EBDI® - Application of a High BMEP Downsized Spark Ignited Engine

Rod Beazley
Vice President – Spark Ignited Engines
Ricardo Inc.
• EBDI® is an extreme downsized 3.2L SI V6 to replace a 6.6-7L CI engine
• Homogenous stoichiometric operation at all loads with cooled EGR
• Parallel sequential boosting system
• Targets: 35bar BMEP (E85), 30bar BMEP (E0)
• Significant opportunity for piece cost reduction compared to CI engine
• CI to SIDI Fuel system saving $1300 - 2000
• Aftertreatment saving of $2400 – 3000
• Reduction of diagnostic complexity - less engineering expense and less warranty
Development Path

- The EBDI project is a natural “next step” in the evolution of the spark ignited engine.
Applicability

- Scaleable technology by varying the number of cylinders with more cost efficient emissions solution
Base Engine Impact

- Cylinder Block
- Cylinder Head
- Crankshaft
- Pistons / Rods
- Head Gaskets & Bolts
- Intake Manifold
- Oil System
- Camshaft
- Direct Injection Fuel System
- Turbocharging
- EGR and CAC
Dyno Results (1)

- Data shows that “high low speed torque” is not unique to diesel engines
  - SI engines can achieve higher low speed torque with less cylinder pressure
Dyno Results (2)
Controls and Calibration

- Engine operation optimized dependent on fuel octane and ethanol content using advanced control strategies

- Injection Duration and Timing
- Fuel Pressure
- Ignition Timing
- Boost Pressure
- Cooled EGR Flow
- Camshaft Timing
- CVVL

[Diagram showing various engine control components and their interconnections]
BMEP Extension Potential

Decreased Displacement
Increased BMEP
1,600 RPM

Equivalent Displacement
Match or Extend BMEP
2,400 RPM

Diesel
E85
E85 Torque Ext
Future Opportunities!