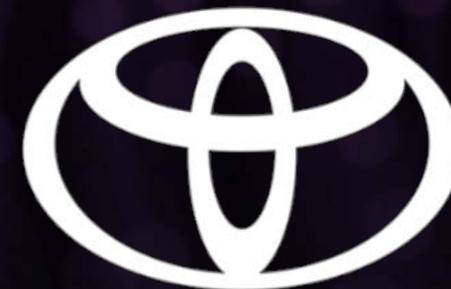


AVEVA PI WORLD – 18/05/2022

Energy abnormality elimination with the PI System

The path to carbon zero

Matteo Biasciutti – Kevin Rosati



AVEVA

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Energy abnormality elimination with
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About our company

Toyota Motor Europe

3000 dealers

9 plants
including
3 hybrid factories
in **7 countries**

R&D centre **European Headquarters** **Training centre**

Toyota Connected Europe

Motorsports centre
Toyota Motorsport GmbH

Toyota Fleet Mobility

29 National Sales and Marketing Companies
in **53 countries**

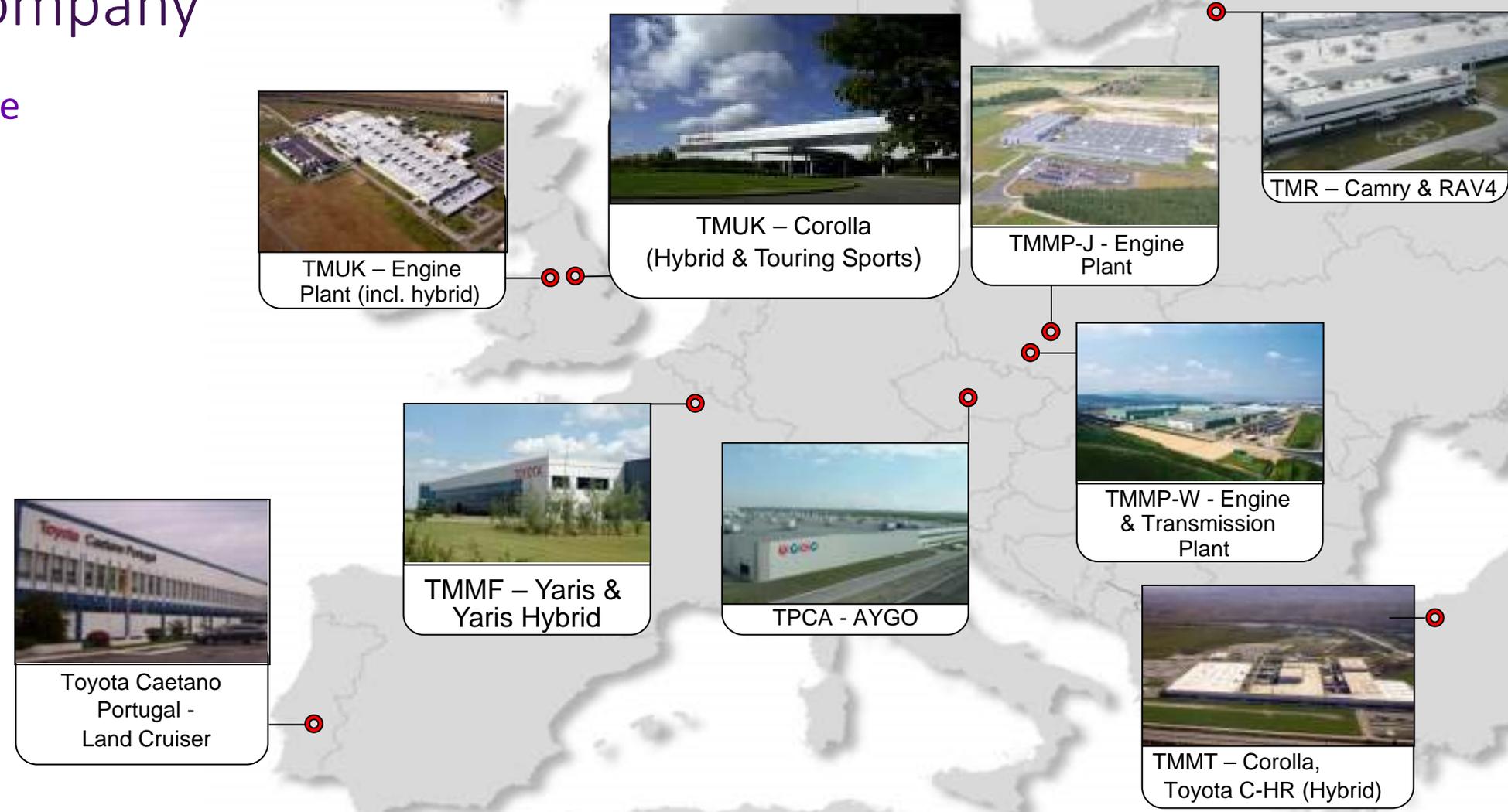
Creative European design studio
Toyota European Design Development ED²

14 parts and 7 vehicle logistic centres

6.4 % EU Marketshare in 2021

About our company

Toyota Motor Europe



TOYOTA ENVIRONMENTAL CHALLENGE 2050



CHALLENGE 1

New Vehicle
Zero CO₂
Emissions Challenge

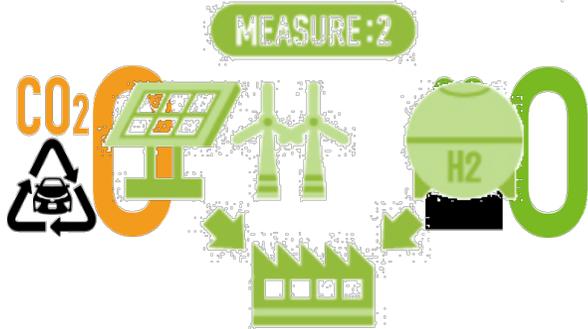


CHALLENGE 2 MEASURE:1

Simple & Smart

CHALLENGE 3

Plant Zero CO₂ Emissions Challenge



CHALLENGE 4

Challenge of Optimizing and Reducing CO₂ Emissions for Usage

CHALLENGE 5

Challenge of Establishing a Recycling-based Society and Sustainable Energy

CHALLENGE 6

Challenge of Establishing a Future Society in Harmony with Nature

H₂



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Business challenge adressed

CO2 breakdown

Energy distribution

(source : Energy monitoring system)

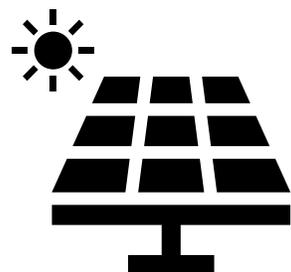
Energy consumption :



CO2 impact :

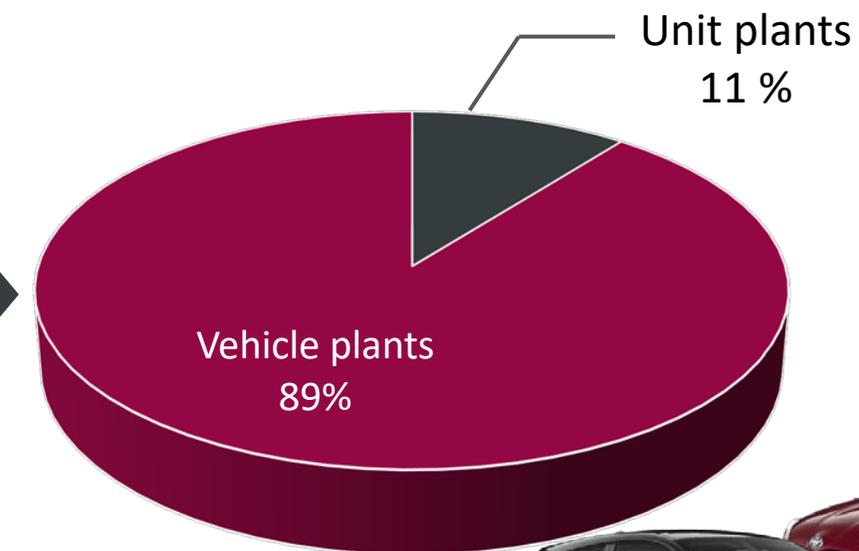


100 % of our electricity usage is **carbon-free**



CO2 generation per plant

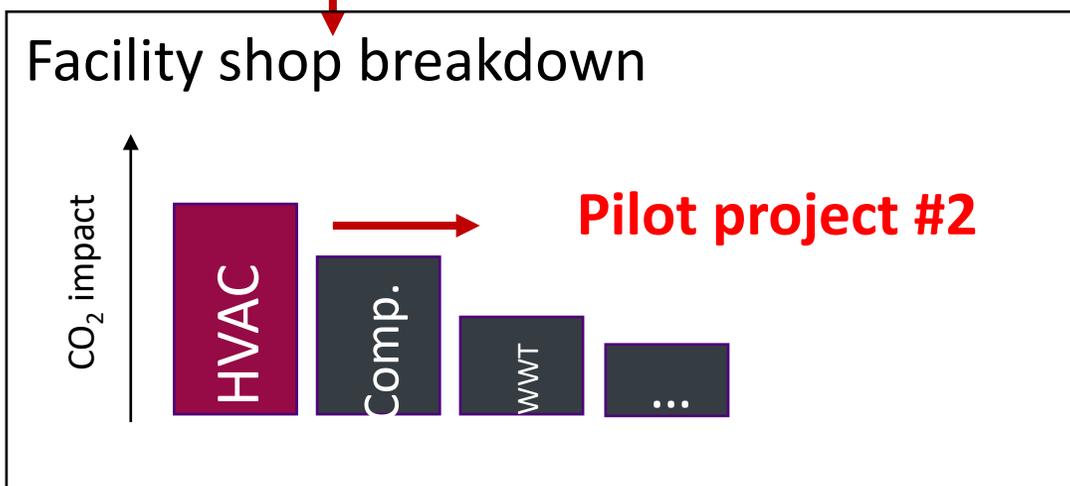
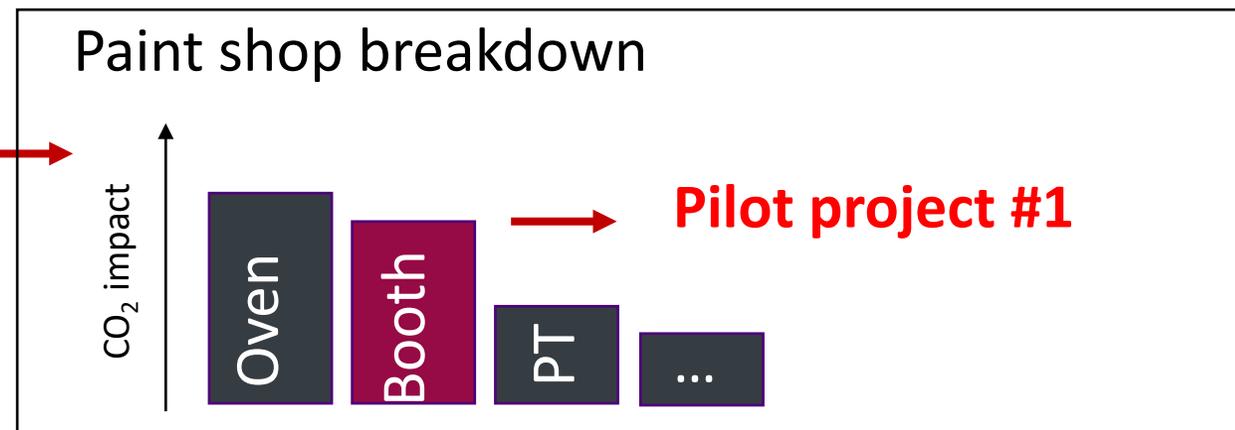
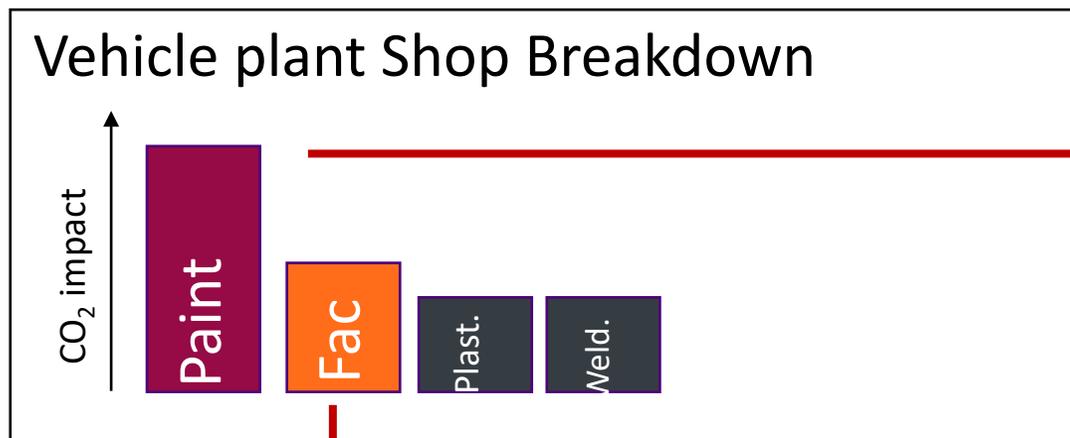
(source : Energy monitoring system)



AVEVA

Business challenge adressed

CO2 breakdown



Presentation main topic

We want to reduce Muda*

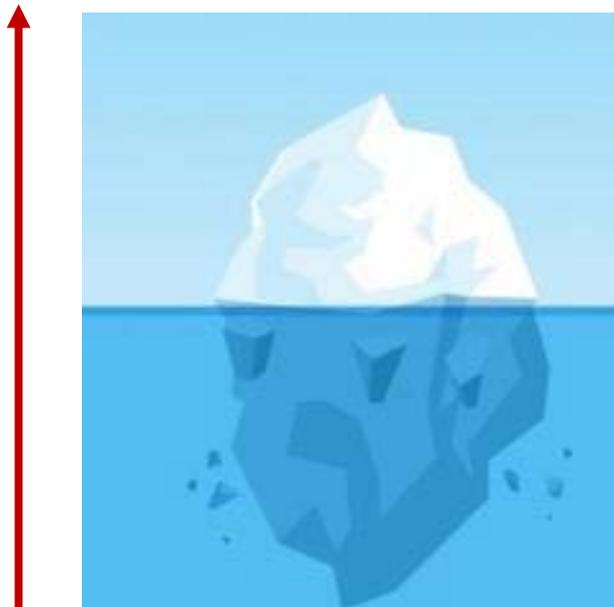
*MUDA = Japanese word for waste



Business challenge adressed

Using PI System capabilities to reduce abnormal consumption

Energy consumption



Visible

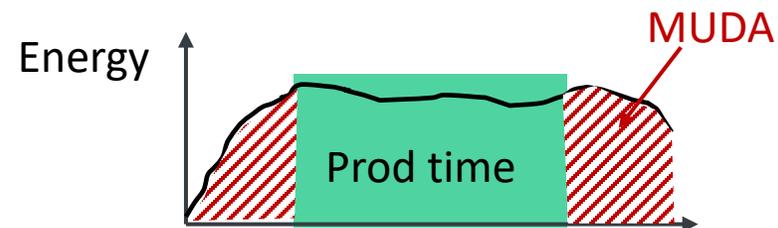
Energy usage that we can understand
What we are expecting from our standards , what we see

EX :  Temperature  Equipment ON

Non-Visible

Influencing factors not visible to operators

EX : Ramp-up time requirement

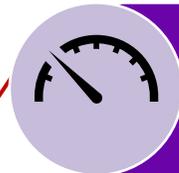
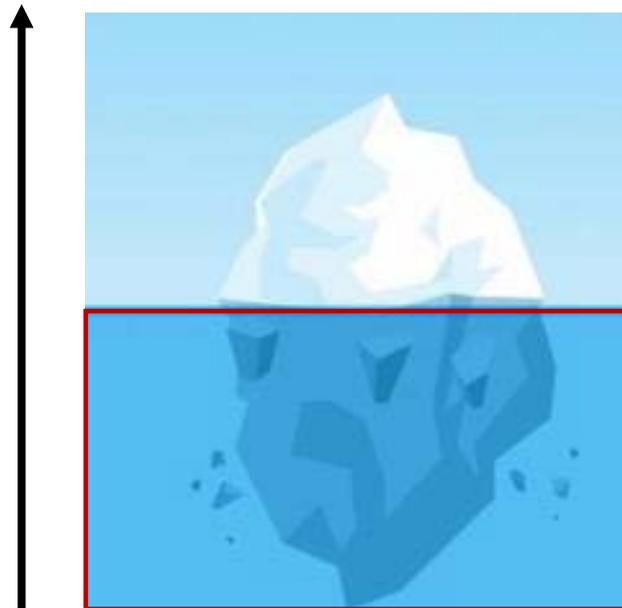


Business challenge adressed

Using PI System capabilities to reduce abnormal consumption

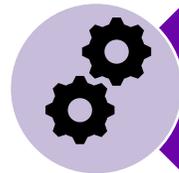
How to reduce it ? Make it visible !

Energy consumption



Measure and store data

PI Interface /
Data Archive



Analyse data series

PI Asset
Analytics



Report the result

PI Datalink /
PI Vision



Notify in case of abnormality

Event Frames

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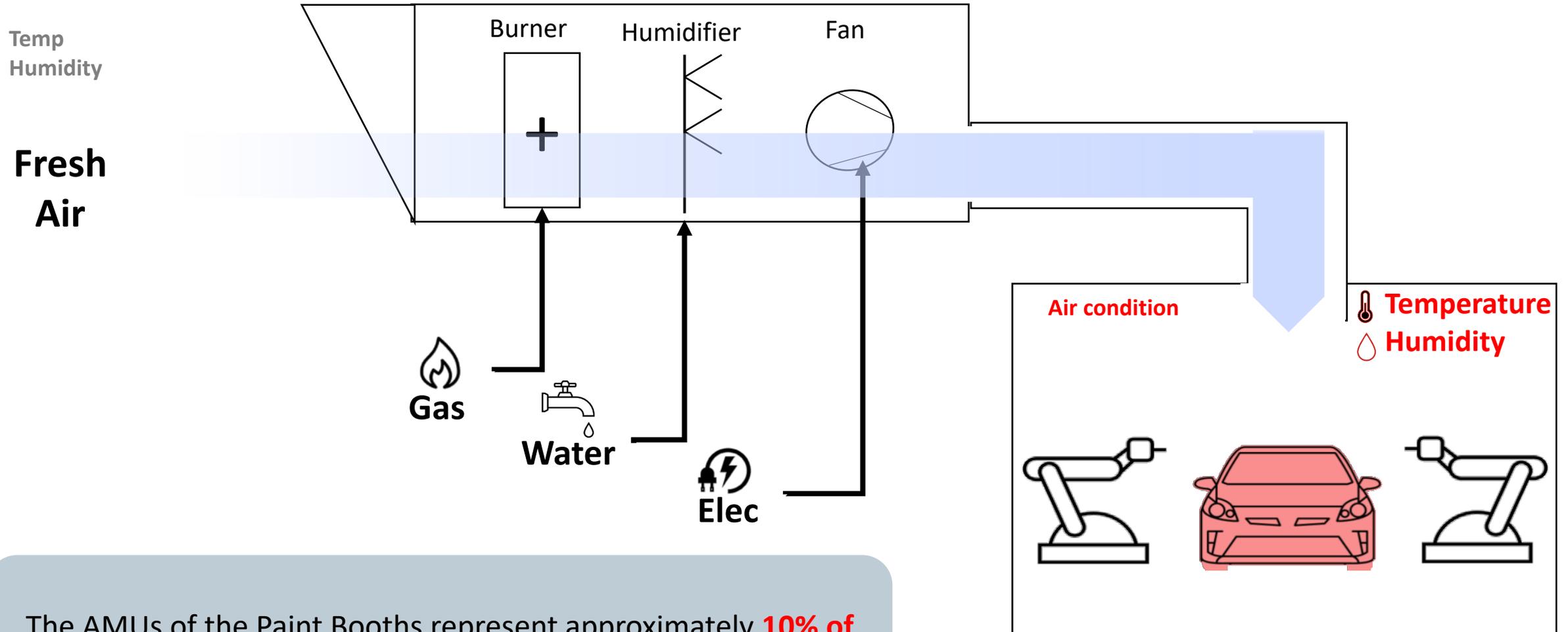
Elimination of energy waste with PI System

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Conclusion

Principles of Paint Booths

Air Make Up Unit



The AMUs of the Paint Booths represent approximately **10% of the energy consumption** of a site

Objectives

Ultimate goal : eliminate Energy MUDA*

Production time

Non-Production time

Guarantee quality using the minimum amount of energy

Use Energy only when necessary



Definition of indicators



Data visualization and improvements



Field involvement

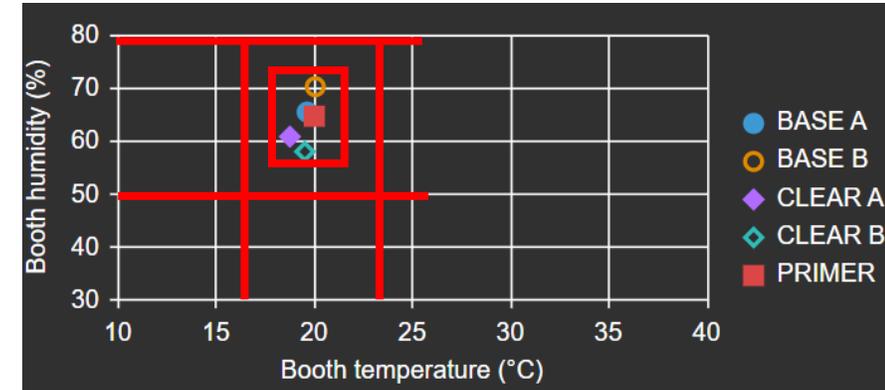
Objectives

Ultimate goal : eliminate Energy MUDA*

Production time

Guarantee quality using the minimum amount of energy

- Ensure that the parameters (T°C/H%) remain within tolerance ranges
- Avoid overshooting
- Detect and inform in the event of abnormality



Definition of indicators



Data visualization and improvements



Field involvement

Paint Booth – Production Time Display

PRIMER Monitoring AMU cabins

AMU Operating Zone: 1

10.22 °C
66.77 %

22.53 °C

20.63 °C
65.07 %

39.54 %

Paint Booth ●

Relative Humidity
64.87 % ● OK

Temperature

Equipment

- Burner is operating
- Humidifier is operating

Legend		
Quality status	Energy status	Symbol
OK	OK	●

PRIMER QUALITY ALLARM 4/8/2022 1:36:59 PM 4/8/2022 1:54:49 PM **Critical** 17m 49s

1. Operating Zone

4/8/2022 7:13:07 AM 8h 4/8/2022 3:13:07 PM

2. Intake Air Parameters (after Rotary Heat Exchanger)

4/8/2022 7:13:07 AM 8h 4/8/2022 3:13:07 PM

Intake temper 10.22 °C
Intake humidi 66.77 %

3. Pump / Burner parameters

4/8/2022 7:13:07 AM 8h 4/8/2022 3:13:07 PM

Humidifier pum 39.54 %
Gas Burner Co 22.53 °C

4. Supply Air Parameters

4.1 Temperature

4/8/2022 7:13:07 AM 8h 4/8/2022 3:13:07 PM

TsetMax 24 °C
TsetMin 20 °C
Booth temperatur 19.99 °C
Supplied temper 20.63 °C

4.2 Relative Humidity

4/8/2022 7:13:07 AM 8h 4/8/2022 3:13:07 PM

RHsetMax 70 %
RHsetMin 65 %
Supplied humid 85.07 %
Booth humidity 64.87 %

Abnormality Table

Event Name	Start Time	End Time	Severity	Duration
PRIMER QUALITY ALLARM	4/8/2022 2:04:49 PM	4/8/2022 2:09:59 PM	Critical	5m 10s
PRIMER ENERGY ALLARM	4/8/2022 1:55:59 PM	4/8/2022 2:11:40 PM	Major	15m 40s
PRIMER QUALITY ALLARM	4/8/2022 1:36:59 PM	4/8/2022 1:54:49 PM	Critical	17m 49s

Objectives

Ultimate goal : eliminate Energy MUDA*

Production time

Non-Production time

Guarantee quality using the minimum amount of energy

- Ensure that the parameters (T°C/H%) remain within tolerance ranges
- Avoid overshooting
- Detect and inform in the event of abnormality

Use Energy only when necessary

- Follow start / stop operations vs planning
- Detect and inform in the event of an abnormality
- Set up a PDCA cycle



Definition of indicators

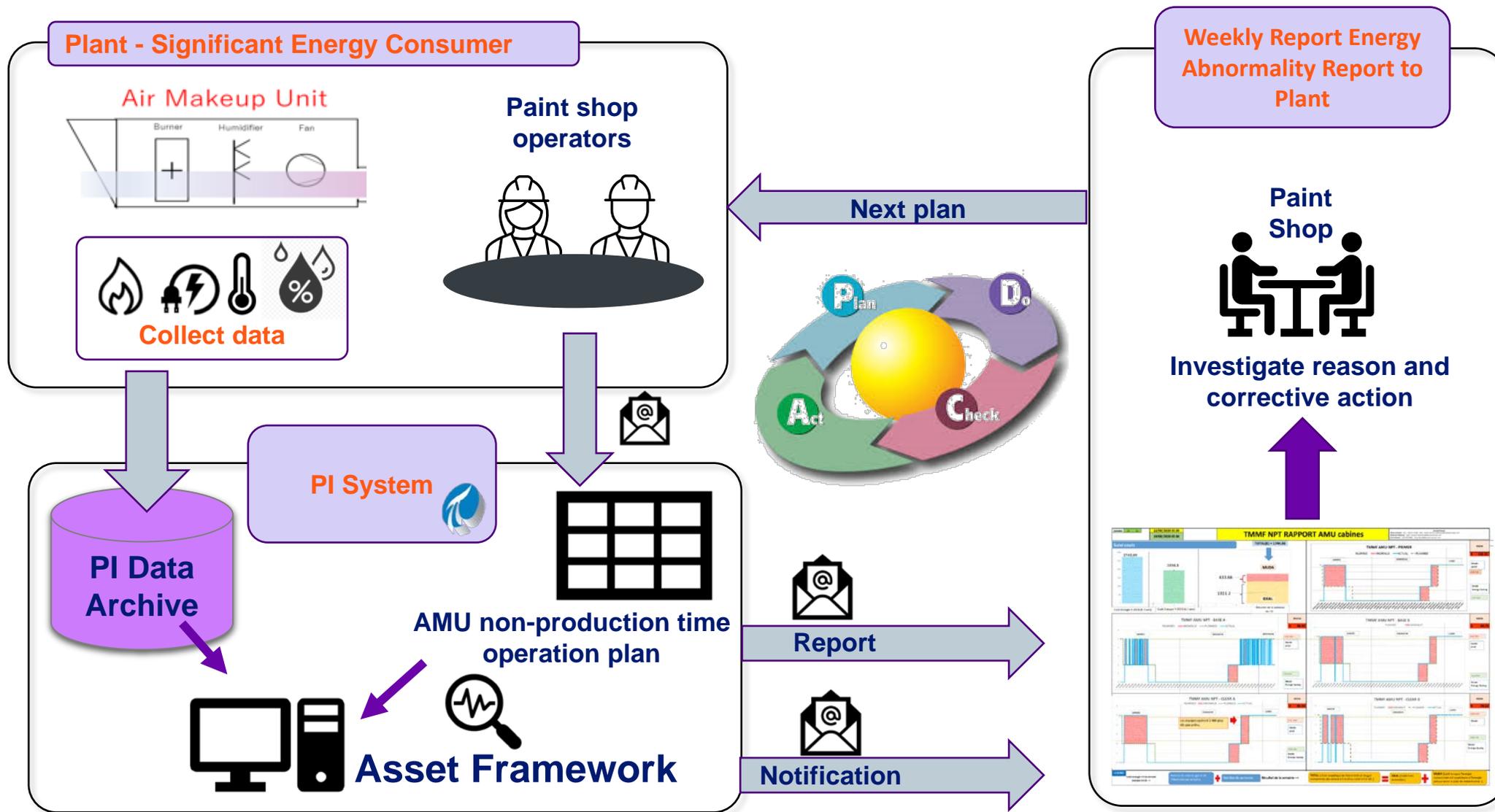


Data visualization and improvements



Field involvement

Paint Booth – Non Production Time Report Concept



Paint Booth – Non Production Time Display

Paint Booth AMU - Non Production Time

PRIMER

Event Name: PRIMER Abnorm...

Reason Code Editor

PRIMER Abnormality

- Reason
 - Cleaning Company MUDA
 - Early start of production MUDA
 - Late stop of production MUDA
 - Mis operation MUDA
 - Other
 - Rescheduling of maintenance plan NOT MUDA
 - Trials NOT MUDA
 - Unexpected maintenance NOT MUDA
 - Wrong planning MUDA

Buttons: Clear, Apply, Cancel

Reason: [Pencil icon] Acknowledgment: Acknowledge

Prod

Energy saving

11/2/2021

Plan

Actual

11/9/2021 12:24:14 PM

BASE A

Event Name: BASE A Abnormality

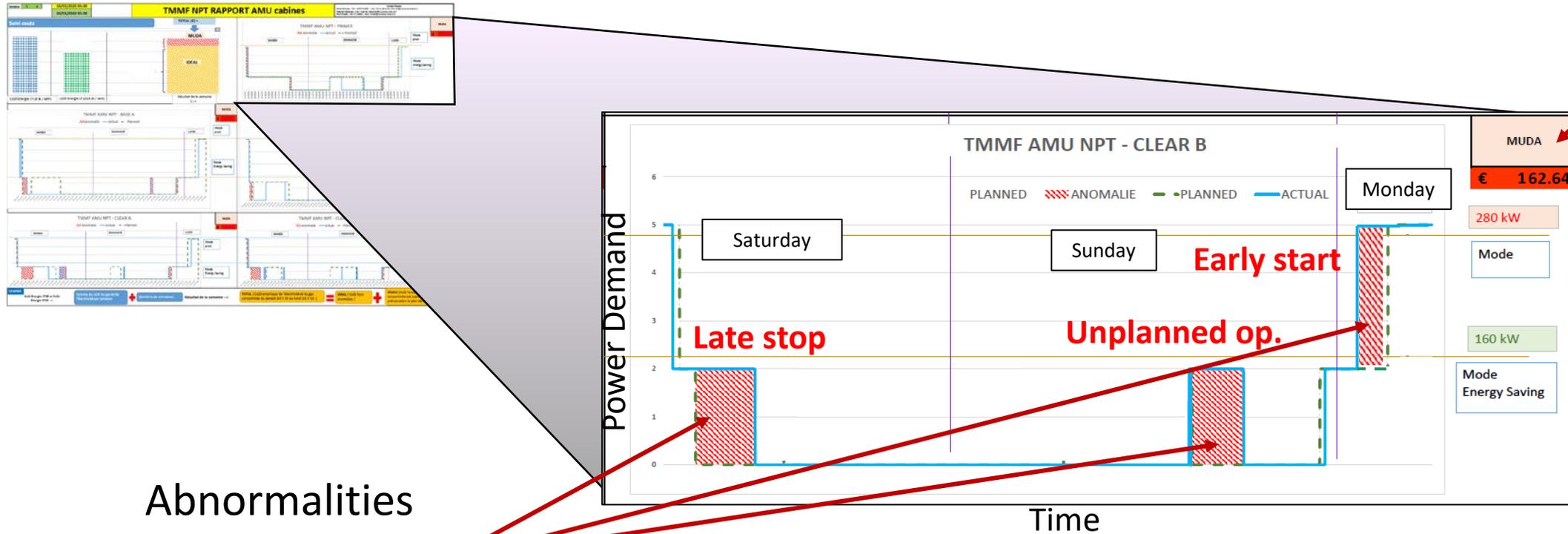
Start Time: 11/6/2021 6:55:36 AM

End Time: 11/6/2021 10:08:00 AM

Duration: 3h 12m

Reason: [Pencil icon] Acknowledgment: Acknowledge

Paint Booth – Non Production Time Report



MUDA cost
(gas + elec)

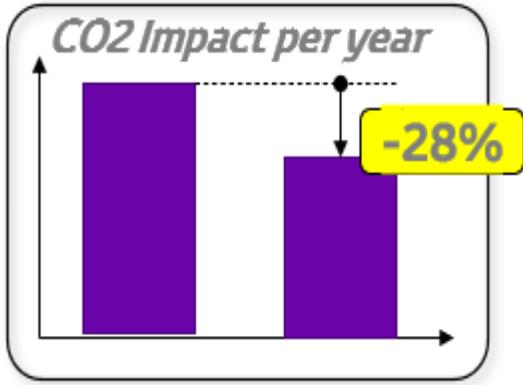
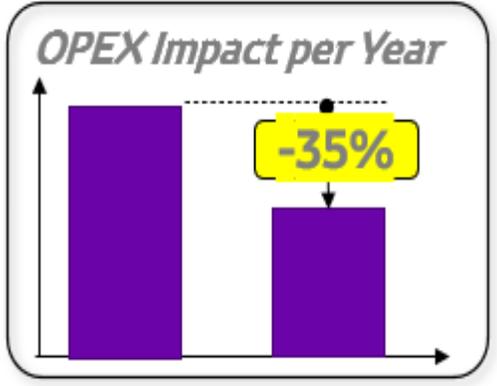
Abnormalities
shown in red

Report principles :

abnormalities and results should be **immediately visible**. On the other hand, the report should make **deeper discussion** possible

Results and Next Steps

• Non Production Time

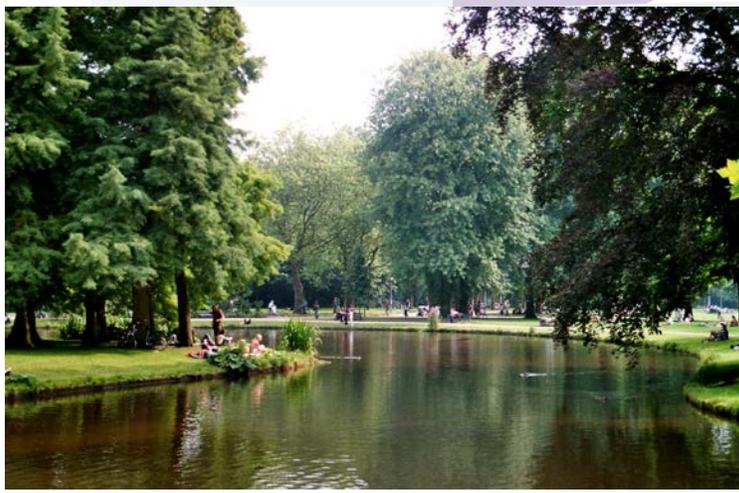
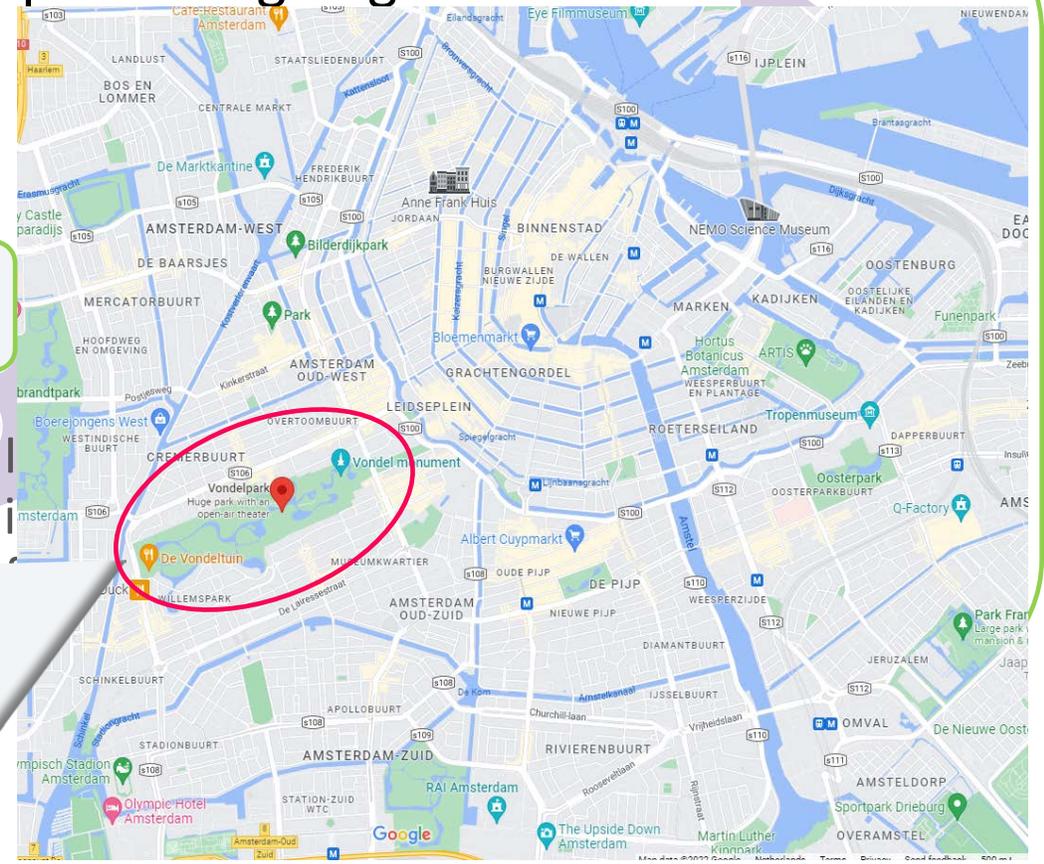


Investment : 0 €

YOKOTEN* phase ongoing

Standardize

Monitor and



We can reduce **CO₂ emissions** equivalent to a forest the size of **2.5 times Vondelpark**

• *YOKOTEN= Japanese word for “Roll-Out”

Other projects

Implementation for different aspects

Building ventilation abnormality reporting

TMMF HVAC Abnormality Management Weekly Report

Area: **Press Shop** | Start Date: 03/01/2021 23:59 | End Date: | Time Interval: 7.5m | Update Dates: |

Yearly cumulative MUDA cost

Press shop gas energy cost

Press shop MUDA CO2 emissions

HVAC equipment not in use

To come

- Track and report unnecessary consumption
- Implement continuous improvement cycle

Transformer management panel

TOYOTA Energy Monitoring System

Transformer Management Panel

TR201D

Capacity: 2,000 kVA

Winding type: Dyn11/TNC

SOP date: |

Load follow-up

Breaker info

Model: SACE PR112 P 4000A

I1: 4,000 A | I2: 0 A | I3: 16,000 A | UCC: 5.92 %

Events tracking

Name	Value	Units	Average	Minimum	Maximum	Trend
TR201D Current	1,091.1	A	1,079.2	1,019.4	1,114.9	
TR201D Voltage	400.3	V	404.25	397.74	411.77	
TR201D Power Factor	0.94077		0.93825	0.90503	0.95296	
TR201D Temp Phase 1	54	°C	54.046	50	58	
TR201D Temp Phase 2	55	°C	54.876	49	61	
TR201D Temp Phase 3	51	°C	49.058	43	56	
TR201D Room temperatur	0	°C	0	0	0	

- Easy follow-up of load, power factor, temperature
- Quicker investigation in case of failure

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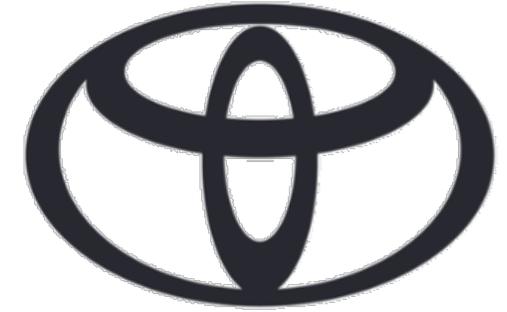
3

Elimination of energy waste with PI System

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Conclusion

Reduce Energy Abnormality towards 0 CO2



Challenge

- Allow operators to **optimize the energy** consumption of paint booths
- Implement a **sustainable** continuous improvement approach
- Demonstrate the possibilities of the system

Solution

- Connection of process and energy data in an **AF data model**
- Setting up automatic **analysis** and generating **events** and **notifications**
- Establishment of weekly **reporting** and **PI Vision** dashboard

Benefits

- **35% reduction** in energy consumption and **28 % reduction** of CO₂ impact during non-production time
- Better control of equipment
- Awareness of the energy impacts of processes

Thanks to the PI System, we are able to deliver the relevant information to the relevant person at the relevant time.

Therefore, we can use the relevant amount of energy at the relevant place in the relevant time



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- matteo.biasciutti@toyota-Europe.com

THANK YOU

謝謝

DZIĘKUJĘ CI

NGIYABONGA

TEŞEKKÜR EDERİM

DANKIE

TERIMA KASIH

GRACIES

WHAKAWHETAI KOE

DANKON

TANK

TAPADH LEAT

SALAMAT

SPASIBO

GRAZIE

MATUR NUWUN

ХВАЛА ВАМ

MULŢUMESC

PAKMET CIZGE

고맙습니다

GRAZIE

شكرا

FAAFETAI

ESKERRIK ASKO

GO RAIBH MAITH AGAT

HVALA

HVALA

БЛАГОДАРЯ

GRACIAS

MAHADSANID

TI БЛАГОДАРАМ

TEŞEKKÜR EDERİM

TAK DANKE

DANKJE

EΥΧΑΡΙΣΤΩ

GRATIAS TIBI

OBRIGADO

MAHALO IĀ 'ŌE

TAKK SKALDU HA

МЕРЦИ

RAHMAT

MERCI

GRAZZI

PAKKA PÉR

ありがとうございました

DI OU MÈSI

ĎAKUJEM

HATUR NUHUN

PAXMAT CAĠA

SIPAS JI WERE

TERIMA KASIH

CẢM ƠN BẠN

UA TSAUG RAU KOJ

TI БЛАГОДАРАМ

СИПОС

WAZVIITA

FALEMINDERIT