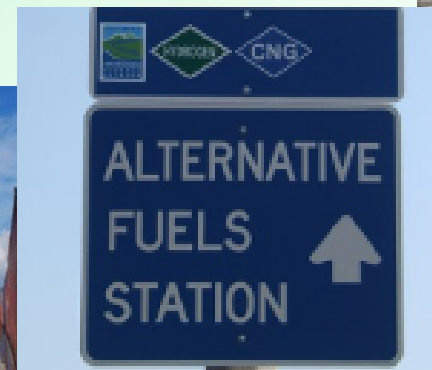
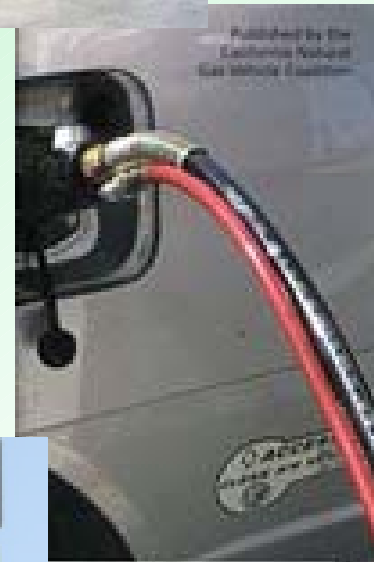


# PIER's NGV Roadmap: *A framework for collaborative R&D*

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# The Strategic Role of NGVs

***A key player in the emerging alt-fuel portfolio***

- Easily adopted early non-petroleum option
- Initial focus on heavy-duty truck and bus niches
- Later: broader HDVs, cars, then non-highway vehicles
- Ideal public preparation for fuel cell vehicle fueling
- Transition: peak by 2050, then may flatten or decline
- Some niche applications to continue indefinitely

# Some Significant Barriers

- Too few HD engine choices
- Too few NG vehicle types and models
- Lack of supporting incentives
- High fueling infrastructure costs & site limitations
- Vehicle/engine conversions too costly
- R&D costs and risks for individual companies

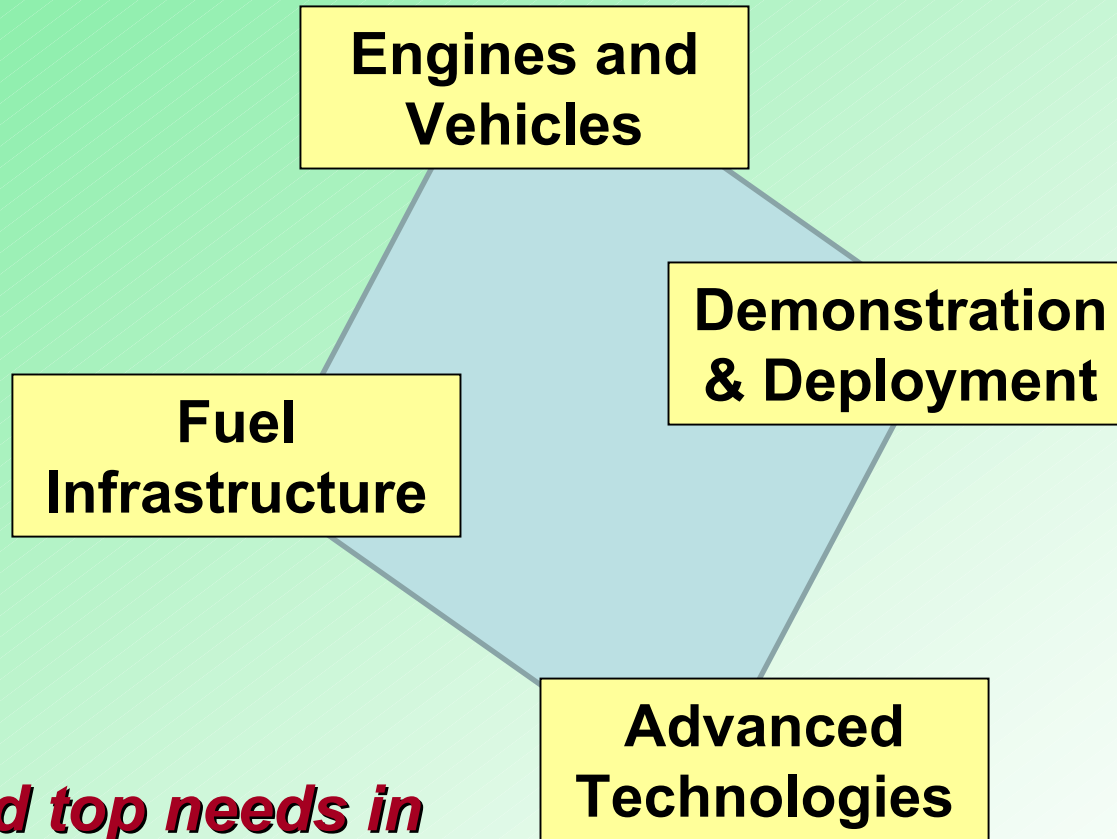
# Many R&D Opportunities

- Many participants in initial input searches
- Identified over 50 needed advancements
- 25 participants met at Asilomar
- Set tentative priorities within key categories
- First cut at sequencing top 15 topics

***Now we need NGV industry review and refinement***



# Categories of Roadmap Topics



***Identified top needs in each category***

# Engines and Vehicles

*This is the crucial near-term priority*

- Integrate NG technology into broader range of MDVs and HDVs by OEMs
- More HD engine sizes and alternatives
- Improve HD engine cost, efficiency, and emissions
- Develop and certify off-road applications



# Advanced Technologies

***We can't delay these until the other R&D is done***

- Hybridization...for HD NGV trucks and buses
- Low-cost onboard NG storage tanks
- Optimization and verification of vehicle usability of HCNG fuels
- HCCI engine technology advancement



# Fueling Infrastructure

## *Needed for broader HDV and LDV markets*

- Retrofit technology for legacy fleet to accommodate fuel variability
- Improve pressure relief devices for composite tanks
- No-leak LNG dispensing nozzles
- More cost-effective home refueling for LD NGVs



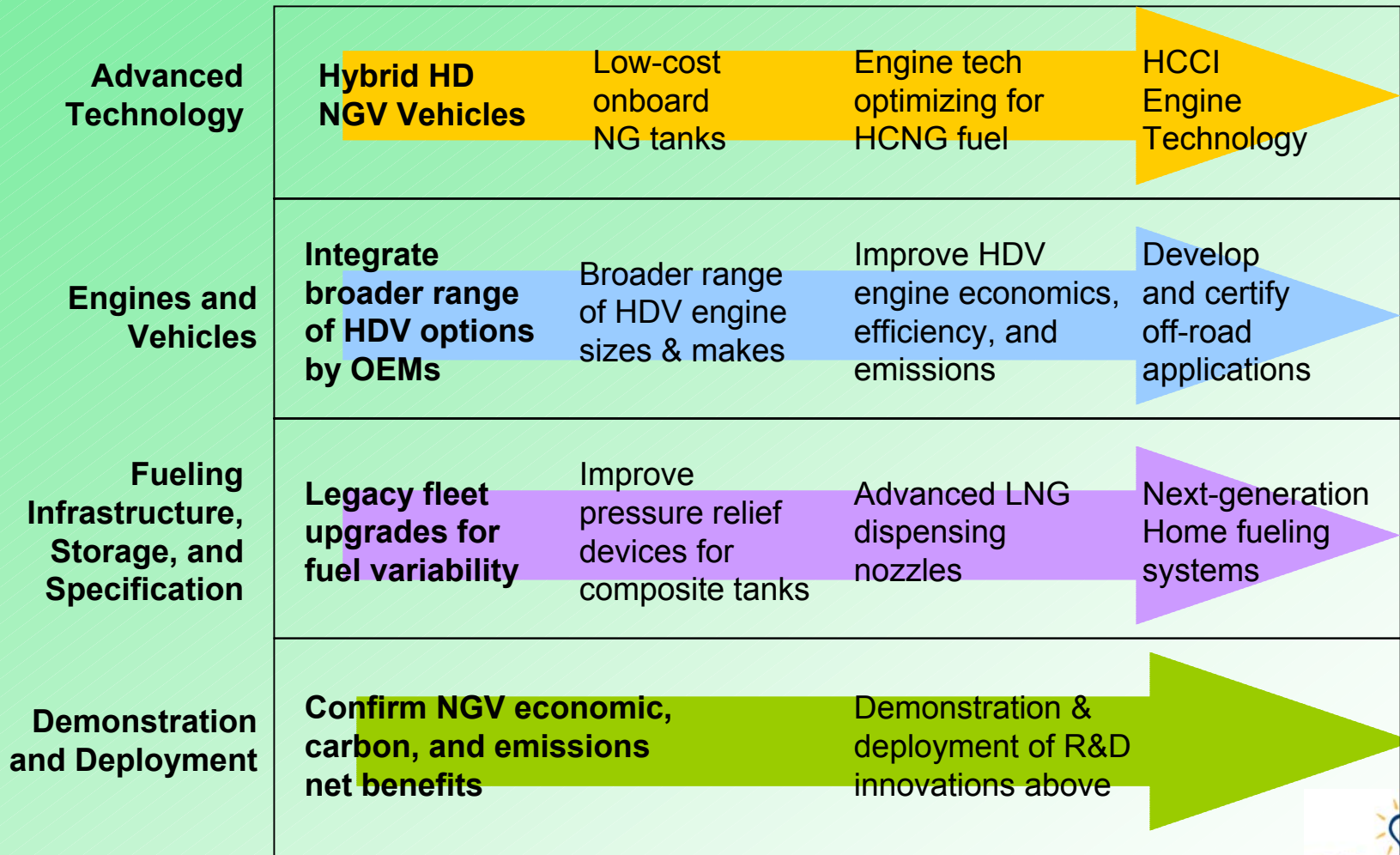
# Demonstration and Deployment

## *The essential connection to the market*

- Confirm NGV economic, carbon, and emissions net benefits
- Other demonstrations and deployment support activities of Roadmap innovations as they emerge



# Tentative Roadmap Priorities



# Next Tasks—With YOUR Help

- Semi-final draft roadmap
- Industry review
- Final draft roadmap
- Industry review
- PIER management review
- Publication of Roadmap



***But how will its R&D get into use?***

# Research is not enough

- Strong collaboration between industry and government R&D efforts
- Public policy support for NGV role
- Codes and standards adjustments
- Utility programs to bridge to market
- Public education

***These are outside the R&D roadmap but crucial***

# Questions?

***Participation and  
recommendations  
always welcome***

***Thanks for your  
interest in this  
PIER effort!***

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