

Renewable Hydrogen



NREL
Hydrogen Technologies
and Systems Center

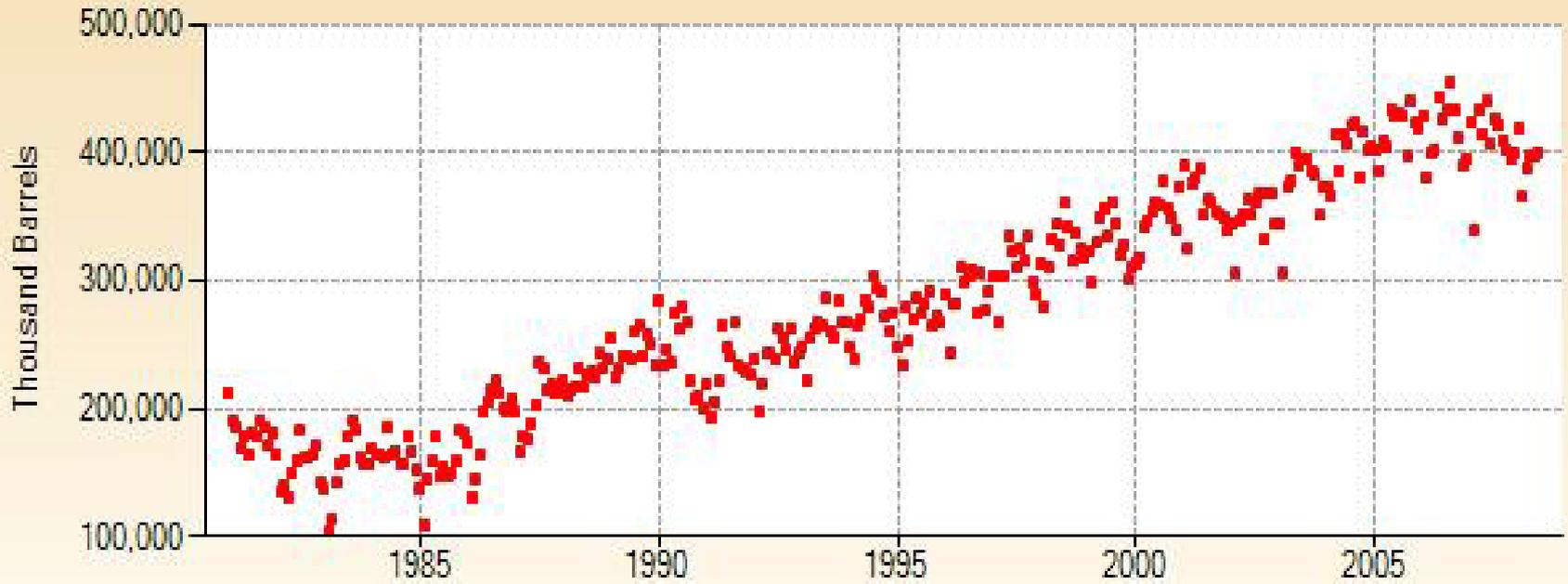
Dr. Robert J. Remick

November 16, 2009

NREL/PR-560-47433

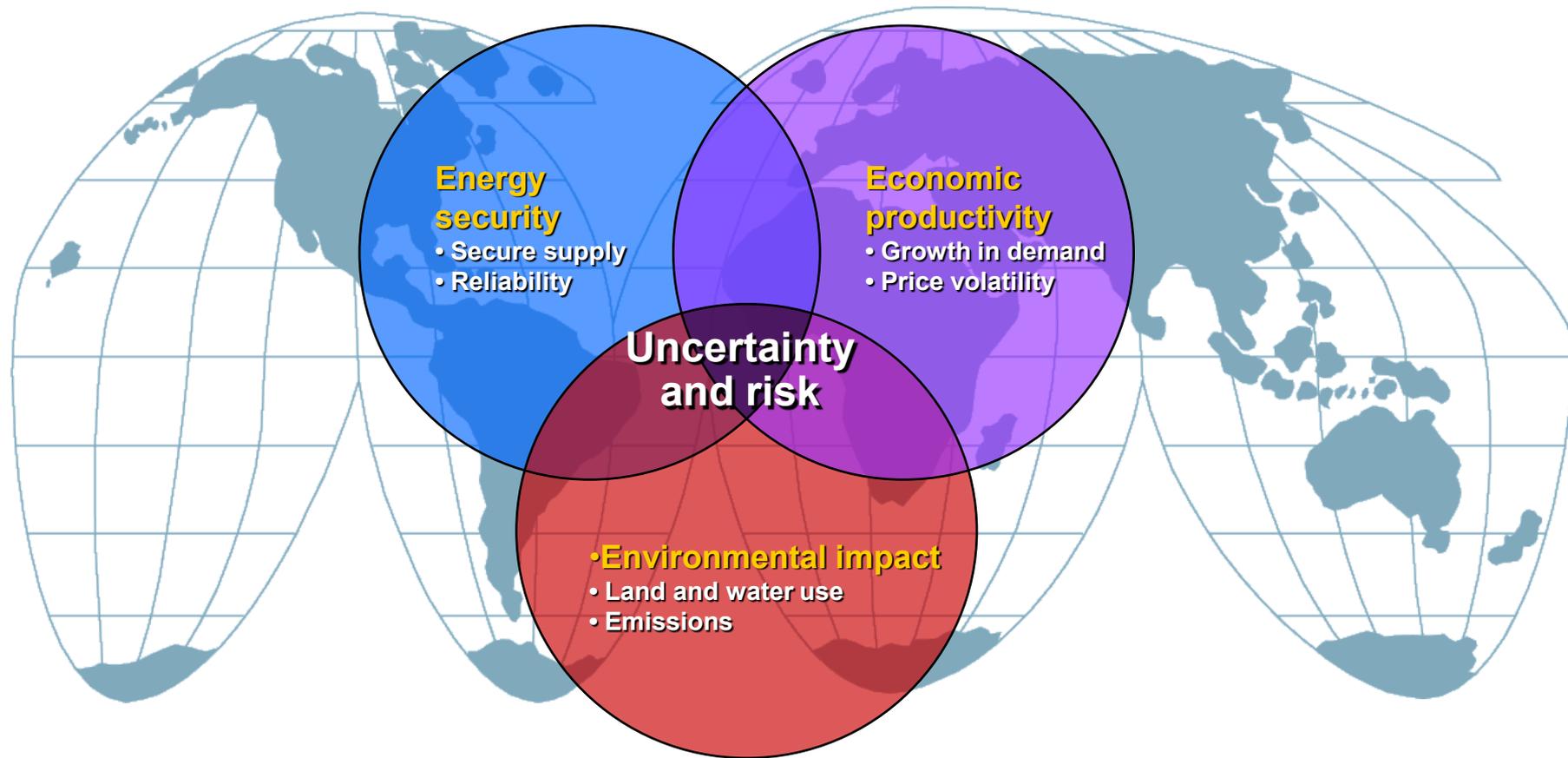
U.S. Dependence on Imported Oil

Monthly U.S. Crude Oil and Petroleum Products Imports from All Countries



Source: U.S. Energy Information Administration

Energy Solutions are Challenging



We need a balanced portfolio of options—
including clean, domestic energy technologies.

Why Hydrogen?

- Diverse Domestic Resources
- High Efficiency & Reliability
- Zero / Near-zero Emissions

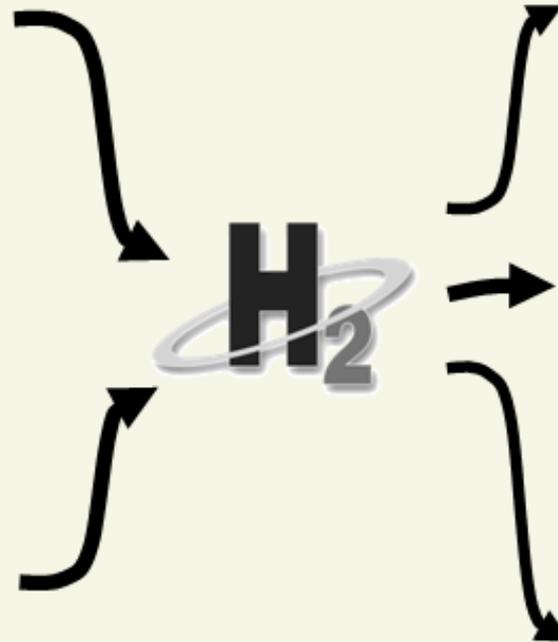
Renewable Sources:

- Wind
- Biomass
- Solar
- Geothermal
- Hydro
- Ocean



Non-Renewable Sources:

- Nuclear
- Coal (with carbon sequestration)
- Natural Gas (for transition period only)



**Stationary/
Backup Power**



Transportation



Specialty Markets



NREL/SRNL Verify >400 mile range

Test Route



Evaluation of Range Estimates for Toyota FCHV-adv Under Open Road Driving Conditions



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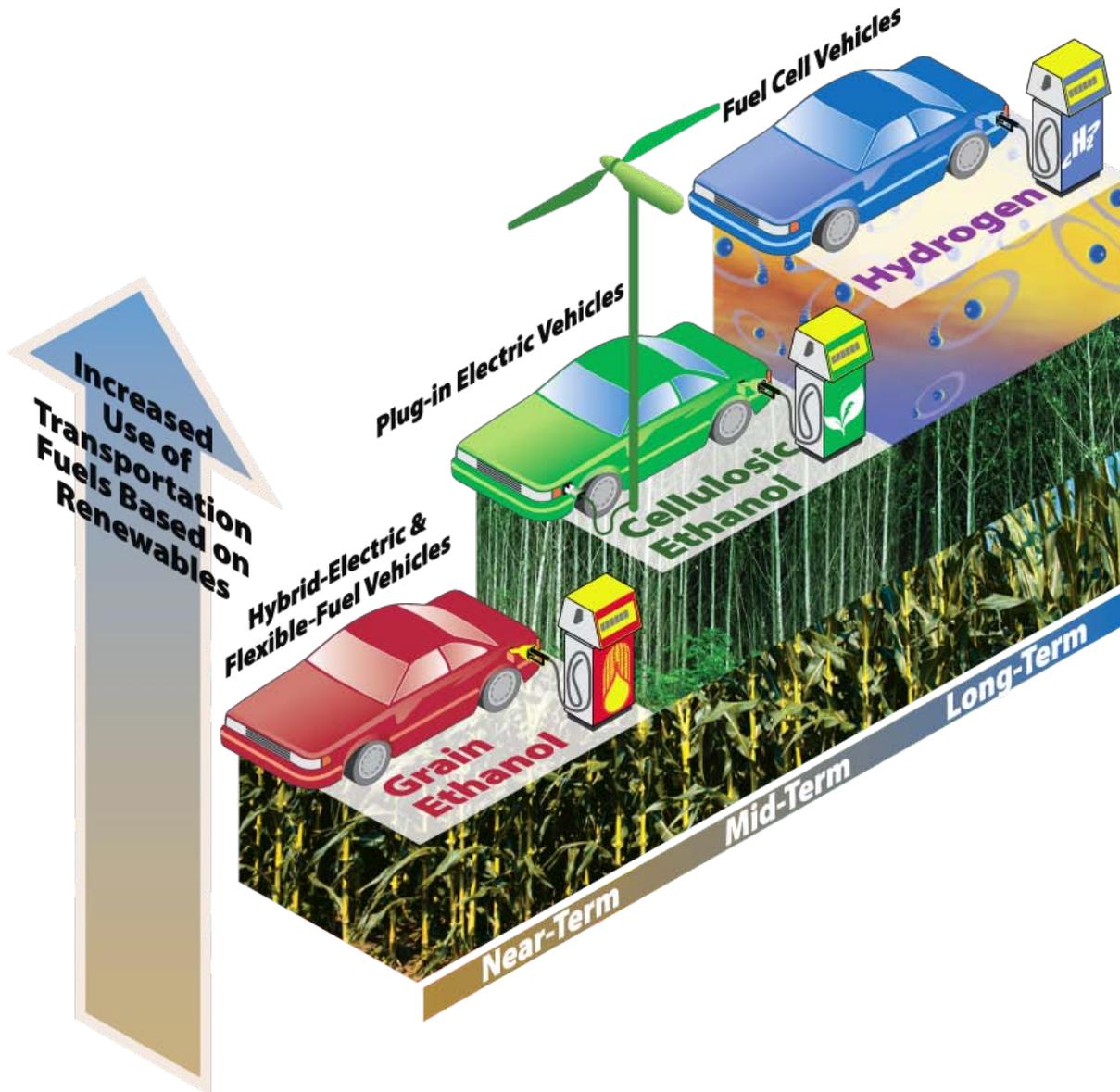


¹ National Renewable Energy Laboratory

² Savannah River National Laboratory

- **There are about 240 million light-duty vehicles in the registered in the USA**
- **The average age of the light-duty fleet is 15 to 17 years**
- **If we are going to address climate change and energy security quickly we need to do it with the existing fleet.**

Driving into the Future Using a Mix of Domestic of Fuels



- Are we approaching the questions of changing out the light-duty fleet from a suburban point of view?
- Where is the urban dweller going to “plug in” if most urbanites park on the street?
- How will the need to replace the battery pack or the fuel cell perturb the used car market?

For the present we need to keep all options under consideration.

