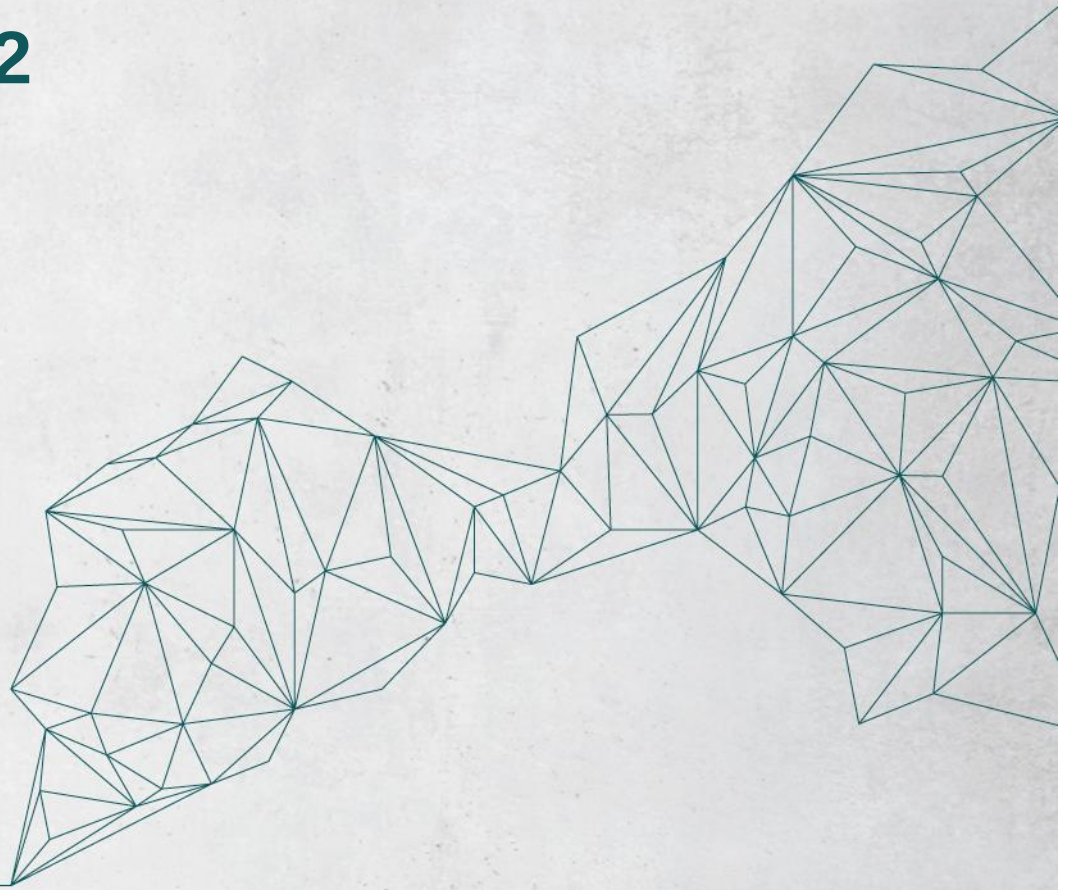
Chillventa Specialist Forums 2022
Chillventa Fachforen 2022

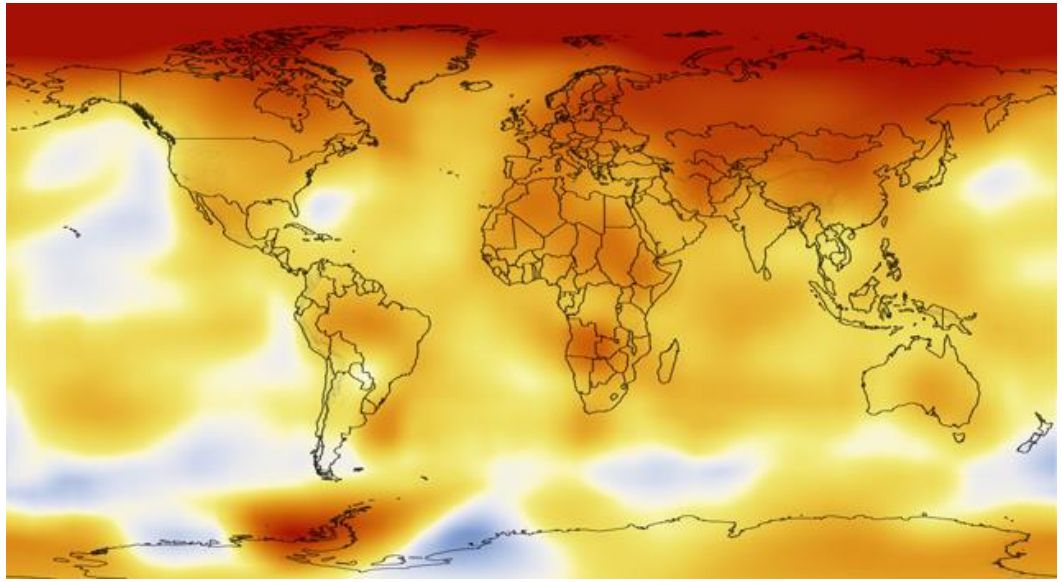
CONNECTING EXPERTS.



How the Digitalisation will Revolutionise Operating Efficiency

- Air Conditioning, Heat Pumps and Refrigeration use 20% of global electricity
- These systems represents 30-60% of electricity in buildings.

- **10-30% savings potential = 2 to 6 % of global electricity**
- **Reduction of peak power**
- **Use building inertia to move load in time**
- **Reduce failures and downtime**



ClimaCheck Sweden AB
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The future will be different and transition has started

- **Digitalisation will change Business as Usual**
  - Most systems have all or most of sensors required for complete performance analyses
  - Equipment owners want to have pay-back on their investments in BMS/BAS/SCADA and IoT
- **Pressure on Energy efficiency and reduction of peak loads is on**
- **Onsite troubleshooting and inspections are inefficient**
  - Experts are not available onsite and it is costly to get them there
  - All technicians/engineers are not experts on everything
  - Analytics makes information of data
  - Thousands of systems can be analysed and benchmarked on component level online
  - Automated Fault Detection and Diagnosis serve competent experts with early warning

ClimaCheck

1986
Patent on Thermodynamic method

2004
ClimaCheck Founded

2007
ClimaCheck *online*

2017
ClimaCheck *Gateway*

2020
ClimaCheck *Certified systems*

2022
1000+ systems
20,000,000+ "data points" are analysed every day

Portable with printer

ClimaCheck onsite with PC

IoT – ClimaCheck online

Integration BMS/BAS

Integration BMS/BAS

API

2011
WWF Climate Solver

2015-2020
Sands Macau
Banner Health
Metro 12 stores

2020
Metro 60 Stores
US Navy

2021-2022
Vasakronan connects Geothermal systems
Metro 200 new stores

dena award ClimaCheck project to develop Energy performance indicators

Future Energy Lab

dena
Deutsche Energie-Agentur

- 450 000 Euro project to develop Energy Performance Indicator platform
- Germany has aggressive targets to decrease energy consumption
- **dena** - the German energy agency has identified the need for action
  - In small and medium sized companies that lack in house experts
  - In refrigeration, air conditioning and heat pump systems
- **dena** want to speed up implementation by establishing
  - Energy Performance Indicators “EnPI” for benchmarking of system based on categories
  - A cost-effective web based solution for Small and Medium Sized enterprises “SMEs”
- ClimaCheck has developed solutions for performance analysing and monitoring since 2004 and cooperate with
  - **Kühlanalyse** – German distributor and expert on analysing and optimisation
  - **Idun Real Estate Solutions** – Expert on secure data platforms on RealEstateCore standard

Wanted - Test pilots interested in benchmarking their systems

ClimaCheck

A global problem need a solution

Europe

AKADEMISKA HUS

NACKA KOMMUN

KTH VETENSKAP OCH KONST

RI. SE

CHALMERSFASTIGHETER

Region Uppsala

ATRIUM LJUNGBERG

Pandox

SISAB
Skolfastigheter i Stockholm AB

AMF Fastigheter

Vasakronan

VEOLIA

AstraZeneca

IKEA

Transport for London

EDEKA

FRESENIUS HELIOS

METRO CASH & CARRY

North / South America

NREL Transforming ENERGY

Banner Health

Intermountain Healthcare
Healing for life

Chemours™

Asia

CLP 中電

澳門金沙 Sands Macao

Africa

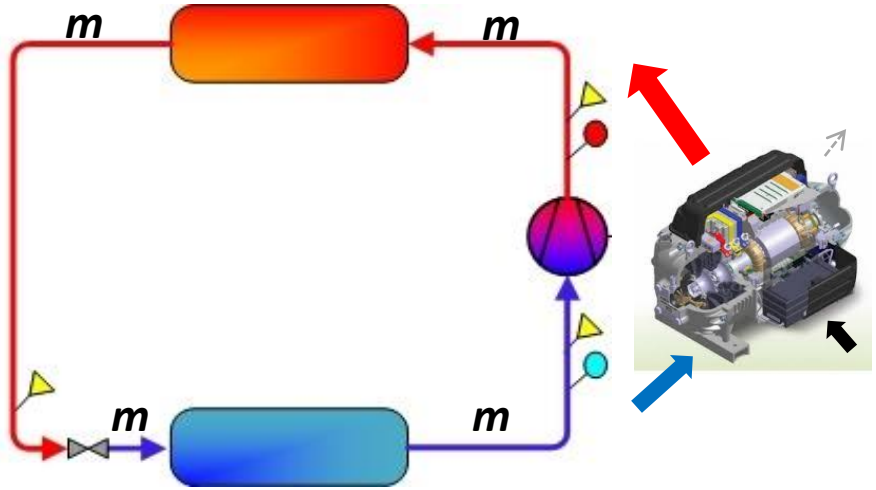
V&A WATERFRONT · CAPE TOWN

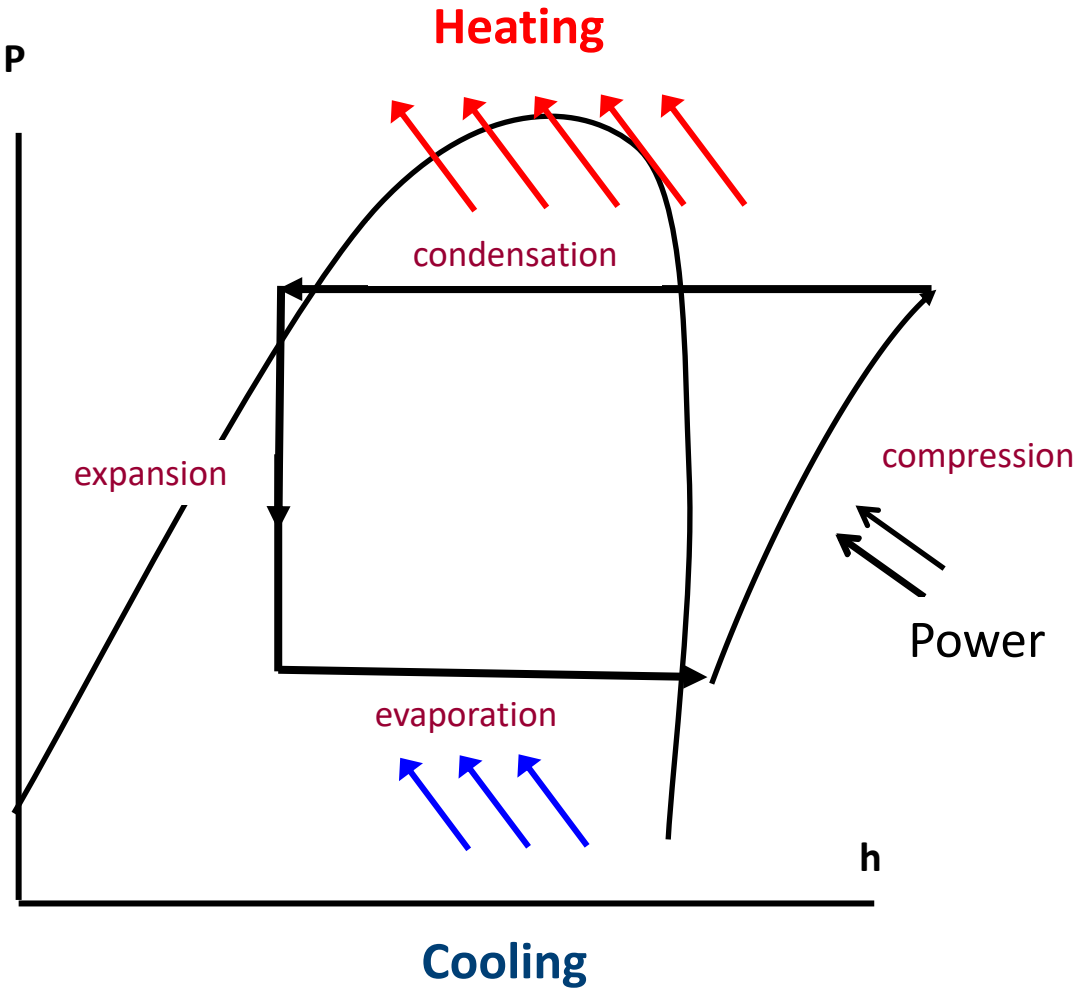
Nampak
packaging excellence

BBP
Barghest Building Performance

Thermodynamic Method = Internal Method

internationally validated and proven - opens the “Black Box”





ClimaCheck

Performance analysis

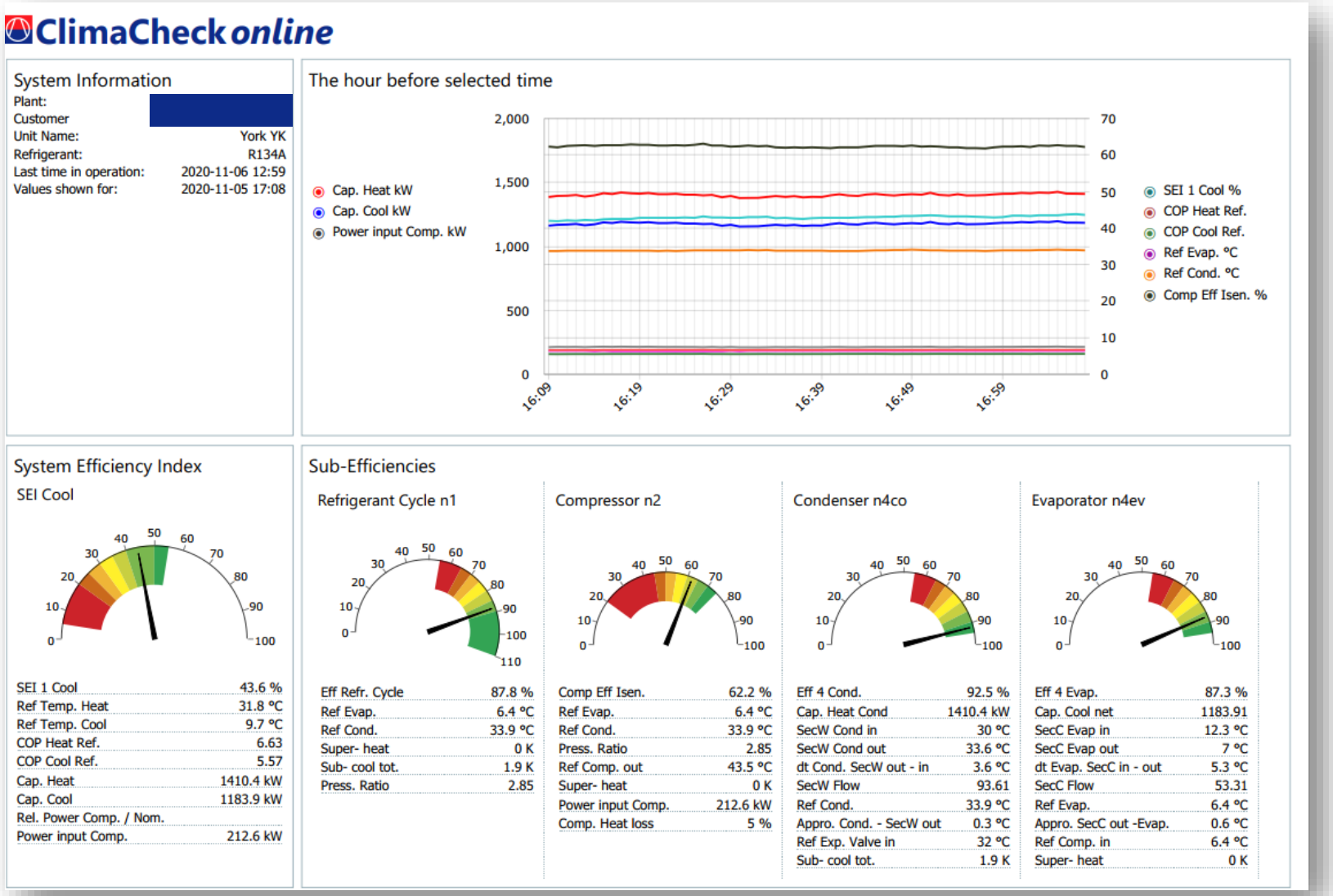
Crucial information/ KPI's

- **System Efficiency Index – SEI**
  Same KPI's for all buildings that doesn't change continuously as COP/EER or kW/RT.
- Producing business intelligence supporting decision making

Predictive maintenance

- Detect deviations in performance and functionality instead of "outside the envelope"
- Early Warnings (Fewer alarms)

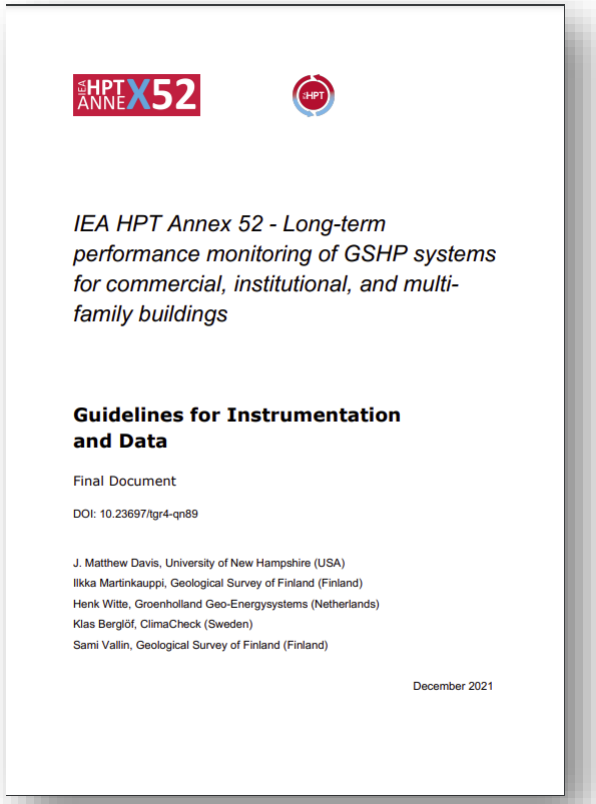
Benchmark



Guideline establish best practice

International Energy Agency, Annex 52

Guidelines for Instrumentation and Data



IEA HPT Annex 52 - Long-term performance monitoring of GSHP systems for commercial, institutional, and multi-family buildings

Guidelines for Instrumentation and Data

Final Document

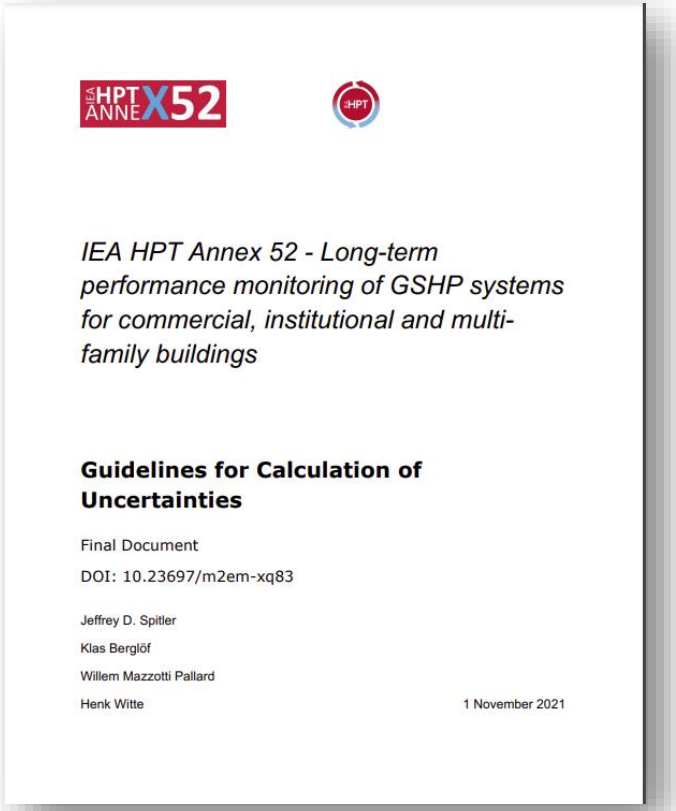
DOI: 10.23697/tgr4-qn89

J. Matthew Davis, University of New Hampshire (USA)
Ilkka Martinkauppi, Geological Survey of Finland (Finland)
Henk Witte, Groenholland Geo-Energysystems (Netherlands)
Klas Berglöf, ClimaCheck (Sweden)
Sami Vallin, Geological Survey of Finland (Finland)

December 2021

Click to right and left to open Guidelines.

Guidelines for Calculation of uncertainties



IEA HPT Annex 52 - Long-term performance monitoring of GSHP systems for commercial, institutional and multi-family buildings

Guidelines for Calculation of Uncertainties

Final Document

DOI: 10.23697/m2em-xq83

Jeffrey D. Spitler
Klas Berglöf
Willem Mazzotti Pallard
Henk Witte

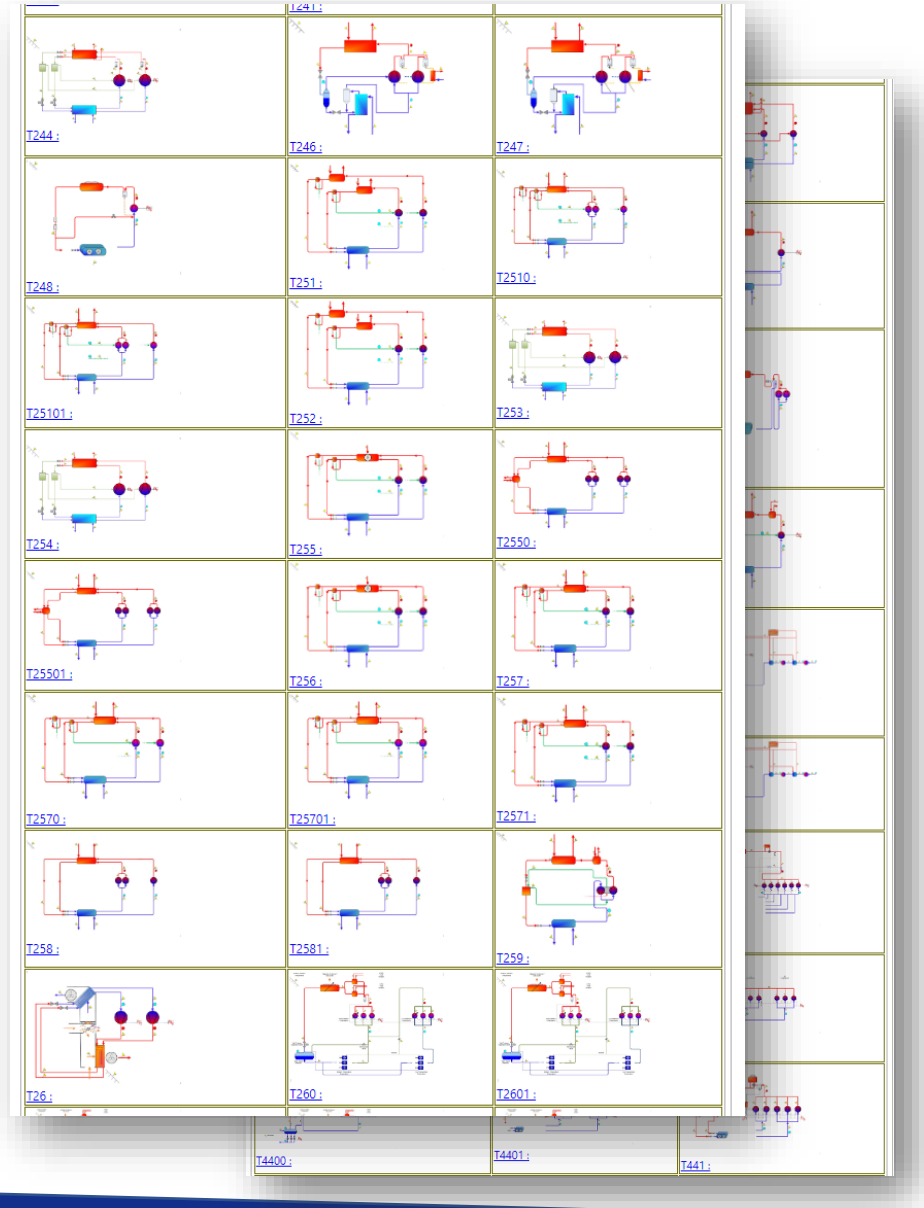
1 November 2021

Project driven by demand for structured M&V procedures and performance indicators

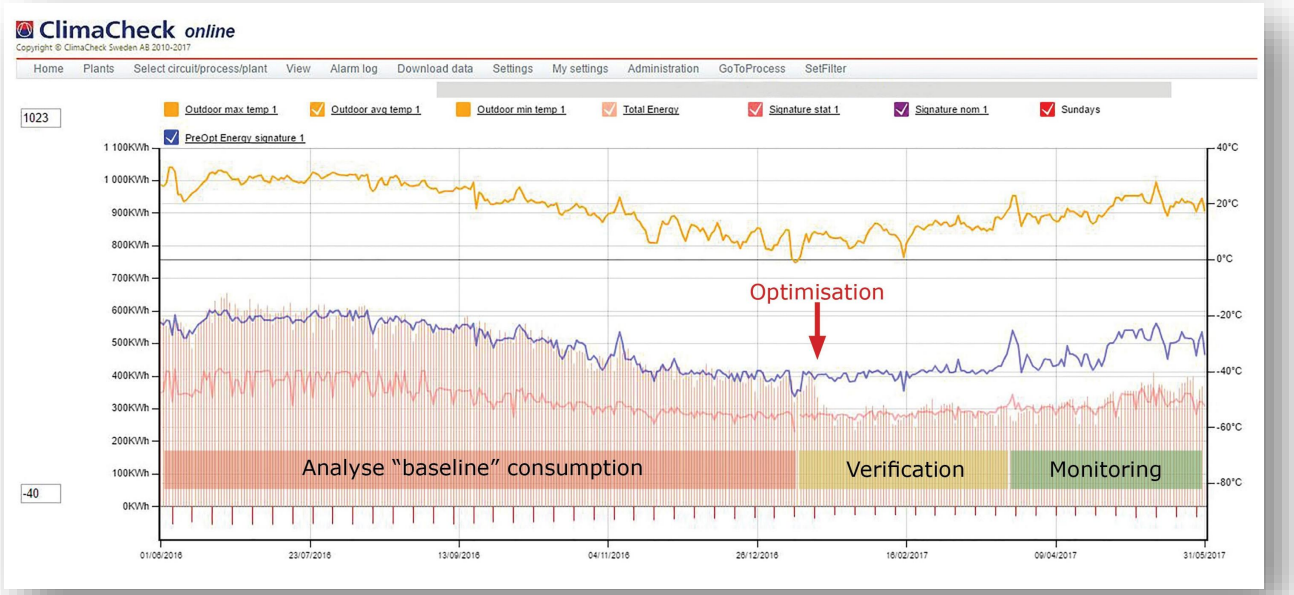
for Ground Source Heat pumps/Chiller

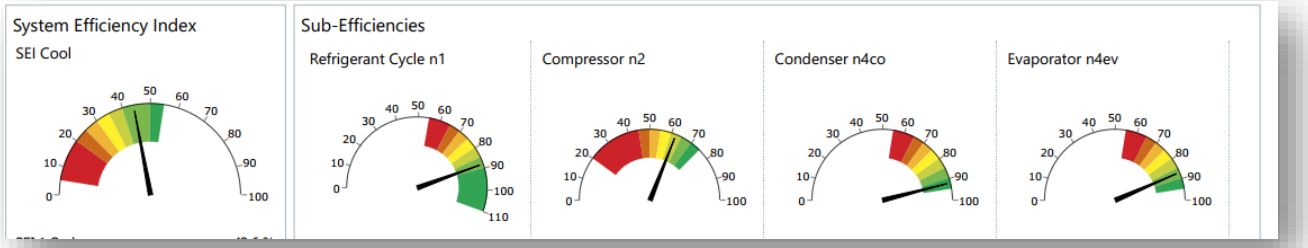
But structure generally applicable for verification and benchmarking of vapor compression systems

Straight forward - but there are hundreds of designs



It is all about making actionable information out of data





Systems are not stable and do not operate at rating/design

60% of energy overlooked

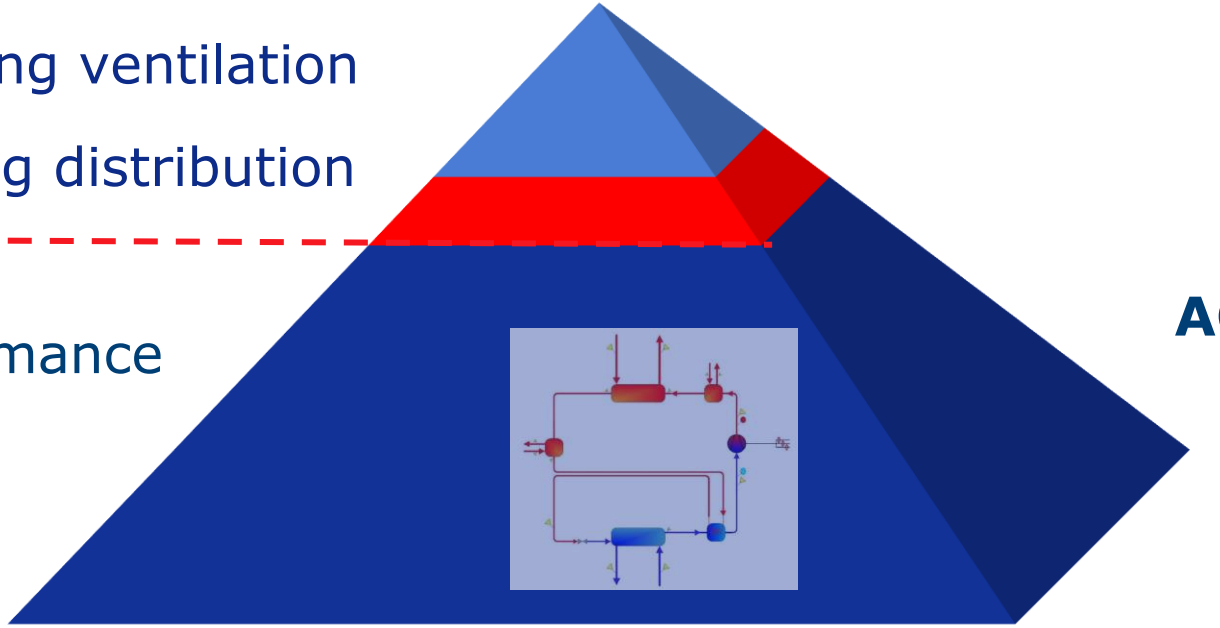
Conventional commissioning

Scheduled maintenance

Initial balancing ventilation

Initial balancing distribution

Performance

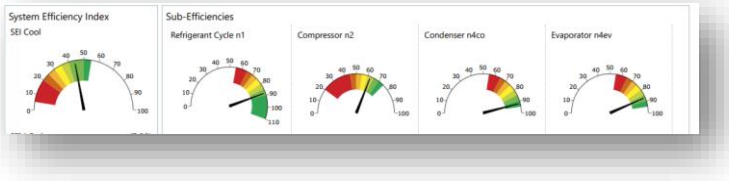


Continuous commissioning

Predictive maintenance

Secondary systems 40%

AC / Heat Pump Unit 60%



Measure and Analyse → Verification → Monitor

Typical Findings

Common Identified Problems
Controls – not well commissioned – adapted for the site
Refrigerant – shortage or over-charge
Flow balancing – to high or low on secondary media (air/water/brine)
Heat exchangers – fouling of – recirculation of air – corrosion
Fan/pump – high power consumption – under performance
Compressor – damage or wear
Insufficient capacity control – requires VFDs better capacity control
VFD installed but not correctly set-up – not used – not stable
Components changed/upgraded – without review system/controls

Significant savings achieved

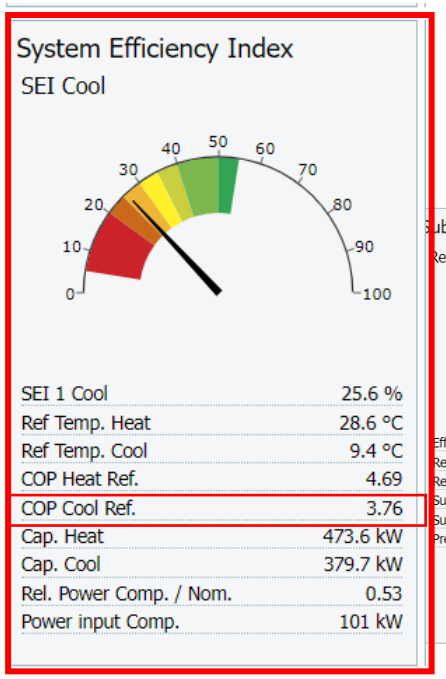
Historical savings structured optimisiation	
Supermarkets	20 - 30%
Heat pumps	10 - 30%
Ice rinks	20 - 40%
Industry	10 - 30%
Air Conditioning	10 - 30%

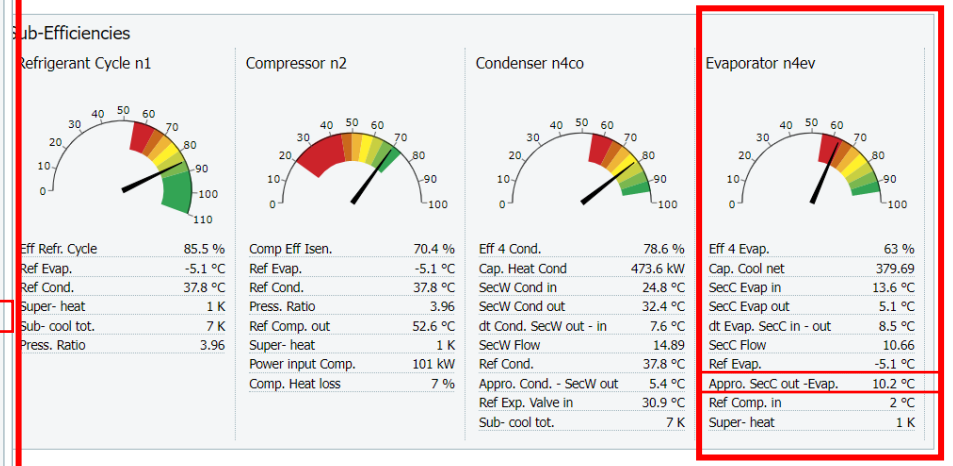
It is critical to pin-point deviations and optimise

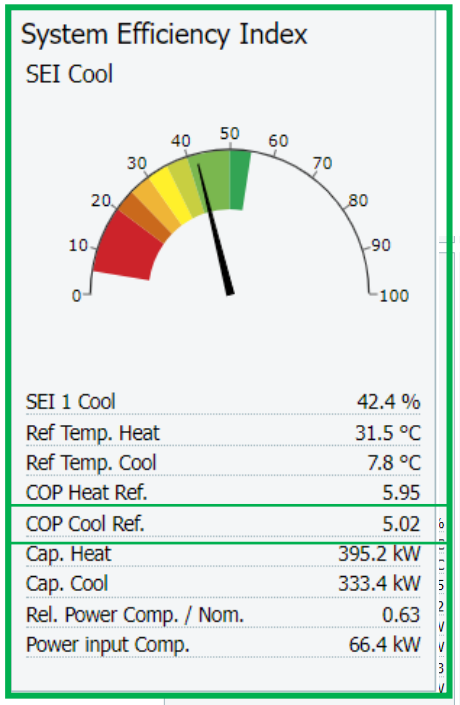
Bad COP 3.76

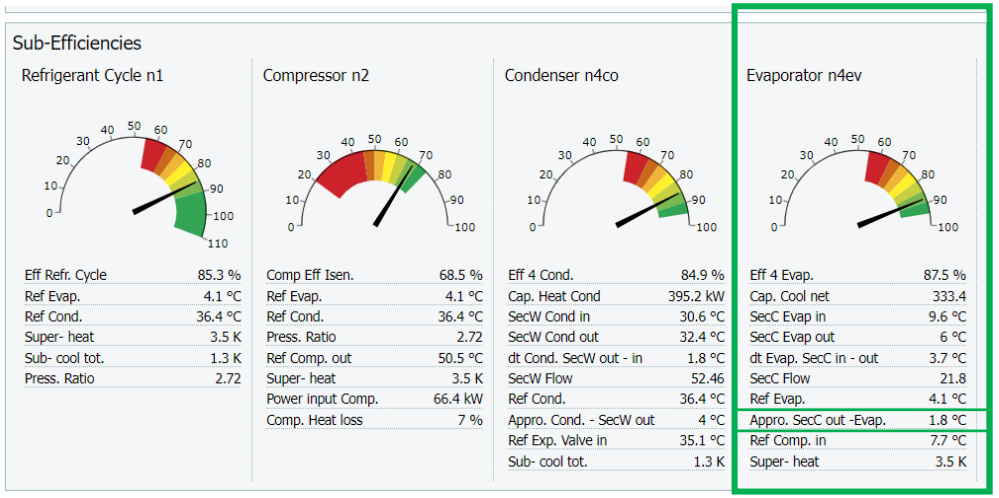
Same chiller – same supply temp

Good COP 5.02









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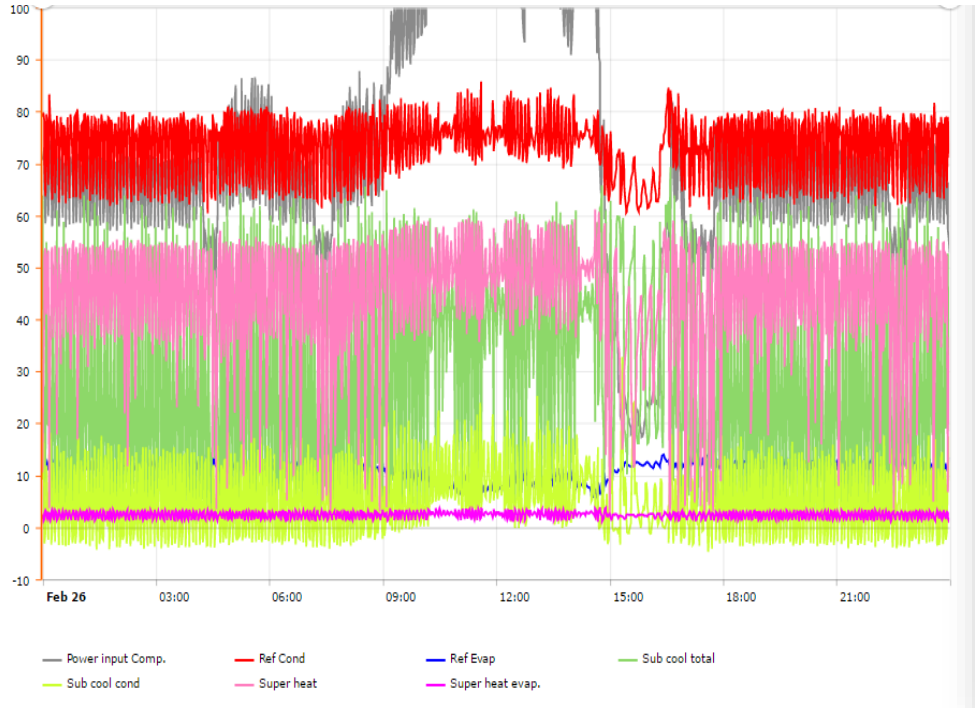
If you cannot measure it - you cannot control it

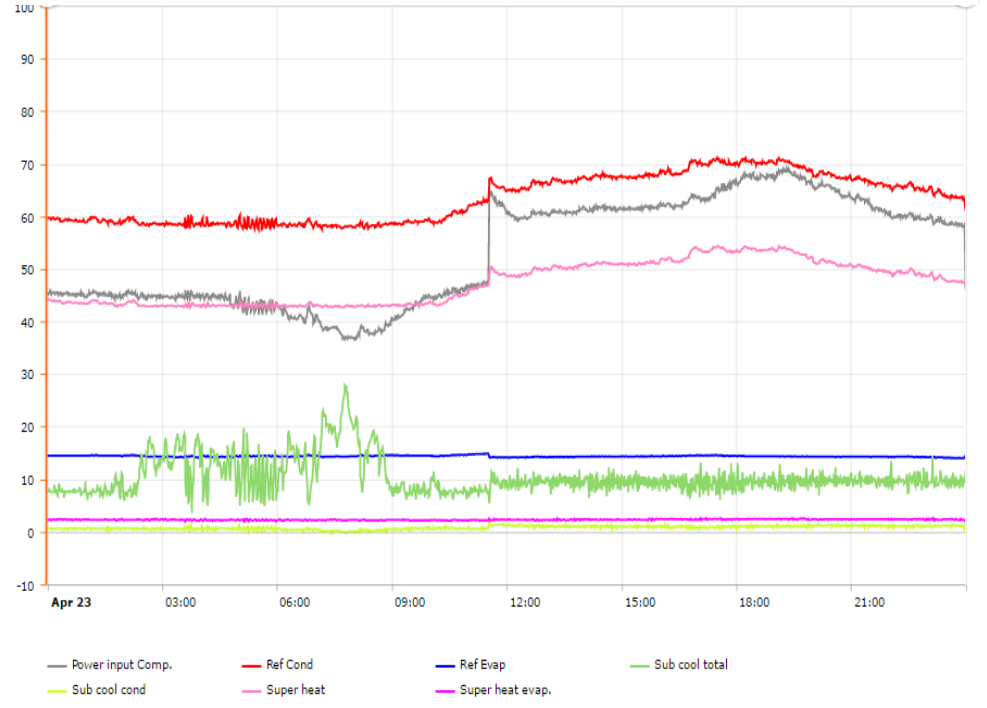
- Understanding of the entire system necessary
- Analysing performance and controls is the key

State of the art CO2 rack with one variable speed compressor

Before



After



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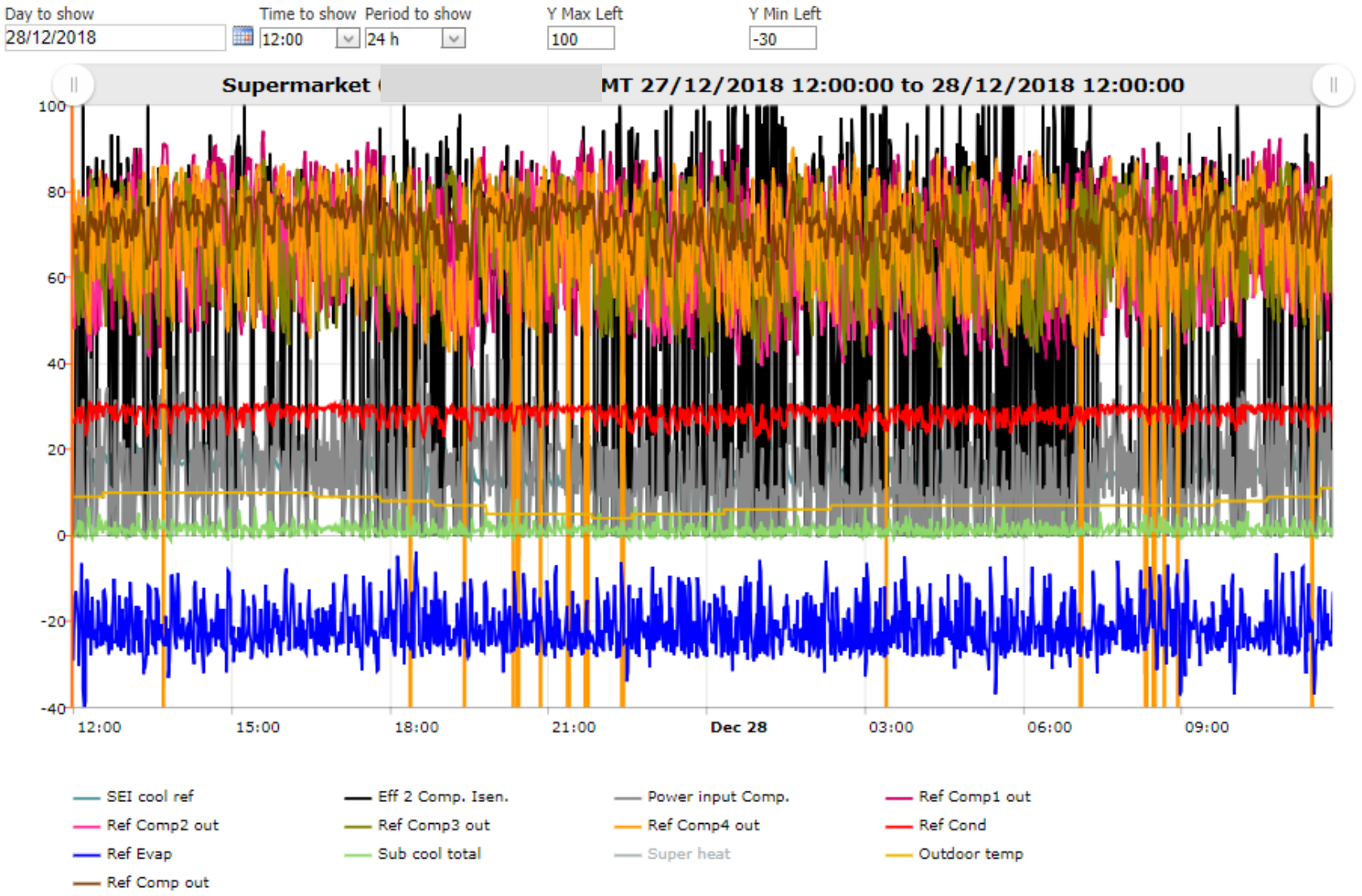
Supermarket rack - erratic controls



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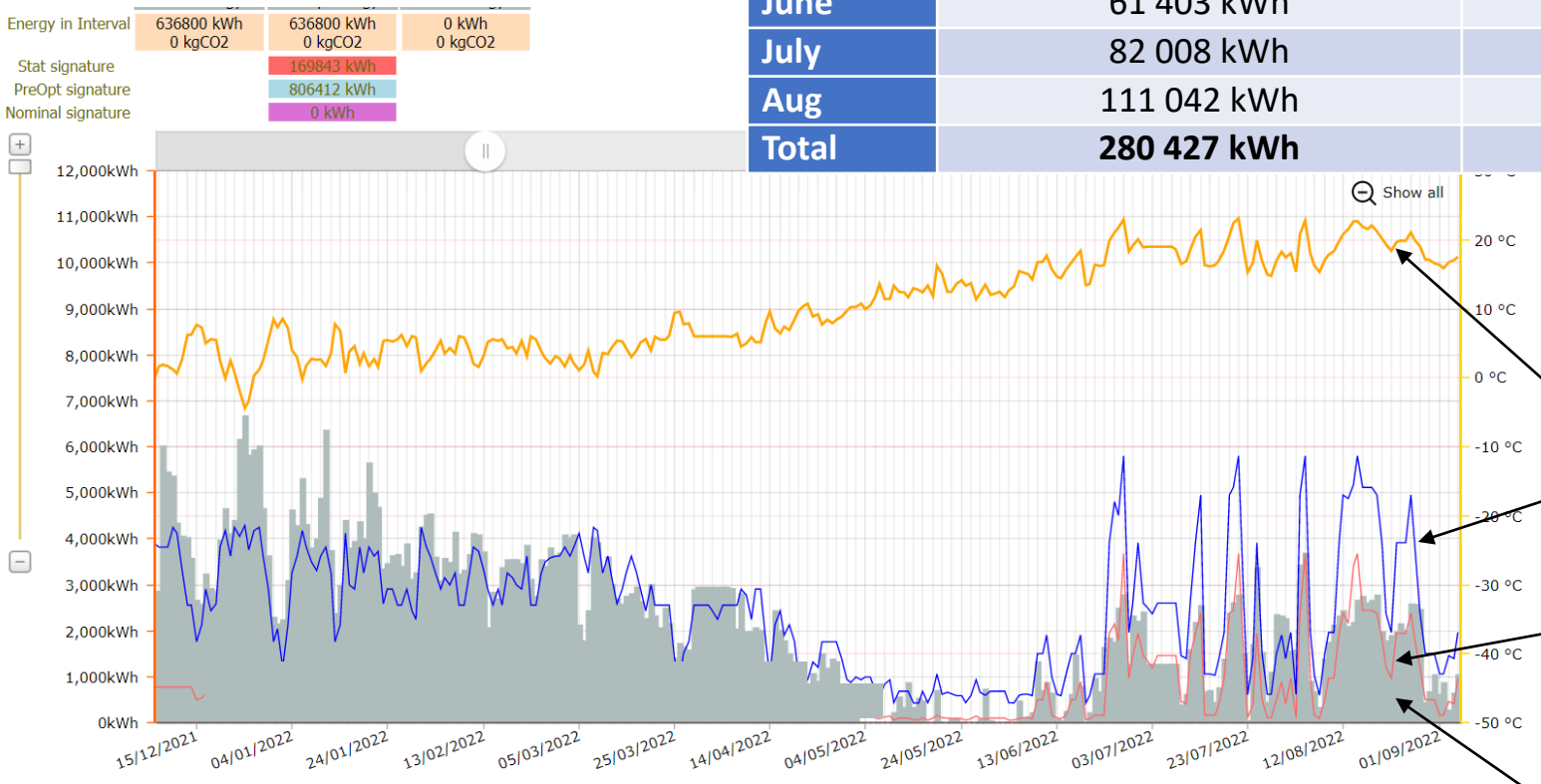
Chiller plant 50% (141 586 kWh) saving May-August 2022

	Baseline energy signature (blue line)	Energy consumption post (grey bars)	Difference in comsumption
May	25 974 kWh	6 027 kWh	-19 947 kWh (-77%)
June	61 403 kWh	25 389 kWh	-36 014 kWh (-58%)
July	82 008 kWh	46 444 kWh	-35 564 kWh (-43%)
Aug	111 042 kWh	60 981 kWh	-50 061 kWh (45%)
Total	**280 427 kWh**	**138 841 kWh**	**-141 586 kWh (-50%)**



Graph 12 months (24 hour values)

Yellow line = ambient temperature

Blue line = expected consumption with baseline performance

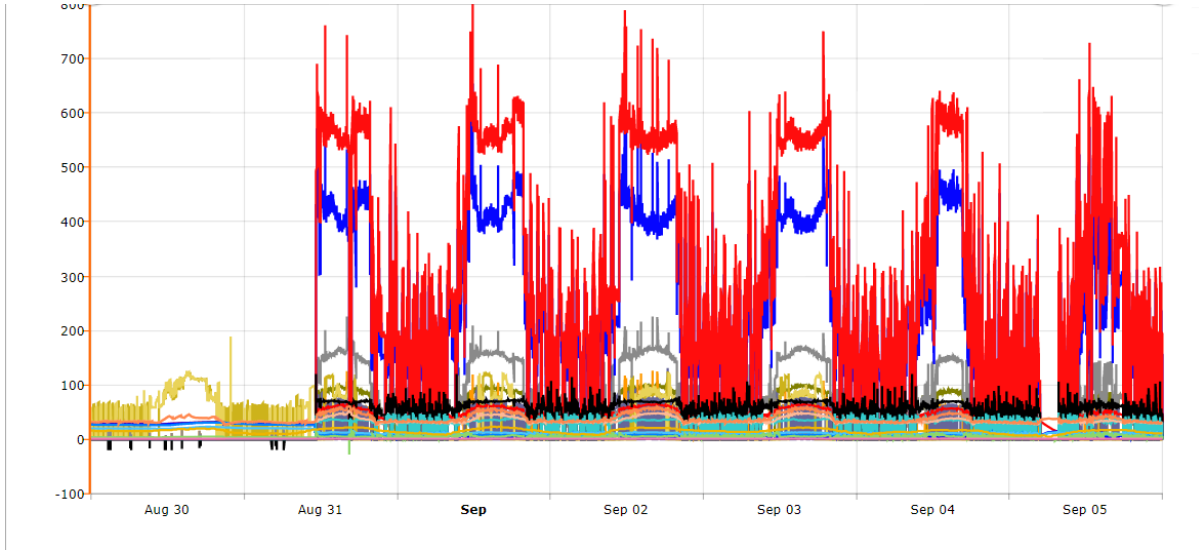
Red line = Post measure energy signature (from May so no low ambient data yet)

Grey bars = compressor energy per 24 hours

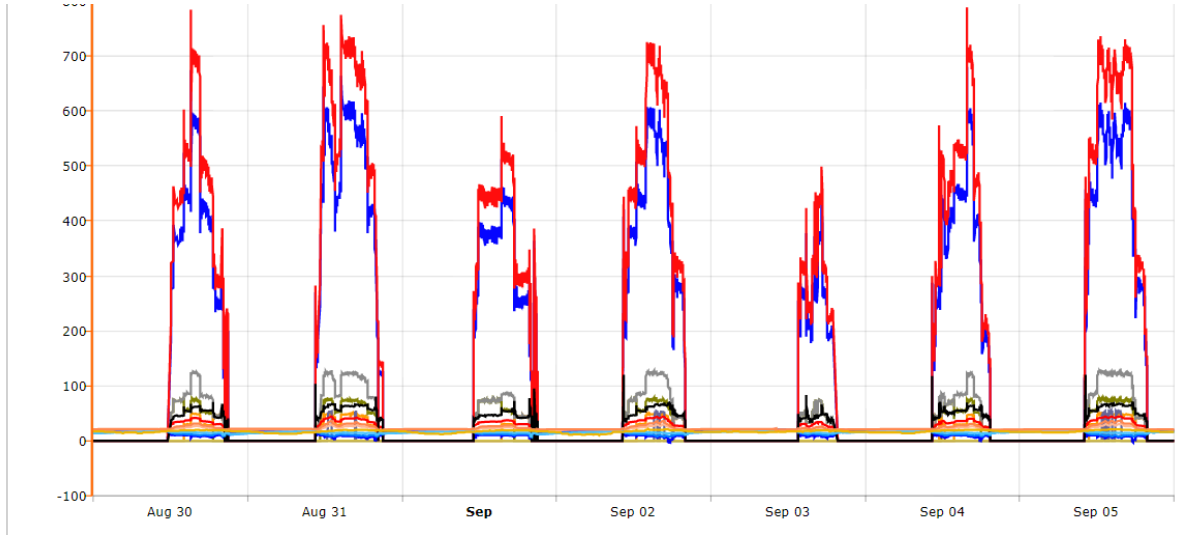
Before (2021) and post corrective measures (2022)

Controls stabilised – **no more tripping** of screw chillers

Before



After



Red – condenser capacity

Blue - cooling capacity

Grey - power

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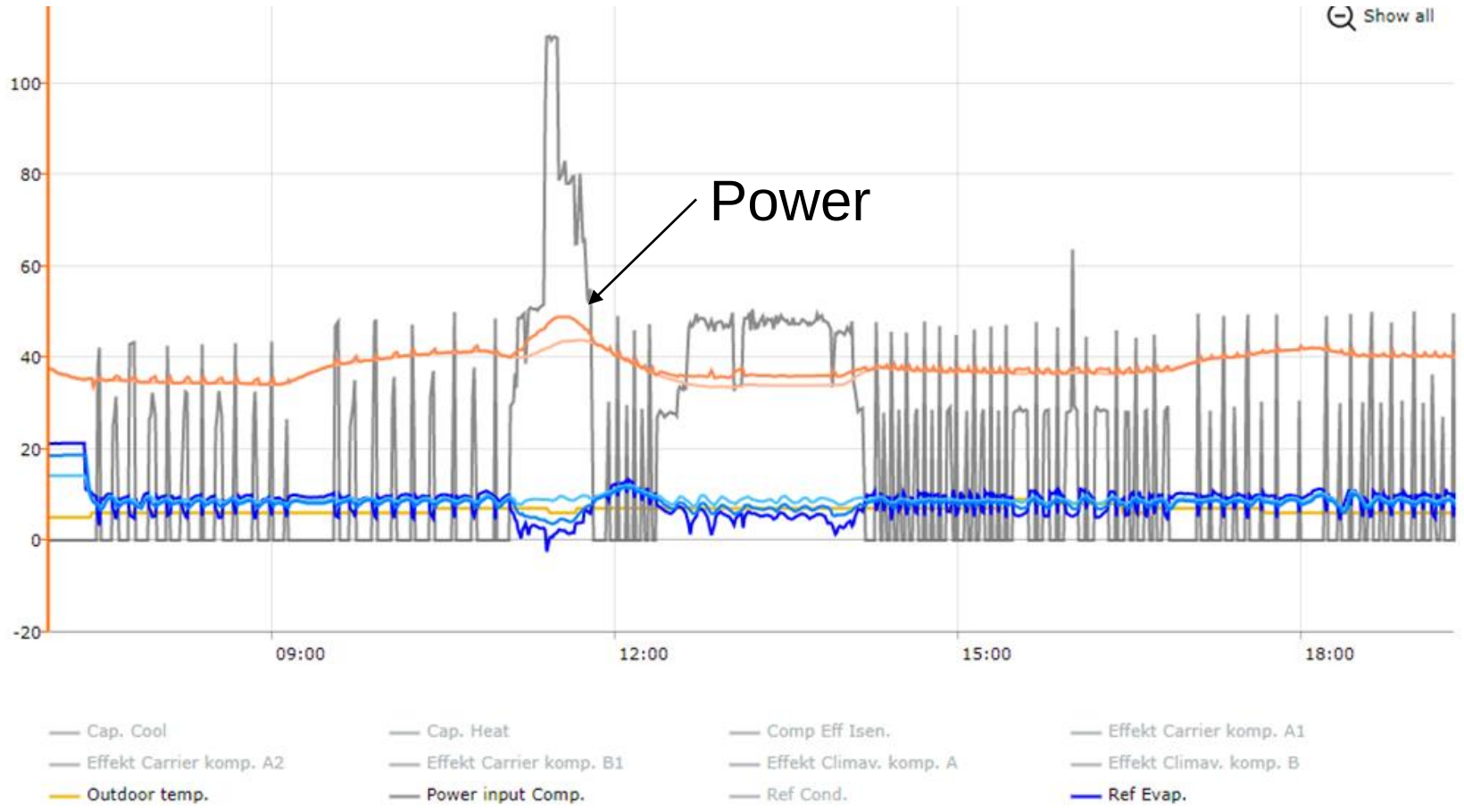
Chiller killer

Start/stop

- Oil carry over
- Compressor trips
- Increased wear
- Lousy efficiency



We see hundreds off these systems!

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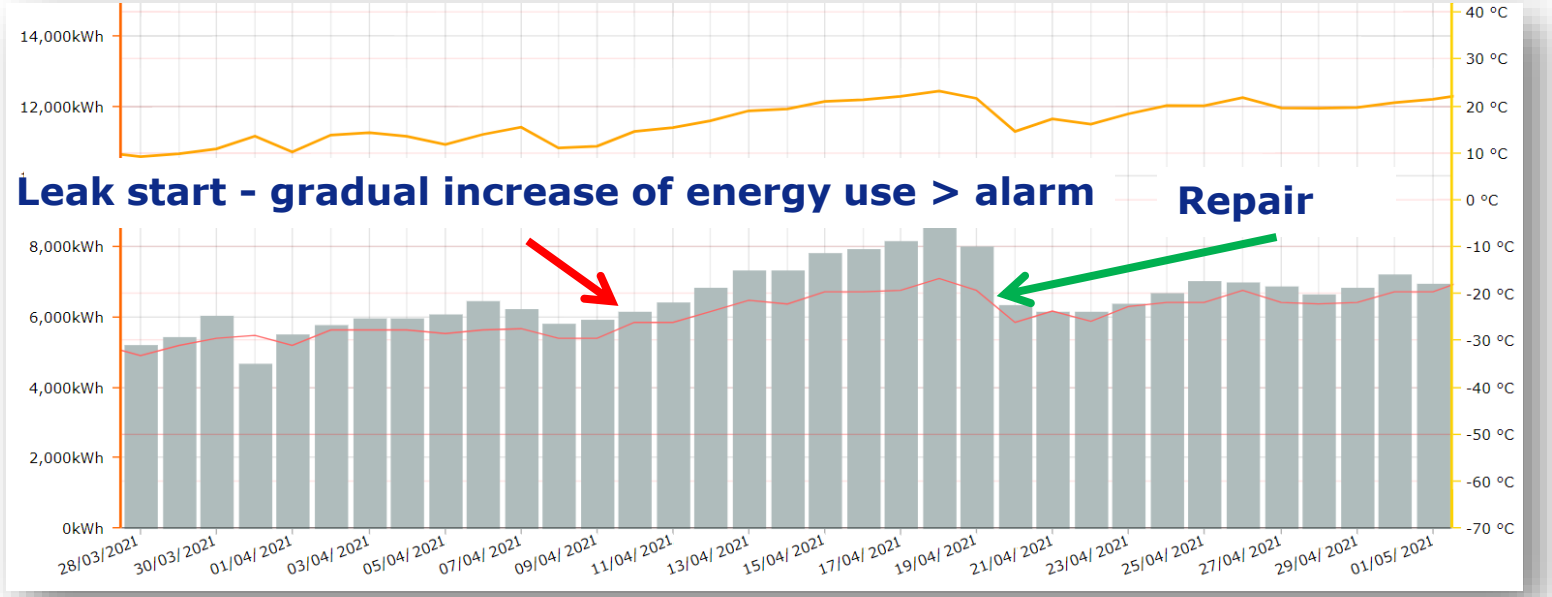
The impact of an optimised system

"Indirect leak detection"

Energy efficient is also reliable

10-30% Reduced energy consumption

Fewer breakdowns



Indirect leak detection

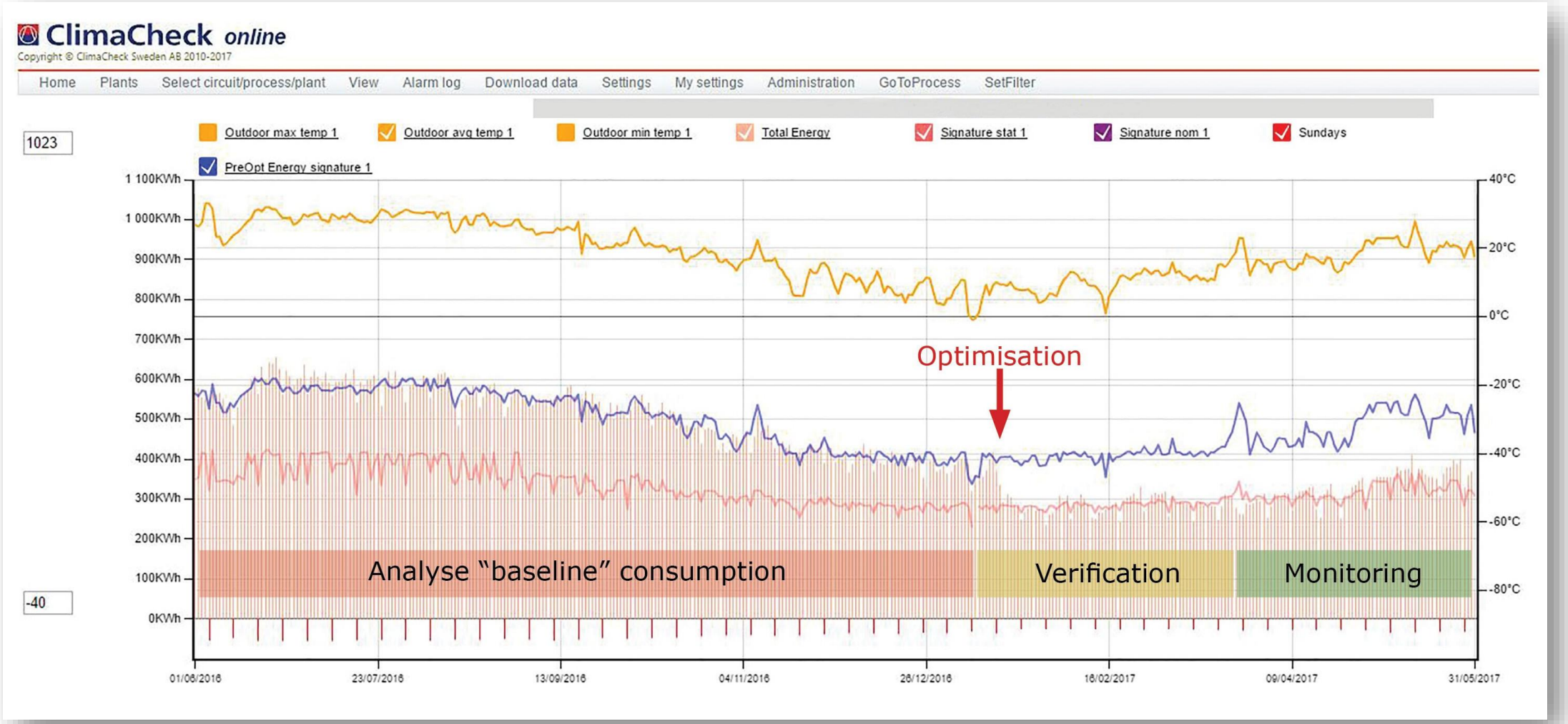
Leaks are difficult to detect with gas warning detectors

- gas is only detectable near leak and is then dispersed and carried away with ventilation air.

Indirect leak detection is often more reliable and cost effective

- ClimaCheck online offer “indirect leak detection”.
- Leaks are detected by deviation in
  - Subcool
  - Superheat
  - Evaporation
  - Increase start/stopp
  - Energy signature

Optimisation should be verified and monitored



Questions

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