ALEATICA
Smart & Sustainable Infrastructure

Electric Road System
Dynamic Wireless Power Transfer
Charge by Travelling

High-capacity electric charging while driving on the road via contact-free dynamic inductance charging adapted to any type of vehicle

A35 Brebemi

Francesco Bettoni

President A35 Brebemi

Electric Road System
Dynamic Power Transfer

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IVECO bus during testing

Electric Road System
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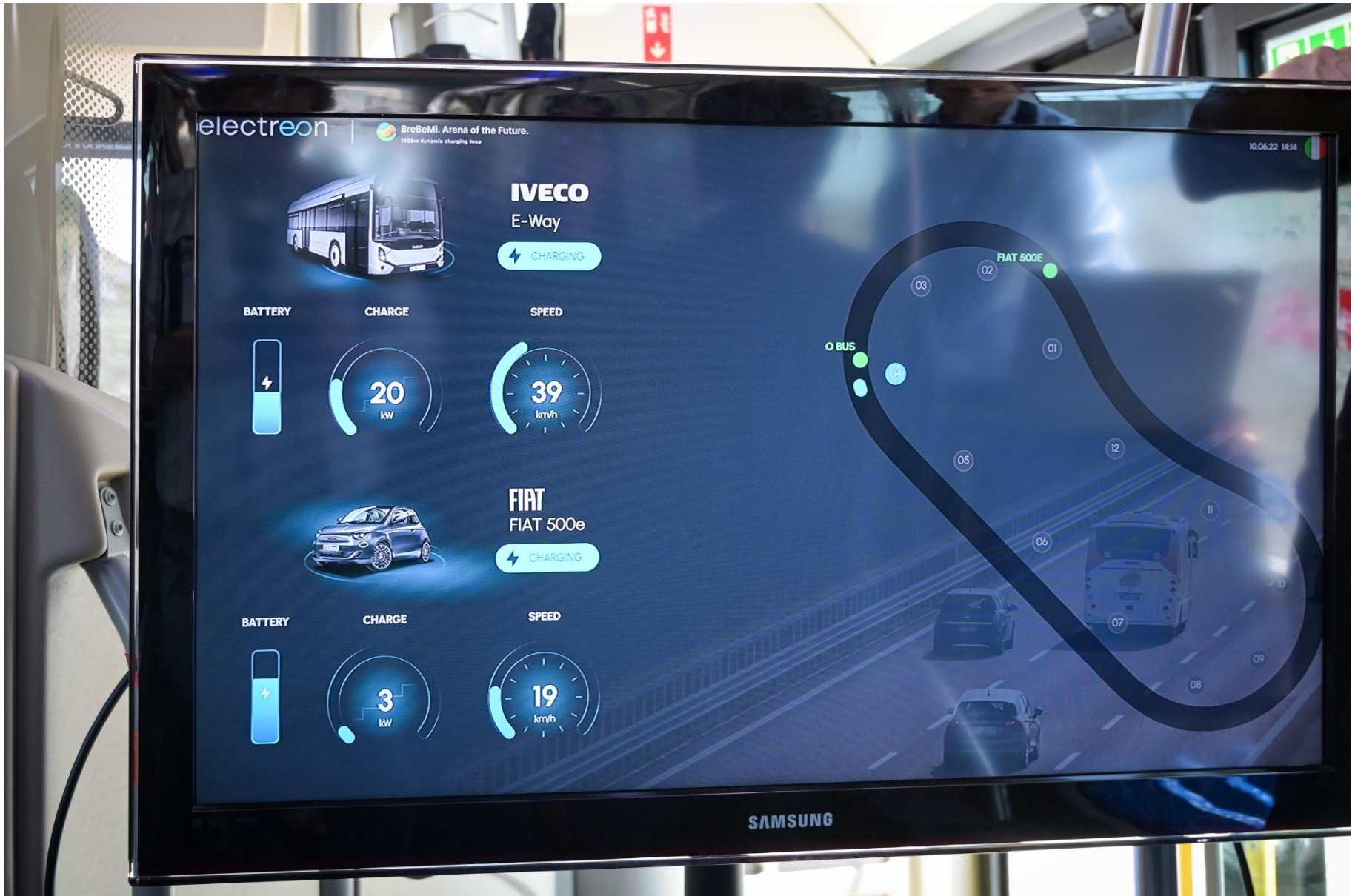

Screen showing energy storage

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Dynamic Power Transfer

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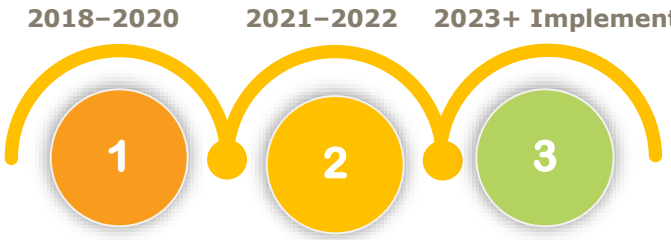
Lines of work

1. A 1,050-metre asphalt ring fed with an electrical power of 1 MW.
2. 'Dynamic Wireless Power Transfer' technology applied to various ranges of electric vehicles.
3. Advanced 5G connectivity to guarantee the utmost road safety and V2I communications.
4. Optimizing the road surface to make it more durable and maintain the efficiency of the inductive charge.
5. Assessment of environmental benefits.

Phases of the project



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Dynamic Wireless Power Transfer

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Industrial partners

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- ERS system WPT — electreon
- Development and integration of the WPT system — STELLANTIS, IVECO, IVECO BUS
- Power, distribution, and ESS — ABB, Prysmian Group, FIAMM
- Asphalt — MAPEI
- Construction — PIZZAROTTI SINCE 1910
- Communications V2I — TIM

Research centres

- Power source and charging — POLITECNICO MILANO 1863 — **SYSTEMS:** Study of the power system, distribution, protection, and electromagnetic fields.
- Materials & Environment — UNIVERSITÀ DI PARMA — **INFRASTRUCTURE:** Electromagnetic fields and their interaction with asphalt.
- Environment — ROMA TRE UNIVERSITÀ DEGLI STUDI — **ENVIRONMENT**: estimate of impacts and benefits

Emergency services

Polizia di Stato

VIGILI DEL FUOCO CORPO NAZIONALE

SAFETY: Emergency management

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Vehicle	Speed [km/h]	Energy consumed per km [kWh]	Energy stored per km [kWh]
Car	70	0.16	0.35
Car	100	0.2	0.25
Bus	70	1.3	1.1
Bus	80	1.5	0.9
Truck	70	1.9	2.5
Truck	80	2.1	2.2

The efficiency of the system in terms of energy transferred from the network to the vehicle is expected to be about 88 [%].

Electric Road System
Dynamic Power Transfer

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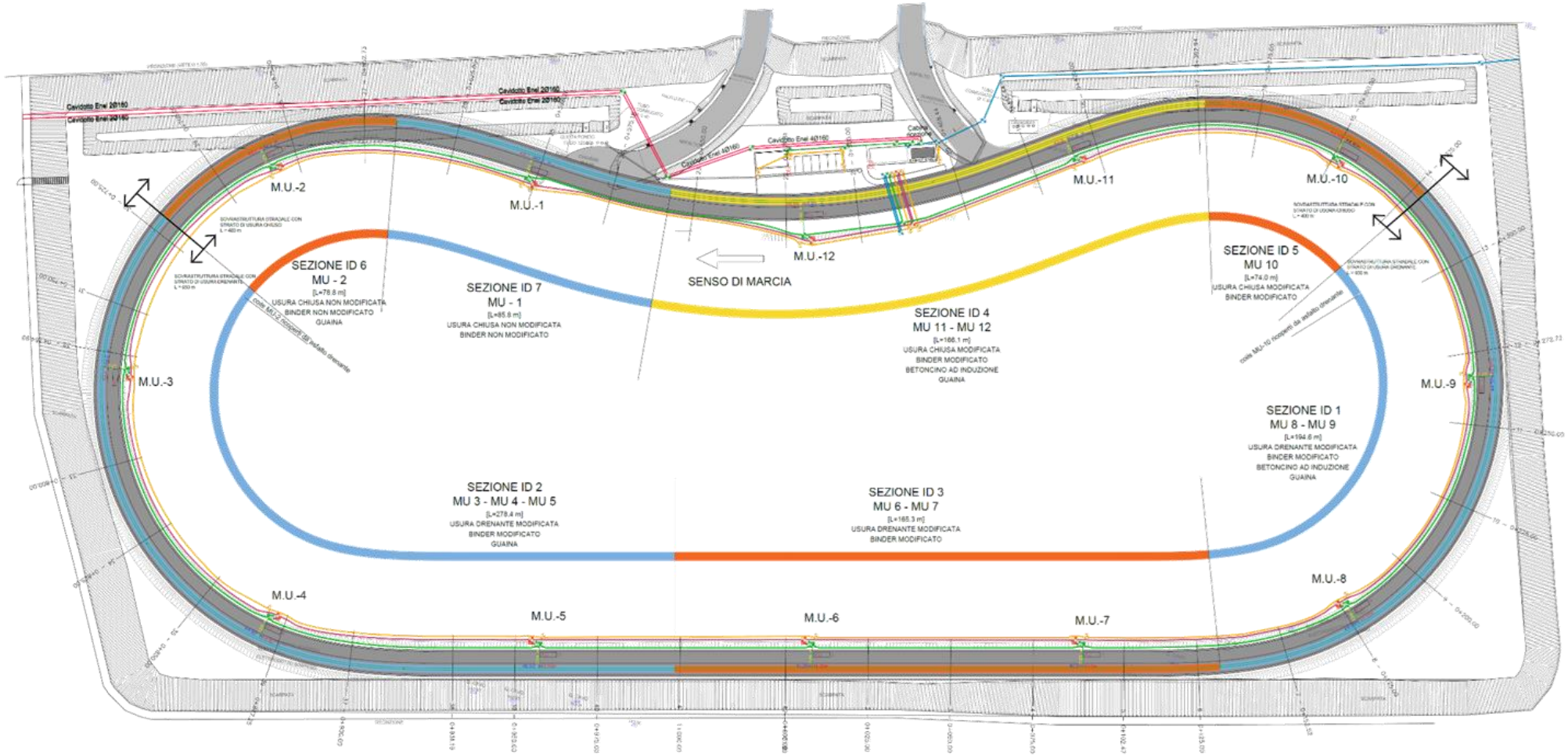

THE PATH WAS DIVIDED INTO 7 SECTIONS OF DIFFERENT TYPES DEPENDING ON CONSTRUCTION DETAILS AND MATERIALS

EACH SECTION REFERS TO A DIFFERENT TYPE OF ROAD

THE GOAL WAS TO ANALYSE THE BEHAVIOUR OF THE SYSTEM IN TERMS OF EFFICIENCY ON VARIOUS TYPES OF ROAD NETWORKS

Electric Road System

Dynamic Power Transfer

Construction times and costs per km*

Time to install the systems **7 days**

Time for civil works **3 days**

\+ Start up

Cost €/km **1.5-2 million**

*Typical section 4 km

Electric Road System

Analysis during the tests

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INFRASTRUCTURE AND COMPONENTS

- DEVELOPMENT OF AN ELECTRICITY DISTRIBUTION ARCHITECTURE CAPABLE OF INTEGRATING LOCALLY PRODUCED RENEWABLE ENERGY WITH ENERGY FROM THE NATIONAL MAINS
- DEVELOPMENT OF MONITORING AND REMOTE CONTROL SYSTEMS USING DIGITAL PLATFORMS AND ANALYSIS OF THE ELECTROMAGNETIC FIELDS
- INTEGRATION OF THE TECHNOLOGY ON VEHICLES AND THE NECESSARY OPTIMIZATION FOR THE RELATED HOMOLOGATION
- MECHANICAL BEHAVIOUR OF THE ROAD SUBJECTED TO THE MAGNETIC FIELD

POLITECNICO MILANO 1863 UNIVERSITÀ DI PARMA

electreon ABB Prysmian Group MAPEI STELLANTIS IVECO IVECO BUS TIM PIZZAROTTI SINCE 1910

Electric Road System

Analysis during the tests

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SAFETY

- RISK PREVENTION AND PROTECTION MEASURES FOR BOTH THE INFRASTRUCTURE AND VEHICLES
- INTEGRATED SAFETY MANAGEMENT OF THE VEHICLE CHARGING INFRASTRUCTURE
- VEHICLE ASSISTANCE PROTOCOLS
- EMERGENCY INTERVENTION PROCEDURES
- STAFF TRAINING AND SHARING OF EMERGENCY PROCEDURES
- SIMULATIONS

Polizia di Stato

VIGILI DEL FUOCO CORPO NAZIONALE

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electreon ABB STELLANTIS IVECO IVECO BUS TIM

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ENVIRONMENTAL IMPACTS

ENVIRONMENTAL IMPACTS WILL BE ANALYSED ON TWO DIFFERENT LEVELS:

A) ASSESSMENT OF ENVIRONMENTAL BENEFITS COMPARED TO THE CURRENT FLEET DRIVING ON TRADITIONAL MOTORWAYS

B) ASSESSMENT OF ENVIRONMENTAL BENEFITS WITH RESPECT TO PLUG-IN SYSTEMS

IN BOTH CASES, DIFFERENT EMISSIONS CONTRIBUTIONS WILL BE ANALYSED IN TERMS OF BOTH DIRECT AND INDIRECT EMISSIONS.

THE FOLLOWING WILL BE CONSIDERED

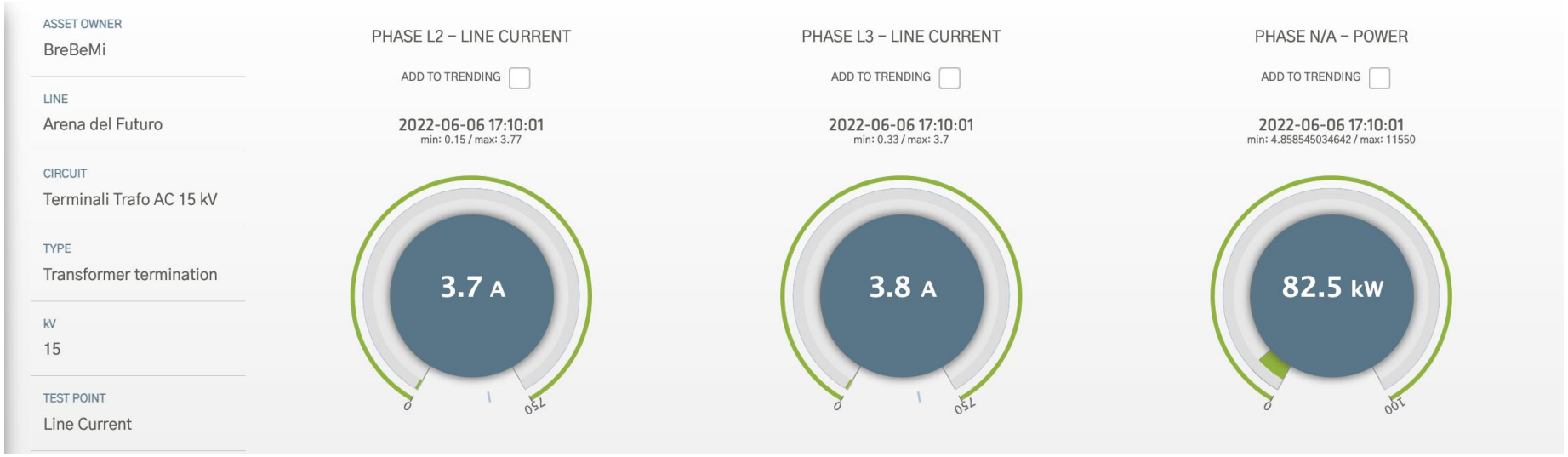
- **DIFFERENT CLASSES OF VEHICLES**
  - **FIAT 500 ECONOMY CAR …**
  - **IVECO INTERCITY BUS …**
- **DIFFERENT PROPULSION SYSTEMS:**
  - **INTERNAL COMBUSTION ENGINE (DIESEL, PETROL)**
  - **ELECTRIC ENGINE**

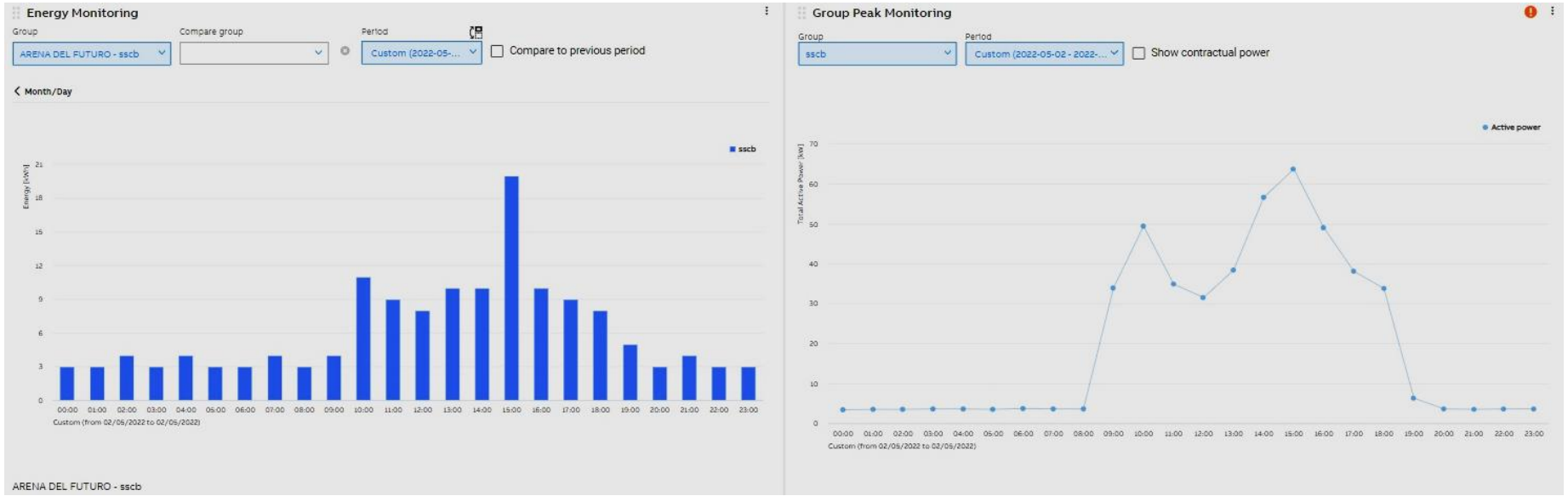
ROMA TRE UNIVERSITÀ DEGLI STUDI · UNIVERSITÀ DI PARMA · STELLANTIS · IVECO · IVECO BUS

Electric Road System

Dynamic Power Transfer

Energy & Power





Electric Road System

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Power transmitted by the DWPT system

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IVECO BUS

FIAT 500e

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Dynamic Power Transfer

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Advantages

Facing an increase in demand:

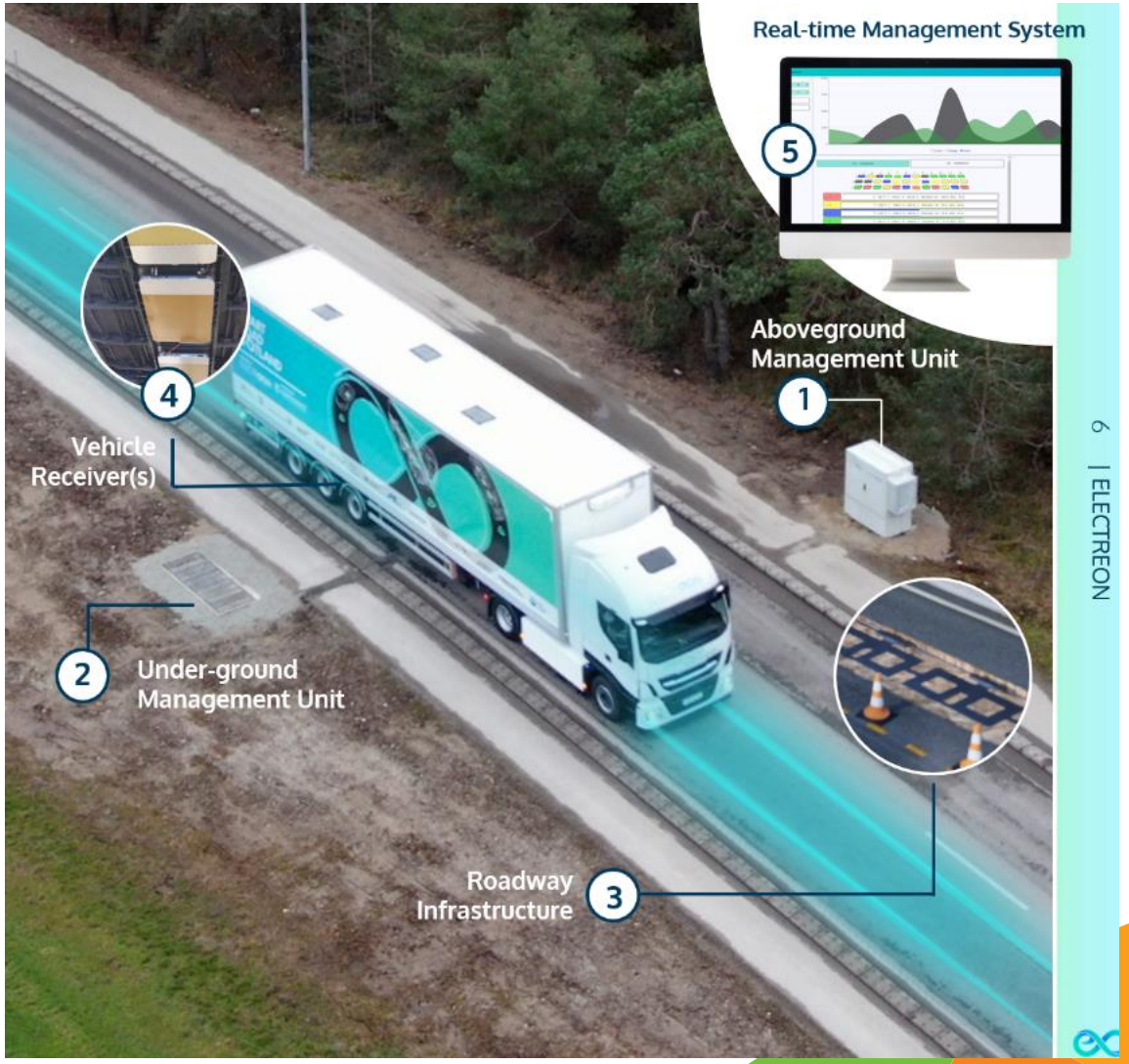
- Electric
- Components for batteries and battery chargers
- Battery charging and occupied space

The ERS system leads to:

- Solutions to the issue of space; it uses nearby areas on the road.
- Leads to a reduction of batteries in vehicles.

Opportunities:

- New activities that add value with profit margins for the different stakeholders.
- Defining and creating key roles in the nascent value chain tied to electrification of the road infrastructure.



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A35 Brebemi engineering team

Giuseppe Mastroviti
- Technical and Operational Director of A35 Brebemi

Gianfermo Lupi
- Systems Designer and Manager

Enzo Fruguglietti
- Director of Works and Safety Coordinator

Ilaria Napoli
- Environmental and Sustainability Manager

Andrea Vezzoli
- Works and Standards Manager