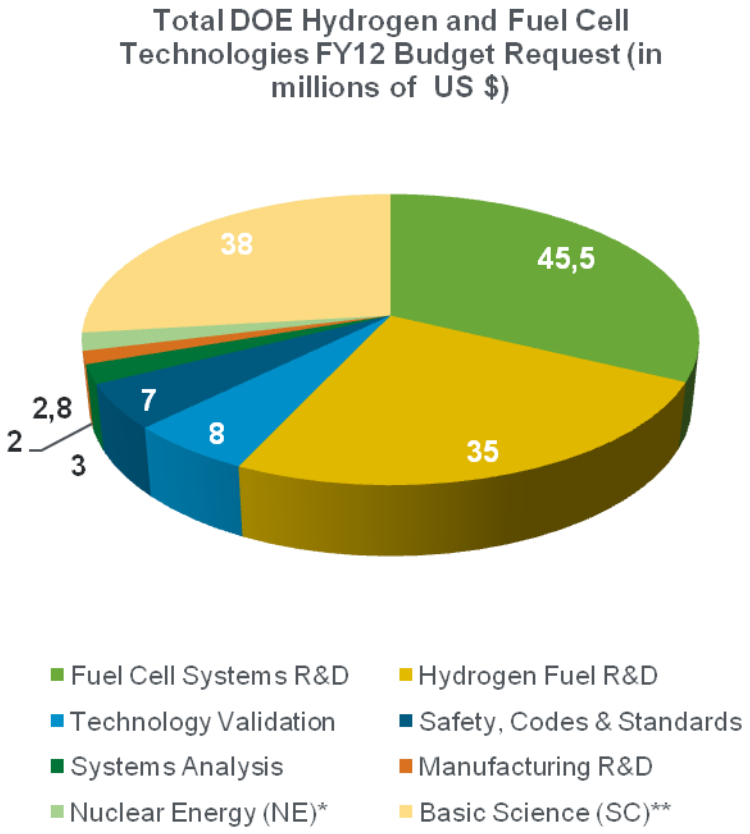
H_2 & Fuel Cells Budget

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Approximately $100 M for Applied RD&D in Hydrogen and Fuel Cells (EERE)

Funding *($ in thousands)*				
Key Activity	**FY 2011 Appropriation**	**FY 2012 Request**	***House Mark***	***Senate Mark***
Fuel Cell R&D	43,000	45,450	41,450	42,000
Hydrogen Fuel R&D	33,000	35,000	33,000	33,000
Technology Validation	9,000	8,000	5,000	8,000
Market Transformation	0	0	0	3,000
Safety, Codes & Standards	7,000	7,000	7,000	7,000
Education	0	0	0	0
Systems Analysis	3,000	3,000	3,000	3,000
Manufacturing R&D	3,000	2,000	2,000	2,000
Total	**$98,000**	**$100,450**	**$91,450**	**98,000**



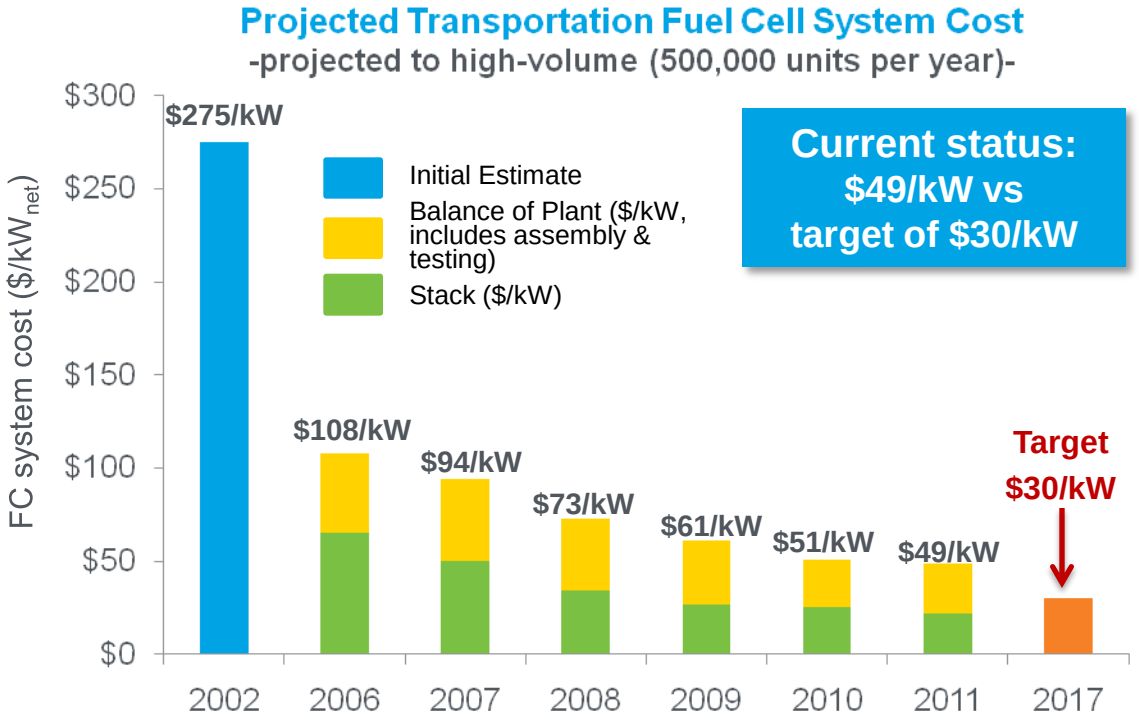
SECA: $25M for Fossil Energy (House mark)

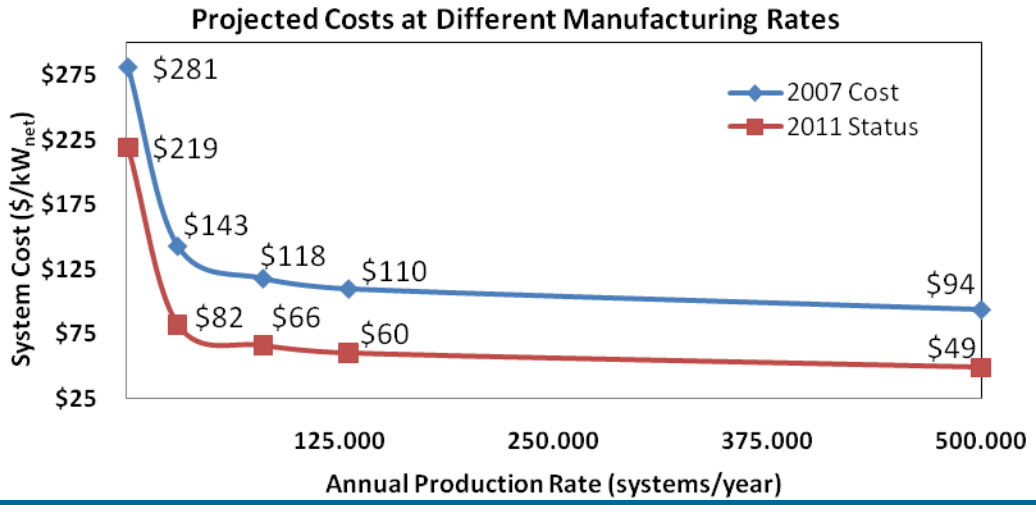
Notes: Hydrogen Fuel R&D includes Hydrogen Production & Delivery R&D and Hydrogen Storage R&D.

Progress – Fuel Cells

DOE-funded efforts have reduced the projected high-volume cost of fuel cells to $49/kW (2011)*

- ***More than 30% reduction since 2008***
- ***More than 80% reduction since 2002***





***Based on projection to high-volume manufacturing (500,000 units/year).** The projected cost status is based on an analysis of state-of-the-art components that have been developed and demonstrated through the DOE Program at the laboratory scale. Additional efforts would be needed for integration of components into a complete automotive system that meets durability requirements in real-world conditions.*

DOE Funded Accomplishments

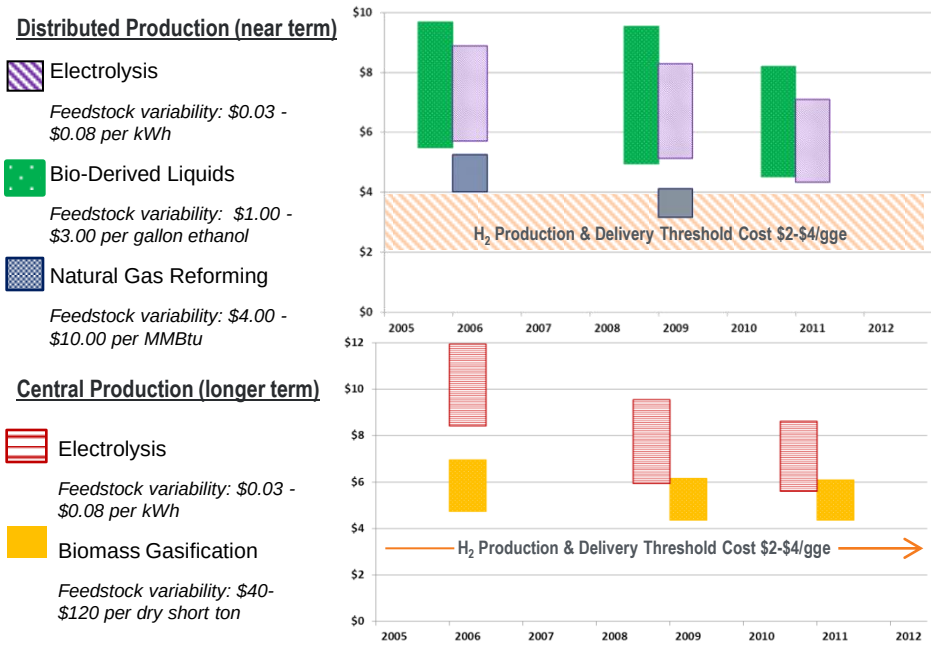
Reduced cost of H_2 production (multiple pathways)

Vehicles & infrastructure

- 170 fuel cell vehicles, 24 hydrogen stations
- > 3.3 million miles traveled
- > 146 thousand total vehicle hours driven
- ~ 2,500 hours (nearly 75K miles) durability
- ~ 5 minute refueling time (4 kg of hydrogen)

H_2 fuel cell buses (w/ DOT) have a 42% to 139% better fuel economy when compared to diesel & CNG buses

Projected High-Volume Cost of Hydrogen Production1 (Delivered2)—Status

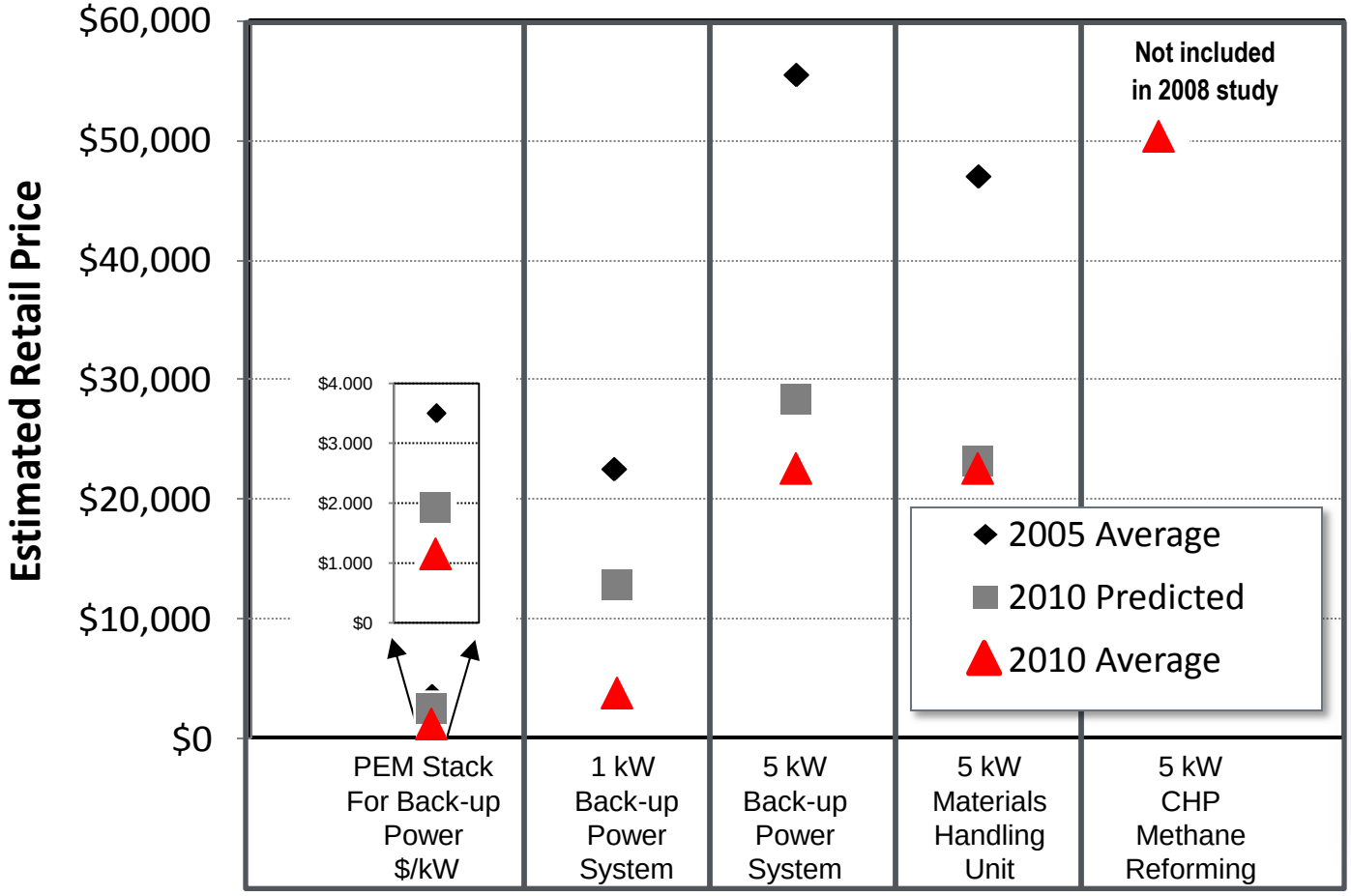


- **Tanks can achieve >250 mile range**
- **Validated vehicle that can achieve 430 mi**
- **Developed and evaluated more than 400 material approaches experimentally and millions computationally**

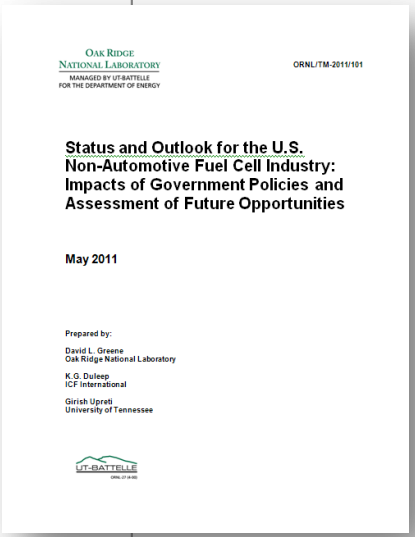
- **Demonstrated cycle-life of >50,000 refuelings of metal tanks for forklift applications**
- **Developed safety courses, educated >17,000 first responders and code officials through introductory web-based courses and advanced hands-on training**

Early Market Cost Reduction Analysis

Comparison of 2008 ORNL Study and 2010 Fuel Cell Cost Estimates



- 50% or greater reduction in costs
- 2008 model generally underestimated cost reductions



OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

ORNL/TM-2011/101

Status and Outlook for the U.S. Non-Automotive Fuel Cell Industry: Impacts of Government Policies and Assessment of Future Opportunities

May 2011

Prepared by:
David L. Greene
Oak Ridge National Laboratory
K.G. Duleep
ICF International
Girish Upreti
University of Tennessee

UT-BATTELLE

http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/ornl_non_automotive_fuelcell.pdf

2005 and 2010 averages based on estimates supplied by OEMs. 2010 predicted assumed government procurements of 2,175 units per year, total for all market segments. Predictions assumed a progress ratio of 0.9 and scale elasticity of -0.2.

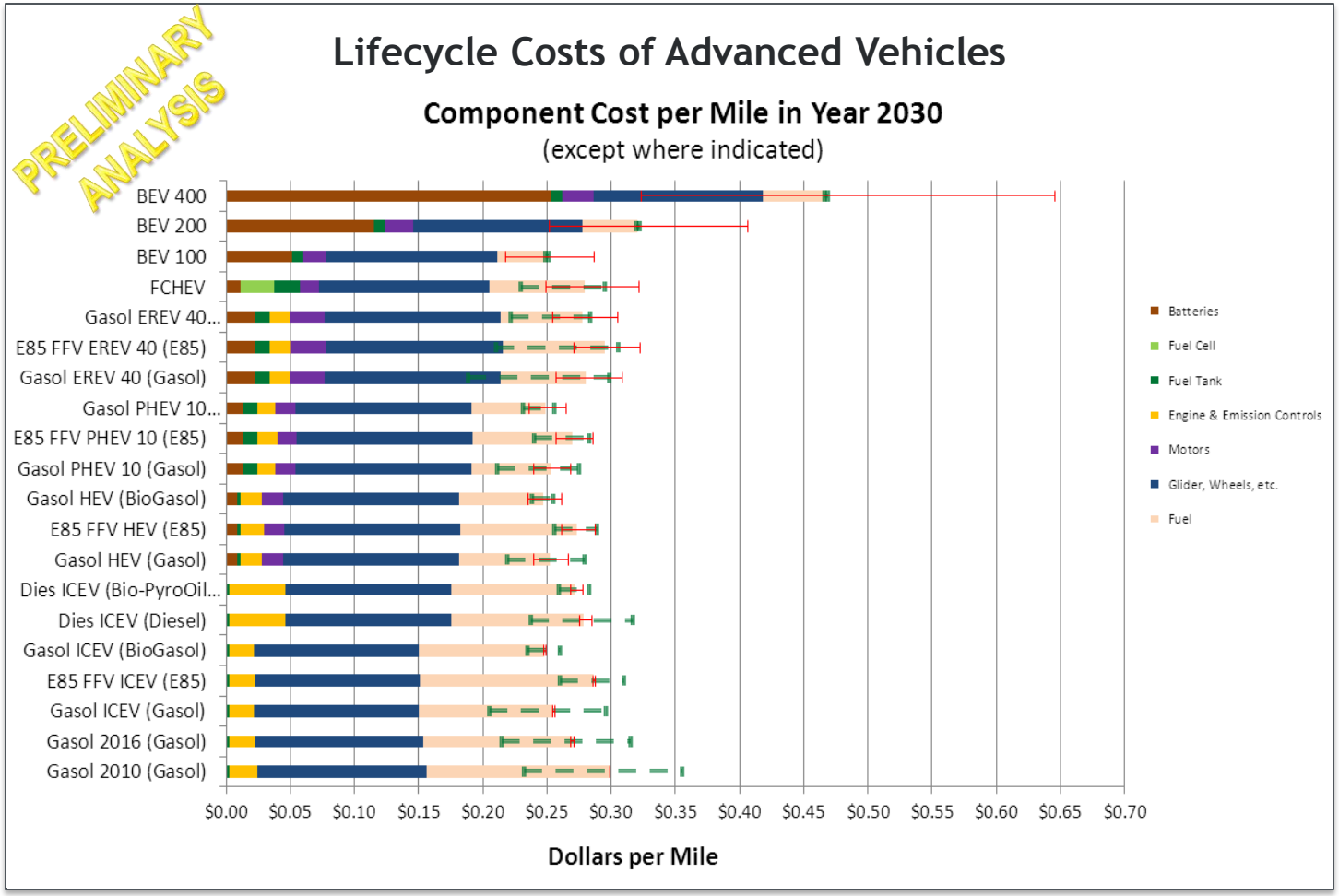
ORNL

RFI: Total Cost of Ownership for Future Light-Duty Vehicles

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

RFI Closes: December 16, 2011

For Questions, Email: TCORFI@go.doe.gov

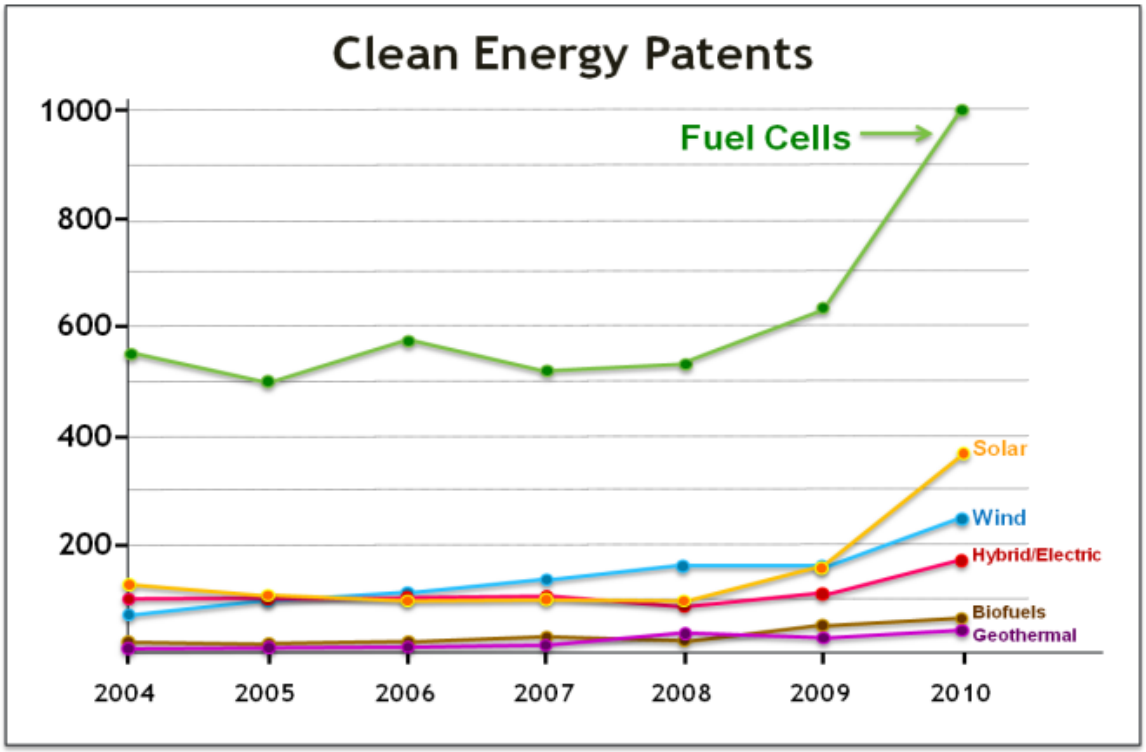


Error bars include fuel price volatility (green) and different assumptions for technology success (red) (2030 timeframe)

Feedback is requested on:

- The assumptions (aggressive, moderate or conservative levels of success for various technologies).
- The projection of cost reduction rates for technologies that are not yet fully commercial.
- The general financial analysis approach used.

Fuel Cell Patents Reflect Emerging Growth



Clean Energy Patent Growth Index[1] shows that fuel cell patents lead in the clean energy field with nearly 1,000 fuel cell patents issued worldwide in 2010.

- **3x more than the second place holder, solar, which has just ~360 patents.**
- **Number of fuel cell patents grew > 57% in 2010.**

[1} 2010 Year in Review at: http://cepgi.typepad.com/heslin_rothenberg_farley_/