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Discussion Paper

# Carbon Markets and Saudi Arabia

## A Review of Options and Analysis of Carbon Crediting Potential




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## About KAPSARC

KAPSARC is an advisory think tank within global energy economics and sustainability providing advisory services to entities and authorities in the Saudi energy sector to advance Saudi Arabia's energy sector and inform global policies through evidence-based advice and applied research.

This publication is also available in Arabic.

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# Executive Summary and Key Messages

The Kingdom of Saudi Arabia has been taking steps towards carbon market development to stimulate domestic and international climate action. In 2022, the government announced a domestic greenhouse gas (GHG) crediting mechanism – the Greenhouse Gas Crediting and Offsetting Mechanism (GCOM) – which will be the first government-led carbon crediting mechanism to be set up in the Gulf region. In parallel, Saudi Arabia's largest sovereign wealth fund, the Public Investment Fund (PIF), has established the Regional Voluntary Carbon Market Company (RVCMC) that is providing a marketplace for internationally traded carbon credits.

In response to this growing interest in carbon markets in Saudi Arabia, KAPSARC implemented a study to better characterize and understand the potential for carbon crediting in the Kingdom. The focus was specifically on providing estimates of the potential for supply and demand of carbon credits, drawing on current voluntary corporate commitments by domestic firms and various assumptions related to the emissions abatement and carbon removal potential in selected sectors and activities.

The first part of the paper presents a reference guide to carbon markets, which includes a taxonomy of instruments covering three broad types – namely, cap-and-trade emission trading systems (ETSs), output-based ETSs, and crediting mechanisms in Section 2. This section also provides an explanation of the functioning of carbon crediting mechanisms and their setup on the demand and supply sides. In addition, it discusses future trends in this space, including linkages between different carbon market instruments, regulation in the voluntary carbon market, and carbon border adjustments.

The second part of the paper presents the current landscape of carbon markets in Saudi Arabia and provides estimates of potential carbon credit supply and demand (Section 3). These estimates can help inform the development of voluntary public-private led climate action in the Kingdom based around carbon credits, which are taking place under both government-led (GCOM) and private-sector led (voluntary, ICP-based) markets. The main findings from Section 3 include:

- **On the demand side,** if Saudi corporations maintain their ambitious net-zero pledges and incorporate carbon credits into their decarbonization strategies, carbon credit demand will be sustained and will increase significantly over the coming decades.

- In the low demand scenario, which assumes that the modelled companies' carbon credit use rises gradually up to 5% of their total mitigation effort by 2050, total demand for carbon credits would reach 1.0 $MtCO_2eq$ in 2030 and 22.4 $MtCO_2eq$ in 2050. In the high demand scenario, where carbon credit use rises gradually up to 20% of total mitigation effort by 2050, the total demand for carbon credits would reach 4.0 $MtCO_2eq$ in 2030 and 89.6 $MtCO_2eq$ by 2050.

- **On the supply side**, decisive action to bring new projects online at scale can ensure that mitigation benefits delivered through carbon crediting are kept within the borders of Saudi Arabia. Such developments can also contribute to the government's climate change targets, rather than the acquisition of credits that originated in other countries.

- Depending on baseline and additionality choices, domestic credit supply from renewable energy has a theoretical potential to supply 2-4 million $MtCO_2eq$ by 2030. This would suffice to cover domestic carbon credit demand in the medium term (assuming the buyers would be willing to purchase this credit type). Alongside potentially significant levels of CCUS credits (theoretical potential peaking at 27 $MtCO_2eq$ from the 2030s) and nature-based credits from mangrove plantations, domestic supply from these three mitigation activity areas would suffice to meet credit demand in the low-end demand scenario. However, higher levels of demand would require credit supply from other domestic sectors and activities, or international sources.

- Notably, the results of the study should be carefully considered in the context of the methodological choices and assumptions used to estimate carbon credit demand and supply. Updated and more refined estimates can be made as improved and more extensive data on Saudi corporate emissions and their mitigation strategies becomes available. Further clarity on the rules around the GCOM will also improve estimates of potential credit supply (e.g., in terms of project types and baseline choices).

Further formalization of a carbon credit market in the Kingdom is important for many reasons. These include providing a powerful entry point through which both governments and operators can take early steps into the monitoring and reporting of emissions and the trading of carbon-based units, thereby helping to drive technological innovation and supporting socio-economic development. A more structured market can also position Saudi Arabia as a progressive regional leader of climate action, prepare the ground for possible compliance-based mechanisms in the future, and support further engagement in international climate action and markets, such as those emerging from Article 6 of the Paris Agreement.

# Acronyms and Abbreviations

| | |
|---|---|
| **A6.4ER** | Article 6.4 Emission Reduction under the Paris Agreement Crediting Mechanism |
| **CaT** | Cap-and-trade emissions trading system |
| **CDM** | Clean Development Mechanism under the Kyoto Protocol |
| **CER** | Certified emission reduction from the Clean Development Mechanism |
| **CORSIA** | Carbon Offsetting and Reduction Scheme for International Aviation |
| **$CO_2$** | Carbon dioxide |
| **ETS** | Emissions trading system |
| **ERU** | Emission reduction unit from Joint Implementation |
| **GCOM** | Saudi Arabia's Greenhouse Gas Crediting & Offsetting Mechanism |
| **GHG** | Greenhouse gas |
| **ICP** | Independent crediting program |
| **JI** | Joint Implementation under the Kyoto Protocol |
| **PACM** | Paris Agreement Crediting Mechanism |
| **QELRO** | Quantified emission limitation and reduction obligation under the Kyoto Protocol |
| **RVCMC** | Saudi Arabia's Regional Voluntary Carbon Market Company |

# 1. Introduction

The entry into operation of the Paris Agreement in 2020 has precipitated a new wave of public and private sector climate action responses. For governments taking initial steps towards climate change mitigation, a variety of policy and regulatory design options are available. Measures include economic instruments, which can be price-based (e.g., taxes that seek to promote a demand response by placing a price on emissions) or quantity-based (e.g., emissions trading systems [ETSs] that place a limit on the volume or intensity of emissions by covered entities and allow for the trading of units between them to comply with the cap), regulatory instruments, and other instruments. The latter include regulatory mandates (e.g., bans, targets or performance standards for products and/or emissions), voluntary agreements (e.g., with industry sectors and operators to reduce and/or offset emissions), information policies (e.g., awareness-raising campaigns, eco-labels) and government-led programs (e.g., spending and procurement) (Somanathan et al. 2014; Dubash et al. 2022).

Increasingly, governments around the world are turning to economic instruments rather than discretionary or regulatory approaches to develop flexible and cost-effective responses to climate change mitigation. Market-based instruments generally allow entities with lower abatement costs to act first and monetize their actions by selling resulting credits to entities that face higher abatement costs (e.g., Nordhaus 2013).

At the time of writing, various types of carbon pricing instruments are being implemented or are under development around the world, including ETSs, domestic carbon crediting mechanisms, and hybrid schemes (Figure 1). The use of these policy instruments, which can be collectively referred to as "carbon markets," has grown substantially over the past few years. According to the Intergovernmental Panel on Climate Change (IPCC), carbon pricing and carbon markets are the most prevalent policy responses to climate mitigation globally today (Dubash et al. 2022).

The Gulf region is closely tracking this global trend. Various policies and actions relating to carbon markets are underway in the region, including the establishment of independent crediting programs (e.g., the Global Carbon Council in Qatar) and emergent proposals for ETSs (e.g., as has been mooted in the United Arab Emirates).

The Kingdom of Saudi Arabia is also taking significant steps towards carbon market development to stimulate domestic and international climate action. In 2022, the Saudi government announced a domestic greenhouse gas (GHG) crediting mechanism, the Greenhouse Gas Crediting and Offsetting Mechanism (GCOM), which will be the first government-led carbon crediting mechanism to be set up in the Gulf region. The GCOM has been tailored to the unique circumstances and energy transition challenges faced in Saudi Arabia, while taking into account international best practice. In parallel, Saudi Arabia's sovereign wealth fund, the Public Investment Fund, has established the Regional Voluntary Carbon Market Company (RVCMC), which is providing a marketplace for internationally traded carbon credits.

The RVCMC has so far undertaken two record-breaking auctions of carbon credits with international credits issued by the independent crediting program (ICP) administered by Verra.

In response to the growing interest in carbon markets in Saudi Arabia, this study aims to better characterize and understand the potential for carbon crediting in the Kingdom. The focus was on providing estimates of the potential for supply and demand of carbon credits, drawing upon current voluntary corporate commitments by domestic firms, and various assumptions related to the emissions abatement potential in selected sectors. These estimates can help inform the development of voluntary public-private led climate action in the Kingdom, based around trade in carbon credits, taking place both under government-led (GCOM) and private-led (voluntary, ICP-based) crediting mechanisms.

This paper is laid out as follows: Section 2 provides background on carbon markets and considers the latest developments in various parts of the world. Section 3 presents the landscape of carbon markets in Saudi Arabia and provides estimates of potential carbon credit supply and demand. Section 4 draws on these to provide key findings and recommendations.

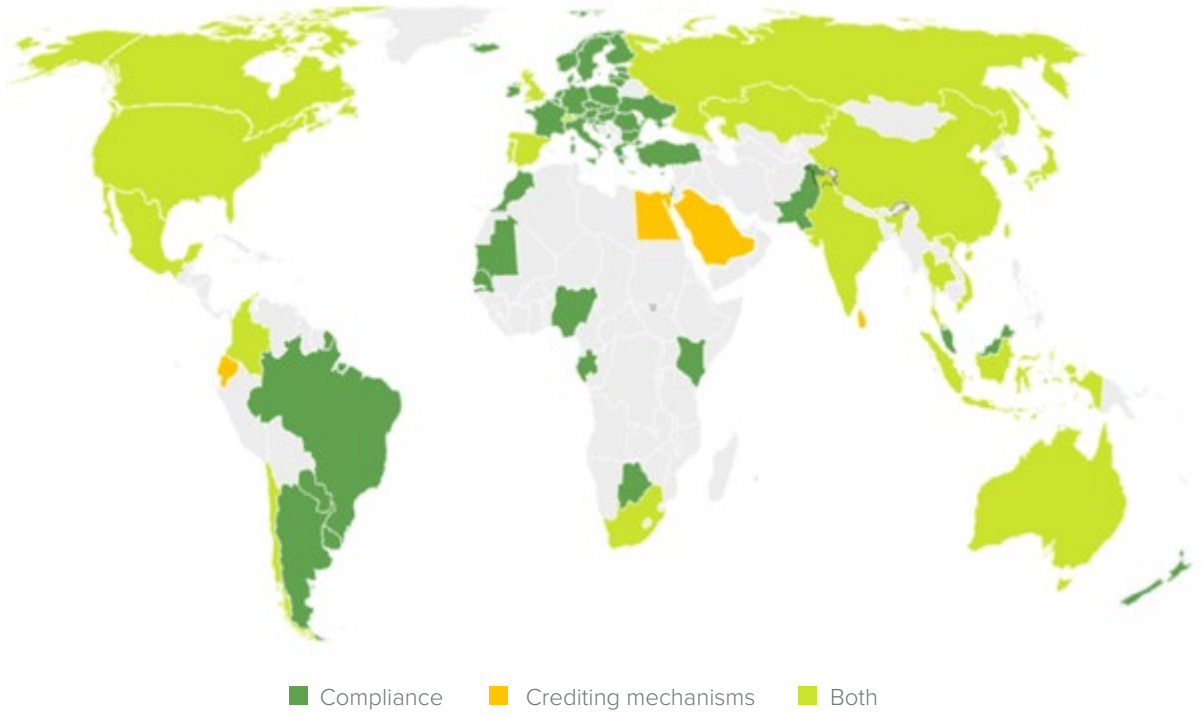
# 2. About Carbon Markets

Carbon pricing systems, including both ETSs and carbon taxes, are currently estimated to cover 12.8 $GtCO_2$-equivalent ($GtCO_2e$) of anthropogenic GHG emissions, equal to around 24% of worldwide emissions. Of this, more than 10 $GtCO_2e$ relates to ETSs, which cover around 19% of global GHG emissions (World Bank 2024). A total of 36 ETSs are in place across various jurisdictions worldwide, with a further seven under development and 18 under consideration (Figure 1) (World Bank 2024; ICAP 2024).

A range of international, domestic, and private carbon crediting programs are also operational worldwide, and their number and diversity has been growing over recent years. While the combination of ETSs and crediting programs both form important constituent parts of carbon markets, the types of units are different: ETSs involve the issuance of emission allowances to operators of emitting activities, while crediting programs issue carbon credits to developers of emission reduction and removal projects. In some situations, the two may be fungible.

The following sections provide an overview of the various types of carbon market instruments, including their key features, differences, scope of system linkage, and evolution.

**Figure 1.** Carbon pricing instruments around the world, 2024 (implemented and under development).




*Source: Alarfaj (2024), based on World Bank (2024).*

# 2.1 Emissions Trading Systems

## 2.1.1 Cap-and-Trade ETS

Traditional carbon market design has been based on the cap-and-trade concept. A cap-and-trade ETS is a quantity-based mechanism under which regulators set an absolute, jurisdiction-wide, quantified "cap" on direct emissions from large stationary point source emissions (e.g., fossil thermal electricity generating facilities and other large industrial facilities, such as refineries, cement kilns, and steel plants). More recently, cap-and-trade systems have been expanded to cover mobile emission sources (e.g., aviation, maritime, and road transport) and buildings, albeit mainly applied at the point of fuel sale rather than on dispersed individual emitters. The New Zealand ETS is alone globally in including large forestry within the scope of a cap-and-trade system.

The system "cap" is determined in advance (ex ante), denominated in 1 ton emissions units (1 $tCO_2e$), with the units allocated to individual covered operators through either free allocation, auctioning, or a combination thereof. The emissions units, which are often referred to as "allowances," act as a "right to emit GHGs by the holder." Operators of ETS-covered facilities must monitor their emissions over a set period (generally a calendar year), report them to the ETS regulator, and subsequently surrender allowances equal to their reported emissions in order to discharge their obligations under the system.

Operators can buy units in order to meet their compliance position (e.g., when they emit more than the units they were allocated or acquired through auctions) and sell units when they emit less than the units they are holding. This type of unit trading sets the basis for an ETS carbon market. Examples of cap-and-trade ETSs include the Kyoto Protocol (Box 1), the EU ETS, the California cap-and-trade Program (CaT), and the UK ETS.

In principle, cap-and-trade ETSs offer the most certainty over the environmental outcome because the quantity of allowable emissions is explicitly controlled through the cap ex ante. Over time, the cap, and therefore the allowances in circulation, can be ratcheted downwards in line with increasing climate ambition.

## Box 1. The Kyoto Protocol and the First International Carbon Market

The Kyoto Protocol, through setting country-level targets and its three flexibility mechanisms, established the world's first substantial international cap-and-trade based carbon market.

The Protocol established emission reduction targets for Annex I Parties to the UNFCCC – i.e., developed country parties – known as "quantified emission limitation and reduction obligations" (QELROs). Each Annex I country's QELRO was defined in terms of a percentage annual emission limitation/reduction target for a basket of six GHGs over the periods 2008-2012 and 2013-2020 relative to emissions in a base year, most typically 1990. The QELROs were converted into country level emissions caps and substantiated through the allocation of emissions budgets to each Annex I Party. The budgets were denominated in 1t$CO_2$e Assigned Amount Units (AAUs). Each Party received its AAU allocation in its Kyoto Protocol registry account for each of the Kyoto Protocol commitment periods (the first being 2008-2012 and the second being the period 2013-2020). In aggregate, the allocations of AAUs made up the Kyoto Protocol "cap."

The Kyoto Protocol also introduced three flexibility mechanisms by which Annex I Parties could comply with their QELRO. First, under international emissions trading, Parties could trade AAUs among themselves. Second, Parties could acquire offset credits that originated from mitigation projects located in either Annex I countries (Joint Implementation; JI) or non-Annex I countries (the Clean Development Mechanism; CDM). Any AAUs, JI emission reduction units (ERUs), and CDM certified emission reductions (CERs) can be counted towards compliance with a Party's QELRO within the relevant Kyoto Protocol commitment period. For an ERU trade, a corresponding AAU had to be canceled in the registry of the originating (host) country Party in order to avoid double counting and to maintain the environmental integrity of the Kyoto Protocol "cap." In the case of CERs, since they originated from non-Annex I countries that did not have QELROs, no AAU adjustment was required.

In some situations, Annex I governments bought CERs and ERUs directly (bilaterally) from other parties, often through intermediaries such as the World Bank. In other approaches, some Annex I governments also devolved the acquisition of CERs and ERUs to the private sector (e.g., by linking the credits to domestic ETSs). For example, the European Union allowed companies covered by the EU ETS to use CERs and ERUs as compliance units in its ETS Phases I and II (2005-2007 and 2008-2012), which, upon surrender to the EU member state, were available to be counted towards their QELRO. Japan similarly introduced a private sector acquisition program that was used by the government to acquire CERs and ERUs that could be counted towards its QELRO.

## 2.1.2 Output-Based or Intensity-Based ETS

While traditional models of cap-and-trade ETSs continue to be adopted by new jurisdictions in both the developed and developing world, recent years have also seen the implementation of intensity-based or output-based ETSs. This type of system establishes an emissions "cap" according to the monitored and reported output and direct emissions for covered activities over a calendar year (ex post). Therefore, unlike a cap-and-trade ETS, the operators receive their allocation of units after the event, according to their level of output (e.g., megawatt-hours [MWh] of electricity) and the benchmark for their given activity or product (e.g., a $tCO_2$ per megawatt-hour of electricity supplied to a grid, i.e., 0.35 $tCO_2$/MWh, or an emission rate of 0.85 $tCO_2e$ per ton of cement clinker) over the compliance period (e.g., a calendar year). If their emissions exceed the allocation, they must acquire more units, or where they fall under it, they may sell the surplus, thus setting the basis for a carbon market.[1] Examples of current output-based ETSs include Canada's Federal Output-Based Pricing System and its various Provincial ETSs, the Australian Safeguard Mechanism, Indonesia's ETS, and China's national and various subnational ETSs.

An output-/intensity-based ETS offers a somewhat more flexible carbon pricing model than cap-and-trade because the cap adjusts annually according to fluctuations in levels of output and therefore automatically responds to increases or decreases in economic activity. An output-/intensity-based ETS can be better suited to jurisdictions with more volatile or growing economies, often based on primary or secondary industries. Over time, the allocation benchmark can be reduced to drive greater efficiency in the covered activities.

## 2.1.3 Additional Flexibility Mechanisms Within ETSs

Both cap-and-trade or output-based ETSs may include additional flexibility mechanisms by which to comply that can lessen the economic impact on covered entities. These can include a buy-out price in an ETS (that allows covered entities to pay their way out of the obligation), the ability to bank or borrow allowances across compliance periods, and/or the integration of carbon credits for meeting part or all of covered entities' compliance obligations. In the latter case, covered operators can use carbon credits as supplemental fungible equivalents to the units/allowances employed within the ETS. Investments into carbon credits will be attractive when the internal cost of compliance for entities covered by the ETS is higher than the market price for credits.

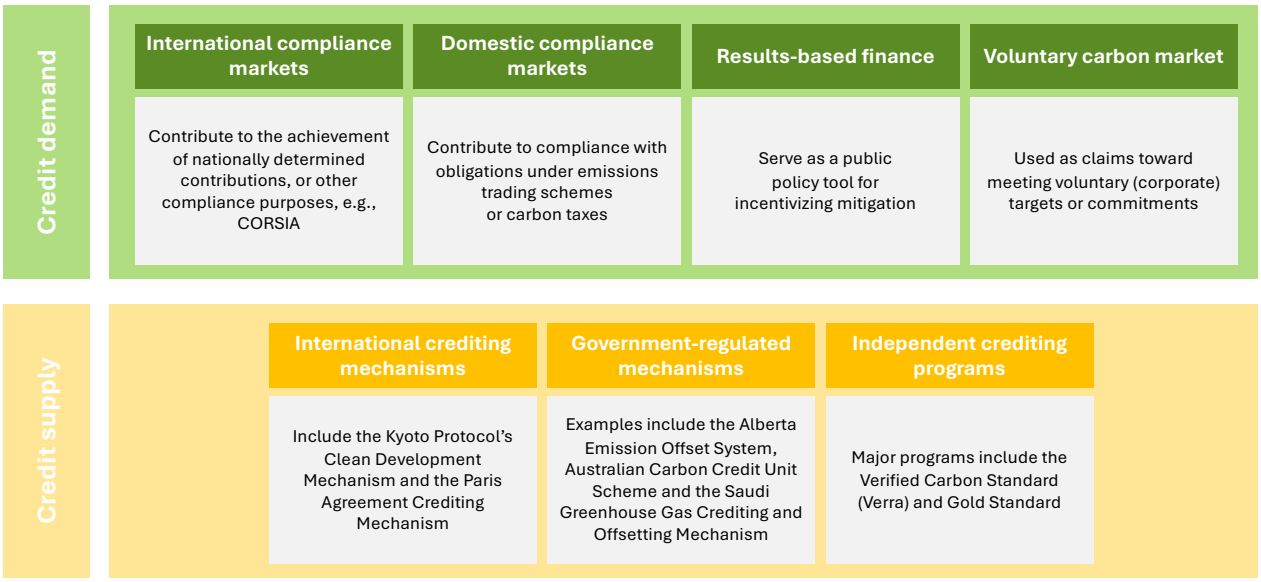
To avoid the double counting of emission reduction or removals as both reductions inside the ETS and credits from outside, carbon credits used for ETS compliance should originate from sectors or entities not covered by the ETS – either from activities in non-ETS sectors in the same jurisdiction, or from other jurisdictions not subject to, or linked with, the ETS in question. In other words, an activity implemented by a compliance entity to reduce its own emissions under an ETS cannot also be registered as an activity that generates offset credits for use by the operator or other entities covered by the ETS – to do so would result in the emission reduction effect of the activity being counted twice within the ETS.

According to the World Bank (2024), around 40% of carbon pricing schemes worldwide – both ETSs and taxes – allow for the use of carbon credits, covering 23 ETSs and 7 carbon taxes. The degree to which such flexibility may be used varies from system to system. For example, at the time of writing, both Indonesia's and Kazakhstan's ETSs allow for 100% eligible credits to be used for system compliance, while the Korean ETS allows for up to 5%, and the California CaT currently allows up to 4%, which will increase to 6% from 2026. Several national carbon tax policies allow for the use of selected carbon credits (e.g., in South Africa and Colombia – see below).

## 2.2 Crediting Mechanisms

In recent years, there has been a significant expansion in carbon crediting systems worldwide. The World Bank (2024) characterizes the carbon credit market as consisting of four different market buyer segments: international compliance, domestic compliance, voluntary, and results-based finance, which draw from three main sources of supply – international, domestic, and independent crediting mechanisms. These are summarized below (Figure 2), and are considered in greater detail in the following sections.

**Figure 2.** Types of carbon crediting mechanisms and market segments.




*Source: Authors, based on World Bank (2024).*

### 2.2.1 Credit Demand

Carbon crediting programs have been primarily established either to support flexibility mechanisms in carbon pricing systems and/or to underpin claims regarding voluntary climate action by private actors. Both types of use cases can be described as "offsetting," as entities buy and retire the carbon credits as a means to balance their own ongoing GHG emissions.

However, the demands on carbon crediting have evolved over recent years as buyers have sought to use them for varying purposes. The different demand sources and use cases are reviewed in more detail in the following section.

## International Compliance Markets

As noted in Box 1, the Kyoto Protocol introduced a substantial international market for carbon credits. The market primarily operated over the period 2005 to 2012, spanning the time from when the Kyoto Protocol was ratified until the end of its first commitment period. Thereafter, CER demand dwindled, and the JI was dormant until its termination in 2022. In the absence of significant CDM demand post 2012, the UN introduced a voluntary, unilateral cancellation procedure that allowed CERs from the CDM to be used within the voluntary carbon market (VCM) (see the section on the voluntary carbon market below).
A similar type of international market for emission units and carbon credits is expected to develop under the Paris Agreement via Article 6. Thereunder, cooperation between countries is envisaged through the international transfer of units – or so-called internationally transferred mitigation outcomes (ITMOs) – that can be counted by the buyer country against their national Paris Agreement climate mitigation pledges (i.e., the nationally determined contributions or NDCs). Carbon credits, or mitigation outcomes, traded between countries can ultimately be consolidated as ITMOs when accounting for progress against NDCs. However, the nature and style of a country's NDC pledges makes the accounting of ITMO transfers a more complex proposition than the top-down targets established under the Kyoto Protocol. Hence, work on the exact rules of Article 6 took nine years to establish, and were completed at COP29 in Baku in November 2024.

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), implemented by the UN International Civil Aviation Organization (ICAO), is another emerging source of international carbon credit demand. As well as introducing measures for emission reductions (e.g., sustainable aviation fuel use), CORSIA implements mandatory offsetting using carbon credits. Following a pilot phase (2021-2023), the first phase of CORSIA, which started in January 2024, requires aviation operators to acquire and cancel carbon credits against a portion of their reported emissions for flights between the current 126 participating states. Demand for credits under CORSIA is anticipated to grow as both participation and target stringency increase.

## Domestic Compliance Markets

Several domestic carbon pricing systems also establish demand for carbon credits through flexibility mechanisms (see Section 2.1.3). Domestic crediting systems linked to ETSs exist in China, Canada, Canadian provinces, California, Korea, and Kazakhstan, among others, as well as for carbon taxes in Switzerland, South Africa, Columbia, and Chile. In the latter cases, credits can be surrendered to the relevant authorities to offset carbon tax liabilities. In several cases, the systems make use of existing carbon credit supply infrastructure, typically tailored to national circumstances (e.g., the use of domestic CDM projects in the Korean ETS and China ETS, or privately-run independent crediting programs in the California CaT – see Section 2.2.2).

Following discussions at the UN Sharm El-Sheikh Climate Change Conference (COP27), the UN's carbon crediting mechanism under Article 6.4 of the Paris Agreement – now called the "Paris Agreement Crediting Mechanism" or "PACM" – can also be used to originate carbon credits for domestic use (UNFCCC 2022). In these circumstances, credits originated under the PACM (so-called "A6.4ERs") would not need to be authorized by the host Party for use towards another Party's NDC or for other international mitigation purposes such as CORSIA, but would instead be labelled as "mitigation contribution A6.4ERs." The term "mitigation contribution" is envisaged as a means to signify that the mitigation achieved by the relevant PACM activity is only contributing towards the host country's NDC and not another country's NDC, and therefore cannot be counted as an ITMO (see also the Results-Based Finance section below).

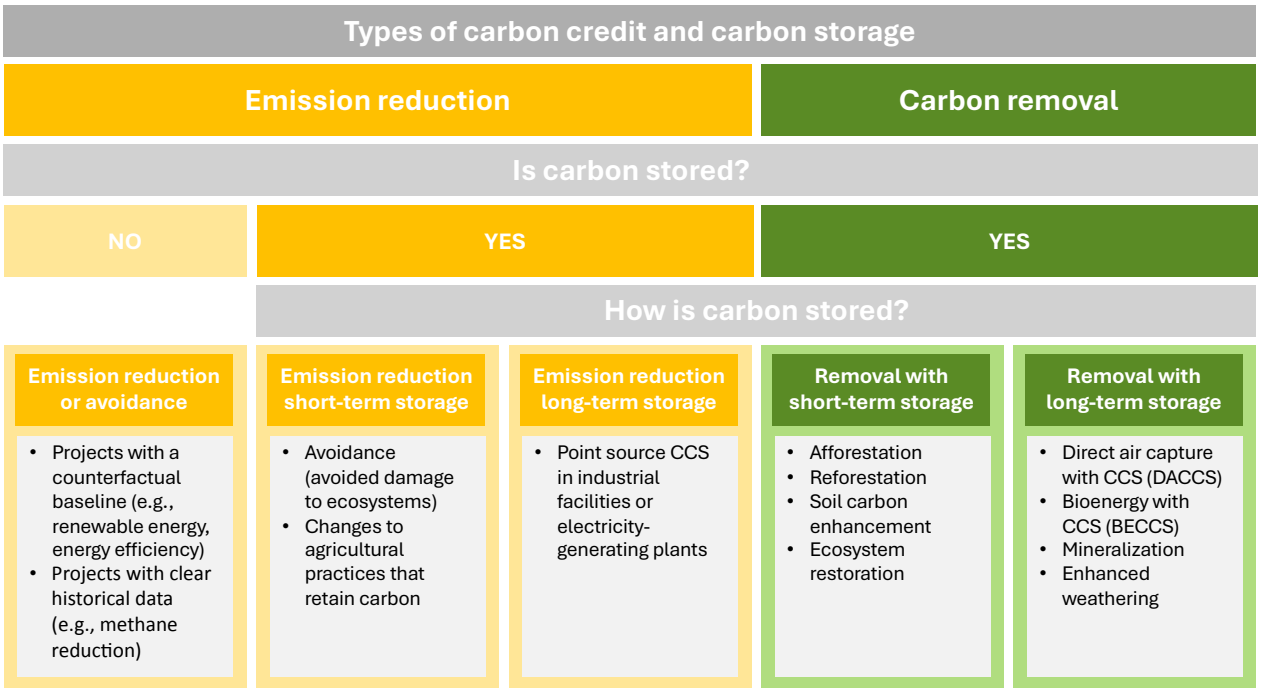
## Voluntary Carbon Market

Voluntary climate action, where entities seek to make climate-related claims based on the acquisition and cancellation of credits, has also expanded over recent years. These approaches have typically involved corporations making voluntary climate-related pledges (e.g., emission reduction and/or climate neutrality) and acquiring and cancelling carbon credits to offset their reported ongoing emissions. Such arrangements are widely termed "the VCM." Estimates suggest that voluntary demand accounts for around 90% of the total demand for carbon credits (World Bank 2024).

Views remain divided, however, on the utility of such voluntary practices. On the one hand, groups such as the Science-Based Targets Initiatives (SBTi) suggest that such claims only count where measurable action is also being taken by the entity to reduce its own emissions, and they also suggest that credits might only be used to counterbalance residual emissions and can only count towards credible "neutralization" claims when credits originate from carbon removal activities (SBTi 2024a). Other observers are also supporting a transition towards claims based on carbon credits that almost exclusively originated from carbon removal rather than emission reduction activities (Allen et al. 2020; Axelsson et al. 2024; ISO 2022). Nevertheless, there have also been discussions on investing in emission reduction credits in the near term as a form of "beyond value chain mitigation," which describes mitigation action that goes beyond the direct and indirect emissions of an entity (Axelsson et al. 2024).

Allen et al. (2020) provided a taxonomy of different types of carbon offsets to highlight which types of activities result in carbon removals as opposed to emission reductions (Figure 3).

**Figure 3.** Taxonomy of carbon credits.




*Source: Authors, based on Allen et al. (2020).*

On the other hand, the Voluntary Carbon Market Integrity Initiative's (VCMI) Claims Code of Practice (VCMI 2023) has sought to find a less extreme version of claims guidance for corporations voluntarily acquiring and cancelling carbon credits.

The area of corporate claims and offsetting remains subject to uncertainty, particularly because the VCM and associated climate-related claims are under growing scrutiny from regulators, researchers, and non-governmental organizations (e.g., the actions being taken by the EU to prohibit carbon neutral claims on consumer products).

In some situations, the viability of corporate climate action pledges may be enhanced through voluntary agreements with governments. Notably, various public-private voluntary-based crediting systems have been or are being implemented worldwide, including in Australia, Thailand, India, and Japan, to encourage voluntary climate action.

A summary of the types of carbon market policy options described is set out in Table 1, alongside examples in operation today.

**Table 1.** Summary of carbon market instrument types.

| Type | Covered activities | Market approach | Examples |
|---|---|---|---|
| **Cap-and-trade-based emissions trading scheme (ETS)** | • Traditionally large point source emitters (e.g., fossil power, steel, cement, etc.).<br>• Road transport, aviation, maritime and commercial buildings also increasingly covered (e.g., in the Korea ETS, California CaT, and EU ETS).<br>• New sectoral models emerging (e.g., for buildings and transport in Europe, and for oil and gas emissions under Canada's proposed Federal cap). | • System-wide cap set ex ante for covered activities and sectors, based on the scheme operator's emissions target.<br>• Capped entities may acquire allowances and surrender to scheme operator as "permits to emit" based on previous, verified emissions.<br>• Allowances acquired through any or all of the following: free allocation, and/or auctioning (by system operator), and/or trading between market participants. | • EU ETS<br>• UK ETS<br>• Switzerland ETS<br>• Kazakhstan ETS<br>• California ETS<br>• Korea ETS |
| **Intensity- or output-based ETS** | • Large point source emitters (e.g., fossil power, steel, cement etc.). | • System-wide cap set ex post for covered activities and sectors, based on reported activity, emissions, and the scheme operator's relevant intensity benchmark for covered activities.<br>• Entities emitting below the sectoral benchmark may sell to entities whose emissions exceed the benchmark.<br>• Market formation through ex post adjustments. | • China National ETS<br>• Canada Federal and Provincial systems<br>• Australian Safeguard Mechanism<br>• Indonesia ETS |
| **Crediting mechanisms** | • Various mitigation activities falling outside the scope of climate-related regulations or carbon pricing systems (varies by scheme). | Carbon credit uses:<br>1. International cooperation to meet NDCs (i.e., Article 6 trades).<br>2. Internationally agreed offsetting quota (e.g., CORSIA).<br>3. Flexible mechanism for ETS compliance (or other carbon pricing).<br>4. Voluntary offsetting (including voluntary agreements between companies and governments). | (a) Domestic compliance: Kazakhstan ETS, Indonesia ETS, Korea ETS, California CaT, etc.<br>(b) International compliance: CORSIA; Article 6<br>(c) Voluntary (public-private partnerships): Japan GX-ETSIndia Carbon Credit Trading Scheme (CCTS)<br>(d) Voluntary (fully private): corporate climate-related claims |

*Source: World Bank (2024); authors' interpretation.*

## Results-Based Finance

Results-based finance (RBF) is another potential source of carbon credit demand that has historically received less attention than offsetting-based approaches. RBF is a non-market approach involving the use of carbon credits as a measure of outcomes of a support program, with the carbon credits being used to trigger financial disbursements to the originating entities. The emergence of so-called "mitigation contribution" claims is also lending more weight to potential RBF-type use cases for carbon credits. For example, acquisition of "mitigation contribution A6.4ERs" by entities other than domestic compliance buyers can be considered as a form of results-based finance.

As noted above, the term "mitigation contribution" stems from discussions under the PACM, where it is being applied to situations where an activity generates A6.4ERs, but the host country provides an authorization only for mitigation contribution, and not for counting towards NDCs or other international mitigation purposes (OIMP), such as CORSIA, meaning the units are not an ITMO (UNFCCC 2022). Mitigation contribution A6.4ERs are not subject to corresponding adjustments. This means that the mitigation outcomes resulting from the action will remain accounted for against the NDC of the country of origin, and therefore should not also be counted against another climate mitigation target (e.g., another country's NDC, or under CORSIA). The corollary is that if a credit acquirer also makes a mitigation-based offset claim on credits originating from the same activity, double counting and double claiming would occur (i.e., claiming of the outcome by both the country hosting the project activity and the host country of the entity acquiring the carbon credit). Limiting the use case for the A6.4ER acquirer to claims relating to its financial "mitigation contribution" to the host country, rather than for offsetting their own emissions, is considered to eliminate the possibility of double counting or double claiming.

## 2.2.2 Credit Supply

Three sources of carbon credit origination are in operation today: international, domestic and independent, as noted in Figure 2. These different credit supply sources are reviewed below. The basis on which carbon credits are originated is summarized in Box 2.

## Box 2. Generic Modalities and Procedures for Carbon Credit Origination

Carbon credits are typically originated from project-based or "baseline-and-credit" emission reduction or removal activities. This type of crediting arrangement involves the implementation of a climate mitigation project, the monitoring and measurement of its total emissions, and the comparison of these emissions against a notional, counterfactual baseline (i.e., the most likely scenario to occur without implementation of the mitigation project, which is also sometimes referred to as a business-as-usual scenario). The difference between the baseline emissions and the monitored emissions (and/or removals) – namely, the resulting net accounting of emission reductions or removals – sets the basis for issuing carbon credits to the activity operator.

A number of other factors must be taken into account in carbon crediting project design, including:

- **Eligibility.** The mitigation activity type must be eligible under the crediting program and have an applicable existing methodology that it may use (or otherwise one could be developed).
- **Additionality.** The mitigation activity needs to go beyond what might have otherwise happened – for example, under a business-as-usual or otherwise project baseline scenario (i.e., the implemented project was not required by law or for another reason, and that the main driver for the mitigation activity was the revenue from the sale of carbon credits).

- **Boundaries and leakage.** The project should clearly define the emissions sources to be monitored and counted as the activity's total emissions, and the treatment of emissions that may arise as a result of the project but occur outside of the control of the project developer.

- **Crediting period.** The duration over which the project activity will be eligible for crediting, which can vary by project type.

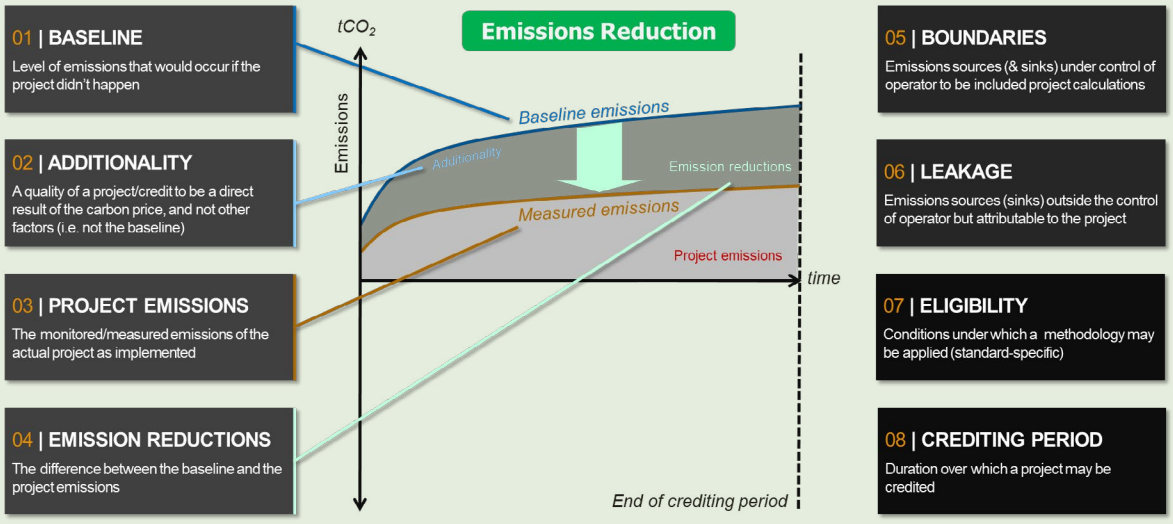
The exact rules for project monitoring and accounting are laid out in what are variably termed methodologies, methodological standards, or protocols, which are applicable to different types of mitigation activities. These various methodologies/standards/protocols are prepared and managed by crediting program operators (e.g., a national-level crediting mechanism or an ICP). A range of supplementary tools, guidelines, and modules also often exist within the collection of rules making up a carbon crediting program.

To date, the various carbon crediting programs have included a wide range of eligible reduction and removal activity types, and a plethora of methodologies are available through which to register activities and to generate carbon credits. The carbon credit supply market continues to evolve, with methodologies and activities being regularly added and updated. However, no central record of carbon market system coverage is available.

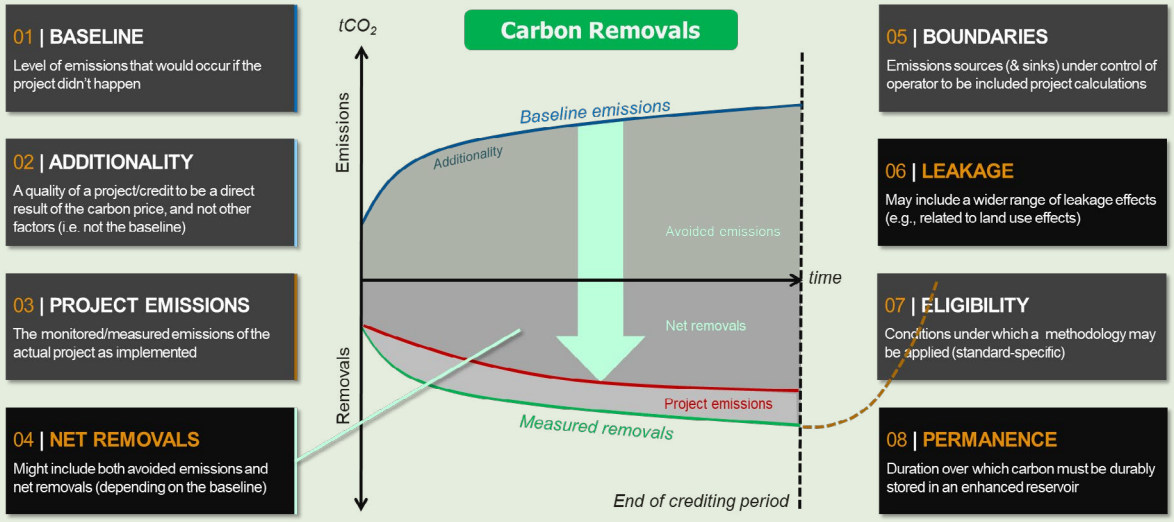
The design features for project-based crediting for emission reduction mitigation activities are summarized graphically below, with the additional features for carbon removal activities highlighted separately:

## Graphical Summary of Design Features for Baseline-and-Credit

**Box Figure 1(a).** Emission reductions.



**Box Figure 1(b).** Carbon removals (differences from 1(a) shown with orange text and darker boxes).




*Source: Authors.*

The various carbon crediting programs also tend to consist of similar governance, structural, and procedural arrangements for implementation, as set out below:

**Box Figure 2.** Core components of a carbon crediting program.

**I. Governance, Management, and Administrative Arrangements**

- Defines who runs the scheme and oversight bodies.
- Establishes rulemaking procedures (i.e., how it is operated).
- Defines types of eligible activities.
- Sets out principles underpinning credit origination.
- Establishes rules for the accreditation of verifiers, etc.

**II. Methodologies, Standards, Protocols, and Tools**

- Establishment of monitoring and measurement methods through which to calculate the quantified level of emission reduction or removal achieved by specific activity types.
- Includes specific monitoring and reporting requirements (approaches and scope of monitoring and reporting may vary according to the specifics of the program).

**III. Registry**

- Electronic database for recording each registered activity.
- Provides basis for issuing unique tagged electronic credits for each ton of certified $CO_2$ equivalent emission reduction and/or removal.
- Issued credits transferred to the registry account of an activity operator upon submission and approval of verified monitoring reports for the registered activity.
- Can be operated in-house or through a third-party platform.

*Source: Authors.*

Collectively, the procedural and governance components outlined in this box determine the quality framework for a crediting program. Carbon credit quality is typically defined by the properties of being real, measurable, additional, not resulting in leakage, not double counted, and permanent.

## International Crediting Programs

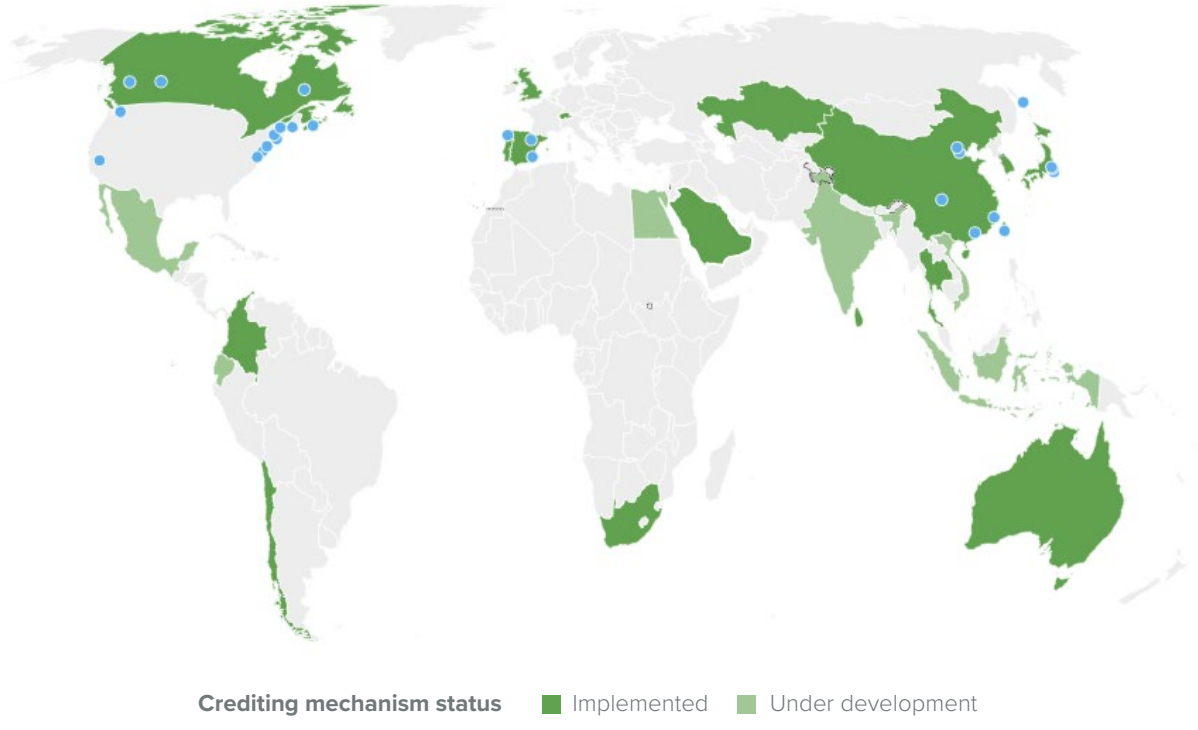
This category relates to carbon credits issued for international-climate-policy-related purposes (e.g., under the Kyoto Protocol and the PACM). Under the Kyoto Protocol, project-based carbon credits – CERs and ERUs from CDM and JI, respectively – could be originated from mitigation projects in either developing or developed countries (see Box 1). Demand was driven by the QELROs of Annex I countries (see Box 2). Following the decline of the Kyoto Protocol, CERs continue to be issued, acquired, and cancelled for the purpose of voluntary claims in the VCM.

Since its start in around 2005, the CDM is reported to have issued more than 2.4 billion CERs covering more than 8,000 projects and Programmes of Activities across the developing world (UNFCCC 2024).

## Domestic Crediting Programs

This category includes various government-run carbon credit schemes, with varying regional, national, and sub-national coverage. Currently, 35 such schemes are reported to be in operation, with 11 more under development (Figure 4).

**Figure 4.** Government-administered carbon crediting mechanisms around the world, 2024.




*Source: Alarfaj (2024), based on World Bank (2024).*

Several crediting mechanisms are linked to compliance systems. Examples with direct linkages to ETSs include the Provincial-run Alberta Emissions Offset System and the British Columbia schemes linked to sub-national ETSs in Canada, the China CER scheme linked to Chinese ETSs, and the Korea Offset Credit Mechanism linked to the Korea ETS.

Examples without direct ETS linkage include the following:

- The Australian Carbon Credit Unit Scheme (ACCU), although this has recently been linked, at least in part, to the output-based ETS under the Australian Safeguard Mechanism.
- Thailand Voluntary Emission Reduction (TVER), which relies on voluntary purchase, but is seeking linkages to compliance schemes such as CORSIA.
- Japan's J-Credits and Joint Crediting Mechanism, covering domestic and international credits, respectively, with the intention to link to the GX-League under the proposed GX-ETS (see Box 3).
- India's proposed Carbon Credit Trading Scheme (CCTS), which would link to the proposed Indian ETS.
- Saudi Arabia's Greenhouse Gas Crediting & Offsetting Mechanism (GCOM) (discussed in section 3.1).

Other domestic, sub-national, and regional crediting mechanisms in operation include the UK's Woodland Carbon Code and Peatland Code, the Portuguese Voluntary Carbon Market, France's Label Bas Carbon, Spain's FES-$CO_2$ Program, and the Sri Lanka Carbon Crediting Mechanism.

In the unlinked cases, the carbon crediting schemes were initially aimed at encouraging voluntary engagement in climate action (e.g., in Australia and Thailand), but several have been taking subsequent steps towards formalizing links to compliance schemes, as outlined above. In several cases, as well as being established as government-led mechanisms, government support was also provided to sustain the mechanism (e.g., Australia's ACCU reverse auctions and tax credits for project developers in the case of Thailand). Japan's arrangements under the GX-League, however, are more geared around a public-private partnership type arrangement between industry and government (see also Box 2).

## Box 3. Japan's GX-League and GX-ETS and Market-Based Mechanisms

The GX-League is among the main policy measures brought forward by Japan's Ministry of Economy, Trade and Industry to address GHG emissions and achieve climate neutrality in 2050.

The GX-League is founded on three key pillars:

- **Creating Future Society.** This includes visioning the low carbon future and a "GX Company Code of Conduct" for member firms, which sets out various requirements for emission reductions.
- **Market Creation and Rulemaking.** From 2023 onwards, GX member companies, by agreeing to the code of conduct, will participate in various market initiatives to create carbon market components. These include standards, guidelines, and certification systems, among others.
- **Carbon Credit Exchange Scheme.** This comprises a voluntary ETS, known as the GX-ETS. Under it, GX-League members can pledge their own ambitious reduction targets, and where their performance exceeds Japan's NDC target, surplus credits may be exchanged. Periodic review of progress is included, as is a proposed new Japanese market trading platform (JPX Carbon Credit Exchange).

Japan already has two carbon crediting systems that have been in place since 2013, and that will be used to support GX-ETS implementation:

1. J-Credit scheme covers a wide range of eligible domestic emission reduction and removal activities. So far more than 60 methodologies exist, covering a wide range of activities.
2. Joint Crediting Mechanism (JCM) is based on bilateral agreements with developing countries to originate carbon credits from international partners for use towards meeting Japan's NDC. So far, 28 partner countries have joined the JCM, including Saudi Arabia.

Other types of credits may also be eligible within the GX-ETS, according to recent draft proposals.

*Source: METI (2022).*

# Independent Crediting Programs

Independent crediting programs (ICPs) are privately-operated carbon credit registries that set their own methodological standards/protocols, governance frameworks, and issuance rules.
The ICPs have been in existence for longer than the international or regulated carbon credit programs. The American Carbon Registry (now referred to as simply "ACR") was established by the Environmental Resources Trust in 1996 with an original focus on U.S.-based voluntary credit buyers seeking nature conservation climate mitigation philanthropy with strong environmental co-benefits. Since that time, the scope of the ACR has evolved, and the number of ICPs has grown gradually to include the Gold Standard (Switzerland, 2003, which started off as a "bolt-on" to CDM projects), the Voluntary Carbon Standard (VCS; operated by Verra in the U.S. since 2006), and the Climate Action Reserve (CAR; operational in the U.S. since 2008).

More recently, the diversity and specialisms of the ICP operators has also increased, with newer market entrants including the Global Carbon Council (established 2016, based in Qatar) and engineered carbon removal specialists Puro.Earth and Isometric (established in 2018/19 and 2022, respectively).

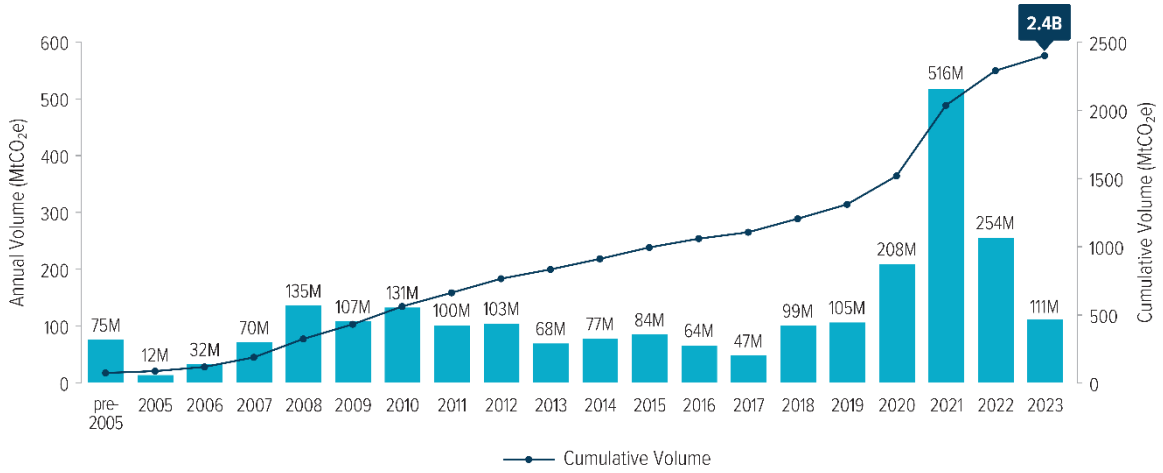
Although the ICPs were historically small in comparison with the Kyoto offset markets, they were given a significant boost at the start of the Paris Agreement era through the launch of the Taskforce for Scaling the Voluntary Carbon Market (TSVCM), led by former Governor of the Bank of England Mark Carney (see TSVCM 2021). In its Phase 1, the TSVCM stated that:

> A liquid voluntary carbon market at scale could allow billions of dollars of capital to flow from those making commitments, such as carbon neutral or net zero, into the hands of those with the ability to reduce and remove carbon (TSVCM 2021, p. 2).

The TSVCM initiative coincided with something of a VCM boom, with the volume of ICP carbon credit supply growing significantly compared to pre-2020 levels (Figure 5).

In some cases, credits from ICPs are also linked with regulated schemes. For example, California Air Resources Board (ARB) approved offset credits originated under selected methodologies from ACR, VCS, and CAR can be used for compliance purposes in the California CaT. The ICAO-appointed Technical Advisory Body (TAB) also endorses specific ICP methodologies as sources of CORSIA-Eligible Emission Units (CEEUs; i.e., credits that can be used by airlines under CORSIA).

**Figure 5.** Voluntary carbon market size by volume of traded carbon credits, pre-2005 to 2023.




*Source: Forest Trends' Ecosystem Marketplace (2024).*

Even though linkages between carbon credits and compliance schemes exist, more than 90% of demand remains linked to voluntary action in the VCM (Section 2.2.1). However, as outlined in Section 2.2.1, lingering concerns regarding the integrity of both the supply side (credit quality) and the demand side (claims) are hampering VCM development. These concerns are seemingly reflected in the downturn in the supply of credits through 2023 compared to the previous three years. To address such concerns, the Integrity Council for the Voluntary Carbon Market (IC-VCM) Core Carbon Principles seek to guide best practice among ICPs on the supply side (IC-VCM 2024) as a complement to the VCMI Claims Code of Practice mentioned above (Section 2.2.1).

Despite the traded VCM carbon credit supply hitting a high of 500 $MtCO_2e$ and a value of US$2.1 billion in 2021 (Figure 5), the VCM remains much smaller than ETS market size. For comparison, in the EU alone, more than 1.1 billion ETS units (i.e., EU Allowances) were in circulation in 2023, with government revenue from the auctioning of EU Allowances in 2022 generating around €38.8 billion ($42.2 billion) (EEA 2023). The London Stock Exchange Group reportedly estimated the global compliance carbon market in 2023 to be worth US$948.8 billion (Twidale 2024) – several hundred times that of the VCM.

# 2.3 Future Trends for Global Carbon Markets

## 2.3.1 Linking Markets and Harmonizing Carbon Pricing

Climate action is a global challenge that requires global responses. A globally uniform emissions price can be a means to address climate action in a harmonized and optimized manner and to mitigate against free riding (LSE 2011; Cramton, Ockenfels, and Stoft et al. 2015; Cramton et al. 2017). Many future climate action scenarios developed in integrated assessment models explore global technical and economic responses to climate mitigation based on uniform carbon prices applicable in all world regions (Carbon Brief 2018).

However, the reality is more complex. First, a universal carbon price does not address equity issues and differentiated responsibilities that are ingrained within the UNFCCC and the Paris Agreement. Second, there are significant challenges to linking ETSs due to concerns over, among others, differences in ETS scope, variations in measurement rules, the comparability of stringency/ambition and the level of the cap, and the potential impacts that such differences can pose for the competitiveness of similar GHG emitting industries across regions. The linking of two seemingly well-aligned ETSs in Switzerland and the EU, for example, took more than 10 years of negotiations.

The one-way linking of carbon credits to an ETS for flexibility purposes can be more straightforward. In seeking to link carbon credits to ETS markets, an ETS regulator needs to take account of several important features:

- **Eligible activity types (qualitative restrictions).** Carbon credits should originate from outside of the scope of ETS-covered activities or sectors to ensure both the additionality of actions (i.e., they are not actions driven by the ETS price) and to avoid double counting effects (i.e., the actions are not counted as both credits towards compliance under the ETS, and also reductions inside the ETS). In these respects, examples of potentially eligible mitigation activities include projects in agriculture, forestry, waste management, buildings, or non-$CO_2$ gases. Qualitative restrictions could also be applied to, for example, the supply of credits from other countries (e.g., by selection based on the stringency of national climate ambition).

- **Scheme governance and credit quality.** The integrity and robustness of the crediting program in regard to, for example, general rules or standards, specificities of methodologies, application of independent verification, and quality of credit infrastructure are all important considerations.

- **Limitations on credit use (quantitative restrictions).** The potential supply – or oversupply – of credits is also an important factor. Oversupply will diminish the incentive to reduce emissions internally and can potentially crash the price within an ETS where unlimited access to carbon credits from low-cost mitigation activities is allowed (see Section 2.1.3 for examples of the credit supply restrictions in some ETSs).

To control these factors, domestic compliance markets have increasingly tended to link to domestic crediting programs instead of ICP or international schemes. A purely domestically regulated approach allows system regulators to maintain consistency in the scope and coverage of eligible credits and to ensure equivalency in the governance arrangements and measurement requirements applied to both credits and the domestic ETS.

Where compliance markets seek to link to carbon credits from ICPs or international schemes, system operators usually establish a "gateway" with defined rules that can manage these issues (e.g., there is an ARB approval process for credits in the California CaT and the CORSIA has a Technical Advisory Body that makes recommendations to the ICAO Council regarding eligible crediting standards and credit types). Notably, however, where credits originate from third countries outside the scope of the ETS, a wider set of eligible activities may be considered as the risk of double counting is diminished.

In the VCM, similar concerns over double counting also persist. In these circumstances, the concerns are made more complex by the nature of corporate emissions reporting, which tends to cover not only direct (so-called Scope 1) emissions, but also indirect emissions from bought-in electricity and heat (Scope 2) and emissions related to goods and services in corporate supply chains, including customer emissions from product use (i.e., various categories of Scope 3 emissions). In these circumstances, it is possible that carbon credits are acquired from mitigation projects outside the direct control of the corporate entity, but that address emissions from activities inside the corporation's supply chain that directly impact its Scope 2 or 3 emissions. This means that the mitigation associated with these credits also drives reductions in the firm's own reported Scope 2 or Scope 3 emissions. As a result, using the credits to make offsetting claims against the company's Scope 1, 2, and 3 emissions would result in double counting. Guidance by groups such as the SBTi therefore recommend that companies deliver climate action outside of their value chains, which can avoid this risk (so-called "beyond value chain mitigation") (SBTi 2024b). Nevertheless, this practice of double counting within the value chain remains an ongoing concern, especially for Scope 3 emissions.

## 2.3.2 Regulating the VCM

Recent years have seen some jurisdictions take steps to further regulate claims related to corporate climate and the linkages therein to the VCM. In the EU, for example, the 2023 updates to the Corporate Sustainability Reporting Directive (CSRD) set down more stringent rules for corporate climate-related disclosures for EU-listed firms. These include detailed guidance in the European Sustainability Reporting Standard (ESRS 2023), which outlines how GHG reduction targets, actual emissions, and carbon credit use should be reported.

In the U.S., the Securities and Exchange Commission is also enacting enhanced climate-related disclosure rules for listed companies (Securities and Exchange Commission 2024a and 2024b). The new rule requires firms to, inter alia, disclose capitalized costs, expenditures expensed, and losses related to carbon credit offsetting if used as a material component to achieve a listed firm's disclosed climate-related targets or goals. These moves can potentially create more robust, less volatile, VCM-oriented carbon markets.

## 2.3.3 Carbon Border Adjustments

The emergence of border adjustment mechanisms based on carbon pricing is stimulating interest in establishing national carbon pricing systems in many parts of the world. For example, the EU's fledgling carbon border adjustment mechanism (CBAM) seeks to equalize production costs between domestic and imported goods by applying an equivalent carbon price to selected imports. Phasing in the CBAM will allow for the synchronized phase out of free allocation of EUAs to trade-exposed EU-based industrial activities that are covered by the EU ETS. This should strengthen the economic incentive for these sectors to reduce emissions.

The U.S. Senate has also mooted several proposals for similar carbon-price based border adjustment measures (Gangotra, Carlsen, and Kennedy 2023). Under these proposals, exporters to covered jurisdictions can gain tax relief where the country of production applies some form of carbon pricing.

Collectively, carbon border adjustment mechanisms can potentially drive the creation of domestic carbon pricing systems and carbon markets across many parts of the world, as they may directly or indirectly incentivize other countries to implement equivalent national schemes and allow them to collect carbon revenues domestically (Mehling et al. 2019).

# 3. Potential for Carbon Credit Markets in Saudi Arabia

## 3.1 Current status

In 2021 the government of Saudi Arabia announced a national net-zero GHG target for 2060 and adopted the concept of the circular carbon economy (CCE) as the framework for pursuing its medium- and long-term climate mitigation ambitions. The CCE concept emphasizes technology-neutral, holistic, context-specific, and cost-effective approaches to achieving emissions circularity, and its implementation in Saudi Arabia is being backed up by ambitious technology-specific targets, including 50% power generation capacity shares for both renewables and natural gas by 2030, a CCUS capture capacity of 44 $MtCO_2$ by 2035, and the planting of 50 billion trees across the region (Aldhuwaihi and Luomi 2024; Saudi Green Initiatives 2024a). In parallel, the country's major corporations, including Saudi Aramco and the chemicals firm SABIC, have set net-zero GHG targets for operational emissions (Scopes 1 and 2) for 2050, and many others are contemplating following suit. These developments are also spurring a growing interest in the potential role of carbon markets in Saudi Arabia to facilitate implementation.

Achieving full emissions circularity, or net-zero emissions, in the context of Saudi Arabia's hydrocarbon wealth and the major high-emitting industries built around it will demand major efforts, both in terms of emission reductions and removals. As the government and major corporations develop the roadmaps and implementation strategies toward these goals, carbon markets have emerged as a potential option to explore as part of the broader mitigation toolkit. Saudi Arabia's updated first NDC from 2021 notes that cooperative approaches under Paris Agreement Article 6 "will play a role in achieving the Kingdom's climate change ambitions … enhance private sector engagement, advance innovation in business models, unlock investment flows and support cleaner energy technology development" (Kingdom of Saudi Arabia 2021). On the corporate side, Saudi Aramco has announced plans to mitigate 16 $MtCO_2e$ per year by 2035 via a combination of nature-based solutions and "offsets" and, towards this goal, voluntarily bought and retired approximately 500,000 carbon credits in 2023 as part of an RVCMC auction and planted 6.5 million mangrove trees (Aramco 2024a).

A recent modelling assessment of a net-zero pathway for Saudi Arabia found that an annual emissions decline of more than 3% from 2030 to 2060 as well as large-scale deployment of technological carbon removals would be essential (Kamboj et al. 2023). As outlined above, domestic carbon market mechanisms offer the possibility for cost-effective mitigation potential discovery. International market-based cooperation under Article 6 could potentially also unlock further options (e.g., government-authorized transfers of nature-based removals). Mirroring global trends post 2020, carbon markets in Saudi Arabia have seen rapid developments in two areas: the corporate-led VCM and government-regulated domestic crediting mechanisms.

### Regional Voluntary Carbon Market Company

As the first mover in the VCM space in Saudi Arabia, the Public Investment Fund (PIF), the sovereign wealth fund, together with the Saudi stock exchange, Tadawul, launched its Voluntary Carbon Market Initiative in 2021, which became the Regional Voluntary Carbon Market Company (RVCMC) in 2022 (PIF 2022).
The RVCMC's stated purpose is to provide guidance and support in carbon credit purchases to companies in the Middle East and North Africa region. In pursuit of its core

goal, the firm has organized three record-breaking VCM auctions. The first two auctions, which took place in 2022 and 2023, collectively sold more than 3.6 million carbon credits to Saudi and international companies. PIF-affiliated and other Saudi-headquartered companies constituted the majority of buyers, while renewable and clean energy-based credits registered by Verra comprised the majority of the credits sold (VCM 2024). Notably, all credits were sourced from outside Saudi Arabia.

At the Baku Climate Change Conference (COP29) in late 2024, the RVCMC launched the Saudi-based VCM carbon exchange. The exchange is reported to have initially enlisted 22 Saudi Arabian and international companies, and will make available carbon credits that originated from 17 projects from countries around the world (Gualandi 2024). The RVCMC also held a third credit auction in Baku on the exchange's opening day, which reportedly witnessed the sale of 2.5 million carbon credits. The company has also previously announced plans to set up an investment fund for mitigation projects (RVCMC 2023; Arab News 2024).

## Greenhouse Gas Crediting and Offsetting Mechanism

The Saudi GCOM is the first government regulated domestic carbon crediting mechanism to be established in the Middle East and North Africa region. The GCOM was first mooted at the 2022 UN Climate Change Conference in Sharm El-Sheikh (COP27) and formally launched at the 2023 MENA Climate Week in Riyadh (Ministry of Energy 2023). Its development and operation are led by Saudi Arabia's CDM Designated National Authority (DNA), the country's Paris Agreement DNA and the focal point for national GHG emission inventories and reporting to the UNFCCC.
The GCOM intends to support cost-effective mitigation toward Saudi Arabia's climate change mitigation targets by mobilizing cooperation among national entities and across sectors. Credit demand is not envisaged to be driven by a compliance mechanism (ETS or carbon tax) but rather by voluntary participation by public and private entities interested in offsetting their GHG emissions (GCOM 2024a). Mitigation projects from all sectors and potentially also from outside the Kingdom can be credited under the GCOM, and alignment with Article 6 is encouraged but not mandatory (GCOM 2024b).

Projects under the GCOM can either opt for GCOM-specific methodologies or "internationally recognized methodologies" (GCOM 2024c). As of September 2024, the Saudi DNA had published five methodology documents for various emission reduction project types deemed strategically important for the country:

1. Switching from oil to natural gas in the power sector.
2. Renewable energy generation.
3. Low-carbon hydrogen use in iron and steel production.
4. Electric vehicles.
5. CCUS.

Four out of the five are based on existing CDM methodologies, while the CCUS methodology builds upon the CDM modalities and procedures document (UNFCCC 2012), given the absence of approved methodologies. The documents simplify the CDM methodologies in order to reduce transaction costs and increase ease of use. The GCOM website also lists three examples of crediting standards that could qualify under the category of internationally recognized methodologies: voluntary standards VCS (Verra), Gold Standard, and I-REC.[2]

## Credit Supply

Saudi Arabia's experience with carbon crediting to date is limited. As of mid-2024, there were no registered VCM crediting projects in the Kingdom.[3] Under international crediting mechanisms, it registered eight CDM projects and Programmes of Activities and two JCM projects stretching back across the period 2012-2018 (for more, see: Luomi, Bosse and Sergeeva 2023; Kondo 2023).

Both the VCM company and particularly the GCOM can potentially help drive carbon crediting project supply, as well as demand, in the Kingdom. While the PIF and Tadawul's efforts in driving VCM participation have been laudable, a more structured, consistent, and target-based approach is only likely to be achieved through a regulated mechanism that offers stable and enduring demand for credits.

# 3.2 Domestic Demand and Supply Potential

This section presents the methodological approach and results of an analysis of the potential for GHG credit demand and supply in the Kingdom. The first part details the approach to estimating credit demand by large Saudi corporations, including related assumptions made, and presents four demand scenarios reflecting varying assumptions on the share of credits that companies may on average be using to make voluntary offsetting claims.

The second part provides an initial assessment of the potential supply for carbon credits in Saudi Arabia. The analysis consists of a three-step approach: assessing mitigation potential at a high level; narrowing down the scope of potential creditable activities by screening criteria including scalability, ease of implementation, and avoidance of double counting; and developing quantitative scenario estimates of crediting potential based on factors including eligibility, the length of the crediting period, and emission baselines.

## 3.2.1 Potential Domestic Credit Demand

### Sources of Credit Demand in Saudi Arabia

Within the broad ambit of carbon pricing and carbon markets, credit demand can emerge from a variety of sources (Section 2). Such sources can vary across different countries depending on their state of readiness and implementation of carbon pricing and carbon markets.

Given the current status of carbon markets in Saudi Arabia, where the Saudi government has launched a standalone national domestic carbon crediting scheme (GCOM) that is not linked to a compliance mechanism (Section 3.1), demand for carbon credits is expected to be driven by Saudi entities in the public and private sectors that have voluntarily set emission targets and that plan to purchase carbon credits as a cost-effective means to achieve their targets.

Table 2 lists large publicly listed companies in Saudi Arabia that generally have significant levels of GHG emissions and that have voluntarily set net-zero or other types of long-term emission reduction targets. Setting such voluntary emission targets is expected to contribute to enhancing a company's local and global reputation while potentially attracting greater levels of investment, especially from investors focused on contributing to decarbonization. These Saudi companies with long-term emission reduction targets are expected to be the primary source of demand for voluntary carbon credits in Saudi Arabia, as the purchase and retirement of carbon credits can help these companies achieve their emission reduction targets more cost effectively. As Table 2 shows, these companies together account for a significant share of total national GHG emissions, which were estimated at 664 $MtCO_2eq$ by the DNA (Kingdom of Saudi Arabia 2024) for the year 2019. For example, Saudi Aramco, the country's national oil company, emitted 67.3 $MtCO_2eq$ of Scope 1 and 2 emissions in 2023, which represents around 10% of the country's total emissions. Similarly, SABIC, Saudi Arabia's leading chemicals company, emitted 52.1 $MtCO_2eq$ of Scope 1 and 2 emissions in 2022, representing almost 8% of total national GHG emissions. The Saudi Electricity Company (SEC), the Kingdom's largest electricity producer, generated 151.9 $MtCO_2eq$ of Scope 1 and 2 emissions in 2023, which is roughly one-fifth of the Kingdom's total emissions.[4]

Another anticipated source of demand for carbon credits in Saudi Arabia is the PIF's "Giga-Projects," which are major investments by the PIF that are "designed to stimulate the economy and their benefits are expected to expand significantly beyond the real estate and infrastructure sectors, helping to diversify the economy away from oil, especially given their sheer scale" (PIF 2024). These Giga-Projects include NEOM, a city-scale project that aims to be a global hub for businesses and innovative living, and Red Sea Global, a developer of sustainable and luxury tourism destinations. Both NEOM and Red Sea Global have placed sustainability at the heart of their visions. For example, Red Sea Global has committed to net-zero operational emissions by 2030 and net-zero carbon emissions from assets over the lifetime of the project (Red Sea Global 2024). Given the scale of these projects, they are expected to be significant sources of demand, especially in the short term during the major construction phases.

Following the implementation of CORSIA (see Section 2.2.1), major airlines based in Saudi Arabia like Saudia, Flynas, and the upcoming Riyadh Air are all expected to

contribute significantly to the demand for carbon credits. Saudi-based airline corporations have already started using carbon credits toward voluntary offsetting claims. For example, Saudia claims to have operated the "longest carbon net positive flight in the world" in 2022 through the purchase and retirement of "Gold Standard approved and CORSIA certified" carbon credits from a hydroelectric project in India, with the quantity of offsets purchased exceeding the emissions generated by the flight (SAUDIA 2022).

**Table 2.** The quantity of emissions generated and emission targets of publicly listed companies in Saudi Arabia.

| Entity | Sector | Near-term emission target | Net-zero emission target | Latest Scope 1 and 2 emissions in $MtCO_2eq$ (reporting year) | Mention of using carbon credits in their sustainability strategy? |
|---|---|---|---|---|---|
| Saudi Aramco | Integrated energy and chemicals | 52 $MtCO_2eq$ reduction below baseline by 2035 | Net-zero Scope 1 and 2 GHG emissions by 2050 | 67.3 (2023) | "Aramco retired approximately 500,000 carbon credits in 2023, against a corporate emissions plan to use carbon markets to support the delivery of our 2035 and 2050 ambition" (Aramco 2024a, p. 46). The 500,000 credits were purchased through the RVCMC auction. |
| SABIC | Chemicals | 20% reduction in Scope 1 and 2 GHG emissions by 2030 (relative to 2018) | Net-zero emissions by 2050 (carbon neutral by 2050) | 52.1 (2022) | No public mention of using carbon credits in their reports. |
| Saudi Electricity Company (SEC) | Utilities | | Net-zero Scope 1 and 2 emissions by 2050 | 151.9 (2023) | Its purchase of 0.50 $MtCO_2eq$ of carbon credits mentioned as an example of past actions to achieve goals. |
| ACWA Power | Utilities | 50% reduction in GHG intensity by 2030 compared to 2020 | Net-zero emissions by 2050 | 64.8 (2023) | ACWA Power noted a "maximum use of up to 5% carbon capture credits" in 2050 (ACWA Power 2023). |
| STC | Telecom services | 50% reduction in Scope 1 and 2 emissions by 2030 (from 2019 baseline)<br><br>46.2% reduction in Scope 3 emissions by 2030 (from 2019 baseline) | STC has committed to a net-zero target by 2050, which encompasses Scope 1, 2, and 3 emissions | 0.28 (2023) | "To offset emissions that could not be immediately reduced, we purchased verified, high-quality carbon credits … at the largest-ever voluntary carbon credit auction event held in Nairobi, Kenya" that was organized by RVCMC (STC 2024, p. 73). |
| Tasnee | Chemicals | | Net-zero carbon emissions from the petrochemical complex in Jubail by 2060 | 4.1 (2023) | No public mention of using carbon credits in their reports. |

**Table 2.** Continued.

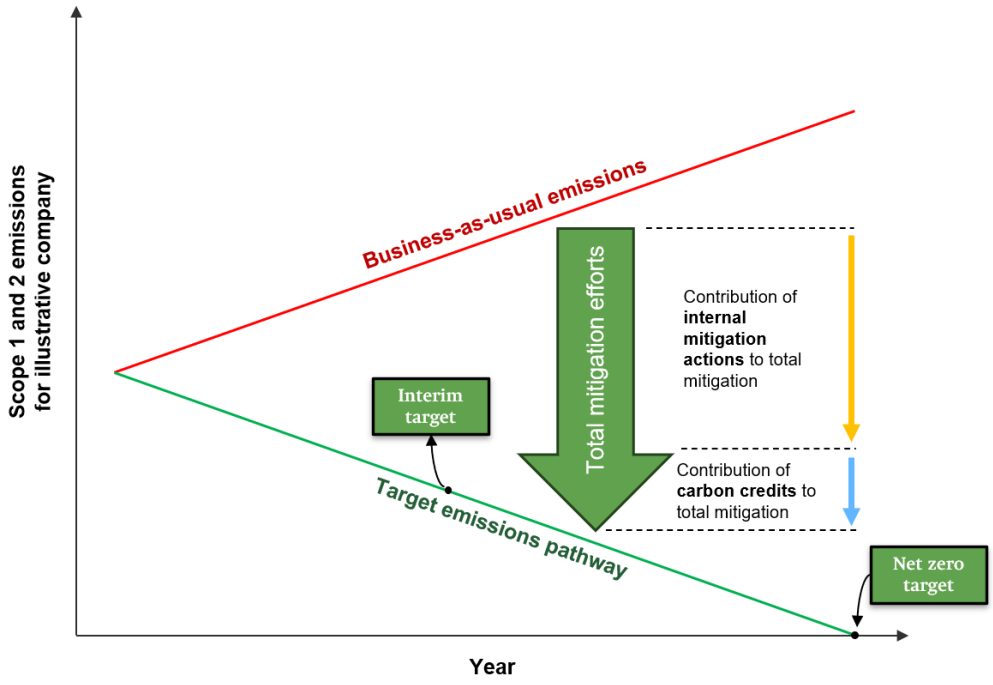
| Entity | Sector | Near-term emission target | Net-zero emission target | Latest Scope 1 and 2 emissions in $MtCO_2eq$ (reporting year) | Mention of using carbon credits in their sustainability strategy? |
|---|---|---|---|---|---|
| Bahri | Transportation and logistics | | Cut GHG emissions by 50% by 2050 | 2.9 (2020) | No public mention of using carbon credits in their reports. |
| Petro Rabigh | Refining and chemicals | Achieve a 25% reduction in Scope 1 and 2 GHG emissions from existing assets by 2027 compared to 2021 | Net zero by 2060 (in line with national net-zero ambition) | 9.6 (2022) | No public mention of using carbon credits in their reports. |

*Sources: Aramco (2024a); SABIC (2023); SEC (2024); ACWA Power (2023, 2024), Ma'aden (2024), STC (2024), Tasnee (2024), Bahri (2020), Sipchem (2023), Petro Rabigh (2023).*

## Methods for Estimating Credit Demand in Saudi Arabia

To generate estimates of potential carbon credit demand in Saudi Arabia, the emissions data published by major publicly listed companies on the Saudi stock exchange, Tadawul, were used. Non-publicly listed companies were excluded because of the absence of reported emissions data. The analysis relies on four elements: (1) a business-as-usual projection of emissions for each company that runs up to 2050, (2) a target emissions pathway (generally a net-zero emissions pathway) for each company, (3) the total mitigation efforts or actions required by each company to shift from business-as-usual to the target pathway, and (4) the contribution of carbon credit purchases and retirements to each company's total mitigation efforts. The approach is illustrated in Figure 6.

**Figure 6.** Illustration of the approach used to estimate the demand for carbon credits by each company.




*Source: Authors.*

To generate a business-as-usual projection of emissions, historical emissions data were used for each company. However, given the absence of sufficiently long time series data on emissions (most companies generally started reporting emissions in 2018 or later, yielding only a handful of data points), simple trend extrapolations (e.g., linear or exponential) were used to estimate business-as-usual emissions for each company, with the choice generally made based on the level of correlation. In the case of Aramco, a fixed percentage growth rate was used, as it produced a business-as-usual projection that passed through the company's publicly disclosed 2035 emissions projection. In the case of SEC, its baseline was established based on internal analysis by SEC (2023). Excluding SEC, all of the derived baseline emission projections for the companies listed in Table 2 are shown in Figure 7.

**Figure 7(a).** Baseline emission projections by the authors for companies with Scope 1 and 2 emissions that exceed 40 $MtCO_2eq$.

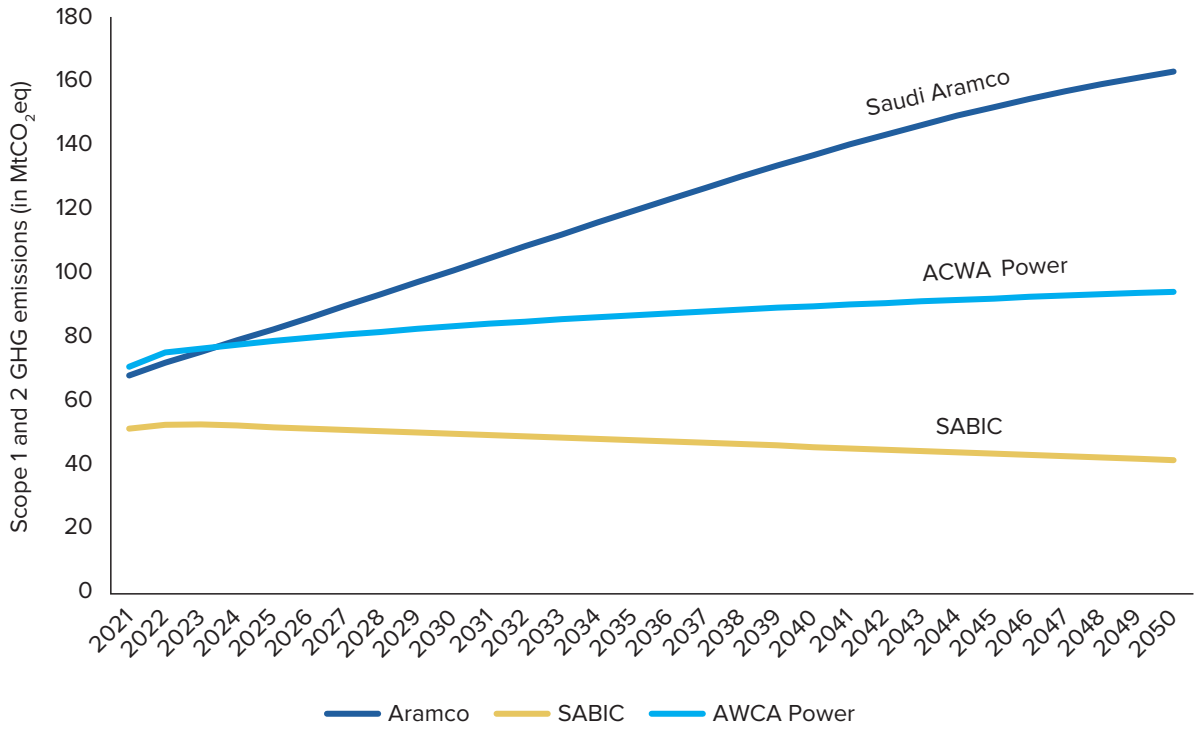
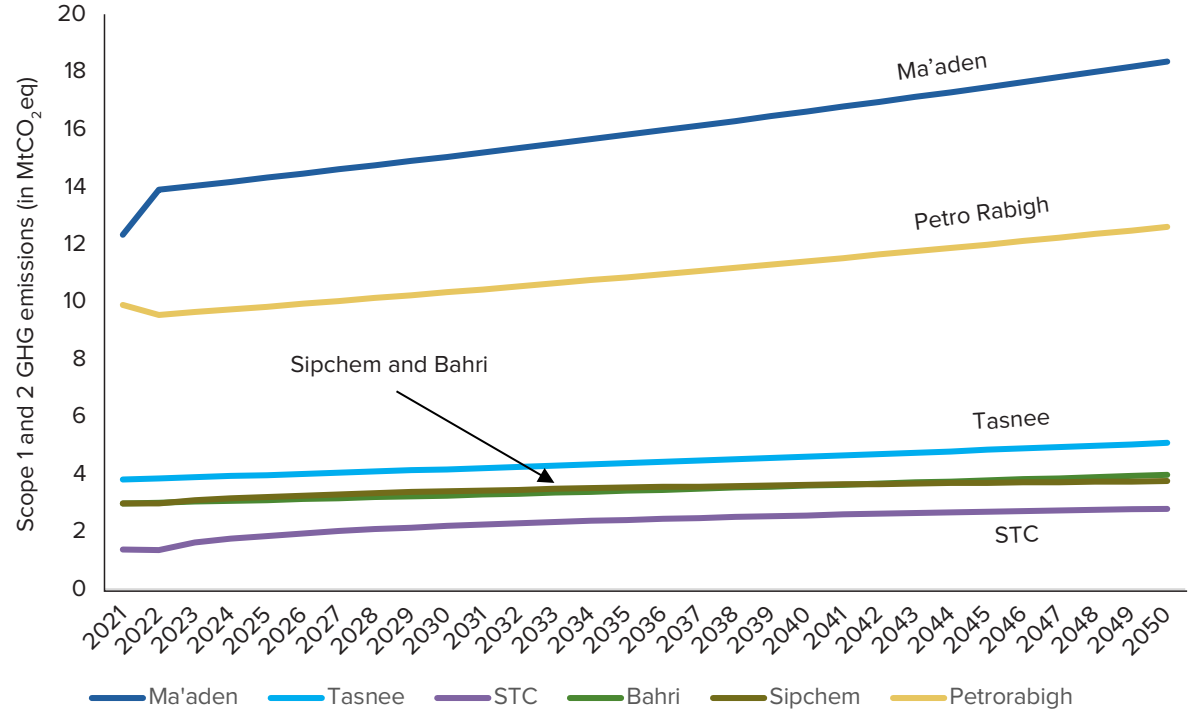



**Figure 7(b).** Baseline emission projections by the authors for companies with Scope 1 and 2 emissions below 40 $MtCO_2eq$.




*Sources: Aramco (2024a); SABIC (2023); SEC (2024); ACWA Power (2023, 2024), Ma'aden (2024), STC (2024), Tasnee (2024), Bahri (2020), Sipchem (2023), Petro Rabigh (2023).*
*Notes: SEC is excluded from the Figure.*

To generate the target emissions pathway for each company, polynomial curves were fitted that passed through each company's interim and long-term targets. For all companies other than Bahri, the long-term target was a net-zero target. For companies that had only set a long-term target, interim targets were assumed to be similar to those publicly set by other Saudi companies in the same sector (or adjacent sectors). The target emissions pathways for all the companies listed in Table 2 are shown in Figure 8.

The total mitigation actions required to shift from business-as-usual to the target pathway were calculated by taking the difference between the business-as-usual and target emissions pathways, both measured in units of $MtCO_2eq$. The calculation was made for each year between the start year (2024) of the analysis and the end year (2050).

Within the estimated reduction wedge of each firm following the method shown in Figure 6, an estimate of the potential contribution of carbon credits was made. This estimate provides the basis for the potential carbon credit demand estimates in the Kingdom over the next 25 years or so. The contribution of carbon credits is based on a percentage that is assumed to reflect a reasonable share for the contribution of carbon credits towards total mitigation actions. This assumed share is the key variable driving the analysis.

**Figure 8(a).** Target emission projections by the authors for companies with Scope 1 and 2 emissions that exceed 40 $MtCO_2eq$.

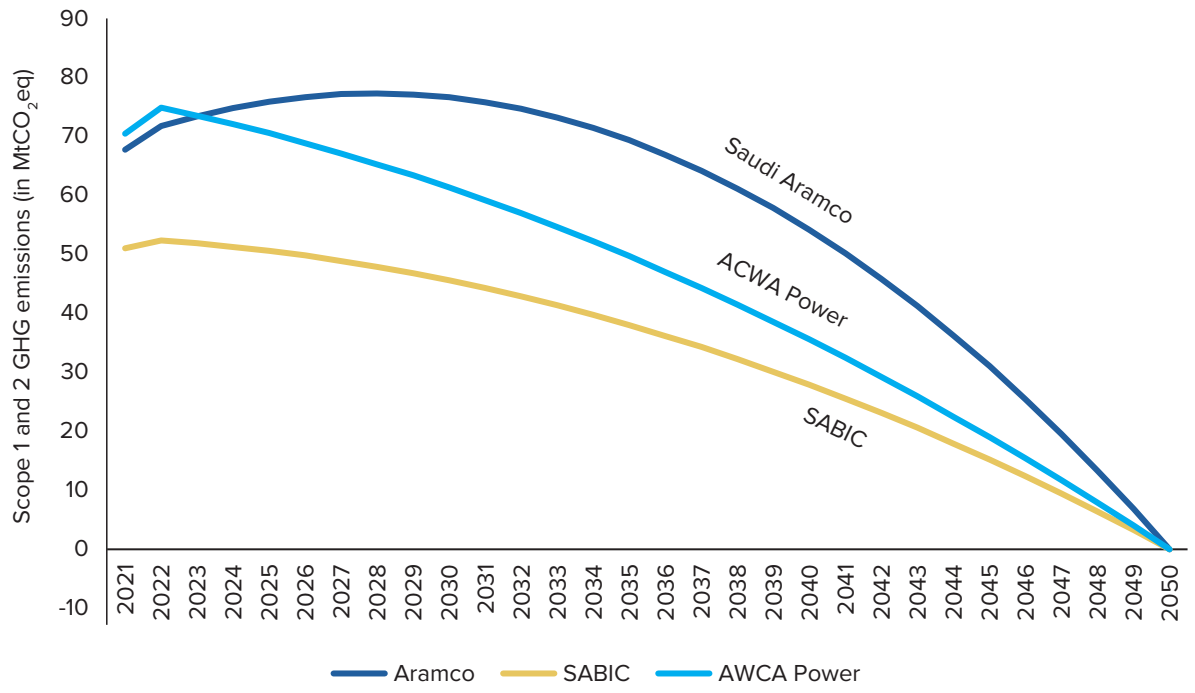
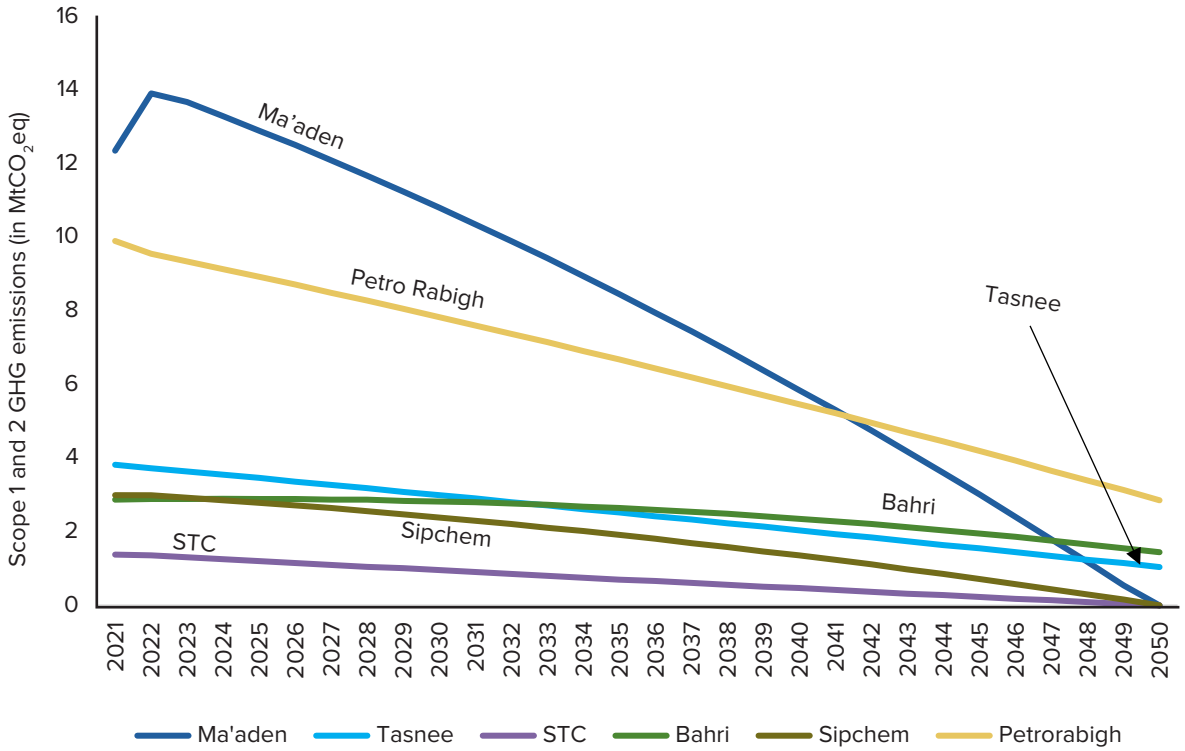


**Figure 8(b).** Target emission projections by the authors for companies with Scope 1 and 2 emissions below 40 $MtCO_2eq$.




*Sources: Saudi Aramco (2024a); SABIC (2023); SEC (2024); ACWA Power (2023, 2024), Ma'aden (2024), STC (2024), Tasnee (2024), Bahri (2020), Sipchem (2023), Petro Rabigh (2023).*
*Notes: SEC is excluded from the Figure.*

## The Contribution of Carbon Credit Usage to Total Mitigation Efforts

To obtain a range for the share/contribution of carbon credits to the total mitigation efforts of each company, the sustainability reports of Saudi and international companies were reviewed for information on their carbon credit usage plans and strategies. As shown in Table 2, a few Saudi companies have outlined their past actions or plans for carbon credit usage. For example, Saudi Aramco retired around 500,000 carbon credits in 2023 as part of its plan to utilize carbon markets to meet its 2035 and 2050 emission targets (Aramco 2024a). Aramco has also stated that it has recently "developed its Internal Guidelines for Carbon Offsets and Crediting that commit to sourcing high integrity carbon credits" (Aramco 2024a). Furthermore, Aramco lists "natural climate solutions and offsets" as the fifth of five pillars for mitigation, demonstrating that it is expected to account for 30.7% of Aramco's total mitigation efforts by 2035. This fifth pillar includes both Aramco's internal mangrove planting efforts both in and outside Saudi Arabia (which can be referred to as "insetting") and its purchase and retirement of carbon credits (for offsetting). Dividing the 30.7% share equally between insetting and offsetting, carbon credits could contribute roughly 15% of Aramco's total mitigation efforts. ACWA Power also detailed its plans for carbon credit usage, stating a "maximum use of up to 5% carbon capture credits" by 2050 (ACWA Power 2024). Other companies like STC and SEC have made no public mention of these shares but instead only described their past engagements with carbon markets as buyers of credits (SEC 2024; STC 2024).

While many international companies have described their plans for carbon credit usage (e.g., Shell 2023; Kerry Logistics 2024), very few have provided quantitative estimates of their potential contribution to their total mitigation efforts over the coming decades. Examples include American Airlines, which has stated that "the aviation sector will need to rely on carbon offsets and removals to neutralize residual emissions." American Airlines expects carbon credit usage to account for roughly 20% of its total mitigation actions by 2050 (American Airlines 2024). In contrast, energy sector service company Baker Hughes issued a statement that it currently aims to reduce its GHG emissions through internal efforts only, stating that it "will not use carbon offsets to help meet these objectives" (Baker Hughes 2022).[5]

In summary, a review of the sustainability reports of Saudi and international companies suggests that carbon credits could contribute anywhere between 0% to 20% of a company's total mitigation efforts, but there remains a lot of uncertainty as companies develop and update their plans around carbon credit usage, which could change significantly in the long term. In fact, the regular revision of a company's offsetting strategy has been presented as a key principle for net-zero aligned carbon offsetting (Axelsson et al. 2024).

## Other Important Assumptions

Saudi entities can purchase carbon credits issued through the GCOM or by ICPs like Gold Standard and Verra. In the absence of any data that could capture the preferences of different Saudi entities, assumptions have been used to model these preferences. In the short-term, it will likely take time to build a supply of domestic GCOM credits due to project registration and implementation timelines, so it is assumed that demand in the short term will be entirely met by international carbon credits. Over the medium-term, the supply of GCOM credits is expected to increase steadily until the end of 2030, so that from 2031 onwards, it is assumed that 80% of total carbon credit demand is being met by domestic GCOM credits. (In other words, it is assumed that Saudi entities will inherently prefer to buy GCOM credits once there is enough supply.)

The methodology illustrated in Figure 6 was applied to the 10 major publicly listed companies in Saudi Arabia (per Table 2). However, since there are Saudi entities for which no data was available, and there are likely other publicly listed Saudi companies that are currently exploring the possibility of setting net-zero targets, it is assumed that every year starting from 2024, other Saudi entities will set new net-zero targets and become potential sources of demand. To capture the additional demand that is created by these other entities, it is assumed, in the absence of data, that their combined demand would be equal to 2.5% of the demand of the 10 analyzed companies in 2024, rising by 2.5% each year until 2035 as more and more entities set net-zero targets. It is assumed that the additional demand by all these other entities reaches a maximum of 30% of the total estimated demand for the 10 major companies that were listed in Table 2.

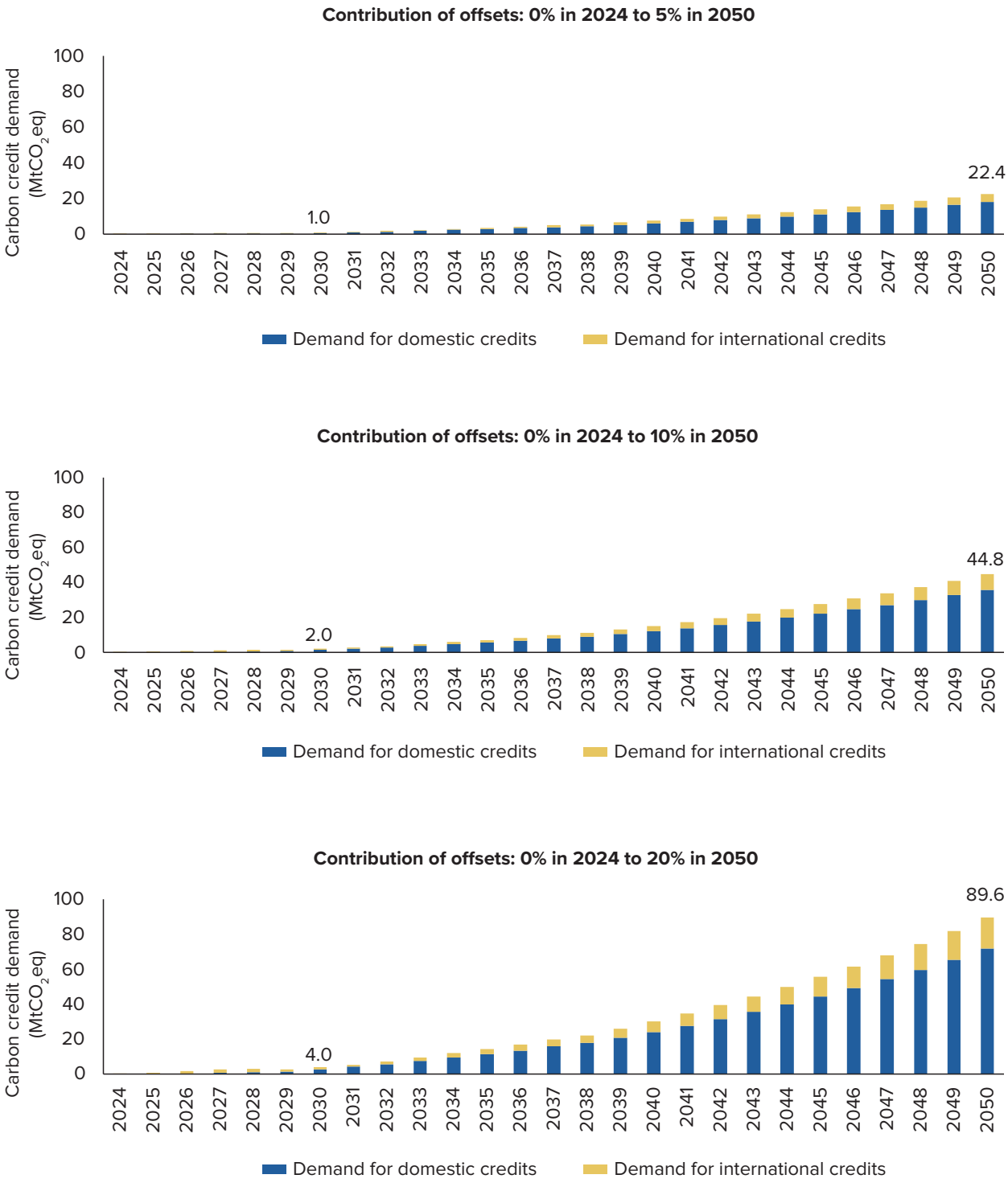
## Saudi Carbon Credit Demand Results and Discussion

Figure 9 shows four scenarios for total carbon credit demand by Saudi companies between 2024 and 2050. The four scenarios are based on changing the assumed contribution of offsetting to each firm's total mitigation efforts. In a low scenario where the contribution of offsetting rises linearly from 0% in 2024 to 5% by 2050, the total demand for carbon credits is estimated at 1.0 $MtCO_2eq$ in 2030 and 22.4 $MtCO_2eq$ in 2050. In a high scenario where the contribution of offsetting rises linearly from 0% in 2024 to 20% by 2050, the total demand for carbon credits is estimated at 4.0 $MtCO_2eq$ in 2030 and 89.6 $MtCO_2eq$ by 2050. In all scenarios, the contribution of offsetting rises linearly from a value of zero in 2024 to the scenario's maximum share in 2050. This slow growth in the contribution of carbon credits towards each company's target reflects how the credits are expected to contribute less in the short term since companies will initially have a larger potential for internal mitigation actions, and more over the long term as those internal mitigation options get exhausted.

Figure 9 also breaks down the four scenarios for total carbon credit demand into demand for credits issued by GCOM and ICPs, reflecting the assumption that Saudi entities will prefer to purchase GCOM credits as they become available.

In conclusion, the results presented in this section reflect the assumptions and analysis of the evolution of potential domestic carbon credit demand in Saudi Arabia between 2024 and 2050. The results illustrate the expectation that demand will be lower in the short term and higher in the long term as Saudi entities offset their residual, hard-to-abate emissions to achieve their long-term net-zero targets. Nevertheless, these results are sensitive to companies' policies regarding carbon credit usage, which in turn are influenced by global guidelines and perceptions around the use of carbon credits to achieve near-term and long-term climate targets.

**Figure 9.** Scenarios of carbon credit demand by Saudi entities between 2024 and 2050.




*Source: Authors.*

## 3.2.2 Potential Domestic Credit Supply

As discussed in Section 2.2, the current global carbon market consists of three main sources of carbon credits supply: international, domestic, and ICPs (see also Figure 2). While there are differences, all carbon crediting programs generally follow a similar baseline-and-credit accounting approach that seeks to issue carbon credits for the quantified amount of emission reductions and/or removals achieved by specific, identifiable management interventions or activities (Box 2).
Saudi Arabia's unique geography and economy (e.g., extreme temperatures and aridity, and strong dependance on fossil fuels) means that not all sectors and mitigation actions will be relevant for the potential supply of domestic carbon credits (Luomi, Bosse, and Sergeeva 2023). Rather, key mitigation areas are likely to encompass activities such as energy production and transformation, electricity generation and use (including water desalination), industry (especially petrochemicals), and waste management (Luomi, Bosse, and Sergeeva 2023).

The following subsections provide an initial assessment of the potential supply for carbon credits in Saudi Arabia. The assessment draws from national knowledge and expertise on climate mitigation strategies and known design features as well as methodological considerations within the existing carbon market.

The methodological approach is as follows:

- First, potential sources for carbon credit supply are assessed based on the major economic activities in the country and therefore the greatest emissions abatement and/or carbon removal potential.

- Second, a set of screening criteria are developed by which to identify mitigation actions within the given sectors and to select the most nationally relevant mitigation options to take forward to a more detailed assessment of crediting potential.

- Third, the crediting potentials of the selected mitigation actions to 2050 are estimated based on factors such as eligibility for crediting of the given intervention/activity, the potential crediting period (in years), the baseline (e.g., the levels emissions that would have occurred had the activity not been implemented), and forecasts for deployment of the mitigation action (i.e., how much could get deployed in coming years).

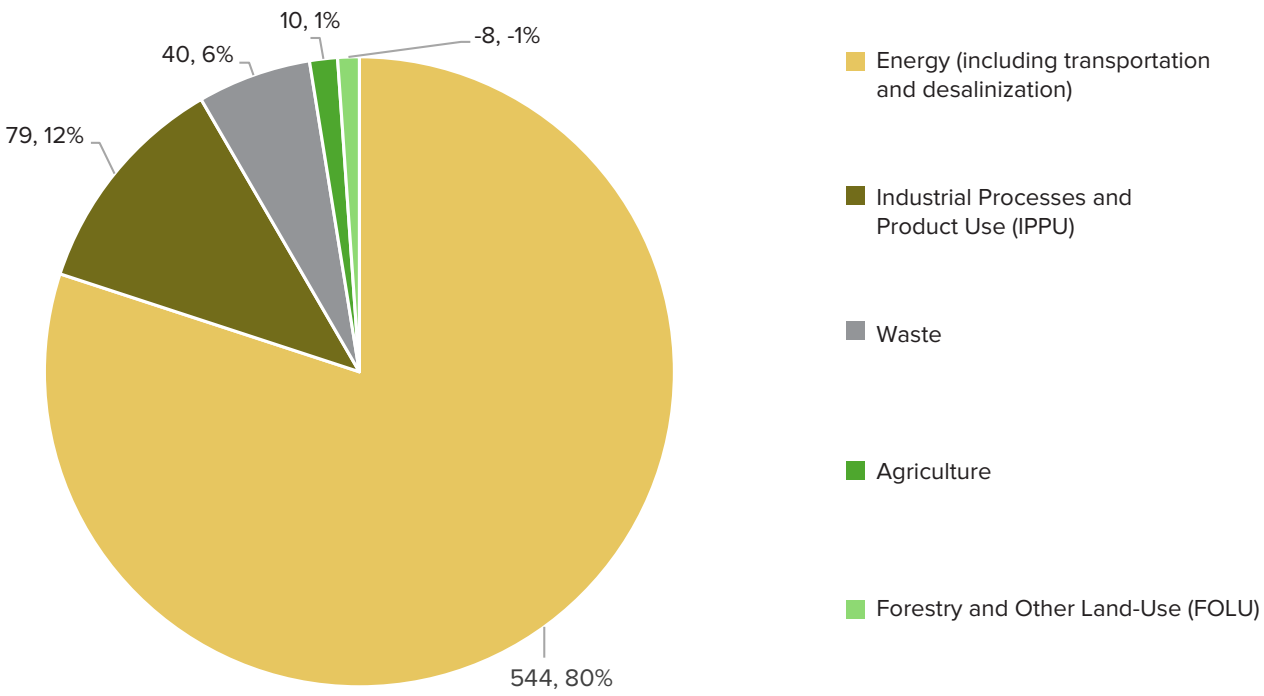
Each of these three aspects is discussed in more detail below.

### High-Level Assessment of Potential Sources

Estimating overall mitigation potential is a first step to understanding how many credits could be supplied by projects within a given region. For Saudi Arabia, the scope of potential opportunities lies in a few key emitting sectors and activity types.
For example, according to DNA data for 2019 (Kingdom of Saudi Arabia 2024), the major sources of GHG emissions in the country are electricity and heat generation (stationary combustion, which also includes desalination), other energy sector activities (e.g., oil and gas production and transformation), and transport (mobile combustion) using fossil fuels. These sectors account for 82% of national GHG emissions (Figure 10). Relevant mitigation actions for these sectors could include substitution by renewable power generation, transport modal shift, energy efficiency measures in various sectors, and/or carbon capture, utilization and storage (CCUS).

At the other end of the spectrum, agriculture and waste combined account for less than 8% of national GHG emissions, and the land sector makes only a negligible contribution to national emissions totals, with a small level of carbon removals (Figure 10).

**Figure 10.** Saudi Arabia's GHG emissions by IPCC reporting category, 2019, $MtCO_2e$.




*Source: Kingdom of Saudi Arabia (2024).*
*Notes: IPPU = Industrial process and product use; FOLU = Forestry and other land use. CH4 GWP100 = 28. N2O GWP100 = 265.*

Consequently, mitigation activities undertaken in all of the sectors highlighted in Figure 10 may be eligible for crediting, although a more significant focus on energy and industry can be expected.

## The Concepts of Additionality and Double Counting

Aspects such as mitigation opportunity (i.e., which types of technologies may be deployed), additionality (e.g., which technologies act to accelerate mitigation ahead of what may otherwise occur), and double counting are also important considerations for estimating the potential of a carbon crediting system in Saudi Arabia.
Some mitigation technologies remain at early development or near-market status, making their deployment and scale-up more challenging (e.g., CCUS).

Other mitigation technologies may only result in small incremental improvements or require more complex changes to existing production processes or for many actors to make behavioral changes (e.g., domestic energy efficiency measures or modal shifts in transport). These factors may constrain the rate and scale at which certain mitigation actions take place.

In some circumstances, mitigation activities may already be happening due to other factors – such as, for example, being already financially attractive compared to alternatives, or where certain actions are required by law or regulations. Renewable energy is a commonly cited example. Yet, a key basis for crediting a mitigation action is that the anticipated revenue from the sale of carbon credits was a decisive factor triggering the investment, and that without the prospect of selling carbon credits, an alternative, more emissive investment or action would

have otherwise happened. This important feature of a carbon credit is known as its "additionality" – that is, the credited action is considered additional to what would have otherwise happened in an alternative baseline scenario.[6]

Additionality of a creditable mitigation action/project is typically demonstrated through the application of three tests:

1. **Regulatory surplus.** The mitigation activity exceeds what is required by law and regulations in the relevant jurisdiction and economic sector.

2. **Financial additionality.** The mitigation activity is not the most economically attractive course of action, taking into account barriers to investment.

3. **Common practice.** The mitigation activity is not common practice in the relevant jurisdiction and economic sector.

Notwithstanding fairly broad agreement on the approaches to additionality testing, its demonstration in practice is difficult due to the many variables affecting investment choices, an often lack of full transparency (or information asymmetry), and the inherent challenges in forecasting counterfactual, what-if type scenarios from which to draw the baseline.

Finally, caution is needed to avoid the crediting of mitigation activities that could potentially lead to double counting. In this respect, carbon credits should not be originated from mitigation activities within a buyer entity's own operations (see Section 2.3.1).

Double counting can arise in energy efficiency projects – for example, where the energy efficiency measures reduce electricity demand, which reduces the direct emissions of electricity generators – that may in turn also buy the credits to offset their remaining, ongoing emissions. Taken to an extreme conclusion, if energy efficiency measures led to a 50% reduction in emissions from electricity generation, which are all subject to crediting and acquired by the electricity generators, they could claim a net of zero emissions even though emissions had actually only been cut by half.

For this reason, project actions that reduce emissions within a firm's value chain are sometimes referred to instead as *insets* or *insetting* as opposed to *offsetting* (see also Section 2.3.1). Careful control of the source of credits, the types of entities using credits, and the types of claims made regarding offsetting should all be considered when designing a domestic carbon crediting mechanism.

## Developing Criteria to Identify Creditable Mitigation Actions

Certain features can be assumed to characterize the source and types of carbon credits that could be originated in a domestic crediting scheme in Saudi Arabia. Features include mitigation potential, additionality, and ease of implementation (e.g., in terms of methodological complexity). The latter aspect is particularly important for countries with limited experience in developing carbon credit projects, such as Saudi Arabia (Luomi, Bosse, and Sergeeva 2023).
These features were used to guide the development of criteria by which to identify sectors and activities for a more detailed assessment of crediting potential (Table 3).

**Table 3.** Features of viable offset projects for KSA.

| Criteria | Description |
|---|---|
| **Mitigation potential** | • To what extent can the activity reduce emissions/increase removals nationally? |
| **Project feasibility/scalability** | • How mature is the technology?<br>• How easy are individual project activities to implement?<br>• Can the activities be rapidly scaled to make significant reductions/removals? |
| **Ease of implementation (methodological complexity)** | • Are baselines clear and easy to determine? Are monitoring methods simple?<br>• Are reductions permanent and/or can liability for reversal be allocated?<br>• Can it be readily implemented under a domestic offset program? |
| **Risk of double counting** | • Is there a risk that reductions/removals will be counted twice?<br>• Will the activity create reductions/removals within buyer entities' GHG inventories? |

*Source: Authors.*

In respect of ease of implementation, methodological approaches applied to some mitigation project types can be more complex than others (Box 4).

## Box 4. Examples of Methodological Choices and Ease of Implementation

Methodological choices pose trade-offs between complexity, accuracy and environmental integrity, which impact upon ease of implementation. For example, a renewable power project can meter the amount of electricity dispatched to a grid (or other demand source) and assume that an equivalent amount of fossil thermal electricity is displaced, which produces a mitigation effect. A simple emission factor applied to each dispatched kilowatt-hour of renewable electricity can be used to calculate the baseline for the activity (e.g., an emissions factor of 0.35 $tCO_2e$/kWh). This simplified approach assumes a fixed mitigation effect, although the reality is more complex because grid emissions vary over time, resulting from changes in the mix of plants that are dispatching power. Other more dynamic methodologies exist by which to establish emission factors for grid electricity systems, but these are more analytically demanding (e.g., methods involving a so-called build margin, operating margin, and/or the combined margin) (UNFCCC 2018).

Similarly, methodological approaches for some types of mitigation activity may require historical datasets or the collection of data ahead of implementation. Detailed monitoring data and information can also be anticipated post implementation. For example, this is usually the case for mitigation measures that rely on individual behavioral changes (e.g., workers, general public) or project activities involving nature-based climate solutions (which often require historical reference data and extensive/advanced monitoring to be implemented after the project's start). In the case of the former, simply introducing a new practice is insufficient to achieve a mitigation effect absent of significant uptake by users. For example, public transport projects require a modal shift by users away from private car use, or some residential, commercial, or transport fleet-related energy efficiency measures require behavioral changes by users and operators. Monitoring changes in behavioral practices is therefore also needed to determine the total mitigation effect.

Some project activities may also meet previously suppressed demand, which can erode the level of mitigation achieved. For example, by making services available to users who previously went without access.

## Initial Screening of Mitigation Options

Using the screening criteria described above, an assessment of a range of domestic carbon crediting opportunities was undertaken. The assessment considered positive attributes (mitigation potential and feasibility/scalability) and negative attributes (implementation complexity and double-counting risk).

Each criterion was scored on a scale of 1 to 5 and summarized using a traffic-light-style scale, with green for positive attributes and red for negative attributes. The results of the rapid assessment are presented below (Figure 11; the darker shading shows a half point).

Summary features for selected mitigation project types outlining the rationale for some of the scores is also set out below (Table 4).

**Figure 11.** Results of assessment of sectoral/activity type crediting potential within Saudi Arabia.




*Source: Authors.*

**Table 4.** Features for crediting selected mitigation activity types.

| Type | Mitigation potential | Feasibility/scalability | Implementation complexity (methodological) | Double-counting risk |
|---|---|---|---|---|
| Renewable energy | High. Displacement of predominately fossil thermal power. | Can be deployed fairly rapidly given low costs at present, and the lack of space constraints in Saudi Arabia. | Simple standardized baseline methods can be applied to determine additionality and mitigation effects (i.e., fixed emission factor for the baseline). More complex methods may be adopted (e.g., build margin). | High. Power generators may count the reduction and also acquire the credits as offsets against ongoing emissions. |
| Energy efficiency | High. High grid emission factors. | Potential exists in industry, commercial, and residential settings in Saudi Arabia, and also in desalination upgrading and transport (fleet driving training). | Measurement and attribution of energy efficiency actions face challenges. Additionality can depend on prevailing energy efficiency regulations and financial incentives to reduce electricity consumption in Saudi Arabia. | High. Power generators may count the reduction and also acquire the credits as offsets against ongoing emissions. |
| Fugitive emissions in petroleum systems | High. | Potential exists to eliminate leaks from transmission system as well as routine flaring and venting (c. 16 Mt $CO_2$e/yr). May be challenging to scale due to costs of gas evacuation infrastructure. | Methodologies exist but can vary in complexity. Likely to be straightforward to implement in Saudi Arabia given extensive expertise and data. Risk of double counting (double claiming by credit buyers). | High. Petroleum producers may count the reduction and also acquire the credits as offsets against ongoing emissions. |
| Waste | Low | Potential exists to reduce methane from landfills in KSA through flaring and/or energy recovery. Waste-to-energy competes with low-cost natural gas and oil in Saudi Arabia. | Methodologically straightforward to implement. Additionality can be high for waste-to-energy (power generation) due to competition with low-cost gas and oil. | Low. Waste handlers unlikely to be buyers of credits. |
| Transport | Medium. Modal shift complex to achieve. | Modal shifts involve switching users from cars to trains or bus rapid transit.<br>Costly and slow to build. | Modal shift requires baseline surveys of users prior to implementation, and surveys to determine the extent to which users have switched transport modes to estimate mitigation effects (i.e., crediting amount). | Low. Transport operators unlikely to be buyers of credits. |
| CCUS and technological carbon removal | High. Significant points sources | Projects are expensive and slow to implement.<br>Difficult to scale in early stages, although should become easier over time. | Some methodological components can be straightforward (baselines, additionality). Monitoring of storage and management of the non-permanence and carbon reversal risk creates challenges for methodology design. | Medium. Petroleum producers likely not to count the reduction and also acquire the credits as offsets against ongoing emissions. |
| Agriculture and forestry and other land use (FOLU) | Low | Generally limited potential in Saudi Arabia due to its arid climate. Mangrove planting may produce some mitigation effect and offer co-benefits for nature conservation and ecosystem development. | Baselines can be challenging to identify and develop (e.g., use of reference levels). Monitoring of sink enhancements faces challenges due to the difficulties of accurately measuring carbon stocks. Non-permanence and carbon reversal risk creates challenges in a similar way as for CCUS and technological carbon removal. | Medium. Some large agricultural producers may be buyers of credits. |

*Source: Authors.*

## Estimates of Crediting Potential to 2050 for Selected Mitigation Actions

The evaluation presented above suggests several sectors/activity types could be promising for domestic credit development in Saudi Arabia. Primary candidates would include renewable energy, CCUS/technical carbon removal (e.g., direct air capture with geological $CO_2$ storage), and waste (landfill gas management), as well as, potentially, energy efficiency and transport.
In regard to waste, data and information on the size of individual sites, their location, and their specific design aspects is not currently available (e.g., whether they are contained or open waste management systems), hindering an assessment of the mitigation potential of approaches such as landfill gas management (flaring, conversion of energy). As such, no analysis was undertaken.

Energy efficiency and transport were also excluded from the analysis due to the complexity of estimating mitigation potential, as well as other methodological complexities described above.

For the other potential creditable activities, the following approach was taken.

**Renewable energy.** Saudi Arabia holds significant potential for solar photovoltaic (PV) development, with mitigation through the displacement of mainly oil-fired thermal power generation. The main methodological challenges for carbon credit development are uncertainty over additionality and the risk of double counting. Methodological complexity may also pose challenges if sophisticated baseline emissions calculation approaches are considered necessary. In these respects, the GCOM (see Section 3.2.1) has published a "Methodology for Determining Emission Reductions Resulting from Electricity Generation from Renewable Resources" (SD-DNA-M2), which suggests that the baseline emission factor should be the "combined margin $CO_2$ emission factor for grid connected power generation" (GCOM 2024d). However, no guidance is provided on how to calculate the combined margin. The CDM "Methodological Tool: Tool to Calculate the Emission Factor for an Electricity System, Version 07.0" (UNFCCC 2018) is a more complex, data and analysis intensive method for calculating the combined margin emission factor for an electricity grid. For Saudi Arabia, where experience with carbon pricing is low, it may be preferable to start with a simpler approach to the combined margin, such as the grid average emission factor over one year, which should be calculable using data from the grid system operator. Alternatively, a more conservative fixed build margin could be applied, based on the type of plant that would otherwise be built in the absence of the renewable power project (e.g., 0.35 $tCO_2e$/MWh, assuming a modern gas-fired power plant). In the analysis below, a fixed baseline emission factor is assumed.

**CCUS and DAC with geological storage (DACCS)**. Saudi Arabia holds significant potential to capture and geologically store $CO_2$ from point sources such as electricity generation and industrial plants. Similarly, expansion of renewable energy generation coupled to DACCS could offer a means to permanently remove $CO_2$ from the atmosphere on a net basis (Odeh et al. 2024). Such projects are complex and costly to develop, but would not face major methodological issues relating to additionality. Greater challenges lie in assuring the long-term permanence of such actions and allocating responsibility to compensate in the event of re-release (referred to widely as carbon reversal). Double counting may also be an issue where the CCS actions reduce the direct emissions of the buying entity and also generate credits for offset use. The GCOM Methodology for Determining Emission Reductions Resulting from CCS/CCUS Activities (SD-DNA-M5) requires project developers to manage the risk of seepage of $CO_2$ injected into geological reservoirs through good site selection and management, including effective monitoring during and after (post) injection, and the use of corrective measures to control any significant irregularities in the subsurface behavior of the $CO_2$ (GCOM 2024e). The requirements under GCOM draw from CDM and align with common best practice for crediting geological storage activities. In the analysis below, the target quantity of CCS is used as the basis for estimating crediting potential. In practice, the amount of credits may be lower due to the need to account for project emissions relating to any fossil $CO_2$ emission sources relating directly to activities (e.g., heat and power generation).

**Agriculture and FOLU (mangroves).** Saudi Arabia is likely to offer rather limited potential for carbon crediting through agriculture and FOLU. However, the area is of interest for various reasons. First, mangrove planting largely occurs outside the value chain of entities that would be acquiring credits, and therefore avoids double-counting risks. Second, uptake of $CO_2$ by mangrove growth results in carbon removals rather than just emission reductions. Third, mangrove planting offers

a potentially small-scale project approach that can be attractive for new entrants in the field (e.g., project developer start-up firms).

Moreover, there are significant ongoing mangrove development programs in the Kingdom led by Aramco and the Saudi Green Initiative. These schemes target the planting of hundreds of millions of trees through to 2050. For example, Aramco has reportedly planted more than 4.3 million trees on the Arabian and Red Sea coasts, and a further 2 million seedlings in Yanbu (Aramco 2024b). The Saudi Green Initiative plans a further 100 million plantings by 2030 (Saudi Green Initiatives 2024b), with Aramco pledging to plant 350 million trees by 2035.

For agriculture, granular data is presently lacking on the specific emission source types, while the nature of the mitigation opportunities for agriculture and FOLU need further refinement (e.g., locations for mangrove planting). In the analysis below, an estimate of the level of carbon removal that could be achieved by mangrove planting has been made based on the various announced programs in the Kingdom (see below).

The estimated credit supply for mitigation activities involving renewable energy generation, CCUS, and mangrove planting, as well as the assumptions underpinning the estimates, are set out below.

## Estimates for Renewable Energy Crediting Potential

Using the assumptions summarized in Table 5, the total domestic potential credit supply from renewable energy projects is estimated to lie between 21 and 40 million to 2035, with a peak annual credit supply of between 2 to 4 million across the late 2020s (Figure 12).

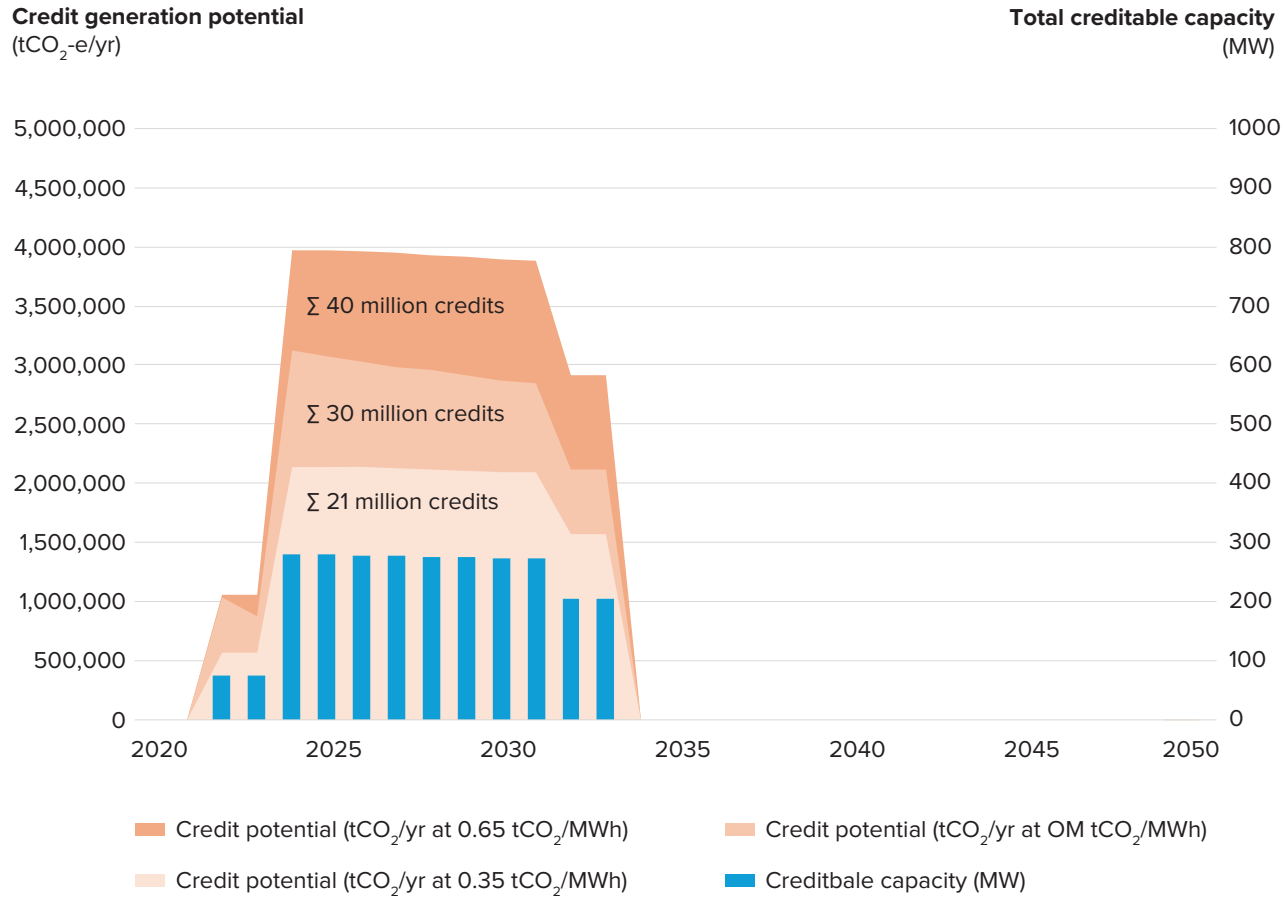
The estimate is at the upper end of what could be feasible and depends on many factors, including whether ambitious renewable deployment plans are met, and whether projects and actions aligned with the national policy are considered to be additional and therefore eligible for crediting. In respect of the latter, ICPs such as Gold Standard and the VCS (Verra) do not consider most renewable energy project types to be additional except in special circumstances (e.g., in least developed countries, or where renewable penetration into the electricity grid is less than 5% of connected capacity). The Global Carbon Council does not impose such restrictions. Noting these constraints, only a 10-year crediting period is assumed, and from 2030 onwards, new renewable energy project activities are no longer considered eligible for crediting.[7]

**Table 5.** Assumptions used to estimate renewable energy credit supply in Saudi Arabia.

| Factor | Assumption |
|---|---|
| Eligibility | • New capacity additions between 2022 and 2030 eligible for crediting.<br>• Post 2030, new renewable energy project activities will be non-additional, and therefore no longer eligible for crediting. |
| Crediting period | • 10 years, fixed (as per Global Carbon Council, the only major crediting standard awarding credits to renewable power projects) (Global Carbon Council GCM001). |
| Baseline | • Three estimates applied:<br>↳ 0.35 $tCO_2e$/MWh (approximate natural gas build margin).<br>↳ 0.65 $tCO_2e$/MWh (heavy fuel oil build margin).<br>↳ Grid operating margin (taken from the KAPSARC Energy Model (Matar 2016), ranging 0.675 to 0.473 $tCO_2e$/MWh over the crediting period). |
| Deployment | • Based on the KAPSARC Energy Model (Matar 2016), which estimates the amount of new renewable capacity that may be deployed based on current plans. |

*Source: Authors.*

**Figure 12.** Estimated carbon credit supply from renewable energy projects in Saudi Arabia under three baseline factors, 2020-2050.




*Source: Authors.*
*Note: Total creditable capacity is the amount of installed capacity (in MW) that is considered eligible for carbon credits under the assumptions and constraints outlined above.*

## Estimates for CCUS Crediting Potential

Using the assumptions summarized in Table 6, the cumulative domestic potential credit supply from CCUS projects is estimated at around 180 million credits to 2050, with a peak supply of 27 million credits per year starting in the 2030s (Figure 13).

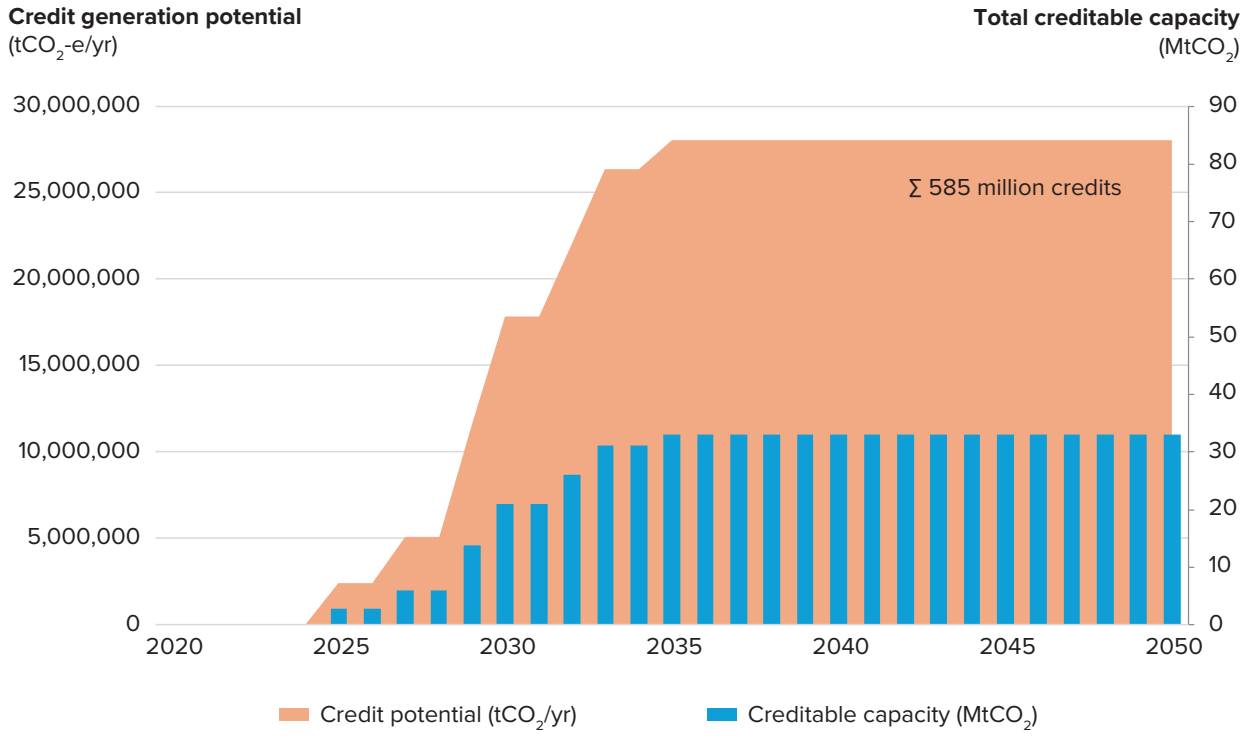
The estimate is at the upper end of what could be feasible and depends on whether ambitious development plans will be met. Notably, the estimates do not include the 9 million $tCO_2$ Jubail project planned for completion in 2027 and the 11 million $tCO_2$ capacity planned by Aramco (2024c), as these have been pledged in Aramco's corporate targets and are expected to contribute to Aramco's net-zero target.

**Table 6.** Assumptions used to estimate CCUS credit supply in Saudi Arabia.

| Factor | Assumption |
|---|---|
| Eligibility | • New capacity additions from 2022 eligible for crediting.<br>• Aramco deployment under corporate target not eligible for crediting. |
| Crediting period | • 10 years, renewable indefinitely (based on American Carbon Registry, 2021v2.0). |
| Baseline | • Need to account for energy penalty of $CO_2$ capture, which increases the levels of $CO_2$ generated per unit output (in some circumstances).<br>• Assume 85% of captured $CO_2$ is eligible for crediting (i.e. 15% energy penalty). |
| Deployment | • Assume deployment occurs aligned with:<br>↳ Aramco target (9 $MtCO_2$ by 2027; 11 $MtCO_2$ by 2035).<br>↳ KSA national target (44 $MtCO_2$ by 2035).<br>• KSA Target minus Aramco Target = assumed Creditable Capacity.<br>• Deployment towards targets is staggered to smooth curve. |

*Source: Authors.*

**Figure 13.** Estimated carbon credit supply from CCUS projects in Saudi Arabia, 2020-2050.




*Source: Authors.*

## Estimates for Crediting Potential from Mangrove Planting

Applying the assumptions summarized in Table 7, the cumulative potential domestic credit supply from mangrove planting activities is estimated to be around 21 million credits to 2050, with a peak supply of 1.6 million credits per year in the mid-2040s (Figure 14).

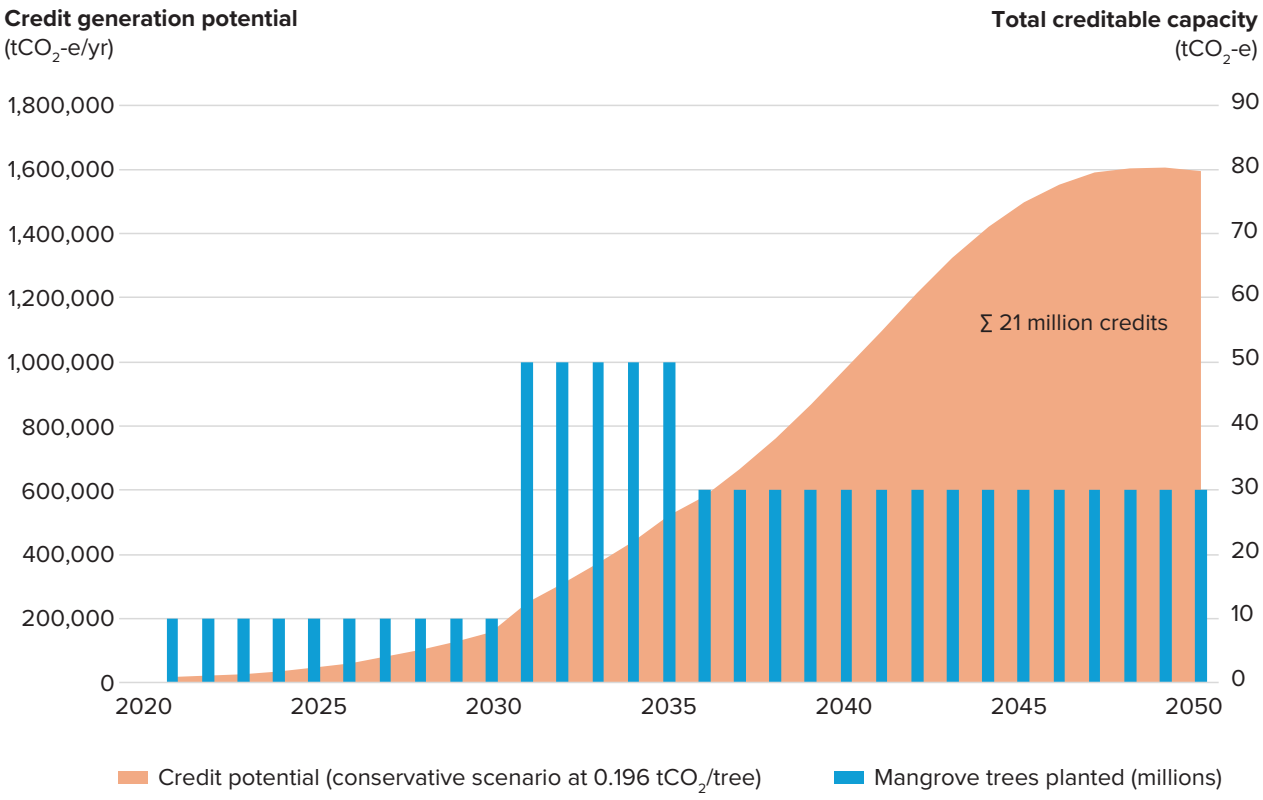
Estimating the carbon credit potential of mangrove planting is extremely uncertain. As well as planting rates, factors affecting success include the survival rate of saplings, their assumed growth rate, and the maximum carbon storage potential of mature mangrove trees. The estimated potential provided is considered to be conservative because it assumes fairly moderate survival rates and a maximum carbon sequestration potential at the lower end of the empirical evidence base (Osaki 2013). Small changes to any of these factors lead to significant changes in the estimated potential.

**Table 7.** Assumptions used to estimate mangrove planting credit supply in Saudi Arabia.

| Factor | Assumption |
|---|---|
| Eligibility | • At least two crediting methodologies exist for mangrove management, restoration, and establishment (Gold Standard 2024 [draft]; Social Carbon 2024).<br>• VERRA-VCS is also exploring possibilities. |
| Crediting period | • Nature-based solutions project activities tend to have long crediting periods (60-100 years). |
| Baseline | • Assume that all newly-planted mangroves lead to new, additional removals (zero removals in the baseline). |
| Deployment | • Planting rate estimated from Aramco and Saudi Green Initiative (200 million trees by 2030; 350 million trees by 2035. Assumed to continue planting around 30 million trees per year through to 2050).<br>• Survival rate: 25% of planted trees (based on mixed results in the literature, e.g., Takagi 2023; Kodikara et al. 2017). No specific data on mangrove planting survival rates in Saudi Arabia (Red Sea or Arabian Gulf).<br>• Trees assumed to uptake $CO_2$ over 25 years from planting date until reaching maturity.<br>• Mature tree (aboveground and belowground biomass) assumed to be 0.196 $tCO_2$ per mature tree (based on tropical [dry] in Osaki 2013).<br>• Sigmoid curve used to simulate $CO_2$ uptake by tree growth from planting to full maturity |

*Source: Authors.*

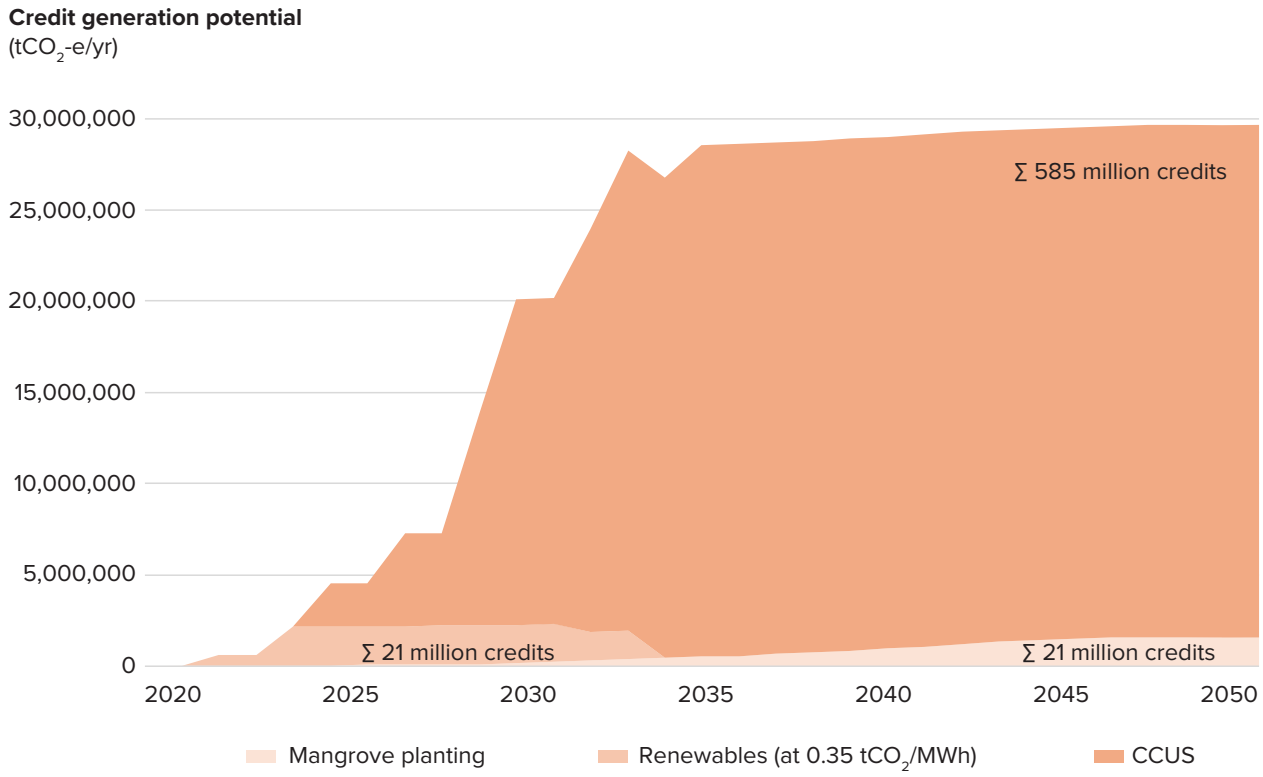
**Figure 14.** Estimated carbon credit supply from mangrove planting activities in Saudi Arabia, 2020-2050.




*Source: Authors.*

Based on the estimates for the three types of mitigation activity types described above, the total domestic carbon credit supply in Saudi Arabia could reach almost 30 million per year by 2033 and sustain similar levels of crediting up to 2050. The largest supply of credits is clearly from CCUS, accounting for 85-95% of total estimated credit supply (Figure 15).

**Figure 15.** Total estimated carbon credit supply from renewable energy, CCUS and NBS (mangrove planting) activities in Saudi Arabia, 2020-2050.




*Source: Authors.*

# 4. Conclusion and Next Steps

The estimates presented show that if Saudi corporations maintain their ambitious net-zero pledges and incorporate carbon credits into their decarbonization strategies, demand for carbon credits will be sustained and increase significantly over the coming decades. On the supply side, decisive action to bring new projects online at a scale can also ensure that a share of mitigation benefits delivered through carbon crediting are kept within the borders of Saudi Arabia. Such developments can also contribute to the government's climate change targets, rather than the credits being sourced from other countries.

In the low-demand scenario, which assumes the modeled companies' carbon credit use rises gradually up to 5% of their total mitigation effort by 2050, total demand for carbon credits would reach 1.0 $MtCO_2e$ in 2030 and 22.4 $MtCO_2e$ in 2050. In the high demand scenario, where carbon credit use rises gradually up to 20% of total mitigation effort by 2050, the total demand for carbon credits would reach 4.0 $MtCO_2e$ in 2030 and 89.6 $MtCO_2e$ per year by 2050.

Domestic credit supply from renewable energy alone has the theoretical potential to supply 2-4 million $MtCO_2e$ in 2030, which would suffice to cover the domestic demand in the medium term (assuming the buyers would be willing to purchase this credit type). Alongside potentially significant levels of CCUS credits, which have the theoretical potential to increase to a peak of 27 $MtCO_2e$ per year from the 2030s onwards, along with a stream of nature-based credits from mangrove plantations, domestic supply from these three mitigation activity areas would suffice to meet credit demand in the low-end demand scenario. However, in order to cater for higher levels of demand, supply would need to come from additional sectors/activities or from international projects.

The positive outlook notwithstanding, it is important that the results of the study are carefully considered in the context of the methodological choices and assumptions made to reach them, as described in Section 3. Updated and more refined estimates should be possible as improved and more extensive data on Saudi corporate emissions and their mitigation targets, plans, and pathways become available. Further clarity on the rules around the GCOM will also help to refine estimates of potential credit supply.

Carbon market development remains an active and ongoing activity in Saudi Arabia at the time of writing. The GCOM and RVCMC continue their efforts to bring carbon credits to market from both domestic and international sources. Firms in Saudi Arabia remain interested in acquiring carbon credits to support voluntary decarbonization claims.

Yet, there are a number of reasons to consider further formalizing the carbon credit market in the Kingdom. Carbon credit-based market systems can provide a powerful entry point through which both governments and operators can take early steps into monitoring and reporting emissions and trading carbon-based units. Such systems offer the potential to evolve over time into more ambitious compliance-based systems – either cap-and-trade or output-based ETSs – as experience with carbon market implementation grows.

## 4.1 Market Opportunities

Introducing a more structured carbon market in Saudi Arabia could help to drive technological innovation and support socio-economic development. In particular, the technologies with the largest crediting potential in Saudi Arabia, namely, CCUS and also approaches such as DACCS, both of which are wholly dependent upon carbon-based incentives to be economically viable.

The adoption of the GCOM can create a new source of economic activity in Saudi Arabia, especially in the small- and medium-sized enterprise sector. Demand for credits can stimulate entrepreneurs to seek and develop mitigation activities, and to devise new methodologies for crediting identified actions. This can help enhance Saudi Arabia's service sector and knowledge economy.

In general, a more formalized system of emission measurement and reporting as well as the origination of carbon credits can act to increase environmental awareness among workers and society at large.

A more structured market can also position Saudia Arabia as a progressive regional leader on climate action and support further engagement in international climate action and markets, such as those emerging from Article 6 of the Paris Agreement.

## 4.2 Design Considerations

Pushing ahead with ambitious carbon crediting programs and potential market evolution can be a powerful lever for economic and social development in Saudi Arabia. Yet, carbon markets can be challenging to develop in a fair and equitable manner, and carbon credits can be complex instruments that require some care in design and origination.

On the demand side, there will be a need to ensure the environmental integrity of the crediting scheme and the carbon credits. In these respects, as several companies have mentioned that they will be targeting only high-quality carbon credits, with some companies like ACWA Power (2024) specifically highlighting their plans to buy only carbon capture credits, the sustainability strategies of Saudi companies and their plans for offsetting will likely evolve as global guidelines change, potentially leading to uncertainty in the demand for carbon credits. In the medium to long term, as Saudi Arabia builds greater experience around carbon markets, it is possible that compliance-based systems will be introduced (in certain sectors), potentially driving further demand for carbon credits originating from the remaining sectors.

In considering both supply and demand, the risk of double counting must also be taken into account. Double counting will undermine the environmental integrity of the market because the same action gets counted and claimed twice. Many of the creditable activities identified herein can occur inside the value chain of Saudi firms that would also be the buyers of the carbon credits (i.e., mitigation actions will have direct effects on their Scope 1, 2, or 3 GHG emissions inventories). Reducing both the reported GHG emissions of buyers (Scope 1, 2, or 3) and generating carbon credits for the same action results in double counting (see Section 2.1.3).

Furthermore, economic and competitive impacts also need to be taken into account. If the setting of climate-related targets and the acquisition of carbon credits remains entirely discretionary, market distortions can occur. Ambitious buyer entities can ultimately end up subsidizing less ambitious competitors, for example, between power generating companies with and without targets. Less ambitious firms could develop credits and sell these to ambitious firms, which will impact dispatchable electricity prices and, ultimately, the market functioning of national renewable energy capacity auctions (i.e., entities without emissions targets can generate at lower costs due to the credit purchase subsidy received from buyer entities with targets)

On the supply side, care is also needed to retain practicality and deliverability. Saudi Arabian enterprises have only limited experience with carbon markets and carbon credits, so complex rules and methodologies are unlikely to encourage participation. Therefore, it will be important to maintain a good balance in the number and complexity of crediting methodologies, and to implement parallel capacity building, training, and information campaigns in order to raise awareness among corporations and to empower project developers. An evolutionary pathway to system development should be adopted given national start points. As experience grows over time, rules can be adapted and methodologies updated and renewed where necessary. Integration and alignment with the global carbon credit marketplace can perhaps be best viewed as a medium-term goal as domestic knowledge and experience grows.

# Endnotes

[1] For example, in the case of electricity generating facilities, establishment of a benchmark of 250 $kgCO_2$/kWh would mean that for every 4 kWh of power exported to the grid by the facility over the course of a year, a 1 $tCO_2$ allowance would be allocated and issued ex post. Similar GHG intensity benchmarks can be established for other types of products.

[2] Notably, I-RECs are not carbon credits but non-GHG-metric-based certificates of origin measured in megawatt hours (MWh) that companies can use to make voluntary Scope 2 emissions claims (ITSF 2024). In addition to MWh of renewable electricity produced, 13 other non-GHG metrics accommodated by the GCOM as of July 2024 included installed renewable electricity generation capacity, floor area of energy-efficient buildings, person/ton-kilometres of electric vehicles, tons of grey hydrogen/ammonia replaced with green/blue hydrogen/ammonia, tons of waste incinerated, and tons of agricultural production localized (GCOM 2024f). A novel feature for a crediting mechanism, how these non-GHG metric-based credits will interplay with the traditional carbon credits still remains to be established.

[3] Verra's registry includes a small-scale mangrove planting project in the Eastern Province, pending registration and verification as of July 18, 2024 (Verra 2024).

[4] The emissions of these companies in some cases may include emissions from operations that occur outside of Saudi Arabia.

[5] Some companies, particularly in the oil and gas sector, have started to roll back their ambitious climate action plans because of the challenges associated with the energy transition (Wilson 2024).

[6] *Additionality* is a key component high environmental integrity offsetting, because without the carbon credit incentive, emissions would be higher. Additionality is therefore primarily about identifying and linking causality to a mitigation action.

[7] Based on the view that both VERRA-VCS and Gold Standard already exclude renewable energy projects from the scope of crediting because it is considered non-additional except in exceptional circumstances (e.g., in some least developed countries).

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# About the Project

KAPSARC's Carbon Markets and Paris Agreement Article 6 project aims to support Saudi Arabia's participation in and engagement with domestic and international carbon markets. It seeks to contribute to increasing awareness and strengthening understanding of carbon markets in Saudi Arabia and the broader Gulf Cooperation Council (GCC) region through empirical, evidence-based, policy-oriented research and analysis. Carbon markets can support both private sector and government efforts to reduce or remove greenhouse gas (GHG) emissions and contribute to reaching the goals of the Paris Agreement in an effective way while providing various benefits to multiple stakeholders. Among other things, well-functioning carbon markets can lower the costs of GHG emission reductions, support the transfer of clean technologies and finance, and unlock higher mitigation ambition over time.

The project focuses on questions including the following:

- What lessons can be learned from Saudi Arabia's and the Gulf region's past experience with carbon markets that are helpful for the post-2020 era?
- How is the international carbon market landscape shaping up, including in relation to regulated carbon markets, voluntary carbon markets (VCM), and mechanisms linked to Article 6, and what are the related challenges and opportunities?
- What can Saudi Arabia do to reap the most benefits from both regulated and VCM approaches and instruments? Which design options best suit Saudi Arabia's priorities and goals?




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