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Zero-emission construction machinery in China, 2025

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This market spotlight series provides snapshots of China's zero-emission off-road construction machinery sector, highlighting market trends, technology development, and the industry's readiness to develop and deploy zero-emission machinery at scale.

WHAT IS CONSTRUCTION MACHINERY?

Construction machinery refers to heavy equipment and off-road vehicles used to perform various tasks on construction sites, such as excavating, grading, lifting, demolition, material handling and transportation, and land preparation. These machines are widely deployed in key industrial enterprises, ports, and mining operations for material handling, transportation, and other specialized applications. This series focuses on excavators, loaders, drilling rigs, reach stackers, cranes, road rollers, and bulldozers. Forklifts and aerial work platforms are excluded from the analysis given their widespread zero-emission model availability in mass production, with electrification rates approaching 100% for small forklifts (< 3 tons) and aerial platforms in the Chinese market. Other equipment types such as graders, material grabbing machines, and milling machines are not included due to insufficient available data.

Figure 1
Major classifications of construction machinery

Note: Equipment types considered in this analysis are shaded blue, with the primary analysis categories indicated by solid fill and the secondary categories shown with a patterned fill.

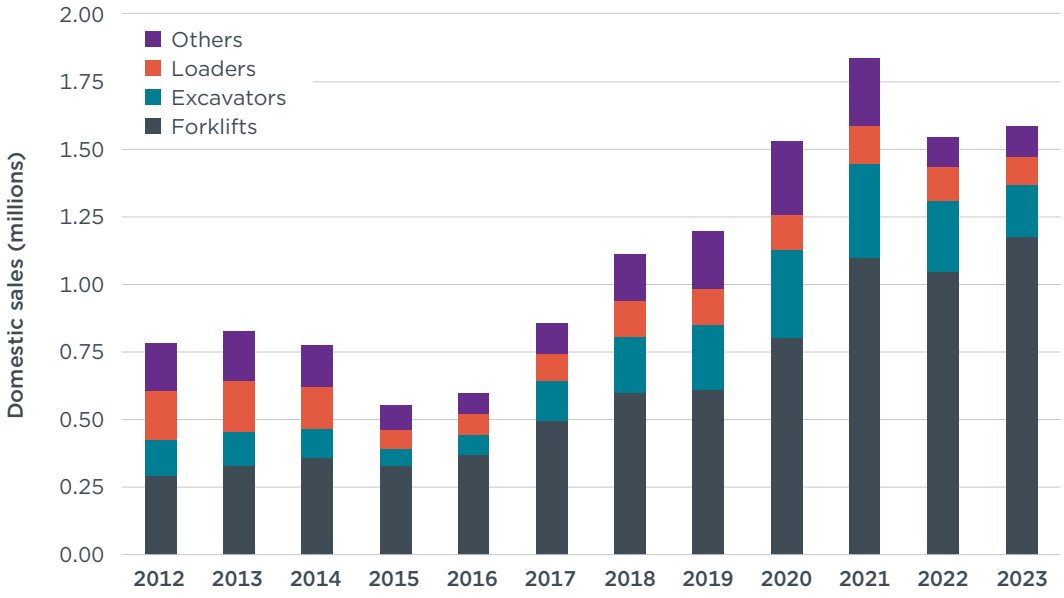
RECENT MARKET TRENDS

China's construction machinery market doubled in size from 2012 to 2023, with annual sales rising from 0.78 million to 1.58 million units. Following an industry contraction from 2012 to 2015—primarily driven by tightening real estate policies—the construction machinery sector entered a period of strong recovery, underpinned by infrastructure investment and equipment upgrades to meet emission standards. Annual sales peaked at 1.8 million units in 2021, more than triple the 2015 level of 553,000 units. Though sales dipped in 2022 amid COVID-19 disruptions and a real estate slump, the market recovered in 2023, reaching 1.6 million units, up 2.6% year-on-year.

Forklifts led the market with a 74% share in 2023, followed by excavators (12%) and loaders (7%), together accounting for over 90% of total sales. This reflects growing demand for logistics automation alongside continued strength in traditional machinery segments.

Figure 2

Sales volume and market share of construction machinery categories in China, 2012–2023



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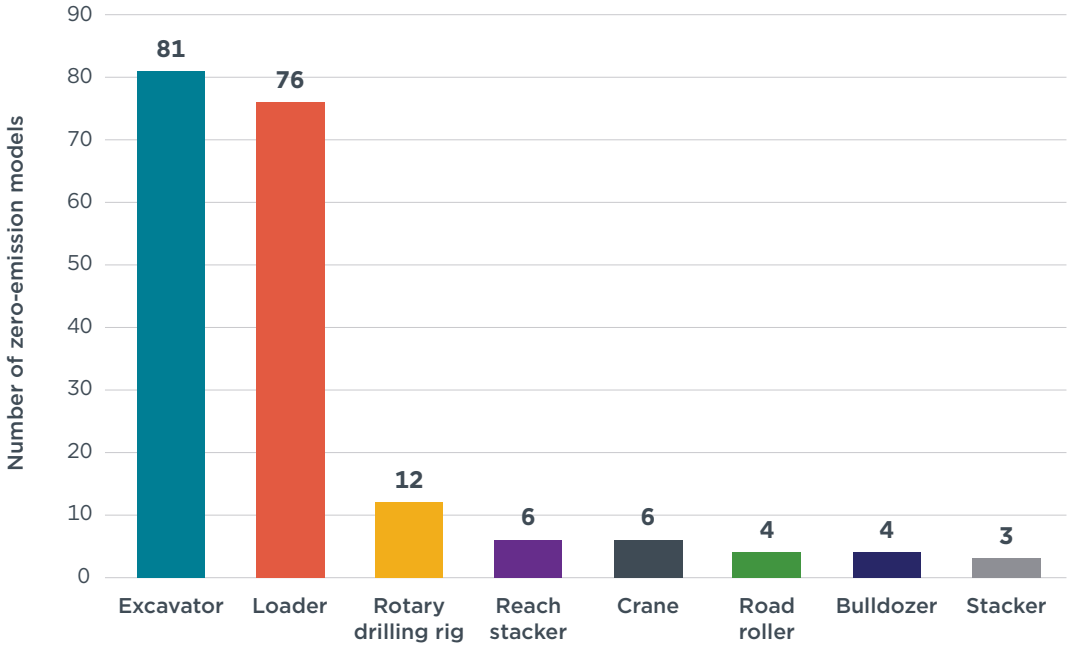
MODELS, MANUFACTURERS, AND POWERTRAINS OF ZERO-EMISSION CONSTRUCTION MACHINERY

By the end of 2024, nearly 200 zero-emission construction machinery models had been introduced in China. Excavators and loaders together accounted for over 80% of these models. Excavators led the market with 81 available zero-emission models, followed closely by loaders with 76 models. Rotary drilling rigs have gained traction, with 12 models by the end of 2024, marking rapid progress in a segment that had limited electrification options until recently. In contrast, more specialized equipment such as reach stackers, cranes, road rollers, and bulldozers remain at nascent stages of electrification, with only a handful of available models in each category. This divergence reflects the alignment of market demand and technical feasibility, as equipment with versatile applications, adequate charging infrastructure solutions, and compelling cost-benefit performance may be better positioned for zero-emission breakthroughs.

Figure 3

Zero-emission construction machinery models in China, 2024



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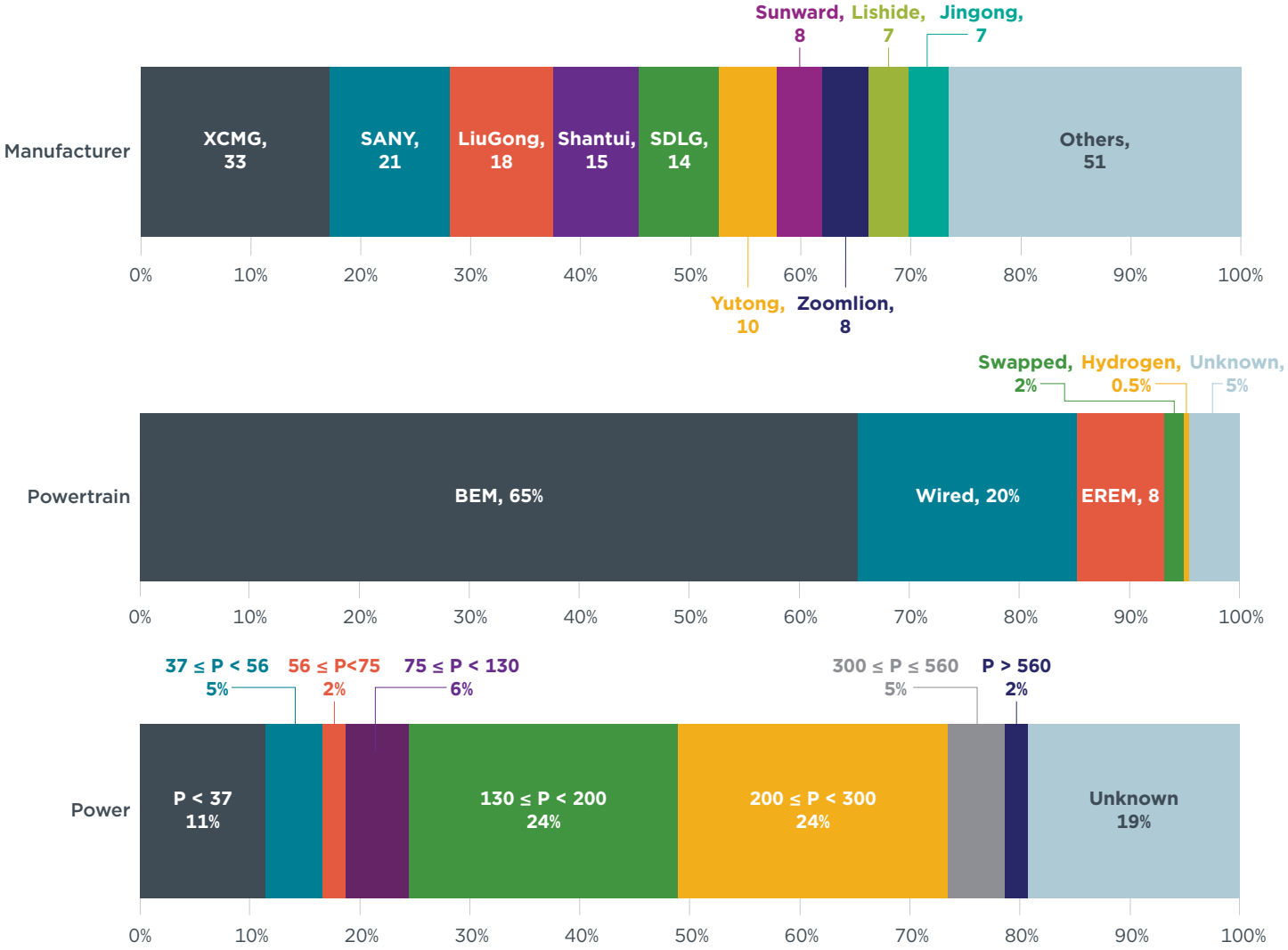
Model offerings in China's zero-emission construction machinery market are concentrated among a group of major players, with the top 10 manufacturers accounting for nearly 73% of all available models as of 2024. Most of these leading companies offered at least 10 electric models, highlighting their strong commitment to electrification. XCMG led with 33 models, followed by SANY (21), LiuGong (18), Shantui (15), and SDLG (14). Yutong, Sunward, Zoomlion, Lishide, and Jingong each accounted for between 7 and 10 models. The expansion of model offerings in the zero-emission construction machinery market suggests that electrification is no longer a niche effort but an increasing focus in product development across the industry.

The powertrain mix is dominated by battery electric machinery (BEM), which accounted for 65% of available models in 2024, followed by wired electric variants at 20%. Extended-range electric machinery (EREM)—battery-powered machinery equipped with an auxiliary power source, typically a small combustion engine, to generate electricity and extend range—accounted for 8% of the powertrain mix. Other technologies, including battery swap-capable and hydrogen fuel-cell systems, each represented less than 5% of the market.

Based on the power segments defined in current off-road engine emissions regulations, more than half of zero-emission models available as of 2024 fell within the 75–300 kW range, indicating a strong focus on medium-duty applications, while high-power segments (above 300 kW) remained nascent but are beginning to show signs of expansion.

Figure 4

Zero-emission construction machinery model distribution by manufacturer, powertrain technology, and regulatory rated power bins (P), 2024



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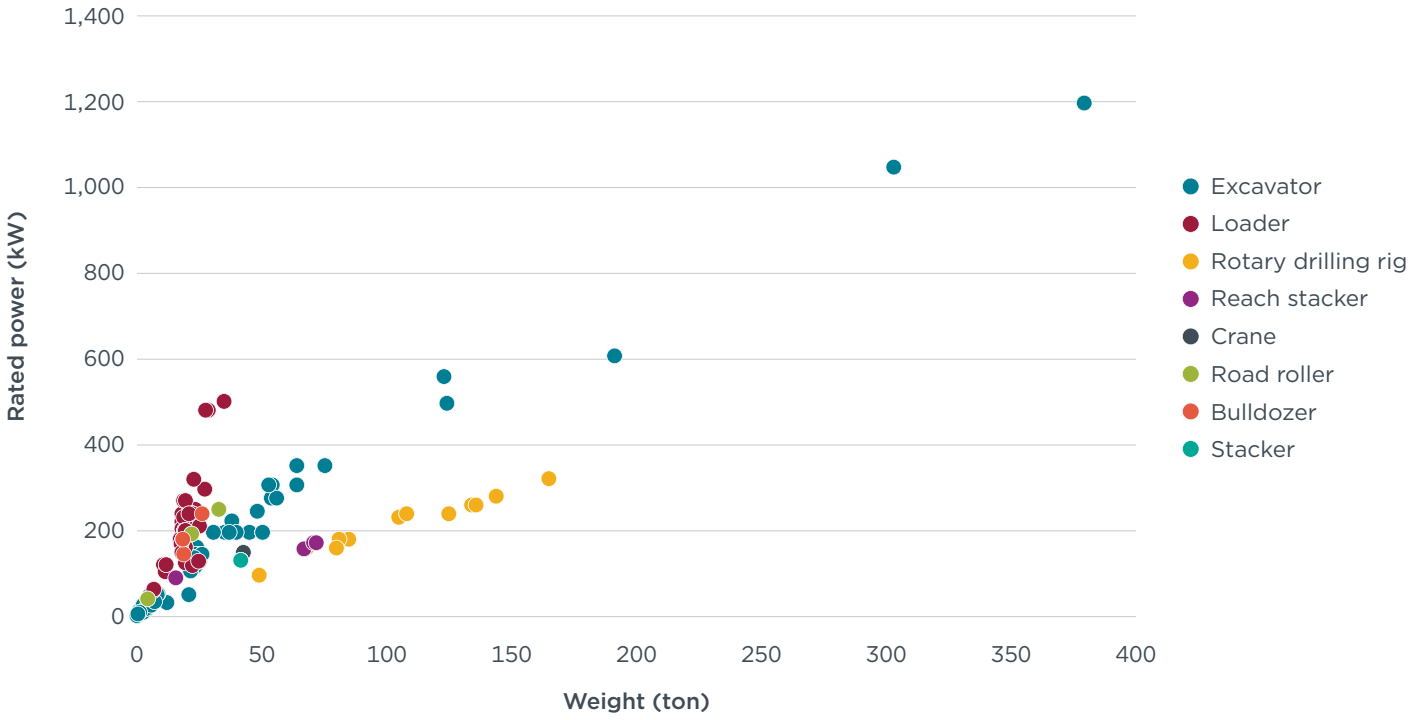
Zero-emission construction machinery spans a wide range of weights and power ratings, reflecting diverse applications. Excavators exhibit the widest distribution, ranging from under 10 tons to nearly 400 tons in weight and from below 50 kW to over 1,200 kW in rated power. Loaders cluster in lighter-duty segments, generally below 50 tons, but extend up to 500 kW in power. Rotary drilling rigs occupy a mid-range band in weight (up to 165 tons) while maintaining relatively lower rated power, below 350 kW. The dispersion of models across such a wide range demonstrates that electric powertrains are being adapted to support both light-duty urban tasks and heavier-duty construction, industry, and infrastructure operations.

Figure 5

Power and weight distributions of major zero-emission construction machinery categories in China, 2024



Note: Each circle in the figure represents a single model.

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ZERO-EMISSION LOADERS

The loader submarket has demonstrated remarkable progress in the zero-emission transition over the past 3 years. Electric loaders surpassed 10% market penetration in Q2 2024, up from just 1.1% in Q1 2023. Adoption has since accelerated, with electric models capturing 12.4% of total sales in Q2 2024 and 17.1% in Q1 2025. Loaders are thus at the forefront of the zero-emission transition for construction machinery in China.

As of 2024, electric loader models were largely concentrated in medium- to high-power segments, with 27% in the 130–200 kW range and 49% in the 200–300 kW range. This may reflect advances in electrification in applications like the cement and construction industries, where these power ranges dominate. Meanwhile, there is limited electric loader coverage in both the lowest-power (below 56 kW) and highest-power (above 560 kW) categories, which suggests both a technological frontier and a market opportunity for electrification in light-duty and extremely heavy-duty applications in this submarket.

Diesel models, for their part, mostly fall in the mid-power segment (130–200 kW), which comprises 67% of such models, with significantly fewer models (0.2%) in the 200–300 kW range.

Figure 6

Loaders produced in Q1 2025 by powertrain (left) and sales trend of electric loaders from Q1 2022 to Q1 2025 (right)

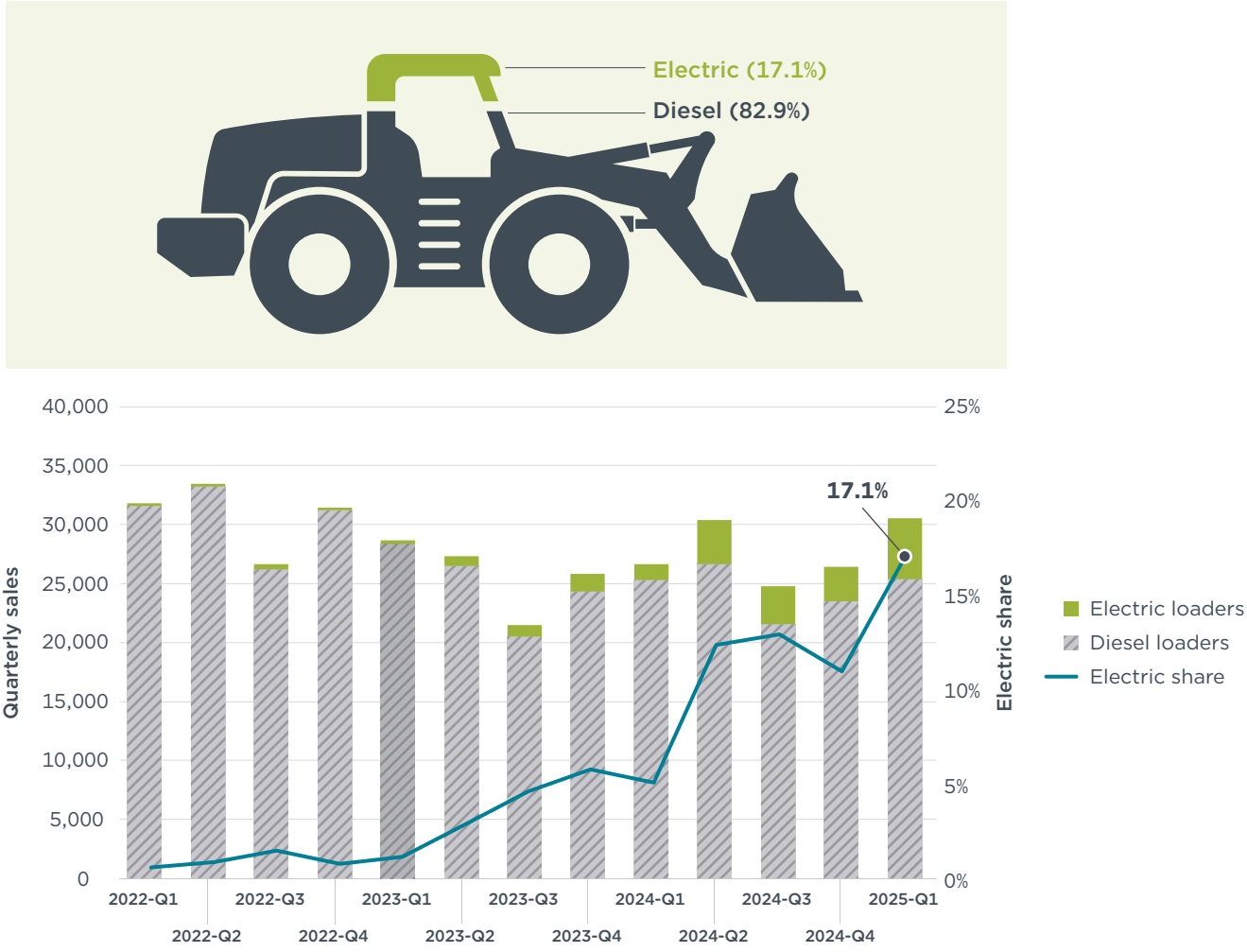

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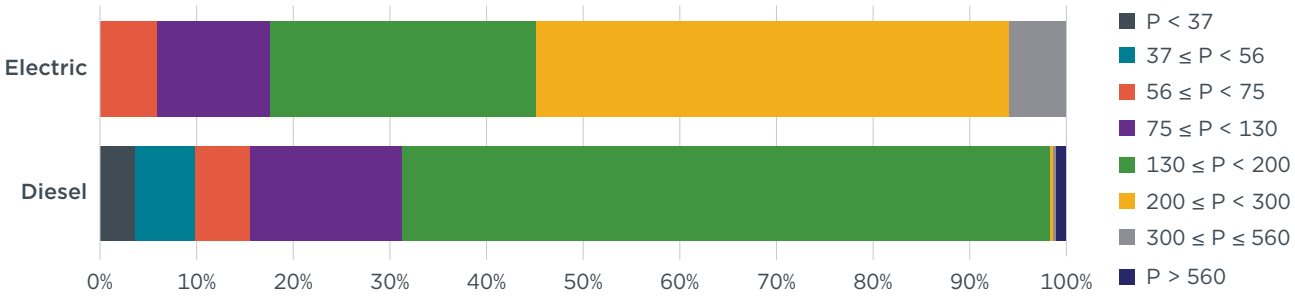
Figure 7

Power distribution of electric and diesel loader models, 2024



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The electric loader market is highly concentrated, with the top 10 manufacturers accounting for over 90% of available model offerings. Market leaders vary in terms of the power and weight distributions of their models. For example, XCMG sells 11 electric models and has the most comprehensive portfolio, with offerings spanning from compact to heavy-duty applications; their models range between 7 and 35 tons in weight and from 64 kW to over 500 kW in power. SDLG and Shantui follow closely with 10 models each; SDLG and Shantui specialize in mid-range applications

(weighing 18–27 tons with 230–300 kW power and 12–22 tons with 100–240 kW power, respectively). LiuGong rounds out the top tier with nine models in its lineup. Among other competitors, Jingong, Longking, and Yingxuan provide six models each. SANY follows closely with five electric options, preceding Boretech's four and Lovol's two model offerings.

Figure 8

Manufacturer distribution of zero-emission loader models, 2024

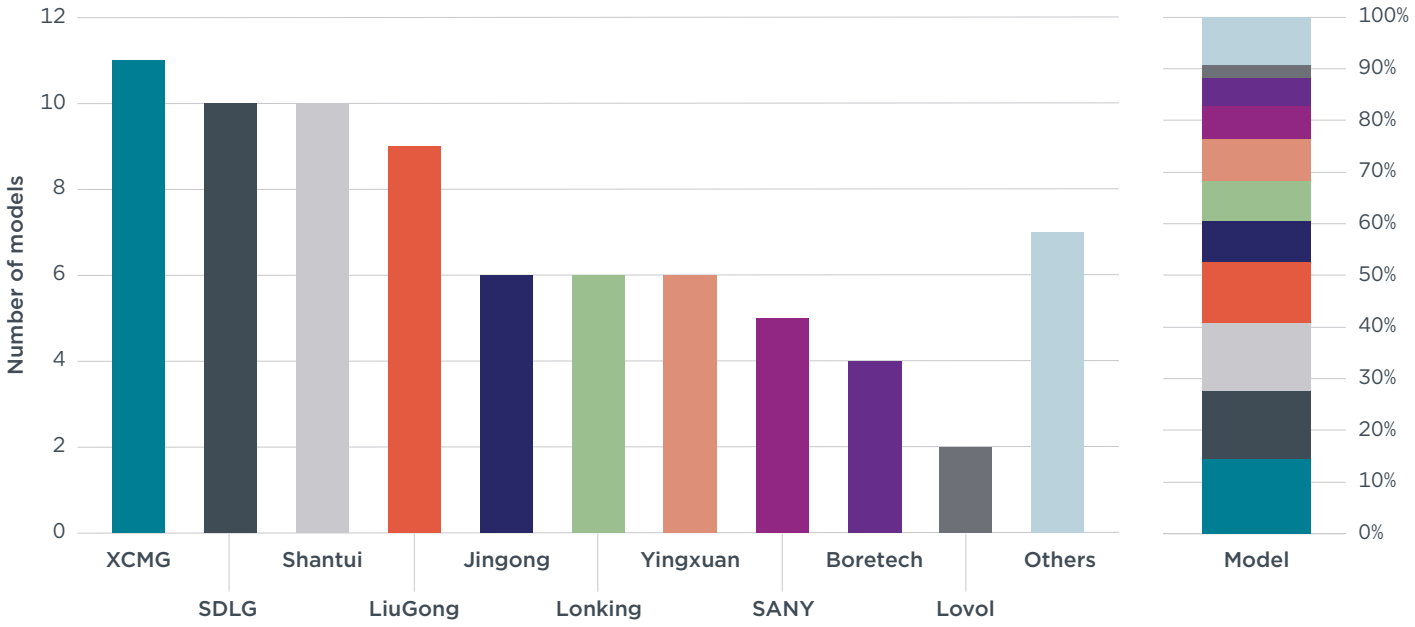

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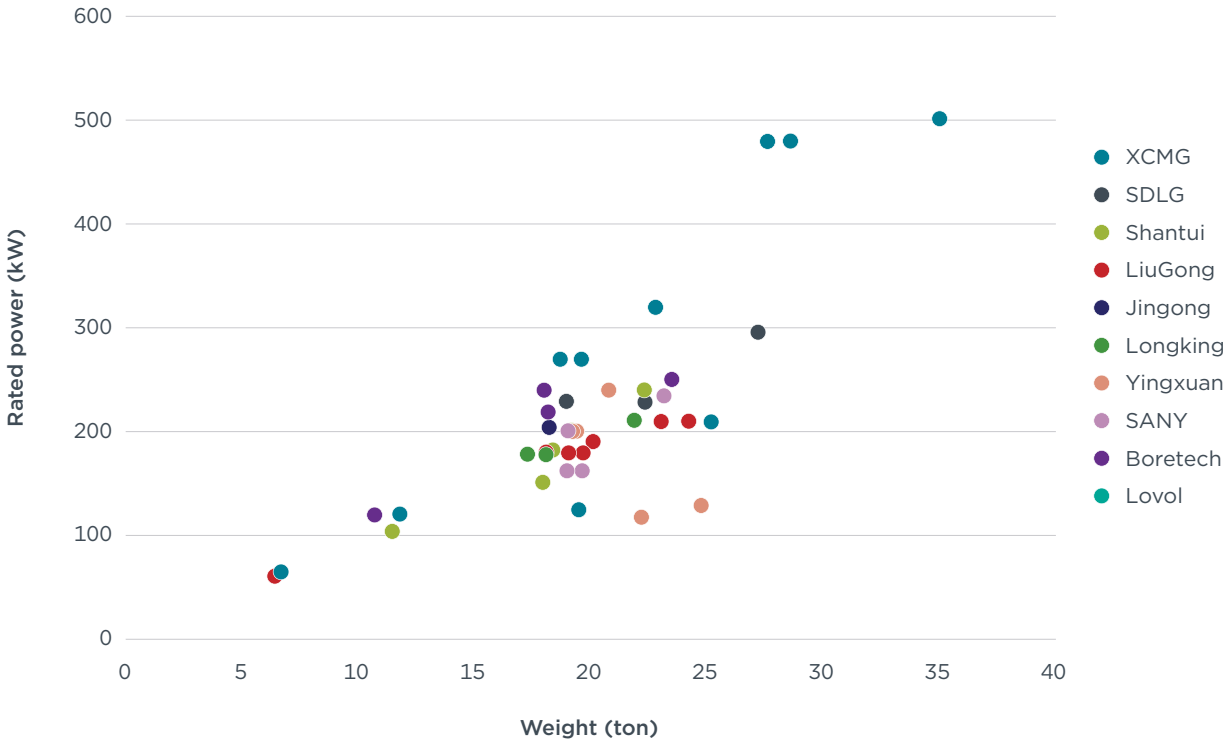
Figure 9

Power and weight distributions of zero-emission loaders by manufacturer, 2024



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ZERO-EMISSION EXCAVATORS

In the excavator submarket, diesel powertrains remain the dominant choice, while electric alternatives remain in early stages of adoption with less than a 1% sales share. Electric excavators had virtually no market presence through 2023, with quarterly sales remaining at zero until Q4 2023. Electric penetration gradually climbed to 0.08% by Q1 2025 with a peak of 0.14% in January 2025, signaling a growing market interest in zero-emission models.

Electric excavator models now span all eight regulatory power ranges in China, matching the coverage of conventional diesel models despite their minimal sales volume. They are particularly concentrated in the lowest-power (below 37 kW) and middle-power (130–200 kW) segments, which accounted for 28% and 26% of electric models, respectively, in 2024. The diesel excavator submarket is similarly distributed, with 19% of models in the lowest-power segment, 25% in the middle-power segment, and 17% each in intermediate segments (37–56 kW and 75–130 kW).

The availability of electric models in higher-power segments represents significant progress from the market's early stage, when electric excavator models were highly concentrated in smaller-power segments. Moreover, the resemblance in power distribution between electric and diesel models implies that electric offerings are increasingly meeting diverse market needs across project scales.

Figure 10

Excavators produced in Q1 2025 by powertrain (left) and sales trend of electric excavators from Q1 2022 to Q1 2025 (right)

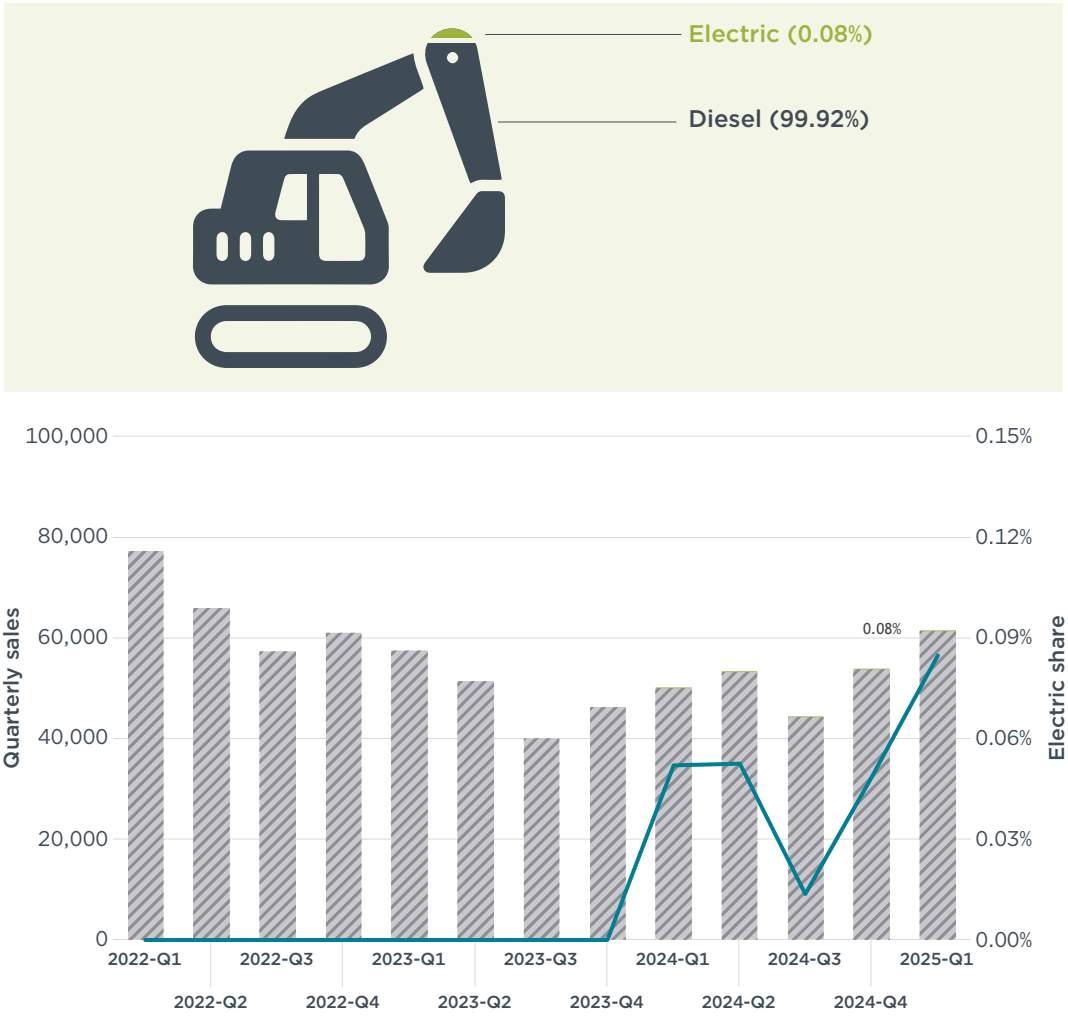

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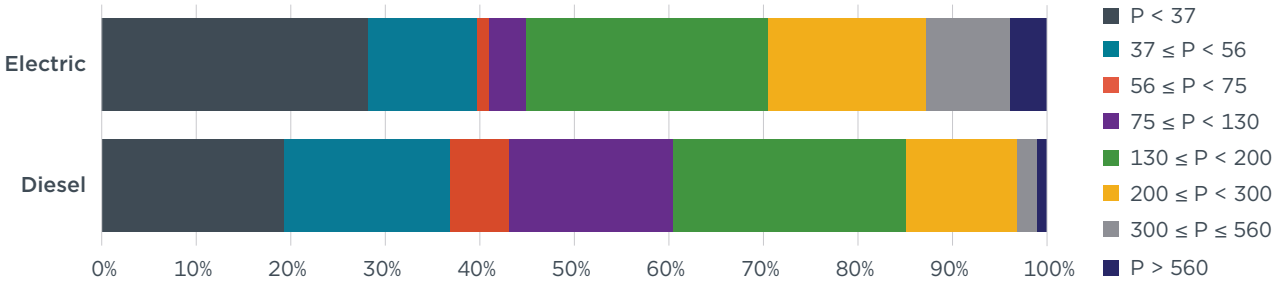
Figure 11

Power distribution of electric and diesel excavator models, 2024



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Model offerings are highly concentrated among leading producers, with the top 10 manufacturers collectively accounting for approximately 90% of all zero-emission models available on the market in 2024. XCMG led by a wide margin with 17 models, offering the most comprehensive electric product line and breaking new ground in the heavy-duty segments; its portfolio includes multiple high-capacity models exceeding 600 kW, with the most powerful reaching over 1,200 kW and nearly 400 tons in weight. SANY (10 models), LiuGong (8), and Sunward (8) followed, covering mainstream applications from compact to large excavators (2–55 tons). Lishide and Sandvik offered seven and six models, respectively, while Volvo, Bonny, Zoomlion, and SDLG offered between four and five models each.

Figure 12

Manufacturer distribution of zero-emission excavator models, 2024

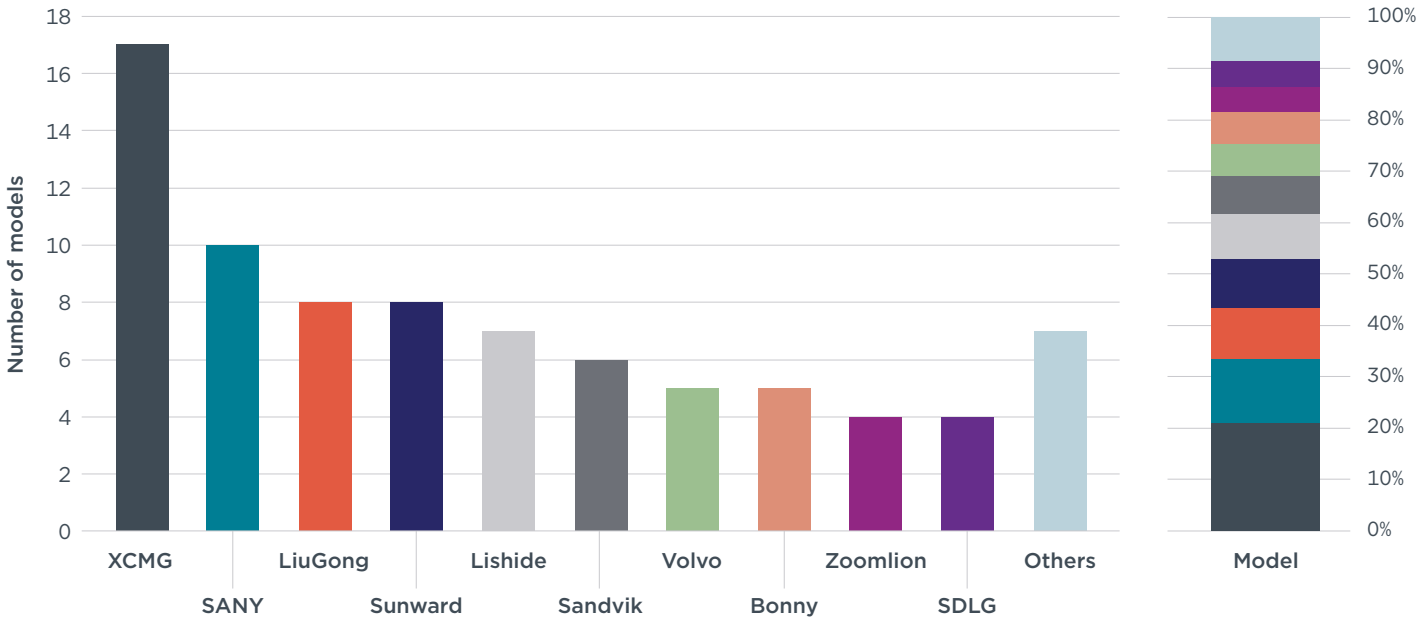

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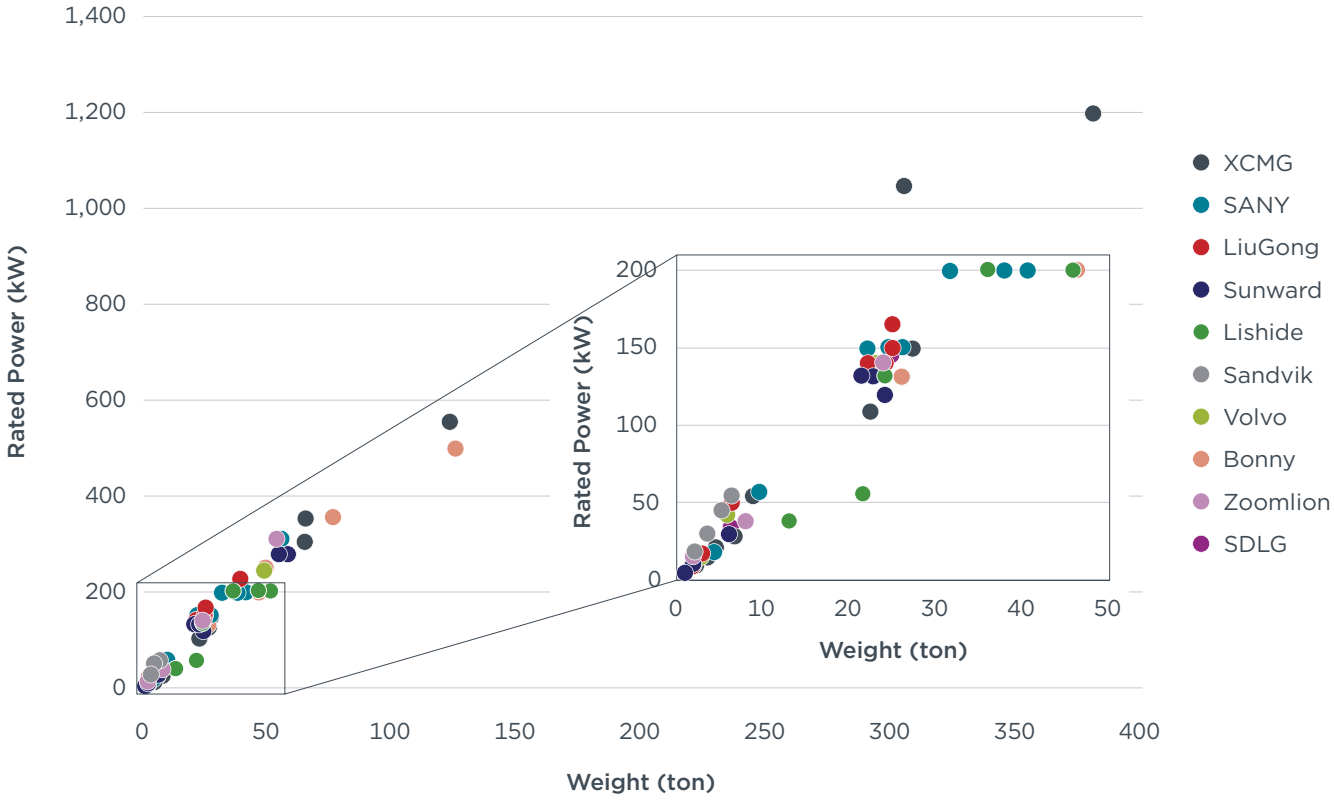
Figure 13

Power and weight distributions of zero-emission excavators by manufacturer, 2024



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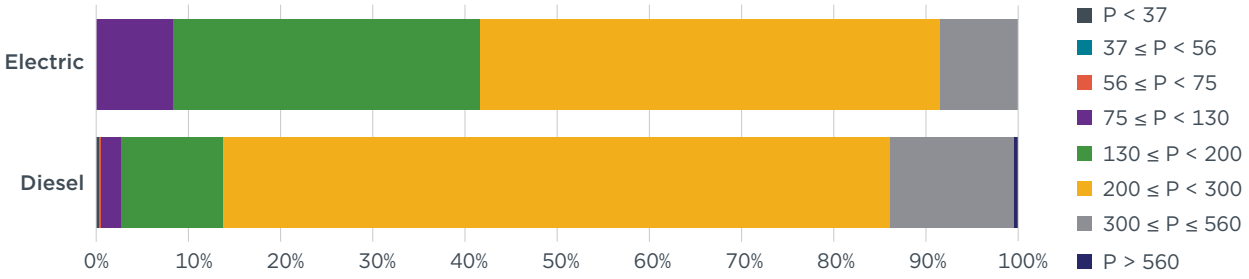
ZERO-EMISSION ROTARY DRILLING RIGS

The rotary drilling rig submarket remains predominantly diesel powered, with electric alternatives still in early adoption stages and sales data yet to be systematically reported in the China Construction Machinery Association (CCMA)'s industry yearbook. Nevertheless, this submarket has demonstrated growing momentum in the zero-emission transition, emerging as one of the leading construction machinery types for electrification after excavators and loaders, with 12 electric models available in 2024.

Electric rotary drilling rigs already cover most of the power ranges offered by diesel models, indicating strong potential to meet prevailing operational requirements. Diesel models are heavily concentrated in the mid- to high-power segments (75–560 kW), with 72% of offerings falling in the 200–300 kW range, followed by 300–560 kW (14%) and 130–200 kW (11%). Electric models follow a similar distribution, with 50% in the 200–300 kW range and 33% in 130–200 kW range, while lower-power (75–130 kW) and higher-power (300–560 kW) categories each comprise just one model. Expanding into higher-power ranges (above 300 kW) would further improve the coverage of electric models.

Figure 14

Power distribution of electric and diesel rotary drilling rig models, 2024



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The zero-emission rotary drilling rig submarket in China is highly concentrated, with only two leading manufacturers, Yutong and Zoomlion, offering commercial models. Yutong established itself as the market leader after introducing China's first electric drilling rig models in 2021. Yutong now offers 10 models, covering light-duty (below 50 tons and 100 kW power) and heavy-duty (above 150 tons and 300 kW power) applications and multiple powertrain configurations, including battery electric, wired electric, and EREM. Zoomlion offers two medium-duty electric models, representing a smaller but growing presence in the market. While these pioneers have demonstrated the technical feasibility of electrification in this submarket, otherwise limited manufacturer participation underscores the need for broader industry engagement to drive market transformation.

Figure 15

Manufacturer distribution of zero-emission rotary drilling rig models, 2024

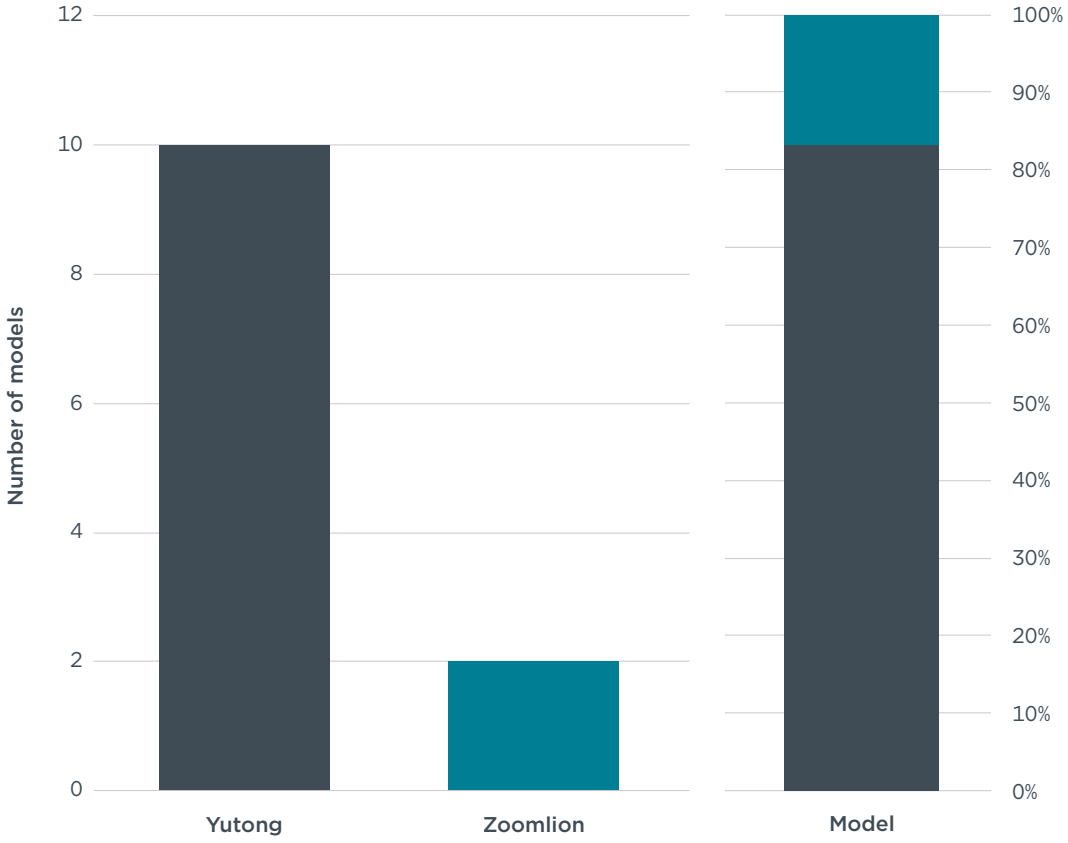

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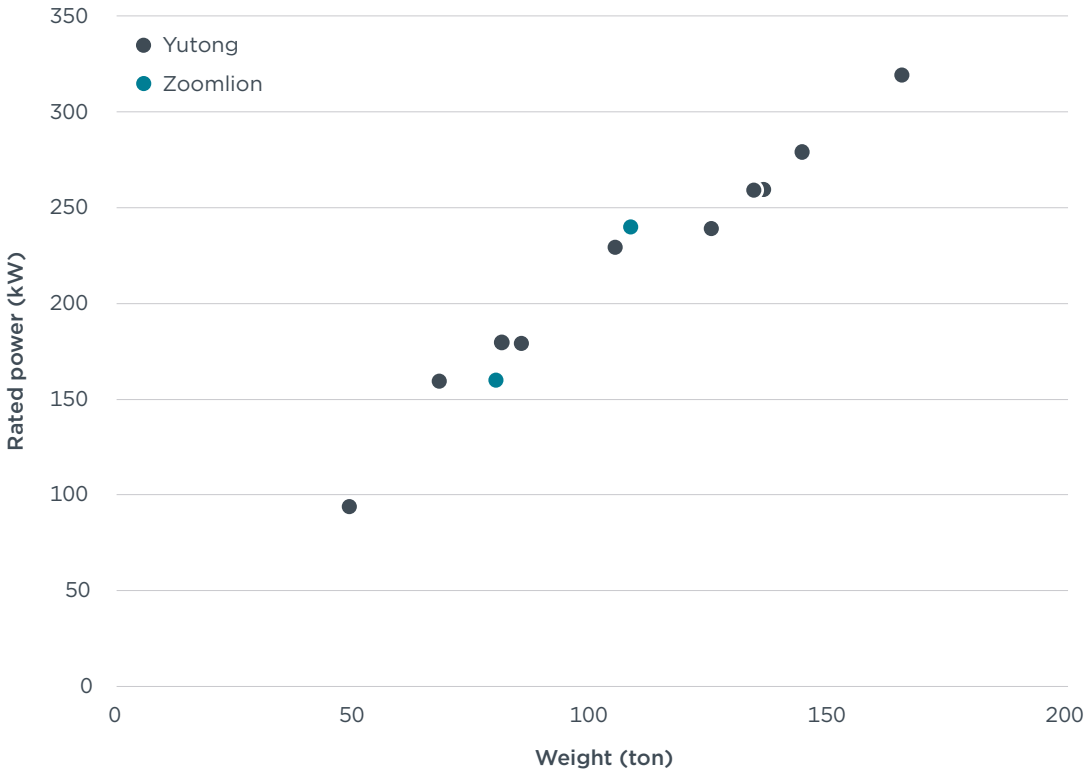
Figure 16

Power and weight distributions of zero-emission rotary drilling rigs by manufacturer, 2024



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DEFINITIONS, DATA SOURCES, METHODOLOGY, AND ASSUMPTIONS

- **Zero-emission construction machinery** refers to construction machinery, devices, or equipment that produce no tailpipe emissions during operation.
- Model availability metrics are used in this report to gauge technological capability and market diversity in the absence of comprehensive sales data for zero-emission construction machinery. Many equipment types lack zero-emission machinery sales reporting entirely and existing figures often omit technical specifications such as power distribution details.
- Data in Figure 2 are based on the CCMA's *China Construction Machinery Industry Yearbook* for 2013 to 2024.
- Data in Figures 3–5, 7–9, and 11–16 are based on model-level statistics of diesel and zero-emission construction machinery in China (June 2024) from the Chinese Research Academy of Environmental Sciences Vehicle Emission Control Center. Forklifts and aerial work platforms are not included in our analysis due to their widespread zero-emission model availability.
- Data in Figures 6 and 10 are based on CCMA's monthly sales and electric market penetration data (January 2022 to March 2025) for excavators and loaders.

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