ERTRAC Conference
Implementing the Strategic Research Agenda

Decarbonization

Hybridization of Powertrains in Road Transport

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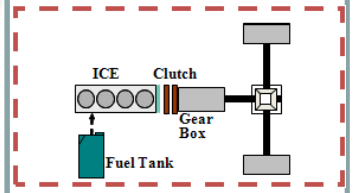
European Roadmap Hybridisation of Road Transport

Surroundings of Hybrids

The challenge of decarbonisation of transport at acceptable costs, could not be solved without Hybrids

Conventional Vehicles



Hybrid Electric Vehicles

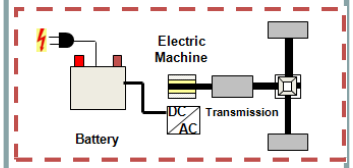
Micro Hybrid | **Mild Hybrid** | **Full Hybrid (Parallel /Power-Split / Serial)** | **Plug-In Hybrid Range Extender**

- + Pure Electric Drive
- + Electric Take-off
- + Engine Assistance
- + Kinetic Energy Recovery
- Start - Stop

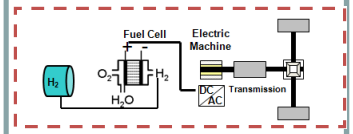
Hybridisation aiming at assisting the combustion engine

Hybridisation aiming at running the vehicle by electric propulsion

Battery Electric Vehicles



Fuel-Cell Electric Vehicles

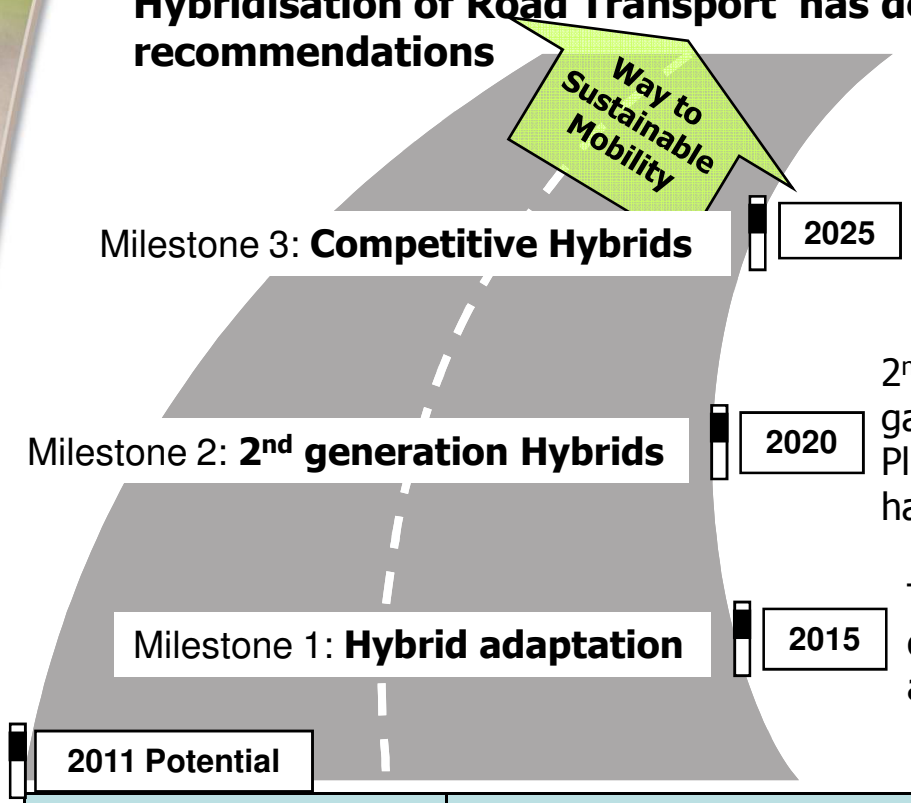


- ⇨ **Hybrid Electric Vehicles combine the advantage of two different propulsion systems:**
  To drive with zero emission and to drive more efficient on long distances
- ⇨ **Hybrids suits a lot of vehicle configurations:**
  Small city cars, long distance family cars, delivery vans, city-buses

European Roadmap Hybridisation of Road Transport

Milestones

In order to strengthen and extend the competitiveness of European automotive industry in the field of Hybrid Vehicles, the 'European Roadmap Hybridisation of Road Transport' has defined the necessary milestones and recommendations



Hybrid Vehicles competitive regarding costs and benefits will conquer the market. Modular and flexible Hybrid Vehicle designs will make the market more interesting.

2nd generation hybrids will provide efficiency gains for all consumers. Mass production of Plug-In Hybrids and Range Extender Hybrids has started.

The already started and ongoing introduction of hybrids into the market is based on the adaptation to existing vehicles.

	Application	ZEV range (km)	CO_2 reduction potential
Plug-In Hybrid	Best application for 'All-Round' cars	20 km – 80 km	15% - 90%
Range Extender Hybrid	Proper solution for city traffic	80 km-120 km	10% - 95%

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Main Recommendations

Future challenges for the Hybrids will be surely:

- ⇨ **The relation costs vs. benefits. The question will be which additional Hybrid costs will be accepted by the customer, which (cost) benefits can be achieved during a reasonable time of operation**
- ⇨ **To enlarge the ZEV range, to adapt the ICE to Hybrid demands, to make Hybrids lightweight, safe and more robust**
- ⇨ **To overcome those challenges, research efforts must be undertaken mainly for the following fields:**
  - ⇨ **Energy Storage Systems**
    Batteries smaller, cheaper, lightweight, safe, more robust, long life time and with high power & energy density
  - ⇨ **Drive Train technologies**
    New concepts for electrical machines & electro mechanical technologies, low-cost, lightweight
  - ⇨ **System Integration & Modular Hybrid Architecture**
    To build robust, small, integrated and efficient hybrid configurations
  - ⇨ **Grid Integration**
    Fast, contact-less, bidirectional charging infrastructure
  - ⇨ **Safety Aspects**
    Crashworthiness of lightweight / small cars
  - ⇨ **Integration into the Transport system**
    Development of solutions capable for high number of pieces (mass production)