The Honda Clarity Program and Infrastructure Needs

for CEC FY10-11 Investment Plan Research
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Hydrogen FC is a great choice

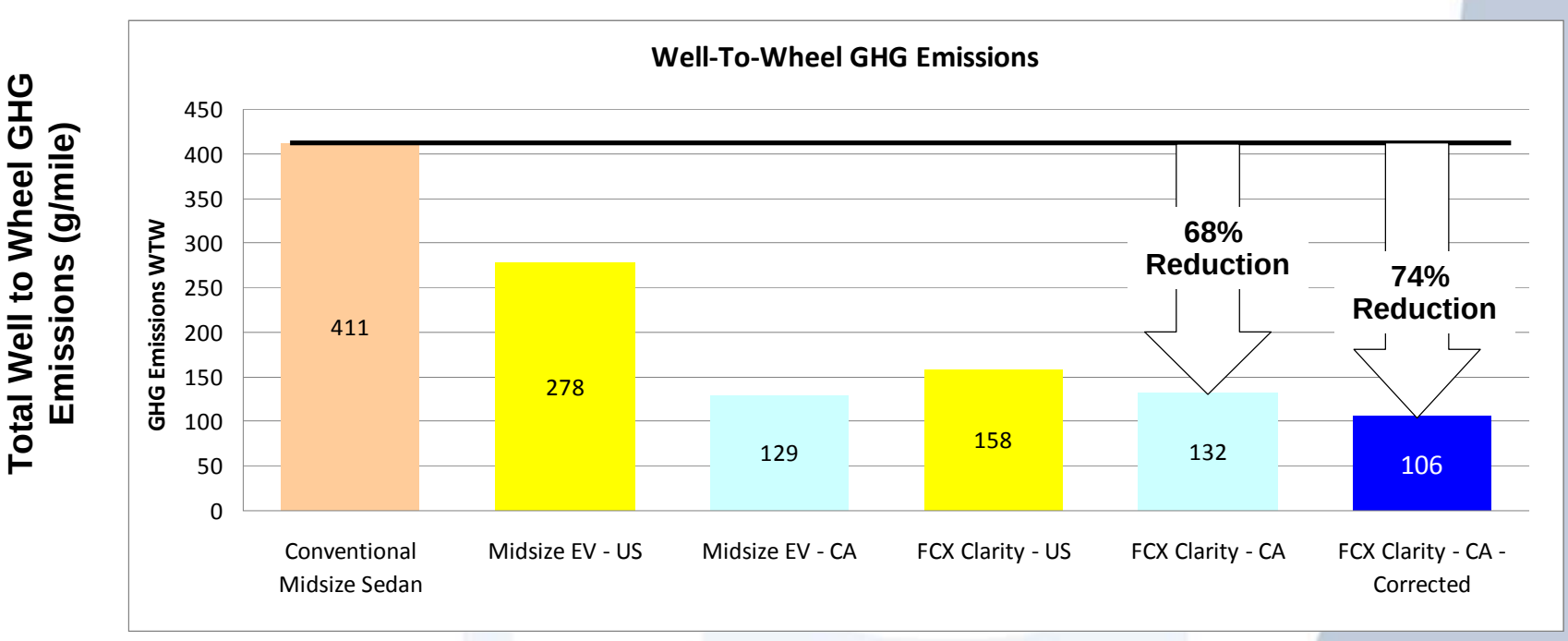
- **Power Plant Efficiency**
  - **Fuel Cells create electricity very efficiently**

    Greater efficiency than Natural Gas Combined Cycle power plant (used to make electricity)
- **Renewable fuel potential (solar, wind, etc.)**
- **Multiple pathways to make the fuel**
  - **Methane Steam Reforming**
  - **Hydrolysis**
  - **Large and Small Scale potential**
- **Zero Tailpipe Emissions**
- **Greenhouse Gas Reductions**
  - **Large Short-term benefits**
  - **Near Zero long-term potential**
- **Proven Safe Fuel**
  - **Vehicles meet FMVSS**

Natural Gas Combined Cycle Power Plant

Well to Wheel Emissions for Midsize Sedan

- Midsize Fuel Cell Sedan can Significant GHG Reductions
  - 68% Using Natural Gas to produce Hydrogen
  - 74% Using Natural Gas and Renewables (33%) per SB1505



CA Grid @ 378g/kWh; EV includes 21.3% Renewable, 78.7% NG
FCX Clarity is corrected to assume 33% Renewable for Hydrogen per SB1505
Other GREET Modeling…

Smaller, More Compact, More Powerful Stack

Improvements In Seven Years:
4X in Power/Volume! 5X in Power/Weight!

Year stack technology announced	1999	2003 ('05 FCX)	2006 ('08 FCX Clarity)
Stack appearance			
Output	60 kW	86 kW	100 kW
Volume	134 L	66 L	52 L
Weight	202 kg	96 kg	67 kg
Electrolytic Membrane	Fluorine	Aromatic	Aromatic
Operating Temperature Range	0 - 80 °C	- 20 - 95 °C	- 30 - 95 °C
Stack Construction	Bolt-fastened construction	Panel box construction	1-box construction
Cell Structure	Machined carbon separators Separate seals	Stamped metal separators with unitized seals	Vertical flow cell structure Wave flow channel separators

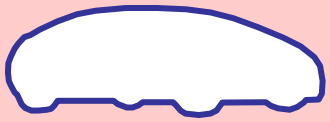
Prospect of FCV Commercialization

Demonstration stage | **Limited Introduction to market** | **Mass production stage**

2000

2010 (Market Preparation, Establish Market Foundations)

~2020



Summer 2008

- **Target: cost, durability & reliability equal to gasoline-fueled vehicles**

- **Improvement of durability and reliability**
- **Extend practical range**
- **Cost reduction**

Demonstration test

- **Improvement of vehicle performance**
- **Extended to cold areas**

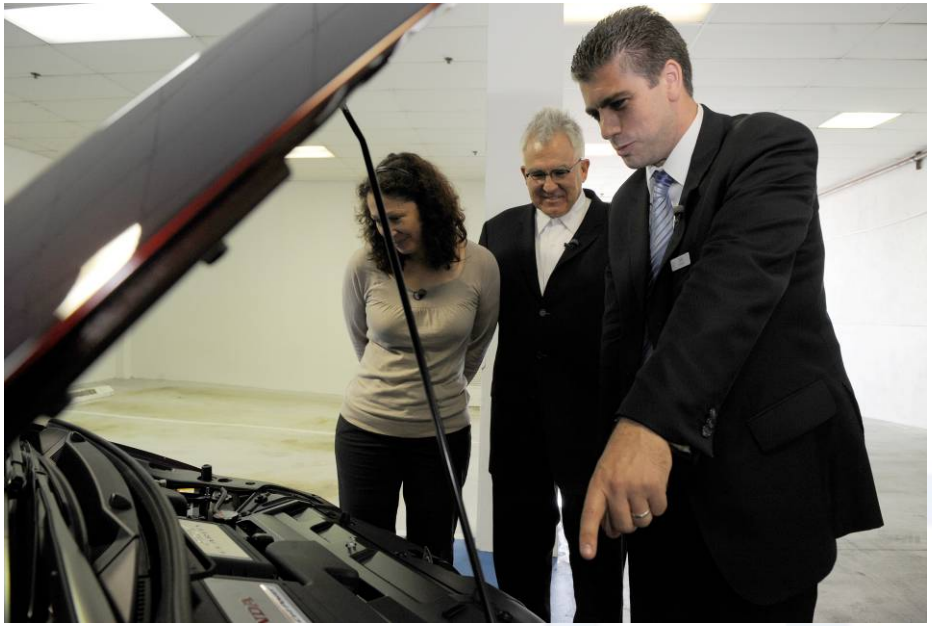
Aim at mass production by progressive efforts

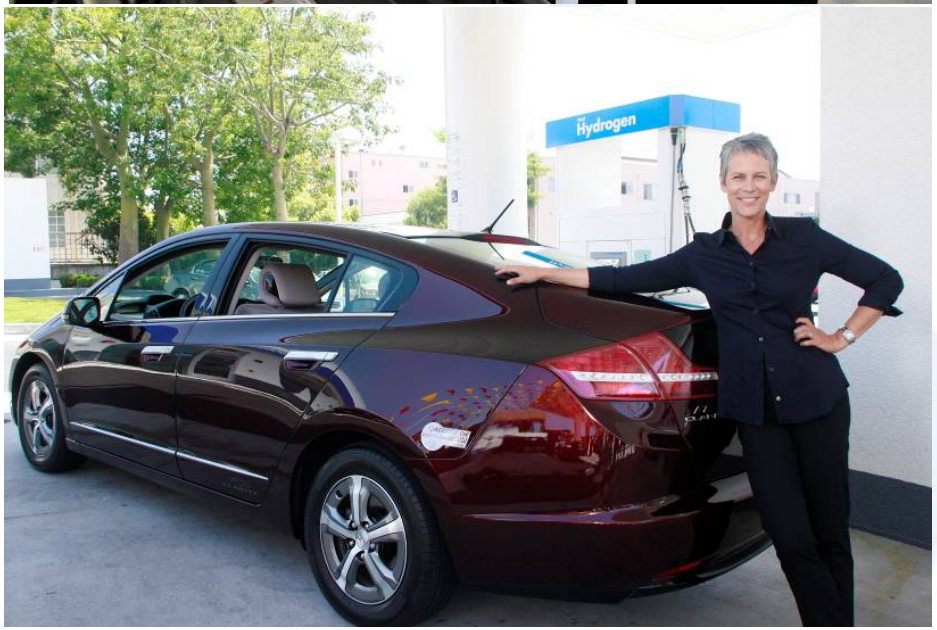
FCX Clarity

- **First Customers**
  - Delivered ten vehicles to customers
  - First deliveries in July, 2008
  - Selection process: geography, driving patterns, access to infrastructure

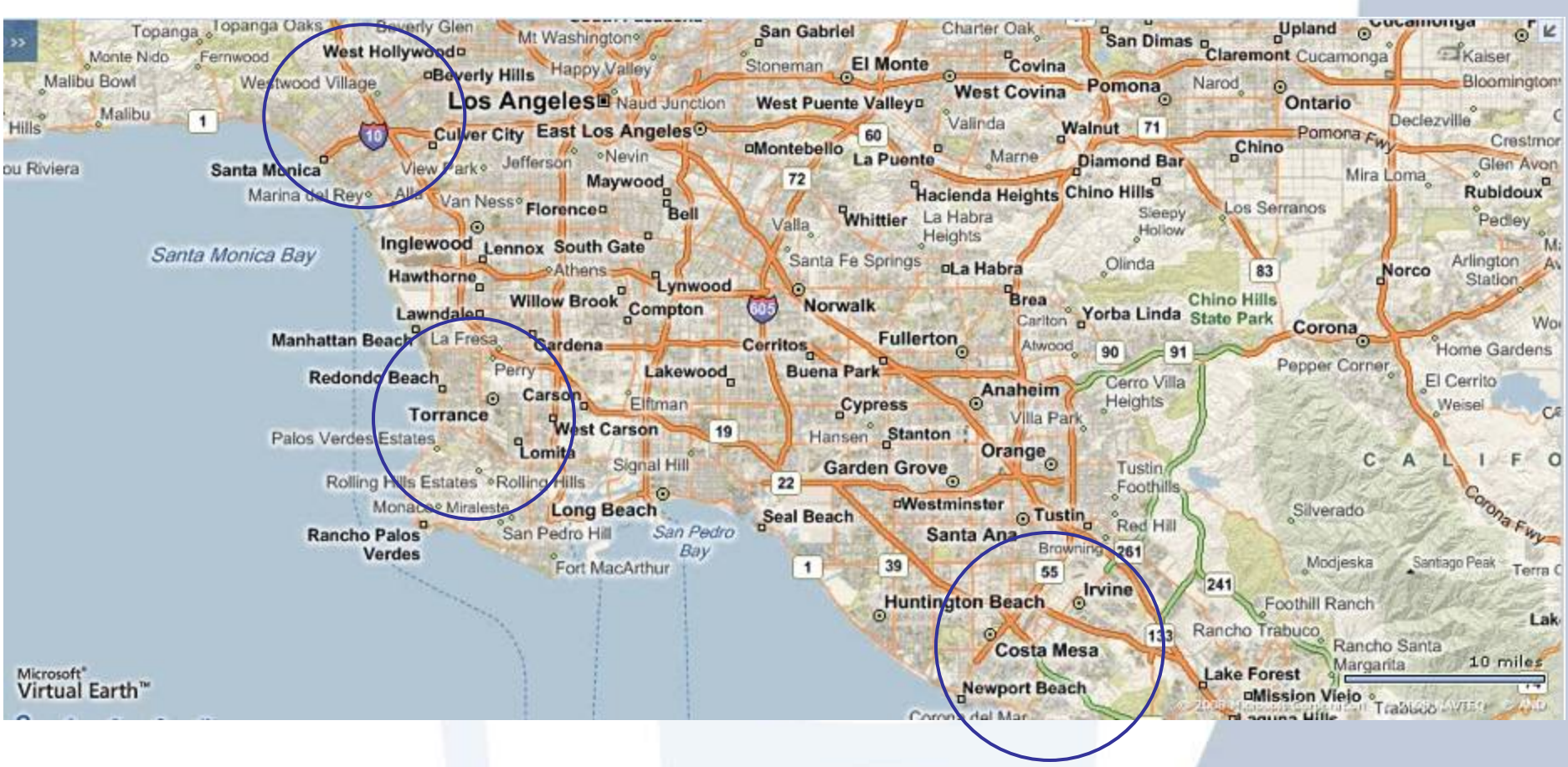
- **First Fuel Cell Vehicle Dealership Network**
  - Three Official Clarity/FCX dealerships: Santa Monica, Torrance, and Costa Mesa
  - Clarity dealership responsibilities:
    - Sales, Service, Parts, Customer Relations
- **Fuel Cell Production**
  - Dedicated FC Production: Exclusive Clarity factory
  - Dedicated FC stack production, with Honda-unique manufacturing equipment

Dealership Delivery – Market Advancement



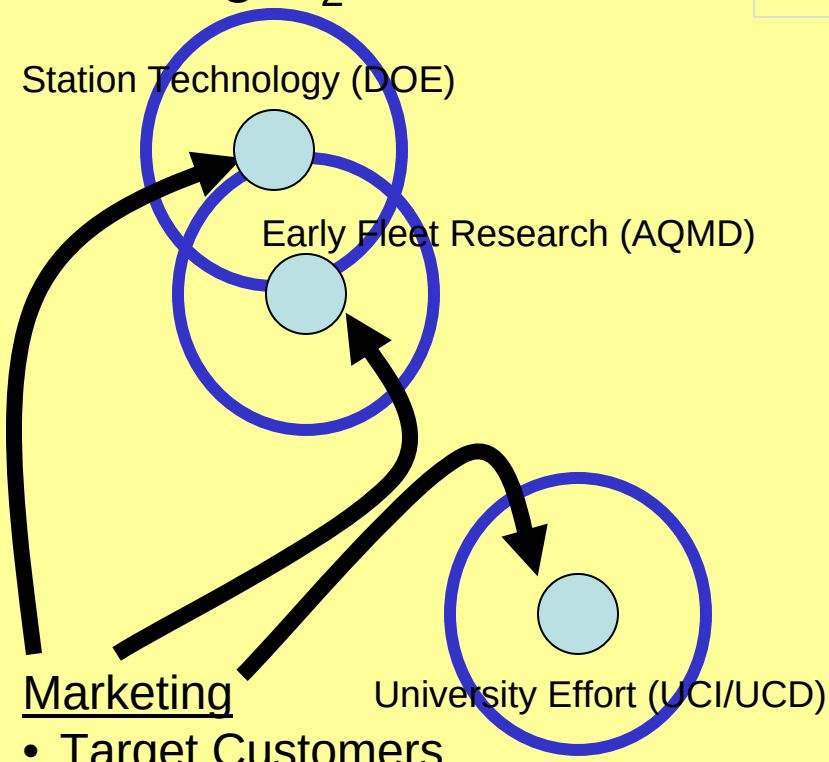


LA Markets with the highest H_2 / Clarity Interest



Shifting the Infrastructure Paradigm

Chasing H_2 Infrastructure



<u>Marketing</u>

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

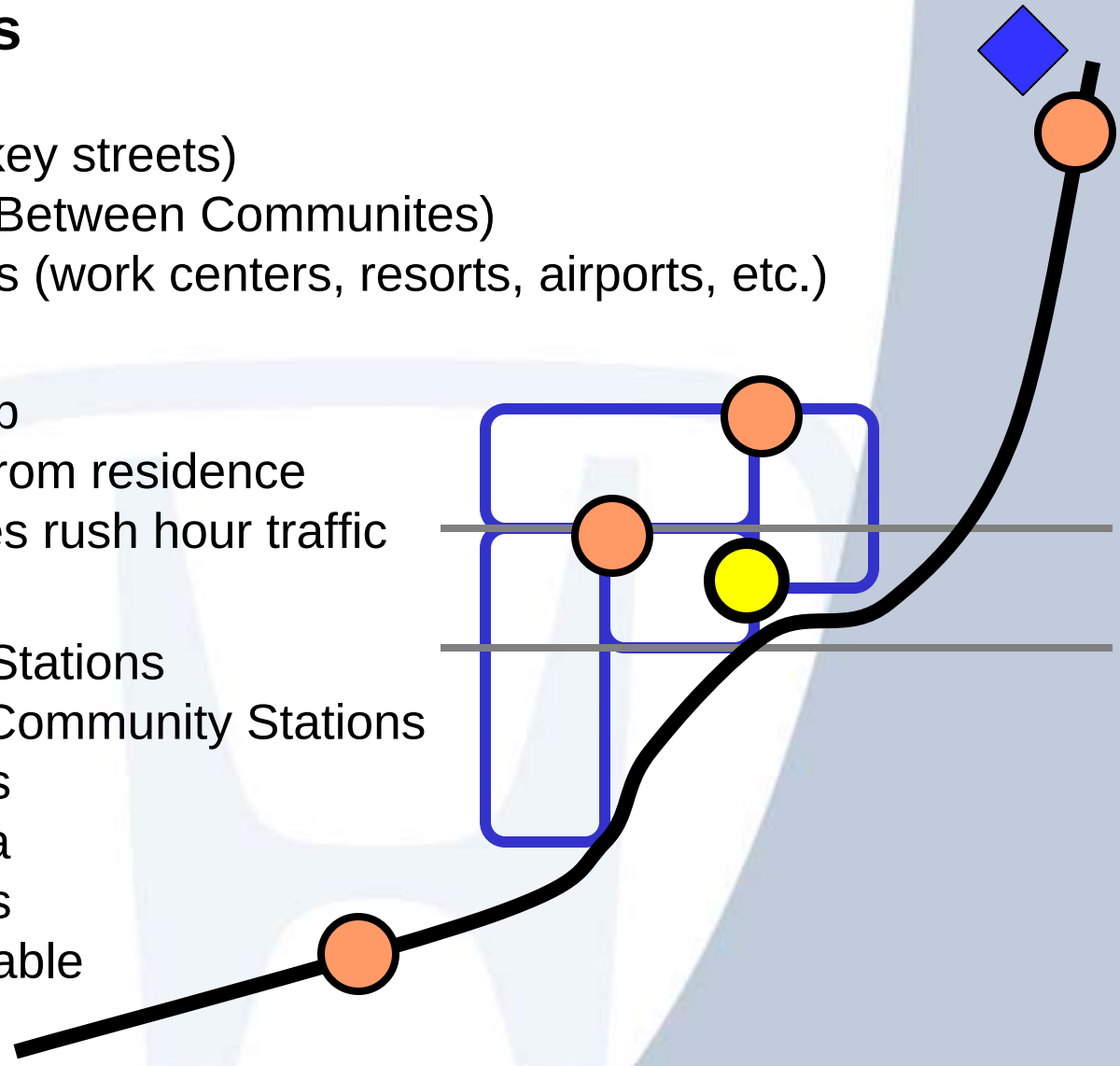
Market Driven

<u>Market-Driven Fundamentals:</u>

- Building Hydrogen Communities
- Target Customers
  - Demographics
  - Mind-Set
  - Emotional Appeal
- Sustainable Markets
  - “Neighbors tell neighbors”

“Market Driven” Infrastructure

- **Begin with Markets**
  - Identify Communities
  - Consider Corridors (key streets)
  - Consider Highways (Between Communites)
  - Consider Destinations (work centers, resorts, airports, etc.)
- **“Cluster Concept”**
  - Redundancy / Backup
  - Primary - 5 minutes from residence
  - Backup - ≤ 15 minutes rush hour traffic
- **Consider Stations**
  - “Marquee” or Image Stations
  - Smaller Convenient Community Stations
  - Destinations & Nodes
  - Mix of 35 and 70 mpa
  - Diverse Technologies
  - Diverse Sizes, Scaleable



Fuel Cell Policy Issues

Fuel Cells are under attack:

- **DOE proposed funding cuts to their Hydrogen program**
- **Auto Industry facing financial trouble**
- **CA Budget: CEC Funding for hydrogen**
- **Result: Infrastructure progress has been slower than anticipated**

Why Fuel Cells have been attacked?

- **EV advocates**
- **"Technology du Jour"**
- **Zero sum game / Resources**

Growing recognition:

- **80 in 20 Goal**
- **Portfolio Approach**
- **Diversification (too much risk)**
- **Real progress with fuel cells**
  - **Milestones met!**

Continuous, long-term support is crucial to the successful deployment of fuel cell vehicles.

Honda's Fuel Cell Program Support

- Honda, with industry, pushing to restore DOE funding
  - Meetings with Congress
  - Meetings with White House
  - Meetings with DOE
  - This seems to be bearing fruit. We expect funding to be restored.
- Full commitment to continue the program
  - Clarity is functioning well
  - Program is going well

  "Surpassing Expectations"
- Slowing down volumes to match:
  - Infrastructure deployment uncertainties (see following page)
  - Global economic realities
  - Other challenges

Infrastructure Issues Challenges

- No industry standard for station capacity
- Long delays between contract award and station opening
  - CEC's aggressive action to open stations could take? 1 ~ 2 years?
- Station "opening" often includes production ramp-up issues
  - First fill at the press conference does not mean "open for routine business"
- Station Partnerships lack leadership & commitment:

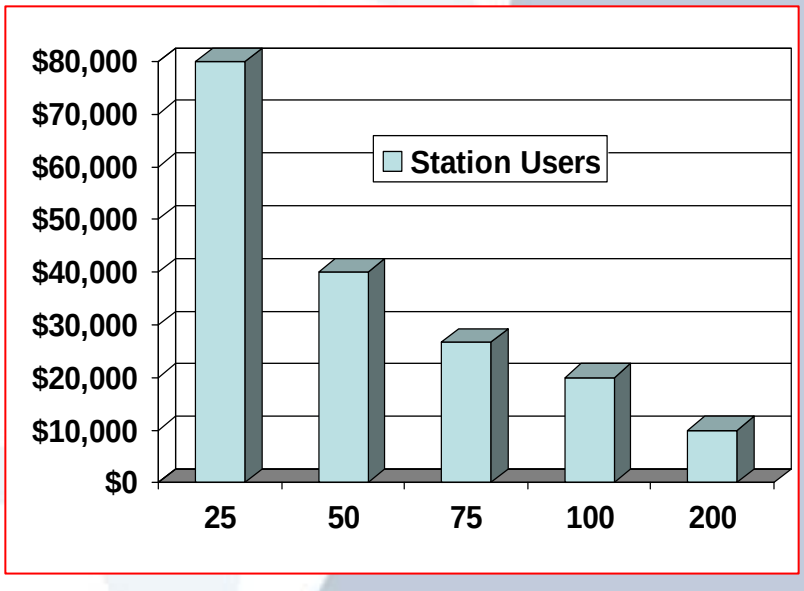
  Weak/Uncertain
  - Retailer
  - Distributor
  - Energy Partner

  Strong
  - Equipment Providers
  - Public Funders/Investors
  - OEMs

  Commitment of these parties is highly variable, lacks leadership

A Proposal for Infrastructure Development

- Investor's & OEMs need
  - Greater certainty
  - Reduced risk of stranded investments
- Moving Forward:
  - OEM's identify target market areas:
    - 25+ customers per location (collaborate through CaFCP)
    - Very specific station locations
    - Timeframe for deployment (e.g. 18+ months)
  - Infrastructure investors:
    - Target OEM locations
    - Investment/incentive declines as customers increase
    - Risk of station disuse is lowered
    - Incentive goes to Infra instead of OEM or Consumer directly



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The Power of Dreams