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How is the future Railway System going to look like?

ERRAC Rail 2050 Vision
ERRAC 2030 R&I Priorities
Shift2Rail contribution for freight rail

KTH Railway Group Seminar
The European railway system of 2050:
What is needed and how Shift2Rail contribute?

Stockholm, 2019, May 22nd

Ulrich Meuser, TTSXR, Deutsche Bahn AG

ERRAC 2050 Vision in a nutshell

"In 2050, rail transport in Europe is the backbone of an intermodal "Mobility as a Service" within cities and beyond, for both passengers and goods, meeting the needs of customers, EU citizens and society. The suppliers and service organisations of the European rail industry are recognised as the world's thought leaders for railway products and services."

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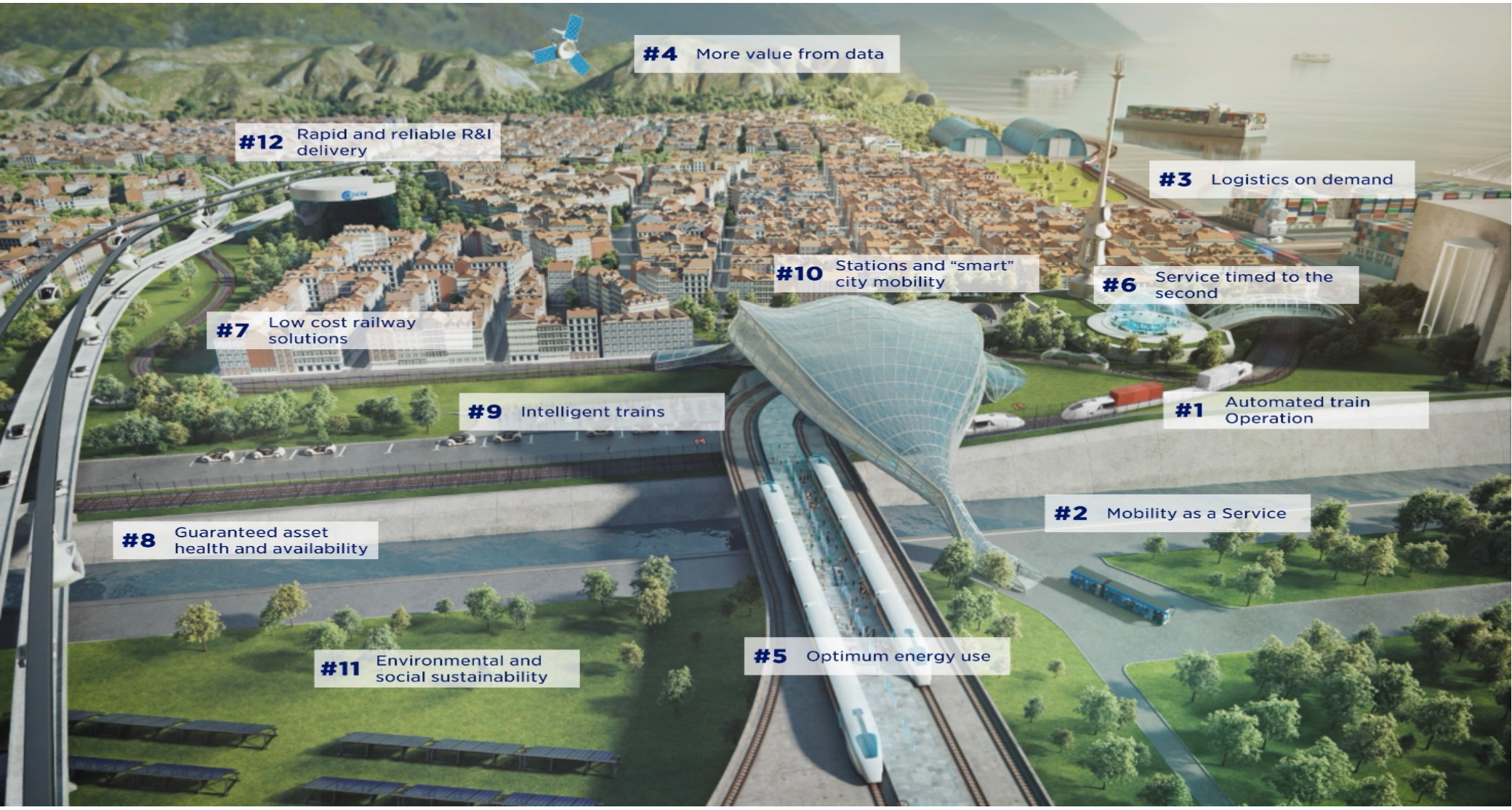
RAIL 2050 Vision

Rail systems capabilities



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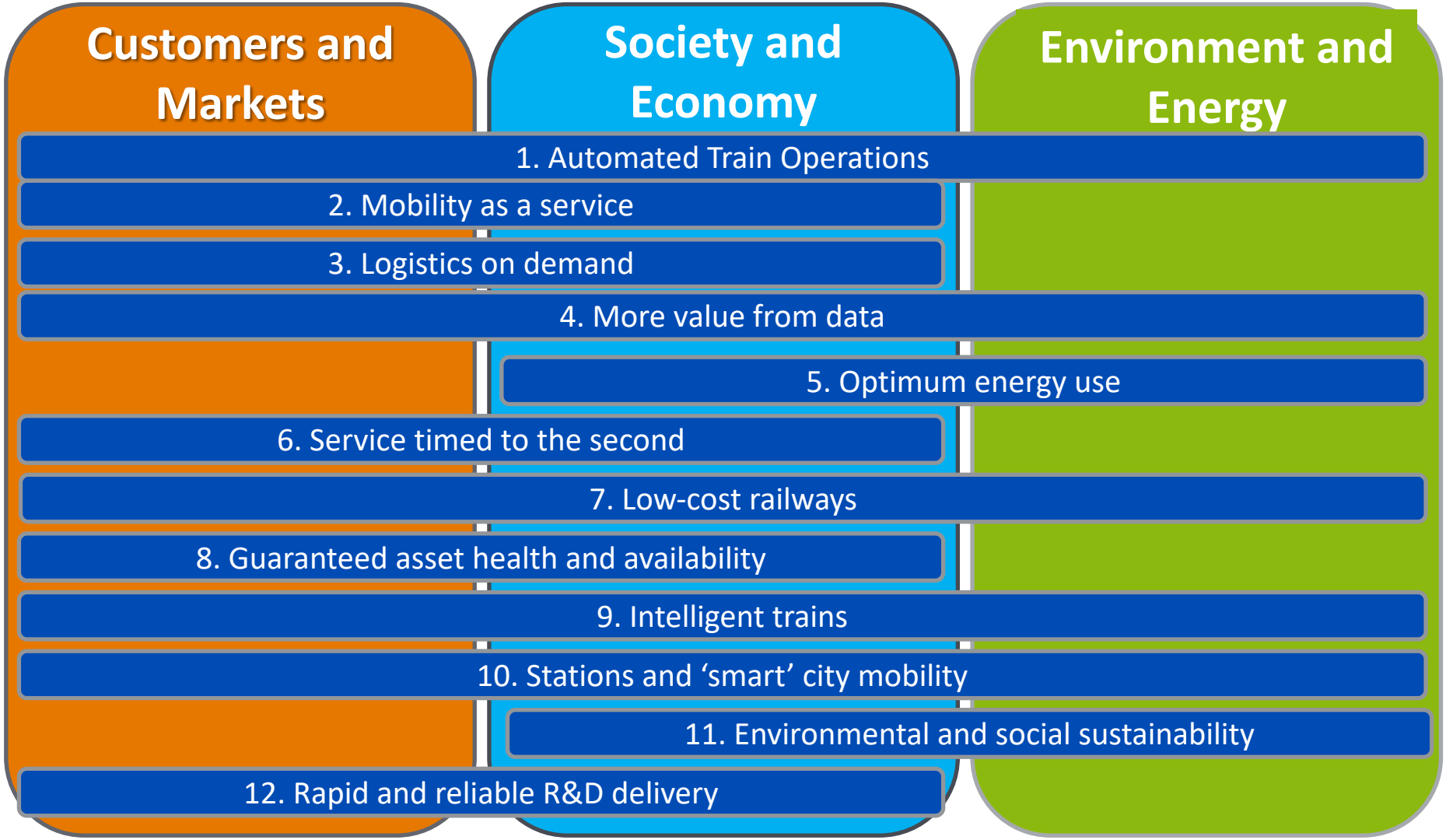
RAIL 2050 Vision

Rail system contribution to Europe



Automated Train Operation - ATO

The Capability

Trains are able to operate themselves and run closer together based on an automated train operation system, boosting the capacity significantly on existing lines. Autonomous and remote controls provide a safe operation. Rail operations are partly or fully automated.

Sub-capabilities

Automated (passengers and freight) trains run closer together with increased flexibility.
Passenger and freight train preparation processes are automated.
Vehicles split and join on the move. New operational approaches (e.g. virtual coupling, convoying, reduced headway, communication connections between trains/units) are employed.
Self-propelled automated / autonomous single units guide themselves through the system

RAIL 2050 Vision

European rail transport 2050

- Mobility as a Service
  - Every individual across Europe has access to mobility
  - Efficient and barrier-free interchanges between transport modes for safe, reliable and smooth journeys
  - Rail system is able to detect and respond to individual and collective European citizens' needs, delivering end-to-end mobility solutions
  - Passengers are able to access real time personal communication and new services before, throughout and after the journey

- Logistics on Demand
  - Innovative logistics services are driven by customer demand
  - Shipments are moved efficiently, safely and securely through the "physical internet"
  - Freight rail system is fully integrated with the automated multimodal logistic chain
  - Freight transport units are flexible, interchangeable, multipurpose and autonomous
  - Freight transport units can communicate with one another as well as infrastructure

RAIL 2050 Vision

European rail transport 2050 -

- Smart cities
  - Rail is the backbone of urban mobility
  - Stations at the heart of smart cities, being places to work, live meet and communicate
  - New energy-efficient station designs provide easy access and seamless interchange across all transport modes
  - Railways are a core part of smart city planning, mobility management systems and city fulfilment and delivery services, promoting interconnection by freeing up land which was previously needed by private road vehicles and minimizing pollution and congestion

Mechanisms for an effective delivery framework

- Framework
  - Substantially increase the European funding instruments for R&D, following the European rail Public-Private –Partnership Shift2Rail
  - Simplify funding rules and regulations
  - Enable and incentivise a much shorter time to market from initial research to commercialisation
  - Create new dynamics in regulation to allow innovative technologies to be adopted more quickly
- R&D collaboration
  - Promote the development of an R&D ecosystem with centers of excellence fostering a high participation in knowledge networks, opening new forms collaboration, technology transfer from other sectors
  - Supporting tight collaboration of rail operators, infrastructure managers, rail industry, universities and research organisations
  - Maintain strong links with academic institutions and foster collaboration with specific R&D programs, enabling students to be part of rail R&D programs
  - Attract, develop and retain highly-skilled staff and best researches, engineers and managers for European railway
- Effective cooperation with other modes of transport

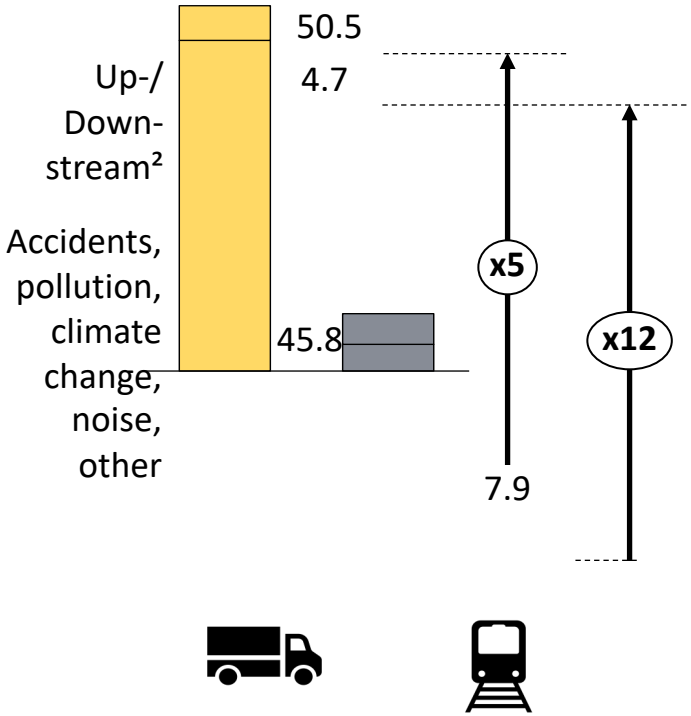
Environmental impact of using freight rail

Comparison of external costs[1]

in EUR/1,000 ton-km, 2012

Selected external cost categories

Total



RAIL 2030 R&I Priorities

The Challenges

CHALLENGES FOR THE MOBILITY OF 2030

ATTRACTIVENESS & CONVENIENCE	MAXIMISED AFFORDABLE CAPACITY	SUSTAINABILITY/SECURITY
End-user/citizen driven services (passenger & logistics)	Matching capacity with demand	Decarbonised Mobility
Integrated door-to-door mobility	Affordable and minimising infrastructure changes	Energy efficiency
Minimizing Journey Time. No waiting times	Resilient transport system and quick recovery	Reducing congestion in populated areas
Punctual, reliable & secure	Customized & Flexible: adaptable to changing needs	Limiting noise, vibration and ground space
Comfortable & quiet		More secure and resilient
Affordable and tailored for all needs		

"The rail sector addresses these challenges as the backbone of integrated mobility"

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RAIL 2030 R&I Priorities

Answers and actions

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THE RAIL SECTOR'S ANSWERS TO THESE CHALLENGES *(Supported by Horizon Europe)*

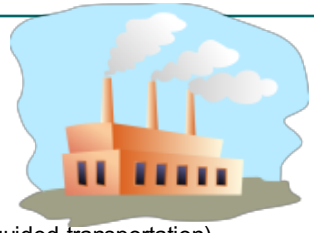
DIGITALIZATION	AUTOMATION	NEW MOBILITY SOLUTIONS	SUSTAINABLE SOLUTIONS
Connected & integrated railways	Real time operational management	Seamless integration between modes of transport	Green energy technologies
Intelligent & cost efficient asset management	Trains running closer together: Platooning & virtual coupling	Smaller and more frequent trains	Interconnection between Energy and Mobility systems
Cyber-security solutions	Autonomous trains	New types of rail transport solutions (pods & others)	Apply Digitalization to energy
End-Users/Citizens centric services	Automated freight operation	Stations and Terminals as Mobility hubs	Silent railways
Digital control command	AI & Robotics		Pro-active Security
	Extracting value from data		Non-invasive inspection solutions

COST SAVINGS AND DEPLOYMENT OF INNOVATION

Improved deployment, bottom-up transport-system standards solution, better adapted /regulation/certification (virtual), rapid deliveries…

RAIL 2030 R&I Priorities

Multi-Modal Mobility



Overview Multi-Modal Mobility

Passenger

Freight

Urban	Suburban	Regional	Long-distance
Walkability Metro LRT (e)-Bus Shared modes: Taxi (e)-Car-sharing (e)-Cycle(-sharing) app-based services Pods Cars (e)-vans Drones	Last mile services Commuter trains LRT / Tram-train (e)-Bus (e)-Cars (e)-vans (e)-trucks Pods Drones	Last mile services Regional trains (e)-coaches Shared mobility: Car-sharing/pooling (e)-Cars Pods Freight rail around regional logistic hubs Drones	Last mile connectivity and urban modes Highspeed-Rail Sleeper rail (e)-coaches Shared mobility: Car-sharing/pooling (e)-Cars Pods Hyperloop or other „revolution“ Air travel / planes Freight rail

Communication Infrastructure

Operational Infrastructure

Energy Infrastructure

Destination/ Transport task

…

Modular Pods for passengers and freight

Groundbound Railways (rail-guided transportation)

Lightrail vehicle | **Metro train**

Commuter train | **Freight train**

Regional train | ***Pod carrier RAIL***

Intercity train | **Highspeed train**

Rail Infrastructure

Groundbound Street (non rail-guided transportation)

Car | **Bus** | **Truck / Van** | **Walking / Bicycles** | ***Pod carrier STREET***

Road Infrastructure

Air

Plane | **Helicopter/ Drone** | ***Pod carrier AIR***

Airport/Hub Infrastructure

Water

Ships / Vessels | ***Pod carrier WATER***

Water transport Infrastructure

Groundbound Hyperloop

Vacuum Tube | **Pod carrier TUBE**

Hyperloop Infrastructure

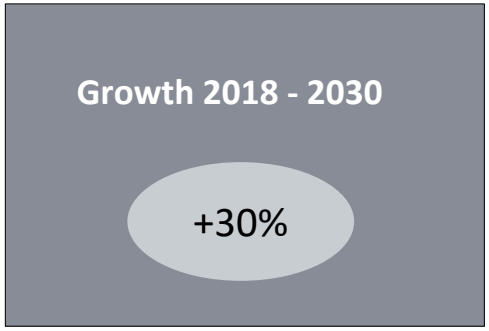
V0x_UITP

Challenges and opportunities for freight rail

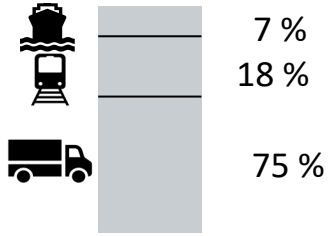
Additional 570bn ton-km will be transported on road in 2030 assuming constant modal shares

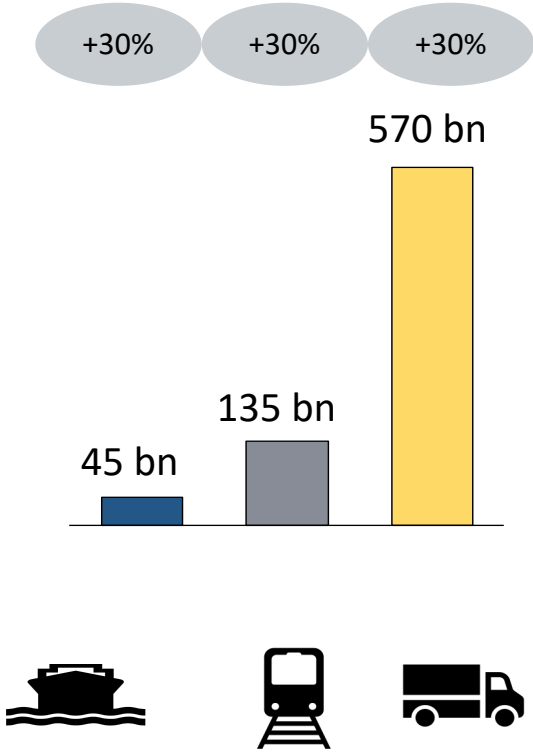
Additional freight transport 2030 vs. 2018
in bn ton-km; EU 28 + CH, N; excluding pipeline, sea and air[1]

Optimistic base scenario



Modal share 2018 - 2030





Corresponds to

- Roughly the size of the entire German freight transport market (~600 bn ton-km in 2015)
- 1 million additional trucks[2] on European roads

1 Not in focus, market size ~ 1,250bn ton-km in 2015
2 Estimated range of 600,000 - 1,400,000 trucks
3 Stagnation of rail modal share (since 2004) continues

Source: Eurostat, OECD

A higher modal share of 30% freight rail by 2030 is the macro-economical better solution for European transport growth

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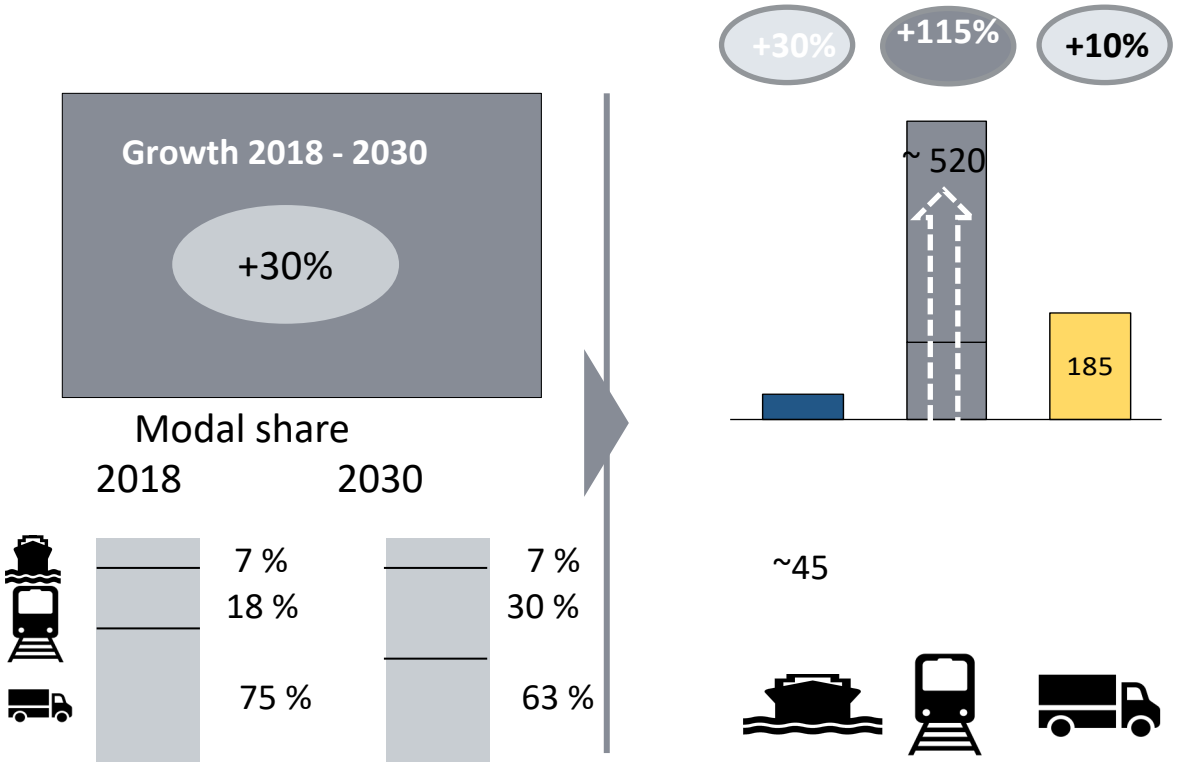
Impact of modal shift on additional freight transport 2030 vs. 2018

in bn ton-km; EU 28 + CH, N; excluding pipeline, sea and air



Estimated impact 2019 - 2030[2]

- Economic gain of ~ 100bn EUR due to less externalities (before costs of rail expansion)
- ~ 290 Mio. tons CO_2 saved
- ~ 40,000 premature deaths due to pollution avoided
- ~ 5,000 fatalities due to truck accidents saved

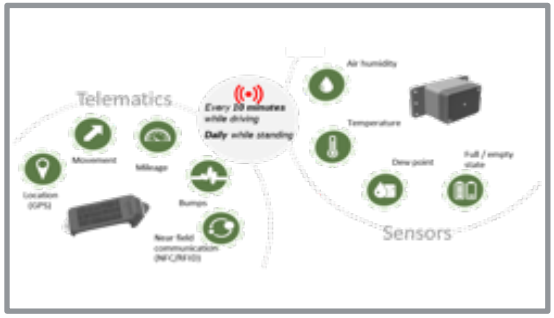
Every percent modal share increase has strong positive impact on environment/society[4] !

1 Freight transport growth without modal shift
2 Assuming linear growth of rail modal share from 18% in 2018 to 30% in 2030
3 Average for Europe, not each country; shares in AT (32%) and CH (37%) in 2015 even higher; conditional ambition (see next chapter)
4 Reduction of ~ 8 bn EUR in external cost, ~ 25 mio. tons CO_2, ~ 3,500 premature deaths/fatalities (assuming constant growth)

Source: CER, EuroStat, EU Commission, EAA

RUs need to strengthen innovation and enhance speed of digitalization/deployment of available technology

Digitisation/ Automation/ technical innovation in rail freight

	Automation (Driving, coupling)	Telematics/Wagon Intelligence	Electronic Customer Portals
			
Customer/RU benefits	Higher reliability (e.g., no change of drivers) Reduced cost of labour-intensive and safety-relevant activities More economical operation of feeder networks	Innovative services/products for customers (e.g., monitoring of goods) Optimised transport management/ fleet availability Optimized maintenance and operational processes (e.g., remote brake test)	Bundling of e-services (e.g., empty wagon order, booking, track & trace/alerts, data analysis) Enhanced ease of use of rail freight Reduced cost in order management

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Shift2Rail

Vision of the Innovation Programme 5 „Freight“

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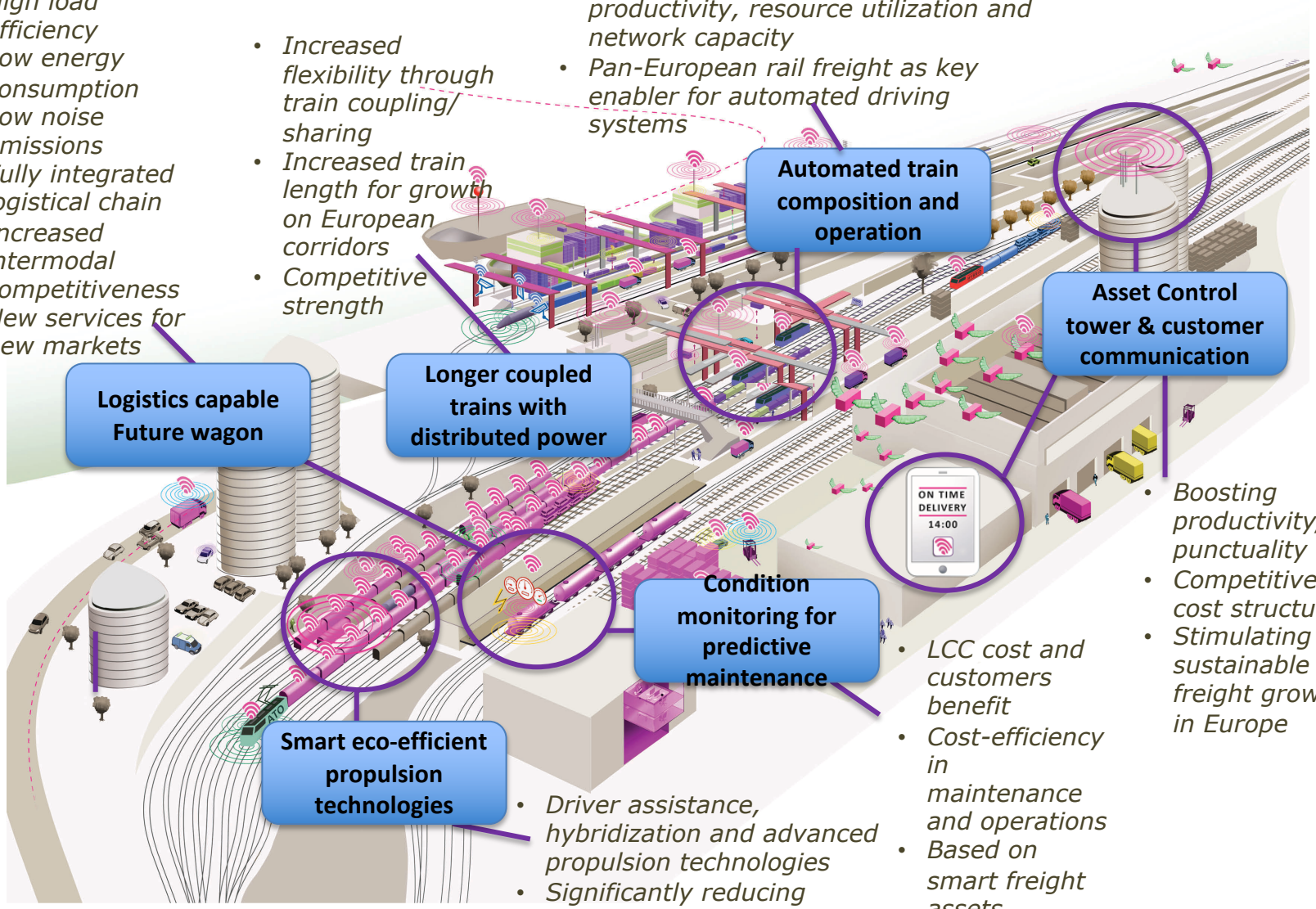
- *High load efficiency*
- *Low energy consumption*
- *Low noise emissions*
- *Fully integrated logistical chain*
- *Increased intermodal competitiveness*
- *New services for new markets*

- *Increased flexibility through train coupling/ sharing*
- *Increased train length for growth on European corridors*
- *Competitive strength*

- *Maximizing service quality, productivity, resource utilization and network capacity*
- *Pan-European rail freight as key enabler for automated driving systems*



- *Boosting productivity/ punctuality*
- *Competitive cost structures*
- *Stimulating sustainable rail freight growth in Europe*

- *LCC cost and customers benefit*
- *Cost-efficiency in maintenance and operations*
- *Based on smart freight assets*
- *Maximizing reliability*

- *Driver assistance, hybridization and advanced propulsion technologies*
- *Significantly reducing energy consumption and emissions*

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Thank you for your attention