

# Constructeurs d'Automobiles Européens : vision du *futur en R&D* dans le domaine de la motorisation

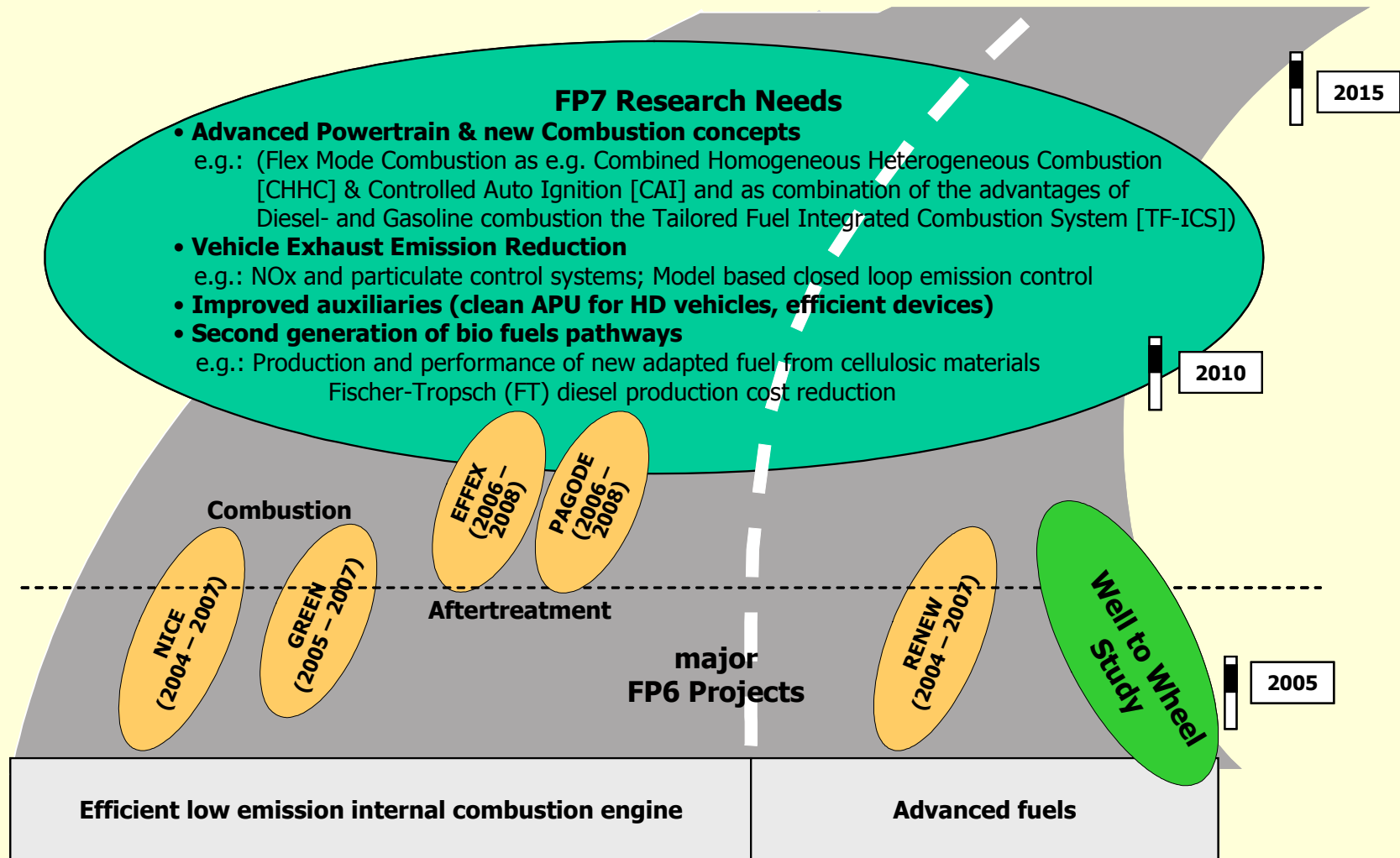
- Divers groupes de travail ont étudié la proposition du **programme PCRD7**, que la **Commission Européenne** a dévoilé en 2005. Parmi ces groupes, le **groupe Powertrain de EUCAR** a formulé des contributions plus détaillées aux programmes de travail de PCRD7. Ces propositions ont été enrichies par les travaux d'autres organismes au niveau européen. Les suggestions assemblées ont été publiées par EUCAR. Cette vision ne devrait pas être interprétée comme couvrant tous les aspects de R&D de la recherche future pour les véhicules à moteur. C'est plutôt le résultat actuel donné par les groupes de travail de **l'inventaire des priorités pour la recherche future**.
- Cette présentation s'intéresse uniquement à la partie Groupe Motopropulseur et Carburants de ces propositions. La motivation des recherches futures est de **minimiser l'impact des émissions des polluants sur la qualité de l'air et de promouvoir des technologies de réduction des gaz à effet de serre**. La synthèse est donnée ci-après :

# Output of SG- P on Research Priorities

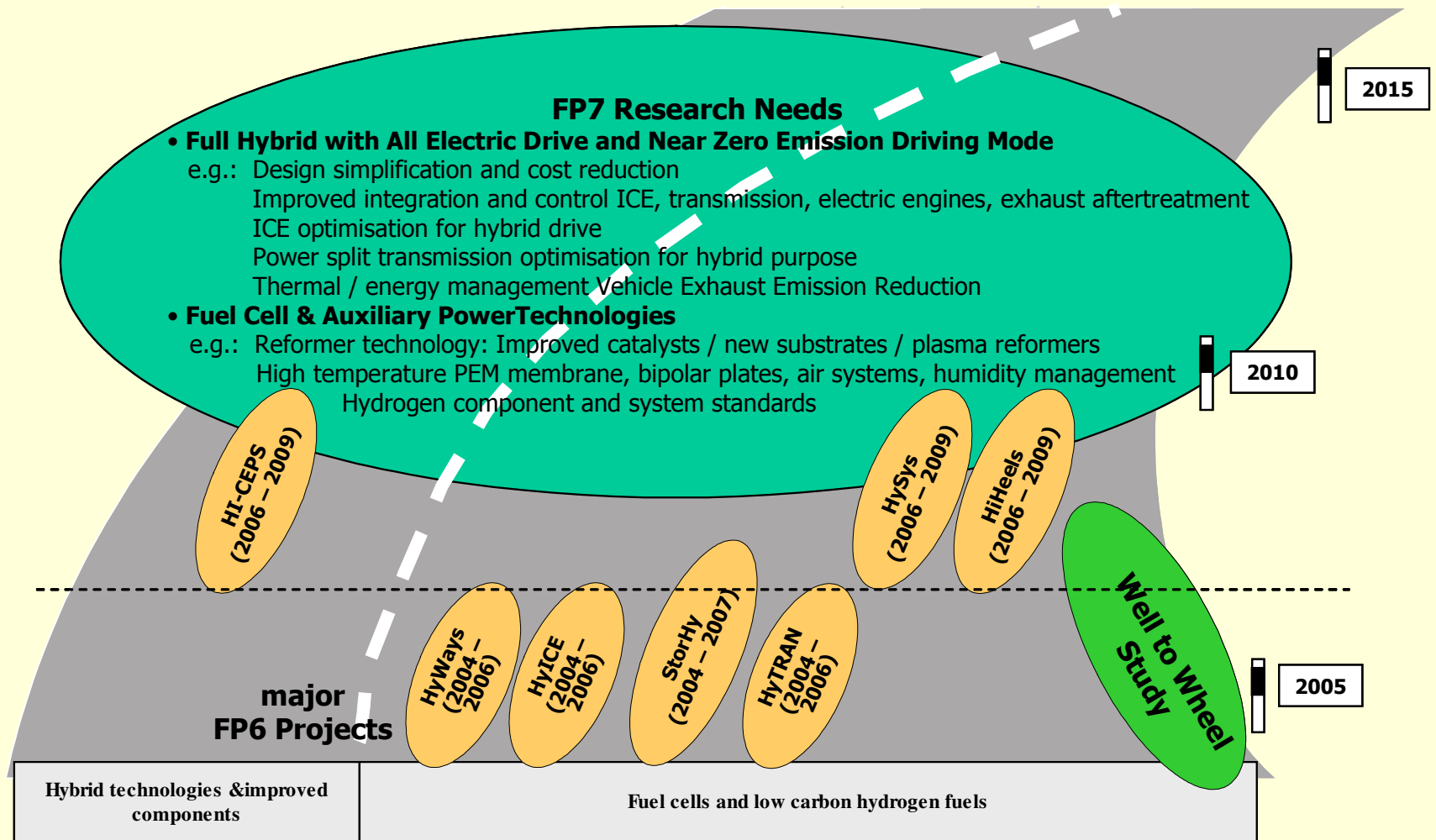
## Major Topics for Powertrain Issues:

- **Efficient low emission internal combustion engine vehicles & advanced fuels**
- **Hybrid technologies & improved components**
- **Fuel Cells and low carbon hydrogen fuels**
- **Elements on Improved vehicle design and Strategic analyses**

# Efficient Low Emission Internal Combustion Engine Vehicles and Advanced Fuels



# Hybrid Technologies & Fuel Cells and Low Carbon Hydrogen Fuels



# Efficient Low Emission Internal Combustion Engine Vehicles and Advanced Fuels (1)

For the period **to 2020**, **Internal Combustion Engines** will continue to be **the propulsion backbone as powertrain** for Passenger Cars, Light Duty Vehicles and Heavy Duty Trucks.

**The *Integrated system approach*** begins to be more and more important.

In the future, vehicles with Internal Combustion Engines (ICE) have to be regarded as ONE system in the chain of:

- new advanced combustion processes
- with dedicated transmission
- and integrated aftertreatment
- with optimum fuel formulations (including synthetic and bio-components)

# Efficient Low Emission Internal Combustion Engine Vehicles and Advanced Fuels (2)

To achieve **this *Integrated System Approach***, research needs are:

- Advanced Powertrain & new Combustion concepts for high efficiency and low emissions
  - Advanced combustion processes (Flex Mode Combustion as e.g. Combined Homogeneous Heterogeneous Combustion [CHHC] & Controlled Auto Ignition [CAI] and as combination of the advantages of Diesel and Gasoline combustion the Tailored Fuel Integrated Combustion System [TF-ICS])
  - High efficiency HD Diesel
  - Flexible and enhanced powertrain components (Variable Valve Actuation, fuel injection, boost, lean operation, adapted ignition systems)
  - Improved control (combustion mode change, information enabled drivetrain control, thermal management of engine and aftertreatment system)
  - High specific torque (downsizing)
  - Advanced air management (boosting, high EGR levels)
  - Advanced transmission systems and control
  - Efficient CNG engines
  - Flexible CNG tank technology

# Efficient Low Emission Internal Combustion Engine Vehicles and Advanced Fuels (3)

- Vehicle Exhaust Emission Reduction
  - NOx and particulate control systems
  - Model based closed loop emission control
  - Improved CO and HC treatment
  - New substrates and catalysts
  - Aftertreatment for Gas engines
- Vehicle Energy Management
  - Air conditioning and cooling systems
  - Improved auxiliaries (clean APU for HD vehicles, efficient devices)
- Improved materials
  - Light Weight Materials and Reduced Friction
  - Advanced Lightweight Powertrain (target : 20% reduction)
  - Design and material for high pressure and high temperature ICE
- Fuels to improve engine efficiency and emission
  - Adapted fuels for new combustion processes CHHC, CAI and TF-ICS
  - Fischer Tropsch (FT) diesel production cost reduction
  - DME, engine technology and fuel production
  - Production and performance of new fuel formulations (Reduction of aromatics in fuels)

# Hybrid Technologies & Improved Components

Research targets are to reach the most stringent urban emission targets (eg Enhanced Environmental Vehicle (EEV) emission levels) at competitive cost.

- Full Hybrid with All Electric Drive and Near Zero Emission Driving Mode
  - Design simplification and cost reduction
  - Improved integration and control of ICE, transmission, electric engines, exhaust aftertreatment
  - ICE optimisation for hybrid drive
  - Power split transmission optimisation for hybrid vehicles
  - Thermal / energy management
  - Energy recovery with high efficiency
  - High efficiency/low cost energy storage media and devices (batteries, materials, auxiliaries, converter)
  - High voltage components
  - Vehicle energy management and control systems
  - Electric motors: package, cost, efficiency, specific power
  - Power electronics: high temperature, low cost, integration in e-motor
  - Wiring, connectors, switches, fuses for high voltage application
  - Standards for e-components
  - Vehicle safety



# Fuel Cells and Low Carbon Hydrogen Fuels

Research target is that Fuel Cell Vehicles begin to contribute to carbon dioxide reduction by 2020.

- Fuel Cell & Auxiliary Power Technologies
  - Reformer technology: improved catalysts, new substrates, plasma reformers
  - High temperature PEM membrane, bipolar plates, air system, humidity management
  - Balance of plant components
  - Hydrogen component and system standard
  - Components such as air supply units, sensors, controls and power electronics
  - Cost-effective low carbon-routes for H<sub>2</sub> production and distribution
- Hydrogen production, handling and storage
  - Hydrogen liquefaction with high efficiency
  - Reversible storage systems for transport applications
  - Safety in hydrogen production, storage, distribution and use.
- Hydrogen from non-fossil sources
- Hydrogen from HCs with carbon capture and storage

# Future vehicle design elements

New approaches incorporating advanced architecture, embedded systems, systems engineering and communication technologies offer improved vehicle performance, Research is needed over a broad area covering:

- **Application of wireless technologies inside the vehicle**
- **Sustainable Electromagnetic Environment**
- **Software and System Engineering**
- **Improved quality by improved electronic components**