Engines and Fuel Systems

ARPA-E NG Vehicles Workshop
Morning Breakout

1/26/2012

Session Summary
Group 1: Engines & Fuel Systems

Suggested FOA Metrics

- Long haul truck NG engine with thermal efficiency approaching 50%
  - ~32-35% SOA (SI and CIDI)

- Modest additional system cost
  - 2-year payback

- No major compromises in safety, maintenance, crash-worthiness, etc. as 2012 HD vehicle

Potential Technology Pathways

- Engines and critical components designed for natural gas fuel
- Direct Injection
  - Injectors, ignition systems
- HCCI
  - Controls
- Lean Burn SI
  - NO_x aftertreatment (catalysts, novel SCR)
  - Hythane (on-board reformation, combustion optimization)
- Enable fixed speed operation (CVT, series hybrid architecture)
- Compression ratio and cylinder design
- Other ideas:
  - Turbines
  - Proactive engine monitoring and diagnostics

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Possible Approaches for ARPA-E FOA

- Achieve higher efficiencies in ICEs
  - Less fuel per mile (lower cost, higher range)
- Must consider engine as part of a system
  - Implications for fuel delivery and aftertreatment
- Enable "clean sheet of paper" design for natural gas
  - Today's systems are derivative designs

Key Constraints to these Approaches

- High cost of engine design and development (~$250M)
  - Component development is one strategy
- User acceptance
  - Particularly important for HD: durability, maintainability
  - Cost and payback