

HCNG in China

For 3rd international H fuel Forum
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China Association for Hydrogen Energy

China attach importance to Hydrogen

China Long-term Scientific and Technological Development Plan (2006 – 2020)

In 27 frontier technologies: No.11 including fuel cell key materials technology ; whole No.15 is hydrogen energy and fuel cell technologies; No.16 including fuel cell power station

There are 68 top priority projects in 11 key industries, and the No.36 is fuel cell vehicles and fuel cell engine.

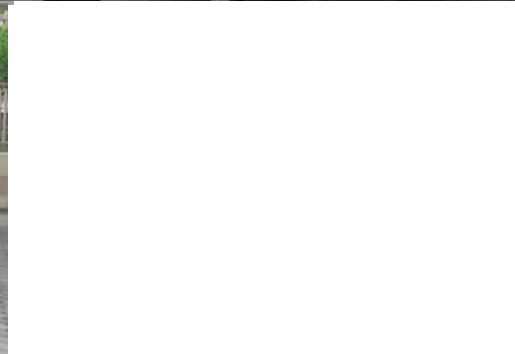
- the hydrogen and fuel cell attracts more attention and will be developed rapidly in China in coming 15 years



Why HCNG?

- 1) Bridge to Hydrogen Economy
- 2) Friend of off grid wind energy
- 3) Improve CNG emission

Fuel cell cars in WHEC2010





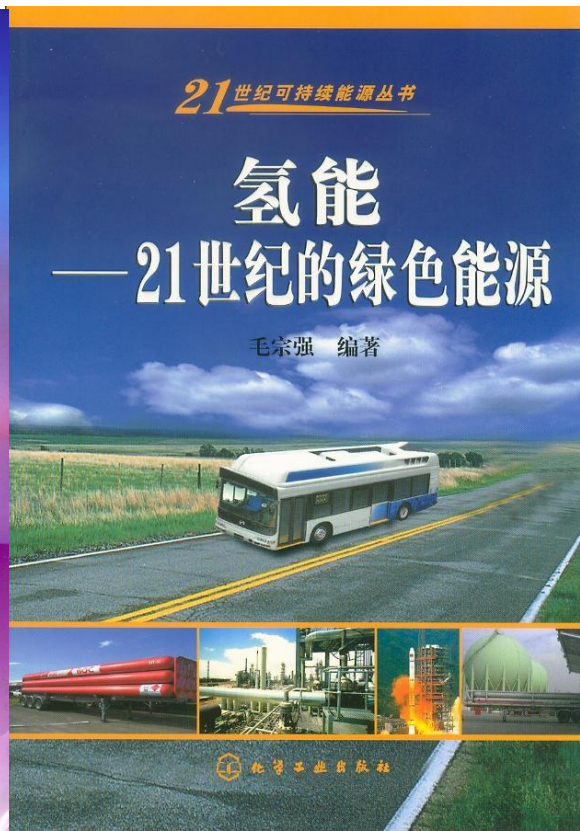
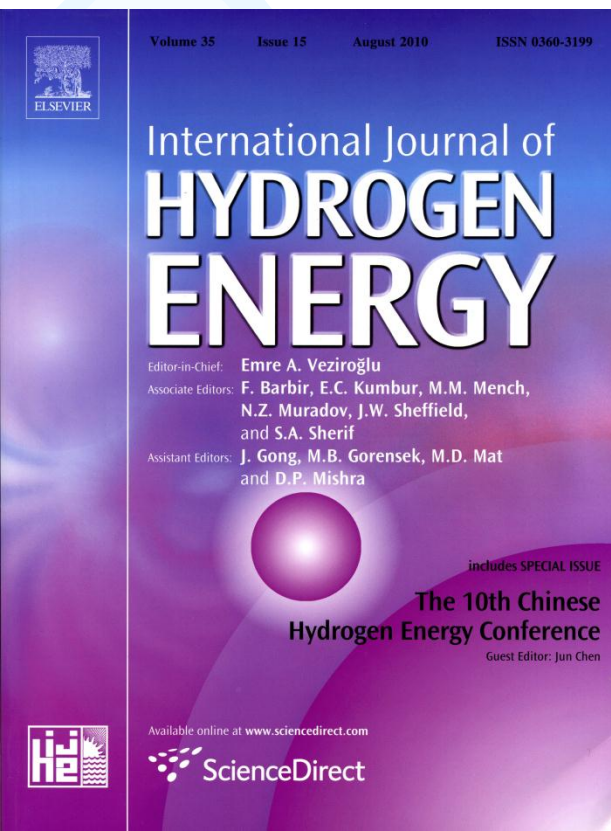
HCNG passenger car in WHEC 2010, Germany, Essen, May 2010



1) HCNG fuel RD&D in China

毛宗强,刘志华. 中国氢能发展战略思考[J]. 电池,2002,.

Z.Q. Mao, Hydrogen energy in China, 14th World Hydrogen Energy Conference, 2002.06.09-13, Montreal, Canada



1) HCNG fuel RD&D in China

At present the hydrogen combustion is a real practical way. It is interested that the hydrogen- natural gas mixture can reduce the NOx evidently. It is believed that combustion is the practical way to use hydrogen in China before the fuel cells being commercial.

1) HCNG fuel RD&D



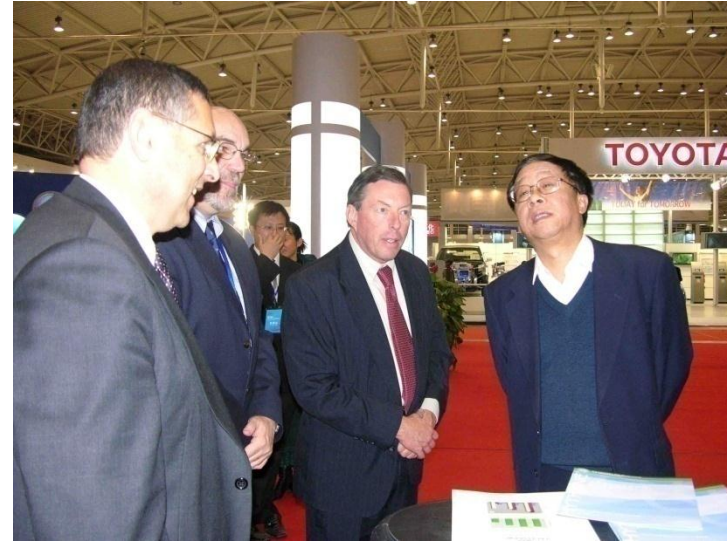
Ms.L ZHANG, Gregory Egan, Frank Lynch, ZQ Mao, Gregory H Solomon, A ZHANG met in WA, Australia on Sept.15,2004 (from left to right)

1) HCNG fuel RD&D



Discussing HCNG with Mr BS LI of High Technology division of MOST in MOST meeting room on Oct.15,2004.

1) HCNG fuel RD&D

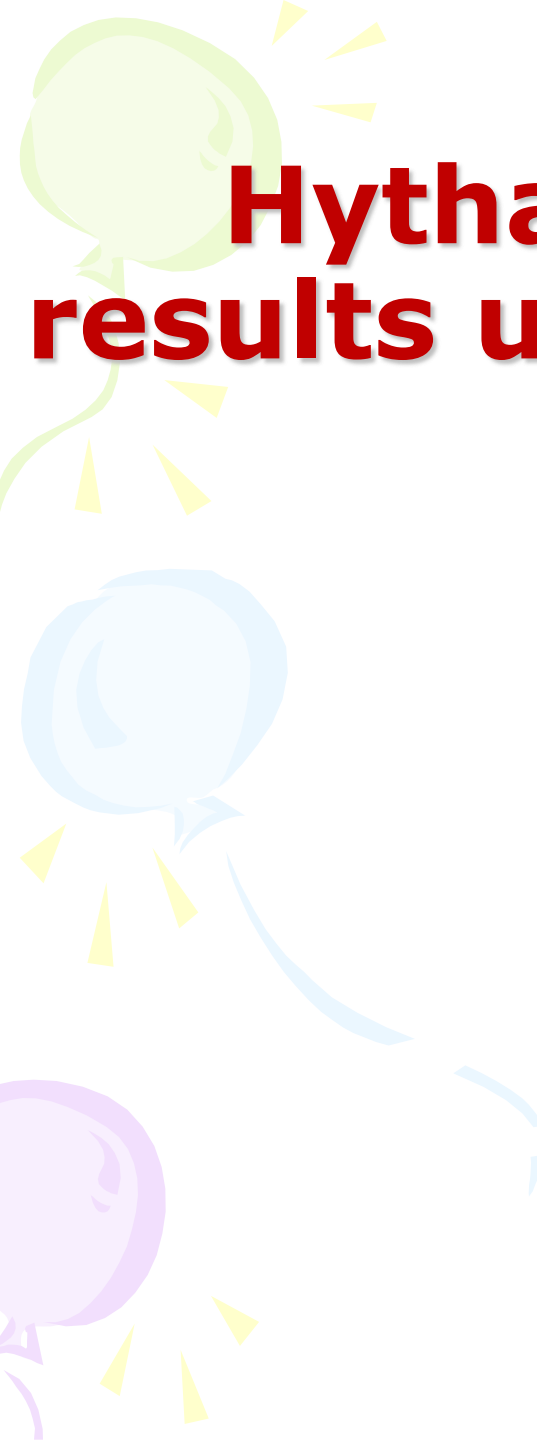


第四届北京国际清洁汽车技术及产品展览会
2005年11月27日



1) HCNG fuel RD&D

- Prof. A Zhang, Tsinghua University, signed an agreement on CDM of HCNG with HYTHAN CHINA on July 1, 2005.
- HYTHAN CHINA signed an agreement of HCNG engine R&D with YuCai Co. in October 2005.
- HYTHANE CHINA signed MOU with CATAC about Hythane engine authentication in Tianjin on Nov.10, 2005.



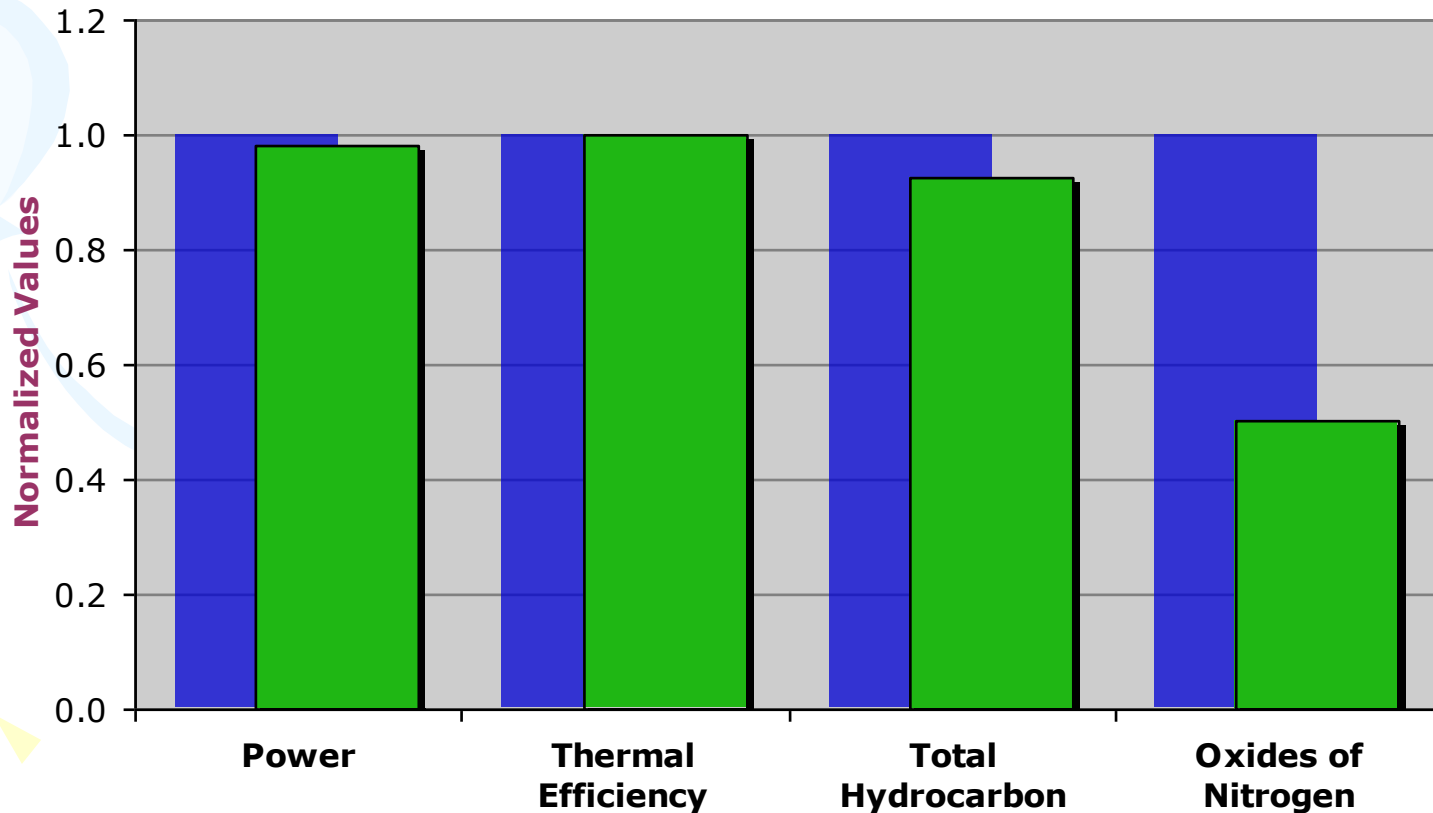
Hythane China got good results using Yucai CNG Engine

YUCHAI HYTHANE ENGINE NOVEMBER 2005 DATA

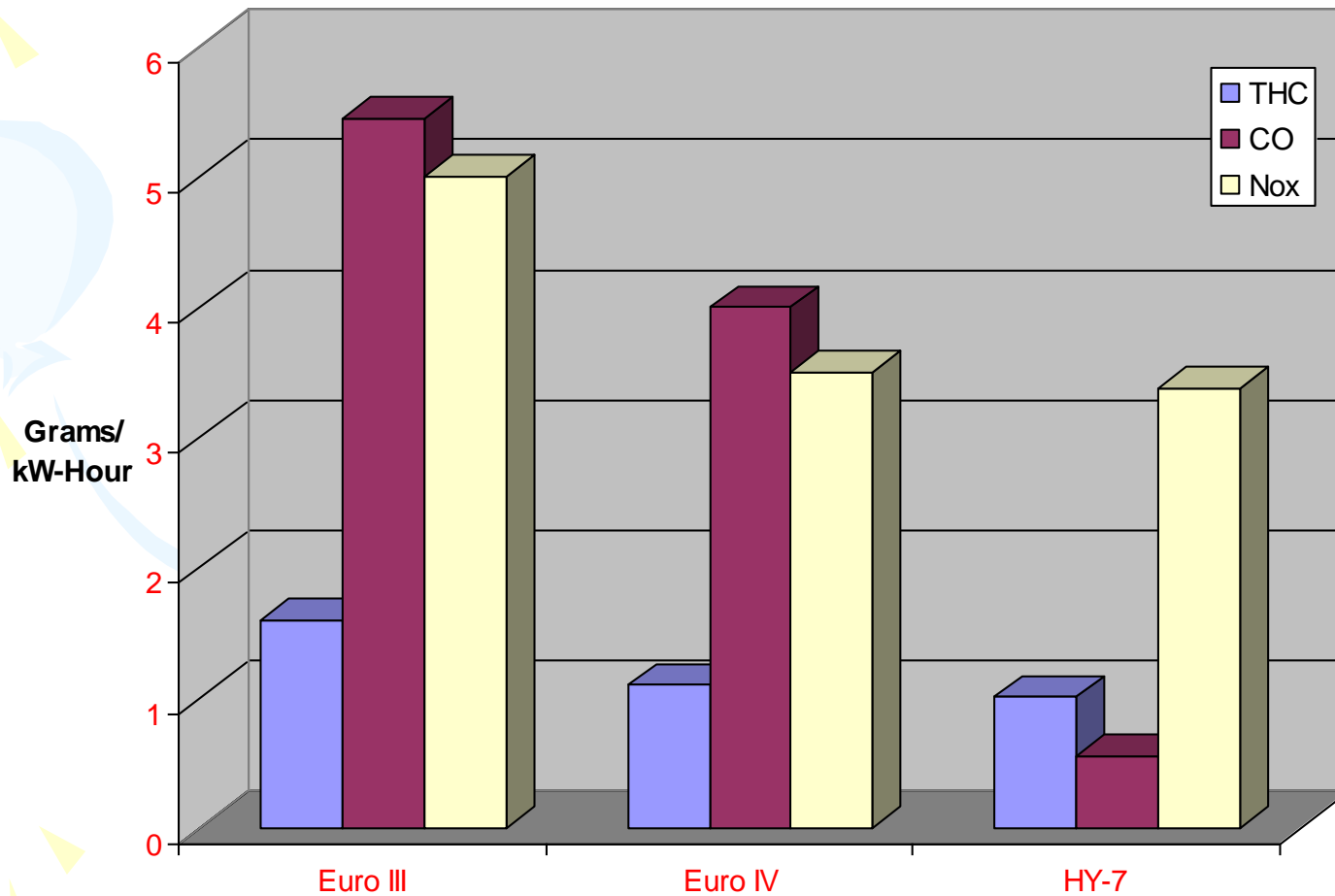
Yuchai YC6G260N Emissions Results
European Stationary Cycle

YUCHAI HYTHANE ENGINE

■ [CNG [baseline ■ [Hythane [7% H2 by energy



Yuchai Euro IV Hythane Emissions



1) HCNG fuel RD&D



March 2006 DR. Mao visited Japan



March 2009 DR. Mao visited India
HCNG filling station.

2) HCNG Engine RD&D support by MOST

MOST 863 Project 2006AA11A1B7

R&D of hydrogen/natural gas engine
(2006-2008)

国家十一五863课题“氢气/天然气发动机研究开发”(2006AA11A1B7)(2006-2008年)



Comparing of HCNG & CNG Engine (I)

HCNG(20H%) Engine data

转速 (rpm)	1200	1600	2000	2400	2800
转矩 (N·m)	644.0	609.5	600.3	596.7	563.0
功率 (kW)	80.93	102.1	125.7	150.0	165.1
气耗率 (g/kW·h)	200.3	205.2	205.4	207.5	215.7

CNG Engine data

转速 (rpm)	1200	1600	2000	2400	2800
转矩 (N·m)	562.0	620	603	558	518.0
功率 (kW)	70.62	107.2	126.38	140.2	154.1
气耗率 (g/kW·h)	196.8	195.6	200.7	206.5	215.4

Comparing of HCNG & CNG Engine (II)

Emission of HCNG engine

NOX (g/kW·h)	CO (g/kW·h)	NMHC (g/kW·h)	CH4 (g/kW·h)
2.5	0.04	0.23	0.22

GB17691-2005 Euro IV Standard

NOX (g/kW·h)	CO (g/kW·h)	NMHC (g/kW·h)	CH4 (g/kW·h)
3.5	4.0	0.55	1.1

MOST 863 project

- **MOST 863 project: Hydrogen product by renewable energy & HCNG bus R&D. fund:9.4M RMB**

- 科技部 863项目：可再生能源制氢及 HCNG城市客车研发 (2005AA501880)

北京清能华通科技发展有限公司 ,经费
940万人民币



HCNG Bus test

No	Product date	Run range	Test date	Power
1	2006. 11. 30	4978km	2007. 2. 2	hybrid
2	2006. 11. 30	6907km	2007. 2. 2	ICE
3	2007. 01. 20	3037km		ICE
4	2007. 02. 05	689km		ICE



From Mr. OY Meng



China HCNG bus Data

- Max. speed: 80km/h
- Max. climbing: 25%
- Accelerated time: (0-50km/h) ≤ 20 Sec
- Emission: EURO III
- Range: ≥ 300 km
- Fuel economy: The similar with CNG bus

A decorative graphic on the left side of the slide features a green balloon at the top, a blue balloon in the middle, and a purple balloon at the bottom, all with yellow streamers and triangular flags.

3) HCNG fuel RD&D by Shanxi GEDR

山西省国新能源发展集团有限公司

HCNG Project:

- HCNG heavy tracks: 20% HCNG
- HCNG Industrial fuel: >10% HCNG
- HCNG home fuel: about 5% HCNG

HCNG station in GEDR:

- **Design capacity:**

2-2.5MPa HCNG 150,000NM³/d

20-25MPa HCNG 50,000NM³/d

- **Filling time for each track** < 10min

- **Expect open date:** End of October 2010.



HCNG Track DEMO

Track type: N6105S2303

Engine: YC6J210-33

Number: 10-30



3) HCNG fuel RD&D by Shanxi GEDR, TU, & CAHE



4) HCNG Future in China

- About 100 billion M3 CNG is used about 4% in National Energy
- There are 200 billion CNG will be used in China in 2015.
- At the moment there are about 400,000 CNG vehicles in China.
- We estimated 1M HCNG vehicles and 3000 CNG/HCNG filling stations in end of 2015.

节能与新能源汽车技术开发进程（规模应用）

选择有条件的城市，连续三年组织开展“十城千辆”新能源汽车示范，重点在公共交通工具

中央财政对公交车、出租车运营单位和其他政府采购部门进行补贴。其中，燃料电池车20—60万人民币/台





**Thanks for your
attention!**