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RohMax Oil Additives

Hydraulic Fluid Industry Trends,

Improved Fluid Selection Techniques,

MEHF Performance Advantages

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Summary of HF End-User Comments 2001-2004 Conference Interviews - USA

Most End-Users:

- are knowledgeable about their equipment
- Understand engine oils but NOT hydraulic fluids
- Rely on Oil Distributors to recommend HF
- Focus on oil operating temperature, not viscosity
- Like the new NFPA fluid selection standard

OEM's:

- Fluid is an afterthought in system design
- Moving towards smaller systems with higher pressures
- Have new interest in pump efficiency, fuel efficiency.
- Are working to reduce hydraulic system noise

Summary of HF End-User Comments 2001-2004 Conference Interviews - USA

Oil Marketers:

- Focus on volume and lowest cost products
- Monograde HF is primary recommendation
- Multigrade is a specialty “problem solver”
- Find it hard to demonstrate value of fluids with VI = 150
  - Low temperature performance is typical reason for selection

Hydraulic Fluid Trends

Higher Pressures

- Mobile equipment now 4000 psi, moving to 6000 psi

Smaller, Lighter Equipment

- Reduced fluid volumes
- Less residence time

Higher Fluid Operating Temperatures

- 80 °C common for mobile equipment
- 100+ °C peak temperatures

Standard Hydraulic Fluid Viscosity Grade Options

Indoor-Stationary Equipment

- ISO VG 22 – 100 Monograde HF
- Automatic Transmission Fluid (ATF)

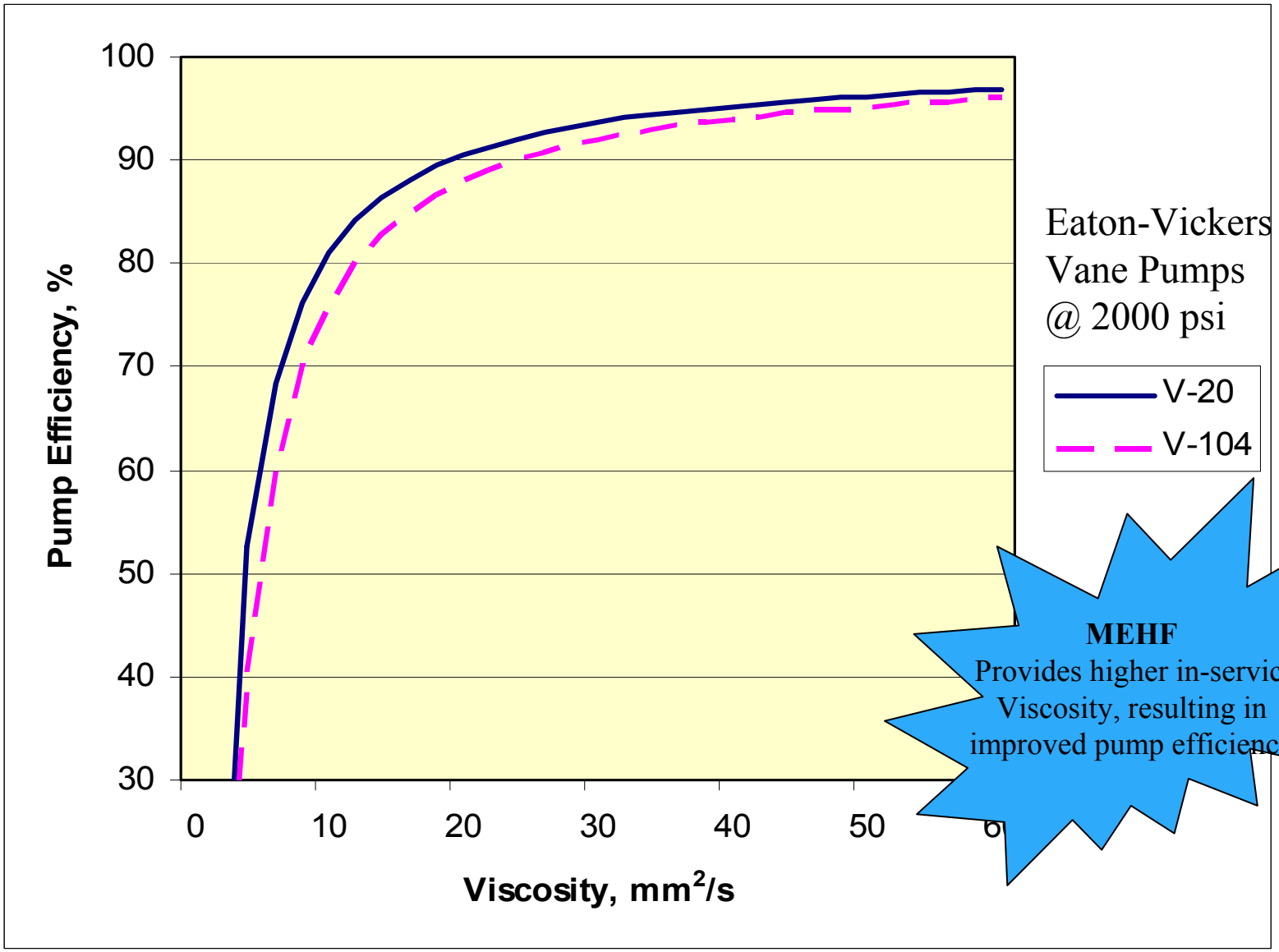
Mobile Equipment

- ISO VG 22 – 100 Monograde HF
- Automatic Transmission Fluid (ATF)
- Engine Oils, 10W, 5W-30, 15W-40
- Multigrade HF (VI 125 – 250)

What is the Best Choice ?

All of these fluids can "work", but….

Volumetric Efficiency Losses



Modeling Volumetric Pump Efficiency

For the Eaton Vickers Vane Pumps used in this study:

Pump	Flow rate, liter/minute	Volumetric Efficiency at 2000 psi, %
Eaton V-104	$Qa = 32.2 - 0.0384*P_d/KV$	$V_E = 100*(1-2.4/KV)$
Eaton V-20	$Qa = 31.70 - 0.0302*P_d/KV$	$V_E = 100*(1-1.9/KV)$

Volumetric Efficiency = Actual Flow Rate / Nominal Flow Rate:

$$V_E = 100 * Qa/Qn$$

Viscosity Impact on Pump Efficiency

	Used Oil Viscosity @ 100°C, cSt	Volumetric Pump Efficiency	Efficiency Loss vs. Multigrade HF
MEHF 46 (NFPA Grade L32-68)	8.9	73.0	----
Engine Oil 5W-30	7.5	68.0	-7%
ISO 46 Monograde	6.7	64.2	-14%
Engine Oil 10W	6.3	61.9	-18%
ATF	5.4	55.6	-32%

Eaton Vickers V-104C Vane Pump @ 2000 psi

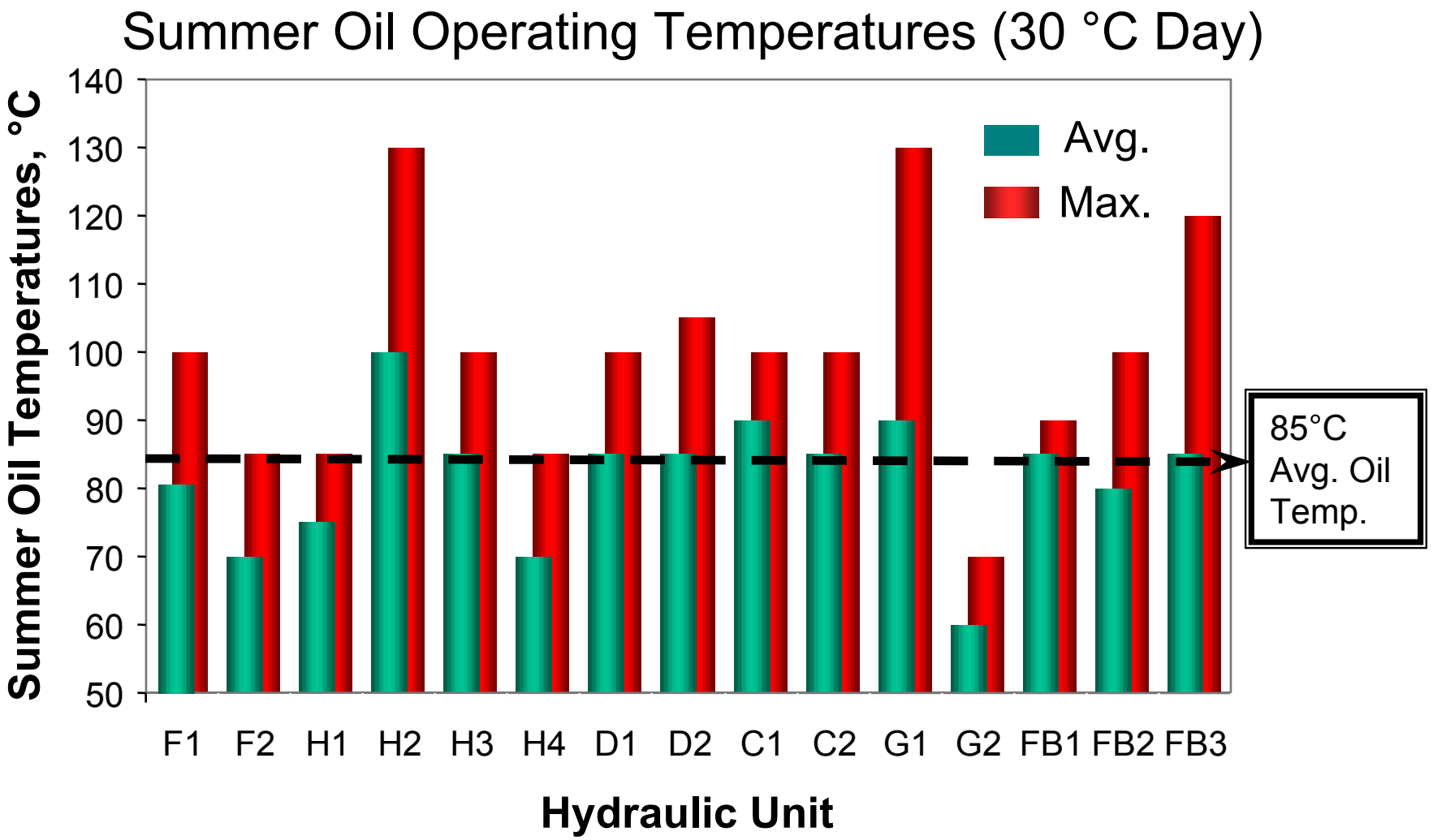
Canadian Forestry Equipment Field Test

Consider field test temperature data in 15 hydraulic units

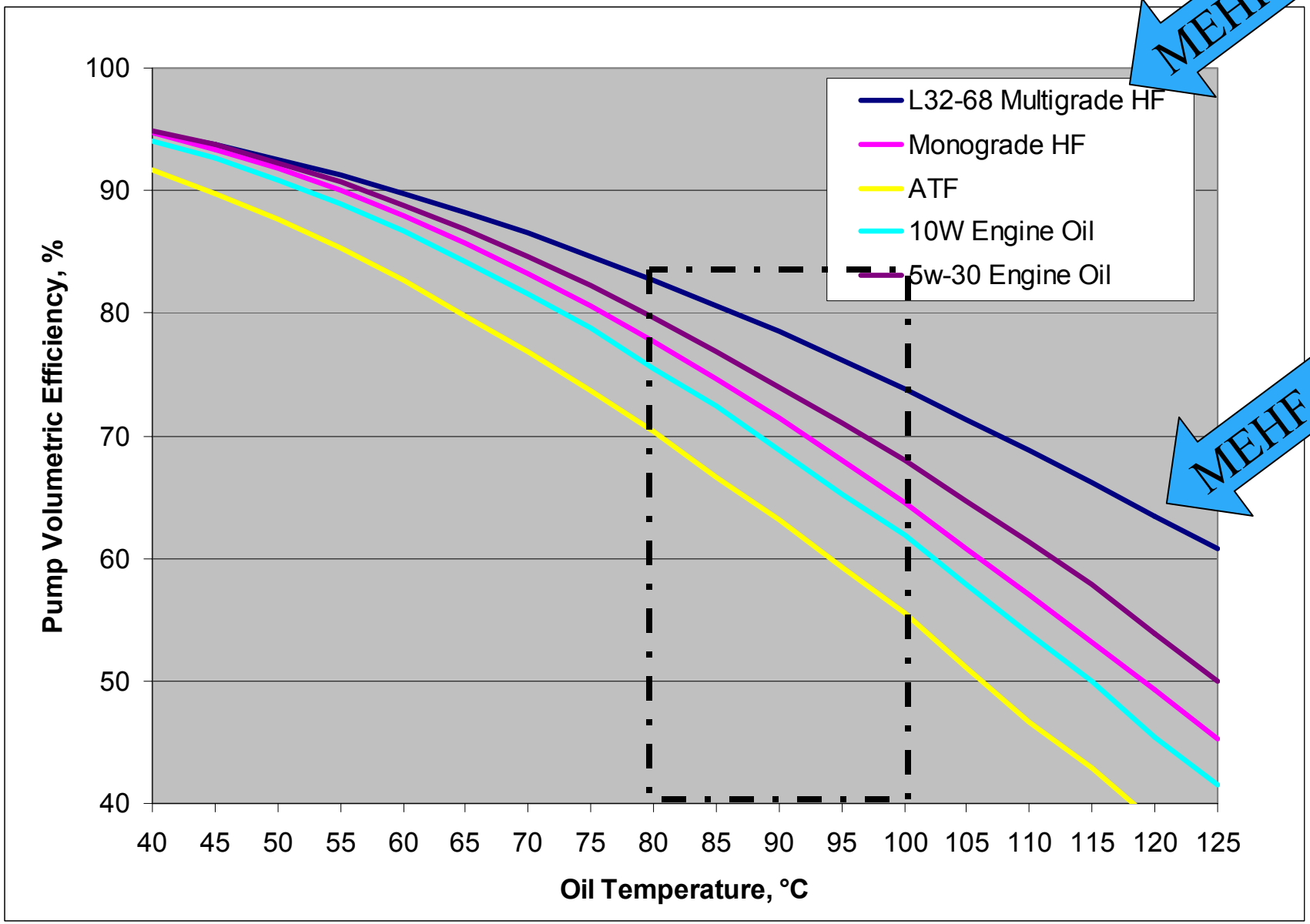
Compare Energy Efficiency in summer conditions

- Monograde HF
- Engine Oil
- ATF
- Multigrade HF

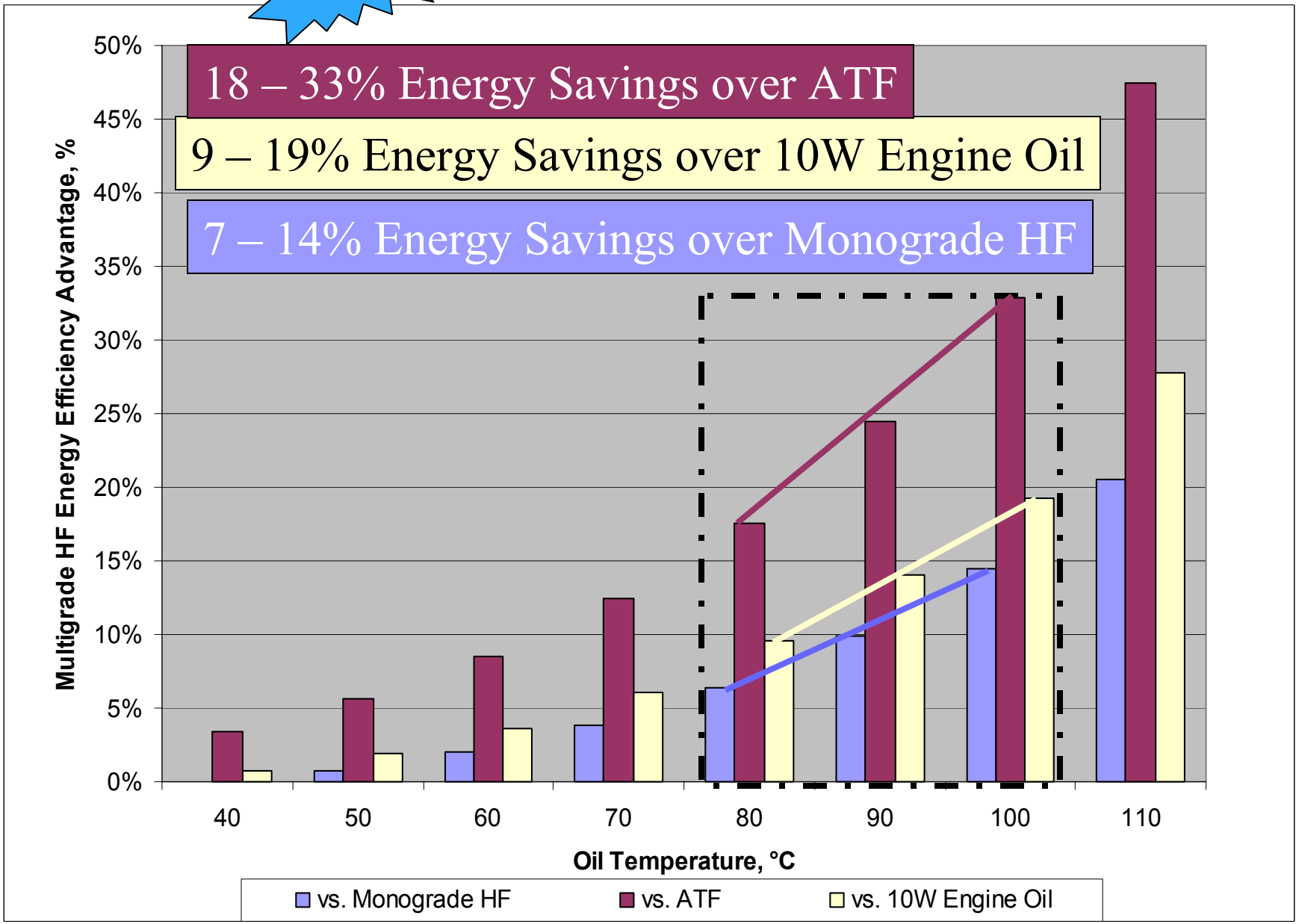
Canadian Forestry Equipment Field Test Data



Effects of Fluid Viscosity on Pump Efficiency



Multi MEHF HF Energy Savings Advantage



Multigrade Hydraulic Fluids Save Money !

Compare pump Energy requirements to deliver equivalent amounts of work

- Higher pump efficiency means lower energy consumption
- Higher pump efficiency means lower oil temperatures

Translate Energy Savings into kW, fuel or $ savings

In this simple example, a vane pump operating at 2000 psi and 85°C (field test conditions), can potentially save:

- 8% Energy compared to a monograde HF
- 11% Energy compared to 10W engine oil
- 21% Energy compared to ATF

Conclusions

Multigrade Hydraulic Fluids Save Energy

- At cold start-up
- At normal operating temperatures

Reduced Fuel Consumption means
Added Value for your customers

Replace HM hydraulic fluids with
"High Value" MEHF