



Unlock your Small and Medium Enterprises (SME's) energy savings: a practical guide to sustainable operations

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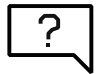
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The session will be **recorded** to allow distribution afterwards



Your **microphone** is automatically **muted**



Please ask your question in the Questions chat window and they will be addressed during the «**Q&A session**» at the end of the presentation





Agenda

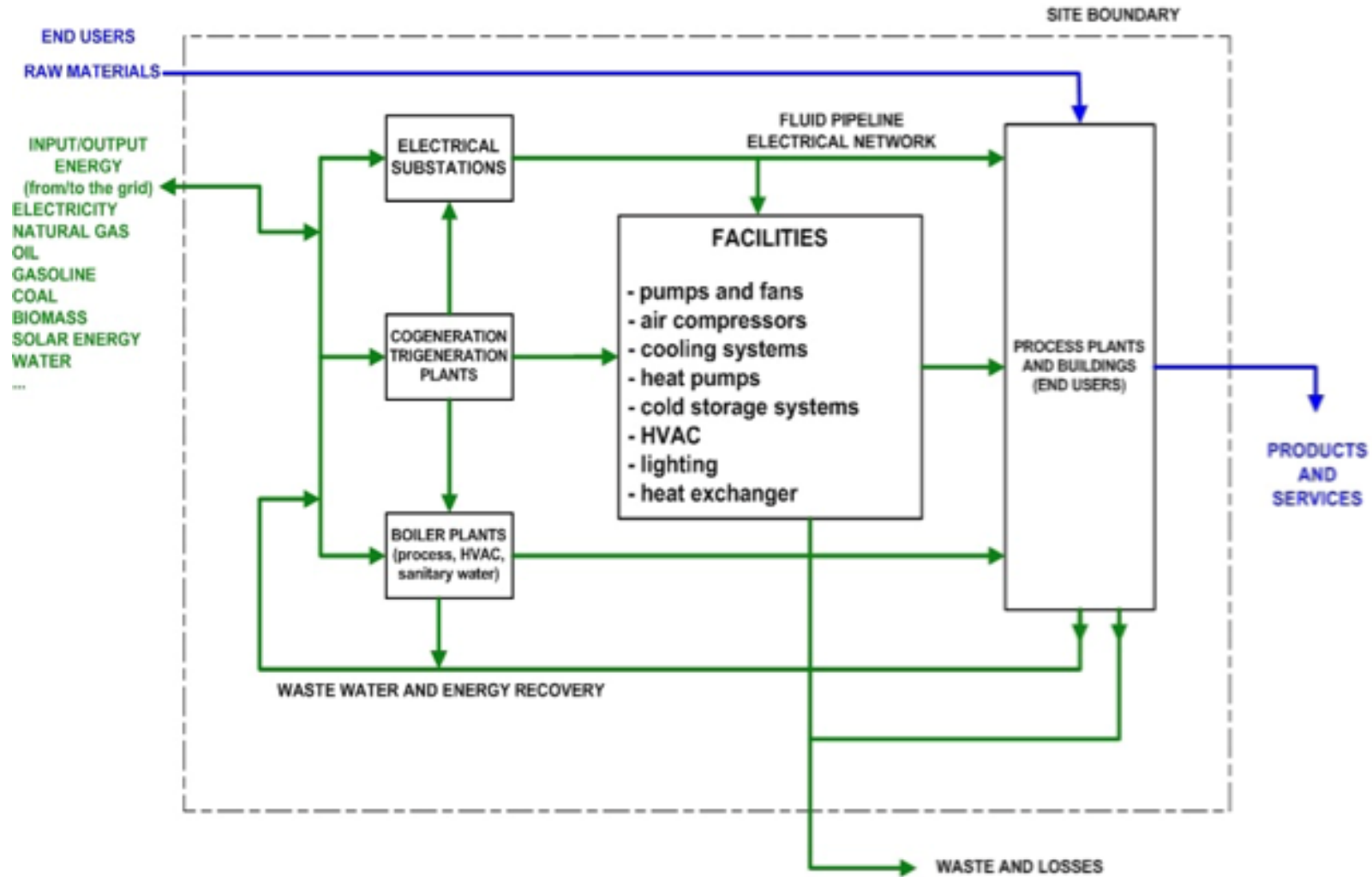
01. How to make the site's energy and water flow general scheme
02. How to model the site and the key utilities
03. How to allocate consumptions to uses and end users
04. How to improve KPIs for tracking and savings
05. How to define strategies and plans for efficient and renewable energy
06. Tips for choosing the right technologies
07. Summary
08. Sensorfact offering
09. Q&A

1

How to make site's
energy and water flow
general scheme

How to make a general scheme of the site

- Fix the boundary of the site
- Fix the input-output flows through the site
- Fix the main transformations of the input flows and the main facilities and processes



This scheme comes from the Giovanni Petrecca's archive. Any resemblance to real sites is purely coincidental

2

How to model the site
and the key utilities

Model preparation



Make models of the site following the **energy flows from the INPUT to the FINAL USERS** belonging to facilities and processes

- **Site's electrical model**
- **Site's thermal model**
- **Site's water model**

Made on the basis of rated power (kW) or mass flow-rate (water, others)

Multiplied by

working hours and average load factors

To obtain energy consumption (kWh, Sm³ natural gas, others) **and mass** (m³ water, others) **allocated to uses and end-users**

A sample of electrical model of the site

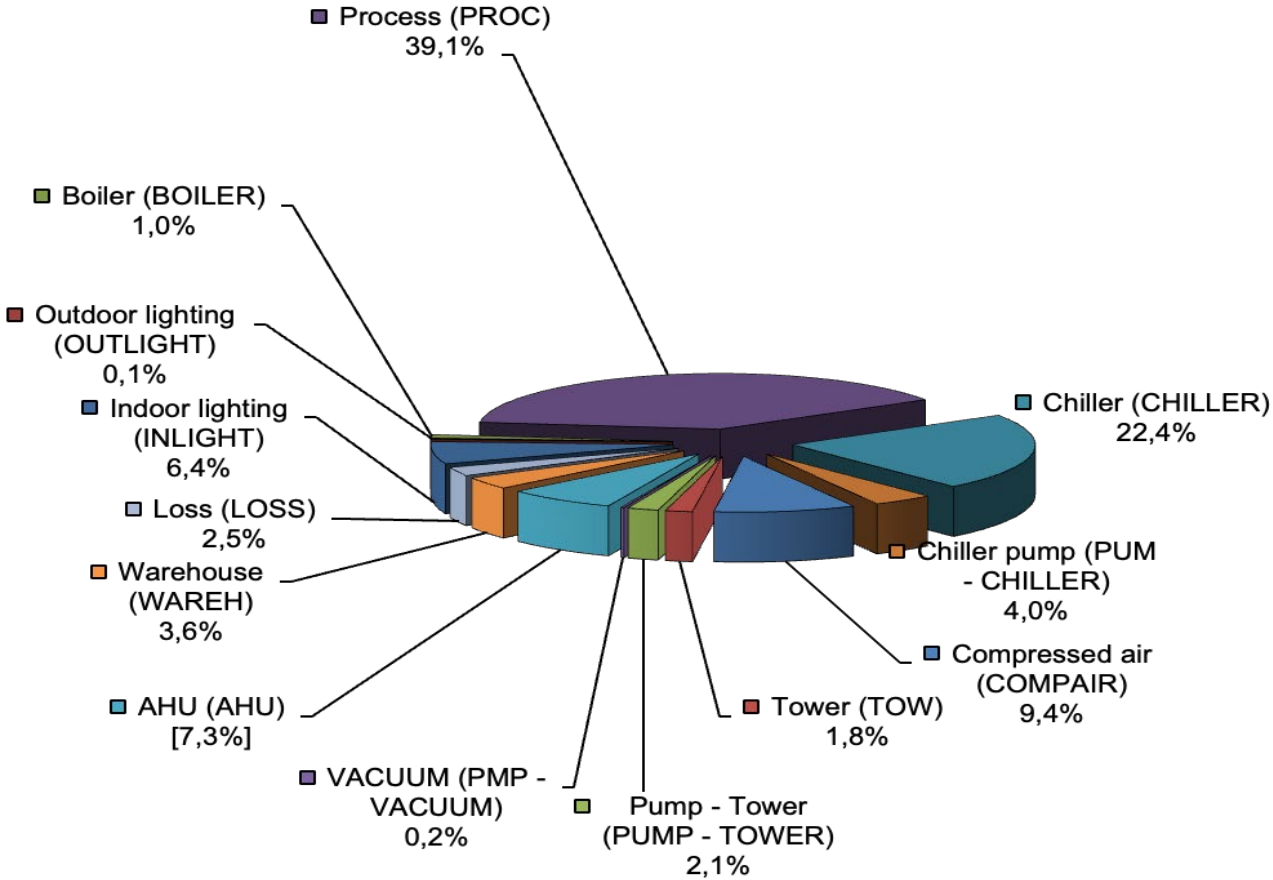
TABLE ELECTRICAL MODEL - SITE XXX														
				rated power	installed units	total rated power	load factory/efficiency	average input power	daily working hours	working days	yearly working hours	input energy	input energy share by end users	Uses
users	AREA	ACTIVITY	USES	kW	unit	kW	%	kW	hour/day	day/year	hour/year	kWh/year	%	
Indoor lighting	Factory & Warehouse	facility	INLIGHT	0,236	1.134	267,62	100,0%	267,62	24	280	6.720	1.798.433	4,17%	
Outdoor lighting	Outside parking	facility	OUTLIGHT	2,000	15	30,00	35,9%	10,78	12	365	4.380	47.233	0,11%	
Boiler steam	Refinery	facility	BOILER	75,000	1	75,00	50,0%	37,50	24	365	8.760	328.500	0,76%	
UTA hvac 1	Raw material storage	facility	UTA	11,00	1	11,00	35,0%	3,85	24	365	8.760	33.726	0,08%	
UTA hvac 11-1	Chocolate storage	facility	UTA	75,00	1	75,00	35,0%	26,25	24	365	8.760	229.950	0,53%	
Supply pumps n.5- glycol 40%	Cooling plant	facility	PUMP - CHILLER	186,50	1	186,50	25,0%	46,63	24	365	8.760	408.435	0,95%	
Cooling pumps n-10 - water	Cooling tower	facility	PUMP - TOWER	74,60	1	74,60	25,0%	18,65	24	365	8.760	163.374	0,38%	
Compressor 1- ZR450	Air compressed plant	facility	COMPAIR	448	1	448,00	25,0%	112,00	24	260	6.240	698.880	1,62%	
Compressor 2 - ZR450	air compressed plant	facility	COMPAIR	448	1	448,00	25,0%	112,00	25	260	6.500	728.000	1,69%	
Compresso 3 - ZR500 (VSD)	Air compressed plant	facility	COMPAIR	521	1	521,00	75,0%	390,75	26	260	6.760	2.641.470	6,13%	4.068.350
Water pump	VACUUM	facility	PMP - VACUUM	34,00	1	34,00	30,0%	10,20	24	365	8.760	89.352	0,21%	
Chiller 9 - Fixed speed - R134A - (-1°C)	Cooling plant	facility	CHILLER	527	1	527,00	30,0%	158,10	24	365	8.760	1.384.956	3,21%	
Chiller 11 - VSD, variable speed drive) - R134A	Cooling plant	facility	CHILLER	407	1	407,00	58,1%	236,64	24	365	8.760	2.072.952	4,81%	
Cooling Tower 5 (air flow 250 m ³ /h)	Cooling plant	facility	TOW	22,25	1	22,25	50,0%	11,13	24	365	8.760	97.455	0,23%	
PROCESS-Building 1	Building 1	process	PROC	1.400,00	1	1.400,00	100,0%	1400,00	24	365	8.760	12.264.000	28,45%	
Others													44,23%	
Losses	Factory	various	LOSS	125,00	1	125,00	100,0%	125,00	24	365	8.760	1.095.000	2,54%	
TOTAL						10.095		5.164,68				43.104.526	100%	

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3

How to allocate
consumptions to uses
and end users

A sample of electric energy sharing to point out the most consuming uses



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Modelling the highest consumption areas

- **Modelling is crucial** for energy efficiency
- **Start with *real* insights** on your consumption and take necessary actions
- **At first, point out energy waste**

In the highest-consumption areas:

- **Make specific models** for cooling plants, compressed air, AHU, ..
- **Look for incorrect demand** from users, e.g. temperature, humidity, flow-rate, ...
- **Look for potential energy recovery**
- **Look for more efficient equipments** (boiler, cooling plant, compressor, cooling tower, air compressed systems)
- **Find out and measure KPIs**

A sample of electrical model of air compressed system

4

How to improve KPIs
for tracking and savings

The reference KPIs

- **Make sure you have the proper set of KPIs**
- **Benchmark your KPIs with the reference KPIs**
- **Draw actionable conclusions**

Table 20.3 Basic KPIs

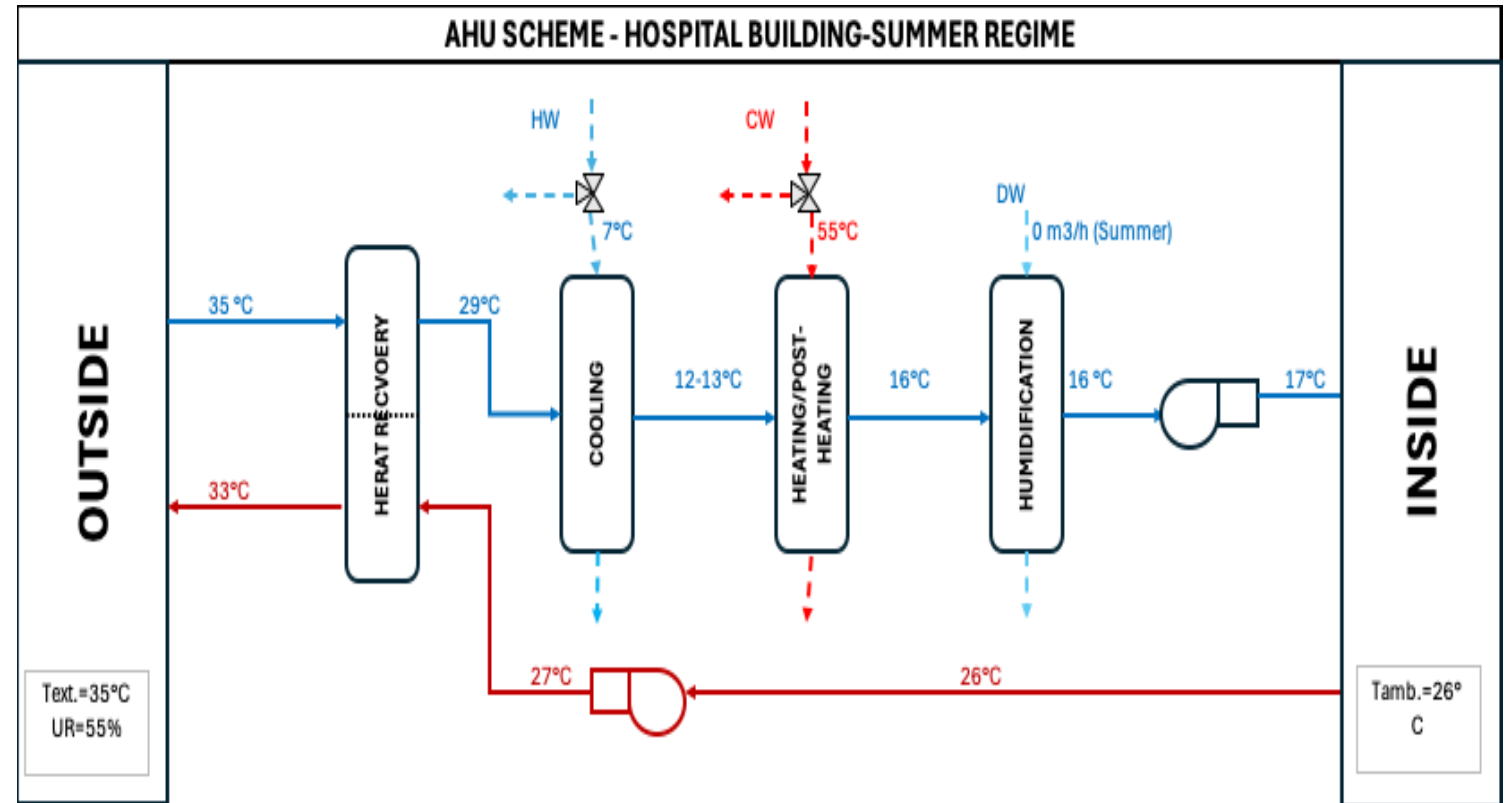
	By	SI unit	English unit
Steam production	Boiler	12–14 kg _{steam} /kg _{oil}	12–14 lb _{steam} /lb _{oil}
Steam production	Boiler	9–11 kg _{steam} / Sm ³ _{natural gas}	0.25– 0.31 lb _{steam} / Sft ³ _{natural gas}
COP cooling above ice point	Cooling compressor	3–6	3–6
COP cooling below ice point	Cooling compressor	0.7–2	0.7–2
COP cooling above ice point	Cooling absorption	0.7–1	0.7–1
Compressed air	Air compressor	0.11– 0.14 kWh/ Sm ³ _{inlet air}	0.0031– 0.004 kWh/Sft ³ _{inlet air}
COP heating	Heat pump-compressor	3–6	3–6
Condensing water	Cooling tower	0.01– 0.02 m ³ / kWh _{compressor}	2.6–5.2 gallon/ kWh _{compressor}
Condensing water	Discharged water	0.1–0.2 m ³ / kWh _{compressor}	26–52 gallon/ kWh _{compressor}
Auxiliaries in cooling tower or air condenser	Fans and pumps	0.05–0.1 kWh _{aux} / kWh _{compressor}	0.05–0.1 kWh _{aux} / kWh _{compressor}
Utility plant	Condensing turbine plant	4.5 kWh/kg _{oil}	2 kWh/lb _{oil}
Utility plant	Combined gas turbine plant	5.3 kWh/ Sm ³ _{natural gas}	0.15 kWh/ Sft ³ _{natural gas}
Water storage	Pump	250–300 t × m/kWh	216,680– 260,000 gallon × ft/kWh
Lighting	Luminaire	50–100 lm/W	50–100 lm/W
Lighting a building	Luminaire	10–20 W/m ²	0.93– 1.86 W/ft ²
Lighting a factory	Luminaire	5–10 W/m ²	0.46– 0.93 W/ft ²
Heating and cooling a building	Heating and cooling	10–20 W/m ³	1,205– 2,410 Btu/h × ft ³
Heating and cooling a factory	Heating and cooling	5–10 W/m ³	602– 1,204 Btu/h × ft ³

Volume of natural gas usually referred to 15.6 °C, 60 °F and 0.1 MPa, 14.69 psi

Volume of inlet air for compressed air plant referred to 15.6 °C, 60 °F and 0.1 MPa, 14.69 psi

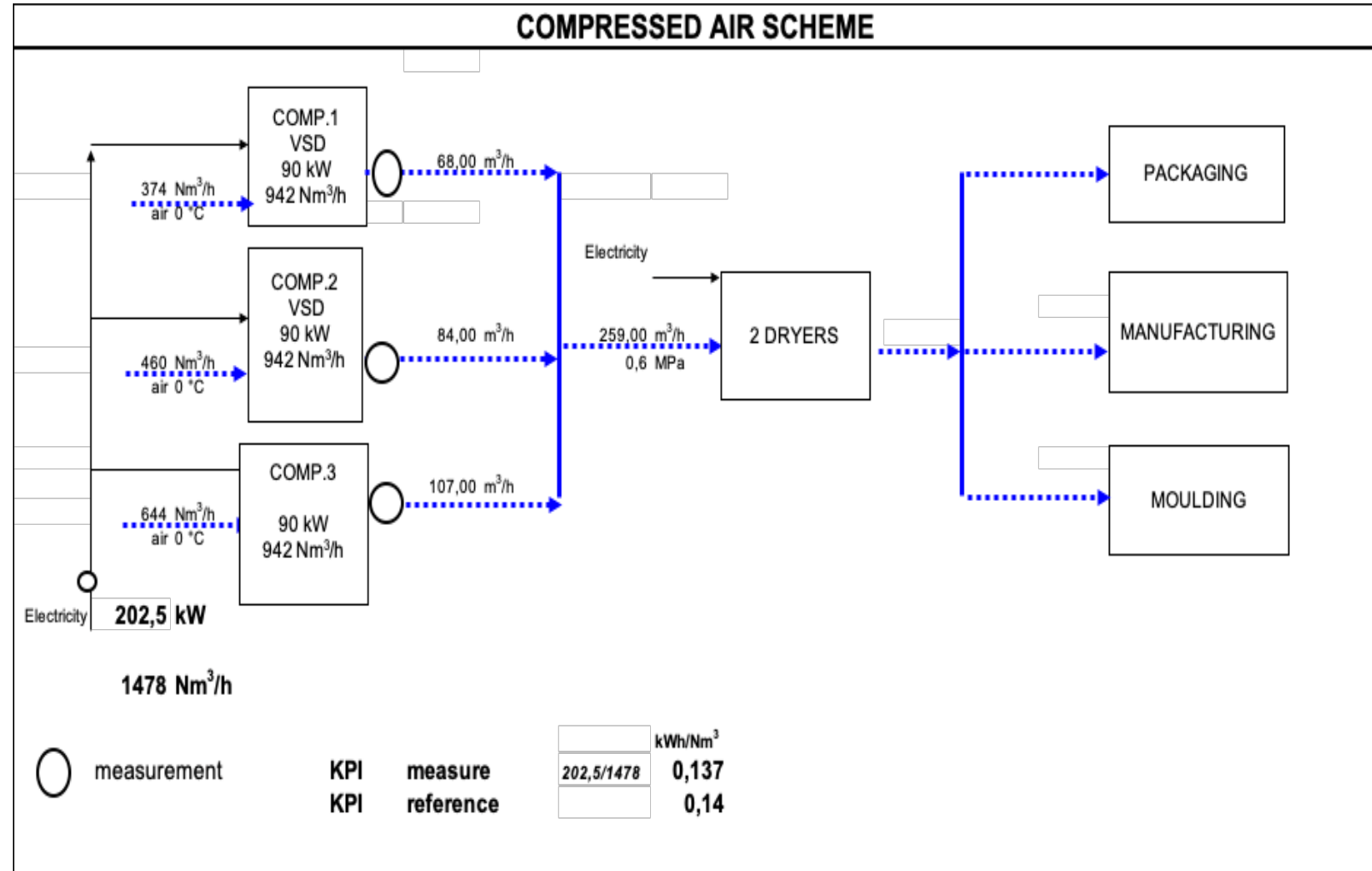
Air Handling Unit (AHU) system example

1. **Step 1 : KPIs can be estimated** on the basis of rated performances.
2. **Step 2:** In order to plan the investments **KPIs must be measured.**
3. **Step 3: Savings can always be obtained by a proper control of the operational parameters** (pressure, flow-rate, humidity ratio).



Compressed air system example

- Step 1: KPIs can be estimated on the basis of rated performances.
- Step 2: In order to plan the investments **KPIs must be measured**.
- Step 3: Savings can be obtained by a proper control of the operational parameters (operating pressure, flow-rate)



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5

How to define strategies
and plans for efficient and
renewable energy

Define strategies



A team of consultants and / or internal staff **make strategies** for energy savings and environmental protection

- **Look at the models**, find out the most consuming uses, go into operational details, **make proposals** for energy saving & environmental protection
- **Consider capital cost, public aids and savings** (saving in energy and operating costs plus or minus additional costs)
- **Do economic analysis** by means of the Pay-Back, Present Worth (PW) and Internal rate Return (IRR) to point out the most performing proposals
- **Fill in a comparative Table** setting down the proposals for a single Site or for more Sites
- Regardless of the Site's activity, **investigate** proposals on **tools for distributed and centralized control** of process and facility plants

A comparative table of proposals

6

Tips for choosing the right
technologies

Tips for choosing the right technologies

- Look at the list
- Associate the listed proposals to your site
- Check the economic and technical feasibility
- Make a preliminary study

SOME TIPS TO HELP TECHNICIANS CHOOSE THE RIGHT TECHNOLOGIES FOR ANY SITUATION	year 2024			year 2021		
	capital cost 2024=+30% cost 21					
	0,25 €/kWh			0,15 €/kWh		
	0,8 €/Sm ³			0,3 €/Sm ³		
	payback	IRR	based on	payback	IRR	based on
	year	%	year	year	%	year
PHOTOVOLTAIC PLANT (efficiency 22-25%)	5,5	16,50%	15	6	14,50%	15
HIGH EFFICIENCY TRANSFORMER (8760 hours/year) (extra cost)	6	14,50%	15	10	5,50%	15
HIGH EFFICIENCY BOILERS (DA 90% A 95%; 5000 hours/year)	5	18,00%	15	9,5	7,20%	15
POWER FACTOR CONTROL (COS φ from 0,65 to 0,9; 5000 hours/year)	3	>20%	10	4,5	18,00%	10
COGENERATION PLANT (6000 hours/year)	2,7	>20%	10	2,6	>20%	10
TRIGENERATION PLANT (6000 hours/year)	3	>20%	10	3	>20%	10
ORC PLANT (6000 hours/year)	5	15,00%	10	6	10,50%	10
HIGH EFFICIENCY MOTORS (IE4 versus IEEE STANDARD) (6000 hours/year) (extra cost)	3	>20%	15	5	18,00%	15
PIPELINE INSULATION (2500 hours/year)	2	>20%	15	2	>20%	15
NON DISSIPATIVE PUMP CONTROL BY VSD (50% flow rate reduction,4000 hour/year)	3	>20%	10	4	21,00%	10
HIGH EFFICIENCY COOLING COMPRESSOR PLANT (EER from 3 to 6; 6000 hours/year)	5	15,00%	10	6	10,50%	10
HEAT RECOVERY FROM COOLING PLANTS (30% of the rated refrigeration power) (6000 hours/year)	2,5	>20%	15	3,5	>20	15
COMPRESSED AIR-PRESSURE REDUCTION (compressor ratio from 9 to 7; 10% of electric energy saving, 5000 hours/year)	3	>20%	15	4,5	21,00%	15
VSD INSTEAD OF FIXED SPEED FOR COMPRESSED AIR(8760 hours/year, reference 50% no-load)	5	15,00%	10	6	10,00%	10
HEAT PUMP INSTEAD OF BOILER (extra cost)(reference 2000 hours/year)	2	>20%	15	10	5,50%	15
HVAC-HEAT RECOVERY FOR RE-HEATING (2000 hours/year)	3,5	>20%	15	8	9,00%	15
LED LIGHTING INSTEAD OF STANDARD FLUORESCENT LAMPS (5000 hours/year)	2,5	>20%	10	4	21,00%	10
PLANT CONTROL (8760 hours/year)	4	21,00%	10	7	7,00%	10
HEAT RECOVERY FROM LIQUID OR GAS STREAM BY USING EXCHANGERS (6000 hours/year)	2,5	>20%	10	4	21,00%	10

7

Summary

Summary

- **Make** the site's energy and water flow general scheme
- **Model** the site and the key utilities, mainly on the basis of rated powers
- **Allocate** consumptions to uses and end users and make models of the highest consumption uses
- **Improve** KPIs for tracking and savings, **makes schemes of facilities** to point out how **to measure KPIs**
- **Define strategies and plans** for efficient and renewable energy by means of technical and economic analysis (Pay Back, Present Worth, IRR)
- **Choose the right technologies** and check economic and technical feasibility for the site

8

Sensorfact offering



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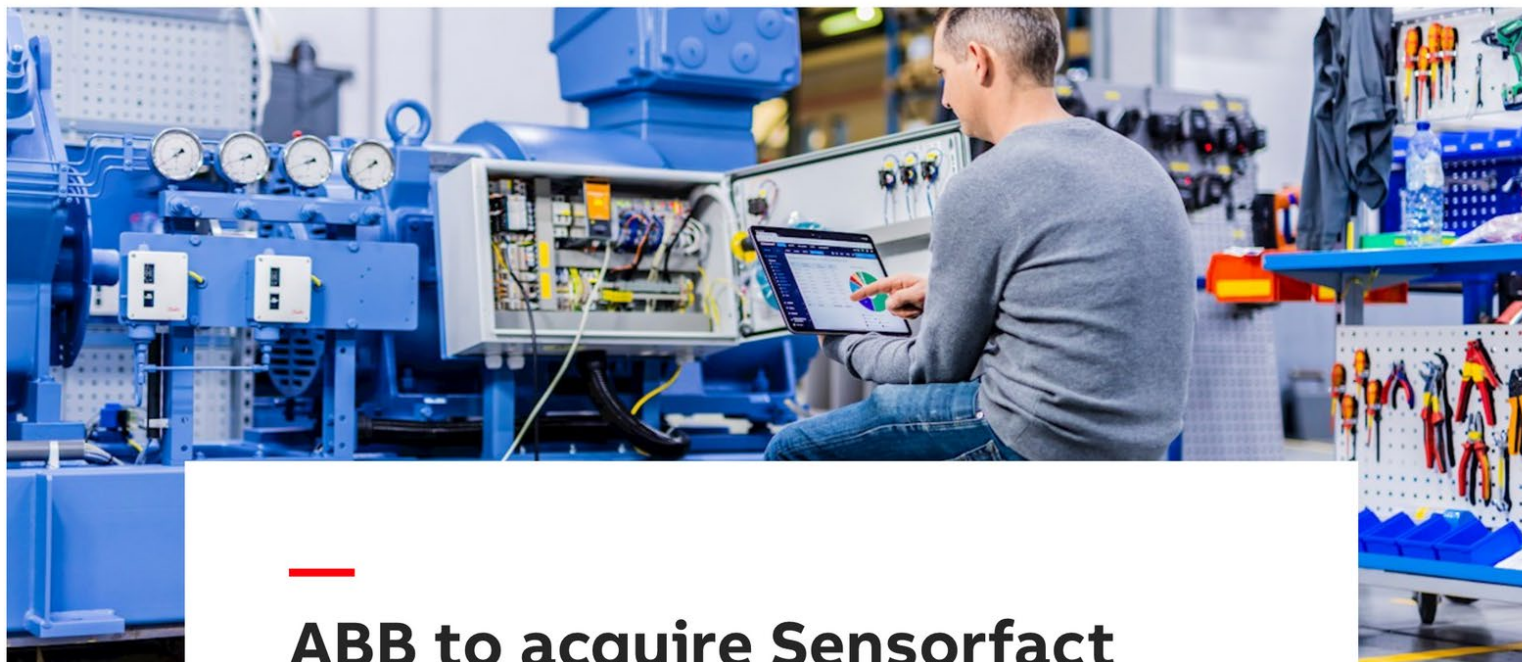


ABB to acquire Sensorfact expanding its digital energy management offering

Group press release | Zürich, Switzerland | 2025-01-21

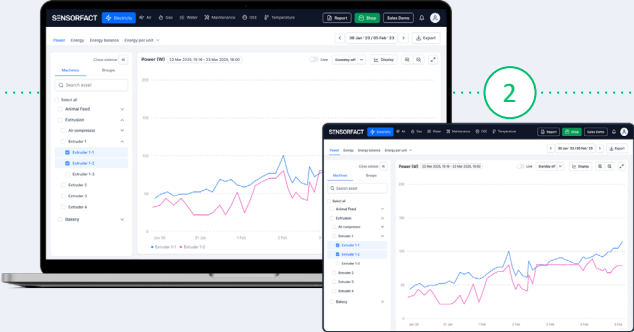
All-in-one solution

Hardware



1

Software



2

Advice



3



Easy-to-install wireless sensors



Smart software using algorithms



Tailor-made advice by our consultants

Sensorfact consultancy | Our algorithms and energy consultants assess >20 potential savings opportunities

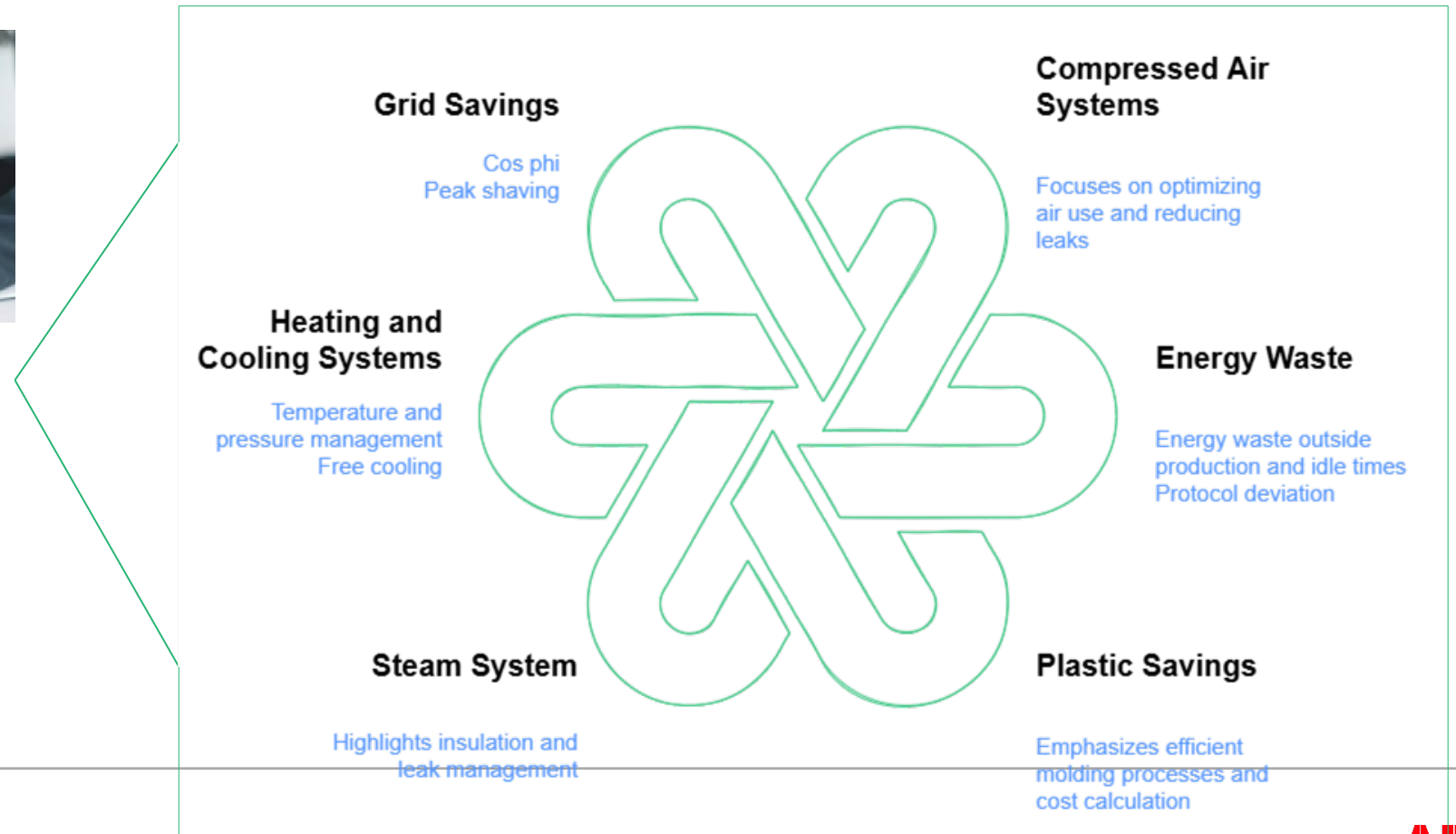


Consultant

Dedicated energy consultant that:

- Analyses your data
- Validates the data with you
- Prepares advisory report

Overview of savings portfolio

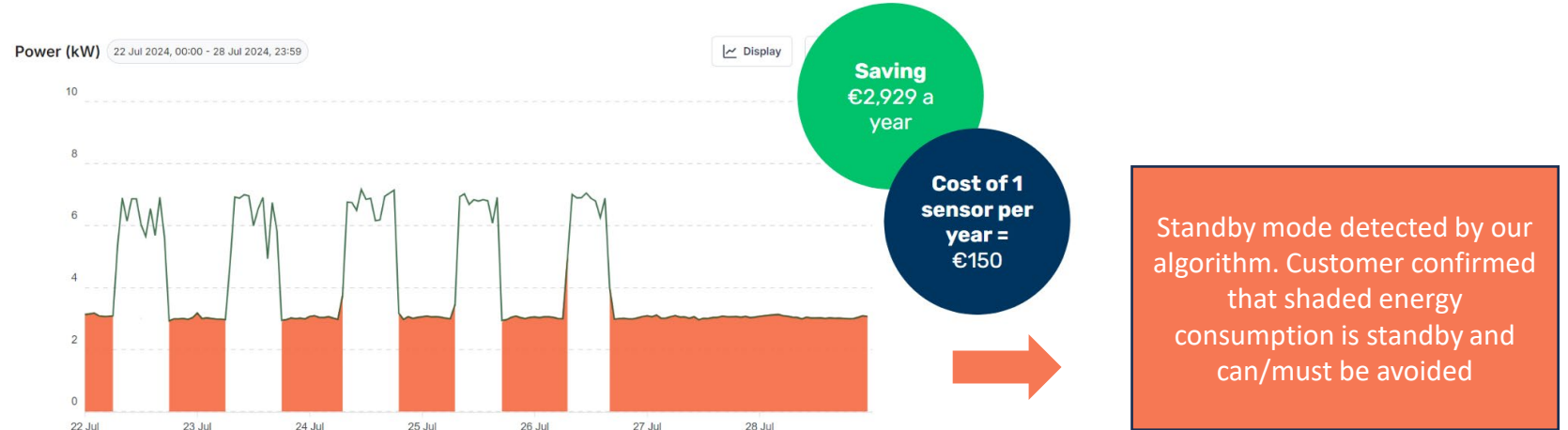


Sensorfact consultancy | Examples of energy savings we often find

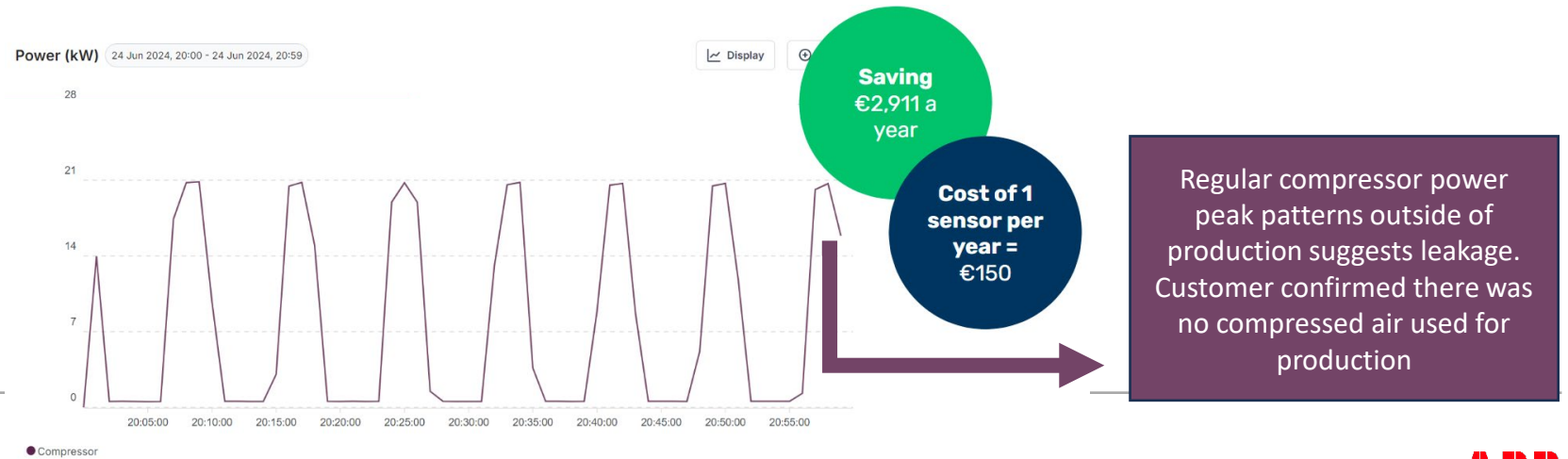
Saving opportunity example

- 1 Energy waste outside of operating hours (standby waste)

How we identified this and confirmed with customer

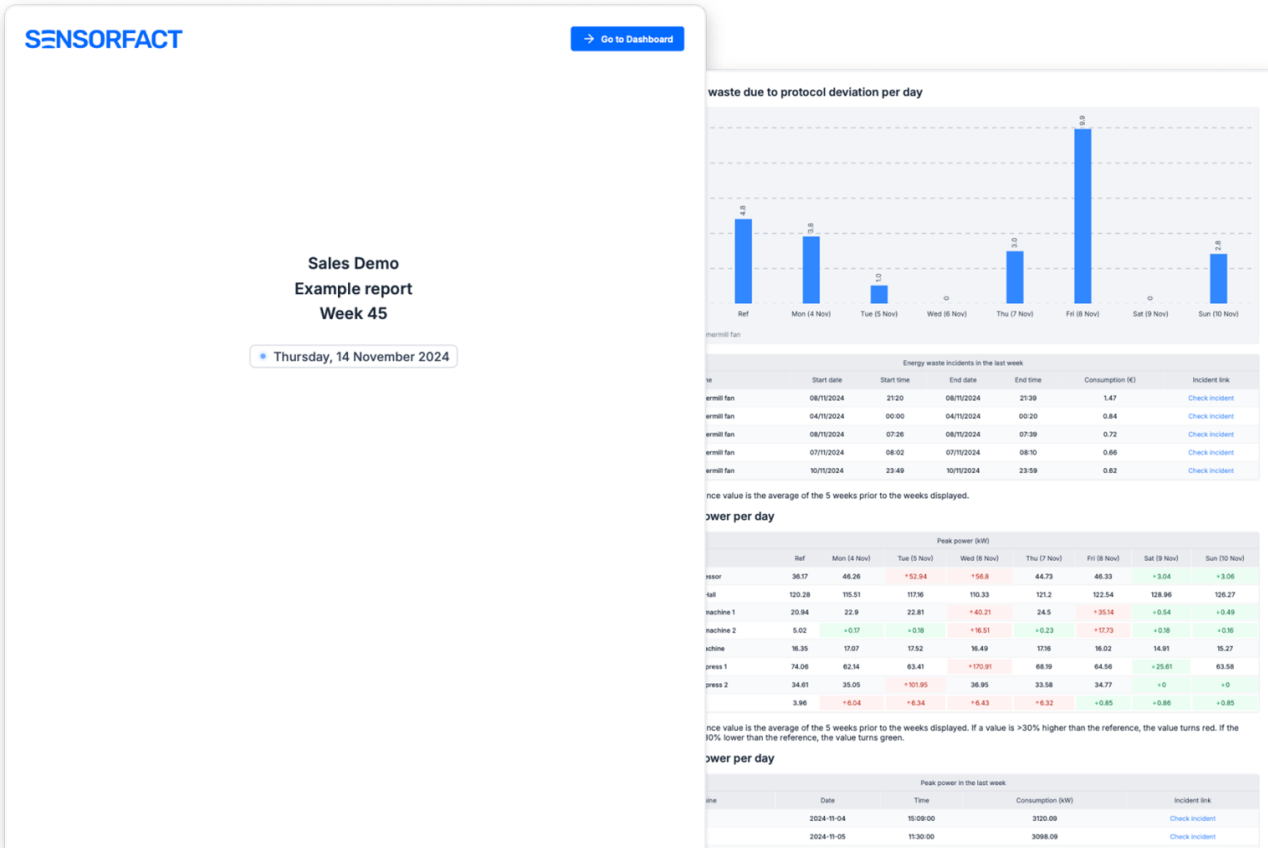


- 2 Compressed air leakages



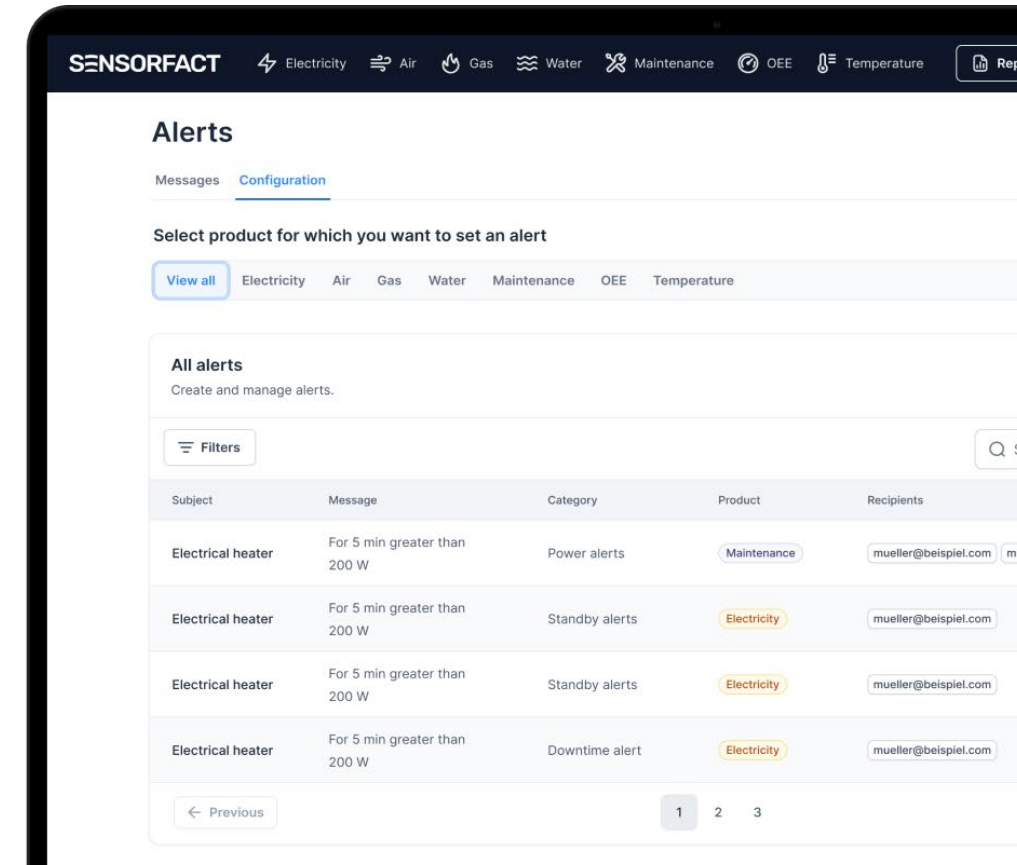
KPI tracking & alerts | Track the impact of savings initiatives and avoid waste

Tracking reports



Available tracking report modules: Energy consumption (per shift & outside of operating hours), Peak power, Electricity consumption per production hour, Standby energy consumption, Protocol deviation, Electricity consumption per status.

Alerts (standby & power)



AUDIENCE QUESTIONS



THANK YOU

<https://www.sensorfact.eu/>

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TO OUTFIT**

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