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
Welcome

Philippe Stefanos
Sustainability advisor
UIC

Asset and building energy monitoring best practice workshop
Asset and building energy monitoring best practice workshop

Agenda
Introduction

Philippe Stefanos
Sustainability advisor
UIC
### Agenda of the meeting

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Presenter</th>
<th>Organization</th>
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<td>10 h 00</td>
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<td>Philippe Stefanos</td>
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<tr>
<td>10 h 05</td>
<td>Introduction - Context</td>
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<td>10 h 20</td>
<td>Energy saving programme at Dutch railway stations</td>
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Asset and building energy monitoring best practice workshop

Introduction
Context
**Electric railway system consumption by field**

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Public accessibility</th>
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<tr>
<td></td>
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<tr>
<td>Train control systems</td>
<td>Passenger information systems</td>
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<td></td>
<td>Heating, cooling, ventilation (not accounted for in “Real estate”)</td>
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<tr>
<td>Telecommunication</td>
<td>Conveyor systems (escalators, elevators, conveyor belts)</td>
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<td>Lighting</td>
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<td>Point/switch heating</td>
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<td>Power supply system</td>
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<td>Railway communication</td>
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<td>ICT/data</td>
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<td>Business/staff communication</td>
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<td>Tracks (e.g., lighting for staff)</td>
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<td>Tunnels</td>
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<td>Power for power plants</td>
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<td>Power for electrotechnical subsystems</td>
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<td></td>
<td>Depots/siding</td>
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<td>Other technical equipment</td>
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<td>Real estate</td>
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<td>Large stations</td>
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<td>Medium and small stations</td>
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<td>Operational buildings</td>
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<td>Offices</td>
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<td>Distribution losses</td>
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<td>Maintenance workshops</td>
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<td>Service facilities</td>
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<td>Ticket machines</td>
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<td>Distribution losses</td>
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<td>Maintenance workshops</td>
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<td>Freight</td>
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<td>Finger tips</td>
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<td></td>
<td>Distribution losses</td>
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<td>Maintenance workshops</td>
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**Passenger transport**

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Introduction

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

<table>
<thead>
<tr>
<th>Consumption profile (including traction)</th>
<th>Consumption profile (excluding traction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger transport, 72%</td>
<td>Passenger transport, 28%</td>
</tr>
<tr>
<td>Freight, 15%</td>
<td>Freight, 6%</td>
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<tr>
<td>Infrastructure, 8%</td>
<td>Infrastructure, 40%</td>
</tr>
<tr>
<td>Real estate, 5%</td>
<td>Real estate, 25%</td>
</tr>
</tbody>
</table>

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

Katelijn van den Berg
Program manager Sustainability
NS Stations
The Netherlands sustainably accessible. For everyone.
Stations portfolio
Real estate portfolio
Workshop portfolio
Data driven approach

Possible measures
- Energy efficiency
- Gas reduction
- Production

Fastlane inventarisation
Long term maintenance plan
Developments, renovations, rental contracts

INPUT

ROADMAPS
Per building
Per portfolio

AMBITION
Paris Proof: norm value of energy use per m² per function
Yearly target:
- 3,5% total energy reduction
- 5,5% fossil energy reduction
30 MW production in 2030
Fastlane approach per building

1. Location
2. Desk research
3. Viewing
4. Expert session
5. Modelling
6. Fitting energy usage
7. FastLane
8. Scenarios
9. Dashboard
Energy saving scenarios

A. Minimal
B. Intermediate norm
C. End norm: Paris Proof
D. Maximized
E. Production
Asset strategy

- Tenants
- Service and maintenance

- New buildings
- Buying

- Renovation
- Transformation

- Demolition
- Selling
- Out of use

New in portfolio

Maintain

Invest

Divest
Portfolio Roadmap

List of buildings

Core portfolio

Asset strategy + sustainability year per building

Fastlane scenarios

Optimisation

Energy performance: usage and planned reduction
<table>
<thead>
<tr>
<th>Type</th>
<th>Subtype</th>
<th>2023</th>
<th>2030 ‘On the way to Paris Proof’</th>
<th>2050 Paris Proof</th>
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<tbody>
<tr>
<td>Offices</td>
<td>Label C 225 kWh/m²</td>
<td>Label A 160-135 kWh/m²</td>
<td>Label A+++ 70 kWh/m²</td>
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<tr>
<td>Retail</td>
<td>Shop with goods refrigeration</td>
<td>291 kWh/m²</td>
<td>150 kWh/m²</td>
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<tr>
<td></td>
<td>Shop without goods refrigeration</td>
<td>155 kWh/m²</td>
<td>80 kWh/m²</td>
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<tr>
<td></td>
<td>Logistics with goods refrigeration</td>
<td>155 kWh/m²</td>
<td>85 kWh/m²</td>
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<tr>
<td></td>
<td>Logistics without goods refrigeration</td>
<td>97 kWh/m²</td>
<td>50 kWh/m²</td>
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<td>Other</td>
<td>Stations, monument</td>
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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

Helps improve customer experience and satisfaction
Contribute à améliorer l'expérience et la satisfaction client

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 économies en énergie grâce au suivi en temps réel de leur consommation énergétique et des températures dans les salles d'attente

Contributes to integrating into an energy sobriety approach
Contribute à s'intégrer dans une démarche de sobriété énergétique

More energy-efficient stations by real-time monitoring of their energy consumption and temperatures in waiting rooms
Des gares plus économies en énergie grâce au suivi en temps réel de leur consommation énergétique et des températures dans les salles d'attente

Contributes to integrating into an energy sobriety approach
Contribute 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.

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

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

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

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

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.

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.
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'énergie 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.

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?

   - 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.

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.

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


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)
Stay in touch with UIC:

www.uic.org

#UICrail

Energy Taskforce
Energy and CO₂ Sector meeting 2023

Thank you for your attention.