Overview of Global and Regional Lubricants and Base Oil Markets

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Presentation Outline

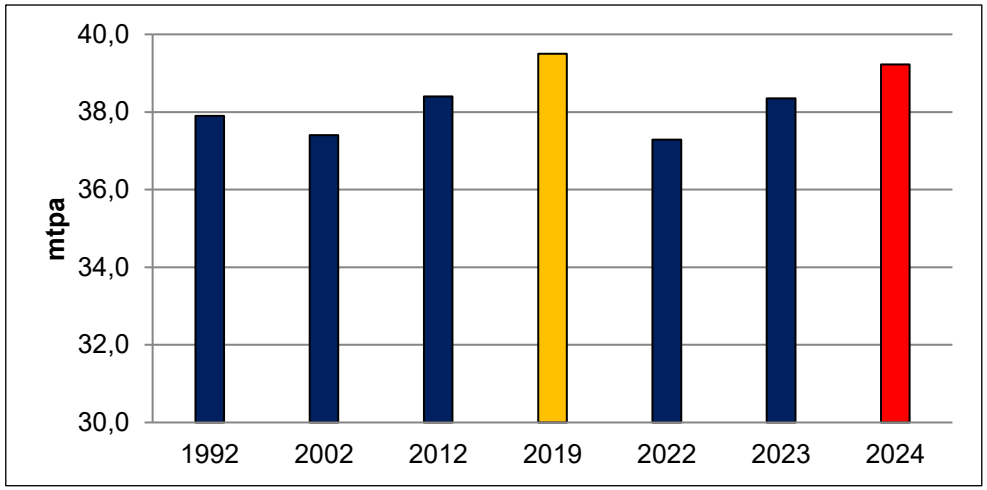
- ❑Global Lubricants Industry
- ❑Global Base Oil Industry
- ❑Technical Drivers
- ❑Impact on Lubricant and Base Oil Industries
- ❑Latin and South America Overview
- ❑Summary and Conclusions

Global Lubricants Industry Overview

- **Global lubricant demand realized slight growth in 2024**
  - Near full global recovery from COVID-19 (99+% recovery)
  - Latin/South America continue to recovery (90+% recovery)
- **Base oil overcapacity despite Group I closures**
  - New Group II/III capacity pending in India, South East Asia
- **Global conflicts create logistical challenges**
  - Israel-Iran, Israel-Hamas, Russia-Ukraine, Houthi crisis (Red Sea)
- **Geopolitics reshaping global trade, domestic policies**
  - Many elections globally, some government changes, policy review
  - US tariff policy targets China, EU, Canada, Mexico, others
- **"Green Initiative" movements losing some momentum**
  - EV push under review by many countries (hybrids an option?)
  - US EPA reviewing fuel economy targets (reduced aggressiveness)
  - China low cost EV's create potential trade protection (EU)

Global Lubricants Demand

- **Global lubricant demand realized slight growth in 2024**
  - Rate of recovery region and country dependent
- **Future demand forecasts slight growth thru 2032**
  - Population, vehicle growth, economic changes, follow GCD forecasts
  - Political stability/instability and US tariff strategy short-term concerns
  - New advanced equipment, conservation initiatives (EV's, sustainability)
  - Continued growth of synthetic and semi-synthetic products
- **Demand peak influenced by EV success (PCMO decline)**



Sources – KEPC, Fuchs, SBA, Kline, IHS Markit

Global demand growth only 1.4 mtpa in past 32 years

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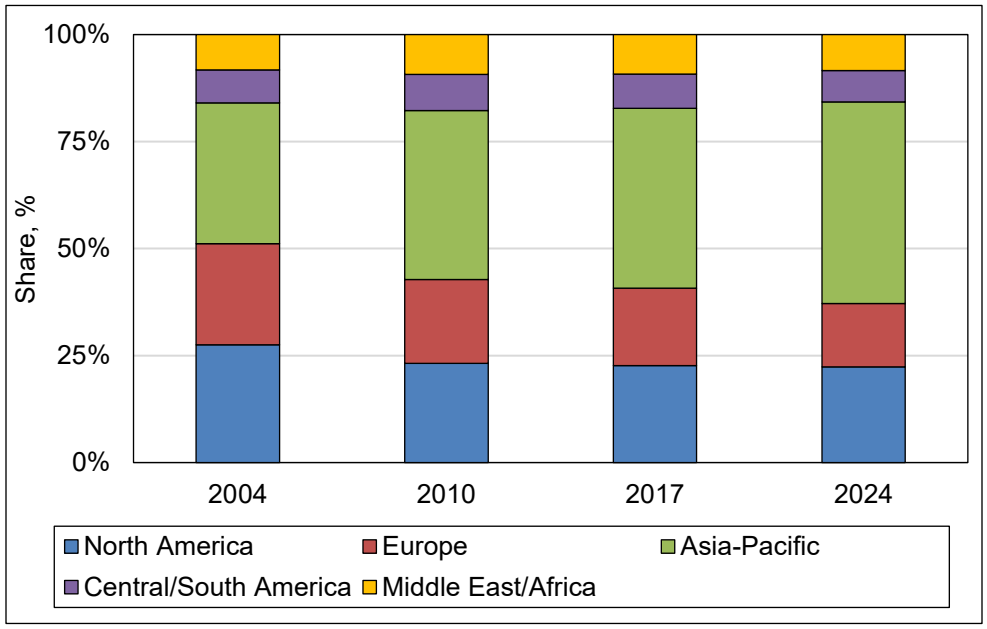
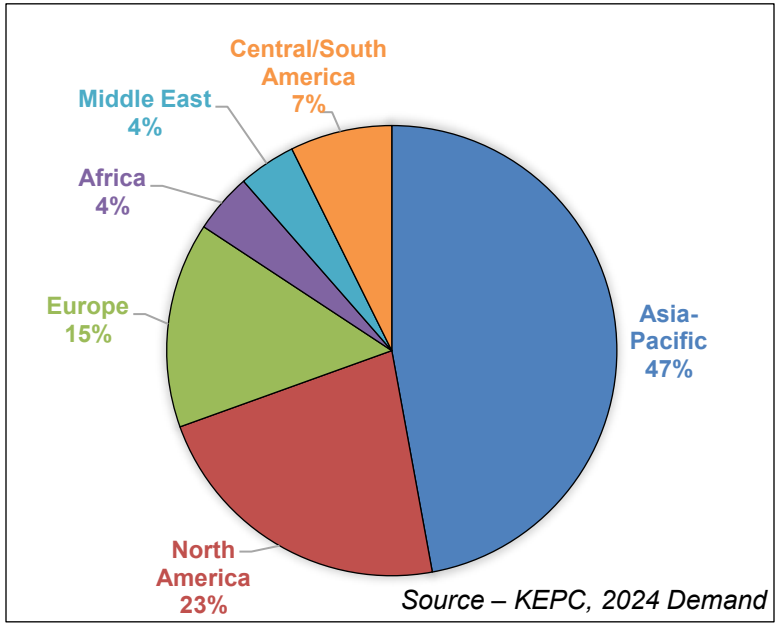
Regional Profile – Lubricant Demand

- **Asia-Pacific evolved into region with largest demand**
  - China and India key influence; India to impact future region growth
- **North America and Europe demand has declined**
  - Energy efficiency, lube management, synthetic/semi-synthetic growth
- **Central and South America shows growth (recent, future)**





Sources – KEPC, Fuchs, SBA, Kline, IHS Markit

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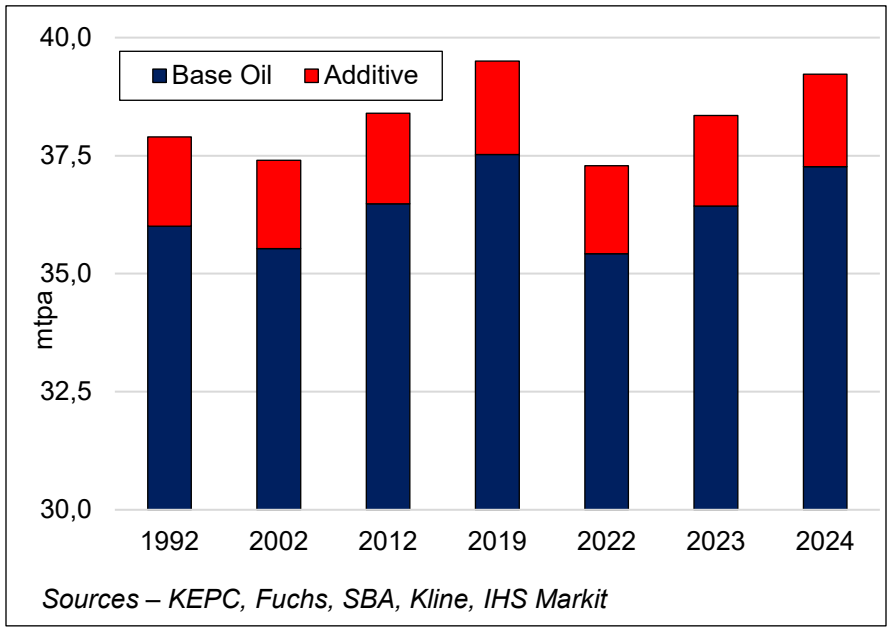
Global Base Oil Industry Overview

- **Base oil and finished lubricant demand aligned**
  - Base oil component estimated at 95%; additives (w/o diluent) at 5%
- **Continuing growth in Group II-III at expense of Group I**
  - Group III strongly aligned with PCMO and low SAE grades
  - Group II strongly aligned with HDEO for emissions, durability
  - Groups I, II, V support industrial and Process Oil segments
- **Base oil industry has become global *(global slates)***



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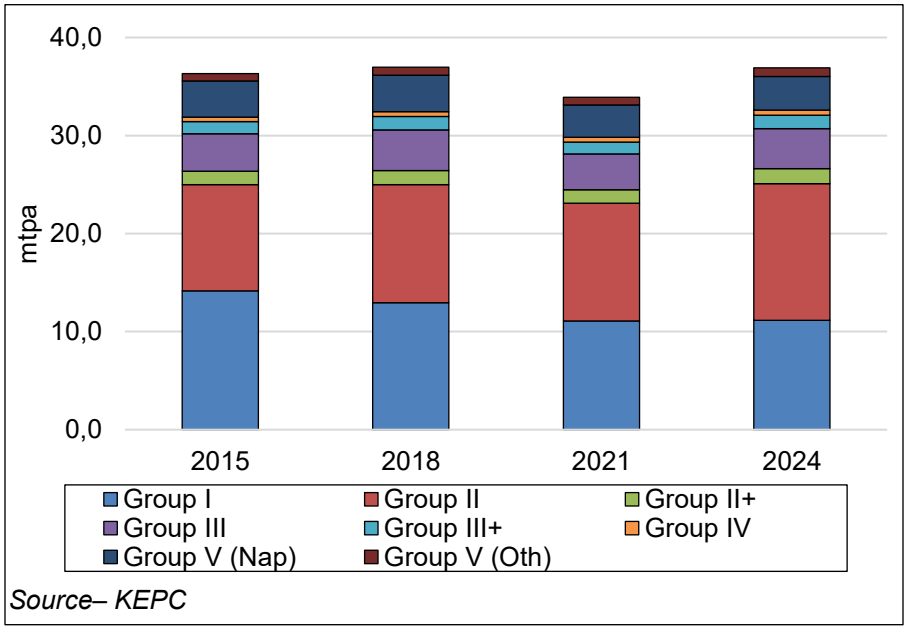

Source– KEPC

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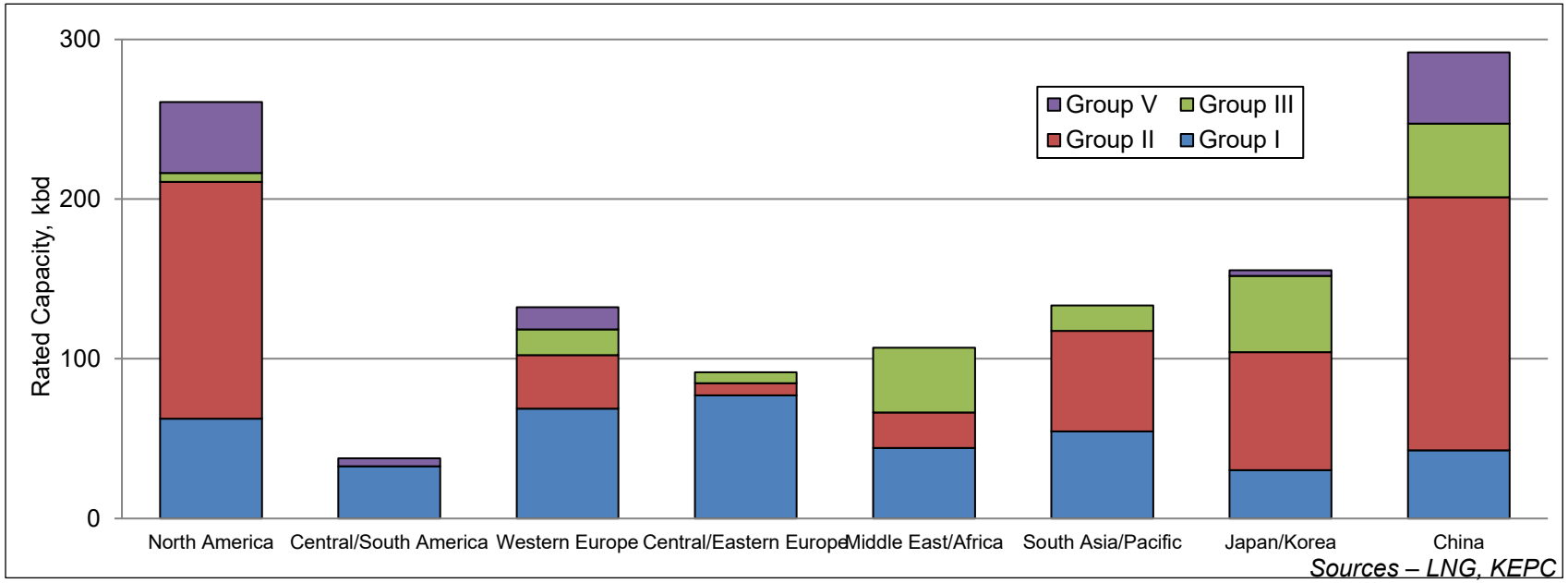
Global Capacity Profile – Virgin Base Stocks

- ❑ North America dominant in Group II/II+ capacity
- ❑ Europe (West, East, Central) main source for Group I
- ❑ South Korea, South Asia, Middle East Group III sources
- ❑ North America and China main naphthenic sources
- ❑ LA/SA has Group I and small naphthenic capacity



Overcapacity requires ongoing rationalization

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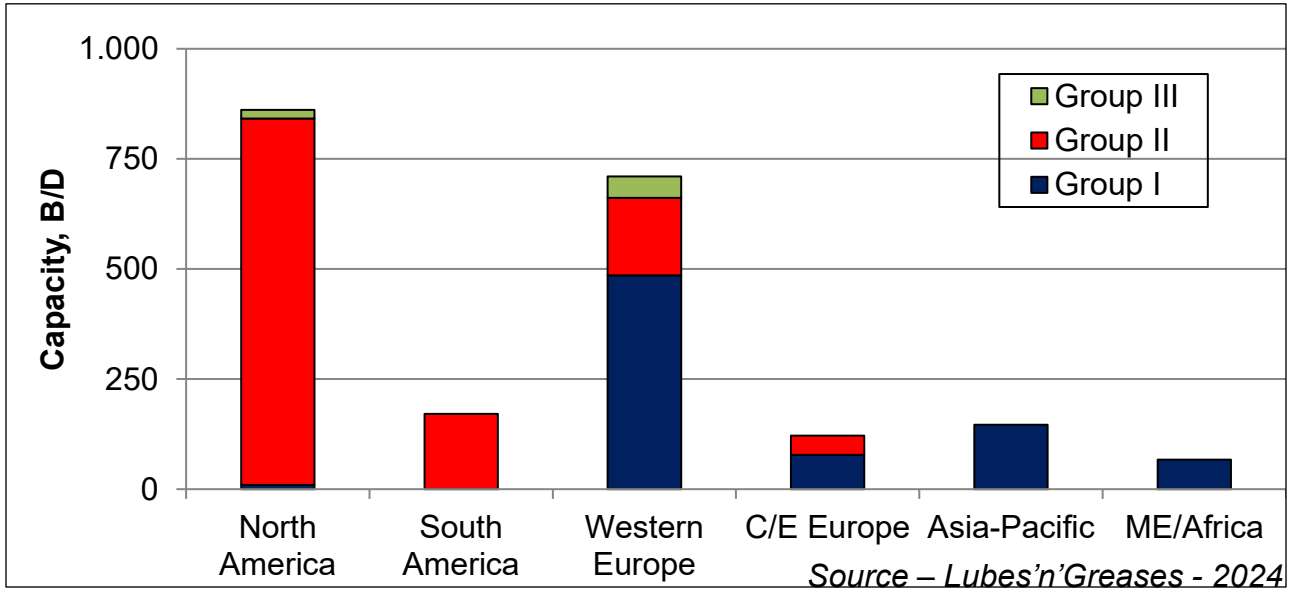
Global Re-Refining Summary

- **Largest production in North America, Western Europe**
  - Significant Group II production in NA – feedstock, process driven
  - Group III now observed in North America, Western Europe, Malaysia
  - Many countries have small facilities, fuels/VGO, poor quality, under radar
- **RRBO trends – increasing quality, low carbon footprint**
  - Several countries pursuing used oil collection, re-refining (e.g. India)



Opportunity for new capacity

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Technical Drivers

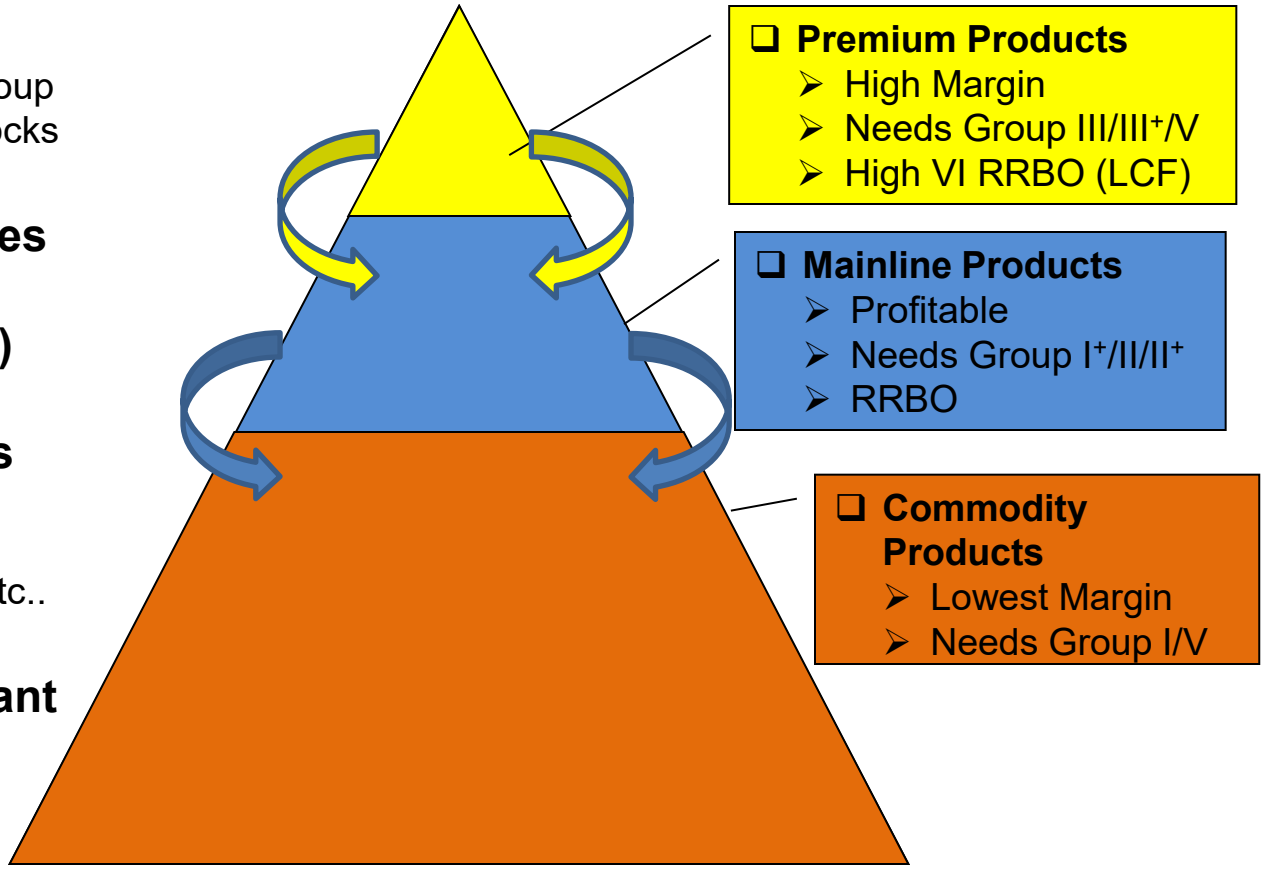
The Impact of Performance Changes to the Lubricants Market

- **Fuel economy**
  - Shift in recommended viscosity to light and very light grades
- **Emissions**
  - Engine oils now have volatility and chemical limitations
- **Durability**
  - Engine oils now need to demonstrate extended drain capabilities while maintaining fuel economy and emission control

Base oil contribution has been continuing development of high VI alternatives

Technical Drivers Provide Growth Opportunity for Premium Base Stocks

- **Continued growth in premium products**
  - Creates opportunities for Group II, III, IV and RRBO base stocks
- **Increased quality of mainline products creates need for higher quality base stocks (incl RRBO)**
- **Commodity products remain at reduced levels**
  - Niche products require specialized base stocks like Bright Stock, naphthenics, etc..
- **Despite slight growth in global demand, significant rebalance related to technical requirements**
  - Impacts base oil selection



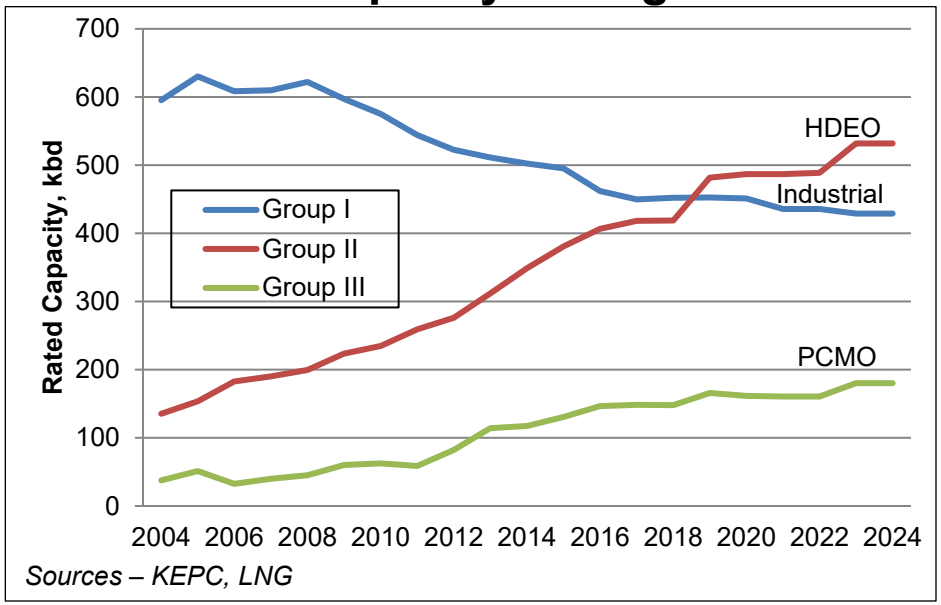
Oversupply in one market space overflows into lower quality levels where reduced margin opportunities exist

Impact on Lubricant and Base Oil Industries

Base Stock Demand Aligning with Finished Demand Technical Needs

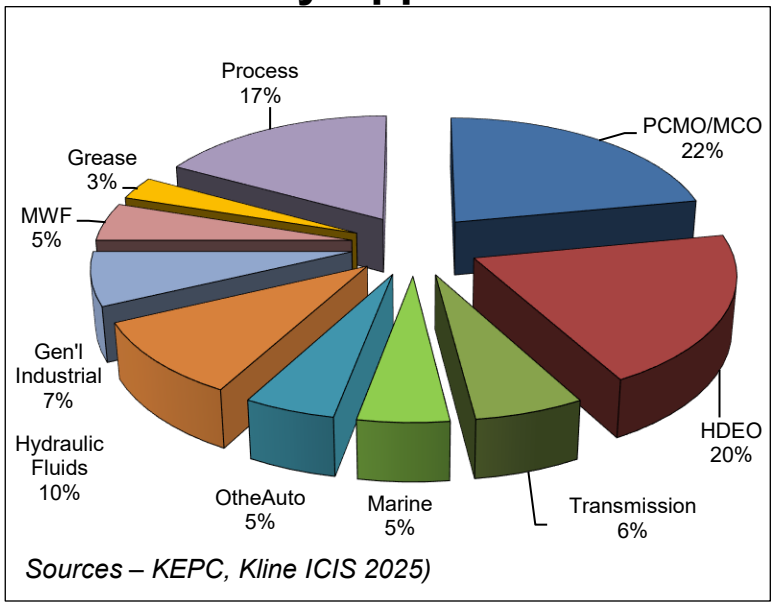
- **Group II-III capacity continues to grow to support automotive industry demands**
  - Group III supports PCMO and fuel economy
  - Group II supports HDEO and emissions-durability
  - Excess supply spills into other product applications

Capacity Changes



Sources – KEPC, LNG

Demand by Application - 2024



Sources – KEPC, Kline ICIS 2025)

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Shifting Policies and Their Consequences

❑United States Policy Reset

- ➢ Many previous gov't initiatives under review, reduce, cancel
- ➢ The Inflation Reduction Act (IRA) created EV growth thru tax credits
  - ✓ In 2024, many eligible models eliminated for tax rebates
- ➢ Several states now easing mandates and/or delaying ICE phase out
  - ✓ Ford and GM postponing EV rollouts in favor of hybrids

❑EU OEMs Shifting E-mobility strategy

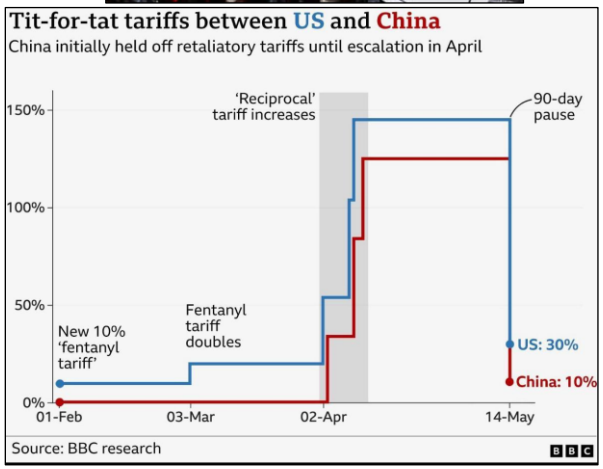
- ➢ Subsidy rollbacks, including Germany EV support cut
- ➢ Increasing competition from low cost China EVs prompts EU trade protection discussions
- ➢ Market shift towards hybrids; more cautious compliance timelines

❑ China Dominating EV Market

- ➢ China exported 1.2 Million EVs in 2023; more than double 2022
- ➢ Low cost EVs flooding European and Southeast Asia markets

Tariffs Create Confusion, Uncertainty, Opportunity

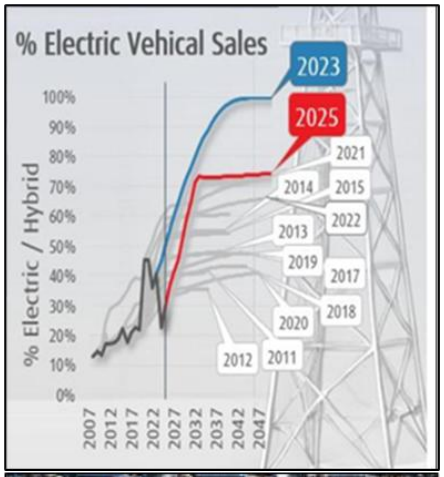
- **Tariffs affect trade flows between participating countries**
  - Impacts import/export dynamics
  - Creates confusion to customers, small business, logistics providers, traders/distributors
- **Tariffs can be emotional to countries with long-standing US partnership**
  - Increases national pride, can lead to retaliation
- **Tariffs create need to explore other markets to sell goods and services**
  - New partnerships, improve domestic accountability (remove inter-regional tariffs)
- **Tariffs should be strategic and logical**



E-Mobility Update

- **Continued global growth in EV sales**
  - Rate of change slowing in several countries
  - Hybrid acceptance growing
- **Regulatory policies & priorities shifting**
  - Market agility required to adopt and adjust quickly
- **Regulatory frameworks & policies influencing EV market changing rapidly**
  - US easing EV mandates, delaying ICE bans
- **OEMs dealing with uncertainty; seeking alternate fuel options to EV**
  - Invest in alternate technology options?
  - Hybrid technology preferred interim choice

Key take away – Difficult to force sustained change thru gov't policies and subsidies only; customer acceptance is key to success as they should drive change!

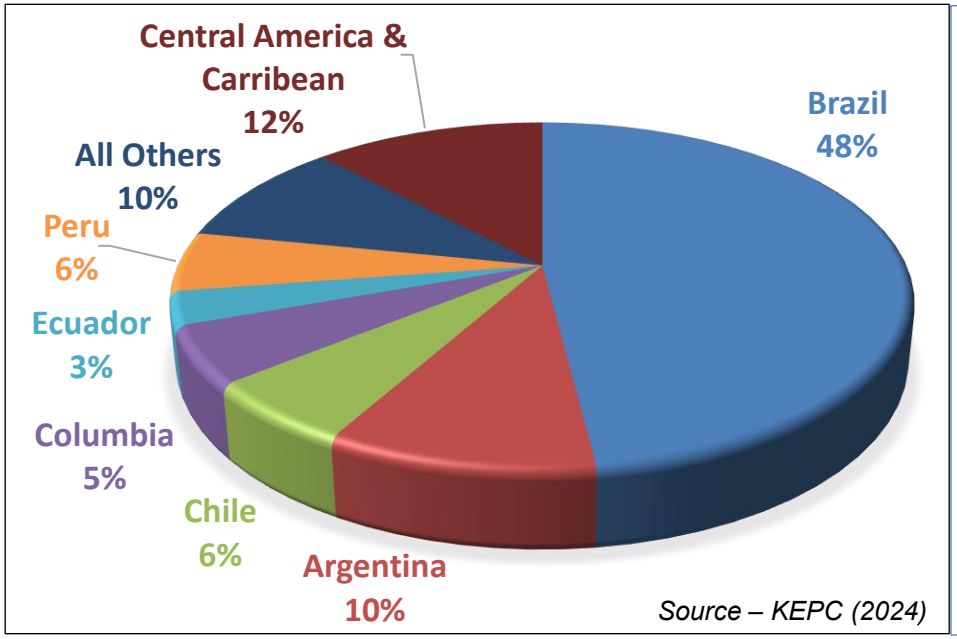


Latin and South America Overview

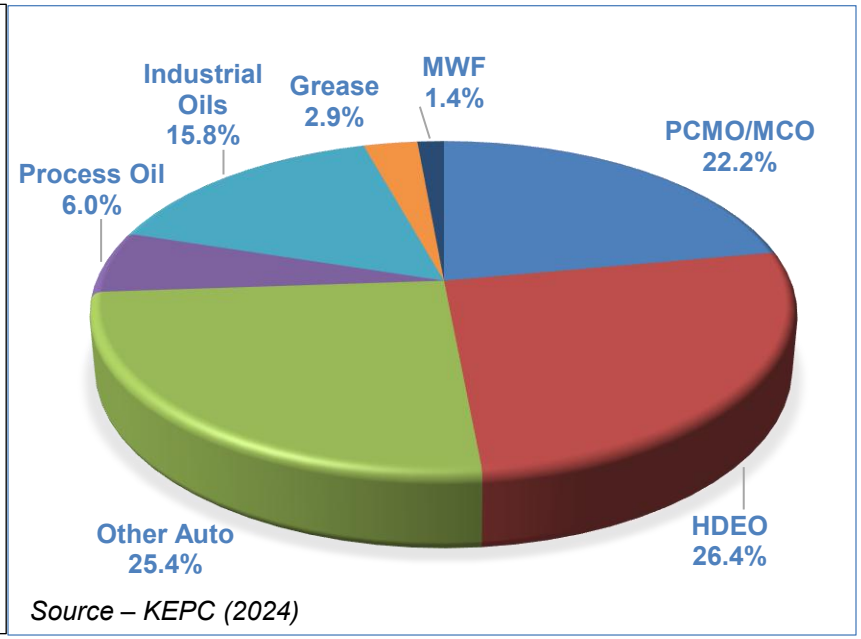
Lube Demand – Latin and South America - Current

❑Lubricant demand estimated at 2.87 mtpa in 2024

- ➢ Brazil represents the largest lubricant market
- ➢ Large automotive demand – HDEO largest followed by PCMO/MCO
- ➢ Industrial oils support agriculture, manufacturing, mining



Source – KEPC (2024)



Source – KEPC (2024)

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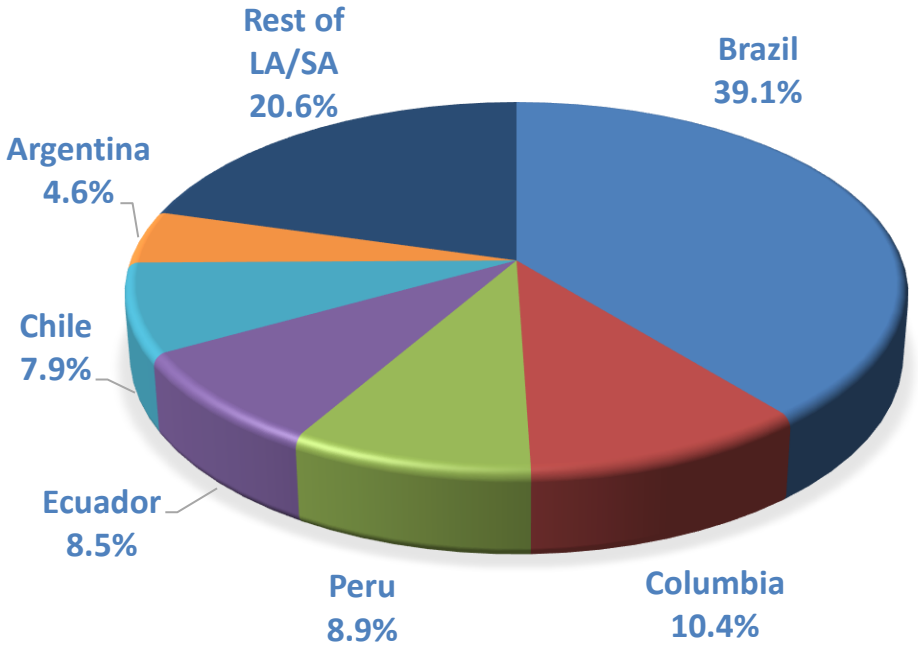
Trade Flows Between US, Latin/South America

- **Significant disparity between imports and exports of base oils and lubricants between LA/SA and US**
  - South America represents 81.7% of US exports in 2024 followed by Central America (excluding Mexico) at 10.4% and Caribbean at 7.9%

Year	US Imports, B/D	US Exports, B/D
2015	917.8	27,515.1
2016	641.1	27,312.3
2017	227.4	29,235.6
2018	156.2	29,758.9
2019	68.5	27,961.6
2020	35.6	26,882.2
2021	90.4	27,917.8
2022	148.0	36,167.1
2023	21.9	30,506.9
2024	52.1	28,786.3

Source - EIA



Source – EIA; distribution of US exports in 2024

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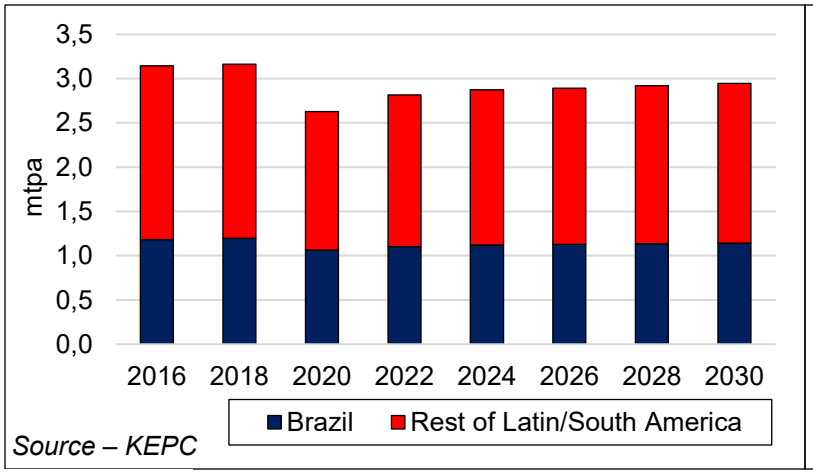
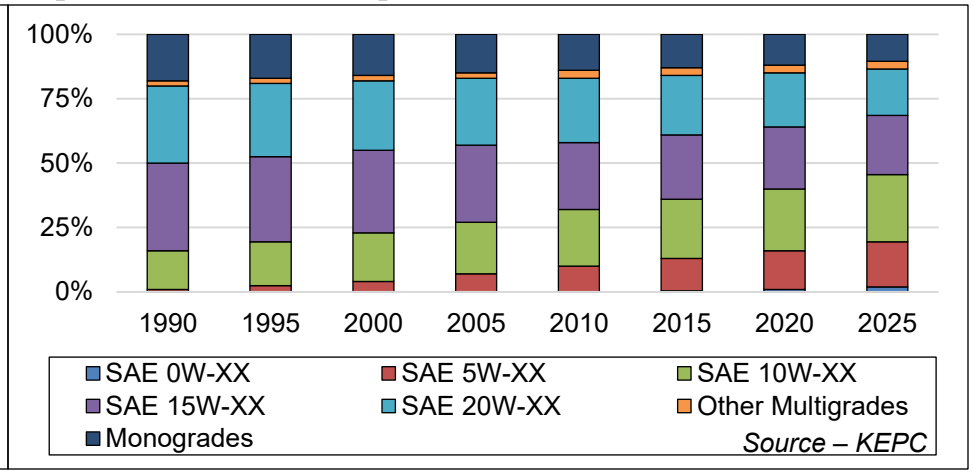
Lube Demand – Latin and South America - Future

- **Region to see slow but continued growth**
  - Forecast demand at 2.94 mtpa by 2030
  - Demand to follow GDP performance
- **PCMO SAE grade changes support fuel economy**
  - Industry SAE 5W-20/30 requires Group II$^+$, SAE 0W-16/20 Group III
  - With OEM approvals, base oil requirements increase to Group III (SAE 5W-20/30) and Group III$^+$ (SAEW 0W-16/20)
- **Availability of Group II and Group III imports support HDEO transition from Group I to Group II**





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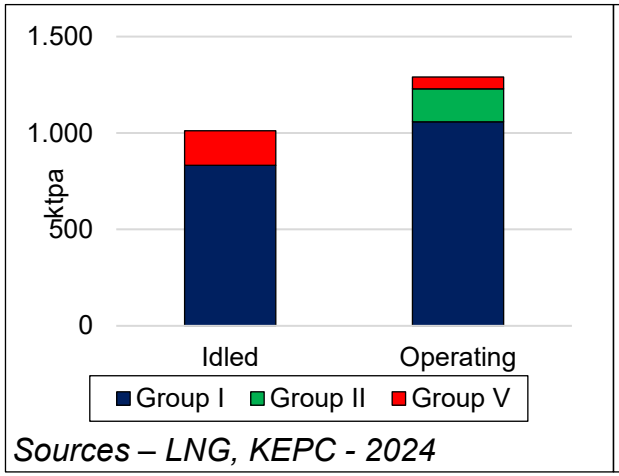
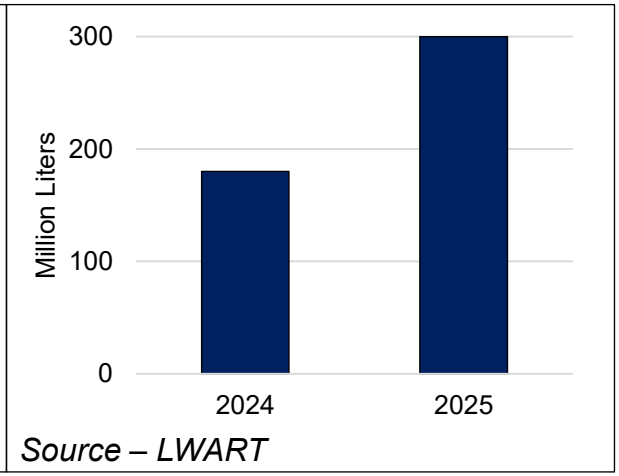
Latin/South America Base Stock Capacity Profile

- **Region capacity historically dominated by Group I**
- **Political and economic uncertainty impacts production**
  - Several Group I and V refineries idled; limited chance for restart
  - Includes PEMEX Group I refinery in Salamanca
- **Limited opportunity for near term investment**
  - Petrobras continuing assessment of Group II investment
  - Growing Group II-III demand achieved thru imports and LWART RRBO
- **Re-refining (LWART Group II) bright spot for region**
  - Completion 1Q'26; increase production from 180 to 300 Million Liters



Sources – LNG, KEPC - 2024



Source – LWART

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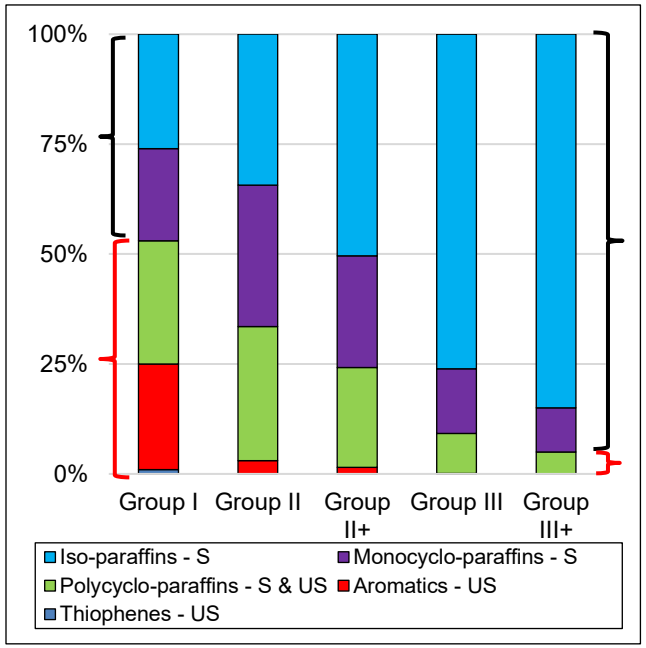
Demand Drivers for Lubricants/Base Oils

- **Engine oils formulated with base oil (typically 2-3), an additive package and a Viscosity modifier (with/wo PPD)**
  - Blended oil must align with SAE J300 high/low temperature viscometrics
- **Every formulation has a target blended base oil viscosity (BOV) to maximize blend efficiency and first time on spec performance**
  - Key properties include KV@100°C, VI, CCS, Noack volatility
- **For SAE 0W-XX grades, Group III primary base oil requirement**
  - For SAE 5W-XX grades, use Group II$^+$ or blends of Group II-III or Group II-III$^+$
- **For OEM performance, higher VI Group III$^+$ required for SAE 0W-XX grades; Group III for SAE 5W-XX grades**

Performance	Industry Performance (API, ILSAC, ACEA)				Industry + OEM Performance (GM, BMW, MB, VW, Volvo, etc)			
SAE Grade	**0W-16**	**0W-20**	**5W-20**	**5W-30**	**0W-16**	**0W-20**	**5W-20**	**5W-30**
BOV Properties								
KV @ 100°C	4.6	4.6	4.9	4.9	4.7	4.6	5.1	5.0
VI	120-125	125	115	115	≥130	≥130	≥120	≥120
BO Group	III	III	II$^+$	II$^+$	III$^+$	III$^+$	III	III

Re-Refining – Improving Quality

- **Solvent processing (Group I) retains sulfur, aromatics**
  - Unstable components
  - Degrades when exposed to high temperatures in engine environment
- **Hydroprocessing (Group II, Group III) removes S; converts aromatics to paraffins**
  - Creates more stable composition
- **Modern auto oils use Group II-III base oils**
  - Stable components remain through oil use; can be recovered/re-refined *"indefinitely"*



Source – KEPC estimates
*Code – **S = Stable**; **US = Unstable***

Re-refining contributes to closed loop process and circular economy!

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Summary and Conclusions

- **Lubricant demand realized slight growth in 2024**
  - Near full recovery from COVID-19 (region/country dependent)
- **Future demand shows sustained growth thru 2032**
  - Peak timing impacted by EV growth, associated PCMO decline
- **Base oil overcapacity exists despite some closures**
  - Additional closures required to offset new Group II-III capacities
  - LWART Group II re-refinery expansion LA/SA region bright spot
- **Base oil demand continues trend to Group II-III**
  - Aligns with automotive industry demands
  - Provides increasing UMO quality for re-refining industry
- **Re-refining industry has future opportunities**
  - Low carbon footprint, improving quality, Group II^{+} and Group III now achievable in many regions
  - Many countries developing regulations to support re-refining industry

Thank you

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