

# Hydrogen Fuel Cells and Alternatives in the Energy and Transport Sectors Issues for Developing Countries

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# Hydrogen Fuel Cells

- A Disruptive Technology
- Will have a broad impact on energy, transport and other sectors
- Are part of a wave of new technologies that are knowledge based, research intensive and systems embedded
- Like other new wave technologies, ICTs and Biotechnology, can potentially give rise to problems of exclusion ( the digital divide, knowledge gaps)

## Proton Exchange Membrane (PEM) Fuel Cells

- Use a fuel supply to combine hydrogen and oxygen in an electrochemical process that generates an electric current.
- The process involves an ion exchange polymer membrane as the electrolyte and electrodes of fine metal mesh on which a platinum catalyst is deposited. It converts H<sub>2</sub> directly into electricity without combustion or moving parts.
- If hydrogen is used as the fuel, a fuel cell vehicle (HFCV) is virtually pollution free.

# Are Hydrogen Fuel Cells A Clean Technology ?

*This depends upon the way the hydrogen  
is produced*

# Technologies for the production of Hydrogen

Most H<sub>2</sub> is currently produced from natural gas which is 'cleaner' but not 'clean'.

Others being developed or tested include

- coal gasification
- co-generation using nuclear reactors
- co-generation in desalination processes
- wind, thermal or solar power for electrolysis
- biomass

# Hydrogen Fuel Cells in Energy and Transport :How Soon?

## The Debate

Some say the bottlenecks are technological  
and that more basic research is needed

The US Department of Energy (Doe) appears to be making more rapid progress in achieving breakthroughs than expected.

Platinum loading in 2005, for example, was lower than the DOE's 2010 target and there was a 20 fold improvement in the catalyst.

## Some say it is costs

The cheapest hydrogen fuel cell cars on the road today still cost 125,000 USD or more.

But Daimler Chrysler, General Motors, Honda and others have announced targets closer to 35,000 USD or lower within 8 to 10 years.

Early adopters have also emerged and orders have been placed by large retailers, baggage handlers and other users of indoor electric vehicles for HFC fork lift trucks.

## Others see the problem as a lack of infrastructure

We have already moved beyond hydrogen refuelling test and demonstration projects.

Today companies such as Shell, BP and Johnson Matthey are building infrastructure as needed.

The pull of demand from cities like Amsterdam and those in the Scandinavian countries that are planning for fleets of hydrogen fuel cell buses by the year 2015, is stimulating the building of refuelling stations.

## How Soon?

Many now predict that Hydrogen Fuel Cell vehicles will be commercially available in **2020** and stationary power based on hydrogen fuel cells will be in use before then. **This is only 13 years from now.**

To put this in perspective: It takes on average 10 years to turn a first year university student into a Ph.D. whether in policy, management or the sciences.

## Making Choices about Hydrogen and Alternatives

Countries differ in their interest in hydrogen and fuel cells and in the priority they assign to HFCs and other renewable energy strategies. These differences reflect local needs, resources and objectives. **THERE IS NO UNIVERSAL 'RIGHT' PATHWAY TOWARDS CLEAN AND RENEWABLE ENERGY .**

What does seem clear, however, is that we need to begin to move in this direction. It is unlikely that gasoline will hold the same place in the hierarchy of transport fuels or energy sources in 2020. Choices will have to be made and new strategies developed and implemented.

# Issues For Developing Countries

- Making choices about urban transport and pollution
- Dealing with the problems of exclusion that have characterized recent technological revolutions
- Accommodating the diversity of needs in the South
- Securing the benefits of the emerging hydrogen economy

# Where is the Developing World Now?

Some developing countries – Brazil, China, Egypt, India, Malaysia and South Africa, for example, are

Building the knowledge base needed for choice by strengthening tertiary education & public sector research on hydrogen, fuel cell technologies and renewable energy

Developing strategies and establishing targets and benchmarks

# The UNU-MERIT Hydrogen Fuel Cell Exchange

[www.merit.unu.edu](http://www.merit.unu.edu)

*Seeks to deal with the problem of exclusion by*

- Creating awareness of hydrogen, fuel cells & alternatives
- Developing networks that build local capacity to evaluate these technologies and make informed choices
- Strengthening the policy process by supporting the development of networked centres of excellence for training and research in the South and between North and South
- Contributing to the flow of knowledge and information by encouraging the creation of networks to monitor the pace of change in hydrogen fuel cell technologies and the emergence of new policies and strategies to deal with these changes.

**THANK YOU**