

# NOVVI

Improved Performance Delivering a Low  
Carbon Future Through Extraordinary  
Innovation.



## **Top-Tier, Carbon-Neutral Base Oils: The Best Route to Lowering Your Carbon Footprint**

**By William R. Downey Jr.  
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20 October 2022**



# **A TOP-TIER, HYDROCARBON BASE OIL...**

**The Best Route  
to Lowering Your Carbon Footprint**

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to Lowering Your Carbon Footprint**

**Who Is Novvi?**

# WHO IS NOVVI?

**Accelerate adoption of  
high-performance,  
sustainable chemicals.**





# WHAT IS A HYDROCARBON BASE OIL?



**Biobased  
≠  
Veg Oil or  
Ester**

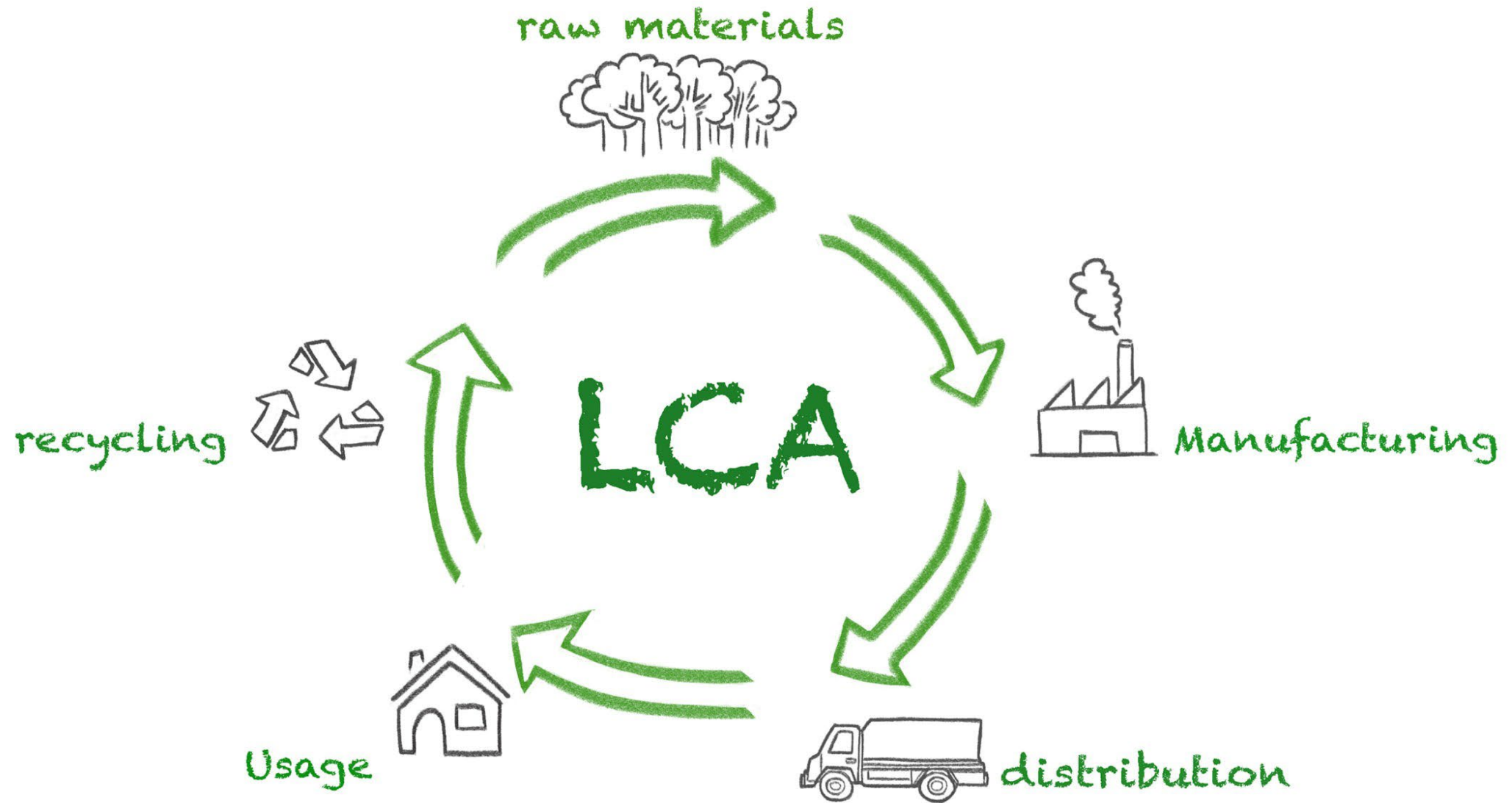


**SSBO**

# **A Top-Tier, Hydrocarbon Base oil; Best Route, Low Carbon**

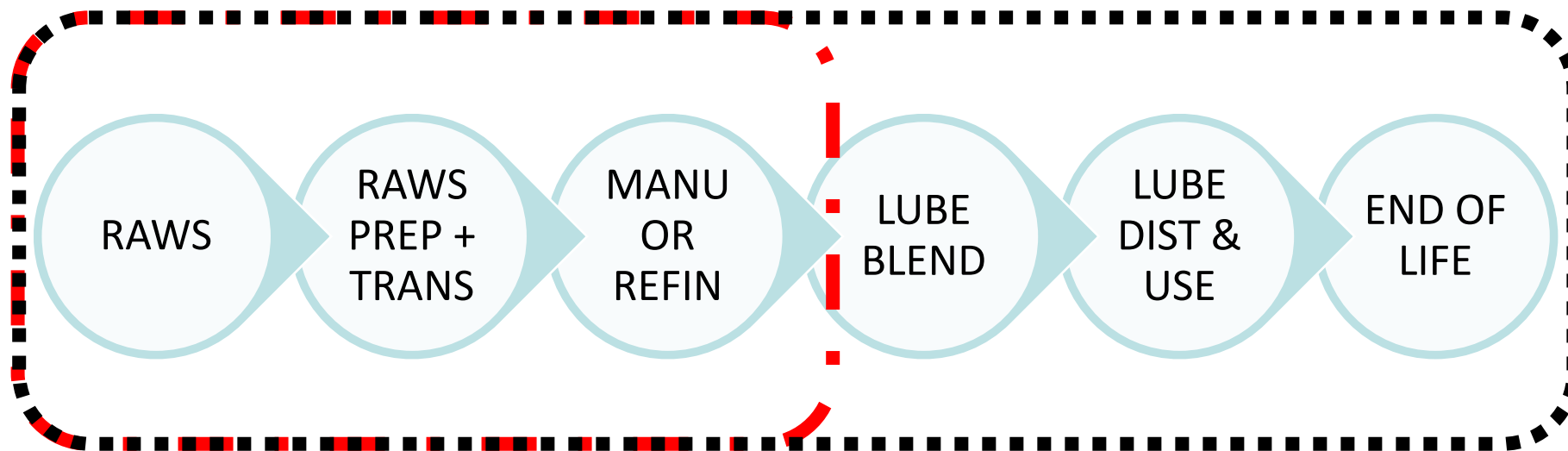
## **What Is Carbon Footprint?**

# STARTS WITH A LIFE CYCLE ASSESSMENT – AN LCA



# A BASE OIL LCA LOOKS LIKE THIS


## CRADLE-TO-GATE – C2Ga



## CRADLE-TO-GRAVE – C2Gr



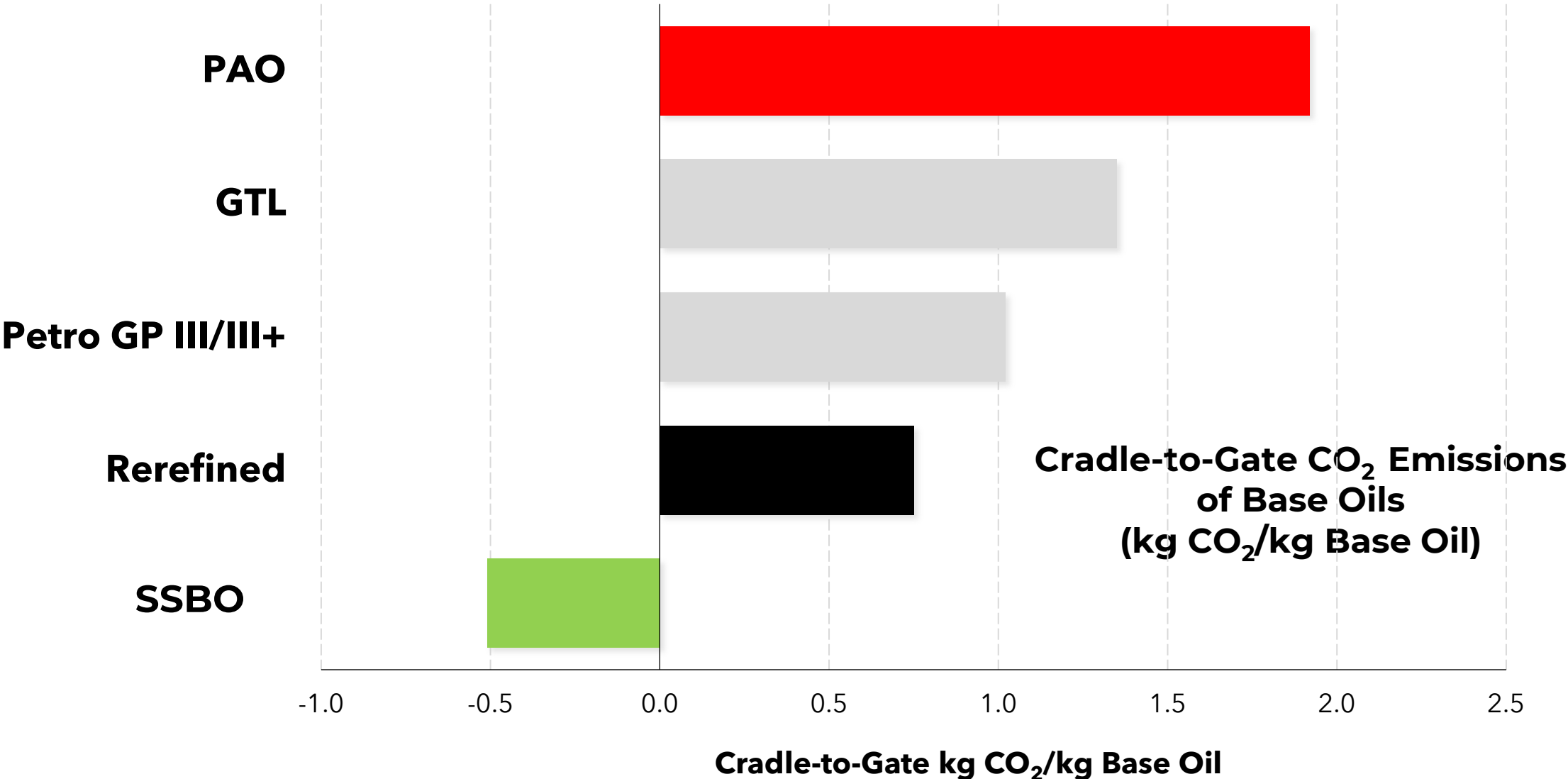
# WHAT IS THE DIFFERENCE? RAW MATERIALS



CO<sub>2</sub> In  
O<sub>2</sub> Out

- Process is feedstock agnostic
- ...And discloses the plant oil source to customers
- Emphasis on sustainability credentials
- Suppliers sign a contract and provide proof of compliance
- Dynamic area and Nowvi has options
- ESG policies of large companies driving change
- Yes, foodstuffs but small impact

# NOVVI'S BO IS A CARBON NEGATIVE PRODUCT (CRADLE-TO GATE)

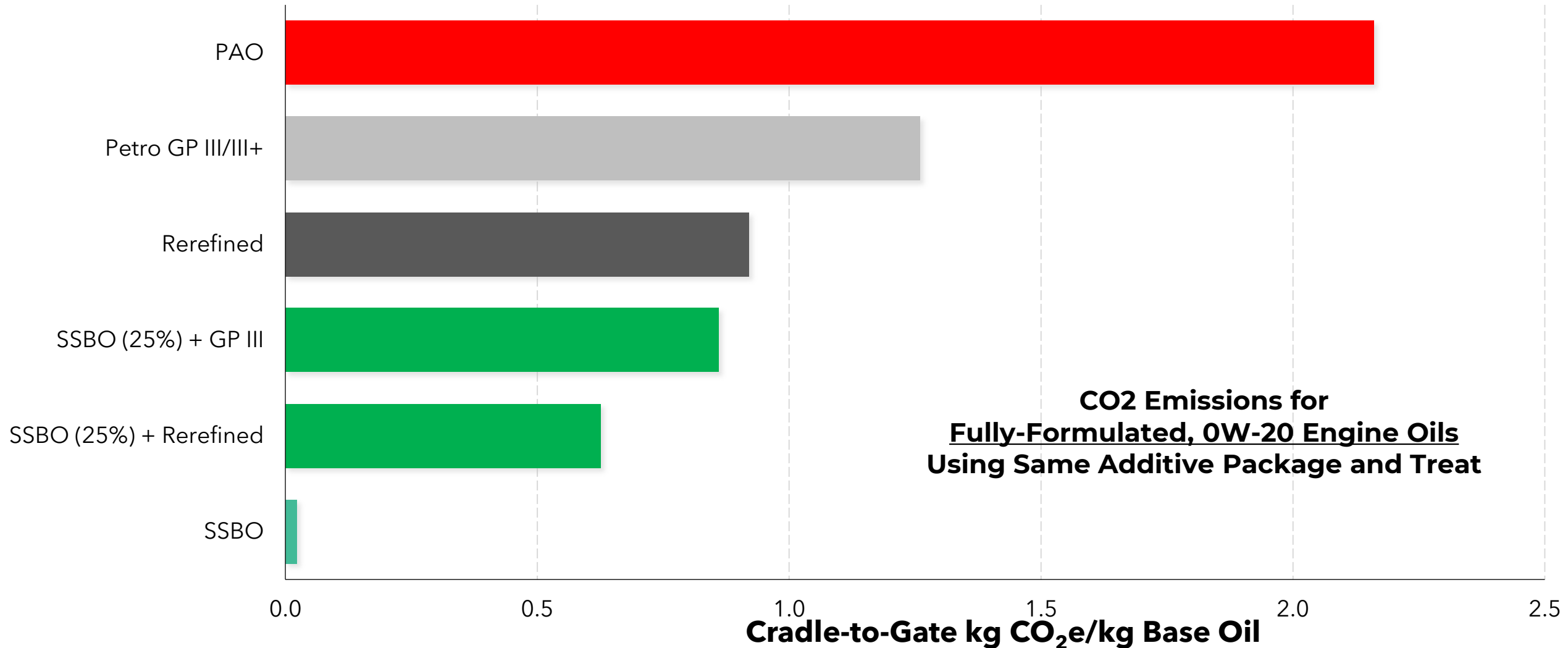


Petroleum derived base stock Cradle-to-Gate analysis; obtained from peer reviewed publications: Girotti et al, 2011, Forman 2008, Fehrenbach, Ifeu 2005



# A CARBON NEGATIVE BASE OILS CAN MAKE...

## ... Lower Carbon Footprint Engine Oils



# HYDROCARBON BASE OIL, TOP-TIER PERFORMANCE, CARBON NEGATIVE...

Carbon Negative – Using LCA Accounting,  
Measure Total CO<sub>2</sub>E produced  
Cradle-to-Gate.

Positive, Neutral or **Negative?**



# **A Top-Tier, Hydrocarbon Base oil; Best Route, Low Carbon**

## **What Makes 'Top-Tier' Performance?**

# HOW IS IT TOP-TIER? BETTER FUEL ECONOMY (FE)

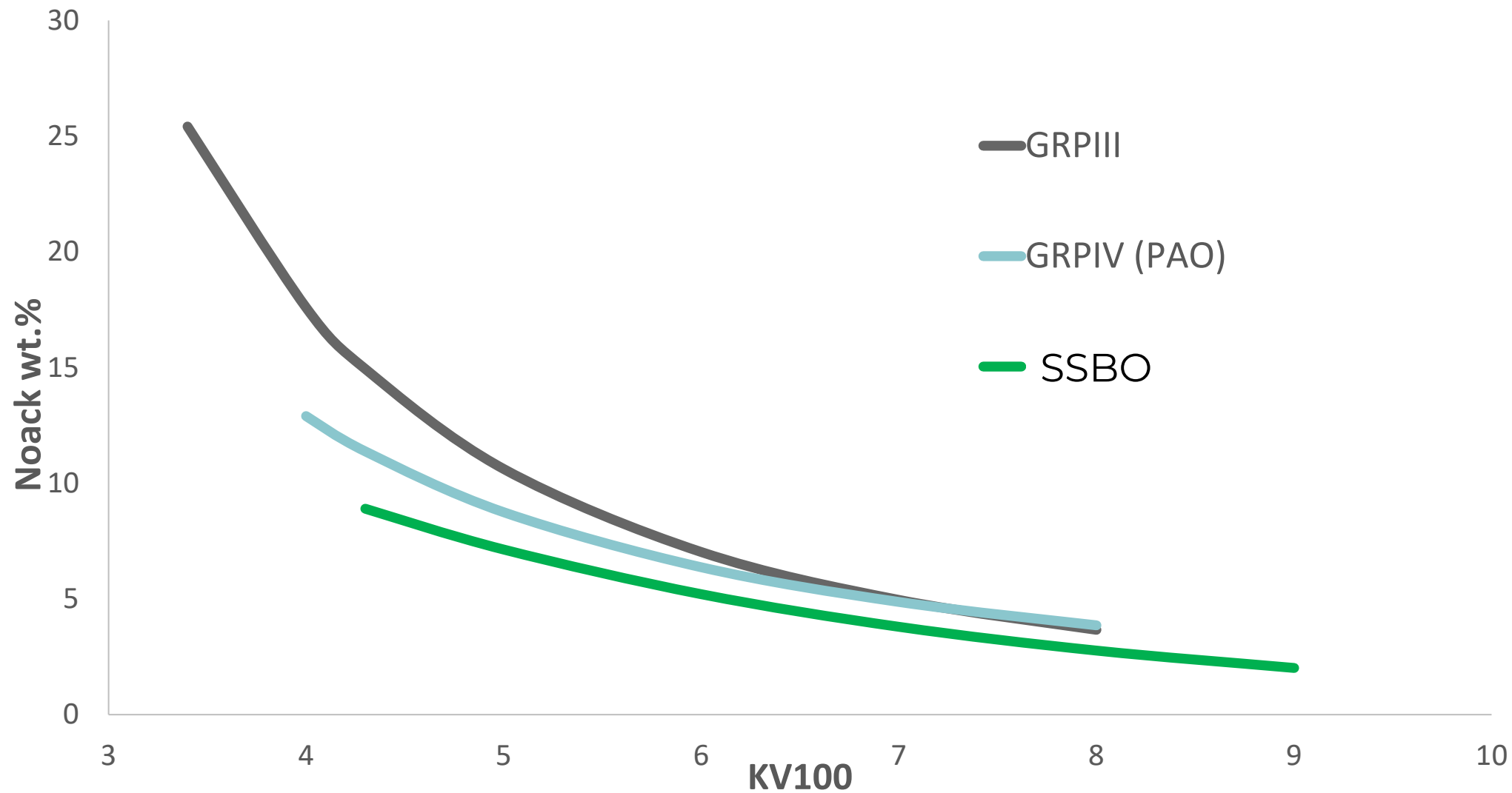
## Base Oil Contributes to FE By 3 Main Physical Properties:



**Viscosity/  
Volatility**

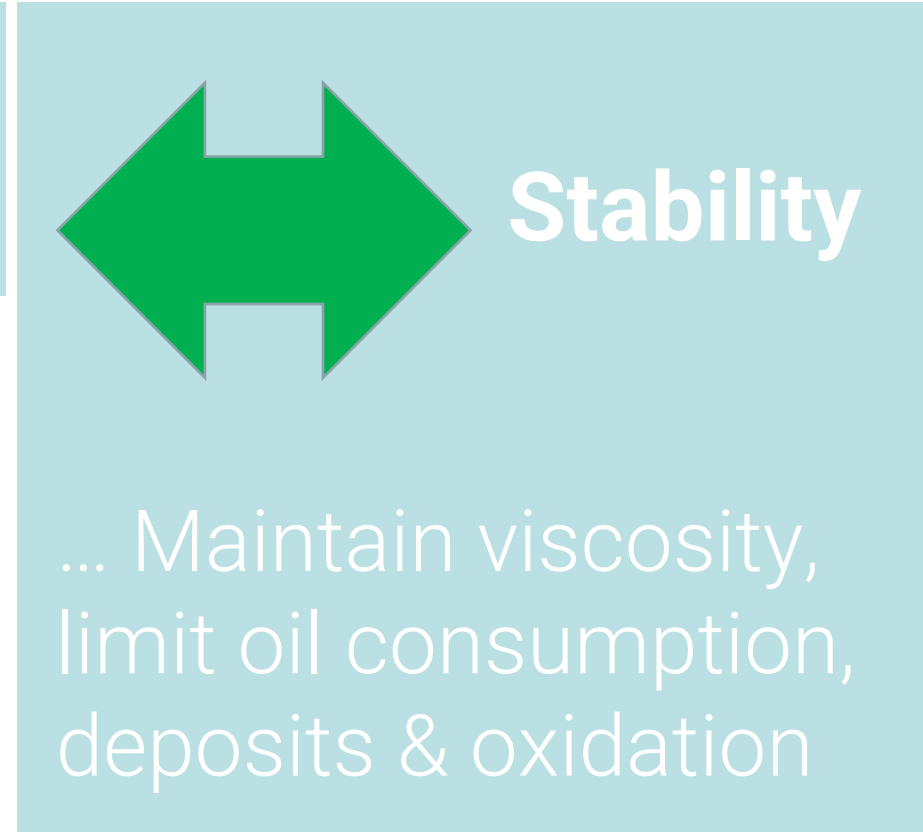
... And balance stability  
& engine protection

# SSBO HAS THE LOWEST NOACK... BY DESIGN



# THE PROBLEM: BETTER FUEL/ENERGY EFFICIENCY

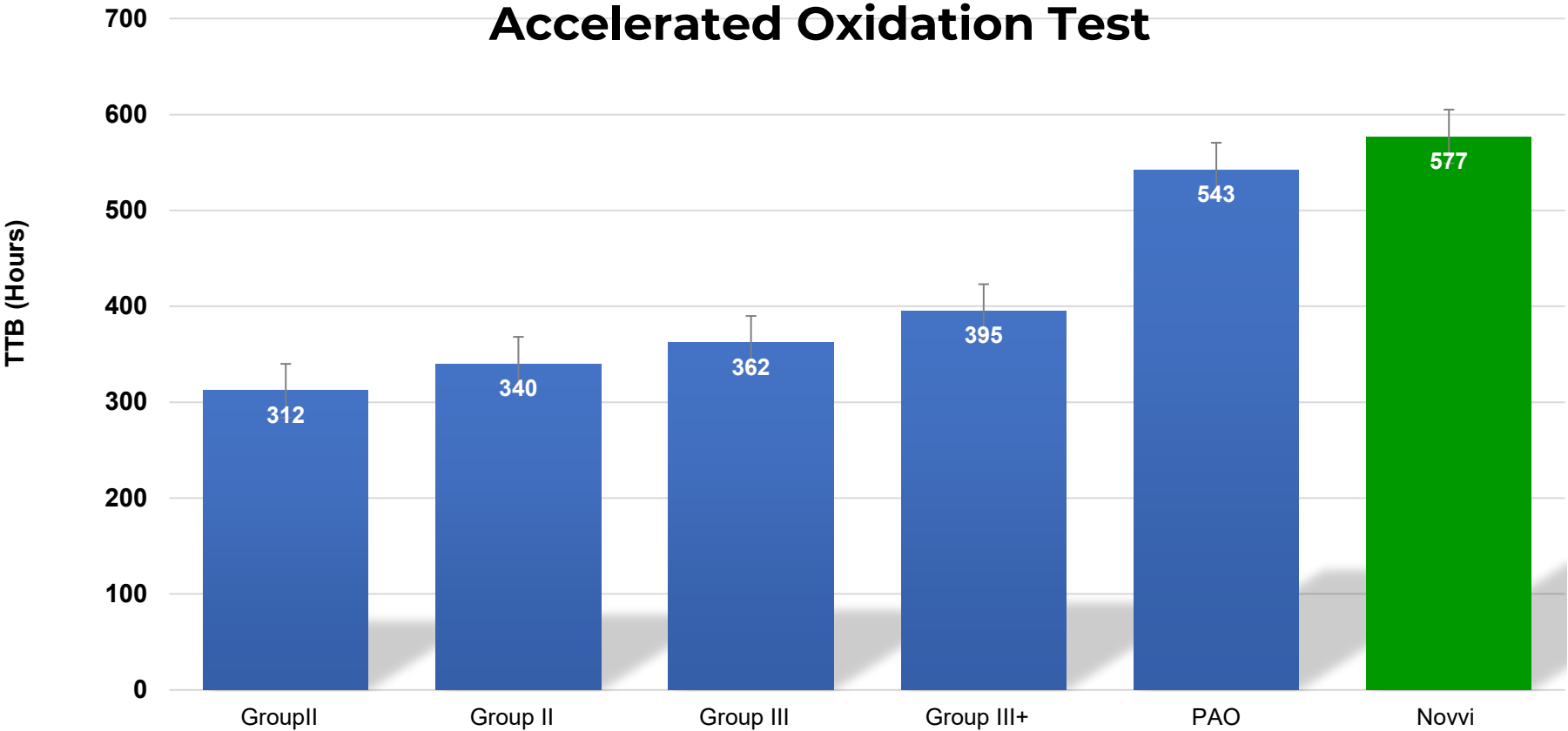
## Base Oil Contributes to FE By 3 Main Physical Properties:





# NOVVI HYDROCARBONS SHOW IMPROVED OXIDATION STABILITY

SSBO has comparable oxidative stability to Group IV and better than Groups III and III+



# THE PROBLEM: BETTER FUEL/ENERGY EFFICIENCY

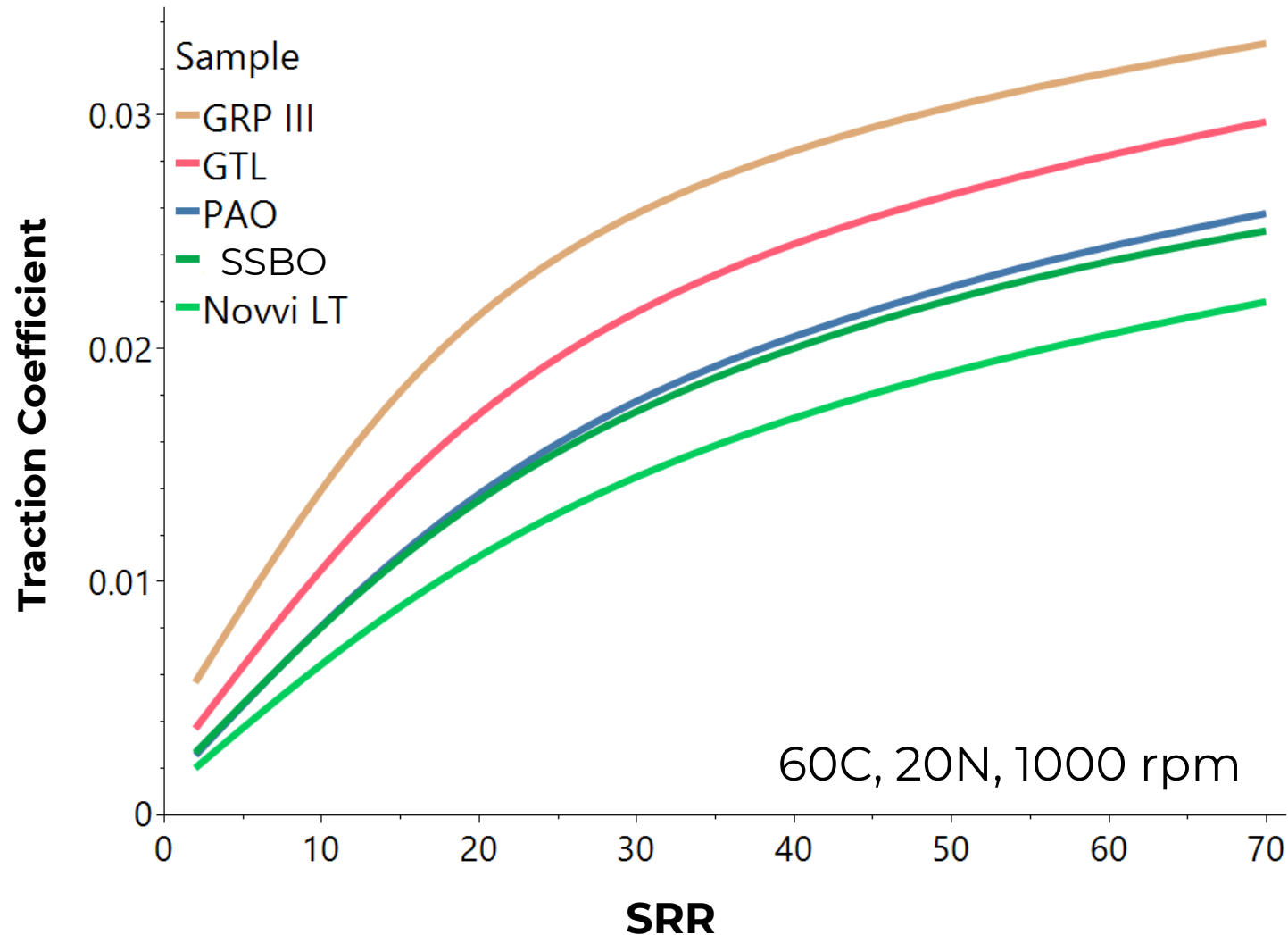
## Base Oil Contributes to FE By 3 Main Physical Properties:



Frictional  
Properties

... Improve frictional  
characteristics & wear  
protection.

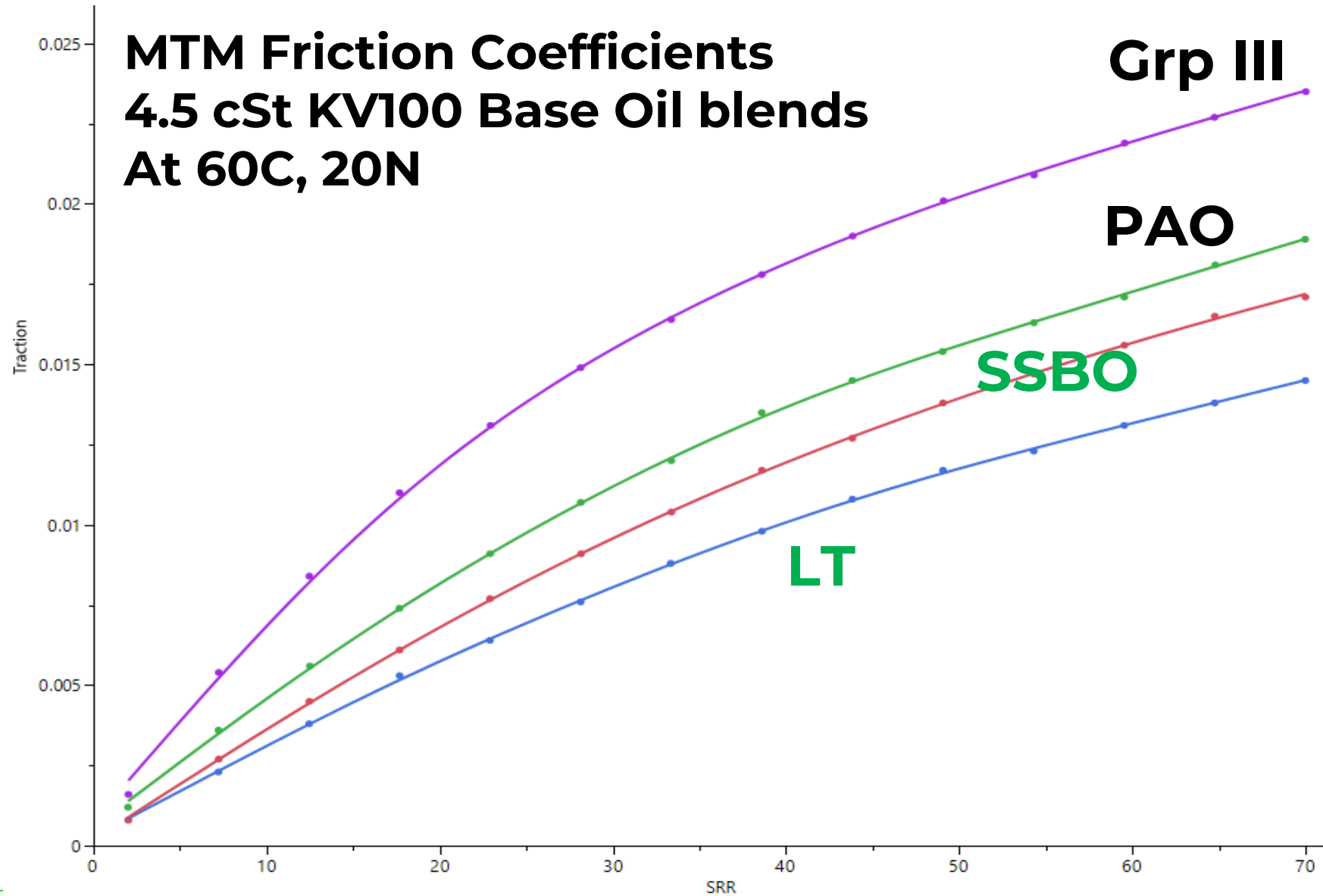
# TRACTION CURVES COMPARING COMMERCIAL BASE OILS



Base oil structures optimized for low-traction coefficients leads to improvements in:

- Improved ICE fuel economy
- Increased BEV range
- More efficient gear oils and hydraulic fluids

# BASE OIL STRUCTURE DEFINES FRICTION COEFFICIENTS





# **HYDROCARBON BASE OIL, TOP-TIER PERFORMANCE, CARBON NEGATIVE..**

**‘Top-Tier’ Performance Means:**

- Low Viscosity**
- Low Volatility**
- Strong Stability**
- Low Friction**
- Without Compromise**

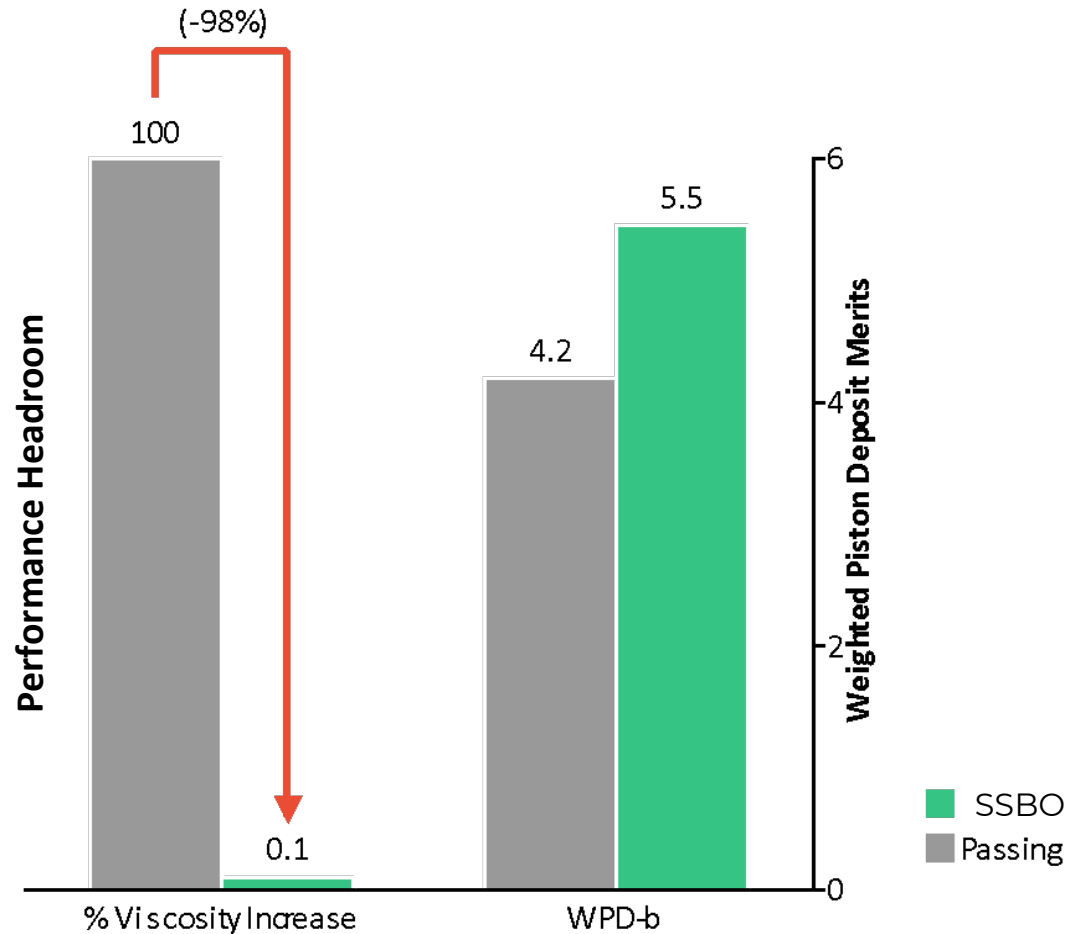
# **A TOP-TIER, HYDROCARBON BASE OIL...**

**The Best Route  
to Lowering Your Carbon Footprint**

**But Does it Work?**

# SYNNOVA SEQUENCE IIH ENGINE TEST PERFORMANCE IN A 0W-20

Results of Sequence IIH Engine Test on a SynNova® -based 0W-20 PCMO, Compared To Passing Requirements



Approvals and on-going work:

- API SP/ ILSAC GF-6 - **Approved**
- dexos®1 Gen2 - **Approved**
- ACEA C3, MB 229.31, API SN - **Approved**
- ACEA C6 & C7, dexos Gen 3 capable
- Additional work with selected OEMs underway
  - Field tests underway in Las Vegas taxi cabs
  - Field, rig, and bench tests with complete and underway

# NO SACRIFICE TO WEAR AND DEPOSITS



**Full Synthetic Oil:  
FAIL ON RING groove WEAR**



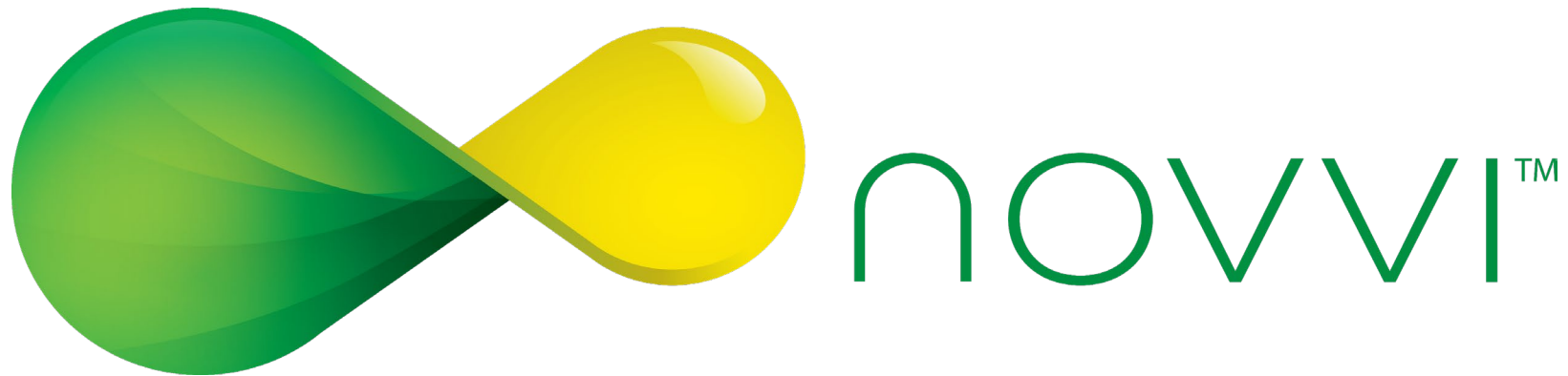
**SSBO Formulation:  
PASS**



## · ... and Carbon Negative? – You Bet!

- ❑ Nowvi - improve the planet with low-carbon alternatives to petroleum
- ❑ Nowvi's base oils are 100% plant-based, synthetic base oil
- ❑ Fuel economy and energy efficiency is the opportunity for Nowvi
- ❑ Nowvi will accomplish fuel economy & energy efficiency through a top-tier base oil with low viscosity, plus:
  - ✓ Excellent oxidation stability
  - ✓ Lowest volatility
  - ✓ Best Coefficient of Friction
  - ✓ Excellent engine test results
- ❑ A life cycle analysis (LCA) measures the net CO<sub>2</sub>E emitted through the creation and use of a material – cradle2 gate or cradle2 grave
- ❑ Carbon negative means more CO<sub>2</sub> used than generated by LCA
- ❑ For base oil LCAs, the key difference is the raw material
- ❑ **More sustainable as it reduces CO<sub>2</sub> emissions**
- ❑ SSBO - used today in a wide range of automotive & Industrial end uses

# Any questions?



For Detailed Data Version of this Presentation or  
any additional questions:

<mailto:Downey@novvi.com>

# TOP-TIER, LOW VISCOSITY 4CST BASE OILS

	Test Method	Sustainable Synthetic Base Oil (SSBO)	Grp III+ A	Grp III+ B	PAO
Kinematic Viscosity @100°C (cSt)	D445	4.3	4.2	4.1	4.1
NOACK Volatility (wt%)	D5800	8.0	13.0	11.0	12.4
Oxidation Stability – Time to 100% Visc. Increase (hrs.)	Novvi – Proprietary Test	580	400	500	540
Frictional Coefficient @60°C, 20N, 70% SRR	MTM – Proprietary Method	0.023	0.032	0.029	0.024
Cradle-to-Gate CO2 Footprint (kg CO2/kg base oil)	ISO 14044	-0.5	1.1	1.2	2.2

# COOLING PERFORMANCE

