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The Influence of Electric Vehicles on Engineering Plastics

April 7, 2024 • Plastics Industry Briefing

CHEMICAL MARKET ANALYTICS
BY OPIS, A DOW JONES COMPANY



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The Influence of Electric Vehicles on Engineering Plastics

Brendan Dooley

Global Director, Engineering Plastics
Chemical Market Analytics

Forces of change in the automotive ecosystem

Forces of change are key variables that will influence the future; they are the building blocks for scenario development and are multidimensional and far-reaching, and could unfold in different ways



Technology innovation and adoption—Driverless technology and electric cars



Quest for economic and environmental balance



Consumers and their behavior



Energy prices and availability



Companies and the new automotive universe

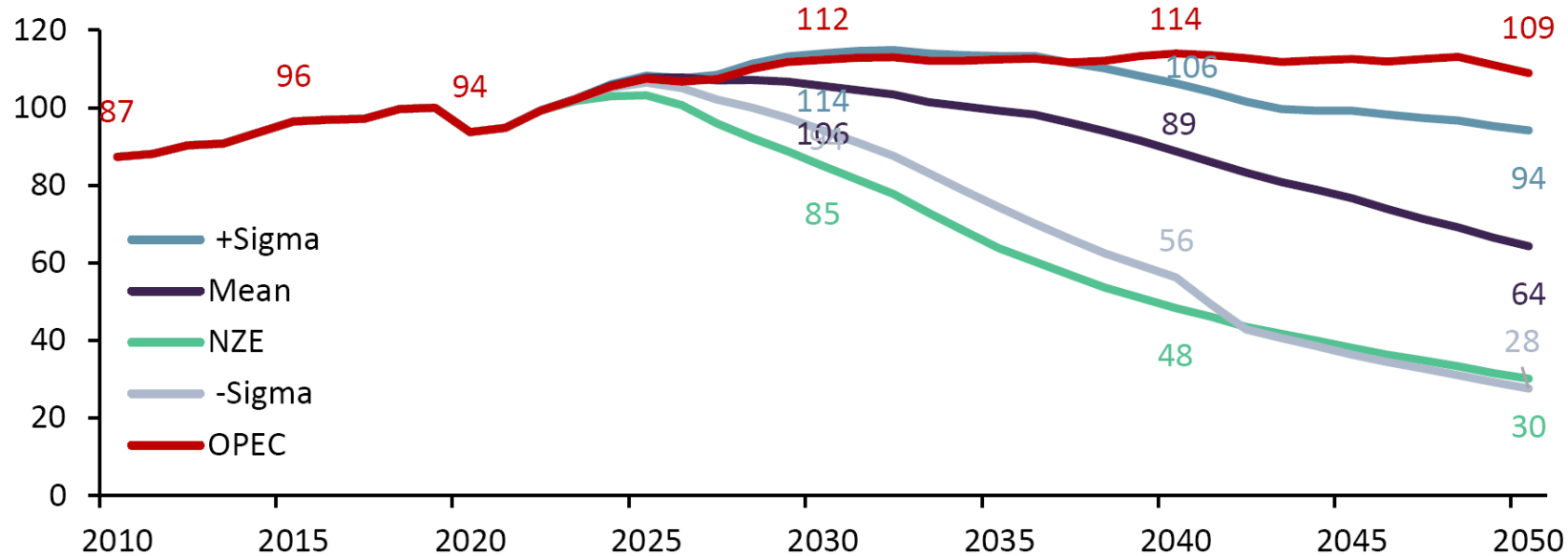
Total global liquids supply towards 2050 depends on the trajectory of decarbonization

OPEC scenario sees bullish liquids demand with a gradual increase in demand up until 2045. The aviation, road transportation, and petrochemical sectors will each see oil demand grow by around 4 million bpd between 2021 and 2045. The electric vehicle (EV) fleet approaches 540 million vehicles by 2045, representing more than 22% of the global fleet.

NZE scenarios from the IEA sets a narrow pathway for global energy to achieve net zero CO₂ emissions by 2050. Oil demand peaks in 2021 and falls sharply to 30 million bpd in 2050. NZE is a backward-calculated scenario with the main goal being to cap global warming to 1.5°C. The NZE scenario sees major changes in the composition of product demand, requiring refiners to adapt refinery configurations and business models and to invest more heavily in emission reductions, hydrogen, and biofuels.

Mean scenario (1.9°C) assumes that the oil peaks at 106 million bpd in 2026 and declines progressively. EV adoption develops according to reasonably risked-down current EV manufacturers' targets. Oil substitution in other sectors develops pursuant to current decarbonization policies.

Global liquids supply (MMb/d)



+Sigma scenario (2.2°C) is an upside probabilistic range from the Mean scenario. Oil demand peaks in 2031 at 111 million bpd and declines to 93 million bpd in 2050.

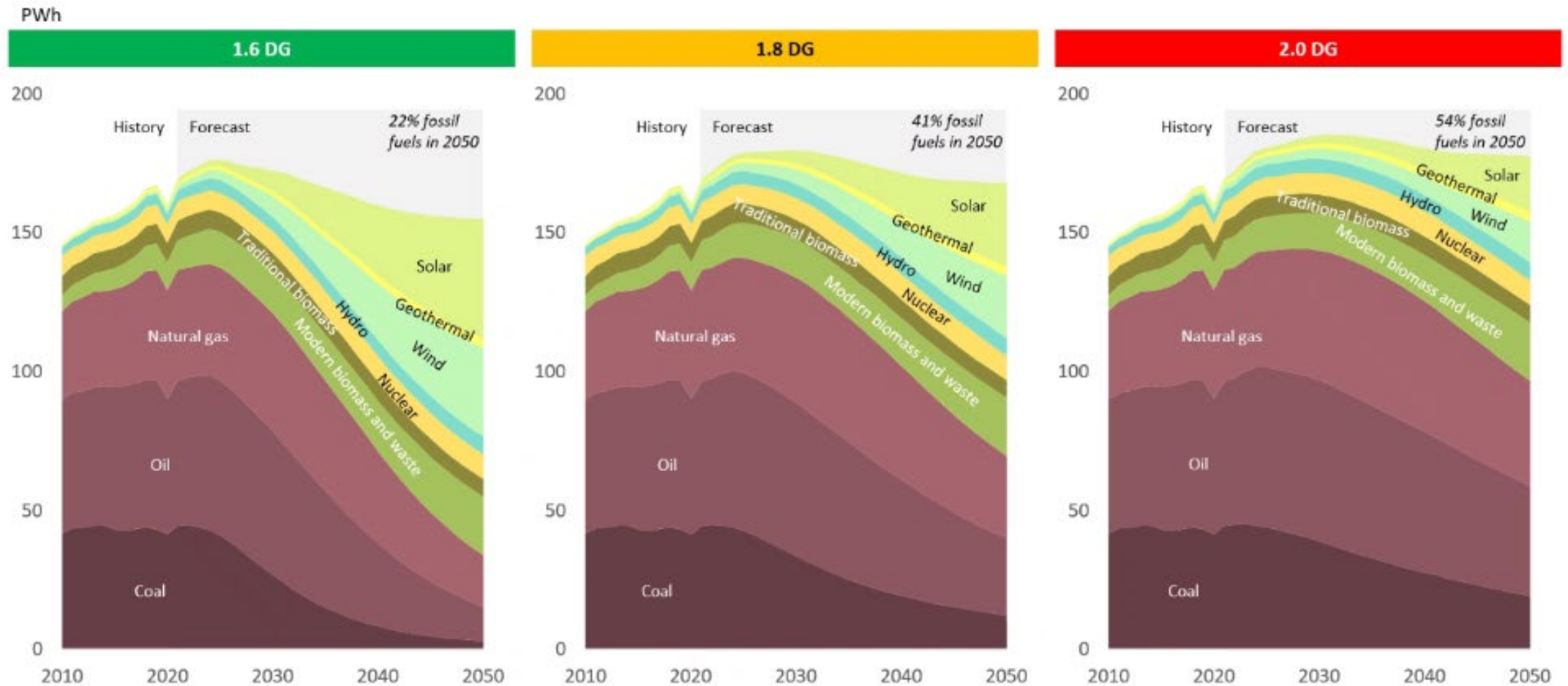
-Sigma scenario (1.6°C) is a reasonable downside probabilistic range from the mean scenario. Oil demand peaks at 105 million bpd in 2025 and falls sharply to 22 million bpd in 2050.

Source: Rystad Energy research and analysis

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Ambitious climate scenarios assume increasing reliance on renewables and less on fossil fuels

Global primary energy development by degree scenario



Light-duty vehicle sector is the main driver of the rapid drop in oil demand

In the mean (1.9 °C) scenario, light-duty vehicle demand drops sharply to 8 MMb/d in 2050 after peaking at almost 30 MMb/d in 2026

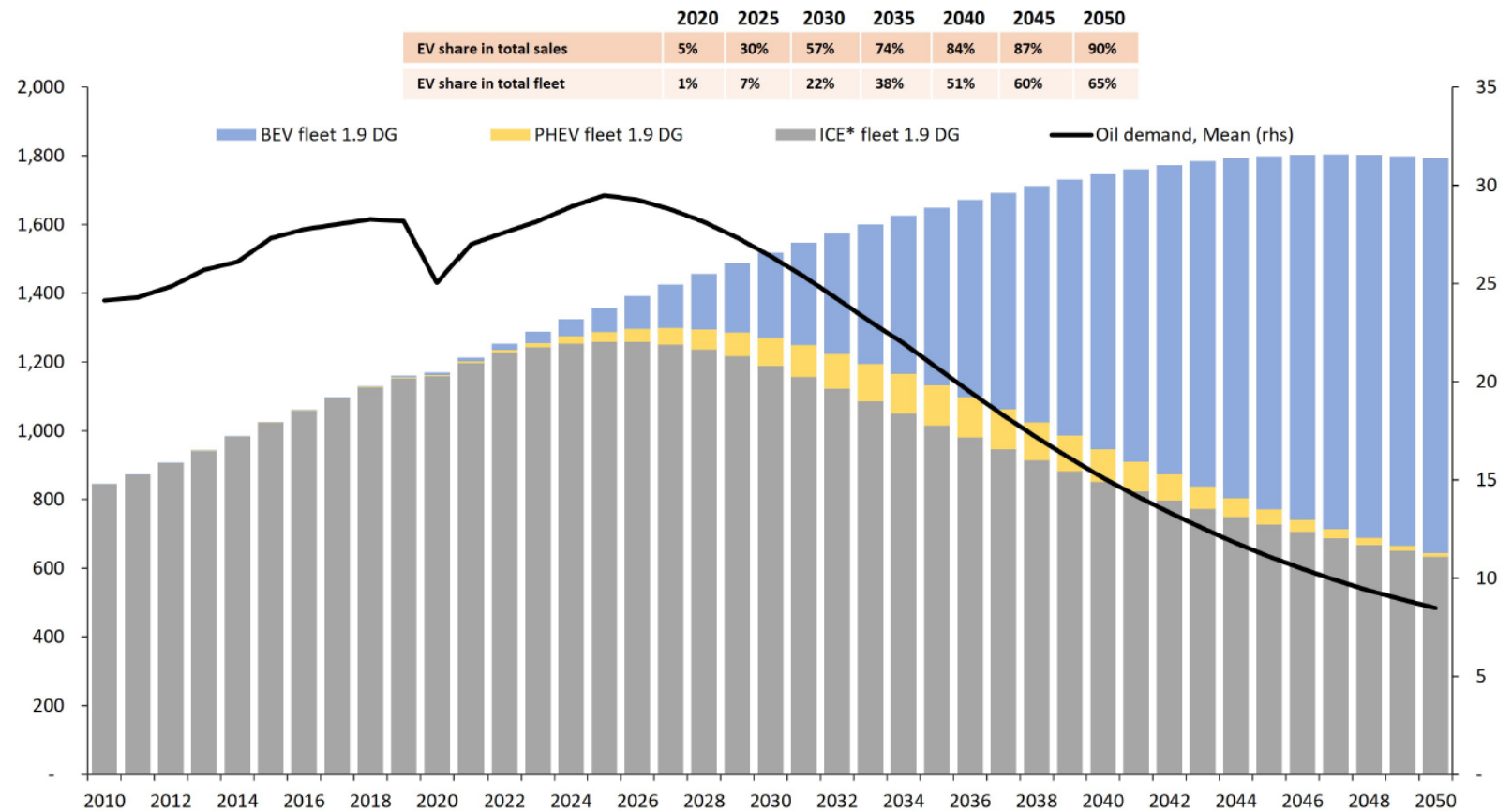
Assumptions:

- Electrification at a brisk pace, especially in Europe and China
- EVs will have conquered more than half of the share in global sales by 2030
- Electrification of passenger road transport is irreversible
- Potential reduction of the distance traveled by passenger cars (more public transport)

Global passenger vehicle fleet and oil demand

Million vehicles

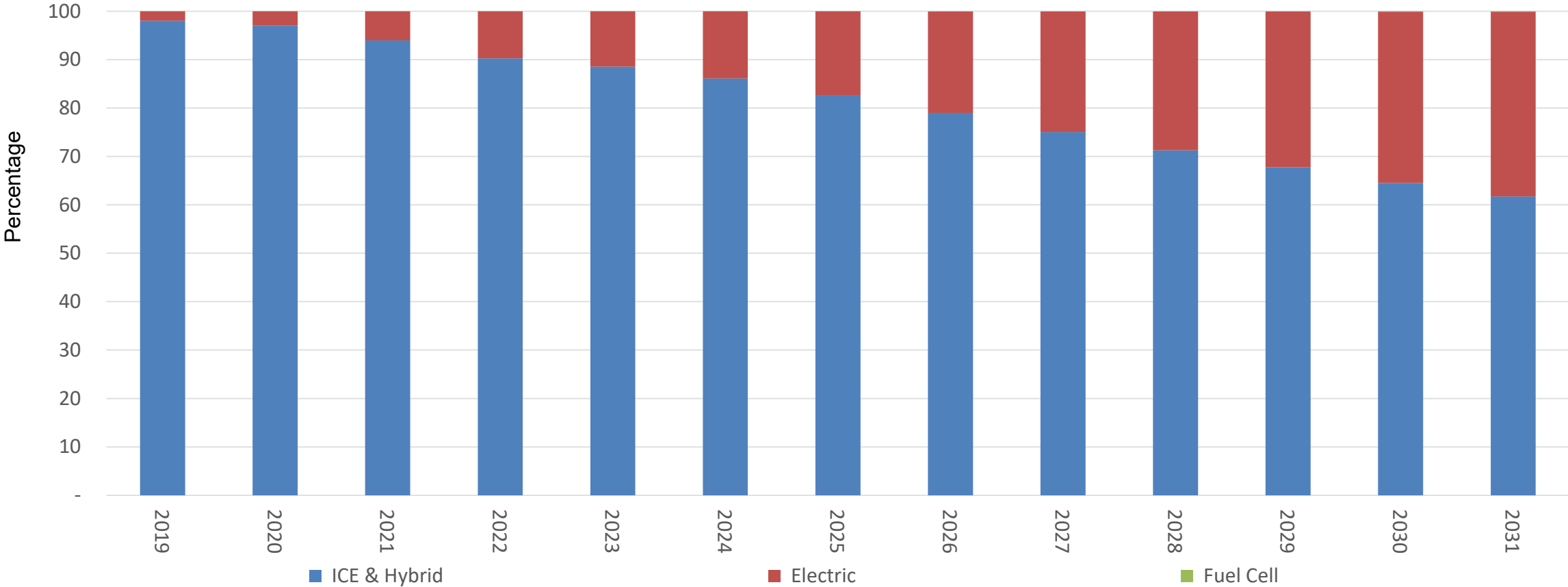
Million barrels per day



Source: Rystad Energy research and analysis

Transition away from Combustion Engines exceeds 30% worldwide by end of the decade and reduces demand for Plastics in Conventional Fuel Systems

Worldwide Light Vehicle Production by Fuel Type



Source: GlobalData

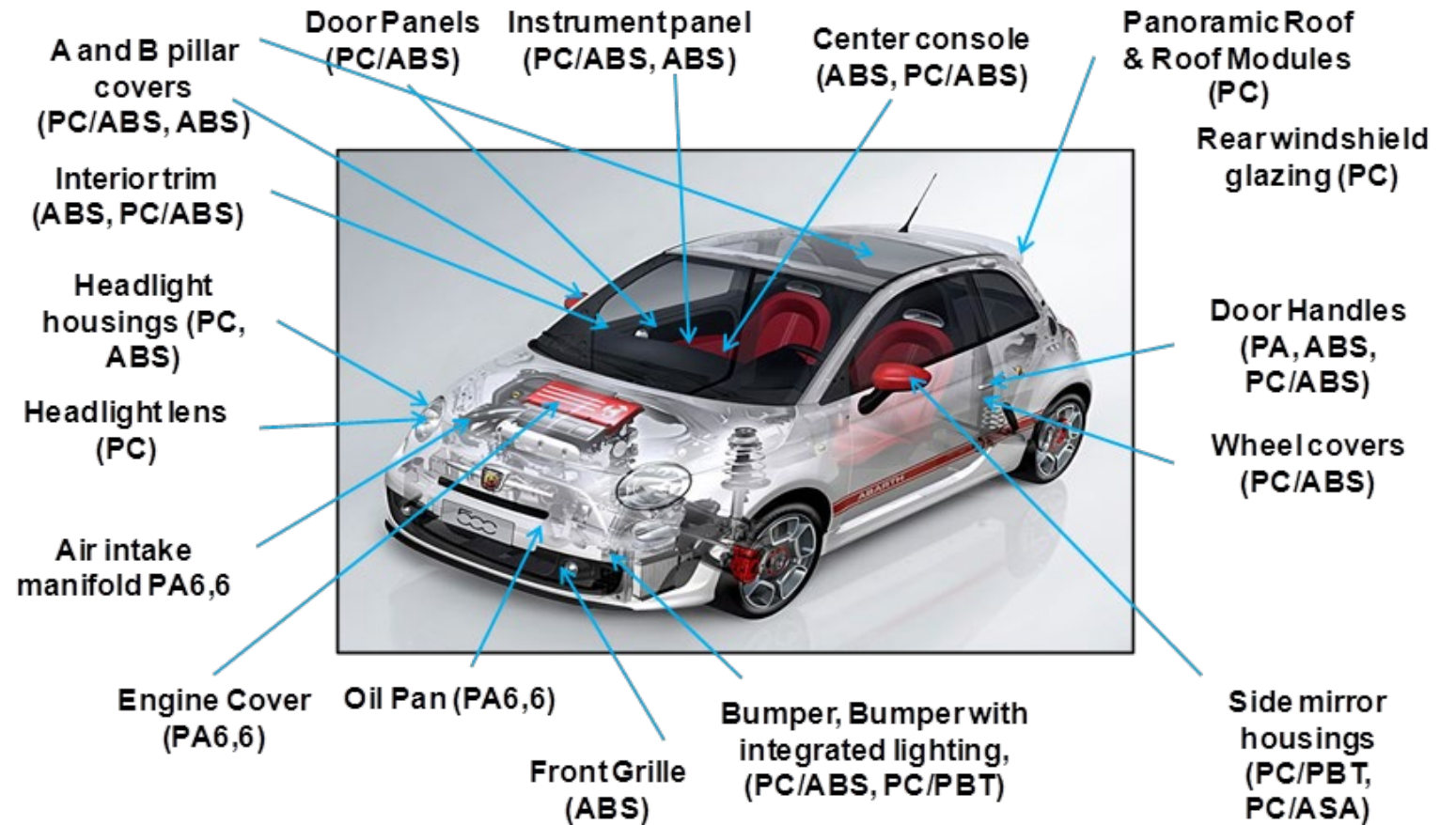
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Big choices are facing the Engineering Plastics and Automotive Industries

What will changes in automotive powertrains mean to the supply of feedstock to the chemical industry?

How will design changes in the automotive sector affect the demand for chemicals and materials such as engineering plastics and synthetic elastomers?

What are the strategic implications for the chemical industry's structure and participants?



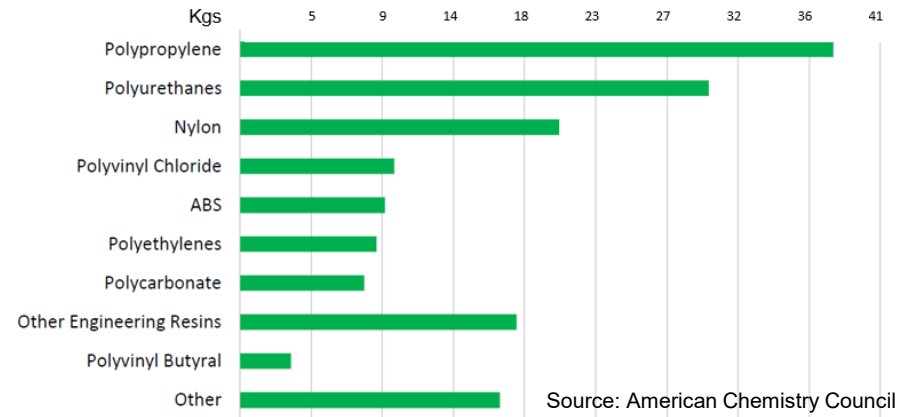
Plastics and polymers content exceeds \$400 per light vehicle

Demand for Engineering Plastics is expected to increase as Light Vehicle Production rises.

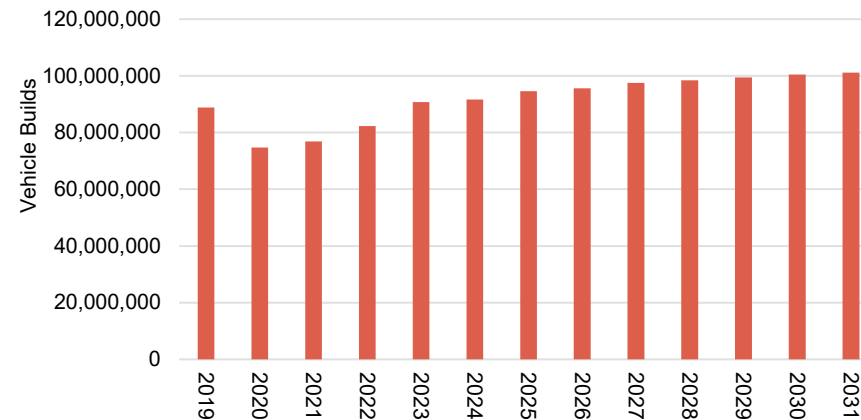
Passenger vehicle content:

- 38 kg PP
- 20 kg Nylon
- 10 kg PVC
- 9 kg ABS
- 9 kg PE
- 8 kg PC

Average Plastic & Polymer per Light Vehicle in the USA



Worldwide Light Vehicle Production



Source: Chemical Market Analytics by OPIS

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Engineering Plastics demand in Automotive reduced in Fuel Systems of Hybrids / EVs but Battery and Electrical Systems expected to increase Overall Demand to 2.3% AAGR 2023-2050

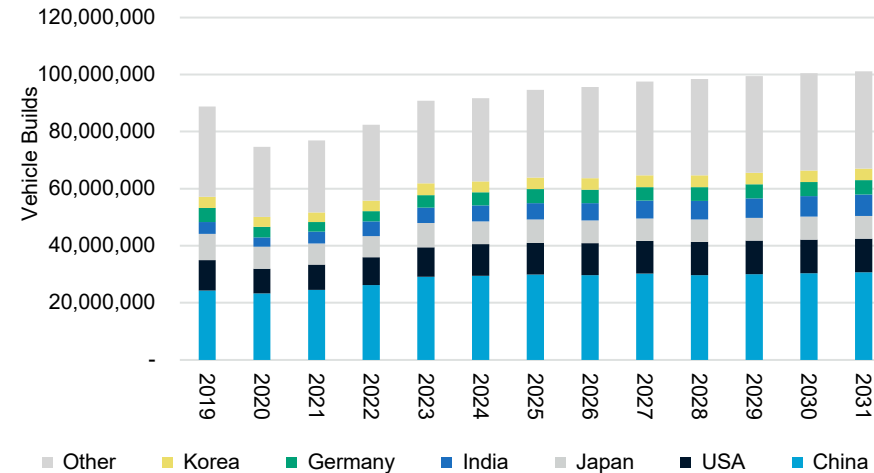
Interiors, Exterior and Lighting applications are less sensitive to the transition to electric vehicles.

Fuel Systems and Chassis applications are subject to the most erosion of demand.

Battery Supports and Enclosures, and Charging Equipment standards continue to develop and evolve as a hotly contested market opportunity.

Engr Plastics	2023-33 AAGR%	2023-50 AAGR%
CHI	2.8	2.1
JAP	0.1	0.1
KOS	(0.5)	(0.5)
SEA	3.7	2.8
WEP	1.3	1.0
NAM	1.6	1.6
WLD	2.6	2.3

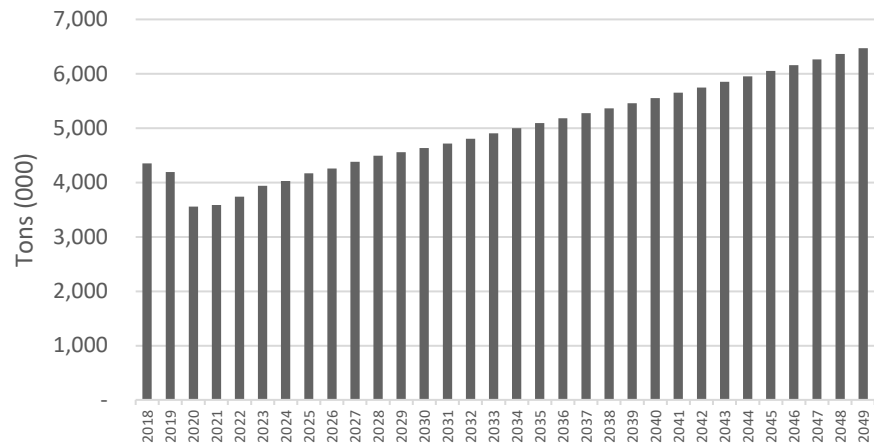
Countries with Largest Light Vehicle Production



Source: Chemical Market Analytics by OPIS

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Worldwide Automotive Industry Demand for Engineering Plastics



Source: Chemical Market Analytics

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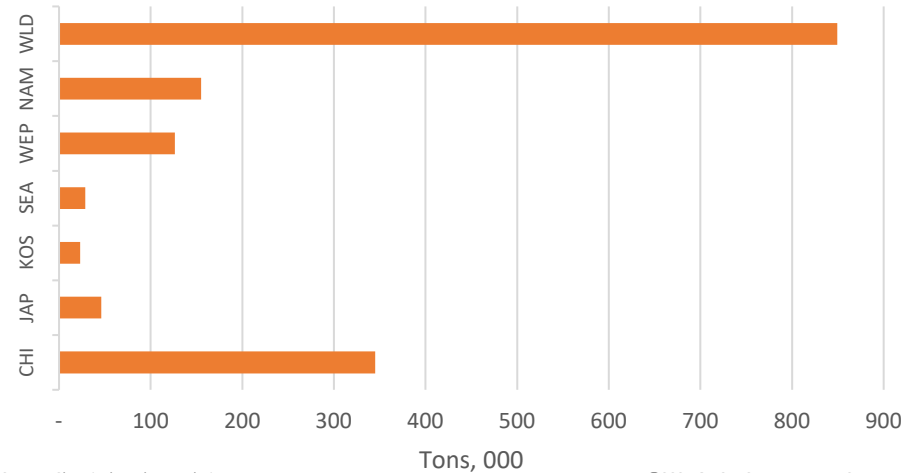
Polycarbonate demand influenced by evolution of Styling and Infotainment features including Headlamps, Display Panels and Distinctive Exterior Lighting is forecast to increase by 3.5% AAGR 2023-2050

Consumer styling preferences for smaller, more compact Headlamps would reduce demand.

More and larger Display Panels and Brand Identifying Exterior Lighting features are expected to increase demand.

PC	2023-33 AAGR%	2023-50 AAGR%
CHI	5.0	3.5
JAP	1.2	0.6
KOS	0.6	(0.1)
SEA	5.0	3.9
WEP	1.6	0.3
NAM	2.7	2.8
WLD	4.2	3.5

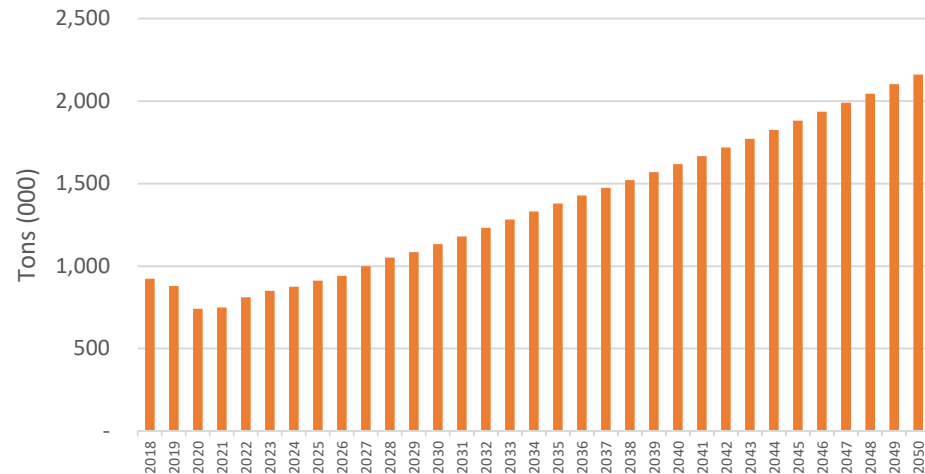
2023 Worldwide Automotive Industry Demand for Polycarbonate



Source: Chemical Market Analytics

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Worldwide Automotive Industry Demand for Polycarbonate



Source: Chemical Market Analytics

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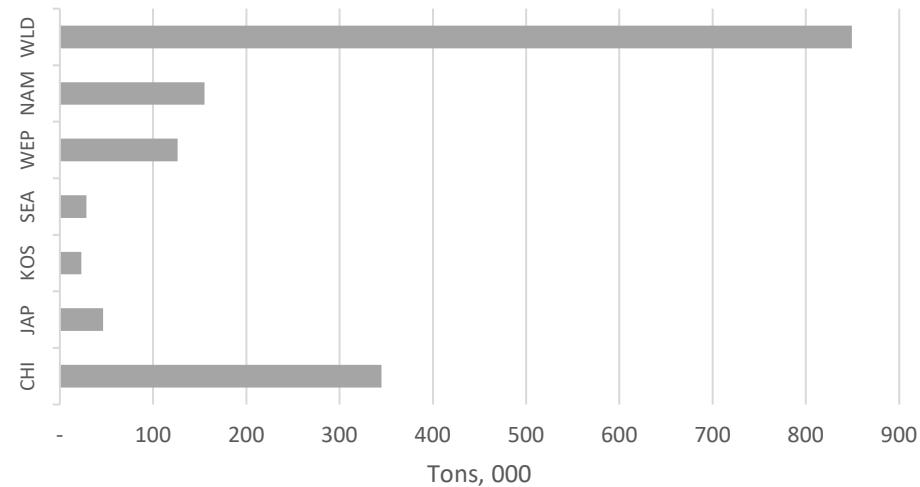
ABS impacted by Interior Styling choices in the transition to Hybrid and EVs but more modest changes on Exterior applications for ABS

Interior Center Stack Comfort and Infotainment control functions are likely to migrate to the Display Panel Housings may have some growth potential for ABS.

Exterior Radiator Grilles expected to fade away but Rear View Mirror Housings, License Plate Buckets, Lamp Housings, Leaf Screens, etc. are applications likely to remain.

ABS	2023-33 AAGR%	2023-50 AAGR%
CHI	1.8	1.2
JAP	(0.0)	(0.1)
KOS	(0.9)	(0.9)
SEA	3.4	2.9
WEP	2.3	1.8
NAM	1.5	0.5
WLD	1.7	1.3

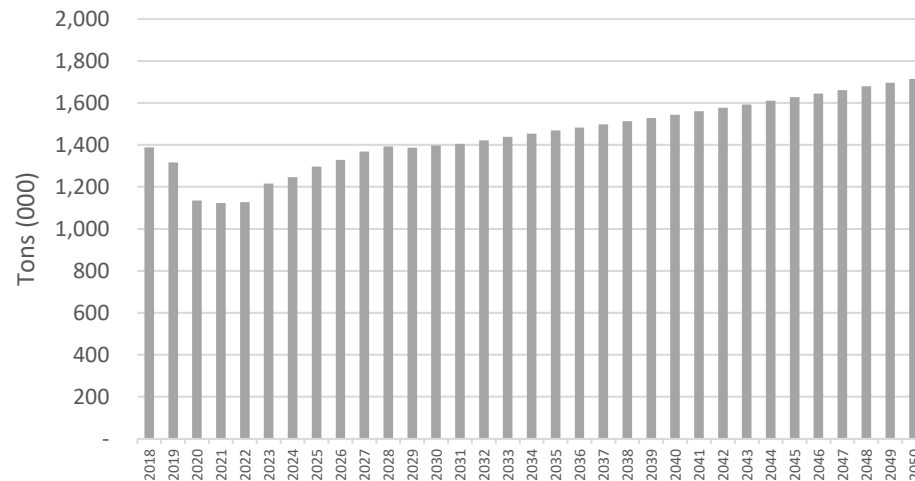
2023 Worldwide Automotive Industry Demand for ABS



Source: Chemical Market Analytics

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Worldwide Automotive Industry Demand for ABS



Source: Chemical Market Analytics

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Nylon consumption by Fuel Systems grow smaller but new applications for High voltage, high heat Electrical Systems drive demand growth

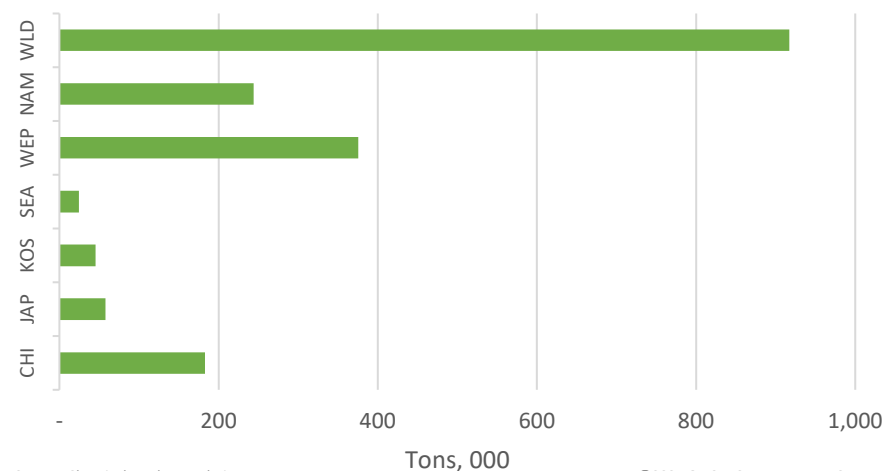
Fuel system components which are reduced in hybrids and eliminated in EVs.

EV electrical systems require Nylon's heat resistance, high dielectric strength and flammability resistance.

Battery Structures & Battery Enclosures and Charging Equipment standards continue to evolve while development efforts are poured into this hotly contested market opportunity.

Nylon	2023-33 AAGR%	2023-50 AAGR%
CHI	1.5	1.2
JAP	(0.9)	(0.3)
KOS	(0.7)	(0.2)
SEA	3.8	2.1
WEP	1.0	0.8
NAM	1.3	1.4
WLD	1.4	1.4

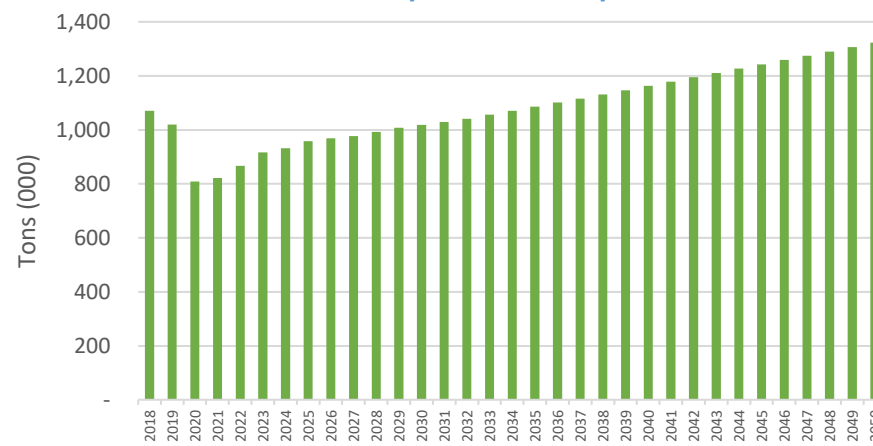
2023 Worldwide Automotive Industry Demand for Nylon



Source: Chemical Market Analytics

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Worldwide Automotive Industry Demand for Nylon

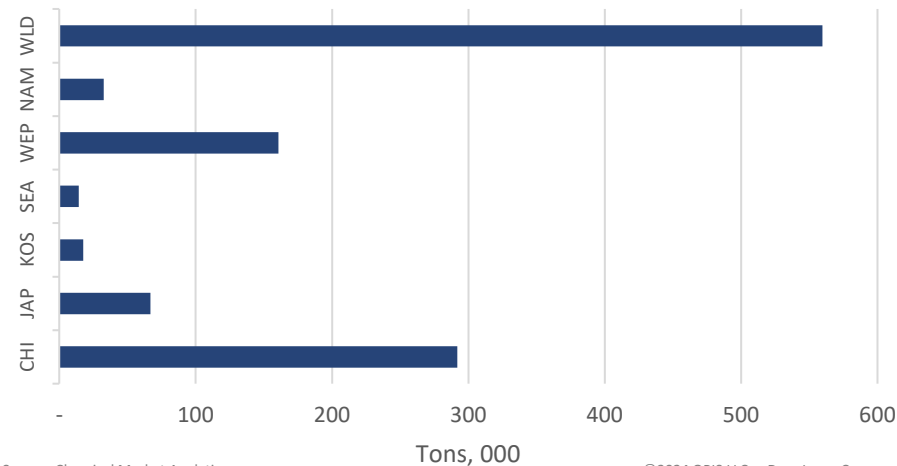


PBT significant growth in multi-pin connectors with growth of safety, comfort, convenience and infotainment features

Automotive Demand for PBT began with the AM radio and evolved with Power Door Locks, Air Bag Modules, Belt Tensioners, Climate Control, Lane Departure Warning, Power Lift Gates, Backup Camera, Infotainment, LIDAR, etc. etc. with more in the pipeline, especially with the emerging development of (semi) autonomous driving.

PBT	2023-33 AAGR%	2023-50 AAGR%
CHI	2.0	1.4
JAP	0.4	0.2
KOS	0.2	0.1
SEA	2.4	1.7
WEP	0.8	0.8
NAM	0.6	1.1
WLD	1.6	1.2

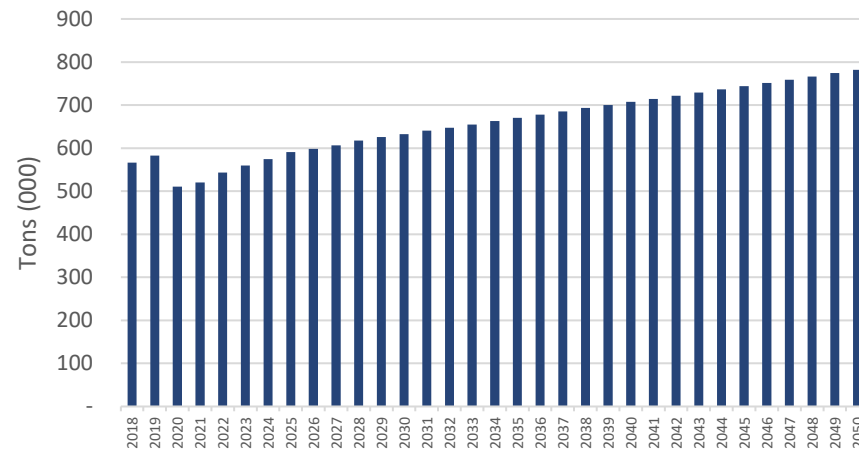
2023 Worldwide Automotive Industry Demand for PBT



Source: Chemical Market Analytics

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Worldwide Automotive Industry Demand for PBT



Source: Chemical Market Analytics

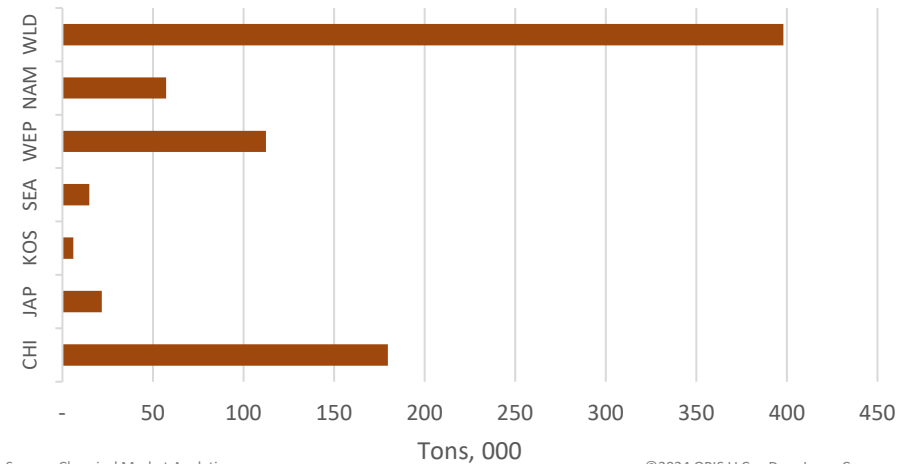
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POM is most difficult to predict with declining Fuel System applications but lubricity and NVH anything that moves,

Countless Gears, Grommets, Seat Glides, GChristmas Tree Connectors, Locks, Air Bag Modules, Belt Tensioners, Climate Control, Lane Departure Warning, Power Lift Gates, Backup Camera, Infotainment, LIDAR, etc. etc. with more in the pipeline, especially with the emerging development of (semi) autonomous driving.

POM	2023-33 AAGR%	2023-50 AAGR%
CHI	2.0	1.4
JAP	(0.5)	(0.2)
KOS	0.1	0.1
SEA	4.0	2.5
WEP	1.0	0.8
NAM	0.8	1.1
WLD	1.7	1.5

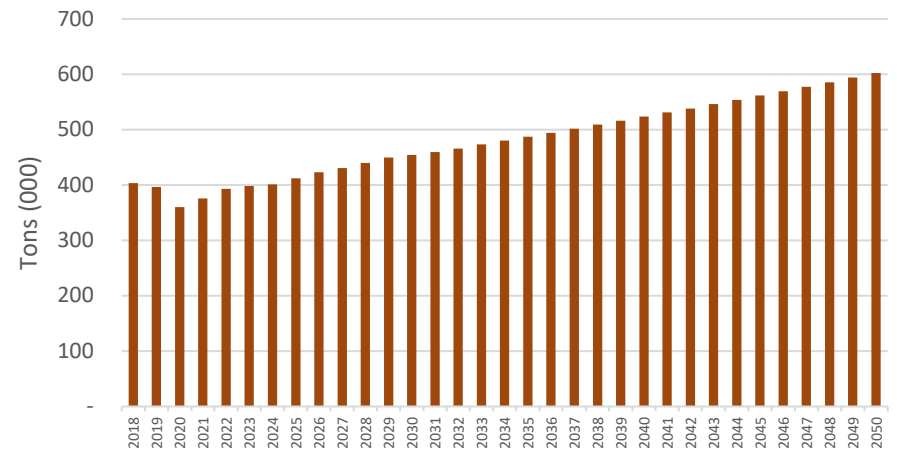
2023 Worldwide Automotive Industry Demand for POM



Source: Chemical Market Analytics

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Worldwide Automotive Industry Demand for POM



Source: Chemical Market Analytics

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Green tech is exciting but a minor component to meet demand growth

	Interior	Exterior	Lighting	Fuel Systems	High Voltage Systems	Safety, Comfort & Infotainment	Chassis, Structural
PC	▲ ▲	—	▲	n/a	n/a	▲ ▲	n/a
ABS	▲	▼	—	n/a	n/a	▲ ▲	n/a
Nylon	—	—	—	▼ ▼	▲ ▲ ▲	—	▲
PBT	▲ ▲	—	▲	▼	—	▲ ▲ ▲	n/a
POM	—	—	—	▼	n/a	▲	n/a

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