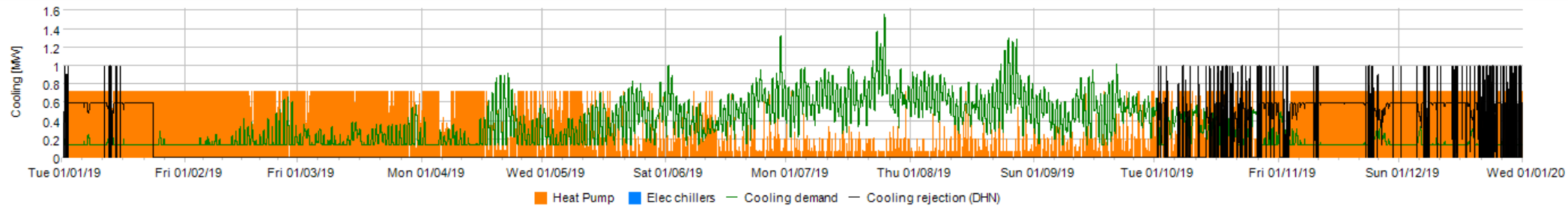
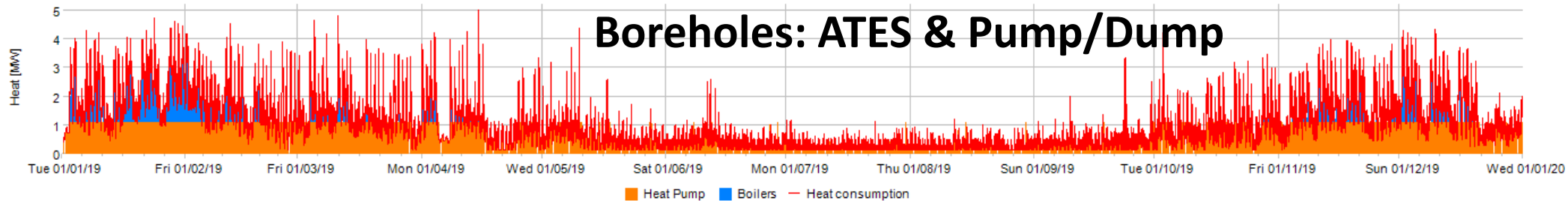
# No Boreholes/Cooling Rejection



# Boreholes: Pump & Dump



# Boreholes: ATEs & Pump/Dump



# Financial Results at Current Energy Prices

Planning period			20years		
Discount rate			3.50%		
		Reference	CHC NO Boreholes	CHC Pump & Dump	CHC ATES & Pump & Dump
<b>Investment</b>	[million £]	0.00	4.09	4.96	4.96
<b>Extra investment in alternative</b>	[million £]		4.09	4.96	4.96
<b>Yearly operation income</b>	[million £]	-7.82	-7.15	-6.70	-6.51
<b>Yearly improved operation income</b>	[million £]		0.67	1.11	1.31
<b>Net Present Value of investment</b>	[million £]		5.43	10.82	13.66
<b>Simple Pay Back Time of investment</b>	years		6.10	4.47	3.79
<b>Internal Rate of Return</b>	%		15.45	21.95	26.15

# Is CHC the New CHP?



Not quite, but every little helps!



Cooling is not as widely needed as electricity – but growing...



Gets better with higher prices



Boreholes/ATES are important to deal with heating/cooling mismatch

**Thank you for the attention**

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# CHP vs CHC

CHP	CHC
Electricity is always needed	Cooling less so... but demand increasing?
Electricity grid exists	Cooling networks (or ambient loops) much less so
Nice seasonal match up between heat and power demands	Seasonal mismatch between heating and cooling demands
Increasingly wind and solar are eroding the hours CHP “should” run (in the UK behind the meter CHP economics mean this is ignored)	In Northern Europe winter cooling can often be done by “free” cooling (compressor on chiller is turned off).