Green Consultancy

Climate Change and the Transport Sector: Carbon Pricing and Offset Mechanisms

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Introduction

1.1 TRANSPORT AND CLIMATE CHANGE

There is consensus among scientists that the primary cause of global warming is the rapid increase in the concentrations of heat-trapping gases in the atmosphere, mainly caused by human activities, such as the burning of fossil fuels (IPCC 2013, 2014). The transport sector has been identified as making a substantial contribution to this situation. The sector relies heavily on burning fossil fuels, with 94 per cent of the total transport energy demand provided by oil, corresponding to over 53 per cent of global oil consumption (IEA 2012). As economic growth increases (alongside the demand for personal mobility and freight), energy security and sustainability in the transport sector have become major areas of concern – given that transportation energy sources need to be available at an affordable price, and given that the sector is a major contributor to global warming.

On a global scale, the transport sector contributes approximately a quarter of total energy-related CO₂ emissions, and this contribution is growing faster than for any other energy end-use sector (IPCC 2014). Statistics from the International Council of Clean Transportation (ICCT 2017) show that road vehicles such as cars, trucks, buses and motorcycles, account for nearly three-quarters of global transport emissions. Several factors are contributing to the rising emissions trend, including population growth, economic development and greater demand for travel, but also socio-economic factors such as the increasing demand for larger vehicles. Road emissions have increased despite a higher share of electric vehicles around the world (IEA 2019).\(^1\)

Due to the long-lived nature of CO₂ in the atmosphere, the impact of today’s emissions will likely drive problems related to climatic change over the next century. If current trends continue, rapid growth in greenhouse gas (GHG) emissions will lead to fundamental shifts in the Earth’s climate equilibrium, which will have significant impacts on human society. Hence, cutting emissions from the transport sector will be central to curbing global warming. Without stringent policy intervention, transport emissions are expected to double by 2050 (IPCC 2014).

It is important to note that transport systems and services are not just contributing to climate change but are also particularly vulnerable to the potential impacts of a changing climate. For example, rising sea levels and the associated increase in the frequency and severity of bushfires, storm surges and flooding incidents may be among the most worrying consequences of climate change. Since reliable transport is a critical part of economic and social welfares, it is imperative for countries across the world to develop and implement effective adaptation strategies to increase the resilience of transport against climate change.

1.2 AUSTRALIA’S TRANSPORT EMISSIONS

Australia’s total GHG emissions were estimated to be 510.1 million tonnes (Mt) of carbon dioxide equivalent (CO₂-e) for the year to September 2020, down 4.4 per cent or 23.3 Mt CO₂-e on the previous year (Australian Government 2020). The decline in emissions reflects ongoing reductions in emissions from electricity (down 4.0 per cent) and fugitive (down 7.3 per cent) emissions from fuel extraction due, in part to a reduction in venting and flaring, and the short-term effects of COVID related restrictions on emissions from transport (which fell 10.2 per cent) and from the after-effects of the recent drought on agriculture (down 2.5 per cent) (Australian Government 2020). Overall, total emissions in Australia have declined by 21.7 per cent since their peak in the year to June 2007. At the same time, they were 8.1 per cent below emissions in 2000 and 19.0 per cent below emissions in 2005 (Australian Government 2020).

\(^1\) In 2018, the global share of electric vehicles sold increased to more than 2.5%, with fleets of electric buses and trucks procured in more and more cities around the world (IEA 2019).
The largest contributors are eight of Australia’s major sectors: electricity, transport, fugitive\(^2\), stationary energy excluding electricity, industrial processes and product use, agriculture, waste and land use, land-use changes and forestry (LULUCF) (Australian Government 2019a). While the electricity sector is responsible for the largest share of CO\(_2\) emissions (approximately 33%), transport is Australia’s third-largest source of GHG emissions after electricity and the stationary energy sector, accounting for roughly 18% of emissions (Australian Government 2020). In the year to September 2020, transport contributed 89.8 Mt CO\(_2\)-e to Australia’s emissions. Transport emissions are produced from the direct combustion of fuels, such as petrol, diesel oil, liquefied petroleum gas (LPG) and aviation turbine fuel, in transportation by road, rail, domestic aviation, rail, domestic shipping, off-road recreational vehicle activity and gas pipeline transport (Australian Government 2018).

In percentage terms, as illustrated by Figure 1.1, Australia’s transport emissions have been steadily rising with the largest growth by 64.9 per cent (39.8 Mt CO\(_2\)-e) between 1990 and the year to September 2020. The main driver for the increase in transport emissions is the continuing growth in passenger and freight activity that is supported by steady economic and population growth as well as a switch to diesel vehicles (Australian Government 2018). Pollution levels from transport are projected to continue to grow until 2030 and beyond, reaching 111 Mt CO\(_2\)-e in 2030, a further 9 per cent above the 2018 levels (Australian Government 2018).

\[\text{Figure 1.1: Per cent change in emissions, by sector (1990-2020)}\]

The primary source of transport emissions in Australia is road transport, which accounts for 84.3 per cent (85.8 Mt CO\(_2\)-e) of transport emissions. Emissions are mainly driven by the popularity of motor vehicles as modes of passenger and freight transport in Australia. As shown in Figure 1.2, passenger cars account for almost half (44 Mt CO\(_2\)-e) of Australia’s transport emissions, which is roughly the same amount of yearly emissions as Queensland’s entire electricity supply (Australian Government 2018, Queensland Renewable Energy Expert Panel 2016).

The Australian transport sector has consistently ranked in the bottom quintile of the International Energy Efficiency Scorecard over the years. In 2018, Australia lagged behind Indonesia, Poland, Mexico, Russia and Ukraine on transport efficiency, scoring fewer than 10 points out of a possible 25

\(^2\) The fugitive sector typically covers emissions from extraction, storage, handling, transmission and distribution of solid, liquid, and gaseous fuels. Major sources of carbon emissions in the fugitive sector include, for example, refineries and offshore installations in upstream oil and gas production.
Australian vehicles also generate more GHG emissions per kilometre than comparable countries due to other factors, including high car use, preference for heavier vehicles, lack of GHG emissions standards or fuel-efficiency standards in place, and relatively low spending on public transport compared to roads (Climate Council 2017). The national average CO2 emissions intensity for all new passenger and light commercial vehicles sold in 2018 was 180.9 g/km, while the average passenger vehicle in Australia emitted 171.5 g of CO2 per kilometre in 2017 (National Transport Commission 2019). Emissions from cars are projected to decline from 2025 when increases in activity will be offset by improved fuel efficiency and fuel switching to electric vehicles (Australian Government 2019a).

**Figure 1.2: Transport emissions projections (1990-2030)**

1.3 AUSTRALIA’S CLIMATE TARGETS AND POLICIES

To avoid environmental catastrophe, the international community has agreed to prevent global temperatures from rising by 2°C above pre-industrial levels under the 2015 Paris Agreement (IPCC 2018). In November 2016, Australia ratified the Paris Agreement with a target of 26-28 per cent emissions reductions below 2005 levels by 2030 (Australian Government 2015). However, as the magnitude of environmental change is more significant than previously expected, the Intergovernmental Panel on Climate Change (IPCC) calls for unprecedented global efforts to stabilise global warming at 1.5°C, which requires decreasing net emissions by around 45 per cent by 2030 and reach net zero emissions by 2050 (IPCC 2018). Countries have been asked to flag plans for net-zero emissions by 2050. Currently, Australia is not on track to meet its emissions reduction target for 2030.

The Federal Government has yet to confirm its methodology and approach for estimating sector-specific emissions reduction targets, suggesting that there is currently no official target for the reduction of emissions in the transport sector. Under the National Energy Guarantee, the Federal Government proposes to lock in an emissions reduction target for the electricity sector, consistent with achieving a 26 per cent reduction on 2005 levels by 2030 (Energy Security Board 2018). This approach implies that other sectors would also be required to meet their equivalent 26 per cent prorata share. Reducing transport emissions by 26 per cent below 2005 levels requires the sector to cut its emissions by a third by 2030 compared to a business-as-usual scenario (Climate Council 2018a). Australia remains among the few OECD countries without mandatory GHG emission standards in place for vehicles, despite this being signalled by the government as a key part of policies to meet...
Australia's future climate target (Climate Council 2017). Over 70 per cent of light vehicles sold worldwide are subject to mandatory vehicle emissions standards (Climate Change Authority 2014b). In countries such as the United States, Japan and China, mandatory standards have proven to be effective in delivering environmental and economic benefits (Climate Change Authority 2014). In Australia, new cars sold emitted an average of 45 per cent more CO2 per km than new cars sold in Europe in 2017 (National Transport Commission 2019). Australia is also the only OECD country without an official fuel efficiency target (ICCT 2015). If stringent standards are introduced for light vehicles, Australia can deliver up to 65 Mt CO2-e of emission reductions by 2030 (Australian Government 2017), a number considerably higher than annual CO2 emissions by the entire New South Wales coal-fired power stations (Climate Council 2018b).

The success of mandatory standards in cutting emissions relies on the replacement of high-emission vehicles by low-emission vehicles over time (Climate Council 2018b). Given that the cost of electric vehicles continues to drop (despite limited government incentives in Australia), current technological advances could lead to a significant reduction in road emissions (IEA 2018). In Australia, the adoption of electric vehicles is being held back by the lack of policy support and national/state targets, higher upfront cost, limited choices of available electric vehicles for sale and limited access to electric vehicle charging infrastructure (Climate Council 2018b). According to ClimateWorks (2018), there were 2284 electric vehicles sold in 2017, making up only 0.2 per cent of the Australian market. Without regulatory intervention, Australia is likely at risk of lagging behind and missing opportunities to reduce emissions.

There have been proposals from the Federal Government to either reduce vehicle emissions or introduce fuel efficiency standards (ICCT 2017). These policies, however, are still at an early stage of development. Australia does not have a well-defined green freight program in place but has been considering establishing an initiative similar to those implemented in the European Union and the United States (ICCT 2017). In February 2019, the Australian Government also announced the development of a National Strategy for Electric Vehicles to manage the transition to new vehicle technology and infrastructure (Australian Government 2019b).

As illustrated by the European Union, putting a price on carbon can encourage low-carbon growth and lower GHG emissions in specific industry sectors. So far, many carbon pricing mechanisms are confined to the electricity sector or energy-intensive industries, but several governments are now considering introducing a price on CO2 emissions also in sectors such as transport and buildings. Future requirements for further reducing GHGs from all major CO2 emitting sectors makes it likely that also the transport sector will be affected by a price on carbon. The following section provides a review of carbon pricing mechanisms and instruments in an international and domestic context.

## Carbon Pricing

### 2.1 Carbon Pricing Mechanisms

Climate change is often considered to be the result of a market failure to account for the external cost of GHG emissions to our society (Fang 2018). In order to reduce CO2 emissions, the pricing of carbon has been proposed as the most promising tool to decarbonise global economic activities. As pointed out by the World Bank Group (2019), the need to strengthen and accelerate carbon pricing has also been reaffirmed in recent years by international organisations, such as the IPCC, the International Monetary Fund (IMF) and the Organisation for Economic Co-operation and Development (OECD). Currently, almost 100 countries accounting for 55 per cent of global emissions have adopted or are planning to adopt carbon pricing as a tool to meet their commitments to the Paris Agreement (World

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3 The international “Euro standards” have been placed for new vehicles in Australia since the early 1970s and these have been progressively tightened over the years (Department of Infrastructure, Regional Development and Cities 2014). However, Euro standards only apply to air pollutants, e.g., nitrogen oxides, hydrocarbons, carbon monoxide. Separate regulatory emissions standards are also required for CO2 emissions.
Carbon pricing involves putting a price on GHG emissions, forcing emitters to internalise the costs of future damages due to climate change. The “polluter pays” principle of carbon pricing makes emitters accountable for their negative externalities while creating an economic incentive for them to minimise their costs by reducing emissions (Bowen 2011). Carbon pricing also sends a price signal to shifts consumption and investment patterns with the aim to encourage the uptake of clean technologies and accelerate a smooth transition to a low-carbon economy (UNFCCC 2019a). The choice and design of a carbon pricing instrument for any specific jurisdiction depends on economic circumstances, constitutional provisions, international commitments, and the capability to develop and implement the system (Haites 2018). Carbon pricing instruments can take on several forms, including the implementation of an emissions trading system or the imposition of a carbon tax on each metric tonne of carbon dioxide emitted.

EMISSIONS TRADING

Under an emissions trading system, a limit or cap on total allowable emissions for a given period is set in advance in a country or region. Permits to pollute are either allocated to or purchased by emitters. Given that emitters must have allowances to cover their emissions, permits can then be traded among emitters: a polluter whose emissions are trending below its cap can sell its excess permits to emitters with larger carbon footprints. Through demand and supply for emission allowances, a market determining the price of the permits is created. If the cap is set low, permits will be in short supply, leading to a higher price of emissions (which, in turn, provides emitters with an incentive to curb their emissions). Therefore, the system is also known as cap-and-trade.

Because permits are tradable, market forces determine the distribution of reduction efforts that keep emissions within the cap (Stavins 2007). A well-designed cap-and-trade system thus allows emitters to realise emission reductions in the most flexible and cost-effective manner (UNFCCC 2019a). Overall, a cap-and-trade system provides certainty regarding mitigation outcomes because the cap helps to ensure that the required emissions reductions will take place by keeping emitters within their pre-allocated emissions budget (UNFCCC 2019a). For example, the European Union Emissions Trading Scheme (EU ETS) for CO2 allowances was set up in 2005 and is one of the major pillars of the EU to meet emission reductions under the Kyoto Protocol (Stavins 2007) (and now the Paris Agreement). Emissions from sectors covered by the EU ETS will be reduced by 21 per cent of the 2005 level by 2020 (European Commission 2019).

CARBON TAX

A carbon tax directly sets a price of carbon by defining the rate of the tax for each tonne of GHG emitted. Those emitters subjected to the tax have an incentive to reduce their tax payments by lowering their emissions. A gradual rise in the carbon tax rate over time can help to reflect the growing damage caused by climate change and give emitters time to adjust (Fang 2018). With a carbon tax, the price of emissions is set by policymakers rather than by a market mechanism. Carbon taxes thus provide price certainty because emitters subject to the tax know exactly how much they need to pay for their emissions. However, regulators have less direct control over the level of emissions reductions to be achieved. Hence, a potential administrative burden derives from the need to adjust tax rates frequently in response to changing circumstances. A carbon tax raises revenues, which can be earmarked to lower distortionary taxes, reduce the national debt, and support mitigation and adaption activities or be returned to households as dividends (Fang 2018). Several Scandinavian countries implemented a carbon tax in the early 1990s. The Swedish carbon tax is today by far the highest in the world, with a price of US$127/t CO2-e (World Bank Group 2019). The Canadian province of British Columbia introduced North America’s first revenue-neutral carbon tax on fuel consumption in 2008, covering 70 per cent of provincial GHG emissions (World Bank Group 2019).
COMPARISON

Both emissions trading and carbon tax schemes aim to reduce emissions by defining a price for emissions, but they achieve this goal in distinct ways. A cap-and-trade system lets the market determine the price of permits while a carbon tax lets the market determine emission reductions. The level of the cap or tax and its rate of decrease (for a cap) or increase (for a tax) over time determines the extent to which emissions are reduced (RFF 2019). Table 1 provides a brief summary of the most relevant features of an emissions trading scheme and a carbon tax.

<table>
<thead>
<tr>
<th></th>
<th>Emissions Trading</th>
<th>Carbon Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Price</td>
<td>Determined by the demand and supply for emissions allowances.</td>
<td>Set as a tax rate for emissions.</td>
</tr>
<tr>
<td>Emissions Reduction</td>
<td>Determined by the level of the cap on total allowance emissions and the rate of decrease of the cap.</td>
<td>Determined by the tax level on emissions and the rate of increase of the tax.</td>
</tr>
<tr>
<td>Examples</td>
<td>EU ETS, New Zealand ETS, Korea ETS, Shanghai pilot ETS</td>
<td>Alberta Carbon Tax, British Columbia Carbon Tax, Finland Carbon Tax, Sweden Carbon Tax, France Carbon Tax, Norway Carbon Tax</td>
</tr>
</tbody>
</table>

2.2 CARBON PRICING SCHEMES

The total value of emissions trading schemes and carbon taxes worldwide has been estimated to be US$82 billion in 2018, a 56 per cent increase compared to 2017 (World Bank Group 2018). As of April 2019, carbon pricing has been implemented in 46 national and 28 subnational jurisdictions around the world as illustrated in Figure 2.1 (World Bank Group 2019). There have been 57 carbon pricing initiatives implemented or proposed, consisting of 28 emissions trading systems in regional, national and subnational jurisdictions and 29 carbon taxes primarily implemented on a national level (World Bank Group 2019).

In total, these carbon pricing initiatives cover 11 gigatons of CO2-e, equivalent to 20 per cent of global emissions (World Bank Group 2019). Several developing countries subject to climate risk also announced their intention to introduce carbon pricing programs by 2025 (UNFCCC 2019a). It is thus expected that, by 2020, the share of total emissions covered by carbon prices will increase to 25 per cent (UNFCCC 2019a).

Although carbon pricing continues to make headway with various initiatives under consideration, both coverage and price levels are far less sufficient to shift transformation at scale. At present, less than five per cent of global emissions covered under carbon pricing initiatives are priced at a level consistent with delivering on the Paris Agreement, which has been estimated to be US$40/t CO2-e to US$80/t CO2-e by 2020 and US$50/t CO2-e to US$100/t CO2-e by 2030 (CPLC 2017). Moreover, about half of global emissions covered by a carbon price are still priced below US$10/t CO2-e (World Bank Group 2019).

In addition, carbon prices are far from being uniform across countries, ranging from less than US$1/t CO2-e in Mexico to a maximum of US$127/t CO2-e in Sweden (World Bank Group 2019). Compared to countries acting alone, an international carbon market established under the Paris Agreement could reduce the cost of limiting global warming to 2°C by 2050 by up to 54 per cent or US$3940 billion (World Bank Group 2016). It is thus crucial for policymakers across the globe to ensure the alignment of prices over time and address the challenges of carbon leakage (World Bank Group 2016).

In Australia, the Federal Government introduced the Carbon Pricing Mechanism (CPM) on July 1, 2012, which was, in fact, a hybrid scheme. The scheme covered approximately 60 per cent of
Australia’s carbon emissions and imposed obligations on a range of large businesses and industrial facilities (Maryniak et al. 2019). The policy package was meant to underpin Australia’s national commitment to reduce emissions by 5 per cent of the 2000 level by 2020 and up to 25 per cent with credible action mobilised on a global scale (Jotzo 2012). Under the mechanism, liable entities had to pay a fixed carbon price for carbon emitted above the annual threshold. The predetermined price commenced at A$23/t CO2-e in 2012-2013, increasing at a rate of 2.5 per cent per year in real terms (Maryniak et al. 2019). For the first three years, the government was aiming to sell an unlimited number of permits at a fixed price, while permits could not be traded or banked (Jotzo 2012). Hence, the mechanism was very similar to a carbon tax during the initial fixed-price period. The fixed price model was aimed to allow more time for liable entities to adjust and prepare for a transition to a cap-and-trade system that was expected to start on July 1, 2015 (Maryniak et al. 2019). There were plans to link the CPM to credible international carbon markets, such as the EU ETS, during the flexible price period (Jotzo 2012). Other notable features of the CPM included the plan to return half of the expected revenue to households in the form of lower income taxes and higher welfare payments; assistance to emissions-intensive trade-exposed industries through free permits; an offset mechanism for agriculture and forestry; and an investment fund in renewable technology (O’Gorman and Jotzo 2014).

Figure 2.1: Summary map of carbon pricing initiatives

Following a change in government, the CPM was repealed with effect from July 1, 2014. The centrepiece of government emissions reduction efforts is now the Emissions Reduction Fund (ERF), which uses a reverse auction to select projects for emission cuts. In the absence of an emissions cap for covered sectors, the ERF provides an incentive for emission reduction activities across the economy to meet Australia’s international climate commitments (Climate Change Authority 2017). The ERF includes a safeguard mechanism that places a legislated obligation on large emitters to maintain their emissions within historical levels (Climate Change Authority 2017). Yet, given that the ERF is a voluntary scheme, there are ongoing concerns regarding its ability to deliver the promised emissions cuts under the Paris Agreement, the performance of the emissions reduction projects funded by the ERF and its economic burdens on taxpayers (Climate Change Authority 2017).
2.4 INTERNAL CARBON PRICING

Given the increasing concern about the financial implications of climate change, carbon pricing is going forward as an important factor in investments and decision making. The industry-led Task Force on Climate-related Financial Disclosures (TCFD) established by the G20’s Financial Stability Board (FSB) provides guidance on how to institutionalise climate change in mainstream financial reporting. The recommendations of the TCFD list internal carbon pricing as one of the key metrics for disclosure on climate-related risks and have been driving more interest in carbon pricing as a climate risk management tool (CDP 2017). A growing group of companies are thus integrating climate risk into their operations and investment decisions and align their corporate governance frameworks with climate objectives (CDP 2019). By assigning a monetary value to GHG emissions, internal carbon pricing has emerged as an essential mechanism that can help companies manage their climate risk and identify new business opportunities inherent in addressing climate change during the transition to a low-carbon economy (CPLC 2017).

The number of companies that have disclosed the use or plan of internal carbon pricing has increased from 150 in 2014 to over 1,300 in 2018, including more than 100 Fortune Global 500 companies with collective annual revenues of about US$7 trillion (CDP 2019). The widespread adoption of an internal carbon price has been primarily driven by the parallel development of carbon pricing policies as well as the increasing demand from different stakeholders of companies for comprehensive climate disclosure (CDP 2019).

The carbon prices reported by companies vary from US$0.3/t CO2-e to US$906/t CO2-e (World Bank Group 2019). Some companies peg their internal carbon prices to different price signals across jurisdictions and even factor in the probability of an increase in mandatory carbon prices in the future (World Bank Group 2019). Around half of the companies that have disclosed their internal carbon price are using rates above the required levels in the jurisdictions in which they are headquartered (World Bank Group 2019). A growing number of companies have reported that they are maturing in their use of an internal price on carbon within their business strategies and operations (CDP 2016). Moreover, companies with a combined market cap of $1.5 trillion have disclosed tangible impacts as a result of the integration of internal carbon pricing into business planning (CDP 2016).

An internal carbon pricing mechanism can be integrated with a variety of ways into the corporate decision-making process. The two conventional forms deployed by companies to assess and manage climate risk are carbon fees and shadow prices (CDP 2019). Both approaches set an explicit price per tonne of carbon emissions, but they differ in that carbon fees generate a steady revenue stream that can be used to fund projects or activities, while shadow pricing does not (CDP 2019).

CARBON FEES

A carbon fee is charged internally per tonne of carbon emitted by a business unit (CDP 2019). It can be calculated according to the amount of investment needed to meet the company’s emissions reduction targets, and can be adjusted to reflect any change in the company’s business objectives and investment strategies (Ahluwalia 2017). At this point, internal carbon fees are still set low, from US$5/t CO2-e to US$20/t CO2-e, to investigate how they can motivate behaviour changes and shift investments to low-carbon alternatives (Ahluwalia 2017). While the collected revenues raised can be used in a variety of ways, they are often used to stimulate innovation for clean technologies and facilitate other sustainability activities (CDP 2019).

However, the implementation of an internal carbon fee can be complicated because of the requirement of an administrative structure to collect revenues, distribute revenues across business units, and evaluate revenue allocation (Ahluwalia 2017).
SHADOW PRICES

Many companies assign a shadow price (i.e., a theoretical price) to their carbon emissions so that they can evaluate their climate risk exposure throughout business operations and identify opportunities in a carbon-constrained future (CDP 2019). It is typically used when making choices about capital investments required to meet climate-related targets or estimating lifecycle costs of an emissions reduction project (Ahluwalia 2017). Serving as an important proxy for future carbon regulations, a shadow price can help prioritise investments in low-carbon options. In contrast to internal carbon fees, a shadow price is typically never charged or realised in actual dollars, suggesting that no revenues are collected for carbon emissions. It is often viewed as a part of risk assessment and management strategy rather than a cost imposed across business units. Hence, if the goal is limited to send a price signal to guide decision making, then shadow pricing will be a more appropriate approach.

Shadow prices are often set in line with mandatory carbon prices, commodity prices, taxes on commodities or prices of renewables (Ahluwalia 2017). While some companies apply a uniform price to cover their global business, others introduce a range of prices, with the highest one used for stress testing their carbon-intensive assets in jurisdictions that are highly exposed to carbon regulations. Similar to the approach for carbon fees, many companies subject to carbon pricing regulations tend to apply a shadow price higher than the mandatory level to better prepare themselves for a potentially higher price on carbon due to more stringent regulatory requirements on emissions. For example, global oil and gas companies operating in regulated carbon markets adopt a shadow price that ranges from US$27.92/t CO2-e to US$80/t CO2-e (Ahluwalia 2017), while the vast majority of global emissions covered by carbon pricing initiatives are priced below US$10/t CO2-e (World Bank Group 2019).

Table 2 provides a brief summary of the most relevant features and differences between carbon fees and carbon shadow pricing. After reviewing different mechanisms for pricing carbon emissions, the next section will focus on carbon offsets as an alternative strategy to reduce the carbon footprint of governments, industry sectors, companies, or individuals.

<table>
<thead>
<tr>
<th></th>
<th>Carbon Fees</th>
<th>Shadow Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition</strong></td>
<td>A monetary value attached to each tonne of carbon emitted by responsible business units.</td>
<td>A theoretical price assigned to carbon emissions to assist capital investment decisions.</td>
</tr>
<tr>
<td><strong>Objectives</strong></td>
<td>To generate a revenue stream that can be used to fund projects to reduce emissions of the company.</td>
<td>To assess and manage potential business risks from future carbon regulations and guide investments and R&amp;D activities towards low-carbon options.</td>
</tr>
<tr>
<td><strong>Calculation</strong></td>
<td>Commonly calculated as the amount of investment needed to meet the company's emissions reduction targets.</td>
<td>Often set in line with mandatory carbon prices, commodity prices, taxes on commodities or prices of renewables.</td>
</tr>
<tr>
<td><strong>Revenue Allocation</strong></td>
<td>Revenues used to stimulate innovation for clean technologies and facilitate sustainability activities.</td>
<td>No real dollars charged for carbon emissions.</td>
</tr>
<tr>
<td><strong>Benefits</strong></td>
<td>Send a price signal to business units to shift investments to low-carbon projects and motivate behaviour and cultural changes.</td>
<td>Help prioritize investments in low-carbon alternatives and prepare the company for future carbon regulations.</td>
</tr>
<tr>
<td><strong>Challenges</strong></td>
<td>Require an administrative structure to collect and distribute revenues and evaluate revenue allocation.</td>
<td>Only serve as a risk strategy - may not send a strong price signal to reduce emissions or motivate behaviour and cultural changes.</td>
</tr>
</tbody>
</table>
Carbon Offsets

3.1 CARBON OFFSET MECHANISMS

To deal with emissions that remain after mitigation efforts, individuals and organisations are turning to carbon offsets as an alternative strategy to reduce their carbon footprint. As a market-based tool, carbon offsetting involves investing in projects that avoid or reduce GHG concentrations in the atmosphere or sequester them before emissions. A carbon offset credit is a tradable unit with a monetary value that can be bought and sold among different entities to balance their emissions to achieve carbon neutrality. Each offset credit is often taken to be equivalent to one tonne of carbon dioxide equivalent. Offsets can be derived from various types of projects. The most common project types are in the areas of renewable energy and energy efficiency (David Suzuki Foundation & Pembina Institute 2009). Renewable energy projects, such as solar power, avoid GHG emissions from the burning of fossil fuels, while energy efficiency projects lower energy consumption and thus reduce emissions (David Suzuki Foundation & Pembina Institute 2009). Other projects like tree planting can absorb carbon from the atmosphere and store it in plants and soils (David Suzuki Foundation & Pembina Institute 2009). These projects have the potential to deliver environmental benefits and spur clean energy development during the transition period to a low-carbon economy.

Carbon offsets have several advantages over other emissions reduction systems such as the one discussed in Section 2. While both emissions trading schemes and offsetting mechanisms allow entities to purchase emissions reduction through either allowances or offsets, carbon offsetting ensures emissions reduction benefits accrue from certified offset projects. Offsetting might also be more effective than a tax, as there is no guarantee that tax revenues will be recycled to fund projects that are designed to balance out carbon footprints. There can be economies of scales as well that pooled funds can be collected through offset credits from several companies to finance large offset projects which can only be underwritten jointly (IEA 2008). Offsets also provide flexibility in a way that companies can invest in different offset projects from year to year to reflect changes in their climate objectives and strategies (IEA 2008).

3.2 COMPLIANCE OFFSET MARKET

When it comes to purchasing carbon credits to offset emissions, countries or companies have two options: the compliance market and the voluntary market. The compliance market refers to a scheme that exists under mandatory government regulations limiting GHG emissions below a mandated level.

The origins of mandatory carbon offsetting can be traced back to the Kyoto Protocol, a legally binding international treaty adopted in 1997 that commits signatory countries to reduce GHG emissions. There are three mechanisms under the Kyoto Protocol that were implemented to help countries meet their mandatory emissions reduction targets.

- **The Clean Development Mechanism (CDM)**
  As the cornerstone of the Kyoto Protocol, the CDM is considered as a global compliance market for offsetting emissions, accounting for 90 per cent of offset project transaction volumes and value (Kollmuss et al. 2010). This mechanism sets binding emissions quota for those industrialised countries and allows them to invest in emissions reduction projects in developing countries without reduction targets (Kollmuss et al. 2010). The CDM uses Certified Emissions Reductions (CERs) as carbon offsets generated by CDM-approved projects, located in developing countries (Kollmuss et al. 2010). Hence, it is more expensive for small projects to acquire CERs.
through the CDM because of the relatively higher administrative costs under the Kyoto Protocol (Parliamentary Office of Science and Technology 2007).

- **The Joint Implementation Mechanism (JI)**
  This mechanism supports offset projects taking place within industrialised countries with binding emission commitments to the Kyoto Protocol (Kollmuss et al. 2010). Carbon credits issued under the JI are known as Emission Reduction Units (ERUs). Both the CDM and JI provide Kyoto countries with a cost-effective manner to meet their emissions reduction targets by purchasing credits generated by offset projects in other countries.

- **International Emissions Trading**
  Based on its emissions reduction target, each country is allocated an emission allowance and is allowed to trade its surplus to ensure that the system as a whole remains below the set cap. Offsets act as an alternative compliance mechanism to emission allowances regulated under the cap-and-trade emissions trading schemes. Several countries or regions have established their own trading mechanisms to help reach their emissions reduction goals. For example, the EU ETS was set up in 2005 to help EU nations to achieve their Kyoto targets. Offsets generated from the CDM and JI projects are also eligible for compliance under the EU ETS, which are the largest component of the compliance offset market (Kollmuss et al. 2010). Hence, prices for the CDM and JI offsets are linked to the broader markets for the EU ETS and Kyoto allowances.

These three mechanisms constitute the framework of the compliance carbon market, where industrialised countries can trade their surplus emission allowances or credits from offsetting to demonstrate compliance against their Kyoto targets. Given that carbon offsets sold under these mechanisms are regulated, the associated real emissions reduction, in general, present a certain level of quality and credibility.

### 3.3 VOLUNTARY OFFSET MARKET

Despite the ambitious goals set by the Kyoto Protocol and the Paris Agreement, a comprehensive international carbon market has not been established yet. There remain many regions and sectors that have not been covered by the compliance market. Given the increasing concern over climate change, there has been an upsurge of voluntary actions taken by individuals and organisations to curb carbon emissions. Separate from government targets and policies, the voluntary market covers carbon offset trading that takes place outside the Kyoto Protocol trading and offsetting mechanisms. It serves as a channel for those who choose to demonstrate leadership on climate change by going beyond existing government regulations and voluntarily taking responsibility for their climate impacts. It also offers an alternative option for sectors and industries where further emissions reduction is limited under the regulated market, or the abatement costs are extraordinarily high.

Although currently small compared to the compliance market under the Kyoto Protocol in terms of the number of transactions and market value, the voluntary market has been experiencing steady growth over the years. The demand for voluntary carbon offsets has grown significantly, from 0.3 Mt CO₂-e in 2008 to 42.8 Mt CO₂-e in 2018 (Ecosystem Marketplace 2018). Globally, businesses are the leading purchaser in the voluntary market, accounting for approximately 66 per cent of overall purchases, followed by individuals and governments (Ecosystem Marketplace 2009). Companies not subject to caps on emissions are considering carbon offsets as a critical element of their corporate climate strategies and have utilised the voluntary market to offset some or all of their emissions. These companies reflect about 80 per cent of the demand that drives the voluntary market (Ecosystem Marketplace & Business for Social Responsibility, 2008). The motivations behind such strategies include meeting corporate emissions reduction targets, gaining carbon market experience, preparing for future regulatory requirements, and enhancing brand differentiation (David Suzuki
Many well-known companies, including BP, Google, HSBC, and Nike, are voluntarily using offsets to reduce their carbon footprint (David Suzuki Foundation & Pembina Institute 2009). Some airlines, such as Qantas and Air New Zealand, also offer their passengers an option to purchase carbon credits as the time of booking, donating to projects that are designed to offset the emissions of the flights.

To meet rising interest, the number of offset vendors in the voluntary market has increased dramatically over the years. In general, vendors own a portfolio of offset projects, which tend to be smaller scale and located in developing countries (Parliamentary Office of Science and Technology 2007). Some vendors also provide other services, such as calculation or estimation of GHG emissions and energy efficiency consulting (David Suzuki Foundation & Pembina Institute 2009). As shown in Figure 3.1, a large number of offset projects have been issued during 2008 and 2018 around the world, mainly in Asia and North America. Since 2005, offset projects have helped to reduce, avoid or sequester total emissions of 437.1 Mt CO2-e (Ecosystem Marketplace 2018). In addition, offset issuances and retirements have picked up since the late 2000s, reaching record-highs in 2017 (Ecosystem Marketplace 2018). It is estimated that offset projects have issued 62.7 Mt CO2-e, an equivalent of not consuming almost 150 million barrels of oil, while retired 42.8 Mt CO2-e in 2017 alone (Ecosystem Marketplace 2018). One possible explanation for this uptick in 2017 is the increased commitment by individuals and organisations to take climate actions sparked by the Paris Agreement (Ecosystem Marketplace 2018).

Carbon credits produced in the voluntary markets are often referred to as Verified Emission Reductions (VERs). There is no central regulatory mechanism to govern them. Hence, compared to offsets regulated under compliance programs, the VERs have the advantage of lower transaction costs (Kollmuss et al. 2010). Since the voluntary market does not require carbon credits to undergo an international certification under the CDM process, the VERs are generally not tradable between schemes (Kollmuss et al. 2010). In contrast to offsets in the compliance market where prices are set at a relatively consistent level, offset prices in the voluntary market tend to vary widely, ranging from

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4 While this is a substantial amount, it should be noted that this only slightly exceeds energy-related emissions in Australia in 2016.
$0.1/t \text{ CO}_2\text{-e} \text{ to over } $70/t \text{ CO}_2\text{-e} \text{ (Ecosystem Marketplace 2018).}^{5} \text{ The difference in the voluntary offset prices can be attributed to several, including project types, project locations, quality, market demand and the stringency of the project requirements (Kollmuss et al. 2010).}

The voluntary market operates parallel to the compliance market and is primarily based on the CDM and JI mechanisms under the Kyoto Protocol. Still, there are differences between these two markets. First, the voluntary market is self-regulatory, and projects are not obliged to be certified by any standard. However, a majority of offset vendors choose to get their projects certified because the certification can enhance the credibility of their projects and result in relatively higher prices than non-certified offsets (Arnoldus and Bymolt, 2011). Second, the certification process in the voluntary market is less complicated and less costly than that in the compliance market (Arnoldus and Bymolt, 2011). That means projects that fail to register with the CDM may be able to get certified to a standard in the voluntary market. The lower cost of certification in the voluntary market also facilitates the development of small-scale offset projects that are economically unattractive for the compliance market.

### 3.4 CARBON OFFSET STANDARDS

Despite the potential benefits, the use of the offsetting system has also attracted several criticisms. In particular, the scepticism is felt with regard to the quality of offset projects available in the market - some of the offsets have no climate benefits at all. Moreover, variations in quality between offset projects are exacerbated by the fact that vendors have different objectives, leading to calls for monitoring and regulations. Another complaint repeatedly directed at the voluntary market is that there is a lack of transparency. In contrast to the compliance market, the voluntary market for carbon offsets is exposed to less scrutiny and is not linked to any binding emission reduction targets. Hence, the lack of regulation and vast differences in the quality of offset projects highlight the need for standard schemes that cover the voluntary market to quantify and verify the impact of a project. Concerned about the quality and impact of different carbon offsets on offer, few international standards have been developed in an attempt to ensure offsets meet essential quality criteria and increase the confidence of offset buyers to make informed decisions. In addition to the CDM standards, two of the most prominent standards in the voluntary offset market are the Gold Standard and the Verified Carbon Standard.

#### (1) The CDM

The CDM was established for compliance under the Kyoto Protocol. It also sets out its standard procedures for assuring the quality of offset projects. It is the most widely accepted standard for quality assurance in the compliance market (David Suzuki Foundation & Pembina Institute, 2009).

#### (2) The Gold Standard (GS) - [https://www.goldstandard.org/](https://www.goldstandard.org/)

The GS is developed by a group of NGOs to provide voluntary standards and certification for carbon offsets. It is built on the foundations of the CDM standards but it also incorporates guidelines to promote sustainable development and environmental integrity (David Suzuki Foundation & Pembina Institute 2009). This standard limits eligible offset project types to renewable energy and energy efficiency. It certifies compliance credits approved through the CDM process to make sure that offset projects meet critical environmental criteria. All GS projects are also independently verified by a third party to ensure integrity. For projects that are not part of the CDM, a voluntary market version of the Gold Standard has been developed.

#### (3) Verified Carbon Standard (VCS) - [https://verra.org/project/vcs-program/](https://verra.org/project/vcs-program/)

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5 Clearly, the lower range of offset prices is priced far below a level consistent with delivering on the Paris Agreement.

6 Unless referenced otherwise, the information in this section is based on the official websites of these standards.
The VCS is one of the leading standards for voluntary carbon offsetting, which sets up a rigorous assessment process for all VCS projects to be certified. Collectively, almost 1,500 certified VCS projects have mitigated more than 200 Mt CO\textsubscript{2}-e from the atmosphere. Its certification process differs from the GS or the CDM that it is less rigorous with regard to basic quality criteria, such as additionality. Hence, the VCS opens the potential for a broader range of offset projects.

There are also some initiatives by the offset industry to regulate itself. However, these initiatives are often regarded as guidance on how vendors should conduct their business rather than as a standard for offset projects to follow (David Suzuki Foundation & Pembina Institute 2009). For example, the International Carbon Reduction and Offset Alliance (ICROA) is an association of several offset vendors that provide carbon reduction and offset services around the world. The primary goal of the ICROA is to promote best practice in carbon offsetting and management. All ICROA member companies follow and disclose against its Code of Best Practice, which sets up requirements that all offsets should be verified by a credible third-party auditor and be issued and retired in an independent registry.

### 3.5 CARBON OFFSET CRITERIA

A number of criteria have been developed as guidelines for offset schemes to address some of the criticism. These criteria are relevant for CDM projects but are also crucial for the voluntary market. If these criteria are met, there is a higher possibility that the offset project is of higher quality, resulting in real reductions in carbon footprint. It is thus vital for purchasers to have a basic understanding of these criteria to ensure their offsets have the most benefit for the climate.

1. **Additionality**

An offset project is considered additional if its emission reductions would not occur in a business-as-usual scenario. That means emission reductions achieved by offsetting needs to be in addition to what would have happened in the absence of the project. The amount of credits generated by a project is the difference between the baseline emissions and the project emissions. The most widely recognised and strictest series of tests for additionality to date is the CDM additionality tool created under the Kyoto Protocol. An independent review panel needs to confirm the results conducted by United Nations accredited auditors (David Suzuki Foundation & Pembina Institute 2009). The certification procedure thus provides written assurance that an offset project can deliver the emissions reduction that it claims.

2. **Quantification**

Offset projects must result in measurable emissions reduction. The process of quantification includes the establishment of an emissions baseline, i.e., the emissions that would have occurred without the offset project (Ramseur 2009). Once the baseline has been determined without biased, project developers or vendors need to apply a credible methodology to estimate the amount of emissions that can be reduced or avoided as a result of offsetting (David Suzuki Foundation & Pembina Institute 2009).

3. **Auditing**

Offset projects need to be professionally audited over time to ensure the statements about emissions reduction are true and correct. The project design needs to be validated before the project commencement to confirm that its emissions reduction is additional and accurate (David Suzuki Foundation & Pembina Institute 2009). An independent assessment is also required after the project has been implemented to verify whether emissions reduction that took place reaches the level anticipated. To promote objectivity, validation and verification should be performed by qualified third-party auditors. To avoid conflicts of interest, offset buyers should not have their projects...
audited by the same company that offers advice on offset projects (David Suzuki Foundation & Pembina Institute 2009).

(4) Permanence

Permanence refers to whether the climate benefit spans over the life of the offset project and depends on project types. This criterion is most pertinent to offset projects based on sequestration like tree planting, which can release some or all of their stored carbon back into the atmosphere due to deforestation or fire (Arnoldus and Bymolt, 2011). Hence, there needs to be long-term monitoring to ensure that emission credits sold are maintained over time and avoid cancelling the climate benefit associated with the offset. Alternatively, an offset could come with a guarantee to be replaced by another if the reduction is temporary (Ramseur 2009).

(5) Ownership

To avoid double-counting and provide transparency, clear ownership rights should be established to emission reductions that a project presents. That means, no more than one individual or organisation is allowed to claim the climate benefit from the reduction twice. One possible practice is to enforce offset vendors to access a registry where credits can be accounted for and retired from circulation when sold (David Suzuki Foundation & Pembina Institute 2009).

(6) Leakage

Leakage refers to a situation where emissions reduction in one region causes an increase in emissions somewhere else as a result. Offset vendors need to assess the likelihood of the leakage at the project design stage and come up with possible solutions to minimise it (David Suzuki Foundation & Pembina Institute 2009). Any leakage that remains should be removed from the emissions reduction achieved by the offset project (David Suzuki Foundation & Pembina Institute 2009).

3.6 CARBON OFFSETS IN AUSTRALIA

As a signatory to the Paris Agreement, Australia has committed to reducing emissions by 26-28 per cent below 2005 levels by 2030. The primary policy mechanism to achieve this target is currently the ERF, which encourages Australian entities to adopt new practices and technologies to reduce emissions. Domestic emissions reduction projects can earn Australian Carbon Credit Units (ACCUs), which can be sold to the Government through a carbon abatement contract or to other organisations that seek to offset their emissions (Australian Government 2019c). There are more than 750 projects registered under eligible activities, including energy efficiency, waste management, revegetation, livestock management and savanna fire management (Australian Government 2019c). As of 2017, the ERF has approved carbon abatement contracts for 193 Mt CO$_2$-e from 477 projects at an average price of A$12 (Australian Government 2019c). On 25 February 2019, the Government introduced the $3.5 billion Climate Solutions Package to deliver on Australia’s emissions reduction targets under the Paris Agreement. This package includes the Climate Solutions Fund, which provides an additional A$2 billion to purchase further abatement through the ERF. The Government also established the Safeguard Mechanism (applying limits to large emitters) to ensure that emissions reduction efforts funded through the ERF are not counteracted by significant increases above the business-as-usual levels elsewhere in the economy (Australian Government 2019c). In addition, the Australian Government developed the National Carbon Offset Standard (NCOS) for the measurement, verification and disclosure of voluntary carbon initiatives. Best practice guidelines have been developed for organisations, products and services, events precincts and buildings. The VERs verified by the GS and VCS are eligible offset units under the NCOS.
Case Study

4.1 CARBON SHADOW PRICING – ROYAL DUTCH SHELL

Royal Dutch Shell PLC, commonly known as Shell, is an international oil and gas company. The expertise of the company lies in the field of exploration, development, production, refining and marketing of oil and natural gas, and also in the manufacturing and marketing of chemicals (Royal Dutch Shell plc 2018). To reinforce the position as a leader in the oil and gas industry while meeting global energy demand in a responsible way, Shell is attempting to address climate change and has started to implement carbon pricing as a core GHG management strategy. In 2000, Shell launched an internal carbon trading system, called the Shell Tradable Emission Permit System (STEPS) to help meet the self-imposed emissions targets and prepare for the EU ETS that started in 2005.

Beginning in 2000, Shell generally applied a uniform internal carbon price, called the “GHG Project Screening Value” (PSV), to evaluate its investment decisions. Since 2008, the PSV has been set at $40 per tonne of CO2-e to all new and existing projects of all sizes and types across all regions of operation (Royal Dutch Shell plc 2018). Serving as a vital risk management tool, the PSV assesses the potential exposure of a project to future carbon regulations while incentivising investments in CO2 abatement (Royal Dutch Shell plc 2018). For example, when the carbon costs of regulation are expected to increase within the planning period, the application of the PSV can drive investments in energy-efficient, low-carbon alternatives, which are more attractive in a carbon-constrained future.

The PSV can also help to identify early-stage opportunities to reduce emissions. For instance, projects with a higher carbon footprint may be halted at an early stage. Alternatively, these projects may be required to use a combination of low-carbon technologies to capture and store carbon dioxide deep underground (Royal Dutch Shell plc, 2018).

In 2018, Shell shifted away from using the flat PSV to country-specific estimates of future carbon costs (Royal Dutch Shell plc 2018). These estimates were developed using the current Nationally Determined Contributions submitted by countries under the Paris Agreement. Shell estimates that the PSV will increase to $85 per tonne of CO2-e in some countries to more accurately reflect the implementation of climate-related policies and regulations (Royal Dutch Shell plc, 2018). To further support the goal of the Paris Agreement, Shell also aims to reduce its Net Carbon Footprint of the energy products by 2-3% in 2021, 20% in 2035, 50% by 2050 compared with its 2016 level (Royal Dutch Shell plc 2018).

4.2 QANTAS CARBON OFFSETS

Qantas Airways Limited is the largest Australian airline by fleet size, international destinations and flights. Given the ongoing aviation growth and environmental impacts, Qantas is recognising climate risks and has developed carbon strategies to remain competitive in a carbon-constrained future. Recently, Qantas has announced a zero net emissions commitment by 2050, which it plans to achieve through the use of carbon offset schemes, fuel efficiency improvement and investment in new technologies (Qantas 2019a). However, the reliance on offsets has certainly not been without criticism, given that emissions are realised (and not avoided) in the first instance.

Qantas launched its carbon offset program in 2007. Since then, Qantas has offset over 3 million tonnes of carbon emissions, making itself the largest emission offsetter of any airline (Qantas 2020a). The program delivers offset services to more than 30 corporate customers and business partners across Australia and the world, making real environmental and social changes (Qantas 2020b). So far, there is around 10 per cent of its customers that already choose to offset their flights.
(Qantas 2019c). To better design and communicate its initiatives, Qantas also started incentivising frequent flyers by offering 10 Qantas points for every dollar spent on offsetting (Qantas 2020b). This move highlights its appreciation for efforts made by its customers and the commitment of Qantas to a more sustainable aviation industry.

The contribution from customers goes directly to a portfolio of carbon offset projects that collectively help mitigate climate change while nourishing communities. The existing projects include protecting iconic natural places like the Great Barrier Reef, conserving native Tasmanian forest, and working with the Indigenous community to reduce wildfires in Western Australia (Qantas 2020a). These projects are accredited under the highest international standards, such as the Gold Standard and the Verified Carbon Standard (Qantas 2020a).

Qantas has committed a $50-million investment for biofuel and works with governments and private sector partners to support the development of a sustainable aviation fuel industry in Australia (Qantas 2020c). In addition, Qantas aims to continue to reduce its emissions through investments in more fuel-efficient aircraft and smarter flight planning (Qantas 2019b). To minimise the impact on the environment, Qantas also aims to implement the world’s most ambitious airline waste targets by reducing 75% of its waste-to-landfill by the end of 2021 (Qantas 2020c).

In 2016, a historic agreement was reached to help the aviation industry to meet its commitment to carbon-neutral growth from 2020. The Carbon Offset and Reduction Scheme for International Aviation (CORSIA), commencing in 2021, requires airlines to offset the growth of their emissions. Hence, in addition to reporting under the Australian Government’s National Greenhouse and Energy Reporting Scheme since 2009, Qantas also committed to aligning reporting on climate-related issues to the TCFD recommendations in 2017 and commenced reporting its international emissions for CORSIA compliance starting from 2019 (Qantas 2020c).

4.3 AN AUSTRALIAN CARBON OFFSET PROVIDER - GREENFLEET

Greenfleet is a leading not-for-profit organisation with a climate protection plan that is based on forest restoration. Greenfleet plants native biodiverse forests to offset carbon emissions and help mitigate climate impacts. Since 1997, Greenfleet has planted more than 9.4 million native trees creating more than 500 biodiverse forests in Australia and New Zealand, on behalf of thousands of individuals and business partners (Greenfleet 2020d). These forests capture 3.4 million tonnes of carbon emissions from the atmosphere, preserve biodiversity and restore natural ecosystems (Greenfleet 2020d). Greenfleet ensures that the trees planted to offset emissions are legally protected for up to 100 years. If the trees are destroyed by natural disasters or browsing by animals, they will be replaced or replanted in another area. For example, in response to challenges such as drought and other ecosystem impacts, additional 17,206 trees were planted across six of the planting sites in 2018 (Greenfleet 2018).

For organisations seeking carbon neutral certification in Australia, Greenfleet offers a unique package of Greenfleet offsets bundled with the credits approved by the Climate Active Carbon Neutral Standard (Greenfleet 2020b). Given that the Standard approved credits are predominately derived from existing international carbon emission reduction projects, this joint approach ensures contributions to the offsetting program can support future reforestation projects that will capture carbon from the atmosphere (Greenfleet 2020b). In addition, Greenfleet offers a workplace giving program that allows corporate employees to make regular donations from their pre-tax salary to further their environmental impacts (Greenfleet 2020e).

For individuals who want to offset a year’s worth of carbon emissions (23 tonnes of CO2-e per person), Greenfleet also offers a CarbonCover 365 plan, which will help grow biodiverse native
forests and restore habitat for wildlife for $1 a day (Greenfleet 2020c). Greenfleet is also a registered charity with the Australian Charities and Not-for-profits Commission (ACNC), which means eligible tax-deductible donations to Greenfleet have Deductible Gift Recipient (DGR) status (Greenfleet, 2020a).

**Recommendations**

Based on the above discussions, there are several recommendations for the transportation sector:

1. **Internal Carbon Pricing**
   - Companies should review the characteristics of their sectors, before choosing and implementing internal carbon pricing strategies. Not every approach is feasible for each sector.
   - To respond to the rising shareholder concerns and demonstrate corporate responsibility and leadership, transport companies should consider internal carbon pricing as a part of their climate change strategy and risk assessment processes. In light of the uncertainty surrounding climate change policy in Australia, corporate carbon pricing can help to advance emissions reduction goals and prepare for future climate-related regulations.
   - To meet multiple climate-related objectives, a company can adopt a hybrid approach. There is no one best type of internal carbon pricing.
   - For a carbon fee approach, the level of carbon prices should be secondary to the price signal sent to employees and business units. The primary purpose of implementing an internal fee on carbon is to increase the awareness of climate change and motivate behaviour and cultural change.
   - Shadow prices should evolve and reflect any possible changes in the cost of climate change as a result of further regulatory constraints on emissions and unexpected climate impacts. Companies can consider setting the initial price higher than current price levels set by the government to prepare for more stringent climate-related risks.
   - Setting an initial ambitious decarbonisation approach will reduce climate-related risks resulting from increasing regulatory carbon prices. Thus, companies may, e.g., consider applying a shadow price consistent with achieving the Paris temperature target, US$40/t CO2-e to US$80/t CO2-e by 2020 or US$50/t CO2-e to US$100/t CO2-e by 2030 (CPLC 2017).
   - Shadow pricing can be a particularly useful risk management tool for companies in high-emitting sectors that may face the risk of stranded assets due to future constraints on GHG emissions.
   - Results from the integration of internal carbon pricing such as emission reductions and cost savings should be evaluated, reported, and incorporated into business processes to understand how ‘carbon-adjusted’ prices would look like for the company. For example, if shadow prices set earlier have not driven emission reductions by the desired amount within the business units, companies are encouraged to adjust the price to reap their intended benefits.
   - Given that a shadow price does not lead to actual financial flows, additional safeguard mechanisms may be required to ensure the effectiveness of shadow pricing.
   - Companies, especially the leading ones in each sector, that have experienced increased savings (or profits) by introducing internal carbon pricing should highlight the economic benefits they have achieved to peer companies at a high-profile level.
Leadership should effectively communicate the emission targets and climate change strategies of the company with all stakeholders, including shareholders, suppliers and customers, to optimise the use of internal carbon pricing.

(2) Carbon Offsets

- Carbon offsets provide an avenue to address emissions which cannot be avoided in the first instance.
- Before purchasing carbon offsets, companies need to determine their carbon footprint and identify the largest sources of emissions. An internal reduction should be attempted as the first climate change solution. The option to purchase offsets should come in only when further emission reductions are not possible. That means, carbon offsets should only be a supplement to emission reduction efforts made by the company.
- Companies should assess their climate-related risks and decide on offset objectives within their climate policies and strategies. Companies need to make decisions on the scope of business activities to offset and the type of offset projects to purchase.
- Offset projects need to be of high quality to ensure they deliver real climate benefits. Companies should look for offsets that have been certified to well-recognised standards, such as the CDM or the GS, which can help meet critical quality criteria.
- When exploring the range of offset projects available, companies should look for offset vendors that provide detailed information and track the ownership and performance over the lifetime of their projects.
- Companies also need to timely communicate with their employees, customers and other stakeholders whether the offset projects purchased have helped achieve emissions reduction targets and other climate-related goals.
- Companies should consider linking both carbon pricing and offset initiatives to their reports on and disclosure of climate risks.
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