Energy efficiency measures

VöVs 9. Forum Nachhaltige Energie

17. November 2022

Eishalle St-Léonard (Poya), Freiburg

Presented by Audun Ingebrigtsen / Bane NOR

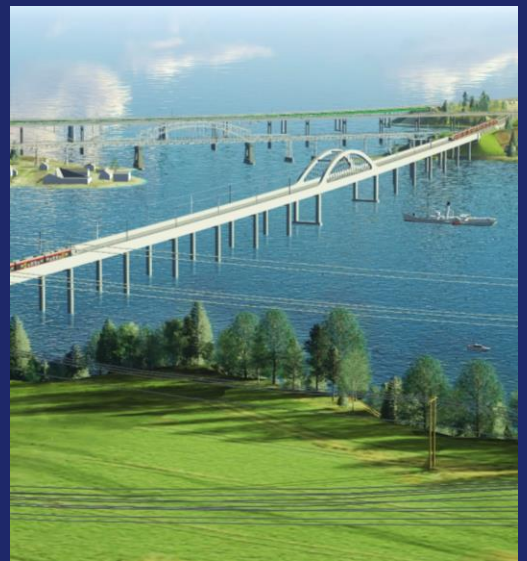
Agenda

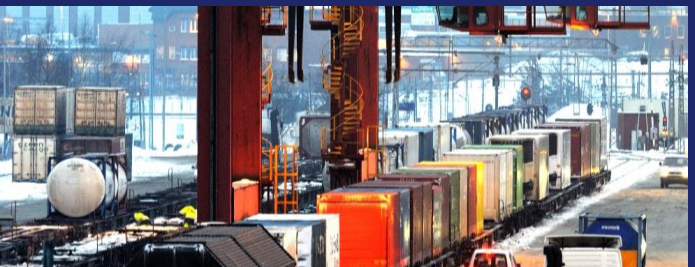
- Who is Bane NOR and how is the Norwegian railway organized
- Energy efficiency measures in Bane NOR
- Questions

Who is Bane NOR?

And how is the Norwegian railway organized?

This is Bane NOR





Our Corporate Social Responsibility

Bane NOR is responsible for the railway network in Norway:

Tracks, stations, traffic management and everything else that is needed for the train companies to run their trains efficiently and safely.

Planning, construction, administration, operation and maintenance of the national railway network

Traffic management and operational coordination responsibility for the safety work

Operational responsibility for coordination of preparedness and crisis management

BANE NOR


Manager of railway infrastructure, but also…
Telecom company
Fiber company
Electric power company
Train company
Rescue and emergency response
Railway School
BANE NOR


OUR VISION
More on track leaves a smaller footprint
BANE NOR

Who does what in the railways?

Supervision

Norwegian Railway Authority

Manages and develops infrastructure and hubs

BANE NOR

Operation and maintenance of infrastructure

Via suppliers and contractors

Driving the trains

The train companies

Passenger: 7
Freight : 12

Maintains the trains

Several companies

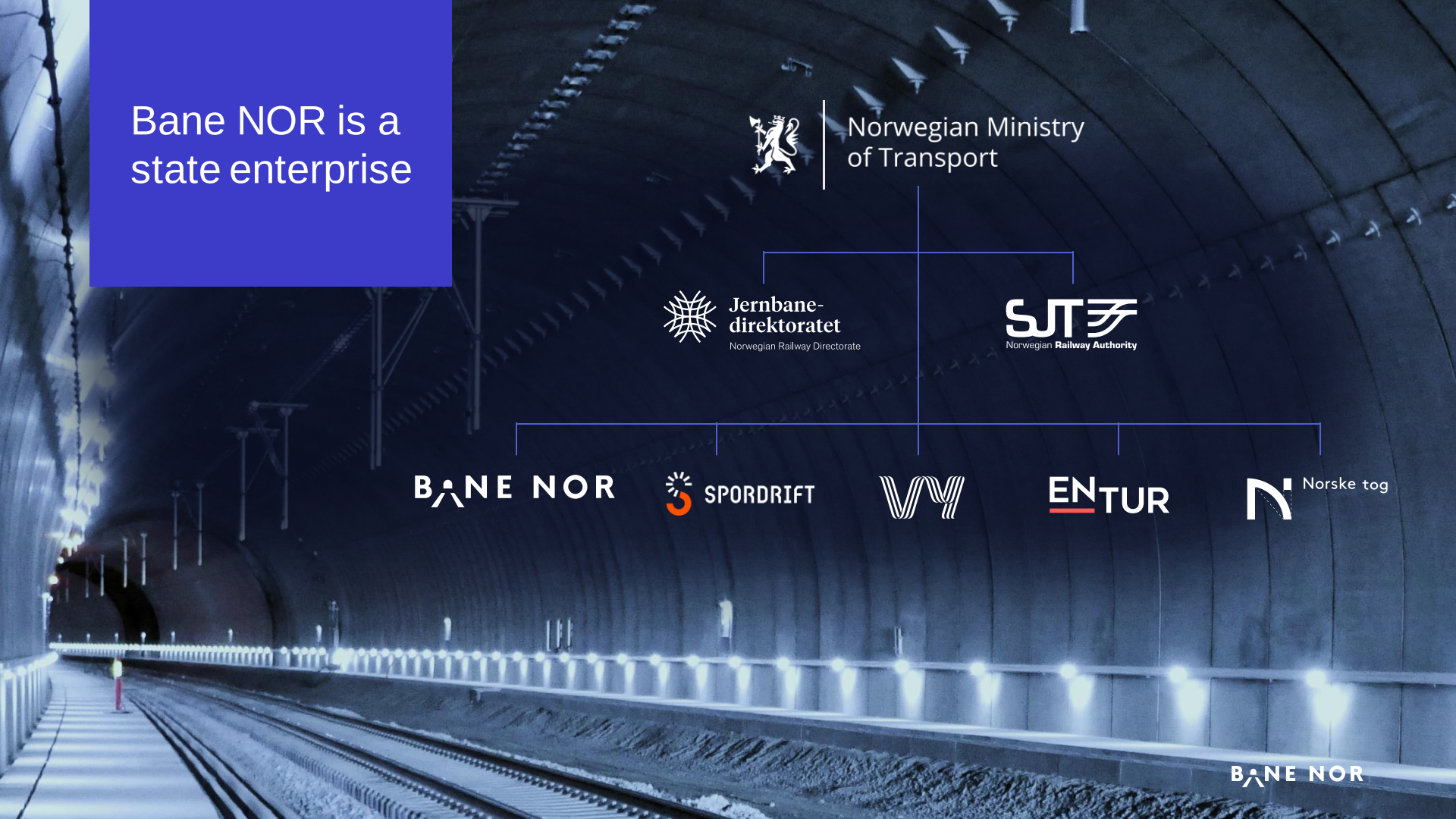
Leasing out train equipment

Norske tog and Railpool

Ticket sales and national travel planner

ENTUR

Bane NOR is a state enterprise



Bane NOR in numbers

2021

4221

kilometers of railway tracks. Only 296 km with double tracks

2618

bridges

335

train stations and stops for passenger traffic

1750

level crossings in operation on sections with regular train traffic

31

Freight and timber terminals

723

tunneles

Source: Bane NORs annual report 2021

Bane NOR in numbers

2021

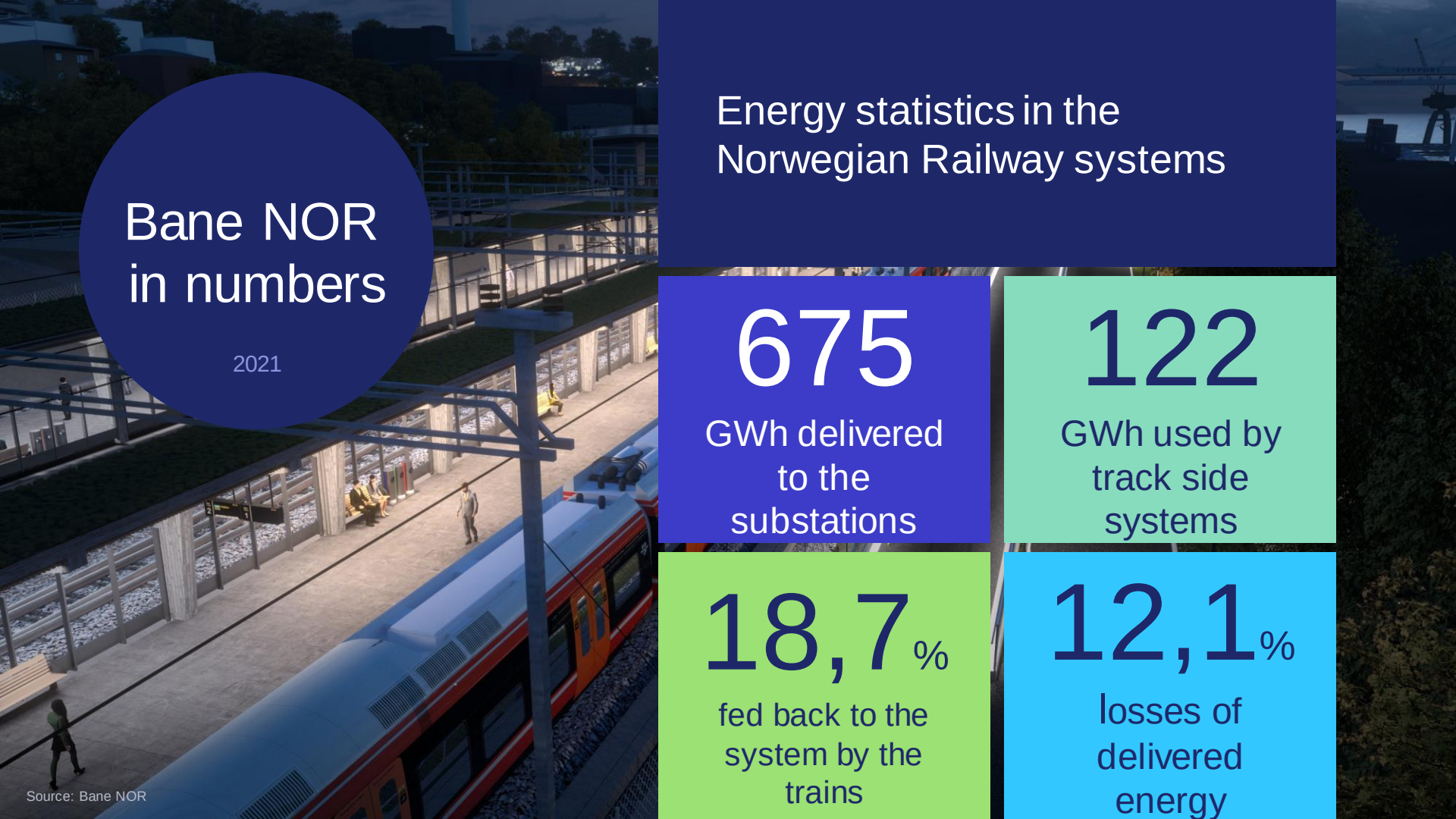
41,4 mil.

Train journeys registered in Norway in 2021 (2019: 80 mil. train journeys)

37,5 mil.

Tons of goods transported by rail in Norway in 2021 (2019: 35 mil. tons)

Source: Statistics Norway



Bane NOR in numbers

2021

Energy statistics in the Norwegian Railway systems

675

GWh delivered to the substations

122

GWh used by track side systems

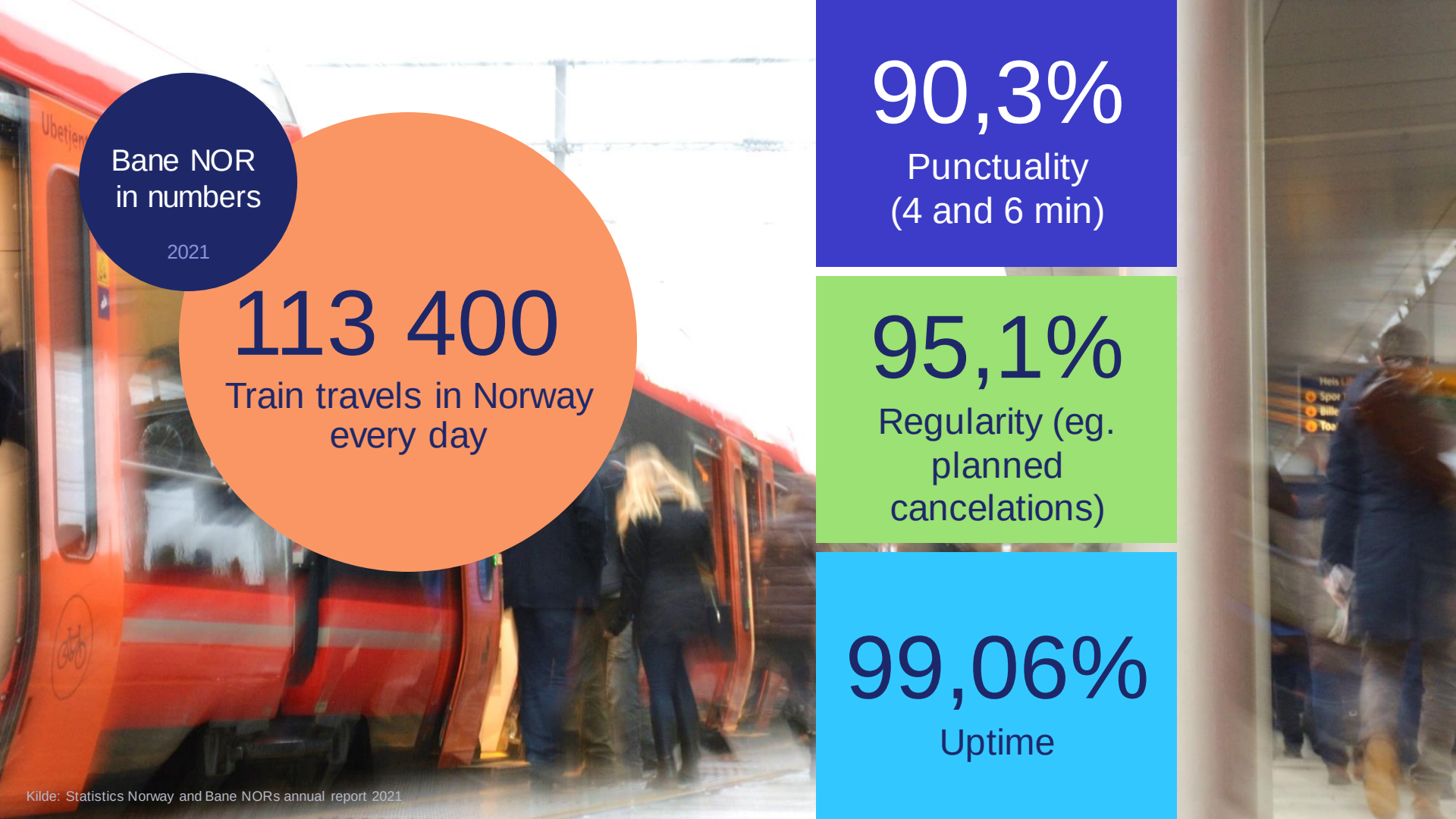
18,7 %

fed back to the system by the trains

12,1 %

losses of delivered energy

Source: Bane NOR



Bane NOR in numbers

2021

113 400

Train travels in Norway every day

90,3%

Punctuality (4 and 6 min)

95,1%

Regularity (eg. planned cancelations)

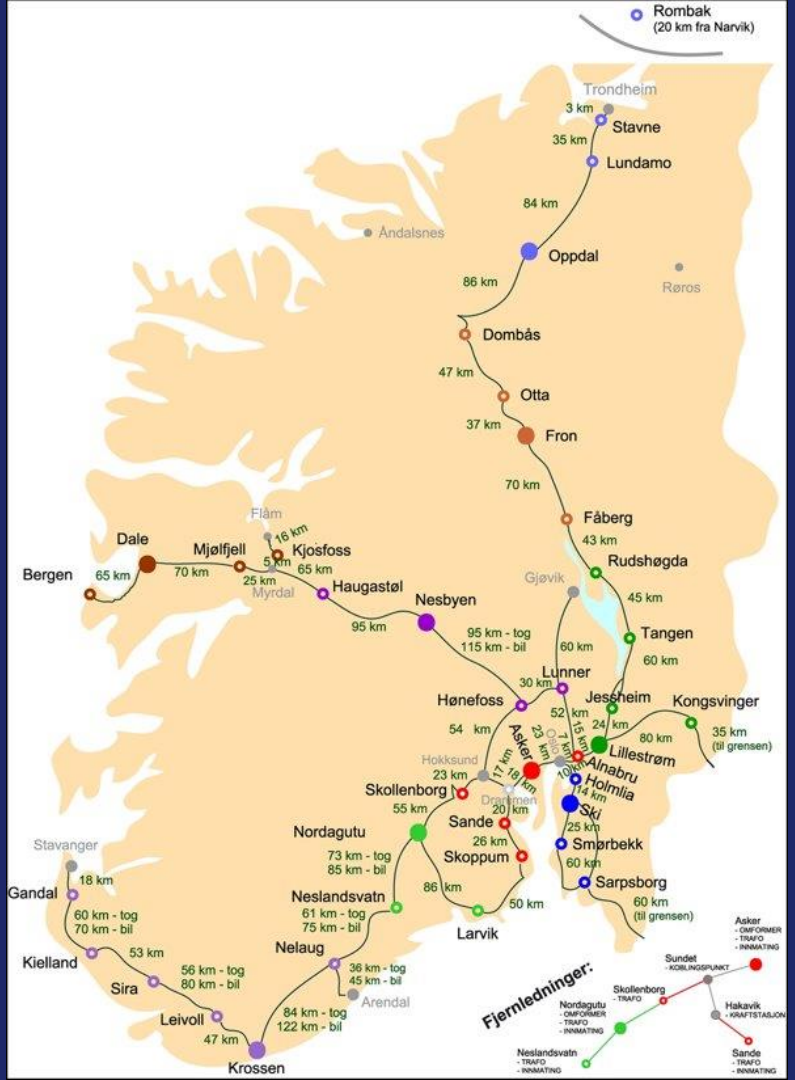
99,06%

Uptime

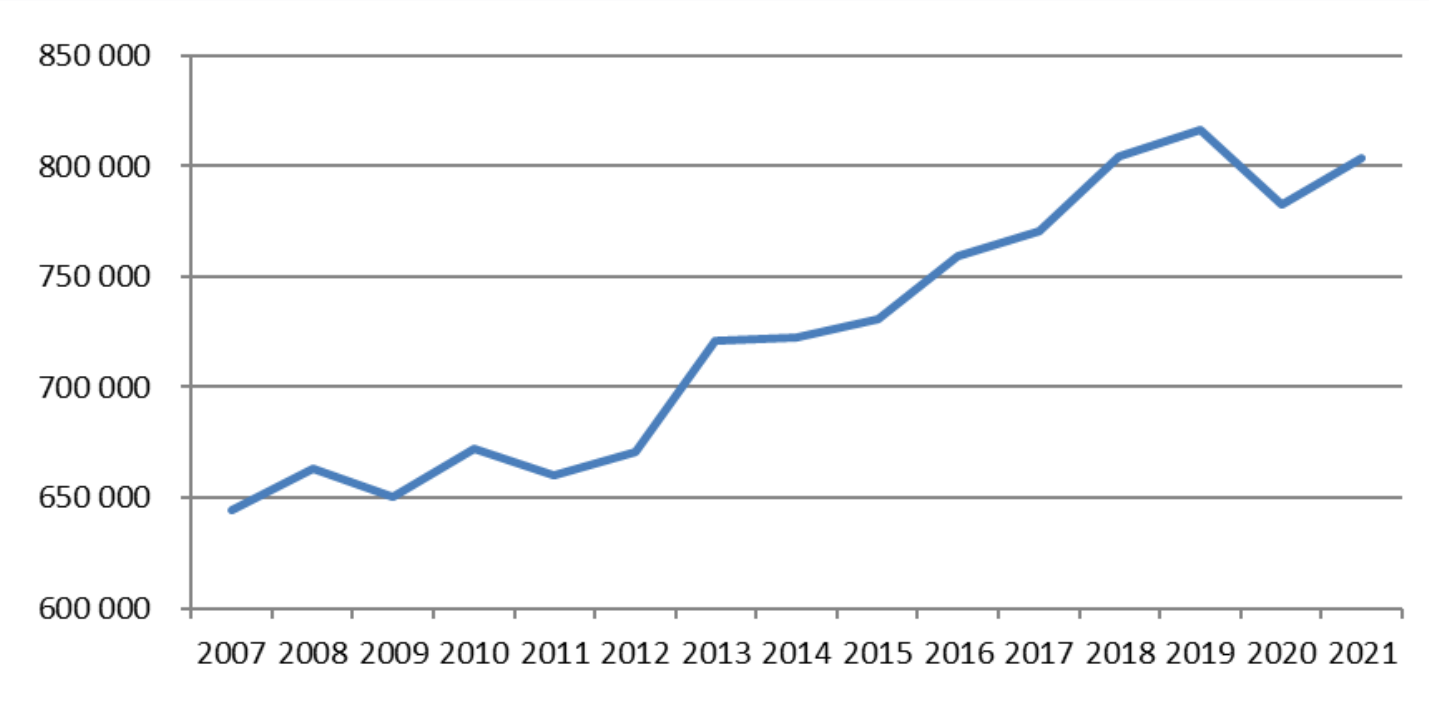
Kilde: Statistics Norway and Bane NORs annual report 2021

Energy supply in Bane NOR

- 37 converter stations
- 81 installed converter generators
  - 57 rotating converters
  - 19 static converters
  - 5 mobile static converters
- 5 transformer stations
- 1 power station
- 246 km of high-voltage supply network
- 1 nationwide operations center
- 834 MVA installed converter effect
  - 431 MVA static converters
  - 403 MVA rotating converters

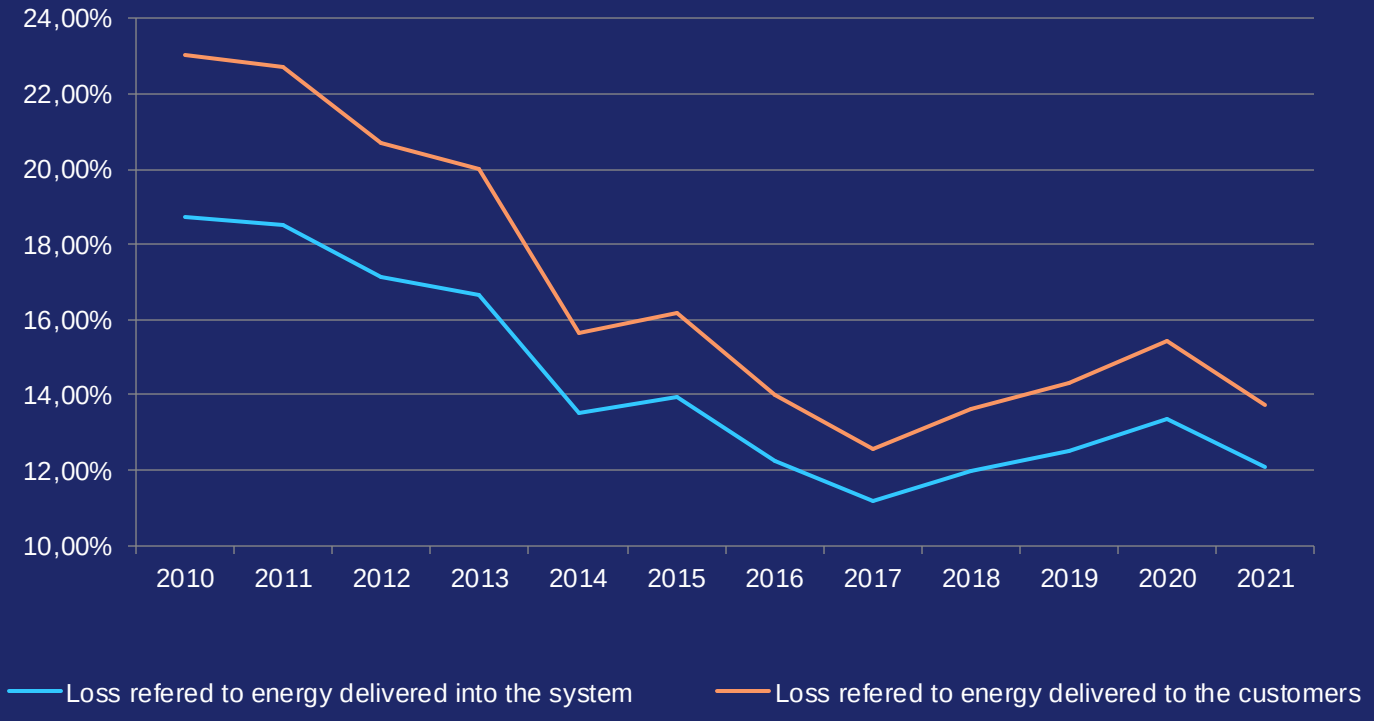


Energy delivered into the system



BANE NOR

Development of losses in the energy delivered to the trains



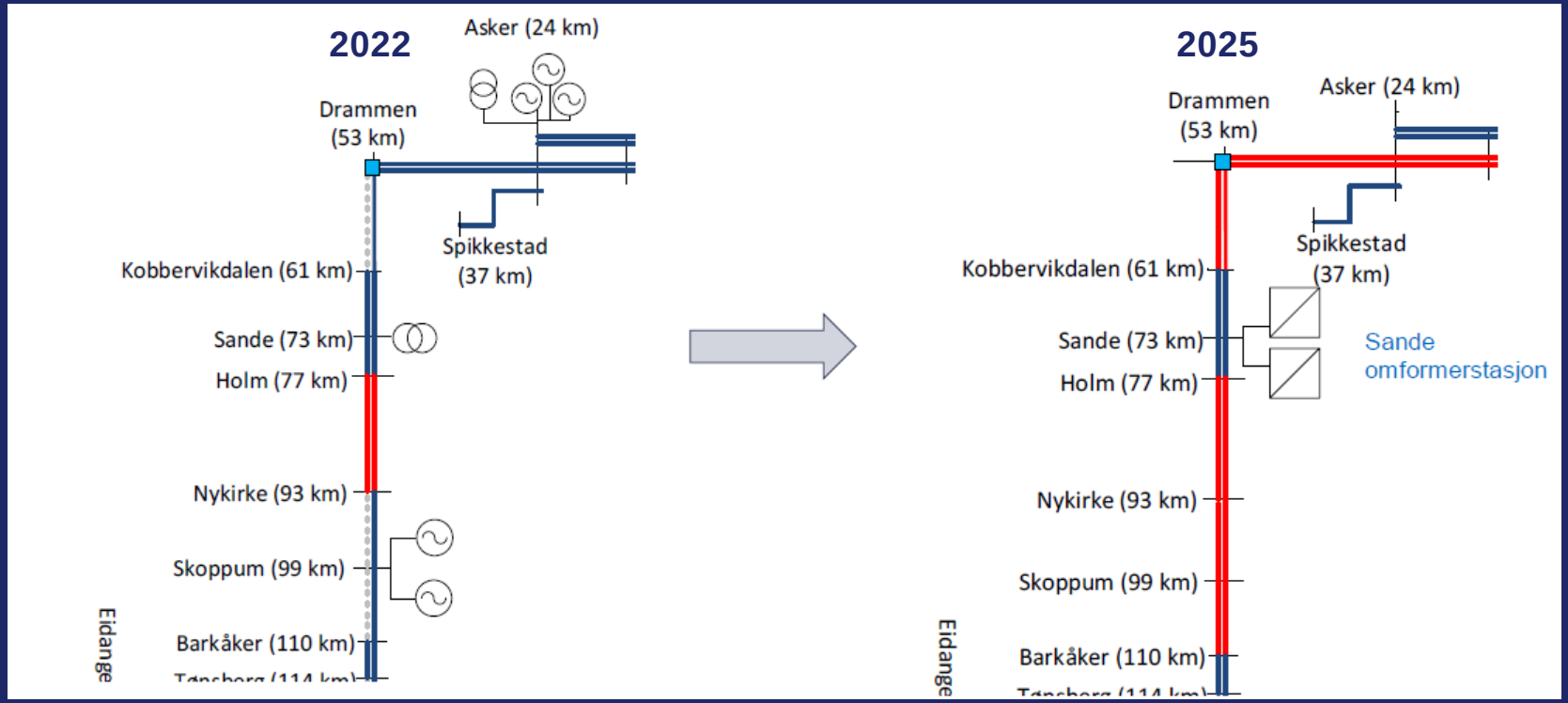
BANE NOR

Energy effiency measures in Bane NOR

The following energy measure topics will be covered

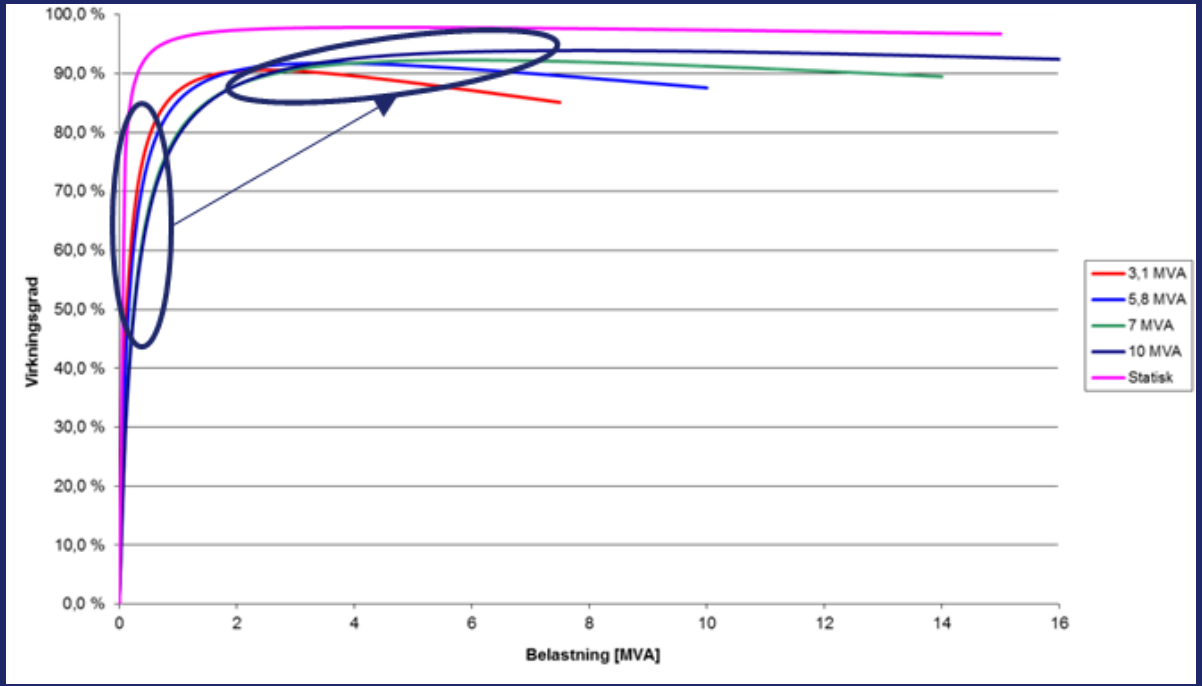
- Changes in the electric traction power supply system
  - Changes in converter station structure
  - Smart regulations of existing rotary substations
  - Rebuild rotating converters to HOG
  - Change overhead catenary system from 15 kV to 30 kV
- Regenerative breaking
- Solar Energy
- Power regulations of electrical heating of Railway switches
- Innovation – New type of railway switch heating
- Infrastructure energy data
- Energy efficiency in existing real estate properties and new
- Energy efficiency in construction projects

Changes in the converter station structure in this area will reduce the energy loss with 5 GWh per year



Smart regulation of the rotating sub stations

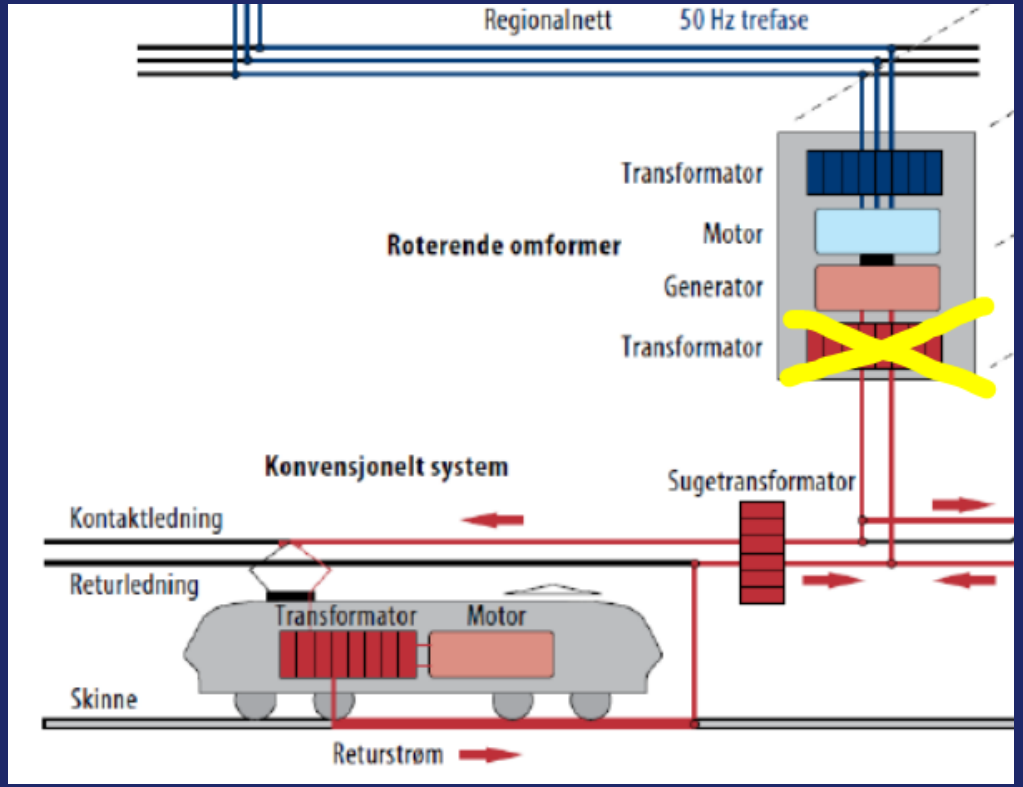
- Moving the working point to the machines will reduce the losses
- Makes the system more robust av save us for costly expansions
- 2022-2025



BANE NOR

Rebuilding the rotating substations to HOG

- Reduces the losses with:
  - About 50-60 % by load
  - About 30 % with no load



HOG = High voltage generator rotating converter

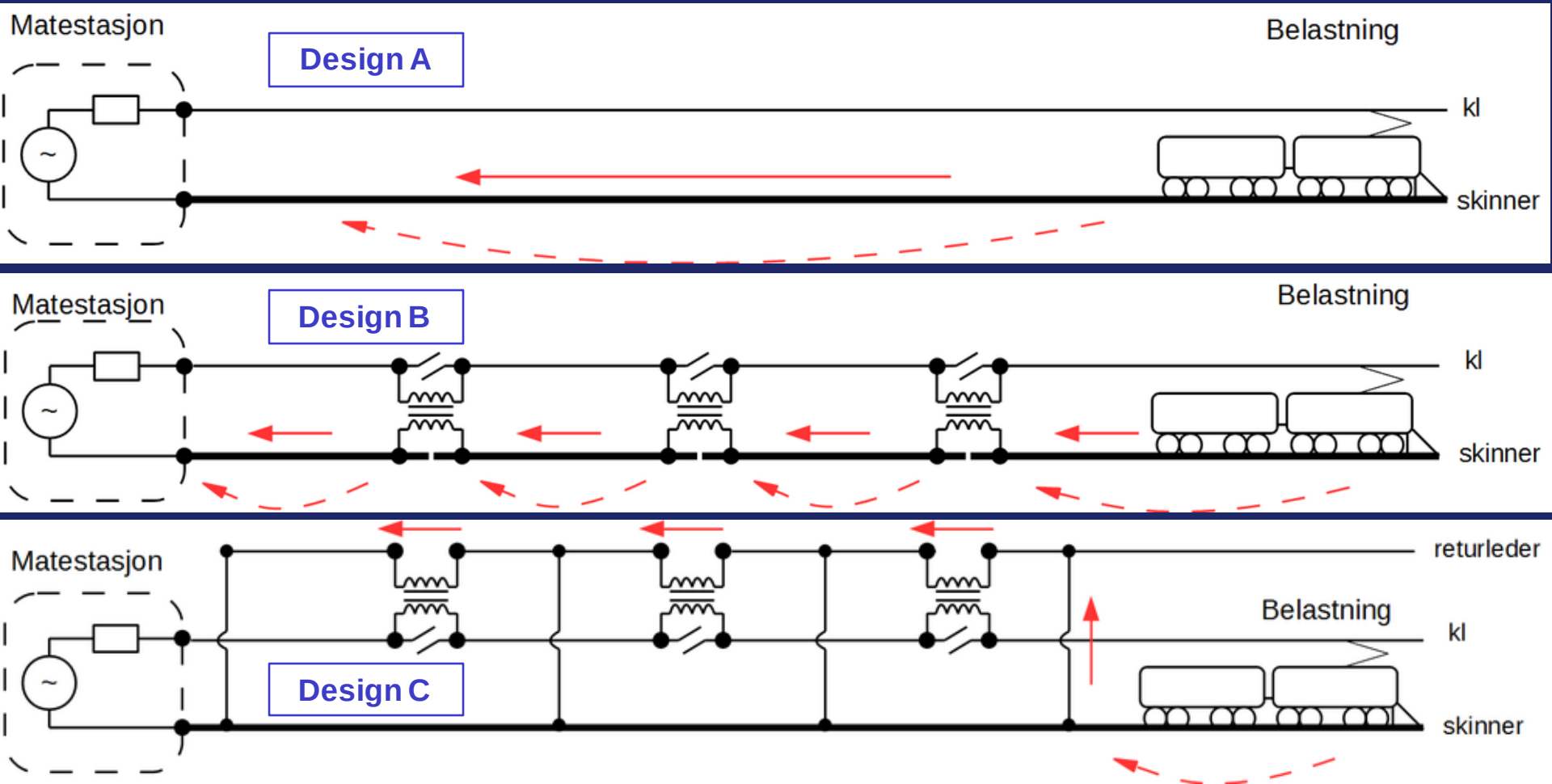
From a 15 kV to a 30 kV overhead catenary system

- Today 16 GWh is lost in the overhead catenary system every year

- By changing from the old 15 kV to the new 30 kV system we estimate that the losses will go down with 60-75%

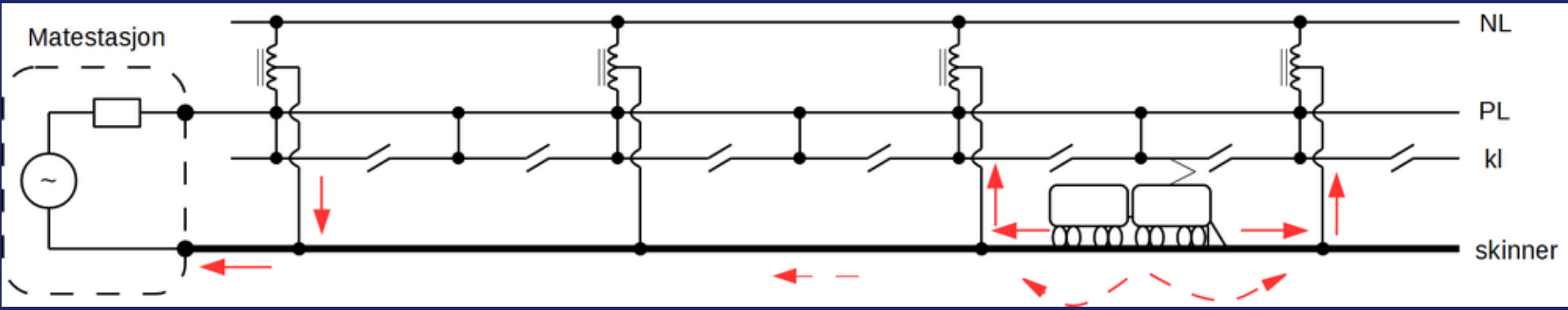
The new system has also a different cross section on the cables

Traditional overhead catenary 15 kV system

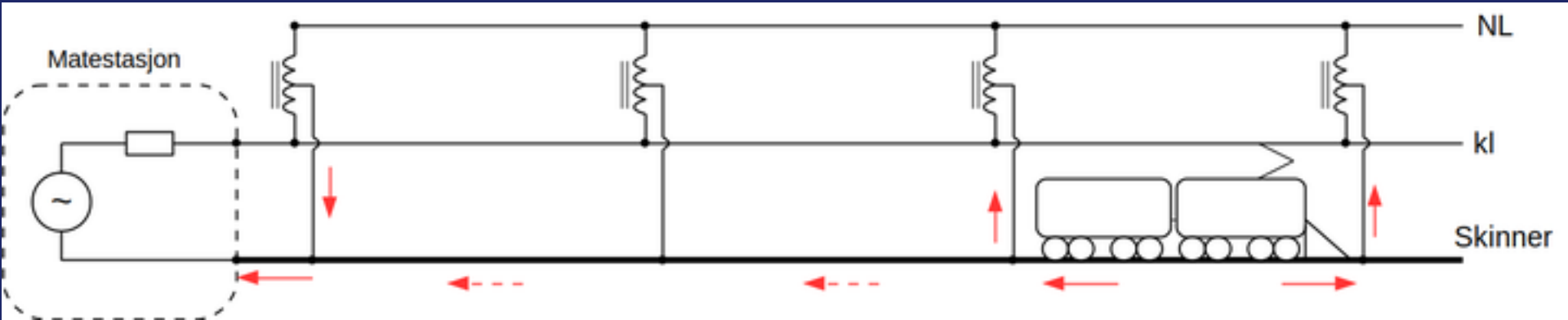


New and modern overhead catenary 30 kV system – KL-AT

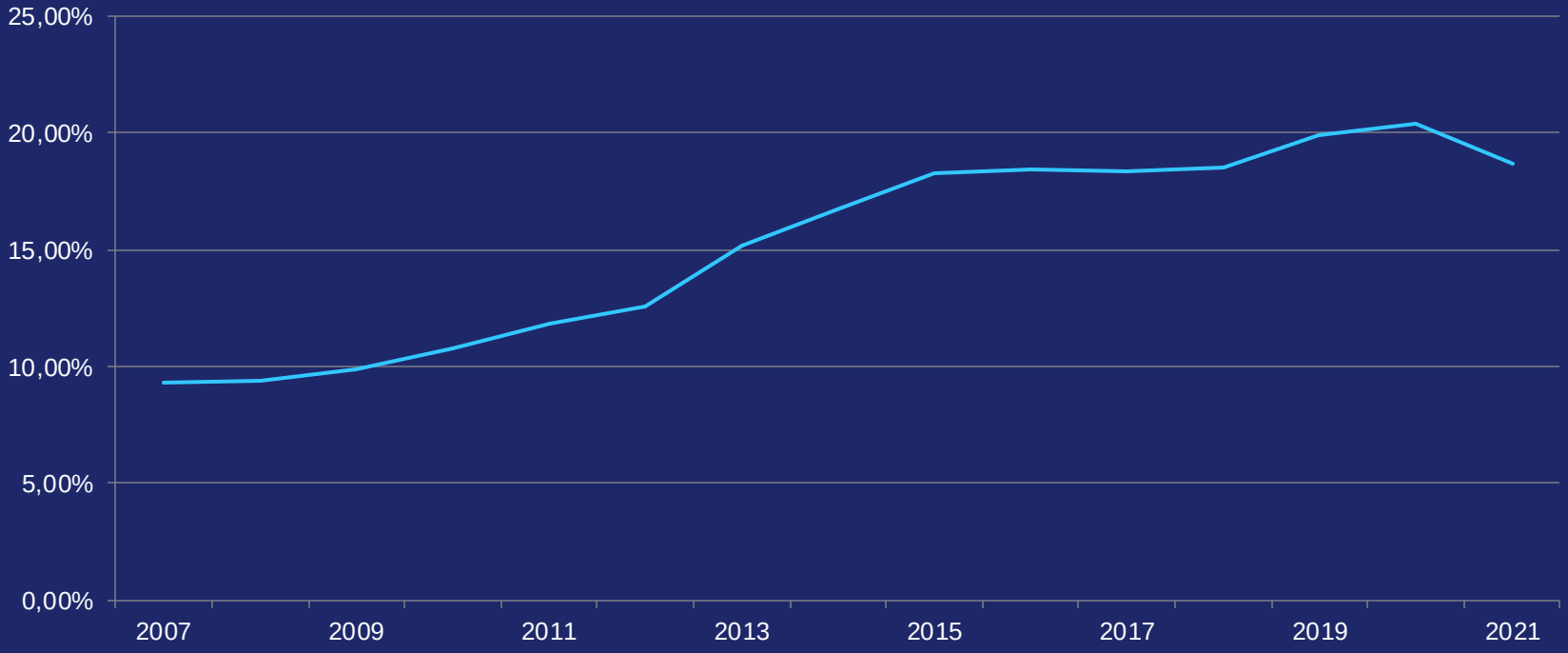
Design E



Design F

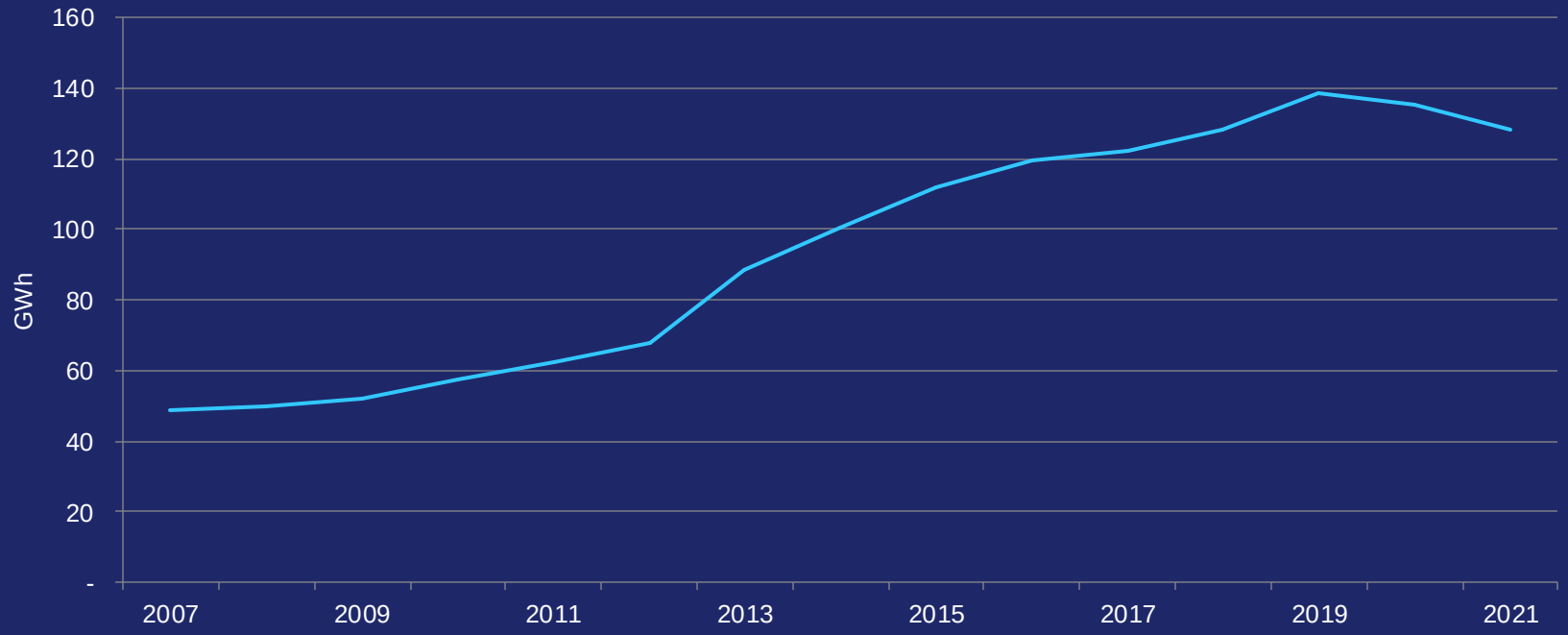


Development of regenerative energy from the trains



BANE NOR

A potential on 20 GWh remains to be harnessed



BANE NOR

Solar Energy – Railway station

- Drammen station in 2025
- Size: 4500 m^2
- Estimated yearly production: 100 MWh

Solar Energy – Switchgear

- Size: 323 m^2
- Estimated yearly production: 46 MWh
- Built: 2017
- Covers most of the energy demand for the switchgear during the summer

Solar Energy – Future plans

- Started a procurement process to get one or more suppliers in place who can design and deliver solar energy systems on existing buildings and installations.

Photo: Kjell Bakken / Bane NOR and Geodata AS

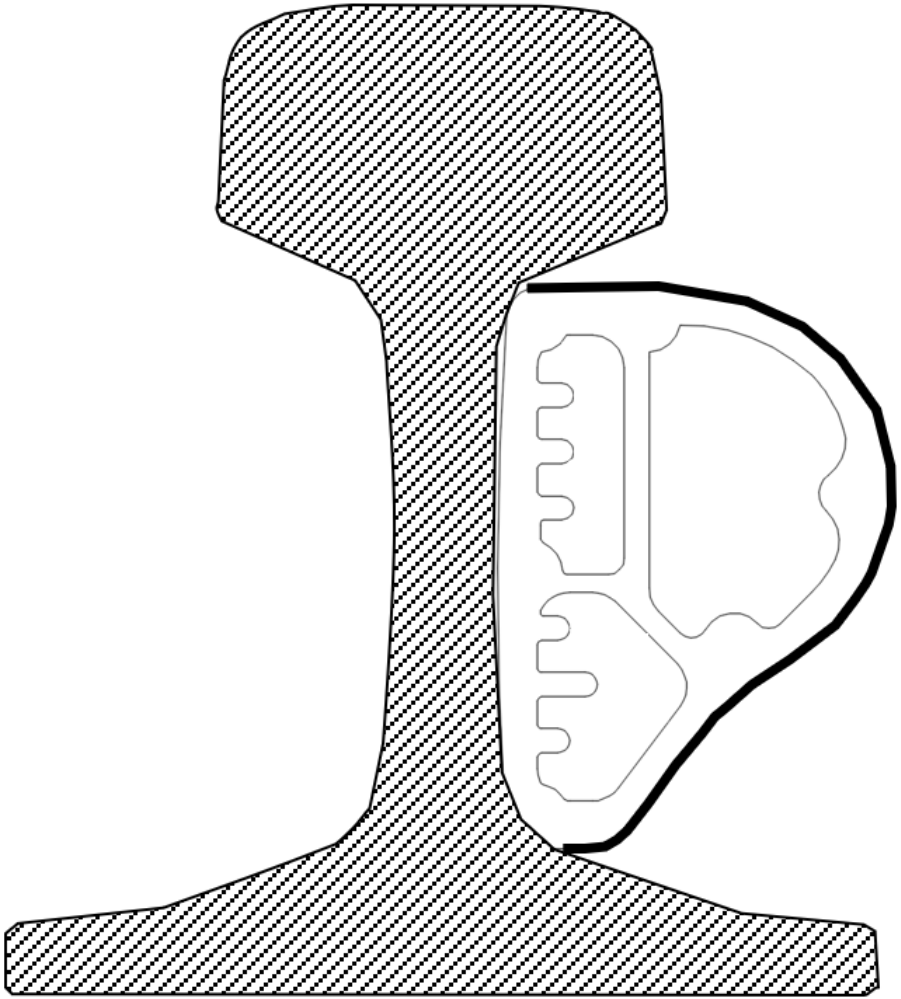
Heating of railroad switches

- 2013: Railroad switch heating stood for 50% of the total energy consumption in Bane NOR
- 2013: 50% of the group cabinets was not power regulated
- 2017: 20% unregulated
- 2022: ?
- Potential energy reduction: 50-60%
- New overview is being made and potential savings is calculated
- A tool for the leaders in the different districts to make investment decisions

Photo: Jarle Gåsøy/Spordrift

Innovations – Rail switch heating system

- A flow of warm liquid heats the Rail
- A ground-source heat pump results in a minimal energy consumption
- Thought used near train workshops and other buildings that already has a ground-source heat pump installed.

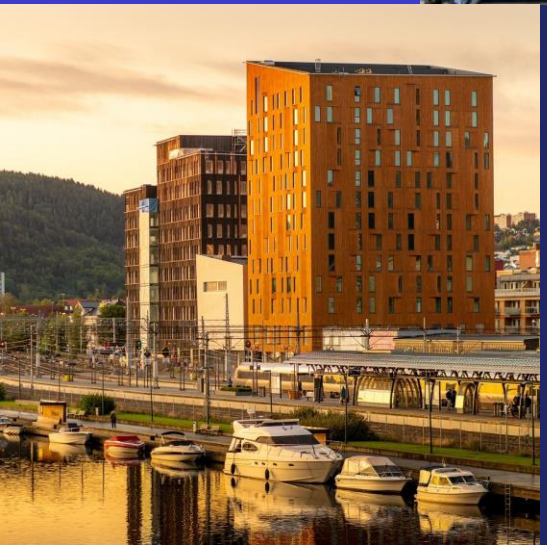


Energy data – Infrastructure power (50 Hz)

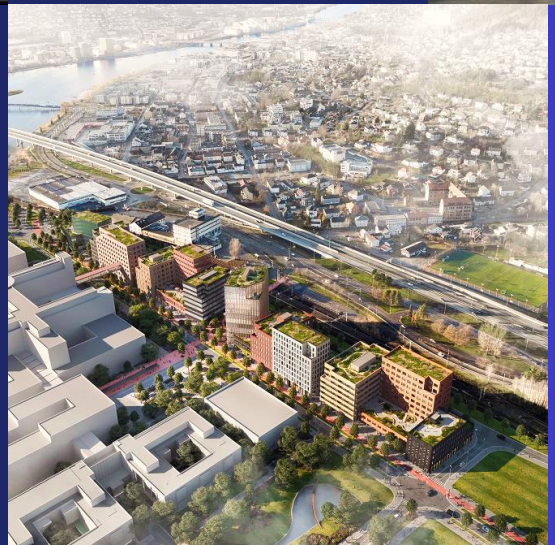
- Standardization of energy metering metadata
- Build reports so energy usage can be easily followed up and analyzed, both aggregated on different levels and down to one specific metering point.
- Defining what type of objects that always would need its own energy meter
  - Rail switch heating system is definitely one of them

Real Estate Division

The country's leading hub developer



They develop attractive hubs so that more people will travel by train



1260 buildings

335 stations

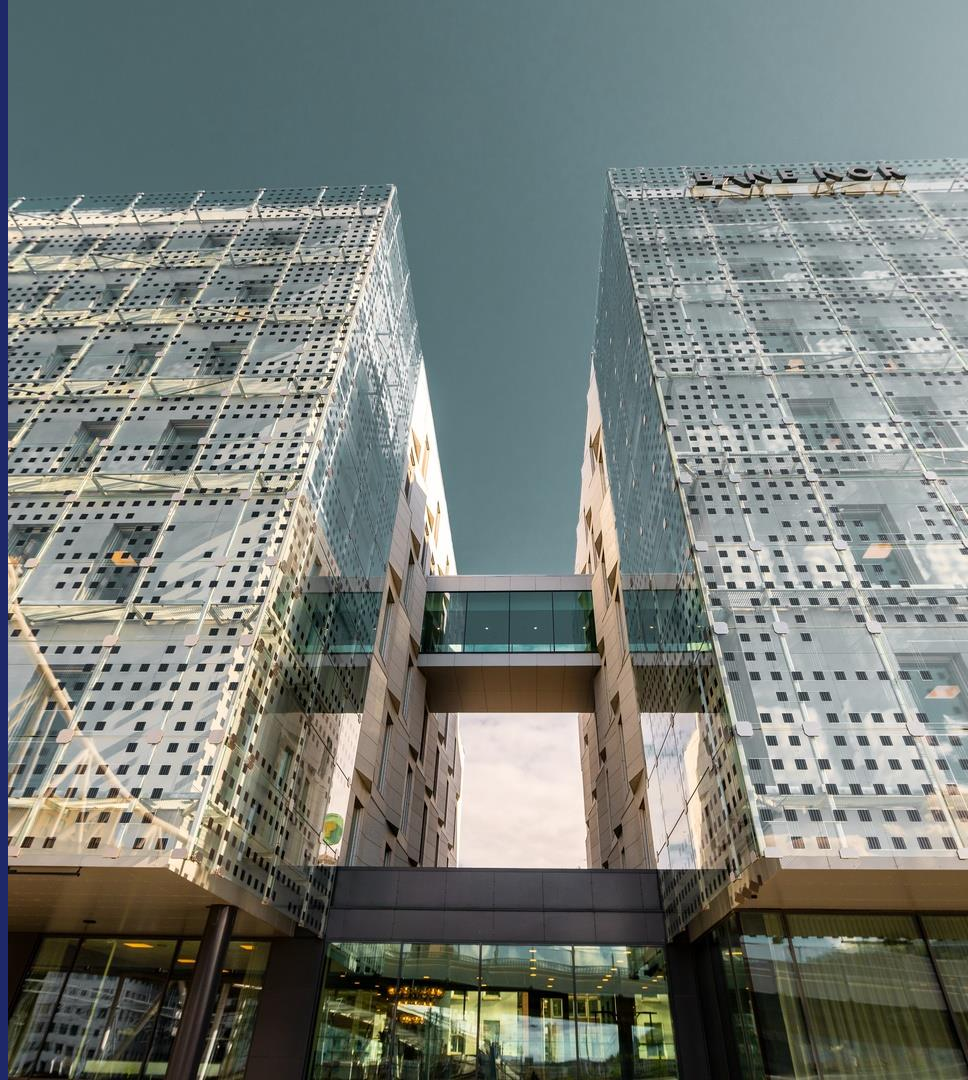
13 workshops

3600 rental contracts

150 development projects

Real Estate Division

- Has an ambition to achieve BREEAM NOR Excellent on all new building projects
- Will establish BREEAM In-Use as their management for operation and maintenance of their properties.
- Following the BREEAM principals when developing new buildings or manage existing results in more energy efficient buildings

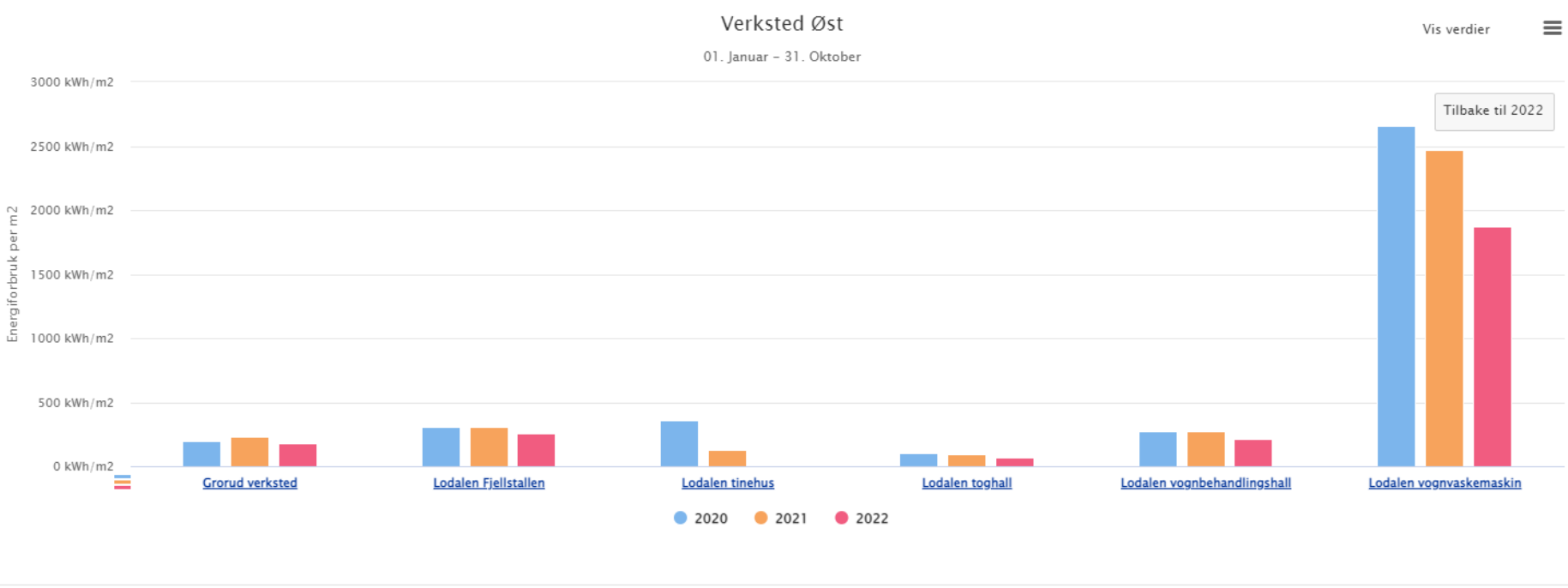


BREEAM = Building Research Establishment Environmental Assessment Method.

Photo: Terje Borud / Bane NOR

Real Estate Division – Benchmarking of existing properties

Energiforbruk pr. m^2 fordelt på eiendomsgruppe: [BNE / Stasjoner Øst / Drammen st.bygn.-bygg A / EL Felles bygg A & B (HM)]



Lukk

Energy efficiency in development projects

- All our big infrastructure projects will now follow the BREEAM NOR Infrastructure (formerly CEEQUAL) methodology.

- This means that our projects will lower its total energy usage to get better carbon footprint on its projects. Electric driven engines use less energy than fossil ones.

BANE NOR

We create the railway
of the future

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