Project general information

Project name:	HySYS – Fuel Cell Hybrid System Component Development
Coordinator:	DaimlerChrysler, Dr. Jörg Wind
Project main partners:	CRF, DC, PSA, Renault, Volvo, VW, AVL, Bosch, Continental Temic, Magna Steyr, Saft, ATB, Fischer
Starting Date:	01.12.2005
Ending Date:	30.11.2009
Budget Total / Funding:	22.7 MEURO / 11.2 MEURO
FP6 Thematic Area:	Sustainable Development, Global Change and Ecosystems

Motivation and Objectives

Motivation:

- Improvement of system components for FC-hybrid vehicles is necessary to meet all necessary requirements for mass production
- System components for electric drive trains for FCV and HEV is necessary as well
- Close cooperation of car industry with suppliers is needed for a successful market introduction of FC and ICE-hybrid vehicles
- Involve supplier industry more deeply in FC- and ICE Hybrid component development by cooperation in a European project

Objective:

- Improved low cost FC-system components (air supply, hydrogen supply, humidifier, H2-sensors) suitable for mass production
- Improved low cost E-drive components (E-motor, power electronics, battery) suitable for mass production
- Optimised system architecture for low energy consumption and high performance
- All achievements will be validated in vehicles (2 validators)

IP structure HySys

Project Management (DC) — SP 1000

Standardisation and Requirements (AVL) — SP 2000

- WP 2100 Definition of system and vehicle requirements(DC)
- WP 2200 Identification and analysis of synergies with ICE Hybrids (AVL)
- WP 2300 Codes, Standards and Safety (Renault)
- WP 2400 Training activities (AVL)

FC System Components (DC) — SP 3000

- WP 3100 Air Supply(DC)
- WP 3200 Humidification (DC)
- WP 3300 H2 sensors (PSA)
- WP 3400 Hydrogen Line (CRF) (Injectors)

Drive Train Components (CRF) — SP 4000

- WP 4100 Electric drive w. stepup: Bench Test (CRF)
- WP 4200 Electric drive w. DC/AC+DC/DC integration (DC)
- WP 4300 Battery Systems (Saft)

System Level (PSA) — SP 5000

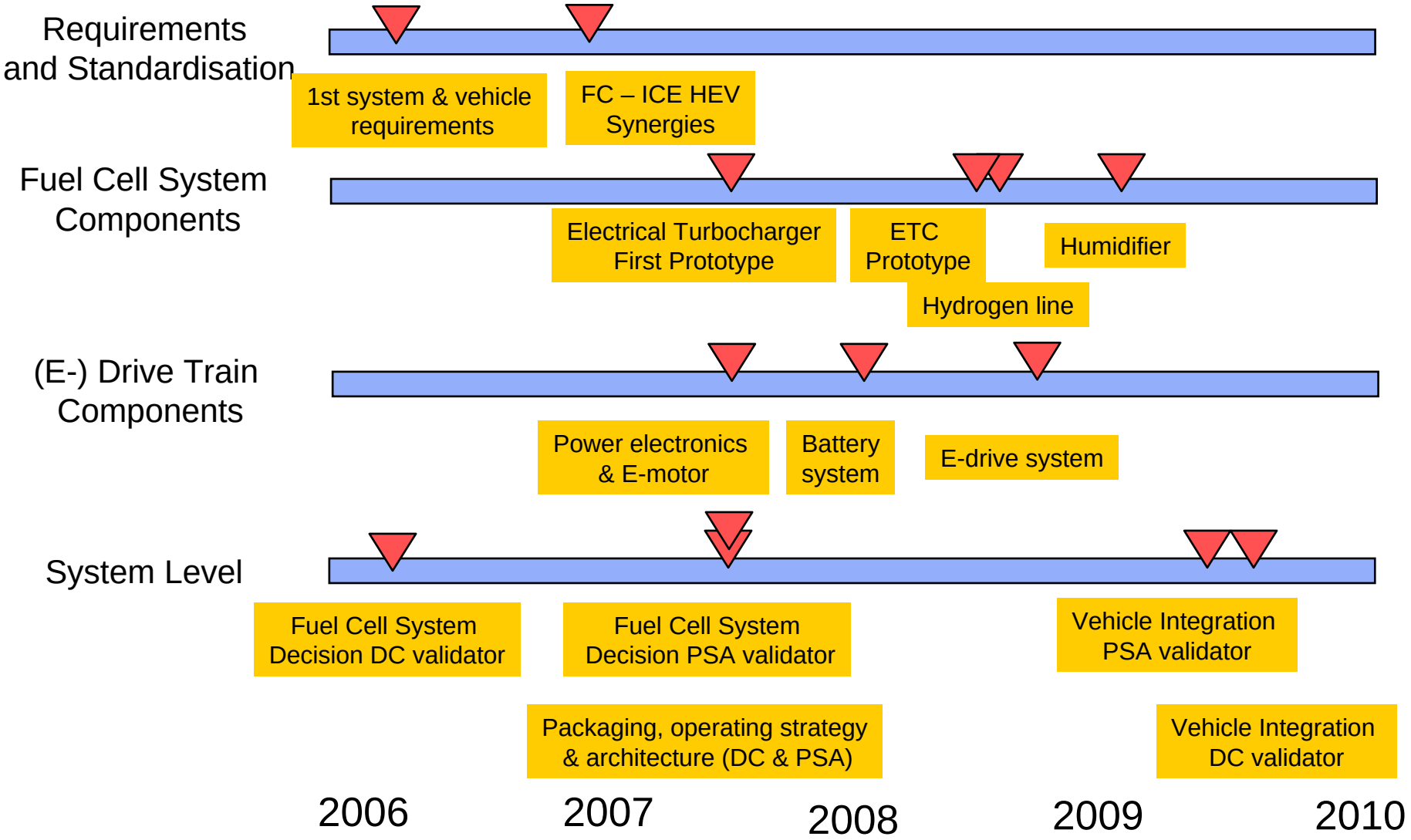
Vehicle validators:

- WP 5100 Full FC Delivery Van (DC)
- WP 5200 Small Power FC Duty Vehicle (PSA)

System integration aspects:

- WP 5300 Modular system control and assessment of FC hybrid performance (AVL)

Project Milestones



HySYS - Progress and Results

Definition of Vehicle Requirements

Parameter	DC Validator (Sprinter)	PSA Validator
Motor Power (cont/Peak)	70/100 kW	40/70 kW
Fuel Cell Power	70 – 90 kW	20 kW
Gearbox	One gear ratio	One gear ratio
Batterie LiIon	30 – 50 kW, 2 kWh	50 kW, ca. 2.3 kW.h
Weight empty/fully loaded	<= 2.7 t / 3.5 t	1.6 t / 2.2 t
Range at ½ load	> 300 km	350 – 400 km
Vmax Vmax continuous	130 km/h @ grade 0%	130 km/h @ grade 0% 90 km/h @ grade 0%
Acceleration	0-80km/h < 21 s 0-100 km/h < 37 s	0-50km/h < 7 s 0-100 km/h < 20 s
Climbing ability fully loaded Vmax at ½ load on 4% slope	35% N/A	20 % > 80 km/h

HySYS - Progress and Results
Drive Train Components

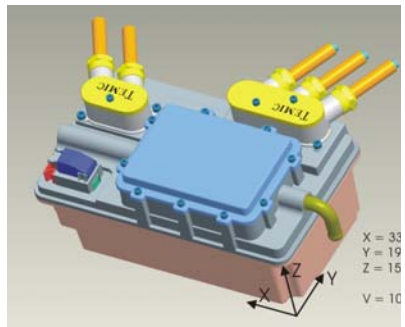
E-Drive System

Current Technology: AC induction and PM brushless with low liquid cooling temperature (55-60 °C) power electronics

Innovative Technology: buried PM synchronous and mixed motors
- e-motor: higher specific torque-power and efficiency
- power electronics: higher integration and cooling temperature (up to 90°C)
- HV-HV DC/DC converter: modular solution with high power density

Challenges:
- integrate the step-up stage with the traction inverter at low cost (WP4100)
- define an e-drive solution suitable for both validators using the same power electronics components(WP4200)

Results:
- e-drive specs and related devices design (optimisation in progress)

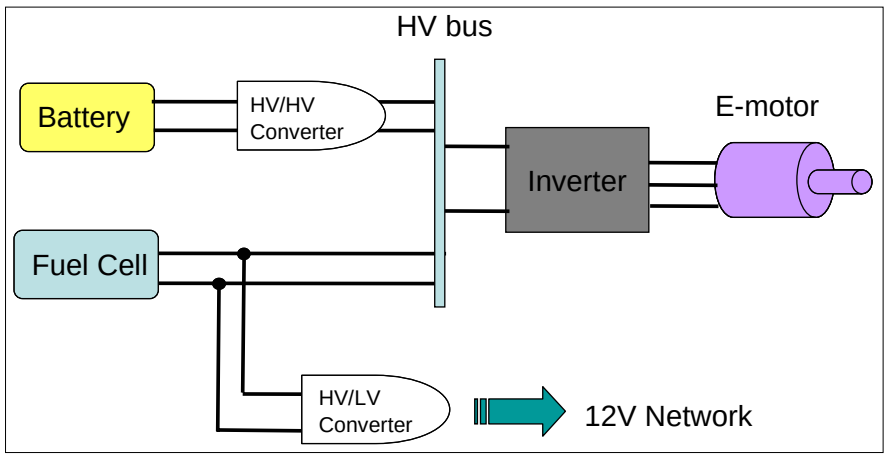


WP4200 Inverter

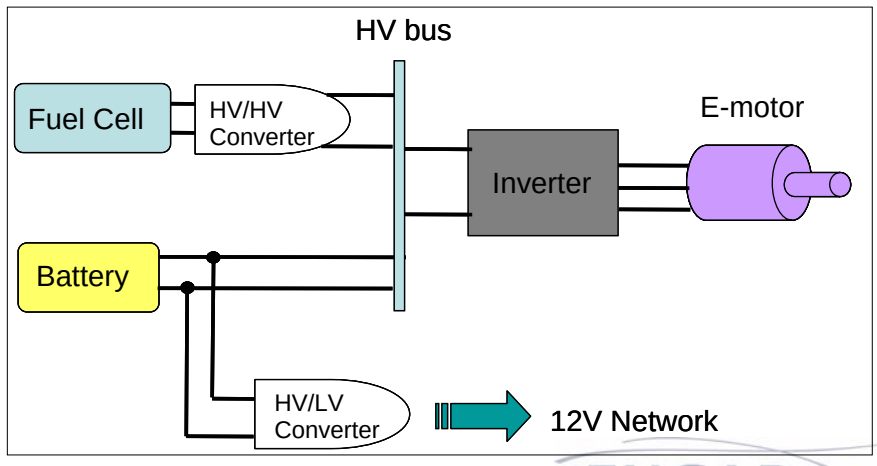
WP4100 E-motor

Drive System architecture:

A: Full FC Delivery Van (DC)



B: Small Power FC Duty Vehicle (PSA)



HySYS - Progress and Results
Drive Train Components

Battery System

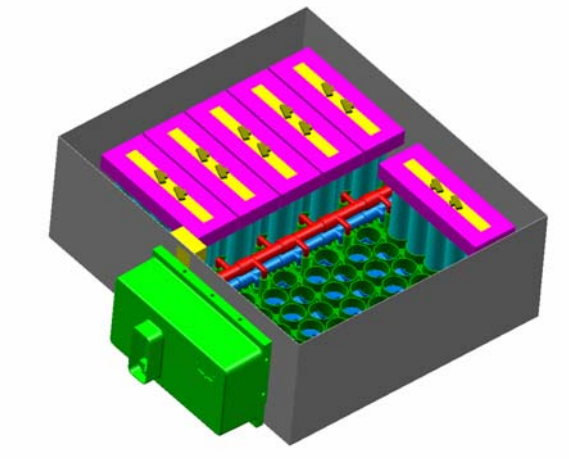
Current Technology: Ni-MeH

Innovative Technology: Li-ion
- higher specific power: from 1.35 to 2 kW/kg (2 s pulse)
- higher specific energy: from 46 to 63 Wh/kg (at cell level)
- higher efficiency: from 85 to 95% (at Pnom)
- improved lifetime: from 8 to 15 years

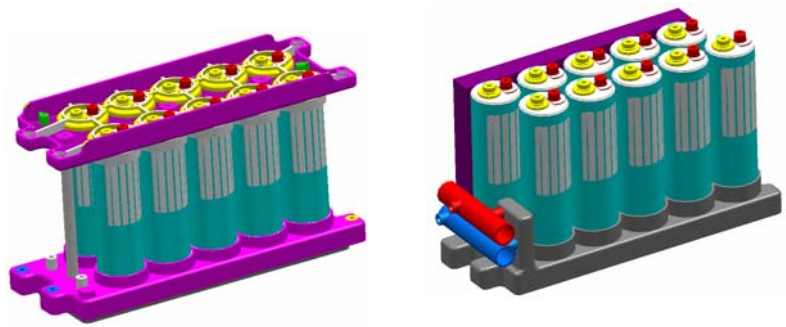
Challenges:
- find the best performance vs. cost solution at Battery System level

Results:
- Preliminary design review

Battery Modules and BMS
(from Lion-heart project)



Hy-SYS Battery System: preliminary design



Hy-SYS Battery Module: possible liquid cooled solutions under investigations

Expected Final Results

- Expected final results.
  - Low cost automotive electrical turbochargers for air supply with high efficiency and high dynamics
  - Low cost humidifiers with high packaging density
  - Low cost hydrogen sensors for automotive use
  - Effective low cost hydrogen supply line
  - High efficient, high power density drive train
  - Low cost high power Li-Ion batteries
  - Enhanced FC-drive train efficiency
  - Two FC-vehicles to validate the achieved results and visualize the progress

Use/Impact of expected final results

- It is a goal to use the technical achievements of the project in future fuel cell and ICE-hybrid vehicles for the mass market
- Improved FC-system and e-drive components could be mass-produced and delivered by the suppliers to the automotive industry, providing competitive FC system components and FC vehicles
- The results of HySYS will be one step further towards the hydrogen economy and also a basis for future European research activities
- The validator vehicles built up in HySYS could be prototypes for vehicles in future EC demonstration projects
- HySYS could be one nucleus for the JTI as strategic partners are cooperating in the project
- Availability of low cost FC system components is important for timing of market introduction of FC vehicles and thus for timing of introduction of hydrogen as transport fuel

Thank you very much for your attention