



# Low-Carbon Procurement Accelerates Net-Zero Transition

An Overview of Heavy Industry's Case in China





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# Authors and Acknowledgments

## Authors

**Kaidi Guo, Wei Li, Yujun Xue, Rong Yan**

## Other Authors

**Shuyi Li, Ting Li**

All authors listed alphabetically. All authors from RMI unless otherwise noted.

## Contacts

Wei Li, [wli@rmi.org](mailto:wli@rmi.org)

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# Executive Summary

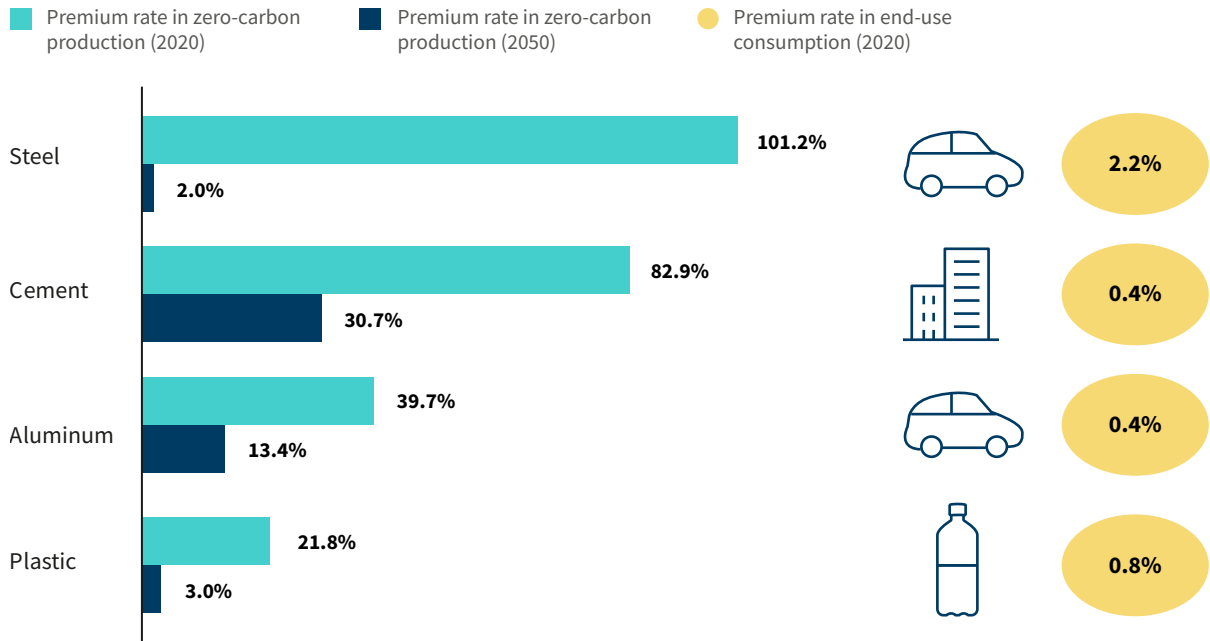
Accelerating the decarbonization of heavy industry from the demand side means we should enable the purchase of and promote a market for low-carbon industrial materials.<sup>i</sup> Demand-side actions play an important role in the decarbonization of heavy industry in three ways:

1. Carbon emissions from industrial materials account for 30%–60% of total carbon emissions in some major downstream industries (e.g., real estate, building, machinery, and equipment manufacturing) whose decarbonization pathways inevitably require the use of low- or zero-carbon materials (e.g., steel, cement, and aluminum).
2. The green premium is shared when the higher abatement costs of the commodity industry are passed downstream. Thus, cultivating a market for low-carbon industrial materials with relatively low-cost demand-side procurement can create economies of scale and help reduce abatement costs in upstream industries. For example, the green premium for key zero-carbon industrial materials on the production side is typically 20%–100%, and when transferred to downstream industries, the premium on the consumption side can be reduced to 0.8%–2.2%, creating more favorable conditions for consumption and procurement (see Exhibit 1, next page).
3. The government and leading enterprises can send a positive signal for the low-carbon transition by demonstrating the feasibility of low-carbon procurement. Public procurement in China accounts for about 3.6% of national gross domestic product (GDP), with the possibility of continuous growth compared with 12% in Organisation for Economic Co-operation and Development (OECD) countries. Early procurement pilots by the government and first-mover companies act as clear signs of actions.

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<sup>i</sup> Industrial material in this report refers to the materials used in the manufacture of industrial products or used in buildings. Example industrial materials are steel, plastic, cement, and aluminum.

## Exhibit 1: Green premium (%) for carbon-free industrial materials on the production and consumption sides



RMI Graphic. Source: RMI research.

At present, global and Chinese practices tend to embed low-carbon procurement into the schemes of “green procurement,” which refers to procurement practices that have a lower environmental footprint. For both governments and enterprises, green procurement is becoming an important tool for carbon reduction:

- Internationally, green public procurement, as exemplified by the systems in the European Union, South Korea, and the United States, is mainly targeted at the building and infrastructure industries. The best practices include carbon accounting methodologies and databases, a compliance or incentive system, and a premium sharing mechanism.
- In China, the government has been practicing green procurement policies and pilot projects, focusing on green products with energy or material efficiency, as well as green packaging and green building materials. However, the current practice usually does not include carbon metrics in the “green” indicators. At the product level, green products tend to focus more on the end-use phase and typically do not include the embodied carbon of industrial materials. At the project level, the embodied carbon of buildings is recommended in life-cycle carbon accounting but in practice needs more awareness in current pilot projects.

In terms of corporate actions, international pioneers are enabling green and low-carbon procurement through supply chain carbon management. As of July 2021, more than 650 large companies worldwide have committed to Scope 3 carbon reductions. Common corporate practices are divided into five categories: (1)

carbon target setting, (2) carbon emissions accounting and management, (3) partnership and cooperation mechanism, (4) supplier capacity building, and (5) incentive and screening mechanism. Some leading Chinese companies also have committed to decarbonizing the supply chain. The trend in China is to prioritize carbon accounting methods, product-level carbon data and labeling, carbon disclosure, and promotion of supply chain carbon targets.

Low-carbon procurement can be designed based on the existing framework of green procurement, but it is necessary to integrate carbon criteria. A low-carbon procurement system should include at least the following basic elements: (1) definition of the scope of low-carbon procurement; (2) carbon accounting and certification system; (3) carbon criteria for products, services, and/or suppliers; (4) incentives for low-carbon products and services; and (5) implementation, monitoring, and evaluation (see Exhibit 2). The design of a low-carbon procurement system should be based on the consensus of stakeholders along the value chain, which will impact all the basic elements mentioned above. The stakeholders of low-carbon procurement include upstream suppliers, downstream consumers or producers, policymakers, investors, industry associations, and certification organizations. A synergy should be created among them to ultimately ensure low-carbon procurement.

## Exhibit 2: Elements of low-carbon procurement

	Public procurement	Private procurement
Defining low-carbon procurement	<ul style="list-style-type: none"> <li>✓ Goods</li> <li>✓ Engineering projects</li> <li>✓ Services</li> </ul>	<ul style="list-style-type: none"> <li>✓ Raw materials</li> <li>✓ Products</li> <li>✓ Services</li> </ul>
Accounting and certification systems	<ul style="list-style-type: none"> <li>✓ Product life-cycle carbon emissions data</li> <li>✓ Product- and project-level carbon accounting methods</li> <li>✓ Low-carbon product certification and crediting systems</li> </ul>	<ul style="list-style-type: none"> <li>✓ Enterprise life-cycle carbon emissions data</li> <li>✓ Supplier carbon emissions data</li> <li>✓ Scope 2 and 3 carbon accounting methods for enterprises</li> <li>✓ Sharing of value chain carbon data and mutual recognition of methods</li> </ul>
Requirements for products, services, and their suppliers in carbon emissions	<ul style="list-style-type: none"> <li>✓ Procurement list</li> <li>✓ Carbon limits for products</li> <li>✓ Supplier rating</li> </ul>	<ul style="list-style-type: none"> <li>✓ Setting Scope 3 targets</li> <li>✓ Enterprise list</li> <li>✓ Carbon limits for products</li> <li>✓ Supplier rating</li> </ul>
Incentives for low-carbon products, services, and their suppliers	<ul style="list-style-type: none"> <li>✓ Direct financial incentives</li> <li>✓ Indirect financial incentives</li> <li>✓ Nonfinancial incentives</li> </ul>	<ul style="list-style-type: none"> <li>✓ Rating upstream suppliers</li> <li>✓ Investors' requirements for supply chain carbon reduction</li> <li>✓ Consumers' preference</li> </ul>
Implementation, monitoring, and evaluation systems	<ul style="list-style-type: none"> <li>✓ Centralized procurement</li> <li>✓ Preparation and disclosure of green low-carbon procurement documents</li> <li>✓ Acceptance of project based on performance</li> </ul>	<ul style="list-style-type: none"> <li>✓ Setting Scope 3 targets</li> <li>✓ Long-term partnership with low-carbon suppliers</li> <li>✓ Optimization of internal procurement process</li> </ul>

RMI Graphic. Source: RMI research

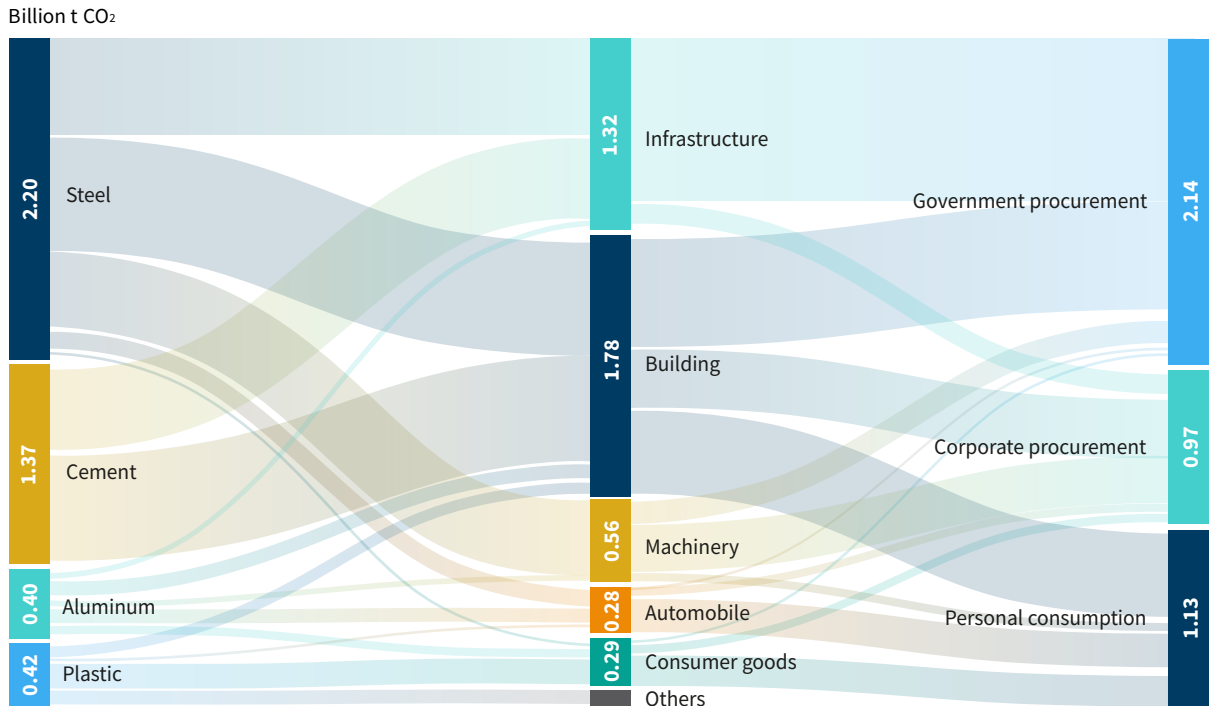


We identify first-mover value chains for low-carbon procurement based on the embodied carbon of industrial materials in downstream products and the carbon responsibility of major purchasers of final products:

- The downstream industries for steel, cement, aluminum, and plastics are primarily in five categories: infrastructure, building, machinery, transportation, and consumer goods (see Exhibit 3).
- The largest downstream industries in terms of industrial material sourcing, and therefore the largest carbon reduction potential, are building and infrastructure. These two industries account for more than 70% of the total emissions from the four major industrial materials listed above.
- The largest buyer of industrial materials in China is the government. Approximately half of total CO<sub>2</sub> emissions from steel, cement, aluminum, and plastics go to government-purchased goods and projects. The total carbon emissions of industrial materials purchased directly or indirectly (i.e., through contracted projects) by the government is about 2.14 billion tons, accounting for about 21.2% of China's total carbon emissions.
- Meanwhile, the importance of individual consumers and corporate purchasers cannot be ignored. Individuals who buy or construct their own buildings and purchase transportation and consumer goods, and companies that develop real estate projects and purchase machinery, equipment, and vehicles will have a say in the carbon emissions requirements of upstream industrial materials.



### Exhibit 3: Carbon flows of four major industrial materials



Note: Annual carbon emissions values based on RMI research. Infrastructure data is derived from the proportion of annual fixed-asset investment; building includes public buildings, urban residential buildings, and rural residential buildings; machinery includes four sectors: general equipment, special equipment, instruments, and transportation equipment, which are divided into 14 segments; automotive/transportation includes passenger cars, buses, and large vehicles (such as trucks, fire trucks, and sanitation vehicles); and consumer goods classification is based on the National Bureau of Statistics. The calculation of the proportion of downstream procurement mainly takes into account beverage, clothing, shoes, hats and knitwear, cosmetics, daily necessities, home appliances and audio and video products, furniture, and stationery and office supplies.

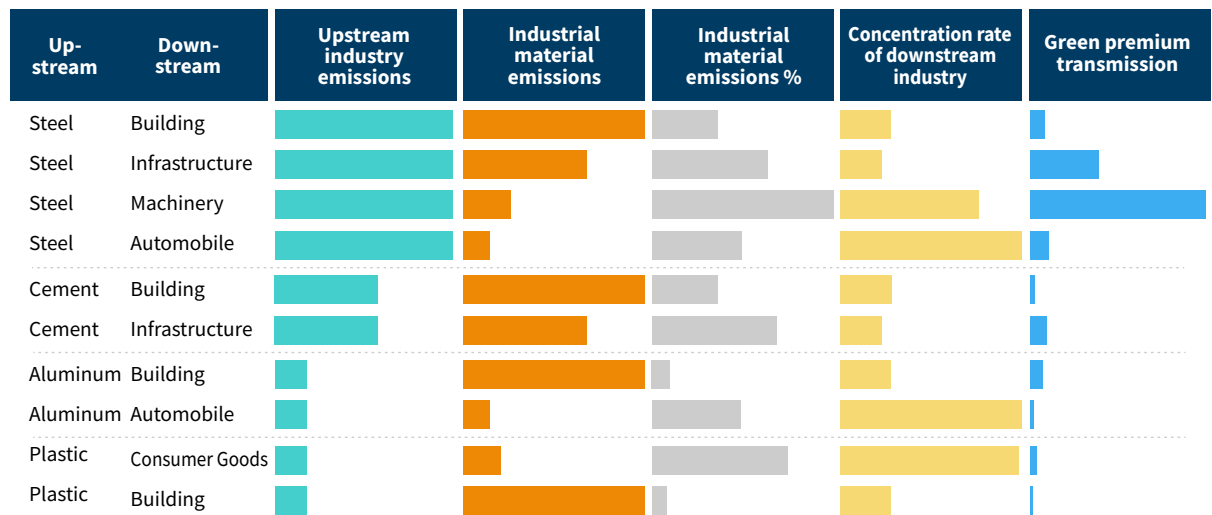
RMI Graphic. Source: RMI research

For steel, cement, aluminum, and plastics, the first opportunities for low-carbon procurement are in the steel-automotive, steel-building, cement-building, aluminum-automotive, and plastics-consumer goods industry value chains (see Exhibit 4, page 9, and Exhibit 5, page 10):

- The automotive and building sectors are leading the way in low-carbon steel sourcing. Steel is a significant source of embodied carbon in buildings, accounting for 26% of a building's life-cycle carbon emissions. In addition, the green premium of zero-carbon steel drops to 1.6% when passed on to the consumer, providing opportunities for early applications of low-carbon steel. The automotive industry is highly concentrated, with a concentration rate of the top 10 companies (CR10) of 86%. Hence, through means such as joint procurement, leading automobile companies can have greater bargaining power, and their low-carbon procurement will impact the steel producers. At the same time, the high quality and strong brand premium of the leading automobile companies allow for high acceptance of green premiums by the industry.

- The first-mover opportunities for low-carbon cement procurement are mainly in the building industry, which is dominated by government-funded building projects and developer-financed projects. Building projects, especially high-end projects, are ideal for first-mover demonstrations of low-carbon cement and other low-carbon building materials because of the greater acceptance of premiums by government or high-end consumers, the general public’s awareness of environmental issues, and the already established methodology for life-cycle carbon accounting of buildings.
- The first opportunities for low-carbon sourcing of aluminum can be found in the automotive industry. As aluminum replaces steel in automobiles to reduce weight, the use of aluminum will become more widespread. The high carbon footprint of aluminum will hinder the life-cycle carbon reduction of vehicles. Automobile companies have better bargaining power and influence on aluminum suppliers due to its high concentration in the automobile industry, while consumers have better acceptance of a green premium and brand premium for automobiles.
- The main low-carbon application scenario for plastics is found in the consumer goods industry, where the end-users are mainly individual consumers. Consumer goods, including beverages, clothing, cosmetics, electrical appliances, and other major consumer categories, are characterized by a high brand premium. The green premium on the consumer side can be as low as 1%, absorbing the price fluctuations caused by the rising cost of plastics. At the same time, the CR10 of brands in the consumer goods industry reaches 84%, so they have high bargaining power and influence on industrial materials.

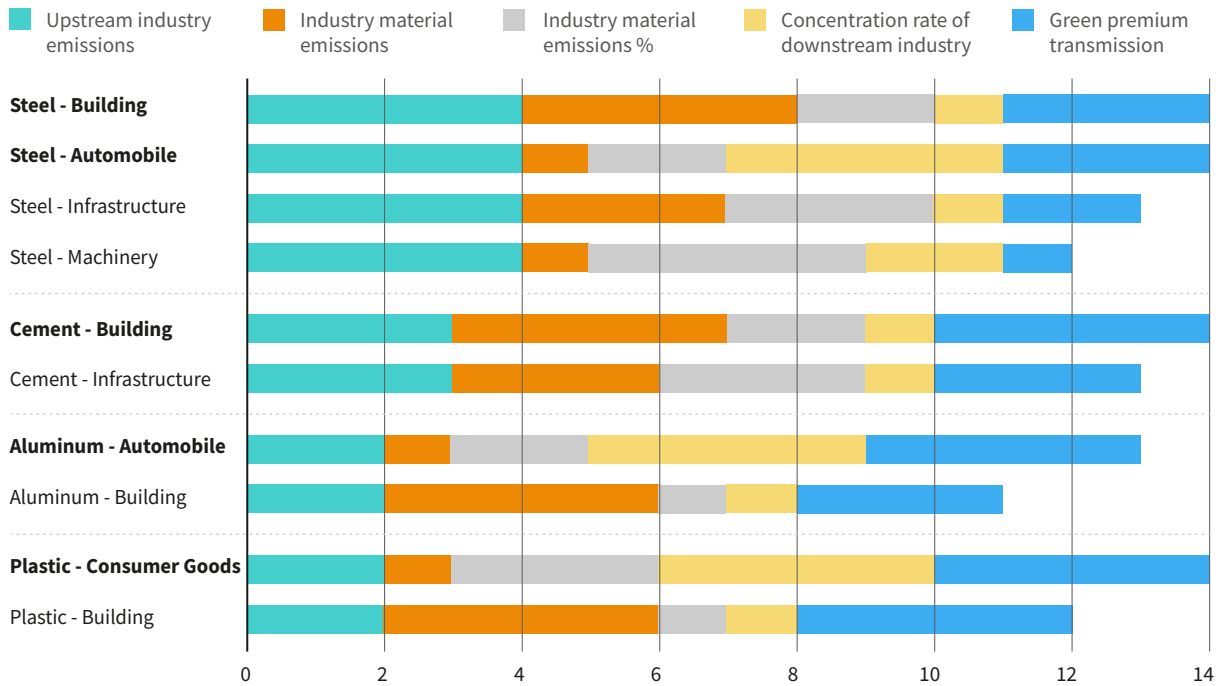
**Exhibit 4: Identifying opportunities for low-carbon procurement of main industry materials (relative values)**



Note: The bars in this graph show the relative values of each dimension vertically: (1) upstream industry emissions, the total emissions of the upstream material industry; (2) industrial material emissions, the total embodied emissions of industrial materials in the downstream products; (3) percentage of a given material emissions, the percentage of emissions of a given material out of the total embodied carbon; (4) downstream industry concentration, the market share of the top 10 companies in the downstream sector; and (5) green premium transmission, the green premium of the final product when using a given zero-carbon industrial material.

RMI Graphic. Source: RMI research

## Exhibit 5: Identifying opportunities for low-carbon procurement of main industry materials (ratings)



Note: The rating for each vertical dimension is derived from the ranking of the values, which ranges from 1 to 4. A higher rating means the value chain is more suitable for low-carbon procurement in that dimension. The ratings are summed to illustrate the priority level of each value chain. The value chain with the highest overall rating is in bold and could be considered a priority low-carbon procurement channel.

RMI Graphic. Source: RMI research

In general, the carbon reduction potential that can be achieved through low-carbon procurement depends on the development of markets for low-carbon products and services. After comparing the low-carbon procurement framework and current practices in China, we identified the main directions and future opportunities for the development of low-carbon procurement in China, which can be summarized as follows:

- Establish product carbon accounting methodologies and databases to lay the foundation for low-carbon procurement.
- Include carbon metrics in green procurement standards and take into account the embodied carbon of industrial materials. Integrate carbon requirements in procurement standards, incentives, and other policy designs.
- Develop and adopt more sophisticated approaches to supplier carbon emissions, such as product-level carbon labels, instead of relying on inventories.
- Refine the current incentives for low-carbon procurement, such as subsidy standards and a green public procurement roadmap in public procurement and incentive schemes for suppliers of low-carbon industrial materials in corporate procurement.
- Strengthen coordination and cooperation across value chains and sectors and explore an effective coordination mechanism.

# 1. Low-Carbon Procurement is Key to Accelerating Industrial Decarbonization

Industrial materials such as steel, cement, chemical products, and aluminum are widely used to manufacture various products used in social and economic operation and people's lives, and their production emits a large amount of carbon dioxide.<sup>ii</sup> Globally, the four major industrial materials — steel, cement, plastics, and aluminum — emit 15.5% of total carbon emissions in their production.<sup>1</sup> As the world's largest industrial country, China's carbon emissions from these four industries,<sup>iii</sup> as typical heavy industries, account for 52% of the country's total emissions.<sup>iv</sup> Reducing industrial emissions is therefore important for the country to both meet its goal of carbon peaking by 2030 and carbon neutrality by 2060, and encourage emissions reductions across all industries.

At present, most of the carbon reduction efforts in industry are on the supply side, focusing on the key technologies for low- and zero-carbon production and their applications in industry. However, the demand-side issues, such as rising costs and insufficient downstream applications due to the high cost of low-carbon production, also urgently need a breakthrough.

Governments and companies are the most important large consumers of industrial commodities, and their procurement of industrial materials is an important part of their economic activities. Worldwide, public procurement accounts for an average of 13%–20% of GDP.<sup>2</sup> In OECD countries, it accounts for 12% of national GDP; and in developing countries, the number is up to 30%.<sup>3</sup> The cost of industrial materials and consumables for manufacturing companies often accounts for approximately 50% of product costs.<sup>4</sup> Not only do downstream buyers have a say in the selection and use of industrial materials, but the carbon emissions of industrial materials are also transferred to downstream products along the industrial chain. Therefore, demand-side actions, represented by green and low-carbon procurement,<sup>v</sup> are becoming an important issue for the entire value chain to promote industrial carbon reduction.

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**ii** Scope 1 emissions.

**iii** Scope 1 and 2 emissions.

**iv** According to RMI data, steel, cement, chemicals, and aluminum account for 22%, 13%, 13%, and 4% of total national emissions, respectively.

**v** This report considers green procurement as the act of governments and businesses procuring environmentally friendly products and services by considering the environmental impact of products. The term “green” is usually defined more broadly than “low carbon.” When discussing carbon emissions, this paper refers to the act of purchasing low-carbon products and services as “low-carbon procurement.”

## Green Procurement vs. Low-Carbon Procurement

“Green procurement” is a common term used to describe procurement of products, services, or projects that have a low environmental footprint. For example, the European Commission defines green public procurement as “a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured.”<sup>5</sup>

China’s Ministry of Ecology and Environmental Protection defines green procurement as “the act of enterprises in procurement activities to promote the concept of green and low-carbon, to give full consideration to environmental protection, resource conservation, safety and health, low-carbon recycling, and to prioritize the procurement and use of energy-saving, water-saving, material-saving industrial materials, products and services conducive to environmental protection.”<sup>6</sup> Therefore the term “green” is usually defined more broadly than “low carbon.” The distinction and definition of green and low-carbon procurement in this report is based on the above definitions.

## Carbon Emissions from Industrial Materials Account for a Larger Share of Total Emissions in Some Major Industries

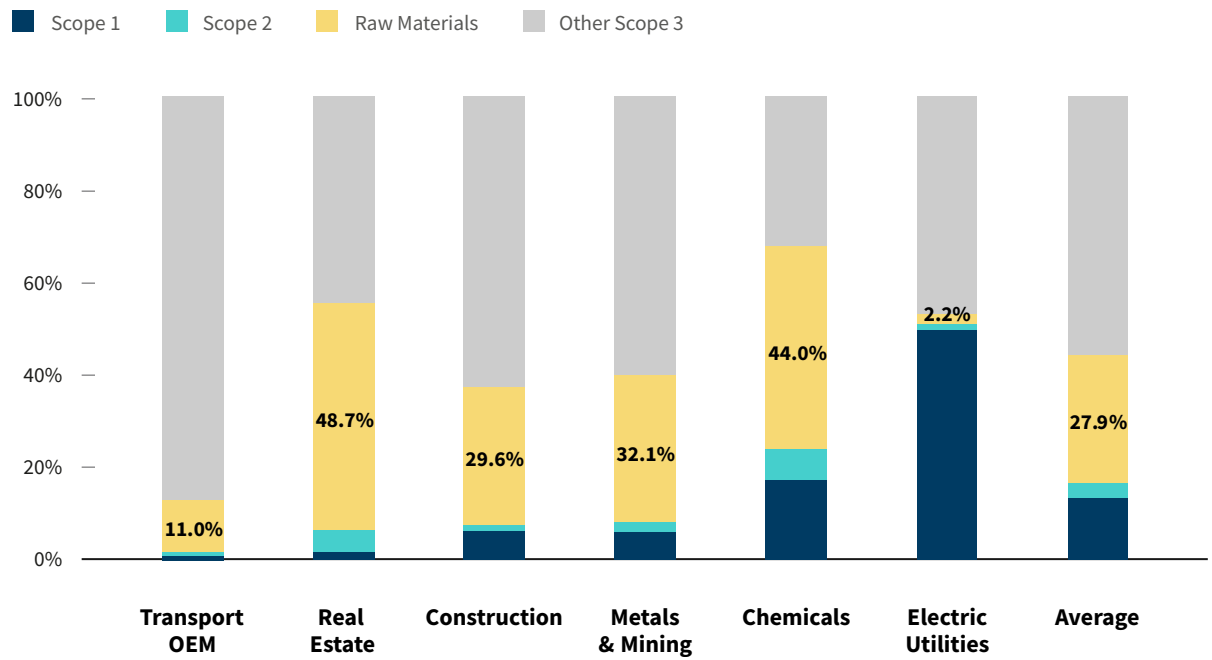
Reducing the carbon emissions from industrial materials is an important way for downstream industries to achieve carbon neutrality, and the decarbonization efforts of downstream industries in turn will push upstream industries to reduce carbon emissions. For industries such as real estate, building, and machinery and equipment manufacturing, carbon emissions from industrial materials such as steel, cement, and aluminum account for a relatively high proportion of their total carbon emissions. Of the 15 Scope 3 emissions categories defined by the GHG Protocol,<sup>7</sup> two categories — purchased goods and services and capital goods — are related to companies’ procurement of industrial materials, and they take up a significant share of the total Scope 3 emissions (see Exhibit 6, next page). If emissions from these categories are not considered, these industries will not be able to achieve zero emissions.

Take the real estate industry as an example; the largest Scope 3 emissions come from capital goods,<sup>vi</sup> accounting for 49% of total carbon emissions.<sup>8</sup> As for the automotive industry, although its main carbon emissions are from the operation phase of vehicles, the share of industrial material emissions will inevitably increase in the future as electric vehicles become more popular. As downstream industries seek to use low-carbon materials in their products, they will incentivize the material suppliers to decarbonize and eventually realize synergistic carbon reduction across the value chain.

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<sup>vi</sup> Please refer to GHG Protocol for the definition of capital goods.

## Exhibit 6: Shares of emissions from industrial materials in selected industries



RMI Graphic. Source: CDP

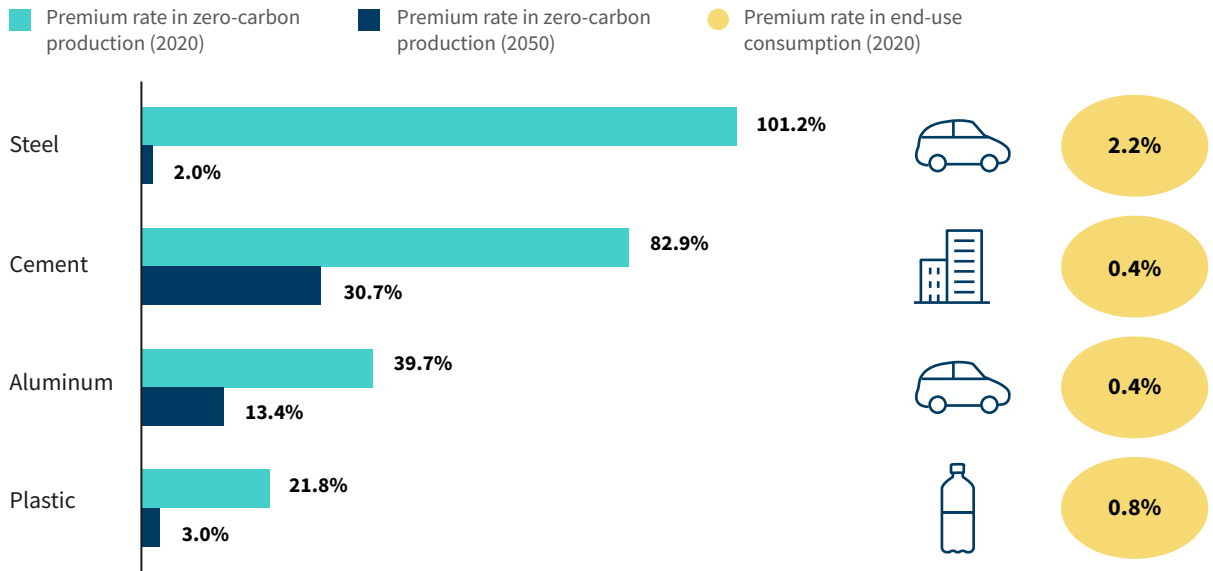


# Demand-Side Procurement Helps Ease Cost Pressures of Industrial Low-Carbon Transition

Low-carbon procurement can also play a role in reducing costs and improving efficiency. First, through the demand-side procurement of low-carbon industrial materials, the green premium of heavy industrial transformation can be transferred to downstream industries and consumers. Therefore, the transition costs are shared among multiple stakeholders, and the economic pressure is reduced. The premium for producing low-carbon industrial materials is still high: For example, this study estimates a 101% premium for producing zero-carbon steel and an 83% premium for producing zero-carbon cement. However, if the high cost of low-carbon industrial materials is passed downstream, the premium for final products purchased at the consumer end can be kept within 5% because industrial materials are only a small portion of the total cost of the end product (see Exhibit 7).

Second, heavy industrial enterprises need to invest heavily in the transition to zero carbon, and only sufficient market demand can bring about the economies of scale that reduce unit costs. This study estimates the green premium of carbon-free industrial materials will decline by 20%–100% over the next 30 years if economies of scale can be achieved. The main driving forces are a robust demand-side market and large-scale production. Low-carbon procurement of industrial materials will create a comparative advantage for industrial enterprises that actively reduce emissions, which in turn will provide them with the financial and market support needed to reduce emissions and promote further reductions in emissions costs.

**Exhibit 7: Green premium for carbon-free industrial materials on the production and consumption sides**



Note: The carbon-free technology paths for each material in this exhibit are steel: hydrogen metallurgy; cement: solid waste + carbon capture and storage; aluminum: renewable energy + direct air capture; and plastic: naphtha + electrocracking to ethylene in 2020, green methanol to ethylene in 2050. The downstream applications for each material are steel: automotive; cement: building; aluminum: automotive; and plastic: water bottles.

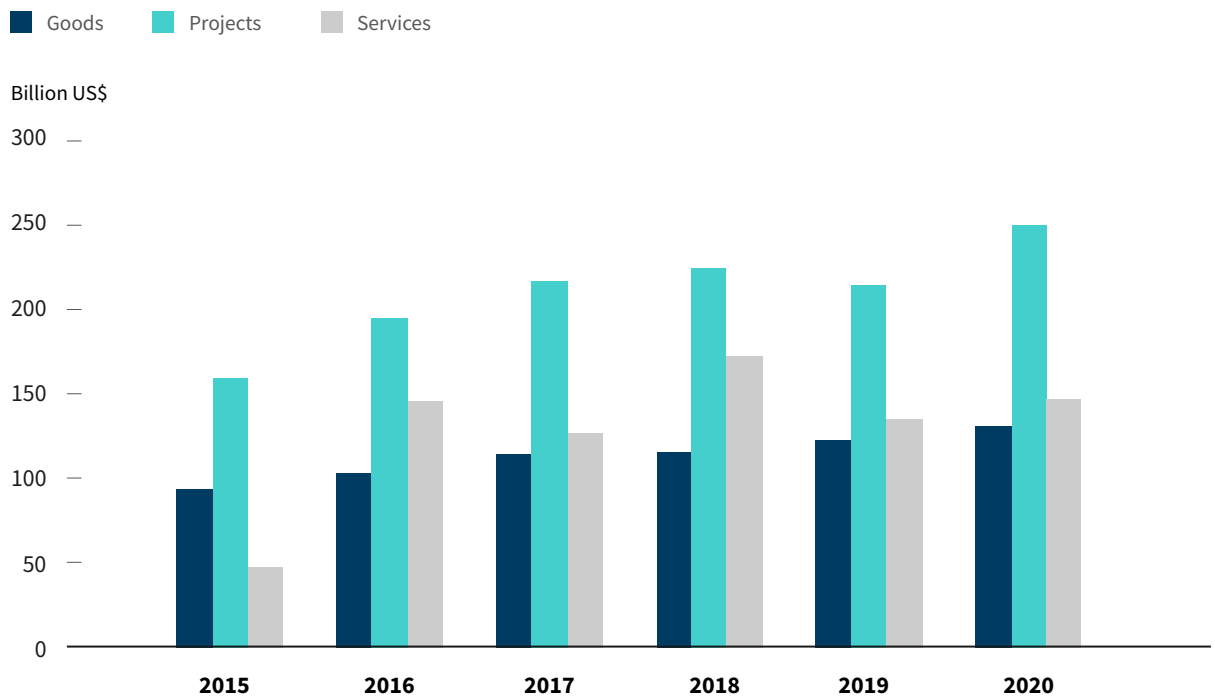
RMI Graphic. Source: RMI research

## Low-Carbon Procurement Will Release a Guiding Signal for Value Chains to Reduce Emissions

With resource advantages, the government and leading enterprises can send out positive signals of a low-carbon transition to whole industries through low-carbon procurement. The scale of public procurement in China in 2020 is 3.7 trillion renminbi, accounting for 10.2% of the national fiscal expenditure and 3.6% of the national GDP.<sup>9</sup> The national procurement of energy- and water-saving products reached 56.66 billion renminbi in China, accounting for 85.7% of the procurement of similar products.<sup>10</sup> The impact of public procurement both in terms of total amount and its percentage of GDP and finance expenditures is increasing year by year (see Exhibit 8 and Exhibit 9, next page).

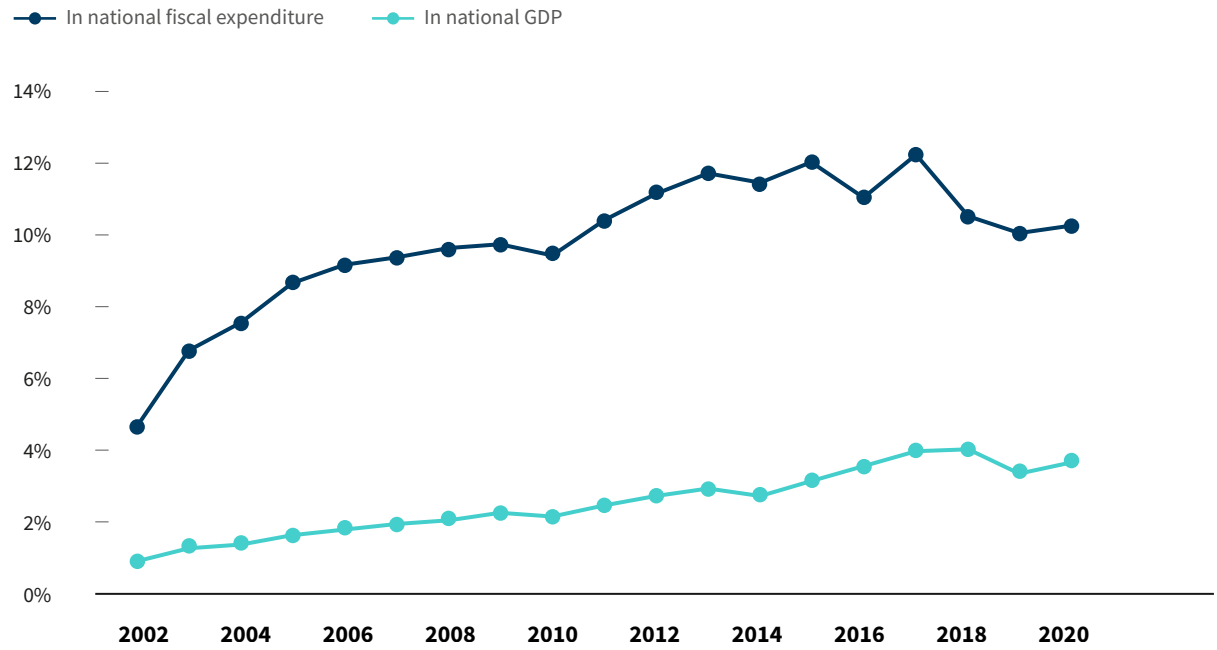
Compared with the OECD's 12% of national GDP, public procurement in China still has room for further growth. We can expect that public procurement will remain an important measure to guide the green, low-carbon market and will play an increasingly important role. In terms of corporate actions in green procurement of industrial materials, one example is the China Real Estate Industry Green Supply Chain Initiative, launched by leading real estate companies in 2016, which has now incubated more than 3,800 "white-listed" suppliers that provide building materials that meet material, energy, and environmental criteria.<sup>11</sup>

**Exhibit 8: Scale of public procurement of goods, projects, and services in China, 2015–20**



RMI Graphic. Source: Ministry of Finance, summary of data published year by year

### Exhibit 9: Proportions of national public procurement in fiscal and GDP expenditures, 2002–20



RMI Graphic. Source: Ministry of Finance, summary of data published year by year

## 2 Green Procurement of Industrial Materials: Progress and Trends

### Globally, Public Procurement Has Become a Trending Tool to Guide the Development of the Low-Carbon Industrial Market

**Green procurement by governments around the world is primarily focused on the building and infrastructure industries, and leading practices have already established carbon accounting methodologies and comprehensive system designs.**

Globally, green public procurement has gradually become a mainstream policy tool to promote carbon reduction. Since the 1990s, developed countries gradually have established a public procurement system based on environmental principles. In recent years, with the promotion of carbon reduction and climate actions, the EU, South Korea, the United States, and other countries and regions have introduced legislation, initiatives, guidelines, and other policies and tools to promote public procurement of low-carbon industrial materials.

- The EU published a directive on public procurement in 2014, *Buying Green: A Handbook on Green Public Procurement* (3rd edition) in 2016, and *Making Public Procurement Work in and for Europe* in 2017, gradually creating a system of mandatory green public procurement. Of the 27 EU member states, all 23 except Estonia, Hungary, Luxembourg, and Romania had introduced national-level green procurement legislation by April 2022.
- The US federal Buy Clean program was established in December 2021. It establishes a task force and provides funding to support the purchase of US-made, low-carbon building materials in federally procured and funded projects to promote US industrial development and job growth.<sup>12</sup>
- The Inflation Reduction Act, passed by the US federal government in August 2022, aims to curb inflation by reducing the deficit, investing in domestic energy production, and promoting clean energy. According to the act, financial assistance will be provided for green development in areas such as energy production and consumption, electric vehicles, and infrastructure. The act specifically mentions financial assistance will be provided for the development of Environmental Product Declarations (EPDs) and eco-labels, and significant funds will be allocated to support federal programs to purchase materials and products with low embodied carbon.
- In South Korea, the Act on Promotion of Purchase of Green Products, introduced in 2005, requires all government departments to submit green procurement implementation plans to the Korea Environmental Industry and Technology Institute, setting voluntary green procurement targets and stating the expenditure and quantity of green products purchased in the previous year's

performance report. The act defines the products and services that are applicable to green procurement and links the definition to eco-labels such as the Korea Eco-label and Good Recycled Mark, greatly promoting Korea's eco-labeled products.<sup>13</sup>

In terms of the industries involved, globally, green public procurement programs are dominated by the building and infrastructure industries, which are the main demand side for industrial commodities. They also include office products, transportation, and other products. For example, the EU's directive on green public procurement requires mandatory green procurement of product categories such as office information technology equipment, road transport, and buildings, and has specific EPD and life-cycle assessment (LCA) reporting requirements for public procurement of building projects.

The US Buy Clean Act includes procurement of building materials for new buildings, actively promotes pilot programs for public procurement of low-carbon building materials, and improves transparency of environmental data and standardization of carbon emissions information for building materials. It focuses on key materials such as aluminum, steel, concrete, and cement. The US Inflation Reduction Act, on the other hand, provides funding for the procurement of low-carbon industrial materials, primarily for federally funded building and transportation projects, to reduce the embodied carbon in government projects.

Currently, some leading international green public procurement programs have shown a relatively comprehensive institutional design, as evidenced by:

- An increasingly sophisticated product-level carbon accounting methodology and database. The concrete industry in the northeastern United States is one example. As of June 2022, cement manufacturers in the region have provided 8,421 EPDs for ready-mixed concrete, covering a variety of concrete strength levels.<sup>14</sup> The Korea Online E-Procurement System standardized the entire public procurement process including e-tendering, e-ordering, e-contracting, and e-payment. Meanwhile, the system also has access to external databases, making procedures such as confirming qualifications and identities easier, and greatly improving efficiency.<sup>15</sup> The Dutch government provides two types of official calculators for procuring low-carbon building materials and reducing the carbon emissions of buildings: the CO<sub>2</sub> Performance Ladder, which calculates the carbon reduction over the entire life cycle of a project, and the DuboCalc, which calculates the energy and material consumption over the entire life cycle of a project.
- Incorporating mandatory or incentive policies to reduce the carbon footprint of industrial materials. An example of a mandatory policy is the US Buy Clean Act. This policy sets global warming potential (GWP) limits for common building materials.<sup>vii</sup> Products that exceed the GWP limits are not purchased. An example of an incentive policy is the Dutch carbon offset system for building projects. The system requires companies bidding on government projects to submit project carbon reduction benefits calculated using a CO<sub>2</sub> performance ladder. The government divides the project's carbon reduction benefits into five levels, and each level corresponds to a certain discount in the bid price. The government uses the discounted bid price to select the winning company, which is tantamount to incentivizing companies to implement a wider range of carbon reduction measures.
- Taking account of the costs associated with low-carbon procurement, including cost premiums for

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**vii** GWP is a measure of the impact of greenhouse gases on global warming. It is the relative ability of a given gas to cause global warming when compared with the same mass of carbon dioxide. The GWP of carbon dioxide is defined as 1.

low-carbon products and the costs of related certification processes. For example, the US Inflation Reduction Act proposes grants totaling \$250 million for building material manufacturers to evaluate EPDs; \$2 billion for the General Services Administration, which is responsible for procuring federal government projects, to purchase low-carbon building materials or retrofit buildings; and \$2 billion for the Federal Highway Administration to purchase materials or products with low embodied carbon. The Norwegian government earmarked more than 9 million krone in its 2017 budget to support public procurement for low-carbon and innovative purposes.<sup>16</sup>

## **Green public procurement in China is dominated by the building materials and packaging industries, and carbon metrics are expected to have a greater weight in the future.**

China's green public procurement originates from the Public Procurement Law, the Regulations for the Implementation of the Public Procurement Law, and other laws and regulations for energy conservation and environmental protection. In 2019, four ministries, including the Ministry of Finance, jointly issued a notice paper requiring the priority procurement and mandatory procurement of green products based on the category inventory and certificates.<sup>17</sup> Two inventories are referred to in the policy, one of which includes building materials such as cement, concrete, gypsum board, and ceramic products.<sup>18</sup> This is an early policy to purchase green industrial materials in China, as well as an important institutional basis for the current green public procurement.

Since 2020, with China's commitment to carbon neutrality and the gradual establishment of the 1+N policy system, the creation of a low-carbon market from the demand side through green procurement has become a policy consensus and is mentioned in several policy documents.

First, green procurement and increasing demand for low-carbon products are an essential part of various action plans of carbon peaking in certain industries:

- The *Opinions on Financial Support for Good Carbon Neutral Work in Carbon Peaking*, issued by the Ministry of Finance in May 2022, emphasizes the improvement of green public procurement, with a focus on the development of a standard system of green buildings and green building materials in government projects. It requires public procurement documents to clarify any green or low-carbon requirements and to increase efforts in the procurement of green or low-carbon products.<sup>19</sup>
- The *Implementation Plan for Carbon Peaking in the Industrial Sector*, issued by three ministries and commissions including the Ministry of Industry and Information Technology in August 2022, clearly states that the "Action for Green, Low-carbon Product Supply" is one of the two major actions to achieve carbon peaking in the industrial sector. The action clarifies specific initiatives such as carbon footprint accounting of industrial products, green or low-carbon product inventory, a green product certification and labeling system, and development and promotion of 10,000 kinds of green or low-carbon products.<sup>20</sup>
- The *Implementation Plan for Carbon Peaking in the Building Materials Industry* issued in November 2022 by four ministries and commissions, including the Ministry of Industry and Information Technology, also emphasizes support for green building materials through public procurement to increase the proportion of green building materials used.<sup>21</sup>

- The *Implementation Plan for Carbon Peaking in Non-Ferrous Metals Industry*, issued at the same time, also proposes using green designs for industrial products and guiding downstream industries to apply green non-ferrous metal products.<sup>22</sup>

Second, the promotion of green procurement has also become important for the establishment of a national circular economy:

- The *Guidance on Accelerating the Establishment of a Green Low-Carbon Circular Economic System*, issued by the State Council in February 2021, is about improving the low-carbon, circular development of the consumption system. It clarifies the specific measures to promote the consumption of green products, increases green public procurement, expands the scope of green product procurement, and gradually extends the green procurement system to state-owned enterprises.<sup>23</sup>
- The *14th Five-Year Plan for the Development of the Circular Economy*, issued by the National Development and Reform Commission in July 2021, proposes to strengthen fiscal and financial policy support, increase government green procurement efforts, and actively purchase products from renewable resources.<sup>24</sup>

The green public procurement of industrial materials is dominated by building materials and packaging materials in China. In the procurement of green building materials, the Green Building Material Pilot initiated by the Ministry of Finance and the Ministry of Housing and Urban-Rural Development in six pilot cities since October 2020 is an important starting point. Since 2022, the government has issued several initiatives to promote green building materials in rural areas, expand pilot cities, improve the carbon emissions accounting system, and incorporate carbon metrics into the green building materials standard. In green packaging procurement, the government commissioned four delivery companies to pilot green procurement in 2019 and will establish a green supplier management inventory. In 2020, three ministries provided guidance to and published standards of the packaging in public procurement, requiring the use of green packaging.

Facilitated by the carbon peak and carbon neutrality goals, low-carbon procurement has become more prominent in green procurement in recent years. Two trends become visible: First, a carbon emissions accounting and certification system will be established; second, carbon metrics will be integrated into the green procurement system. Traditionally, China's green product certification, by definition, considers various factors ranging from energy saving, water saving, environmental protection, recycling, and renewable energy usage, with carbon as one of the optional factors. In practice, green products purchased by the government are more concerned with health and environmental qualities instead of carbon emissions. At the same time, the lack of product-level carbon accounting methods and databases remains a barrier. Since 2022, the government has introduced new policies to strengthen the foundational work such as low-carbon product certification. Following this trend, a low-carbon procurement system is being developed:

- In April 2022, three ministries and commissions, including the National Development and Reform Commission, issued the *Implementation Plan on Accelerating the Establishment of a Uniform and Standardized Carbon Emission Statistics and Accounting System*, which requires the development of carbon accounting methods for industrial materials, semifinished and finished products in key industries, starting from priority industries and products such as electricity, iron and steel,



aluminum, cement, lime, flat glass, oil refining, ethylene, and synthetic ammonia.<sup>25</sup>

- In August 2022, four ministries issued the *Implementation Plan for the Raw Materials Industry*, proposing to strengthen green product evaluation standards, establish a carbon database over the life cycle of key products, and include the carbon footprint for industrial materials products in the evaluation system.<sup>26</sup>
- The *Implementation Plan for Carbon Peaking in the Industrial Sector* proposes to incorporate carbon emissions indicators for cement, glass, ceramics, lime, wall materials, and other products in the Green Building Materials standard.<sup>27</sup>

Since 2020, China has conducted two groups of green building material procurement pilots in 54 cities, which have provided useful information about green public procurement. The building projects included in this policy are hospitals, schools, affordable housing, and other government-funded projects. These pilots help establish methods of green public procurement, such as adopting a procurement target; establishing green building materials inventory; developing an integrated e-platform for public procurement; improving green building materials certification, project bidding, and project auditing processes; and mobilizing green finance incentives (see Exhibit 10).

### Exhibit 10: Summary of public procurement pilots for green building materials

	Target planning	Standard development	Digital platform	Financial support			Favorable evaluation	Insurance system
				Product level	Project level	Enterprise level		
Huzhou	✓	✓	✓	✓	✓	✓	✓	✓
Shaoxing	✓	✓	✓	✓	✓		✓	
Hangzhou	✓	✓	✓		✓			
Qingdao	✓	✓	✓		✓	✓	✓	
Foshan	✓	✓	✓	✓	✓			
Nanjing	✓	✓	✓		✓		✓	✓

RMI Graphic. Source: RMI research

# Leading Chinese and International Companies Actively Reduce Emissions from Supply Chain and Industrial Materials

## International companies are promoting low-carbon procurement through five measures centered on supply chain carbon management.

Internationally, the procurement of low-carbon industrial materials by enterprises is mainly through supply chain carbon management, which is part of reducing Scope 3 emissions. Companies have gradually realized carbon management should not be limited to the boundaries of legal entities but should also consider upstream and downstream carbon reduction from the perspective of the entire value chain, especially for companies with a relatively large share of industrial material emissions. As of July 2021, more than 650 large companies worldwide have committed to Scope 3 carbon reductions.<sup>28</sup> Cases of corporate procurement of low-carbon industrial materials can be found downstream in the following industries: steel, such as the automotive and machinery industries; cement, such as the real estate industry; aluminum, such as the electronic equipment and aviation industries; and plastic products, such as the personal consumer goods and electronic equipment industries (see Exhibit 11, next page).

Enterprises' actions to promote green and low-carbon procurement can be divided into five categories, including (1) setting carbon reduction targets, (2) carbon emissions accounting and management, (3) selecting partnership programs, (4) building suppliers' carbon reduction capabilities, and (5) supplier incentive and screening. Some best practices of leading international companies are as follows:

- **Setting of carbon reduction targets:** Set Scope 3 emissions targets, especially across the entire supply chain. For example, Apple has committed to carbon neutrality in its supply chain by 2030; and Mercedes-Benz Group has proposed a 42% reduction in its Scope 3 carbon emissions by 2030 compared with 2019 and a zero-carbon supply chain by 2039.<sup>29</sup> The carbon reduction target in the supply chain is an important basis for companies to source low-carbon industrial materials and define their environmental, social, and governance (ESG) responsibilities.
- **Carbon accounting and management:** This includes requiring suppliers to provide carbon emissions data and helping them improve the quality of their data. For example, Apple has developed a greenhouse gas reporting tool for suppliers to calculate their Scope 1 and Scope 2 emissions.<sup>30</sup> BASF uses a supplier carbon management system to systematically collect the product carbon footprint from suppliers, supplemented by third-party on-site audits or online reviews to improve the standardization of global supplier assessments. The company aims to have 80% of its suppliers improve their sustainability performance by 2025.<sup>31</sup>
- **Partnerships:** These include direct investment in carbon reduction activities or long-term purchasing agreements for low-carbon products. Examples of investment-based partnerships between automotive companies and their suppliers, such as steel companies, include BMW Group's stake in Boston Metal, which supports the introduction of steel decarbonization technologies to industrial-scale production. Mercedes-Benz has invested in H2 Green Steel, a Swedish steel production company.<sup>32</sup> In the case of long-term procurement, BMW has signed green steel agreements with H2 Green Steel and Salzgitter Steel. The delivery period of the two companies starts in 2025 and 2026, with the aim of covering more than 40% of the steel requirements of BMW's European plants by 2030, which is expected to reduce carbon emissions by 400,000 tons per year.<sup>33</sup>

- Build supplier capacity for carbon reduction: Improve communication and training for suppliers. For example, L'Oréal regularly organizes events such as Suppliers Days (titled “Spread the Green Vibes” in 2021) dedicated to sustainability and focused on training for strategic suppliers.<sup>34</sup>
- Incentives and evaluation: Some companies organize supplier evaluations to financially reward suppliers with excellent performance in energy conservation and carbon reduction, while incorporating climate factors into the supply chain bidding and evaluation system. For example, Dell incorporates climate change–related data in its supplier evaluation system and deducts points from suppliers that do not meet the requirements.<sup>35</sup> Singapore City Developments Limited has implemented a corporate green procurement policy and requires key suppliers to meet environmental, health, and safety qualification guidelines.<sup>36</sup>

### Exhibit 11: Cases of international companies sourcing low-carbon industrial commodities

Company	Country	Sector	Supply Chain/ Scope 3 Target	Carbon Reduction Measures of Supply Chain	Cases of Green, Low-Carbon Procurement
<b>Apple</b>	United States	Consumer electronics	Supply chain carbon neutral, 200+ suppliers using renewable electricity by 2030	Launch supplier energy efficiency program, supplier clean energy program; develop supplier greenhouse gas reporting tool	Procure zero-carbon aluminum from Alcoa-Rio Tinto
<b>Dell</b>	United States	Consumer electronics	Supply chain emissions reduced by 60% in 2030 compared with 2019	Include climate change performance in supplier awards; encourage supplier innovation in reducing emissions and carbon through rating	Procure sustainable bamboo packaging to replace plastic packaging
<b>Mercedes-Benz</b>	Germany	Transportation OEM	42% reduction in Scope 3 emissions by 2030 compared with 2019; zero carbon in supply chain by 2039	Upstream innovation collaboration with supplier sustainability awards starting in 2019	Procure low-carbon-footprint steel from steel companies such as Salzgitter AG
<b>Volvo</b>	Sweden	Transportation OEM	25% emissions reduction in supply chain by 2025 compared with 2018	Incentives, exchanges, and rating; sustainability communication with key suppliers; annual sustainability events	Procure fossil-free steel from Hybrit Project
<b>CDL</b>	Singapore	Real estate	24% reduction in Scope 3 emissions by 2030 compared with 2016	Integration of climate change in supply chain bidding system; supplier communication and rating with financial incentives	Application of at least 42% sustainable materials in Singapore forest apartment project

Company	Country	Sector	Supply Chain/ Scope 3 Target	Carbon Reduction Measures of Supply Chain	Cases of Green, Low-Carbon Procurement
<b>Airbus</b>	United States	Aero space	46% reduction in Scope 3 emissions by 2035 compared with 2015	Contract suppliers are required to implement environmental management systems to better reduce carbon	Agreement with Novelis to study sustainable aluminum for aviation
<b>L'Oréal</b>	France	Consumer goods	25% reduction in full scope emissions by 2030; 50% reduction in operational emissions of strategic suppliers compared with 2016	Supplier exchange and education, events such as Suppliers Days dedicated to sustainability, and focused training for strategic suppliers	Procure packaging made from recycled plastic from Veolia
<b>Shell</b>	Britain	Energy	100% reduction in Scope 3 emissions by 2050 compared with 2016	Integrate climate change into supply chain bidding system; provide economic incentives for carbon reduction; deliver a collaborative platform to help suppliers reduce carbon	Renewed the framework agreement with Baosteel for green steel procurement

RMI Graphic. Source: RMI research

## Chinese companies need to improve target setting, data foundations, and information disclosure in the future, within the current policy framework.

China's policy toward green private procurement has gone through a development process from green procurement to green supply chain management and from policy guidance to pilot implementation. In 2014, three ministries issued *The Green Procurement Guide for Enterprises* to prioritize the procurement of energy- and water-saving industrial materials in favor of environmental protection.<sup>37</sup> In 2016, the Ministry of Industry and Information Technology proposed building a green manufacturing standard system and evaluation system by 2020, introducing green design product evaluation standards, establishing green supply chain standards, and issuing third-party evaluation rules for green manufacturing.

In 2020, China issued a series of specifications for green supply chain management, covering evaluation, procurement control, and material inventories. The specifications laid the foundation for green procurement of enterprises. In recent years, China has encouraged enterprises to take green procurement and green supply chain measures from the perspective of the circular economy and energy efficiency. Recent policies such as those on the circular economic system (2021) and industrial energy efficiency improvement (2022) have clearly proposed green supply chain pilots by leading companies.

However, guiding policies such as procurement process and implementation details of low-carbon private procurement still need to be improved. *The Implementation Plan for Carbon Peaking in the Industrial Sector* (2022) clearly proposes a supply chain action to support the companies in the automotive, machinery, electronics, textile, and communications industries playing a leading role in integrated supply chain carbon management.<sup>38</sup> It calls for a unified green product certification and labeling system to promote the low-

carbon development of the entire supply chain. The plan encourages the development and disclosure of carbon reduction reports of key suppliers. The policy shows the direction for enterprises to implement low-carbon procurement, but implementation will be key in the coming years.

In practice, although some leading Chinese companies have already committed to carbon peak and neutrality and developed action plans accordingly (see Exhibit 12, next page), they should provide more concrete actions for low-carbon procurement and supply chain decarbonization. Specifically:

- **Target setting:** Chinese companies lack clear Scope 3 or supply chain carbon reduction targets. According to the Science Based Targets initiative (SBTi) database, as of July 2021, of the 652 large global companies that have committed to Scope 3 emissions reductions, only 12 are Chinese.<sup>39</sup>
- **Foundations:** Although some Chinese companies are adopting supplier screening by checking their environmental and energy-saving certifications, the practices mostly focus on green power procurement or environmental products, while industrial materials are generally not included in the scope of company carbon accounting.
- **Disclosure:** Some companies have begun to disclose green supply chain initiatives through sustainability and social responsibility reports, but the overall level of disclosure needs to be improved, as does the comparability and granularity of the information disclosed.

## Exhibit 12: Cases of Chinese companies' procurement of low-carbon industrial materials

Company	Sector	Supply Chain/ Scope 3 Target	Green Procurement Initiatives	Case of Green Procurement
<b>Sino-Ocean Group</b>	Real estate	Net-zero emissions of Scope 1, 2, and 3 in the entire value chain by 2050	<p>Work with upstream and downstream enterprises to create a complete green supply chain system and implement sustainable concepts such as low-energy- consumption equipment and green supply chain.</p> <p>Regularly award the “Sustainable Pioneer Supplier” to recognize the contribution of suppliers in the green supply chain.</p>	Purchase eco-friendly gypsum boards from Saint-Gobain, which was awarded “Sustainable Pioneer Supplier” by Sino-Ocean Group
<b>China Overseas Estate</b>	Real estate	Green building materials and green products account for more than 60% of total procurement by 2023	Implement the China Overseas Estate Standard for Green and Healthy Housing; 74 suppliers have reached the standard, accounting for 46% of all suppliers.	Include Dulux in the supplier inventory, which is among the first to be certified as a “China Green Product” for architectural coatings
<b>Seazen</b>	Real estate	N/A	Roll out green procurement, create a green supply chain system, and promote more than 24 strategic cooperative suppliers to obtain the China Green Building Material Product Certificate.	Its project, Wuyue Plaza, proposed energy-saving and environmental protection requirements to its partners to ensure carbon emissions meet national standards
<b>Lenovo</b>	Consumer electronics	25% reduction in carbon emissions for its product use by 2030 compared with 2019	<p>Enterprise level: Create a green supply system from supplier management, green recycling and other dimensions, and green information platform.</p> <p>Product level: Regularly collect climate change data from suppliers and define key performance indicators related to climate change for suppliers.</p>	Lenovo ThinkPad products use 100% recycled material or bamboo fiber as buffer for their packaging
<b>Geely</b>	Transportation OEM	20% reduction in supply chain emissions for vehicle series by 2025 compared with 2020	<p>Build a sustainable supply chain system and ESG working group to promote green procurement for 100% recycled packaging.</p> <p>Implement supply chain carbon footprint accounting and reduction program planning based on G-Carbon Cloud platform.</p>	Zeekr 001 body is made of 15% recycled steel and 25% recycled aluminum alloy
<b>Sinopec</b>	Energy	N/A	<p>Compile and issue Sinopec Green Material Procurement Catalogue (2021 Edition) to guide green procurement.</p> <p>Publicize and implement the concept and system of material supply management and propose higher requirements for suppliers in green procurement.</p>	SINOPEC Shanghai Petrochemical insists on green procurement, purchasing more than 40 million renminbi of green products in the first half of 2022

# 3 Building a Low-Carbon Procurement System: Basic Elements

## Overview of Basic Elements of Low-Carbon Procurement

A low-carbon procurement system can be built on the existing framework of green procurement, but carbon performance should be integrated into the framework. The goal of low-carbon procurement is to develop a robust market for low-carbon products and achieve a value-chain synergy in carbon reduction. To summarize the current practices both in China and internationally, a low-carbon procurement system, whether for public or private procurement, should include at least the following basic elements (see Exhibit 13, next page):

- Definition of scope: Specify the types of products and services for which low-carbon procurement is to be implemented.
- Data accounting and certification system: Define carbon emissions calculation methodologies and crediting system; improve product life-cycle carbon emissions database.
- Carbon criteria for products, services, and their suppliers: Based on value-chain carbon reduction targets, the buyer should propose specific requirements for purchased products, services, and their suppliers, including carbon emissions threshold and/or other ESG performance requirements.
- Incentives for low-carbon products, services, and their suppliers: Use of financial or nonfinancial means to encourage value-chain participants who provide or apply low-carbon products and services.
- Implementation, monitoring, and evaluation system: Ensure effective implementation of low-carbon procurement, monitor, and evaluate the impact of implementation.



## Exhibit 13: Elements of low-carbon procurement

	Public procurement	Private procurement
Defining low-carbon procurement	<ul style="list-style-type: none"> <li>✓ Goods</li> <li>✓ Engineering projects</li> <li>✓ Services</li> </ul>	<ul style="list-style-type: none"> <li>✓ Raw materials</li> <li>✓ Products</li> <li>✓ Services</li> </ul>
Accounting and certification systems	<ul style="list-style-type: none"> <li>✓ Product life-cycle carbon emissions data</li> <li>✓ Product- and project-level carbon accounting methods</li> <li>✓ Low-carbon product certification and crediting systems</li> </ul>	<ul style="list-style-type: none"> <li>✓ Enterprise life-cycle carbon emissions data</li> <li>✓ Supplier carbon emissions data</li> <li>✓ Scope 2 and 3 carbon accounting methods for enterprises</li> <li>✓ Sharing of value chain carbon data and mutual recognition of methods</li> </ul>
Requirements for products, services, and their suppliers in carbon emissions	<ul style="list-style-type: none"> <li>✓ Procurement list</li> <li>✓ Carbon limits for products</li> <li>✓ Supplier rating</li> </ul>	<ul style="list-style-type: none"> <li>✓ Setting Scope 3 targets</li> <li>✓ Enterprise list</li> <li>✓ Carbon limits for products</li> <li>✓ Supplier rating</li> </ul>
Incentives for low-carbon products, services, and their suppliers	<ul style="list-style-type: none"> <li>✓ Direct financial incentives</li> <li>✓ Indirect financial incentives</li> <li>✓ Nonfinancial incentives</li> </ul>	<ul style="list-style-type: none"> <li>✓ Rating upstream suppliers</li> <li>✓ Investors' requirements for supply chain carbon reduction</li> <li>✓ Consumers' preference</li> </ul>
Implementation, monitoring, and evaluation systems	<ul style="list-style-type: none"> <li>✓ Centralized procurement</li> <li>✓ Preparation and disclosure of green low-carbon procurement documents</li> <li>✓ Acceptance of project based on performance</li> </ul>	<ul style="list-style-type: none"> <li>✓ Setting Scope 3 targets</li> <li>✓ Long-term partnership with low-carbon suppliers</li> <li>✓ Optimization of internal procurement process</li> </ul>

RMI Graphic. Source: RMI research

The design of a low-carbon procurement system should be based on the coordination of various stakeholders. The stakeholders related to low-carbon procurement include upstream suppliers, downstream consumers, policymakers, investors, industry associations, and certification entities; they play their respective roles to ensure the completion of low-carbon procurement (see Exhibit 14, next page).

## Exhibit 14: Key stakeholders involved in the low-carbon procurement

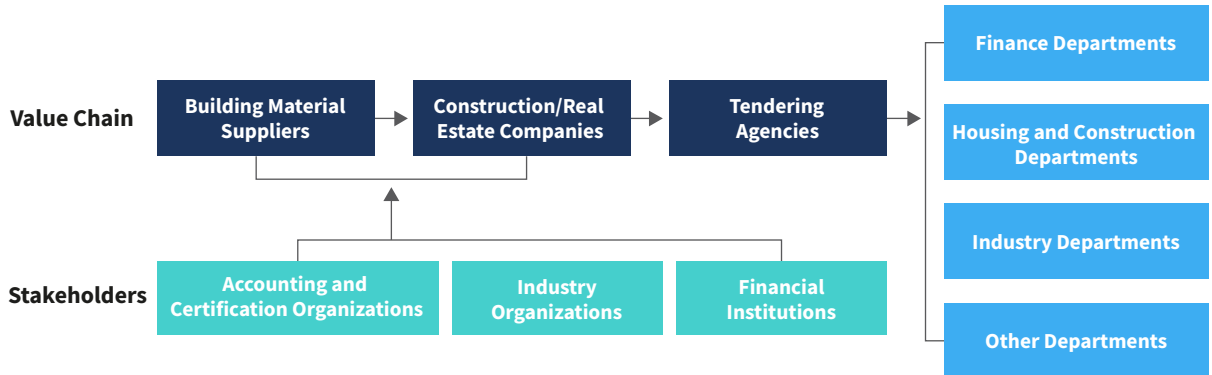
	Public procurement	Private procurement
<b>Industrial material suppliers</b>	Produce low-carbon industrial material Adopt low-carbon technologies to reduce emissions	
<b>Downstream enterprises</b>	Participate in bidding and contract government projects  Provide products and services required by the government	Support and purchase low-carbon products and services  Require suppliers to reduce carbon emissions  Monitor carbon emissions from suppliers
<b>Government</b>	Determine procurement budget, scope, and rules  Develop low-carbon procurement standards, propose low-carbon procurement requirements, and improve institutional guarantees	Develop requirements, norms, and standards for enterprise green procurement Implement low-carbon procurement incentive programs
<b>Consumers</b>	Support low-carbon projects, products, brands, and enterprises through procurement of low-carbon products and services	
<b>Investors</b>	Set guidelines for low-carbon investment and financing  Propose requirements for ESG and carbon management to invested enterprises, especially for supply chain carbon management	
<b>Industry organizations</b>	Develop industry standards for carbon reduction  Establish industry alliances to lead low-carbon innovation in the industry  Guide enterprises to develop low-carbon procurement  Monitor the progress of low-carbon procurement	
<b>Certification organizations</b>	Provide third-party certification of low-carbon products  Provide the methodological basis of carbon accounting	

RMI Graphic. Source: RMI research

In China, stakeholder coordination mostly focuses on three aspects, namely coordination among various regulations and policies, among different agencies, and between the central and local governments. One example is the procurement of building materials in China's public building projects, where a green procurement policy is now being implemented (see Exhibit 15, next page). From the policy perspective, there are two laws governing public procurement, namely the Government Procurement Law and the Bidding Law, however, they are not entirely consistent in provisions, thus causing some confusion in

practice. Public procurement of green building materials requires coordination among several government agencies, such as the Ministry of Finance, the Ministry of Housing and Construction, and the Ministry of Industry. Coordination is also needed to form a task force to work on green public procurement. In addition, there are a variety of standards and specifics at national and local levels on green procurement that are not consistent and compatible, therefore coordination is also needed.

### Exhibit 15: Major stakeholders in the public procurement of green building materials

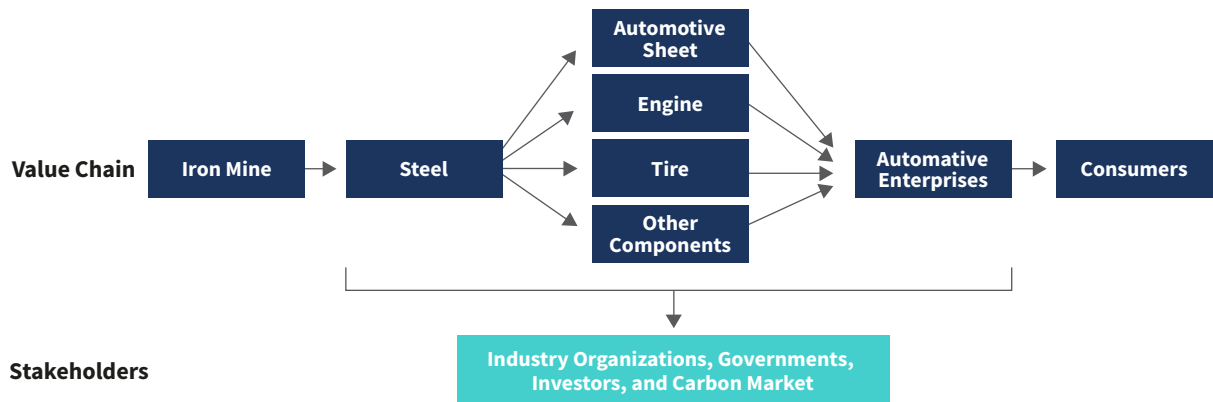


RMI Graphic. Source: RMI research

Stakeholder coordination in green private procurement is mainly about coordination within and outside the value chain. Taking the procurement of low-carbon steel by automobile enterprises as an example (see Exhibit 16, next page), steel enterprises are not only the primary suppliers that supply steel directly to automobile manufacturers, but also the secondary suppliers that supply steel to component manufacturers who will in turn deliver vehicle components to car makers. Automobile companies usually cannot manage their secondary suppliers directly and therefore need to manage their emissions through their primary suppliers along the value chain.

Meanwhile, upstream industries in the steel industry, such as mining, industrial material transportation, and energy, will also impact the carbon emissions of steel. On the other hand, policymakers, consumers, and investors can influence the decision-making of low-carbon procurement by companies. A robust low-carbon industrial material market can only be achieved if stakeholders within and outside the value chain establish a synergized awareness, measurement system, certification mechanism, and market signals toward carbon reduction.

## Exhibit 16: Major stakeholders in automobile enterprises' procurement of low-carbon steel



RMI Graphic. Source: RMI research

## Define the Scope of Low-Carbon Procurement

Public procurement includes goods, projects, and services. Among these, projects account for the largest procurement amount, around 47% in 2020. The government can require project contractors to adopt low-carbon design and use low-carbon materials in publicly funded projects to reduce carbon emissions throughout the project life cycle. Goods are the main category that practice green procurement at present, and the government can require its procured goods meet certain carbon emissions standards. Services include those the government needs and those it provides to the public. The government can require its service providers to provide low-carbon social and public facilities services.

At present, the Chinese government only mandates green procurement of certain goods but does not consider projects or services as part of green procurement. Even under this framework, green metrics normally focus on their usage and operational phase, with few requirements for industrial materials. Under the current policy, green procurement is only required for 10 categories of energy-saving products, and the other energy-saving and eco-labeled products are available for priority procurement. In addition, there are still many products that have not been included in the green procurement inventory; therefore, the detailed rules for their green procurement are lacking.<sup>40</sup> In terms of project procurement, green building materials have experienced some procurement practices since the establishment of the green building materials evaluation in 2015. The practice is expected to be further promoted nationwide in the future, but the availability and diversity of certified products cannot cover some limited applications in building projects.

Companies should define the scope of low-carbon procurement based on their own carbon reduction targets, roadmap, and supply chain targets. Low-carbon procurement is possible for industrial materials, products, and services. Companies with a large share of industrial material emissions are encouraged to include upstream carbon reduction in their carbon management. Low-carbon procurement of industrial materials refers to the purchase of industrial materials with a low-carbon footprint and their subsequent use in production. Low-carbon procurement of products targets low-carbon products such as equipment and components produced by upstream companies. Low-carbon procurement of services requires service providers to maintain lower emissions levels throughout their service life cycle.

## Data, Accounting, and Certification

Implementation of low-carbon procurement requires the support of activity and emissions data, as well as carbon accounting methodologies at the industry, project, company, and product levels.

First, suppliers in the value chain, such as industrial material suppliers, component companies, and product manufacturers, should establish a database and life-cycle carbon accounting methods at the product level. The carbon footprint is an important basis for downstream low-carbon procurement. At present, the product-level carbon accounting system is gradually being established in China, with the data being improved. For example, in the steel industry, more than 20 product category rules (PCRs) and standards related to LCA and carbon footprint are being researched or published. At the same time, carbon labels for building materials are being developed, and a platform for publishing steel EPDs based on PCRs has been established.

Second, buyers in the value chain, such as governments and enterprises, should develop their own carbon accounting methods and carbon reduction targets and include carbon emissions from upstream products and services in their own carbon boundary. The government should establish a calculation method for carbon emissions in the public sector and a carbon accounting method for engineering projects to verify the carbon emissions level of contracted projects. Enterprises should improve the carbon accounting method for Scope 3 emissions at the enterprise level, actively commit to reducing Scope 3 emissions, and expand the coverage of suppliers' carbon data to improve data accuracy. At present, China requires building projects to analyze carbon emissions at the design stage. According to the Building Carbon Emissions Calculation standard, the life-cycle carbon emissions of buildings include the embodied carbon from industrial materials.

In addition, data sharing and consistency of methodologies in all parts of the value chain are also urgently needed. At present, although some companies are exploring carbon accounting methods, there is a lack of consistency between upstream and downstream methods and data sharing, which hinders the effective development of low-carbon procurement. In April 2022, three ministries issued a new implementation plan to establish a uniform and standardized carbon emissions accounting system, which proposed that such a system be established by 2023 and be further refined by 2025.<sup>41</sup> The policy has provided the direction for a consistent carbon accounting system that will benefit low-carbon procurement.

## Carbon Criteria for Products, Services, and Suppliers

Downstream buyers should clearly propose carbon emissions requirements for the products and services based on their own carbon reduction targets. There are typically four forms of management mechanisms regarding supplier carbon management: product inventory, company inventory, limits, and ratings (see Exhibit 17, next page). They can be used individually or in combination for best results. Among them, product and company inventories are mainly used in China because they are easy to apply without a large amount of data. With improvement of the carbon database in China, we can expect that future carbon management will evolve toward a quantitative approach, and carbon criteria for products can take a combination of different forms.

## Exhibit 17: Supplier carbon criteria

Carbon criteria for purchased products and services	Definition	Example	Advantages	Disadvantages
<b>Product inventory</b>	For the products included in the inventory, prioritized or mandatory procurement of products with energy-saving and environmental labeling.	Use the <i>Government Procurement Inventory of Energy-Saving Products and Public Procurement Inventory of Environmental Labeling Products</i> to offer preferential treatment to eligible certified products in public green procurement. The treatments include prioritized procurement and compulsory procurement.	Fosters the energy-saving and eco-friendly market in selected product areas and improve the low-carbon procurement system through prioritized or mandatory procurement.	Threshold for energy-saving and eco-friendly certification is low without clear requirements for carbon attributes. It is difficult to truly incentivize low-carbon products.
<b>Company inventory</b>	Implement prioritized or mandatory procurement for products or enterprises on the inventory.	SEE Foundation launched the Green Supply Chain Initiative for China's Real Estate Industry with others to select high-quality upstream suppliers by establishing "white list" and "green list" criteria and recommend them to real estate enterprises for prioritized procurement.	Easy to operate, does not require a large amount of data, and can widely encourage companies with better environmental performance.	Difficult to evaluate and identify the carbon performance of specific products; difficult to further incentivize companies on the list to reduce emissions.
<b>Limits</b>	Specify the upper limit of carbon intensity for each product and only purchase products with lower carbon intensity.	California requires government projects to purchase products below the industry GWP average when purchasing six products in four material categories: structural steel, steel reinforcement, flat glass, and mineral wool board insulation.  BMW Group requires upstream steel enterprises to provide life-cycle evaluation reports for products such as auto sheets and further audits suppliers' climate change performance, requiring year-on-year reductions in the carbon footprint of industrial materials.	The most direct method for upstream industrial material industries; carbon reduction.	High requirements for carbon emissions database, requiring a certain number of low-carbon industrial material suppliers.
<b>Rating</b>	By measuring the actual carbon emissions of suppliers, select the suppliers with small emissions. This is generally used for the selection of service providers at the project level.	The Dutch government requires general contractors to measure the life-cycle carbon emissions of buildings (including building materials) and offers a certain bid discount according to their carbon reduction benefits. The bidder with the lowest bidding price wins the tender.  Dell has incorporated climate change performance into its supplier incentive program, using quarterly scorecards to encourage suppliers to set carbon reduction targets.	Reduces carbon by encouraging healthy competition among market participants, with relatively little disruption to the market.	Because limits or fixed standards are not set, it is more difficult to ensure whether the project carbon reduction is aligned with the overall carbon reduction target.

RMI Graphic. Source: RMI research

## Incentives for Low-Carbon Products and Services

Low-carbon products typically have a higher green premium than ordinary products. Incentives that can motivate market participants to engage in low-carbon procurement are an important part of policy design. The government can provide diversified incentives for enterprises, projects, and products involved in low-carbon procurement. At present, China has practiced an array of nonfinancial and financial incentive tools. Direct financial incentives (subsidies, rewards, etc.), indirect financial incentives (financial preferences, etc.), and nonfinancial incentives (preferential in procurement, prioritized evaluation, etc.) are being experimented with in the pilot project of green building materials (see Exhibit 18). In the future, various incentive tools can be designed based on current practices.

### Exhibit 18: Incentives for low-carbon public procurement

Incentives for Low-Carbon Enterprises	Incentives for Low-Carbon Projects	Incentives for Low-Carbon Products
Qingdao grants financial incentives of up to 5 million renminbi to innovative enterprises in production and R&D of green building materials.	Shaoxing incorporates the incremental cost of green building materials in the project cost, adding 300 renminbi per square meter for projects meeting the three-star green building standard.	Huzhou grants a one-time award of 200,000 renminbi to building materials enterprises meeting green product certification and adds 20,000 renminbi for each additional green product certification.
Huzhou increased the loan interest rate subsidy and guarantee rate subsidy standards by 10% for excellent enterprises in green building materials.	Projects of Huzhou Municipal Government implement the green building materials quality insurance system for building materials included in the public procurement catalog, with a subsidy of 25% of the insurance premium.	Foshan grants a one-time supportive fund of 50,000 renminbi to enterprises meeting the green building material certification.
<b>Financial incentives</b> <ul style="list-style-type: none"> <li>Grant financial rewards, tax breaks, green loan interest subsidies, guarantee rate subsidies, etc. to certified enterprises researching, producing, and certifying green building materials.</li> <li>Incorporate the incremental cost of green building materials into the project cost in government projects.</li> <li>Grant subsidies for building material enterprises to apply for EPD (United States).</li> </ul>		
<b>Nonfinancial incentives</b> <ul style="list-style-type: none"> <li>Build a digital platform for green building information disclosure, digitize the city's green building project database, and regularly feed to financial institutions to promote the efficient flow of financial resources to the green building sector.</li> <li>Provide credits or bid discounts to construction bidders who propose to use green building materials.</li> </ul>		

RMI Graphic. Source: RMI research



Companies can also incentivize upstream suppliers to participate in low-carbon initiatives. For example, Dell has incorporated climate change performance into its supplier awards, and suppliers can increase their scores by joining third-party carbon disclosure platforms and participating in Dell's climate change training. Dell uses assessment activities to encourage suppliers to improve energy efficiency, reduce carbon emissions, and increase the use of renewable energy. Sino-Ocean Group established the Sino-Ocean Group Responsibility Award for suppliers with outstanding environmental and health performance.

Companies also need incentives from external stakeholders for their low-carbon procurement, including governments, investors, and consumers. For example, investor incentives are mainly related to financial institutions requiring companies to reduce carbon emissions, especially in the supply chain. Currently, global ESG fund assets under management have grown rapidly over the past five years to \$24 billion.<sup>42</sup> Some investment institutions and industry organizations are already requiring Scope 3 performance of investee companies be included in their disclosure and performance evaluation. For example, the US Securities and Exchange Commission has proposed including companies' Scope 3 performance in their regular financial performance reports; and Deutsche Bank's climate targets for the oil and gas and automotive sectors already include Scope 3 emissions.<sup>43</sup> Consumer interest in green products will also drive corporate carbon reduction. According to a Bain market survey, 30% of consumers in China have started to buy sustainable products in 2020–22, and 95% of consumers are willing to pay a green premium for sustainable products.<sup>44</sup>

## Implementation with Monitoring and Evaluation

To improve the implementation of low-carbon procurement, the government should specify the implementation requirements for each step of the procurement process, from the preparation of procurement documents, bid evaluation, and contract signing to performance acceptance.<sup>45</sup> At the same time, the government can use methods such as mass procurement to increase the procurement scale, ensure the economy of procurement, and realize the standardized control of industrial materials. The public procurement contract should clarify its requirements for suppliers or contractors to use green and low-carbon industrial materials and conduct acceptance inspection in accordance with the procurement contract.

At the same time, the government should also strengthen the supervision and evaluation of low-carbon procurement. First, the government can regularly publish the progress of low-carbon procurement, commission qualified third-party organizations to evaluate the actual carbon reductions of projects, and regularly check compliance with the carbon reduction targets. Second, the government should continuously update the low-carbon inventory and related management metrics according to the new development, continue to improve low-carbon procurement, and guide suppliers to reduce emissions in the long run. Third, a reward and punishment system should be established. The system can use the carbon reduction effect achieved by each supplier and government agency through procurement, as well as how the funds are used for evaluation. Fourth, information technology should be used to monitor the whole process of low-carbon procurement, build a unified procurement platform, improve the transparency of supplier qualifications and product information, and promote fair competition in the low-carbon procurement market.

Companies should ensure suppliers reduce their carbon emissions and provide capacity building to suppliers. Companies with a larger share of emissions from industrial materials need to set carbon reduction targets for the supply chain, paying special attention to suppliers' carbon management. Companies should also increase climate awareness training for employees, especially in procurement.

At the supplier level, enterprises should require suppliers to disclose carbon emissions and take measures to reduce them and select suppliers with effective carbon performance. At the project level, enterprises should optimize the supplier evaluation system in the internal procurement process, improve the proportion of environmental factors, and regularly track and evaluate the key climate performance indicators. They should expand the application of low-carbon procurement methods and related tools and establish long-term cooperation with low-carbon suppliers through long-term procurement and direct investment.

# 4 An Outlook for Low-Carbon Procurement: Priority Industries and Key Actions

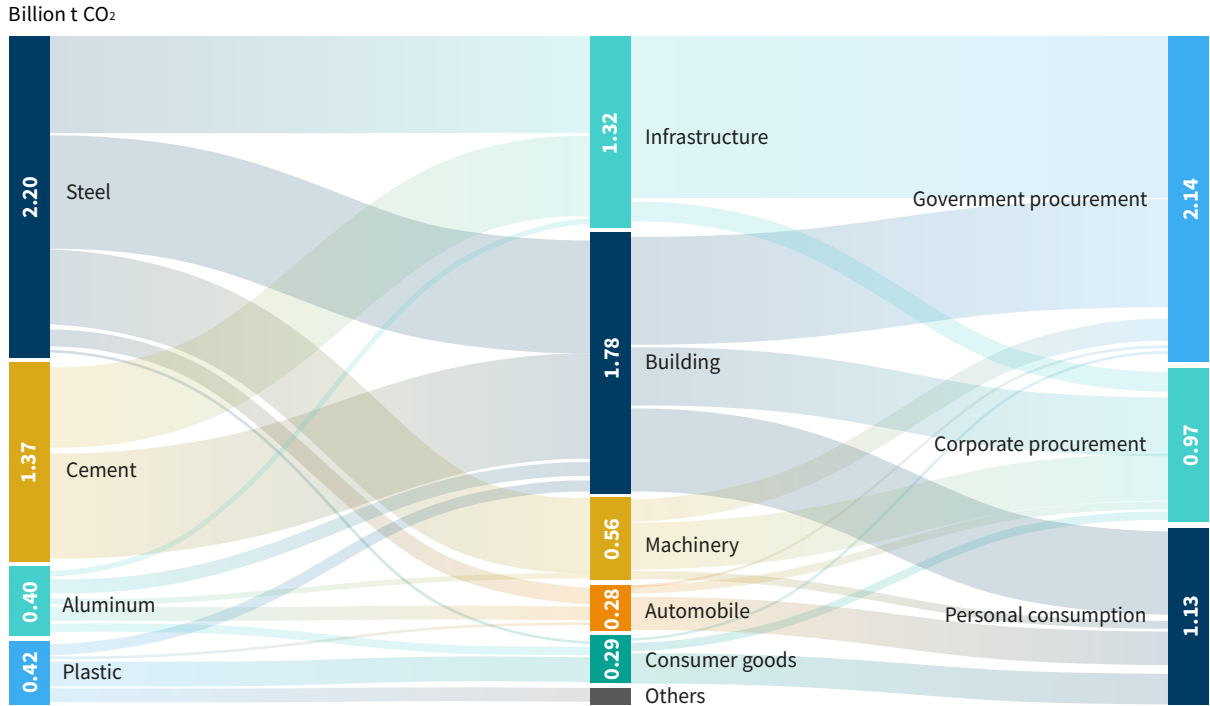
## Priority Industries

Industrial materials include steel, cement, aluminum, and plastics. The downstream sectors of industrial commodities are mainly concentrated in five major demand sectors: infrastructure, building, machinery, transportation, and consumer goods. By analyzing the flow of carbon emissions from upstream to downstream sectors, the areas of low-carbon procurement implementation with the greatest carbon reduction potential can be identified (see Exhibit 19, next page).

The procurement of large-scale, low-carbon industrial materials in building and infrastructure industries will be important to promote low-carbon procurement. The main downstream users of steel are infrastructure, building, machinery, and automotive. The main downstream users of cement are infrastructure and building. The main downstream users of aluminum are building, automotive, and consumer packaging. The main downstream users of plastics are consumer goods and building. Building and infrastructure have the most embodied carbon coming from industrial materials, accounting for more than 70% of the total carbon emissions from steel, cement, aluminum, and plastics. RMI estimates China's building industry consumes about 350 million tons of steel and 960 million tons of cement annually; the infrastructure industry consumes more than 280 million tons of steel and 710 million tons of cement. The embodied carbon from industrial materials accounts for about 50% of the total carbon emissions of the real estate sector (including Scopes 1, 2, and 3). Embodied carbon in the construction industry (including building and infrastructure) accounts for approximately 30% of the industry's total carbon emissions.

The largest buyer of industrial materials in China is the government. Approximately half of total CO<sub>2</sub> emissions from steel, cement, aluminum, and plastics are from government-purchased goods and projects. Therefore, public procurement will be important in developing a low-carbon market for industrial materials. The total carbon emissions of industrial materials purchased directly or indirectly (through government projects) by the government is about 2.14 billion tons, accounting for about 21.2% of China's total carbon emissions.<sup>46</sup> At the same time, procurement by individuals and enterprises is significant too. Individuals can construct their own buildings and purchase vehicles and consumer goods. Enterprises develop real estate projects and purchase machinery, equipment, and transportation vehicles. These channels all play a significant role in influencing the carbon emissions of upstream commodities.

## Exhibit 19: Carbon flows of four major industrial materials



Note: Annual carbon emissions values based on RMI research. Infrastructure data is derived from the proportion of annual fixed-asset investment; building includes public buildings, urban residential buildings, and rural residential buildings; machinery includes four sectors: general equipment, special equipment, instruments, and transportation equipment, which are divided into 14 segments; automotive/transportation includes passenger cars, buses, and large vehicles (such as trucks, fire trucks, and sanitation vehicles); and consumer goods classification is based on the National Bureau of Statistics. The calculation of the proportion of downstream procurement mainly takes into account beverage, clothing, shoes, hats and knitwear, cosmetics, daily necessities, home appliances and audio and video products, furniture, and stationery and office supplies.

RMI Graphic. Source: RMI research

We identify the priority demand sectors for implementing low-carbon procurement from several dimensions. Steel, cement, aluminum, and plastics are all important industrial materials and are weak substitutes for one another. For each industrial material, at least one value chain had to be selected for inclusion in the analysis. The analysis first screened the demand sector of the industrial materials for embodied carbon. Only value chains with larger amounts of embodied carbon were selected, as shown in Exhibit 20 (page 41).

Based on this, a methodology was developed to identify first-mover low-carbon supply chains that will be feasible to implement low-carbon procurement (see Exhibit 20 and Exhibit 21, pages 41 and 42). The evaluation is based on the importance of the embodied carbon in the downstream industry and the impact of the downstream industry on the industrial materials. Indicators to measure the importance of embodied carbon include the following:

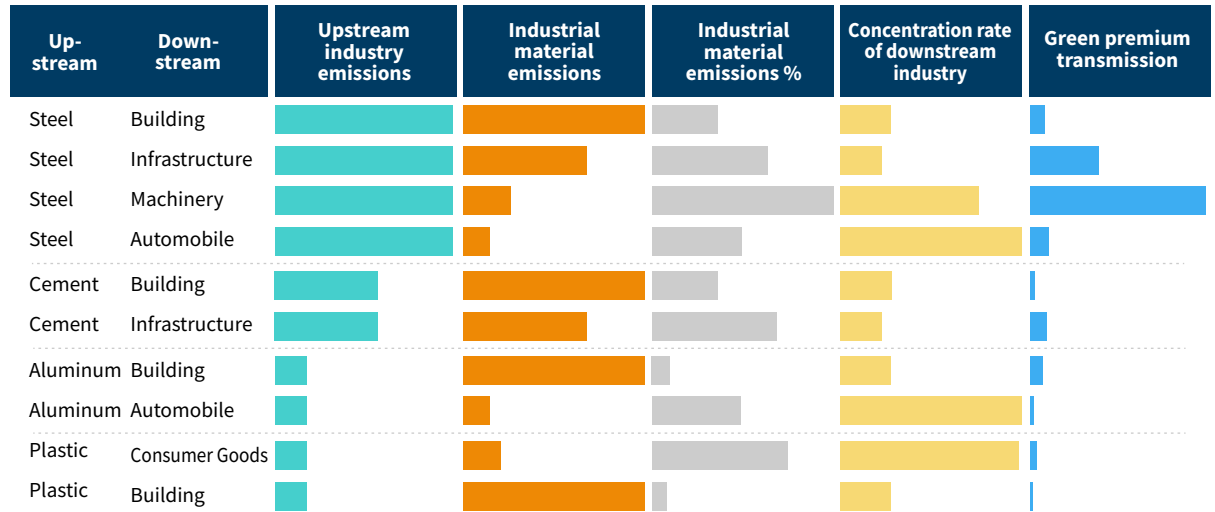
- Upstream industry emissions: the total carbon emissions of the industrial material industries, which measure the need for decarbonization in the upstream industry
- Embodied carbon in the demand sector: the share of industrial material emissions in the downstream industry, which measures the importance of industrial material decarbonization for the downstream industry
- Industrial material emissions share: the share of a certain kind of industrial material in the carbon emissions of the downstream industry, which measures the importance of this industrial material for the decarbonization of the downstream industry

Indicators to measure the influence of downstream industries include the following:

- Downstream industry concentration (CR10), which is the percentage of the top 10 companies by market size in the demand sector. The higher the industry concentration, the greater the bargaining power of the leading companies and their influence on the upstream supply chain.
- Cost increase in the end product due to a shift to zero-carbon industrial material. The lower the green premium in downstream products, the more economically feasible it is to use carbon-free industrial materials.

Considering the suitability of the five dimensions, the analysis discusses the demand-side industries where each industrial material is suitable for low-carbon procurement.

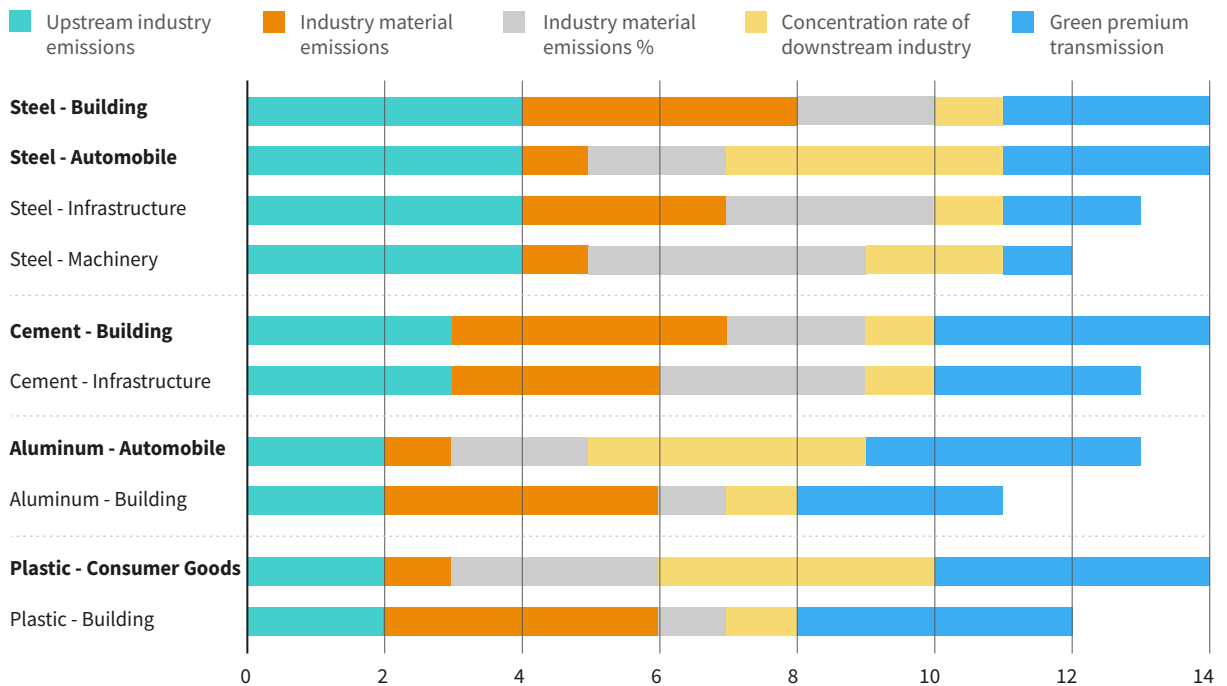
## Exhibit 20: Identifying opportunities for low-carbon procurement of main industry materials (relative values)



Note: The bars in this graph show the relative values of each dimension vertically. Upstream industry emissions are the total emissions of the upstream material industry. Industrial material emissions are the total embodied emissions of industrial materials in the downstream products. Percentage of a given material emissions is the percentage of emissions of a given material out of the total embodied carbon. Downstream industry concentration is the market share of the top 10 companies in the downstream sector. Green premium transmission is the green premium of the final product when using a given zero-carbon industrial material.

RMI Graphic. Source: RMI research

## Exhibit 21: Identifying opportunities for low-carbon procurement of main industry materials (ratings)



Note: The rating for each vertical dimension is derived from the ranking of the values, which ranges from 1 to 4. A higher rating means the value chain is more suitable for low-carbon procurement in that dimension. The ratings are summed to illustrate the priority level of each value chain. The value chain with the highest overall rating is in bold and could be considered a priority low-carbon procurement channel.

RMI Graphic. Source: RMI research

For the four main industrial materials (steel, cement, aluminum, and plastics), the first opportunities for low-carbon procurement can be found in the five value chains. The pioneer value chains are steel-automotive, steel-building, cement-building, aluminum-automotive, and plastics-consumer goods.

- The automotive and building industries are the first-mover demand sectors for low-carbon steel procurement. Most of the carbon emissions from the steel industry are transferred to the building and infrastructure industries. Steel accounts for about 48% of the embodied carbon for buildings and is significant for carbon reduction in the building sector.<sup>47</sup> Steel transfers a moderate green premium to building costs, which is ideal for early adoption of low-carbon steel materials. The automotive industry accounts for a relatively small share of steel use. However, the low-carbon procurement of a few key automotive enterprises is expected to have a greater impact due to the high concentration of the automotive industry. At the same time, the high-quality requirements of automotive steel, coupled with the strong brand effect of the leading automotive enterprises, offer high green premium affordability. The steel-to-automobile value chain is the pioneer in the implementation of low-carbon steel procurement.

- The first opportunity for low-carbon cement procurement could be in the building industry, led by government-funded building projects and private projects by developers. About 70% of cement is used in the building and infrastructure sectors.<sup>48</sup> Infrastructure projects, due to their public service and low profit or even negative profit nature, have limited affordability of green premiums; therefore, infrastructure is not likely to be the first industry to procure large-scale zero-carbon cement. Building projects, especially high-quality projects with high standards, are better choices for the pilots of procuring low-carbon cement and building materials. The advantages include high project quality requirements, high environmental and climate awareness of users, and the existing basis for life-cycle carbon accounting of buildings.
- The first opportunities for low-carbon aluminum procurement may be in the automotive industry. Aluminum is mainly used in buildings and automobiles. It is increasingly used to replace steel and reduce weight in vehicles. Aluminum can be expected to have more extensive use in the industry and constitute an important part of the embodied carbon of automobiles. Like the steel-to-automobile value chain, car companies have better bargaining power and influence on aluminum suppliers due to high industry concentration, while consumers have higher acceptance of green premiums and brand premiums for automobiles. Therefore, the automobile industry is a better choice to promote early procurement of low-carbon aluminum.
- The first opportunities for low-carbon procurement for plastics will be in consumer goods, where the end-users are dominated by individual consumers. Plastics are mainly used as consumer packaging plastics and engineering plastics (as in the building industry). Consumer goods (including packaging) are the most important downstream application of plastics, accounting for approximately 46% of total plastics consumption. Plastics are an important component of consumer products but not a big share of the cost. Some consumer goods (e.g., plastic packaging) may have a higher proportion of plastic costs. However, major consumer product categories such as beverages, apparel, cosmetics, and electrical appliances have high brand premiums and can better absorb the rising plastic costs. Consumers also have a high level of environmental awareness and can afford some amount of green premium. At the same time, the consumer goods industry has a high concentration of large companies with strong bargaining power and influence over industrial materials.

## Key Actions

The demand-side carbon reduction potential depends on the development of a low-carbon product market. At present, there are already early examples in low-carbon procurement around the world. In China, the existing green procurement policy framework, pilot projects, and discussions of integrating carbon into green procurement lay the foundation for a complete and comprehensive low-carbon procurement system and large-scale implementation in the future. The key actions and opportunities for low-carbon procurement in China can be summarized as follows.



First, product-level carbon accounting methods and data collection will provide the basis for low-carbon procurement. At present, China is still developing product-level carbon accounting methods. The databases and calculation methods of different companies and industries are not consistent. Data disclosure and data sharing among companies lack transparency. The government and enterprises have not yet established a system to measure the carbon emissions of purchased materials and products. There is an urgent need to improve the data and methodological basis for low-carbon procurement.

Second, carbon emissions requirements must be incorporated in green procurement standards, based on full consideration of the embodied carbon of industrial materials, and the requirements must be implemented in procurement standards, incentives, and other policy designs. At present, the measurement of green products covers a wide range of metrics from environment, resources, safety, and health to recycling, but a quantitative requirement for carbon emissions is lacking. Green public procurement practices mainly focus on emissions during the use of a product but typically ignore the carbon from industrial materials. In general, companies lack a clear target and guidance on how to reduce carbon emissions from industrial materials. We recommend that the procurement of low-carbon industrial materials be piloted in industrial value chains with better potential, as identified in this study.

A procurement management methodology based on product carbon footprint should be developed. The current procurement management method is inventory based, which lacks more sophisticated management of product-level information. The inventory approach has the advantage of being relatively easy to implement without a large database. However, it cannot quantify the embodied carbon at the product level and cannot promote the use of low-carbon industrial materials. With the improvement of data collection, future carbon management will evolve toward a data-based approach, and carbon management in the procurement process can adopt a combination of different approaches, such as carbon footprint threshold and project-level carbon calculator.

In terms of incentives, a more specific and standardized subsidy policy should be proposed to support low-carbon procurement, both in government and for companies. Currently, some pilot projects have demonstrated the use of a subsidy to cover green premiums, for example, in public procurement of green building materials. However due to the high premium, companies still find it challenging to apply low-carbon materials at large scale. Therefore, it is necessary to improve the incentive system of low-carbon procurement and strengthen the carbon management of project contractors and industrial material suppliers. It is also important to provide appropriate incentives for low-carbon industrial material suppliers, users, and other stakeholders in the industrial chain.

Finally, coordination and collaboration among value-chain stakeholders should be strengthened to create synergy. At present, consensus between upstream and downstream industries is still being formed, which includes agreeing on carbon targets, establishing a consistent carbon accounting method, and sharing carbon reduction responsibilities. In public procurement, a lack of synergy in relevant policies and difficulties in coordination among departments are major barriers. By the same token, private low-carbon procurement will also need to strengthen the coordination with multiple levels of suppliers. Companies should improve their value-chain carbon ambitions and supplier management capabilities.

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### **RMI Innovation Center**

22830 Two Rivers Road  
Basalt, CO 81621

[www.rmi.org](http://www.rmi.org)

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