

Sustainable Mobility – Fuel Cell Vehicles

DREAMS...
REALITY...



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Drive your way™



The Power to Surprise™

Agenda

- History
- Technology Development
- Current Activities
- Deployment Strategy

Hyundai & KIA Development History

2008 ~ 2009

- *Borrego FCV* (115 kW, HMC)
- *Sportage FCV-II* (100kW, HMC)

2007 ~ 2008

- *Tucson FCV-II* (100kW, HMC)
- *Low Floor FCBus II* (200kW, HMC)
- *I-Blue FCV* (Concept)

2005 ~ 2006

- *Tucson FCV, Sportage FCV* (80kW, HMC)
- *Low Floor FCBus* (160kW, HMC)



Korea, MKE Fleet Program
(2006.08 ~ 2010.07)

※ MKE: Ministry of Knowledge Economy
Similar to US DOE

2004 ~ 2005

- *Tucson FCV* (80kW, UTCP)
- *Sportage FCV* (80kW, UTCP)



USA, DOE Fleet Program
(2004.09 ~ 2009.12)

2000 ~ 2002

- *Santa Fe FCV* (75kW, UTCP)



CaFCP
(2000.11 ~ Present)

Tucson FCV & Tucson FCV II

▣ Tucson FCV (2004) ▣

▣ Tucson FCV II (2007) ▣



	Tucson FCV	Tucson FCV II
Fuel Cell Power	80 kW, UTCP	100 kW, HMC
Aux. Power	LiPB	Super-capacitor
Motor System	80 kW	100 kW
H₂ Tank	3.6 kg H ₂ @ 350 bar	3.6 kg H ₂ @ 350 bar

Sportage FCV II & Borrego FCV

▣ Sportage FCV II (2008) ▣

▣ Borrego FCV (2008) ▣



	Sportage FCV II	Borrego FCV
Fuel Cell Power	100 kW, HMC, Metal BP	115 kW, HMC, Carbon BP
Aux. Power	Super-capacitor	Super-capacitor
Motor System	100 kW	115 kW
H₂ Tank	3.6 kg H ₂ @ 350 bar	7.9 kg H ₂ @ 700 bar

Low Floor FCBus

▣ FCB I (2006) ▣

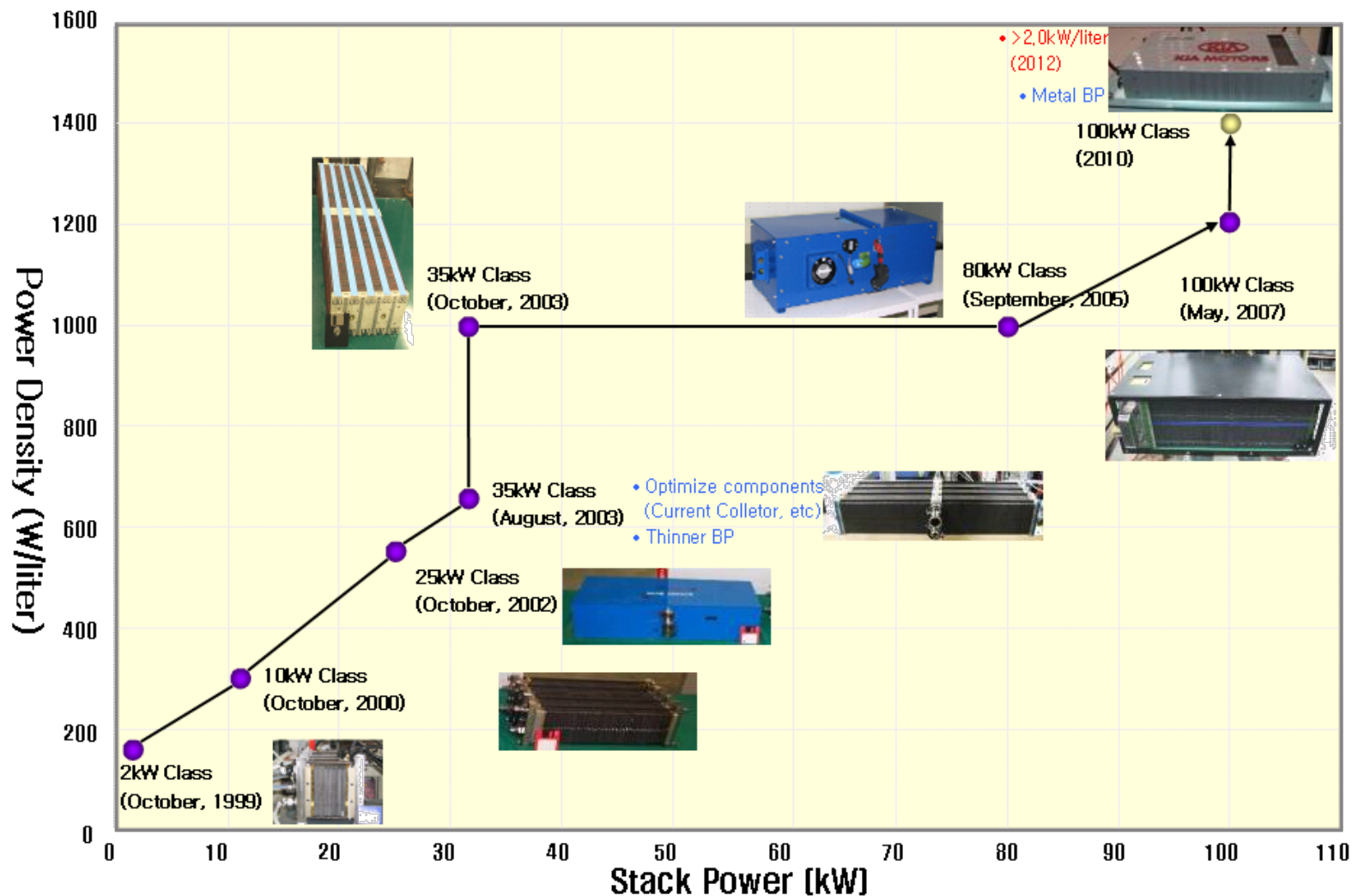


▣ FCB II (2008) ▣



	FCB I	FCB II
Fuel Cell Power	160 kW, HMC	200 kW, HMC
Aux. Power	Super-capacitor	Super-capacitor
Motor System	240 kW	300 kW
H₂ Tank	40 kg H ₂ @ 350 bar	30 kg H ₂ @ 350 bar

HMC Fuel Cell Stack



Driving Range

San Francisco – LA Trip without Refueling, 396 mi (2008)



Golden Gate Bridge



I-5 Highway

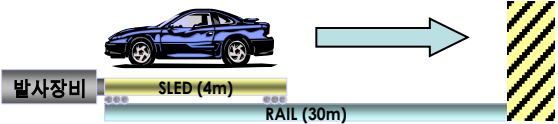

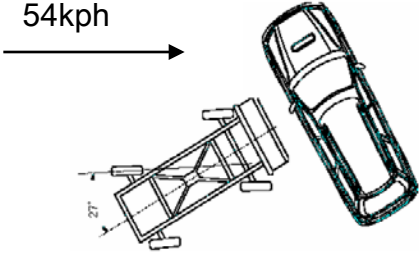

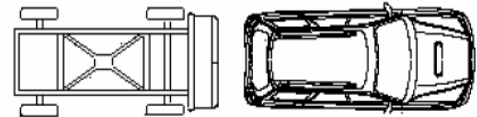

The public-road test program started at the Golden Gate Bridge in San Francisco and, via I-5 Highway, concluded at Los Angeles, covering approximately 396 miles on single fueling.

- Additional drivable distance : 75miles
- Total Range for this test run : 471miles
- Avg. fuel efficiency for the run : 60.47mpkg



Los Angeles

Safety Verification

Test Item	Test Code	Test Set-up
<p>Sled Impact Test (Hyundai Internal)</p>	<p>Tracing of 75kph (Impact : 40G)</p> 	 <p>Test : He gas, 30bar</p> <p>No Leak, Check the deformation of H₂ storage and delivery system</p>
<p>Side Impact Test (FMVSS 305)</p>	<p>54kph</p> 	 <p>Test : He gas, 10bar</p> <p>No Leak for 1.5hrs</p> <p>Check the deformation of H₂ storage and delivery system.</p> <p>Check the H₂ tank burst pressure.</p>
<p>Rear Crash Test (FMVSS301)</p>	<p>48kph</p> 	 <p>Test I : He gas, 30bar</p> <p>Test II : He gas, 350bar</p> <p>No Leak in the H₂ storage and delivery system</p>

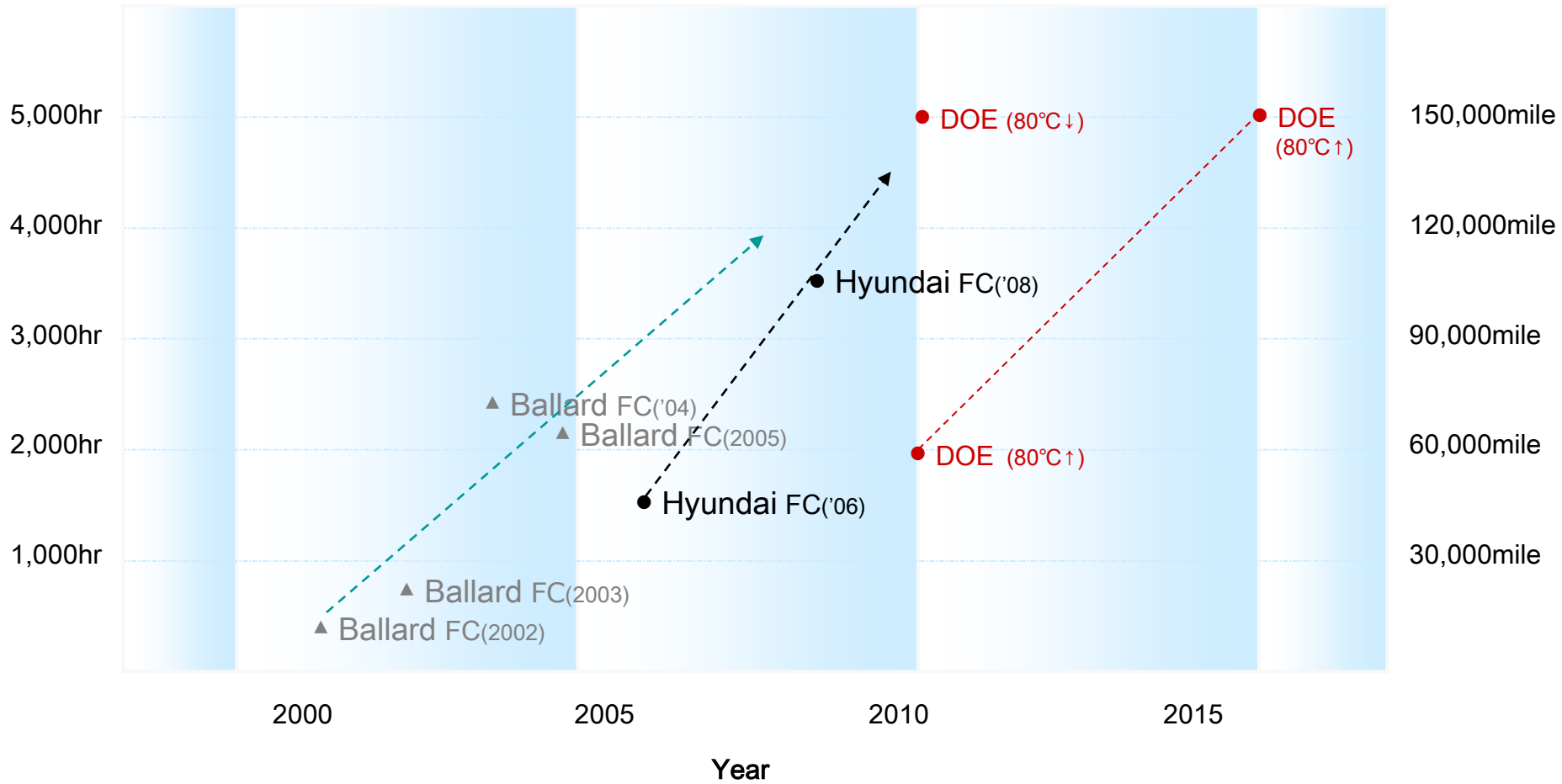
Cold Start

Start Up at -20 C

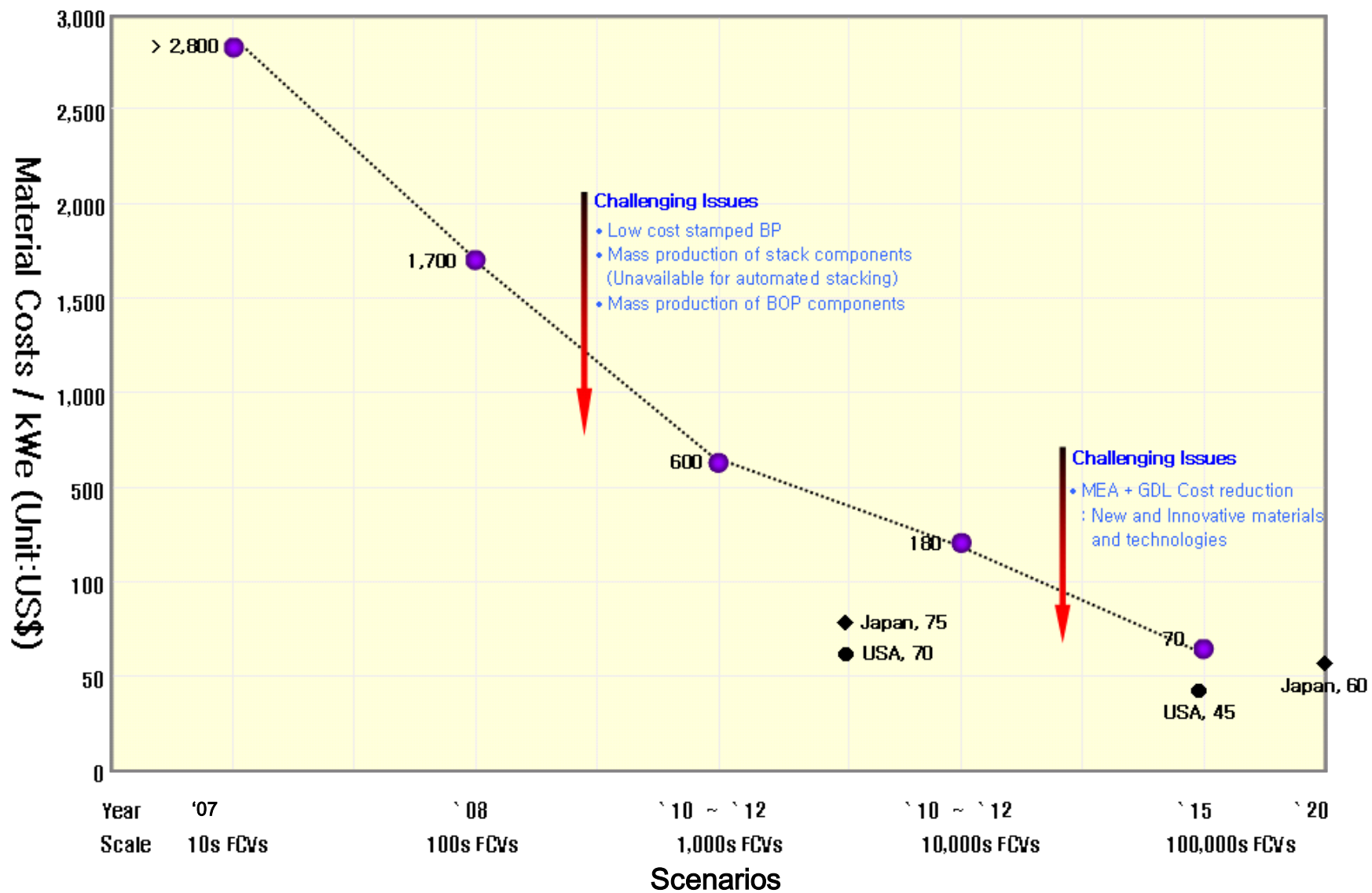
- Vehicle was soaked at -20 C for 24 hours in the environment chamber
- Start up at without external power supply



Durability



Cost Target



USA, DOE Fleet Program

1. Objective - Verification of commercialization of FCEV

2. Period : 2004. 12 ~ 2009. 12

3. Vehicles : 33 Tucson/Sportage FCVs

4. Partners

- Chevron (Hydrogen Filling Station)
- UTC Power (Fuel Cell Stack)
- Hyundai-Kia (Vehicle Development & Maintenance)



Korea, MKE Fleet Program

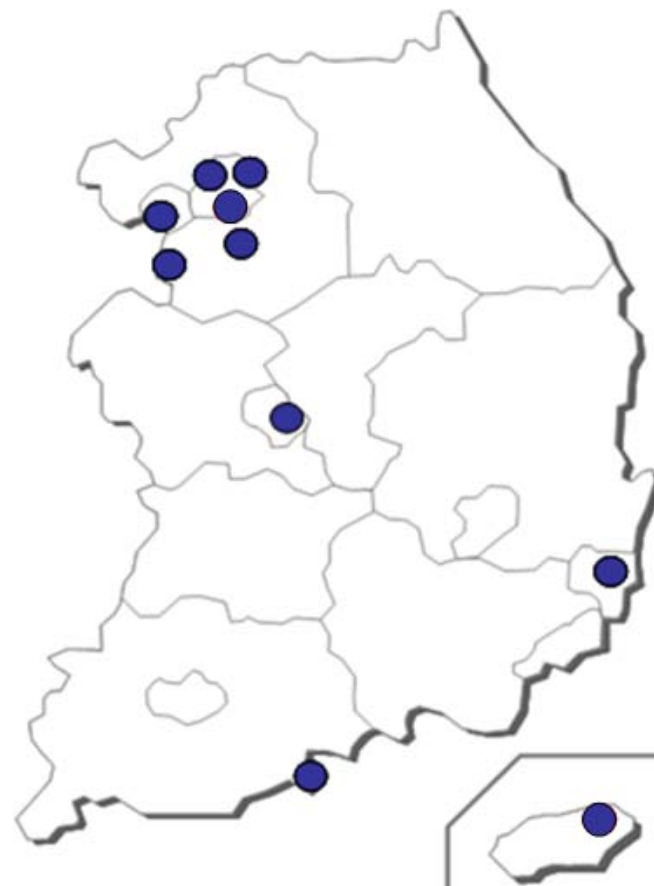
1. Objective - Verification of commercialization of FCEV

2. Period : 2006. 8 ~ 2010. 7

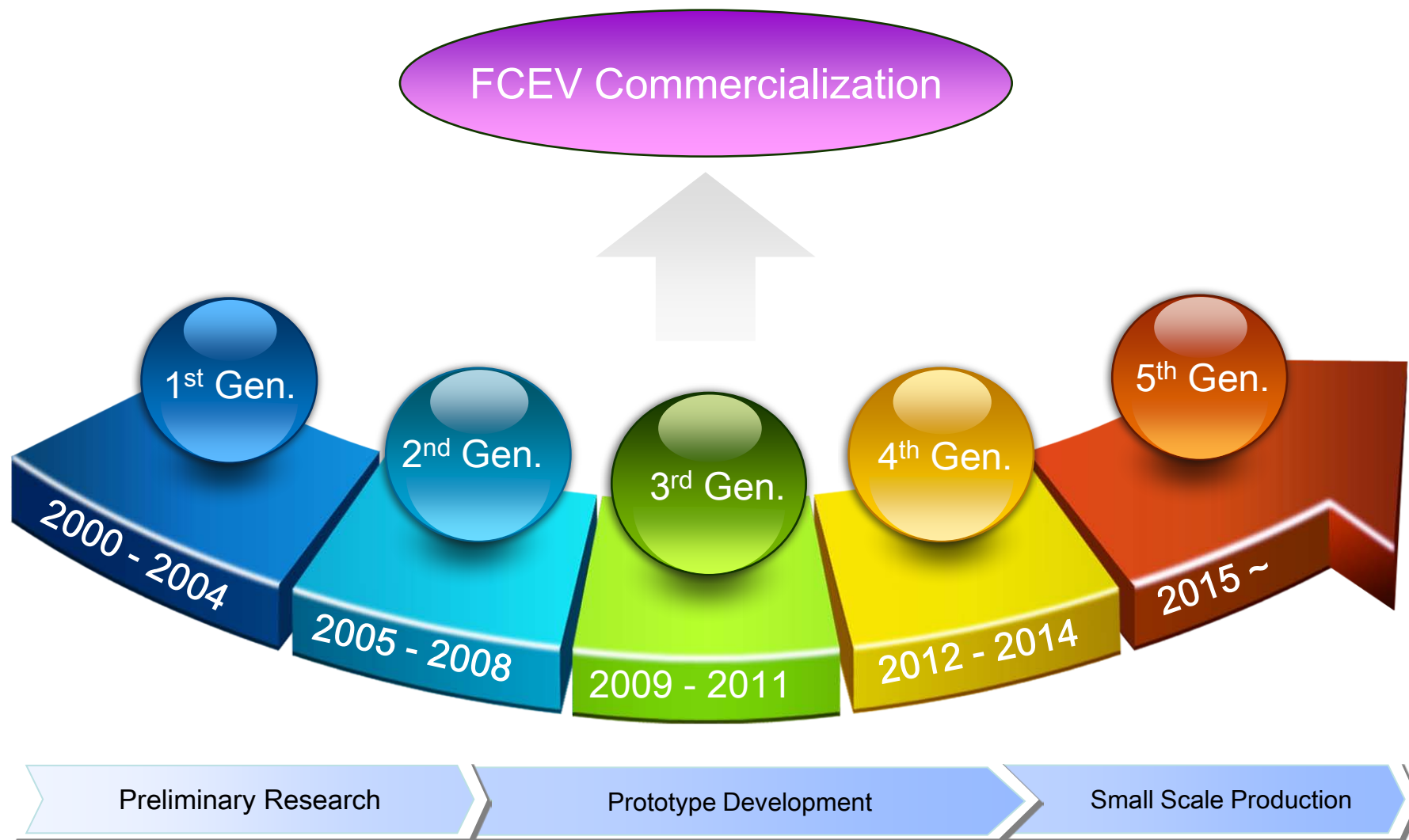
3. Vehicles : 30 FCVs, 4 FCBuses

4. Partners

- Fuel Cell Stack & Vehicle Development : Hyundai-Kia Motors
- Hydrogen Fueling Station : 10 (5 new stations)
 - Operation
Hyundai Motors(2), KOGAS(1), GS-Caltex(1), SK-Energy(1)
 - Construction
Hyundai Motors(2), KIST/Hyundai Motors(1)
Dongdeok Industrial Gas(1), SPG Chemical(1)
- Education & PR : NGVTEK (HMC's affiliates)
- Researches commissioned : KIST, Konkuk Univ., Ulsan Univ.



Roadmap for FCV Development



4th Generation FCV

2012 Series Production

- Small scale production
- 100kW PEMFC with metallic bipolar plate
- Lithium Polymer battery
- more than 60% system efficiency
- -20°C cold startup capability



Thank You