IEA INTERNATIONAL ENERGY AGENCY
HYBRID & ELECTRIC VEHICLE IMPLEMENTING AGREEMENT

IA-HEV

Electric freight vehicles – out of niche into mass market

Results of the IA-HEV Task 27 “Electrification of transport logistic vehicles” 3rd Workshop held in Vienna on October 19th, 2016

suggested citation format:

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iea Energy Technology Network

www.ieahev.org

IA-HEV Task 27

Electrification of transport logistic vehicles

3rd Workshop: "Electric freight vehicles - out of niche into mass market"

October 19th, 2016

AustriaTech – Federal Agency for Technological Measures
Meeting room 3rd floor
Raimundgasse 1/6, 1020 Vienna

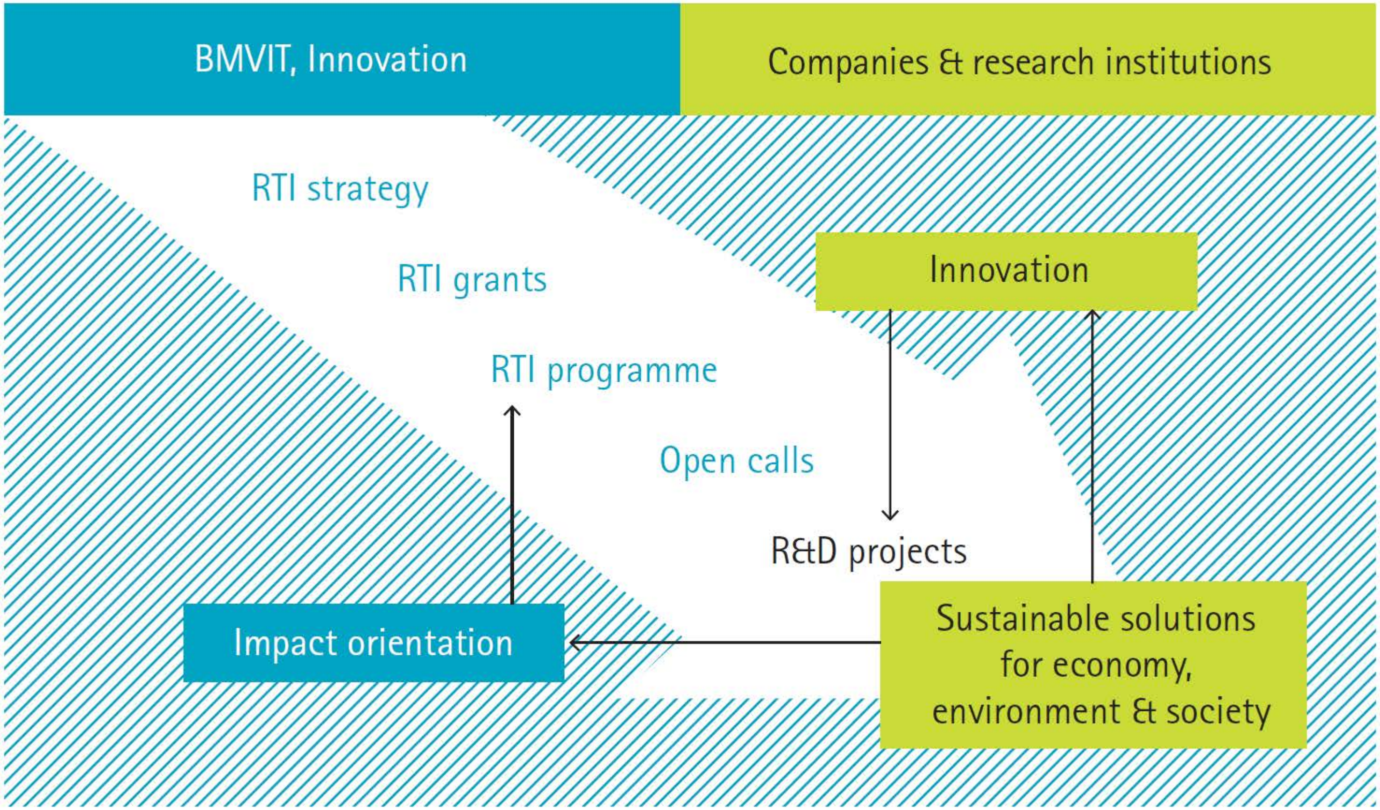
09:00	Registration
	Moderation Martin Beermann, JOANNEUM RESEARCH
	Welcome and Introduction
09:30 - 09:40	Welcome adress by the Austrian IA HEV ExCo representative *Sarah Krautsack, Ministry for Transport, Innovation and Technology bmvit*
09:40 - 09:50	Introduction to Task 27 *Florian Kleiner, DLR*
	Electric freight vehicles as pillar of sustainable logistics
09:50 - 10:15	Electric freight vehicles out of niche: experiences, requirements and expectations *Barbara König, Council for Sustainable Logistics CNL*
10:15 - 10:40	GreenCityHubs - an enabler for electric freight vehicles? *Bartosz Piekarz, i-LOG Integrated Logistics GmbH*
10:40 - 11:00	*Coffee break*
	Governmental perspectives and implementation plans for electric freight vehicles
11:00 - 11:30	Facts and figures of the United Kingdom *Bob Moran, Department of Transport, Office for low emission vehicles (OLEV)*
11:30 - 12:00	Facts and figures of Germany *Dominique Sevin, National Organisation Hydrogen and Fuel Cell Technology (NOW)*
12:00 - 12:30	Facts and figures of Austria *Henriette Spyra, AustriaTech - Federal Agency for Technological Measures*
12:30 - 13:30	*Lunch break*
	Performance and limits of electric freight vehicles
13:30 - 14:00	Supermarket logistics with the electric truck fleet of Coop *Georg Weinhofer, Coop-Switzerland*
14:00 - 14:30	Technology developments and experiences in the Netherlands *Eric Beers, RAI Vereniging (Platform of Sustainable Transport, NL)*
14:30 - 15:00	*Coffee break*
	eDrive system designs for electric freight vehicles
15:00 - 15:30	Electric fleet vehicle testing *John Farrell, National Renewable Energy Laboratory*
15:30 - 16:00	Fuel Cell Range Extender - Zero emission vehicle concept for logistic applications *Markus Passath, Magna*
16:00 - 16:10	Closure of the workshop day

Sarah Krautsack, bmvit

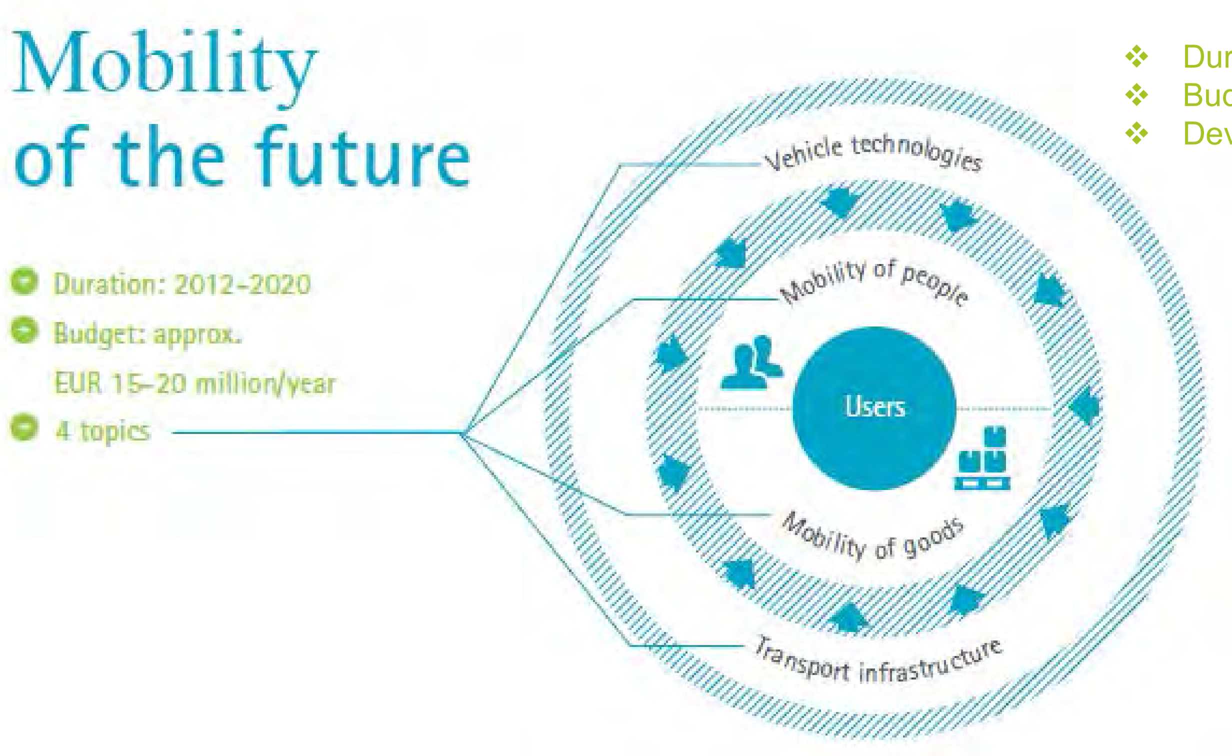
Welcome address by the Austrian IA HEV ExCo representative

19th November 2016, Vienna

From the RTI strategy to sustainable solutions



RDTI-Programmes



Lighthouse Programme for Electric Mobility

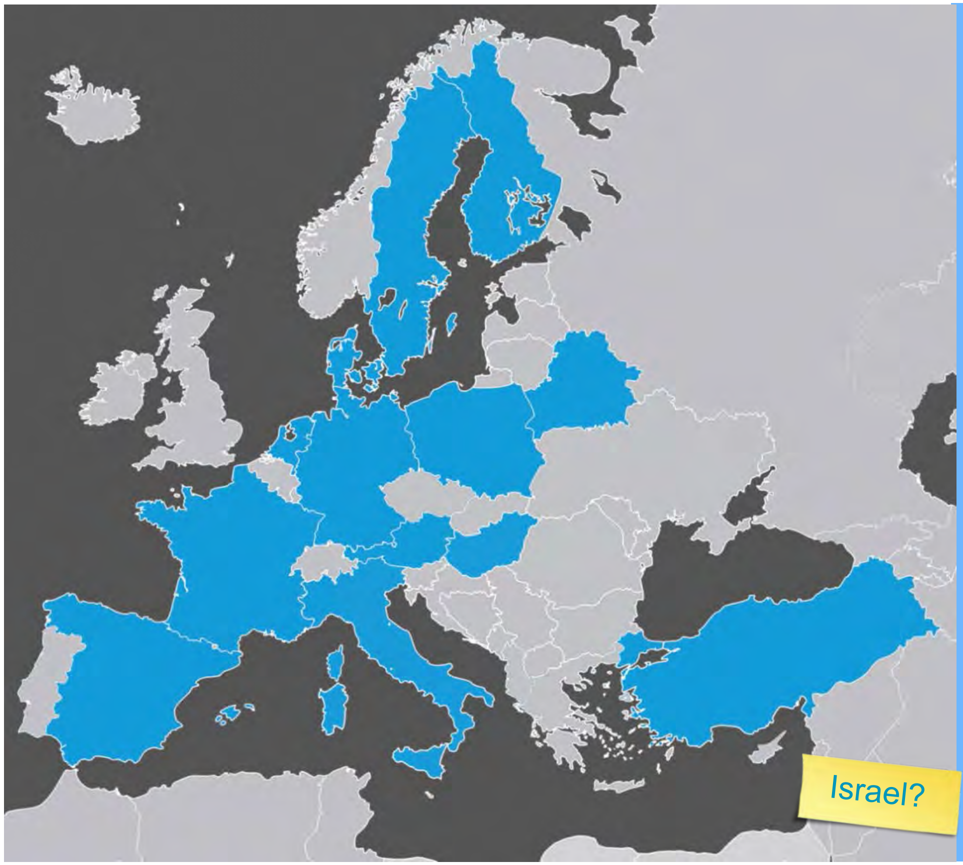
- Duration: 2009-2017
- Budget: approx. 5 million/year
- Development, Implementation

ERA-NET Cofund-Call “Electric Mobility Europe” Overview

- **Objective:** Accelerate the time to market for solutions for integrating electric mobility in Europe’s (sub-)urban mobility systems
- coming soon: www.electricmobilityeurope.eu
- **Budget: 25 M €** (incl. EC co-financing), AT: 1,5 M €
- Opening: 2 November 2016, **(deadline: 6 February 2017)**

ERA-NET Cofund-Call "Electric Mobility Europe"

13 Member Countries



13 countries

- Austria
- Belarus
- Denmark
- Finland
- France
- Germany
- Hungary
- Italy
- The Netherlands
- Poland
- Spain
- Sweden
- Turkey

2 regions

- Catalonia (ES)
- Piedmont (IT)

ERA-NET Cofund-Call "Electric Mobility Europe" Thematic Key Areas

- **5 Thematic Key Areas:**
  - System integration (transport, [sub]urban areas)
  - Integration of urban freight and city logistics in the e-mobility
  - Smart Mobility concepts and ICT applications
  - Public Transport
  - Consumer behaviour and societal trends

- Outcome: **Highly visible demonstration and implementation projects!**

Kontakt

Austrian Ministry for Transport, Innovation and Technology
Unit of Mobility and Transport Technologies

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HYBRID & ELECTRIC VEHICLE IMPLEMENTING AGREEMENT

IA-HEV

Welcome to IA-HEV Task 27 3rd Workshop

"Electric freight vehicles - out of niche into mass market"

Florian Kleiner, Martin Beermann, Bülent Çatay, Eric Beers, Huw Davies, Bob Moran, Ock Taeck Lim, Stephan A. Schmid

Deutsches Zentrum für Luft- und Raumfahrt German Aerospace Center · JOANNEUM RESEARCH LIFE · Sabancı Universitesi · Office for Low Emission Vehicles · Coventry University · rai vereniging Rijwiel en Automobiel Industrie · 울산대학교 UNIVERSITY OF ULSAN

iea Energy Technology Network

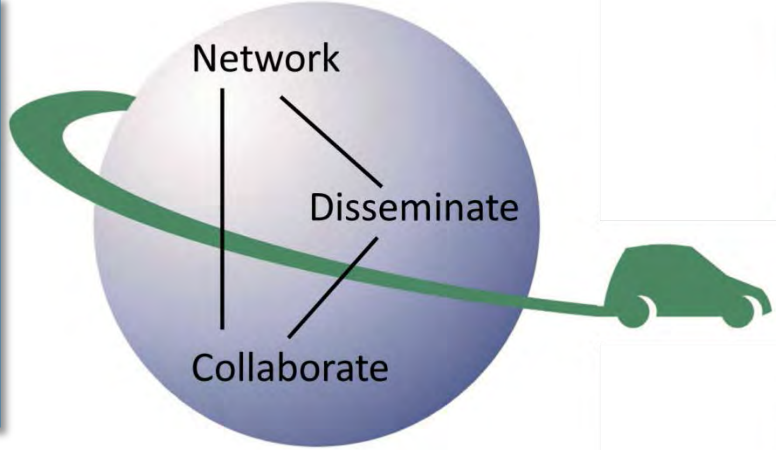
International Energy Agency
Hybrid & Electric Vehicle Implementing Agreement

IA-HEV Mission

- Supply objective information to support decision making
- Facilitate international collaboration in pre-competitive research and demonstration projects
- Foster international exchange of information and experiences

Target audience

- Governmental bodies at national, regional and city levels
- Automotive industry
- Component suppliers
- Utilities



IEA INTERNATIONAL ENERGY AGENCY HYBRID & ELECTRIC VEHICLE IMPLEMENTING AGREEMENT

www.ieahev.org

Need for alternative vehicles

Ever increasing freight demand

- Worldwide road-freight activity and energy use have almost doubled in the last two decades *[IEA 2012]*

Challenges for Cities

- Worldwide urbanization and online retailing activities are increasing inner city air pollution *[UN 2011]; [RSS 2012]*

§

Expected changes of the regulation framework:

Emission free inner city delivery
CO_2 limits for HDV
…

Development and market introduction of alternative transport logistic vehicles is essential


[1]


[2]


[3]

IEA INTERNATIONAL ENERGY AGENCY
HYBRID & ELECTRIC VEHICLE IMPLEMENTING AGREEMENT

Task 27: Electrification of transport logistic vehicles
Objectives & Working Method

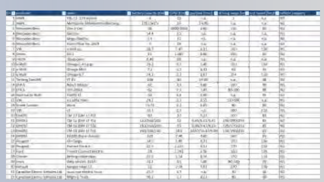
Objectives

(1) summarize the status of vehicle and infrastructure technologies, implementation and hurdles

(2) identify early niche markets and commercialization opportunities

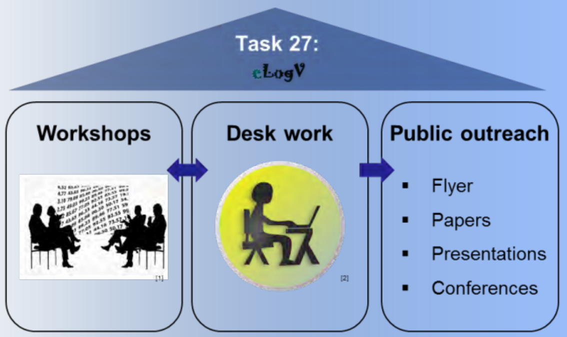
(3) provide policy recommendations for further research and deployment activities

project profiles



vehicle database

Working Method

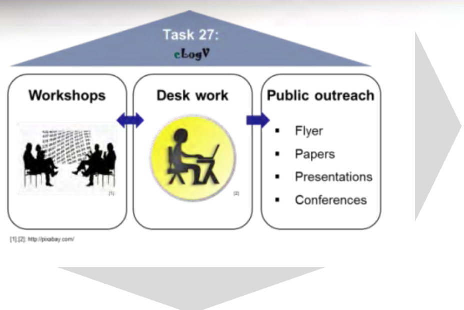


[1],[2]: http://pixabay.com/

Objectives are addressed in three ways:

- workshops: to involve stakeholders and collect information
- desk work: to establish the scientific foundations, input for workshops and papers
- public outreach: to raise awareness in the broader community

Task 27 – current Outputs
(http://www.ieahev.org/tasks/e-logistics-task-27/)



- **EVS28 (2015) paper:**
  Comparison of country individual Relevant Cost of Ownership per ton-kilometers for light commercial vehicles

- **EEVC (2015) paper:**
  Status and trends for electrified transport logistic vehicles

- **EL-MOTION 2016 conference presentation:**
  International experiences within the IEA HEV Task 27 „Electrification of transport logistic vehicles“

- **Project profiles:**
  Key facts of ongoing or terminated demonstration projects from the partner countries

- **1st Workshop held in Germany (2015-03-19)**:
  “Electric transport logistic vehicle technology and its application”
  - Expert presentations regarding battery and fuel cell technology and real world data from electric transport logistic vehicles
  - Workshop session – Hurdles of implementation: Discussions about barriers, drivers, strategies and expectations

- **2nd Workshop held in Amsterdam (2016-04-12)**:
  “Experiences and prospects of electric freight vehicles”
  - Best practice experiences of pioneer cities
  - Experiences from early adopters of electric freight vehicles
  - Current status of charging infrastructure technologies for heavy duty vehicles

- **Vehicle database:**
  Key facts of electric commercial vehicles available on the market or presented as prototypes. Approx. 90 vehicles are listed up to now.

IEA INTERNATIONAL ENERGY AGENCY HYBRID & ELECTRIC VEHICLE IMPLEMENTING AGREEMENT

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German Aerospace Center

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JOANNEUM RESEARCH LIFE

IEA INTERNATIONAL ENERGY AGENCY HYBRID & ELECTRIC VEHICLE IMPLEMENTING AGREEMENT

Electric freight vehicles out of niche: experiences, requirements and expectations

Barbara König
Council for Sustainable Logistics
Council für Nachhaltige Logistik (CNL)

Council for Sustainable Logistics

- founded in 2014
- 15 companies
- Goal:
  joint progress in the field of sustainable logistics

Institut für Produktionswirtschaft und Logistik

University involvement

working programm

CNL scan · process · share

- Focus area: electric commercial vehicles
  - Projects aiming at implementation
  - Cooperation with manufacturers
- 3 task groups
  - E-truck
  - City logistics
  - Warehousing
- Service for members
  - Processing of ecological, social, political, legal and economical aspects
  - 4 events a year
  - NEWSletter
  - Homepage
  - Event schedule

Goal: TCO-neutral electric commercial vehicles

© Kreisel

© CNL

experiences, requirements and expectations

e-fahrzeuge.info

- comprehensive market overview
- BEVs and FCEV
- commercial vehicles and passenger cars

Post

CNL
scan · process · share

© Österreichische Post AG

- CO_2-neutral delivery since 2011
- biggest e-mobility fleet in Austria
- 238 e-cars, 181 e-mopeds,
  593 e-bikes, 52 CNG-cars*
- Purchase of green electricity only and own solar plants: >1.300 kWp
- obstacles
  - availability of electric commercial vehicles
  - shipping space not big enough
  - low range of EV

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* Nachhaltigkeitsbericht 2015 der Post AG

Project LEEFF

LEEFF LOW EMISSION ELECTRIC FREIGHT FLEETS

Goal: TCO-neutral e-VAN

LEEFF LOW EMISSION ELECTRIC FREIGHT FLEETS

Goal: 41% CO_2-Reduction

CNL scan · process · share

- Development of an e-VAN ready for serial production

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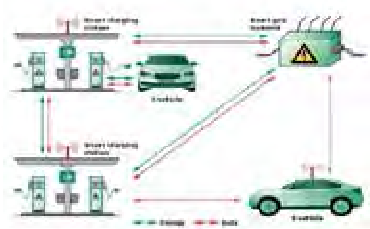
KREISEL

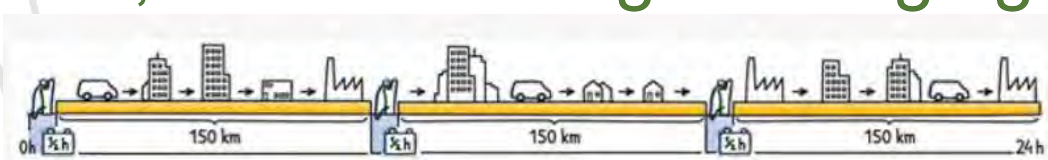
OBERAIGNER Powertrain

- charging infrastructure for electric freight fleets



© Smatrics

- new businessmodel for fleet-operators
- fleet management, vehicle routing & charging strategy



BOKU gW/N

Requirements

- 200 km
- equal payload
- shipping space min. $10 m^3$ for 3,5 to
- TCO-neutral

from 3,5to e-van – 40to e-truck

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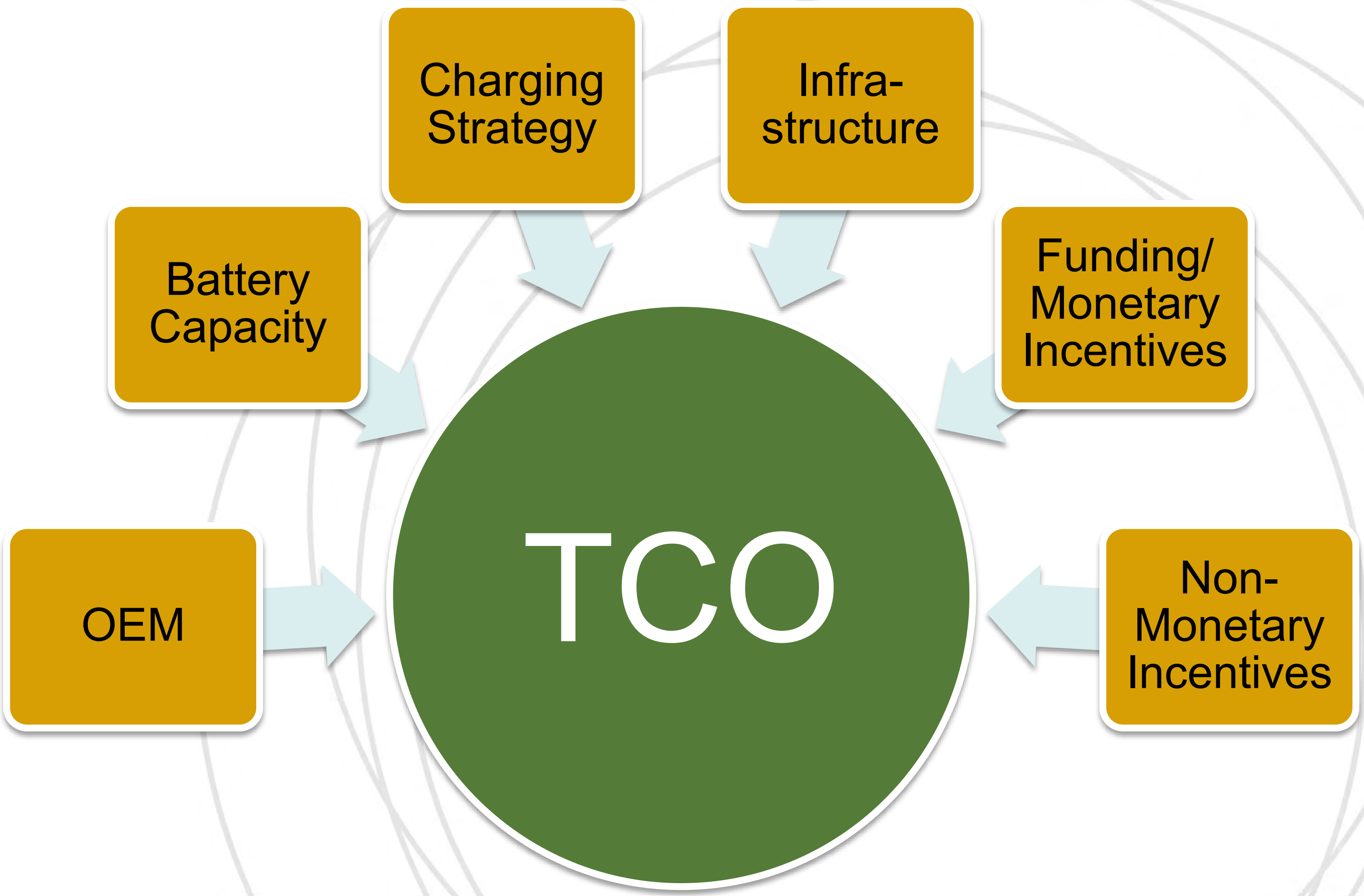
TCO
electric commercial vehicles



zero-emission city logistics

European Commission's Transport White Paper:

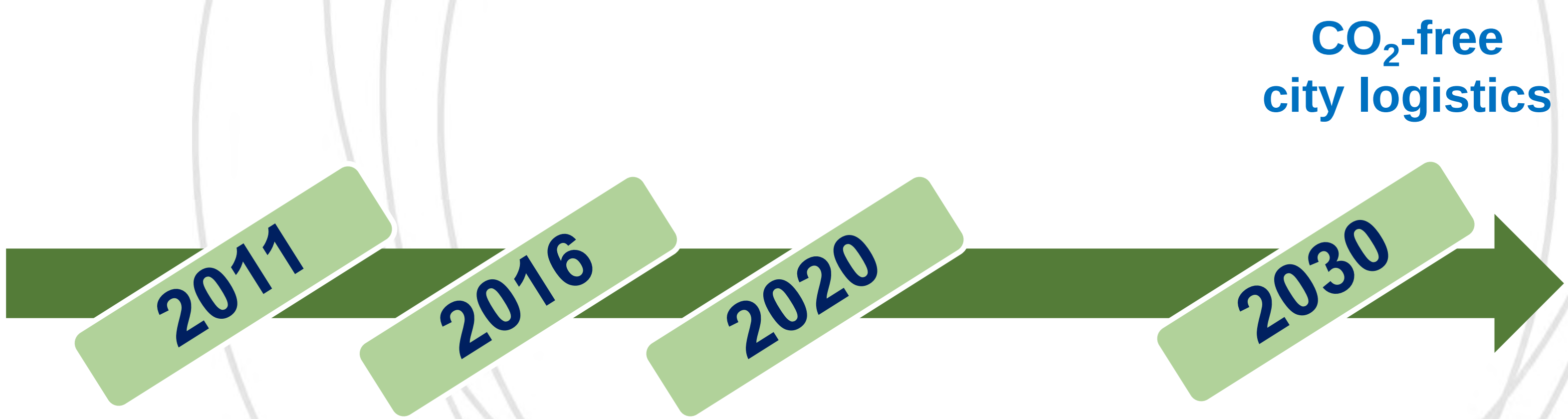
essentially CO_2-free city logistics in major urban centres by 2030

zero-emission city logistics

European Commission's Transport White Paper:

essentially CO_2-free city logistics in major urban centres by 2030

average exchange of vehicle after 8-10 years



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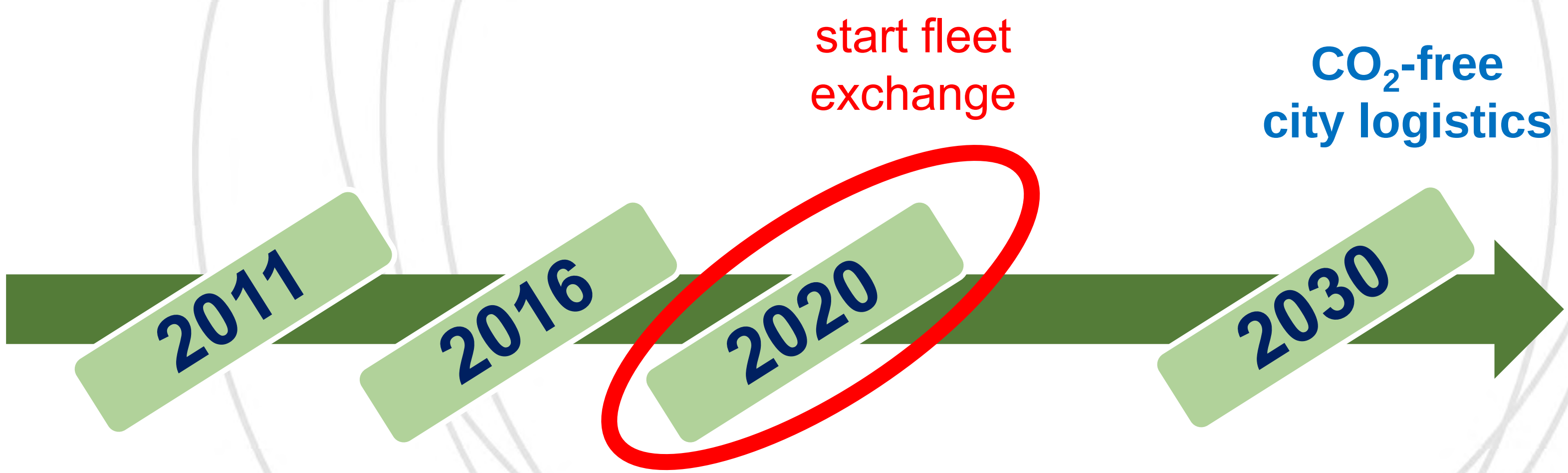

COOPERATION
key to success

CNL scan · process · share

- to achieve the 2030-goal of CO_2-free city logistics we need new forms of cooperation
  - – cross-company
  - – cross-sectoral
  - – multi-institutional

- Council for Sustainable Logistics is a model example of this kind of cooperation

Objectives

- expand the CNL
  - New members
- Cooperation with OEMs
- Cooperation with the federal goverment and cities

CONTACT

DI **Werner Müller – Project lead**
DI **Barbara König,** BEd

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Web: www.councilnachhaltigelogistik.at

Green City Hubs

Project Presentation

Dr. Bartosz Piekarz
Head of Research & Development
bp@i-log.at

supported by FFG

#1
OUR RESEARCH ROADMAP

i-LOG Research Roadmap | As Consortium Leader

i-LOG logistik engineering

GREEN CITY HUBS

FFG

Concept for
Sustainable Inner-City
Last Mile Logistics

LEEFF: LOW EMISSION ELECTRIC FREIGHT FLEET

- 8 EV out of 20 vans in the total fleet
- 500.000 electric km to drive
- 40% planned CO2-reduction

powered by klima+ energie fonds

LEEFF LOW EMISSION ELECTRIC FREIGHT FLEETS

DELIVERY ON DEMAND

New **Business and Operating Model** for Parcel Service

DOD
DELIVERY ON DEMAND

Project Partners | An Interdisciplinary Approach

i-LOG logistik engineering

Projektpartner		Kernkompetenz
i-LOG Integrated Logistics GmbH Hörsching	i-LOG logistik engineering	Konsortialführerin; Projektmanagement, Logistik Know-How
Lehrstuhl für Produktion und Logistik (mit int. Schwerpunktsetzunt) Universität Wien	universität wien	Transportplanung; Logistische Netzwerkoptimierung
Tbw Research GesmbH Wien	tbw RESEARCH	Städtische Standortplanung
Institut für Fahrzeugantriebe & Automobiltechnik TU Wien	TU WIEN Technische Universität Wien Vienna University of Technology	Alternative Antriebstechniken LKW Einsatzprofile
Satiamo GmbH Eberstalzell	SATIAMO SAVES TIME AND MONEY	CO2-Monitoring; Know How Transport- / Dienstleistermarkt

Praxispartner

rexel ELEKTRO-GROSSHANDEL

ADAMAH BioHof

SCHACHINGER TRCplus Branchenlogistik weitergedacht.

Award Winning Project "Research"| VCÖ Mobilitätspreis 2016

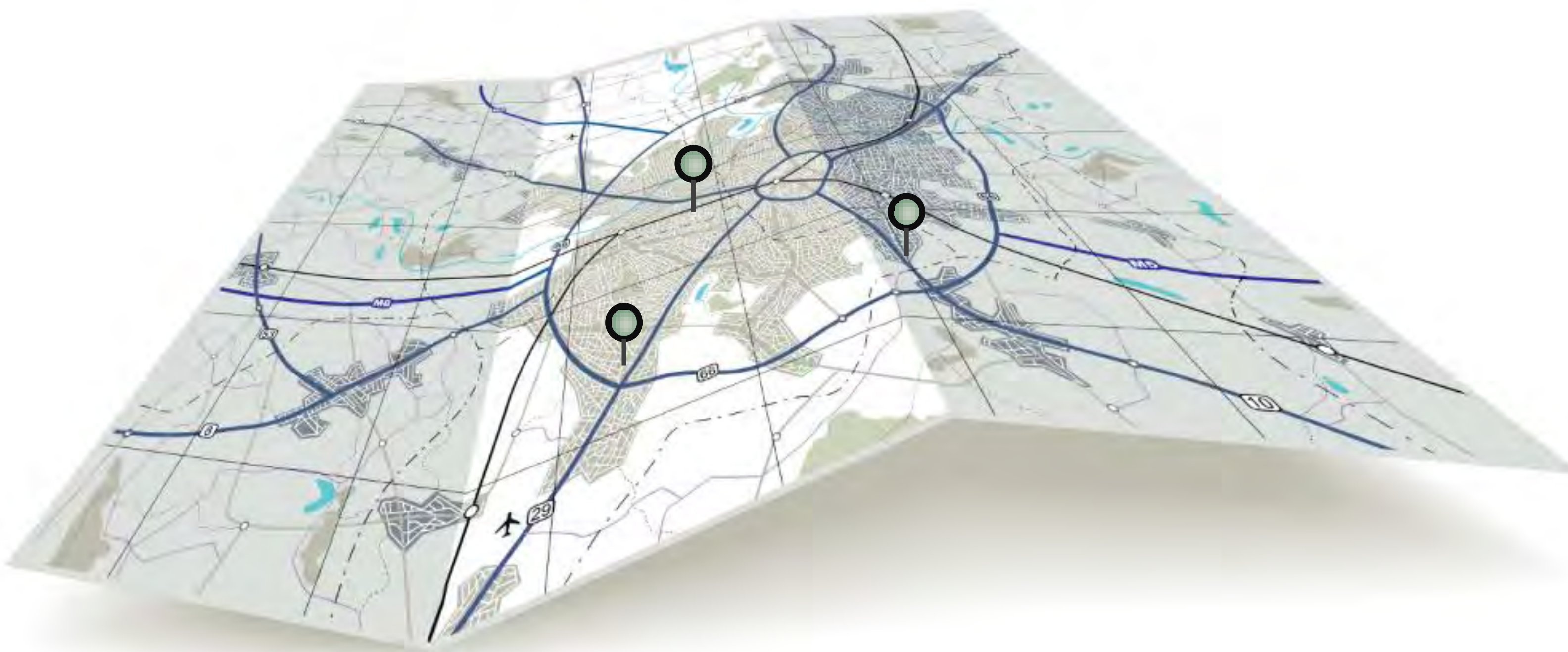
i-LOG logistik engineering

#2
PROJECT GOAL

PROJECT GOAL

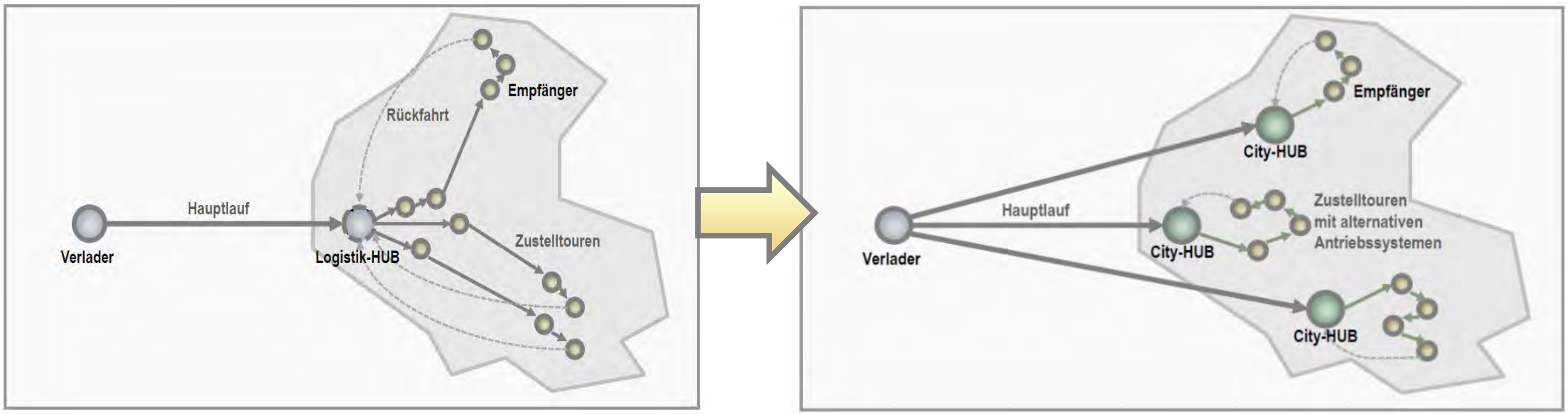
Concept and feasibility study of a sustainable last mile delivery logistics

- based on several, inner-city logistic HUBs
- using delivery vehicles with alternative drive systems
- in the context of adapted transport planning



Implications through the Use of City-HUBs

- shorter delivery trips = reduction of driven kilometers in the city
- with higher potential for alternative drive systems
- thereby reducing CO2-footprint



- but with higher intensity of logistical infrastructure

PROJECT BACKGROUND: CITY OF VIENNA

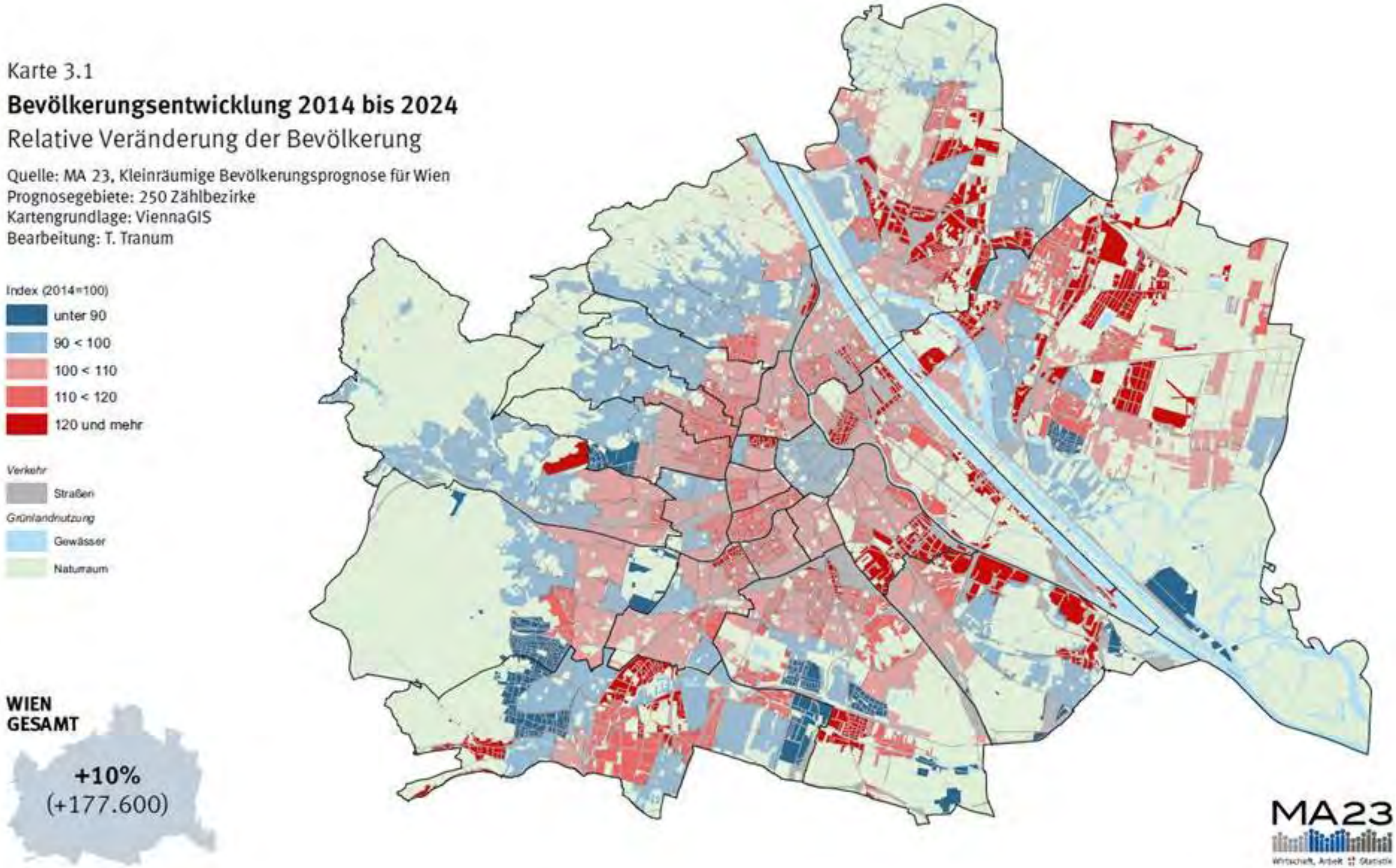
Population: 1.85 Mio. (2029: > 2 Mio.)
Vienna Region: 3.7 Mio.

Highest gross regional product in Austria (GRP per capita 47,200 EUR)

Economic Growth 2005–2013:+24%

<u>Key Sectors</u>:
Life Sciences, Engineering, IT & Communication, Chemical Industry,…., Logistics

VIENNA | DYNAMICS OF GROWTH



#3 RESEARCH APPROACH

THE RESEARCH APPROACH

i-LOG logistik engineering

Location Model
tbw RESEARCH

- Multi Level Decision Model

Energy Consumption Model
TU WIEN

- Telematics-based simulation model

Practical Experience
i-LOG logistik engineering

- Process Models
- Valid Cost Models
- Practical HUB locations

Planning Model
universität wien

- Multi-Objective Assignment Problem

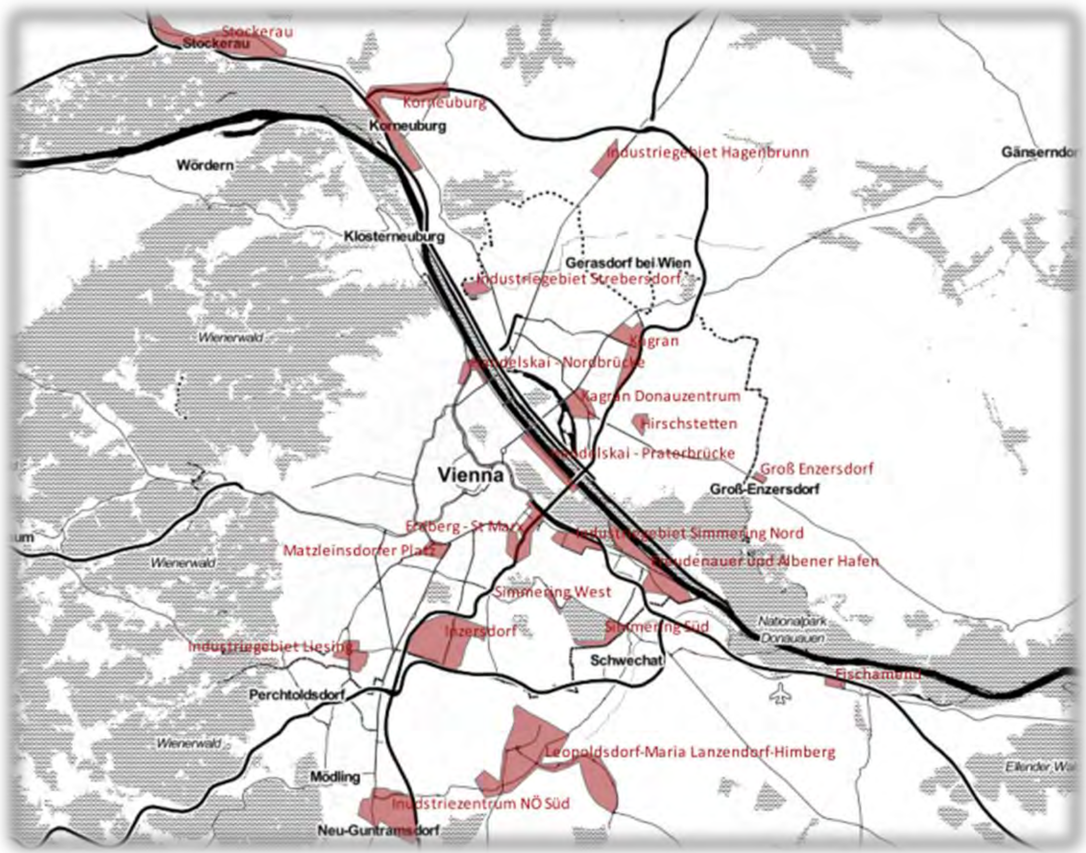
Control Panel
SATIAMO SAVES TIME AND MONEY

- Visualizer
- Decision Support Tool

Location Model

Area of Interest: Larger Urban Zone of Vienna

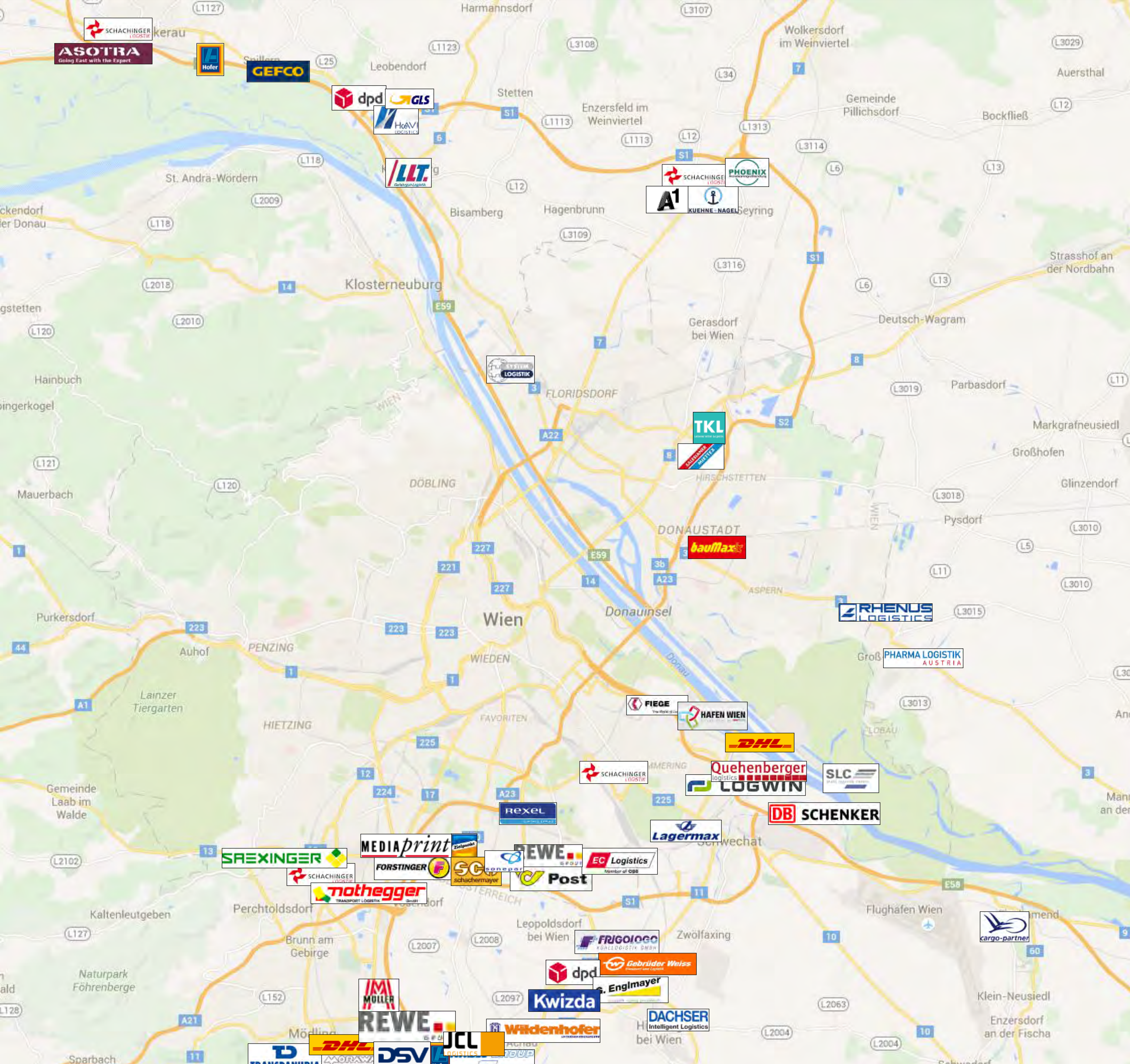
- we defined a total of
  21 urban logistics clusters
- each cluster was rated
  by the following indicators
  - suitability for long haul lines
  - current land planning scheme
  - present logistical intensity
  - proximity to customers
  - proximity to "sensitive zones"



i-LOG
logistik engineering

Logistics Attractiveness Index

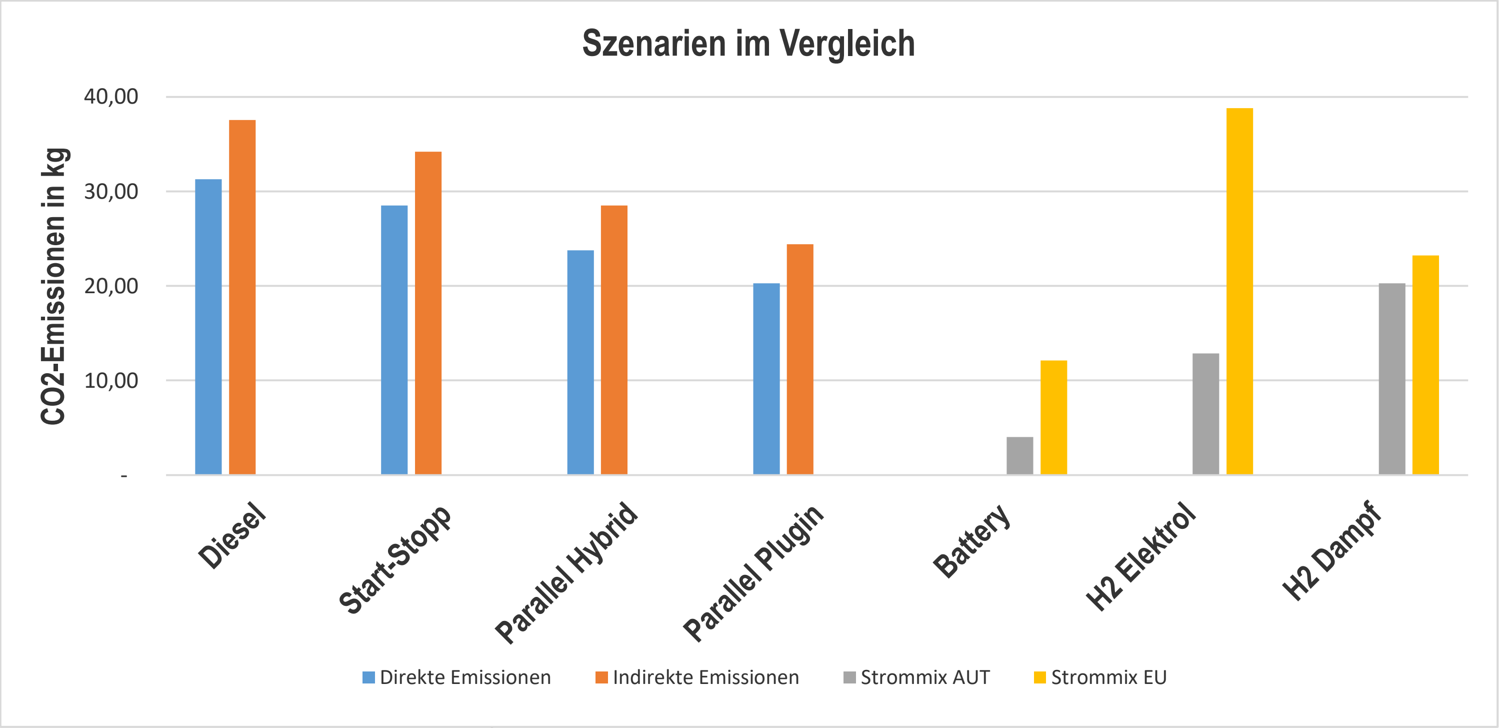
by the "Real World"



ENERGY CONSUMPTION MODEL

Components of the Energy Consumption Model

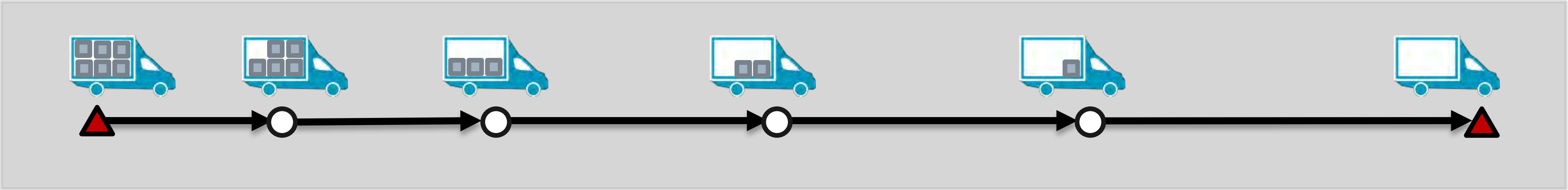
- 7 types of vehicles (see chart)
- 3 scenarios of energy mix (Vienna, Austria und EU)
- additional factors like seasonality (summer, winter, etc.) and speed corridors



Planning Model

Impacts on Vehicle Routing

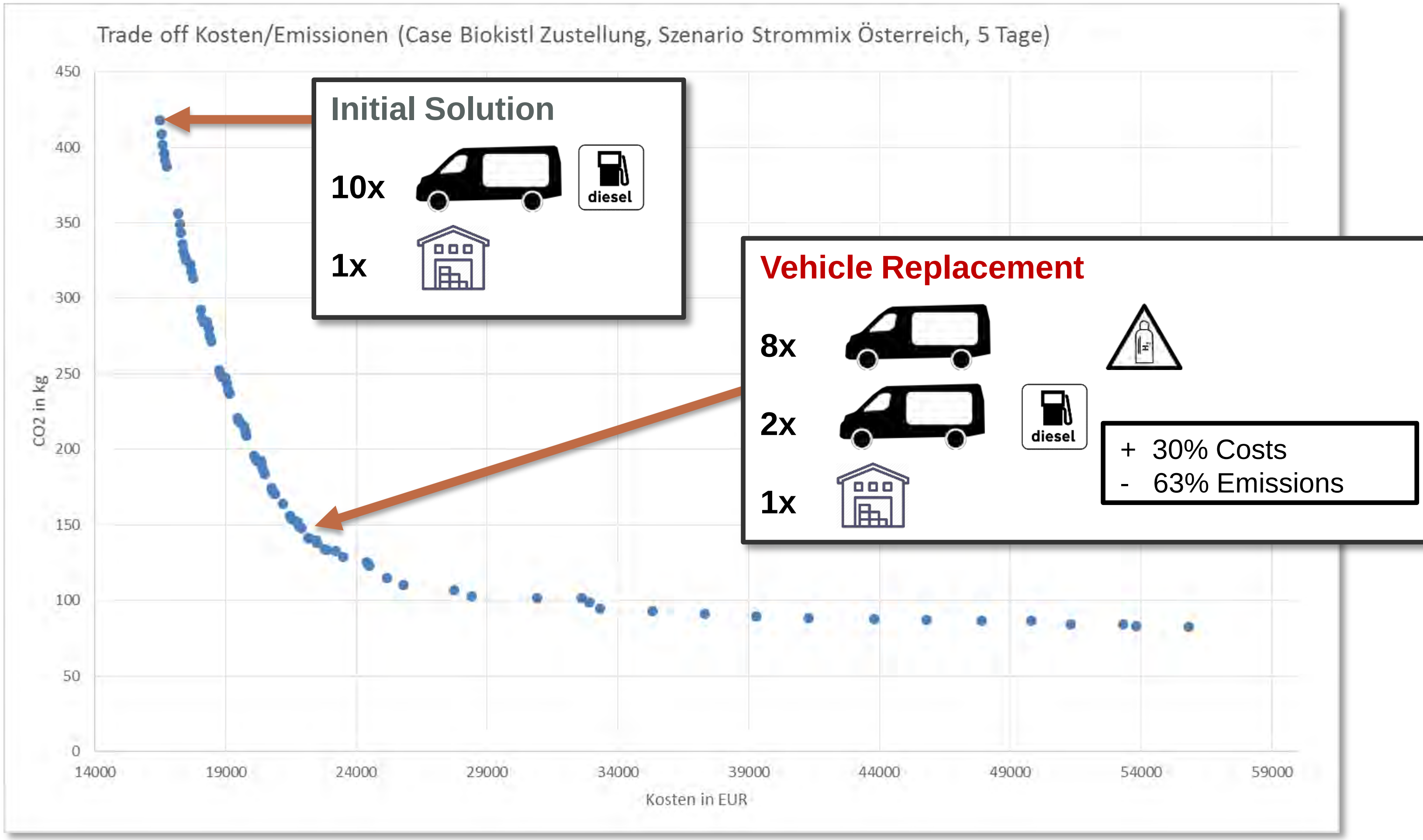
- short distances with heavy load at the beginning of the tour
- longer distances with low load at the end of the tour



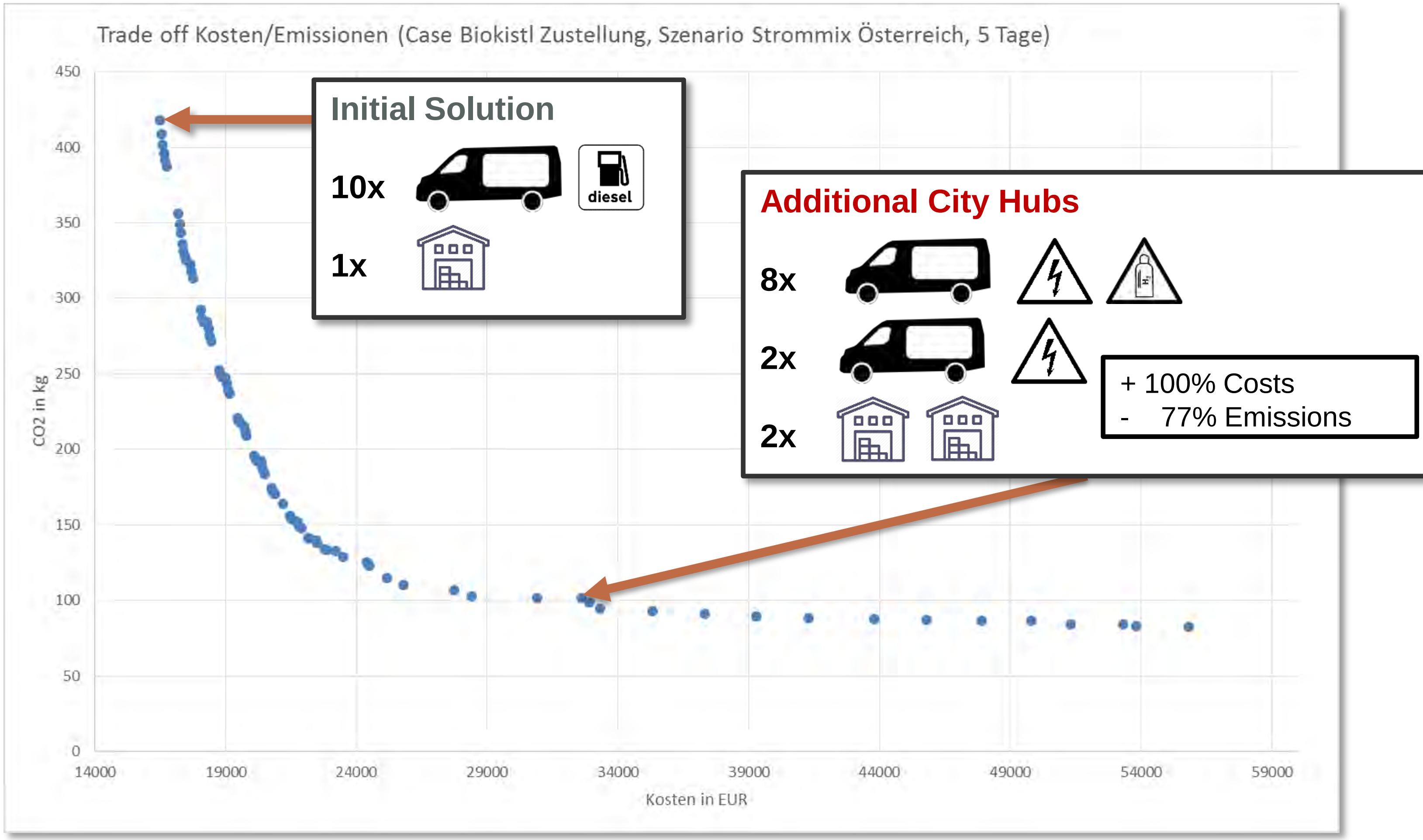
Impacts on Fleet Structure

- vehicle replacement can lead to a significant CO2 reduction with relatively little investment
- electric vehicles should be used mostly in urban areas

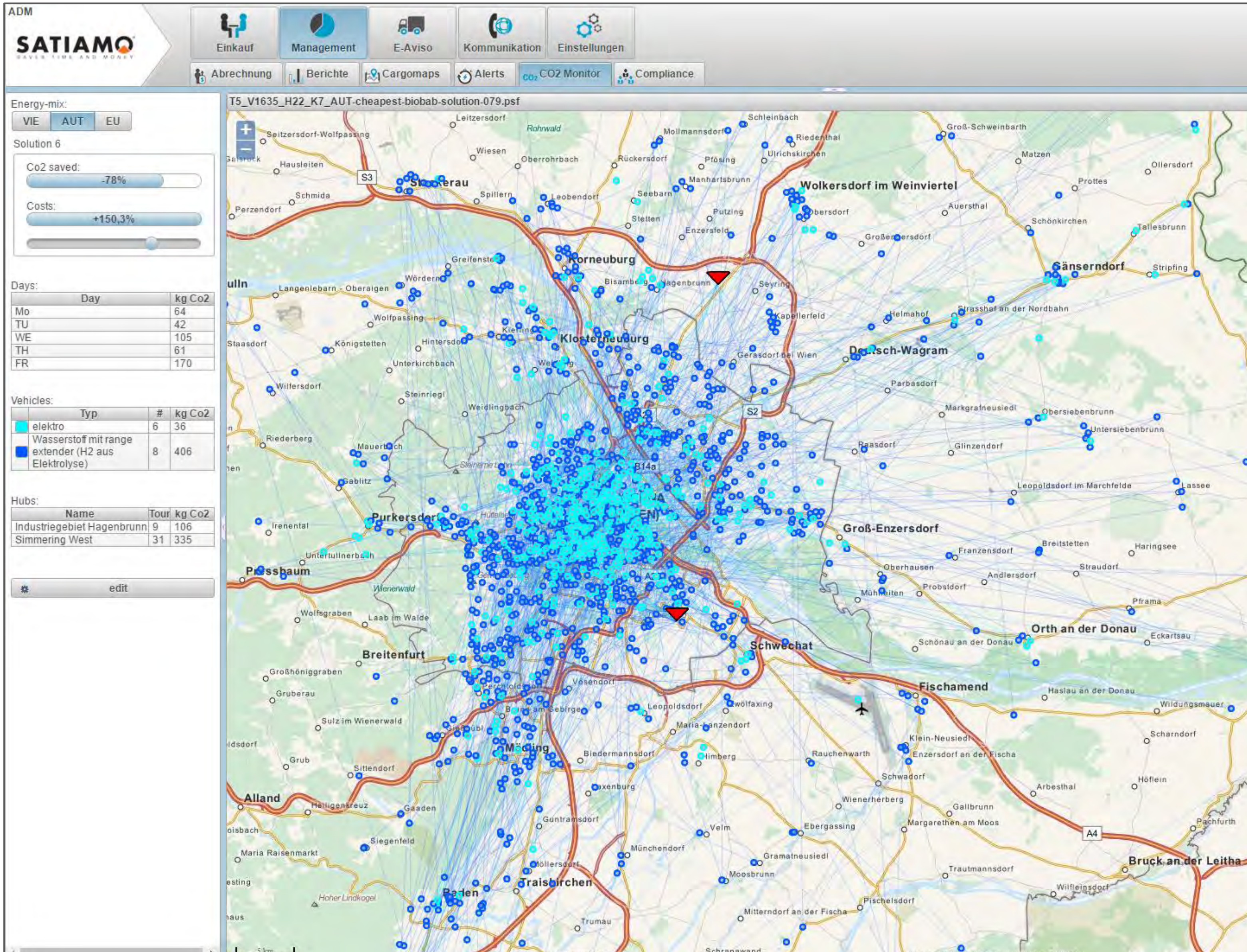
Costs / Emissions Trade-Off Analysis



Costs / Emissions Trade-Off Analysis



VISUALIZATION & SIMULATION THOUGH AN INTEGRATED ONLINE TOOL



#4
KEY FINDINGS

Key Findings

(1) There is a valid solution finding methodology available for complex urban / last mile distribution issues.

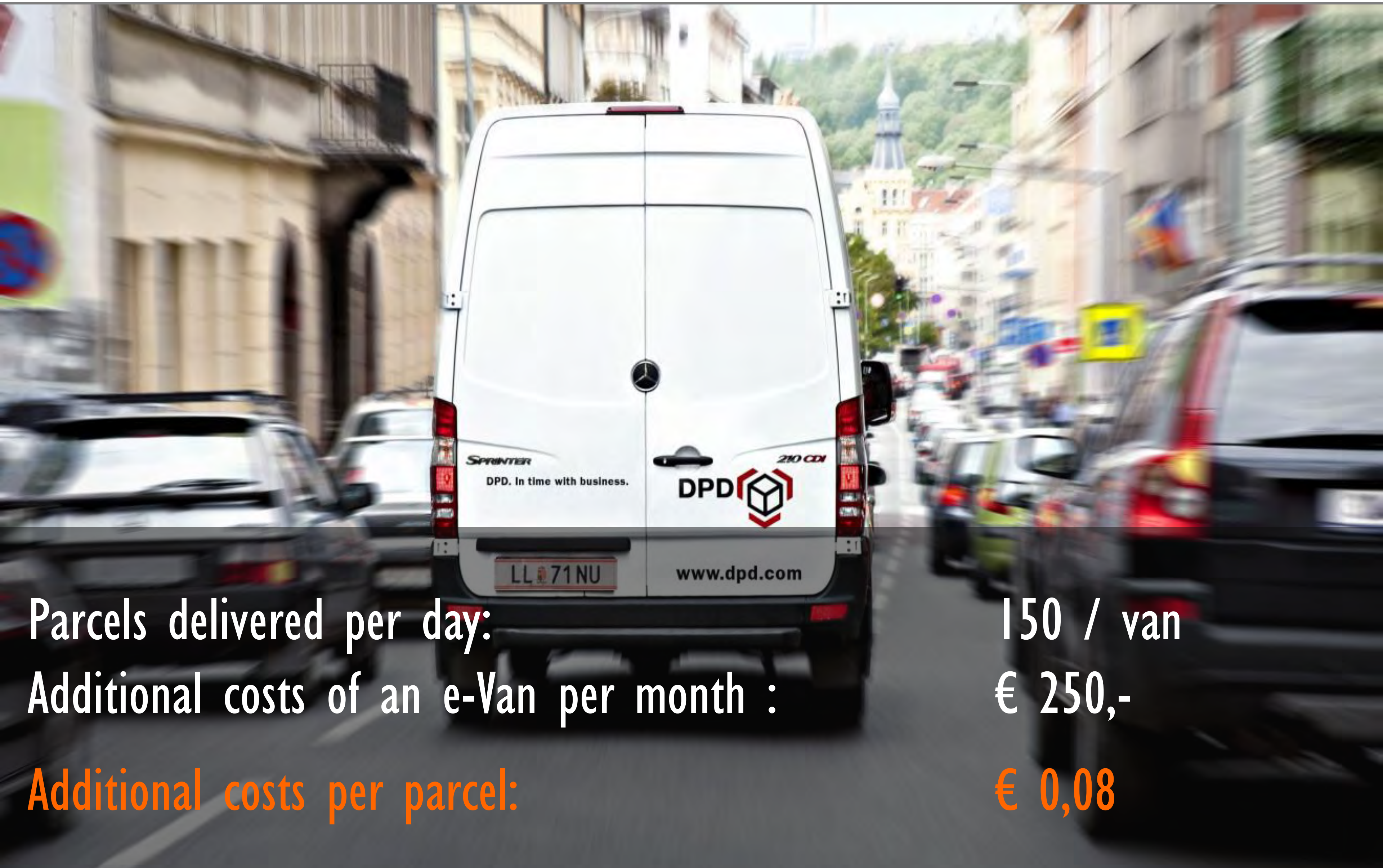
(2) Traffic-induced emissions in urban areas result only for a low degree of driven mileage. To this extent, kilometers traveled are only a poor reference base for any city toll considerations.

(3) The costs of urban city hubs are still too high. Since the utilization of city hubs is limited to only 1-2 hours per day, “shared hub”-approaches appear to be more useful.

#5 RECOMMENDATIONS

#1 How much more does it cost?

logistik engineering



Parcels delivered per day: 150 / van

Additional costs of an e-Van per month : € 250,-

Additional costs per parcel: € 0,08

#2 Only a "Restricted Access"-Solution makes Sense for Cities

i-LOG logistik engineering

#3 Total Gross Weight of a LCV should be raised to 4.25 to

..otherwise we might get in trouble with the police..

#4 Bottleneck: Availability of e-Vans & Innovative Business Models

logistik engineering

New technology has to be combined with an advanced business model.

- **Fleet integration** advisory
- On-demand availability / provision of **electric vehicles**
- Integrated **service & maintenance**
- Installation and maintenance of **charging infrastructure**
- **Training/informational** material

+

+

pay-per-use

THANK YOU FOR YOUR ATTENTION!

Office for Low Emission Vehicles

GOING ULTRA LOW

UK government policy towards zero emission vehicles

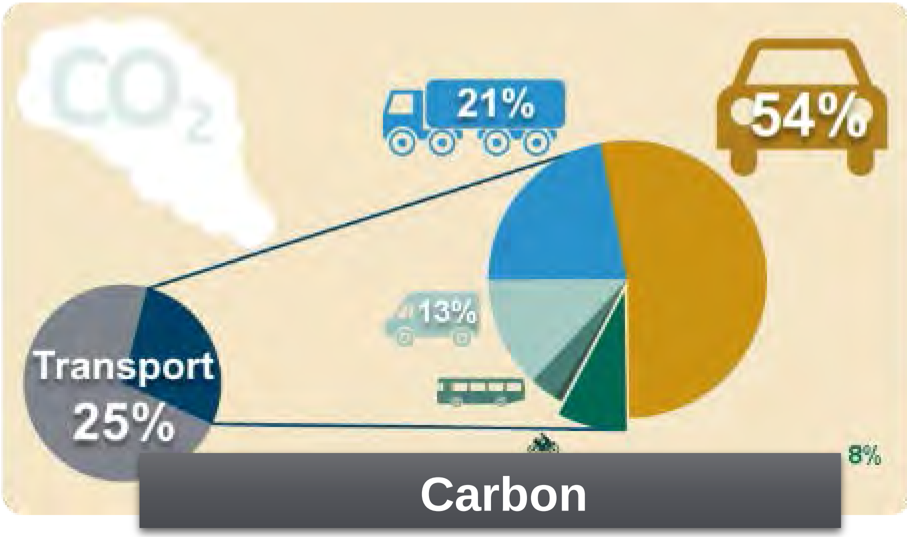
Bob Moran

IA-HEV eLogV workshop in **Vienna** on **19 October 2016**

Office for Low Emission Vehicles

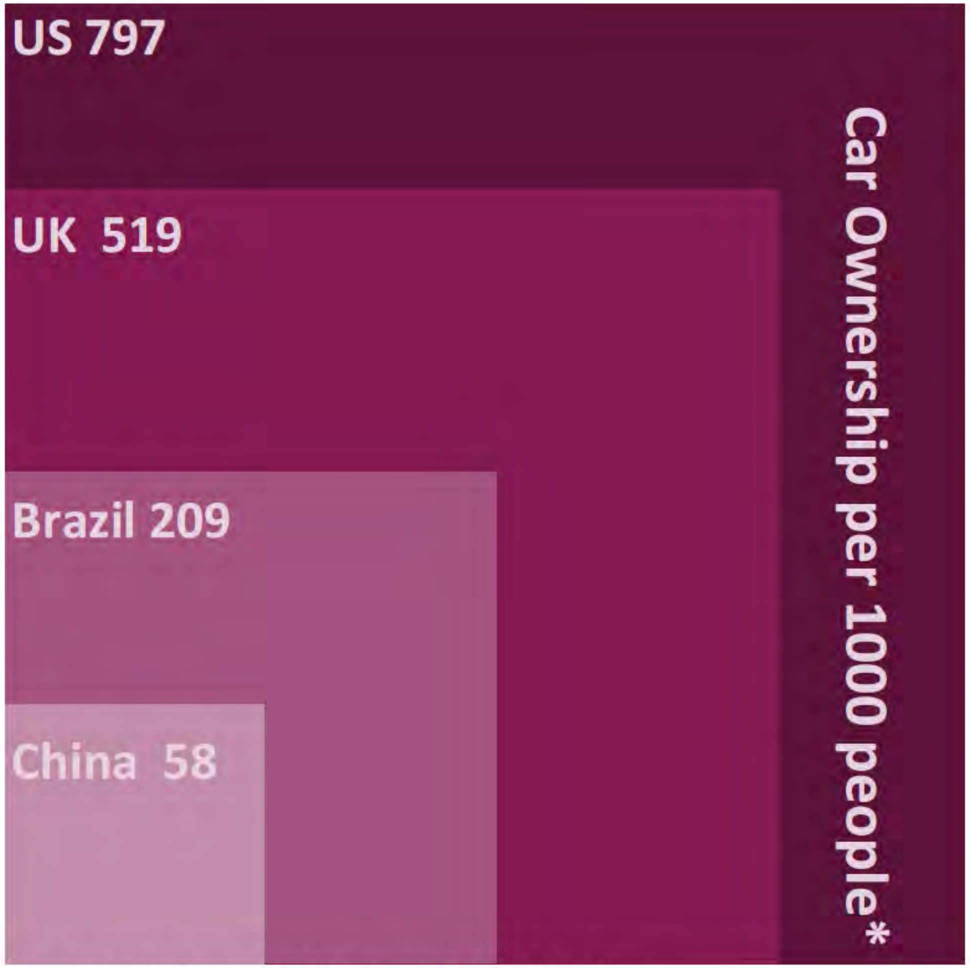
CAN ELECTRIC VEHICLES SAVE THE WORLD?
NO. But they might help …

Zero emission vehicles? FOUR key UK policy drivers.



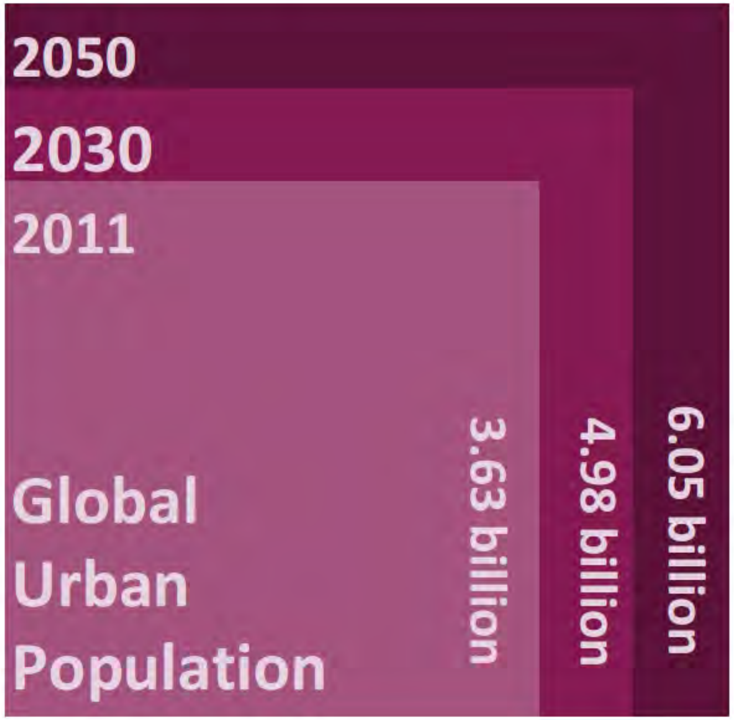
Office for
Low Emission
Vehicles

Global trends …



* Brazil data 2008, all others 2010

By 2020, around **60%** of the world's population will live in cities

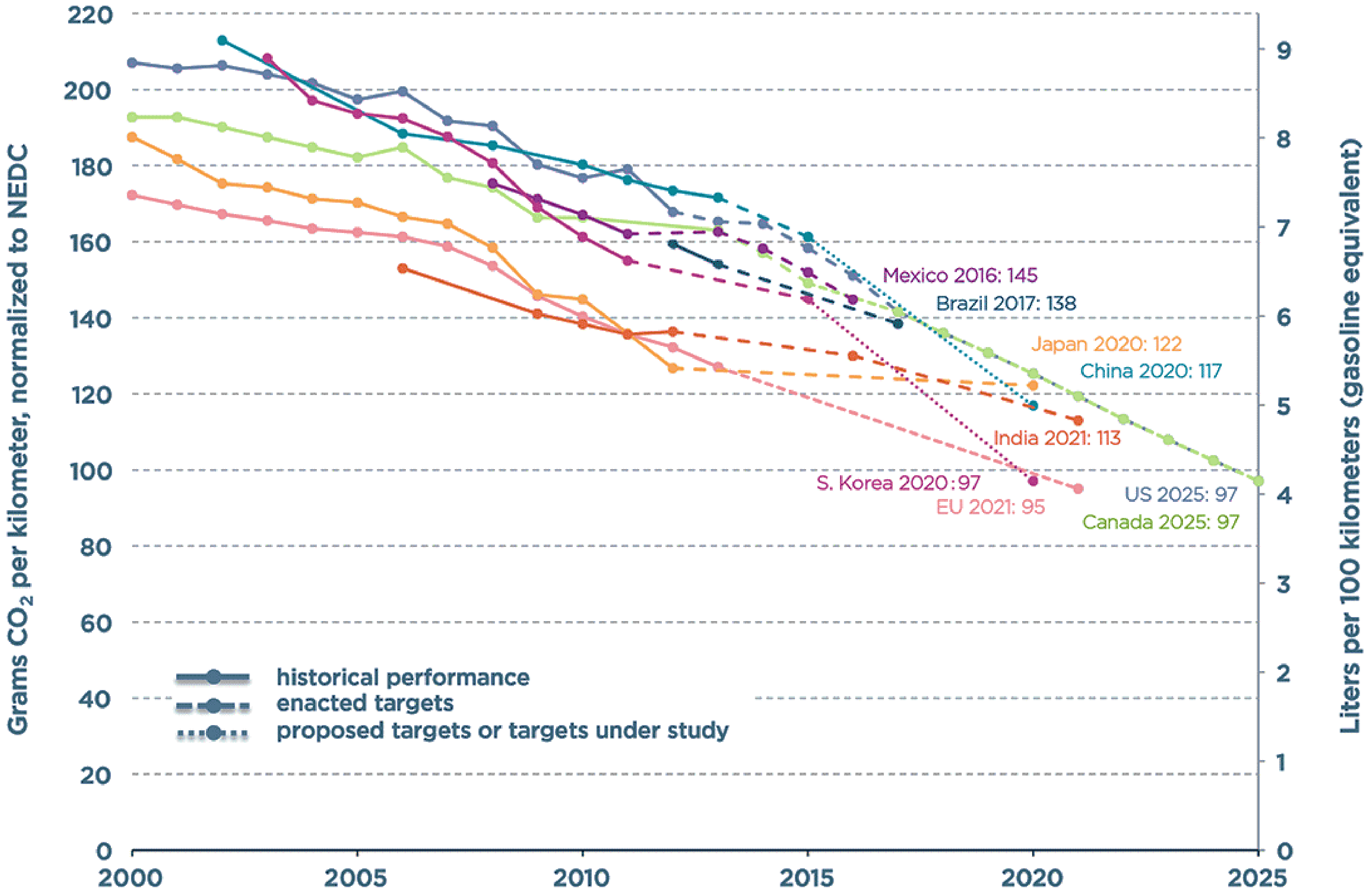


Office for Low Emission Vehicles

Global trends …

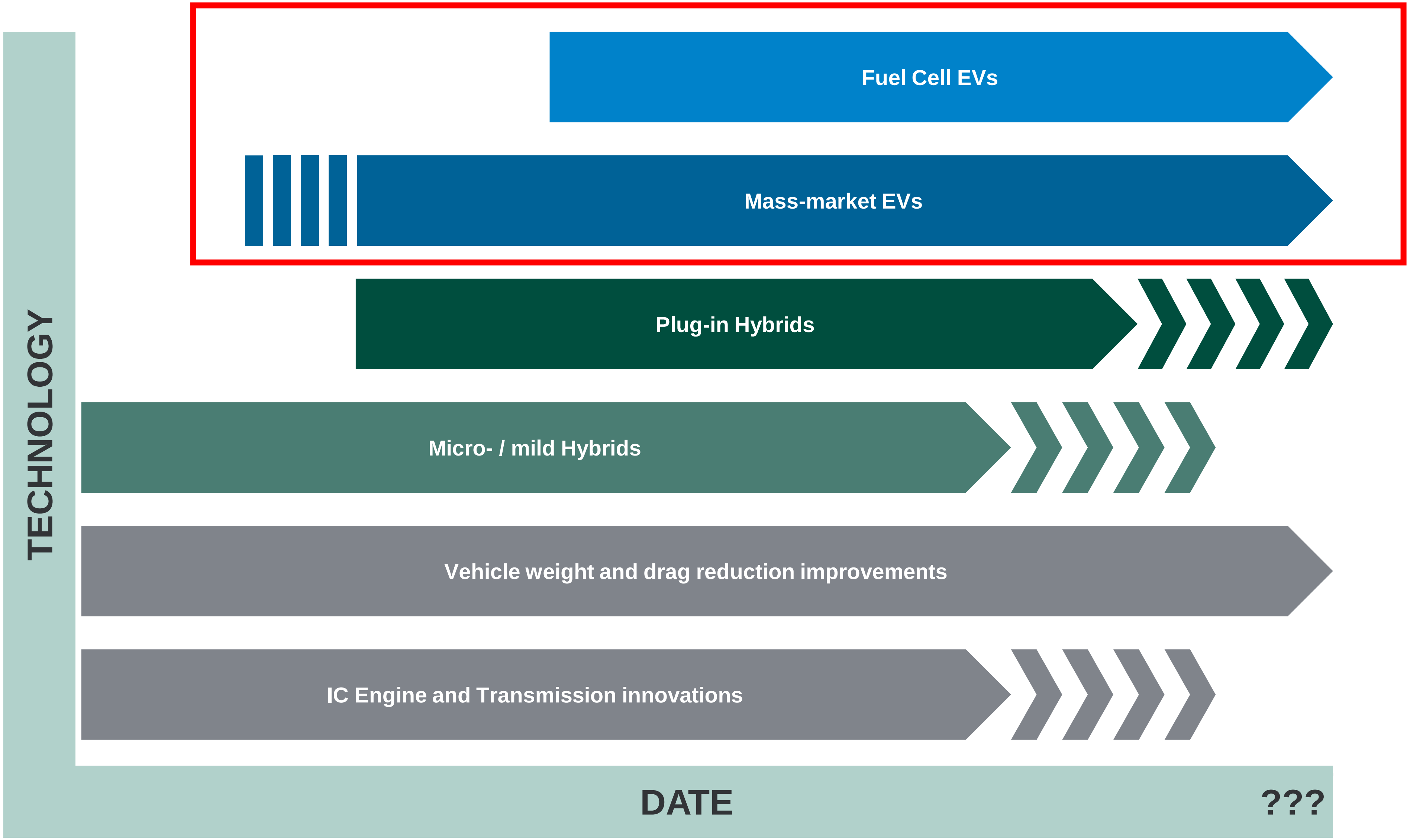
Office for
Low Emission
Vehicles

Global responses …

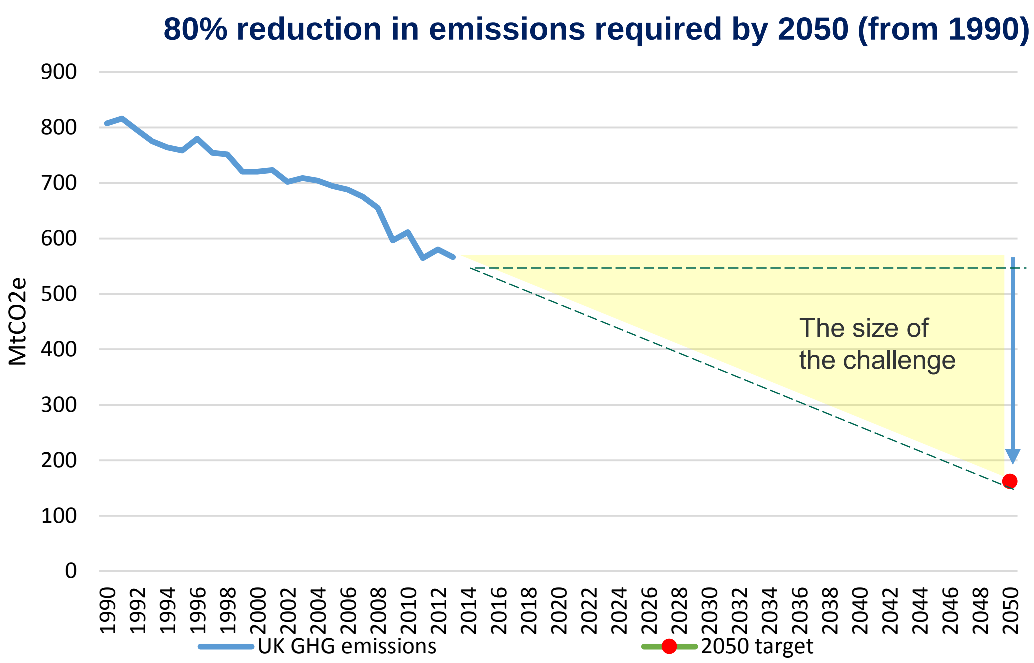


Office for
Low Emission
Vehicles

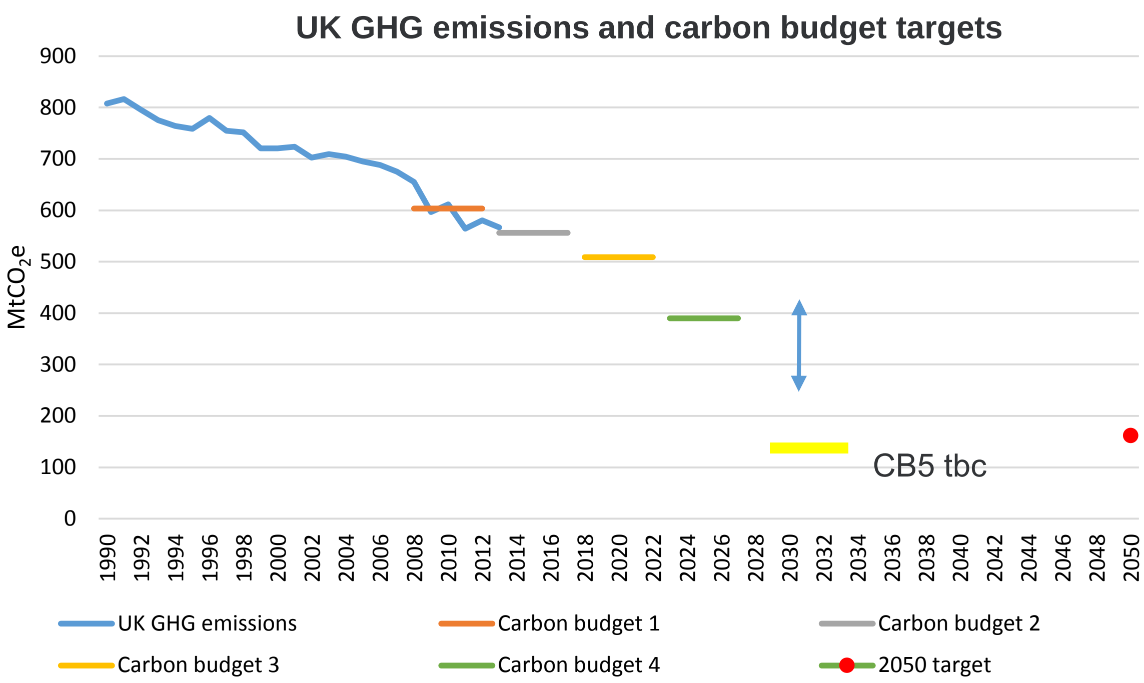
… leading a once in a generation technology transition



UK Climate Change Act 2008 requires an 80% reduction in emissions in the UK by 2050 (against a 1990 baseline)

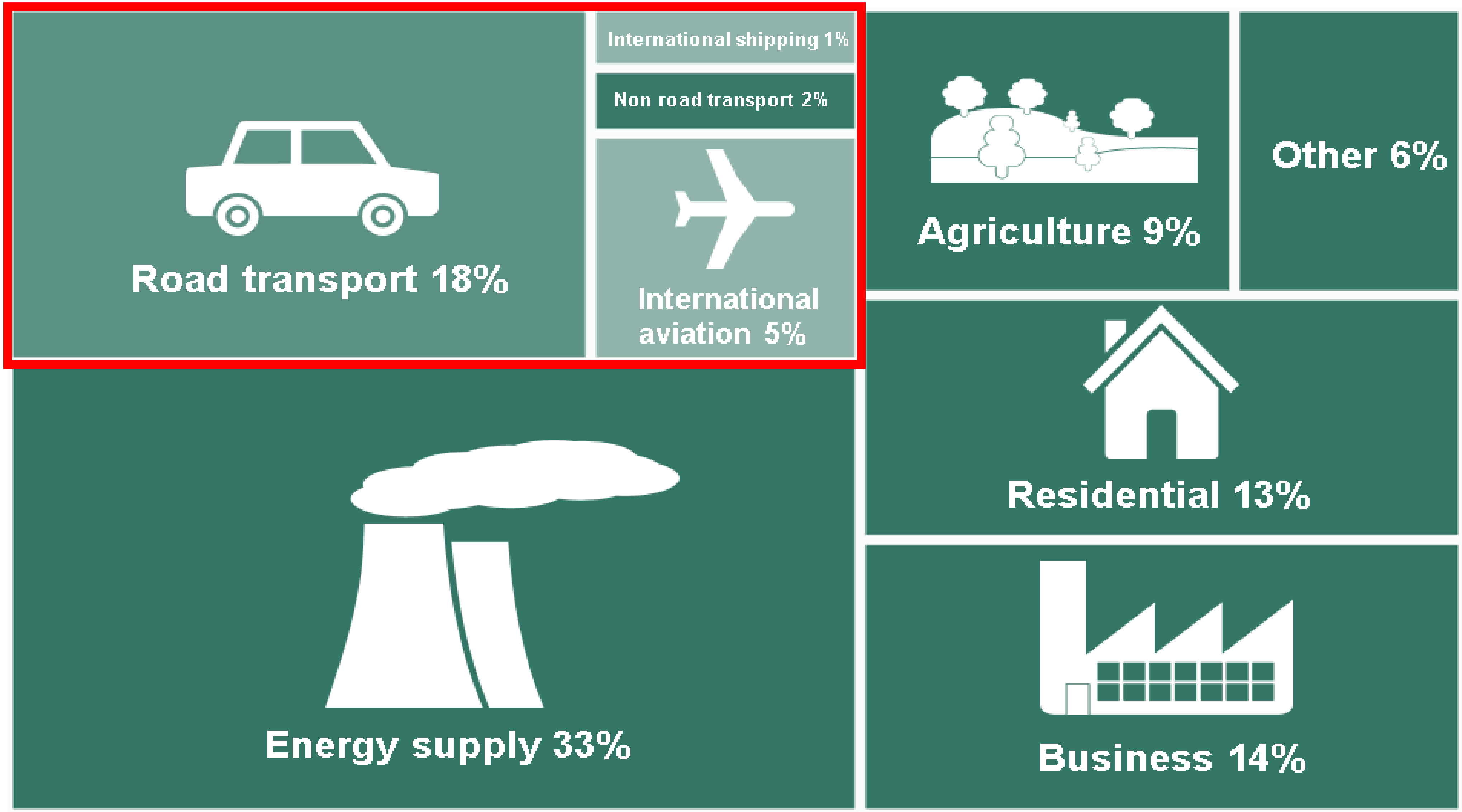


- Legally binding ‘carbon budgets’ to cap emissions of greenhouse gases (GHG) over rolling 5 year periods.
- Committee on Climate Change (CCC) and Adaptation Sub-Committee to advise on progress and direction.
- UK Government duty to deliver a UK Climate Change Risk Assessment report to Parliament every 5 years.

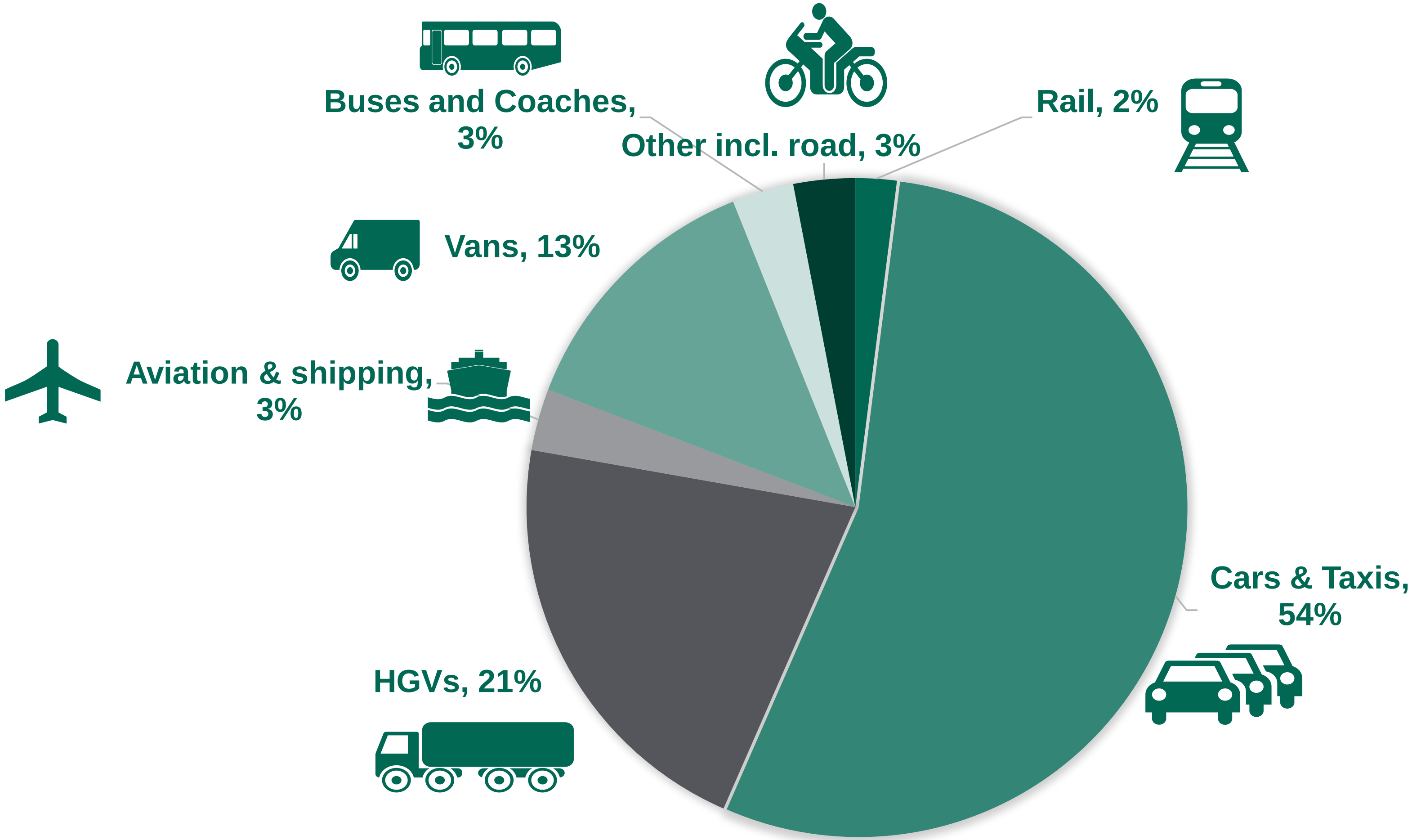


Office for Low Emission Vehicles

25%+ of UK total GHG emissions come from transport … up from 15% in 1990



UK transport emissions - dominated by road vehicles >90%



UK Transport GHG emissions (incl. international transport): 2013

Office for Low Emission Vehicles

Stretching Government goals and funding since 2011 …

MANIFESTO
MAY 2015

‘Our aim is for almost every car **and van** to be a zero emission vehicle by 2050 and we will invest **£500m** over the next five years to achieve it.’

SPENDING REVIEW
NOVEMBER 2015

The government will spend more than **£600m** between 2015-16 and 2020-21 to support uptake and manufacturing of ultra-low emission vehicles (ULEVs) …and keep the UK on track for all new cars to be effectively zero emission by 2040.

Department for Transport | Department for Business, Energy & Industrial Strategy

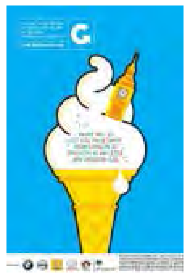
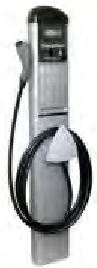
Office for Low Emission Vehicles

Cabinet Office
HM Treasury

R&D | **Incentives** | **Energy Issues** | **Comms** | **Infrastructure** | **Supply Chain**





UK H_2 Mobility

Office for
Low Emission
Vehicles

Most comprehensive policy programme in the world?

£400m+	Plug-in Car Grant
£20m+	Commercial vehicles / two-wheelers
£2m+	*Go Ultra Low* comms campaign
£40m	Go Ultra Low Cities
£30m	Buses
£20m	Taxis
£35m	London
£30m+	Chargepoint infrastructure
£10m+	Hydrogen
£15m	Highways England chargepoints
£125m+	Research and development
£10m	Battery prize

Office for Low Emission Vehicles

£600m support package 2015 - 2020

£20m+ Plug-in Van Grant

20% off an eligible van
(up to **£8,000**)

- N1; UN-ECE 100.00 comp.
- <75g CO_2/km
- 10 – 60 miles ZEV range
- 50 miles top speed
- 3 year vehicle warranty
- 5 year battery warranty

Office for Low Emission Vehicles

Grow automotive by stimulating innovation, speeding up technology development and reducing emissions

£125m+ Research and Development

Office for
Low Emission
Vehicles

"Low Carbon Truck Trial" 2012 - 2016

£125m+ Research and Development

- **£11m** part funded **~350 alternatively fuelled commercial vehicles** demonstrating low carbon truck technologies in real-world settings and primed the UK market with a series of accessible gas refuelling stations.
- **Generated a body of evidence to support fleet and government decision making**.
- Consortia includes John Lewis, United Biscuits, Stobarts, Argos, DHL, Tesco, Wincanton and GasRec.
- Final stages of evaluation of carbon emissions, air quality impacts, costs and operational performance.
- **Final data report to be published 2016** …

"Low Emission Freight Demonstration"

£125m+ Research and Development

- £19m+ to stimulate 'real-world' on-road demonstration trials of 'near to market' technologies for vans, HGVs.
- Encouraging greater focus on <u>zero emission capability</u> and urban delivery than previous truck trial,
- Funding associated publicly accessible infrastructure, especially that that could unlock alternatively fuelled vehicles for other users.
- Working closely with industry, operators and others.
- July 2016 launch for **April 2017 start!**
- www.gov.uk/olev

Office for Low Emission Vehicles

UK Government plans

- Incentives, infrastructure + R&D plans
- Autumn Statement 2016
- New Auto Sector Strategy
- UK position on EU vehicle CO_2 regs
- Focus on industrial strategy
- Carbon Budget plans
- Modern Transport Bill

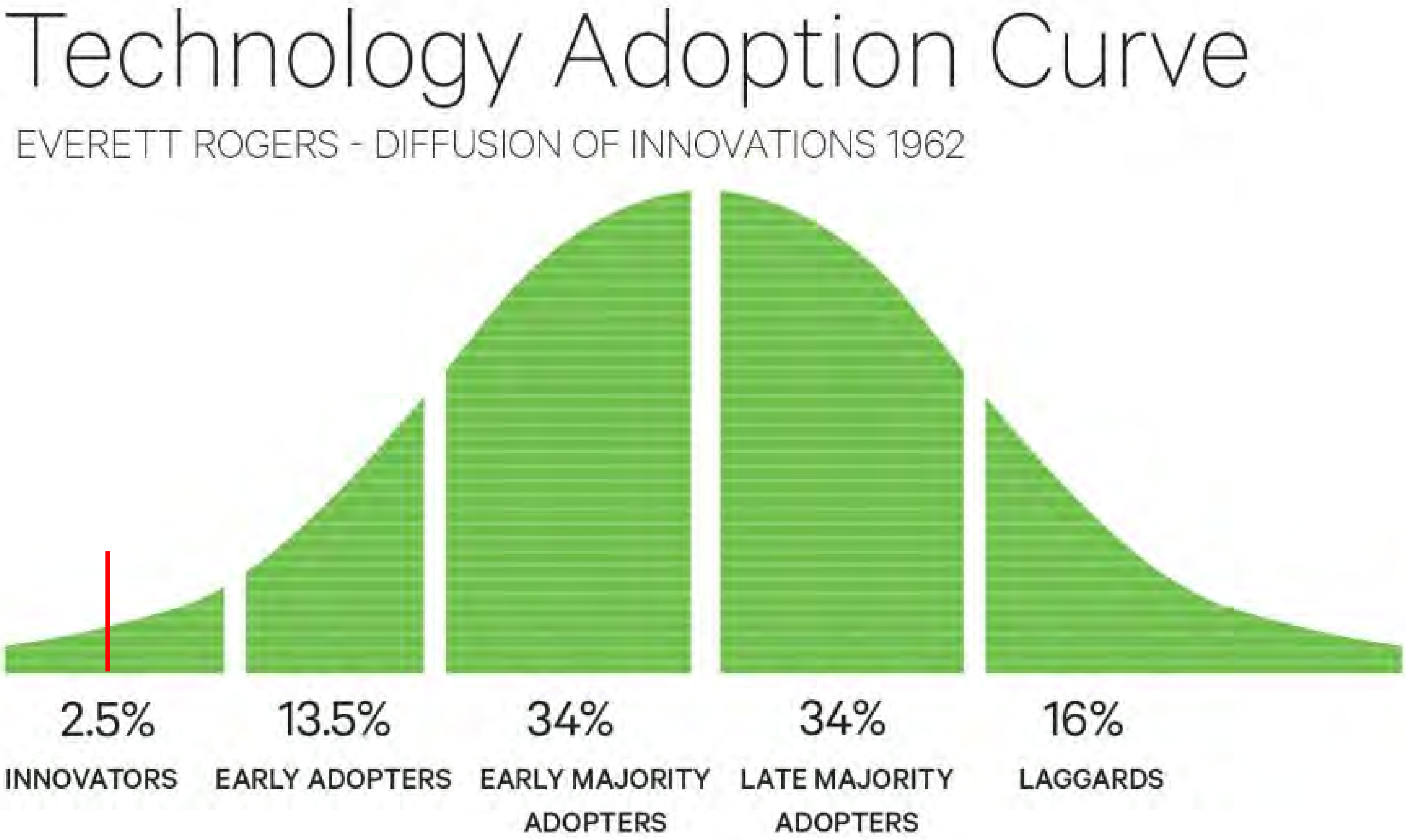
Refreshed Government strategy for ultra low emission vehicles

ALL vehicles covered

2017 and beyond

Office for
Low Emission
Vehicles

Normalisation …



THANK YOU

www.gov.uk/olev

@OLEVgovuk

National Organisation Hydrogen and Fuel Cell Technology

IA-HEV Task 27 eLogV
3rd Workshop: Electric Freight Vehicles – out of niche into mass market

Facts and Figures of Germany

Dominique Sévin (NOW GmbH) | Wien / Vienna | 19/10/2016

National Organization Hydrogen and Fuel Cell Technology – NOW GmbH

Structure and tasks

National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)
Electromobility Model Regions programme

- Coordination and implementation of policies adopted by BMVI, BMWi, BMU, BMBF, BmEL, and possibly further senior federal authorities
- Coordination of other programs of the federal government in relevant fields of technology

Mobility and Fuel Strategy of German government
EU Directive on development of alternative fuels infrastructure

- Support of BMVI with development of MFS and CPT
- Developing national strategy framework for hydrogen and electricity
- Monitoring as a basis for the analysis and evaluation of specific measures

International exchange

- Cooperation and coordination regarding European and international initiatives, including the representation of public interests in relevant policy bodies

Communication

- Stakeholders and the general public
- Networking

Development, coordination and implementation of national strategies and public-private initiatives in the technology field of sustainable propulsions systems on behalf of the federal government

Objectives of German Federal Government:
Reduction of final energy consumption and CO_2 emissions

10% by 2020
40% by 2050
Final energy consumption in mobility sector

40/55/80-95%
CO_2 emissions by 2020/2030/2050

33.6 million tons
CO_2 emissions in mobility sector

Endenergieverbrauch Verkehrssektor	1,7 %	-10 % ggü. 2005	

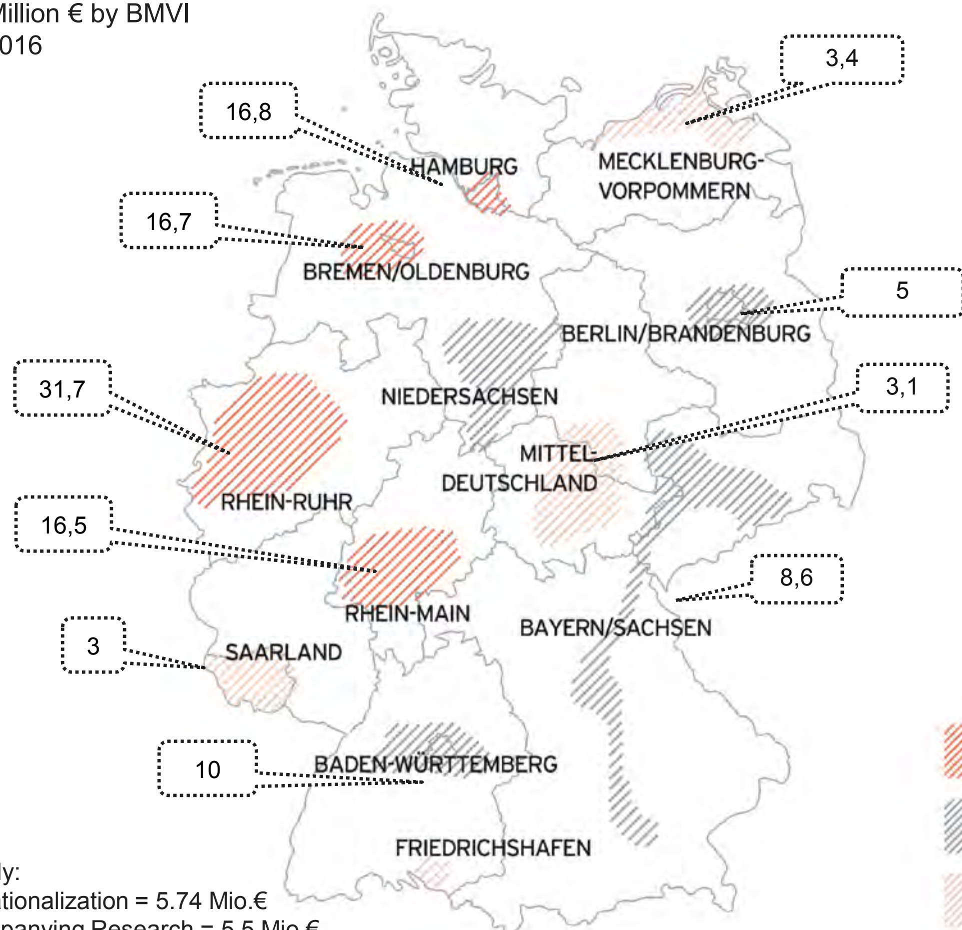
Need for action in mobility sector!

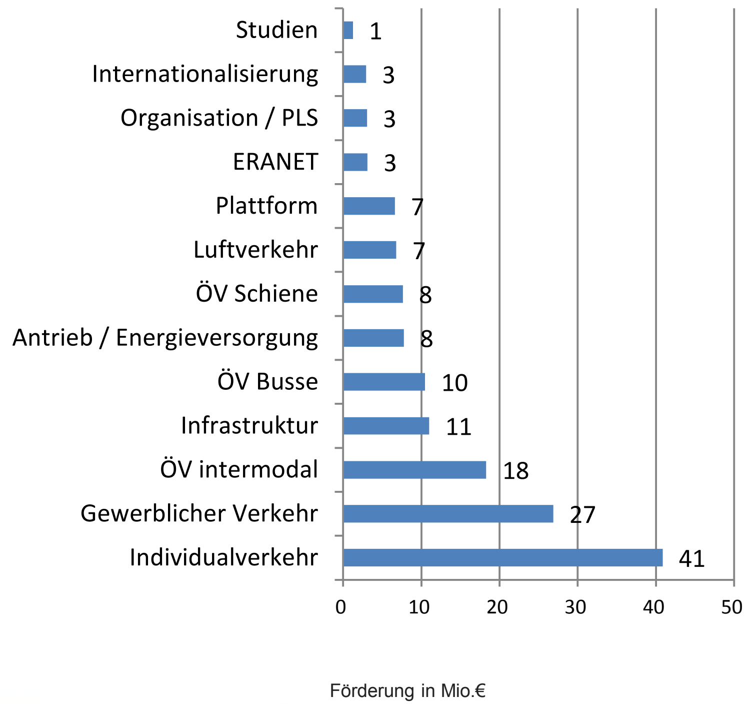
Source: The Mobility and Fuels Strategy, 2013

German Ministry for Traffic and digital Infrastructure BMVI

Overview Funding Electric Mobility since 2011

Funding Million € by BMVI
as at 01/2016





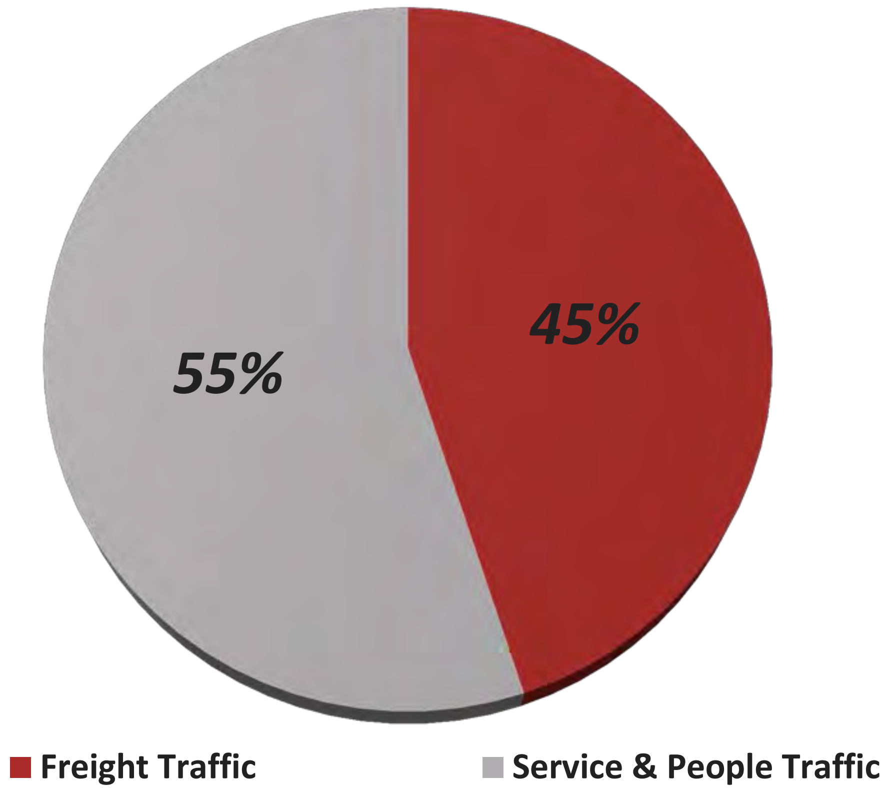
Model Regions Electromobility

Additionally:

- Internationalization = 5.74 Mio.€
- Accompanying Research = 5.5 Mio.€
- Verification of Technology = 20 Mio.€

Urban commercial traffic in Germany

Urban commercial transportation in German cities accounts for approx. 30-35% of total traffic



EV urban freight:
Strategic importance for German Government

- Action plan “Freight Transport and Logistics” by BMVI as at 2014 (update 2016)
  - Increasing importance of Electric Mobility
- High potential for reducing pollutant emissions (up to 29% Carbon dioxide emission savings)
  - preventing penalties for municipalities
- High potential for supporting market acceleration
  - Two thirds of new vehicle registration in Germany made in business sector
  - highest potential in sector light Utilities (< 3.5 tons, 72% share)

- **Important role in Federal and regional funding programs!!!**

Federal Ministry of Traffic and digital Infrastructure:
Current Funding Guideline Electric Mobility

FUNDING GUIDELINE ELECTRIC MOBILITY 2015

- Procurement of vehicles and building up of charging Infrastructure (funding 40 percent of “Innovation Delta”)
- Working out municipal concepts to boost electric mobility in cities and counties
- Research and development for further assistance towards market acceleration

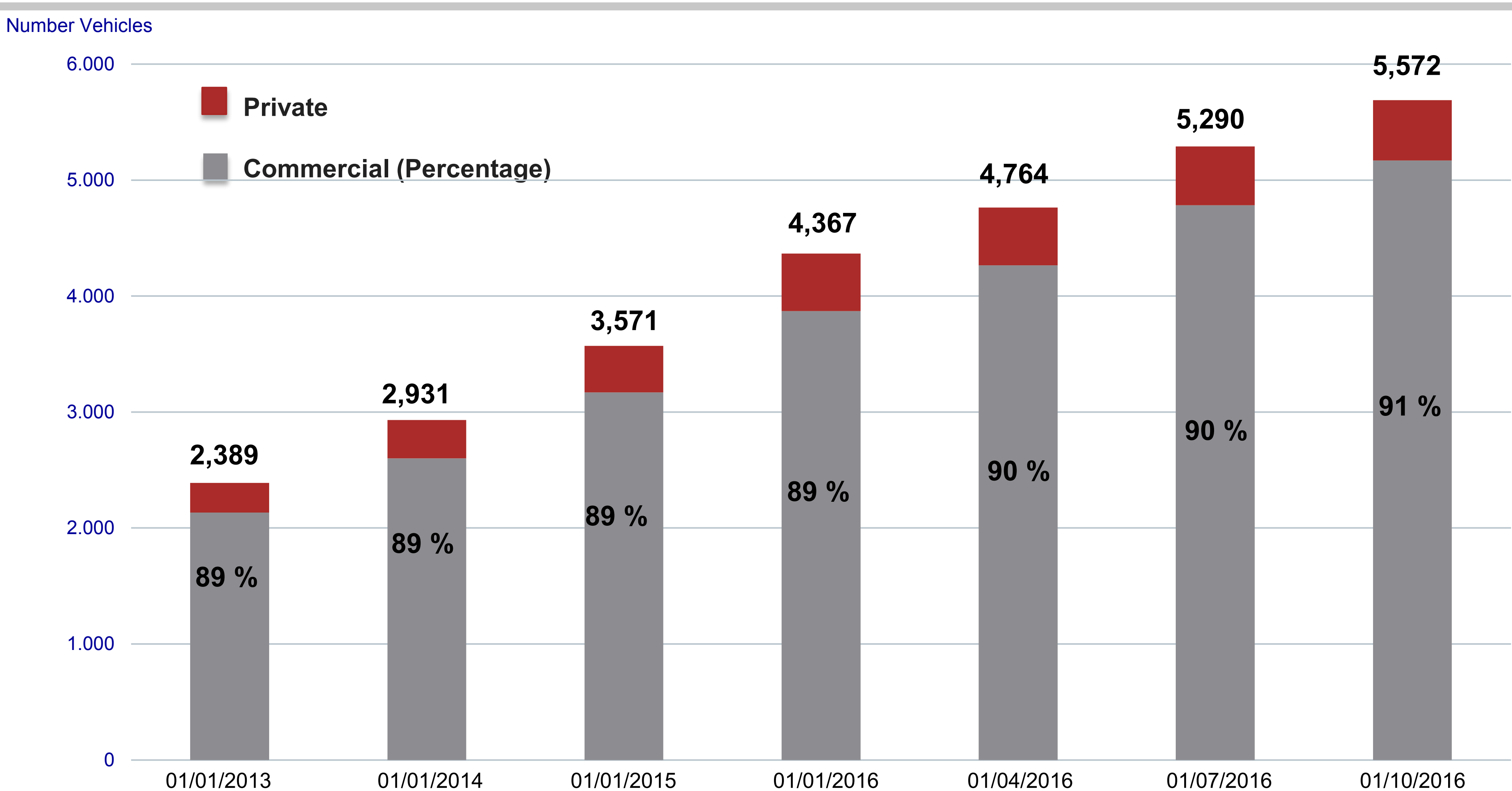
Guideline Funding Electric Mobility 2015:
Sample calculation

VW Golf (Golf 85 KW TSI CL):	**€17,000**
VW eGolf:	**€29,000**
Price difference:	**€12,000**
Funding amount (40% investment grant):	**€4,800**

Renault Kangoo (diesel / 2-seats):	**€13,500**
Renault Kangoo Z.E. (2-seats):	**€20,300**
Price difference:	**€6,500**
Funding amount (40% investment grant):	**€2,600**

* Approximate reference values : Actual promotion may vary depending on equipment

EV urban freight:
Number light Utilities & EV Trucks in Germany (BEV & PHEV)



Database: Federal Motor Transport Authority, 2016

Market Situation in Germany:
light e-Utilities & e-Sprinter (up to 3.5/4.25 tons)

Citroën Berlingo Electric

EcoCraft EcoCarrier

Ford Transit Connect

Daimler Vito E-Cell

Iseki Megaworker

Micro Vett Fiorino

Nissan eNV200

Peugeot Partner Electric

Renault Kangoo Z.E. / Z.E. Maxi

VW Abt E-Caddy

Streetscooter Work

emovum e-Ducato

BEV

BEV

BEV

IVECO Daily Electric

BEV

Smith Edison

BEV / also available as 4.6 tons

Mercedes Sprinter

PHEV

Market Situation in Germany:
e-Trucks (up to 7.5 tons, only BEV/REV)

EFA-S P80 e
(REV)

Emoss Electric Dyna EV200
(BEV)

Orten E 75 AT/TL
(BEV)

Framo e 180/280
(BEV)

Market Situation in Germany:
e-Trucks (> 7.5 tons)

BEV

Scania G 360 4x2 Electric

Trolley Truck / diesel-hybrid

Emoss CM 10 / 12 / 16 /18

10 / 12 / 16 /18 t

Smith Newton

7,5 / 10 /12 t

Framo e 180/280

7,5 - 44,0 t

E-Force

Based on IVECO Stralis / 18 t

Market Situation in Germany:
Announced e-Sprinter & e-Trucks

VW e-Crafter

- 4.25 tons
- BEV

Fuso Canter E-Cell

- Announced for 2017
- BEV

Hyundai H350

- Prototype presented on IAA Commercial Vehicles 2016
- FCEV

Mercedes Urban e-Truck

- Prototype presented on IAA Commercial Vehicles 2016
- BEV

Nikola One

- Expected 12/2016
- Range up 1,931 km / Hydrogen free for first 1 million miles
- FCEV

Mercedes Future Truck 2025

- Semi-autonomous prototype
- BEV

Market Situation in Germany:
Overview

	≤ 3.5 t/4.25 t	3.5/4.25 t to 7.5 t	7.5 t to 12.0 t	> 12.0 t	Total Number
Number	8	12	5	8	30
Thereof…					
BEV	7	10	4 (+1*)	7	22
REEV	-	1	-	-	1
FCEV	1	1	-	1	1

*Trolley Truck

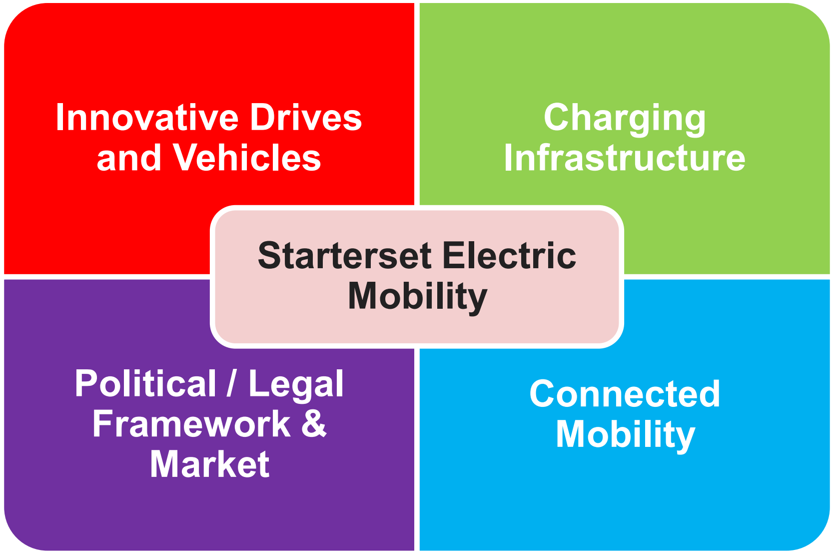
Due to constructions and battery size several models can be divided up in various categories.

Accompanying Research by BMVI:
New working group „eLogistics“

Vehicles
- Light Utilities
- EV trucks (up to 18 tons)
- Special Vehicles

Technology
- Technology review (BEV, PHEV, FCEV)
- Market observation & analysis
- Concepts for charging infrastructure

Practicality & Readiness
- Supply chains
- Urban transport
- Distribution traffic



Market Incentives Electric Mobility:
Decision by German Federal Government at 18/05/2016

PURCHASE INCENTIVE	CHARGING INFRASTRUCTURE	TAX FUNDING	PUBLIC FLEETS

▪ Environmental Premium (4,000€ for BEVs and FCEVs; 3,000€ for PHEVs)
▪ Financing 50% each by Government and OEMs
▪ Funding of vehicles with a maximum purchase price of 60,000€
▪ Total budget: 1,2 Billion € maximum until 2019
	▪ Total budget: 300 million €
	▪ 200 million € promote fast charging (DC)
	▪ 100 million € promote normal charge (AC)
	▪ At least 15,000 charging stations will be set up
	  ▪ 10,000 normal
	  ▪ 5,000 fast
		▪ Tax free charging on working place for employee
		▪ Extension of tax exemption for EVs from 5 to 10 years
			▪ 20 % EVs in federally owned fleets
			▪ Total costs of investments: 100 million €

National Organisation Hydrogen and
Fuel Cell Technology

Thanks for your Attention!

www.starterset-elektromobilitaet.de

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austriatech

Electric freight vehicles – out of niche into mass market
Facts& Figures Austria

IA-HEV Task 27 Workshop, 19 October 2016, Vienna

Henriette Spyra, AustriaTech – Federal Agency for Technological Measures

Agenda

- Who is speaking to you?
- Status Quo
- What will change? Upcoming challenges

AustriaTech is a national-level Transport Agency

- Agency of the **Austrian Ministry for Transport, Innovation and Technology**
- Focus on Innovation, ITS Deployment and E-Mobility
- NCP for implementation process of **AFI DIRECTIVE 2014/94/EU**

- Implementation of measures from the **2012 E-Mobility Implementation Plan**
- Advisory & project support
- Advisory for national RDD programs
- Annual E-Mobility monitoring report for Austria
- Policy support and coordination during EU legislation processes
- Policy support and coordination during national transposition processes on behalf of bmvit (as currently ongoing for **AFI Directive 2014/94/EU**)
- Cooperation with regional and local authorities (cities, municipalities)
- Participation in international working groups (e.g. IEA-HEV IA, UNECE QRTV)

E-Mobility at AustriaTech

Status Quo Austria

E-Logistics in Austria – 2 things you'll always hear

- Rail modal split above EU average – 32% of goods transported by railway system (objective: 40% by 2025)
- Austrian Postal Service, as one of the most important logistics providers, has the largest electric fleet of the country: > 1.300 E-Vehicles (cars, scooters, E-Quads, E-Bikes)

...but a lot of work needed to reach 2030 goal of CO_2-free logistics in urban areas...

Status Quo: Vehicle Registrations (Q3/2016)

Vehicle Type, Fuel Type / Energy Source	2010	2011	2012	2013	2014	2015	2016 (Q3)
Cars M1	328.563	356.145	336.010	319.035	303.318	308.555	252.178
Petrol incl. Flex Fuel	159.740	159.027	143.325	134.276	126.503	122.832	101.104
Diesel	167.130	194.721	189.622	180.901	172.381	179.822	144.493
Battery-Electric (BEV)	112	631	427	654	1.281	1.677	2.919
Plug-In-Electric (PHEV)	n/a	n/a	n/a	184	434	[illegible]	879
Hydrogen (FCEV)	n/a	n/a	n/a	[illegible]	[illegible]	[illegible]	[illegible]
New Electric Vehicle Registrations M1	**112**	**631**	**427**	[illegible]	[illegible]	[illegible]	[illegible]
Share of EVs in new M1 Registrations	**0,03%**	**0,18%**	**0,13%**	[illegible]	[illegible]	[illegible]	[illegible]
Other Battery Electric Vehicles of Classes L, M, N	**1.225**	**979**	**1.400**	[illegible]	[illegible]	[illegible]	[illegible]
Motorbikes/Trikes/Quadricycles (class L)	1.206	923	1.094	585	672	651	919
Busses (class M2 and M3)	8	5	14	15	1	12	14
Duty Vehicles Class N1 (< 3.5 t)	11	51	292	191	203	267	380
Duty Vehicles Class N2, N3 (> 3.5 t)	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]

BEV registrations **(+138.9%)**

Very few freight vehicles **(380 N1)**

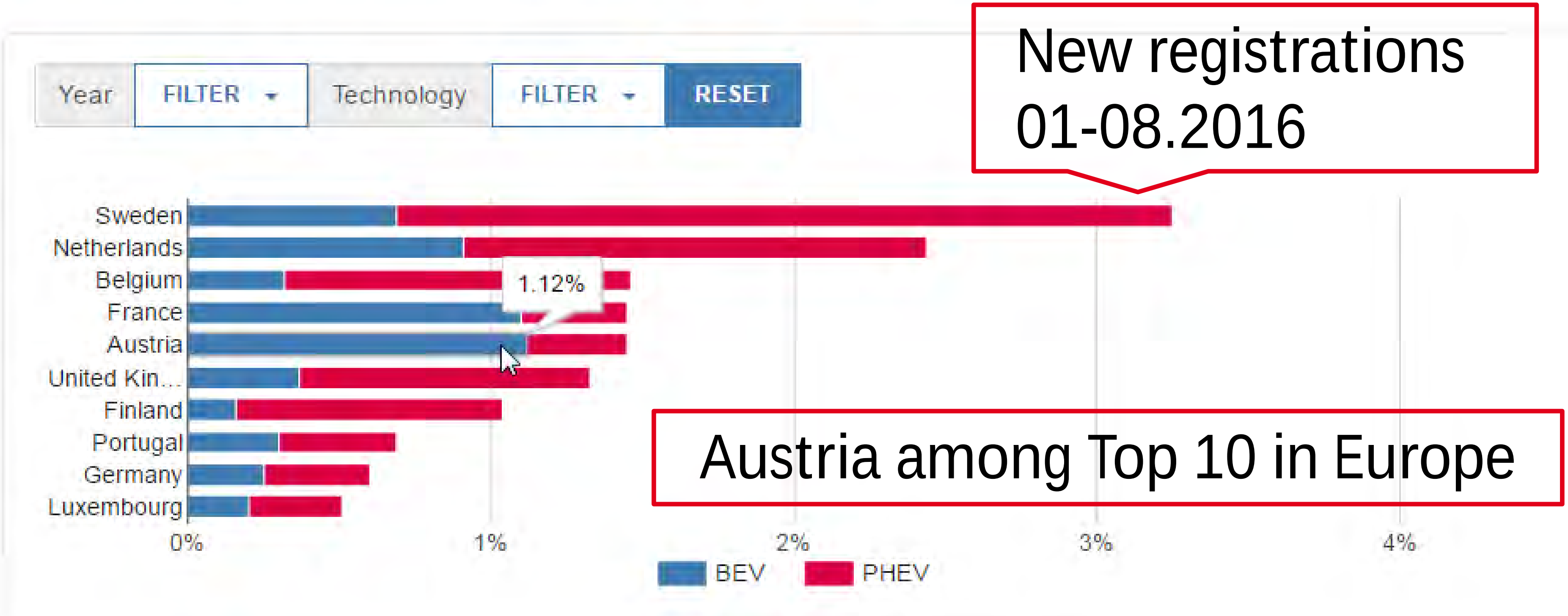
Status Quo: Vehicle Population (08/2016)

Vehicle Type, Fuel Type / Energy Source	2010	2011	2012	2013	2014	2015	2016 (08)
Cars M1	4.441.027	4.513.421	4.584.202	4.641.308	4.694.921	4.748.048	4.805.885
Petrol inc. Flex Fuel	2.445.506	1.997.066	2.001.295	2.003.699	2.011.104	2.019.139	2.036.501
Diesel	1.988.079	2.506.511	2.570.124	2.621.133	2.663.063	2.702.922	2.738.029
Battery-Electric (BEV)	353	989	1.389	2.070	3.386	5.032	7.710
Plug-In-Electric (PHEV)	n/a	n/a	n/a	408	776	1.512	2.391
Hydrogen (FCEV)	n/a	n/a	n/a	n/a	3	6	13
Electric Vehicle Population M1	**353**	**989**	**1.389**	**2.478**	**4.165**	**6.550**	**10.114**
Electric Vehicle - Change on Previous Year	**58,3%**	**180,2%**	**40,4%**	**78,4%**	**68,1%**	**57,3%**	**-**
Share of EVs in M1 population	**0,01%**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**0,21%**
Other battery electric vehicles of classes L, M, N	**3.217**	[illegible]	[illegible]	[illegible]	[illegible]	**6.532**	**7.845**
Motorbikes/Trikes/Quadricycles (class L)	3.034	[illegible]	[illegible]	[illegible]	[illegible]	5.324	6.243
Busses (class M2 und M3)	113	[illegible]	[illegible]	[illegible]	[illegible]	138	152
Duty Vehicles Class (< 3.5 t)	69	135	428	619	819	1.069	1.449
Duty Vehicles Class (> 3.5 t)	1	1	1	1	1		1

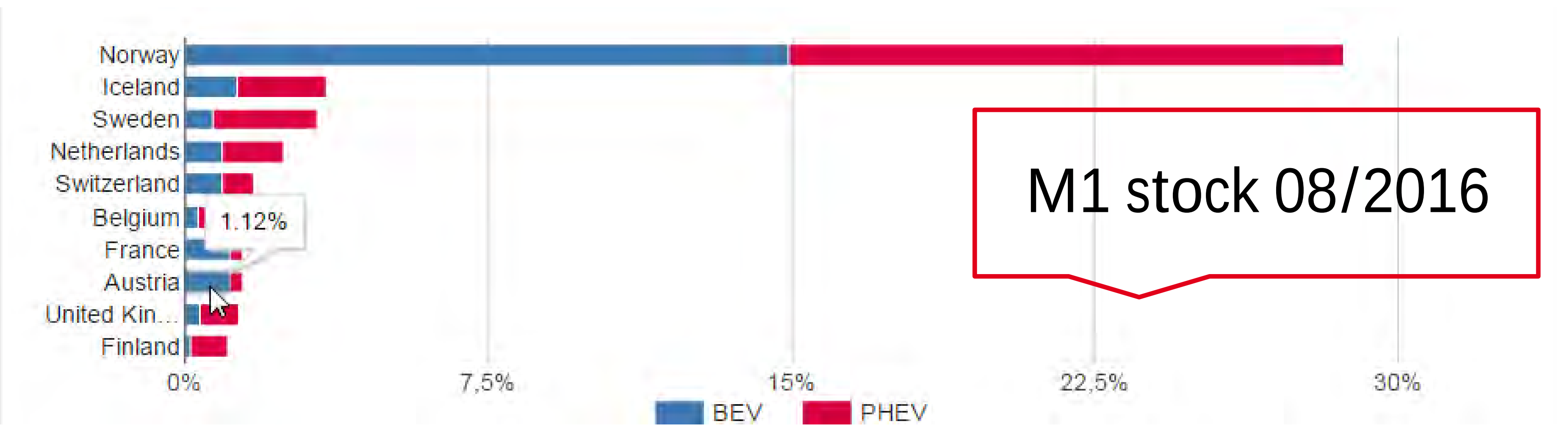
> 10.000 EVs
~ 0,2% of car population

Very few duty vehicles (~1.500 N1)

Top 10 PEV (M1) market share Countries in the European Union

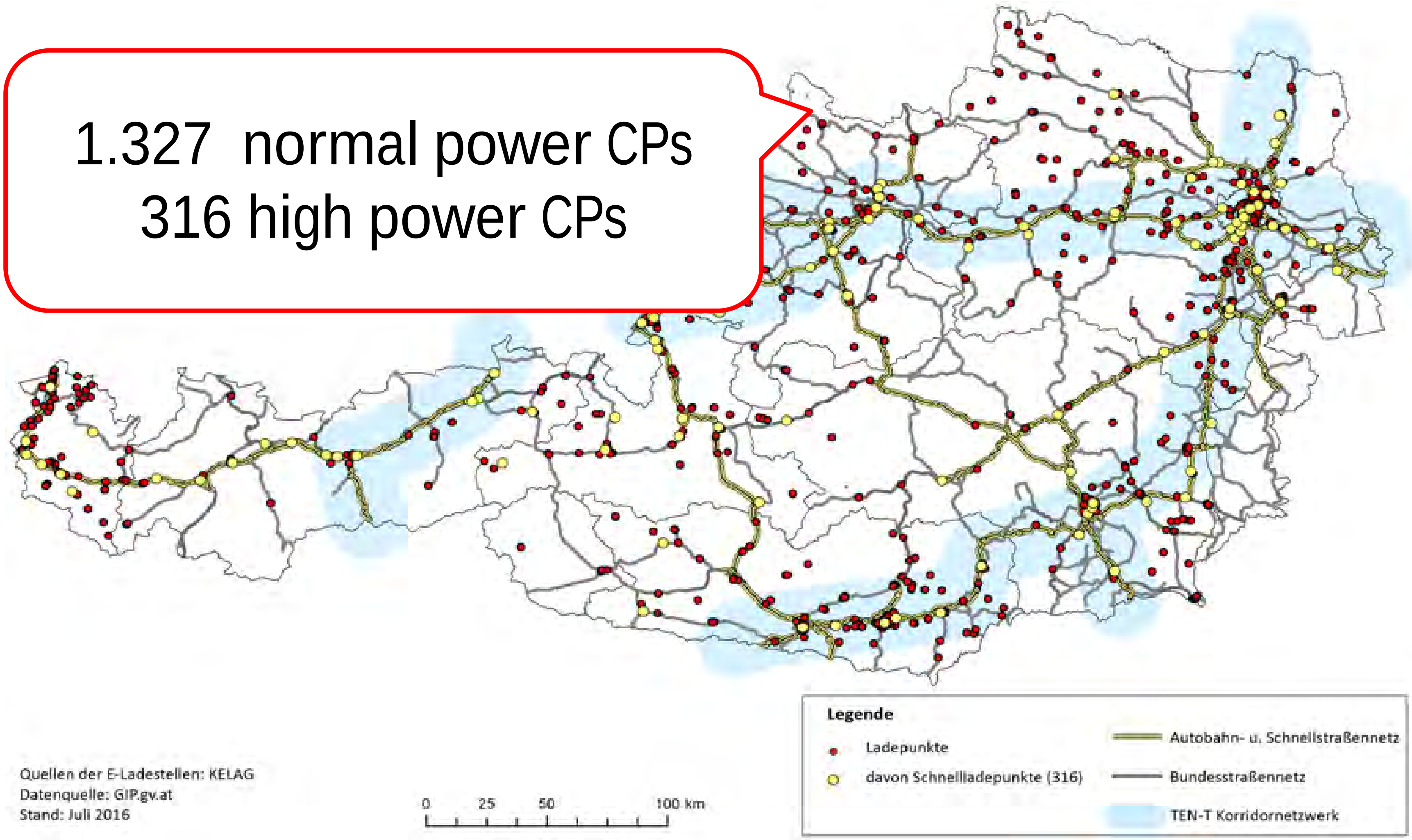


© **EAFO** (including figures from Jan - Aug 2016)



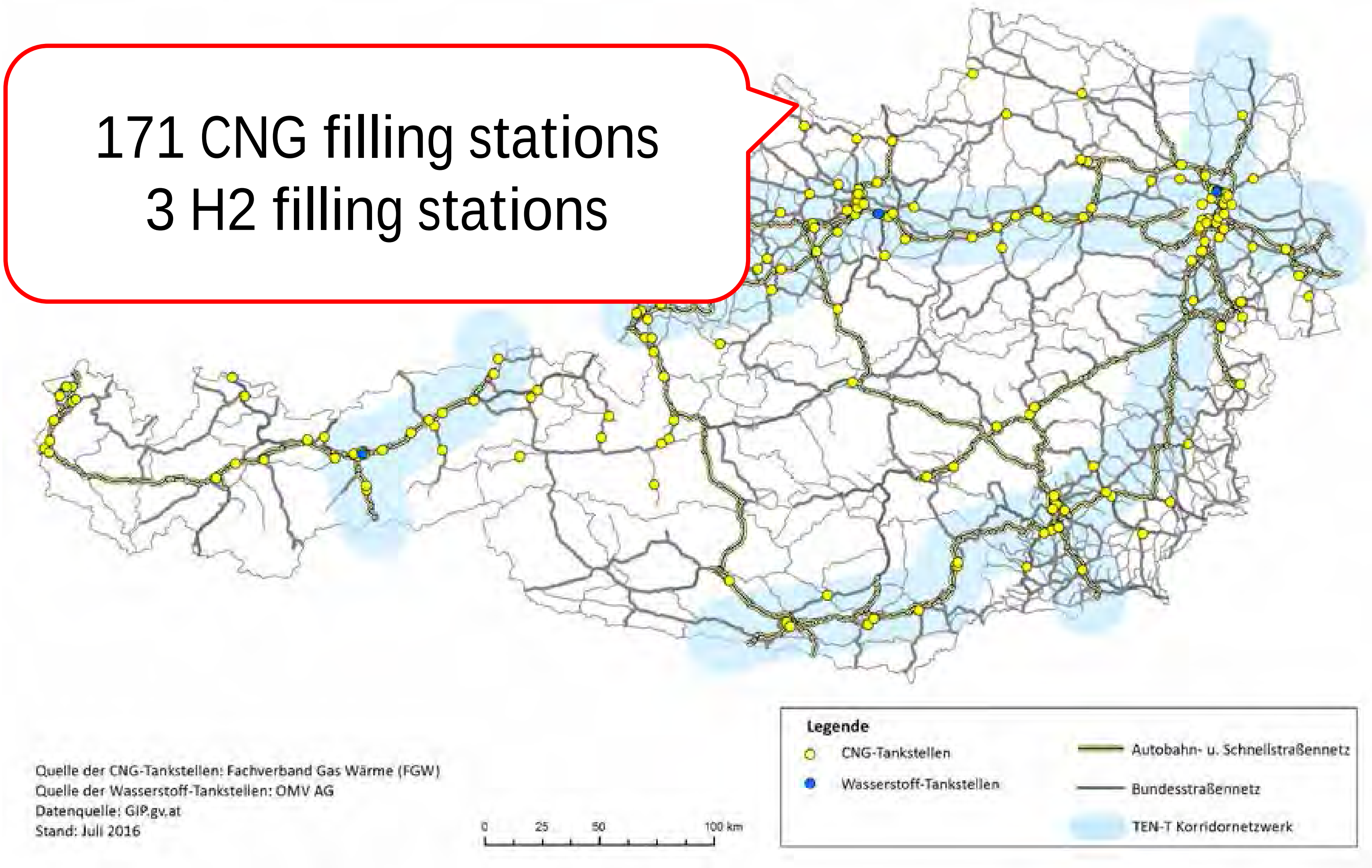
Status Quo: Charging Infrastructure (07/2016)

1.327 normal power CPs
316 high power CPs



Status Quo: CNG and Hydrogen Infrastructure

171 CNG filling stations
3 H2 filling stations



Incentives for E-Mobility

Status Quo Incentives E-Mobility

Purchase Incentives	Taxes	Innovative/green public procurement
Direct purchase incentives for companies, public authorities etc. (klimaaktiv mobil and regional funding)	NoVA exemption (registration tax) Exemption engine-related insurance tax NEW FROM 2016: changes in company car taxation	Large scale public tender for EVs currently in preparation by Federal Procurement Agency BBG

Research, Development & Demonstration	Municipal incentives	Regulatory frameworks
Electric Mobility Flagship Projects Model regions electric mobility Mobility of the Future Urban E-Mobility	e.g. parking management, exemption of EVs from restrictions with or without reduced (free) parking fees; additional parking space	e.g. adaptation of building regulations for easier installation of charging infrastructure

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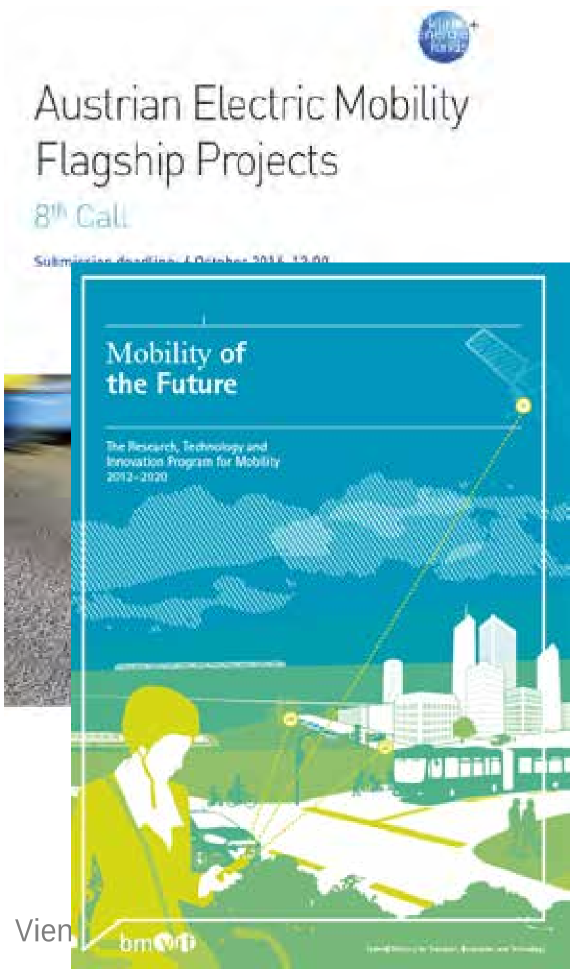
E-Logistics Support @ bmvit

FTI Support	Deployment Support



kombinierte mobilität für graz!

eTAXI

smart urban logistics
Eine Initiative des Klima- und Energiefonds

What will change? Upcoming challenges

National Policy Framework Clean Power for Transport

- National transposition of Directive 2014/94/EU on Alternative Fuels infrastructure build-up to be notified to EC by Nov 18, 2016
- Art. 3: National Policy Framework for the **development of the market as regards alternative fuels in the transport sector and the deployment of the relevant infrastructure**
- Public sector to set *"measures necessary to ensure that ... objectives contained in the national policy framework are reached"*

National implementation process: build on existing strategies and use process to drive change

Erstes Jahr Nationale Umsetzung 2015	Zweites Jahr Nationale Umsetzung 2016
• Österreichweite Online-Konsultation Saubere Energie im Verkehr • WS Elektrizität, CNG, LNG, H2 05/2015 – 09/2015 • WS Bundesländer 06/2015 - 10/2015	• Workshops Graz, Salzburg, Innsbruck • Erstellung des Nationalen Strategierahmens:

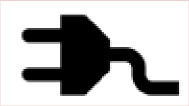
NPF 18.11.2016

Implementation + further measures!

Relevant objectives in Austria's NPF

- Explicit recognition that massive change in mobility system is needed and that diesel/petrol use needs to decrease significantly
- Transition to low- and zero emission vehicles
- Change needed to fulfil already existing legal and political objectives on air quality, decarbonisation etc.
- Explicit objectives in Austria's regions, e.g. new Styrian E-Mobility strategy assumes that by 2030 95% of new vehicle registrations will be EVs

Some relevant measures in Austria's NPF

Planned adaptation	Details
Road law 	Objective: reserve parking space at charging stations Symbol and EV definition in road law
Vehicle classification & labelling 	Unified labelling of clean vehicles (L, M1, N1), includes BEV , PHEV with at least 50km electric range, FCEV; evaluation to increase electric range
Law on driving licences	Objective: allow drivers with class B license to drive E-Vans up to 4.25t
Procurement	• Continue purchase support for duty vehicles • Establish public procurement objective for low emission vehicles & obligatory use of TCO approach
Industry dialogue	Establish industry dialogue together with CNL aimed specifically at increasing use of E-duty vehicles in cities and building up necessary infrastructure

The challenge: Many existing strategies, projects and initiatives…

…which are still not sufficient to reach Paris or 2030 objectives though!

Open issues – the big picture

GHG emissions: EU targets & Austria

EU 2020 targets (-20% CO_2-Emissionen to 1990)
Ö-Effort Sharing: 2020 (-16% CO_2-Emissionen to 2005)

EU 2030 targets (-40% to 1990)	Red -%	
ETS	43%	(to 2005)
Non-ETS	30%	(to 2005)
Austria		
Possible national sectoral target for transport (non-ETS)	**36%**	**(to 2005)**

Transport: Increas

	Tr M			
1990				
2005				
2008				
2009				
2010				
2011				
2012				
2013				
2014	21,7		22,3	
2015			22,2	
2016			22,1	GHG gas emissi... ...ets according to Austrian K
2017			22	
2018			21,9	
2019			21,8	
2020	**21,7**		**21,7**	
2030	**15,7**	**Possible necessary national sectoral target**		**- 28%** in comparison to national 2020 KSG target

<u>MINUS</u> 25/30% CO_2-emissions in the transport sector by 2030 (within 14 years)
-> despite forecasts of growing transport volumes, ...

Virtually zero CO_2-emissions in road transport by 2050

Worldwide CO_2 budget:
1000 gigatons of CO2

Austria's share: 1 per mille
à 1000 million tonnes of CO_2
à Approx .14 years with current emission levels left (~75 tCO2e p.a) -> beyond that overshooting of 2°C target

à **Every ton saved now until 2030 gives leeway for post 2030**

Possible measures:

- **Backcasting** based on final reduction targets (COP21, post EU 2030 effort sharing decision)
- Backcasting for 2030 and 2050
- **Long term planning perspective** for businesses & European industry
- **100% zero emission** registration targets/quotas for different vehicle classes:
  2030 range: Passenger cars, LDV
  2040 range: HDV

austriatech

henriette.spyra@austriatech.at

AustriaTech – Gesellschaft des Bundes für technologiepolitische Maßnahmen GmbH
Raimundgasse 1/6 I 1020 Wien I Österreich I www.austriatech.at

IA-HEV Task 27 Workshop
Supermarket logistics with electric trucks

Dr. Georg Weinhofer

Vienna, October 19th 2016

Coop (Switzerland): revenue of 27 billion CHF in 2015 with retail, wholesale and production

Retail (only in Switzerland

coop
coop city
coop bau+hobby
coop @home
coop mineraloel
coop pronto
coop restaurant
coop vitality
coop to go
Inter Discount
Fust Und es funktioniert.
microspot.ch
nettoSHOP.ch
siroop Happy Shopping
toptip
Lumimart
Betty Bossi
IMPORT PARFUMERIE
CHRIST UHREN & SCHMUCK
THE BODY SHOP
Marché

Wholesale

TRANSGOURMET
SELGROS
PRODEGA GROWA
VALENTIN GASTRO
EUROCASH
TRINKWERK
COOK

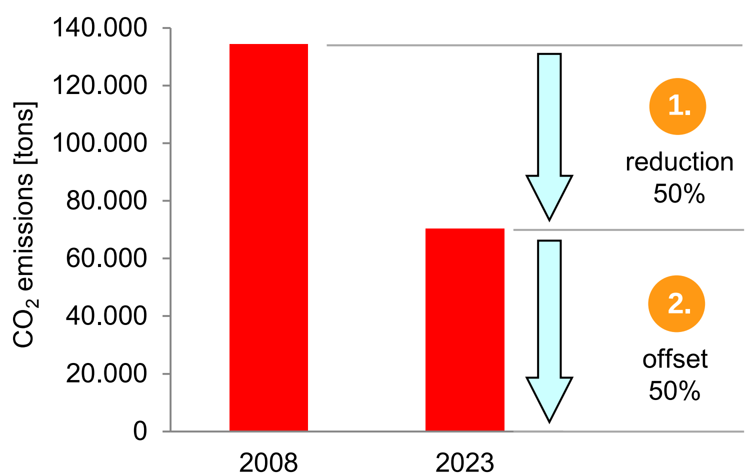
Production

Bell
swissmill
CHOCOLATS HALBA
hilcona
PASTA GALA
Steinfels SWISS
REIS
GASTRO-STAR
nutrex
sunray
pearlwater

Coop exercises its responsibility for climate protection

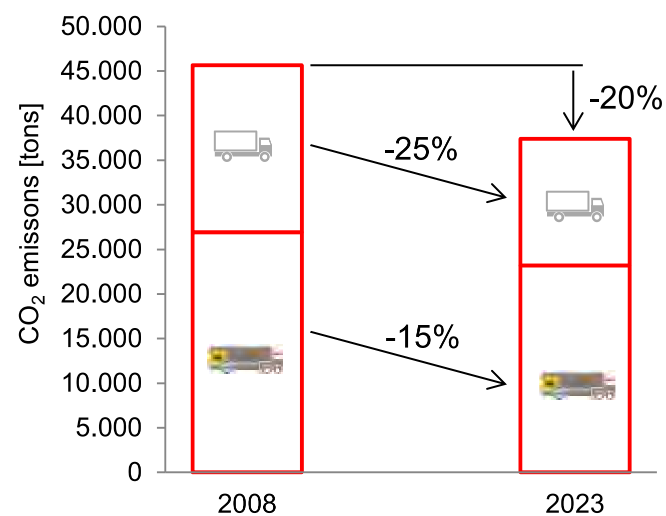
CO_2 neutral by 2023

- Ambitious target «CO_2-neutral by 2023» set in 2008.
- Until 2023 the annual CO_2 emissions will be reduced as much as technical possible and economical suitable. After 2023 the remaining CO_2 emission will be offset externally.



CO_2 reduction of goods transport

- Goods transport (Coop and third party) accounts for 40% of CO_2 emissions.
- Until 2023 the annual CO_2 emission of goods transport should be reduced by 20% compared to 2008.



measures to reduce CO_2 emissions of goods transport

idea and realization in 2013

idea

- 18 tons electric truck for same use as conventional diesel truck
- usual container and cooling system
- electric powered cooling system

realization

- bought electric truck «E-Force»
- container installed by Frech-Hoch
- Cooling system with Thermoking and Fröhlich Transklima adapted and installed

technology of electric truck «E-Force»

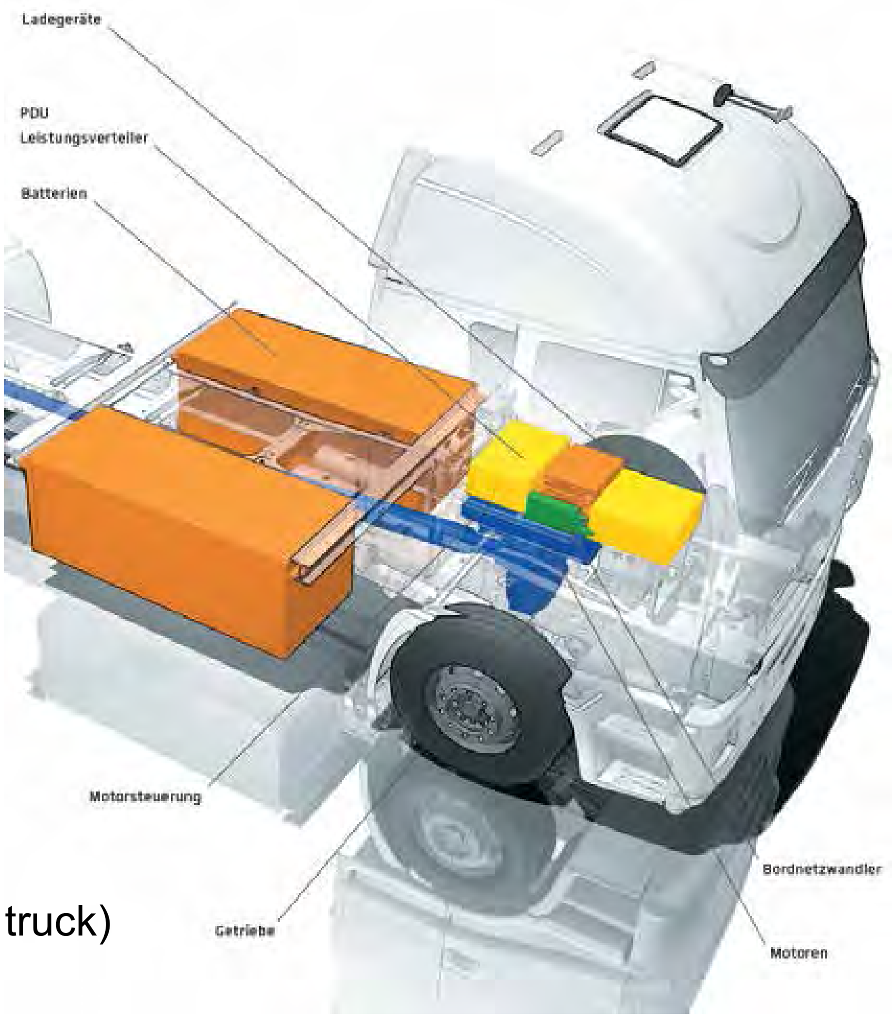
CHASSIS
IVECO Stralis

ENGINE
2 engines á 150 kW (total 408 PS)

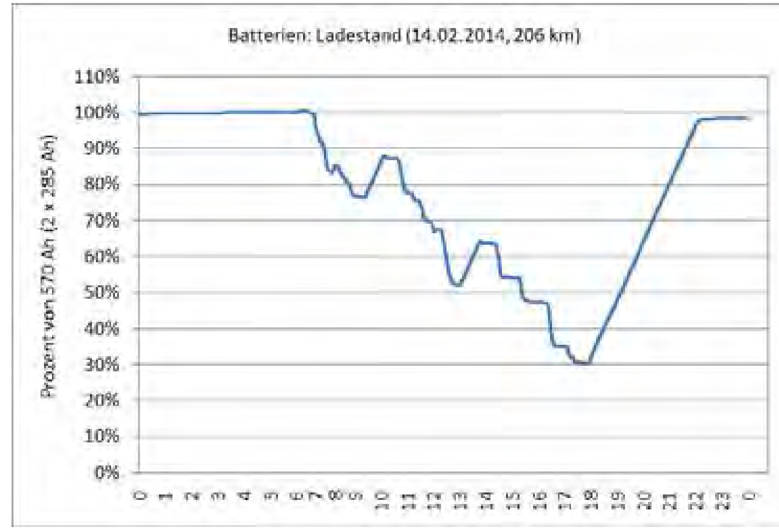
BATTERIES
2 blocks á 285 Ah (120 kWh)
each 1.3 tons, $LiFePO_4$
recharge in 6 hours with 400V/63A/44kW

WEIGHT
empty weight: 8 tons
weight for container an cargo: 10 tons

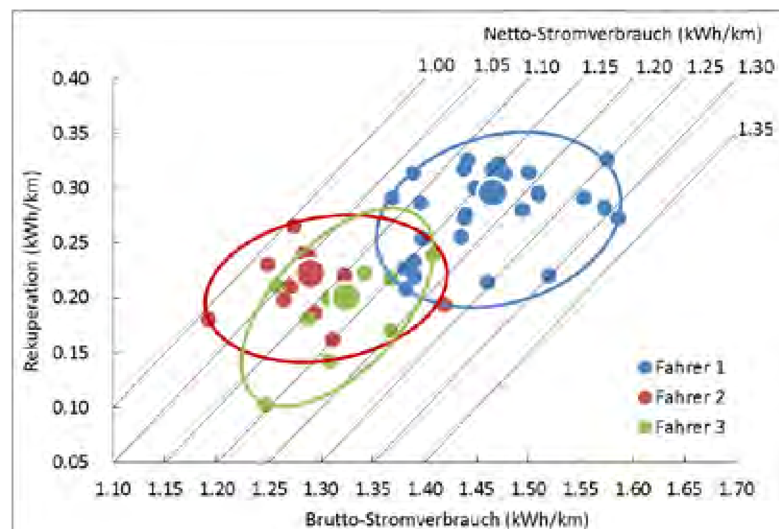
COOLING
Thermoking (powered from electric system of truck)



since January 2014: goods transport to supermarkets



- cargo load: 6.1 tons
- truck is used on normal solo-tours (no trailer) in metropolitan area Zurich on six days a week
- net power consumption: 1 to 1.3 kWh per km
- range: up to 240 km (without recharge)
- so far 80'000 km use (35'000 km in 2016)



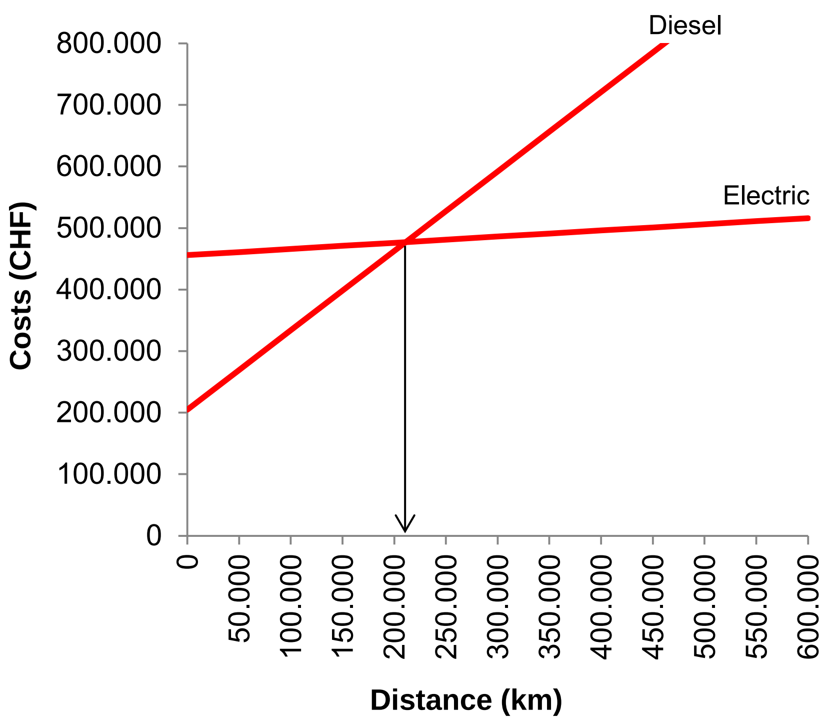
four more «E-Force» bought in 2016

since April 2016: use also in delivery wholesale

- challanges compared to supermarkt logistics:
  - o higher number of deloading stations (lifting platform is more often in use)
  - o transport of non-cooled, cooled and frozen products at the same time
- cargo load: 6.0 tons
- truck is used on normal delivery tours in metropolitan area Zurich
- net power consumption: 1 to 1.3 kWh per km
- range: up to 240 km (without recharge)
- so far 10'000 km use
- from December 2016 on there will be a further truck in use for deliveries in Berlin

profitability of electric truck «E-Force»

	Diesel	Eletric
chassis	100%	340%
container + cooling	100%	100%
investment costs	100%	220%
fuel	100%	20%
service	100%	25%
charge for street use	100%	0%
Tax	100%	80%
operating costs	100%	10%



Conclusion of use of electric truck «E-Force»

+ no constraints regarding transported volum and disposition
+ total substition of a comparable diesel truck (solo use in city / metrop. area)
+ low noise, good acclereration

– use on tours with autobahn not so good (less recuperation)
– use with a trailer not possible

I do not drive another truck anymore!

Coop truck driver

project "mobility in a closed water circle"

water vapor

hydraulic power station

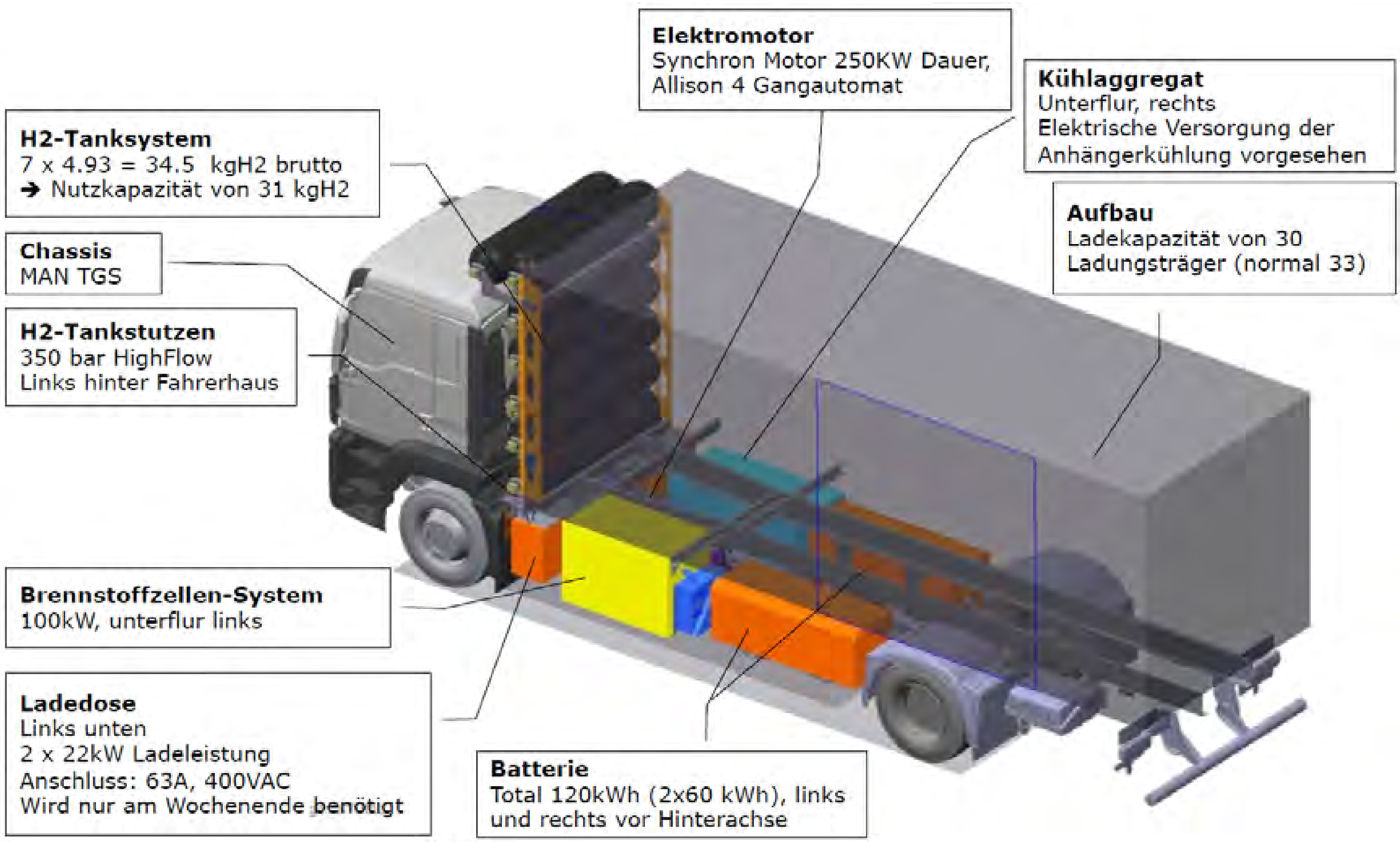
fuel cell vehicle

electrolysis

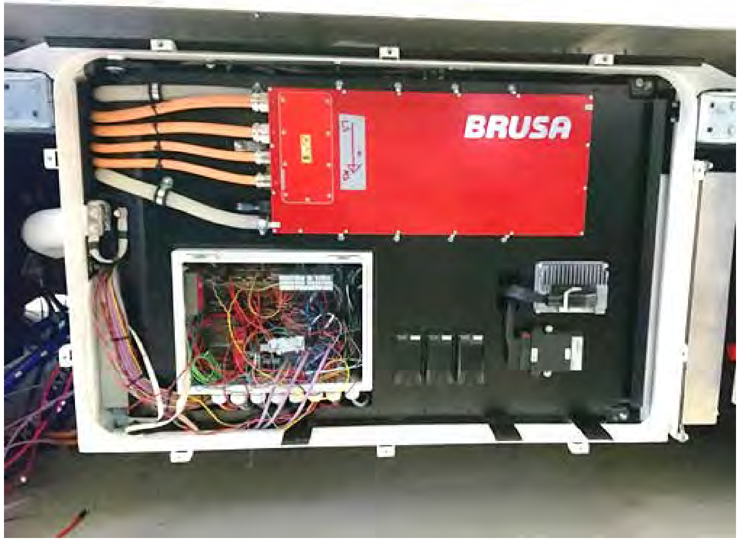
hydrogen station

transport of hydrogen

construction of a fuel cell electric truck (use from 11/2016)



construction of a fuel cell electric truck (use from 11/2016)



Thank you for your attention!

Eric Beers

Start of HyTruck in 2006

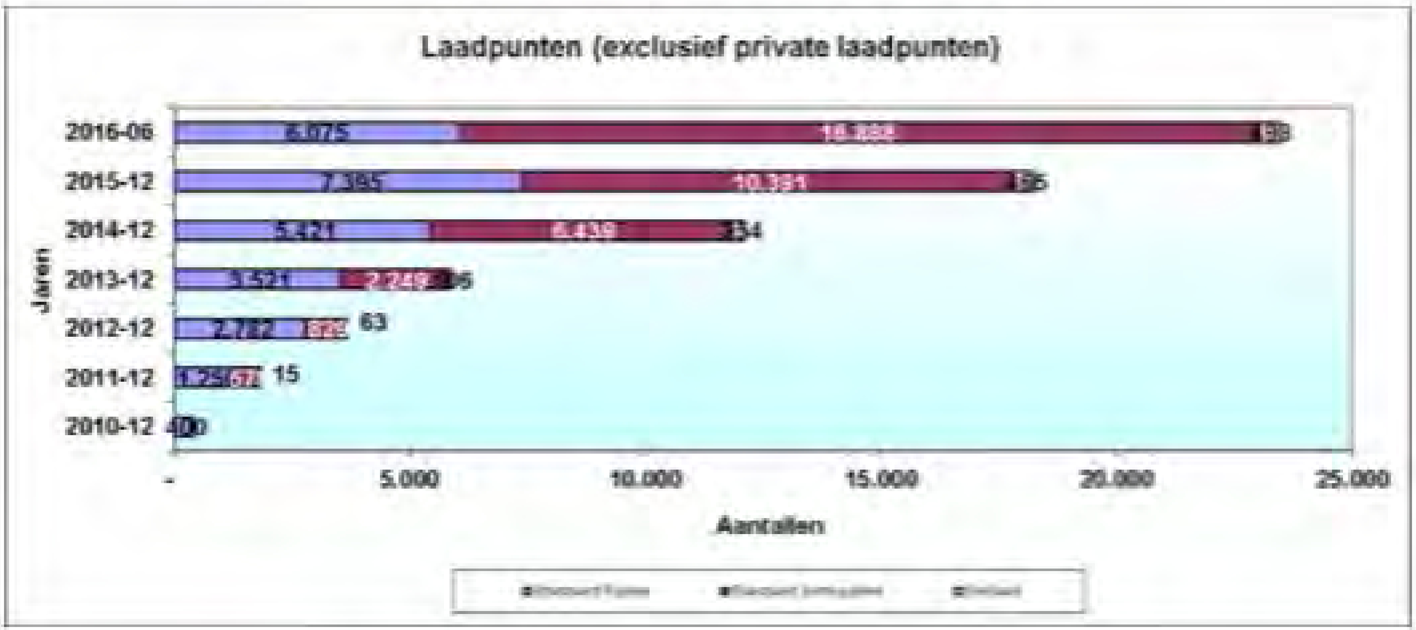
Total markt in Holland
june 2016

Aantal geregistreerde elektrische voertuigen in Nederland[1]

Aantal per / Type voertuig	31-12-2014	31-12-2015	30-04-2016	31-05-2016	30-06-2016
Personenauto (BEV)	6.825	9.368	10.566	10.690	11.041
Personenauto (E-REV, PHEV)#	36.937	78.163	80.464	81.124	81.887
Personenauto (FCEV)			23	23	24
Bedrijfsauto ≤3500	1.258	1.460	1.553	1.496	1.522
Bedrijfsauto >3500	46	50	56	58	61
Bus *	80	94	101	105	104
Quadricycles (vh driewielig)	769	872	900	939	957
Motorfiets	196	268	311	314	319
Totaal op de weg	**46.111**	**90.275**	**93.974**	**94.749**	**95.915**
Bromfietsen	3.441	3.610	3.682	3.682	3.728
Snorfietsen	23.850	28.459	29.820	30.265	30.708
Brommobielen	172	219	236	240	239
Totaal inclusief brom/ snorfiets/brommobiel	**73.574**	**122.563**	**127.712**	**128.936**	**130.590**

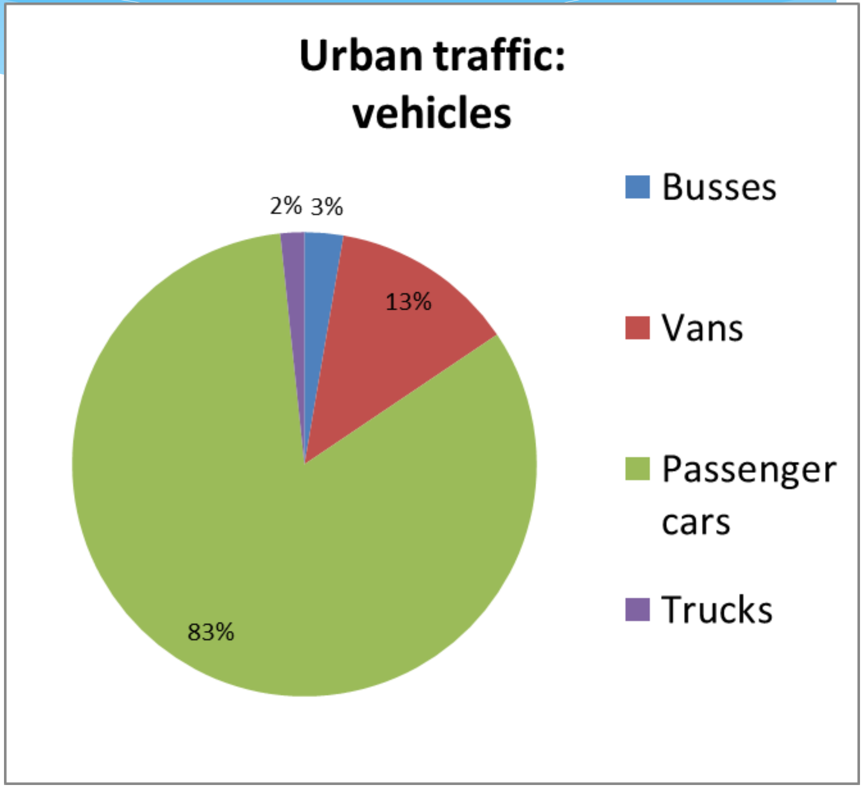
* Inclusief trolleybussen en een aantal hybride bussen; # Exclusief volledig hybride voertuigen

Charging-points



Commercial vehicles in urban traffic

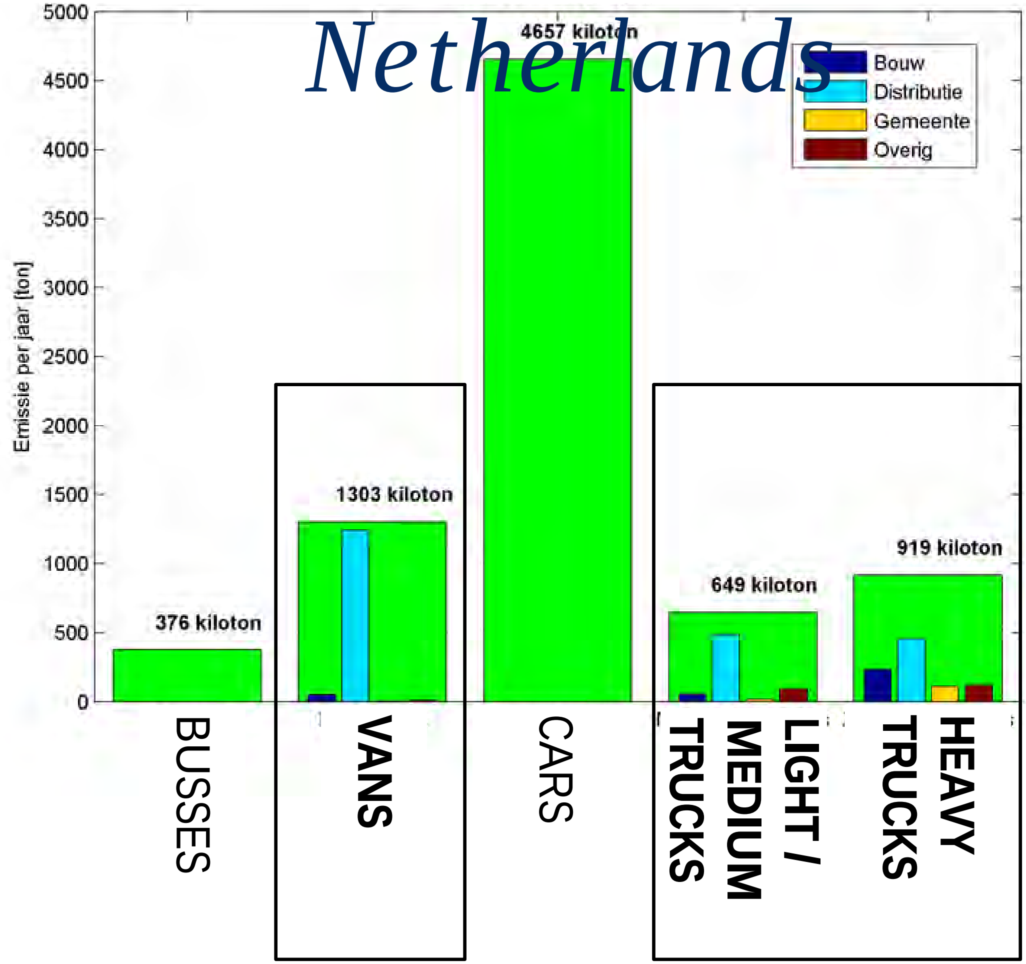
- Commercial vehicles (vans and trucks) account for about 15% of urban traffic
- Varies slightly between cities (especially ratio trucks – vans)



Source: Vehicle fleet scan Amsterdam (TNO, 2014)

Urban freight transport

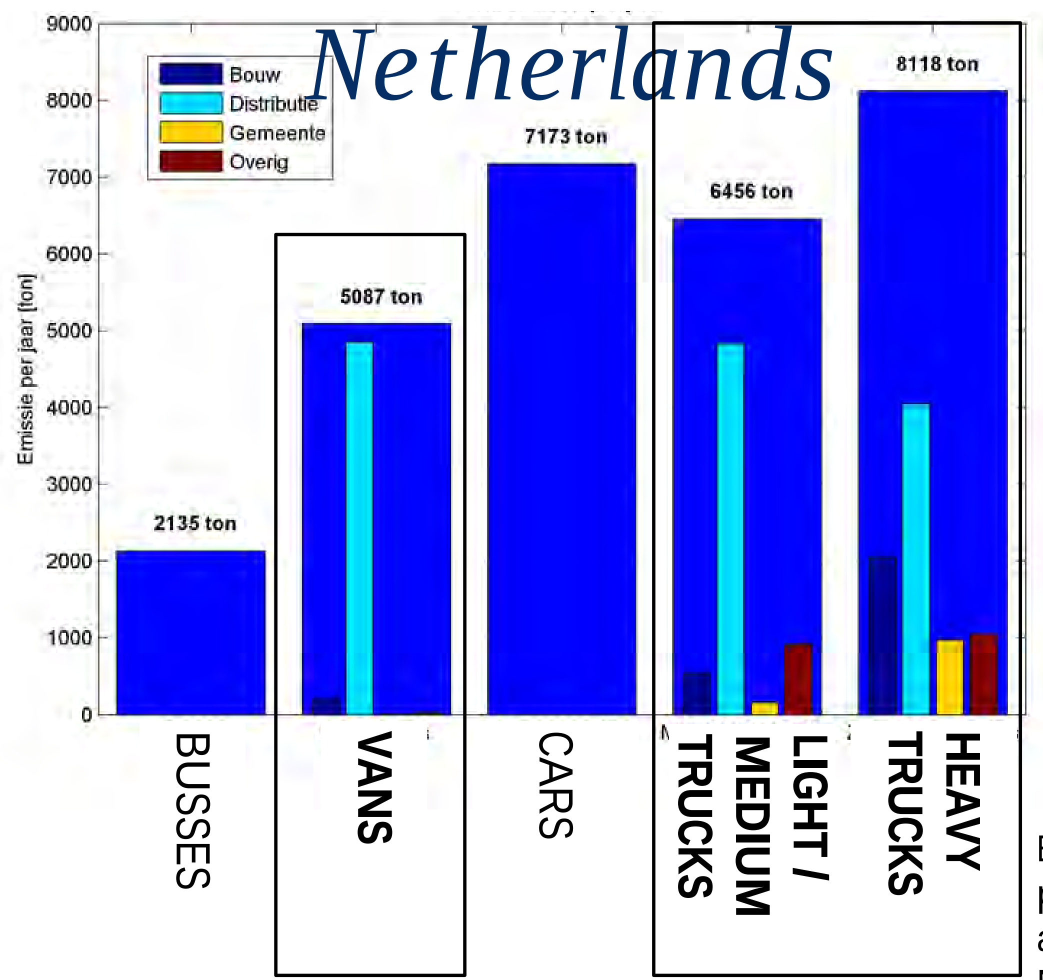
Total CO_2 emissions city traffic in the Netherlands



Estimated total emissions per year per vehicle type for all urban traffic in the Netherlands (TNO, 2015)

Urban freight transport

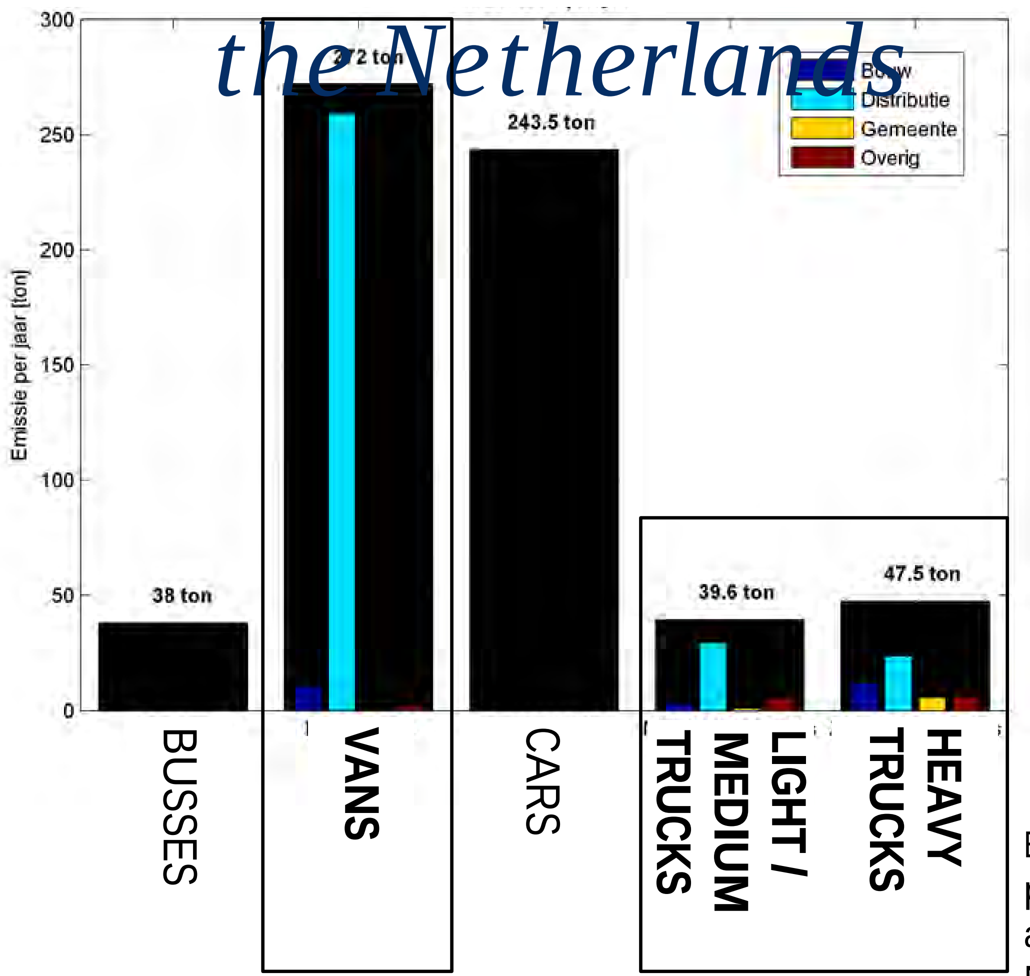
Total NOx emissions city traffic in the Netherlands



Estimated total emissions per year per vehicle type for all urban traffic in the Netherlands (TNO, 2015)

Urban freight transport

Total PM10 emissions city traffic in the Netherlands

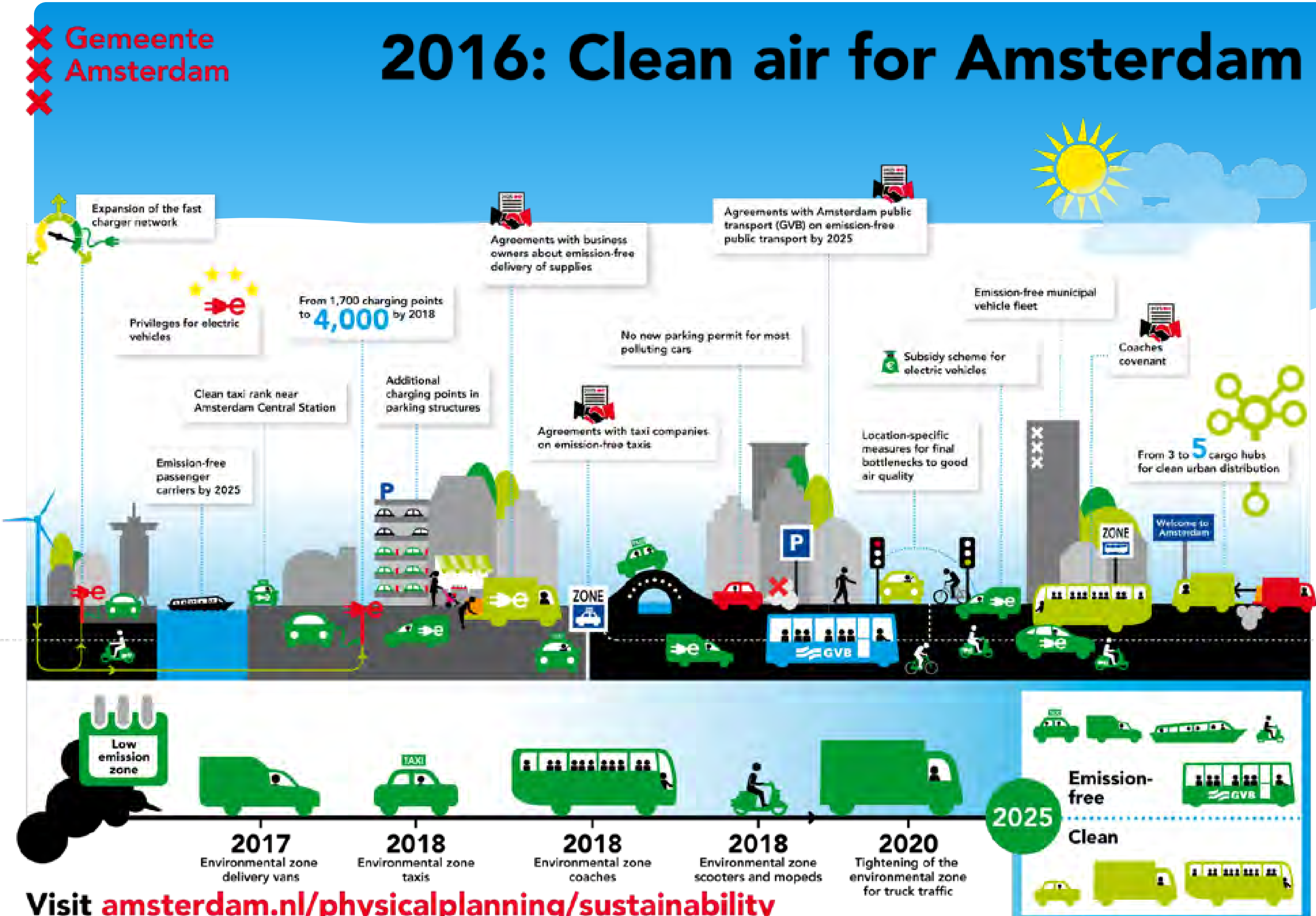


Estimated total emissions per year per vehicle type for all urban traffic in the Netherlands (TNO, 2015)

2. Give subsidies for EV trucks

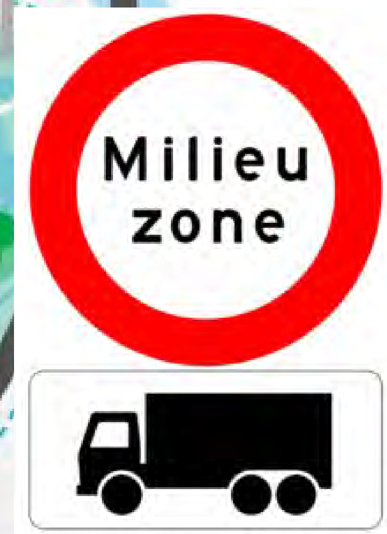
NOT: the polluter earns BUT: reward frontrunners

And: € for trucks is far more cost efficient than for passenger cars



Gemeente Amsterdam
2016: Clean air for Amsterdam
Expansion of the fast charger network
Privileges for electric vehicles
From 1,700 charging points to 4,000 by 2018
Agreements with business owners about emission-free delivery of supplies
Agreements with Amsterdam public transport (GVB) on emission-free public transport by 2025
Emission-free municipal vehicle fleet
No new parking permit for most polluting cars
Subsidy scheme for electric vehicles
Coaches covenant
Clean taxi rank near Amsterdam Central Station
Additional charging points in parking structures
Agreements with taxi companies on emission-free taxis
Location-specific measures for final bottlenecks to good air quality
From 3 to 5 cargo hubs for clean urban distribution
Emission-free passenger carriers by 2025
ZONE
Welcome to Amsterdam
GVB
Low emission zone
2017 Environmental zone delivery vans
2018 Environmental zone taxis
2018 Environmental zone coaches
2018 Environmental zone scooters and mopeds
2020 Tightening of the environmental zone for truck traffic
2025
Emission-free
Clean
Visit amsterdam.nl/physicalplanning/sustainability

3. LEZ: an infrastructure to secure your ambition



4. Privileges for EV Trucks

50 kilometres, daily 5 days a week

- Cargohopper operates in Amsterdam and Enschede
- 5 self developed vehicles do up to 70 drops a day covering 50km,
- 1.100.000 kg annually
- Beloved in the city: Cargohopper is Amsterdam!
- We have a perfect solution to distribute copier paper, but..
- We haul construction materials

Ook in bestelauto´s:

More VANS

DURATRUCK by GINAF



Heavy trucks

Vele mogelijkheden:


ORTEN
ELECTRIC TRUCKS


HEERLIJK, DAT GROENE RIJDEN!
Heineken


100% ELEKTRISCH
TRANSPORT
STIL EN MILIEUVRIENDELIJK
LIDL
van Straalen
EMOSS
AEROCELL
AEROCELL


trucks

City distrib

340km

81,7 km

68,8 km

212 km

76,4 km

Emoss serie:

* Based on DAF LF serie from 12-19 tons rigids
* Battery package between 120-240kWh
* Range of 150-240 km
* 44 kW chargers on board (4-6 h charging)
* Incl chargingpiont (380V 63Amp)
* Incl Cab heather
* Incl datalogger and online connection

emoss
Driven by innovation


DE ROOY transport


Sligro
BEZORGSERVICE

020stadsdistributie


topmovers.nl


TOP
MOVERS
boudesteyn verhuizers


REEV tractor unit

Driven by innovation

DURATRUCK by GINAF


home
e-trucks
nieuws
in de media
contact
Cure gaat voor 100% Electrisch!

Performance and specs

* Daf LF 19 tons chassis
* Payload 9200 kg
* Range 200km (200kWh)
* 44 kW chargers , 4-5 h charging
* Distribution in and round Utrecht , daily between 200-240 km

Performance and specs

* Daf LF 19 tons chassis
* Payload 9850 kg
* Range 160 km (160 kWh)
* 44kW chargers on board
* Daily distribution in Rotterdam (80-100km)

Performance and specs

* DAF 16 tons chassis
* Payload 6000 kg
* Range 200 km (200kWh)
* Charging 4-6 h
* Moving company surrrounding of Amsterdam

Performance and specs

* Daf LF 12 tons chassis
* Payload ± 3000kg
* Range 120 km (160kWh)
* Cooling machine
* 44kW chargers
* Citydistribution in Amsterdam (Bio Fruts)

* MAN 19 tons chassis
* Freezing box and electric cooler
* 240 kWh battery
* Range 200 km
* Supermarket delivery

emoss
Driven by innovation

Cost and savings

* **Costs:**
* Chassisprice 3-4 times a normal dieselchassis
* Charging points at your company
* Trainig of mechanics and drivers
* (Cost / km + € 50,- per day)

* **Savings**:
* Fuel : ± 60% lower " fuel" cost (dutch figures)
* Maintanance (?)

Electric city distribution

* Clean, quiet and energie efficient
* Pleasure to drive
* Extra cost can be reduced by previleges and city rules
* No public charging required

6. Procurement: practice what you preach

2015 - 2020

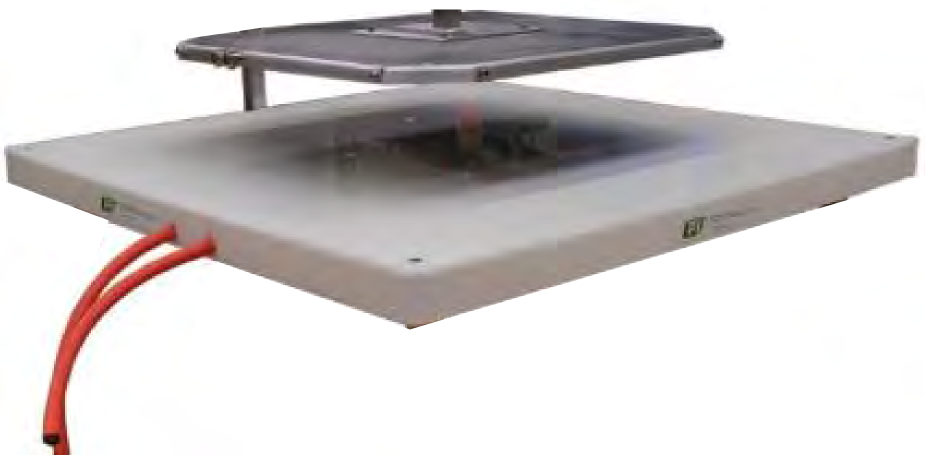
- Subsidy needed on 0-emission trucks
  - Niche product, high costs
  - In interest of total community

  - **OR**: (statement:)

- Clear regulations on (future) emission zones (CITIES)
  - Investment in vehicles for long term
  - Regulations stimulate development

Mercedes at the IAA sept 2016

Outlook



3 kW (6 kW)

22 kW

„50 kW“

100 kW

200 kW

300 kW

Siemens /Scania

The core of the system is an intelligent pantograph combined with a hybrid drive system.

Hydrogen in near future

* Bigger range > 500 km
* Heavier specs > 25 ton
* Fast filling (max 10 min)
* Light weight icw batteries

* New projects are starting up in Holland
* Using the existing electric chassis as bases
* Both tractor and rigids
* Sevaral suppliers for fuelcell systems

Scania test vrachtwagens op waterstof

Deel op LinkedIn | Deel op Twitter

19-08-2016 15:30 | Door: Hidde Middelweerd

Scania slaat de handen ineen met Asko, één van de grootste transportbedrijven van Noorwegen, om vrachtwagens te testen die worden aangedreven door elektrische energie vanuit waterstofgas.

* Thank you for the attention :
* eric@beers.nl
* Mob : +31 651587696

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Medium and Heavy Duty EV Activities
NREL Update

John Farrell
Kenneth Kelly & Kevin Walkowicz
National Renewable Energy Lab

IA-HEV Task 27 – Electrification of Transport Logistic Vehicles
3rd Workshop on Electric Freight Vehicles
October 19th, 2016

National Renewable Energy Lab

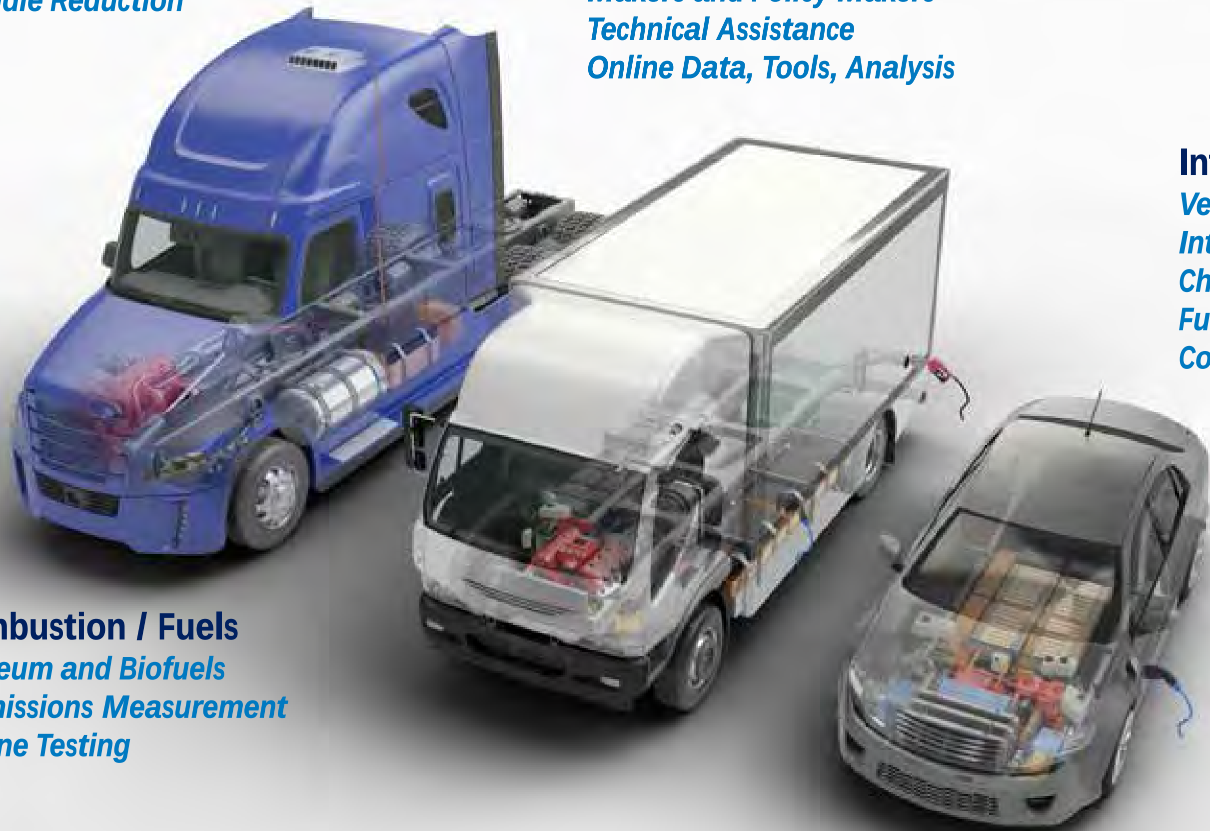
NREL Vehicle RD&D Activities

Vehicle Thermal Management
Integrated Thermal Management
Climate Control / Idle Reduction
Advanced HVAC

Vehicle Deployment / Clean Cities
Guidance & Information for Fleet Decision Makers and Policy Makers
Technical Assistance
Online Data, Tools, Analysis

Regulatory Support
EPAct Compliance
Data & Policy Analysis
Technical Integration
Fleet Assistance

Infrastructure
Vehicle-to-Grid Integration
Integration with Renewables
Charging Equipment & Controls
Fueling Stations & Equipment
Connected and Autonomous



Advanced Combustion / Fuels
Advanced Petroleum and Biofuels
Combustion / Emissions Measurement
Vehicle and Engine Testing

Vehicle and Fleet Testing
MD/HD Field Testing & Analysis
MD/HD Chassis Dyno Testing
Duty Cycle Analysis
Data Collection, Storage & Analysis
Vehicle Systems Modeling

Advanced Power Electronics and Electric Motors
Thermal Management
Advanced Heat Transfer
Thermal Stress and Reliability

Advanced Energy Storage
Thermal Characterization / Management
Life/Abuse Testing and Modeling
Computer Aided Engineering
Electrode Material Development

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Vehicle Thermal Management
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Advanced Power Electronics and Electric Motors
Thermal Management
Advanced Heat Transfer
Thermal Stress and Reliability

Advanced Energy Storage
Thermal Characterization / Management
Life/Abuse Testing and Modeling
Computer Aided Engineering
Electrode Material Development

Medium- and Heavy- Vehicle Field Testing and Evaluations

Evaluate the performance of alternative fuels and advanced technologies in medium- and heavy-duty fleet vehicles - in partnership with commercial and government fleets and industry groups vehicles.

Collect, analyze and publicly report data:

- Drive cycle and system duty cycle analysis
- Operating cost/mile
- In-use fuel economy
- Chassis Dynamometer emissions and fuel economy
- Scheduled and unscheduled maintenance
- Warranty issues
- Reliability (% availability, MBRC)
- Implementation issues/barriers
- Subsystem performance data & metrics (ESS, engine, after-treatment, hybrid/EV drive focus)

Data stored in FleetDNA for security and limited public accessibility

Frequent interactions and briefings with stakeholders – fleets, technology providers, researchers, and government agencies

Fleets

UPS, FedEx, Coke, Frito-Lay, Foothill Transit, PG&E, Long Beach Transit, Miami-Dade, Verizon, Walmart, Waste Management…

+

Vehicle & Equip Mfg's

Proterra, BYD, Odyne, Parker-Hannifin, Cummins, Volvo, Peterbilt, Smith EV, Eaton, Allison, BAE, EDI, Altec, Navistar, PACCAR, Oshkosh, …

=

Useful Data, Analysis and Published Reports

NREL Field Data, Testing, & Analysis Tools

Data from Field Evaluations helps populate FleetDNA database

DOE Fleet Tools (DRIVE, FASTSim, AFleet, etc.) used to analyze and investigate impacts – data used to validate and improve tools

Published information and data used by fleets, industry, DOE and other research programs, and other agencies

Collect Lab and Field Data

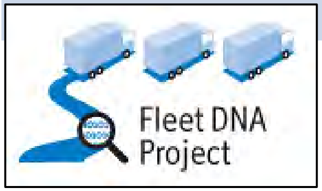
Capture, Store and Analyze

Laboratory Testing

Explore & Optimize

Communicate & Inform

Identify Barriers, New R&D Opportunitie s Validate Efforts



NATIONAL Clean Fleets PARTNERSHIP U.S. Department of Energy

21st CENTURY TRUCK PARTNERSHIP

Partnership with Fleets and Technology Providers = Relevant Results & Optimized Solutions for Real World Applications

NREL Technology Evaluation Projects

DOE Current/Planned Fleet Projects		Non-DOE Projects
UPS HHV Renewable Diesel Extended Range Hybrid 	Long Beach Transit BYD EV Transit Bus w/ WPT 	SCAQMD -S.C. Fleet DNA -Zero Emissions Cargo Transport 
Miami-Dade HHV Refuse Trucks 	Foothill Transit Proterra Fast Charge EV Transit Bus 	CA Air Resources Board (CARB) -Heavy Hybrid Vehicle Analysis -Aerodynamics Testing
Fleet Platooning 	Duke Energy Odyne PHEV utility trucks 	EPA -Heavy-Duty Phase II GHG -Drive Cycle Development
EV – V2G School Bus 	EDI PHEV Utility Truck w/export power 	TARDEC -Autonomous vehicle data collection/ analysis 
Frito Lay Smith Electric EV delivery 	PG&E Electrified Utility Trucks 	Nat'l Park Service -Data collection analysis and recommendations 

Includes electrified vehicles

Bringing Fleet Data to Life – Fleet DNA

Objectives:

– Capture and quantify drive cycle and technology variation for the multitude of medium- and heavy-duty vocations
– Provide a common data storage warehouse for medium- and heavy-duty vehicle data across DOE activities and labs – www.nrel.gov/fleetdna
– Integrate existing DOE tools, models, and analyses to provide data driven decision making capabilities

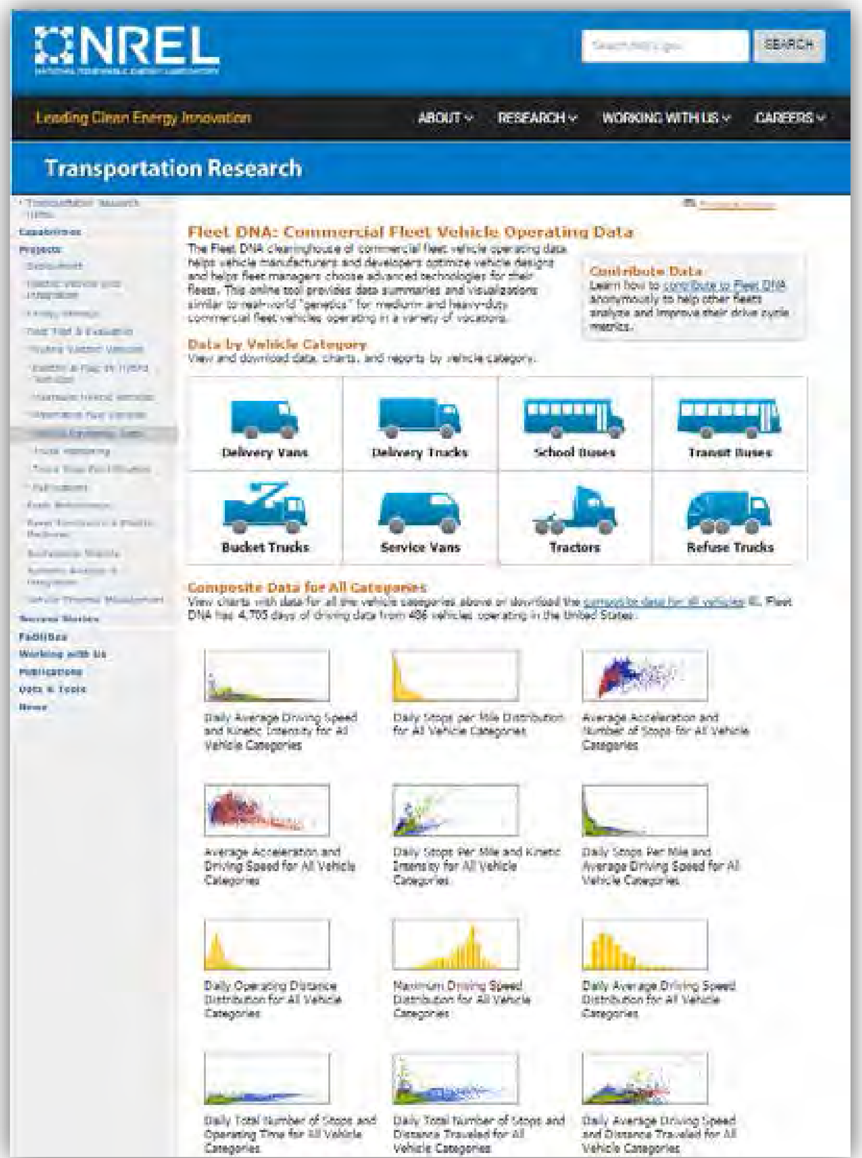
For Government : Provide in-use data for standard drive cycle development, R&D, tech targets, and rule making

For OEMs: Real-world usage datasets provide concrete examples of customer use profiles

For Fleets: Vocational datasets help illustrate how to maximize return on technology investments

For Funding Agencies: Reveal ways to optimize impact of financial incentive offers

For Researchers: Provides a data source for modeling and simulation

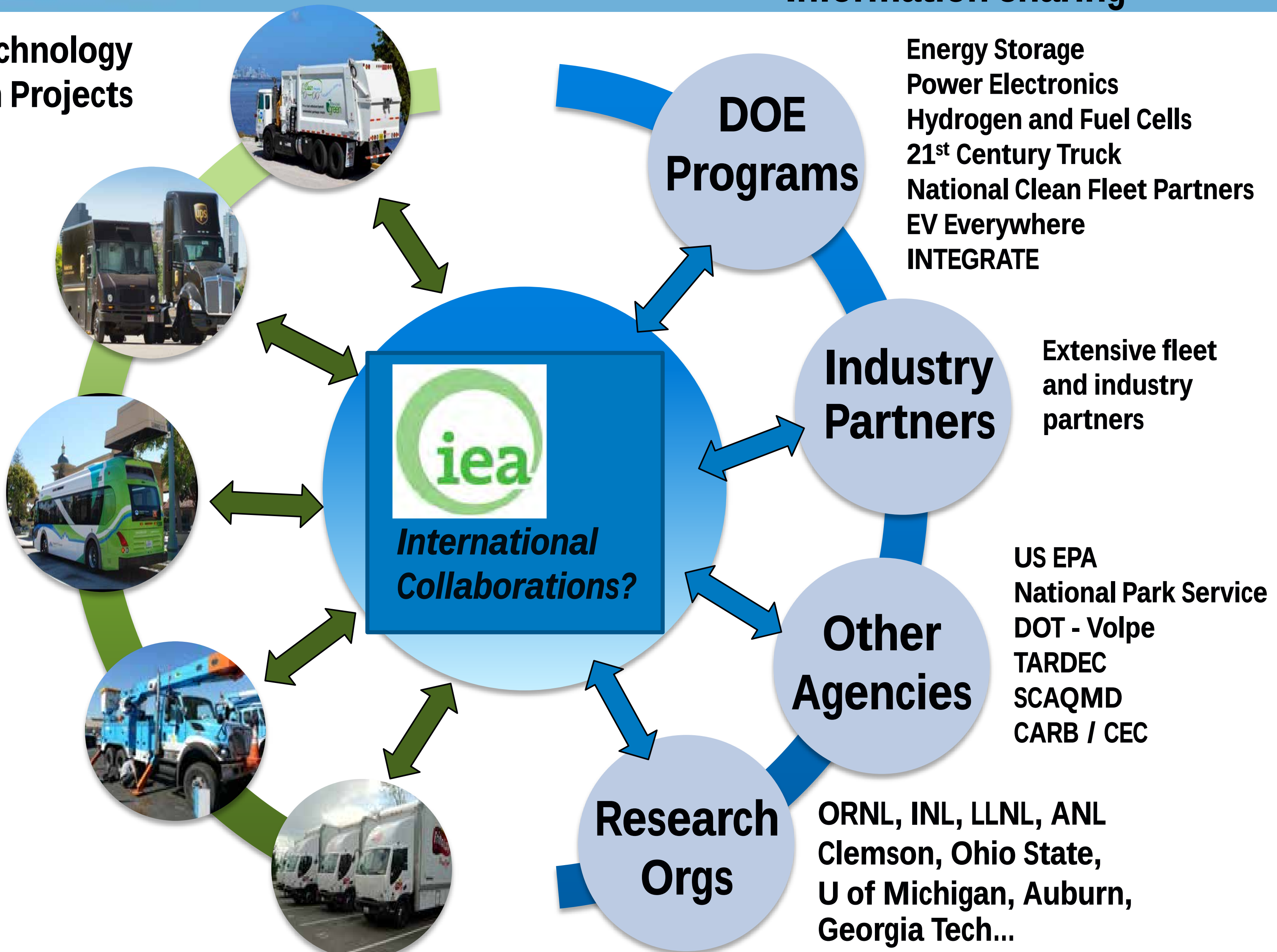


www.nrel.gov/fleetdna

Data and Information Exchange

Collaborations, Data and Information Sharing

Vehicle Technology Evaluation Projects



Fleet DNA – Current Data Status

	Vehicles	Days	Miles
Local Delivery	419	123,166	3,069,150
Line Haul	85	5,213	2,107,655
Food & Beverage Delivery	227	66,732	1,779,335
Package Delivery	186	32,688	834,764
Regional Haul	29	1,243	452,471
Tanker	25	1,067	377,207
Other Class 8 Trucks	73	5,549	270,367
Mass Transit	50	2,386	234,955
Utility	120	7,970	122,364
Drayage	34	805	85,574
School Bus	247	1,466	85,454
Refuse Pickup	82	1,474	70,747

Fleet DNA Data Highlights :

- 9.5 M miles of on-road 1Hz GPS and CAN data
- ***5.3 M EV miles from Recovery Act medium-duty EV projects***
- 2.4 M miles from heavy-duty industry through IAG with EPA

NREL Medium- and Heavy-Duty EV Data Inventory

Vehicle Platform		Vocation	Project Type	Date Range	Vehicle Count	EV Days	Mileage	Locations	Data Notes
	Navistar eStar	Class 3 Delivery Van	Data Collection	7/12 – 6/14	101 EVs	17,447	353,700	35	1 Hz CAN 'Over-the-Air'
	Smith Newton G1	Class 6 Delivery Truck	Data Collection	11/11 – 6/14	259 EVs	96,461	2,441,700	81	1 Hz CAN 'Over-the-Air'
	Smith Newton G2	Class 6 Delivery Truck	Data Collection & Fleet Evaluation	1/13 – 6/15	*Data*: 200 EVs *Eval*: 10 EVs & 9 Baseline	75,000+	1,875,000+	*Data*: 39 *Eval*: 1	*Data*: 1 Hz CAN OTA *Eval*: 1 Hz CAN Logger, 534 EVSE Days, facility power feed, utility bills, battery degradation
	Odyne PHEV Utility	Class 4+ Utility Trucks	Data Collection	12/14 – 6/15	92 PHEVs	1,057	25,100	N/A	1 Hz CAN 'Over-the-Air'
	Proterra FC Transit Bus	Class 7 Transit Bus	Fleet Evaluation (Ongoing)	7/14, 10/14, 1/15, 4/15	12 EVs and TBD Baseline	775	92,300	1	2 Hz CAN 'Over-the-Air', Maintenance, Charging Utility Bill
	TransPower Electric Drayage	Class 8 Port Tractor	Data Collection (Ongoing)	10/14 - Present	3 EVs (Additional Pending) & 2 Baseline	172	24,600	3	1 Hz CAN OTA

EV V2G School Bus

Lead: Mike Lammert, NREL

Partners:

Cost Share:

EV V2G Partnership - $1.4M CEC / $2.2M SCAQMD

School Districts – access to EV and baseline buses, chargers, and facilities for instrumentation / data collection

TransPower – information/data on EV system; 1 Hz data on EV school buses

Goals/Objectives

- Demonstrate and document that the total cost of ownership of EV school buses with V2G capability
- Contribute EV bus optimization efforts through the duty cycle characterization of current conventional and hybrid vehicles in service.

Background and Value

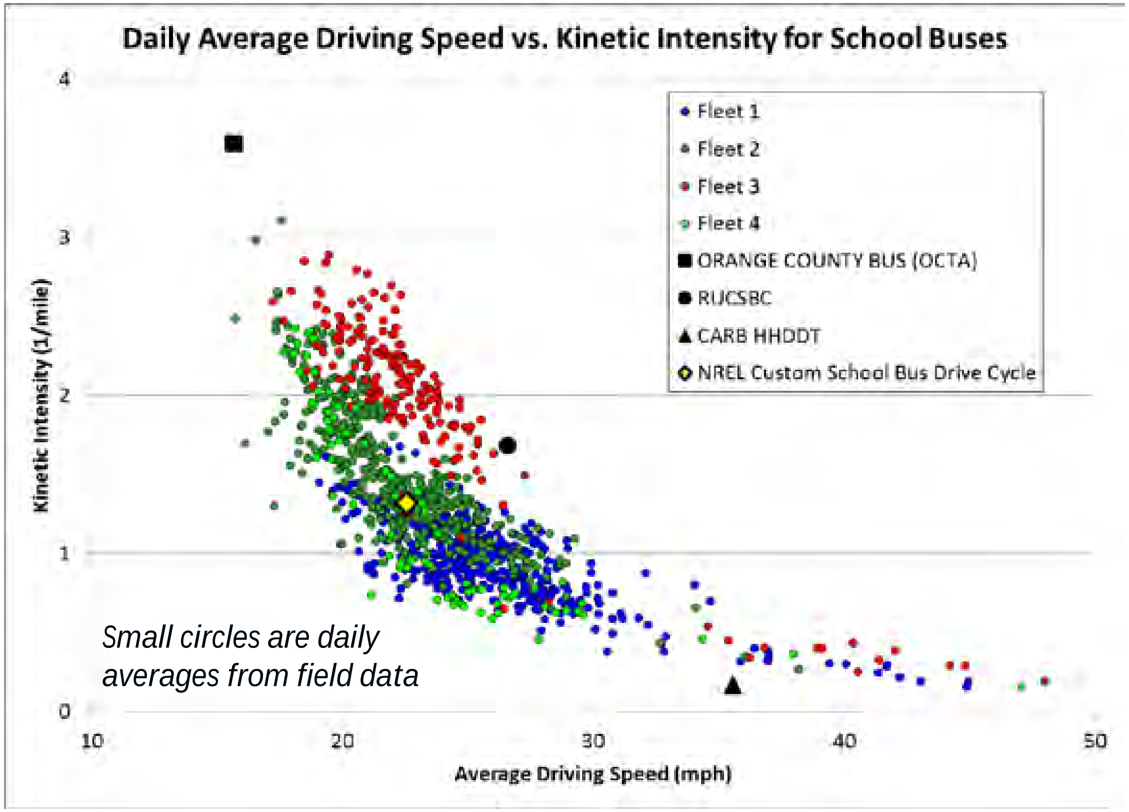
- Leverages investment of CGI technical and project team with funding from CEC and SCAQMD and many cost share elements
- Collaboration between Fleet Test and Vehicle Grid Integration
- Contribute data to FleetDNA database & knowledge base on school bus duty cycles and electrification potential

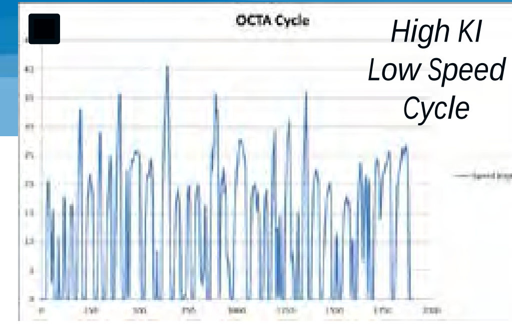
- 6 EV buses deployed in 3 CA school districts – Napa Valley, Torrance, Edison
- EV buses began service 2016-17 school year
- NREL collecting in-use data throughout the school year

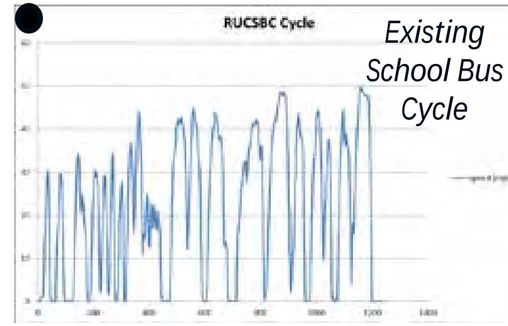
EV Bus Configuration	
Chassis	International / Blue Bird DT466 retrofits
System Integrator	TransPower
Motor	150 kW peak / 110 kw continuous
Battery	115 kWh LiFePO4
Bi-directional inverter	EPC Power Epic 150 150kW inverter / 70kW charger

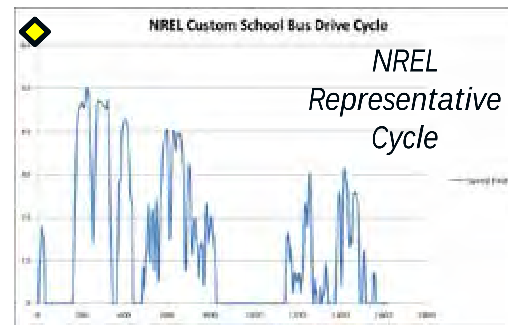
Field Duty Cycle and Representative Drive Cycles

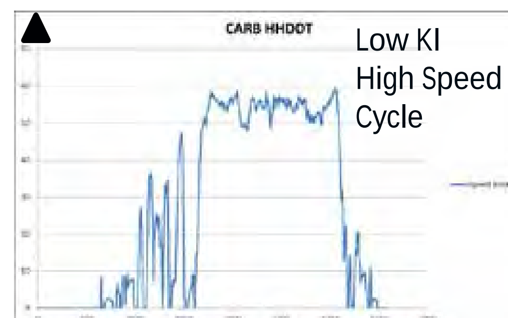
Baseline School Bus Duty Cycle Data





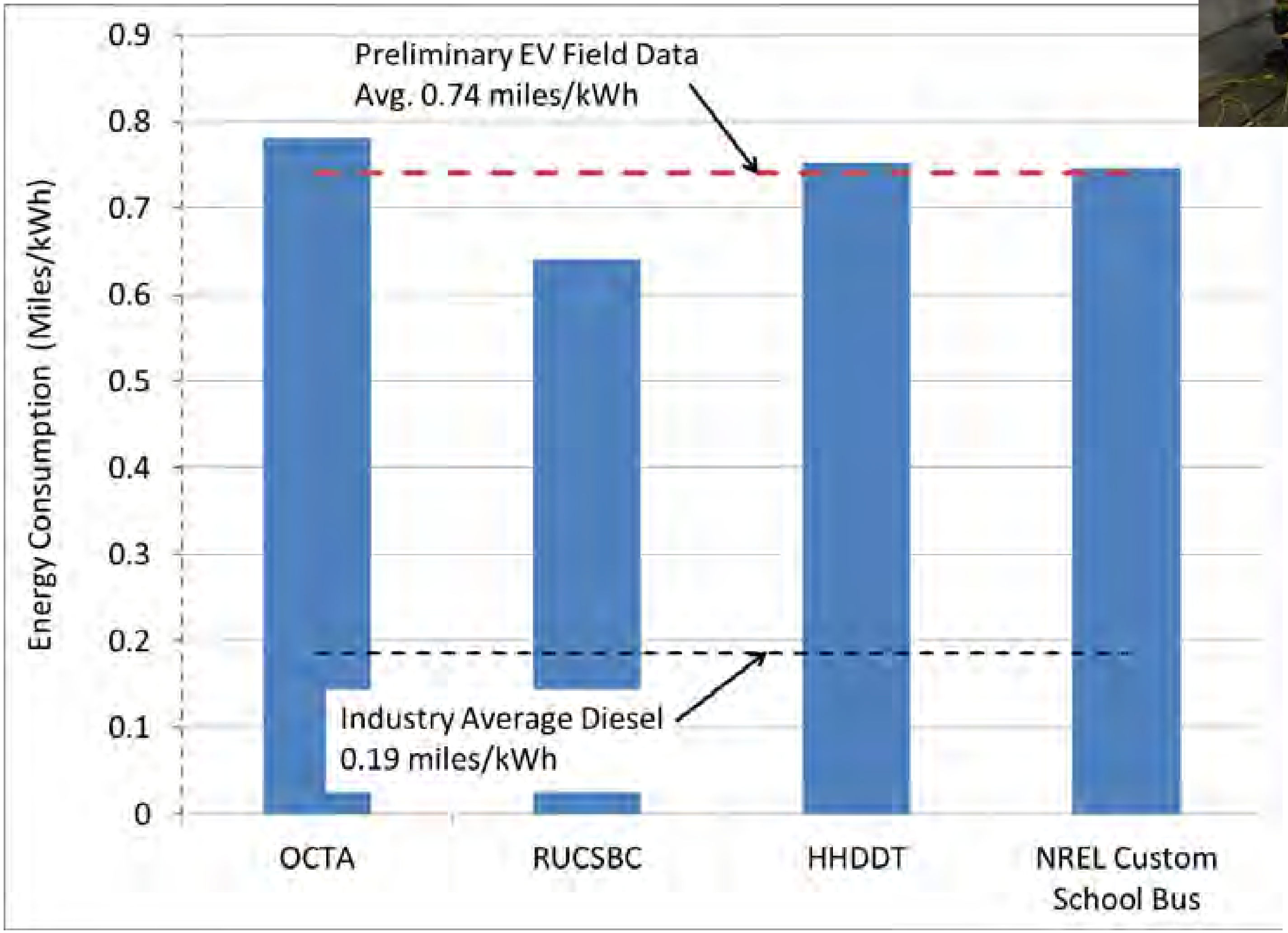






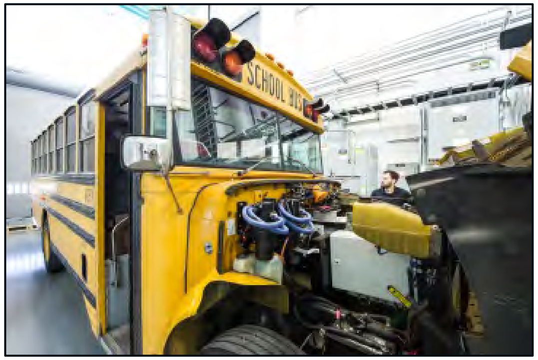
Test Cycle	■ OCTA	● RUCSBC	▲ HHDDT	◆ NREL Custom School Bus
Max Speed (mph)	40.6	49.7	59.3	49.9
Average Speed (mph)	15.7	26.6	35.6	22.6
Stops per Mile	4.7	1.4	0.5	1.9
Kinetic Intensity (1/mile)	3.6	1.7	0.2	1.3

Initial Chassis Dynamometer Results



Plan Forward…

- Report on IEEE testing of bi-directional inverter
- In-use vehicle performance data collection from all 6 EV buses 2016-17 school year – 1 Hz GPS and EV component data (motor, battery, inverter – voltages, currents, temperatures, etc)
- Collect data on facility and EVSE electrical power demands
- Develop validated FASTSim EV school bus model to investigate battery sizing requirements and route selection
- Evaluate total operational costs including electricity usage, demand charges, managed charging strategies, and grid services (V2G)
- Interim and final technical reporting (2017)



Zion National Park – Visitor Shuttle

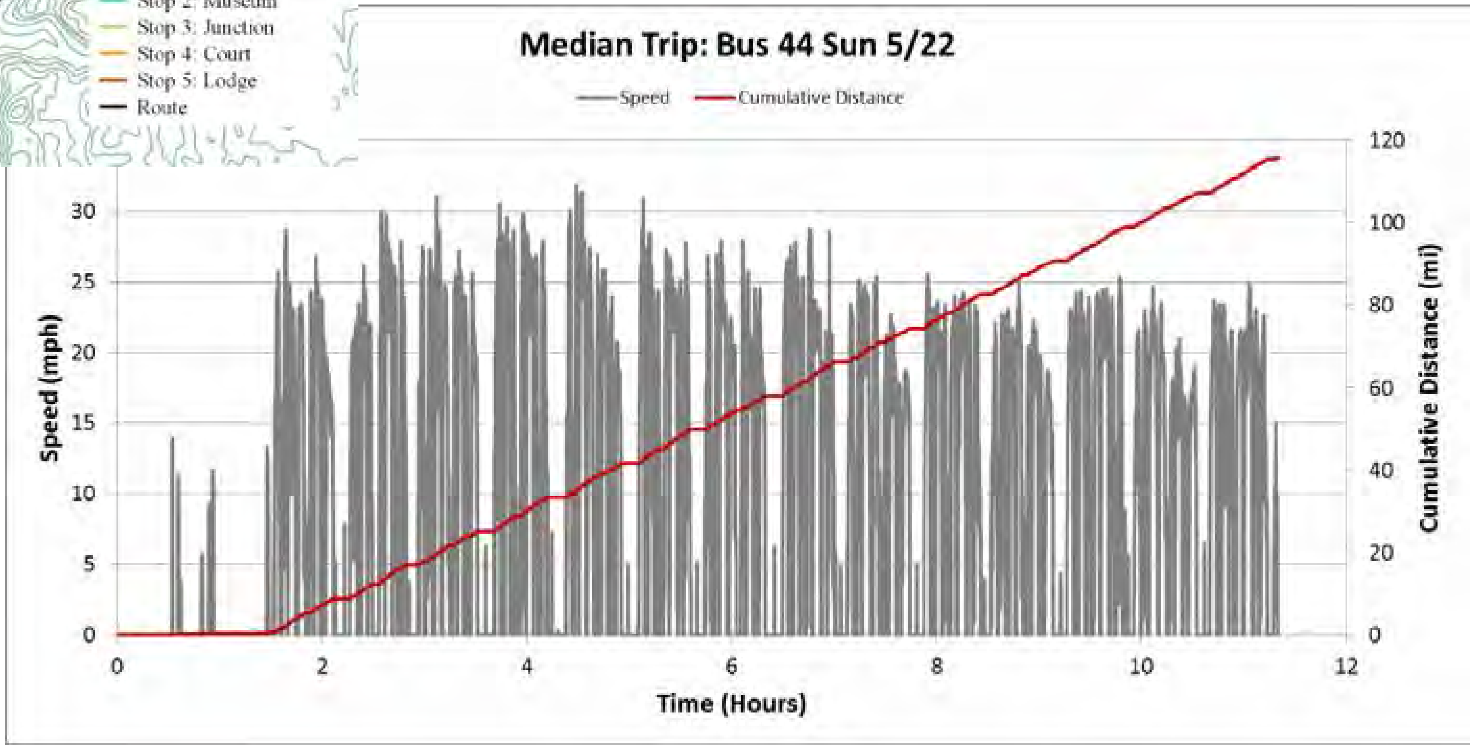
- Zion National Park currently operates a fleet of 14 propane-power shuttle buses
- Data collection and analysis of drive-cycle characteristics of baseline shuttle buses duty cycle
- NPS is working with NREL to use this drive-cycle information to optimize the conversion of 14 of its propane buses to run on electricity.
- Leveraging existing tools and capabilities, NREL supplied the NPS with data and information to be used in their upcoming EV shuttle bus retrofit solicitation.

16 mile round trip / 500 ft elevation gain / 10-15 trips per day
Passenger capacity : 105

Typical Daily Drive Cycle

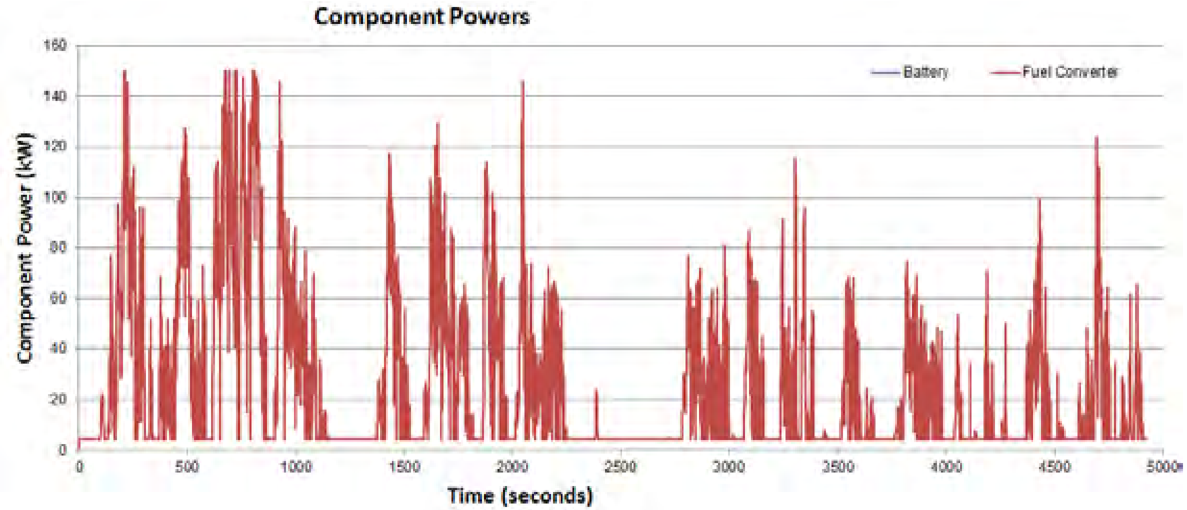
TABLE I. RECORDED VEHICLE DATA

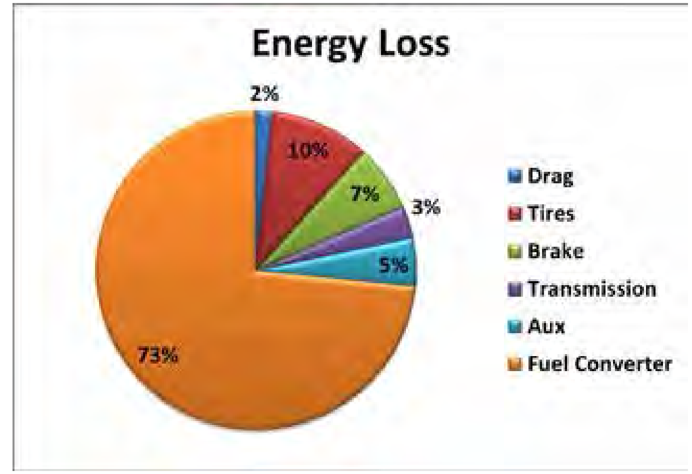
Bus #	Operation		Mean Dwell Time (Min.)				
	Days in Use	*Trips*	*Stop 1*	*Stop 2*	*Stop 3*	*Stop 4*	*Stop 5*
41	9	76	3.74	1.67	1.23	1.50	3.21
42	9	75	3.98	1.70	1.36	1.58	3.21
43	10	76	3.95	1.74	1.31	1.59	3.63
44	11	87	4.19	1.65	1.15	1.45	3.36
45	7	63	3.85	1.76	1.34	1.58	3.32
46	9	74	3.87	1.78	1.13	1.51	3.21
47	9	74	4.00	1.73	1.25	1.54	3.23
48	11	95	3.83	1.65	1.29	1.65	3.37
49	10	76	3.82	1.66	1.32	1.55	3.05
Total	85	696	3.92	1.70	1.27	1.55	3.29



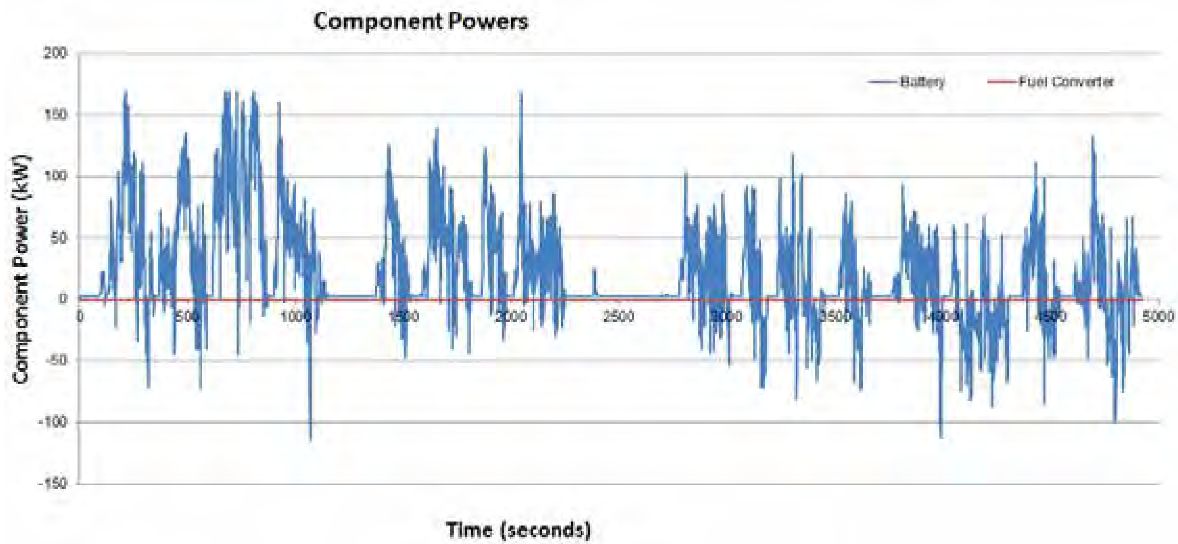
Zion National Park – FAST Sim Model

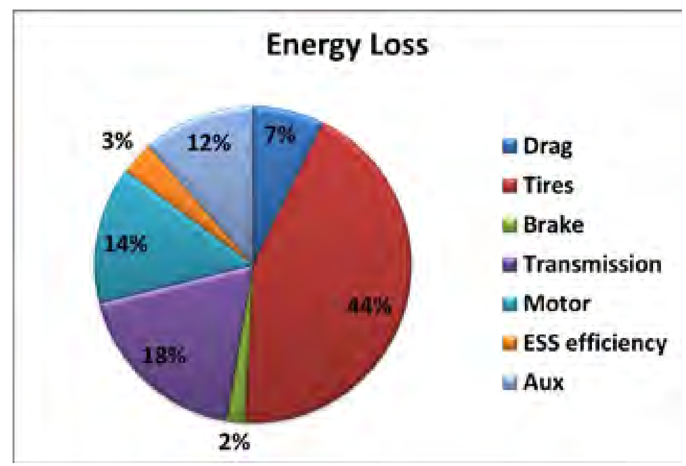
Baseline Powertrain Simulation: Total Work 34.1kWh





EV Powertrain Simulation: Net Work 28.7 (include energy recapture)





Battery Size Requirements

Baseline Vehicle

- Empty: 37,220 lbs
- GVWR: 53,000 lbs
  - Capacity: 15,780 lbs
  - Passenger Capacity (150#) : 105

Electric Shuttle – battery sized for overnight charging – 400kWh

- Empty: 37,220 lbs
- GVWR: 53,000 lbs
- 400 kWh ESS: 5,870 lbs
  - Capacity: 9,910 lbs
  - Reduced Passenger Capacity : 66

Electric Shuttle – battery sized for single round trip with on-route fast charging – 40 kWh

- Empty: 37,220 lbs
- GVWR: 53,000 lbs
- 40 kWh ESS: 587 lbs
  - Capacity: 15193 lbs
  - Reduced Passenger Capacity : 101

National Park Service – Future Plans

NPS currently reviewing EV shuttle bus retrofit proposals

Fact sheet and website describing data collection and analysis
http://www.nrel.gov/transportation/fleettest_electric_zion.html

Upcoming Publication:
"Analysis of In-Route Wireless Charging for the Shuttle System at Zion National Park" - *IEEE Workshop on Emerging Technologies: Wireless Power*

Application of methodology with other Parks and agencies
- Yosemite National Park

2016-17 EV / PHEV Evaluation and Development Projects

UPS / Workhorse Extended Range Hybrid

Long Beach Transit / BYD EV Transit Bus with WAVE wireless charging and managed depot charging

Duke Energy / Odyne PHEV utility truck with export power

Cummins – Class 6 Medium-duty Extended Range Hybrid for Urban Delivery

Bosch – Class 4 Medium-duty Extended Range Hybrid Parcel Delivery

NREL Medium and Heavy-Duty Fleet Testing and Technology Evaluations

Supported by:

U.S. Department of Energy
Vehicle Technologies Office

Vehicle Systems Program
– Lee Slezak and David Anderson

For more information:
Kenneth Kelly
National Renewable Energy Laboratory
kenneth.kelly@nrel.gov
phone: 303.275.4465

NREL Fleet Evaluations Website
http://www.nrel.gov/transportation/fleettest.html

Fleet DNA Website
www.nrel.gov/fleetdna

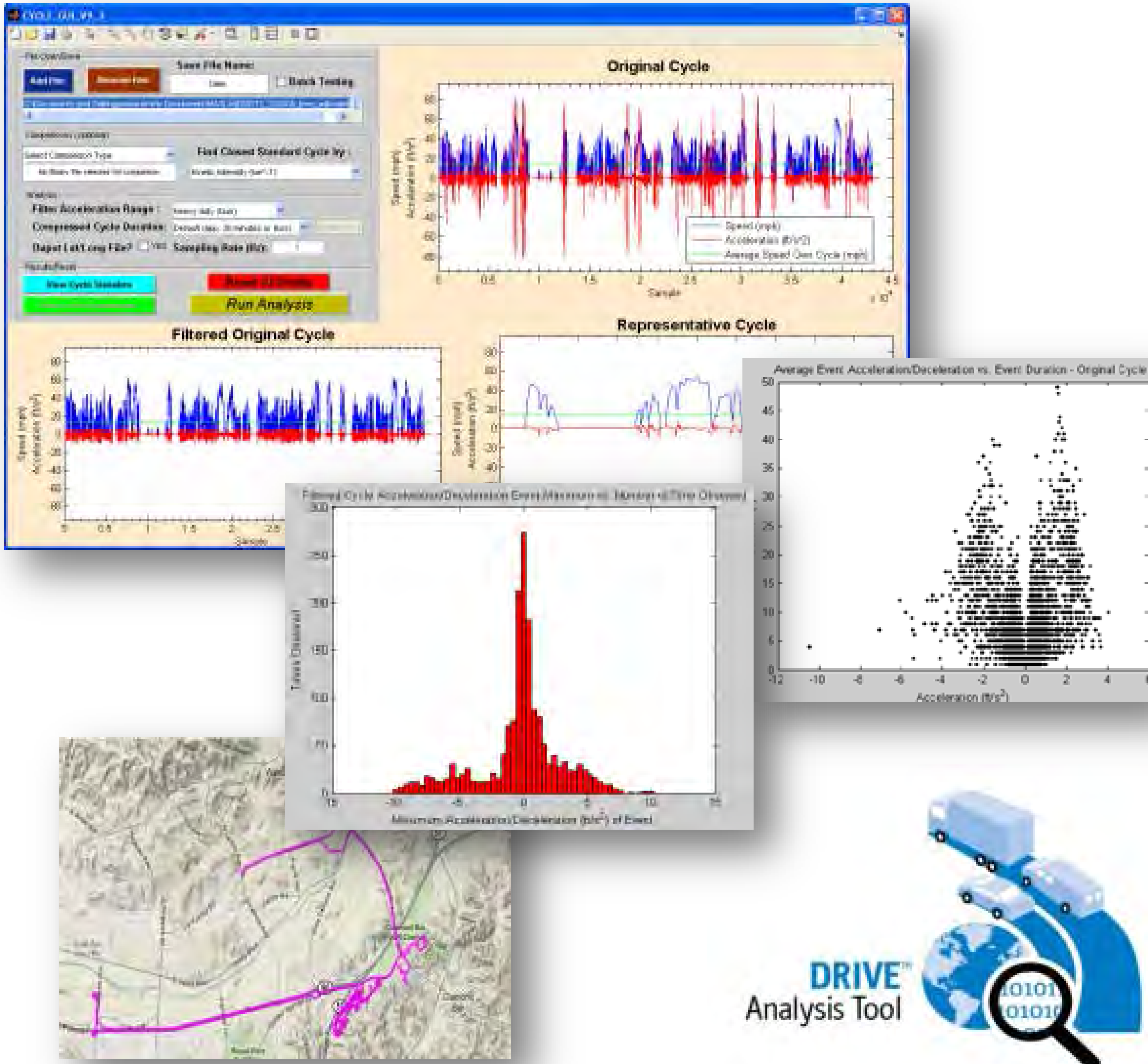
DriveCAT
www.nrel.gov/transportation/drive-cycle-tool

www.nrel.gov

NATIONAL RENEWABLE ENERGY LABORATORY

Drive-cycle Rapid Investigation, Visualization and Evaluation (DRIVE) Tool

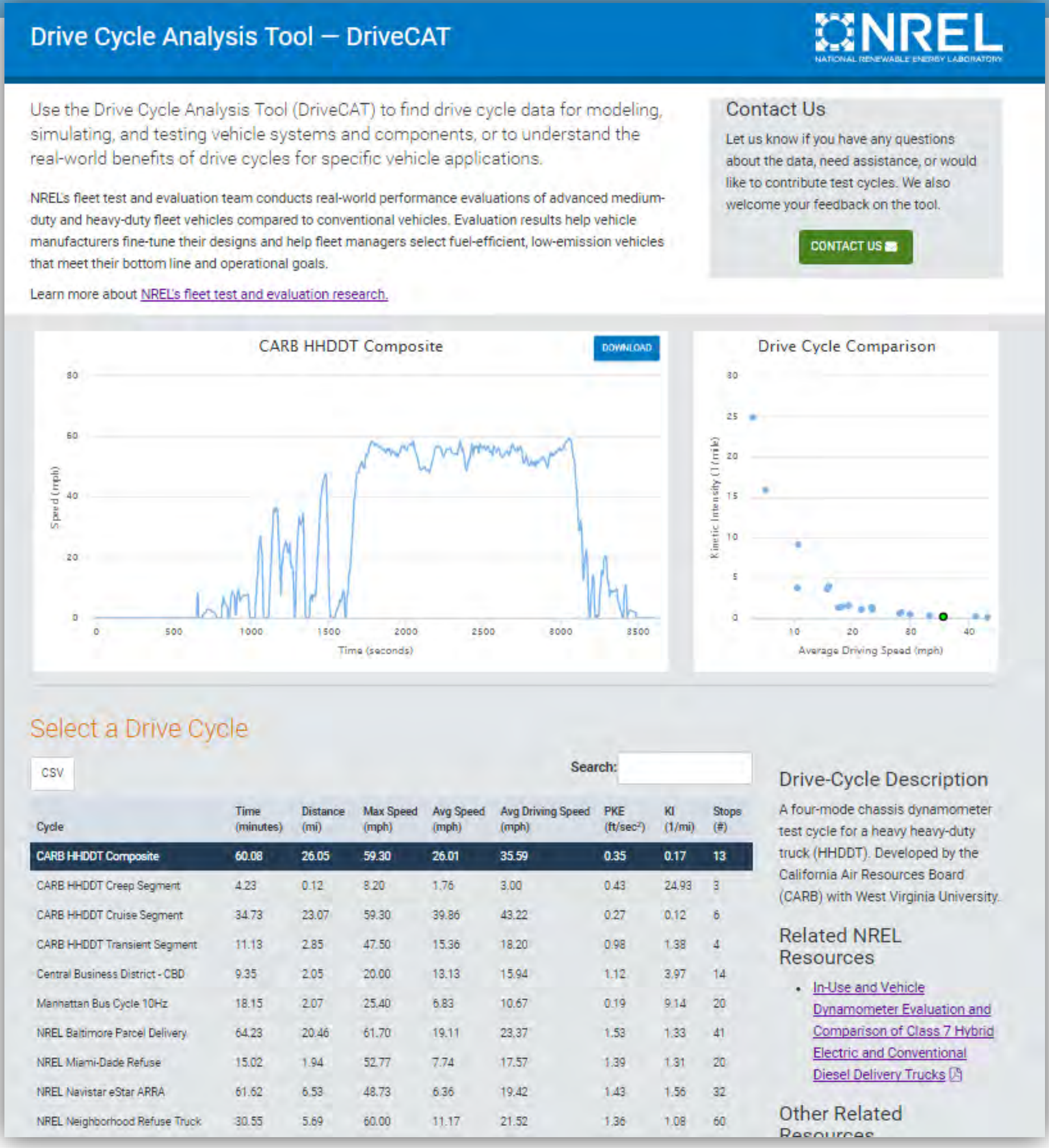
- Created to help fleets and OEMs analyze vehicle usage data for proper vehicle placement, design and testing
- Combines large amounts of user data then filters, creates new cycles & identifies best fitting existing cycle
- Quickly processes and analyzes data :
  - Over 250 metrics
  - Histograms
  - Scatter plots
  - Creates custom cycle
  - Recommends standard cycles



DRIVE Analysis Tool

Drive Cycle Data Library – NREL DriveCAT

- Provide a common, publically available, easy to use site for standard and custom drive cycles for medium- and heavy-duty vehicles
- Capture , quantify and compare drive cycle variation across the spectrum of medium- and heavy-duty vocations
- Allows users to download raw time series data of drive cycles for their own use



Drive Cycle Analysis Tool — DriveCAT

NREL NATIONAL RENEWABLE ENERGY LABORATORY

Use the Drive Cycle Analysis Tool (DriveCAT) to find drive cycle data for modeling, simulating, and testing vehicle systems and components, or to understand the real-world benefits of drive cycles for specific vehicle applications.

NREL's fleet test and evaluation team conducts real-world performance evaluations of advanced medium-duty and heavy-duty fleet vehicles compared to conventional vehicles. Evaluation results help vehicle manufacturers fine-tune their designs and help fleet managers select fuel-efficient, low-emission vehicles that meet their bottom line and operational goals.

Learn more about NREL's fleet test and evaluation research.

Contact Us

Let us know if you have any questions about the data, need assistance, or would like to contribute test cycles. We also welcome your feedback on the tool.

CONTACT US

Select a Drive Cycle

CSV

Search:

Cycle	Time (minutes)	Distance (mi)	Max Speed (mph)	Avg Speed (mph)	Avg Driving Speed (mph)	PKE (ft/sec²)	KI (1/mi)	Stops (#)
CARB HHDDT Composite	60.08	26.05	59.30	26.01	35.59	0.35	0.17	13
CARB HHDDT Creep Segment	4.23	0.12	8.20	1.76	3.00	0.43	24.93	3
CARB HHDDT Cruise Segment	34.73	23.07	59.30	39.86	43.22	0.27	0.12	6
CARB HHDDT Transient Segment	11.13	2.85	47.50	15.36	18.20	0.98	1.38	4
Central Business District - CBD	9.35	2.05	20.00	13.13	15.94	1.12	3.97	14
Manhattan Bus Cycle 10Hz	18.15	2.07	25.40	6.83	10.67	0.19	9.14	20
NREL Baltimore Parcel Delivery	64.23	20.46	61.70	19.11	23.37	1.53	1.33	41
NREL Miami-Dade Refuse	15.02	1.94	52.77	7.74	17.57	1.39	1.31	20
NREL Navistar eStar ARRA	61.62	6.53	48.73	6.36	19.42	1.43	1.56	32
NREL Neighborhood Refuse Truck	30.55	5.69	60.00	11.17	21.52	1.36	1.08	60

Drive-Cycle Description

A four-mode chassis dynamometer test cycle for a heavy heavy-duty truck (HHDDT). Developed by the California Air Resources Board (CARB) with West Virginia University.

Related NREL Resources

- In-Use and Vehicle Dynamometer Evaluation and Comparison of Class 7 Hybrid Electric and Conventional Diesel Delivery Trucks

Other Related Resources

www.nrel.gov/transportation/drive-cycle-tool

EV Vehicle and Component Data – 1Hz

Vehicle Data Parameters

Vehicle ID
Vehicle weight or mass
Payload
Door Status
Timestamp
Operation state
Shifter position
Transmission gear state (if applicable)
Accelerator position
Brake pedal on state or applied pressure
Vehicle speed
Distance driven
GPS latitude
GPS longitude
GPS elevation
Ambient temperature
Air conditioner state
Air conditioner compressor power
Heater state
Air compressor status / pressure

Component Data Parameters

Battery current
Battery voltage
Battery pack SOC
Battery pack min cell voltage
Battery pack max cell voltage
Battery pack balance mode state
AC charging current
AC charging voltage
Battery pack bulk temperature
Battery pack min cell temperature
Battery pack max cell temperature
Motor temperature
Power electronics/charger temperature
DC/DC voltage
DC/DC current
Motor speed
Motor torque
Motor power (electrical)

Baseline Data Channels – 1Hz 75+ Channels

Date	EngSpeed	EngSpeedAtIdlePoint1	EngOilPress
time	Aftertreatment1IntakeNOx	EngPercentTorqueAtIdlePoint1	ParkingBrakeSwitch
BoxT	Aftertreatment1IntakeO2	EngSpeedAtPoint2	WheelBasedVehicleSpeed
BoxV	Aftertreatment1OutletNOx	EngPercentTorqueAtPoint2	BrakeSwitch
Acc_Lat	Aftertreatment1OutletO2	EngSpeedAtPoint3	PTOState
Acc_Long	DslPrtcltFilter1SootLoadPercent	EngPercentTorqueAtPoint3	EngFuelRate
Acc_Vert	DslPrtcltFltr1TmSncLstActvRgnrtn	EngSpeedAtPoint4	BarometricPress
gps_Time	DslPrtcltFltrActvRgnrtnFrcdStts	EngPercentTorqueAtPoint4	AmbientAirTemp
gps_Lat	Aftrtrtmnt1DslPrtcltFltrInt_0001	EngSpeedAtPoint5	EngAirInletTemp
gps_Long	Aftrtrtmnt1DslPrtcltFltrDffPrss	EngPercentTorqueAtPoint5	EngTurboBoostPress
gps_Quality	Aftrtrtmnt1PrtcltTrpOtltGasTemp	EngSpeedAtHighIdlePoint6	EngIntakeManifold1Temp
gps_NbSatellite	Aftertreatment1ExhaustGasTemp1	EngGainOfEndspeedGovernor	EngAirInletPress
gps_Altitude	Aftrtrtmnt1DslPrtcltFltrInt_0000	EngReferenceTorque	EngExhaustGasTemp
gps_Speed	EngExhaustGasTempRightManifold	EngTripFuel	BatteryPotential
AccelPedalPos1	EngExhaustGasTempLeftManifold	EngTotalFuelUsed	EngFuelRate_1
EngPercentLoadAtCurrentSpeed	Aftrtrtmnt1SCRCatalystTankLevel	EngCoolantTemp	EngineSpeed
ActMaxAvailEngPercentTorque	EngExhaustGasRecirculation1Temp	EngFuelTemp	TotalVehicleDistance
EngTorqueMode	NominalFrictionPercentTorque	EngOilTemp1	*Aftertreatment channels not available on all vehicles due to proprietary messaging
DriversDemandEngPercentTorque	EstEngPrsticLossesPercentTorque	EngIntercoolerTemp	
ActualEngPercentTorque	ExhaustGasMass	EngFuelDeliveryPress	

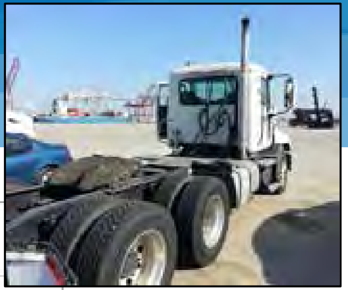
Medium and Heavy-Duty EV Data and Publications

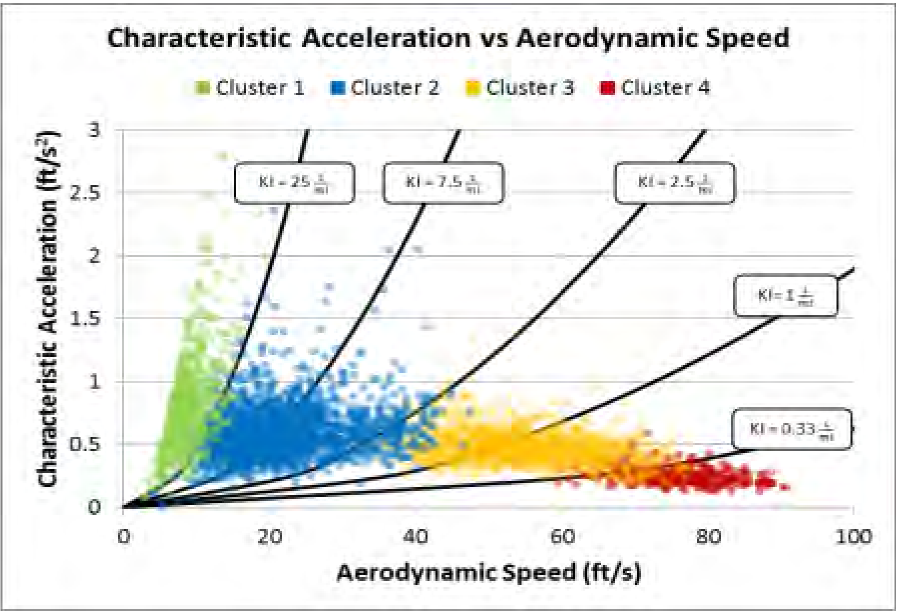
- **NREL Field Test and Evaluations team has extensive EV and PHEV data and publications that has been posted on the Electric and Plug-In Hybrid Electric Fleet Vehicle Testing web site.**

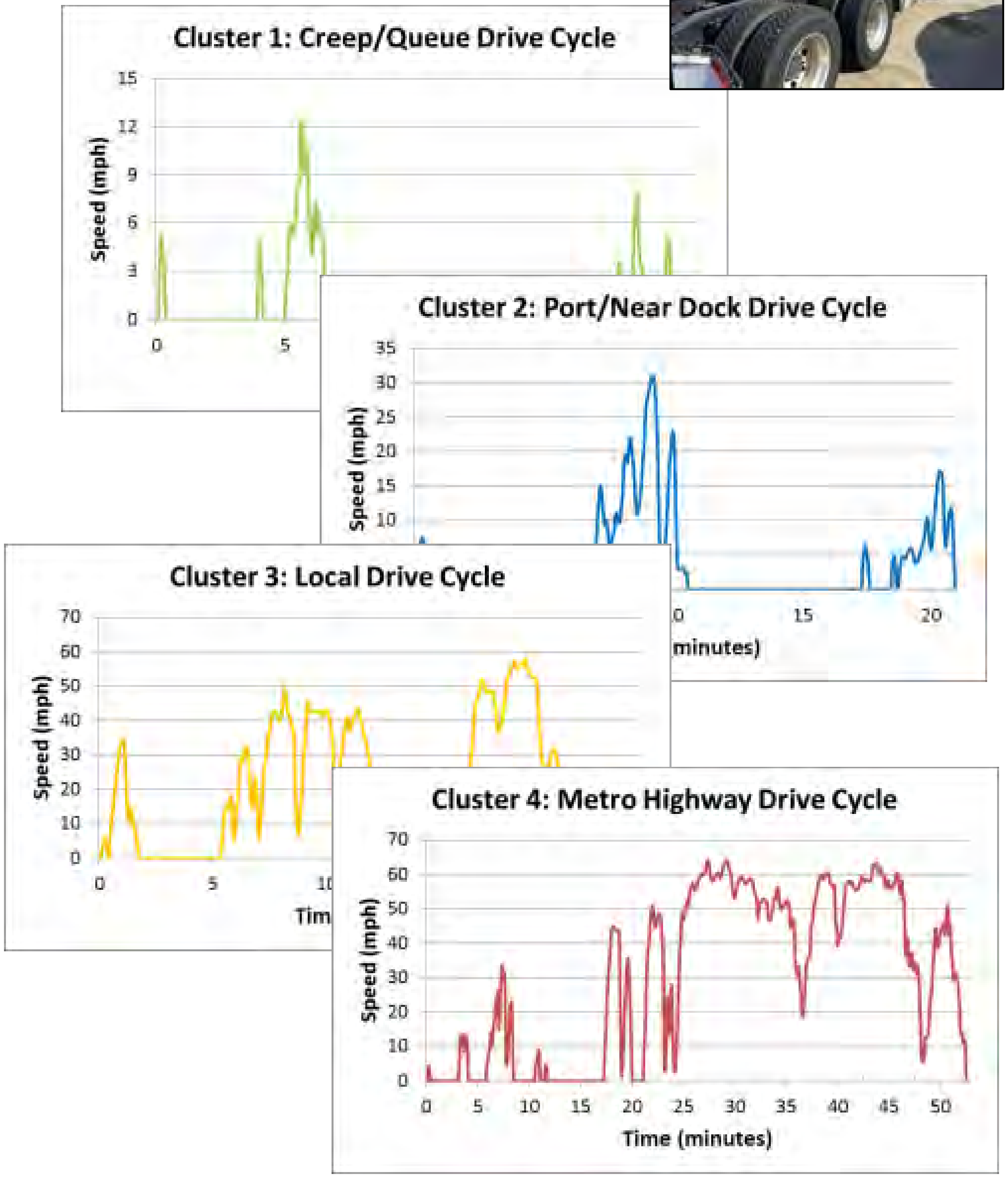
  http://www.nrel.gov/transportation/fleettest_electric.html
  - California school district electric school buses
  - Foothill Transit electric buses
  - Frito-Lay electric delivery trucks
  - Odyne plug-in hybrid electric utility trucks
  - PG&E plug-in hybrid electric utility trucks
  - SCAQMD electric drayage trucks
  - Smith and Navistar electric and plug-in hybrid electric vehicles
  - Zion National Park propane-to-electric shuttle buses

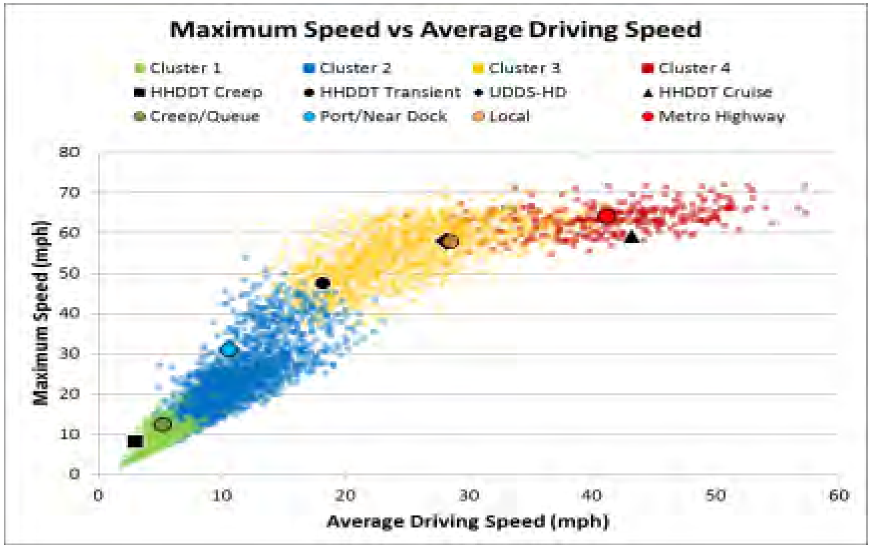
- **EV Data Summaries**
  - Smith 1st Generation EV Cumulative EV data report - http://www.nrel.gov/docs/fy14osti/62066.pdf
  - Smith 2nd Generation EV Cumulative EV data report - http://www.nrel.gov/docs/fy15osti/64238.pdf
  - Navistar eStar EV Cumulative EV data report – http://www.nrel.gov/docs/fy14osti/61899.pdf
  - Odyne PHEV Utility Truck Cumulative PHEV data report – http://www.nrel.gov/transportation/pdfs/67116.pdf

NREL Drive Cycle Analysis - Clustering









IA-HEV

Electrification of Transport Logistic Vehicles

19th of October 2016 | Vienna

Fuel Cell Range Extender – Zero emission vehicle concept for logistic applications

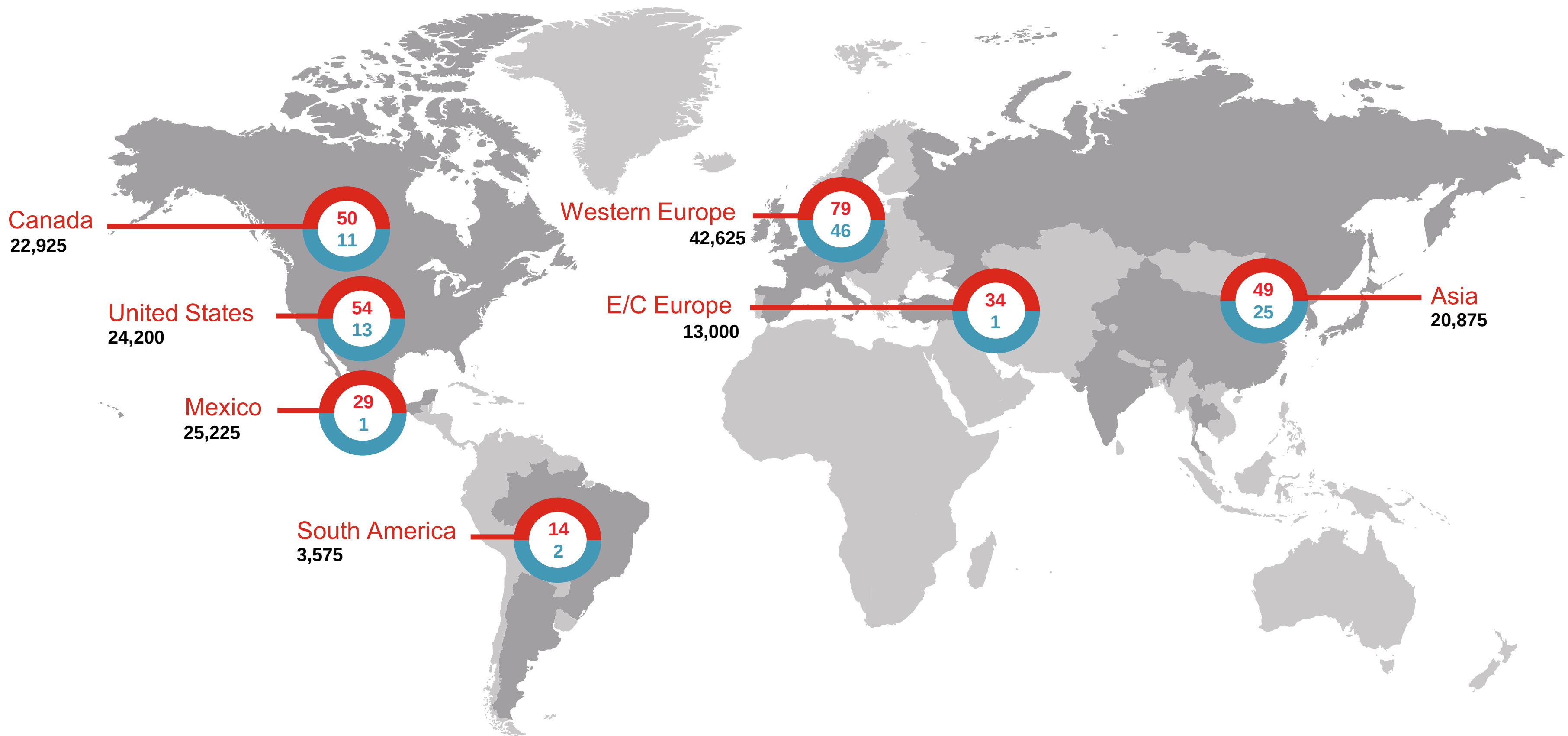
Markus Passath

Senior Technical Engineer Alternative Mobility

MAGNA STEYR

MAGNA International Global Operations

MAGNA



~152,000 People	29 Countries	● 309 ● 99	$32.1 Billion (2015 Sales)	● Manufacturing / Assembly ● Engineering / Product Development / Sales ● Number of Employees Q2 2016

MAGNA Steyr Locations
Worldwide Presence / Worldwide Network

MAGNA

Sales
Auburn Hills

Engineering Services
Graz, Böblingen, Cologne, Ingolstadt, Mühlhausen, Munich, Rüsselsheim, Sailauf, Sindelfingen, Wolfsburg, Etupes, Paris, Turin, Gothenburg

Vehicle Contract Manufacturing
Graz, Hambach

Fuel Systems
Graz, Sinabelkirchen, Weiz, Grevenbroich, Neumarkt, Schwäbisch Gmünd

Sales
Graz, Cologne, Munich, Rüsselsheim, Sindelfingen, Wolfsburg, Paris, Turin, Warwick

Engineering Services
Changchun, Shanghai, Shenyang, Wuhan, New Delhi, Pune, Shin-Yokohama

Fuel Systems
Changchun, Shanghai

Sales
Shanghai, Pune, Shin-Yokohama, Seoul

~10,225 People	33 Countries	● 9 ● 24	Headquarters: Graz	● Manufacturing / Assembly ● Engineering / Product Development / Sales ● Number of Employees August 2016

MAGNA Steyr
Product Portfolio

Engineering

From systems and modules to complete vehicle engineering

Contract Manufacturing

World Class flexible solutions from niche to volume production

Fuel Systems

Energy storage systems made of steel, plastic and aluminum

Flexible and global solutions customized for the OEM

Magna's Innovation Pillars

MAGNA

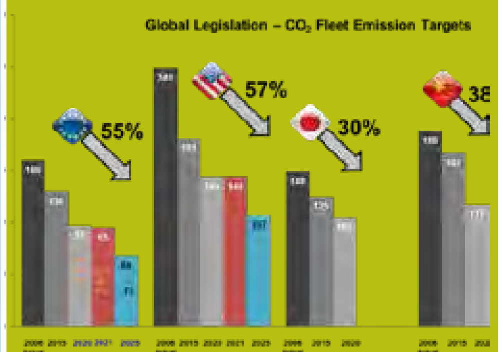
SMARTER

Comfort, Convenience and Connectivity

for future HMI demand, interior concepts will be completely changed

CLEANER

Efficiency and Sustainability



lots of different legislation targets lead to different approaches

SAFER

Active and Passive Safety

Advanced Driver Assistance Systems (ADAS) enable semi autonomous driving

LIGHTER

Lightweight Material and Science

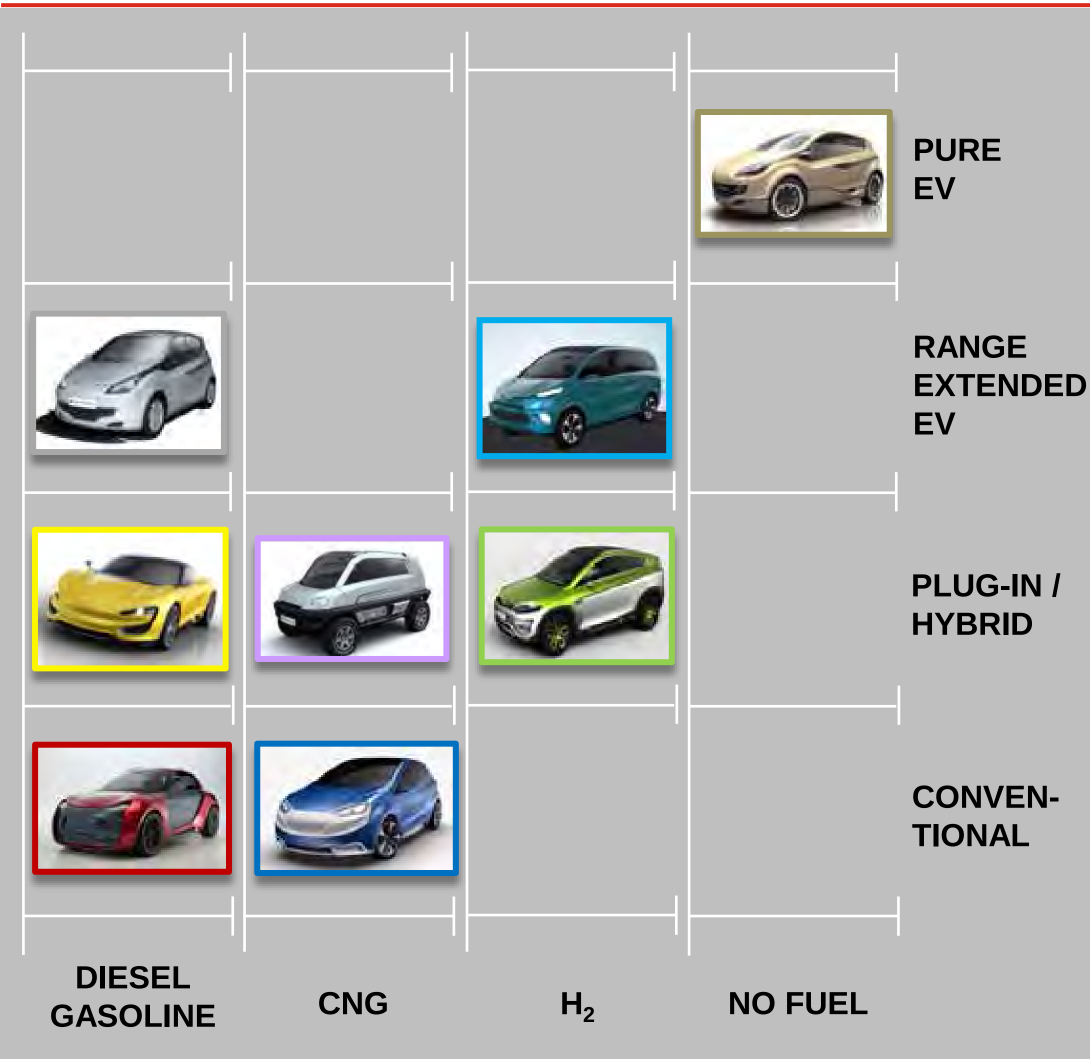
improve driving performance,

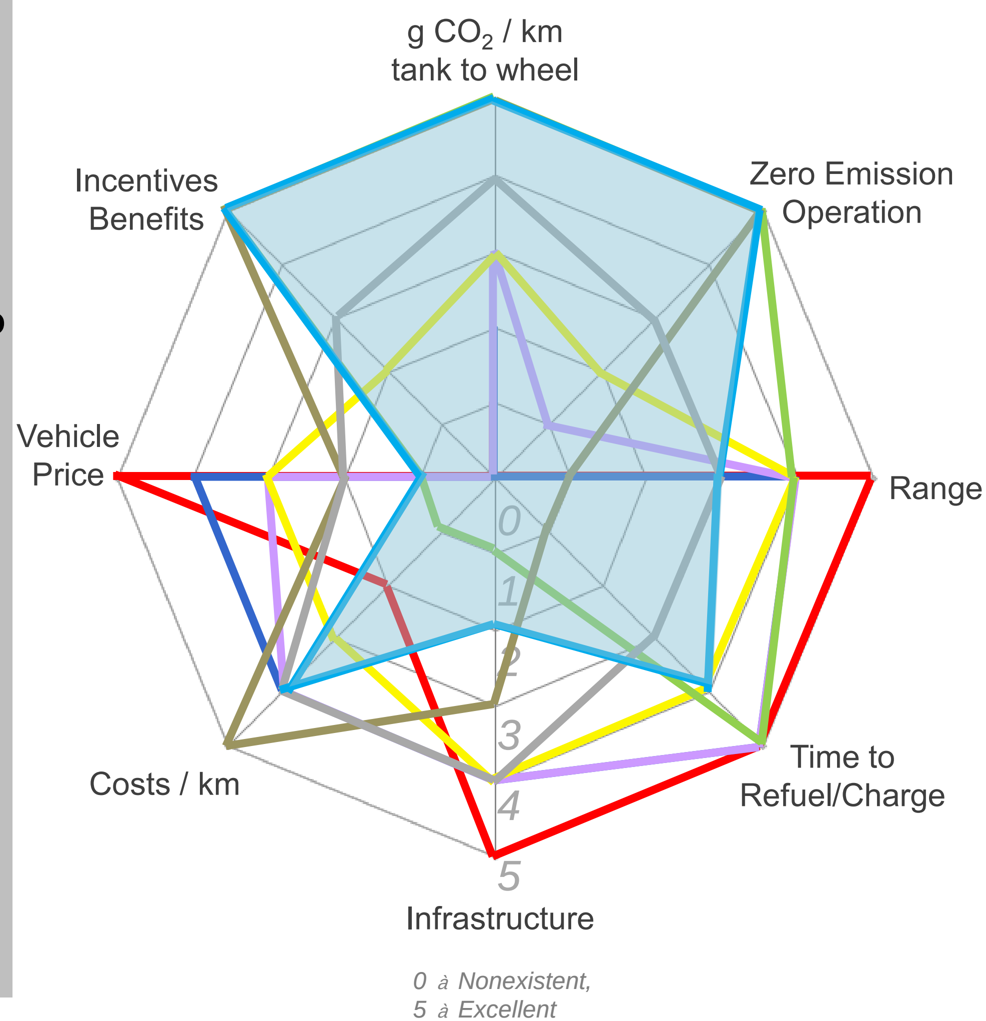
CO_2 & fuel economy, Total Cost of Ownership (TCO)

AFFORDABLE

Development and Manufacturing Efficiency

xEV TECHNOLOGY COMPARISON

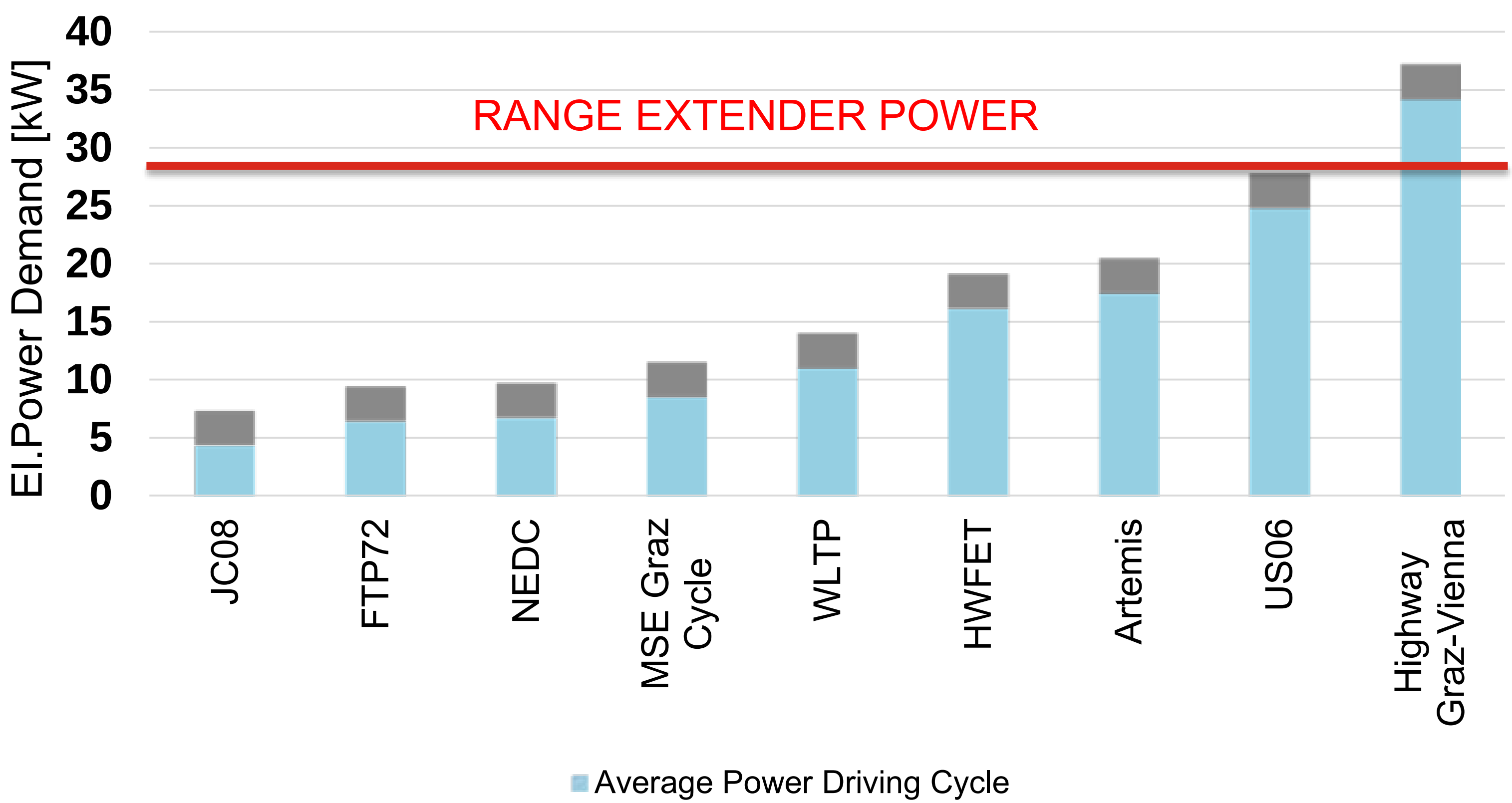




Pros and cons on each technology leads to purpose oriented solutions

ENERGY MANAGEMENT

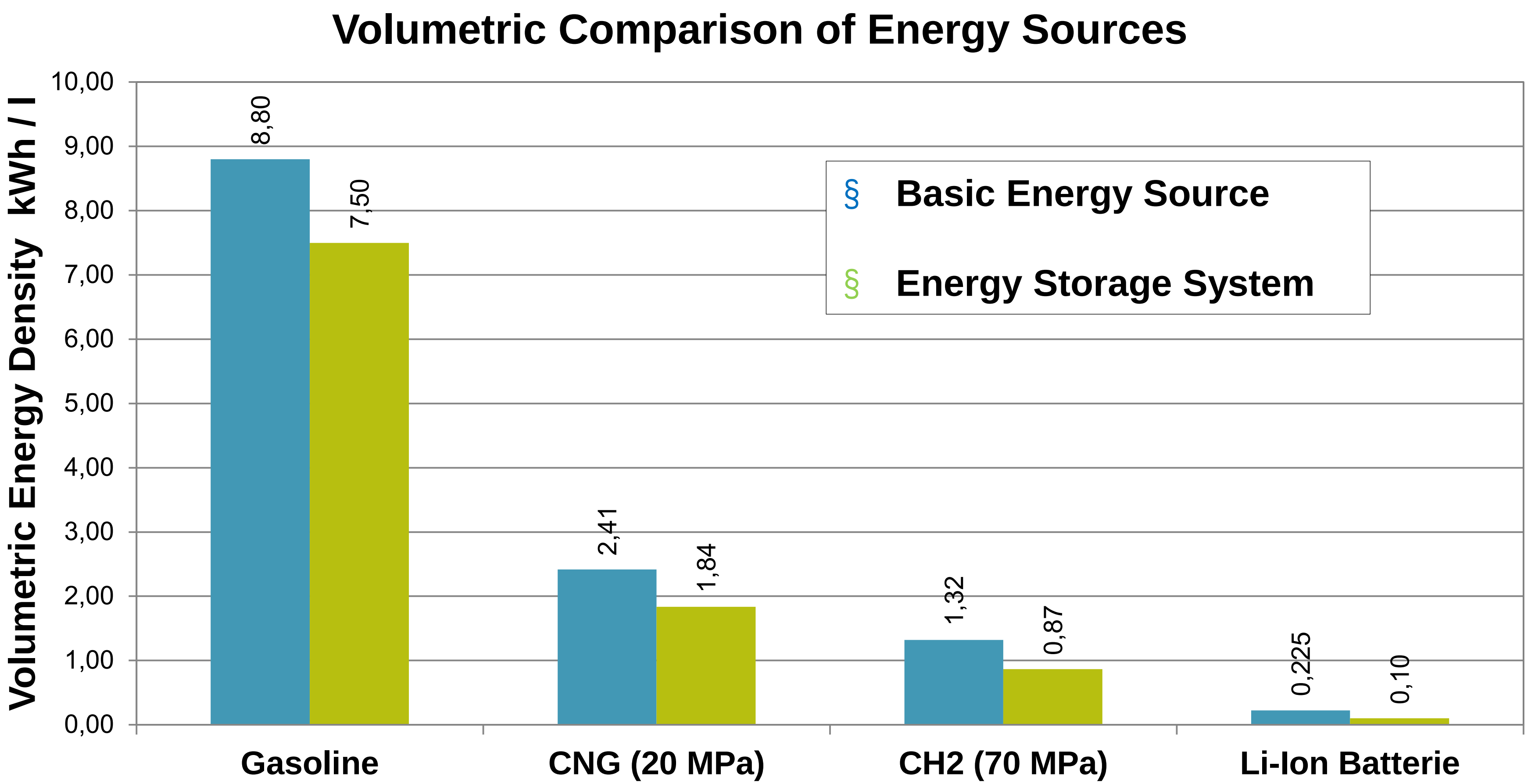
HOW MUCH AVERAGE POWER IS NEEDED FOR DRIVING?



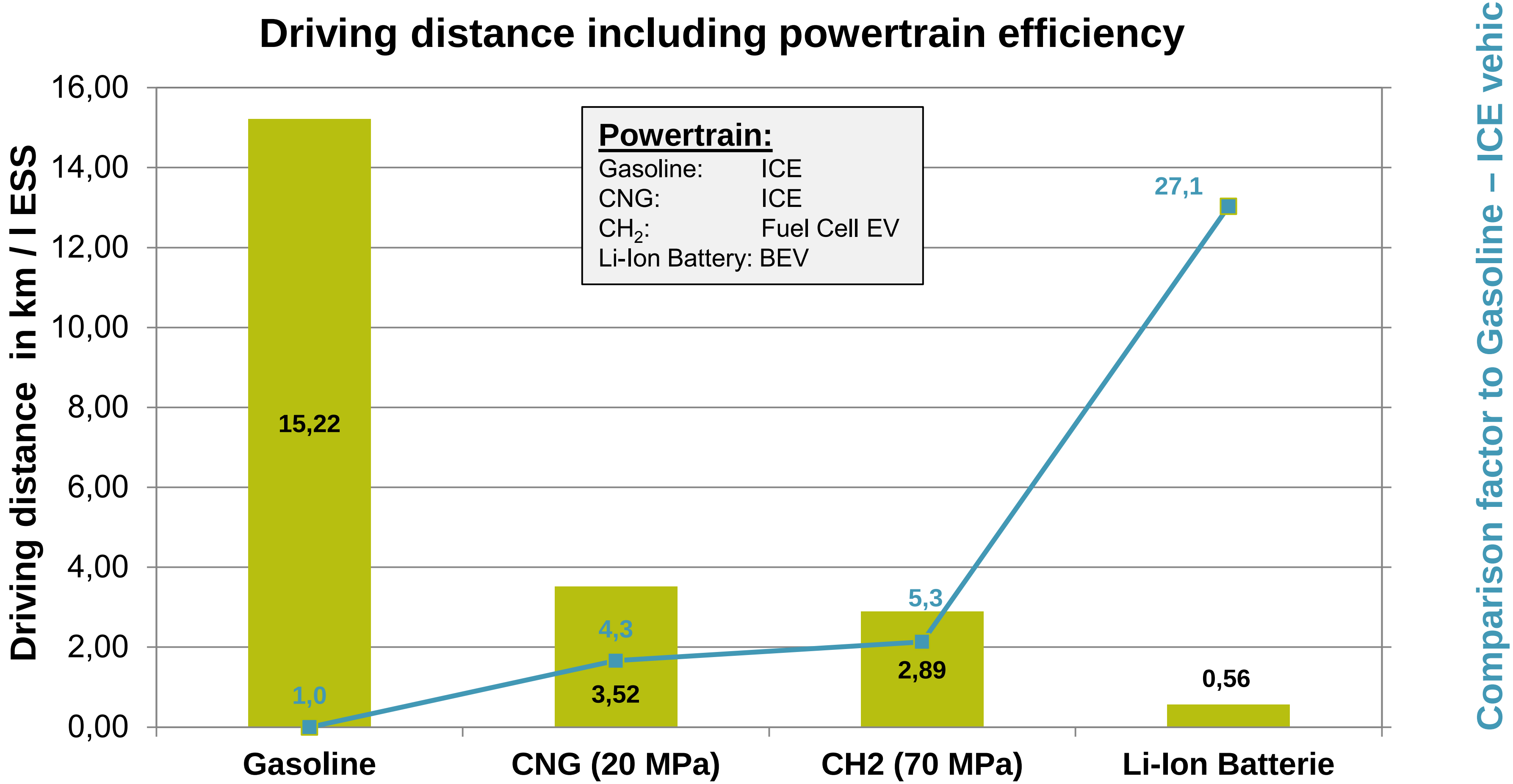
25-30 kW Fuel Cell Power will be sufficient for Charge sustaining mode

ENERGY STORAGE SYSTEMS

HOW MUCH SPACE IS NEEDED?



HOW MUCH RANGE IS POSSIBLE ?

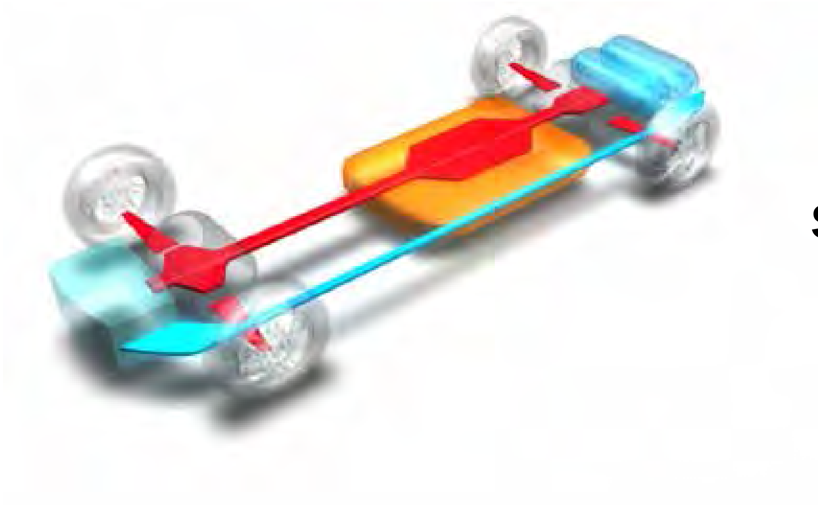


Big challenge in the target conflicts between Range-Space-Weight

FUEL CELL RANGE EXTENDED ELECTRIC VEHICLE

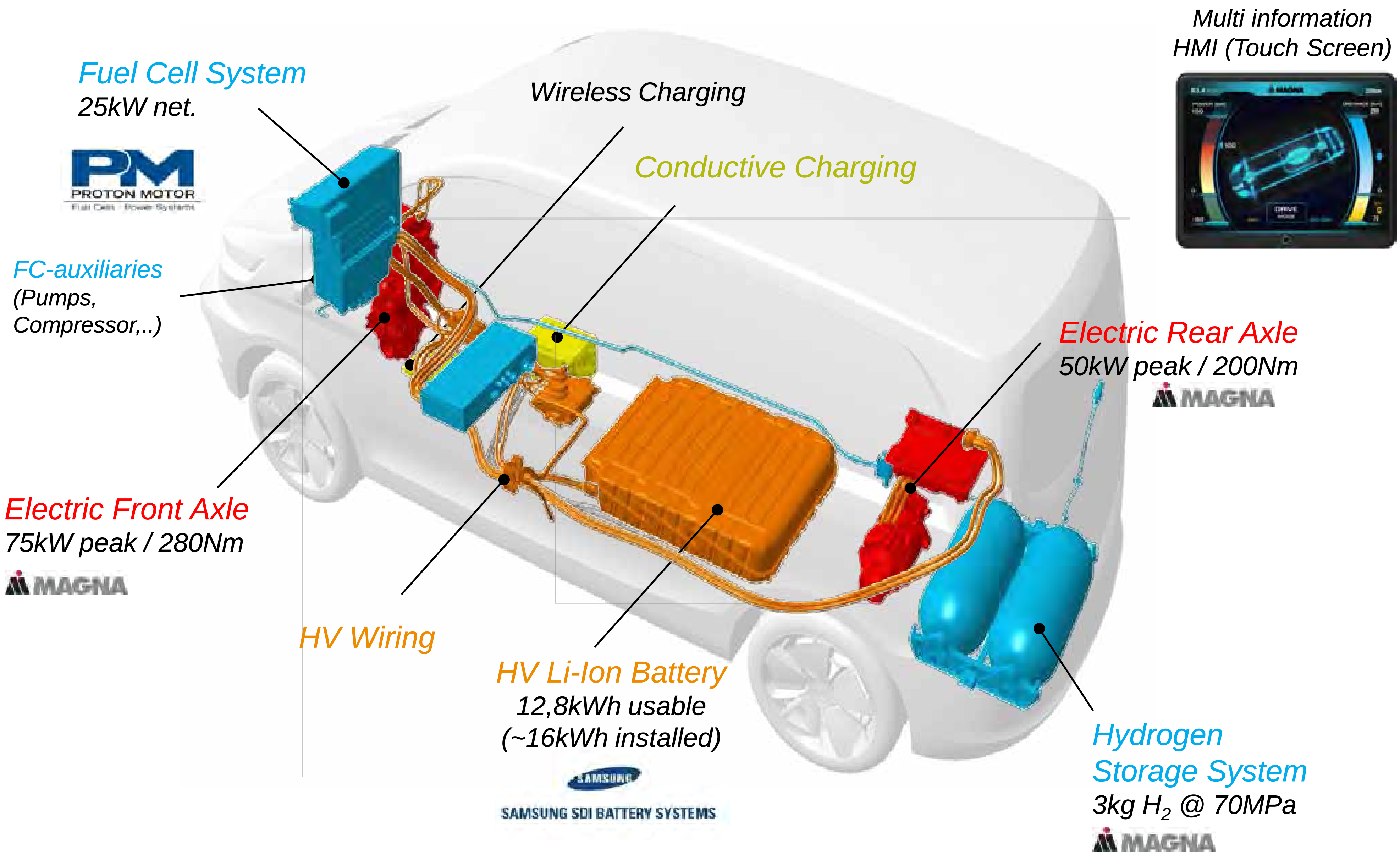
VEHICLE TARGETS:

- Zero emission
- Long driving range
- Fast refueling time
- AWD powertrain

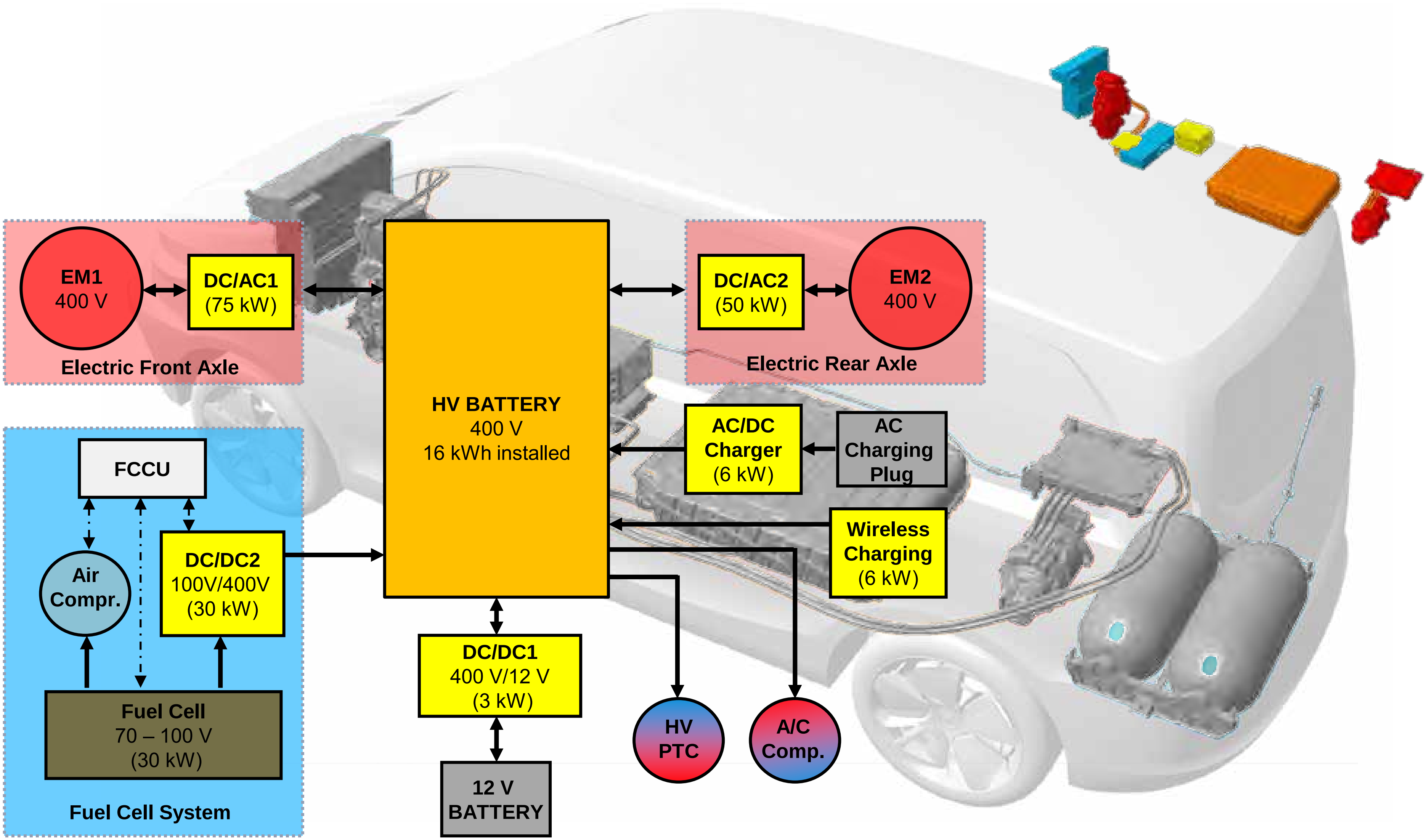


SPECIFIED SYSTEMS à

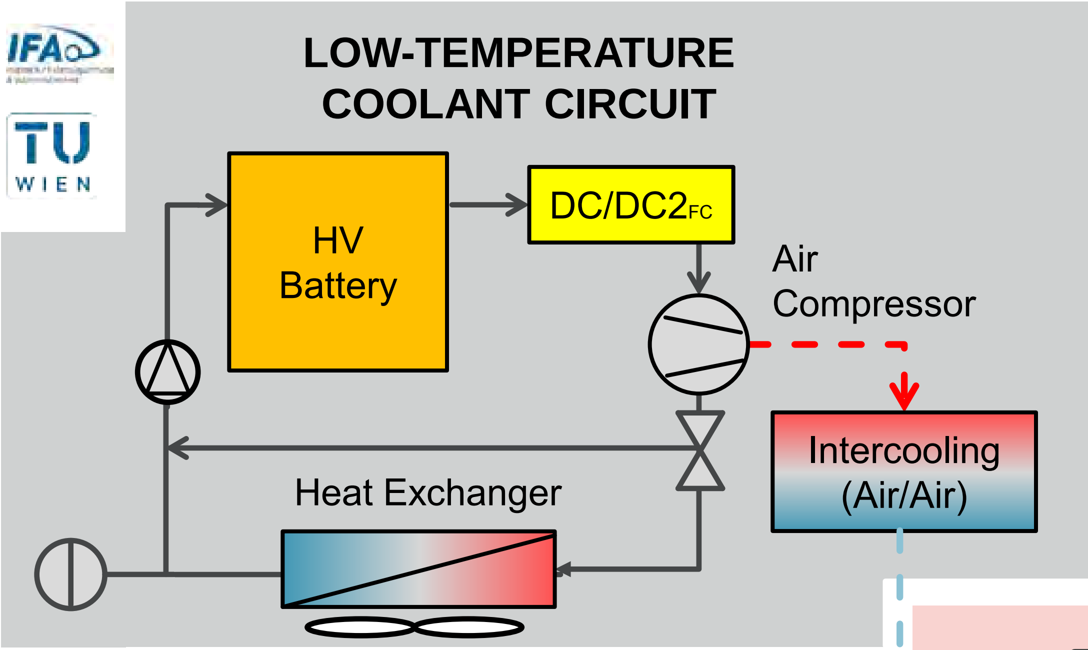
SYSTEM LAYOUT AND OVERVIEW

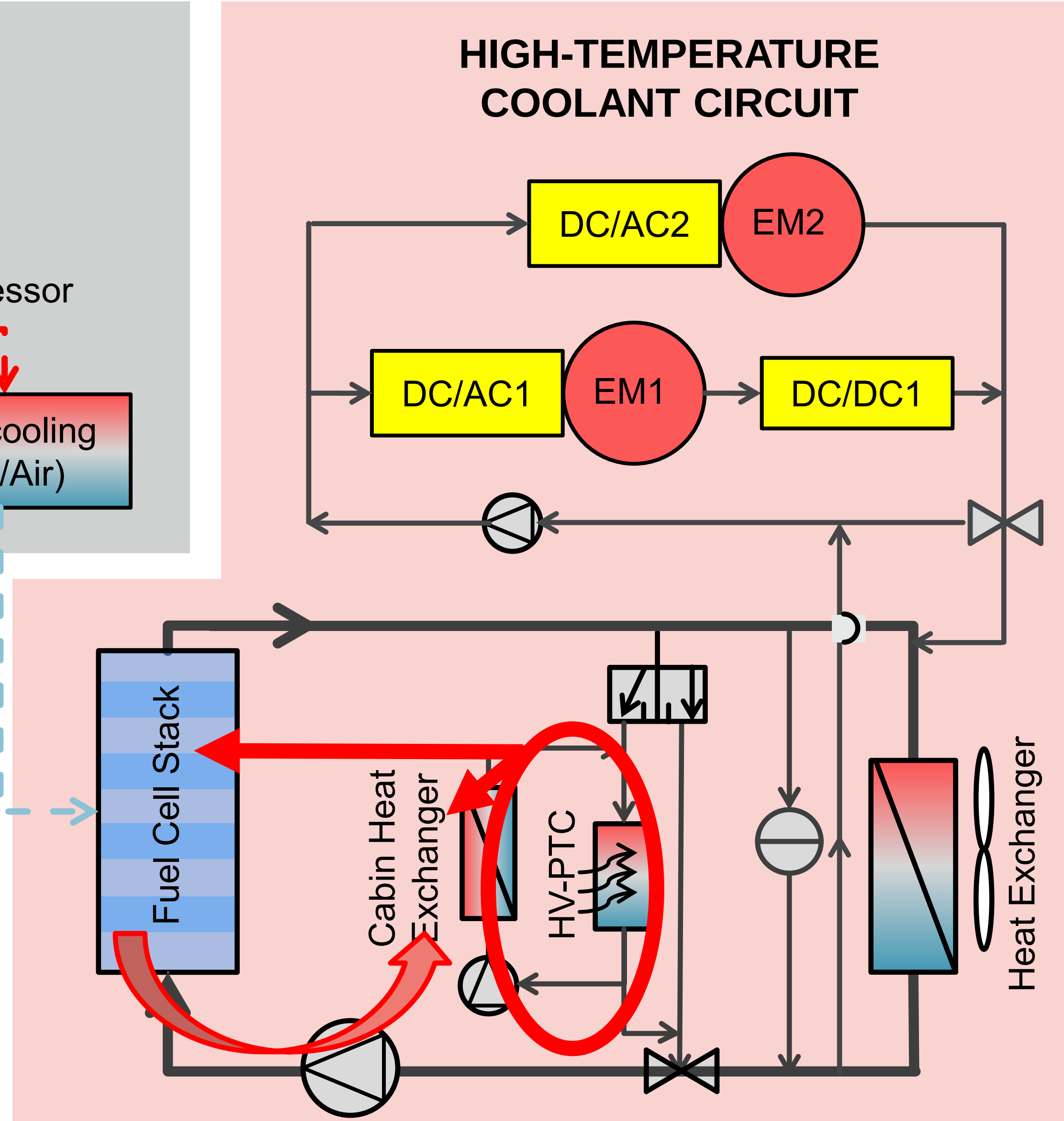


HV ARCHITECTURE



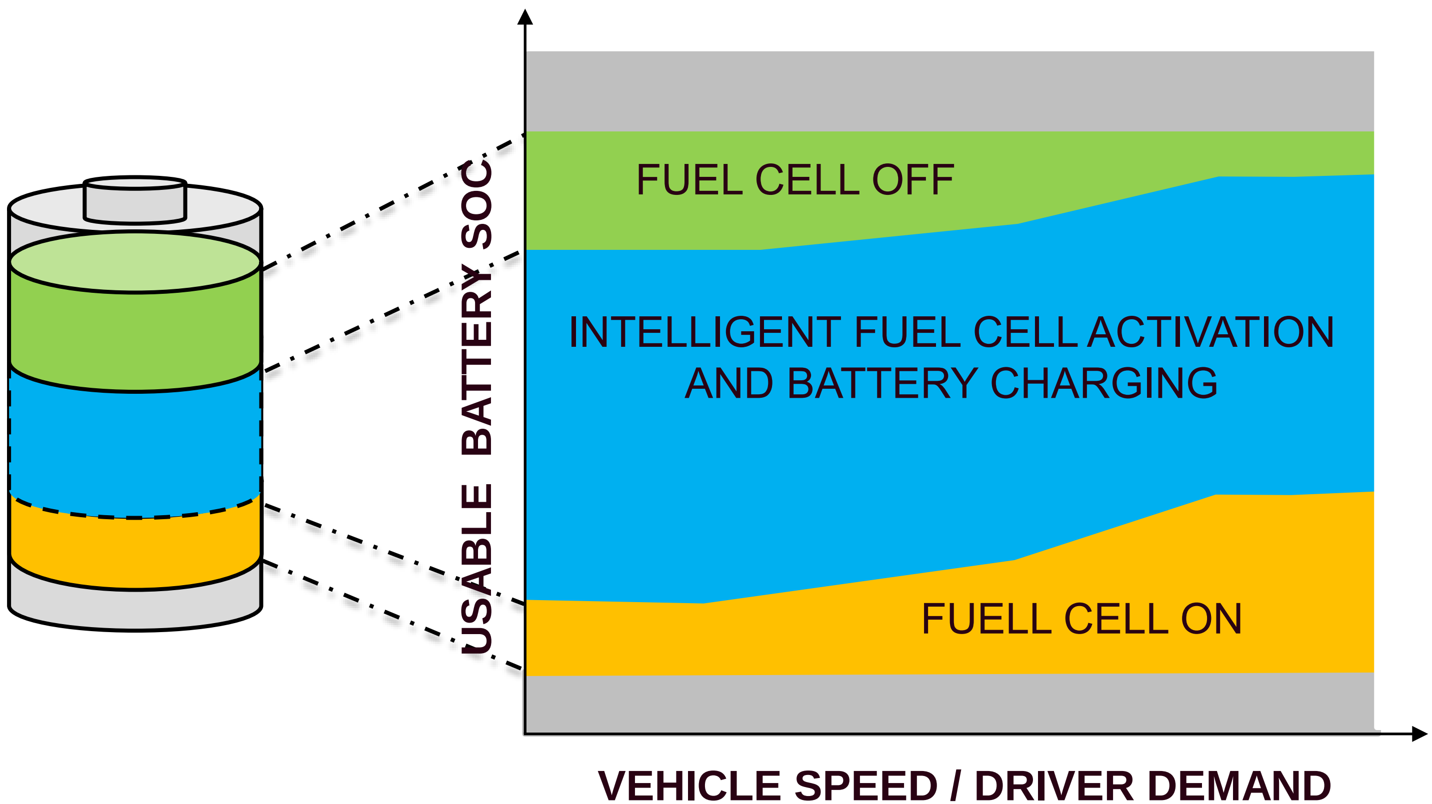
THERMAL MANAGEMENT CONCEPT





- Ø **2 CIRCUIT COOLANT-SYSTEM FULFILLS FULL RANGE OF COMPONENT DEMANDS**
- Ø **COMBINED ELECTRIC FUEL CELL AND CABIN HEATING**
- Ø **FUEL CELL WASTE HEAT USAGE FOR CABIN HEATING**

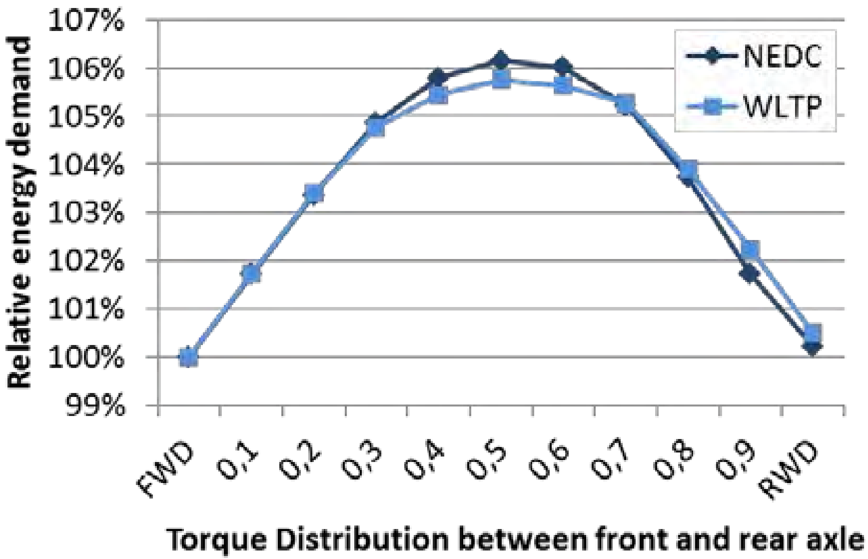
WHEN TO USE BATTERY AND FUEL CELL?



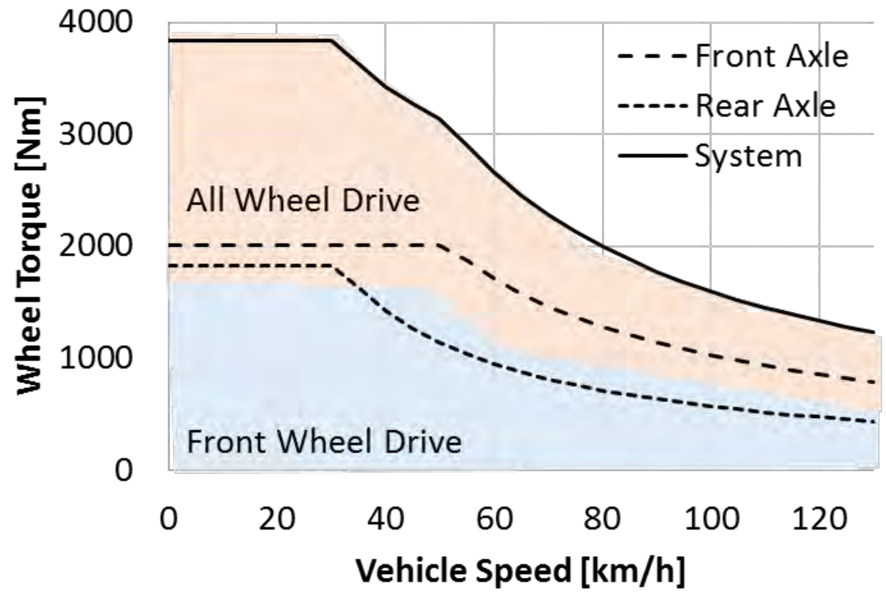
Smart operating strategy combines efficiency and drivability

TORQUE DISTRIBUTION: e4x2 vs e4x4

Energy demand depending constant all-wheel distribution at NEDC and WLTP



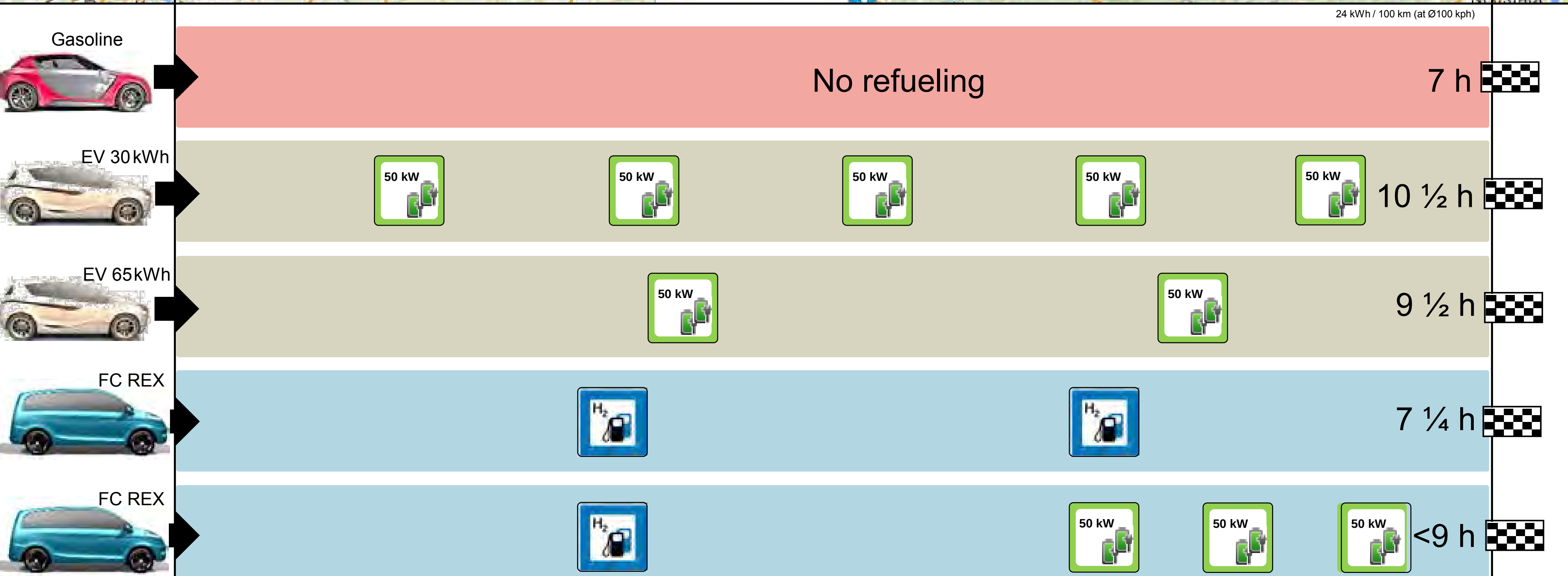
Schemes of an energy-optimized all-wheel



EFFICIENCY BASED TORQUE DISTRIBUTION

VEHICLE OPERATION

R&D-ID: MSE-016



VEHICLE OPERATING MODES

SUMMARY

VEHICLE TARGETS:

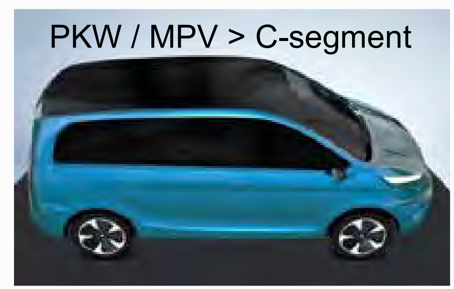
- Zero emission ✓
- Long driving range ✓
- Fast refueling time ✓
- All wheel drive ✓

FIELDS OF APPLICATIONS…

Source:
www.dpd.com/de/home/ueber_dpd/presse_center/

Source:
http://www.southeastairportshuttle.com.au/about-us/

Source:
http://www.ukh2mobility.co.uk/news-media/



READY FOR A RIDE / VISIT…

MAGNA

PROJECT PARTNERS:

PROJECT LEAD:	MAGNA STEYR
CONTACT:	Helfried Müller, Head of Alternative Propulsion Systems – R&D

SAMSUNG SDI BATTERY SYSTEMS · PM PROTON MOTOR · TU WIEN TECHNISCHE UNIVERSITÄT WIEN · HyCentA · bmvit · FFG