Comparative combustion study of B30, RD100 & Petroleum Diesel



Clean Fuels' Technical Workshop
10/27/26
–
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GM Strategy with Clean Fuels

Prove readiness with AUTO 3.0 and Truck 3.0 — then scale only when technical, economic, and market conditions are demonstrated.

	1 · Technical proof	2 · Standards & policy enablement	3 · Market adoption/business value
AUTO 3.0 Drop-in Gasoline pathway pathway	Fungibility, emissions/OBD, durability, cost, availability	CRC · ASTM · NCWM engagement	Incremental pathway for E15 adoption + CAFE/GHG/LCFS value
TRUCK 3.0 Drop-in Diesel pathway (RD100 & B30)	Blend validation, performance, performance, customer protection	CRC · ASTM · NCWM engagement	RD100 & B30 adoption + Scope 3 Scope 3 reduction

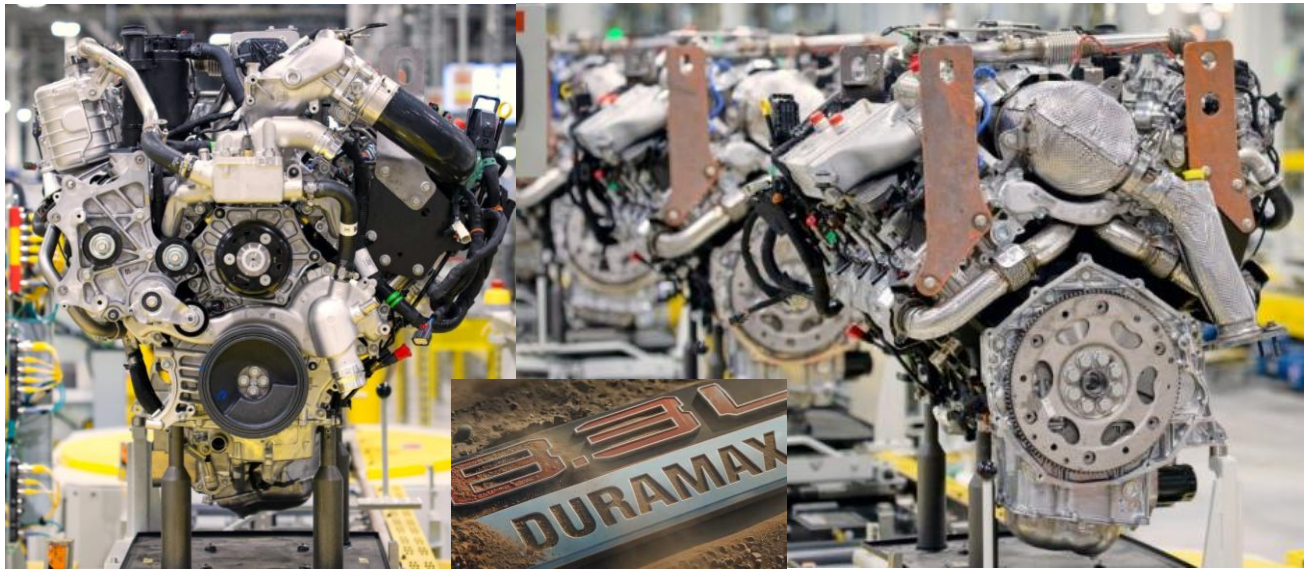
- **Complete the evidence base** Continue AUTO 3.0 and Truck 3.0 testing — — fungibility, emissions/OBD, durability, cost, availability.
- **Shape the ecosystem selectively** Targeted participation in CRC, ASTM, and and NCWM to shape pragmatic standards.
- **Stay capital disciplined** Advance pathways as readiness is proven; optionality without premature commitments.
- **Convert learning into value** Position validated pathways for credits and Scope 3 reductions.

Why this matters for GM

- **Protects the customer experience**: Aligns fuel standards with vehicle performance, durability, and customer requirements.
- **Reinforces decarbonization**: Both vehicles and fuels move toward lower carbon footprint and lifecycle emissions.
- **Preserves business flexibility**: Helps GM respond quickly to changes in policy, fuel availability, and marketplace demand.

Engine Selected: Prototype Duramax L6P

All-new 8.3L V8 turbo-diesel (codename “Mongoose”) for the 2027 Chevrolet Silverado HD and GMC Sierra HD.



8.3 L
V8 turbo-diesel

555 hp
@ 2,500 rpm

1,230 lb-ft
@ 1,400 rpm

Allison
10-speed automatic

38,000 lb
max gooseneck towing*

20,000 lb
max conventional towing*

+85 hp / **+255 lb-ft** **vs. outgoing 6.6L L5P**

L6P: 555 hp / 1,230 lb-ft | L5P: 470 hp / 975 lb-ft

ENGINE ARCHITECTURE

01
Compacted-graphite-iron block

02
Forged crankshaft & rods; steel pistons

03
Variable-geometry turbocharger

04
Dual-stage air-to-water charge cooling

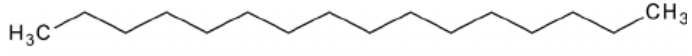
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Integrated intake, revised aftertreatment

Sources: GM official reveal (Sep. 24, 2026); GM teaser / media;

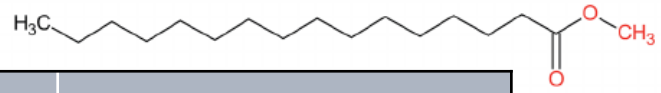
**Towing figures apply to properly equipped / configuration-specific models.*

Low Carbon Fuels Selected

- **Renewable Diesel** – Hydrocarbons (similar composition as diesel) produced via Hydrotreating



- **Bio-Diesel** – Fatty Acid Methyl Esters (FAMEs) produced via Transesterification

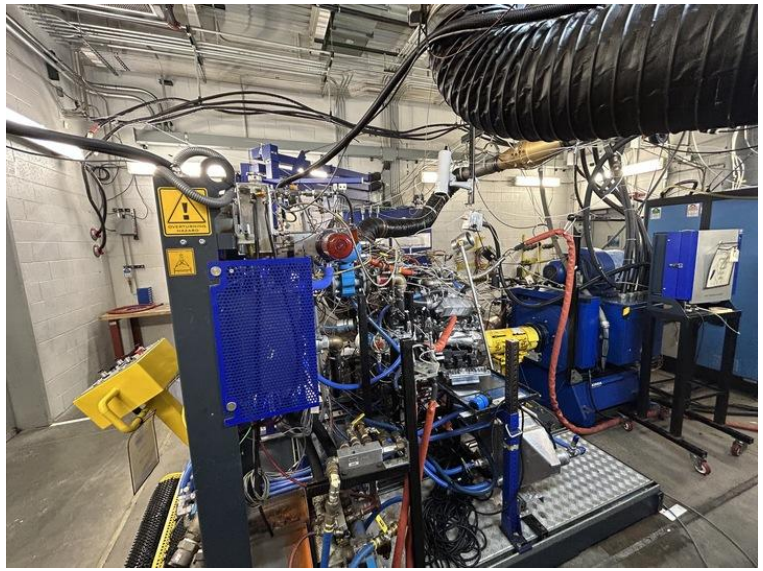


Key Properties	Petroleum Diesel	Renewable Diesel 100	Bio-Diesel 30
Cetane Number	42-45*	75-90*	45-50*
Cetane Index	43*	93.64	42.1
Density (g/cm3)	0.839	0.774	0.851
Lower Heating Value (MJ/kg)	42.92*	43.96	41.24
Lower Heating Value (MJ/L)	36.01*	34.03	35.09
Carbon Weight in Fuel (%)	87.15*	84.95	84.04
Hydrogen Weight in Fuel (%)	12.85*	15.05	12.58
Oxygen Weight in Fuel (%)	0*	0	3.38
Carbon Intensity (gCO2e/MJ)	91-94*	42.33*	60-70*

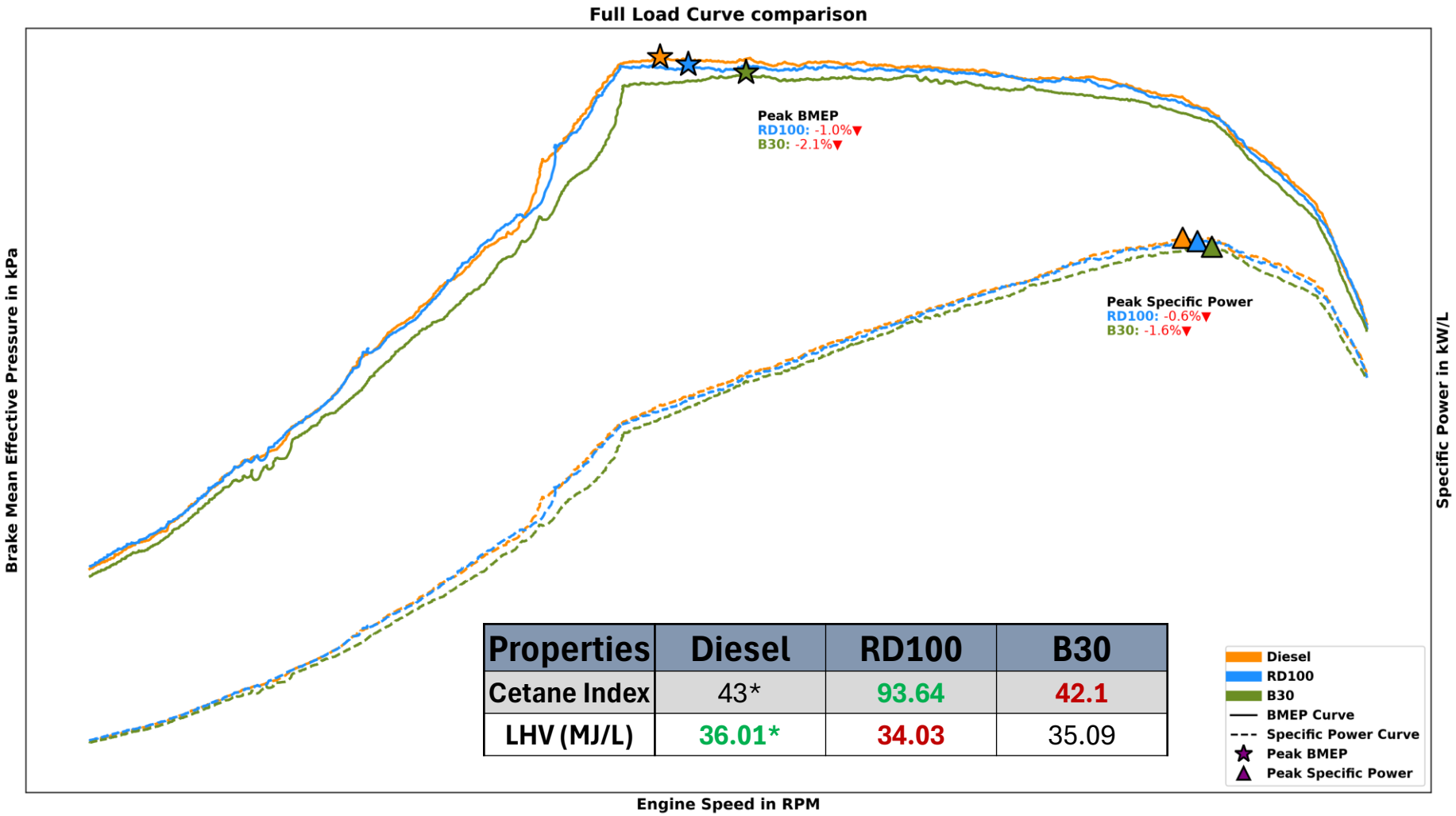
*Approximate values, not measured or tested

Truck 3.0 Sub-Project Objectives & Tests

- Evaluate B30 & RD100 as “drop-in fuels” for engine performance & emissions.
    - Tests conducted – Full load curve (similar to a SAE power run)
      – Steady-state key points (derived from road & light-duty emission cycle)
- Evaluate the emission and performance trade-offs of the existing hardware with B30 & RD100.
    - Tests conducted – EGR/Boost Sweeps (to quantify impact of LCFs on combustion)



Transient Full Load Curve with LCFs (Drop-In Assessment)



Properties	Diesel	RD100	B30
Cetane Index	43*	93.64	42.1
LHV (MJ/L)	36.01*	34.03	35.09

Comments

- Both fuels are within the error band for manufacturing variability of ±2% for power certification.

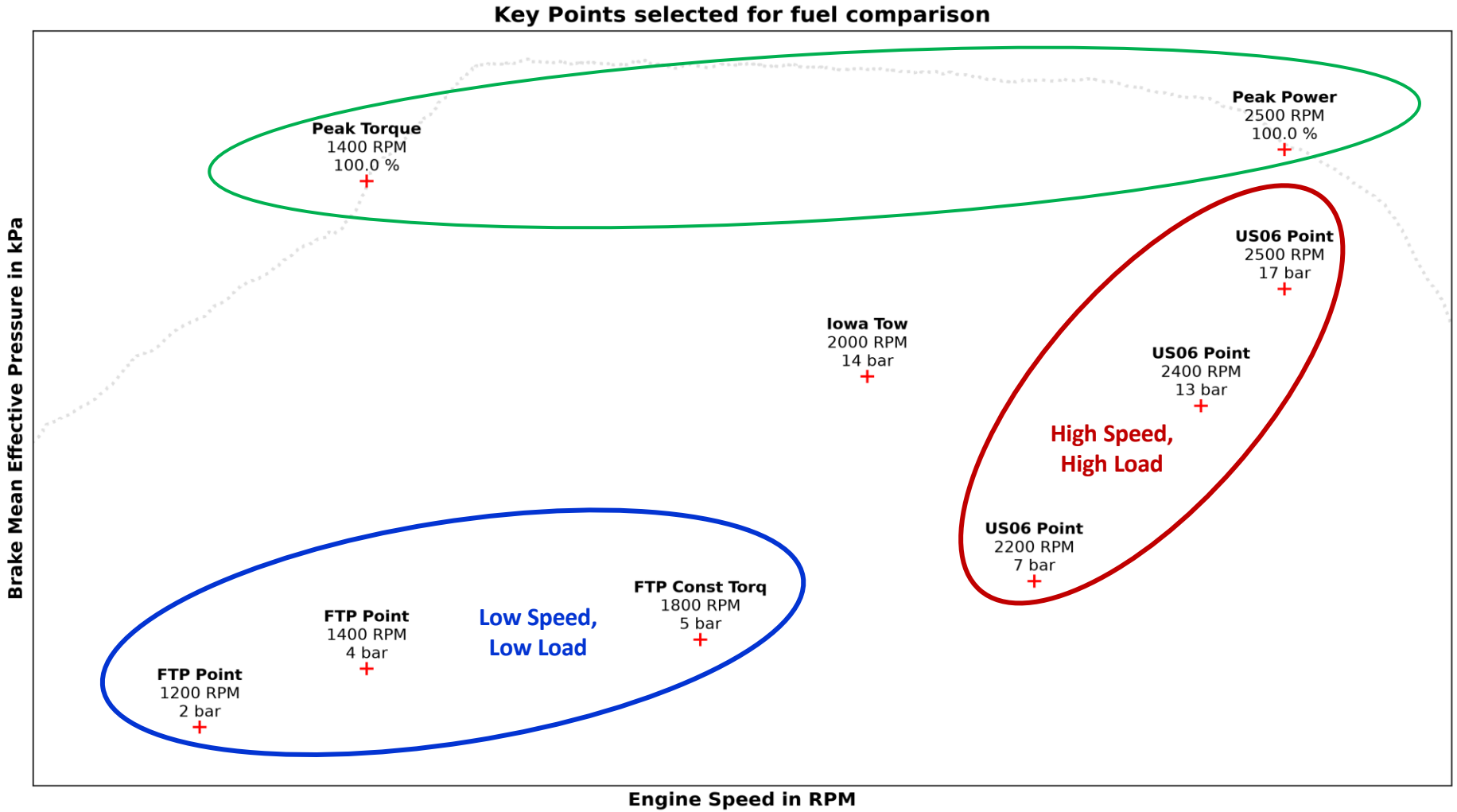
- B30 full load curve follows the energy density difference.

- Cetane impact of RD100 would be interesting to study at Peak Power.

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Note- Full load curve is not representative of the production L6P engine

Key Points for Steady-State evaluation



Note- Full load curve is not representative of the production L6P engine.

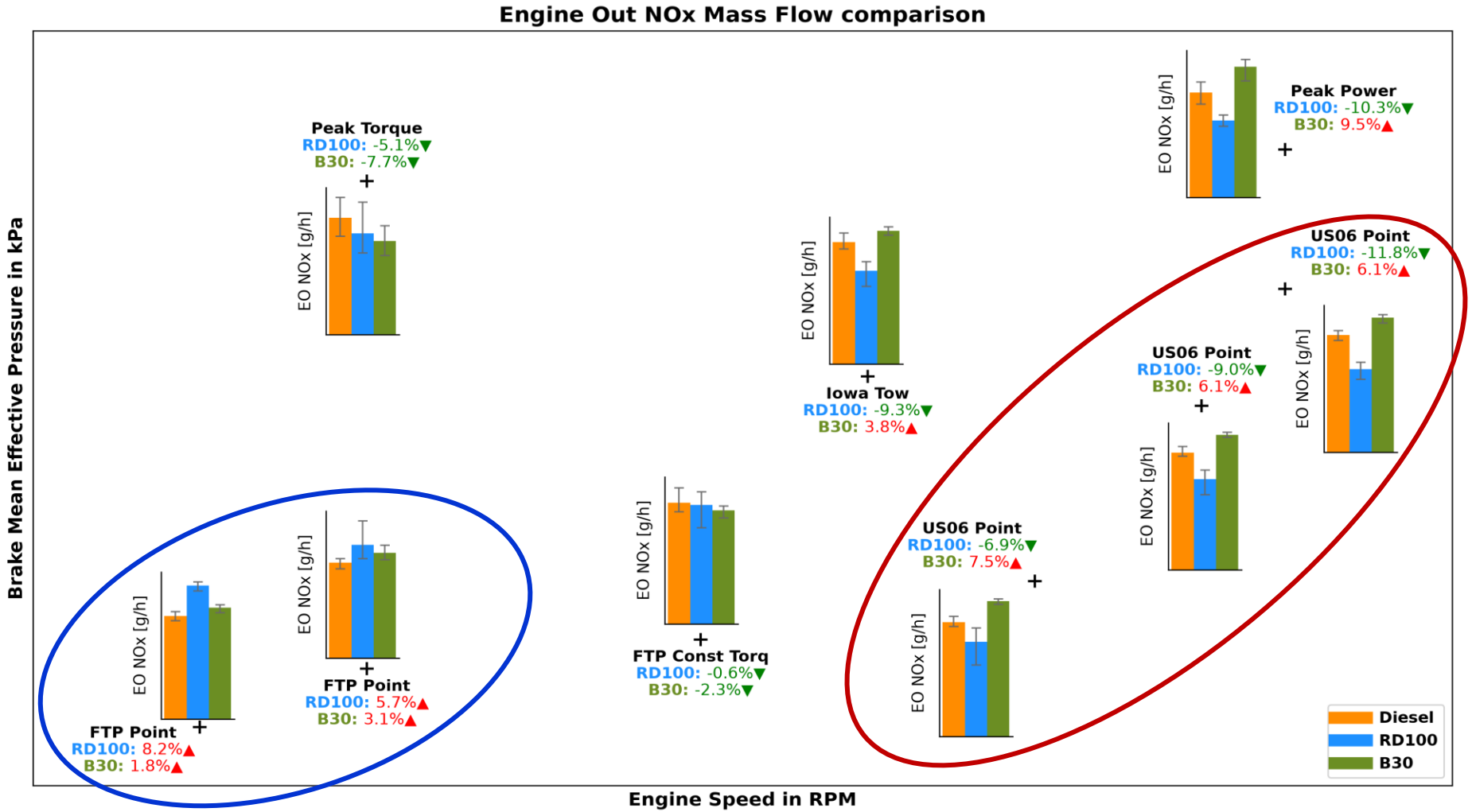
Comments

- Low speed-low load & high speed-high load points derived from FTP75 & US06 cycles.

- Mid speed-mid load point derived from constant-speed towing conditions representative of typical customer use.

- Peak Torque and power points run in Open Loop dyno control mode.

Engine Out NOx Mass Flow comparison (Drop-In Assessment)



Comments

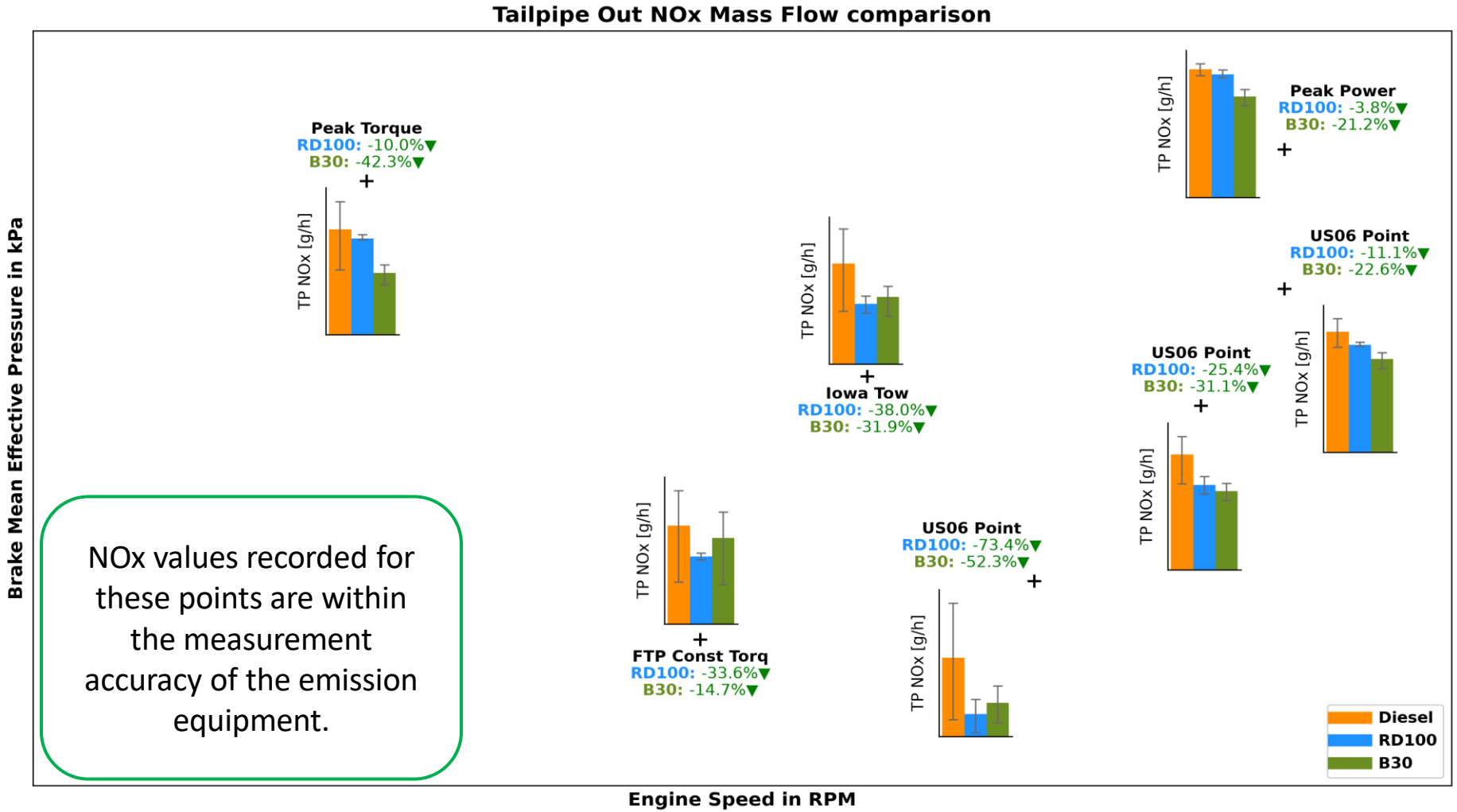
- Engine Out NOx differences are acceptable within engineering margin.

- FTP Points see an increase in NOx with both fuels.

- US06 Points have higher NOx with B30.

Note- NOx concentration is measured using a CLD NOx analyzer.

Tailpipe Out NOx Mass Flow comparison (Drop-In Assessment)



NOx values recorded for these points are within the measurement accuracy of the emission equipment.

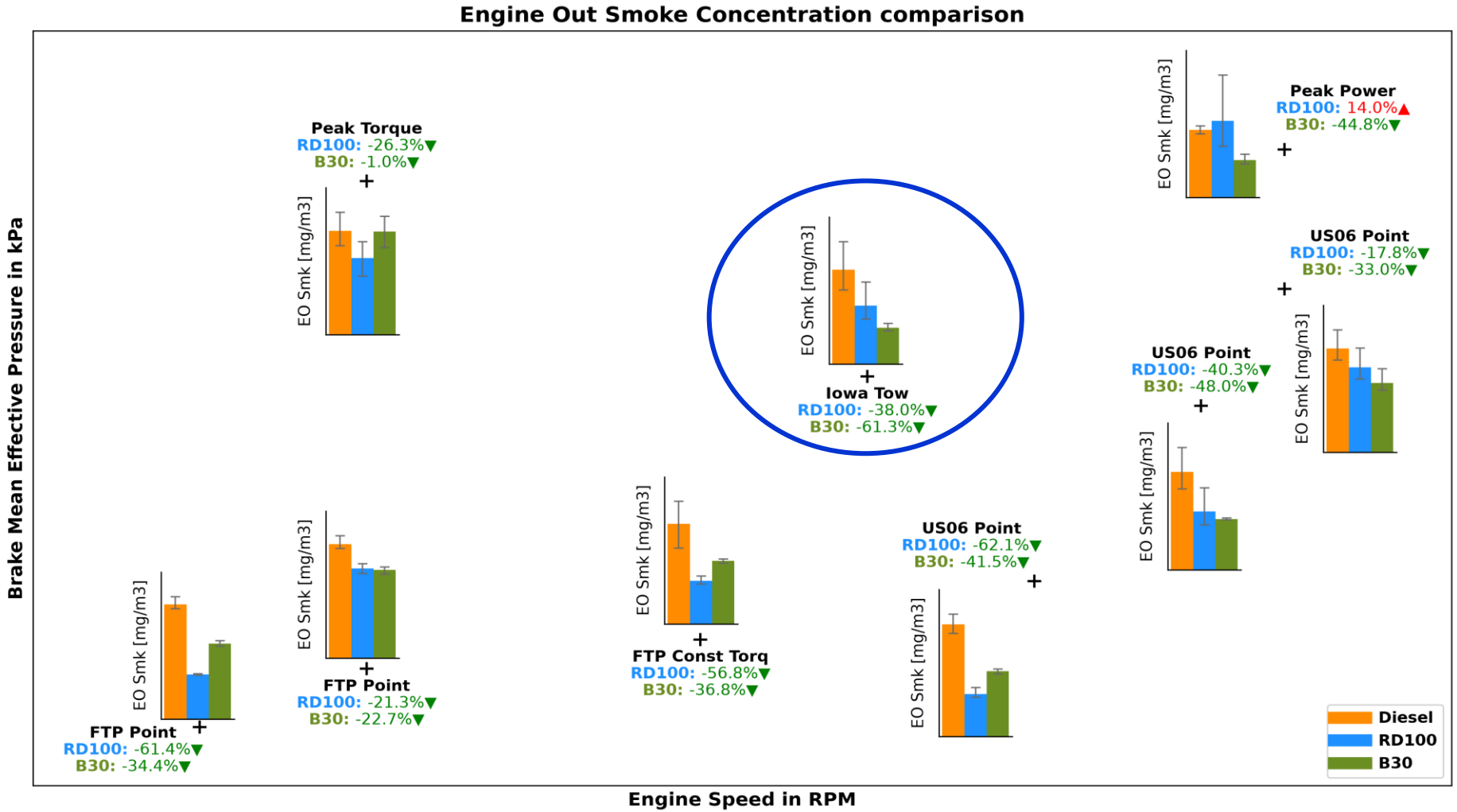
Comments

- Equal or better Tailpipe NOx with both fuels irrespective of the Engine Out NOx differences.

- For FTP points hidden the NOx values at Tailpipe are 0g/h.

Note- NOx concentration is measured using a CLD NOx analyzer.

Engine Out Smoke Concentration comparison (Drop-In Assessment)



Comments

-Lower soot overall for all steady-state points.

-How to quantify impact of fuel on emissions?

Note- Soot concentration is measured using a Micro Soot Sensor.

EGR/Boost Sweep test setup

- **Iowa Tow Point** – 2000rpm & 14bar (Constant Torque)

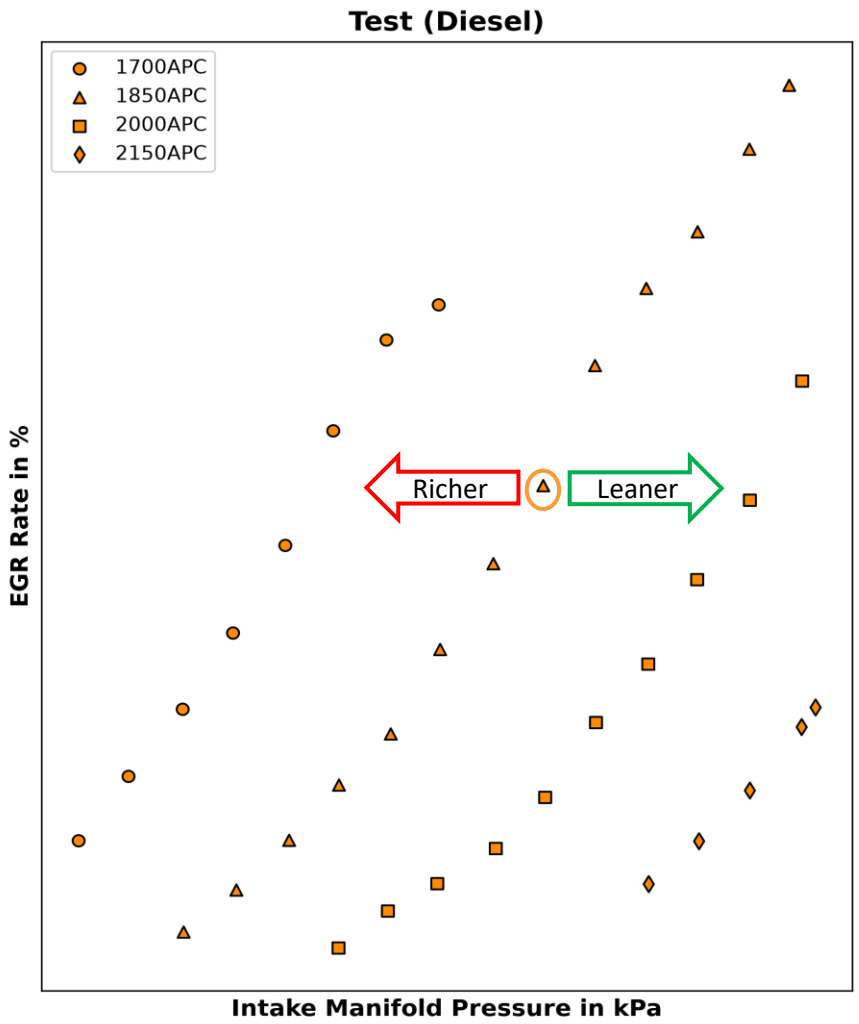
- **Combustion Constants** – Combustion Mode
  – Rail Pressure
  – Start of Main Injection
  – Timing & Quantity for Pilot 1
  – Timing & Quantity for Pilot 2

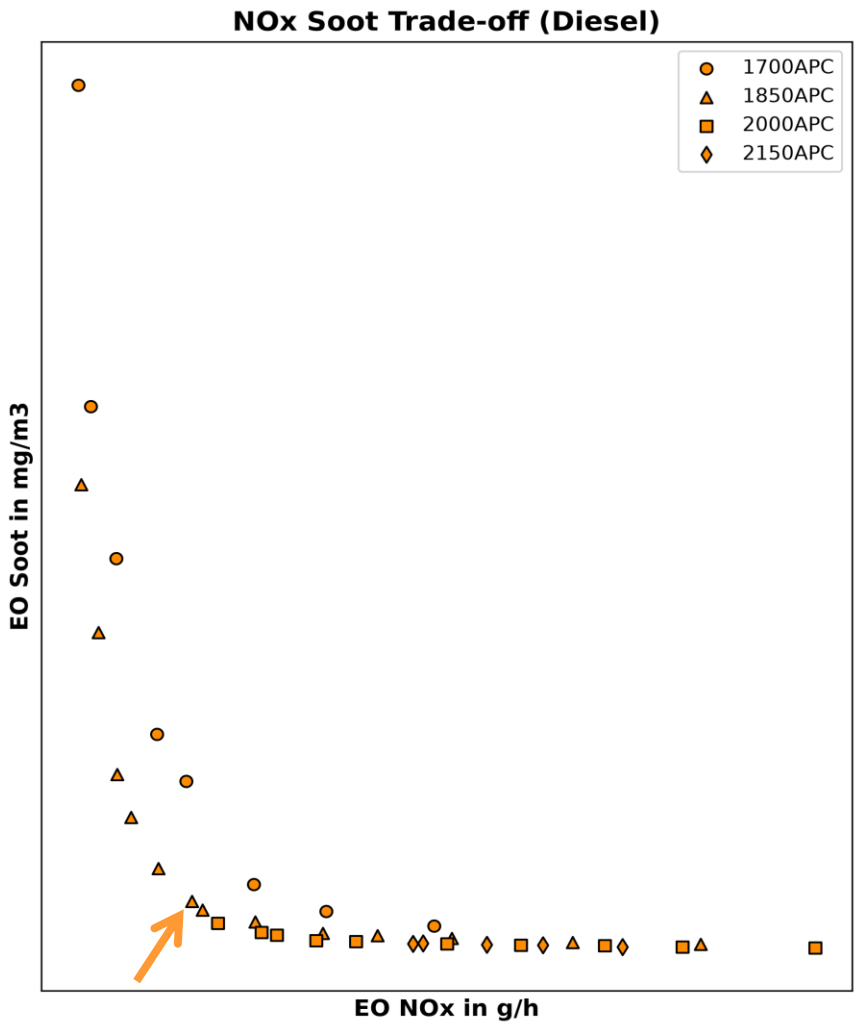
- **Combustion Variable** – Main Injection Quantity (will change to maintain constant torque)

- **Air-system Constant** – Maximum VGT position

- **Air-system Variables** – Fresh Airmass per cylinder (1700, 1850, 2000 & 2150 APC)
  – Boost Pressure (5kPa intervals till hardware limits)

EGR/Boost Sweep test





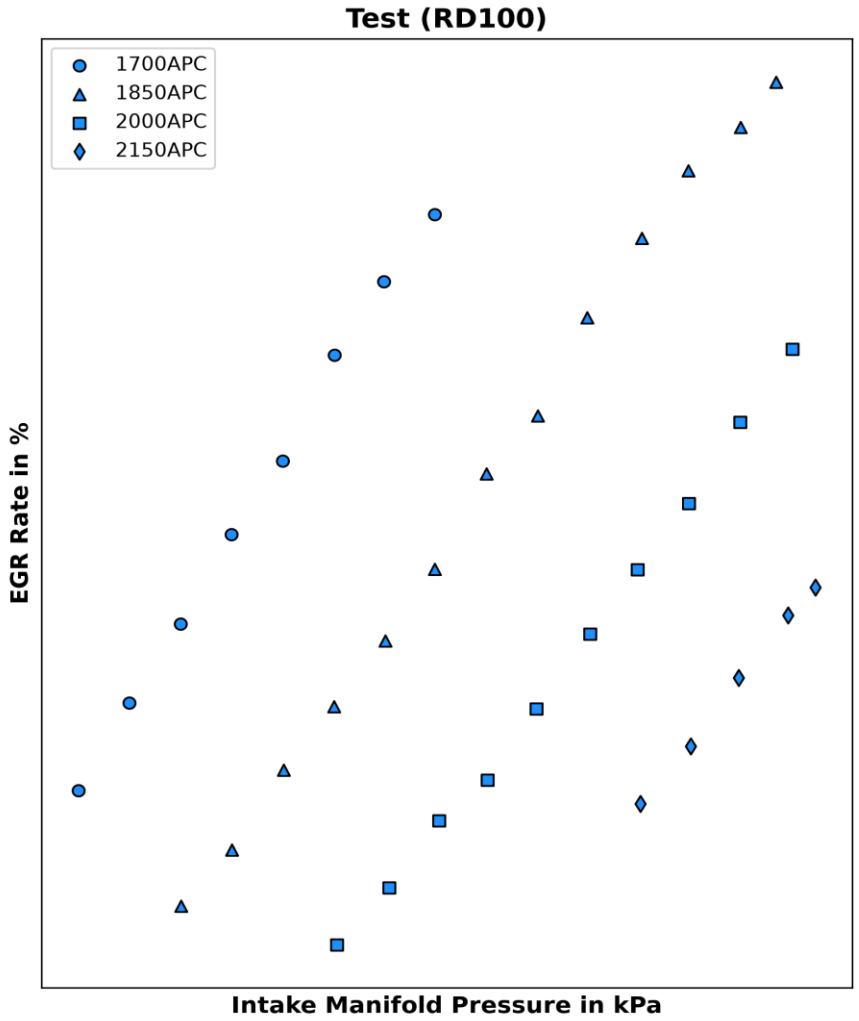
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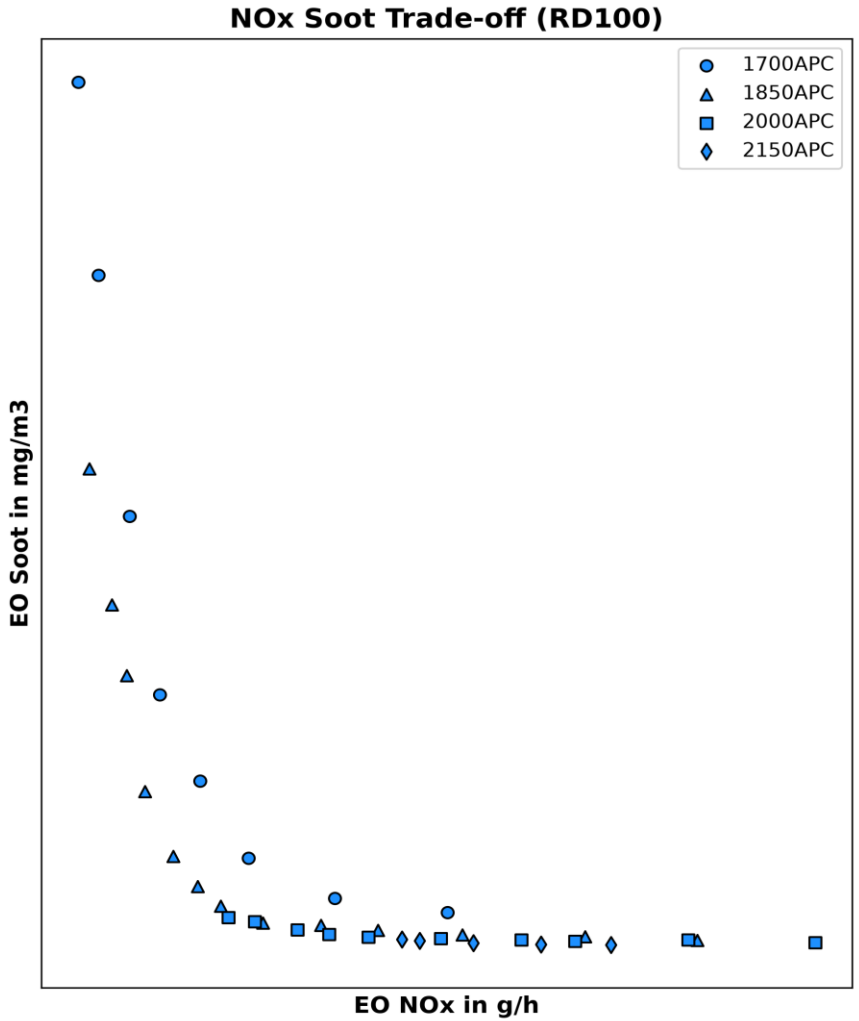
- Going higher with boost pressure while keeping fresh Air Per Cylinder (APC) constant increases EGR rate.

- Higher APC with constant fueling is leaner operation and vice versa.

- This test acts like an emission sensitivity analysis of the hardware.

EGR/Boost Sweep test





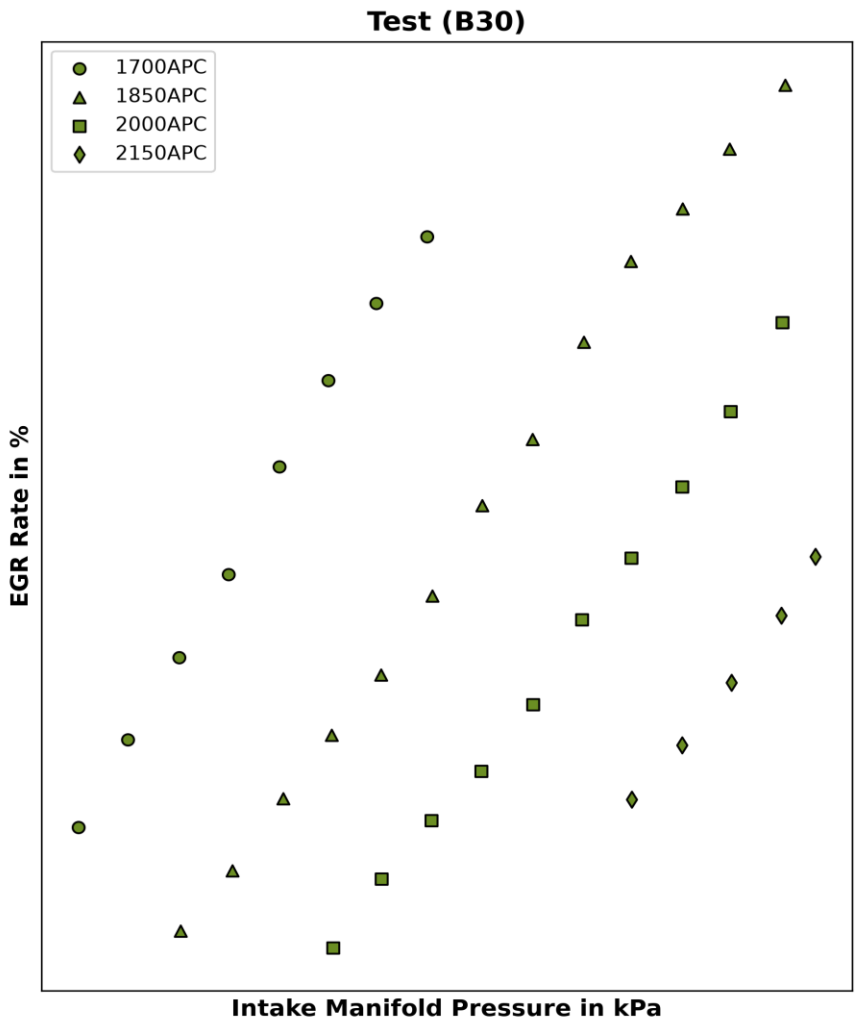
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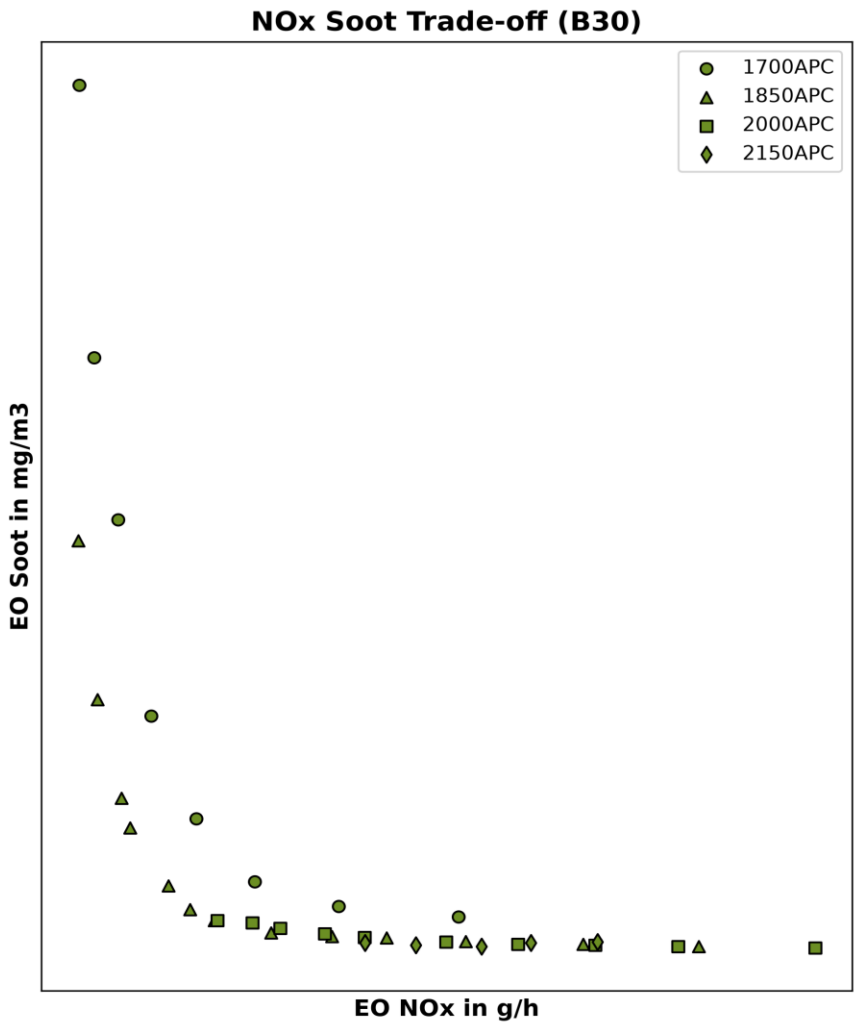
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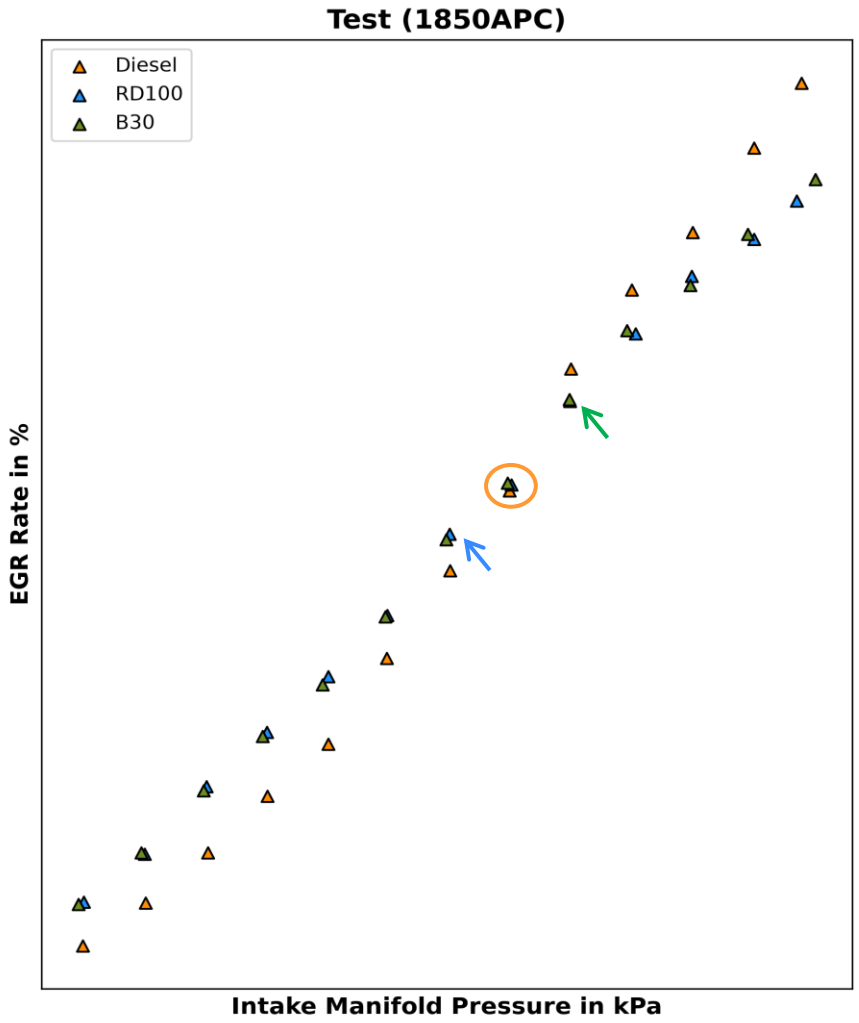
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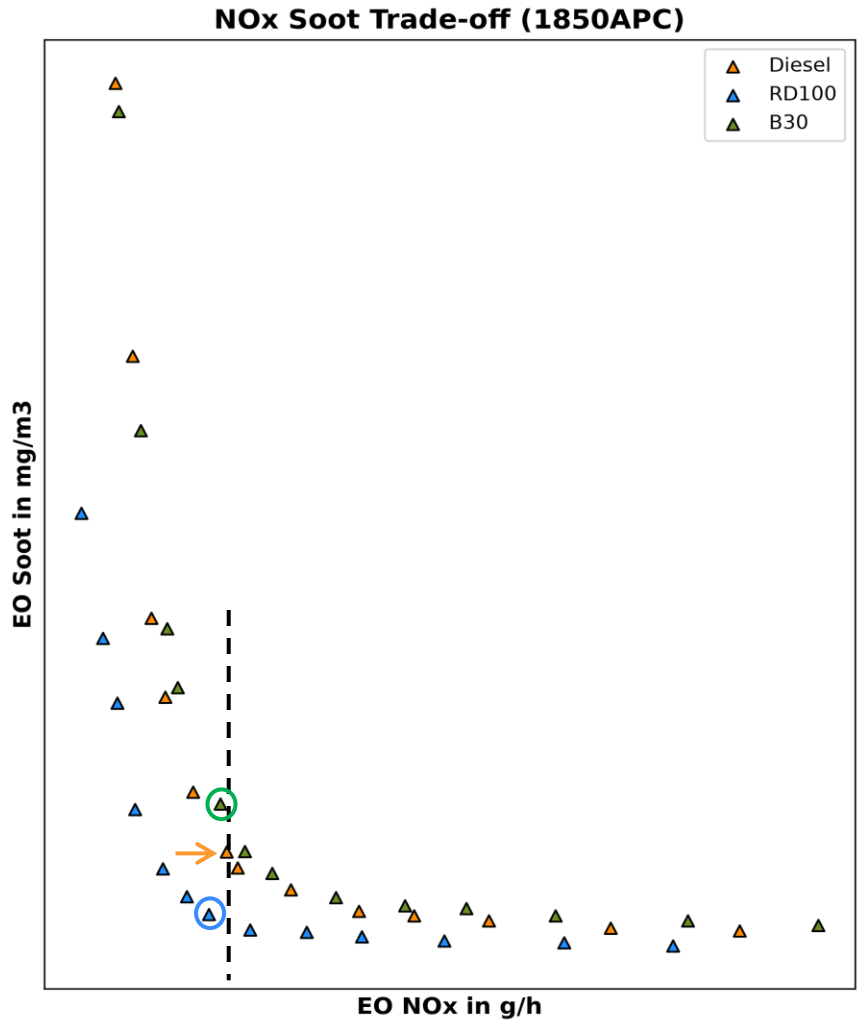
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Fuel comparison at constant APC





Comments

- The trade-off shift with RD100 is in a favorable direction.

- B30 trade-off is very similar to petroleum diesel.

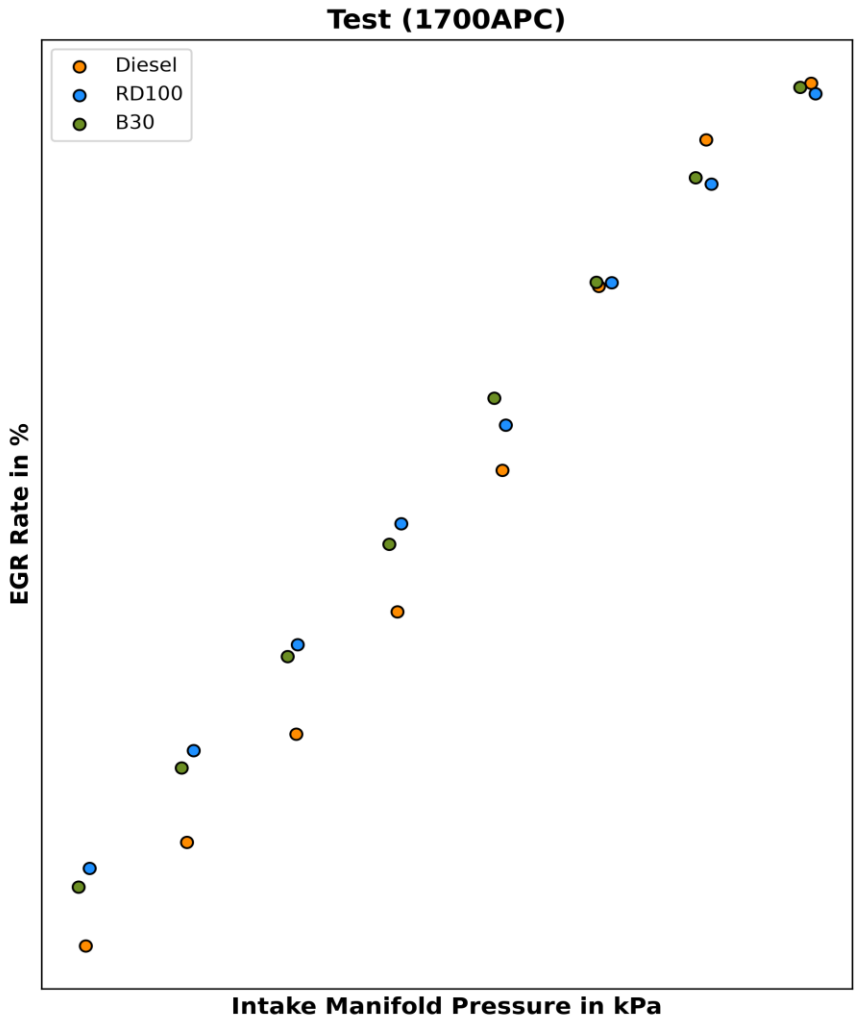
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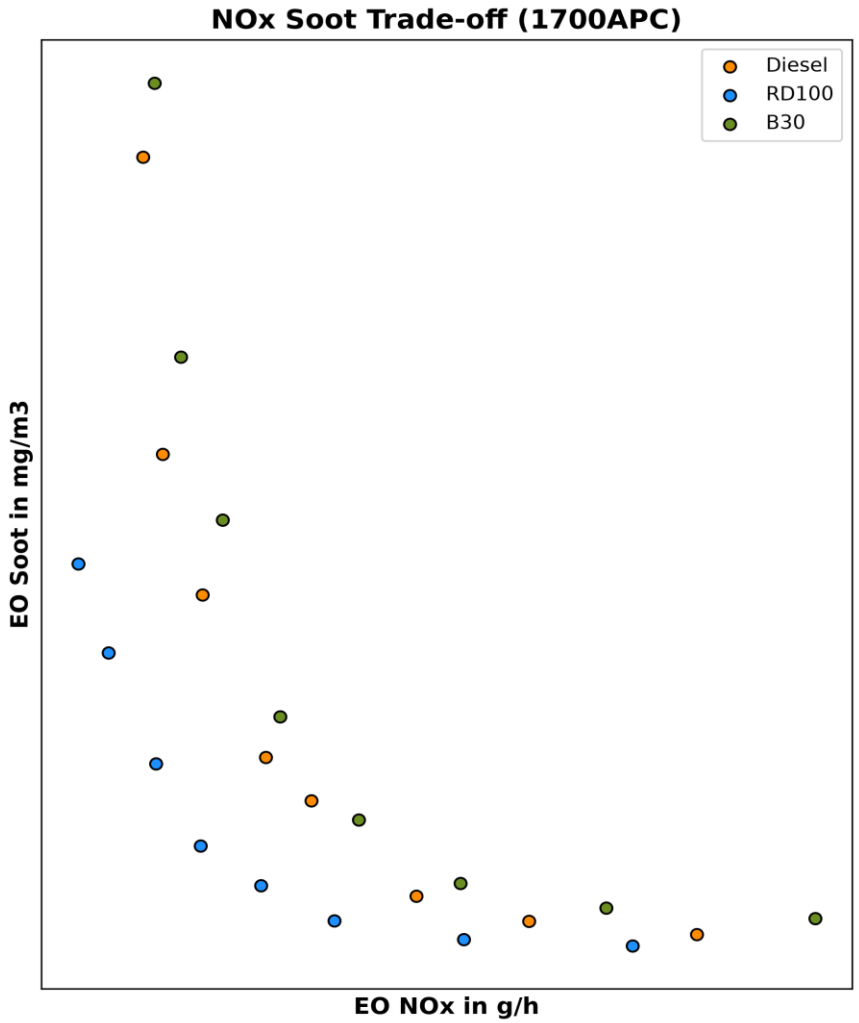
Calibration Takeaway

- FE gains to be realized with RD100 leveraging the NOx-Soot trade-off.

- No improvement opportunities with B30.

Fuel comparison at constant APC





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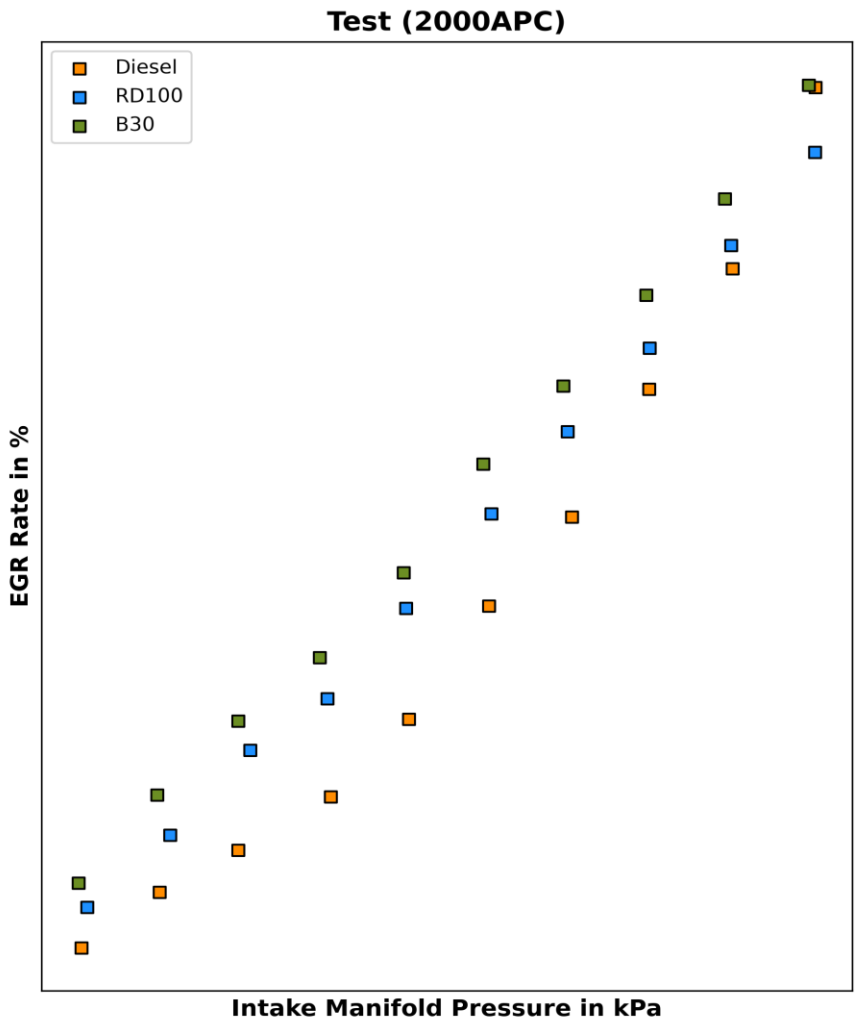
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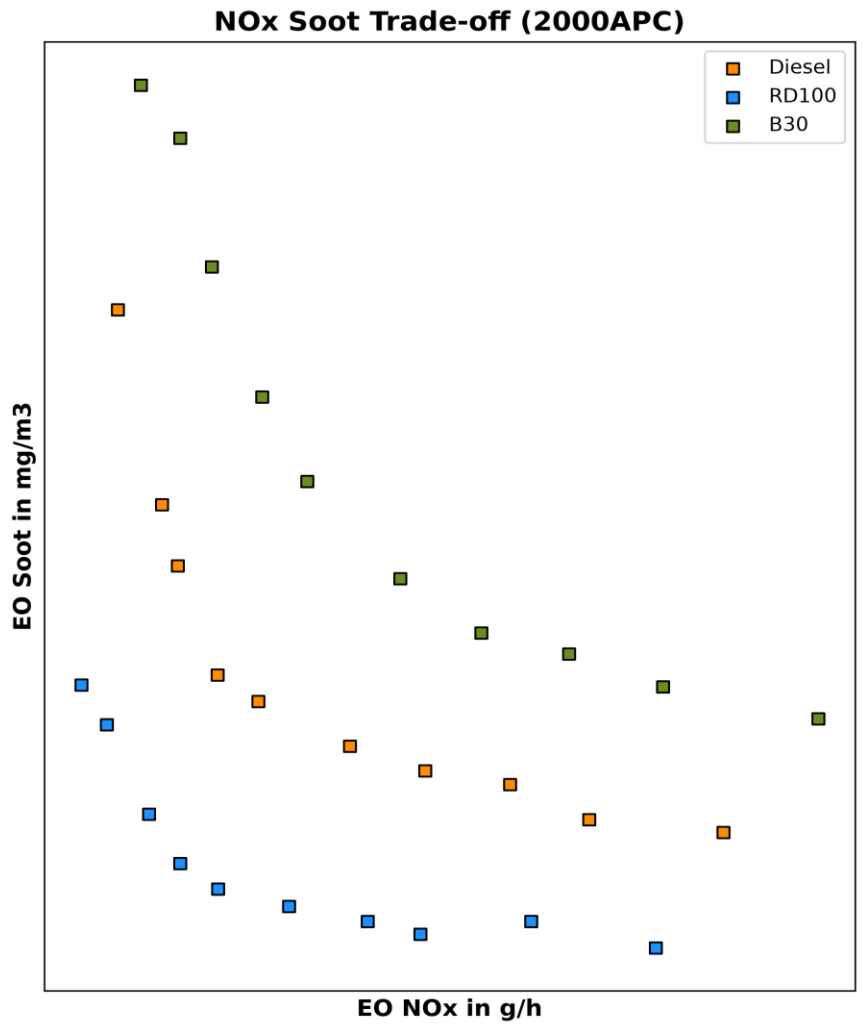
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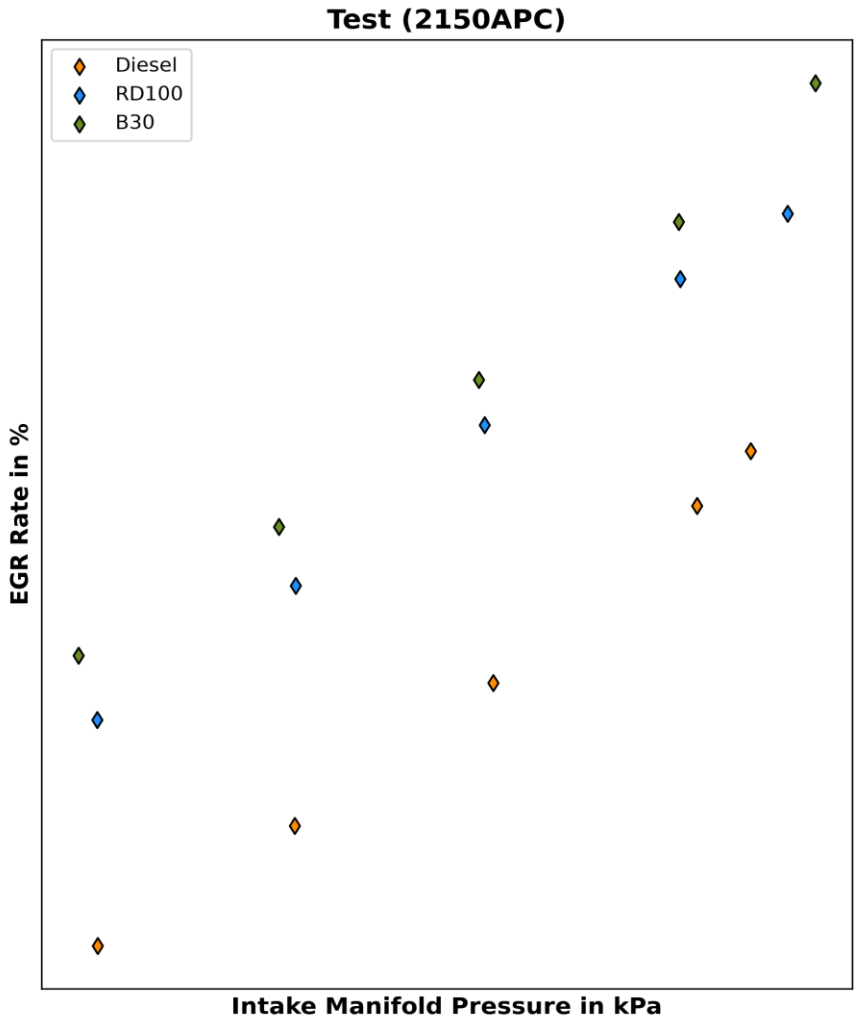
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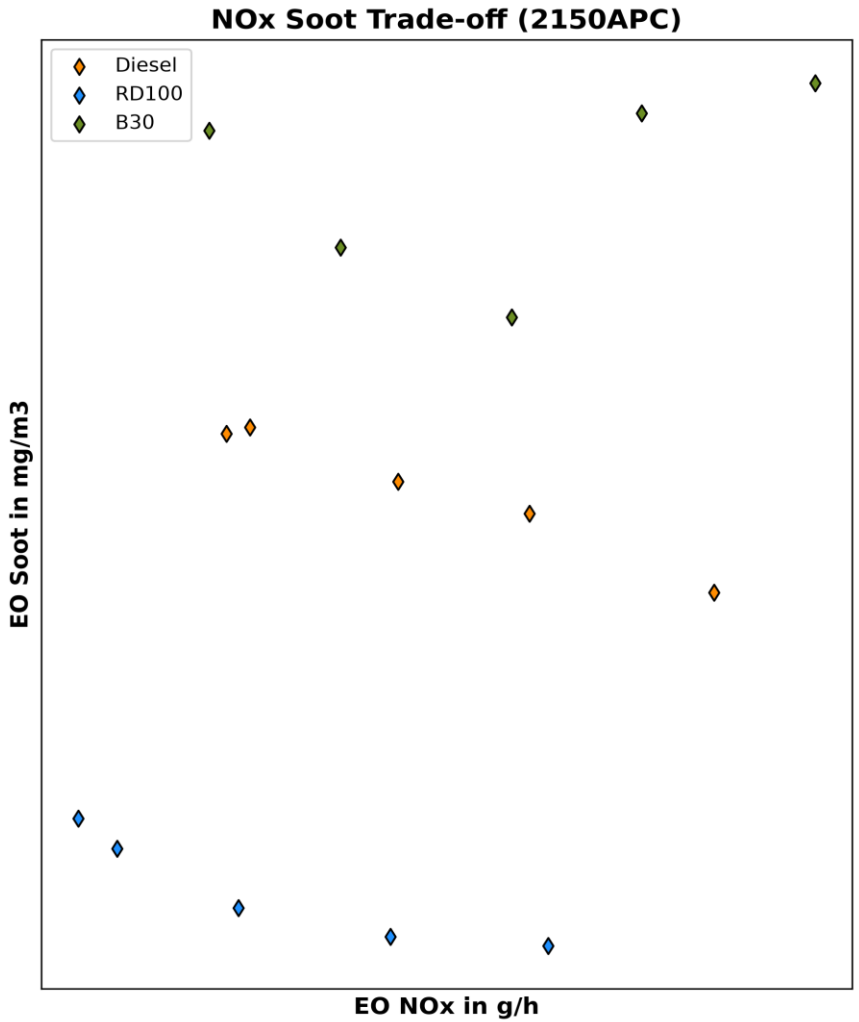
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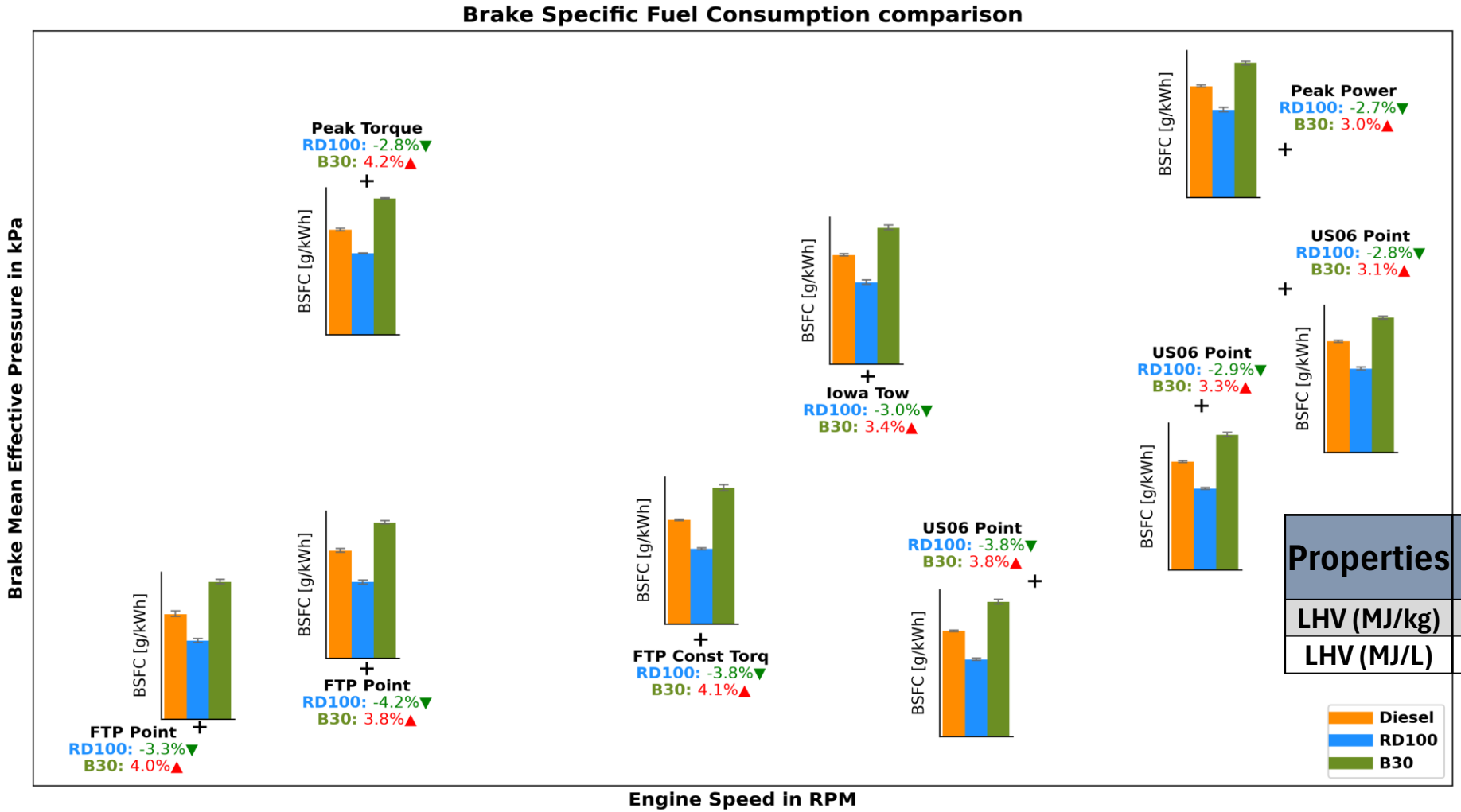
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Calibration Takeaway

- FE gains to be realized with RD100 leveraging the NOx-Soot trade-off.

- No improvement opportunities with B30.

Brake Specific Fuel Consumption comparison (Drop-In Assessment)



Comments

- RD100 has 3-4% better BSFC overall (mass based)

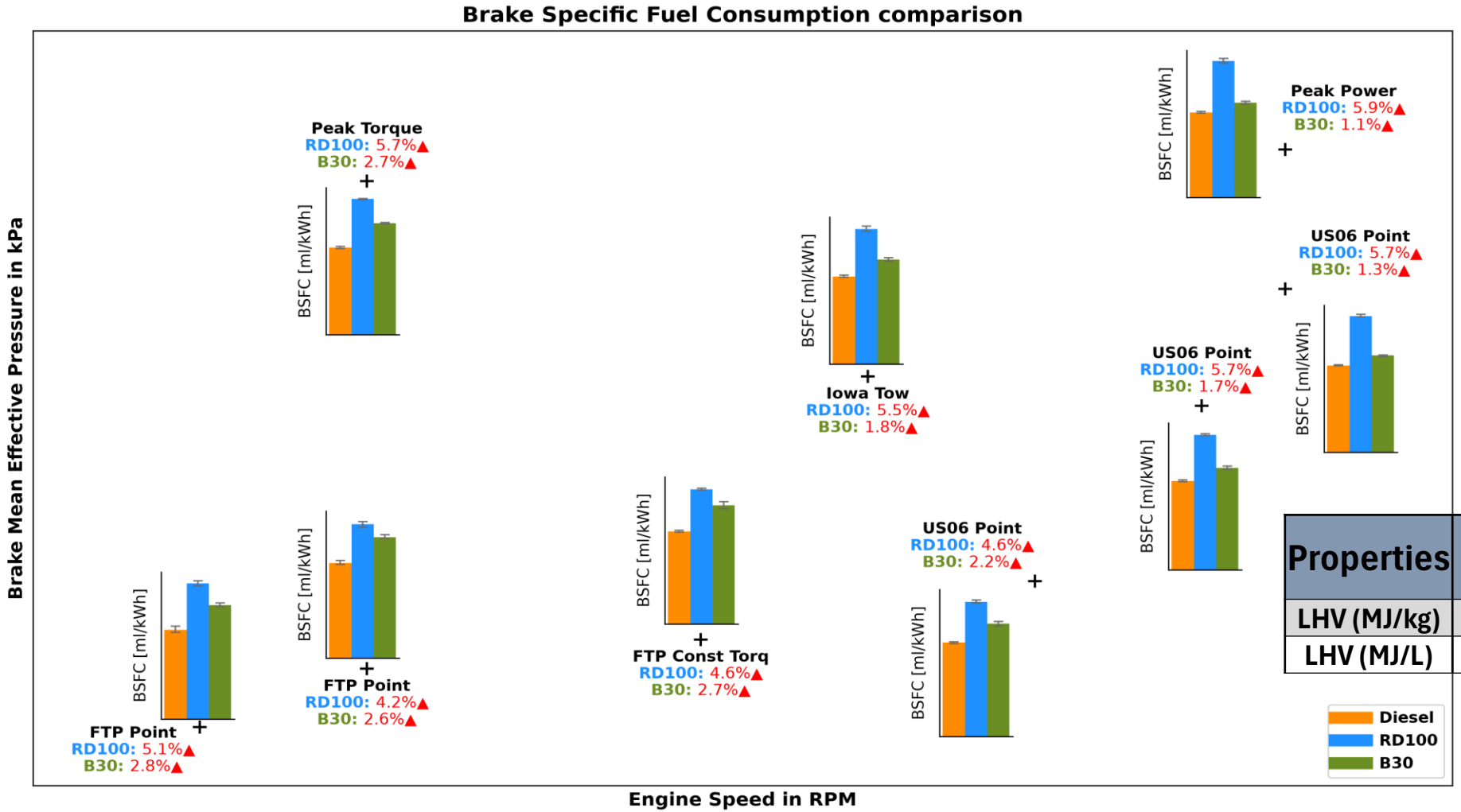
- B30 has 3-4% worse BSFC overall (mass based)

- Volume based?

Properties	Diesel	RD100	B30
LHV (MJ/kg)	42.92	43.96	41.24
LHV (MJ/L)	36.01*	34.03	35.09

*Approximate values, not measured or tested

Brake Specific Fuel Consumption comparison (Drop-In Assessment)



Comments

- BSFC benefits with RD100 are not realized on a volume basis.

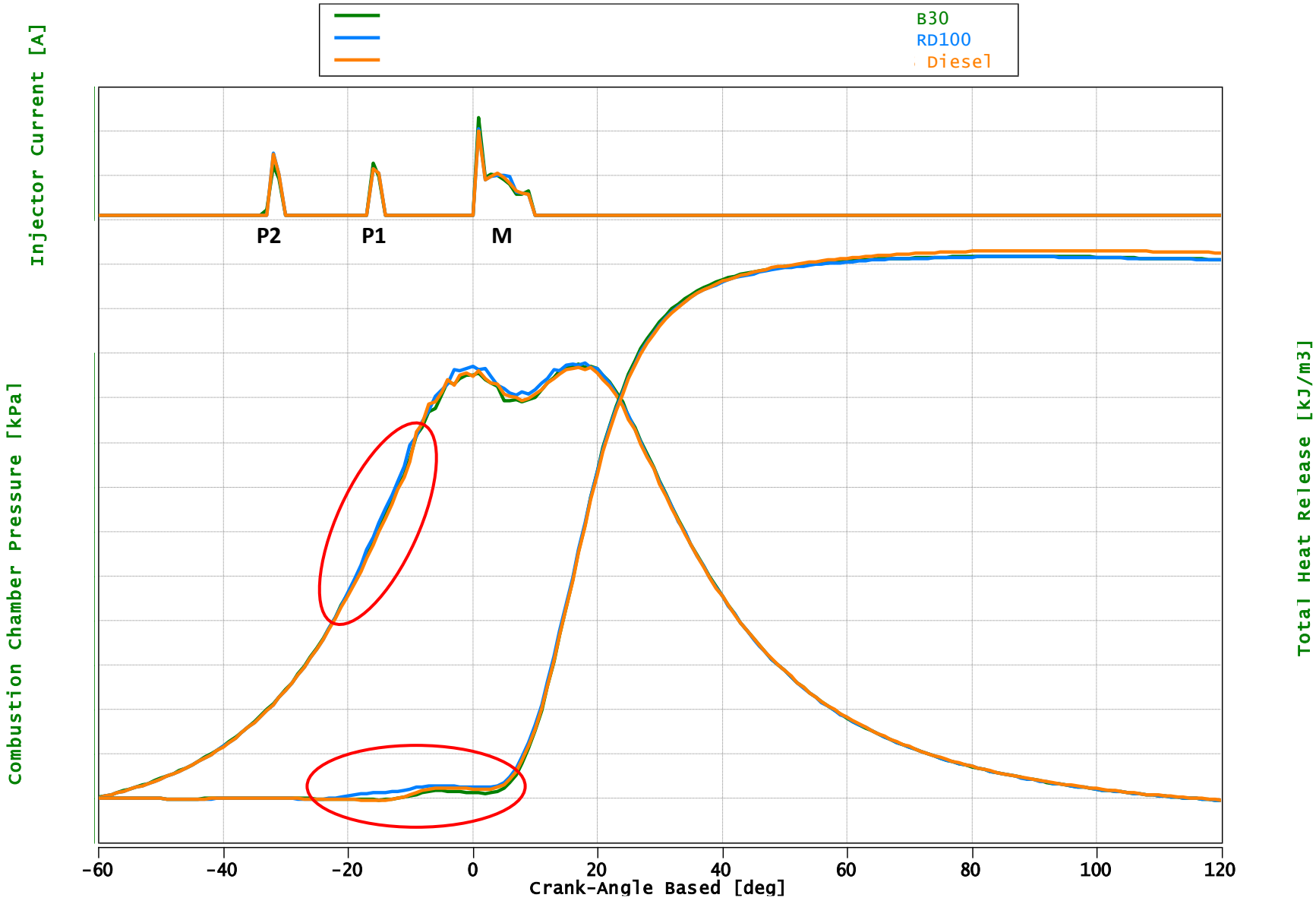
- B30 volume based BSFC is in-line with diesel.

- Areas for improvement?

Properties	Diesel	RD100	B30
LHV (MJ/kg)	42.92	43.96	41.24
LHV (MJ/L)	36.01*	34.03	35.09

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Combustion Analysis for Iowa Tow point



Comments

- Iowa Tow point at 1850APC with the same EGR rate.

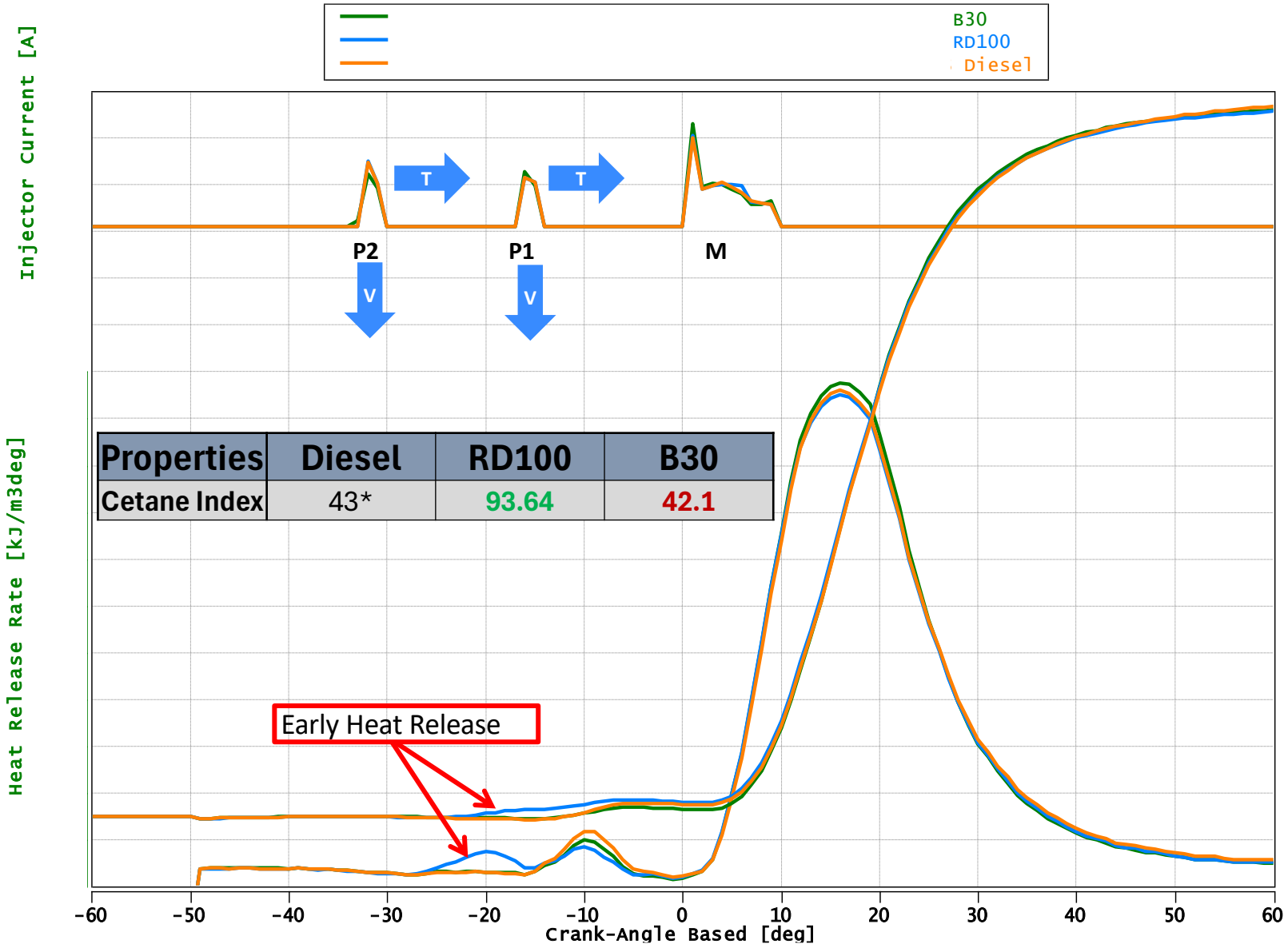
-Same color scheme as the steady state evaluation.

-All combustion plots are 100 cycle averages of cylinder 1.

- B30 combustion trace is aligned with diesel.

- RD100 combustion trace shows deviation before TDC.

Combustion Analysis for Iowa Tow point



Properties	Diesel	RD100	B30
Cetane Index	43*	93.64	42.1

Comments

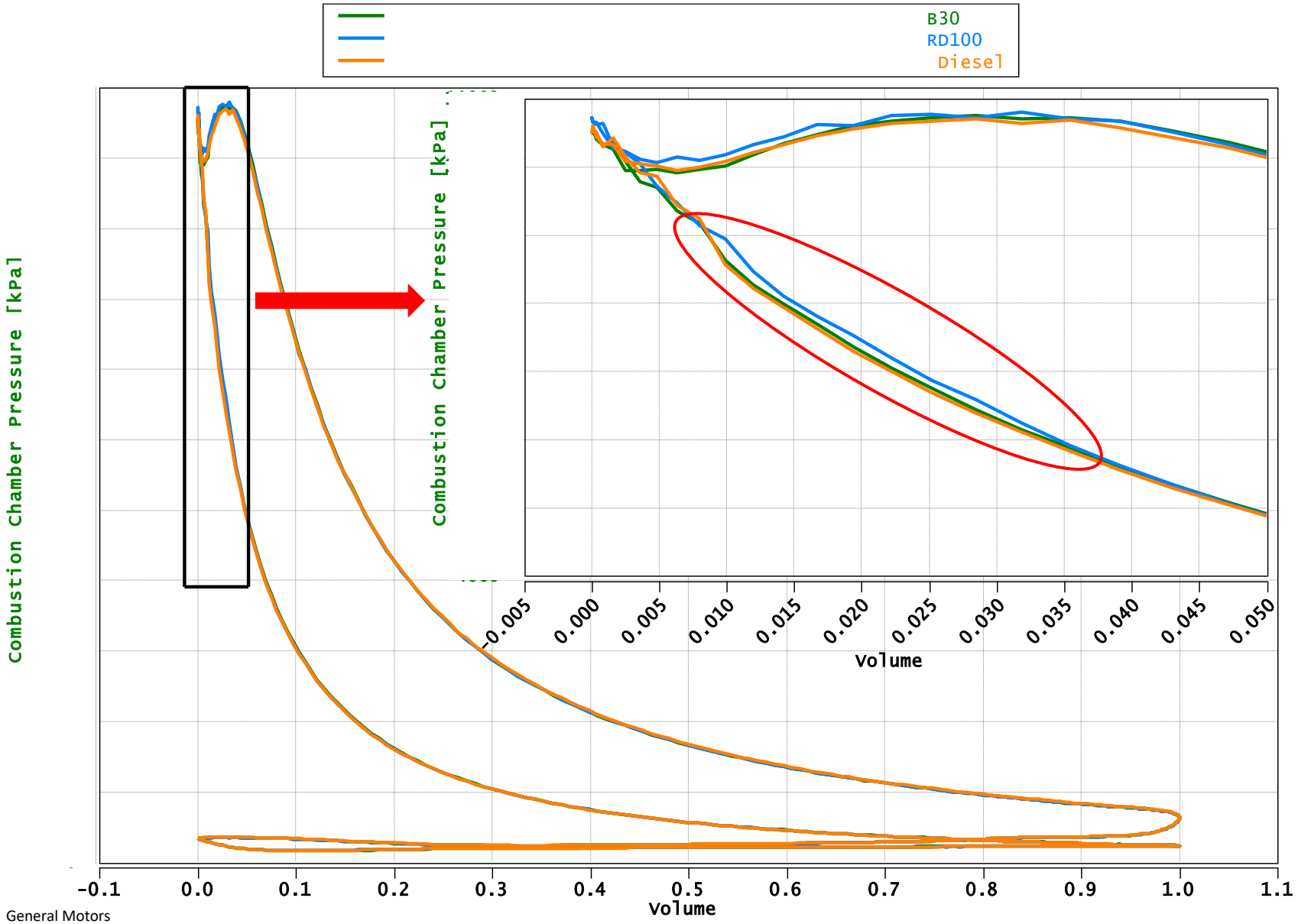
- Pilot 2 injection for RD100 is burning earlier compared to diesel.

- B30 burns very similar to petroleum diesel.

Calibration Takeaway

- Pilot 2 & Pilot 1 injections for RD100 can be moved closer to TDC and injection volumes can be reduced for a consistent HRR curve.

Combustion Analysis for Iowa Tow point



Comments

- Compression work increases for RD100 due to the early heat release.

- PV trace for B30 is aligned with diesel.

Calibration Takeaway

- FE gains to be realized with RD100 by optimizing combustion.

Summary

- Both RD100 & B30 show similar level of tailpipe emissions compared to petroleum diesel in steady-state evaluation.
- Both RD100 & B30 show a reduction in fuel economy on a volume basis compared to petroleum diesel in steady-state evaluation
- RD100 shows the most potential for fuel economy improvement if we can detect it and calibrate for it.
- Results align with previously published industry findings and internal studies at GM.

