PRODUCTION OF CLEAN HYDROGEN FOR FUEL CELLS BY REFORMATION OF BIOETHANOL

BIO - H2

Project funded by the European Community under the 'Fifth Framework' Programme (1998-2002)

BIO-H_2 Team

Queen's University of Belfast (QUB)

Netherlands Energy Research Foundation (ECN)

Peugeot Citroën Automobiles (PCA)
Renault (REN)
CNRS/IRC (IRC)

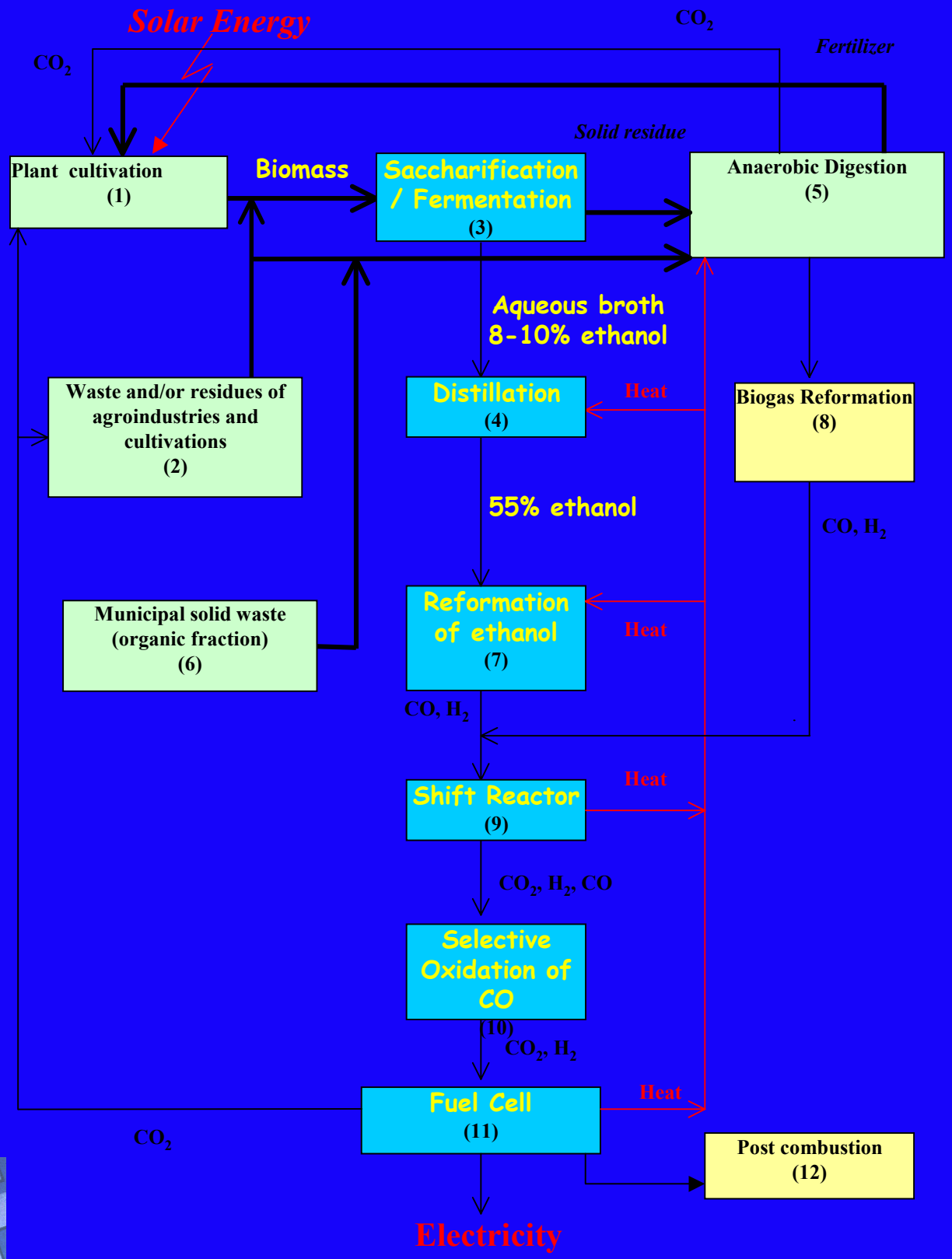
Centro Ricerche FIAT (CRF)
ENEA Research Centre of Rotondella (ENEA)

University of Patras (UPAT)

BIO-H2 Main Innovation

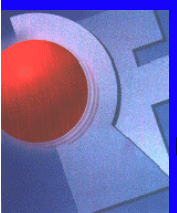
The *major overall innovation* of the project lies in the integration of biomass conversion systems with catalytic and chemical reactor technologies in a manner which may offer high energy efficiency for the specific application (electrically powered automobiles) and zero emissions of pollutants, including CO_2, to the atmosphere.

BIO-H2 - OVERALL PROCESS FOR PRODUCTION OF ELECTRICITY FROM BIOMASS



BIO-H2 Objectives

1. To optimise the ethanol production process from biomass in terms of efficiency and cost
2. To develop and study the performance characteristics of suitable catalytic materials for the steam reforming of bio-ethanol.
3. To develop suitable bio-ethanol reformers for on-board applications. In addition to the main ethanol reformer, the system will also be supplied with units which will carry out the water-gas-shift reaction and selective oxidation of CO. The integration of these systems with the main reformer will be an important task.
4. To design, construct and test all system components in an integrated manner.
5. To develop a computer model for the entire system.
6. To perform an economic evaluation of the proposed system and to compare it, technically and economically, with alternative systems employing fossil fuels, such as methanol and gasoline.



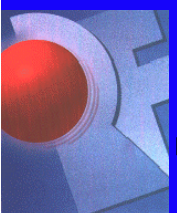
BIO-H2 Main Goals

Two Main Tasks

Ethanol Production Process from Bio-masses

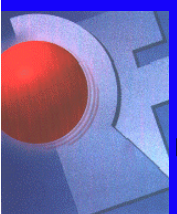
- Ethanol Production Process from Biomasses

- Ethanol Reformer for Automotive Applications



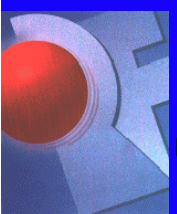
BIO-H2 Ethanol Process Targets

- Detailed LCA and cost evaluation
- Approximate production costs below 0.2 EURO/l
- Predicted ethanol yield about 320 litre/ton of dried biomass
- Energy consumption 700 kJ of ethanol
- Fix correct targets for costs, yields and atmospheric emissions of the SSF process

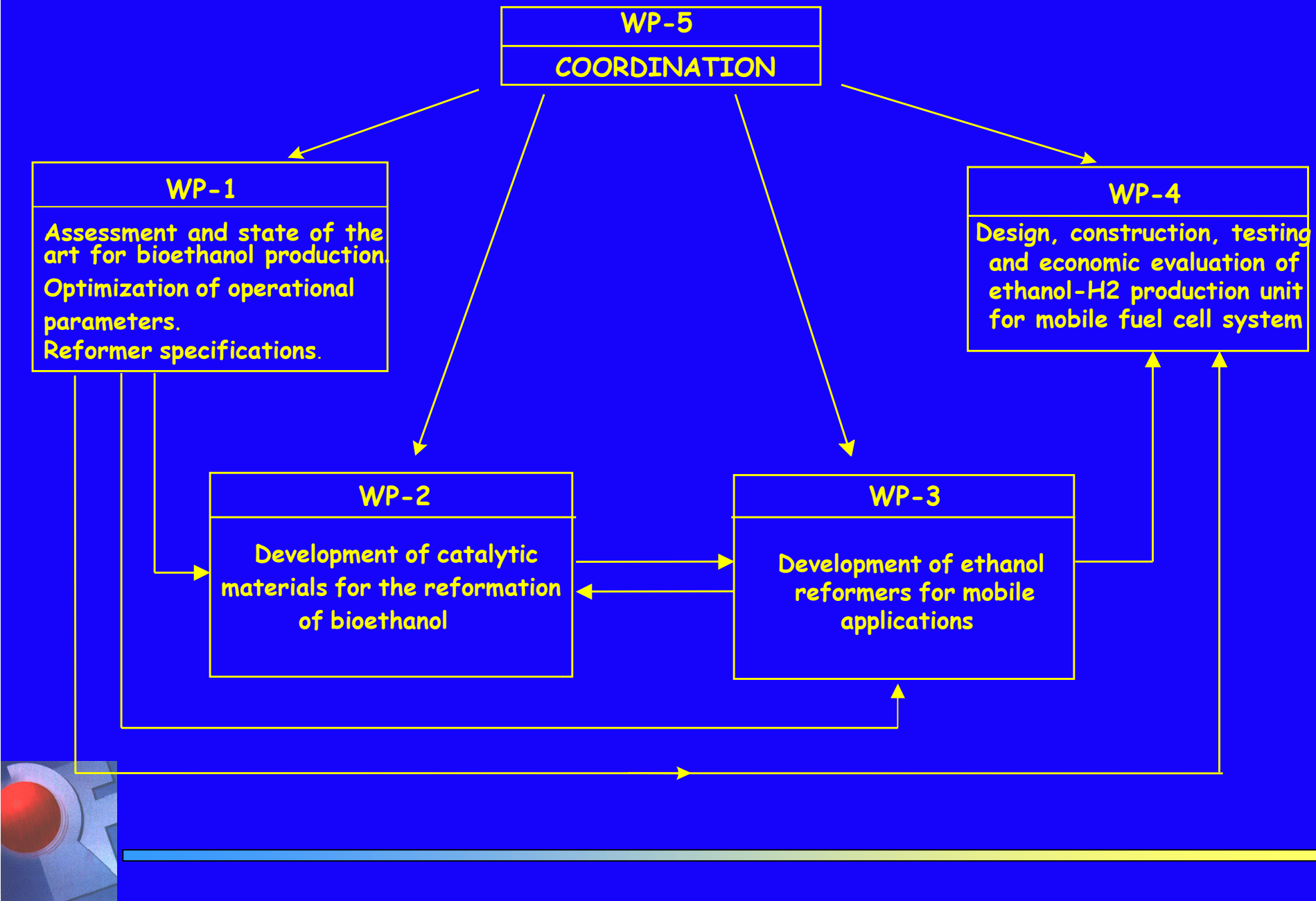


BIO-H2 Reformer Targets

	Mid Term targets	Final Target
Maximum Unit Size	5 kWe	5 kWe (50 kWe specs)
Power Density	> 0.5 kWe/liter	1 kWe/liter
Specific Power	> 0.5 kWe/kg	1 kWe/kg
Energy Efficiency	> 75%	84%
Start-up to Full Power	5 min.	3 min.
Turndown Ratio	N/A	8:1
Transient response	5-7 sec	3- 5 sec (10% - 90% of load)
Projected Cost	N/A	16 EURO – 25/kW



BIO-H2 Project Overview



BIO-H2 Actual Status

Actions (first year):

- Consortium Agreement - ***on going***
- Specifications for on-board reformers - **completed**
- Assessment and state-of-the art for bioethanol production - **completed**
- Optimised conditions for bioethanol production from steam-exploded biomass - ***on going***
- Results of initial screening of 20 ethanol reformer catalysts - ***on going***
- Results of initial screening of WGS, selective CO oxidation and post combustion catalysts - ***on going***