

# Heavy-Duty Automotive Trends and Outlook

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Worldwide Environmental Strategy & Compliance  
Cummins Inc.

*April 19, 2016*





**Net gain of  
200,000  
people per  
day!**

# Growing Need for Resources



*In 15 years...*

**30%**  
MORE ENERGY

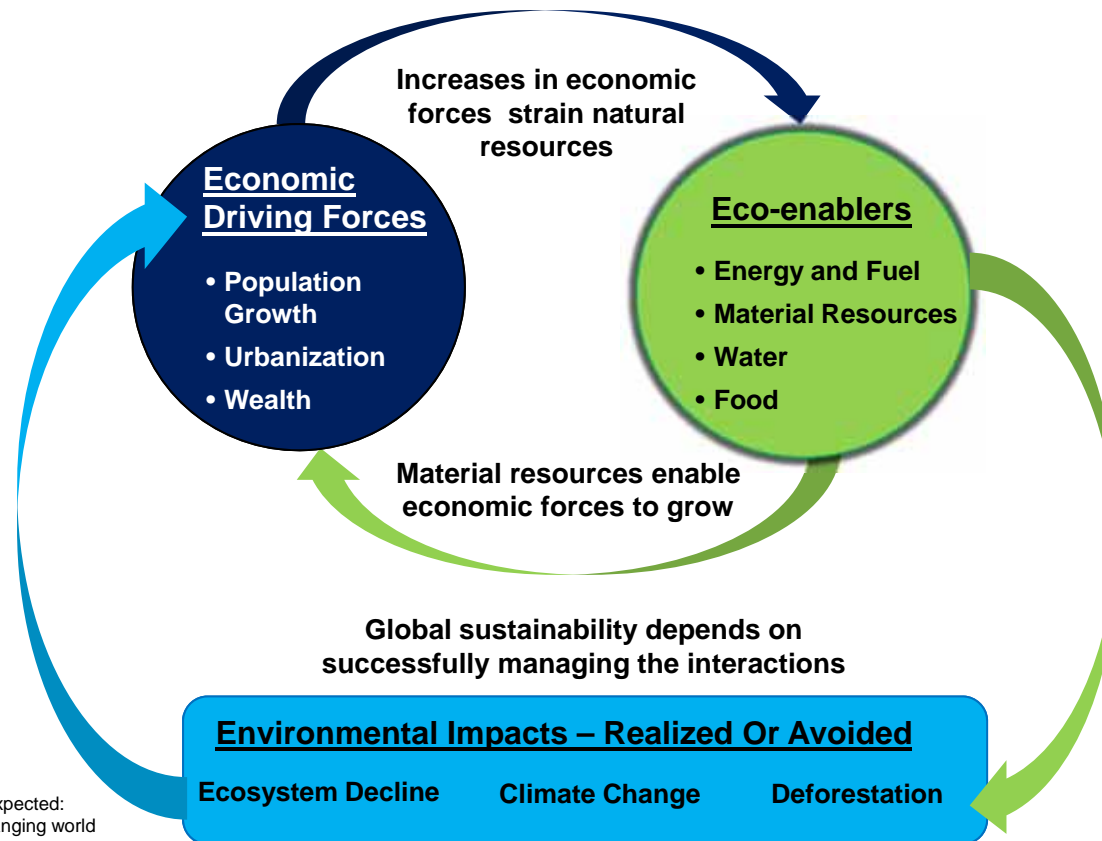
**55%** MORE  
MATERIAL  
EXTRACTION

**40%** MORE  
FRESH  
WATER

**50%**  
MORE FOOD

Source: KPMG "Future State 2030"

# Environmental & Economic Megatrends



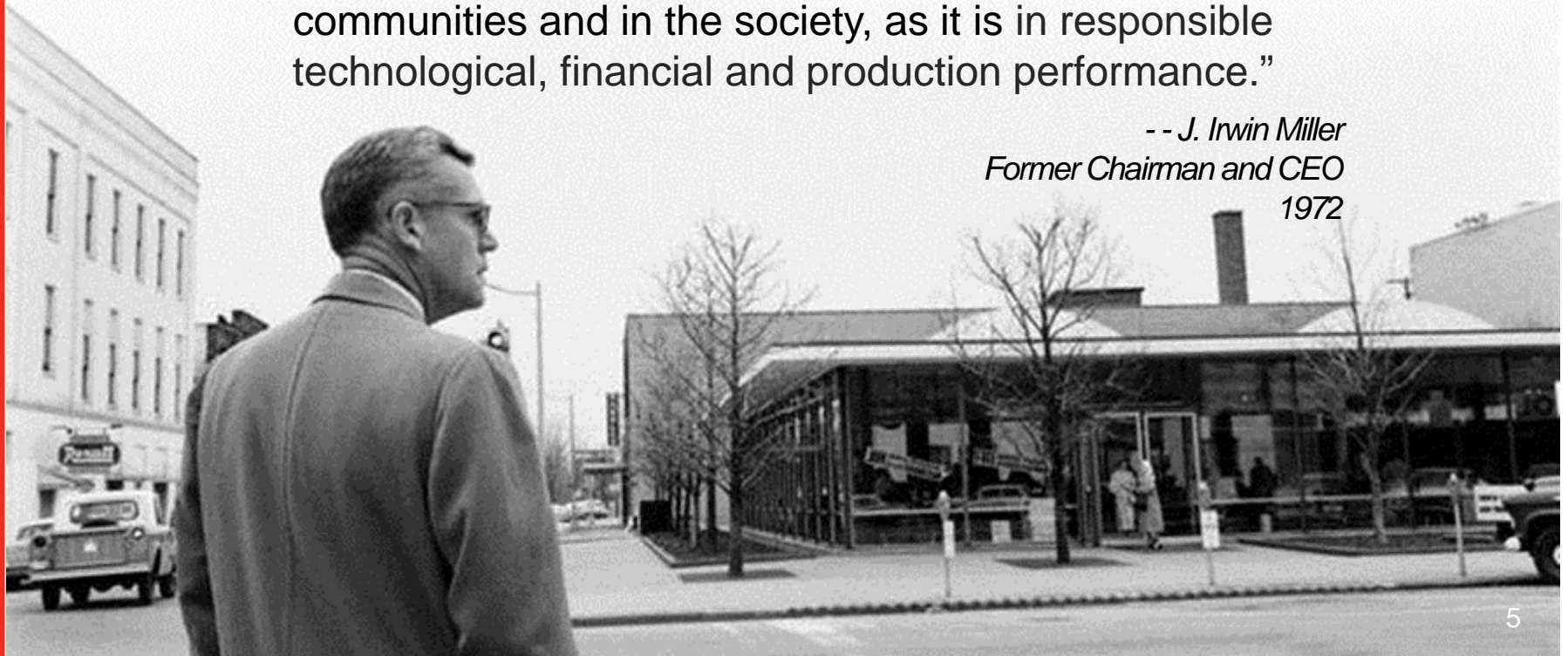
Source: KPMG Expect the Unexpected:  
Building business value in a changing world



# Cummins Legacy and Core Values

“...we believe that our survival in the very long run is as dependent upon responsible citizenship in our communities and in the society, as it is in responsible technological, financial and production performance.”

-- J. Irwin Miller  
Former Chairman and CEO  
1972



# Cummins Global Presence



**190+**  
Countries  
and territories

**154**  
Fortune  
500 rank

**1919**  
Founded &  
headquartered  
in Columbus,  
Indiana

**6**  
continents



**55,000**  
Employees  
worldwide

**4**

Business units &  
global power  
leader

# Cummins and the Environment



**“WE DEMAND THAT EVERYTHING WE DO LEADS TO A CLEANER, HEALTHIER AND SAFER ENVIRONMENT”**

- Set environmental direction for the company everywhere we have an impact
- Integrate environmental impact into business decisions and processes
- Drive compliance and accountability to environmental requirements
- Inspire individual employee environmental responsibility



**FACILITIES**



**PRODUCTS**



**GLOBAL  
NETWORK**



**CUSTOMERS**



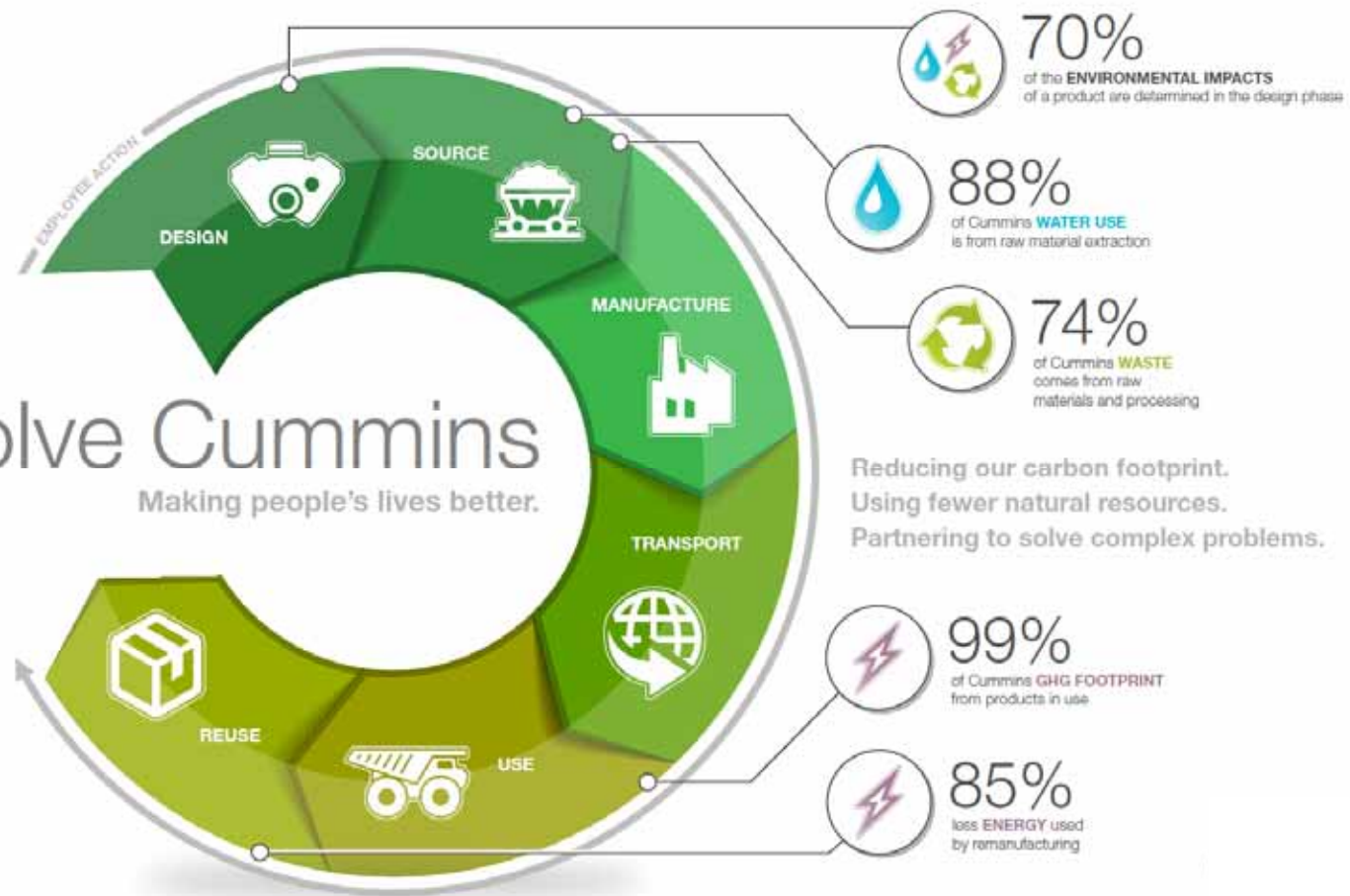
**PUBLIC POLICY**



**EMPLOYEES &  
COMMUNITIES**

# Envolve Cummins

Making people's lives better.







## **Env**olve Cummins Priorities

### FOCUS

### ACTION AREAS

**Reducing our carbon footprint.**



New product fuel efficiency • facility GHG reduction • renewable energy • products-in-use fuel efficiency • logistics • remanufacturing

**Using fewer natural resources.**



Water reduction and neutrality • increased recycling • zero disposal • materials efficiency • packaging • advanced manufacturing

**Partnering to solve complex problems.**



Supplier and community collaboration • new technologies • metals and water availability • ngo's • governments

# Customers and Environmental Success



2014 Actual

65.4

\$262

0.65

**2020 Goal**

**350**

**\$1,400**

**3.50**

2020  
Cumulative

1,563  
million gallons

\$6,252  
million USD

15.6  
million metric  
tons (MMT)

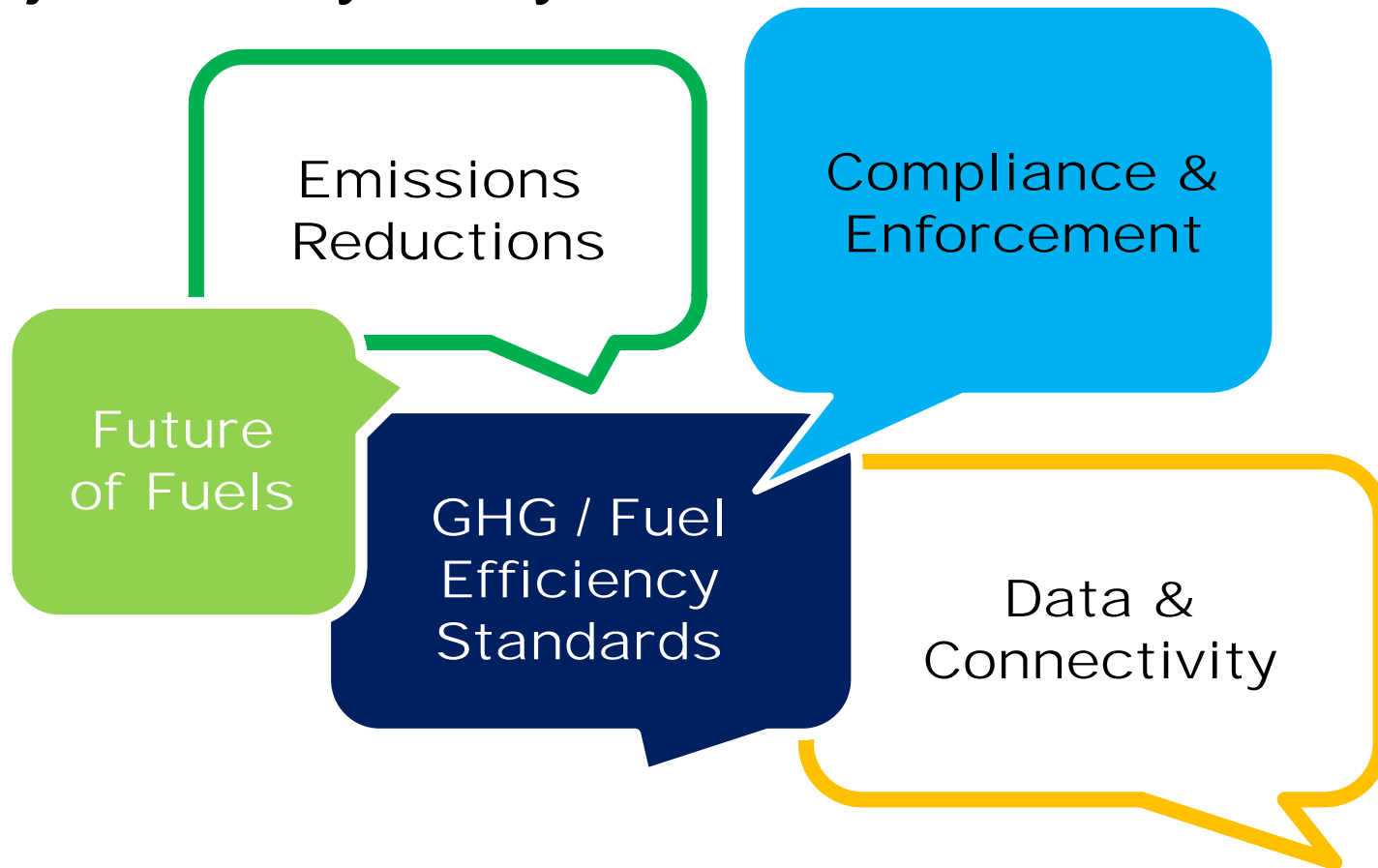
## Rio Tinto - Customer Improvements

- Fuel Use: 4%, 10M Liters Annually
- CO<sub>2</sub>/Yr: 27,000 MT
- Savings: \$14.2M Annually

**3.2M**

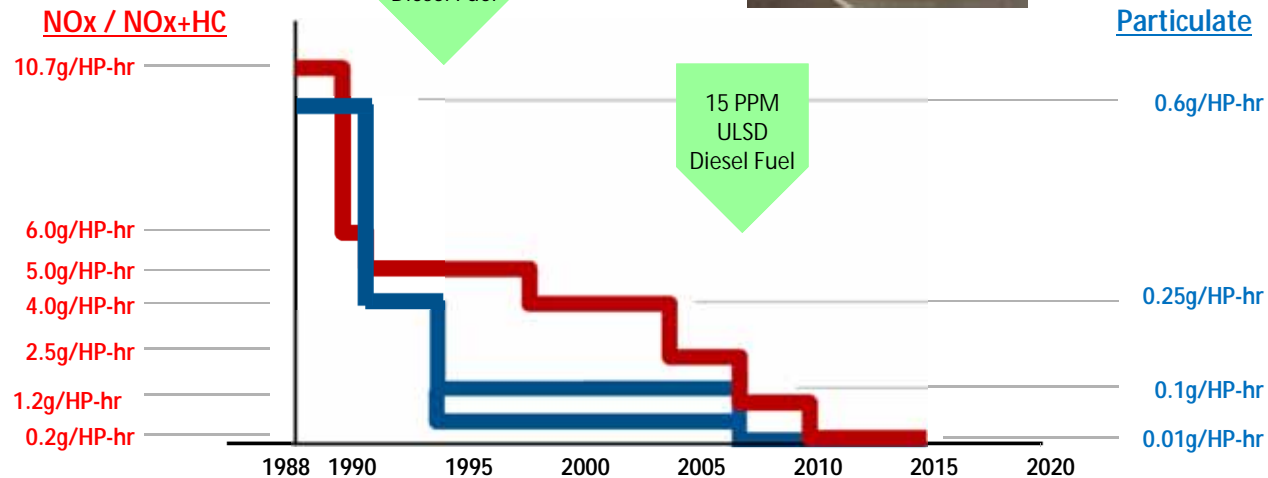
Equivalent cars  
off the road for a  
year by 2020

# Major Heavy-Duty Automotive Trends



# Emissions Reductions

LOWER NOx



California Environmental Protection Agency

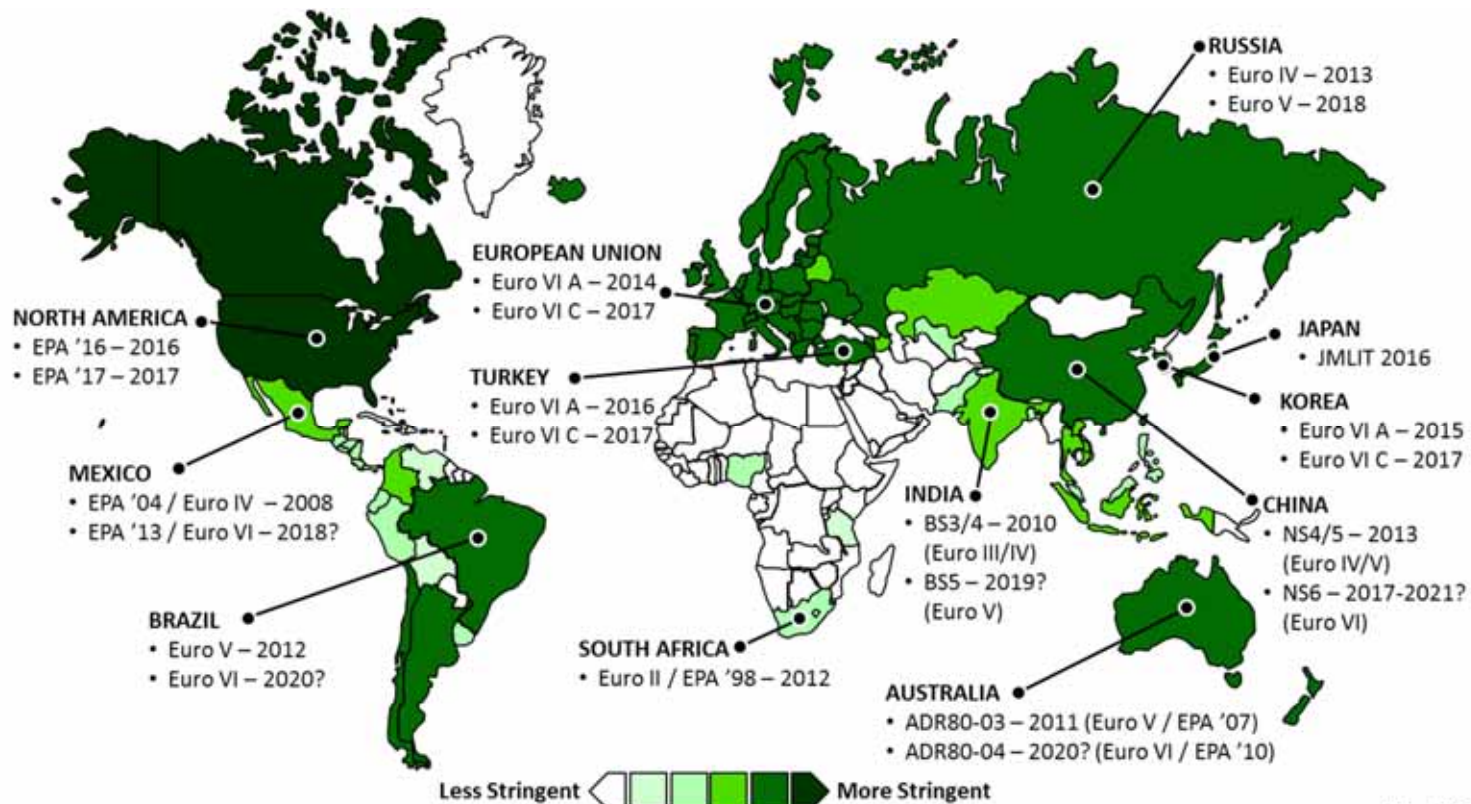
 **Air Resources Board**

Target: 90% further reduction in NOx



# Emission Reductions

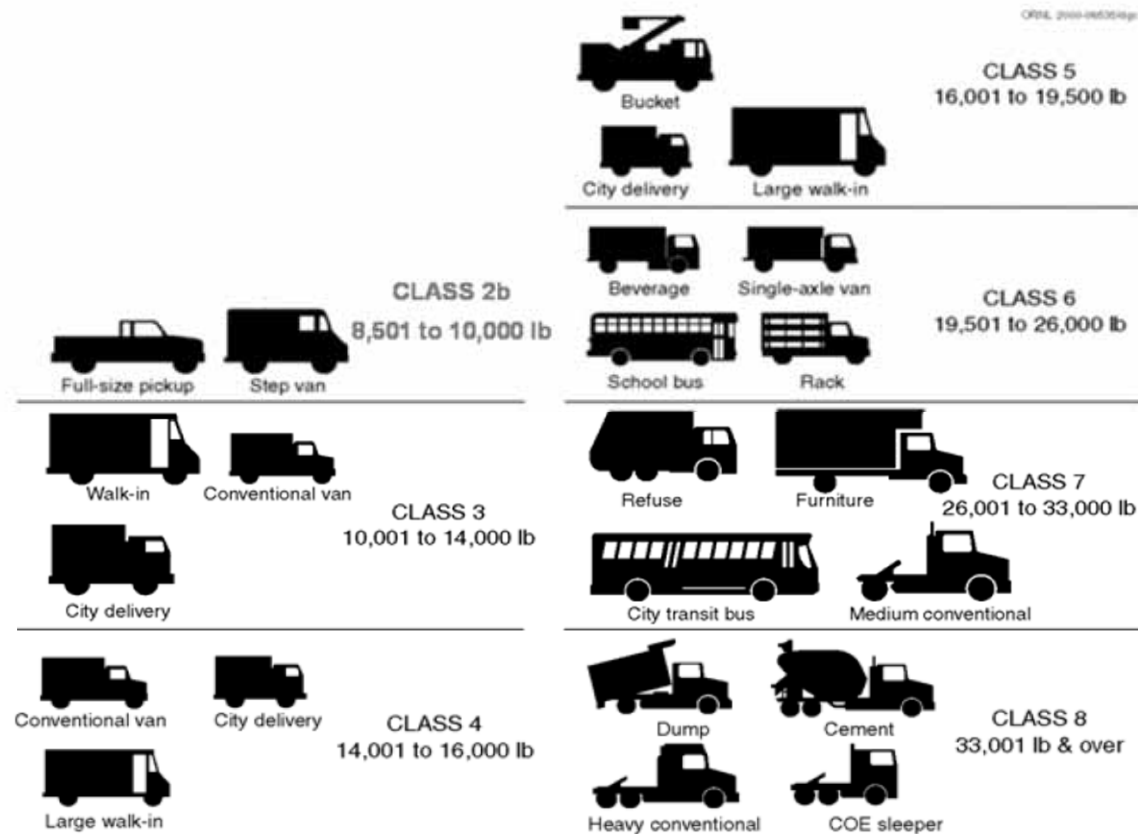
## GLOBAL HEAVY-DUTY ON-HIGHWAY REGULATIONS



Rev 2016-02-22

# Emission Reductions

## DIVERSE COMMERCIAL VEHICLE APPLICATIONS



# Compliance and Enforcement

## IN-USE TESTING



"Rolling Coal" is tampering



Heavy-duty in-use testing (PEMS)



Light-duty chassis-dyno testing (lab)



Light-duty in-use testing (PEMS)

# Compliance and Enforcement

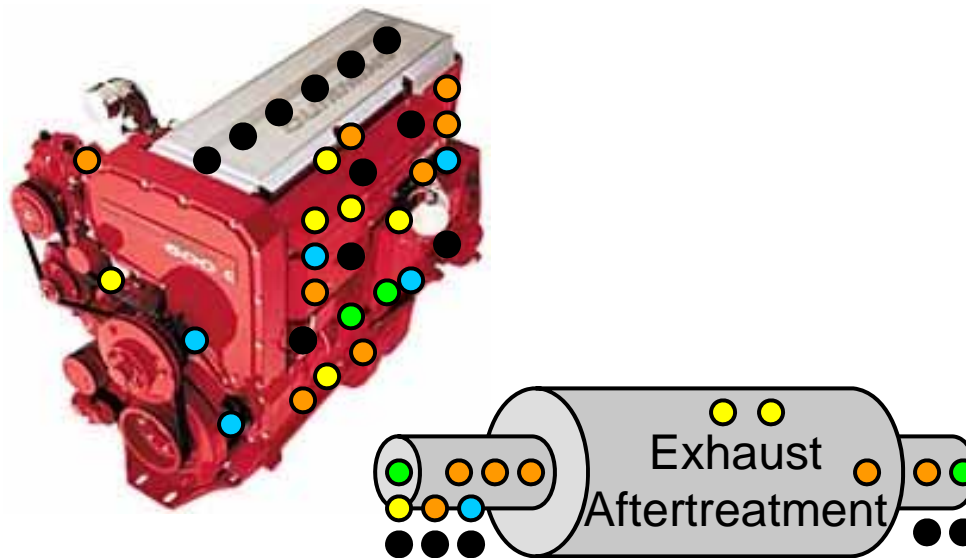
## ENGINE AND ELECTRONICS GROWTH



**2002**

**100** Sensors

**10** Actuators



● Pressure

● Temperature

● Position

● Chemical

● Actuators

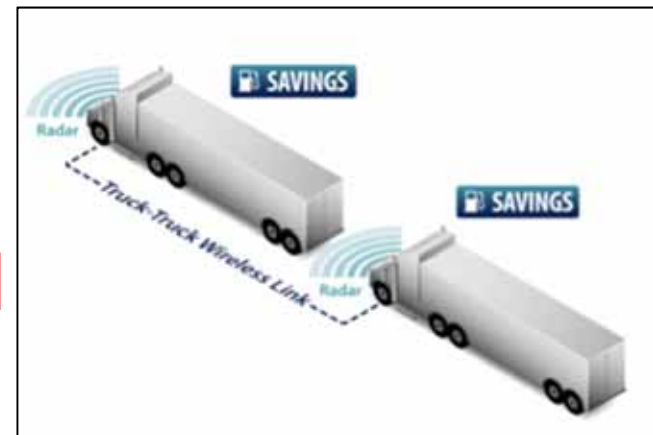


# Data and Connectivity

## DRIVER ASSIST / PLATOONING



Daimler autonomous platoon demo March 2016



# Greenhouse Gas & Fuel Economy

## COMMERCIAL VEHICLE APPROACH



### ► Fuels

Reduced carbon intensity  
Bio Diesel, CNG, LNG

### ► Engines

Brake Thermal Efficiency  
Improvements



### ► Vehicles

Tires  
Aerodynamics  
Weight  
Speed / Idle Controls

### ► Fleets / Operators

Deployment of Low GHG vehicles  
Logistics, Driver training & aids



### ► Highways / Infrastructure

Highway Construction / Congestion  
Speed limits  
Increased GVWs, LCVs



# Greenhouse Gas & Fuel Economy

## STAKEHOLDER COLLABORATION

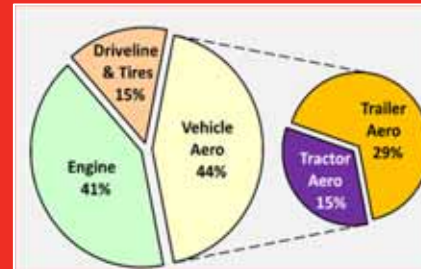
The Art Of The Possible



*May 21, 2010*



*August 9, 2011*



*2013*

**75%**  
Fuel economy  
improvement



# Greenhouse Gas & Fuel Economy

## WASTE HEAT RECOVERY





# Greenhouse Gas & Fuel Economy

## WASTE HEAT RECOVERY

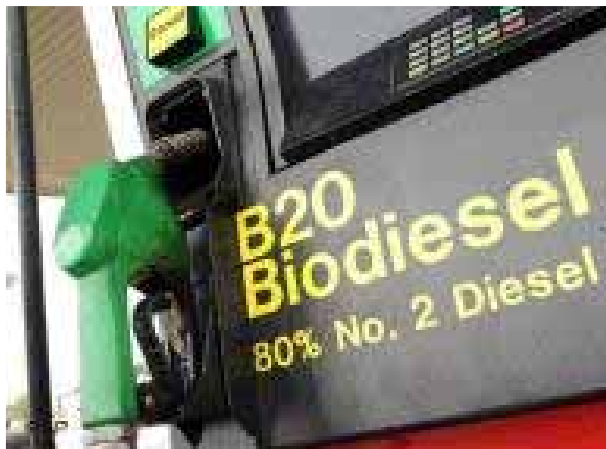


# Future of Fuels

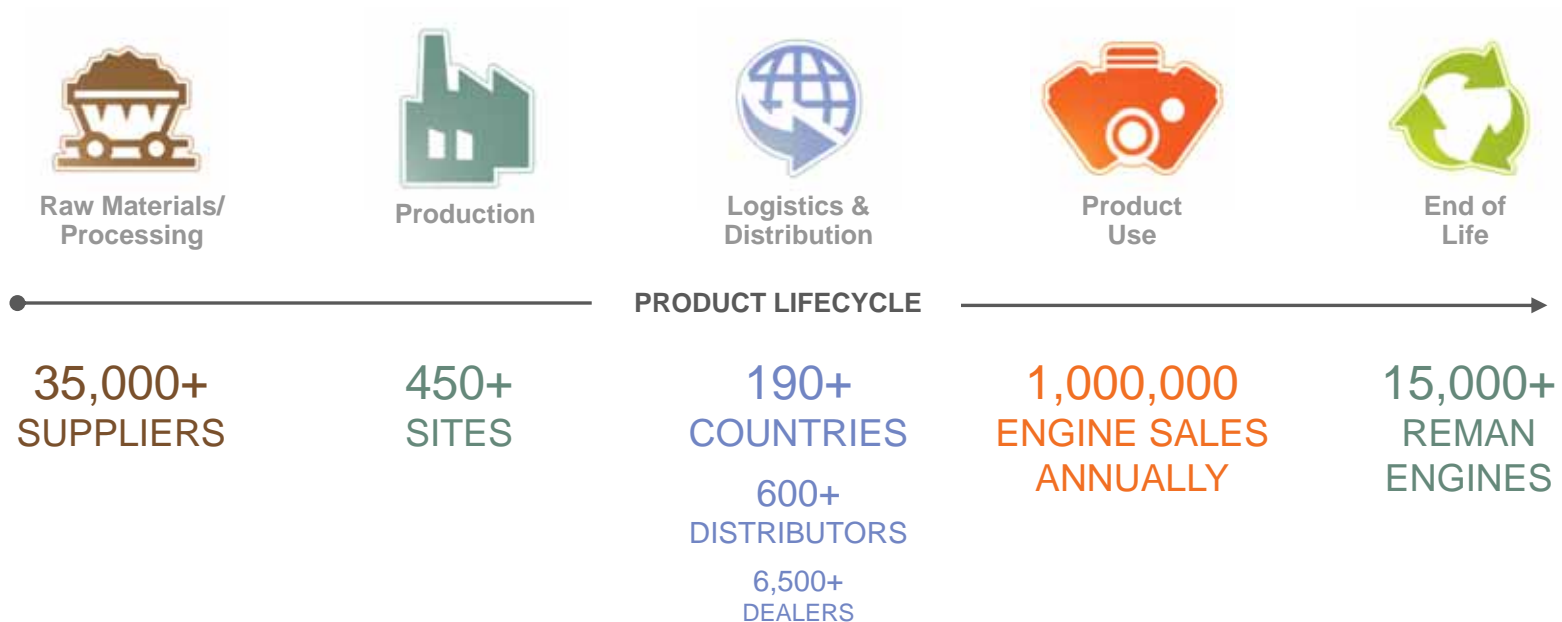
CURRENT VIABILITY



California air regulators readopt fuel standard to fight climate change



# The Power to be Part of the Solution



Fueled by 54,000 employees and meaningful public policy and stakeholder engagement.

