Investigating B30 Blends in Modern Diesel Vehicles

Opportunities, challenges, and test learnings: GM / Johnson Matthey B30 fuel comparison



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Why B20+ matters: fuel and vehicle systems are interconnected

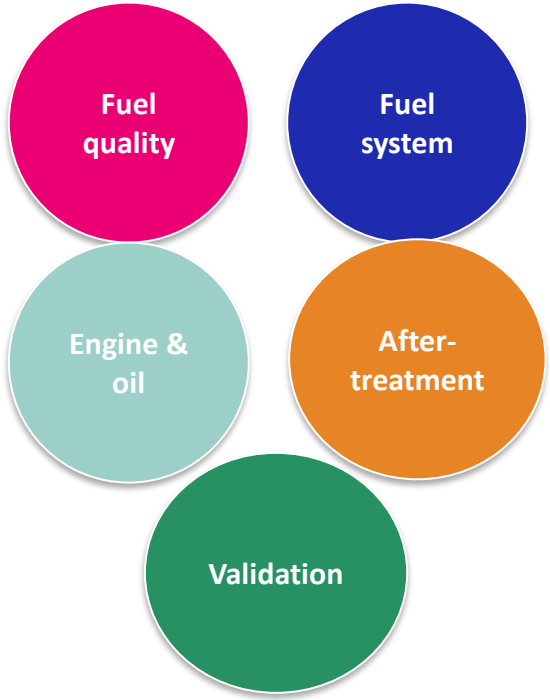
Higher biodiesel blends can support decarbonization, but adoption requires coordinated fuel-quality and vehicle-system actions.

Low-carbon liquid fuels can complement electrification where diesel platforms remain important.

GM's B20+ perspective emphasizes a holistic approach across fuel standards, hardware, calibration, diagnostics, and validation.

Key risks include cold-flow behavior, water separation, materials compatibility, oil dilution, injector fouling, and aftertreatment effectiveness.

Fuel quality and oxidation stability strongly influence the robustness of the complete system.



B30 is a practical bridge between conventional diesel and higher-blend capability.

Study objective: Isolate the impact of B30 versus ULSD

Controlled testing focused on fuel characterization and aftertreatment response across representative operating conditions.

Evaluate differences in engine-out and tailpipe behavior between B30 and ULSD.

Characterize fuel response over cold, warm, hot, transient, regeneration, and steady-state conditions.

Assess whether the prototype aftertreatment system maintains conversion performance with B30.

Identify learning areas for calibration, regeneration strategy, and future validation.

Study is consistent with prior CFAA–SwRI work on higher biodiesel blend short-term impacts on aftertreatment performance, and emissions.

Test matrix

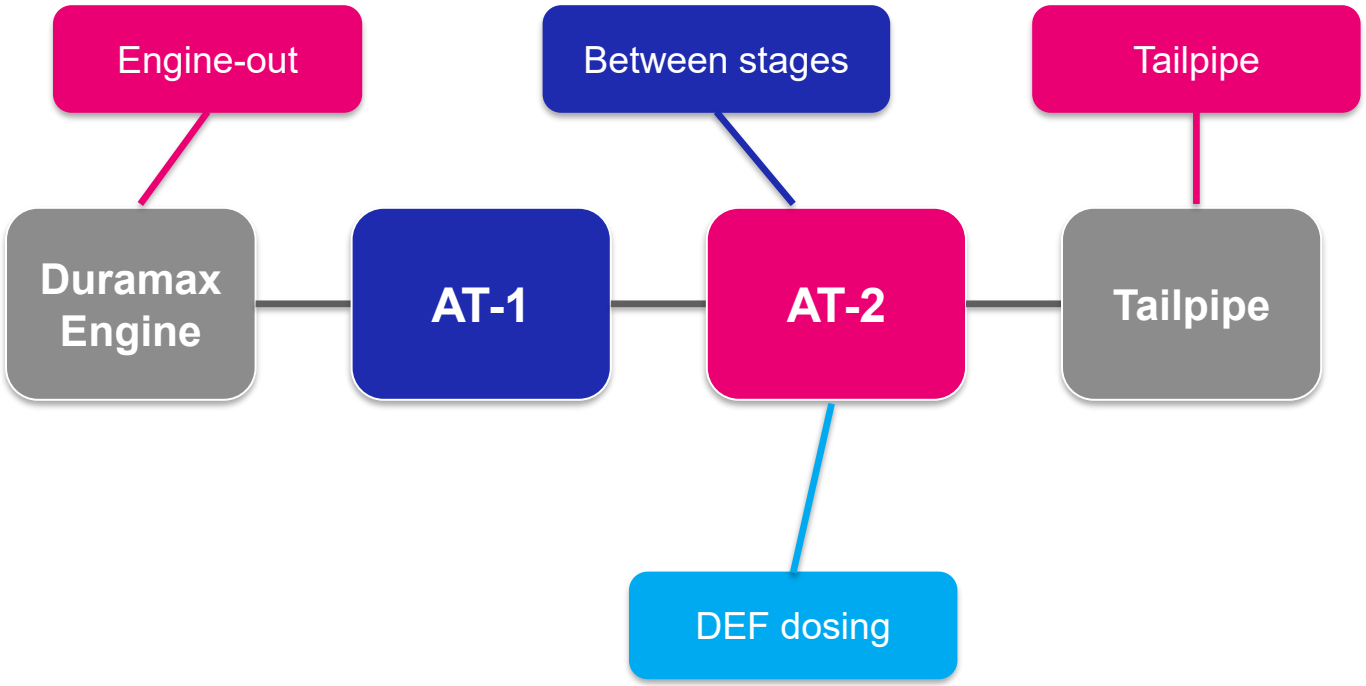
- **Cold FTP75**
- **Warm FTP75**
- **US06-1**
- **US06-2**
- **Regeneration**
- **Steady state**

Focus metrics: fuel consumption, CO_2, HC, CO, NOx, N_2O, temperature, conversion, and NO_2/NOx.

Indicative laboratory study — not a certification or emissions-compliance guarantee.

Test configuration: representative modern diesel aftertreatment

The evaluation used a Tier 3 - 6.6L Duramax LML engine plus multi-stage aftertreatment layout.

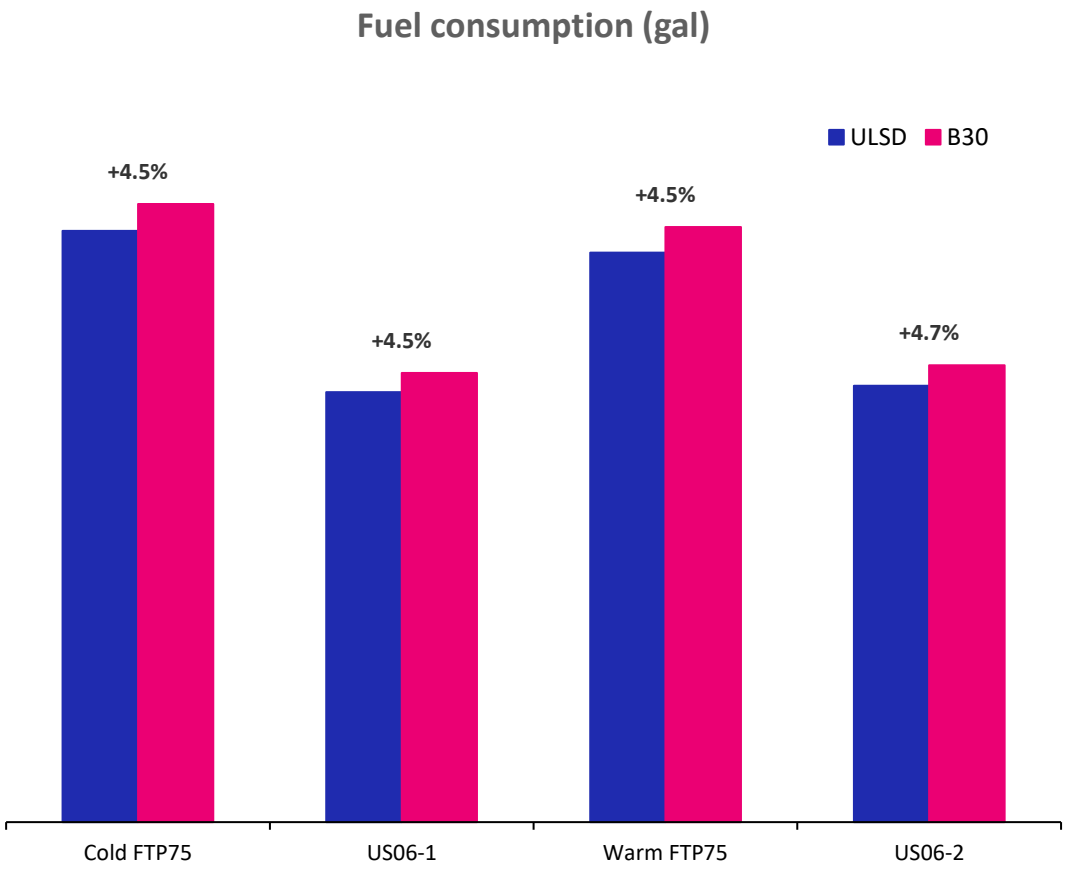


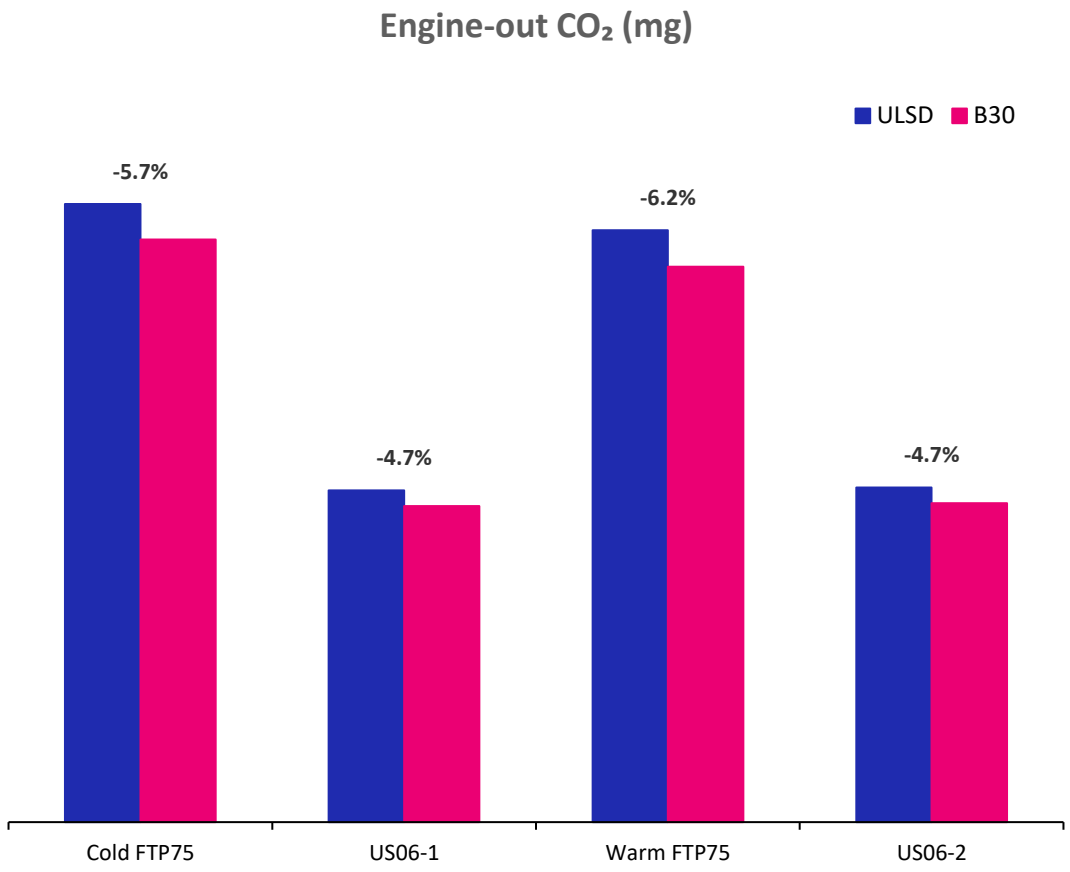
Three sampling locations included FTIR; two included FID capability for more accurate HC/CO measurement.

The system setup enabled comparison of engine-out emissions, catalyst response, temperature behavior, and tailpipe results.

Fuel use increases slightly with B30, while engine-out CO_2 decreases

Across all drive cycles, B30 required more fuel volume but produced lower measured engine-out CO_2.

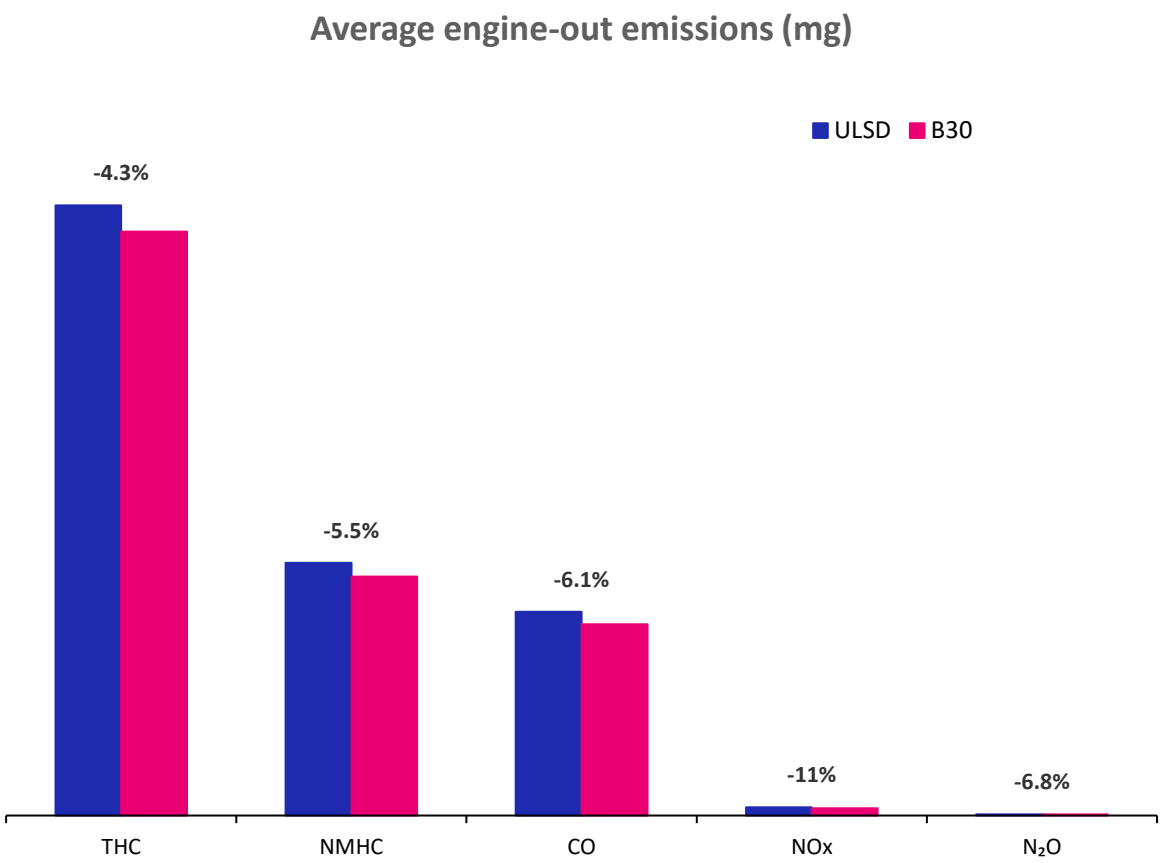


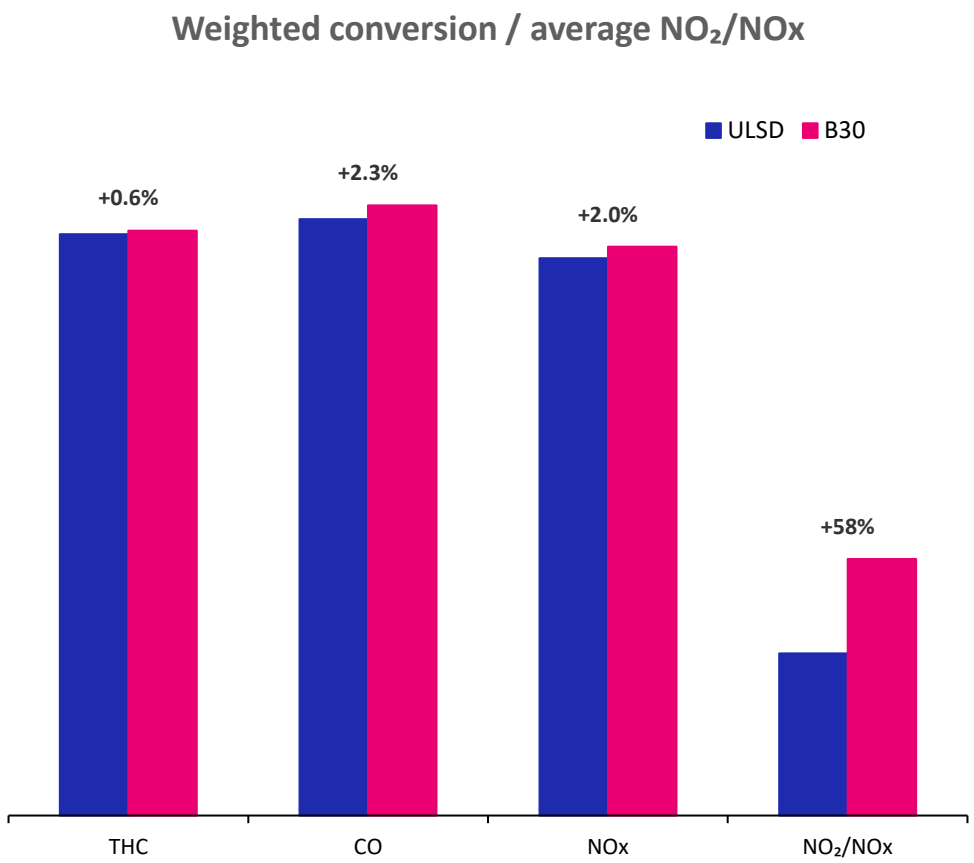


Interpretation: lower energy density drives higher volume consumption; carbon intensity per cycle is nevertheless lower in the B30 runs.

Cold-start performance is the clearest B30 advantage

During cold FTP75, B30 reduced engine-out emissions and improved measured catalyst conversion.

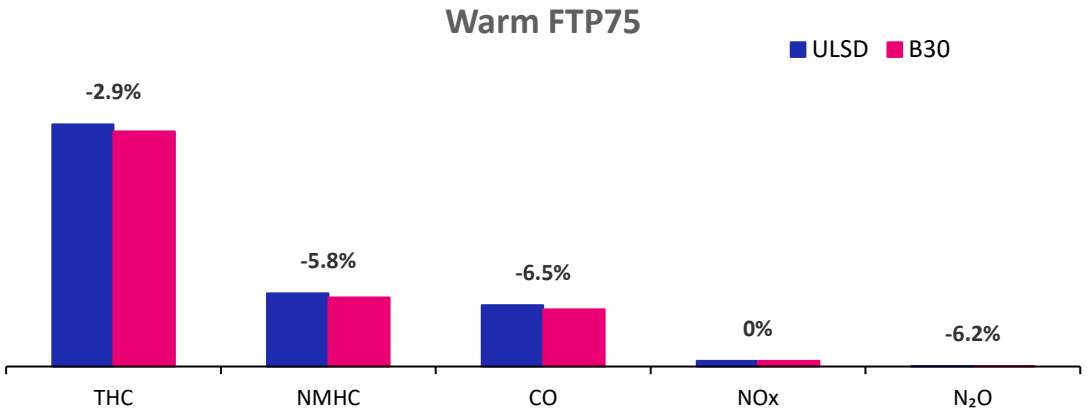


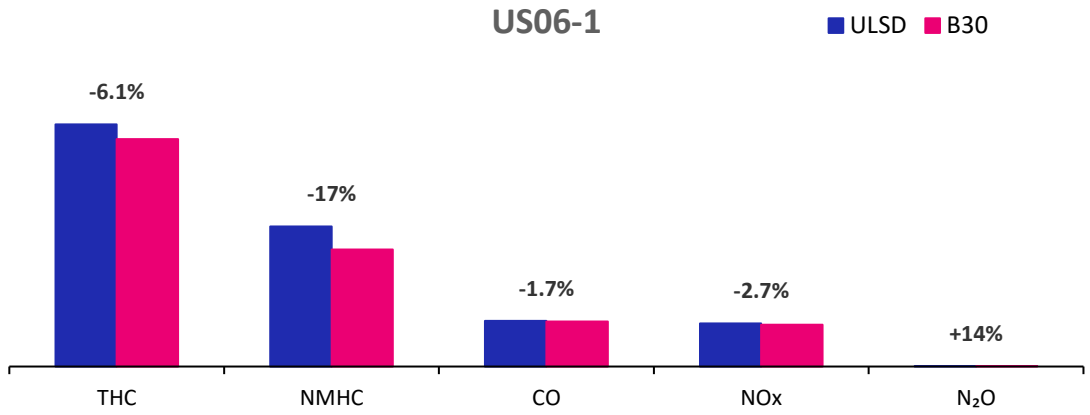


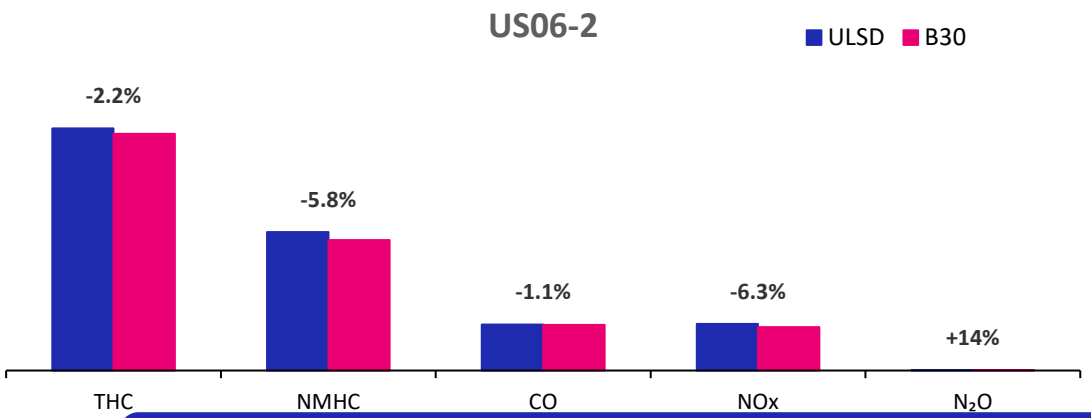
B30's higher NO_2/NOx entering SCR is consistent with improved cold-start NOx conversion.

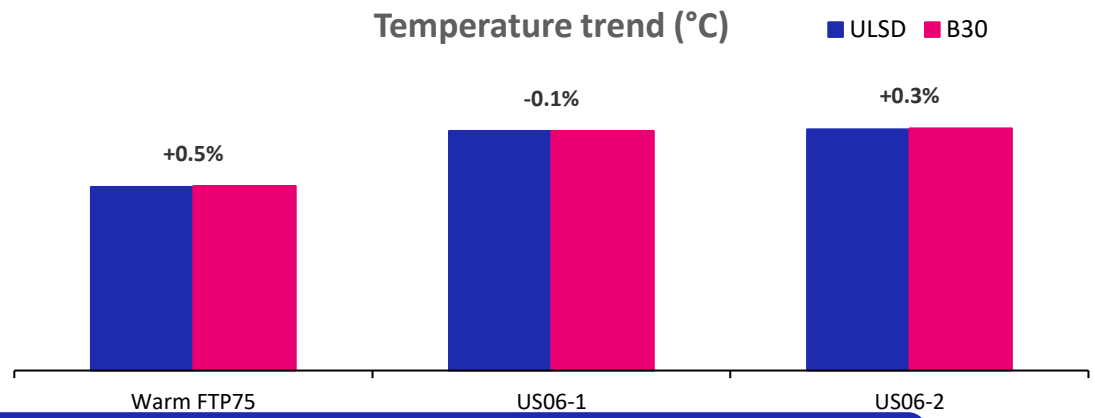
Warm and transient-cycle emissions are broadly comparable

The B30-vs-ULSD gap narrows as temperatures rise, and the US06 cycles show near-identical engine-out emissions.





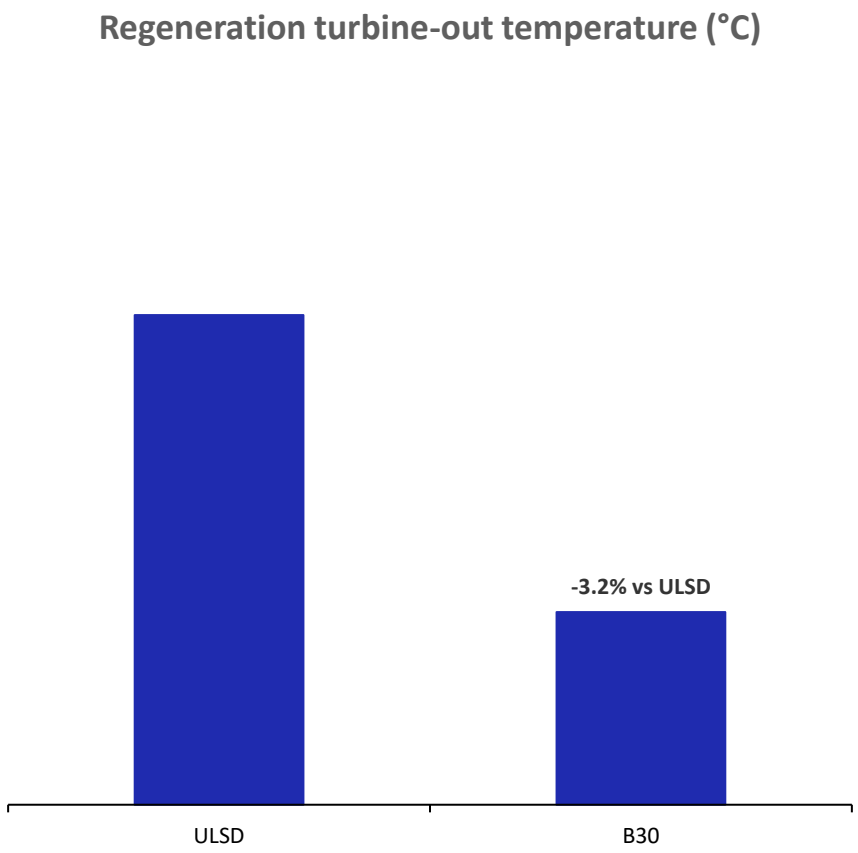




Learning: temperature conditions largely explain why the warm-cycle emission differences are smaller than in cold start.

Regeneration is the main thermal sensitivity with B30

At identical settings, B30 produced approximately 20°C lower turbine-out temperature than ULSD.



Same settings — Lower B30 temperature

Lower regeneration temperature may affect thermal margin and soot-oxidation robustness.

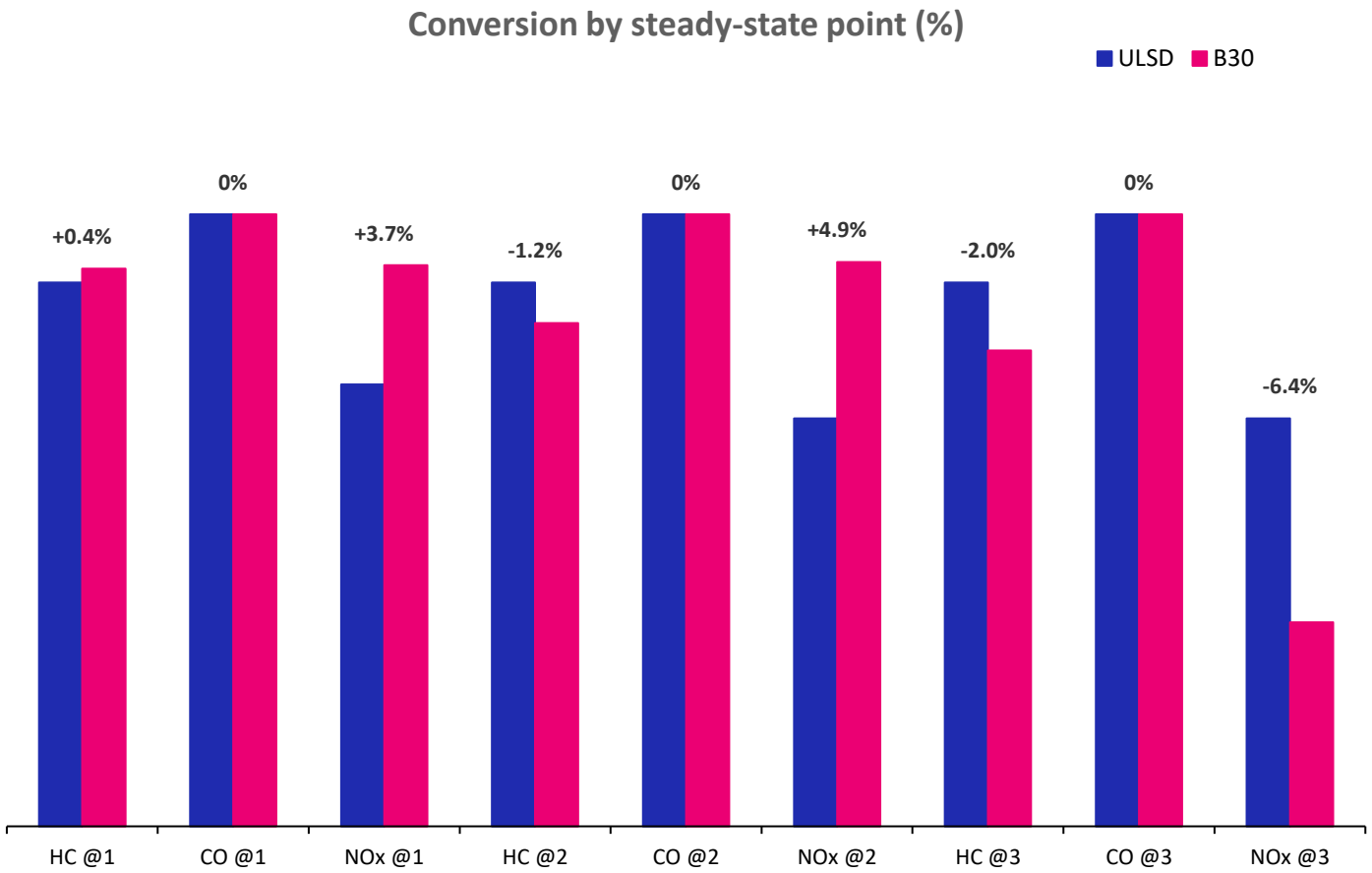
Potential countermeasures include calibration adjustment, regeneration duration changes, or supplemental heat strategies.

Any mitigation must be balanced against fuel dilution, injector coking, and component durability risks.

Design implication: B30 capability should not be judged only by drive-cycle emissions; regeneration performance is a separate validation dimension.

Steady-state catalyst conversion remains robust

Conversion performance was similar across flow points, while B30 showed lower temperatures at the higher-flow condition.



Both fuels maintained high HC and CO conversion.

NOx conversion remained high overall, with differences by flow point.

Lower high-flow temperatures for B30 match the regeneration trend.

Learning: steady-state conversion was not the limiting issue in this test; thermal management is the more important watch item.

B30 improves cold-cycle conversion but increases N_2O in warmer operation

The data point to a tradeoff: more favorable NO_2/NOx can improve SCR function while also increasing N_2O formation under some conditions.

Cold FTP75

B30 NOx conversion: 90.9% vs 89.1% for ULSD.

Average NO_2/NOx: 41.0% vs 25.9%.

Tailpipe N_2O: 56.7 mg vs 61.3 mg.

Warm FTP75

B30 NOx conversion: 90.9% vs 90.2%.

Average NO_2/NOx: 42.8% vs 28.9%.

Tailpipe N_2O: 67.3 mg vs 64.7 mg.

NO_2/NOx ↑ — SCR NOx conversion ↑

N_2O formation can ↑

NO_2 availability is beneficial for low-temperature SCR chemistry.

At warmer conditions, elevated NO_2 can shift selectivity toward N_2O.

Calibration and catalyst formulation must manage this tradeoff.

What the combined learning means for B30-capable vehicle development

B30 appears technically manageable, but robust adoption depends on system-level validation and targeted countermeasures.

Fuel & materials

Control oxidation stability, metals, deposits, corrosion, and polymer compatibility.

Engine & oil

Evaluate fuel dilution, oil formulation, drain interval, injector fouling, and calibration.

Aftertreatment

Confirm catalyst light-off, NOx/N_2O selectivity, regeneration temperature, and dosing robustness.

Validation & field

Use fuel surveys, DFMEA-driven testing, dyno/vehicle work, OBD checks, and fleet evidence.

Ongoing Activities: expand from controlled B30 comparison to durability, regeneration, fuel-quality variation, and vehicle-level validation.

Cross-study comparison: JM B30 vs SwRI high-blend biodiesel

Same direction on temperature; different outcomes on NOx because of blend level, engine and aftertreatment.

Topic	JM: B30 vs ULSD	SwRI: B20 / B50 / B100 vs diesel
Test platform	6.6L LML + DK68 aftertreatment (DOC/SCR/CSF/SCR/SCR); Cold/Hot FTP-75, US06, steady-state, regen	2017 X15 Stage 3 low-NOx demo engine, dual-SCR dual-dosing, aged parts; FTP, LLC, RMC
Engine-out NOx	Lower on cold FTP; gap closes when warm; near-identical on US06	Higher on FTP and RMC with blend level; LLC insensitive
Exhaust temperature	~Equal on FTP/US06; ~20°C lower in regen; lower at high-flow steady state	SCR temps 10-15°C lower at B50, a further 10-15°C lower at B100 (hot FTP)
Tailpipe / conversion	Better cold-start conversion (NO_2/NOx ~26% to ~41%); equivalent warm and hot	B20 absorbed by aftertreatment; B50/B100 higher FTP and LLC NOx before recalibration (B100 +23 mg/hp-hr)
N_2O	Higher N_2O from SCR per NOx converted (e.g. 0.045 vs 0.043 cold, 0.033 vs 0.030 warm), tied to higher NO_2	Not reported
CO_2	Engine-out CO_2 ~4-5% lower per cycle with ~4-5% more fuel volume	Tailpipe BSCO_2 neutral for B20; B50 +1% / B100 +1-1.5% at high load; R50B50 neutral; excludes upstream
DPF soot	Not assessed	Lower engine-out soot; DPF dP 3-4x lower (B50) and 7-8x lower (B100)

JM data are indicative (non-certified lab; n=3 cycles, n=1 steady-state, n=2 regen). The studies use different engines, aftertreatment and blends, so results are directional, not directly additive.

Source: JM, B30 Fuel Comparison (10 Jul 2025); SwRI, Short-Term Fuel Impacts on Tailpipe Emissions from a 2027 HD Low NOx Engine (25 Oct 2023).

Conclusion: Biodiesel is viable if exhaust temperature is managed through calibration

B30 shows no tailpipe penalty in JM data; SwRI shows where higher blends break down and how recalibration recovers them.

1

Temperature is the common lever.

Both studies show cooler exhaust with biodiesel (JM: ~20°C lower in regen; SwRI: 10-30°C lower SCR temps at B50/B100). In SwRI, lower temperature was the primary driver of tailpipe NOx; higher engine-out NOx was secondary.

2

Moderate blends carry the lowest risk.

JM B30 matched ULSD when warm and improved cold-start conversion; SwRI B20 was absorbed by the aftertreatment while B50/B100 were not. B30 has not been tested on a heavy-duty low-NOx system, so this is an inference.

3

Recalibration recovers the penalty.

SwRI cut B100 tailpipe NOx impact from +23 to +4-5 mg/hp-hr (B50: +8 to +3-4) and restored torque and cycle work in about 3 weeks, using fueling and air-handling changes.

4

Watch items remain.

Cold-start NOx is still elevated at high blends (SwRI); N_2O rises with higher NO_2/NOx (JM); tailpipe CO_2 is neutral to +1.5% at B50/B100, so the CO_2 benefit is mainly upstream. Offsetting benefit: DPF soot loading drops 3-8x (SwRI), reducing regeneration need.

Overall conclusion

Biodiesel can be a viable lower-carbon diesel pathway. Proceed with B30 using temperature-focused calibration, N_2O/NO_2 control in the SCR, and cold-start validation. Next steps: test B30 on the target platform and quantify lifecycle CO_2.