Impax
ASSET MANAGEMENT

Carbon risk for investors: Building a "Smart Carbon" portfolio

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EXECUTIVE SUMMARY

There is an increasing likelihood that governments of major economies will act within the next decade to reduce greenhouse gas emissions, probably by intervening in the fossil fuel markets. Impax argues that investors should model the impact of this potential intervention and replace their market-weighted basket of energy stocks with a new energy basket that includes lower weightings of some fossil fuel stocks with equivalent higher weightings in stocks of companies active in energy efficiency markets, thereby maintaining exposure to energy price factor risk.

- Government intervention to reduce pollution is typically based on taxation, "cap and trade" schemes or standards; in the context of policy to mitigate climate change, we focus on "Carbon Pricing" as a proxy for these policy instruments.
- There are strong indications that today's prices of energy stocks do not account for the risk of such government intervention. The recent rapid, catastrophic demise of coal stocks suggests an important precedent regarding market mis-pricing.
- Given the complexity of the issue, investors seeking a comprehensive analysis may struggle to implement their ideas. We recommend an approach that focuses on "first order" issues.
- The most popular methodologies to date rely on "carbon foot-printing"; however, as this typically fails to take account of a company's pricing power, investors who use it to guide portfolio changes may actually be increasing risk.
- Impax has concentrated on listed companies engaged in the exploration and production of fossil fuel assets ("E&P Stocks"). As suppliers of globally traded commodities, these companies are unlikely to be able to pass on the full effect of Carbon Pricing to their customers or to quickly adjust their revenue or asset base to avoid this exposure.
- Using a scenario approach to Carbon Pricing, Impax has analysed the economic risk of major stocks in the MSCI World Energy Index, computing an expected valuation anomaly in those potentially affected. The expected valuation anomalies have informed the appropriate level of divestment of each stock.
- We recommend that divested amounts are reinvested in a basket of stocks of companies providing goods/services that enhance energy efficiency; these stock prices are typically correlated more closely with the retail price of energy (which is expected to rise with Carbon Prices) than with the wholesale price of energy (which is expected to fall).
- We have not included companies active in renewable energy markets as the corresponding stock universe is dominated by a small number of large cap names – investing in it would, we believe, introduce material, additional risks.
- Our portfolio optimisation model currently recommends a reallocation of 30% of the holdings of a typical portfolio in oil and coal producers.
- To implement this strategy, investors may choose to replace their traditional basket of energy stocks with a new basket/index that reflects the recommendations for reallocation.
- We also recommend that investors (a) seek additional information from fossil fuel asset owners (in order to improve their risk analysis), (b) engage with regulators to mandate further disclosure of this information, and (c) continuously refine their assumptions and modelling of this issue in order to adjust their positioning as to the quantum, timing and likelihood of Carbon Pricing.
- Investors who wish to engage with management teams of fossil fuel asset owners can still do so if they opt for partial divestment.
- In time, it is likely that the market values of all stocks will incorporate carbon risk. However, investors who position themselves ahead of this change should out-perform.

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1. CARBON RISK FOR INVESTORS: BUILDING A "SMART CARBON" PORTFOLIO

The debate around the "carbon bubble", un-burnable carbon, stranded assets and fossil fuel divestment has attracted significant media and analyst attention[1]. High profile, headline remarks are often phrased in emotive language, leaving fiduciaries frustrated and, in many cases, minded to "do nothing." Nevertheless, as recently confirmed by the Paris Climate Change Agreement, it is now likely that governments will act during the next decade to reduce greenhouse gas emissions, for example by taxing fossil fuel supply or consumption, through what we refer to as "Carbon Prices[2]". It is this clear direction of travel that has introduced a material financial threat to portfolios today; faced with this risk (of government action), a "wait and see" approach is ill-advised.

Scale and recent underperformance of E&P Stocks

After "Financials", "Energy" represents the second largest sector in most broad-market equity portfolios. For example, at the end of December 2015, E&P Stocks represented 6.1 percent of the MSCI World Index.

In recent years, E&P Stocks have significantly underperformed the rest of the stock market. For example, over a 3 year period, between 1 January 2013 and 31 December 2015 the MSCI World Energy Index fell by 22 percent in USD while the MSCI World Index of generic equities rose by 27 percent. Even more notable has been the demise of listed coal stocks: in the five years since 1 March 2011 the basket of listed coal stocks in the S&P Energy Index lost 93 percent of its value[3].

Following this recent weak performance, which was largely unexpected by both market commentators and insiders alike[4], many investors are ambivalent about the future of E&P Stocks. Are they set for a rebound, perhaps due to economic and statistical "mean reversion", or have they become afflicted by new structural weakness, which could undermine any short term recovery and potentially cause even further loss of value over the medium term?

It is in this context that the discussion around "carbon risk" has taken on a new significance, as far-sighted investors remind themselves not to limit their analysis to short-term drivers of supply and demand.

Approaches to the assessment of Carbon Risk

Commentators on this new area of risk typically respond to one or more of three questions: (1) which market sectors should be analysed? (2) how should the risk be assessed? and (3) how should a portfolio be modified in light of the risk analysis?

On the first question (which markets should be analysed), analysts have an understandable desire to assess an entire portfolio; for example, the recent Mercer report on addressing climate change offers a comprehensive framework across multiple asset classes[5]. Others, such as Carbon Tracker, focus on potential "demand destruction" for fossil fuels[6]. We believe that the more comprehensive the scope of the review, the more challenging the design of an actionable plan for investors.

For the second question (how should the risk be assessed), there has been a strong focus on "carbon foot-printing" as a mechanism for assessing risk, whereby the (direct and possibly indirect) CO_2 emissions of a company are used as a proxy for its financial exposure to climate change policy[7]. This approach has already been questioned on the grounds that there is no consensus on the methodology[8]. However, we are also concerned that a "foot-printing" approach typically takes no account of the pricing power of the underlying company, i.e. its ability to pass on cost increases (for example those linked to future Carbon Prices) to its customers, for example those arising from taxation of fossil fuel supply; by mis-pricing carbon risk, foot-printing may actually increase risk. Our analysis focuses instead on estimating the direct financial impact on individual companies of likely changes to government policies.

A further aspect of risk assessment methodology is the depth of analysis. Carbon Tracker has produced supply cost curves for each of the fossil fuels – coal, oil and gas, utilising asset-level cost data[9]. A recent paper by the Smith School of Enterprise and the Environment argues that analysis of climate risk should be done at the level of the individual asset in relation to the power sector[10].

[1]For more background on these issues visit www.carbontracker.org
[2]Policies to reduce pollution are typically based on taxation, "cap and trade" schemes or standards. If they're effective, they reduce consumption (and hence emissions). We focus on "Carbon Pricing" as a proxy for these policy instruments.
[3]See " US Coal Crash", Carbon Tracker http://www.carbontracker.org/report/the-us-coal-crash/
[4]See "The Oil Price Shock: Primary, Secondary and Collateral Effects", A. Damodaran http://aswathdamodaran.blogspot.co.uk/2014/12/the-oil-price-shock-primary-secondary.html
[5]Investing in a Time of Climate Change', Mercer, 2015
[6]http://www.carbontracker.org/report/lost_in_transition/
[7]e.g http://www.theactuary.com/features/2015/06/carbon-risk-how-do-we-measure-and-manage-it
[8]e.g http://www.iigcc.org/files/publication-files/Carbon_Compass_final.pdf (pp17-46)
[9]Carbon supply cost curves series, available at http://www.carbontracker.org/library/#capex-analysis
[10]See http://www.smithschool.ox.ac.uk/research-programmes/stranded-assets/satc.pdf

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We agree with this view and believe that, for a complete risk assessment, asset-level analysis is essential; however, we are concerned that, in the absence of sufficient data, this approach isn't yet practicable.

On the third question (how should a portfolio be modified), many analysts recommend that investors tilt their portfolios away from holdings that are deemed "risky" from a climate and carbon risk perspective, typically with rebalancing to reduce tracking error versus a benchmark[11]. We are concerned that this methodology places too much reliance on historical risk profiles and is therefore inconsistent with an overall thesis that the investment risk landscape for climate change has changed significantly in the last two to three years. Equally, as set out below, we believe that an explicit allocation of exposure from "fossil fuel energy" to "energy efficiency" gives the best expected risk-return profile.

2. IMPAX'S METHODOLOGY – OVERVIEW

Our approach is based on four principles chosen to facilitate the development of an actionable plan for investors:

- **Simplicity**, focusing on higher order issues. For reasons set out below, we have confined our analysis to those companies engaged in the exploration and/or production ("E&P") of fossil fuels;
- **Direct financial impact**. We have looked at the potential consequences of policies to limit climate change on cash flows rather than using carbon emissions as a proxy;
- **Portfolio optimisation**. We recommend that capital divested from the fossil fuel sector be re-invested in the Energy Efficiency sector to maintain energy price factor exposure; and
- **Dynamic management**. As climate change risk and policy responses are likely to evolve considerably over the next five to ten years, we suggest that investors plan for periodic adjustments in this assessment and response. We also argue that investors should (a) where they have partially divested their holdings, continue to press E&P companies for greater disclosure on risk issues, (b) liaise with regulators to put pressure on those companies to disclose additional information that can facilitate the assessment of risk and (c) continuously refine and recalibrate their assumption to incorporate new information.

The premise of our approach is that nimble investors can adjust their portfolios to reflect an estimated level of climate change risk and thereby improve the expected outcome.

We acknowledge that investors with larger portfolios, particularly those who consider themselves "universal owners", may struggle to make these adjustments, and a "carbon risk overlay" strategy may be required.

Focusing on E&P Stocks

For a typical investor, a material exposure to carbon risk arises through ownership of companies engaged in the exploration and production of fossil fuel assets ("E&P Stocks"). As these companies produce commodities that are marketed widely, they typically have weak pricing power i.e. are unlikely to be able to pass on the full effect of Carbon Pricing to their customers or to adjust their revenue or asset base quickly enough to avoid this exposure. In contrast, many other companies such as regulated utilities, manufacturing businesses and logistics or transportation operators may be significant energy consumers and have a material "carbon footprint", but are likely to mitigate the impact of any increase in their energy costs arising from Carbon Prices, for example by raising their own prices, changing their business models or relocating where Carbon Prices are more favourable. Given the complexity of these effects, we believe that E&P Stocks provide a robust proxy for the first-order Carbon risk exposure of a typical investor, and can be used to develop a model for assessing and managing that risk.

Assessing the potential drop in oil consumption

At its heart, carbon risk focuses on the potential for consumption of fossil fuels to be materially lower than is implied by today's prices. A recent literature review indicates that it is unclear whether the market prices reflect climate change risk[12], while our review of methodologies used by sell side analysts indicates that most do not factor potential future Carbon Pricing into their calculations. The apparent mis-pricing of coal stocks in 2011 (see section 1) indicates that markets may indeed be blind to significant risks.

[11] e.g http://www.top1000funds.com/profile/2014/09/19/the-challenges-of-a-low-carbon-mandate/
[12] http://www.sv.uio.no/econ/english/research/unpublished-works/working-papers/2016/memo012016.html

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We therefore assume that the expected effect of all drivers of supply and demand, except climate change policy, is currently fully reflected in the forward (price) curves for oil, and that climate change risk can be represented by changes in expected Carbon Prices resulting from an analysis of fundamentals discussed in the following paragraphs.

As set out in Appendix 1, a simplified model of the crude oil industry indicates that the imposition of Carbon Prices is likely to have three effects: (a) raise the retail price of oil paid by consumers, (b) reduce the wholesale price of oil received by producers, and (c) reduce oil consumption, potentially rendering those assets with a high marginal cost of production "stranded"[13]. Given the inherent volatility of the price of oil and the relatively strong lobbying power of oil producers, the most significant of these factors is (c), i.e. the risk of stranded assets[14].

To determine the impact on E&P Stocks we analysed detailed, projected production curves of the relevant E&P companies within the MSCI World Index and identified those where we see the highest risk to valuation from Carbon Prices. In particular, we looked for companies that operate assets at the higher-cost end of the production curve and which could therefore experience a material reduction in output should Carbon Prices be implemented.

Although we do not expect a global Carbon Price to be introduced in the foreseeable future, evidence from China, the European Union, the United States, Canada and other countries indicates that national or regional Carbon Prices are more likely.

To minimise complexity, we have modelled a global Carbon Price, which can be thought of as the weighted average of what will actually be implemented, or more broadly as the shadow cost, for the representative investor, of regulation aimed at curbing greenhouse gas emissions.

Assessing the impact on cash flow and valuation of E&P Stocks

There is plenty of debate over how markets value E&P Stocks. Financial theory suggests that investors should look at the company's reserves and resources in the context of future commodity (e.g oil) prices[15]. Some analysts point to a wider range of factor drivers than just the oil price, particularly oil price volatility, interest rates and (stock) market levels[16]. Our analysis is based on a straightforward discounted cash flow model to formalise our views on carbon risk.

We have used scenarios to estimate the potential impact to each company's cash flow from Carbon Prices and determined an expected anomaly in each stock price today.

Re-investment in Energy Efficiency (but not Renewable Energy)

We recommend that investors should: (a) reduce exposure to E&P Stocks whose assets are likely to be most impacted by Carbon Prices; and (b) in order to maintain their energy factor exposure, redeploy the divested amounts into stocks whose principal business is in the Energy Efficiency sector ("Energy Efficiency Stocks") – prices of these stocks* are typically correlated to retail energy prices, which, as explained above, are likely to rise when Carbon Prices are imposed.

We have not included companies active in renewable energy markets models for two reasons: (a) their stock prices have a lower historical correlation to both the oil price and the MSCI World Energy Index than do Energy Efficiency Stocks, most likely due to the high exposure of renewable energy markets to changes in government policy[17]; and (b) the universe of renewable E&P Stocks is dominated by a small number of large cap names, and so, in our view, provides an unattractively high level of stock-specific risk.

***In considering this switch, investors should also note that the E&P Stocks and Energy Efficiency stocks are exposed to other risks that are not described in this paper.**

[13]For example: http://www.smithschool.ox.ac.uk/research-programmes/stranded-assets/Stranded%20Assets%20and%20Scenarios%20-%20Discussion%20Paper.pdf http://www.longfinance.net/images/reports/pdf/hsbc_oilcarbon_2013.pdf
[14]Environmental standards to reduce pollution, for example vehicle fuel efficiency requirements, reduce consumption without producing a differential between retail and wholesale prices. However, all else being equal they should produce the same level of "stranded assets" as taxation or cap-and-trade schemes.
[15]e.g "Oil and Gas Company Valuations." A. Howard et al http://www.srr.com/assets/pdf/oil-and-gas-company-valuations-business-valuation-review.pdf
[16]See "Performance & Volatility of Oil & Gas Stocks." RS Shaharudin http://repository.um.edu.my/74980/1/oil%20paper%20roselee.pdf
[17]e.g "US solar shares rise on hopes for tax credit extension" - http://www.reuters.com/article/us-usa-stocks-solar-idUSKBN0TY2KF20151215.

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3. IMPLEMENTING THE INVESTMENT STRATEGY

To implement this strategy and produce a "Smart Carbon" portfolio we have used a portfolio optimisation method to reallocate from E&P Stocks with a material pricing anomaly into Energy Efficiency Stocks.

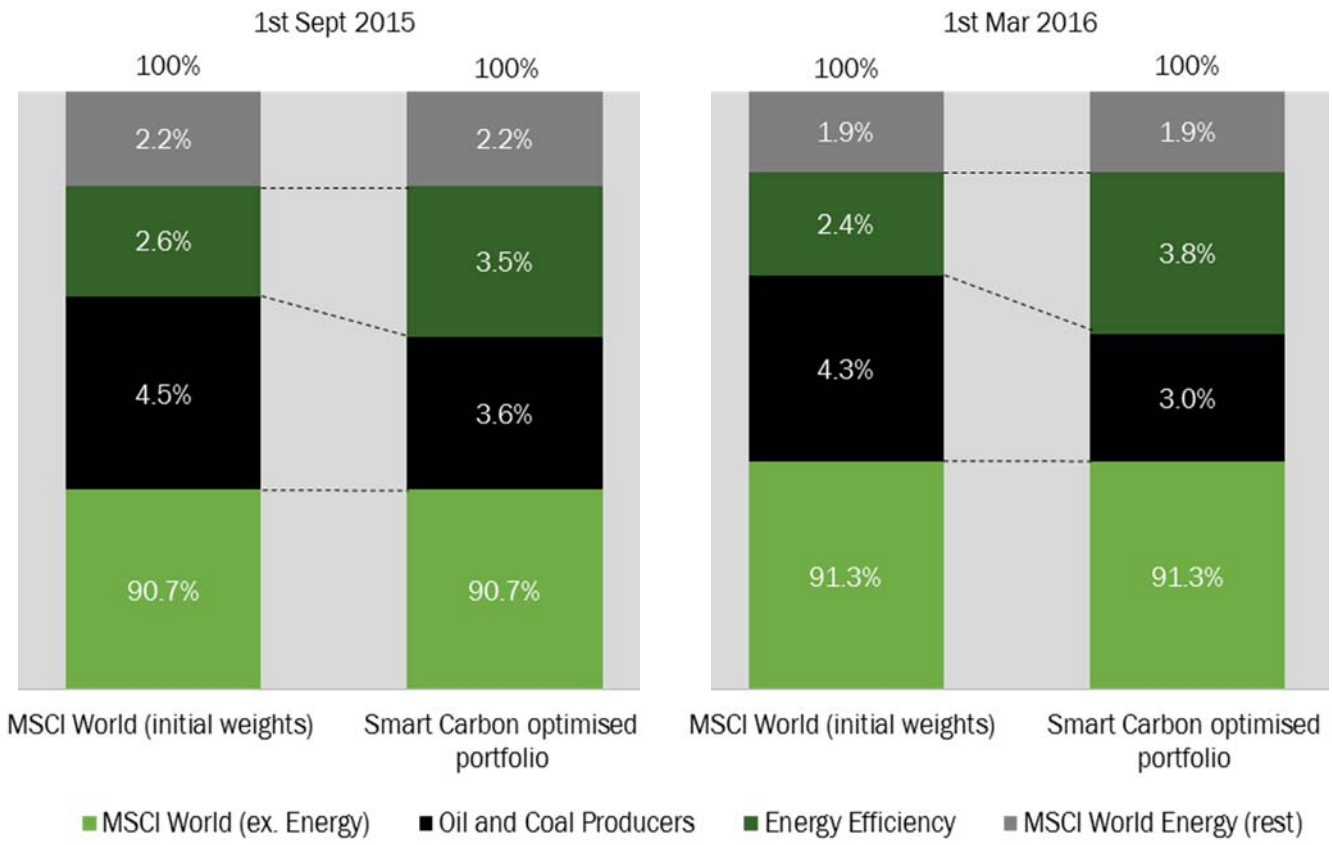
Initial model results

We established a paper portfolio on 1 September 2015, and have re-run with updated data for 1 March 2016[18]. The recommended portfolios at each date are shown in Figure 1.

The recommended level of divestment is greater in March 2016 than it was in September 2015. As expected future oil prices fall, the relative size of the valuation anomaly in today's stock prices increases, and hence the recommended levels of divestment increase.

Those investors who may be tempted to hold on to their current energy holdings in the expectation of a price recovery should note that a switch to Energy Efficiency Stocks in the short term should allow them to maintain a significant degree of energy price factor exposure while potentially turning the potential downside from climate change policy risk into upside potential.

Figure 1: Recommended portfolios



[18]Model portfolio run using FactSet

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4. CONCLUSION AND NEXT STEPS

We believe that our approach provides investors with a straightforward, actionable roadmap for assessing climate change risk and implementing appropriate responses in a portfolio.

However, given both the complexity of this issue and the changing dynamics, particularly around climate science and policy, we strongly recommend that investors integrate three further steps into their approach:

- Seek additional information from fossil fuel asset owners. Disclosure of information around the impact of Carbon Prices on future production can significantly improve the risk analysis;
- Engage with market regulators to mandate further disclosure of information around climate change risk; and
- Continuously refine their assumptions and modelling of this issue in order to adjust their positioning as the quantum, timing and likelihood of Carbon Pricing evolves. We recommend that the model is updated at least every six months.

We also recommend additional work to refine our model further, in particular, more detailed analysis of asset-level risks. We also believe this approach can be applied to other economic sectors, taking into account pricing power issues as set out above.

Those investors who wish to engage with management teams of E&P Stocks can still do so if they opt for partial divestment – selling a portion of a stock that is deemed "risky" and engaging with management to discuss a change of strategy that could mitigate the perceived risk is, in our view, entirely appropriate.

In time, it is likely that the market values of all stocks will incorporate carbon risk. However, investors who position themselves ahead of this change should out-perform.

For further information on this investment strategy please contact SmartCarbon@Impaxam.com

5. APPENDIX 1 – A MODEL OF CARBON RISK

Figure 2 shows a simple supply-demand plot for a fossil fuel sector, e.g crude oil. The Supply Curve is built up from assets of specific volume (x-axis) and specific marginal cost of production (y-axis); for example, Middle Eastern oil is likely to be to the left of the curve, while Arctic deep sea reserves will be to the right. Imposing a Demand Curve gives the volume consumed by the industry, V_0, and the market price P_0 which is both paid by consumers and received by suppliers.

Figure 3 shows the impact of one type of Carbon Pricing, in which governments impose a tax T on the industry, raising the Supply Curve, which now intersects with the Demand Curve at a new point. The volume consumed drops to V_1, while consumers pay P_1 but suppliers receive only P_2. Assets represented by bars between V_0 and V_1 become stranded.

We believe that the key issue here is Stranded Assets. It is likely that, in the early years at least (which matter most in today's determination of net present value), industry lobbying will limit the level of Carbon Prices imposed such that the potential price reduction suffered by the industry, i.e., P_0 minus P_2, will be relatively low, while the risk of this reduction from today's vantage point will be dwarfed by the volatility of commodity prices. In contrast, owners do not all face the same Stranded Asset risk, so those with relatively low risk in this regard have an incentive to lobby for a Carbon Price that penalises competitors with a higher risk.

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Figure 2: Illustrative crude oil market

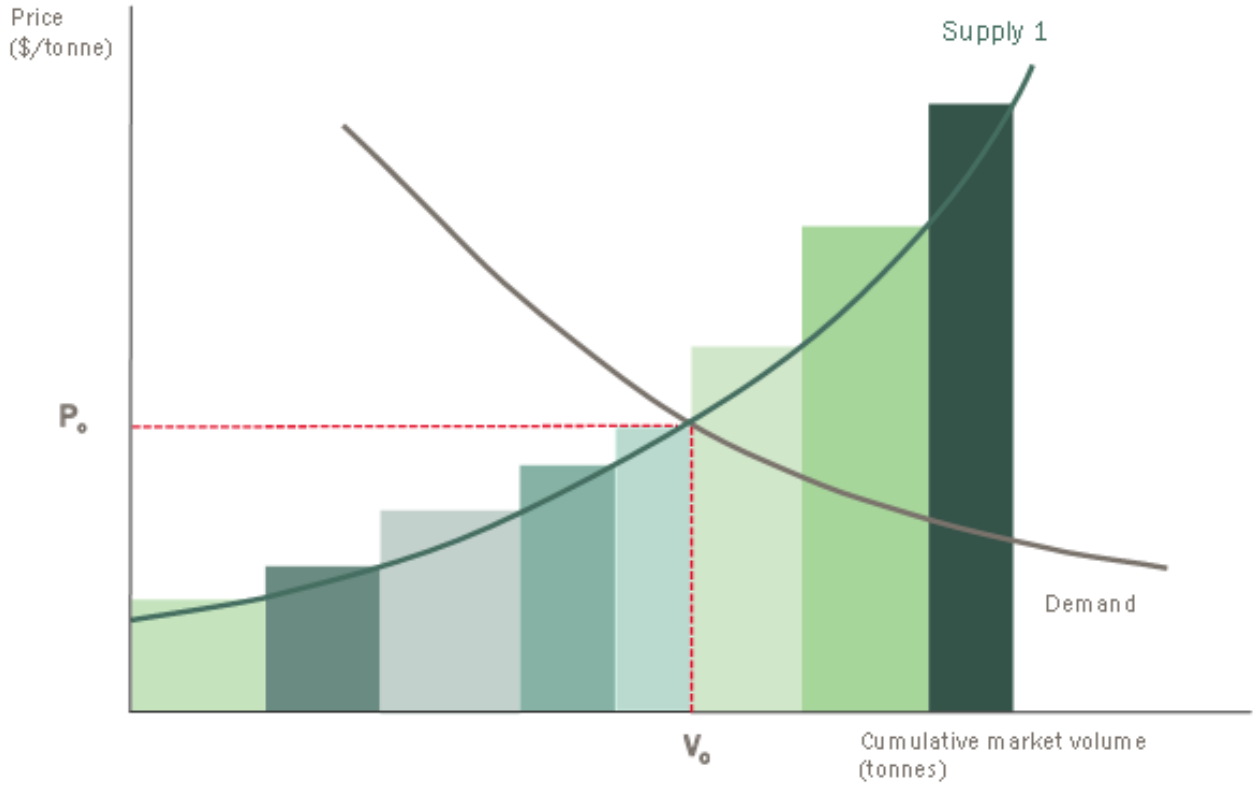
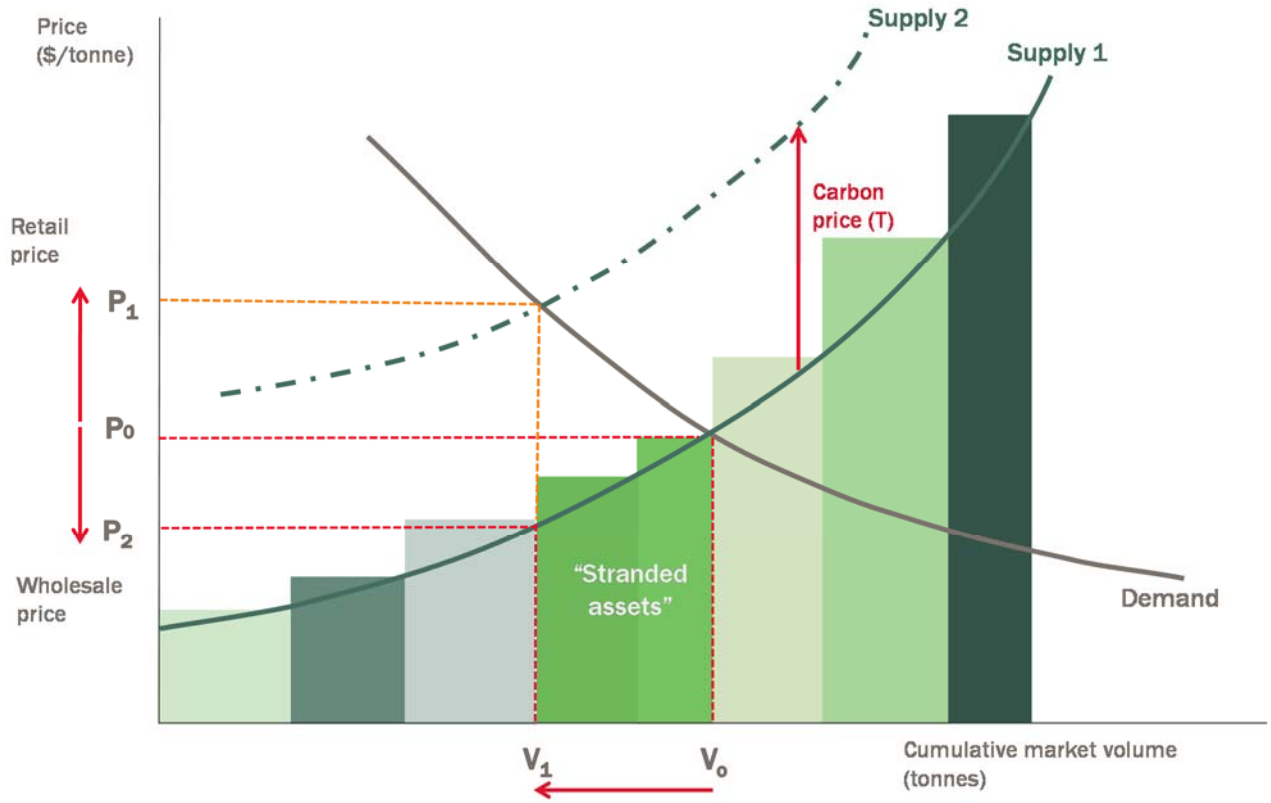


Figure 3: Effect of Carbon Pricing



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