

# Honda Fuel Cell Vehicle Activities

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DOE HTAC - November 04, 2009

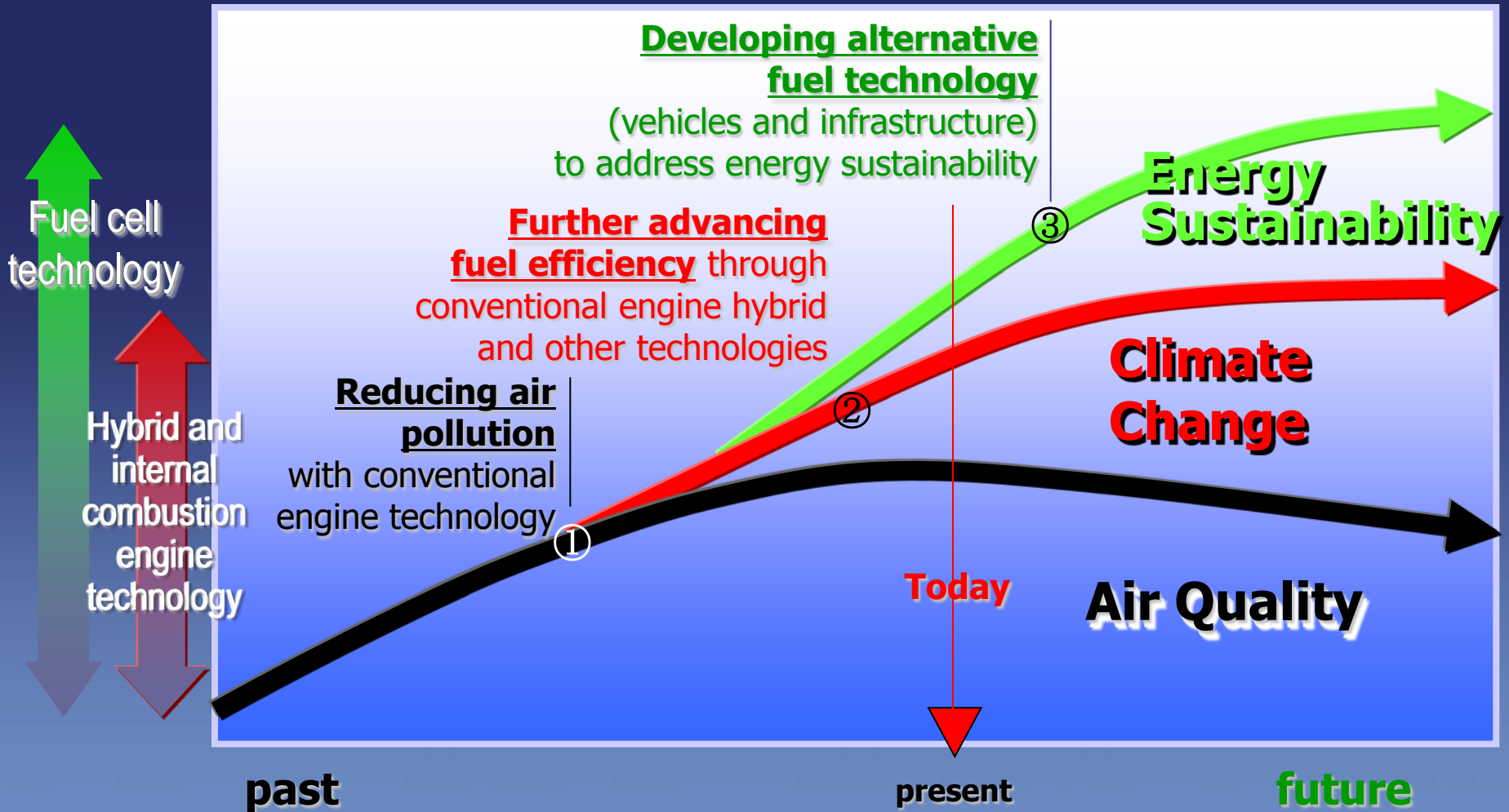


# AGENDA

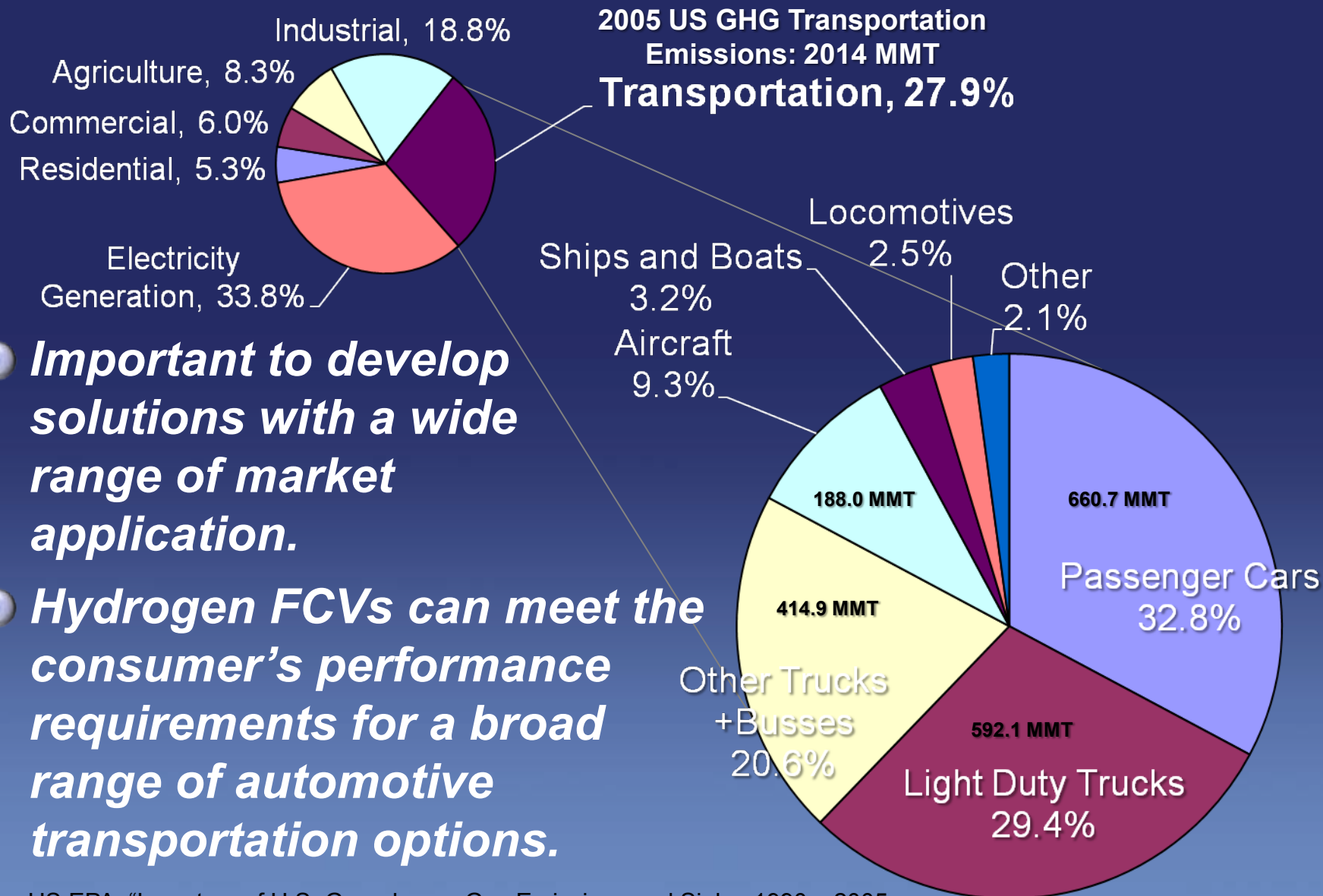
- Value of Fuel Cell Electric Vehicles
- Technology Advancements
- Hydrogen stations
- Fuel Cell Electric Vehicle customer activity
- Summary

# Significance of Fuel Cell Electric Vehicles

FCV technology helps concurrently address the problems of air pollution, climate change, and limited energy resources.



# US Greenhouse Gas Emissions



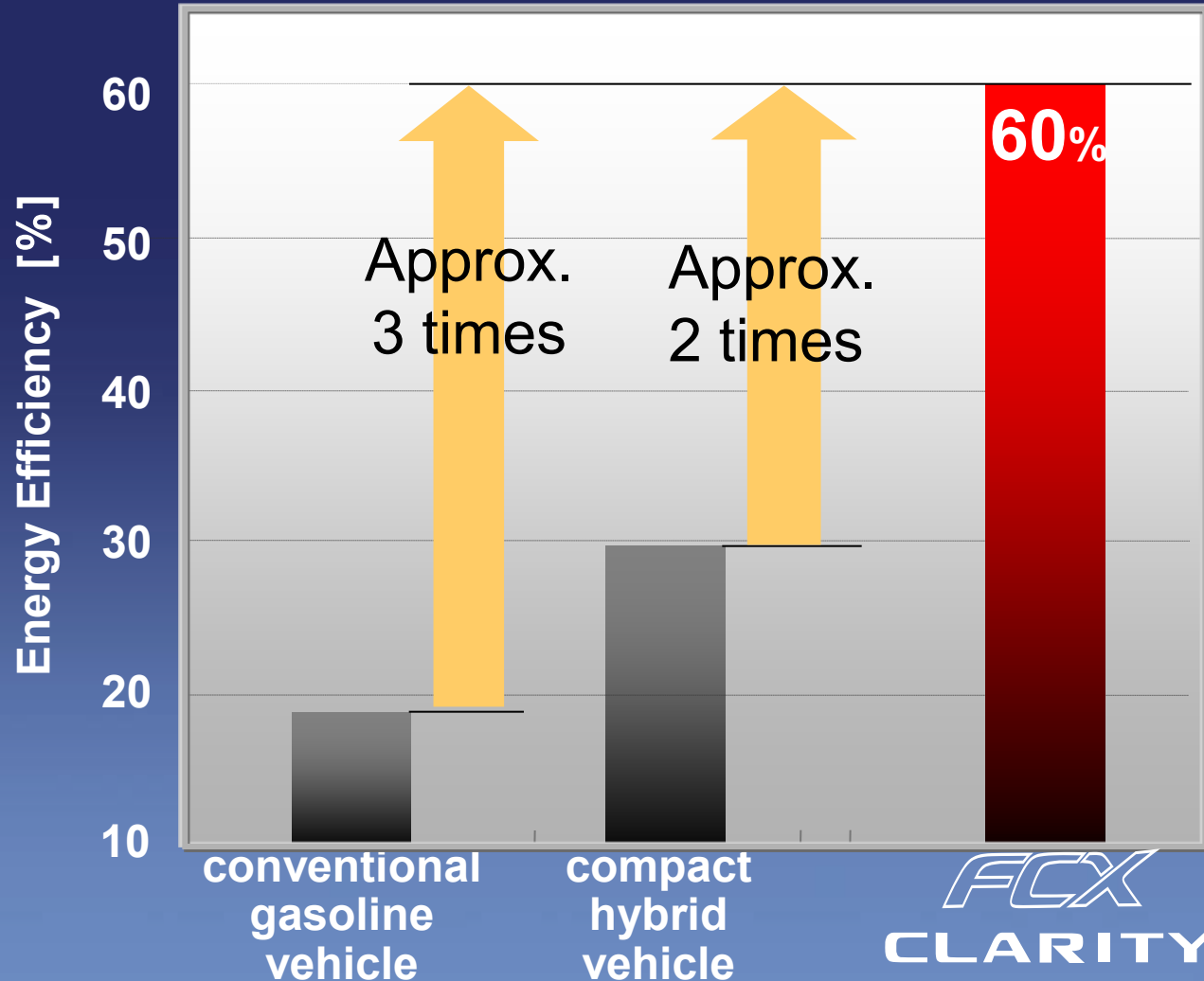
- ***Important to develop solutions with a wide range of market application.***

- ***Hydrogen FCVs can meet the consumer's performance requirements for a broad range of automotive transportation options.***

# High Energy Efficiency

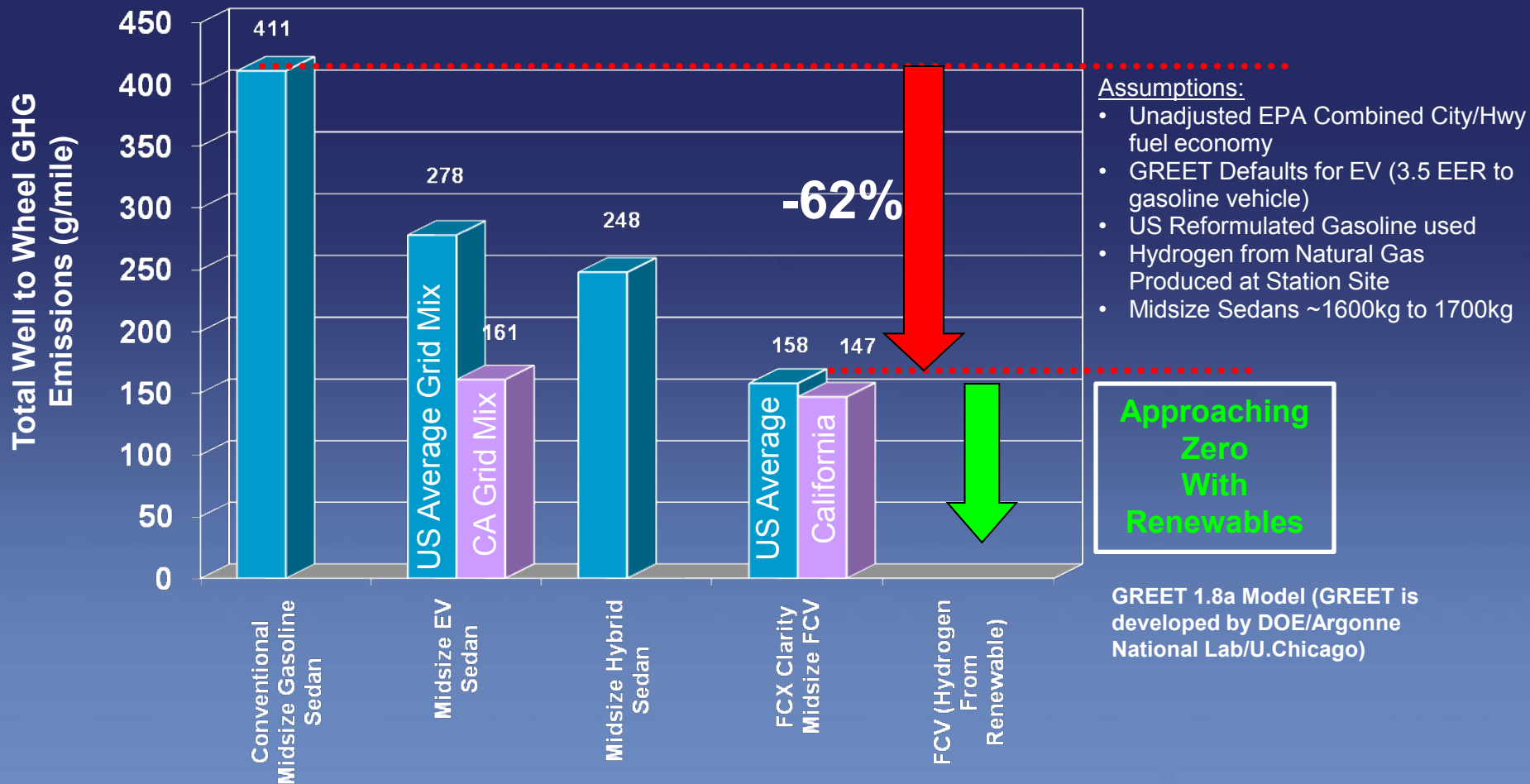
Energy efficiency of FCX Clarity:

- twice that of hybrid-electric vehicle
- three times that of gasoline vehicle



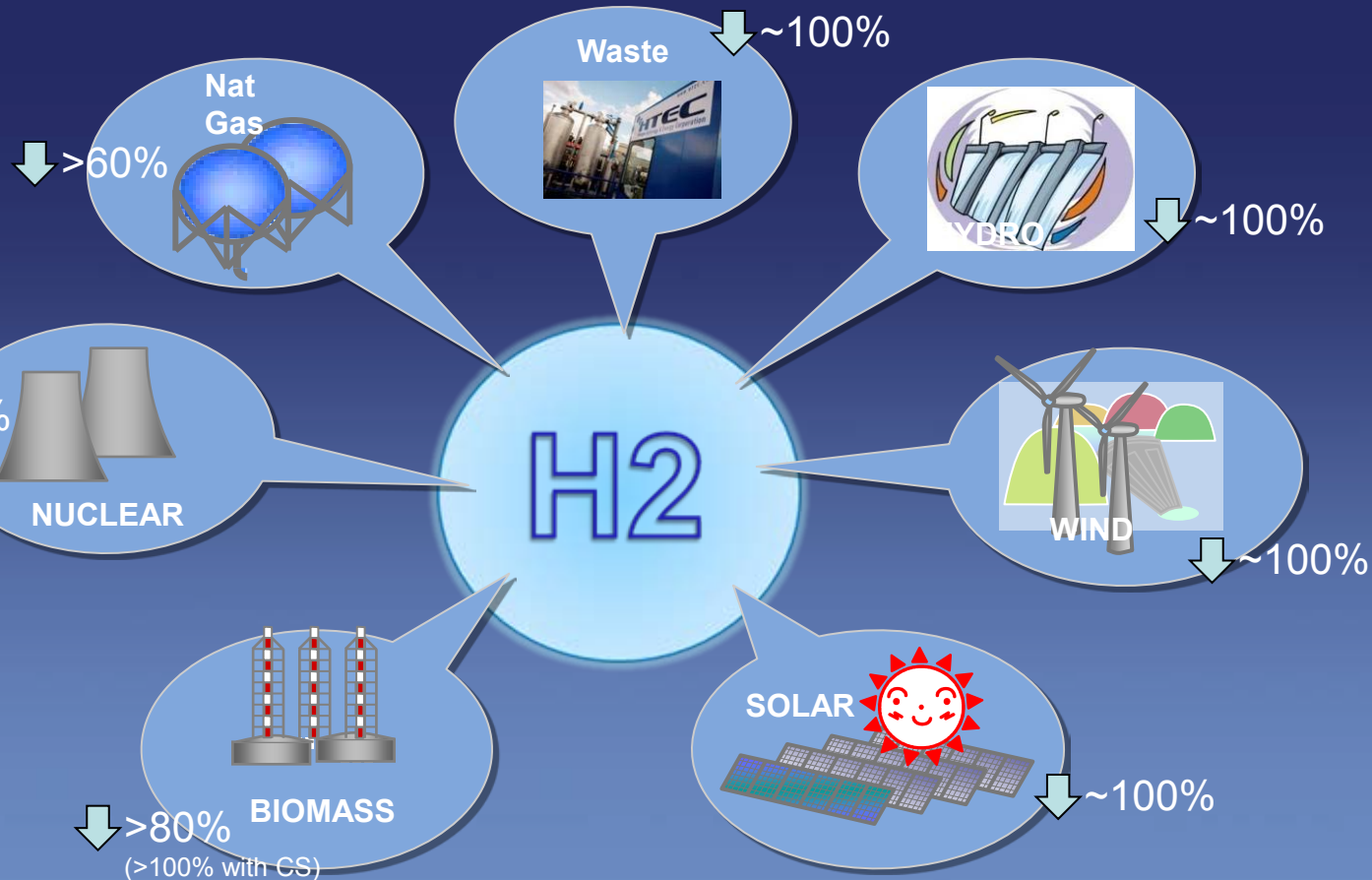
# Well to Wheel Emissions for Midsize Sedan

- **Midsize Fuel Cell Sedan can achieve over 60% reduction in CO2 using Natural Gas to produce Hydrogen (~100% with renewables).**
- **40% less CO2 than BEV Sedan on U.S. Avg. Grid Mix**



# Energy Flexibility

- **Ability to use diverse energy sources**
- **Long term shift to sustainable and renewable sources**
- **Majority from natural gas today**



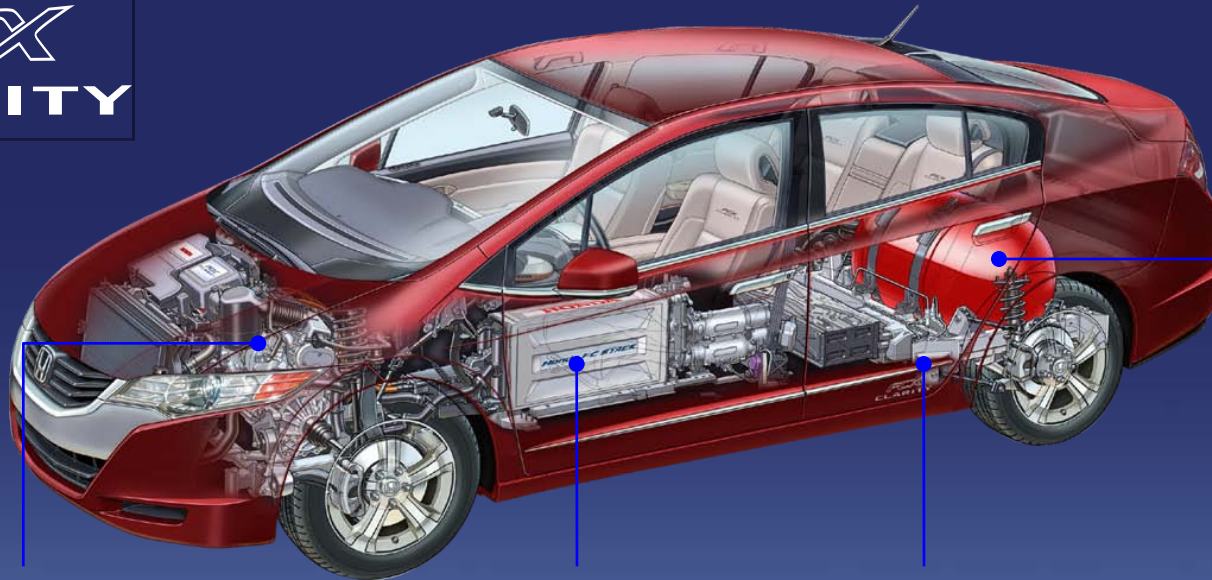
## Local Sources:

Orange County Sanitation District Station: H<sub>2</sub> from sewage treatment biodigester gas.

Torrance Station: Pipeline from SMR.

# Innovative Layout & Package

*New achievement for Fuel Cell Vehicles, due to innovation of compact, distributed components*



Coaxial motor-gearbox  
drive train

Compact fuel cell stack  
(center tunnel layout)

Lithium-ion  
battery

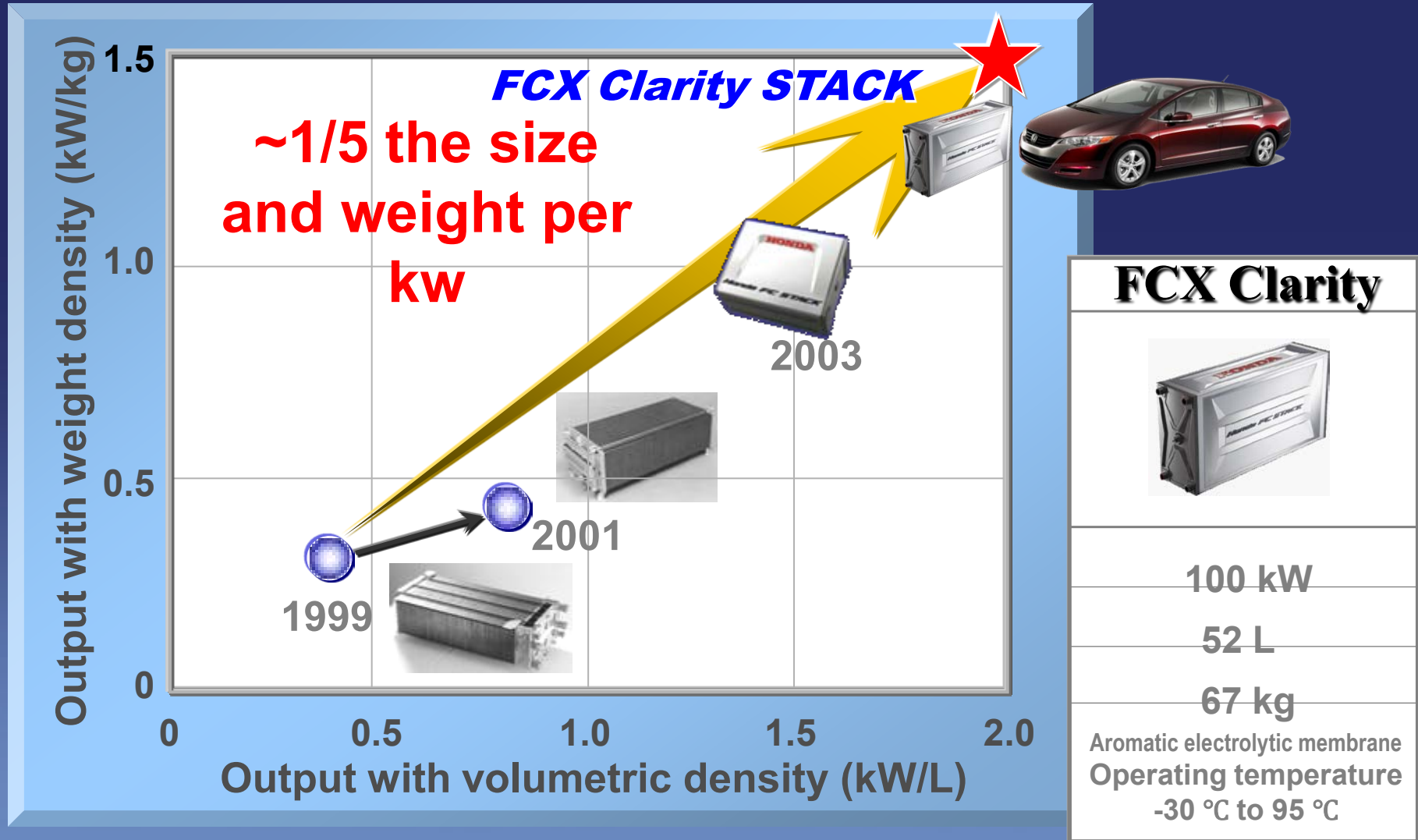
Hydrogen tank  
(Gaseous fuel)

- Compact, high output Fuel Cell system to fit in center tunnel
- Human-fitting cabin: low floor height, spacious, safety engineered
- New Vertical Gas Flow fuel cell stack takes full advantage of gravity to efficiently drain water formed during electricity generation.



# Fuel Cell Performance

Rapid advances in stack size & weight reduction



# Fuel Cell Vehicle Production

- *Dedicated FCV Production: Exclusive Clarity factory*
- *Dedicated FC stack production, with Honda-unique manufacturing equipment*



# LA Markets: Highest H<sub>2</sub> and FC Vehicle Interest



[WWW.FCX.HONDA.COM](http://WWW.FCX.HONDA.COM) → Identify Customer Interest

# Shifting the Infrastructure Paradigm

## Chasing H<sub>2</sub> Infrastructure

Station Technology (DOE)

Early Fleet Research (AQMD)

University Effort (UCI/UCD)

Marketing

- Target Customers
  - Station proximity
  - Mind-Set
  - Demographics

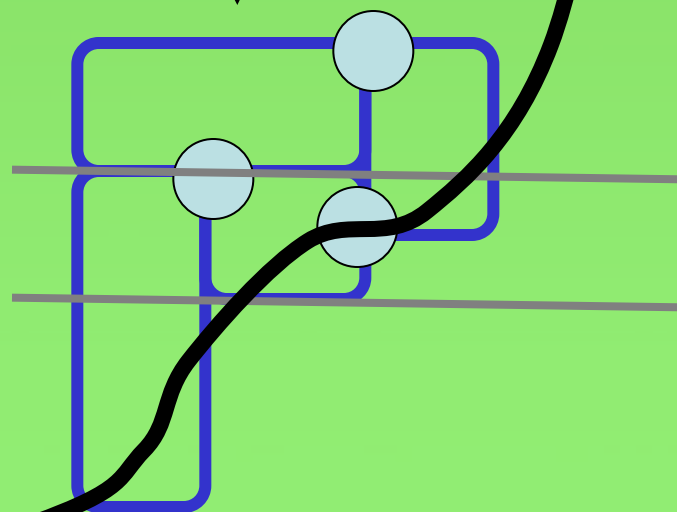
## Market Driven Clusters

Build Hydrogen Communities

Retail Consumer focus

Minimal Network

- Efficient use of Stations
- Marketing
  - Target Customers
    - Demographics, Mind-Set, Emotional Appeal
  - Messaging, Advertising



# 3 Year Lease, Dealership Deliveries



"The car has spoiled me from driving 'normal' cars"  
– Jim Salomon

## Range

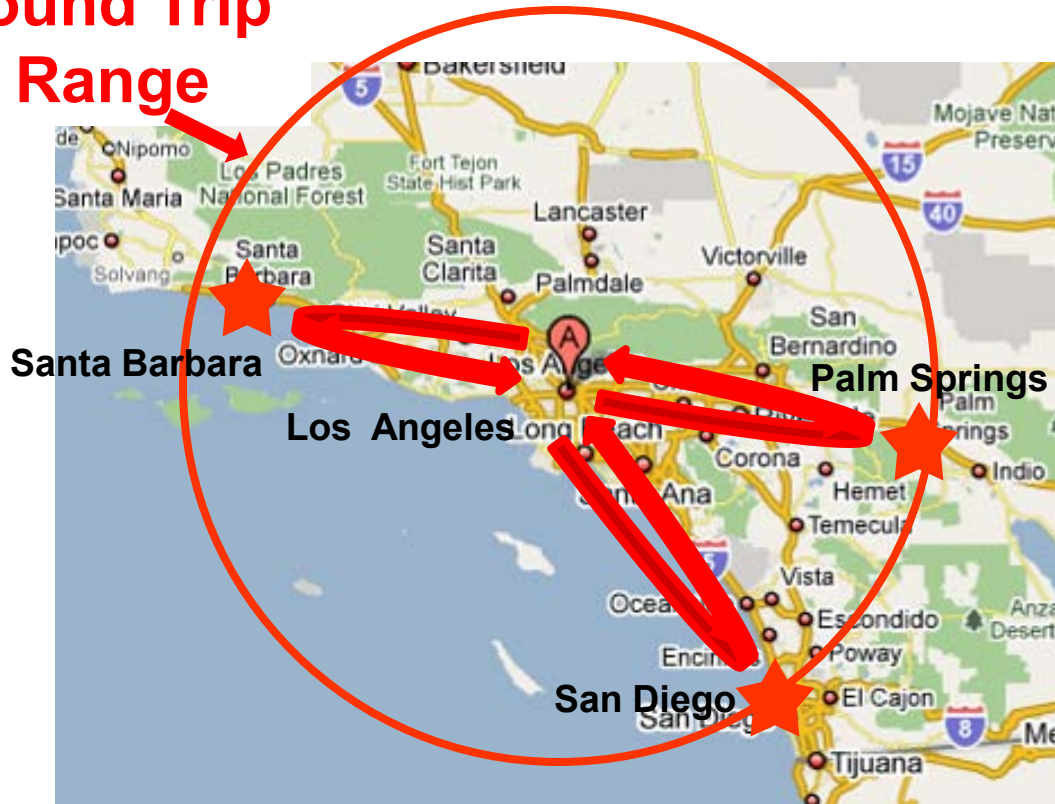
**240 mi.** or.. **338 mi.**

(EPA 'real world' range)

(unadj. EPA city range,  
for comparisons w/ BEVs)

## Recharge Time

### Round Trip Range



**Full in < 5 minutes**

# Advanced Vehicle Technologies

(Current Status)



Path	Social Values				Marketability			
	Air Quality	GHG	Energy Sustain.	Energy Security	Infra-structure	Vehicle Cost	Full Function	Appeal
Improved Gasoline	White	Yellow	Orange	Yellow	Green	White	Green	Green
Bio Fuels (Current)	White	Yellow	Yellow	Yellow	Yellow	White	Green	Orange
Bio Fuels 2 <sup>nd</sup> Gen	White	White	Green	Green	Orange	White	Green	White
Diesel	Yellow	Orange	Orange	Yellow	White	Orange	Green	White
Nat. Gas	Green	Orange	Yellow	Green	Orange	Yellow	Green	White
Hybrid	Green	White	Yellow	White	Green	Orange	White	Green
Plug-in Hybrid	White	White	White	White	Yellow	Orange	Orange	Green
Battery EV	Green	White	Green	Green	Orange	Orange	Orange	Green
Fuel Cell EV	Green	Green	Green	Green	Orange	Orange	Green	Green

- Very Good
- Good
- Fair ~ Good
- Challenging
- Extremely Challenging

# Summary Thoughts

- Societal energy and environmental needs are clear, well understood
  - H2 Fuel Cell Vehicles address transportation goals concurrently
- Vehicles are advancing, yet early low-volume costs are high
  - Vehicle advancements ongoing, research funding still important
- H2 Station Technology advancing, early low volume costs are still high
  - Support multiple H2 infrastructure technologies, California is stepping up for funding, Fed Govt. should provide additional public funding for the high initial costs
- Codes and Standards still immature, station proposal approvals delayed
  - Develop standards with education of approval authorities



# HONDA

The Power of Dreams



Mt. Shasta