

# Hydrogen Fuel Cells and

# Natural Environment

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## Current Issues

- Global fuel shortages and geo-political games between OPEC and the rest of the world determines oil and gas supplies.

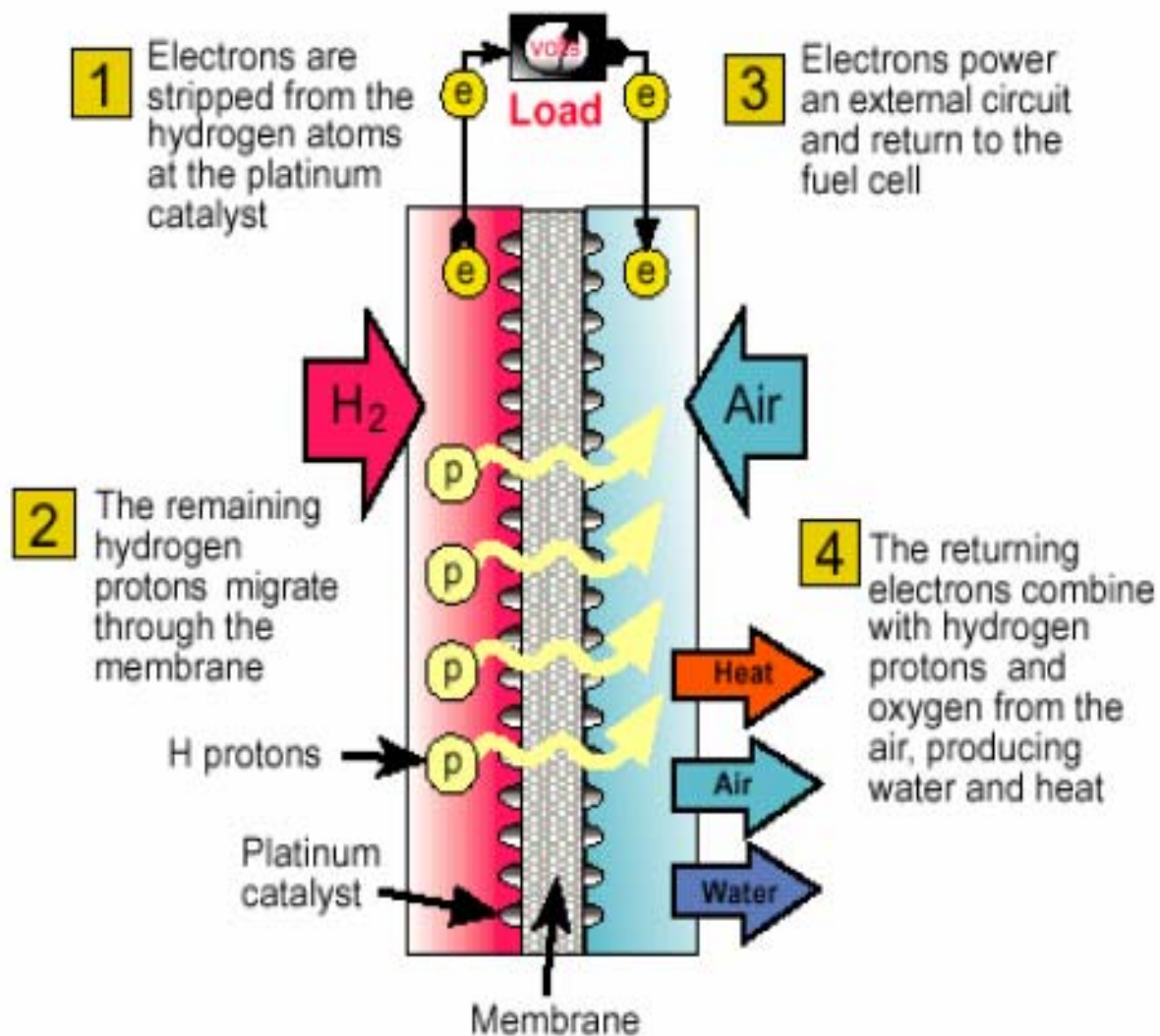
## Environmental Issues of United States

- Climate and environment have started changing mainly due to agricultural and industrial practices.
- Through population growth, fossil fuel burning, and deforestation, there has been mixture of gases in the atmosphere that affect human life.
- The United States' energy policy has historically stimulated the development of a fuel-intensive economy based on natural resource extraction and processing.
- World's largest emitter of energy-related carbon dioxide.
- In recent years, the shift from cars towards larger vehicles is the reason for a reversal of years in fuel efficiency improvements
- Need for fuel efficiency

## Hydrogen Energy

- It is found in water, biomass and organic compounds such as natural gas, methanol, and propane.
- Fuel Cell - electrochemical device that converts fuel's chemical energy directly to electrical energy with high efficiency. Electricity is created through separation process.

# How a Fuel Cell Works



- Method of production – reformation
- Reforming of natural gas is currently the least expensive method of producing hydrogen, and used for about half of the world's production of hydrogen.
- Hydrogen can be derived from renewable energy resources such as water and at the same time provide a clean and abundant energy source, capable of meeting zero emission effect.

# Fuel Cell Applications

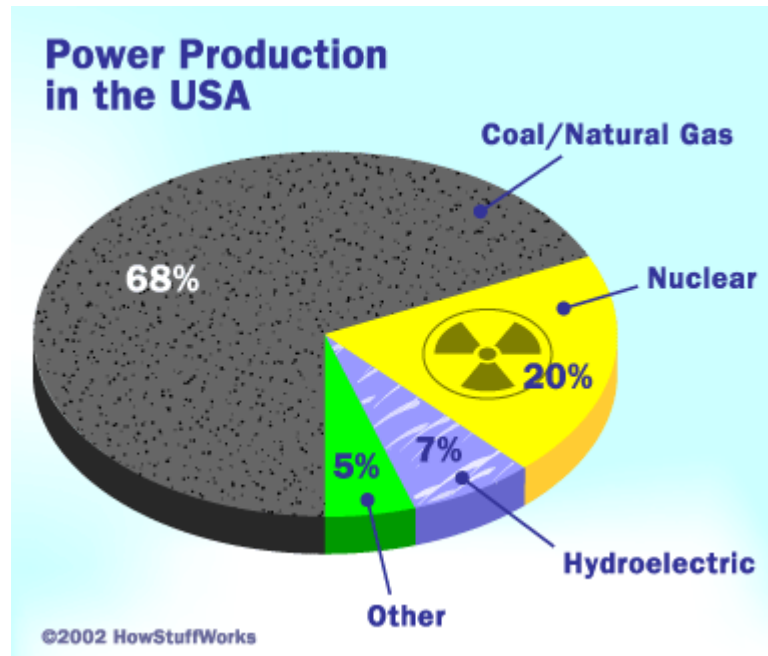
- ◆ Transportation - The majority of fuel cell vehicles is used in fleet vehicles, such as buses, light duty vehicles and local governments world wide.



- Car manufacturers are the largest investors ( DaimlerChrysler's, Ford, Toyota, Honda, GM )

# Economic Benefits of Hydrogen Energy

- Reduce demand for petroleum and at the same time provide better air quality. – United States imports more than 50 percent of its oil which equals more than 10 million barrels a day. Dependence on foreign oil is a challenge to economic security, because dependence can lead to price shocks and fuel shortages. U.S. energy dependence is higher today than it was during the "oil shock" of the 1970s, and oil imports are projected to increase. Passenger vehicles alone consume 8 million barrels of oil every single day, equivalent to 80 percent of oil imports.



- Fuel cell vehicles could act as generators supplying the power to the offices to the building
- Implementation issues – distribution systems