



Autoemotion

Project Twin Drive First step to Electrical Vehicle

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1. Project motivation.

Motivation

- § The trends in the car market show a progressive bigger interest for **low consumption and emissions** cars as well as for the ones that are able to **use clean energies** (regenerative energy).
- § Within the different technologies for alternative power train systems studied by SEAT and Volkswagen since the 1990's the **Twin Drive concept** takes a relevant place in the last two years.
- § SEAT has chosen the Twin Drive concept as it **reduces the consumption and emissions** substantially and allows a reasonable range by **pure electric driving** without emitting pollution and using if desired only clean energies.
- § The Twin Drive technology is considered by SEAT as the **suitable previous step** towards the pure electrical as both technologies are in certain aspects very similar.

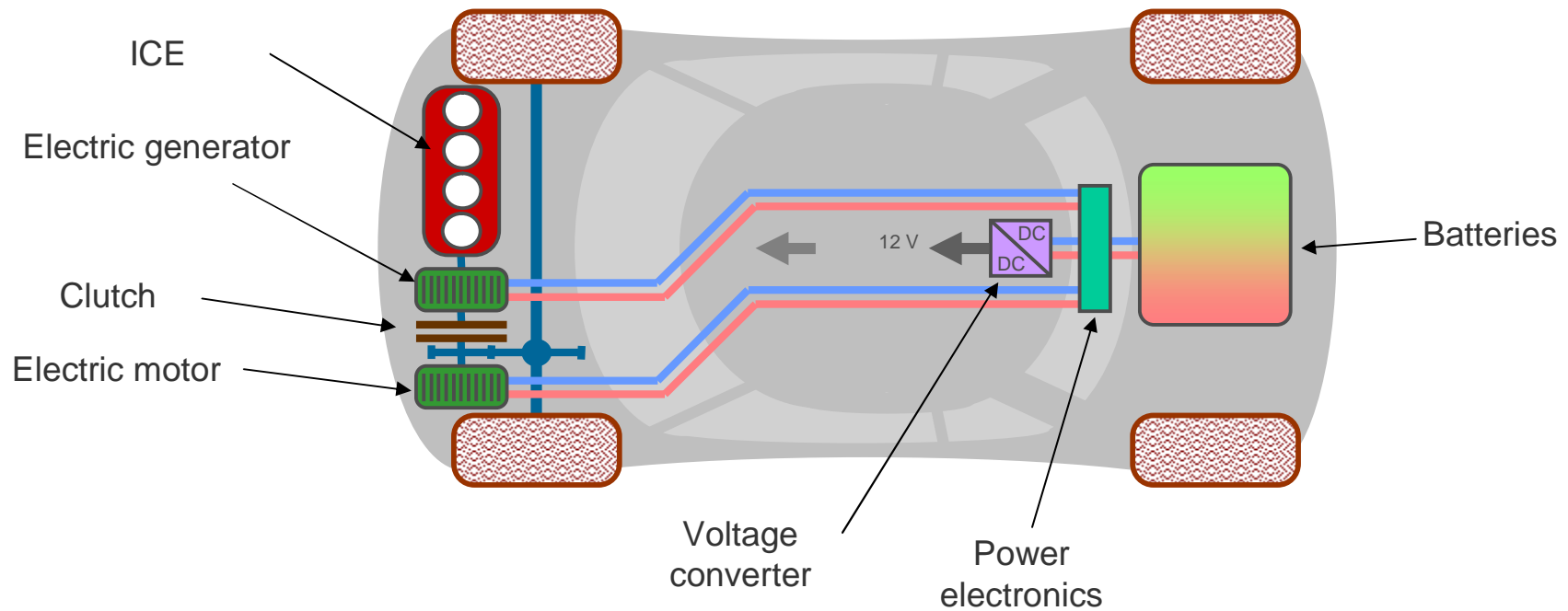
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2. Project description

Basic Concepts Twin Drive 2



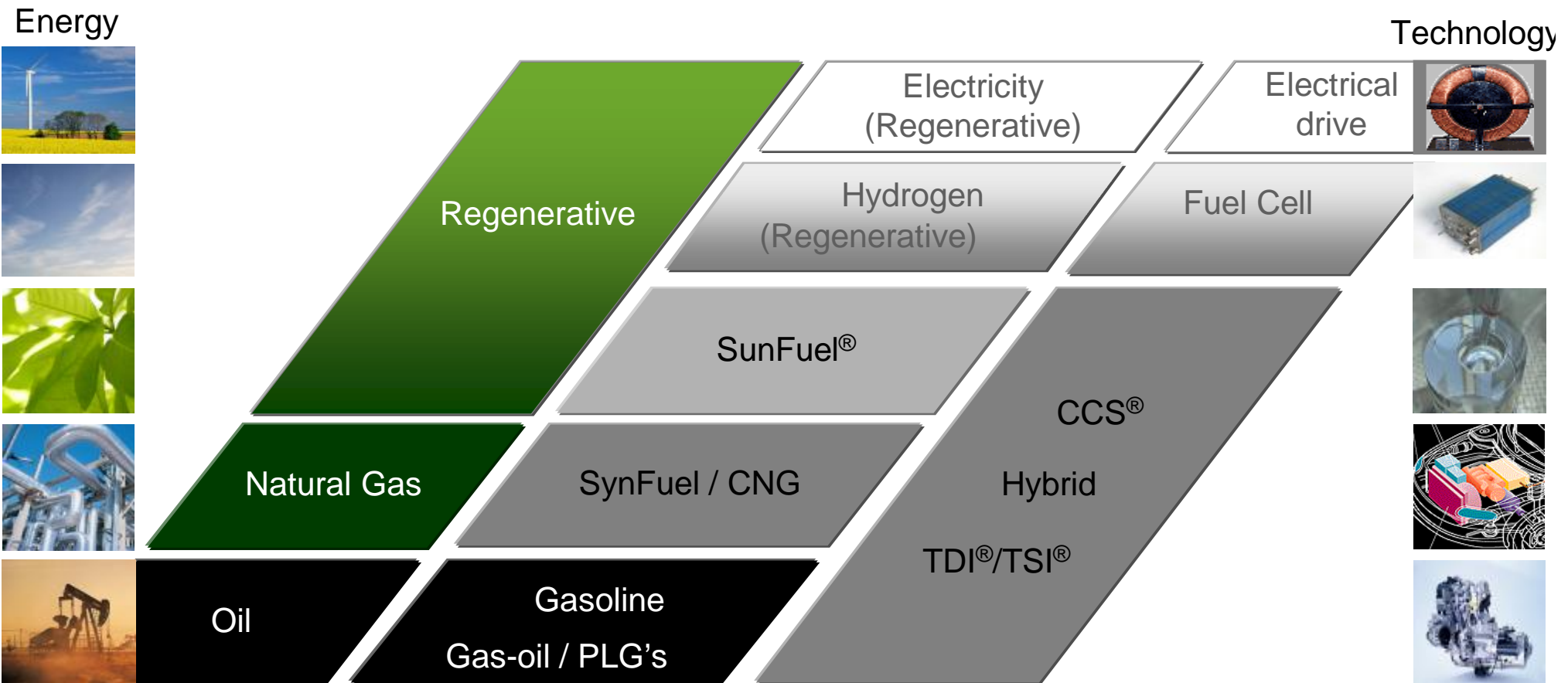
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3. Basic concepts for hybrid vehicles.

Power train Strategy for different energies in VW Group

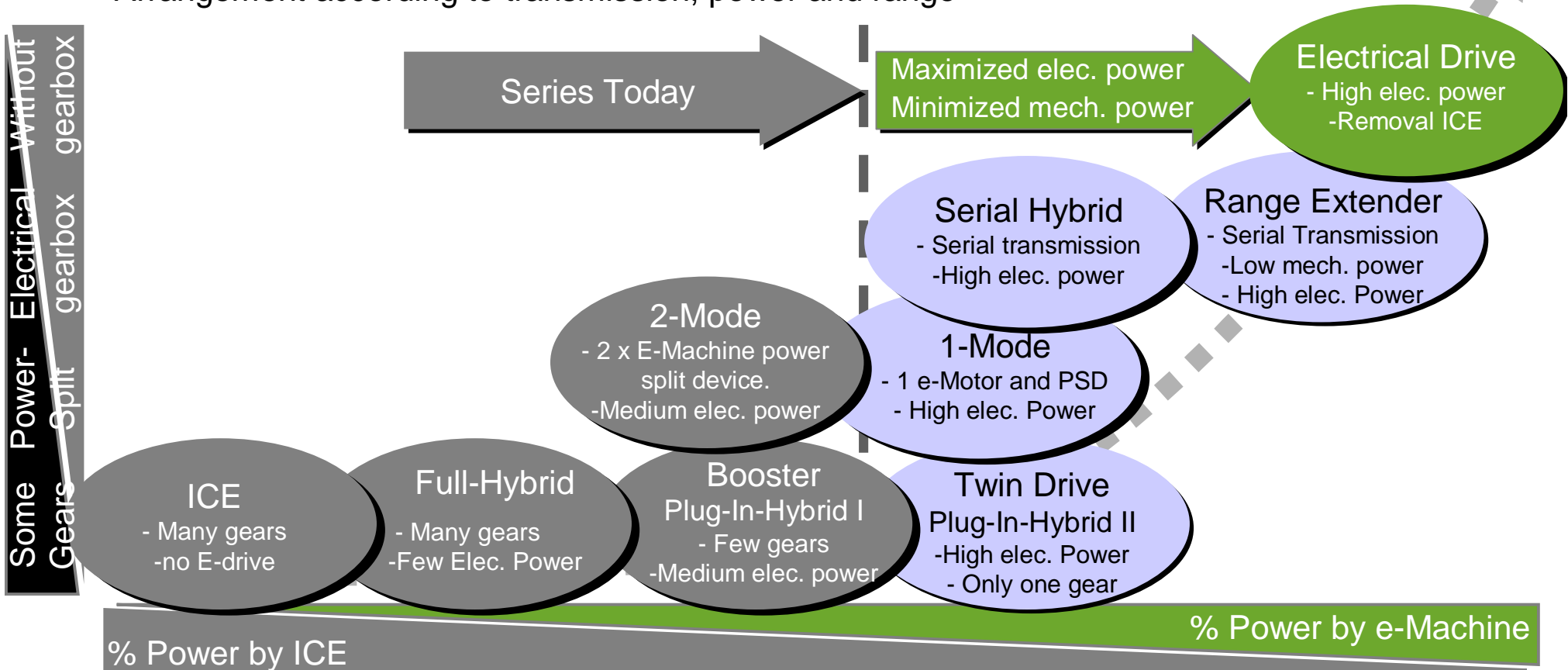


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3. Basic concepts for hybrid vehicles.

Power train electrification. Concept overview according to main parameters

Arrangement according to transmission, power and range



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3. Basic concepts for hybrid vehicles.

Power train electrification. Summary of concepts and terms

§	Electrical Power	<<	ICE Power	=>	ECO-Power (Mild Hybrid)
§	Electrical Power	~<	ICE Power	=>	Booster (Full Hybrid)
§	Electrical Power	>~	ICE Power	=>	Twin Drive
§	Electrical Power	>>	ICE Power	=>	Range extender
§	Electrical Power high enough			=>	Pure electric car

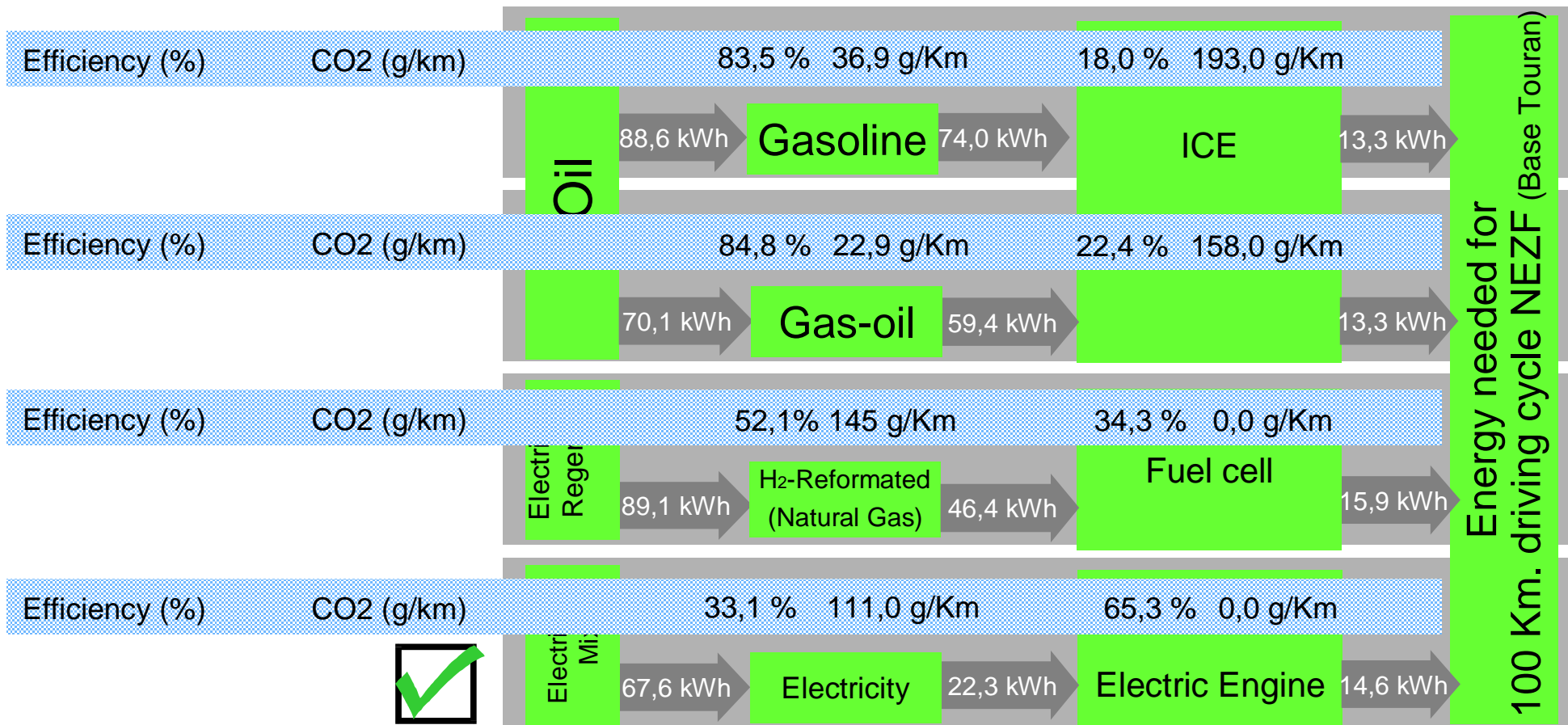
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4. Studied alternatives and concept selection

WTW Efficiency Balance of energies, energy carriers and Power trains.

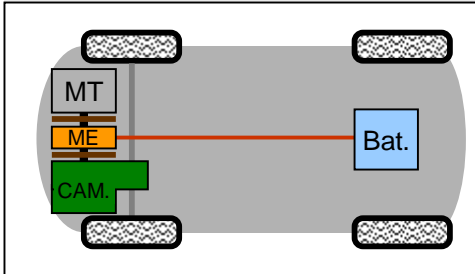


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4. Studied alternatives and concept selection

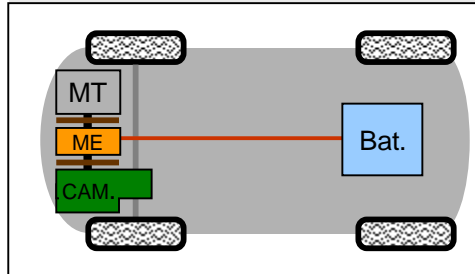
Power train electrification . Architecture and characteristics.

Full-Hybrid
Paralel Hybrid




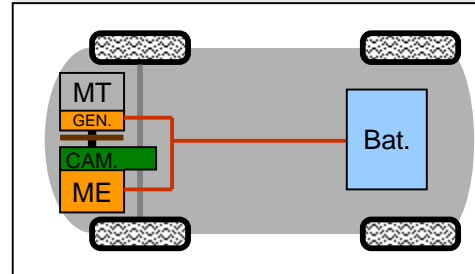
- Parallel propulsion and elec. Power ~ 15 KW/t.
- Direct transmission with gearbox (6,7 gears).
- Concept for consumption optimization : Start-Stop, Energy recovery.

Booster
Plug-In-Hybrid I



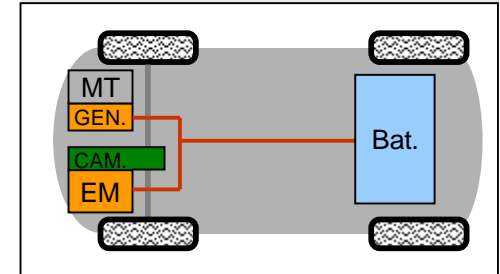
- Parallel propulsion with bigger elec. power.
- Direct transmission with gearbox (4,5 gears)
- Concept for low elec. Range (5...30 km) and boost function.

 TwinDRIVE
Plug-In-Hybrid II



- Parallel or serial propulsion with medium elec. power
- Direct transmission (parallel) with only one gear.
- Concept for medium elec. range (30...80 km)

Range Extender



- Serial propulsion and high elec. power.
- Without direct transmission from the ICE
- Concept for a higher elec. Range (80...120 km)

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4. Studied alternatives and concept selection

Summary of reasons for choosing Twin Drive.

§ Advantages vs. a conventional ICE vehicle

§ Hybrid mode with around **25% consumption and emissions saving** by NEFZ cycle

§ **Electric mode** with 50 Km. range.

§ Possibility to load electricity from the 220 V elec. net using **cheaper and clean energy** which supposes less or no CO₂ emissions (depending on the electricity production).

§ Advantages vs. Range extender and Pure electric vehicle

§ Dimensions and weight from the new elements in the vehicle are not critical and allow a reasonable **integration** in the existing vehicle architecture.

§ **Previous step** to pure electrical vehicle ensuring range required from costumers and reasonable costs.

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§ Project Motivation

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§ Project description

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§ Basic concepts for hybrid vehicles.

4

§ Studied alternatives and concept selection

5

§ Technical, economical and industrial challenges

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5. Technical, economical and industrial challenges.

Propulsion electrification. Main weak points

- § This new technology presents today some weakness which should be improved in order to become a competitive technology in a mid term.
- § The **specific energy storage** capacity of the Li-ion batteries is too low in comparison with other systems.
- § The Li-ion Batteries are **dangerous** and require expensive production, transport and service procedures as well as specific facilities.
- § The **specific cost** per KWh y KW of batteries and e-machines makes harder to get the profitability of the projects based in these technologies. There is no possibility to reduce costs without a big technological change.
- § The **high investments** needed for the development of these technology, complicates the progress specially in the existing economic climate.
- § In order to establish a favorable framework for the development with some competitors that pushes the cost reduction, is necessary to **promote the interest** in this technology and its development.

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5. Technical, economical and industrial challenges.

Example of promotion of this technology by a multi-branch association. Germany

Mission:

- § Experimentation with a fleet of 20 vehicles from Volkswagen in Berlin and Wolfsburg

Additional Partners to Volkswagen:

- § E.ON as a energy producer and supplier: Supplies the energy and prepares the net and control systems for it as well the Business cases.
- § University of Münster: Research in Chemicals in the field of cells to improve the energy storage.
- § Evonik / LiTec, GAIA, Fraunhofer Gesellschaft ISIT: Development of new product and production technologies for batteries for automotive applications.
- § IFEU: Check of the CO₂ emissions of the fleet (with the cooperation of VW)
- § DLR: Determinate customer profiles, customer survey, etc...





on to emotion

Thanks for your attention