



## **Vossloh Rail Vehicles**

Economic Mobility

June 2010

# Vossloh Rail Vehicles

## Business Areas



### LOCOMOTIVES

- ▶ **Diesel-Electric Locomotives**
- ▶ Electric Locomotives
- ▶ Shunting Locomotives
- ▶ Components for locomotives (bogies)

### PASSENGER VEHICLES

- ▶ Metros
- ▶ Tramways
- ▶ Tren Tram
- ▶ Commuter, regional trains
- ▶ Components for vehicles (bogies)

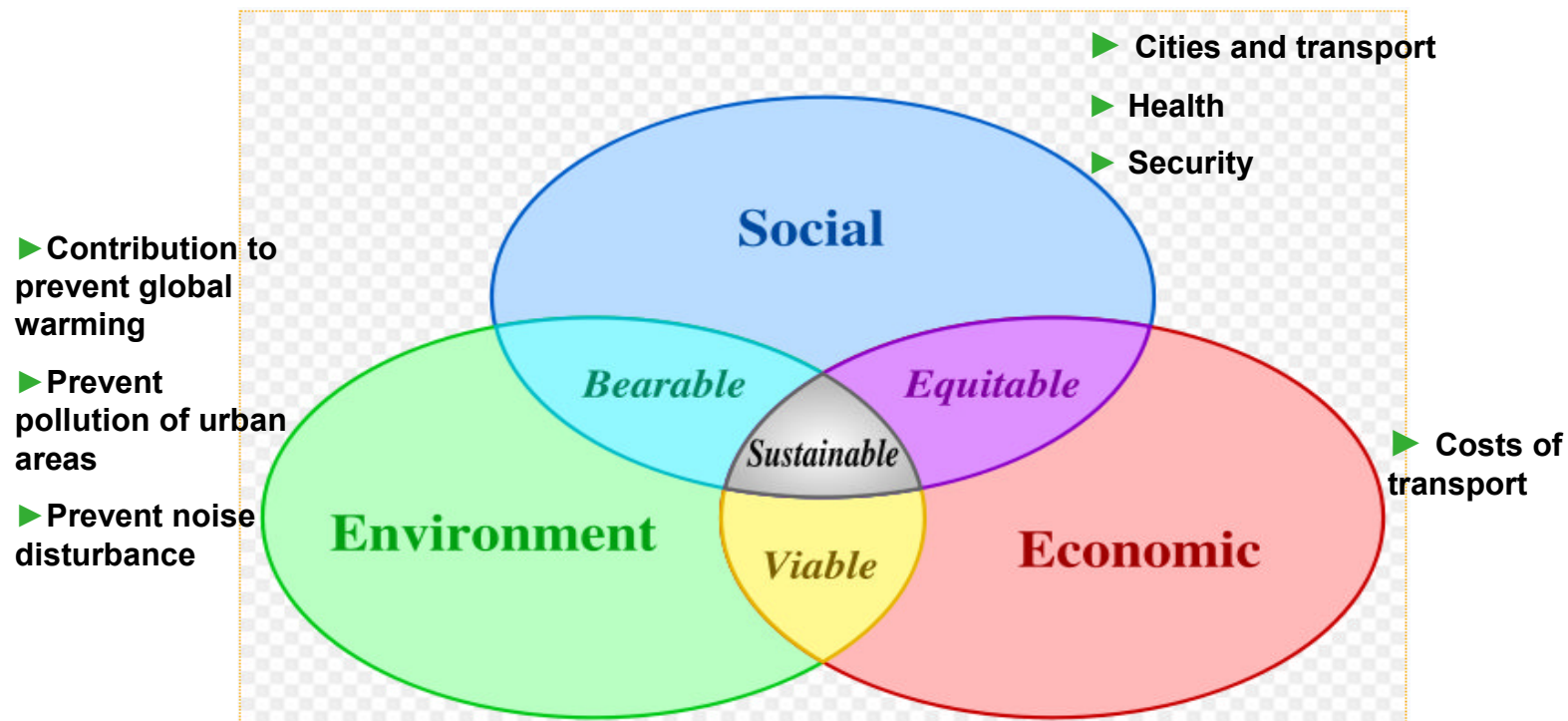
### MAINTENANCE

- ▶ Maintenance of locomotives
- ▶ Maintenance of urban rail vehicles

## What does Sustainability mean?

### The three pillars of the sustainable mobility

To contribute to the social progress and the economic growth using available resources in the most efficient manner while always looking for economic efficiency and reducing emissions.

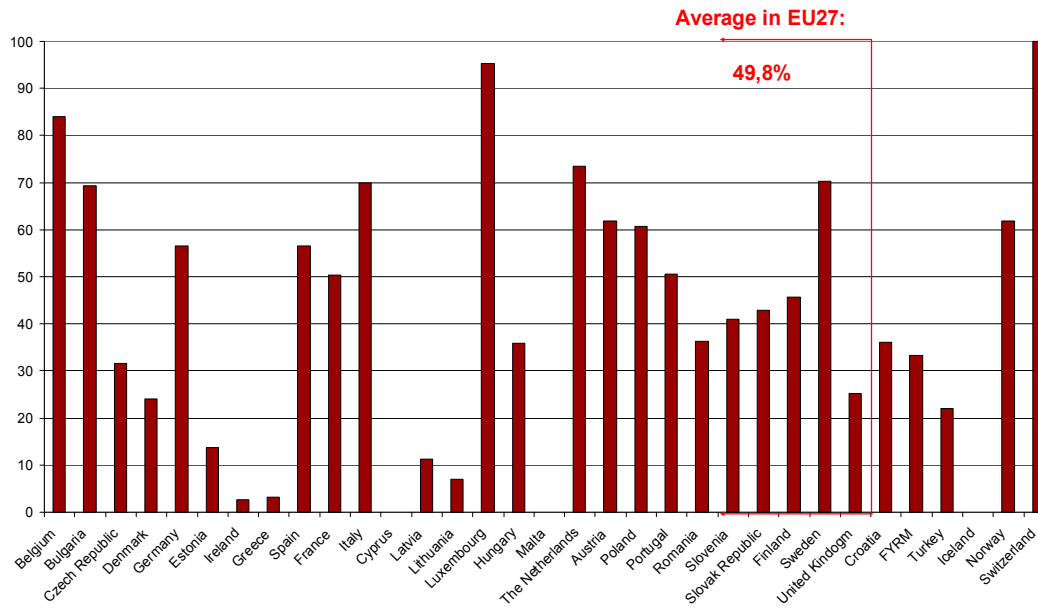


Vossloh Rail Vehicles products are compromised with the 3 pillars of a sustainable mobility.

# Diesel Market Case: Worldwide importance

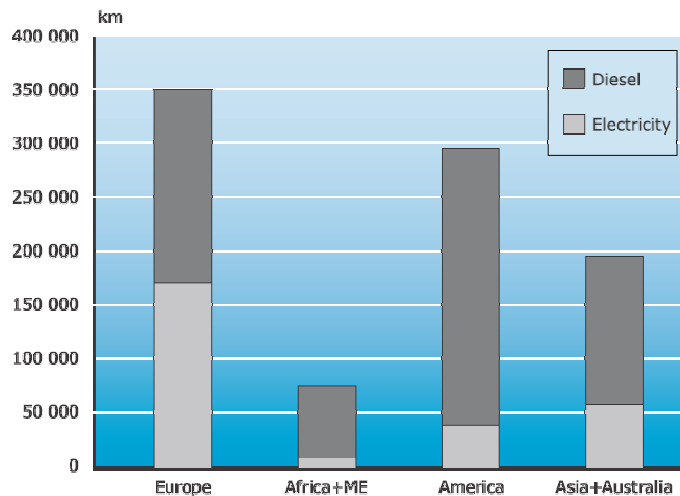
## Diesel – Electric Rail Traction.

### Electrified Railway Lines



Diesel is essential in half of EU railway lines

Source: Energy & Transport in figures, 2007. EC, Directorate General Energy and Transport



Diesel is essential in most worldwide railway lines

Source: UIC Statistics, 2003

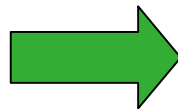
## Vossloh solution: Euro Family Locomotives Case: sustainable challenge

Towards a new concept of diesel locomotives which optimizes rail transport



**EURO Family**

Engineering  
+  
Design  
+  
modern  
production  
techniques



Efficient and  
technologically  
sophisticated  
locomotives



### ► **Economic efficiency–Low operational costs**

- 1.1 Higher haulage capacity
- 1.2 Energy efficiency: Reduction of consumption
- 1.3 Reduction of maintenance costs. Reliability
- 1.4 Interoperable locomotives
- 1.5 Homologation of locomotives in different European countries

### ► **Safety**

- 2.1 Safety of freight and driver
- 2.2 Comfort of the driver

### ► **Respect for the environment**

- 3.1 Noise reduction
- 3.2 Reduction of exhaust emission

## Euro Family: Towards a new concept of diesel locomotives

Economic efficiency - Higher Haulage Capacity

► Performance of the EURO4000:

- Engine EMD 16-710 G3C-T2 of 3.178 kW
- 400 kN starting tractive effort
- Co-Co axle arrangement (6 axles)



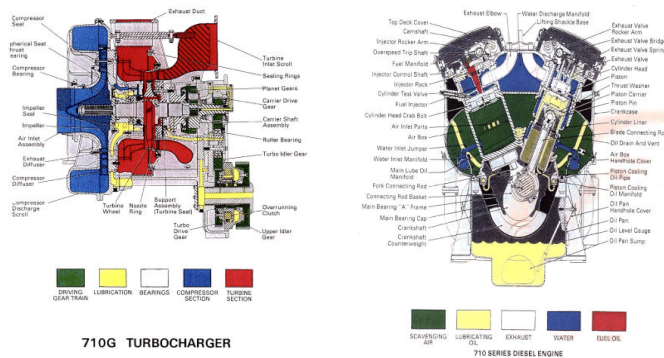
	Train	Slope	1loc (EURO4000)	2loc (EURO4000)
<b>European</b> Freight trains	<b>750m</b> <b>2000t</b>	0‰	105 km/h	(+) 120 km/h
		4‰	70 km/h	105 km/h
		8‰	45 km/h	75km/h
		12‰	30 km/h	60 km/h
<b>Spanish</b> Freight Trains	<b>450m</b> <b>1200t</b>	0‰	(+) 120 km/h	(+) 120 km/h
		4‰	95 km/h	(+) 120 km/h
		8‰	70 km/h	105 km/h
		12‰	50 km/h	85 km/h

# Euro Family: Towards a new concept of diesel locomotives

## Economic efficiency – Reducing energy consumption

### Internal engine design improvements:

- ▶ Improved injection and charging technology
- ▶ Optimized air cooling
- ▶ More efficient turbocharger
- ▶ EGR



### Improvements in the locomotive design:

- ▶ Energy recovery in the electric brake for ancillary use
- ▶ Design of car body-shell more aerodynamic and with less weight
- ▶ Reduction in friction of all rotating elements in locomotive and train
- ▶ Greater efficiency of our auxiliary systems achieving a ratio Installed Power vs. High wheel Power than that of our competitors
- ▶ **EFITren** (an accurate fuel consumption estimator) and **Driver Assistance System (DAS)** to run the locomotive with the optimum use of energy
- ▶ **EFITren** (an accurate fuel consumption estimator) and **Driver Assistance System (DAS)** helps drivers to run the locomotive with the optimum use of energy giving them information on real-time.
- ▶ **TWC**: The control, diagnosis and location system of Vossloh offers

## Euro Family: Towards a new concept of diesel locomotives

Economic efficiency – Interoperability and cross border operations

- ▶ **Standards:** EURO Family fulfill all European norms and TSI
- ▶ **Cab:** central European desk and high standards of comfort and safety for the driver.
- ▶ **Anti-collision protection:** Shock energy absorbing systems
- ▶ **Safety system:** EURO family includes the possibility to integrate some specific country safety systems or ETCS to enable interoperability and cross-border operations
- ▶ **Homologation:** Euro4000 is already homologated in 7 European countries and 3 different cross-border situations:
  - Iberian Peninsula
  - Scandinavian countries
  - France-Belgium-Germany



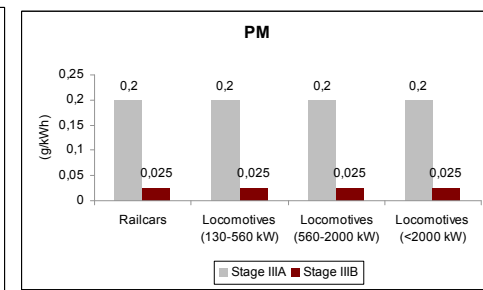
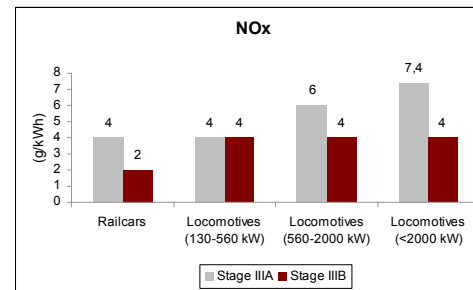
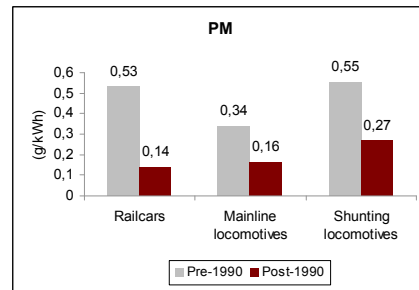
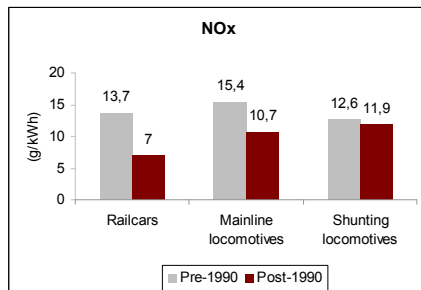
Countries where EURO4000 is homologated

Locomotives with higher flexibility, reliability and capacity to haul → lower costs for the operator

## Euro Family: Towards a new concept of diesel locomotives

### Environmental friendly – Reduction of exhaust emissions

- ▶ Vossloh locomotives fulfill Stage IIIA of the European Directive NMRR 97/68/EC, revised by the new Directive 2004/26/EC. (mandatory since 2009)
- ▶ Vossloh is leader of working group of the European Project CleanER-D, coordinated by UNIFE. The goal is to develop the first European locomotive that fulfill Stage IIIB.
- ▶ Stage IIIB is similar to normative EURO V of road vehicles.



# Euro Family: Towards a new concept of diesel locomotives

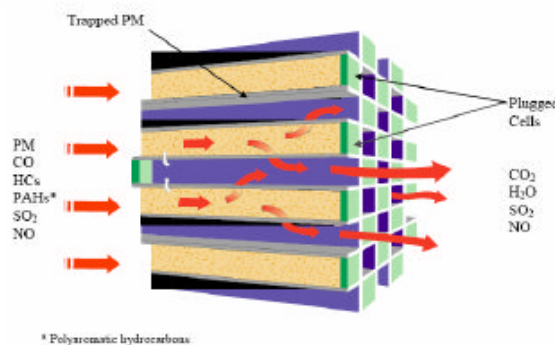
## Environmental friendly – Reduction of exhaust emissions

► According to the Rail Diesel Study of the UIC, to meet **Stage IIIA**, is necessary:

- Low sulfur fuel
- Internal engine design improvements:
  - EGR (exhaust gas recirculation)
  - Improved injection and charging technology
  - Optimized air cooling...

► To meet **Stage IIIB** are also necessary exhaust after-treatment systems:

- Diesel Particle Filters (DPF)
- Combined particle oxidation catalyst
- Selective Catalytic Reduction (SCR)
- NOx absorber catalysts...



### Summary:

To reduce the exhaust emissions we can act with technical and operational measures over 3 important points:

1. **Combustion:** Internal engine design improvements
2. **Exhaust after-treatment systems**
3. **Combustibles:**
  - Better quality fuel (low sulfur...)
  - Biodiesel
  - Alternatives (H<sub>2</sub>)

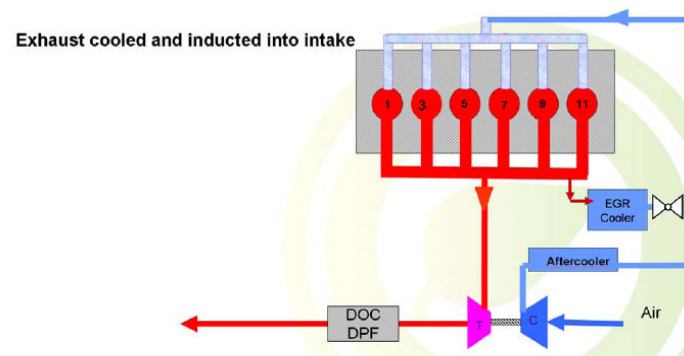


Figure 7: Scheme of C175 with EGR and DPF-system