General presentation and introduction

Cold Chain Market in Europe & SWS-PowerBox®

November 2021

1. Cold Chain in Europe a potential market for rail?

Market size EU

USD 75 billion in 2019*

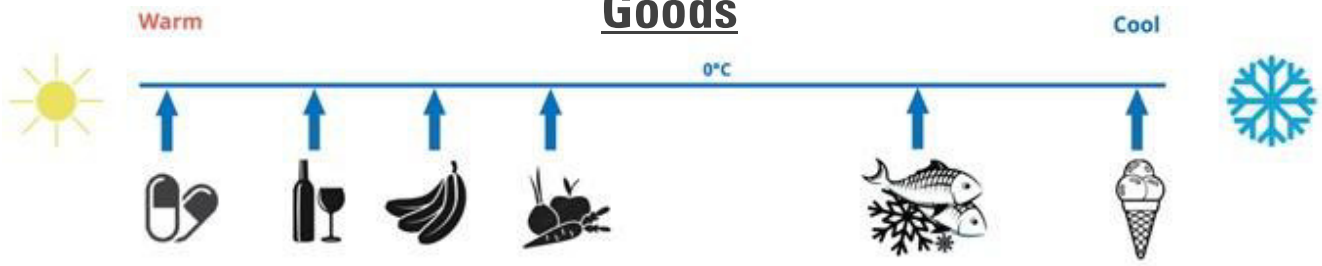
Drivers

- **Modal shift in the EU by 2030**
  "30 by 2030" = increase from 17% to 30%
  Market share of rail freight in the EU
- **Rail** has **6 times less CO2 emissions** than road transport
- **Reduction of** road freight traffic
  (e.g. fine dust pollution due to rubber abrasion by trucks)

Modal share**

- **Road ≈ 90 %**
- **River ship ≈ 4 %**
- **Rail ≈ 2 %**
- **Air ≈ 4 %**

Goods



How do shift a significant part of the cold chain transport market to rail?

* https://lb-aps-frontend.statista.com/statistics/1108444/cold-chain-logistics-market-size-europe/
** Estimation

2. Challenges for the transport market

- X Increasing LCC, fuel prices and maintenance costs
- X Lack of staff especially truck drivers
- X Costs for the emission of CO_2
- X Reduction of noise pollution
- X Road transport further answers on environmental pollution problems e.g. via tire abrasion, NOx, etc. needed
- X Digitalisation with real time information will become an industry standard
- X Until 2021 no eco-friendly solution to transport temperature sensitive goods on rail available

The answer for these challenges for cold chain transport on rail is the SWS-PowerBox®

3. SWS-PowerBox® - Overview

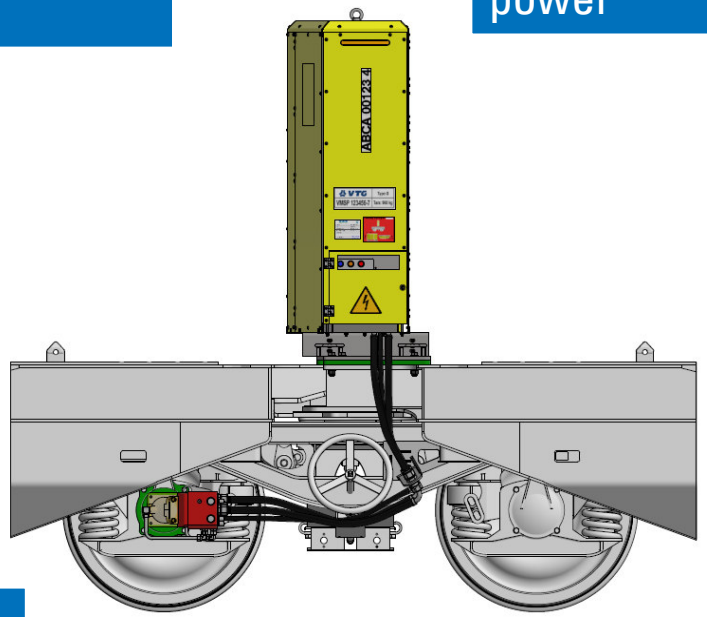
Very low LCC & maintenance costs

Modular concept

No CO_2 emission

No noise pollution

100% eco-friendly



Up to 72 KWh battery power

Using movement energy

Plug & Play principal - easy to install

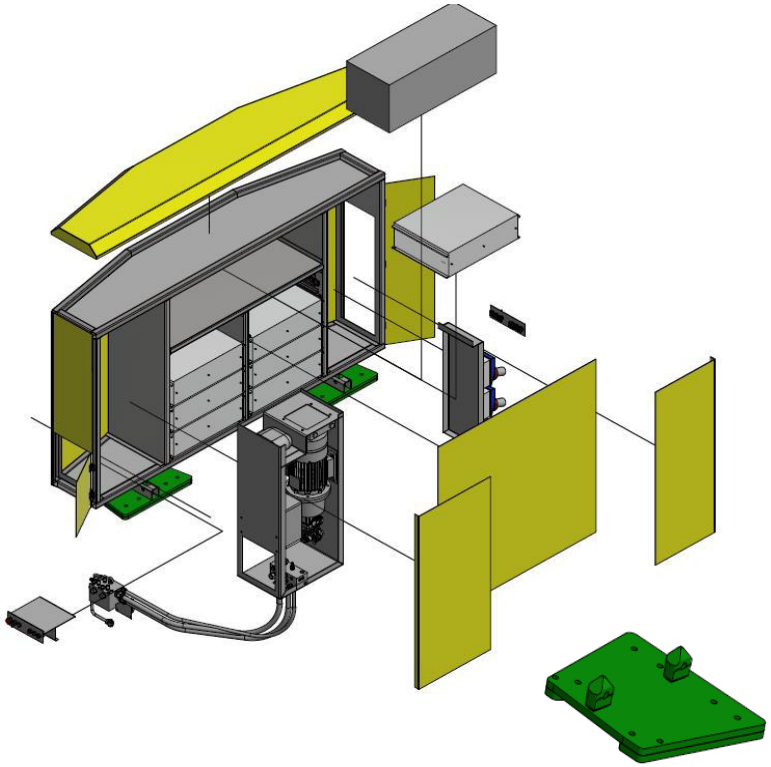
For all common cool container / swap body / trailer types

80', 90' and pocket wagons

4. SWS-PowerBox® - A modular concept

SPECIFICATIONS

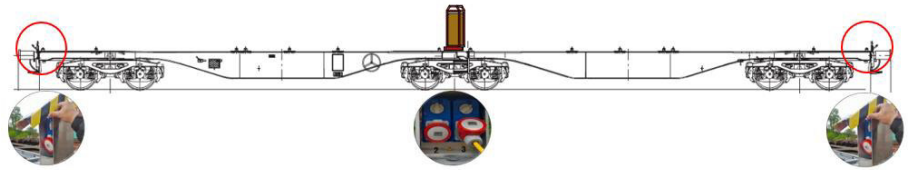
Compact design with Plug & Play technology	Solid steel frame with sheet steel outer casing Real-time monitoring for system management and control
Battery storage system	LiFePO4 battery strings á 9 kWh (High-performance lithium iron phosphate batteries)
Storage capacity	From 18 kWh to max. 72 kWh
Power output	3 x 400V (up to 30 kW)
Plugs	2 x CEE 32A 5-pole 6h 2 x CEE 32A 4-pole 6h 2 x CEE 32A 4-pole 3h 1 x load socket CEE 4-pole 3h on each buffer side
Charging plug @terminal	Type 2 charging socket incl. adapter CEE 32A 5-pole 6h (left and right on each side of the car)
Energy charging system	Through recuperation by means of hydraulics via axle generator with 22 kW
Weight	e.g. model with battery capacity 72 kWh: 1,520 kg



The modular concept enables a quick exchange in case of problems with any components, to avoid expensive downtimes.

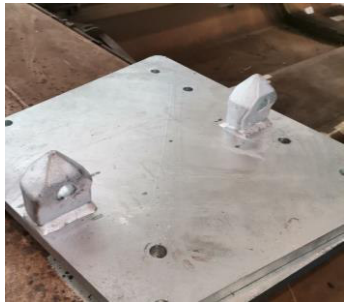
5. Range of applications

The SWS-PowerBox® is positioned on the centre bogie on 80' & 90' as well as TWIN container carrying wagons, which allows maximum use of all common loading schemes

	Rail wagon	Possible Load
	**80' WAGON**	2 x 40' Reefer Container 4 x 20' Reefer Container
	**90' WAGON**	2 x 45' (40') Reefer Container 4 x 20' Reefer Container 4 x 7.45m Refrigerated Swap Body
	**POCKET WAGON**	2 x 45' refrigerated semi-trailer 2 x 45' (40') Reefer Container 4 x 20' Reefer Container 4 x 7.82m Refrigerated Swap Body

6. SWS-PowerBox® - How to install

1 **Mount the adapter plates on the rail wagon**

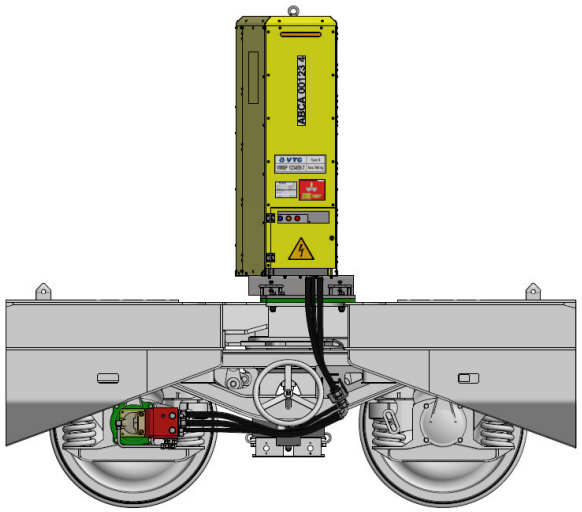


2 **Lift the box on the wagon**

3 **Fixation of the box**

4 **Installation of the axle pump**

5 **Ready to use**



7. How to switch on/off & Grid charging

SWITCH ON

1. Open Plug
2. Plug cable
3. Turn switch to „1“
4. Press start/stop button

SWITCH OFF

1. Turn switch to „0“
2. Pull cable
3. Close the Plug - Standby

Grid charging via type 2 charging plug or via adapter to CEE plug 32A
Battery charging takes place in the terminal or at the loading track via type 2 charging plugs, which are fitted on each wagon side of the SWS-PowerBox®. The software automatically switches to mains operation and charges the batteries.

8. SWS-PowerBox® - Features

Segment	Information	Fulfilment
Homologation	Ready to use and can be operated in all European countries	✓
Operations and Safety	Easy to handle and comply with all safety standards	✓
Monitoring	Real-time monitoring available (actualisation of data every minute) & remote error analysis possible	✓
Maintenance and LCC	3-year cycle, modular components and no significant LCC compared to diesel systems	✓
Environmental aspects	Zero CO2 and no other emissions or noise pollution	✓
Standards	All relevant rail and technical standards are satisfied	✓
Installation	Plug & Play principal, easy to install	✓

9. 20.000 Hours SWS-PowerBox vs. Diesel

Economical comparison

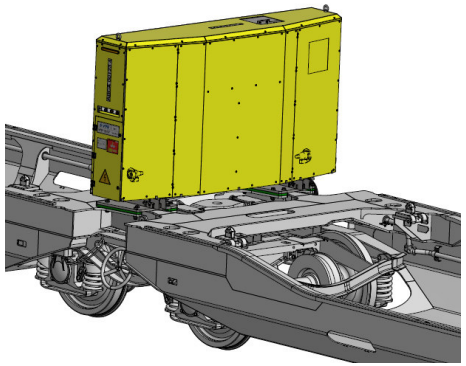
	(A) SWS-PowerBox®	(B) Diesel-powered generator*
Indicative list price	**€ 92.000 per wagon**	**€ 36.000** per wagon**
Specification	63 kWh LiFePO4	Generator GX 36
OPERATING COSTS 20k hours	**€ 22.000**	**€ 230.000 ***
TOTAL COSTS	**€ 114.000**	**€ 266.000**

Diesel + 230% LCC in 20k hrs

Ecological comparison

	(A) SWS-PowerBox®	(B) Diesel-powered generator
CO2-Emissions 20k hours	**0 tonnes per Box**	**326 tonnes per Generator**
Price per tonne CO2	EUR 25	EUR 25
TOTAL COSTS	**€ 0**	**€ 8.150**

Over 50% Cost savings



326 TONS

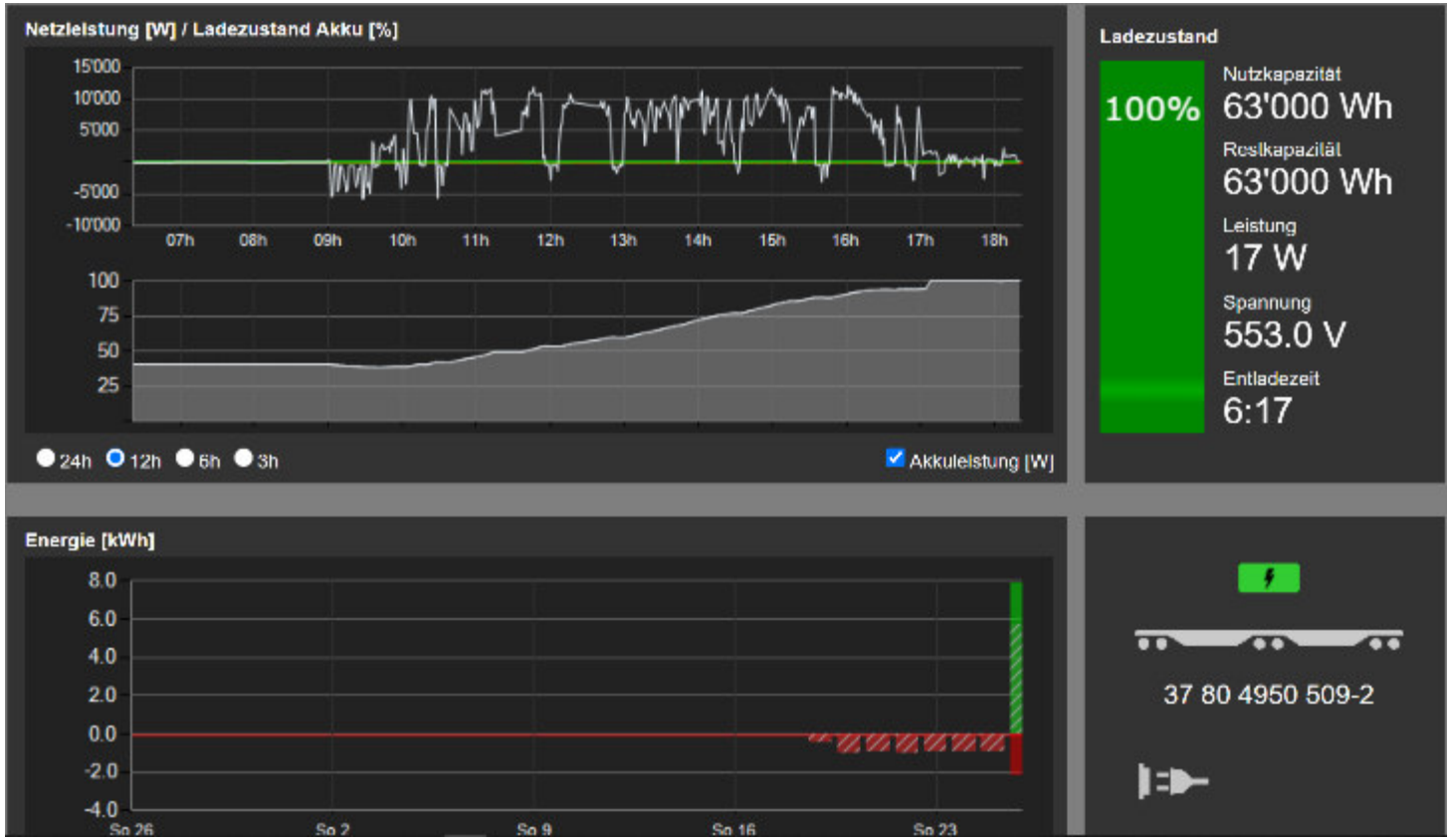
CO_2 SAVINGS

**The costs are estimated values*
***Replacement acquisition necessary after 10.000 hrs*
****Diesel price EUR 1.55 per liter, 400 liter tank, 6.15 liter per hr., max. 65h operational time per filling, 500hrs maintenance interval*

10. Tests

Test run Norway - Departure

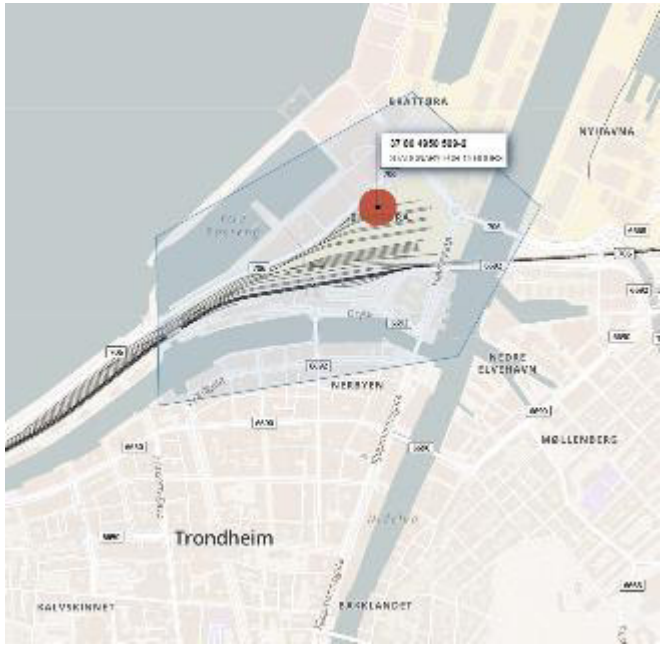
Remote Monitoring 26 August 2020, 18:21



26.08. - 9:00 Reefer loaded
26.08. - 9:30 Departure

Test run Norway - Arrival

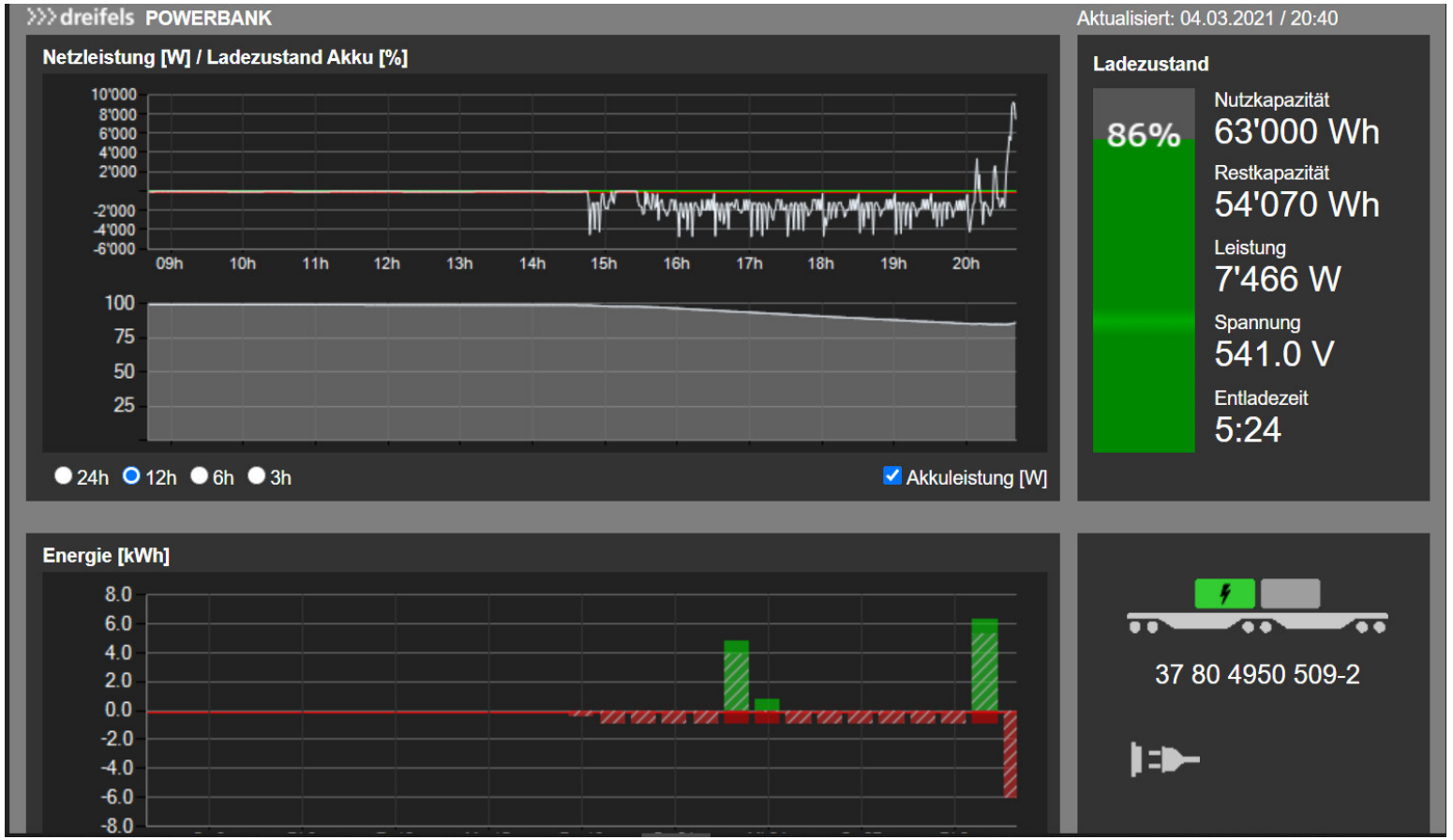
Remote Monitoring 27 August 2020, 08:26

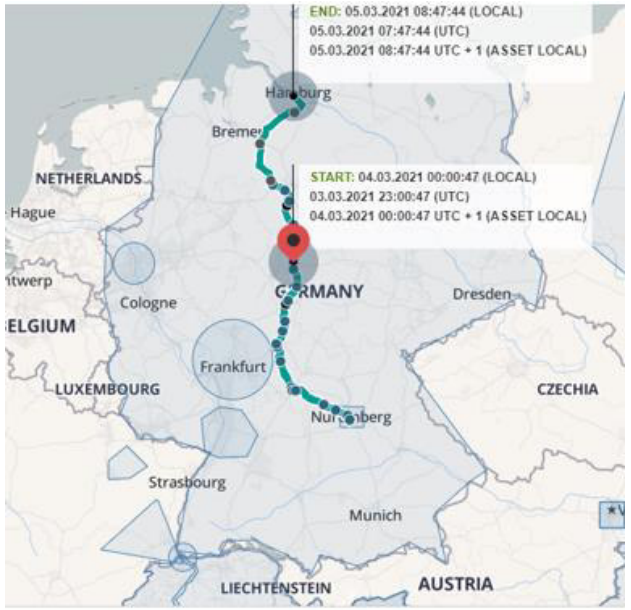


26.08. - 18:30 Arrival
27.08. - 06:45 Reefer unloaded

Test run 1 Germany - Departure

Nuremberg – Hamburg | Remote Monitoring 4 March 2021, 20:45

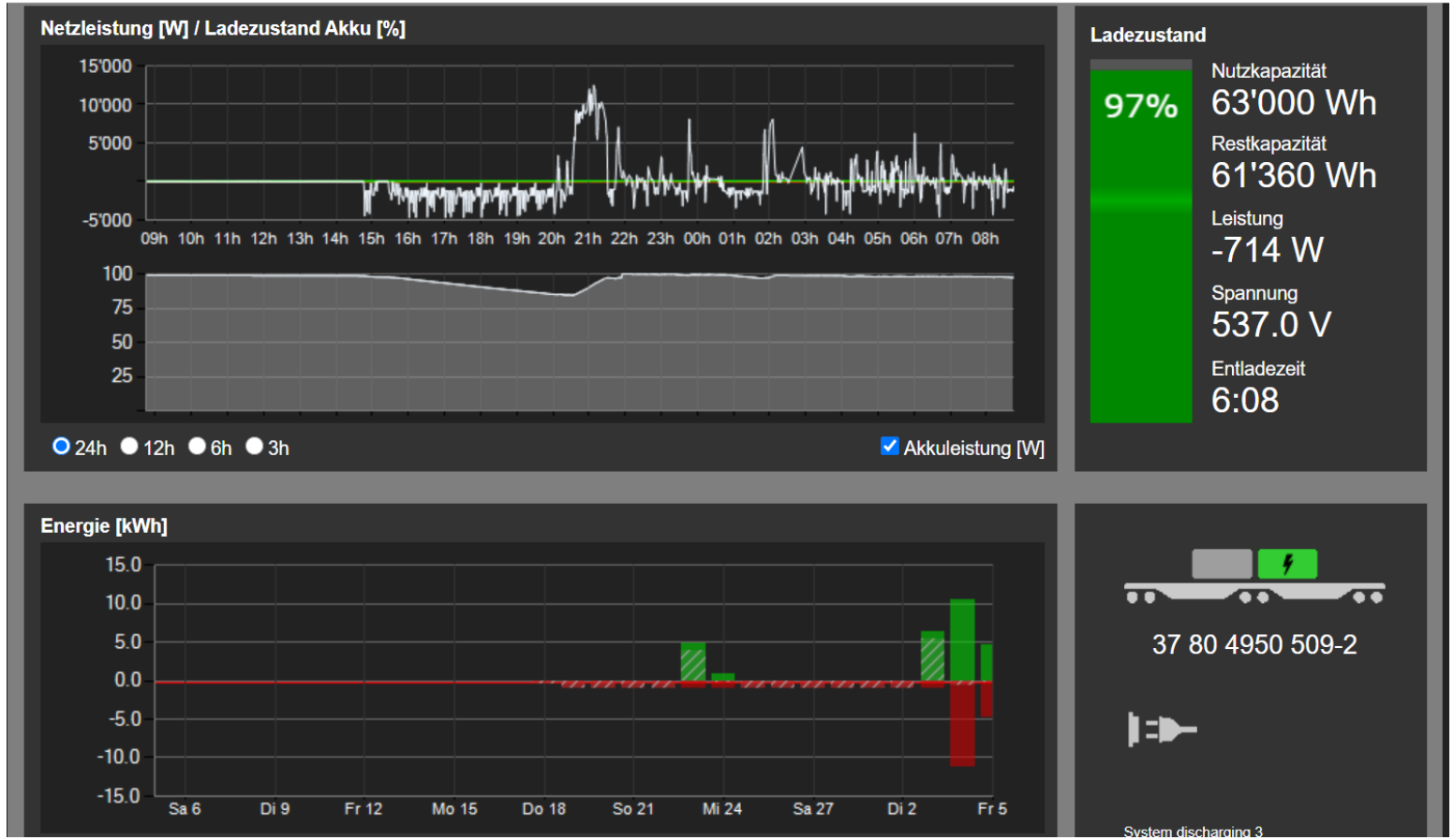


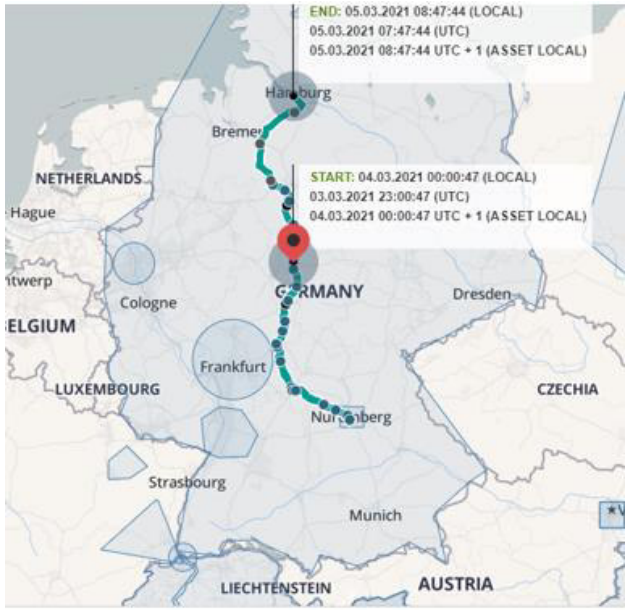


04.03. - 14:45 Reefer loaded
04.03. - 20:00 Departure
Reefer inside temperature 0°C

Test run 1 Germany - While driving

Remote Monitoring 5 March 2021, 08:44



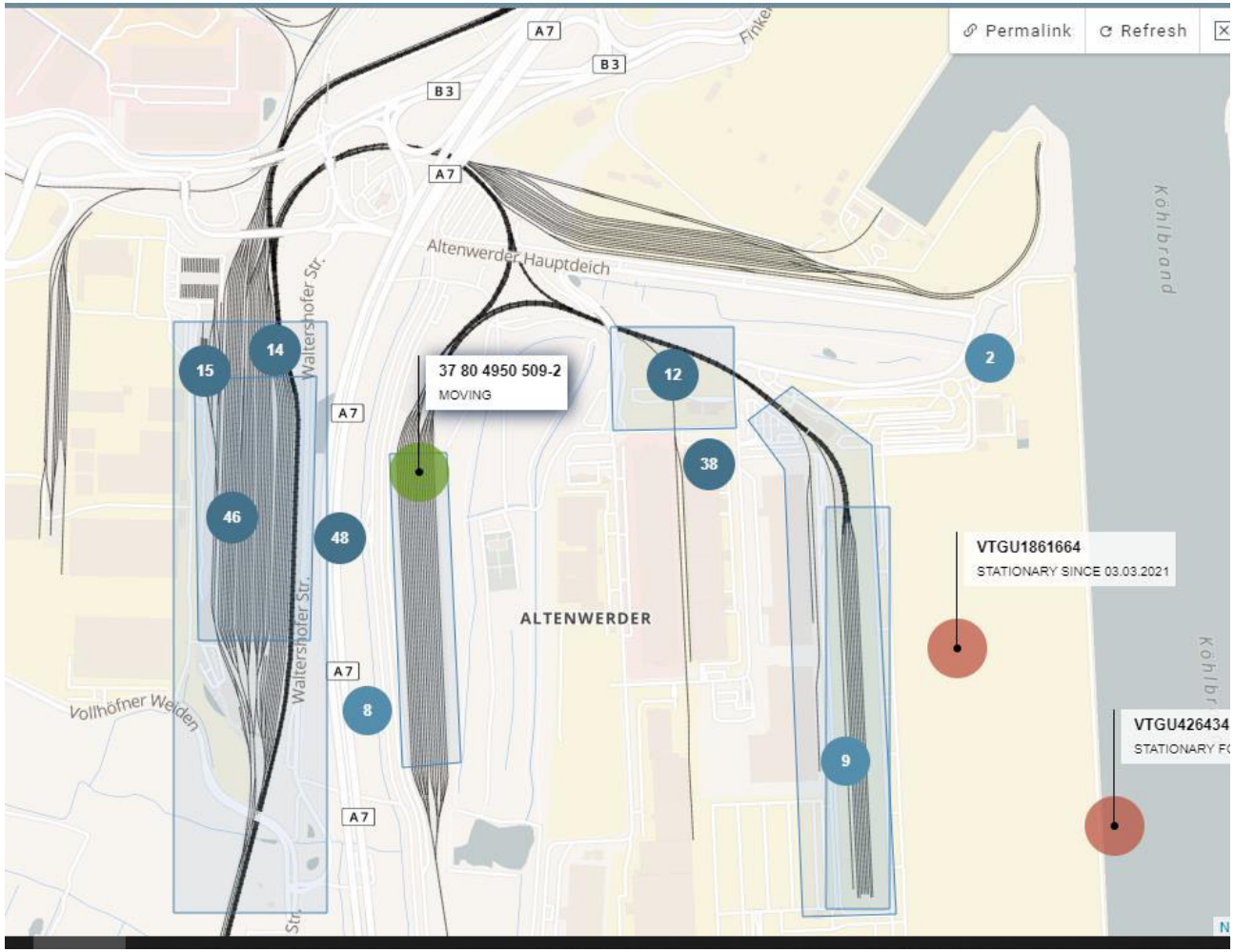


04.03. - 14:45 Reefer loaded
04.03. - 20:00 Departure
05.03. - 08:47 Arrival Hamburg

Test run 1 Germany - Arrival

Arrival in Hamburg Altenwerder

5 March 2021, 08:44



Test run 1 Germany - Arrival

Arrival in Hamburg Altenwerder

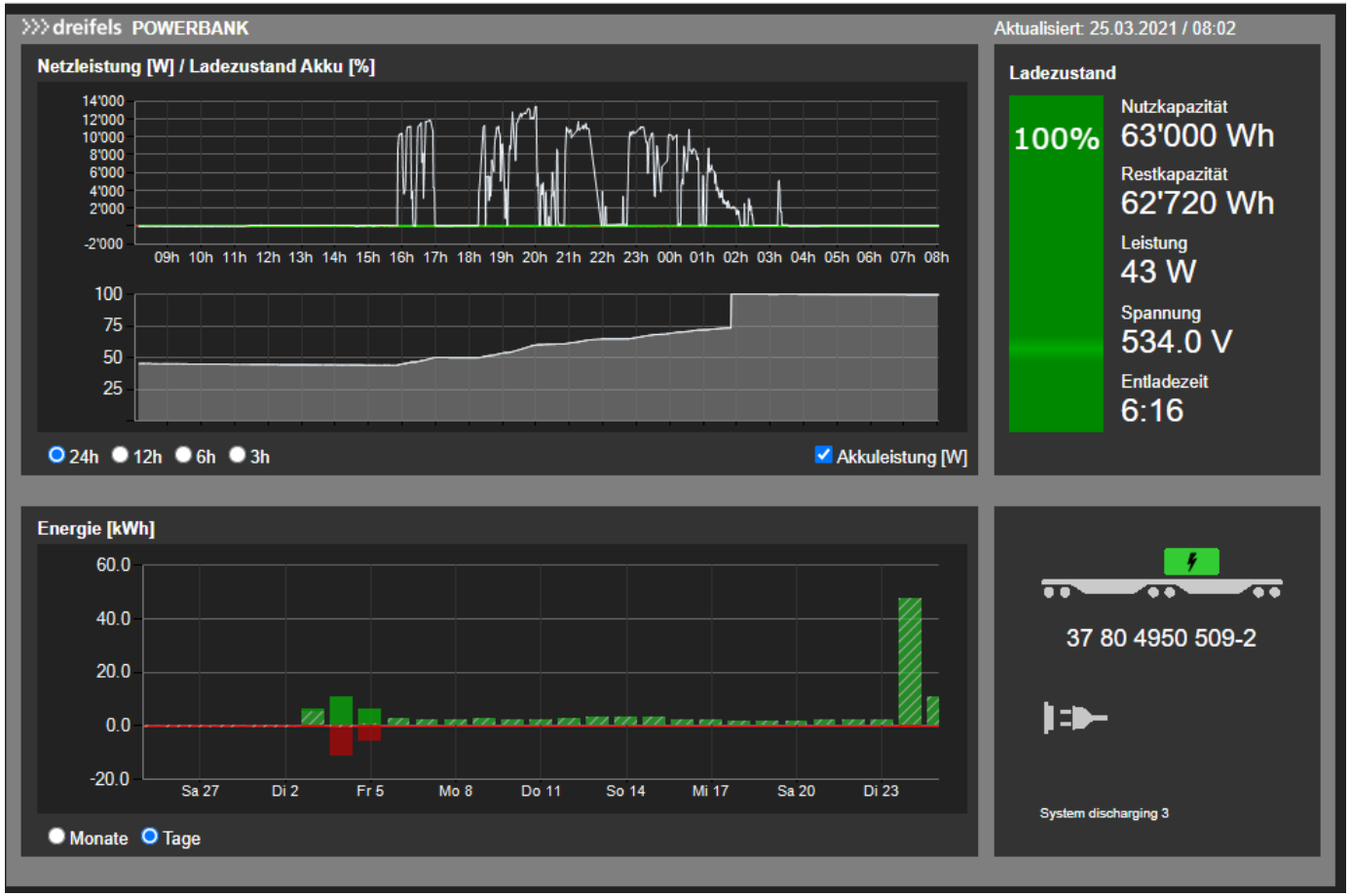
5 March 2021, 08:47

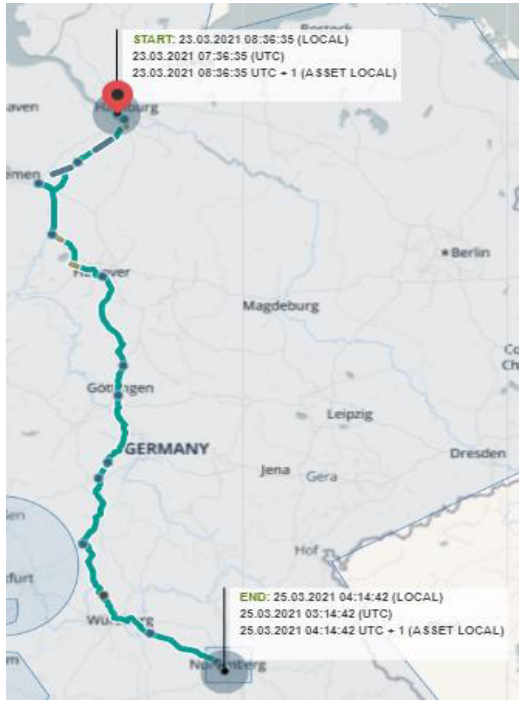
Reefer interior temperature 0°C

Outside temperature 0°C to 15°C

Test run 2 Germany - Departure/Arrival

Hamburg – Nuremberg | Remote Monitoring 25 March 2021, 08:02

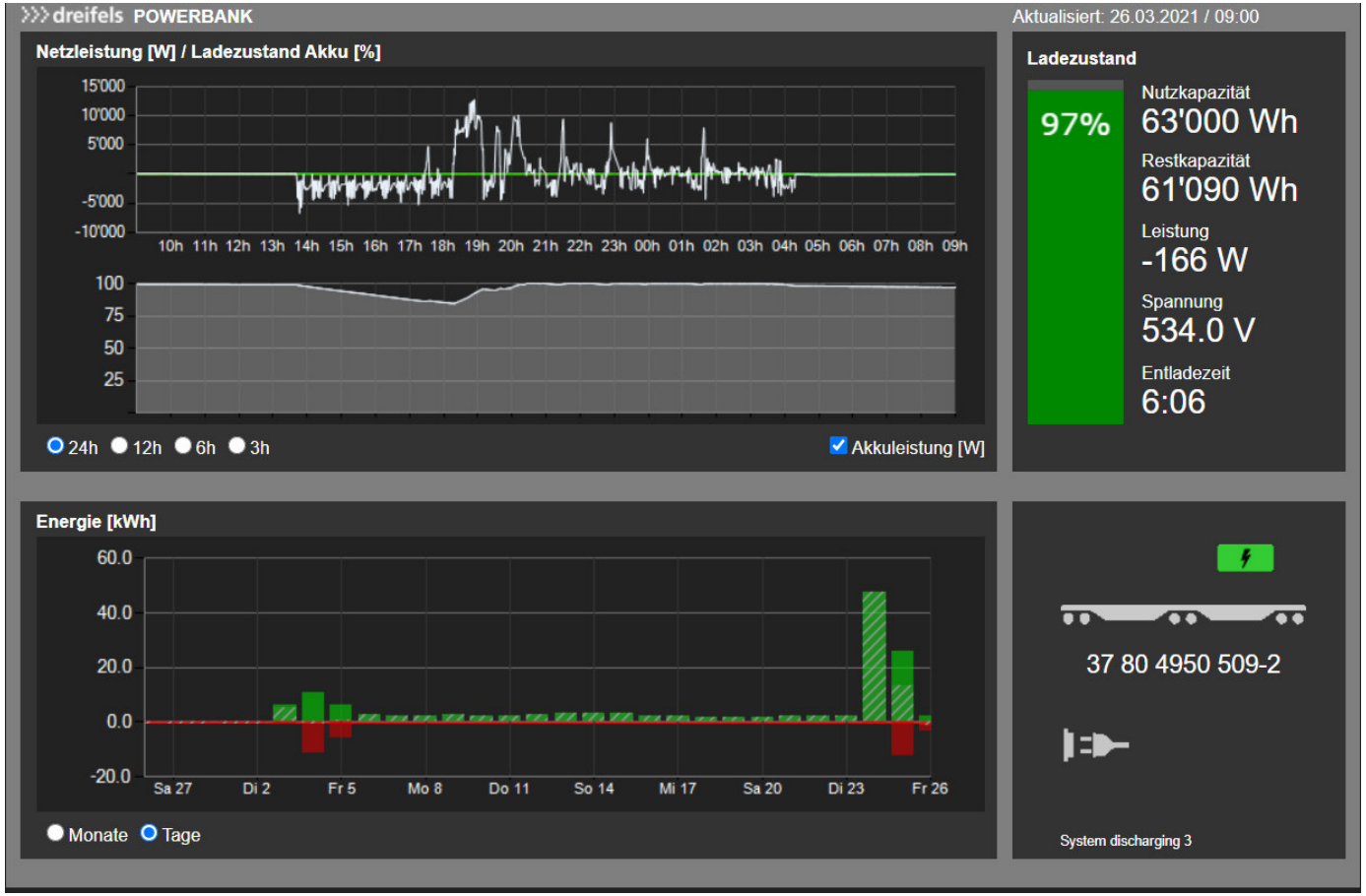


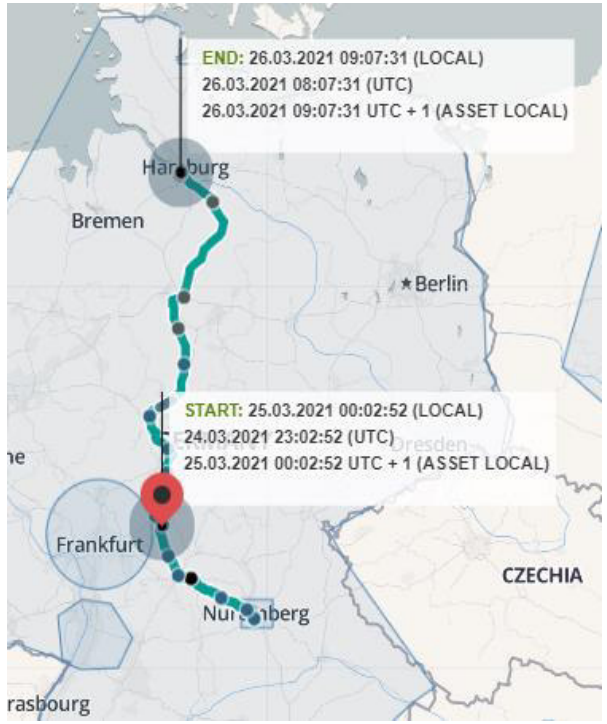


Empty back to Nuremberg
25.03. - 04:14 Arrival, fully loaded

Test run 2 Germany - Departure/Arrival

Back to Hamburg | Remote Monitoring 26 March 2021, 09:00





25.03. - 13:45 Reefer loaded
25.03. - 17:30 Departure
26.03. - 04:30 arrival + reefer unloaded

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