



U.S. DEPARTMENT OF
ENERGY

Hydrogen Safety Workshop Wrap-up



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DOE-NREL
Hydrogen Sensor Workshop
June 8, 2011
Chicago, IL

DOE Multiyear Plan (2007)

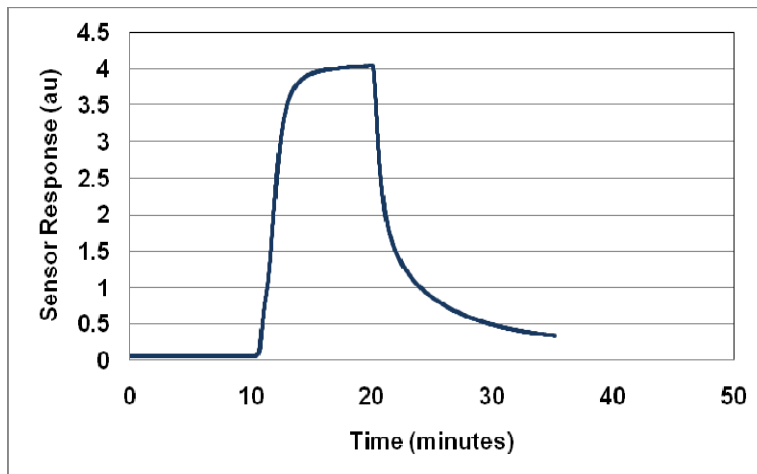
Table 3.7.2. Targets for Hydrogen Safety Sensor R&D

- Measurement Range: 0.1%-10%
- Operating Temperature: -30 to 80°C
- Response Time: under one second
- Accuracy: 5% of full scale
- Gas environment: ambient air, 10%-98% relative humidity range
- Lifetime: 10 years
- Interference resistant (e.g., hydrocarbons)

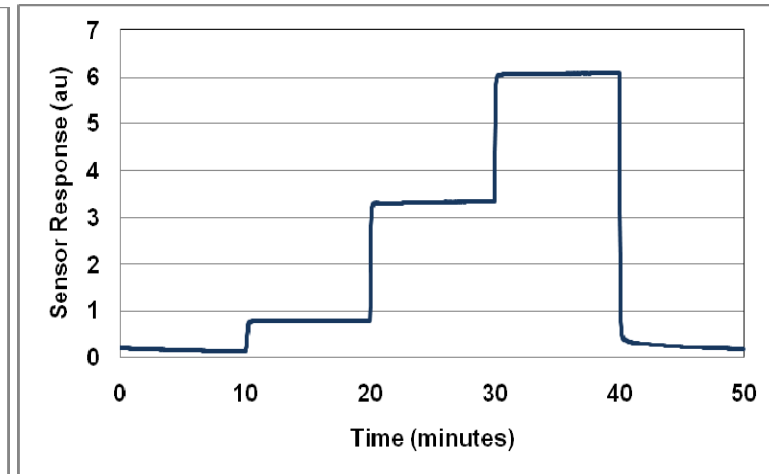
Advances since 2007

New Sensor Technologies

- Thick and thin film technologies are emerging
 - faster kinetics
 - lower power
 - some different approaches to selectivity
 - Uncertain lifetime / robustness against poisons



2003

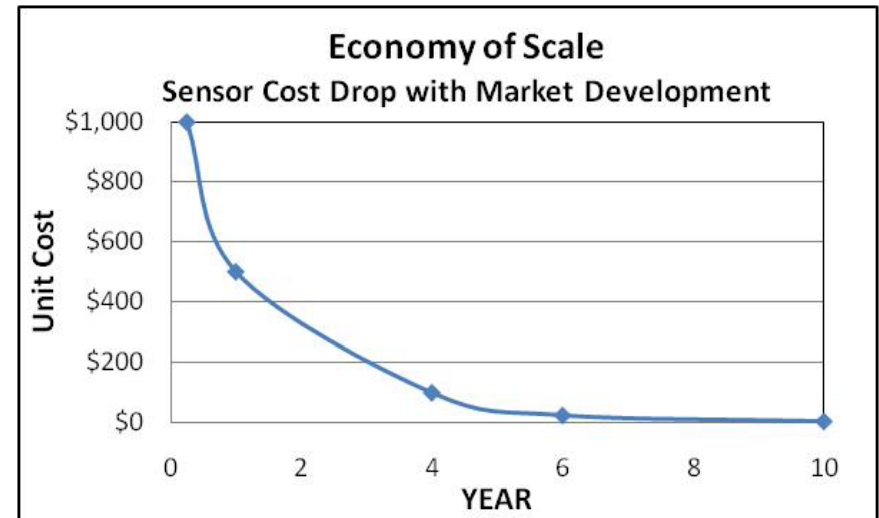


2009

Sensor Cost: Economy of Scale

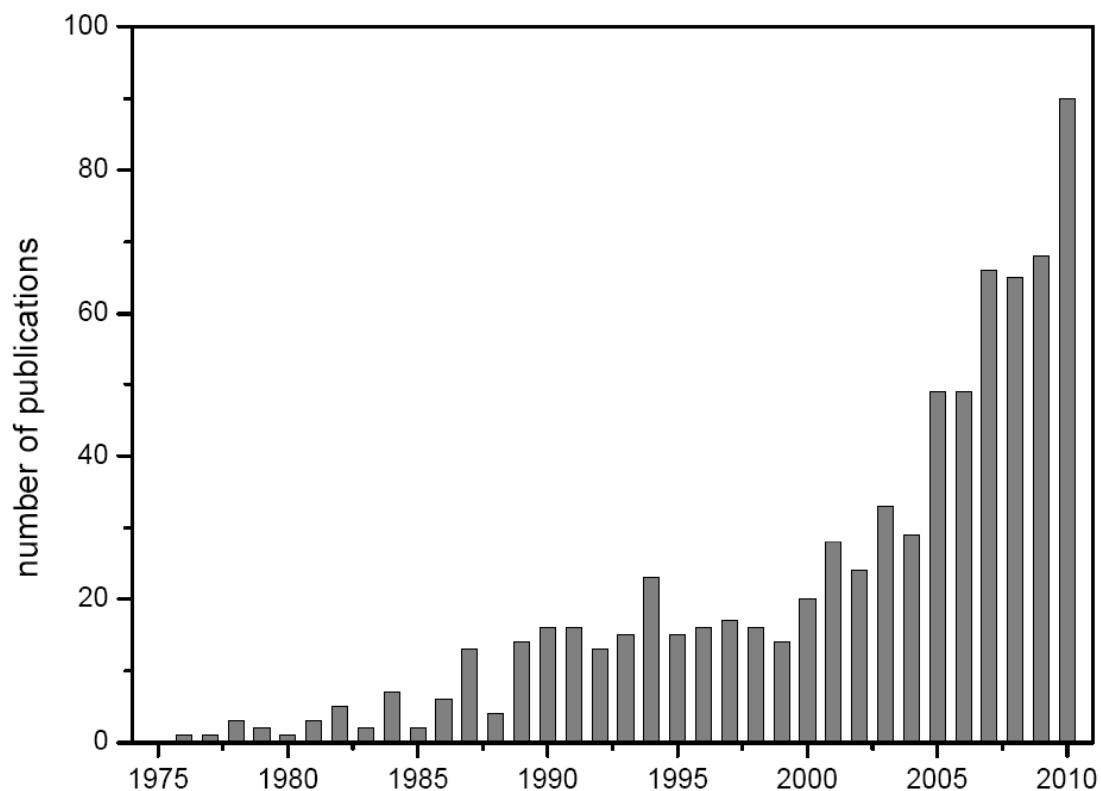


Level of Maturity	# of units	Cost
Platform assessment	10	\$1,000
Pre-Prototype	100	\$500
Pre-Production	1000	\$100
Production	10,000	\$25
Full-Scale Production	100,000	< \$5



- Sensor Costs
 - Economy of scale
 - Predicated on market
 - Growing but still in the future
 - Near-term markets are here; vehicle release in 2015

NREL-DOE Hydrogen Sensor Research # of Sensor Technologies



35 year trend in H2 Sensor Publications

From Hübert and Brett-Boon et al.

“Hydrogen Sensors—A review” *Sensors and Actuators* 2011

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Science Citation Index Expanded which is operated by Thomson Reuters

Safe Utilization of Hydrogen

- Fuel Cell and Hydrogen Energy Association
 - <http://www.fchea.org>
- H2 Incidents (Steve Wiener, PNNL)
 - <http://www.h2incidents.org>
- International Energy Association-Task 31 (Safety) (William Hoagland, Element 1)
- Hydrogen Sensors Working Group,
 - FCHEA (Robert Wichert)
- International Conference on Hydrogen Safety
 - (Sept 12-14, 2011, San Francisco, CA)
 - <http://www.ichs2011.com/>



Fuel Cell &
Hydrogen Energy
Association



TRANSFORMING THE **ENERGY** NETWORK

Hydrogen Sensor Task Force

- An active on-going FCHEA Task Group
 - Investigation of Sensor Requirements in the United States
 - Comparison of Sensor Standards Requirements
 - *Members include SDOs, government labs (DOE, NREL, CA Fuel Cell Partnership), sensor developers, end-users,*
 - *A natural continuation of the NREL-DOE Hydrogen Sensor Workshop*
- *Next Meeting:*
 - *Wednesday January 15, 11:00 AM Eastern Time*
 - *Call in: 641-594- 7000; Pass Code: 824011#*
 - *Webinar: <https://www1.gotomeeting.com/register/730432537>*
 - *Robert Wichert, FCHEA (916 966-9060, wichert@fuelcell.com)*

The 2011 NREL-DOE Hydrogen Sensor Workshop

THANK YOU!!

- **DINNER**
 - Optional (e.g., not provided)
Giordano's Chicago Style Pizza
9415 West Higgins Road

