

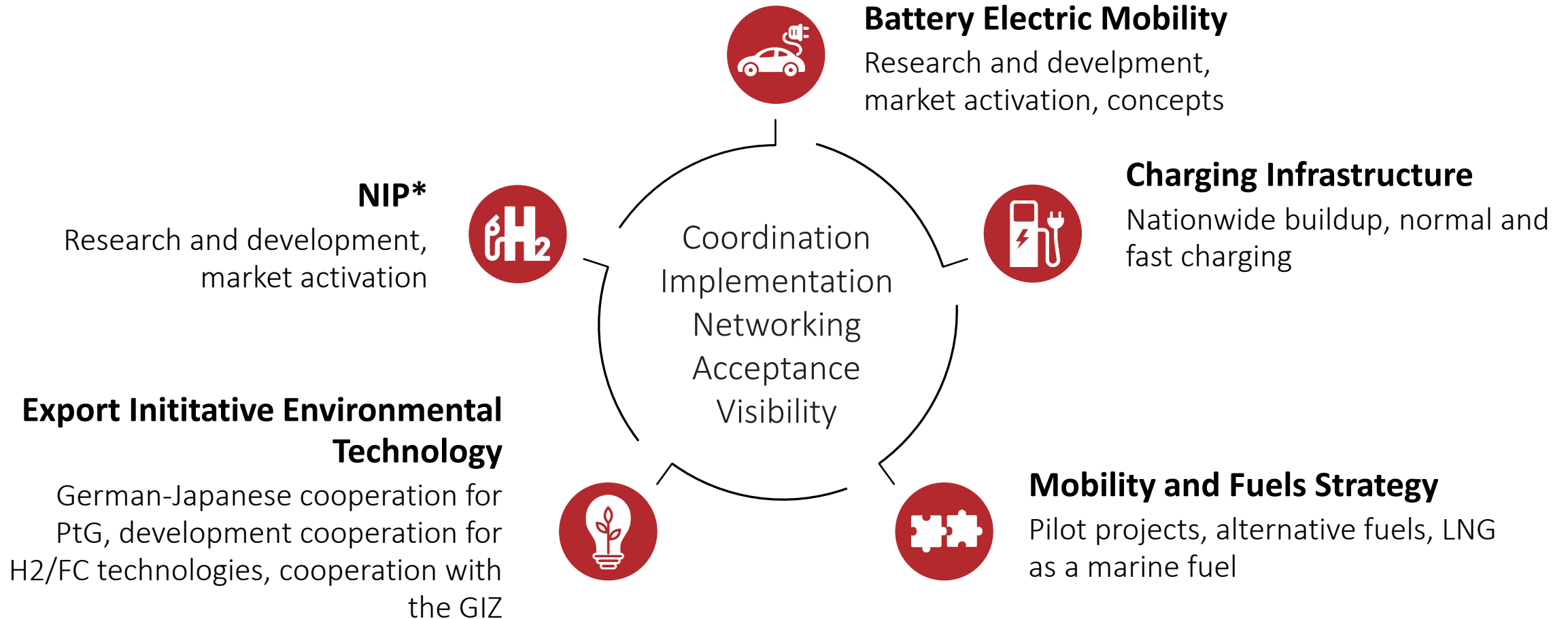
Elena Hof | Lansing | 27th March 2019

Hydrogen Rail Status - Germany -

H2@Rail Workshop, U.S. Department of Energy

SHAPING SUSTAINABLE MOBILITY

Integrated implementation of German national funding programmes



NIP – VEHICLE AND INFRASTRUCTURE ACQUISITION



5 calls

241 Mio. € requested funding of which

191 Mio. € are requested funding for trains

85 Mio. € granted



Cars	563
LDV	500



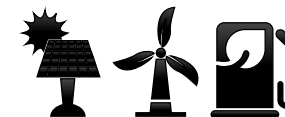
Busses	84
HRS	3
Ely	1



Trains	164
HRS	13
Ely	7



Ships	1
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HRS	47
Ely	11

AGENDA

Towards zero emissions in rail transport

Hydrogen rail infrastructure
Timetable for deploying
fuel cell railcars in Germany

1

Framework conditions

Commissioned by the
 Bundesministerium
für Verkehr und
digitale Infrastruktur

Coordinated by the
 NOW
National Office
for Hydrogen

2

R&D projects – fuel cell and battery

3

Acquisition of hydrogen trains & infrastructure

4

European developments

5

Common challenges

6

Current activities

THE GERMAN RAIL NETWORK

34.000 km of which
59% are electrified
(goal: 70% by 2025)

Regional rail
transport: 36% of
train-kilometres with
diesel traction

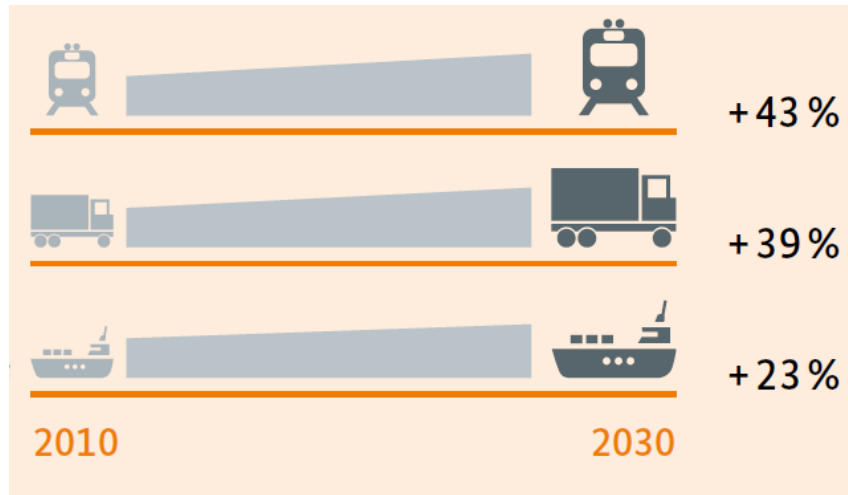
1 km electrification
costs 1-2 Mio €

- Electrification through catenaries
→ feasible for tracks with a high level of traffic
- Battery electric trains
→ lucrative for tracks with already existing catenaries in some parts
- Fuel cell electric trains
→ lucrative for longer tracks (up to 1.000 km range) without catenaries and with availability of inexpensive hydrogen sources

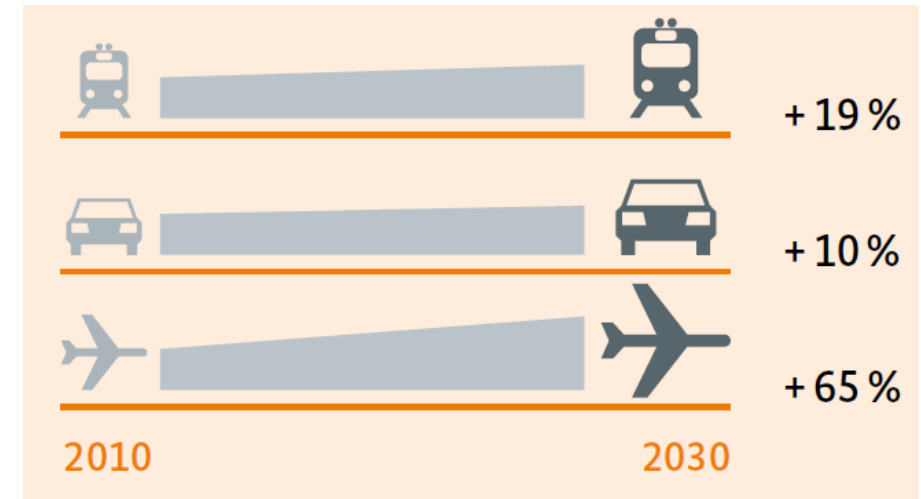
Conclusion: SIGNIFICANT POTENTIAL FOR BOTH BATTERY AND FUEL CELL ELECTRIC TRAINS IN GERMANY

TRAFFIC FORECAST GERMANY 2030

Freight transport



Passenger transport



Source: https://www.bmvi.de/SharedDocs/DE/Anlage/MKS/energie-auf-neuen-wegen.pdf?__blob=publicationFile

Great potential for fuel cells in heavy duty applications!

R&D PROJECTS

Fuel cell and battery electric trains



X-EMU

Siemens, RWTH Aachen – Fuel cell drive for hybrid EMU trains



TALENT 3

Bombardier, TU Berlin, NVBW, SWEG – development of a battery electric train



iLint

Alstom, DLR – development & validation of a fuel cell electric train



EcoTrain

DB RegioNetz, TU Chemnitz, TU Dresden – modular battery drive and storage technology

SUCCESS STORY CORADIA ILINT

From intention to market launch



Letter of intent for the use of hydrogen trains in the federal states of Lower Saxony, Hesse, Baden-Württemberg and North Rhine-Westphalia

September 2014



Federal financial funding amounting to **9.04 million €** for the project **BetHy** by **Alstom** for the development of the hydrogen train **Coradia iLint**

November 2014



Alstom receives the admission for passenger service within the German rail network for the Coradia iLint

July 2018



Start of the trial operation of the Coradia iLint on the route Cuxhaven – Bremerhaven – Bremervörde – Buxtehude in Lower Saxony

September 2018

ACQUISITION OF HYDROGEN TRAINS IN GERMANY

Defined projects



LNVG, LOWER SAXONY

Cuxhaven – Bremerhaven – Bremervörde – Buxtehude

14 trains + HRS in Bremervörde, acquisition until the end of 2021,
operation starting in early 2022

RMV/FAHMA, HESSE

RMV lines 11, 12, 15 & 16

28 trains + HRS in Frankfurt-Höchst, acquisition and start of operation in 2022

RAIL ELECTRIFICATION IN EUROPE



Degree of electrification (%) Non-electrified tracks (km)

Switzerland	100	1
Netherlands	76	3.058
France	51	14.809
Great Britain	34	10.770
Ireland	8	1.786

EUROPEAN HYDRAIL ACTIVITIES



[Press releases and news](#) 14 May 2018

Alstom confirms plans to bring hydrogen trains to the UK

Alstom today confirms plans to bring its world leading hydrogen technology to trains in the UK. This is the first substantive industry response to the Government's challenge to remove diesel rolling stock by 2040. The company is working with Eversholt Rail on plans to convert Class 321 electric trains to hydrogen operation, fitting hydrogen tanks and fuel cells to upcycle trains that are some of the best proven on the network into Britains most advanced rolling stock.



France on track for hydrogen train roll-out

Four lines in Nouvelle Aquitaine will be used to trial manufacturer Alstom's hydrogen-powered locomotives



Mon 12 Nov 2018 10h03



ZILLERTALBAHN HYDROGEN TRAIN

Fuel cell trains for austria

The Zillertalbahn will be the first narrow gauge railway in the world with a hydrogen fuel cell propulsion. With this green technology, 800,000 liters of diesel and 2,160 tons of CO2 can be saved every year. Molinari provided a research study to electrify the train with alternative propulsion systems and has prepared the tender documents and accompanied the Zillertalbahn at the tender process. The pre-qualification has been completed successfully and now Molinari supports the Zillertalbahn with procurement of the fuel cell vehicles.

COSTS & FINANCING

- Battery and fuel cell electric trains currently cost approximately 1.5 Mio € more than a comparable diesel train
- Risk surcharges
- Who is responsible for the infrastructure (costs, risks)?
- Usually high costs for „green“ hydrogen production through electrolysis due to levies

REGULATION & LEGAL ASPECTS

- Lengthy approval and admission procedures
- Access to infrastrucutre owned by the „DB Netz AG“
- Legal aspects of tendering procedures

Common Challenges



„FOR RAIL TRANSPORT WE INTEND TO ESTABLISH A COMPREHENSIVE FUNDING PROGRAM, WHICH COVERS BOTH THE ELECTRIFICATION OF TRACKS AND THE ACQUISITION OF VEHICLES AND THE RESPECTIVE CHARGING/REFUELING INFRASTRUCTURE. FURTHERMORE, REGIONAL RAIL TRANSPORT IS INTENDED TO BE SUPPORTED THROUGH INVESTMENT GRANTS FOR FUEL-CELL-HYBRID-RAILCARS INCLUDING FACILITIES & DEPOT MODIFICATIONS AS WELL AS THE CONSTRUCTION AND OPERATION OF HYDROGEN REFUELING STATIONS.“

– TRANSLATED FROM THE COALITION AGREEMENT BETWEEN CDU, CSU & SPD, 2018

NEW FUNDING GUIDELINE



- Applications for 164 fuel cell trains, 11 HRS and 4 onsite electrolyzers
- expressions of interest for more than 300 battery and fuel cell electric trains until 2024



New funding programm for the acquisition of trains with alternative drives

- Announced budget 2019: 13.9 Mio € + 38.8 Mio € until 2024
- Funding guideline in preparation

MARKET ANALYSIS

ALTERNATIVE DRIVES IN REGIONAL RAIL TRANSPORT

1

Comparison of European countries

2

Technology comparison

3

Status-quo of the German rail network

4

Detailed analysis of specific tracks

5

Market potential for battery and fuel cell

6

Derivations concerning funding

NOW

NOW-GMBH.DE



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