INTERNATIONAL UNION
OF RAILWAYS

Welcome to the

ASSET AND BUILDING ENERGY MONITORING

Best practice workshop

Please rename as [Name Surname (Company)]
Please remain on mute while a speaker is active

UIC Energy & CO2 Sector
Philippe Stefanos, UIC
Gerald Oldemonnikhof, Prorail
Christophe Gueudar Delahaye, SNCF

24 October 2023, Paris

Asset and building energy monitoring best practice workshop

Welcome

Philippe Stefanos
Sustainability advisor
UIC

Asset and building energy monitoring best practice workshop

Agenda
Introduction

Philippe Stefanos
Sustainability advisor
UIC

Agenda of the meeting

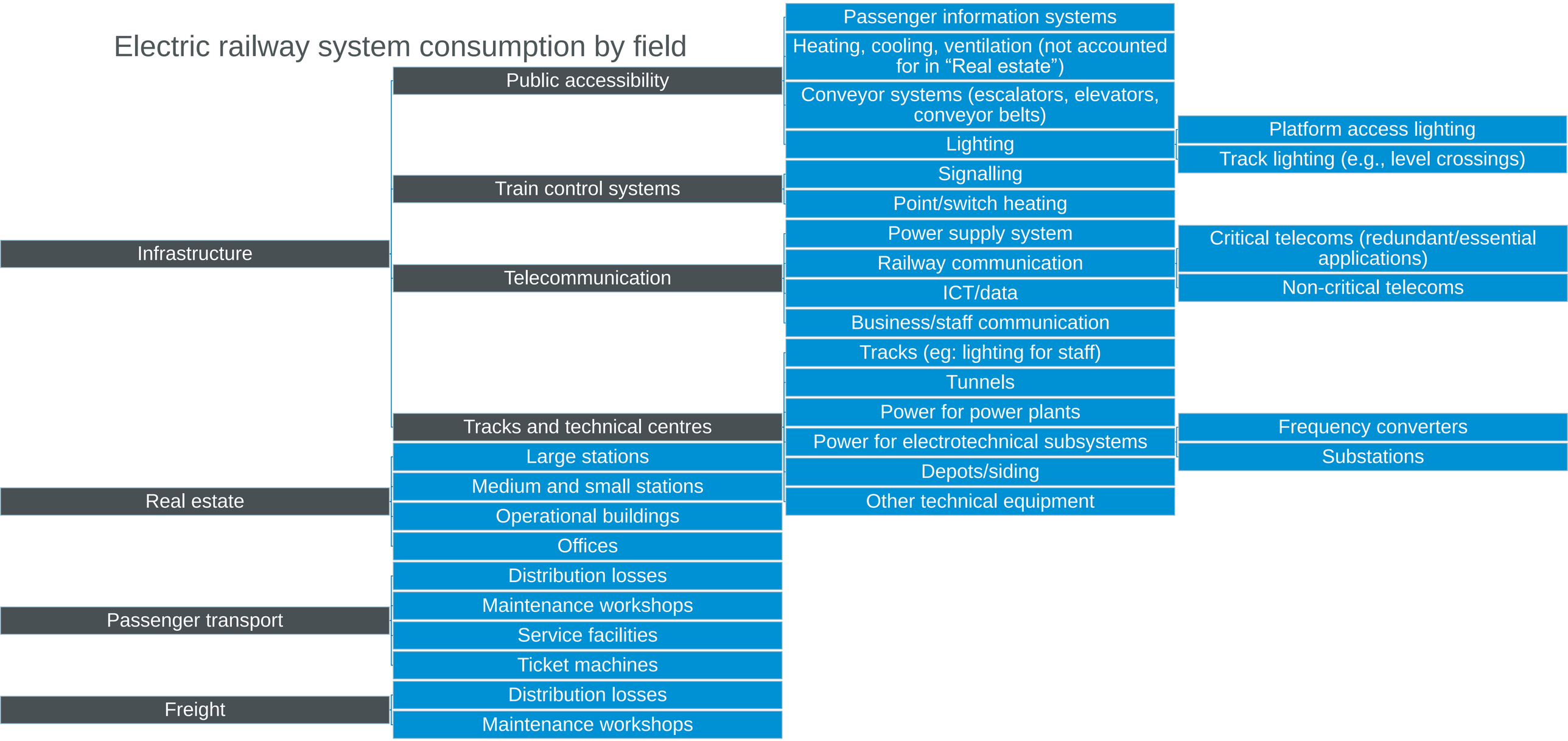
10 h 00	Welcome - Opening	Philippe Stefanos	UIC
10 h 05	Introduction - Context	Philippe Stefanos	UIC
10 h 20	Energy saving programme at Dutch railway stations	Katelijn van den Berg	NS Stations
10 h 45	*Break*		
10 h 50	Smart station project - Monitoring, management	Arnaud Pelud	SNCF Gares & Connexions
11 h 15	Sharing session	All	
11 h 45	Feedback, conclusion	All	
12 h 00	*End of workshop*		

Asset and building energy monitoring best practice workshop

Introduction
Context

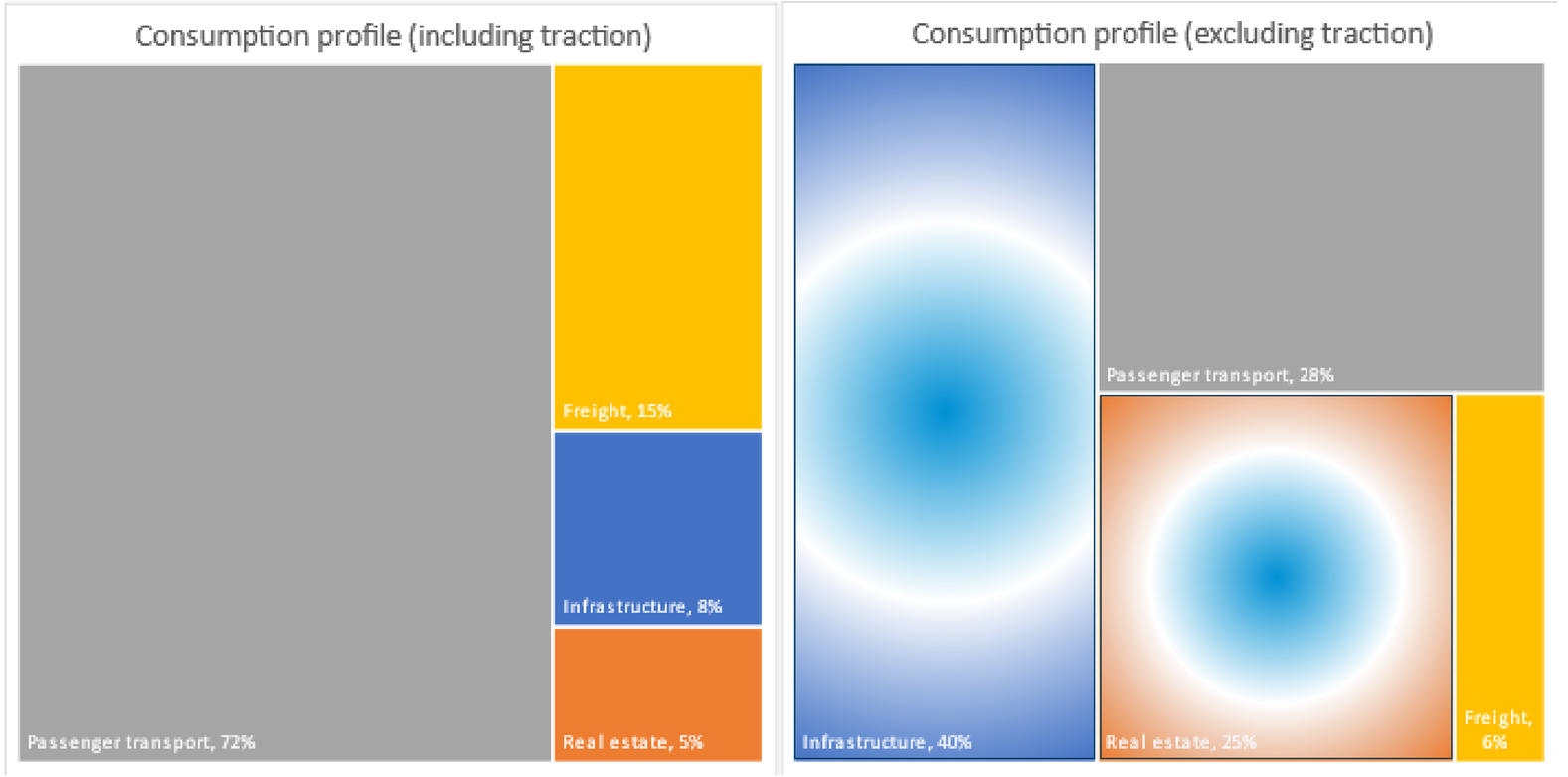
Introduction

Electric railway system consumption by field



Introduction

Energy consumption in rail (2023 survey - Energy saving report)



Consumption profiles by main category based on UIC Members responses to the survey.
Left square (100%) includes energy consumption for traction.
Right square (100%) excludes traction.

Introduction

- Why monitoring is useful
  - Understand consumption
    - Profile
    - Patterns
  - Identify saving potential
  - Aware control of energy flows
  - Notice savings due to proper control
  - Set and reach [realistic] energy saving targets

Introduction

- Why monitoring is useful
  - Control to avoid grid congestion, improving distribution
  - Adapt power management to the evolving electrification.
    Higher levels of electrification require more visibility on consumption:
    E.g., large road electric vehicles charging:

Introduction

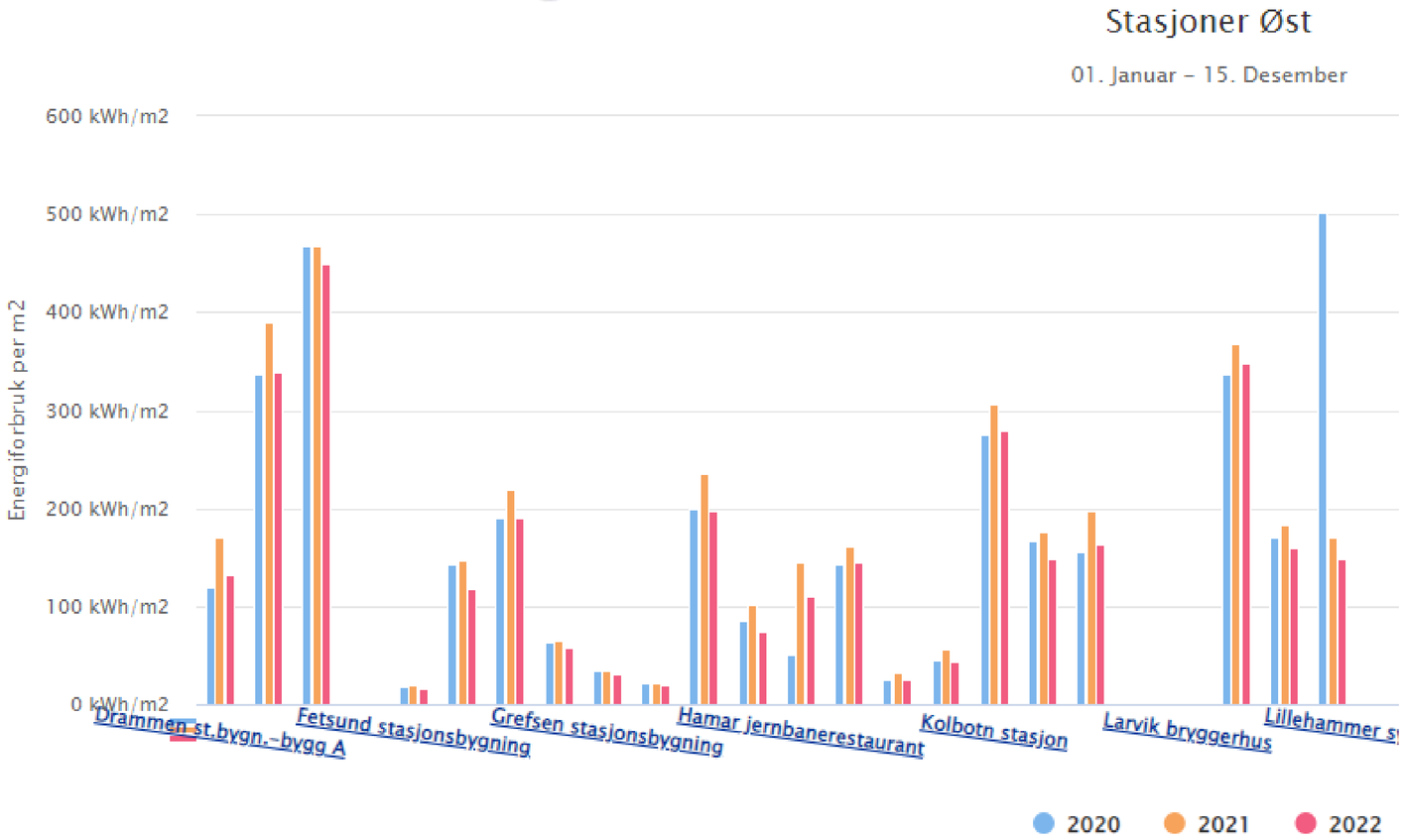
- Going further
  - Exact invoicing
  - Costs understanding (& control)

Introduction

- Going further
  - Helps knowing the real efficiency of an equipment (VS theoretical efficiency)
  - Helps identifying the best operational state(s) of an equipment

Introduction

- Going further
  - Allows benchmarking *(Bane NOR example)*



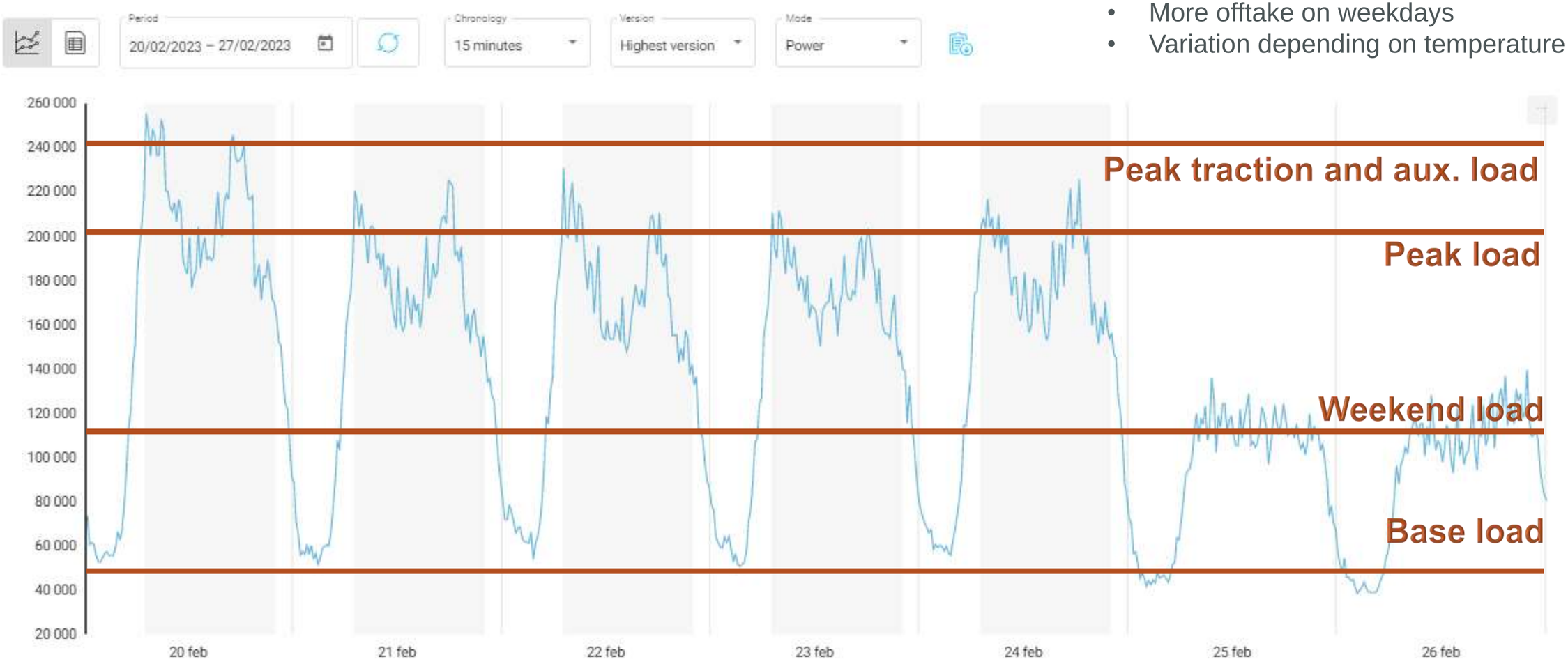
Introduction

- Going further
  - Benchmarking at system level to compare overall consumption
    e.g., buildings
  - Benchmarking at equipment level to compare efficiency

Introduction

Example: Belgium - Traction energy consumption
Courtesy Infrabel

Profile & patterns:
- Low volume of baseload 60 MW
- Steep increase
- Higher level in morning and evening peak
- More offtake on weekdays
- Variation depending on temperature



Introduction

- Side benefits
  - System health indication
  - Computer-based optimisation
    - Based on monitoring (defining efficient working points) and/or
    - Paired with monitoring (management system)

Introduction

- Challenges
  - Understanding measurement covering many devices
  - Understanding the functioning (e.g., temporal) of a specific system/equipment
  - How to save energy without impairing the role of one or many equipment

Asset and building energy monitoring best practice workshop

NS Stations

Katelijn van den Berg
Program manager Sustainability
NS Stations

The Netherlands sustainably accessible. For everyone.


Sustainable mobility

=


Fossil free

+


Circular

+


Green

+


For everybody

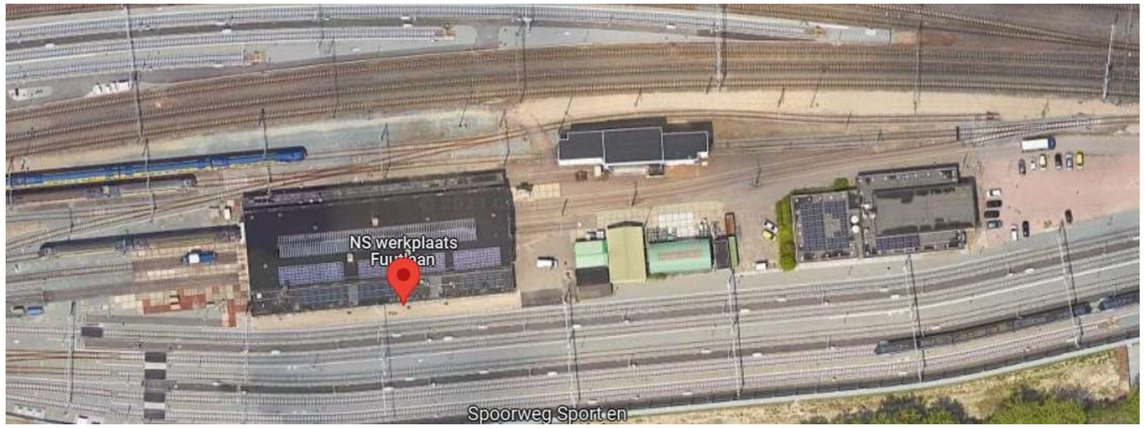
+


By everybody

Stations portfolio

Real estate portfolio

Workshop portfolio



Data driven approach

INPUT

Possible measures
- Energy efficiency
- Gas reduction
- Production

Fastlane inventarisation

Long term maintenance plan

Developments, renovations, rental contracts

ROADMAPS

Per building
~
Per portfolio

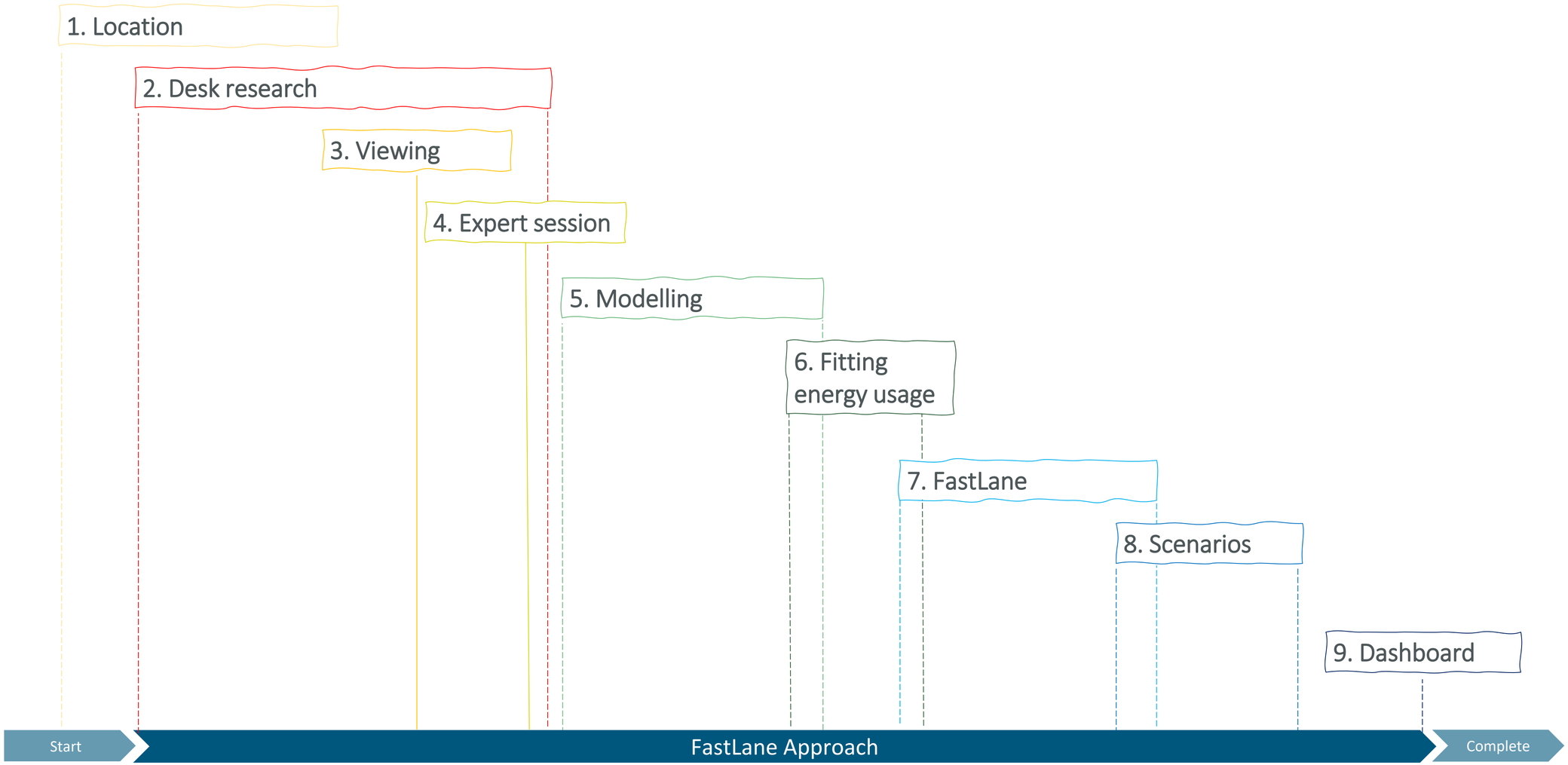
AMBITION

Paris Proof: norm value of energy use per m^2 per function

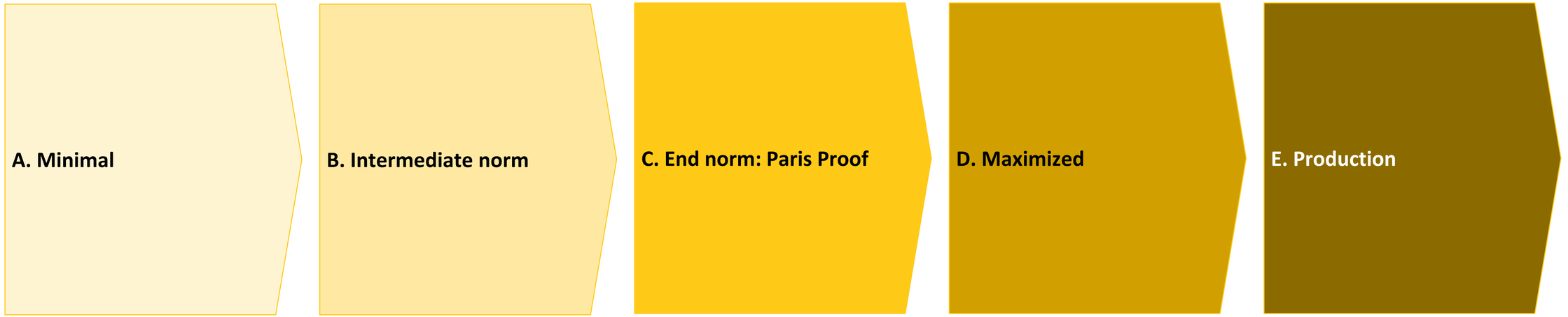
Yearly target:
- 3,5% total energy reduction
- 5,5% fossil energy reduction

30 MW production in 2030

Fastlane approach per building

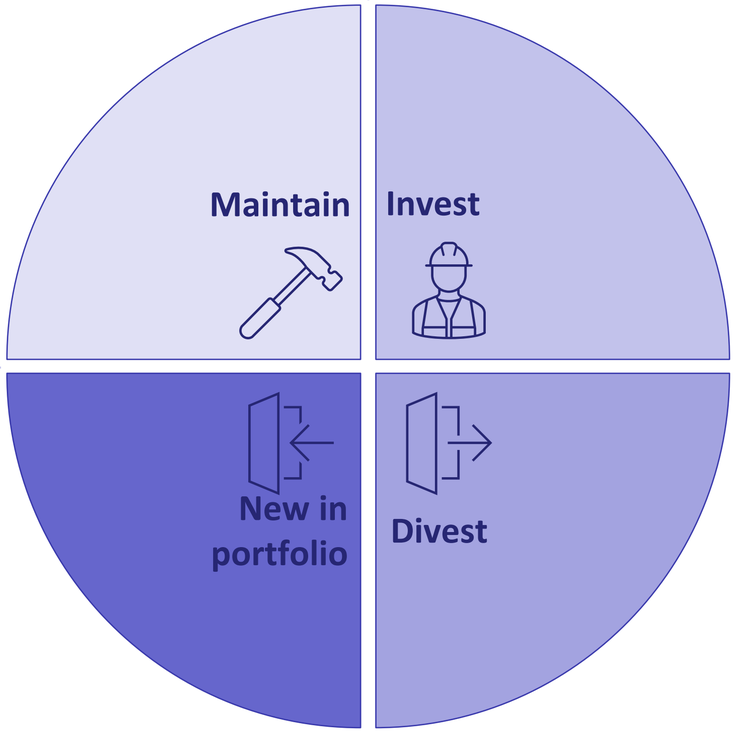


Energy saving scenarios



Asset strategy

- Tenants
- Service and maintenance



- Renovation
- Transformation

- New buildings
- Buying

- Demolition
- Selling
- Out of use

Portfolio Roadmap

List of buildings

Core portfolio

Asset strategy + sustainability year per building

Fastlane scenarios

Optimisation

Energy performance: usage and planned reduction

Ambition Paris Proof

Type	Subtype	2023	2030 'On the way to Paris Proof'	2050 Paris Proof
Offices		Label C 225 kWh/m²	Label A 160-135 kWh / m²	Label A+++ 70 kWh / m²
Retail	Shop with goods refrigeration	All energy saving measures with payback period <5 years	291 kWh / m²	150 kWh / m²
	Shop without goods refrigeration		155 kWh / m²	80 kWh / m²
	Logistics with goods refrigeration		155 kWh / m²	85 kWh / m²
	Logistics without goods refrigeration		97 kWh / m²	50 kWh / m²
Other	Stations, monument		n.t.b.	n.t.b.

Agenda of the meeting

10 h 00	*Welcome - opening*	*Philippe Stefanos*	*UIC*
10 h 07	*Introduction - Context*	*Philippe Stefanos*	*UIC*
10 h 20	*Energy saving programme at Dutch railway stations*	*Katelijn van den Berg*	*NS Stations*
10 h 45	***Break***		
10 h 50	**Smart station project - Monitoring, management**	**Arnaud Pelud**	**SNCF Gares & Connexions**
11 h 15	**Sharing in subgroups**	**All**	
11 h 45	**Feedback, conclusion**	**All**	
12 h 00	***End of workshop***		

Asset and building energy monitoring best practice workshop

SNCF Gares & Connexions

Arnaud Pelud
SMART STATION S2 Project leader
SNCF Gares & Connexions

SMART STATION PROJECT

Smart Station Presentation

2023 October 24

Objectives and challenges of these project

(Objectifs et enjeux du projet)

For more reliable stations.

Pour des gares plus fiables

Improved equipments availability rates through faster response times

*Des **taux de disponibilité des équipements améliorés** en permettant des interventions plus rapides*

For more eco-responsible stations

Pour des gares plus éco-responsables

More energy-efficient stations by real-time monitoring of their energy consumption and temperatures in waiting rooms

*Des **gares plus économes en énergie** grâce au suivi en temps réel de leur consommation énergétique et des températures dans les salles d'attente*

Helps improve customer experience and satisfaction

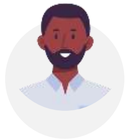
Contribue à améliorer l'expérience et la satisfaction client

Contributes to integrating into an energy sobriety approach

Contribue à s'intégrer dans une démarche de sobriété énergétique

Connected equipments

Des équipements connectés



Operator in the station

Exploitant de la gare

Energy Manager

Supervision tool

Outil de supervision

Smart Station

Escalators

Escaliers mécaniques

Lifts

Ascenseurs

Automatic doors

Portes automatiques

Pumps for Lifting

Pompes de relevage

Electrical installations

Installations électriques

GOP

Energy meters

Compteurs d'énergie

Waiting rooms

Salles d'attente

Sensitive areas

Locaux sensibles

Customer satisfaction

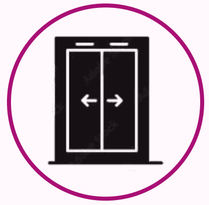
Satisfaction client

The Smart Station application is a part of a **customer satisfaction** initiative, focusing on **improving the availability** of equipment, enabling **better responsiveness in the** event of a fault, but also **detecting blackout risks**.

*L'application Smart Station s'inscrit dans une démarche de **satisfaction client**, en s'axant sur **l'amélioration du taux de disponibilité** des équipements, permettant une **meilleure réactivité** en cas de défaut, mais aussi **en détectant les risques black-out**.*

Escalators

Lifts



Automatic doors

Electrical installations

Pumps for lifting

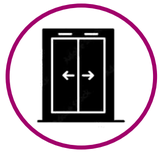
APE equipments

Les équipements APE

APE equipment includes **automatic doors**, **escalators** and **lifts**.

As key station facilities, they make it **easier for customers to move around** the station.

*Les **portes automatiques**, **escaliers mécaniques** et **ascenseur** forment les équipements **APE**. Equipements clés en gare, ils permettent **de fluidifier les déplacements des clients** à travers la gare.*


The Smart Station application provides the informations you need to monitor this equipments:

L'application Smart Station donne les informations nécessaires à la supervision de ces équipements :

- Know **the operating status in real time**, and whether if it is **STOP**.
  *Connaître le statut de fonctionnement **en temps réel** et savoir s'il est **à l'arrêt**.*

- Identify **the causes of the stoppage**, so that the **appropriate teams can be called in**: maintenance, energy or the field operator to restart the plant immediately.
  *Connaître **les causes de l'arrêt** et ainsi faire **intervenir les équipes adéquates** : maintenance, énergie ou l'exploitant terrain pour une remise en marche immédiate.*

Energy sobriety

La sobriété énergétique

In order to reduce energy consumption in stations and adopt a **low-energy** approach, the Smart Station application is used to monitor :

*Afin de réduire la consommation énergétique des gares et de s'inscrire dans une démarche de **sobriété énergétique**, l'application Smart Station permet la supervision des*

Sensitive Areas

Waiting rooms

Energy meters

Actual consumption is monitored so that action can be taken to reduce energy bills.

*Les **consommations réelles** sont suivies pour mener des actions de réduction des factures énergétiques.*

In September 2022, the **SNCF Gares & Connexions** group made a commitment to reduce **its energy consumption** by **10% in 2 years**.

*Le groupe **SNCF Gares & Connexions** s'est engagé, en septembre 2022, à réduire de **10% sa consommation d'énergie sur 2 ans**.*

About ...

A propos de …

Sensitive Areas

The **temperature of sensitive premises** is monitored using the Smart Station application. This supervision makes it possible to **detect abnormal temperature variations** and ensure that the temperature is adequate for equipment to function properly**.**

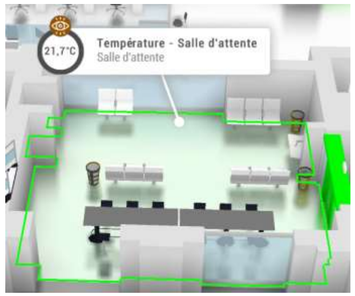
*La **température des locaux sensibles** est supervisée dans l'application Smart Station. Cette supervision permet de **constater les variations de température anormales** et d'assurer une température adéquate au bon fonctionnement des équipements.*

Waiting rooms

The station waiting rooms have been newly supervised, making it possible to adopt an **energy-saving approach by limiting heating and air-conditioning**.

To make it easier to avoid drift, the alert is automated according to **indoor and outdoor temperatures**.

*Les salles d'attente en gare sont nouvellement supervisée, permettant ainsi de **s'engager dans la démarche de sobriété énergétique en limitant le chauffage et la climatisation**.*
*Pour faciliter les dérives, l'alerte est automatisée en fonction des **températures intérieures et extérieures**.*



Counters

The meters include both **electricity** and **gas meters**. Supervision of this equipment makes it possible **to analyse consumption** and **measure the effectiveness of actions taken**, as well as to compare actual consumption with SNCF Immobilier invoices.

*Les compteurs concernent à la fois les **compteurs électriques** et les **compteurs gaz**. La supervision de ces équipements permet **d'analyser les consommations** et de **mesurer l'efficacité des actions menées**, mais aussi de comparer la consommation effective avec les factures SNCF Immobilier.*

Some figures

Quelques données chiffrées

The equipments monitored in the application **with an impact on energy sobriety** represents :

*Les équipements monitorés dans l'application **impactant la sobriété énergétique** représentent*

371 electricity meters
272 electricity sub-meters
330 gas meters

35 monitored waiting rooms
30 external temperature sensors

Annual energy savings represent 114 MWh/year (potential economy 303 K€/year)

Les économie annuel d'energie représentent 113.8 MWh/an soit 303.4 K€/an

A commitment from all Gares & Connexions players on the ground

Un engagement de tous les acteurs Gares & Connexions sur le terrain

The success of the Smart Station application depends not only on technology and equipment supervision, but also on **the involvement of SNCF Gares & Connexions staff in the station**.

*La réussite de l'application Smart Station ne repose pas que sur la technologie et la supervision des équipements, mais aussi par **l'implication des acteurs SNCF Gares & Connexions en gare***

As station experts, **SNCF Gares & Connexions** can use this new technology to focus on providing the best possible **customer experience** in stations, while at the same time taking **steps to reduce energy consumption.**

*En expert des gares, **SNCF Gares & Connexions,** grâce à cette nouvelle technologie, peut ainsi se concentrer sur la **réalisation d'un parcours client** en gare dans les meilleures conditions possibles, tout en mettant en œuvre des **actions pour s'engager dans un contexte de sobriété énergétique**.*

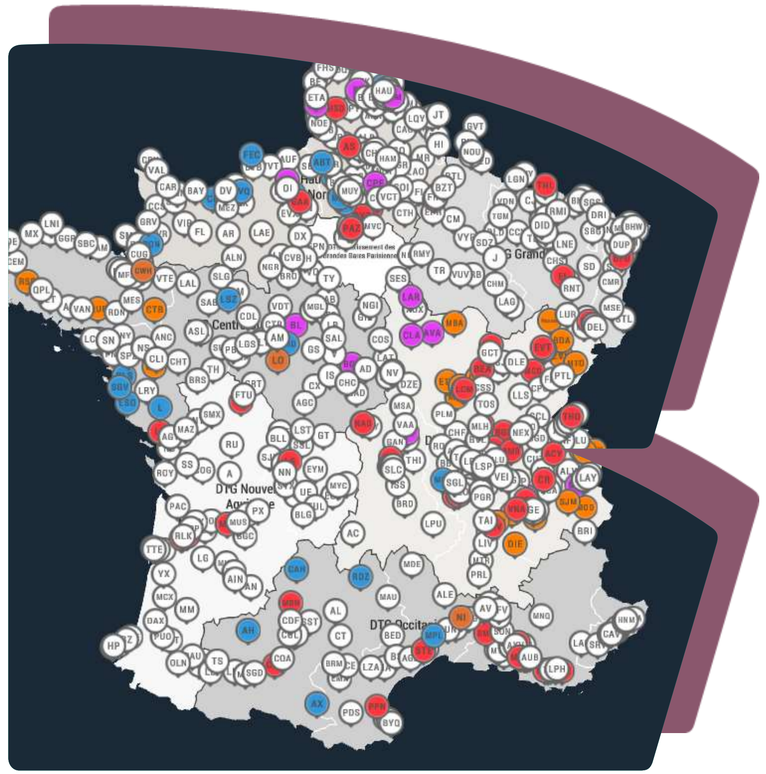
Supervised stations

The **Smart Station** project aims to improve **customer experience and satisfaction** by **monitoring priority equipment in stations.**

*Le projet **Smart Station** vise à améliorer **l'expérience et la satisfaction client** grâce à la **supervision des équipements prioritaires en gare***

The installation of **connected sensors** on the various pieces of equipment selected means that a **supervision application can be set up** to centralise **the status of the equipment in real time.**

*La pose de **capteurs connectés** sur les différents équipements sélectionnés permet la mise en place d'une **application de supervision** qui centralise **l'état des équipements en temps réel***



530

Currently supervised stations

695

Targets for 2023

Asset and building energy monitoring best practice workshop

Sharing sessions

Participants will be sent in 3 breakout rooms

Sharing session
Guiding topics

1. Assets & buildings energy consumption profile
    - Offices buildings' consumption profile?
    - Stations' consumption profile?
    - Workshops' consumption profile?
    - Tunnels' consumption profile?

2. Monitoring (best practice / lessons learned):
    - Energy saving potential identification
    - Strategies/change management to extend/improve monitoring
        - IM and RU have a lot of data.
          Are there good examples of companies who do a lot with data-analytics?
    - Strategies/change management to implement saving solutions
    - Other uses?

Sharing session

1. Assets & buildings energy consumption profile

Bart Van der Spiegel, Infrabel:

- For offices, Working hours profile: 5h to 7h, increasing consumption, until end of morning, then dropping starting 15h.
- For stations, more dependent to lighting and use (according to sunlight)
- Tunnels can be monitored thanks to CO2 (adjusting ventilation need to exhaust in tunnel (mostly from freight trains). Due to fire safety rules, ventilation represent a lot of installed power, but only partially in use and when needed. Tunnels are not always equipped with submeters.

Sharing session

1. Assets & buildings energy consumption profile

Gerald Oldemonnikhof, ProRail:

- Offices: High consumption during summer nights (ventilation setting)
- Tunnels: Light in tunnels 24/7 in NL (regulation). High power installed for ventilation and water pumping system (because below sea level). Energy saving potential here with smart ventilation.

Sharing session

1. Assets & buildings energy consumption profile

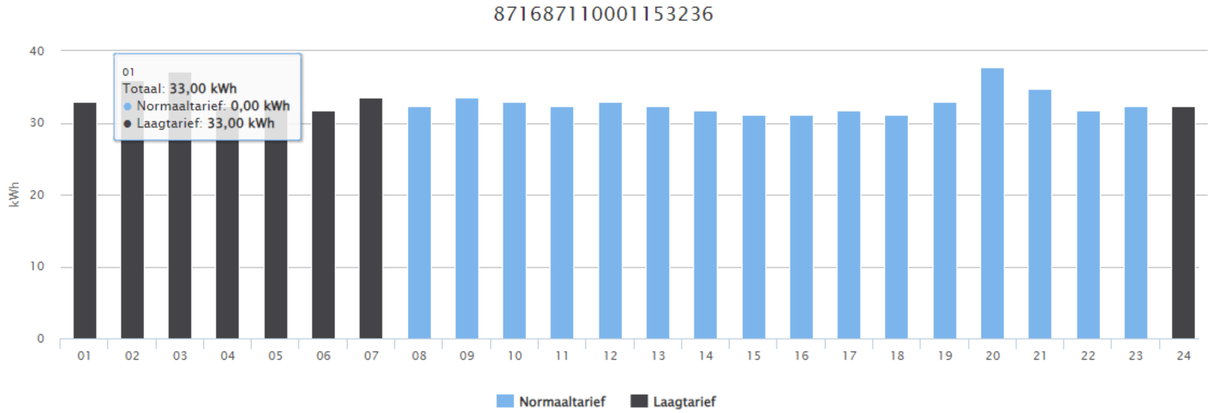
Katelijn van den Berg, NS Stations:

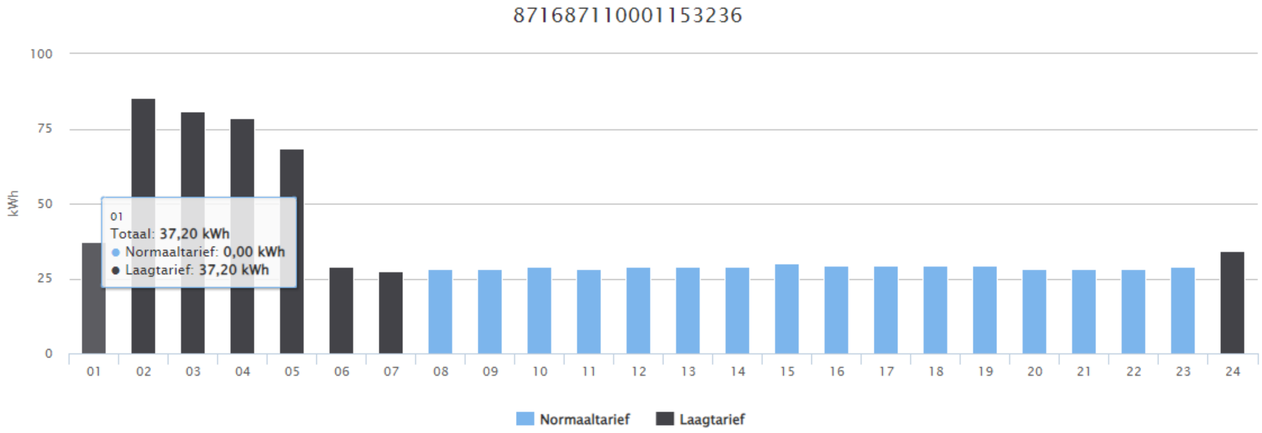
- Shops (shops machines e.g., coffee machines): interesting consumption during rush hour, smart/remote switching off would be useful.
- User specific monitoring (case by case) would be useful.
- A general profile for shops is identified against rush hours.
- Substantial energy saving could be achieved with a bottom-up approach (end-user management of energy demand).

Sharing session

1. Assets & buildings energy consumption profile

In the Netherlands the consumption of a tunnel is typically quite constant (see first figure), but on some days we can notice a peak (second figure). For stations and workshops you may see the same.



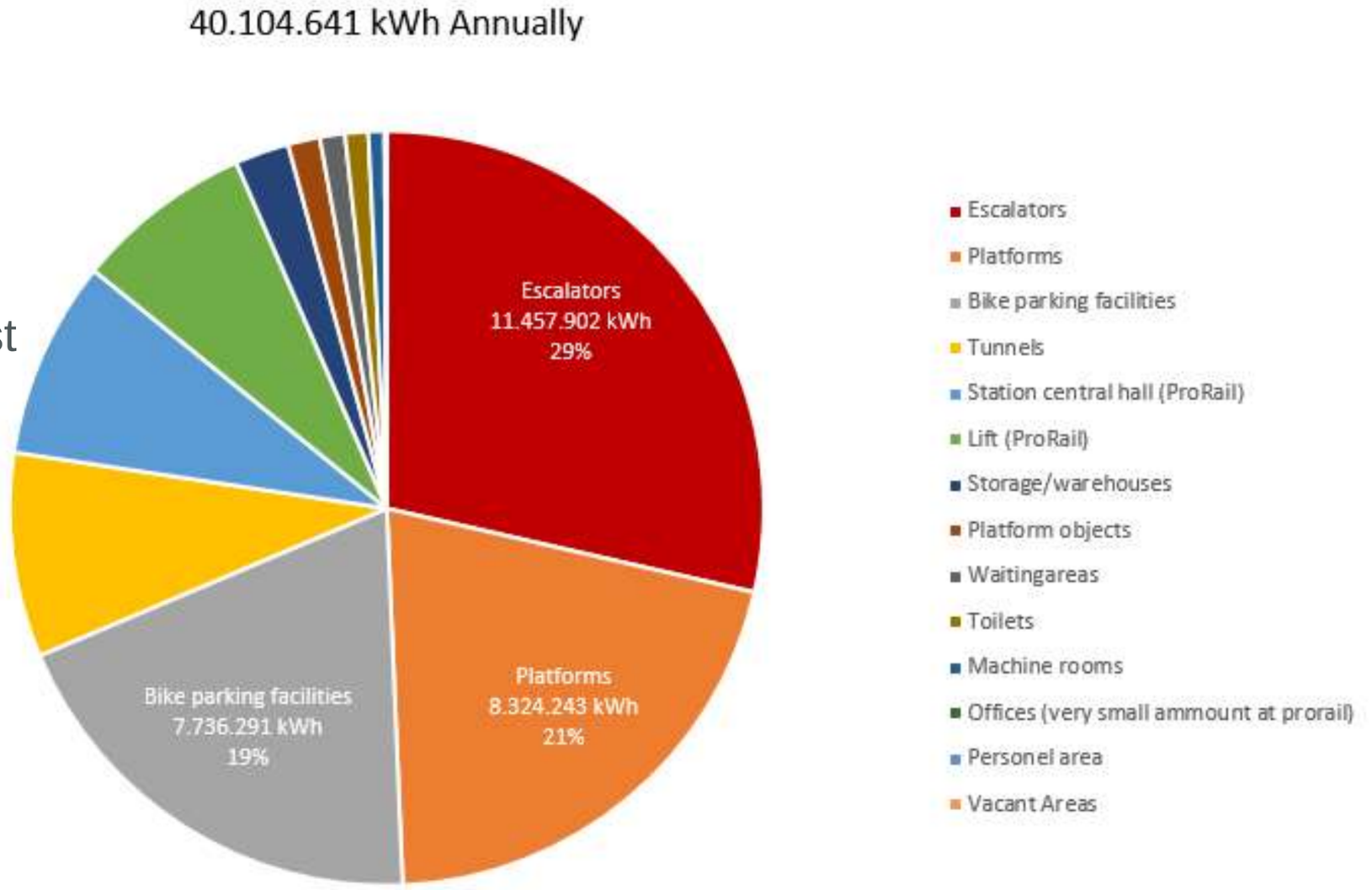


Sharing session

1. Assets & buildings energy consumption profile

Andreas Toufexes, ProRail:
Escalators consume the highest share at ProRail (See graph).
Light is the main consumption for bike parking facility.

Note: In the Netherlands, stations are owned by NS stations (the operator), important to consider when reading the graph.
ProRail also only have a small office surface in stations.



Sharing session

2. Monitoring (best practice / lessons learned):

Michel Ryser, SBB:

- For better understanding, it is useful to compare peaks and reality with baseload. A lot of saving potential can be identified: peaks can often be avoided (shaved-off) without noticing a change and avoiding extra (power demand) fees.
- Going further, even normal consumption and baseload can be lowered by optimal setting, without impairing normal operation.

Sharing session

2. Monitoring (best practice / lessons learned):

Sharad Arora, NCRTC:

- SEUs (Specific Energy Usage) areas may be identified first. KPIs are to be defined for them all.
- Benchmarking is to be established by calendar year (may be through theoretical calculations/available data).
- Then KPIs are to be measured and compared each year for identification of the SEUs where specific attention is required.
- Then action on specific consumption can be taken.

Sharing session

2. Monitoring (best practice / lessons learned):

Zhongbei Tian, Birmingham Univ.:

- Renewable (PV) production site, to compensate buildings/assets consumption.
- Efficient regenerative braking use needs time granularity to be seen on monitoring. It will be required to properly match very short braking time vs monitoring time.

Asset and building energy monitoring best practice workshop

Feedback
Discussion
Conclusion

Conclusion

- Temperature control (heating/cooling) consumption is an important energy consumption to monitor and manage for all assets and to care about customer comfort:
  Too strong heating or cooling can be harmful for both overconsumption and comfort.

- Tunnel ventilation is lot of installed energy, which is important to control. Smart management can be made against CO2 levels (cited by Infrabel).

- When identifying saving potentials, make sure to use the proper baseload as reference.

- Besides, a lot of energy can be saved by acting on baseload consumption also:
  Even outside visible peaks, consumption level can represent unnecessary consumption. Peaks mean obvious energy intensity, but sometime the baseload can also be nicely reduced without problems (Latent energy consumption can be avoided).
  This can mean more saving on the longer run.

- Therefore, the interest of using specific (functional unit) e.g., KPI Wh/m2 or specific ratio related to the activity in the asset/building (e.g., Wh/person (Wh/unit))

- It would be interesting to know what KPIs should be used for benchmarking by type of site (workshop follow up)

Philippe Stefanos

stefanos@uic.org

Sustainability Advisor

INTERNATIONAL UNION OF RAILWAYS

Stay in touch with UIC:

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Energy Taskforce

Energy and CO_2 Sector meeting 2023

Thank you for your attention.