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WORLD ECONOMIC FORUM

Clean Power for Industry in China: Policy Enablers for the Industrial Sector

WHITE PAPER

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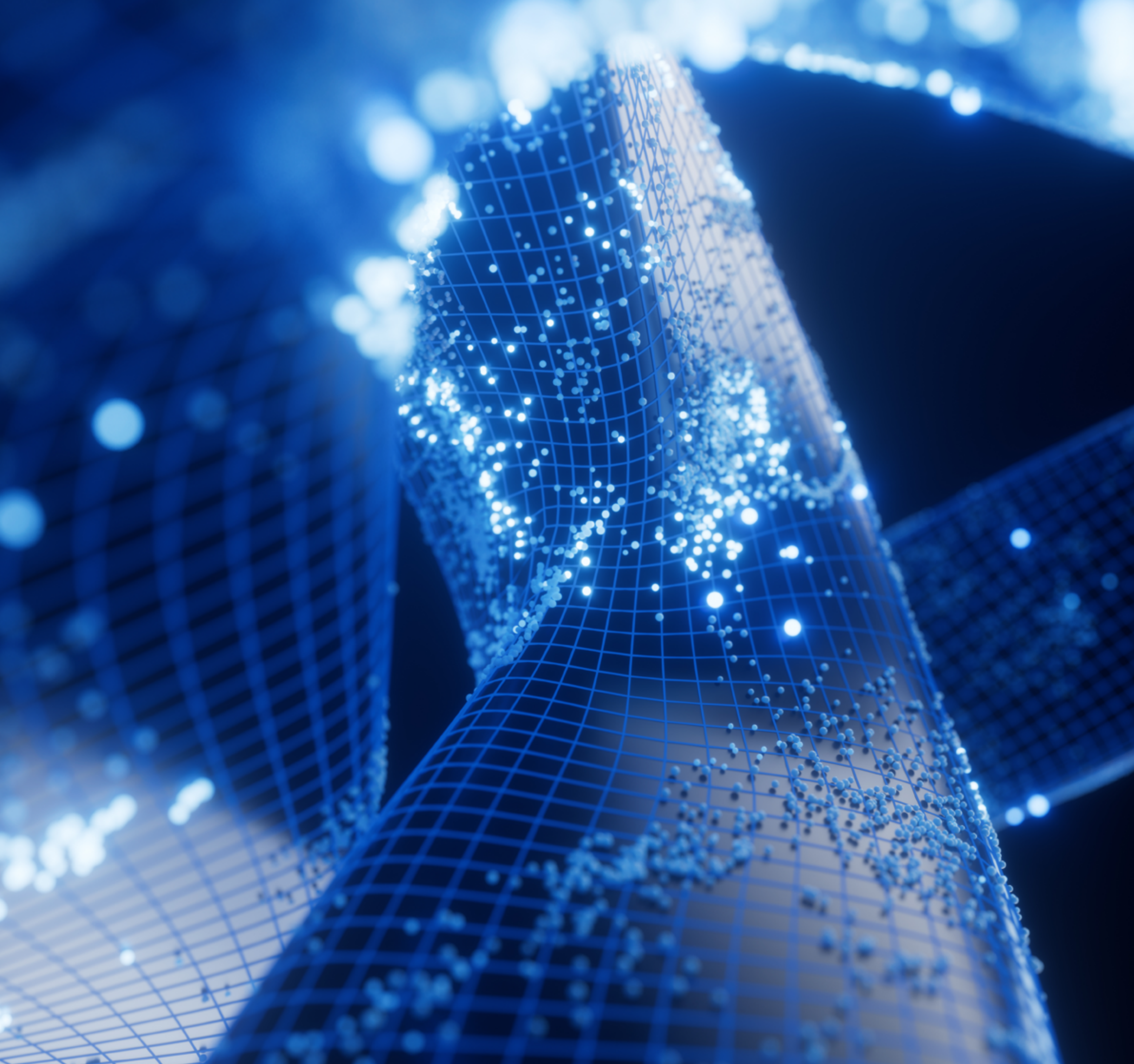

Images: Getty Images

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Foreword

Roberto Bocca
Head of Centre for Energy and Materials; Member of the Executive Committee, World Economic Forum

Samantha Zhu
Senior Managing Director, Chairperson and Market Unit Lead, Greater China, Accenture

Sustainable development emphasizes the disruption of traditional production methods and the use of innovation to drive structural transformation of the economy, industry and energy systems, steering them in a clean and low-carbon direction in order to establish a green production system.

This will be crucial for China to achieve what it terms "high-quality development", with the low-carbon transition being a way of manifesting "tech for good"– leveraging technology to promote the emerging green professions and shaping production to become more climate-friendly, as well as injecting new momentum into green economic development.

In China, industry is the second-largest source of carbon emissions, accounting for about one-third of national output in 2020.[1,2] To achieve sustainable development, the Chinese government has proposed carbon peaking and carbon neutrality (termed the "dual carbon" goals),[3] marking the industrial sector as the focal point for achieving low-carbon transformation and powering high-quality development.

Throughout the country's comprehensive upgrading process – and bearing in mind the positive impact of clean energy use on climate change and sustainable development – it will be essential to maintain a balance among energy sustainability, affordability and security.[4] For industry, both material transformation and energy transition are required. This involves optimizing the conversion of raw materials into advanced products while also mobilizing different levers for process transformation, such as electrification, energy efficiency and use optimization, and switching to clean fuels. All will require reducing industry's reliance on fossil fuels. By 2060, industry's electricity demand in China is projected to double, and this need will mainly be met by renewable energy.

China plays an increasingly important role in, and is a leading contributor to, the global transition to clean energy, spearheading the manufacturing of clean energy technologies and solutions. With its strong position in clean energy, China also holds the potential to lead the transformation of the industrial sector, driving economic growth while ensuring an equitable and sustainable transition. For end users, this shift towards clean energy by industry will be an important focus area over the next decade. The global net-zero transition depends on China's contribution, and industrial-sector companies urgently need to promote a comprehensive reshaping through sustainable actions to achieve high-quality development.

Executive summary

Ten policy options for consideration are presented to advance clean power deployment in China's industrial sector.

Industries can facilitate low-carbon energy transformation by transitioning to clean power generation and scaling green power procurement.[5] Addressing economic constraints through policy, developing industrial energy storage and promoting green power consumption are key enablers for on-site and off-site solutions. Moreover, government policies play a crucial role in driving corporate transformation by optimized market mechanisms, collectively realizing China's dual-carbon goals (carbon peaking and carbon neutrality).

FIGURE 1 **Ten policy options for consideration in deploying clean power in China's industrial sector**

Two themes	Five directions	Ten policy options for consideration
Upgrading industrial energy storage	Guiding the development of business innovation in energy storage	1 Coordinating industrial energy storage under construction and planning nationwide 2 Encouraging innovative business models and supporting policies to safeguard the benefits to all parties involved in energy storage projects
	Improving the integration of energy storage in the power market	3 Integrating energy storage with the electricity spot market at a faster rate and deepening the profit model of energy storage in the spot market 4 Expanding the range of ancillary services involved in energy storage and increasing the variety of auxiliary services available for energy storage 5 Exploring behind-the-meter distributed-power trading
Scaling up green electricity consumption	Optimizing top-level design for the green power market	6 Coordinating the advancement of green power and Green Electricity Certificate (GEC) trading to comprehensively enhance the level of green power consumption 7 Establishing a mechanism linking green power, carbon and GEC markets to stimulate trading willingness and activity
	Facilitating green power trading throughout China's provinces and regions	8 Establishing a national coordination body to address and eliminate interprovincial trade barriers 9 Creating a reasonable transmission pricing mechanism to optimize resource allocation and enhance the trading of cross-regional power resources
	Encouraging long-term green power procurement	10 Enhancing the flexibility of long-term power purchase agreements (PPAs) and exploring innovative PPA models such as sleeved long-term PPAs and virtual PPAs

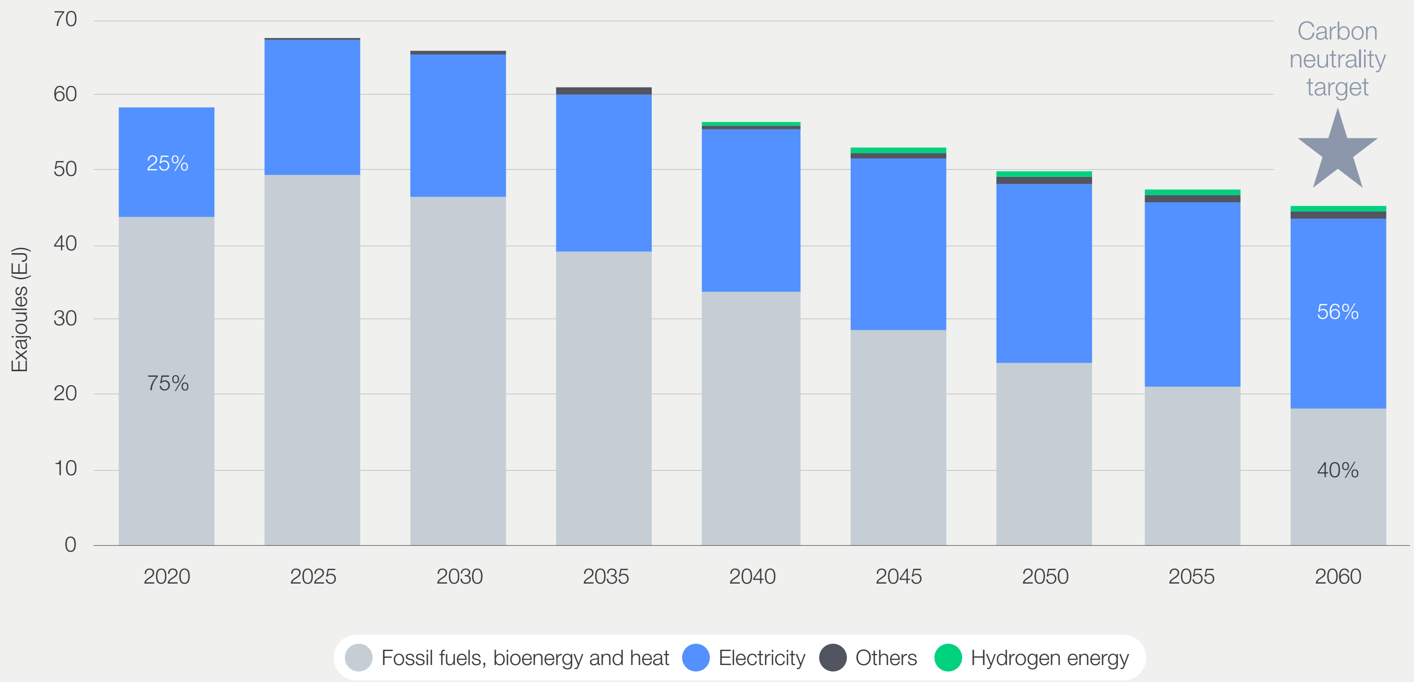
Source: Expert interview, Accenture analysis

Introduction: Clean energy use is essential for industry

China's two-step transition to a green economy must prioritize the consumption of clean energy by industry.

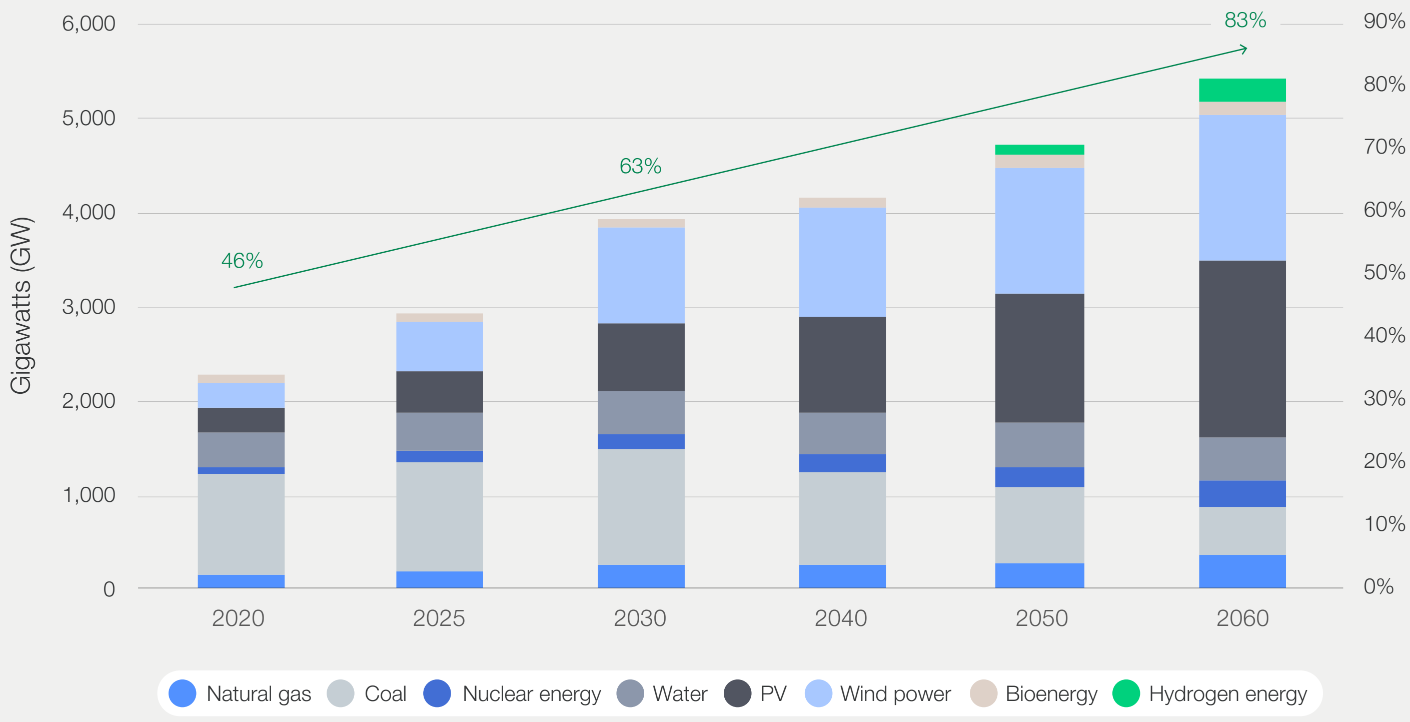
China is a significant producer of vital raw materials for industry and the source of more than half of the steel, aluminium and cement and nearly half of the chemicals and paper used worldwide. Consequently, the country has significant potential to reduce industrial emissions. The main abatement levers include enhanced electrification and increased use of clean energy to meet industrial energy needs. Electricity's share of the energy mix for industry will have to rise from 25% in 2020 to 56% by 2060 to achieve net zero, and 83% of power generation will have to come from renewables.[6]

FIGURE 2 **Projected percentage of industrial sector power to come from electricity vs. other sources by 2060**



Source: International Energy Agency, Accenture analysis

FIGURE 3 | Share of power generation from renewables



Source: International Energy Agency, Accenture analysis

Government policy is driving industry's successful transition to clean energy use

Government policy is the vital force driving the transition of industries towards clean energy and is essential to advancing clean energy deployment. By providing a strategic framework for industrial clean energy consumption, institutional optimization mechanisms and innovation models can create incentives for investment and reduce the operating costs of clean power projects, in turn stimulating the adoption of clean energy. Further, stringent environmental standards and emissions restrictions urge industrial businesses to phase out inefficient and polluting production processes and adopt cleaner, more efficient energy sources and technologies.

Scope of the study

There are two approaches for industry to deploy clean power in order to decarbonize and support electrification: transitioning to clean power generation on-site and scaling green power procurement – subject to resource availability and economic and expertise constraints.

Within the industrial sector, new technologies such as distributed renewable energy in the form of rooftop photovoltaics (PV) are maturing. However, wind and solar curtailment remains a concern for operators, despite the reduced levelized cost of electricity, which has made clean energy deployment more cost-effective.[7] On-site renewable energy distribution and storage are expected to mitigate high wind and solar curtailment rates – a solution that has recently garnered policy support from both central and local governments in China. **Beyond the industrial sector**, reforming the power market, particularly the green power market, and optimizing engagement mechanisms will help to ensure the scale-up of green power procurement.

This paper will examine how policy can strengthen the wide adoption of on-site clean energy and green power procurement in industry.

1 Upgrading industrial energy storage

Encouraging business innovation and improving the power market framework for storage integration are key to advancing the high-quality, sustainable development of industrial energy storage.

Energy storage plays an important role in clean power deployment, helping to mitigate supply fluctuations; manage peak demand periods to maintain grid stability; and improve reliability of power consumption. Recent years have seen a boom in energy storage in China. The country plans to install more than 30 gigawatts (GW) of new energy storage by 2025 and comprehensive marketization will be realized by 2030.[8]

Globally, China holds the leading position in new energy storage installations. As of the end of 2022, it had commissioned 8.7GW of new energy storage.[9] In 2022, front-of-the-meter energy storage (energy storage installed on the power supply side and grid side) accounted for 93% of new energy storage in China,[10] retaining its dominant position. However, substantial growth is anticipated in industrial and commercial energy storage.[11]

The market development mechanism for user-side energy storage, particularly in commercial and industrial sectors, has matured. Market-driven approaches have advanced storage technology and fostered sustainable development. To further enhance on-site clean energy deployment and self-consumption, it is essential to promote energy storage integration in industrial parks and businesses. Policy guidance can play a role in this process, focusing on two main areas to facilitate industrial energy storage upgrades: first, guiding the development of industrial energy storage and spurring business innovation; second, building systems for spot trading, ancillary services and behind-the-meter distributed power trading to boost operational efficiency and economic benefits for energy storage.

1.1 Guiding the development of business innovation in energy storage

Integrating new energy storage equipment with renewables such as on-site distributed PV and decentralized wind power is crucial for cleaner industrial electricity consumption. However, new energy storage largely based on electrochemical batteries remains costly. The life-cycle cost of electricity from lithium-ion batteries, for example, typically ranges from RMB 0.3/kilowatt-hour (kWh) to RMB 0.6/kWh, which is close to or above the average on-grid electricity price of RMB 0.35/kWh.[12] Decision-makers must engage stakeholders in reducing costs and increasing the efficiency of industrial and even general energy storage. Developing a mechanism for allocating relevant resources would be a major breakthrough.

Coordinating industrial energy storage installation plans: Bearing in mind the variability among Chinese regions in terms of their natural resources, economic levels, energy demands and policy environments as well differences in industry business models, value chains, energy consumption scenarios and technology levels, energy storage projects should be custom-designed to suit local conditions. While scaling up installations, nationwide coordination can guide the robust development of industrial energy storage in terms of the overall planning and layout and can lower the risk of inefficient, overlapping investments by industries, as well as maximizing the economic viability and social benefits of investing in energy storage projects and minimizing any associated cost increases from investment and construction risks.

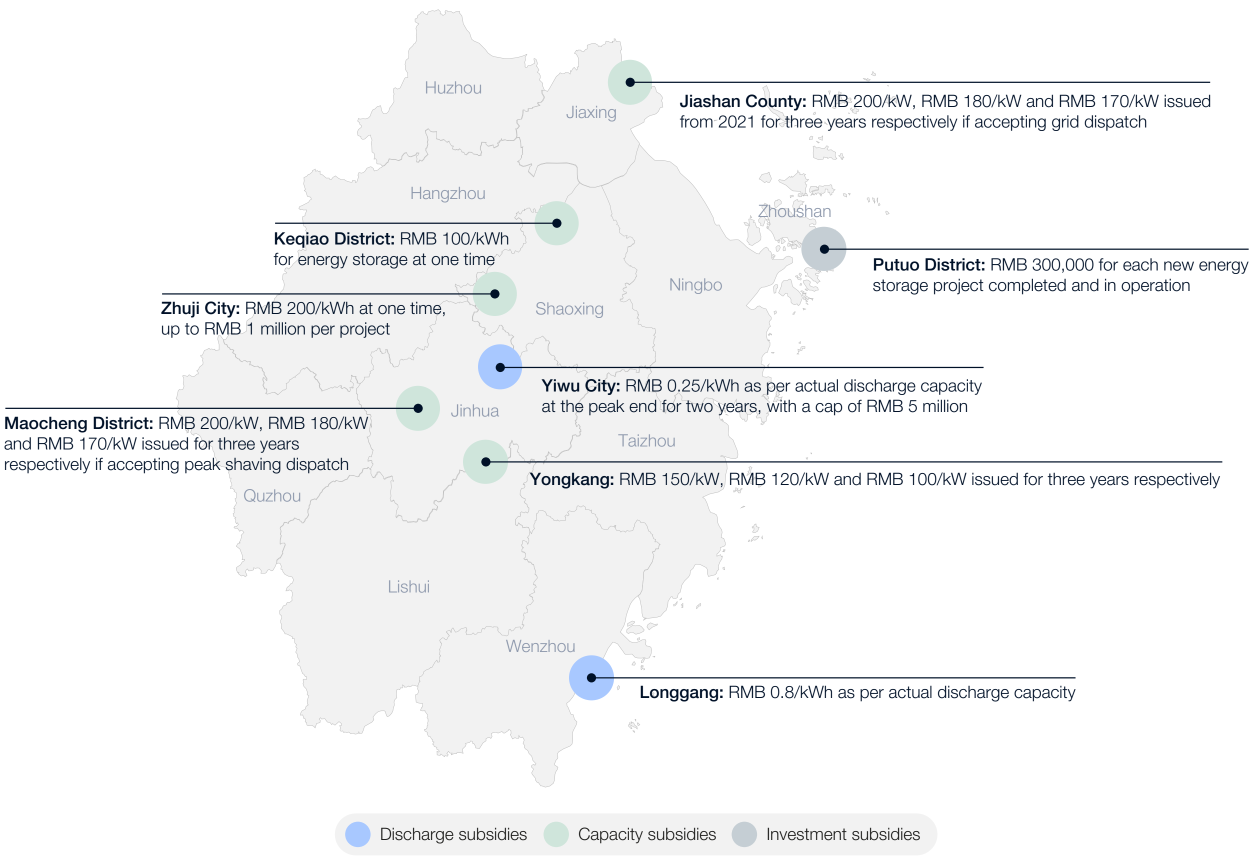
Encouraging innovative business models and supporting policies: The prohibitive cost of energy storage equipment discourages many industrial businesses from making necessary changes. Widening access to funding channels and innovative business models can slash the financing costs and ease financial burdens, while supportive policies help to protect the interests of and improve the effectiveness of all stakeholders. For example, in addition to owner investment, energy performance contracting and pure leasing, the "energy performance contracting and financing leasing" model might offer an alternative. Industrial energy storage can be combined with distributed energy storage technologies to explore application scenarios such as sharing services, virtual power plants and community energy storage, achieving integration of power "source-grid-load-storage".[13] In addition, support mechanisms should be gradually implemented. For the shared leasing market, establishing operational standards and guidelines as well as a trustworthy leasing platform for regional capacity are needed to ensure the transparency and fairness of transactions.

CASE STUDY 1

Zheijiang

In Zhejiang, market participants initially hesitated to engage with energy storage systems due to high construction costs and lengthy return periods. This has been tackled by diverse user-side incentives that enable improved project cost-effectiveness and support the development of the PV and storage industries. Developing an energy storage system now has a pay-off period comparable to that of a PV project. A new 100 megawatt (MW) industrial and commercial PV power plant equipped with a 20% capacity, two-hour energy storage system requires an investment of RMB 315 million ($43.6 million) and is projected to generate revenues of RMB 2.67 billion ($369.3 million) over 25 years with a payback period of 2.95 years. Meanwhile, an energy storage power station, costing RMB 28.4 million ($3.9 million), is forecast to achieve revenues of approximately RMB 82.59 million ($11.4 million) over eight years, with a payback period of 2.8 years.

FIGURE 4 | **Subsidies for energy storage in Zhejiang Province** (not exhaustive)



Source: Public information, Accenture analysis

1.2 Improving the integration of energy storage in the power market

Increasing the potential returns for operators can create incentives for the deployment of energy storage. There are three strategies for doing this: integrating energy storage with the electricity spot market (a market for immediate or near-term electricity trading) more quickly; introducing more types of ancillary services in the market for which energy storage can be used; and exploring behind-the-meter (BTM) solutions.[14] Policy-makers should consider using these strategies to boost industry owners' confidence in energy storage operation.

Accelerating the integration of energy storage with the electricity spot market: As the electricity spot market in China evolves from local pilots to nationwide operations, provinces including Shandong, Shanxi, Gansu, Qinghai and Guangdong have enacted policies that send two signals to the energy storage market. First, local policies will expedite the integration of energy storage into the electricity spot market. As income sources broaden, energy storage will become more cost-effective. Second, as the market-trading mechanism improves and more independent energy storage power stations are engaged and participate in spot markets, trading experience and capabilities will become increasingly important.

More pilot areas are needed for the electricity spot market. Interprovincal and regional collaboration policies will broaden both participation in the energy storage market and the range of income sources for the energy storage market. Meanwhile, industrial energy storage projects that are too small to meet market demands on their own should be encouraged to engage in spot, ancillary and long-term market trading through aggregation in virtual power plants.[15,16] Inner Mongolia, Hebei, Shanghai, and Guangdong have introduced pilot policies and guidelines.[17,18,19,20] In terms of the profit model, China encourages local regions to dynamically adjust the time division and floating proportion of time-of-use (TOU) for regulated electricity tariffs based on electricity spot market prices to reduce electricity costs for businesses.[21,22] By buying at low prices and selling at higher rates on the electricity spot market, industrial energy storage can maximize profits, thus achieving commercial viability.

Expanding the range of ancillary services energy storage operators can offer: Industrial energy storage systems could release or store electricity in response to grid commands, ensuring a balance between power supply and demand while offering ancillary services such as peak and frequency modulation. As the electricity spot market matures, peak modulation might become fully available through the electric energy market, weakening the role of peak modulation services. Developing a diversified, comprehensive ancillary services market thus becomes a new target for policy-led electricity market reforms. Increasing the variety of ancillary services provided by energy storage systems can demonstrate their flexibility and the excellence of the diversified services on offer, as well as increasing the projects' profitability.

CASE STUDY 2

United Kingdom

The United Kingdom boasts more than 20 varieties of electricity-market services that involve energy storage, either in operation or in development.[23] New service categories are on the way in response to power system changes. These offers frequency regulation services, including fixed frequency response, dynamic containment, dynamic stabilization and dynamic regulation,[24,25] which help stabilize the national grid and avert blackouts caused by frequency fluctuations.

Exploring the behind-the-meter distributed-power market: By selling electricity directly to nearby users via the distribution grid, this model bypasses the conventional process of selling electricity to grid companies at low prices before users buy back at high prices. While engaging a microgrid composed of industrial energy storage units in the direct electricity retail market on the distribution side, this model lays the groundwork for shared energy storage systems among users. Despite its benefits, distributed-power sales have experienced limited success through three developmental stages, with only a few pilots such as Suzhou Industrial Park and Wucheng Industrial Park in Zhenglu Town, Changzhou City. The limited number of implemented projects has constrained the opportunities for energy storage to participate in distributed-power sales.

FIGURE 5 | Three developmental stages of government policy-led BTM distributed-power trading

	Stage 1: Launch behind-the-meter distributed-power trading	Stage 2: Announce the first batch of pilots	Stage 3: Encourage participation in market trading
Date	October 2017	2019	Late 2021
Policy document	*Notice on Launching the Pilot Program of Distributed Power Market-Based Trading*	*Notice on Announcing the First Batch of Grid Parity Projects for Wind Power and Photovoltaic Power Generation in 2019* *Notice on Actively Promoting the Work Concerning Subsidy-Free Grid Parity for Wind Power and Photovoltaic Power Generation*	*Implementing Opinions on Deepening the Reform of "Simplifying Procedures, Decentralizing Powers, Combining Decentralization with Appropriate Control, and Optimizing Services" and Optimizing the Business Environment in the Energy Field* *Implementing Opinions on Accelerating Rural Energy Transformation to Supporting the Revitalization of Rural Areas* *Guiding Opinions on Accelerating the Construction of a Unified National Electricity Market System* *The 14th Five-Year Plan for Modern Energy System*
Highlights	– Make clear the scale cap for distributed power generation projects – Identify three trading models – Establish the verification principles for wheeling expenses	– Announce the first list of 26 distributed-power market-based trading pilots – Roll out the pilot price policy	– Provide express support for participation of distributed power in market transactions – Clearly encourage entities engaged in distributed PV and wind power to trade directly with surrounding users

Source: Accenture analysis

To continually promote the BTM market, power generators, utility and grid operators, and offtakers could coordinate in two ways to address the impact of added distributed renewable power sources on the distribution grid. The first is by establishing a reasonable, scientific pricing system that reflects the cost and value of the BTM model. Drawing from international experience, a comprehensive pricing system that includes grid-usage fees, digital trading platform costs and ancillary services costs, coupled with national-level cost monitoring, can ensure fair compensation for operational expenses.

The second is by improving the mechanisms for sharing the power-balance responsibility to address the challenges posed by BTM to grid management. The current fee structure of the grid does not adequately compensate grid companies for the services provided, leading to a mismatch between responsibilities and rights. Existing pricing for auxiliary services is overly focused on power generation and overlooks user responsibilities. By broadening the scope of ancillary services to include users and establishing a cost compensation mechanism, a more equitable cost distribution can be achieved while invigorating market participation.

CASE STUDY 3

Germany

A German company, sonnen, has rolled out the sonnenCommunity platform to facilitate peer-to-peer energy transactions for individuals, as well as small and medium-sized enterprises (SMEs). Participants can redistribute surplus power through an integrated virtual energy pool, enabled by sonnen's battery modules. The platform charges a transaction fee of €0.25/kWh alongside a monthly management fee of €20 for the use of its services.[26]

2 Scaling up green power consumption

Incentives to procure off-site green power could be created by optimizing market design, unifying nationwide trading and promoting power purchase agreements.

Despite China's ample green power supply and market-based trading policies, trading activities remain subdued. In 2023, intra-provincial green power trading amounted to 53.77 terawatt-hours (TWh), a mere 1.2% of the total intra-provincial power trading.[27] At present, industrial businesses exhibit hesitancy in expanding off-site green power procurement. To scale up their green power procurement and consumption, priority should be given to optimizing top-level design for the green power market, facilitating green power trading throughout the provinces and regions and encouraging long-term green power procurement.

2.1 Optimizing top-level design for the green power market

Optimizing top-level design for the green power market is vital for attracting greater participation from industrial businesses. In the process of engaging in green power trading, companies currently face a number of challenges, from choosing between green power and a green electricity certificate (GEC) to an absence of mechanisms to link various markets, as well as a lack of clarity regarding green power premiums. Market participants can be provided with clear guidelines to promote the use of green power and GEC trading, while coordinating linkages between market mechanisms. This will help bolster participants' confidence, in turn encouraging the sound and sustainable development of the green power market.

Coordinating the advancement of green power and GEC trading to comprehensively enhance the level of green power consumption: Currently industrial businesses can participate in the market either through green power trading (obtaining both green power and GECs) or GEC trading (obtaining GECs only). As the green power market evolves, it is essential to steer industrial businesses towards coordinating the advancement of green power and GEC trading to comprehensively enhance the level of green power consumption. Coordinating green power and GEC trading will further boost green power consumption. As such, green power trading will stimulate the development and use of renewables, forging a direct and efficient green power trading platform. This will facilitate the establishment of a unified national certification, circulation and pricing system, creating a basis for integrating green power into a national unified electricity market. Moreover, by bundling in with electric energy and GEC trading, the green power trading model improves the certification system for green power consumption, aligning better with international energy certification. GEC trading, on the other hand, offers industrial businesses not yet prepared to engage directly in green power trading a pathway to cleaner energy, thereby enhancing market inclusiveness and flexibility.

Improving the mechanism linking the green power, carbon and GEC markets: The green power market needs to enhance the mechanism for connecting with various markets. In establishing the integration among the electricity, carbon and GEC markets, it is essential to comprehensively strengthen their linkages, continue to optimize the channel for information exchange between these markets, and build a regulatory platform for environmental value transfer. This mechanism will help enhance overall coordination and promote resource sharing across market trading databases.

2.2 Facilitating green power trading throughout China's provinces and regions

China's renewables are primarily found in the western and northern regions of the country, whereas industrial businesses with high energy demands are concentrated in its eastern and southern regions, resulting in a geographical mismatch. Unless businesses from renewable-poor areas migrate to areas rich in renewables, green power transmission throughout the provinces and regions can serve to balance the supply and demand of electricity. Nonetheless, industrial green power procurement is challenged by unclear mechanisms and the need for time-consuming coordination for cross-industry, cross-cluster joint procurement and cross-regional power transmission. In places such as Shanghai, where the number of renewables is limited, businesses face either a scarcity of green power or high costs, which stifles the growth of green power procurement in the industrial sector there.

Establishing a national coordination body to address and eliminate interprovincial trade barriers: China has set a clear goal to establish a preliminary national unified electricity market system by 2025.[28] Currently, most power trading occurs within provinces, with interprovincial trading accounting for only about 20% in 2023.[29] To eliminate interprovincial barriers requires coordination at a national level. While allowing for provincial autonomy, national authorities can coordinate the distribution and efficient use of power resources nationwide, improving a unified, multi-tiered market system with national and regional synergy. Under this market system, provinces are encouraged to adopt more flexible trading models by relaxing procurement restrictions. Building upon grid-to-grid trading under prevailing unified purchases and sales, point-to-point (direct trading between a generator and an offtaker) green power trading throughout provinces should be promoted through more flexible bilateral negotiations to safeguard the rights and interests of both trading parties. To tackle the difficulties facing SMEs in relation to green power consumption, cross-industry joint procurement should be facilitated for businesses, allowing them to engage in cross-provincial green power trading in the form of an industry cluster. This will ease the burden on grid coordination and augment the price advantage of large-scale green power procurement. Enhancing interprovincial power dispatching capabilities will help ensure reliable power transmission.

Creating a reasonable transmission pricing mechanism to optimize resource allocation and enhance the trading of cross-regional power resources: Interprovincial power-trading efficiency can be boosted by establishing a guarantee mechanism for cross-regional transaction prices and regulating transmission fees. The accumulated transmission fees of interprovincial power trading increase trading costs and reduce trading volumes, undermining the execution of cost-effective trading schemes. Solving these issues will entail refining the pricing system and building a price-guarantee mechanism that reflects market conditions dynamically. This means adjusting transmission prices to mirror market supply and demand, transmission losses and network congestion, distributing costs fairly and transparently and stimulating interprovincial trading. Meanwhile, policy reform and changes to the regulatory framework are needed to provide support for such mechanisms, ensuring fair benefits and driving the energy transition and the healthy growth of the power market.

2.3 Encouraging long-term green power procurement

China encourages businesses to sign 5–10 year renewable energy purchase agreements for mid-to-long-term power trading,[30] while guiding local governments to prioritize the processing and approval of multi-year contracts.[31] However, few long-term green power purchase agreements (PPAs) have been taken up in China and they remain in the market cultivation and initiation stages. In practice, such long-term agreements offer users locked-in costs but at the expense of stability risks in the long run, so meeting the demand of industrial businesses for stable power consumption and solving the difficulties and pain points of long-term green power purchase are key to promoting long-term PPAs and supporting clean energy consumption in China's industrial sector.

To enforce long-term purchases, more flexible green PPAs and innovative tools must be adopted. Alongside optimizing traditional long-term green PPAs, there is room to explore innovative purchase models such as sleeved PPAs with third-party retailers, virtual PPAs (VPPAs) and hybrid PPAs (see Table 1).

TABLE 1 | **PPA model cases and practices** (non-exhaustive)

	Power purchase agreement (PPA)	Sleeved PPA	Private-wire PPA	Virtual/synthetic PPA (VPPA)	Other emerging contractual structures
Challenges addressed	Uncertainty of long-term power costs Need for secure, stable power supply Compliance with environmental regulations	Technical barriers for regular PPA between power users and generators Mismatch between generation and load Intermittency of renewable energy sources	Grid transmission fees Occupation of grid resources	Generator and users located in separate grid systems Fluctuations in long-term electricity prices	24/7 clean power model: granular (e.g. hourly) matching of power demand with supply Blockchain: traceability and tokenization of energy sources Multibuyer/aggregated PPA: resolves lack of bargaining power for SMEs
Definition and application	Contracts in China with a term of five-plus years based on the medium-to-long-term power-trading framework	PPAs between offtakers and generators, with mirror agreements between offtakers and intermediaries (retailers/utilities), authorizing the intermediaries to offer balancing services to meet load as needed Provides consumers with long-term renewable energy security and reduces the impact of supply uncertainty on business operations	Private transmission line between the contracting parties, with privately owned facilities for physical delivery of power Suitable for situations in which the source of power generation is close to the power users	A contract for difference (CfD) as a financial product with no physical delivery of power The generator and the consumer define a strike price, and both parties exchange the difference between the strike price and the market price	Integration of leading technology or innovative business models into PPAs
Advantages	Long-term electricity security for consumers Long-term locking-in of electricity costs	Reduction of the impact of renewable energy supply variability on business operations	Avoidance of public grid transmission fees Significant bargaining power for businesses over generators	Hedging against electricity-market price volatility High degree of freedom for consumers	Flexibility and improved power quality while securing stable prices, market hedging benefits and supply
Key points for implementation	Contracting parties agree on contract duration, electricity structure, price structure and ownership of environmental certificates	Cooperation and a separate mirror agreement with an intermediary Suitable for companies seeking to stabilize power supply and reduce cost uncertainties	Contracting parties need to be in close proximity Need to secure capital expenditure and capability for operations and maintenance	Regulatory requirements for financial instruments Virtual PPAs need to ensure environmental credits or renewable energy guarantees of origin (REGOs)	
Cases	Covestro signed several multi-year PPAs with CGN New Energy for 300GWh of wind and solar power annually[32] Linde signed separate 25-year PPAs with Guangdong Energy Group and China Three Gorges for a total of 320GWh of solar power per year[33] BASF signed a 25-year fixed-price PPA with Brookfield using levelized cost of electricity (LCOE) as a baseline to provide 100% renewable power for its Verbund site in Zhanjiang, China[34]	Meta in the US signed a special service contract with the Public Service Company of New Mexico (PNM), which engaged in PPAs with power generators to provide a green tariff service to Meta data centres[35]	In the United Kingdom, a Welsh Water treatment plant entered a private-wire PPA for the procurement of electricity from a nearby 9MW solar farm developed by Cardiff Council[36]	BT Group entered a 10-year fixed-price VPPA with BayWa r.e. for 80% of the Dalquhandy wind energy, including an associated REGO[37] Microsoft Japan signed a 20-year VPPA with Shizen Energy for solar power from the Inuyama project, and the VPPA helped the project secure financing from Société Générale[38] GDS entered a 21-year VPPA with Cenergi in Malaysia to power its data centre park in Johor[39]	Google, in collaboration with LevelTen Energy, piloted a more intelligent and agile PPA contracting method, facilitating the use of 24/7 carbon-free energy[40,41] Merck China signed a 10-year PPA with China Resources Power based on blockchain technology to track the origin of renewable energy[42] Thermo Fisher Scientific and Eurofins Scientific jointly signed a 15-year, 127MW solar VPPA with ib vogt in Spain[43,44]

Source: Accenture analysis

Conclusion

Transitioning to cleaner energy is crucial if China is to meet its net-zero target for the industrial sector.

In the next decade, China is set to expedite industrial decarbonization, with the intention of shifting from controlling energy consumption and intensity to controlling carbon emissions and carbon intensity. In this process, the government could play a much more proactive role in identifying practical applications and boosting businesses' confidence to participate.

For Chinese industry to deploy clean power on a large scale, it will be necessary to:

1. Upgrade industrial energy storage by reducing storage costs and enhancing the economic benefits of storage operations.

2. Scale up green power consumption by optimizing top-level design for the green power market, facilitating green power trading throughout China's provinces and regions and encouraging long-term green power procurement.

On the production side, the integration of green power with the production of downstream raw materials – such as green hydrogen, green ammonia and green methanol – could be strengthened. On the infrastructure side, the new power systems could be optimized to balance the grid expansion and the cost-effectiveness of user-side BTM facilities. On the demand side, participation in demand response could be incentivized to facilitate the grid's supply-and-demand balance amid the growing integration of renewables.

While the pathways and timelines for carbon peaking may vary among industries, there is a consensus that it is essential to raise the share of clean power and reduce GHG emissions. As the economy develops and emerging sectors come to prominence, the structure of carbon emissions in China's industries is expected to undergo significant changes, with shifts in the sectors that are the primary sources. The soaring demand for computational power from generative AI, for example, will lead to a surge in electricity consumption among high-tech, internet and telecommunication businesses with in-house data centres. New challenges will also arise from balancing industrial upgrading and the clean energy transition.

Collaborative efforts among government, businesses, multilateral agencies and all sectors of society are imperative. More policies and measures are needed to speed up research and development, hasten the application of clean energy technologies, accelerate China's nationally determined contributions amid global action against climate change and propel the country's economy and its society towards a sustainable transition.

Contributors

World Economic Forum

Yiran He
Specialist, Industry Decarbonization, World Economic Forum, China

Eleni Kemene
Lead, Industry Decarbonization, World Economic Forum, Switzerland

Accenture

Xiaopeng Fan
Lead, Net Zero Transitions, Greater China

Kaiqi Hu
Strategy Consultant, Greater China

Alec Yue Zhang
Strategy Manager, Greater China

Xun Zhang
Lead, Sustainability Services, Greater China

Advisers

Roberto Bocca
Head of Centre for Energy and Materials; Member of the Executive Committee, World Economic Forum

Kristen Panerali
Head, Clean Power, Grids and Electrification, World Economic Forum

Julie Romanet-Perroux
Managing Director – Energy Transition, Accenture

Jörgen Sandström
Head, Transforming Industrial Ecosystems, World Economic Forum

Justin Stark
Net Zero Transitions Manager, Accenture

Miguel Torreira
Global Utilities Strategy Lead, Accenture

Carol Zhou
Head of Centres and Impact, Greater China, World Economic Forum

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China Centre for Information Industry Development, Ministry of Industry and Information Technology

Mingfu Chen
Advisor, Digital and Green Transition

Wenqiang Liu
Vice-President; Director-General, Carbon Peaking and Carbon Neutrality Research Center for Industry and Information Technology

Yang Liu
Deputy Director, International Cooperation

Zhihua Shao
Deputy General Manager, Suzhou

Weidong Zhao
Director, Energy Saving and Environmental Protection

Yue Zhao
Chief, Green Energy Research Office

Expert Advisory Group

Jan-Peter Bredehöft, Senior Vice-President Operations and Site Management Greater China, BASF

Tori Liu, Director, Public Affairs, Trina Solar

Linwei Ma, Director, Tsinghua-Rio Tinto Research Centre, Tsinghua University

Shubin Niu, Vice-President, GCL-ET

Linhua Tang, Leader, Information, Shanying Zhejiang

Jinglei Tian, Director, Research Centre for Sustainable Development, HBIS Group

Kevin Tu, Managing Director, Agora Energy Transition China

Danyang Wang, Branding Director, JinkoSolar

Weiquan Wang, Deputy Secretary General, Chinese Renewable Energy Industries Association (CREIA)

Lei Yang, Deputy President of the Institute of Energy, Peking University

Chenchen Yao, Director, Head of ESG, JinkoSolar

Chen Zhao, General Manager, Government Affairs, Rio Tinto China

Frank Zhong, Deputy Director General, World Steel Association

Additional stakeholders

Alf Barrios, Chief Commercial Officer; China Chair, Rio Tinto

Hrvoje Bujanović, State Secretary, Ministry of Economy and Sustainable Development of Croatia

Haisheng Chen, Chairman, China Energy Storage Alliance

Liming Chen, Chair of Greater China, World Economic Forum

Jifan Gao, Chairman and Chief Executive Officer, Trina Solar

Sanjeev Gupta, Executive Director, Financial Services, Africa Finance Corporation

Songxian Jiang, Programme Specialist, China Climate Action, World Economic Forum

Jan Klawitter, Head, International Policy, Anglo American

Vee Li, Energy Sector Lead, China Climate Action, World Economic Forum

Yiren Li, Deputy General Manager, HBIS Group; Associate Dean, World Steel Development Research Institute

Ella Yutong Lin, Lead, Programming and Communications, World Economic Forum

Wei Liu, Secretary-General, China Energy Storage Alliance

Wenli Liu, Deputy Director-General of International Business Department, China Huaneng Group

Xiaoshi Liu, Executive Deputy Secretary-General, China EV100

Simon O'Connell, Chief Executive Officer, SNV

Xinhong Qin, Partner Service Lead, Business Engagement China, World Economic Forum

Thammasak Sethaudom, President and Chief Executive Officer, Siam Cement Group

Stephanie Shi, Curator, Centre for Energy and Materials, World Economic Forum

Minglong Wang, Deputy General Manager, Datang Shandong

Bing Xia, Government Engagement Lead, CRTG China, World Economic Forum

Simon Yang, Global Vice-President; China President, bp Group

Yong Yu, Chairman, HBIS Group

Yong Zhao, President, China Huaneng Group Energy Research Institute

Samantha Zhu, Chairperson; Market Unit Lead, Greater China, Accenture

Production

Bianca Gay-Fulconis
Designer, 1-Pact Edition

Alison Moore
Editor, Astra Content

Endnotes

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World Economic Forum
91–93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland

Tel.: +41 (0) 22 869 1212
Fax: +41 (0) 22 786 2744
contact@weforum.org
www.weforum.org