Institute of Energy, Peking University

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FROM INDUSTRY PRACTICE TO REGIONAL COORDINATION

Practices and Prospects for Asia-Pacific Energy Cooperation and Coordination

北京大学能源研究院
INSTITUTE OF ENERGY

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China's Participation in APEC Energy Partnership Network
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TABLE OF CONTENTS

Executive Summary

The Asia-Pacific region is at a critical juncture where rising energy security risks, accelerating green transition, and industrial restructuring are unfolding in parallel. Economies in the region vary significantly in resource endowments, development stages, industrial foundations, market structures, and governance capabilities. These differences create considerable complementarity for energy cooperation, while adding complexity to cross-border project implementation and regional coordination. This report delves into corporate practices in energy storage, hydrogen, wind power, photovoltaics (PV), transport electrification, and low-carbon fuels, as well as the practices of industry platforms and China's Participation in APEC Energy Partnership Network. It analyzes the evolving trajectory of Asia-Pacific energy cooperation—from product trade and individual projects toward industry chain collaboration, multi-stakeholder participation, and institutional coordination.

This report identifies four common challenges currently facing Asia-Pacific energy cooperation: First, institutional and market disparities across economies raise project adaptation costs. Second, technical standards, testing and certification, and carbon accounting frameworks are not yet fully aligned. Third, infrastructure and local industrial capacity building are relatively underdeveloped. Fourth, revenue mechanisms and long-term investment security for renewable energy projects still need improvement. Relevant practices also offer four key takeaways: First, industry practice serves as an important starting point for identifying regional cooperation needs and priorities. Second, localization and industry chain collaboration are essential to enhancing the long-term value of cross-border cooperation. Third, synergy between infrastructure and market mechanisms plays a key role in expanding energy system services through renewable energy technologies. Fourth, multi-stakeholder coordination and experience translation are vital safeguards for boosting regional cooperation effectiveness.

Building on the above analysis, this report calls on Asia-Pacific economies to uphold voluntary-cooperation principles of "for all, openness, synergy, pragmatism, and universal benefit". On the basis of respecting differences, voluntary participation, and mutual benefit, priority should be given to advancing cooperation in five areas: First, strengthening regional energy resilience and energy security to consolidate the foundation for shared development. Second, enhancing power infrastructure resilience and boosting system regulation and risk response capabilities. Third, optimizing the regional allocation of clean energy to open up space for industrial and investment cooperation. Fourth, promoting energy inclusivity and capacity building for shared gains from energy transition. Fifth, leveraging digital and intelligent technologies to improve the effectiveness of coordination and pragmatic cooperation. By strengthening industry chain collaboration, regulatory alignment, infrastructure development, investment security, and research outcome commercialization, Asia-Pacific energy cooperation can progressively evolve from project-based collaboration toward long-term, stable, and multi-layered institutional coordination.

Chapter 1 Research Background

1.1 Asia-Pacific Energy Cooperation Enters a New Phase with Equal Emphasis on Security, Transition, and Development

The Asia-Pacific is one of the world's most vibrant regions in terms of energy production, consumption, trade, and technological innovation. It comprises both resource-rich economies and manufacturing and service hubs that depend heavily on energy imports. It includes both advanced economies with well-established power infrastructure and mature energy markets, and emerging economies still advancing universal energy access, grid upgrading, and industrialization. These disparities in resource endowments, development stages, industry mix, and governance capabilities have long created considerable complementarity for energy cooperation. As a result, regional energy cooperation cannot rely on energy trade or project-based investment models alone, but requires more systematic coordination across industry, technology, infrastructure, market rules, and governance mechanisms.

In recent years, the global energy landscape has undergone profound shifts, exposing Asia-Pacific energy cooperation to an increasingly complex external environment. On the one hand, geopolitical tensions, volatile international energy prices, supply chain restructuring, and more frequent extreme weather events have once again put energy security high on policy agendas across the region. For economies with heavy reliance on energy imports, a stable, affordable, and diversified energy supply remains essential to economic performance and public well-being. On the other hand, continued climate action and energy transition efforts—driven by rapid advances in low-carbon technologies such as wind power, photovoltaics, energy storage, new energy vehicles, hydrogen, and carbon capture, utilization, and storage (CCUS)—are reshaping the region's energy industry chains, value chains, and governance structures. The focus of energy cooperation is shifting from traditional resource supply and power project development to a wider range of areas, including renewable energy manufacturing, localized industry chains, energy storage-based regulation, and the integration of energy and transport.

In 2026, China assumes the role of APEC rotating chair and host of the annual APEC meetings. Under the theme of forging "an Innovative and Synergistic Asia-Pacific Energy Community for All", China has identified three priority areas: high-quality universal energy access, artificial intelligence (AI) plus energy, and energy cooperation and coordination. This demonstrates that Asia-Pacific energy cooperation has moved beyond energy trade between supply and demand sides, and beyond intergovernmental policy exchanges. It now calls for an integrated approach that brings together energy security, industrial development, technological innovation, investment cooperation, and improvements in people's lives to shape a more pragmatic, open, and sustainable regional cooperation framework.

Against this backdrop, deepening energy cooperation and coordination in the Asia-Pacific carries significant strategic importance. First, it enhances regional energy security and resilience. Through cross-border power cooperation, interconnection of critical energy infrastructure, and collaboration on energy technologies and industry chains, Asia-Pacific economies can optimize resource allocation on a broader geographic scale and mitigate the risks associated with reliance on any single energy source, supply chain, or market. Second, it helps align the energy transition with industrial development. New energy cooperation should go beyond equipment exports and project development to stimulate local manufacturing, skills training, job creation, supply chain building, and industrial upgrading—thereby turning the energy transition into a new driver of regional economic growth. Third, it improves regional rules and governance capacity. As the share of renewable energy goes up and cross-border energy cooperation deepens, issues related to project development, grid access standards, electricity markets, green certification, carbon accounting, environmental and social responsibility, data security, and long-term operation and maintenance are becoming more salient. Addressing these challenges requires more robust coordination mechanisms among governments, businesses, financial institutions, technical organizations, and local communities.

1.2 Multilateral Energy Cooperation Requires Stronger Industry Linkages and Practical Support

Existing multilateral cooperation mechanisms have played an important role in policy dialogue, experience sharing, and capacity building. However, there is still room for improvement in facilitating the implementation of complex energy projects, aligning with industry needs, and synergizing market rules. First, energy projects tend to involve large-scale investment, long development cycles, multiple stakeholders, and complex regulatory requirements. Principles-based initiatives alone are insufficient to address the practical challenges of project implementation, ranging from permitting and financing to grid connection, land use, community engagement, and operational responsibilities. Second, Asia-Pacific economies differ significantly in their energy market rules and policy frameworks. New energy projects often have to navigate multiple institutional differences, including localization requirements, grid access rules, electricity pricing mechanisms, environmental permitting, green certification, and cross-border settlement. Third, energy cooperation increasingly involves companies' technology roadmaps, business models, data platforms, supply chain governance, and long-term service capabilities. Only when closely aligned with corporate practice can intergovernmental policy exchanges lead to feasible and replicable cooperation pathways.

For these reasons, Asia-Pacific energy cooperation and coordination needs to further evolve from being driven by mechanism to being led by industry practice. An industry-practice-led approach means that, based on government efforts in building platforms, refining rules and balancing interests, business projects serve as a vehicle, through which technology, capital, engineering capacity, operational expertise, and local needs are brought together. Through this process, problems are identified, solutions are developed, and rules are solidified. As shown by the cross-border cooperation practices of energy companies, demonstration projects generally go beyond equipment supply or engineering contracting. Instead, they feature comprehensive arrangements—joint ventures, local manufacturing, talent cultivation, long-term operation and maintenance, community engagement, green financing, and alignment of standards—all tailored to the host country's energy transition and industrial development goals. Corporate practices in energy storage, photovoltaics, wind power, hydrogen, and new energy vehicles offer a critical lens for understanding and addressing the institutional barriers identified above.

In this sense, corporate case studies are not merely materials for showcasing the achievements of Asia-Pacific energy cooperation; they also help reveal the mechanisms of regional energy cooperation and coordination. By examining the cooperative practices of leading energy companies from China and other APEC economies in areas such as energy storage, photovoltaics, wind power, transport electrification, and low-carbon energy infrastructure, common challenges in Asia-Pacific energy cooperation can be identified, replicable experience can be gained, and forward-looking policy initiatives can be proposed.

Chapter 2 Enterprise, Industry Platform, and Partnership Network Practices in Asia-Pacific Energy Cooperation and Coordination

This chapter examines cases of pragmatic cooperation involving companies from China and other APEC economies, industry platforms, and China's Participation in APEC Energy Partnership Network, forming a case-based framework featuring "corporate practices-industry platforms-multilateral mechanisms". Cases from Chinese companies highlight capabilities in industry chain collaboration, project implementation, and integrated solution development in the Asia-Pacific region. Cases from companies in other APEC economies focus on international experience in low-carbon transition of traditional energy and clean energy applications. Cases from industry platforms and the Partnership Network illustrate how policy research, industrial coordination, and multilateral cooperation mechanisms can translate challenges and demands identified in frontline corporate practice into regional cooperation priorities.

2.1 Chinese Corporate Practices in Asia-Pacific Energy Cooperation

1. CATL: Boosting clean energy integration and grid resilience in the Asia-Pacific through solar-plus-storage systems

Contemporary Amperex Technology Co., Limited (CATL) is a global pacesetter in renewable energy power batteries, energy storage batteries, and system solutions. In recent years, the company has been deeply involved in clean energy infrastructure development across the Asia-Pacific, building a portfolio of representative projects in Southeast Asia, Oceania, and other APEC economies—spanning storage system integration, renewable energy integration, and grid resilience.

In Southeast Asia, CATL has deployed a 227 MW solar PV plus 100 MW/451 MWh storage solution for the SCM/IKIP industrial park in Indonesia. Designed for an off-grid mining site, the solar-plus-storage system replaces traditional diesel generation, cutting power costs by 50% and carbon emissions by 90%. Beyond promoting the green transition of energy-intensive nickel processing, the project also offers a model of clean energy supply for remote areas and off-grid industrial parks in island economies. In Oceania, CATL has provided the Collie battery energy storage system (500 MW/2,400 MWh) for Synergy, an energy efficiency contractor, in Western Australia, and is participating in the first phase of the Reeves Plains Energy Hub (250 MW/1,000 MWh) in South Australia. These projects are connected to the main grids, supporting the orderly retirement of coal-fired power while enabling high-proportion renewable energy integration.

From the perspective of regional energy development, these projects have three implications. First, they enhance renewable energy integration. Despite high rooftop solar penetration, Western Australia faces significant temporal and spatial mismatch between supply and demand, compounded by limited grid flexibility. Large-scale storage can absorb excess solar power during daytime off-peak hours and discharge during evening peak hours, helping to relieve grid balancing pressures. Second, they strengthen energy resilience. The storage systems offer millisecond-level frequency response and voltage support to the grid, enhancing its operational stability amid extreme weather events, conventional power plant retirements, and fluctuations in power supply and demand. Third, they facilitate low-carbon industrial transition. The Indonesian project focuses on critical minerals such as nickel processing, enabling energy-intensive industrial parks to adopt clean power models and helping mining and metallurgy companies meet rising international standards on carbon footprints, green supply chains, and low-carbon compliance. Located in a traditional coal industry region, the Collie project in Western Australia supports the orderly retirement of coal-fired power and the development of renewables. Meanwhile, it drives local community transformation and green job creation, boosting the industrial and employment transition in traditional energy regions.

Cross-border project implementation is often complicated by differing institutional environments in various economies. First, varying energy governance models and market mechanisms across economies mean that storage projects must operate under very different commercial logics—from market-based power dispatch frameworks to vertical management systems for state-owned public utilities. Companies need to redesign business models for each market, which greatly drives up the cost of scaling clean energy technologies across regions. Second, the lack of mutual recognition in technical standards and certification systems—covering storage safety, grid connection codes, and testing and certification—requires companies to repeatedly adapt and re-certify for different markets, adding to project adaptation and compliance costs. Third, there is often a phased mismatch between policy requirements and the capacity of local supply chains. Some economies set high local procurement ratios for renewable energy equipment, yet domestic manufacturing and service capacities are still nascent, creating temporary tensions between policy aspirations and industrial readiness. Fourth, large storage projects require long investment payback periods (often exceeding 15 years), while some economies adjust energy policies and electricity pricing mechanisms on shorter cycles. This might lead to retroactive contract adjustments and uncertainty in projected returns, discouraging large-scale private capital participation.

2. CIMC Enric: Multi-scenario demonstration and institutional exploration of hydrogen and green fuel infrastructure

CIMC Enric Holdings Limited ("CIMC Enric") is the clean energy equipment and engineering services arm of China International Marine Containers (Group) Co., Ltd., also known as CIMC. It mainly provides storage and transportation equipment, processing facilities, and system solutions for clean energy. In recent years, building on its clean energy capacity and hydrogen storage and transportation equipment, the company has expanded into hydrogen refueling facilities, distributed hydrogen power generation, and low-carbon marine fuels such as green methanol. It has also worked with public utility companies, science and technology parks, and relevant government departments in Hong Kong to explore multi-scenario applications of urban hydrogen and green marine fuels.

In terms of commercial buildings, CIMC Enric partnered with The Hong Kong and China Gas Company (Towngas) in a hydrogen refueling and power generation project at a commercial building in North Point. The project uses modular hydrogen storage and fuel cell systems to provide power supply, electric vehicle charging, and emergency backup power for the building. As for science and technology parks, CIMC Enric served as the EPC contractor for a pipeline hydrogen extraction and fuel cell power generation demonstration project of the Hong Kong Science & Technology Parks Corporation. The project extracts hydrogen from hydrogen-enriched gas in the municipal gas pipeline network and generates electricity on site, exploring an innovative pathway for repurposing existing gas infrastructure and integrating distributed energy resources into urban systems. In the green shipping sector, CIMC Enric has partnered with the Transport and Logistics Bureau of the Government of the Hong Kong SAR to develop a cross-regional green methanol supply chain, featuring "production in South China, storage and transportation in Zhanjiang (a coastal city in Guangdong Province), and anchorage bunkering in Hong Kong". The project completed the first commercial anchorage bunkering demonstration in Hong Kong for methanol dual-fuel vessels sailing on major routes between China and Europe, covering production, storage and transportation, and bunkering, and providing a practical reference for developing the Asia-Pacific green shipping corridor.

From the perspective of regional energy cooperation, these practices have four key implications. First, they enable more efficient use of existing energy infrastructure. Pipeline hydrogen extraction leverages Hong Kong's existing gas network to develop distributed hydrogen power, which can supply energy locally during peak demand. Green methanol connects production in South

China, storage and transportation in Zhanjiang, and anchorage bunkering in Hong Kong, facilitating the coordinated use of regional energy resources. Second, they expand low-carbon transition pathways for urban areas and the shipping sector. Hydrogen applications extend to commercial buildings, science and technology parks, and other urban settings—models that can be further scaled to coastal cities and port logistics. Green methanol anchorage bunkering provides practical reference for low-carbon fuel substitution in ocean-going shipping. Third, they diversify the regional clean energy supply mix. Pipeline hydrogen extraction complements green hydrogen imported from the Greater Bay Area. Hydrogen storage and transportation can supplement cross-regional energy transmission and adapt to distributed energy resource needs in islands and remote areas. Besides, the cross-regional green methanol supply chain further expands the sources of low-carbon marine fuels. Fourth, they enhance energy security and resilience. Distributed hydrogen can provide backup power during grid failures and extreme weather events. The model of in-situ pipeline hydrogen extraction and distributed hydrogen power helps strengthen the resilience of the energy system. Cross-regional storage, transportation, and port bunkering of green methanol also contribute to the stability of shipping fuel supply.

Project practices also reveal that the cross-regional development of hydrogen and green marine fuels continues to face multiple institutional and market barriers. First, emerging sectors such as hydrogen and green methanol involve multiple regulatory domains—including gas supply, hydrogen production, power generation, and port fuel operations—and the routine approval and regulation mechanisms for the energy sector still need to be improved. Differences across economies in market access, hazardous materials management, and port operations add to the coordination costs and investment uncertainty of cross-regional projects. Second, testing and certification, carbon accounting and traceability, and bunkering code of practice for hydrogen equipment, low-carbon hydrogen, and green methanol are not yet fully aligned, increasing project adaptation and market development costs across regions. Third, mechanisms for cross-border energy flows, cross-regional carbon value transfer, and project revenue streams still need to be strengthened. Distributed hydrogen and green methanol projects require substantial investment and place higher demands on long-term, stable market frameworks. In addition, Hong Kong's hydrogen supply and regional storage and transportation networks require greater coordination, while the alignment between green methanol production, storage and transportation, and port bunkering facilities needs to be enhanced to support the large-scale application of these models.

3. Envision Energy: Supporting Mexico's low-carbon energy transition through a smart wind power project

Envision Energy Co. Ltd. ("Envision Energy") is a prominent global green technology company specializing in smart wind power, intelligent energy storage systems, and green hydrogen solutions. Within APEC economies, Envision Energy has participated in local renewable energy development through project investment, equipment supply, digital management, and long-term operations and maintenance (O&M), with its business gradually extending to full-lifecycle project services.

In Mexico, Envision Energy has co-invested in a wind power project on the Yucatán Peninsula, together with local renewable energy developer Vive Energía and a Spanish enterprise. Envision Energy supplied the wind turbines for the project, along with a 10-year package of intelligent monitoring, predictive maintenance, and on-site services. With an installed capacity of 92.4 MW, the project went into operation in July 2020. Between 2021 and 2023, annual net electricity generation remained stable at 280-290 GWh, helping to ease the power supply gap in Yucatán State, reduce its reliance on electricity from other Mexican states, and enhance regional energy self-sufficiency. The project secured power purchase and clean energy certificate contracts through Mexico's Long-Term Power Auction (LTPA), with a 15-year power supply agreement and a 20-year Clean Energy Certificate, providing long-term revenue certainty.

From the perspective of regional energy development, this project not only expanded clean power supply, but also created a cooperation model that brings together the complementary strengths of companies from various countries. To be specific, it combines Envision Energy's wind power equipment, digital monitoring, and long-term O&M capabilities, the Spanish partner's infrastructure investment and project management experience, and the local developer's market development, stakeholder coordination, and commercial operation expertise. The project development and operation was underpinned by Mexico's LTPA mechanism, which demonstrates the synergy between cross-border capital, technology and equipment, local development capabilities, and energy market rules. In addition, the project includes community liaison, private investment, and renewable energy technology training, supporting the cultivation of local professionals and project O&M capacity building.

Project experience shows that cross-border wind power cooperation encompasses full-lifecycle governance requirements, from technology adaptation and long-term O&M to environmental management and community engagement. The Yucatán region's high temperatures, high salinity, and high humidity call for adaptive design of wind power equipment to suit the environmental conditions. Once operational, the equipment relies on local service teams, intelligent monitoring, and predictive maintenance systems to ensure long-term stable performance. Complementing these efforts, the project has set up a community liaison office and carried out environmental monitoring and technical training. This demonstrates that large-scale, cross-border wind power projects require sustained community engagement, environmental management, and local capacity building, in addition to addressing technical, financing, and market access challenges, to deliver long-term stable operation.

4. LONGi: Strengthening the Asia-Pacific photovoltaic industry chain through local manufacturing

LONGi Green Energy Technology Co., Ltd. ("LONGi") is a major global provider of photovoltaic technology and product solutions. The company established production capacity in Malaysia at an early stage, building a local manufacturing system covering silicon ingots, wafers, cells, and modules, positioning Malaysia as a key hub for its manufacturing and operational footprint across the Asia-Pacific region.

In East Malaysia, LONGi has built production bases in Kuching and Bintulu, Sarawak, since 2016, gradually developing a vertically integrated manufacturing chain—from silicon ingots and wafers to cells and modules. In West Malaysia, LONGi has put in place the first phase of its module plant in Serendah, Selangor, in 2023. The plant will be built in two phases, with total photovoltaic capacity reaching 8.8 GW upon full completion. The first phase has created approximately 900 local jobs, with more than 2,000 expected in the future. In 2023, LONGi employed over 8,000 people at its Malaysian facilities, of whom 99.9% were local hires.

From the perspective of regional energy and industrial development, LONGi's business presence in Malaysia has helped shift photovoltaic cooperation from product trade toward local manufacturing and industry chain collaboration. First, it has strengthened the local PV manufacturing ecosystem. LONGi's production bases in Kuching, Bintulu, and Selangor have a combined annual capacity exceeding 10 GW, making them an integral part of Malaysia's PV manufacturing landscape. Second, it has boosted local employment and built professional capacity. Through expanded local recruitment, technical training, and localization of operations and management, the project has supported job creation and skills development in the local manufacturing sector. Third, it has promoted regional PV industry chain coordination. LONGi's multi-segment manufacturing capabilities in the country have enabled China-Malaysia photovoltaic cooperation to extend beyond single-product supply into manufacturing, talent development and regional operations, reinforcing Malaysia's role as a hub within the Asia-Pacific PV manufacturing ecosystem.

Cross-border PV manufacturing also operates within a complex institutional environment. First, international trade and market access rules have become increasingly intricate. In recent years, different markets have strengthened anti-dumping and countervailing measures, product access requirements, local content mandates, and carbon footprint rules—making it harder for companies to allocate production capacity, organize supply chains, and manage compliance across regions. Second, rapid technological iteration places higher demands on overseas capacity adjustments. As photovoltaic technology pathways further evolve, product prices face downward pressure and capacity utilization remains insufficient. As a result, overseas production bases must continually upgrade technology, retrofit equipment, and adjust production lines to stay aligned with shifting market demands and technology trends. Third, requirements for green supply chain governance are more stringent. As international markets lay greater emphasis on full-lifecycle carbon emissions and supply chain sustainability, overseas manufacturing facilities must not only ensure product quality and production capacity, but also advance the use of clean energy, product carbon footprint certification, and supplier environmental and social responsibility management.

2.2 Energy Cooperation Practices of Companies from Other Apec Economies

1. GE Vernova: Advancing Asia-Pacific low-carbon power generation cooperation through hydrogen-blended gas turbine technology

GE Vernova was spun off from GE's energy businesses and became an independent company dedicated to the energy sector in 2024, with operations spanning power generation, wind power, and electrification. Building on its gas turbine, grid, and digital control technologies, the company has been actively exploring hydrogen applications in power generation. It has also leveraged the quick start-stop and flexible ramping capability of gas turbines to support grid stability under high renewable penetration. At its DeBary project in the United States, GE Vernova has been testing 100% hydrogen combustion in a 7E gas turbine, accumulating experience in different hydrogen blending ratios and combustion technologies.

In China, GE Vernova partnered with Harbin Electric Corporation to supply two 9HA.01 combined-cycle gas turbine units with hydrogen-blending capability for the Daya Bay Petrochemical Zone Comprehensive Energy Station in Huizhou, Guangdong Province. The project entered commercial operation in 2024, supplying up to 1.34 GW of electricity to the grid and providing industrial steam for the petrochemical park. The turbines were manufactured locally, and in May 2025, the project achieved a 10 vol% hydrogen co-firing rate, showcasing a cooperation model that combines international technology, local manufacturing, and integrated energy supply for industrial parks. In 2025, GE Vernova's LM2500 aeroderivative gas turbine completed its first retrofit for hydrogen co-firing at the Huadian Jiujiang project in Jiangxi Province, achieving 5% hydrogen blending. The project combines local hydrogen production and blending technologies to explore an integrated value chain—from wind-solar electrolytic hydrogen production to gas turbine hydrogen co-firing power generation. In Australia, the Tallawarra B power station, powered by GE Vernova's 9F.05 gas turbine, entered commercial operation in 2024 with an installed capacity of 320 MW. The plant provides flexible power during peak demand or when wind and solar output is low, and is equipped with natural gas and green hydrogen co-firing capability, though actual deployment still depends on local green hydrogen supply and economic viability.

From the perspective of regional energy transition, these practices have four key implications. First, they promote the integration of international technologies with local industrial capacity. The Huizhou project brought together a multinational equipment provider, a local manufacturer, and an energy operator to align advanced turbine technology with local manufacturing, engineering, and industrial park energy needs—showcasing a model for localized application of clean power generation technologies. Second, they support the coordinated development of low-carbon power generation and power system flexibility. Gas turbines can provide rapid ramping when wind and solar output falls short; with green hydrogen, they can further reduce the carbon emissions from power sources. Third, they explore localized and phased hydrogen application. The Chinese projects deploy hydrogen co-firing in both large combined cycle units and light-duty gas turbine, combined with local manufacturing and retrofit capabilities, demonstrating the application of integrated regional energy supply. The Australia project focuses on building a peak-shaving power station capable of gradually adopting green hydrogen, reflecting that different economies can pursue differentiated pathways based on hydrogen availability, power mix, and industrial foundation.

Cross-border project implementation also entails multiple challenges. First, technical standards and regulatory frameworks vary across economies. Differences in requirements for hydrogen blending ratios, combustion testing, emissions monitoring, materials safety, and environmental permitting can drive up costs related to equipment adaptation, testing and certification, and project approvals. Second, hydrogen sources and supporting infrastructure are unevenly developed. Hydrogen-blending capability does not guarantee access to green hydrogen; it still depends on local production capacity, storage and transport infrastructure, fuel pricing, and long-term supply arrangements. As evidenced by the Tallawarra B project, end-use equipment may become operational before the green hydrogen supply chain matures. Third, localized collaboration and commercial mechanisms need further refinement. Cross-border projects involve multiple stakeholders—equipment suppliers, manufacturers, energy operators, government agencies, and hydrogen providers—requiring coordination on technical interfaces, division of responsibilities, long-term O&M, and revenue-sharing mechanisms. Differences across economies in hydrogen incentives, capacity remuneration, and ancillary service frameworks can also affect project returns and scalability.

2. Woodside: A cross-border transition from traditional oil and gas business to low-carbon ammonia supply

Woodside Energy ("Woodside") is a major Australian energy company with a long history in oil and gas development and LNG production. In recent years, while maintaining its traditional energy business, Woodside has gradually ventured into new territories, including hydrogen, ammonia, and carbon management, as part of its broader transition from an oil and gas producer to a diversified energy supplier. In 2024, the company entered the ammonia market by acquiring the Beaumont New Ammonia Project in Texas, United States, which has become a milestone in its expansion into renewable energy businesses. The project will switch to low-carbon ammonia production upon commissioning of third-party industrial facilities.

The Beaumont project has a designed annual capacity of 1.1 million tons in its first phase. It produced its first ammonia in December 2025, completed shipment of its first ammonia cargo in February 2026, and was formally handed over to Woodside for operation in March of the same year following performance testing and project commissioning. While the project currently produces conventional ammonia, Linde, a global industrial gases and engineering company, will build, own, and operate the supporting industrial gas facilities, supply carbon-abated hydrogen and nitrogen, and capture the CO_2 generated from hydrogen production during its low-carbon ammonia phase; ExxonMobil will provide CO_2 transport and geological storage services. Due to delays in the construction of third-party industrial gas supply facilities, the timeline for low-carbon ammonia production has been revised to 2027. The project thus forms a multi-stakeholder value chain, connecting industrial gas supply, ammonia synthesis, CO_2 transport and storage, project operations, and product sales.

From the perspective of corporate transition and regional energy cooperation, the project has three key implications. First, it demonstrates a pathway for traditional energy companies to move into low-carbon energy products. By acquiring a project already under construction, Woodside extended its business from oil, gas, and LNG into ammonia and low-carbon energy markets. This serves as a case study of how established energy players can leverage their expertise in large-scale project management, international marketing, and commodity trading to engage in the new low-carbon energy value chain. Second, it establishes a cross-firm, cross-segment collaboration model for low-carbon industry chains. Decarbonization of the project hinges not only on the ammonia plant itself, but also on the synchronized operation of low-carbon hydrogen production, CO_2 capture, transport, and storage. This highlights that scaling up low-carbon ammonia requires joint participation from stakeholders across industrial gas, energy, carbon management, and commercial sectors. Third, it delivers low-carbon energy alternatives for hard-to-abate sectors. Beyond its role as a chemical feedstock, low-carbon ammonia shows promise as a marine fuel, power generation fuel, and hydrogen carrier, offering new cross-border supply options for industrial and transport decarbonization across APEC economies.

Cross-border project implementation also presents multiple challenges. First, following acquisition, considerable efforts are needed to continue engineering activities and ensure operational integration. In Woodside's case, acquiring a project still under construction requires the original developer to complete remaining construction, testing, and staff handover. Besides, aligning engineering responsibilities, operational readiness, and management systems adds complexity to cross-border project oversight. Second, the low-carbon transition of the project depends heavily on third-party supporting facilities. Low-carbon ammonia production needs the synchronized commissioning of Linde's hydrogen and nitrogen supply facilities and ExxonMobil's CO_2 transport and storage. Delays within any link may derail overall project progress. The postponement of the low-carbon ammonia production timeline reflects the high level of coordination required in industry chains spanning multiple companies with respect to construction schedules and responsibility delineation. Third, uncertainty still surrounds low-carbon certification and market returns. The emission reduction performance of low-carbon ammonia is subject to multiple factors, calling for full-lifecycle mechanisms for carbon accounting, certification, and traceability. To date, Woodside's offtake agreements remain primarily for conventional ammonia, with the low-carbon ammonia market still in its nascent stage. Divergences across economies over product definitions, carbon accounting methodologies, policy support, and import certification could also drive up costs for cross-border certification and market development.

2.3 Pragmatic Cooperation Cases from Industry Platforms and China'S Participation in Apec Energy Partnership Network

1. China EV100: An industry research platform for promoting international exchange on NEVs and transport-energy integration

China EV100 is an industry think tank and cross-sector collaboration platform in the new energy vehicle (NEV) sector. Through policy research, industry seminars, international exchanges, and resource matchmaking, it connects government agencies, research institutions, industry associations, and enterprises across the value chain, delivering research and exchange initiatives for the NEV industry. In recent years, its international research portfolio has gradually expanded from NEVs and supply chains to cover charging infrastructure and the integration of transport, energy, and power systems.

For international transport and energy research, China EV100 conducts policy, technology, and industry studies on NEV internationalization and transport-energy integration. On the policy front, it follows up closely on policies, regulations, and standards for NEVs, clean energy, energy storage, and power sectors in overseas markets. On the technology front, its research focuses on large-scale vehicle-grid interaction applications, smart charging, V2G, and the synergy between NEVs and new power systems. It analyzes issues including the interface between vehicle charging/discharging and grid operations, the large-scale application of distributed energy resource storage, and the alignment of renewable energy integration with transport power load. On the industry front, it tracks global NEV market trends and vehicle-grid interaction business models, offering actionable insights for companies pursuing international cooperation and overseas business presence.

For international exchanges, China EV100 organizes thematic seminars and technical exchanges with international institutions, bringing together domestic and international OEMs, charging operators, grid firms, energy companies, and research institutions to share experience and explore challenges on policies, standards, technology innovation, use cases, and business models. These efforts help identify trends, practical hurdles, and pathways in areas such as vehicle-grid interaction (VGI), low-carbon energy, and green power adaptation. They also deepen cross-economy understanding of the synergy between NEVs and energy systems, and translate common industry challenges into topics for research and discussion. This lays a basis for international cooperation in emerging sectors such as NEVs, smart charging, V2G, and energy storage, facilitating the transition of NEVs into demand-side flexibility resources.

Overall, China EV100 plays a significant role in fostering the overseas ecosystem for NEVs and strengthening regional industry coordination in the Asia-Pacific. On the one hand, it relays overseas policy frameworks, industry needs, and resource advantages to Chinese companies, helping advance NEV ecosystem cooperation beyond product exports toward coordinated upgrade of overseas manufacturing, infrastructure and services. On the other hand, it translates enterprises' technical expertise and research outcome commercialization into topics for exchange, thus promoting their global sharing. Through this two-way linkage, China EV100 acts as a bridge between industry practice and regional cooperation, providing platform support for the overseas development of the NEV ecosystem and transport-energy integration in the Asia-Pacific region.

2. Global Energy Interconnection Development and Cooperation Organization: Advancing cross-regional energy cooperation through research, standards, and multi-stakeholder collaboration

The Global Energy Interconnection Development and Cooperation Organization ("GEIDCO") is an international cooperation platform dedicated to global energy transition and sustainable development, with a focus on promoting cross-regional energy cooperation. Established in 2016 following China's proposal to build a Global Energy Interconnection mechanism, GEIDCO conducts planning studies, international exchanges, standards collaboration, project matchmaking, and capacity building on energy transition, clean energy development, and cross-border power interconnection. It seeks practical pathways for specialized international platforms to facilitate cross-regional energy cooperation.

In terms of network building, GEIDCO's membership has grown from 13 at its founding to nearly 1,400 today, covering enterprises, think tanks, universities, industry associations, and financial institutions across 143 countries. Through its "members-four alliances-partners" mechanism, it conducts regular exchanges and has established partnerships with UN agencies and regional organizations. This multi-stakeholder engagement helps bring together government, industry, research, and financial resources on a single platform, providing an organizational foundation for cross-regional energy dialogue and project cooperation.

On the research and standards front, GEIDCO has published nearly 100 research outputs on energy interconnection planning, technology, and policy, including a series of flagship reports on global and continental energy interconnection outlooks, as well as clean energy development and investment. It has also worked on the indicators of the Global Electricity Development Index and building a platform for clean energy resource development. In parallel, GEIDCO has advanced international standard setting, focusing on new power systems and cross-border grid interconnection. In 2025, it released its first seven international standards, aligning planning studies and technology pathways with standards collaboration.

On the project cooperation front, GEIDCO works to translate research into concrete partnerships through planning studies, project databases, and international coordination. It has established a project database for global energy interconnection that covers more than 900 projects, and conducts feasibility studies on cross-border power interconnection and clean energy development. In the Asia-Pacific, GEIDCO has advanced feasibility studies on Korea-China power interconnection, among other cross-regional cooperation initiatives. In addition, it has developed new project models tailored to regional resource endowments and industrial conditions, such as "electricity-mining-metallurgy-industry-trade" coordination and "power-hydrogen-carbon" integration. These models offer new project approaches to foster a synergy between clean energy resource development and coordinated industrial growth.

Capacity building is another key pillar of GEIDCO's work in boosting international energy cooperation. It has built a training system covering energy transition, climate change, technical standards, engineering practices, and investment and financing, delivering over 20 training programs with more than 8,000 participants from over 80 countries. Meanwhile, through engaging in international dialogues on issues such as climate change and biodiversity, GEIDCO aligns energy planning with sustainable development goals related to climate and ecology, expanding the scope for policy and capacity-building in energy cooperation.

From the perspective of regional energy cooperation, GEIDCO's practices have three key implications. First, through planning studies, data platforms, and standards collaboration, it provides a shared knowledge and technical framework for energy cooperation across different economies, reducing information gaps and perceptual disparities in cross-regional cooperation. Second, leveraging its membership network, international organization partnerships, and project database, GEIDCO connects governments, enterprises, research institutions, and financial organizations, synergizing planning research, technical standards, and project collaboration. Third, through project implementation and capacity building, it translates research outcomes into actionable and replicable cooperation models, offering practical references for economies at different stages of development to engage in clean energy development, infrastructure construction, and energy transition.

3. China's Participation in APEC Energy Partnership Network: A platform for multi-stakeholder coordination and delivery of cooperation outcomes

China's Participation in APEC Energy Partnership Network ("the Partnership Network") is an important platform connecting domestic institutions with APEC energy cooperation frameworks. Established in 2017 under the auspices of the National Energy Administration of China, the partnership network aims to pool the efforts of Chinese government agencies, energy companies, research institutions, industry associations, and international organizations, so as to comprehensively advance practical energy cooperation across the Asia-Pacific region. Member institutions of the partnership network may take part in policy consultations and technical collaboration across the various expert groups and task forces of the APEC Energy Working Group (EWG), engage in and deliver APEC energy projects, and provide intellectual input for APEC Energy Ministerial Meetings, multilateral outcome documents, and China-led cooperation initiatives.

In terms of operation, the Partnership Network has put in place a working model that is guided by governments, orchestrated by platform, driven by institutional collaboration, and oriented toward shared outcomes. It counts 76 participating entities, including enterprises, research institutions, and international or industry organizations. In line with the focus of expert groups and task forces under the APEC EWG, these participants have been reorganized into six groups: clean fossil energy, renewable energy, energy efficiency and conservation, energy resilience, energy data analysis, and a multi-thematic group. This structure provides organizational support for China's systematic engagement in APEC energy cooperation.

In policy exchanges and multilateral engagement, the Partnership Network acts as a bridge. It has sent Chinese delegations on multiple occasions to attend APEC EWG meetings, joint expert group meetings, Energy Ministerial Meetings, and thematic seminars. It has also undertaken over 200 liaison-related tasks ranging from meeting nominations and participant coordination to input on reports, questionnaire surveys, and election campaigns. This enables member institutions to engage more deeply in APEC energy discussions, rule-making, and establishment and improvement of mechanisms.

In project cooperation and capacity building, the Partnership Network enables members to better participate in APEC cooperation through submissions for APEC-funded project proposals, forum hosting, and official training programs. In 2025, member institutions secured three APEC-funded projects and two self-funded APEC projects—a significant increase that has boosted China's capacity to propose initiatives, shape agendas, and deliver outcomes under the APEC framework. In parallel, the 11th Asia-Pacific Energy Sustainable Development Summit & APEC Officials Training Program drew participants from government departments of 13 APEC economies, five international organizations, and relevant domestic and overseas entities, creating a platform for policy exchange and experience sharing.

In standards alignment and research outcome commercialization, the Partnership Network, through its thematic groups, has been working to translate research findings, corporate practices, and industry needs into policy initiatives, cooperation projects, and capacity building activities under the APEC framework. Each thematic group carries out research exchanges, project proposal submission, technical reviews, participation in international meetings, and support for outcome documents in its respective area of focus. These efforts lay a foundation for standards alignment, policy dialogue, and pragmatic cooperation in APEC energy cooperation. Through this mechanism, the Partnership Network distills practical insights from enterprises, research institutions, and industry associations into regional cooperation issues eligible for the APEC agenda.

That said, there remains room for further improvement in the Partnership Network's operational mechanism and research outcome commercialization. First, pathways for translating research and project outcomes into APEC policy initiatives, multilateral cooperation deliverables, and adoption in the policies and markets of individual economies require further refinement. Second, member engagement, professional competence, and collaborative efficiency still need improvement, particularly in cross-group exchanges, regular communication, understanding of APEC rules, and international presentation skills. Third, stable cooperation channels between the partnership network and APEC economies, international organizations, and relevant expert groups need to be further strengthened, so as to better support project cooperation, technical reviews, initiative development, and consultations on outcome documents.

Overall, China's Participation in APEC Energy Partnership Network serves as a vital bridge between corporate practice and intergovernmental cooperation. For one thing, it engages research institutions, enterprises, and industry platforms in APEC energy cooperation, so that corporate project experience and industry needs could be translated into issues for regional cooperation. For another, it channels APEC demand for policy dialogue, capacity building, and project cooperation to domestic enterprises and research institutions, prompting targeted participation in international energy cooperation. Through this mechanism, the Partnership Network transforms fragmented industry practice, specialized research findings, and industry demands into discussable, reviewable and actionable cooperation topics under the APEC framework. This captures the transition process from industry practice to institutional coordination, and provides an important mechanism for deepening Asia-Pacific energy cooperation and coordination in the years ahead.

Chapter 3 Common Challenges and Practical Experience in Asia-Pacific Energy Cooperation

Drawing on the practices of enterprises, industry platforms, and the Partnership Network, Asia-Pacific energy cooperation has developed solid industrial capacity and accumulated substantial project experience. That said, a series of common challenges spanning economies, sectors, and industry chains have come to the fore. These challenges need to be addressed through regional cooperation platforms such as APEC, with a focus on policy dialogue, standards alignment, capacity building, and mechanism innovation. Taking stock of these challenges and lessons provides a critical foundation for moving from industry practice to institutional coordination.

3.1 Common Challenges in Asia-Pacific Energy Cooperation

1. Institutional and market disparities across economies increase project adaptation costs

Asia-Pacific economies differ considerably in energy resource endowments, development stages, energy governance models, and market mechanisms. As a result, the same technology may face vastly different business logics and deployment conditions in various economies. For example, energy storage projects adopt different models under market-based dispatch systems and vertically managed state-owned utility frameworks, exerting an impact on their market participation, operational models, and partnership structures. Emerging sectors such as hydrogen and green methanol span multiple regulatory domains, including gas supply, hydrogen production, power generation, hazardous materials management, and port fuel operations, while some economies have yet to establish routine regulatory frameworks. Vehicle-grid interaction, on the other hand, involves multiple stakeholders—automakers, grid operators, charging service providers, and end users—and requires coordination of roles and responsibilities across different government agencies and market players.

Meanwhile, economies vary in their requirements for project approval, market access, local content requirements, and industrial support policies. When entering a new market, companies need to recalibrate their project development, partnership arrangements, local stakeholder engagement, and operational management approaches. Such institutional and market disparities not only extend project preparation and implementation timelines, but also drive up organizational and coordination costs, and pose scalability challenges for cross-border cooperation.

2. Technical standards, testing and certification, and carbon accounting frameworks are not yet sufficiently aligned

As Asia-Pacific energy cooperation expands into new technologies and business formats, discrepancies in standards and certification are increasingly becoming a major barrier to project implementation. Economies adopt different standards for energy storage system safety, grid connection requirements, hydrogen refueling facilities, and bidirectional charging and discharging. When entering a new market, companies are often required to undergo repeated testing and certification, driving up project costs and extending implementation timelines. In photovoltaic manufacturing, divergences in product entry requirements, carbon footprint criteria, and local content certification rules across markets also compel companies to allocate more compliance resources to cross-border supply chain management.

Rules for the accounting and certification of green and low-carbon attributes also need to be aligned. At present, economies diverge on product definitions, full-lifecycle carbon accounting frameworks, certification requirements, and traceability mechanisms, which might raise the costs of cross-border certification and market development. The cross-border flow and market adoption of renewable energy products such as low-carbon ammonia, green hydrogen, and green methanol call for stronger alignment in full-lifecycle carbon accounting, certification, and traceability rules. Vehicle-grid interaction, meanwhile, faces challenges related to the mutual recognition of technical standards for bidirectional charging and discharging, as well as the coordination of data security rules.

3. Infrastructure and local industrial capacity building have yet to catch up with demand

Some Asia-Pacific economies have seen rapid growth in new energy vehicles and renewables, while supporting systems including energy storage, charging infrastructure, component supply, maintenance services, battery recycling and skilled workforce development remain at an earlier stage of maturity. CATL's solar-plus-storage project in an off-grid industrial park in Indonesia highlights the demand for energy storage, microgrids, and clean energy solutions in island economies, remote areas, and off-grid industrial parks.

Meanwhile, there is a phased mismatch between local content requirements and the capacity of local supply chains. Some economies mandate high local procurement ratios for renewable energy equipment, yet local manufacturing and service capabilities remain in their early stages. GE Vernova's experience also shows that end-use equipment with hydrogen-blending capability may come online before a stable green hydrogen supply chain is in place. Likewise, the development of green marine fuels calls for production, specialized storage and transport, and port storage and bunkering facilities to be built in tandem. CIMC Enric's practice demonstrates that while a cross-regional green methanol supply chain has been piloted, supporting infrastructure including specialized storage and transport, transshipment, and port bunkering still needs to be enhanced. This indicates that the rollout of new energy projects requires coordination of end-use applications, supporting infrastructure, local industrial capacity, and long-term operational arrangements.

4. Revenue mechanisms and long-term investment security for renewable energy projects need to be strengthened

Projects in energy storage, vehicle-grid interaction, distributed hydrogen, and low-carbon fuels deliver multiple benefits, including system regulation, carbon emissions reduction, energy security, and industrial development, respectively. Yet their scaled deployment remains constrained by revenue mechanisms and long-term investment conditions. The CATL case shows that large-scale energy storage projects have long payback periods, while some economies adjust energy policies and electricity pricing mechanisms on shorter cycles, which might lead to uncertainty in projected returns. The CIMC Enric case reflects that distributed hydrogen and green marine fuel projects require substantial upfront investment and long payback periods, and that mechanisms for cross-border energy flows, carbon value recognition, and long-term revenue streams still need to be strengthened—placing greater demands on stable market expectations and business models.

In addition, renewable energy projects often require coordinated commissioning across multiple stakeholders and supporting facilities. The Woodside ammonia project's heavy reliance on third-party industrial gas supply and CO_2 transport and geological storage facilities demonstrates that coordination across companies and segments directly affects overall project performance. How to align different participants through long-term contracts, risk-sharing, and revenue-sharing mechanisms is a key factor in determining whether a project can achieve stable operation and scalability.

Taken together, while these challenges manifest in different forms, they all point to a shift: Asia-Pacific energy cooperation is moving beyond collaboration on specific products and projects into deeper areas, including infrastructure, market mechanisms, industry chains, and governance arrangements. The issues arising across these cases—institutional adaptation, standards and certification, local capacity, revenue mechanisms, and multi-stakeholder coordination—underscore that regional cooperation must better respond to practical industry needs. Experience sharing, regulatory dialogue, capacity building, and pragmatic cooperation can foster more enabling conditions for the large-scale application of new technologies and new business formats.

3.2 Key Takeaways from Asia-Pacific Energy Cooperation Practices

1. Industry practice serves as an important starting point for identifying regional cooperation needs and priorities

Asia-Pacific economies differ considerably in energy demand, industrial foundations, market environments, and governance approaches. In practice, the challenges facing different technologies and cooperation models also vary. CATL's initiatives in Indonesia and Australia address distinct needs: clean energy supply for remote areas in the former, and power system regulation under high renewable penetration in the latter. GE Vernova's projects in China and Australia likewise demonstrate that hydrogen applications require technology choices and implementation pathways tailored to local hydrogen availability, power mix, and industrial foundations.

For these reasons, greater importance should be attached to feedback from industry practice in deepening Asia-Pacific energy cooperation. Drawing on the real-world needs and project contexts of diverse economies, common challenges may be promptly identified and consolidated, with frontline experience translated into a key basis for policy dialogue, regulatory coordination and regional cooperation.

2. Localization and industry chain collaboration are essential to enhancing the long-term value of cross-border cooperation

Cross-border energy cooperation in the Asia-Pacific is gradually extending beyond single-product and equipment trade to encompass R&D and manufacturing, engineering and construction, operations and services, and professional capacity building. LONGi's project in Malaysia integrates PV manufacturing with local employment, technical training, and regional industry chain development. GE Vernova advances the localized deployment of technology through collaboration among international technology providers, local manufacturers, and energy operators.

These practices suggest that cross-border projects can improve long-term operational performance and local development contributions only when they are steadily aligned with local industrial systems, market entities, and talent pools. Greater emphasis should be placed within energy cooperation on industry chain collaboration, local capacity building and long-term service frameworks, ensuring that technology cooperation reinforces industrial upgrading, employment growth, and skills development.

3. Synergy between infrastructure and market mechanisms plays a key role in expanding energy system services through renewable energy technologies

As the share of renewables rises and renewable energy technologies advance, Asia-Pacific energy cooperation needs to look beyond the volume of clean energy supply and adopt an integrated approach to production, transmission and distribution, storage, and consumption—recognizing the system value for regulation of energy storage and demand-side flexibility resources. The CATL case shows that as storage applications extend from equipment products to power system services, their scaled deployment places new demands on grid access rules, ancillary power service mechanisms, and project revenue models. Storage and flexible loads in end-use settings, such as transport, buildings, industrial parks, and manufacturing, also require supporting infrastructure, technical specifications, operational rules, and market mechanisms to work in tandem.

Asia-Pacific economies could therefore strengthen exchanges on relevant rules, market mechanisms, and experience sharing on project operation, enabling new energy technologies to play a greater role in system regulation, renewable energy integration, and emergency response, and thereby enhancing overall resilience of the energy system.

4. Multi-stakeholder coordination and experience capitalization are vital safeguards for boosting regional cooperation effectiveness

Cross-border energy cooperation involves multiple stakeholders, including governments, enterprises, infrastructure operators, research institutions, and industry associations. Effective coordination across these different actors directly impacts project implementation and cooperation outcomes. The Woodside low-carbon ammonia project highlights the need for concerted progress across supply, production, transport, and carbon management. China EV100, GEIDCO, and China's Participation in APEC Energy Partnership Network each operate from different angles—industry research, specialized international cooperation, and APEC multilateral mechanisms—to build communication channels linking industry practice, professional research, standards collaboration, and regional exchanges.

Therefore, greater communication and coordination among stakeholders should be fostered within Asia-Pacific energy cooperation. Common challenges and practical lessons from project implementation can be promptly identified, while experience sharing is advanced via policy dialogue, capacity building, and pragmatic cooperation, enhancing the coherence and sustainability of regional cooperation.

Taken together, the experience from the cases above points to several interrelated priorities for Asia-Pacific energy cooperation: improving the adaptability of cooperation to the specific conditions of different economies; enhancing the long-term benefits of cross-border cooperation through localization and industry chain collaboration; strengthening the synergy between infrastructure, operational rules, and market mechanisms to unlock the system value of renewable energy technologies such as storage and vehicle-grid interaction; and increasing regional cooperation effectiveness through multi-stakeholder communication and experience sharing. These practical insights provide a solid foundation for further deepening Asia-Pacific energy cooperation. Building on this basis and aligned with the priorities of APEC energy cooperation, Chapter IV sets out cooperation initiatives covering regional energy resilience, power infrastructure, clean energy deployment, energy inclusivity, and the application of new technologies.

Chapter 4 Proposals to Deepen Asia-Pacific Energy Cooperation and Coordination

To advance Asia-Pacific energy cooperation and coordination, the principles of voluntary cooperation should be upheld, which features for all, openness, synergy, pragmatism, and universal benefit. First, for all entails fully respecting the disparities among economies in resource endowments, development stages, technological capacity, energy demand and transition pathways, and supporting each economy in pursuing a development path tailored to its own conditions. Second, openness entails fostering an open, stable and transparent environment for regional energy cooperation and facilitating smoother exchanges of energy resources, technologies, products, services, capital and experience. Third, synergy entails strengthening communication, collaboration and coordinated actions among governments, enterprises, research institutions and various social stakeholders to jointly address systemic challenges in energy security and green transition. Fourth, pragmatism entails focusing on practical needs and concrete projects, and translating consensus into replicable, scalable and actionable cooperation outcomes through policy dialogue, knowledge sharing, capacity building and demonstration projects. Fifth, universal benefit entails ensuring that the gains from energy cooperation benefit diverse economies and communities more equitably, while continuously improving the accessibility, affordability and reliability of energy services.

Building on these five principles, Asia-Pacific energy cooperation should pursue a balanced approach to energy security, green transition, industrial development, and scientific and technological innovation. Priorities include bolstering regional energy resilience and energy security, enhancing the resilience of power infrastructure, optimizing the regional deployment of clean energy, advancing universal benefit in energy access, and harnessing the power of new technologies such as AI and smart grids to drive coordinated development of policies, industries, markets and governance mechanisms.

4.1 Strengthening Regional Energy Resilience and Security to Consolidate the Foundation for Shared Development

Asia-Pacific economies differ considerably in energy resource endowments, supply-demand structures, and levels of external dependence. Energy price volatility, supply chain shifts, extreme weather events, and other contingencies might impact regional energy security and economic performance. Energy resilience should be embedded across all stages of energy cooperation, including strengthening risk identification, information sharing, and emergency coordination, as well as promoting diversification in energy types, supply sources, transport corridors, technology pathways, and industry chain layout. This will enhance the reliable supply of key energy products, technology and equipment, and professional services, while balancing energy security, green transition, and economic and social development. By boosting the capacity of energy systems to withstand shocks, recover rapidly, and adjust dynamically, the impact of volatility in energy supply and demand on industrial activity and people's well-being can be mitigated, paving the way for the long-term stability and development of the Asia-Pacific region.

4.2 Enhancing Power Infrastructure Resilience and Boosting System Regulation and Risk Response Capabilities

As the share of renewable energy rises and end-use electrification steps up, power systems are assuming a more prominent foundational role in resource allocation and energy security. A balanced approach should be taken to the development of power sources, grids, loads and energy storage, advancing grid upgrades, distributed energy resources development, and the enhancement of flexible regulation capabilities. In light of the specific conditions of different economies, efforts should be made to advance research and exchanges on grid planning and cross-regional power interconnection, and enhance the interconnection of power infrastructure and cross-regional resource dispatch. Meanwhile, greater attention should be given to engaging end-use energy resources in transport, buildings, industry, and industrial parks in system operations, so as to enhance the regulatory capacity of demand-side resources and their value for emergency response. Furthermore, infrastructure building, market mechanisms, and investment and financing arrangements should be promoted in a coordinated manner, with better policy continuity and a more stable investment outlook to channel long-term capital into critical energy infrastructure. Through these efforts, greater resilience of power systems can be translated into new opportunities for investment growth and industrial development.

4.3 Optimizing the Regional Allocation of Clean Energy to Open Up Space for Industrial and Investment Cooperation

Asia-Pacific economies are highly complementary in clean energy resources, technological capabilities, manufacturing base, and market demand. More open regional cooperation can help improve resource allocation efficiency. Taking into account the resource endowments and market needs of individual economies, cross-regional cooperation on the supply and application of low-carbon energy sources, such as green hydrogen, green methanol, and low-carbon ammonia, should be explored to foster a stronger synergy among production, storage, transport, and end-use facilities. Efforts should be made to connect clean energy development, equipment manufacturing, engineering and construction, operation services, and end-use applications. This will enable cross-border cooperation to extend beyond single-product and equipment trade toward full industry chain collaboration, while forging stable linkages with local industrial systems and market demand. Communication and coordination should be strengthened across regulatory policies, technical standards, testing and certification, low-carbon accounting, and market rules to improve regulatory compatibility, transparency, and predictability, while respecting the development stages, institutional conditions, and independent choices of individual economies. This will also reduce duplicative certification and institutional friction. A better environment for regional cooperation can facilitate the smooth flow of technology, capital, and professional services, driving clean energy investment, manufacturing upgrade, and local industrial capacity building.

4.4 Promoting Energy Inclusivity and Capacity Building for Shared Gains from Energy Transition

The ultimate impact of energy cooperation should be gauged by improvements in the quality of energy services and people's well-being. Enhancing energy accessibility, affordability, and reliability should be a core objective of regional cooperation, extending appropriate technologies, investment resources, and service capabilities to areas and sectors with gaps in energy services. Through APEC cooperation mechanisms, specialized international organizations, and industry platforms, multi-tiered talent development and experience sharing should be carried out, covering energy planning, engineering practice, project operation and maintenance, as well as investment and financing. This will support local companies and diverse market players in boosting their professional capacity to engage in energy cooperation, contributing to employment growth, skills upgrading, and community development.

4.5 Leveraging Digital and Intelligent Technologies to Improve the Effectiveness of Coordination and Pragmatic Cooperation

Exchange and application of AI, smart grid, and digital technologies in energy supply-demand forecasting, resource dispatching, equipment management, risk early warning, and demand response should be strengthened to improve energy system efficiency and risk identification capacity. Digital technologies should be better integrated with power infrastructure, distributed energy resources, and end-use energy consumption to unlock the system value of dispersed energy resources and flexible loads. Meanwhile, technological innovation and institutional development should work in tandem, strengthening the linkages between industry practice, policy research, and regional cooperation mechanisms. Through joint research, demonstration applications, and experience assessment, proven practices can be consolidated into replicable and scalable regional outcomes, continuously enhancing the implementation capacity and coordination effectiveness of Asia-Pacific energy cooperation.

Chapter 5 Conclusion

Drawing on the practices of corporate projects, industry platforms, and the Partnership Network, this report demonstrates that Asia-Pacific energy cooperation is evolving toward industry chain collaboration, multi-stakeholder participation, and institutional synergy. The cases reviewed indicate that the effectiveness of cross-border energy cooperation hinges not only on technology, capital, and project investment, but also on the ability to adapt to local needs, align with institutional frameworks, build supporting capacities, and foster stable partnerships. Meanwhile, as cooperation expands into new areas and involves more diverse participants, industry practices have further highlighted the shared need across economies for stronger cooperation and coordination in policy dialogue, regulatory alignment, infrastructure synergy, and market mechanisms.

Looking ahead, regional cooperation platforms such as APEC should be leveraged to further smooth the pathway from industry practices to cooperation issues and institutional outcomes, ensuring that policy dialogue, project cooperation, and capacity building reinforce one another. By consolidating and scaling up proven experience, more stable and sustainable cooperation arrangements can be gradually formed, enabling Asia-Pacific energy cooperation to better contribute to energy security, green development, and shared prosperity in the region.

北京大学能源研究院
INSTITUTE OF ENERGY

Institute of Energy, Peking University

Add.: Room 603, 6th Floor, Peking University Science and Technology Building, No. 298 Chengfu Road, Haidian District, Beijing, China.

Z.C.: 100871

Email: www.energy@pku.edu.cn

Tel: +86-10-62751150

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