# 2005 DOE Hydrogen Program Review

***Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project***

TEAM: ChevronTexaco Technology Ventures
Hyundai-Kia Motor Company
UTC Fuel Cells

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Project ID TV11

This presentation does not include any proprietary or confidential information.

# Overview

## Timeline

January 15, 2004

September 30, 2009

< 5% completed

## Barriers

| Peformance Measure | Units | 2008 Target | 2015 Target |
|---|---|---|---|
| Fuel Cell Stack | Hours | 2000 | 5000 |
| Range | Miles | 250 | 300 |
| $H_2$ Cost | $/kg | $3.00 | $1.50 |

## Budget

Total project funding - $93.9 mil

- ✓DOE share = $37.8 mil
- ✓Contractor share - $56.1 mil

Funding FY04 - $3.0 mil

Funding FY05 - $0.7 mil

## Team Members

- Hyundai-Kia Motor Companies
- UTC Fuel Cells
- Hyundai Kia America Technical Center
- Alameda Contra Costa Transit
- Southern California Edison

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# Objectives

- To better understand how fuel cell vehicles and hydrogen infrastructure can be designed to work together to fuel vehicles of the future.
- To understand how an average individual would react to a fuel cell car / hydrogen energy station.
- Compare different methods of hydrogen generation along with the use of stationary fuel cells to co-generate power.
- Test the impact of different climatic conditions on fuel cell cars.
- Assist in the development of research for use in important safety and legal codes and standards.

# Approach - Infrastructure

- Up to six fueling stations using different types of hydrogen generation technologies.
  - ✓Ranges from natural gas reforming to electrolyzers
- Some stations may deploy stationary fuel cells to study overall station balance and grid interconnections.

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# Approach -FCVS

- 32 fuel cell SUVs – Hyundai Tuscon and Kia Sportage, both powered by UTC fuel cells
- Three climatic conditions – hot, mild and cold weather sites.
- To increase range, two generations of hydrogen storage tank will be tested on the vehicles, 350 bar and 700 bar.
- Other planned generational differences are:
  - ✓ Cost reduction of key components
  - ✓ Increased reliability of BOP components
  - ✓ Increased reliability of fuel cell power train system

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# Progress / Results - Infrastructure

- First of up to six the six hydrogen stations deployed at Chino, CA
  - ✓ Reforms natural gas using the auto thermal reforming (ATR) process.
  - ✓ Station is capable of producing 15 kg of hydrogen per day and has a storage capacity of 105 kg.
  - ✓ Station is capable of dispensing 5,000 psig to two vehicles simultaneously
  - ✓ As part of station development, several training sessions were held for first responders.
  - ✓ Station received Canadian Standards Association (CSA) approval.
  - ✓ Station now has the final permit to operate.
  - ✓ Currently the station is undergoing various commissioning steps.

# Progress / Results - Vehicle

- Finished building 2 of the 32 fuel cell SUVs
  - ✓ These cars are currently undergoing road trials in Korea
  - ✓ These cars are scheduled to arrive at Chino, CA in late May where they will undergo further testing before being introduced into fleet operation.
  - ✓ Up to 7 additional cars in 2005
  - ✓ All material on order or received for 2005 deliveries
  - ✓ Data Collection system developed/validated in 2005
  - ✓ Hydrogen safe workshop to provide maintenance and service for fleet vehicles in 2005

# Future Work - Infrastructure

- Engineering design work for next hydrogen station, at Rosemead, CA, well underway.
  - ✓ Rosemead station will use an alkaline electrolyzer

- Engineering design of future stations is being developed on site-appropriate timeline.

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# Future Work -FCVS

- Engineering consideration and development for FCV Test
  - ✓ *Hydrogen safe Chassis Dyno facility in 2005*
  - ✓ *Baseline test for the first generation FCV in 2005*

# BACKUP SLIDE #1
# Hydrogen Safety - Infrastructure

- We currently believe that one of the most significant hydrogen hazards associated with the Chino facility (already built for this project) is:

  - ✓ *The unplanned and uncontrolled release of high pressure hydrogen (e.g. from storage or dispensing), which carries with it risk to equipment and personnel.*

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# BACKUP SLIDE #2
# Hydrogen Safety - Infrastructure

- Our current approach to deal with this hazard scenario is:
  - ✓ *To design equipment according to code, including safety instrumentation/controls (e.g. pressure relief device, gas sensors, etc).*
  - ✓ *To procure equipment from vendors with experience in high pressure hydrogen.*
  - ✓ *To install equipment according to code and permits.*
  - ✓ *To insure site commissioning and testing procedures are developed and implemented before putting site into full operation.*
  - ✓ *To insure Operation & Maintenance programs (e.g. Safe Work Practices, Operator Training for vehicle dispensing) are developed according to vendor recommendation and company practice*

# BACKUP SLIDE #3
# Hydrogen Safety -FCVS

- We have designed the fuel cell vehicles to contain redundant mechanisms to ensure hydrogen safety.
  - ✓ *Active ventilation system ensures the concentration of the exhaust hydrogen under 25% of the lower flammable limit of hydrogen.*
  - ✓ *The crash sensors to detect impacts at the front and rear of the vehicle.*
  - ✓ *Safety design consideration of its location for the hydrogen sensors in the cabin, fuel cell plant and around the fuel storage system.*

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