

*THE FASTEST AND MOST COST-EFFECTIVE PATH FOR  
DECARBONIZING HEAVY-DUTY APPLICATIONS*



**ClearFlame**  
ENGINE TECHNOLOGIES

**Green Drives – Naperville, IL**  
**Overview – May 17<sup>th</sup>, 2023**

# Sustainability will be a competitive differentiator

More than  
**90%**  
of S&P 500  
companies

&

**70%**  
of Russell 1000  
companies

Now publish some form of sustainability report

## THE CLIMATE TARGETS

OF FORTUNE 500 COMPANIES

In 2019, the world's 500 largest companies employed **70M people** and generated **\$33T in revenues**. Given their size and influence, many of these companies have made commitments to reduce their carbon footprint.

**This timeline provides a holistic view of when each company expects to achieve its stated target.**

### CLIMATE TARGET TYPE



#### CARBON NEUTRAL'

Achieved when a company completely offsets its greenhouse gas emissions.



#### RENEWABLE 100% (RE100)

Achieved when a company relies on 100% renewable energy.

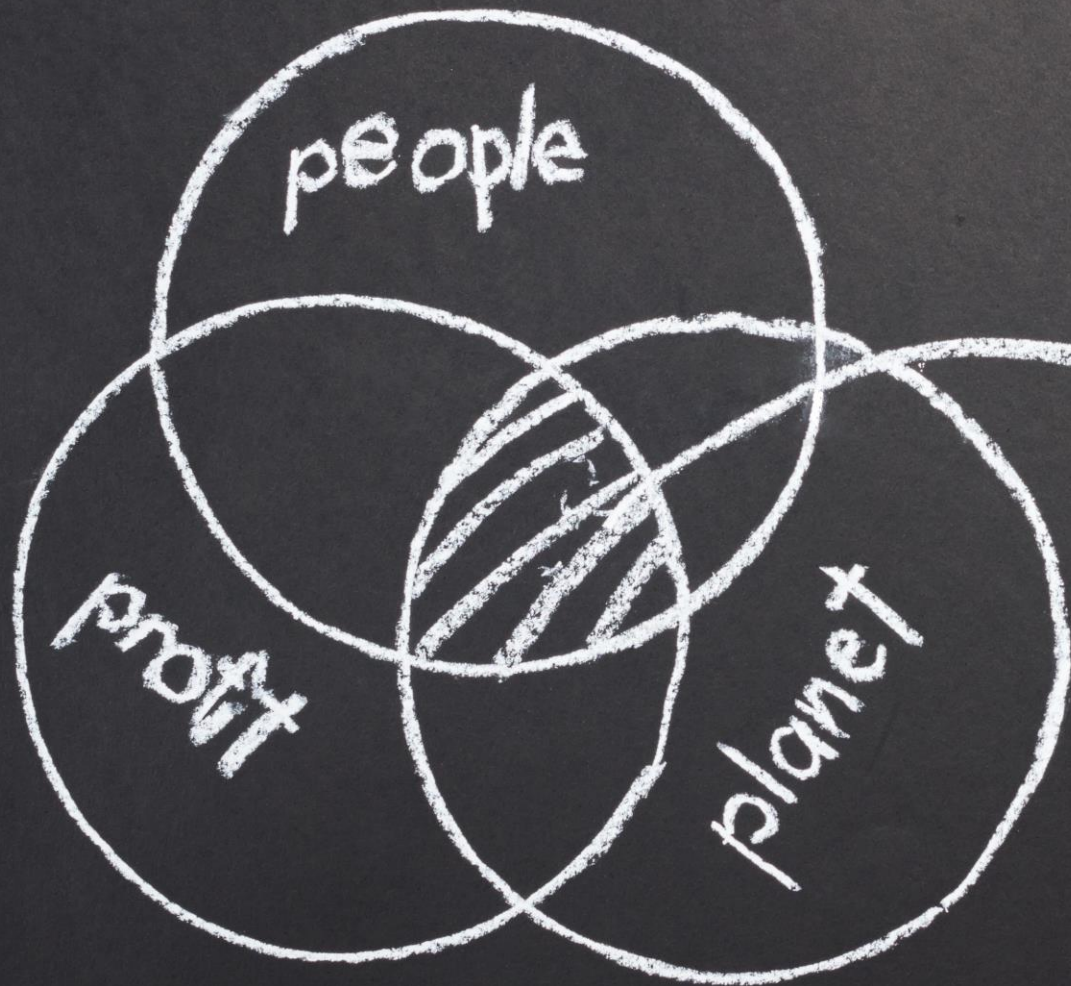


#### SCIENCE BASED TARGETS (SBT)

Emissions are reduced in line with the need to keep global warming below 2 degrees Celsius.

The screenshot shows a Politico article page. At the top, the Politico logo is in red, with navigation links for 'CONGRESS MINUTES', 'PRO', and 'E&E NEWS'. Below the logo, the article is categorized under 'FINANCE & TAX'. The main headline is 'SEC's Gensler weighs scaling back climate rule as lawsuits loom'. A sub-headline reads 'Potential changes to the proposal have been debated for months.' The author is listed as 'By DECLAN HARTY' with a timestamp of '02/04/2023 01:58 PM EST'. Social media sharing icons for Facebook, Twitter, and a link icon are visible. The article text begins with 'Securities and Exchange Commission Chair Gary Gensler is considering scaling back a potentially groundbreaking climate-risk disclosure rule that has drawn intense opposition from corporate America, according to three people familiar'.





→ sustainability



# Diesel Engines are Essential

**Trucks move nearly 3/4ths of the nation's freight by weight.**



**Over 100 billion dollars is spent on diesel fuel a year for business purposes**

**26%**  
**OF ON-ROAD GREENHOUSE GAS EMISSIONS**





## EV: One Answer, not the Only One



**“Long haul heavy trucks with significantly heavier batteries suffer from limited range and reduced payload capacity.”**

- Chris Spear, President and CEO  
American Trucking Association



# What is the Ideal Alternative to Diesel Fuel?



**Low Cost**



**Low Carbon**

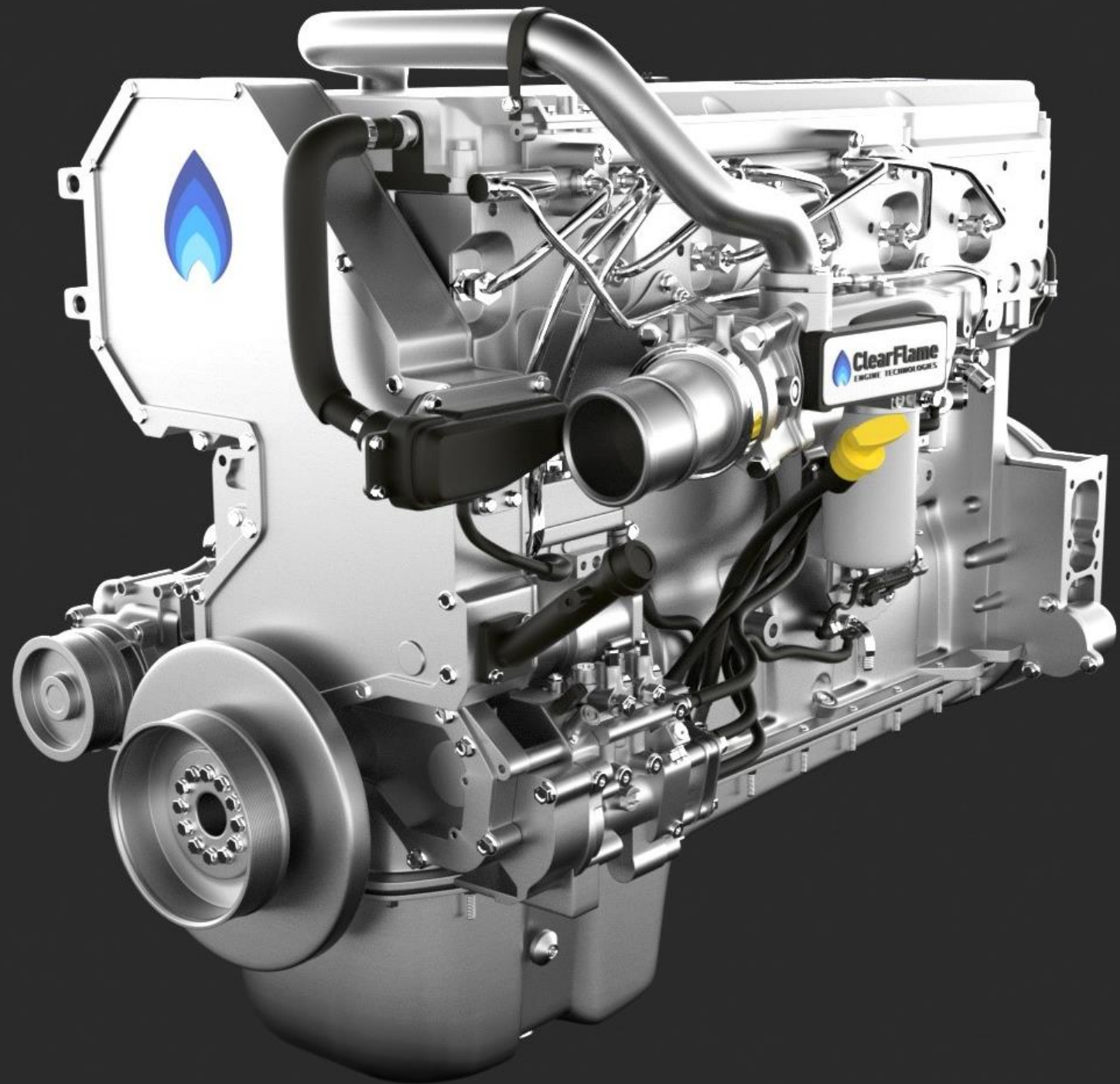


**Performance  
& Operability**



**Scale &  
Availability**













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# Why We Chose Our Path: Profit

Price per mile	Diesel @\$4.28/DGE*	Ethanol @\$2.63/DGE*	Differential
Truck	\$0.29	\$0.39	+\$0.10
Maintenance	\$0.12	\$0.12	0
Tires	\$0.03	\$0.03	0
Fuel	\$0.61	\$0.37	-\$0.24
<b>Total</b>	<b>\$1.05</b>	<b>\$0.91</b>	<b>-\$0.14</b>
	Diesel	Ethanol	Differential
Lifetime CO <sub>2</sub> (tons)	1,394	808	-42%

\*DGE = diesel gallon equivalent



























“ClearFlame's technology offers the lowest total cost of ownership of any current technologies, including diesel, natural gas, electric and hydrogen.”  
- TCO Study by GNA

Payback in  
**18 months**

Reduce lifetime  
CO<sub>2</sub> by  
**42 %**



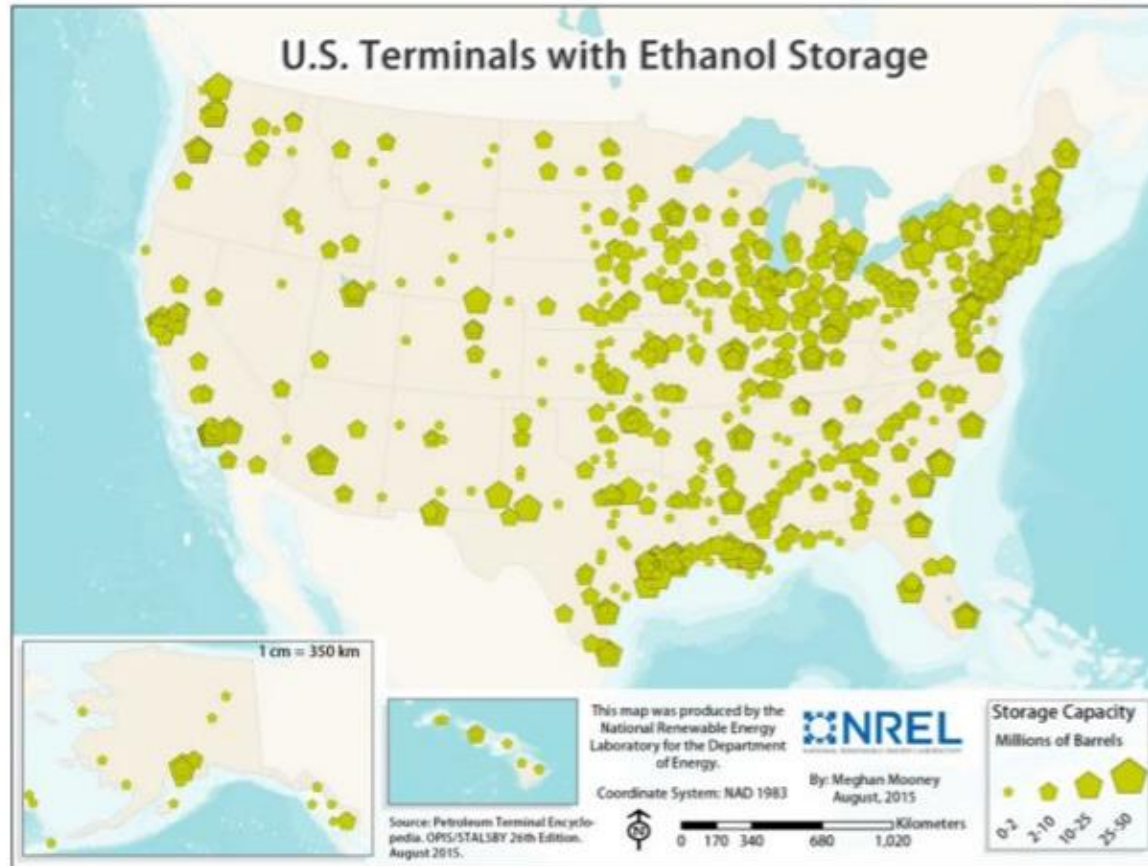
# Why We Chose Our Path: Carbon Reduction

	 <b>BATTERY/ELECTRIC</b>	 <b>HYDROGEN</b>	 <b>SUSTAINABLE LIQUID FUELS</b>
1 icon represents limited long-term opportunity  2 icons represents large long-term opportunity  3 icons represents greatest long-term opportunity 			
Light Duty Vehicles (49%)*		—	TBD
Medium, Short-Haul Heavy Trucks & Buses (~14%)			
Long-Haul Heavy Trucks (~7%)			 ←
Off-road (10%)			
Rail (2%)			
Maritime (3%)			
Aviation (11%)			
Pipelines (4%)		TBD	TBD
<b>Additional Opportunities</b>	<ul style="list-style-type: none"> <li>• Stationary battery use</li> <li>• Grid support (managed EV charging)</li> </ul>	<ul style="list-style-type: none"> <li>• Heavy industries</li> <li>• Grid support</li> <li>• Feedstock for chemicals and fuels</li> </ul>	<ul style="list-style-type: none"> <li>• Decarbonize plastics/chemicals</li> <li>• Bio-products</li> </ul>
<b>RD&amp;D Priorities</b>	<ul style="list-style-type: none"> <li>• National battery strategy</li> <li>• Charging infrastructure</li> <li>• Grid integration</li> <li>• Battery recycling</li> </ul>	<ul style="list-style-type: none"> <li>• Electrolyzer costs</li> <li>• Fuel cell durability and cost</li> <li>• Clean hydrogen infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple cost-effective drop-in sustainable fuels</li> <li>• Reduce ethanol carbon intensity ←</li> <li>• Bioenergy scale-up</li> </ul>





# Why this Approach? Fuel Availability



U.S. Ethanol Availability





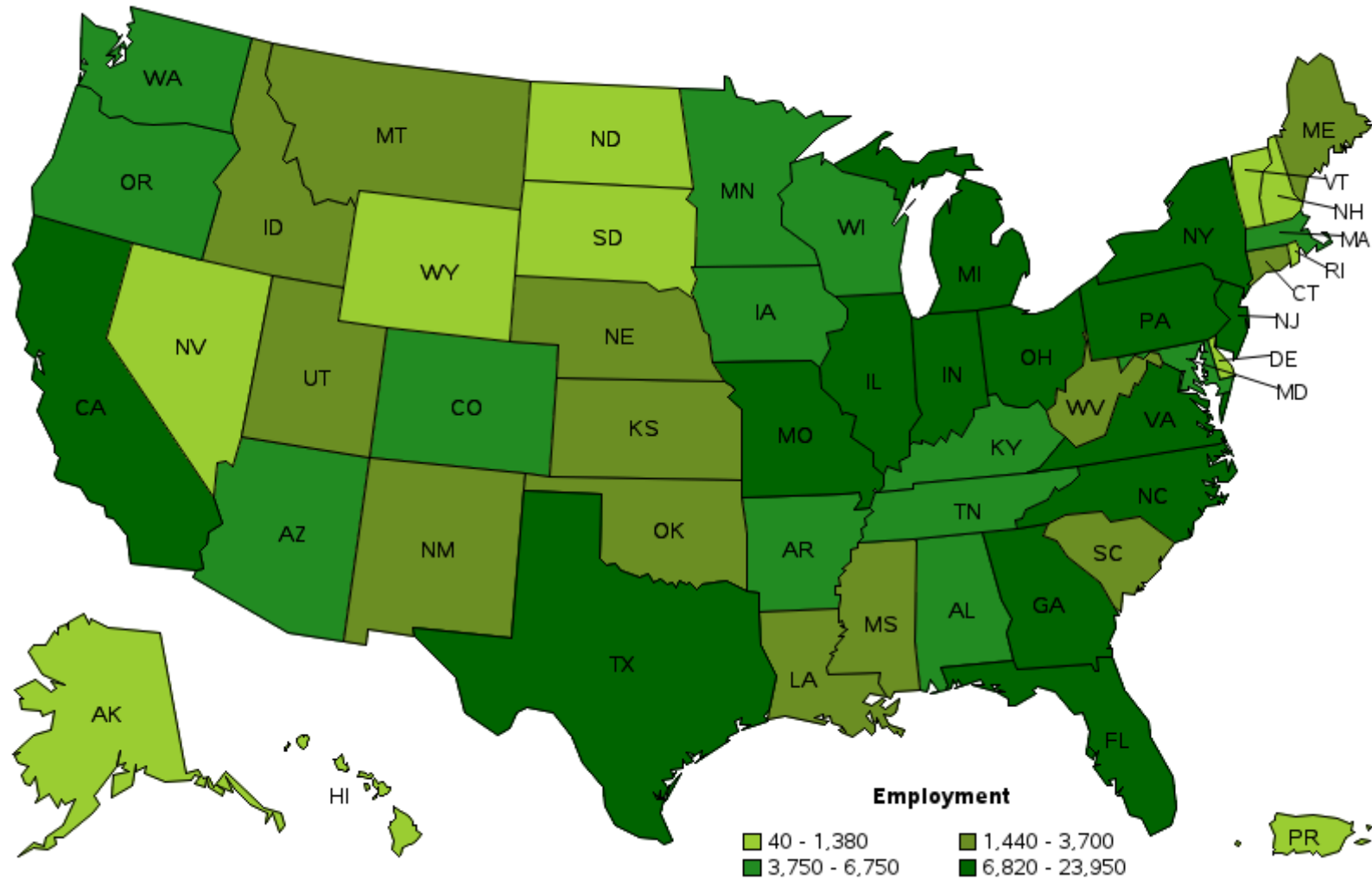


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# Why We Chose Our Path: Service/Repair





# What is the Ideal Alternative to Diesel Fuel?



**Low Cost**



**Low Carbon**



**Performance  
& Operability**

**+**



**Scale &  
Availability**





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# ENGINEERING TRANSFORMATIONAL INNOVATIONS

for people, planet and profit



Long-Haul Trucking

Mining

Power Generation

Agriculture