



WIRTSCHAFTSKAMMER WIEN
DIE INDUSTRIE



Hybrid rail systems



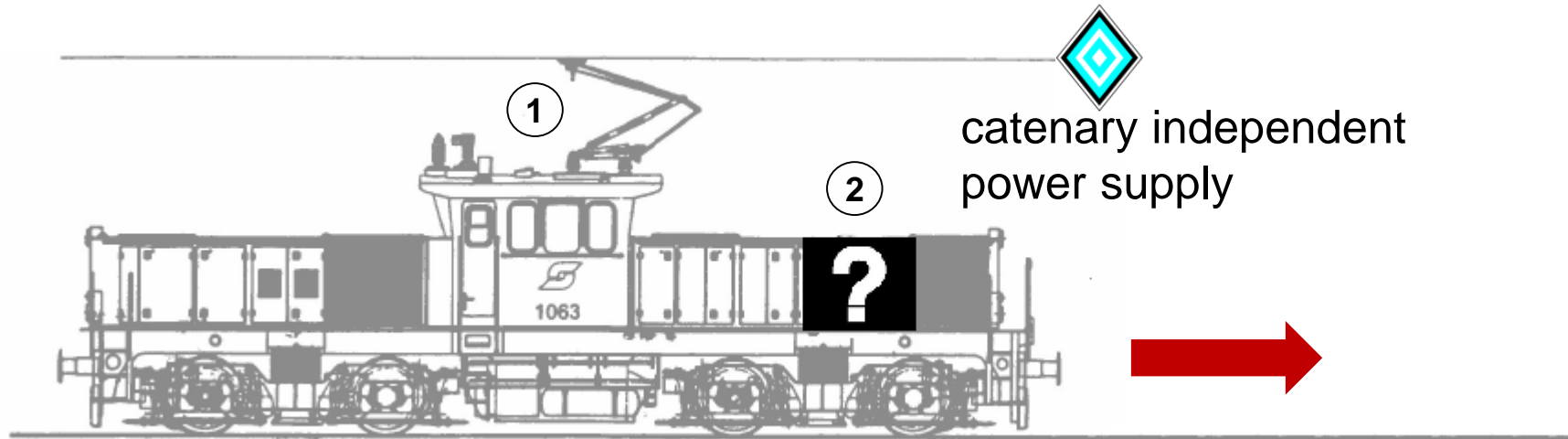
eHybrid shunter

V1.0
Harald Tisch

- Shunting operations often have to be done with diesel locomotives, although the predominant use is under the electric power line.
- Electric locomotives can not be used because of short distances without catenary (e.g. for freight loading).



Electric power from the catenary



- physical work at least 720.000 kJ
- Power at wheels 150-200 kW
- Possibility to recharge under the catenary

no exhaust emissions /
CO₂-free



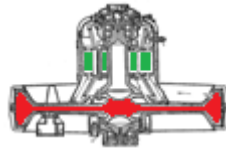
noice reduced



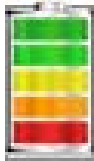
cost-optimised



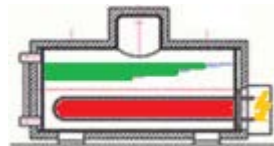
- Flywheel mass



- accumulator



- steam boiler



- non-target:
combustion engine



- kinetic energy

- chemical/electric energy

- compressed air-/thermic energy

- other

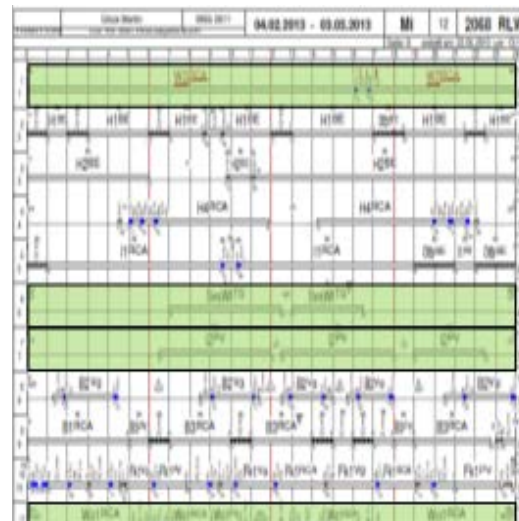


ÖBB-Produktion GmbH checked all existing diesel loco services under the boundary condition of "max. 2 hours performance without catenary":

Results:

48 fields of application were identified.

For rail construction efforts up to 40 additional use cases could be possible .



4 partners for the feasibility study

January – June 2015

Zweissystem Lok zur Überbrückung Oberleitungsfreier Arbeitsbereiche	VOITH Turbo GmbH
Elektrische Lokomotive mit zusätzlichem Akku-Energiespeicher für oberleitungsfreien Betrieb	Molinari Rail Austria GmbH
	Vienna University of Technology - Institute for Mechanics and Mechatronics, E325
Elektrolok mit Wasser-Elektrolyse-/Brennstoffzellen-Technologie für Vershub in Eisenbahnnetzen mit und ohne Fahrleitung	HET Hochleistungs-Eisenbahn- und Transporttechnik Entwicklungs
	Montanuniversität Leoben - Institut für Elektrotechnik
	Deutsches Zentrum für Luft- und Raumfahrt e.V.
Machbarkeitsstudie für einen Energiespeicher auf elektrischer Vershublokomotive Rh1063 für Betrieb ohne Oberleitung	Tecsol

VOITH

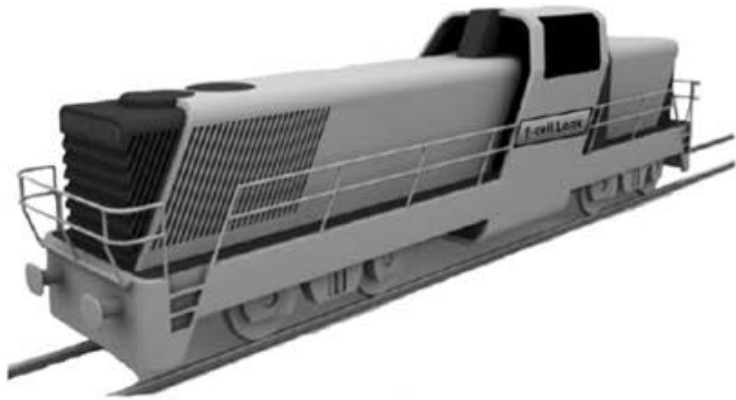


MOLINARI



Other separated applicants

Elektrische Lokomotive mit zusätzlichem Supercap- und Akku-Energiespeicher für oberleitungsfreien Betrieb	Molinari Rail Austria GmbH
	Vienna University of Technology - Institute for Mechanics and Mechatronics, E325
Elektrische Lokomotive mit zusätzlicher Brennstoffzelle für oberleitungsfreien Betrieb	Molinari Rail Austria GmbH



Hybridlocomotive based on H₂-fuel cell
(the fuel cell works as range extender)



Battery energie storage (LiFePo₄) with
supercaps for shunting operations
without catenary and charging during
catenary operation



eHybrid shunter

Battery energie storage (LiFePo4) with supercaps



Construction works

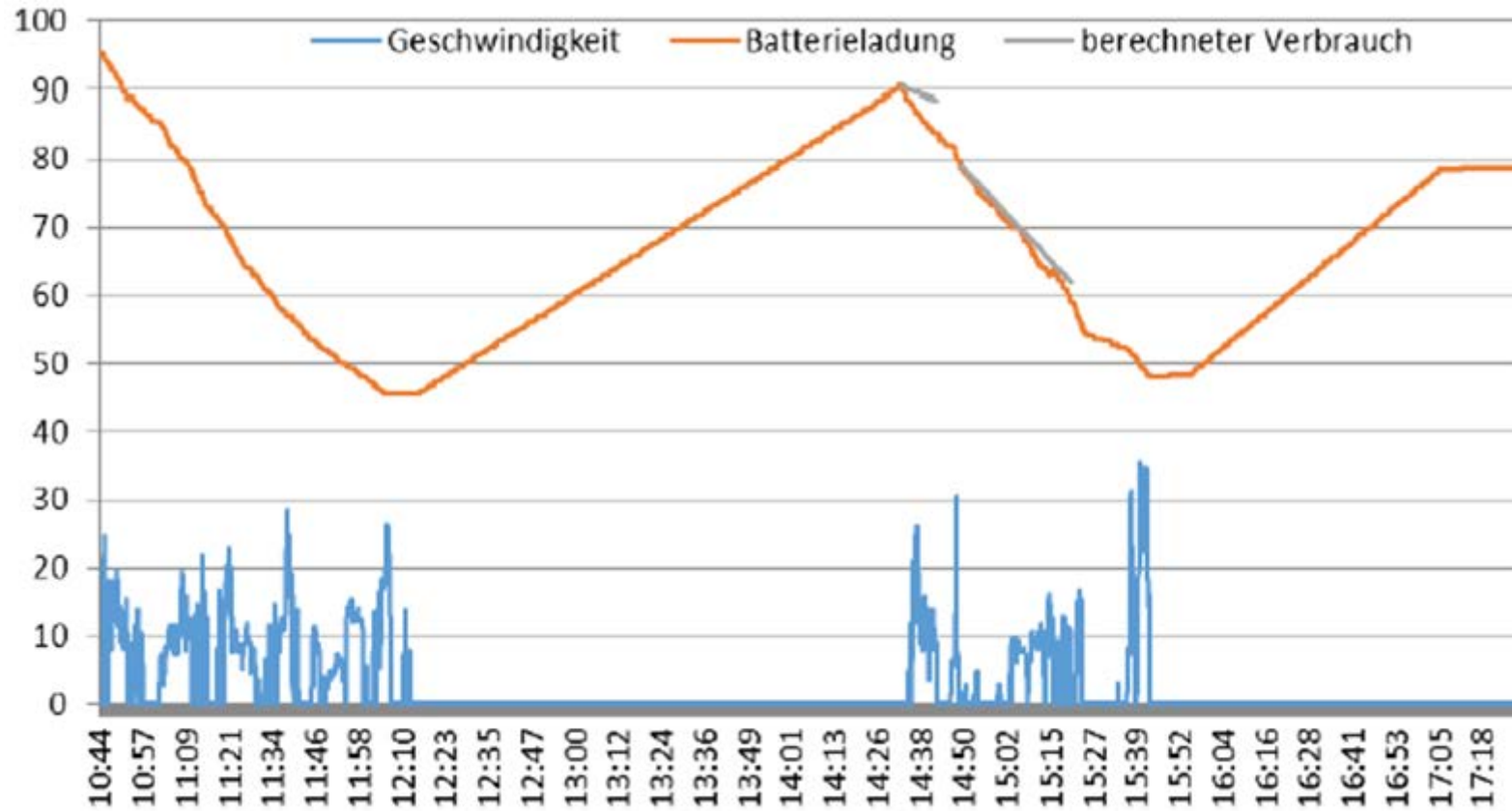


eHybrid shunter

heavy haul test run at AB Leoben



Test Run at AB Leoben



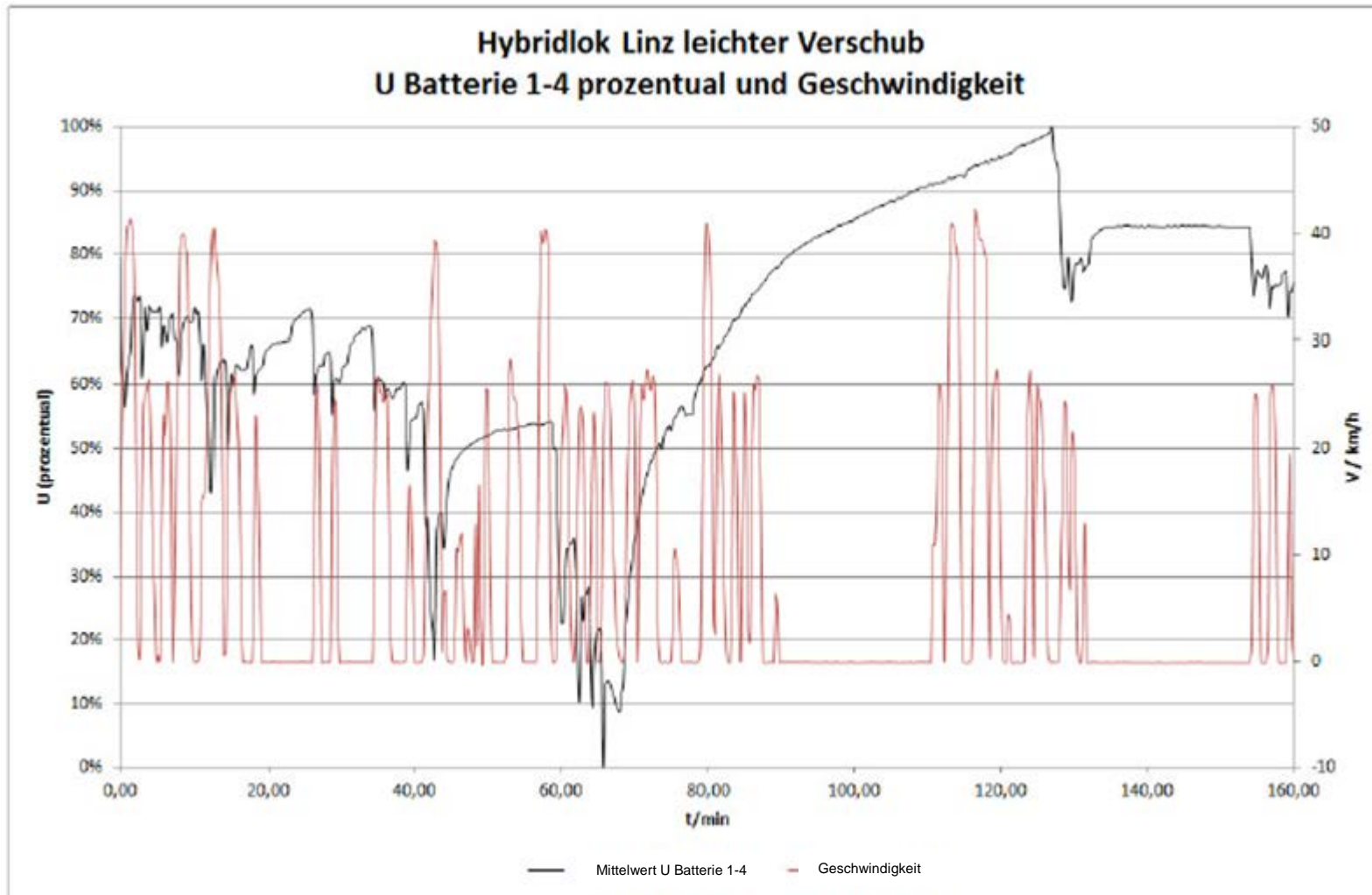
Construction works



eHybrid shunter

test run at Attnang Puchheim





eHybrid shunter (battery solution)

Next steps: tender process



Variant 1:

New
Procurement
eHybrid



Variant 2:

Refurbish-
ment
eHybrid



- **Repowered Loco Type 2068**
- With approvable **Zero-Emission** propulsion
 - Using a **Mobile Generator Unit (MGU)** which should be proven and approvable
 - Integration of a hybrid electric unit
 - Scalable to 1.000kW
- **Project should be implemented in 2 Steps**
 - Step 1: elektrification of the power train
 - Step 2: electric supply of the power train
- **depending on the Business case (shunting yard, area service, service train, work train) two specifications are possible:**
 - Battery + Fuel Cell – Hybrid
 - Batterie + Fuel Cell + Supercap (Tribrid)





Questions?



DI Harald Tisch

System engineering

Rolling stock

ÖBB-Produktion GmbH

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More Information: <https://konzern.oebb.at/de/nachhaltigkeit/klima/die-e-hybridlok-rollt-an>

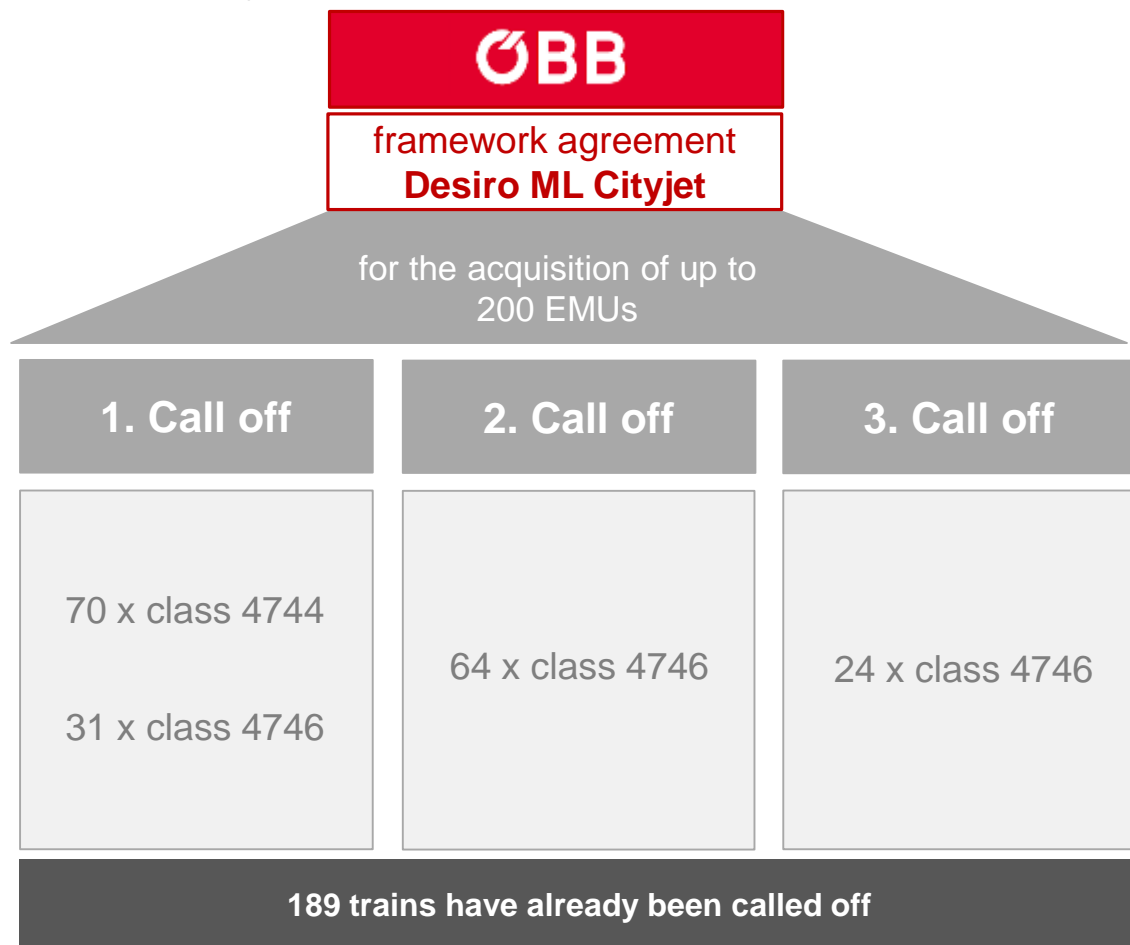


project Cityjet eco

V1.0

Thomas Gerstenmayer

Projekt Implementation Desiro Main Line



motivation

To develop an EMU which could switch to battery power for use on non-electrified lines, and which running on electrified lines



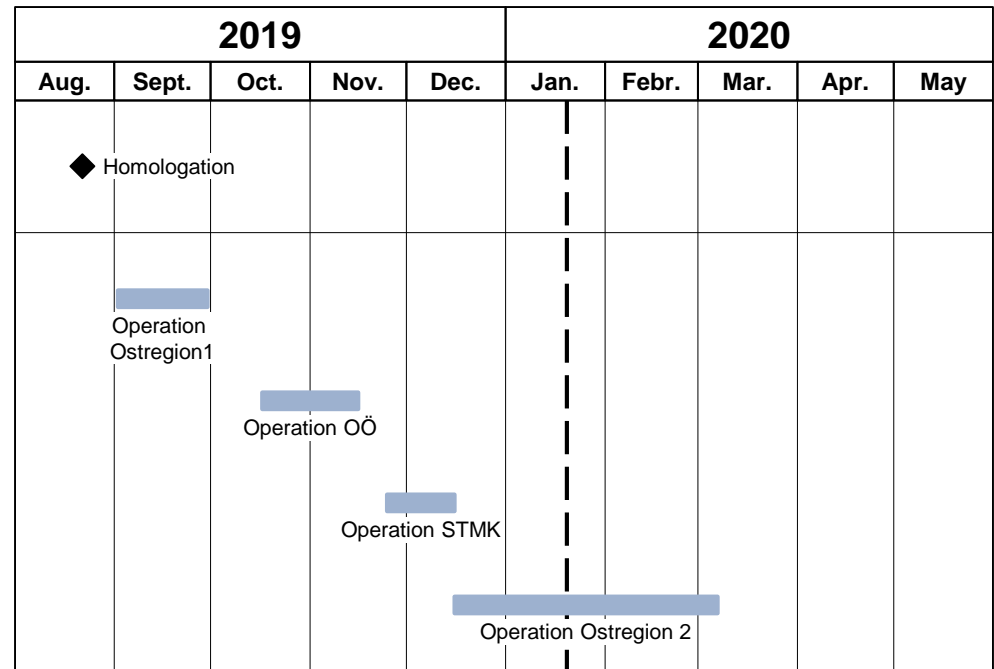
The 24 vehicles from the 3rd supply contract are equipped with a pre-equipment, which makes the conversion to battery vehicles possible.

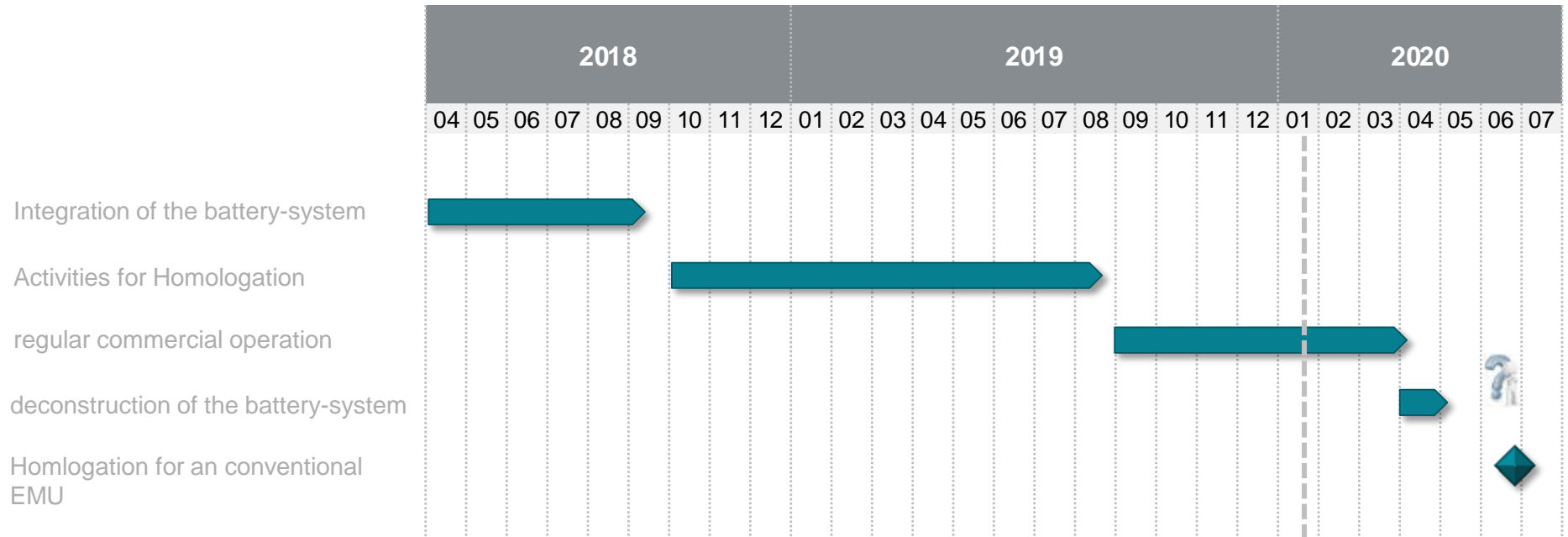
Pilotproject Cityjet eco



Objective: To create a short-term option for the replacement of diesel vehicles in regional rail transport

- The Cityjet eco is the first battery train approved according to European standards
- Since 02.09.2019 the vehicle is in use in passenger service
- The operation was almost trouble-free and all travel times could be maintained
- Parallel to the pilot vehicle, a series solution and a concept for charging stations is being worked on
- The 24 (+11) vehicles from the 3rd supply contract are prepared for the extension to battery-hybrid vehicles



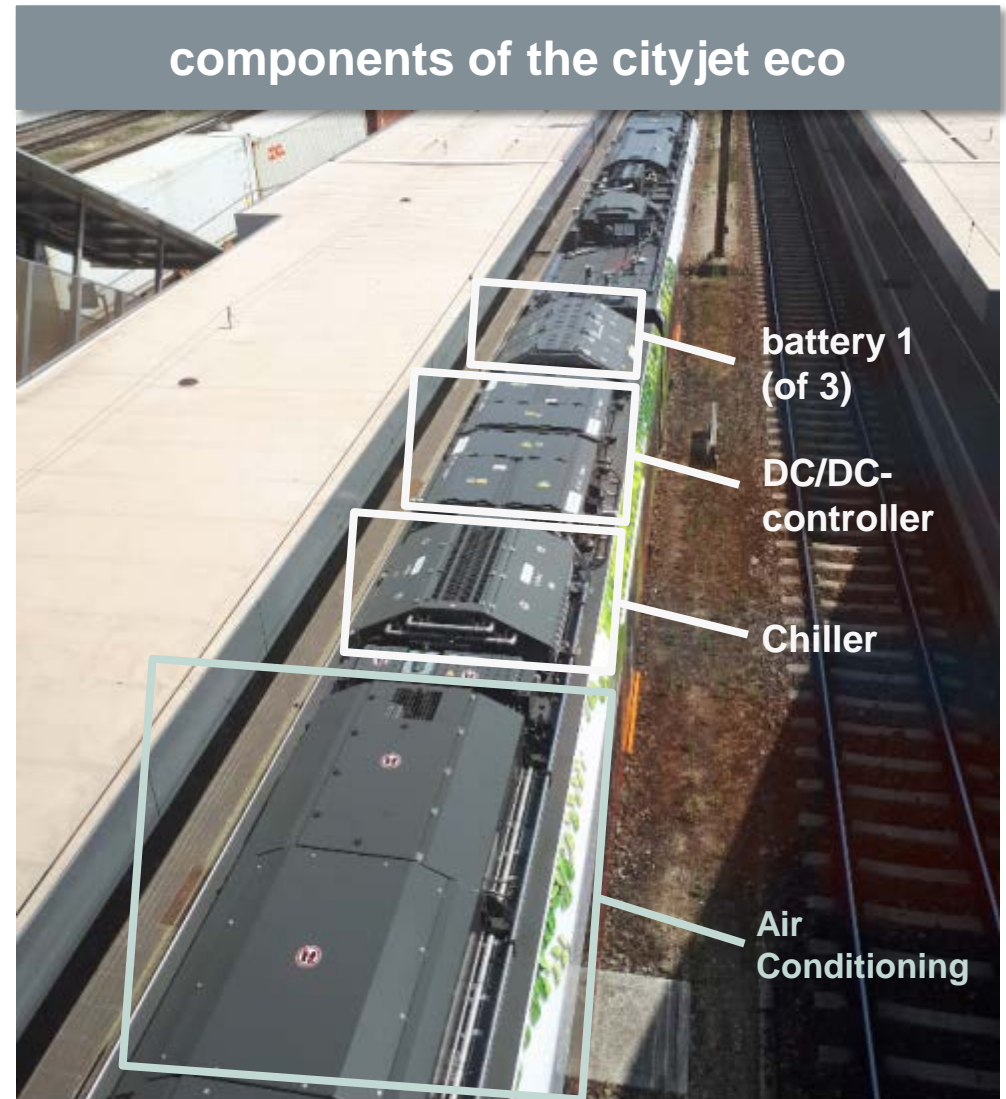


the Project is a cooperation between the ÖBB Personenverkehr und Siemens Mobility



The Desiro ML Cityjet vehicle concept is predestined for extension to a battery-powered vehicle

advantage: the complete battery equipment can be accommodated on the centre car



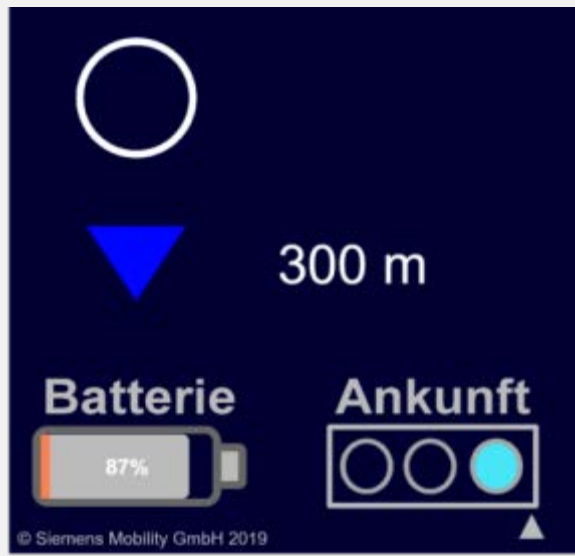
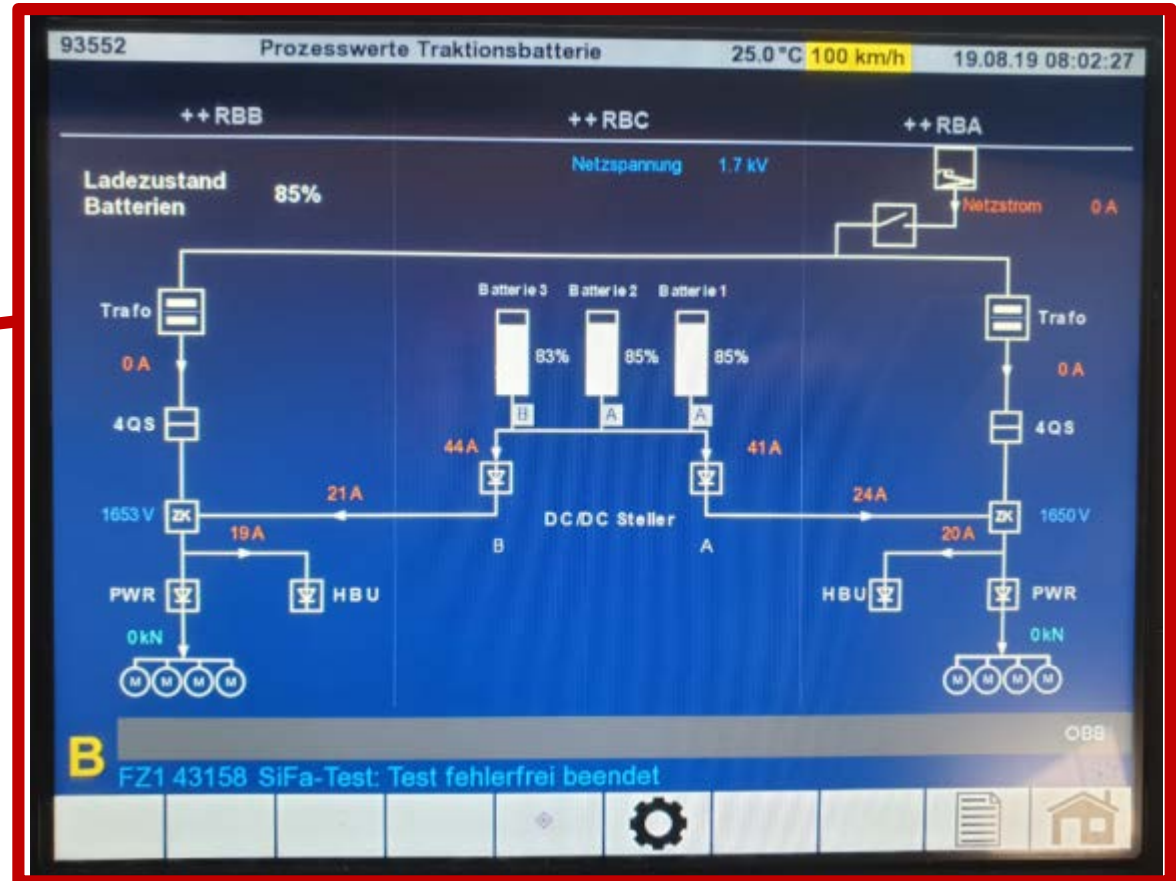
The **battery system** includes:

- 3 battery container
- 2 DC/DC controllers
- 1 chiller (for cooling/heating)



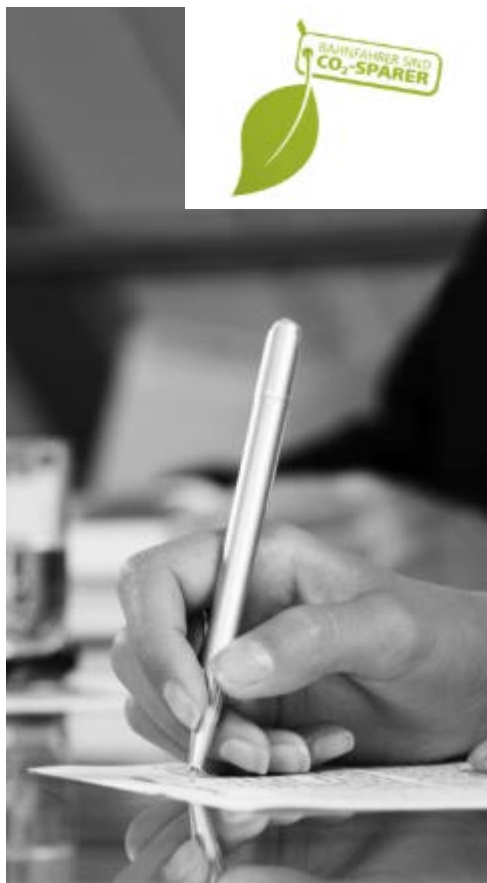
Cityjet eco

visualization of the battery-system



In the project, importance was attached to ease of use and little training effort.

Additional, a Driver-Assistance-System was developed in the project to signalize the range forecast and to give recommendations for the most energy-efficient driving style



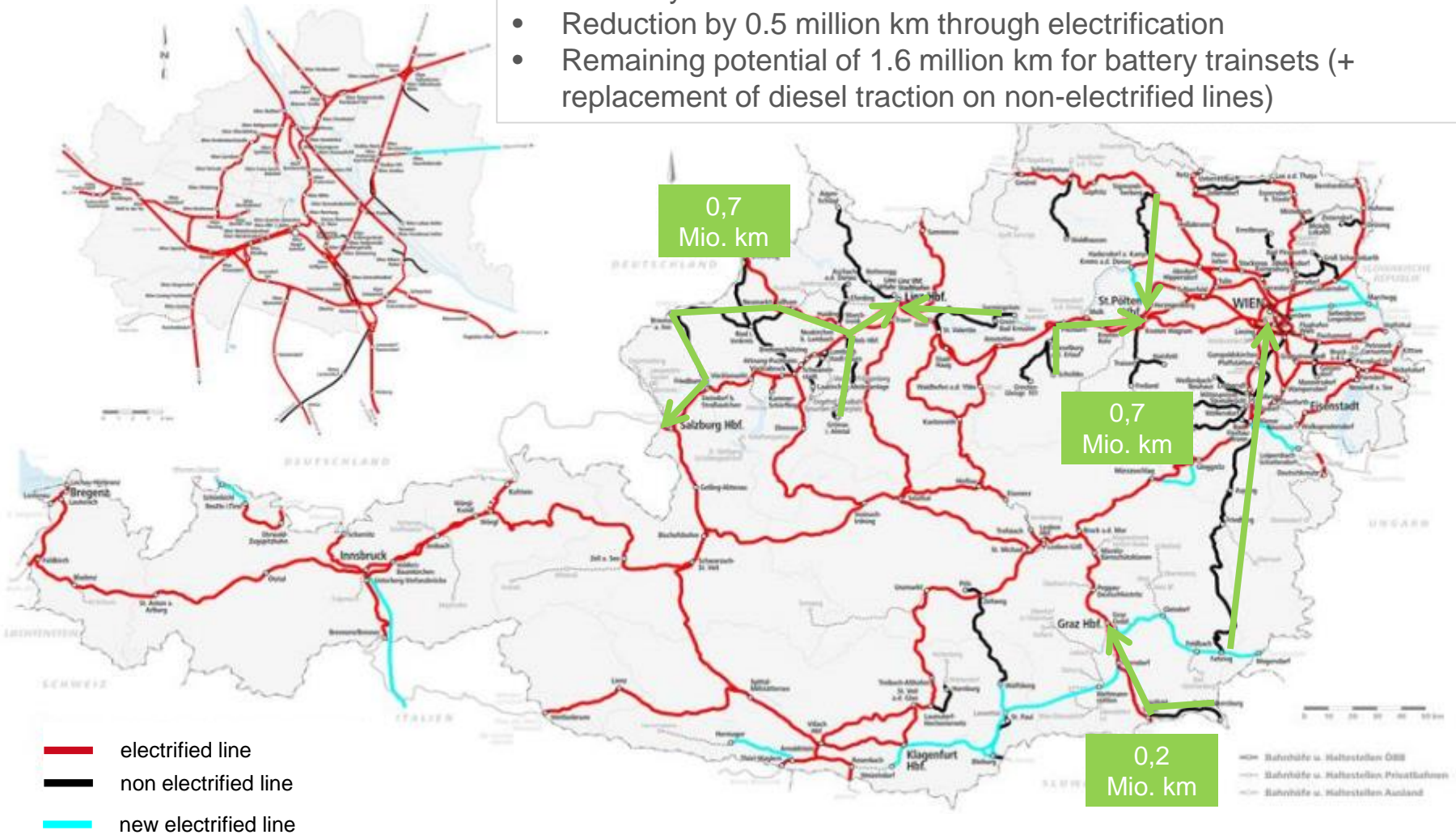
Social benefits

Benefits for operators and passengers

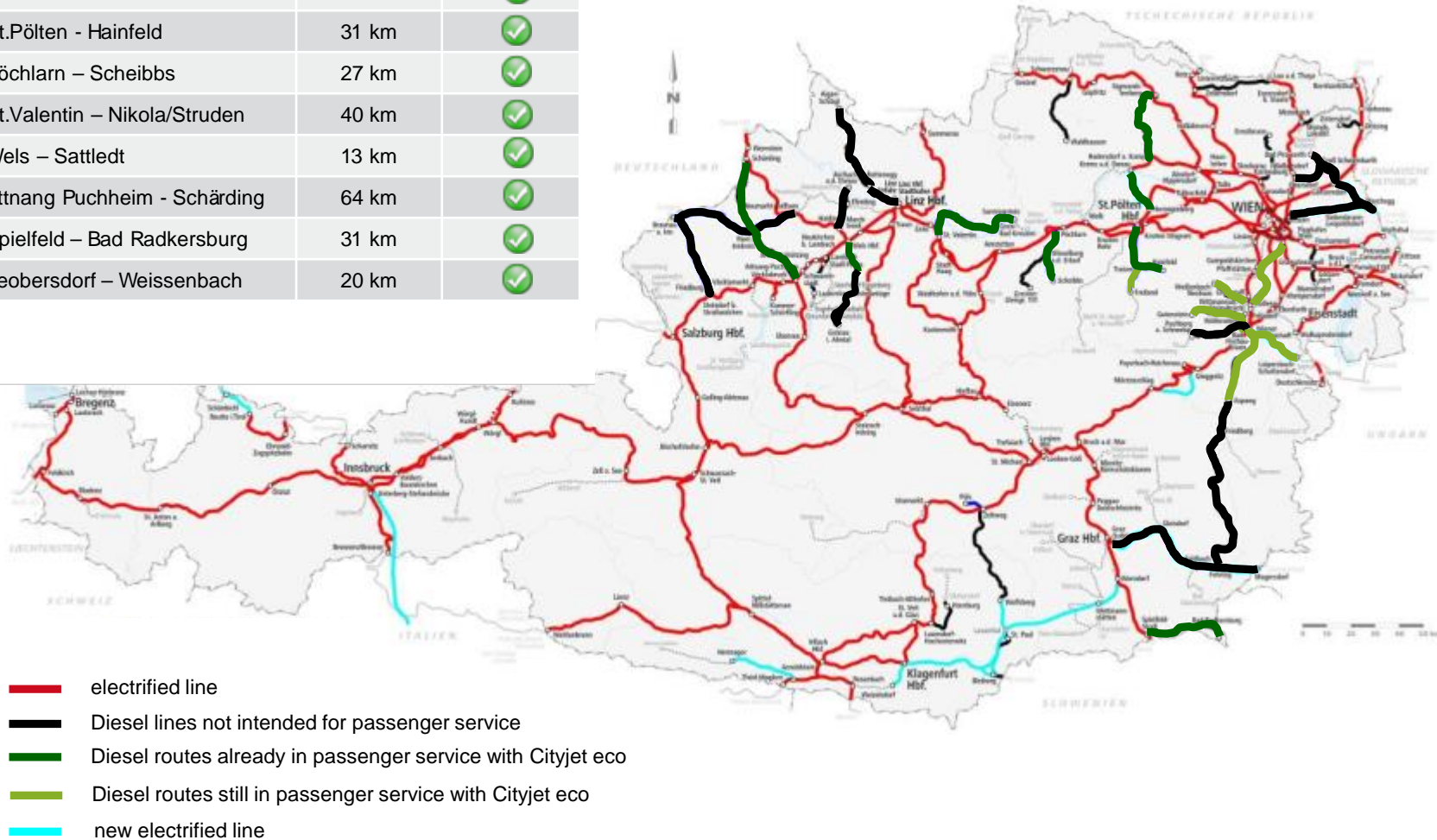
- 1 Lower costs**
The total cost of ownership (TCO) of a battery train is lower compared to conventional diesel trains
- 2 Reduced emissions**
Reduction of CO₂, NO_x and particulate emissions
- 3 Noise reduction**
Compared to diesel vehicles, the noise level is reduced. Especially in the station, for example in preheating mode
- 4 More flexible operation**
through battery railcars and conventional EMUs, fleet standardization, new connections can be offered
- 5 Avoidance of infrastructure costs**
Avoidance of expensive, uneconomical electrification projects through the use of battery trains
- 6 Greater comfort and fewer transfers**
Direct connections, shorter travel times and greater comfort
→ increased passenger numbers



- Currently 2.1 million train-km in diesel traction "under contact wire".
- Reduction by 0.5 million km through electrification
- Remaining potential of 1.6 million km for battery trainsets (+ replacement of diesel traction on non-electrified lines)



Route	Length (1 Direction)	Result
Herzogenburg - Krems	20 km	✓
Hadersdorf - Horn	35 km	✓
St.Pölten - Hainfeld	31 km	✓
Pöchlarn – Scheibbs	27 km	✓
St.Valentin – Nikola/Struden	40 km	✓
Wels – Sattledt	13 km	✓
Attnang Puchheim - Schärding	64 km	✓
Spielfeld – Bad Radkersburg	31 km	✓
Leobersdorf – Weissenbach	20 km	✓





Implementation Desiro Mainline



- 1st ETCS Baseline 3.4 Implementation worldwide
- Power Systems 15kV/16.7Hz~ and 25kV/50Hz~
- Homologation for 4-fold traction

ERA-TV

- Desiro ML cityjet **BL04.23a**
- Class 4744
- Class 4746

4th Railway Package	Baseline 3.0 Homologation for the final concept for 24 (+11) battery trains		Homologation AUT Class 4746 & 4744 PZB & ETCS Only the subject areas that have not yet been assessed for BL 1.0 and BL 2.0.
	Baseline 2.0 Homologation for 24 (+11) pre-equipment battery trains		Extension of Homologation AUT Class 4746 & 4744 PZB & ETCS
3rd Railway Package	Baseline 1.0 Homologation for battery Prototype		Homologation AUT Class 4746 PZB
	Baseline 4.23 Homologation for conventional Desiro ML		AUT & GER Class 4744 PZB & ETCS Class 4746 PZB & ETCS

Fullfillment of all TSI's and NNTR's

TSI = Technical specifications for interoperability

NNTR = notified national technical rules



cityjet- **eco**



Both railway companies and customers benefit from battery-powered rail transport

Together with our competent partner, we have developed an alternative to diesel traction on partially or non-electrified railway lines

The vehicle is tested in real operation and optimisations are carried out on the basis of the findings

the aim is to develop and implement the ideal solution





Questions?



Thomas Gerstenmayer, BSc

Project Management Vehicle Implementation

Urban and regional transport

ÖBB-Personenverkehr AG

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More Information: <https://www.oebb.at/de/neuigkeiten/cityjet-eco.html>



H2 multiple unit

V1.0

Martin Priessnitz

advantage

Big range
Concept of operation
comparable to diesel railcar

disadvantage/challenge

H2-Infrastruktur has to be build
low energy efficiency (compared to
electricity from catenary)

various european vehicle manufacturers (passenger traffic)

- Alstom → series production
- Siemens → in developement
- Stadler → in developement



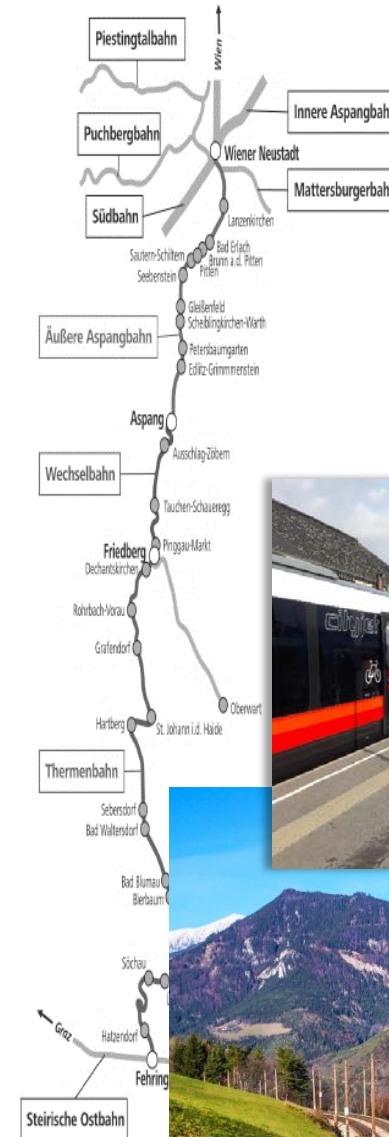
H2 multiple unit

Pioneer project H2 Aspangbahn



Vorhaben

- Innovative project to test two approved **H2-multiple units** (including maintenance & filling station) **in passenger traffic**
- Main application area **Aspangbahn**: geografic challenging diesel line
- **Project goals**
 - extensively **testing of H2-multiple units in regular operation (passenger traffic)**
 - **development of H2 Know-how** (technical, operational, economical / approval, logistic) as basis for future **System decision making (H2/Akku)** for lines which **are not intended to be electrified**
 - Pilot run serves as a **supplement to the Elektrifizierung program**
 - Use of „**green certified**“ **hydrogen from Austria**
- **Project timetable**
 - **Concept project** spring 2019 (project principal: **A. Matthä**)
 - **preparation project** 07/2019-03/2020
 - **projected use in passenger traffic**: 04/2020-07/2020
- **Partner**: ÖBB (Personenverkehr, Produktion Technische Services, Infrastruktur, Holding), Alstom, Air Products, austrian technical offices, inside the train: components of austrian manufacturers



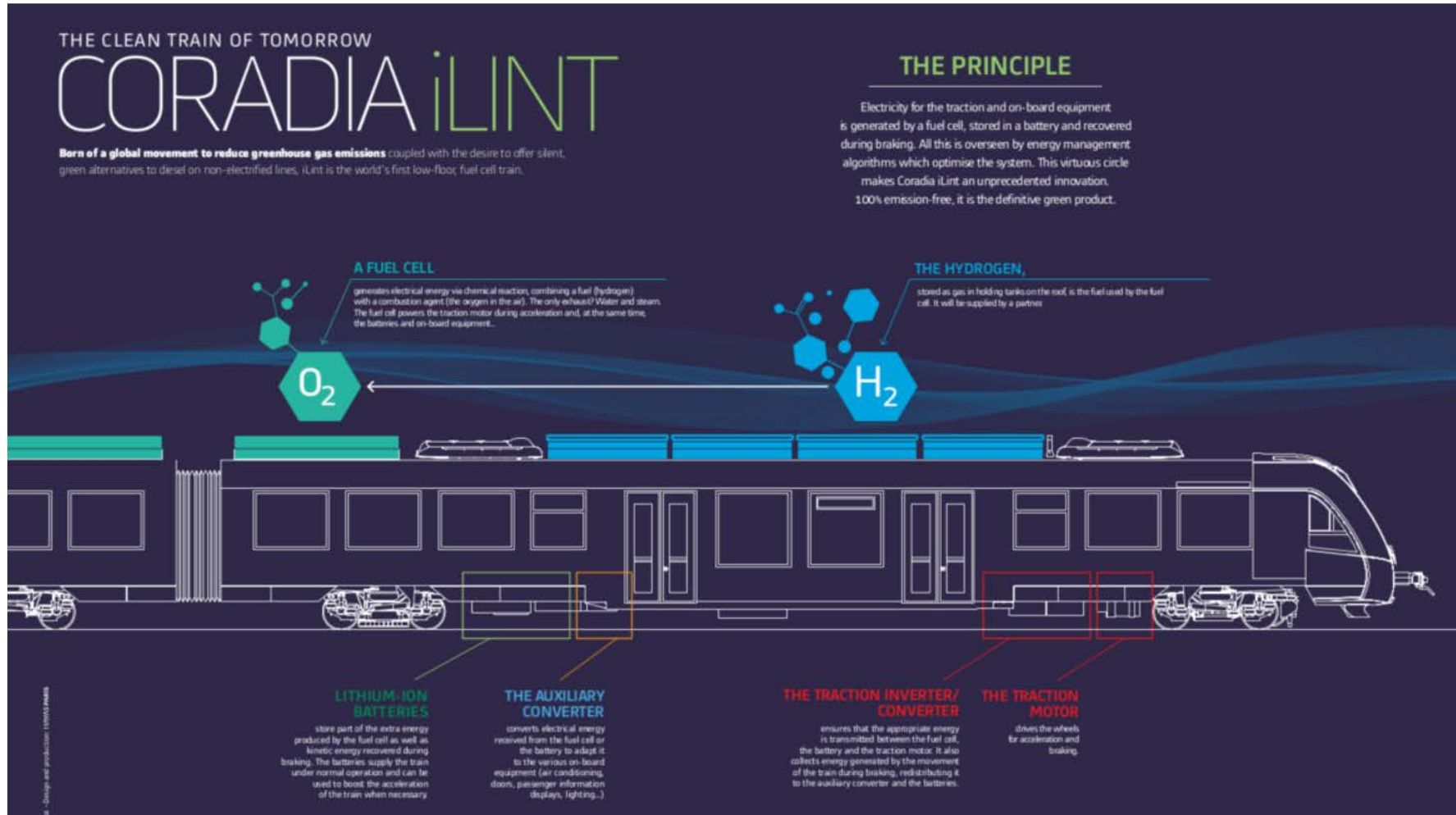
Measurement and test run Austria 12/2019



Thanks for your attention!

HEUTE. FÜR MORGEN. FÜR UNS.

Technical Data	AC mode	Battery mode
Wheel arrangement	Bo'Bo'+2'2'+Bo'Bo'	
Track gauge	1,435 mm	
Maximum speed	140 km/h	120 km/h
Traction power	up to 2,600 kW	
Installed battery capacity		528 kWh
Starting acceleration	1.0 m/s ²	0.77 m/s ²
Power supply	15 kV AC / 25 kV AC	
Length (over coupling)	75,152 mm	
Floor height	600 mm	
Entrance areas	6 on each urban train	
Capacity	244 seats on urban train	
Maximum axle load	< 17 t including traction battery pack	
Crashworthiness	TSI and EN 15227 conform	
Fire protection	CEN / TS 45545 and DIN 5510 Fire protection level 2	



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