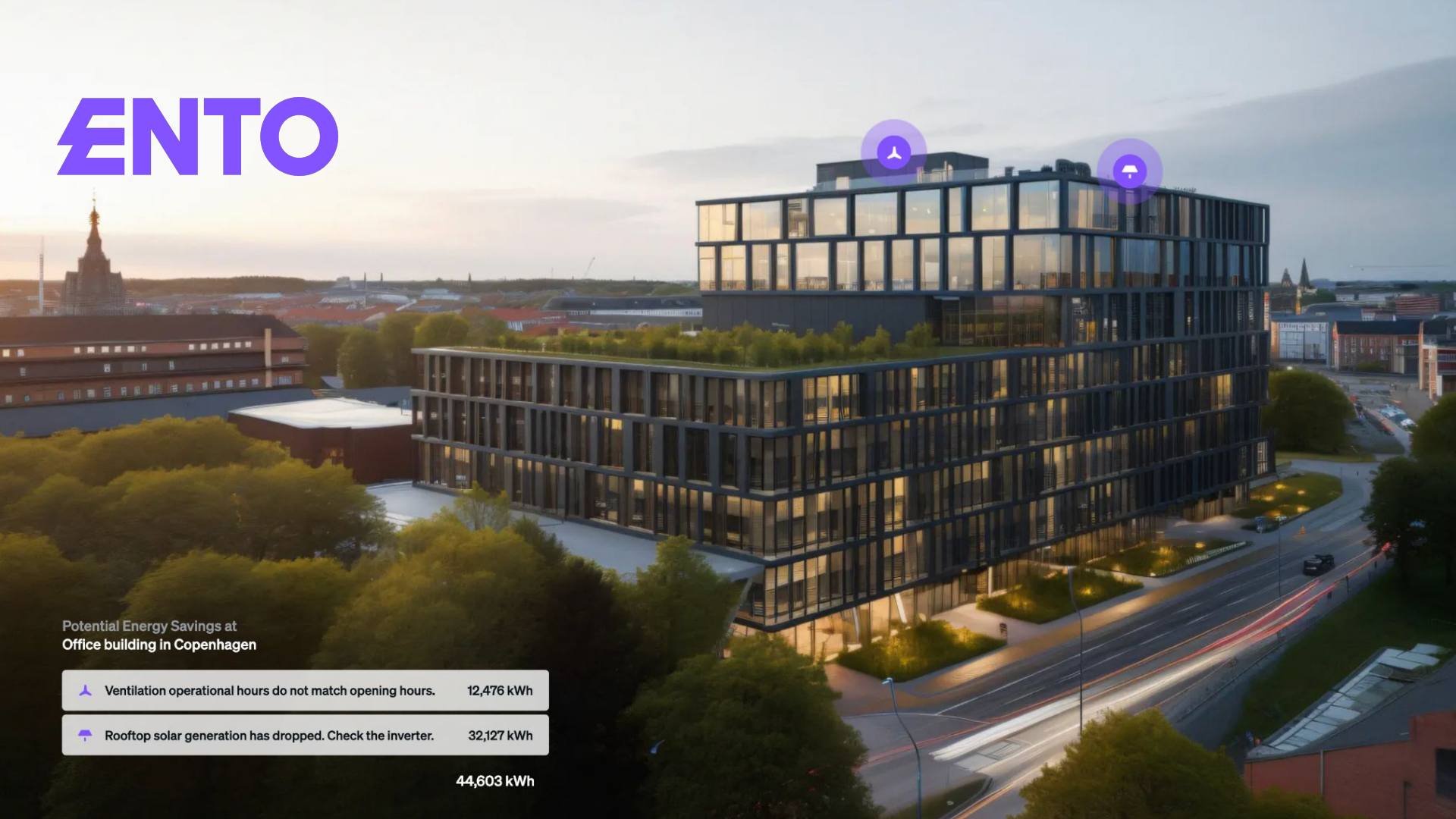

ENTO
Potential Energy Savings at
Office building in Copenhagen
Ventilation operational hours do not match opening hours. 12,476 kWh
Rooftop solar generation has dropped. Check the inverter. 32,127 kWh
44,603 kWh

Fra teknik til værdiskabelse med kunstig intelligens

Introduktion - energioptimering

Teknik - maskinlæring

Værdiskabelse - kunstig intelligens

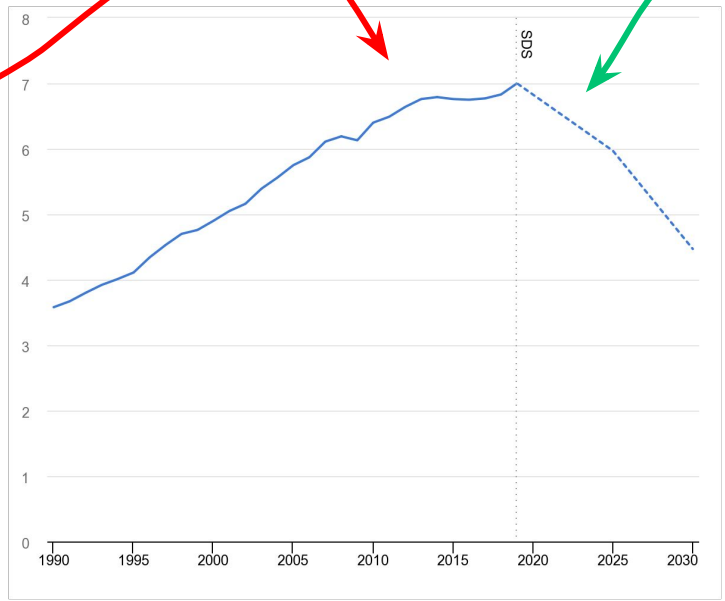
Kunstig intelligens

Kan det bruges til energioptimering?

Vi har et **gigantisk globalt** problem med bygningers energiforbrug

What is happening

What needs to happen



IEA, Buildings sector energy-related CO2 emissions in the Sustainable Development Scenario, 2000-2030, IEA

Traditionel energioptimering er ineffektivt

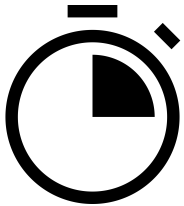
Installation af sensorer og opsamling af data

Manuel analyse af data eller “blind” energioptimering

Ingen eller mangelfuld måling af resultater

Kunstig intelligens gør energioptimering effektivt

~~Installation af sensorer og opsamling af data~~



Integrer forbrugsdata du har i forvejen på 5 minutter

~~Manuel analyse af data eller "blind" energioptimering~~

Brug algoritmer til at identificere de bedste initiativer

~~Ingen eller mangelfuld måling af resultater~~

Detaljerede før- og eftermålinger med få klik

Sådan virker vores kunstige intelligens

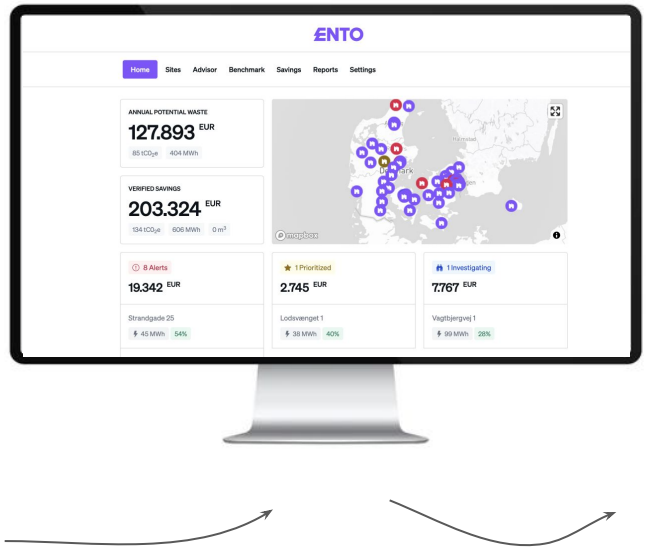
Energiforbrugsdata
Adresser

Vejrdata

Åbningstider

Bygningsinformation

Kalender information
(klokkeslæt, ugedag, ugenummer, offentlige helligdage)



- ✓ Identificer energispild i elforbrug, fjernvarme, gas, vand
- ✓ Monitorering af solceller uden bimålere
- ✓ Dimensionering af nye varmepumper og solcelleanlæg
- ✓ Verificering og dokumentation af energibesparelser

Kunstig intelligens

Kan det bruges til energioptimering?

Teknik

Er computere bedre til at **lave grafer** end mennesker?

Hvordan virker det?

M

Explain machine learning in 30 words

Machine learning is a type of artificial intelligence that enables computer systems to learn from data and improve their performance without being explicitly programmed.

Hvordan virker det?

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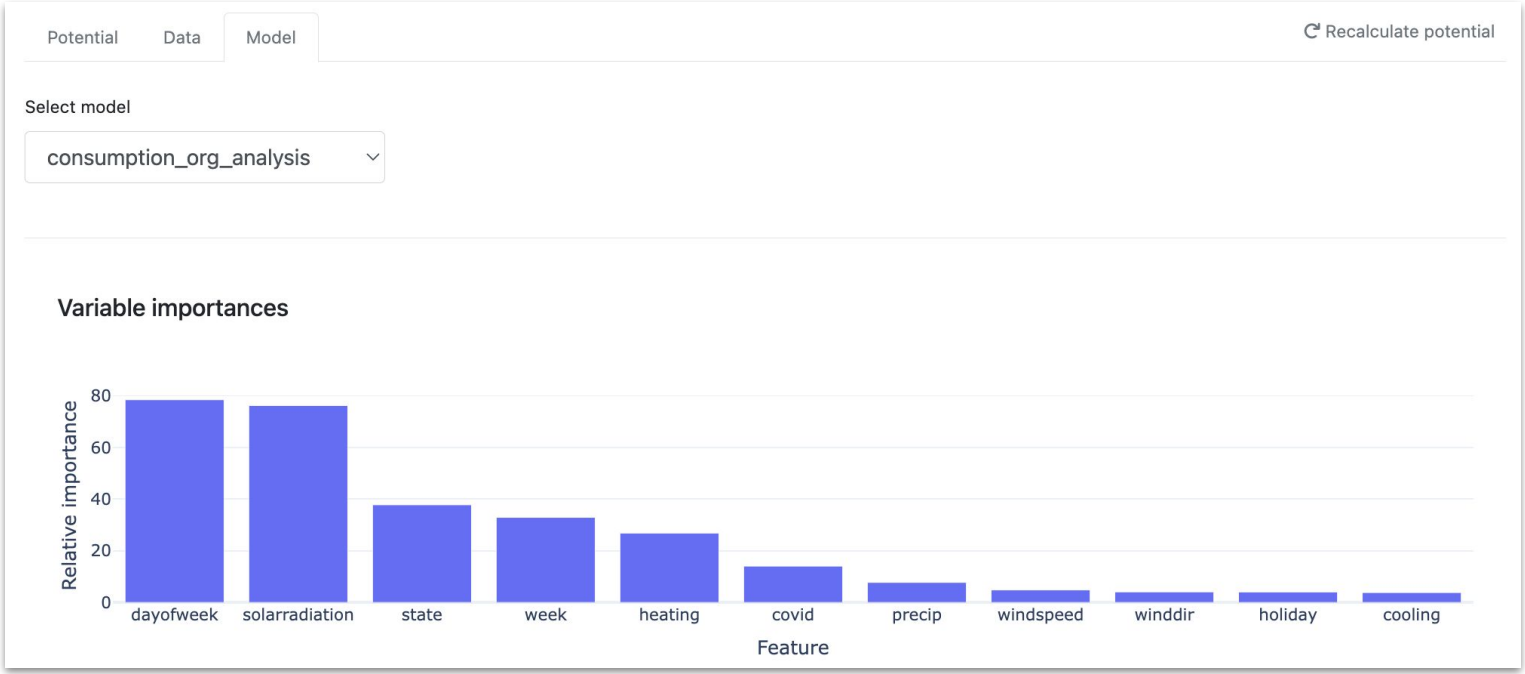
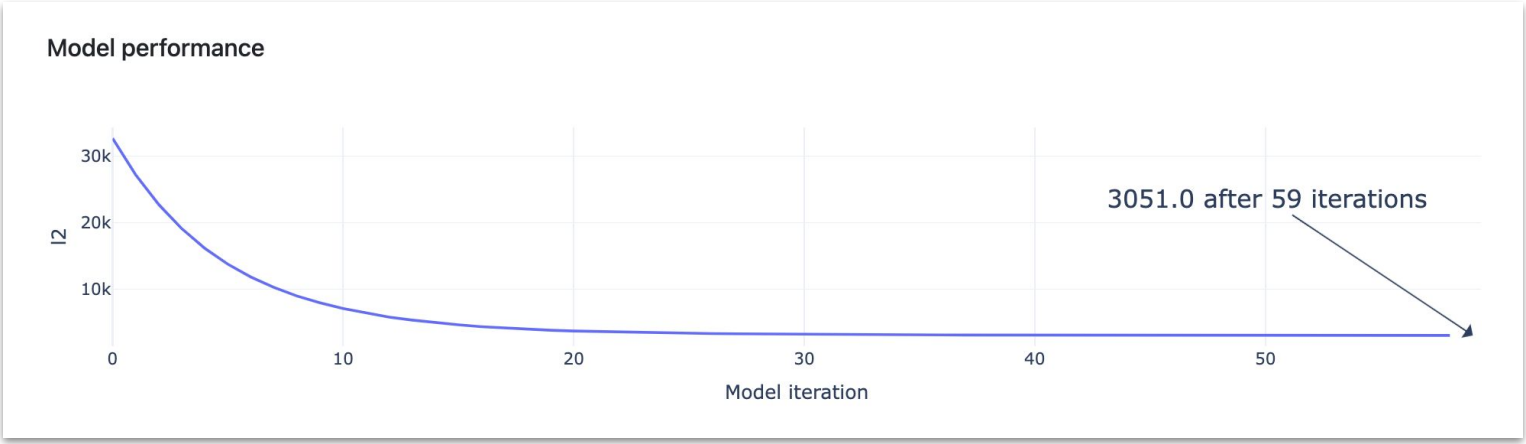
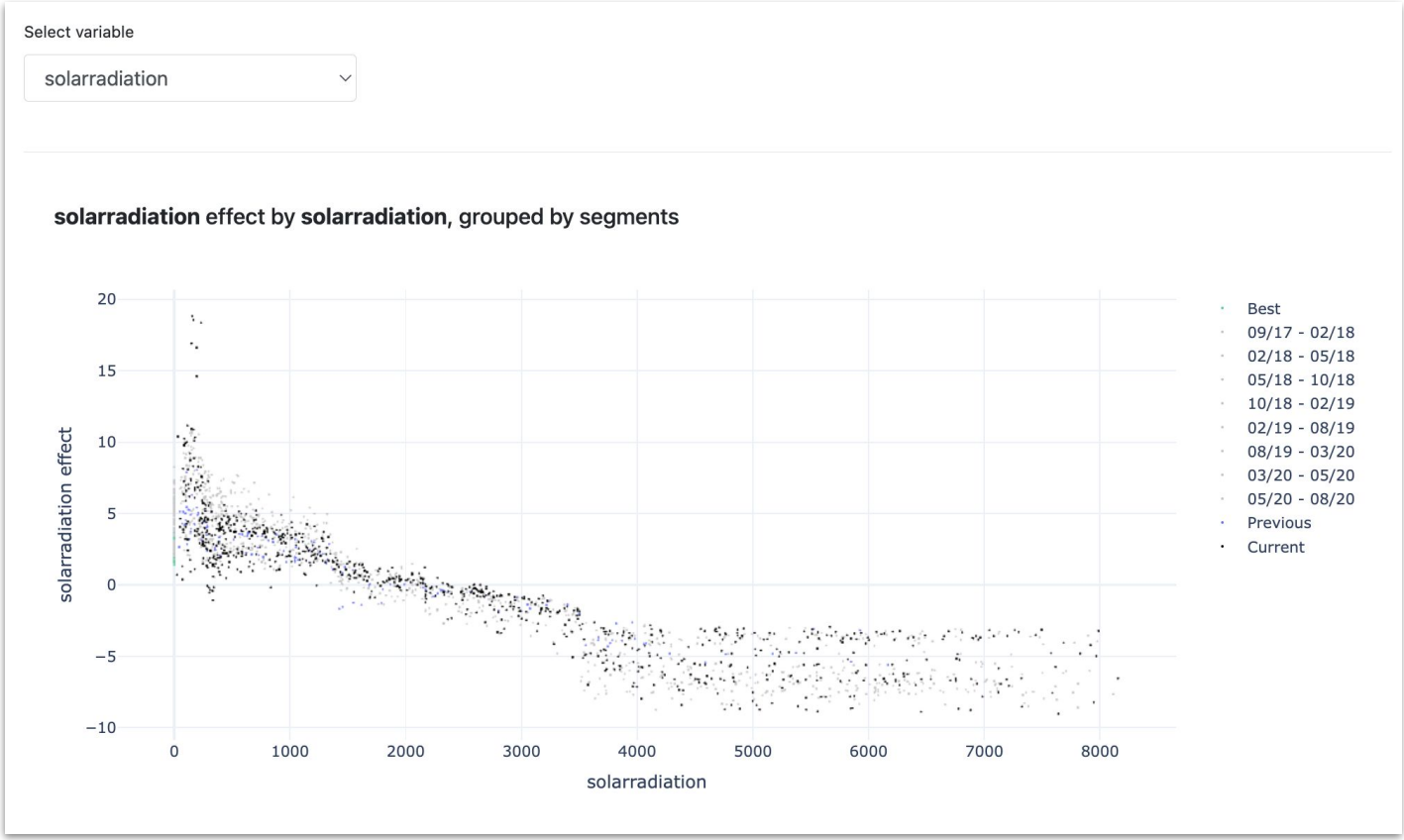
“Learn from data”



".. and improve their performance"



Eksempel - solindstrålings påvirking af energiforbrug



Teknik

Er computere bedre til at **lave grafer** end mennesker?

Værdiskabelse

Er computere bedre til at **forstå** store datamængder end mennesker?

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Explain the difference between AI and machine learning in 30 words

Artificial intelligence (AI) is a broad field of creating intelligent machines, while machine learning is a subfield of AI that involves training machines to learn from data and improve their performance.

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TECHNOLOGY

Let the sun shine on your energy budget

Solar panels – and power inverters – are prone to failing when they're about 10–15 years old. No human should look at graphs every day for that long, so we've built an AI that does exactly that.

SOLAR PV

Solar PV Issue

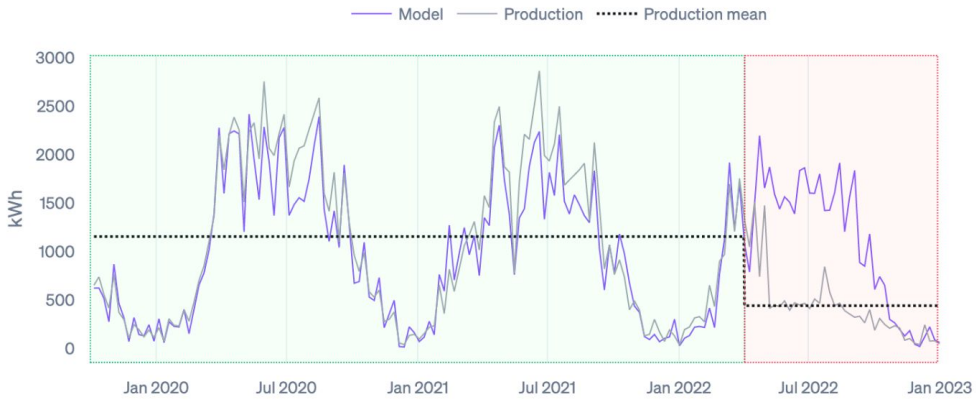
Investigated | Apr 02, 2022

Prioritize | Ignore | Register action

Potential | Data | Model

Solar PV model and production weekly data

Recalculate potential



ESTIMATED SAVINGS

37 MWh

10,021 EUR | 8,573 $kgCO^2$

RETURN ON INVESTMENT

Materials	5,087 EUR
Service	1,017 EUR
Total	**6,104 EUR**
Payback time	8 months

	PV INSTALLATION CAPACITY	PV TILT	PV ORIENTATION
Suggested	55.9 kW	40 °	180 °

The detected problem of this Solar PV system can be due to inverter failures. An estimated cost for materials and service for installing new inverters is provided for this case.

+ Additional Information

DISTRICT HEATING

Penalty

Prioritized | Feb 01, 2023 | Savings 9%

Investigate | Ignore | Register action

Potential | Data | Model

District Heating Penalty

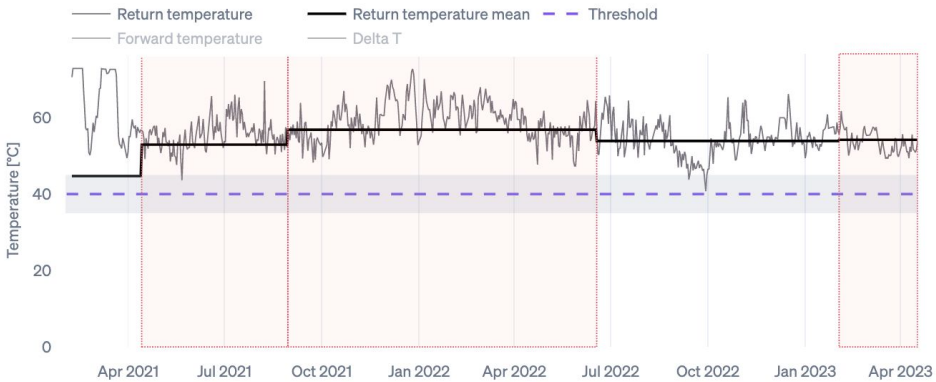
Recalculate potential

RETURN TEMPERATURE SAVINGS

Current state

54.2° ↑ 36 %

Preceding year **55 °**



ESTIMATED SAVINGS

4,539 EUR

9%

RETURN ON INVESTMENT

Materials	0 EUR
Service	670 EUR
Total	**670 EUR**
Payback time	8 weeks

GAS

Heating

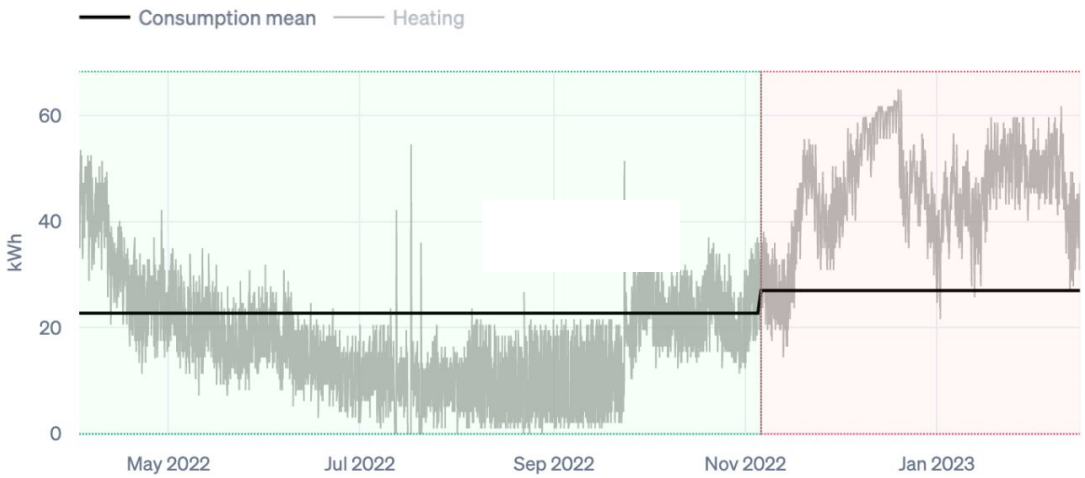
Nov 05, 2022 | Savings 20%

Prioritize | Investigate | Ignore | Register action

Potential | Data | Model

Heating consumption

Recalculate potential



What does it mean?

The **heating consumption** of the building is affected by the efficiency of the building envelope and by the indoor temperature.

ESTIMATED SAVINGS

37 MWh

20% | 6,836 EUR | 6,783 $kgCO^2$

ELECTRICITY

Baseload consumption level

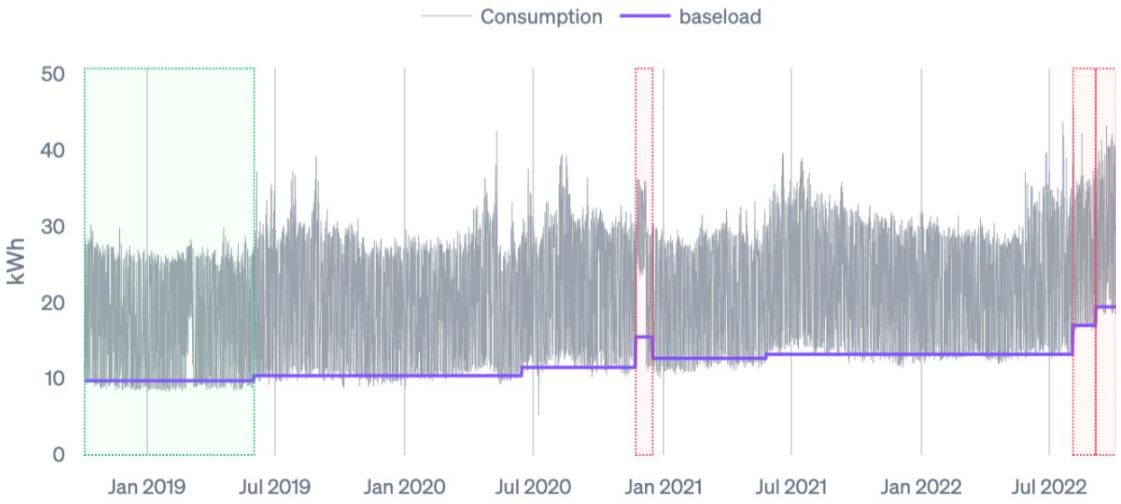
Prioritized | Oct 07, 2022 | Savings 28%

Investigate | Ignore | Register action

Potential | Data | Model

Electricity consumption and baseload

Recalculate potential



What does it mean?

The chart shows **baseload** which is a (daily minimum) level of electricity consumption, with other factors removed.

ESTIMATED SAVINGS

53 MWh

28% | 14,149 EUR | 11,104 $kgCO^2$

VENTILATION

Schedule

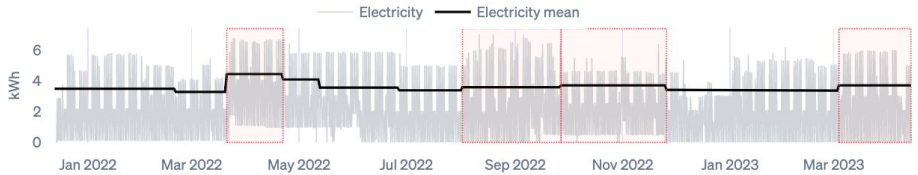
Savings 24%

Prioritize | Investigate | Ignore | Register action

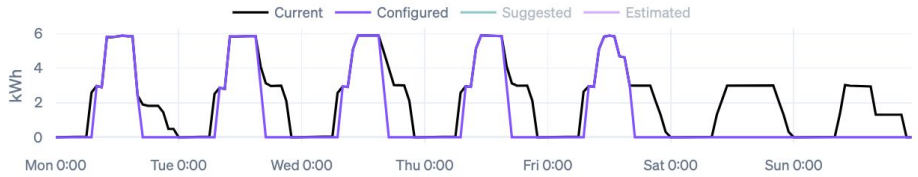
Potential | Data | Model

Recalculate potential

Ventilation



Week profile for latest segment



	BASE LOAD	PEAK LOAD	START HOUR	SHUTDOWN HOUR	RAMP UP	RAMP DOWN	WEEKEND
Estimated	0.0 kW	5.9 kW	8:00	16:00	2 hours	2 hours	0.49
Configured	0.0 kW	5.9 kW	7 :00	1! :00	2 hours	2 hours	0.00

What does it mean?

The saving potential for improving the **ventilation** schedule could be realized by decreasing the ventilation operation when there is no occupancy, for example in the night time or in the weekend.

ESTIMATED SAVINGS

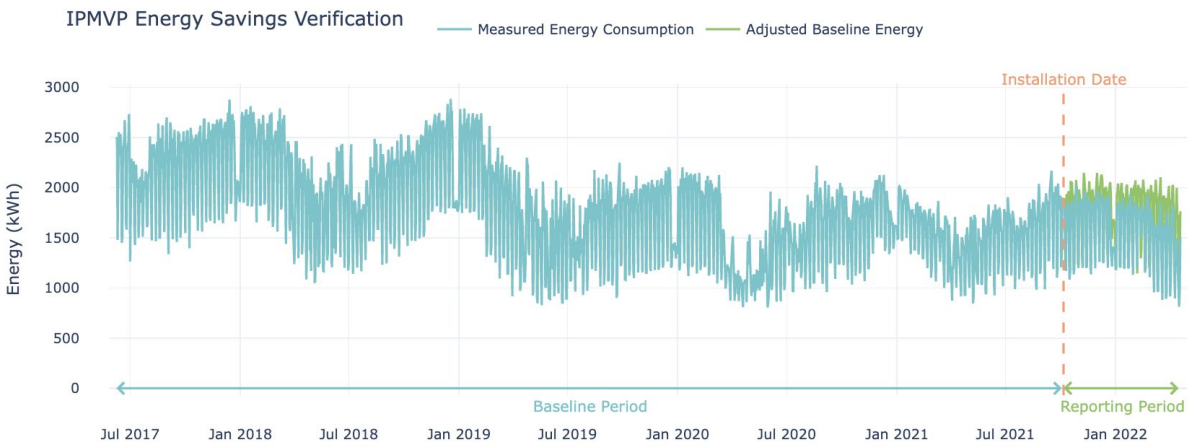
8 MWh

24% | 2,213 EUR | 1,803 kgCO^2

Rådhuset Holstebro, Kirkestræde 11 - Ændret tider i ventilationen

VERIFIED SAVINGS	28 MWh	6 tCO_2e	55,485 DKK

Expected Energy Savings	**30** MWh	Implemented By	Yonas Meshaima
Expected Carbon Savings	**6** tCO_2e	Implemented At	Oct. 5, 2021
Expected Cost Savings	**60,299** DKK	Verification Period	Nov. 2, 2021 (4 weeks)
Expected Volume Savings	-	Verification Progress	
IPMVP Verified Electricity Savings in the first 196 days	**36 ±6** MWh		
Cost Service	**0** DKK		
Cost Material	-		

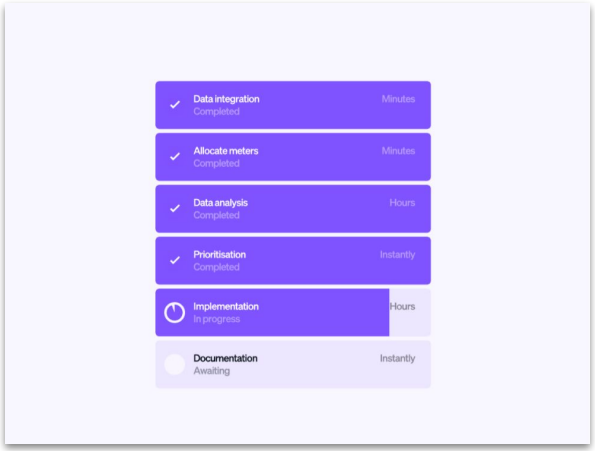


Værdiskabelse

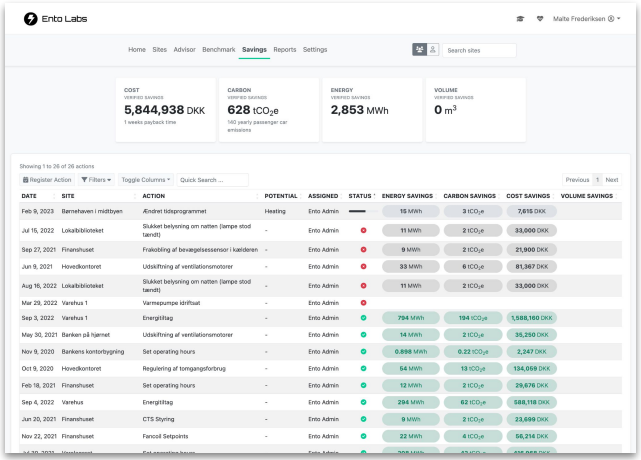
Er computere bedre til at forstå store datamængder end mennesker?

Værdiskabelsen jeg ser..

Integrer alle energikilder



Ingen manuel opsætning eller analyse



Samlet overblik over bygningers performance, mulige forbedringer og dokumenterede besparelser