NATIONAL STATEMENT

Activities Related to Hydrogen Development in China

CURRENT RTD ACTIVITIES IN CHINA

National Basic Research Program — 973 Programs

1) Fundamentals of Large-scale Production, Storage and Transportation of Hydrogen and the Related Fuel Cells
2) Basic Research of Hydrogen Production in Scale Using Solar Energy

National High Technology Development Program—863 Programs

1) Post-Fossil Thematic Project on Hydrogen Technology
2) Post-Fossil Thematic Project on High-Temperature Fuel Cell Technology
3) Clean Coal Tech. Project on Innovative Hydrogen Production
4) Target-Oriented Key Project on Electric Automobile

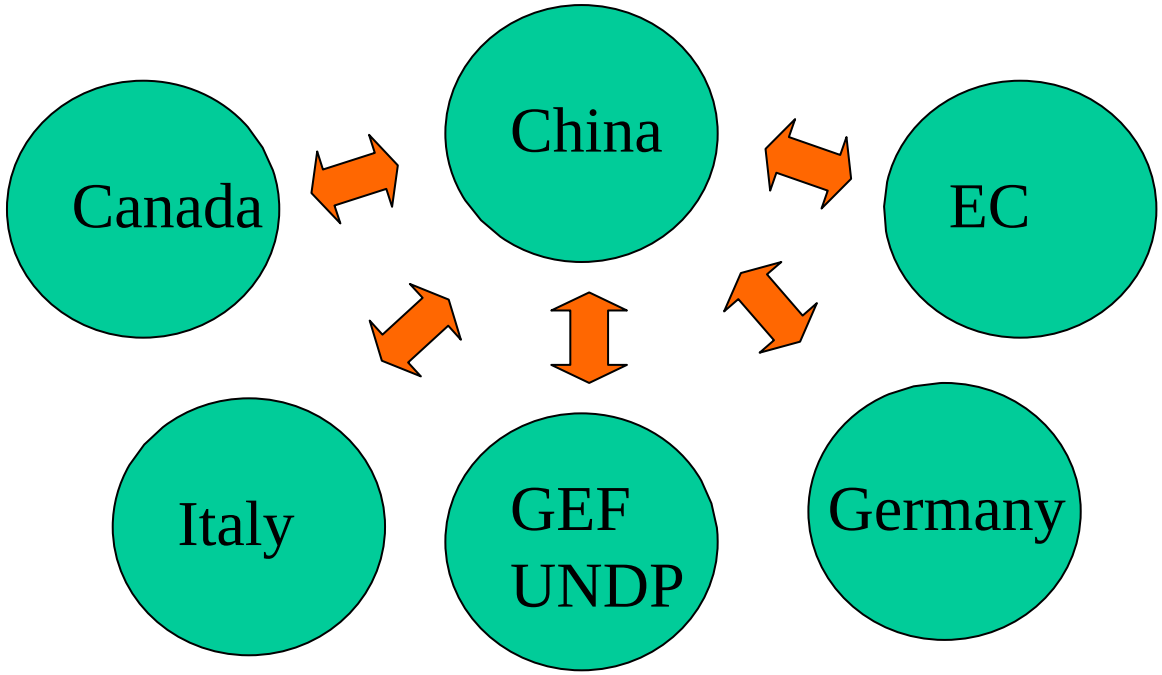
CURRENT ACTIVITIES IN CHINA

——STRATEGIC PLAN AND COOPERATION

Strategy

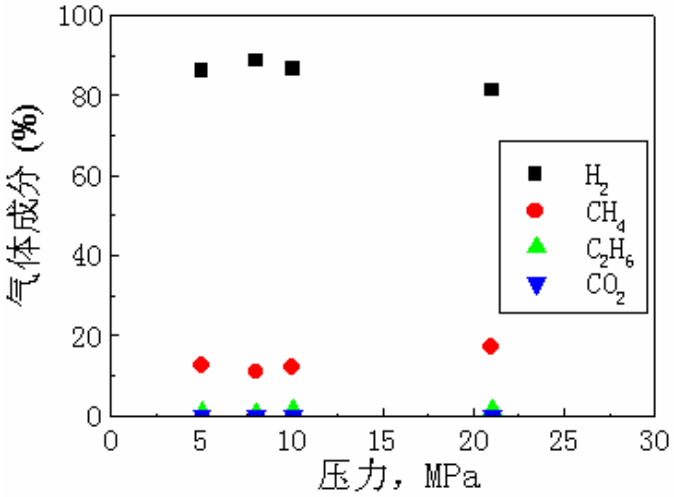
- Hydrogen as Key Topic in National Medium- and Long-term Strategy of Science and Technology Development
- Strategy on Hydrogen and China's Energy Sustainable Development, Chinese Academy of Sciences

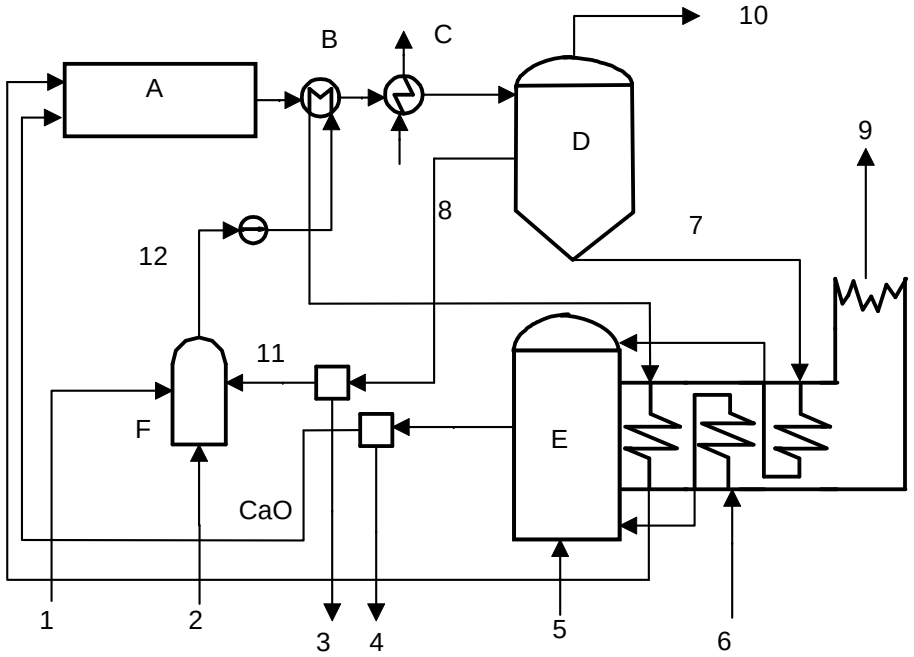
International Cooperation Programs in China



Hydrogen Production from Carbonous Materials with CO_2 Sequestration-ready

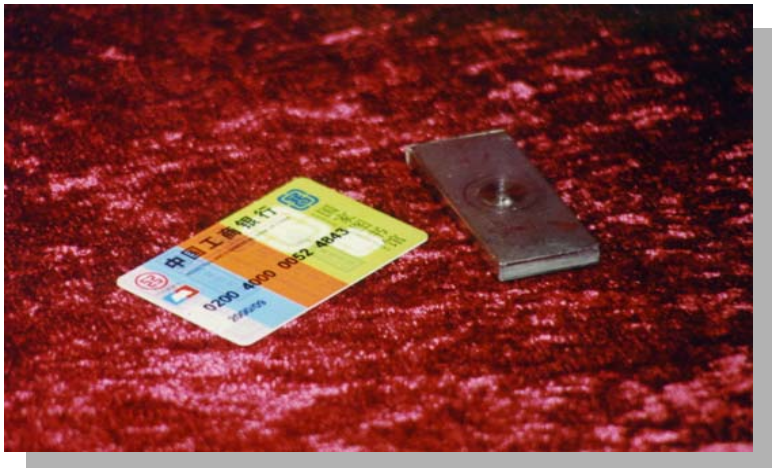
Efficiency□>75% (compared with current 55%)





A□Main reactor□B□Heat recovery exchanger□D□Tri-phase separator□E□Regenerator□F□Slurry preparation□1□Coal□2□Feeding water□3□Waste water□4□Solid waste□5□Limestone supply□6□Air□7□Solid□8□Liquid□9□Discharged gas□10□Fuel gas□11□Water□12□Slurry

Storage



More than 3000 tons metal hydride were produced in China

MH hydrogen storage units for hydrogen recovery and purification

MH hydrogen storage units for hydrogen purification and compression

Mini-type MH hydrogen storage-purification unit

Mini-type MH hydrogen compressor

Earliest FC vehicles in China

Date	Type	Seat	FC Power kW	H2 supply	Max speed km/h	Range km
1999	Cart 	8	5	C.G. H_2 and C.G. O_2	20	80
1999	Cart 	8	5	C.G. H_2 and Air	20	80

Fuel Cell Bus in China

Type		Light Duty Bus	Light Duty Bus	Mini Van
				
Date		Jan, 2001	April, 2001	Oct, 2001
Overall Dimension mm	L	7030	5990	N/a
	W	2200	2010	N/a
	H	2750	3180	N/a
Max Speed km/h		65	80	113
Range/refueling km		120	200	N/a
FC developer		DLICP	Lu Neng	GM
FC Type Power KW		PEM 25kW	PEM 18kW	PEM 25kW
Motor Power KW		AC Inductive 27	AC Inductive 36	AC Inductive
H_2 Supply Pressure Mpa		Compressed 25	Compressed 25	Compressed

Performance of the fuel cell bus and car

Type		City Bus	Car
Picture			
Developed		Dec, 2002	Oct, 2002
Overall Dimension mm	Length		
	Width		
	Height		
Max Speed km/h		65	106
Range/refueling km		200	231
FC developer		DLICP/SL*	Shenli
FC Type/ Power KW		PEM/60	PEM/40
Motor Power, KW		AC Inductive/100	AC Inductive
H_2 Supply Pressure MPa		Compressed 25	Compressed

CHINA'S CONCEPT OF HYDROGEN ECONOMY

Hydrogen economy is the economy sector based on the infrastructure in terms of hydrogen production, storage, delivery and utilization.

In the hydrogen economy, diversified and domestically available hydrogen sources, production processes with contaminants elimination and carbon dioxide sequestration if necessary, will eventually wipe out our concerns on energy security, air pollution, climate change and dwindling resources.

CHINA’S HYDROGEN AND ENERGY VISION

Preliminary phase（2020）

Doubled energy supplied guarantees the quadruple of GDP, from 2000 to 2020. Implementation of “energy saving priority”, complemented by technical development, China will strive to explore coal exploitation and utilization with high efficiency and clean process. In this phase, the development of hydrogen will focus on its utilization. The main goal is to realize maturing of core technologies for vehicle fuel cell system, and commercialization of fuel cell vehicles in several key cities.

CHINA’S HYDROGEN AND ENERGY VISION

Mid-term（2035）

Primary energy gets significantly diversified. Coal still dominates the energy mix, but coal-based power generation system with zero-emission gets commercialized and deployed gradually. The proportion of nuclear energy gets increased, and power and hydrogen generation from renewables is gradually deployed in scale. But coal is still the main hydrogen source.

CHINA’S HYDROGEN AND ENERGY VISION

Long-term（2050）

Primary-phase sustainable energy system has been constructed. The increased energy demand is mainly met by development of renewable energy and nuclear energy after 2035. The proportion of coal decreases gradually to less than 50% in 2050. The national hydrogen delivery pipeline system is primarily established, and hydrogen economy is realized.

CHINA'S HYDROGEN AND ENERGY VISION

	Phase 1	Phase 2	Phase 3
Production	**Natural gas and oil as original hydrogen source**	**Coal-based FC / turbine hybrid cycle with carbon sequestration commercialization**	**Post-fossil based hydrogen generation demonstration and commercialization**
Delivery	**On-site hydrogen generation**	**Regional hydrogen infrastructure construction**	**Construction of national hydrogen delivery network**
Utilization	**Hydrogen ICE and FCV demonstration**	**Distributed hydrogen-fueled power generation demonstration**	**Hydrogen serves as complementary energy carrier as electricity**

CHINA'S HYDROGEN INITIATIVES BEFORE 2020

Before 2020, China should focus on laboratory technology development and expect breakthroughs in fields of:

1. **Hydrogen-fueled vehicle technology**
2. **Large-scale coal-based hydrogen generation and near-zero emission technology**
    1) Co-production of hydrogen/electricity/liquid fuel from coal
    2) High-efficiency hydrogen generation from carbonaceous fuel
    3) Carbon dioxide sequestration
3. **High-performance hydrogen storage technology**
4. **Distributed hydrogen utilization technology**
    1) Stationary hydrogen fuel cell
    2) Hydrogen-fueled gas turbine and internal combustion engine
    3) Hybrid cycle integration and optimization

EXPECTATIONS FROM THE IPHE

1. China’s effort on hydrogen and FC is significant taking the account of her GDP power.
2. But absolutely much lower than developed countries.
3. Any type of cooperation is appreciated, especially in
   - Innovative Hydrogen Production from Coal
   - Standard and code
   - Stratagem study
   - Fundamental research
   - Technical and commercial demonstration
4. IPHE is potential to server as the communication platform