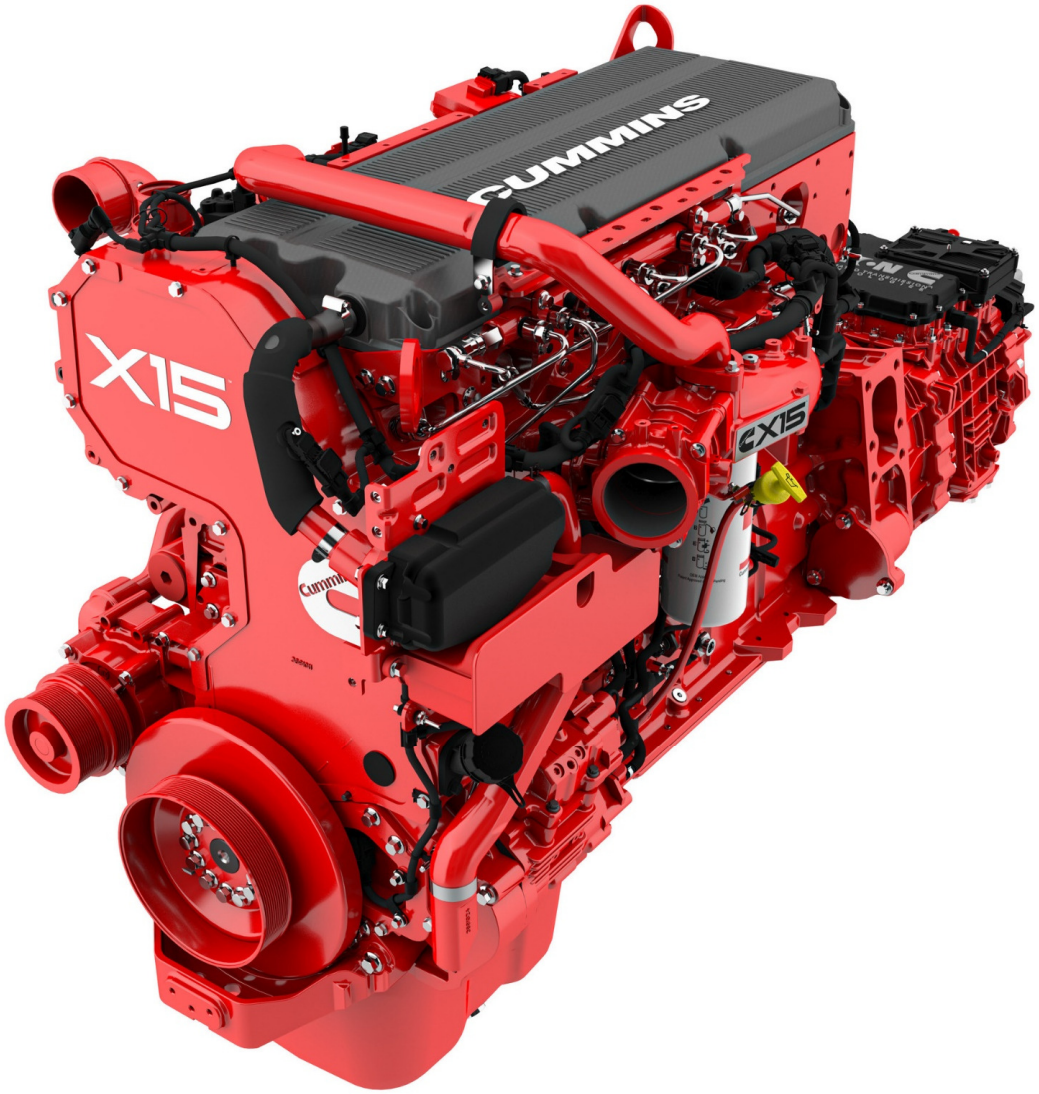


On-Highway Product Update 2022 Sutphen Dealer Meeting

October 25, 2022

OUR ENVIRONMENTAL
SUSTAINABILITY STRATEGY

Making people's lives better by powering a more prosperous world requires a healthier planet.

PLANET 2050

Leveraging our unique skills, experiences, and stakeholder relationships, we are committed to addressing climate change and air emissions, using natural resources in the most sustainable way, and ensuring our communities are better because of our presence in them. We have quantifiable goals for 2030 and visionary longer-term aspirations for 2050.

DESTINATION ZERO

Our strategy to go further, faster to reduce the greenhouse gas and air quality impacts of our products in a way that is best for our customers and all stakeholders.

CUMMINS WATER WORKS

Our initiative to address the global water crisis by strengthening communities through access to sustainable water.

MISSION

Making people's lives better by powering a more **prosperous world**

VISION

Innovating for our customers to **power their success**

Destination Zero

Lower emissions today

Reduce well-to-wheels emissions

Drive wide-scale customer adoption

Achieve zero emissions by 2050

Our commitment requires changes to our products

2030 GOALS: DOING OUR PART TO ADDRESS CLIMATE CHANGE AND AIR EMISSIONS

25%

Reduction in scope 3 absolute lifetime GHG emissions from newly-sold products

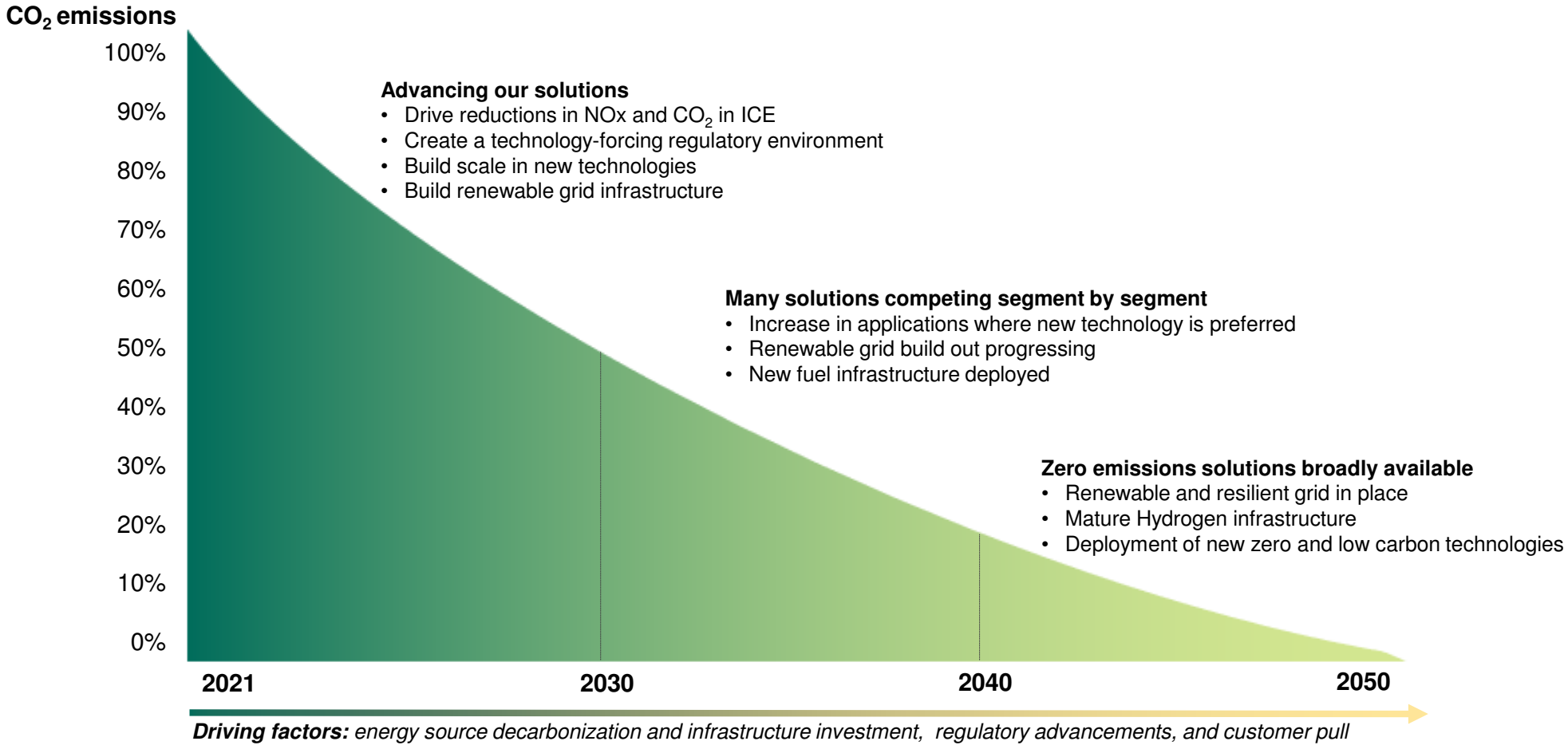
55MMT

million metric tons reduced from scope 3 GHG emissions from products in the field

50%

Reduction in absolute GHG emissions from facilities and operations

Reaching Destination Zero



Accelerating toward

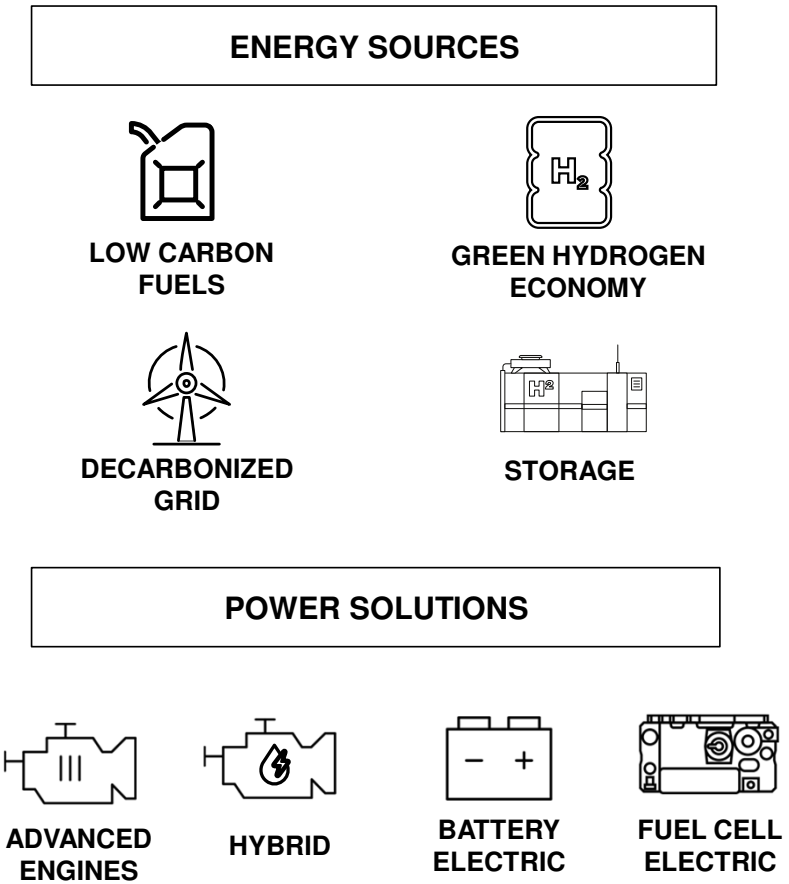
Destination Zero

Cummins will continue to innovate and invest as we advance along the path to zero, but we can't do it alone.

Action is required today

Progress requires partnership

Technology leadership is critical



Emissions acronyms

- NMHC- Non-Methane Hydrocarbons
- NOx- Nitrogen Oxides
- CO2- Carbon Dioxide
- PM- Particulate Matter
- NTE- Not To Exceed emissions levels

Emissions simplified

CRITERIA AIR EMISSIONS

- Particulate matter (PM) and other emissions like nitrogen oxides (NOx)
- Contribute to smog and negative public health outcomes
- Close to zero with today's technologies, but NOx can be lowered further

GREENHOUSE GASES (GHG)

- Carbon dioxide (CO_2), methane, nitrous oxide, and others
- Trapped heat contributes to climate change
- Constraints in what can be achieved with fossil fuels
- For most of our applications, no well-to-wheels zero carbon solutions exist today

Reducing well-to-wheels emissions

BY INNOVATION OF THE ENERGY SOURCES AND THE POWER SOLUTIONS

ENERGY SOURCES

Innovate and scale low carbon fuels

Decarbonize and improve resiliency of the grid

Develop and mature the green hydrogen economy

POWER SOLUTIONS

Increase adoption of fuel cell, battery electric and hybrids

Reduce GHGs from internal combustion engines

- In August 2020, CARB adopted a low NOx emission regulation for heavy-duty engines a.k.a. the Omnibus regulation *[4871]*. The rule tightens FTP NOx limits to 0.050 g/bhp·hr from 2024 and to 0.02 g/bhp·hr from 2027, introduces a new LLC certification cycle and a corresponding set of NOx limits, and significantly extends emission durability and warranty requirements.
- In 2022, the EPA re-opened its low NOx regulatory process and proposed new emission standards for heavy-duty engines that would be to some degree harmonized with the CARB low NOx rule.

Year	CO	HC[a]		NO_x	PM
					General
2015	**15.5**	**0.14**	-	**0.02[l]**	**0.01**
2024[m]	15.5	0.14	-	0.05	0.005
2027[m]	15.5	0.14	-	0.02	0.005

Regulatory Requirements

Bold = Firm
Not Bold = Forecasted

US/Canada

Lower NOx std (TBD)
Other cert, warranty, UL, in-use changes

Final Rule

GHG Phase 3

EPA (Projected) : Rule Making Proposal

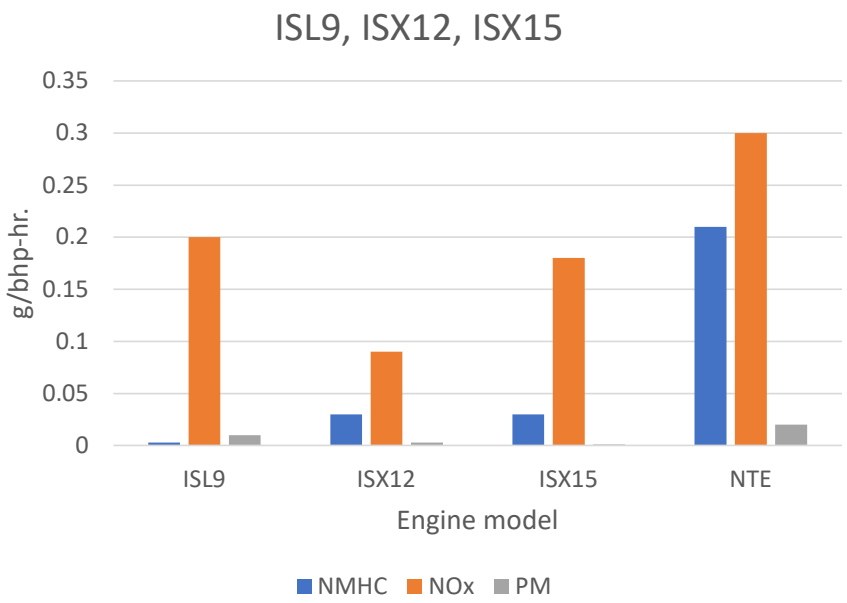
			2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
	GHG Vehicle Certification*				**-12%**			**-5.6%**			**-5%**			(TBD)			(TBD)		
	GHG Engine Certification				**-3%**			**-2.5%**			**-2.5%**			(TBD)			(TBD)		
REGULATIONS	**EPA**	**NOx / PM**	**0.20 / 0.01**								0.035-0.05 / 0.005								
		Emission Warranty / EUL	**5Y/100K Mi / 10Y/435K Mi** **5Y/100K Mi / 10Y/185K Mi**								TBD								
	CARB	**NOx / PM**	**0.20 / 0.01**					**0.050 / 0.005**			**0.02 / 0.005**								
		Additional Compliance						**Low load cert cycle, MAW in-use compliance**											
		Emission Warranty / EUL	**5Y/100K Mi / 10Y/435K Mi** **5Y/100K Mi / 10Y/185K Mi**			**5Y/350K Mi / 10Y/435K Mi** **5Y/150K Mi / 10Y/185K Mi**					**7Y/450K Mi / 11Y/600K Mi** **7Y/220K Mi / 11Y/270K Mi**				**10Y/600K Mi / 12Y/800K Mi** **10Y/280K Mi / 12Y/350K Mi**				

Diverging regulations with more stringent CARB requirements

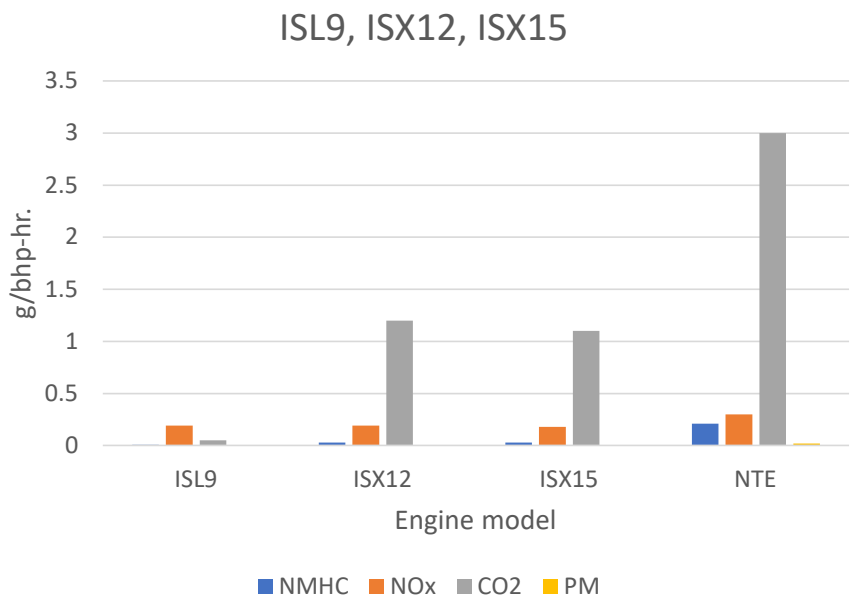
** Tractor Average*

Key emissions or changes for 2010 & 2013
2010-NOx/PM reduced 90% from 2004
2013-On-board diagnostics (OBD)

2010

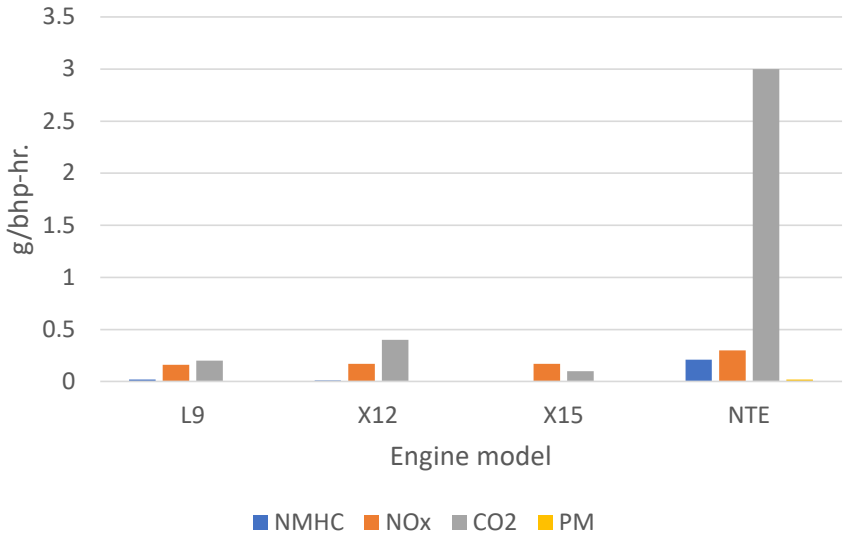


2013

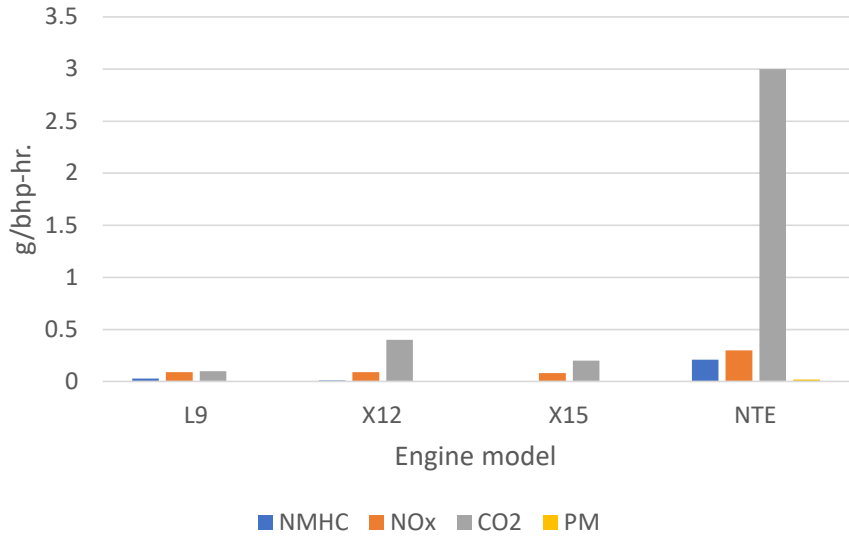


Key emissions or changes for 2017 & 2021 2017-GHG PH 1, single module aftertreatment 2021-GHG PH 2

2017



2021



2024 X15 Product Plan

X15™

EPA 0.2g NOx
CARB 0.05g NOx

2022	2023	2024	2025	2026
EPA21 *(Current Product)*		**EPA24** *(longer Single Module AT)*		
		CARB24 *(Compact Twin AT)*		

EPA & CARB Capable

EPA

EPA 2024 X15 Product Introduction

Design and deliverables to be confirmed through pending and final verification

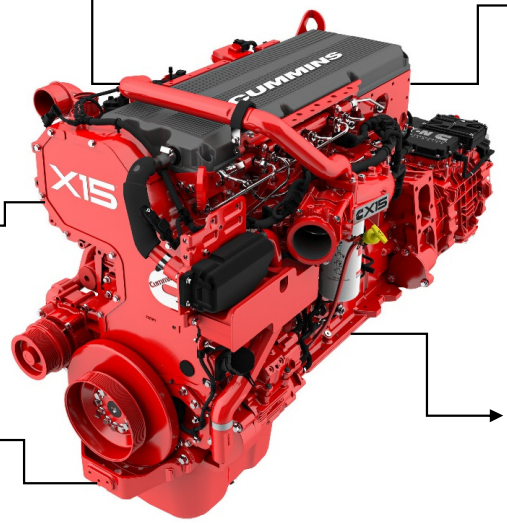
- Common platform with 2021 X15 to build upon proven reliability and durability
- Current diesel technology to meet EPA 2024 regulations
- Improved Fuel Efficiency and Greenhouse Gas emissions
- Powertrain Feature Enhancements for Fuel Economy and Drive-ability
- Optimized maintenance intervals with EngineGuard

X15™

Turbocharger
- Improved fuel efficiency

Vehicle Integration
- Common fit and interfaces with 2021 X15

Power Cylinder
- Reduced friction for improved efficiency



Electronics System
- CM2450 ECM
- **Next generation connectivity solutions**
- **EngineGuard Maintenance Monitor**

FA-4 10W30 Oil
- First Fill for GHG improvement

Exhaust System
- **Increased SCR length**
- **Reduced backpressure**

Single Flow SCR

- Efficiency / TCO
- Connectivity
- Reliability
- Regulatory

2024 X15 Engine Walk-Around

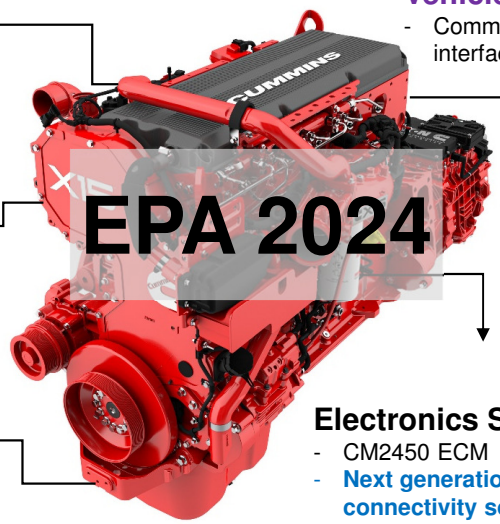
Design and deliverables to be confirmed through pending and final verification

EPA 2024

Turbocharger
- Improved fuel efficiency

Vehicle Integration
- Common fit and interfaces with 2021 X15

Power Cylinder
- Reduced friction for improved efficiency



FA-4 10W30 Oil
- First Fill for GHG improvement

Electronics System
- CM2450 ECM
- **Next generation connectivity solutions**
- **EngineGuard Maintenance Monitor**

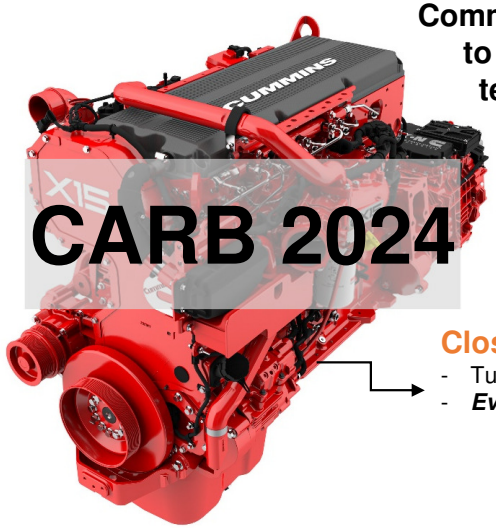
Exhaust System
- **Increased SCR length**
- **Reduced backpressure**

Single Flow SCR

- Efficiency / TCO
- Connectivity
- Reliability
- Regulatory

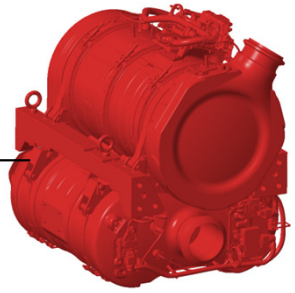
CARB 2024

Common Engine Architecture to EPA 2024 with below technology additions

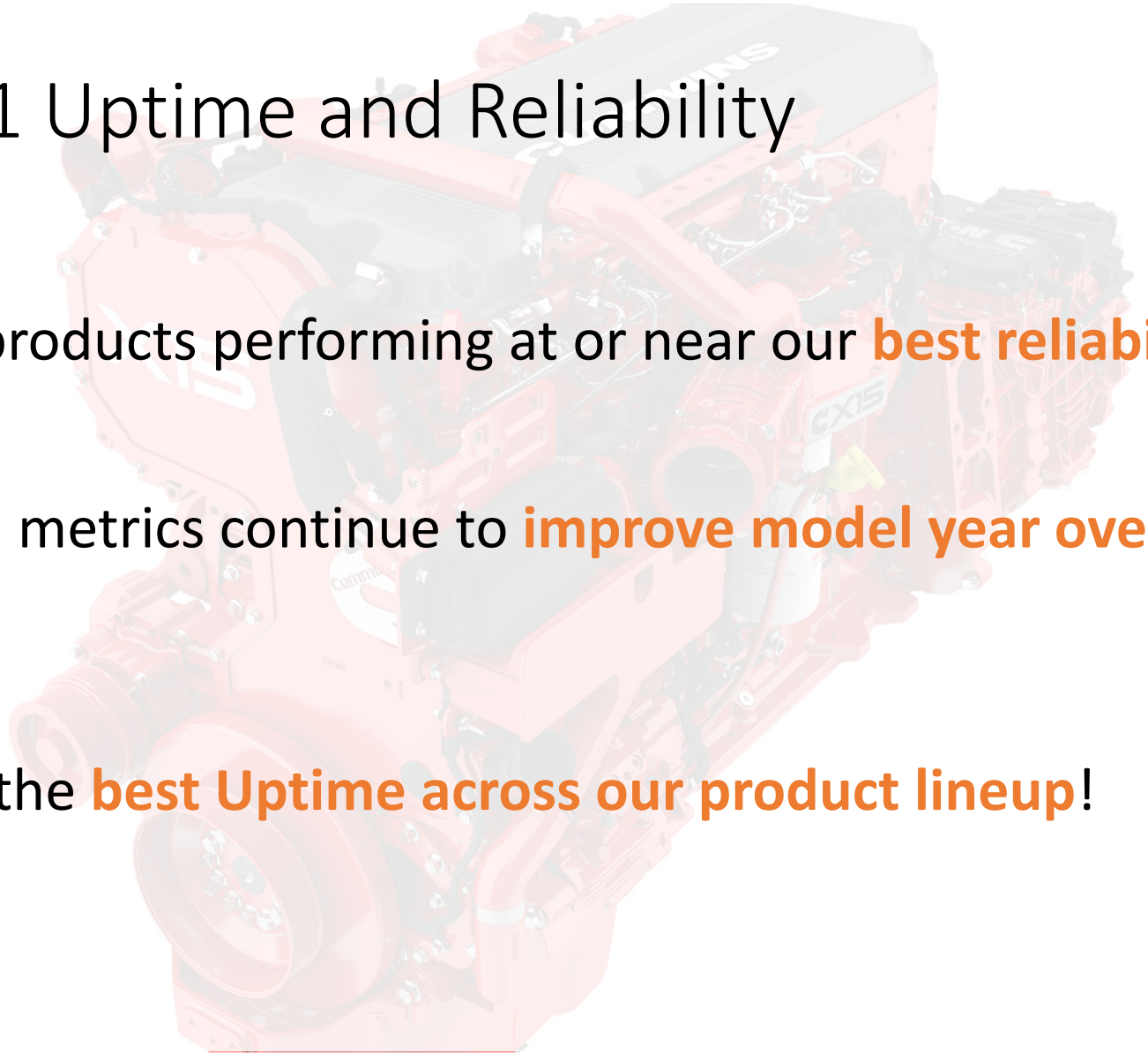


Closed Crankcase Breather
- Turbocharger inlet interface change
- ***Evaluating need for CCV***

Exhaust System
- Compact Twin Design
  - Dual Flow SCR
  - NO auxiliary Heater
- Efficiency & capability
- New vehicle interface & mounting



EPA2021 Uptime and Reliability

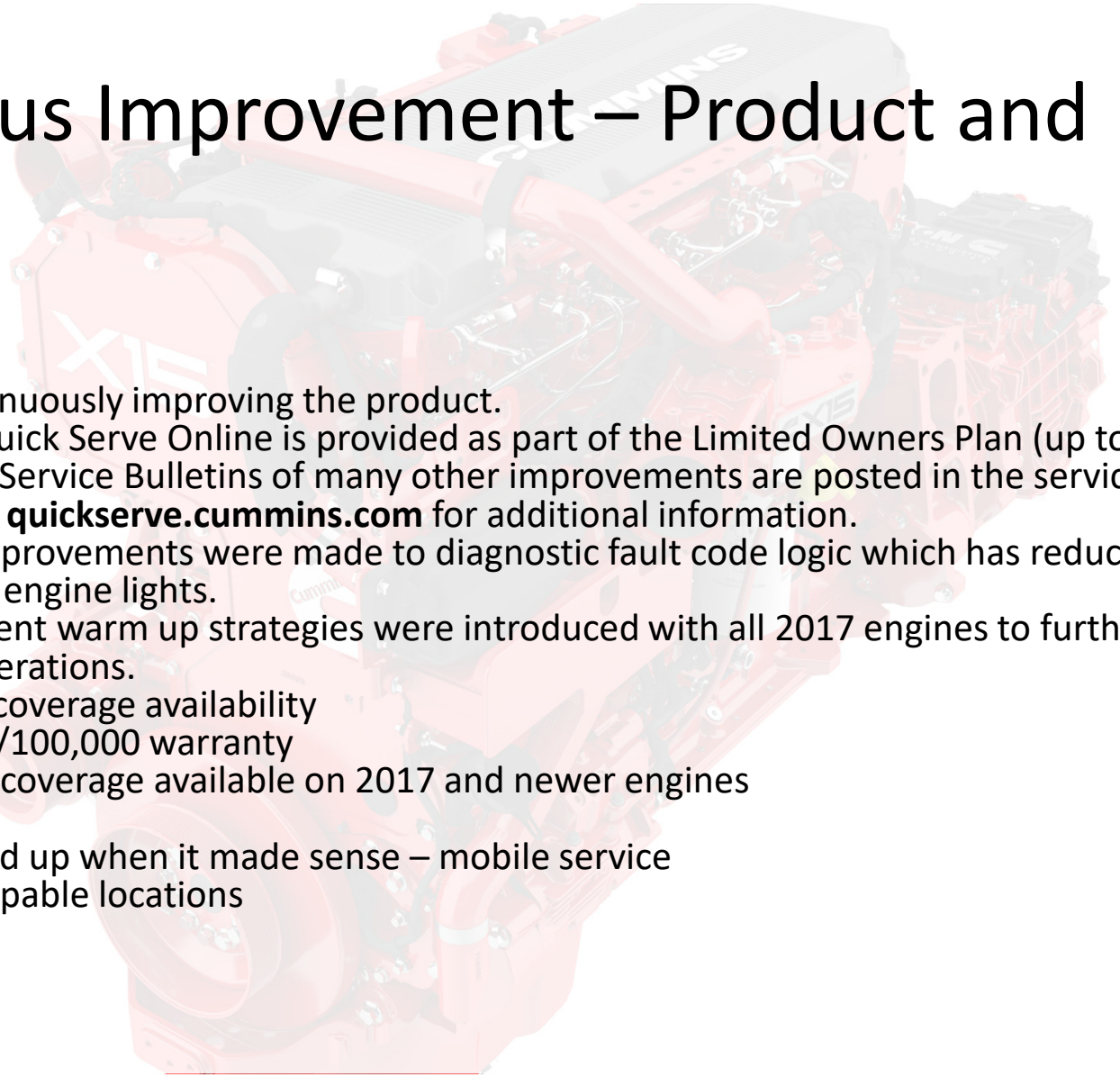


EPA 2021 products performing at or near our **best reliability ever**

Zero Touch metrics continue to **improve model year over model year**

Delivering the **best Uptime across our product lineup**!

Continuous Improvement – Product and Support

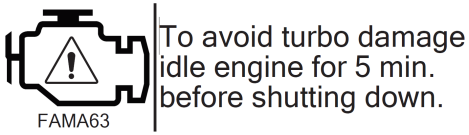


1. Cummins is continuously improving the product.
2. Free access to Quick Serve Online is provided as part of the Limited Owners Plan (up to 5 ESNs). Technical Service Bulletins of many other improvements are posted in the service area for a given ESN. Go to **quickserve.cummins.com** for additional information.
3. In 2014, many improvements were made to diagnostic fault code logic which has reduced the number of check engine lights.
4. New aftertreatment warm up strategies were introduced with all 2017 engines to further reduce the number of regenerations.
5. Industry leading coverage availability

- Standard 5 year/100,000 warranty
- 6, 7, and 8-year coverage available on 2017 and newer engines

1. Support

- We have stepped up when it made sense – mobile service
- Use the most capable locations
- Escalation path



Five-Minute Investment to Increase Uptime

- Allowing your engine to idle for five minutes after a run can significantly reduce the temperature in the turbocharger, which will greatly improve reliability. In custom fire apparatus installations, heat is trapped in the engine tunnel with very little airflow to reduce temperature. These extreme heat conditions can challenge the temperature capability limits of many engine components. Our testing has proven that a five-minute idle period prior to engine shutdown reduces critical component temperatures considerably in fire truck applications.
- We know we can't change the design of a custom fire truck, so we've implemented a number of improvements since 2019 to increase turbo reliability in custom fire truck applications.

1. In 2019, we added additional coolant plumbing for the turbos that are most commonly used in fire apparatus. This reduces the temperature in the turbocharger and the variable geometry (VG) actuator.
2. To further alleviate heat concerns, we have implemented electronic components with higher temperature capability in the VG actuator that reduce the possibility of heat-related cracking failures.
3. A new turbo actuator calibration was released to reduce cycling and further improve reliability.

- Cummins is committed to continuing to develop engines with even greater reliability. Allowing your engine to idle for five minutes after a run can significantly improve the life of your turbocharger.


ENGINE OPERATING GUIDELINES
1. LET ENGINE IDLE 3-5 MIN. AFTER FULL LOAD OPERATION
2. FOR EXTENDED IDLE, ENGAGE HIGH IDLE SWITCH
3. ALLOW 30 MIN IDLE TIME FOR COOL DOWN AFTER REGERATION
4. REFER TO SECTION 99-101-009 OF THE CUMMINS OWNERS MANUAL FOR ADDT'L INFO

Fire Apparatus Cummins Dealer Certification Program

- Lite Repair Dealer Certification
- Target Audience: Fire Apparatus OEM Dealers
- Fire apparatus service providers often have a closer relationship with local fire departments and may be able respond to their needs faster than the nearest CSSNA branch. Adding engine repair to their capabilities can provide a one-stop shop for a market where uptime is absolutely critical.
- In this space, the need exists to enable Fire Apparatus Service Providers to perform warranty repairs on Cummins engines

What is dealer certification?

- Cummins distributor and dealer partner to support our mutual end user customer.
- Dealer is authorized by their local Cummins distributor to perform warranty repairs on selected Cummins engines.
- Certification is administered through a contract between the dealer and the Cummins distributor, provided all requirements are met.
- Contracts outline the expectations and obligations of both parties.

Benefits:

- Timely aftermarket parts support and direct or indirect sales support and training
- Technical service support, training, and warranty claim support.
- Managing cost of investment to remain consistent with market assumptions
- Access to Cummins expertise and business tools
- Access to marketing material
- Real time product and training information
- One face to the customer
- Being part of a worldwide recognized brand

Certification Process

- *Prior to certification*
  - Dealer identifies primary engine population
  - Understand dealer service level and certification investment required
    - Parts, Information, Training and Tooling
- *Working toward certification*
  - Dealer and Cummins Sales and Service location work together to select engines and service levels
  - Local Cummins Sales and Service location develops certification proposal
  - Cummins Sales and Service Local Account Executive submits Excel form for approval
- *Maintaining certification*
  - Annual re-certification audit performed by Cummins Sales and Service location
  - Complete any new required technical and warranty training
  - Replenish and maintain appropriate parts stocking

Lite Repair

Requirement	Definition
Signage	2x2 non-lighted sign – externally posted
Tooling	Varies by engine models selected; non-Cummins equivalent tools accepted
Training	Online technician and warranty training; no instructor led requirement
Parts	Sufficient inventory to prevent delay of warranty repairs
Information	QSOL, CVC, EDS, Insite Pro
Authorized Repairs	*Troubleshooting and repair on the following components: engine water pump, exhaust manifold, fan hub, belt tensioner, thermostat, coolant heaters, brushes, oil fill cap, dipstick and dipstick holder, filter heads, filters, belts, external lines,cup plugs, hoses, valve cover, valve cover gasket, vibration damper, EGR cooler, oil cooler, turbocharger, aftertreatment inspection and repairs, aftertreatment system sensors, engine mounted sensors, wiring harness, and ECM Calibrations on product(s) for which that service provider is certified.*
Restrictions	*Not authorized to repair fuel system, ECMs, electronic systems, internal rotating or reciprocating components and removal of cylinder head*

Cost to certify on 2013 ISL9

Item	Cost	Parts
QuickServe Online (Annual Subscription)	$1,350	Negotiated at the local level to determine adequate stocking levels
INSITE Pro (Annual License)	$770	
L9 CM2350 L116B Service Tools	$3,780.94	
Online Warranty Training	N/C	
Total	$5900.94	

Item	Cost	Parts
ISL9 CM2350 L101 Service Tools	$242.01	Negotiated at the local level to determine adequate stocking levels

Q+A


Cummins