

FitchRatings

Assessing Auto Manufacturers' Zero Emission Vehicle Transition Risk

European and U.S. Manufacturers Are Better Positioned

Assessing Auto Manufacturers' Zero Emission Vehicle Transition Risk

European and U.S. Manufacturers Are Better Positioned

"Most legacy auto manufacturers are taking the transition to zero emission vehicles seriously. Manufacturers are investing in battery technology, production and capacity, and designing compelling electric vehicles and setting ambitious goals. Most are geographically diversified, limiting exposure to markets with more aggressive policies, such as Europe. However, some are laggards, notably Japanese manufacturers."

Alex Bumazhny, Group Credit Officer

Related Research

Industrials – Long-Term Climate Vulnerability Scores (February 2023)

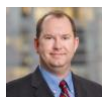
Global Auto Manufacturers and Suppliers Outlook 2023 (December 2022)

Carbon Transition May Weaken U.S. Automaker Credit Metrics as EV Sales Rise (EV Margins Will Drive Extent of Effects) (January 2022)

Analysts



Alex Bumazhny, CFA
+1 212 908-9179
alex.bumazhny@fitchratings.com



Stephen Brown
+1 312 368-3139
stephen.brown@fitchratings.com



Cigdem Cerit
+34 93 467-8840
cigdem.cerit@fitchratings.com



Satoru Aoyama
+81 3 6897-8984
satoru.aoyama@fitchratings.com



Jing Yang
+86 21 6898-7987
jing.yang@fitchratings.com



Jeong Min Pak
+822 3278-8360
jeongmin.pak@fitchratings.com

Fitch Ratings scored 15 global auto manufacturers' zero emission vehicle (ZEV) transition risk, with eight having medium risk, five with lower risk and two with higher risk. The analysis considers original equipment manufacturers' (OEMs) ZEV transition readiness and market exposure.

Readiness considers OEMs' ZEV technology, including platform, battery electric vehicle (BEV) sales mix, pipeline of ZEV vehicles, stated ZEV penetration goals and battery supply capacity. Market exposure considers OEMs' market mix in terms of markets' ZEV related policies and ZEV adoption rates.

The ZEV transition risk analysis is separate from Fitch's Climate Vulnerability Score (Climate.VS) framework, is ordinal and is not an assessment of credit effects on OEMs from transition. However, it serves as a complement to Climate.VS., which is 50 by 2030 for OEMs. The score is consistent with a rating effect of up to one notch in most cases.

Fitch performed a hypothetical scenario analysis in a January 2022 report, *Carbon Transition May Weaken U.S. Automaker Credit Metrics as EV Sales Rise*, which assumed up to a 50% BEV penetration rate in the U.S. by 2030 and a range of BEV margins. For a hypothetical OEM, assuming a BEV operating margin of 8% and a 50% BEV mix, leverage increases by 1.1x. This is consistent with the Climate.VS score of 50.

European OEMs Lead, Japanese Lag

Of the five lower-risk OEMs, three are European: Mercedes-Benz Group AG (A-/Positive), Renault SA (BB+/Stable) and Stellantis N.V. (BBB/Stable). All three scored as leaders in the ZEV transition readiness category and were adequately diversified away from markets with more stringent ZEV policies, namely Europe.

The other two are General Motors Company (GM; BBB-/Positive) and Hyundai Motor Company (HMC; BBB+/Stable). HMC's analysis includes subsidiary Kia Corporation (BBB+/Stable), with its ratings equalized.

On the other end of the spectrum are Japanese OEMs, two of which have higher risk: Toyota Motor Corporation (A+/Stable) and Nissan Motor Co. (Not Rated). Both are diversified by market but scored relatively poorly in readiness sub-factors relating to ZEV penetration goals and battery capacity. Toyota performed worse than Nissan on ZEV readiness, largely based on lower BEV sales mix.

Other Considerations

Not considered in the ZEV transition risk are segment exposures. Premium and lighter vehicles are more conducive to BEV transition. Premium cars have higher margins that absorb higher costs and buyers that can more easily look past higher prices. Lighter cars generally require less batteries.

This report does not consider other increasingly important competitive elements that will play a role in future mobility, such as autonomy and software. Additionally, size and financial flexibility could be critical in allowing a quick transition.

Transition Will Be Disruptive

The global auto industry is going through a transition toward ZEV via BEV. The precise pace of this transition is hard to estimate but it is gaining momentum. This is based on recently imposed bans on internal combustion engines (ICE), legislative ZEV incentives, a quick ramp up in technological efficacy and sales of BEVs, and OEMs' large investments in producing BEV models and securing battery supply.

The transition could be disruptive for OEMs. Fitch assigned a sector-level Climate.VS of 45 for 2025 and 50 by 2030 and thereafter for auto manufacturers. A Climate.VS of 50 means climate risk factors present challenges and may weaken the credit profile.

A Climate.VS of 50 is characterized by solid demand from drivers but a need for material changes to products or production methods, which may threaten profitability. Fitch also assigns Climate.VS to individual issuers based on sector exposures and, on an issuer level, Climate.VS of 50 is consistent with a rating effect of up to one notch in most cases, corresponding to the time frame of the Climate.VS.

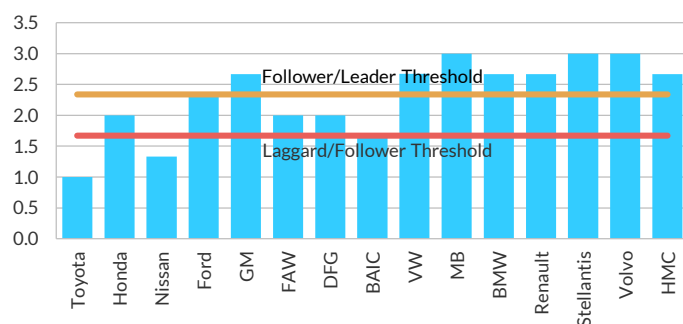
Fitch performed a hypothetical scenario analysis in a separate report, *Carbon Transition May Weaken U.S. Automaker Credit Metrics as EV Sales Rise*, which assumed up to a 50% BEV penetration rate in the U.S. by 2030 and a range of BEV margins. For a hypothetical OEM, assuming a BEV operating margin of 8% and a 50% BEV mix, leverage increases by 1.1x. This is consistent with the Climate.VS score of 50.

Fitch assessed OEMs' market exposure and ZEV transition readiness to assess ZEV transition risk. Per the analysis, OEMs that have lower exposure to markets with more aggressive ZEV adoption and have higher transition readiness are deemed to have lower transition risk. The analysis is meant to be ordinal, meaning the assessment is more of a relative ranking of OEMs as opposed to an opinion on absolute credit effects on respective issuers from ZEV transition.

How disruptive transition toward ZEVs will be on OEMs depends in large part on investments and exposure to markets with more aggressive transition timelines. Segment exposure will play a role with premium and lighter vehicles being more conducive to BEV transition.

Size and financial flexibility of an OEM can allow for a more rapid transition, which can prove to be critical for OEMs that scored as laggards in the ZEV transition readiness factor, such as Toyota. Another important element not considered in this report is the competitiveness of OEMs' software and autonomy technology, which are increasingly becoming competitive differentiators.

Zero Emission Vehicle Readiness Scores



GM – General Motors Company. FAW – China FAW Group Co., Ltd. DFG – Dongfeng Motor Group Co., Ltd. BAIC – Beijing Automotive Group Co., Ltd. VW – Volkswagen AG. MB – Mercedes-Benz Group AG. BMW – Bayerische Motoren Werke AG. HMC – Hyundai Motor Company.
Source: Fitch Ratings, Fitch Solutions

Japanese OEMs Have Higher Transition Risk

Toyota and Nissan are the sole higher risk OEMs. Honda Motor Co., Ltd (A/Stable) has more ambitious ZEV penetration goals and disclosed battery supply agreements with Contemporary Amperex Technology Co. Ltd (CATL; BBB+/Positive) and LG Energy Solution Ltd. (Not Rated), which moved the OEM to medium risk.

Six of the eight medium risk OEMs, have aggressive market exposures, either to Europe or China, offsetting possibly stronger readiness scores. All five lower risk OEMs were assessed as leaders for ZEV transition readiness and have phased market exposure. Three of the five are European with GM and HMC rounding up the group.

ZEV Transition Readiness

As discussed in detail in the Scoring Methodology section below, the ZEV readiness score equally weighs three sub-factors: ZEV technology and BEV sales and pipeline (TSP); stated ZEV goals (SZG); and battery capacity announced, being built or secured (BC).

If the average score is borderline, Fitch defaulted to a score based on the plurality of the sub-factor scores. Eight of the 15 OEMs scored as leaders in the overall readiness score.

All six European OEMs scored as leaders, with HMC and GM the only non-European OEMs to score as leaders. European OEMs were helped by across the board solid BC and TSP scores. GM also did well in all sub-factors, although BEV penetration mix, a subcomponent of TSP, was below peers. This was offset by the imminent releases of BEV variants of popular models, such as GM's Equinox and Silverado. HMC did well across all categories, although SZG was on par with peers.

Japanese OEMs, as a group, scored lower relative to peers from other regions, with Toyota scoring as a laggard in all three sub-factors. None of the Japanese OEMs scored as leaders in any of the three sub-factors. This could be in part due to disclosure discrepancy, particularly as it relates to battery capacity, relative to other OEMs.

Most European and U.S. OEMs disclose prominently battery capacity plans in investor presentations and announcements, which contrasts to Japanese OEMs where capacity disclosure was generally sparser.

Aggregate Scoring Table

OEM	Country	Overall Score	Readiness	Exposure
Toyota	Japan	Higher	Laggard	Phased
Honda	Japan	Medium	Follower	Phased
Nissan	Japan	Higher	Laggard	Phased
Ford	U.S.	Medium	Follower	Phased
GM	U.S.	Lower	Leader	Phased
HMC	Korea	Lower	Leader	Phased
FAW	China	Medium	Follower	Aggressive
DFG	China	Medium	Follower	Aggressive
BAIC	China	Medium	Follower	Aggressive
VW	Germany	Medium	Leader	Aggressive
MB	Germany	Lower	Leader	Phased
BMW	Germany	Medium	Leader	Aggressive
Renault S.A.	France	Lower	Leader	Phased
Stellantis N.V.	Netherlands	Lower	Leader	Phased
Volvo Cars	Sweden	Medium	Leader	Aggressive

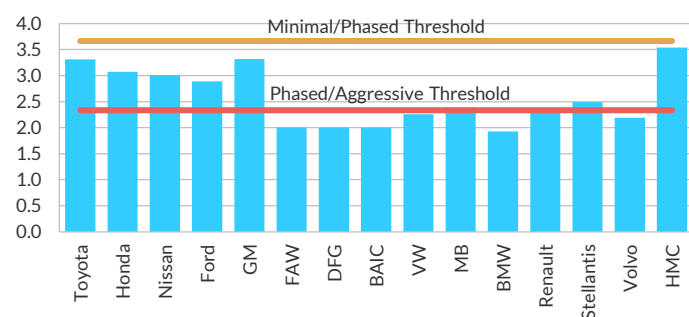
OEM – Original equipment manufacturer. GM – General Motors Company. HMC – Hyundai Motor Company. FAW – China FAW Group Co., Ltd. DFG – Dongfeng Motor Group Co., Ltd. BAIC – Beijing Automotive Group Co., Ltd. VW – Volkswagen AG. MB – Mercedes-Benz Group AG. BMW – Bayerische Motoren Werke AG.
Source: Fitch Ratings, Fitch Solutions

Market Exposure

Most OEMs scored phased, the middle of the three possible scores, for market exposure. This reflects the geographically diversified, large nature of OEMs included in the report. Of the 15 OEMs, nine scored phased, six scored aggressive and none scored minimal. Half of the aggressive scores were tied to three Chinese OEMs that mainly deliver vehicles within China, more consistent with an aggressive market.

China has a 40% goal for new energy vehicles (NEV), mainly BEV and plug-in hybrid electric vehicles (PHEV), by 2030 and to exceed 50% by 2035. The country has stringent EV targets for OEMs under a "dual-credit" program, similar to California's ZEV policy. China has a high adoption of EVs with over a 20% penetration mix in 2022, among the highest globally in large markets.

Market Exposure Scores



GM – General Motors Company. FAW – China FAW Group Co., Ltd. DFG – Dongfeng Motor Group Co., Ltd. BAIC – Beijing Automotive Group Co., Ltd. VW – Volkswagen AG. MB – Mercedes-Benz Group AG. BMW – Bayerische Motoren Werke AG. HMC – Hyundai Motor Company.

Source: Fitch Ratings, Fitch Solutions

The other three OEMs with aggressive market exposure are Volkswagen AG (A-/Stable), Bayerische Motoren Werke AG (Not Rated) and Volvo Cars (Not Rated), all have heavy exposure to Europe or China. Europe is categorized as the most aggressive market with a 2035 ZEV mandate.

Although many OEMs scored phased for market exposure, the spectrum within phased is broad with several OEMs scoring close to minimal. The OEM that came the closest is HMC, with high exposure to other, mainly APAC, excluding China and the Middle East, and lower exposure to China. GM, with no exposure to Europe, scored similarly.

Japanese OEMs scored close to minimal with higher exposure to Japan, which does not have ZEV mandates and has a carbon transition strategy more accepting of hybrid electric vehicles (HEV) and PHEVs.

Scoring Methodology

We assess ZEV transition risk as lower, medium or higher. The overall risk score is a composite of market exposure and ZEV transition readiness factors with the latter receiving a greater weighting in case of a tie. The scores are meant to assess ZEV transition risk of OEMs relative to each other. The scores are not reflective of Fitch's view on the efficacy of OEMs' ZEV transition strategies. They are also not meant to reflect Fitch's view on the absolute level of credit risk related to the transition.

For instance, a low risk OEM may still face rating pressure should BEV adoption happen at a more accelerated pace or the OEM experiences execution issues while transitioning. Similarly, a high-risk OEM may see minimal rating pressure if adoption is slower or the OEM manages to accelerate ramp up of BEV production more rapidly than peers. The ZEV transition risk assessment complements Fitch's Climate.VS, which more directly ties to credit implications and ratings.

Exposure Summary Table

(%) OEM	EU/U.K.	China	U.S./ South Korea	Japan	Other	WA Score ^a	Score
Toyota	11	11	27	24	28	3.45	Phased
Honda	3	21	40	16	20	3.30	Phased
Nissan	12	17	33	15	22	3.18	Phased
Ford	23	6	51	0	20	2.89	Phased
GM	0	24	48	0	28	3.32	Phased
FAW	0	100	0	0	0	2.00	Aggressive
DFG	0	100	0	0	0	2.00	Aggressive
BAIC	0	100	0	0	0	2.00	Aggressive
VW	48	25	10	1	16	2.13	Aggressive
MB	41	10	26	0	22	2.52	Phased
BMW	44	20	22	0	14	2.21	Aggressive
Renault	64	0	3	0	32	2.36	Phased
Stellantis	45	1	32	1	20	2.46	Phased
Volvo Cars	46	15	22	3	14	2.11	Aggressive
HMC	14	3	40	0	43	3.54	Phased

^aWA score: 1 – EU/U.K., 2 – China, 3 – U.S./South Korea, 4 – Japan, 5 – Other.

A higher score means a less aggressive market in terms of ZEV policies and adoption.

1.00–2.33 maps to aggressive, 2.33–3.66 maps to phased and 3.66–5.00 to minimal.

Some of the market mix percentages are estimations. China is weighted at 50% to account for joint venture structures for non-Chinese OEMs. OEM – Original equipment manufacturer. WA – Weighted average. GM – General Motors Company.

FAW – China FAW Group Co., Ltd. DFG – Dongfeng Motor Group Co., Ltd.

BAIC – Beijing Automotive Group Co., Ltd. VW – Volkswagen AG. MB – Mercedes-Benz

Group AG. BMW – Bayerische Motoren Werke AG. HMC – Hyundai Motor Company.

Source: Fitch Ratings, Financial Filings, Wards Intelligence for Japanese OEMs

ZEV Transition Readiness

EV transition readiness is split into three sub-categories: TSP, SZG and BC. The overall ZEV transition readiness score is based on the simple average of the scores of the three sub-categories.

In an event of a borderline average score, Fitch bases the overall readiness score on a plurality of the sub-factor scores. This was the case with Ford Motor Company (BB+/Positive) and Beijing Automotive Group Co., Ltd. (BBB+/Stable).

The sub-category descriptions and calibration of the sub-categories are largely based on the OEMs' ZEV transition readiness in relation to each other and are not a Fitch assessment of an ideal ZEV strategy. Also, the descriptions are meant to be illustrative and not precise. Therefore, a sub-category score may involve a level of approximation.

Fitch discounts HEVs' and PHEVs' inclusion in the current EV mix and targets given relatively lower disruption and execution risk association with converting to PHEVs versus BEV. PHEV technology can be more seamlessly incorporated into existing ICE platforms and battery procurement is less of an operational risk. The report focuses more on BEVs, relative to fuel cell hydrogen vehicles, given the former's greater momentum in terms of sales and OEM and infrastructure investment.

TSP

TSP assesses OEMs' near-term ZEV transition readiness by assessing BEV technology, or whether the OEM has a dedicated BEV platform or rather relies on shared ICE/BEV platforms.

TSP gauges near-term transition readiness based on sales mix of ZEVs as a percentage of total sales, reinforced by the pipeline of near-term ZEV releases. We put more emphasis on releases that substitute or add to OEMs' core, high volume vehicles, e.g. GM's Chevrolet Equinox EV, and are relatively reasonable value propositions.

SZG

SZG is based on OEMs' stated ZEV transition goals usually stated as a year by which the OEM will go fully BEV or a mix percentage by a certain year. When assessing SZG, Fitch overlays execution risk, which considers goals relative to the other two factors: TSP and BC.

BC

BC aims to measure OEMs' battery procurement plans relative to existing total vehicles sales. BC considers whether capacity is through long-term contracts or in-house/joint venture (JV) manufacturing with the latter more favorably factoring into the score.

The kWh capacity/2022 sales ratio, used as a proxy for BC, excludes JV sales in the denominator for non-Chinese OEMs to the extent broken out by OEM. Chinese volume is assumed to be through JVs unless otherwise stated. There is no timeframe but the metric aims to exclude non-concrete plans such as long-term targets.

In compiling inputs into the analysis, we found the BC factor to be most susceptible to variability in reporting. Hence, it is possible that some OEMs are penalized for more sparse reporting on BC and some benefit from more robust reporting.

The overall ZEV transition readiness is based on a calculation that assigns a '3' to leader, '2' to follower and '1' to laggard to each of the three factors. The average of the above scores maps as follows to the overall transition readiness score:

Weighted Average Score	Category
1.00–1.67	Laggard
1.67–2.33	Follower
2.33–3.00	Leader

Source: Fitch Ratings, Fitch Solutions

Market Exposure

Market exposure gauges OEMs' exposure, based on units sold to markets that have aggressive regulations to spur ZEV adoption or a ban on ICE vehicles. The market exposure score considers recent ZEV penetration rates and the general BEV-friendliness of the markets, as illustrated by the state of the charging infrastructure, for example.

China is an example of a market with very high and growing penetration of EVs but with ZEV laws not as draconian as Europe's 2035 ban on ICEs, notwithstanding Germany's proposal for allowing e-fuel powered cars. As with ZEV transition readiness, Fitch is focusing on ZEVs, mainly BEVs.

We assume converting ICE vehicles to HEVs or PHEVs, if hypothetically required by regulations, can be done without considerable strain on credit profiles with lower operational risk in terms of converting existing models and procuring battery capacity. PHEVs have a battery capacity of less than 20 kWh, smaller than a third of a compact BEV, e.g. Chevy Bolt.

OEMs with an exceptional readiness could in theory benefit from a high exposure to aggressive markets by capturing market share from OEMs with lower readiness. However, OEMs included in this report are starting from a small base in terms of ZEV penetration mix and even the leaders in readiness face considerable execution risk transitioning toward more aggressive ZEV targets. Therefore, we consider exposure to aggressive markets as a net headwind for the purpose of this report.

We mapped major markets to five market exposure scores: aggressive, advanced, phased, lenient and minimal. These categories roughly align with EU/U.K., China, U.S./South Korea, Japan and other. Latin America is typically a major component of the other category. If Japan or South Korea are not broken out, we include these markets in other. We give 50% weightings to vehicles sold under JVs, which are common in China.

The overall market exposure is based on a calculation that assigns a '5' to minimal, '4' to lenient, '3' to phased, '2' to advanced and '1' to aggressive. The weighted average of the above scores map as follows:

Weighted Average Score	Category
1.00–2.33	Aggressive
2.33–3.66	Phased
3.66–5.00	Minimal

Source: Fitch Ratings, Fitch Solutions

Readiness Methodology

	Laggard	Follower	Leader
ZEV Technology and BEV Sales and Pipeline (TSP)	2022 BEV sales mix is less than 2%.	2022 BEV sales mix is 2%–6%.	2022 BEV sales mix is greater than 6%.
	No proprietary BEV dedicated platform.	Proprietary BEV dedicated platform imminent or platform available through a JV or a third-party arrangement.	Proprietary BEV dedicated platform.
	Few or niche ZEV models available by 2025.	Several ZEV models widely available by 2025.	Multiple ZEV models widely available by 2025, adding or replacing core ICE models.
Stated ZEV Goal (SZG)	Not stated or very ambiguous long-dated goals. Or goals are more aggressive but have high execution risk.	Stated goal with at least 50% of sales to be ZEV by no later than 2035 or goals are more aggressive but have high execution risk.	Stated goal with at least 75% of sales to be ZEV by no later than 2035. Some execution risk but goals seem achievable.
Battery Capacity Announced, Being Built or Secured (BC)	Less than 10 kWh/2022 auto sales. Mainly third-party contracts.	10–20 kWh/2022 auto sales. Mix of third-party contracts and vertical integration.	20–30 kWh/2022 auto sales. Mainly vertical integration.

BEV – Battery electric vehicle. ZEV – Zero emission vehicle. JV – Joint venture. ICE – Internal combustion engine.

Source: Fitch Ratings, Fitch Solutions

Exposure Methodology

	Aggressive	Advanced	Phased	Lenient	Minimal
Jurisdictions	EU/U.K.	China	U.S./South Korea	Japan	Other
Illustrative Policy Description	Complete phase out of non-ZEVs by 2035.	Aggressive targets. Considerable political momentum toward BEV adoption.	Some targets and incentives. Local bans.	Phaseout policies allow HEVs or PHEVs. Some policies and targets to encourage ZEVs.	Minimal ZEV policies.
Policy Comments	EU requires no greenhouse gas emissions by 2035. U.K. ban starts in 2030 but PHEVs are allowed until 2035.	40% stated goal for NEV (BEV and PHEV) share by 2030 and >50% by 2035. Stringent NEV targets for OEMs under dual-credit program.	ZEV targets and subsidies. ICE bans by 2035 in New York and California.	Japan has a 2035 ICE ban, which excludes PHEVs. ZEV subsidies.	
Illustrative BEV Penetration Based on 2021 Sales (%)	>15	10–15	5–10	<5	<1
2021 Sales Penetration (IEA; Includes PHEV) (%)	Germany – 25	China – 16	U.S. – 5	Japan – <1	India – <1
	U.K. – 15		South Korea – 8		Brazil – <1
	France – 15				
	Italy – 9				
2021 Fast Chargers per 100,000 Pop. (IEA)	Spain – 7				
	Germany – 110	China – 327	U.S. – 66	Japan – 63	Brazil – <1
	U.K. – 113		South Korea – 293		India – <1
	France – 69				
	Italy – 36				
	Spain – 56				

ZEV – Zero emission vehicle. BEV – Battery electric vehicle. HEV – Hybrid electric vehicle. PHEV – Plug-in hybrid electric vehicles. NEV – New energy vehicles, mainly BEV and PHEV. OEM – Original equipment manufacturer. ICE – Internal combustion engines.

Source: Fitch Ratings, Fitch Solutions

Appendix 1: Readiness Scoring Details

Zero Emission Vehicle Transition Readiness: Japan

Factors	Toyota Motor Corporation	Honda Motor Co., Ltd.	Nissan Motor Co., Ltd.
BEV Platform	bZ4X has a dedicated BEV platform, jointly developed with Subaru.	Dedicated platform: e:NS1, e:NP1. Ultium battery platform developed jointly with GM and Honda e: Architecture.	Prologue, Accura ZDV (2024), Commercial-use mini-EV (2024).
2022 BEV Sales Mix	21,000 BEV and FCEV, 0.2% of fiscal 2021 total, 24.6% including HEV.	0.37% of fiscal 2021 total unit sales.	2.3% BEV only (fiscal 2021), 13.4% including HEV.
Pipeline	bZ4X launched in 2022 but with low volumes. Lexus RZ 450e (2023).	Prologue, Accura ZDV (2024), Commercial-use mini-EV (2024).	Ariya; Sakura.
TSP Score	Laggard Plans to sell 3.5 million BEVs by 2030, about 1/3 of current sales.	Follower Plans to produce more than 2 million EVs per year by 2030, about half of current sales. All BEVs or FCEVs by 2040.	Follower Expand the global model mix of EVs, BEVs and HEVs, to more than 55% by 2030. BEV-only models will represent 70% of electrified line up.
SZG Score	Laggard 40 GWh, about 5 kWh/auto sales, capacity being built in Japan and U.S. Unknown volumes from partnerships with CATL, BYD Co. Ltd., JVs with Panasonic (PPES and PEVE), Toshiba Corp., GS Yuasa Corporation.	Follower 163 GWh, supply secured through partnership with CATL at 123 GWh and JV with LG Energy. Unknown volume of GM's Ultium battery and from Blue Energy and Panasonic.	Laggard Unknown volumes from Panasonic, Envision AESC, 20% owned by Nissan, and CATL. Battery development partnerships with Envision AESC in Japan and U.K.
BC Score	Laggard	Follower	Laggard
Numerical Score	1.00	2.00	1.33
Overall Score	Laggard	Follower	Laggard

BEV – Battery electric vehicle. FCEV – Fuel cell electric vehicle. HEV – Hybrid electric vehicle. EV – Electric vehicle. JV – Joint venture. CATL – Contemporary Amperex Technology Co. Ltd. PPES – Prime Planet Energy & Solutions. PEVE – Primearth EV Energy Co., Ltd. GM – General Motors Company. TSP – ZEV technology and BEV sales and pipeline. SZG – Stated ZEV goal. BC – Battery capacity announced, being built or secured.

Source: Fitch Ratings, Fitch Solutions

Zero Emission Vehicle Transition Readiness: U.S. and South Korea

Factors	Ford Motor Company	General Motors Company	Hyundai Motor Company (HMC)
BEV Platform	Mach-E is built on modified ICE platform. E-Transit and F-150 Lightning are on ICE platforms.	Advanced dedicated EV platform (Ultium).	Dedicated platform E-GMP launched in 2021, common platform by HMC/Kia Corporation.
2022 BEV Sales Mix	3.3% BEV sales mix (U.S. only).	1.7% EV sales mix (U.S.) in 2022.	Global BEV mix in 2022: 5.3% (HMC) 5.4% (Kia).
Pipeline	Mach-E and F-150 Lightning ramping up. Next-gen EV platform within a few years.	Wide range of EV models across various categories/price points in the next several years.	17 models by 2030 (HMC), 14 models by 2027 (Kia).
TSP Score	Follower 50% BEV target by 2030.	Follower 100% BEV target (U.S.) by 2035.	Leader HMC: 36% target by 2030, Genesis 100% by 2030 and 100% in EU by 2035. Kia 30% by 2030.
SZG Score	Follower More than 80 GWh announced through BlueOval SK JV in the U.S. + 35 GWh LFPs through Ford/CATL plant + 25 GWh + Ford/LGES/Koc plant in Turkey. Equates to 37 kWh/2022 vehicles sold, ex. China.	Leader 135GWh Ultium Cells LLC JV supply in U.S. announced so far. Equates to 37 kWh/2022 global vehicle sold, ex. China.	Follower Combined plan for 40 kWh/units sold by 2030. Kia alone plans for 24 kWh/units sold by 2026. Supply is through a combination of JVs with battery makers and supply agreements.
BC Score	Leader	Leader	Leader
Numerical Score	2.33	2.67	2.67
Overall Score	Follower	Leader	Leader

BEV – Battery electric vehicle. EV – Electric vehicle. ICE – Internal combustion engine. JV – Joint venture. LFP – Lithium iron phosphate batteries. CATL – Contemporary Amperex Technology Co. Ltd. LGES – LG Energy Solutions. TSP – ZEV technology and BEV sales and pipeline. SZG – Stated ZEV goal. BC – Battery capacity announced, being built or secured.

Source: Fitch Ratings, Fitch Solutions

Zero Emission Vehicle Transition Readiness: China

Factors	China FAW Group Co., Ltd.	Dongfeng Motor Group Co., Ltd.	Beijing Automotive Group Co., Ltd.
BEV Platform	JV BEVs with Toyota and VW are based on the BEV platforms (e-TNGA, MEB). A new JV with Audi will use the PPE platform and the FME platform for its proprietary brand Red Flag launching in 2023–2024.	JVs with Nissan, Honda and several smaller JVs, including export-oriented eGT jointly owned with Nissan-Renault and proprietary brands. Nissan uses CMF-EV platform. Honda has dedicated e:N platform. DPCA JV, 5% of sales, has eHMIA platform.	JVs EQE launched on MB's EVA platform and HMC's E-GMP IONIQ 5 on the GMP platform.
2022 BEV Sales Mix	4.9% BEV sales mix in 2022. JV sales 100% included.	>14% BEV sales mix in 2022 mainly contributed by proprietary brands and eGT JV. BEV share of JV with Honda meaningfully weaker than other JVs.	BEV mix at 7.6% in 2022, mainly driven by proprietary brands. MB's JV BEV mix below 3% and HMC's JV BEV sales is neglectable
Pipeline	ID.CROZZ (71,568 sold in 2022), Toyota bZ4X (2022), ID.Aero (2023), Audi Q6L e-tron and A6 e-tron (2024–2025). Audi plans to offer five BEVs in China by 2025.	DF Nissan: ARIYA (2022), new SUV (2024). DF Honda: e:NS1 (2022), e:Ny1 (2023). VOYAH: Free (2021), Dreamer (2022), Chasing Light (2023). eGT: Dacia Spring (2022), Nano BOX (2022).	Beijing Benz EQE (2022), ARCFox αT (2022); Beijing HMC IONIQ 5 (2023).
TSP Score	Follower NEV 20% of group unit sales by 2025, 30% of proprietary and 40% of Hongqi. Most of proprietary brand would be NEV by 2030	Follower 1 million NEV unit sales by 2025 for group. Nissan aims for a 35% EV sales share in China by fiscal 2026, lowered from 40%. Honda JV 40% by fiscal 2030 (BEV + FCV).	Follower 75% 2025 target for proprietary brand. No specific MB JV target but parent wants to go all electric by 2030. HMC JV targets 200,000 BEV sales by 2025 (250,000 vehicles sold in 2022).
SZG Score	Follower FAW's JV with CATL started to supply Hongqi and FAW-VW from 2020, with annual capacity of over 40 GWh, about 14 kWh/unit sold. JV partner VW owns a stake in large battery supplier Gotion.	Follower 9.6 GWh annual capacity at Dongfeng's JV with CATL and building a new battery production base with Sunwoda with planned capacity at 30 GWh. Total 18 kWh/auto sales.	Follower Beijing Benz (52% of BAIC's units sold) built its own battery pack plant in Beijing. MB has other battery investments in China.
BC Score	Follower	Follower	Laggard
Numerical Score	2.00	2.00	1.67
Overall Score	Follower	Follower	Follower

BEV – Battery electric vehicle. JV – Joint venture. VW – Volkswagen AG. MB – Mercedes-Benz. HMC – Hyundai Motor Company. NEV – New energy vehicles. BAIC – BAIC Motor Corp. Ltd. CATL – Contemporary Amperex Technology Co. Ltd. TSP – ZEV technology and BEV sales and pipeline. SZG – Stated ZEV goal. BC – Battery capacity announced, being built or secured. Source: Fitch Ratings, Fitch Solutions

Zero Emission Vehicle Transition Readiness: Europe One

Factors	Volkswagen AG (VW)	Mercedes-Benz Group AG	Bayerische Motoren Werke AG (BMW)
BEV Platform	MEB platform for VW ID cars, PPE for higher-end Audi and Porsche.	Platforms are modular, with EV offering for every model. From 2024, will introduce MMA for compact and mid-sized car EVs. Additional platforms in 2025 for larger vehicles.	Currently uses CLAR multi-purpose platform. In 2025 will use BEV-only Neue Klasse platform.
2022 BEV Sales Mix	6.9% BEV mix 2022.	BEV accounted for 7.3% of sales in 2022.	BEV accounted for 7.3% of sales in 9M22.
Pipeline	ID.Buzz (US 2024), Porsche Macan EV (2024).	By 2025, target up to 50% share of BEV and plug-in hybrid. By 2030, ready to go all electric where the market conditions allow.	By 2023, 90% of the vehicle portfolio will offer at least one BEV. >30% share of BEV by 2025, >50% by 2030.
TSP Score	Leader BEV 50% U.S./China and 70% in Europe by 2030.	Leader NEV 20% of group unit sales by 2025, 30% of proprietary and 40% of Hongqi. Most of proprietary brand would be NEV by 2030.	Leader 1 million NEV unit sales by 2025 for group. Nissan aims for a 35% EV sales share in China by fiscal 2026, lowered from 40%. Honda JV 40% by fiscal 2030 (BEV + FCV).
SZG Score	Leader Two plants being built with combined capacity of 80 GWh, 15 kWh/units sold. Long-term raw material contracts.	Leader Four battery plants in Germany, two in APAC, one in U.S. 1/3 stake in ACC with goal of reaching 120 GWh by 2030. Other partners are CATL, Farasis Energy and Envision AESC.	Follower Developing battery plants in EU (20 GWh) and U.S. (30 GWh) with CATL and EVE Energy Co. as cell suppliers.
BC Score	Follower	Leader	Leader
Numerical Score	2.67	3.00	2.67
Overall Score	Leader	Leader	Leader

BEV – Battery electric vehicle. EV – Electric vehicle. NEV – New energy vehicle. FCV – Fuel cell vehicle. ACC – Automotive Cells Company. CATL – Contemporary Amperex Technology Co. Ltd. TSP – ZEV technology and BEV sales and pipeline. SZG – Stated ZEV goal. BC – Battery capacity announced, being built or secured. Source: Fitch Ratings, Fitch Solutions

Zero Emission Vehicle Transition Readiness: Europe Two

Factors	Renault S.A.	Stellantis N.V.	Volvo Cars
BEV Platform	Dedicated platform: CMF-EV, CMFB-EV, CMFA-EV, KEI-EV and LCV-EV will be used by the Alliance members.	Four dedicated EV platforms: small, medium and large frame.	One dedicated EV platform (First model EX90 SUV)
2022 BEV Sales Mix	39% European sales mix from (EV + Hybrid) in 2022. Global 10% BEV mix in 2022.	Global 5% BEV mix in 2022.	Global 11% BEV mix in 2022.
Pipeline	30% BEV target by 2025, 50% of the launches will be BEV.	75+ models and BEV sales of five million by 2030. By 2030 50% BEV mix in U.S. and 100% in EU.	50 % BEV sales in 2025, 100% by 2030.
TSP Score	Leader 75% 2025 target for proprietary brand. No specific MB JV target but parent wants to go all electric by 2030. HMC JV targets 200,000 BEV sales by 2025 (250,000 vehicles sold in 2022).	Leader 1 million NEV unit sales by 2025 for group. Nissan aims for a 35% EV sales share in China by fiscal 2026 (lowered from 40%). Honda JV 40% by fiscal 2030 (BEV + FCV).	Leader 75% 2025 target for proprietary brand. No specific MB JV target but parent wants to go all electric by 2030. HMC JV targets 200,000 BEV sales by 2025 (250,000 vehicles sold in 2022).
SZG Score	Follower Gigafactory with Verkor in construction, capacity from 16 GWh 2025 to 60 GWh by 2030. Ongoing partnership with LG Energy.	Leader Five Gigafactories being built with cell partners. 400 GWh (65 kWh/units sold in 2022) including 150 in U.S./Canada and 250 in EU, will provide for 50% of 2030 target. Raw material partnerships in place.	Leader Battery plant with Northvolt being built, capacity at 50 GWh (81 kWh/units sold).
BC Score	Leader	Leader	Leader
Numerical Score	2.67	3.00	3.00
Overall Score	Leader	Leader	Leader

BEV – Battery electric vehicle. EV – Electric vehicle. JV – Joint venture. NEV – New energy vehicles. FCV – Fuel cell vehicle. MB – Mercedes-Benz. HMC – Hyundai Motor Company. TSP – ZEV technology and BEV sales and pipeline. SZG – Stated ZEV goal. BC – Battery capacity announced, being built or secured.

Source: Fitch Ratings, Fitch Solutions

DISCLAIMER & DISCLOSURES

All Fitch Ratings (Fitch) credit ratings are subject to certain limitations and disclaimers. Please read these limitations and disclaimers by following this link: <https://www.fitchratings.com/understandingcreditratings>. In addition, the following <https://www.fitchratings.com/rating-definitions-document> details Fitch's rating definitions for each rating scale and rating categories, including definitions relating to default. Published ratings, criteria, and methodologies are available from this site at all times. Fitch's code of conduct, confidentiality, conflicts of interest, affiliate firewall, compliance, and other relevant policies and procedures are also available from the Code of Conduct section of this site. Directors and shareholders' relevant interests are available at <https://www.fitchratings.com/site/regulatory>. Fitch may have provided another permissible or ancillary service to the rated entity or its related third parties. Details of permissible or ancillary service(s) for which the lead analyst is based in an ESMA- or FCA-registered Fitch Ratings company (or branch of such a company) can be found on the entity summary page for this issuer on the Fitch Ratings website.

In issuing and maintaining its ratings and in making other reports (including forecast information), Fitch relies on factual information it receives from issuers and underwriters and from other sources Fitch believes to be credible. Fitch conducts a reasonable investigation of the factual information relied upon by it in accordance with its ratings methodology, and obtains reasonable verification of that information from independent sources, to the extent such sources are available for a given security or in a given jurisdiction. The manner of Fitch's factual investigation and the scope of the third-party verification it obtains will vary depending on the nature of the rated security and its issuer, the requirements and practices in the jurisdiction in which the rated security is offered and sold and/or the issuer is located, the availability and nature of relevant public information, access to the management of the issuer and its advisers, the availability of pre-existing third-party verifications such as audit reports, agreed-upon procedures letters, appraisals, actuarial reports, engineering reports, legal opinions and other reports provided by third parties, the availability of independent and competent third-party verification sources with respect to the particular security or in the particular jurisdiction of the issuer, and a variety of other factors. Users of Fitch's ratings and reports should understand that neither an enhanced factual investigation nor any third-party verification can ensure that all of the information Fitch relies on in connection with a rating or a report will be accurate and complete. Ultimately, the issuer and its advisers are responsible for the accuracy of the information they provide to Fitch and to the market in offering documents and other reports. In issuing its ratings and its reports, Fitch must rely on the work of experts, including independent auditors with respect to financial statements and attorneys with respect to legal and tax matters. Further, ratings and forecasts of financial and other information are inherently forward-looking and embody assumptions and predictions about future events that by their nature cannot be verified as facts. As a result, despite any verification of current facts, ratings and forecasts can be affected by future events or conditions that were not anticipated at the time a rating or forecast was issued or affirmed.

The information in this report is provided "as is" without any representation or warranty of any kind, and Fitch does not represent or warrant that the report or any of its contents will meet any of the requirements of a recipient of the report. A Fitch rating is an opinion as to the creditworthiness of a security. This opinion and reports made by Fitch are based on established criteria and methodologies that Fitch is continuously evaluating and updating. Therefore, ratings and reports are the collective work product of Fitch and no individual, or group of individuals, is solely responsible for a rating or a report. The rating does not address the risk of loss due to risks other than credit risk, unless such risk is specifically mentioned. Fitch is not engaged in the offer or sale of any security. All Fitch reports have shared authorship. Individuals identified in a Fitch report were involved in, but are not solely responsible for, the opinions stated therein. The individuals are named for contact purposes only. A report providing a Fitch rating is neither a prospectus nor a substitute for the information assembled, verified and presented to investors by the issuer and its agents in connection with the sale of the securities. Ratings may be changed or withdrawn at any time for any reason in the sole discretion of Fitch. Fitch does not provide investment advice of any sort. Ratings are not a recommendation to buy, sell, or hold any security. Ratings do not comment on the adequacy of market price, the suitability of any security for a particular investor, or the tax-exempt nature or taxability of payments made in respect to any security. Fitch receives fees from issuers, insurers, guarantors, other obligors, and underwriters for rating securities. Such fees generally vary from US\$1,000 to US\$750,000 (or the applicable currency equivalent) per issue. In certain cases, Fitch will rate all or a number of issues issued by a particular issuer, or insured or guaranteed by a particular insurer or guarantor, for a single annual fee. Such fees are expected to vary from US\$10,000 to US\$1,500,000 (or the applicable currency equivalent). The assignment, publication, or dissemination of a rating by Fitch shall not constitute a consent by Fitch to use its name as an expert in connection with any registration statement filed under the United States securities laws, the Financial Services and Markets Act of 2000 of the United Kingdom, or the securities laws of any particular jurisdiction. Due to the relative efficiency of electronic publishing and distribution, Fitch research may be available to electronic subscribers up to three days earlier than to print subscribers.

For Australia, New Zealand, Taiwan and South Korea only: Fitch Australia Pty Ltd holds an Australian financial services license (AFS license no. 337123) which authorizes it to provide credit ratings to wholesale clients only. Credit ratings information published by Fitch is not intended to be used by persons who are retail clients within the meaning of the Corporations Act 2001.

Fitch Ratings, Inc. is registered with the U.S. Securities and Exchange Commission as a Nationally Recognized Statistical Rating Organization (the "NRSRO"). While certain of the NRSRO's credit rating subsidiaries are listed on Item 3 of Form NRSRO and as such are authorized to issue credit ratings on behalf of the NRSRO (see <https://www.fitchratings.com/site/regulatory>), other credit rating subsidiaries are not listed on Form NRSRO (the "non-NRSROs") and therefore credit ratings issued by those subsidiaries are not issued on behalf of the NRSRO. However, non-NRSRO personnel may participate in determining credit ratings issued by or on behalf of the NRSRO.

Copyright © 2023 by Fitch Ratings, Inc., Fitch Ratings Ltd. and its subsidiaries. 33 Whitehall Street, NY, NY 10004. Telephone: 1-800-753-4824, (212) 908-0500. Fax: (212) 480-4435. Reproduction or retransmission in whole or in part is prohibited except by permission. All rights reserved.