



International Partnership  
for the Hydrogen Economy

th IPHE Steering Committee Meeting

14-15 September, 2005 , Kyoto

***R&D on Hydrogen  
Refueling Station  
at **SK** Corporation,  
KOREA***

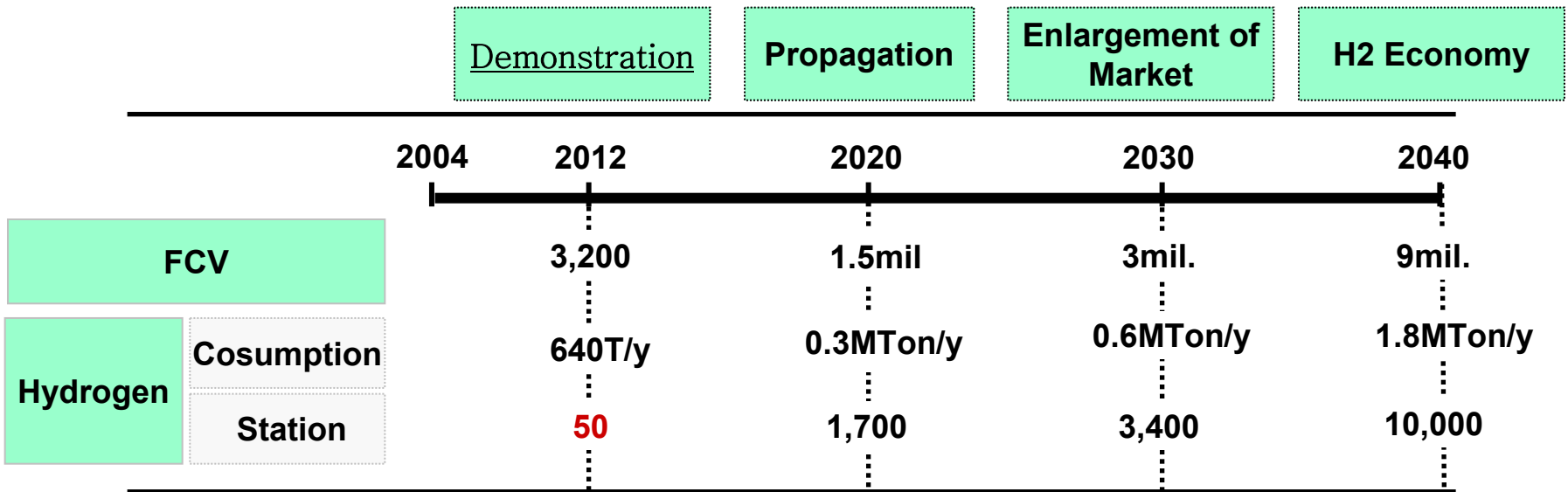
**September 15, 2005**

**Young-Seek Yoon**

**Corporate R&D Center  
**SK** Institute of Technology  
**SK** Corporation**

# Roadmap for H2 Infrastructure in Korea

Strong support from the government for Hydrogen and Fuel Cell R&D  
 - Energy Security and Improving Environment



FCV : 20,000 km/y

# R&D on Hydrogen Station in Korea

- 4 Hydrogen stations are being developed and will be completed in 2007.
- **SK** is playing a pivotal role in national RD&D programs for the commercialization and propagation of hydrogen stations in Korea.

Organization	H <sub>2</sub> Energy R&D Center (MOST)	National RD&D Organization for H <sub>2</sub> FC (MOCIE)				
		Target	Contractors	Fund/Period	Products	Construction
	SR of LNG, H <sub>2</sub> Supply system for H <sub>2</sub> station	Develop in house technology for H <sub>2</sub> Station	Construction and Demonstration of H <sub>2</sub> Station	Construction and Demonstration of H <sub>2</sub> Station		
	Main – KIER Cooperators - <b>SK</b> , KOGAS	Main – <b>SK</b> Sub - KIST, KIER, KRICT, etc.	Main – <b>KOGAS</b> Sub – H&KMC	Main – <b>GS Caltex</b>		
	\$M5/5.5yr ('03 ~ '09)	\$M6.3/5yr ('04 ~ '09)	\$M3.6/4yr ('04 ~ '08)	\$M3.6/4yr ('04 ~ '08)		
	LNG reformer, LNG H <sub>2</sub> Station	LPG reformer, LPG H <sub>2</sub> Station	LNG H <sub>2</sub> station	Naphtha H <sub>2</sub> Station		
	Oct. '05	Aug. '07	Aug. '06	Dec. '06		

# SK Corp. & CRD R&D Center of SKIT

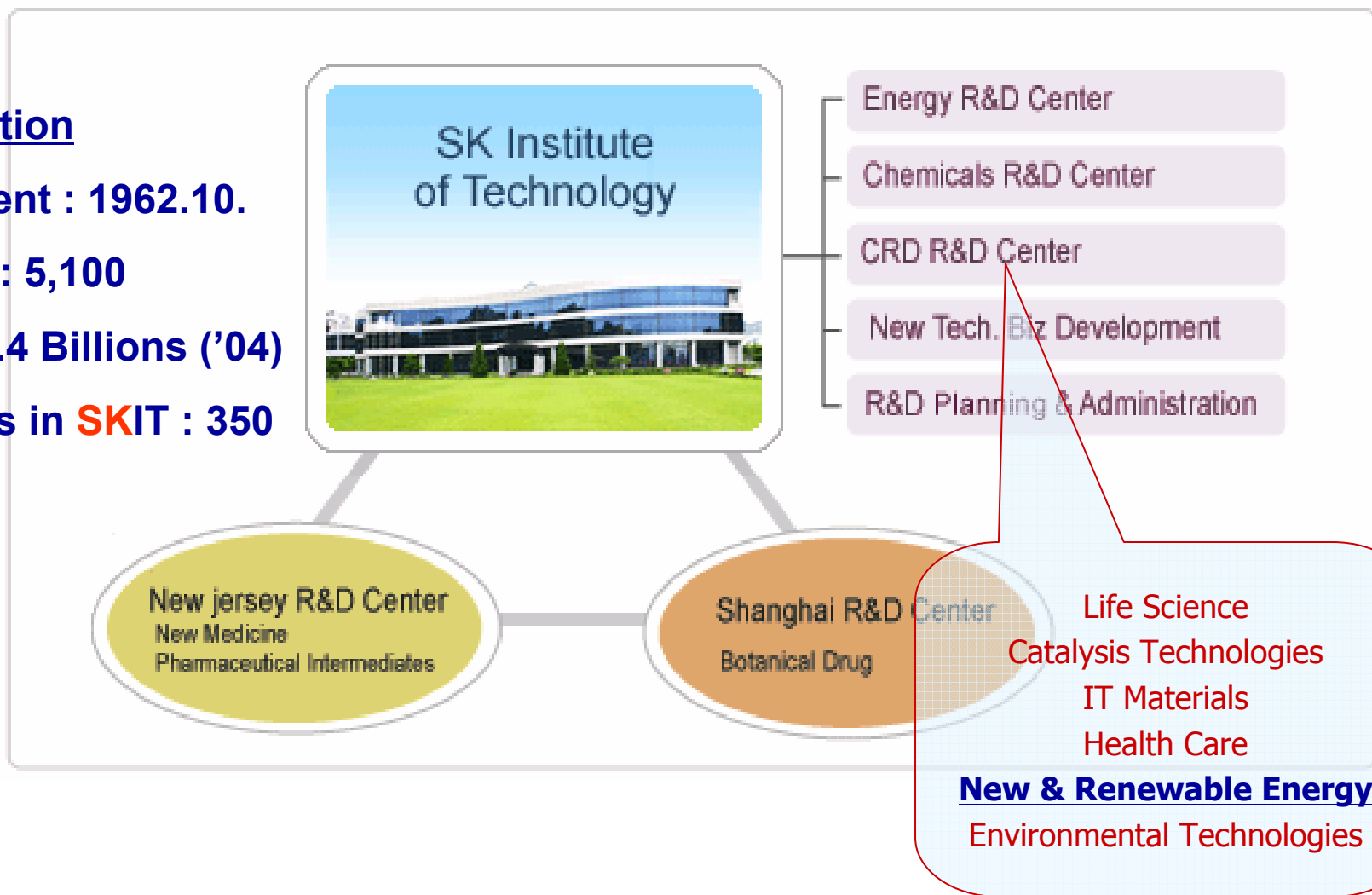
## SK Corporation

Establishment : 1962.10.

Employees : 5,100

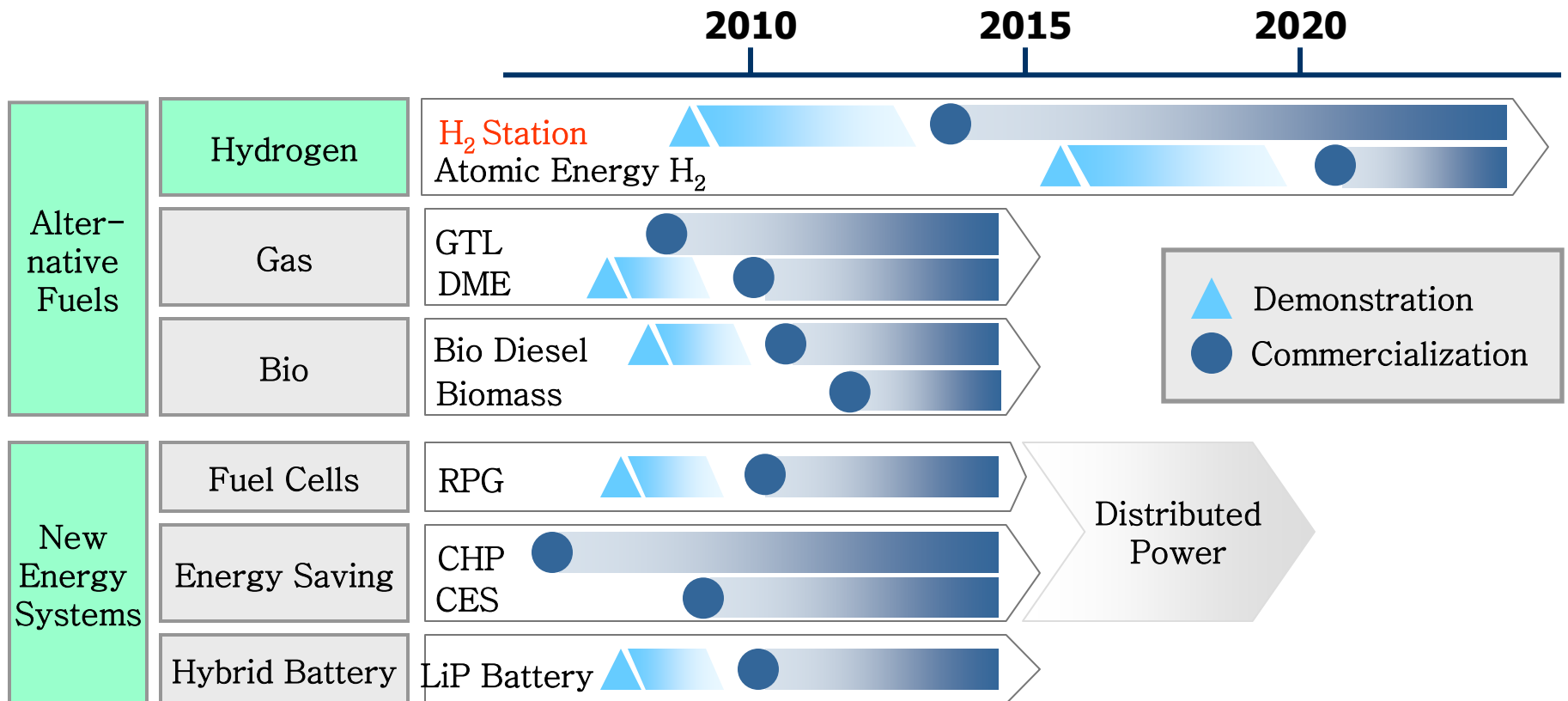
Sales : \$ 17.4 Billions ('04)

Researchers in SKIT : 350



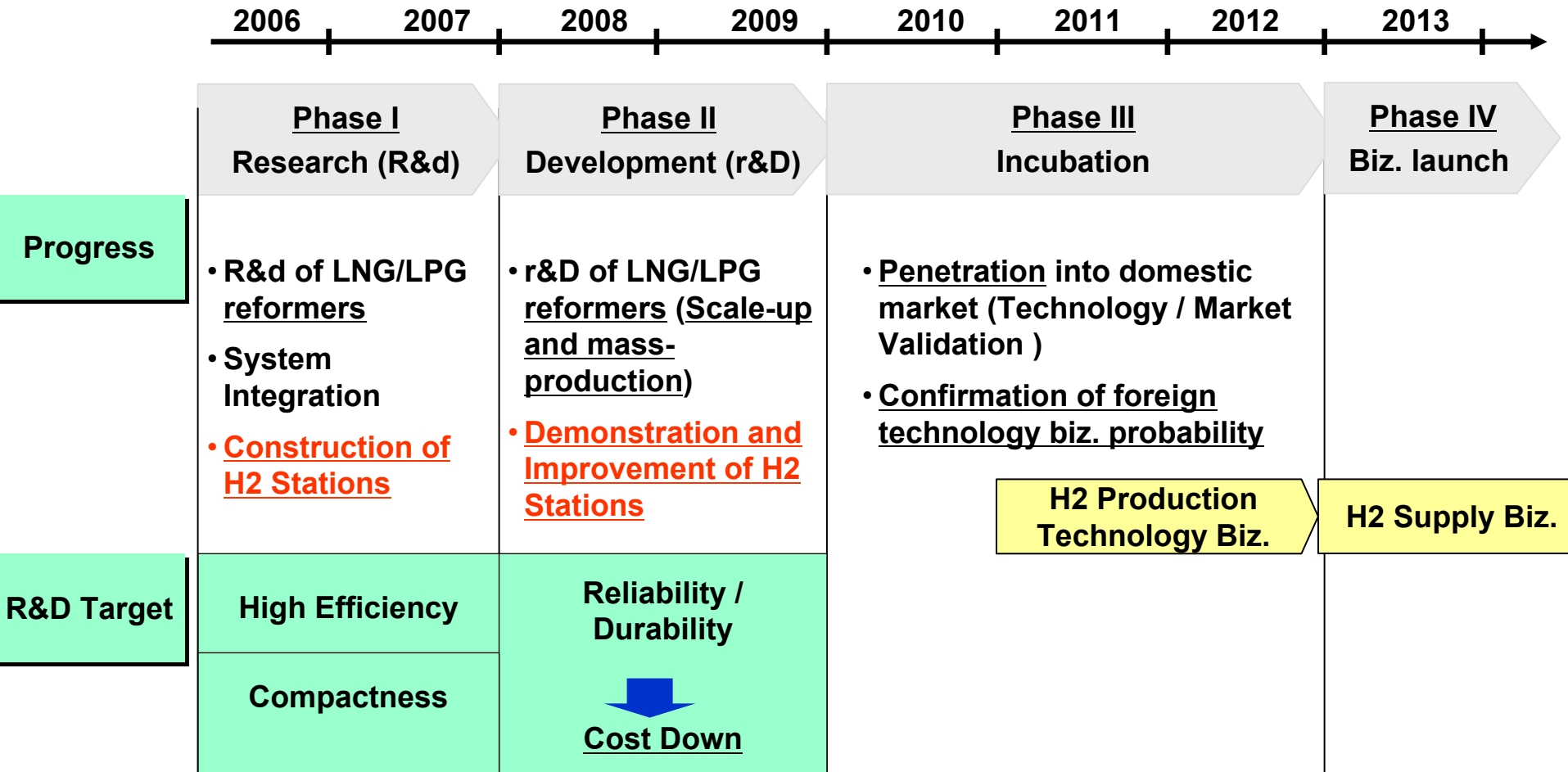
# Roadmap for New & Renewable Energy at SK

Secure and provide new & renewable energy sources for the future



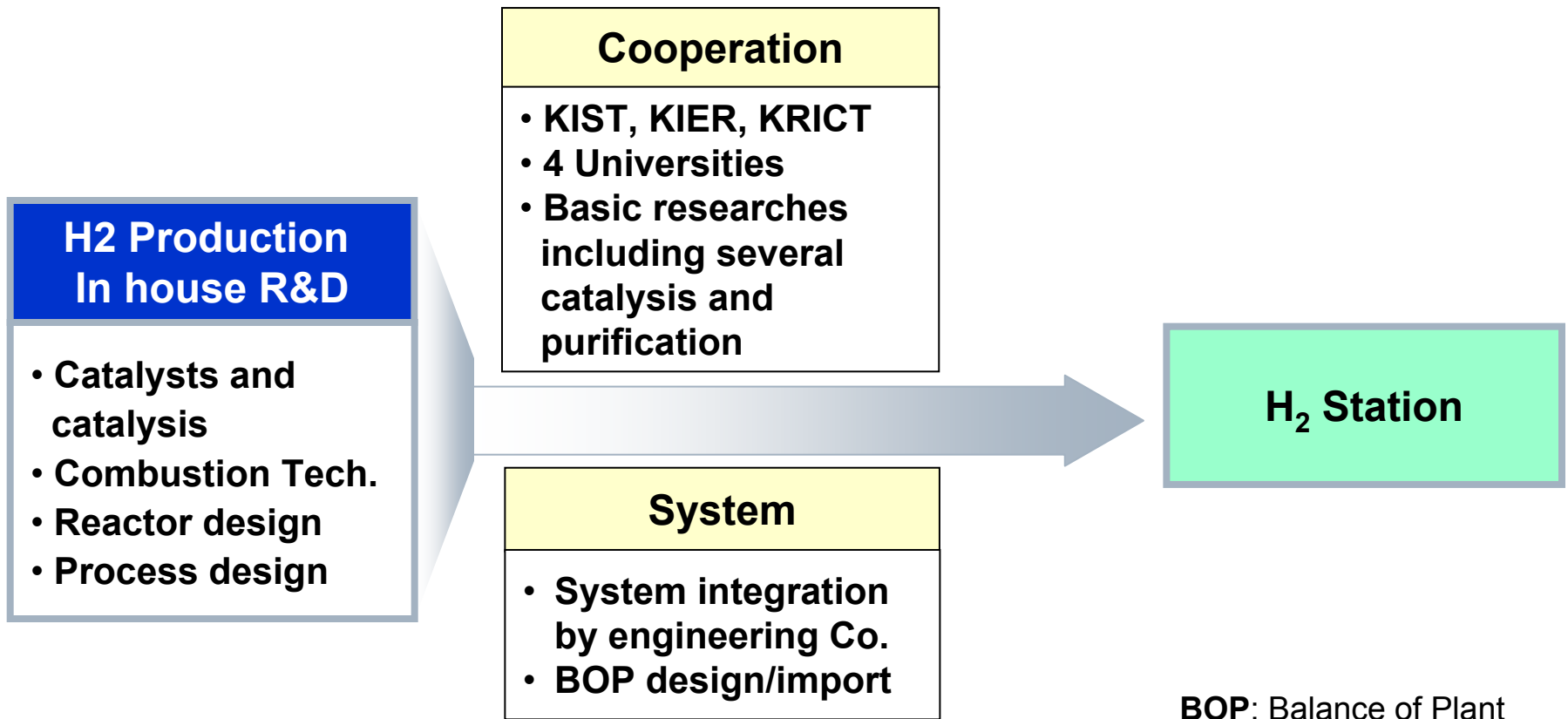
# SK's R&D and Business Plan for H2 Stations

- A 30Nm<sup>3</sup>/h class H2 station using LPG will be constructed in 2007.
- Demonstration and improvement of H2 station by 2009.



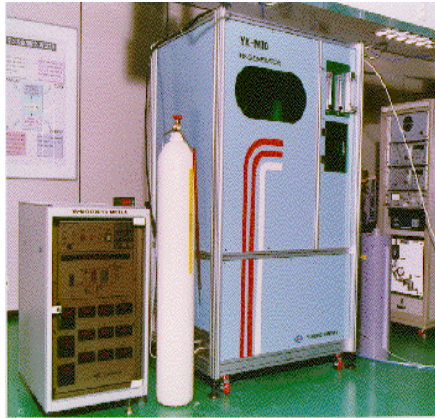
# R&D Strategy for H2 Station

- Focus on H2 production technology, which is one of the key technologies in hydrogen stations for FCVs
- Collaborate with three national institutes & four universities



# History of SK's H2 Production Technology

## H2 Generator (1996 ~ 1998)



- Steam reforming + PSA
- Hydrogen Purity : 99.99+ %
- US Patented
- Supply
  - MeOH Type : KOGAS (10 Nm<sup>3</sup>/hr)
  - NG Type : KEPCO(5 Nm<sup>3</sup>/hr),  
Samsung Eng.(10 Nm<sup>3</sup>/hr)

## UHP H2 Generator (2001)



Capacity : 10 Nm<sup>3</sup>/hr  
Size : 80 X 60 X 175(cm)  
Full automatic  
Explosion-proof

### Characteristic

- Feed : Methanol
- Tech. : SR, Metal Membrane, Comb. Cat.

### Applications

- R&D facility for H2 supply
- Industrial H2 supply



# Current Status of SK's H2 Production Technology

## Key Technology

30Nm<sup>3</sup>/hr High Efficient Steam Reformer System

Catalysis

Process Design

Combustion Technology

Reactor Design

- Screening of commercial catalysts
- Optimization of reaction conditions
- Improve and develop required catalysts

- Optimum Heat & Mass Balance
- Optimization of Reforming Process
- PFD

- Decision of Burner Type & Design
- High Efficient Burner Design for Combustion of Natural Gas & PSA off-gas

- Integrated Design of Burner & Reformer
- Steam Reformer & Shift Reactor Design
- Optimum Heat Exchange & Heat Recovery

# 30Nm<sup>3</sup>/h Class LNG Steam Reformer Prototype



Reformer combined with H-E & Control Unit

## Design Value in SR

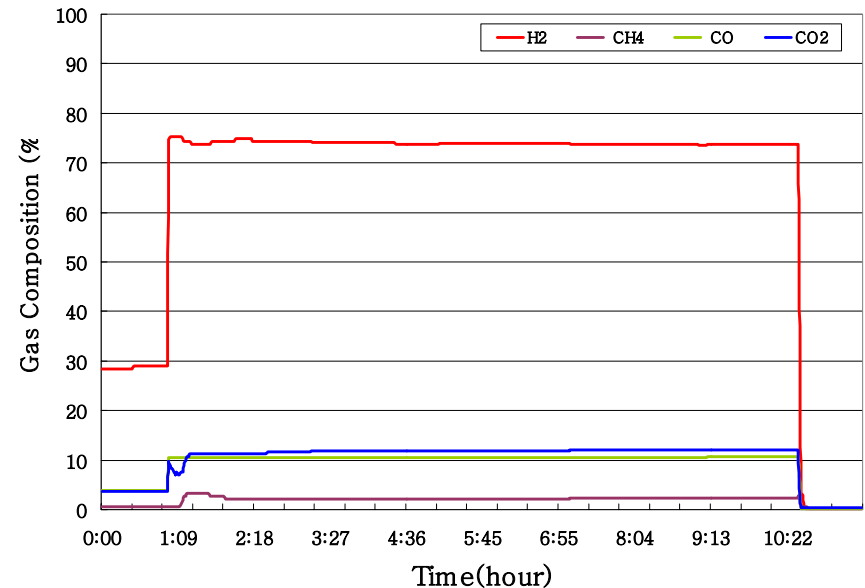
H<sub>2</sub>: 75.5%  
CH<sub>4</sub>: 2.3%  
CO: 12.3%  
CO<sub>2</sub>: 10.1%  
Conversion of CH<sub>4</sub>: 90%



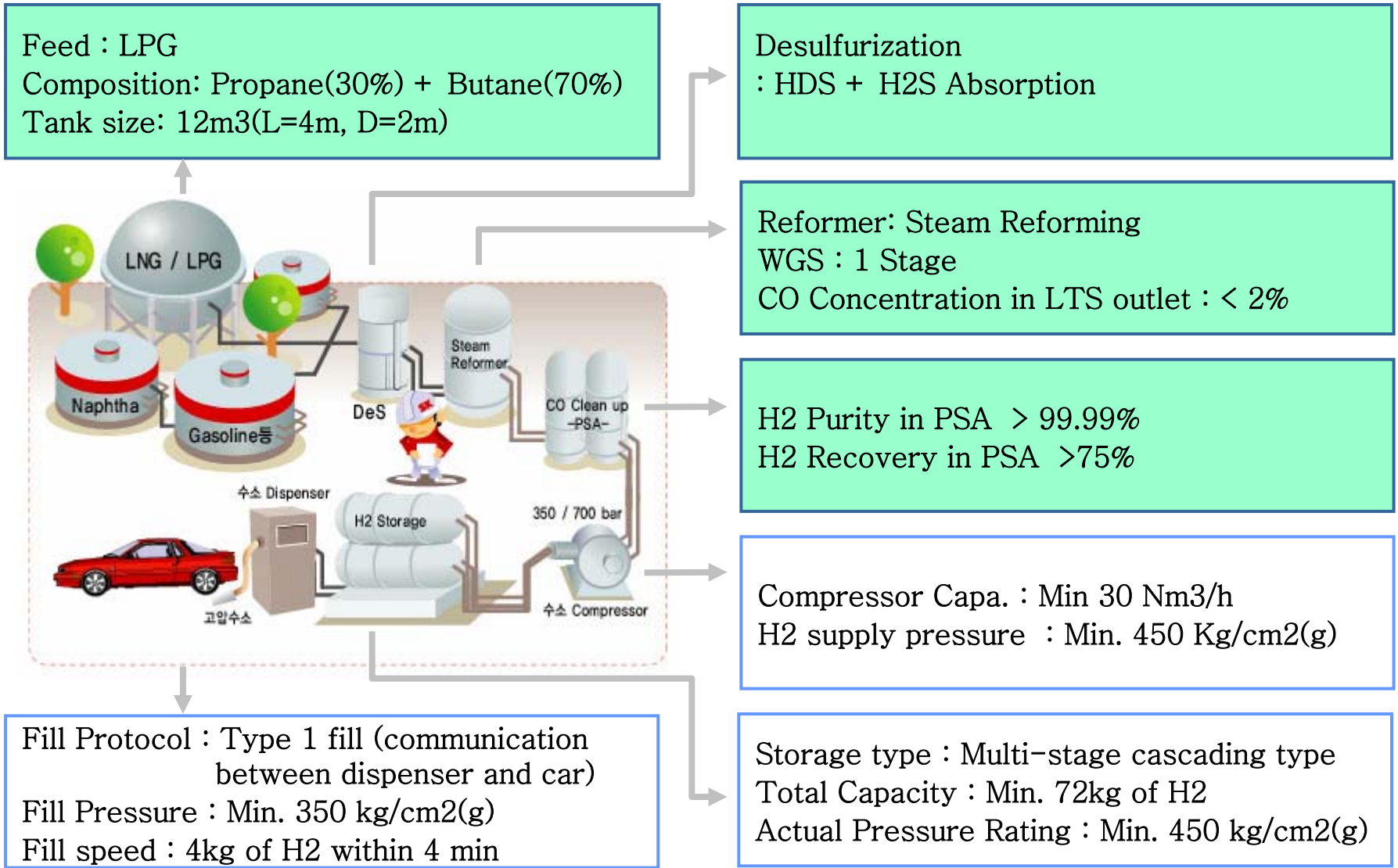
## Experimental Value in SR

H<sub>2</sub>: 73~75%  
CH<sub>4</sub>: 2~3%  
CO: 11%  
CO<sub>2</sub>: 12%  
Conversion of CH<sub>4</sub>: 88.3%

## Reformate Composition

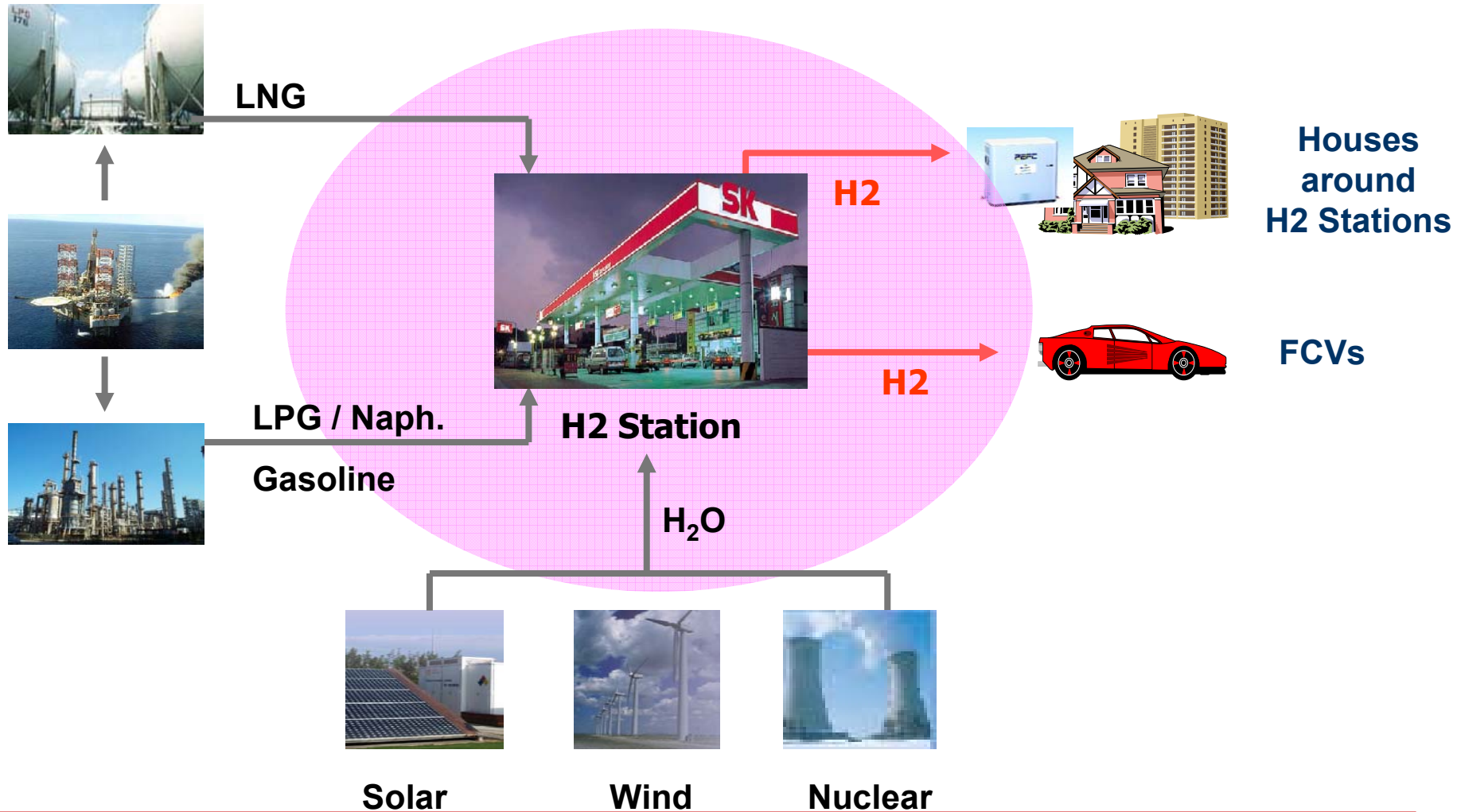


# Conceptual Design of LPG type H2 Station



# SK's Hydrogen Energy Vision

Domestic market leader in supplying hydrogen for automobiles & other users



**SK**

**SK Corporation, the first and biggest energy and chemicals company in Korea**



**Thank You for Your Attention!**

**SK Institute of Technology**

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