Collaboration

• Daimler + Nissan + Ford: 2017, 100,000 units
• Honda + GM: 2020
• BMW + Toyota: 2020
• Volkswagen + Ballard: 2016-18

• Hyundai: series production begun
Collaboration

- **Industry led**
  - H₂Mobility: up to 400 stations in Germany
    - Shared public financing sought
  - HySUT: 100 Stations by 2015 in Japan
    - Public financing committed

- **Scandinavia**
  - Cars in showrooms
  - 11 stations in operation, 1 under construction

- **Government led**
  - California: 100 stations by 2023

- **H₂USA**
Commercialization

- 2013~2015: Hyundai
- 2015: Honda, Toyota
- 2017: Daimler
- 2017: Nissan? Ford??
- 2020: VW?, BMW??
- GM?
So What Can Go Wrong?

- Too many question marks?
- Vehicle and infrastructure rollout mis-aligned, or cars don’t sell, or cost reductions prove elusive
  - Small commercialization hiccup could have big consequences
    - Backlash, political support wanes
- ZEV rule, infrastructure delay limit sales outside California
- BEV advocates raise competitive stakes
  - Political support wanes
So What Can Go Wrong?

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Confrontation

• Regulations weakened: AAM, AGA ask reconsideration of ZEV rule
• Lack of infrastructure - infrastructure spending seen as government “waste”
What Can Go Wrong?

- Station costs remain too high
- Hydrogen prices stay higher than gasoline
- Stations slow to come on line in CA
- No public stations outside CA
- Oil industry in US uncooperative
- Not enough risk-sharers
  - Federal government remains on the sideline
- Upstream infrastructure slow to develop
  - 20 M cars = 3% to 4% of projected US electricity demand
What About Natural gas?

Projected Natural Gas use for Fuel Cell electric Vehicles

Natural Gas Use (Quads/year)

2005 2010 2015 2020 2025 2030 2035 2040

2005 2010 2015 2020 2025 2030 2035 2040

Projected Natural Gas use for all other sectors from AEO2010

Figure 2. U.S. natural gas production, 1990-2035 (trillion cubic feet)

Energy Outlook 2012 Early Release Overview
Do You Know This Man?
Murphy Made It and So Can We!

- Murphy, 1949

- How much sudden deceleration can a person can stand in a crash?
- A lot, it turns out.

- Nichols 4\textsuperscript{th} Law: "Avoid any action with an unacceptable outcome."
Contact

Bob Rose
202-785-4222
brose@fuelcells.org
www.fuelcells.org