



LARGE SCALE DEPLOYMENT OF ELECTRIC ROADS

CHALLENGES AND POSSIBILITIES

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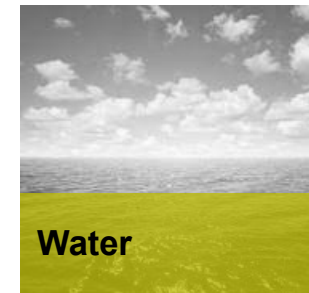
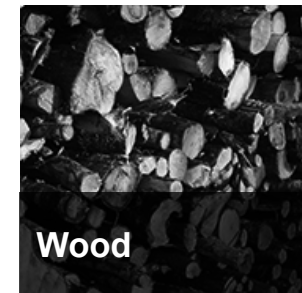
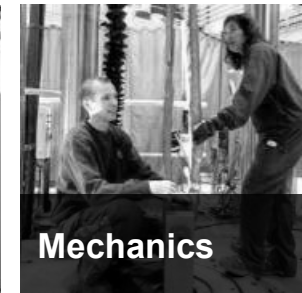
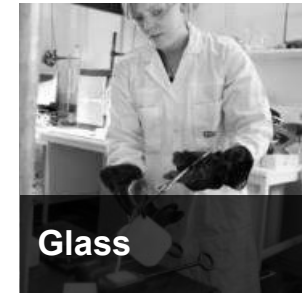
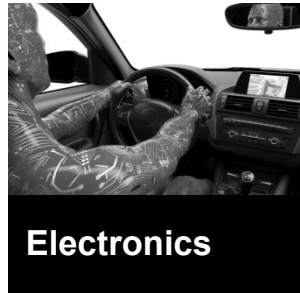
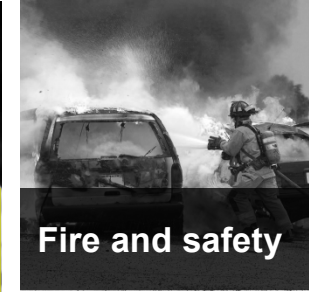


RISE – Research Institutes of Sweden

- Present across the whole of Sweden. And beyond.
- 2,200 employees, 30 % with a PhD.
- Turnover approx. SEK 2.5 billion (2016).
- SME clients account for approx. 30 %.
- Runs 100s of test and demonstration facilities, open for industry, SMEs, universities and institutes (RISE is owner and partner in 60 % of all Sweden's T&D facilities).



With our broad range of **competencies**
and unique expertise, we create
added value



Research & Innovation platform for Electric Roads

- Strategic project with government and industry funding
 - Strategic Vehicle Research and Innovation (FFI) program
 - Swedish Transport Administration
- Coordinated by RISE Viktoria
- 15 partners and an extensive reference group
- From mid-2016 to the end of 2019
- 3rd Electric Road Systems Conference 2019, Frankfurt
 - www.electricroad.org

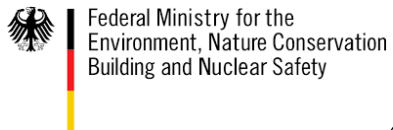


- **Partners:** RISE Viktoria, Airport City Stockholm, Chalmers University of Technology, Fortum, KTH Royal Institute of Technology, Lund University, Profu, Region Gävleborg, Region Kalmar, Scania CV, Swedish Transport Administration, Institute of Transport Economics (TØI), Volvo Group and VTI
- **Reference group:** Alstom, Bombardier, Elonroad, Elsäkerhetsverket, Elways, Energiforsk, E.ON, Ericsson, Ernsts Express, FKG, NCC, NEVS, Postnord, Siemens, SSAB, Swedish Energy Agency, TRB Sverige, Vattenfall and Volvo Cars ...

CollERS – A German & Swedish partnership for innovation



Funded by:



CHALMERS

Funded by:



* National project leader

Swedish-German research collaboration on Electric Road Systems

- The project consists of the core members from the Swedish Research and Innovation Platform for Electric Roads and the two national German research projects Roadmap OH-Lkw and StratON
- The overall goal of the project is to increase joint knowledge of ERS through cooperation between Germany and Sweden, and to discuss potential long-term strategies for a successful transnational implementation of ERS in Europe.
- Swedish part is coordinated by RISE Viktoria
- January 2018 to the end of 2019
- <https://www.viktoria.se/projects/collERS>



Federal Ministry for the
Environment, Nature Conservation
Building and Nuclear Safety



Swedish partners:

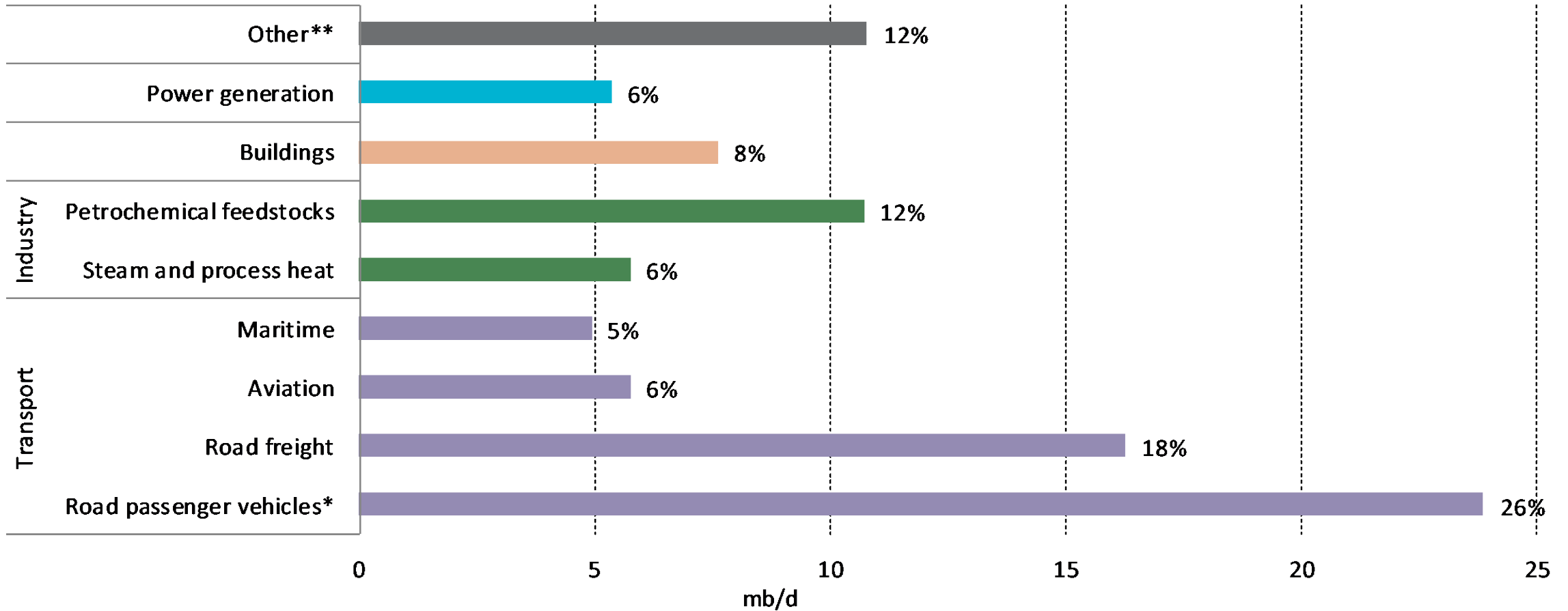
RISE Viktoria, Chalmers University of Technology, KTH Royal Institute of Technology, Swedish Transport Administration

German partners:

Öko-Institut, Institut für Energie- und Umweltforschung Heidelberg (ifeu), Heilbronn University, Fraunhofer Institute for Energy Economics and Energy System Technology

The problem

2015 road freight accounts for nearly 1/5th of global oil demand



Note: * Passenger vehicles includes buses and 2- & 3-wheelers

** Includes agriculture, transformation, other non-energy use (mainly bitumen and lubricants).

Electric Roads?

Evolution of ERS

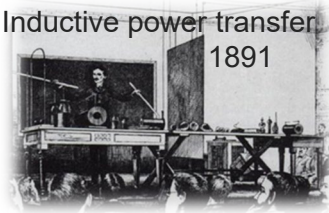
Overhead lines
1882



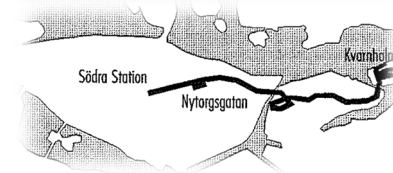
Conductive rail, 1881



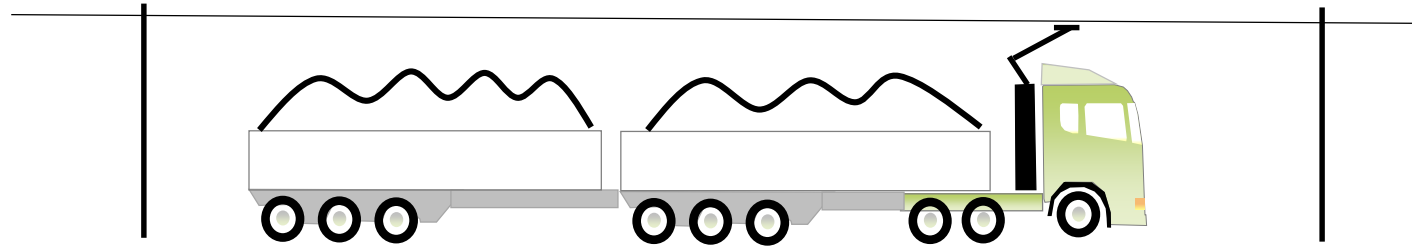
Inductive power transfer
1891



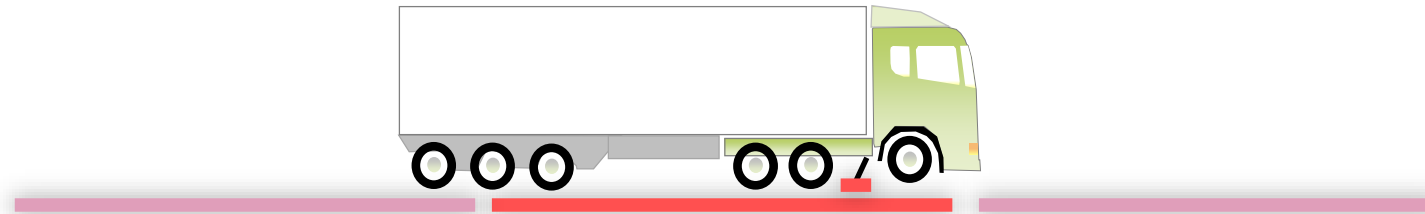
1942-1959



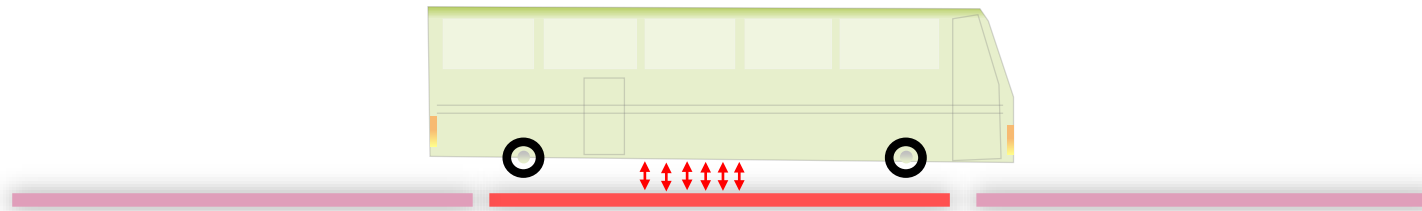
Different solutions



Overhead lines

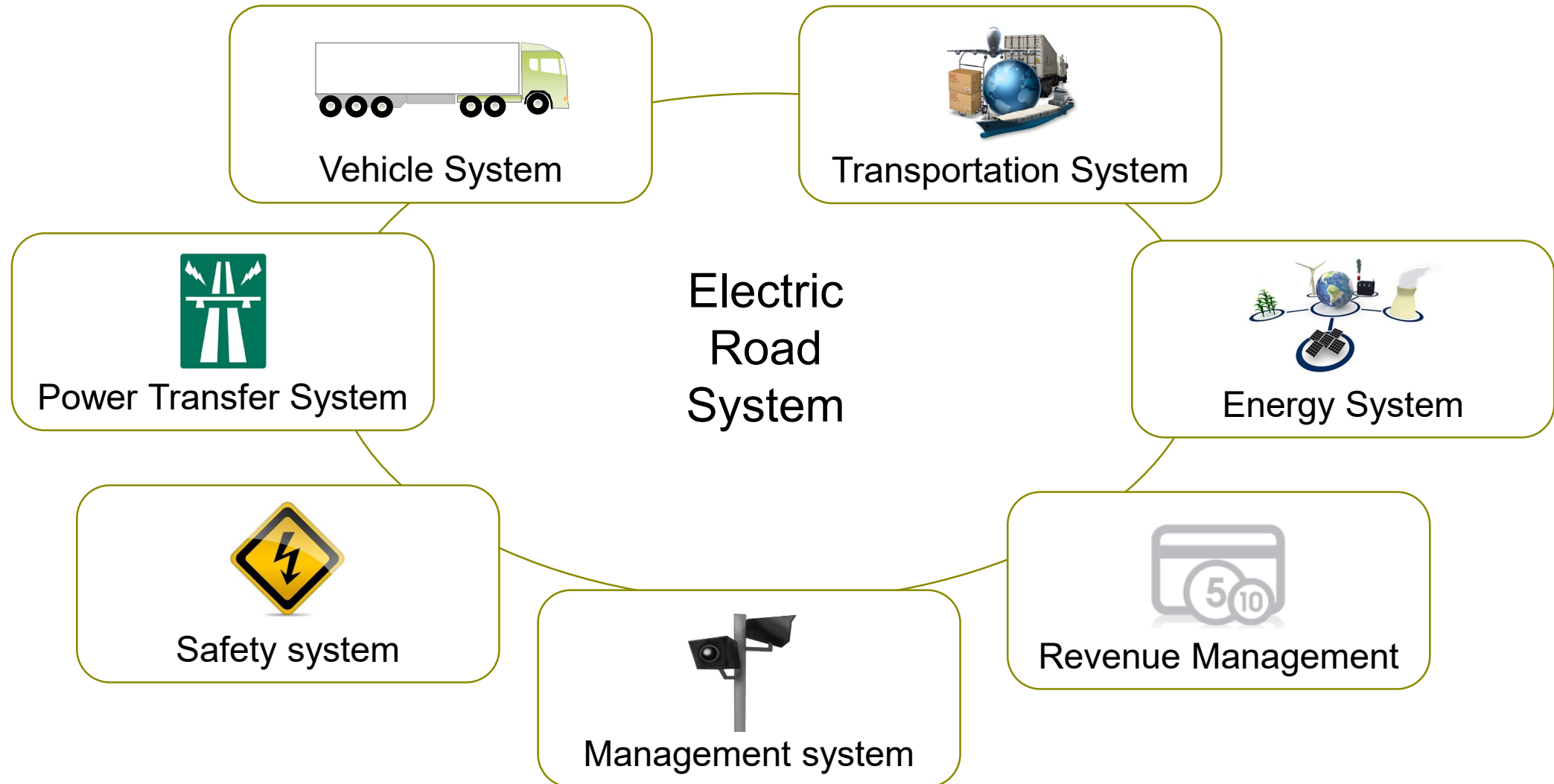


Rail



Wireless
(induction)

Electric roads creates a **systems-of-systems** and a business eco system with **several actors** and **new roles**



ERS development in Sweden

Research projects



BOMBARDIER



SCANIA



ELONROAD



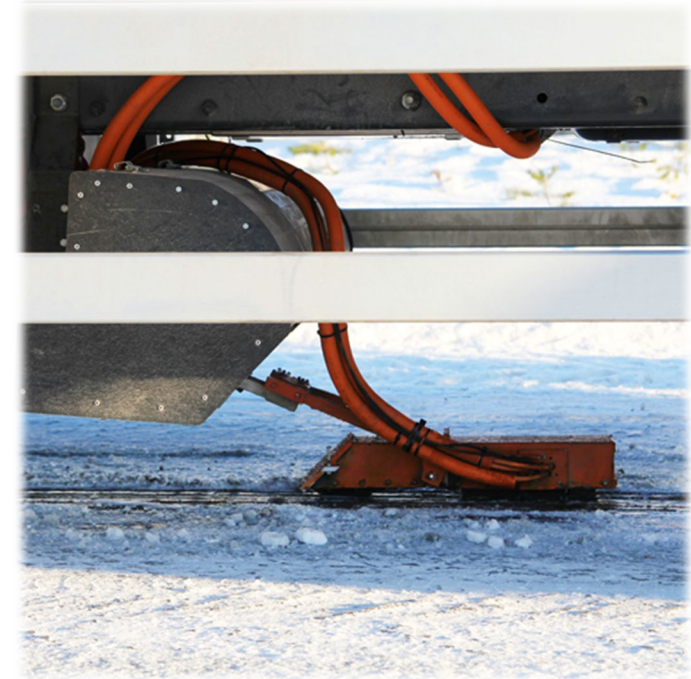
ALSTOM
VOLVO

Electric Road on E16



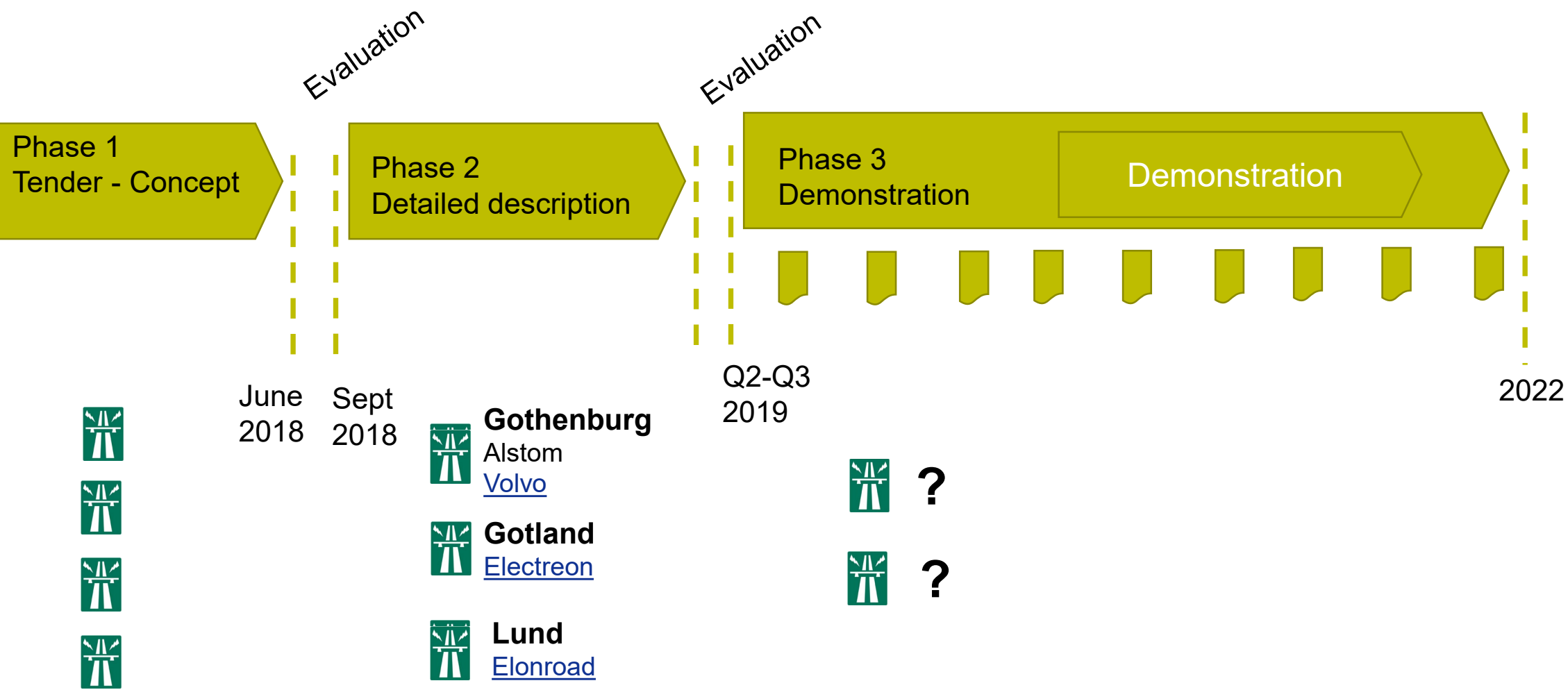
<http://www.regiongavleborg.se/regional-utveckling/samhallsplanering-och-infrastruktur/elvag/the-electric-highway-in-english/about-the-project/>

eRoadArlanda

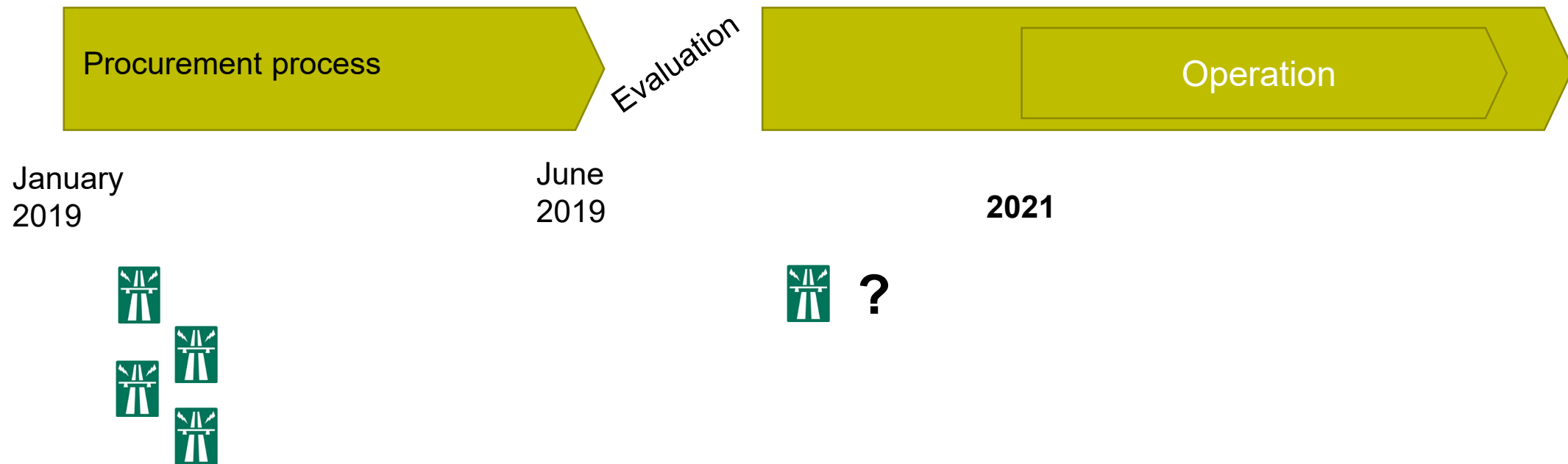


<https://eroadarlanda.se/>

Next demonstration - Pre-Commercial Procurement (PCP)



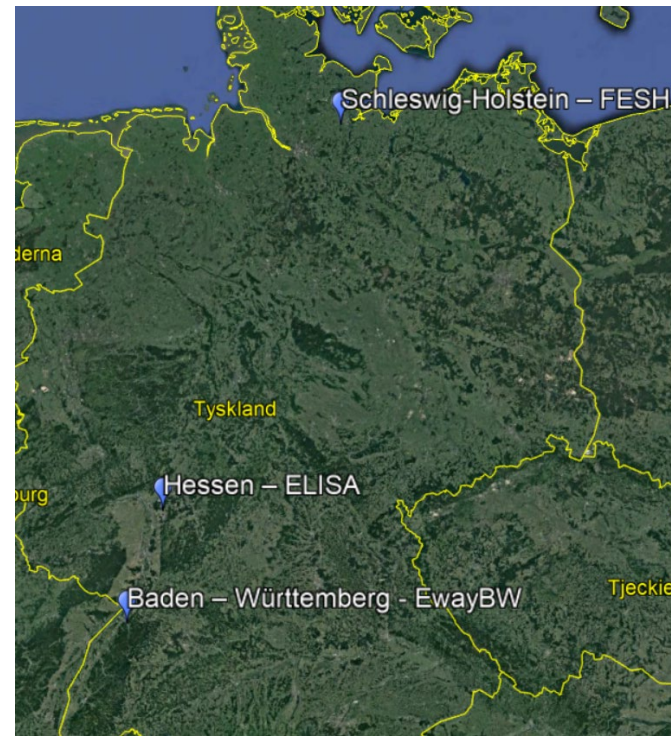
ERS Pilot, 20-30 km, 100+ ERS vehicles



ERS around the world

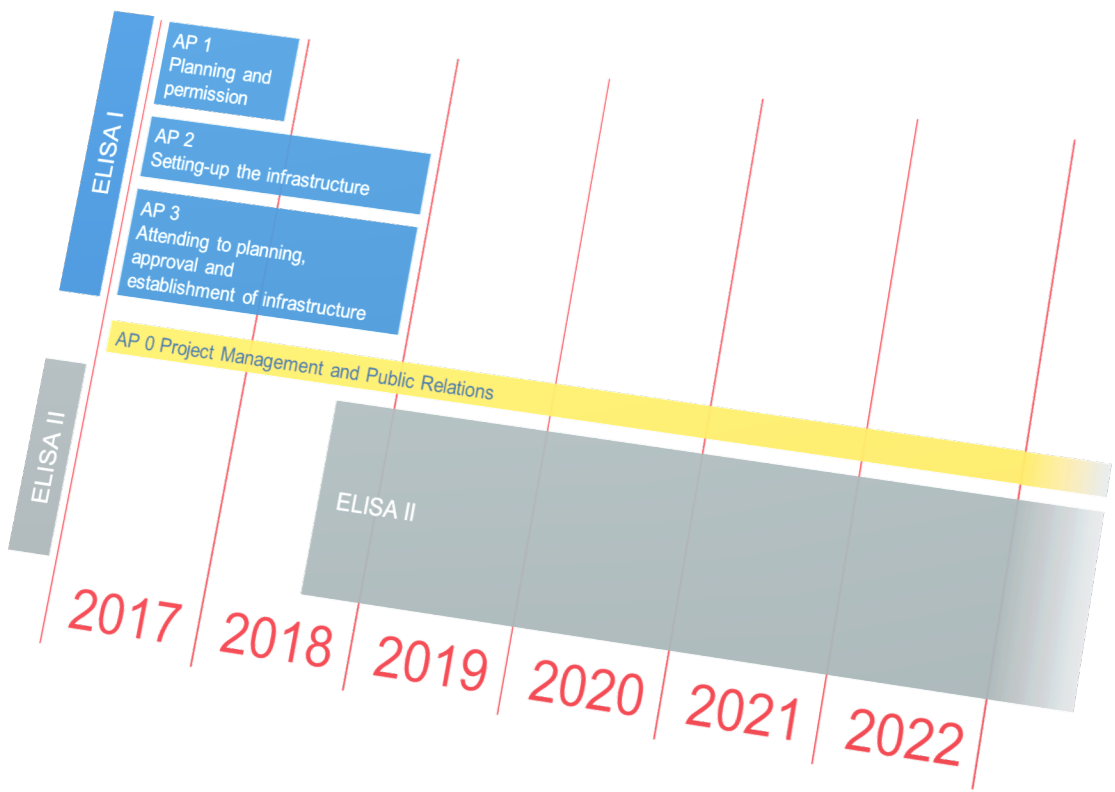
Field trials in Germany

- Hessen – A5 – Projekt [ELISA](#)
- Schleswig-Holstein – Projekt [FESH](#)
- Baden – Württemberg - B 462 – [EwayBW](#)



Two test vehicles from Scania

Hessen – A5 – Projekt ELISA



Test in Tel-Aviv

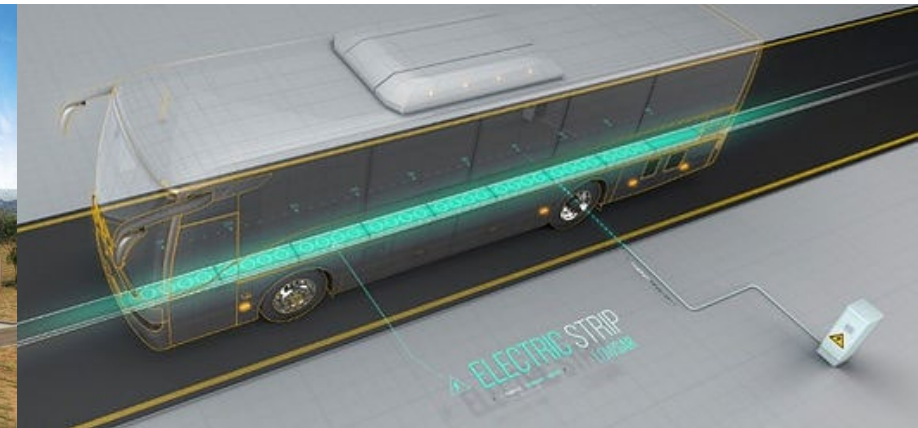
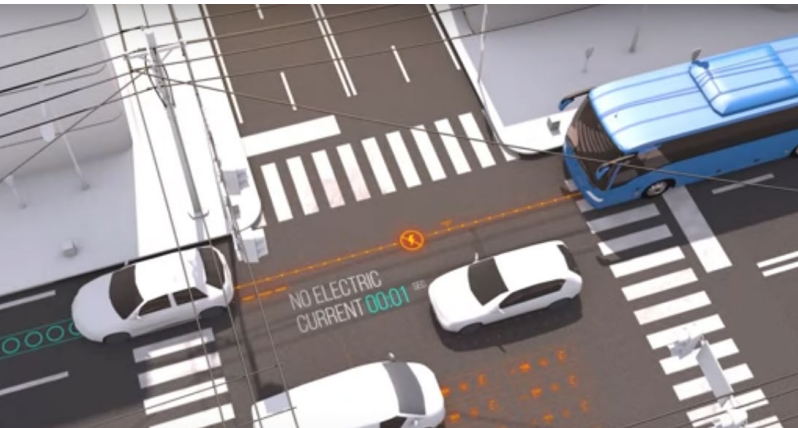


“Tel Aviv transit service Dan Bus Company announced plans to invest \$2.2 million in ElectRoad. ElectRoad’s technology buries electric coils beneath roads to wirelessly charge electric vehicles as they drive.”

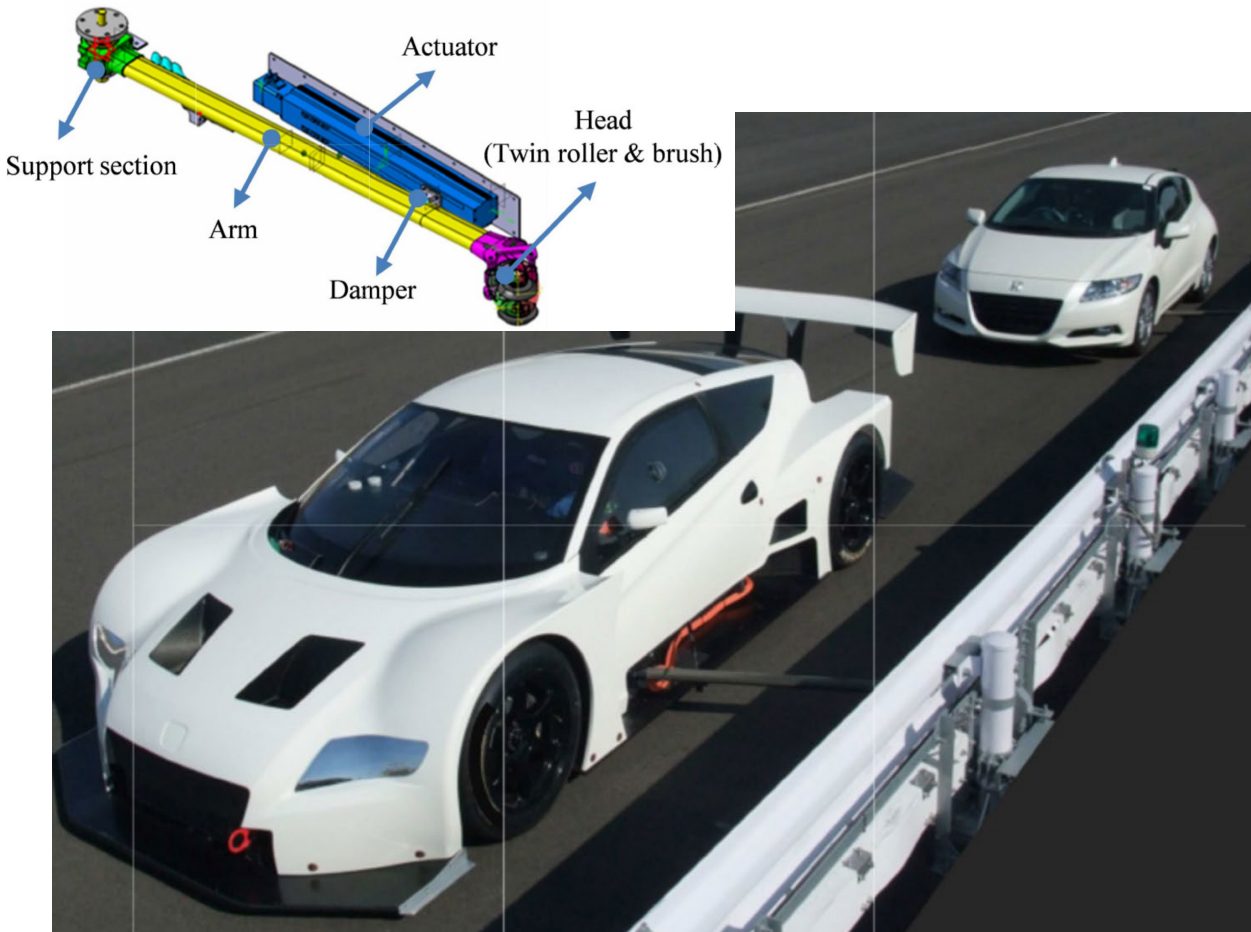
<https://inhabitat.com/israeli-bus-company-to-invest-2-2m-in-wireless-charging-electric-roads/>

”cooperation with the automobile manufacturer alliance Renault-Nissan-Mitsubishi.”

<https://www.electrive.com/2018/07/25/inductive-charging-electreon-cooperates-with-renault-nissan-mitsubishi/>



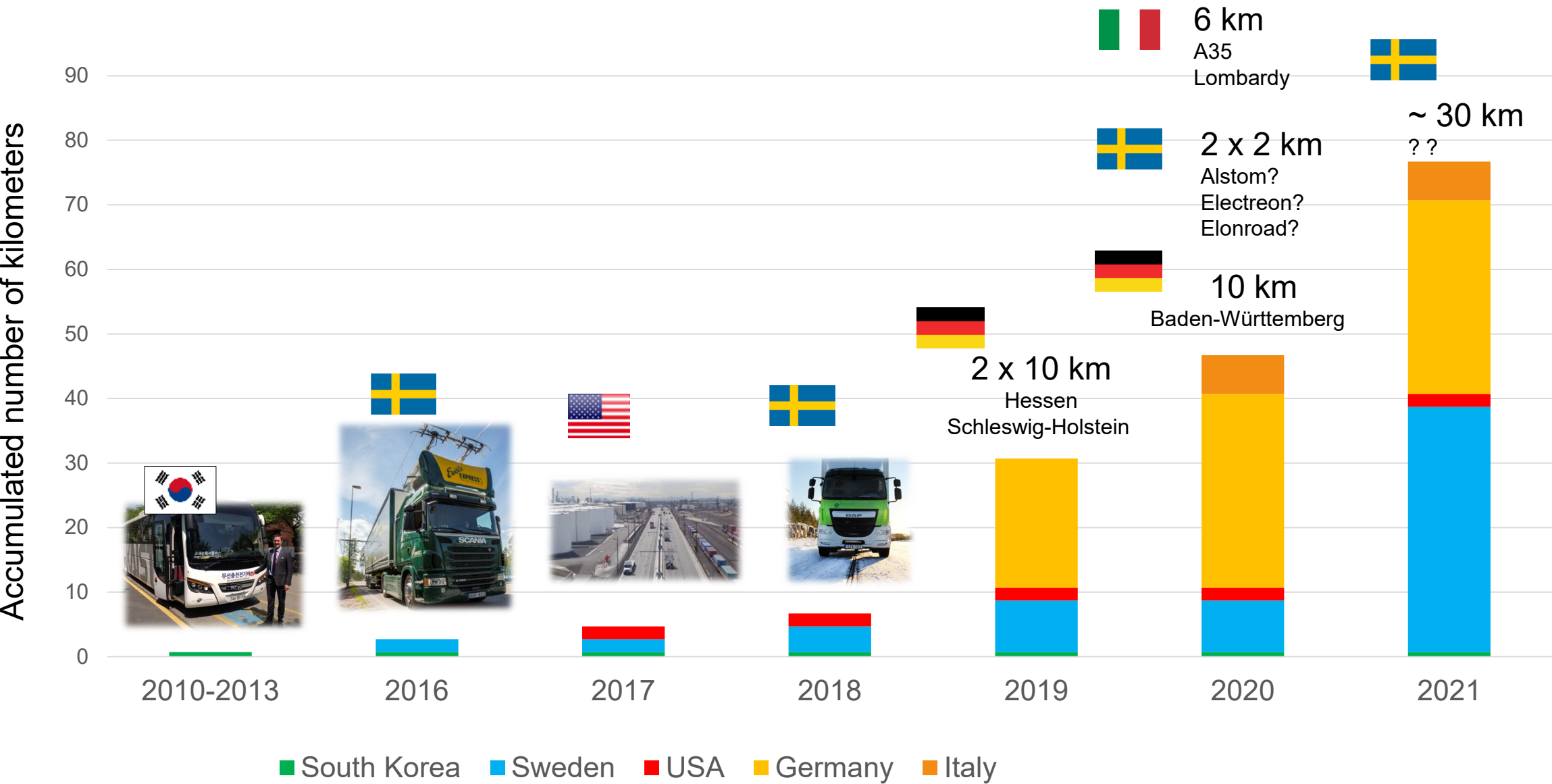
Test at Honda R&D



- Test of infrastructure and vehicle system at 156km/h
- Dynamic charging, 180 kW, DC 600 V, 300 A
- Goal 450kW
 - 4 km ERS per 100km @ 100km/h



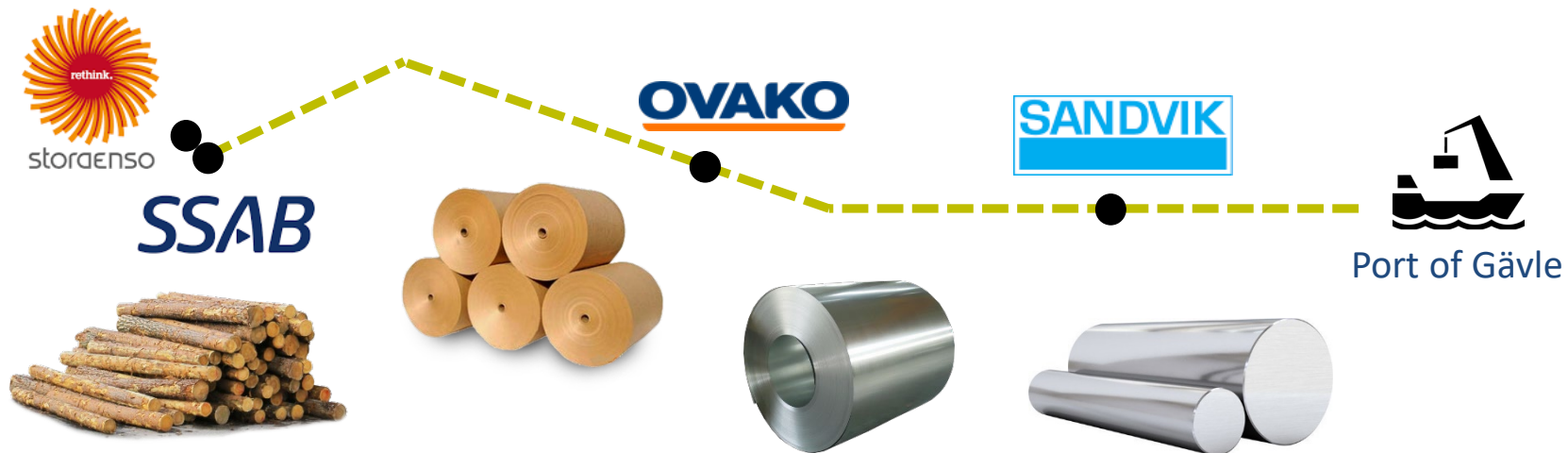
ERS on public roads



ERS Business case

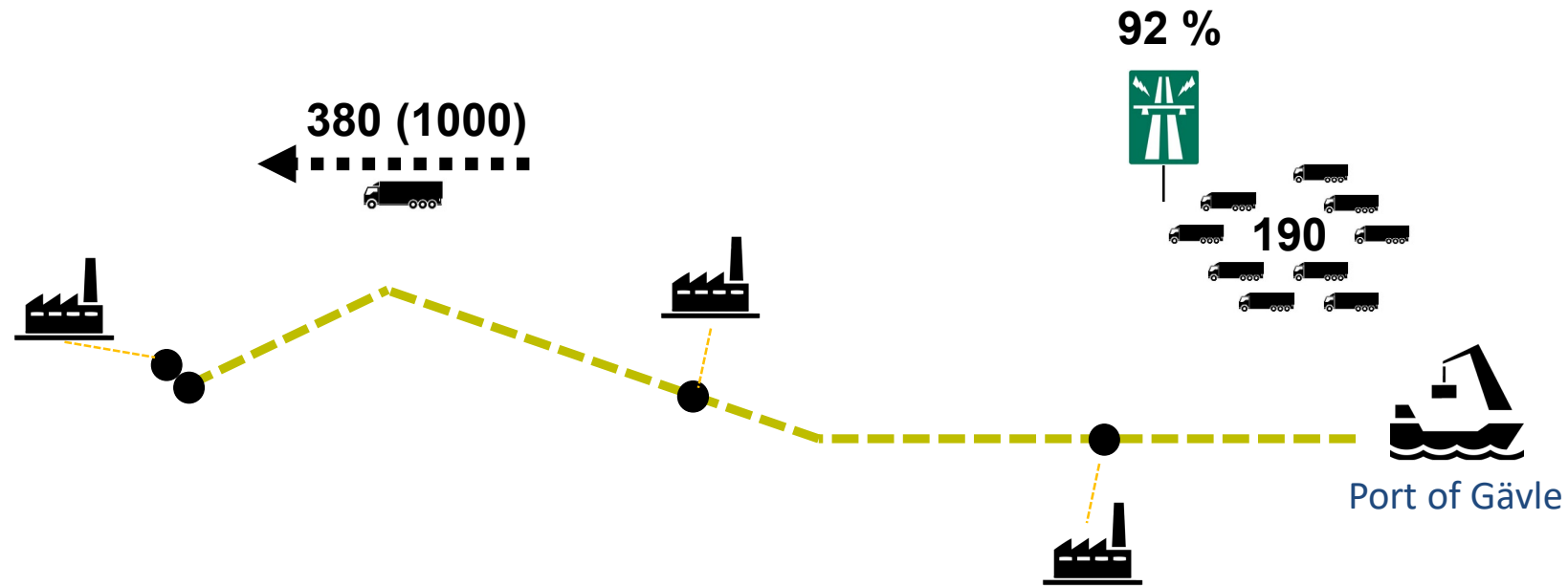
Case study – Gävle - Borlänge

- Distance 120 km
- 500 – 1000 trucks per day



When does an electric road go break even?

In this case...



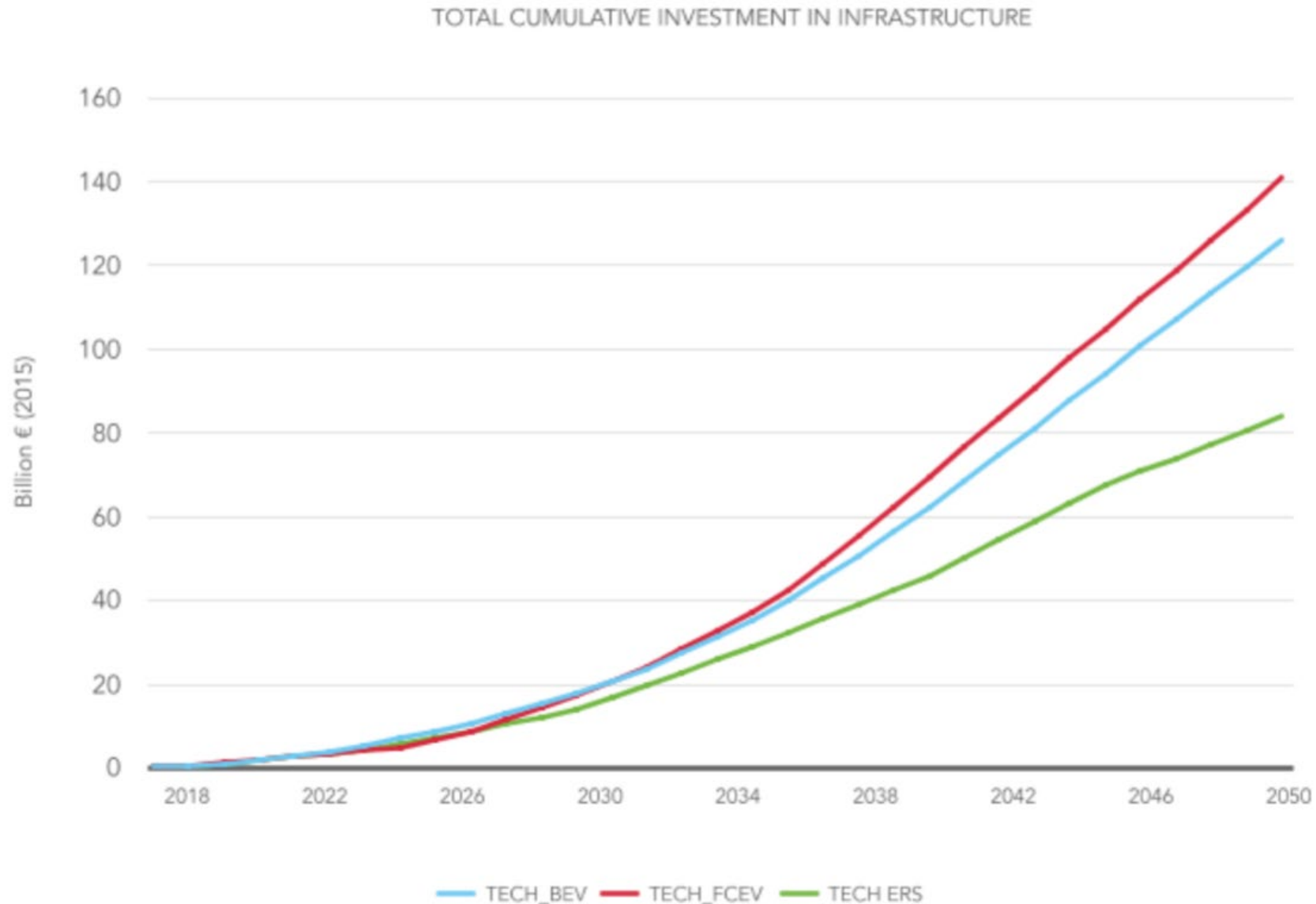
ERS “EU” Business case

From report “Trucking into a Greener Future” by Cambridge Econometrics

http://www.camecon.com/wp-content/uploads/2018/09/Trucking-into-a-Greener-Future_Summary-report.pdf

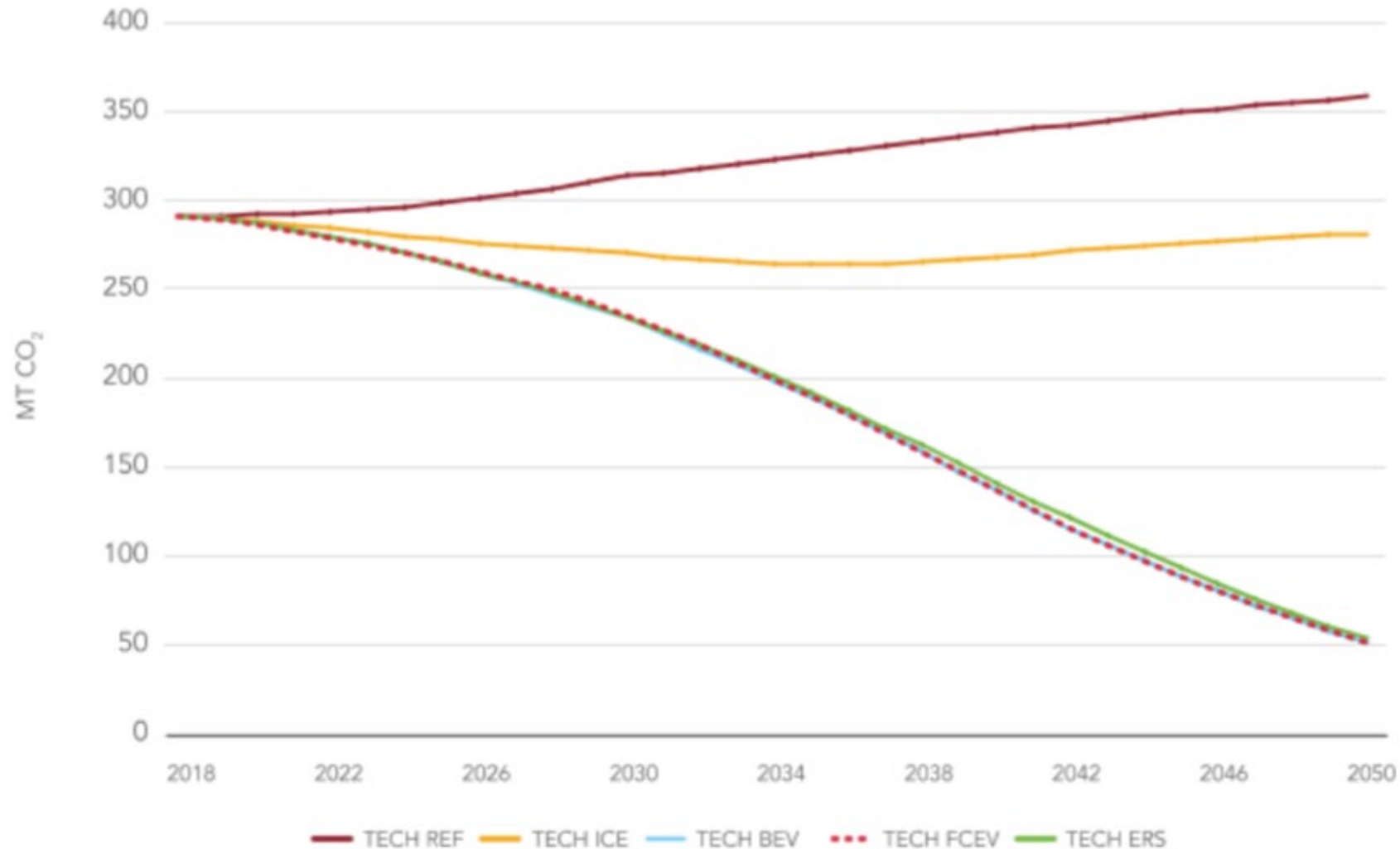
<https://www.camecon.com/wp-content/uploads/2018/09/Trucking-into-a-green-future-Technical-Report.pdf>

Infrastructure cost



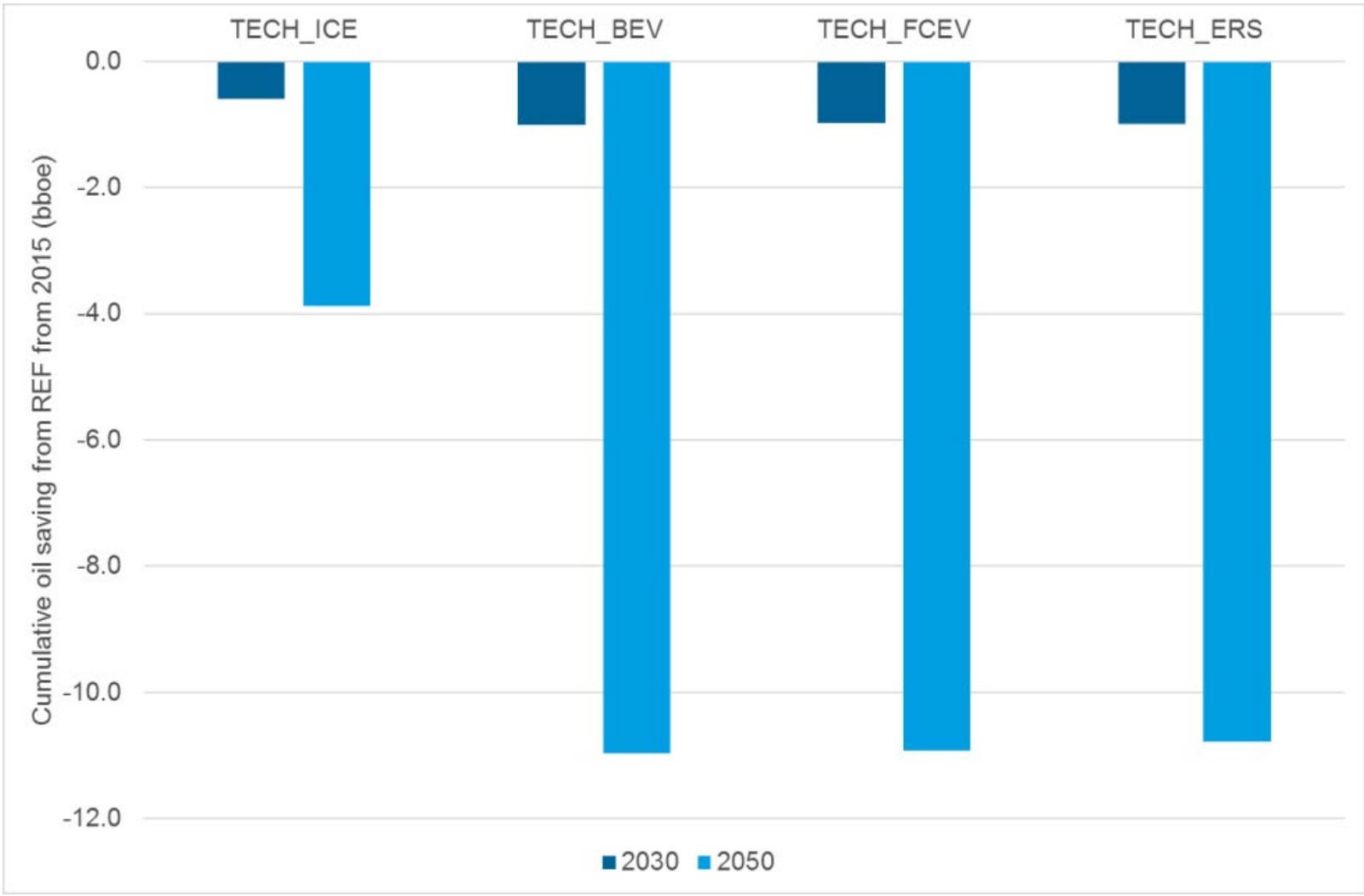
Total cumulative investment needs in infrastructure in each scenario.

Emission reductions



Impact of the ZEV scenarios on EU CO₂ emissions from the overall HGV fleet in each scenario.

Oil imports (difference from reference)



The future of ERS

Outlook



Tesla truck



Einride T-pod



ERS in Asia



ERS growth



International Cooperation

Conclusion

ERS is no silver bullet!

All solutions are needed to achieve sustainable transports!

Opportunities

- Sustainable transports
- Oil independency
- Reuse of infrastructure

Challenges

- Interfaces and standards
- Support systems
- Vehicle transformation
- Business model



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