

Asian Insights SparX

Environmental, Social, and Governance

DBS Group Research . Equity

26 Oct 2021

Is carbon credit an investable asset?

- The voluntary carbon credit price increased over 24% with a record high volume in 8M21
- Expect the carbon price to rise 15-20% further in 2022
- Tightened requirement in additionality and project quality to boost market confidence and liquidity
- Expect increasing participation from Asian companies

Robust demand to boost prices of voluntary carbon credit. Thanks to net zero carbon commitment from an increasing number of corporations and stronger participation from traders and speculators, transaction volume and market value of the voluntary carbon market set record highs in 8M21 with an over 24% increase in the average carbon price. Strong momentum in the voluntary carbon market should lift the carbon price further by 15-20% in 2022.

Higher project quality and standardised market practice to enhance market confidence. Tightened requirement for additionality test will ensure higher project quality with a real impact on carbon reduction. Standardised market practice, such as project risk assessment and post-trade arrangement, will enhance the confidence of credit buyers. These will bring about strong market liquidity to further reflect the true underlying value of carbon credit.

Expect participation from more Asian companies in the long run. Most Asian energy companies are actively reducing emission for compliance requirements. But their participation in the voluntary market will increase to reduce residual emission as they achieve their net zero targets.

HSI: 26,132

ANALYST
Patricia Kai Ki YEUNG +852 36684189
patricia_yeung@dbs.com

Pei Hwa HO +65 6682 3714
peihwa@dbs.com

Duladeth BIK +66 28577833
duladethB@th.dbs.com

William SIMADIPUTRA +62 2130034939
williamsima@dbs.com

Ian Haan CHUI +852 36684174
ianchui@dbs.com

The DBS Asian Insights SparX report is a deep dive look into thematic angles impacting the longer-term investment thesis for a sector, country, or region. We view this as an ongoing conversation rather than a one-off treatise on the topic, and we invite feedback from our readers, and, in particular, welcome follow-on questions worthy of closer examination.

Table of Contents

Investment summary

A report by Ecosystem Marketplace estimated that a drop of 23GT of net emission each year by 2030 is required to meet the 1.5°C ambition under the Paris Agreement, implying **a 23-57% CAGR in the amount of carbon offset to be issued in the upcoming 10 years.** The voluntary carbon market[1] plays an important role in achieving these, as the proceeds from the sale of carbon credits[1] in the voluntary market are used for development of projects to reduce carbon emission.

The voluntary carbon market is growing significantly, evidenced by the jumps in both market size and trading volume of 58% and 27% from 2020 to 8M21 respectively, according to the latest report by Ecosystem Marketplace. We reckon that the current growth momentum will continue, and **investors can benefit along the way through participation in the voluntary carbon market**.

Trove Research projected that the carbon credit price has to at least double **from US$10 per ton in 2020 to US$20-30 per ton in 2030** in order to incentivise sufficient investment in carbon offset projects for the demand. The annual carbon market value is also expected to increase from US$400m currently to US$10-25bn by 2030. We estimate the **carbon price in the voluntary market will climb at least 15-20% in 2022**. **A price hike in high-quality projects could be even higher**, i.e., those projects that can pass the additionality test, represent real emission reductions, generate other social benefits for UN sustainable development goals (better health, gender equality, biodiversity, etc.), and have a short vintage year of less than five years.

Robust demand for carbon credit is underpinned by net zero commitment from an increasing number of corporations. Apart from regulatory requirements, companies are facing climbing pressure from banks, investors, and customers in climate commitment. According to a report, *Taking Stock: A global assessment of net zero targets*, by Energy and Climate Intelligence Unit and Oxford Net Zero, **at least 21% of the world's 2,000 largest public companies have committed to meet net zero targets**. These companies together represent sales of nearly US$14tn.

On the supply side, although there is credit surplus which could post pressure on credit price, we reckon there are a few factors mitigating the pressure. First, there is increasing demand from corporations for high-quality carbon projects to avoid accusation of greenwashing[1]. Thus, The Taskforce on Scaling Voluntary Carbon Markets **will impose a higher threshold standard, which will improve the overall project quality** and slow down the issuance of carbon credits. Second, **around 80% of the active carbon credit projects have a vintage year of five years or above**. These projects raise a red flag on project quality; hence, there is low possibility of retiring these projects. Third, **credit registries have implemented stricter restrictions on renewable energy projects** and only allow those from the least developed countries to be registered, further limiting supply growth.

Data from Ecosystem Marketplace showed that the voluntary carbon market registered 27% and 58% growth from 2020 to 8M21 in trading volume and market value respectively. **Both transaction volume and market value were record high.** The growing interest does not come from just corporates for their net-zero strategy, but also from speculators or traders. Standardisation in market practice will enhance confidence in the market and encourage traditional financing institutions, including banks, to participate. **Stronger market liquidity will help reflect the true underlying value of carbon.**

Risks of buying carbon credits include changes in rules and regulations, political risk, price volatility, and execution risks. In particular, the ongoing negotiations on the Article 6 under the Paris Agreement and the validity of credits under the Clean Development Mechanism[1] for country-level compliance could indirectly affect demand in the voluntary market.

We have seen some positive developments in carbon trading in Asia, where China, Japan, Korea, and Indonesia have already announced national climate commitment. These have prompted Asian energy companies to be more active in fighting the climate change problem. While their initiatives currently focus on the compliance market, **we believe they will reduce residual emission in order to achieve their net zero commitments through participation in the voluntary market.**

[1] *Please refer to Appendix III for more information.*

How does the voluntary carbon market reduce carbon emission?

The next annual UN climate change conference will be held in late October/early November 2021 in Glasgow. The conference will bring together world leaders to commit to global climate action to bring about immediate, rapid, and large-scale reductions in greenhouse gas (GHG) emissions. Otherwise, limiting warming to close to 1.5°C or even 2°C will be out of the question.

We have seen some positive development in Asia, where China, Japan, Korea, and Indonesia have already announced national climate commitment. However, carbon reduction from compliance carbon trading markets[2] is not enough to bring about sufficient carbon reduction under the Paris Agreement. Trading of carbon credits in a transparent and verifiable voluntary carbon market[2] is also needed to facilitate global decarbonisation. We believe investors can benefit from the growth of the global voluntary carbon market through participation because the carbon credit[1] price is set to take off.

What is carbon credit?

Carbon credit is a tradable permit that allows a company to claim reduction of a certain amount of carbon dioxide (CO_2) or an equivalent GHG, typically one metric tonne of CO_2 per carbon credit.

In a voluntary market, companies or individuals can purchase carbon credits or verified emission reductions[2] (VER) from carbon funds or carbon exchanges. They can also acquire carbon credit or carbon offset[2] directly from projects targeted at removing or reducing GHG from the atmosphere. However, the GHG removal or reduction of these projects must be real, measurable, and verified by an ISO-accredited third-party verifier under one of the carbon credit standards (such as Verified Carbon Standard, American Carbon Registry, Climate Action Reserve, and Gold Standard). These standards have their own registries allowing the carbon credits to be tracked to avoid the risk of double-counting or being claimed by more than one party.

How many types of carbon credit?

Carbon credits can be grouped into three large categories:

- avoidance projects, i.e., avoid emitting GHGs completely, including renewable energy projects, forestry and farming emissions avoidance projects, soil management practices in farming;
- reduction projects, i.e., reduce the volume of GHGs emitted or reduce demand for energy, such as cookstove projects, fuel efficiency or the development of energy-efficient buildings; and
- removal projects, i.e., remove GHG directly from the atmosphere, for example, nature-based solutions (such as reforestation projects, afforestation projects, regenerative agriculture) and technology-based solutions (such as carbon capture).

Major criteria for carbon credit

Criteria	Explanation
Real	Emission reduction are real and have already occurred
Additional	Emission reduction are in addition to what would have occurred otherwise
Permanent	Emission reductions are non-reversible or are sequestered for a number of years in the case of carbon bio-sequestration projects
Verifiable	Sufficient data quantity and quality must be available to ensure emission reductions can be verified
Quantifiable	Emission reductions are reliably measured, estimated, or quantified
Enforceable	Ownership is undisputed and enforcement mechanisms exist to ensure that all programme rules are followed and the market's environmental integrity is maintained

Source: International Emissions Trading Association

Can carbon credit help in turning the world greener?

The answer is positive. The proceeds from the sale of voluntary carbon credits are used for development of the above three major types of carbon credit projects to reduce carbon emission. The voluntary carbon market, unlike the compliance market, which mainly covers high emission sectors or companies, does not have restrictions about participants. Thus, any corporate or individual, who would like to contribute to the environment, can take part in carbon trading. Thanks to the increasing awareness in climate change, more

[2] *Please refer to Appendix III for more information.*

corporates have set carbon reduction goals, and issuance of carbon credit in the voluntary market has climbed significantly, indicating increasing funding for carbon reduction projects.

In addition, some companies have residual emissions that cannot be eliminated due to cost considerations or technology limitation, while they have less influence over some emissions from parts of their supply chain or portfolio than their direct operations. Some companies would like to go beyond the targets set in the compliance market to complement their climate strategy. These companies are able to achieve further emission reduction by financing carbon reduction elsewhere through the voluntary carbon market.

The key is that the funding raised from the voluntary market can drive actions to truly additional projects for more emission reduction while simultaneously embracing increasing government regulation and policies.

What is a carbon credit worth?

What goes into the price?

Prices of carbon credit vary from less than US$1 per credit to over US50 per credit, depending on the difference in the project nature and quality. Higher-quality projects have higher demand, hence the higher prices. Project quality is assessed through the standard by which it is certified.

Value created by reduction of 1tCO_2

Projects	UN Sustainable Development Goals achieved *	Value created in 2017 (US$)	Reference carbon price (US$/t$CO_2$)
Wind	8, 7, 13	86	10-18
Forestry	15, 8, 13	242	18-34
Cookstoves	13, 15, 8, 1, 3	267	15-20
Biogas	13, 15, 8, 1, 3	465	22-24

Source: Gold Standard

** UN Sustainable Development Goals:*
1: No poverty
3: Good health and well-being
7: Affordable and clean energy
8: Decent work and economic growth
13: Climate action
15: Life on land

In particular, additionality is a key factor to consider. If the emissions reduced or avoided by the project are additional to "business as usual" or would not have occurred without revenue from carbon offsets, it is considered as additional; hence, the more impact on the environment, the better the quality and higher the carbon credit price.

The carbon price also depends on the nature of the project. It is because the carbon price does not reflect only carbon reduction of the project but also other contributions to the UN Sustainable Development Goals that it can achieve. For example, in addition to reduced air pollution, an improved cookstove project (which replaces wood-based fuel or charcoal stoves by more efficient devices) in Africa can also improve health conditions mainly for women and children; hence, saving money that would have been spent on respiratory illness. Cooking time is also reduced and more time can be spent in other areas, such as schooling. When less wood is required for combustion, deforestation will also decline. These social benefits on health, gender equality, and biodiversity allow the carbon price to trade higher.

Project location is also a key price determinant. For example, a new energy project in a developing country to replace combustion of coal for power generation will have a greater impact on the environment than the same project in a developed country. In addition, due to the lack of infrastructure or other resources, extra costs may be implemented; hence, carbon credits will be sold at a higher price.

Project vintage (i.e., the age of the carbon credit) is believed to affect the price as well. Old projects where project standards were not as stringent are believed to have poorer quality; hence, lower carbon prices.

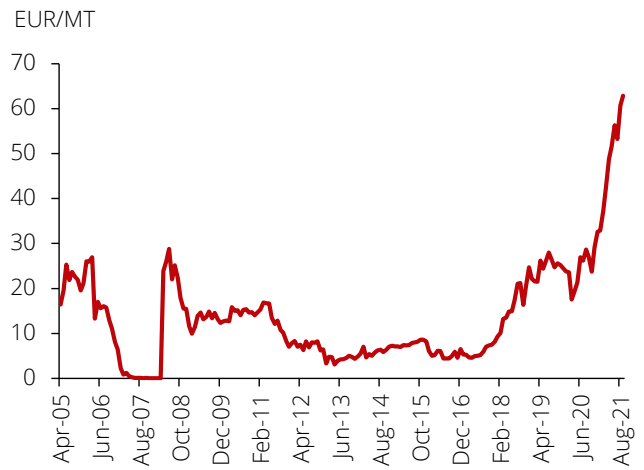
Project scale will also affect the price. Large-scale projects tend to have a lower price on a per unit basis. Large volume discount will sometimes be offered to buyers as well.

Where does demand come from?

Notwithstanding the above parameters impacting the carbon price, the primary driver is the market dynamics, i.e., demand and supply. Taking reference to EU Emission Trading System (ETS), the world's first and so far the largest carbon market, the carbon price dropped from almost EUR30 per emission allowance in 2008 to less than EUR5 in 2013. It was mainly due to weaker demand amid the economic recession and a large influx of

certified emission reductions[3] from Clean Development Mechanism[3] (CDM) projects.

EU ETS carbon price



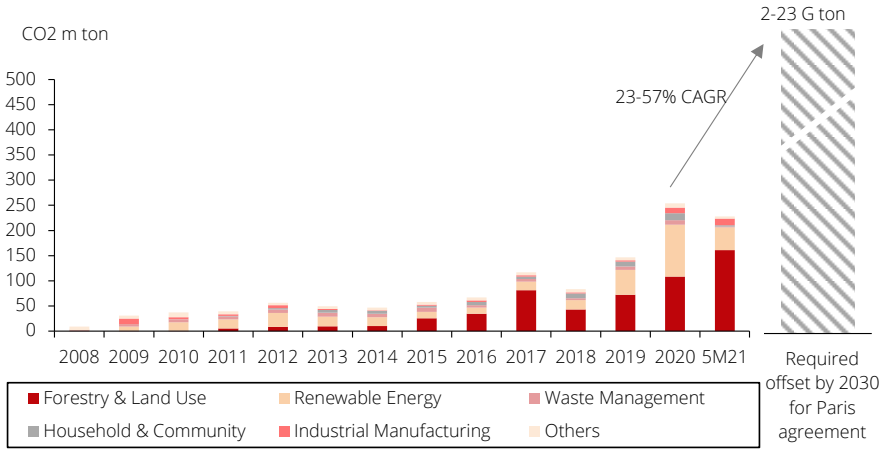
Source: Thomson Reuters

However, with a lower number of allowances available in the market, the carbon price started to pick up in 2017. The latest rally from EUR 24 per emission allowance to EUR 59 since October 2020 was also due to the expectation of increasing demand. We expect a similar pattern in the carbon price in the voluntary market because of strong growth in demand.

A report by Ecosystem marketplace estimated that **a drop of 23GT of net emission each year by 2030** is required to meet the 1.5°C ambition, implying a 23-57% CAGR in the number of carbon offsets to be issued in the upcoming 10 years. A study by UK-based Trove Research projected the annual carbon market value to increase from US$400m currently to US$10-25bn by 2030. McKinsey also echoed the view and estimated that the global demand for the voluntary carbon market could increase by a factor of 15 by 2030 and 100 by 2050.

Meanwhile, there is stronger demand for carbon offsets from an increasing number of corporates. Apart from regulatory requirements, companies are facing climbing pressure from banks, investors, and customers in climate commitment. According to a report, *Taking Stock: A global assessment of net zero targets*, by Energy and Climate Intelligence Unit and Oxford Net Zero, **at least 21% of the world's 2,000 largest public companies have committed to meet net zero targets**. These companies together represent annual turnover of nearly US$14tn.

Carbon offset issued



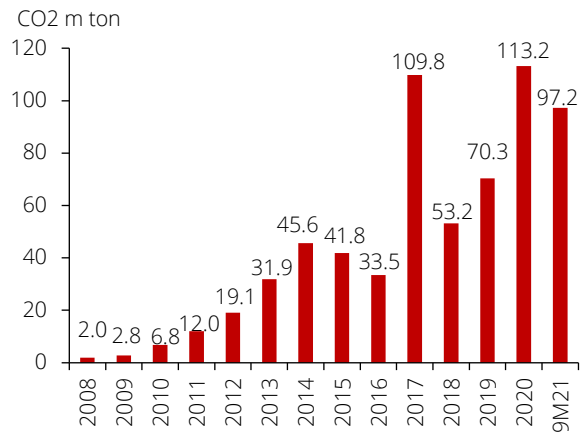
Source: UC Berkeley, Verified Carbon Standard, Gold Standard, American Carbon Registry, Climate Action Reserve, DBS

[3] *Please refer to Appendix III for more information.*

By September 2021, **the number of members of the United Nations' Race to Zero[4] campaign has almost doubled** since 12 months ago. These members, coming from 110 countries, include companies, cities, and financial and education institutions, and they are committed to reduce carbon emission through various methods, such as improving manufacturing processes, switching to low-carbon fuels, buying green electricity, as well as acquiring carbon offsets. These are the major driving force for carbon credit demand in the voluntary market.

The increasing demand is also reflected in the rising amount of carbon offset being retired. In fact, the amount of retired carbon offset had a CAGR of over 30% during 2016 and 2020. In the nine months of 2021, the amount of retired carbon credit already reached 86% of that in 2020. We believe as more companies execute their climate strategy, the strong momentum in the retirement of carbon offset will continue.

Carbon credit retired



Source: UC Berkeley, Verified Carbon Standard, Gold Standard, American Carbon Registry, Climate Action Reserve, DBS

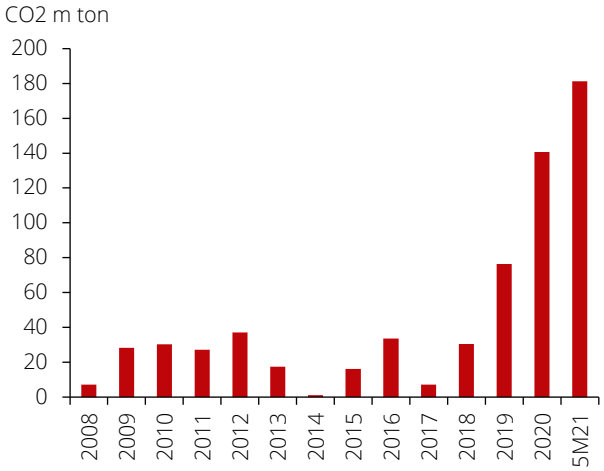
Higher standard to cap surplus

Since 2018, the gap between offset issuances and retirements has widened due to the anticipation of stronger demand in the coming years and speculation on carbon price hikes. The surplus could post a negative impact on the prices of carbon credit. However, we believe there will be a few factors mitigating the negative impact from the surplus of carbon credit.

Firstly, many offsets traded on the market have low quality, do not represent real emission reductions, or do not meet the requirement of additionality. The integrity of the carbon offset market has caused an issue on the supply of carbon credit.

The Taskforce on Scaling Voluntary Carbon Markets has recently formed a new independent governance body for the voluntary carbon markets and finalised the Core Carbon Principles (CCPs) to be launched in 2022 in phases. CCP-compliant projects will have to have a clear, measurable, and direct impact in reducing carbon emissions and full environmental and social integrity. We believe **a higher threshold standard will improve the overall project quality** and slow down the issuance of carbon credits, which is positive to the carbon price.

Net issuance of carbon credit



Source: UC Berkeley, Verified Carbon Standard, Gold Standard, American Carbon Registry, Climate Action Reserve, DBS

Risk of greenwashing[5]

In addition, due to the market's worry on the quality of active projects in the voluntary market, many corporates are becoming more careful in project selection when buying carbon offsets/credits to avoid the risk of greenwashing. The use of low-quality credits or credits with dubious credentials to claim the achievement of sustainability goals will be detrimental to corporate

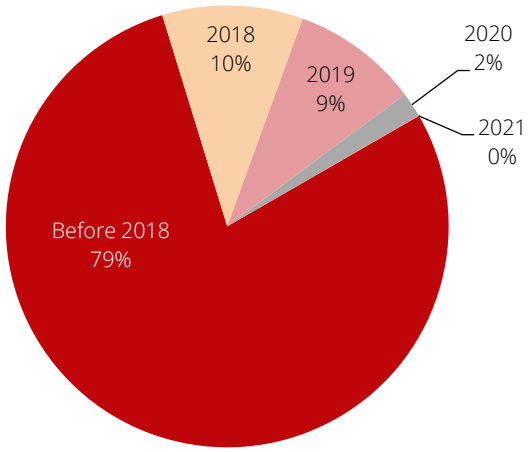
[4] *Race to Zero is the United Nation-backed global campaign rallying non-state actors, including companies, cities, regions, financial and educational institutions, to take rigorous action to halve global emissions by 2030.*

[5] *Please refer to Appendix III for more information.*

branding and governance. The risk is particularly high for nature-based projects, where the project area is large with complex and slow data collection and analysis.

In normal cases, carbon credits with vintage year (i.e. the year the emission reduction occurred) within one to three years of the emissions are usually cancelled out or retired, i.e., claimed as carbon reduction. Those with a vintage year greater than five years will raise a red flag on the project quality and are unlikely to be retired.

Breakdown of active carbon offset by vintage year



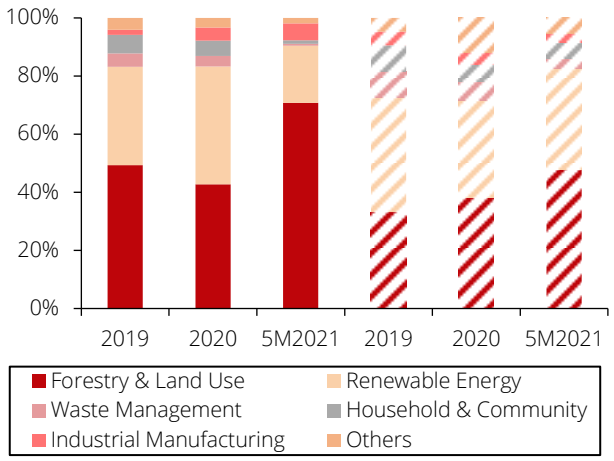
Source: UC Berkeley, Verified Carbon Standard, Gold Standard, American Carbon Registry, Climate Action Reserve, DBS

From the database of four major registries, almost 80% of the active carbon offsets have a vintage year of five years or above. We believe demand for these credits for retirement will be increasingly low as investors put more focus in project credential. Thus, supply of high-quality carbon credit is, in fact, limited. We could not rule out the possibility of removal of the surplus of low-quality carbon credit, as requirements on project quality are getting tightened. Trove Research estimated that removal of the surplus could lift up the average carbon credit price by US$10/tCO$_2$.

Supply from renewable energy projects in least developed countries only

The percentage of nature-based/forestry projects and renewable energy projects has been increasing, in both issuance and retirement. However, carbon credits from renewable energy projects in developed countries are encountering increasing challenges of meeting the additionality test. The cost of renewable energy projects has reduced significantly with improvement in technology, allowing these projects to be cost effective, particularly in developed countries. Thus, no additional funding from the sale of carbon credits is required to finance these projects; hence, these projects do not meet the requirement for issuance of carbon credit. In fact, the four main carbon credit registries have already implemented stricter restrictions on renewable energy projects and only allow those from least developed countries to be registered. This will restrict the supply from developed countries and is positive to carbon credit prices.

Issuance and retirement of carbon offset by project type*



Source: UC Berkeley, Verified Carbon Standard, Gold Standard, American Carbon Registry, Climate Action Reserve, DBS
** Solid bar: issuance of carbon offset*
Shaded bar: retirement of carbon offset

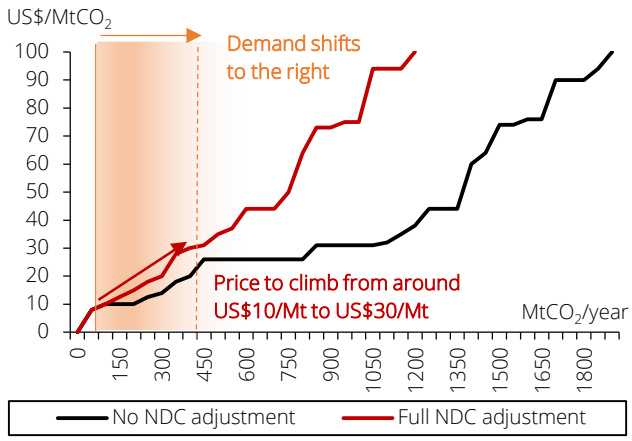
Carbon price to more than double in 10 years

Another factor affecting carbon credit prices is project cost, which can vary considerably, depending on project type, scale, and location. Some projects, such as land-based projects (including forest restoration), can benefit from economies of scale. But for other projects, such as carbon capture, costs will depend on more factors, such as type of long-term storage, CO_2 concentration, and transportation distance.

In a research report by Trove Research, supply of carbon credit from major project types (including nature-based solution, carbon capture & storage, and renewable energy in the least developed countries) has been estimated. Note that carbon emission reduction under the nationally determined contributions (NDCs) under the Paris Agreement are not considered additional; hence, they are not eligible for the voluntary carbon market and adjustment is needed.

The following chart shows the supply curve of global carbon credit with and without NDC adjustment. Trove Research estimated that the **average carbon credit price stood at around US$10 per ton in 2020 but will increase to US$20-30 per ton** when demand climbs to 430Mt per year or above in 2030. Thus, Trove Research projected that the carbon credit price has to at least double in order to incentivise sufficient investment in carbon offset projects for the demand. If more projects are needed to pass the additionality test so that carbon emission reduction can be achieved beyond NDCs, the carbon credit price will be even higher. In an aggressive case where demand of 1,300MtCO_2 is required per year in 2030, price could be even higher at over US$100/Mt$CO_2$.

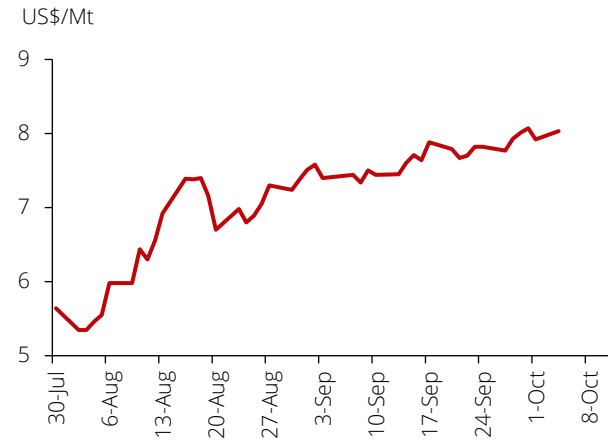
Global carbon credit price projections



Source: Global Carbon Credit Supply model, Trove Research, DBS

Data from Thomson Reuters suggested that the nature-based carbon credit price already jumped 48% since August 2021. With these backdrops, **we reckon the price can rise 15-20% further in 2022. The price hike in high quality projects could be even higher**, i.e., those projects that can pass the additionality test, represent real emission reductions, generate other social benefits for UN Sustainable Development Goals (such as better health, gender equality, and biodiversity), and have a short vintage year of less than five years.

Nature-based carbon credit price



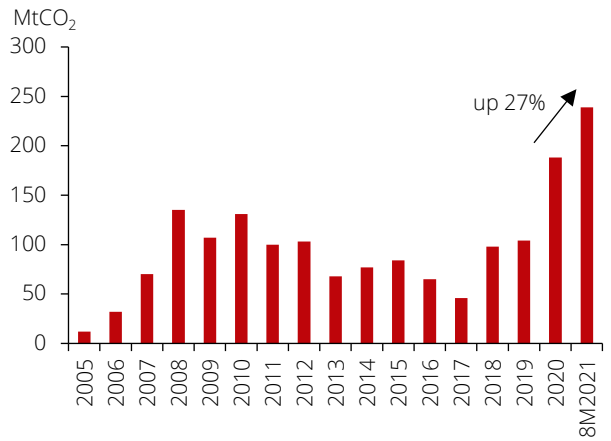
Source: Thomson Reuters

Is liquidity a concern?

With the exception of EU ETS, which is the largest carbon trading market globally, one of the key issues of most carbon markets, both compliance and voluntary, is poor liquidity. This has a significant negative impact on the carbon price. Take China's newly launched national carbon market as an example: with the exception of the first day, where trading volume reached over 4m tons, trading volume has been very low and reached as low as less than 100 tons on a few days. A key reason for the low trading volume is the lack of participants.

While carbon offsets can be bought directly from project developers, most buyers purchase from brokers. Transactions are also done on a project-by-project basis, which is time consuming. Transparency of the voluntary market is currently low with limited information on pricing and project quality, discouraging participation from many buyers. In addition, more frequent transactions or larger transacted volume from buyers will also drive demand for more efficiency and cost-effective market practice.

Trading volume of voluntary carbon market



Source: Ecosystem Marketplace, DBS
** including trading volume in Chicago Climate Exchange*

The latest report from Ecosystem Marketplace showed that the voluntary carbon market set a record high in both market volume and value in the first eight months in 2021, driven by corporate net-zero ambition and growing interest in carbon markets to achieve Paris climate goals. As shown in the chart, the strong momentum in growth in trading volume in 2020 has carried on to 2021, where 239Mt of CO_2 was already achieved in 8M2021, compared with 188Mt in 2020. The jump in market size is stronger from US$473m in 2020 to US$748m in 8M2021, implying an over 24% increase in average carbon price per Mt during the same period. It is even more encouraging that the growing interest does not just come from corporate for their net-zero strategy, but also from speculators or traders.

The market is now moving towards more standardisation and taking the form of traditional commodities. For instance, a higher threshold standard on additionality will be adopted to ensure real emission reductions. Project risk will be assessed and rated so that buyers are aware of the potential downside. Establishment of post-trade infrastructure, such as clearing houses, is also important for the development of a future market and to provide counterparty default protection. It also helps promote transparency of market data. The adoption of advanced technology for verification and remote monitoring (particularly for nature-based projects) will ensure faster progress, more accurate measurement, and no carbon leakage[6]. All these will enhance confidence in the market and encourage traditional institutions including banks, to participate. As carbon credit is getting the form of a commodity, interest from traditional commodity trading firms will also increase. Market liquidity will improve, reflecting the true underlying value of carbon.

What are the risks?

Regulatory changes and political risk

Although many countries have already made their carbon reduction pledges, details of related policies are yet to be ironed out. The implementation of these policies can result in only a few carbon projects being able to meet the regulatory criteria or additionality test; hence change the supply of carbon credit for the voluntary market.

While the initiatives by the market stakeholders to standardise market practice are mostly welcome, more rules and regulations are likely to be revised as the voluntary carbon market evolves and develops. The ongoing negotiations on the Article 6 under the Paris Agreement, which regulates the international transaction of carbon market, have also created uncertainty for credit buyers, possibly slowing down project implementation. In addition, there are a lot of legacy credits in the CDM system, where prices are much lower than the credits in the voluntary market. The validity of these CDM credits for country-level compliance could weaken governments' efforts in achieving nationally determined contributions and increase global emission. These will also indirectly affect demand in the voluntary market.

Price volatility

Like any other commodities, carbon credit prices are determined by demand and supply. Market manipulation or speculations could cause immediate distortion in demand and supply, resulting in swings in prices. This risk will be higher at the early stage of market development. However, as the market grows with higher transaction volume, market manipulation will be more difficult.

Execution risk

Direct purchase of carbon credit from project developers allows credit buyers to have deeper engagement and control over the project with better understanding of the project's quality. Transaction costs can also be avoided. However, project sourcing is difficult and time-consuming. Buyers will also be subject to delivery risk, as project lead time is usually long.

[6] *Please refer to Appendix III for more information.*

Another purchasing option is brokers, retailers, or carbon exchanges, which will be responsible for project identification, project quality evaluation, documentations, etc. A wide range of projects and projects are usually available. Execution of the transaction will be relatively quick and easy at a relatively higher cost. Buyers will also find it harder to obtain information to evaluate the project quality and to know whether the carbon credits fit the purpose or climate strategy of the buyers.

What have Asian energy companies done in the carbon market?

Generally speaking, relatively more corporates from western countries have net zero commitment with higher participation in the voluntary carbon market. Most Asian energy companies place their priority in the compliance market to fulfil their obligations in carbon emission under their domestic legal regimes. However, increasing pressure from investors, regulators, and customers will prompt these companies to set net zero targets. In the long run, they will follow the steps of their western counterparts and buy more carbon credits in the voluntary markets to offset residual emissions.

China/Hong Kong

China: gaining experience in the compliance market

China has eight regional compliance carbon trading platforms and the national carbon market kick-started in July 2021. Although China's independent power producers (IPPs) have limited exposure to voluntary carbon trading, they gained experience trading in these compliance markets. Companies such as China Resources Power (CR Power) (836 HK), Datang Power (991 HK), China Power (2380 HK), and China Longyuan (916 HK) have all established dedicated carbon asset management functions. These functions include capacity building, trading, and calculation/allocation of emission quotas, among others. CR Power is also increasing efforts on developing Chinese Certified Emission Reduction[7] (CCER) units. In 2019, CR Power arranged its sister company CR Snow Breweries to buy relatively low-cost CCER units. Datang Power bought 630,000 tons of pilot carbon allowances and completed 610,000 tons of SWAP transactions of carbon emissions.

Snapshot of Big Three's carbon neutral strategy

PetroChina

To have oil, gas, and green energies each account for a third of its portfolio by 2035.

Adding renewable projects - geothermal, wind power, and solar power, and other alternative projects totalled 3.5m tonnes of standard coal equivalent per year in 2021. Another 350k tonnes of standard coal equivalent projects under construction.

Other efforts by PetroChina include the construction of hydrogen refuelling stations and research and development of carbon capture and storage.

Sinopec

Plan to spend Rmb30bn on hydrogen energy by 2025:

1) To add hydrogen refuelling facility at up to 1,000 of its service stations in China;

2) To produce >1m tpa of green hydrogen (from renewable energy sources) by 2025. First green hydrogen plant in the city of Ordos in Inner Mongolia will come online in 2022 with intial production of 10k tpa hydrogen.

Diversify its renewable operations in the solar, wind power, and biomass sectors. It plans to build 2GW each of solar and wind power in 2021-25, including 400MW of distributed solar power installations at 7,000 retail sites

CNOOC

Target to spend 5-10% of capex on new energy sector over the next years.

First offshore windfarm commenced in end 2020; plan to grow renewable capacity to 5-10GW by 2025 from current installed installed offshore windfarm capacity of approx. 1.5GW as of end Aug-2021

Source: Companies, DBS

The three major Chinese national oil companies (NOCs)—Petrochina (857 HK), Sinopec (386 HK), and CNOOC (883 HK) — have all strengthened their climate ambitions. PetroChina aims to achieve near-zero emissions by 2050 and intends to peak its carbon emissions by 2025. Sinopec also aims to peak its carbon emissions by 2025 and to achieve carbon neutrality by 2050. CNOOC plans to reduce its GHG emissions by 16% between 2020 and 2025 and aims to peak its carbon emissions before 2030 and achieve carbon neutrality before 2060. They have laid out a roadmap in their clean energy transformation (as illustrated in the table). In addition, with the establishment of carbon credit platforms, they have also participated in the carbon trading market to meet the carbon reduction goals.

[7] *Please refer to Appendix III for more information.*

During the launch of the Shanghai Carbon Trading market in July-2021, over 30 subsidiaries under the big three - consisting of mainly the power generation, refining and petrochemical businesses - were included in the first batch of participants. It was reported that 10 of the 30 companies under Petrochina and Sinopec had transacted carbon credit in July-2021. For instance, on the first trading day, four Sinopec subsidiaries purchased 210,000 Mt of emission credits under the regular trading scheme. Subsequently, it made the first bulk trade (>100,000 Mt) on the new national exchange, purchasing 100,000 Mt of carbon credits from China Resources Group to offset emissions from its own power plants.

Hong Kong: shifting to renewable energy to sell carbon credits

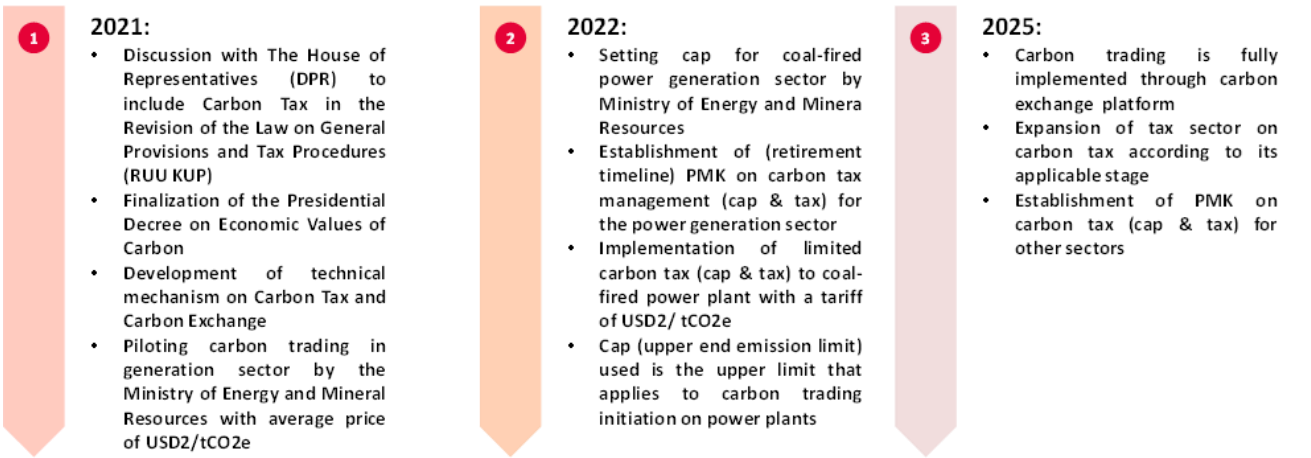
Hong Kong does not have any carbon trading system, but Hong Kong energy companies are active in voluntary carbon trading. For instance, CLP (2 HK) has renewable energy projects from which it derives carbon credits. It also launched its Smart Energy Connect (SEC) digital solutions platform to sell these credits. Most credits available for sale are derived from its wind projects in India. Wah Kwong, a Hong Kong-based shipping company, and Pacific Basin Shipping Ltd. (2343 HK) bought carbon credits from CLP before. In Sep-21, CLP released its Climate Vision 2050 Targets. The company committed to achieving net-zero greenhouse gas emissions by 2050. CLP also committed to an interim target to phase out coal-based assets in phases by 2040. Should CLP be unable to reduce emissions by 2050, any residual GHG emissions will be addressed through the purchasing of offset credits. In Australia, CLP's wholly owned subsidiary EnergyAustralia allows residential customers to opt-in and fully offset the carbon emissions associated with their usage at no added cost. EnergyAustralia will calculate emissions associated with household usage of customers and purchase corresponding carbon offsets to cancel out the emissions. EnergyAustralia also has a similar programme for business customers to offset their emissions for a flat fee.

Indonesia

Through 'cap and trade scheme' in 2025

Compliance carbon trading – Indonesia carbon trading will start with the coal-fired power plant (PLTU) operator. In order to achieve zero emission by 2058 and peak emission by 2040, Indonesia will set 2025 as the year of carbon trading via the carbon trading exchange platform and will be widening the implementation to other industries beyond the PLTU such as agriculture, waste management, and forestry.

Indonesia: carbon trading and tax implementation timeline



Source: PLN , MEMR, DBS HK

Indonesia also proposes the energy transition mechanism scheme where a Carbon Reduction Fund will be formed to take over the existing PLTU from Indonesia Electricity Company (PLN) and Independent Power Plant via equity ownership scheme. This scheme will generate carbon credit that can be traded in the carbon market. Simultaneously, the government will also establish a Clean Energy Fund to help to finance the development of the renewable energy power plant post PLTU retirement.

Company strategy to cope with carbon trading

- Internal financing strategy for coal mining business. PT. Adaro Energy Tbk. (ADRO IJ) fund raising via issuing bonds amounted US$750m will be the last fund-raising window for its coal mining concession under Adaro Indonesia. Meanwhile, with net cash on the balance sheet, PT Indo Tambangraya Megah Tbk. (ITMG IJ) distributes generous cash dividend, allowing Banpu, the main shareholder, to reinvest the capital from ITMG's coal business into cleaner energy.

- Preserving the forest for future carbon trading potential. ADRO IJ holds a licence for utilisation of carbon absorption (Izin Usaha Pemanfaatan Penyerapan, dan/atau Penyimpanan Karbon, IUP PAN/RAB Karbon), which enables ADRO to participate in carbon trading. Once operational, ADRO via PT Hutan Amanah Lestari will be the largest license holder for the green forest reserves for carbon storage/absorption in Indonesia. Meanwhile, ITMG is still internally assessing its forest reserves potential before the carbon trading officially start in the next three years.

- Early coal-fired power plant retirement scheme. Despite Adaro Power will commence its 2x1,000 MW PLTU next year namely Bhimasena Power Indonesia, it also welcomes the early retirement scheme and is willing to switch to renewable energy before the phase out period of its PLTU. In particular, if the term is favorable for the super-critical power plant which emit less carbon emission and consume coal more efficiently. Medco Power Indonesia (MPI) the power generator subsidiary of PT Medco Energi Internasional (MEDC IJ) sticks to renewable energy, mainly geothermal and solar PV, on top of its gas-fired power plant. The strategic partnership with Kansai Power to develop gas-fired power plants for nickel and copper smelting operation has demonstrated MPI's no thermal coal commitment. It also allows less carbon footprints across the value chain.

Thailand

Voluntary Emission Trading Scheme kicked in 2015

Thailand's experience of carbon market mechanisms began in 2007, when the government established the Thailand Greenhouse Gas Management Organization (Public Organization) or TGO to implement and manage GHG emissions projects. The public body launched two programmes in 2013:

- The Thailand Voluntary Emission Reduction programme, a baseline and credit programme. By 2020, it had 191 registered projects that are due to reduce emissions by 5.28 Mt CO_2-eq annually.
- The Thailand Carbon Offsetting Program. It encourages public and private organisations to calculate their carbon footprint and buy carbon credits to offset their unavoidable emissions.

In 2015, TGO launched the Thailand Voluntary Emission Trading Scheme (V-ETS) after six years of preparation. It is designed to serve as a pilot, setting up the infrastructure to develop a national emission trading system and identify gaps and opportunities. Thailand has benefited from the pilot trading scheme in various ways: in addition to gaining valuable knowledge and capacity on carbon markets, it now has the legal framework to establish an effective emission trading system.

Thailand V-ETS is one of the GHG mitigation mechanisms developed by TGO to promote GHG reduction implementation under the domestic voluntary carbon market and to design the Measurement, Reporting, and Verification or MRV System in accordance with the international standard, ISO 14064-1, 14064-3, and 14065.

In the fiscal years 2015–2017, TGO developed the pilot project of "Thailand Voluntary Emissions Trading System" Phase 1 (covering 3 years) and continued to conduct Phase 2 from 2018 to 2020 (covering 3 years), which aims to develop, test, and improve the MRV system, operation regulations, and trading platform for the GHG emissions-intensive industrial sectors appropriate for the Thai context. The project implementation results show that there are 55 pilot plants from 10 industrial sectors, comprising Petrochemical, Cement, Iron and Steel, Pulp and Paper, Food and Beverage (sub-sectors; instant food, animal feed, sugar, and beverage) Plastic, Refinery, Glass, Ceramic, and Textile.

Aim for carbon neutrality by 2030

Given increasingly concern over Environment, Social, and Governance (ESG) and sustainability from investors, regulators, and consumers, most of Thailand's energy listed companies under our coverages are aiming to achieve carbon neutrality by 2030. This includes i) improving operational efficiency by using less energy sources and/or increasing proportion of renewable energy, ii) increasing environmentally friendly and recyclable products such as petroleum products under EURO5 standard, biochemical, and recycling chemical products, and iii) promoting the use of electric vehicles (EV) to reduce carbon emission.

Appendix I: How does carbon trading work in a voluntary market?

Project Developer
Carbon credit / offset projects include renewable energy, forestry, energy efficiency improvement, carbon capture, etc.

Validation
Projects are validated by an ISO accredited third party.

Verification and credit issuance
After verification, carbon credit will be issued by one of the carbon credit standards and registered in their registries. These credits will be tracked to avoid double-counting or being claimed by more than one party.

Market intermediaries
Carbon credits can be sold to the market through market intermediaries, including traders, brokers and carbon exchanges.

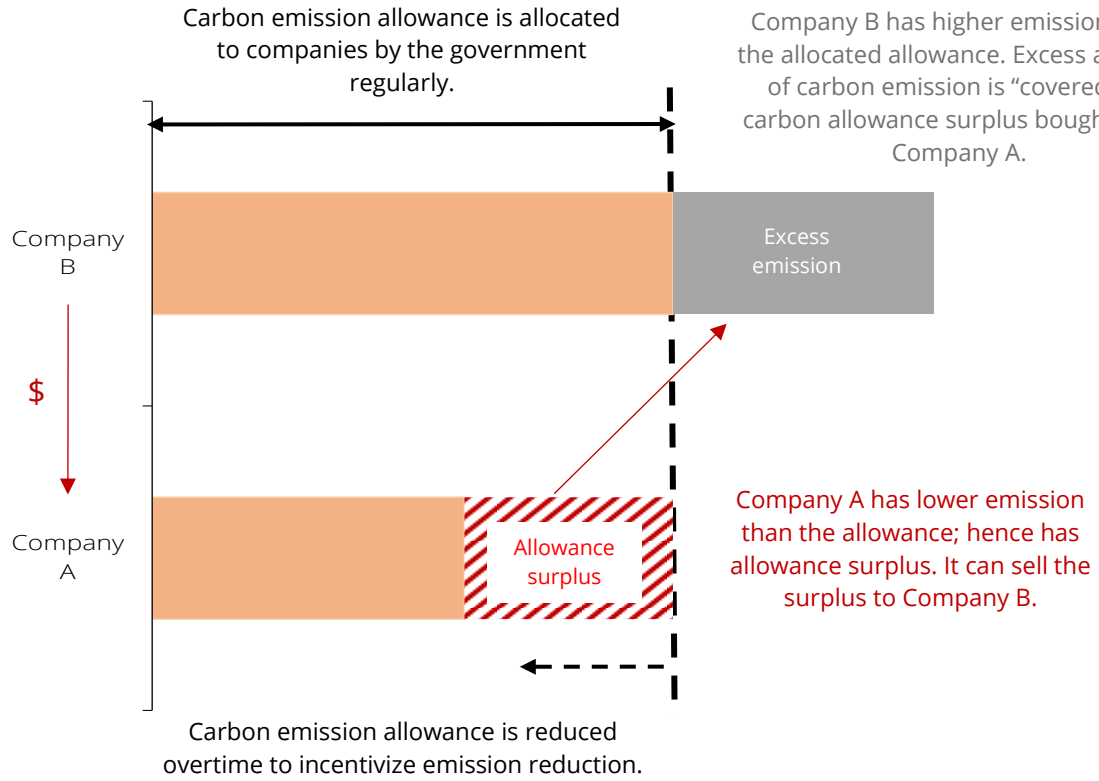
Buyer
Corporates and individuals, who want to reduce their carbon emission, can buy carbon credits directly from project developers. They can also buy from traders or carbon exchanges.
These credits can be sold back to the market for trading.

Google
CATHAY PACIFIC
VISA
bp
DBS
Microsoft

Credit Retirement
Buyers can claim their carbon emission reduction after retiring the credits. After retirement, the credits cannot be traded anymore.

Source: DBS

Appendix II: How does carbon trading work in a compliance market?



Source: DBS

Appendix III: Glossary

Compliance vs Voluntary

Carbon trading markets can be categorised under compliance schemes and voluntary programmes. Compliance markets are legally binding mandatory emission trading schemes (ETS) and are regulated by national or regional carbon reduction regimes. In mandatory trading, emission allowance available each year typically are allocated by authorities and decline each year to achieve reduction in GHG emission. The world's first and largest so far compliance carbon trading market is the EU ETS.

Voluntary markets operate outside of compliance markets and allow regulated or non-regulated entities or individuals to participate on a voluntary basis. Note that carbon credits from voluntary markets are usually not allowed to fulfil demand in compliance markets.

Emission allowance/ Carbon offset / Carbon credit

Emission allowance is a tradable right that allows a company to emit a certain amount of carbon dioxide (CO_2) or an equivalent GHG, typically one metric tonne of CO_2 per emission allowance. Emission allowance is under the compliance market and is usually traded in an emission trading system.

Carbon offset refers to the actual reduction of CO_2 or an equivalent GHG, typically one metric tonne of CO_2 per carbon offset and is used to compensate for the carbon emission elsewhere. It usually results in the generation of carbon credit after verification. Thus, individuals or corporates can compensate for their carbon emission through the support of sustainable projects with carbon reduction.

Carbon credit is a tradable permit that allows a company to claim reduction of a certain amount of CO_2 or an equivalent GHG, typically one metric tonne of CO_2 per carbon credit. Carbon credits can be acquired directly from carbon reduction projects verified by ISO-accredited third-party verifiers, according to certain standards (such as Gold Standard and Verified Carbon Standard).

CDM/CER/VER/CCER

Countries with commitments under the Kyoto Protocol to limit or reduce GHG emissions must meet their targets primarily through national measures. These committed countries could also achieve part of their targets in other developing countries through the Clean Development Mechanism (CDM). Every tonne of carbon emissions avoided within a CDM project would result in a certified emission reduction (CER), or a claim in reduction of CO_2 or an equivalent GHG. CER can be upgraded to CER Gold if it meets the Gold Standard, where carbon reductions are real, verifiable as well as make a net-positive contribution to the economic, environmental, and social welfare of the domestic society.

Voluntary emission reduction (VER) is a carbon credit that is generated by carbon offsetting projects for the voluntary markets. Like CER, it can be upgraded to VER Gold if it meets the Gold Standard as the above.

Chinese Certified Emission Reduction (CCER) is the emission trading scheme in China. Currently, the registration for CCER projects is suspended.

Greenwashing

Greenwashing is a communication and marketing strategy in conveying a false impression or providing misleading information about a company's effort in becoming more environmentally friendly, in terms of carbon reduction, production of environmentally friendly products, etc.

If a project does not meet the additionality test, i.e., carbon reduction from that project would have been undertaken anyway without funding from the sale of credit, the buyers claim credit for being environmentally responsible but in fact are doing nothing to mitigate the climate change problem.

Carbon leakage

Carbon leakage refers to a situation where the carbon sequestered by one project is replaced by an increase in carbon emissions elsewhere.

DBS Bank, DBS HK, DBSVTH, DBSVI, recommendations are based on an Absolute Total Return* Rating system, defined as follows:
STRONG BUY (>20% total return over the next 3 months, with identifiable share price catalysts within this time frame)
BUY (>15% total return over the next 12 months for small caps, >10% for large caps)
HOLD (-10% to +15% total return over the next 12 months for small caps, -10% to +10% for large caps)
FULLY VALUED (negative total return, i.e., > -10% over the next 12 months)
SELL (negative total return of > -20% over the next 3 months, with identifiable share price catalysts within this time frame)

**Share price appreciation + dividends*

Completed Date: 26Oct 2021 14:33:08 (SGT)
Dissemination Date: 26 Oct 2021 14:48:40 (SGT)

Sources for all charts and tables are DBS Bank unless otherwise specified.

Please contact the primary analyst for valuation methodologies and assumptions associated with the covered companies or price targets.

Any assumptions made in this report that refers to commodities, are for the purposes of making forecasts for the company (or companies) mentioned herein. They are not to be construed as recommendations to trade in the physical commodity or in the futures contract relating to the commodity referred to in this report.

DBSVUSA, a US-registered broker-dealer, does not have its own investment banking or research department, has not participated in any public offering of securities as a manager or co-manager or in any other investment banking transaction in the past twelve months and does not engage in market-making.

ANALYST CERTIFICATION

The research analyst(s) primarily responsible for the content of this research report, in part or in whole, certifies that the views about the companies and their securities expressed in this report accurately reflect his/her personal views. The analyst(s) also certifies that no part of his/her compensation was, is, or will be, directly or indirectly, related to specific recommendations or views expressed in the report. The research analyst (s) primarily responsible for the content of this research report, in part or in whole, certifies that he or his associate[8] does not serve as an officer of the issuer or the new listing applicant (which includes in the case of a real estate investment trust, an officer of the management company of the real estate investment trust; and in the case of any other entity, an officer or its equivalent counterparty of the entity who is responsible for the management of the issuer or the new listing applicant) and the research analyst(s) primarily responsible for the content of this research report or his associate does not have financial interests[9] in relation to an issuer or a new listing applicant that the analyst reviews. DBS Group has procedures in place to eliminate, avoid and manage any potential conflicts of interests that may arise in connection with the production of research reports. The research analyst(s) responsible for this report operates as part of a separate and independent team to the investment banking function of the DBS Group and procedures are in place to ensure that confidential information held by either the research or investment banking function is handled appropriately. There is no direct link of DBS Group's compensation to any specific investment banking function of the DBS Group.

COMPANY-SPECIFIC / REGULATORY DISCLOSURES

1. DBS Bank Ltd, DBS HK, DBS Vickers Securities (Singapore) Pte Ltd ("DBSVS") or their subsidiaries and/or other affiliates have proprietary positions in China Resources Power, China Longyuan Power, PetroChina, China Petroleum & Chem, CNOOC Ltd, CLP Holdings, Adaro Energy, Indo Tambangraya Megah, Cathay Pacific, recommended in this report as of 30 Sep 2021.

2. Neither DBS Bank Ltd nor DBS HK market makes in equity securities of the issuer(s) or company(ies) mentioned in this Research Report.

Compensation for investment banking services:

3. DBS Bank Ltd, DBS HK, DBSVS their subsidiaries and/or other affiliates of DBSVUSA have received compensation, within the past 12 months for investment banking services from Medco Energi Internasional as of 30 Sep 2021.

4. DBS Bank Ltd, DBS HK, DBSVS, their subsidiaries and/or other affiliates of DBSVUSA have managed or co-managed a public offering of securities for Medco Energi Internasional in the past 12 months, as of 30 Sep 2021.

5. DBSVUSA does not have its own investment banking or research department, nor has it participated in any public offering of securities as a manager or co-manager or in any other investment banking transaction in the past twelve months. Any US persons wishing to obtain further information, including any clarification on disclosures in this disclaimer, or to effect a transaction in any security discussed in this document should contact DBSVUSA exclusively.

Disclosure of previous investment recommendation produced:

6. DBS Bank Ltd, DBS Vickers Securities (Singapore) Pte Ltd ("DBSVS"), their subsidiaries and/or other affiliates may have published other investment recommendations in respect of the same securities / instruments recommended in this research report during the preceding 12 months. Please contact the primary analyst listed on page 1 of this report to view previous investment recommendations published by DBS Bank Ltd, DBS Vickers Securities (Singapore) Pte Ltd ("DBSVS"), their subsidiaries and/or other affiliates in the preceding 12 months.

[8] An associate is defined as (i) the spouse, or any minor child (natural or adopted) or minor step-child, of the analyst; (ii) the trustee of a trust of which the analyst, his spouse, minor child (natural or adopted) or minor step-child, is a beneficiary or discretionary object; or (iii) another person accustomed or obliged to act in accordance with the directions or instructions of the analyst.

[9] Financial interest is defined as interests that are commonly known financial interest, such as investment in the securities in respect of an issuer or a new listing applicant, or financial accommodation arrangement between the issuer or the new listing applicant and the firm or analysis. This term does not include commercial lending conducted at arm's length, or investments in any collective investment scheme other than an issuer or new listing applicant notwithstanding the fact that the scheme has investments in securities in respect of an issuer or a new listing applicant.

RESTRICTIONS ON DISTRIBUTION

General	This report is not directed to, or intended for distribution to or use by, any person or entity who is a citizen or resident of or located in any locality, state, country or other jurisdiction where such distribution, publication, availability or use would be contrary to law or regulation.
Australia	This report is being distributed in Australia by DBS Bank Ltd, DBS Vickers Securities (Singapore) Pte Ltd ("DBSVS") or DBSV HK. DBS Bank Ltd holds Australian Financial Services Licence no. 475946. DBS Bank Ltd, DBSVS and DBSV HK are exempted from the requirement to hold an Australian Financial Services Licence under the Corporation Act 2001 ("CA") in respect of financial services provided to the recipients. Both DBS and DBSVS are regulated by the Monetary Authority of Singapore under the laws of Singapore, and DBSV HK is regulated by the Hong Kong Securities and Futures Commission under the laws of Hong Kong, which differ from Australian laws. Distribution of this report is intended only for "wholesale investors" within the meaning of the CA.
Hong Kong	This report is being distributed in Hong Kong by DBS Bank Ltd, DBS Bank (Hong Kong) Limited and DBS Vickers (Hong Kong) Limited, all of which are registered with or licensed by the Hong Kong Securities and Futures Commission to carry out the regulated activity of advising on securities. DBS Bank Ltd., Hong Kong Branch is a limited liability company incorporated in Singapore. This report has been prepared by a person(s) who is not licensed by the Hong Kong Securities and Futures Commission to carry on the regulated activity of advising on securities in Hong Kong pursuant to the Securities and Futures Ordinance (Chapter 571 of the Laws of Hong Kong). This report is being distributed in Hong Kong and is attributable to DBS Bank (Hong Kong) Limited ("DBS HK"), a registered institution registered with the Hong Kong Securities and Futures Commission to carry on the regulated activity of advising on securities pursuant to the Securities and Futures Ordinance (Chapter 571 of the Laws of Hong Kong). DBS Bank Ltd., Hong Kong Branch is a limited liability company incorporated in Singapore. This report has been prepared by an entity(ies) which is not licensed by the Hong Kong Securities and Futures Commission to carry on the regulated activity of advising on securities pursuant to the Securities and Futures Ordinance (Chapter 571 of the Laws of Hong Kong). This report is being distributed in Hong Kong and is attributable to DBS Bank (Hong Kong) Limited, a registered institution registered with the Hong Kong Securities and Futures Commission to carry on the regulated activity of advising on securities pursuant to the Securities and Futures Ordinance (Chapter 571 of the Laws of Hong Kong). DBS Bank Ltd., Hong Kong Branch is a limited liability company incorporated in Singapore. For any query regarding the materials herein, please contact Carol Wu (Reg No. AH8283) at dbsvhk@dbs.com
Indonesia	This report is being distributed in Indonesia by PT DBS Vickers Sekuritas Indonesia.
Malaysia	This report is distributed in Malaysia by AllianceDBS Research Sdn Bhd ("ADBSR"). Recipients of this report, received from ADBSR are to contact the undersigned at 603-2604 3333 in respect of any matters arising from or in connection with this report. In addition to the General Disclosure/Disclaimer found at the preceding page, recipients of this report are advised that ADBSR (the preparer of this report), its holding company Alliance Investment Bank Berhad, their respective connected and associated corporations, affiliates, their directors, officers, employees, agents and parties related or associated with any of them may have positions in, and may effect transactions in the securities mentioned herein and may also perform or seek to perform broking, investment banking/corporate advisory and other services for the subject companies. They may also have received compensation and/or seek to obtain compensation for broking, investment banking/corporate advisory and other services from the subject companies.  Wong Ming Tek, Executive Director, ADBSR

Singapore	This report is distributed in Singapore by DBS Bank Ltd (Company Regn. No. 196800306E) or DBSVS (Company Regn No. 198600294G), both of which are Exempt Financial Advisers as defined in the Financial Advisers Act and regulated by the Monetary Authority of Singapore. DBS Bank Ltd and/or DBSVS, may distribute reports produced by its respective foreign entities, affiliates or other foreign research houses pursuant to an arrangement under Regulation 32C of the Financial Advisers Regulations. Where the report is distributed in Singapore to a person who is not an Accredited Investor, Expert Investor or an Institutional Investor, DBS Bank Ltd accepts legal responsibility for the contents of the report to such persons only to the extent required by law. Singapore recipients should contact DBS Bank Ltd at 6327 2288 for matters arising from, or in connection with the report.
Thailand	This report is being distributed in Thailand by DBS Vickers Securities (Thailand) Co Ltd.
United Kingdom	This report is produced by DBS Bank Ltd which is regulated by the Monetary Authority of Singapore. This report is disseminated in the United Kingdom by DBS Vickers Securities (UK) Ltd, ("DBSVUK"). DBSVUK is authorised and regulated by the Financial Conduct Authority in the United Kingdom. In respect of the United Kingdom, this report is solely intended for the clients of DBSVUK, its respective connected and associated corporations and affiliates only and no part of this document may be (i) copied, photocopied or duplicated in any form or by any means or (ii) redistributed without the prior written consent of DBSVUK. This communication is directed at persons having professional experience in matters relating to investments. Any investment activity following from this communication will only be engaged in with such persons. Persons who do not have professional experience in matters relating to investments should not rely on this communication.
Dubai International Financial Centre	This research report is being distributed by DBS Bank Ltd., (DIFC Branch) having its office at units 608 - 610, 6th Floor, Gate Precinct Building 5, PO Box 506538, DIFC, Dubai, United Arab Emirates. DBS Bank Ltd., (DIFC Branch) is regulated by The Dubai Financial Services Authority. This research report is intended only for professional clients (as defined in the DFSA rulebook) and no other person may act upon it.
United Arab Emirates	This report is provided by DBS Bank Ltd (Company Regn. No. 196800306E) which is an Exempt Financial Adviser as defined in the Financial Advisers Act and regulated by the Monetary Authority of Singapore. This report is for information purposes only and should not be relied upon or acted on by the recipient or considered as a solicitation or inducement to buy or sell any financial product. It does not constitute a personal recommendation or take into account the particular investment objectives, financial situation, or needs of individual clients. You should contact your relationship manager or investment adviser if you need advice on the merits of buying, selling or holding a particular investment. You should note that the information in this report may be out of date and it is not represented or warranted to be accurate, timely or complete. This report or any portion thereof may not be reprinted, sold or redistributed without our written consent.
United States	This report was prepared by DBS Bank Ltd. DBSVUSA did not participate in its preparation. The research analyst(s) named on this report are not registered as research analysts with FINRA and are not associated persons of DBSVUSA. The research analyst(s) are not subject to FINRA Rule 2241 restrictions on analyst compensation, communications with a subject company, public appearances and trading securities held by a research analyst. This report is being distributed in the United States by DBSVUSA, which accepts responsibility for its contents. This report may only be distributed to Major U.S. Institutional Investors (as defined in SEC Rule 15a-6) and to such other institutional investors and qualified persons as DBSVUSA may authorize. Any U.S. person receiving this report who wishes to effect transactions in any securities referred to herein should contact DBSVUSA directly and not its affiliate.
Other jurisdictions	In any other jurisdictions, except if otherwise restricted by laws or regulations, this report is intended only for qualified, professional, institutional or sophisticated investors as defined in the laws and regulations of such jurisdictions.

DBS Regional Research Offices

HONG KONG
DBS (Hong Kong) Ltd
Contact: Carol Wu
13th Floor One Island East,
18 Westlands Road,
Quarry Bay, Hong Kong
Tel: 852 3668 4181
Fax: 852 2521 1812
e-mail: dbsvhk@dbs.com

MALAYSIA
AllianceDBS Research Sdn Bhd
Contact: Wong Ming Tek
19th Floor, Menara Multi-Purpose,
Capital Square,
8 Jalan Munshi Abdullah 50100
Kuala Lumpur, Malaysia.
Tel.: 603 2604 3333
Fax: 603 2604 3921
e-mail: general@alliancedbs.com
Co. Regn No. 198401015984 (128540-U)

SINGAPORE
DBS Bank Ltd
Contact: Janice Chua
12 Marina Boulevard,
Marina Bay Financial Centre Tower 3
Singapore 018982
Tel: 65 6878 8888
e-mail: groupresearch@dbs.com
Company Regn. No. 196800306E

THAILAND
DBS Vickers Securities (Thailand) Co Ltd
Contact: Chanpen Sirithanarattanakul
989 Siam Piwat Tower Building,
9th, 14th-15th Floor
Rama 1 Road, Pathumwan,
Bangkok Thailand 10330
Tel. 66 2 857 7831
Fax: 66 2 658 1269
e-mail: research@th.dbs.com
Company Regn. No 0105539127012
Securities and Exchange Commission, Thailand

INDONESIA
PT DBS Vickers Sekuritas (Indonesia)
Contact: Maynard Priajaya Arif
DBS Bank Tower
Ciputra World 1, 32/F
Jl. Prof. Dr. Satrio Kav. 3-5
Jakarta 12940, Indonesia
Tel: 62 21 3003 4900
Fax: 6221 3003 4943
e-mail: indonesiaresearch@dbs.com