WORKSHOP A

SESSION ONE

Presentation 1

Challenges of New Technology for Technical Inspection

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Challenges of New Technology for Technical Inspection

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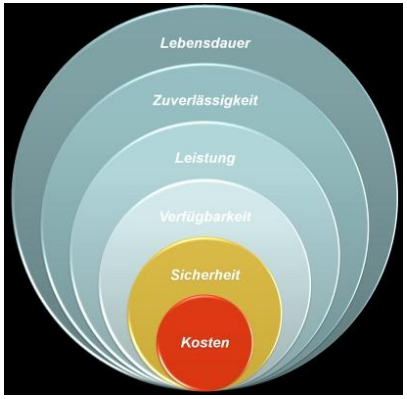
Global Head of E-Mobility

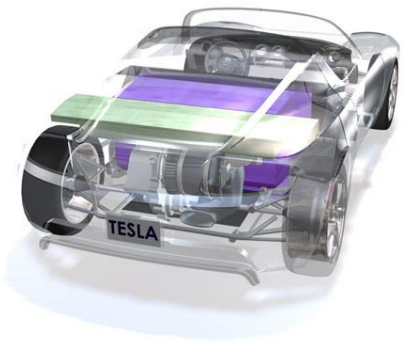
Agenda

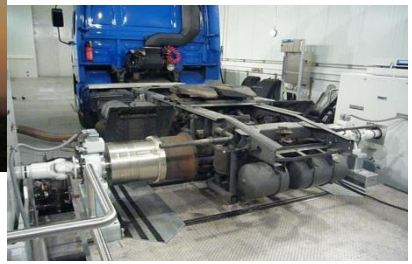
1	Introduction to E-Mobility
2	Definition of High Voltage Systems
3	Challenges during the Vehicle Inspection
4	Potential Hazards due to High Voltage
5	Scope of Additional Testing
6	Future Topics

1. Introduction to E-Mobility

Market and Offer - All different Ways of E-Mobility







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Genau. Richtig.

1. Introduction to E-Mobility

Electric Mobility Past and Present

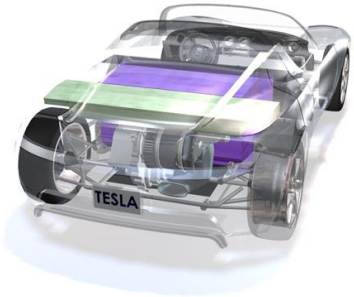
The development of electric vehicles (EV) is in its third phase at present

Elektromote by Werner Siemens, Berlin

Bergmann parcel delivery vehicle

Apollo 17 mission

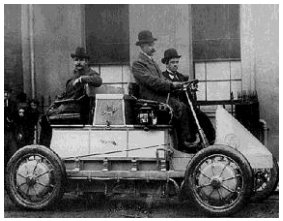
General Motors EV1



Tesla Roadster

1881 1900 1922 | 1972 | 1992 1996 | 2008 2013

Phase I



Lohner-Porsche 4-wheel drive racing car

Hansa-Lloyd electric truck CL5

Phase II

Golf III - Citystromer

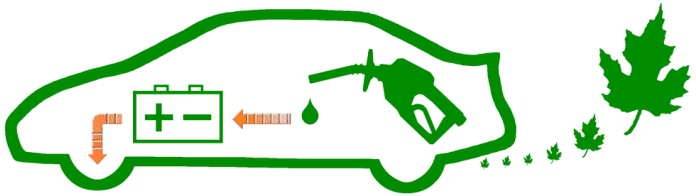
Phase III

Toyota Formula 1 TF 109-02

1. Introduction to E-Mobility

Global Market Offers - Definition of new vehicle concepts to increase energy efficiency

Hybrid



- Micro Hybrid
- Mild Hybrid
- Full Hybrid
- Plug-in Hybrid

Conventional

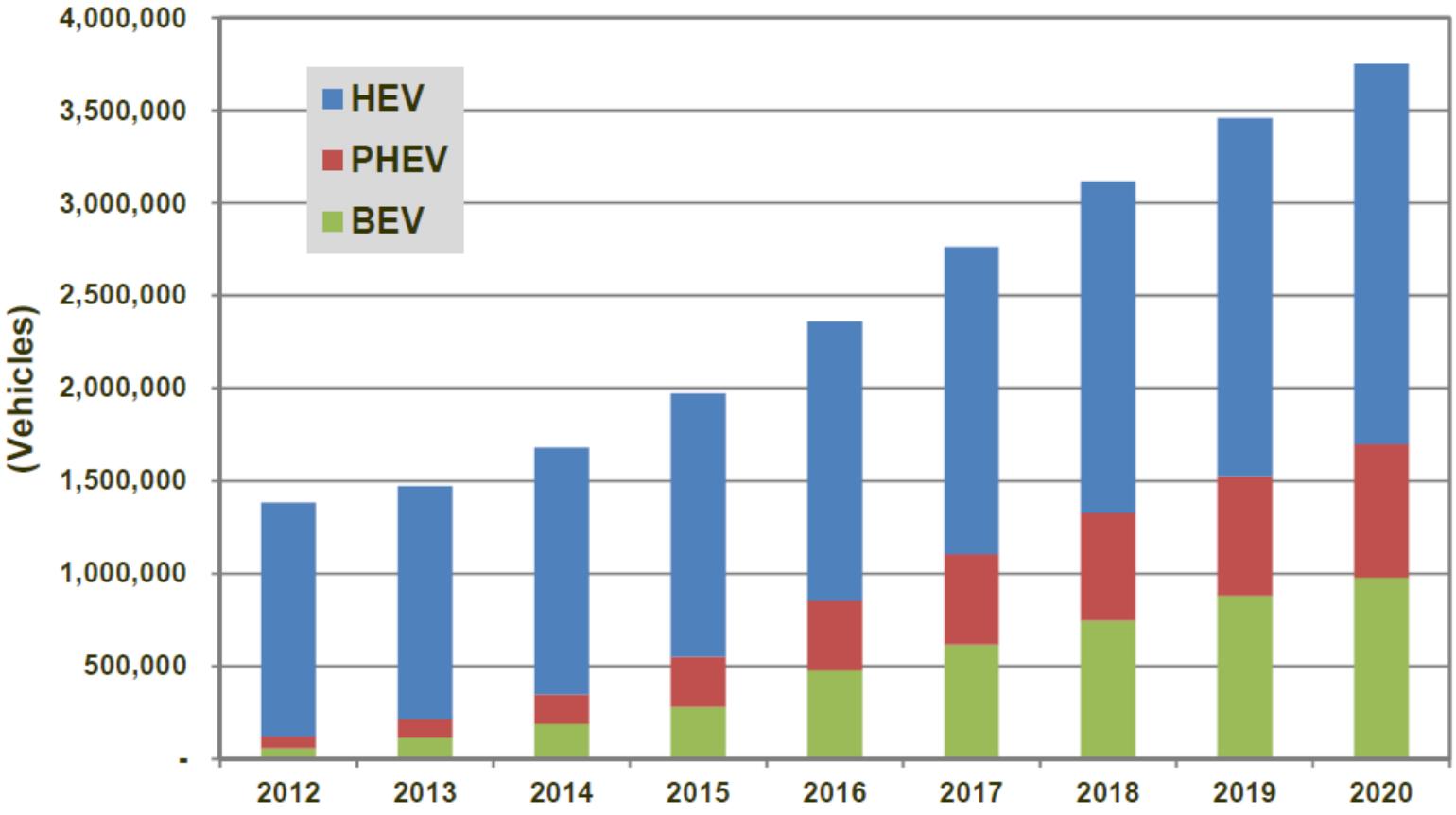
Battery

Fuel Cell

E-Mobility

1. Introduction to E-Mobility

Global Market Growth Expectation - Worldwide Sales of E-Vehicles per Type, 2012-2020

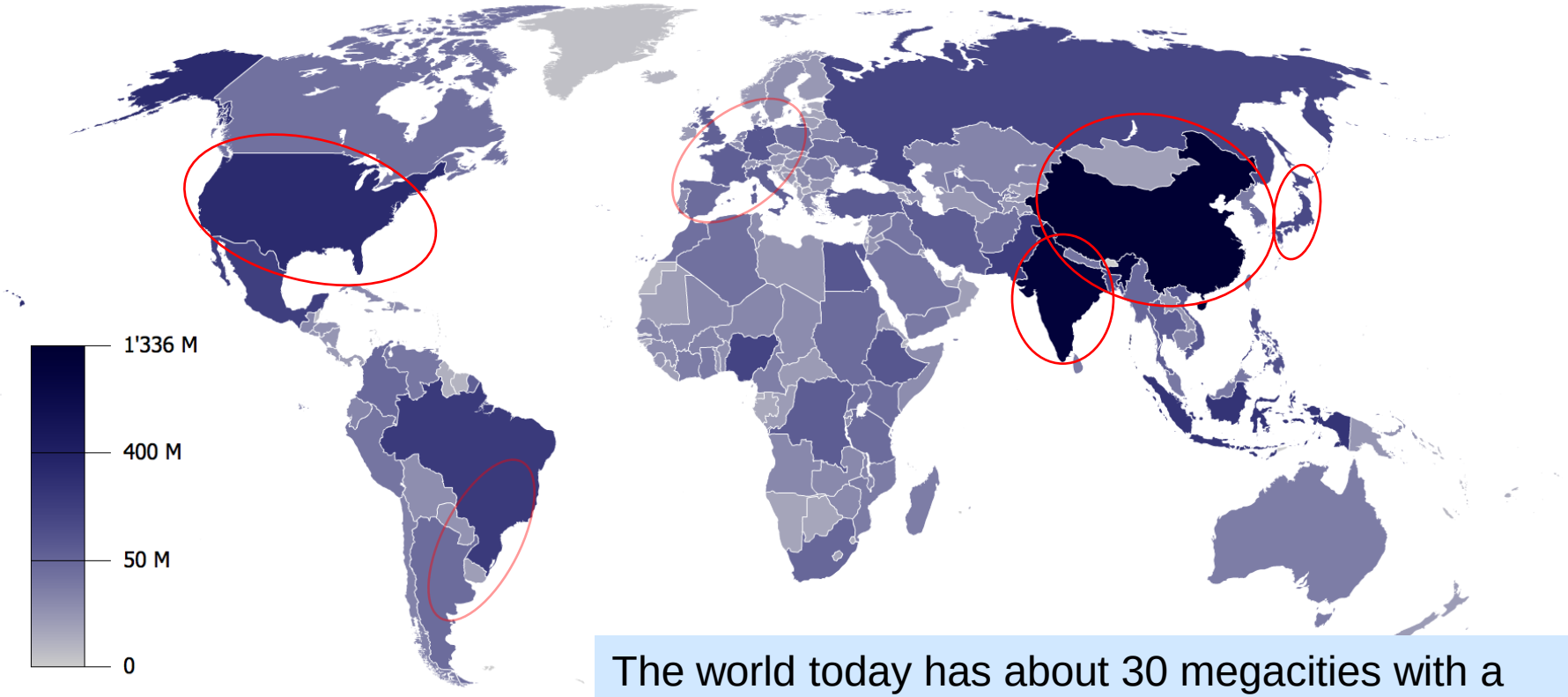


Quelle: Pike Research

HEV = Hybrid Electric Vehicle
PHEV = Plug In Hybrid Electric Vehicle
BEV = Battery Electric Vehicle

1. Introduction to E-Mobility

Global E-Mobility Focus Markets



The world today has about 30 megacities with a population of more than 10 million. The tendency for urbanisation is rising significantly.

Source: www.wikipedia.de

1. Introduction to E-Mobility

The **Process Chain** of E-Mobility at TÜV Rheinland

Industrie Service | Mobility | Products | Systems | Training and Consulting

Energy Generation and Grids

Storage Systems/Batteries

Vehicle Utilization
- Homologation
- Training
- Recycling

Distribution/ Charging Stations
- Charging Station
- Exchange Station

Billing System, Data Security

Generation

Transport

Distribution

Billing

Operation

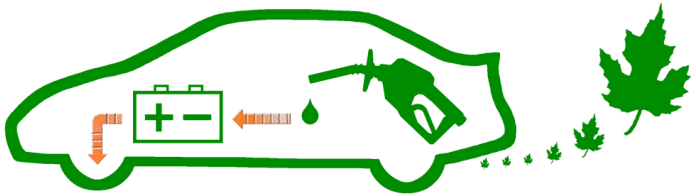
Storage

2nd/3rd Life

2. Definition of High Voltage Systems

Global Market Offers - Definition of new vehicle concepts to increase energy efficiency

Hybrid



- Micro Hybrid
- Mild Hybrid
- Full Hybrid
- Plug-in Hybrid

Conventional

Battery

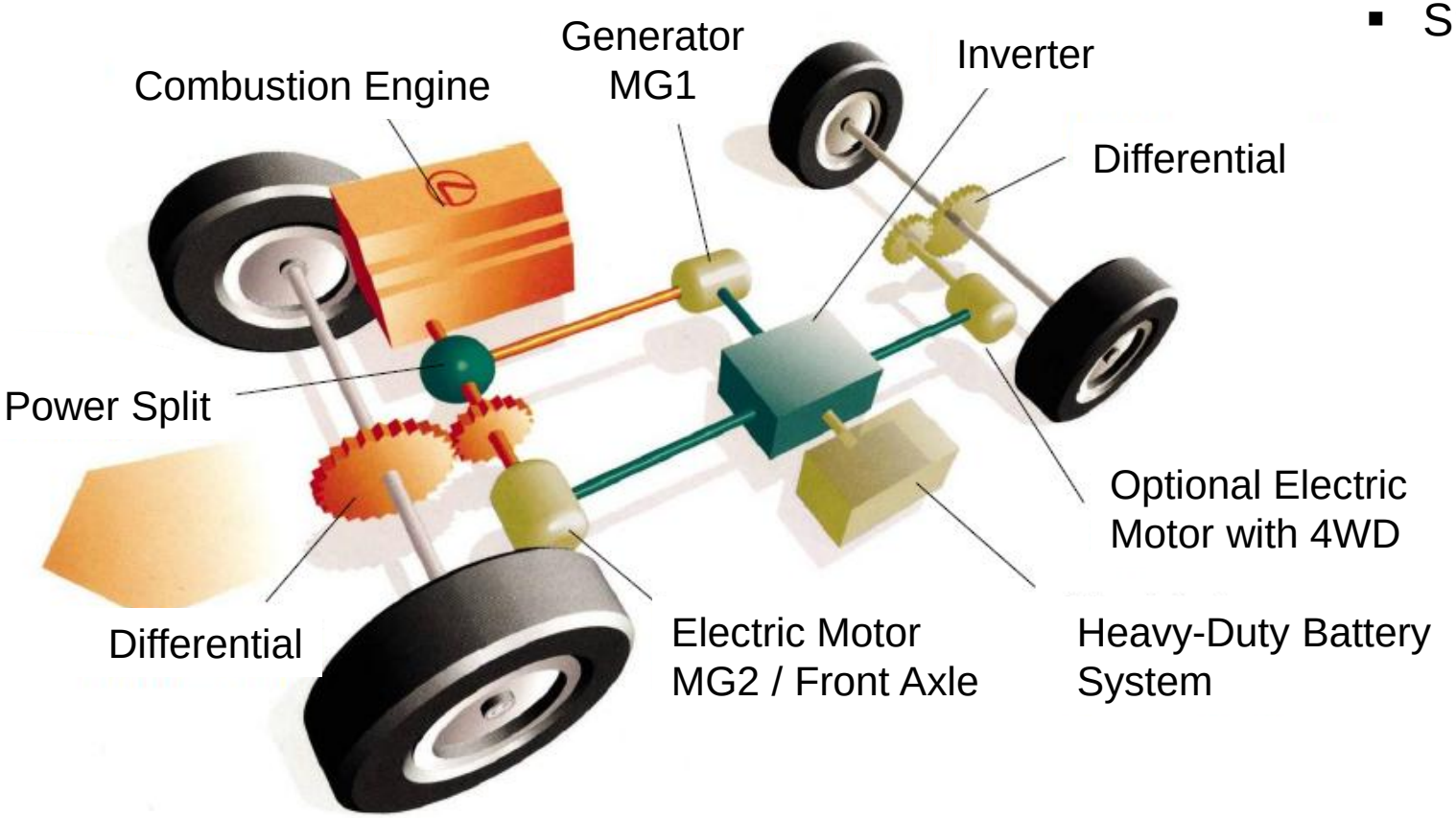
Fuel Cell

E-Mobility

2. Definition of High Voltage Systems

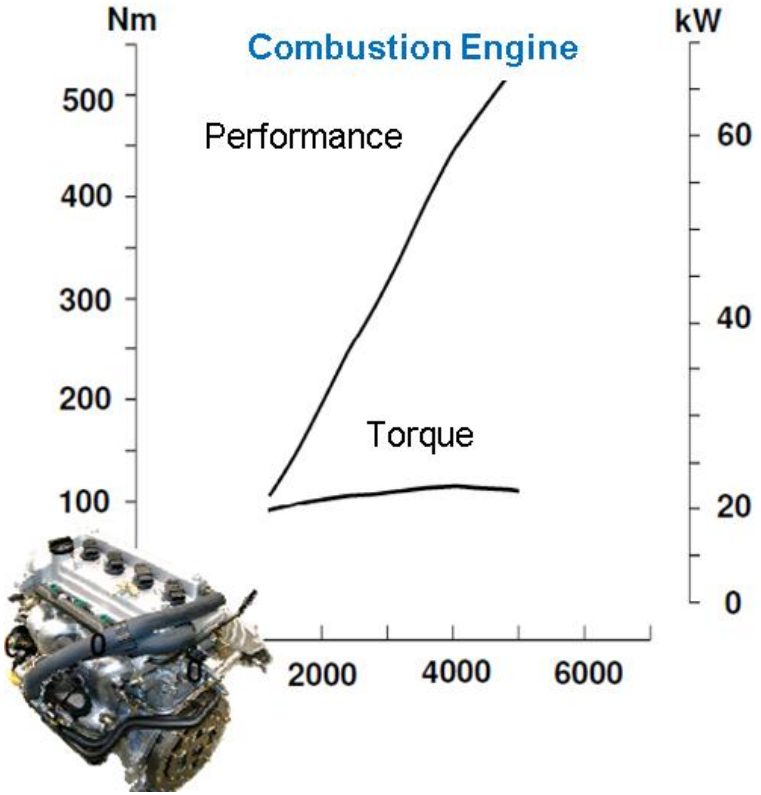
- Serial
- Parallel
- Split

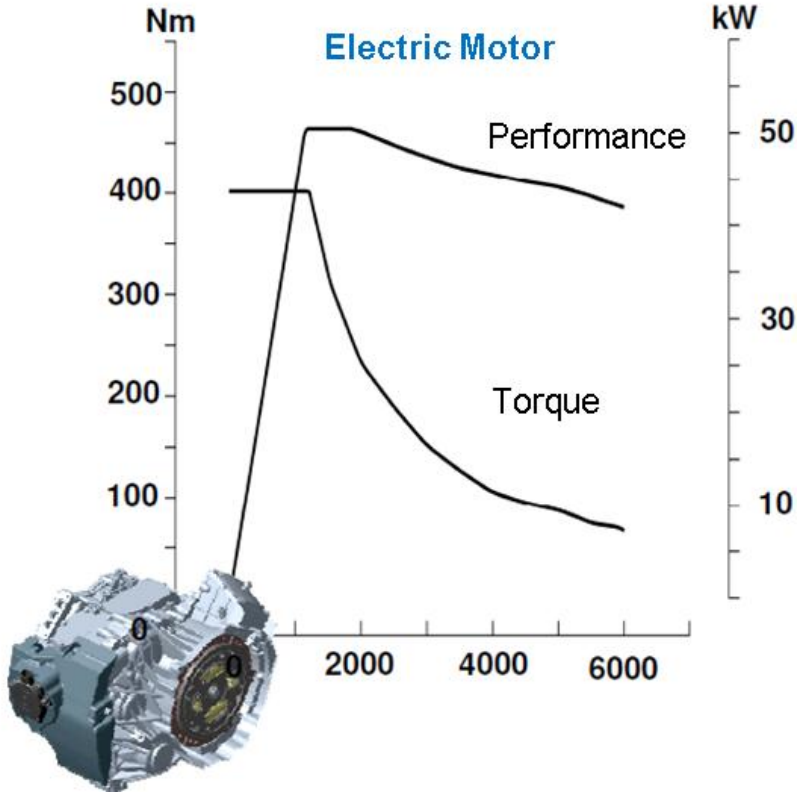
Power-split Hybrid



2. Definition of High Voltage Systems

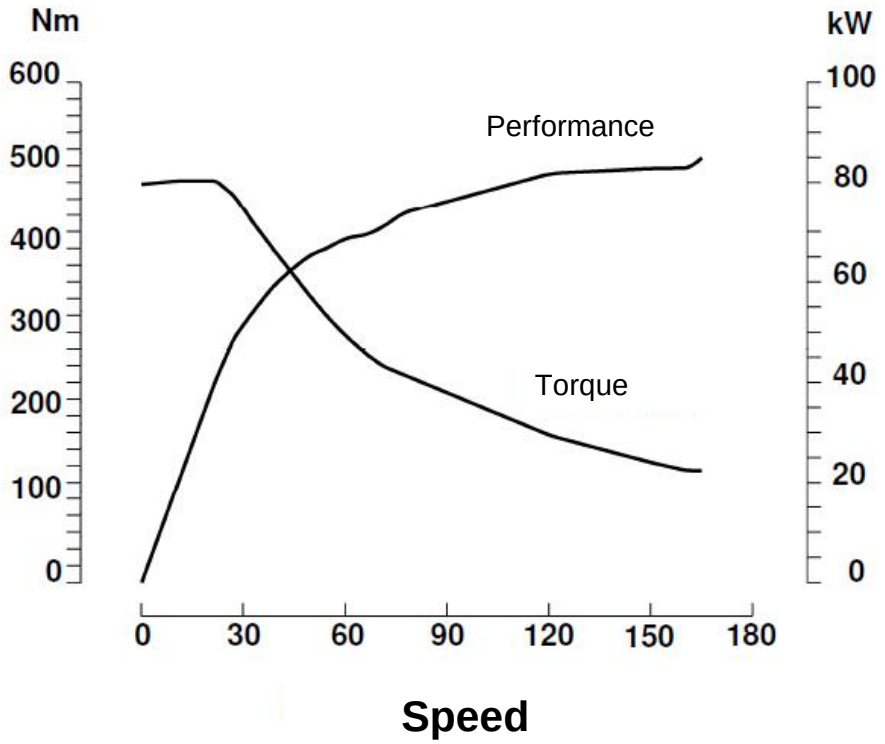
Power diagrams





2. Definition of High Voltage Systems

Power diagram for a hybrid system



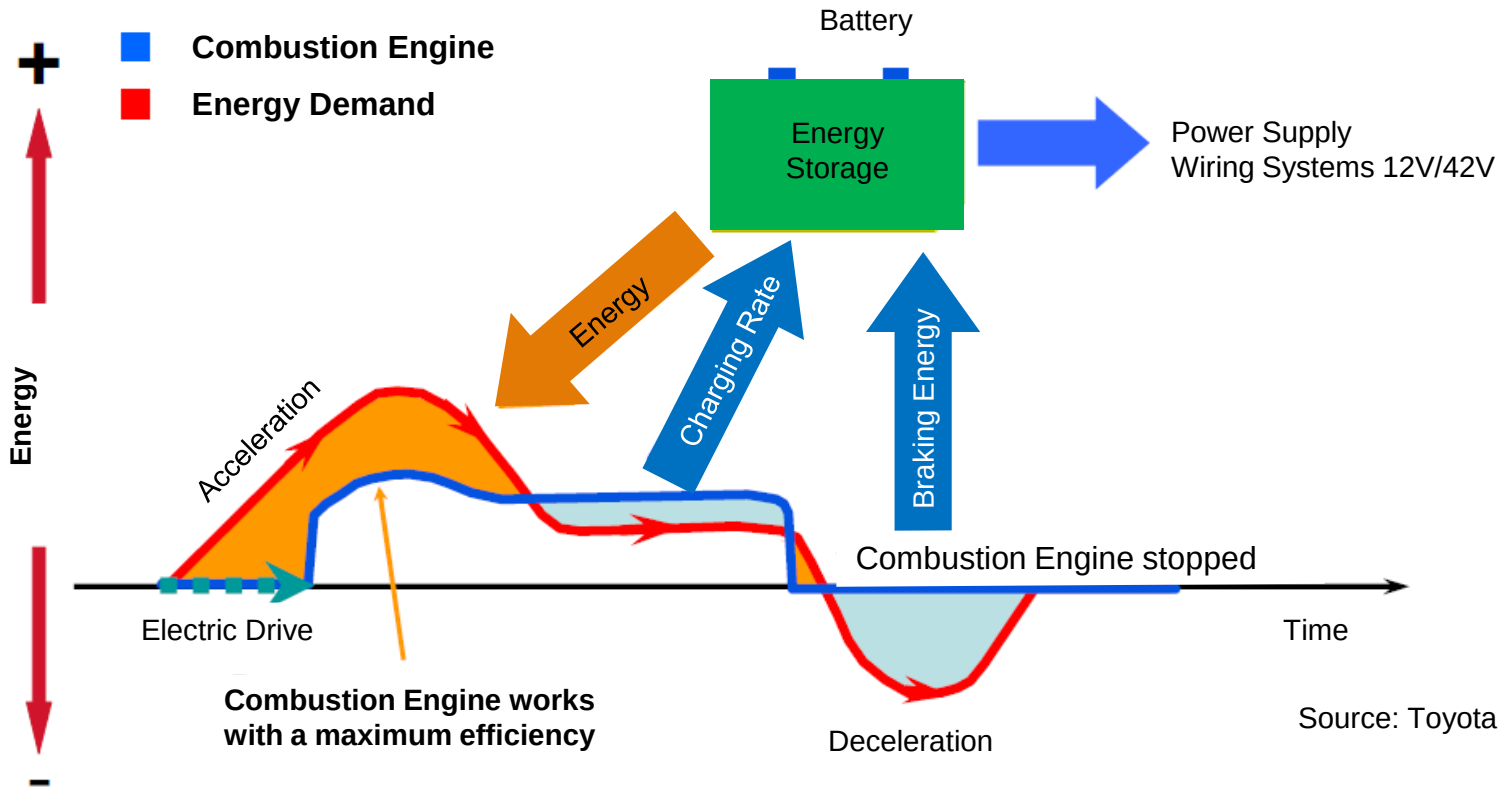
Two Types of drive that are mutually supportive

E-Motor: high starting torque

Combustion Engine: high engine power

2. Definition of High Voltage Systems

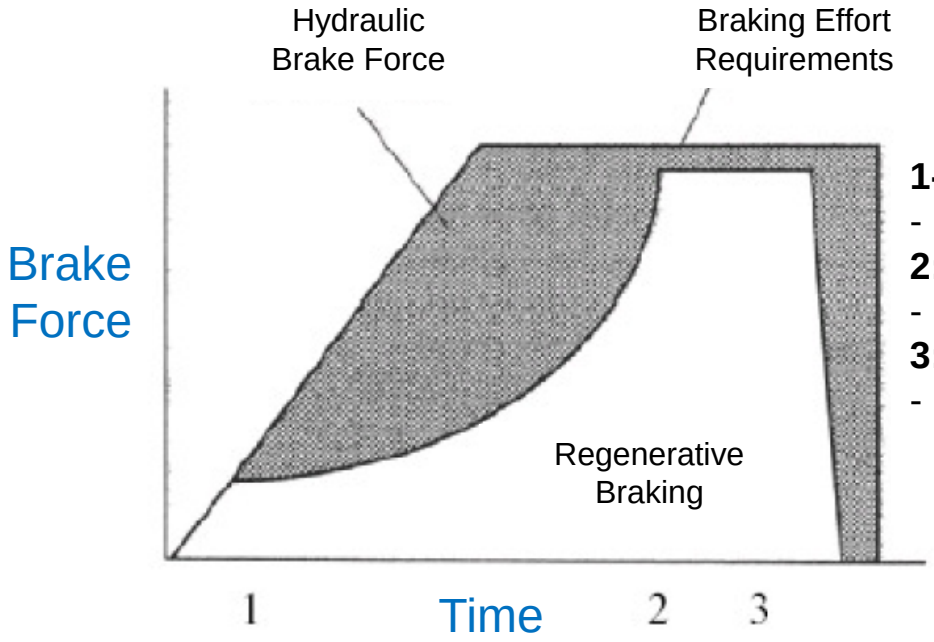
Hybrid drive energy management



Source: Toyota

2. Definition of High Voltage Systems

Comparison between the behaviour of hydraulic and electrical braking



1-2: Field Weakening
- Building of brake force

2: E-Motor in Anchor Adjusting Range
- maximum energy recovery

3: Battery is charged
- no further regenerative braking possible

Purely electric braking is not allowed!

2. Definition of High Voltage Systems

Electrical drives – Overview

Main properties of electrical drive concepts

	HEV	PHEV	EV
Power	10 - 40 kW	30 - 80 kW	30 - 80 kW
Voltage	42 - 300 V	150 - 400 V	400 V
Energy per cycle	< 300 Wh	> 4 kWh	> 15 kWh
Cycles during 12 yrs operation	300,000	4,000	2,000
Battery size	0.6 - 2 kWh	5 - 15 kWh	> 15 kWh
Battery mass	≈ 50 kg	≈ 120 kg	≈ 250 kg
Battery Price	≈ 1.000 €	≈ 7.500 €	≈ 12.000 €

3. Challenges during the Vehicle Inspection

View under the hood

3. Challenges during the Vehicle Inspection

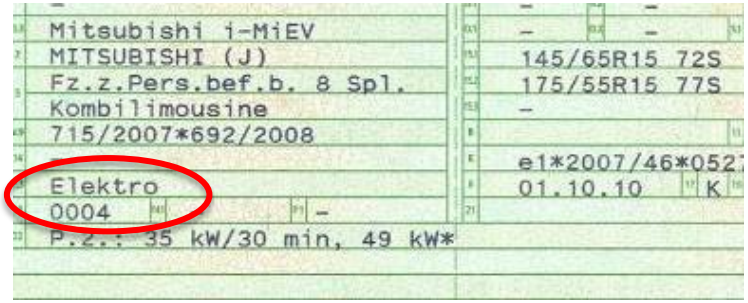
Electrical drive train: how to identify an EV

Registration Documents:

E.g. T.1:

Field P.3: Fuel type or source or energy

E.g. "Electric", "Hybr. petrol/E",…



Vehicle registration certificate (Part 1):

Field 5: Drive type

E.g. "Key no. 25", ….

25 = combination of combustion engine
with an electric drive (hybrid)

3. Challenges during the Vehicle Inspection

Electrical drive train: how to identify an EV

Dashboard displays:

Renault

Toyota

Volkswagen

3. Challenges during the Vehicle Inspection

Electrical drive train: how to identify an EV

Markings on the vehicle:

Labels / striking stickers

Warnings

Cable colour coding
(HV cables/conduits are generally orange*)

*: Colour only changed to orange with ECE R-100, rev. 01

4. Potential Hazards due to High Voltage

Injuries caused by electrical current and batteries

Batteries

Electrical current, toxic substances, explosion

Electrical effect - Low voltage

Thermal effect - High voltage

Brain *Loss of consciousness*

Heart *Ventricular fibrillations*

Lungs *Toxic, hot vapours Inhalation trauma, Ruptures*

Muscles *Cramping, twitching, tears*

Eyes *Flash burns*

Ear *Bang trauma*

Skin *Burns, acid burns*

Internal organs
Cooking effect, burns

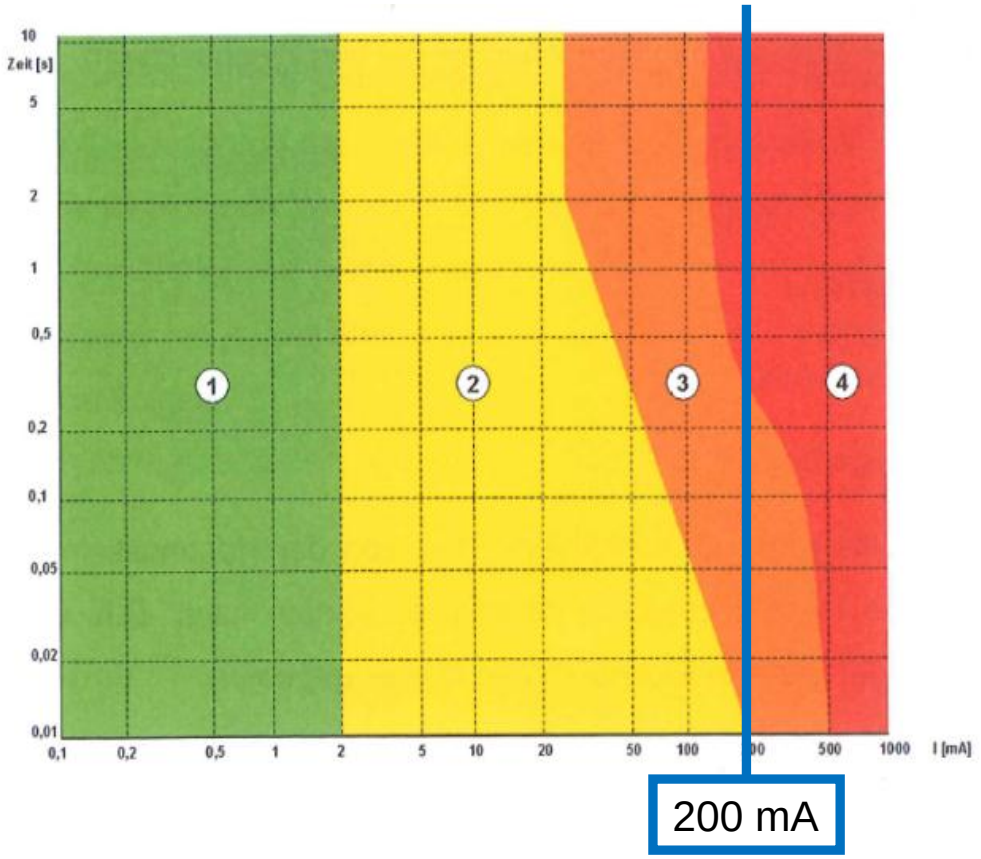
Bones
Breaks due to falls Crushing

4. Potential Hazards due to High Voltage

Physiological Effects of Energy on the Human Body

These effects are depending on currency level and exposure time.

- Zone 1: No effect
- Zone 2: No harmful physiological effect
- Zone 3: Muscle contraction, breathing difficulties; disruption to the conduction system in the heart
- Zone 4: Ventricular fibrillations likely, possible cardiac arrest, respiratory arrest, serious burns



4. Potential Hazards due to High Voltage

Examples:

- Unprofessional changes on the vehicle (work/repair/tuning by “electrical lay person") possible.
- High-voltage components not identifiable as such at a glance.
- Negative effects due to not easily visible wear conditions.
- Use of non original spare parts.

- Prominent HV markings/cable colours in force since ECE R-100.

5. Scope of Additional Testing

Additionally to Appendix VIIIa we see further potential in the following points:

e.g. effect/function testing of the overall system

Test run

- Overall function of the (electrical) drive train,
- Overall function of the braking system (with/without conditioning), Function of (HV) pilot lamps, displays, alarms, active vehicle operation state, …

e.g. visual/effect/function testing of components

Electromotor(s), performance electronics

- Function, state, installation position, manipulation, …

Electric steering, power-assisted braking, recuperation function

- Function, state, effect, …

5. Scope of Additional Testing

Additionally to Appendix VIIIa we see further potential in the following points:

e.g. visual/effect/function testing of components

High-voltage cable harness

- State, installation position, connections, shielding, equipotential bonding, …

Traction battery, (BMS), housing for HV components

- State, attachment, design, ventilation, cooling, …




5. Scope of Additional Testing

Additionally to Appendix VIIIa we see further potential in the following points:

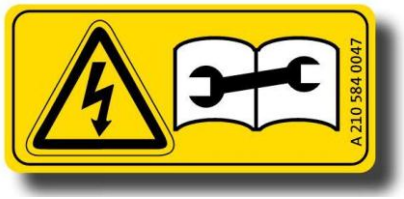
e.g. visual/effect/function testing of components

Special Heater Systems, air-conditioning

- Function, effect, state, attachment, design, sealing, …

Warning/safety notices

- Presence, design, ...



Charging connections/Charging cables

- Function, state, (immobiliser), …

6. Future topics

- Electric mobility includes more than just electric vehicles.
- Electric mobility is an indispensable component of economical and ecological individual mobility, now and in the future.
- Sustainable mobility is more than just a task for the automobile manufacturers: it is a task for all of society and all of the economy.
- Road Safety is manly driven by an optimized PTI system to ensure a very high technological level in operation.

Our claim: At the very least, electric mobility must match the safety and attractiveness of conventional mobility.

Thank you very much for your attention!

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