

Asia Pacific Corporate Carbon Exposure Survey

Highlights Climate Change Concerns & Increased Mitigation Activities



IN BRIEF

Corporates in Asia Pacific are seriously concerned about the impact of climate change on their industries, and are preparing to tackle increasing legislation aimed at curbing greenhouse gas emissions, according to responses to a survey conducted among issuers from 13 countries and 16 sectors across the region rated by Standard & Poor's Ratings Services. The survey and this following analysis were completed jointly with carbon-analytics firm RepuTex Ltd.

The survey was sent to more than 300 corporates, and 28 responses received. Around nine out of 10 respondents expressed their concern about the impact of physical climate change on their industry, with most concern expressed by corporates operating in Japan, Malaysia, and India. In terms of the sector breakdown: real estate, metals & mining, consumer products and transportation envisage climate change as having the most physical impact on their operations.

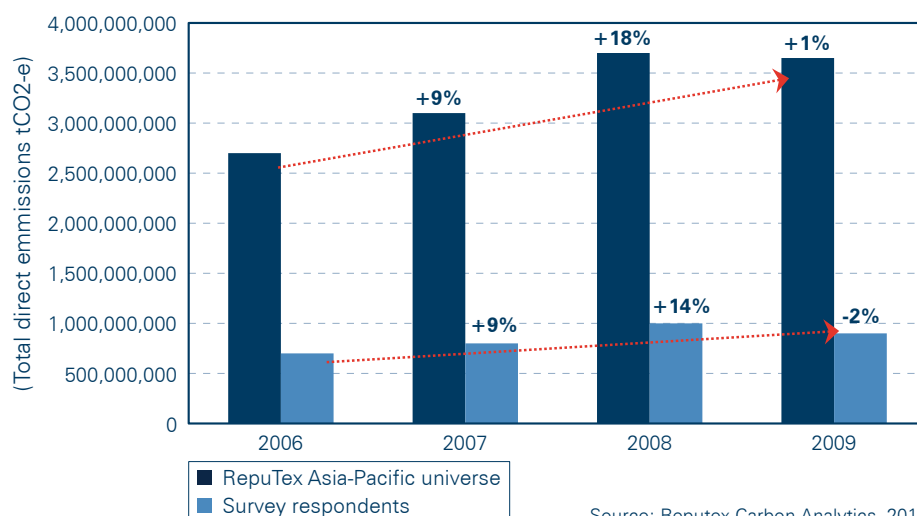
The other key findings of the survey were as follows.

- Although more than a half of the surveyed respondents view the regulatory and physical risks of climate change as "serious", in our view only a minority of companies demonstrated a comprehensive understanding of those risks. Existing levels of awareness around factors such as carbon prices, expected climate change regulation, financial risks, and opportunities are relatively low, indicating that there is a substantial knowledge gap that may need to be addressed to achieve effective risk management for affected companies.
- According to the data provided by RepuTex, the most carbon-intensive sectors in the Asia-Pacific region are utilities (58%), energy (18%) and materials (13%). In terms of country breakdown, Japan (31%), China (29%) and South Korea (11%) produce the largest portion of carbon emissions in the region.
- Recognising climate change and carbon-reduction commitments as a possible source of competitive advantage, 46% of the survey respondents already perform direct emissions forecasting to determine future carbon liabilities and build carbon-management strategies.
- The survey also indicates that respondents believe that the current and evolving regulatory and physical environment in the Asia-Pacific region could lead to the following opportunities: investors increasingly using an understanding of variations in carbon performance within sectors to identify which companies pose the greatest risks to portfolios, as well as opportunities presented by carbon-efficient leaders; reduced exposure to increasing energy costs through new technologies and behavioural change; and, potential acceleration in R&D of new technologies in carbon intense sectors, on the back of enforced carbon-reduction regulations.

TOTAL DIRECT EMISSIONS ACROSS THE REGION PLATEAU FOLLOWING STRONG RISE

According to supplementary data provided by RepuTex, total direct emissions among 1,657 Asia Pacific companies monitored by that firm have grown significantly from 2006 to 2008, in line with industrial production and economic growth across most Asian economies, notably China and South Korea. A slowdown in economic and industrial output as a result of the global financial crisis resulted in a slight drop in emissions across most Asia-Pacific companies in 2009. The data for corporate issuers rated by Standard & Poor's who responded to the survey suggests much better performance in terms of emissions than their industry peers (see chart 1).

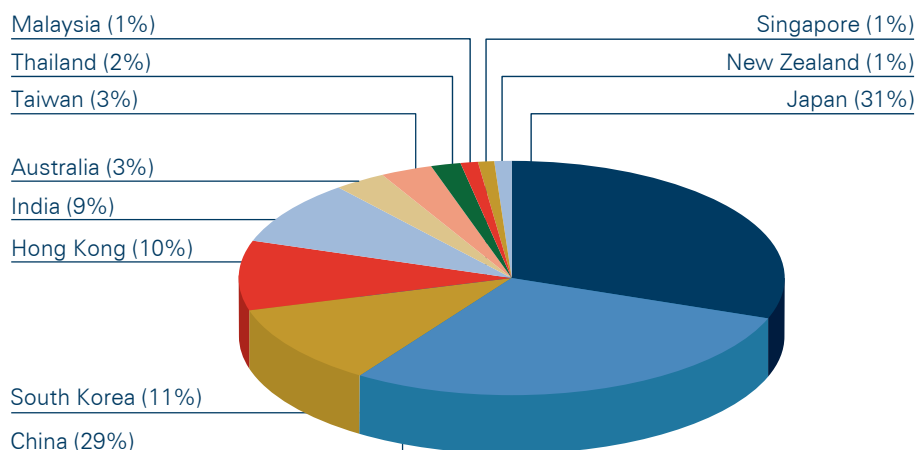
Chart 1
Asia-Pacific Universe
Direct Emissions History



This finding is also backed up by the survey results indicating that more than seven out of 10 respondents rank their relative position in terms of carbon exposure as much more favourable than the sector benchmark.

Analysis undertaken by RepuTex of companies across the Asia-Pacific region indicates that more than 70% of regional emissions from the selected RepuTex universe are derived from companies based in Japan (31%), China (29%), and South Korea (11%) (see chart 2).

Chart 2
Asia-Pacific Universe
Direct Emissions History



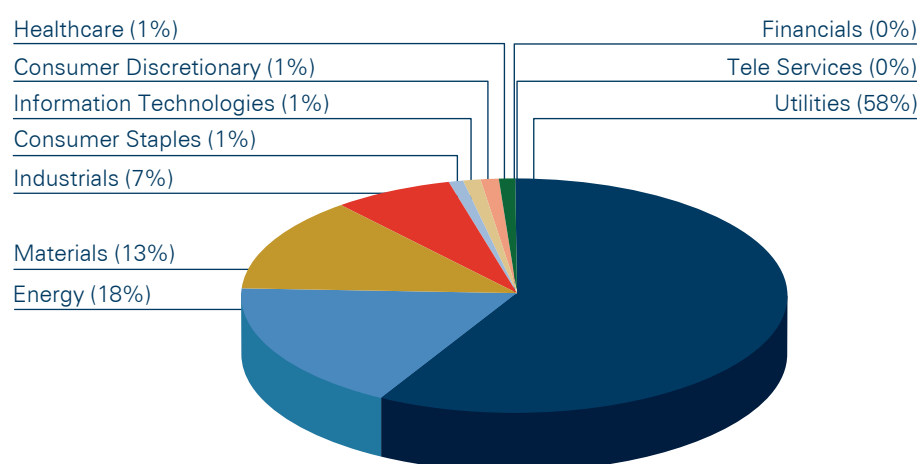
Utilities represent the overwhelming source of emissions across the regional universe in the RepuTex analysis, accounting for 58% of direct emissions, due to a strong reliance on fossil fuels. The energy (18%) and materials (13%) sectors were highly represented, with these sources in combination with utilities accounting for almost 90% of all emissions.

Direct emissions from the energy sector arise from upstream oil & gas extraction processes (e.g. flaring) as well as downstream refining processes. Offshore oil & gas production generally is more carbon intensive than are onshore operations.

Materials sector companies, including cement, steel, and fertilizer producers, directly emit greenhouse gases through fossil fuel usage as well as through industrial emissions relating to the chemistry of each process.

Transport companies, in particular airlines, are the major contributors to the Industrial sector's direct emission, which represents 7% of emissions across the regional universe according to RepuTex (see chart 3).

Chart 3
Asia-Pacific Universe
Emissions By Sector



Source: Reputex Carbon Analytics, 2010

CARBON RISK TRANSFORMED INTO A SOURCE OF COMPETITIVE ADVANTAGE

The survey results show that the most proactive corporates have already started incorporating carbon management across their entire value chains as part of their competitive-advantage strategies. One of the respondents said that it complies with the CO₂ Emission Reduction Program implemented by the Tokyo Metropolitan Government, such that it has begun implementing plans for CO₂ reduction in its Tokyo headquarters and discloses its progress every fiscal year via its Website. Some comments clearly indicate that in the survey respondents' view the incremental cost of creating a solid carbon-management strategy is trivial in comparison to its potential value in acquiring competitive advantage.

In anticipation of a mandatory emissions trading scheme (ETS) and official guidelines for accounting for liabilities and revenues associated with emissions, we believe that the utilities and airports sectors are pre-empting future regulatory carbon-reduction frameworks covering their operations and already reveal costs associated with their carbon footprints in their financial statements. In particular, Asia-Pacific airlines that fly in-and-out of and within the European Union face an imminent exposure to carbon regulation from 2012. According to the survey results, corporates from New Zealand that are already covered by a national ETS and have obligations to report their activities and surrender New Zealand units under that ETS are leading the trend. Companies from Australia, Japan, Malaysia, and South Korea also are actively preparing for future mandatory emissions-reporting obligations.

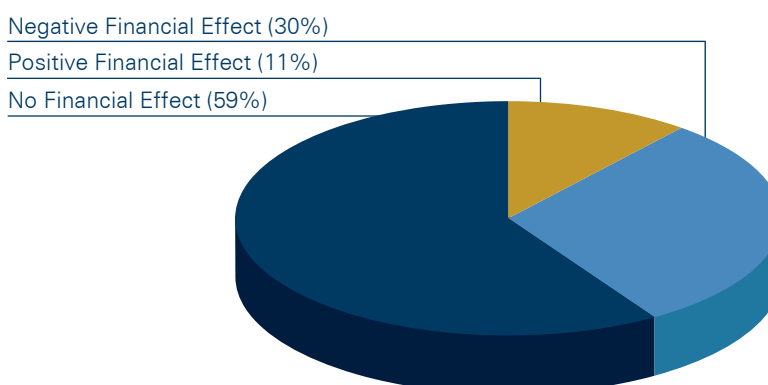
In total, 18% of the respondents stated that they already account for carbon liabilities in their statements and 32% of the respondents declared that they have just started looking into this.

Respondents from all sectors across entire Asia-Pacific region clearly stated that they anticipate climate change regulations to progressively affect their financial statements, with 41% of the respondents reporting that to a certain degree they already feel the impact of carbon regulations on their fund-raising activity.

It appears that some companies are already taking advantage of new climate legislation, with 11% of respondents—representing the oil & gas and electric utilities sectors from Australia, Malaysia, and Thailand—indicating that they have experienced positive effects of carbon regulations to date, notably via investment in low-emissions activities such as renewable energy, coal seam gas, and LNG. However, the chemicals, consumer products, utilities, integrated gas, and airports sectors from Australia, China, Japan, South Korea, Taiwan, and Thailand, show signs of experiencing negative effects of the carbon-reduction regulations on their fund-raising abilities (see chart 4). Research undertaken by RepuTex indicates that investors worldwide are increasingly more knowledgeable about carbon exposure, and analyse which companies present the greatest risks to portfolios, as well as opportunities created by carbon-efficient leaders.

China, Japan, and Taiwan were most concerned about regulatory frameworks.

Chart 4
Financial Impact of Carbon Reduction Regulations On Corporate Fund-Raising Abilities



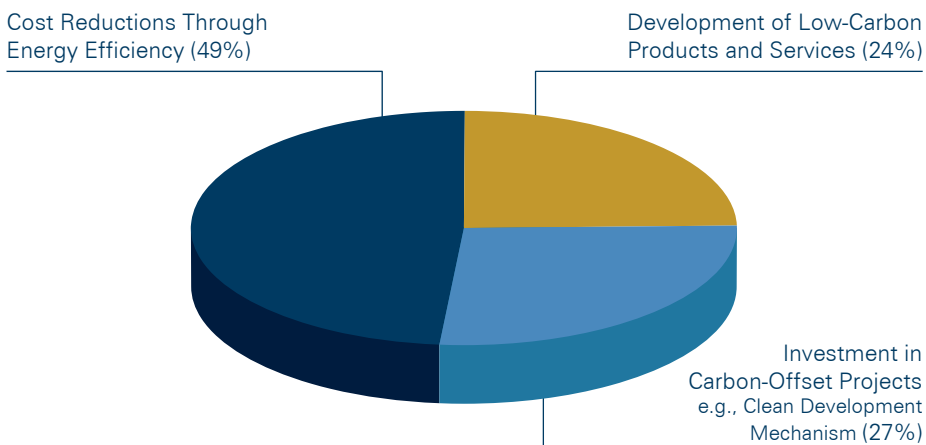
ASIA-PACIFIC CORPORATES INCREASINGLY ENGAGED IN CARBON-REDUCTION ACTIVITIES

We believe that corporate carbon-management strategies generally have been hampered by the current uncertainty and lack of clarity around both the nature and timing of future carbon regulations across the globe. However, the survey results indicate that Asia-Pacific corporates are increasingly engaged in carbon-reduction activities across their entire value chains. The respondent corporates appear to be actively exploring strategies to turn financial risks from carbon regulations into opportunities and a source of competitive advantage.

Energy efficiency was indicated as being the most preferable option across sectors and geographies, with respondents in the transportation and media & entertainment sectors entirely relying on this option.

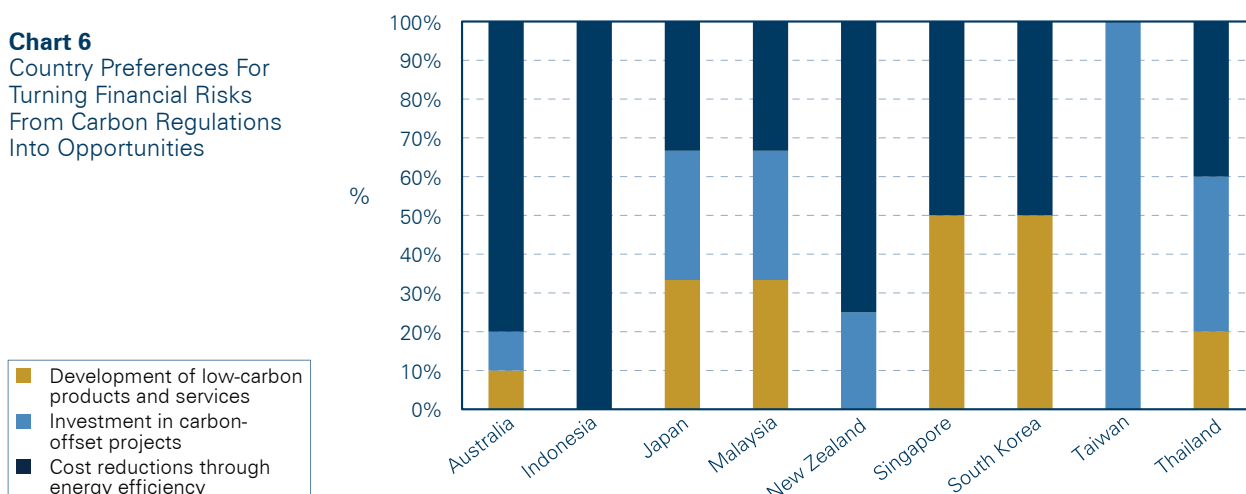
Investment in carbon-offset strategies was chosen by respondents in the oil & gas, integrated gas, and airports sectors as the most feasible carbon-abatement option. Development of low-carbon products and services was favoured by the metals & mining and retail sectors (see chart 5).

Chart 5
Preferences For Turning
Financial Risks From
Carbon Regulations
Into Opportunities



In terms of geographical position, respondent corporates from Australia, Indonesia, and New Zealand view themselves as being better positioned to reduce carbon risk through energy-efficiency measures. Chart 6 describes corporates' preferred options for turning carbon risk into opportunity by the main operations location.

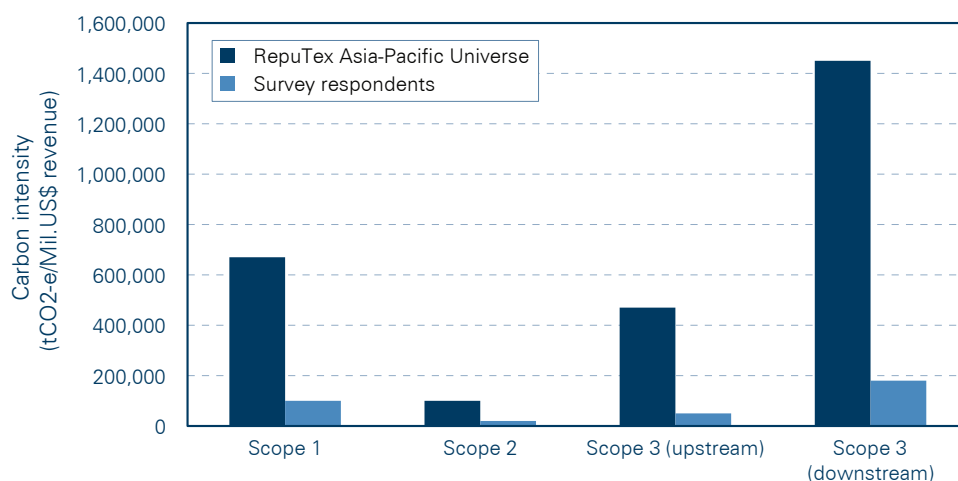
Chart 6
Country Preferences For
Turning Financial Risks
From Carbon Regulations
Into Opportunities



VALUE CHAIN EMISSIONS ANALYSIS POINTS TO VARYING PERFORMANCE

RepuTex undertook a benchmarking exercise to model the levels of Asia Pacific's average emissions-intensity by scope and to compare the results with the performance shown by the survey's respondents (see chart 7).

Chart 7
Asia-Pacific Universe
Value Chain Carbon
Intensity Chart



Source: Reputext Carbon Analytics, 2010

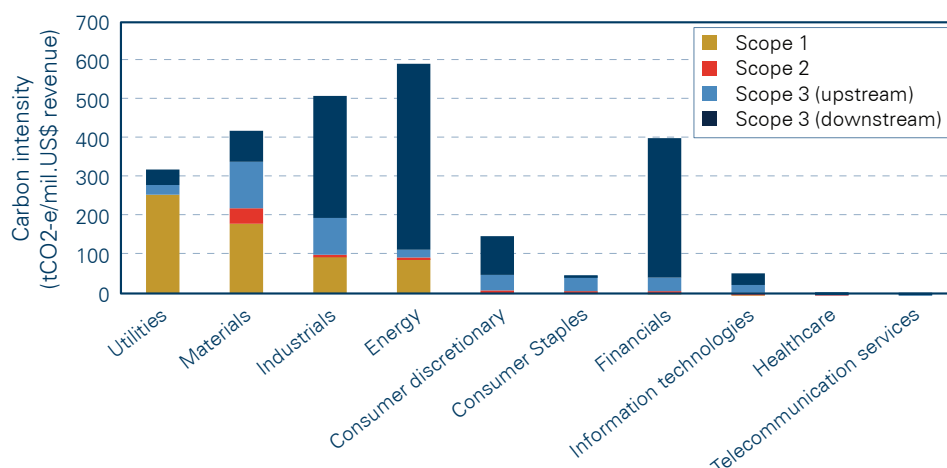
Value-chain carbon-intensity generally is regarded as a good indicator of vulnerability to carbon pricing. Expressed in terms of tonnes of CO₂-e emitted per million dollars of revenue, carbon intensity corresponds to the total emissions (direct and indirect) throughout a company's value chain in order to put goods or services in the market, including the end usage of these products and services. For example: for the automotive sector, total carbon-intensity analysis includes the quantity of carbon needed to produce a car (i.e. Scope 3 – Upstream), the fossil fuel consumed during production (i.e. Scope 1), electricity consumption during production (i.e. Scope 2), and the carbon emitted during the use and eventual disposal/recycling of a car (i.e. Scope 3 – Downstream). By applying this comprehensive-value-chain approach to carbon risk, RepuTex believes its analysis more accurately reflects a company's entire carbon risk and dependence. See Appendix for definitions for the scopes of emissions.

In a carbon-constrained economy, direct carbon intensity indicates a company's exposure to carbon-permit liability under a cap-and-trade or a carbon-tax system. Supply chain and electricity carbon intensity allow an assessment of a company's likely indirect cost exposure.

Downstream carbon intensity provides insight into a company's broader exposure to carbon risk. For instance, through a border tax, Australia's coal exporters could incur liability for their "downstream" or product-usage-related emissions in carbon-conscious European markets.

Overall, the direct and indirect (Scopes 2 & 3) carbon intensity of RepuTex's Asia-Pacific universe is higher than that of survey respondents, indicating a higher degree of vulnerability and impacts to cost under future carbon-pricing regimes. We believe this is mainly due to a lower representation of carbon-intensive industries within the surveyed universe.

Chart 8
Asia-Pacific Universe
Carbon Intensity By
Sector



Source: Reputex Carbon Analytics, 2010

Value-chain emissions at a sector level reveal that respondent companies in the utilities and materials sectors have significant direct emissions, while respondents in the consumer discretionary and consumer staples sectors are exposed to high supply chain (Scope 3 and Upstream) emissions (see chart 8).

For materials, Scope 2 emissions primarily arise from high electricity usage during metal smelting and refining processes. Overall, 74% of the survey respondents are quantifying their Scope 2 emissions. Given that electricity prices generally increase post an ETS, companies who do not implement energy-efficiency strategies may be less well-placed to minimise future costs.

For utilities and materials, RepuTex estimate that direct emissions contribute 77% and 44% of value-chain emissions, while for industrials (e.g. building products, construction), energy, and consumer staples, indirect emissions make up around 82%, 86%, and 84% of each sector's value-chain carbon intensity, respectively. We believe that this indicates that utilities and materials could face significant direct-permit liability under a cap-and-trade or a carbon-tax system whereby liability is dependent on the level of direct carbon intensity. Meanwhile, industries with high indirect emissions are likely to experience higher supply chain and impacts on electricity price due to a pass-through of carbon costs in our view.

Overall, the survey results indicate limited accounting for Scope 3 emissions, with only 30% and 26% of the respondents stating that they quantify their supply chain and downstream emissions, respectively.

According to the survey, the most proactive sectors in quantifying emissions appeared to be chemicals, metal & mining, and airports. Of the respondents from these sectors, 100% indicated that they quantify their direct carbon footprint (Scope 1).

In terms of geographical distribution, the survey indicates that corporates that take an active voluntary approach in quantifying their direct carbon footprint are based in Australia, Japan, Malaysia, New Zealand, South Korea, Taiwan, and Thailand.

All the respondents that already quantify their direct emissions outlined that while calculating their carbon footprint they do a complete coverage of all facilities under operational control and compute their emissions data based on standard methodologies (e.g. GHG Protocol). For instance, a construction company has applied GHG Protocol guidelines to establish its carbon-emissions inventory (including some Scope 3 emissions such as business travel). This inventory accounts for emissions from constructions sites, buildings, and also the company's headquarters, and it has the potential to provide "good practice" guidelines for the construction industry.

Nearly 80% of the respondents chose implementing energy efficiency measures as the most preferable and feasible option to mitigate carbon exposure. Investing in clean technologies, innovation, and renewable energy, and retrofitting and optimising existing processes, were chosen by 71% of the respondents. We believe that this indicates that respondents are taking advantage of “low-hanging fruit” such as energy-efficiency measures, which often result in cost savings (i.e. “negative cost”).

In terms of corporates’ upstream emissions (Scope 3), only 4 % of respondents were confident that they were knowledgeable about their supply-chain partners’ carbon intensity. Meanwhile, 52% of the respondents stated that they are knowledgeable but only to some extent.

Around one-third of respondents said that they have considered the potential increase in supply-chain cost that may occur under a low-carbon economy, and expressed their readiness to tackle their upstream emissions, with 39% of the total number considering streamlining their supply-chain operations and 30% of total number favouring finding a way of selecting supply partners that have lower emissions.

The most proactive sectors ready to undertake actions to reduce the risk of carbon cost from their supply chain were the transportation, chemicals, electric utilities, and integrated gas sectors. In terms of geographic locations, these corporates are placed in Australia, Japan, Malaysia, New Zealand, and South Korea.

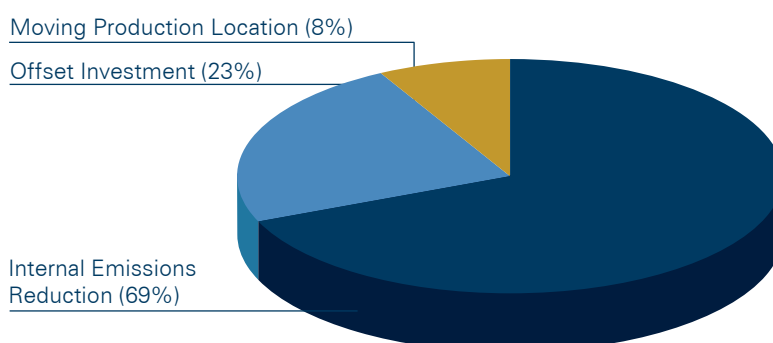
According to the survey respondents, the best-positioned sectors in terms of passing carbon costs to the end consumer are the electric utilities, integrated gas, and airports sectors. The sectors that have a partial ability to pass on carbon cost are chemicals, metals & mining, and oil & gas.

Respondent corporates from Taiwan, South Korea, Singapore, and New Zealand believe that regulatory framework will give them the ability to shift additional costs of emissions reduction on to the end product/service users.

In total, 57% of the respondents seriously consider developing strategies to manage downstream carbon costs that arise from the potential imposition of carbon tariffs on imported products from Asia Pacific suppliers. Of the respondents, 38% are planning to develop alternative low-cost carbon products, and 19% purchasing of carbon offsets or investing in carbon-offset projects.

Considering strategies to mitigate entire carbon exposure, 59% of survey respondents chose internal emission reduction as their preferred option. Only 5% of the respondents considered the possibility of moving production locations, meaning minimal carbon leakage to non-regulated markets. This contrasts with the results from the Standard & Poor’s European Corporates Carbon Exposure Survey, published March 1, 2010 (see footnote 2), which showed moving of production location was chosen by 17% of the respondents as a possible option. (See chart 9.)

Chart 9
Preference For Mitigating
Entire Carbon Exposure



CARBON COST ANALYSIS

For illustrative purposes, RepuTex has modelled the implementation of a hypothetical regional ETS for the selected Asia-Pacific countries covered in the survey. The purpose of this exercise was to investigate the potential direct (i.e. permit trading) and indirect (supply chain and electricity costs) financial impacts of a typical ETS on Asia-Pacific corporates.

The scheme was applied equally across all markets, based on the following assumptions:

- Implementation of a cap-and-trade scheme across all Asia-Pacific countries.
- Economy wide ETS covering all sectors
- Overall mid-term target of 20% by 2020
- ETS inclusion threshold of 25,000 tCO₂-e (direct emissions only)
- Starting carbon price of US\$20/tCO₂-e

BACKGROUND TO REPUTEX'S ETS LIABILITY MODEL

RepuTex's Carbon Liability Model adopts a holistic approach to measuring direct (permit and trading) and indirect (electricity and supply chain) carbon costs facing each company, in addition to projections of costs passed through to consumers—for example, impact on post-ETS revenue from the increased price of goods. This net position is termed the company's Total Carbon Liability.

Each key carbon impact is modelled using a combination of company research and Scopes 1, 2, and 3 greenhouse gas emissions data compiled by RepuTex.

Total ETS liability	=	I. Net permit expense	+	II. permit trading cost	+	III. Electricity price impact	+	IV. supply chain impact	–	V. Revenue impact
(passed-on costs)										
Direct carbon costs					Indirect carbon impacts					

The translation and normalisation of liabilities into comparable metrics is essential for benchmarking the real risks that a company faces from a hypothetical ETS.

RepuTex measures carbon risk using three financial metrics to allow flexible and meaningful comparisons:

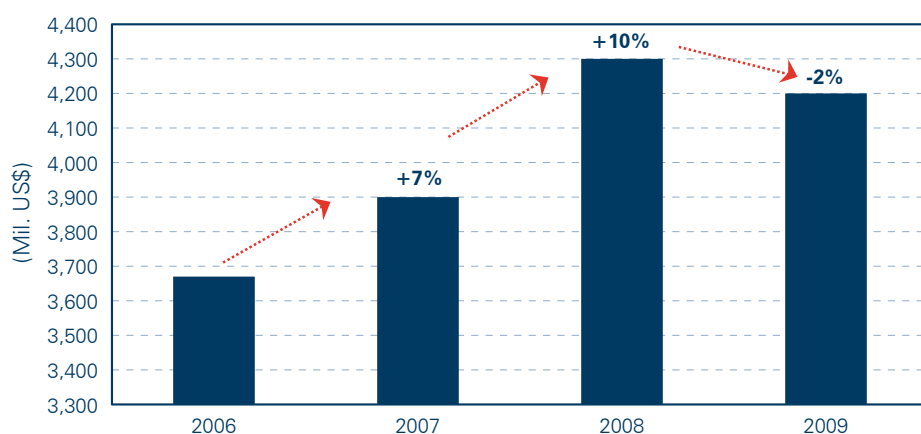
- Revenue exposure: carbon liabilities as a percentage of revenue
- EBITDA exposure: carbon liabilities as a percentage of EBITDA
- Value at carbon risk (VACR): valuation impact of carbon liabilities as a percentage of market value.

Value at carbon risk (VaCR) is a proprietary investment risk metric developed by RepuTex to model and translate firm-level carbon liabilities into an ex-ante valuation impact. Accordingly, VaCR estimates the market value of a firm that is expected to be “at risk” should that firm continue to operate “as is” under a proposed ETS (i.e. in the absence of emissions abatement).

In determining VaCR, RepuTex adopts a capitalisation-of-“cost”-earnings approach that measures the impact on net profit after tax in conjunction with the company’s current pre-carbon P/E multiple.

Using the RepuTex ETS liability model, for Asia-Pacific companies across the selected universe, the average annual cost of a hypothetical regional ETS in 2006 would have been about US\$3.62 billion. Based on emissions growth experienced across the region, a 7% increase would have occurred by 2007, followed by a 10% increase to US\$4.2 billion by 2008. Costs dropped slightly in 2009, attributed to the industrial slowdown post the global financial crisis (see chart 10).

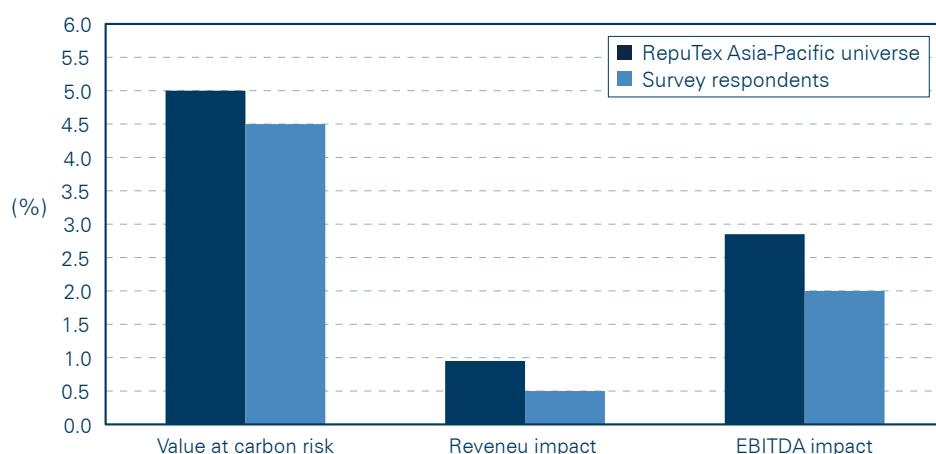
Chart 10
Asia-Pacific Universe
Annual ETS Costs



Source: Reputex Carbon Analytics, 2010

Based on the commencement of a hypothetical regional ETS, Asia-Pacific companies within the universe may be exposed to up to a 5% VACR impact, with the survey respondent sub-set exposed at a slightly lower 4.2% (see chart 11). Higher carbon prices due to increased demand within the market would potentially mean a higher valuation impact for Asia-Pacific companies.

Chart 11
Average ETS
Valuation Impacts



Source: Reputex Carbon Analytics, 2010

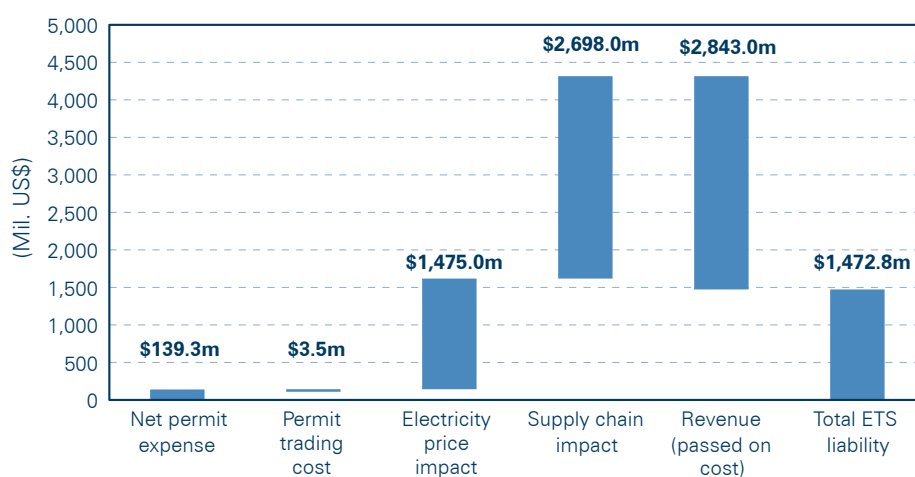
COST BREAKDOWN ACROSS THE VALUE CHAIN

Recognising climate change and carbon-reduction commitments as a possible source of a company's competitive advantage, 46% of the survey respondents already perform their direct emissions forecasting to determine their future carbon liabilities and to build carbon-management strategies around it.

Survey results indicate that the oil & gas, metals & mining, electric utilities, and integrated gas sectors anticipate significant carbon exposure under future ETS, and are already performing direct-emissions forecasting to determine future carbon liabilities.

A trend is shown by the survey respondents from China, Malaysia, Australia, Japan, South Korea, and Thailand, who indicated that they perform direct emission forecasting. One of the respondents stated: "We review our operation from upstream to downstream to identify key operations that have negative impacts on the environment and climatic change, and take necessary action—medium-to-long-term action plans to contribute to greener operations in Malaysia".

Chart 12
Asia-Pacific Universe
Value-Chain-Liability Profile



Source: RepuTex Carbon Analytics, 2010

In assessing a company's emissions profile and its potential liability on a carbon price, we believe it is important to take a holistic-value-chain approach so that overall costs to a business model can be assessed and abatement strategies implemented accordingly.

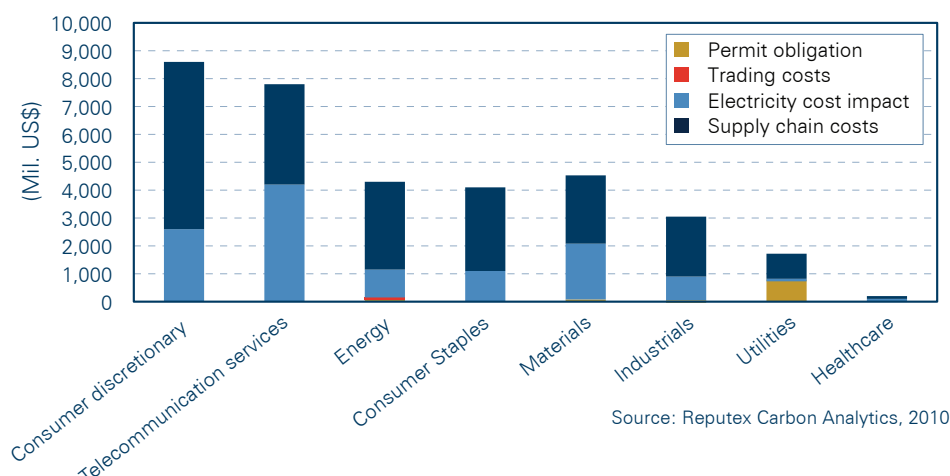
Across the Asia-Pacific universe selected and analysed by RepuTex, indirect (supplier, electricity) carbon liabilities outweigh direct permit-trading costs, with the latter accounting for only 3% of total ETS costs; indirect supply chain and electricity costs make up 63% and 34% of total costs, respectively.

A large percentage of incurred costs—US\$2.84 billion, or about 65% of total costs—is likely to be passed through to downstream customers through higher pricing arrangements, leaving a net liability across the universe of US\$1.47 billion. RepuTex estimates pass-through rates by reviewing the competitiveness of an industry and the given firm within that industry. Pre-carbon profit margins relative to industry group are an important metric according to RepuTex; it is also, in our view, essential to conduct sensitivity analysis as estimates are established.

In both Standard & Poor's and RepuTex's opinions, the ultimate impact on a given industry is likely to be determined by the market dynamics (strength of competition, suppliers etc), government subsidies, and costs structures. At the company level, carbon exposure generally is assessed on the basis of the specific expected costs of carbon and the potential revenue flows associated with carbon regulation and competition.

In our view, companies with strong market positioning, and carefully selected and closely managed supply chains and procurement practices, and those with energy efficiency and abatement policies, are likely to be best-placed to mitigate such indirect costs.

Chart 13
Asia-Pacific Universe
Value-Chain-Liability-
Profile By Sector



According to the analysis carried out by Reputex, value-chain costs by sector indicate that despite having the lowest exposure to a direct carbon price, consumer discretionary and telecommunications companies could potentially have the highest overall annual carbon liability due to high supply-chain cost exposure. The level of indirect exposure for each company is assessed by reference to pricing power and market positioning. (See chart 13.)

Utilities, energy, and materials companies are likely to make up the largest share of the carbon compliance markets across Asia Pacific. This trend is in line with the European ETS experience, which is the largest operational scheme globally.

As well as direct-permit expenses, materials companies, including carbon-intensive industries such as steel, cement, chemicals, and fertilizer manufactures, are also likely to face very significant increase in cost for raw materials, fuel, and electricity, in our view.

The above analysis indicates that a carbon price would have important implications for survey respondents, notably those within the consumer discretionary, energy, and consumer-staples industries. Survey responses indicate that consideration of supply-chain emissions has taken a backseat to direct emissions, with only 5% of survey respondents having a reasonable idea about their supply-chain partner's carbon intensity, whilst 52% of respondents indicated "some" knowledge, and the remaining 43% had no knowledge at all.

Overall, results reflect that for Asia Pacific, there is further room for development of risk analysis of both direct and indirect carbon costs, as well as the competitive implications of these carbon risks and liabilities.

SURVEY METHODOLOGY

In this survey, we canvassed the views of 318 corporate issuers rated by Standard & Poor's on their current and anticipated future position in terms of their corporate carbon exposure.

The results cover a wide variety of industry sectors. They include those sectors that have obvious high carbon exposure—electric utilities, chemicals, building materials, and oil & gas. They also encompass sectors that, due to the nature of their activity, are not directly exposed to carbon legislation to the same extent—auto suppliers, for example. The response rate of 28 completed questionnaires represents 9% of the sample population, which is above average for this kind of survey and therefore statistically valid in our view. Furthermore, the spread of responses is reasonably broad across all industrial sectors.

FOOTNOTES

1. RepuTex is a research firm specialising in carbon risk analytics for global companies and investment professionals and a recognized knowledge source for market participants seeking to measure, benchmark, and price carbon risk and exposure. RepuTex specialises in data-driven advisory and analytical services, underpinned by the company's proprietary database of emissions information on more than 250,000 assets in 80 markets globally. RepuTex was founded in 1999 and is headquartered in Hong Kong, with offices in Melbourne, Australia. For more information visit: www.reputex.com
2. Standard & Poor's "European Companies Look To Carbon Markets And Reduction Measures To Manage Their Emissions Exposure", published March 1, 2010.

APPENDIX: 'SCOPES OF EMISSIONS' REFERRED TO IN REPUTEX ANALYSIS

SCOPE 1: DIRECT CARBON INTENSITY

This metric refers to the carbon dioxide-equivalent emissions of direct emissions of a business activity per million U.S. dollars (tCO₂e/Mil.US\$ revenue). Direct emissions include: fuel use, energy use, manufacturing process activity, mining activity, and on-site waste disposal.

SCOPE 2: INDIRECT CARBON INTENSITY

This metric refers to the carbon dioxide-equivalent emissions associated with electricity purchase or consumption (or steam or heating/cooling) per million U.S. dollars revenue (tCO₂e/Mil.US\$ revenue) for a particular business activity.

SCOPE 3 (UPSTREAM): SUPPLY CHAIN CARBON INTENSITY

This metric refers to the carbon dioxide-equivalent emissions per million U.S. dollars revenue (tCO₂e/Mil.US\$ revenue) associated with the supply chain (e.g. raw materials, logistics) of the business activity

SCOPE 3 (DOWNSTREAM): USE PHASE CARBON INTENSITY

This metric refers to the carbon dioxide-equivalent emissions per million U.S. dollars revenue (tCO₂e/Mil.US\$ revenue) associated with the use phase of a product (e.g. downstream N₂O emissions of fertilizers when applied for agricultural purposes).

DIRECT CARBON FOOTPRINT (SCOPE 1)

This refers to the total direct carbon footprint of a company (tCO₂e). This direct carbon footprint includes:

- Stationary combustion: To produce electricity, steam, heat or power using equipment in a fixed location.
- Mobile combustion: Fuels used in transportation e.g. cars, trucks, marine, aviation; and emissions from non-road equipment such as equipment used in construction, agriculture and forestry.
- Physical and chemical processes: Other than fuel combustion (e.g. the manufacture of cement, aluminium, adipic acid and ammonia).
- Fugitive sources: Releases for the production, processing, transmission, storage, and use of fuels and other substances that do not pass through a stack, chimney, vent exhaust pipe or other functionally-equivalent opening (such as releases of sulfur hexafluoride from electrical equipment; hydrofluorocarbon releases during the use of refrigeration and air condition equipment; and methane leakage from coal mining and natural gas transport).

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