



Innovation You Can Depend On™

■ 您可信赖的创新 ■ L'innovation

Sur Laquelle Vous Pouvez Compter

■ 期待に答える技術革新 ■

Innovación En La Que Usted Puede

Confiar ■ 신뢰할 수 있는 혁신

■ Inovação Que Você Pode Confiar

■ नवयुक्ति जिस पर आप निर्भर कर सकें ■

# Advanced Technologies For and From (And Far From) Indiana

NAE Regional Meeting – Purdue University

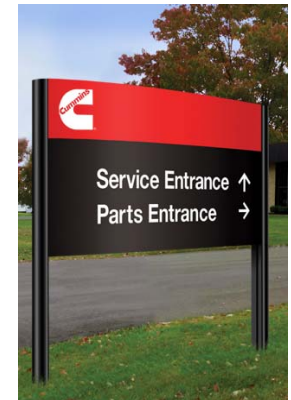
Dr. John C. Wall

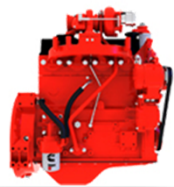
Vice President – Chief Technical Officer

Cummins Inc.

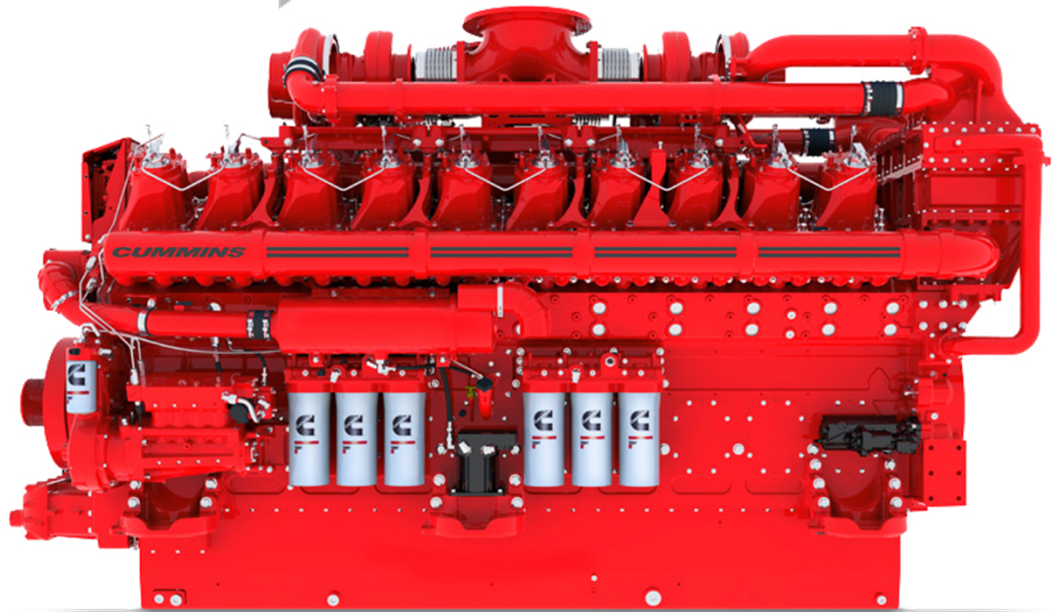
April 28, 2014

One World. One Mission.  
Technical Excellence.





55 hp



5000 hp



# Our Products Must Meet Customer Requirements



High Performance



Low Noise and Emissions



Reliable



Fuel Efficient



Low Initial Cost

Durable

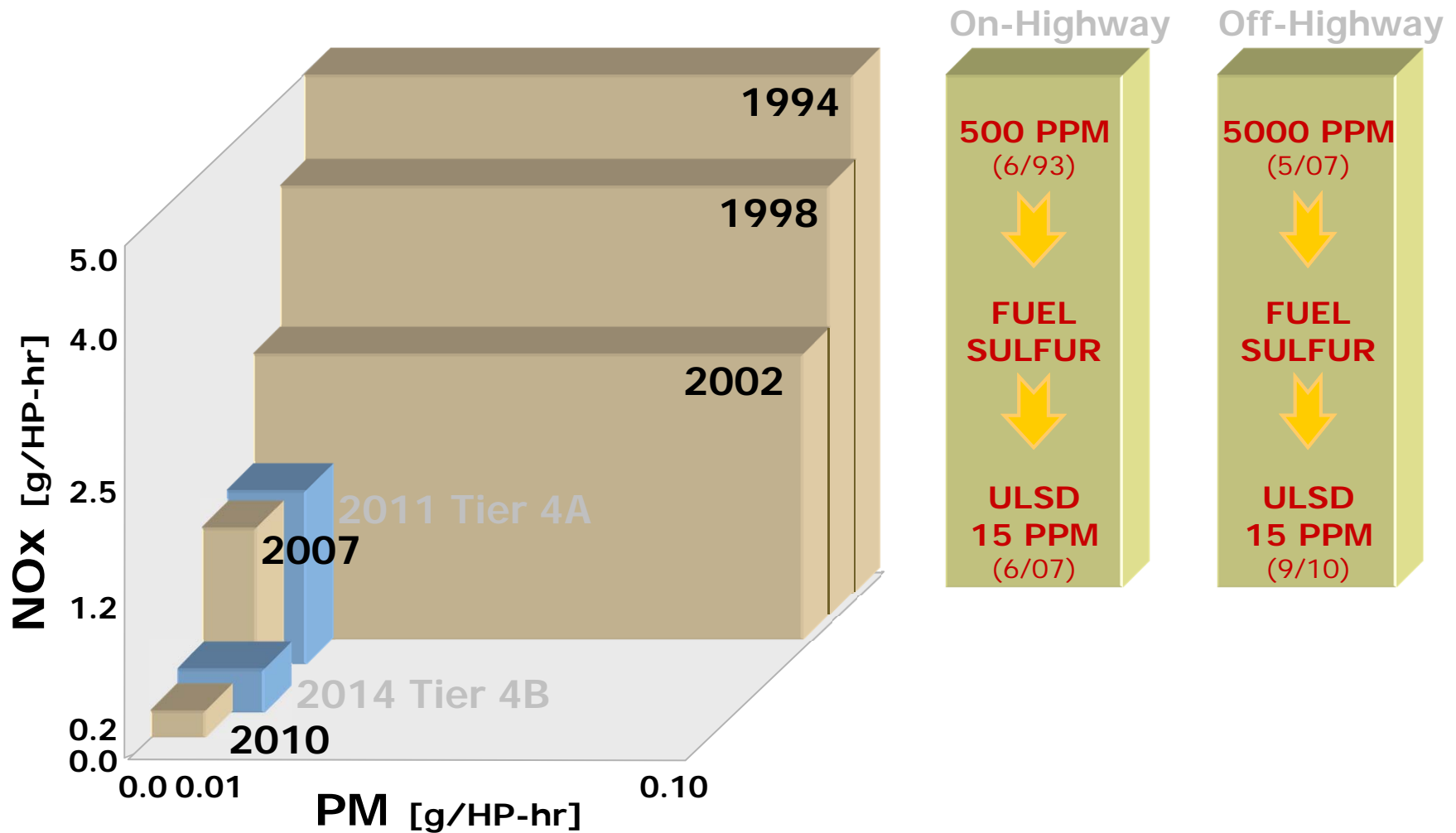


Low Maintenance



Connected and Integrated Systems

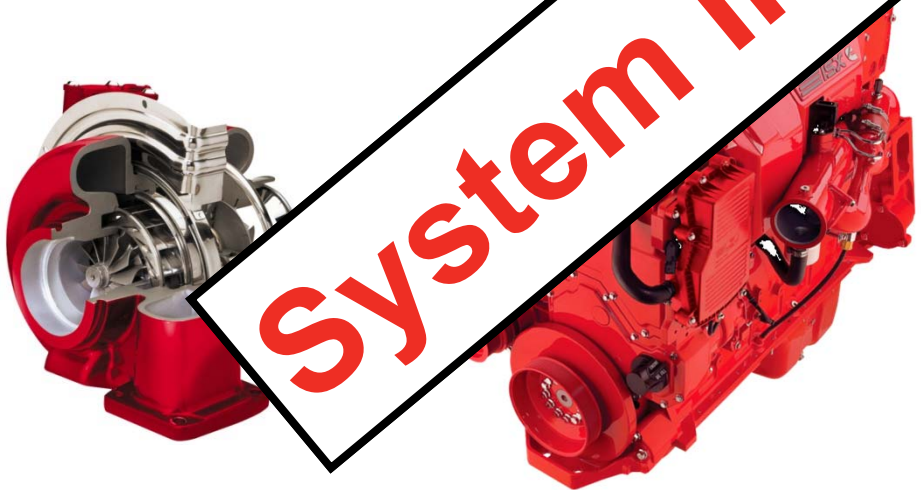
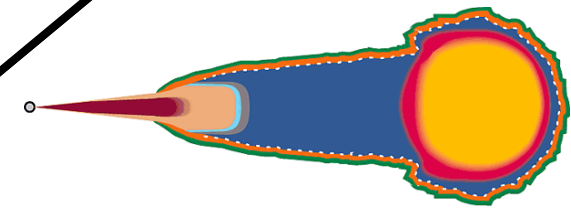
# Evolution of US EPA Diesel Standards



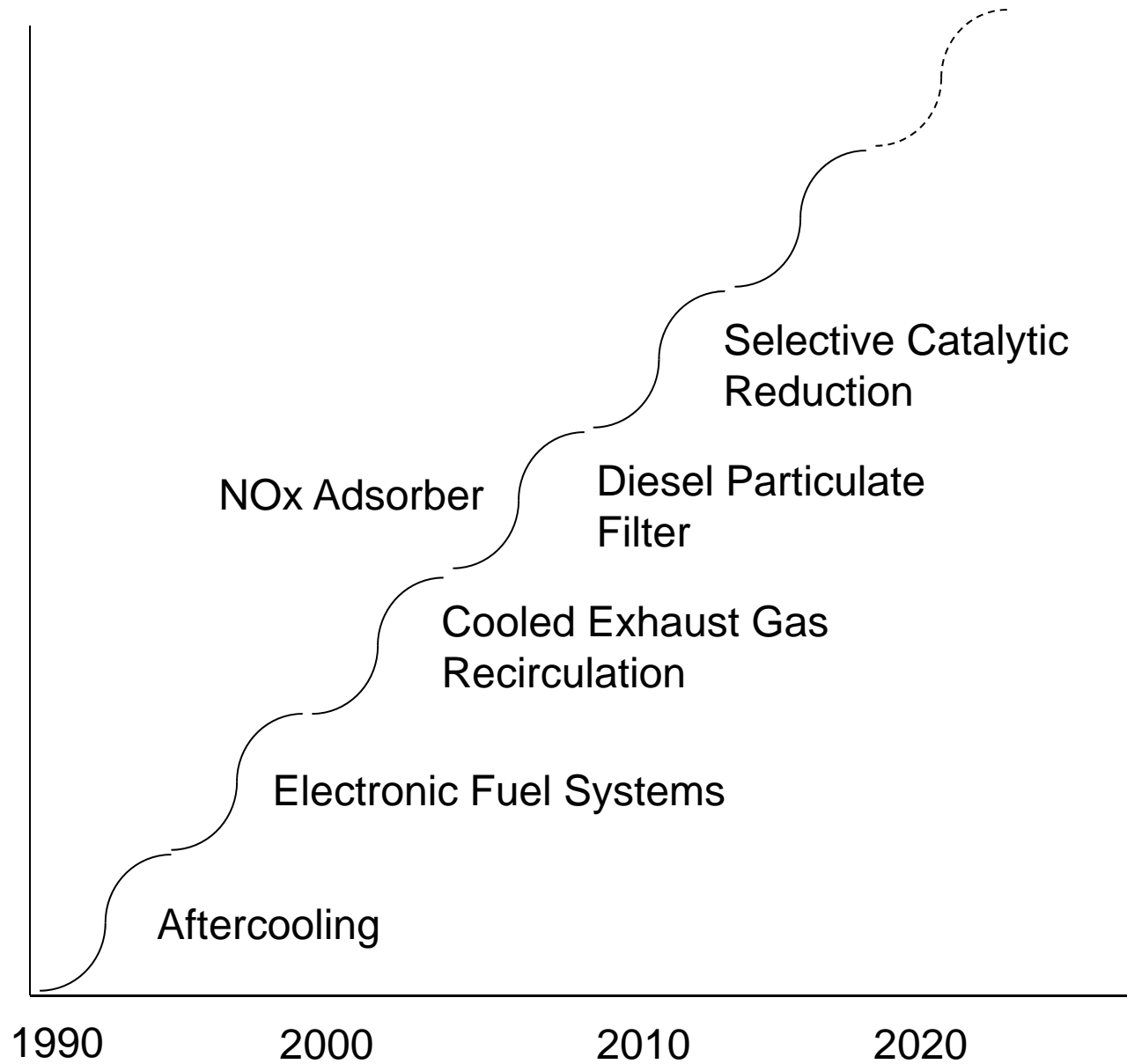
# Innovation in Critical Component Technologies



**System Integration**

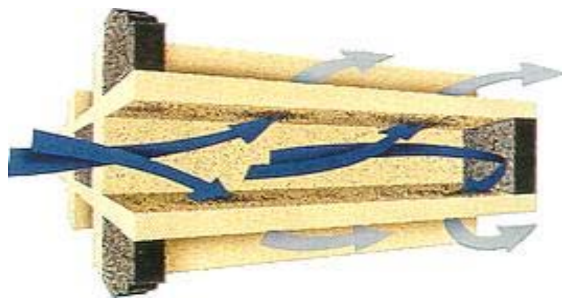


# Evolution of Diesel Technology

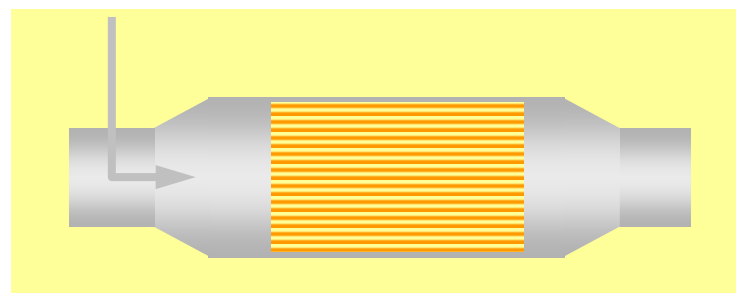


# Integrating Engine and Aftertreatment

## Active Particulate Filter

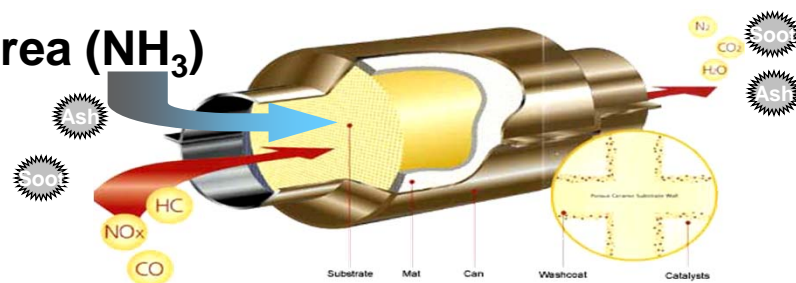


## NOx Adsorber



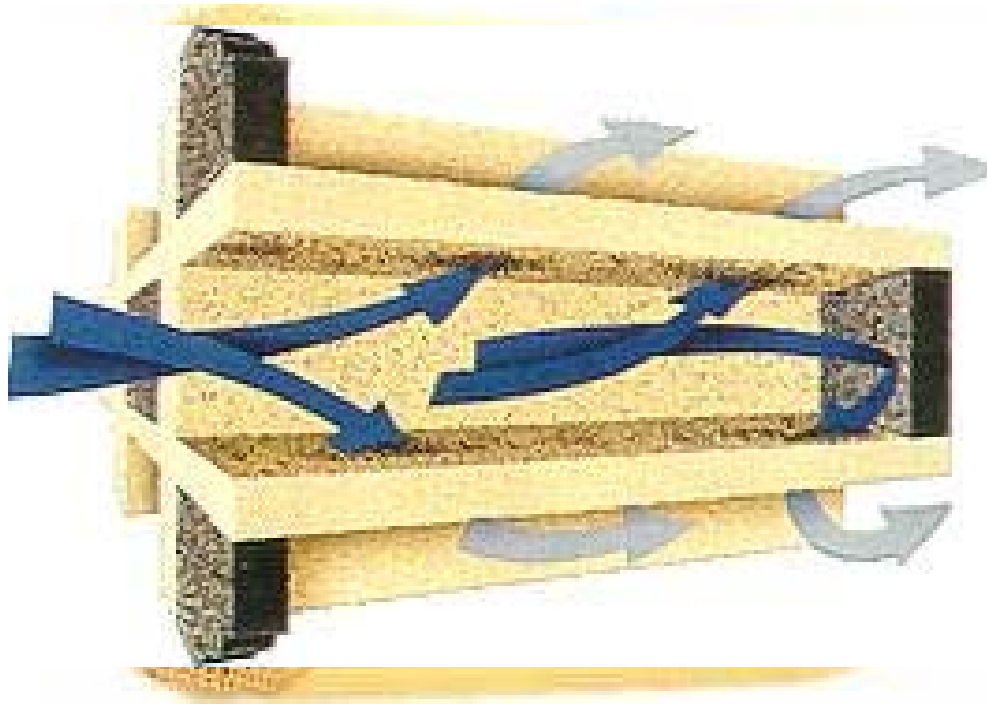
## NOx Control Using Urea SCR

Urea ( $\text{NH}_3$ )



# Integrating Engine and Aftertreatment

## Active Particulate Filter





# Selective Catalytic Reduction (Urea-SCR)

## Oxidation Catalyst



## Urea Hydrolysis



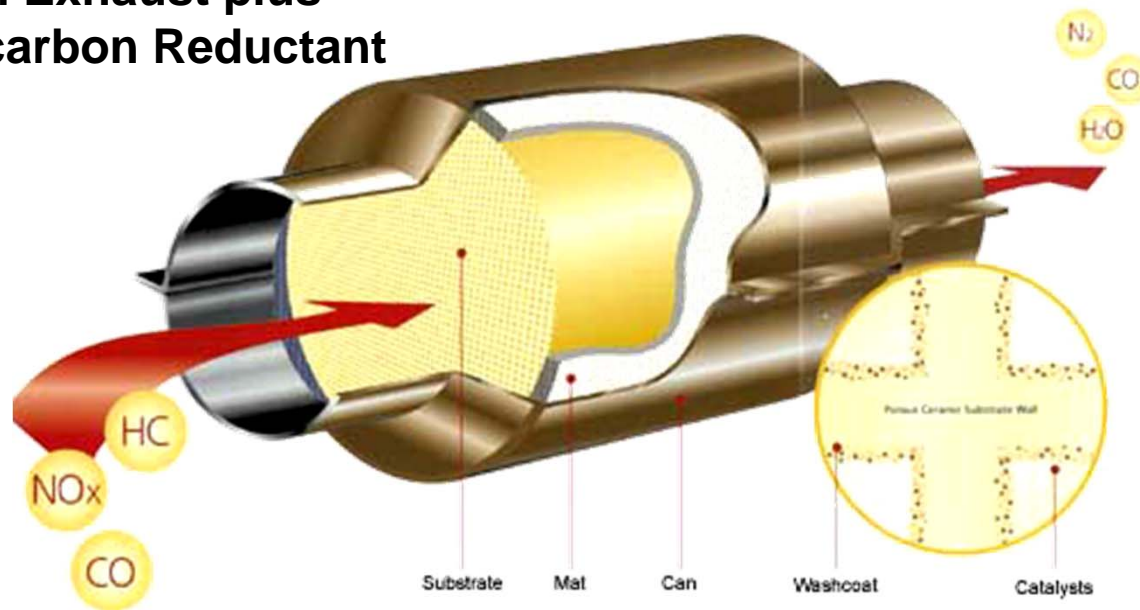
## SCR Catalyst



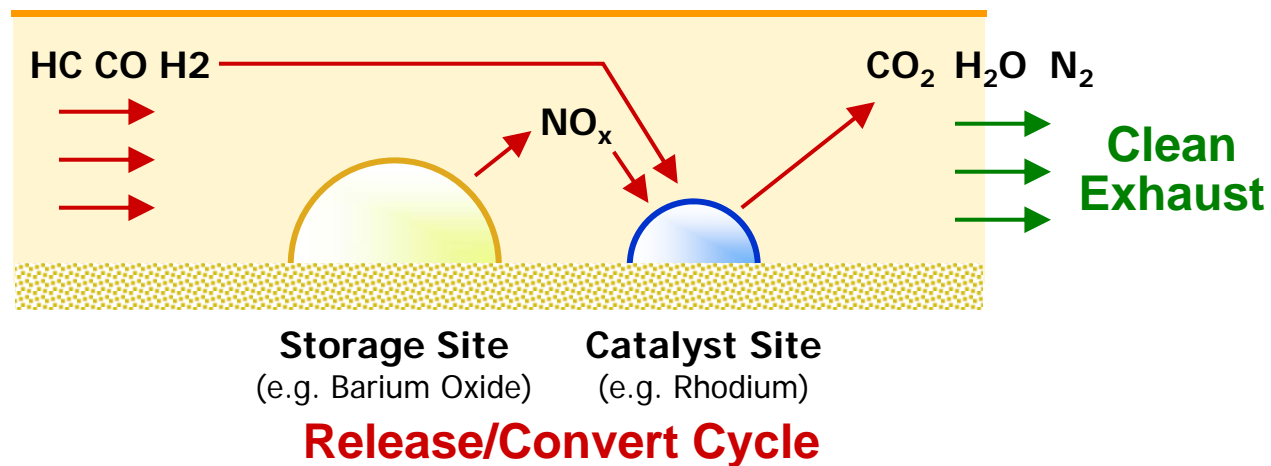
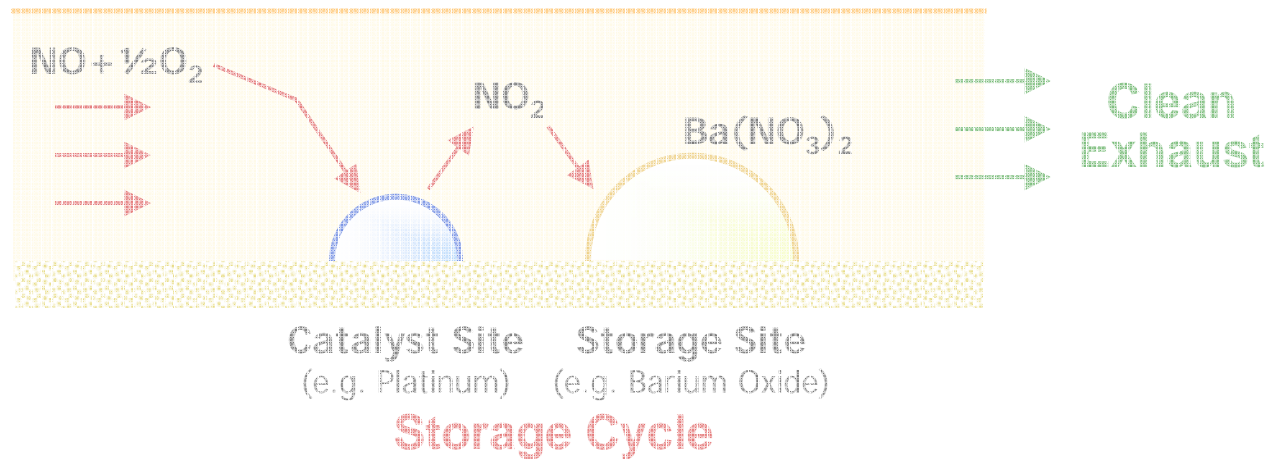
“Selective”

# NOx Adsorber Catalyst

Rich Exhaust plus  
Hydrocarbon Reductant



# NOx Adsorber Catalyst



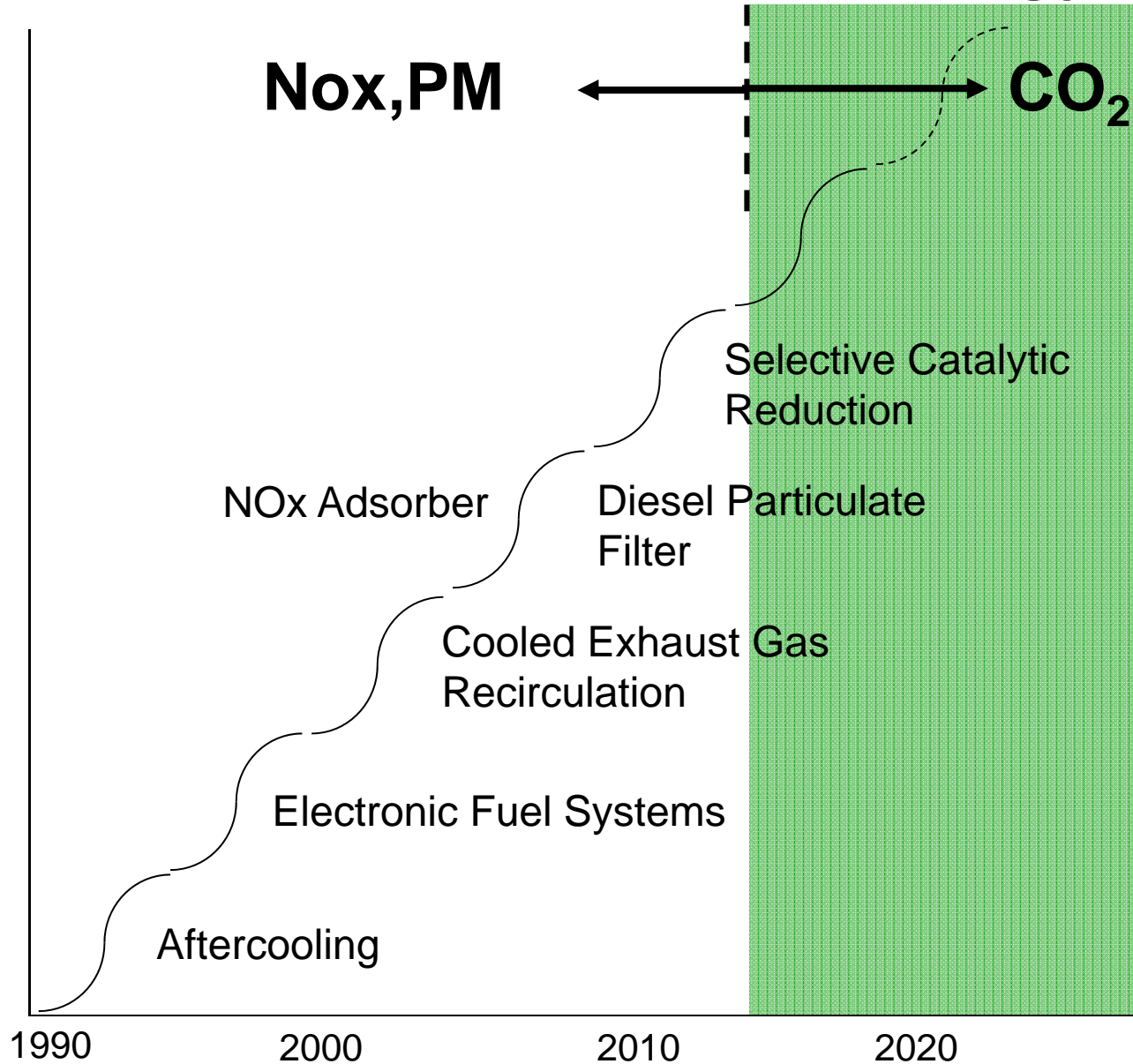
# The Right Technology Matters

- Broad technology portfolio
- Fit technology to market application

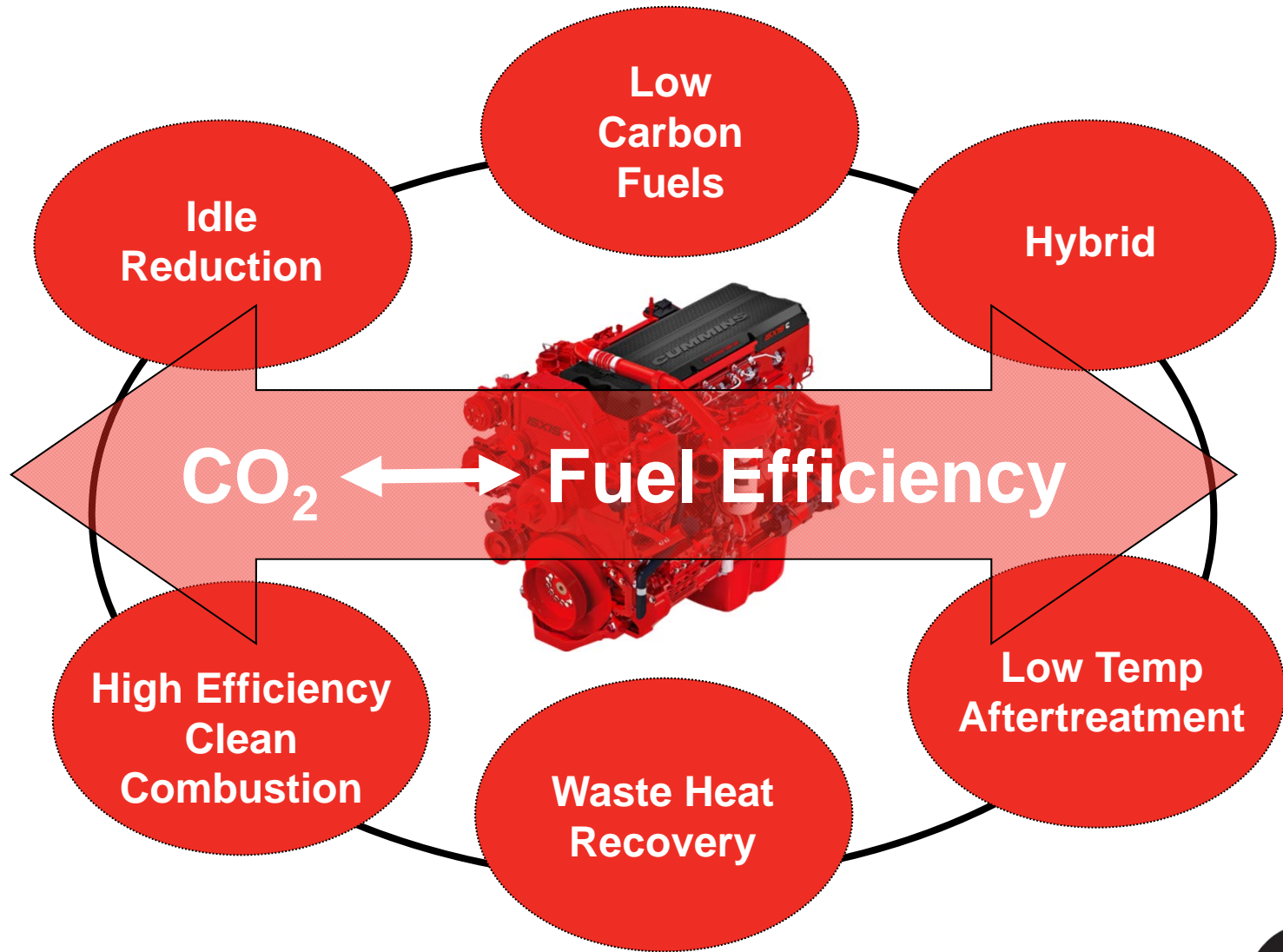
Application	First Date	In-Cylinder Only	Cooled EGR/VGT	NOx Adsorber	SCR	PM Aftertreatment
Tier 3 / EU Stage IIIA	2005	●				
EPA Tier 2 > 751 hp	2006	●				
Euro 4 On-Highway	2006				●	
EPA 07 On-Highway	2007		●			●
EPA 07/10 Pickup Truck	2007		●	●		●
Euro 5 On-Highway	2009				●	
EPA 10 On-Highway	2010		●		●	●
Tier 4 Interim / Stage IIIB	174-751 hp	2011	●			●
	75-173 hp	2012				



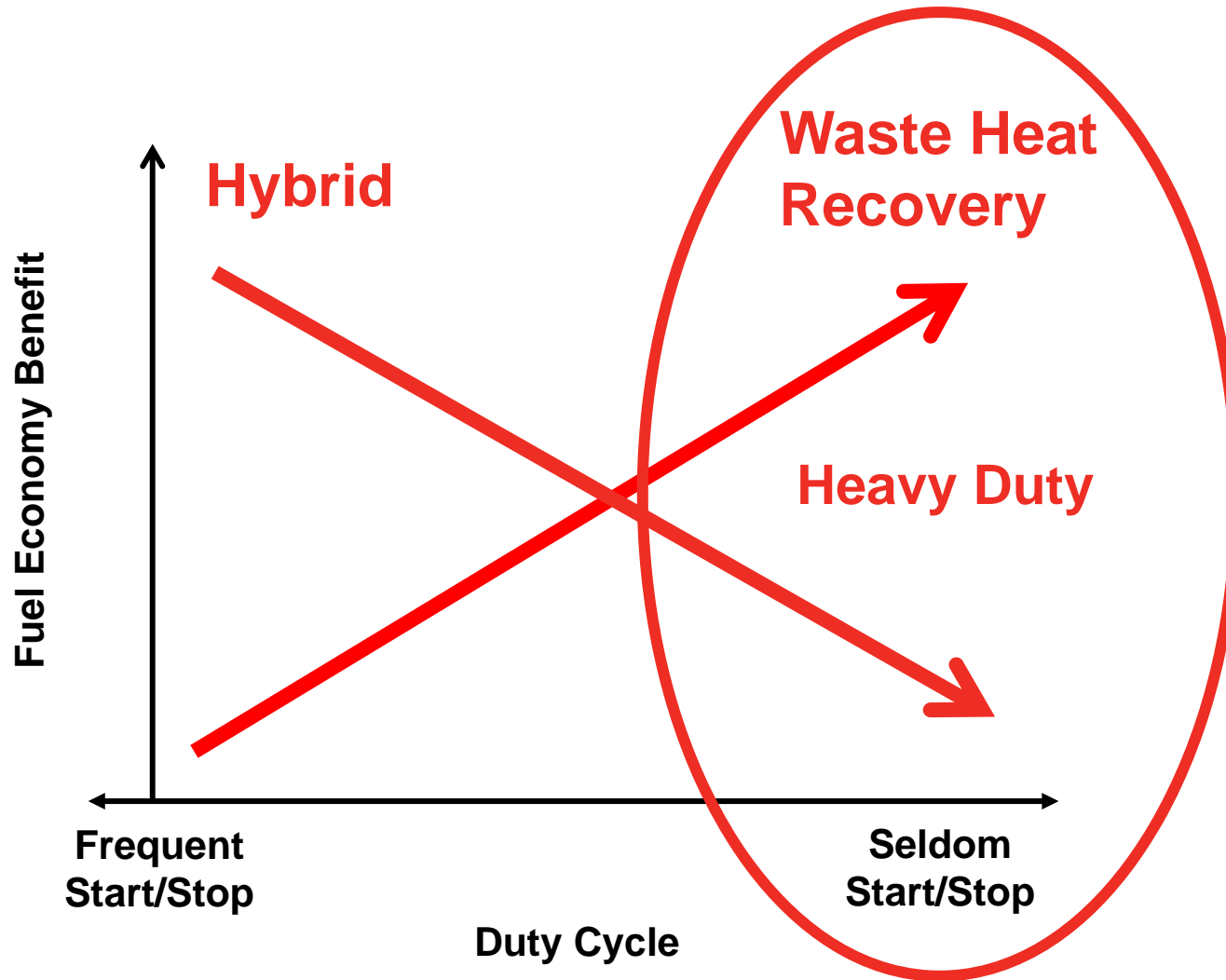
# Evolution of Diesel Technology



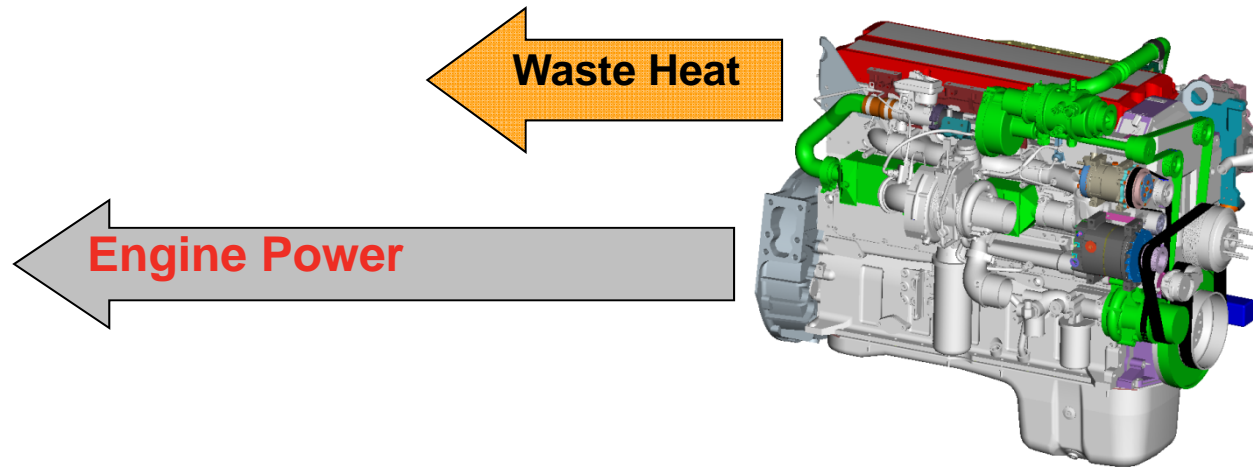
# Reducing CO<sub>2</sub>



# Waste Heat Recovery vs. Hybrid

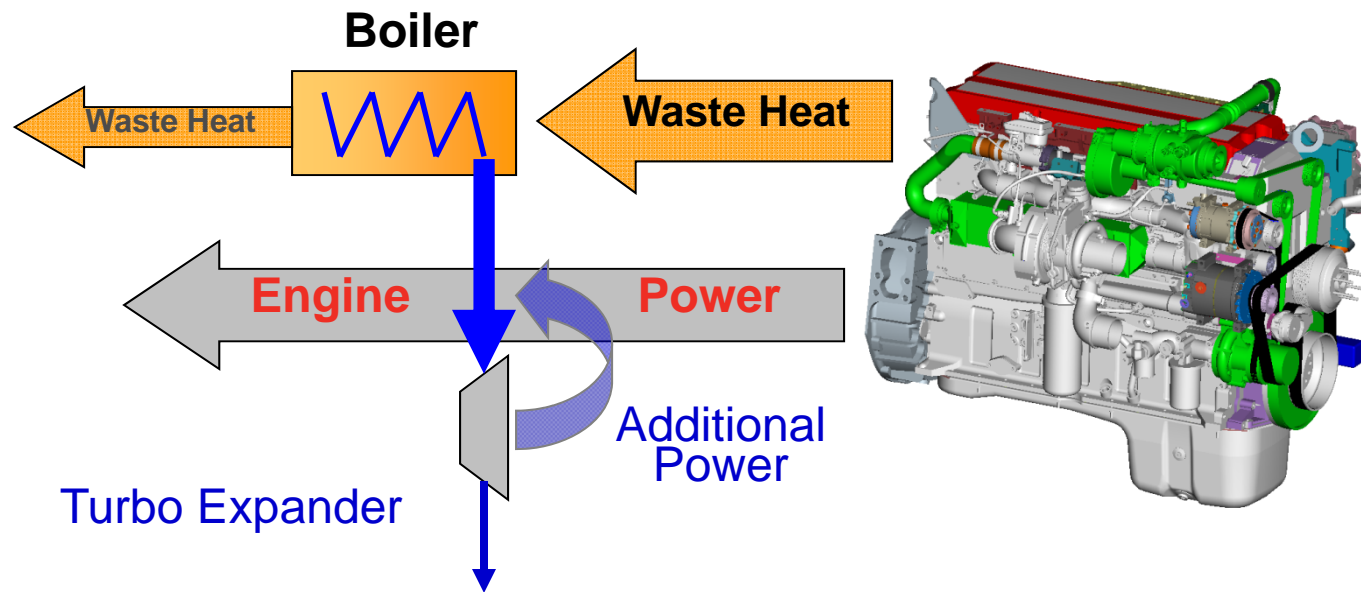


# Base Engine

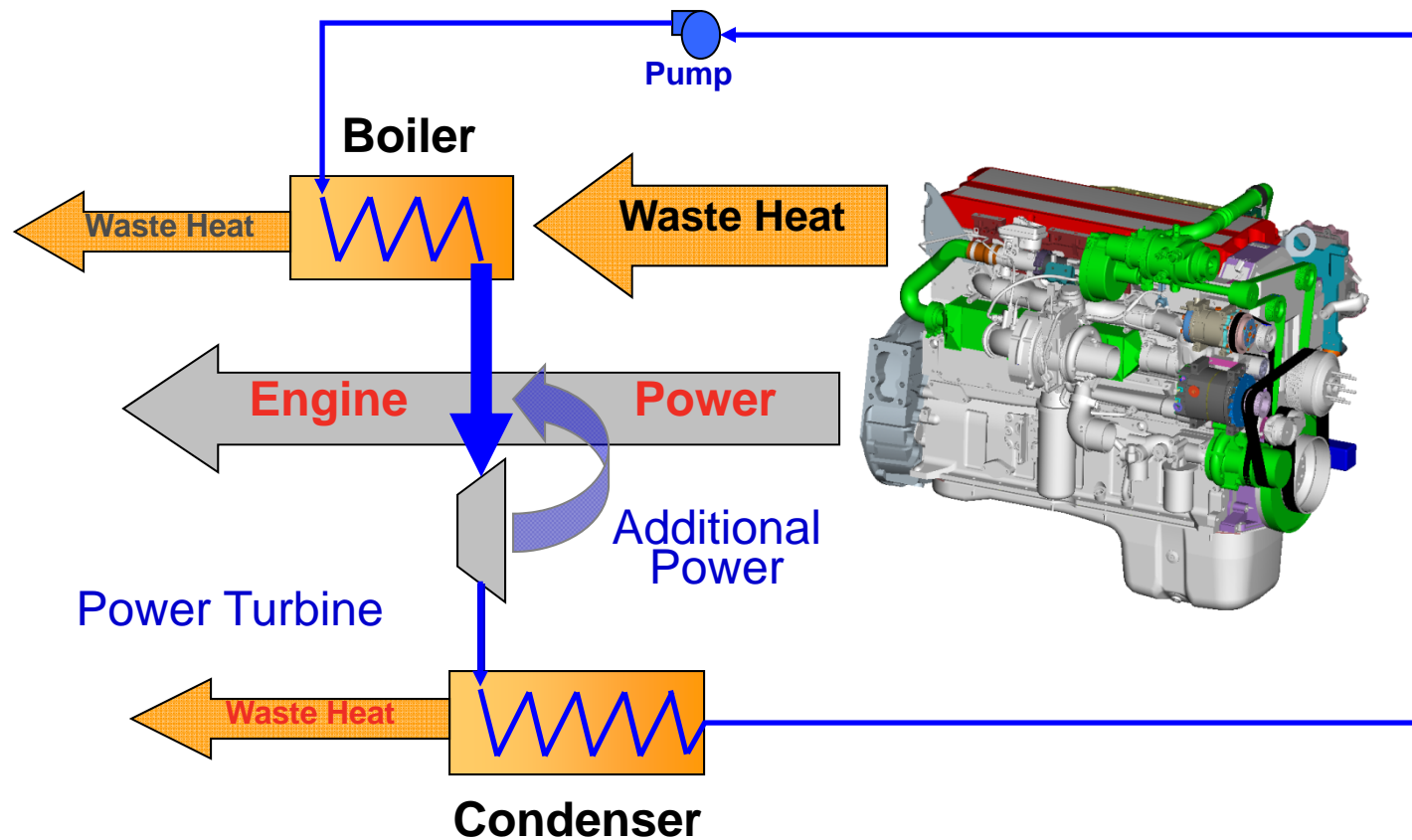




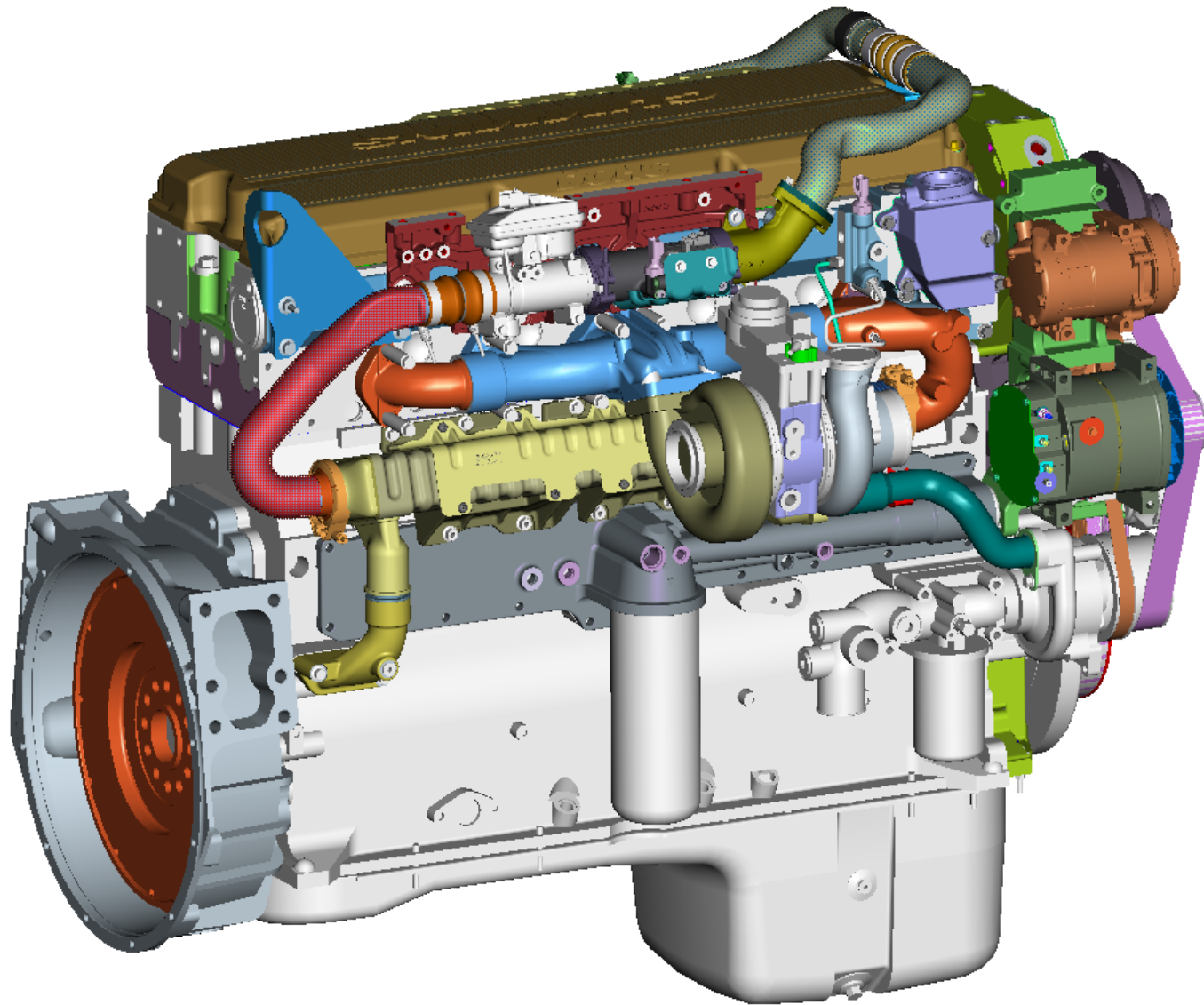
# Waste Heat Recovery



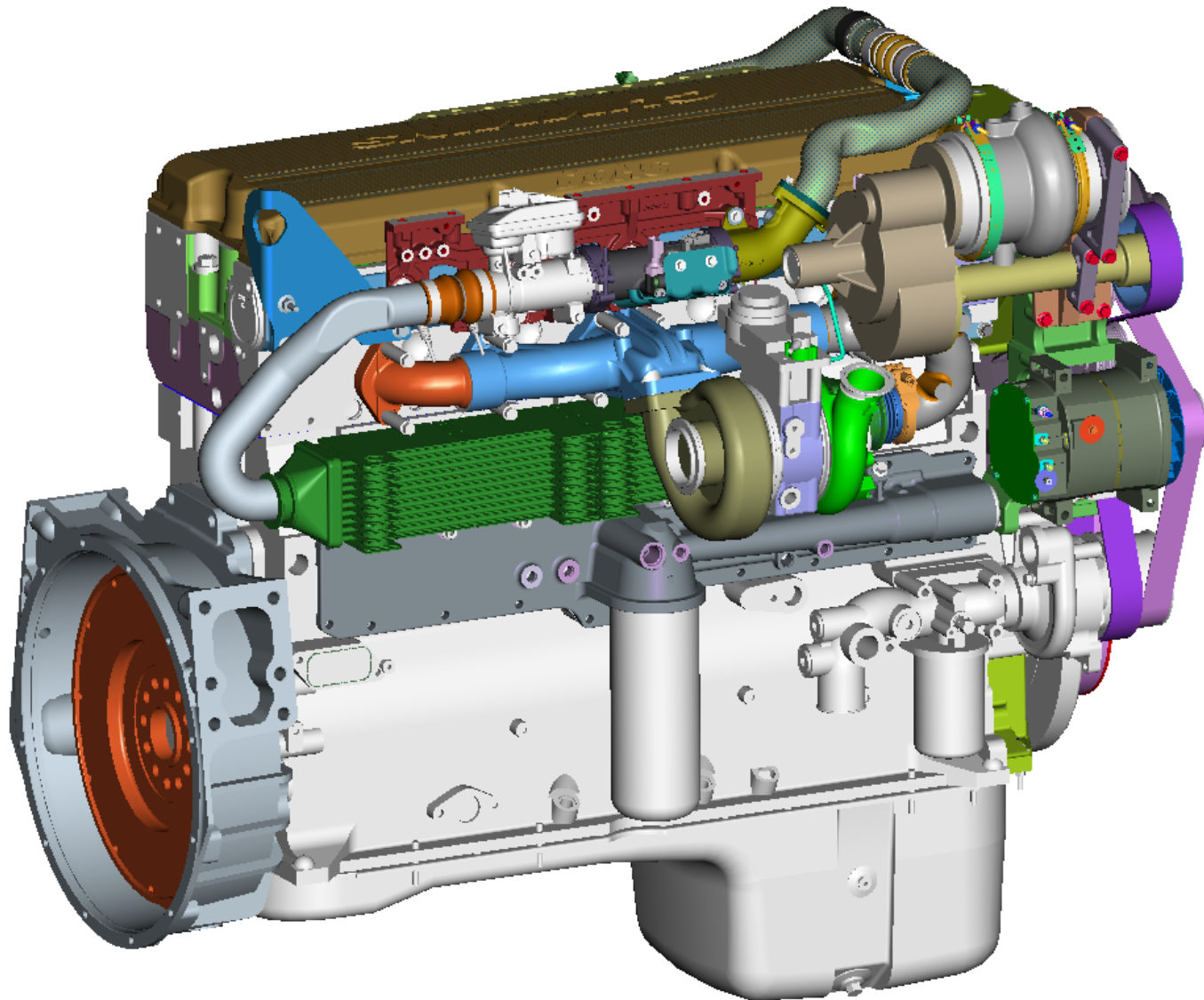
# Waste Heat Recovery



# ISX Engine with EGR



# ISX Engine with WHR

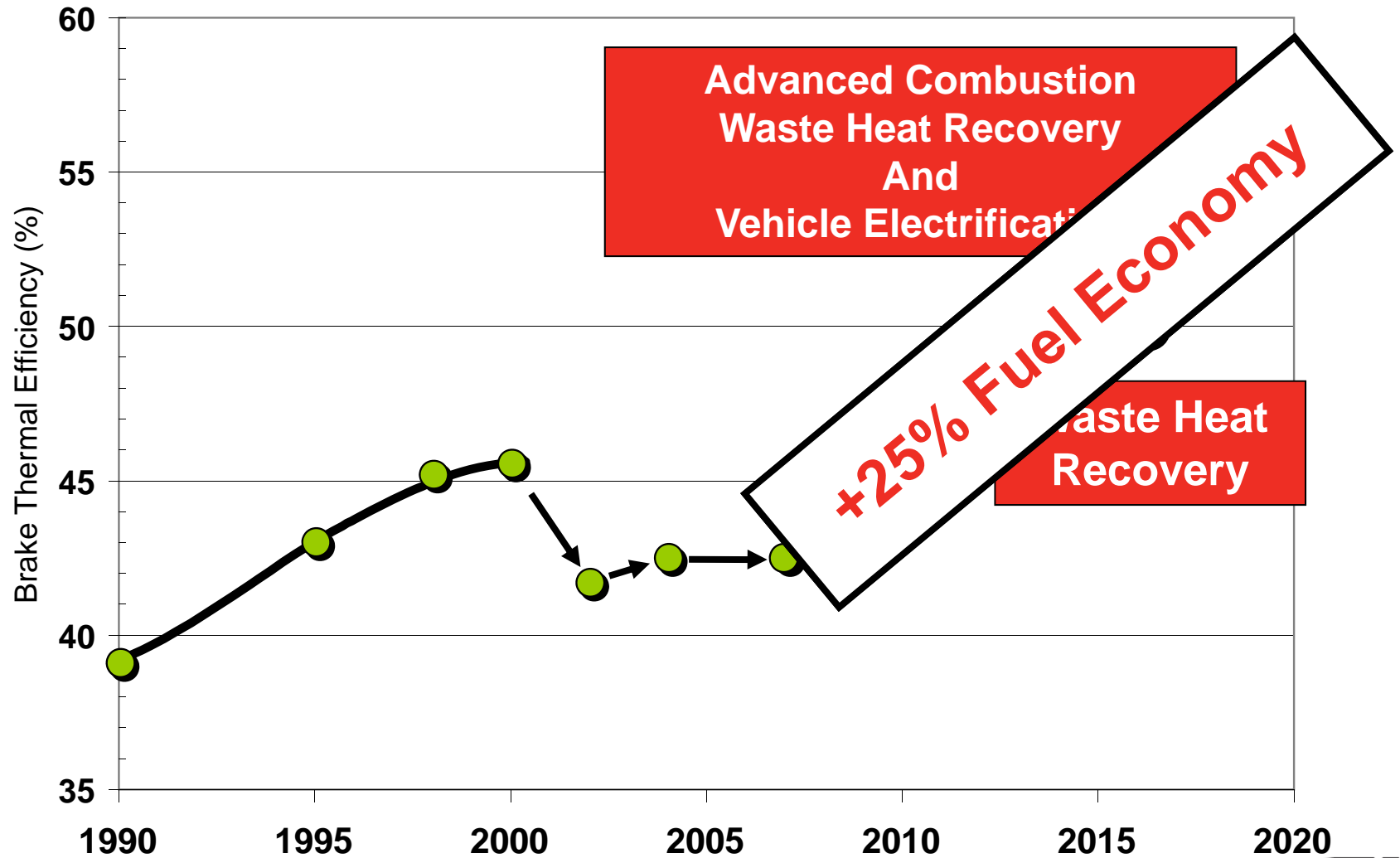


# Cummins DOE SuperTruck Program

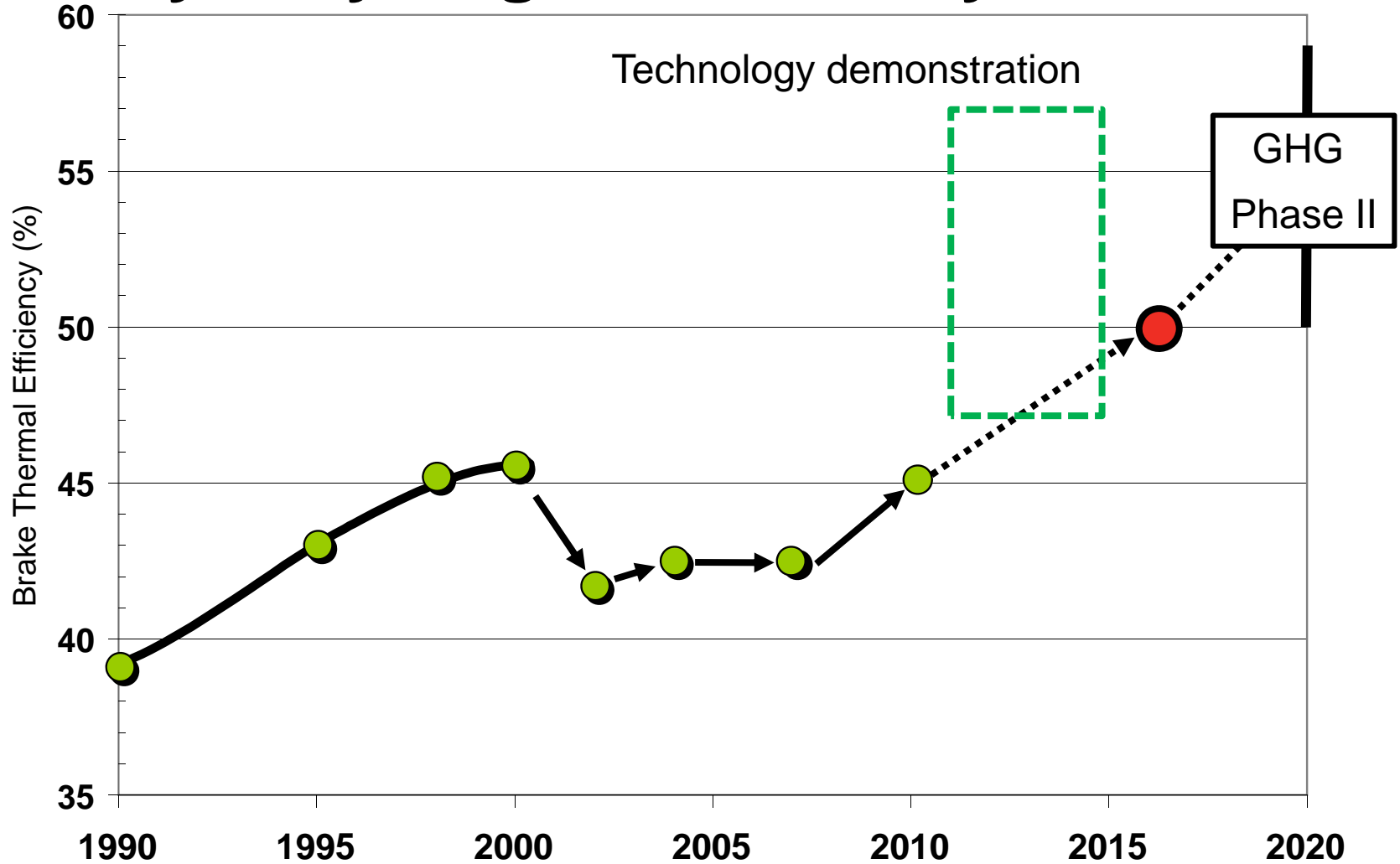
**System Integration**



# Heavy Duty Engine Efficiency



# Heavy Duty Engine Efficiency



# Advanced Medium Mobile Power Sources (AMMPS)



- >20% Improvement in fuel economy
- Up to 800 lb weight reduction

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# “Fit For Market”

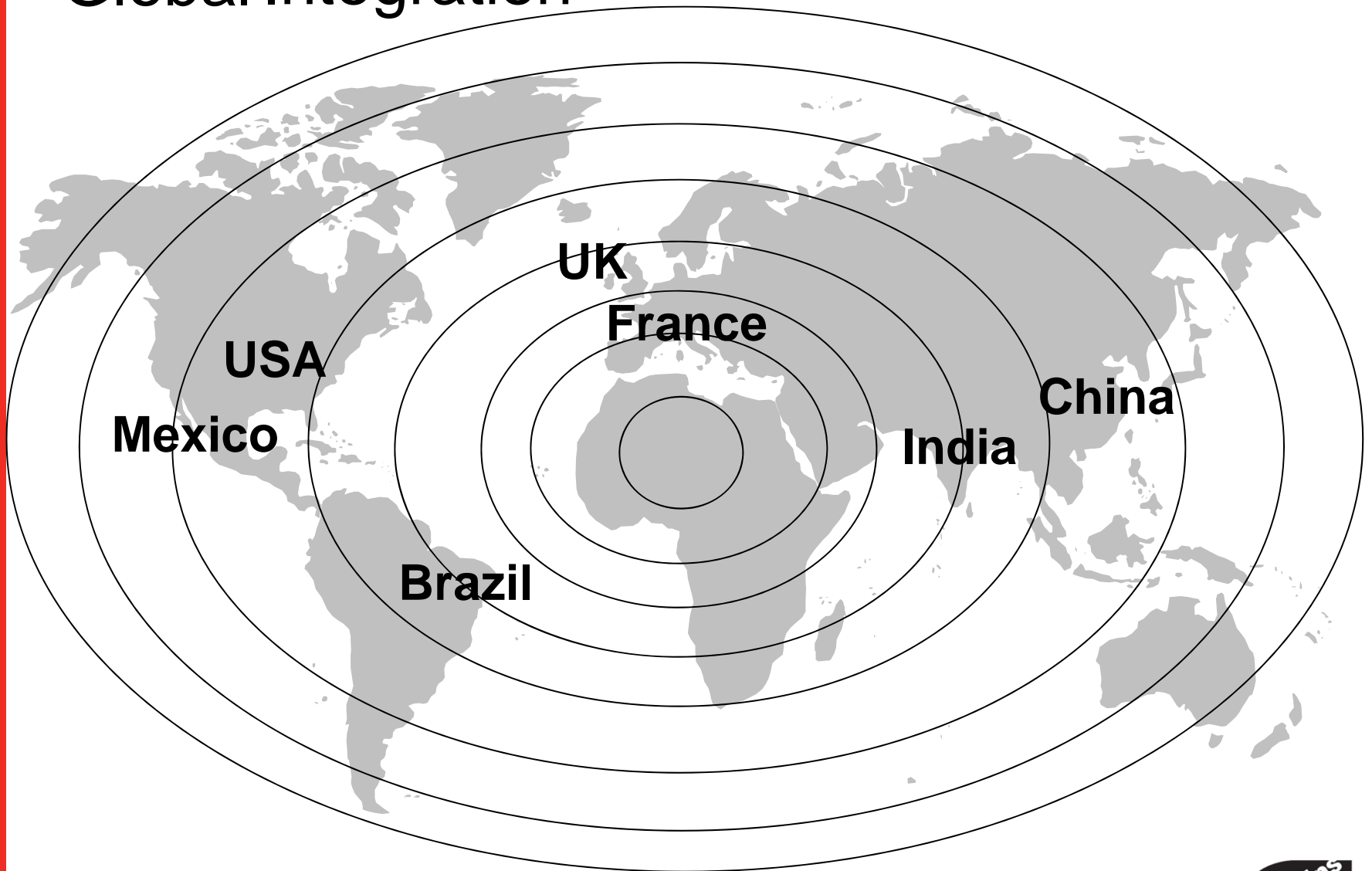
- *Global Presence*
- *Global Access*



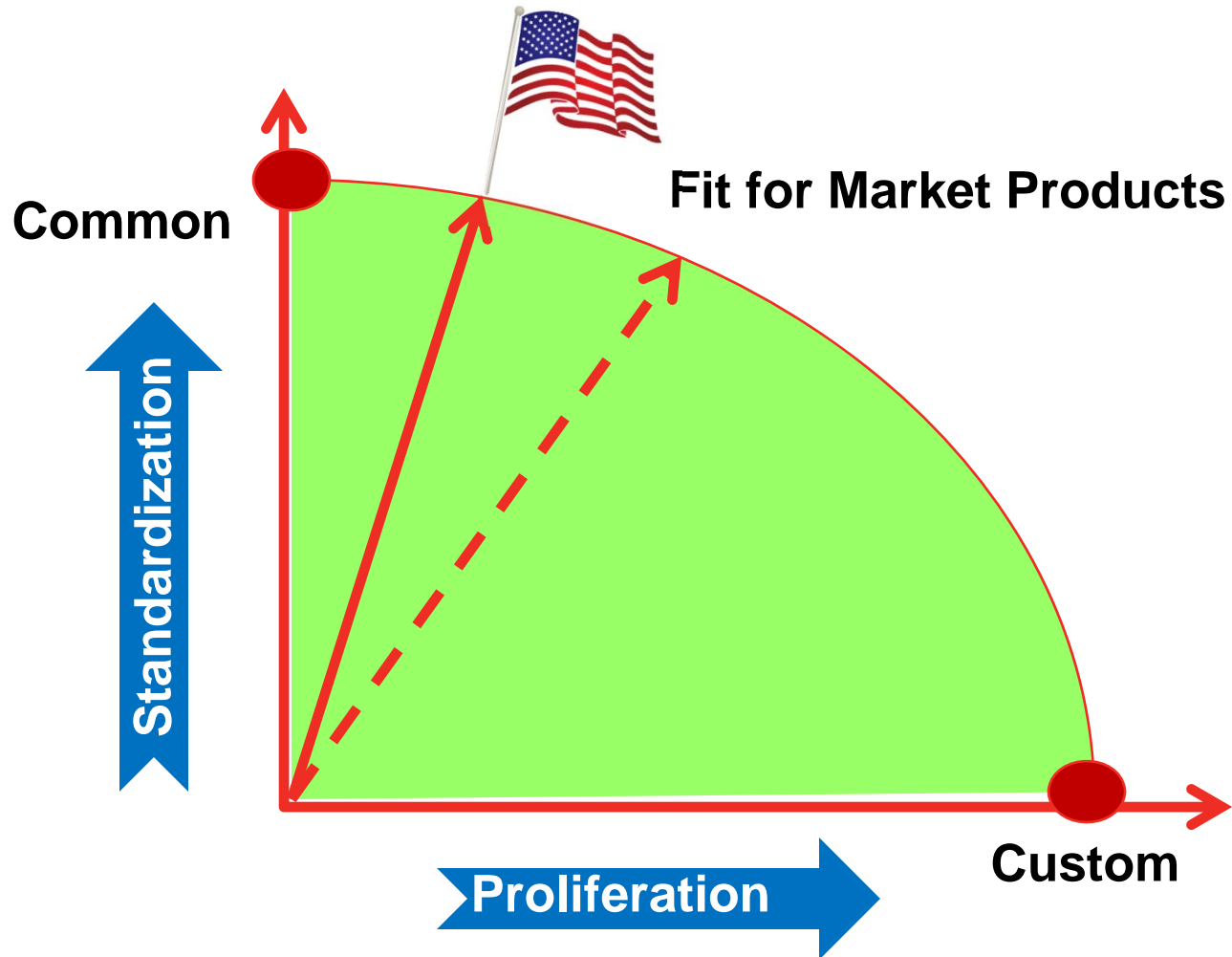
# Global Engineering Footprint



# Global Integration



# Fit for Market – Striking the Right Balance in Product Architecture





**Highly Sociable**



**High Performance**



**Low Maintenance  
and Easy  
Serviceability**



**High  
Energy  
Efficiency**



**Low Initial Cost**



**Reliability**



**Durability**



**Connected and  
Integrated  
Systems**

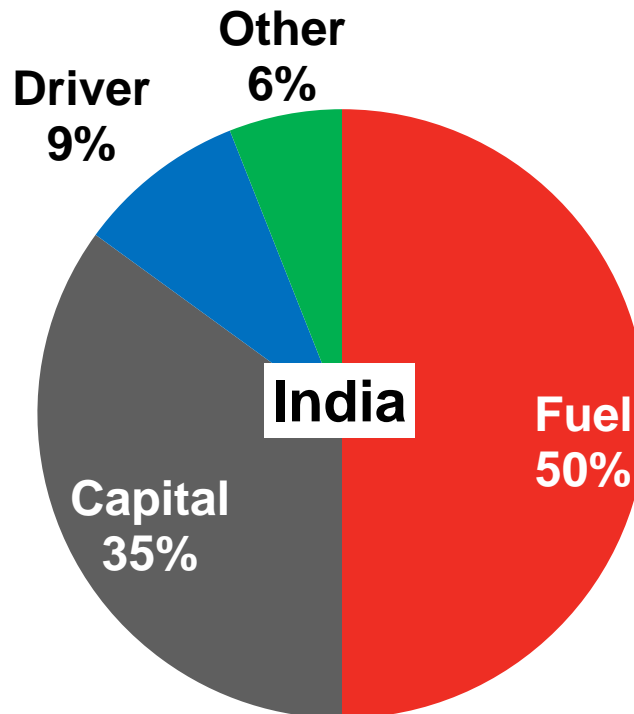
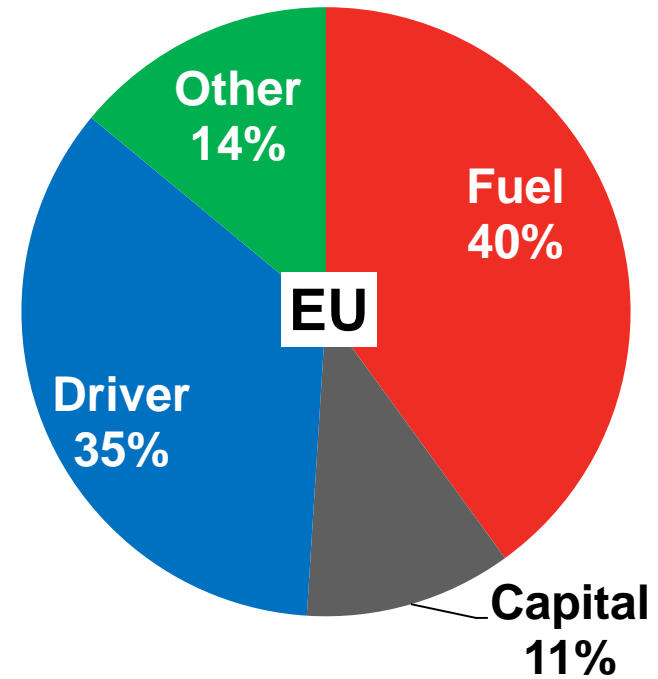


**High Aesthetics  
and Perceived  
Quality**





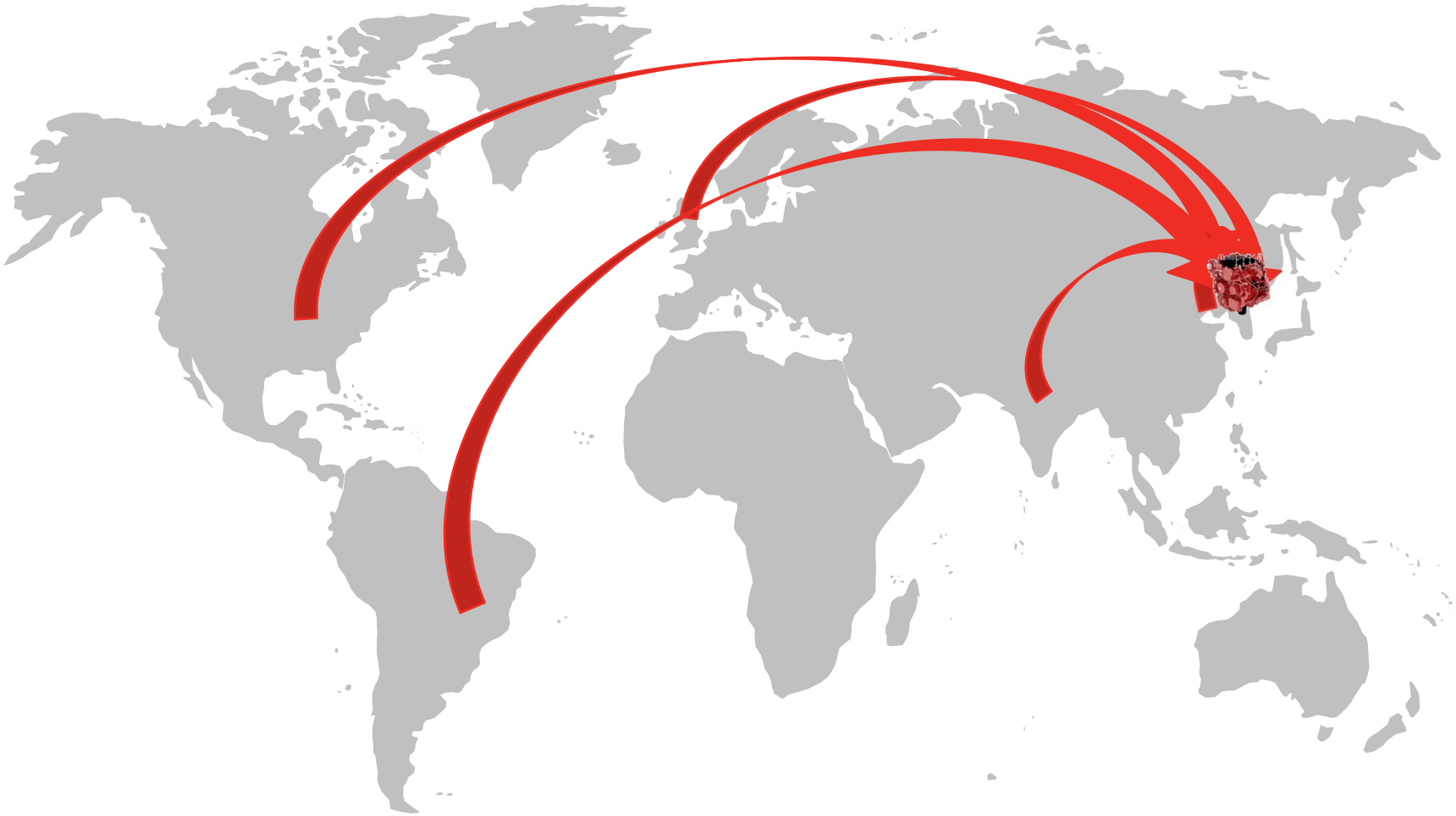
# Annual Truck Operation Cost Structure



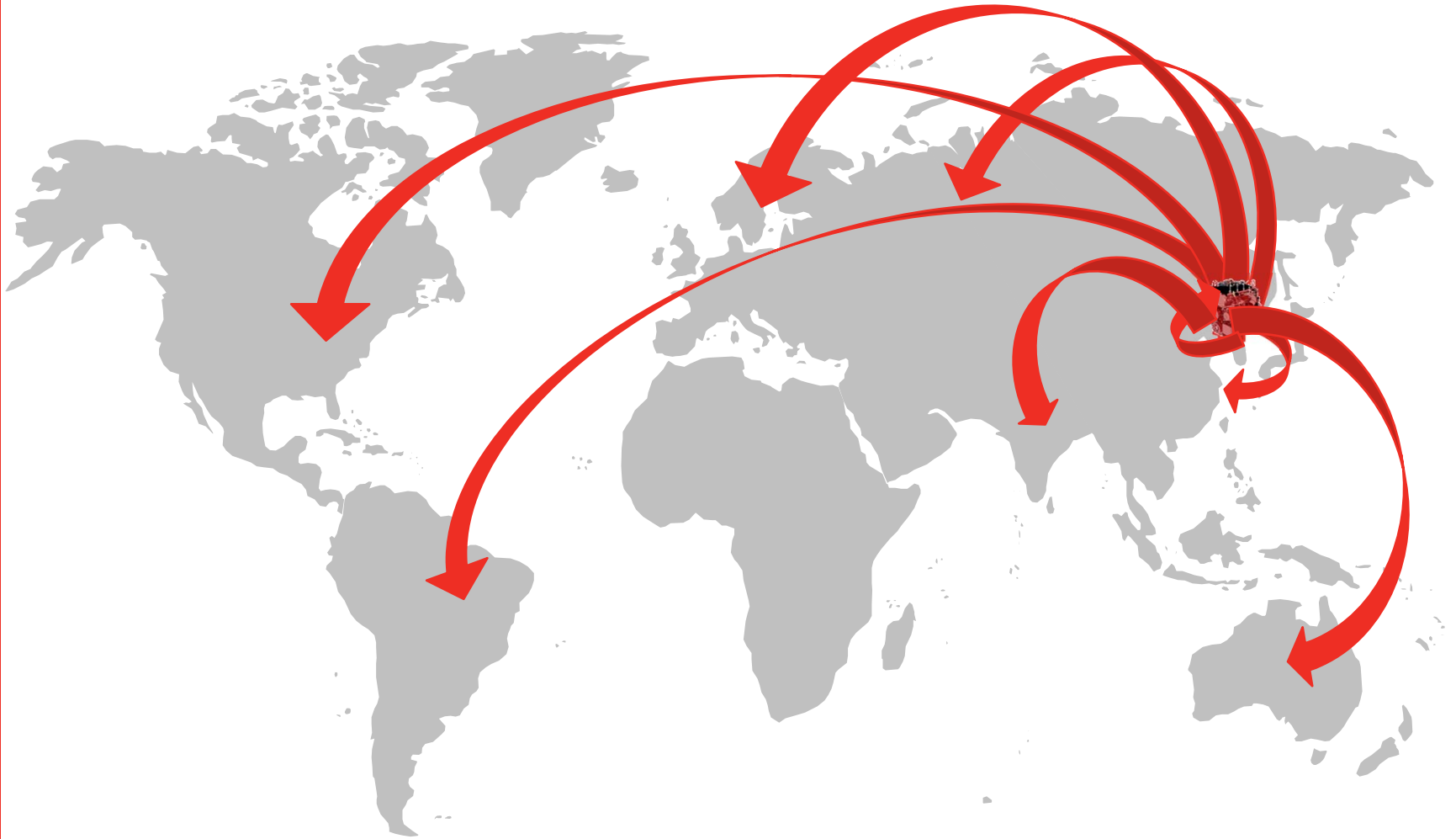




# ISF 2.8L/3.8L Engineering



# ISF 2.8L/3.8L Sales



# Building to Support Global Growth

PUNE, INDIA



WUHAN, CHINA



SEYMOUR, INDIANA



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