

## eHighway

Electrified heavy duty road transport, Patrik Akerman

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## Road freight emissions trends make it clear: Solutions for decarbonization are needed

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Transport will increasingly be the biggest challenge for decarbonization in **Europe**.



Source: European Commission reference scenario for 2050 (2013) Unrestricted © Siemens AG 2016 If current trends continue, surface freight will become largest source of **global** transport emissions by 2030.



Source: ITF Transport Outlook - Scenarios to 2050 (2016)

#### Measures to reduce road freight CO<sub>2</sub> emissions



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### **Alternative concepts**

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Investigated concepts comprise external power supply and on-board storage systems



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# Zero emission trucks are possible with renewable energy, but efficiency varies greatly

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1) Including storage Source: German Ministry of Environment

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## Infrastructure built on the heavily trafficked roads can address significant part of heavy duty emissions

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Image: HDV density on BAB-network ; Source: Verkehr in Zahlen 2012; TREMOD 2012

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### **Alternative concepts**

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Investigated concepts comprise external power supply and on-board storage systems



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## What an Electric Road System could look like



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### Siemens' Electric Road System: eHighway



#### Advantages



- High energy efficiency
- Reduced operating costs
- Swift integration into existing infrastructure
- Safe, reliable and open technology

Electrification of hybrid trucks via an overhead catenary system

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#### How it could work



## Electric Road Systems are able to integrate a wide range of technologies without operational limitations

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#### Hybrid concepts

- Parallel hybrid
- Serial hybrid
- Diesel or gas combustion engines

#### **Full electric concepts**

- On-board energy storage by batteries or capacitors
- Recharging schemes
- Fuel cell technology



Technological alternatives of Electric Road Systems: Overhead or groundbased transmission technologies (Wiberg and Rådahl, 2012).

## No concessions on truck availability and performance

Full electric operation up to 90 km/h

#### **Operability in all situations**

- Passing
- Cutting in / out of lanes
- Full electric idling

## Compatible with and complementary to alternative fuel technologies

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### But is it realistic?



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### Videos from demonstration project on Swedish highway near Gävle

https://www.youtube.com/watch?v=s2Q2Tk2IL0o&index=1&list=PLPIRtIVZUfnyuNDEvsaU5npEu-dEPPbW9

https://www.youtube.com/watch?v=fmcMmYdF6IA&index=6&list=PLPIRtIVZUfnyuNDEvsaU5npEu-dEPPbW9

https://www.youtube.com/watch?v=VGe2u8PQ-10&index=5&list=PLPIRtIVZUfnyuNDEvsaU5npEu-dEPPbW9

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# eHighway is developing quickly and is ready for commercial use in near future



#### **Development project**

- Test track of 2.1 km with realistic highway conditions outside of Berlin
- Cooperation with e.g. Scania and Volvo
- Technical assessment of complete system by TU Dresden & BASt (the German Federal Highway Research Institute)
- Analysis of the economic and ecological impacts by German federal ministries lead to approval of field trial plan by 2017
- Public reports found positive results for applications considered with German transport volumes and energy costs (SRU, UBA (Sept 2015) and Öko-Institute (forth-coming in 2016))
- Studies from outside of Germany (e.g. Sweden and California) confirm potential economic benefits

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## **Example of external assessment**

Umweltforschungsplan des Bundesministeriums für Umwelt, Naturschutz, Bau und Reaktorsicherheit

Forschungskennzahl 3713 45 103 UBA-FB-00 [trägt die UBA-Bibliothek ein]

#### Erarbeitung einer fachlichen Strategie zur Energieversorgung des Verkehrs bis zum Jahr 2050

von

Peter Kasten Moritz Mottschall Öko-Institut e.V., Berlin

Wolfgang Köppel Charlotte Degünther DVGW-Forschungsstelle am Engler-Bunte-Institut des Karlsruher Instituts für Technologie (KIT), Karlsruhe

Martin Schmied Philipp Wüthrich INFRAS AG, Bern

Öko-Institut e.V., Schicklerstraße 5-7, 10179 Berlin

Im Auftrag des Umweltbundesamtes

08/2015

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The German Federal Environment Agency (UBA) commissioned the independent German Öko-Institute to make a comprehensive strategy for traffic energy supply until 2050:

- final version to be published in 2016
- covers all modes of transport
- refers to following options for long haul road freight transport
  - Carbon neutral fuels (sustainable biofuels, synthetic fuels from renewables)
  - Fuel cell electric vehicle (hydrogen from renewables)
  - Direct use of electricity (electric road systems)

Example : costs of carbon neutral long haul road freight transport (see next slide)

### External assessment ... ecologically and economically beneficial



#### Key assumptions:

- Length of electric network: 4,000 km; Infrastructure costs: 2.2 million €/km; Maintenance 2.5% of investment per year
- Additional vehicle costs: per today 50,000 €/ truck; per 2050 19,000 € per truck; share of direct electric traction: 60% in 2050

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#### Where are we now?

#### Sweden – Operation started



- Innovation Procurement Process for demo projects by Trafikverket
- Field trial (2 years) started <u>June 22</u>
- **Overall aim:** evaluate ERS-options prior to introduction on road network
- Scania as truck OEM, second truck will join operation next year

#### USA – trucks ready



- **eHighway** to reduce emissions of port links on **1-mile** infrastructure near ports in L.A. and Long Beach
- Cooperation with Volvo Trucks and local truck converters
- Contract with South Coast Air Quality Management District testing throughout 2017.

#### **Germany – field trial planned**



- **R&D Projects** (ENUBA) incl. test track
- Federal Ministries for Economy (BMWi) and Environment (BMUB) – decided on field trial of eHighway ERS in call 10/2015
- Presently project ideas are being evaluated and will be decided on soon
- Construction approx. 2017 // field project approx. 2017-2019

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## The path forward focuses on the electrification of highly frequented routes

### eHighway application fields \_\_\_\_

#### Near term



Shuttle transport

Mine transport

Long term



Long haul traffic

The development path of road electrification can echo that of rail electrification a century ago

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### Thank you for your attention



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Patrik Akerman Business Developer eHighway

Siemens AG Mobility Technology & Innovation eHighway

Erlangen

Mobile: +49 (172) 735 1509 E-mail: patrik.akerman@siemens.com

www.siemens.com/mobility/ehighway

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