Vilken roll spelar järnvägen i det framtida transportsystemet?

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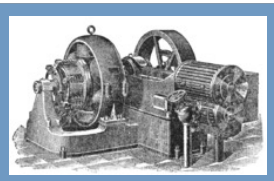
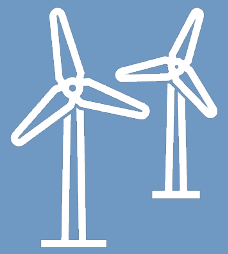
ALSTOM
• mobility by nature •

Waves of Electrification
Historic shifts in generation, transmission and consumption

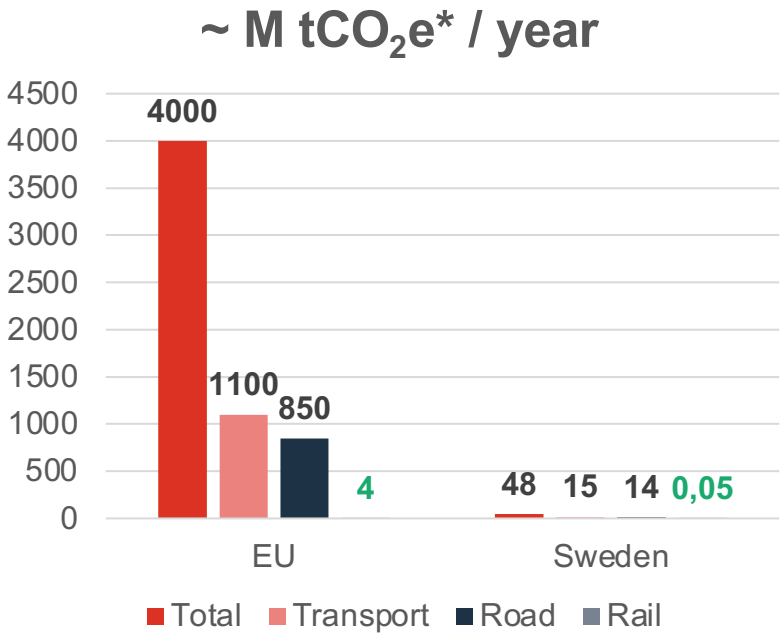
	Generation		Transmission		Consumption	
1. 1850 ~ 1890	Small scale thermal		Point-point	DC =	Lighting (public, industry)	
2. 1890 ~ 1920	Medium scale hydro and fossil thermal		Regional grid	AC ~	Industrial manufacturing, Rail	
3. 1920 ~ 1950	Large scale hydro and fossil thermal		National grid (HV AC)		Households (appliances, lighting)	
4. 1950 ~ 2000	Thermonuclear		Electronic grid management (HVDC, FACTS)		Electronic devices, telecommunications (industrial and consumer)	

The Fifth Wave of Electrification?
Today and beyond

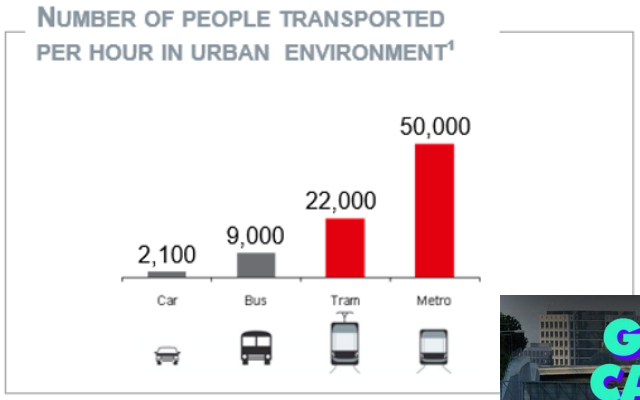
	Generation	*Transmission*	*Consumption*
5. 2000 ~	Wind and solar 	Flexible and smart grid 	• Pan-electrified mobility • High efficiency electronics and lighting  • Pro-sumers

Can we be smart about sustainable transport?

Shifting transport modes reduces emissions[1]



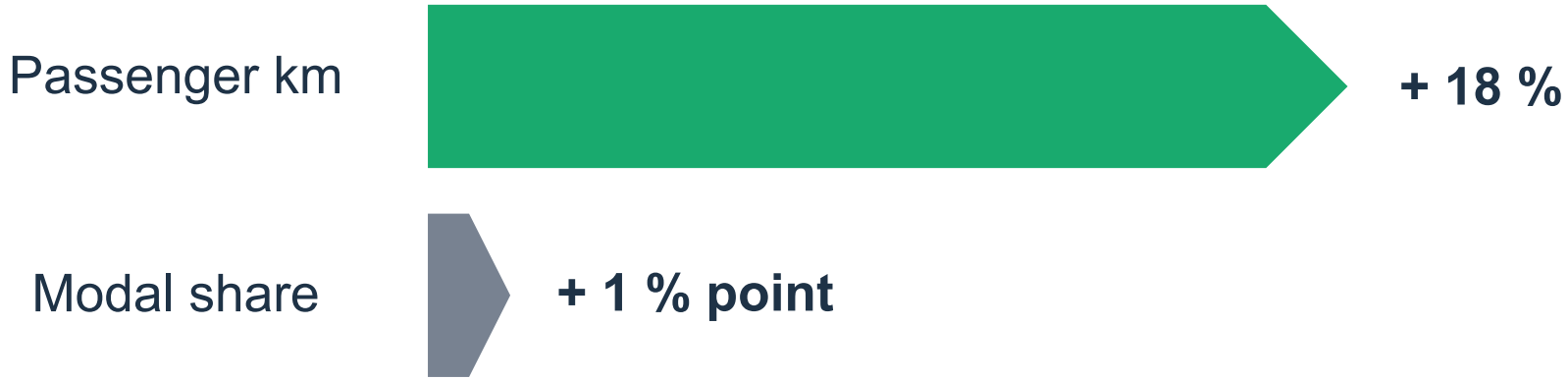
What is an efficient use of transport capacity? [2]



1. Eurostat, Quarterly greenhouse gas emissions in the EU, 2022; Naturvårdsverket: Territoriella utsläpp och upptag av växthusgaser, 2022; Naturvårdsverket: Inrikes transporter, utsläpp av växthusgaser
2. Number of people crossing a 3 to 5 meter-wide space in an hour in an urban environment, Source: International Association of Public Transport (UITP)

How are we doing with the modal shift to rail?
EU

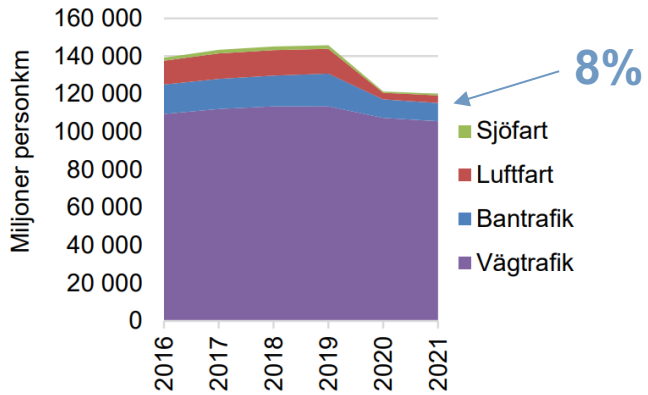
EU27 passenger rail transport evolution 2007 - 2018[1]



1. Raitech.com, 2021, Esther Geerts
2. Europeans' satisfaction with passenger rail service, Flash Eurobarometer 463, Survey conducted by TNS Political & Social at the request of the European Commission, Directorate-General for Mobility and Transport, 2018
3. Long distance journeys completed within 5 min of scheduled arrival on routes where rail and air travel compete in 2018, SJ 2019, Hur påverkar tillförlitligheten resenärers val av färdmedel?, Svanberg & Göransson, VTI, 2020

How are we doing with the modal shift to rail?
Sweden

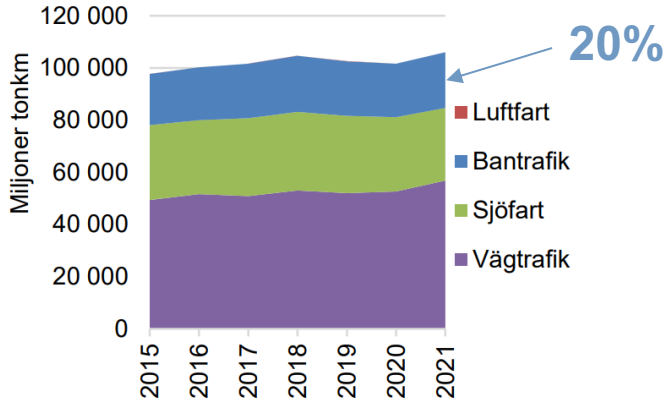
Passengers



Persontransportarbetet under 2021 var 120 miljarder personkilometer

- **88 %** inom vägtrafik, oförändrad andel mot 2020
- **8 %** inom järnväg, spårväg och tunnelbana, oförändrad andel mot 2020
- **1 %** inom sjöfart, oförändrad andel mot 2020
- **3 %** inom luftfart, oförändrad andel mot 2020

Goods



Godstransportarbetet under 2021 var 106 miljarder tonkilometer

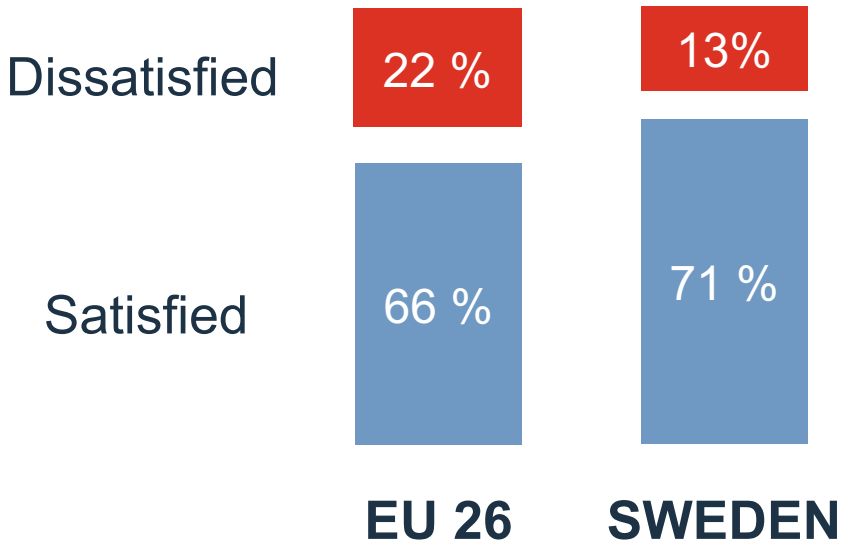
- **54 %** inom vägtrafik, en ökning med 2 procentenheter mot 2020
- **20 %** inom järnväg, oförändrad andel mot 2020
- **26 %** inom sjöfart, en minskning med 2 procentenheter mot 2020
- **<0,1 %** inom luftfart

No shift in sight in Sweden

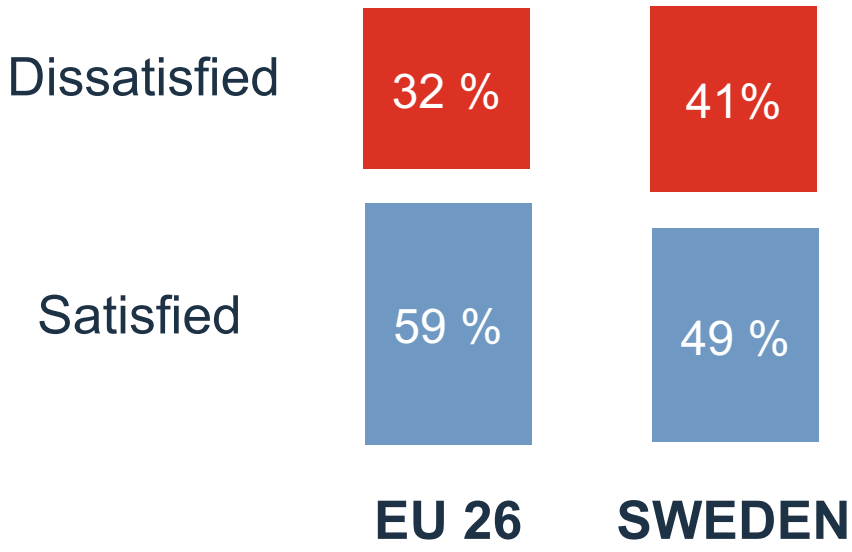
Source: Transportarbete i Sverige 2000–2021, Trafikanalys, 2022-10-04

Why are we not shifting modes?
European and Swedish perspectives on core performance

Passenger satisfaction Frequency[1]



Passenger satisfaction Punctuality and Reliability[1]

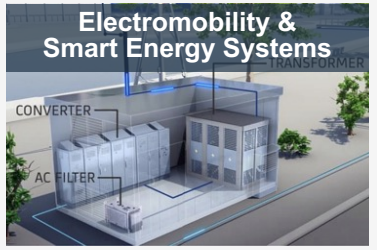
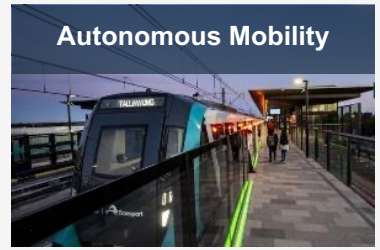
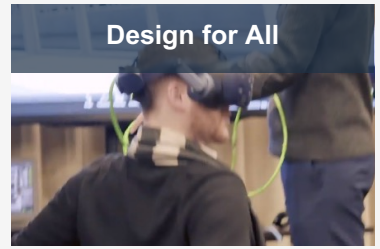


*…but punctuality vs aviation is **72 %** compared to **57%** in Sweden* [2]

Swedish trains run acceptably often but are quite unreliable and late!

1. Europeans' satisfaction with passenger rail service, Flash Eurobarometer 463, Survey conducted by TNS Political & Social at the request of the European Commission, Directorate-General for Mobility and Transport, 2018
2. Long distance journeys completed within 5 min of scheduled arrival on routes where rail and air travel compete in 2018, SJ 2019, Hur påverkar tillförlitligheten resenärers val av färdmedel?, Svanberg & Göransson, VTI, 2020

Priority areas and convictions for innovation that drive Alstom

Priorities	Convictions	2025 Targets		
GREEN MOBILITY	**Lead societies to a low carbon future**	25% energy savings for solutions portfolio Eco-design for 100% of new solutions		
SMART MOBILITY	**Make mobility simple to operate and ride**	200 Alstom fleets supervised by the Alstom Mobility Data Platform		
INCLUSIVE AND HEALTHIER MOBILITY™	**Create mobility solutions that all people can enjoy riding**	'Design for All' commitment applied to 100% of newly designed solutions		

Innovations that are ready to use
Green Mobility Solutions

Electromobility & Smart Energy System Examples

Hesop™ reversible substation power converters to **reuse energy** from electrodynamic braking in tracks with DC supply

On-board battery or hydrogen fuel cell energy storage systems for new or retrofitted trains for zero emissions on non-electrified lines

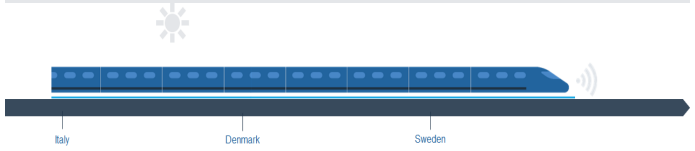
Mitrac ™ TC1500 modular traction platform offering customers **sustainable value at sustainable cost** adapted to the needs for energy efficiency, reliability, maintenance and noise (including SiC and PM motors)

Innovations that are ready to use
Smart Mobility Solutions

Digital Mobility Intelligence & Autonomous Mobility Examples

ERTMS for Seamless Operation

- Enhanced cross-border **interoperability**
- All **weather** Operations
- With any **network** (private or public 4G/5G)

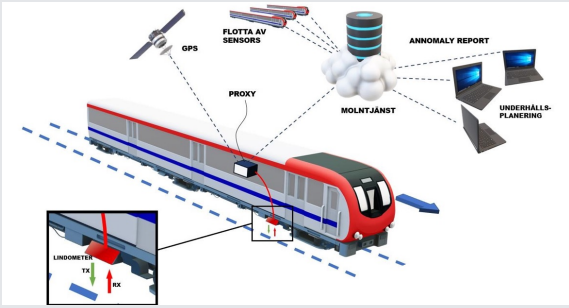


ATO for Seamless Driving

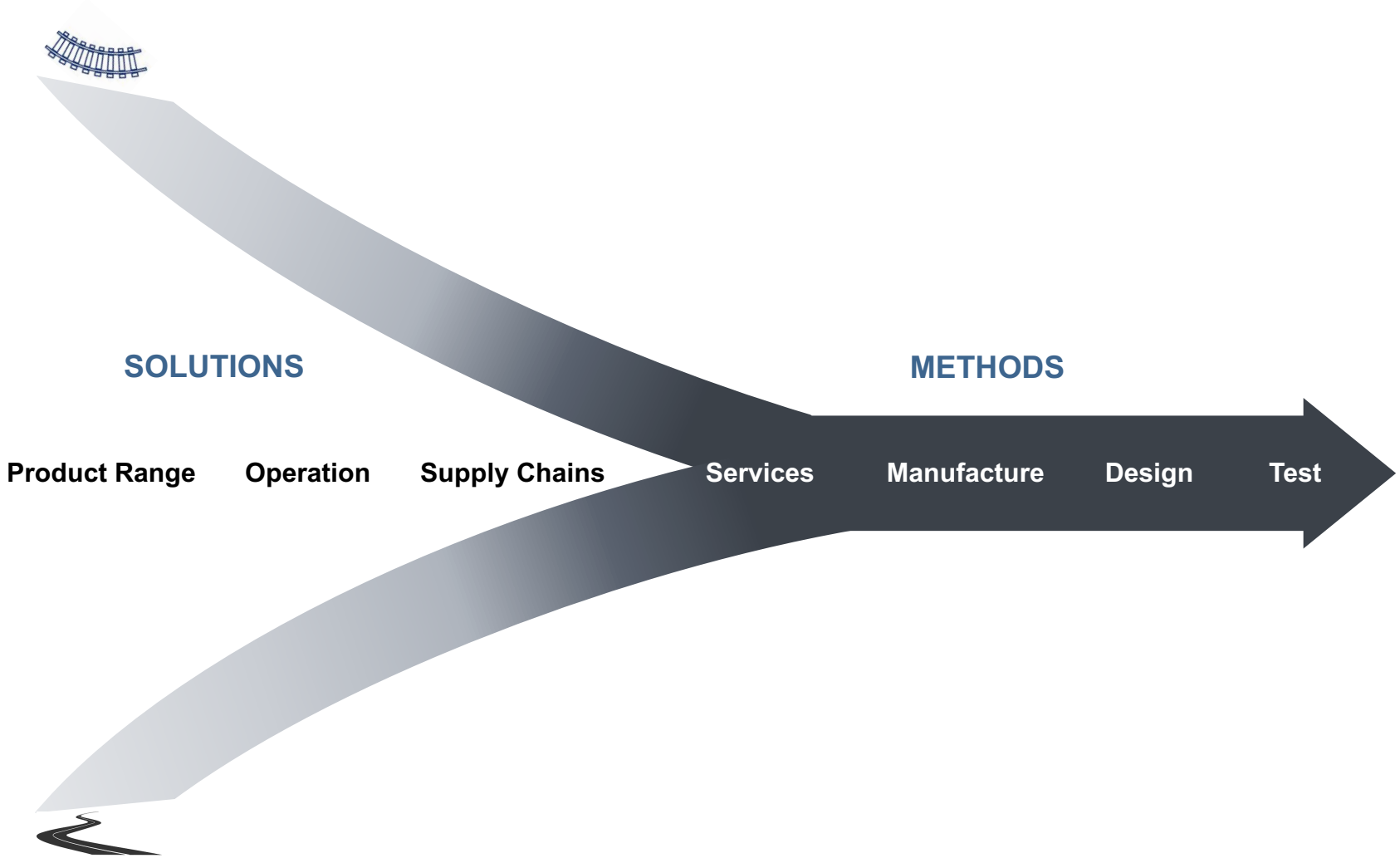
- Increase **capacity**
- **Energy** savings
- Enhanced **performance** regularity

Smart maintenance

- Visual and manual inspection will be significantly lowered or even eliminated.
- Proactive maintenance to increase performance of infra.

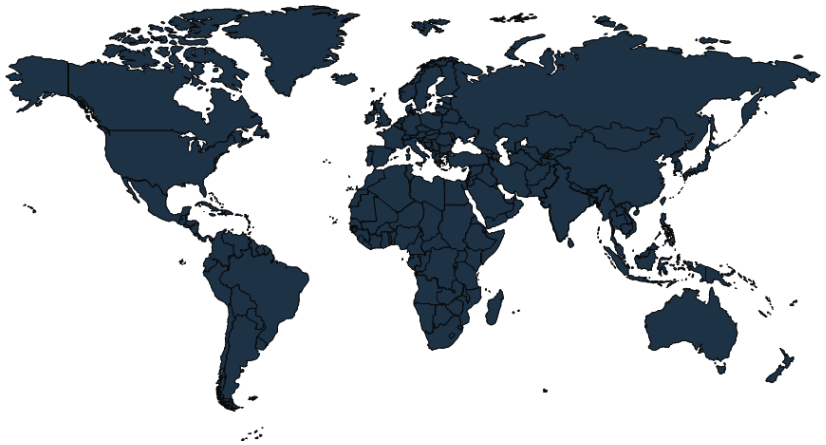


Innovation Trends
Rail and Road Synergies in E-mobility and Autonomous Operation



Collaborate to Innovate
E-mobility Test and Technology Center and Innovation Station

MARKET



INNOVATIONS

- Green Mobility
- Smart Mobility
- Healthy and Inclusive Mobility

CO-FUNDING

NATIONAL

Region Västmanland

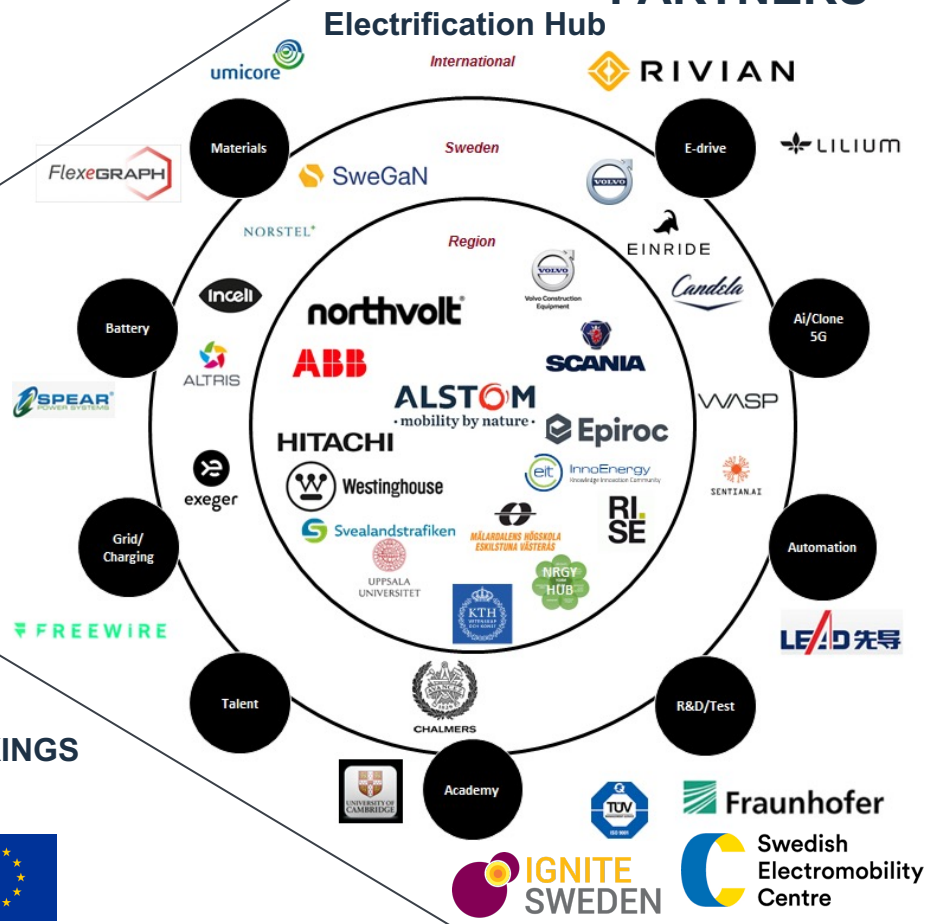
VINNOVA

Energimyndigheten

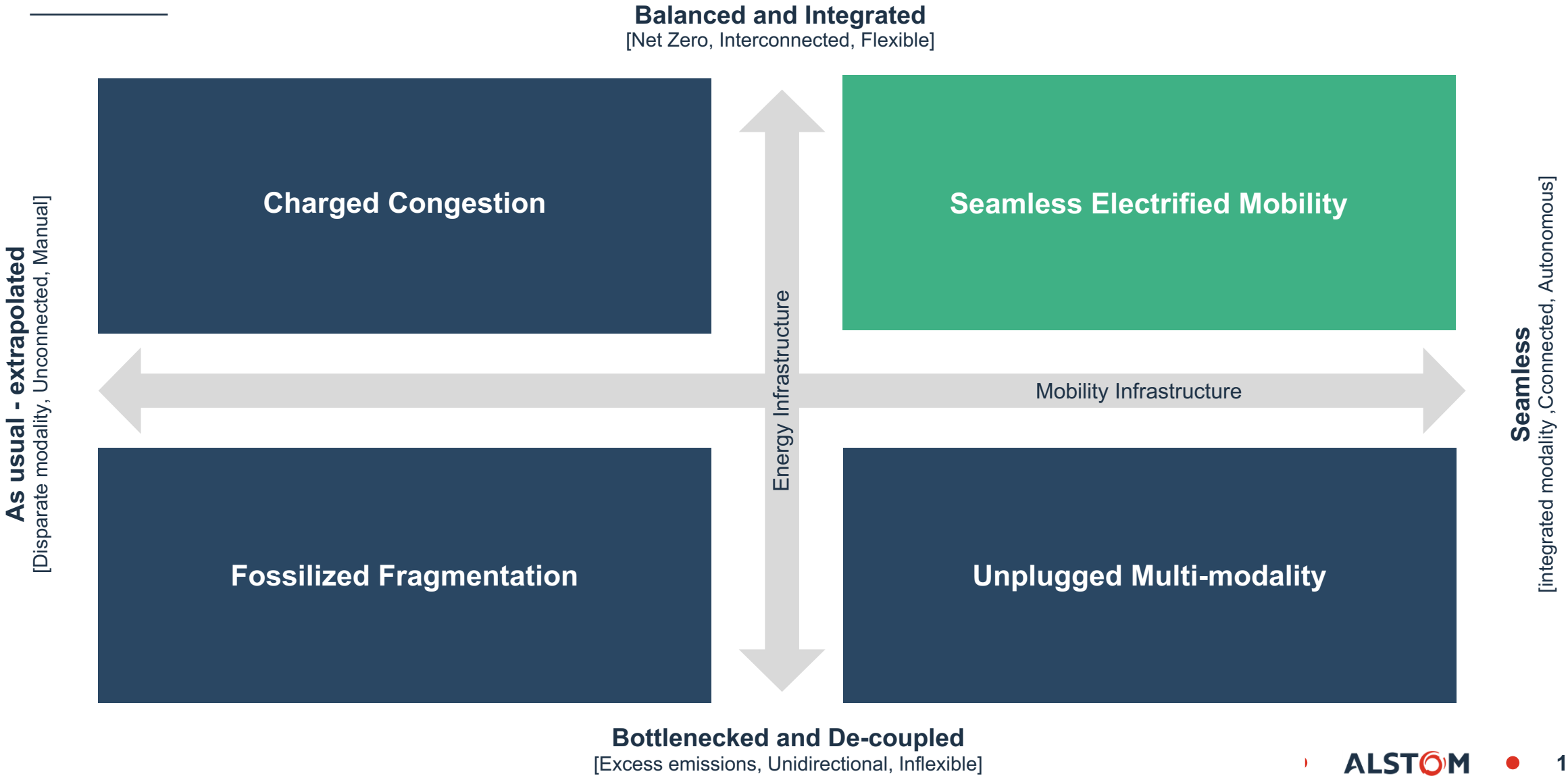
KK-stiftelsen

EU
JOINT UNDERTAKINGS
CLUSTERS

INNOVATION PARTNERS

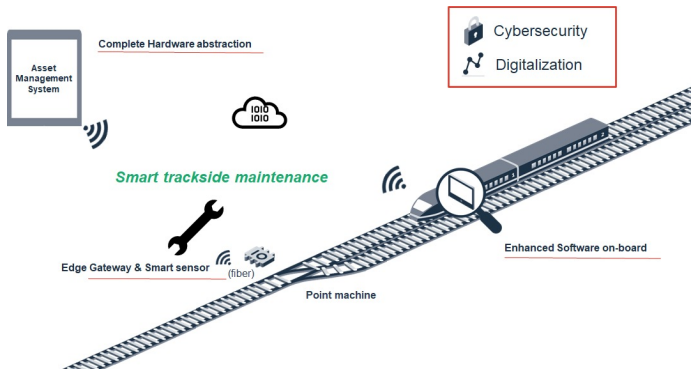


Innovation needs interaction between Energy and Mobility sectors
Possible Scenarios



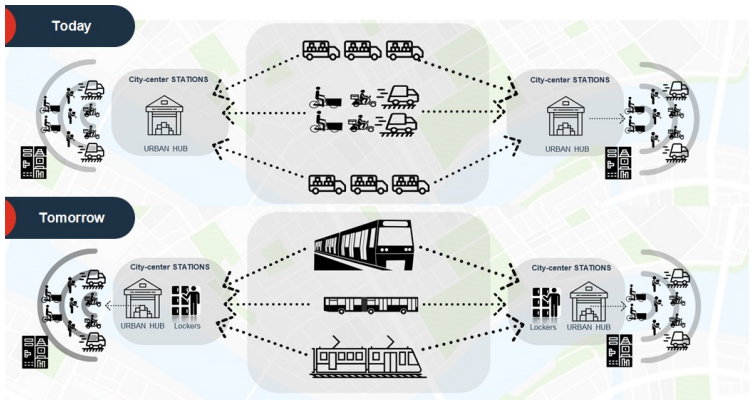
Innovations on the horizon

Leveraging tomorrow's architectures for new services



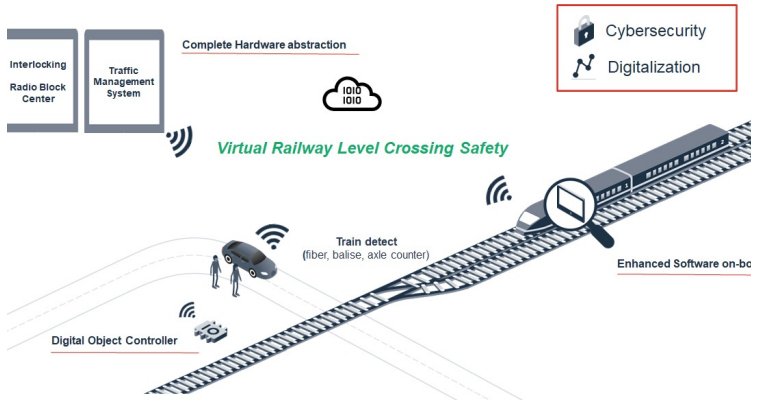
Smart Trackside Maintenance of Point Machines

Bringing **intelligence where** it needs to be, rebalancing hardware to **software when** it needs to be.



Urban Freight Orchestration

Public Transport and infrastructure as the backbone of the Urban Freight Ecosystem



Virtual Railway Level Crossing Safety

Reduce accidents in unsupervised crossings.

Connecting with **other digital ecosystems** to create sustainable value at sustainable cost

Why does it take so long to implement innovations in rail?
Insights from the UK

- The franchising system is not designed to drive or reward innovation[1]
- Procurement frameworks are unfit for entrepreneurs[1]
- Data are fragmented, siloed and unreliable[1]
- The funding landscape is difficult to navigate and is not output driven[1]
- The culture in rail is resistant and reluctant to grasp innovation[1]

- The complex railway ecosystem is prohibitive to new entrants from outside the sector, with barriers present in policy, procurement, culture, and process, where misaligned costs and benefits prevent the justification of investment. [2]
- A clear path to market with a simple benefit and reward structure will stimulate private sector investment in skills and facilities. [2]
- There is no one-size-fits-all approach, but personnel at all levels should be coached to understand the value of, and how to enable, innovation. [2]

These insights are also relevant for Sweden!

1. The UK passenger rail system:how and why is it changing?, Professor John Preston, University of Southampton (Future of Mobility: Evidence Review, Foresight, Government Office for Science, UK), December 2018
2. A RAILWAY INNOVATION STRATEGY, Getting ready for Great British Railways, Railway Industry Association (RIA), UK, April 2022

A call for mobility innovation action!

Five priorities for government, public and private actors

01

Use the capacity we have efficiently!

- Create incentives for efficient use of capacity in the larger intersecting system of mobility and energy

02

Create incentives for innovations with an impact!

- Combine a systems perspective with individual entrepreneurship and initiative

03

Be open while ensuring trust!

- Digitalisation demands a reframing of data ownership, business models and security

04

Collaborate off the beaten track!

- We alone do not have all the answers for rail transport but need to learn from, share and collaborate with others

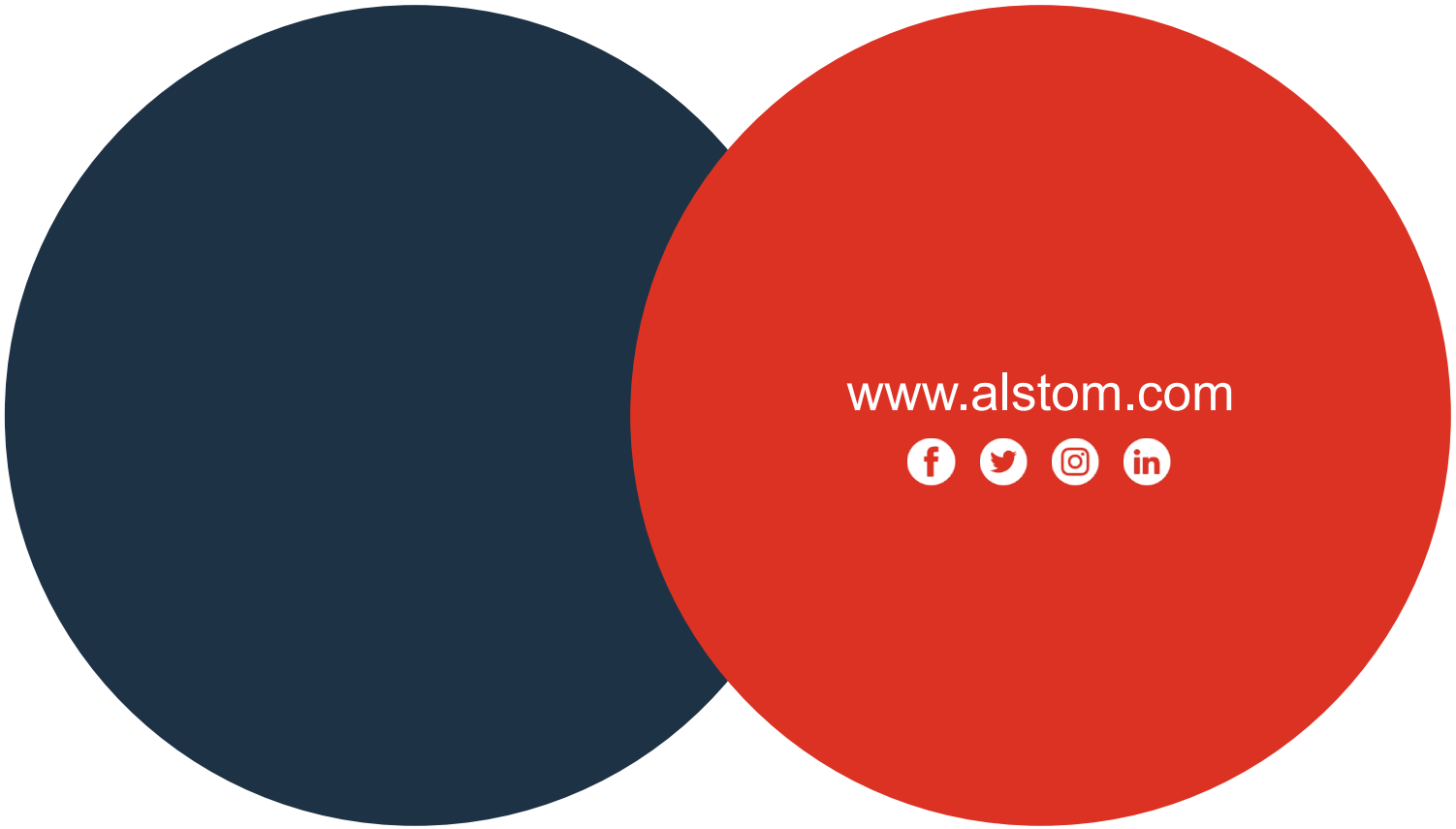
05

Fight fragmented innovation funding!

- Sweden needs a cross-sector approach to funding and funds to match EU's priorities

Waiting is not an option…

Towards a Seamless Electrified Mobility



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