

The role of Industrial oils in the journey towards Energy Efficiency and Sustainability

Roberto Saruls

I Meet the Industrial Market | October 25th, 2023 - São Paulo / Brazil



Project Goals

- Evaluate IGO Energy Efficiency (Electricity or Diesel savings) with LZ EE polymer
- Evaluate Gearbox temperature reduction with LZ EE polymer
- Extend the benefits to other Industrial applications (OGL, Hydraulics)
- Demonstrate Sustainability data with use of LZ EE polymer

Understanding the Value Chain | Market Needs

Operators



Energy Savings



Increased Productivity



Lower Operating Temperatures



Extended Lubrication Intervals

Lubricant Manufacturer



Proven Performance



Lower Formulating Costs



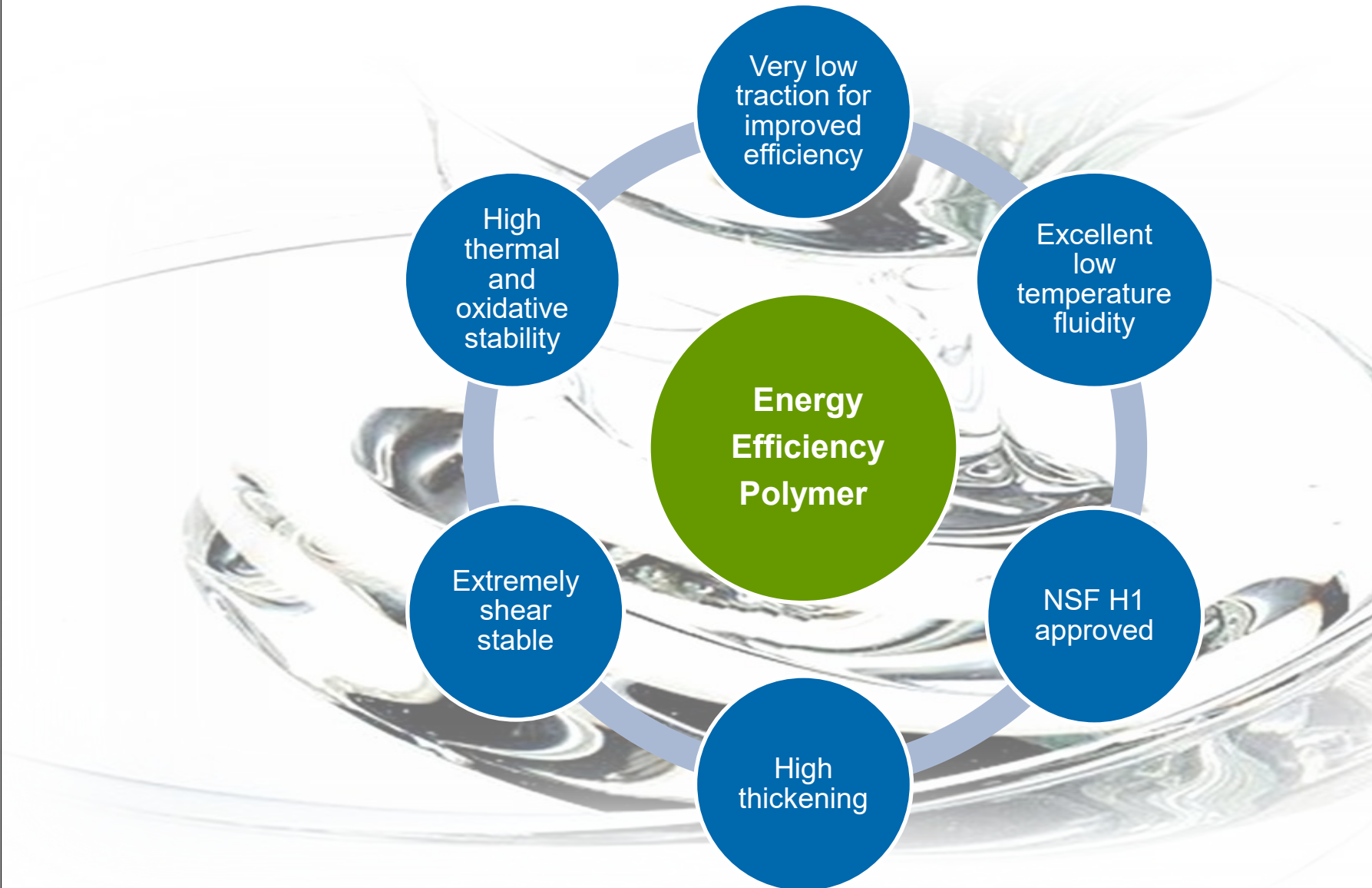
One Product, Multiple Applications

Sustainability

Peace of Mind

Energy Efficient (EE) Polymer

Energy Efficient Polymer



Energy Efficient Polymer



Very low traction for improved efficiency

Lower operating temperatures
Greater energy and fuel efficiency

Excellent low temperature fluidity

Reduced need for higher cost synthetic base oils

NSF H1 approved

Food grade use
Formulating flexibility

Extremely shear stable

Maintain proper wear protection throughout usage intervals

High thermal and oxidative stability

Longer service life
High performance under severe conditions

Extremely high thickening

Lower treat rate
Cost effective formulations

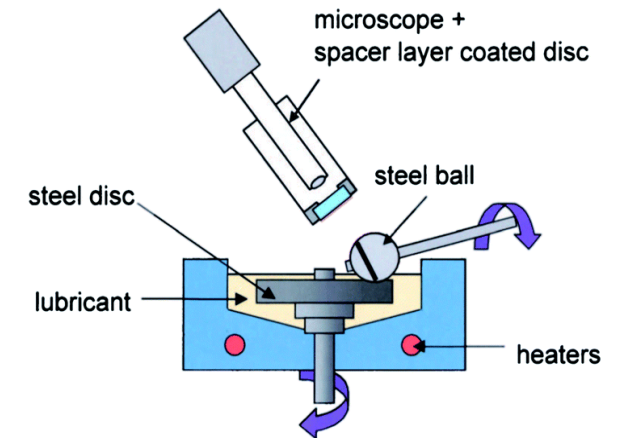
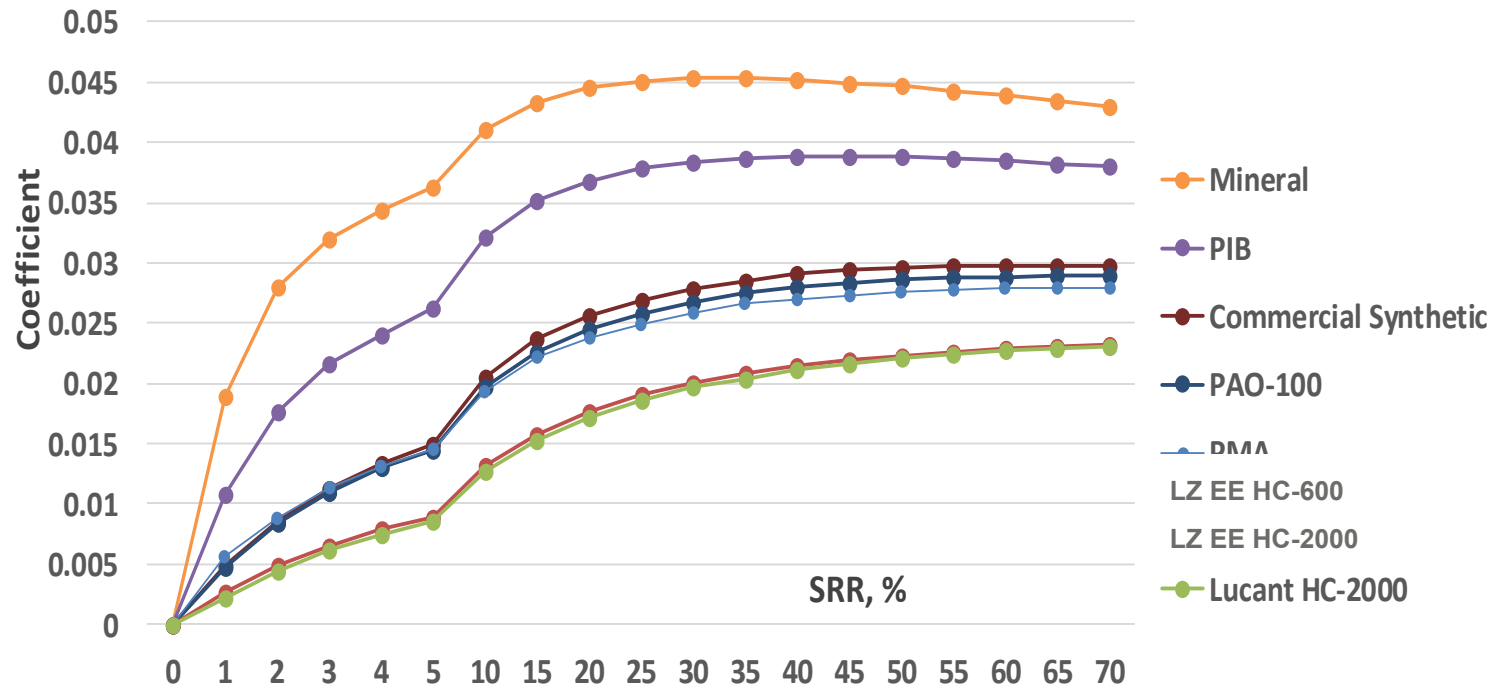
EE Polymers | A Wide Range Of Viscosity Grades

		HC-100	HC-150	HC-600	HC-1100	HC-2000
Item	Method	Typical Values				
Colour	ASTM D1209	10	10	10	10	10
Density (15°C)	ASTM D4052	0.843	0.846	0.850	0.850	0.851
Kin. Viscosity 100°C 40°C	ASTM D445	100 cSt 1,300 cSt	150 cSt 2,200 cSt	600 cSt 9,850 cSt	1,100 cSt 18,900 cSt	2,000 cSt 37,500 cSt
Viscosity Index	ASTM D2270	165	170	240	270	300
Pour Point	ASTM D97	-30°C	-21°C	-6°C	3°C	9°C
Flash Point	ASTM D92	270°C	270°C	290°C	290°C	290°C
20 Hour KRL SSI	CEC L-45	0	0	5	10	15



Lower Traction For Improved Efficiency

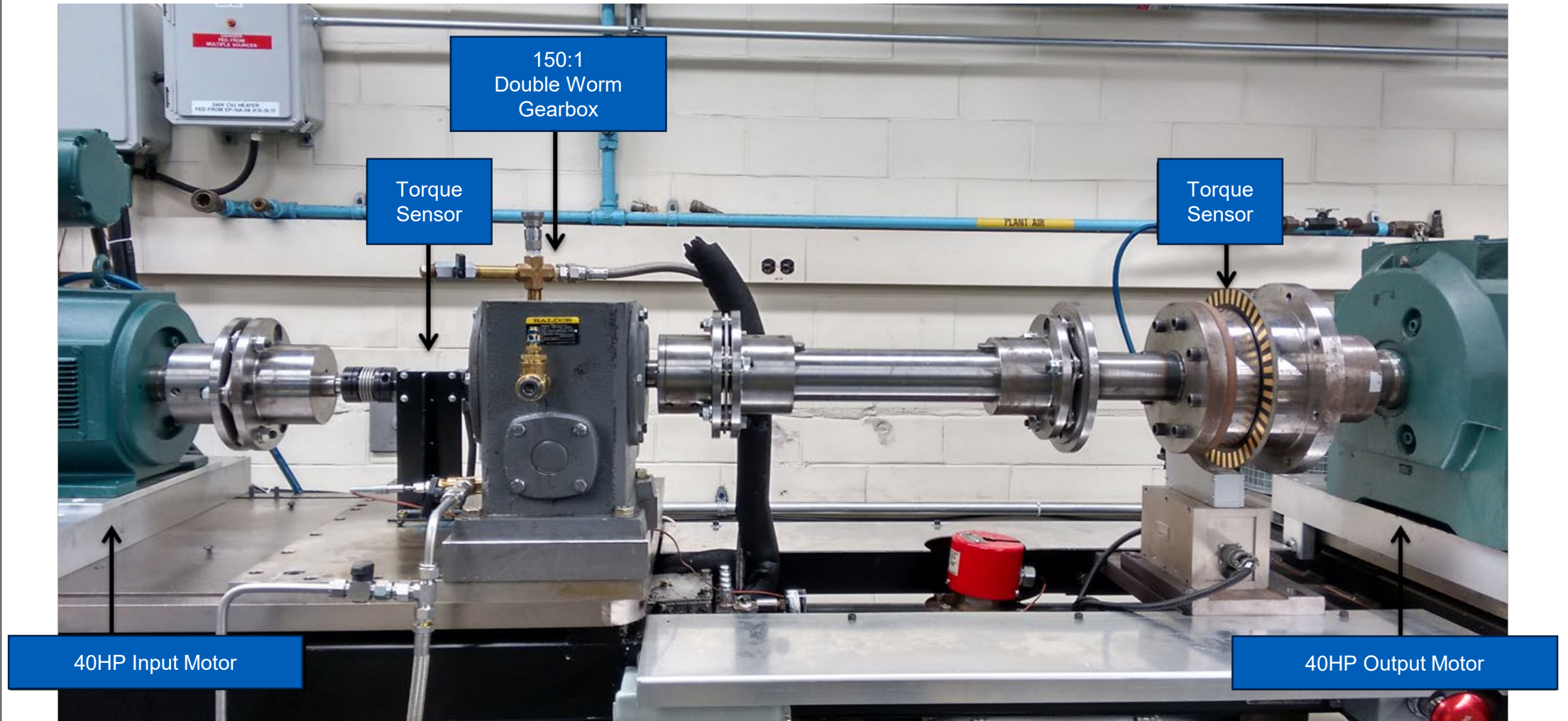
Traction Coefficients versus Slide-Roll Ratio (%) for Various Thickening Agents (100°C, 1.25GPa, 2.5m/sec)



The ball is charged against the face of the disc and the ball and disc are independently propelled to create a mixed rolling/sliding contact. The force of friction between the ball and the disc measures the Coefficient of Friction.

Industrial Gear Oil (IGO)

IGO | Energy Efficiency Test Rig

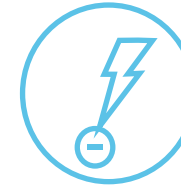
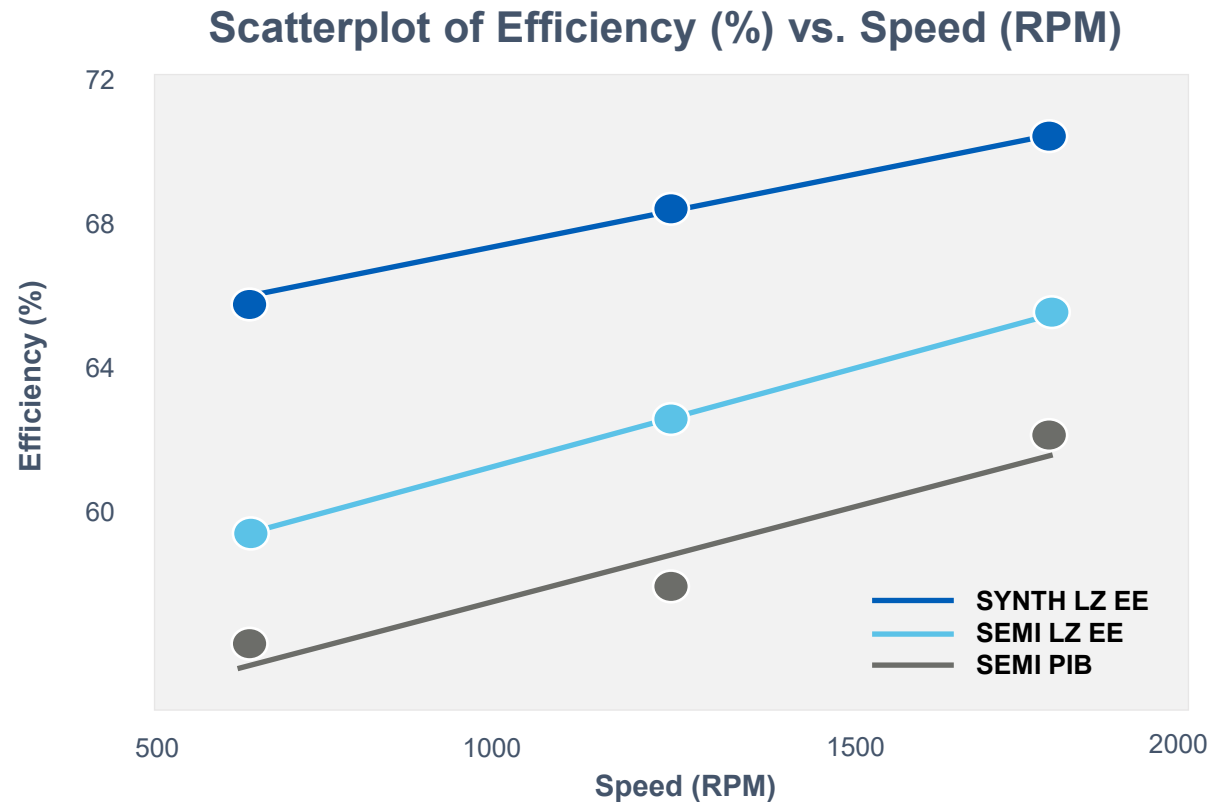


IGO | Testing the Performance of Different Fluids

Fluid Id.	Fluid Formulation	API Base Oil Group	ISO Viscosity
Semi PIB	LZ IGO additive + Chevron Gp II + PIB	II (Semi Synthetic IGO)	320
Semi LZ EE	LZ IGO additive + Chevron Gp II + Energy Efficient Polymer	II (Semi Synthetic IGO)	320
Synth LZ EE	LZ IGO additive + Energy Efficient Polymer + PAO	IV (Synthetic IGO)	320



IGO | Energy Efficiency



Energy Savings

Full Synthetic

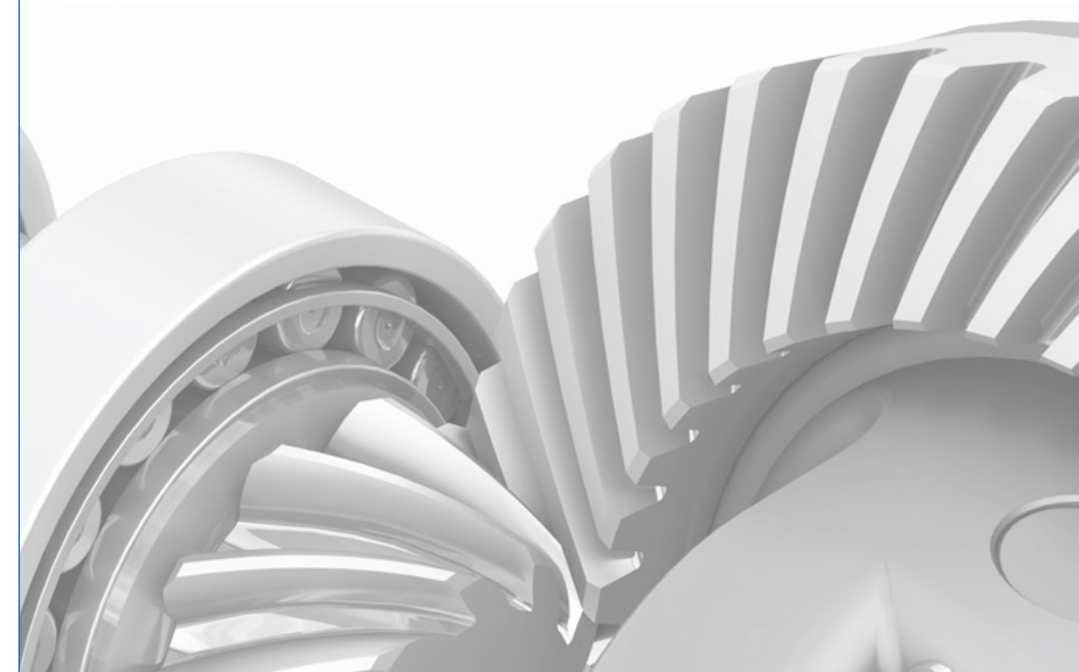
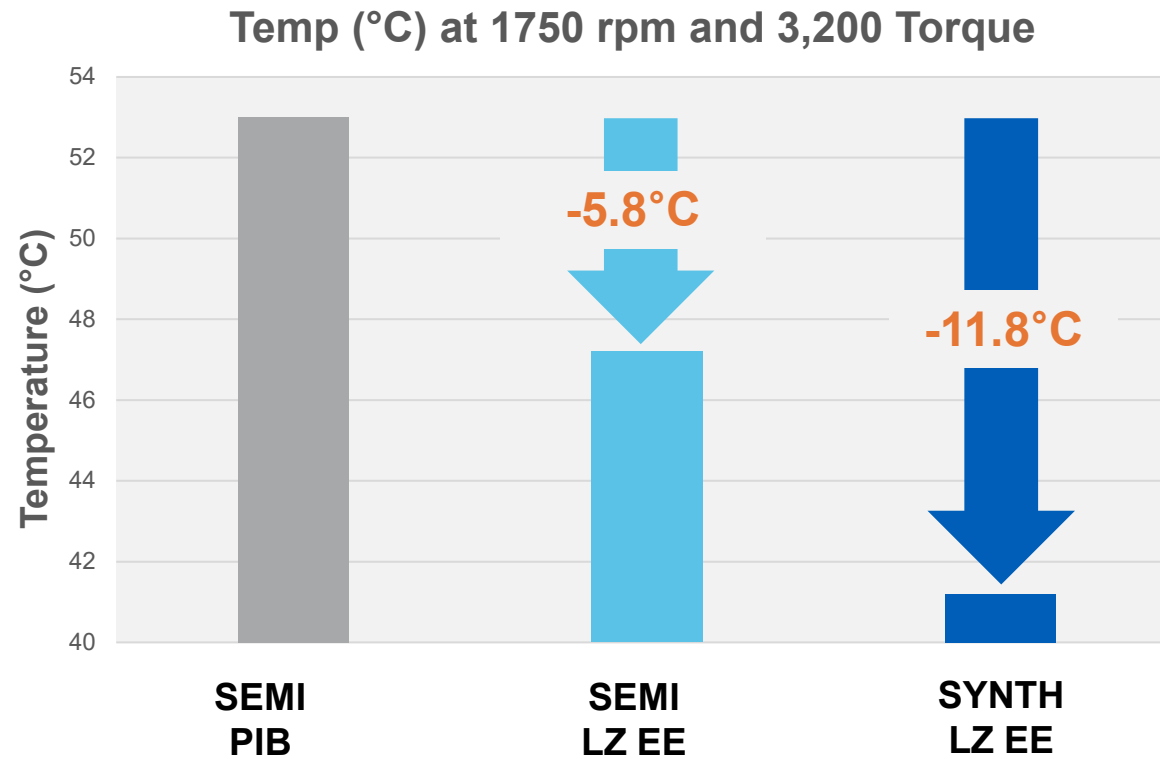
8%

Semi-Synthetic

3%

Significant energy savings when using the EE Polymer

IGO | Operating Temperature



Significant temperature reduction when using the EE Polymer

Synthetic IGO | Advanced Performance

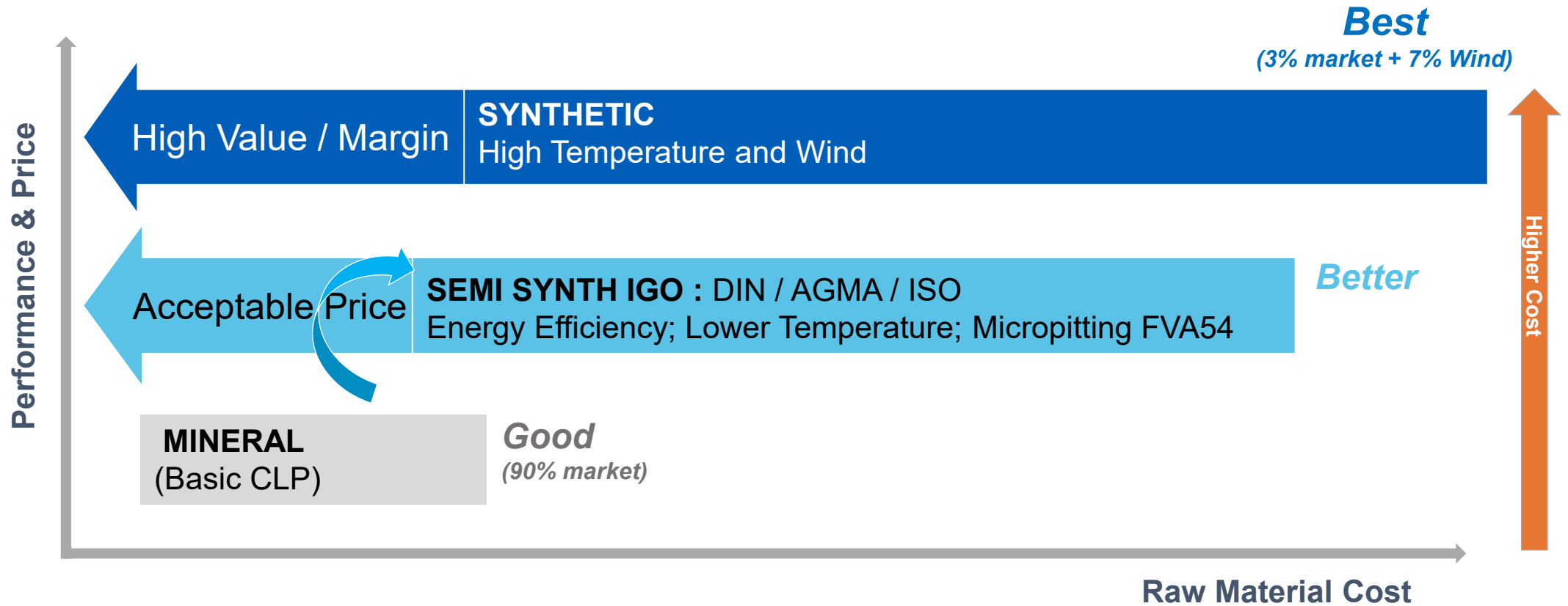
Specification	IGO additive + Energy Efficiency Polymer + PAO
AGMA 9005-F16 (2016)	✓
Chinese GB 5903 L-CKC/L-CKD (2011)	✓
David Brown S1.53.101 Type H (1997)	✓
DIN 51517-3 (2018)	✓
Fives Cincinnati EP Gear Oils (2011)	✓
Flender GmbH (revision 16.1 upgrade)	✓
General Electric GED50E35 (2015)	✓
ISO 12925-1 CKSMP (2018)	✓
RENK Augsburg 36011-11	✓
U.S. Steel 224 (un-dated)	✓

100%

This combination provides an extensive list of approvals to address the IGO market needs

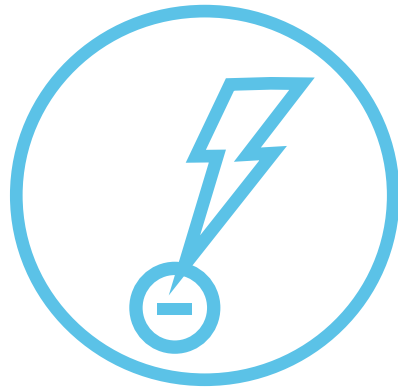
Semi Synthetic IGO | Insight!

A disruptive concept to uplift IGO traditional market



High market value with acceptable market price versus Basic CLP

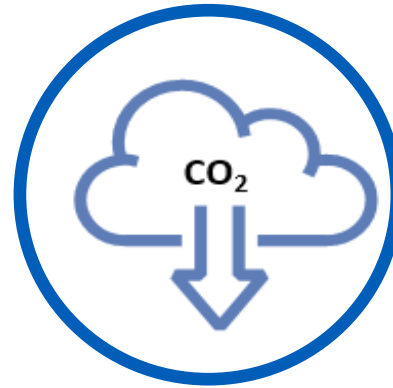
IGO | Energy Efficiency in Numbers



Reduce Electricity Usage by

452,458

kWh/Year



Reduce CO₂ emissions by

128

Tonnes/Year



CO₂ Reduction equivalent of planting

5,820

Trees/Year

Data based on Lubrizol Energy Efficiency Rig per 12-month operation expanded to a fleet of 100 Gearboxes

A new era in IGO Energy Efficiency

Extending the Benefits to Multiple Applications

Maximizing Efficiency | Multiple Applications



Open Gear | Reduced Operating Temperature



FZG Test

17°C Lower Operating Temperature*

* LZ EE OGL compared to a standard OGL formulated with GI and bright stock

Hydraulics | Measuring Vehicle Efficiency

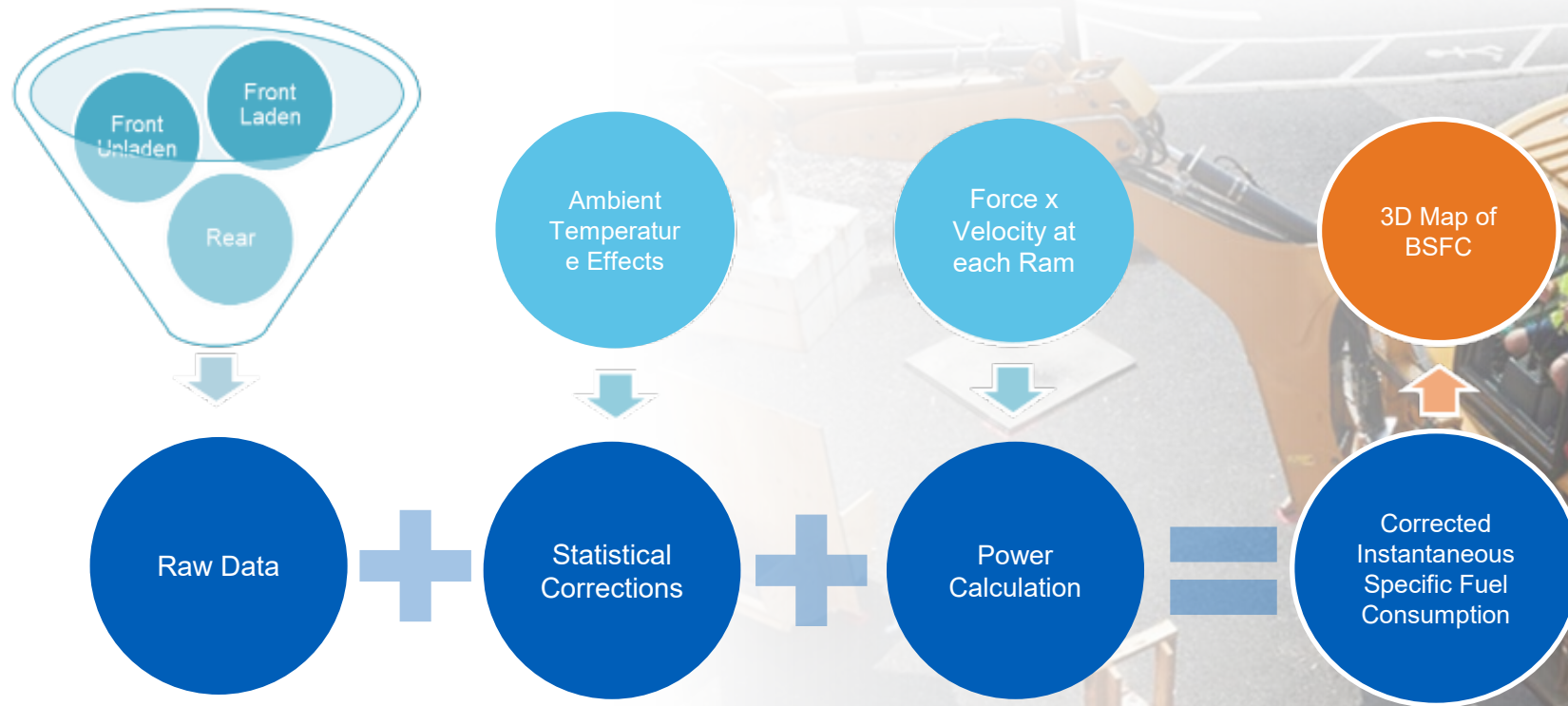


Hydraulic flow meter

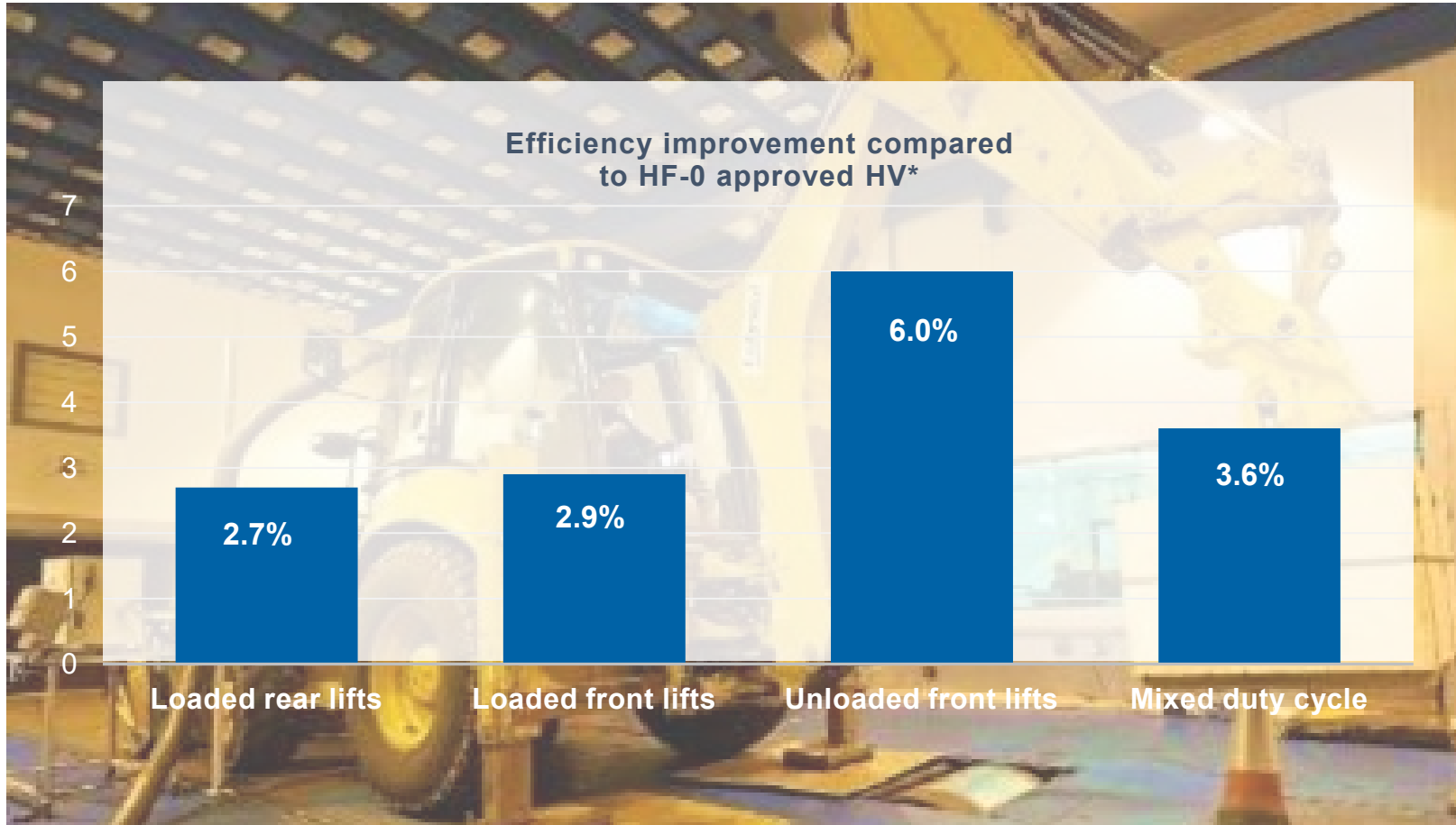


Hydraulics | Measuring Vehicle Efficiency


Example of data analysis steps and output



Hydraulics | Energy Savings in Mobile Equipment



Average of
3.8%
FUEL
Savings



- Climatic chamber and external testing with controlled duty cycles
- Higher efficiency observed and statistically validated in defined duty cycles

*HV = high viscosity

Hydraulics | Energy Savings in Stationary Equipment

Plastic Injection Molding Machine (PIMM) Field Trial

Max Clamping Force	10,000 kN
Injection Pressure	1170 bar (16,969 PSI)
Oil Volume	1800 Litres (475.5 Gallons)



Hydraulics | Energy Savings in Stationary Equipment



Plastic Injection Molding (PIM)

*700 Ton Machine
Cincinnati Milacron*



Co-Injection Machine

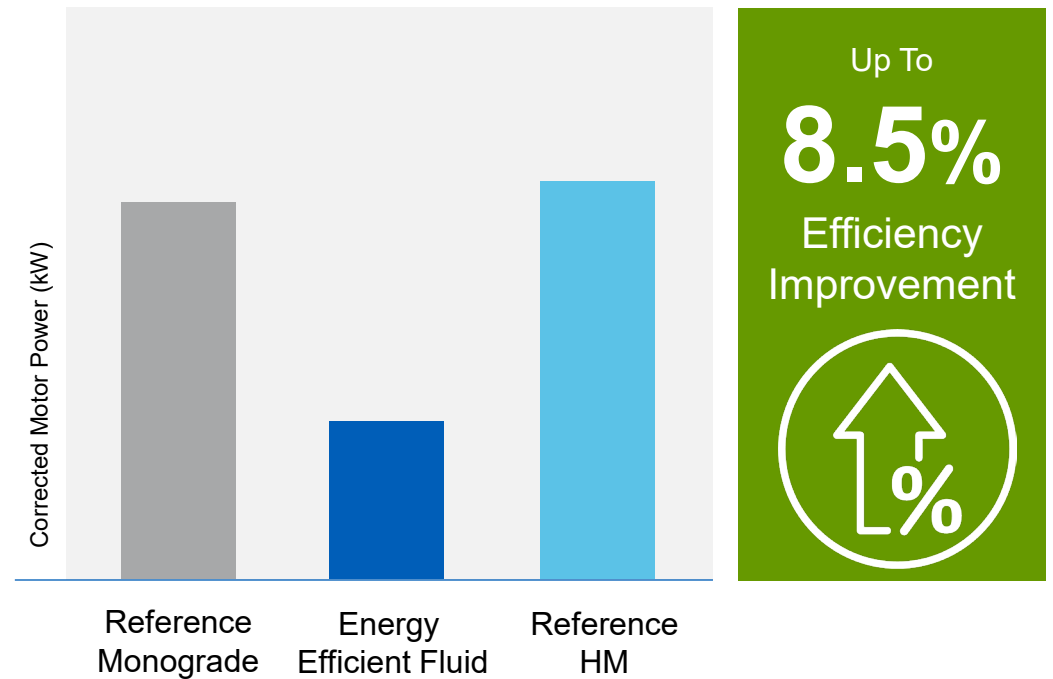
*Skin Injector Sled (Surface)
Core Injector Sled (Structure)*

Hydraulics | Complete Value Proposition - Insight!

Lubrizol cleaner package
to cleans up existing
hydraulic systems

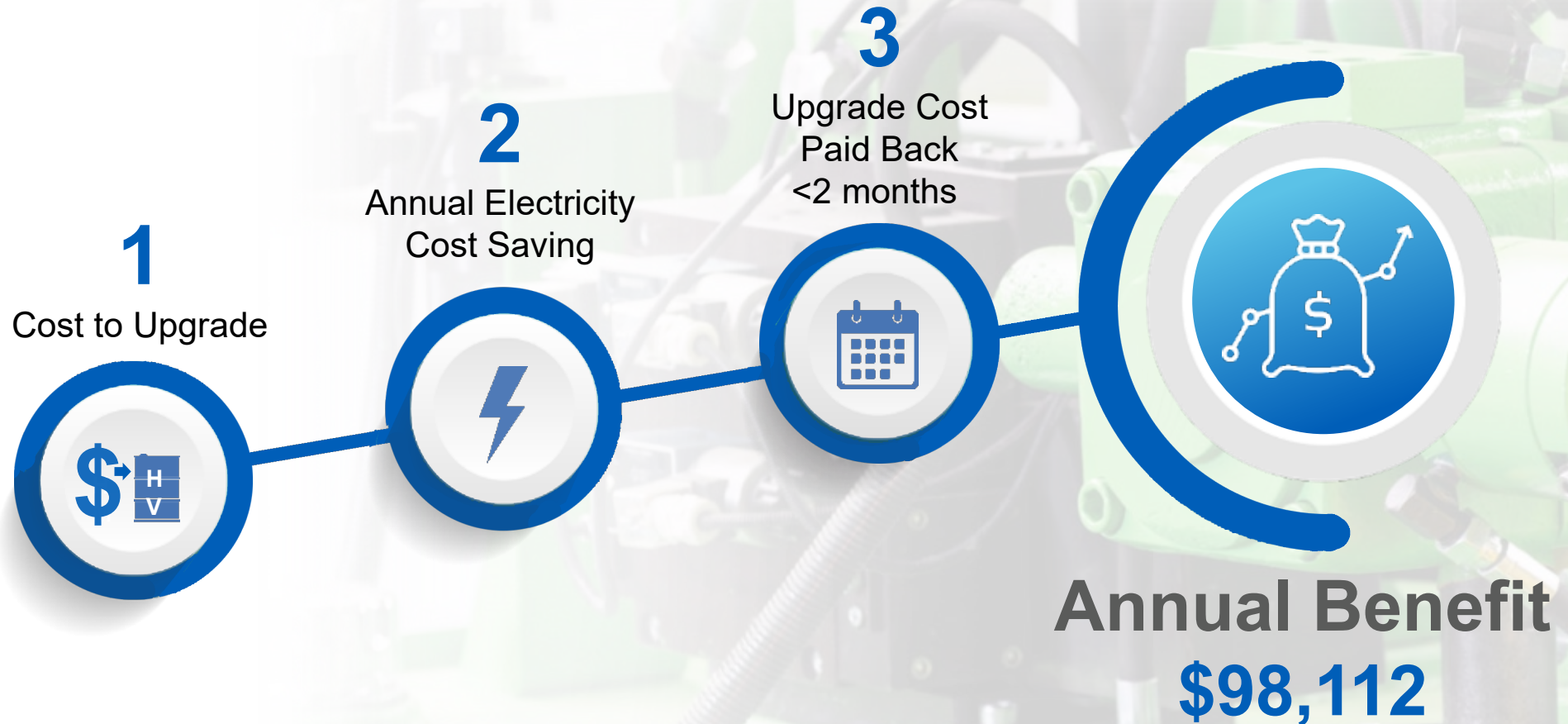


Hydraulic oil containing
Energy Efficient Polymer






Data from the Plastic Injection Molding Machine Field Trial

Upgrading Your System to an Efficient Hydraulic Fluid



Calculation Information: Generic 10 IM machines with 1500lt oil reservoir volume operating at a consistent work rate of 24 hrs/day, 365 days/year

Hydraulics | Energy Efficiency in Numbers

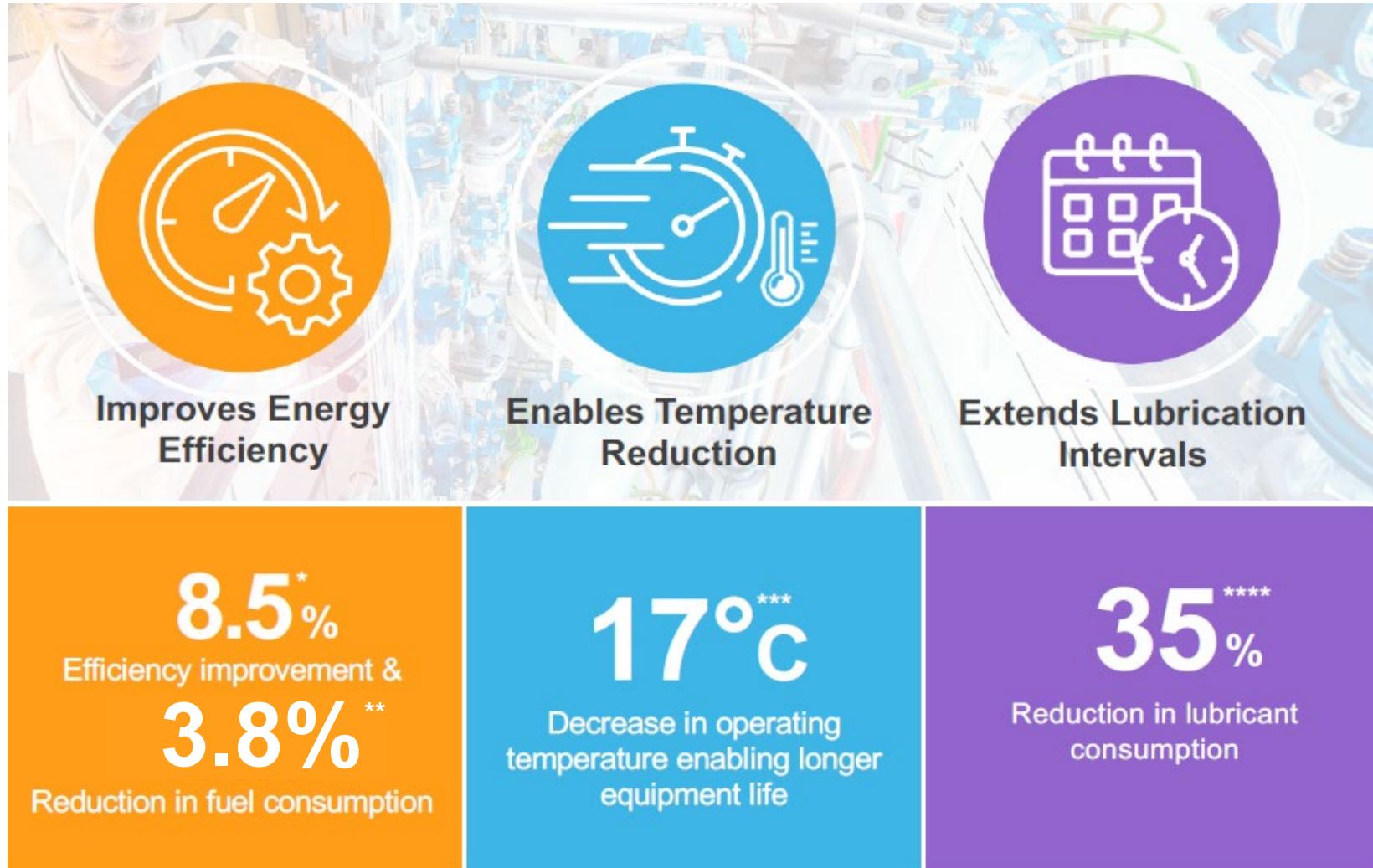
Metric	Mobile Fleet	Stationary Factory
 Productivity	Move 391,000 tons	Produce 566,031 units
 Profitability	Save \$42,500 on fuel	Save \$98,112 on utilities
 Sustainability	Eliminate 138 tons of CO₂	Eliminate 192 tons of CO₂

Data based on a generic backhoe loader field trial, per 12-month operation
 Diesel Lts / CO₂ factor = 2.67 . Source : EPA

Enhancing Productivity, Profitability, and Sustainability

Why using the Energy Efficient Polymer?

Energy Efficient Polymer | Operators Benefits



*Reduced hydraulic power consumption (kW) of a plastic injection molding machine when comparing the use of Lubrizol's LUCANT-based hydraulic fluid against a conventional mono-grade hydraulic fluid.

**Fuel efficiency improvement results of a backhoe loader operating a number of duty cycles when comparing the use of Lubrizol's LUCANT-based hydraulic fluid against a conventional multi-grade hydraulic fluid.

***Lubrizol's LUCANT-based industrial gear oil compared to standard mineral oil IGO in the laboratory FZG test.

****Lubricant interval comparison based on sugar mill journal bearings operating temperature and seal formation.

Energy Efficient Polymer | Lubricant Manufacturer Benefits



Deliver proven performance

With robust testing capability around the world, we help you demonstrate the real value of your products to your customers – with the data to back it up.



Simplify operations

LUCANT™ products span the range of industrial products, so you can simplify the performance polymers you must carry.



Bring you peace of mind

Lubrizol's expertise in product formulating and application along with our extensive OEM collaboration, you can rest assured that Lubrizol will help eliminate barriers in the product approval process.



Reduce formulation costs

Thickening efficiency reduces treat rate providing up to 45%* cost savings.

Thank You! / VALEU!