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LISTED INFRASTRUCTURE:

Spotlight on structural growth opportunities in Asia

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At-a-glance

- Rapid economic development and evolving demographic trends create structural growth opportunities for energy, transportation, and communications infrastructure.
- Asia's evolution into a growing source of consumer demand complements its traditional role as a manufacturing center, with intra-regional trade on the rise.
- Renewable and natural gas infrastructure buildouts in Asia, as well as innovation coming out of the region, anchor the ongoing global energy transition.

Rapid economic growth is driving demand for new infrastructure

Population growth, urbanization, exports, and wealth accumulation have made Asia home to some of the fastest growing economies in the world. The regional economy is poised to grow 4-5% over 2023-2025, led by China and India, compared to 1-2% in developed markets[1]. Aided by capital inflow from overseas, these dynamics translate into atttractive growth potential for listed infrastructure companies.

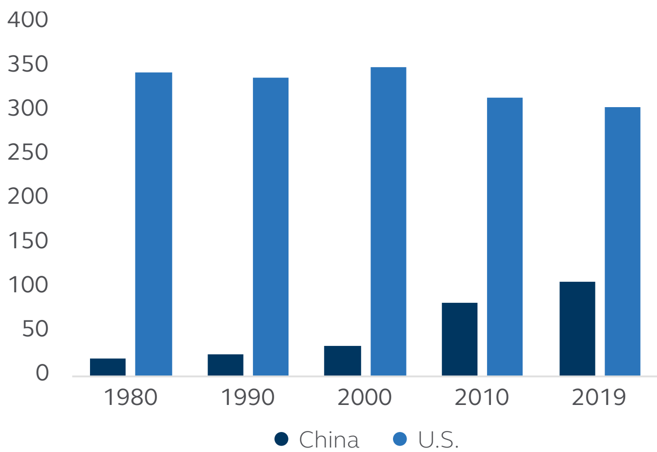
Energy demand in Asia is growing 4% per year, supported by rising standards of living that have more than tripled per capita energy consumption since 2000. Following this path, China now represents approximately one-third of global electricity consumption, boosting Asia's share from around a quarter in 2000 to an estimated half by 2025, according to the International Energy Association (IEA). On the supply side, China plans to increase wind and solar power generation from approximately one-fifth of the national generation mix to 70% by 2050, requiring an 8x increase in capacity[2]. To support the national decarbonization agenda, some large state-controlled power providers aim to more than triple their installed renewable capacity over the next few years. City gas projects complement renewables development in meeting China's growing energy needs. Leading gas distributors are growing normalized retail volumes by more than 10% annually, supported by new gas connections and rising industrial and commercial activity[3].

[1] Goldman Sachs, November 12, 2022. *"Asia Views: 2023 Outlook: Inflation Peaks and Growth Troughs."*
[2] IEA, March 2023.
[3] Principal Asset Management Listed Infrastructure team estimates, October 2023.

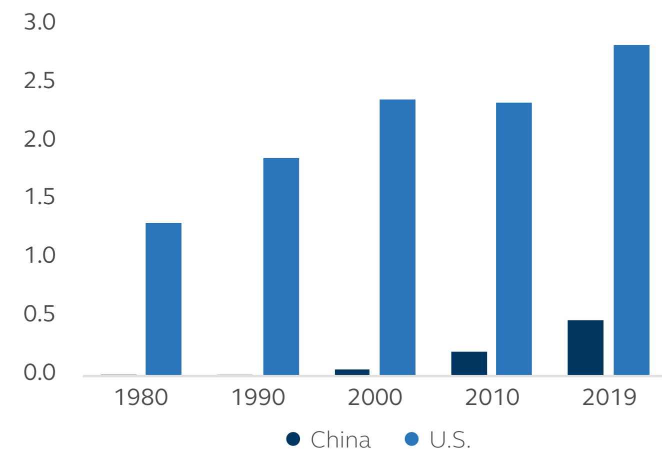
EXHIBIT 1: Comparisons of per capita air traffic and energy consumption in China and the U.S.

Growth prior to the COVID pandemic

Energy consumption per capita (mmBtu)



Air transport passengers per capita



Source: World Bank, U.S. Energy Information Administration, 2020. MmBtu = Metric Million British Thermal Unit

Growing populations, rising incomes, and increased mobility drive growth for airports, toll roads, and rail transportation. Unsurprisingly, Asia was already home to 12 of the world's 25 largest airports in 2019, and is expected to remain one of the fastest growing regions for passenger growth globally for the next two decades, alongside the Middle East (Airports Council International). As the world's largest source of tourists, China's aviation hubs benefit from structural growth in outbound travel. Alongside traffic growth are tailwinds for non-aeronautical businesses, specifically duty-free retail concessions with relatively attractive revenue share rates. Over half of the Asian population is now part of the global consumer class, defined by daily spending of $12 or more[4]. In China, per capita gross domestic product (GDP) has grown 5-10% per year over the preceding decades and is likely to continue growing at the lower end of the range in a normalized travel environment[5]. Over time, per passenger spend has the potential to catch up to developed market peers, which are at 2-3x the level of major Chinese airports under normal conditions.

Communications infrastructure operators also benefit from the widespread adoption of mobile video and rapid data consumption growth. Along with 5G deployment, these factors complement continuing geographic saturation and network densification in driving new tower buildout and colocation of cell equipment. Meanwhile, tenancy ratios of emerging markets tower companies (1.6-1.9x) are low vs. developed markets peers in the U.S. (2-2.5x)[6], suggesting significant upside to profitability over time if the gap is too narrow. Uneven digital capabilities signal the need for sizable infrastructure investments in slower-moving areas. For example, in Indonesia, mobile connectivity lags that of its Southeast Asian peers; data consumption per connection is approximately one-third that of Thailand and Malaysia, while tower penetration is less than half vs. peers[4]. This dynamic should stimulate robust network buildout, densification, and upgrades in Indonesia, supporting a long runway for tower buildout and colocations.

Connectivity and interdependence are driving greater regional influence than ever before

The notion of Asia as a single region is an oversimplification. Covering about 3/5 of the world's population, Asia is a heterogeneous ecosystem spanning diverse cultures and countries of varying scales and stages of economic development. Advanced nations such as Japan, South

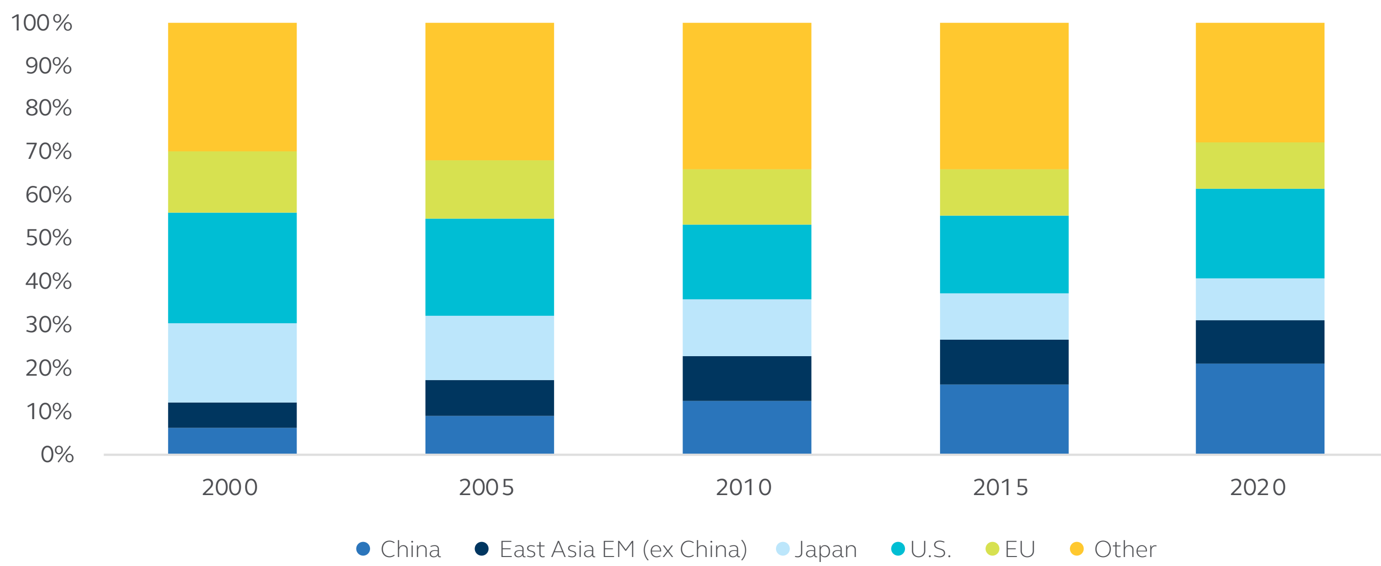
[4] Brookings Institute, March 20, 2023. *"Asia's trade at a turning point."*
[5] World Bank, May 2023.
[6] Principal Asset Management Listed Infrastructure team estimates, October 2023.

Korea, Australia, and New Zealand are characterized by high levels of urbanization and GDP per capita. They are generally providers of capital, technology, and demand for goods and services. Meanwhile, emerging markets, including Indonesia, Thailand, and the Philippines, are net suppliers of labor. Then there is China, the world's second largest economy, accounting for one-third of global growth over the past decade, and India, an emerging powerhouse - both large enough and sufficiently unique to define their own categories.

Exports have historically been a key driver of regional development, propelling some countries to high-income status. Low-cost manufacturing advantages make Asia a production hub for the world; regional developments can have outsized impacts on global supply chains. Even as China shifts away from labor-intensive manufacturing, other countries such as Vietnam are picking up share.

According to Brookings Institute research, sources of demand have also been shifting, with emerging East Asia growing more than 6% per year on average over the past decade. This segment now accounts for 17% of global trade, and with a trade-to-GDP ratio of 105%, they engage in more cross-border trade of the goods they produce than other emerging markets in Latin America and Africa. The evolving Asian landscape creates significant opportunities for regional companies serving cross-border demand (e.g., ports and airports). Intra-regional trade in Asia comprises 2/5 of total trade, the highest share since 1990, with China as both the largest trading partner and the largest source of final demand for the region, surpassing the U.S. and the EU. From 2000 to 2020, the fraction of export value generated by emerging Asian economies met by demand within the region has grown from 12% to 31%[7].

EXHIBIT 2: Sources of final demand for emerging East Asia exports



Source: OECD Inter-Country Input-Output Tables, Brookings Institution. Note: East Asia EM (ex. China) includes Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, and Vietnam, 2023.

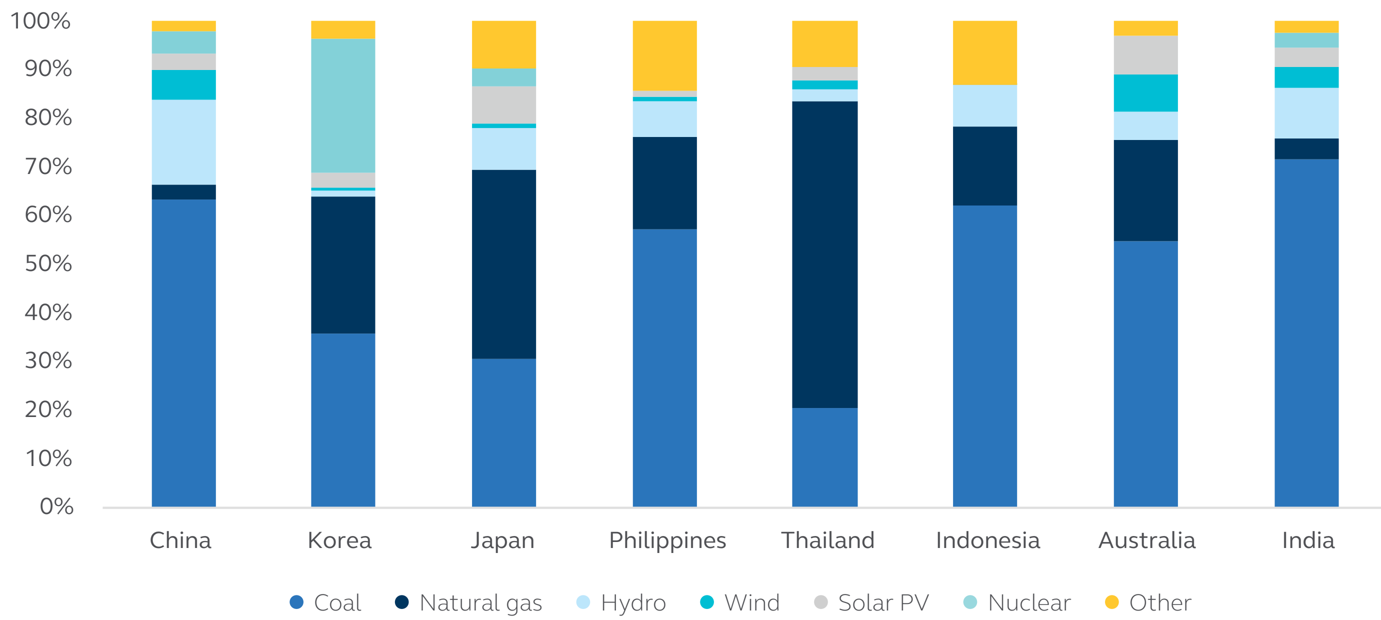
The impacts felt around the world from China's zero-COVID policy, in place during 2020-2022, is a reminder of Asia's critical role in the global economy. Sporadic lockdowns disrupted global supply chains as consequent price inflation hurt consumers, while a closed border stunted international travel and tourism. For instance, Thailand, which derives 12% of its GDP from tourism and more than a quarter of tourist receipts from Chinese visitors, saw a significant hit to its GDP. In the absence of high-spending Chinese visitors, many international airports across Asia were unprofitable[8]. With China's reopening beginning in 2023 comes a brighter outlook for global enterprise.

[7] Brookings Institute, March 2023. *"Asia's trade at a turning point"*
[8] Reuters, November 2022, *"Tourism revival likely boosted Thailand's GDP growth in Q3"*

A cleaner world depends on energy infrastructure development in Asia

Asia generates almost half of global carbon emissions given the region's significant reliance on coal-fired power generation. China, India, Japan, Korea, Indonesia, and Australia are among the world's largest coal consuming nations. At the same time, the region harbors distinctive geographical and manufacturing advantages that are helping renewables to be cost competitive with fossil fuels. Onshore wind and solar projects have already reached grid parity in China, India, and Australia. A diminishing mix of coal power generation and lower energy costs point to attractive opportunities for listed infrastructure companies to create positive environmental and social impacts in the region.

EXHIBIT 3: Power generation mix in Asian countries



Source: International Energy Agency, 2020.

Asia has around 45% share of global installed renewable capacity, much of it across China, India, and Australia. Despite this, wind and solar accounted for only 10% of total power generation vs. 29% in Germany and 25% in the UK[9], indicating significant growth potential going forward. Across the region, more than 15 countries have established emission reduction targets. China, which derives approximately 60% of its electricity from coal, has committed to net zero by 2060. Carbon neutrality roadmaps broadly call for substantial renewable capacity buildout and expansion projects have already begun, with capacity additions projected to reach 2 terawatts (TW) during 2021-30[10]. Zooming out, under its Net Zero 2050 scenario, the Network for Greening the Financial System estimates that an average of $9.2 trillion per year will need to be spent on physical assets for energy and land-use systems through 2050, more than a third of which are in Asia.

We also expect natural gas will play an important role in Asia's energy transition. With significantly lower

[9] World Energy & Climate Statistics – Yearbook 2022. Enerdata.
[10] J.P. Morgan, January 2022. *"APAC clean energy ecosystem: A multi-decade-long uptrend."*

carbon intensity than coal, gas is critical to meeting baseload demand, stabilizing electric grids and ultimately supporting renewables adoption by smoothing out fluctuations in intermittent power generation. Switching from coal to gas becomes imperative for reducing urban pollution while enabling home heating and cooking, industrial production, and commercial activity. In our view, China will invest more than any country in natural gas infrastructure as Beijing aims to move past peak emissions by 2030. We expect gas consumption in China to grow for at least another decade, following a long track record of resilient expansion (i.e., 10% demand compound annual growth rate (CAGR) over the preceding decade even with COVID-related disruptions) and given further gas penetration via new connections. According to Global Energy Monitor, Asia-Pacific (APAC) has more than $350 billion of projects under way to expand liquified natural gas (LNG) terminals, gas power plants and pipelines, etc. - triple the estimated investment in Europe.

Of course, technological advancements are necessary to further reduce fossil fuel dependence, and countries like Japan and Australia are leading the way in developing and commercializing new technologies such as hydrogen and carbon capture and storage. According to McKinsey, grey hydrogen, hydrogen that is produced with natural gas generation, accounts for almost all hydrogen production today given cost constraints. Green hydrogen, which is produced using renewable power, is projected to see meaningful cost declines from US$4-6/kg to under US$1.5 by 2050. Asia has various cost advantages for producing green hydrogen, including abundant low-cost renewable power and robust manufacturing capabilities for the hydrogen supply chain. As such, the region is expected to be both a large producer and a large consumer of hydrogen, with supply and demand hubs varying across the region. Land-constrained countries such as Japan and South Korea will rely heavily on hydrogen consumption to decarbonize. Meanwhile, Australia is positioned as an export hub given the country's plentiful space for low-cost renewable power generation. China and India, projected to account for more than half of Asia's 2050 hydrogen demand, can be largely self-sufficient[11].

Final thoughts

Asia continues to outpace most developed markets in economic growth, as the region evolves into both a significant producer and consumer of global goods and services. Significant incremental investments in energy, transportation, and communications infrastructure are required to support structural trends in power consumption, decarbonization, mobility, and digitalization across the region. Asia also has a critical role to play in supporting the global energy transition. Investing in listed infrastructure represents an opportunity for investors to capture attractive financial returns, while also supporting key contributions to sustainable development.

[11] McKinsey, September 14, 2022. *"Green Growth: Capturing Asia's $5 trillion green business opportunity."*

Risk Considerations

Past performance is no guarantee of future results. Investing involves risk, including possible loss of principal. Infrastructure companies may be subject to a variety of factors that may adversely affect their business, including high interest costs, high leverage, regulation costs, economic slowdown, surplus capacity, increased competition, lack of fuel availability, and energy conservation policies. Foreign securities involve special risks, including currency fluctuation and lower liquidity. Some global securities may represent small and medium-sized companies, which may be more susceptible to price volatility than larger companies.

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