

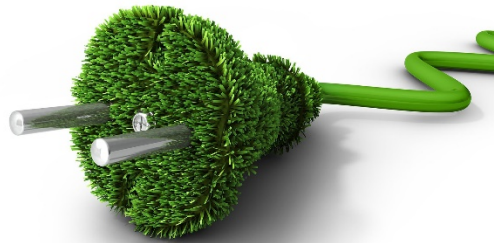
# Renewable and Sustainable Energy



Presented by Dewmi and  
Conghui

# What is sustainable energy?

- Build on Energy efficiency and renewable energy
- Renewable energy is the most important
- Concerned about ecology, economy and society
- Goal - World energy security, reducing dependence fuel resources and reducing greenhouse gases
- Several definitions



- "Effectively, the provision of energy such that it meets the needs of the present without compromising the ability of future generations to meet their own needs. ...Sustainable Energy has two key components: renewable energy and energy efficiency." – *Renewable Energy and Efficiency Partnership* (British)
- "Dynamic harmony between equitable availability of energy-intensive goods and services to all people and the preservation of the earth for future generations." And, "The solution will lie in finding sustainable energy sources and more efficient means of converting and utilizing energy." – *Sustainable Energy* by J. W. Tester, *et al.*, from MIT Press.
- "Any energy generation, efficiency and conservation source where: Resources are available to enable massive scaling to become a significant portion of energy generation, long term, preferably 100 years.." – *Invest*, a green technology non-profit organization.
- "Energy which is replenishable within a human lifetime and causes no long-term damage to the environment." – *Jamaica Sustainable Development Network*

# What is Renewable energy?

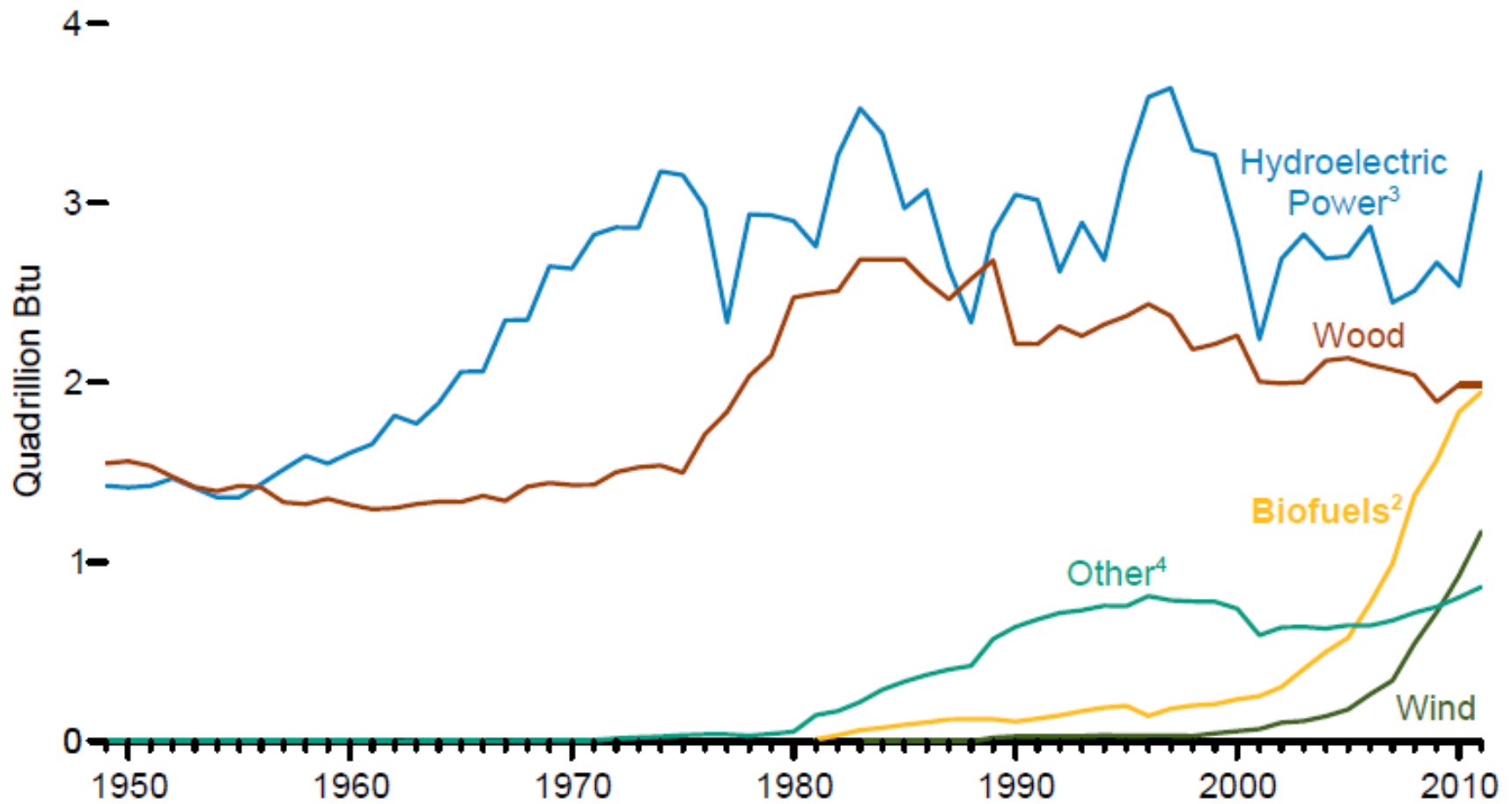
- Energy that is collected from renewable resources, which are naturally replenished on a human timescale.
- Sunlight, wind, rain, tides, waves, and geothermal heat.



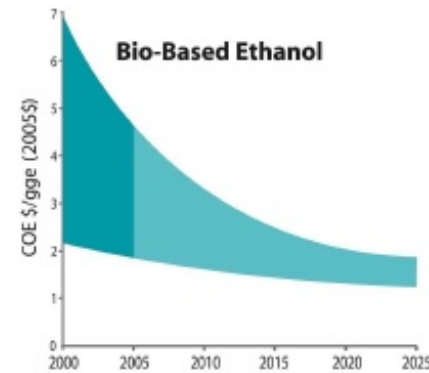
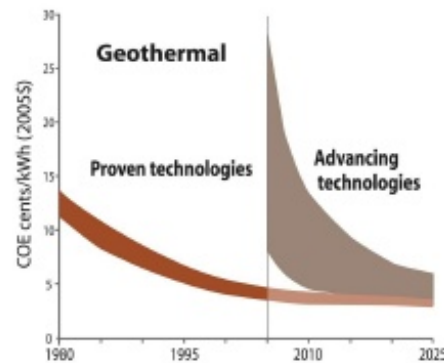
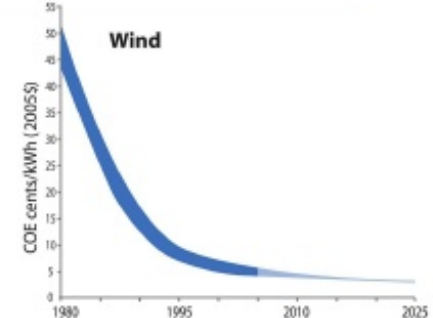
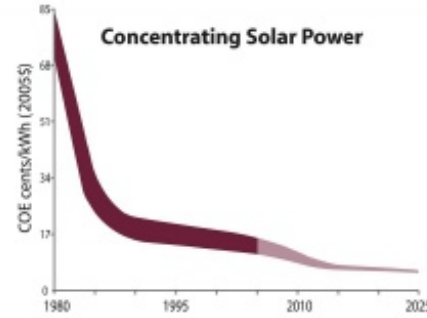
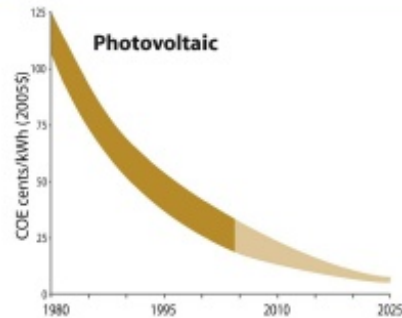
# Timeline

- Three generations of renewables technologies
- **First-generation technologies** started from the industrial revolution at the end of the 19th century and include hydropower, biomass combustion and geothermal.
- **Second-generation technologies** include solar heating and cooling, wind power, modern forms of bioenergy and solar photovoltaic.
- These are now entering markets as a result of research, development and demonstration (RD&D) investments since the 1980s.
- The initial investment was prompted by energy security concerns linked to the oil crises (1973 and 1979) of the 1970s.
- **Third-generation technologies** are still under development and include advanced biomass gasification, biorefinery technologies, concentrating solar thermal power, hot dry rock geothermal energy and ocean energy. Advances in nanotechnology may also play a major role.

## Renewable Energy Consumption by Source, 1949-2011



# Renewable Energy Cost Trends



Source: NREL Energy Analysis Office ([www.nrel.gov/analysis/docs/cost\\_curves\\_2005.ppt](http://www.nrel.gov/analysis/docs/cost_curves_2005.ppt))

<sup>1</sup>These graphs are reflections of historical cost trends NOT precise annual historical data. DRAFT November 2005

# Renewable energy sources

- Biomass
  - Wood and wood waste
  - Municipal solid waste
  - Landfill gas and biogas
  - Ethanol
  - Biodiesel
- Hydropower
- Geothermal
- Wind
- Solar
- Hydrogen and fuel cell
- Thorium

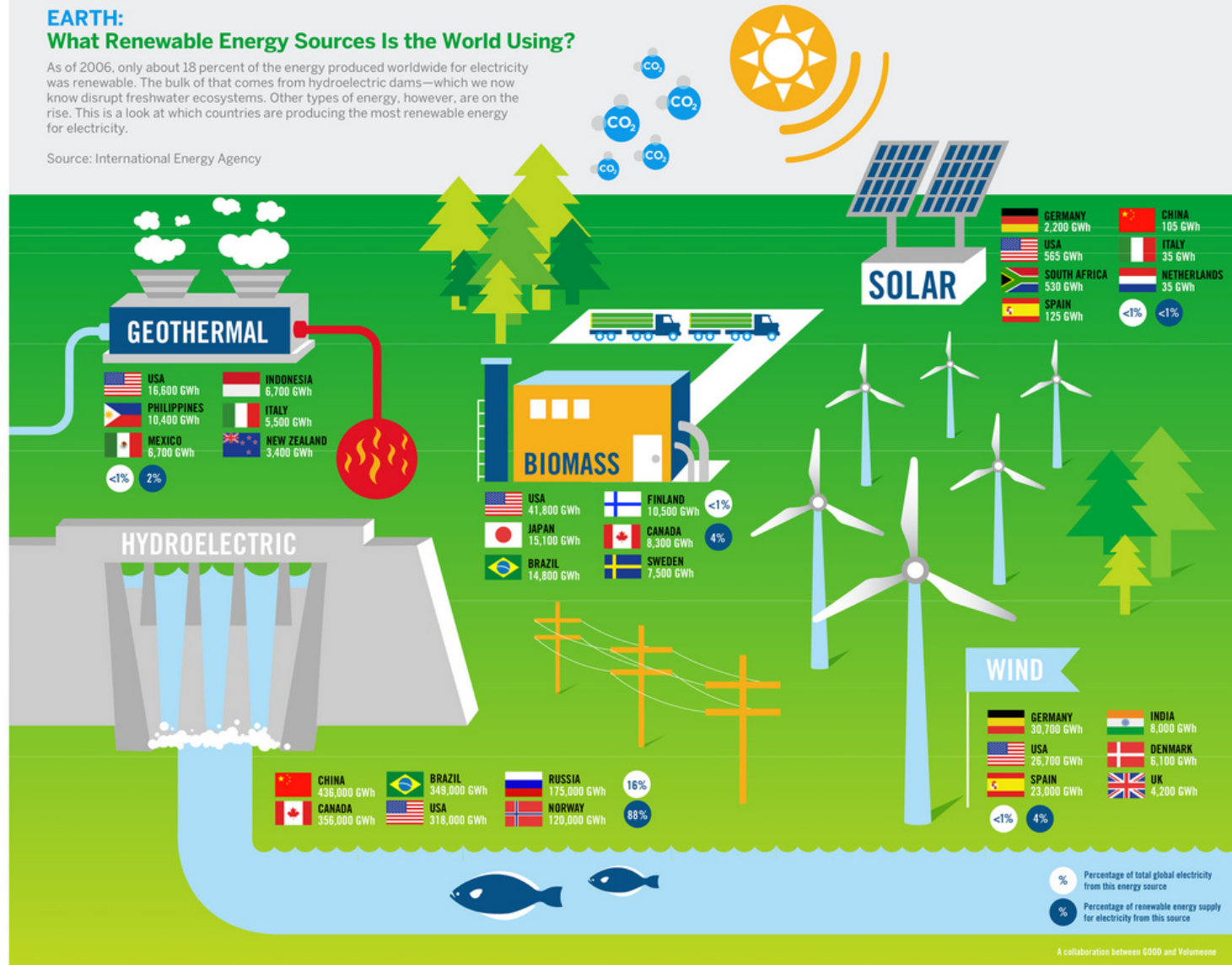




# EARTH: What Renewable Energy Sources Is the World Using?

As of 2006, only about 18 percent of the energy produced worldwide for electricity was renewable. The bulk of that comes from hydroelectric dams—which we now know disrupt freshwater ecosystems. Other types of energy, however, are on the rise. This is a look at which countries are producing the most renewable energy for electricity.

Source: International Energy Agency



# Solar

- Solar energy relies on the nuclear fusion power from the core of the Sun. This energy can be collected and converted in a few different ways. The range is from solar water heating with solar collectors for domestic use to the complex technologies of direct conversion of sunlight to electrical energy.



# Wind

- Wind energy can be used to pump water or generate electricity, but requires extensive areal coverage to produce significant amounts of energy



# Hydroelectric energy

- This form uses the gravitational potential of elevated water that was lifted from the oceans by sunlight.
- It is not strictly renewable since all reservoirs eventually fill up and require very expensive excavation to become useful again.



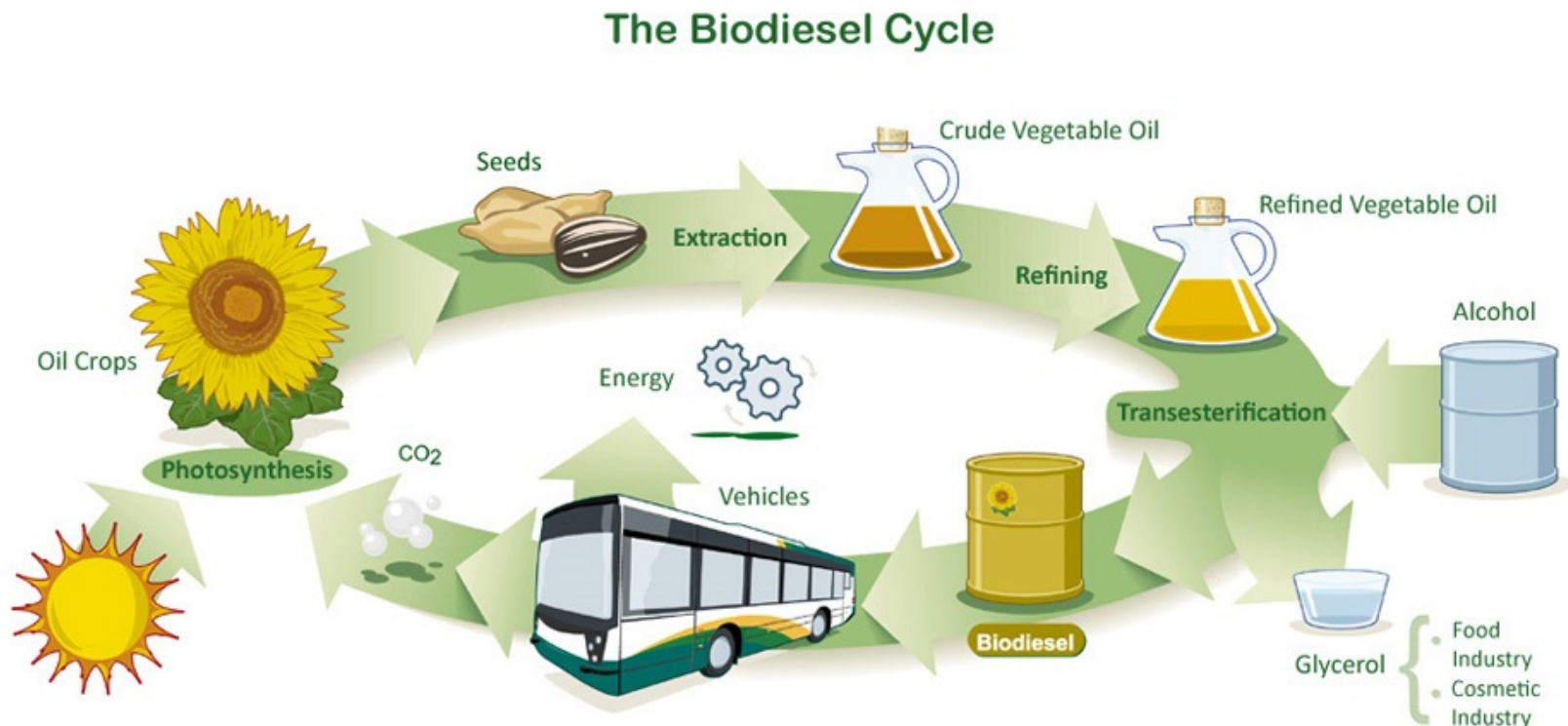
# Geothermal power

- Energy left over from the original accretion of the planet and augmented by heat from radioactive decay seeps out slowly.
- Soil everywhere tends to stay at a relatively constant temperature, the yearly average, and can be used with heat pumps to heat a building in winter and cool a building in summer.



# Biomass energy

- Some of the more modern forms of biomass energy are methane generation and production of alcohol for automobile fuel and fueling electric power plants.



# Hydrogen and fuel cells

- Hydrogen can be burned as a fuel, typically in a vehicle, with only water as the combustion product.

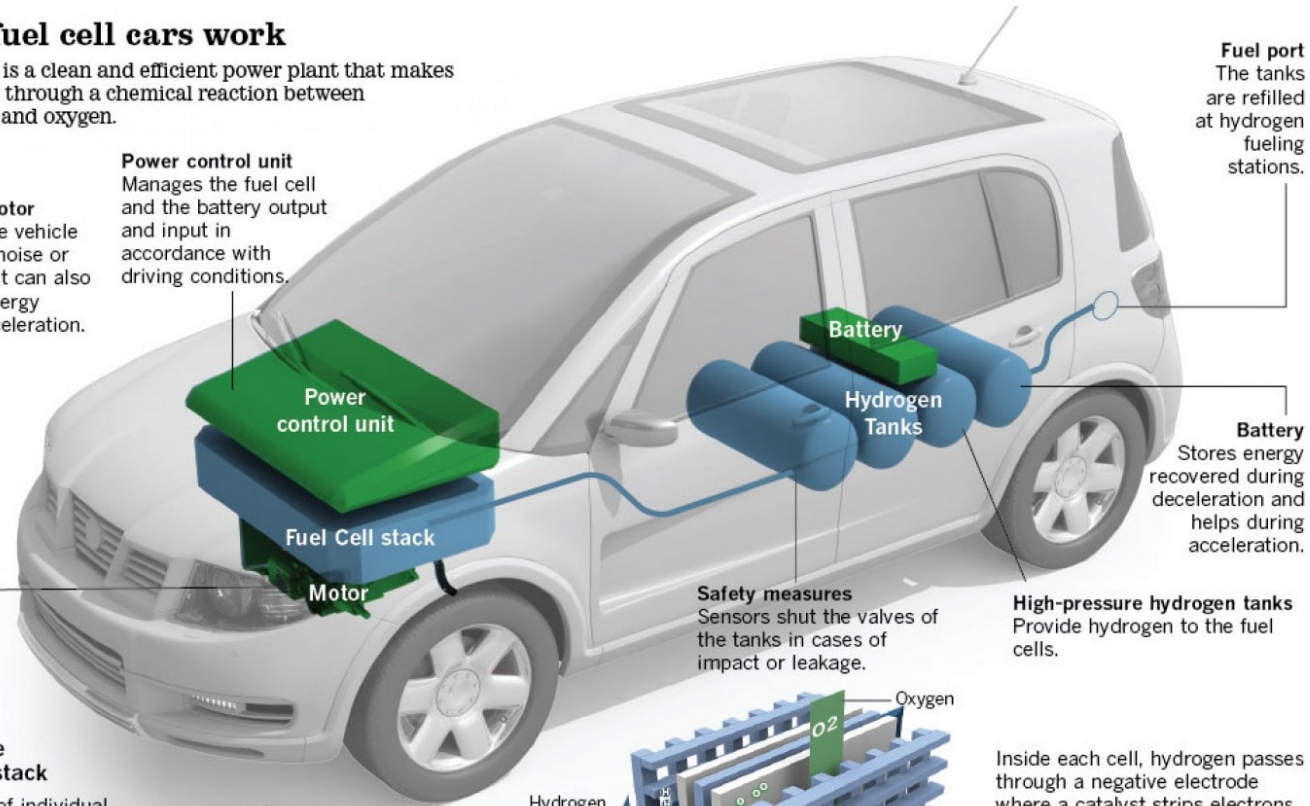
## How fuel cell cars work

A fuel cell is a clean and efficient power plant that makes electricity through a chemical reaction between hydrogen and oxygen.

**Electric motor**  
Propels the vehicle with little noise or vibration. It can also recover energy during deceleration.

**Power control unit**  
Manages the fuel cell and the battery output and input in accordance with driving conditions.

**Fuel port**  
The tanks are refilled at hydrogen fueling stations.



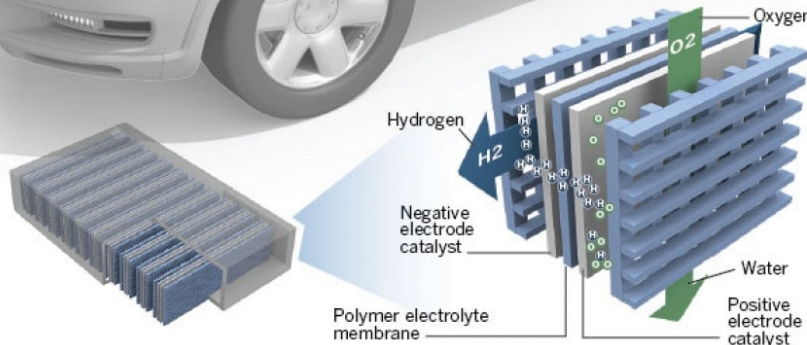
**Battery**  
Stores energy recovered during deceleration and helps during acceleration.

**Safety measures**  
Sensors shut the valves of the tanks in cases of impact or leakage.

**High-pressure hydrogen tanks**  
Provide hydrogen to the fuel cells.

## Inside the fuel cell stack

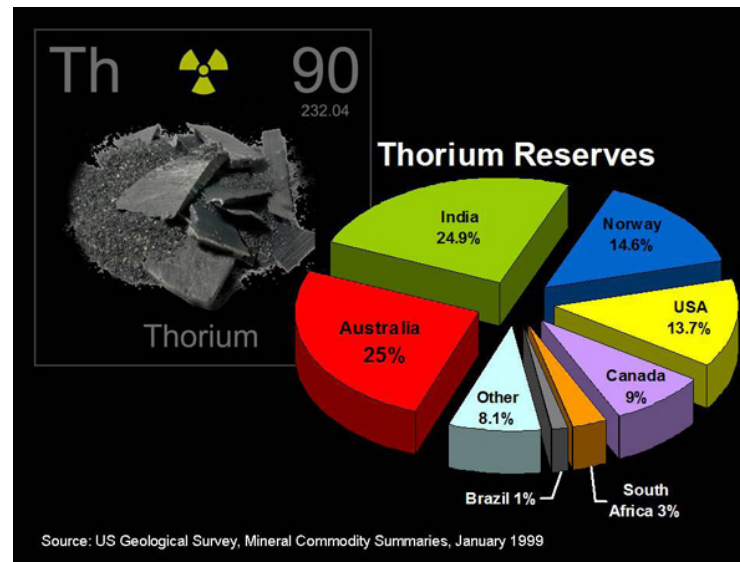
Hundreds of individual fuel cells — each producing less than one volt — are assembled inside the stack to produce enough voltage for the motor.



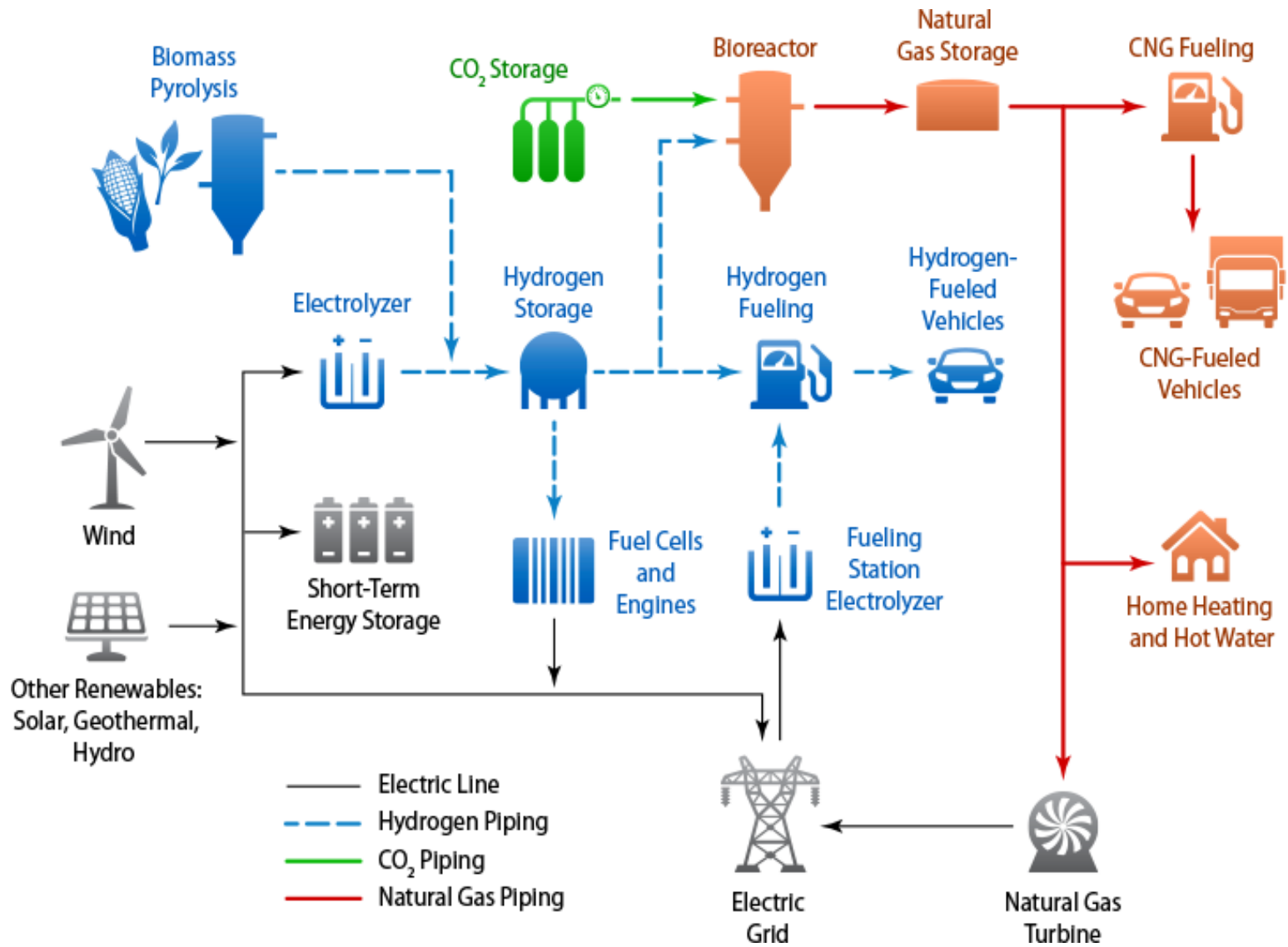
Inside each cell, hydrogen passes through a negative electrode where a catalyst strips electrons from the atoms. The electrons flow from the negative to the positive electrode, generating electricity. Electrons and hydrogen atoms travel through an electrolyte membrane to reach the positive side, where they join with oxygen to become water.

# Thorium

- Problems in U power plants - radioactive waste disposal, safety, the risks of a severe accident, and technical and economical problems in dismantling of old power plants
- Thorium is a fissionable material used in thorium-based nuclear power.
- Advantages - greater abundance, superior physical and nuclear properties, better resistance to nuclear weapons proliferation and reduced plutonium and actinide production.







# THANK YOU



# Reference

- [https://en.wikipedia.org/wiki/Sustainable\\_energy](https://en.wikipedia.org/wiki/Sustainable_energy)
- <http://www.altenergy.org/renewables/renewables.html>
- [https://en.wikipedia.org/wiki/Smart\\_grid#Definition\\_of\\_.22smart\\_grid.22](https://en.wikipedia.org/wiki/Smart_grid#Definition_of_.22smart_grid.22)

