



Global Investors Move Into Renewable Infrastructure

Reviewing the World's Top Renewable Energy Financiers

Executive Summary

"A transition to net zero will affect how risk is measured and managed, and how assets are valued. This transition is creating the greatest commercial opportunity of our age."

– Mark Carney, former Bank of England Governor

This report validates Mark Carney's statement by highlighting the recent momentum building in favour of investment in climate-friendly energy transition sectors.

Low carbon energy transition assets are creating investment opportunities, and they have also demonstrated significant resilience, consistently attracting capital despite the COVID-19-induced global economic crisis.

In financial year (FY) 2020, the clean energy sector received record investment commitments totalling US\$501 billion – 9% more than the previous year. The renewable energy segment led with US\$303bn in 2020, which is 60% of total investment committed into the overall low carbon energy transition sector.

**Investors committed
a record US\$501bn into
low carbon assets in 2020.**

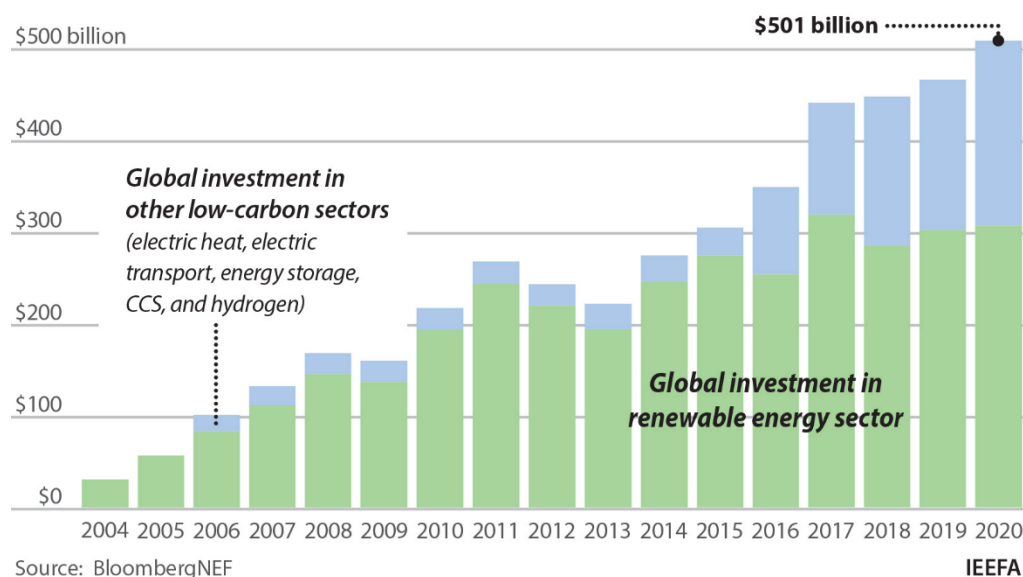
In addition to the inherent advantages of investment in the clean energy sector such as relatively higher risk-adjusted returns and stable project cashflows, the COVID-19 stimulus packages of some governments, especially in Europe and South Korea, put green investment at the forefront of recovery plans, driving further clean energy investment.

The net zero emissions by 2050 financial alliance pledges of 2021 have created a strategic shift in dialogue, building on the Paris Agreement of 2015 to now emphasise the role global finance can play in working to limit global average temperature increases to 1.5 °C above pre-industrial levels. The Paris Agreement stipulates finance will be critical on two fronts – divestment away from carbon intensive assets and mobilising capital towards low carbon energy transition assets. Investors have been pressuring fossil fuel companies via divestment or engagement and in recent years, investor-led momentum for stronger climate action has been

building, as tracked by IEEFA.¹ However, as Carney pointed out, fossil fuel divestment is just one part of the story; shifting from avoiding the financial risks associated with climate change to embracing the investment opportunities offered by the energy transition is equally important.

Global Investment in the Energy Transition Tops \$500bn

The renewable energy sector dominates low-carbon investment



In this report, IEEFA focuses on the investment opportunities of decarbonisation, i.e., global capital flowing into the development of low carbon infrastructure assets, especially asset level investment into renewables infrastructure.

We highlight global commercial investors that are actively investing in renewable energy infrastructure across the world. We showcase recent renewable energy investment activities of the top 10 global commercial banks as per Bloomberg New Energy Finance's (BNEF) Clean Energy League Table of 2020. We cover renewable energy investment activities of a diverse set of 10 world-leading equity investors. Finally, we examine 10 major energy transition sector deals across diverse technologies installed across geographies. Our report primarily focuses on the recent renewable energy investment activities of these financial institutions since 2020.

The top commercial banks in our list provided a cumulative debt of US\$30bn to renewable energy infrastructure in FY2020.² Tellingly, no U.S. banks appear in this list; rather, it is dominated by large European banks along with 3 Japanese banks.

¹ IEEFA. [Financial institutions are restricting fossil fuel funding.](#)

² The number primarily includes the debt issued at primary market for financing and refinancing of renewable energy assets. It does not include any other investment such as investment in public listed equities, secondary bond markets and private equity investment.

Large U.S. banks have only recently started joining the global movement of investment into climate-focused sectors. In 2021, JPMorgan Chase and Bank of America, two of the largest fossil fuel financiers over the past five years, set a target of US\$2.5 trillion and US\$1.5 trillion respectively of sustainable climate-friendly deals over the next 10 years. Similarly, Citigroup Inc. and Morgan Stanley have announced they will mobilise US\$1 trillion each. However, these U.S. banks with trillions in asset ownership have yet to demonstrate progress towards fulfilling these commitments amid the building global momentum.³

The equity investors in our list are from a diverse range of financial services (pension funds, asset managers, infrastructure funds, diversified financial groups and private equity investment firms). We selected these entities based on their proven track record in renewable energy investment and due to their top management backing the role of finance in solving the climate challenge.

In the final section of the report, we highlight 10 globally significant renewable energy infrastructure projects which are either in an advanced stage of construction or recently operational. These projects cover diverse technologies and illustrate the growing opportunities in energy transition industries of the future.

³ Bloomberg. [Wall Street's Trillion-Dollar ESG Club Comes with Huge Tax Perks](#). 23 April 2021.

Table of Contents

Executive Summary	1
Introduction	6
Renewable Energy Investments Show Resilience	6
Renewable Infrastructure: A Preferred Investment Theme	8
China Is Leading the World in Energy Transition Investments.....	10
U.S. Electric Storage Installations Booming.....	10
Massive European Investment Outpaced Thermal Generation.....	11
India Solar Capacity Investment Drive	11
Actions and Promises on Energy Transition Investment.....	11
Top 10 Global Debt Investors Leading Financing of Renewable Energy	15
Sumitomo Mitsui Banking Corporation Group, Japan	16
Banco Santander SA, Spain	17
Mitsubishi UFJ Financial Group Inc, Japan.....	19
CaixaBank, Spain	21
BNP Paribas SA, France	22
Societe Generale SA, France	24
Cooperatieve Rabobank, Netherlands	25
Mizuho Financial Group Inc, Japan.....	26
Credit Agricole Group, France	28
ING Groep NV, Netherlands	29
Global Equity Investors	31
Amundi Asset Management	31
BlackRock	32
Brookfield Asset Management	34
Canada Pension Plan Investment Board (CPPIB)	36
Caisse de dépôt et placement du Québec (CDPQ).....	38
Copenhagen Infrastructure Partners (CIP)	40
Cubico Sustainable Investments.....	41
Global Infrastructure Partners	42
Kohlberg Kravis Roberts (KKR).....	43
Macquarie Group	44
Top Global Renewables Deals	46
SSE and Equinor Dogger Bank Offshore Wind Farm, UK.....	46

Table of Contents (continued)

Changfang and Xidao Offshore Wind Farm Project, Taiwan..... 47

Enel Piaui, Bahia, Rio Grande do Norte and Pernambuco Onshore Wind Portfolio, Brazil..... 48

Xcel Sagamore Onshore Wind Farm, U.S. 49

Al Dhafra Solar PV Plant, UAE..... 49

Xuan Thien Ea Sup Solar Project in Dak Lak, Vietnam 50

SB Energy Phalodi-Pokhran Solar PV Plant, India..... 51

Asian Renewable Energy Hub, Australia 51

Fengning Pumped Storage Power Plant, China..... 53

Gateway Energy Storage, U.S. 53

Annexure 1..... 55

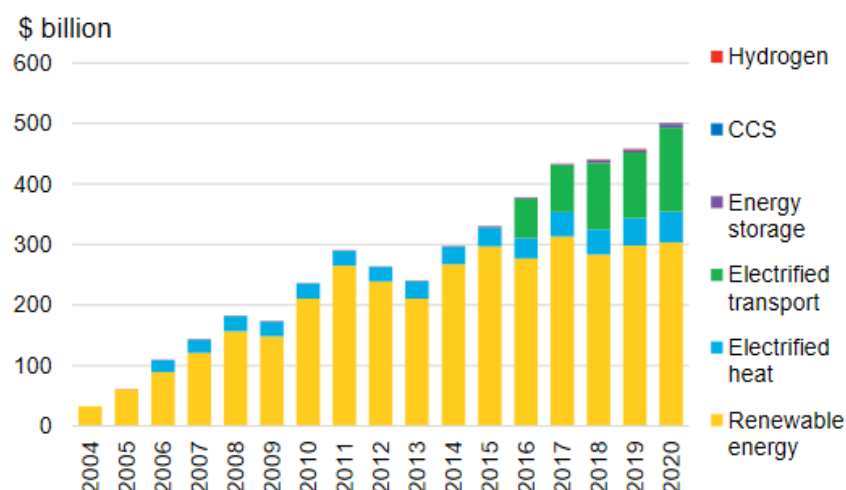
About the Authors 56

Introduction

Renewable Energy Investments Show Resilience

Renewable energy is one of the few sectors that can claim growth in 2020 in terms of investment inflows. Despite the economic disruption caused by the ongoing COVID-19 pandemic which has severely impacted investments, investors committed a record US\$501bn into low carbon assets in 2020 – up 9% on the previous year. This includes investment in energy transition sectors such as renewable energy, energy storage, electric vehicle infrastructure, hydrogen production and carbon capture and storage, small-scale solar systems and heat pumps.

Figure 1: Global Investment Into Energy Transition by Sectors



Source: BNEF.

As per BloombergNEF data, renewable energy has continued to attract more investment than other low carbon sectors, increasing 2% in 2020 compared to the previous year to US\$303bn (60% of total low-carbon investments).⁴ The electric transport and allied charging infrastructure sector received the second biggest investment of US\$139bn in 2020 which is 28% higher than 2019.⁵

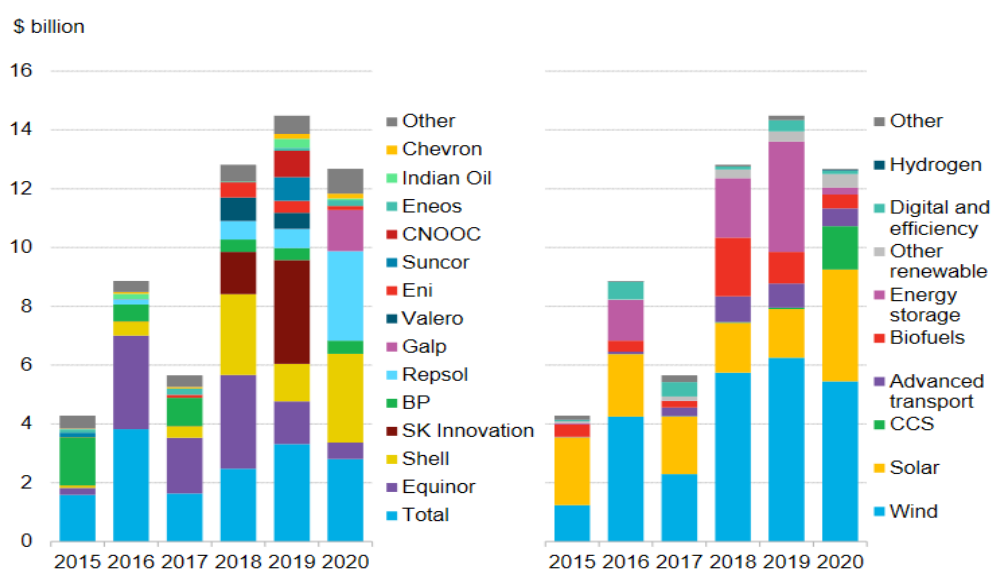
It is the 7th consecutive year that renewable energy investment has breached US\$250bn (excluding large hydro investments). The significant uptick in solar energy installation and the US\$50bn surge in offshore wind power projects have been the major drivers of capital mobilisation into renewable energy infrastructure build-out. Solar power projects attracted investment worth US\$147bn in 2020 while wind power investment declined by 6% to US\$143bn despite the major uptake in offshore wind power projects.

⁴ The investment figure includes investment from corporates, private financial institutions, governments and households.

⁵ BloombergNEF. [Energy Transition Investment Trend](#). 19 January 2021.

Renewable energy investment trends shown in Figure 1 reflect a consistent and resilient flow of capital into decarbonisation investments. Several factors ensured strong investment in the renewables sector such as stable and minimum volatility long-term project cashflows; conducive policy environments set against rising climate change risk; volatile fossil fuel prices and demand; increasing divestment momentum against fossil fuels;⁶ and an increasing focus on sustainable financing. In addition, some governments kept green investment at the forefront of their economic recovery plans – the European Commission’s €750bn stimulus is a notable example.⁷

Figure 2: Clean Energy Investment by Oil and Gas Companies



Source: BNEF.

A key trend underpinning renewable energy investment is the pivot by an increasing number of oil and gas companies. Led by European majors, these firms are looking to transition from carbon intensive to low carbon portfolios to adhere to their net-zero commitments. While renewable energy investment by these oil and gas behemoths reduced by 12% year-on-year to US\$12.7bn in 2020, the capex proportion allocated to renewable energy infrastructure increased to 6% which is higher than in previous years.

A key trend underpinning renewable energy investment is the pivot by an increasing number of oil and gas companies.

⁶ IEEFA. [Financial institutions are restricting fossil fuel funding.](#)

⁷ European Commission. [Recovery plan for Europe.](#) 2020.

The majority of these investments come from European companies such as Shell, Total, Galp and Repsol.

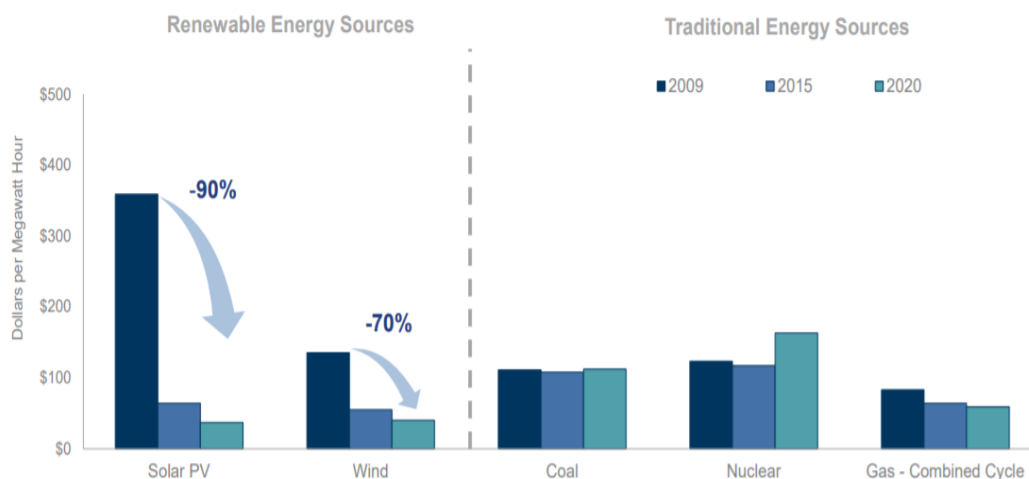
Renewable Infrastructure: A Preferred Investment Theme

The transition to low carbon sources of energy is increasingly inevitable given the looming climate crisis and the improving clarity on energy transition policies by a growing number of countries. Renewable energy sources are proven technologies that will ensure this transition is achieved in the coming decades.

With 82% growth in energy consumption since 2010, clean energy sources (solar, wind, hydro, etc.) are expected to become the single largest source of energy globally, estimated to grow at a staggering rate of 137% through to 2050. To meet this growth potential ~US\$55 trillion of investment may be needed. The International Energy Agency (IEA) recently modelled a comprehensive pathway to net-zero carbon emissions by 2050 which represents a US\$100 trillion investment opportunity in clean energy infrastructure by 2050.^{8,9} These numbers infer that the renewable energy sector will be a multi-decade growth story.¹⁰

Total renewable energy installation in 2020 reached a record 260 gigawatts (GW) despite the COVID-19 pandemic, 50% higher than the previous record. In contrast, total fossil fuel capacity dropped to 60GW in 2020 from 64GW in 2019. Renewable energy now represents one-third of total power capacity and one-quarter of electricity generation globally.¹¹

Figure 3: Change in New Build Levelized Cost of Energy Since 2009



Source: Lazard's Levelized Costs of Energy version 14.0. Latest data available as of 31-Dec-2020.

⁸ Forbes. [The IEA's Net-Zero Climate Pathway Is A \\$100 Trillion Investment Opportunity](#). 2 June 2021.

⁹ IEA. [Net Zero by 2050](#). May 2021.

¹⁰ Goldman Sachs Asset Management. [GS Clean Energy Income Fund \(GCEDX\)](#). April 2021.

¹¹ IRENA. [World Adds Record New Renewable Energy Capacity in 2020](#). 5 April 2021.

The secular growth trend of renewable energy infrastructure is primarily driven by declining costs, conducive government policies tackling climate change risk, economies of scale, clarity on the energy transition, growing capacity, and technological advancements. As shown in Figure 3, the levelized cost of wind and solar power sources have declined by 70% and 90% since 2009, respectively. These are now the cheapest power sources and, in some cases, are replacing or undercutting existing conventional carbon intensive power sources. Once the cost of energy storage falls sufficiently, the issue of intermittency in renewable power can also be resolved.

Revenue from renewable energy projects is almost guaranteed by fee-based long-term contracts. The sector has offered strong risk-adjusted returns in the past five years with lower volatility compared to other income-oriented equities, as well as broader equities in the U.S. (see Table 1).

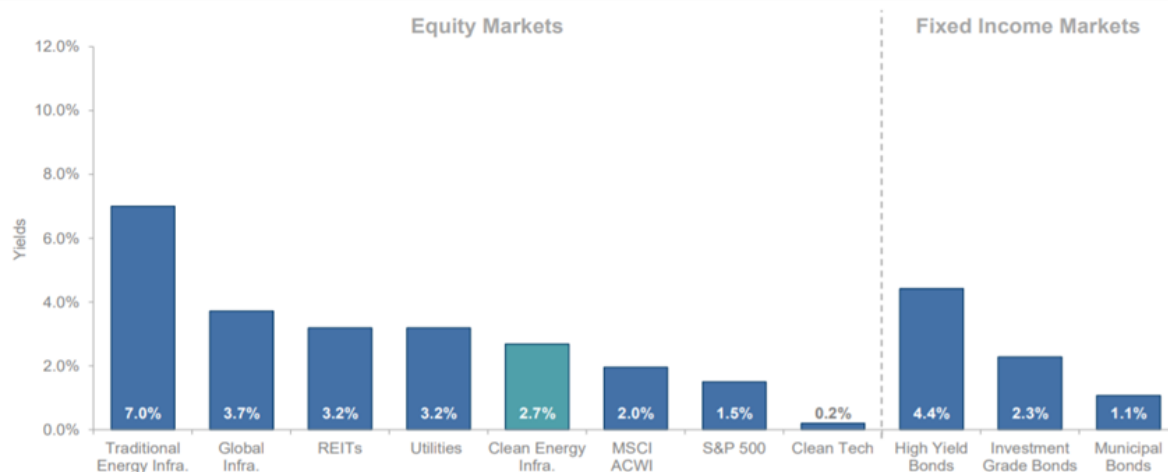
Table 1: Five-Year Risk-Return Metrics Across Income-Oriented Asset Classes & Broader Equity Markets

	Traditional Energy Infra.	Clean Tech	REITs	Utilities	S&P 500	Clean Energy Infra.	Global Infra.	MSCI ACWI
5-Year Returns	5.0%	38.0%	7.0%	9.0%	16.0%	19.0%	8.0%	14.0%
Volatility (Annualized)	26.3%	33.3%	22.5%	21.4%	19.1%	18.0%	16.9%	15.5%
Sharpe Ratio	0.10	1.40	0.40	0.50	0.90	1.10	0.50	0.90

Source: Goldman Sachs Asset Management.

In addition, clean energy assets have offered attractive yields with stable cashflows as shown in Figure 4.

Figure 4: Income-Oriented Asset Yields

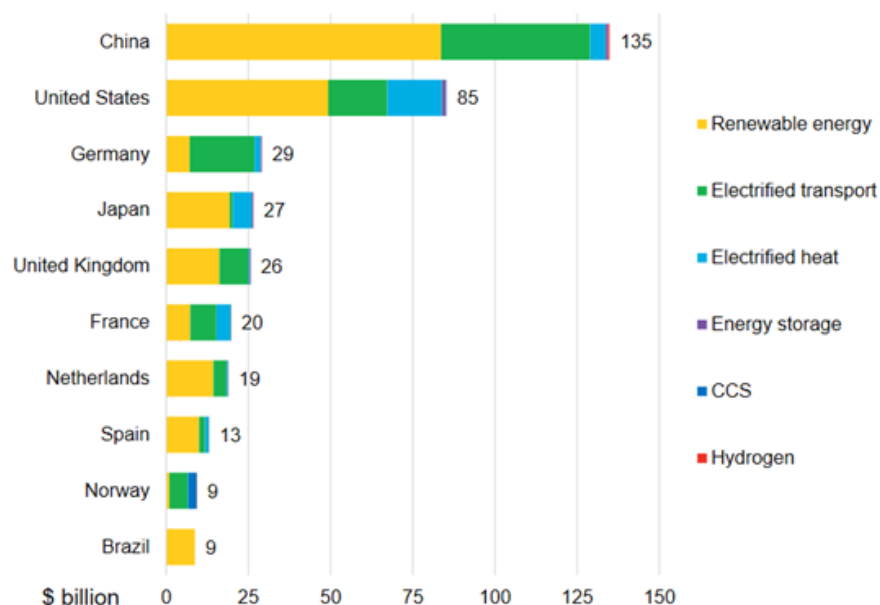


Source: Goldman Sachs Asset Management.

China Is Leading the World in Energy Transition Investments

China was the largest investor into energy transition infrastructure in 2020 despite a 12% decline to US\$135bn. The U.S., which invested US\$85bn into the sector in 2020, was next. China invested US\$84bn into renewable energy capacity and US\$45bn into the electrification of transport.

Figure 5: Global Investment in Energy Transition by Country, 2020



Source: BNEF.

With a commitment to reach net-zero emissions by 2060, we expect China to deliver a record surge in solar capacity installations in next five years. In 2020, China installed 60.4GW of wind and 48.2GW of solar power projects, double its total renewable installations in 2019. However, China also installed 56.4GW of thermal power plants in 2020, the highest level since 2015 – a move entirely inconsistent with its commitment to deliver on its net-zero by 2060 ambition.¹²

U.S. Electric Storage Installations Booming

The U.S. also saw a decline of 11% to US\$85bn of investment in the energy transition sectors. While renewable investment fell 20% to US\$49bn, electric transport saw a surge of 3% to US\$18bn. However, the U.S. still managed to install a total of 19GW of solar power in 2020. Furthermore, the U.S. saw a boom in its electric storage installations which tripled in 2020 and accounted for 38% of total storage capacity additions globally.^{13,14}

¹² Reuters. [China doubles new renewable capacity in 2020; still builds thermal plants](#). 21 January 2021.

¹³ Wood Mackenzie. [Americas to lead global energy storage market by 2025](#). 20 April 2021.

¹⁴ BloombergNEF. [Energy Transition Investment Trend](#). 19 January 2021.

Massive European Investment Outpaced Thermal Generation

European countries led much of the increase in energy transition investment in 2020, thanks to various green stimulus packages to revive their economies. These nations invested US\$166bn in low carbon sectors – 67% more than the previous year's investment, and larger than the investment by China and the U.S.

Investment was primarily driven by large offshore wind farms in the UK and the Netherlands, and a significant uptake in electric vehicle sales in those countries.¹⁵

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Renewable energy generation in European nations outpaced thermal generation with 40% of the total electricity supply met by renewable energy sources in the first half of 2020 compared to 34% from fossil fuel-based thermal power plants.¹⁶ The UK's record run of 67 days without sourcing power from coal plants made 2020 the greenest year yet for its power grid. Spain emerged as the solar powerhouse with a 60% increase in solar installation in 2020 versus 2019.

India Solar Capacity Investment Drive

India, which has been one of the top destinations for investment into the solar sector, saw a 72% decline in solar installations during 2020 and the slowest installation of wind power projects in 10 years. The slump in renewable energy additions on account of over-leveraged utilities was accentuated by the world's largest COVID-19 lockdown. Yet solar power auctions in 2020 set successive record-low tariffs as investors across the globe showed significant interest in the Indian solar market. As highlighted by IEEFA in previous research into potential investment into India's renewable energy infrastructure, there are early positive signs in 2021 as far as solar capacity installations are concerned.¹⁷ India's solar capacity increased by 88% year-on-year with additions of 2,056 megawatts (MW) of installations in first quarter (Q1) 2021. Furthermore, India's utility-scale solar pipeline stands at 53.6GW with an additional 24.1GW of projects either tendered or pending auction in Q1 2021.¹⁸

Actions and Promises on Energy Transition Investment

More than 100 countries have aligned with the Paris Agreement and pledged to become carbon neutral in the next 30 years.¹⁹ But while policymakers and governments can provide a conducive policy environment to encourage emissions

¹⁵ BloombergNEF. [Energy Transition Investment Trend](#). 19 January 2021.

¹⁶ Ember. [Renewables beat fossil fuels](#). 22 July 2020.

¹⁷ IEEFA. [Capital Flows Underpinning India's Energy Transformation](#). February 2021.

¹⁸ Mercom India. [Q1 2021 India Solar Market Update](#). 27 May 2021.

¹⁹ Energy & Climate Intelligence Unit. [Net Zero Emission Race – 2021 Scorecard](#). 2021.

reduction and promote green investment, the commitment of commercial investors to climate change goals is critical in accelerating the energy transition.

CDP, a pioneer in developing a global environmental disclosure system for investors, found in its recent survey that portfolio emissions of global financial companies were 700 times larger than their direct emissions. The survey found almost 50% of these institutions do *not* have any system to comprehensively measure the climate impact of their investment portfolio. CDP points out that more action is required from many investors to deliver on their pledges to meet the Paris Agreement goals.²⁰

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The 2015 Paris Agreement was a significant milestone because it emphasised the role of finance in tackling climate change risk. It was the first major United Nations (UN) event to focus the attention of investors on climate risk while providing guidance on the decarbonisation of economies. It laid out a decarbonisation pathway to limit global average temperature rises to 1.5 °C above pre-industrial levels.

Decarbonisation to meet the Paris Agreement is broadly a two-pronged approach in terms of climate finance:

1. divesting capital away from companies that are major contributors to greenhouse gas emissions, and
2. investment into clean energy transition infrastructure.

As Mark Carney, former Bank of England governor and current vice chair at Brookfield Asset Management recently said: “It is as much about investing in companies that are part of the solution than it is about divesting. We're shifting from risk to greatest commercial opportunity of our age thus aligning value in the market with what we want in society.”²¹

IEEFA has reviewed the coal, oil and gas divestment policies of hundreds of globally significant financial institutions (GSFI) including commercial banks, insurance companies, pension funds, asset management groups, export credit agencies and development financial institutions. As of 1 June 2021, 172 of these GSFI had an exclusion policy around coal-based projects and 77 a policy on unconventional exploration or production of oil and gas (for example, from oil sands and Arctic drilling). While many GSFI have less stringent fossil fuel divestment policies, IEEFA is seeing clear market-based momentum building towards systematically reducing

²⁰ CDP. [Finance sector's funded emissions over 700 times greater than its own](#). 28 April 2021.

²¹ Bloomberg. [Carney Calls Net-Zero Greenhouse Ambition 'Greatest Commercial Opportunity'](#). 9 November 2020.

investment in carbon intensive assets. GSFIs are starting to ‘walk the walk’ by aligning with policy, and crucially the economics, of renewables versus fossil fuels. The market will ensure investors keep further tightening their fossil fuel exclusion policies.²²

In addition to fossil fuel divestment, decarbonisation requires significant investment in energy transition infrastructure. The Glasgow Financial Alliance for Net Zero (GFANZ), chaired by Mark Carney, was formed in April 2021 to mobilise the trillions of dollars required to build a net zero emissions global economy to deliver on the Paris Agreement decarbonisation goal. The industry-led, UN-convened Net-Zero Banking Alliance (NZBA) is the banking element of GFANZ and was formed with 43 leading banks. GFANZ is a coalition of 160 banks, asset managers, investors and insurers with a combined worth of US\$88 trillion in assets, representing one of the most significant and largest financial efforts to decarbonise lending portfolios.^{23 24}

There has been a significant upsurge in the choice and number of funds focusing on climate finance and these funds are attracting record amounts of cash. For instance, Morningstar estimates that in 2020, climate-focused mutual funds and exchange-traded funds almost tripled in size to US\$177bn. In the same year, some 76 climate change-focused funds were introduced, taking the worldwide total of such funds to 400. Europe boasts the lion’s share of these funds with 284 offerings in the market as of December 2020, compared with only 42 in the U.S.²⁵

In addition to fossil fuel divestment, decarbonisation requires significant investment in energy transition infrastructure.

The story is similar for European and U.S. commercial banks. For many years, large European commercial banks have been at the forefront of providing debt capital to renewable energy projects across the globe, and their U.S. counterparts are now in process of catching up. European banks are not only setting up stringent fossil fuel divestment policies, these banks have also been lending billions of dollars annually for many years into renewable energy infrastructure. This is the main reason that no U.S. commercial bank has secured a place in the list of top 10 debt providers in BNEF’s Clean Energy League Table. More recently, top U.S. financial institutions have been increasingly announcing investments of trillions of dollars into sustainable themes. The four largest financial institutions have announced a cumulative target of US\$6 trillion investment into sustainable and climate-friendly projects. JPMorgan and Bank of America, two of the largest fossil fuel financiers, have pledged to invest US\$2.5 trillion and US\$1.5 trillion in climate change-focussed

²² IEEFA. [Financial institutions are restricting fossil fuel funding.](#)

²³ UNEP-FI. [43 Banks launch Net zero Banking Alliance as key part of consolidated Glasgow Cop Climate Action.](#) 21 April 2021.

²⁴ UNEP. [Global insurance and reinsurance leaders establish alliance to accelerate transition to net-zero emissions economy.](#) 11 July 2021.

²⁵ Bloomberg. [Climate Fund Choices for Investors Are Multiplying.](#) 28 April 2021.

sectors in the next 10 years, while Citigroup and Morgan Stanley have also announced investment of US\$1 trillion each in climate-friendly sectors.²⁶

In this report, IEEFA focuses on the investment side of decarbonisation i.e., global capital flowing into the development of low carbon infrastructure assets, especially asset level investment into renewable energy infrastructure. We highlight global commercial investors that are actively investing in renewable energy infrastructure. We showcase the top 10 global commercial banks as per BNEF's Clean Energy League Table of debt investors and 10 global equity investor leaders (covering pension funds, infrastructure funds, asset managers and private equity investment firms). We also highlight 10 major energy transition sector deals across diverse technologies. This report primarily focuses on the renewable energy investment activities of these financial institutions in FY2020 and ongoing FY2021.

²⁶ Bloomberg. [Wall Street's Trillion-Dollar ESG Club Comes with Huge Tax Perks](#). 23 April 2021.

Top 10 Global Debt Investors Leading Financing of Renewable Energy

Debt investment will be critical in reaching the decarbonisation goal of the Paris Agreement given that debt investors own assets worth hundreds of trillions of dollars. A typical infrastructure project requires a larger component of debt capital (60-80%) compared to equity capital (20-40%). Hence, in this section, we discuss the top global commercial debt investors that are investing significantly in renewable energy infrastructure.

We have selected the top 10 global commercial banks that were leading financiers of renewable energy projects in FY2020, based on BNEF's Clean Energy League Table (See Table 2). These 10 banks lent cumulative debt of US\$30bn to renewable energy infrastructure last year. Note, we are reporting only the debt issued by these banks for financing and refinancing the renewable energy infrastructure assets directly in the primary debt market. We do not include any investment by these banks in the secondary debt market, investment in publicly listed equities of renewable energy companies, and private equity investment.

The top 10 list is dominated by European commercial banks and three Japanese banks. For each bank, we highlight investment trends into clean energy assets over the last five years, showcasing key recent renewable energy transactions. We also outline the diversity of their investments in terms of technology and geographies, and briefly discuss their commitment towards fossil fuel divestment.

Table 2: Lead Arranger Ranking Related to Renewable Energy Projects (FY2020)

Rank	Name of the Bank	Headquarters	Number of Projects	Loan Amount (in US\$m)
1	Sumitomo Mitsui Banking Corporation Group	Japan	78	4,253
2	Banco Santander SA	Spain	75	3,927
3	Mitsubishi UFJ Financial Group Inc	Japan	66	3,857
4	CaixaBank SA	Spain	39	3,848
5	BNP Paribas SA	France	54	3,025
6	Societe Generale SA	France	64	2,717
7	Cooperative Rabobank UA	Netherlands	65	2,570
8	Mizuho Financial Group Inc	Japan	38	1,986
9	Credit Agricole Group	France	48	1,891
10	ING Groep NV	Netherlands	36	1,687

Source: BNEF League Table 2020, IEEFA calculations.

IEEFA notes leading Japanese banks in the list – Sumitomo Mitsui Banking Corporation (SMBC), Mitsubishi UFJ Financial Group (MUFG) and Mizuho Financial Group, Inc – were not among the founding members of the Net-Zero Banking Alliance which was launched in April 2021 by the United Nations Environment Programme Finance Initiative (UNEP-FI), and which is part of the Glasgow Financial

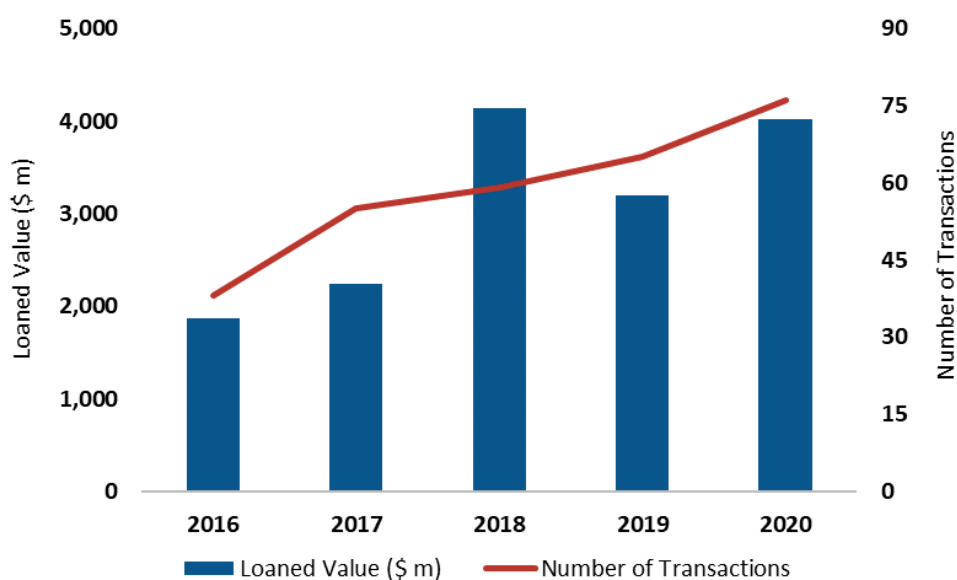
Alliance for Net Zero (GFANZ). Furthermore, Cooperative Rabobank, Credit Agricole and ING Groep were also not amongst the founding members of the Alliance.²⁷

Sumitomo Mitsui Banking Corporation Group, Japan

Sumitomo Mitsui Banking Corporation Group (SMBC) is a subsidiary of Sumitomo Mitsui Financial Group, headquartered in Japan. With assets worth ¥226 trillion (US\$2.07 trillion), SMBC group is the second largest financial institution in Japan in terms of asset size.

The group invested ¥520bn (US\$4.77bn) into renewable energy projects in 2018. It provided a cumulative debt of US\$3.2bn to renewable energy projects and secured third rank in BNEF's league table in the year 2019 (see Figure 6). The group has issued several green bonds with €1.7bn (US\$2.03bn) of outstanding green bonds as of March 2020. Furthermore, the group has a target of investing ¥10 trillion (US\$92bn) into green finance project in the current decade,²⁸ although we note this is immaterial relative to late-to-the-party U.S. banking majors like JPMorgan Chase and Citi, which have both pledged US\$1 trillion by 2030.^{29,30}

Figure 6: Yearly Debt Investment into Renewables by SMBC Group



Source: BNEF, IEEFA calculations.

SMBC was involved in both of the biggest renewable energy projects to date –

²⁷ UNEP-FI. [43 banks launch net-zero banking alliance as key part of consolidated Glasgow Cop climate action](#). 21 April 2021.

²⁸ SMBC. [Sustainability Report](#). 2020.

²⁹ JP Morgan Chase. [JPMorgan Chase Targets More Than US\\$2.5 Trillion over 10 Years to Advance Climate Action and Sustainable Development](#). 15 April 2021.

³⁰ Citigroup. [Environmental and Social Policy Framework](#). March 2021.

Dogger Bank Offshore Wind Farm³¹ and TAQA Al Dhafra solar PV plant.³²

SMBC is amongst 12 banks which have financed the £3bn (US\$4.14bn) Seagreen offshore wind farm of 1.5GW capacity located in the UK. The project is 42% funded through government subsidies. The bank debt of 19-year tenor consists of a £159.5m generation term loan, a £43.8m generation credit facility, £401m transmission term loan, a £115m transmission revolving credit facility, and a £237.7m ancillary facility.³³

SMBC was involved in both of the biggest renewable energy projects to date.

SMBC has invested in clean energy projects across the globe including in emerging markets such as India, Chile, Peru, and Mexico. Two of its key transactions in India include SB Energy's solar PV projects in the states of Rajasthan and Andhra Pradesh³⁴ and EDEN Renewables India's 450MW (US\$165m) solar power project located in Rajasthan.³⁵

In August 2020, SMBC financed two renewable energy projects in Chile developed by Opdenenergy. SMBC provided total capital of US\$103m (€87m) to the Sol de los Andes solar project (104MW) and La Estrella wind farm (50MW).³⁶

Similar to other big Japanese banks, SMBC is at the forefront of investing in renewable energy projects. However, it also has a weak policy on carbon intensive fossil fuel projects so has yet to align with Japanese Prime Minister Yoshihide Suga's globally ambitious net-zero emissions pledge.³⁷

Banco Santander SA, Spain

Banco Santander, a Spanish multinational financial services company with assets worth €1.5trillion, is ranked number two in BNEF's league table of financing renewable energy projects in 2020 (see Table 2). It is the only bank among its peers that has always been in the top 10 renewable energy financiers to date in terms of both volume and number of deals.

Impressively, Banco Santander has been involved in more than 793 renewable energy finance deals, investing more than €32bn over the last decade. It financed

³¹ Proximo. [Proximo Weekly: Offshore wind on steroids](#). 5 February 2021.

³² PV Magazine. [Financial closing for 2 GW solar park in Abu Dhabi](#). 23 December 2020.

³³ IJGlobal. [Power & Renewables Report](#). 14 September 2020.

³⁴ Economic Times. [CPPIB to acquire SoftBank's 80% in SB Energy for \\$425 million](#). 30 December 2020.

³⁵ ETEnergy World. [EDEN Renewables India secures USD 165 million finance for 450-MW solar project](#). 28 January 2021.

³⁶ REVE. [Opdenenergy closes financing with SMBC for 87 million for photovoltaic and wind energy in Chile](#). 14 August 2020.

³⁷ Bloomberg. [Japan Pledges Net-Zero Emissions by 2050 Without Clear Roadmap](#). 26 October 2020.

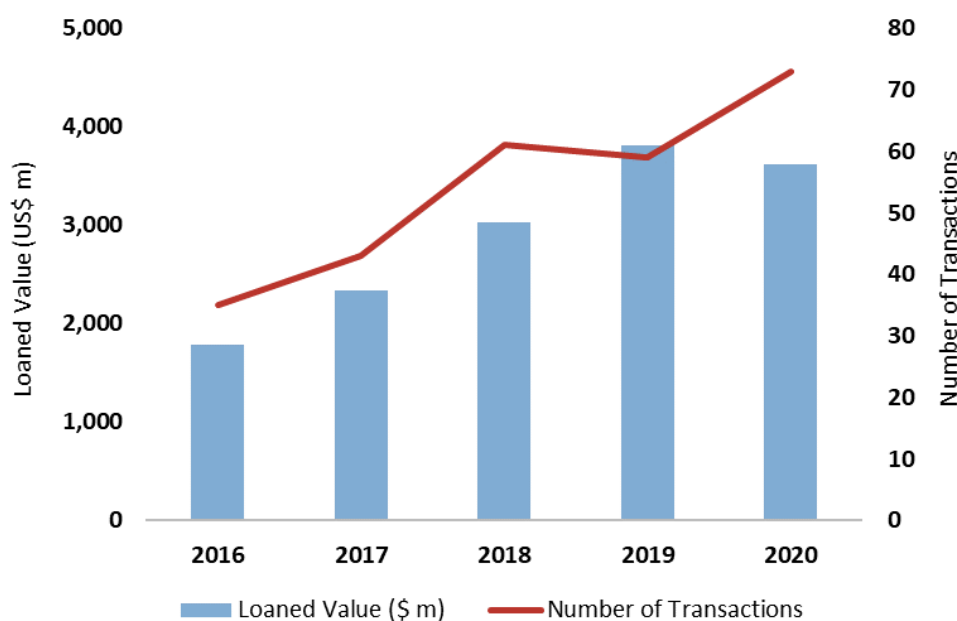
greenfield renewable energy projects with a total cumulative capacity of 8GW in the year 2019.³⁸

Banco Santander is one the lead arrangers in financing the Dogger Bank project touted to be the largest offshore wind farm project in the world.³⁹ Banco Santander is also one of 12 major banks involved in financing the UK-based Seagreen offshore wind farm of 1.5GW capacity.

In April 2020, Santander along with KeyBank Capital Markets Inc. closed US\$333m debt financing of a 215MW solar power generation project located in Fresno County, California. The project Little Bear Solar is being developed by Longroad Energy, a U.S.-based renewable energy developer, owner and operator.⁴⁰ Santander also provided a credit line of US\$139m (£100m) to NextEnergy Capital in May 2020 which is being used to finance two major subsidy-free solar PV projects in the UK.

Whilst a world leader in renewables banking, most of Banco Santander's investments are in European countries and very few leverage Bank Santander's competitive advantages in emerging markets such as Brazil and Chile.

Figure 7: Yearly Debt Investment Into Renewables by Banco Santander



Source: BNEF, IEEFA calculations.

Unlike its Japanese counterparts, Banco Santander has a strong exclusion policy against financing major carbon-intensive fossil fuel projects such as coal mining,

³⁸ Santander. [Climate Finance Report: 2019-June 2020](#).

³⁹ Dogger Bank Wind Farm. [Dogger Bank Wind Farm A and B reaches financial close](#). 26 November 2020.

⁴⁰ Longroad Energy News. [Longroad Energy completes financing for 215 MW-DC Little Bear Solar Projects](#). 7 April 2020.

coal-fired power plants, and the exploration and production of unconventional oil and gas projects. These strong policies and its significant renewable infrastructure investment show a much better alignment than its peers with its ambition to achieve net-zero carbon emissions across its group companies by 2050.⁴¹

Mitsubishi UFJ Financial Group Inc, Japan

Mitsubishi UFJ Financial Group (MUFG) of Japan, with total assets worth approximately US\$3tn, is one of the leading commercial banks financing renewable energy infrastructure across the globe. As per BNEF estimates, MUFG is third amongst global financial institutions in terms of renewable energy investment. It financed 66 renewable energy projects in 2020 with a cumulative investment totalling US\$3.9bn.

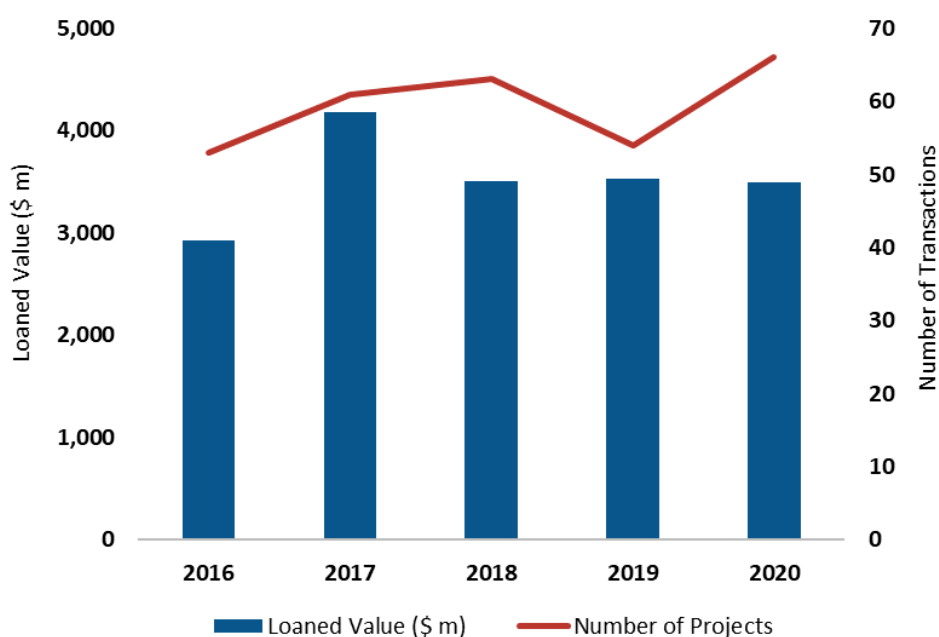
**MUFG is third
amongst global financial
institutions in terms
of renewable energy
investment.**

MUFG has been active in the renewable energy space in the last fiscal year and the ongoing year as well. To date, it has financed over 450 renewable energy projects with a cumulative capacity of 75GW including 30 offshore wind farms.⁴²

As shown in Figure 8, MUFG has consistently provided a cumulative debt of more than US\$3bn for renewable energy projects since 2016, with the highest being in 2017. However, there has been a relatively flat lending profile in renewables over the last 5 years and we note MUFG has continued to invest many multiples of this into high emission fossil fuel projects over the same period. Given Prime Minister Suga's exceptionally ambitious climate pledge for Japan to reduce emissions by 46% by 2030, it would, in IEEFA's view, serve MUFG to 'walk the walk' in alignment with the Japanese government, and help facilitate the step change in capital required to build the zero emission industries the future requires.

⁴¹ Santander. [Santander Group sets ambition to be net zero by 2050, supported by first decarbonization targets](#). 22 February 2021.

⁴² MUFG. [Sustainability Report-2020](#).

Figure 8: Yearly Debt Investment Into Renewables by MUFG

Source: BNEF, IEEFA calculations.

MUFG acted as the mandated lead arranger, hedging bank, and global facility agent for the 2GW TAQA Al Dhafra PV Plant in UAE, which will be the largest single solar plant project in the Gulf region (second only to India's Bhadla Solar Park in Rajasthan). The project is being developed by a consortium of Abu Dhabi National Energy Company (TAQA), Masdar, EDF Renewables and Jinko Power Technology Company and is due to be commissioned in 2022.⁴³ The transaction value is estimated at US\$1bn and is project financed by Bank of China, Credit Agricole, HSBC, Sumitomo Mitsui Banking Corporation and Standard Chartered in conjunction with MUFG.⁴⁴

MUFG has invested in three project finance deals for Softbank in the solar generation sector in India. The most recent project finance investment by MUFG was for a 900MW solar farm in Rajasthan. The project is being developed by SB Energy and is worth US\$333m.⁴⁵ The transaction closed just before SB Energy was acquired by CPPIB from Softbank in December 2020. In February 2020, MUFG also provided US\$276m of construction finance for a 150MW wind power generation project located in Missouri.⁴⁶

⁴³ MUFG Press Release. [MUFG closes financing of Al Dhafrah PV2 solar project in Abu Dhabi](#). 6 January 2021.

⁴⁴ REVE, [EDF Renewables – Jinko Power consortium reaches the financial closing of the world's largest solar project and launches its construction in Abu Dhabi](#), 22 December 2020.

⁴⁵ Saur Energy International. [MUFG Gets Green Certification for Softbank's 900 MW PV Project in India](#). 24 December 2020.

⁴⁶ Tagmydeals. [Kings Point Wind Farm – TL](#). February 2020.

MUFG acted as an export credit agency to finance Dogger Bank in the UK, which will be the world's largest offshore wind farm with a capacity of 3.6GW. This landmark deal worth US\$7.6bn has been financed by 29 banks and three export credit agencies. The project, being developed by SSE Renewables and Equinor, will be able to meet 5% of the UK's electricity demand.⁴⁷

As per BNEF's clean energy league table, MUFG has invested in 7 renewable energy projects in Chile. It also acted as a lead arranger and sole green structuring advisor for a US\$112m syndicated financing facility for the deployment of a 100MW solar power project in Malaysia in December 2020.⁴⁸ This shows that MUFG is active not only in developed countries but is also becoming a lender in emerging markets such as Chile, Malaysia, Vietnam and India which are more vulnerable to climate change impacts and need significant foreign capital to deploy clean energy projects.

Although MUFG is playing an instrumental role in mobilising capital for deployment of renewable energy projects across geographies, IEEFA notes it needs to tighten its policy on financing carbon-intensive sectors such as unconventional oil and gas exploration and production⁴⁹, just as it has done with respect to coal.⁵⁰

CaixaBank, Spain

CaixaBank is the third largest bank in Spain in terms of asset size (€445bn). Like other large European banks, CaixaBank also has a stringent exclusion policy against major carbon-intensive fossil fuel companies such as those involved in coal power generation, coal mining, oil sands exploration or production, and exploration or production of oil and gas in the Arctic region.⁵¹ CDP recognises CaixaBank as one of the leading companies in the fight against climate change.⁵²

CaixaBank is a leading financier of renewable energy projects with €3.16bn in the renewable energy sector and via sustainable financing. It has funded more than 39 projects in the sector which included 25 transactions worth €2.07bn within Spain, which as a result emerged as the solar powerhouse in Europe. CaixaBank also financed several renewable energy projects in Chile, one of the few emerging markets where it invested in 2020.^{53,54} Solar energy projects got 60% of the bank's total investment last year.

⁴⁷ Dogger Bank Wind Farm. [Dogger Bank Wind Farm A and B reaches financial close](#). 26 November 2020.

⁴⁸ AsianPower. [MUFG spearheads financing facility for 100MW Malaysia solar plant](#). March 2021

⁴⁹ MUFG. [Policies and Guidelines](#). 2019.

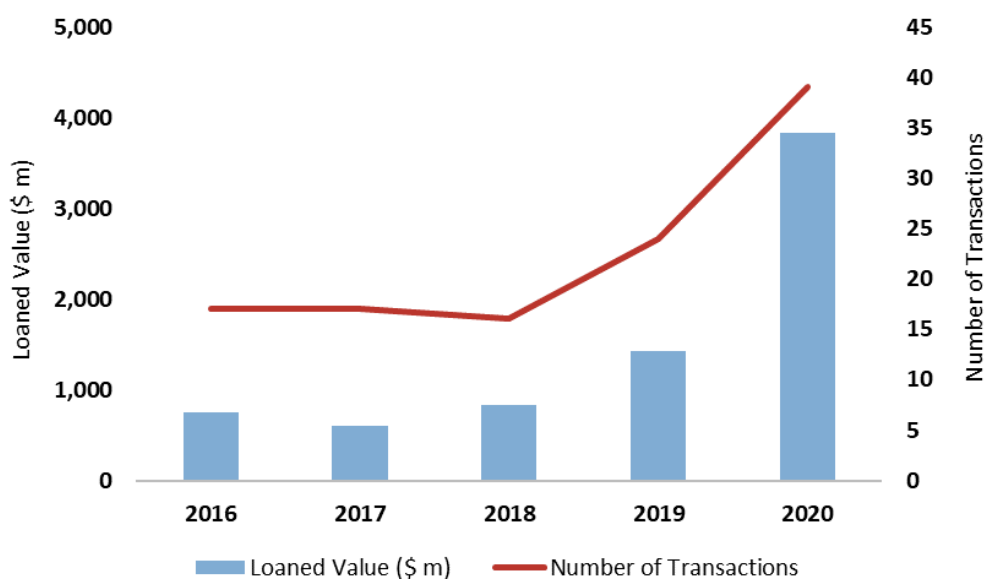
⁵⁰ MUFG. [Revision of the MUFG Environmental and Social Policy Framework](#). 26 April 2021.

⁵¹ CaixaBank. [Environmental Risk Management Policy](#). February 2019.

⁵² CaixaBank. [CDP recognises CaixaBank as one of the leading companies in the fight against climate change](#). 8 December 2020.

⁵³ CaixaBank. [Record in funding of renewable energy and sustainable financing](#). 12 February 2021.

⁵⁴ IJGlobal. [Cabo Leones I refinancing and expansion, Chile](#). 24 July 2020.

Figure 9: Yearly Debt Investment Into Renewables by CaixaBank

Source: BNEF, CaixaBank and IEEFA calculations.

CaixaBank was involved in a couple of the key renewable energy transactions of 2020, as recognised by Project Finance International (PFI). The first was the 497MW Fecamp offshore wind farm project in France, acknowledged as the 'EMEA Green Deal of the Year'. The second was the Dogger Bank offshore wind farm, acknowledged as the 'Global Green Deal of the Year'. These major transactions put CaixaBank in fifth position in BNEF's Clean Energy League Table – a jump of 18 places in 2020. Furthermore, it surged to fifth position in the European ranking of green and sustainable borrowing as per the data provided by Refinitiv.

The bank was involved in 56 operations in 2020, providing financial services and products worth over €5bn through green and sustainable loans. It used innovative financial structures such as sustainable factoring in the agreements with Endesa and Siemens Gamesa, as well as facilitating green guarantees for Siemens Gamesa. Furthermore, it consulted on the placement and issuance of 13 bonds worth more than €7.9bn that were labelled green, social or sustainable.⁵⁵

BNP Paribas SA, France

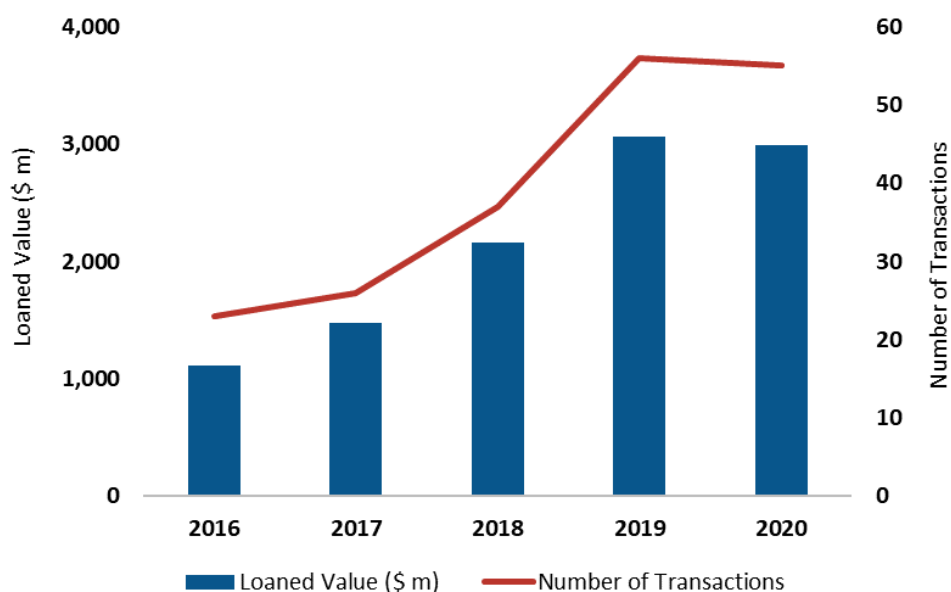
BNP Paribas, the largest bank in Europe by assets, is a proactive investor in clean energy projects. As per BNEF clean energy league table, BNP Paribas provided total loans worth of €3.03bn towards winds and solar projects directly as asset financing or refinancing in FY2020. However, BNP Paribas reported total renewable financing of €17.8bn in FY2020 which may include investment in stocks, secondary market

⁵⁵ CaixaBank. [Record in funding of renewable energy and sustainable financing](#). 12 February 2021.

bonds or private equity of renewable companies.

BNP Paribas has committed to invest €18bn (US\$22bn) in 2021.⁵⁶ It was ranked third amongst project finance lenders in Europe, the Middle East and Africa (EMEA) for renewable energy deals in terms of volume financed by the mandated lead arrangers in 2020.

Figure 10: Yearly Debt Investment Into Renewables by BNP Paribas



Source: BNEF, IEEFA calculations.

Like CaixaBank, BNP Paribas was a founding member of the Net-Zero Banking Alliance launched by the UNEP-FI.⁵⁷ The bank's fossil fuel exclusion policy and its significant investment in renewable infrastructure across geographies is also a promising indicator of its commitment to the 2015 Paris Agreement.⁵⁸

BNP Paribas financed the world's largest offshore wind project at Dogger Bank as well as the largest solar PV project, the TAQA Al Dhafra solar PV project located in the UAE where it was the lead bank, sole bookrunner, lead arranger and hedge provider. It also served as the sole equity bridge loan (EBL) provider to EDF Renewables and Jinko Power, two of the project sponsors.⁵⁹

BNP Paribas' role as a lead arranger in the Dogger Bank offshore wind project helped it to win Global Adviser of the Year in PFI's 2020 awards. It also invested in

⁵⁶ BNP Paribas. [Social and Environmental Responsibility](#).

⁵⁷ UNEP-FI. [43 banks launch net-zero banking alliance as key part of consolidated Glasgow Cop climate action](#). 21 April 2021.

⁵⁸ BNP Paribas. [BNP Paribas joins the Net zero Banking Alliance launched by the UNEP](#). 21 April 2021.

⁵⁹ BNP Paribas. [Al Dhafra PV2: The Largest Single Site Solar Plant in the World](#). 23 February 2021.

SB Energy's 900MW solar farm project in Rajasthan in December 2020.⁶⁰

BNP Paribas, along with Rabobank and UniCredit Bank, facilitated and invested in the maiden corporate green bond issued by Eurogrid GmbH, the parent company of 50Hertz. The green bond, worth €750m (US\$897m), is financing the transmission grid project that will connect the Ostwind 1 and 2 offshore wind projects to the German high voltage grid.⁶¹

In addition, BNP Paribas acted as joint-lead manager for €12.5bn (US\$15bn) of sustainable bonds issued in response to the COVID-19 crisis, highlighting its commitment towards responsible investment.⁶²

Societe Generale SA, France

Societe Generale, headquartered in France, is one of the leading financial groups in Europe. It has dedicated €120bn (US\$143bn) to financing energy transition projects over 2019-2023. The group has been investing in renewable energy projects across the globe since 2009. It was ranked number one and number two in financing renewable energy projects in Europe, the Middle East and Africa (EMEA) by Infranews in 2020 and Dealogic in 2019 respectively.

In 2019, the group raised €26.6bn (US\$32bn) for renewable energy projects and also raised additional capital of €82.4bn (US\$98bn) via green bonds.⁶³

Societe Generale is actively investing in the burgeoning solar energy sector in India. In its first ever renewable energy investment, Societe Generale acted as mandated lead arranger and bookrunner, hedge provider and line of credit provider for SB Energy's 900MW solar farm in Rajasthan. The bank is providing a currency risk hedging solution for SB Energy in the form of a USD/INR green cross-currency swap. Societe Generale is also co-investing with the Asian Development Bank (ADB) in Engie's ongoing 200MW solar PV project worth Rs7.7bn (US\$105m) in the state of Gujarat. It is acting as the mandated lead arranger, green loan co-ordinator and letter of credit lender. This is the first time Societe Generale has arranged renewable energy project finance in India's local currency.⁶⁴

⁶⁰ BNP Paribas News. [BNP Paribas named Global Adviser of the Year in Project Finance](#). 15 January 2021.

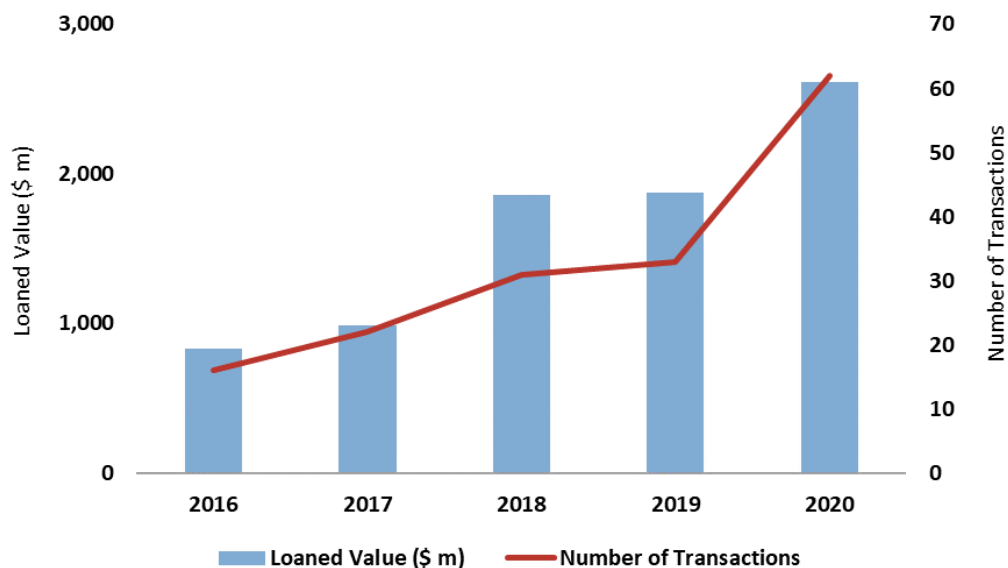
⁶¹ Offshore Wind Magazine. [Eurogrid's debut Green Bond to finance German offshore wind connections](#). 7 May 2020.

⁶² BNP Paribas. [BNP Paribas, Accelerating a More Sustainable Economy](#).

⁶³ Societe Generale. [Climate Disclosure Report](#). September 2020.

⁶⁴ Societe Generale. [The Sun Rises on Renewable Energy in India](#). 23 February 2021.

Figure 11: Yearly Debt Investment into Renewables by Societe Generale SA



Source: BNEF, IEEFA calculations.

In addition to its increasing investment in renewable energy infrastructure, it has a strong exclusion policy against financing carbon intensive fossil fuel sector companies. It was one of the first global banks to commit to reducing its portfolio exposure to oil and gas extraction by 10% by 2025.

Societe Generale was a founding member of the UNEP-FI Net Zero Banking Alliance.⁶⁵ The bank aims to align its portfolio with trajectories for carbon neutrality by 2050.⁶⁶

Cooperatieve Rabobank, Netherlands

The Cooperatieve Rabobank (Rabobank) is the second largest bank in the Netherlands with assets more than US\$900bn. It is amongst the top 10 financiers of renewable energy with a cumulative investment of €2.4bn (US\$2.9bn) across 55 projects in 2020. In addition, it had €16.34bn (US\$19.5bn) of sustainable assets under management, €6.3bn (US\$7.5bn) of sustainable funding and €52.3bn (US\$62.4bn) of sustainable financing overall in 2020.⁶⁷

The majority of Rabobank's investments have been in European nations and the U.S. In March 2021, it provided a two-year tenor construction credit line of US\$150m to Distributed Solar Development (DSD) for its commercial and industrial (C&I) development pipeline in the U.S. DSD, a wholly owned subsidiary of BlackRock, has

⁶⁵ UNEP-FI. [43 banks launch net zero banking alliance as key part of consolidated Glasgow COP climate action](#). 21 April 2021.

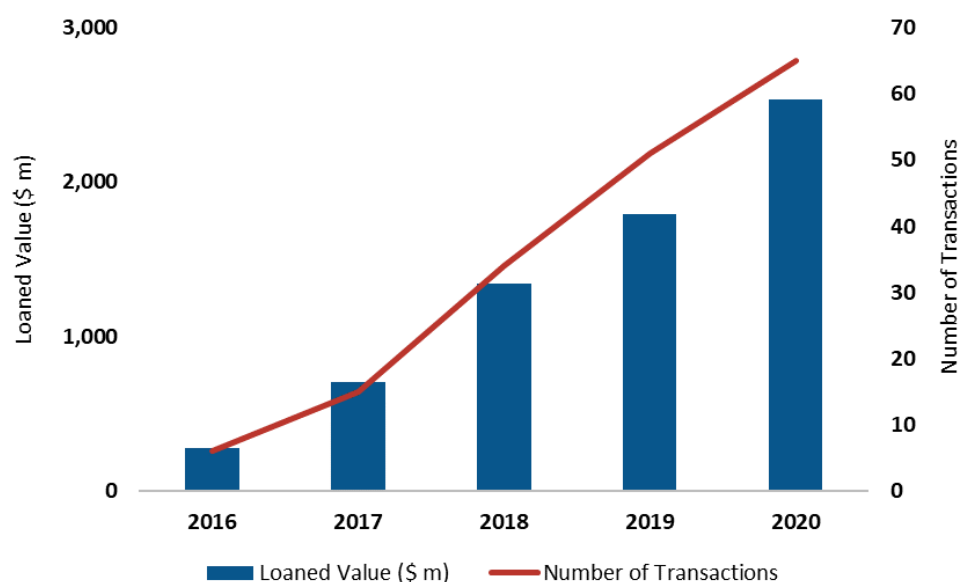
⁶⁶ Societe Generale. [Societe Generale joins the Net Zero Banking Alliance](#). 21 April 2021.

⁶⁷ Rabobank. [Annual Report](#). 2020.

successfully secured funding for its distributed solar generation project development from several other financial institutions such as Credit Suisse, Morgan Stanley, Silicon Valley Bank and Fifth Third Bank.⁶⁸

In 2020, Rabobank provided a US\$284m construction loan as a lead arranger to Algonquin for its Sugar Creek Wind Farm project located in the U.S. It also provided another construction loan of US\$500mn to Invenergy for its Deuel Harvest Wind farm located in the U.S.⁶⁹

Figure 12: Yearly Debt Investment In Renewables by Rabobank



Source: BNEF, IEEFA calculations.

Rabobank is one of 12 financial institutions that have committed to provide hybrid project debt of US\$1.35bn to India's Adani Green Energy. The debt capital raised will be used for a 1.69GW solar and wind portfolio which is under construction in the state of Rajasthan.⁷⁰

Mizuho Financial Group Inc, Japan

Mizuho Financial Group (Mizuho) is amongst the top 5 largest banks in Japan with total assets of US\$2.6 trillion and a leading provider of financing for renewable energy projects. As shown in Figure 13, Mizuho provided US\$1.85bn of project finance as a lead arranger for the renewable energy sector in 2019, a jump of 55% over its renewable energy investment in 2018.⁷¹ In 2020, it was ranked 22nd overall in BNEF's Clean Energy League Table. It has primarily invested in clean energy

⁶⁸ PV-Tech. [DSD lands US\\$150m construction finance for C&I solar pipeline](#). 4 March 2021.

⁶⁹ Rabobank Brochure. [The financial link in the global food chain](#). 2020.

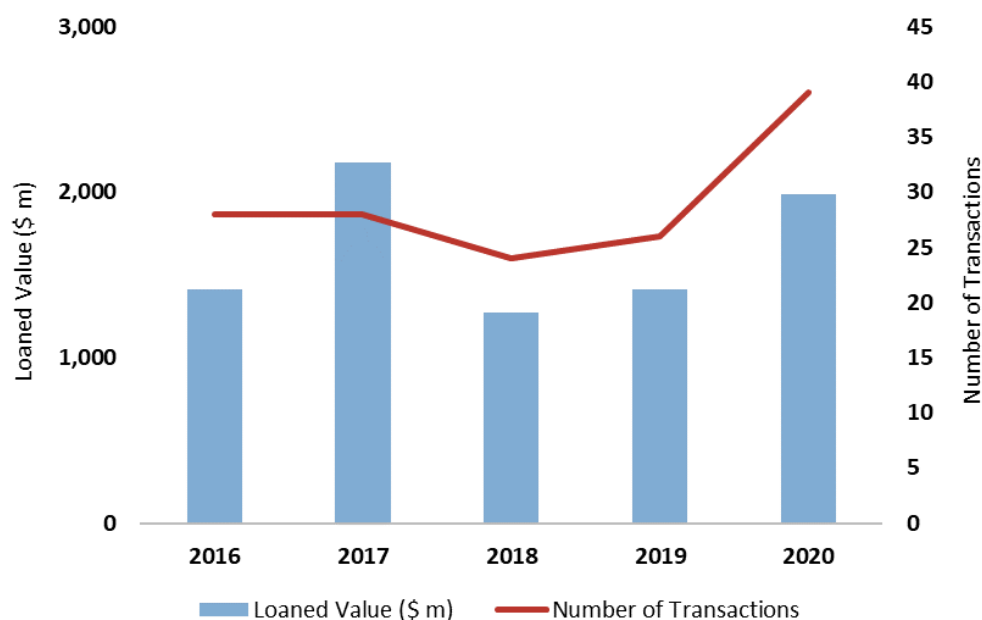
⁷⁰ Power-Technology. [India's Adani Green Energy raises \\$1.35bn for renewable projects](#). 18 March 2021.

⁷¹ Mizuho Annual Review. [Integrated Report](#). 2020.

projects located in developed nations such as the U.S., the UK, Australia and Canada, while largely ignoring the burgeoning Asian market for zero emission investments.

Mizuho is in a consortium of 6 banks providing the project debt for a 209MW onshore wind project, the Murra Warra located in Victoria, Australia. The project, estimated at US\$400m, is due to be completed in 2022 and is being developed by renewable energy development company RES and global investment bank Macquarie Group.⁷²

Figure 13: Yearly Debt Investment Into Renewables by Mizuho



Source: BNEF, IEEFA calculations.

Mizuho was amongst a group of international lenders which in January 2020 facilitated an innovative refinancing arrangement for the US\$650m Hornsdale Wind Farm with a cumulative capacity of 309MW. The project, located in the state of South Australia, will be refinanced by other banks including the Korea Development Bank, Natixis and Societe Generale.⁷³

In July 2020, Mizuho and the Japan Bank for International Cooperation (JBIC) provided a senior debt of US\$467m for the construction of 10km² Siraj-1 solar project in Al Kharsaah, west of Doha.⁷⁴ The 800MW capacity solar PV generation project was secured in a tender by France's Total and Japan's Marubeni at a bid of

⁷² Renew Economy. [RES, Macquarie land finance and buyer to double size of Murra Warra wind farm](#). 3 August 2020.

⁷³ Herbert Smith Freehills. [Herbert Smith Freehills advises on platform refinancing of Hornsdale Wind Farm](#). 24 January 2020.

⁷⁴ PV Magazine. [Japanese banks back world's second cheapest solar project](#). 23 July 2020.

\$0.01449/kWh, which was the world's lowest bid at that time.⁷⁵

Mizuho, MUFG Bank and SMBC have finalised an agreement to provide a loan for an offshore wind farm of 139MW cumulative capacity located at the ports of Akita (55MW) and Noshiro (84MW) in the coastal zone of Japan's Akita prefecture. The US\$922m project is being sponsored by Akita Offshore Wind, a subsidiary of Marubeni.⁷⁶

Credit Agricole Group, France

Credit Agricole is one of the top 10 banks and the largest cooperative financial institutions in the world. It has been one of the leading – and earliest – financiers of renewable energy projects. Back in 2015, it financed 20.5GW of renewable energy projects.

Credit Agricole has arranged approximately US\$17.5bn capital for sustainable and green bond investing. It formed Unifergie, a subsidiary company to finance Credit Agricole's clients' energy transition projects. Unifergie has been providing innovative financial solutions for diverse renewable energy technologies for the last 20 years.

Credit Agricole has invested in clean energy projects located in emerging markets including Chile and Ukraine. In July 2020, it granted a second bridging loan of €21m with a tenor of one year to Acciona's subsidiaries in Ukraine, which was in addition to its first bridging loan of €39m. The loan amount is financing the cost of construction of the 44MW Gudzovka and Arcyz solar power plants located in the southern part of Ukraine. It is Credit Agricole's second such renewable energy investment in Ukraine.⁷⁷

**Credit Agricole has
invested in clean energy
projects in emerging
markets including Chile
and Ukraine.**

Credit Agricole acted as joint bookrunner, co-structuring bank, mandated lead-arranger, hedge provider, and green loan coordinator for a refinancing transaction comprising a green loan of US\$399m in Chile. This is the largest green loan to date in Latin America. It includes refinancing operating renewable energy assets of Arroyo Energy Investors (Arroyo), a private equity investor focused on power and energy infrastructure. The refinancing has been used to finance Arroyo's 2 operating renewable energy assets – the 110MW Conejo Solar PV plant and the 210MW

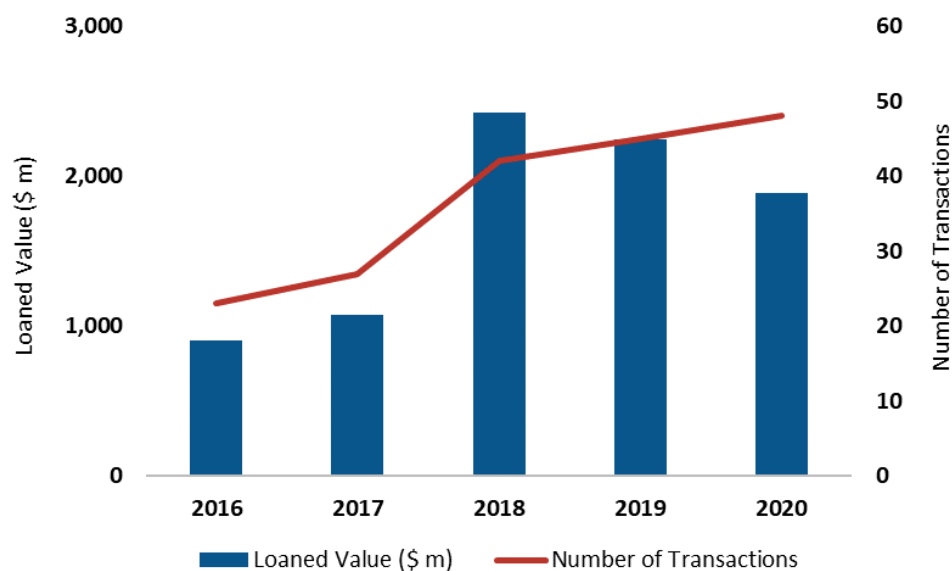
⁷⁵ The Siraj-1 project lost the record of lowest solar power bid when Chinese developer Jinko Power and French energy company EDF secured a bid of US\$0.01353/kWh for the 1.5GW Al Dhafra solar project in Abu Dhabi.

⁷⁶ Power Technology. [Akita Noshiro Offshore Wind Farm Project](#). February 2020.

⁷⁷ Credit Agricole. [CA Ukraine finances Acciona's second project in Ukraine](#). 2 July 2020.

Parque Eolico El Arrayan onshore wind farm.⁷⁸

Figure 14: Yearly Debt Investment Into Renewables by Credit Agricole



Source: BNEF, IEEFA calculations.

Credit Agricole also acted as a joint bookrunner and lead arranger in Chile's first sustainability bonds issuance and the Formosa market's first sustainability bond transaction by a foreign issuer. The dual listed US\$1.5bn sustainability bond on the Taipei Exchange and London Stock Exchange generated significant interest from Taiwanese investors and successfully diversified its global investor base.⁷⁹

ING Groep NV, Netherlands

The ING Groep (ING) is the largest financial services company in Netherlands. ING has a stringent policy around major carbon intensive fossil fuel project financing. The group has stopped financing companies that are engaged in thermal coal power generation, Arctic offshore oil and gas exploration, mining, and exploration of oil sands.⁸⁰ ING publishes the Terra Progress Report which details the group's progress in aligning its loan book, worth more than €700bn, to the Paris Agreement.⁸¹

In 2019, ING increased its renewable energy financing to €1.19bn and reduced its direct exposure to coal-fired power projects by 43%. In 2020, ING committed to reduce its financing to upstream oil and gas projects by 19% by 2040, which, although a start, is far from aligned with a 1.5°C world. ING, in its Terra Progress

⁷⁸ Credit Agricole. [Private equity firm arroyo energy closed one of the largest green loans in Latin America](#). November 2020.

⁷⁹ Credit Agricole. [Crédit Agricole CIB supported Chile's inaugural Formosa bonds in a sustainable format](#). 15 April 2021.

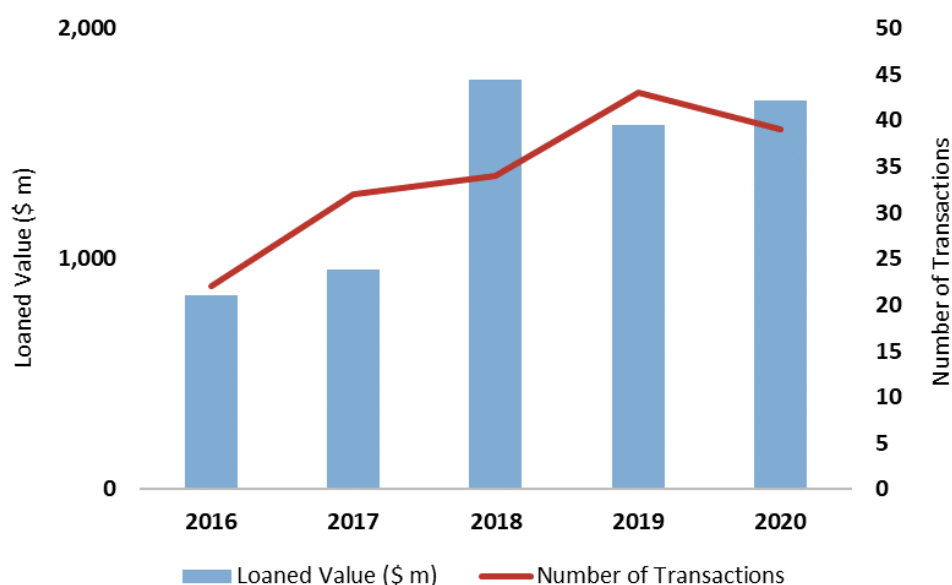
⁸⁰ ING. [ESR Policy Framework](#).

⁸¹ ING. [Terra Approach](#).

Report, mentions that 55% of its portfolio's production is low-carbon power generation.

In October 2020, ING entered into a landmark renewable energy transaction in Angola. The sub-Saharan African nation is a frontier market that is considered a very risky investment destination by the investor community. ING entered into a financing agreement for a €640m loan, with Angola's Ministry of Finance acting as borrower, to provide full funding for 7 solar power generation projects in the country. ING acted as lead arranger and lender in an EKN-denominated export credit facility agreement of €560m with a repayment tenor of 18 years. Swedish Export Credit Corporation (SEK) acted as the main manager of this export credit arrangement for the transaction. The Development Bank of Southern Africa (DBSA) acted as a lender and ING as an arranger for the remaining €80m with a repayment tenor of 12 years. The Angolan portfolio of 7 solar PV projects with a cumulative capacity of 370MW is being developed by Sun Africa LLC. The project is one of Angola's nationally important projects as it will replace diesel generation on the national grid.⁸²

Figure 15: Yearly Debt Investment Into Renewables by ING Groep NV



Source: BNEF, IEEFA calculations.

ING was involved in more than 30 renewable energy transactions in 2020 across European countries, the U.S. and Australia, and has invested more than US\$1.5bn into renewable energy projects since the start 2020. It is amongst 29 major financial institutions involved in the Dogger Bank offshore wind project, the largest clean energy project to date. It is also one of 12 financial institutions committed to providing hybrid project debt of US\$1.35bn to India's Adani Green Energy.

⁸² Tagmydeals. [Angola Solar - ECA/DFI Backed Financing](#). 26 October 2020.

Global Equity Investors

In this section we highlight players that have a proven track record in renewable energy investment with top management backing the role of finance in the race against climate change. We selected equity investors from a diverse set of financial institutions – 2 pension funds, 3 asset management firms, 1 dedicated renewable energy infrastructure fund, 2 core infrastructure funds, 1 diversified private equity firm and 1 diversified financial services group.

The 2 pension funds are from Canada and both have significant investment in renewable energy infrastructure across geographies. Other larger pension funds, such as the Government Pension Investment Fund of Japan and the National Pension Fund of South Korea did not make our list due to either lower levels of investment in renewable energy assets or a lack of public information regarding their renewable investments.

We also included a few smaller infrastructure funds given the fact they are aggressively investing in the sector in contrast to many other larger funds. Furthermore, some of these funds are dedicated to greenfield renewable energy investment which showcases the risk-taking capacity of the fund as well as a commitment to climate goals.

Amundi Asset Management

Amundi, a Credit Agricole Group company, is the largest asset manager in Europe and among the top 10 in the world in terms of assets under management. It manages assets worth €1.73tn with €378bn (22% of total AUM) of assets in responsible investment.⁸³

In 2016 Amundi and EDF launched Amundi Energy Transition (AET), an asset management company to invest in long duration, yield generating, clean energy projects. Within 4 years of its launch, AET has grown and is now managing €526m of clean energy assets. It currently owns more than 350 clean energy assets with a cumulative capacity of 1.7GW across wind and solar generation. In December 2020, it acquired wind and solar portfolios across France, Spain and Italy. It also created a wind platform called Opale Vesontio in partnership with the industrial group Opale with a 27MW wind project as its first acquisition. The platform is a further addition to AET's independent electricity producer called Hexagon Renewable Energy created in partnership with TTR Energy and four other investors. Hexagon acquired a portfolio of 19 wind projects in France of total capacity of 770MW.⁸⁴

Amundi is also active in promoting clean energy growth in emerging markets. In February 2021, it launched Amundi Funds Emerging Markets Green Bond which is a green bond strategy open to international institutional and retail investors looking to invest in emerging markets. The fund will invest in hard currency corporate green bonds as well as sovereign bonds from selected emerging markets such as

⁸³ Amundi. [Responsible Investment Policy](#). 2021.

⁸⁴ Amundi. [Infrastructure and Energy Transition](#).

Brazil, India, China and Indonesia. The open-ended fund for emerging markets comes after a successful closing of the US\$1.42bn Amundi Planet Emerging Green One in 2018, another green fund for emerging markets.⁸⁵

In July 2020, Amundi launched an emerging markets environmental, social and corporate governance (ESG) exchange traded fund (ETF) called Amundi MSCI Emerging ESG Leaders UCITS ETF (SADM) with a seed investment of €500m in assets by Ilmarinen, one of Finland's largest pension insurance companies. SADM will offer exposure to high ESG-rated corporates from 26 emerging markets.⁸⁶

In November 2020, Amundi entered into partnership with Sonnedix, a global independent solar power producer to invest €50m into the European solar PV market via Amundi Energies Vertes (AEV). AEV, a renewable infrastructure investment vehicle, will invest in a mix of greenfield and brownfield renewable energy assets leveraging the 900MW portfolio owned by Sonnedix in the region.⁸⁷

Although Amundi is investing in renewable energy infrastructure assets across the globe, it needs to tighten its fossil fuel divestment policy. Its current policy has a very relaxed threshold of investing in coal companies which are generating revenue of 25%-50% from coal mining and/or thermal power generation.⁸⁸ Further, it has no exclusion policy on unconventional oil extraction projects such as oil sands or Arctic drilling projects. To be truly on a path to becoming a net-zero carbon entity, Amundi needs to upgrade its fossil fuel exclusion policy.

BlackRock

BlackRock is the biggest asset manager in the world with AUM of US\$8.7 trillion. We include BlackRock in our list to emphasise the critical role such a mammoth asset manager can potentially play in driving capital towards a low carbon economy.

BlackRock has only recently started to focus on the financial risks and growing investment opportunities of climate change. It has now integrated ESG strategies into all its US\$2.5trillion of actively managed assets and launched the biggest ever ETF with an ESG focus securing around US\$1.25bn from investors. The ESG-ETF is investing in the Russell 1000 and U.S. firms that are best positioned for the low-carbon energy transition.⁸⁹ IEEFA notes there is still significant work ahead to ensure ESG-branded products are true to label, not just greenwash.

BlackRock has successfully raised several billion dollars for its funds committed to energy transition and renewable energy generation infrastructure investment. One of BlackRock's private market funds raised US\$5.1bn to invest capital into energy

⁸⁵ International Investment. [Amundi announces the launch of Amundi Funds Emerging Markets Green Bond](#). 15 February 2021.

⁸⁶ ETF Stream. [Amundi launches emerging markets ESG ETF](#). 6 July 2020.

⁸⁷ Renewable Energy Magazine. [Sonnedix and Amundi announce a partnership to invest in the European solar PV market](#). 23 November 2020.

⁸⁸ IEEFA. [Asset Managers Leaving Coal](#). 2021.

⁸⁹ The Australian Financial Review. [BlackRock scores biggest-ever ETF launch with new ESG fund](#). 13 April 2021.

transition infrastructure such as renewable energy. The private fund has investment in 18 onshore wind projects in Europe and one of the world's largest floating solar projects, located in Taiwan. BlackRock's three global renewable energy funds have already invested in more than 250 renewable power projects and have managed more than US\$5.5bn of renewable power assets on behalf of over 150 investors globally.⁹⁰

In April 2021, BlackRock raised another US\$4.8bn of capital for its third global renewable energy fund (Global Renewable Power Fund III) from more than 100 institutional investors.⁹¹ It is the third BlackRock fund committed to investing in renewable energy assets. The fund's mandate is to invest into global renewable energy infrastructure, and it has already completed three investments which include an onshore wind project in Europe, a solar power generation project in Asia and a distributed solar project in the U.S.

In another major transaction in April 2021, BlackRock joined with Singapore government-owned sovereign wealth fund Temasek Holdings to form a new company called Decarbonisation Partners. This company will invest in start-up companies that have potential to reduce the world's dependence on fossil fuels and help in meeting the goal of zero-carbon emissions within three decades. The two giant investment managers have committed an initial US\$600m towards this initiative. This funding includes seed capital of US\$300m which will be used to mobilise US\$1bn of investment for their first fund.⁹²

BlackRock has recently become vocal in its support for the transition to renewable energy which is key to delivering on its net zero by 2050 commitments. It has started to invest large sums of capital into renewable energy infrastructure, and like Brookfield Asset Management, talks of multi-trillion-dollar investment opportunities.

However, IEEFA thinks BlackRock has capacity to invest much more in renewable energy than it is currently investing. Investment managers relatively much smaller than BlackRock in terms of AUM are investing a much higher ratio of capital into renewable energy assets. In IEEFA's view, BlackRock must take the lead in renewable energy infrastructure investment, especially when it comes to forging a path to deliver risk-protected infrastructure capital into high-growth emerging markets at scale. Capacity building is a key global priority, as current infrastructure investing is

**In IEEFA's view,
BlackRock must take
the lead in renewable
energy infrastructure
investment.**

⁹⁰ Blackrock. [Global Renewable Power](#).

⁹¹ Businesswire. [BlackRock Real Assets Achieves a US\\$4.8 Billion Final Close for Global Renewable Power Fund III](#). 8 April 2021.

⁹² Bloomberg. [BlackRock, Temasek to Raise Billions for Carbon-Cutting Startups](#). 13 April 2021.

predominantly directed to US\$-denominated developed markets with flat energy demand prospects.

Brookfield Asset Management

Brookfield Asset Management, headquartered in Canada, is one of the world's most successful infrastructure investment management firms with AUM of US\$600bn across diverse asset classes. It has investments across infrastructure, real estate, renewable energy, private equity and fixed income assets in more than 30 countries.

Brookfield is one of the largest renewable energy investors in the world with a portfolio of more than 19GW of operational renewable energy generation. It is a truly diversified renewable energy investor both in terms of technologies and geographic location of its investments.

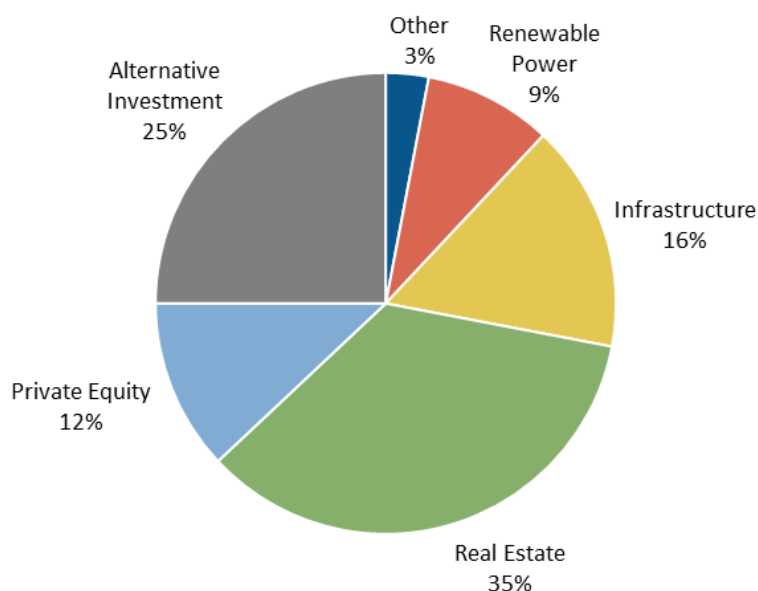
Brookfield's investments in diverse renewable energy technologies comprise 7.9GW of hydro, 4.7GW of wind, 2GW of utility-scale solar, 900MW of distributed-solar generation and 2.7GW of storage located in North and South America, Europe, India and China. It currently owns wind energy projects of 2,075MW capacity in the U.S., 483MW in Canada, 1,015MW in Europe, 457MW in Europe, 210MW in India, 200MW in China and 250MW in other Asian countries.⁹³

Brookfield has a portfolio of more than 19GW of operational renewable energy generation.

The renewable energy portfolio is managed by Brookfield Renewable Partners (BRP) which is a pure-play renewable energy player. BRP has been an early leader in transitioning to a low carbon business and currently manages renewable energy assets worth more than US\$57bn which is 9% of Brookfield's total AUM (Figure 16). It delivered supernormal returns of 91% in 2020 with an annual average of 20% since its inception two decades ago. Its development pipeline currently stands at 23GW which will more than double its renewable portfolio in coming years.⁹⁴

⁹³ Brookfield Renewable Partners. [Annual Report](#). 2020.

⁹⁴ MotleyFool. [Brookfield Renewable Sees a More Than \\$100 Trillion Opportunity Ahead](#). 13 February 2021.

Figure 16: Brookfield Investment Into Various Sectors and Asset Classes

Source: Brookfield.

In March 2020, BRP acquired the remaining 38% stake in the U.S.-listed YieldCo TerraForm to create a US\$50bn platform which is one of the largest publicly traded pure-play renewable energy companies with multi-technology assets across the globe. In a deal worth more than a billion dollars, Brookfield paid a premium of 17% to TerraForm's US\$15.60 share price at market close on 10 January 2020 when the initial proposal was made. As of the date of transaction, TerraForm owned more than 4.2GW of operational wind and solar assets across the U.S. and EU.⁹⁵

Brookfield is set to acquire 1GW of solar PV generation assets located in the U.S. for US\$810m from Exelon Generation Company, a distributed solar generation platform. The acquisition would comprise of 360MW of operating solar and 700MW of solar generation projects under development across the U.S. The deal will help to increase Brookfield's distributed generation portfolio to reach 2GW by mid 2021.⁹⁶

Colombia's Isagen, a subsidiary of Brookfield, acquired the 27MW Llanos 4 and 25MW Llanos 5 PV parks from Trina Solar in January 2021. It has plans to expand its renewable portfolio to more than 1.5GW in coming years.⁹⁷

Brookfield has taken some credible steps in reducing its fossil fuel exposure. It successfully divested a 51% stake in Dalrymple Bay Coal Terminal (DBCT) via an initial public offering (IPO). DBCT, located in the state of Queensland, Australia, is one of the largest coal export terminals in the world and has been under operational

⁹⁵ IPE. [Brookfield Renewable and TerraForm merge to create \\$50bn platform](#). 18 March 2020.

⁹⁶ ReNews. [Brookfield to acquire 1GW US PV portfolio](#). 11 December 2020.

⁹⁷ BNamericas. [Colombia's Isagén eyes 1,500MW renewables expansion](#). 15 January 2021.

lease by Brookfield for more than a decade.⁹⁸

Vice Chairman Mark Carney recently boasted about the carbon-neutral portfolio of Brookfield on account of its significant investment in renewable energy. Carney came under serious criticism for his statement as it glossed over the fact that Brookfield has significant investment in coal and fossil fuel assets as well. This criticism from experts highlights that investors should not use the excuse of avoided emissions as a means of achieving a carbon neutral portfolio.⁹⁹

Canada Pension Plan Investment Board (CPPIB)

Canada's largest pension asset manager (AUM C\$457bn) CPPIB has been active in the renewables space since 2017 when it acquired two operational wind plants in Brazil through a joint venture with Votorantim Energia. It is one of the top pension funds actively investing in renewable energy across the globe. CPPIB was also ranked as the world's largest infrastructure investor in 2020 (refer Annexure 1).

CPPIB has steadily increased its renewable energy assets from 0.01% in 2016 to 1.5% of the fund value in 2020 with a combined value of more than US\$6.6bn. It invested twice as much in renewable energy in 2020 as it did in 2019.

One of its major investments is the acquisition of Pattern Energy Group Inc. at a valuation of US\$6.1bn. Pattern Energy is a renewable energy yieldco with a portfolio of 28 renewable energy projects across Canada, the U.S. and Japan.

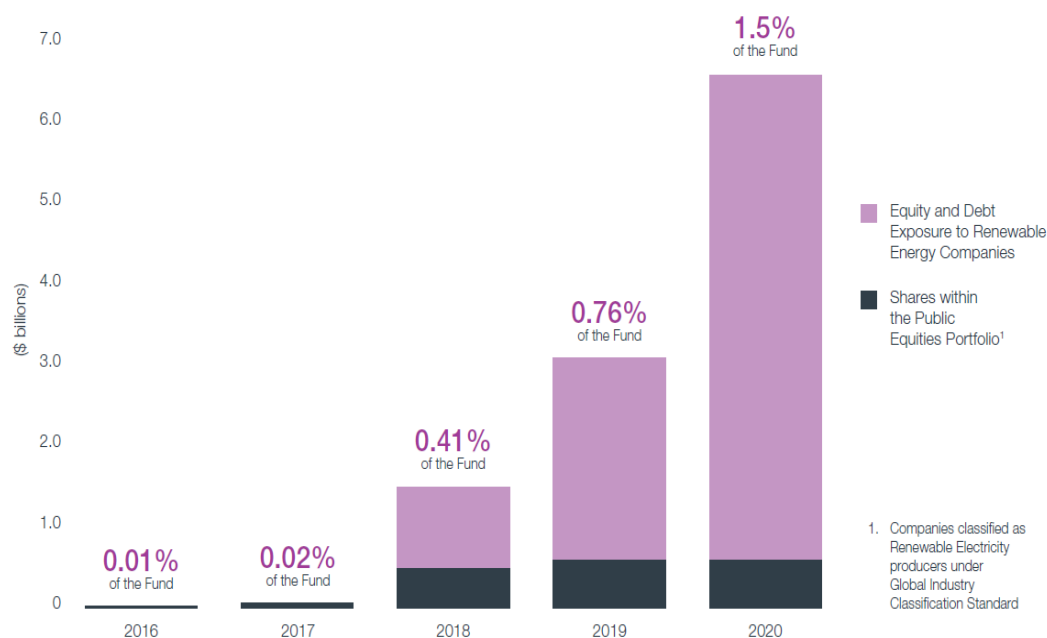
In January 2021, CPPIB committed €245m into its UK-based platform Renewable Power Capital Limited (RPC) to acquire a portfolio of three wind farms of 175MW cumulative capacity from OX2. The wind farms are expected to become operational in 2022.¹⁰⁰

CPPIB has approximately 4.5GW of operating clean energy assets across the globe including in Brazil, Canada, Germany, Japan and the U.S. It had invested a cumulative equity capital of C\$9bn in renewable energy globally as of September 2020 across diverse clean energy projects in various phases of development and operations.

⁹⁸ Infrastructure Investors. [Brookfield floats stake in Dalrymple Bay Coal Terminal via IPO](#). 10 December 2020.

⁹⁹ Bloomberg Green. [Mark Carney Walks Back Brookfield Net Zero Claim After Criticism](#). 26 February 2021.

¹⁰⁰ CPPIB. CPP Investments commits €245 million to Renewable Power Capital subsidiary in support of first investment in European renewables. 7 January 2021.

Figure 17: CPPIB's Renewable Energy Portfolio Exposure (as of June 2020)

Source: CPPIB's 2020 Sustainable Investing Report.

CPPIB is not only active in developed countries but is also investing significant capital in emerging markets as well. In January 2018, it committed a total investment of US\$491m in ReNew Power, India's leading independent renewable energy developer with total assets of 10GW (both operational and committed). In February 2020, CPPIB was reported to be looking to acquire an additional 24% stake ReNew Power from Goldman Sachs, but this did not eventuate.

In another transaction, CPPIB almost acquired SoftBank's 80% equity stake in SB Energy India, an 80:20 joint venture (JV) with Bharti with invested equity capital totalling US\$737m (reported as of December 2019). The sale price was announced as US\$425m, with an additional \$100m to be paid subject to future outcomes.¹⁰¹ However, the deal did not materialise, and Adani Green Energy committed to acquire the entire stake of Softbank's SB Energy with an enterprise valuation of US\$3.5billion (including debt). With this acquisition, Adani Green will add another 4.9GW of renewable energy capacity taking its portfolio to 24.3GW which is just 0.7GW short of its 25GW target by 2025.¹⁰²

CPPIB has committed US\$600m towards the National Investment and Infrastructure Fund (NIIF) in December 2019. NIIF is a fund management company set up by the Indian government in February 2015 that invests in infrastructure, clean energy projects and related sectors in India. NIIF manages US\$4.4bn of capital

¹⁰¹ Economic Times. [CPPIB to acquire SoftBank's 80% in SB Energy for \\$425m](#). 30 December 2020.

¹⁰² CleanTechnica. [SoftBank To Exit India Solar Business In US\\$3.5 Billion Deal](#). 8 June 2021.

commitments across three funds.¹⁰³

CPPIB's other prominent recent renewables transactions are the 49% stake acquisition of the entity holding Enbridge's stake in Eolien Maritime France SAS, Enbridge's partnership with EDF Renewables, for approximately €80m in May 2020 and the acquisition of NextEra Energy Partners' portfolio of six operating solar and wind power projects in Canada.¹⁰⁴

In April 2021, CPPIB launched Sustainable Energy Group (SEG) with an AUM of C\$17.7bn by merging its two investment divisions – Energy & Resources (AUM of C\$8.5bn) and Power & Renewables group (AUM of C\$9.2bn). SEG's existing portfolio includes solar, onshore and offshore wind, hydro power, grid-scale battery solutions, distributed energy generation assets, energy efficiency projects, mobility, and carbon capture and sequestration assets. However, the SEG also includes traditional mid-stream assets, thermal power generation assets and liquefied natural gas assets as well.¹⁰⁵

Caisse de dépôt et placement du Québec (CDPQ)

CPDQ is Canada's second largest pension asset manager with an AUM of C\$340bn. As of December 2019, CDPQ's investments in renewable energy made up to 4% (C\$13.6bn) of the total portfolio value.

CDPQ owns a 51% controlling stake in NYSE-listed Azure Power (market capitalisation of Rs143bn [US\$2.0bn]) which is one India's largest renewable power producers. CDPQ purchased a stake of US\$75m in Azure Power prior to the IPO in 2016 and progressively increased to a controlling stake in Azure by March 2020.¹⁰⁶ Azure Power has a 7GW portfolio of solar in development across India (1.8GW operational as of June 2020). This includes a 4GW solar project won in December 2019 at Rs2.92/kWh as part of a tender package to also build a 1GW solar module manufacturing facility (the original 500MW manufacturing capacity was upscaled to 1GW under a greenshoe option, and Azure has proposed partnering on the manufacturing unit with Waaree Solar, which operates an existing 2GW solar module manufacturing facility).¹⁰⁷ However, in December 2020 Azure Power was informed that the Government of India's Solar Energy Corporation of India (SECI) had been unable to complete the 4GW PPA – a situation that continues to date, until and unless it can in turn sign power supply agreements (PSAs) with state distribution companies (DISCOMs), which were balking at the high tariffs relative to recent record low solar tariffs available elsewhere.¹⁰⁸

¹⁰³ IEEFA Report: [Capital Flows Underpinning India's Energy Transformation](#), 16 February 2021.

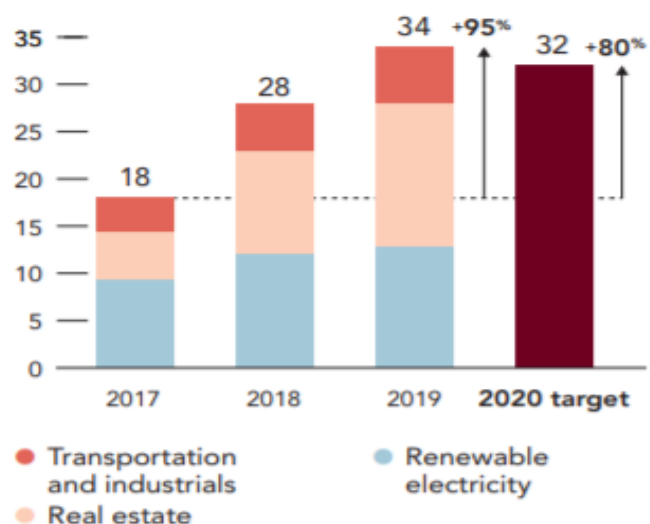
¹⁰⁴ CPP Investments. [Report on Sustainable Investing](#). 2020.

¹⁰⁵ CPPIB. [Sustainable Energy Group](#). April 2021.

¹⁰⁶ IEEFA Report: [Capital Flows Underpinning India's Energy Transformation](#), 16 February 2021.

¹⁰⁷ PV Magazine, [Azure Power secures up to 4 GW of solar project capacity under manufacturing-linked tender](#), 13 December 2019.

¹⁰⁸ Economic Times. [No response from discoms for power offtake from 4 GW tender, SECI tells Azure Power](#). 25 December 2020.

Figure 18: Low Carbon Investment of CDPQ (in billions of US\$)

Source: CPPIB's 2020.

CDPQ, in December 2020, announced one of its largest transactions to invest US\$1bn in Invenergy Renewables LLC (Invenergy) which is the largest private developer, owner and operator of solar and wind generation projects in North America.¹⁰⁹ CDPQ has been associated with Invenergy for almost a decade as both an investor and minority equity owner. CDPQ recently acquired Q-Energy's portfolio of 73 solar PV projects with a total capacity of 216MWp operating in Spain.¹¹⁰

CDPQ and Xebec Absorption (Xebec) have jointly invested US\$155m to acquire HyGear, a Dutch-based leader in onsite hydrogen generation solutions for industrial and fuel cell electric vehicle refuelling applications. While Xebec, a global provider of clean energy solutions, invested US\$100m via a public offer deal, CDPQ concurrently invested US\$50m via the private placement route. Through this strategic deal, CDPQ has embarked on its global green hydrogen strategy.¹¹¹

In another key large transaction, CDPQ along with Cathay Private Equity has committed to co-invest 50% of the 650MW Greater Changhua offshore wind farm in Taiwan sponsored by Ørsted. The project cost is estimated to be TWD75bn (US\$2.7bn) and is expected to complete by 2022.¹¹²

In April 2021, CDPQ announced it will co-invest up to US\$125m in sustainable solutions in the next three years along with Energize Ventures, a leading global

¹⁰⁹ CDPQ News Release. [CDPQ to invest US\\$1 billion in Invenergy Renewables](#). 18 December 2020.

¹¹⁰ CDPQ News Release. [Q-Energy to sell 73 photovoltaic plants to CDPQ](#). 13 October 2020.

¹¹¹ CDPQ News Release. [Xebec Launches Hydrogen Strategy with Transformative Acquisition of HyGear](#). 8 December 2020.

¹¹² CDPQ News Release. [Ørsted brings in renowned investors, CDPQ and Cathay PE, for Greater Changhua 1 Offshore Wind Farm](#). 28 December 2020.

alternative investment manager.¹¹³

Copenhagen Infrastructure Partners (CIP)

CIP is one of the world's largest dedicated fund managers in greenfield renewable energy infrastructure investments. It currently manages seven funds with investment commitments from hundreds of leading global investors comprising insurance companies, pension funds and large family offices. The fund has grown to €15bn of investment commitment to date from €1bn in 2012. It was the world's first large, dedicated fund for utility-scale greenfield renewable projects in 2012. A decarbonisation leader, PensionDanmark was the founding investor in CIP and was the sole investor in the first fund in 2012.

CIP has an ambitious target to invest €75-100bn in renewable energy infrastructure by 2030. December 2020 saw Vestas, a global wind turbine technology leader with a portfolio of servicing 122GW wind turbines across 82 countries acquire a 25% minority stake in CIP at a valuation of €500m to further expand its exposure to the global transition to a net-zero carbon economy.¹¹⁴

CIP has an ambitious target to invest €75-100bn in renewable energy infrastructure by 2030.

In April 2021, CIP achieved final closure of its seventh global greenfield renewable energy fund Copenhagen Infrastructure IV (CIP IV) after securing €7bn from investors. The fund was oversubscribed by €1.5bn showing significant interest from more than 100 institutional investors across the globe. The investors, from the Nordics, Europe, North America, Asia and Australia, have committed investment into the fund and will hold 50%. The fund has already invested in 15 renewable energy projects.¹¹⁵

CIP is developing the Changfang and Xidao project which will include two 589MW offshore wind farms located in Taiwan. Around 25 international and Taiwanese banks, financial institutions and six export credit agencies are going to finance the project. The project has already raised investments worth US\$3bn (TWD\$90bn). It is expected to finish construction of all its phases by the first quarter of 2024.¹¹⁶

In July 2020, CIP entered a tax equity financing arrangement with Bank of America for the 347MW utility-scale solar PV Greasewood project located in Texas.¹¹⁷

¹¹³ Reuters. [Canada pension fund CDPQ sets partnership to invest \\$125m in clean tech](#). 1 April 2021.

¹¹⁴ CIP. [CIP raises capital from Vestas to further innovate and strengthen its position as a global market leader within greenfield renewable energy investments](#), 18 December 2020.

¹¹⁵ IEEFA. [CIP raises €7 billion for new green energy development fund](#). 20 April 2021.

¹¹⁶ Power Technology. [Changfang and Xidao Wind Farm Project](#). 21 February 2021.

¹¹⁷ NS Energy. [CIP and Bank of America enter tax equity financing for the Greasewood utility scale solar project](#). 14 July 2020.

CIP acquired the Woodford wind project located in Illinois from Tri Global Energy which is an originator and developer of utility-scale renewable energy projects. The project will have two separate phases of interconnection in the PJM interconnection with each phase of 400MW capacity. The project is expected to be operational by the end of 2021.¹¹⁸

CIP is completely concentrated in developed countries such as the U.S., UK, Germany and Taiwan, and has not yet invested in any clean energy projects in developing countries.

Cubico Sustainable Investments

Cubico Sustainable Investments (Cubico) of the UK, another world leading renewable energy infrastructure company, was founded in 2015. We include Cubico despite it being a relatively new company because in less than six years of operation, it boasts a portfolio of over 4.3GW of renewable energy assets located across more than 13 countries including emerging and frontier nations such as Brazil, Mexico, Colombia and Uruguay. Furthermore, it was initially funded with US\$2bn of investment by three prominent financial institutions – Banco Santander of Spain which was the leading renewable energy lender of 2020, Ontario Teachers' Pension Fund of Canada which was amongst the top 10 infrastructure investors in 2020¹¹⁹ and the Public Sector Pension Investment Board (PSP Investments) which is one of Canada's largest pension investment managers. After transferring 19 wind, solar and water infrastructure assets to Cubico, Banco Santander fully exited from Cubico in 2016. Currently, Cubico is owned equally by Ontario Teachers' Pension Fund and PSP Investments.^{120,121}

In 2020, Cubico was one of the leading renewable energy investors with a total investment of over US\$1bn across solar and wind generation projects.¹²² It has entered a partnership with Peel NRE to develop 500MW of wind and solar projects across the UK via a newly created entity called Peel Cubico Renewables. The company will originate, develop, and operate the portfolio of projects over the next 5 to 10 years.¹²³

In March 2021, Cubico acquired a 100% stake from I-Squared Capital in Grupo T-Solar which is a 274MW solar power generation platform with €1.5bn of assets across Spain and Italy. The platform currently owns 167MW of solar assets in Spain,

¹¹⁸ Renewables Now. [CIP buys 800-MW Illinois wind project from Tri Global](#). 18 December 2019.

¹¹⁹ Infrastructure Investor. [The full list of the 50 largest institutional investors in global infrastructure](#). 1 September 2020.

¹²⁰ Ontario Teachers' Pension Plan. [Santander, Teachers' and PSP Investments launch Cubico Sustainable Investments](#). 28 May 2015.

¹²¹ Newswire. [PSP Investments and Ontario Teachers' to acquire Santander's stake in Cubico Sustainable Investments](#). 22 July 2016.

¹²² BNEF League Table-2020.

¹²³ IPE Real Assets. [Cubico and Peel partnership targets 500MW of UK wind, solar projects](#). 29 April 2021.

7MW of solar assets in Italy and 100MW of concentrated solar power assets in Spain.¹²⁴

In January 2020 Cubico acquired Astidey S.A., a 50MW operational wind farm in Uruguay taking its wind energy portfolio to 100MW in the country.¹²⁵ In February 2020, Cubico acquired Arenales Solar of Spain, which owns a 50MW concentrated solar power plant, from PanEuropean Infrastructure Fund, managed by DWS.¹²⁶

Global Infrastructure Partners

Global Infrastructure Partners (GIP) is an independent infrastructure investment firm which invests in companies operating in the energy, natural resources, power generation, transport, water, waste management and manufacturing sectors. It currently has assets under management (AUM) of US\$71bn and has investments in some of the major renewable energy companies such as ACS Renewables which operates solar and wind power generation projects in Spain.

In December 2020, GIP announced the acquisition of MAP® RE/ES which is the renewable energy portfolio of MAP® Energy. The acquisition will lead to ownership of royalty interests in more than 16GW of operating wind and solar projects located in the U.S. This transaction will help GIP expand its current portfolio of 10GW of operating solar and wind assets worth US\$9bn and over 65GW renewable projects under construction.¹²⁷

In January 2020, the New York State Common Retirement Fund (NYSCRF) announced it would co-invest US\$250m in renewable energy with one of GIP's major funds, the US\$22bn Global Infrastructure Partners (GIP) IV fund. NYSCRF committed US\$1.03bn (£750m) to GIP IV in November 2019 to invest into renewable energy projects.¹²⁸

GIP's Indian arm acquired the entire 306MW solar portfolio of RattanIndia for Rs1,670 crores (US\$227m) in September 2020.¹²⁹ In another transaction in India, GIP and CIC Capital Corporation acquired Vena Energy (then called Equis Capital) for US\$5bn in 2018.¹³⁰

GIP is currently exploring raising US\$100mn in equity in India via two innovative financial instruments: floating an Infrastructure Investment Trust (InvIT) for Vector

¹²⁴ Cubico. [Cubico Sustainable Investments acquires Grupo T-Solar and KKR minority shareholding](#). 30 March 2021.

¹²⁵ Cubico. [Cubico Sustainable Investments acquires a 50 MW operational wind farm in Uruguay](#). 15 January 2020.

¹²⁶ Cubico. [Cubico Sustainable Investments acquires a 50 MW operational concentrated solar power plant in Spain](#). 5 February 2020.

¹²⁷ PR Newswire. [Global Infrastructure Partners announces acquisition of MAP® Energy's renewable energy business](#). 29 December 2020.

¹²⁸ IPE. [NYSCRF to co-invest in renewables alongside GIP's \\$22bn mega-fund](#). 30 January 2020.

¹²⁹ Business Standard. [RattanIndia sells entire solar portfolio of 306 Mw to GIP for Rs 1,670 cr](#). 2 September 2020.

¹³⁰ IEEFA. [Global capital mobilising for India's \\$500bn renewable energy infrastructure opportunity](#). 16 February 2021.

Green Energy, its Indian green energy platform, and GIP's Vector Green Energy plans to raise Rs 12.37bn of capital via green bonds.¹³¹

Kohlberg Kravis Roberts (KKR)

Kohlberg Kravis Roberts (KKR) is one of the world's largest investment firms managing investment across multiple asset classes such private equity, energy, infrastructure, real estate and capital markets around the globe. It has been investing in renewable energy projects for a decade and has deployed capital in more than 10.5GW of renewable energy assets to date.

KKR will invest a total of US\$1.4bn in the two transactions with a cumulative renewable energy capacity of 1.63GW owned by NextEra Energy Partners (NextEra). The transaction would be done in two parts – an approximately US\$300m direct equity buyout of a 50% stake in a 1GW NextEra portfolio and US\$1.1bn convertible equity portfolio financing to buy a separate 1.13GW NextEra portfolio. These renewable energy asset portfolios consist of 12 distinct operating utility-scale wind and solar generation assets across the U.S. KKR also signed a Letter of Intent with NextEra to further invest US\$900m in future renewable energy projects of NextEra.¹³²

KKR has shown a major interest in Indian infrastructure assets with a focus on the renewable energy sector. In October 2020, it launched its renewable energy platform company called Virescent Infrastructure (Virescent) which owns and operates renewable energy assets in India. Virescent currently owns 317MW of solar PV assets located in the states of Maharashtra and Tamil Nadu, recently acquired from Shapoorji Pallonji Infrastructure Capital for US\$209m. KKR's heightened interest in Indian renewable energy infrastructure is going to play a critical role in helping India achieve its ambitious national renewable energy target of 450GW by 2030.¹³³

In April 2019, KKR became a majority shareholder (60%) in Sterlite Investment Managers Limited of India, the investment manager of IndiGrid, an Infrastructure Investment Trust ("InvIT") holding operational power transmission infrastructure assets. IndiGrid has operational grid transmission assets of Rs139bn (US\$1.85bn), with a further Rs65bn in development covering 6,280 circuit kilometres (ckm) and 11,460 MVA capacity transmission network with an average 32-year life.¹³⁴ KKR also acquired a 23% stake in the IndiGrid InvIT. Furthermore, Esoteric II (an affiliate of KKR) has also been inducted as the sponsor in the IndiGrid InvIT.¹³⁵ GIC of

¹³¹ LiveMint. [GIP' Vector Green Energy plans to raise Rs1237 crore through a green bond](#). 14 April 2021.

¹³² BusinessWire. [KKR Invests with NextEra Energy and NextEra Energy Partners in Portfolios of Renewable Energy Assets](#). 2 November 2020.

¹³³ PV Magazine. [KKR's India platform will acquire operating renewables assets](#). 30 October 2020.

¹³⁴ IEEFA. [Global capital mobilising for India's \\$500bn renewable energy infrastructure opportunity](#). 16 February 2021.

¹³⁵ Business Standard. [IndiGrid unitholders approve KKR as InvIT sponsor with special majority](#). 30 September 2020.

Singapore co-invested with KKR, taking a 20% equity stake in IndiGrid.

In another significant follow-on transaction, KKR-backed IndiGrid is going to acquire a 100% equity stake in NER II Transmission from Sterlite Power at a valuation of Rs46.25bn (US\$624m). This acquisition would increase IndiGrid's AUM by 34% to over Rs200bn (US\$2.8bn).¹³⁶

KKR has invested more than US\$24bn in 40 infrastructure assets around the world.

KKR has invested more than US\$24bn in 40 infrastructure assets around the world. It has raised another US\$3.9bn of capital in January 2021 for its first Asia-Pacific infrastructure fund, for investments ranging from waste management and renewable energy to communication towers.¹³⁷

Macquarie Group

Macquarie Group Limited (Macquarie) is an Australian-listed financial services company with operations in 31 countries spanning across verticals such as asset management, retail and business banking, investment banking, renewables development, commodity trading and asset finance.

Macquarie and its managed funds were early investors in renewable energy infrastructure with more than US\$46bn in renewable infrastructure out of its US\$116bn of investment in infrastructure assets (out of total AUM of US\$420bn). It has arranged financing for more than 12.8GW of renewable energy projects globally. In the financial year 2020, Macquarie invested or arranged US\$7bn for renewable energy projects.¹³⁸

The group has invested or arranged A\$3.1bn for green energy projects in FY2021. So far, 30GW of its green energy projects are in development and 14GW of projects are operational as of March 2021. Macquarie has been a consistent investor into green energy and energy efficient projects – it invested A\$9.5bn, A\$7.9bn and A\$9bn in FY2018, FY2019 and FY2020 respectively.¹³⁹

In January 2021 it was reported that since acquiring the Green Investment Bank (GIB) from the UK government in 2017, this one unit of Macquarie Group had financed £6.9bn worldwide in green investment projects, including £4.7bn in financing in the UK and Europe, and employed 450 staff across 25 countries in this sector.¹⁴⁰ With existing investment via GIB, Macquarie has committed or arranged more than £20bn of capital for renewable energy investment via its Green

¹³⁶ Business Today. IndiGrid to acquire 100% stake in NER II from Sterlite Power for Rs 4,625 crore.

¹³⁷ IEEFA. [Global capital mobilising for India's \\$500bn renewable energy infrastructure opportunity](#). 16 February 2021.

¹³⁸ Macquarie. [Our long-term commitment to renewable energy](#). 2020.

¹³⁹ Macquarie. [Macquarie Group Annual Report](#). 31 March 2021.

¹⁴⁰ FT. [Macquarie confirms £3bn financing of UK green projects](#). 4 January 2021.

Investment Group (GIG). It has more than 30GW of renewable projects in the pipeline including existing assets under GIB.¹⁴¹

In February 2021, Macquarie Infrastructure and Real Assets (MIRA), a leading alternate asset manager, raised more than €1.6bn capital for investment into renewable energy via Macquarie Green Investment Group Renewable Energy Fund 2 (MGREF2). MGREF2 targeted raising a minimum of €1bn and got investment from more than 32 investors including pension funds, insurance companies, and sovereign wealth funds. MGREF2 is a 25-year closed-end fund which will invest into diversified portfolios of renewable energy assets including platform companies, and the construction and operational stages of solar and wind energy projects. The fund will invest in projects located in Western Europe, the U.S., Canada, Mexico, Japan, Taiwan, Australia and New Zealand. The fund has already made two investments to date – a 10% stake in the 576MW Gwynt y Môr Offshore Wind Farm in the UK and a 50% stake in a 268MW portfolio of operating residential rooftop solar projects in the U.S.¹⁴²

MIRA, which is the world's largest infrastructure manager, currently manages investments into more than 12.3GW of clean energy projects globally. MIRA's other fund called MGREF1, raised by GIB initially, owns a 1.45GW portfolio of six offshore wind projects in the UK. MIRA has committed to transform into a net zero emission portfolio by 2040.¹⁴³

Macquarie group also provided a US\$100m credit facility to U.S. renewables owner Vesper for the development of 3GW of solar and a 2.5GWh storage pipeline in the U.S. The credit facility would enable Vesper to provide securities for power purchase agreements and interconnection deals with energy transmission networks including PJM, CAISO and ERCOT.¹⁴⁴

Shemara Wikramanayake, the CEO of Macquarie Group, was one of only two global chief executives in 2019 who were appointed Commissioners of the United Nations-sponsored Global Commission on Adaptation. The appointment reflected her commitment to the issue of climate change. At the 2019 UN Climate Action Summit, she showcased her desire to invest Macquarie's US\$116bn infrastructure funds into climate-resilient infrastructure. She stated that climate change-related investments, especially climate adaptation-related investments, will be at the forefront of the emerging wave of this new investment class.¹⁴⁵ This positive signal, sent at the highest level, is reflected in Macquarie Group's focus on prioritising global renewable energy infrastructure.

¹⁴¹ Macquarie. [Green Investment Group](#).

¹⁴² Power Technology. [Macquarie raises \\$1.9bn fund for renewable project investment](#). 11 February 2021.

¹⁴³ Macquarie. [Macquarie raises €1.6 billion for renewable energy investment](#). 10 February 2021.

¹⁴⁴ PVTech. [Vesper Energy to fast-track development of US solar pipeline after closing Macquarie financing](#). 25 November 2020.

¹⁴⁵ The Australian Financial Review. [Macquarie bets on green revolution in finance](#). 10 September 2019.

Top Global Renewables Deals

We have selected 10 globally significant renewable energy infrastructure projects to illustrate the rapid scaling up of financial and operating capacity, and also to illustrate the growing geographic and technology opportunities in zero-emissions energy industries of the future. These transactions are selected to ensure the diversity of geographies as well as technologies. The transactions are primarily from 2020 and ongoing 2021.

SSE and Equinor Dogger Bank Offshore Wind Farm, UK

The offshore wind farm at Dogger Bank, an isolated sandbank in the central to southern North Sea spanning UK, German, Danish and Dutch waters, will be the world's largest offshore wind farm. At 3.6GW capacity, it will be developed in three phases of 1.2GW capacity each. The first phase is Dogger Bank A, located around 131km from shore which has a development area of 515km². The second phase is Dogger Bank B which is also located around 131km from shore with a development area of around 599km². The third phase, Dogger Bank C, has a development area of 560km² and is located 196km from shore. The project is the largest renewable energy transaction of 2020.

29 banks and 3 export credit agencies are providing US\$6.6bn debt, plus ancillary facilities of US\$934m for Dogger Bank A and B development.

Dogger Bank A and B are being developed via a joint venture between SSE Renewables (40%), Equinor (40%) and Eni (20%), whereas Dogger Bank C is being developed by Equinor and SSE Renewables in a 50:50 partnership. SSE Renewables, a leading developer and operator of renewable energy in the UK with a renewable portfolio of 4GW, will lead the construction in all three phases of the project. Equinor of Norway, a leading energy provider in the UK, will lead the operation of the wind farms.¹⁴⁶

SSE Renewables and Equinor have successfully reached financial closure for the first two phases of the project. Dogger Bank A and B will require an estimated capex of £3bn (US\$4.1bn) each with offshore transmission capex of approximately £800m (US\$1.1bn) per phase. There are 29 banks and three export credit agencies involved in providing the debt of £4.8bn (US\$6.6bn) plus ancillary facilities of around £0.7bn (US\$934m) for Dogger Bank A and B development. These phases are being financed at a leverage ratio of 65% to 70% for the generation assets and 90% of the forecast OFTO sale proceeds for the transmission assets. The financiers for this project,

¹⁴⁶ Dogger Bank. [About the Project](#).

primarily from Europe and Japan, include Lloyds Bank, NatWest, Societe Generale, Banco Santander, BNP Paribas, and MUFG Bank.

The Wind Farm project secured a 15-year contract with the Low Carbon Contracts Company (LCCC) through the UK Government's Contract for Difference (CfD) auction. The auction resulted in the following strike prices for the three phases of the project:

- Dogger Bank A would deliver the power at a strike price of £39.65/MWh (in 2012 prices, CPI-indexed) for delivery in 2023/24 (less than half the £92.50/MWh strike price of the Hinkley C nuclear power plant)
- Dogger Bank B and C would deliver power at a strike price of £41.61/MWh (in 2012 prices, CPI-indexed) for delivery in 2024/25.

Dogger Bank Wind Farm has exclusive development rights for 50 years from 2010. The development of the three phases is expected to complete by March 2026. The onshore construction for Dogger Bank A and B is underway. The offshore construction is expected to begin in the second quarter of 2022. The two phases are expected to begin their commercial operation in 2025. Once fully operational in 2026, the project is expected to produce 18TWh of electricity, enough to meet 5% of the UK's electricity demand.¹⁴⁷

Changfang and Xidao Offshore Wind Farm Project, Taiwan

Changfang and Xidao, an offshore wind farm project, will be developed in the Taiwan Strait, approximately 11km off the coast of Fangyuan Township, Changhua County, central Taiwan. The project will include two offshore wind farms of combined capacity 589MW. The project is expected to begin commercial operation in Q1 2024. Copenhagen Infrastructure Partner (CIP), one of the largest dedicated greenfield renewable infrastructure investment managers, is developer of the project. CIP II and CIP III, the two managed funds of CIP, own the majority stakes in the project along with Taiwan Life Insurance and TransGlobe Life Insurance as minority shareholders.

The project has already secured project financing of TW\$90bn (US\$3bn) from a consortium of 25 leading international and Taiwanese banks, and six export credit rating agencies. Some of the lead financiers include MUFG Bank, ABN Amro Bank, Banco Santander, SMBC Bank, HSBC, Standard Chartered, and Deutsche Bank. Nippon Export and Investment Insurance will underwrite the loan portion of TW\$10.2bn (US\$340m) via insurance to support the wind turbine generator procurement.

The project will be developed in three phases with the first phase involving installation of 95MW of wind turbines by 2022, the second phase involving the installation of 446.5MW and the final phase involving installation of the remaining 47.5MW in 2023.

¹⁴⁷ Dogger Bank. [Dogger Bank Wind Farm A and B reaches financial close](#). 26 November 2020.

The project has already secured a 20-year PPA to sell its generated electricity to Taiwan Power Company. The project is expected to create 5,300 jobs and TW\$9.2bn (US\$300m) of additional economic co-benefits.¹⁴⁸

Enel Piauí, Bahia, Rio Grande do Norte and Pernambuco Onshore Wind Portfolio, Brazil

Enel Green Power (Enel) of Italy via its Brazilian subsidiary Enel Green Power Brasil Participações Ltda is currently developing 1.3GW of renewable energy projects in Brazil. The project includes four onshore wind farms of total capacity 1,054MW – Lagoa dos Ventos III (396 MW) in Piauí state, Morro do Chapéu Sul II (353 MW) in Bahia state, Cumaru (206 MW) in Rio Grande do Norte state and Fontes dos Ventos II (99 MW) in Pernambuco state as well as one solar PV project - São Gonçalo III (256 MW) in the state of Piauí.

Enel, which has an installed renewable capacity of more than 47GW across the globe, is investing approximately BRL5.6bn (US\$1.1bn) in the project. It currently has an installed renewable capacity of 3.4GW which includes 1.21GW of wind, 979MW of solar and 1.3GW of hydro.

Enel will negotiate and sign power supply contracts with corporate consumers in the Brazilian free energy market to sell clean electricity generated by the project. The project is expected to start the majority of its commercial operation in 2021, to become fully operational by 2022. Once fully operational, the project will generate more than 5.5TWh of energy per year, thus avoiding carbon emissions of approximately 3m tonnes every year.

Enel is also building another 716MW Lagoa dos Ventos wind facility in the municipality of Dom Inocêncio, in the state of Piauí. This would be Enel's largest wind farm globally. With an additional installation of the Lagoa dos Ventos III (396MW) onshore wind farm in the same location, the total onshore wind capacity in Piauí will reach around 1.1GW. The additional new capacity of 396MW will require capital investment of US\$353m.

The installation of a 256MW São Gonçalo III solar PV project in the municipality of São Gonçalo do Gurguéia in the state of Piauí will require investment of US\$142m. With this additional installation in São Gonçalo, which already has the 608MW São Gonçalo solar park, the region will host South America's largest solar park with cumulative capacity of 864MW.

The 353MW Morro do Chapéu Sul II onshore wind farm located in the municipalities of Morro do Chapéu and Cafarnaum, in the state of Bahia, will required investment of US\$340m. The region already has a 172MW Morro do Chapéu Sul wind farm which has been operational since 2018. Enel is looking to raise around US\$184m for the 206MW Cumaru wind farm located in the municipality of São Miguel do Gostoso

¹⁴⁸ PowerTechnology. [Changfang and Xidao Wind Farm Project](#). 2020.

in the state of Rio Grande do Norte.¹⁴⁹

Xcel Sagamore Onshore Wind Farm, U.S.

Xcel Energy, an electric utility in the U.S., has constructed a huge onshore wind farm of 522MW capacity called Sagamore Wind Farm. It sprawls over 156 square miles in eastern Roosevelt County, New Mexico. The project is the largest operational wind farm in the state of New Mexico, offering 40% more generating capacity than the second largest operating facility in the state already serving close to 194,000 homes annually.¹⁵⁰

Xcel Energy received investment of US\$900m in the project. The project will help Xcel Energy in its plans to reduce its carbon emissions by 80% by 2030 and to be 100% carbon free by 2050. The wind project will help the state in achieving its goal of 100% carbon-free electricity by 2045 with an intermediate target of 50% electricity from renewables by 2024.¹⁵¹

The developer started construction of the project in 2019 after entering into 25-year leases for 100,000 acres for US\$89mn with 175 landowners. The construction was completed within a year with 95% of the farmland still available for agriculture.

Al Dhafra Solar PV Plant, UAE

Al Dhafra Solar PV project with 2GW of capacity will be the world's biggest single site solar power project. It is located in the Al Dhafra region which is approximately 35km south of Abu Dhabi in the UAE. The project will be a public-private partnership where two government-owned power sector companies, Abu Dhabi National Energy Company (TAQA) and Masdar, own 60% and the remaining 40% is owned by EDF Renewables of France and Jinko Power of China.¹⁵²

**Al Dhafra Solar PV project
will be the world's biggest
single site solar
power project.**

In July 2020, the joint venture between TAQA, Masdar, EDF and Jinko Power signed a 30-year PPA with Emirates Water and Electricity Company at a highly competitive tariff of US\$1.35 cents/kWh. The tariff further improved to US\$1.32 cents/kWh on account of hedging and financing cost improvements (only to be beaten by a 20% lower result in the April 2021 Saudi Arabia solar tender win of just US\$1.04

¹⁴⁹ Enel. [Enel Green Power starts construction of 1.3 GW of new renewable capacity in Brazil](#). 14 December 2020.

¹⁵⁰ Xcel Energy. [Sagamore Wind Project](#). 2020.

¹⁵¹ IEEFA. [Xcel Energy completes construction of 522MW Sagamore wind farm in New Mexico](#). 17 December 2020.

¹⁵² Power Technology. [Al Dhafra Solar Project, Abu Dhabi](#). 2020.

cents/kWh¹⁵³). The project achieved financial closure in December 2020 following commitment from several international banks including BNP Paribas, SMBC Bank, MUFG Bank, Credit Agricole and Abu Dhabi Islamic Bank among others.¹⁵⁴

The project will deploy the latest solar PV modules based on crystalline, bifacial module technology which can achieve efficiency of 22.5%. The project will help in reducing carbon emissions by more than 2.4m tonnes per year. Once operational in 2022, the project will use 4 million solar panels to generate electricity, powering approximately 160,000 homes across the UAE.

Xuan Thien Ea Sup Solar Project in Dak Lak, Vietnam

Xuan Thein Ea Sup solar PV project, located in Dak Lak in Vietnam, is proposed to have a total capacity of 831MW. It is claimed to be the largest solar power generation project in Southeast Asia with total investment expected to be US\$862m. The 273MW first phase of the project was completed well before schedule.

The project involves approximately two million solar panels, a 500kV/1,200MVA transformer station and 22.2km of 500kV. LONGi, the leading Chinese solar manufacturer, is the major supplier of solar modules. The project, once completed, will produce electricity output of 1.5bn kWh per year. The Xuan Thein Group is planning to scale up capacity of the project to 2.8GW by early 2022, taking advantage of the high solar potential and abundant land in the Dak Lak region.¹⁵⁵

Vietnam has emerged as a favourable renewable energy investment destination amongst emerging markets.

Vietnam has long been reliant on coal as the cheapest source of energy. However, with rising environmental concerns, a growing economy and falling solar prices, Vietnam has shown significant progress in solar energy deployment. It has emerged as a favourable renewable energy investment destination amongst emerging markets for global investors.

Vietnam's utility solar market, which was absent until 2017, grew to 5GW within three years and surpassed Malaysia and Thailand's solar market. Vietnam intends to increase the proportion of renewable energy to 29% of total power generation by the end of this decade. The current feed-in-tariff (FiT) policy is playing an instrumental role in accelerating the deployment of solar power plants across Vietnam. The year-end deadline to avail the benefits of FiT (US\$8.38 cents/kWh)

¹⁵³ PV Magazine. [Saudi Arabia's second PV tender draws world record low bid of \\$0.0104/kWh](#). 8 April 2021.

¹⁵⁴ PV Magazine. [Taqa announces financial closing for the world's largest solar power plant](#). 22 December 2020.

¹⁵⁵ Saur Energy International. [LONGi Supplies 273 MW Modules for 831 MWp Solar Project in Vietnam](#). 31 December 2020.

incentivised Vietnamese solar developers to install a staggering 6.71GW of rooftop solar within the last month of 2020. The country deployed a total of 9GW of rooftop solar and 1.55GW of utility solar in the year 2020 taking cumulative solar installations of the country to 17GW.

Japanese and South Korean investors in Vietnamese coal projects have started pulling away from their investments which has put pressure on Chinese investors to follow suit. As investors continue to move away from financing coal, Vietnam will need to keep introducing policies favourable for renewable energy installation in the country, given the ongoing strength of energy demand growth expected.¹⁵⁶

SB Energy Phalodi-Pokhran Solar PV Plant, India

The now Adani Green-owned SB Energy India, one of the largest independent renewable power producers in India, is developing a huge 900MW solar power generation project in the Phalodi-Pokhran park located in the Indian state of Rajasthan. The project, with a capex of more than US\$400m, achieved financial closure in August 2020 after raising a US\$333m green bond certified by Climate Bonds Initiative (CBI). The transaction is India's first project debt deal which followed the guidelines aligned with the LMA/APLMA green loan principles, a framework for the sustainability financing market to record the environmental impact of projects. Once operational, the project will be one of the top 10 largest solar projects in India, which already has several of the world's largest solar projects.¹⁵⁷

MUFG Bank of Japan was the sole green structuring advisor for the debt raised by SB Energy. As per the BNEF league table, the project used several global debt arrangers such as BNP Paribas SA, MUFG Bank Ltd, Sumitomo Mitsui Banking Corp, and Societe Generale. The significant interest in the project from global investors led to one of the lowest levelized costs of electricity in the world, of US\$1.695cents /kWh.¹⁵⁸

Asian Renewable Energy Hub, Australia

The Asian Renewable Energy Hub is a one-of-a-kind transformational project with an unprecedented scale of renewable energy deployment, along with green hydrogen/green ammonia export potential. The proposed project includes 26GW of wind and solar energy projects out of which 23GW of generation will be used to produce green hydrogen and green ammonia. It could take top position from China's massive Three Gorges Dam development in terms of total generation capacity. The project is expected to generate up to 100TWh of clean energy annually and its expected project life is more than 50 years. The project is being developed in the

¹⁵⁶ Vietnam Briefing. [Vietnam's Solar Industry: Bright Prospects for Investors](#). 8 March 2021.

¹⁵⁷ IJGlobal. [SB Energy Phalodi-Pokhran Solar PV Plant \(900MW\)](#). 7 January 2021.

¹⁵⁸ Saur Energy International. [MUFG Gets Green Certification for Softbank's 900 MW PV Project in India](#). 24 December 2020.

Pilbara region of Western Australia where it has been allocated 6,500 km² of land.¹⁵⁹

The mammoth project is being developed by a consortium of global energy leaders which include green hydrogen developer InterContinental Energy, project developer CWP Energy Asia, wind turbine manufacturer Vestas, and private equity investor Pathway Investments. The first stage of 15GW of renewable energy installation will comprise of a 10GW wind power project and a 5GW solar PV project. At least 3GW of total capacity will be kept in reserve to supply the Pilbara region, a hub of several of Australia's largest industrial energy consumers. The project is expected to incur a massive construction cost of well over US\$30bn in a multi-phase development over the coming decade.

**The Asian Renewable
Energy Hub is a
one-of-a-kind
transformational project.**

The project initially aimed to have a capacity of a still-staggering 15GW. As plans crystalised, there has been a major expansion, and it has grown to a total of 26GW of wind and solar on account of the addition of ammonia production to export green hydrogen. The initial development phase started back in 2014. While the project received environmental approvals for its massive 15GW first stage from the Western Australian government in 2020, the federal environment minister has refused to approve the latest plans for the project due to the possible impact on threatened migratory species and internationally recognised wetlands.¹⁶⁰

The project is expected to provide huge employment, investment, decarbonisation and export industry development benefits for Australian citizens. It will generate a huge volume of very cheap clean electricity for the region. It is expected to create up to 5,000 construction jobs in the first 10 years of the project with an additional 3,000 operation and maintenance jobs for more than 50 years of the project's expected life. It will be a major centre for production of cost-effective green hydrogen at large scale which will be supplied to prospective markets within Australia as well as overseas to countries like Japan and South Korea. The project, once operational, would be a major contributor to global efforts to decarbonise economies.¹⁶¹

¹⁵⁹ The Asian Renewable Energy Hub. [Renewable Energy at Oil and Gas Scale](#).

¹⁶⁰ The Guardian. [Environment minister rules huge renewable energy hub in WA 'clearly unacceptable'](#). 21 June 2021.

¹⁶¹ Renew Economy. [Massive Asian Renewable Energy Hub grows to 26GW of wind and solar](#). 16 October 2020.

Fengning Pumped Storage Power Plant, China

Fengning pumped storage power plant will replace Bath County (3GW/24GWh) in the U.S. as the world's largest pumped-storage hydroelectric power plant with a capacity of 3.6GW.

The project is under construction at a site 180km from Beijing in Hebei province. It will serve Beijing-Tianjin-North Hebei electrical grid as a peaking plant to balance the large variable wind and solar parks located in the northern Hebei and inner Mongolia region. The project is expected to supply power for the 2022 Winter Olympic Games.

The project has been under construction since 2013 and is being developed in two 1.8GW stages. The first stage is expected to be operational later in 2021 and the second phase in 2023.

The construction cost of the project was reportedly £2.1bn (US\$2.7bn) in June 2013, but this looks to be an unrealistically low estimate given the long history of capital cost blowouts on major infrastructure projects of this nature globally, especially with such a long delay in the construction. It is being developed by State Grid Xinyuan Company, a subsidiary of state-owned State Grid Corporation of China. The company will also take care of the operation and maintenance of the project.¹⁶²

With the completion of the Fengning project, the total installed capacity of China's pumped hydro projects will reach 40GW.

Given its extensive mountainous terrain, China has more installed pumped hydro storage capacity than any other country. With the completion of the Fengning project, the total installed capacity of China's pumped hydro projects will reach 40GW.¹⁶³

Gateway Energy Storage, U.S.

LS Power, a development, investment, and operating company focused on energy infrastructure in North America, has developed one of the world's largest single battery storage site for clean energy integration. The lithium-ion battery project, with a capacity of 250MW/250MWh, is located in the East Otay Mesa community in San Diego County, California. The project is expected to support the state in its clean energy and storage goals while providing grid stability in an environment with increasing amounts of renewable energy.¹⁶⁴ As per BNEF, the lead debt arrangers

¹⁶² NS Energy. [Fengning Pumped Storage Power Plant](#).

¹⁶³ Drax. [Pumping power: pumped storage stations around the world](#). 30 December 2020.

¹⁶⁴ LS Power. [LS Power Energizes Largest Battery Storage Project in the World, The 250 MW Gateway Project in California](#). 19 August 2020.

of the project include some of the biggest global financial institutions such as RBC Capital Markets, BNP Paribas SA, Mitsubishi UFJ Financial Group Inc, and ING Capital LLC.

LA Power, which has been involved in 45GW of power generation including utility-scale solar, wind, hydro, natural gas-fired and battery energy storage projects, is developing several other battery storage projects, such as Diablo Energy Storage (200 MW) in Pittsburg, California; LeConte Energy Storage (125 MW) in Calexico, California; and Ravenswood Energy Storage (316 MW) in Queens, New York. All of these projects will be instrumental in integrating clean energy into the grid.

Annexure 1

Top 25 Global Infrastructure Investors

Rank	Institution	HQ	Infra allocation (%)	Infra allocation (US\$m)
1	Canada Pension Plan Investment Board	Toronto	10.4%	33,793
2	Abu Dhabi Investment Authority*	Abu Dhabi	3.0%	24,840
3	Caisse de dépôt et placement du Québec	Québec	8.1%	21,253
4	Allianz Global Investors	Munich	3.3%	20,543
5	National Pension Service of Korea	Jeollabuk-do	3.1%	19,726
6	APG	Amsterdam	2.8%	17,115
7	Ontario Municipal Employees Retirement System	Toronto	19.0%	15,977
8	China Investment Corporation (CIC)	Beijing	1.8%	15,000
9	BCI (formerly British Columbia Investment)	Victoria	10.1%	13,887
10	Ontario Teachers' Pension Plan	Toronto	8.3%	13,115
11	Public Sector Pension Investment Board	Ottawa	10.0%	12,961
12	Legal & General Investment Management	London	0.8%	12,073
13	Pensioenfondszorg en Welzijn	Zeist	4.0%	10,705
14	Australia Future Fund **	Melbourne	7.0%	8,326
15	AustralianSuper	Melbourne	6.9%	7,984
16	Alberta Investment Management Corporation	Edmonton	8.1%	7,201
17	QSuper	Brisbane	8.7%	7,052
18	Samsung Life Insurance	Seoul	2.9%	6,889
19	Manulife Investment Management	Toronto	2.3%	6,817
20	ATP	Hillerød	5.1%	6,776
21	Hanwha Life Insurance	Seoul	7.8%	6,497
22	Universities Superannuation Scheme (USS)	Liverpool	6.3%	6,127
23	Washington State Investment Board ***	Olympia	4.9%	5,643
24	Aberdeen Standard Investments	Edinburgh	1.7%	5,307
25	Employees Provident Fund of Malaysia	Kuala Lumpur	2.3%	5,267

Source: Infrastructure Investor.

* Allocation is an average of the institution's range to infrastructure.

** Includes allocation to timber.

*** Includes allocation to real assets.

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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