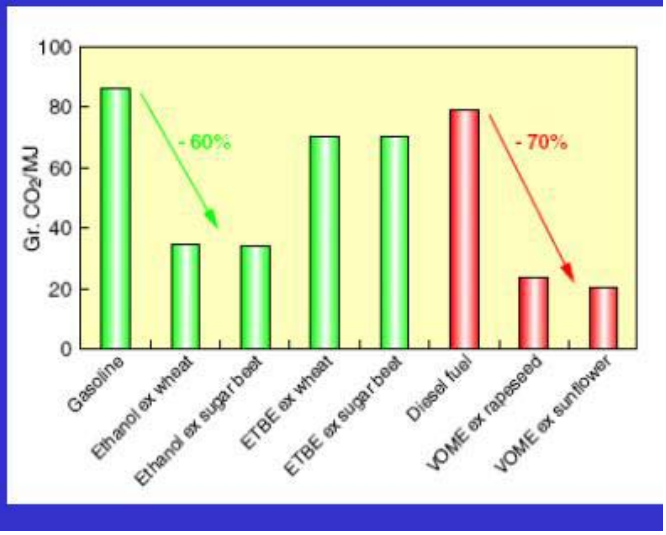
Biofuels in Europe

Following the oil shocks of the 1970s, many countries saw biofuels as a realistic solution to the problem of dependence on oil resources. Furthermore, biofuels could be blended with conventional fuels to achieve gains in the area of polluting vehicle emissions. Their development was slowed, however, by the counter-shock of 1986 and the persistence of high prices.

Public opinion is exerting pressure on public authorities tofight the greenhouse effect. The latter are looking forsolutions to reduce greenhouse gas (GHG) emissions, especially in the transport sector. It is thought that the use of biofuels substantially reduces GHG emissions compared to conventional motor fuels. In fact, when biofuels are used in their pure form, the decrease in GHG emissions ranges from 60% to 70%, respectively, for ethanol versus gasoline and for vegetable oil methyl esters (VOME) versus diesel.



Given that conventional crude reserves are concentrated in the Middle East, that there is uncertainty as to their mediumand long-term prospects and that regional production might peak, many governments are implementing policies to promote the emergence of alternative energy resources. In this respect, biofuels appear to be a significant option.

Finally, the uptrend in oil prices over the last two years encourages the development of alternatives solutions, especially biofuels. The biggest barrier to the large-scale development of biofuels remains their excessive cost compared to petroleum motor fuels. But biofuels are attractive because they have a major advantage over other alternative fuels: they can be blended with conventional motor fuels, so that there is no need to adapt vehicles or develop a dedicated distribution system.

Two biofuels are already candidates for industrial development: vegetable oil methyl esters (VOME) and ethanol, mainly used in Europe in the form of ethyl tertio butyl ether (ETBE).

The long-time leading biofuel producer in Europe, France has been overtaken by Germany for VOME and Spain for ethanol. At the practical level, the latter largely anticipated the European directive stating that biofuels should make up 5.75% of transport energy consumption by 2010, thus expanding EU production by a factor of 20.

Looking beyond 2010, the target date fixed by European directive, one can envisage new biofuel technologies, mainly pathways that convert lignocellulosic matter (wood, straw, etc.) into motor fuels. Two options are under considerations. One method using enzymes to synthesize ethanol has been under development in recent years, mainly in North America. The second, which uses the Fischer-Tropsch process to synthesize diesel fuels, includes a biomass gasification stage.

Depending on the availability of vegetable matter for conversion, these pathways could serve to cover as much as 10% of the road transport requirements in the European Union by 2020.

The hydrogen economy

Image of WE-NET System

Catalysis and the hydrogen economy

The size and capital investment, energy intensiveness, as well as delivery issues restrict the simple extension of existing SMR plants to fill the void needed in H_2 production for a H_2 economy.

Forecasts suggest future H_2 needs exceed 14 times the world's current production of H_2; this volume coupled by restrictions of CO_2 co-production would seem to limit the options for future H_2 production. Production of H_2 by new process technologies, including CH_4 decomposition, CO_2 reforming, biohydrogen, photodecomposition of water.

Catalysis will play multiple roles in all aspects of H_2 production.

Multiple needs exist for catalysts with respect to the photodecomposition of water, CPO based processes, highly active and low cost WGS catalysts, catalysts to assist in the capture and storage of CO_2, improved hydrocarbon reforming, improved electrocatalysts and photocatalysts, improved hydrodesulfurization catalysts, and biophotolytic catalysts for decomposing water.

There is no single, clear route for near term (3–10 years) production of the huge volumes of CO_2 free (byproduct) H_2 needed if a H_2 economy it to emerge to serve the world's energy needs.

Long term sources of energy should be sustainable, environmentally sound, and based on very efficient processes.

Solar photocatalysis (perhaps 40 years away from any wide spread application) probably has the greatest potential of meeting the volumes of H_2 needed without CO_2 co-product, as long as the significant technical and cost issues can be surmounted.

If this did happen, it would create a huge, new market for H_2, which would be much bigger than today's H_2 business.


GREEN CHEMISTRY
Twelve Principles of Green Chemistry
1. Prevention
2. Atom Economy
3. Less Hazardous Chemical Syntheses
4. Designing Safer Chemicals
5. Safer Solvents and Auxiliaries
6. Design for Energy Efficiency
7. Use of Renewable Feedstocks
8. Reduce Derivatives
9. Catalysis
10. Design for Degradation
11. Real-time Analysis for Pollution Prevention
12. Inherently Safer Chemistry for Accident Prevention