

Asian Insights SparX

COVID-19 and the Energy Transition Landscape

Refer to important disclosures at the end of this report

DBS Group Research . Equity

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Chance for Change

- Key observation – renewable energy emerges relatively unscathed from the pandemic while other direct energy sources flounder, demonstrating its investment-worthiness.
- There is no longer any escaping the inevitable for energy industry players as
  - i) renewable energy is already the cheapest source of power in many countries and hence, will be the main growth driver for the energy industry in coming years
  - ii) energy storage solutions are on the cusp of solving intermittency issues
  - iii) electrification across end-use sectors will continue to expand over the next decade, and
  - iv) investors are increasingly incorporating "green" features in their investment framework, rendering access to capital difficult for those who are not aligned.
- Wait and watch for the inflection point is no longer valid. Fossil fuel plays need to adjust business models to embrace the transition, with M&A being an important consideration.
- Policymakers globally need to take this opportunity to recalibrate their green goals as well, though Asia has unfortunately been found wanting in this aspect so far.

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1. KEY TAKEAWAYS: A CHANCE FOR INDUSTRY PLAYERS TO REVAMP THEIR STRATEGIES IN A POST PANDEMIC WORLD

Renewable energy emerges relatively unscathed from the pandemic; time for a rethink in investment strategies? The COVID-19 pandemic dented energy demand severely in the first half of 2020. But while demand for traditional fossil fuel sources like oil, coal and natural gas are headed for their worst declines in history in 2020, renewable energy stands out as the most resilient with likely flatline contribution to the global grid, thereby increasing its share in the overall energy pie in most countries. The relative resilience of renewable energy could drive investment into lower-risk lower-return business models typical of the industry, rather than increasing exposure to more volatile market dynamics of traditional energy sources.

COVID-19 does not need to accelerate the energy transition, it is already inevitable. We hit the ground with a comprehensive survey of leading energy players in Asia over the past month and asked them about their thoughts on how they are preparing for the energy transition and whether the pandemic will affect the momentum. While there is mixed outlook on whether COVID-19 will accelerate the green energy transition – and we agree – it is amply clear that unlike in the past, a big chunk of industry players in Asia are preparing for the eventual energy transition scenario and no longer ignoring the repercussions of not doing so. The reason why we have reached this inflection point is that over the last decade, the world has made significant technological achievements that puts us in a much more favourable position to enact sustainable change now:

i) Renewable energy is now a serious contender against fossil fuels, with solar PV and onshore wind being the most affordable sources of newbuild generation for at least two-thirds of the world population, which accounts for 71% of global GDP and 85% of electricity generation. The Levelised Cost of Energy (LCOE) of solar photovoltaic system (PV) and onshore wind have fallen radically over the past decade –by a remarkable 88% and 60% respectively. Hence, renewables are no longer an exotic high price dream. It is mainstream and does not leave much scope for excuses.

ii) Intermittency issues inherent in renewable generation should be resolved in the short-to-medium term, as energy storage technology is quickly becoming more cost competitive and durable, while vehicle-to-grid technology would make it possible for us to tap on a burgeoning electric vehicle fleet to store surplus electricity generated.

iii) Advancement in alternative clean fuels like hydrogen, which could potentially come into the mainstream by 2030 timeline, and expanded electrification across end-use sectors (beyond transportation) would spell more trouble for fossil fuels in the longer term.

iv) With climate change risks now firmly established, there is a growing chorus among the common people, the experts, the voters, the investors, the corporates and increasingly, even policymakers to work towards green and equitable economic growth.

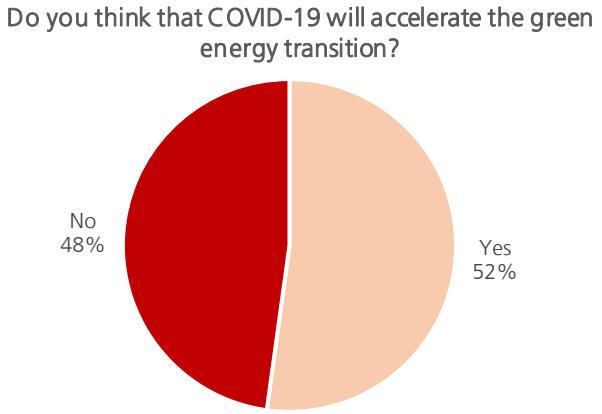
v) Thus, green financing continues to gain momentum and corporates globally are progressively embracing green energy to boost ESG scores, as more investors are incorporating ESG considerations in their investment framework. This will lead to a distinct uptrend in companies procuring green energy for their operations, as well as companies producing green energy for sale or captive consumption.

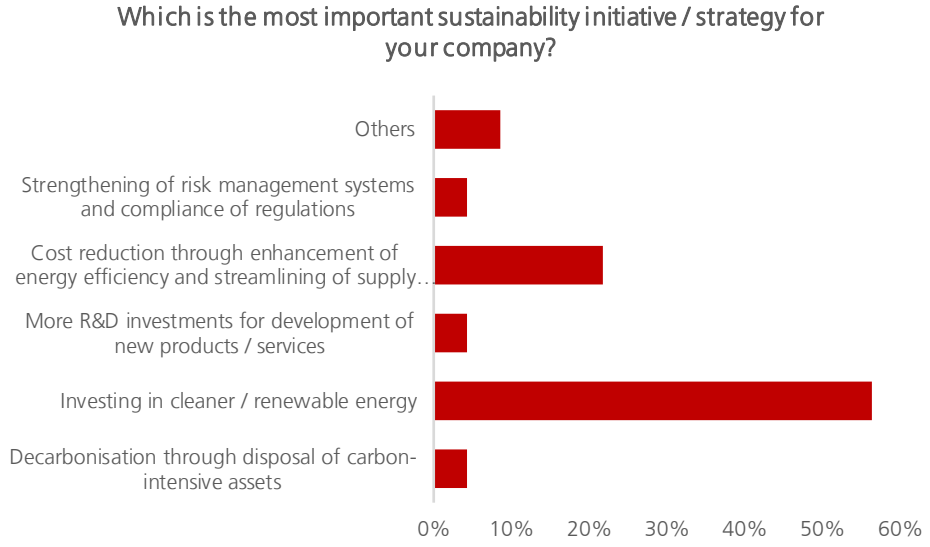
The pandemic will provide opportunity for fossil fuel plays to change business models to benefit from the energy transition. The long-term growth drivers for fossil fuels like coal, oil and gas (except LNG) do not look too promising at this point of time and returns for industry players will mainly depend on supply discipline, which is tough to enforce in a free market, leading to wild volatility and uncertainty from time to time. Thus, it might be sensible to diversify into longer term stable business models, with cheap financing to boot. However, if we focus on international oil majors, despite the expected growth in renewables in the primary energy mix, Big Oil only spent less than 2% of its combined budget on renewables and clean energy investments in recent years. That too varies widely between regions, with European players leading the charge while US oil majors remain largely pure hydrocarbon-focused companies.

Looking forward, we observe Norwegian energy company Equinor is the only one putting serious money into the energy transition strategy. Thus, we believe the COVID-19 hard reset could prove to be the catalyst for oil majors to pump more capital into renewables, acquiring assets, developing skills and nurturing the capacity to transition beyond petroleum. They would be cutting capex across overall investment portfolios by 20-25% owing to the fallout arising from the COVID-19 pandemic, but this can be achieved easily without making any cuts to renewable projects. The pandemic is creating a number of distressed sellers and reducing acquisition costs for assets and companies, thereby creating opportunities for Big Oil to accelerate its energy transition through acquisitions. With deep cuts in E&P spending announced already and, in some cases, dividends, oil majors may free up their balance sheets to ramp up their stakes in renewable investments, facilitated by new mergers and acquisitions. This thesis holds true not just for Big Oil but other energy companies primarily involved in the fossil fuel value chain.

Indeed, energy industry participants in Asia are looking to invest more in renewables, as per our proprietary survey. We also asked survey participants about their most important sustainability initiatives, the most promising investments in the energy value chain and about changes to their business strategy arising from the pandemic fallout. The most prominent insights appear to be 1) renewable power generation looks the most attractive, followed by LNG infrastructure and upstream oil & gas at this point, and 2) investing in the renewables/ clean tech is the key sustainability strategy and an important business growth strategy, along with M&A activities, amid the pandemic. Both corroborate our thesis that corporates will tend to diversify their exposure in the renewables space in order to meet growth targets, climate change targets, sustainability targets and retain access to financing. We will likely see higher capex requirements from corporates to invest in or acquire capabilities in lower-carbon solutions to adjust to the energy transitiontheme, and the financial industry will thus play an increasingly key role here, in allocating capital to fund these strategic initiatives.

Key survey findings (details in Appendix 1)





Source: DBS Bank

What COVID-19 can achieve is changing how policy leaders react today.

COVID-19 gave us a brief glimpse of a greener world – global lockdowns and the shutdown of fossil-fuel burning plants and factories led to clear blue skies and markedly better air quality, even in the most polluted cities in the world. And while we will witness the largest decline in global carbon emissions this year – a record 8% dive in 2020 vs a 2% drop during the GFC, it will likely be only a fleeting improvement. Even as the world grapples with one of the steepest recessions it has ever faced in the near term, climate change, although more gradual and less perceptible than the pandemic, could exacerbate structural inequality and has a far more disastrous long-term impact on the global economy. As governments around the globe dole out economic packages to rescue their economies, well-designed stimulus measures incentivising returns linked to lower carbon footprint and increase in green spending are the needs of the hour. Such policies can concurrently solve the dichotomy of economic growth and climate change concerns, and alleviate global inequality, but the situation could take a turn for the worse from global warming in the future, unless remedial steps are taken.

Asia is unfortunately lagging in policy response so far. The world cannot meet its climate change goals if Asia is not on board, as China (29%), India (7%) and rest of Asia Pacific (15%) churn out 51% of global carbon emissions, owing to population concentration, and higher dependence on fossil fuel. As governments in Asia understandably focus on easing the immediate economic fallout of the pandemic via the provision of wage subsidies, unemployment benefits and support to the financial sector, the region is significantly behind in embracing a "green" economic recovery. Only a few Asian countries have declared green measures thus far, while general stimulus efforts will likely support the current "brown" trajectories in countries without sound climate policies. Given that non-fossil fuel jobs in the energy sector are much more labour intensive, and employment generation is a key populist goal in many Asian countries, we believe this is also a critical aspect for policymakers to consider, while scripting future fiscal stimulus measures to align more closely with climate change and the necessary energy transition objectives.

There are other near-term challenges to overcome as well, of course. Overall, even though we believe the long-term uptrend of renewable energy development will remain intact due to the rapidly decreasing development costs and the unavoidable need to meet climate change and environment-related targets for both governments and corporations, we should be aware of accompanying risks. These include i) current pandemic-related risks - postponement of projects, lower returns on renewables projects owing to removal of incentives, and continuing reluctance on the part of policymakers to effect changes, ii) renewable supply chain concentration in China, which could lead to unwanted disruptions, iii) the lack of political will to remove fossil fuel subsidies in many countries, which have distorted the energy sector, iv) the manpower issues – while green energy transition is likely to lead to positive employment effects in the longer term, in the interim, there will be supply mismatch, lack of training facilities, possibility of pay cuts for workers switching careers and relocation issues, and v) bottlenecks in existing energy infrastructure which was built based to cater to the fossil fuel industry, and cannot cope with the high growth of renewable power which is non-dispatchable. The above challenges will lead to more grid congestion, grid reliability issues and lower-than-expected renewables project returns.

But where there is a will, there will be a way. The crux of the matter is that there is no longer any escaping the inevitable. The inflection point is behind us, a wait and watch policy is no longer valid, and legacy players need to adjust business models to embrace the transition, or risk falling behind. In addition, policymakers globally need to take this opportunity to recalibrate their green goals as well, particularly in Asian countries.

2. COVID-19 IMPACT ON DIRECT ENERGY SOURCES – RENEWABLE ENERGY GAINS MARKET SHARE AMID THE PANDEMIC

Crude oil demand is by far the biggest casualty during 1H20, with global demand expected to fall by 9% in 2020

- Lockdowns imposed throughout the world to curb the virus crippled crude oil demand in 1H20, as transportation (road and jet fuels) accounts for around 53% of global oil consumption.
- Road fuel demand has started to normalise with the lifting of lockdowns, especially as commuters switch to private car transportation.
- Jet fuel demand is still severely depressed, and will remain a drag, as global commercial air traffic is likely to only reach pre-COVID-19 levels in late 2022-2023, given significantly lower flight capacity and the retirement of less fuel-efficient planes.
- However, the resurgence in COVID-19 cases underscores the fragility of the recovery, as it could translate into greater-than-expected downside for oil demand this year.

COVID-19 will have a lasting impact on oil consumption trends, though peak oil is not quite here yet

- Oil consumption intensity is likely to decline at a faster pace over the next few years as consumers alter their behaviour.
- Commuters in major cities like New York, Oslo, Paris and Milan, and even Jakarta are turning to cycling to avoid public transportation.
- Proliferation of online shopping, especially for groceries during lockdowns amid COVID-19 may have caused a permanent shift in consumer preferences.
- Work from home and video conferences, the new normal amid COVID-19, will likely moderate business travel and travelling to the office when the pandemic is finally over.

Gas demand to be less affected than coal; gas and coal demand will falter due to a sharp decline in electricity demand and industrial activity

- Global coal and natural gas demand are expected to decline by around 8% and 4% respectively, based on IEA projections; the decline in coal consumption in 2020 would be the biggest drop since World War II, while the reduction in gas demand in 2020 would be more than double that of the GFC (-2% y-o-y) and the largest decline on record.
- Both coal and gas consumption will be adversely impacted by keen competition from renewable sources, and weaker demand from the power sector.

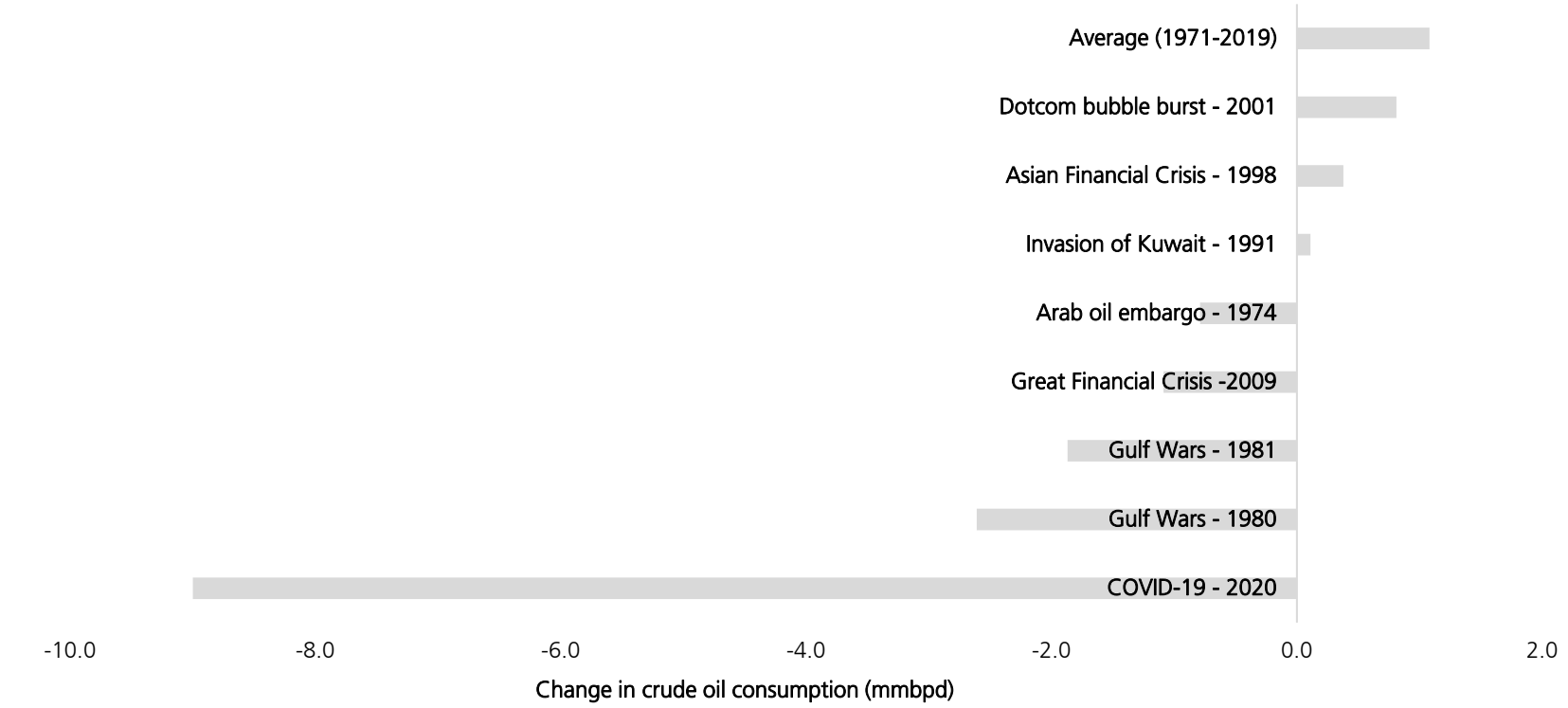
- However, coal will fare worse than natural gas as an abundance of natural gas has pushed gas prices to the lower end of coal-to-gas switching range, which suggests that power generation at a less efficient gas plant will be more affordable than at a more efficient coal burning plant.

Renewable energy is the only energy fuel expected to see positive demand growth in 2020

- Despite lower global electricity generation this year, renewable generation is expected to eke out a modest 0.5% increase.
- Demand growth this year is underpinned by new projects coming on stream during the year, coupled with renewable energy's low operating and maintenance costs and priority access to the grid.
- Renewables continued to exhibit resilience amid the pandemic, steadily gaining market share in the electricity mix at the expense of traditional fossil fuels.
- Electricity generation from renewables exceeded coal in the US for the first time in 130 years, according to the EIA. Similarly, in Europe, the share of variable renewables (VRE) reached a record high during the lockdown, with VRE's share in Germany surpassing the 90% level over a few weeks.

COVID-19 IMPACT ON CRUDE OIL

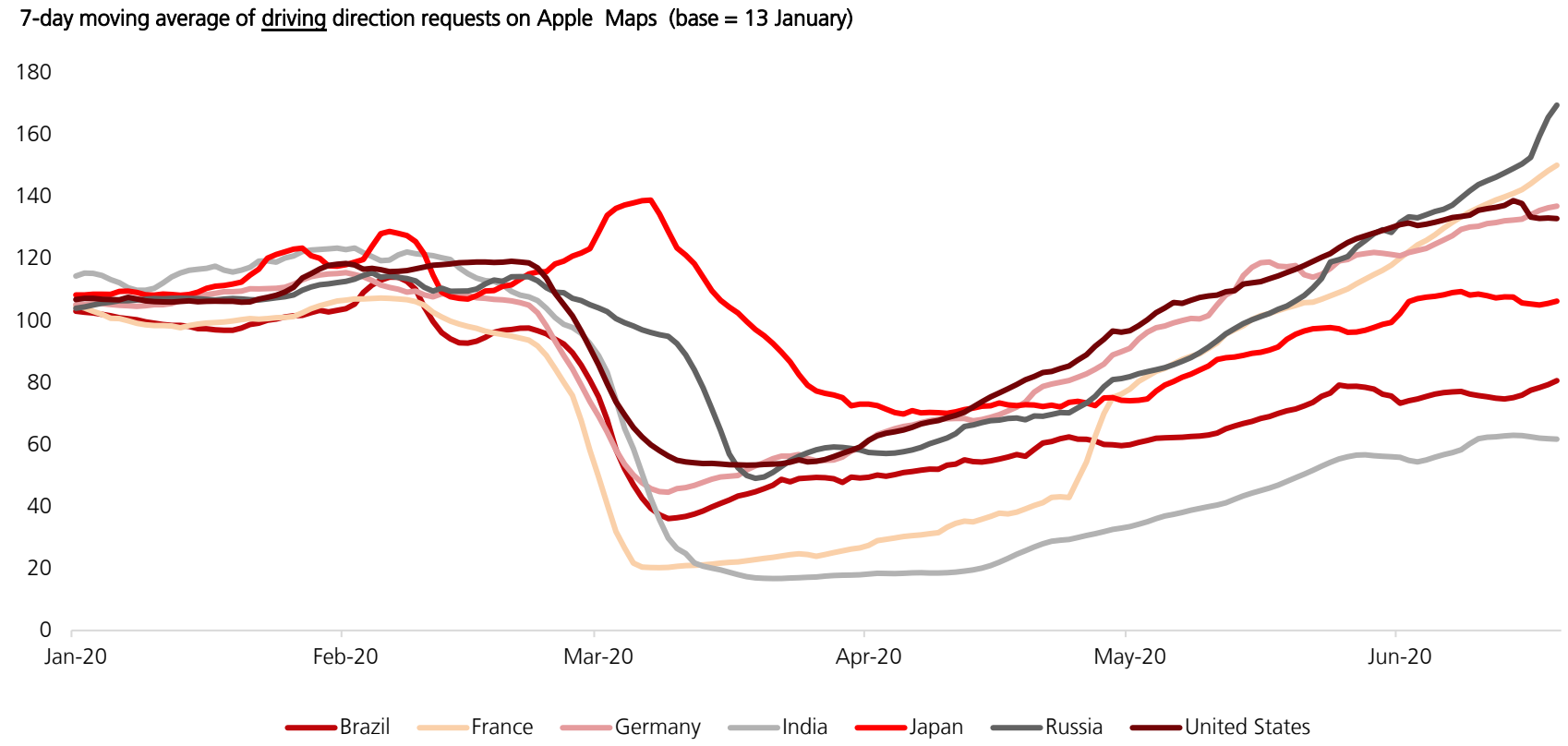
Crude oil is on course for its worst year since the Gulf War



Source: BP PLC, DBS Bank

COVID-19 IMPACT ON CRUDE OIL

Road transportation normalised with the easing of lockdowns; recent sharp increases could indicate shift to private transportation

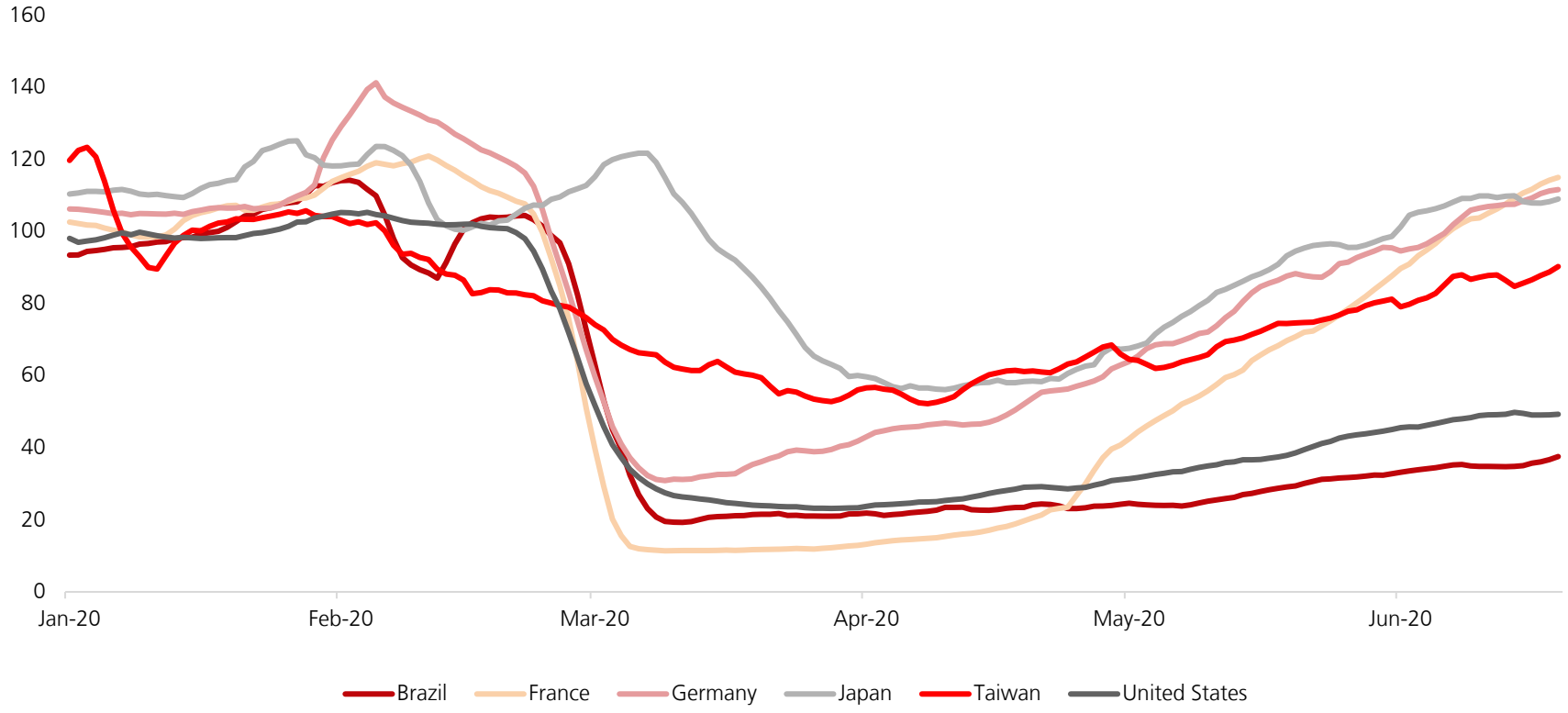


Source: Apple Mobility Data, DBS Bank

COVID-19 IMPACT ON CRUDE OIL

Transit levels are trending up at a slower pace, but remain depressed in countries with rising new COVID-19 cases

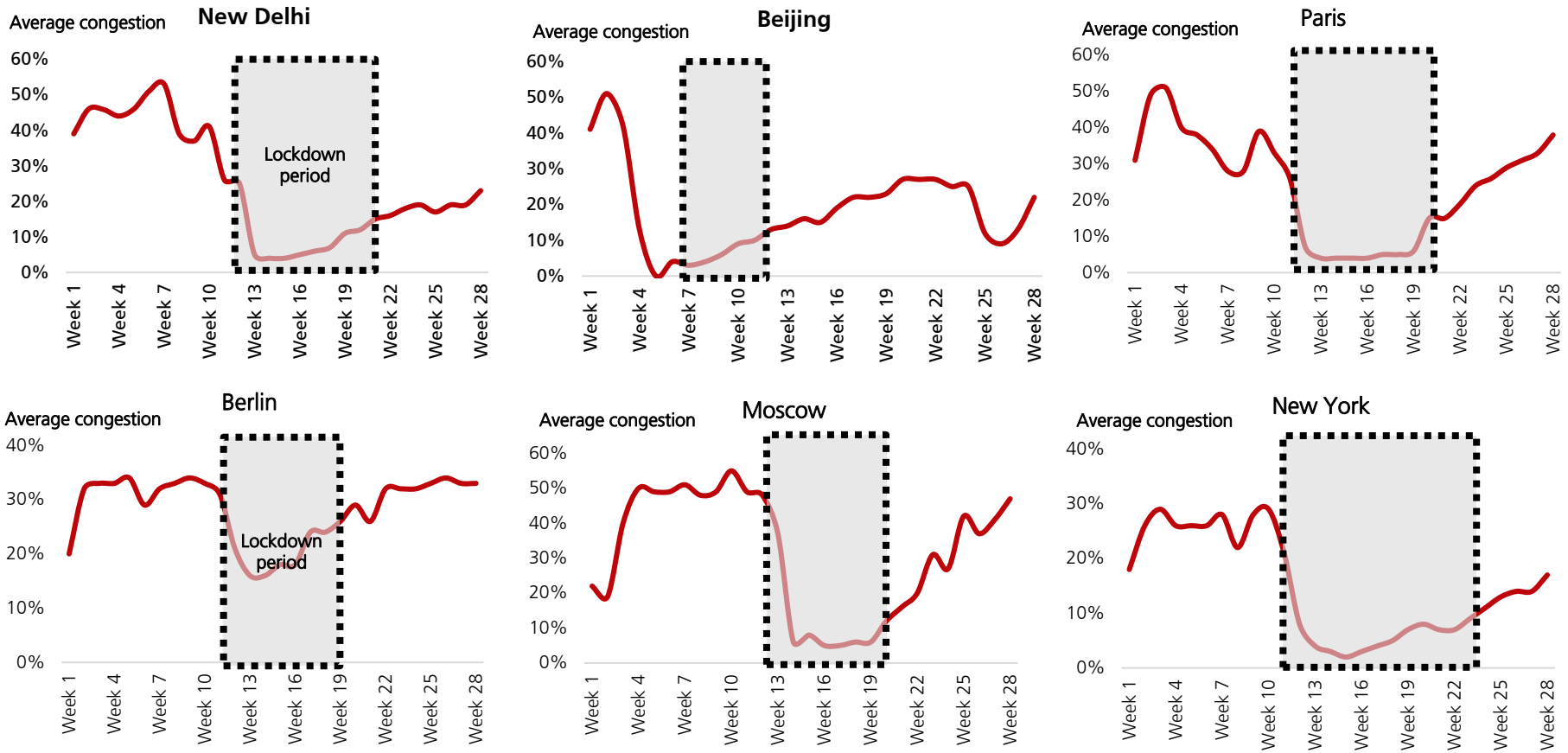
7-day moving average of transit direction requests on Apple Maps (base = 13 January)



Source: Apple Mobility Data, DBS Bank

COVID-19 IMPACT ON CRUDE OIL

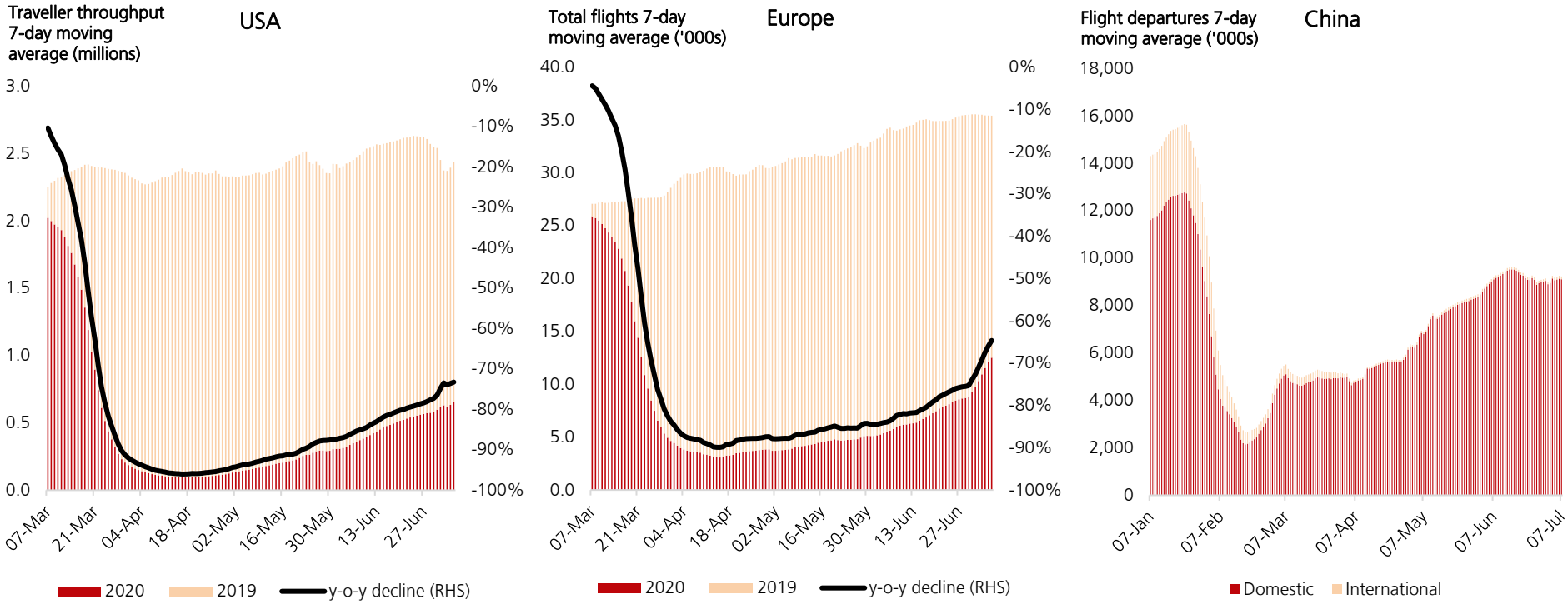
Road congestion levels at most major cities are still below pre-COVID levels, suggesting that road activity has some way to go



Source: TomTom Data, DBS Bank

COVID-19 IMPACT ON CRUDE OIL

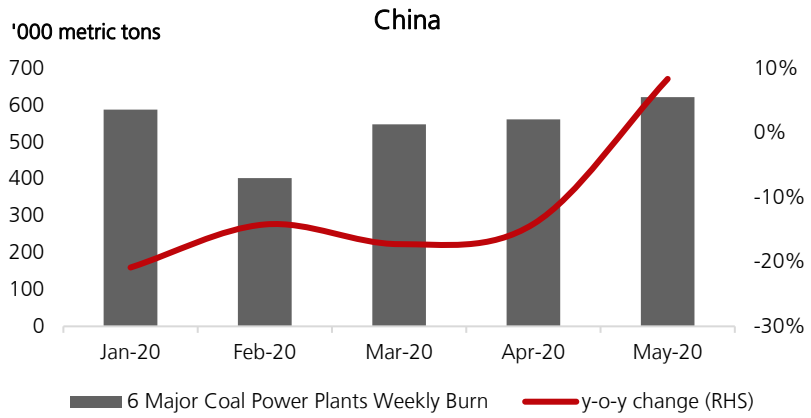
Flight activity is inching up globally, but continues to be considerably below pre-COVID levels

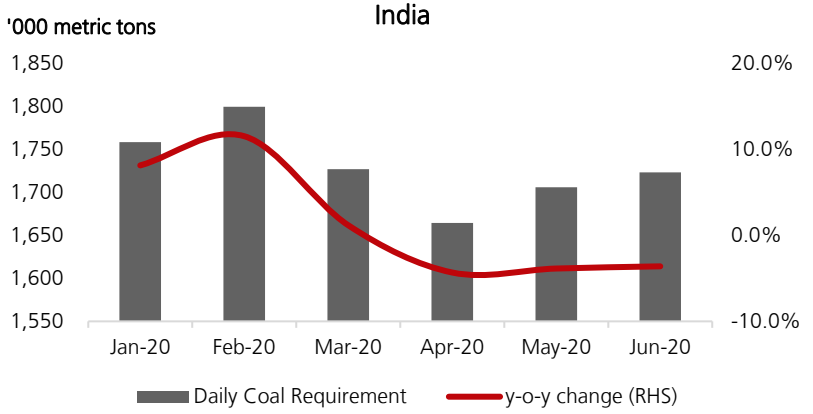


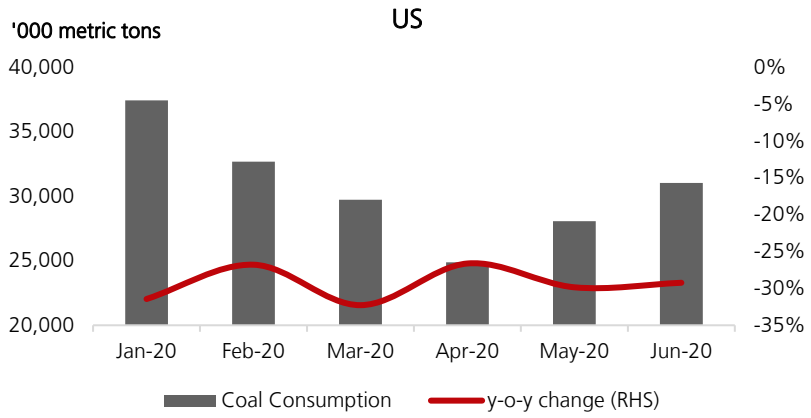
Source: BloombergNEF, DBS Bank

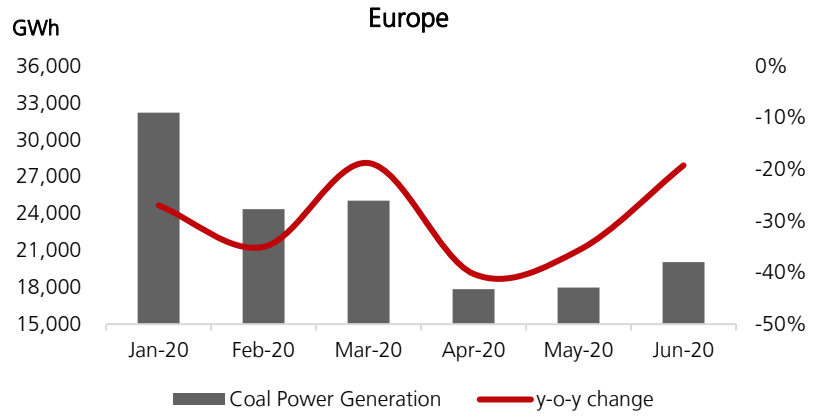
COVID-19 IMPACT ON COAL

China climbs out of the abyss; coal consumption plummeted amid displacement by other fuels and a stark decline in electricity generation





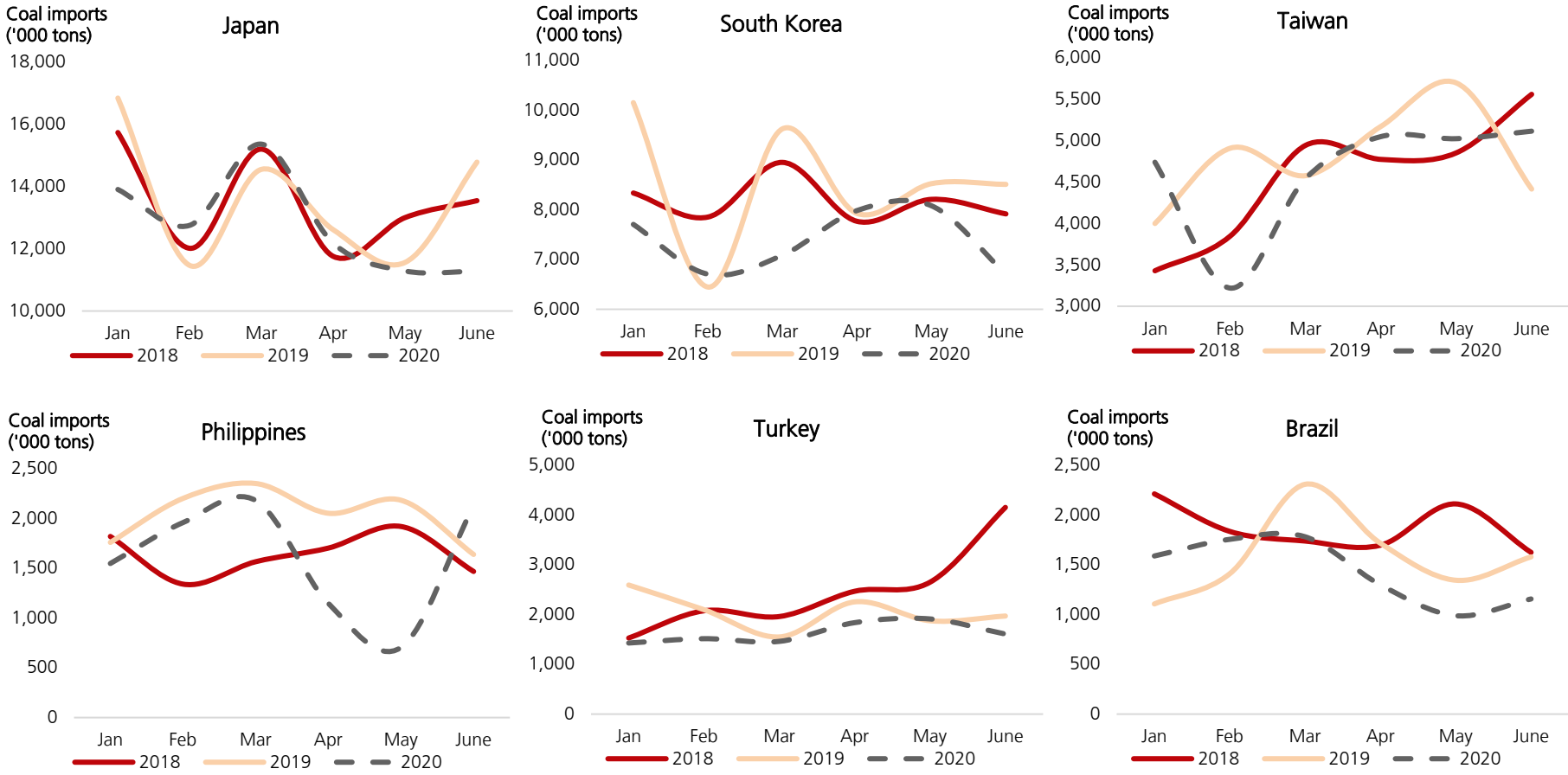




Source: Bloomberg Finance L.P., DBS Bank

COVID-19 IMPACT ON COAL

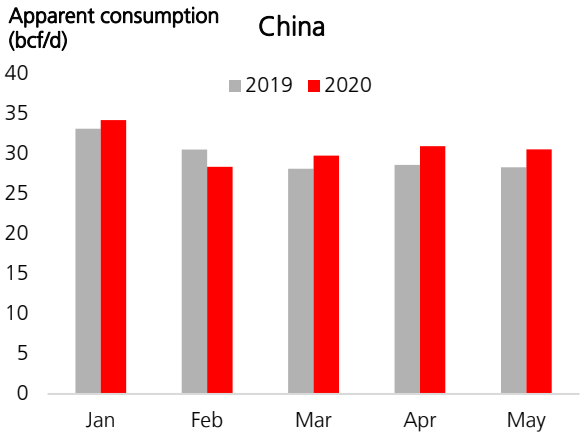
Coal import levels in other countries paint a consistent story

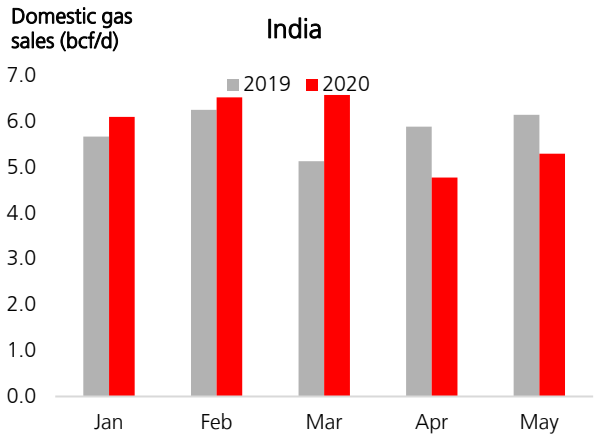


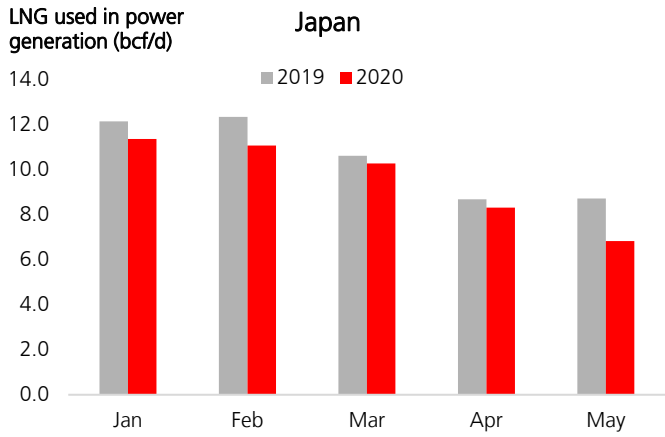
Source: Bloomberg Finance L.P., DBS Bank

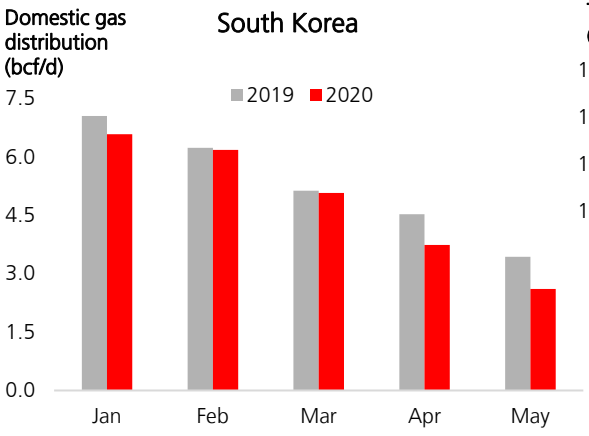
COVID-19 IMPACT ON NATURAL GAS

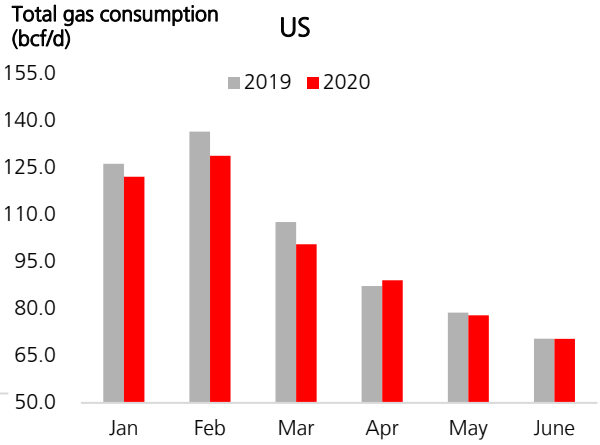
Natural gas demand in China swung back to growth; encouraging sign in US and Europe, while other countries struggle to regain lost ground

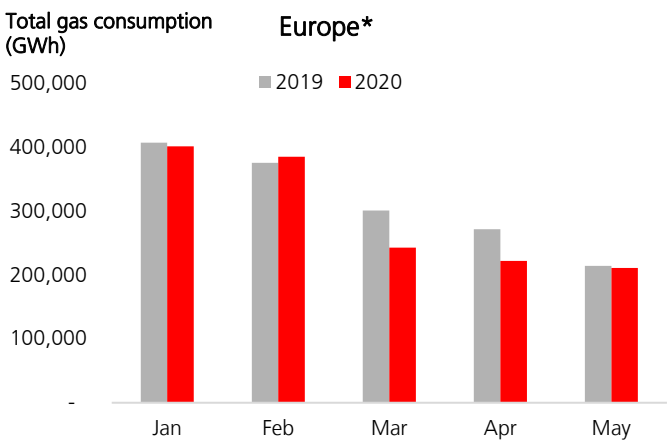








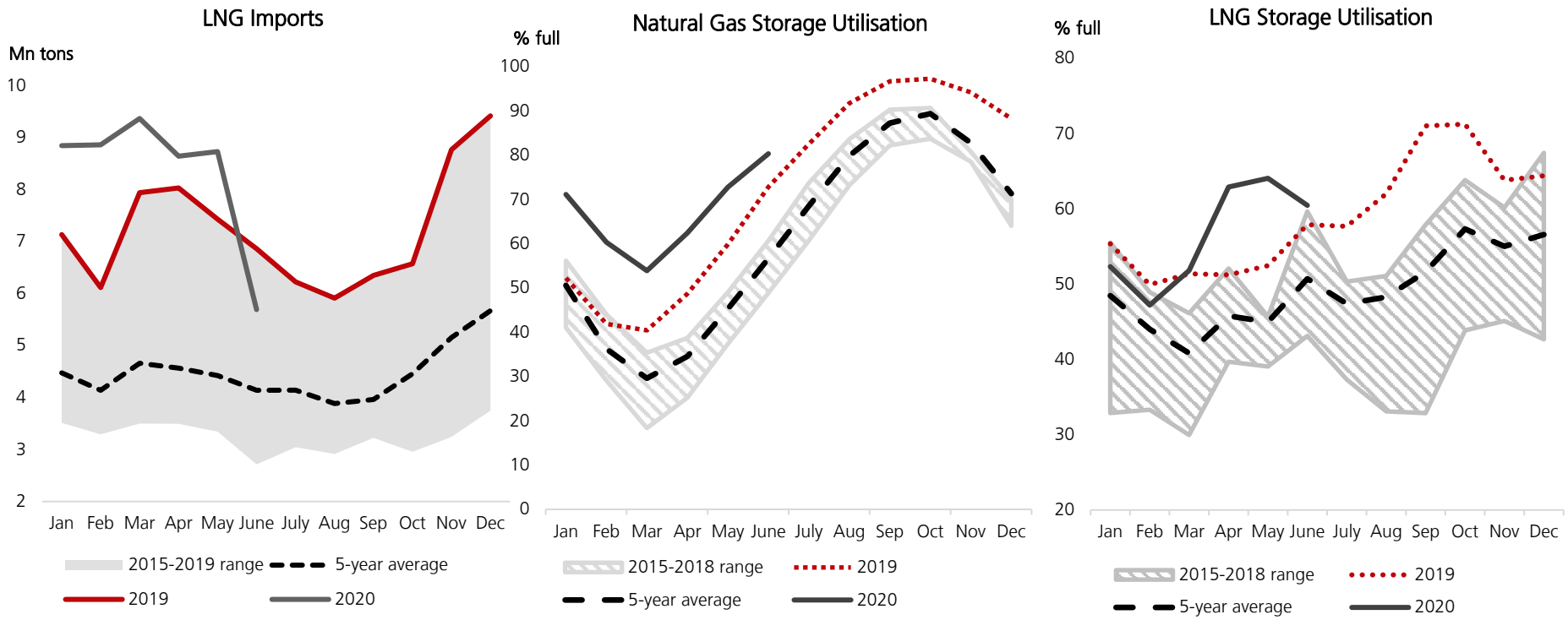




*Source: Bloomberg Finance L.P., DBS Bank, * - Europe includes Italy, France, UK, Germany, Spain, Netherlands and Belgium*

COVID-19 IMPACT ON NATURAL GAS

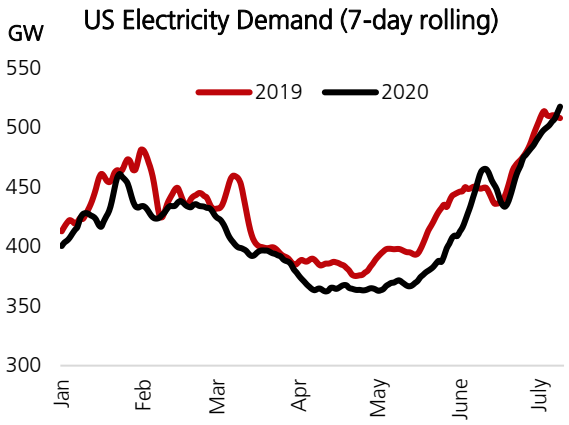
Rising LNG imports, coupled with weak demand led to record-high gas storage levels in Europe

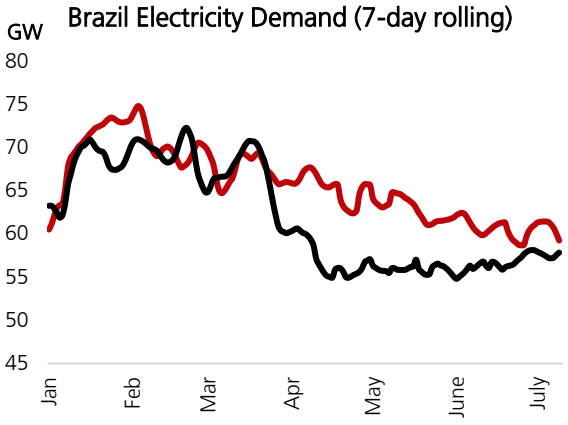


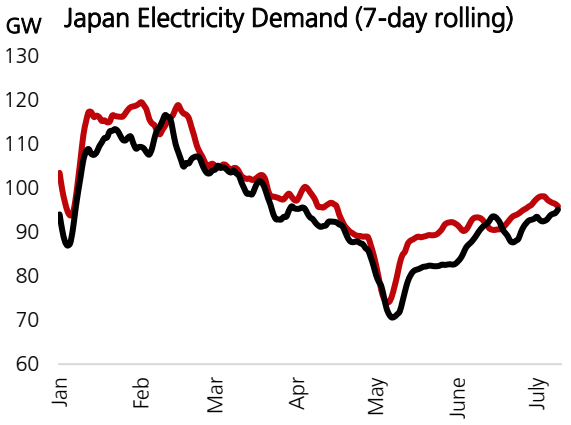
Source: Bloomberg Finance L.P., DBS Bank

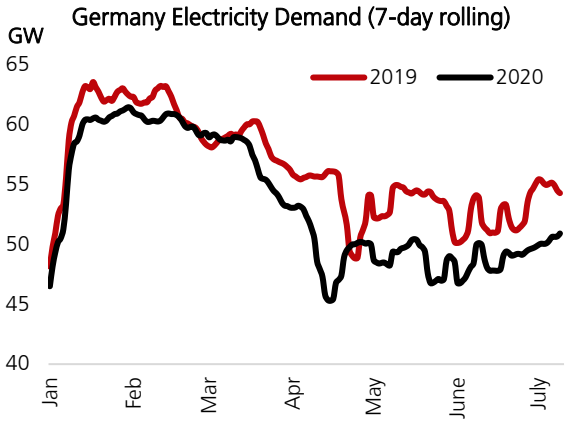
COVID-19 IMPACT ON RENEWABLE ENERGY

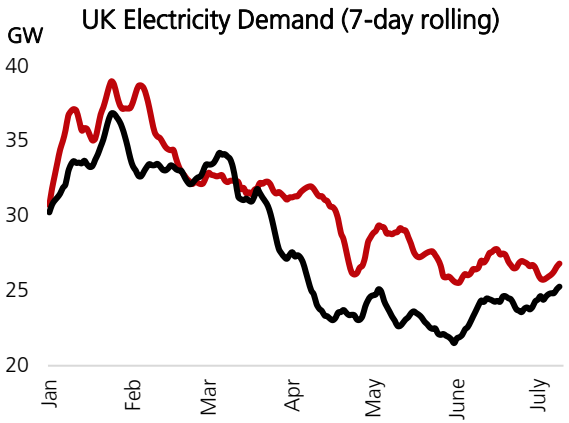
Electricity demand among the selected countries fell by 5-10% in 1H20

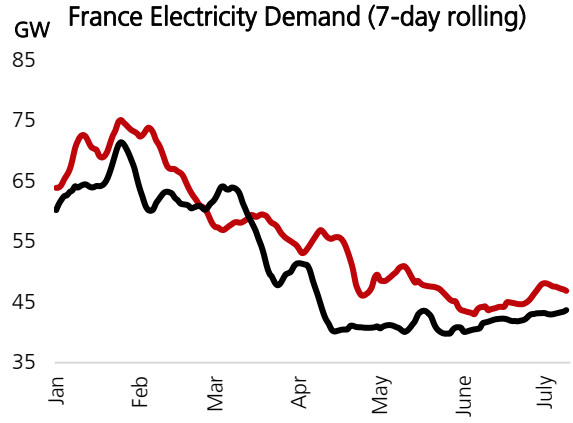








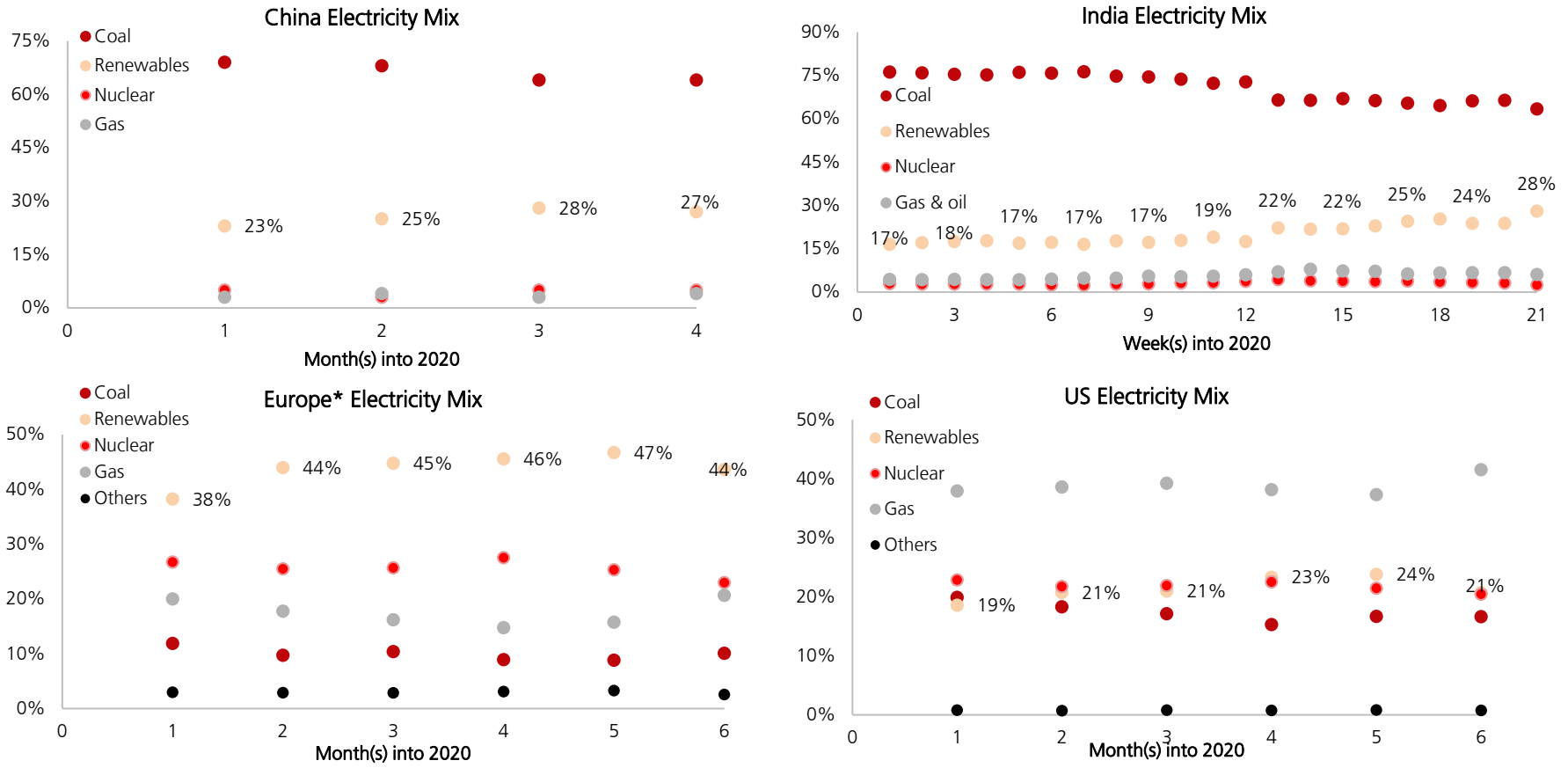




Source: BloombergNEF, DBS Bank

COVID-19 IMPACT ON RENEWABLE ENERGY

Renewable energy demonstrated the most resilience, garnering market share away from traditional fossil fuels



*Source: BloombergNEF, EIA, DBS Bank, * - Europe includes Italy, France, UK, Germany, Spain, Netherlands and Belgium*

3. THE STARK INEVITABILITY OF RENEWABLE ENERGY IN FUTURE

Renewable energy is now a serious contender against coal and natural gas; energy storage technology is quickly becoming more cost-competitive

- The Levelised Cost of Energy (LCOE) of solar photovoltaic system (PV) and onshore wind have fallen radically over the past decade – based on estimates by BNEF, global LCOE benchmarks for PV and onshore wind decreased by a remarkable 88% and 60% from 2H09 to 1H20.

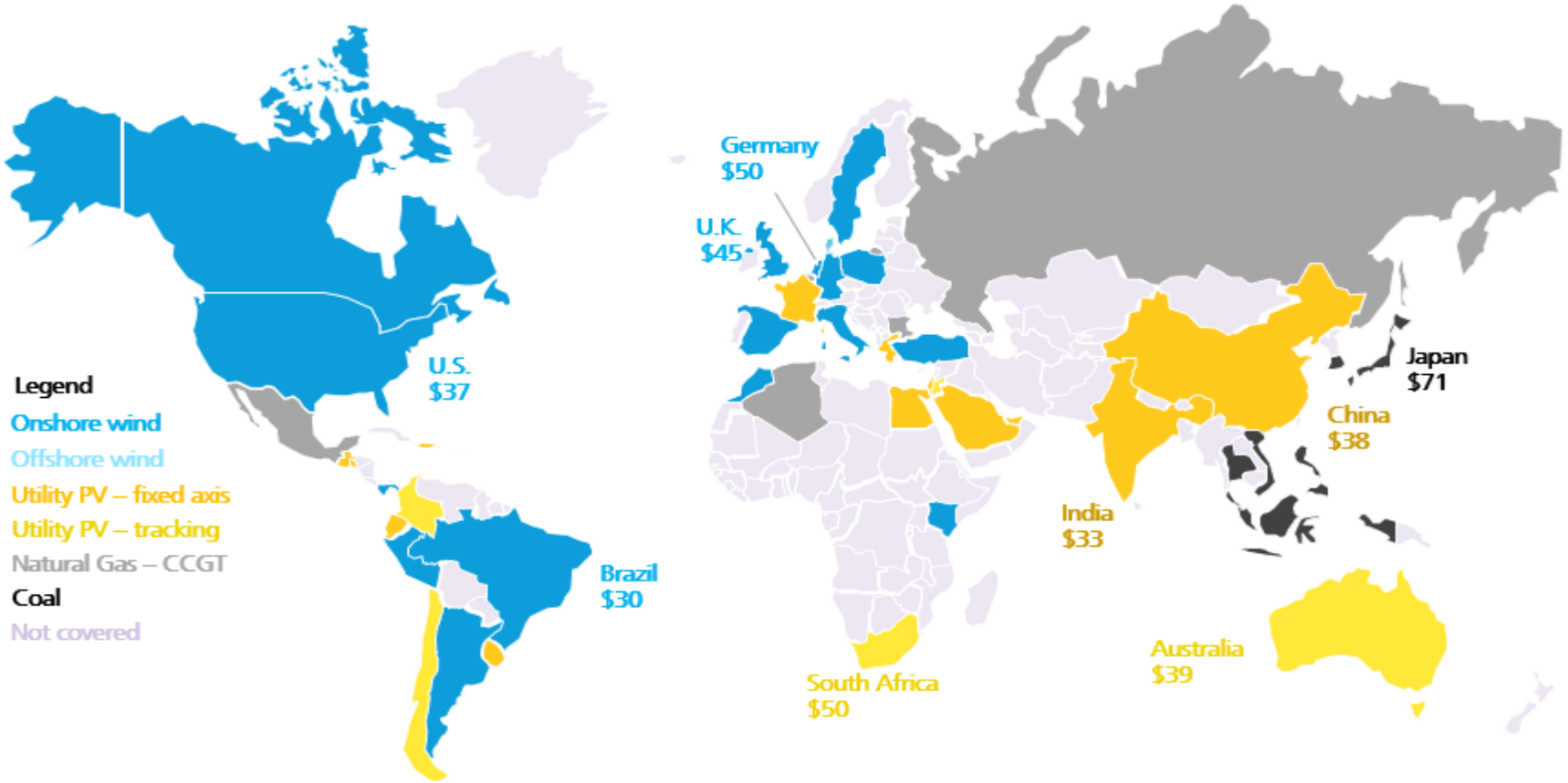
- PV and onshore wind are now the cheapest source of new bulk power generation in countries that account for 72% of global GDP and 85% of electricity demand – IRENA estimates that on average, it is cheaper to build new PV and onshore wind power than continue operating many existing coal plants. This is substantiated by analysis in a report by the Rocky Mountain Institute and Carbon Tracker Initiative, which expects the share of uncompetitive coal plants worldwide to rise to 60% in 2022 and 73% in 2025, from 39% in 2019.

- Costs for battery storage technology declined at a faster pace relative to renewables – LCOE for a utility-scale battery (4-hour duration) was at US$150/MWh in 1H20, down 81% from end-2H12. Additionally, it is already cheaper to install a battery than open-cycle gas turbines and gas-reciprocating plants in major gas importing regions like Europe, China and Japan.

- There is scope for further cost reductions as the world continues to learn, innovate and scale – IRENA projects central LCOE of PV and onshore wind to see reductions of 58% and 25% respectively between 2018 and 2030. Offshore wind, while not quite as cost-efficient as traditional fossil fuels now, will be on par with them by the late 2020s; LCOE of offshore wind is expected to drop by 55% from 2018-2030.

RENEWABLE ENERGY IS NOW THE CHEAPEST SOURCE OF ENERGY IN MANY PARTS OF THE WORLD

Most affordable source of energy by country

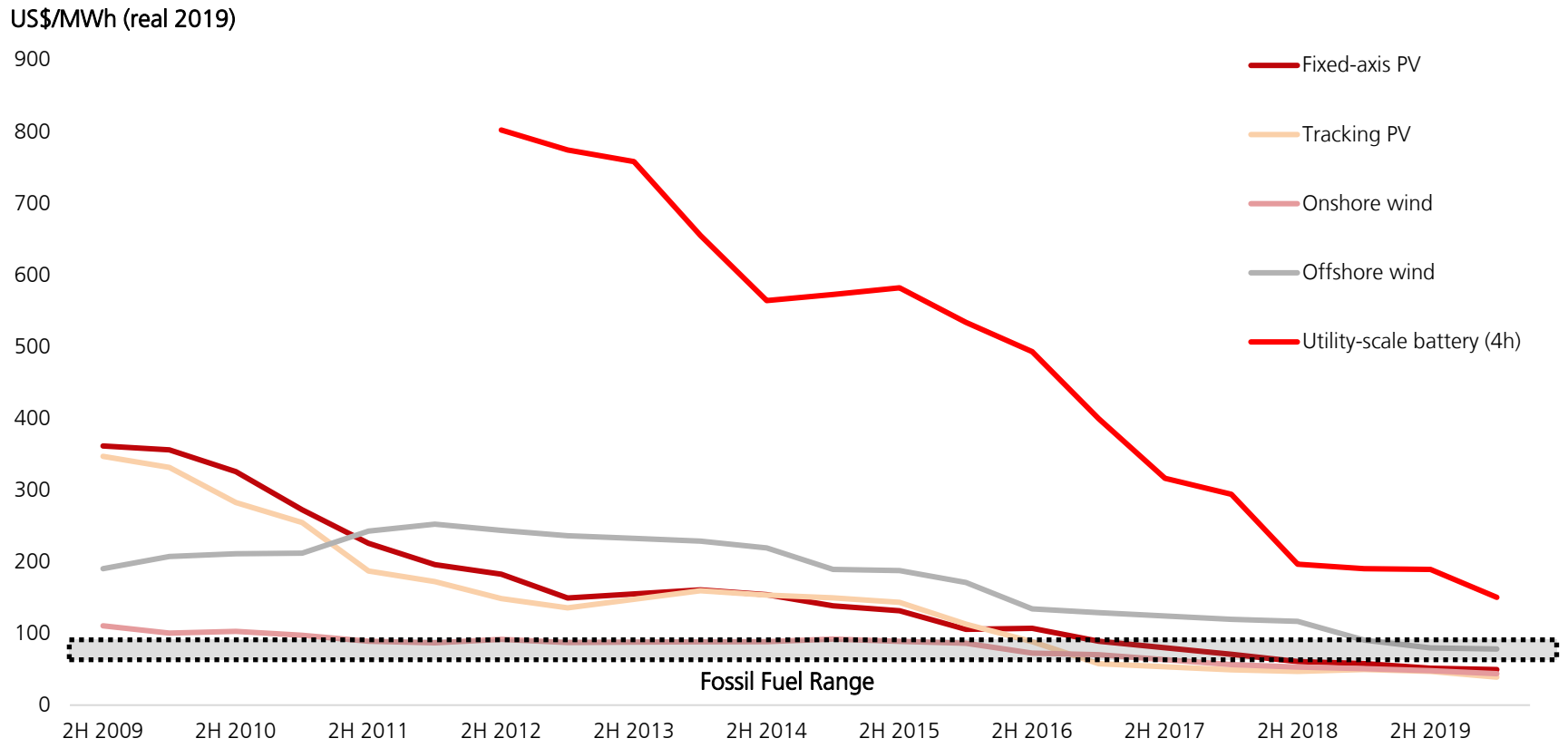


Source: BloombergNEF, DBS Bank

Note: Country borders on maps may be an approximation and do not represent the opinion of the analyst(s) or of DBS Bank Ltd.

CURRENT LCOE OF RENEWABLES IS VASTLY LOWER THAN IT WAS BACK IN THE GFC (2009)

Historical LCOE of renewables and utility-scale batteries



Source: BloombergNEF, DBS Bank

BATTERY STORAGE STILL HAS SOME WAY TO GO THOUGH

There have been increasing discussions on the possible adoption of a decentralised power or renewable power system with power storage as a key solution. Currently, utility-scale battery storage systems are being deployed in Australia, Germany, Japan, UK, the US and some other European countries. In the US, a 4MW/40MWh battery storage system is able to reduce almost 400 hours of congestion in the power grid and save up to US$2.03m in fuel costs. It is also perceived as a solution for peak-shaving. IRENA is projecting energy storage deployment in emerging markets to increase by over 40% annually until 2025. By 2030, small-scale battery storage is expected to increase significantly.

However, issues with battery storage systems remain. Some of the major problems include:

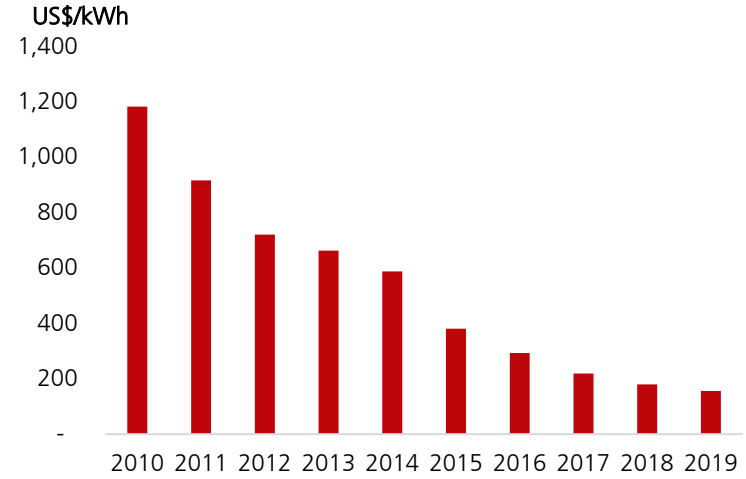
- **Investment returns:** This is one of the major concerns. Although LCOE for battery storage has been dropping fast (see chart below), large-scale battery storage systems have been deployed mainly as a replacement for high-cost diesel or where electricity prices are high. In countries with low electricity prices or narrow differentials in peak-hour and off-peak-hour electricity prices, investment returns for battery storage systems could be marginal.

- **Storage limitations**: Lithium-ion batteries have limits in terms of the amount of energy they can store.

- **Environmental and socio-political concerns**: There are increasing concerns about the environmental costs of mining lithium, recycling or disposal of expired battery packs and the use of child labour in the cobalt industry in the Democratic Republic of the Congo.

- **Safety issues:** Some high-profile safety-related issues in recent years concerning battery storage have alarmed industry observers. These include the explosion at the Arizona Public Service facilities in April 2019 and multiple incidents of storage-related fires in South Korea.

Lithium-ion battery price trends



Source: BloombergNEF, DBS Bank

ADVANCEMENTS IN OTHER ALTERNATIVE CLEAN FUELS CONTINUES

Improvement in alternative clean fuels technology like hydrogen, coupled with expanded electrification across end-use sectors spell even more trouble for fossil fuels in the longer term

- **Similar to renewable energy, the cost of renewable (green) hydrogen from electrolysis plunged by 60% between 2010 and 2020** to around US$4/kg today – hydrogen is already cost-competitive in a few applications, like serving as a feedstock for the production of ammonia and methanol, in refining, and as a fuel for space-heating in regions where heat pumps are predominant. A paper by the Hydrogen Council shows that green hydrogen costs are projected to fall by an additional 60% by end-2030, which will enable it to become viable in more applications like trucks, buses, taxis likely by the 2030 timeframe.

- **The production cost of electric vehicles (EVs) declined considerably from 2010-2019** on the back of an 87% drop in lithium-ion battery prices; BNEF expects EVs to reach price-parity without subsidies for internal combustion vehicles by the mid-2020s.

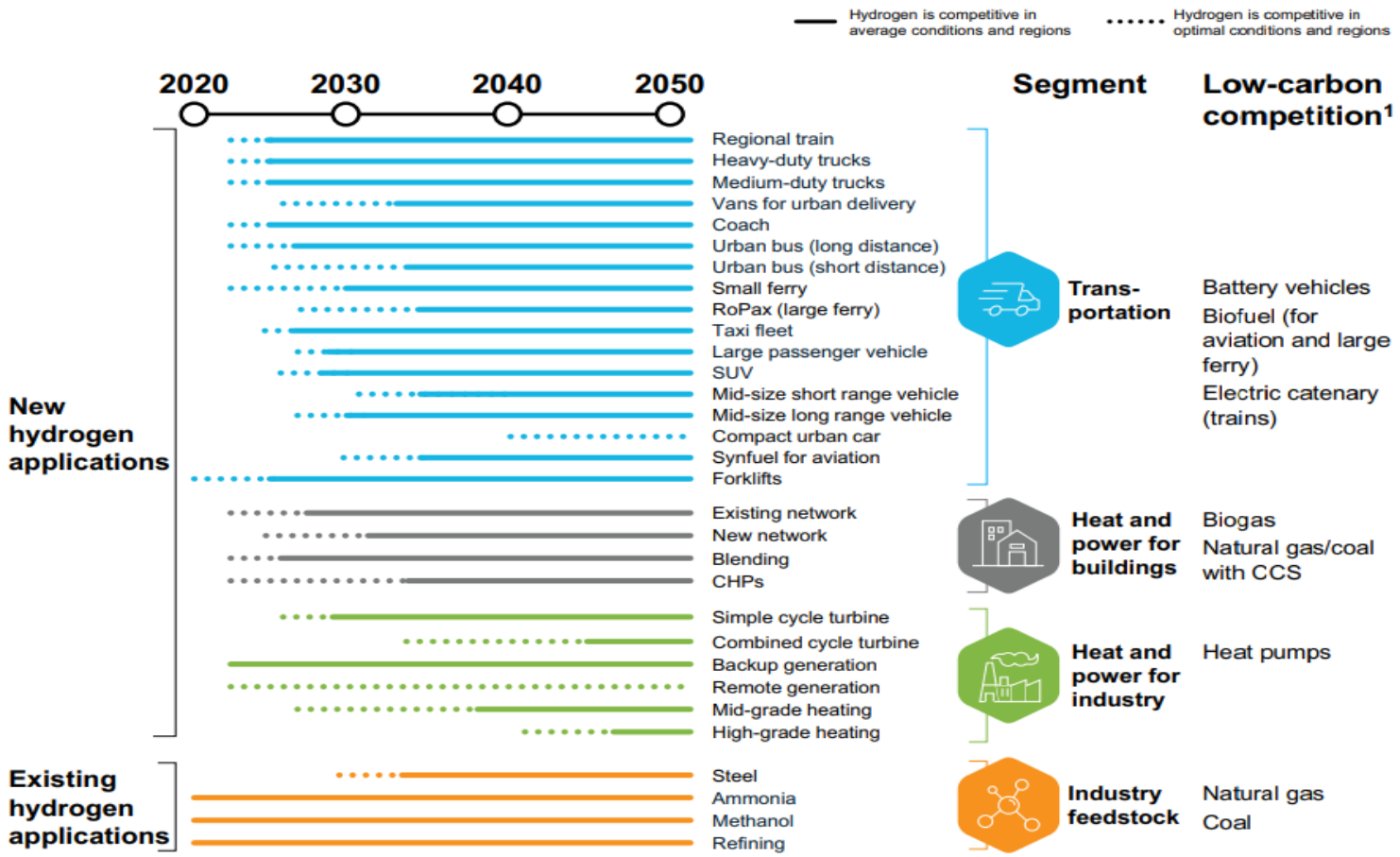
- **Accordingly, passenger EV sales is projected to skyrocket** to 54m units in 2040, from an expected 1.7m units in 2020, or at a 20% CAGR during the period; commercial EV sales are anticipated to grow at an even faster CAGR of 24% during the period.

- **The sheer growth in EV deployment can greatly augment power grid flexibility by becoming grid-storage units** and reduce curtailment by regulating electricity demand via smart charging.

- **Apart from the electrification of the global vehicle fleet, the electrification of buildings is a feasible route** today because there are viable and more efficient substitutes to conventional equipment that are powered by fossil fuels. Heat pumps can replace furnaces or boilers to heat homes and water, while gas-powered ovens and burners can be replaced with electric ranges and induction cooktops – BNEF believes that more than half of energy consumed by buildings in countries like the UK and Germany could be electrified by 2050.

HYDROGEN ENERGY COULD BE ON THE CUSP OF MAINSTREAM ADOPTION ACROSS VAROUS SECTORS BY 2025-2030

Time line of hydrogen's viability across different segments

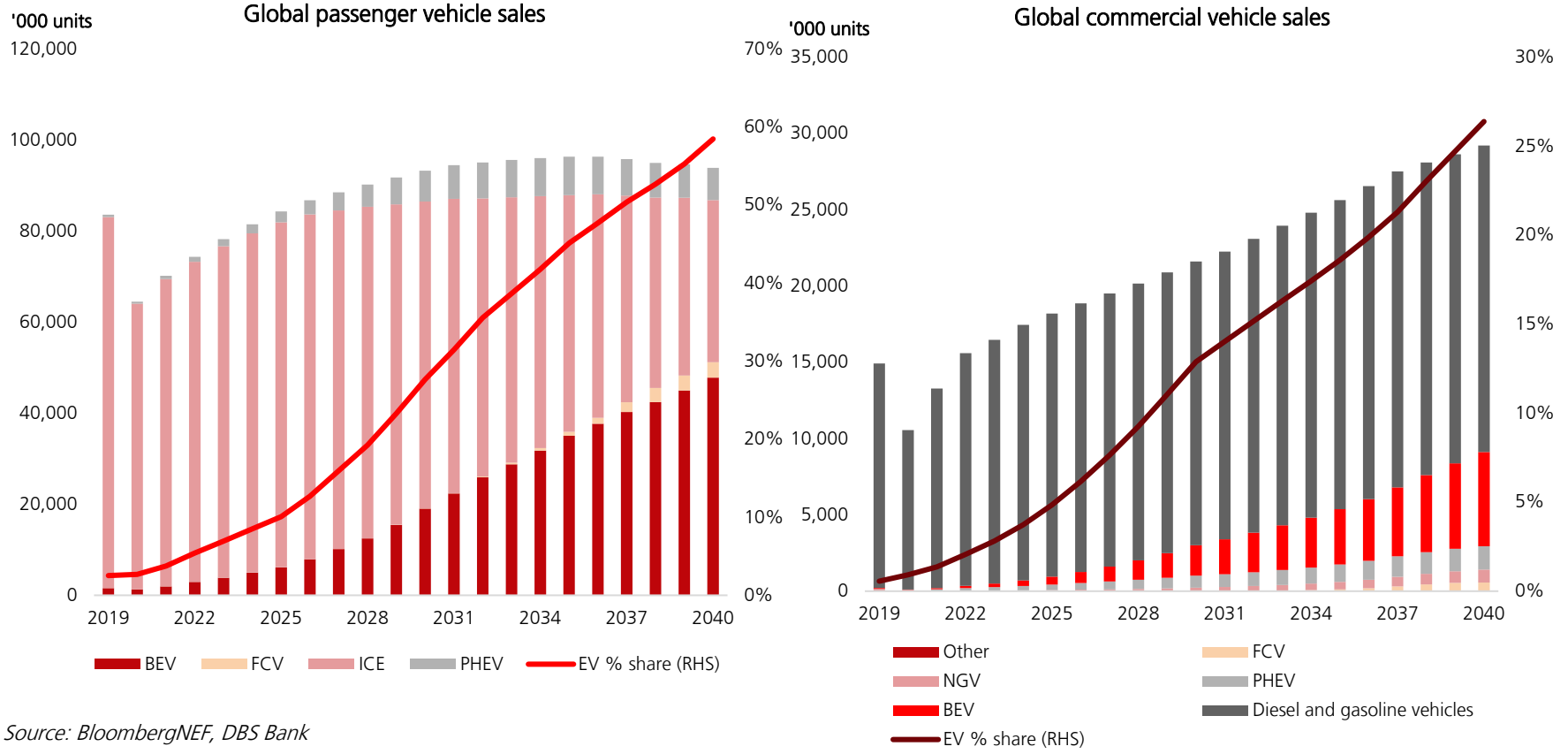


1. In some cases hydrogen may be the only realistic alternative, e.g. for long-range heavy-duty transport and industrial zones without access to CCS

Source: Hydrogen Council

INTRODUCTION OF ELECTRIC VEHICLE-FRIENDLY POLICIES TODAY COULD ACCELERATE ITS GROWTH

BNEF projected global sales of passenger and commercial vehicles



Source: BloombergNEF, DBS Bank

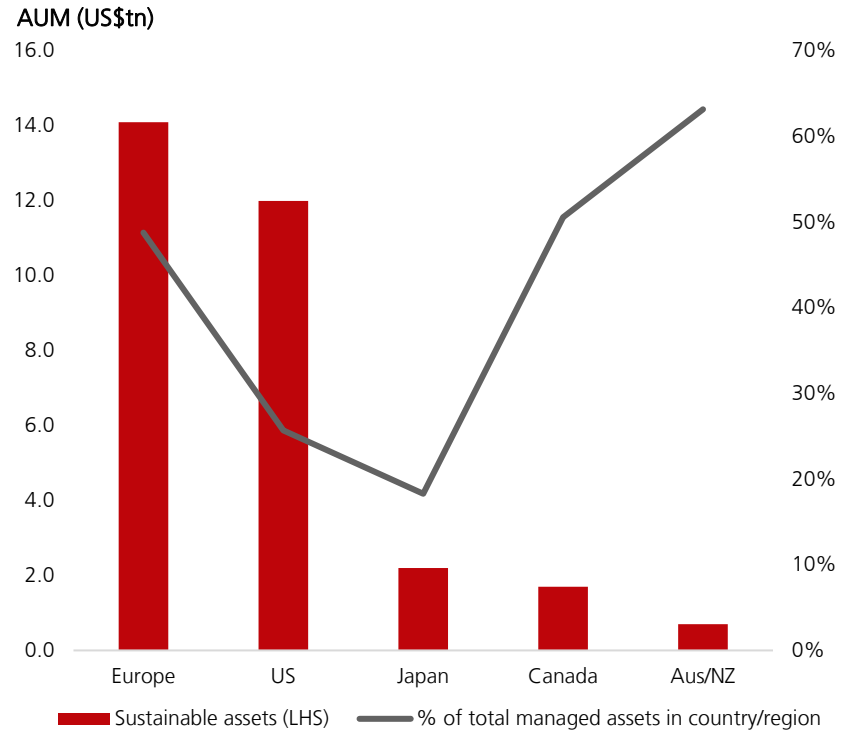
GREEN FINANCING CONTINUES TO GAIN MOMENTUM

Green financing is likely to continue gaining momentum; corporates globally are increasingly embracing green energy to boost ESG scores

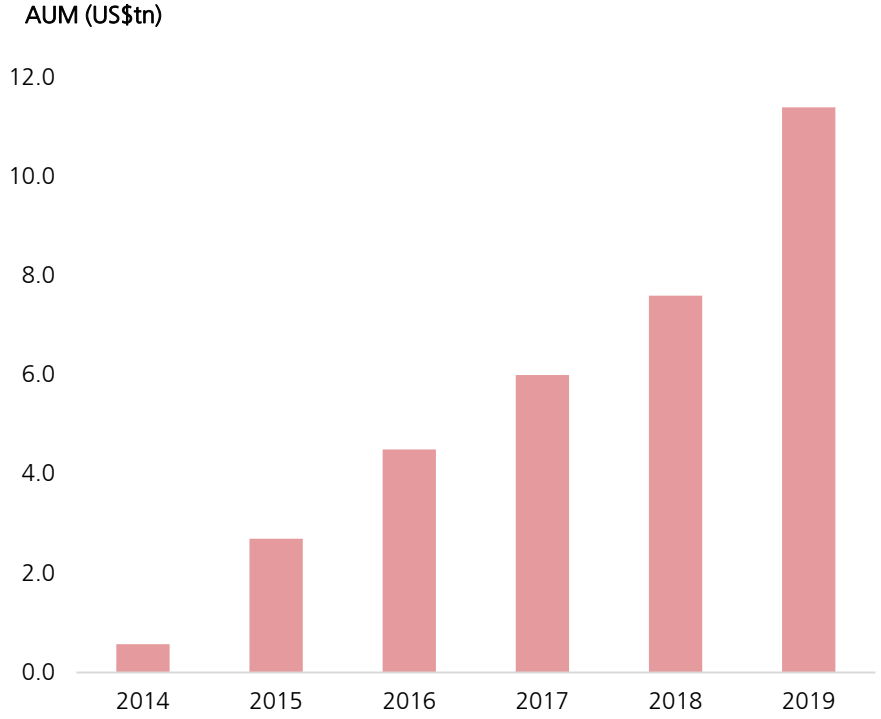
- Available financing for fossil fuel companies is likely to become scarcer as investors are increasingly incorporating ESG considerations in their investment framework; corporates are securing more green energy for their operations globally.
- According to estimates by the Global Sustainable Investment Alliance, around US$30.7tn of funds were held in sustainable assets in 2018, (more than double the amount [US$13.6tn] in 2012), representing 33.3% of total AUM in that year.
- Sustainable debt issuance soared to US$478bn in 2019, from US$40.5bn in 2014, for an implied 64% CAGR during the period.
- 1,240 institutions including sovereign wealth funds, insurance companies, pension funds, representing more than US$14.1tn in value (up from US$52bn in 2014) have pledged to divest from fossil fuels.
- Climate Action 100+, an investor initiative aimed at keeping the world's largest greenhouse gas emitters in check, has grown to 450 investors with over US$40tn in AUM today, from 225 investors with US$26.3tn in 2017.
- There is a distinct uptrend in companies procuring green energy for their operations - cooperations globally bought 19.6GW of clean energy in 2019, up 44.1% from 2018, with a total of 52.4GW of clean energy bought between 2009 and 2019.

THERE IS A SEISMIC SHIFT TOWARDS SUSTAINABLE INVESTING

Sustainable assets AUM and share of total assets across regions (2018)



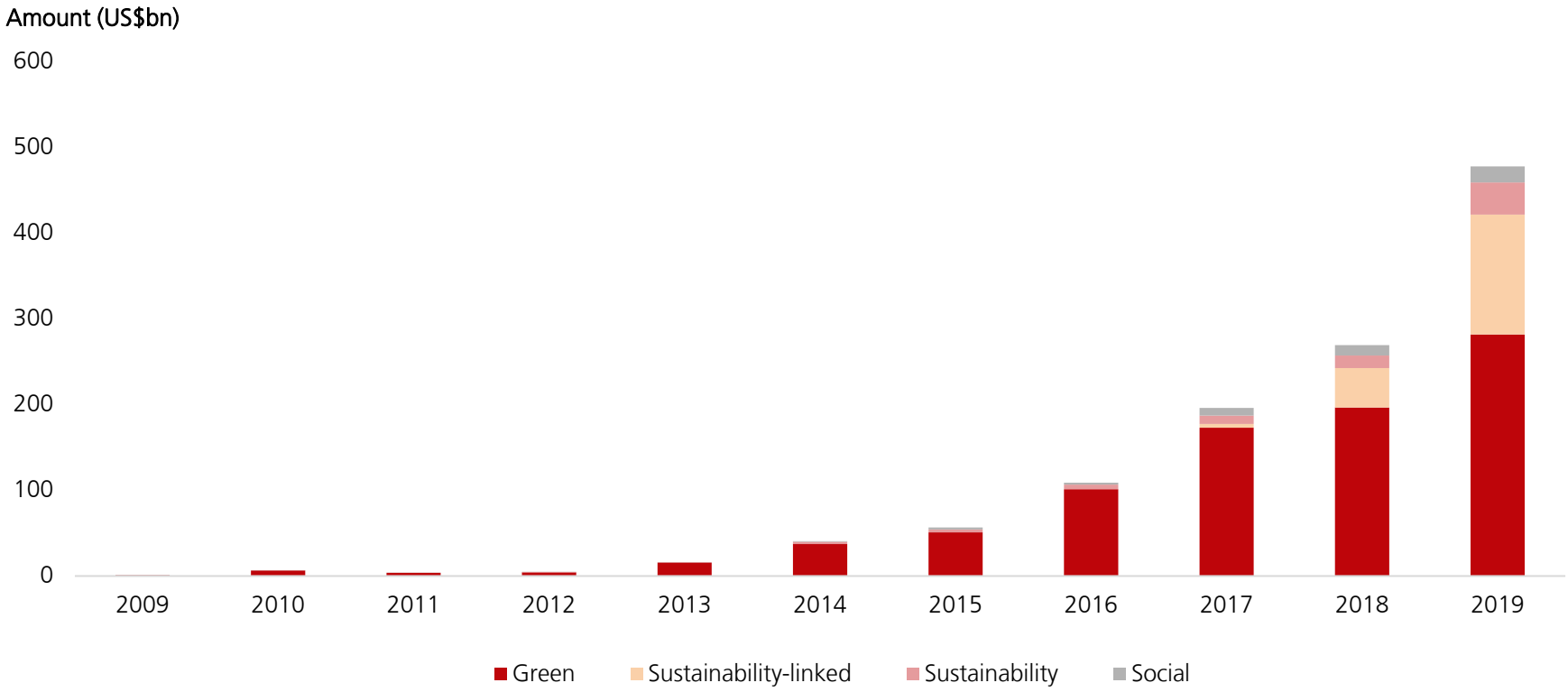
AUM of institutions committed to divesting fossil fuels



Source: Global Sustainable Investment Alliance, 350.Org, DBS Bank

SUSTAINABLE DEBT ISSUANCE IS GOING THROUGH THE ROOF

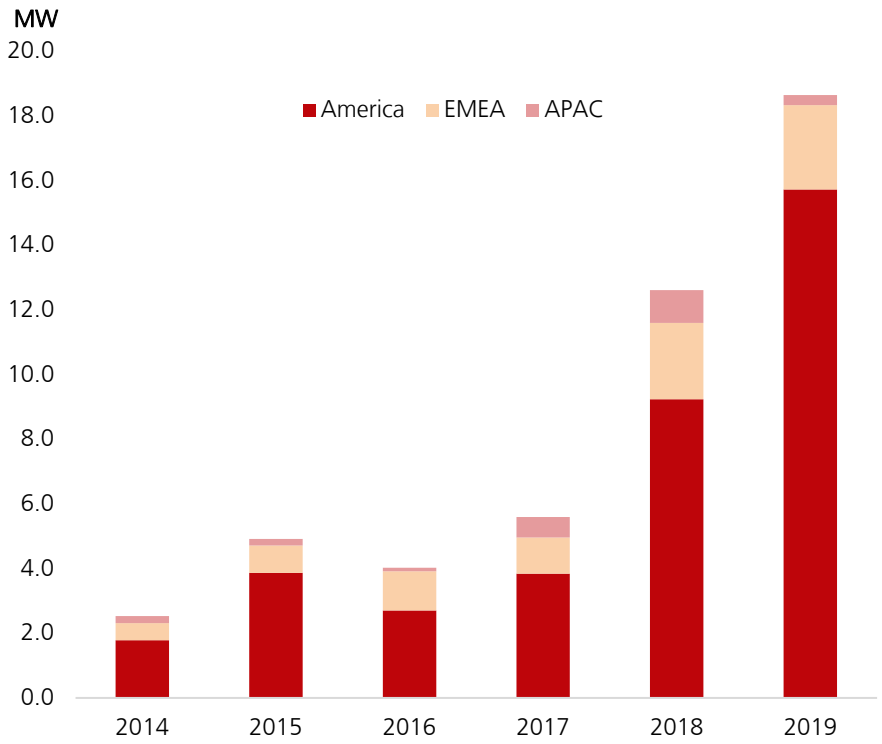
Growth of sustainable debt from 2009-2019



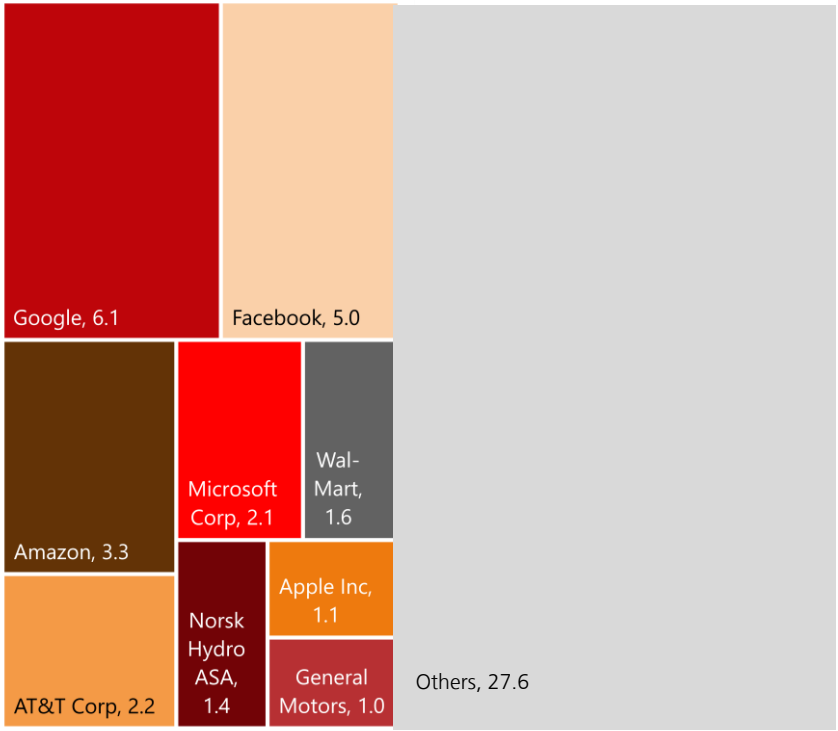
Source: BloombergNEF, DBS Bank

CORPORATES WANT TO HARNESS CLEAN ENERGY, PPA VOLUMES UNDERPINNED BY TECHNOLOGY GIANTS

Historical growth in corporate PPAs signed by region



Corporate PPA composition by company



Source: BloombergNEF, DBS Bank

4. TRADITIONAL ENERGY PLAYERS NEED TO DO MORE TO BENEFIT FROM THE TRANSITION – FOCUS ON OIL MAJORS

Despite the expected growth in renewables in the primary energy mix, "big oil" only spent only around 1-1.5% of its combined budget on renewables and clean energy investments in recent years. That too varies widely between regions, with European players leading the charge. Royal Dutch Shell, Total, BP, Eni, and Equinor are among the oil majors that have embarked on their transition from oil companies to energy companies while US oil majors such as ExxonMobil, Chevron, and ConocoPhillips largely remain pure hydrocarbon-focused companies. Smaller European oil players such as Repsol and GALP have embraced renewables to a larger degree.

Still figuring out the best approach. As oil majors progressively position themselves for the energy transition, wind and solar are playing an increasingly important role in the energy industry. However, strategies in this regard are still quite nascent. Oil firms are still trying to figure out how their current cash cows can be replaced for the benefit of their own sustainable future.

Why do oil majors need to take energy transition into account in their future capital investment and growth strategy?

- Mix of primary energy consumption to swing towards renewables inevitably by 2030 and limit growth options in traditional fossil fuels industry, and oil majors will need to take this into account while thinking about returns to stakeholders.

- Globally growing concerns about climate change following the Paris Agreement provides the main drive for such strategies to hedge against hardening investor sentiment towards carbon emissions.

- Available financing for fossil fuel companies are likely to become scarcer as investors are increasingly incorporating ESG considerations in their investment framework; corporates are securing more green energy for their operations.

National oil companies (such as Petrobras, Pemex, Lukoil and Chinese majors) are constrained by stringent government policies and regulatory frameworks. Among the national companies, Saudi Aramco leads the way with its US$200bn partnership with Softbank in solar energy. More broadly, Saudi Arabia recently tripled its renewable energy target and the UAE government launched its 'Energy Plan 2050', aiming to cut carbon dioxide emissions by 70% and improve energy efficiency by 40%. Overall, we believe international oil majors will have more leeway to adjust to the changing normal.

Overall capex trends by oil majors

Total Capex US$ bn	2014	2015	2016	2017	2018	2019	2020E
BP	23.3	18.0	18.4	16.5	15.1	15.2	15.5
Chevron	40.3	34.0	22.4	18.8	19.5	20.2	20.0
Exxon	38.5	31.1	19.3	23.1	25.9	31.1	34.0
Shell	44.8	33.9	25.6	23.4	23.8	25.6	25.0
Total	26.4	23.0	17.5	14.4	12.4	14.0	14.5
Equinor	19.6	14.7	10.1	9.4	9.9	10.0	10.5
Eni	15.0	12.0	10.4	10.1	10.1	8.8	9.0
ConocoPhillips	11.5	10.1	4.9	4.5	6.1	6.3	6.5
Global Oil Majors	**219.4**	**176.7**	**128.6**	**120.2**	**122.8**	**131.3**	**135.0**

Source: Companies, DBS Bank

Estimated renewables spending trends by oil majors as % of total capex

Renewables Capex US$ m	2014	2015	2016	2017	2018	2019	2020E
BP	1.6%	2.3%	0.7%	0.4%	0.2%	0.9%	1.2%
Chevron	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Exxon	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Shell	0.1%	0.2%	0.2%	0.2%	0.1%	0.2%	1.4%
Total	1.3%	2.6%	4.3%	6.3%	5.1%	2.9%	2.4%
Equinor	0.0%	0.0%	0.5%	1.9%	0.2%	0.5%	0.4%
Eni	0.0%	0.0%	0.4%	0.4%	0.2%	2.1%	2.0%
ConocoPhillips	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Global Oil Majors	**0.3%**	**0.7%**	**0.8%**	**1.0%**	**0.6%**	**0.8%**	**1.0%**

Source: Companies, Rystad Energy, DBS Bank

As evident from the above, global oil majors can be grouped into two main categories:

1) Renewable leaders/energy transition companies: Royal Dutch Shell, Total, BP, Eni, Equinor; and
2) Renewable energy laggards with rather pure hydrocarbon focus and low activity in terms of renewable strategy: ExxonMobil, Chevron, ConocoPhillips.

There appears to be a strong negative correlation between the oil majors' proved oil reserves and their renewable energy strategies. Oil majors with smaller levels of proved oil reserves are moving into the renewable space faster, whereas those companies with large pools of oil reserves are rather choosing the strategy to progress at a more moderate speed, with BP being the outlier. We take a more detailed look at their respective strategies in the following section.

Summary and brief comparison of oil majors' strategies so far for the renewables space (more details in Appendix 2)

	Shell	BP	ExxonMobil	Chevron	TOTAL	Eni	Equinor	ConocoPhillips
Formally articulated renewables strategy	Yes	Yes	No	No	Yes	Yes	Yes	No
Focused renewables division	Yes	Yes	No	No	Yes	Yes	Yes	No
Renewables capex indicative annual plan (US$ bn)	~1.0	~0.5	0	0	~0.5	~0.3	1.0-1.5	0
Currently invested in:								
Solar	Yes	Yes	No	Yes	Yes	Yes	Yes	No
Wind	Yes	Yes	No	Yes	Yes	Yes	Yes	No
Biofuels	Yes	Yes	Yes	No	Yes	Yes	No	No
Hydro	No	No	No	No	Yes	No	No	No
Carbon Capture	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Energy Storage/ EV Charging	Yes	Yes	No	No	Yes	No	Yes	No
Renewables focused venture capital division	Yes	Yes	No	Yes	Yes	Yes	Yes	No

Note: The table is meant for illustration of strategic bend and is not an exhaustive list of low carbon solutions/ renewables/ clean tech/ decarbonisation strategies by oil majors

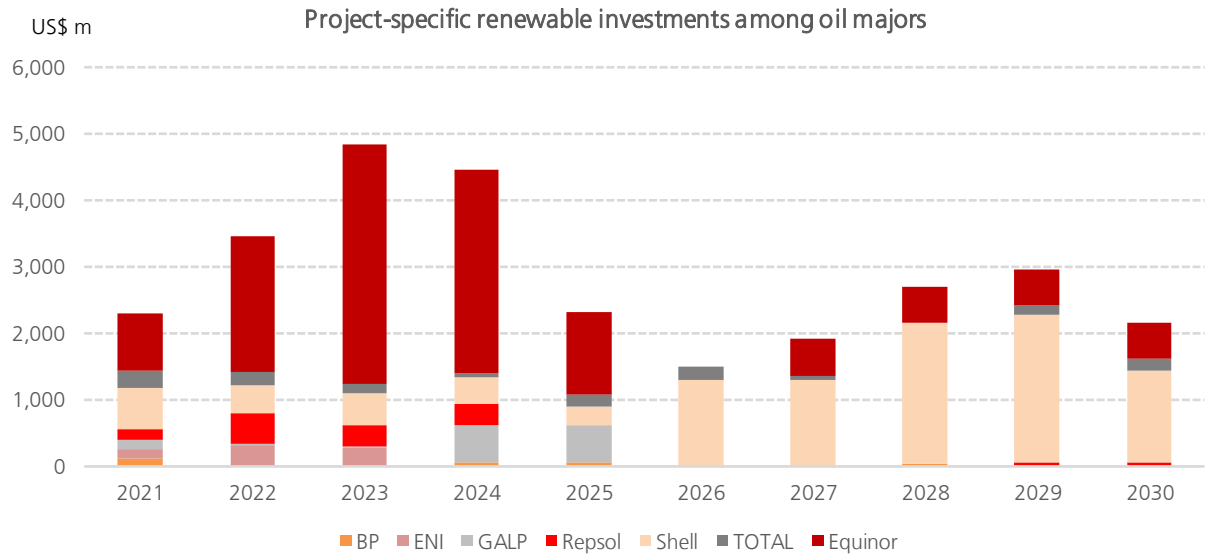
Source: DBS Bank estimates based on our analysis and understanding of public information released by companies mentioned above

A detailed reading of the strategies and trends outlined above reveals that:

- Of the eight oil majors under consideration, five have made reasonable investments in renewable energy - BP, Shell, TOTAL, Equinor, Eni.
- Notably, all oil majors except ExxonMobil and ConocoPhillips have developed or are developing solar and wind assets, whereas none of the oil majors are investing in geothermal energy.
- Hydro power activities are rather limited with only Total having exposure.
- Biofuels and carbon capture are well represented.
- Energy storage is an increasingly active sector in line with the expected rise in the penetration of electric vehicles.
- Six out of eight oil majors (Shell, Chevron, TOTAL, BP, Eni, Equinor) have created a renewable venture capital fund to invest in emerging renewable technologies and innovative renewables start-ups.

WHAT DOES THE FUTURE LOOK LIKE FOR OIL MAJORS' RENEWABLE SPENDING?

Projections for capital expenditure on renewables among oil majors in next 5-10 years



Source: Rystad Energy, DBS Bank

Investments in solar and wind energy projects by the world's oil majors over the next five years are expected to reach US$17.5bn, according to a Rystad Energy study. However, the total renewables capex tally of oil majors pales in comparison to the US$166bn they are forecast to spend on greenfield oil and gas projects during the same period.

Of the total forecast capex, just one company, Equinor, accounts for the lion's share or close to 60% of the projected amount over the next five years, thus making it the only one putting serious money into the energy transition strategy. Equinor, the Norwegian state-controlled energy giant, will drive renewable investment among majors, spending U$6.5bn over the next three years to build its capital-intensive offshore wind portfolio. We do not expect this forecast to be heavily affected by the fluctuating oil price or capex cuts, as much of the company's renewable portfolio is already committed, such as the massive Dogger Bank offshore wind project in the UK.

If Equinor is removed from the equation, investments in renewables by major oil and gas companies would be seen in a very different light, falling over the next three years. This decline does not even factor in any of the recent capex cuts announced by the majors. With the notable exceptions of Equinor and Portuguese player GALP, the investments in renewables by the other oil giants will not even match the typical capex requirements of a single oil and gas field in their respective portfolios.

Barriers to further investment in renewables faced by international oil majors:

- Lack of track record and competition from entrenched and full-fledged renewable energy firms which have scale in the business may limit growth options
- Technology obsolescence risks: oil majors have had their hands burnt in the past and have had to write down investments in nascent technologies which did not realise their full potential
- Changing regulations in renewables market, especially with respect to subsidies and feed-in tariffs create uncertainties for new investors
- Lower returns in the power sector compared to high-risk high-return nature of the fossil fuel business may not fit in to all business models

Can the oil majors think any differently now after the pandemic? M&A will be the way to go from hereon…

- Oil majors would be cutting capex across overall investment portfolios by 20-25%, owing to fallout caused by the COVID-19 pandemic, but this can be achieved easily without any cuts to renewable projects.
- COVID-19 could also be the catalyst for oil majors to pump more capital into renewables, acquire assets, develop skills and nurture the capacity to transition beyond petroleum.
- The pandemic is creating a number of distressed sellers and reducing acquisition costs for assets and companies, thereby creating opportunities for oil majors to accelerate their energy transition through acquisitions.
- With deep cuts in E&P spending already announced and in some cases, dividends, oil majors may free up their balance sheet to ramp up their stakes in renewable investments, facilitated by new mergers and acquisitions.

5. COVID-19 SHOULD BE THE IMPETUS POLICYMAKERS NEED TO TACKLE THE CLIMATE CRISIS

- There is a growing chorus among policymakers for a green and equitable recovery, including the UN, the UK, South Korea, Germany, Austria and Switzerland.

- And investors and corporates. Other important groups share similar sentiments – in the US, more than 300 companies with combined market valuation of US$11.5tn are calling on the US Congress to incorporate climate action in recovery packages. In Europe, investors managing more than US$12tn of assets are calling for a recovery plan to be tied to climate goals.

- And voters. Ipsos conducted a survey on climate change involving 28,000 adults which found that the mass population (71%) felt that climate change in the long-term is as serious a crisis as COVID-19 – additionally, 65% of respondents showed their preference for a 'green' economic recovery, and 57% of them shared that they will be less inclined to vote for a political party that fails to take climate change seriously.

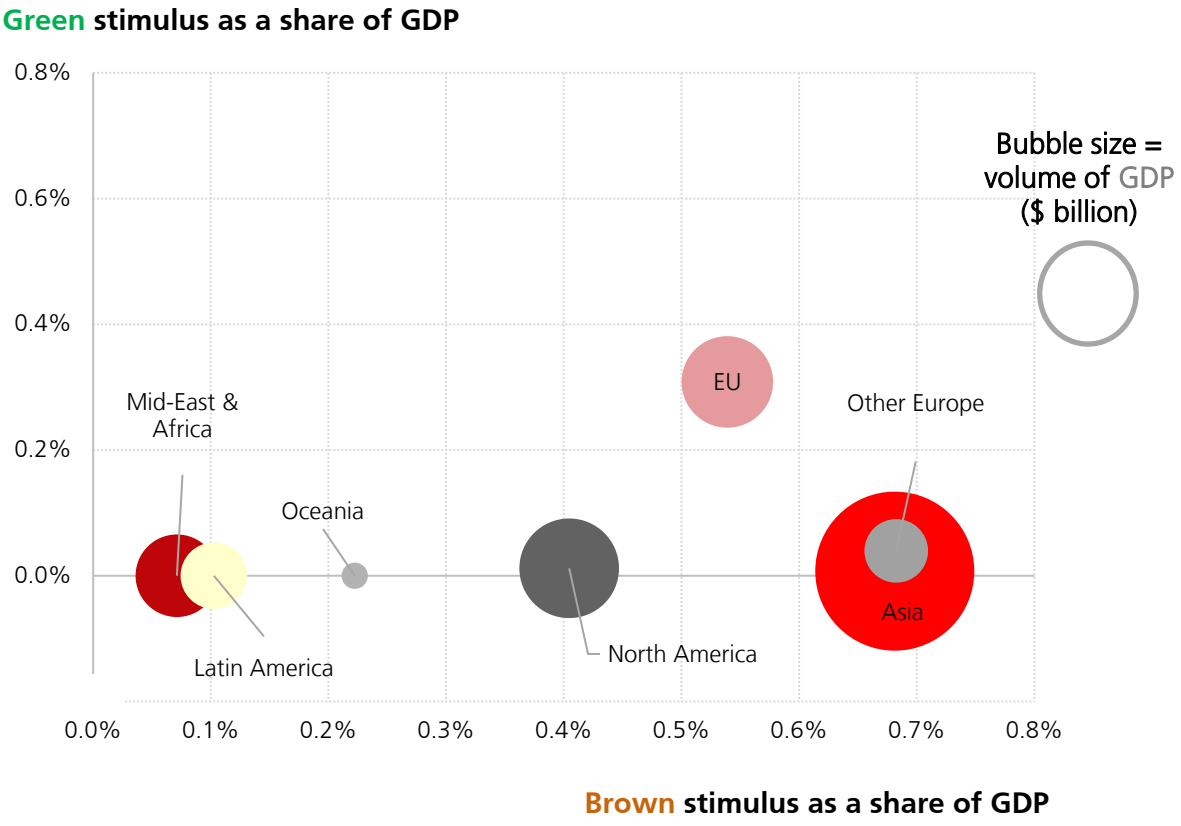
- Not reflected yet in economic packages. The vast majority of stimulus packages introduced thus far have understandably been directed at easing the immediate economic fallout via the provision of wage subsidies, unemployment benefits and support to cooperations.

- With the exception of Europe. However, Europe stands out from the rest of the regions, with a 0.57 green-to-brown spending ratio (US$0.57 of green spending for every dollar of brown spending), while Asia is significantly behind at a miniscule 0.01 – only a few Asian countries have declared green measures thus far. South Korea has announced commendable stimulus plans with climate objectives. Although China is not spending on pollution-heavy activities like it did back in 2009, its comparatively brown sector base and weak environment policy means that general stimulus efforts will likely support its current brown trajectory.

- Asian countries may need to do more. Whether COVID-19 marks an inflection point in the war against climate change hinges on Asia's response though. Asia Pacific accounted for more than 50% of global carbon emissions in 2019, with China and India collectively accounting for around 33% of global emissions. Hence, progress on climate change will be stifled unless there are concerted efforts involving Asia. Although majority of fiscal stimulus in the region thus far is 'colourless' (maintaining the current status quo), such flows will likely support a status quo that is skewed towards adverse climate outcomes. As governments in the region mull additional stimulus packages to revive the economy, we are hopeful that they will align fiscal spending with climate objectives to forge a more sustainable future.

ONLY US$54BN OUT OF US$11TN OF TOTAL STIMULUS MEASURES ARE IDENTIFIED TO BE GREEN THUS FAR

Green and brown stimulus as a share of GDP by region



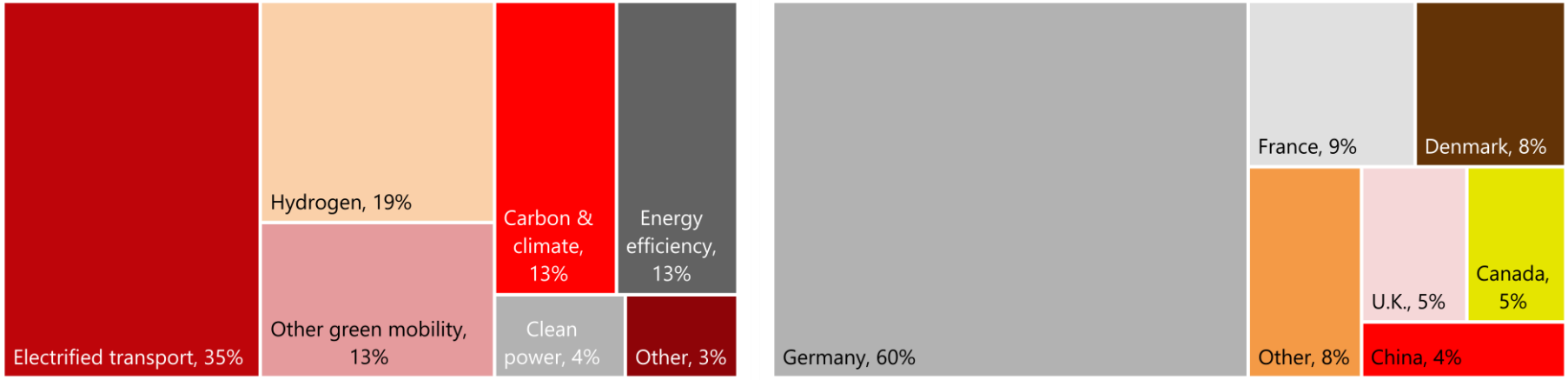
Source: BloombergNEF, DBS Bank

- IMF estimates that governments around **the world had announced close to US$11tn of stimulus policies** as at early July. Based on BNEF's green policy tracker, we estimate that most of the announced stimulus thus far are colourless (carbon-neutral), while around 6.0% of the quantum are brown (likely to increase carbon emissions) in nature, which is more than 10x the amount dedicated to green measures.

- **Europe continues to dominate in green policy response,** with Germany unveiling a stimulus package worth US$44bn earmarked for climate-related spending in June. Over in Asia, South Korea is leading the way, while other Asian nations are largely behind. EU leaders are still finalising a herculean US$2.1tn budget, of which 25% (US$522bn) will be climate related.

ONLY US$54BN OUT OF US$11TN OF TOTAL STIMULUS MEASURES ARE IDENTIFIED TO BE GREEN THUS FAR

Breakdown of green stimulus (potential to reduce long-run emissions) by sector and country



- More than a third of green spending are to be spent on electrified transportation - Germany is doubling subsidies for electric and hybrid car purchases, from €3,000 to €6,000, until the end of 2021 and mandating all petrol stations to offer EV charging points, while much of the US$8.9bn stimulus extended to the French transportation sector includes increasing subsidies for EVs until December. China is extending EV car subsidies and tax breaks for New Energy Vehicles by two years until the end of 2022 and has laid out plans to expand the country's charging network by 50% in 2020.

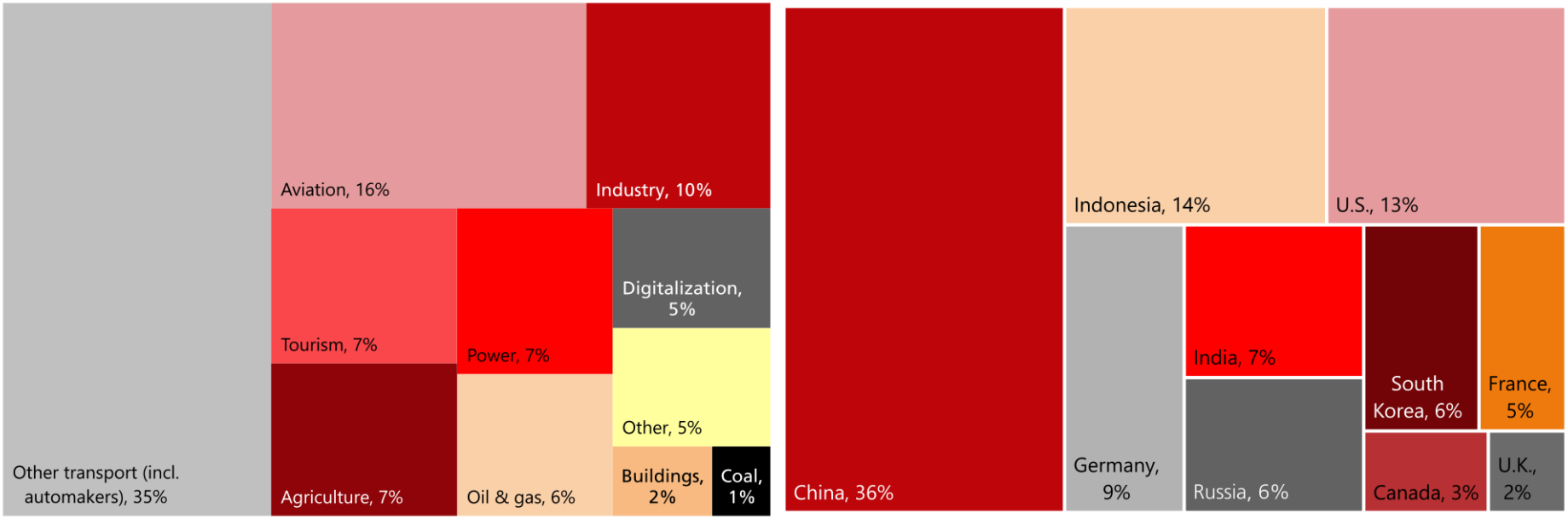
- Hydrogen energy has also been prominent in stimulus packages, representing around 20% of green spending tracked by BNEF. Apart from Germany which has pledged to spend US$7.9bn to boost domestic hydrogen production, transport and use, South Korea has announced that it will increase spending and promote financing on hydrogen infrastructure as part of the green new deal. Meanwhile in Australia, the Clean Energy Finance Corporation and Australian Renewable Energy Agency have committed US$189m and US$44m respectively to support funding for the hydrogen sector.

- Other promising sectors include energy efficiency, such as Denmark's proposed funding for green renovations to social housing, which includes replacing heating systems that run on fossil fuels, and carbon & climate, which includes carbon capture and storage technology, etc.

Source: BloombergNEF, DBS Bank

BROWN STIMULUS EXCEEDS GREEN STIMULUS BY MORE THAN TEN TIMES

Breakdown of brown stimulus (likely to increase net emissions) by sector and country



- Brown stimulus (without green conditions) were largely introduced to save sectors directly impacted by COVID-19, such as aviation, tourism, oil and gas, including company bailouts.

- Apart from direct stimulus, we note that some countries have implemented aggressive environmental policies to support their economies – China has accelerated approvals for coal mining and offered subsidies for fossil fuel vehicles; Indonesia has passed a deregulation bill to ease limitations on the scale of mining operations, and allows automatic permit extensions for operators for up to 20 years; South Africa restricted renewable power generation and allowed the deferment of carbon taxes to support fossil fuel power generators; airlines around the world are getting bailouts supported their respective governments, but only a few of them have green strings attached.

Source: BloombergNEF, DBS Bank

WORLD GDP COULD FALL BY 20% BETWEEN 2020-2100 IF WE STAY ON THE CURRENT CLIMATE TRAJECTORY

Well-designed green policies can concurrently delink economic growth from climate change, and alleviate global inequality reinforced by global warming

- The long-term impact of global warming will be devastating, but it will not be felt evenly by countries throughout the world - Oxford economists found that a 3°C increase in global average temperatures by 2100 could potentially decimate global GDP by over 20%, with emerging regions bearing the brunt of the impact.

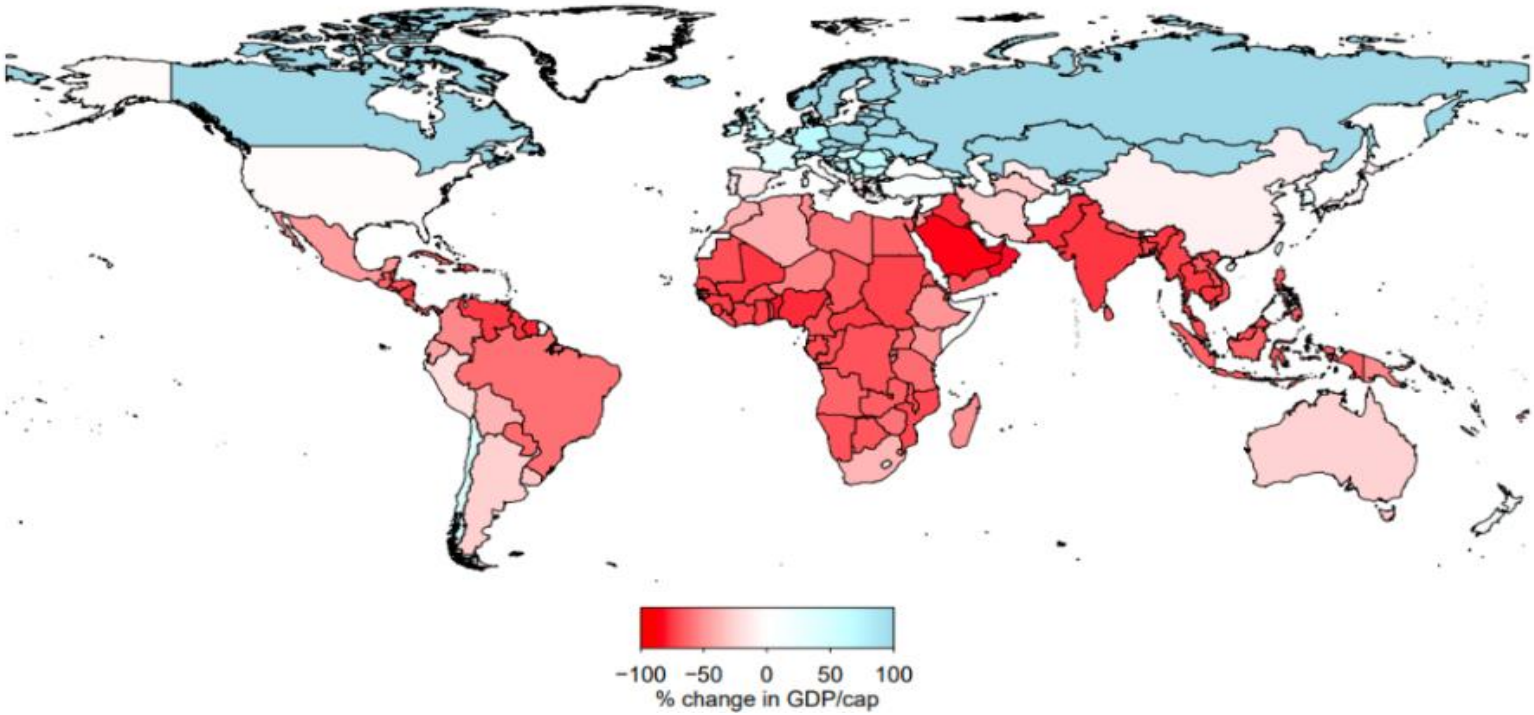
- The study finds that tropical and subtropical countries whose average temperatures are already warmer than 15° C today, and where most of the developing countries in the world lie, face catastrophic economic degradation from increase in global temperatures, much more than regions whose average annual temperatures today are cooler than 15° C, including those in North America and Europe, who even stand to benefit slightly in the short term from rising temperatures.

- Recent studies performed by the IMF, IRENA, IEA and McKinsey all suggest that green stimulus packages by governments can effectively kickstart the economy, and set the world on a far more sustainable path – 1) in a joint study between the IEA and IMF, IEA calculates that its proposed medium-term Sustainable Recovery Plan, with an annual cost of US$1.1tr for the next three years (0.7% of global GDP), can add 1.1% to global GDP each year between 2020 and 2023, 2) not only are more jobs created by government spending on renewable technologies and efficient energy compared to fossil fuels, the jobs created will remain relevant in the New Economy.

- A recent survey conducted by Oxford involving finance ministries, central banks, and other leading organisations showed that most experts felt that while most green policies may take longer to deliver actual results, this is more than compensated by their high long-run multipliers; five policies were identified to be well-suited to deliver on economic and climate goals.

WORLD GDP COULD FALL BY 20% BETWEEN 2020 AND 2100 IF WE STAY ON THE CURRENT CLIMATE TRAJECTORY

Change in GDP per capita in 2100 if global average temperatures rise by 3°C

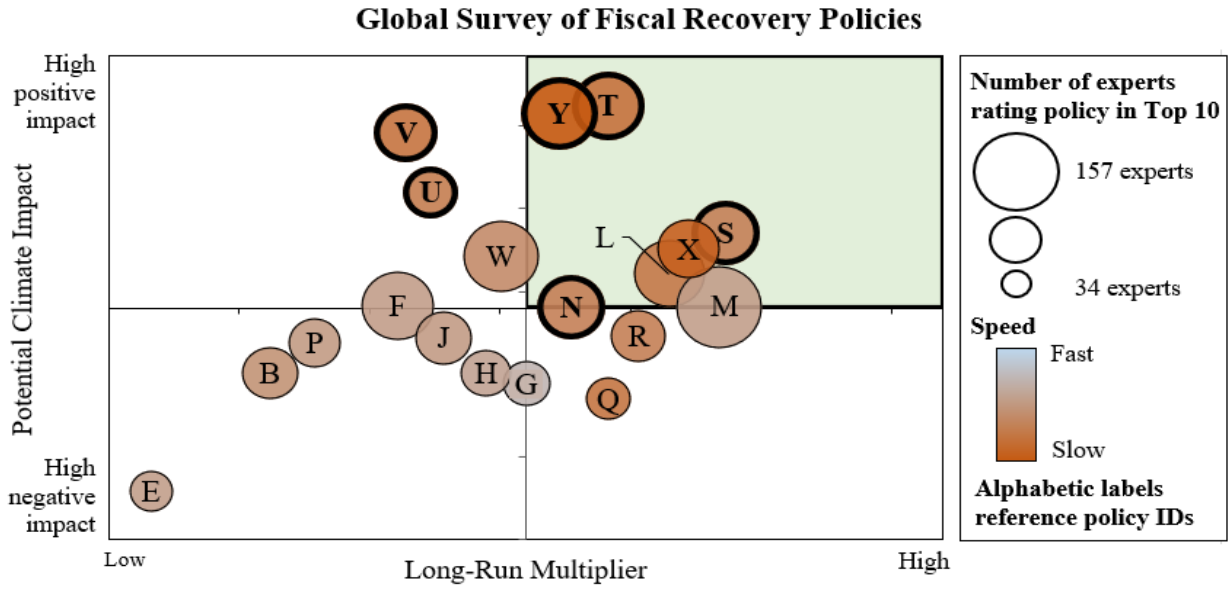


Source: Oxford Smith School of Enterprise and the Environment

Note: Country borders on maps may be an approximation and do not represent the opinion of the analyst(s) or of DBS Bank Ltd.

EXPERTS FEEL POLICIES CENTERED ON ADDRESSING CLIMATE CHANGE ARE TOP PRIORITY

Results of global survey of fiscal recovery policies



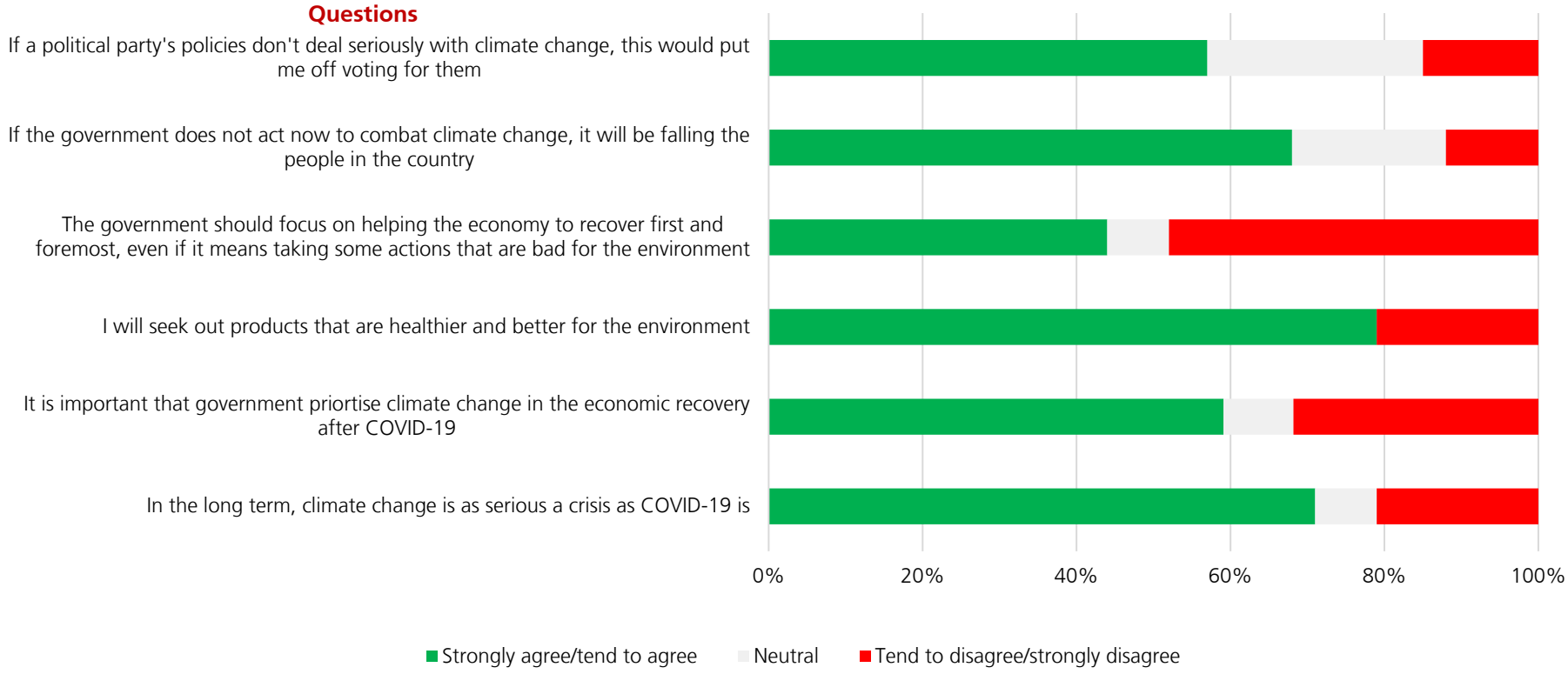
B	Assisted bankruptcy (super Chapter 11)	Q	Traditional transport infrastructure investment
E	Airline bailouts	R	Project-based local infrastructure grants
F	Not for profits, education, research, health inst. bailouts	S	Connectivity infrastructure investment
G	Reduction in VAT and other goods and services taxes	T	Clean energy infrastructure investment
H	Income tax cuts	U	Buildings upgrades (energy efficiency)
J	Business tax relief for strategic and structural adj.	V	Green spaces and natural infrastructure investment
L	Education investment	W	Disaster preparedness, capacity building
M	Healthcare investment	X	General R&D spending
N	Worker retraining	Y	Clean R&D spending
P	Rural support policies		

Source: Oxford Smith School of Enterprise and the Environment

- Respondents were asked to rank in a relative and subjective manner, different policies on three metrics – speed of implementation, long-run economic multiplier, and climate impact potential.
- The results showed that many experts felt that policies which are beneficial for the environment can also offer strong economic returns.
- The five policies located in the top right quadrant were assessed to be the most attractive, including i) clean R&D spending, and ii) clean energy infrastructure investment.
- While most green policies may take longer to deliver actual results, it is more than compensated by their high long-run multipliers.

THE GENERAL POPULATION ALSO SUPPORTS A SUSTAINABLE ECONOMIC GROWTH TRAJECTORY

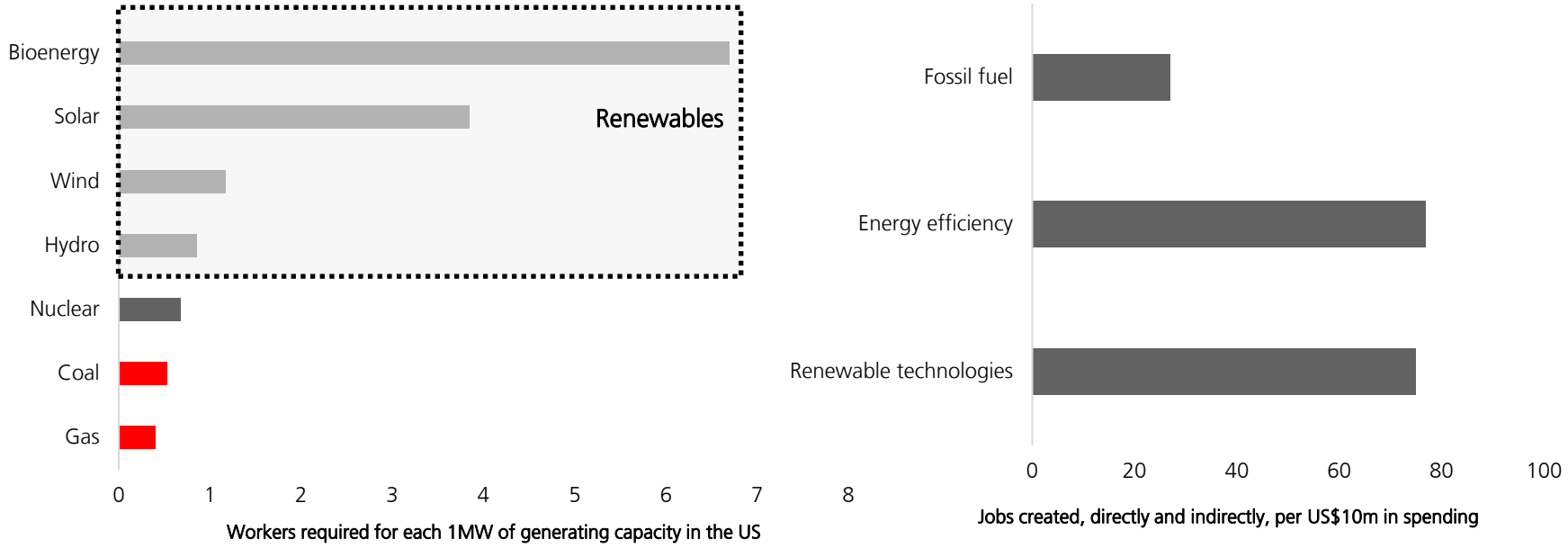
Summary of Ipsos Earth Day 2020 survey



Source: Ipsos Earth Day 2020 Survey

NON-FOSSIL FUEL JOBS IN THE ENERGY SECTOR ARE ALSO MUCH MORE LABOUR INTENSIVE

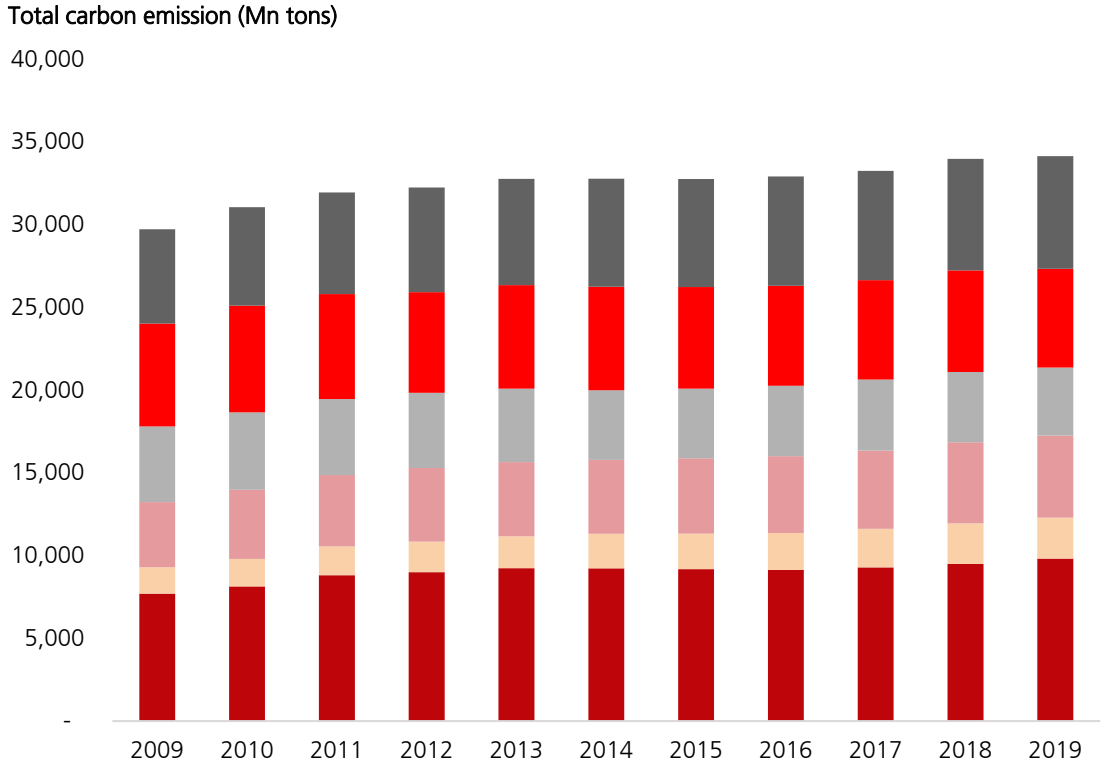
Labour intensity of jobs in the energy sector in the US (left) and globally (right)

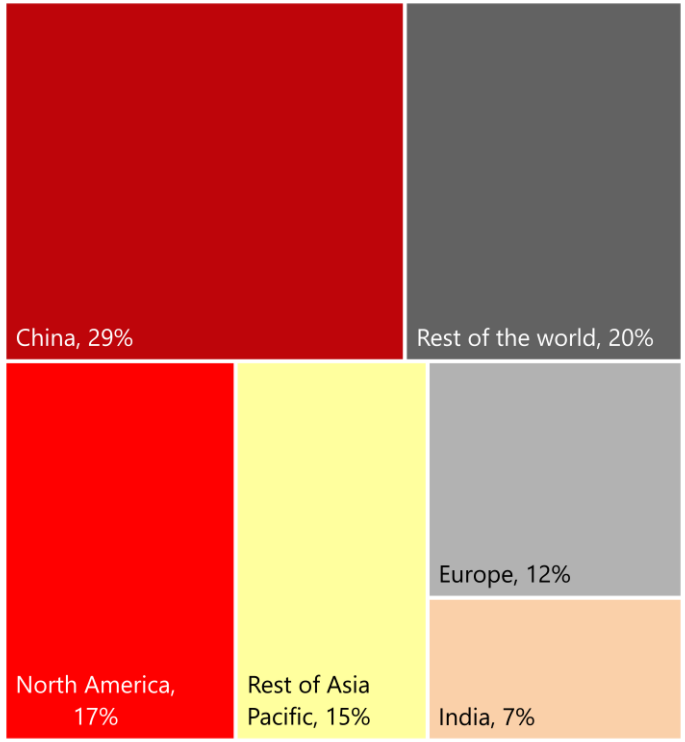


Source: BloombergNEF, McKinsey, DBS Bank

CRUCIALLY, THE WORLD CANNOT MEET CLIMATE CHANGE GOALS IF ASIA IS NOT ON BOARD

Historical changes in carbon emissions and carbon emissions by country (2019)

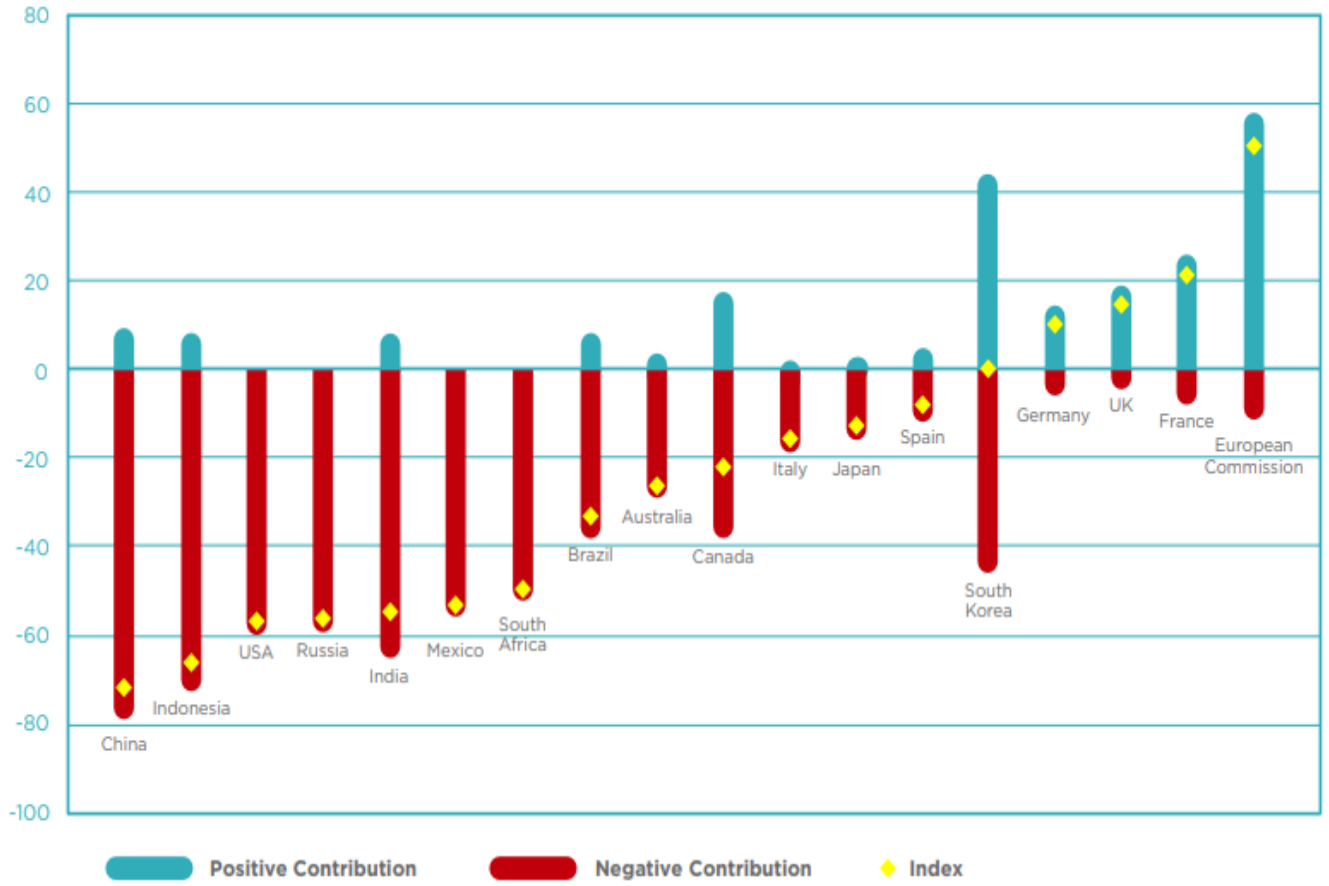




Source: BP PLC, DBS Bank

STIMULUS RESPONSE BY MOST ASIAN COUNTRIES SO FAR IS LESS ORIENTED TOWARDS THE ENVIRONMENT

Vivideconomic's Green Stimulus Index



Source: Vivideconomics, DBS Bank

- The Green Stimulus Index by Vivideconomics measures the environmental orientation of a country/region's stimulus funding based on 1) the scale of funds flowing into environmental intensive sectors, 2) the existing green orientation of those sectors, and 3) the efforts which steer stimulus toward (or away from) pro-environmental recovery.
- Vivideconomics has been tracking government stimulus measures from April. Despite some improvement over the past few months, most countries in the study were still found to have concerningly negative scores. In Asia, these countries included China, Indonesia and India. More details on Indonesia's strategy in Appendix 3.

6. OTHER NEAR-TERM CHALLENGES TO THE PACE OF ENERGY TRANSITION

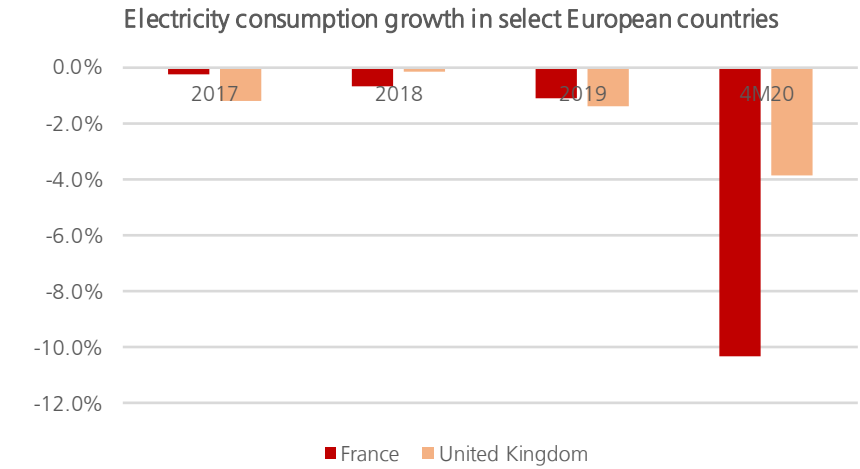
Even though we believe the long-term uptrend of renewables development will remain intact due to rapidly decreasing development costs and the need to meet targets relating to climate change, we should be aware of slowdown risks in the short term. Other than the lack of suitable policy response, some of the other challenges that should be noted:

PANDEMIC-RELATED RISKS

Post pandemic, many governments are placing priority on boosting their respective economies at the expense of other equally important issues such as the move towards cleaner energy sources. The case for renewable energy has taken a further beating from the economic and social shocks caused by the ongoing global pandemic on various countries. Some of the key risk factors include:

- **Fall in electricity consumption could lead to postponement of projects:** For example, COVID-19 had led to electricity consumption dropping 10.3%/3.8% y-o-y in France /UK in the first four months of the year (4M20). These two countries have postponed auctions on renewable energy by 2-18 months due to shrinking power demand.

Fall in electricity consumption could lead to slowdown in new renewables projects in France and the United Kingdom

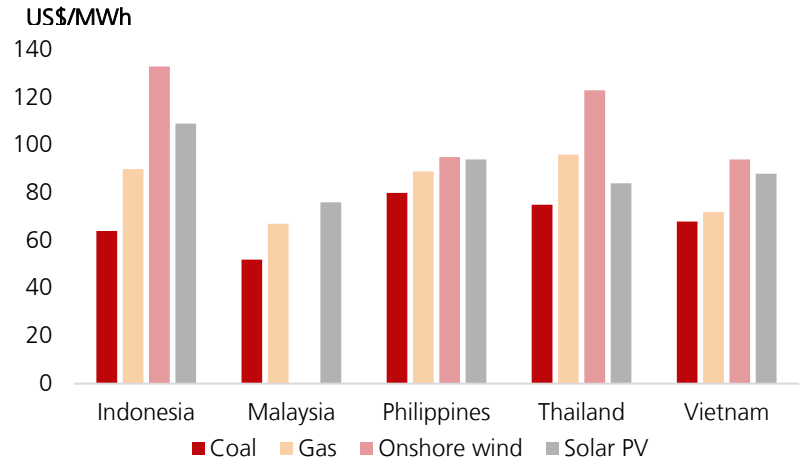


Source: CEIC

- **Higher risks and lower returns:** There could also be increased financing and policy risks for the renewable energy sector caused by factors such as extreme economic challenges caused by lockdowns, auction delays and lower feed-in tariff (FiT). These emerging risks could slow down upcoming projects with lower internal rate of return (IRR).

- **Reluctant policy makers:** In many developing countries in Asia, growth of energy demand remains strong in the long term. But in view of the high intermittency of renewables, many policy makers are reluctant to walk away from fossil fuel power plants, despite potential issues related to climate change. For example, Indonesia has passed the Coal and Mineral Mining Law to support the expansion of coal-fired power. Japan and South Korea are expected to continue financing coal-fired independent power producers (IPPs) in Indonesia and Vietnam. According to Bloomberg New Energy Finance (BNEF), in 1H20 the benchmark levelised cost of electricity (LCOE) for solar was 48%/25% higher than coal-fired power plants in Indonesia and Vietnam respectively. Naturally, financially weaker countries would prefer to fall back on coal-fired plants with lower costs to meet most of their power demand growth in the near term (next 1-2 years).

Unsubsidised benchmark LCOE in Southeast Asia (1H20)

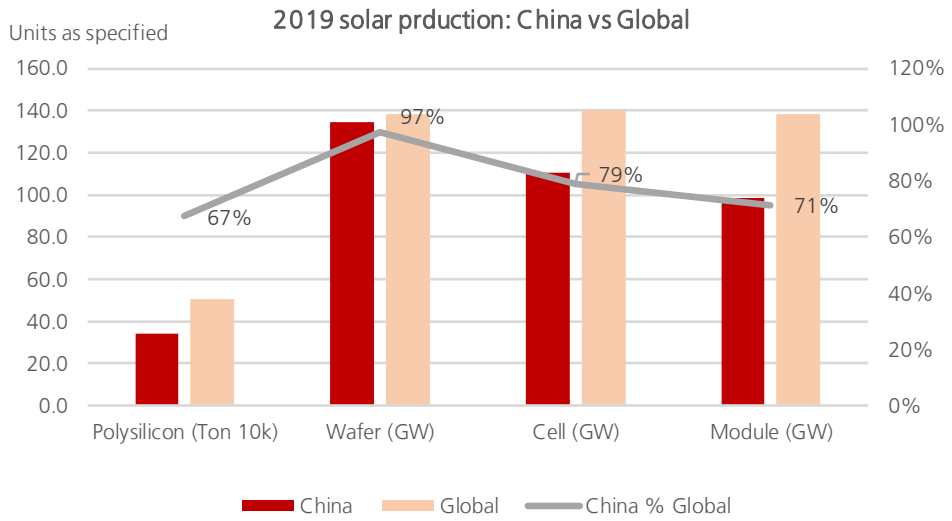


Source: BNEF, DBS Bank

RENEWABLE SUPPLY CHAIN VULNERABILITY

Supply chain concentration in China. In 2019, China contributed 71% of total global solar module supply due to strong cost-competitiveness and economies of scale. However, after COVID-19 hit the country in January and February 2020, many local manufacturing facilities were suspended. China's solar module exports fell 11%/21% y-o-y, causing a shortage of solar components and disrupting the whole value chain. This highlights the solar industry's over-reliance on China. As solar power generation plays a vital part in the global energy transition, discussions are ongoing on developing domestic manufacturing capabilities for the solar market.

China dominates global solar supply chain



Source: China Photovoltaic Industry Association (CPIA)

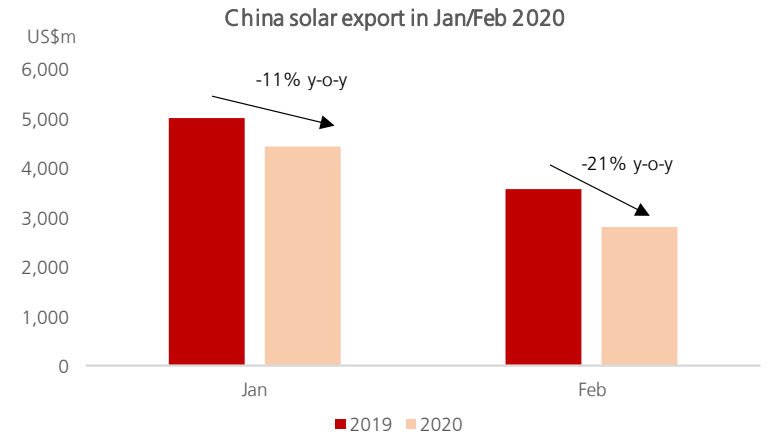
Emerging countries such as Vietnam and India have limited domestic manufacturing capacity for the solar market with an incomplete supply chain. Their production technology is far behind their Chinese counterparts, leading to significant cost disadvantages. To illustrate this point, even during trade tensions with US and India, Chinese modules were still much cheaper than their domestic brands. One possible solution that can both resolve the supply vulnerability and ensure low costs, is to set up more JVs domestically.

For example, a JV between Vietnam and China operating in Vietnam may:

1) enjoy lower tariffs and labour costs to lower LCOE of solar electricity
2) help Vietnam improve its production technology and labour skills in the solar industry
3) secure domestic supply in Vietnam and boost its renewable energy mix

The Asian Development Bank may play a crucial support role in getting more suppliers to build capacity. The Asian Development Bank (ADB) has suggested that its members play a more active role in the solar photovoltaic (PV) value chain. The bank will help them build their manufacturing capacity and human resources. In countries without any capacity, Dr. Zhai Yongping (Chief of Energy Sector Group of ADB) has proposed some basic starting points including assembly of solar modules, and mounting structures as well as operations and maintenance.

Fall in exports from China could disrupt the global supply chain



Source: Wind

THE PREVALENCE OF FOSSIL FUEL SUBSIDIES

Fossil fuel subsidies – how long will they exist? In many countries, fossil fuel subsidies support users in the low-income brackets and lead to lowering of direct and indirect fuel costs in the industrial sector. However, disproportionate fossil fuel subsidies have distorted the energy sector in various ways including:

1) Apart from reducing the cost-competitiveness of other energy forms particularly renewable energy, fossil fuel subsidies also reinforce the advantages of fossil fuels in the energy market.

2) Investment decisions by private sector are also distorted, leading to a preference for fossil fuel-based technologies to renewable alternatives.

3) The termination of fossil fuel subsidies has been slow because it could lead to energy price hikes in the short term and hence cause political difficulties in the near term, long before the benefits of cleaner air and long-term cost reductions in the future are appreciated.

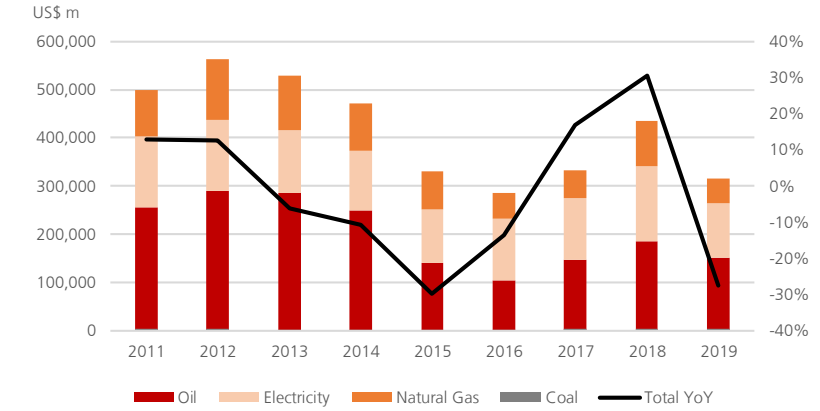
Some relevant data from international agencies showing the disparity in subsidies for fossil fuels vis-a-vis renewables:

- According to the International Renewable Energy Agency (IRENA), in 2017 around 70% of total energy subsidies of US$634bn were for fossil fuels followed by renewable energy at around 20%.

- According to the International Energy Agency (IEA), in 2019 subsidies for fossil fuel dropped 27% y-o-y to US$317.6bn. Although subsidies are expected to drop by 43% in 2020, this is mainly due to the decline in energy consumption amid COVID-19. In other words, subsidies for fossil fuel might remain much higher compared to those for renewables.

- According to the International Institute for Sustainable Development (IISD), only 10-30% of fossil fuel subsidies would pay for the global energy transition to renewables. The high subsidies for fossil fuel will diminish the cost competitiveness of clean energy and distract from green energy investments.

Trends in global fossil fuel subsidies (Real 2019 dollars)



Source: IEA

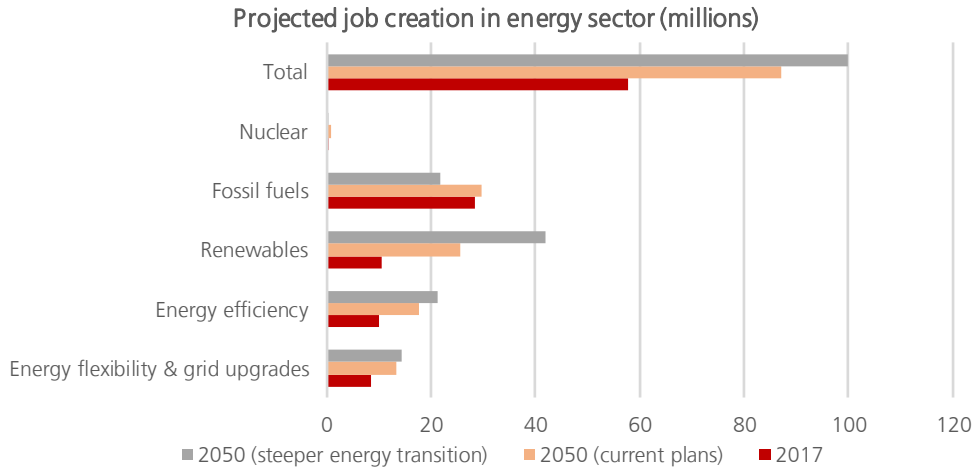
COVID-19 economic damage may cause rethink even in existing renewables subsidies. Post COVID-19, renewable energy auctions have been postponed in many European and American countries. Some countries have turned more positive about coal-fired projects in Southeast Asia. Such phenomena might result in a shrinkage in renewable energy subsidy or even a decrease in the percentage that renewables take in total energy subsidy. For example, in 2015, Indonesia's expenditure on coal subsidies (US$664m) was five times that on renewable energy subsidies (US$133m). The pandemic-led collapse of fossil fuel prices, coupled with rising fuel subsidies, will make coal-generated electricity even cheaper and further deter the energy transformation in the country.

MANPOWER ISSUES

Green energy transition is likely to lead to positive employment effects, as projected by many empirical studies:

- In 2018, IRENA estimated that around 11m people worldwide were employed in the renewables sector, up from 7.3m in 2012. This represented 18% of all energy sector jobs.
- By 2050, IRENA estimates that employment in the renewable energy sector could reach 42m people worldwide (around four times that of 2018), under an accelerated "Energy Transition" scenario that allows a stronger shift to renewable energy. Under "Current Plans" scenario of energy transition, the renewable energy sector could employ around 26m people.
- Thus, accelerated "Energy Transition" scenario would expand employment by >12m people compared to various governments' status quo or "Current Plans", after taking into account potential job losses in the fossil fuel sector.
- The net increase in global employment under the accelerated "Energy Transition" scenario in 2050 vs. 2018 is estimated at 72%, compared to 51% under "Current Plans" scenario despite the potential job losses in the fossil fuel sector.

Global jobs in the energy sector – projections



Source: IRENA

Percentage difference in regional employment between steeper "Energy Transition" and "Current Plans", 2050

Global	+0.2%
North America	+1.0%
Latin America	-0.2%
European Union	+2.4%
Rest of Europe	-0.2%
Middle East and North Africa	-0.2%
Sub-Saharan Africa	0.0%
East Asia	+0.1%
South East Asia	-0.1%
Rest of Asia	-0.1%
Oceania	+0.5%

Source: IRENA

However, the changes in employment will not be evenly distributed across countries (refer table alongside). Most new jobs are expected in more developed regions such as North America and Europe. However, developing countries are not expected to benefit much. For instance, by 2050 IRENA estimates a marginal increase of 0.7m new jobs created in China under the steeper "Energy Transition" scenario, compared with the "Current Plans" scenario. Furthermore, it also expects job losses outside the energy sector.

There are various reasons affecting job creation during an energy transition:

1) **Supply mismatch**: Most new job opportunities in the renewable energy sectors are for workers and technicians particularly in construction and installation. Training and capacity building are required before skilled workers in fossil fuels can consider switching careers. There is strong demand for electrical engineers with skills in clean energy solutions. However, there is a supply mismatch as most engineers are currently specialising in different technologies from those applied in the renewables sector.

2) **Lack of training facilities**: Some countries such as Indonesia are heavily reliant on the fossil fuel sector for employment. Having adequate educational institutions to train the workforce is often a major issue.

3) **Pay gap**: Salary differentials between fossil fuels and renewable energy jobs could lead to possible pay cuts for workers switching careers.

4) **Relocation**: Workers could be forced to relocate because demand for workers in the renewable energy sector and labour supply from job switching in fossil fuels could be from different regions.

These factors could **hinder** workers' motivation to change jobs. Thus, policies are required to properly address these misalignments before governments can move forward with energy transition more aggressively.

BOTTLENECKS IN EXISTING ENERGY INFRASTRUCTURE

Another roadblock in installing renewable technologies is the limitation of existing energy infrastructure which was built to cater to the fossil fuel industry. Some of the key factors include:

- Non-dispatchable: Existing grid infrastructure may not be able to support the high growth of renewable power which is non-dispatchable.
- More congestion, lower returns: Grid congestion and instability have caused delays in the grid connection of renewable power and lower-than-expected project returns, deterring further investments in new renewable energy projects.
- Drifting from growth centres: The growth areas of renewable power have also drifted away from generation and consumption centres.

There are a few major countries that can be useful points of reference:

- Australia: The Australian Energy Market Operator keeps lowering marginal loss factor (MLF) for renewable projects due to grid congestion. Grid congestion is particularly serious when more generation of renewable energy is connected to electrically weak areas of the network that are remote from the regional reference node. As the local price of electricity is equal to the regional electricity price multiplied by MLF, a low MLF will reduce a generator's revenue.

- Netherlands: More grid congestion. The country's PV capacity is expected to jump from 4.4GW in 2018 to 15GW in 2024. The Netherlands Environmental Assessment Agency is estimating new installation of solar power to hit 5GW in 2020. However, grid congestion in northern Netherlands has caused delays in project connection, leading to loss of Sustainable Energy Production (SDE+) renewables incentives and lower project returns for operators. According to Dutch transmission system operators TenneT and Enexis, there is limited available capacity for renewable energy projects at some locations in the northeastern part of the country, such as Groningen and Drenthe.

- Germany: The success of Germany's plans to shift from fossil fuels and nuclear power to 100% renewable energy by 2050 will depend on the stability of its power grid. Germany is one of Europe's biggest industrial economies. Its major industrial hubs are in the south and west of the country. It is important that German's renewable power, which is mainly from wind power generated in the north, can be transported smoothly to areas where it is most needed. However, the country's current power network is too congested to meet these requirements.

Huge investments are required to extend the existing network with a more intelligent energy system before robust renewable energy grids can be installed effectively. The process of power grid extension could be slower than expected because policy makers and regulators are facing anti-grid expansion initiatives led by citizens and environmental organisations. While this can be resolved by underground cables, this solution is relatively more expensive and could also face objection from farmers.

7. APPENDIX 1. SURVEY - WHAT DO INDUSTRY PLAYERS THINK ABOUT THE ENERGY TRANSITION LANDSCAPE?

Important to understand the sentiment of industry players across the energy value chain. As analysts, we can always make judgements to the best of our abilities, but for the most part, we are still sitting in the office, or more increasingly at home, and consuming energy rather than actually being involved in the generation process. Hence, we feel it is important for us to not only come to a conclusion on how the energy transition story will play out post COVID-19, both in the near term and long term, but also to allow actual industry participants to share their views on our platform.

We asked our survey participants seven simple questions. Over the next few pages, we will provide you with a good idea of the responses and the implications, in our view.

1. Do you think that COVID-19 will accelerate the green energy transition?

2. Do you think that COVID-19 could hasten the timeline for peak oil demand?

3. Did the COVID-19 outbreak affect your long-term business strategy and investment plans?

4. Which part/segment of the energy value chain appears the most attractive to you at this juncture from a new investment point of view?

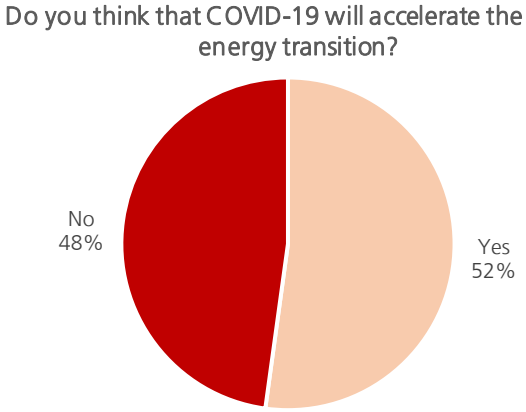
5. What is the biggest threat to your organisation arising from the energy transition?

6. With an increasing proportion of renewable energy in the generation mix, what is your expectation of average electricity prices in your country over the next five years?

7. What is the most important sustainability initiative/strategy for your company?

As Asia's leading bank, we collected responses from across the region – Singapore, Hong Kong, Japan, Philippines, Taiwan, India, Indonesia, China and across the energy value chain – Power Producers, Renewable Energy Developers, Coal Miners, Downstream Gas, Oil and Gas Producers, Oil Services, Energy Trading companies.

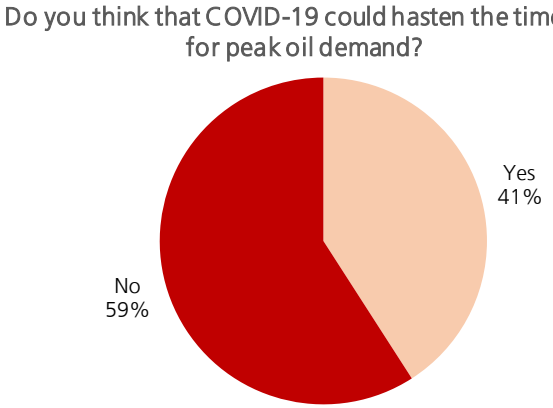
Question 1: Do you think that COVID-19 will accelerate the green energy transition?



Source: DBS Bank

- No clear consensus at this stage.
- Mixed outlook could be the result of near-term slowdown expectations in renewables space owing to lack of positive policy response in Asia.
- However, it is clear that unlike in the past, a big chunk of industry players in Asia do believe in the accelerated energy transition scenario, and will be preparing for it.

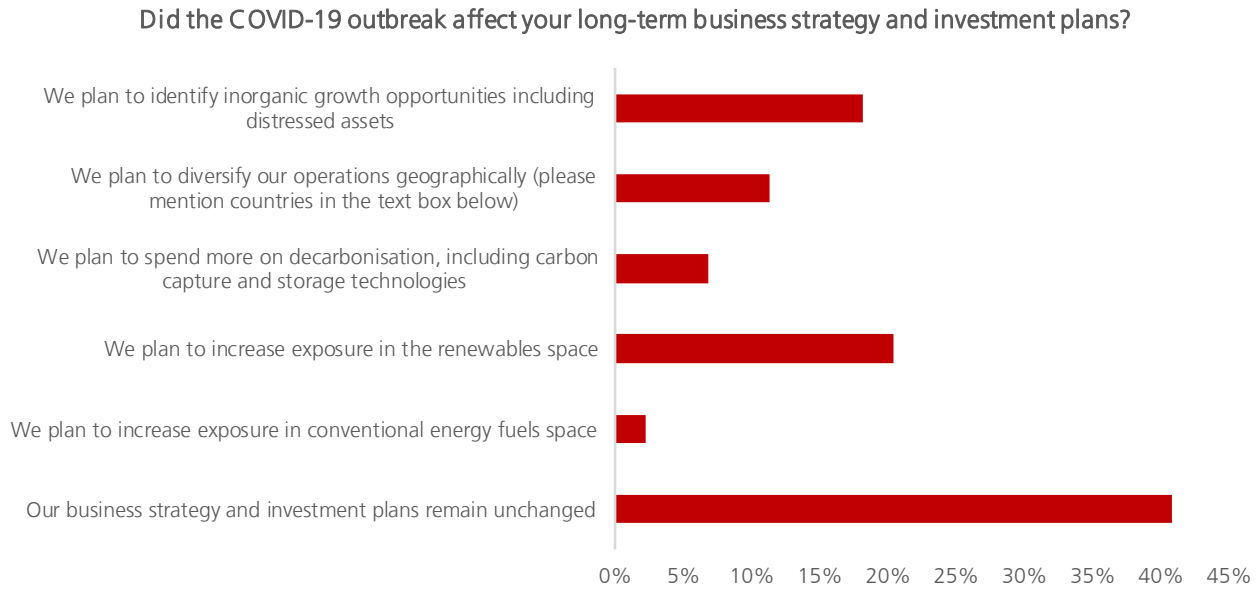
Question 2: Do you think that COVID-19 could hasten the timeline for peak oil demand?



Source: DBS Bank

- Early peak oil believers are marginally the minority.
- A surprising number of participants seem to believe that COVID-19 will cause structural changes to oil demand beyond the one-off impacts expected in 2020/21.
- We agree that the pandemic may not affect the overall timeline of oil demand growth in the future (we expect oil demand to peak at around 2035), but this surely shows the vulnerability of end-user demand for fossil fuels.
- While oil demand growth (relative to pre-COVID-19) will likely resume from 2022 onwards, absolute oil demand projections for the next decade will take a hit owing to the fallout caused by the pandemic.

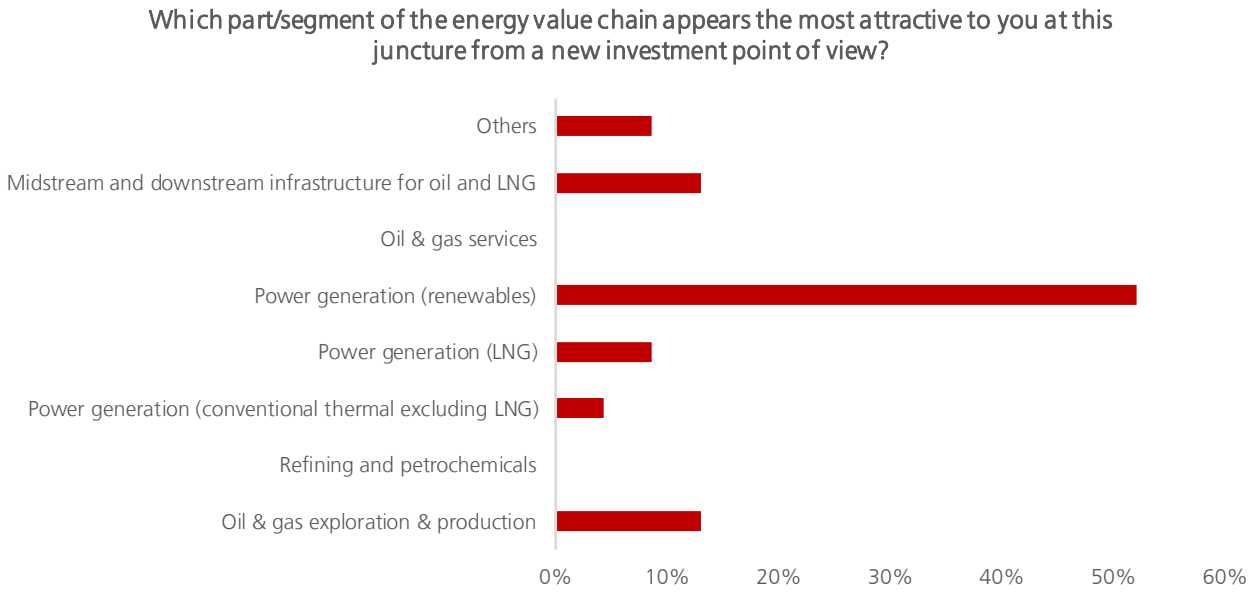
Question 3: Did the COVID-19 outbreak affect your long-term business strategy and investment plans?



Source: DBS Bank

- Most participants do not expect a big shake-up in company strategy owing to the fallout arising from the COVID-19 pandemic.
- A wait-and-see strategy could be apparent, given that the full impact of the pandemic has yet to be seen, and there could be further disruptions in store.
- The other most prominent strategies appear to be 1) increased investments in the renewables space, and 2) M&A activities, both of which tend to corroborate our findings that corporates will tend to diversify their exposure in the renewables space in order to meet growth targets, climate change targets, sustainability targets and retain access to financing, and acquisitions is one way of increasing their presence in this space.

Question 4: Which part/segment of the energy value chain appears the most attractive to you at this juncture from a new investment point of view?



Source: DBS Bank

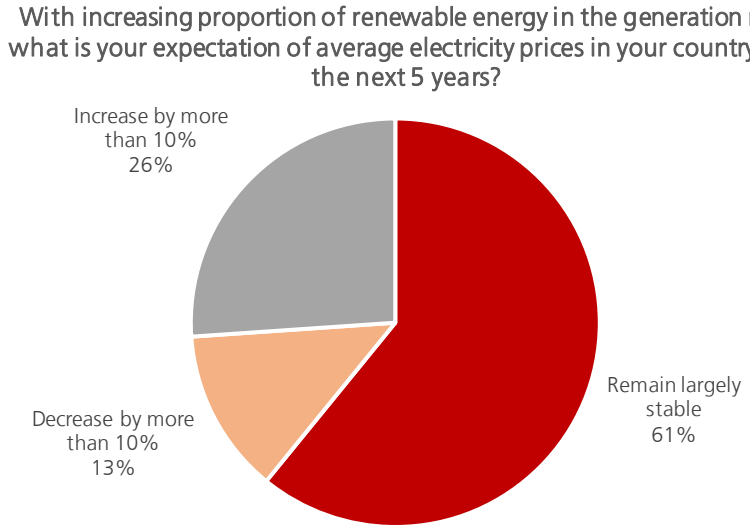
- The simple winner here is renewable power generation as the most sought-after investment opportunity in the energy value chain, despite the near-term challenges and hiccups we had identified earlier.
- Volatility in oil and gas prices may be a key reason for the preference for more stable returns from the renewable energy space.
- Honourable mention of LNG infrastructure, as LNG demand in the Asia Pacific region is expected to hold up much better than other fossil fuels in the near-to-medium term, and many countries, especially in Southeast Asia, could use LNG as a bridging fuel to meet the dual needs of lower carbon solutions and economic growth, while transitioning to more renewable energy usage in the longer term.

Question 5: What is the biggest threat to your organisation arising from the energy transition?

Source: DBS Bank

- The low prevailing oil and gas prices seem to be on the minds of most survey participants here, as competition from renewables and falling LCOEs of renewable sources will limit the potential of price appreciation of fossil fuels, as consumers shift to a more electrified future over time.
- Higher capex requirements to invest in or acquire capabilities in lower carbon solutions to adjust to the energy transition landscape is another key factor, and financing requirements will thus play a key role here.

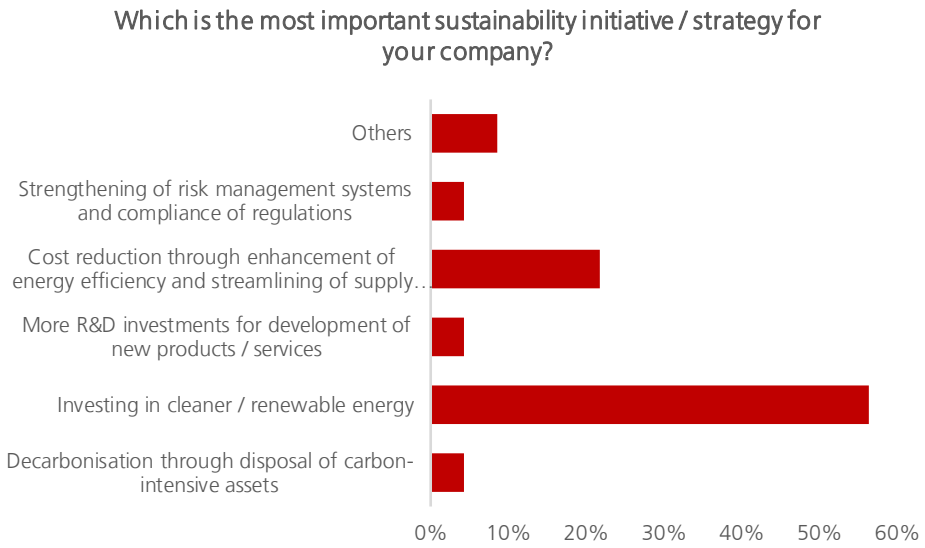
Question 6: With increasing proportion of renewable energy in the generation mix, what is your expectation of average electricity prices in your country over the next 5 years?



Source: DBS Bank

- Electricity prices are expected to remain largely stable or rangebound in the near-to-medium term, as renewables LCOEs converge towards coal and gas, and even as storage costs continue to fall.
- We believe grid congestion and grid stability will be the key issues to look out for in this respect.

Question 7: Which is the most important sustainability initiative/strategy for your company?



Source: DBS Bank

- Again, no surprise, as investing in cleaner energy sources including renewables will be the most prominent way forward for most energy companies in Asia to meet sustainability targets and satisfy their various stakeholders.
- Cost reduction through enhancement of energy efficiency strategies and streamlining of supply chain will be the other key tool in the hands of managers. With this, they will be able to reduce emissions and meet climate change goals without compromising on their ability to generate profits.

8. APPENDIX 2. RENEWABLES AS PART OF DECARBONISATION STRATEGIES OF INTERNATIONAL OIL MAJORS

International Oil major	Clean energy / Decarbonisation strategy

BP	• First oil major to commit significant capital to renewable projects, such as wind and solar, from 1980 onwards.
	• Formerly known as the British Petroleum Company, it was rebranded to Beyond Petroleum in 2001 with a look towards other energy sources beyond oil.
	• BP now takes a more measured approach in renewables, as in the aftermath of the 2010 Deep Water Horizon oil spill incident in the Gulf of Mexico, BP gradually exited and wrote off most of its previous green energy investments portfolio, believed to be worth about US$8-10bn.
	• Following the divestment from renewables, BP has not formulated a clear new renewable energy vision but as per CEO Bob Dudley, is scanning and screening for renewable energy opportunities to plan for a life beyond oil.
	• The company still has more than 2,200 megawatts (MW) of legacy onshore wind capacity assets in the US and has started to re-invest in renewables in recent years.
	• BP is prepared to spend around US$500m per year (organic and inorganic investments) to have some skin in the game and enable growth options for a low carbon future.
	• Key recent acquisitions/ investments in clean energy include:
	  • A 43% stake in Lightsource, which has rebranded to Lightsource BP and is Europe's largest solar power project developer.
	  • Investment in StoreDot, an Israeli developer of rapid-charging batteries.
	  • Investment in US company FreeWire, which makes fast-charging infrastructure for electric vehicles
	  • acquisition of Chargemaster, the UK's leading network of charging points
	• BP has established a venture capital arm with the name BP Ventures in 2006 and has invested over US$300m into an active portfolio of more than 40 entities comprising emerging and disruptive technologies across upstream, downstream, and green energy.

Chevron	• Investments in renewables relatively scarce, with no target in place for a move to cleaner technology. • Exited most renewables projects by 2016, following low returns on investment compared to its core activities, and the focus thereafter has remained on its oil and gas business. There remains a small legacy renewables business in the US. • Managing emissions by improving energy efficiency, reducing flaring, and fixing methane leaks. • Investing in two of the world's largest carbon dioxide injection projects: Quest CCS project in the Canadian oil sands and Gorgon in Australia. • Launched a Future Energy Fund in 2018, with an initial commitment of US$100m set aside to invest in breakthrough technologies that will reduce carbon emissions and provide claner energy.

ExxonMobil	• Exxon has also shown **very little interest in investing in renewable energy technologies**, with no budget or time-scale planned for future projects. • The company's strategy revolves around **reducing greenhouse gas emissions, advancing biofuels, and carbon capture and storage (CCS).** Exxon holds interests in about a third of the world's CCS capacity. In 2019, it announced plans to develop carbon capture fuel cell technology, which produces power and captures and concentrates CO2 for storage – resulting in potential cost reductions. • With regards to advanced biofuel research, the company funds and conducts research in a broad portfolio approach including algae, non-food-based biomass feedstock, and agricultural waste.
Shell	• **Created a strategic framework for resilience regardless of the outcome in terms of future oil prices and renewable energy transition**. CEO Mr. Ben van Beurden told investors recently that Royal Dutch Shell is no longer an oil and gas company, but an **energy transition company**. • **New Energies division** was announced in May 2016, combining its existing low carbon and renewables interests (hydrogen, electric vehicle charging, biofuels, and renewable power) to jointly focus on long-term energy transition themes as part of its diversification strategy. • In 2016, revealed a new energy investment budget of US$200m per year, but this was revised to up to US$1bn per year later in 2017, and then to US$1-2bn per year. Out of this figure, 80% is allocated for the power sector. Thus, Shell's investment target for green energy projects was set at US$4-6bn for the period from 2016 until the end of 2020 – but with less than a year to go, the actual sum may be "well below" those figures. • Acquired **UK-based electricity and gas provider First Utility**, as well as Europe's largest **electric vehicle charging company NewMotion**. • Bought stakes in **US solar power firm Silicon Ranch** and in **Husk Power Systems**, an India-based company that provides renewable power to rural communities and businesses through distributed off-grid installations. • Also investing in grid edge and energy storage companies such as GI Energy, Axiom Energy, and Sonnen.
Total	• One of the frontrunners among oil majors, along with Equinor and Shell, **to transform from traditional oil and gas into a full-fledged energy company**. Strategic rationale of diversifying revenues away from volatile oil prices towards establishing a **robust position in future energy growth markets**. • Total's plan for renewables is to **invest US$500m a yea**r in clean energy technologies. That figure is about **3% of the French oil major's total capital expenditure**, with plans in place to grow its low carbon asset base (downstream gas, renewable energies, energy storage, energy efficiency, clean fuels and carbon capture, utilisation, and storage technology) **to 20% of its total asset base over the next 20 years.** • Made several strategic investments over last 10 years, which included acquisition of a 60% stake in **US solar firm SunPower** in 2011. • Total is **aiming to become a global integrated leader in solar power** and has 1.6 GW worth of solar capacity and plans to increase that to 5GW. • **Other key recent acquisitions/ investments in renewables/ clean energy space include:** i) French **battery manufacturer** Saft, ii) Belgian **green power utility company** Lampiris. iii) A 23% stake in the **French renewable company Eren,** iv) The **French energy efficiency leader GreenFlex** v) A 74% stake in the **French electricity retailer** Direct Energie and vi) A 25% stake in **Clean Energy Fuels Corp** • Established the **venture capital arm Total Energy Ventures** in 2008 and has invested almost US$200m in over 20 innovative start-ups

Eni	• Although not quite up to speed with its rival oil majors, the **Italian company has plans in place to invest further in renewable technologies.** • In 2015, **established a dedicated energy solutions department** to identify and implement renewable growth opportunities. With an eye on growing its **onshore and offshore wind** capacity, Eni formed partnerships with France-based GE Renewable Energy and Norwegian energy company Equinor. • Clean energy sources play a key role in the firm's corporate strategy and it is targeting to deliver **1GW of installed renewable power capacity between 2018 and 2021** by investing €1.2bn (US$1.3bn), with a long-term goal of reaching **5GW installed renewable power capacity by 2025**. • Renewable energy projects (photovoltaics, wind, concentrated solar power, biofuels, and green chemicals) will be developed where the company can leverage technological and geographical synergies with its main core business. Eni targets a project internal rate of return of between 8% and 12% after financing and synergies with upstream operations.
Equinor	• To emphasise on its shift in strategy, Statoil, the Norwegian oil major, recently changed its name to Equinor to reflect the **change from a focused oil company to a broad energy company.** • Primary focus historically on **offshore wind**, leveraging its operational expertise in the North Sea. Wind projects include large-scale conventional offshore developments such as the world's first floating offshore wind turbine installed in Norway in 2009, with an overall portfolio size of 750 MW. • In 2015, the **New Energy Solutions unit** was established as a dedicated business unit to support the company's renewable energy expansion as one of three cornerstones to help manage the long-term climate roadmap. • Over the past two years, 3–5% of annual capital expenditure was spent on renewables. Going forward, the **capital expenditure share attributed to low-carbon energies and renewables could rise to between 15% and 20% of the total capital expenditure by 2030**. • In 2017, Equinor acquired a **40% stake in Scatec Solar's** 162MW Brazilian Apodi solar assets as well as 50% interest in the project execution company, giving the company the knowhow to develop and operate large-scale solar PV plants in the future. Also agreed to buy Danish power and gas trading firm Danske Commodities to strengthen the company's position in power generation from renewable energy. Equinor also acquired a 50% stake in **two offshore wind developments in Poland**. • Established a **US$200m renewables venture capital fund** to invest in innovative renewables start-ups, low-carbon technologies, and associated business models. The fund has completed four major investments to date, including in wind energy leasing, electric vehicle charging infrastructure, and energy storage.
ConocoPhillips	• Remains very focused on the upstream oil and gas business with **no meaningful investment in renewables so far**, and no strategy to diversify into a broader energy play.

Source: Companies, DBS Bank (also adapted from Energy Strategy Reviews 26 (2019) 100370 "The renewable energy strategies of oil majors – From oil to energy?" by Matthias J. Pickl, King Fahd University of Petroleum and Minerals, University Blvd, Dhahran, 31261, Kingdom of Saudi Arabia, also available on the website: https://www.sciencedirect.com/science/article/pii/S2211467X19300574)

9. APPENDIX 3. CASE STUDY – FOCUS ON INDONESIA'S STRATEGY TOWARDS ENERGY TRANSITION

Energy transition plans of bigger economies in Asia like China and India are well known and highlighted by us in our previous reports on Energy Mix and Natural Gas and LNG. However, it is important to note that more developing countries must join the energy transition movement in order to offer a sustainable economic growth story. In this respect, we have conducted an Indonesia energy transition initiative case study, based on the Ministry of Energy and Mineral Resources's (MEMR) presentation on the National Energy Policy in Indonesia. The MEMR revealed that despite Indonesia's commodity-centric energy mix and overall economy, the transition to renewable energy is in the government's mind.

Indonesia is aligning with global initiatives to tackle climate change. The key energy transition initiative for Indonesia is aimed at not only strengthening Indonesia's energy security amid global uncertainties over the COVID-19 pandemic and geopolitical risks such as the US-China trade war, but also demonstrating Indonesia's participation in sustainable initiatives, such as aligning with global initiatives to tackle climate change risks via the Paris Agreement. If this programme is executed well, it could allow Indonesia to reduce its carbon emissions by 29-41%.

Based on the government's strategy, Indonesia aims to increase its renewable energy mix to 23% in 2025, before further increasing this to 31% in 2050. We believe a large chunk of the energy mix transition towards renewable energy will be driven by the Indonesia biofuel programme, as the oil energy mix is set to drop simultaneously, from 42% in 2017, to 25% in 2025 before falling further to 20% in 2020.

Execution will be challenging. This programme looks promising, though the government is aware of the challenges such as Indonesia's archipelago landscape – any initiative to move towards renewable energy from fossil fuel beyond Java island will not be easy due to logistics issues and potential demand challenges. With regards to renewable energy R&D, it is uncertain whether Indonesia can afford the latest technology and facilities that are on par with developing countries, considering that Indonesia is currently facing GDP contraction amid the COVID-19 pandemic.

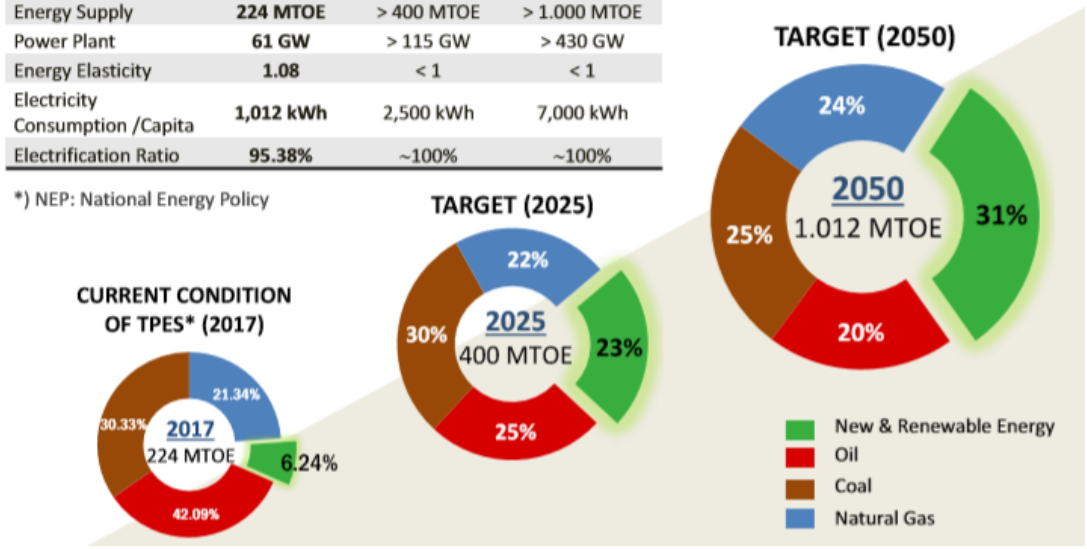
We view Indonesia's biodiesel programme as a low-hanging fruit. With an annual CPO production of 40m MT, 10m cars on the road and a population of 220m, Indonesia can be the world's largest consumer of CPO while reducing its oil imports simultaneously. On the other hand, we expect the reduction of coal consumption to face domestic challenges, considering that coal prices affect the livelihoods of around 50m people mainly in the ex. Java region. Perhaps, the government will push for more natural gas power plants and other energy sources if Indonesia can exploit its trapped natural gas reserves in the eastern part of the archipelago.

Overview of National Energy Condition & Target – Indonesia

NEP* TARGET	2017	2025	2050
Energy Role	*National Capital Development*		
NRE on Energy Mix	**6.24%**	23%	31%
Energy Supply	**224 MTOE**	> 400 MTOE	> 1.000 MTOE
Power Plant	**61 GW**	> 115 GW	> 430 GW
Energy Elasticity	**1.08**	< 1	< 1
Electricity Consumption /Capita	**1,012 kWh**	2,500 kWh	7,000 kWh
Electrification Ratio	**95.38%**	~100%	~100%

*) NEP: National Energy Policy

Note
MTOE: Million Ton Oil Equivalent
NRE: New-Renewable Energy



Source: MEMR, DBSVI

Natural gases: Promising prospects but challenges abound. The current low oil price environment and uncertainties in Indonesia's domestic end-users' gas pricing implementation may affect the appetite for E&P investments and the progress of such projects under development, However, exploration and exploitation efforts in the eastern part of Indonesia hold the key to unlock its reserves and achieve the energy mix target for natural gas in Indonesia.

Currently, Indonesia's infrastructure and pipeline are fragmented due to its archipelago landscape and previous focus on other energy sources such as coal and oil fuel. As the government shifts its focus to cleaner energy sources and reduces its dependence on oil imports, the feasibility and attractiveness of gas infrastructure projects have improved significantly.

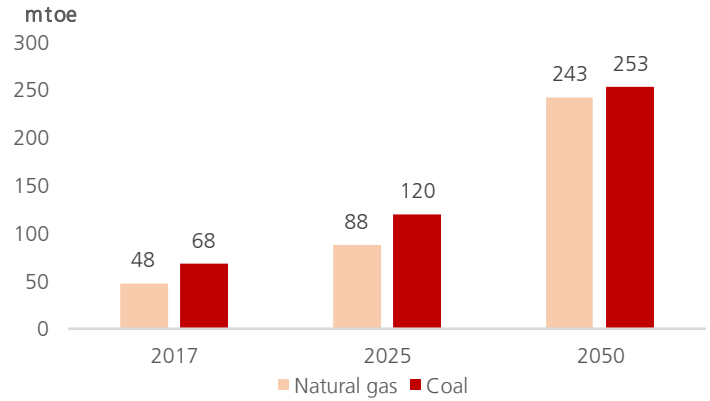
Indonesian coal: Focusing on keeping prices firm. Coal will still be an important energy source going forward. The Ministry of Energy and

Mineral Resources (MEMR) is committed to ensuring that coal consumption remains on an uptrend to support the national optimal electrification rate, driven by coal's affordability and nationwide availability. Moreover, coal is one of the most important commodities for Indonesia's economy and trade balance. Based on the MEMR's energy mix target and forecast of energy consumption in ton equivalent, Indonesia is poised to absorb 88m tons of coal by 2025, which is double vs. the 2017 level, and we believe this is mainly due to the delivery of a 35,000-MW power plant project.

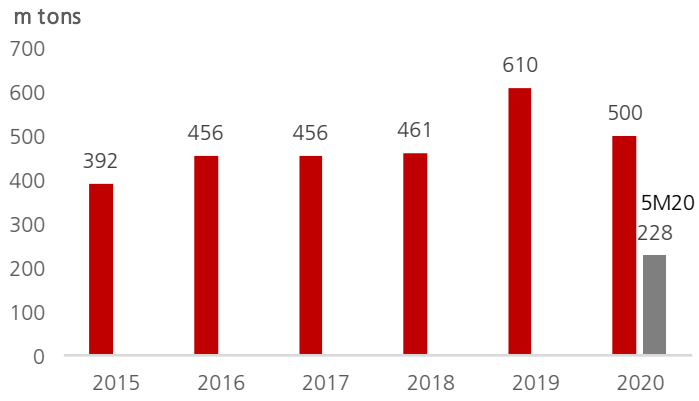
Indonesia will inevitably still rely on coal and needs to keep coal prices firm to prevent any adverse effect on the ex. Java economy – i.e. coal price needs to stay above US$60 per ton (Newcastle 6,000kcal/kg benchmark). In the short term, while waiting for the construction of domestic power plants to be completed in the next couple of years, Indonesia is set to cut domestic coal production amid soft coal demand conditions in overseas markets.

Cutting production in near term. The Indonesian Coal Mining Association (APBI) is targeting coal production to only 500-550m tonnes in 2020 vs. 610m tonnes in 2019. We believe that Indonesia is on track to achieve this new coal output target. The production cut is a positive move to prevent oversupply in the seaborne coal market which suffered from the COVID-19 pandemic lockdown in 2Q20. However, there is a major risk that producers would react to Australia's stricter coal imports by producing more coal even at weaker selling prices. So far, we have not seen any enforcement on coal miners breaching their initial production targets. Indonesia's coal production hit 228m tonnes (as at 5M2020), or less than half of the adjusted annual output target of 500m tonnes for 2020.

Domestic coal consumption target vs. natural gases



Indonesia's annual coal production (m tons)

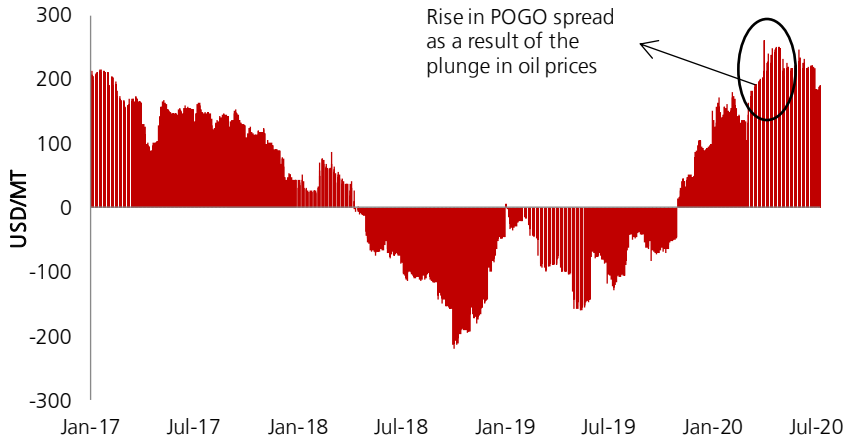


Source: MEMR, DBSVI

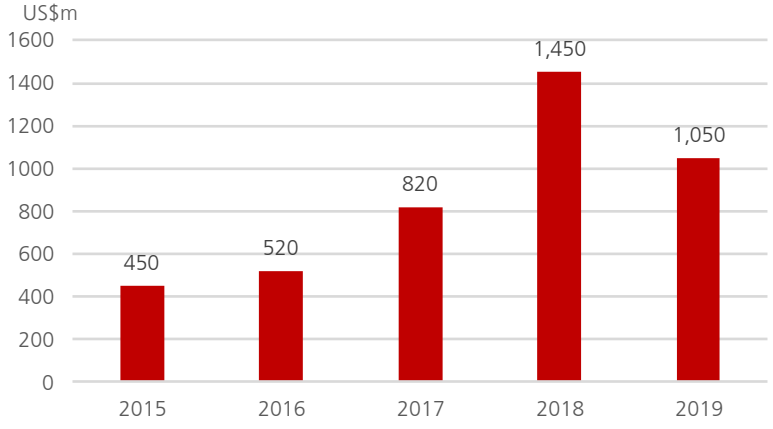
Biofuel: Greener fuel to inevitably replace oil fuel. The Indonesian government successfully revitalised its B20 domestic biodiesel blending programme last year, before striving for B30 (30% biodiesel blend) and possibly B100 in 2025 at the earliest, thanks to strong support from the president himself and a new CPO Fund scheme in 2015. This programme is not only intended to increase crude palm oil (CPO) usage and keep CPO prices firm, but also to reduce its dependence on imported oil. Indonesia has also established the CPO Fund, which pools funds from CPO export levies (Indonesia is collecting US$55 per MT of export levies for every ton of CPO exports), and uses the fund to bridge the gap between CPO prices and retail diesel prices.

The biodiesel programme has, however, never been profitable since its inception – this is underlined by its under-delivery vis-à-vis production targets and delays since 2013 despite the availability of refining capacity. CPO price has never stayed below that of crude oil for long, as CPO is also seeing emerging food-based demand especially at low price levels – this led to the birth of an incentive scheme based on export levies in 2015.

Palm oil-gas oil (POGO) spread



Estimated CPO Fund balance



Source: MEMR, Indonesia Ministry of Finance, DBSVI

Promoting domestic biodiesel demand is important. Biodiesel accounts for 20% of CPO demand globally and 80% of this comes from Indonesia's biodiesel demand. The promotion of biodiesel is aimed at reducing Indonesia's dependence on imported oil, as domestic oil and gas block expansion plans run behind schedule – this is also reflected in Indonesia's renewable energy mix target vis-à-vis oil mentioned earlier.

Export substitution in focus. The programme also incorporates an alternative solution to absorb any excess supply or counter export demand weakness (akin to what happened in 2018), especially as CPO is now facing a crucial time – no thanks to excess supply, demand pressure from the EU (RED II Initiative) and India's higher import tax. Going forward, this programme can also help mitigate any further downward pressure on CPO demand arising from adverse developments, such as the RED II Initiative in the EU. The EU accounts for 20% of global palm oil consumption and there is need to find alternative sources of demand if the EU decides to phase out CPO biodiesel completely by 2030.

CPO Fund collects US$500m-1bn of levies every year, depending on CPO price trends and export tonnage. The fund is deployed to bridge the gap between the prices of CPO (as the feedstock) and retail fuel in Indonesia. Currently, we estimate there is US$1bn left in the CPO Fund in 2020. With the widening price gap between crude oil and CPO, we estimate that the fund will only cover 2020, (assuming a future levy of US$18 per MT for 12m MT of CPO exports). If the CPO Fund is not topped up sufficiently (note that Indonesia's current export levy is only US$55 per MT, and the government is likely to abolish export levies if CPO price drops to below US$500 per MT), Indonesia's biodiesel future would be at a crossroads. Will we return to the pre-2017 level when the execution of the biodiesel programme had been very poor?

Nevertheless, the President is committed to pushing this programme ahead. From an economic point of view, the programme never seems to be feasible – as the narrow price spread between CPO and retail gasoil has never persisted for a sustained period of time – CPO price tends to rebound when its spread with gasoil narrows. However, we understand that the biodiesel programme is more than just an experiment – it also a viable solution for countries to reduce their dependence on imported oil and fix their current account deficit (CAD). Note that Indonesia's oil production is never sufficient to catch up with the rising demand.

Indonesia has a population of 200m and 10m vehicles to readily absorb the supply of biodiesel. Given the size of its CPO industry (Indonesia is the world's largest producer), Indonesia's efforts to boost CPO demand and ensure firm CPO prices are indeed crucial. However, its dependence on the export market means that Indonesia has never been in control of CPO prices and can only be a price taker despite its status as a dominant producer. Supply control is quite an impossible task, as trees keep producing fruits and the maximum shelf life of palm oil is only four months.

Summary of country level plans

- **Empowering domestic resources.** As the world's largest palm oil and coal producer, with the potential to churn out natural gases in the future, Indonesia is well positioned to strengthen its energy security even amid lingering uncertainties over the COVID-19 pandemic and geopolitical risks. It will continue to participate in global initiatives to tackle climate change issues simultaneously via its renewable energy initiatives.

- **Increasing renewable energy proportion in energy mix substantially by 2025, mainly lowering crude oil dependence.** The Indonesian government plans to forge ahead with its energy mix transition to a renewable energy composition of 23% by 2025 and 31% by 2050, from only 6% in 2015. This target will be supported by its biofuel programme, with the goal of cutting its oil energy mix from 42% in 2015 to 25% by 2025. Meanwhile, Indonesia will still utilise its coal and natural gas resources to fire up the country, as reflected in their stable energy mixes of 30% and 22% respectively, in 2025.

- **Biodiesel in the spotlight.** Indonesia is striving to increase its biodiesel blending up to B100 and we estimate this to happen in 2025 at the earliest, from the existing blending of B30 (30% biodiesel). This programme is not only intended to increase CPO usage and keep CPO prices firm, but also to reduce its dependence on imported oil.

- **Support for domestic coal miners, besides natural gas sector.** Indonesia will maintain coal in its energy mix as thermal coal can be procured affordably from domestic miners. Coal price affordability has ensured that domestic demand remains firm, despite the potential expansion of natural gas in the country's energy mix. About 80% of its natural gas is set to be unlocked via E&P expansion to the eastern part of Indonesia.

- **Execution of renewable energy plans increasingly crucial.** Indonesia's archipelago landscape and current low oil prices pose challenges to renewable energy execution plans as oil imports have always offered a short cut to meet growing energy demand. But given the weak export demand for commodities, executing this initiative will become more crucial by the day.

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