

# SIEMENS

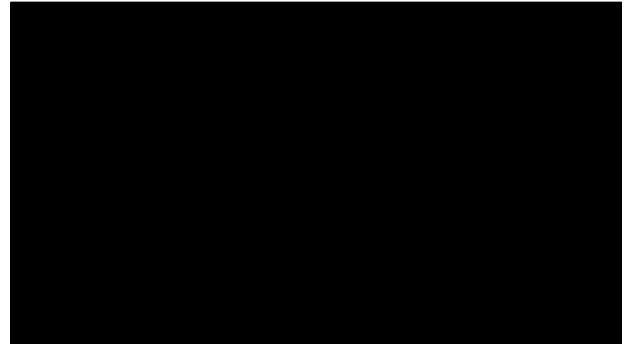



## Zero Carbon emissions in public transportation – Mireo Plus H

The Danube Region Transport Days, Ljubljana, 28. 11. 2022  
Aleš Napast, CEO, Siemens Mobility d.o.o.

Unrestricted | © Siemens Mobility 2022 | DWT 2022 | Towards energy efficient, sustainable transport | 28/11/22

SIEMENS

Our Hybrid Trains will replace Diesel Multiple Units and add further value to our customers in a unique way.

Especially acceleration, longer life cycles of hybrid components and maximum speed of 160 km/h ensure a further development of the regional traffic to the advantage of passengers and operators.

**Vision**  
Rail is the most efficient and most popular mean transport.  
Let's double passengers until 2030!

**Mission**  
With innovations, CO<sub>2</sub> free technologies and highest comfort we attract people

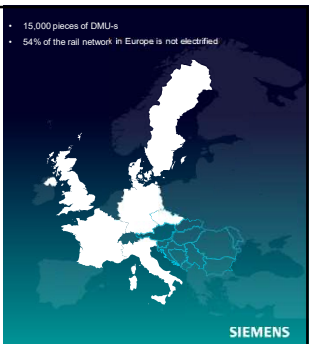
Unrestricted | © Siemens Mobility 2022 | DWT 2022 | 28-29/11/22

SIEMENS

### Rising demand for sustainable mobility

<b>United Kingdom</b> Elimination of all diesel-powered rail vehicles by 2040; Scotland by 2035	<b>Denmark</b> 70% of CO <sub>2</sub> -reduction (base 1990) by 2030
<b>Germany</b> Currently approx. 3,000 diesel-powered rail vehicles in operation, up to 80% of which non-under category, due to short non-electrified sections; Elimination of all diesel-powered rail vehicles by 2045;	
<b>France</b> Plan de Relance 7.9 Mrd. € (rail transport, mobility, reduction of the carbon footprint)	<b>Italy</b> Replacement of over 1,300 cars of obsolete diesel multiple units (average age 30 years)
<b>Czech Republic</b> Only 1/3 of the rail network is electrified	<b>Sweden</b> Target: CO <sub>2</sub> -neutral by 2045

- 15,000 pieces of DMU-s
- 54% of the rail network in Europe is not electrified



Unrestricted | © Siemens Mobility 2022 | Title of conference | english


SIEMENS

### Mireo Plus specific look on Slovenia


For operation on non electrified lines

**SLOVENIA**  
State railway network  
50 % non - electrified lines

51 DMU-s  
No banning yet



— Electrified main line – double track  
— Electrified main line – single track  
— Regional non-electrified line – single track

 **2030**  
 27% of CO<sub>2</sub>-reduction (base 2005) by 2030


Unrestricted | © Siemens Mobility 2022 | DWT 2022 | 28-29/11/22

SIEMENS

### Mireo Plus – For operation on non electrified lines

**GERMANY**


**61%** electrified  
**39%** NOT electrified  
**3000 DMU-s** in use today





— overhead line  
— not electrified  
— conductor rail


Sources: „Wasserstoff für den Schienenverkehr“, VOIVDE Studie, 9/2022

Unrestricted | © Siemens Mobility 2022 | DWT 2022 | 28-29/11/22

 **2045**  
Decarbonization of transport

Overhead line multiple unit 

Battery multiple unit 

Hydrogen multiple unit 

# SIEMENS

### Mireo Plus – For operation on non electrified lines

**Electrified lines** **Connecting electrified lines** **Last mile** **No catenary**

**Mireo**  
Base for the Mireo Plus is the modern Mireo platform concept which runs on electrified lines

**Mireo Plus**  
All Mireo advantages in one hybrid platform with all positive characteristics of the Mireo family: energy-saving, flexible interior, low maintenance and life cycle costs

**Mireo Plus B:** Battery solution for lines that are partially electrified; range: 80 – 120 km  
**Mireo Plus H:** Hydrogen solution for long distances without catenary; range: 600 – 1,000 km

2-car: 47 m, max. 130 seats  
3-car: 63 m, max. 180 seats

Power graph showing Mireo Plus and DEMU performance.

$V_{max}: 160 \text{ km/h}$   $a_{max}: \geq 1.0 \text{ m/s}^2$   
 $P_{max}: 1.700 \text{ kW}$

High performance: 2 powered bogies to ensure reliable operation even under challenging conditions

Page 7 Unrestricted | © Siemens Mobility 2022 | DWT0 2022 | 28-2911102

### Mireo Plus combines latest alternative traction systems in one platform

**Mireo Plus B:**

- Battery solution for lines that are partially electrified; range: 80 – 120 km
- Power supply and absorption during recuperation via battery system

**Mireo Plus H:**

- Hydrogen solution for long distances without catenary; range: 600 – 1,000 km
- Charging of dynamic battery and operation of train via fuel cell (FC)

Timeline of projects:

- 2019: Desiro ML Cityjet eco prototype for ÖBB
- 2020: Mireo Plus B Ortenau
- 2021: Mireo Plus B Netz Ostbrandenburg
- 2022: Mireo Plus B Midtjyske Denmark
- 2020: Mireo Plus H H2goesRail with DB\*
- 2021: Mireo Plus H H2 for Eisenbahn with BRB\*\*
- 2022: Mireo Plus H2 Heidekrautbahn/ Berlin

Page 12 Unrestricted | © Siemens Mobility 2022 | DWT0 2022 | 28-2911102

### Hydrogen trains for 100% clean and emission-free operation

**Our solution: the Mireo Plus H**

Highly efficient **fuel cell from Canadian company Ballard** with high power density and extended service life

**Smart energy management** with hydrogen savings up to 15 %

**H2 tank** for ranges up to 800 km

2-car: 47 m, max. 130 seats, 600-800 km  
3-car: 63 m, max. 180 seats, 800-1000 km

Converter-fed asynchronous machines for **accelerations up to 1.1 m/s<sup>2</sup>** and maximum speeds up to 160 km/h for high cycle frequencies

**LTO technology** for high power charging and long lifetimes of the battery

Page 10 Unrestricted | © Siemens Mobility 2022 | DWT0 2022 | 28-2911102

### Suitable infrastructure must be available where it is needed - view on different infrastructure set ups

**Fleet size**

Very small: ~150 kg H<sub>2</sub> per day  
Middle: ~1,500 kg H<sub>2</sub> per day  
Large: ~3,000 kg H<sub>2</sub> per day

Infrastructure options:

- Mobile hydrogen refueling station
- Refueling station with delivery
- Integrated electrolysis plant

Page 11 Unrestricted | © Siemens Mobility 2022 | DWT0 2022 | 28-2911102

### In the H2goesRail Project will be achieved homologation, fast refueling and tested passenger operation with DB in 2023 and 2024

Workshop infrastructure, Passenger services and maintenance, Hydrogen supply, Fast refueling

Mireo Plus H

Clean Mobility for Future, H2goesRail joint funded project

Page 13 Unrestricted | © Siemens Mobility 2022 | DWT0 2022 | 28-2911102

### Timeline of development and signed customer projects of Mireo Plus H

2017 X-EMU\* Start of development

Project	H2goesRail	H2 for Bayern	Heidekrautbahn
Order award	11/2020	03/2022	03/2022
Number of trains	1	1	7
Number of seats (2nd class / 1st class)	120	120	140
Doors per side	3	3	3
Train length (m)	47	47	47
Level platform access (mm)	550	550	760
Maximum operating speed (km/h)	140	140	120
Start of operation	2023	2023	2024
Service	TSSA**	TSSA**	TSSA**

Page 12 Unrestricted | © Siemens Mobility 2022 | DWT0 2022 | 28-2911102

# SIEMENS

Your contact person



**Ales Napast**  
CEO  
SMO SI  
Letališka 29C  
1000 Ljubljana  
Slovenija

Mobile: +386 (0)41 632 228xxxx  
E-mail: ales.napast@siemens.com



More information  
on our Content Hub  
MIREO PLUS H

Copyright © Siemens Mobility 2022 | D8112 2022 | 28-29/11/22

**SIEMENS**