

# ***The Road Ahead***

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Vice President – Engine Business Engineering

Cummins Inc.



## MISSION

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

## VISION

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

# Our key capabilities accelerate toward Destination Zero

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**11,000** Of the brightest innovators

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**1.6M** Engines manufactured in 2021

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**190** Countries and territories

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**55** Global technical centers

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**\$1B** Annually spent on research and technology

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**10,600** Cummins certified dealer locations

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**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.

# 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

**55<sub>MMT</sub>**

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

**50%**

Reduction in absolute GHG emissions from facilities and operations

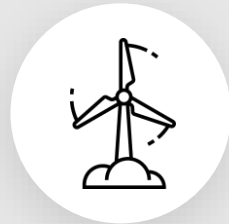
# REDUCING WELL-TO-WHEELS EMISSIONS

By innovating the energy sources and the power solutions

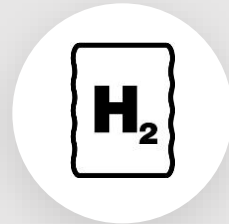
## ENERGY SOURCES



**Innovate and scale  
low carbon fuels**

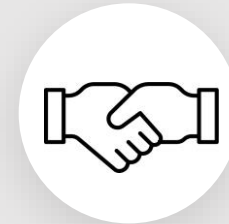


**Decarbonize and  
improve resiliency  
of the grid**

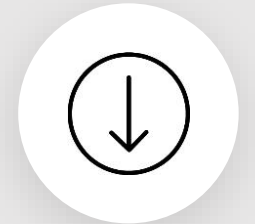


**Develop and  
mature the green  
hydrogen economy**

## POWER SOLUTIONS



**Increase adoption of  
fuel cell, battery  
electric and hybrids**



**Reduce GHGs from  
internal combustion  
engines**

# ADDRESSING A WIDE RANGE OF APPLICATIONS



**HEAVY-DUTY  
TRUCK**



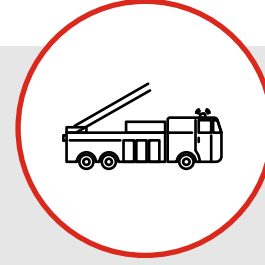
**MEDIUM-DUTY  
TRUCK**



**BUS**



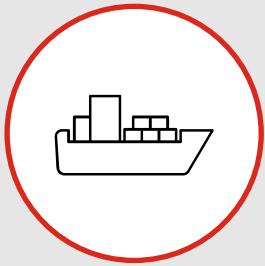
**OIL AND GAS**



**FIRE AND  
EMERGENCY**



**CONSTRUCTION**



**MARINE**



**MINING**



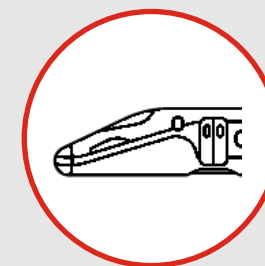
**POWER  
GENERATION**



**DEFENSE**



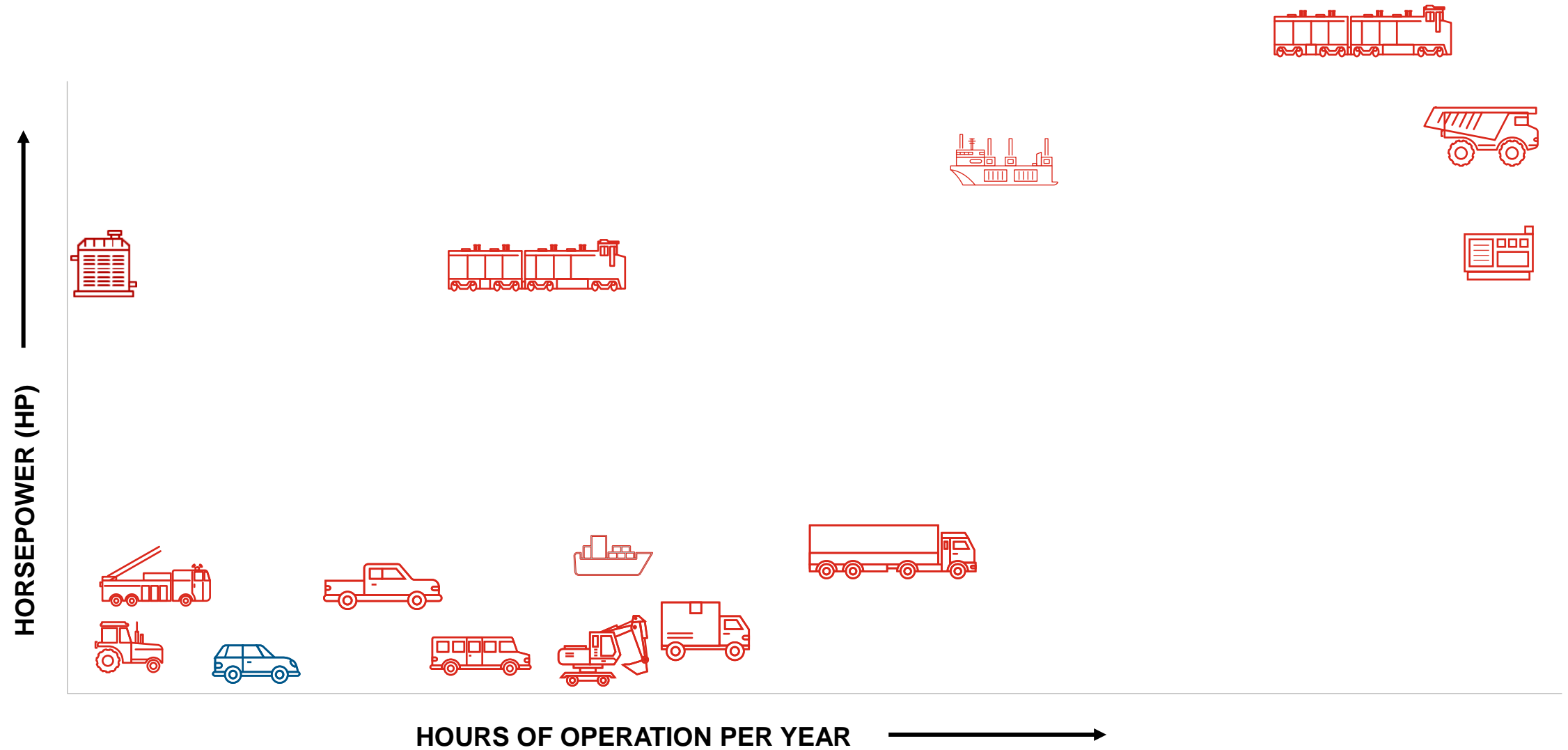
**AGRICULTURE**



**RAIL**



# CHALLENGE IS GREATER FOR DIVERSE APPLICATIONS



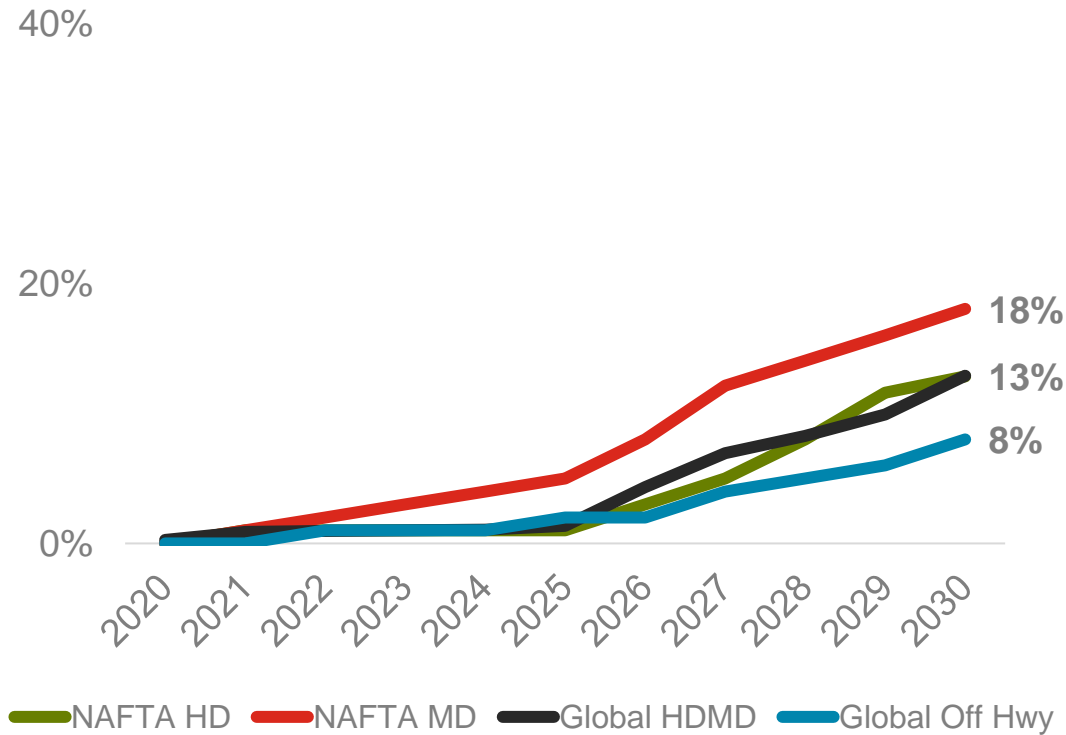


# ZEV ADOPTION WILL VARY IN PACE AND FORM OF TECHNOLOGY

Only Cummins has the capabilities to respond and deliver

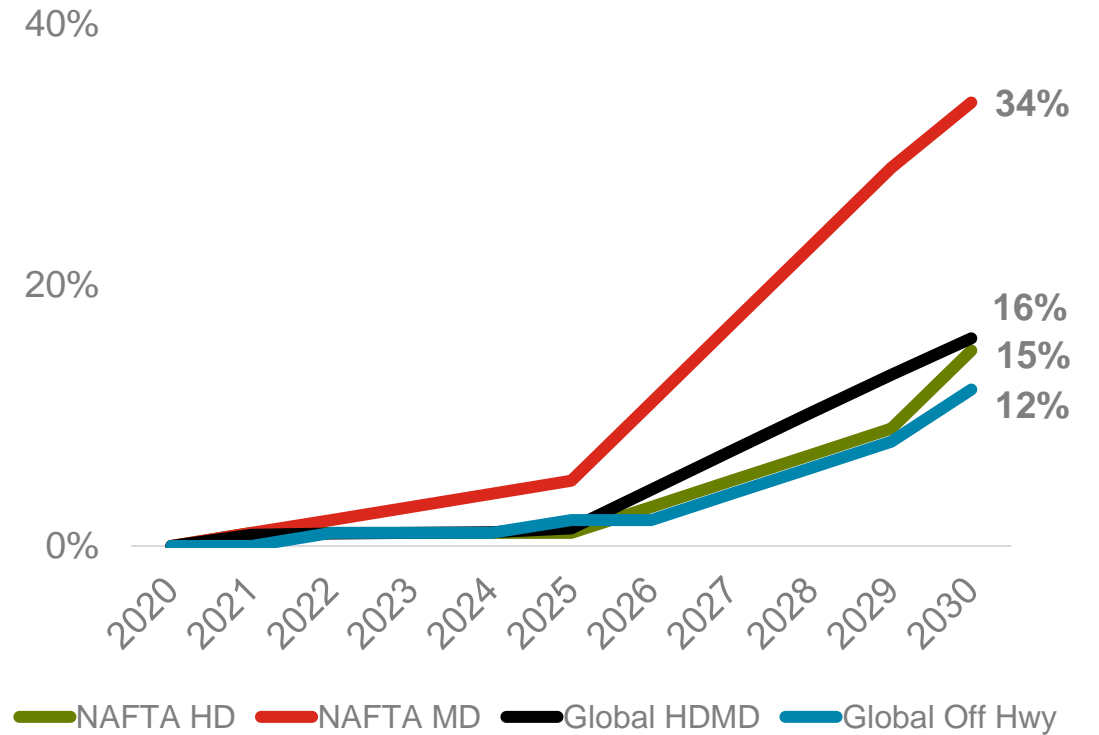
## Slower adoption

ZEV adoption curve (%)



## Faster adoption

ZEV adoption curve (%)

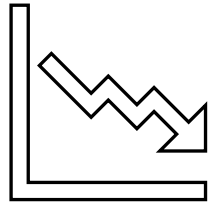


Cases based on external sources and internal analysis

# DESTINATION ZERO



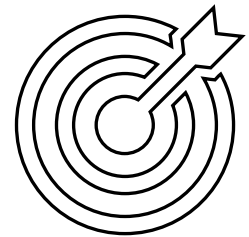
Lower emissions  
today



Reduce well-to-  
wheels emissions



Drive wide-scale  
customer adoption

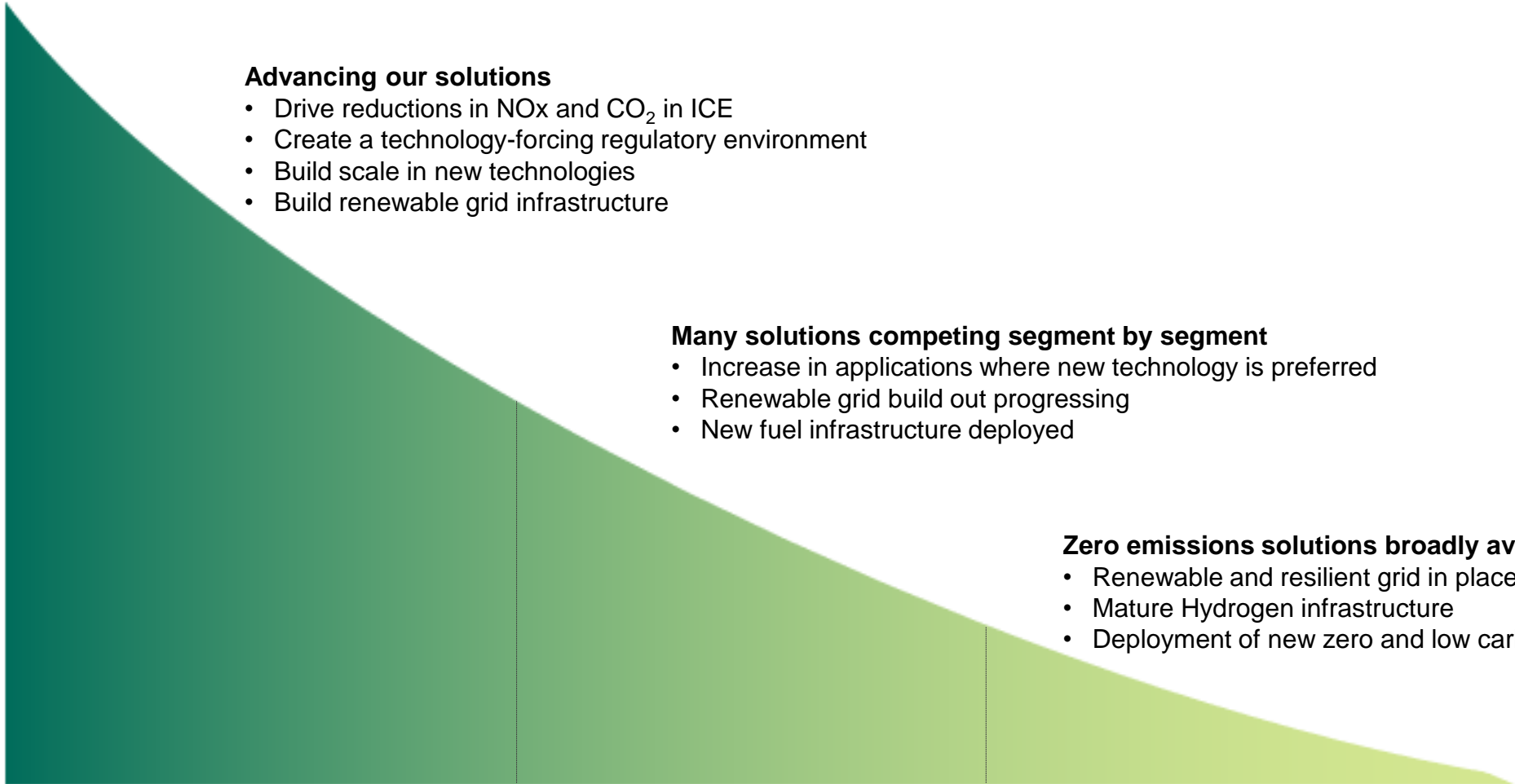


Achieve zero  
emissions by 2050

# REACHING DESTINATION ZERO

CO<sub>2</sub> emissions

100%  
90%  
80%  
70%  
60%  
50%  
40%  
30%  
20%  
10%  
0%



## Advancing our solutions

- Drive reductions in NO<sub>x</sub> and CO<sub>2</sub> in ICE
- Create a technology-forcing regulatory environment
- Build scale in new technologies
- Build renewable grid infrastructure

## Many solutions competing segment by segment

- Increase in applications where new technology is preferred
- Renewable grid build out progressing
- New fuel infrastructure deployed

## Zero emissions solutions broadly available

- Renewable and resilient grid in place
- Mature Hydrogen infrastructure
- Deployment of new zero and low carbon technologies

2021

2030

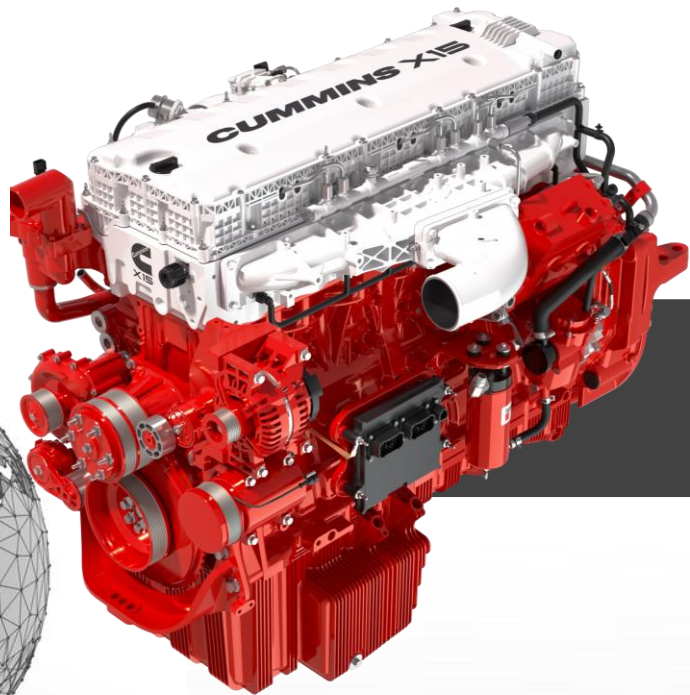
2040

2050

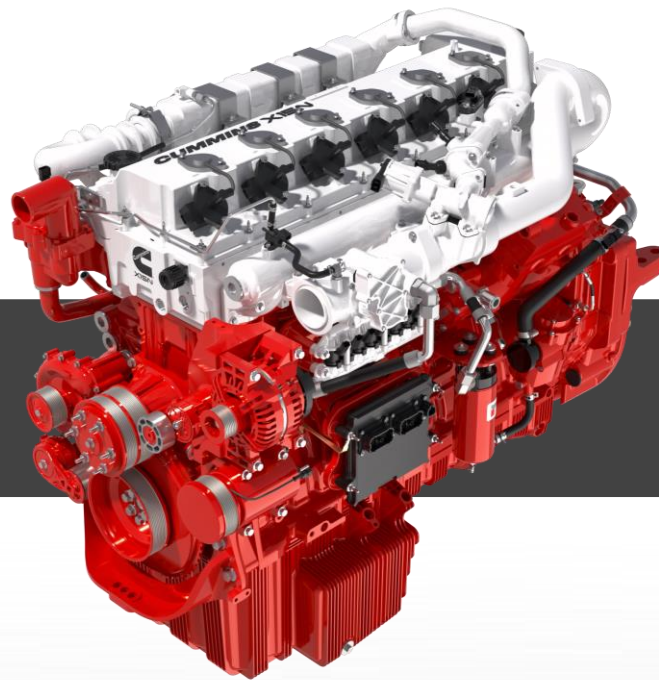
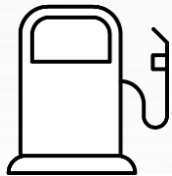
*Driving factors: energy source decarbonization and infrastructure investment, regulatory advancements, and customer pull*

# GLOBAL PLATFORM: FUEL AGNOSTIC

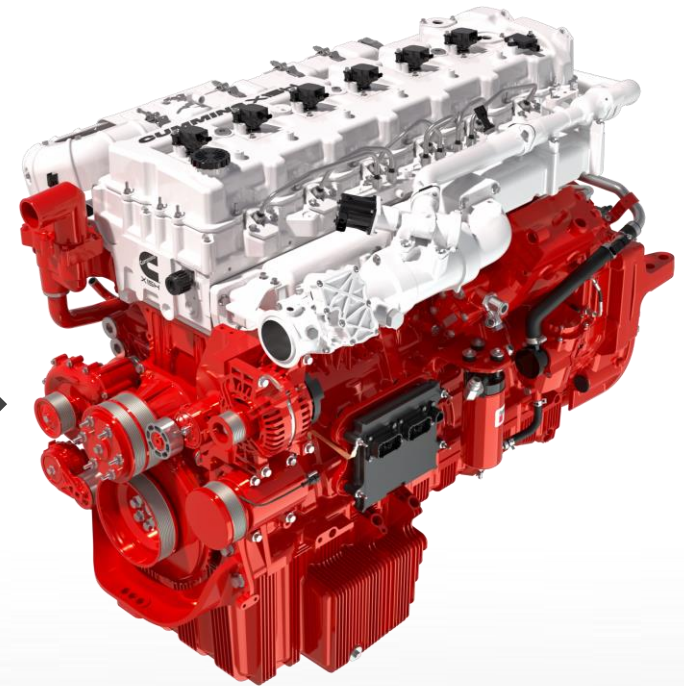
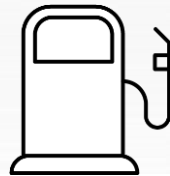
Reliable | Durable | Scale | Common



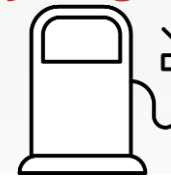
**Diesel**



**Natural Gas**



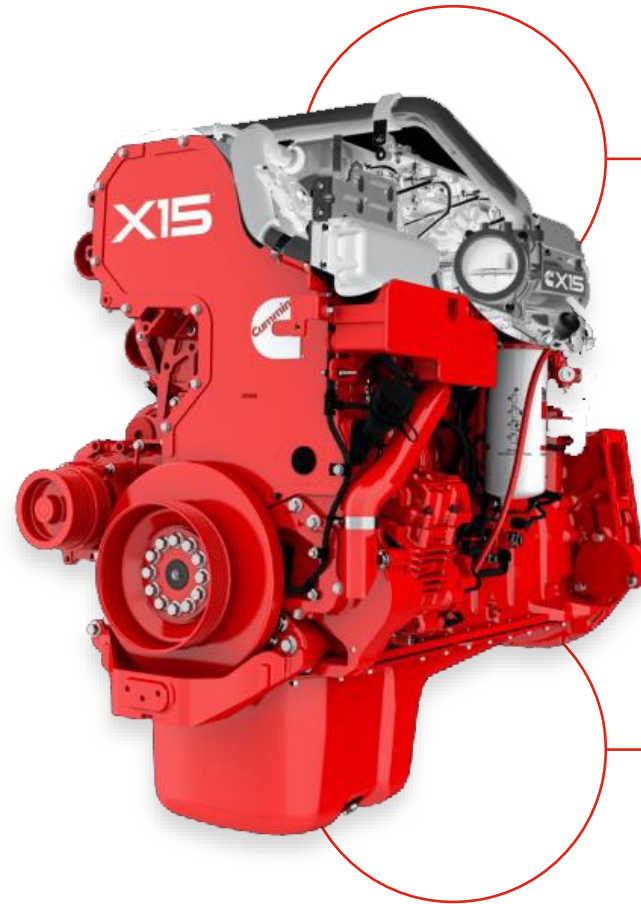
**Hydrogen**



# NEW TECHNOLOGY APPROACH

These new fuel-agnostic engine platforms will feature a series of engine versions that are derived from a common base engine, which means they have a high degree of parts commonality.

Each engine version will operate using a different, single fuel.



Above the head gasket will have different components for different fuel types.

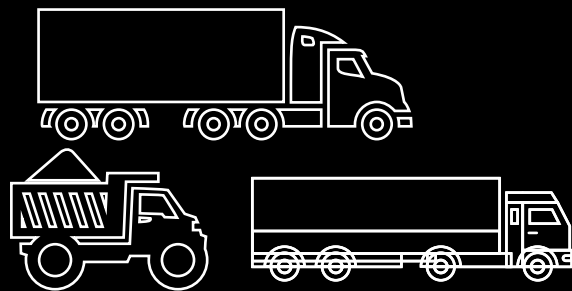
Below the head gasket of each engine will largely have similar components





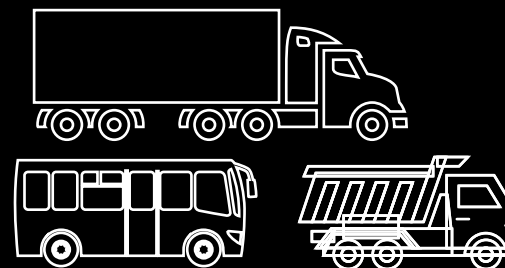
**X**

Clean Diesel  
Natural Gas  
Hydrogen



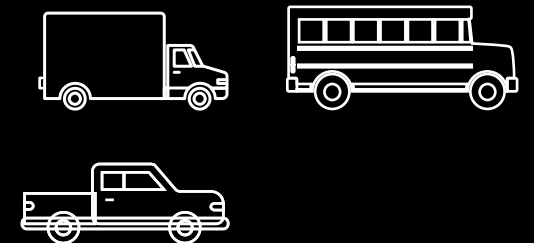
**L**

Clean Diesel  
Natural Gas  
Hydrogen



**B**

Gasoline  
Propane  
Clean Diesel  
Natural Gas  
Hydrogen



# X15 (NEXTGEN) NEW CUMMINS 15L ENGINE

## The Future of Heavy Duty

- Multi-fuel capable platform
  - Natural Gas | **2024**
  - Diesel
  - Hydrogen
- 15L Diesel matching ratings and more
- Significant Fuel Efficiency with a EPA27 GHG capability
- Reduced package size – same base platform and integration as X15N
- Reduce engine weight
  - ~500 lbs less than current 15L diesel
- Integration with Endurant and Allison Transmissions





# HYDROGEN INTERNAL COMBUSTION ENGINES

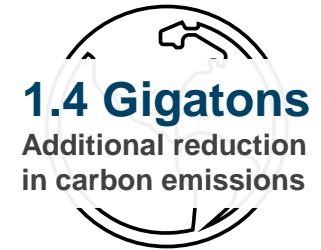
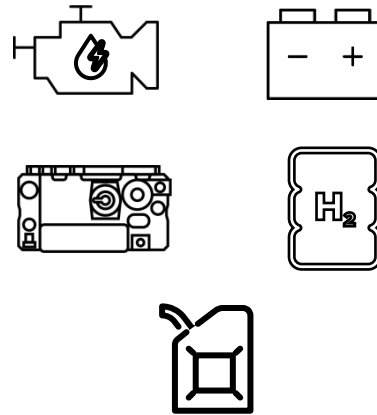
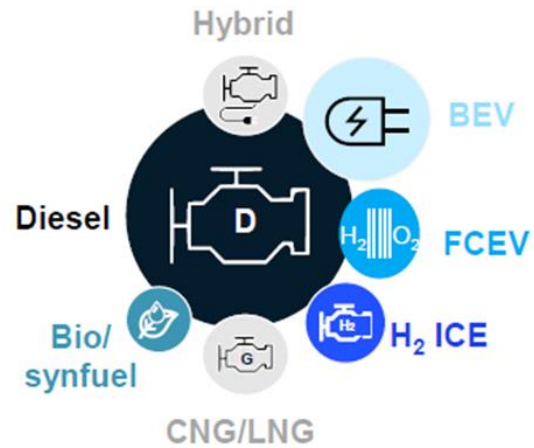
While a fuel cell electric vehicle could be the long-term solution to decarbonizing the long-haul heavy-duty truck market, a hydrogen ICE provides a complementary short- and medium-term solution for decarbonizing.

- ✓ Great Option for the Environment
  - Zero-carbon with green Hydrogen
  - Scale production can begin within the decade
- ✓ Benefits to End Users
  - Competitive initial cost
  - Drop-in regional haul / long haul replacement
  - Familiar powertrain technology, vehicle technology, and maintenance practices
  - Single fuel supply switch
- ✓ Complementary with a Hydrogen Fuel Cell Future
  - Builds scale for Hydrogen storage tanks on vehicle
  - Drives Hydrogen fueling infrastructure

**Hydrogen Engine Powered Class 8 Truck**



# WE CAN LOWER EMISSIONS FASTER



**1.4 Gigatons**  
Additional reduction  
in carbon emissions

= removing all trucks from  
the road for 3 years

Lower emissions  
today with a mix of  
advanced ICE and  
zero-emissions  
solutions

Advance  
low-carbon  
technologies

Greater  
cumulative  
carbon reduction  
than waiting until  
2035 with all ZEV

*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

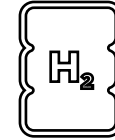
Progress requires partnership

Technology leadership is critical

## ENERGY SOURCES



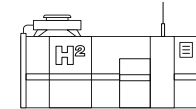
LOW CARBON  
FUELS



GREEN HYDROGEN  
ECONOMY

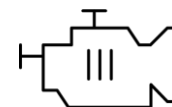


DECARBONIZED  
GRID

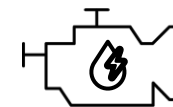


STORAGE

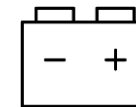
## POWER SOLUTIONS



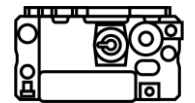
ADVANCED  
ENGINES



HYBRID



BATTERY  
ELECTRIC



FUEL CELL  
ELECTRIC

