



COMSA  
EMTE

# Key on-going railways energy efficiency innovations



[Manuel.Alfageme@COMSAEMTE.com](mailto:Manuel.Alfageme@COMSAEMTE.com)

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## COMSA EMTE group Railways related areas



**TECNOLOGIES &  
SUBSIDIARIES**

**207 M€**

**INFRASTRUCTURE  
& ENGINEERING**

**1.126 M€**



**CONCESSIONS  
& RENEWABLE  
ENERGY**

**1.492 M€ investment**

**ENVIRONMENT**

**Comprehensive services  
in infrastructures, engineering, environment & technology**

**8th Spanish company in this sector & 2nd non listed group**  
**25 Countries ~ 8000 Staff**  
**Railways related business +50%**



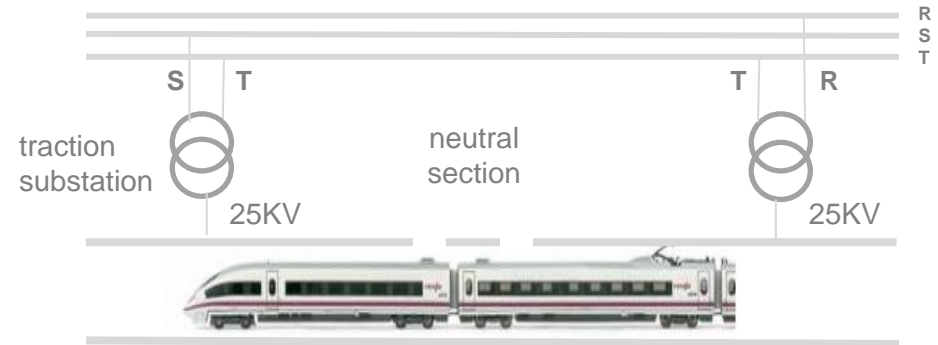
## AC rail power line 50 Hz Current situation

### AC single phase rail power network

- To balance power drawn, track sections connected to different phases
- Neutral section is required to electrically separate sections
- Forcing single side feeding
- Peak power design from every substation
- Power drop reducing inter-substation distance
- Energy loss



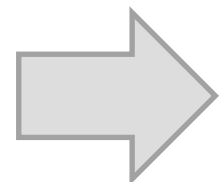
### HV public power grid



### Rail power network

### Two phase 2x25kV with different phases

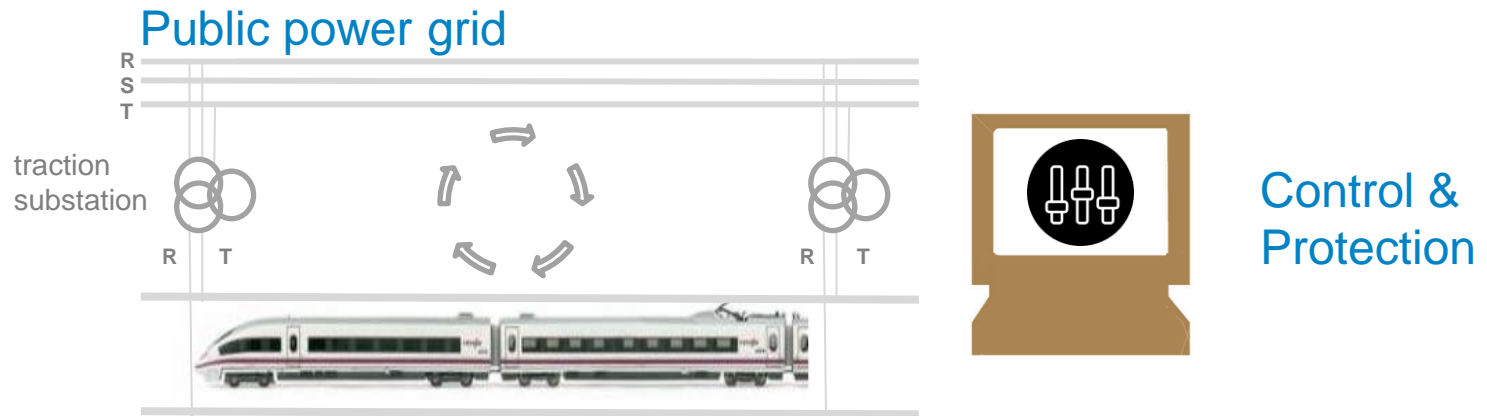
- Longer substation distance
- Complex transformer configurations
- Unbalanced load to the public power grid





## Balancing energy flows in the rail power network

### AC Synchronized network without phases change



Rail power network

### 3 Phase connection to public power grid

- Higher power
- Choice for connection to MV public power

### No phase change required on the rail power network

- No neutral section required
- Double side feeding with load balancing
- Optimized substation sizing
- Larger inter-substations distances
- Less energy loss





## Railways energy monitoring & analysis

### Non intrusive metering sensor network

- For the detailed data acquisition of the dynamic energy flows
- From the complete rail system: consumers and generators

### An open operational data platform

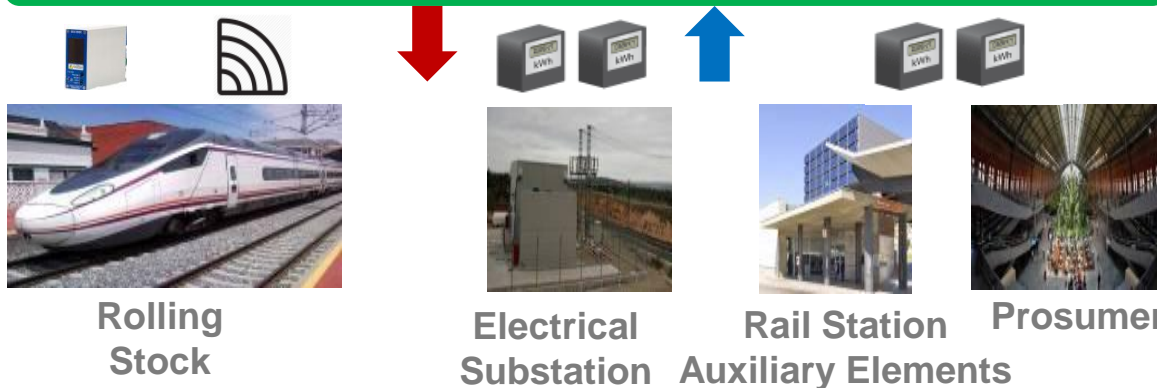
### A set of monitoring & analysis applications

- For the evaluation of the energy management decisions and
- The support of the predictive maintenance of the rail power system



### Energy monitoring & analysis applications

### End to end energy metering sensor network





## Storage for railways energy applications

- Co-creation of a new company
- Developing energy storage product portfolio
- For recovery of excess energy generated by braking trains
- Based on innovative technology
- Addressing railways energy storage applications: energy saving, peak power,...
- In urban/suburban railway market
- Shorter investment payback & larger NPV



[www.comsaemte.com](http://www.comsaemte.com)

C/ Julián Camarillo 6A, 2ª. planta  
28037 Madrid (España)  
T +34 913 532 120

Edificio Numancia 1  
C/ Viriat, 47  
08014 Barcelona (España)  
T +34 933 662 100

