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Charging Ahead: What Does Electrification Mean for the Footprint of the Auto Industry?

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Given the uncertainties over the pace of the transition from engine-powered to battery-powered vehicles, carmakers have taken steps to make production of their ICE (internal combustion engine) vehicles more efficient. Such efforts are designed to help carmakers remain profitable during a period of incurring high costs in developing electric vehicles. One strategy available to carmakers is to cut back on the variety of engine models available across their vehicle model offerings. In simplifying engine options available to consumers, carmakers can reduce the number of engine programs needed to be maintained and developed, thereby optimizing scarce resources.

In this article, we examine evidence of such streamlining among internal combustion engines utilized in light vehicles assembled in North America¹ between 2016 and 2023. This work complements a related [article](#) that discusses forces shaping the footprint of electric vehicle production.

We analyze data provided by S&P Global Mobility. The data set offers a detailed and comprehensive accounting of light vehicle production in North America, including the specific characteristics and location of manufacturing of the engine for each vehicle model produced.² In terms of specific engine characteristics, most familiar to consumers are engine displacement (measured in liters) and number of cylinders (most frequently four or six). Our data source also provides information on the number of valves (most frequently 16 or 24), on the configuration of camshafts that control the valves (most frequently single overhead or dual overhead), and on cylinder configuration (inline or V-shape). For example, the highest volume configuration in North America in 2023 was a four-cylinder, 2.0 liter inline engine featuring 16 valves and a dual overhead camshaft; it accounted for just under 20% of engines installed in new vehicles that year.

In analyzing all engines sourced for light vehicles produced in North America, we find a sharp reduction in the variety of engines between 2016 and 2023. We measure engine variety by all five characteristics observable to us (displacement, number of cylinders, number of valves, configuration of the valvetrain, and cylinder configuration). According to that metric, the number of unique engine models sourced by North American light vehicle assembly plants declined from 60 in 2016 to 35 in 2023. As a result, the highest volume engine model accounted for a larger share of engine sourcing in 2023 (19.6%) than in 2016 (11.6%) (figure 1). The reduction in the number of unique engine models is primarily the result of fewer engine displacement sizes.

1. Variety of engines sourced by North American assembly plants, 2016 and 2023

	2016	2023
Number of unique engine models	60	35
Sourcing share (%) of highest volume engine model	11.6	19.6
Sourcing share (%) of two highest volume engine models	22.7	32.8
No. of engine models comprising 90% of all assembly plant sourcing	24	17

Whereas North American assembly plants sourced 19.3% fewer engines between 2016 and 2023, the number of unique engine models that were sourced declined by a much larger rate of 41.7%.

What impact, if any, resulted from the reduction in engine variety on the footprint of engine sourcing? Light vehicle assembly plants received engines from fewer engine plants in 2023 than in 2016 (the mean dropped from 2.3 to 1.8 plants). Similarly, engine plants shipped to fewer vehicle assembly plants in 2023 than in 2016 (the mean dropped from 4.2 to 3.1 plants).

When we calculated the distance that each engine travels from the engine plant to the final assembly plant where it is installed in a vehicle, we found that the median distance from engine plants to assembly plants declined from 329 miles in 2016 to 256 miles in 2023. Thus, on average, the spatial relationship between engine plants and final vehicle assembly plants was much closer in 2023 than in 2016.

We also observe that the share of engines shipped from an engine plant to an assembly plant across an international border declined between 2016 and 2023. The percentage of engines that assembly plants sourced from engine plants in the same country increased from 54.9% in 2016 to 63.5% in 2023 (figure 2). Excluding engines imported from outside North America, that percentage increased from 64.0% in 2016 to 70.2% in 2023.

2. Share of engines assembly plants receive from same country as engine plants

Assembly plant location	Total engine sourcing (thousands)		% of engines shipped within same country	
	2016	2023	2016	2023
Canada	2,370	1,530	6.7	25.9
Mexico	3,465	3,659	54.0	60.4
United States	11,754	9,007	64.9	71.1
North America total, including imports	17,589	14,195	54.9	63.5

Source: Authors’ calculations based on data from S&P Global Mobility as of January 2024.

Our analysis of data on light vehicle production and related engine sourcing for North America shows a sharp reduction in the variety of engine configurations between 2016 and 2023. We interpret this as an outcome of carmakers’ efforts to manage the transition toward electrification while maintaining profitability of their portfolio of vehicles featuring internal combustion engines.

Related to this streamlining of the ICE engine product mix has been both a significant reduction in the distances between engine and vehicle assembly plants in North America and a reconfiguration of supply linkages. Today, a noticeably higher share of engine sourcing takes place within the same country where the vehicle is assembled.

The bottom line is that while the transition toward electrification reduces the share of vehicles with engines, it also impacts important elements of the development and production of vehicles with engines, such as the variety of engine models as well as their sourcing.

Notes

- ¹ The United States, Canada, and Mexico.
- ² We drop a small number of light vehicle assembly plants producing fewer than 50,000 units from the analysis.

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