

***U.S. Senate Briefing
Washington, DC
June 12, 2009***



***HYDROGEN and FUEL CELLS in
TRANSPORTATION — Policy Choices***

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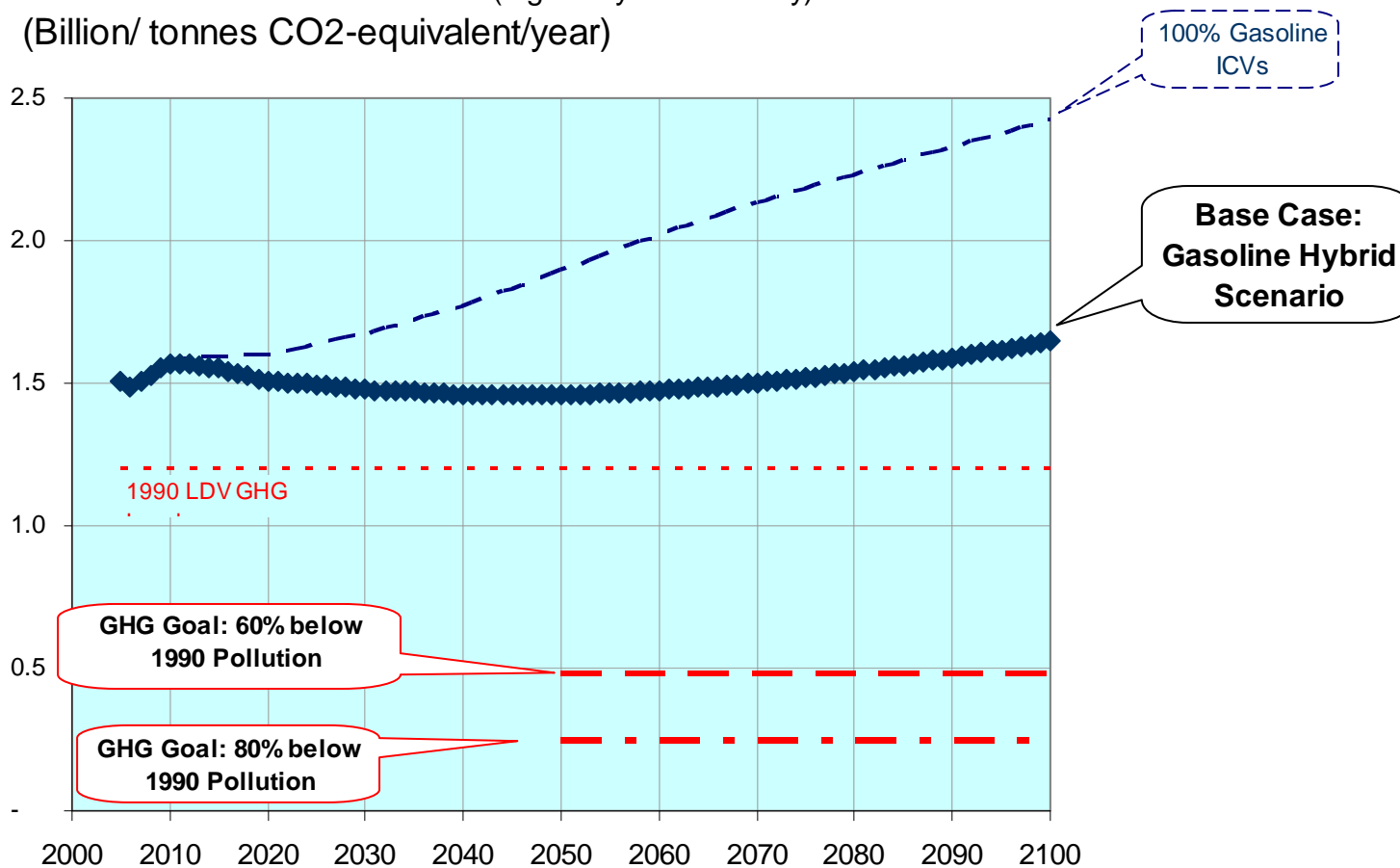
Strategic Value

- ▶ *Remedy poor U.S. fuel diversity—2007: 71% imports, Xport sector uses 67%*
- ▶ *1/3 of carbon emissions are from the transportation sector*
- ▶ *Shift toward a more domestic resource base*
- ▶ *Very wide range of feedstocks, methods to make H2*
- ▶ *Lower international security maintenance—large budget and diplomatic costs*
- ▶ *Grow new domestic primary and supplier industries*
- ▶ *U.S oil import bill \$2-\$6 T in next ten years*
- ▶ *Fuel and feedstock concentrated in vulnerable areas*
- ▶ *Fuel demand growing, price highly volatile*
- ▶ ***WE'LL NEED EVERY OPTION TO GET OFF OIL***



GHG Base Case: Gasoline Hybrid Electric Vehicles (HEVs)

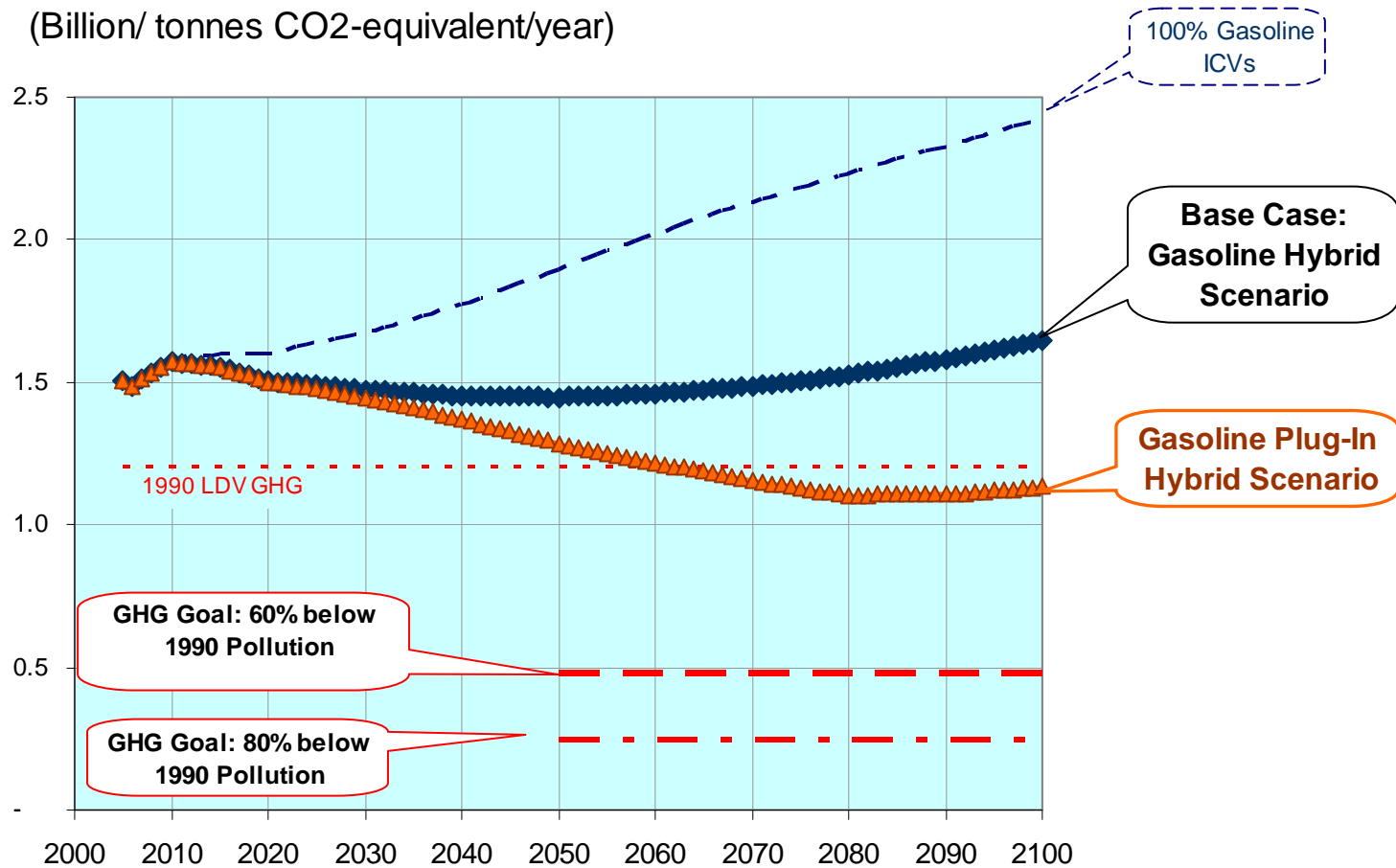
Greenhouse Gas Pollution (Light duty vehicles only)
(Billion/ tonnes CO₂-equivalent/year)





GHG: Gasoline Plug-in Hybrids

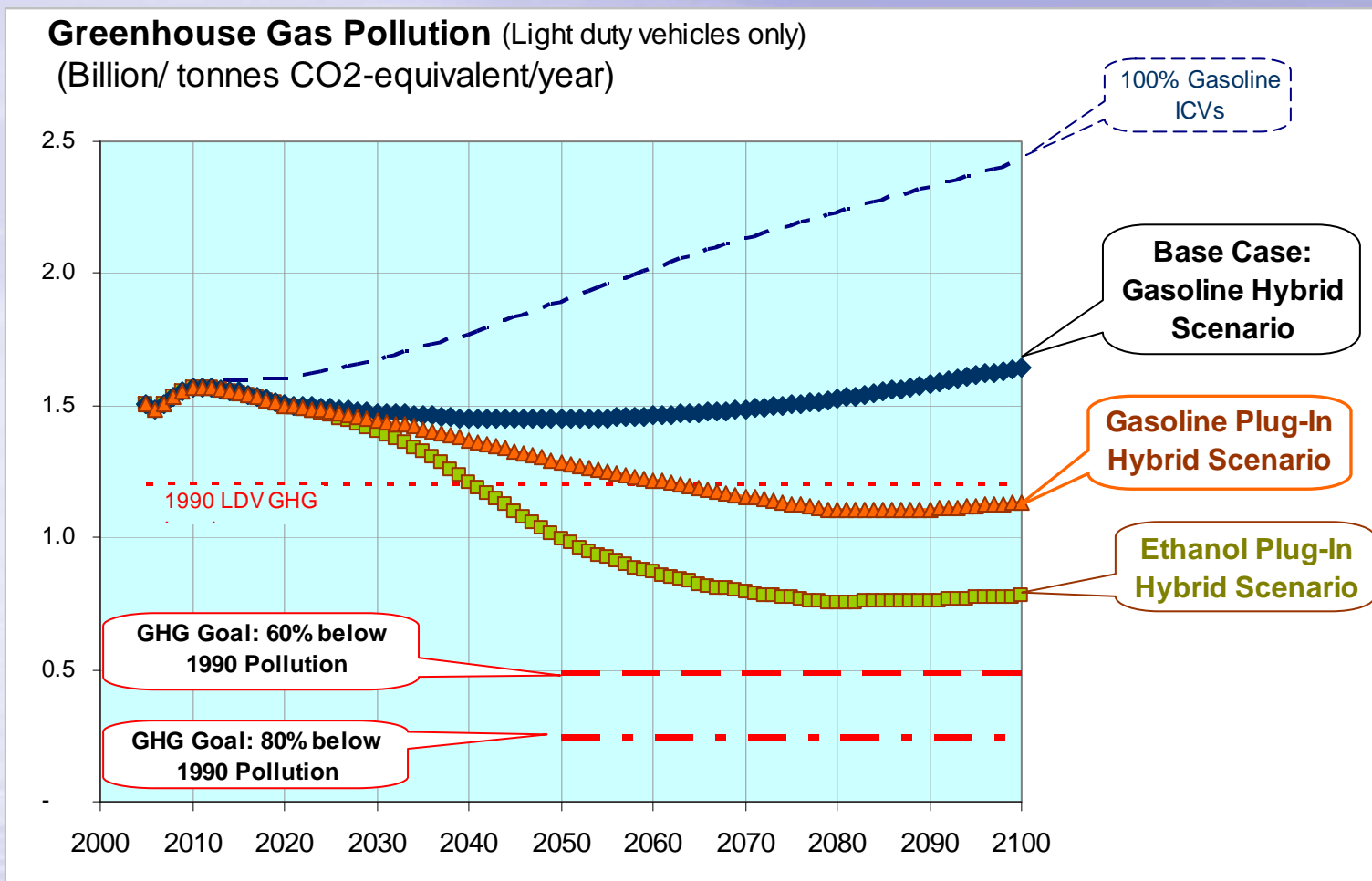
Greenhouse Gas Pollution (Light duty vehicles only)
(Billion/ tonnes CO₂-equivalent/year)





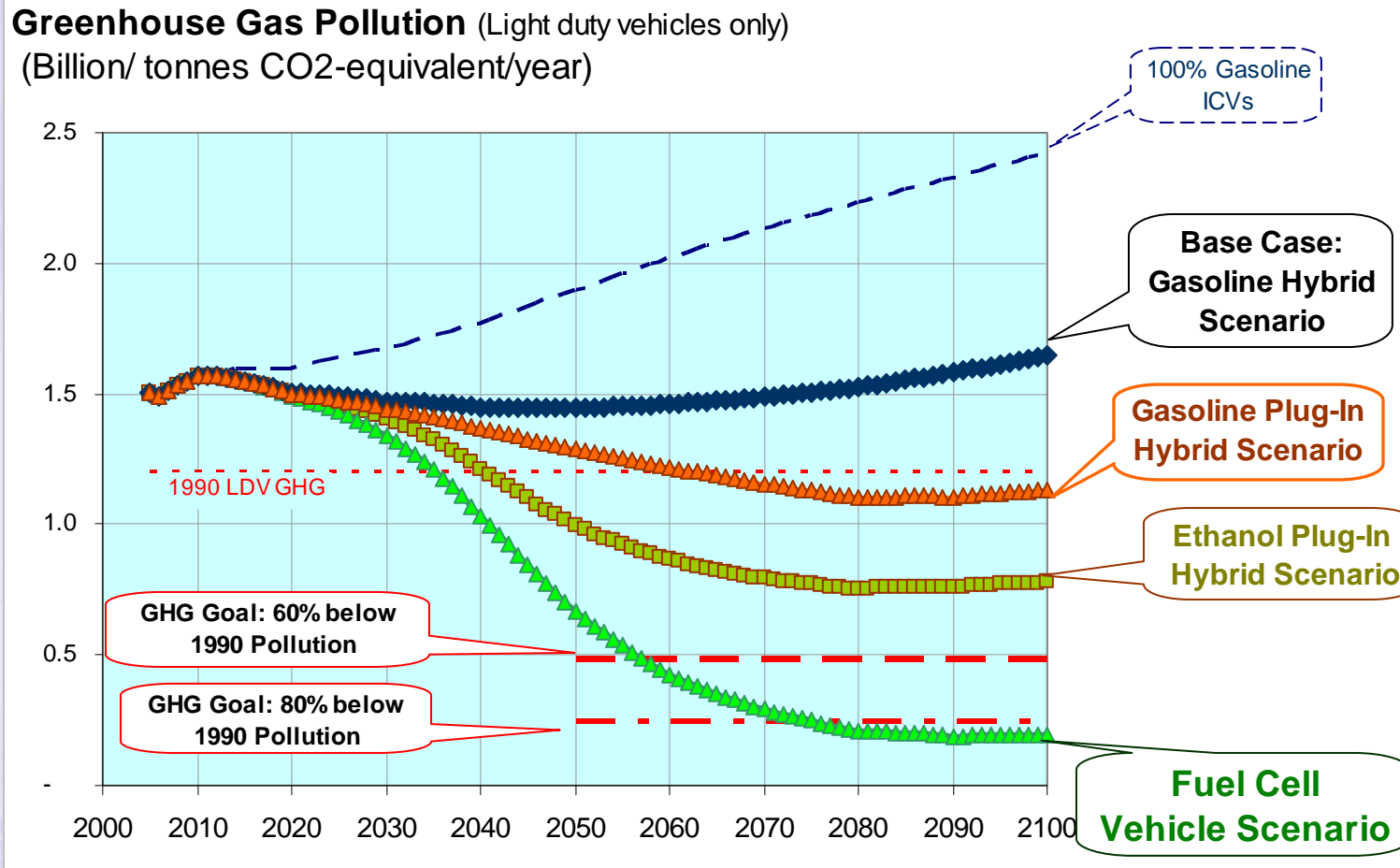
GHG: Ethanol Plug-In Hybrids

(90 Billion gallons/year* Cellulosic Ethanol & 75% PHEV limit)



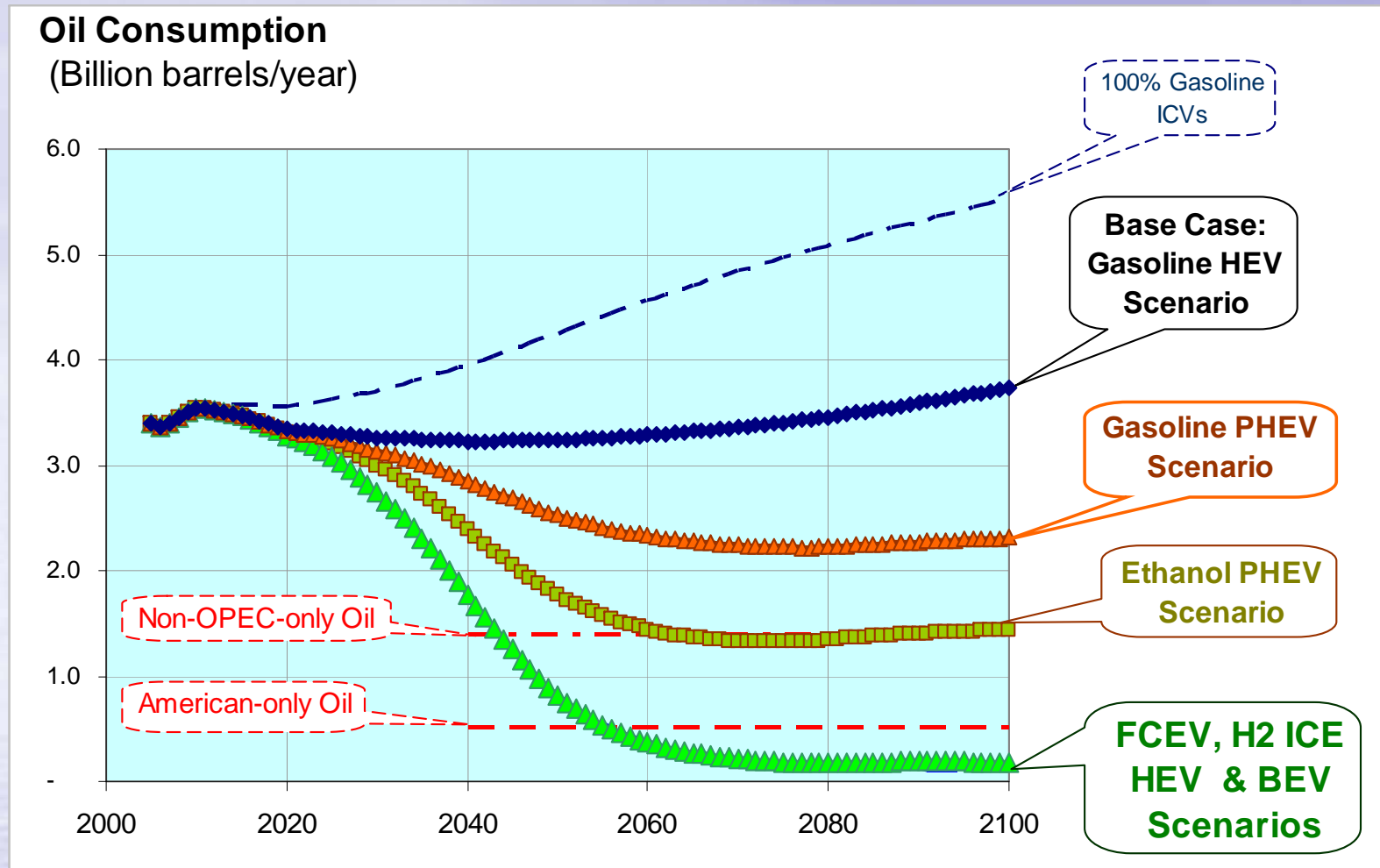


GHG: Fuel Cell Electric Vehicles (FCEVs)



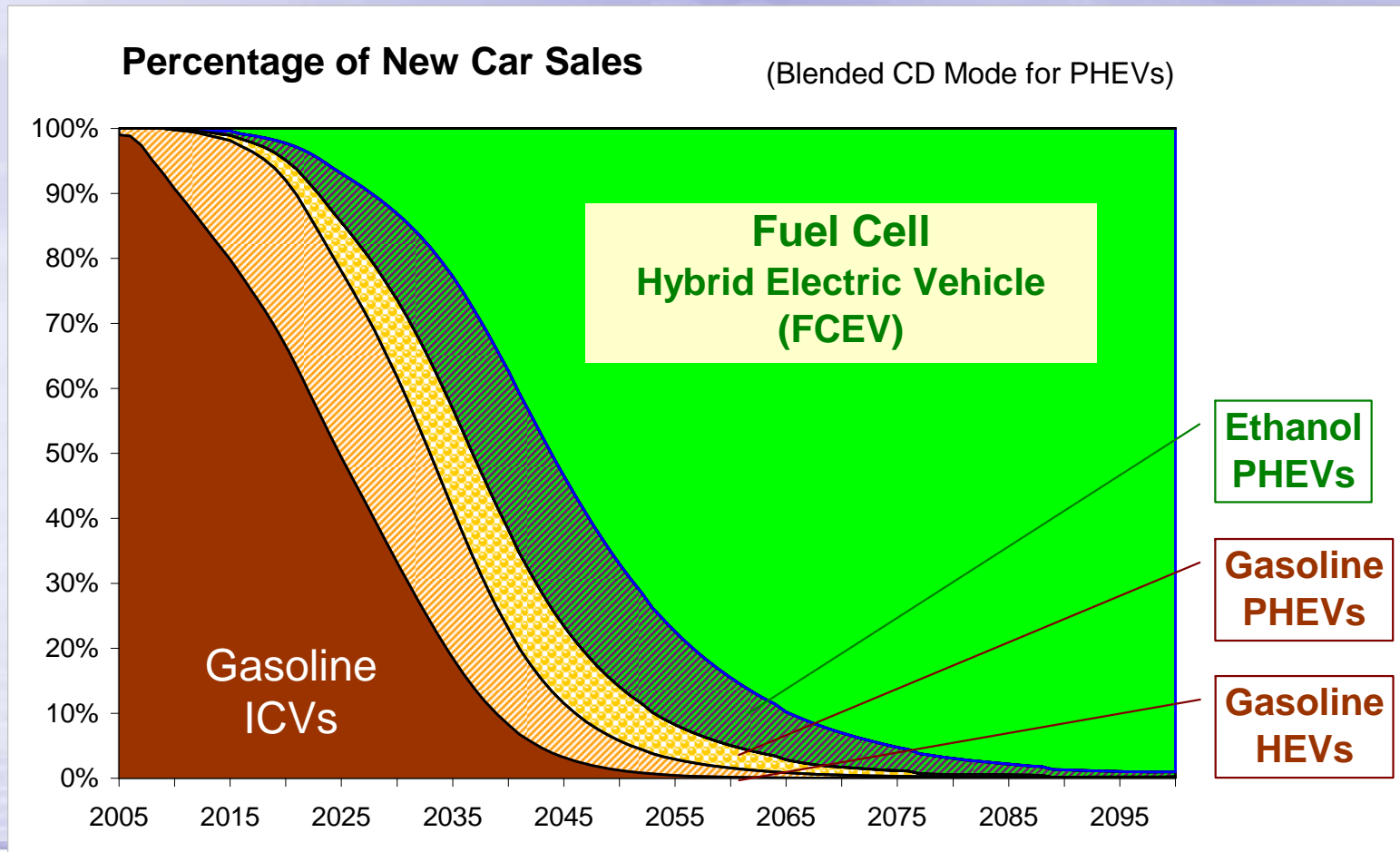


US Oil Consumption





Fuel Cell Electric Vehicle (& BEV, H2 ICE HEV) Scenario Market Shares



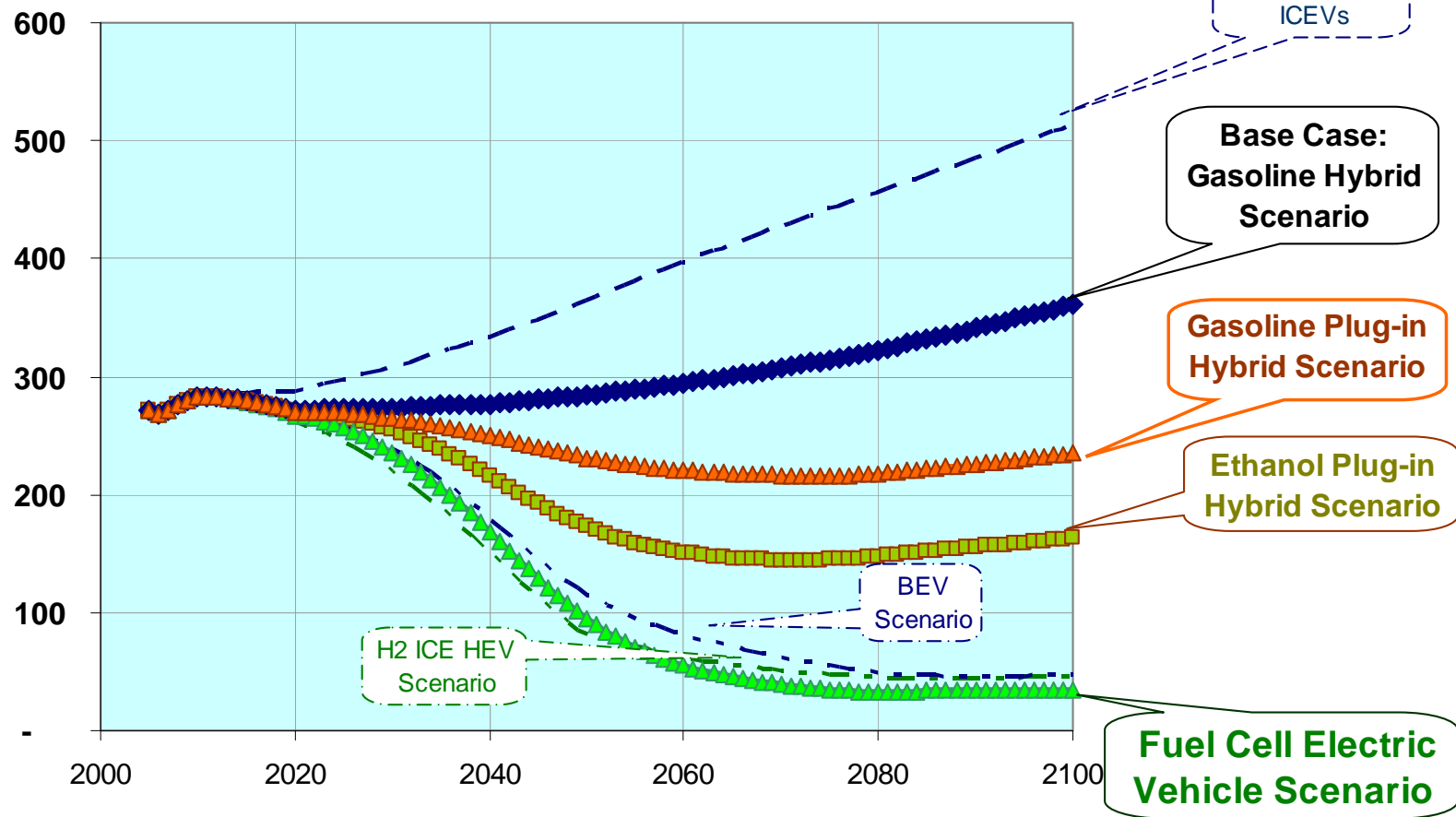


Societal Costs

(due to greenhouse gases, oil imports and urban air pollution)

Total Societal Costs

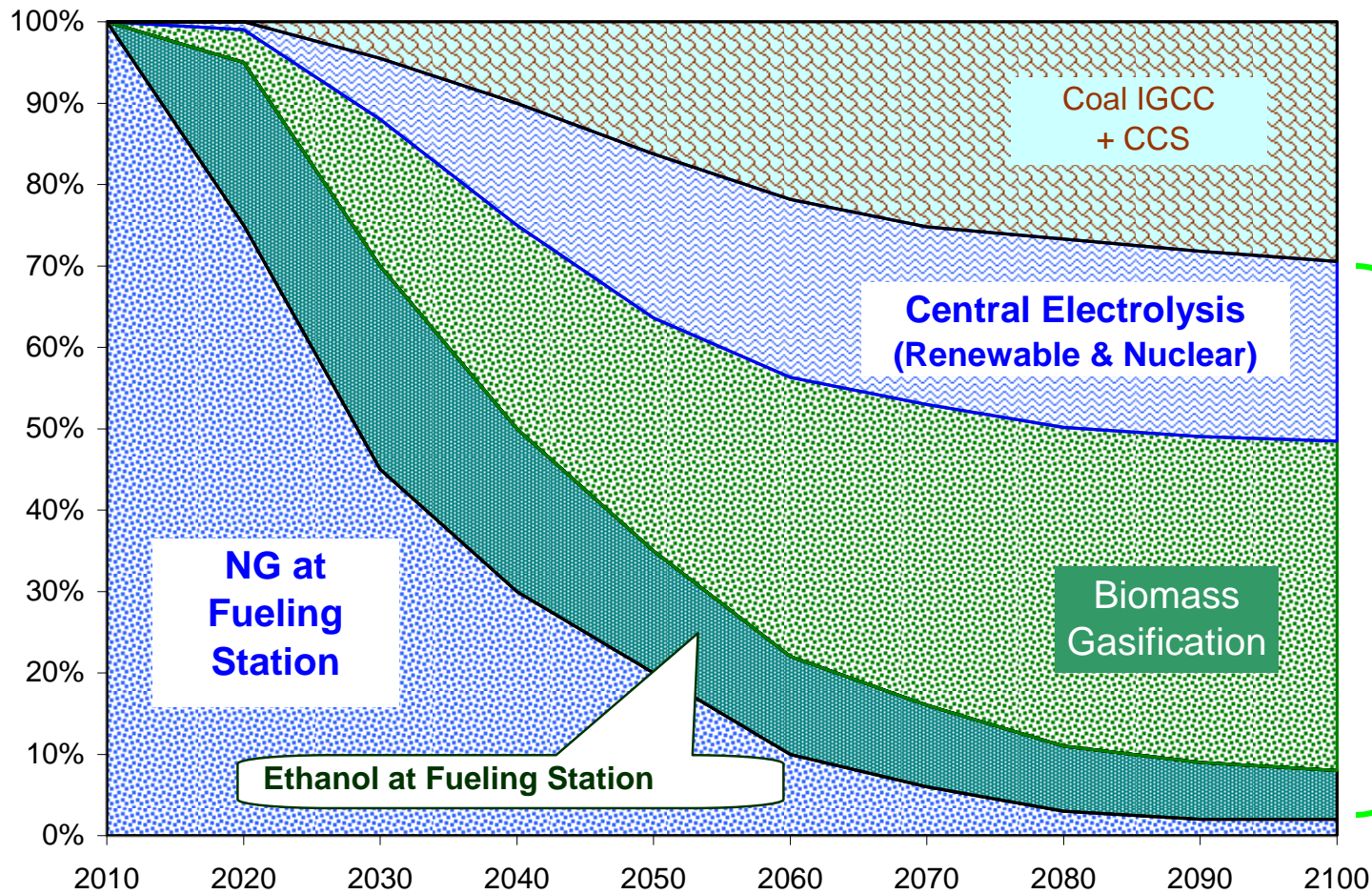
(\$Billion/year)



Greening of Hydrogen



Hydrogen Production Sources



IGCC = integrated (coal) gasification combined cycle
 CCS = carbon capture and storage

Renewable



CRITICAL ISSUES

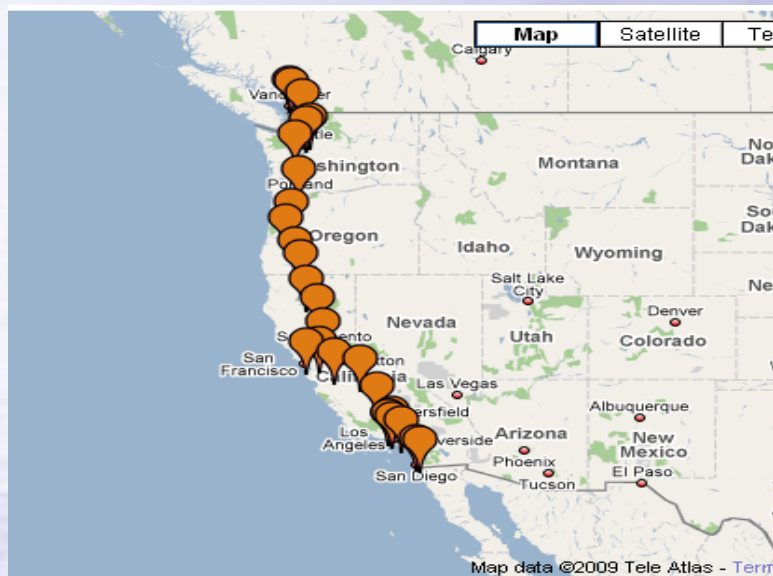
▶ DOE FY 2010 Budget Request for H2 & FC

- H2&FC cut by 66% over 2009—\$132.4 M and H2 zeroed***
- Nuclear H2 zero (-\$8 M), H2 from coal (-\$10 M, -67%)***
- H2&FC have had strong bipartisan support for many years—critical element of a balanced portfolio, leg history***
- Very + public investment results w/DOE's programs, exc. progress on tech goals and costs; key 2015, 2020 goals***
- Would cancel productive momentum, dissolve US leadership; over \$5 B invested***
- Market winners assumed prematurely, counters business models based on asset value***
- Don't need any miracles—priests of science must lift their veil***



Hydrogen Road Tour 2009

- 28 stops in 9 days through 3 states and 2 countries
- 1,700 miles from Chula Vista, CA to Vancouver, BC
- 12 hydrogen fuel cell vehicles from 7 auto manufacturers: Daimler, GM, Honda, Toyota, Nissan, Volkswagen, Hyundai/Kia





Validation of today's vehicles

- ▶ 22,000 miles driven in total: more than 1,700/vehicle (side trips for dinners, the store, etc.)
- ▶ Driven as real vehicles, like a family would on a summer vacation
- ▶ Two of the vehicles regularly get 340-370 miles on one tank
- ▶ Mobile fueling at 700 bar, even when it was over 100°F outside
- ▶ 4 years ago, the vehicles would have climbed mountain passes with A/C off, windows down @ 40 mph
- ▶ This year, they raced.

