



Susterra® the natural choice...
Purity and Renewable Performance

May 25, 2010

Bob Miller



DuPont Tate & Lyle Bio Products LLC



The miracles of science™

DuPont is a science and technology company that operates in five segments: Agriculture and Nutrition, Coatings and Color Technologies, Electronic and Communication Technologies, Performance Materials and Safety and Protection. 2008 revenues were \$32 B.



Tate and Lyle is a world leader in renewable ingredients providing ingredients, solutions and services to food, beverage and industrial customers. Headquartered in London, Tate and Lyle had sales of \$5 B in 2008.



DuPont Tate & Lyle Bio Products, a joint venture formed in 2004, provides renewably sourced, high quality ingredients that deliver superior functionality and enable our customers to offer renewable, natural and sustainable products. Our initial offerings are Zemea® and Susterra® propanediol from corn sugar, a sustainable & renewable resource.

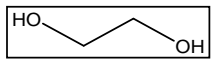
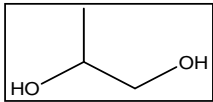

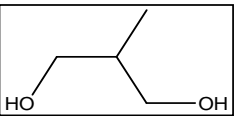
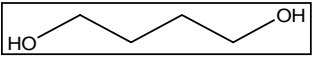
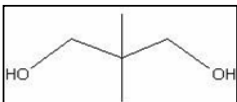
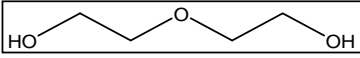
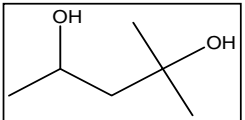
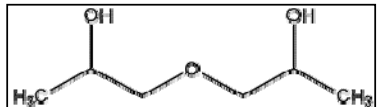


DuPont Tate & Lyle Bio Products Loudon, Tennessee Plant

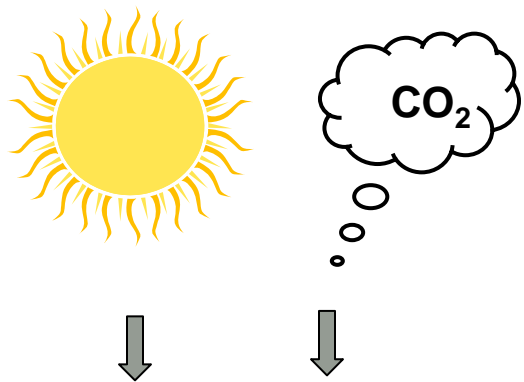
- 12 year R&D effort
- Bio-PDO™ production started in November, 2006
- 100 million pound annual capacity
- \$100 million dollar capital investment



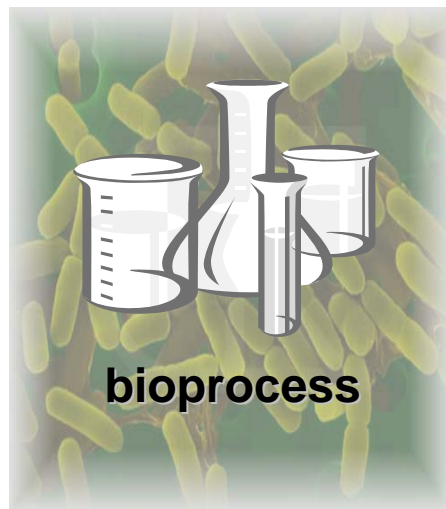
Susterra® Propanediol (PDO) - a range of potential uses

Common	Ingredient	CAS #	Formula	Structure	Mol. Wt.	Bp, oC	Mp, oC	Density
EG	1,2-Ethandiol	107-21-1	C ₂ H ₆ O ₂		62.1	197.6	-12.7	1.116
PG	1,2-Propanediol	57-55-6	C ₃ H ₈ O ₂		76.1	187.3	-60	1.038
Susterra™	1,3-Propanediol	504-63-2	C₃H₈O₂		76.1	214	-24	1.053
MPDiol	2-Methyl-1,3-Propanediol	2163-42-0	C ₄ H ₁₀ O ₂		90.1	221	-91	1.015
1,4 BDO	1,4-Butanediol	110-63-4	C ₄ H ₁₀ O ₂		90.1	230	16	1.017
Neopentyl Glycol	2,2-dimethyl-1,3-Propanediol	126-30-7	C ₅ H ₁₂ O ₂		104.1	208	127	~1.05
DEG	Diethylene Glycol	111-46-6	C ₄ H ₁₀ O ₃		106.1	245	-10	1.118
Hexylene Glycol	2-Methyl-2,4-Pentanediol	107-41-5	C ₆ H ₁₄ O ₂		118.2	197	-40	0.925
DPG	Dipropylene Glycol (several isomers are possible)	25265-71-8	C ₆ H ₁₄ O ₃		134.17	231		1.023

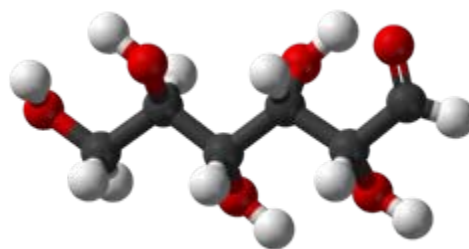
Process to Susterra® Propanediol



Corn



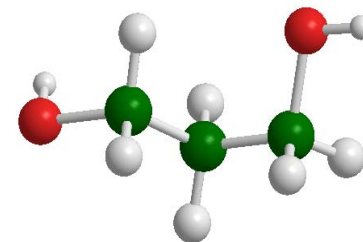
Fermentation process



Glucose



Refine to 99.7% Purity



Susterra®

(Bio-derived 1,3-Propanediol)

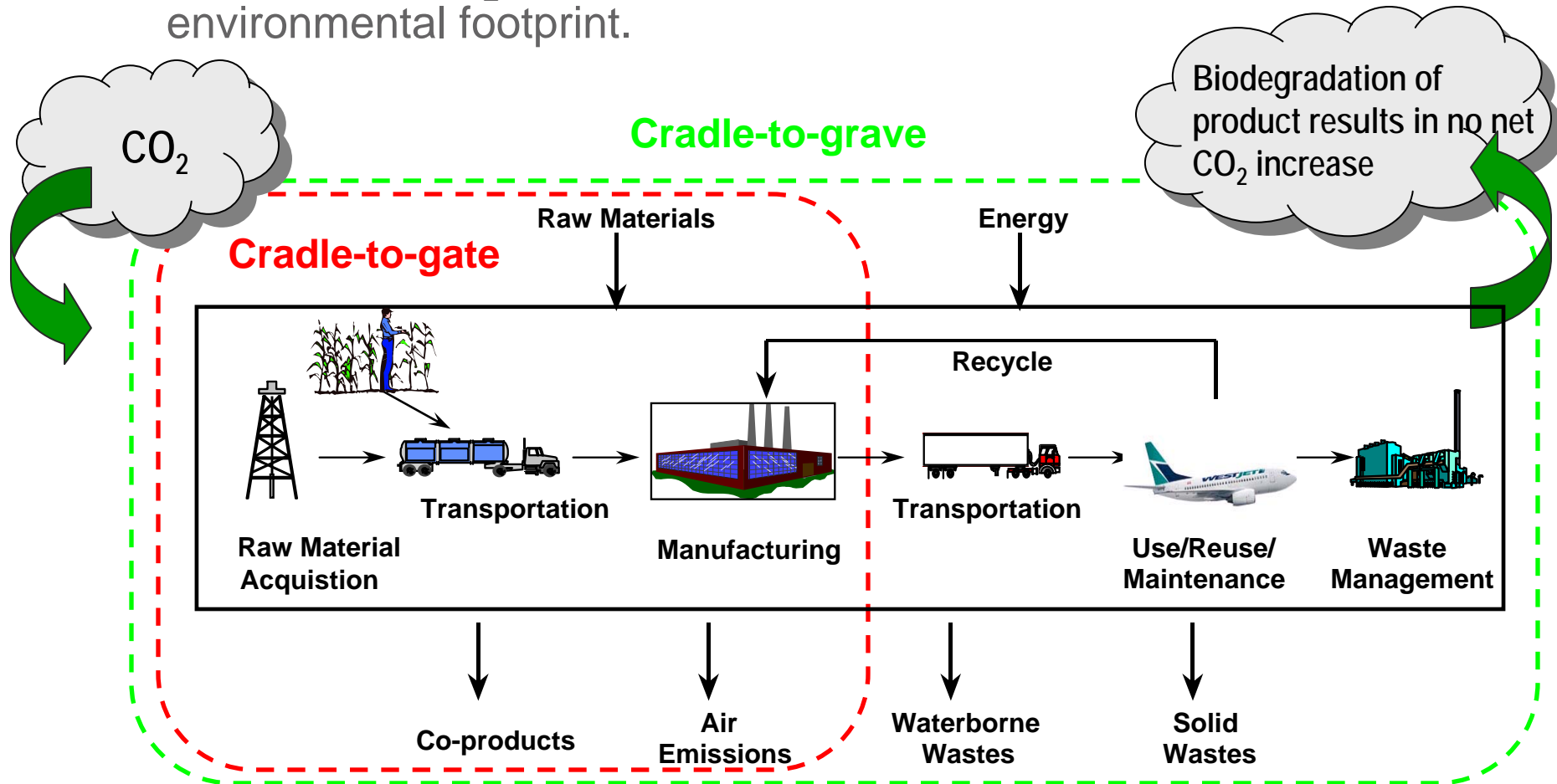
Susterra® Product Specifications

Release properties (reported on COA)¹

Property	Units	Limits	
		Min	Max
1,3-Propanediol	GC area%	99.70	100.00
Color	Hazen/APHA	0	15
Water	ppm	0	1000
Appearance Free of Suspended Matter	Visual pass/fail		

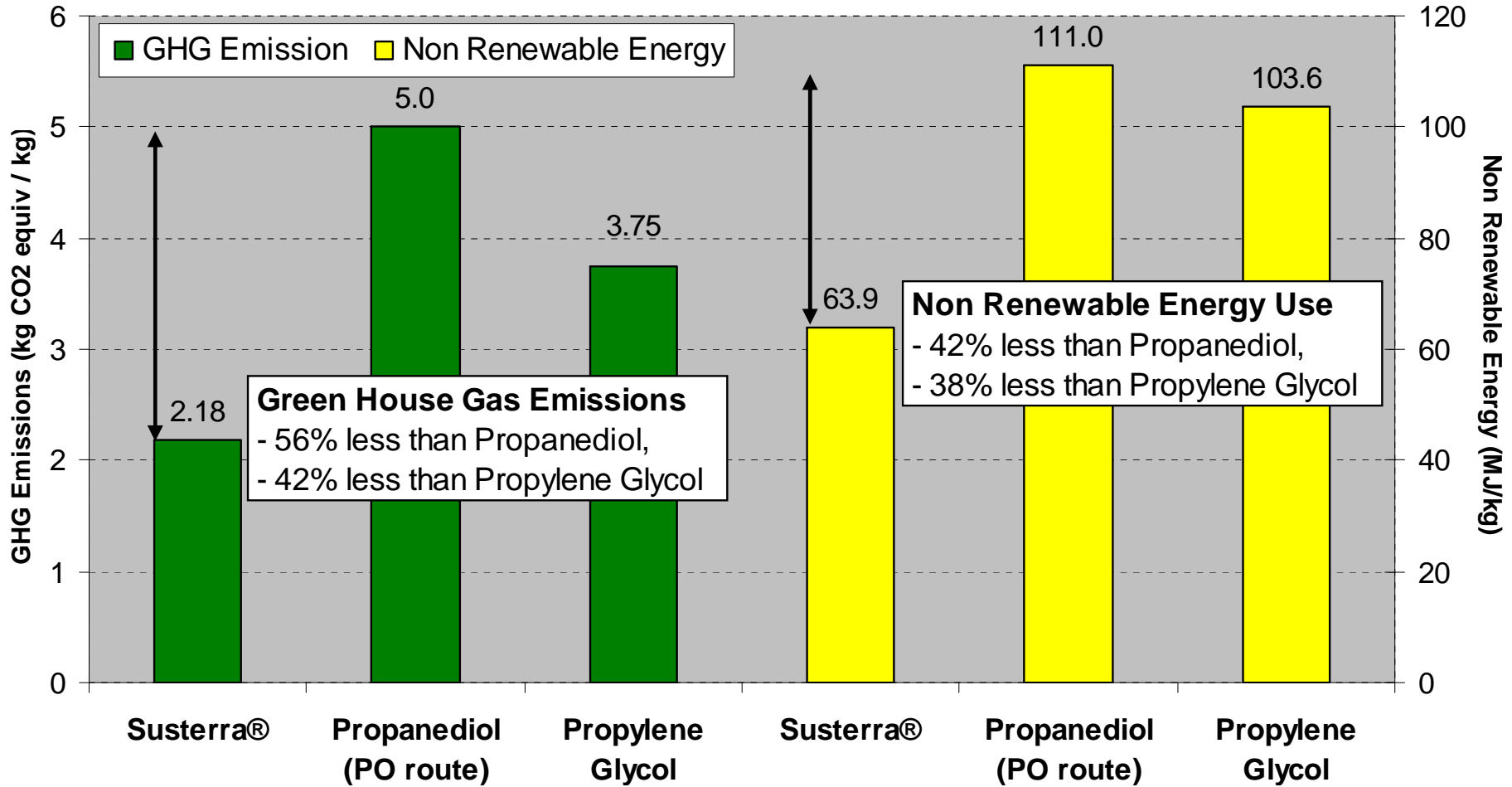
Life Cycle Analysis Approach

LCA is the only standardized method to evaluate the environmental footprint of a whole supply chain. Energy consumption and Green House Gas (CO₂) emissions are key factors in determining environmental footprint.



Susterra® Life Cycle Assessment* Comparison

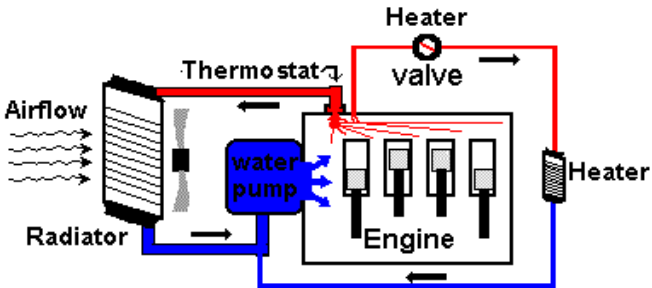
From “cradle-to-gate,” the production of Susterra® consumes 40% less energy and reduces greenhouse gas emissions by more than 40% versus petroleum-based 1,3-propanediol and propylene glycol.



*Susterra® LCA data based on Loudon process design data; peer reviewed by Five Winds International

Industrial Fluid Applications with Susterra® Propanediol

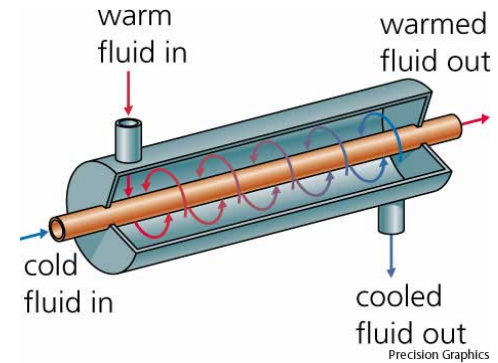
Antifreeze/Coolants



Deicing Fluid



Heat Transfer Fluids



DuPont Tate & Lyle
Susterra™
renewably sourced™ propanediol

ASTM International Committee D15 on Engine Coolants Approves 1,3-Propanediol (PDO)

Function effectively to provide protection against freezing, boiling, corrosion, and cavitation



Designation: D 7518 – 09

Standard Specification for 1,3 Propanediol (PDO) Base Engine Coolant for Automobile and Light-Duty Service¹

This standard is issued under the fixed designation D 7518; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.



Designation: D 7517 – 09

Standard Specification for Fully-Formulated 1,3 Propanediol (PDO) Base Engine Coolant for Heavy-Duty Engines¹

This standard is issued under the fixed designation D 7517; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

Why Engine Coolants With Susterra® Propanediol?

Performance Advantage versus current Glycols

- Similar results to ethylene glycol (EG) based products with the same inhibitor packages
- Improved degradation resistance versus EG

Environmental Benefits:

- Process has 40% less energy usage than chemical PDO
- Lower toxicity than EG

Vehicles using corn-derived Susterra® Propanediol based coolant add 4 lbs of bio-based material

Antifreeze/Coolants – Light Duty & Heavy Duty

Function – Equipment Protection

- Protect engine against freeze damage
- Remove excess heat from the engine
- Protect engine components against corrosion
- Prevent wet sleeve liner cavitation in diesel engines
- Enable long life protection for EGR equipped engines

Performance Advantage

- Increased Equipment Protection
 - Similar freeze point protection at 50% versus EG & PG
 - Lower freeze point protection above 55% versus EG & PG
 - Greater resistance to degradation at high temperatures versus EG & PG
 - Comparable protection against corrosion versus EG & PG
 - Better protection against wet sleeve liner cavitation than EG

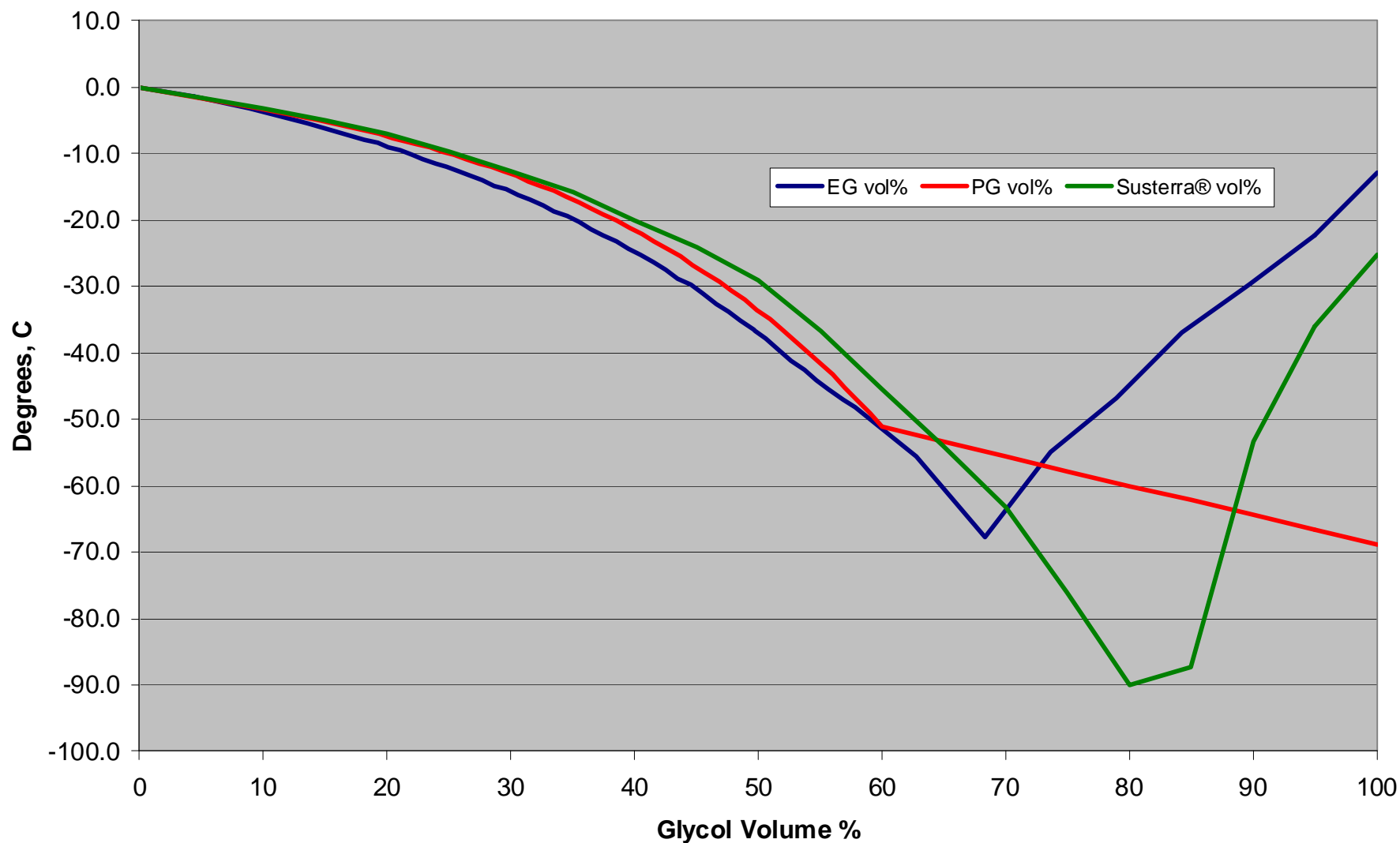
Susterra® Value Propositions in Industrial Applications

Antifreeze/Coolants – Light Duty & Heavy Duty

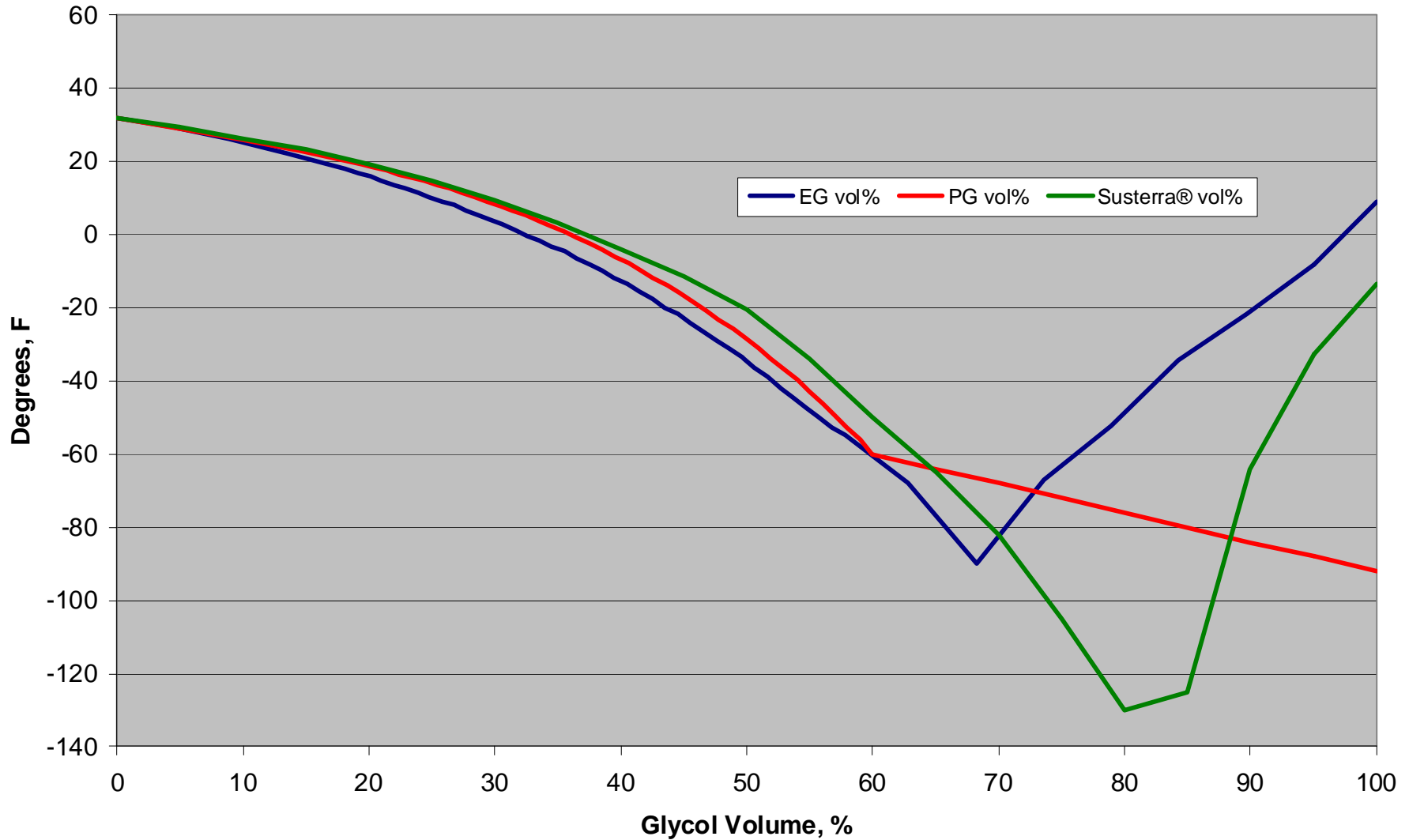
Value Proposition – OEM's & Formulators

- Potential Increased Uptime
 - Potential reduction in service intervals
 - Degradation, Corrosion and Wet Sleeve Protection
- Environmental Protection
 - Lower toxicity than EG
 - Consumes 40% less energy than chemically-derived PDO during production
 - Offers to increase the amount of renewable resourced products on vehicles
- Synergy with environmentally related marketing focus
 - Renewable & sustainable
 - Non-Petroleum Based
 - Less Environmental Footprint

Freeze Points of Aqueous Glycol Solutions

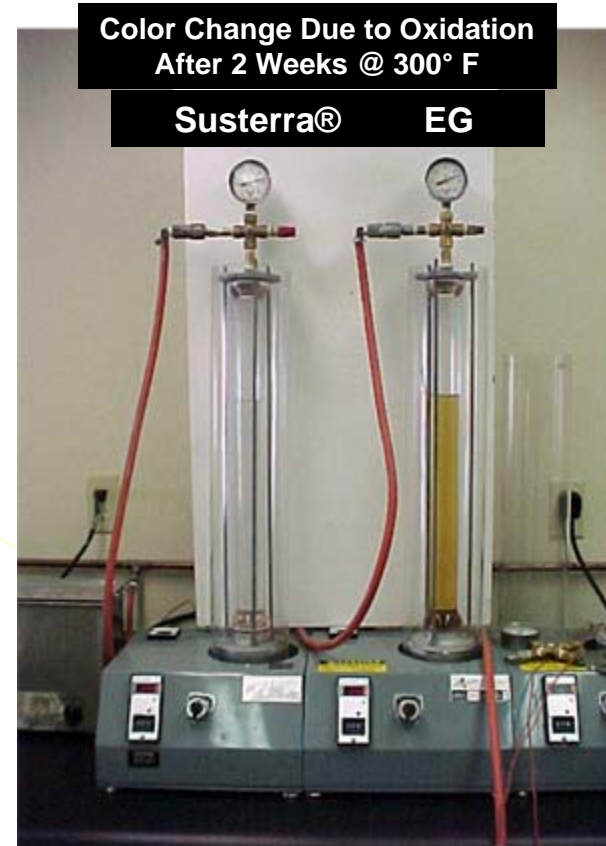
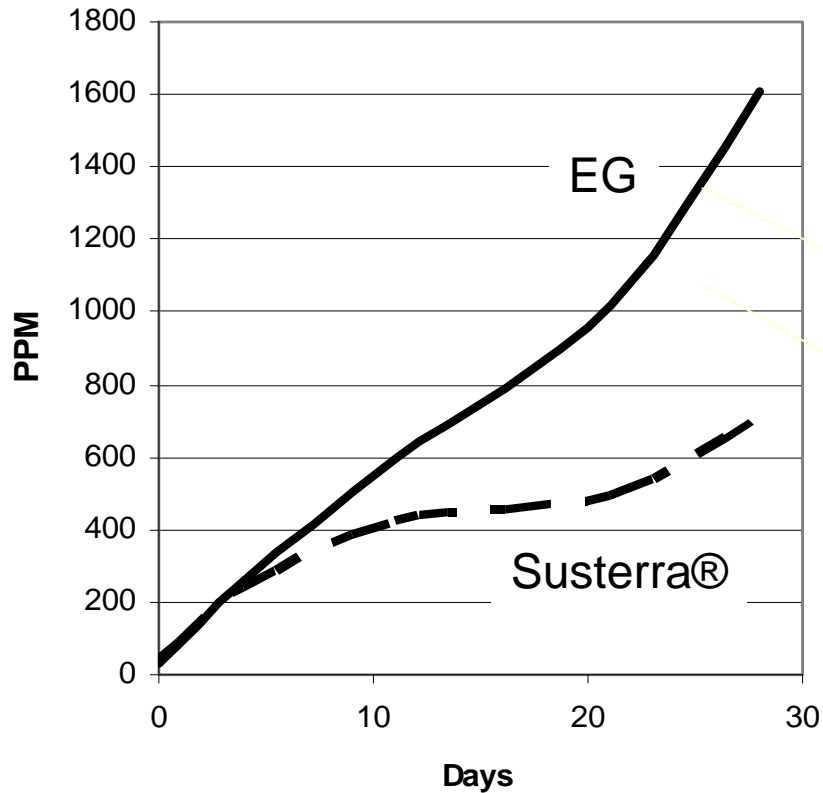


Freeze Points of Aqueous Glycol Solutions



Degradation of 50 wt% Aqueous Glycol Solutions Corrosion of Cast Aluminum Alloys in Engine Coolants @ 150 C

Total Degradation Acids Formed



Glycol Degradation Behavior

Corrosion of Cast Aluminum Alloys in Engine Coolants @ 150 C

pH

