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FUTURE TRENDS FOR SUSTAINABLE MOBILITY

JULIANE MUTH, VOLKSWAGEN AG

HIPS-NET WORKSHOP | BRUSSELS | 23RD JUNE 2015

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VALUE CREATION IN THE AUTOMOTIVE INDUSTRY IS UNDERGOING CHANGE

Climate change

Downsizing

Digitalization

CO_2 emissions

Plug-In-hybrid

Urbanization

Hydrogen

Sustainability

Car sharing

E-mobility

Connected Car

Major cities

Battery technoloy

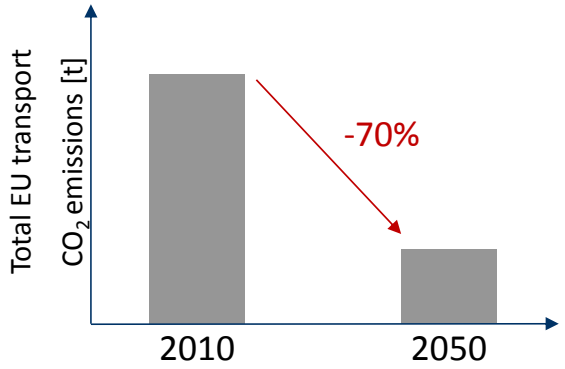
Lithium-ion

Peak Oil

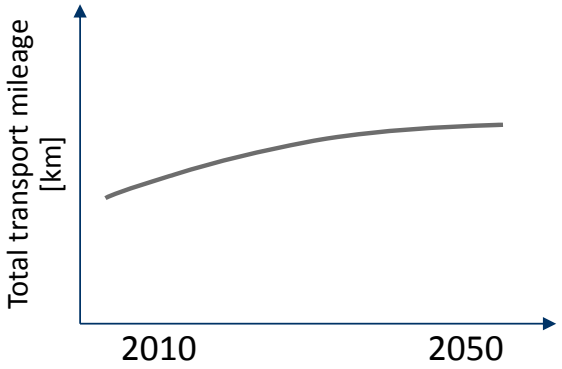
FUEL TRENDS FOR TRANSPORT

business environment

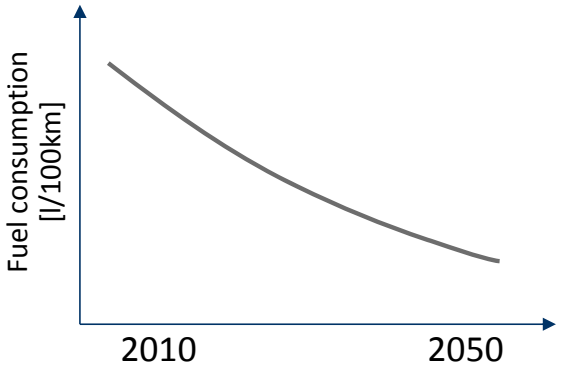
politics



mileage



efficiency

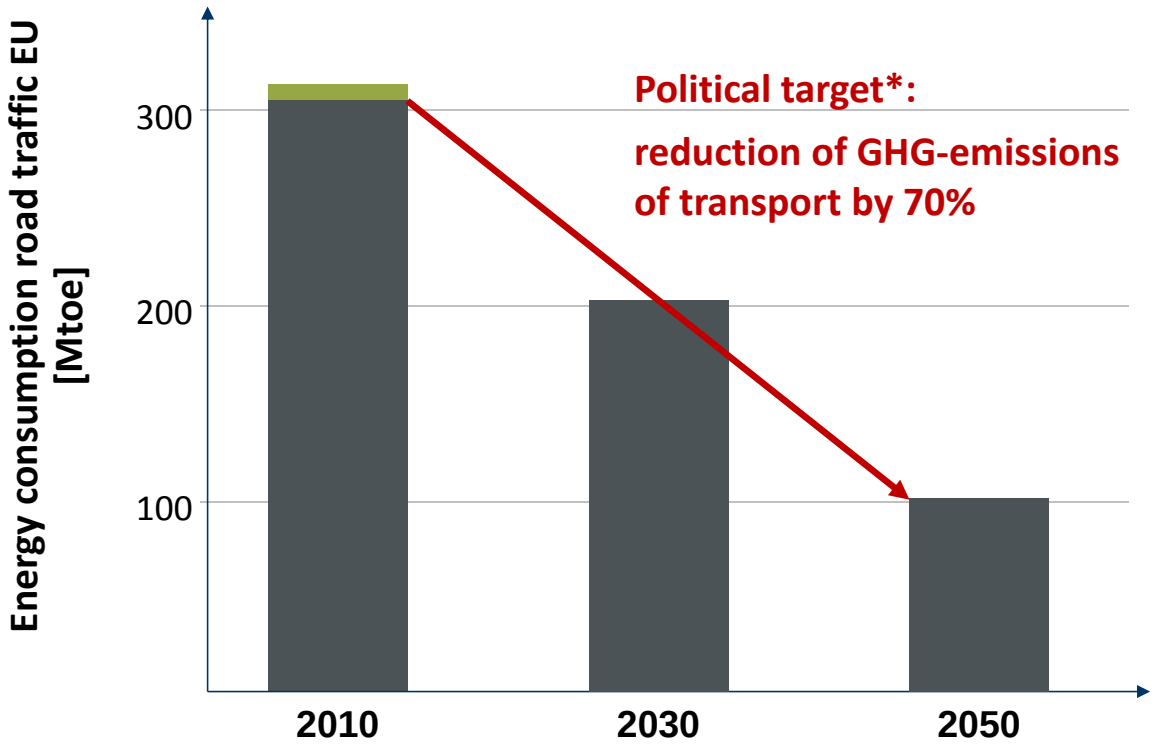


fuel trends

- Electrification of transport
- CO2-reduced fuels for transport

FUEL TRENDS FOR PRIVATE AND COMMERCIAL TRANSPORT

CASE STUDY: ENERGY CONSUMPTION FOR ROAD TRAFFIC IN THE EU*



The use of fossil fuels for road traffic needs to be reduced by a factor of 3 until 2050.

electric mobility
CO_2-reduced fuels
fossil fuels

* 2011 EU WHITE PAPER: Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system

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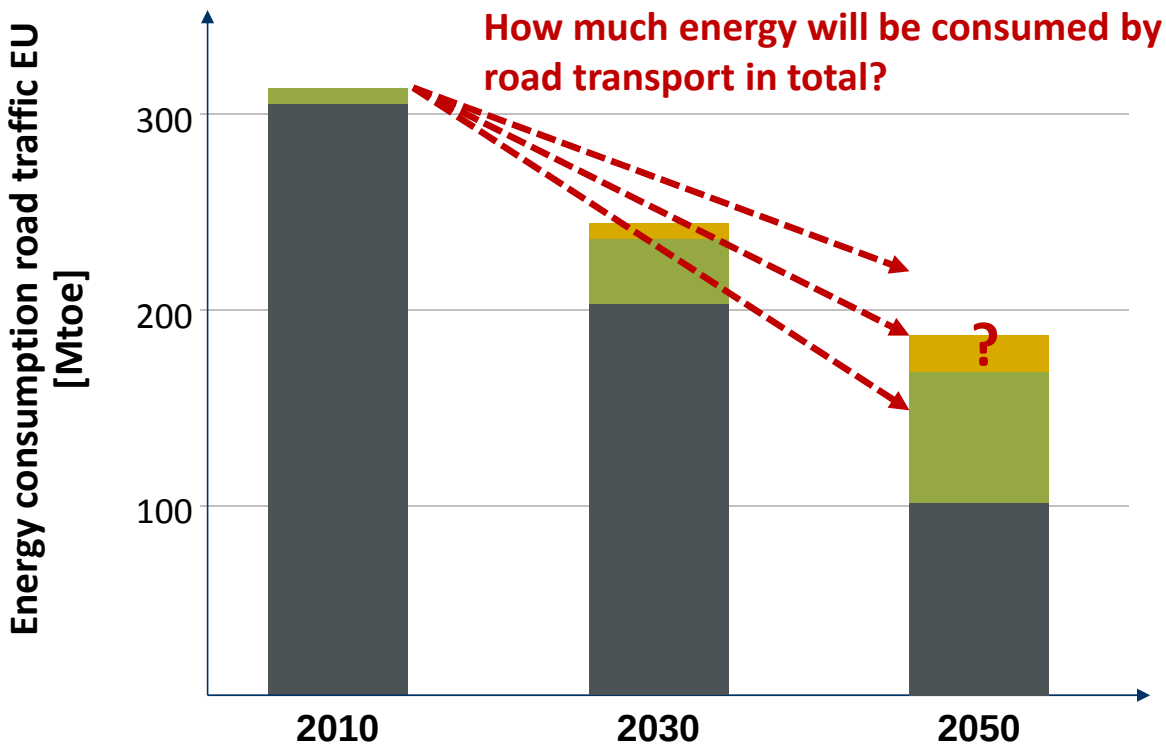

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(1) Electrification

50% of individual mobility will be covered electrically by 2050 (BEV + PHEV)

(2) CO_2-reduced fuels

Amount of „green“ fuels for transport will sevenfold by 2050.

- electric mobility
- CO_2-reduced fuels
- fossil fuels

*based on data of IEA MobilityModell, progtrans, World Transport reports 2012/2013, own consumptions

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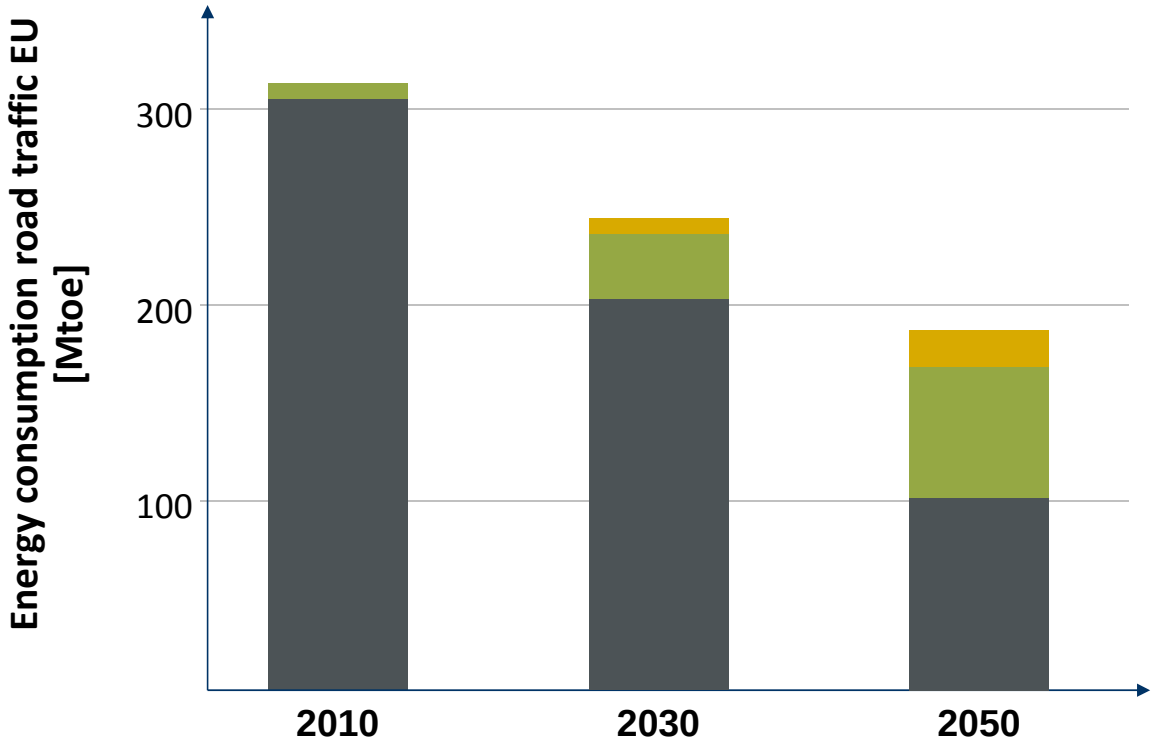

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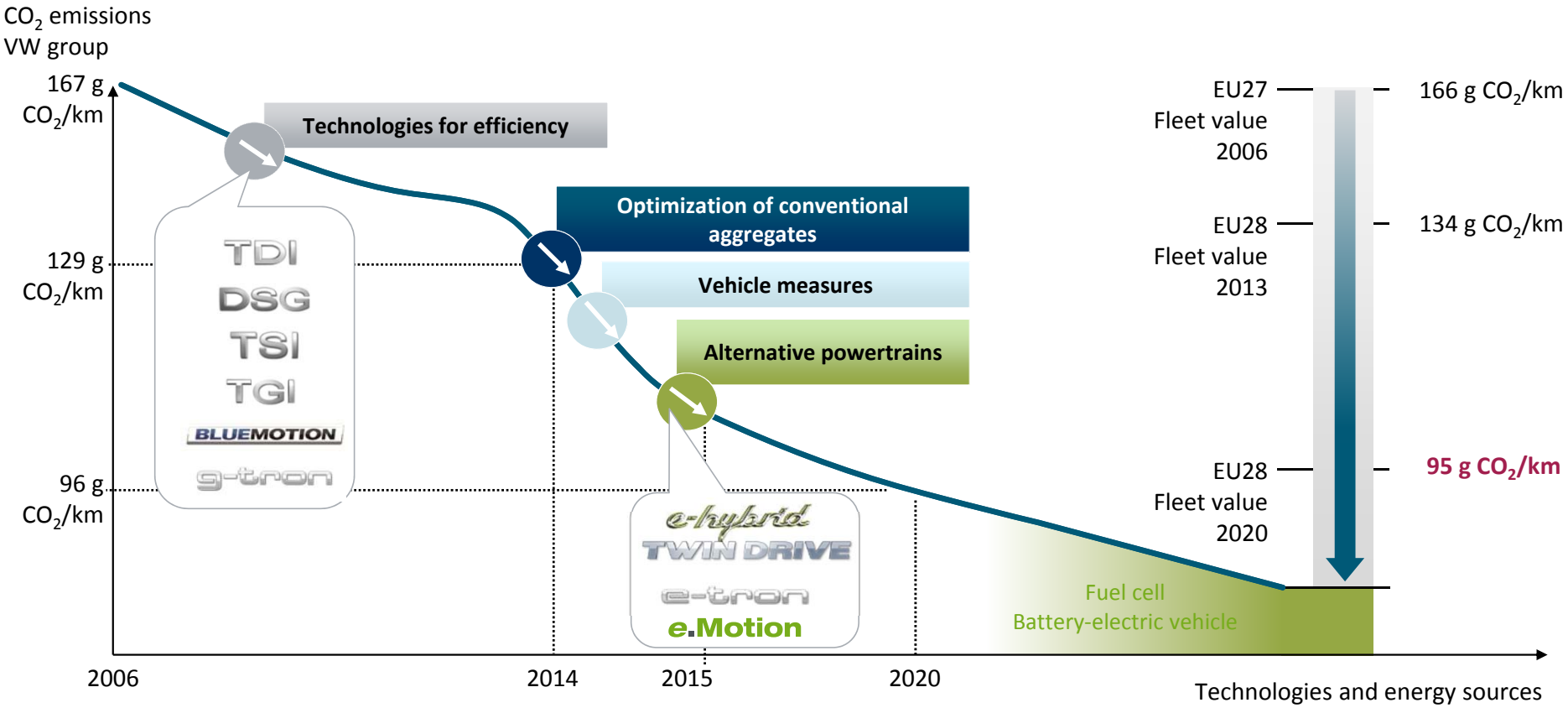
CO_2 TREND IN THE VOLKSWAGEN GROUP



E-GOLF TODAY – SHORT DISTANCE SOLUTION

Technical Data

Maximum speed:	**140 km/h**
Electric motor:	85 kW
Torque:	270 Nm
Consumption, NEFZ:	12.7 kWh/100 km
Electrical range (NEDC):	**190 km**
Energy content battery	24.2 kWh

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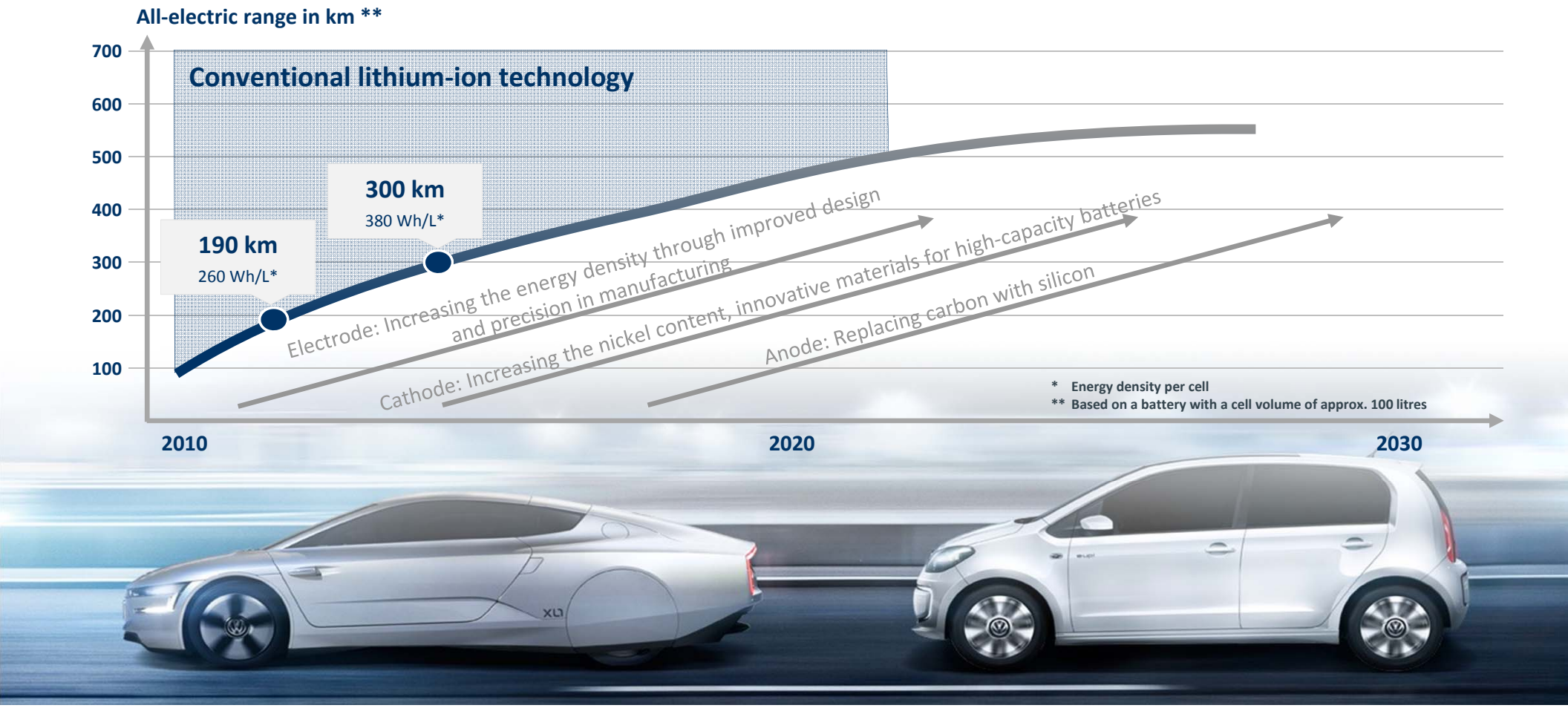
LITHIUM-ION BATTERY: ROADMAP FOR HIGH-ENERGY BATTERIES



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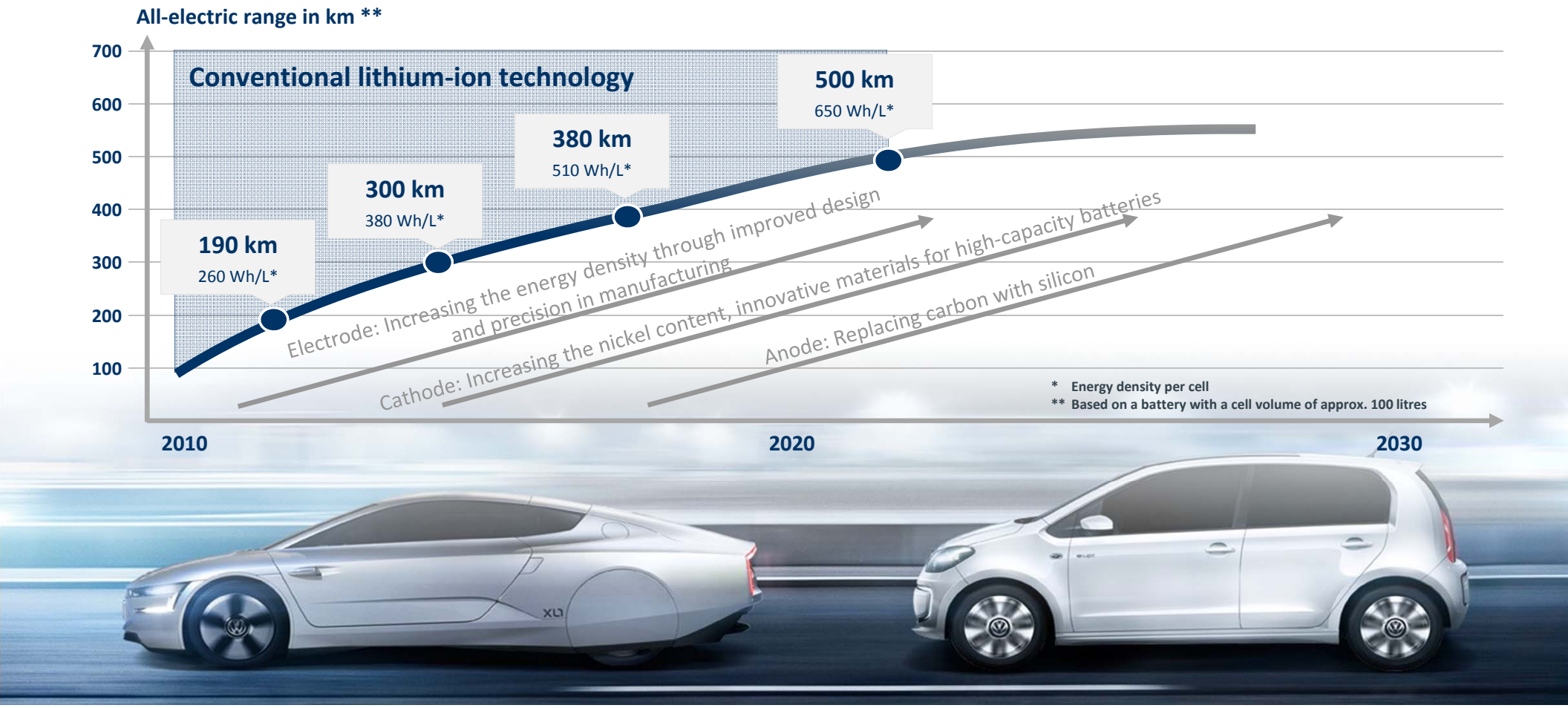
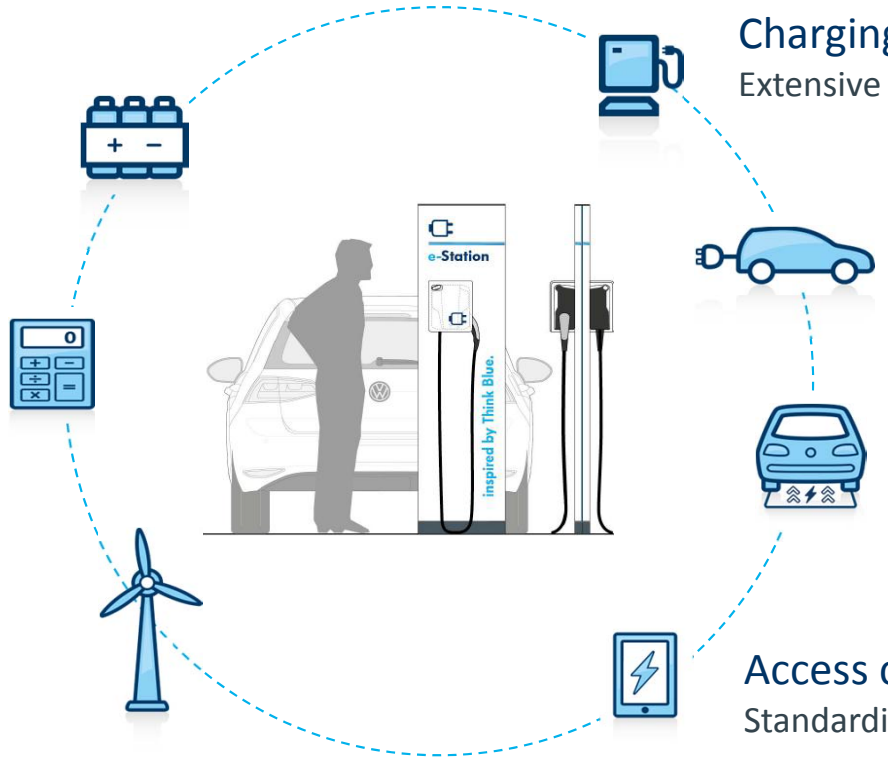


CHALLENGES OF CHARGING

Charging capacity
HV-batteries with high energy content require higher charging capacities.

Operation
Economic efficiency of operation of charging stations

Regenerative energy
Further expansion of CO_2-neutral mobility



Charging infrastructure
Extensive provision of charging stations

Charging interface
Worldwide standardization of the charging plug

Charging comfort
Automatic charging via induction

Access charging station
Standardized authentication and billing

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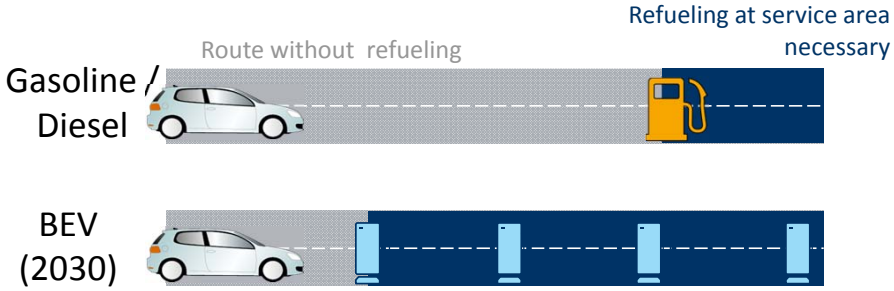
HIGHWAY INFRASTRUCTURE FOR BEVS*

ASSUMPTION: 5 % OR 30 % BEV IN 2030

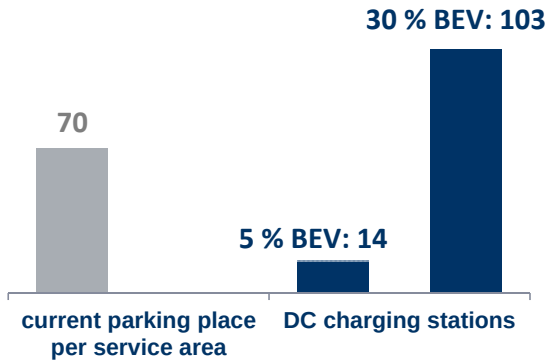
Influence of vehicle range

Example: 800 km highway trip



Number of refueling operations is increasing

Fast-charging stations (200kW)



- ⊕ Individual demand adaption
- ⊖ charging time ~15 minutes for 80% state-of-charge
- ⊖ Exposure of the battery

Connecting power from the grid for service areas of 2.5 MW for 5 % BEV and 20 MW for 30 % BEV in 2030 is required.

* assuming 500km NEFZ-range in 2030

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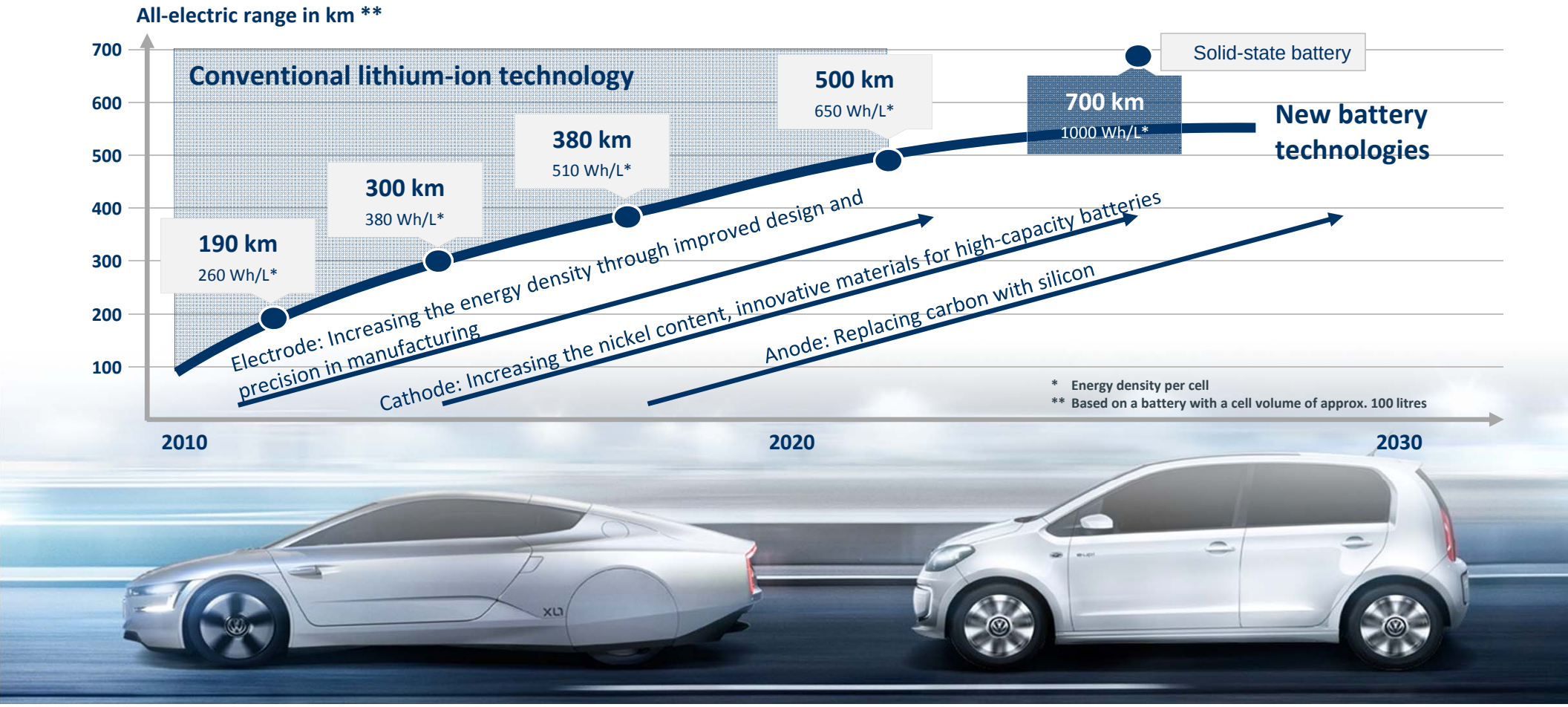
BEYOND LITHIUM-ION BATTERY: SOLID STATE BATTERY



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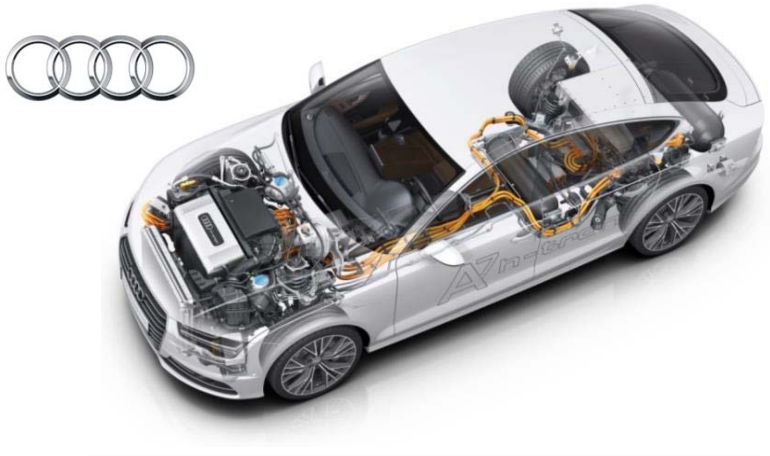
HYMOTION4 – TWO VEHICLE CONCEPTS WITH ONE FUEL-CELL SYSTEM

FOURTH GENERATION OF FUEL CELL VEHICLES IN VOLKSWAGEN GROUP RESEARCH



Volkswagen NMS HyMotion		HyMotion 4	Audi A7 Sportback h-tron quattro	
E-machine:	100 kW	Performance: 80 kW	E-machine:	2 x 85 kW
v_{max}:	160 km/h		v_{max} :	180 km/h
0-100 km/h:	12 sec		0-100 km/h:	8 sec
Range:	420 km		Range:	> 500 km
Battery:	1.1 kWh		Battery:	9.5 kWh

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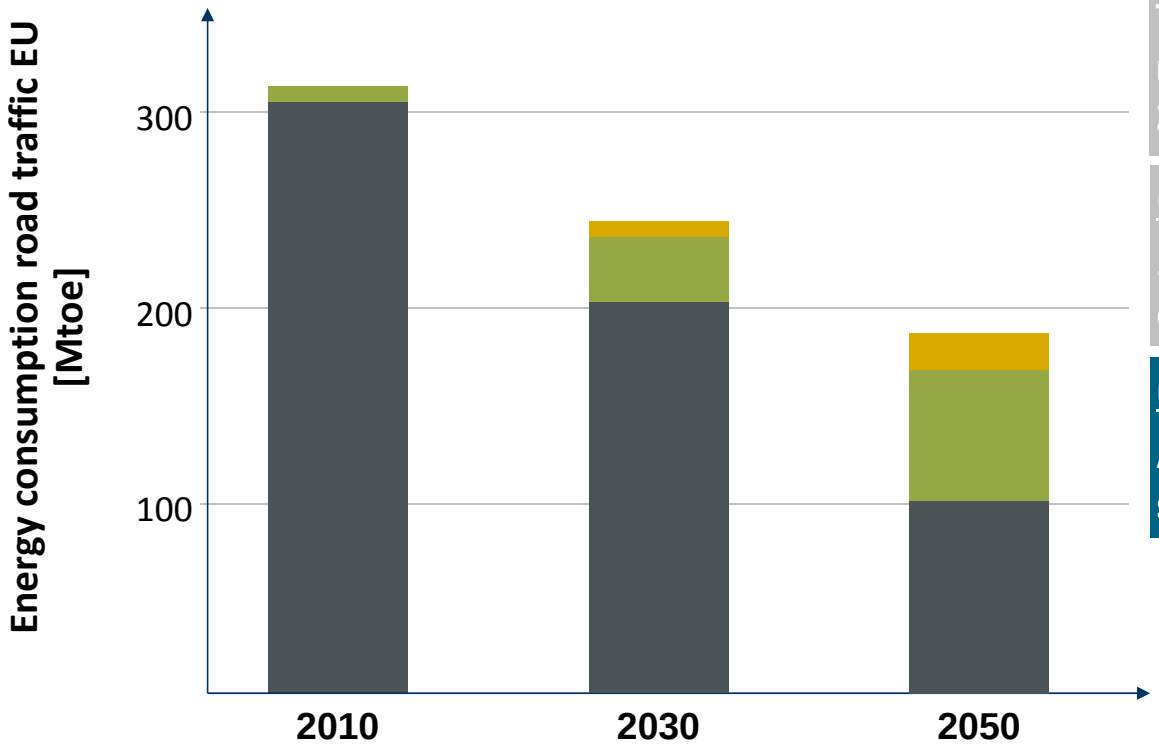

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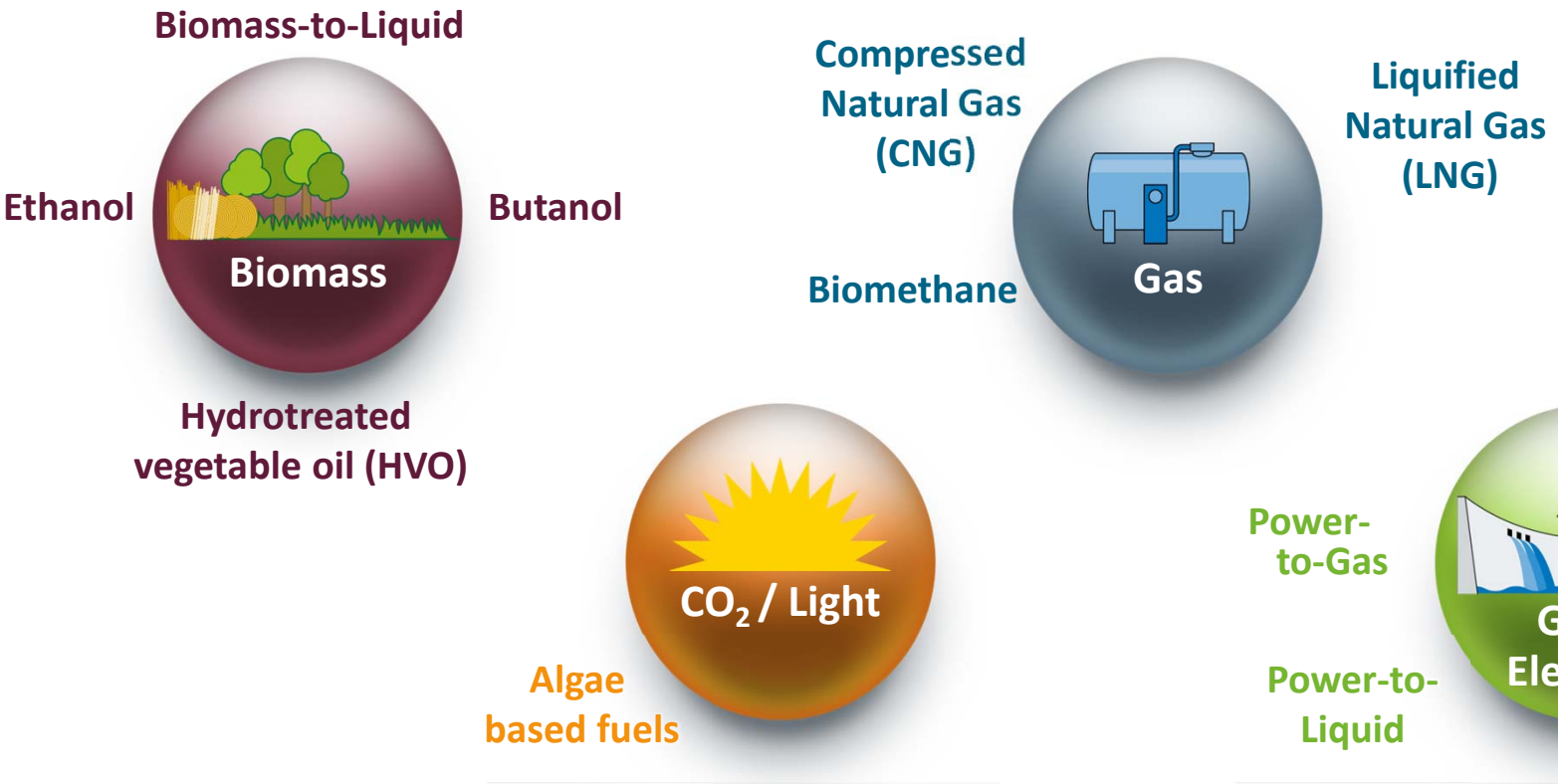
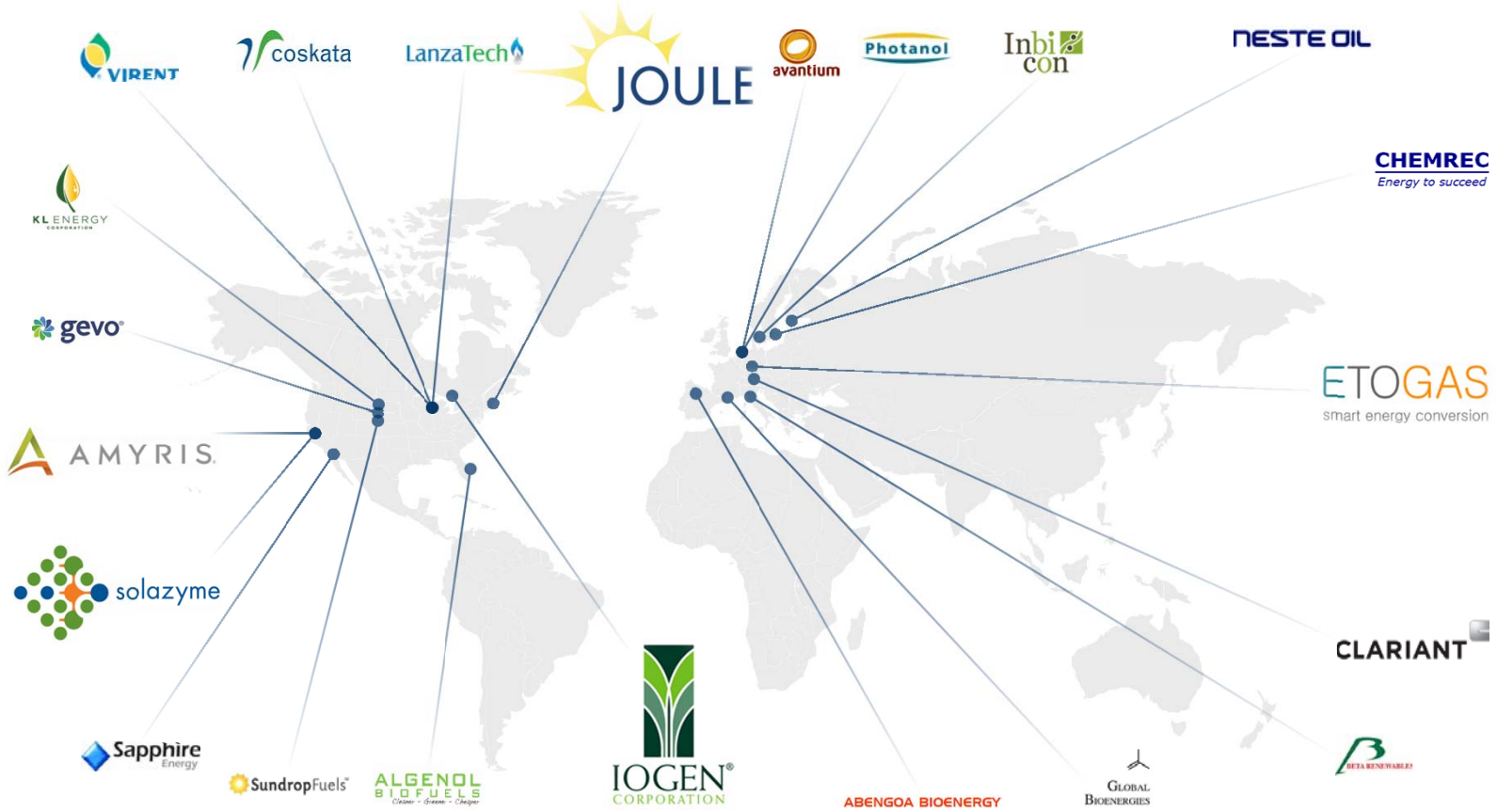
CO2 REDUCED FUELS

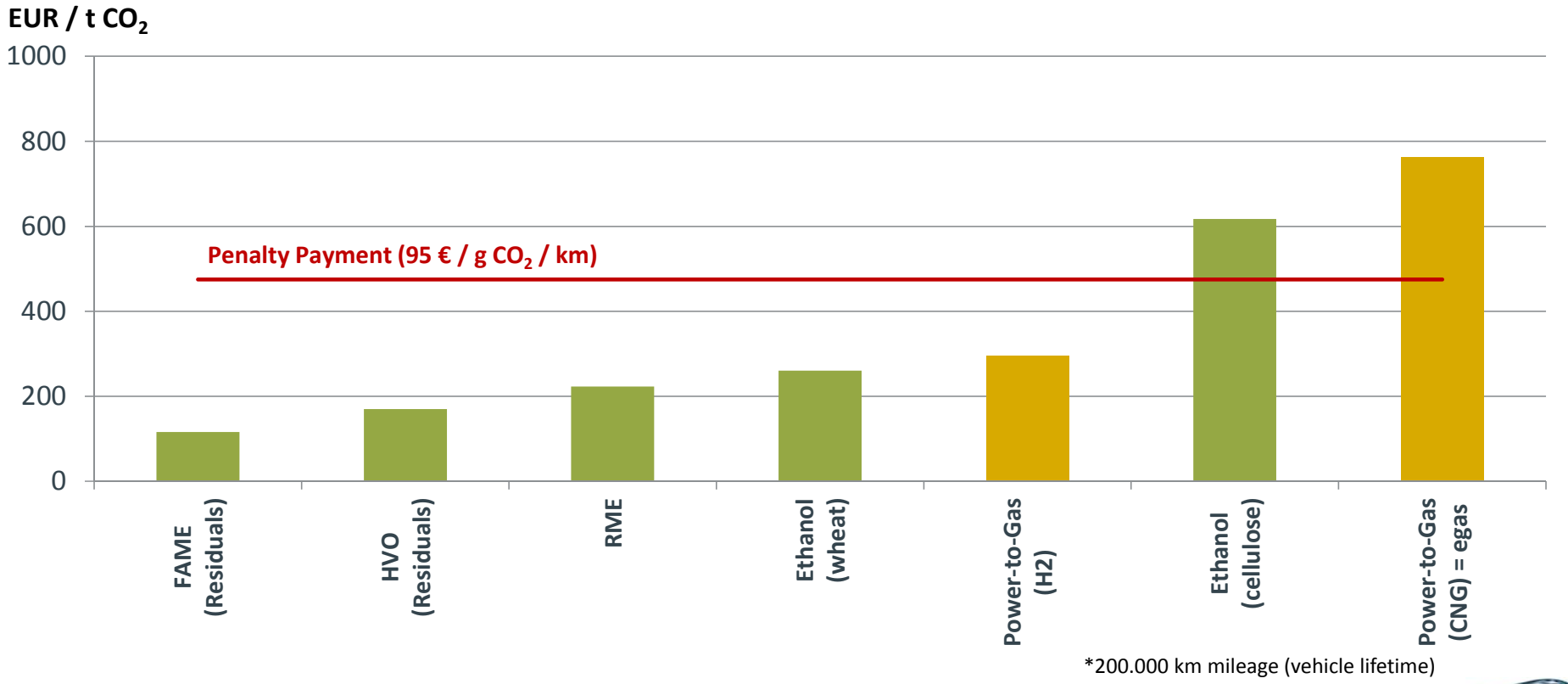


ADVANCED FUELS IN EUROPE AND THE USA (SELECTION)



CO_2-ABATEMENT COSTS 2014

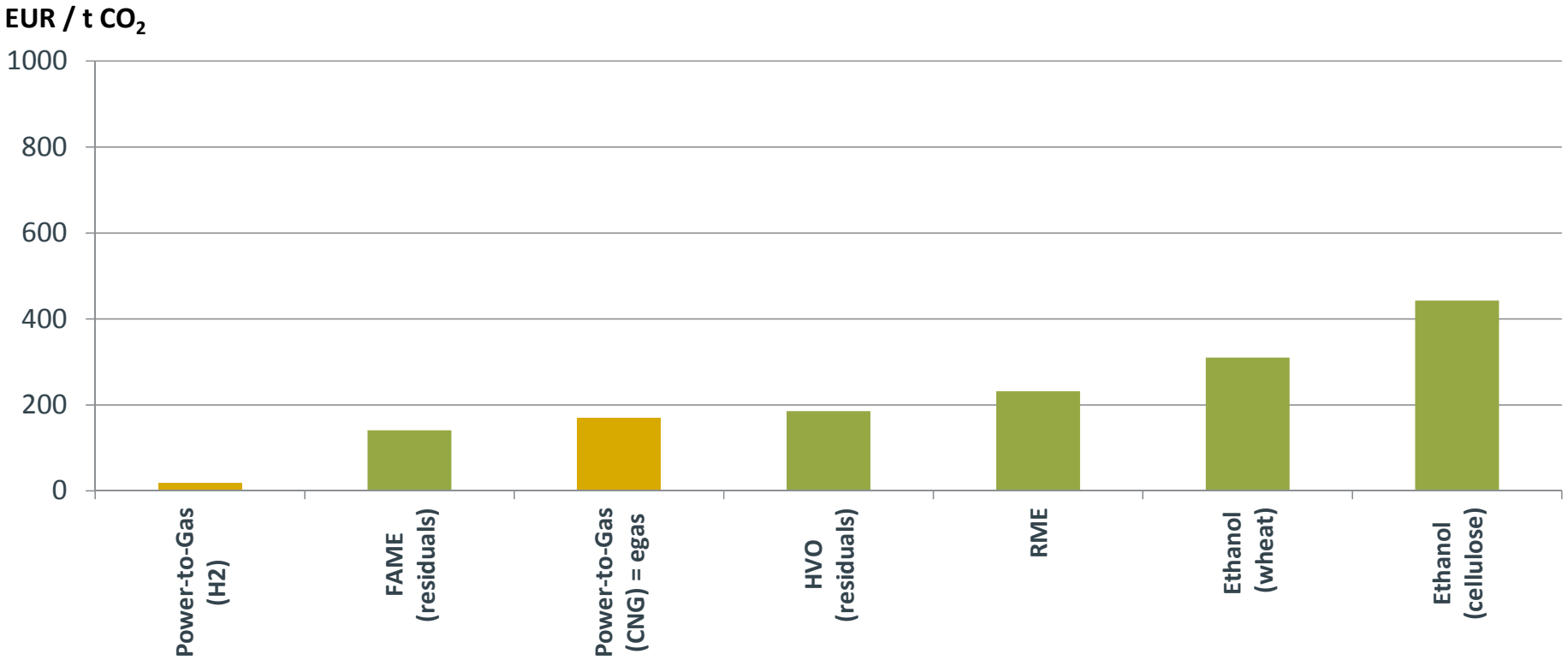
DIFFERENTIAL COSTS TO GASOLINE OVER VEHICLE LIFETIME*



*200.000 km mileage (vehicle lifetime)

CO_2-ABATEMENT COSTS 2020

DIFFERENTIAL COSTS TO GASOLINE OVER VEHICLE LIFETIME*



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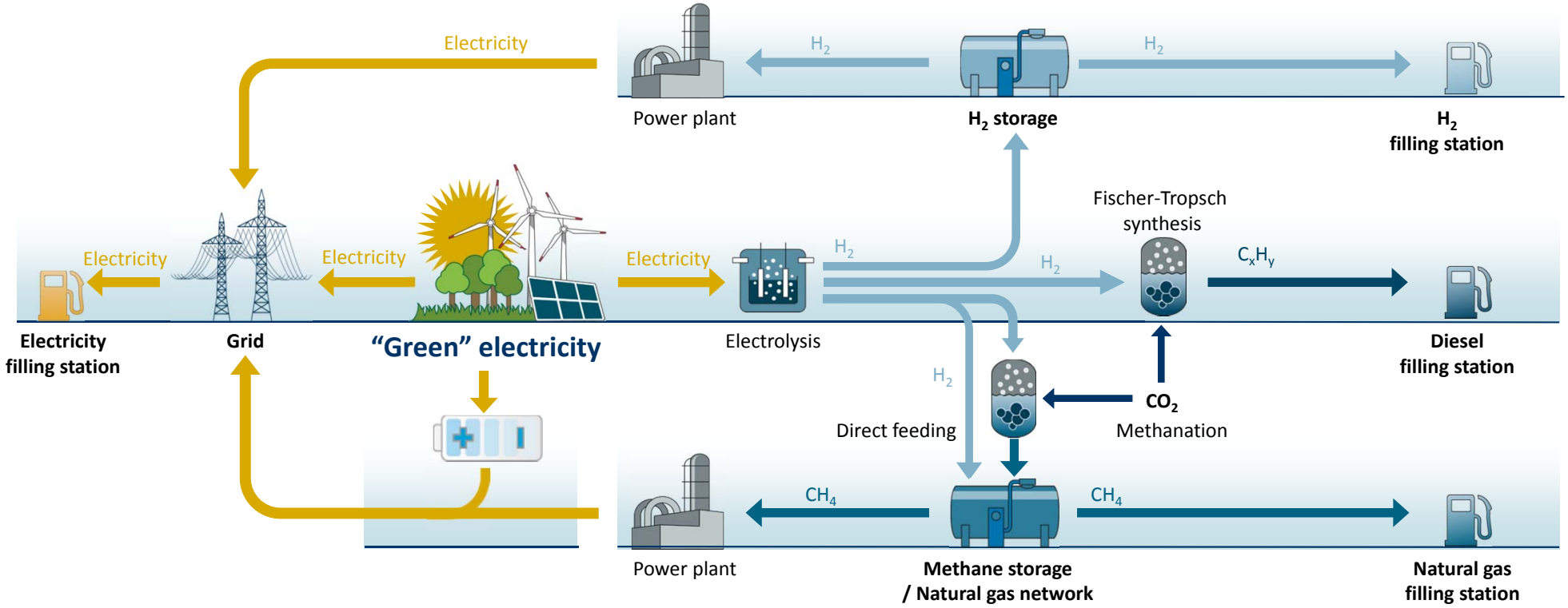
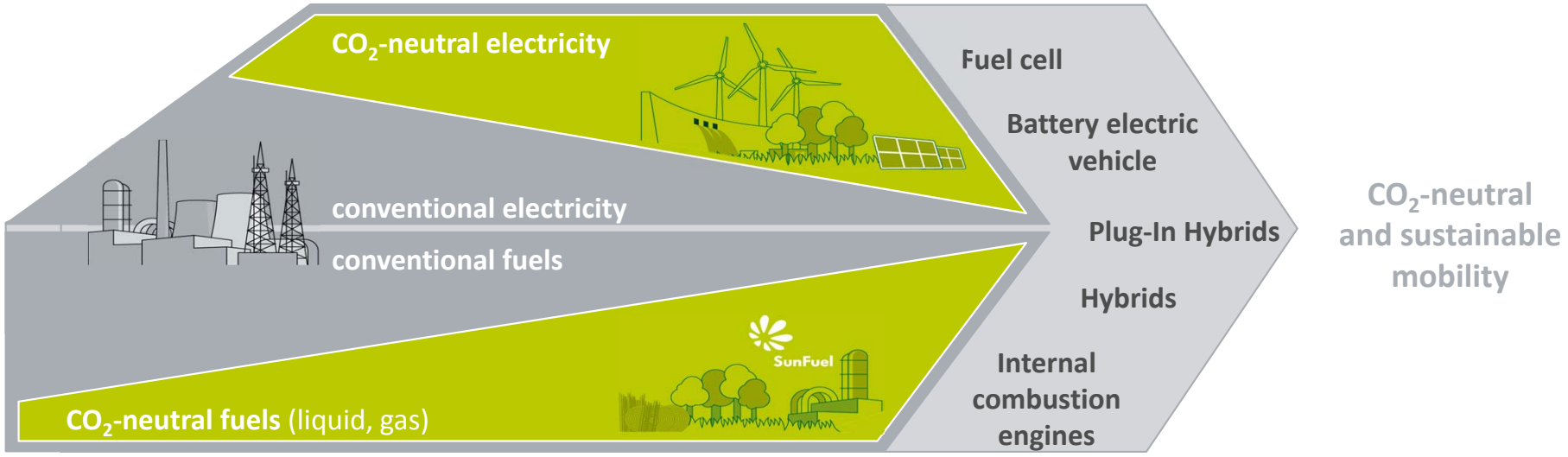
OPTIONS FOR STORING AND USING „GREEN“ ELECTRICITY



The question of future vehicle concepts can only be answered in context with future energy solutions of the energy sector.

VOLKSWAGEN POWERTRAIN AND FUELS STRATEGY

COEXISTENCE OF PROPULSION SYSTEMS



⇨ Coexistence of conventional powertrains and electrified mobility

⇨ Decarbonisation of the energy carrier and higher powertrain efficiency

⇨ A portfolio of various drivetrains will fulfil the customer expectations

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