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Report

When Climate Leadership Stops at Steel

East Asian Automakers and Steel Supply Chain Decarbonization

SFOC

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East Asian Automakers and Steel Supply Chain Decarbonization

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Solutions for Our Climate(SFOC) is an independent policy research and advocacy group that aims to make emissions trajectories across Asia compatible with the Paris Agreement 1.5°C warming target.

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Executive Summary

① Steel is a carbon-intensive industry responsible for over 7% of global greenhouse gas (GHG) emissions, while the automotive industry is a key downstream user, accounting for approximately 12% of global steel demand. Notably, as of 2024, South Korea, China, and Japan collectively account for 61.2% of global crude steel production and 54.8% of consumption, placing these countries at the forefront of the steel supply chain's decarbonization.

② South Korean, Chinese, and Japanese automakers must transparently disclose GHG emissions from steel use, set clear green steel adoption targets and roadmaps, and strengthen participation in global initiatives. Clear, credible demand signals through long-term offtake agreements with steelmakers will be crucial in accelerating decarbonization for both the automotive and steel sectors.

③ To effectively assess and compare decarbonization strategies across steel supply chains, a consistent definition and standard for 'green steel' is essential. As corporate net-zero transition accelerates, globally recognized standards are being required to ensure transparency and accountability.

④ In a rapidly evolving trade environment, the automotive industry faces significant tariff risks if it lacks a robust carbon reduction roadmap for raw materials. Conversely, by systematically managing supply chain emissions and proactively adopting green steel strategies, automakers can mitigate trade risks and strengthen their long-term global competitiveness.

1. The Strategic Importance of the East Asian Automakers in Steel Decarbonization

Steel is a major carbon emitting industry, accounting for at least 7% of global annual greenhouse gas (GHG) emissions.[1] It is a material used across industries including construction, automotive, shipbuilding, machinery, and home appliances. Among such sectors, the automotive industry accounts for requiring approximately 12% of global steel demand.[2] Consequently, decarbonizing the automotive supply chain has become critical to drive emission reductions across the global steel industry.

As of 2024, the East Asian region, including South Korea, China and Japan, accounted for approximately 61.2% of global crude steel production and about 54.8% of apparent steel use (ASU)[3], exerting immense influence over the global steel market and the overall carbon emission structure. Specifically, out of a global production total of 1.88 billion tons, China produced 1,005.1 million tons, followed by Japan (84 million tons) and South Korea (63.6 million tons). In terms of the global ASU of 1,742.4 million tons, China represented 856.6 million tons, while Japan and South Korea consumed 51.4 million tons and 47.8 million tons, respectively.[4]

Notably, in 2024, South Korea ranked fifth globally in its ASU[5], while its use per capita of 923.5 kg ranks first worldwide. Approximately 25-30% of South Korea's steel demand is consumed by the automotive industry, indicating a higher level of steel dependency in the automotive sector compared to other major steel-consuming countries. In Japan, the automotive industry accounted for 12.2% of total steel demand (2024),[6] while in China it is 6-7% of total steel consumption.[7] Taken together, the industry constitutes a critical anchor of steel demand across the three countries. Thus, the pace and depth of automotive sector decarbonization have the power to directly shape the overall GHG emissions reduction performance of the steel industry. Given the automotive sector's reliance on high-grade steel, emissions reductions will

1 World Steel Association: Sustainability Indicators Report (2025)
2 World Steel Association: Steel Use by Sector (2025)
3 Apparent Steel Use (ASU) is obtained by adding up deliveries (defined as what comes out of the steel producer's facility gate) and net direct imports.
4 Calculated based on WSA data
5 This figure includes only the volume consumed domestically (nominal consumption). The volume classified as demand, comprising domestic consumption and exports, is nominal consumption (47.8 million tons) + exports (28.4 million tons), totaling 76.2 million tons.
6 Calculated based on JISF (2025) data
7 SEAISI (2024)

be inherently limited without the parallel decarbonization of steel production processes. This underscores the increasingly critical role of automakers in driving this transition.

Within this industrial structure, Hyundai Motor Company (hereinafter Hyundai Motor) and Kia, which together dominate the South Korean automotive market, exert significant influence over carbon emissions as major consumers of raw materials, particularly steel. Compared to China or Japan, the South Korean automotive market is characterized by an exceptionally high concentration of market share among a few players, implying that their decarbonization strategies can yield large impacts. As of November 2025, Hyundai Motor and Kia sold approximately 650,000 and 500,000 units domestically, respectively, a combined market share of roughly 92%.[8] Furthermore, Hyundai Motor Group possesses a unique structural advantage: it is the only automotive group that operates its own captive steel mill, Hyundai Steel. It is known to supply over 80% of its automotive steel output to Hyundai Motor and Kia, with the remaining 17% exported to overseas automakers.[9] This demonstrates that Hyundai Motor and Kia are in a strong position to influence the production methods and decarbonization strategies of Hyundai Steel. Consequently, the decarbonization roadmaps of these two automakers transcend individual corporate goals; they are the decisive factors determining the carbon reduction performance of the 'Steel-Automotive' nexus and furthermore, the entire South Korean industrial supply chain.

However, results from the 2026 Leaderboard (detailed in the following section) show that the rankings of South Korean, Chinese, and Japanese automakers remain largely unchanged from the previous year, stagnant in the mid-to-lower tiers. This suggests that while these companies are pursuing supply chain decarbonization and sustainability initiatives, there remains significant room for improvement when compared to global frontrunners.

8 Prime Economy (2025)

9 Heather Lee & ASL. (2025)

2. Analysis of the Lead the Charge 2026 Leaderboard Results

1) 2026 Leaderboard

Lead the Charge is a platform of global civil society organizations (CSOs) that calls on automakers to transform their supply chains, eliminate reliance on fossil fuels and address environmental and human rights harms. Since 2023, the annual Leaderboard has been published to assess the performance of leading global automakers in advancing this transition. Focusing on 18 global automakers with the highest potential to drive transformation in the industry, the Leaderboard looks beyond emission reductions achieved through the transition to Electric Vehicles (EVs). Instead, it provides a comprehensive analysis of efforts to establish supply chains that are 'equitable, sustainable, and fossil-free.' The 18 automakers evaluated in the Leaderboard are categorized by the location of their headquarters, as shown in **[Table 1]**.

[Table 1] Automakers by Region

Country/Region	Automakers
South Korea (2)	Hyundai Motor Company, Kia
China (4)	Geely, BYD, GAC, SAIC
Japan (3)	Toyota, Honda, Nissan
Europe (6)	Volvo, Mercedes-Benz, BMW, Volkswagen, Renault, Stellantis
United States (3)	Tesla, Ford, GM

Source: Lead the Charge 2026 Leaderboard

The Leaderboard evaluates automakers' performance across two core dimensions: (i) fossil-free and environmentally sustainable supply chains, and (ii) human rights and responsible sourcing. The first dimension evaluates progress in phasing out fossil fuels and managing climate and environmental impacts across key material supply chains, including steel, aluminum, and batteries. The second dimension examines corporate practices related to human rights, Indigenous rights, labor protections, and responsible mineral sourcing. A distinguishing feature of the Leaderboard is its greater emphasis on demonstrated implementation rather than on policy commitments or disclosure alone.

According to the 2026 Leaderboard results[10], U.S. automakers recorded the highest average scores, followed by the European companies. South Korean automakers ranked in the mid-range, while Chinese and Japanese automakers largely remained in the lower tier. As shown in **[Table 2]**, Hyundai Motor and Kia placed 9th and 11th, respectively, among the 18 automakers assessed. Although Chinese and Japanese companies generally scored lower overall, performance among Chinese automakers varied considerably. Notably, Geely achieved the highest scores among the automakers of the three countries, in categories of: 'fossil-free and environmentally sustainable supply chain' and 'steel', raising the overall Chinese average. By contrast, Toyota, Honda, and Nissan scored near 'zero' in the steel category, placing all three in the lower tiers.

One notable finding is that the steel-sector scores were marked lower than scores in other assessment areas. While Volvo achieved an exceptionally high score (58 points) and selected U.S. and European automakers such as Mercedes-Benz (hereinafter Mercedes) (28 points), Ford (23 points), and Tesla (22 points) performed in the second tier while most companies scored only in the single digits or the lower tenth percentile. This suggests that while many companies recognize steel as a critical area for decarbonization, practical implementation, including setting specific procurement standards, purchasing green steel[11], and facilitating supplier transitions, remains in its nascent stages.

10 The 2026 Leaderboard can be accessed here: https://leadthecharge.org/ko/scorecards-summary/

11 While the Lead the Charge Leaderboard utilizes various terms, such as 'CO_2-reduced steel,' 'near-zero emission steel,' 'green hydrogen-based steel,' and 'carbon-free steel,' this issue-brief consolidates these concepts under the unified term 'Green Steel.' As the most globally recognized terminology, green steel intuitively encompasses the overarching goal of carbon reduction. Furthermore, in the absence of a universally standardized definition, it serves as an effective umbrella term to bridge the diverse technological pathways and transition stages addressed in this brief.

[Table 2] Breakdown of Indicators and Performance Scores for the 18 Automakers

Rank	Automaker	2026 Leaderboard Total Score (%)	Fossil-free and environmentally sustainable supply chain (%)	Steel Sector Average (%)
1	Tesla	49	50	22
2	Ford	45	40	23
3	Volvo	44	55	58
4	Mercedes-Benz	41	39	28
5	Volkswagen	39	31	13
6	BMW	34	30	16
7	Renault	31	28	5
8	Geely	27	31	19
9	Hyundai Motor Company	23	21	12
10	GM	22	20	18
11	Kia	21	20	7
12	Stellantis	21	14	1
13	Nissan	15	13	1
14	BYD	14	13	0
15	Honda	12	8	0
16	Toyota	9	7	0
17	GAC	4	5	0
18	SAIC	3	4	0

Source: Lead the Charge 2026 Leaderboard, reorganized by SFOC

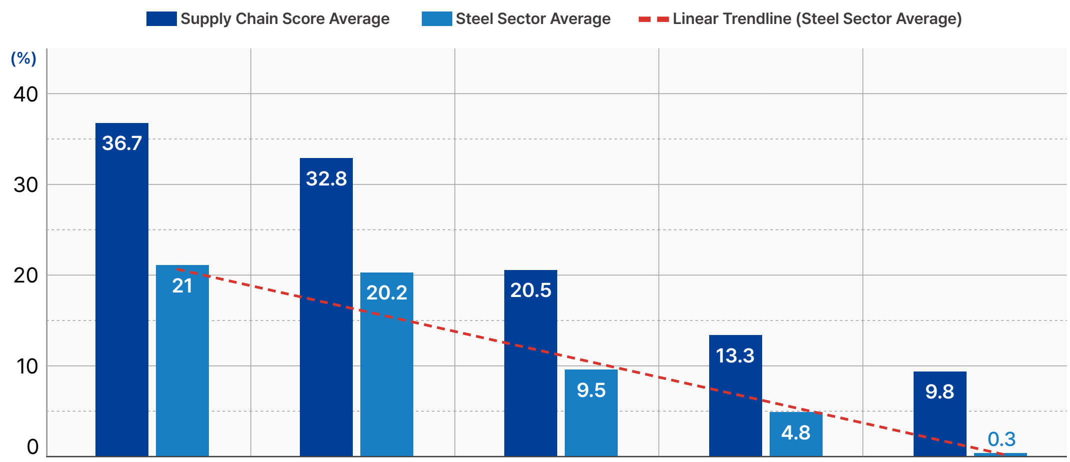
Note: Assessment based on disclosures up to July 1st, 2025; annual reports published thereafter (excluding policies) were selectively considered.

2) Regional Comparison of Automakers: Supply Chain and Steel Sector Performance

[Figure 1] and **[Table 3]** compare the average supply chain and steel sector scores of automakers by region. U.S. automakers recorded the highest performance, with an average supply chain score of 36.7 points and a steel-sector average of 21. European automakers followed closely, with scores of 32.8 and 20.2, respectively. In contrast, the performance of East Asian automakers was significantly lower. The average supply chain score for South Korean companies stood at 20.5, with their steel sector average reaching only 9.5. Chinese automakers (13.3 and 4.8) and Japanese automakers (9.3 and 0.3) remained at even lower levels in both categories. Notably, even the combined average steel sector scores of South Korean, Chinese, and Japanese automakers fall short of the individual averages of their U.S. and

European counterparts. This highlights a pronounced performance gap, confirming that steel decarbonization efforts in East Asia significantly lag behind those in the U.S. and Europe.

[Figure 1] [Table 3] Average Supply Chain Score and Steel Sector Score by Region[12]



Category (by region)	United States (3)	Europe (6)	Korea (2)	China (4)	Japan (3)
Automaker	Tesla, Ford, GM	Volvo, Mercedes-Benz, BMW, Volkswagen, Renault, Stellantis	Hyundai Motor Company, Kia	Geely, BYD, GAC, SAIC	Toyota, Honda, Nissan
Average Supply Chain Score (%)	36.7	32.8	20.5	13.3	9.3
Steel Sector Average (%)	21	20.2	9.5	4.8	0.3

Source: Lead the Charge 2026 Leaderboard, reorganized by SFOC

To examine regional disparities more closely, a comparative analysis of South Korean, Chinese, and Japanese automakers reveals a stark contrast in performance. Geely emerged as the top performer in East Asia, with an average supply chain score of 31 and a steel sector average of 19. These figures place Geely remarkably close to the averages of European (approximately 20) and U.S. (approximately 21) automakers. In contrast, Hyundai Motor (12 points) and Kia (7 points) ranked second and third, respectively among East Asian automakers, yet they remained 7 to 12 percentage points behind Geely. The performance of other Chinese (excluding Geely) and Japanese automakers in the steel sector was even more limited. Nissan scored a mere 1 point, while Toyota, Honda, BYD, GAC, and SAIC remained at zero, indicating no measurable progress in steel decarbonization.

12 The relatively higher average score of Chinese automakers is largely driven by the performance of Geely. Among the East Asian automakers, Geely is assessed as comparatively proactive in disclosing supply chain decarbonization efforts and raw material management policies. It also stands out in several indicators for presenting explicit climate strategies for key materials, including steel. As a result, Geely's performance significantly elevates China's overall average score in the assessment.

These disparities reflect fundamental differences in how automakers perceive steel, a critical risk and emissions reduction priority. The following section examines specific steel supply chain evaluation indicators that illuminate these contrasting approaches.

3) Analysis of Key Steel Supply Chain Indicators

The Leaderboard evaluates steel supply chain performance not simply by confirming steel usage or the presence of stated commitments, but by assessing whether companies clearly understand the structure of their steel supply chains and are actively driving meaningful changes.

Specifically, the Leaderboard assesses company performance across three core dimensions. First, it examines whether Scope 3 emissions related to steel are disclosed at a granular level, including breakdowns by raw material. Second, it evaluates whether companies have established clear mid- to long-term targets for transitioning to green steel, and whether progress toward these targets is quantitatively reported. Third, it assesses the extent to which companies deploy supply chain levers, such as participation in buyer platforms and offtake agreements to actively drive decarbonization among steelmakers. Together, these indicators assess whether steel is treated not merely as an input material, but as a strategic source of climate risk and a priority for emissions reduction, and whether this recognition translates into concrete action across disclosure, target-setting, and implementation.

Accordingly, the following section applies the Leaderboard's indicator framework to conduct a step-by-step analysis of the automakers' practices in:

- **Disclosure of Scope 3 Emissions in the Steel Supply Chain**
- **Target Setting and Implementation for Green Steel Transition**
- **Driving Steel Decarbonization through Supply Chain Engagement**

3. Current Status of Automakers' Steel Supply Chain Management and Decarbonization

1) Scope 3 Emission Disclosures - Steel Use

Steel is one of the major raw materials in automotive manufacturing and a primary source of GHG emissions. On average, steel accounts for roughly 60% of the material composition of mid-size passenger vehicle, with total steel use typically exceeding 900kg per vehicle.[13] According to the International Council on Clean Transportation (ICCT), the GHG emission intensity of steel used in automotive production is estimated at 1.8–2.2 tCO_2e per ton, with a broader range of 0.9–1.7 tCO_2e at the lower bound and 2.0–2.5 tCO_2e at the upper bound.[14] Consequently, to reduce the Life Cycle Assessment (LCA) emissions of vehicles, core strategies are being proposed that focus on reducing the overall steel consumption and advancing vehicle lightweighting, alongside expanding the use of recycled steel and transitioning to steel produced through low-carbon processes.[15]

Globally, corporate GHG emissions are accounted under the GHG Protocol developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), which classifies emissions into Scope 1, 2, and 3. For automakers, Scope 1 covers direct emissions from manufacturing operations, Scope 2 includes indirect emissions from the generation of purchased electricity consumed by the company, and Scope 3 encompasses other indirect emissions occurring across the value chain from sources not owned or controlled by the company. Scope 3 typically accounts for around 90% of total emissions, making it a critical focus area.

Among the 15 Scope 3 categories, Category 1, 'purchased goods and services,' is particularly significant, as it includes emissions from raw materials such as steel, aluminum, and battery materials. Given steel's dominant contribution, steel-sector decarbonization is essential to achieving meaningful reductions in Scope 3 Category 1 emissions.[16] Accordingly, disclosing

13 Greenpeace (2023)

14 ICCT (2024)

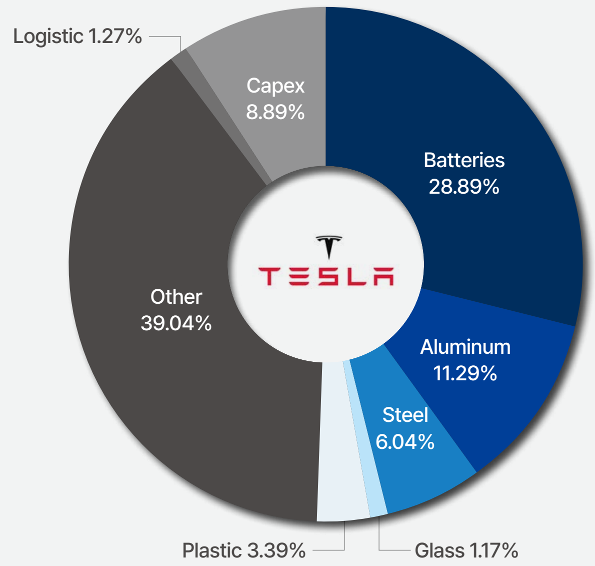
15 As an example of a low-carbon process, Green Hydrogen in Direct Reduced Iron (H2-DRI) production technology, which can reduce both direct and indirect emission intensities to near-zero, is gaining significant attention.

16 Thomas Fugger et al. (2025)

steel consumption and emissions at a granular, raw material level is not only the starting point but also a key indicator used by stakeholders, such as policymakers, investors, and certification bodies, to evaluate a company's implementation progress. Notably, recent evaluation criteria are shifting beyond simply presenting a single aggregate figure for Scope 3 Category 1. Instead, they increasingly focus on whether a company disaggregates and discloses emissions by key raw materials, such as steel and aluminum.

In practice, however, separate disclosure of steel-related Scope 3 emissions remains rare among automakers. Among the 18 companies assessed, Tesla is the only automaker that reports Scope 3 Category 1 emissions separately on steel, indicating that steel accounted for 6.04% of its raw material supply chain emissions in 2024. This serves as a prime example of quantifying the specific contribution of steel to the total emissions of the raw material supply chain.

[Figure 2] Tesla Commodity Supply Chain Emissions by Material Use



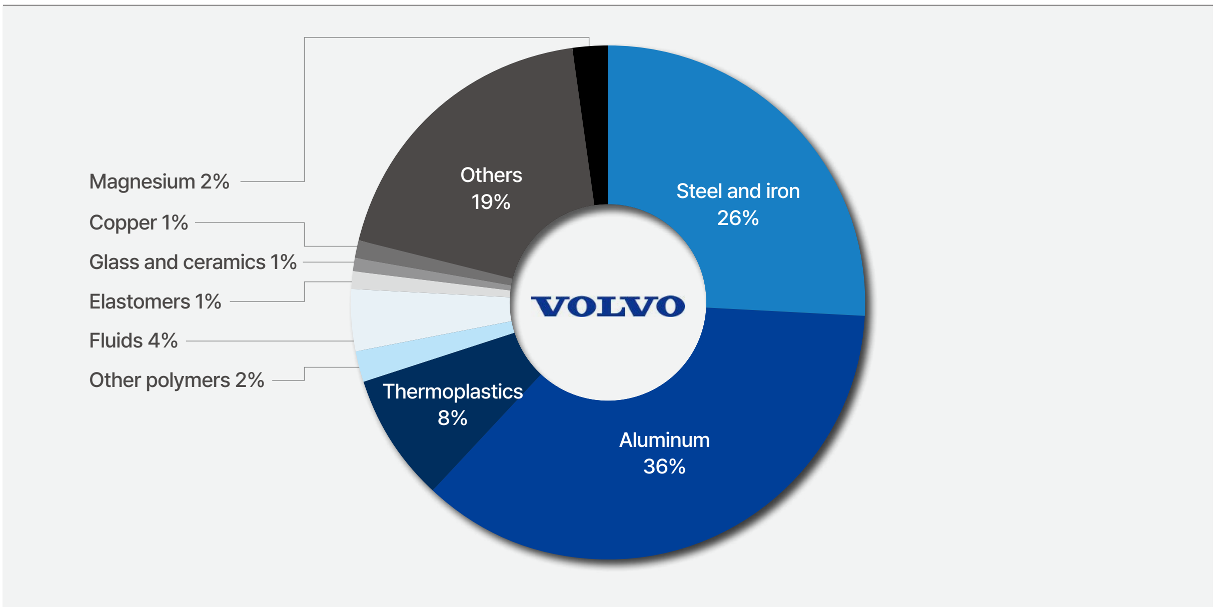
Source: 2024 Tesla Impact Report, image reconstructed

Volvo also shows a relatively detailed approach compared to other automakers. Through its vehicle-level LCAs, Volvo reports the average carbon footprint of individual materials used in EV production, with steel and iron accounting for approximately 26% of total vehicle emissions. More specifically, 'Volvo Cars Position on Sustainable Steel' document indicates that for the XC40 Recharge, around 18% of total emissions originate from steel and iron materials.[17] While

17 Volvo XC40 Recharge, XC40 ICE Model Carbon Footprint Report

this approach does not fully disaggregate Scope 3 emissions across the entire steel supply chain, the model-level disclosure remains meaningful, as it enables comparison of steel-related decarbonization performance across specific vehicle models.

[Figure 3] Volvo's Average CO2 Emissions per Vehicle by Raw Materials



Source: Volvo Car Group's Annual and Sustainability Report 2024, image reconstructed

By contrast, the disclosure practices of Hyundai Motor and Kia make it difficult to understand their overall steel supply chains. Hyundai Motor reports its total iron usage of 1,238,092 tons in its sustainability report. When divided by its 2024 production volume (4,146,335 vehicles), this corresponds to an average iron usage of approximately 0.299 tons per vehicle.[18] Kia also discloses iron-related data, but only for domestic production, reporting an iron intensity of 158.9kg per vehicle. This is based on total iron use of 204,421.1 tons and domestic production of 1,548,000 vehicles.[19] Given that a standard passenger vehicle typically contains around 900kg of steel, the iron usage figures disclosed by Hyundai Motor and Kia account for only a partial segment of their manufacturing process. In other words, their disclosures are limited to a narrow segment of their vehicle manufacturing process, thus they do not sufficiently capture the role of steel within the overall supply chain emissions.

The problem is that such limited disclosure fails to provide the necessary information to identify and track Scope 3 emissions originating from the steel supply chain at a granular, raw

18 Hyundai Motor Company 2025 Sustainability Report, page 115
19 Kia 2025 Sustainability Report, page 108

material level. Unlike Tesla and Volvo, which provide detailed steel-specific emission data, Hyundai Motor and Kia's lack of raw-material-level Scope 3 disclosure obscures the relative weight of steel emissions, hindering their ability to prioritize GHG reduction targets effectively. Consequently, this prevents companies from effectively prioritizing their GHG emission reduction targets. These limitations are further intensified by emerging regulatory frameworks, including the European Union (EU)'s Carbon Border Adjustment Mechanism (CBAM) and ongoing discussions on carbon intensity labeling for industrial products. Without robust and granular data on steel-related emissions, automakers may face higher compliance costs and increased regulatory uncertainty.

Ultimately, disclosure of GHG emissions associated with steel use is not merely a matter of transparency; it is a prerequisite for the effectiveness, credibility, and external validation of automotive decarbonization strategies.

2) Specificity of Decarbonization Targets in the Steel Supply Chain

The second indicator is the specificity of an automaker's decarbonization targets. The assessment focuses on whether a company merely makes broad declarations or provides granular, material-specific targets for inputs like steel and aluminum. This is because high-level supply chain reduction goals alone make it difficult to verify actual progress or the pace of transition at the individual raw material stage. For emission-intensive materials like steel, the absence of material-level targets can dilute accountability and limit the feasibility of implementation. Specifically, this indicator evaluates whether a company has officially set clear mid- to long-term targets for steel consumption and based on those targets, regularly discloses its actual proportion of green steel usage. While the former focuses on the existence and clarity of goals, the latter serves to verify whether those goals are integrated into actual performance management and disclosures, moving beyond mere declarations to the actual implementation stage.

Based on the 2026 Leaderboard results, automakers can be broadly grouped into 3 tiers according to the specificity of their steel decarbonization targets and the extent to which these targets are linked to measurable performance management.

[Table 4] Differences in Approaches to Setting Decarbonization Targets for the Steel Supply Chain

Tier	Leaderboard Evaluation Score	Classification Criteria	Evaluation Summary	Automakers
1	1.2	Officially sets quantitative, time-bound targets specifically for green steel	Publicly declares targets for green steel adoption that include clear percentages, years, and definitions	Ford, GM, Volvo
2	0.4	While the company has established a carbon reduction direction that explicitly includes steel and contains some quantitative elements, specific percentage-based standards and targets remain undisclosed.	Discloses green steel procurement volumes and maintain a steel strategy, but do not disclose the adoption rate of green steel relative to total steel usage	Mercedes-Benz
3	0	Recognizes the importance of reducing carbon emissions in the steel supply chain but lacks quantitative targets for steel.	Limited to general mentions or remains in the preparatory stage.	The remaining 14 companies, including Hyundai Motor Company and Kia

Source: Lead the Charge 2026 Leaderboard, reorganized by SFOC

Note: Prepared based on the 2026 Leaderboard evaluation metrics and results.

Among the 18 automakers assessed, Ford[20], GM[21], and Volvo demonstrated the highest level of specificity in their steel decarbonization targets. Ford and GM have joined the First Movers Coalition (FMC) and committed to sourcing at least 10% of their total steel purchases from 'fossil-free or near-zero steel' by 2030. Volvo, through its participation in the SteelZero initiative, has committed to transition 50% of its steel procurement to 'lower-emission steel' by 2030.[22] A common feature across these companies is the explicit identification of steel as a priority raw material, accompanied by clearly defined adoption rates and timelines, which elevates their targets beyond general commitments. Mercedes also announced a commitment to carbon-neutral procurement across all production materials, including steel, and plans to purchase approximately 200,000 tons of 'CO_2-reduced steel' annually. However, Mercedes was assigned to the second tier, ranking below Ford, GM, and Volvo, as it didn't disclose the specific ratio of green steel relative to its total steel consumption.

Notably, all 4 companies have demonstrated their commitment to green steel by joining global initiatives aimed at expanding market demand, a point that is further detailed in the third indicator.

20 Ford serves as a benchmark for structured target-setting. It has set (1) net-zero goal by 2050 covering the entire vehicle lifecycle, (2) disaggregated targets by 2030 for vehicle use, global operations, manufacturing, and supply chain and (3) further breakdown of the 2030 supply chain target into dedicated sub-targets for priority materials, specifically steel and aluminum.

21 As part of its First Movers Coalition membership, GM has announced plans to transition at least 10% of the crude steel used in manufacturing the sheet steel products that it directly purchases for its manufacturing facilities in the United States, Canada, and Mexico to near-zero-emission steel by 2030.

22 For details on automakers' participation in global initiatives, refer to Table 5 on page 19.

On the other hand, the East Asian automakers acknowledge the importance of steel decarbonization by outlining broad plans for introducing green steel, as well as long-term technological transition pathways. However, no cases were identified in which these commitments are translated into steel-specific, quantitative targets. Instead, most companies rely on aggregated supply chain reduction targets, resulting in a substantial gap relative to leading U.S. and European automakers.

In South Korea, Hyundai Motor has announced that from 2026 it will prioritize the use of 'carbon-reduced steel' for selected vehicle models produced in South Korea and Europe. Produced through recycling steel scrap or using electric arc furnaces (EAF) processes, Hyundai Steel is expected to deliver a 20% emissions reduction compared to conventional products produced using blast furnaces (BF).[23] It also plans to establish quality inspection and carbon emissions verification systems to support the introduction of such steel. Kia has similarly stated its intention to prioritize steel with 20% lower carbon intensity by 2030 as part of its decarbonization strategy.[24] However, both companies remain at a preparatory stage, as they have not disclosed key quantitative details such as target vehicle models, procurement volumes, or the share of 'low-carbon steel' relative to total steel use.

Chinese and Japanese automakers likewise recognize the need for emissions reductions, but steel-specific targets with clearly defined adoption rates and timelines remain rare. Geely has set a goal to reduce average supply chain emissions per vehicle series by 20% by 2025, but this target applies to the entire supply chain and does not clarify steel-specific pathways or volumes.[25] In Japan, Nissan references the expansion of '*green steel (hereinafter GX Steel)*' under its 'Nissan Green Program (NGP) 2030' and has committed to increasing the share of sustainable materials to 40% by weight by 2030. The definition of 'sustainable materials' is defined broadly to include low-carbon, non-toxic, and ethically sourced materials.[26] However, it remains unclear whether steel is included in this target and, if so, to what extent, thereby limiting the ability to assess actual progress in steel decarbonization.[27]

The assessment also examined whether automakers regularly disclose the actual share of green steel used in annual production or procurement. Only two companies met this criterion. Mercedes disclosed the use of EAF-based low-carbon steel in its '360° Environmental Check'

23 Hyundai Motor Company 2025 Sustainability Report, page 31
24 Kia 2025 Sustainability Report, page 29
25 Geely 2024 ESG Report, page 36
26 Nissan 2025 Sustainability Data Book, page 32
27 Nissan 2025 Sustainability Data Book, page 24

LCA models, specifying the use of 39kg of renewable energy-based EAF steel. Given that steel accounts for approximately 45% of the vehicle's total weight (1,980 kg), this corresponds to roughly 4.4% of total steel use.[28] Geely also reported that its Zeekr MIX model incorporates 15% 'renewable steel'[29], but did not provide further details regarding the definition of renewable steel, its production method or associated emissions reductions.

Box 1

Geely achieved the highest score among East Asian automakers in the 2026 Leaderboard. Particularly in the steel sector, it disclosed the proportion of 'renewable steel' used in the Zeekr MIX model and set a target for its Tier 1 key suppliers to use 20% 'recycled steel' by 2025. Furthermore, Geely disclosed in its ESG report that "several mass-produced models have already achieved a recycled steel ratio of 15%," which is considered the highest achievement among other East Asian automakers.

[Figure 4] Zeekr MIX model

Source: Zeekr Official Website

3) Market Signaling for Green Steel through Global Initiatives

The third indicator assesses whether automakers are actively steering steelmakers toward green steel production through participation in global initiatives. This indicator goes beyond declarative commitments and evaluates whether automakers are playing a strategic role in shaping steelmakers' investment and production decisions.

The Leaderboard therefore considers participation in initiatives such as SteelZero, the FMC, and standards and certification schemes such as ResponsibleSteel as key criteria. These serve as a critical evaluation factor as it goes beyond general procurement intent or rhetoric; instead, it implies the potential for concrete long-term offtake agreements through initiative participation. To date, none of the 9 East Asian automakers are known to participate in these initiatives.

28 360 Environmental Check LCA with EQ Technology, page 11
29 Geely 2024 ESG Report, page 36

[Table 5] Automakers' Participation in Global Initiatives

No	Automaker	FMC (Steel Sector)	SteelZero	ResponsibleSteel	Remarks
1	Ford (U.S.)	O	X	X	FMC Steel Sector participation
2	GM (U.S.)	O	X	X	FMC Steel Sector participation
3	Mercedes-Benz (EU)	X	X	O	ResponsibleSteel Member
4	Volvo (EU)	X	O	O	SteelZero, ResponsibleSteel member

Source: SFOC

In parallel, several leading European and U.S. automakers are entering offtake agreements with steel producers, further reinforcing their commitment to green steel procurement. These contracts extend beyond voluntary pledges by providing clear mid- to long-term demand visibility, thereby incentivizing steelmakers to invest in low-carbon technologies and expand production capacity. **[Table 6]** summarizes representative examples of such agreements between automakers and steelmakers.

[Table 6] Examples of Offtake Agreements between Automakers and Steelmakers

Automaker	Steelmaker	Steel Type	Start Date / Status
GM	Nucor	Lower-emission steel	Contract mentioned in TCFD report[30]
	U.S. Steel	Sustainable steel[31]	
	ArcelorMittal	Recycled and renewably produced steel[32]	
Mercedes-Benz	H2 Green Steel (H2GS)	Almost CO_2-free steel[33]	Announced plans to begin production in 2025. Signed a contract to procure 50,000 tons annually.
Volvo	SSAB	Recycled and near zero-emissions steel	Plans announced for application in EX60.[34]

Source: Lead the Charge 2026 Leaderboard, reorganized by SFOC

30 GM TCFD Report, page 9
31 U.S. Steel (February 14, 2023)
32 ArcelorMittal (June 7, 2023)
33 Mercedes-Benz Group (November, 2024)
34 Volvo (June 12, 2025)

4. Conclusion and Recommendations

1) Leveraging Global Best Practices to Secure Competitive Advantage

Compared with U.S. and European peers, South Korean, Chinese, and Japanese automakers lack clear and actionable roadmaps for steel supply chain decarbonization. Although steel is a major raw material and a key contributor to Scope 3 emissions, current strategies largely remain at the level of corporate declarations, with insufficient raw material–specific targets and implementation systems. As a result, the analysis reveals that East Asian automakers face the following limitations compared to global best practices:

(1) First, the absence of clear decarbonization priorities for key raw materials, including steel, makes it difficult for external stakeholders to verify the effectiveness of their supply chain decarbonization strategies.

(2) Second, the absence of specific targets and timelines for green steel transition results in a weak alignment with each company's mid- to long-term strategies.

(3) Third, the practical means to drive structural transformation within the steel industry, such as strategic partnerships and long-term offtake agreements, remain insufficient, limiting the automakers' ability to incentivize steelmakers toward decarbonization.

Given that the East Asian automakers already recognize steel as a critical input for supply chain decarbonization, they must strengthen and standardize disclosure of steel-related emissions and explicitly link this information to their decarbonization strategies. To achieve meaningful emissions reductions, companies should establish concrete, phased targets for green steel adoption, supported by clear implementation roadmaps. Importantly, as the automotive sector is well positioned to act as an anchor buyer for green steel, automakers should play a leading role in providing credible demand signals to steelmakers through participation in global initiatives and offtake agreements.

2) Establishing Green Steel Standards in Comparing and Assessing Steel Supply Chains

Effective evaluation and comparison of steel decarbonization strategies require a clear and consistent definition of what qualifies as green steel. Green steel generally refers to steel produced through renewable energy–based processes and other technologies that reduce net GHG emissions from steel production to levels close to ‘zero.’

However, a commonly agreed definition and standards for green steel have yet to be established. In the absence of such harmonized standards, significant limitations arise not only in comparing corporate performance, but also in designing effective policies and assessing progress toward stated targets. This ambiguity allows corporate strategies to remain at the level of declarative commitments rather than delivering measurable emissions reductions, potentially distorting both the pace and direction of the transition toward decarbonization. This challenge is evident in the inconsistent terminology used by automakers in sustainability reports, where terms such as ‘low-carbon steel,’ ‘100% renewable electricity–based EAF steel,’ ‘CO_2-reduced steel,’ ‘near-zero-emission steel,’ ‘green hydrogen–based steel,’ ‘carbon-free steel,’ and ‘green steel’ are often used interchangeably.

Standards of ResponsibleSteel and the China Iron and Steel Association (CISA)’s C2F framework draw on the International Energy Agency (IEA)’s Sliding Scale approach, which classifies steel based on carbon intensity thresholds adjusted for scrap input ratios. The IEA defines near-zero emission steel within a range of 0.05–0.4 tCO_2 per ton of steel, depending on scrap ratio. ResponsibleSteel and CISA’s C2F standard apply similar baseline thresholds, though they differ in their emissions accounting boundaries.

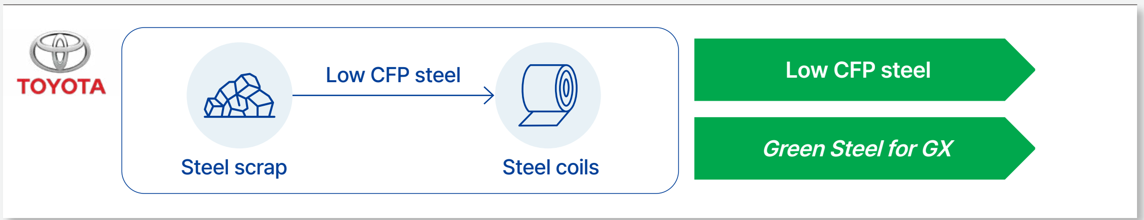
In the Leaderboard, steel is classified into two tiers based on emissions reduction levels. ‘Fossil-free steel’ corresponds to the near-zero emission steel definition of the IEA, with carbon intensity thresholds ranging from 0.05 to 0.4 tCO_2 per ton of steel, depending on the scrap input ratio in crude steel production. ‘Lower-emission steel’ is defined more broadly, covering carbon intensity levels from 0.35 to 2.0 tCO_2 per ton of steel. Initiatives such as SteelZero and the First Movers Coalition (FMC) align their procurement targets with IEA benchmarks. SteelZero is committed to sourcing 50% of total steel purchases as lower emission steel, which aligns with ResponsibleSteel’s Decarbonization Progress Level 2, by 2030. Meanwhile the FMC has set a target for 10% of total steel purchases to meet the IEA near-zero-emission steel by 2030.

Japan adopts a notably different approach. Its standards are based on an allocation methodology, which the carbon emissions reduced at a specific production site (A) may be allocated to products at another site (B), with the condition being that the production chains of these sites are connected. This methodology adopts a 'mass-balance approach' allowing companies to certify steel as 'low-carbon' by allocating emission reductions across various facilities, regardless of whether those reductions occurred within the same physical production process.

Major Japanese automakers, such as Toyota and Nissan, defines '*GX Steel*'[35] as steel produced with significantly reduced carbon emissions in the steelmaking process, based on Japan's Green Transformation (GX) Strategy.[36] Box 2 illustrates '*GX Steel*' application plans and methodologies of Toyota and Nissan. However, both companies face a critical limitation in that their approach is predicated on the mass-balance-based steel.[37]

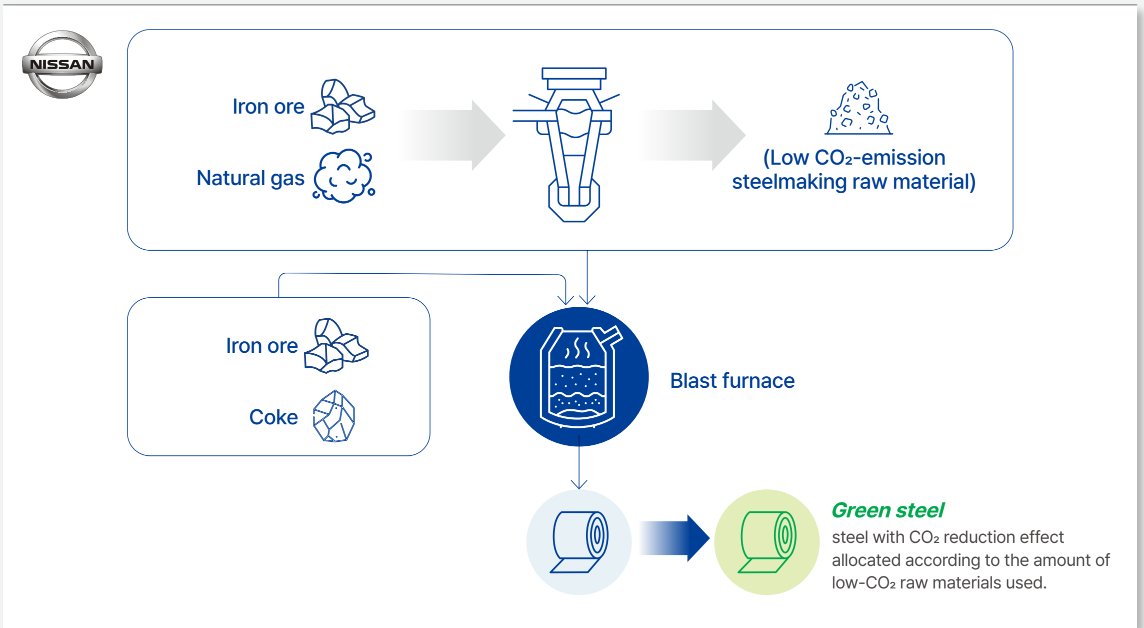
Box 2

[Figure 5] **Toyota Low CFP Steel & '*GX Steel*' Procurement Plans**



Source: Toyota 2025 Sustainability Data Book, image reconstructed

[Figure 6] **Nissan's '*GX Steel*' Procurement Plans**



Source: Nissan 2025 Sustainability Data Book, image reconstructed

Box 2

In their 2025 Sustainability Data Books, Toyota and Nissan announced policies to prioritize the use of low-carbon and '*GX Steel*' as part of their efforts to decarbonize at the raw material level. Toyota detailed that starting in 2025, it began sourcing Kobenable Steel (Kobe Steel), JGreeX (JFE Steel), NSCarbolex Neutral (Nippon Steel), and carbon reduction allocated steel (POSCO Holdings). Similarly, Nissan disclosed that it has been expanding the application of '*GX Steel*' in its vehicles, following the initiation of its collaboration with Kobe Steel in January 2023.

Toyota categorizes such materials as 'low carbon footprint (low CFP) steel' and '*GX Steel*.' It explicitly states that this definition aligns with the standards established by the 'Study Group on Green Steel for GX Promotion' under Japan's Ministry of Economy, Trade and Industry (METI). Nissan also announced the adoption of '*GX Steel*' through the mass-balance approach, which it defines as a process where different raw materials (e.g., low-carbon and conventional materials) are mixed during production, and the resulting carbon reduction effects are concentrated (allocated) to specific steel products.

Amid this trend, Toyota and Tokyo Steel Manufacturing recently made an official announcement regarding the application of EAF steel in vehicle production. Tokyo Steel stated that its pickled hot-rolled sheets have been adopted for several of Toyota's mass-produced models. The company revealed that the emission intensity of this steel is 0.46 tCO2/t-steel, approximately one-quarter of the emissions from the conventional BF process. While EAF-based steel has seen limited use in automotive sheets due to concerns over parts management and quality stability, this announcement is seen as a milestone demonstrating the growing feasibility of large-scale commercialization of low-carbon steel within the automotive industry.

As the term green steel currently carries varying calculation methodologies and standards depending on the country or company, the need for a globally aligned standard is becoming increasingly important. The IEA has emphasized 6 core principles[38] for near-zero emissions definitions, including globally consistent and physical. It further proposes low-emission as an intermediate pathway toward near-zero definitions, defined by a carbon intensity benchmark significantly lower than the average emissions level achievable through Best Available Technology (BAT) in conventional processes. These principles[39] also include signaling the need for progressive improvement over time and clear communication on chain of custody.

35 '*GX Steel*' as defined by the Japanese government is based on the mass-balance approach, meaning steel can be certified as 'green' without necessarily achieving actual reductions in physical carbon emissions.

36 On July 28, 2023, the Japanese government announced the 'GX Promotion Strategy,' signifying the transition of industrial and societal structures from fossil fuels to clean energy.

37 The mass-balance approach allocates emissions reductions to specific products during the initial and transition phases.

38 IEA's principles for near-zero emissions definitions are (1) ambitious, (2) stable, (3) technology neutral, (4) globally consistent, (5) physical, and (6) transparent.

39 IEA's principles for low-emissions definitions are (1) ambitious with clear communication on the ambitious level, (2) signals need for progressive improvement over time, (3) technology neutral, (4) global coherence while accounting for regional starting points, (5) clear communication on chain of custody, (6) transparent, and (6) accessible.

Accordingly, a future definition of green steel should: ▲ align with the IEA's principles for near-zero and low-emission definitions; ▲ adopt ambitious carbon intensity thresholds; ▲ apply an emissions boundary covering Scope 1 and 2, with a transition toward Scope 3 inclusion; and ▲ prioritize transparent, verifiable, and physical emissions reductions. Absent such a definition, it will remain difficult to quantitatively compare and evaluate automakers' steel transition strategies, and the expansion of green steel adoption will remain vulnerable to greenwashing risks.

3) Responding to Strengthening International Trade Regulations

As automotives are globally traded commodities and steel remains one of the most critical cross-border raw materials, steel supply chain decarbonization is no longer an issue confined to domestic environmental policy. Instead, it has become a decisive factor directly impacting international trade order and industrial competitiveness.

Major trade policies, notably the EU CBAM, are increasingly differentiating market access based on the carbon intensity of products and production processes. For the automotive industry, which relies heavily on steel, this shift poses a significant threat, particularly for export-oriented countries. Since May 2023, the EU has mandated emission reporting for 6 sectors, including steel, with the obligation to purchase CBAM certificates commencing in January 2026. Consequently, the South Korean steel industry, which exports over 3 million tons annually to the EU, is projected to face additional costs of KRW 400–500 billion per year.[40]

While automakers are not yet direct targets of CBAM, they are heavily exposed to indirect risks due to their reliance on emission-intensive raw materials. The European Commission has already proposed expanding CBAM to downstream products, such as auto parts, and is deliberating the inclusion of finished vehicles by 2028.[41]

In this rapidly evolving trade environment, the absence of a clear raw material-level decarbonization roadmap will leave the automotive industry directly vulnerable to heavy tariff burdens. Conversely, systematically analyzing supply chain emissions and preemptively securing green steel supplies will serve as a strategic lever to mitigate regulatory risks and bolster long-term industrial competitiveness.

40 Green Economy Daily (December 19, 2025)
41 European Commission (December 17, 2025)

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