SEPTEMBER 19, 2022

2022 Carbon Credits Landscape

We see limited potential for carbon credits as a strategic allocation but remain constructive on the potential for impact investment.

Morningstar Equity Research

Madeline Hume, CFA
Senior Research Analyst

MORNINGSTAR®

Table of Contents

Overview: Carbon Credit Markets Have Experienced an Uptick in Interest 3

Pricing Carbon: Though Popular, Carbon Credits Are Out of Step With Energy Markets and Reduction Targets 7

Reducing Emissions: To Date, Only One Program Has Successfully Flexed Its Muscles 12

Opportunity: Few Compliance Markets Exhibit Robustness Needed to Make Consistent Forecasts 21

Outlook: Most Flaws Can Be Remedied Through Moderate Program Enhancements 25

What Are Carbon Markets?

Energy markets have attracted renewed attention in 2022 as gas prices and power bills have skyrocketed. Fossil fuels have enjoyed a renaissance as demand has surged in lockstep with reopening policies. Acute oil and natural gas shortages caused by persistent disinvestment (in the case of oil) and bad weather (in the case of natural gas) have compelled countries to reconsider energy sources they once spurned, like nuclear power and coal.

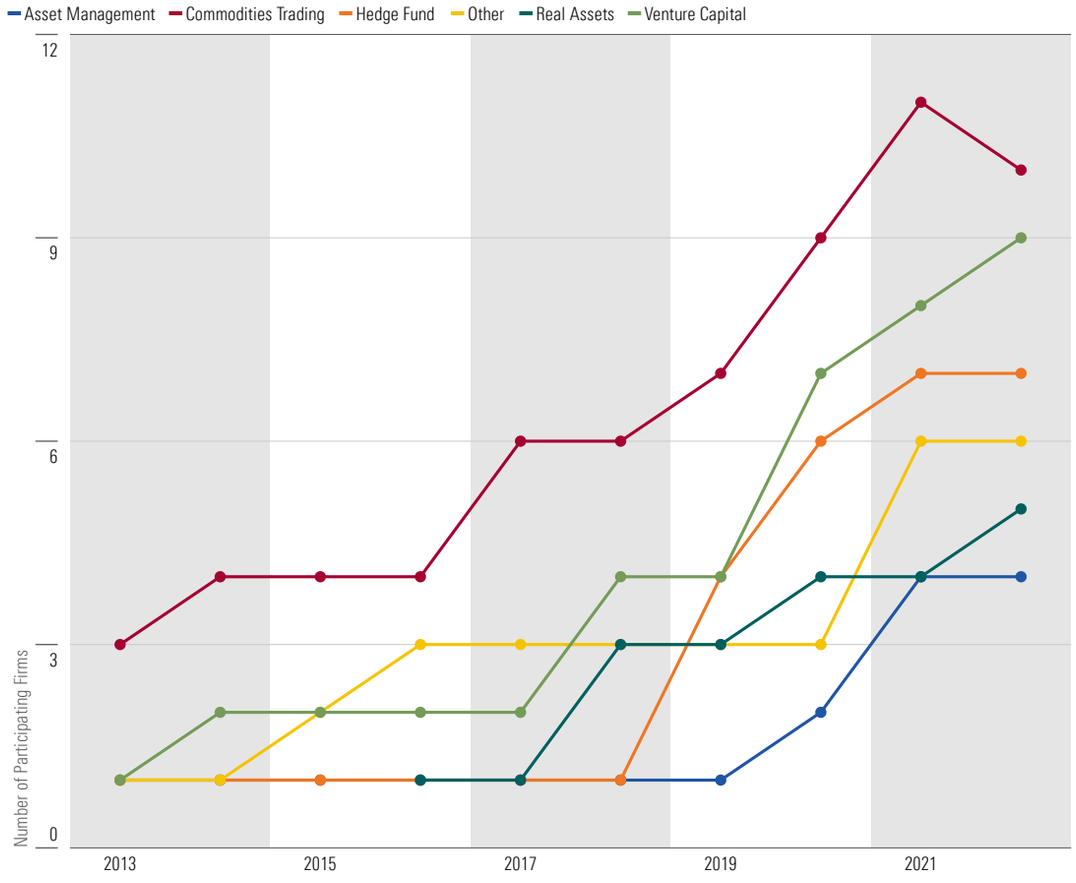
Some of these developments will leave the climate-conscious feeling squeamish. That's one potential reason that interest in a little-known pocket of the financial system, called carbon markets, has also kicked up in recent months.

For the uninitiated: Carbon markets are a nifty piece of financial engineering, economists' best stab at crafting a market-based solution to tackle climate change. They seek to price the future impact of today's industrial emissions on our planet's climate, transforming an implicit cost into an explicit one.

Although straightforward to explain, the instruments that trade on these platforms are tricky to value and exchange. Like the ultimate severity of climate change itself, the future cost to society of a given ton of carbon dioxide is still unknowable--and highly subjective.

There are two main methods, representing two schools of thought. Both markets' goal is to price a ton of carbon. The key difference is in how they're set up. Compliance markets require companies in certain sectors to purchase permits in order to pollute, like paying a toll to drive on an expressway. Meanwhile, voluntary markets function more like the indulgences of medieval Christianity, asking customers to pay retroactively for fossil fuels they have already torched.

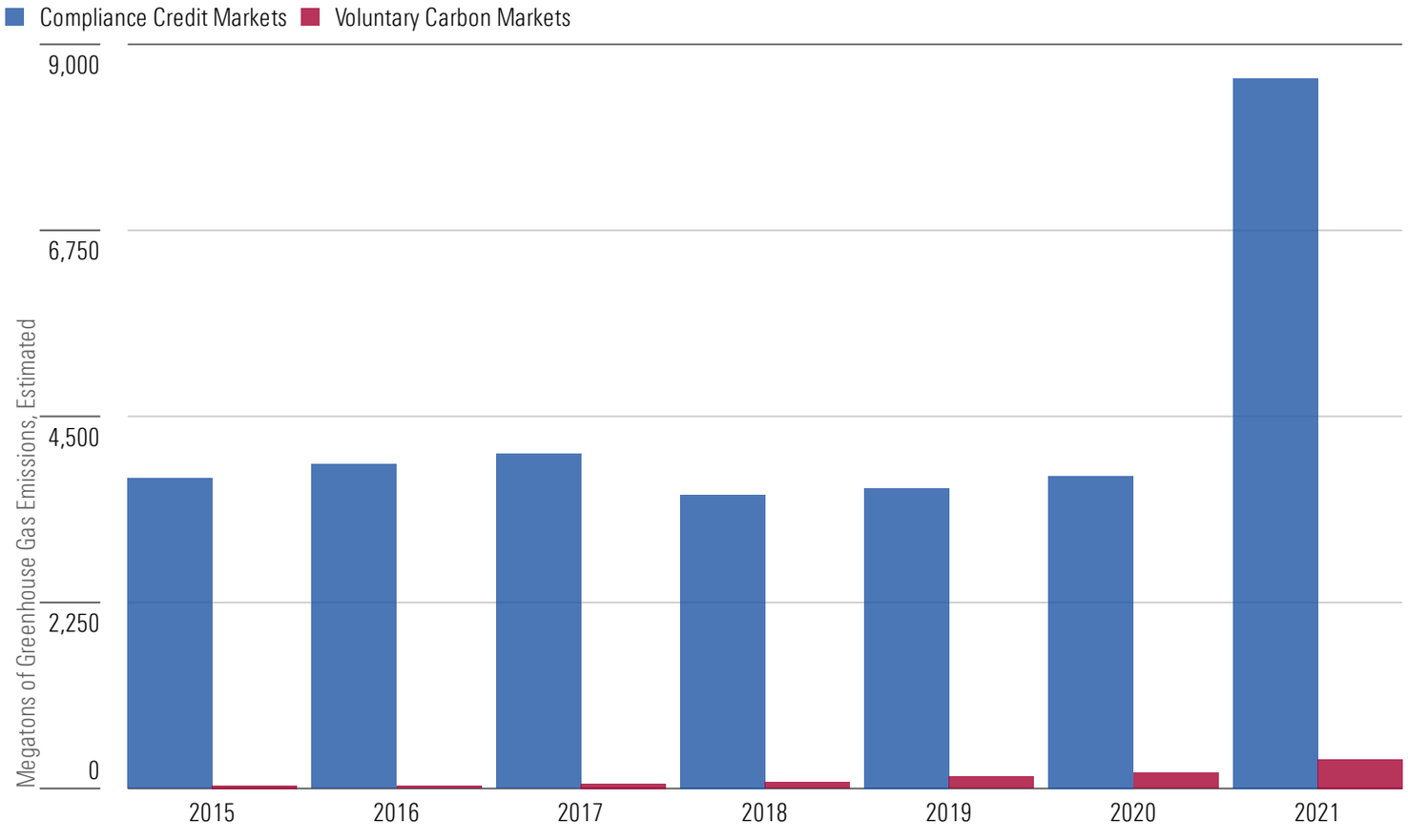
Growing Investor Appetite and High Returns Lure Firms to Carbon Markets



Source: Compliance Instrument Tracking System Service, Western Climate Initiative. Data as of July 2022.

Carbon Offsets Show Promise But Have Limited Reach

After China's Debut, Compliance Markets' Boom Outshines Voluntary Markets' Growth



Sources: World Bank Carbon Pricing Dashboard (WBCPD), Emissions Database for Global Atmospheric Research (EDGAR). Data as of April 2022, global emissions from 2015.

Carbon offsets, which trade on voluntary carbon markets, allow companies and individuals to counteract their expected or actual carbon emissions to meet self-imposed targets.

In order to offset historical emissions, voluntary carbon markets have to actively reduce the amount of carbon currently in the system. Using proceeds raised from carbon-offset sales, the nonprofits managing these programs bankroll renewable energy projects, which reduce future carbon emissions and land-use projects, which strip carbon out of the atmosphere. They may also purchase carbon credits from compliance markets, thereby removing them from circulation.

Voluntary markets gain traction by convincing individuals and companies to take accountability for their emissions, and so far, they have grown at a consistent 45% clip. But building consensus is slow going. According to the World Bank, carbon offsets canceled out just 352 megatons of CO2 equivalent in 2021. (We have stripped out carbon markets associated with the UN's Kyoto Protocol, as those are not strictly voluntary.)

Meanwhile, compliance markets cover more than 8,590 megatons of CO2 equivalents per year, making them the de facto pricing mechanism for carbon.

Compliance Carbon Markets Dominate Among Carbon Pricing Systems, Capturing the Focus of Our Report

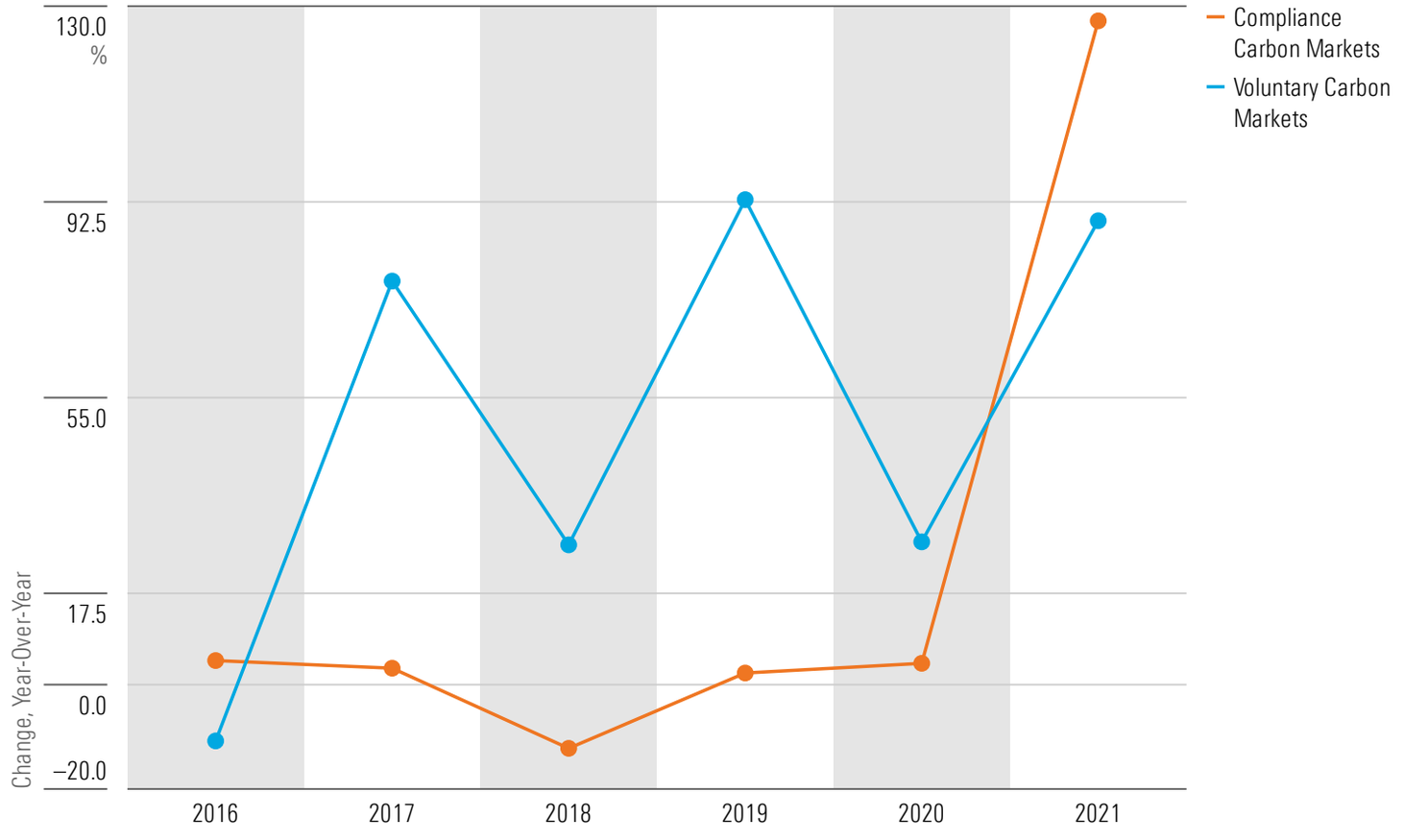
Unlike voluntary markets, compliance markets work through sheer regulatory muscle. This explains why adoption has been more widespread, but also lumpier, because compliance markets go live for an entire jurisdiction in one fell swoop, as with China in 2021.

Compliance market systems often get called "cap-and-trade" programs, because governments mandate that businesses in specified sectors keep carbon emissions under a particular ceiling, called a "cap." This cap may fluctuate but is expected to gradually decline over time.

Firms that pollute less than the government has budgeted can "trade" their excess carbon, in the form of carbon credits, on the open market. As a bonus, they get to pocket the proceeds from the sale. Companies that pollute more than they're allowed to have to buy extra credits, eating into their bottom line. Ideally, the buys and sells should wash out at an equilibrium price of carbon that keeps emissions at or under the cap.

The potential for second-order financial engineering in this market has attracted trading desks and asset managers alike. Compliance markets enjoy the lion's share of market depth and investor interest, so we narrow our focus to carbon credits in this report.

Easy Come, Easy Grow: Compliance Markets Expand Dramatically When New Programs Go Live



Sources: WBCPD, EDGAR. Data as of April 2022, global emissions from 2015.

Key Takeaways

- Seventeen percent of the world's 2021 carbon emissions were cap-and-trade regulated, with scheduled programs expected to contribute an additional 13% of the world's emissions.
- A carbon credit is a government-issued permission slip to burn fossil fuels, but surprisingly, we find that carbon credits don't respond predictably to fossil fuel price movements. Over the past five years, the European Union's carbon credit prices exhibit a beta to the markets of nonrenewable energy of roughly 0.3, on average.
- Over six-month rolling periods during the past five years, the EU's carbon credits moved with energy markets just as frequently as they moved against them.
- After these initial findings, we narrowed our focus to four nonoverlapping markets with at least three years of data. California, Quebec, the European Union, and South Korea placed best within our framework measuring maturity, depth, size, breadth, and investability.
- Proponents of an allocation to carbon credits may argue that low sensitivity to energy markets indicates that these programs are working as designed. Philosophically, carbon must get more expensive to emit to meet reduction targets. Therefore, carbon credits should steadily increase in value over time--regardless of how compelling fossil fuels may be.
- However, we find that even the most sophisticated cap-and-trade programs exert little control on how fast emissions fall, especially early on. Companies that reduce emissions faster than expected flood the market with cheap credits, introducing price volatility.
- The key challenge facing these programs is how to set the cap, or the acceptable rate of emissions abatement. Caps are determined through a blend of forecast emissions, which are at risk of misspecifying both how fast emissions are likely to diminish and the future impact on the climate of historical emissions.
- Supporting this theory, misspecifications have forced both California and the European Union to make major adjustments to their programs in the past three years, while South Korea has declined to make cap commitments beyond 2025.
- When considering these factors together, for a typical investor, we believe that an investment in a carbon credit represents an implicit bet on the robustness of its parent carbon market far more than it does an expression of the future cost to society of present emissions, and therefore it has limited merit as a strategic allocation.
- However, carbon credits may have merit for environmental, social, and governance investors looking to deploy capital in securities based on impact.

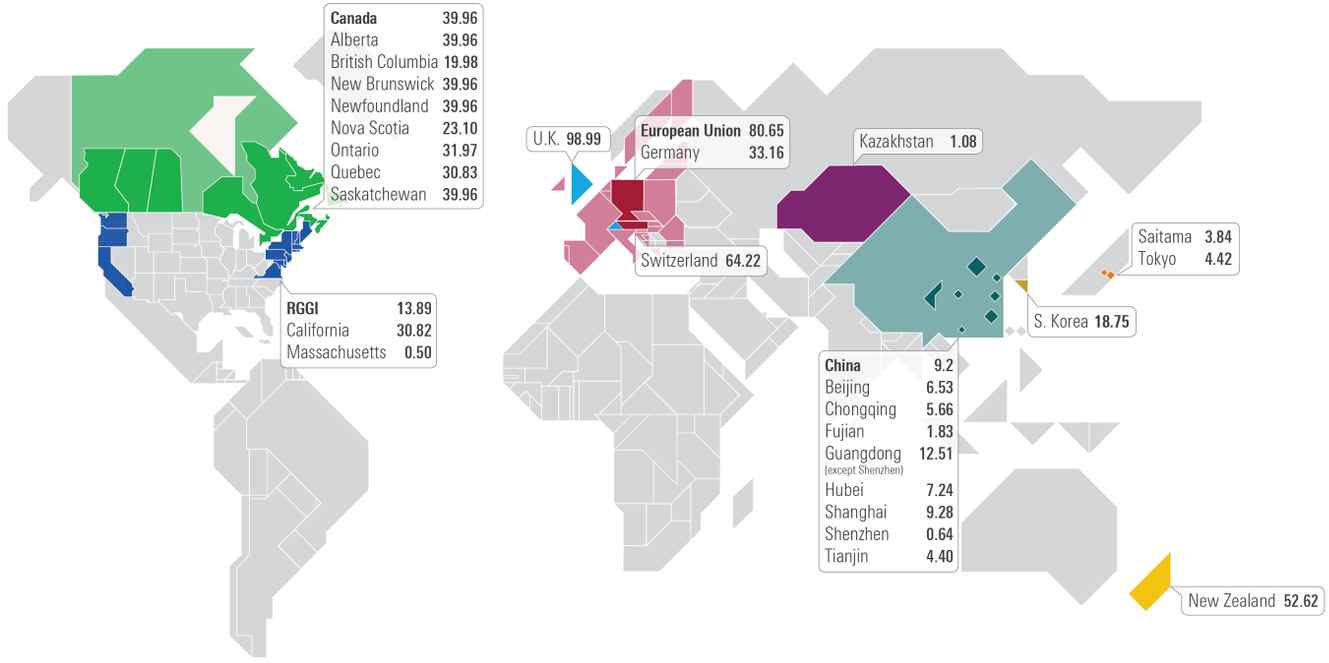
Pricing Carbon

Carbon credits have experienced soaring popularity but remain out of step with energy markets and consensus estimates of carbon prices.

Cap-and-Trade Programs Grow in Prominence

Because of their flexibility, cap-and-trade programs have grown steadily in popularity since the inception of the European Union's inaugural program in 2005. As of December 2021, they now cover a record 17% of the world's greenhouse gas emissions globally. New programs still in development will cover countries responsible for an additional 13% of the world's emissions.

Globally, Emissions Trading Systems Now Cover More Than 17% of the World's Greenhouse Gas Emissions



Source: WBCPD. Data as of April 2022.

Russia-Ukraine Conflict Ignites Debate Over Price Trajectory of Carbon Credits

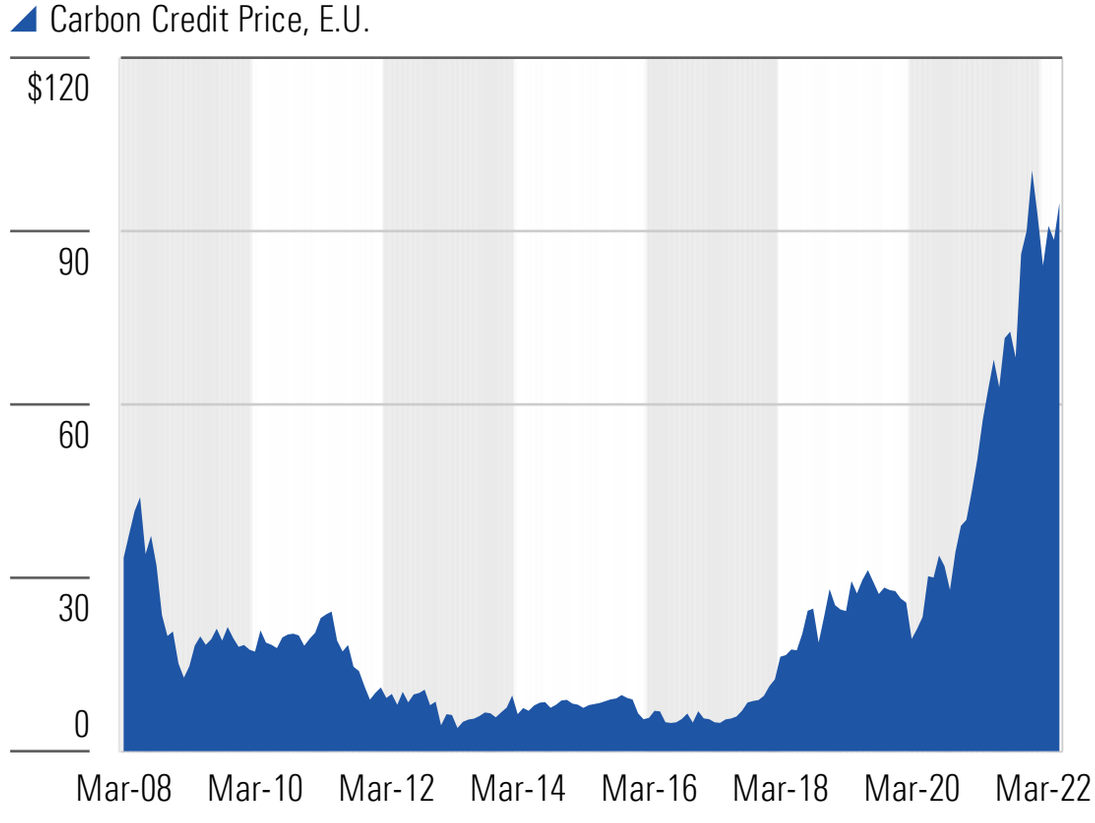
Carbon credit prices surged throughout 2021 and 2022 as an unusually long winter in Europe boosted demand for power, but forecasters speculate that trend may soon burn off. In response to a looming standoff with Russia over natural gas this winter, countries are bracing for biting power shortages and cautioning consumers to cut back. We concur that the cuts are likely to suppress demand but would argue that the balance of forces that determines carbon prices is more complex.

Under compliance markets, less-efficient fossil fuels such as coal require more credits to burn to get the same amount of power. If a regulated sector tilts its consumption mix toward less-carbon-efficient fare, all else equal, we expect an uptick in demand for carbon credits. Greater demand ushers in higher premiums, which act as a drag on the economic incentives to pollute.

There are twin forces at work in the current environment. Higher prices typically sap demand for energy overall, but the withdrawal of Russian natural gas would simultaneously tip the scales toward more carbon-intensive fuel sources like coal. (Under normal conditions, natural gas is the cheapest and greenest nonrenewable source of power; coal produces almost 79% more carbon per unit of energy, according to the Energy Information Administration.)

Like Rome, wind farms aren't built in a day. The acute short-term nature of this crisis makes it necessary to keep every megawatt of existing, albeit inefficient, energy production online despite the ugly economics. Even as demand tanks, carbon output may remain constant or even rise because the resources required to generate that power are less climate-friendly.

Increased Demand for Energy and Tightening Credit Supply Triggers Price Spike in the EU



Source: International Carbon Action Partnership (ICAP). Data as of July 2022.

Carbon Credits Don't Demonstrate Significant Sensitivity to Energy Markets

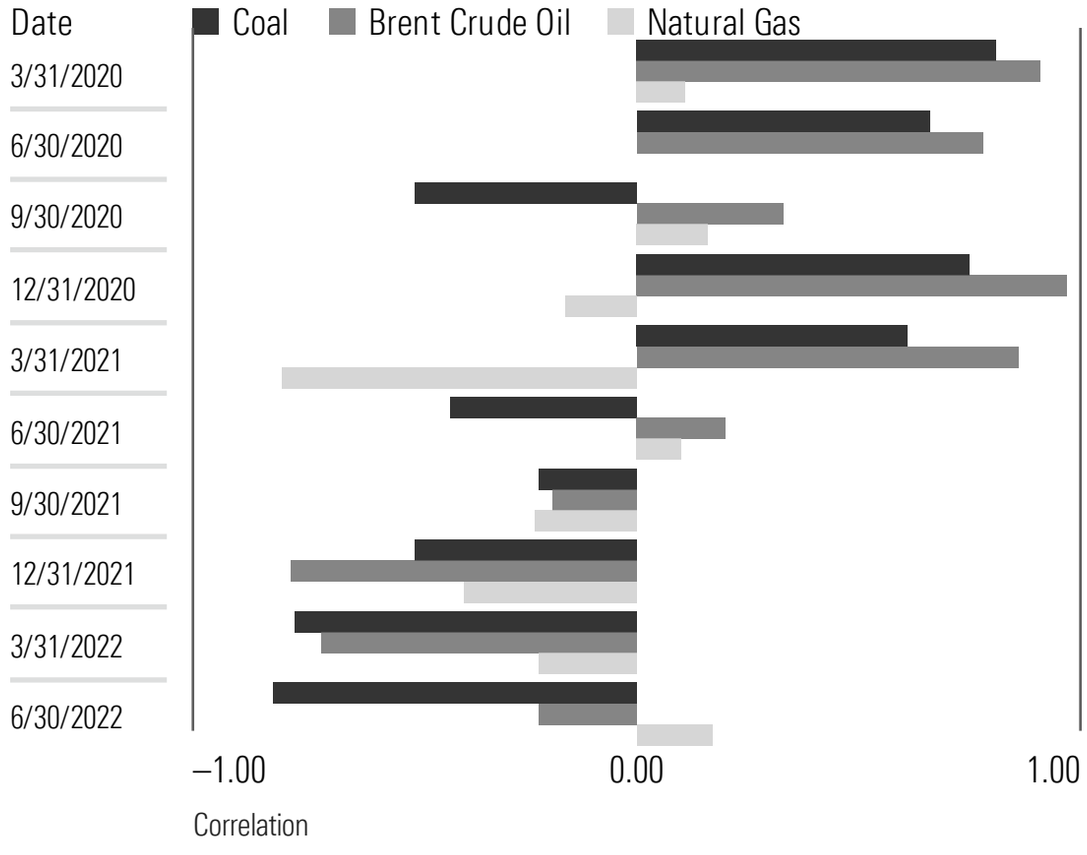
For now, the world is cozying back up to coal despite the soaring costs. Miners are the only umbrella salesman in this rainstorm. But as the pinch unwinds, we would expect that carbon credit prices theoretically should flow from consumption patterns. Because consumption typically perks up when fossil fuel prices fall, carbon credit prices should rise to counteract it, instigating a negative correlation pattern.

But in a compliance carbon market, "compliance" and "carbon" are equally important philosophical inputs. In this case, "carbon" can be thought of as the jurisdiction's energy split, which, as we just dissected, is optimized based on commodity prices and a jurisdiction's mix between them. That shapes demand. The other element is "compliance," or how much sway the government holds over the market, which primarily sets the supply.[1]

In an ideal world, a regulator would lay a steady path for carbon emissions to march down. Over time, the available supply of credits tapers, and the costs to pollute goes up, converging with the long-term theoretical cost of emissions needed to reach climate action goals. In an efficient market, financial institutions would bake that simple relationship into the present value of the security. That would leave fossil fuel demand as the primary driver of a carbon credit's price volatility.

But overall, energy prices pack less of a punch than we expected. In fact, the betas--which consider the level as well as the direction of return relationships--of the European-only S&P GSCI Carbon Emissions Allowances Index typically fall below 0.5 against the commodity markets that we surveyed. That's because over six-month rolling periods during the past five years, the EU's carbon credits actually moved with energy prices just as frequently as they moved against it.

European Carbon Credits Have Unstable Correlations to Fossil Fuel Prices

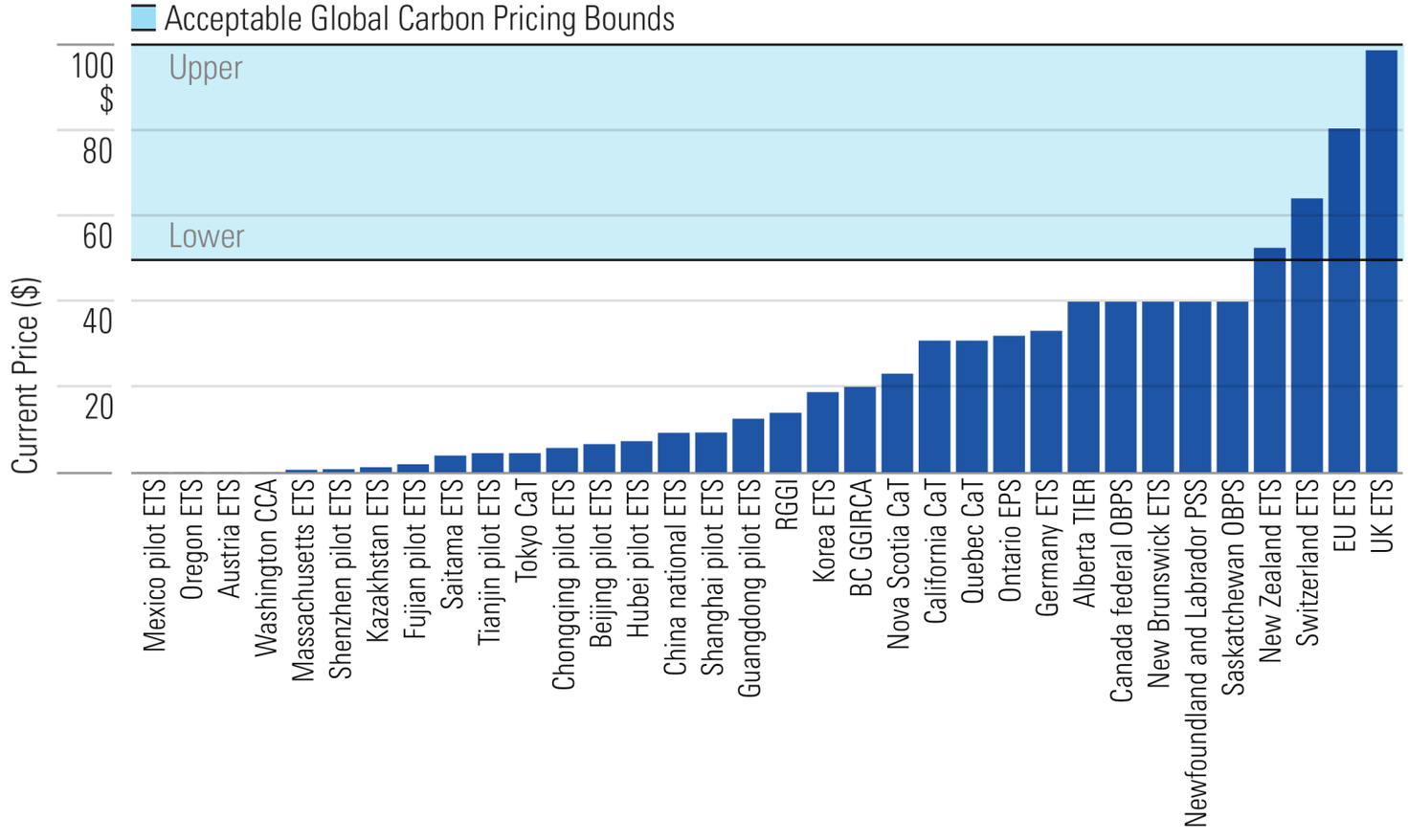


Source: Morningstar Direct. Data as of July 2022.

1 Technically, regulators can also influence demand by tinkering with the number of entities covered under the cap.

Flexibility Leaves These Markets Exposed to Political Shifts

Only Four Cap-and-Trade Programs Price Carbon at Levels That Meet Paris Climate Accord Targets



Source: WBCPD, High-Level Commission on Carbon Prices. Data as of April 2022.

Proponents of cap-and-trade programs may argue that low sensitivity to energy markets indicates that these programs are working as intended. Conceptually, carbon emissions have to get more expensive in order to meet reduction targets, and the price to pollute should climb over time regardless of activity in the energy sector. Indeed, declining supply does explain some of the EU's astonishing performance.

But most governments haven't matched the EU's commitment to climate. In contrast to individuals' peckish but steadily building appetite to offset their own carbon footprints, the political trade winds shaping cap-and-trade regimes are highly capricious.

Today, these forces are not consistent or robust enough to catch any sails. All but four existing programs fall short of the global carbon price threshold of $50-$100 necessary to keep global warming under 2 degrees Celsius in line with the Paris Climate Accord.

Instead, prices for carbon credits vary widely, from $1.08 in Kazakhstan to $98.99 in the U.K. Different regimes may have different methods for setting allowable emissions standards for regulated businesses, further limiting comparability.

Reducing Emissions

Compliance markets have mixed success at reducing emissions. Among the four we studied, only the EU has demonstrated clear success.

We Honed in on Four Programs for Deeper Analysis

California, Quebec, European Union, and South Korea Score Highest; Despite Highly Liquid Futures Market, RGGI Whiffs on Depth and Breadth of Emissions Covered

Initiative Name	Price ($, USD)	Overall Score	Maturity	Depth	Size	Breadth	Investability
California CaT*	30.82	4.0					
EU ETS	87.00	5.6					
Quebec CaT*	30.83	6.8					
Korea ETS	18.75	7.4					
New Zealand ETS	52.62	8.6					
Guangdong pilot ETS	12.51	9.4					
Alberta TIER	39.96	9.4					
Kazakhstan ETS	1.08	10.0					
Tianjin pilot ETS	4.40	10.2					
Shanghai pilot ETS	9.28	10.4					
Beijing pilot ETS	6.53	10.4					
Shenzhen pilot ETS	0.64	10.4					
RGGI	13.89	11.0					
Chongqing pilot ETS	5.66	12.0					
Fujian pilot ETS	1.83	12.2					
Tokyo CaT	4.42	12.8					
Nova Scotia CaT	23.10	13.0					
Hubei pilot ETS	7.24	13.2					
Switzerland ETS	64.22	14.0					
Saitama ETS	3.84	14.8					
Canada federal OBPS	39.96	16.6					
Newfoundland & Labrador PSS	39.96	17.6					
Saskatchewan OBPS	39.96	18.8					
BC GGIRCA	19.98	20.6					

Overall Score: 0.00–7.99; 8.00–15.99; 16.00–24.00

Variables: 0.00–6.86; 6.87–13.72; 13.73–20.60

Sources: WBCPD, Our World in Data. Data as of April 2022.

Given the low degree of comparability between programs and the lack of sensitivity to energy markets, one must look under the hood to understand carbon credits' effectiveness.

To that end, we decided to examine four markets more closely: California, the EU, Quebec, and South Korea. These four markets scored best on a five-pillar framework that we developed to assess nonoverlapping carbon markets that are more than three years old:

- Maturity
- Depth of emissions covered
- Size of market based on total emissions within the jurisdiction
- Breadth of sectors covered
- Investability of assets

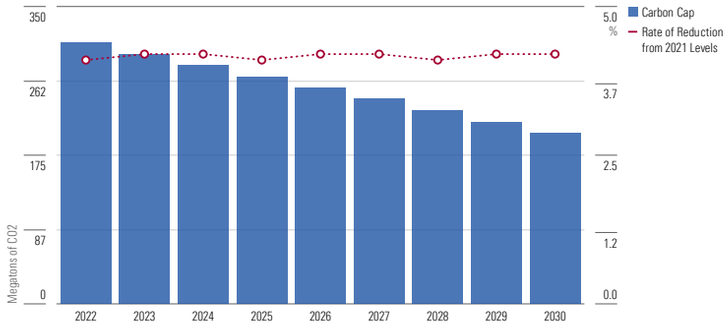
This subset allowed us to go deeper on the question of efficacy. It's a nuanced debate because efficacy can be measured in several different ways. Cap-and-trade programs have many use cases, including fostering innovation in climate technology and leveling the economic incentives between renewables and nonrenewables.

From our point of view, the most effective thing a cap-and-trade program can do on behalf of an investor is craft a price-discovery mechanism that makes carbon a comparable investment throughout time and across jurisdictions. This will discourage producers against investing additional capital in inefficient energy sources and over time should bring emissions within covered sectors to heel.

*The Quebec CaT has linked with the California CaT since 2014 under the Western Climate Initiative (WCI).

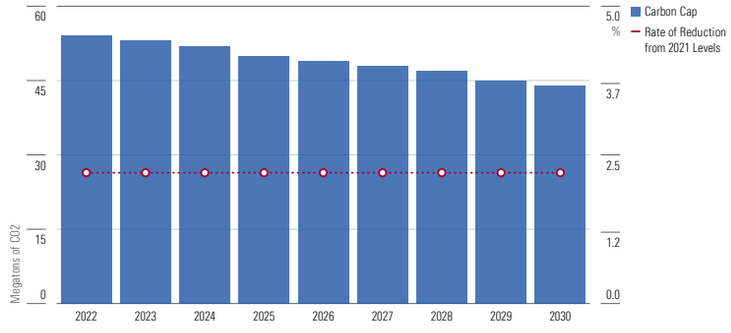
Top Four Programs Expect to Reduce Emissions by a Cumulative 24% Before the End of the Decade

California Has the Most Ambitious Targets



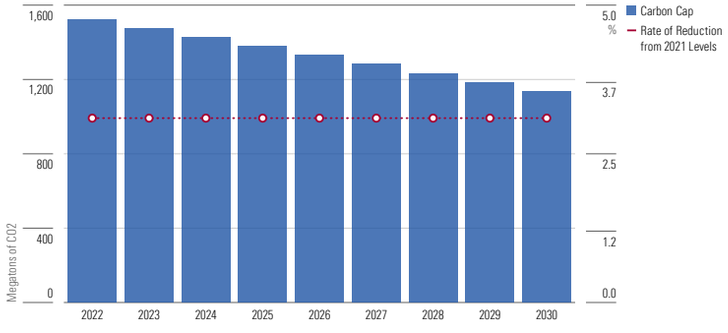
Source: ICAP. Data as of July 2022.

Quebec Belongs to California's Western Climate Initiative



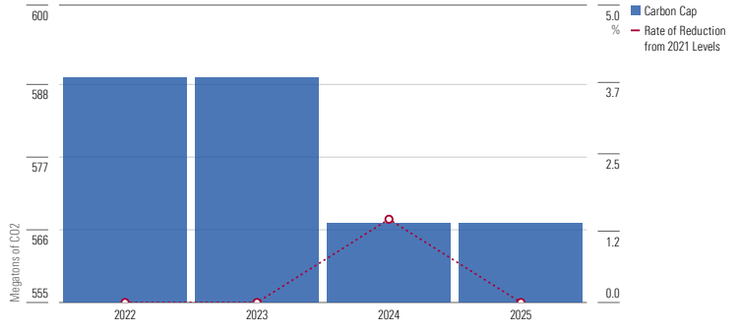
Source: ICAP. Data as of July 2022.

The EU Boasts the Oldest Carbon Credit Market



Source: ICAP. Data as of July 2022.

Newest South Korean Program Has a Phased Approach



Source: ICAP. Data as of July 2022.

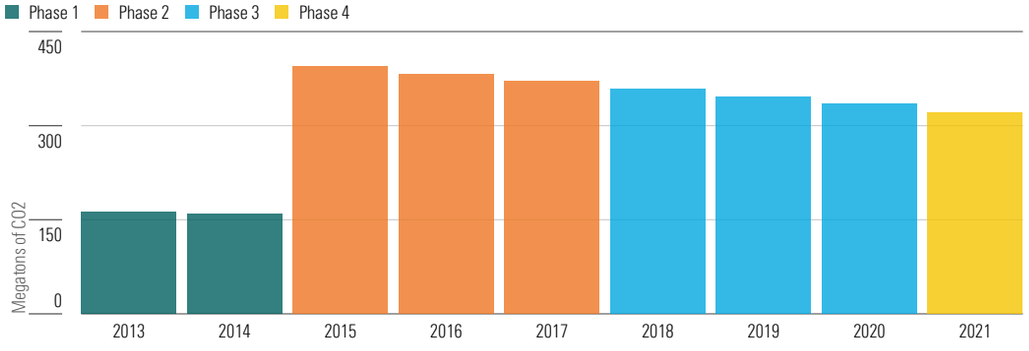
Cap-and-trade programs guide emissions in both implicit and explicit ways, but calibrating and enforcing the available supply of emissions credits, or the "cap," is the most visible tool. A forecast that reaches net-zero commitments often hinges on government projections of declining caps, which should suppress future emissions.

We project that together, the four programs showcased on the left would shave 24% off of their collective jurisdictions' 2021 emissions by the year 2030. Each takes a slightly different road to get there. Take the example of California and Quebec, partners in the Western Climate Initiative. The pair agrees on many of the nuts and bolts of running a cap-and-trade market, but they ratchet down their caps at different rates. California touts an aggressive 4% annual reduction, while Quebec reduces its cap more cautiously.

What all these programs have in common, though, is an implicit guarantee: absent regulator intervention, a winnowing cap will spur a rise in carbon prices as the jurisdiction draws near to its net-zero target date. California's Air and Resource Board recognizes that relationship explicitly, stipulating that "the purpose of the cap-and-trade program [is] to create a steadily increasing price signal." The wrinkle is that regulators can't seem to let their programs lie.

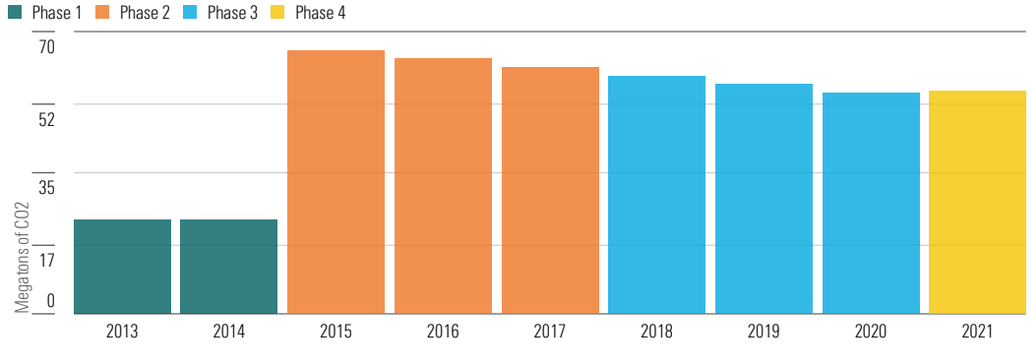
Regulators Often Tinker With Cap-and-Trade Programs, Limiting Comparability Through Time

California Expanded the Scope After an Initial Pilot Phase in 2013-14



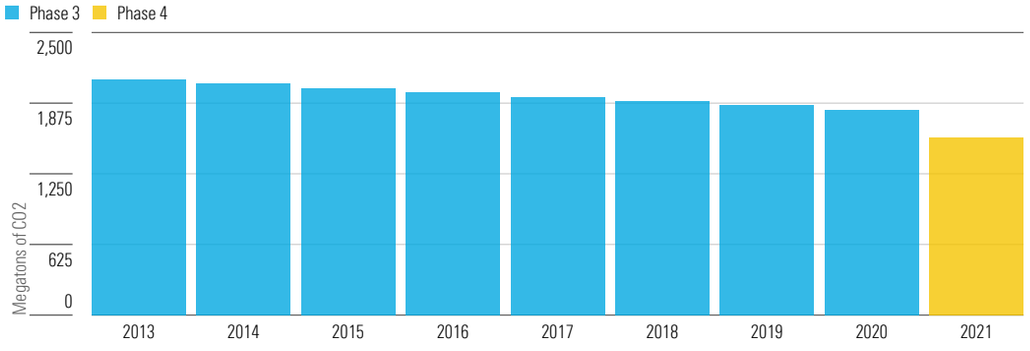
Source: ICAP. Data as of July 2022.

After Trial Period, Quebec Adopted California's Expansion to Include Fuel Distribution



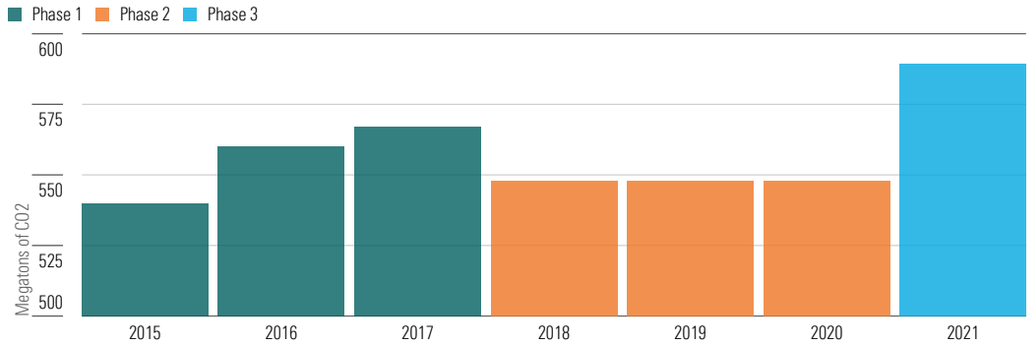
Source: ICAP. Data as of July 2022.

The Exception to the Rule, the EU Has the Most Experience in Setting Policy



Source: ICAP. Data as of July 2022.

South Korea Budgets for Emissions in Three-Year Intervals, Allowing for Variable Caps

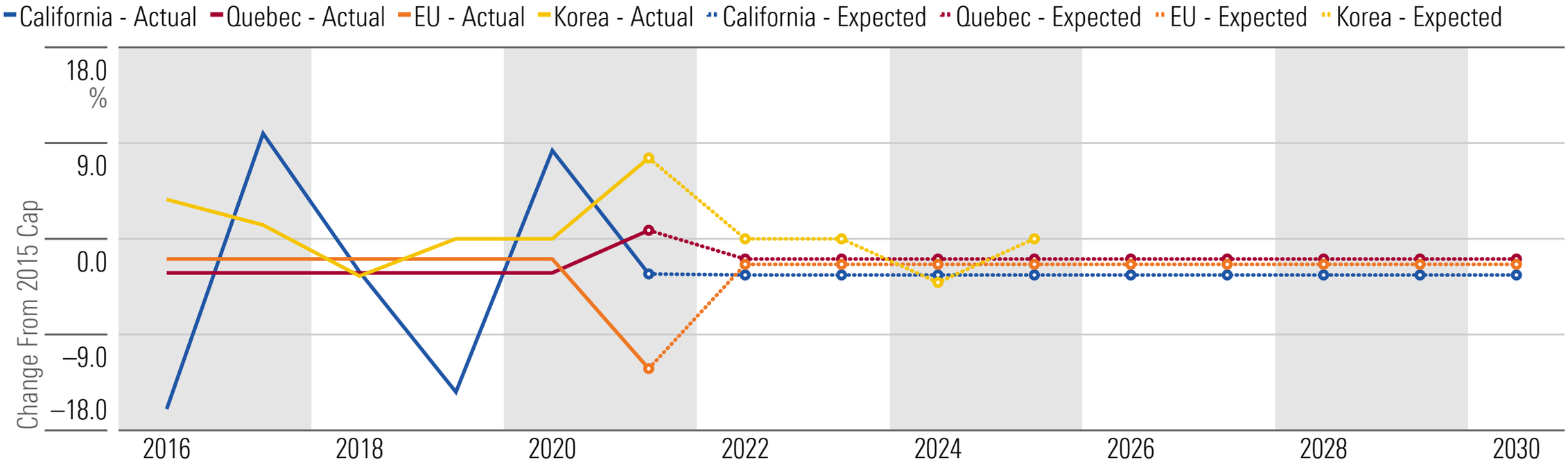


Source: ICAP. Data as of July 2022.

Frequent Adjustments Dim Confidence in the Trajectory of Carbon Prices

A consistent pattern of past cap fluctuations indicates that future emissions caps are likely to taper at a lumpier pace than targets promise--if at all. This has ramifications for the health of carbon credit markets as a medium of financial exchange. Methodological adjustments alter the supply of available credits and the rate of change year over year, making it more difficult for regulators--especially of immature programs--to exert consistent influence on the price of carbon or the contours of future emissions reductions.

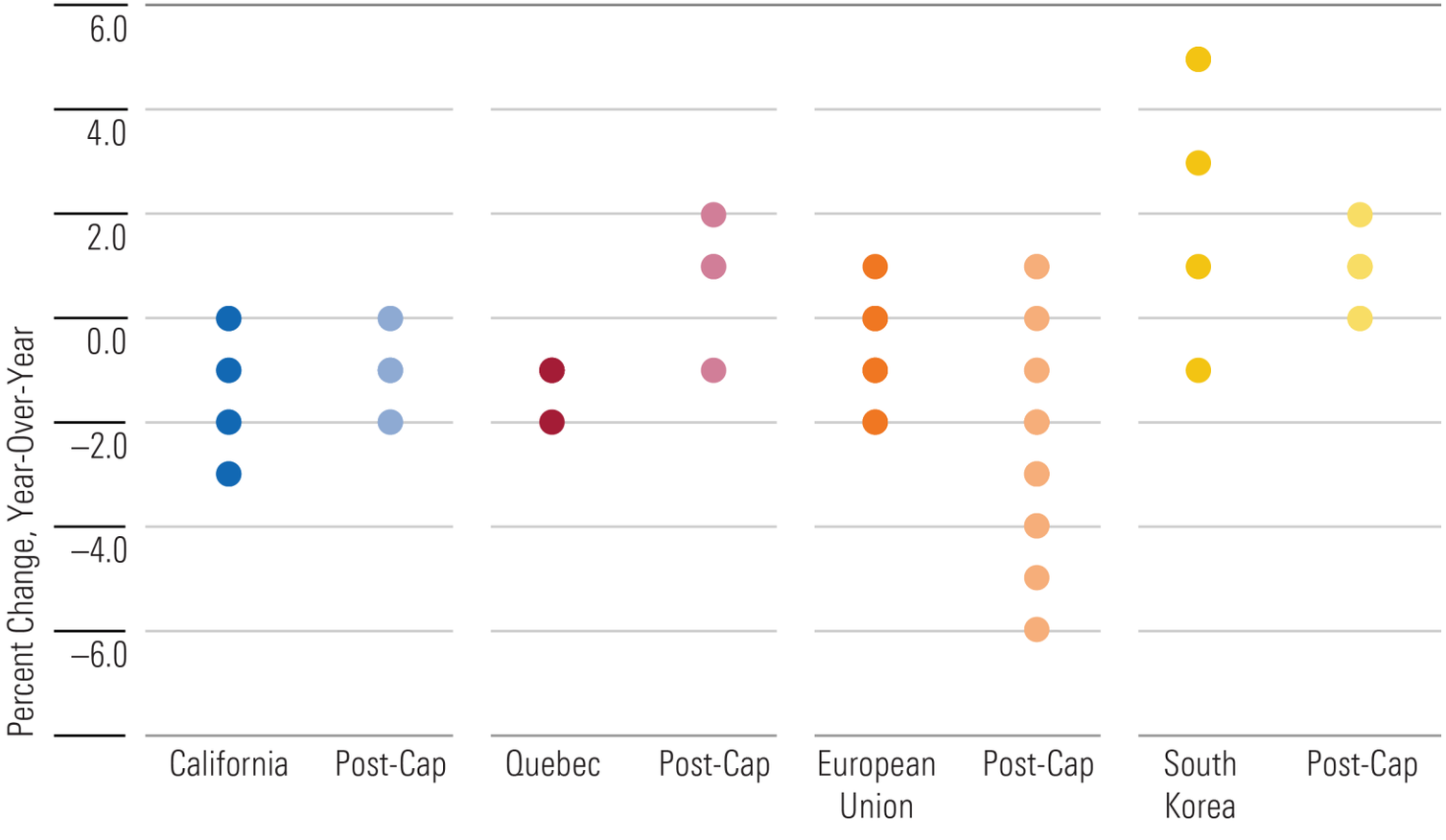
Annual Cap Changes Fluctuate More Than Forecasts Project



Source: ICAP. Data as of July 2022.

In Aggregate, Jurisdictions Respond Differently to Cap-and-Trade Implementation

European Union and South Korea Improve Average Pace of Emissions Abatement; California Reduces Variability But Still Runs Ahead of Schedule, Impeding Programs' Efforts



Sources: California Air Resources Board, Quebec Ministry of the Environment, European Environment Agency, and South Korea Emission Trading Registry System. Data as of July 2022.

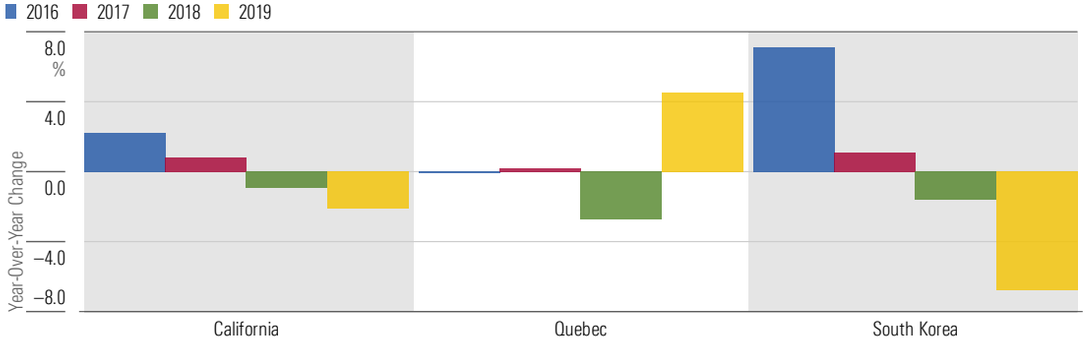
Regulators are aware of the consequences of program adjustments. So why do it anyway? So far, emissions in jurisdictions covered by cap-and-trade programs tend to reach targets earlier than forecast. When this happens, it allows energy producers and industrial firms to hoard credits, forcing regulators to restructure to preserve existing incentives--as California discovered when it hit its 2020 abatement targets four years ahead of schedule in 2016.

This has several implications. Most tangibly, it indicates that governments have a poor ability to forecast the path of carbon emissions in the short term. The problem could be tautological: Research suggests that cap-and-trade programs may entice the largest polluters to cut their carbon footprint at an accelerating pace relative to other firms that are also trimming emissions, thereby causing emissions across the jurisdiction to fall faster than projected.

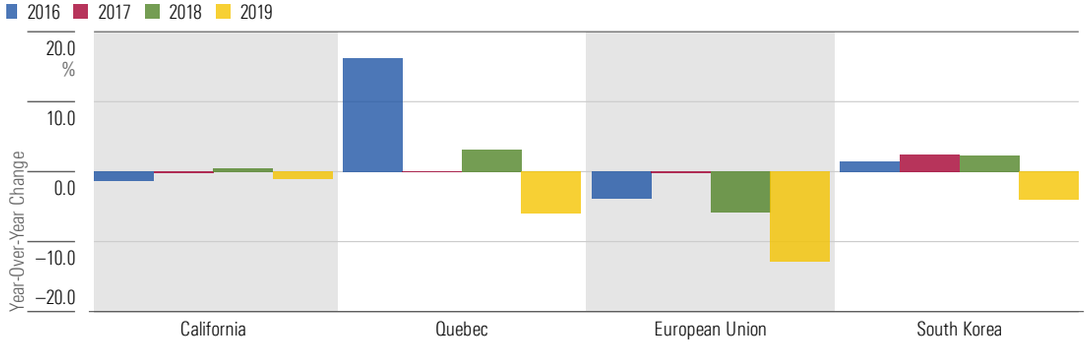
Regardless, it indicates that cap-and-trade programs don't have much influence on the exact pace of carbon reductions. While they may be effective at reducing emissions at a binary level, it's nearly as important to influence the rate at which firms abate emissions to prevent frequent disruptions and instill confidence in the resulting price signal.

Within Sectors, There's Mixed Evidence That Cap Reductions Have Influenced the Pace of Emissions Abatement

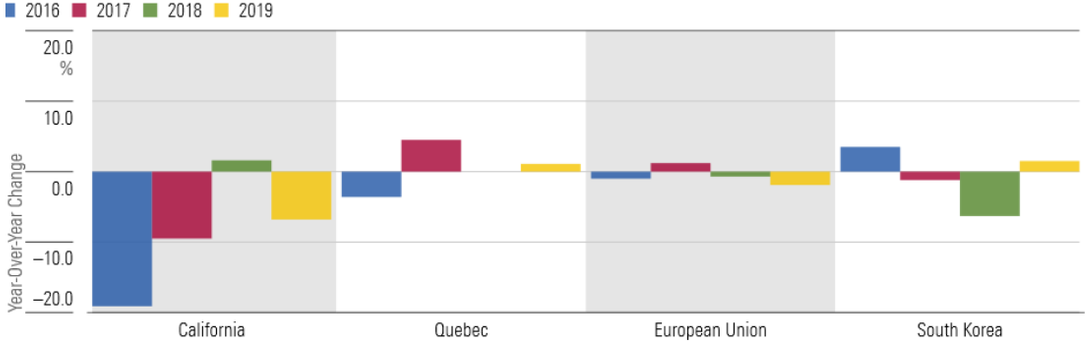
Companies in Building Sectors Have Slashed Carbon Emissions at Accelerating Rates



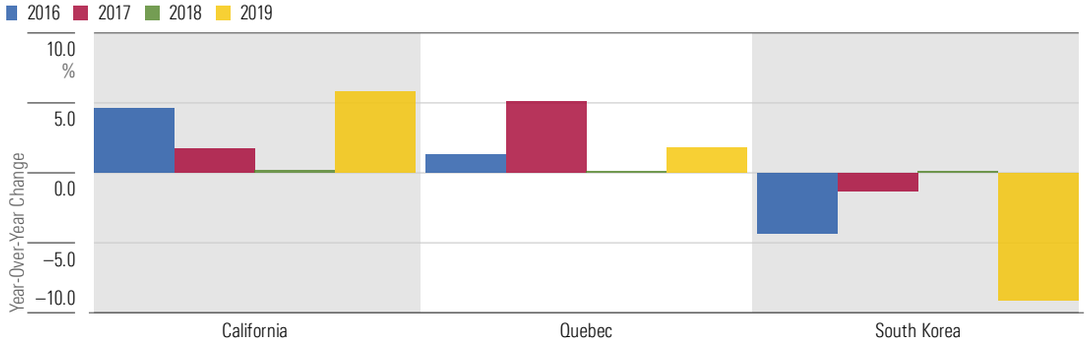
Californian and South Korean Power Plants Trend Flat, EU and Quebec Make Gains



Industrial Firms' Response to Cap-and-Trade Highly Dependent on Jurisdiction



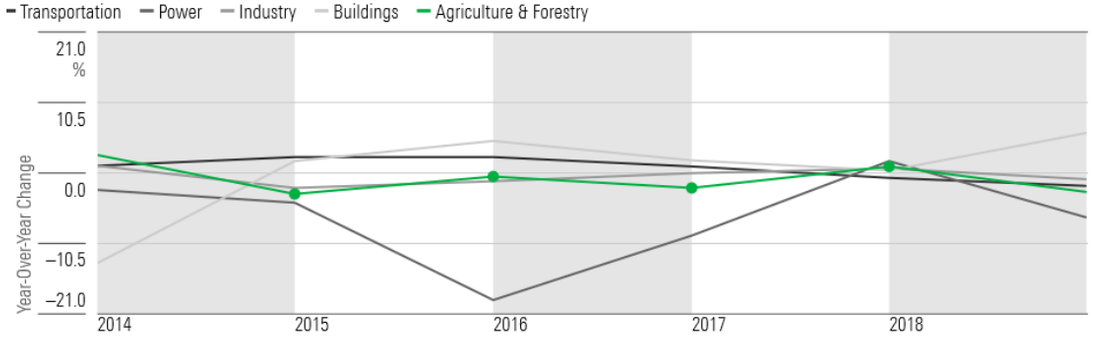
Cap-and-Trade Programs Exert Little Influence Over Transportation Emissions



Sources: California Air Resources Board, Quebec Ministry of the Environment, European Environment Agency, and South Korea Emission Trading Registry System. Data as of July 2022.

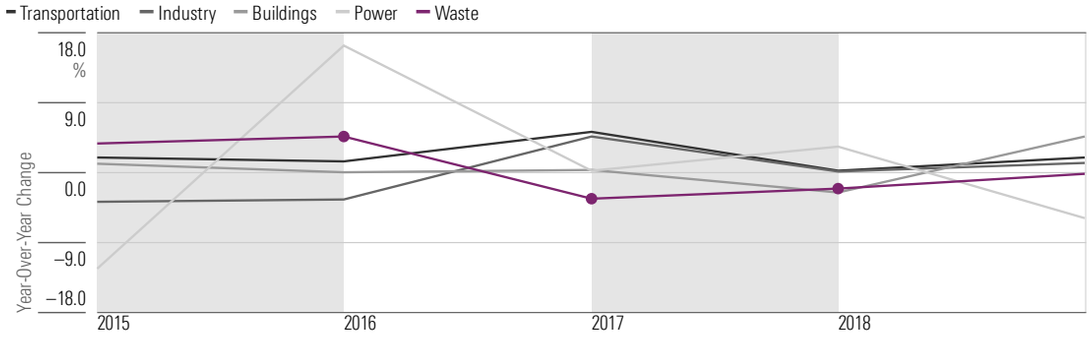
Meanwhile, Sectors Exempt From Cap-and-Trade Programs Have Reduced Emissions at Comparable Rates, Suggesting Other Abatement Policies Exert an Equal Level of Influence

California's Agriculture Sector Steadily Chips Away at Emissions



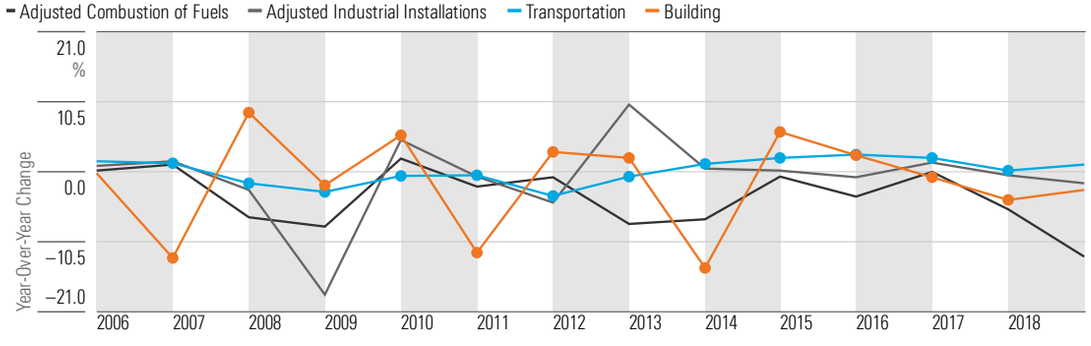
Source: California Air Resources Board. Data as of July 2022.

Quebec's Waste Sector Has Consistently Reduced Emissions Since 2017



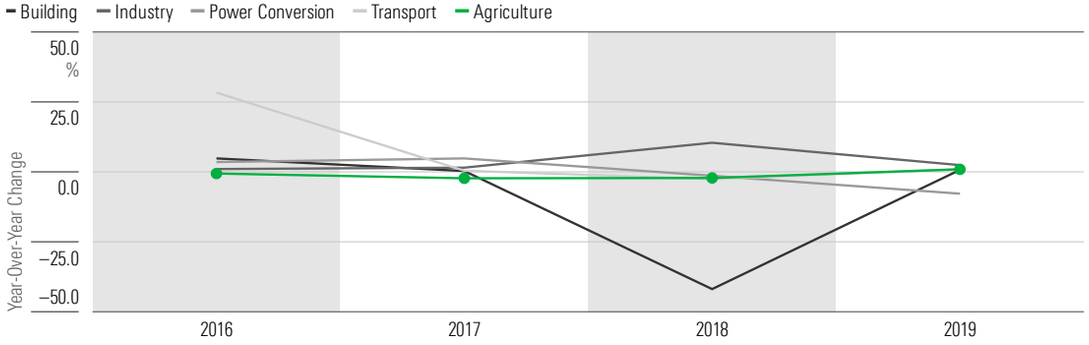
Source: Quebec Ministry of the Environment. Data as of July 2022.

EU's Building and Transportation Sectors Bounce Around But Color Within the Lines



Source: European Environment Agency. Data as of July 2022.

South Korea's Agriculture Sector Reduces Emissions at Most Predictable Rate



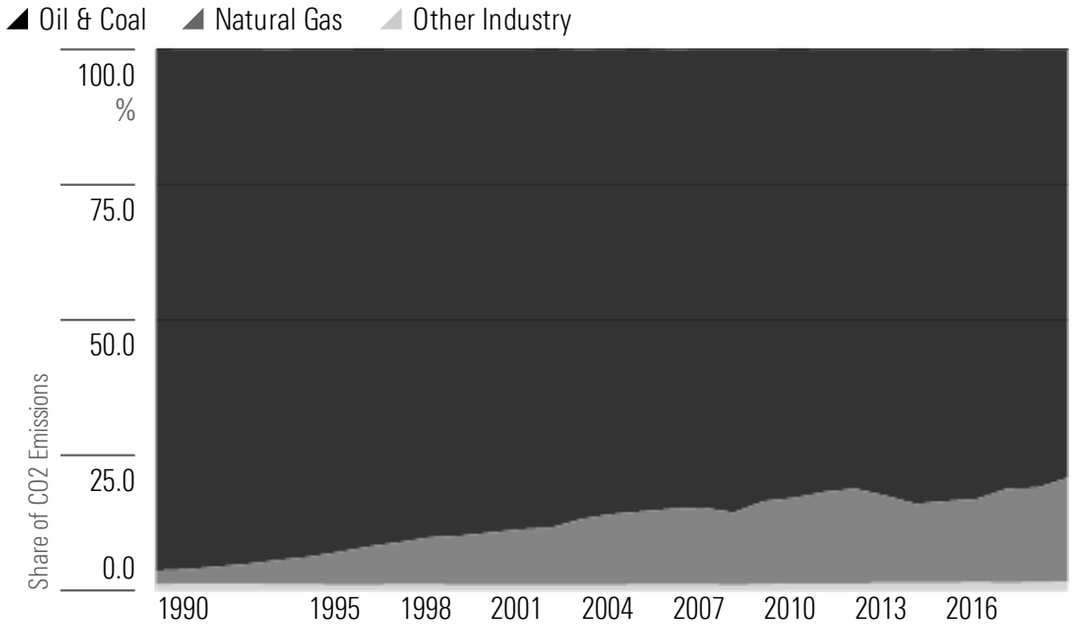
Source: South Korea Emission Trading Registry System. Data as of July 2022.

Cap-and-Trade Program Designs Have Loopholes

Climate action plans relying solely on carbon pricing to drive abatement can entice firms to shift toward more efficient, but still nonrenewable, energy sources like natural gas. This can reinforce a country's reliance on fossil fuels rather than diminish it.

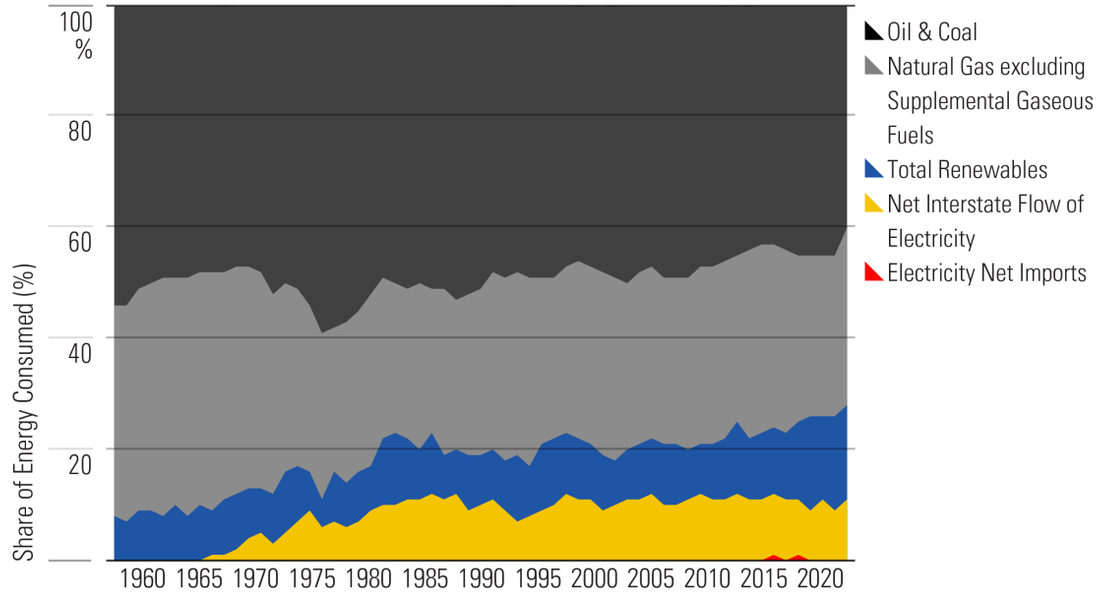
Poorly designed cap-and-trade programs can also create emissions "leakage," where firms outsource fossil fuel production to territories not subject to the cap-and-trade program.

Despite Efficiency, Natural Gas Soaks Up Greater Share of South Korea's Emissions



Source: Our World In Data. Data as of July 2022.

Studies Show Evidence of Leakage In California's Electricity Sector, But Does Not Flow Through to State Level



Source: U.S. Energy Information Administration. Data as of July 2022.

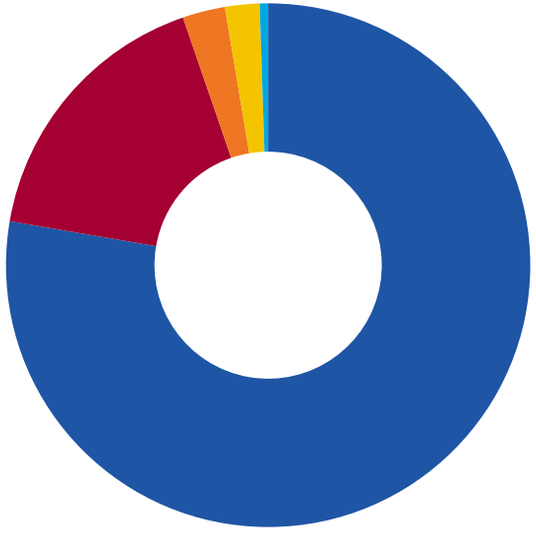
Opportunity

More than a theoretical price of carbon or an emissions goal post, an investment in a carbon credit manifests the dynamics shaping the market that produces it.

Given These Flaws, Which Is the More Relevant Opportunity Set: Carbon Credits or Carbon Markets?

Proponents of an allocation to carbon credits argue that carbon must get more expensive to emit in order to meet ambitious reduction targets, and therefore it represents a lucrative investment opportunity. Investors may be lured in by this philosophically sound argument, but if an investment sounds like it's too good to be true, it probably is. Instead, investors get exposure to a financial proxy of how successful regulators are at executing their ambitious aims. Investors are "betting" on the outcome of carbon markets rather than the value of a ton of carbon. Supporting this theory, flows have rewarded experience over size, given the steep challenge of implementing these programs effectively.

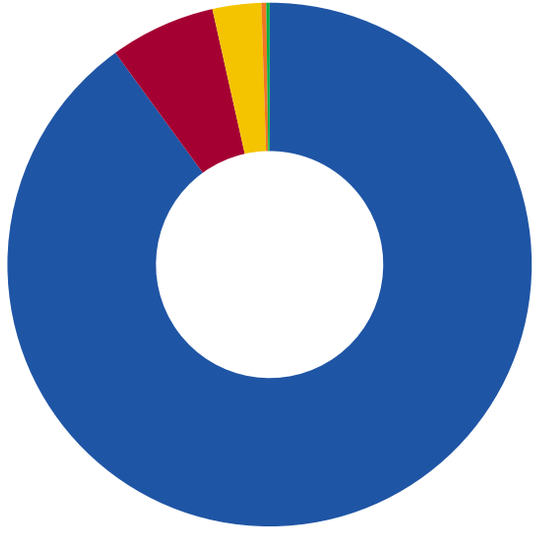
European Union Captures Three Quarters of Emissions Under Regulation…



Jurisdiction	%
European Union	77.69
North America (WCI, RGGI)	17.05
China	2.62
UK	2.13
New Zealand	0.52

Source: Refinitiv. Data as of January 2022.

But More Than 90% of Carbon Credits' Transaction Volume

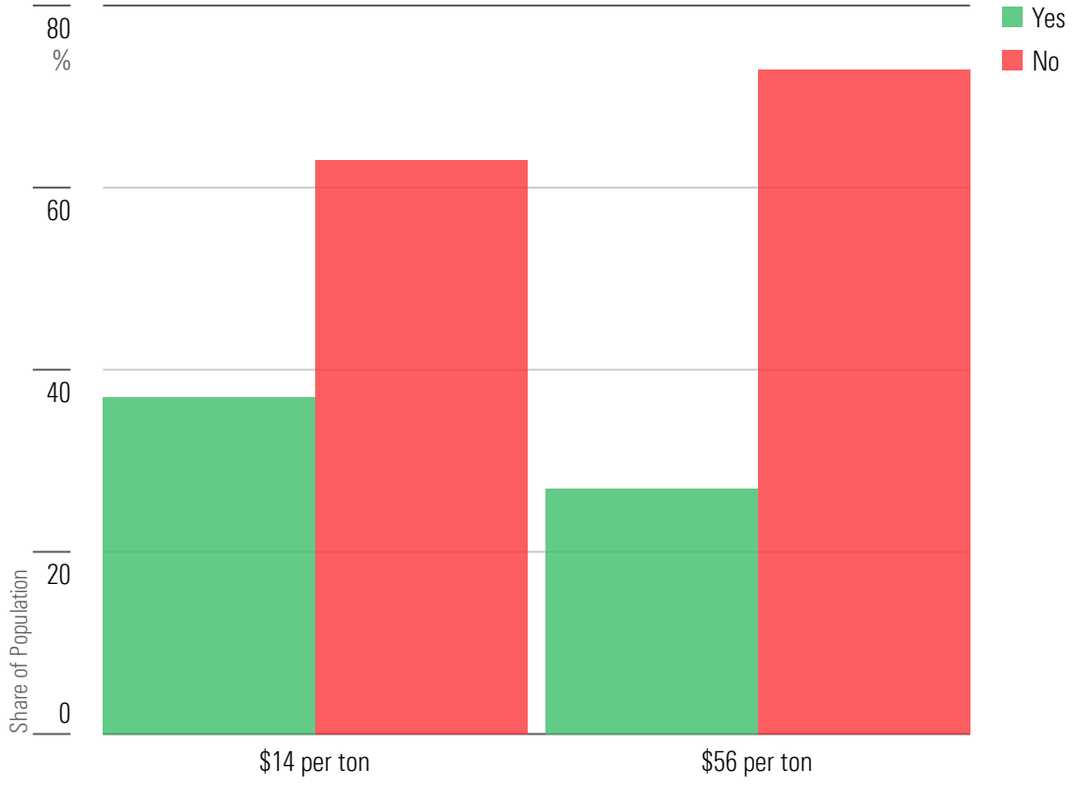


Jurisdiction	%
European Union	89.99
North America (WCI, RGGI)	6.51
UK	3.00
New Zealand	0.30
China	0.20

Source: Refinitiv. Data as of January 2022.

Carbon Markets Have Limited Use as a Strategic Allocation Given Dearth of Political Appeal

Carbon Pricing Is Unpopular Across the Board, and Increasingly Unpopular Beyond $14 Per Ton



Source: University of Chicago. Data as of October 2021.

Effective emissions abatement blends "carrots," or incentives, and "sticks," or penalties. In the past, economists and regulators have rallied behind cap-and-trade programs as a stick because they are cheaper to implement and more popular among constituents than alternatives like direct regulation and carbon taxes. Market incentives motivate the covered group as a whole to find the lowest-cost way to reduce overall emissions. In a perfect world, this obviates the need to create specific government plans on energy mix or areas for reduction.

On the other hand, while several previously slated programs are going live in the next few years, some governments--like the United States--have vocally disavowed the idea of "sticks," which can gum up the legislative process.

Besides being tricky to pass, unpopular sticks that do see the light of day put the governments that pass them into jeopardy. They are consistently at risk of getting replaced by those who promise to remove them. Politicians are not likely to crank up the thermostat when they're in the hot seat, which casts doubt on the potential of cap-and-trades to reach effective price levels.

Survey statistics breathe life into that relationship. Carbon credits poll abysmally. While more than half of Americans would contribute at least $1 a month to combat the effects of climate change (comparable with a carbon tax of $0.75 per ton per year), support takes a nosedive at price levels beyond that.

Just 37% of Americans would support paying $14 extra per year for their own personal carbon footprint, while fewer than 25% would support a price of $56 in accordance with the Paris Climate Accord objectives.

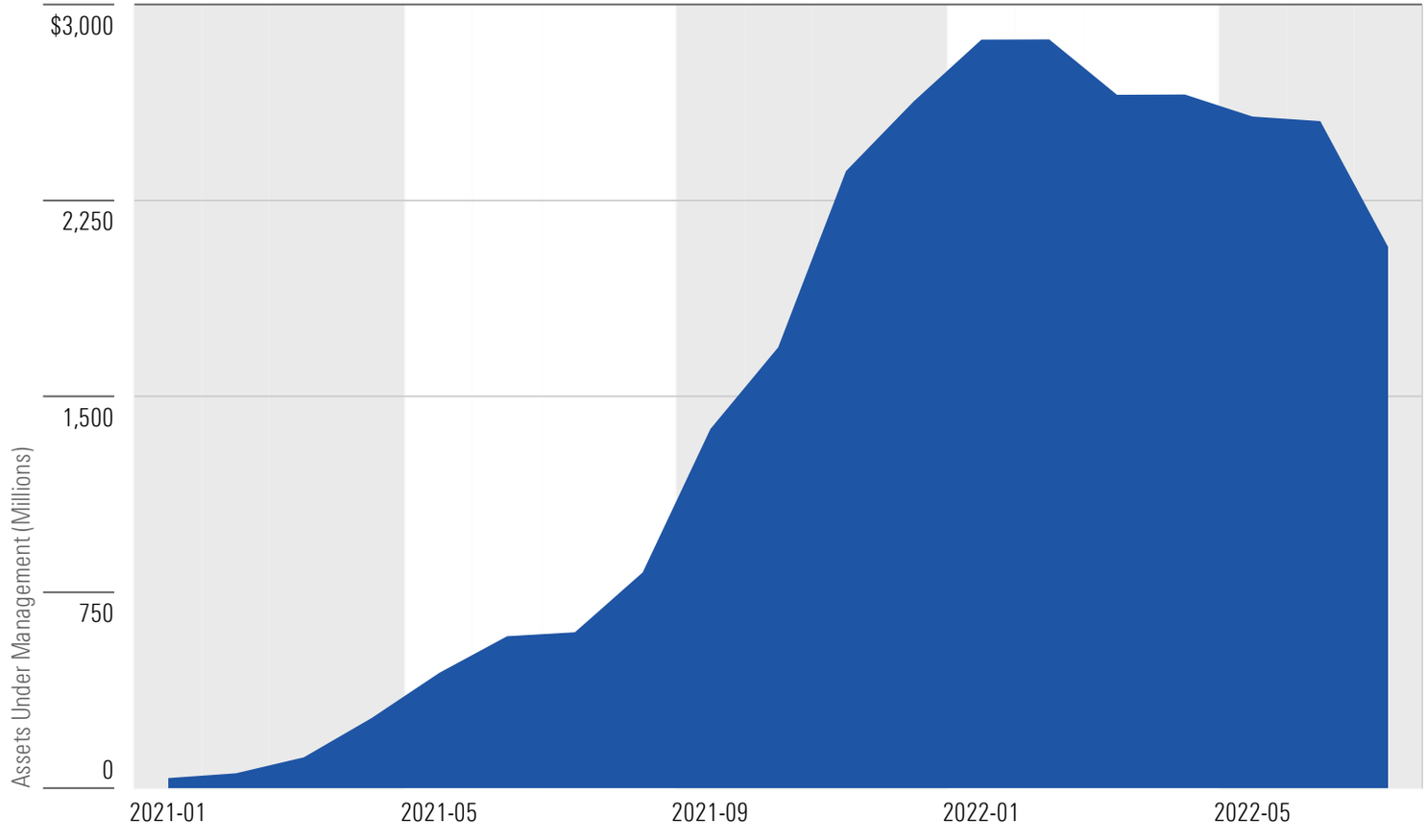
Carbon Credits Have More Merit as an Impact Investment, But This Concept Is Still Under-Explored

Despite the many masters they serve, carbon credits may yet be enticing for investors with ESG objectives and a keen interest in impact.

Today, most funds treat carbon credits as a commodity, and they gain exposure by buying futures or purchasing the spot in a secondary market. As a derivative of an asset, revenue from futures contracts goes to the counterparty that writes the contract as opposed to the governments that created the credits. Rather than exercising them, funds typically sell futures back to the highest bidder when they roll forward the contracts.

With a few minor tweaks, a carbon credit investing strategy could make a much bigger impact. Revenues from primary auctions of carbon credits bankroll clean energy projects in the jurisdictions that sponsor them. In a potential future state, a fund could buy carbon credits at auction. The proceeds from these purchases would fund green energy projects. Alternatively, a fund that deals only in the futures market could take delivery of its futures, temporarily reducing the amount of credits available for emissions. Finally, managers of either stripe could close out their positions by selling their securities to carbon-offsetting programs, ensuring that carbon does not get emitted in the future.

Assets in Carbon Credit Investment Products Have Grown Sharply, But the Use Case for Such Products Is Still Commodity-Focused and ESG-Agnostic



Source: Morningstar Direct. Data as of July 2022.

Outlook

While flaws plague the current systems offering carbon credits, most can be remedied through moderate program enhancements.

The Case Against Carbon Credits

Common Criticisms

- Carbon dioxide is a byproduct of commodity consumption, not a commodity itself. To some purists, input pricing remains the most effective market mechanism for energy production.
- Cap-and-trade programs offer limited coverage of highest-emitting and hardest-to-abate industries, like transportation. Within industries that are covered, regulators often give large quantities of credits away for free. Considered together, these factors indicate that carbon credits may not be representative of the true scope of emissions or cost to emit.
- Cap-and-trade programs do not explicitly incentivize reductions beyond the emissions target. As a result, cap-and-trade prices are more volatile compared with a carbon tax, which maintains a stable cost below emissions targets.
- Most caps are not stringent enough to reach Paris Climate Accord commitments, suggesting that even the regulators who are willing to impose abatement programs are reluctant to follow through with punitive pricing levels.
- Although relationships are unstable, carbon credit prices sometimes rally in tandem with the outlook for the most energy-intensive fossil fuels. While rising carbon prices serve as a drag on these firms' bottom line, the fact remains that carbon credit investors may benefit financially when these polluters' fortunes improve.
- Cap-and-trade programs take time to mature, and the window to reach 2050 net-zero targets is closing fast. Therefore, there is precious little time for new cap-and-trade programs to come online and reach stability, limiting the potential for future growth.

Risks

- Cap-and-trade programs may incentivize more efficient pollutants like natural gas, rather than a secular shift away from fossil fuels. Reliance on imported energy courts political risk and added volatility relative to homegrown renewable sources. A shift toward more efficient nonrenewables, especially natural gas, may introduce a reliance on producers of those fossil fuels, such as Russia.
- In order to keep energy markets afloat during exogenous commodity shocks, regulators sometimes deploy market relief measures to stabilize prices at the same time that investors would be looking to realize gains.
- Other sectors, jurisdictions, or slices of an already covered sector may be added or removed from the program at any point, limiting comparability with historical time series and disrupting pre-existing carbon price trajectories.
- Carbon markets are undiversified. Three programs--the European Union's ETS, California's WCI, and the Northeastern Coast of North America's RGGI--take more than 99% of the market's transaction volume.
- Carbon credits offered by jurisdictions outside of these three may lack sufficient liquidity in order to have effective noncompliance price discovery, and therefore they depend on compliance entities and regulators.
- Conversely, the presence of asset managers and other financial institutions tends to court speculation on the path of future energy and carbon prices.

The Case for Carbon Credits

Impact

- Cap-and-trade programs help price an output that incurs a discrete but otherwise unknowable future cost.
- Research has shown that cap-and-trade programs guide individual firms to be more energy efficient, which should taper emissions per unit of gross domestic product.
- Companies that reduce emissions faster than expected can sell their allotted credits on the open market, improving profitability in sectors that are experiencing pronounced disinvestment.
- In order to avoid paying higher prices for carbon allowances, firms may choose to invest in clean technologies that would otherwise be financially unappealing. This levels the economic incentives between nonrenewables and renewable energy sources.
- When a financial intermediary buys and holds a carbon emission allowance, that allowance gets taken out of circulation and therefore cannot be used to emit more carbon. By making emission allowances an investable asset, cap-and-trade programs foster competition for the supply of credits and may shrink the amount available to energy producers and industrial firms.
- Carbon credits may allow an investor to participate in some of the upside of energy markets while still abiding by the principles of divestment of nonrenewable resources.

Potential Remediations

- Exponential forecasts may be more effective for setting cap reductions relative to linear models that undershoot the pace of emissions reductions and need frequent adjustment, especially for newer programs.
- To address price volatility, governments could impose a convertible credit and tax approach. Under this system, carbon is traded at market price when emissions track above the cap-specified level, but the system would trigger a minimum price if emissions fall below target. California, for example, has implemented a price “floor” for its primary auctions.
- Program design is the major flaw of most emissions trading schemes, and it’s easily rectified. Regulators can work within existing systems to crack down on generous emissions caps, too many free allocations, and volatile prices--if they have the political appetite.

General Disclosure

Unless otherwise provided in a separate agreement, recipients accessing this report may only use it in the country in which the Morningstar distributor is based. Unless stated otherwise, the original distributor of the report is Morningstar Research Services LLC, a U.S.A. domiciled financial institution.

This report is for informational purposes only and has no regard to the specific investment objectives, financial situation, or particular needs of any specific recipient. This publication is intended to provide information to assist institutional investors in making their own investment decisions, not to provide investment advice to any specific investor. Therefore, investments discussed and recommendations made herein may not be suitable for all investors; recipients must exercise their own independent judgment as to the suitability of such investments and recommendations in the light of their own investment objectives, experience, taxation status, and financial position.

The information, data, analyses, and opinions presented herein are not warranted to be accurate, correct, complete, or timely. Unless otherwise provided in a separate agreement, neither Morningstar, Inc. nor the Equity Research Group represents that the report contents meet all of the presentation and/or disclosure standards applicable in the jurisdiction the recipient is located.

Except as otherwise required by law or provided for in a separate agreement, the analyst, Morningstar, Inc. and the Equity Research Group and their officers, directors and employees shall not be responsible or liable for any trading decisions, damages or other losses resulting from, or related to, the information, data, analyses or opinions within the report. The Equity Research Group encourages recipients of this report to read all relevant issue documents for example, prospectus) pertaining to the security concerned, including without limitation, information relevant to its investment objectives, risks, and costs before making an investment decision and when deemed necessary, to seek the advice of a legal, tax, and/or accounting professional.

The Report and its contents are 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 or which would subject Morningstar, Inc. or its affiliates to any registration or licensing requirements in such jurisdiction.

Where this report is made available in a language other than English and in the case of inconsistencies between the English and translated versions of the report, the English version will control and supersede any ambiguities associated with any part or section of a report that has been issued in a foreign language. Neither the analyst, Morningstar, Inc., nor the Equity Research Group guarantees the accuracy of the translations.

This report may be distributed in certain localities, countries and/or jurisdictions ("Territories") by independent third parties or independent intermediaries and/or distributors ("Distributors"). Such Distributors are not acting as agents or representatives of the analyst, Morningstar, Inc. or the Equity Research Group. In Territories where a Distributor distributes our report, the Distributor is solely responsible for complying with all applicable regulations, laws, rules, circulars, codes, and guidelines established by local and/or regional regulatory bodies, including laws in connection with the distribution third-party research reports.

Conflicts of Interest

▸ No interests are held by the analyst with respect to the security subject of this investment research report.

Morningstar, Inc. may hold a long position in the security subject of this investment research report that exceeds 0.5% of the total issued share capital of the security. To determine if such is the case, please click http://msi.morningstar.com and http://mdi.morningstar.com.

▸ Analysts' compensation is derived from Morningstar, Inc.'s overall earnings and consists of salary, bonus and in some cases restricted stock.

▸ Neither Morningstar, Inc. nor the Equity Research Group receives commissions for providing research nor do they charge companies to be rated.

▸ Neither Morningstar, Inc. nor the Equity Research Group is a market maker or a liquidity provider of the security noted within this report.

▸ Neither Morningstar, Inc. nor the Equity Research Group has been a lead manager or co-lead manager over the previous 12 months of any publicly disclosed offer of financial instruments of the issuer.

▸ Morningstar, Inc.'s investment management group does have arrangements with financial institutions to provide portfolio management/investment advice some of which an analyst may issue investment research reports on. However, analysts do not have authority over Morningstar's investment management group's business arrangements nor allow employees from the investment management group to participate or influence the analysis or opinion prepared by them.

▸ Morningstar, Inc. is a publicly traded company (Ticker Symbol: MORN) and thus a financial institution the security of which is the subject of this report may own more than 5% of Morningstar, Inc.'s total outstanding shares. Please access Morningstar, Inc.'s proxy statement, "Security Ownership of Certain Beneficial Owners and Management" section http://investorrelations.morningstar.com/sec.cfm?doctype=Proxy&year=&x=12

Morningstar, Inc. may provide the product issuer or its related entities with services or products for a fee and on an arms' length basis including software products and licenses, research and consulting services, data services, licenses to republish our ratings and research in their promotional material, event sponsorship and website advertising.

Further information on Morningstar, Inc.'s conflict of interest policies is available from http://global.morningstar.com/equitydisclosures. Also, please note analysts are subject to the CFA Institute's Code of Ethics and Standards of Professional Conduct.

For a list of securities which the Equity Research Group currently covers and provides written analysis on please contact your local Morningstar office. In addition, for historical analysis of securities covered, including their fair value estimate, please contact your local office.

For Recipients in Australia: This Report has been issued and distributed in Australia by Morningstar Australasia Pty. Ltd. (ABN: 95 090 665 544; ASFL: 240892). Morningstar Australasia Pty. Ltd. is the provider of the general advice ("the Service") and takes responsibility for the production of this report. The Service is provided through the research of investment products. To the extent the Report contains general advice it has been prepared without reference to an investor's objectives, financial situation or needs. Investors should consider the advice in light of these matters and, if applicable, the relevant Product Disclosure Statement before making any decision to invest. Refer to our Financial Services Guide, or FSG, for more information at http://www.morningstar.com.au/fsg.pdf.

For Recipients in New Zealand: This report has been issued and distributed by Morningstar Australasia Pty Ltd and/or Morningstar Research Ltd (together 'Morningstar'). Morningstar is the provider of the regulated financial advice and takes responsibility for the production of this report. To the extent the report contains regulated financial advice it has been prepared without reference to an investor's objectives, financial situation or needs. Investors should consider the advice in light of these matters and, if applicable, the relevant Product Disclosure Statement before making any decision to invest. Refer to our Financial Advice Provider Disclosure Statement at www.morningstar.com.au/s/fapds.pdf for more information.

For Recipients in Hong Kong: The Report is distributed by Morningstar Investment Management Asia Limited, which is regulated by the Hong Kong Securities and Futures Commission to provide services to professional investors only. Neither Morningstar Investment Management Asia Limited, nor its representatives, are acting or will be deemed to be acting as an investment advisor to any recipients of this information unless expressly agreed to by Morningstar Investment Management Asia Limited. For enquiries regarding this research, please contact a Morningstar Investment Management Asia Limited Licensed Representative at http://global.morningstar.com/equitydisclosures.

For Recipients in India: This Investment Research is issued by Morningstar Investment Adviser India Private Limited. Morningstar Investment Adviser India Private Limited is registered with SEBI as an Investment Adviser (Registration number INA000001357), as a Portfolio Manager (Registration number INP000006156) and as a Research Entity (Registration Number INH000008686). Morningstar Investment Adviser India Private Limited has not been the subject of any disciplinary action by SEBI or any other legal/ regulatory body. Morningstar Investment Adviser India Private Limited is a wholly owned subsidiary of Morningstar Investment Management LLC. In India, Morningstar Investment Adviser India Private Limited has one associate, Morningstar India Private Limited, which provides data related services, financial data analysis and software development. The Research Analyst has not served as an officer, director or employee of the fund company within the last 12 months, nor has it or its associates engaged in market making activity for the fund company.

*The Conflicts of Interest disclosure above also applies to relatives and associates of Manager Research Analysts in India. The Conflicts of Interest disclosure above also applies to associates of Manager Research Analysts in India. The terms and conditions on which Morningstar Investment Adviser India Private Limited offers Investment Research to clients, varies from client to client, and are detailed in the respective client agreement.

For recipients in Japan: The Report is distributed by Ibbotson Associates Japan, Inc., which is regulated by Financial Services Agency. Neither Ibbotson Associates Japan, Inc., nor its representatives, are acting or will be deemed to be acting as an investment advisor to any recipients of this information.

For recipients in Singapore: For Institutional Investor audiences only. Recipients of this report should contact their financial adviser in Singapore in relation to this report. Morningstar, Inc., and its affiliates, relies on certain exemptions (Financial Advisers Regulations, Section 32B and 32C) to provide its investment research to recipients in Singapore.

22 West Washington Street
Chicago, IL 60602 USA

About Morningstar® Equity Research™
Morningstar Equity Research provides independent, fundamental equity research differentiated by a consistent focus on sustainable competitive advantages, or Economic Moats.