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Investing in the Energy Transition

The Opportunity for Institutional Capital

Institutional capital investing in the Global Energy Transition

Gettyimage:
white wind tunnel

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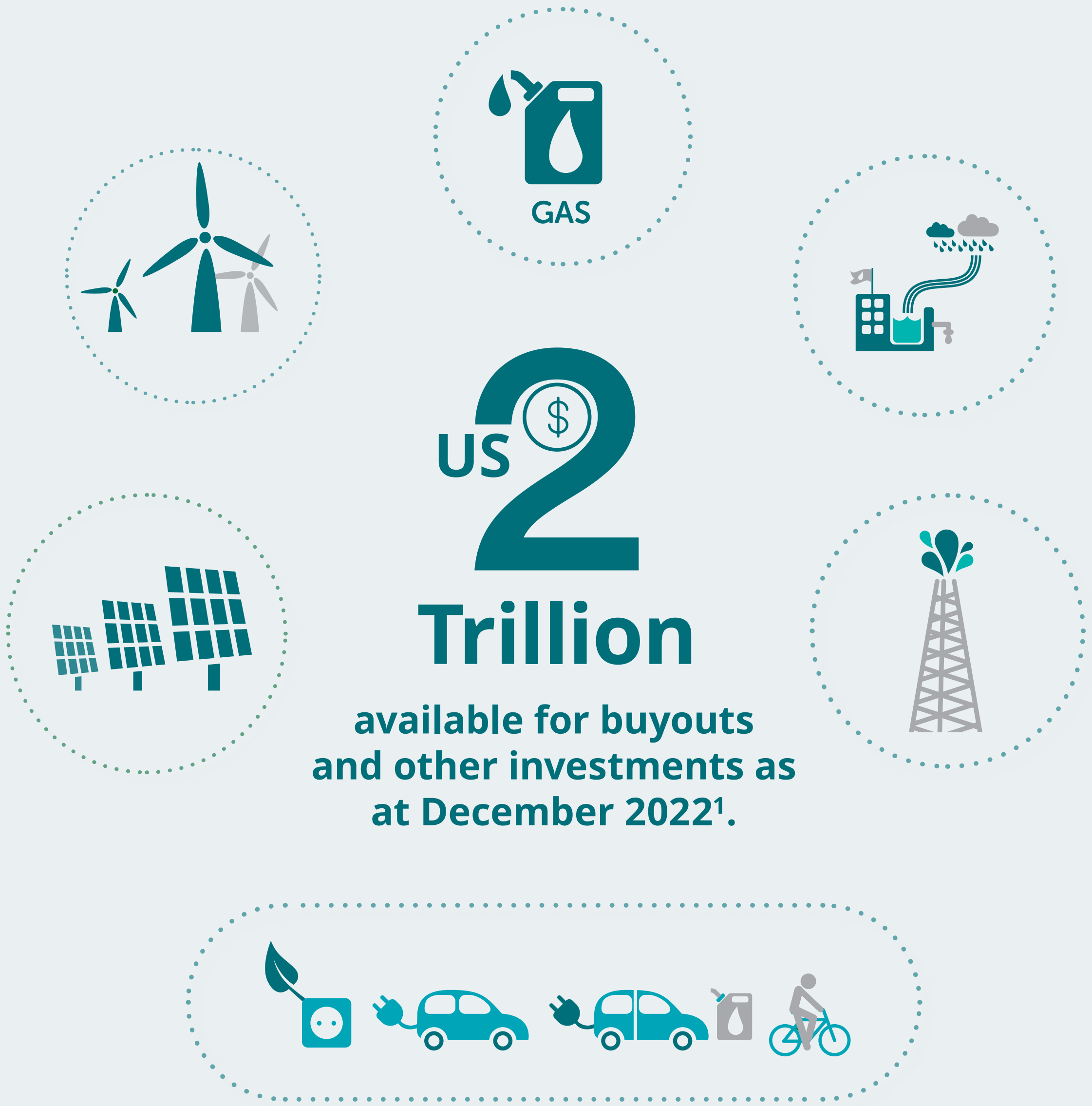
Mobilising Institutional Capital for the Global Energy Transition

Gettyimage:
Panoramic view of wind farm or wind park, with high wind turbines for generation electricity with copy space. Green energy concept.

Across private equity, special asset funds, and infrastructure investors there is immense dry powder waiting to be deployed.

The global private equity industry alone has a record level of cash reserves with an estimated..



Finding opportunities that are of a large enough investment size, whilst being consistent with investment mandates and fund decarbonisation commitments, has been proving a challenge.

This has led to an influx in buyers seeking to acquire traditional renewable assets, such as wind, solar and battery projects, which have proven to be increasingly expensive in hotly contested auctions[2]. Furthermore, if these assets are packaged as one or two operational assets with a very long development pipeline, large multiples may need to be paid by acquirers upfront based on conceptual or planned projects.

Renewable premiums, development and operational risks, and contractual risks of shorter-term power purchase agreements are all compounding factors that can make traditional 'green' investments less attractive to infrastructure investors.

So, it begs the question: given the pricing and operational challenges of pure play renewable investments, how can US$2 trillion of dry powder be deployed to support the energy transition and in accordance with ESG and decarbonisation objectives?

02
The Global Energy and Investment Context

Gettyimage:
Australia, Northern Territory, Hermannsburg, Solar Power Generating Station in Outback

The likelihood of the low-carbon transition occurring is no longer in question.

We are already seeing our global energy mix transform, as well as significant decarbonisation-related investments being made across all sectors.

The question that does remain, however, is how orderly or disorderly the transition will be, over what time-period, and who the winners will be in the low-carbon transformation?

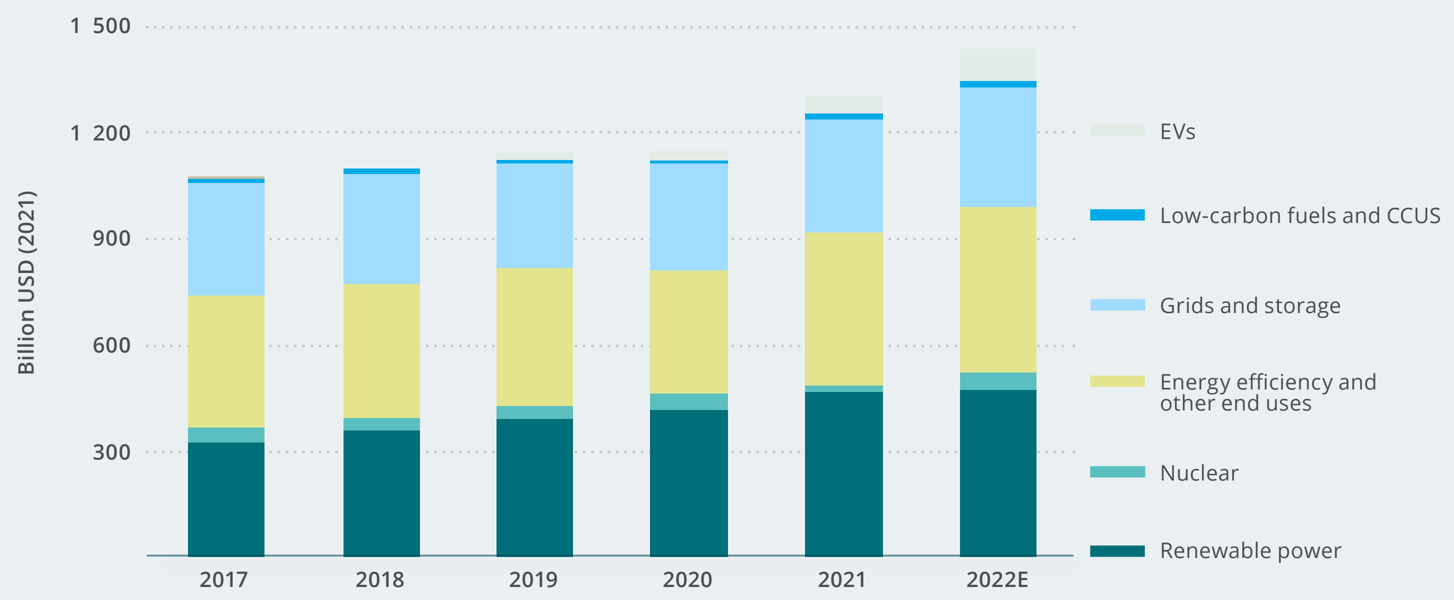
The world is in a critical decade to deliver a more secure, sustainable, and affordable energy system. This has become even more apparent as we face a global energy crisis. This has largely been driven by Russia's curtailment of natural gas supply and European sanctions on Russian oil and coal; severing one of the main arteries of global energy trade.

The backdrop of energy security concerns and sector-wide decarbonisation has heightened pressures on investors.

They must play their role in transitioning the global economy, to ensure that decarbonisation ambitions can be realised in a responsible and orderly way. This has led to a shift in capital flows away from fossil-fuel and auxiliary sectors and towards more 'green' investments such as renewables.

Several factors have driven investment in large-scale renewable projects over recent years, including elevated wholesale electricity prices, government policy incentives, declining technology costs and improved access to finance[3]. Clean energy investment opportunities have now become well understood amongst the private investor community, including institutional investors, pension funds and private equity, especially given that the majority of large investment funds have set decarbonisation and net zero commitments.

Annual Global Clean Energy Investment



Source: International Energy Agency, 2022 World Investment Outlook

US$1.7 trillion is expected to be spent globally on clean energy technologies in 2023 – including renewables, electric vehicles, nuclear power, grids, storage, low emissions fuels, efficiency improvements and heat pumps[4]. Clean energy investments now account for almost three-quarters of the growth in overall energy investment, which has been growing at an average annual rate of 12% since 2020[5]. Global renewable capacity is expected to increase by almost 2400 GW (almost 75%) between 2022 and 2027[6] and the uptick in renewable investment is critical to reduce emissions[7] in the energy sector, which currently account for more than 73% of global CO_2 emissions . The sector's role is, in fact, doubly crucial, with the decarbonisation of the rest of the economy reliant on the growing demand for renewable electricity, such as electric vehicles and residential heating.

Enthusiasm for ESG-friendly investments has also contributed to extremely high valuations in the renewables sector.

The S&P Global Clean Energy index, which tracks the share price of 30 companies, has almost doubled in value from 2020 to 2021, giving it a valuation of 41 times its companies' expected profits, according to Bloomberg data. By contrast, US blue-chip stocks are up about 16% in the past year and are valued at 23 times forward earnings[8].

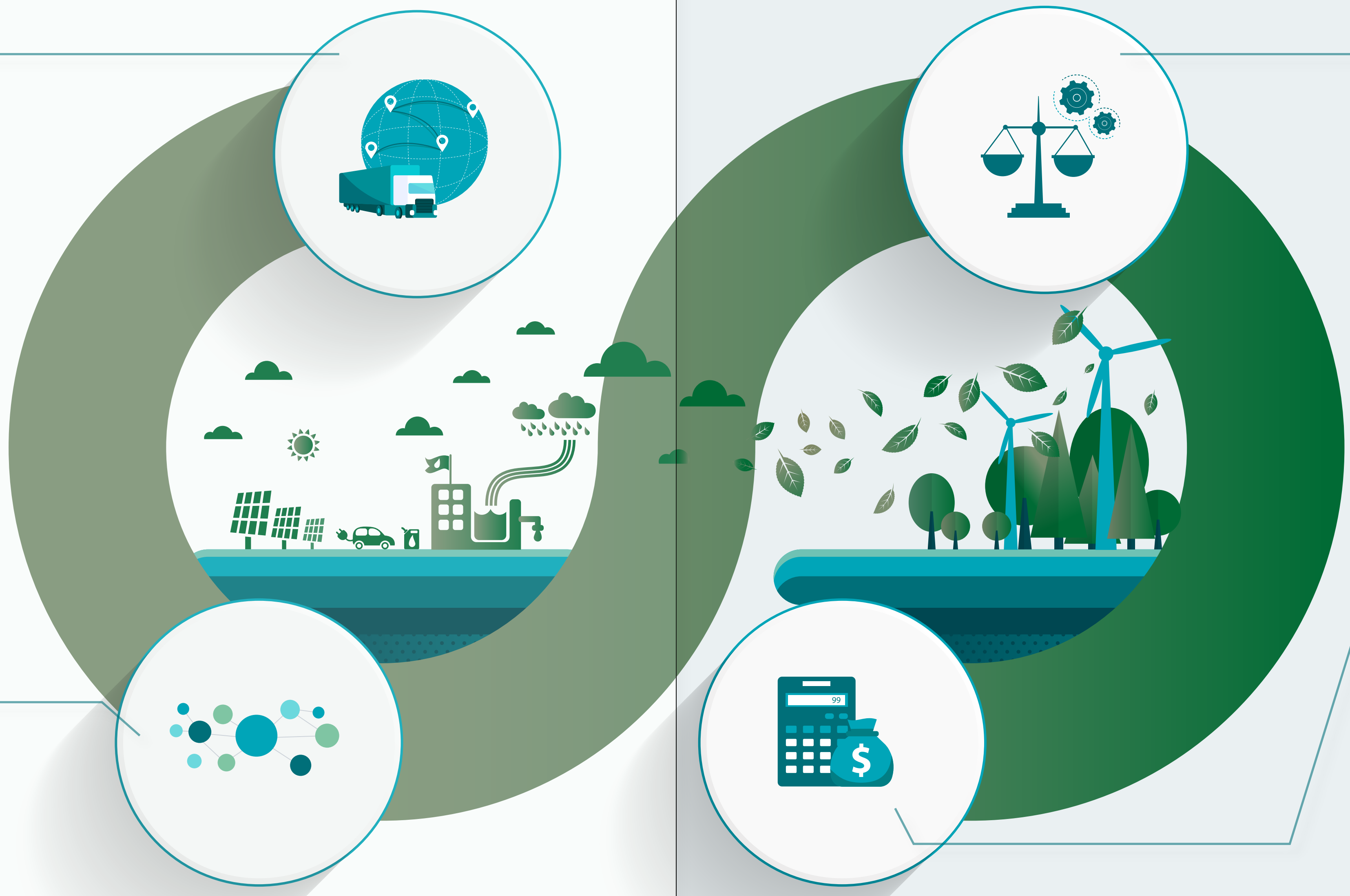
Despite significant investment in renewables to date, it is still not at the level needed to reach international climate goals. If net zero is to be achieved by 2050, the investment gap per year in the renewable energy sector in emerging and developing economies is $1.35 trillion[9].

From private equity and infrastructure investment perspectives, traditional risk-based classifications and investment time horizons are being challenged by fundamental transition-led drivers, such as electric mobility and sustainability targets. These forces mean that the risk/return profile of specific assets need to be reassessed and potentially recategorised to account for new sources of risk and growth.

Whilst the private sector recognises the clean energy investment opportunity, there have been some challenges with investing in renewable energy projects and interesting dynamics playing out over the past 12-24 months. For example:

Development and Integration Challenges

- Lack of skilled labour (e.g. electrical and mechanical engineers and regulatory and compliance managers) has impacted the ability to install and operate new renewable projects and integrate these projects into the grid.
- Lengthy permitting processes and social licence challenges for both new renewable projects and transmission and distribution lines, can threaten the delivery and operation of renewable projects.



Supply Chain Challenges

- Rapid growth in renewables requires stable markets and resilient supply chains. In recent years high volatility in renewables markets – in part due to fluctuations in the supply and prices of raw materials – and changes in regulations have made long-term capacity planning and securing favorable prices for large quantities of raw materials difficult.
- Profitability risks to Original Equipment Manufacturers (OEMs) have been impacting their ability to manufacture renewable energy components, as they are particularly impacted by material price volatility. This is in part due to long-term contracts with customers often containing fixed prices that do not allow for adjustments needed to account for increasing prices of raw materials such as steel, aluminium, and copper.

Although clean energy will be the cornerstone of our low-carbon future, the rising share of renewables brings with it new challenges. Not least of these are the structural strains on existing generation, transmission, and distribution infrastructure created by the inherent intermittency and variability of renewables, a greater number of distributed energy resources, and bi-directional flows of electricity. This brings to rise questions around the role of transition investments to mitigate the immediate impacts of both the global energy crisis and the decarbonising grid – and how such investments can drive the economy towards a low-carbon future in a socially responsible way.

Legal and Regulatory Challenges

- Changing regulation and policy such as energy market redesign, development of new market structures, changes to feed-in tariffs and elimination of tax credits, can generate permitting, development, grid integration and pricing risks for new renewable projects. This in turn can impact ability to access upfront financing and longer-term profitability.

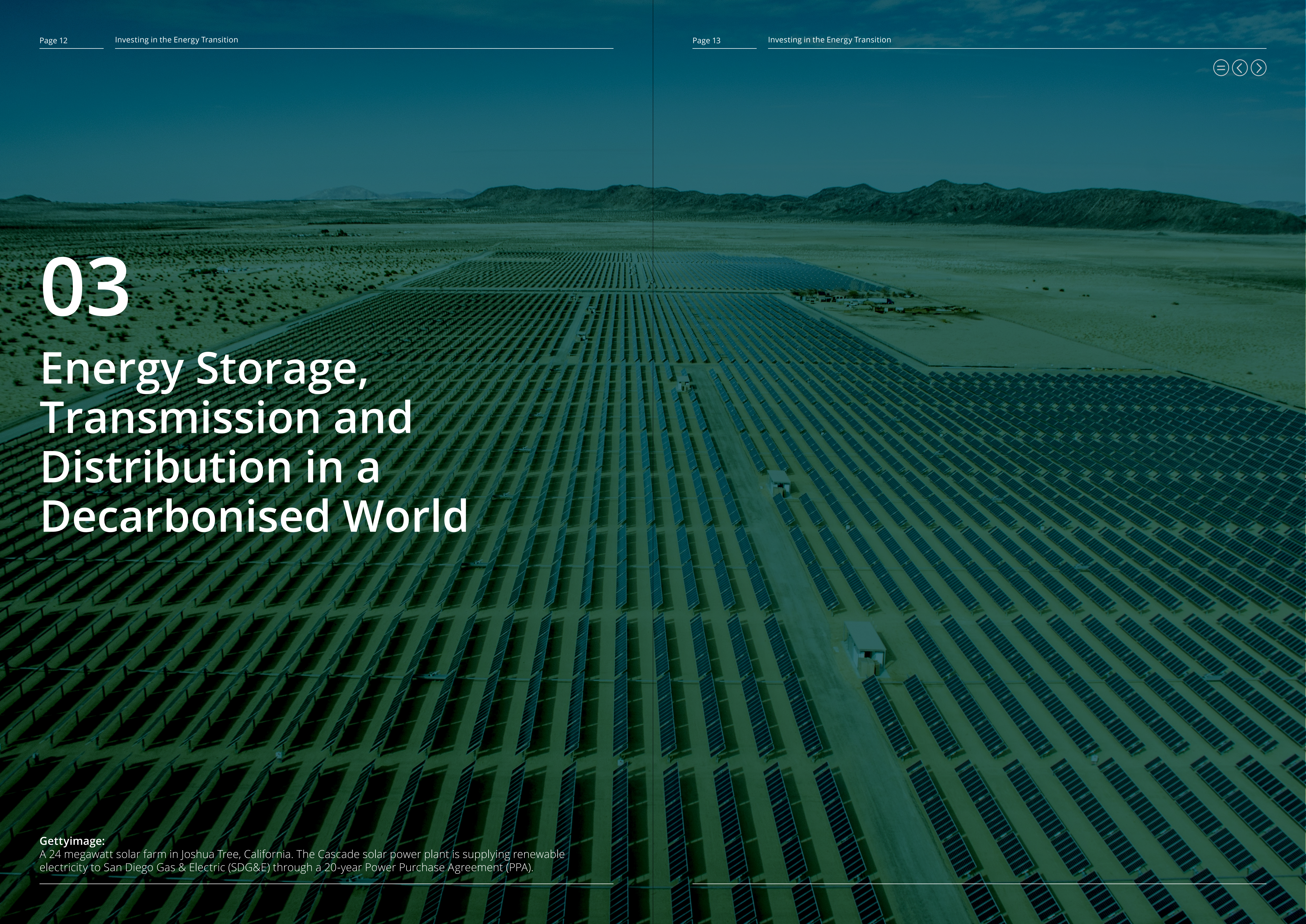
Financing Challenges

- Access to capital can be a challenge, given that greenfield solar and wind projects are capital intensive, have long permitting and gestation periods, and potential financiers are concerned about supply chain, grid integration and social licence risks.
- Securing financing from banks can be challenging given that banks' liability duration can impede them from lending to the renewables sector for the long term and there are refinancing risks for the borrower, as long-term debt financing is required.
- There are questions around who is best placed to finance greenfield renewable projects in different jurisdictions – whether this should this be energy generators, energy retailers, governments, or private investors.

The provisions of the US Inflation Reduction Act (IRA) of 2022 will have impacts on battery, renewable and electric vehicle markets.

For example, in order for US-based vehicle manufacturers to be eligible for tax credits under the IRA, a certain percentage of the critical minerals being used in electric vehicle batteries must be extracted and processed in the United States or a free-trade agreement country[10,11].

Under Section 45X, 50 critical minerals are covered by the act including: aluminium, nickel, graphite, lithium and cobalt. This is of particular significance for non-free trade agreement countries such as China, where a significant number of critical mineral extraction and refinement activities are taking place, and for free-trade agreement countries such as Australia, where these are large critical mineral deposits, but these minerals are often sent overseas for refining and processing. Such regulatory changes create both incentives for new investments and acquisitions, as well as market uncertainties, altering the landscape of energy transition opportunities for investors.



03

Energy Storage, Transmission and Distribution in a Decarbonised World

Gettyimage:
A 24 megawatt solar farm in Joshua Tree, California. The Cascade solar power plant is supplying renewable electricity to San Diego Gas & Electric (SDG&E) through a 20-year Power Purchase Agreement (PPA).

As the world transitions to decarbonised energy systems,

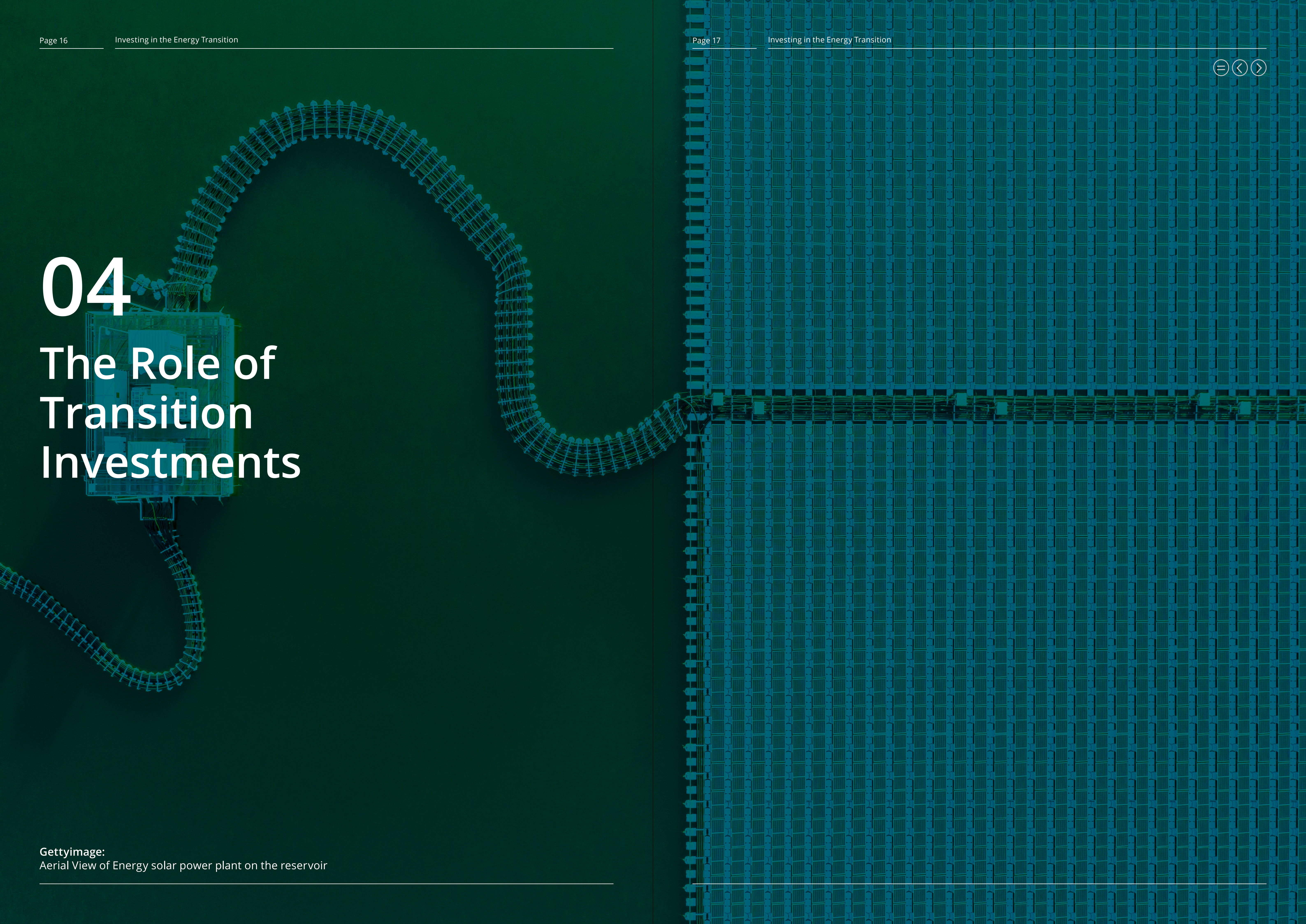
timely deployment of long-duration energy storage technologies will be critical. Firming and storage capabilities and infrastructure, such as batteries, hydro-power, thermal energy, and long duration energy storage solutions such as compressed air energy storage, need to be deployed rapidly and at scale to avoid blackouts and ensure an orderly transition.

Battery storage plays a critical role in plugging the intermittent renewable energy supply through quick and reliable response and alleviating transmission and distribution congestion. Lithium-ion batteries are currently the preferred choice, given the strong understanding of the technology and greater energy density than other battery compositions.

However, there are several constraints associated with battery production and deployment. Poor cost-effectiveness and critical mineral supply shortages , such as lithium and cobalt, have been major factors in holding back greater use of large-scale battery storage. In addition, today's batteries are not well placed to manage durations longer than a few hours, so one of the biggest challenges for the energy transition is dealing with longer periods of minimal sunshine and wind – known as *dunkelflaute* – a German word meaning dark doldrums.

Another challenge with regards to the decarbonisation of the energy system is how to efficiently connect large-scale and distributed renewable energy resources to the grid. Long permitting times and changes to energy-related regulatory frameworks, supply chain delays, and social license challenges can significantly delay the build of new transmission and distribution infrastructure. This means that there can be a mismatch between the construction completion date for a new solar or wind project and the time when it can be connected to the grid and brought online. In the US, under the current state of planning and permitting, interstate transmission lines take on average eight to ten years to complete[13].

These transmission issues are also leading to curtailment of generating assets so that power flows can be maintained within safe limits, both increasing the cost of electricity for the consumer and making it more difficult for renewable developers to secure financing for new wind and solar projects. These considerations bring to light the immense overhaul the energy sector is facing. Given the significant constraints, scheduling delays, and resulting misalignment between renewable electricity supply and demand, it is clear that transition investments will need to be made to ensure the lights stay on and to minimise adverse social impacts that could be the result of a disorderly energy transition.



04

The Role of Transition Investments

Gettyimage:
Aerial View of Energy solar power plant on the reservoir

As the world embarks on the low-carbon transition it is clear multiple generation and storage options need to be deployed to support an orderly transition.

In the US alone it is estimated that by 2050, 6 TWh of energy storage would be required per year to support an electricity system that is 94% renewable – a more than five-fold increase over current US storage capacity[14].

Similarly in Australia, 640 GWh of energy storage would be required per year by 2050 to cater for transport, industry, office and domestic energy consumption – a ten to fourteen-fold increase in Australia's current storage capacity[15]. Given the significant time and investment needed for constructing new firming assets such as batteries and pumped hydro, there is a need to leverage existing infrastructure to smooth the transition as renewables and other storage technologies are built and come online.

One example to illustrate a potential energy transition play is investment in natural gas pipelines; noting that there are several other examples which could be explored.

In December 2021 the European Commission announced that power plants burning natural gas (which emit no more than 0.27 tCO2/MWh[16,17]) can be considered as sustainable investments under the EU taxonomy. Gas is emissions intensive, releasing on average 0.45 tCO2/MWh[18] vs coal releasing ~0.9 tCO2/MWh[19]. It is clear that switching between unabated consumption of fossil fuels, such as from coal to gas, is not the solution for climate change – but this does not preclude a role for gas, and gas pipelines, in the transition.

Gas delivers valuable energy services, some of which – notably seasonal and long-duration storage, rapid dispatchability, high-temperature industrial heat, and winter heating for buildings – are currently difficult to replicate cost-effectively with renewable electricity.

Baseload generation and storage is especially important for large industrial facilities that have high energy demands and often need to maintain operations 24 hours a day. Even if electricity use was to grow even faster and the complete technical potential for electrification was deployed, there would still be sectors requiring other energy sources (given today's technologies), with most of the world's shipping, aviation, and certain industrial processes, such as steel production, not yet "electric-ready". Therein lies opportunities to support decarbonisation of these hard-to-abate sectors through other low-carbon fuel sources such as biomethane and green hydrogen.

Historically, assets in the energy transition were viewed from a binary perspective – as "brown" vs "green", or "dirty" vs "clean". There is a nuanced perspective to be considered for transition investments such as gas pipelines – to be viewed as "olive" investments.

Existing gas infrastructure is set to play an important role in ensuring energy security globally, particularly as coal generators are retiring over the next five to ten years and given the substantial time it takes for new renewable and storage assets to come online. In the short-term gas pipelines support energy security and in the medium to long term, there is potential for these pipelines to be transformed and used to distribute low-carbon fuels such as biomethane and green hydrogen. These pipelines can help decarbonise parts of the energy system that low-carbon electricity cannot currently reach. By enhancing the flexible operation of power systems, transition investments can complement and facilitate the rise of wind and solar.

Investing in new greenfield gas assets is not the argument. Rather, investing in existing gas pipeline infrastructure and preventing it from being mothballed, is part of the ESG story; to deliver a just, socially responsible and orderly transition towards a decarbonised world.

2000-2010

2010-2020

2020-2030

2000-2010

Brown investments:

- Upstream oil and natural gas extraction
- Oil and gas refinery
- Oil and gas infrastructure and pipelines
- Fuel stations
- Coal, iron ore and bauxite mining
- Cement plants
- Fossil fuel power generation

Green investments:

- Utility scale onshore wind
- Utility scale solar
- Hydropower
- Geothermal
- Nuclear
- Transmission and distribution infrastructure

2010-2020

Brown investments:

- Upstream oil and natural gas extraction
- Oil and gas refinery
- Oil and gas infrastructure and pipelines
- Fuel stations
- Coal, iron ore and bauxite mining
- Cement plants

Green investments:

- Utility scale onshore wind
- Utility scale solar
- Hydropower
- Geothermal
- Nuclear
- Transmission and distribution infrastructure
- Battery storage
- Carbon capture, utilisation and storage
- Electric vehicles and charging infrastructure
- Solar thermal
- Biofuels

2020-2030

Brown investments:

- Upstream oil and natural gas extraction
- Oil and gas refinery
- Oil and gas infrastructure and pipelines
- Coal, iron ore and bauxite mining
- Fossil fuel power generation

Olive investments:

- Gas infrastructure and pipelines
- Below and above ground rail
- Seaports
- Shipping
- Aviation
- Steel
- Aluminium
- Cement
- Fuel Stations

Green investments:

- Utility scale onshore wind
- Utility scale solar
- Hydropower
- Geothermal
- Nuclear
- Transmission and distribution infrastructure
- Battery storage
- Long duration energy storage
- Carbon capture, utilisation and storage
- Solar thermal
- Biofuels
- Electric vehicles and charging infrastructure
- Green hydrogen and ammonia
- Hydrogen fuel cell vehicles and refuelling infrastructure
- Hydrogen storage and transportation
- Sustainable aviation fuel
- Sustainable data centres

Note: the above infographic is for illustrative purposes only and is not an exhaustive list

Case Study:

The Future of Gas Networks

Many players across the energy sector face a common challenge: reimagine the business, or risk holding stranded assets and becoming obsolete.

Uncertainties around what the low-carbon future will look like and the decarbonisation pathway that ends up playing out means that gas utilities and infrastructure operators will need to consider alternate business plans amid the possible various scenarios, such as high electrification rates with significantly declining gas, or more moderated electrification with more rapid transitions to biomethane and hydrogen.

There are several opportunities for both gas utilities and gas infrastructure operators to transition to low-carbon fuels. One opportunity is injecting biomethane into natural gas pipelines. In the short term, biomethane production from landfill gas offers a cost competitive alternative to natural gas and is of a similar chemical composition, making it a favourable low-carbon fuel to distribute. However, biogas and biomethane production at scale requires an abundant feedstock supply, such as agricultural waste. In addition, biodigesters are required to upgrade biogas from landfill into biomethane[20], which is then compressed before being injected into gas pipelines. The economic case for biogas improves when biodigesters are favourably located, such as being close to feedstock sources and transmission networks. In Europe most biogas plants have been built to capture feed-in tariffs, however most existing biogas plants are small scale and decentralized in agricultural areas[21]. In the European context biomethane uptake currently provides an alternative to support energy security by reducing the dependency on Russian natural gas, alleviating part of the energy cost pressure on households and companies[22].

Another transformation opportunity for gas networks is green hydrogen distribution, which is produced by electrolysis powered by renewable energy. Hydrogen has a comparable energy density to natural gas and can be transported via modified existing gas infrastructure and networks. Leveraging highly integrated natural gas transmission networks can represent economically, socially and environmentally advantageous ways to distribute large quantities of energy.

Investing in existing gas infrastructure as a means to support the low-carbon transition avoids some of the key challenges the build of new transmission and distribution infrastructure face, such as supply chain and social license challenges, whilst also minimising the use of newly extracted virgin materials, which new renewables and transmission and distribution assets require. Existing gas pipelines are favourably positioned in terms of being centered around ports and routes that connect to large population and industrial hubs, and leveraging these networks will support reducing the delivery timescale for hydrogen[23].

While noting the above, there still are challenges that need to be resolved when repurposing existing gas infrastructure. Injecting small amounts of hydrogen into existing gas networks at around 10-20% can occur without modifications required.

However, anything above 20% requires significant modification. Some key considerations for repurposing networks include:

- The small molecular size of hydrogen permits it to penetrate pipelines in ways that natural gas (methane) cannot. This process of "absorption" can result in the embrittlement of the pipes.
- Coating, sleeves, and casing of material with adequate resistance to hydrogen embrittlement and permeation can be used to overcome this issue, but this still needs to be tested on a commercial scale in transmission pipelines.
- Additional safety measures also need to be considered given the flammability of hydrogen, and equipment must be "spark-proofed" to an even higher degree than when transporting nly natural gas.
- Further feasibility studies and pilot projects are required to better understand the technical, safety and commercial requirements, as well as concurrent development of regulation to support such assets.

Despite the modifications required it can still be cheaper to repurpose existing infrastructure rather than building new pipelines – conversion of existing gas networks to hydrogen operation is estimated to be 10-15% of the cost of new pipeline construction[24].

While not all gas assets can be modified or utilised to distribute hydrogen, feasibility studies are underway to increase a blend of 10-20% hydrogen in existing natural gas pipelines to 100% hydrogen. There are currently several gas-to-hydrogen pilot projects underway – in the US, Europe and Asia-Pacific[25]. For example, in 2021, APA Group in Australia launched a hydrogen pilot project to facilitate Australia's first 100% hydrogen-ready transmission pipeline, which will be converted from an existing natural gas pipeline in Western Australia[26].

It should be noted there are also other options to transport hydrogen, such as converting hydrogen to ammonia or liquid organic hydrogen carriers (LOHCs) and transporting to the consumer by road or sea. This presents opportunities for other sectors to play their role in the energy transition such as the shipping sector, who also have the potential to use hydrogen and ammonia to fuel their own transport operations, thus eliminating their own scope 1 emissions[27].

05

Consideration for the Workforce Transition

Gettyimage:
Two rope access technicians working on higher wind turbine blades.

One key concern for policy makers and private investors alike is that there are not enough people with the right capabilities to build and operate renewable and transmission assets and to support the overall renewable value chain[28].

Having an appropriately skilled workforce impacts the overall attractiveness of energy-related investments for both institutional investors and private equity.

While sometimes overlooked, an attractive element for investing in existing gas infrastructure is the highly skilled workforce and significant capability synergies that can be leveraged. Gas utilities and operators have workforces with considerable operations, maintenance and compliance expertise required to support biomethane distribution and to convert pipelines to hydrogen operation. Gas utilities and operators have a workforce with deep energy systems knowledge and technical and compliance expertise. These skills and experience are needed to not only deliver hydrogen-repurposing projects but also comply with required regulatory and safety processes.

In addition, network operators can leverage their strong relationships and existing customer and supplier bases to undertake ongoing work with potential hydrogen producers and customers to understand the infrastructure and connection requirements to commission pipelines, bringing a hydrogen service to the market and supporting the necessary transformation of the entire ecosystem.

Leveraging existing skillsets from the gas sector also presents opportunities to mitigate adverse social impacts that could flow from the energy transition. By investing in assets that can be transformed, and leveraging existing skillsets to undertake these re-purposing projects and hydrogen operations, investors can play their part in supporting the workforce to further uplift their capabilities, enabling long-term employment in a low-carbon future.

By investing in assets that can be transformed, and leveraging existing skillsets to undertake these re-purposing projects and hydrogen operations, investors can play their part in supporting the workforce to further uplift their capabilities, enabling long-term employment in a low-carbon future.

06
Seizing the opportunity

Gettyimage:
Engineer standing in a field at a wind farm wearing VR glasses

All of these considerations point to an interesting value creation story for private investors to contemplate.

By investing in 'olive' assets, investors have the opportunity to transform businesses to thrive in a low-carbon economy, benefitting from the tailwinds of the energy transition, as well as the potential for higher exit multiples in the future.

In the gas networks example, investing in existing gas infrastructure and ancillary businesses provides energy security for consumers in the short term, and industry-wide decarbonisation in the medium to long term, by distributing low-carbon fuels such as hydrogen and biomethane.

Extending outside of this natural gas case study, there are other opportunities to consider as 'olive investments'. One example could include fuel stations. In this case there would be opportunities to leverage the existing fuel station infrastructure, footprint, commercial brand, relationships, skills and resources to deploy EV charging and hydrogen re-fuelling stations for passenger and commercial vehicles and heavy trucks. Given that demand for petrol- and diesel-powered vehicles are on the decline, private equity or infrastructure investors could take advantage of the opportunity to consider tuck in acquisitions and vertical integration opportunities such as hydrogen production and transportation, further deriving value from the tailwinds of ESG.

Investors could also look beyond pure acquisition strategies and consider strategic partnerships as a way to derive value in the energy transition. One example of this is the recent partnership between German steel producer Salzgitter AG and Ørsted. A memorandum of understanding was established to enable greater value creation for both parties. Ørsted will supply renewable energy through their existing offshore wind assets to Salzgitter, who will use this to produce low-carbon steel. Ørsted plans to then use this low-carbon steel to produce wind turbines, and then the scrap from Ørsted's decommissioned wind turbines will be recycled and supplied back to Salzgitter for integration into their steel production process[29].

With all of this in mind, a key question remains. How can investors consider the balance between investible energy transition opportunities and staying true to their own net zero commitments in the short term, whilst positioning their own investment portfolios to benefit from the tailwinds associated with the transition to a low-carbon economy?

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