Liquid Real Assets Research

March 2024

DWS

Real Assets and the Energy Transition

Seeking opportunity and navigating challenges in a changing energy landscape

IN A NUTSHELL

- The world faces environmental challenges, leading to the age of Energy Transition.
- Real asset companies play a crucial role and are impacted by energy landscape changes.
- Adaptive companies potentially will thrive in the changing environment, becoming enablers of the movement.

Energy enters a new era

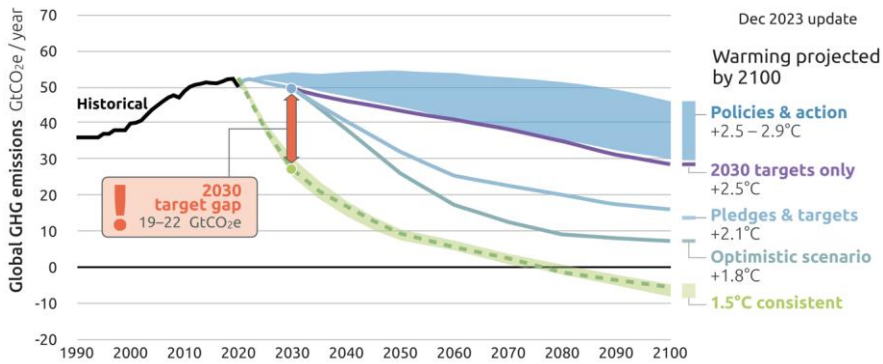
The world is currently facing exceptional environmental challenges (Exhibit 1) which will require joint efforts to deliver transformative solutions, thus heralding the age of **Energy Transition**. At its core, the term Energy Transition refers to moving from the use of traditional fossil fuels to cleaner sustainable alternatives. Understanding the implications that the Energy Transition will have on real assets classes, such as natural resources, real estate, and infrastructure, is paramount since these assets are the backbone of the global economy, and their values are directly affected by changes in the energy landscape. Companies that develop, own, and/or manage these assets will inevitably undergo transformational changes to their operations, financial valuation, and strategic priorities. Some will end up being disadvantaged in the process. Others, however, will embrace the changing environment, adapt in the face of fresh challenges, and grow at an unprecedented pace – these companies will become the enablers of the Energy Transition movement.

While the future is rife with unknowns, one thing is clear: for the world to successfully meet its lofty decarbonization goals, the development of real assets must adapt to meet the world's ever-increasing global energy demands throughout every stage of the Energy Transition. Real assets must evolve and grow, enabling these changes.

In this paper, we analyze the roles various stakeholders play in enabling Energy Transition, consider the challenges real assets companies may face, and explore opportunities for sustainable growth.

Exhibit 1: Global Warming Projected by 2100

Emissions and expected warming based on pledges and current policies

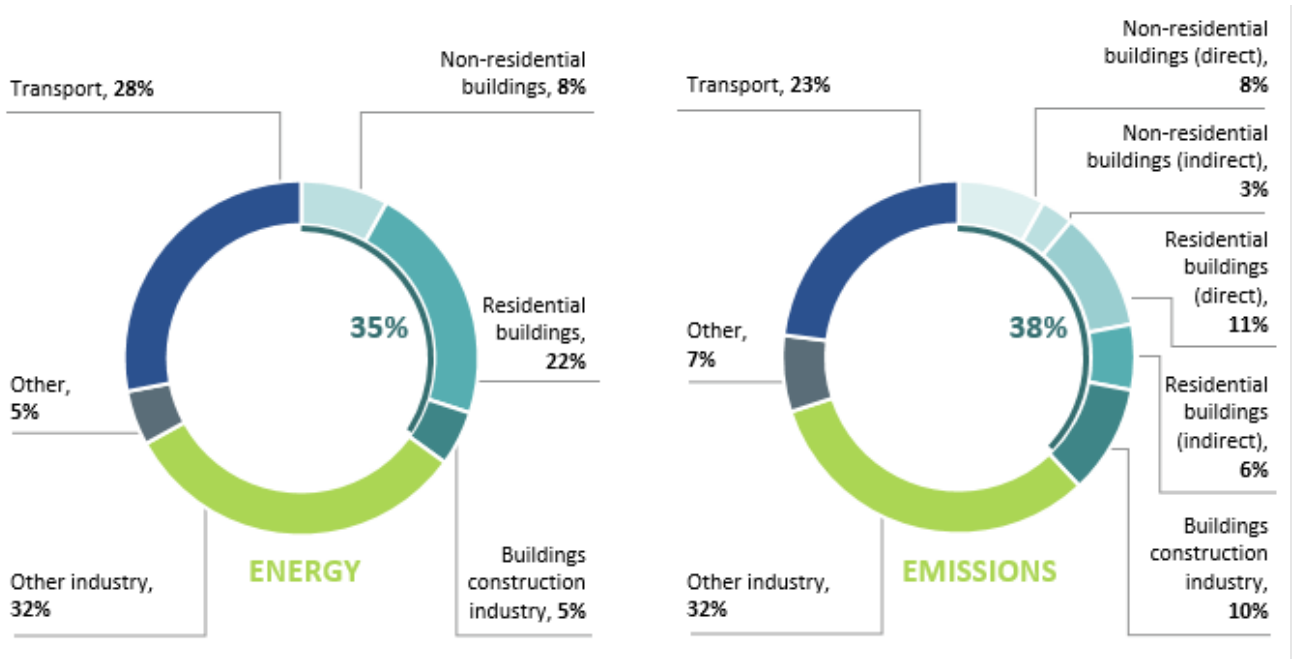


Climate Action Tracker

1 / Real Estate

The importance of energy-efficient buildings and construction is increasing as people become more aware of the impact of climate change. Efficiently constructed buildings can consume less energy and thereby play a key role in reducing greenhouse gas emissions, which are critical to an effective Energy Transition. To put this in perspective, consider the size of real estate's environmental "footprint": according to the International Energy Agency (IEA), the combined sectors of buildings and building construction account for 35% of final energy consumption and almost 40% of total direct and indirect CO^2 emissions globally (Exhibit 2). Thanks to technological advancements in constructing energy-efficient buildings, the trend is becoming more widely adopted as the cost of implementation (and thus, the profitability of the build/investment) is reduced. Innovative technologies such as panels, smart grids and insulative materials are transforming how we design, construct, and operate buildings. Moreover, many countries have introduced building codes that require structures to meet specific energy-efficiency standards. This highlights the significance of real estate in the broader context of the Energy Transition.

Exhibit 2: Global Emissions by Sector



Source: DWS. International Energy Agency (IEA), "Global Status Report for Buildings and Construction 2020". For illustrative purposes only.

As knowledge about the long-term environmental benefits and the ethical importance of sustainability circulates among investors and buyers, a transformational shift in property valuations is also taking place. Green buildings are increasingly seen as more valuable compared to their "non-green" counterparts. These buildings often enjoy quicker sales, higher resale values, lower utility bills, lower default rates, and, in the U.S., lower interest rates on green mortgages. Green buildings can fetch prices up to 7.5% higher than "non-green" buildings.[1] Interestingly, this shift towards building green projects is not only driven by financial incentives and various tax breaks. In fact, the evidence suggests that their relative attractiveness resides with lower operating costs, higher occupancy rates, and increased resale asset values. These characteristics also make them an appealing investment proposition for potential stakeholders.

Looking ahead, the demand for environmentally friendly energy real estate is expected to continue to grow. With consumer demand trends and governmental policies aimed at addressing climate change, the market for such buildings is expected to expand at an annualized multi-year rate of 9 to 11%, reaching a market size of $2.3 trillion by 2030.[2] This reflects the increasing recognition that real estate has a role to play in global sustainability efforts. Energy Transition goes beyond simply

[1] Knight Frank Green Building Value Report (2021)
[2] International Energy Agency (IEA) Net Zero by 2050 Report

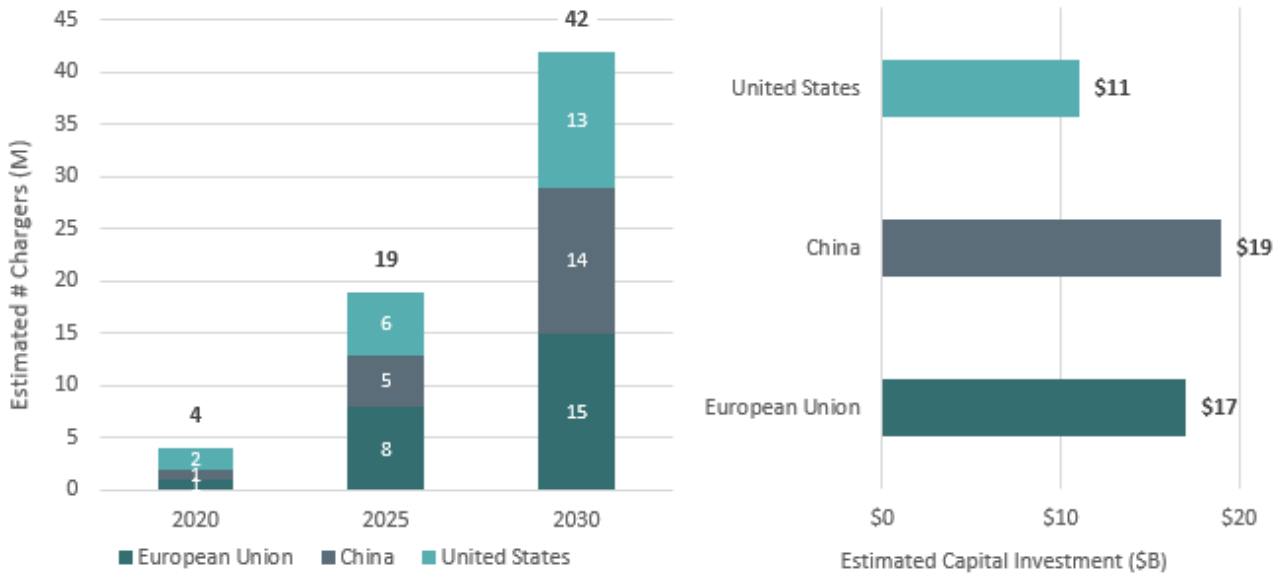
substituting coal with, say, solar or wind power. Rather, it involves changes that affect multiple aspects of everyday life, such as our living/working environments. The rise in demand for energy efficient construction techniques and the growing appreciation for environmentally sustainable properties are just the tip of the iceberg. Real estate, being fundamental to the worldwide economy and our daily lives, will continue to develop alongside the wider Energy Transition and bring forth opportunities for those involved.

2 / Infrastructure

The global shift towards renewable energy sources is also causing significant changes across infrastructure. From transportation networks to energy grids, the infrastructure that supports our society is undergoing a profound transformation as it adapts to this worldwide change. Although there are many segments of infrastructure sector that are being transformed, we will explore two areas where these effects are most noticeable; the adoption of electric vehicles (EVs) and the necessary improvements in charging infrastructure, as well as the grid enhancements needed to accommodate renewable energy sources.

The increasing popularity of electric vehicles clearly shows the impact of Energy Transition. However, for electric vehicles to become the dominant means of transportation, it is crucial to have readily available and effective charging infrastructure. Governments and private entities around the globe are making investments in this domain. According to a report from McKinsey & Company, meeting the demand for EV charging infrastructure could require up to $50 billion in investment by 2030 (Exhibit 3). Deploying charging stations is not just about quantity; strategic placement and accessibility also play vital roles. This progress presents a challenge for current infrastructure planning, but it also offers opportunities for real estate owners and investors who can incorporate charging stations into existing facilities such as shopping centers, public garages, and office buildings.

Exhibit 3: Estimated demand and required capital investment for EV chargers



Source: DWS. "Charging Ahead: Electric-Vehicle Infrastructure Demand", McKinsey & Company, 2020. For illustrative purposes only.

Another important aspect of the Energy Transition is increased reliance on energy sources like solar, wind, and hydro. Unlike fossil fuels, these sources often rely on distributed and intermittent generation, requiring a different grid architecture to optimize functionality. According to Francesco La Camera, the International Renewable Energy Agency (IRENA) Director-General, "annual additions of renewable power capacity must grow three times the current level by 2030 if we want to stay on a pathway limiting global warming to 1.5°C" set by the Paris Agreement. To meet this demand, significant investment is needed to support grid enhancements – these can include technologies such as metering systems, energy storage solutions, and AI-powered predictive analytics for efficient energy distribution. Modernizing the grid is a vital element of Energy Transition that demands substantial financial resources, technological advancements, and policy alignment.

This is why we believe the long-term outlook for infrastructure aligned with Energy Transition is overwhelmingly positive. Global energy transition will require $550 billion spent annually to develop electricity networks by 2030 and will average

$580 billion per year through 2050.[3] The effects of this enormous expansion could not be underestimated, with green infrastructure investments capable of creating 76 million jobs over the next 20 years while adding $2 trillion to global GDP by 2050.[4]

It is abundantly clear that rapid Energy Transition is one of the greatest challenges of our generation, but also an unprecedented opportunity to rebuild aging infrastructure in a way that promotes sustainability and benefits society.

3 International Energy Agency: "World Energy Outlook 2022"

4 International Monetary Fund (IMF) Working Paper - Jobs Impact of Green Energy (2022); "Building a Green Future," IEA, 2023

3 / Natural Resources

Energy Transition is completely changing the natural resources landscape, shifting the world's focus from fossil fuel-based energy sources to sustainable options. These momentous changes impact not only energy production, but also how we extract, distribute and value natural resources. Two of the primary shifts are Western economies' commitments to move away from consuming coal and oil refined products, and increased demand for critical minerals used for smart grids and battery technology.

One notable change brought on by Energy Transition is the declining demand for coal in the U.S. and E.U. member states. Cleaner alternatives such as natural gas and biofuels are gaining popularity. Coal consumption in the U.S. has fallen by more than half since 2010 and by one-third between 2018-2020[5] a trend driven by market conditions and policy measures that support low-carbon energy sources. Natural gas has been the main beneficiary, helping to drive a roughly 40% decrease in coal generation. The future for natural gas is looking bright with opportunities for companies across the value chain involved in its production, liquefaction, and transportation. LNG (Liquified Natural Gas) processing capacity is set to grow from 500bcm in 2022 to 730bcm in 2030, a 4.7% compound annual growth rate (CAGR)[6]. Over time, the market share of natural gas plus renewables is projected to account for 79% of all electricity generated in the U.S. by 2050[7], bringing coal's share of the power stack down to a mere 16%. Such changes will likely create opportunities, challenges, and cycles to come for energy producers across the board.

In the metals space, the global demand for "enabling metals" such as copper, lithium, cobalt, and rare earth elements is on the rise as the world moves towards renewable energy sources. These minerals are vital for developing power grids and advanced battery technologies that support the storage and distribution of clean energy. A typical EV, for example, requires approximately four times the amount of copper, three times the amount of nickel and nine times the amount of lithium compared to a typical internal combustion engine (IC) vehicle (Exhibit 4). Similarly, smart grid implementation along with incremental wind and solar capacity will drive demand for a variety of transition metals including copper, lithium, nickel, etc. As a result, the metal and mining industry is well-positioned to capitalize on elevated levels of capital flowing into renewable energy space.

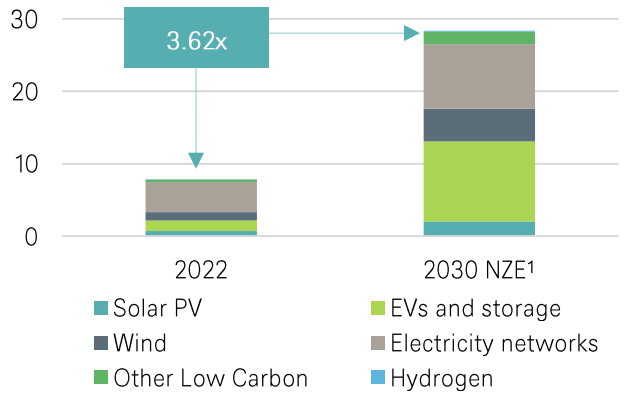
To meet the increasing demand for energy technologies, production of various essential minerals will need to increase by over 500% by 2050 according to World Bank estimates[8]. This surge in demand presents both opportunities and challenges. On the one hand, it can boost the mining industry and contribute to economic development of countries rich in such resources. However, it also raises concerns about sustainable extraction practices and the environmental impact of mining activities. These nuances create unique opportunities for active managers, who can add value by analyzing the extraction practices of individual companies and allocating capital to the most responsible, environmentally sustainable operators. Managing risk appropriately while targeting growth will be important for generating attractive returns over time.

Energy Transition is profoundly affecting the natural resources sector. Society is grappling with the challenge of identifying and prioritizing the resources that foster sustainable growth in a world concerned with climate change. As the demand for coal and certain oil assets declines, while the need for minerals to enable renewable energy technologies grows, stakeholders across the natural resources industry must adapt swiftly and responsibly.

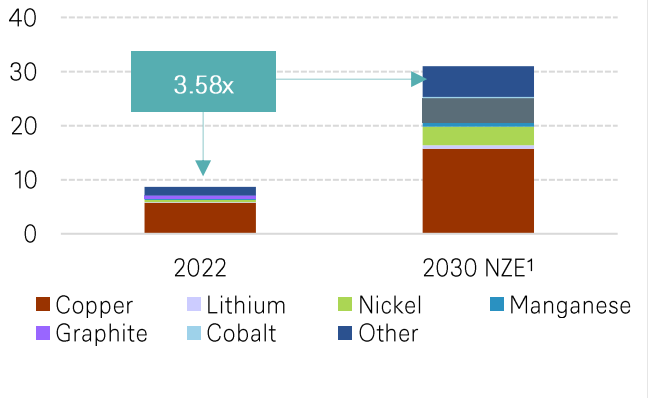
[5] Global Energy Review 2021, IEA
[6] Global Gas Market Outlook, Rystad Energy 2023
[7] Annual Energy Outlook, EIA, 2022
[8] "Critical Minerals for Clean Energy Transitions," World Bank 2020

Exhibit 4: Critical minerals demand for clean energy is set to grow by 3.5 times

By technology in kilotons (Kt)



By mineral in kilotons (Kt)



Source: Source: IEA. Critical Minerals Market Review 2023.
Notes: kt = Kilo Tons, 1 Kilo ton (Meric) = 1000 Tonne. Includes most of the minerals used in various clean energy technologies but does not include steel and aluminum.

4 / Conclusion

Energy Transition is a significant opportunity for the real assets universe. Companies across the space will face unique opportunities and challenges as demand trends continue to shift for hydrocarbons, critical minerals, etc. All must adapt to the changing landscape to remain competitive, and some will likely have to transform their businesses entirely. Although many real asset companies will enjoy leverage to the broader Energy Transition theme, some will likely continue to employ suboptimal environmental practices to keep up with rapidly growing demand. For these reasons, we believe active management of real-assets investments is now more important than ever in order to separate the wheat from the chaff as the Energy Transition landscape evolves.

AUTHOR

Eugene Bidchenco, CFA, CESG
Portfolio Manager – Liquid Real Assets

Glossary

Greenhouse gases are any of the atmospheric gases that contribute to the greenhouse effect. Such gases include car-bon dioxide (CO2), methane (CH4) and nitrous oxide (N2O). For earth, they contribute to an effect like that seen in a sun-exposed glasshouse, by absorbing infrared radiation produced by solar warming on the earth's surface.

Decarbonization is the reduction or elimination of carbon dioxide emissions from a process like manufacturing or energy production.

Renewables are natural resources or sources of energy that is not depleted by use, such as water, wind, or solar power.

A smart grid is an electricity grid that uses information about production and consumption to manage distribution more efficiently.

Net zero describes the achievement of a state in which greenhouse gas emissions due to activities within a company's value chain have no net impact on the climate. This is achieved by reducing greenhouse gas emissions in the value chain according to 1.5°C pathways, and by offsetting the impact of remaining greenhouse gas emissions through appropriate removals of CO2.

Distributed generation refers to electricity generated by various tiny, decentralized energy sources.

Intermittent generation refers to electricity production from sources not continuously available due to external factors beyond control. These sources exhibit variability on a relatively brief time scale.

The compound annual growth rate (CAGR) is the rate of return that would be required for an investment to grow from its beginning balance to its ending balance, assuming the profits were reinvested at the end of each period of the investment’s life span.

Internal combustion engine (IC) refers to engine that generates motive power by the burning of gasoline, oil, or other fuel with air inside the engine, the hot gases produced being used to drive a piston or do other work as they expand.

Important information

For North America:
The brand DWS represents DWS Group GmbH & Co. KGaA and any of its subsidiaries, such as DWS Distributors, Inc., which offers investment products, or DWS Investment Management Americas, Inc. and RREEF America L.L.C., which offer advisory services.

This material was prepared without regard to the specific objectives, financial situation or needs of any particular person who may receive it. It is intended for informational purposes only. It does not constitute investment advice, a recommendation, an offer, solicitation, the basis for any contract to purchase or sell any security or other instrument, or for DWS or its affiliates to enter into or arrange any type of transaction as a consequence of any information contained herein. Neither DWS nor any of its affiliates gives any warranty as to the accuracy, reliability or completeness of the information which is contained in this document. Except insofar as liability under any statute cannot be excluded, no member of the DWS, the Issuer or any office, employee or associate of them accepts any liability (whether arising in contract, in tort or negligence or otherwise) for any error or omission in this document or for any resulting loss or damage whether direct, indirect, consequential or otherwise suffered by the recipient of this document or any other person.

The views expressed in this document constitute DWS Group's judgment at the time of issue and are subject to change. This document is only for professional investors. This document was prepared without regard to the specific objectives, financial situation or needs of any particular person who may receive it. No further distribution is allowed without prior written consent of the Issuer.

Investments are subject to risk, including market fluctuations, regulatory change, possible delays in repayment and loss of income and principal invested. The value of investments can fall as well as rise and you might not get back the amount originally invested at any point in time.

An investment in real assets involves a high degree of risk, including possible loss of the principal amount invested, and is suitable only for sophisticated investors who can bear such losses. The value of shares/ units and their derived income may fall or rise.

War, terrorism, sanctions, economic uncertainty, trade disputes, public health crises and related geopolitical events have led, and, in the future, may lead to significant disruptions in US and world economies and markets, which may lead to increased market volatility and may have significant adverse effects on the fund and its investments.

For Investors in Canada. No securities commission or similar authority in Canada has reviewed or in any way passed upon this document or the merits of the securities described herein and any representation to the contrary is an offence. This document is intended for discussion purposes only and does not create any legally binding obligations on the part of DWS Group. Without limitation, this document does not constitute an offer, an invitation to offer or a recommendation to enter into any transaction. When making an investment decision, you should rely solely on the final documentation relating to the transaction you are considering, and not the document contained herein. DWS Group is not acting as your financial adviser or in any other fiduciary capacity with respect to any transaction presented to you. Any transaction(s) or products(s) mentioned herein may not be appropriate for all investors and before entering into any transaction you should take steps to ensure that you fully understand such transaction(s) and have made an independent assessment of the appropriateness of the transaction(s) in the light of your own objectives and circumstances, including the possible risks and benefits of entering into such transaction. You should also consider seeking advice from your own advisers in making this assessment. If you decide to enter into a transaction with DWS Group, you do so in reliance on your own judgment. The information contained in this document is based on material we believe to be reliable; however, we do not represent that it is accurate, current, complete, or error free. Assumptions, estimates, and opinions contained in this document constitute our judgment as of the date of the document and are subject to change without notice. Any projections are based on a number of assumptions as to market conditions and there can be no guarantee that any projected results will be achieved. Past performance is not a guarantee of future results. The distribution of this document and availability of these products and services in certain jurisdictions may be restricted by law. You may not distribute this document, in whole or in part, without our express written permission.

For EMEA, APAC & LATAM:
DWS is the brand name of DWS Group GmbH & Co. KGaA and its subsidiaries under which they do business. The DWS legal entities offering products or services are specified in the relevant documentation. DWS, through DWS Group GmbH & Co. KGaA, its affiliated companies and its officers and employees (collectively "DWS") are communicating this document in good faith and on the following basis.

This document is for information/discussion purposes only and does not constitute an offer, recommendation, or solicitation to conclude a transaction and should not be treated as investment advice.

This document is intended to be a marketing communication, not a financial analysis. Accordingly, it may not comply with legal obligations requiring the impartiality of financial analysis or prohibiting trading prior to the publication of a financial analysis.

This document contains forward-looking statements. Forward looking statements include, but are not limited to assumptions, estimates, projections, opinions, models, and hypothetical performance analysis. No representation or warranty is made by DWS as to the reasonableness or completeness of such forward-looking statements. Past performance is no guarantee of future results.

The information contained in this document is obtained from sources believed to be reliable. DWS does not guarantee the accuracy, completeness, or fairness of such information. All third-party data is copyrighted by and proprietary to the provider. DWS has no obligation to update, modify or amend this document or to otherwise notify the recipient in the event that any matter stated herein, or any opinion, projection, forecast, or estimate set forth herein, changes or subsequently becomes inaccurate.

Investments are subject to various risks. Detailed information on risks is contained in the relevant offering documents.

No liability for any error or omission is accepted by DWS. Opinions and estimates may be changed without notice and involve a number of assumptions which may not prove valid.
DWS does not give taxation or legal advice.

This document may not be reproduced or circulated without DWS's written authority.

This document is not directed to, or intended for distribution to or use by, any person or entity who is a citizen or resident of or located in any locality, state, country, or other jurisdiction, including the United States, where such distribution, publication, availability, or use would be contrary to law or regulation or which would subject DWS to any registration or licensing requirement within such jurisdiction not currently met within such jurisdiction. Persons into whose possession this document may come are required to inform themselves of, and to observe, such restrictions.

Issued in the UK by DWS Investments UK Limited which is authorized and regulated by the Financial Conduct Authority (Reference number 429806).

In Hong Kong, this document is issued by DWS Investments Hong Kong Limited, and the content of this document has not been reviewed by the Securities and Futures Commission.

In Singapore, this document is issued by DWS Investments Singapore Limited, and the content of this document has not been reviewed by the Monetary Authority of Singapore.

In Australia, this document is issued by DWS Investments Australia Limited (ABN: 52 074 599 401) (AFSL 499640) and the content of this document has not been reviewed by the Australian Securities Investment Commission.

For investors in Bermuda: This is not an offering of securities or interests in any product. Such securities may be offered or sold in Bermuda only in compliance with the provisions of the Investment Business Act of 2003 of Bermuda which regulates the sale of securities in Bermuda. Additionally, non-Bermudian persons (including companies) may not carry on or engage in any trade or business in Bermuda unless such persons are permitted to do so under applicable Bermuda legislation.

For investors in Taiwan: This document is distributed to professional investors only and not others. Investing involves risk. The value of an investment and the income from it will fluctuate and investors may not get back the principal invested. Past performance is not indicative of future performance. This is marketing communication. It is for informational purposes only. This document does not constitute investment advice or a recommendation to buy, sell or hold any security and shall not be deemed an offer to sell or a solicitation of an offer to buy any security. The views and opinions expressed herein, which are subject to change without notice, are those of the issuer or its affiliated companies at the time of publication. Certain data used are derived from various sources believed to be reliable, but the accuracy or completeness of the data is not guaranteed, and no liability is assumed for any direct or consequential losses arising from their use. The duplication, publication, extraction, or transmission of the contents, irrespective of the form, is not permitted.