Report on international voluntary and compulsory carbon markets with special emphasis to mechanisms applied in case of carbon farming and potential opportunities for Ukrainian developers

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16 May 2022

Abstract

This report was written as a part of the Supporting Green Recovery in Ukraine project by the United Nations Development Programme (UNDP) office in Ukraine.
It looks at providing an overview and analysis of existing voluntary and compliance carbon markets worldwide with relevant recommendations for Ukraine. Special emphasis has been given to mechanisms applied in case of agriculture, relevant recent developments, including about agricultural carbon buyers and sellers, carbon credit prices, and future possibilities to participate in the markets by Ukrainian agricultural producers

Disclaimer

Acronyms and Abbreviations

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Bibliography

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Acronyms and abbreviations

AER Annual Emission Report
AFOLU Agriculture, Forestry and Other Land Use
AGNWB Above-ground non-woody biomass
AGWB Above-ground woody biomass
ALM Agricultural Land Management
ARR Afforestation, Reforestation & Re-vegetation
AO Aircraft operator
AVR Accreditation and Verification Regulation
CA Competent Authority
CBAM Carbon border adjustment mechanism
CEMS Continuous emission measurement systems
CIMs Commission Decision determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC
CMR Carbon Market Report
CO_2 Carbon dioxide
$CO_{2\,€}$ Carbon dioxide equivalent
CORSIA Carbon Offsetting Reduction Scheme for International Aviation
CRF Common Reporting Format
EEA European Environment Agency
EEA-31 European Union Member States and Iceland, Liechtenstein and Norway
EFTA European Free Trade Association
ERPA Emissions Reduction Purchase Agreement
ETS SF Eurocontrol Emissions Trading Scheme Support Facility
EU European Union
EUA European Union allowance
EU ETS European Union Emissions Trading System GHG Greenhouse gas
ICAO International Civil Aviation Organisation
IED Industrial Emissions Directive
kt Kiloton
LRF Linear reduction factor
LULUCF Land-use, Land-use Change, and Forestry
MP Monitoring Plan
MRR Monitoring and Reporting Regulation
MRV Monitoring, Reporting and Verification
MRVA Monitoring, Reporting, Verification and Accreditation
MS Member States
Mt Megaton
MW Megawatt
N_2O Nitrous oxide
NAB National accreditation body
PSAMs Price or supply adjustment measures
PFC Perfluorocarbon
PJ Petajoule
SET Small Emitter Tool
SOC Soil Organic Carbon
VAT Value added tax
VOS Verification Opinion Statement
t ton
TJ Terajoule
UNFCCC United Nations Framework Convention on Climate Change

1. Introduction

Today, more and more companies are pledging to contribute to stop climate change by reducing their own greenhouse-gas emissions (GHGs).

The challenge is mainly for two types of enterprises:

- Organizations that aim to achieve net-zero emissions, which means removing as much greenhouse gas from the air as they put into it.

- Organisations that would use carbon credits to offset emissions they can't get rid of by other means.

First of all, it is important to explain what are **"voluntary"** and **"mandatory/compulsory/regulatory compliance, etc"** markets and **what is the difference?**

As its name suggests, the **mandatory carbon market** is used by companies and governments that are legally mandated to offset their emissions. The countries that have joined these markets are those that have accepted and adopted the emission limits established in the Framework of the United Nations Convention on Climate Change (UNFCCC). This market is regulated through international, regional and sub-national carbon reduction schemes, such as the Clean Development Mechanism under the Kyoto Protocol, the European Union Emissions Trading Scheme (EU-ETS) and the California Carbon Market.Each ton of CO2 is measured in carbon credits or CERs (Certified Emission Reductions). These credits or CERs are generated in the implementation phase of the project; and are issued once the reduction has been credited.

The **European Union Emissions Trading System (EU ETS)** is a cap-and-trade system for greenhouse gas (GHG) emissions operating in the 28 EU Member States and the three EFTA countries: Iceland, Liechtenstein, and Norway.

The EU ETS sets a cap on the total amount of carbon dioxide (CO2) and other GHGs that can be emitted by power plants, manufacturing installations and aircraft operators in the system. The cap decreases over time so that total annual GHG emissions, as covered by the system, decrease accordingly.

Within the system, **companies can buy and sell emission allowances as needed**. They can also use limited amounts of international credits from GHG emission-saving projects. Each allowance gives the holder the right to emit 1 tonne (t) of CO2 or, subject to their permitted activity, the equivalent amount of nitrous oxide (N2O) or perfluorocarbons (PFCs).

Projects wishing to offer CERs in the market will need to have their emission reductions validated by Designated Operational Entities (validators and verifiers) and registered by the CDM Executive Board to ensure that real and measurable emission reductions are achieved.

The **voluntary carbon market**, on the other hand, operates outside the compliance markets but in parallel, allowing private companies and individuals to purchase carbon offsets on a voluntary basis.

The main objective for acquiring Verified Emission Reduction (VER) credits, is to neutralize the carbon footprint, motivated mainly by Corporate Social Responsibility (CSR) and public relations. Other reasons are considerations such as certification, reputation and environmental and social benefits.

Basically, **the main difference is that a VER (voluntary market), unlike CERs (mandatory market), cannot be used to achieve obligations under the Kyoto Protocol compliance regime**. However, a CER can be accepted by entities wishing to voluntarily offset their emissions

Companies and individuals can acquire or purchase carbon credits directly from projects, companies or carbon funds. However, as in the regulated market, all VERs must be verified by an independent third party and must be developed and calculated according to one of the existing VER standards.

So, why the voluntary market is getting so much traction?

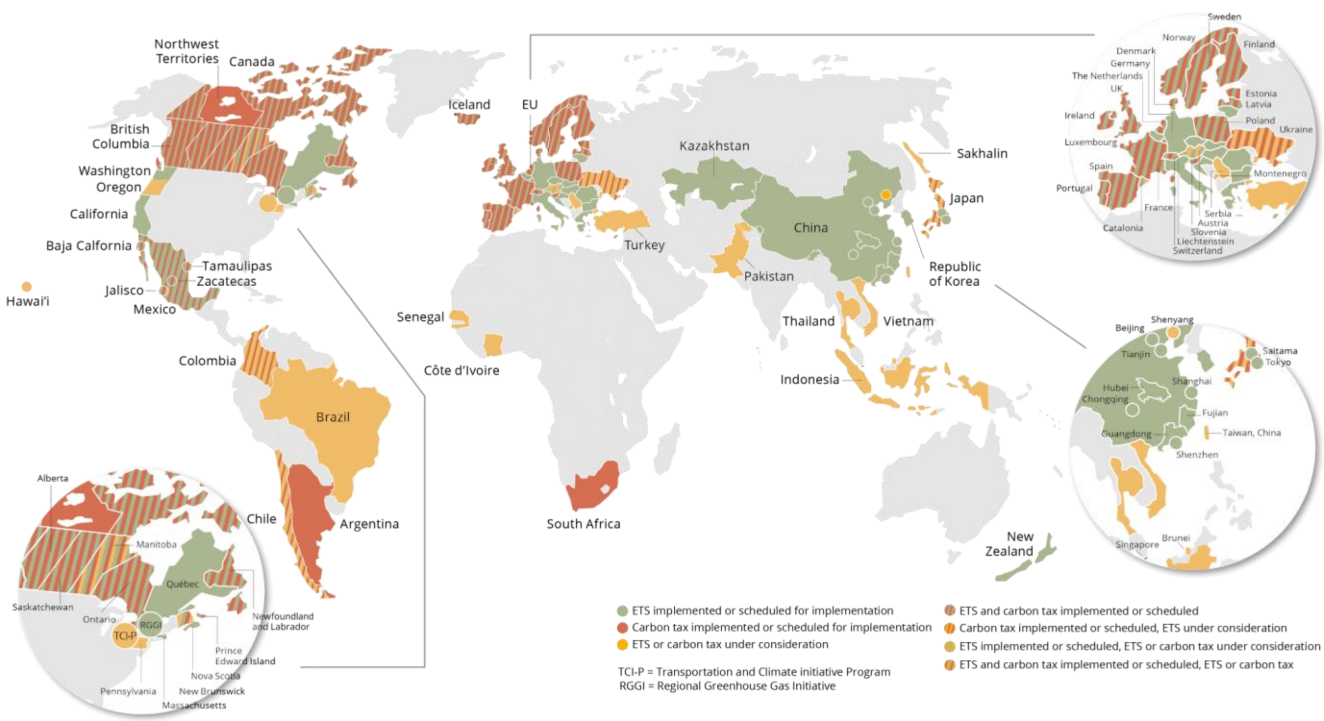
A main benefit of the voluntary market is that **voluntary carbon credits direct private financing to climate-action projects that would not otherwise get off the ground.** These projects can have **additional benefits** such as biodiversity protection, pollution prevention, public health improvements, and job creation. VERs credits also support investment into the innovation required to lower the cost of emerging climate technologies. And scaled-up voluntary carbon markets would facilitate the mobilization of capital to the emerging and under development country (the "Global South"), where there is the most potential for economical nature-based emissions-reduction projects.

One criticality of voluntary market is that is fragmented and complex. Given the demand for carbon credits that could ensure from global efforts to reduce greenhouse-gas emissions, it's clear and necessary that the **world will need a voluntary carbon market that is large, transparent, verifiable, and environmentally robust**.

Today, there are approximately 65 Carbon pricing initiatives selected for carbon pricing, 45 National jurisdictions covered by the initiatives selected, 34 Subnational jurisdictions are covered by the initiatives selected.

In 2021, these initiatives would cover 11.65 GtCO2e, representing 21.5% of global GHG emissions (source: The World Bank).

Below, the figure represents a snapshot of the situation. *Full data provided in the* **Annex 1.**



Carbon pricing initiatives are considered "*scheduled for implementation*" once they have been formally adopted through legislation and have an official, planned start date.

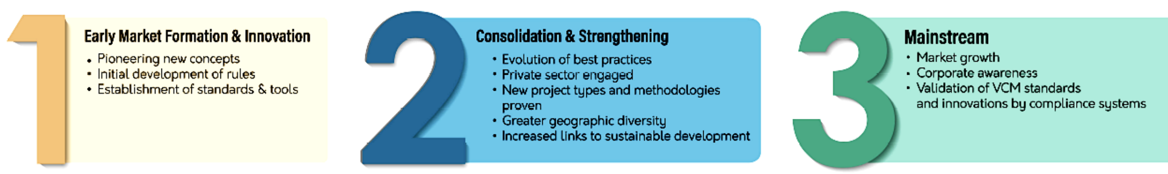
Carbon pricing initiatives are indicated "*under consideration*" if the government has announced its intention to work towards the implementation of a carbon pricing initiative and this has been formally confirmed by official government sources.

Jurisdictions that only mention carbon pricing in their NDCs are not included as different interpretations of the NDC text are possible. The carbon pricing initiatives have been classified in ETSs and Carbon Taxes according to how they operate technically. ETS does not only refer to cap-and-trade systems, but also baseline-and-credit systems such as in British Columbia. However, systems operating like a baseline-and-offsets program, such as Australia Safeguard Mechanism, fall outside the scope of the definition of ETS. Carbon pricing has evolved over the years and initiatives do not necessarily follow the two categories in a strict sense. Due to the dynamic approach to continuously improve data quality, changes to the map do not only reflect new developments, but also corrections following new information from official government sources.

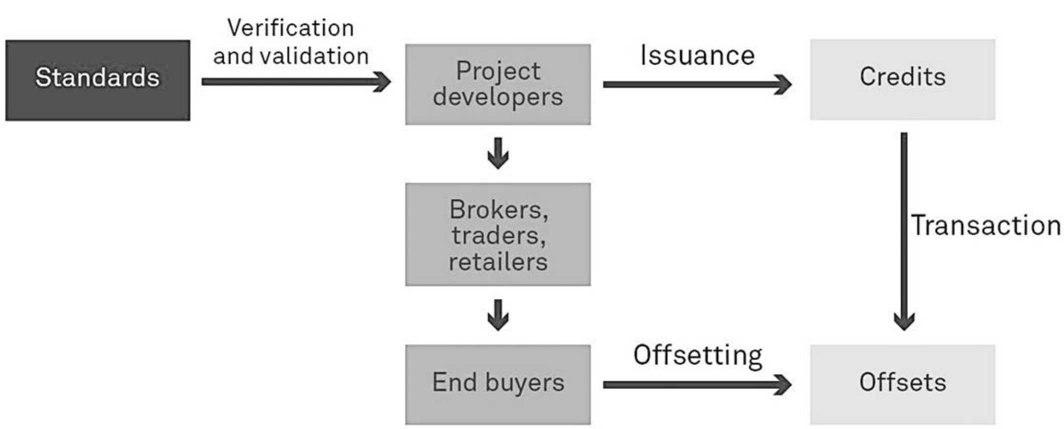
2. Overview, structure, and analysis of Voluntary Carbon Markets

As anticipated, the Voluntary Carbon Market (VCM) was formed with the aim of driving finance to activities that reduce greenhouse gas (GHG) emissions.

In its early days, the market was characterized by pioneering new approaches for fighting climate change. Over time, the VCM has evolved and matured into a robust and effective means to tackle climate change by driving resources to projects which deliver independently verified and additional emissions reductions on a global scale.



Five main players make up the structure and engine of the voluntary carbon markets:



Many brokers act as traders, and many financiers have both brokering arms and project development arms. End buyers can also finance their own carbon project and decide to keep all or part of the issued credits for their own offsetting needs.

All these groups may ultimately market credits to a buyer, or a developer may arrange to sell them direct. All these juxtapositions can have an impact on price, and ultimately affect market transparency.

2.1. PROJECT DEVELOPERS

Project developers represent the upstream part of the market. They set up the projects issuing carbon credits, which can range from large-scale, industrial-style projects like a high-volume hydro plant, to smaller community-based ones like clean cookstoves.

There are projects aimed to destroy or manage the direct emissions resulting from industrial processes such as fugitive emissions management, ozone-capture or destruction of ozone-depleting substances, or wastewater treatment.

Nature-based projects include REDD+ (avoided deforestation), soil sequestration or afforestation. Other types include tech carbon capture such as direct air capture while new categories are being added constantly.

Each credit has a specific vintage, which is the year in which it was issued, and a **specific delivery date,** which is when the credit will be available on the market.

Together with their primary purpose of avoiding or removing GHGs from the atmosphere, **credit projects can also generate additional 'co-benefits'** and help meet some of the UN's Sustainable Development Goals (SDGs). For example, they may contribute to improved welfare for the local population, better water quality, or the reduction of economic inequality.

2.2. END BUYERS

The downstream market is made up of end buyers: companies – or even individual consumers – that have committed to offset part or all of their GHG emissions.

Among the early buyers of carbon credits were tech companies, airlines, and oil and gas majors, but more industry sectors, including finance, are joining the market as they set their own net-zero targets or look for a way to hedge against the financial risks posed by the energy transition.

The **implementation of Article 6 of the Paris Agreement** at **COP26** set the rules for a crediting mechanism to be used by the 193 parties to the Paris deal to reach their emission reduction targets or nationally determined contributions.

The article implementation has made it possible for countries to buy voluntary carbon credits, as long as Article 6 rules are respected.

2.3. RETAIL TRADERS

To link supply and demand, there are brokers and retail traders, just as in other commodity markets.

Retail traders purchase large amounts of credits directly from the supplier, bundle those credits into portfolios, ranging from hundreds to thousands of equivalent tons of CO2, and sell those bundles to the end buyers, typically with some commission.

While most of the transactions are currently happening in bilateral private arrangements and over-the-counter deals, some exchanges are also emerging.

<u>Exchange platforms</u>

Among the **largest exchanges** for carbon credits at the moment are the **New York-based Xpansiv CBL** and **Singapore based AirCarbon Exchange (ACX).**

Exchanges have been trying to **simplify and speed up** the trade of carbon credits – which have a high level of complexity due to the high number of factors affecting their price – by **creating standard products**, which ensure some basic specifications are respected.

For example, both the Xpansiv CBL and ACX have set up standard products for nature-based credits, **CBL's Nature-based Global Emission Offset (N-GEO),** and the **ACX Global Nature Token**. Credit trading under these labels are guaranteed to have set characteristics such as the type of underlying project, a fairly recent vintage, a certification from a restricted group of standards.

Exchanges' standardized products – especially those for forward delivery – are currently preferred by traders and financial players looking to buy and hold in anticipation of skyrocketing carbon credit demand.

End buyers that need to purchase credits to offset their emissions tend to prefer non-standardized products as this allows them to look into the specific characteristic of each underlying project, ensure the quality of the credit being purchased and therefore **protect themselves from potential accusations of greenwashing.**

Often, the exchanges are used to settle large bilateral deals that have been negotiated offscreen.

<u>Xpansiv CBL Exchange</u>

The World's Leading Spot Exchange for ESG Commodity Markets.

CBL is a global exchange platform for transacting energy and environmental commodity products such as carbon, renewable energy, water, and natural gas.

The **Global Emissions Offset™** is a new way to trade carbon. The GEO™ provides companies with streamlined ways to meet compliance and voluntary carbon goals and to manage future price risk.

GEO spot and futures markets enable market participants to buy high-quality carbon offsets—without having to evaluate the vast universe of disparate offset projects. That's because underlying every GEO contract is an offset that meets the stringent eligibility criteria defined by the *International Civil Aviation Organization for CORSIA.*

The GEO spot contract is traded on the CBL exchange and GEO futures on the CME. Together, the contracts provide liquidity, transparent price discovery, risk transference mechanisms, and a reliable benchmark for the global carbon market. CBL offers access to a broad range of individual carbon-offset projects from leading registries, enabling unparalleled choice. But for those who don't want to choose—or don't have the staff to vet individual projects—the GEO provides a turnkey solution. When you buy a GEO, you receive a specific underlying project that meets ICAO-CORSIA criteria.

The CBL exchange is for wholesale participants only, and does not currently support retail clients.

CBL Operating Rules promote a fair, orderly and transparent market by defining how Participants can participate in the Market, how Brokers can broker in the Market, how the Market Operator will operate the Market and how compliance with the Rules will be enforced.

CBL Operating Procedures contain the interpretation and application of the rules, the steps to becoming a participant or broker, ongoing compliance, clearing and settlement, fair and orderly market conduct and more information for operating on the CBL.

<u>CARBON OFFSET PRODUCTS</u>

Product Code	Product Name	Program/Standard
ERT	ACR Emission Reduction Tonnes spot product	American Carbon Registry
CRT	CAR Climate Reserve Tonnes Spot Product	Climate Action Reserve
RRU	REDD+ Result Units (RRU) Spot Product	Coalition for Rainforest Nations (IHS)
GEO	Global Emissions Offset Standard Spot Product	Standard Instruments Program
N-GEO	Nature-Based Global Emissions Offset Standard Spot	Standard Instruments Program
C-GEO-TR	Core Global Emissions Offset Spot Product	Standard Instruments Program
C-GEO	Core Global Emissions Offset Trailing Spot	Standard Instruments Program
VER	Gold Standard Verified Emissions Reductions Spot	Product Gold Standard
VCU	VCS Verified Carbon Units Spot Product	Verified Carbon Standard

<u>AirCarbon Exchange (ACX)</u>

AirCarbon is a Global Carbon Exchange using distributed ledger technology on a traditional trading architecture. It leverages blockchain architecture to create securitized carbon credits.

Today's carbon markets are organized around projects. The UN's CDM registry alone, has 7823 registered projects. Each project has a distinct methodology, country of origin, date of issuance, etc…

AirCarbon securitizes carbon credits around market demand. This allows traders to gain exposure to an asset class as opposed to individual projects. Every token is backed by a 1 tCO2e carbon credit that sits in the Exchange's Trust.

To explain better, AirCarbon applies traditional commodity exchange architecture to carbon credits.

Traditional commodities (e.g.: corn, soybeans, and crude oil) trade digital receipts representing commodities held in a warehouse. These warehouses are organized around predefined specifications. Similarly, AirCarbon currently securitize carbon credits into tradable carbon asset classes. AirCarbon organize credits around the markets they serve. Carbon credits held by the exchange are held in a Trust. For every credit deposited into the Trust, a corresponding one-ton Token resides on the Exchange.

<u>AirCarbon CORSIA Eligible Tokens (CET) :</u>

Each CET represents a Carbon Emission Unit that is eligible under the 2021-2023 pilot phase of the Carbon Offset & Reductions Scheme for International Aviation (CORSIA) scheme established by the International Civil Aviation Organization (ICAO).

Contract Specifications:
Denominations: 1 tCO2e
Contract Size: 1,000 tCO2e (1 Contract = 1,000 tCO2e)

AirCarbon Global Nature Token (GNT):
The GNT was created for buyers with a. Each GNT represents a Carbon Emission Unit generated by a nature-based project (e.g., Forestry).

Contract Specifications:
Denominations: 1 tCO2e
Contract Size: 1,000 tCO2e (1 Contract = 1,000 tCO2e)

AirCarbon Global Nature+ Token (GNT+):

Each AirCarbon Global Nature+ Token (GNT+) represents a Carbon Emission Unit generated by a **nature-based project and accompanied by additional certification(s) for co-benefits achieved** (e.g. Climate, Community & Biodiversity (CCB) standards).

Contract Specifications:
Denominations: 1 tCO2e
Contract Size: 1,000 tCO2e (1 Contract = 1,000 tCO2e)

AirCarbon Sustainable Development Token (SDT):

Each SDT represents a Carbon Emission Unit accompanied by additional certifications or registry approved labels for sustainable development benefits that have been reviewed by third parties.

Contract Specifications:
Denominations: 1 tCO2e

Contract Size: 1,000 tCO_2e (1 Contract = 1,000 tCO_2e)

AirCarbon Renewable Energy Token (RET):

Each RET represents a Carbon Emission Unit generated from a renewable energy project.

Contract Specifications:
Denominations: 1 tCO_2e
Contract Size: 1,000 tCO_2e (1 Contract = 1,000 tCO_2e)

AirCarbon Household Offset Token (HOT):

Each HOT represents a carbon offset generated from an improved cooking solution project that has been certified to have at least 2 SDGs.

Contract Specifications:
Denominations: 1 tCO_2e
Contract Size: 1,000 tCO_2e (1 Contract = 1,000 tCO_2e)

If any interest interest in listing a project on the AirCarbon Exchange, a Ukrainian developer (e.g., farmer) should fill out the form below. AirCarbon will evaluate the project's eligibility for various token types and get back to the developer.

2.4. BROKERS

Brokers usually do not take ownership of the underlying carbon offset credit; rather, carbon offset brokers help to facilitate the transaction in exchange for a commission. Brokers primarily operate in the compliance carbon markets, but some brokers also operate in the voluntary carbon market.

The reason for this is because the compliance carbon markets often involve more frequent and higher volume trades at higher prices, as opposed to the voluntary carbon market.

A few of the most popular carbon offset brokers are:

- Evolution Markets (www.evomarkets.com)
- Brokers Carbon (www.brokerscarbon.com)
- Karbone (http://karbone.com)
- Tradition Green (www.traditiongreen.com)

2.5. STANDARDS AND LABELS

There is a fifth category of actors unique to carbon markets: "standards".

Standards are organizations, usually NGOs, which certify that a particular project meets its stated objectives and its stated volume of emissions.

Standards have a series of methodologies, or requirements, for each type of carbon project. For example, a reforestation project will follow specific rules when calculating the level of CO_2 absorption of the planned forest and therefore the number of carbon credits it produces over time.

A renewable energy project will have a different set of specific rules to follow when calculating the benefit in terms of avoided CO_2 emissions and carbon credits generated over time.

Standards' certifications also ensure certain core principles or requirements of carbon finance are respected:

1. **Additionality**: The project should not be legally required, common practice, or financially attractive in the absence of credit revenues.
2. **No overestimation**: CO_2 emissions reduction should match the number of offset credits issued for the project and should take account for any unintended GHG emissions caused by the project.
3. **Permanence**: The impact of the GHG emission reduction should not be at risk of reversal and should result in a permanent drop in emissions.
4. **Exclusive claim**: Each metric ton of CO_2 can only be claimed once and must include proof of the credit retirement upon project maturation. A credit becomes an offset at retirement.
5. **Provide additional social and environmental benefits**: Projects must comply with all legal requirements of its jurisdiction and should provide additional co-benefits in line with the UN's SDGs.

The following is a list of the most commonly used international standards, used in the Voluntary Offset Market:

- The **VCS Program** is the world's most widely used voluntary emissions reduction standard. More than 1300 certified VCS projects have reduced or removed more than 200 million tonnes of carbon and other greenhouse gases from the atmosphere.

  Along with the **Climate, Community & Biodiversity, and Sustainable Development Verified Impact** standards, it was developed and is managed by Verra, a not-for-profit organization founded in 2005 by environmental and business leaders and based in Washington, DC.

- **Gold Standard** was established in 2003 by WWF and other international NGOs to ensure projects that reduced carbon emissions under the UN's Clean Development Mechanism (CDM) also contributed to sustainable development. Gold Standard has more than 80 NGO supporters and 1400+ certified projects in over 80 countries, creating billions of dollars of shared value from climate and development action worldwide.

  Gold Standard Verified Emissions Reduction (GS VER), launched in May 2006 by WWF-UK is a simplified version of the CDM Gold Standard, using the same basic methodologies. Only available for projects in developing countries. They are focused on renewable energy and energy efficient projects with strong sustainable development benefits.

- The companies united in the **REDD+ Business Initiative** aim to support the further development of the UN's REDD+ mechanism as referred to in article 5 of the Paris Agreement. REDD+ is the most effective instrument to reduce deforestation in the tropics at scale.

- The **W+ Standard** is a unique certification label developed by WOCAN that endorses projects that create increased social and economic benefits for women participating in economic development or environment projects, including those that provide renewable energy technologies, time and labor saving devices, forest and agriculture activities, and employment opportunities.

- The **Climate, Community & Biodiversity (CCB) Standards** identify carefully designed land management projects that simultaneously address climate change, support local communities and smallholders, and conserve biodiversity.

- The **Green-e** label is a US based, nationally recognized standard. It is the nation's leading independent certification and verification program for renewable energy and companies that use renewable energy.

3. CARBON MARKETS PRICING – FUNDAMENTALS

3.1. Pricing a diverse supply

When a company turns to voluntary carbon markets as a potential way to compensate for its carbon emissions, one of the key pieces of information it looks for is the **price of carbon credits**. With this information, a company can decide how ambitious it can be when setting its emission reduction target and whether voluntary markets can really help in reaching it.

At the same time, a clear price signal for carbon allows players already involved in the market to make sure they are trading their credit at a price that reflects the real market value.

But **putting a price on carbon credits is far from a straightforward operation**, mostly because of the **wide variety of credits** in the market and the number of **factors influencing the price**.

Projects issuing carbon credits can be of many different types and sub-types. The nature of the underlying project is one of the main factors affecting the price of the credit.

3.2. Pricing based on market dynamics:

The voluntary carbon market today is primarily driven by supply and demand, regardless of the implications to the project in terms of long-term viability.

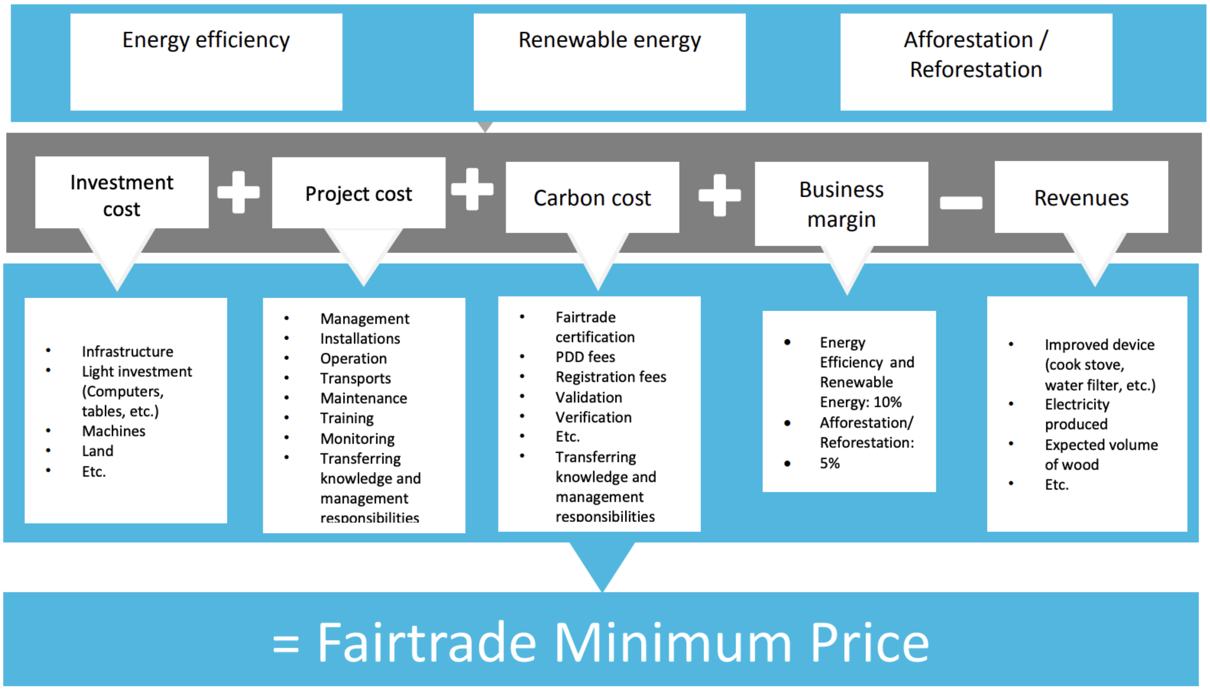
Markets can be very effective for driving competition and reducing the cost of accomplishing an objective. However, what if that objective is the security of our climate and providing access to basic human rights such as food, water, education and good health? Paying for carbon credits at prices below what it costs to maintain a project means that these projects may stop operating in the vulnerable communities they support. Further, neglecting to fully account for the real value they deliver in beyond-carbon development benefits can accelerate a race to the bottom, meaning that the highest quality projects might be the first to fail.

Organisations and individuals have an opportunity to consider longer-term environmental and social impacts of their investment decision and consider both the costs and true value of project outcomes.

3.3. Pricing based on project cost:

A cost-based model takes into account the implementation costs of a project and is used to help ensure the ongoing viability of projects.

The **Fairtrade minimum pricing model** is an example of how this works in practice.



It calculates a minimum price that ensures the average costs of the projects will be covered, plus an additional "Fairtrade Premium" on top that goes directly to the local community to fund activities that help them adapt and become more resilient to an already changing climate.

Fairtrade minimum prices for eligible project types:

- Energy Efficiency – 8.20€/tCO2e + 1€ Fairtrade premium
- Renewable Energy – 8.10€/tCO2e + 1€ Fairtrade premium
- Forest Management– 13€/tCO2e + 1€ Fairtrade premium

A cost-based model is a step toward ensuring project sustainability, yet it does not specifically account for the additional value these projects deliver in sustainable development.

3.4. Pricing based on value delivered:

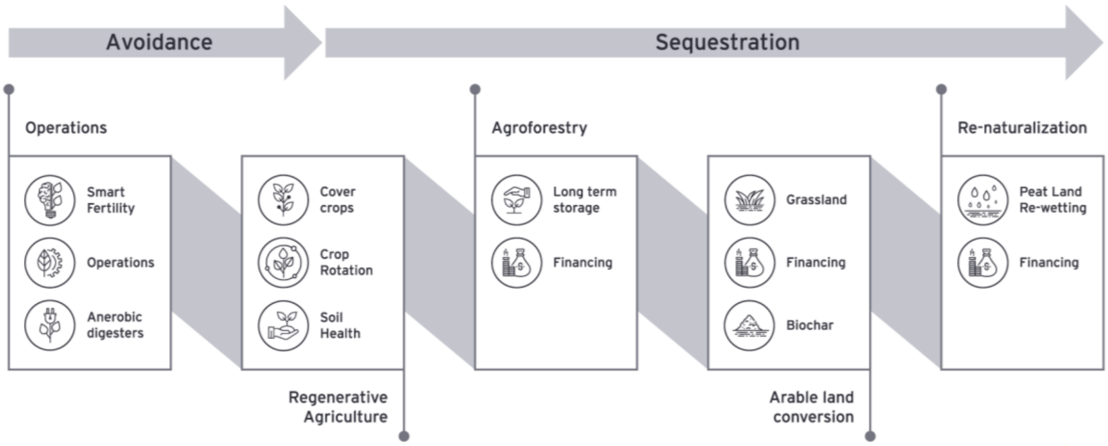
While all Gold Standard-certified projects play a critical role in our transition to a low-carbon economy, projects also go far beyond carbon mitigation.

Using a value-driven model to set a price for carbon credits can truly account for the full environmental, social and economic impacts of a specific project—that is, both in emissions reductions plus the additional development benefits that can transform lives.

4. CARBON CREDITS CATEGORIES OR BASKETS

Carbon credits can be grouped into two large categories or baskets:

1. **Avoidance projects** (which avoid emitting GHGs completely therefore reducing the volume of GHGs emitted into the atmosphere) and
2. **Removal projects** (which remove GHGs directly from the atmosphere).



Avoidance category

The avoidance basket includes renewable energy projects but also **forestry and farming** emissions avoidance projects. The latter, which are also known as REDD+, prevent deforestation or wetland destruction, or use soil management practices in farming that limit GHG emissions – such as projects aiming to avoid emissions from dairy cows and beef cattle through different diets.

Cookstove projects, fuel efficiency or the development of energy-efficient buildings also fall under the avoidance basket and so do projects capturing and destroying industrial pollutants.

Removal category

The removal category includes **projects capturing carbon from the atmosphere and storing it.** They can be nature-based, using trees or soil for example to remove and capture carbon. Examples include reforestation and afforestation projects, and wetland management (forestry and farming). They can also be tech-based and include technologies like direct air capture or carbon capture and storage.

Removal credits tend to trade at a premium to avoidance credits, not just because of the higher level of investment required by the underlying project but because of the high demand for this type of credits. They are also believed to be a more powerful tool in the fight against climate change.

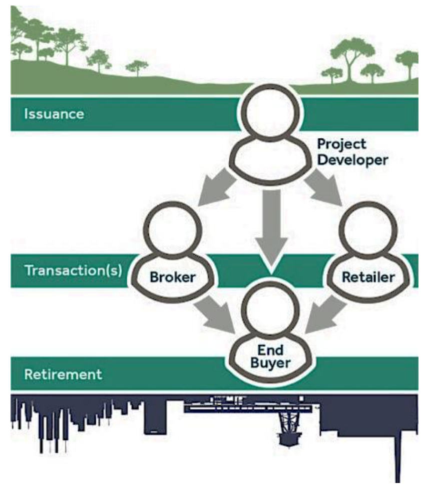
Beyond the type of the underlying project, **the price of carbon credits is also influenced by the volume of credits traded at a time** (the higher the volume the lower the price, usually), **the geography of the project, its vintage** (typically, the older the vintage the cheaper the price), **and the delivery time.**

When the underlying carbon project also helps to meet some of the UN's SDGs, the value of a credit from that project to potential buyers may be higher, and the credit can trade at a premium to other types of projects.

For example, **community-based projects** – which are usually very localized and typically designed and managed by local groups or NGOs – **tend to produce smaller volumes of carbon credits**. It is also often more expensive to certify them. However, they usually **generate more additional co-benefits** and meet the UN's SDGs, contributing, for instance, to improved welfare for the local population, better water quality, or the reduction of economic inequality. For this reason, **credits emitted by community-based projects may trade at a premium to projects that don't meet SDGs**, such as industrial projects, which are typically larger-scale and can often produce large volumes of credits with more easily verified GHG offset potential.

The 2021 market demand story is often told in two parts: the influx of fresh entrants, with both speculative traders and offset end-users; and the resulting strong increase in carbon offset credit prices.

According to OPIS daily assessments (*Oil Price Information Service OPIS is the most widely-accepted price benchmark for supply contracts and competitive positioning because unbiased and independent*), the average price of Voluntary REDD+ credits—frequently sold, premier forestry offsets—jumped about $7.50/mt over the past 12 months, more than doubling. The average cost of vintages 2017 to 2021 hit a high of $13.25/mt in early December, after starting 2021 at a low of $5.73/mt.



For the REDD+ assessments, OPIS considers Reducing Emissions from Deforestation and forest Degradation credits with a Climate, Community and Biodiversity (CCB) Standard certification issued by the Verra carbon registry.

Like the REDD+ credits, benchmark CORSIA-Eligible Offsets (OPIS CEO) rose more than $8/mt in 2021. The OPIS daily CEO assessment reached a high of $9.04/mt in mid-November after starting the year at a low of 80.5 cents/mt.

5. HOW TO PRODUCE AND SELL VOLUNTARY CARBON OFFSETS

5.1. Producing a Voluntary Offset

In order to generate offsets, **a project developer must complete a rigorous process** in order to ensure that real, quantifiable emissions reductions have been achieved.

Although the process can vary, most follow a similar Process for Carbon Offset Projects:

The project begins to work on a **Project Idea Note**: this first step focuses on early-stage preparations, like generating a project plan, assessing the project's feasibility, impacts, and risks, and/or engaging with local stakeholders.

Once the Project Idea Note is fully defined, the project developer makes more concrete plans in a **Project Design Document**: the developer provides information about the project's anticipated emissions reductions, plans for quantifying and monitoring the delivery of climate and other social and environmental benefits, and a demonstration that the project's activities exceed "business-as-usual" reductions and avoids emissions "leakage" (*emissions which are simply displaced to a different location, instead of avoided altogether. E.g., if a forestry project claimed to avoid emissions by preventing deforestation but resulted in other forests being felled*).

Project Idea Note and **Project Design Document** are then "**validated**" by a third-party auditor.

After the project has been implemented and monitored over a period of time, another audit process called "**verification**" assesses the delivery of greenhouse gas mitigation.

Only after the project has successfully passed each of these steps can the project developer begin to issue **tradeable offsets**.

This a simplified explanation of the steps a project developer must complete in order to ensure that real, quantifiable emissions reductions have been generated.

5.2. Selling a Voluntary Offset

Once a project developer issues offsets, these can be sold. But, **with no centralized voluntary marketplace, finding a buyer can be a multi-step, challenging process**.

Today, usual practices are:

1. Some project developers sell their offsets directly to end buyers.
2. Others sell their offsets through a broker or an exchange, which provide platforms for buyers and sellers to meet.
3. Still others may sell to a retailer, who then resells offsets to an end buyer.

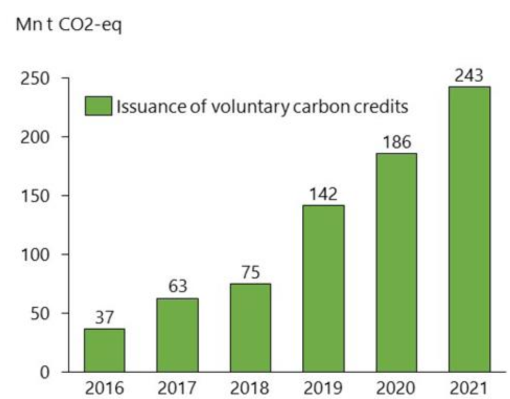
The transaction phase includes any time an offset is sold. Yet once an end buyer is ready to claim that offset against their own emissions, he should retire it. Retired offsets are no longer able to be traded in the market and represent emissions that are permanently "removed" from the atmosphere.

6. Overview of the Potential and Challenges for the Voluntary Carbon Market

The voluntary nature of this business also means that the current status of voluntary carbon markets can be at best described **as fragmented**, and **at worst opaque** and **in some cases even ineffective**.

But the importance of the voluntary carbon market **is not limited to corporate ESG imperatives**. As carbon pricing grows it could be an important tool for project financing, especially for projects that promise to deliver negative emissions, which will be essential to reach increasingly ambitious net-zero targets.

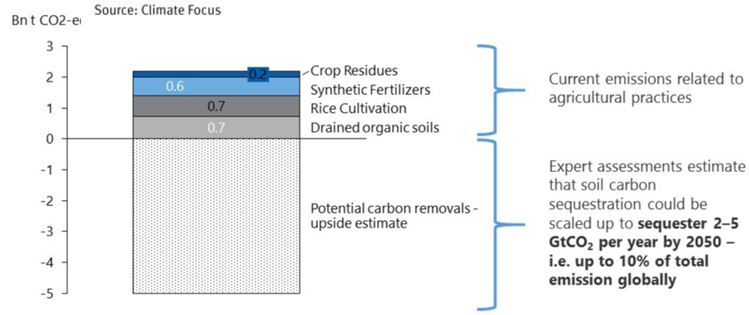
The voluntary carbon market reached a record high in 2021, with almost 250mn t of CO2-eq of credits issued, an increase of over 30% year-on-year. A similar trend was observed for retired credits. Retired credits are purchased by consumers and "retired" to avoid any potential future double counting.



Source: Climate Focus

Companies worldwide across a wide range of sectors have shown interest in tapping voluntary carbon markets in an attempt to reach their carbon neutrality goals, and the recent surge in interest is also driving the need for more transparency and integration.

The voluntary carbon market segment that has been receiving substantial interest, but that also often finds itself in the crosshairs of detractors, is the **"nature-based solutions"** carbon business. These are projects that focus on **nature conservancy (such as reforestation)**, **agriculture-focused projects that aim to use soils as a carbon sink ("soil carbon")**, typically involving practices such as regenerative agriculture and **"carbon farming"**, very attractive due to its claimed huge potential to store carbon, and achieve the much-needed negative emissions.



Source:
- FAOStat,
- Fuss, S., et al. 2018. "Negative emissions—Part 2: Costs, Potentials and Side Effects."
- Smith, P. 2016. "Soil carbon sequestration and biochar as negative emission technologies."
- Zelikova, J., et al. 2020. Leading with Soil: Scaling Soil Carbon in Agriculture

Although agriculture is "only" responsible for around 5% of global annual emissions (this is referring only to soil/crop-related emissions, and excluding animal farming emissions), there is a large body of academic literature that suggests that soil carbon would have to potential to sequester up to 10% of total annual emissions.

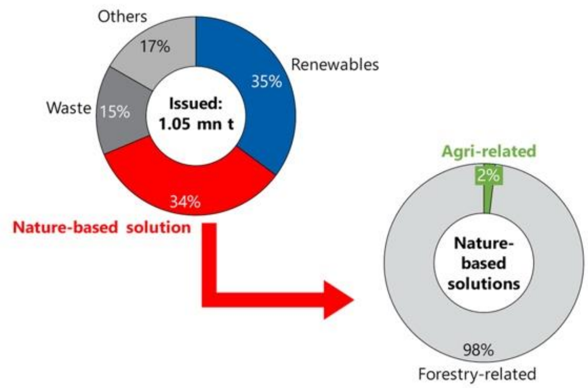
As a result, **incentivising farmers to sequester carbon dioxide from the atmosphere and store it in the biosphere as soil organic carbon is considered a growth area in voluntary carbon markets**:

- Governments see it as a cost-effective way to meet their Paris climate agreement targets, while also boosting biodiversity. Major economies (including USA, Canada, Australia, and soon the EU) have announced initiatives to support carbon farming by establishing appropriate frameworks
- Corporates see such nature-based carbon removals as a cost-effective method to meet their net zero claims

Despite the potential, **the current market for soil carbon-based voluntary credits is not developed enough**.

Agriculture carbon projects currently amount to around 2% of total credits issuances so far.

One of the issues that is affecting the widespread adoption of agriculture-related carbon schemes is **scalability**. Most of these soil carbon schemes are located in North America and Australia, where farm sizes are on average much larger than Asia or Europe. **Large-scale farms allow for a more efficient rollout and monitoring of soil carbon schemes.**



Source: Climate Focus

Soil carbon projects typically require decades-long commitment and steep initial costs (soil sampling and auditing costs are typically covered by farmers), which are not always viable options for farmers, given the relatively low voluntary carbon pricing currently available in the market (typically <$15/t CO2-eq).

In any case, **soil carbon is attracting investment despite the challenges.** New entrants have set up carbon programmes to meet potential demand. Leading agri-input firms have announced their intention to leverage their market positions to develop carbon programmes or other related investments.

What is becoming very clear is there are vast differences in how market participants are approaching key elements of their carbon programs, most notably in the threshold criteria for signing up farmers ("additionality"), how long the Soil Organic Carbon (SOC) must be stored in the soil ("permanence"), and the rigour and precision with which the amount of carbon sequestered is measured.

The degree of differentiation seems driven by varying perceptions on making programmes attractive to farmers while also ensuring the output carbon reduction units are highly valued by consumers. Without any clear guidance by governments (a common feature currently in most commercially-focused aspects of sustainability and energy transition), this will play out over time.

The rigour in the **design and implementation of methodologies is also becoming a crucial aspect** that will affect the ability to roll out these schemes across different geographies and generate a substantial amount of tradeable credits, as well as their market acceptance.

7. Potential of VCMs policies and implementation in case of agriculture and forestry, and takeaways for Ukrainian market

Ukraine occupies the territory of 60'355 thousand hectares or 0.4% of the Earth surface, of which the land amounts to 57'928 thousand hectares. Ukraine owns 8.7% of the world stock of black soil, 2.3% of cropland (8th in the world) and 2.2% of basal area under cereal crops.

Agricultural use lands take almost 70% of Ukraine's territory, forests and other lands, covered in woods and bushes vegetation - 17.6%, and settlement land constitute 4.2%.

Forests is the main sink of GHG emissions in LULUCF (*Land-use, Land-use Change, and Forestry*) sector. According to the State register of Ukraine's forests, the total territory of forest resource is 10.8 million hectares including reclamative afforestation. Prevailing in Ukraine is the State form of forest ownership; about 87% of forests are managed by State entities and organizations. The sector's specific feature includes imbalanced land usage structure, excessive ploughness of territory, and low level of forest cover of the territory (average forest cover in Ukraine amounts to 15.9%, while that in European countries is 37%).

LULUCF sector contribution to total emission/absorption balance is positive. According to National Cadaster of anthropogenic emissions from sources and absorption of greenhouse gases absorbers over 2015 in Ukraine the sector absorbed about 5% of the total GHG emissions. In absolute terms, for the period 2010 - 2015 the level of absorption in the sector stayed within the range of 13-30 million t CO2 equivalent per annum.

Forestlands are net GHG absorbers - on average for the period 2010-2015 the scope of GHG absorption by forests amounted to 65.5 million t of CO2 equivalent per annum. GHG emissions in the sector were mostly coming from croplands, pastures, wetlands, settlements and other lands. The scope of GHG emissions from croplands on average totaled at 38.8 million t CO2 equivalent per annum.

Low carbon policies and measures in land development and forestry

Forest cultivation, sustainable forestry and reduction in the loss of forest cover are the most appropriate activities to increase GHG emissions absorption in LULUCF sector. Of agricultural practices, the optimum include non-exhaustive farming, cattle grazing and organic soil restoration. Ukraine's specific feature include imbalanced land usage structure, excessive ploughness of territory, and also low level of forest cover of the territory (average forest cover in Ukraine amounts to 15.9%, while that in European countries is 37%).

Within the territories of cities and other inhabited localities, the total area of green planting of all types as of 01.01.2015 amounted to 652, 1 thousand hectares. Ukraine belongs to the group of countries with the highest share of agricultural lands in its total area of – 70.8% as of 01.01.2015, including agricultural arable lands – 68.8%, pastures and hey fields– 13.0%.

Policies and measures aim to:

- reduce cropland in the land use structure;
- increase the area of lands covered with forest vegetation, to create new forests (afforestation) and to timely restore the forests (reforestation);
- Rationally place forests and declarative afforestation, which constitute ecological carcass in the landscape, and restore field protection strips and other types of declarative afforestation;
- to take stock of green vegetation in the inhabited localities, assess their status and carbon sequestration;
- to green the inhabited localities, which implies to incentivize measures of support and improvement the status of trees and plants in residential areas of inhabited localities, to increase plants density in urban environment via creating of public and curtilage gardens, green roofs, and to plant different types of vegetation to enable sequestration and uptake of accumulated carbon;
- to enhance interagency coordination, in particular, among forestry, agriculture etc.

- implement and support best practices of farming and forest management, which take due account of climate change and aim to prevent carbon take out from soils in agrocoenosis, increase the level of forest productivity and resilience, to preserve and accumulate carbon in forest phytomass and soil;
- to improve conservation and protection of forests and conservation areas, green vegetation in the inhabited localities, conservation of field protection forest strips and other reclamative afforestation to store the accumulated (sequestered) carbon;
- to introduce economic incentives of land user (owner) to rationally use and protect agricultural lands;
- to combat degradation of agricultural lands and desertization, including via conservation of low productive and technologically polluted lands;
- to improve methods of agro technical regulation of carbon content in soil, which means promotion implementation of innovative agri-technologies, geared towards preservation and improvement of fertility, non-alkalic cultivation and rotation of crops; to lower mechanical impact on the soil;
- to support measures which aim to transform low productive agricultural lands into lands with permanent plantation cover, such as meadow/pasture, garden or forest where the carbon content in the soil and/or biomass will increase;
- to reduce the rate of agricultural lands transformation into build-up lands, as this will help touptake carbon in the soil of such land and also keep their carbon sequestration potential.

Ukraine has made impressive progress on key reforms and restored macro-financial stability, but weak growth and poverty remain a concern.

Despite these economic challenges, Ukraine recognizes climate change as the most consequential factor this century, affecting the economy and future generations, **and appreciates the potential impacts of climate change, with a focus on agriculture, as a key driver of the economy and jobs**. It is not too late for Ukraine to reduce the climate risk to agriculture and forests and enhance opportunities in these sectors.

Recent studies recommend that Ukraine strengthens institutions, policy, and planning; increases scientific capacity and research; and promotes a transition to climate-smart agriculture and forestry. They also highlight the need to develop more comprehensive oblast-level impact assessments, especially for water availability and corresponding costs, to identify specific climate risk considerations for development planning on the local level, so action can be tailored to the sectors facing the highest risk in the country's oblasts.

The area of degraded and unproductive arable land in Ukraine exceeds 20% (more than 6.5 million hectares) **of the total arable land**. Every year, 300 to 600 million tons of soil are lost due to erosion. Depending on the level of degradation, crop yields can be reduced by 50%, and losses from the lack of production amount to more than UAH 20 billion per year. At the same time, **Ukraine's agricultural sector is estimated to cause 35% to 40% of all environmental degradation in the country**.

Given this negative tendency, and following the signing of the United Nations Convention to Combat Desertification, **Ukraine has undertaken responsibilities to rebuild degraded land and soils by 2030 and seek to achieve a neutral level of land degradation in the world**.

A new business model – carbon farming – could tackle issues around sustainable food production and climate change in Ukraine.

- Climate change, regulatory pressures and consumer expectations are changing the way agriculture works
- Carbon farming could be a new enabler of healthy and sustainable ecosystems

- Farmers, consumers, companies and the public sector all stand to benefit – with the right credits system and permanent capture concept in place.

Shrinking productive farmlands, pest outbreaks and climate change are impacting crop cycles and yields. Farmers' concerns on the land are clouded further by national and international issues such as the recent pandemic, regulation, trade issues and embargoes. At the same time, consumers are seeking more sustainable, healthier and affordable food – and greener products overall. It's a complex situation that requires a radical rethink of the agricultural landscape.

As briefed before, and similarly applying in Ukraine, **carbon farming refers to techniques designed to sequester carbon in the soil or avoid the production and release of carbon**. Some of the known methods include the **use of cover crops**, **no-till techniques**, **smart fertility solutions**, **limiting anaerobic digesters** or switching to **rotational grazing**.

New discoveries and innovative approaches are set to offer further ways to sequester carbon in soil.

Carbon farming can be complemented by other mechanisms, such as systems to certify and incentivize good practices around deforestation or water quality.

Let's put this into the Ukrainian's context.

What almost every farm has in common is the huge expanse of soil at its disposal. Soil is an efficient carbon sink, with huge capacity to store carbon over time. A skilled farmer can use carbon farming to manage the carbon pool, flows and greenhouse gas fluxes at farm level with the purpose of mitigating climate change and building sustainable farming practice. Combining evolving data-driven agriculture with carbon farming practices has potential to solve multiple challenges around food security strategies across the country.

All players in the agribusiness and food ecosystem – farmers, seed suppliers, crop protection and input players, processors, equipment manufacturers, food manufacturers – have an opportunity to participate in and contribute to the progress of carbon farming. But beyond the immediate agriculture landscape, the potential of carbon farming has not gone unnoticed.

The question is how to bring together the needs of Ukrainian farmers, government and other stakeholders. Developing innovative business model and enabling growth across the ecosystem will be key. It's a great idea, but farmer participation in carbon farming initiatives is mainly at the pilot phase. Large scale participation cannot be observed to date, and there is no well-known market for credits from carbon farming. For a concept with such an enormous potential these are significant warning signs.

The challenge – and task – now is to bring together all the expertise and perspectives needed to empower change. This relies on the knowledge and experience of farmers and other agribusiness players in managing the soil system, navigating external influences like weather and planning ahead for a low-carbon cycle long-term.

Change will be enabled by **digitalization as a crucial tool in tracking carbon storage and trading credits**.

Ukraine and the International Carbon Action Partnership

Ukraine plans to establish a national ETS in line with its obligations under the 'UkraineEU Association Agreement,' which entered into force in September 2017. Issues related to climate change are addressed in Article 365 (c) Title V, which outlines steps for the implementation of a national ETS, including:

- adopting national legislation and designating competent authority(ies);
- establishing a system for identifying relevant installations and greenhouse gases;
- developing a national allocation plan to distribute allowances;
- establishing a system for issuing allowances to be traded domestically among installations in Ukraine; and

- establishing MRV (Monitoring, Reporting and Verification) and enforcement systems, as well as public consultations procedures.

The country has developed the main elements of the national MRV system to provide a solid basis for the upcoming ETS. In 2019, Ukraine adopted a framework law on MRV. The MRV law entered into force in 2020 and applies to installations from the start of 2021. By 31 March 2022, covered installations must submit the first monitoring reports for 2021.

To establish its ETS, Ukraine plans to develop separate legislation based on at least three years of data from the MRV system. According to a statement made by the Minister of Environmental Protection and Natural Resources in January 2021, the ETS launch could take place as early as in 2025. Ukraine is working on its ETS plans with the assistance of the PMR and the German Corporation for International Cooperation (GIZ).

Main data and information:

Overall GHG emissions (excluding LULUCF) Emissions:	339.2 MtC02e (2018)	
Overall GHG emissions by sector (in MtCO2)	Sector Name	MtCO2e
	Energy (excl. transport)	191.3
	Transport	35.0
	Industrial Processes	56.5
	Agriculture	44.2
	Waste	12.2

<u>GHG reduction target</u>

- BY 2030: GHG emissions will not exceed 60% of 1990 GHG levels, including LULUCF (NDC)
- BY 2035: 20% GHG emissions reduction from final energy consumption from 2010 levels (Energy Strategy 2035)
- BY 2050: GHG emissions from energy and industrial processes will not exceed 31%-34% of 1990 GHG levels (Low Emission Development Strategy 2050)

8. OVERVIEW OF SOME CARBON FARMING MARKETS IN EUROPE AND WORLWIDE

Germany

While carbon farming is a priority for the German government, farmers' opinion is they are not doing enough to support measures financially and environmentalists add that some of the promoted practices have limited climate value.

Farmers recognize that carbon farming is a big opportunity for climate policy as well as agriculture, but while harnessing natural carbon sinks in agriculture and forestry would be "indispensable" for reaching net-zero, they are also raising the voice that such climate measures would also have to pay off financially. Without adequate remuneration, measures will not be implemented to the extent that is needed.

The country's climate protection law foresees carbon sequestration measures in agriculture and forestry should provide an overall sink of 25 million tons of CO2 by 2030. Carbon sequestration measures are therefore being promoted through various policy instruments.

Within Germany's energy and climate fund, €75 million by 2023 is earmarked for humus restoration on arable land, in addition to €21 million from the country's programme for immediate climate action. Moreover, significant funds are budgeted to implement the national Arable Farming Strategy, which aims to "strengthen the contribution of arable farming to climate protection".

But for the German farmers not enough is being done, since in Germany, while overambitious objectives have been set for carbon sinks, a framework for certification or remuneration is lacking, and they significantly need to speed things up.

Once a **unitary and scientifically validated framework** for quantifying the amount of sequestrated carbon is agreed upon, this would need to form the basis for **different mechanisms of remuneration**.

For example, one could imagine remuneration from the energy and climate fund using the means of the CO2 emission trading system, but private remuneration systems could also be envisioned.

However, environmentalists are critical of integrating carbon farming into emission trading schemes. For them, there is a risk that, by generating certificates, the sector's activities for reducing emissions are curbed, because these emissions can then be offset to a large extent.

MEASURING IMPACT: according to German farmers this can be especially problematic whenever the amount of carbon sequestered by a measure is difficult to measure. If Germany want to remunerate the actual impact of carbon farming measures, it is needed a large amount of data and measurements. It is extremely difficult to gather this data as accurately as it would be necessary, especially from small farmers. *This is an important input for the Ukrainian case*. Why? In practice, financial support is most often geared towards remunerating the implementation of specific measures rather than their impact.

Stakeholders' views also diverge when it comes to the question of which specific farming practices the government should focus its efforts on. From farmer's perspective, measures must be **as integrated into production as possible, to guarantee food supply while also avoiding CO2 leakage.**

Measures for humus buildup, such as planting intermediate crops, can be integrated into the active cultivation of agricultural land. But from the perspective of environmental campaigners, such practices are not the most effective on the table for carbon sequestration.

Why? Humus is very fragile and not really suitable for storing carbon over a longer period, because emissions can escape again after they were sequestered, it is very difficult to measure how much of a carbon sink humus can actually provide.

Instead, rewetting moorland is the measure with the "highest potential" for carbon sequestration. In Germany, large moor areas in the northeast and the south of the country that have been degraded hold the potential for providing significant carbon sinks by being rewet.

In October 2021, Germany's federal and regional agriculture and environment ministers signed a common agreement on moor protection and rewetting, which foresees that 5 million tons of CO2 equivalent should be sequestered in moorlands until 2030. However, many farmers see this more cautiously than humus buildup as rewetted areas can only be used for farming to a limited extent. Farms need long-term, reliable income prospects, as well as options for continuing the agricultural usage of areas.

According to current budgeting plans, the national agricultural ministry will spend around €330 million on moorland protection between 2021 and 2025. Among other things, these means will be used to promote measures for enabling farmers to still use rewetted areas per local conditions.

Apart from national measures, Germany also supports carbon farming through the EU's Common Agricultural Policy (CAP). The country's catalogue of so-called "eco schemes" – programmes for remunerating sustainable agricultural practices within the CAP – includes support for crop diversification and the cultivation of leguminous plants set to boost the soil's carbon storage capacity. The bloc's goals for carbon sequestration in agriculture are too ambitious, according to farmers. However, farmers have high expectations for the carbon removal strategy set to be presented by the Commission in December 2021, appreciate the EU Farm to Fork Strategy as providing a suitable framework for carbon farming to become a new business model in agriculture.

France

French farmers endorse carbon farming but highlight transition costs.

With its low carbon strategy, the French government aims to green agriculture through the development of carbon sequestration in soils. French farmers salute the strategy but call for stronger aids for the transition to be financially sustainable.

Launched by the government in 2019, a Low Carbon Label allows the official certification of projects and engagements to reduce greenhouse gas emissions and capture CO2. Farmers can obtain the label through different agronomic techniques, such as **agroecology** or **conservation agriculture**.

Labelled farms can then receive financial support from companies or local authorities wishing to offset their CO2 emissions through the so- called "carbon credits", linking societal engagement to economic value for farmers.

In the framework of France Relance, the French recovery plan adopted to address the impacts of the COVID-19 crisis, the ministry of Agriculture is furthermore offering subventions to allow farmers to conduct a carbon diagnostic on their farm. Endowed with €10 million, the measure launched in April finances 90% of the cost of carbon diagnostics for farmers having settled less than five years ago. It provides them with a personalized action plan to help them decarbonize their farms.

Finally, the national action plan for adapting to climate change adopted in June aims to "set a course for our agriculture and food system to collectively meet the challenge of our climate commitments and obligations.

One of the six major axes of this plan is to "develop the carbon sequestration potential of agricultural soils and forest and agroforestry biomass", in other words, carbon farming.

The agriculture-forestry-wood sector – according to the plan - is of strategic importance for the climate by contributing to climate change mitigation through carbon sequestration.

Concretely, the ministry wants to develop measures to help increase ground cover and "agroecological infrastructures" such as hedges and support the development of Low Carbon methods through the label and carbon diagnostics.

Carbon compensation mechanisms could constitute an important additional lever for mobilizing the agricultural sector in the national climate change mitigation effort. Changing their ways represents a financial cost and a medium-term risk for farmers, since when they change things, we need to wait several years before finding a new equilibrium and seeing positive feedback on their investment.

In this period, financial aid – in the form of compensation for environmental services or higher consumer prices –and a strong political framework are necessary to sustain farmers during their evolution.

To change an agricultural production system towards greener and more sustainable practices, farmers need to invest at a loss for several years, and take risks to work with nature, not always cooperating in their favour. Young farmers starting out today need help to shoulder the risks and investments of the first years.

United Kingdom

British farmers have set an ambitious strategy to reach net-zero greenhouse gas (GHG) emissions in agriculture by 2040. As every farm is different, farmers suggested that a "vast portfolio of measures and incentives" from the government is needed to ensure every farm can get involved. These will include actions to improve farming's resource use **efficiency**, increase **on-farm carbon storage** in vegetation and soil, and boost production of land-based renewable energy.

According to the **National Farmers' Union of England and Wales (NFU),** UK farm emissions currently amount to 45.6 million tons of carbon dioxide (CO2) equivalent a year – about one-tenth of total UK GHG emissions. But in stark contrast to the rest of the economy, only 10% of this is CO2. Around 40% is nitrous dioxide (N2O) and 50% is methane (CH4).

British farmers' opportunities also lie in farming's unique ability to take carbon out of the atmosphere, not only offsetting its own emissions but playing a part in carbon removal for other sectors too. And as people who work the land, farmers are in a great position to extract value from this carbon.

However, it is an extraordinarily complex area of policy, and a robust carbon price will be absolutely crucial if farm businesses are to consider this as a viable income stream in the future.

<u>THE ROLE OF PRECISION FARMING IN UK</u>

NFU believes that net zero challenge also presents some "exciting progressions" for the agriculture sector. An increasing number of farmers have switched to precision farming and GPS systems, which all help businesses decarbonize, and greater investment in the development of agricultural technologies will further aid climate- smart farming.

However, the lack of rural digital connectivity is holding back progress and more needs to be done for farmers to make the most of data and precision technologies (according to a NFU report, only 40% of farmers reported that their broadband speeds were sufficient).

Anyway, for the benefit of Ukrainian developers' knowledge, EU farmers also face a similar situation. The European Commission is pushing for precision farming practices to be part of the next 2023-2027 Common Agricultural Policy (CAP), but **poor broadband infrastructure** remains a headache and to reach their targets, member states must capitalize on advances in innovation, technology and digital solutions – such as **precision farming**.

Not only will these advances encourage sustainability, but they will also lead to higher productivity and reduced inputs for farmers, thereby lowering costs.

UK looks very ambitious in terms of its progress, but those farmers do not feel informed about how they are going to be supported or compensated to make this transition to a low-carbon or zero-carbon agriculture.

Just like British farmers, the EU agricultural sector wants clarity on how farmers will be incentivized and avoid additional burdens and costs. But Europe's green push in agriculture is still facing severe obstacles.

Spain

Similar to other countries in EU, Spain seeks to maintain carbon in soils destined for agriculture in its strategy against climate change with the support of the Common Agricultural Policy (CAP).

However, like other farmers in EU, producers demand more funds to compensate for their efforts.

The Spanish government and autonomous regions negotiated a plan to implement the new CAP.

Around 40% of its budget will be allocated to actions with climate and environmental purposes. Among the new changes are eco-schemes, aid linked to sustainable practices divided between those focused on agroecology, and the so-called low carbon agriculture, which aims to reinforce the sink capacity of soils.

The government has proposed incentives for producers to incorporate **extensive pasture grazing**, **sustainable harvests**, **crop rotation**, **direct sowing**, **conservation agriculture**, and **plant covers and uncultivated land** to protect biodiversity.

The eco-schemes will be financed with €1.107 billion per year until 2027, equivalent to 23% of direct aid from the CAP (first pillar), along with another 2% charged to environmental spending in rural development (second pillar).

The Ministry of Agriculture, Fisheries and Food intends to support farmers in the transition towards more sustainable agriculture from an economic, social and environmental point of view.

Agricultural organisations insist on the need to receive more support in the face of increasing environmental demands and highlight the mitigating capacity of agriculture to capture carbon and prevent it from being released into the atmosphere.

According to the Spanish farmers' association (Asaja), Spain has decided that the CAP funds serve to compensate the efforts of the producers, who do not see the proposal as sufficiently attractive and feels the need to adopt sustainable practices and tackle problems such as soil erosion or fires.

European Commission promotes its strategy "Farm to Fork", which seeks to reduce the use of chemical pesticides by 50% and fertilisers by 20% before 2030. Additionally, **it aims to expand organic farming to 25% of agricultural land**. The plan also includes a Carbon Farming Initiative and a regulatory framework for certifying carbon removals.

In Spain, with 10% of ecological agricultural land, organic farmers push for a model change which would also help boost rural economies, combining job creation and economic benefits with the protection of the environment, the fight against climate change, and an improvement in animal welfare.

Meanwhile, the phytosanitary industry advocates for more investment in precision agriculture with new technologies, innovation, and appropriate legislation. Soil management can be significantly improved in the Iberian Peninsula with practices such as crop rotation, which do not put the survival of farms at risk from an economic point of view.

Poland

I left at the end the scenario and market characteristics probably closer to the Ukrainian case since I consider Carbon Farming ideal to boost Poland's yields.

Carbon farming practices could help Polish farmers cope with permanent drought as they could increase the productivity of their yields and activities serving the purpose of using soil in a more sustainable way and increasing the amount of carbon present in it make the soil more fertile and increase its production values.

Such soil becomes more resistant to drought, which in Polish conditions, with unstable weather and permanent drought in the summer season for the last ten years, can bring farmers higher yields.

However, in Poland at the moment there are no instruments that would support carbon farming in a broader way.

For European Carbon Farmers (ECF, *organisation promoting carbon farming practices in Poland and developing agricultural carbon payment mechanisms*), **regenerative agriculture is a much broader concept than organic farming.**

Appropriate use of regenerative farming methods – and in particular understanding of how nature's cycles work, including the carbon cycle – means that at some point the system becomes organic, meaning not using artificial methods for production.

ECF believes that **not enough farmers are aware that their farm is a part of the whole ecosystem**. The best example is that Polish agriculture still relies heavily on tillage, which is a practice that has a very negative impact on the carbon cycle.

IS CARBON FARMING LIKELY TO DEVELOP IN POLAND?

In Poland, the support for carbon farming will grow, among other reasons, because 40% of the new Common Agricultural Policy's (CAP) budget should be allocated to pro-climate measures. In the long run, farmers will benefit from improved soil quality, improved production performance and greater resilience. The implementation of carbon farming practices may imply the need for new investments, and the additional costs for farmers are compensated under the CAP. But farmers are not rewarded depending on the amount of carbon stored.

Pilot programmes have so far been launched in Europe which aim to reward farmers for tons of carbon sequestered in the soil, and farmers will soon be additionally rewarded for practices based on regenerative agriculture. But I should stress that **a necessary step for carbon farming in the EU and Poland will be the establishment of a legal framework for certification of sustainable carbon removal from natural ecosystems.** The Commission is currently working on a draft regulation on carbon farming, and the certification mechanism is to be proposed by 2023.

Poland's CAP Strategic Plan draft provides eco-schemes typical of carbon farming, such as simplified farming systems, diversification of crop structures and compliance with fertilization plans.

Poland could make use of the CAP, which includes many possibilities to support pro-ecological and pro-climate measures, especially under the second pillar, in rural areas. These funds support organic farming and agri-environmental programmes, which are not commonly referred to as carbon farming, but contribute to absorbing CO_2 from the air and storing it in the soil.

A final observation is that despite having the biggest budget in the EU for the rural development pillar, Poland does not fully exploit the opportunities provided in the CAP. It allocates fewer funds for organic farming and ambitious agri-environmental programmes and spends large sums on other objectives.

Australia

The Australian Carbon Farming Initiative (CFI) is a voluntary carbon offsets scheme.

It is an integral component of the Emissions Reduction Fund (ERF) and allows land managers to earn carbon credits by changing land use or management practices to store carbon or reduce greenhouse gas emissions.

The Carbon Credits (Carbon Farming Initiative) Regulations 2011 were recently amended with the aim at reducing the regulatory burden for forestry sector participation in the ERF, while recognizing the need to ensure ERF projects do not pose a cumulative risk of an adverse effect on water availability.

The amendment to Regulation 3.37 allows for ERF plantation forestry and farm forestry projects in higher rainfall areas to participate in the ERF if they are located in a region where the planting of trees is unlikely to have a material adverse impact on the availability of water.

The regulatory burden for these projects will be reduced as land managers will not need to apply through other pathways in the regulations.

Regional forestry hubs and areas approved as regions for further plantation establishment are:

- Southwest Western Australia
- Tasmania
- Green Triangle, South Australia side

- Green Triangle, Victoria side
- Kangaroo Island, South Australia
- Southern Victoria
- Southwest Slopes, Victoria, and New South Wales
- Northeast New South Wales

Further forestry hubs are under consideration, in addition to the current regional forestry hubs and areas that have been identified as specified regions by the Australian Government.

The Department of Industry, Science, Energy and Emissions Reduction has the lead responsibility for the water rule and is responsible for determining what activities are eligible under the CFI.

The Department of Agriculture, Water and the Environment (DAWE) consistent with its national water policy function, is responsible for advising where plantations are likely to have a material adverse impact on water availability under the CFI.

DAWE has two roles regarding water policy: ensuring compliance under the National Water Initiative (NWI) and under the amended Regulation 3.37 to provide advice on whether projects are likely to have a material adverse impact on water availability.

DAWE conducts risk-based assessments to determine whether the planting of trees would be likely to have a material adverse impact on the availability of water.

When conducting an assessment DAWE will:

- identify where there is no evidence of plantations intercepting water that would otherwise be available for regulated consumption or environmental use; and
- consider state and regional arrangements in place, the region's water allocations, risks to water resources, and monitoring and reporting.

Arrangements to manage interception activities vary across the states and territories and each of them has management, planning, and regulatory arrangements that govern forestry and commercial plantations.

Project proposals in regions that are not included in the specified forestry hubs may still be eligible for the CFI and should refer to the Carbon Credits (Carbon Farming Initiative) Regulations 2011 for more information on eligibility criteria.

USA

To meet the climate challenge, the United States needs a comprehensive national approach. Well-designed federal policy can cut emissions and strengthen resilience while driving economic growth.

In the absence of stronger federal leadership, many states are enacting their own climate goals and policies. They serve as laboratories, demonstrating what's effective and informing national policy.

A growing number of jurisdictions are adopting market-based climate policies. By putting a price on carbon, these policies give businesses the incentive to innovate so they can cut emissions at the lowest possible cost.

Compared to command-and-control regulations, carbon pricing is a market-based mechanism that creates financial incentives to reduce greenhouse gas (GHG) emissions.

12 states that are home to over a quarter of the U.S. population and account for a third of U.S. GDP have active carbon-pricing programs and are successfully reducing emissions.

Those states are California and the eleven Northeast states — Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and Virginia — that make up the Regional Greenhouse Gas Initiative (RGGI).

RGGI is the first mandatory cap-and-trade program in the United States to limit carbon dioxide emissions from the power sector.

California's program was the first multi-sector cap-and-trade program in North America.

Massachusetts has also implemented regulations to establish an additional cap-and-trade program for its power sector that runs in parallel with RGGI but extends out to 2050.

Washington state recently enacted new cap-and-invest legislation to take effect beginning in 2023. Compared to command-and-control regulations, carbon pricing is a market-based mechanism that creates financial incentives to reduce greenhouse gas (GHG) emissions.

Example: American Carbon Registry (ACR)

The ACR is the first independent voluntary offset program in the world and have since branched out to credit emission reductions for both voluntary and compliance (e.g. CORSIA) markets, from projects based primarily in the US.

Main information

Administrative body: Winrock International

Year of implementation : 1996

Type of jurisdiction covered : Independent

Registered activities as of December, 31 2020 : 122

Credit name: Verified Emission Reductions (VERs)

Credits issued (MtCO2e) as of December, 31 2020: 50

Credits retired or cancelled (MtCO2e) as of December, 31 2020: 8.5 Scope

Geographic coverage : Global

Countries with project: 5

Carbon pricing initiatives accepting issued credits for compliance: CORSIA, Washington State CAR

Sectors covered: Agriculture, CCS/CCU, Energy efficiency, Forestry, Fuel switch, Industrial gases, Manufacturing, Renewable energy, Transport, Waste

Price range 2020: US$5.38/tCO2e (unweighted average)

WRAP UP SECTION Part 1 – Common Questions & Answers

Is the voluntary carbon market currently very developmental and fragmentary in nature?

YES, and this represents both an opportunity for market participants and a risk, given the potential reputational fallout from any shortcomings in case methodologies are not adequately sound and are scrutinized in the media. Effective program and methodology planning, and effective Measurement, Reporting and Verification (MRV) of emissions and emissions reductions is perhaps the most critical factor for the establishment of a viable business in this sector.

Who can verify carbon credits?

All credits issued from any of the major carbon standards (CAR, VCS, ACR, GS) will have undergone a robust verification process by an ISO accredited third-party verifier. These credits are also all tracked on registries to ensure emissions reductions are not double counted.

How do I buy CO2 credits?

A commonly used purchasing option is to contract directly with a project developer for delivery of carbon offset credits as they are issued. Such contracts generally take the form of "Emission Reduction Purchase Agreements" (or ERPAs).

What is GHG verification?

GHG emissions validation and verification may be pursued by an organization for a number of reasons such as to contribute to their annual report, to communicate to their customer, to meet regulatory or investor reporting requirements, or publicly disclose their emission reduction achievements.

What is a carbon broker?

Brokers usually do not take ownership of the underlying carbon offset credit; rather, carbon offset brokers help to facilitate the transaction in exchange for a commission. Brokers primarily operate in the compliance carbon markets, but some brokers also operate in the voluntary carbon market.

Can farmers sell carbon credits?

In a voluntary market, companies voluntarily purchase carbon credits to offset their emissions. Currently, markets organized by publicly and privately-owned companies are the only way farmers can sell carbon.

Can I sell my trees for carbon credits?

Credits are issued to individuals or companies growing compliant forests and these credits can be sold to a carbon emitter such as a power company, using them to 'offset' a power station's CO2-e emissions.

What is the difference between carbon credit and carbon offset?

Carbon credits stands for the right to emit that carbon, while the carbon offsets represent the production of a certain amount of sustainable energy to counterbalance the use of fossil fuels.

How do carbon credit markets work?

Carbon markets turn emission reductions and removals into tradeable assets. These credits are generated from emission reduction projects (a solar farm or forest conservation easement, for example) or pollution allowances allocated by government cap-and-trade systems.

How do farmers get carbon credits?

In the case of farming, carbon credits are created based on carbon dioxide you draw down into your soil and GHG emissions you reduce above the soil (for example, through improved nitrogen timing) – beyond what was already happening on your farm. Carbon credits operate like crops in some ways.

What is the relationship between VER offsets and credits?

Voluntary Emission Reductions or Verified Emission Reductions (VERs) are a type of carbon offset exchanged in the voluntary or over-the-counter market for carbon credits. One VER is equivalent to 1 tonne of CO2 emissions.

Verified emission reductions are also commonly known as carbon offsets, carbon credits, or carbon offset credits. Verified emission reductions (VERs) are essentially a reduction in greenhouse gas emissions (GHGs) from a project that is independently audited (i.e., verified) against a third-party certification standard.

How do a developer (e.g., farmer) can sell and get paid for carbon credits?

Farmers and any landowners can sell carbon credits because ALL land can store carbon. Landowners are eligible to receive carbon credits at the rate of one per every ton of CO2 their land sequesters. Landowners can sell carbon offsets on what are called voluntary carbon markets. Then transparent marketplaces such as LandGate helps landowners sell their carbon credit at the highest price through a simple process. When a landowner decides to provide land for carbon credits, they agree to certain practices such as not chopping down trees that store carbon for timber and practicing regenerative agriculture to maximize carbon storage.

These carbon credit buyers are purchasing carbon credits as an investment or are businesses trying to meet internal standards for carbon footprint reduction.

What is carbon storage?

Carbon storage is the process of capturing carbon dioxide from the atmosphere to reduce its presence in the atmosphere. You may also see carbon storage referred to as carbon sequestration, carbon capture and storage, CO2 storage, or carbon offsets.

How does carbon storage work?

Land naturally captures carbon dioxide from the atmosphere through plant vegetation (photosynthesis) and geologic processes. Companies and entities that emit carbon dioxide are now needing to offset their carbon dioxide emissions. Since land is naturally capturing carbon dioxide, landowners could be earning carbon credits that companies want to buy for carbon offsets.

What type of land captures the most carbon dioxide?

For biological carbon capturing, the amount of vegetation growth (photosynthesis) that takes place on farmer's property determines how much carbon dioxide is being removed from the atmosphere. Land that is in areas with dense, mature tree stands and locations with soils containing high percentages of organic carbon captures relatively high amounts of carbon dioxide. Both forested areas and farmland can capture relatively high amounts of carbon dioxide. Areas that are located in dry, arid regions with little to no vegetation capture relatively low amounts of carbon dioxid.

How much could a landowner make selling carbon credits for carbon offsets on his land?

The value of land for carbon offsets will depend on many factors including the acreage, climate, tree coverage, soil types, surface activity, and more. Marketplaces such as LandGate has combined these factors to present sellers with a Carbon LandEstimate™, or an approximation of what their land could be worth in carbon credits through carbon offsets. To find the carbon LandEstimate™, the landowner could simply locate its property on LandEstimate map and claim ownership.

Landowner would be paid for carbon credits on his land based on the amount of carbon dioxide his specific parcel of land captures. Companies will make offers to purchase or lease their carbon credits for an allotted period of time and they will be paid on a regular basis dependent on the individual contract or carbon storage lease they sign with the purchaser.

EXAMPLE of Verification & Selling Process of Carbon Credits for Carbon Offsets

EXECUTION WITH THE MARKETPLACE LANDGATE

Potential landowner can discover the value of its land and maximize profits by listing on Landgate's **transparent marketplace**.

Sellers or lessors receive a free professional appraisal and have experts working to get you the best deal and terms.

Like a real estate agent, LandGate receives a small success-based commission at closing.

11. **Listing/Brokerage Agreement**
    - Client provides legal description of the property to LandGate
    - Brokerage agreement between client and LandGate
12. **Marketing Preparation**
    - LandGate works on the legal description of the property
    - LandGate builds the property on the website
    - LandGate completes an appraisal of the property
    - LandGate reviews the appraisal of the property with the client
13. **Marketing of Property**
    - With the client's approval, LandGate lists and markets the property on our marketplace
    - LandGate receives offers from potential lessees or buyers during the marketing period
    - LandGate maintains a continuous communication with the client about the offers received during the marketing period
    - LandGate makes counteroffers if applicable
14. **Selection of Best Offer**
    - LandGate presents the offers and its recommendation to the client
    - Client selects the best offer
15. **Lease or Purchase Agreement**
    - LandGate negotiates the lease or buying agreement with selected lessee or buyer; LandGate continuously communicates progress to the client and integrates client's requests
    - Client is welcome to hire an attorney that can review and provide legal counsel to the client regarding the lease/buy agreement; LandGate can refer the client to a list of independent local attorneys at client's request
16. **Buyer's Due Diligence**
    - Due diligence is lessee's responsibility including any expense
17. **Closing**
    - Closing
    - Payment

Project name: **Supporting Green Recovery in Ukraine**

Part 2

Overview and analysis of existing compulsory carbon markets worldwide, EU Emissions Trading System and EU carbon farming initiatives through the prism of Ukraine opportunities

9. Introduction to Compulsory/Mandatory/Regulated Carbon Markets

In the first part of this study, we introduced the terms **carbon offset** and **carbon offset credit** (or simply "offset credit").

They are used interchangeably, though they can mean slightly different things:

1. A carbon offset broadly refers to a **reduction in GHG emissions** – or an increase in carbon storage (e.g., through land restoration or the planting of trees) – that is used to compensate for emissions that occur elsewhere.
2. A carbon offset credit is a **transferrable instrument certified** by governments or independent certification bodies to represent an emission reduction of one metric ton of CO2, or an equivalent amount of other GHGs.

The key concept is that offset credits are used to convey a net climate benefit from one entity to another. Because GHGs mix globally in the atmosphere, it does not matter where exactly they are reduced.[1] From a climate change perspective, the effects are the same if an organization: (a) ceases an emission-causing activity; or (b) enables an equivalent emission-reducing activity somewhere else in the world. Carbon offsets are intended to make it easier and more cost-effective for organizations to pursue the second option.

Carbon offset credits are not a simple commodity. Standard-setting organizations have been established to provide quality assurance for carbon offsets.

These carbon offset programs range from **international or governmental regulatory bodies** – such as the United Nation's Clean Development Mechanism (CDM) Executive Board, which oversees carbon offsets under the Kyoto Protocol – to **independent non-governmental organizations (NGOs).** Historically, **governmental bodies certified offset credits for regulatory purposes** ("compliance programs"), while **NGOs primarily served voluntary buyers ("voluntary programs")**; more recently, both types of programs have begun to serve both types of markets. Each carbon offset program issues its own labelled "brand" of credit.

Offset programs perform three basic functions:

1. develop and approve standards that set criteria for the quality of carbon offset credits
2. review offset projects against these standards (generally with the help of third-party verifiers)
3. operate registry systems that issue, transfer, and retire offset credits.

In conjunction of above, **Carbon Pricing is considered a cost-effective policy tool** that governments and companies can use as part of their broader climate strategy.

The three main policy instruments used to price carbon are:

- **Carbon taxes**: Carbon taxes set a fixed price per unit of emissions to help internalize the cost of emissions and provide incentives for emissions reductions.
- **Emissions trading systems**: An Emissions Trading System (ETS) imposes a cap on the total emissions in one or more sectors of the economy. The regulator issues a number of tradable allowances not exceeding the level of the cap. Each allowance typically corresponds to one ton of emissions.5 Entities covered by the ETS are then allowed to trade these allowances, resulting in a market price for the allowances. This type of ETS is also called a "cap and trade system."
- **Crediting mechanisms**: These mechanisms credit emissions reductions or carbon sequestration. They come in various forms, but generally operate by establishing a reference emissions level or intensity (called the baseline) and generating "credits" if firms reduce emissions to below the baseline level, or

by permanently sequestering carbon. Crediting mechanisms thus create a supply of verified credits but cannot operate in the absence of sources of demand, which often comes from linking these to an ETS or a carbon tax (where credits can be used for compliance).

Therefore, Carbon pricing policies are enacted by a government mandate and impose a price based on carbon content. Most commonly, they are enacted by a government mandate through either a **Carbon Tax** or an **ETS.** In the case of a carbon tax, the government determines the price and lets market forces determine emissions reductions.

The **two main forms of an ETS** are: **cap-and-trade** and **baseline-and-credit**.

For cap and trade, the government determines a limit on emissions ("the cap") in a particular period and allowances that make up the cap are either auctioned or allocated according to criteria. The market determines the carbon price.

Under a baseline-and-credit system, baselines are set for regulated emitters. Emitters with emissions above their designated baseline need to surrender credits to make up for these emissions. Emitters that have reduced their emissions below their baseline receive credits for these emission reductions, which they can sell to other emitters.

Crediting mechanisms create tradable credits from voluntarily implemented emission reduction or removal activities, as we have seen in Part 1.

Crediting activities can range from stand-alone projects to programmatic or sectoral activities that have a broader geographical or technical scope. Credits can be issued through domestic crediting mechanisms, where governments set the rules and basis for generating credits. Alternatively, credits can be issued under international mechanisms, like the potential Article 6.4 mechanism under the Paris Agreement.

As also seen, credits are also generated through independent standard-setting organizations, like Verra or Gold Standard. Credits can be used to meet compliance demand, for instance, in helping companies meet their obligations under a carbon tax or ETS. They may also be used to meet voluntary demand, as part of a company's net-zero strategy or for other purposes.

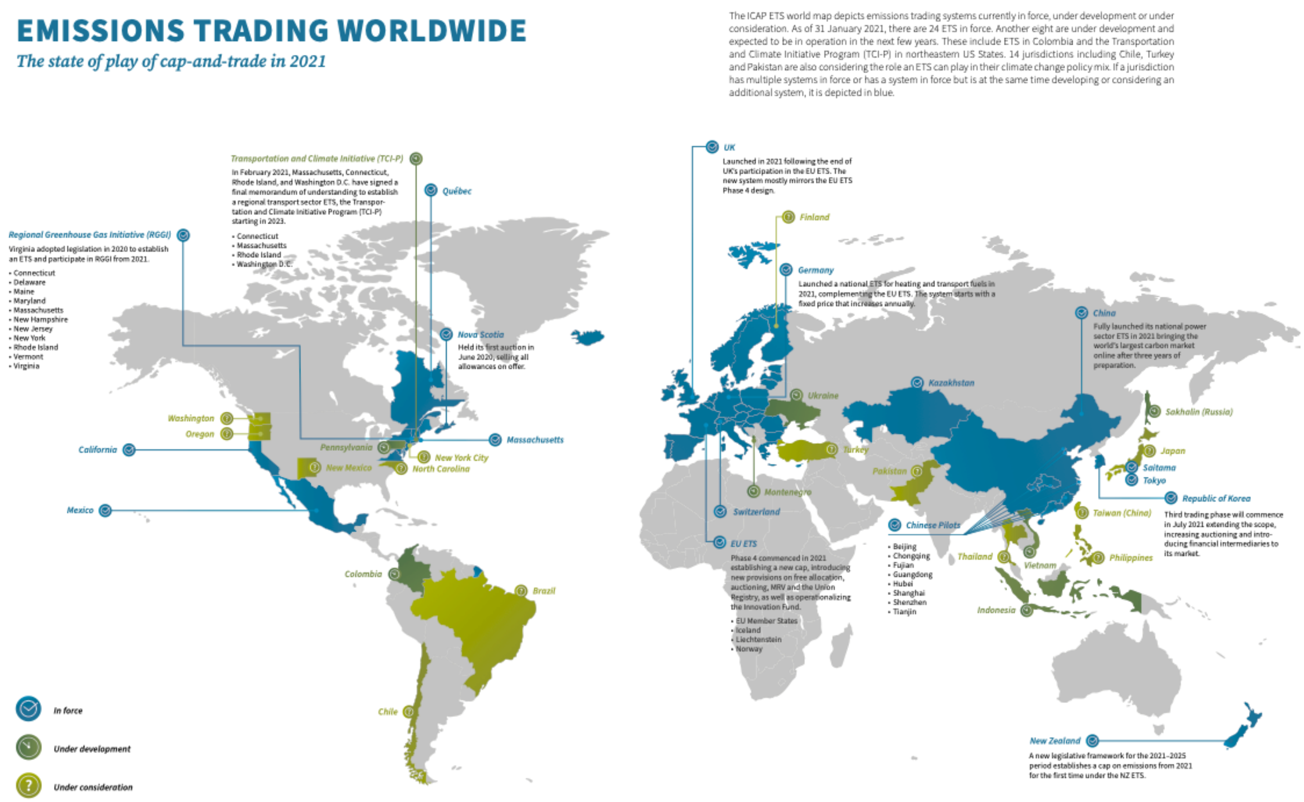
The sum of credit transactions used for voluntary commitments is commonly referred to as the "voluntary carbon market" which we explained extensively in Part 1.

The reason why we include credits from voluntary market programs in this Part 2 introduction is that they can be also used for compliance under some carbon taxes or ETSs.

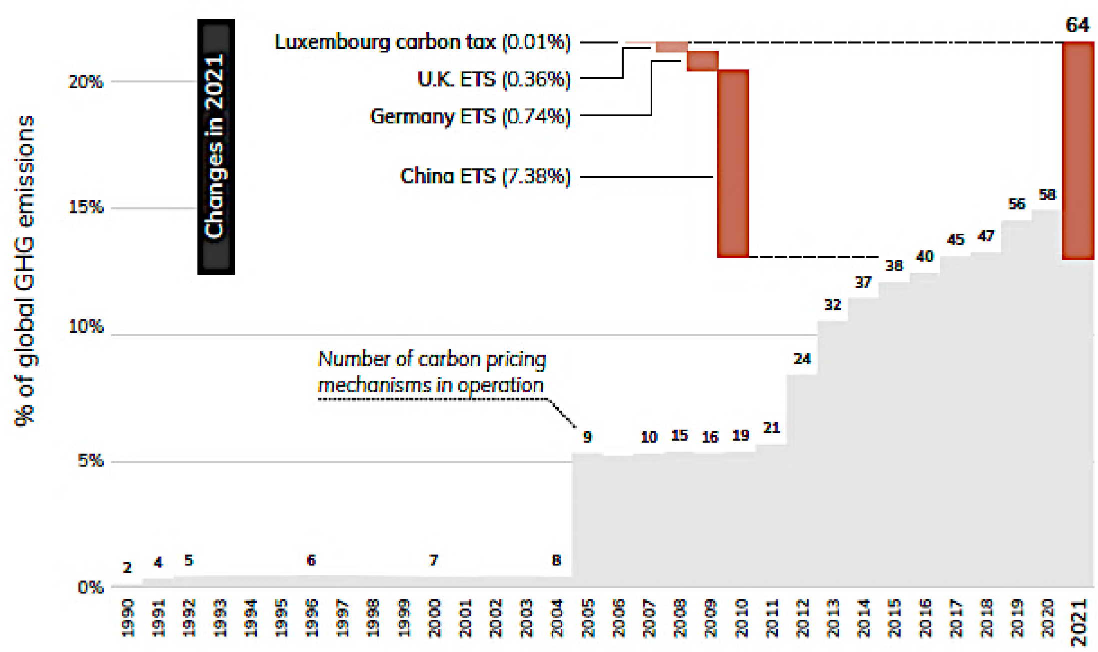
An important theoretical difference between ETSs and other carbon pricing instruments is that the level of emissions reduction is more certain (because the cap dictates the total emissions from covered sectors), but the price is not fixed and is determined by the demand for allowances.

In practice, **most carbon pricing mechanisms act as a hybrid**, **including elements of carbon taxes, ETSs, and crediting systems**.

For instance, most ETSs employ Price or Supply Adjustment Measures (PSAMs) to control the price or quantity of allowances, leading to more certain prices and less certain emissions reductions. This makes the distinction between ETSs and taxes less clear. Different carbon pricing policies can also exist alongside each other at the same time: for instance, a carbon tax could apply in the transport sector, while emissions trading operates in the industry and power sectors.



In 2021, 21.5% of global GHG emissions were covered by carbon pricing instruments in operation, representing a significant increase on 2020, when only 15.1% of global emissions were covered. This increase is largely due to the launch of China's national ETS (see figure)



Source: Global Atmospheric Research (EDGAR) version 5.0 including biofuels emissions. From 2015 onward, the share of global GHG emissions is based on 2015 emissions from EDGAR.

China's national ETS launched in February 2021, becoming the world's largest carbon market.

Initially covering around 2,225 entities in the power generation industry, the plan regulates annual emissions of around 4,000 $MtCO_2$.

Regulated entities will need to surrender allowances to cover their 2019 and 2020 emissions in 2021.

Penalties for the national ETS are currently being drafted by the State Council, with interim regulations proposing fines for entities that fail to surrender sufficient allowances by the compliance deadline.

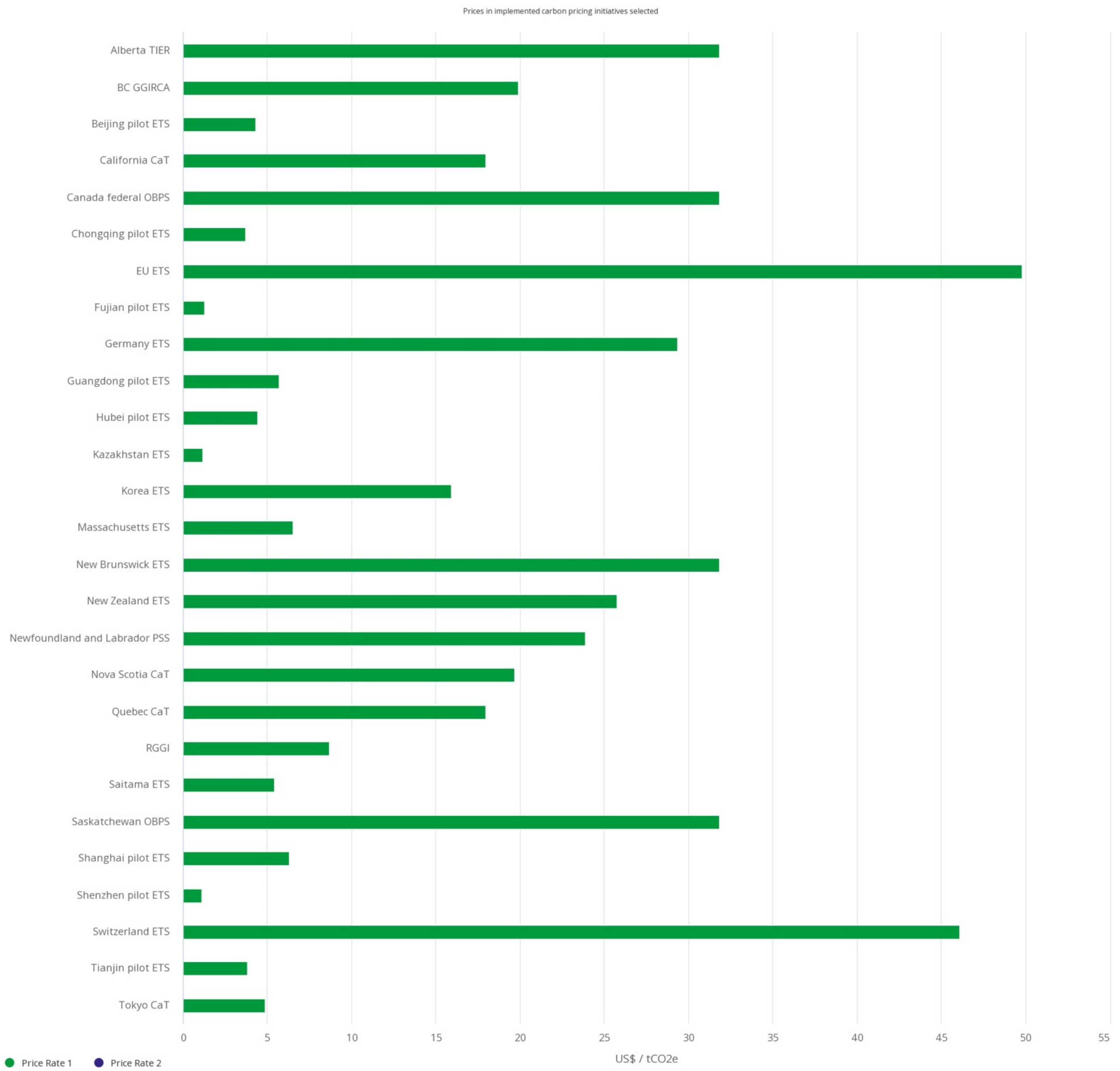
The national carbon market will be a tool to promote China's commitment to peak carbon before 2030 and achieve carbon neutrality before 2060.

In general, a majority of carbon prices still remain far below the USD 40–80/tCO_2e range needed in 2020 to meet the 2°C temperature goal of the Paris Agreement — only 3.76% of global emissions are covered by a carbon price at and above this range.

Even higher prices will be needed over the next decade to reach the 1.5°C target.

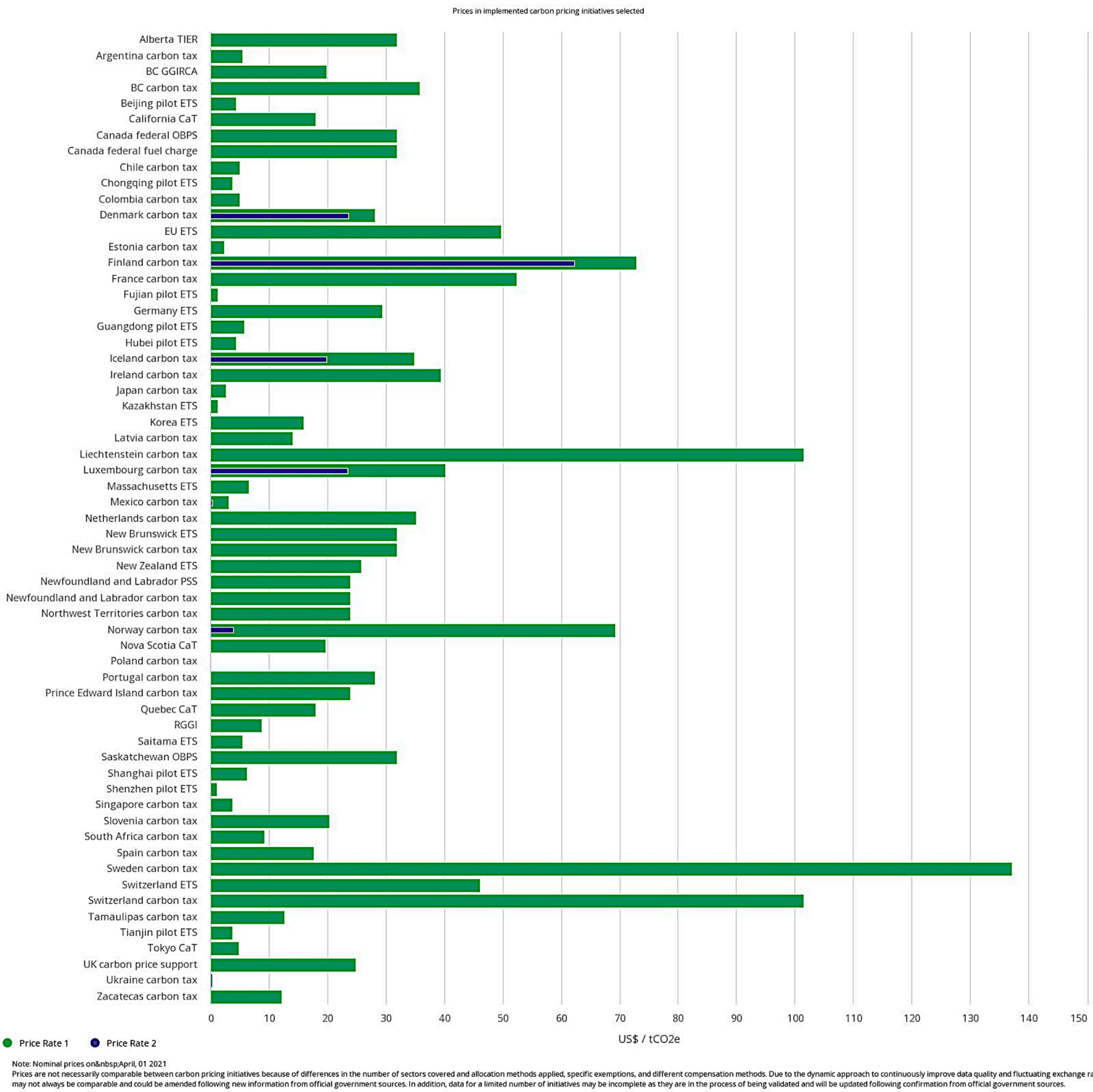
In the graph below it is resumed the pricing level for EU ETS Vs other major ETS implemented end of 2021:

Below, all the ETS implemented in the world by the end of 2021 and carbon pricing comparison:



Note: Nominal prices on April, 01 2021
Prices are not necessarily comparable between carbon pricing initiatives because of differences in the number of sectors covered and allocation methods applied, specific exemptions, and different compensation methods. Due to the dynamic approach to continuously improve data quality and fluctuating exchange rat may not always be comparable and could be amended following new information from official government sources. In addition, data for a limited number of initiatives may be incomplete as they are in the process of being validated and will be updated following confirmation from official government sources.

In the next graph, also Carbon Tax are included as carbon pricing initiatives, implemented as per Q2 2021 (in blue):



The graphs above are linked to the overall information gathered in following tables.

Name	Type	Jurisdiction	Region	GHGs covered [MtCO2e]	Proportion of global GHGs	Value [bn$]
Alberta TIER	ETS	Alberta	North America	153.87512	0.002840319	2.783371811
Argentina carbon tax	Carbon tax	Argentina	Latin America and the Caribbean	88.1248	0.00162666	0.180258345
BC GGIRCA	ETS	British Columbia	North America	0	0	0
BC carbon tax	Carbon tax	British Columbia	North America	46.3749	0.000856016	1.374762505

Baja California carbon tax	Carbon tax	Baja California	Latin America and the Caribbean	N/A	N/A	0
Beijing pilot ETS	ETS	Beijing	East Asia & Pacific	69.65343	0.001285704	0.610211026
California CaT	ETS	California	North America	352.64	0.006509239	5.11326
Canada federal OBPS	ETS	Canada	North America	73.52361	0.001357143	0
Canada federal fuel charge	Carbon tax	Canada	North America	179.72438	0.00331746	3.010831877
Chile carbon tax	Carbon tax	Chile	Latin America and the Caribbean	58.10493	0.001072535	0.1655
China national ETS	ETS	China	East Asia & Pacific	3996.904164	0.073777236	0
Chongqing pilot ETS	ETS	Chongqing	East Asia & Pacific	21.20448	0.000391405	0.530538721
Colombia carbon tax	Carbon tax	Colombia	Latin America and the Caribbean	44.3532	0.000818698	0.116589315
Denmark carbon tax	Carbon tax	Denmark	Europe and Central Asia	22.0087	0.00040625	0.534777077
EU ETS	ETS	EU, Norway, Iceland, Liechtenstein	Europe and Central Asia	1725.77348	0.031855354	33.6623297
Estonia carbon tax	Carbon tax	Estonia	Europe and Central Asia	1.6059472	2.96E-05	0.00274603
Finland carbon tax	Carbon tax	Finland	Europe and Central Asia	40.29444	0.000743779	1.419629896
France carbon tax	Carbon tax	France	Europe and Central Asia	171.723904	0.003169782	8.9675225
Fujian pilot ETS	ETS	Fujian	East Asia & Pacific	76.008	0.001403001	0.256190096
Germany ETS	ETS	Germany	Europe and Central Asia	398.6204	0.007357973	0
Guangdong pilot ETS	ETS	Guangdong (except Shenzhen)	East Asia & Pacific	163.30875	0.00301445	1.921109004
Hubei pilot ETS	ETS	Hubei	East Asia & Pacific	138.37428	0.002554195	0.913140331
Iceland carbon tax	Carbon tax	Iceland	Europe and Central Asia	2.6158	4.83E-05	0.046959019
Ireland carbon tax	Carbon tax	Ireland	Europe and Central Asia	32.16115	0.00059365	0.579608162
Japan carbon tax	Carbon tax	Japan	East Asia & Pacific	1008.9135	0.018623126	2.438185863
Kazakhstan ETS	ETS	Kazakhstan	Europe and Central Asia	156.52129	0.002889163	0.180217114
Korea ETS	ETS	Korea, Republic	East Asia & Pacific	513.41955	0.009477004	17.9672244
Latvia carbon tax	Carbon tax	Latvia	Europe and Central Asia	0.53556	9.89E-06	0.018120264
Liechtenstein carbon tax	Carbon tax	Liechtenstein	Europe and Central Asia	0.054184	1.00E-06	0.002082039
Luxembourg carbon tax	Carbon tax	Luxembourg	Europe and Central Asia	7.03365	0.000129831	0
Massachusetts ETS	ETS	RGGI	North America	11.8849	0.000219379	0.06968782
Mexico carbon tax	Carbon tax	Mexico	Latin America and the Caribbean	188.191055	0.003473743	0.254477281
Mexico pilot ETS	ETS	Mexico	Latin America and the Caribbean	328.718	0.006067673	0
Netherlands carbon tax	Carbon tax	Netherlands	Europe and Central Asia	25.63644	0.000473213	0
New Brunswick ETS	ETS	New Brunswick	North America	N/A	N/A	0

New Brunswick carbon tax	Carbon tax	New Brunswick	North America	5.52318	0.00010195	0.068052327
New Zealand ETS	ETS	New Zealand	East Asia & Pacific	45.25383	0.000835322	0.480839591
Newfoundland and Labrador PSS	ETS	Newfoundland and Labrador	North America	4.58767	8.47E-05	0
Newfoundland and Labrador carbon tax	Carbon tax	Newfoundland and Labrador	North America	5.01443	9.26E-05	0.064347519
Northwest Territories carbon tax	Carbon tax	Northwest Territories	North America	1.33273	2.46E-05	0.018384894
Norway carbon tax	Carbon tax	Norway	Europe and Central Asia	49.33104	0.000910582	1.45477404
Nova Scotia CaT	ETS	Nova Scotia	North America	13.244	0.000244466	0
Poland carbon tax	Carbon tax	Poland	Europe and Central Asia	16.103025	0.000297239	0.001117735
Portugal carbon tax	Carbon tax	Portugal	Europe and Central Asia	23.56424	0.000434963	0.520365678
Prince Edward Island carbon tax	Carbon tax	Prince Edward Island	North America	0.96936	1.79E-05	0.012121315
Quebec CaT	ETS	Quebec	North America	60.90162	0.001124158	0.837522
RGGI	ETS	RGGI	North America	160.263024	0.00295823	0.448362
Saitama ETS	ETS	Saitama	East Asia & Pacific	7.44	0.000137332	0.006587145
Saskatchewan OBPS	ETS	Saskatchewan	North America	8.65238	0.000159711	0
Shanghai pilot ETS	ETS	Shanghai	East Asia & Pacific	104.195	0.001923293	0.80088684
Shenzhen pilot ETS	ETS	Shenzhen	East Asia & Pacific	24.38409	0.000450096	0.074993739
Singapore carbon tax	Carbon tax	Singapore	East Asia & Pacific	44.7824	0.00082662	0.134295162
Slovenia carbon tax	Carbon tax	Slovenia	Europe and Central Asia	10.645914	1.97E-04	0.080870257
South Africa carbon tax	Carbon tax	South Africa	Sub-Saharan Africa	512.248	0.009455379	0.097281635
Spain carbon tax	Carbon tax	Spain	Europe and Central Asia	9.22398	0.000170262	0.120296034
Sweden carbon tax	Carbon tax	Sweden	Europe and Central Asia	44.1486629	0.000814922	2.295169193
Switzerland ETS	ETS	Switzerland	Europe and Central Asia	6.0415476	0.000111518	0.116563086
Switzerland carbon tax	Carbon tax	Switzerland	Europe and Central Asia	18.1246428	0.000334555	1.214004592
Tamaulipas carbon tax	Carbon tax	Tamaulipas	Latin America and the Caribbean	N/A	N/A	0
Tianjin pilot ETS	ETS	Tianjin	East Asia & Pacific	53.757	0.000992279	0.464520504
Tokyo CaT	ETS	Tokyo	East Asia & Pacific	13.18	0.000243284	0.010150587
UK ETS	ETS	United Kingdom	Europe and Central Asia	192.426201	0.003551917	0
UK carbon price support	Carbon tax	United Kingdom	Europe and Central Asia	134.115231	0.002475579	0.85218852
Ukraine carbon tax	Carbon tax	Ukraine	Europe and Central Asia	221.58319	0.004090114	0.047692308
Virginia ETS	ETS	Virginia	North America	0	N/A	0
Zacatecas carbon tax	Carbon tax	Zacatecas	Latin America and the Caribbean	N/A	N/A	0

Name of the initiative	Type of the initiative	Year	Description of the initiative
Alberta TIER	ETS	2007	The Technology Innovation and Emissions Reduction (TIER) is a baseline-and-credit ETS that allows the use of facility-specific benchmarks and covers facilities that emit at least 100 ktCO2e per year. It came into effect on January 1, 2020, replacing the Carbon Competitive Incentive Regulation (CCIR) that started in 2018. Following a change in government in April 2019, Alberta replaced its Carbon Competitiveness Incentive Regulation (CCIR) with the Technology Innovation and Emissions Reduction (TIER) Regulation system, a baseline-and-credit ETS, effective as of January 1, 2020. Under the new system, electricity must continue to meet a clean-as-best gas benchmark while the emissions performance benchmark that other industrial facilities need to meet can now also be based on 90% of their past performance instead of only a sector-wide benchmark under the CCIR. Facility-specific benchmarks will reduce by 1% annually as of 2021. Facilities can meet their benchmark by reducing emissions, purchasing performance credits from other facilities, using Alberta-based emission offsets or paying into a TIER compliance fund at CAN$40/tCO2e (US$32/tCO2e), a price consistent with the federal minimum carbon price for 2021. Use of carbon pricing revenues include investment in programs and policies to reduce emissions and reduction of government debt.
Argentina carbon tax	Carbon tax	2018	The government of Argentina implemented a carbon tax (official name: Impuesto al dioxido de carbono) on January 1, 2018 for most liquid fuels, replacing previous fuel taxes. The revenue is designated to multiple beneficiaries, including the National Housing Fund, the Transport Infrastructure Trust, and the social security system, among others. For fuel oil, mineral coal, and petroleum coke, the tax rate became operational from the beginning of 2019, at 10% of the full tax rate, and will increase annually by 10%age points to reach 100% in 2028. 100% of this revenue is distributed according to the Federal Revenue Distribution System.
Austria carbon tax	Carbon tax	2022	Austria has proposed a carbon levy of €30/t CO2 as part of broader fiscal reforms (including reducing corporate and income tax rates). The proposed carbon tax would start in mid-2022 and rise to €55/t CO2 in 2025.
BC GGIRCA	ETS	2016	The British Columbia Greenhouse Gas Industrial Reporting and Control Act (GGIRCA) enables a price to be put on emissions of industrial facilities or sectors exceeding a specific limit, in addition to the province's existing revenue neutral carbon tax. This established a baseline-and-credit system that will covers liquefied natural gas (LNG) facilities currently under construction, once they become operational.
BC carbon tax	Carbon tax	2008	The British Columbia carbon tax (official name: B.C.'s Revenue Neutral Carbon Tax) aims to encourage people and businesses to innovate and find the most cost-efficient methods of reducing emissions to pay less in carbon tax. Revenue neutral means that the carbon tax revenue is recycled back into the economy through various income tax reductions and tax credits.
Beijing pilot ETS	ETS	2013	The Beijing pilot ETS is a cap-and-trade system that aims to control GHG emissions and coordinate measures against air pollution. It is also a key measure for the city of Beijing to meet its carbon intensity reduction target.
Brazil undecided	Undecided	TBC	Brazil's National Climate Change Policy, enacted in December 2009, aims to promote the development of a Brazilian market for emissions reductions. As part of its activities under the Partnership for Market Readiness (PMR), the Brazilian government is considering the implementation of market instruments to meet Brazil's mitigation targets and reduce overall mitigation costs. Brazil is assessing different carbon pricing instruments, including an ETS and a carbon tax. The Ministry of Economy is developing design options and conducting comprehensive economic and regulatory impact assessments for both instruments.
California CaT	ETS	2012	The California Cap-and-Trade Program is a cap-and-trade system that aims to help put California on the path to meet its goal of reducing GHG emissions to 1990 levels by 2020 and ultimately achieving an 80% reduction from 1990 levels by 2050.
Canada federal OBPS	ETS	2019	The pan-Canadian approach to carbon pricing is a pillar of the Pan-Canadian Framework on Clean Growth and Climate Change. The approach requires all Canadian provinces and territories to have a carbon pricing system in place that aligns with the federal standard. A federal carbon pricing backstop system comes into effect, in whole or in part in any province or territory that requested it or that does not have a price on carbon in place that meets the federal standard. The federal backstop system consists of two components: a tax-like component that is a regulatory charge on fuels and a baseline-and-credit ETS for emissions-intensive and trade-exposed industrial facilities called the Output-Based Pricing System (OBPS). All revenues from the federal system are returned to the province or territory in which they were collected.

Canada federal fuel charge	Carbon tax	2019	The pan-Canadian approach to carbon pricing is a central pillar of the Pan-Canadian Framework on Clean Growth and Climate Change. The approach requires all Canadian provinces and territories to have a carbon pricing initiative in place in 2019 that aligns with the federal standard. A federal carbon pricing backstop system came into effect, in whole or in part, in any province or territory in 2019 that requested it or that does not have a price on carbon in place that meets the federal standard. The federal backstop system consists of two components: a tax-like component that is a regulatory charge on fuels and a baseline-and-credit ETS for emissions-intensive and trade-exposed industrial facilities called the Output-Based Pricing System (OBPS). All revenues from the federal system are returned to the province or territory where they were collected.
Catalonia carbon tax	Carbon tax	TBC	Catalonia introduced provisions in the Catalonian Law on Climate Change in August 2017 for a carbon tax, which will apply to GHG emissions from large installations in the power, industry, agriculture and waste sectors, including EU ETS installations. Income from the tax would go to a Climate Fund to be used for climate change mitigation and adaptation policies. However, the future of this tax is unclear, as parts of the Catalonian Law on Climate Change were deemed unconstitutional by the Spanish Constitutional Court in June 2019 and the tax would need further legal framework to be operationalized.
Chile ETS	ETS	TBC	The implementation of the Chile carbon tax and a monitoring, reporting and verification system is designed to be ETS compatible to facilitate the possible implementation of an ETS in the future. The government is working on a Framework Law on Climate Change that sets a carbon neutrality goal for 2050. The draft law includes provisions for a possible trading system. Reductions below a facility-level regulated emission limits would be certified as an emission reduction by the Ministry of the Environment. These certified emission reductions could then be sold to other regulated entities to help those entities meet their regulated emissions limit. In addition, regulated entities can also use carbon credits from separate emission reduction or sequestration projects to meet their regulated emissions limits. The government would maintain two registries. One dedicated registry would track the projects and the transfers, while another would be used to report emissions from regulated entities. As of 2021, the draft law is still in legislative process after it was submitted to Congress in January 2020.
Chile carbon tax	Carbon tax	2017	The Chile carbon tax is a part of the tax on air emissions from contaminating compounds (impuesto destinado a gravar las emisiones al aire de compuestos contaminantes) and aims to reduce the negative impacts of fossil fuel use for the environment and public health. The tax is part of wider tax reforms to increase taxes for big businesses and lowering them for individuals. Following a broader tax reform in 2020, the carbon tax now applies to installations emitting 25,000 tCO_2 or more, as well as to those that release more than 100 tons of particulate matter into the air each year. Under the previous legislation, installations with a thermal capacity higher than 50 megawatts were subjected to the tax. The amendments also introduced the possibility to use offsets to meet compliance obligations, for which the rules still have to be established. The carbon tax rate remains at US$5/$tCO_2$.
China national ETS	ETS	2021	On December 19, 2017, China's National Development and Reform Commission (NDRC) officially launched the national ETS. In 2018, the climate change policy portfolio (including the development of the ETS) was shifted to the newly established Ministry of Ecology and Environment as part of a broader government restructuring. On February 1, 2021 the national ETS came into effect, initially covering the power sector. Accompanying the announcement of the launch of the China ETS in December 2017 was the release of a work plan outlining targets and the roadmap to develop the national ETS. The ETS roadmap consists of three phases: infrastructure development, simulated trading, and deepening and expanding. The infrastructure development phase is focused on completing the legal foundation and market support systems for the China national ETS, including the trading platform, registry, and data reporting systems. In the final deepening and expanding phase, the power sector will be the first sector to have compliance obligations under the ETS, which can be met by trading allowances on the spot market.
Chongqing pilot ETS	ETS	2014	The Chongqing pilot ETS was the last of the original seven Chinese pilot ETS to start and has experienced limited trading on its carbon market. Among the Chinese pilots, the Chongqing ETS is the only one that covers non-CO_2 gases. The cap-and-trade system aims to strengthen the management and control of GHG emissions while promoting a low-carbon society and accelerating the transformation of the economy.
Colombia ETS	ETS	TBC	On July 27, 2018, Colombia adopted its climate law, which outlines provisions for the establishment of an ETS. The ETS will complement the existing carbon tax and the annual cap will be aligned with Colombia's national GHG emission reduction targets. The climate law also specifies that allowance allocation under the ETS should primarily take place through auctions with revenues directed towards the National Environment Fund. The law states that the government may recognize payments under the existing carbon tax as an approach for emitters to meet their compliance obligations under the ETS.Colombia has been part of the Pacific Alliance and the 'Carbon Pricing in the Americas' initiative to explore regional carbon pricing.

Colombia carbon tax	Carbon tax	2017	The Colombia carbon tax (official name: Impuesto nacional al carbono) was adopted as part of a structural tax reform. The Colombia carbon tax was launched in 2017.
Cote dIvoire carbon tax	Carbon tax	TBC	Cote dIvoire is exploring carbon pricing as part of the policy options to reach the objectives of its NDC. Since 2015, the government has been organizing consultations with stakeholders in the public and private sector and undertaking a preliminary study to assess initial design options for the carbon pricing policy applicable to its national economy. As of 2021, the government still conducts additional analyses to explore in details the main elements to design a potential carbon tax.
Denmark carbon tax	Carbon tax	1992	The Denmark carbon tax (official name: CO2-afgift) was introduced to increase the profile of climate change and provide an economic incentive to consume less energy from carbon-intensive sources. It was introduced gradually as part of a larger environmental tax package, which includes energy taxes and a sulfur tax, as well as subsidies for green investments.
EU ETS	ETS	2005	The European Union Emissions Trading System (EU ETS) represents the central pillar of the EU climate change policy and is the oldest and largest ETS for GHGs operating worldwide. Introduced in 2005 and recently completed its third phase, the system has gone through several reforms and with the revised EU ETS Directive entered into force, its fourth phase started in January 2021.
Estonia carbon tax	Carbon tax	2000	The Estonia carbon tax is part of the Environmental Charges Act (Keskkonnatasude seadus), which aims to limit environmental pollution.
Finland carbon tax	Carbon tax	1990	Finland introduced their carbon tax (official name: Hiilidioksidivero) in 1990, making it the first country to introduce a carbon tax. The carbon tax is a component of the energy tax (official name: energiaverotusta). The energy tax further consists of a variable component based on the energy content of the fuel and a fixed component to finance maintaining security of supply.
France carbon tax	Carbon tax	2014	The French carbon tax is a part of the domestic tariffs on consumption of the energy products (taxes interieures sur la consommation des produits energetiques). The tax was introduced to include the impact of products on climate change and serves as a complementary policy measure to the EU ETS.
Fujian pilot ETS	ETS	2016	The cap-and-trade system intends to prepare companies for the national ETS and contribute to the emissions reduction and ecological development of the province. Unlike the other pilots, the mandate to introduce a pilot ETS in Fujian came from the State Council instead of the National Development and Reform Commission. Given the prominence of the forestry sector in Fujian, it also aims to encourage investments in and development of carbon sequestration projects.
Germany ETS	ETS	2021	On December 20, 2019, the Fuel Emissions Trading Act came into effect in Germany, establishing a national ETS for heating and transport fuels, which are currently not covered by the EU ETS, by putting a price on fuel suppliers and distributors starting in January 1, 2021. This is part of a wider national climate package adopted to help meet Germany's 2030 climate targets and its 2050 carbon neutrality target.
Guangdong pilot ETS	ETS	2013	The Guangdong pilot ETS is the largest ETS among the Chinese ETS pilots, in terms of covered emissions. The cap-and-trade system is a key instrument for the province to transform and upgrade its economy, increase welfare and raise awareness of GHG emission control among society and businesses. It has one of the most active markets among the Chinese ETS pilots with the largest market share of spot trading and is one of two Chinese ETS pilots open to foreign investors. It also allows unincorporated organizations such as funds and trusts to trade in its carbon market. Guangdong is a pioneer region in China in the use auctioning as an allowance allocation method.
Hawaii carbon tax	Carbon tax	TBC	Climate change policies for Hawai'i are being coordinated under the state's Climate Change Mitigation and Adaptation Commission as mandated by Act 32, Session Laws of Hawai'i 2017. One option, amongst others, that is being considered is carbon pricing. Carbon tax bills have been introduced in the 2020 and 2021 sessions, however, they have not passed to date. The State Energy Office, a member of the Commission, released a carbon tax study in February 2021. The report modeled different policy packages to assess impact on emissions and considered revenue recycling options to address the distributional impacts of a carbon price.
Hubei pilot ETS	ETS	2014	The Hubei pilot ETS has the most active market among the Chinese ETS pilots consisting of both spot and forward trades. The cap-and-trade system is a key instrument in achieving the province's GHG emission reduction target by turning carbon emissions into a resource and giving it a value by establishing resource scarcity through a cap on emissions. Hubei has been one of the most active regional markets in China in terms of trading. It also pioneered allowance spot forward trading in China. The Hubei ETS pilot is open to various market participants, including covered entities as well as institutional and individual (domestic and foreign) investors.

Iceland carbon tax	Carbon tax	2010	The Iceland carbon tax (official name: Kolefnisgjald a kolefni af jaroefnauppruna) is part of the Environmental and Resource tax. The tax was introduced as part of the government's tax reform on vehicles and fuels to encourage the use of environment-friendly vehilcles, save energy, reduce GHG emissions and increase the use of domestic energy sources. The tax serves as a complementary policy measure to the EU ETS.
Indonesia ETS	ETS	TBC	Indonesia is working towards a mandatory domestic ETS for the power sector as one of the policy mechanisms to help meet its NDC targets and foster low-carbon sustainable development. The specific design will be determined in implementing guidelines following the Presidential Regulation on Carbon Pricing currently under development, which will likely be combined with the carbon tax and carbon offset mechanisms.
Ireland carbon tax	Carbon tax	2010	The Ireland carbon tax (officially under three names: Natural Gas Carbon Tax, Mineral Oil Tax: Carbon Charge and Solid Fuel Carbon Tax) aims to reduce GHG emissions while using the revenues to boost energy efficiency, to support rural transport, to alleviate fuel poverty and to maintain or reduce payroll taxes. The tax serves as a complementary policy measure to the EU ETS.
Israel carbon tax	Carbon tax	TBC	In August 2021, The Israeli Ministers of Environmental Protection, Finance, Energy, and Economy announced the intention to implement a carbon tax. The carbon tax is anticipated to be applied through the existing fuel excise system and will cover coal, LPG, fuel oil, petcoke and natural gas) from 2023. While initially targeting fossil fuel combustion, there is scope to potentially expand coverage to include other emission sources, such as landfills.The intent is for the carbon tax to be the cornerstone for Israel to achieve its GHG emissions reduction targets.Government ministries continue to develop the policy and implementation plan.
Jalisco carbon tax	Carbon tax	TBC	In June 2020, the Mexican state Jalisco announced its plan to implement a carbon tax by 2021. The price rate and type of fossil fuels covered by the carbon tax are yet to be determined. Revenues would be used for climate change adaptation, mitigation and promoting economic and industrial sustainability.
Japan carbon pricing mechanism	ETS	TBC	An ETS has been under consideration in Japan since 2008. In March 2017, the Global Environment Committee of the Central Environment Council, an advisory committee to the Ministry of the Environment of Japan, formulated the 'Long-term Low-carbon Vision' for the country. The document refers to carbon pricing as essential to decarbonize the society. Based on that discussion, in March 2018 an expert committee on carbon pricing released a study assessing how carbon pricing could help Japan achieve long-term, substantial emissions reductions, as well as solve economic and social issues. In June 2018, a deliberative council, the 'Subcommittee on Utilization of Carbon Pricing, Global Environmental Subcommittee, Central Environment Council', was set up to consider how carbon pricing can encourage Japan to make the transition to a decarbonized society and to achieve economic growth.
Japan carbon tax	Carbon tax	2012	The Japan carbon tax (official name: Tax for Climate Change Mitigation) aims to put an economy-wide and fair burden for the use of all fossil fuels based on their CO2 content to realize a low-carbon society and strengthen climate change mitigation.
Kazakhstan ETS	ETS	2013	The Kazakhstan Emissions Trading Scheme started with a pilot phase in 2013 as a cap-and-trade system covering CO2 emissions of large emitters. Full enforcement of regulations and trading in the Kazakhstan ETS started in 2014, but the system was temporarily suspended in 2016-2017 to tackle operational issues and reform allocation rules. The Kazakhstan ETS was restarted on January 1, 2018 after legislative changes were made to improve the overall GHG emissions regulation, the ETS operation, the monitoring, reporting and verification system, and to lay the groundwork for the introduction of benchmarking.
Korea ETS	ETS	2015	The Republic of Korea launched its national ETS (Korea ETS) in 2015, the first national cap-and-trade system in operation in East Asia. The Korea ETS plays an essential role in meeting Korea's 2030 NDC target of 37% GHG emission reductions below BAU emissions, aiming to reduce GHG emissions in a cost-effective manner, transform the Korean industry to a low-carbon highly energy efficient industry and create new growth through green technology.
Latvia carbon tax	Carbon tax	2004	The Latvia carbon tax (official name: Nodokli par oglek?a dioksida) is part of the Natural Resources Tax Law (Dabas resursu nodokla likums), which aims to limit environmental pollution such as water and air pollution.
Liechtenstein carbon tax	Carbon tax	2008	The Liechtenstein carbon tax was implemented as a result of a bilateral treaty that requires Liechtenstein to transpose Swiss federal legislation on environmental levies into national law.
Luxembourg carbon tax	Carbon tax	2021	On January 1, 2021, Luxembourg started implementing its carbon tax at EUR31.56 (US$ 37.07)/tCO2e for petrol, EUR34.16 (US$40.12)/tCO2e for diesel and EUR20 (US$23.49)/tCO2e for all other energy products except electricity. The rate is planned to increase according to the National Integrated Energy and Climate Plan 2021-2030 to EUR25 (US$29.37)/tCO2e in 2022 and EUR30 (US$35.24)/tCO2e in 2023, to keep Luxembourg on track with its climate targets. Luxembourg's carbon tax policy will complement the EU ETS, which does not cover emissions from transportation, buildings and shipping. The government expects revenue exceeding

			EUR140 (US$164.44) million in 2021 and EUR180 (US$211.43) million in 2022. The expected revenues could be split between measures to combat climate change and social measures, such as a tax credit.
Malaysia ETS	ETS	TBC	Malaysia is considering using carbon pricing instruments, such as domestic ETS and carbon tax to help meet its NDC and long-term decarbonization goals. In October 2021, the Malaysia Climate Action Council will discuss the scope of a domestic ETS and roadmap for its preparation. Malaysia is also considering establishing guidelines for a voluntary carbon market.
Manitoba ETS	ETS	TBC	The Manitoba OBPS is a baseline-and-credit ETS covering industrial facilities with annual emissions of 50,000 tCO_2e or more, which represent about 6% of the province's GHG emissions. The OBPS provides opt-in provisions for smaller facilities. Facilities that exceed their limit can meet their compliance obligations by purchasing performance credits from other facilities, using Manitoba-based offsets or paying the Green Levy.
Manitoba carbon tax	Carbon tax	TBC	The Manitoba OBPS is a baseline-and-credit ETS covering industrial facilities with annual emissions of 50,000 tCO_2e or more, which represent about 6% of the province's GHG emissions. The OBPS provides opt-in provisions for smaller facilities. Facilities that exceed their limit can meet their compliance obligations by purchasing performance credits from other facilities, using Manitoba-based offsets or paying the Green Levy.
Massachusetts ETS	ETS	2018	The Massachusetts ETS (Massachusetts Limits on Emissions from Electricity Generators system) started operation in 2018 and covers the power sector in the state. It complements RGGI to help ensure that Massachusetts achieves its mandatory mitigation targets. The ETS aims to ensure that covered power plants will contribute to the state's target of reducing GHG emissions by 25% below 1990 levels by 2020 and 80% by 2050. The Massachusetts ETS exists in parallel to, but does not directly interact with, RGGI. Auction proceeds are used to fund mitigation, clean energy and vehicle electrification projects, as well as adaptation programs or projects involving communities adversely impacted by air pollution.
Mexico carbon tax	Carbon tax	2014	The Mexican carbon tax is an excise tax under the special tax on production and services (Ley del impuesto especial sobre produccion y servicios). It is not a tax on the full carbon content of fuels, but on the additional CO_2 emission content compared to natural gas.
Mexico pilot ETS	ETS	2020	On January 1, 2020, the Mexico pilot ETS started operation as part of a two-phase process to gradually establish an fully-fledged ETS for promoting cost-effective emission reductions without harming the international competitiveness of covered sectors. The pilot ETS covers power, oil and gas, and industrial sectors, which account for approximately 40% of the country's GHG emissions. Entities with annual emissions from direct sources of at least 100 $ktCO_2$ during 2016-2018, or in any year from the launch of the pilot, will be covered under the pilot ETS.
Montenegro ETS	ETS	TBC	In December 2019, Montenegro adopted the Law on Protection from the Negative Impacts of Climate Change. This law introduces a regulatory framework to limit GHG emissions from power and industry sectors and brings Montenegro closer to its accession to the European Union.
Netherlands carbon tax	Carbon tax	2021	Netherlands Industry Carbon Tax Act (Wet CO?-heffing industrie) entered into force on January 1, 2021 with a carbon tax rate of EUR30 (US$35.24)/$tCO_2e$ (including ETS price). The policy is one of the two initiatives related to national-level carbon pricing proposed under the National Climate Agreement presented by the Dutch government in June 2019. The policy aims at safeguarding a reduction of industrial GHG emissions of 14.3 $MtCO_2e$ in 2030. It is targeted at industrial installations subject to the EU ETS, waste incinerators and facilities emitting large amounts of nitrous oxide, that are not covered under the EU ETS. The measure will be applicable to 235 companies with 284 installations. This carbon tax comes on top of their compliance obligations in the EU ETS.Industrial Installations will have to pay the carbon tax, if their emissions exceed their baseline based on EU ETS benchmarks and a national reduction factor needed to reach the emission target. Emissions below this baseline are exempted and are allocated dispensation rights. Installations can exchange dispensation rights over the past calendar year. Covered installations can also use a surplus of dispensation rights to compensate for a shortage of dispensation rights in the past and thus get a refund of previously paid tax (up to five years earlier).
New Brunswick ETS	ETS	2021	New Brunswick submitted a proposal for its own OBPS for large industrial emitters to the federal government as an alternative to the federal OBPS, which was approved by the federal government on September 21, 2020. New Brunswick transitioned to the New Brunswick carbon pricing system for industry from January 1, 2021.
New Brunswick carbon tax	Carbon tax	2020	New Brunswick introduced a carbon tax as of April 1, 2020 to replace the imposed federal fuel charge on the province. The rate started at CAN$30/$tCO_2e$ (US$24/$tCO_2e$) in 2020 to align with the federal minimum carbon price.

New Zealand ETS	ETS	2008	The New Zealand Emissions Trading Scheme (NZ ETS) is New Zealand's principle policy response to climate change. Originally designed to cover the whole economy, it has the broadest sectoral coverage of any ETS by directly covering forestry, waste and liquid fossil fuels, as well as power and industry. The NZ ETS was originally conceived as a nested system under the Kyoto Protocol, with full links to international carbon markets. However, as of 2015, the NZ ETS became a domestic-only system. In June 2020, the Climate Change Response (Emissions Trading Reform) Amendment Act was passed, putting in place a wide range of reforms to the NZ ETS, including setting a cap on unit supply and establishing an auctioning mechanism. The cap is aligned with New Zealand's net-zero targets to 2050 and 5-yearly emissions budgets established under the 'Climate Change Response (Zero Carbon) Amendment Act 2019.' As indicated by New Zealand's NDC, re-establishing a link to high-integrity international carbon markets will form part of New Zealand's strategy for meeting its 2030 target.
Newfoundland and Labrador PSS	ETS	2019	On October 23, 2018, Newfoundland and Labrador announced the Made-in-Newfoundland and Labrador approach to carbon pricing. The approach aims to minimize the impact of carbon pricing on residents and maintain the province's economic competitiveness while reducing GHG emissions and continue efforts to produce renewable energy. The province's carbon pricing system consists of a carbon tax and a baseline-and-credit ETS. Newfoundland and Labrador's Performance Standards System (PSS) came into force on January 1, 2019. This baseline-and-credit ETS applies to large industrial facilities and electricity generation.
Newfoundland and Labrador carbon tax	Carbon tax	2019	The carbon tax covers fuels primarily used in transportation, building heating, and electricity generation and is currently rated at CAN$30/tCO2e (US$24/tCO2e).
Northwest Territories carbon tax	Carbon tax	2019	The Northwest Territories carbon tax went into force as of September 1, 2019. The carbon tax covers all fossil fuels as part of the territory's Made-in-the-North approach to incentivize investments in initiatives and programs to lead to greater use of renewable and cleaner fuels, while minimizing impacts on the cost of living and doing business.
Norway carbon tax	Carbon tax	1991	The Norway carbon tax (official name: CO2 avgift) aims to achieve cost-effective GHG emissions. The carbon tax is split into an excise tax on mineral products and a separate law for petroleum activities on the continental shelf.
Nova Scotia CaT	ETS	2019	Nova Scotia's cap-and-trade program started operation in 2019 with its first auctions taking place in 2020. The program aims to reduce greenhouse gas emissions in the province and intends to keep the cost of carbon pricing low for all Nova Scotians while meeting the federal requirements on carbon pricing. The province's 2030 overall emission reduction target is to reduce emissions by 53% below 2005 levels, aiming to achieve net-zero emissions by 2050.The ETS compliance period is 2019-2022. Revenues from the ETS will be transferred to the Green Fund, which serves several purpose including financing measures to reduce emissions, research and development of innovative technologies aimed at tackling GHG emissions, and climate change adaptation activities.
Ontario EPS	ETS	2022	Ontario developed an alternative baseline-and-credit ETS to the federal system for large industrial facilities called Emissions Performance Standards (EPS) program following the federal government's assessment that the provincial carbon pricing plan did not meet the federal benchmark. EPS shows similarities with the federal OBPS.
Oregon ETS	ETS	TBC	Oregon has been trying to introduce various carbon pricing bills over the past years and is currently considering a cap-and-trade program via an executive order from the state's governor through a state agency.
Pakistan ETS	ETS	TBC	Pakistan is considering market-based carbon pricing instruments, including an emission trading scheme. In December 2019, Pakistan launched the National Committee on Establishment of Carbon Markets that is tasked with assessing the role and scope of carbon markets in delivering Pakistan's NDC and identifying opportunities for and challenges to improving emissions data. As of 2021, provisions are being drafted for domestic carbon pricing instruments under Article 6, and work is underway on preparing MRV regulations for an ETS.
Pennsylvania ETS	ETS	TBC	On October 3, 2019, the government signed an executive order to develop a proposal for an ETS covering the power sector, with the intention to join or link with RGGI. The first draft of an ETS proposal was released on January 30, 2020 by Pennsylvania's Department of Environmental Protection. The draft proposal is largely consistent with the system design features of the RGGI Model Rule, including the implementation of an emissions containment reserve and a cost containment reserve, as well as quarterly auctions to allocate allowances.
Poland carbon tax	Carbon tax	1990	The Poland carbon tax is part of the Environmental Protection Act (Prawo ochrony srodowiska), which taxes different kinds of environmental emissions such as CO2 emissions, dust, sewage and waste.
Portugal carbon tax	Carbon tax	2015	The Portugal carbon tax is an excise tax under the special taxes on consumption (Codigo dos Impostos Especiais de Consumo). The tax was introduced as part of wider package of green tax reforms and serves as a complementary policy measure to the EU ETS.

Prince Edward Island carbon tax	Carbon tax	2019	The Prince Edward Island carbon tax has been in force since April 1, 2019.
Quebec CaT	ETS	2013	The Quebec Cap-and-Trade System aims to reduce GHG emissions in the highest emitting sectors by promoting energy efficiency as well as the use of energy from renewable sources. The cap-and-trade system intends to stimulate innovation by fostering the emergence of new low carbon drivers for economic development.
RGGI	ETS	2009	The Regional Greenhouse Gas Initiative (RGGI) is a cap-and-trade system covering CO2 emissions from power plants in the Northeast and Mid-Atlantic US states. It is the first mandatory ETS in the United States and started as a cooperative effort among ten states: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont and Virginia to reduce GHG emissions. Each having promulgated its own regulations covering CO2 emissions from the power sector. New Jersey rejoined RGGI as of January 2020 after it left the program in December 2011 and Virginia joined RGGI as of January 2021.
Saitama ETS	ETS	2011	The Saitama target setting type ETS is a baseline-and-credit system that sets mandatory emission reduction targets for large buildings and factories. It was established in April 2011 as part of the Saitama Prefecture Global Warming Strategy Promotion Ordinance and is linked to the Tokyo CaT.
Saskatchewan OBPS	ETS	2019	Saskatchewan introduced a sector-specific output-based performance standards (OBPS) system for large industrial emitters, i.e. an emission intensity-based baseline-and-credit ETS as part of the province's Prairie Resilience to make Saskatchewan more resilient to the climatic, economic and policy impacts of climate change. The Saskatchewan OBPS entered into force as of January 1, 2019. It covers large industrial facilities in the province that emit over 25KtCO2e with a voluntary opt-in for facilities between 10-25 KtCO2e.
Senegal carbon tax	Carbon tax	TBC	Senegal is exploring carbon pricing as part of the policy options to reach the objectives of its NDC. In 2018, a study on the opportunity to introduce carbon pricing at the domestic level was carried out. The government organized consultations with stakeholders in the public and private sector to assess initial design options for the carbon pricing policy applicable to its national economy. It identified the need for additional analyses to explore in details the main elements to design a potential carbon tax.
Serbia ETS	ETS	TBC	On March 18, 2021, Serbia adopted the Law on Climate Change which includes provisions for a monitoring, reporting and verification (MRV) and GHG inventory system. This law is part of Serbia's efforts to align its environmental regulations with EU 2030 climate and energy framework and Serbia starts monitoring its emissions in 2021.
Shanghai pilot ETS	ETS	2013	The Shanghai pilot ETS is a cap-and-trade system that aims to promote the implementation of carbon emission control responsibilities and support the achievement of Shanghai's emission reduction targets. The Shanghai carbon market is the most active among the Chinese ETS pilots in terms of offset credits trading. It also pioneered allowance spot forward trading in China.
Shenyang ETS	ETS	TBC	Shenyang is developing regulations for a carbon market for around 500 participants. Sector coverage is not yet known but it would target sectors not covered by the national ETS. Emissions targets would be set in line with carbon targets the Chinese national government sets on Liaoning province (of which Shenyang is the capital). Regulated entities can use China CCERs to meet their obligation, though the total limit has not been set. Guidelines are also being developed for local offset projects. The system is expected to launch in 2022.
Shenzhen pilot ETS	ETS	2013	The Shenzhen pilot ETS is the first Chinese pilot ETS, launching a cap-and-trade system in the city of Shenzhen in June 2013. It is the only Chinese pilot at the sub-provincial level. The Shenzhen pilot ETS is seen as a means for stable economic growth and comprehensive sustainable development. A unique feature of this pilot ETS is its legal basis: although the majority of pilots are regulated by subnational government orders by the executive body of the government, the Shenzhen Pilot ETS is regulated by a dedicated ETS bill passed by its municipal legislator, the Shenzhen People's Congress. Shenzhen is one of the most active regional markets in China, despite its relatively small size compared to other pilots.
Singapore carbon tax	Carbon tax	2019	The Singaporean government started implemented its carbon tax on January 1, 2019. The carbon tax applies to all facilities with annual GHG emissions of 25 ktCO2e or more, with no exemptions. For the first five years, the carbon tax rate will be set at S$5/tCO2e (US$3.7/tCO2e). The government will review the tax rate by 2023, and intends to increase it to S$10-$15/tCO2e (US$7/tCO2e to US$11/tCO2e) by 2030. On 30 October 2019, AirCarbon Exchange, was launched in Singapore, which supplies the first block-chain powered supply of credits (EEUs) for those in the transport industry seeking to comply with carbon tax standards. The carbon tax revenue supports initiatives to address climate change. In the initial implementation of the carbon tax, companies are not allowed to use international credits against their carbon tax liability, but Singapore remains open to linking its carbon tax framework to other carbon pricing jurisdictions with high environmental integrity.

Slovenia carbon tax	Carbon tax	1996	The Slovenia carbon tax (official name: Okoljska dajatev za onesnazevanje zraka z emisijo CO2 za zgorevanje goriva) is part of a number of environmental taxes, which aim to limit environmental pollution.
South Africa carbon tax	Carbon tax	2019	The South Africa carbon tax came into effect on June 1, 2019. The carbon tax aims to price carbon by obliging the polluter to internalise the external costs of emitting carbon, and contribute towards addressing the harm caused by such pollution.
Spain carbon tax	Carbon tax	2014	The Spanish carbon tax (Impuesto sobre los Gases Fluorados de Efecto Invernadero) is aimed at curbing emissions from fluorinated greenhouse gases (F-gases).
Sweden carbon tax	Carbon tax	1991	The Sweden carbon tax (official name: Koldioxidskatt) is part of the energy tax (official name: skatt pa energi). The tax placed on carbon-intensive fuels aims to actively reduce dependency of fossil fuels.
Switzerland ETS	ETS	2008	The Switzerland Emissions Trading System is a mandatory cap-and-trade system. The ETS started in 2008 with a five-year phase during which companies could voluntarily join as an alternative to facing the Switzerland carbon tax (CO2 levy on fossil fuels). Starting from 2013, the ETS became mandatory for large energy-intensive industries and medium-sized industries can voluntarily join. Participants in the ETS continue to be exempted from the CO2 levy.
Switzerland carbon tax	Carbon tax	2008	The Switzerland carbon tax (official name: CO2 levy) is a central instrument in the Swiss climate policies under the CO2 Act to contribute to limiting the global rise in temperature to less than 2 degrees Celsius. The tax serves as a complementary policy measure to the Switzerland ETS.
TCI-P ETS	ETS	TBC	The Transportation and Climate Initiative Program (TCI-P) is a collaboration of northeastern and mid-Atlantic US jurisdictions to develop a carbon pricing initiative for the transportation sector. Participating US states include Connecticut, Massachusetts, Rhode Island, and Washington D.
Taiwan undecided	ETS	TBC	On June 15, 2015, Taiwan, China adopted the Greenhouse Gas Reduction and Management Act. This law sets an emission reduction target of 50% below 2005 levels by 2050. In February 2017, plans were published to meet this target through the implementation of an ETS, among other policy measures. and indicates that one of the major means to achieve this target will be an ETS. Accordingly, the Taiwanese Environmental Protection Administration (TEPA) has been conducting research on the design options and the timetable for establishing an ETS. The new ETS can build on the mandatory emissions reporting requirements for entities with annual emissions above 25,000 tCO2e from certain sectors, which has been in place since 2013. In March 2018, the government published its GHG Reduction Action Plan. The plan proposes to implement a cap-and-trade system, calculate baseline emissions, and set up regulations, albeit without a precise timeline. On this basis, the central industry authorities in charge of the six major sectors developed GHG Emissions Control Action Programs to provide more detail on each sector's responsibilities to reduce their emissions. In addition, a series of subsidiary regulations has been formulated in preparation for the cap-and-trade system. This includes the 2018 Regulations Governing GHG Offset Program Management, which provides an opportunity for companies to acquire offsets credits. The schedule for launching the ETS is unclear. TEPA is in the process of revising the Act. A carbon fee, carbon tax, and ETS are all under consideration. Regulatory discussions are pending on whether the carbon fee will be implemented first, as well as on how it could be transitioned to the ETS in the future and/or co-exist as a complementary mechanism.
Tamaulipas carbon tax	Carbon tax	2021	In July 2020, the Mexican state Tamaulipas passed legislation enacting a carbon tax as of 2021. The carbon tax rate will be set at three times the daily "Unit of Measurement and Update", an economic reference for determining taxation and other payments set in legislation. This is equivalent to about MXN250 per tCO2e. The carbon tax will apply to fixed sources and facilities that emit more than 25 tCO2e of greenhouse gases monthly. Revenues will be used for programmes and activities aimed at climate change mitigation and adaptation.
Thailand ETS	ETS	TBC	The Thai government is assessing various types of carbon pricing initiatives. As part of this process, Thailand started a voluntary ETS consisting of two phases. The first phase, which is being held over 2015-2017, is testing the MRV system. The second phase, which will run from 2018-2020, will be an ETS simulation covering various industrial sectors, designed to test the registry and allocation systems.
Tianjin pilot ETS	ETS	2013	The Tianjin pilot ETS is a key instrument to lower the costs to achieve the green low-carbon development goals of the municipality of Tianjin and raise awareness on GHG emission control. The cap-and-trade system also aims to promote economic development and industrial optimization and upgrading. Tianjin has held auctions since the institutional transfer of the ETS responsibility in 2019 (see Recent developments about the transfer).
Tokyo CaT	ETS	2010	The Tokyo Cap-and-Trade Program is a baseline-and-credit system. Launched in April 2010, the Tokyo CaT is Japan's first mandatory carbon market and is linked to the Saitama ETS. The Tokyo CaT introduced mandatory emission reduction targets for large emitters.

Turkey ETS	ETS	TBC	Turkey adopted monitoring, reporting and verification (MRV) legislation in 2012 and monitoring of GHG emissions from large installations started in 2015. This legislation establishes an installation-level MRV system for CO2 emissions for roughly 800 entities across the power sector and a range of industrial sectors.Turkey worked with the Partnership for Market Readiness to enhance the MRV regulation through pilot studies in the energy, cement, and refinery sectors. A series of workshops and analytical studies have also been conducted to explore appropriate market-based mechanisms, including a possible ETS.
UK ETS	ETS	2021	The UK ETS started operating on January 1, 2021 following the end of coverage of UK installations under the EU ETS on December 31, 2020. The design features of the UK ETS are very similar to those of the EU ETS Phase 4. However, the UK ETS has a tighter emissions cap (5% lower than the UK's notional share of the EU ETS cap), which will be reduced by 4.2Mt each year. The UK plans to revise its cap no later than 2024 to bring it in line with a net zero-consistent trajectory. The UK ETS design has a Cost Containment Mechanism (CCM) and a transitional Auction Reserve Price (ARP), which aim to mitigate against sustained extreme price movements. The CCM comes into effect based on set time and allowance price triggers. For the first two years, these are set at lower levels than in the EU ETS. The ARP, currently set at GBP22 (US$30)/tCO2e) ensures a minimum level of ambition during the transition from the EU ETS. There will be further public engagement on a Supply Adjustment Mechanism, which could offer another mechanism to address extreme price movements. The ETS will be reviewed in 2023 and 2028, and the UK government has also indicated its openness to linking to other schemes internationally in the future.
UK carbon price support	Carbon tax	2013	The UK carbon price floor aims to reduce revenue uncertainty and improve the economics for investment in low-carbon generation for the UK electricity generation sector. The carbon price floor was introduced because the EU allowances price has not been stable, certain or high enough to encourage sufficient investment in low-carbon electricity generation in the UK.
Ukraine ETS	ETS	TBC	Ukraine plans to establish a national ETS in line with its obligations under the Ukraine-EU Association Agreement, which entered into force on September 1, 2017. Ukraine is in the process of developing the main elements of the national monitoring, reporting and verification (MRV) system for GHG emissions to provide a solid basis for the upcoming ETS.
Ukraine carbon tax	Carbon tax	2011	The Ukraine carbon tax was introduced in the Ukrainian Tax Code as an environmental tax on air pollution from stationary sources.
Uruguay carbon tax	Carbon tax	TBC	In June 2021, a draft bill presented to parliament includes a proposal for a carbon tax on gasoline. The bill indicates an initial carbon rate of 5,286 pesos per tonne CO2 (around $120 per metric tonne).The intent is to replace the existing fuel excise charges applied to gasoline through the Specific Internal Tax (IMESI), with a tax based on the carbon emissions.
Vietnam ETS	ETS	TBC	Vietnam's 'Green Growth Strategy' (2012) pursues the objective of a low-carbon economy and invokes the introduction of market-based instruments. Vietnam is analyzing options for carbon pricing approaches applicable to the country and developing pilot crediting programs for the steel and waste sectors, which could start after 2020. Vietnam is also considering the use of market-based instruments for the waste sector starting in 2020.
Washington ETS	ETS	2023	The state of Washington approved legislation establishing a cap-and-trade program starting 2023 that aligns with the state's statutory emissions targets of 45% from 1990 levels by 2035, 70% by 2040, and net zero by 2050. Modelled after the Western Climate Initiative's design recommendations, the program contains many similarities with California and Quebec, including sectoral scope. The program will cover transportation fuels, electricity generation, natural gas suppliers, and industrial facilities from 2023, expanding to additional sectors in later phases, including waste management and landfills.
Zacatecas carbon tax	Carbon tax	2017	In January 2017, the Mexican state Zacatecas enacted a carbon tax as part of a broader fiscal reform which included the introduction of various ecological taxes. The carbon tax rate was set at MXN250 per tCO2e. The carbon tax applies to fixed sources and facilities. If regulated entities can prove an emissions reduction of at least 20% compared to the previous fiscal year, the tax level payable in the following fiscal year will be reduced by 20%. Revenues are used for different purposes, including social programs and for the creation of climate change funds.

This is the **situation for Ukraine with regards of ETS carbon pricing**.

Status : Under consideration

Year of implementation : TBC

Description: Ukraine plans to establish a national ETS in line with its obligations under the Ukraine-EU Association Agreement, which entered into force on September 1, 2017. Ukraine is in the process of developing the main elements of the national monitoring, reporting and verification (MRV) system for GHG emissions to provide a solid basis for the upcoming ETS.

Recent developments: The Minister of Environmental Protection and Natural Resources in January 2021 announced plans for Ukraine to introduce an ETS from 2025, in line with the EU's Carbon Border Adjustment Mechanism measures and work towards emissions reduction objective for 2030 and a timeframe to reach carbon neutrality as part of its second NDC. MRV requirements for installations came into effect this year and by 31 March 2022, covered entities are required to submit the first monitoring reports for 2021. Before establishing the ETS legislation, Ukraine intends to first collect at least three years of data from its MRV system.

This is the **situation for Ukraine with regards of Carbon Tax**.

Status : Implemented

Year of implementation : 2011

Description: The Ukraine carbon tax was introduced in the Ukrainian Tax Code as an environmental tax on air pollution from stationary sources.

Recent developments: Ukraine's parliament approved an increase in the country's carbon tax from UAH 0.41 (US$0.01)/tCO2e to UAH 10 (US$0.4)/tCO2e as of January 1, 2019. The government also communicated intentions to increase the tax by a further UAH 5 (US$0.18)/tCO2e annually to reach UAH 30 (US$1.1)/tCO2e in 2023. As of 2021, the draft law is registered in the parliament and under consideration along with other initiatives to increase the rate of carbon tax. In addition, emissions below 500 tCO2e are no longer subject to the tax. This means that installations below this threshold are not liable to pay the tax from 2019.

Jurisdictions covered : Ukraine

GHG emissions in the jurisdiction (2015): 312 MtCO2e

Share of jurisdiction's GHG emissions covered : 71%

Sectors and/or fuels covered: The Ukraine carbon tax applies to CO2 emissions from stationary sources, so mainly the industry, power and buildings sectors and all types of fuels. The tax covers all fossil fuels.

Proportion of GHG emissions covered overlapping with other carbon pricing initiatives: N/A

Cap or total emission units (current year or latest year available, ETS only): N/A

Allocation approaches (ETS only): N/A

Competitiveness considerations and/or exemptions: No exemptions are given.

Point of regulation: The users of the fossil fuels covered are liable for payment of the tax.

Compliance cycle: The carbon tax is to be paid on an quarterly basis.

Use of offsets: N/A

Price level : UAH10/tCO2 (US$ 0.3/tCO2)

Price/market stabilization mechanisms (ETS only): N/A

Future price developments (Carbon tax only): The government communicated intentions to increase the tax by UAH 5/tCO2e annually to reach UAH 30/tCO2e in 2023.

Government revenues (2020) : US$31 million

10. Explain the Emission Trading Scheme (ETS) design: the 10 steps to consider and lessons learned for Ukraine future prospects

Carbon pricing by itself cannot address all of the complex drivers of climate change; some combination of regulations, standards, incentives, educational programs, and other measures will also be required. However, as part of an integrated policy package, carbon pricing can harness markets to drive down emissions and help build the ambition needed to sustain a safer climate.

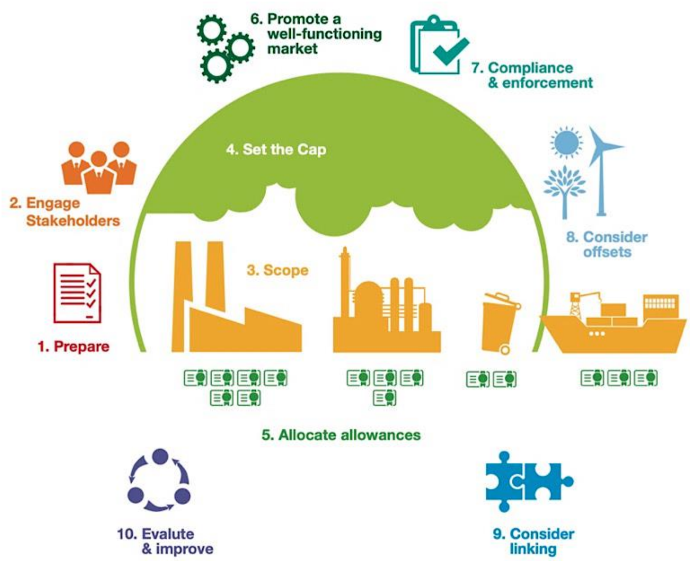
ETSs in particular can provide a backstop to ensure that a policy package achieves set climate goals.

It is important to explain the rationale and the process an ETS must follow in order to be implemented.

In (at least) 10 steps.

This will contribute to the **understanding of the linkages, connections, policy packages and targets inevitably linked to each specific jurisdiction and climate-driven situation.**

All ETSs are developed within a broader policy and legal framework, including other climate change policies.



To position the ETS strategically within the broader policy portfolio, it is important to have a clear view of **how the ETS will contribute to a jurisdiction's climate policy objectives** and **its relationship with other current or planned policies.**

Step 1: Prepare

- Understand what carbon pricing and emissions trading are and how they work
- Determine the objectives for ETS
- Decide the ETS's role in the climate policy mix
- Understand the ETS's interaction with other policies
- Select criteria to assess ETS design options

<u>Lesson learned from previous implementation cases</u>: **An ETS works best as part of a well-thought-out policy package to achieve climate targets and drive sustainable development**.

Jurisdictions have taken different approaches to positioning their ETS relative to other policies. In the case of California, the ETS was adopted within a broad climate change policy portfolio, and the ETS price signal was expected to serve as a backstop to ensure that emission targets would be met if the other measures proved less effective than hoped. In contrast, New Zealand currently employs an ETS as its primary mitigation instrument. Ensuring the right policy mix can improve overall outcomes and help build public support for the introduction of an ETS.

Step 2: Engage stakeholders, communicate and build capacities

- Map stakeholders and respective positions, interests, and concerns
- Coordinate across departments for a transparent decision-making process and to avoid policy misalignment

- Design an engagement strategy for consultation of stakeholder groups specifying format, timeline, and objectives
- Design a communication strategy that resonates with local and immediate public concerns
- Identify and address ETS capacity-building needs

Lessons learned: **Government decision-making can be facilitated by strong executive and ministerial leadership, the clear allocation of responsibilities across departments, and the designation of inter-departmental working groups**.

Governments typically underestimate the strategic importance of meaningful stakeholder engagement and public communications in securing enduring support for an ETS. Some jurisdictions have found that it took 5 to 10 years of engagement and capacity building on climate change market mechanisms to enable informed and broadly accepted ETS policymaking. Tapping stakeholder expertise will improve ETS design and help gain trust, understanding, and acceptance. Creating and executing a communications strategy can help broaden support for an ETS. Developing a suitable and persuasive narrative about the ETS will be vital to gaining popular support. Because the ETS will need to change and be adapted over time, it is important to continue to engage stakeholders to identify when circumstances change and promote enduring broad support for the ETS.

Step 3: Decide the scope

- Decide which sectors to cover
- Decide which gases to cover
- Choose the points of regulation
- Choose the entities to regulate and consider whether to set thresholds
- Choose the point of reporting obligation

Lessons learned: **There is a great diversity across existing ETSs in terms of scope, suggesting there is no single "right" approach**. Almost all systems cover at least the power and industrial sectors.

While some jurisdictions have placed the point of regulation for emissions from fuel combustion upstream to reduce administrative costs (for example fuels in California, Québec, and New Zealand), others have opted for regulation at the point where emissions are generated for alignment with existing regulatory or reporting systems (for example the European Union). Still other systems have opted for hybrid coverage because energy prices are regulated, and carbon price signals would otherwise not pass through the supply chain (for example the Korean ETS and ETSs in China).

Step 4: Set the cap

- Determine the ambition of the cap, type of cap, and approach to cap setting
- Create a robust foundation of data to determine the cap
- Choose time periods for cap setting
- Agree upon formal legal and administrative governance arrangements
- Agree on a long-term cap trajectory and strategy for providing a consistent price signal

Lessons learned: **A cap should rest on a solid foundation of robust underlying data and assumptions**.

Cap setting will benefit from early data collection and greater reliance on historical data as compared to counterfactual projections.

While most jurisdictions have chosen absolute caps to facilitate alignment between caps and targets as well as linking, they have also built in some flexibility over allowance supply to maintain price predictability. In practice, partly because of a concern about high prices, initial caps in many existing ETSs were relatively loose, which contributed to prices that were significantly lower than expected. To support effective market operation and build confidence among market participants, **a long-term cap trajectory**

should be combined with a transparent, rules-based process of possible modifications to the cap and advance notice of future changes.

Step 5: Distribute allowances

- Match allocation methods to policy objectives
- Define eligibility and methods for free allocation
- Define treatment of entrants, closures, and exits
- Set up auctions to play an increasing role over time while reducing free allocation

Lessons learned: **Because large amounts of resources are at stake, allocation decisions can become highly contentious and a key focus of stakeholder attention and political discussion**.

The objectives of allocation (for example, reducing carbon leakage risk or preserving incentives for cost-effective abatement) should be transparently stated upfront and subsequent decisions on allocation design issues should be explained and justified by reference to these objectives. Both the objectives of allocation and allocation design features can be expected to evolve over time.

Decisions on entities' individual allocation should be made separately from decisions on the cap. Auctioning has typically been introduced on a limited scale initially, but with the intention that it will gradually displace free allocation over time. Allocation methods can vary across sectors; for example, the power sector is a typical candidate for auctioning as it is often less prone to carbon leakage than other ETS sectors, while manufacturing sectors have typically received some form of free allocation at least in their initial years. Using auction revenue strategically can be a powerful selling point for an ETS.

Step 6: Promote a well-functioning market

- Establish the rationale for, and risks associated with, market intervention
- Establish rules for banking and borrowing
- Establish rules for market participation
- Identify the role played by a robust secondary market
- Choose whether to intervene to address low prices, high prices, or both
- Choose the appropriate price or supply adjustment measure

Lessons learned: **Excessive price variability risks undermining mitigation in an ETS and reducing public confidence in the system**.

Rules regarding temporal flexibility and market participation affect how markets operate. Banking can help smooth fluctuations over time, while the inclusion of financial market participants in the carbon market can reduce volatility and help provide access to risk-management products.

Step 7: Ensure oversight and compliance

- Identify the regulated entities
- Manage emissions reporting by regulated entities
- Approve and manage the performance of verifiers
- Establish and oversee the ETS registry
- Design and implement the penalty and enforcement approach
- Regulate and oversee the market for ETS emissions allowances

Lessons learned: **A robust compliance regime is the backbone of the ETS and a precondition for its credibility.** The government may need to actively identify new regulated entities as firms are established and change over time. It can be costly to monitor emissions with high levels of accuracy and precision; lower-cost approaches such as using default emissions factors can provide unbiased estimates for predictable sources of emissions. Regulators should take advantage of existing local environmental, tax, legal, and market systems where relevant when establishing ETS compliance and oversight. Making emissions data transparent strengthens market oversight but data management systems must protect potentially confidential or commercially sensitive information. Under-regulation of the trading market may allow for fraud and manipulation, while over-regulation may increase compliance costs and eliminate many of the flexibilities that give carbon markets their efficiency. **In some systems, the reputational implications of noncompliance, especially when reinforced by public disclosure of ETS performance, have proven to be a strong deterrent, but a binding system of penalties is still needed**. When problems with compliance arise, the ETS regulator and the government should respond quickly to safeguard the integrity and liquidity of the market and maintain the trust and confidence of market participants

Step 8: Consider the use of offsets

- Outline the potential role of offsets within an ETS
- Decide on the type of offsets allowed within the system (both geographical scope and governance of program)
- Weigh costs of establishing a domestic offset program versus making use of an existing program
- Decide on qualitative and quantitative limits on the use of offsets

Lessons learned: **Offsets can provide a tool for containing compliance costs, expanding mitigation incentives beyond the covered sectors, and generating co-benefits**. Policymakers need to decide whether to make use of an externally administered crediting mechanism or whether to set up a domestic crediting mechanism, which requires additi onal effort. In either case, valuable experience gained with the use of offsets to date highlights the need to maintain credibility and environmental integrity through robust rules and methodologies. Quantitative limits may be used to control the inflow of low-cost offset credits and the relocation of mitigation co-benefits, and qualitative criteria may be designed to achieve specific policy objectives and to address environmental integrity risks.

Step 9: Consider linking

- Identify potential linkage partners
- Determine the type of link
- Identify the benefits and risks associated with the link
- Discuss compatibility of key program design features
- Form and govern the link

Lessons learned: **Linking requires clear understanding and acceptance of the current and future levels of ambition in partnering jurisdictions' ETSs**. In successful links to date, partners have had strong existing relationships that facilitated the negotiations leading up to the link and the subsequent joint governance of the market. Key design features need to be made compatible to ensure environmental integrity and price stability when linking. For other features, there needs to be confidence that the linking partner or partners' ETS designs will deliver comparable outcomes. This alignment will take time and may need to be phased in. In practice, linking partners to date have aligned system design to a greater extent than strictly necessary for market functioning. Poorly managed links can have unintended consequences, so jurisdictions should start thinking about and preparing for linking as early as possible, but link strategically and only when suitable.

Step 10: Implement, evaluate, and improve

- Decide on the timing and process of ETS implementation
- Decide on the process and scope for reviews
- Identify why the design of the ETS may need to change over time
- Evaluate the ETS to support future improvement

Lessons learned: **Every ETS has required an extensive preparatory phase to collect data and develop technical regulations, guidelines, and institutions**. **Relying on existing institutions where possible can control costs**. ETS pilots can generate valuable learning, but they also risk leaving a legacy of negative public perceptions if they encounter difficulties, and not all lessons may be applicable when the ETS is fully launched. Phasing in an ETS can ease the burden on institutions and sectors but can reduce the ETS's initial environmental impact and can anchor stakeholder expectations on lower ambition in the future. Providing a predictable review process and schedule can reduce policy uncertainty, a major barrier to low-emission investment, but additional unanticipated changes may be unavoidable. Reviewing an ETS's performance can be challenging; data is often limited, and external drivers of economic activity and emissions make it hard to distinguish the effect of the ETS from that of other policies or macroeconomic developments. **Starting data collection before the ETS starts, making entities' data public where possible, and encouraging external evaluations will provide the best chance for successful reviews. Good governance and stakeholder engagement processes are key to successful implementation**.

11. European Union Emissions Trading System (EU ETS)

The EU Emissions Trading System (ETS) is a central instrument of the EU's policy to fight climate change and achieve cost-efficient reductions of greenhouse gas emissions.

Set up in 2005, the EU ETS is the world's first international emissions trading system. It is now in its fourth phase (2021-2030).

Jurisdictions: 27 EU Member States and three European Economic AreaEuropean Free Trade Association (EEA-EFTA) states: Iceland, Liechtenstein and Norway.

The system covers ~40% of the EU's emissions, from the power sector, manufacturing industry, and aviation within the European Economic Area.

The latest reform of the ETS was proposed in July of 2021 as a part of the European Green Deal.

As of January 2020, the EU ETS became linked to the Swiss ETS, the first linking of this kind for both parties.

In July 2021, the European Commission released the "**Fit for 55**" package – a sweeping set of policy proposals spanning all major sectors of the economy to achieve emission reductions of at least 55% below 1990 levels.

The package places the EU ETS at the heart of the EU's decarbonization agenda with major changes that include:

- a one-off reduction to the cap and increased linear reduction factor (from 2.2% to 4.2%);
- the inclusion of the maritime sector into the EU ETS' scope from 2023 onwards;
- a separate fuel ETS for buildings and transport;
- strengthened benchmarks and a faster phase down of free allocation which would be tied to low-carbon investment by the receiving entity;
- the introduction of a carbon border adjustment mechanism (CBAM) that prices imported goods based on their embedded emissions to become fully operational by 2026;
- updated parameters of the Market Stability Reserve (MSR) including a new buffer threshold and an extension of the current intake rate of 24% beyond 2023 (since 2019, the EU ETS operates with a Market Stability Reserve (MSR) which addresses market imbalances by temporarily adjusting allowance supply).

- new regulations around revenue use to address distributional effects and spur innovation, including the creation of the Social Climate Fund.

On the international front, the UK formally withdrew from the EU on 31 January 2020 but continued to participate in the EU ETS until the end of the year as part of the transition period. In parallel, the linking agreement between the EU ETS and the Swiss ETS entered into force in January 2020. A provisional link was established in September, enabling allowance transfers between both registries on pre-announced dates.

Overall GHG emissions (excluding LULUCF) Emissions: 3,893.1 MtC02e

(2018, *overall GHG emissions for the EU-27 that comprises all European Member States, which as of 2021 no longer includes the United Kingdom*).

Overall GHG emissions by sector (in MtCO2)

Sector Name	MtCO2e:
Energy	*2907.1*
Industrial Processes	*343.5*
Agriculture	*394.4*
Waste	*117.2*
International Aviation	*129.2*

GHG reduction target

By 2030: At least 55% below 1990 GHG levels proposed (EU Green Deal), to be set in the Climate Law.

By 2050: Climate neutrality target proposed (European Green Deal), to be set in the Climate Law.

Both updated targets (2030 and 2050) recently have been endorsed by the European Parliament and European Council and are currently in the process of being enshrined into the European Climate Law.

Carbon Price Current Allowance Price (per t/CO2e): **EUR 88.76 (31.12.2021)**

Covered emissions	0.39
GHGs covered	CO_2, N_2O, PFCs

Sectors and thresholds

PHASE ONE (2005-2007):

Power stations and other combustion installations with >20MW thermal rated input (except hazardous or municipal waste installations), industry (various thresholds) including oil refineries, coke ovens, and iron and steel plants, as well as production of cement, glass, lime, bricks, ceramics, pulp, paper, and cardboard.

PHASE TWO (2008-2012):

Aviation was introduced in 2012 (>10,000 tCO_2/year for commercial aviation; >1,000 tCO_2/year for non-commercial aviation since 2013). A number of countries included NOx emissions from the production of nitric acid. The EU ETS also expanded to include Iceland, Liechtenstein, and Norway.

PHASE THREE (2013-2020):

Carbon capture and storage installations, production of petrochemicals, ammonia, nonferrous and ferrous metals, gypsum, aluminum, as well as nitric, adipic, and glyoxylic acid (various thresholds) were included.

PHASE FOUR (2021-2030):

Based on the current legislation, no changes to the scope have been agreed on for Phase 4. Changes are being considered as part of the review of the ETS foreseen under the 2030 Climate Target Plan.

Aviation:

Emissions from international aviation were included in the EU ETS in 2012. In November 2012, the EU temporarily suspended enforcement of the EU ETS requirements for flights operating from or to non-EEA countries ("stop the clock") while continuing to apply the legislation to flights within and between countries in the EEA. Exemptions for operators with low emissions have also been introduced. In light of the progress made under the International Civil Aviation Organization (ICAO) towards a global measure to reduce emissions from the aviation sector (the Carbon Offsetting and Reduction Scheme [CORSIA]), the EU will maintain the intra-EEA scope for the ETS Aviation until 31 December 2023. In 2020, the Commission initiated a process to revise the ETS Directive to address the implementation of CORSIA in EU law in a way that is consistent with the EU's 2030 climate target, with a view of adoption in 2021.

Number of entities: 10,569 power plants and manufacturing installations

Cap

PHASE ONE (2005-2008) and **PHASE TWO (2009-2012):**

The cap was established bottomup, based on the aggregation of the national allocation plans of each Member State. Phase 1 started with a cap of 2,096 $MtCO_2e$ in 2005; Phase 2 started with a cap of 2,049 $MtCO_2e$ in 2009.

PHASE THREE (2013-2020):

A single EU-wide cap for stationary sources: 2,084 $MtCO_2e$ in 2013, which is annually reduced by a linear reduction factor (currently 1.74% or ~38.3 million allowances). This amounts to a cap of 1,816 $MtCO_2e$ in 2020.

PHASE FOUR (2021-2030): A single EU-wide cap for stationary installations set for 2021 at 1,572 $MtCO_2e$. A linear cap reduction factor of 2.2% (of 2008-2012 baseline emissions) applies to both stationary sources and the aviation sector each year. This translates into a year-on-year reduction of the cap by 43 million allowances. The linear reduction factor does not have a sunset clause and the cap will continue to decline beyond 2030. Starting 2021, emissions from UK entities previously covered by the EU ETS are no longer considered in the cap. However, pursuant to Article 9 and Annex 4 of the Protocol on Ireland/Northern Ireland, the cap trajectory in Phase 4 does account for emissions from electricity generators in Northern Ireland.

Aviation Sector Cap:

Emissions for intra-EEA aviation in 2021 are capped at 38 million allowances and will decrease each year by the linear reduction factor of 2.2%. The aviation sector cap was set in 2012 at 210 $MtCO_2e$/year. This cap was meant to reflect the initial inclusion of all flights from, to, and within the EEA in the EU ETS. However, following the "stop the clock" temporary suspension until the end of 2016, the number of aviation allowances put into circulation in 2013-2016 was reduced to 38 million allowances annually and set considerably below verified intra-EEA aviation emissions. In 2017, the intra-EEA scope for aviation was prolonged until 2023. The adjusted annual aviation cap applies up to 2021 and decreases thereafter.

Trading periods

- Phase 1: 3 years (2005-2007)
- Phase 2: 5 years (2008-2012)
- Phase 3: 8 years (2013-2020)
- Phase 4: 10 years (2021-2030)

Allocation

PHASE ONE (2005-2007):

Allocation established through the Member State national allocation plans. Allocation through grandfathering. Some Member States used auctioning and some used benchmark-based allocation.

PHASE TWO (2008-2012):

Similar to Phase 1, with ~90% of allowances allocated for free. Some benchmark-based free allocation; and some auctioning in eight Member States (Germany, United Kingdom, The Netherlands, Austria, Ireland, Hungary, Czech Republic, and Lithuania), amounting to ~3% of total allowance allocation.

PHASE THREE (2013-2020):

57% of allowances auctioned over the entire trading period with the remaining allowances allocated through benchmarking. 88% of the auctioned allowances were distributed to EU Member States based on verified 2005 or average 2005-2007 emissions. 10% was allocated to lower-income EU Member States and the remaining 2% distributed among nine Member States that reduced 2005 emissions by 20% compared to the base year.

Power Sector:

100% auctioning with an optional derogation for the modernization of the electricity sector in certain Member States whose GDP per capita was below 60% of the EU average in 2013.

Manufacturing/Industry:

Free allocation follows product-based benchmarks. Benchmarks were based on activity levels in 2007-2008 and were set at the average of the 10% most efficient installations in the (sub)sector. Subsectors deemed at risk of carbon leakage received free allocation at 100% of the predetermined benchmarks. Subsectors deemed not at risk of carbon leakage had free allocation phased out gradually from 80% of the respective benchmarks in 2013 to 30% by 2020. Where free allocation exceeded the amount reserved for free allocation, a crosssectoral correction factor applied.

Carbon leakage risk was assessed against the following criteria of emissions intensity and trade exposure:

- direct and indirect cost increase >30%; or
- non-EU trade intensity >30%; or
- direct and indirect cost increase >5% and trade intensity >10%.

Cost intensity was determined by the formula *[Carbon price × (direct emissions × auctioning factor + electricity consumption × electricity emission factor)]/GVA*

Trade intensity was determined by the formula *(imports + exports)/(imports + production)*

Aviation Sector:

In 2012, 85% of allowances were allocated for free, based on benchmarks. In Phase 3 (2013-2020), 15% of allowances were auctioned and 82% allocated for free, based on benchmarks. The remaining 3% constituted a special reserve for new entrants and fast-growing airlines. Due to the temporary derogation that applied to flights with third countries, the allocation was adjusted to the intra-EEA scope.

Back-loading:

As a short-term measure to address a growing surplus in the EU ETS, the auctioning of 900 million allowances from 2014-2016 was postponed to 2019-2020. In line with the decision to create the market stability reserve, the back-loaded allowances were placed in the MSR, which became operational in 2019.

New Entrants Reserve:

5% of the total allowances are set aside to assist new installations coming into the EU ETS or to cover installations whose capacity has significantly increased since their free allocation was determined. Until June 2020, a total of 171.1 million allowances were reserved for 1,089 installations during Phase 3. At the end of Phase 3, any unallocated allowances (excluding 200 million reserved for the NER300 in Phase 4) were placed into the MSR. *The NER 300 is an EU low-carbon technology funding program of approximately EUR 2 billion (USD 2.3 billion) monetized through the sale of 300 million allowances that awarded proposals in 2012 and 2014, the latest of which will enter into operation by June 2021.*

PHASE FOUR (2021-2030):

Manufacturing/Industry:

Benchmark values are updated twice to reflect technological progress in different sectors. The first set of benchmark values applies to the period 2021-2025; the second set of values will cover the period from 2026 to 2030. Member States submitted lists of incumbent installations and updated emissions data by 30 September 2019 and are required to do so again by 30 September 2024. Based on this data, the European Commission will update Phase 3 benchmarks.

- Benchmark values in Phase 4 will be adjusted for technological progress year-on-year. An annual reduction rate (0.2% to 1.6%) will be determined for each benchmark. For the steel sector, which faces high abatement costs and leakage risks, the lower end of 0.2% annual benchmark reduction will apply. Further updates on the above may be released as part of the broader ETS review.
- Free allocation may be updated annually to mirror sustained changes in production (if the change is more than 15% compared to the initial level, based on a 2-year rolling average).

Carbon leakage rules:

- The third carbon leakage list adopted in February 2019 applies for the period 2021-2030. The revised list includes a reduced number of sectors classified at risk of carbon leakage. Free allocation for other sectors will be discontinued by 2030 (except district heating).
- Carbon leakage is assessed against a composite indicator of trade intensity and emissions intensity.

- As an additional safeguard for industry, the Phase 4 cap breakdown includes a free allocation buffer of more than 450 million allowances, initially earmarked for auctioning, which can be made available for free allocation if the initial free allocation volume is fully absorbed (thereby avoiding the need to apply the cross-sector correction factor).

Carbon leakage risk is assessed according to the following criteria:

- Trade Intensity x Emissions Intensity > 0.2
- Trade intensity x Emissions Intensity > 0.15 < 0.2; qualitative assessment will follow based on abatement potential, market characteristics, and profit margins.

Emissions intensity is determined by: ***[direct emissions + (electricity consumption x electricity emission factor)]/GVA***

Trade exposure is determined by: ***(imports + exports)/(imports + production)***

Power Sector:

100% auctioning with an optional derogation for the modernization of the electricity sector in certain Member States. Those Member States whose GDP per capita was below 60% of the EU average in 2013 may continue to make use of this optional free allocation through benchmarking. Three out of ten eligible Member States make use of the derogation in Phase 4 (2021-2030). Some Member States chose to monetize the corresponding share of allowances or use them to boost their share of the Modernization Fund.

			Net electricity generation (TWh)								
				of which							
					of which**						
Country	Change in emissions 2020 vs. 2019*	Consumption 2020 vs. 2019 [TWh]	Total	Thermal	Coal	Gas	Nuclear	Hydro	Wind	Solar	Net import
Estonia	-34 %	0.1	-1.4	-1.7	-	-	-	0.0	0.1	0.1	0.4
Greece	-22 %	-3.1	-2.0	-3.8	-4.7	1.7	-	-0.6	2.0	0.4	3.4
Latvia	-19 %	-0.2	-0.7	-1.2	-	-1.1	-	0.5	0.0	-	0.2
Spain	-19 %	-13.9	-10.1	-22.4	-0.2	-13.7	-0.1	6.9	0.1	5.4	-4.2
Bulgaria	-18 %	-0.5	-3.0	-3.3	-3.5	0.1	0.1	0.0	0.2	0.1	2.0
Finland	-16 %	-5.2	-0.2	-4.9	-2.6	0.1	-0.6	3.3	1.7	0.1	0.1
Portugal	-13 %	-1.7	0.6	-2.1	-2.9	0.4	-	3.8	-1.4	0.4	6.1
France	-13 %	-21.6	-35.4	-4.6	-0.7	-3.7	-44.0	5.2	5.6	2.3	5.2
Czechia	-13 %	-2.0	-5.0	-5.0	-6.2	1.0	-0.2	0.3	0.0	0.0	0.8
Sweden	-12 %	-4.6	-5.7	-2.9	-0.3	-0.4	-17.1	6.6	7.7	-	-8.9
Germany	-12 %	-21.7	-34.3	-35.2	-33.9	0.9	-10.1	-0.6	6.3	5.2	15.8
Netherlands	-11 %	-2.4	1.1	-5.5	-9.7	1.8	0.2	0.0	3.8	2.6	-5.0
United Kingdom	-11 %	-	-	-	-	-	-	-	-	-	-
Romania	-11 %	-1.9	-3.2	-3.2	-3.7	0.5	0.2	-0.3	0.2	0.0	4.1
Italy	-11 %	-16.8	-10.7	-11.4	-	-	-	1.0	-1.5	1.3	-5.7
Denmark	-10 %	-0.9	-1.2	-1.6	-0.3	-0.8	-	0.0	0.2	0.2	0.6
Slovakia	-9 %	-1.3	0.2	0.0	-0.7	0.7	-0.1	0.2	0.0	0.1	-2.0
Austria	-9 %	-2.4	-1.6	-2.3	-1.0	-1.4	-	0.5	-0.5	-	-5.8
Luxembourg	-8 %	-0.2	0.4	0.1	-	0.0	-	0.2	0.1	0.1	-0.3
Belgium	-7 %	-1.3	-2.6	1.5	-0.6	2.1	-8.7	0.1	3.2	1.4	-19.2
Poland	-7 %	-6.8	-5.8	-7.9	-9.8	1.3	-	0.3	0.6	1.2	4.9
Ireland	-6 %	-1.3	1.9	-0.3	0.2	0.2	-	0.1	2.1	-	0.6
Cyprus	-4 %	-0.2	-0.2	-0.3	-	-	-	-	0.0	0.1	-
Norway	-4 %	-2.1	19.5	-0.7	-	-0.5	-	15.8	4.4	-	-20.5
Hungary	-3 %	0.0	0.7	0.0	-0.3	0.4	-0.2	0.0	-0.1	1.0	-1.8
Croatia	-3 %	-0.8	0.6	0.5	-0.4	0.9	-	-0.1	0.3	0.0	0.7
Slovenia	-3 %	-0.6	1.1	-0.1	-0.1	0.0	0.5	0.6	0.0	0.0	0.1
Iceland	-2 %	-	-	-	-	-	-	-	-	-	-
Lithuania	1 %	-0.4	1.3	1.2	-	1.1	-	0.1	0.1	0.0	-0.3
Northern Ireland***	2 %	-	-	-	-	-	-	-	-	-	-
Malta	10 %	-0.1	0.1	0.0	-	0.0	-	-	-	-	0.0
Liechtenstein	203 %	-	-	-	-	-	-	-	-	-	-

Source : EEA (2021a); Eurostat (2021).

Aviation:

Free allocation for the aviation sector will be reduced compared to the 82% in Phase 3.

Auctioning:

57% of allowances in Phase 4 will be auctioned. Out of these, 90% will be distributed to Member States based on their share of verified emissions, with 10% distributed among the lower-income EU Member States. Authorities have the right to cancel auctions when the highest bidding price is significantly below the prevailing secondary market price to avoid market distortion. In such a situation, allowances are transferred to subsequent auctions scheduled at the same trading platform.

NER:

The New Entrants Reserve in Phase 4 (2021-30) has been supplied with 200 million from the unallocated NER allowances from Phase 3 (2013-2020).

Banking and borrowing

Unlimited banking has been allowed since 2008.

Borrowing is not allowed. However, implicit borrowing within trading periods is allowed, i.e., the use of allowances allocated in the current year for compliance in the previous year.

Offsets and credits

PHASE ONE (2005-2007):

Unlimited use of Clean Development Mechanism (CDM) credits and Joint Implementation (JI) credits was provided for in the directive. In practice, no credits were used in Phase 1.

PHASE TWO (2008-2012):

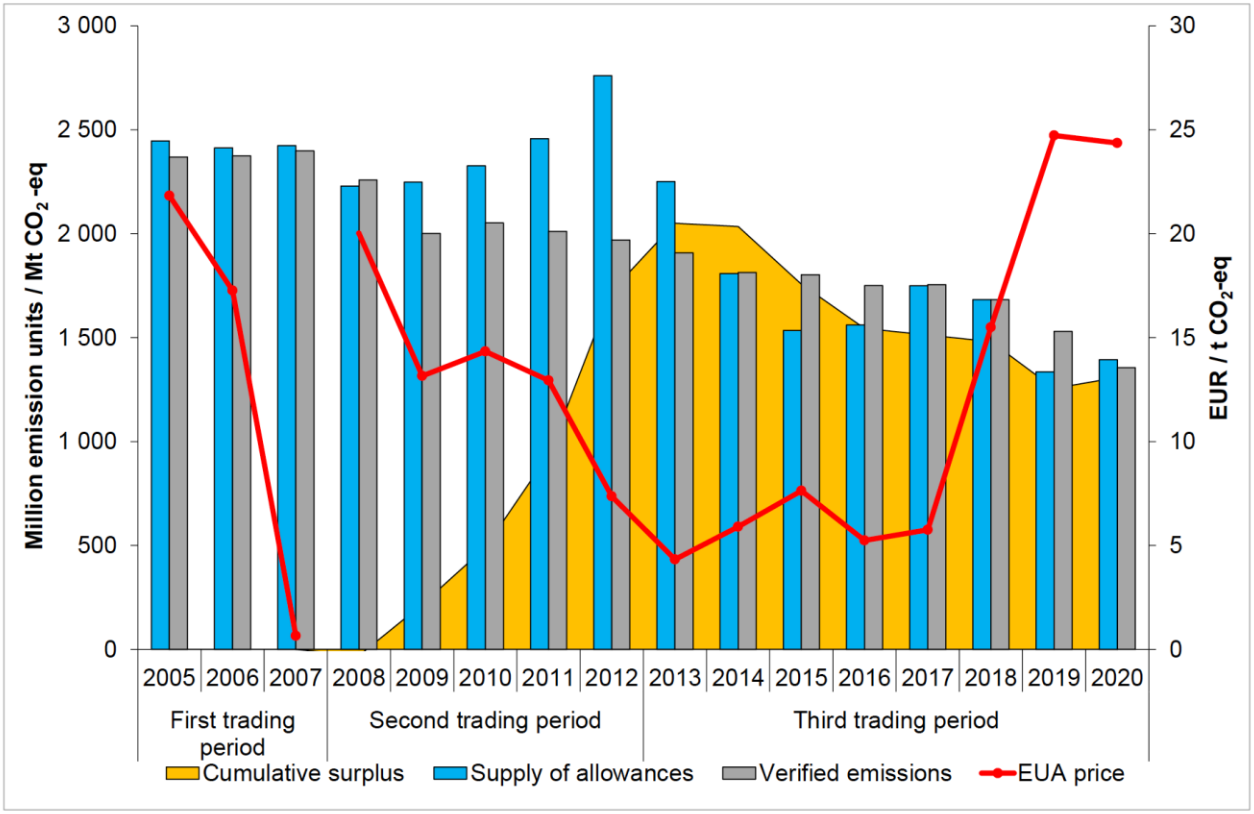
Qualitative Limits: Most categories of CDM/JI credits were allowed; no credits from LULUCF and nuclear power sectors were allowed. Strict requirements for large hydro projects exceeding 20 MW. Quantitative Limits: In Phase 2, operators were allowed to use JI and CDM credits up to a certain percentage limit determined in the respective country's National Allocation Plans. Unused entitlements were transferred to Phase 3 (2013-2020).

PHASE THREE (2013-2020):

Qualitative Limits: Newly generated (post-2012) international credits had to originate from projects in least developed countries. Credits from CDM and JI projects from other countries were eligible only if registered and implemented before 31 December 2012. Projects from industrial gas credits (projects involving the destruction of HFC-23 and N2O) were excluded regardless of the host country. Credits issued for emission reductions that occurred in the first commitment period of the Kyoto Protocol were no longer accepted after 31 March 2015. Quantitative Limits: The total use of credits for Phase 2 and Phase 3 was capped at 50% of the overall reduction under the EU ETS in that period (~1.6 Gt CO2e).

PHASE FOUR (2021-2030):

Based on the current legislation, the use of offsets is not envisaged.



Source: Point Carbon, (2012); EEA (2021b), EEX (2021), ICE (2021)

Market Stability Provisions

MARKET STABILITY RESERVE:

The MSR started operating in January 2019. Its purpose is to **address any supply-demand imbalance of allowances prevailing in the EU carbon market** and to improve the EU ETS's resilience to future shocks.

The EU publishes the total numbers of allowances in circulation (TNAC) by 15 May each year.

- When the TNAC is above 833 million, 24% (12% beyond 2023) of the surplus is withdrawn from future auctions and placed into the reserve over a period of 12 months.
- When the TNAC is less than 400 million allowances, 100 million allowances are taken from the reserve and injected into the market through auctions.

From 2023 onwards, the number of allowances held in the reserve will be limited to the auction volume of the previous year. Holdings above that amount will be invalidated. Thresholds, withdrawal rates, and cancelation provisions of the MSR will be reviewed in June 2021.

In 2019, a total of 397 million allowances were placed in the reserve. In 2020, the total number of allowances withdrawn amounted to more than 375 million, corresponding to a 35% reduction in auction volumes for that year.

Swiss allowance supply is not taken into account when the annual EU withdrawal amount is calculated, and Swiss auction quotas will not be reduced by the mechanism.

CANCELATIONS:

As of Phase 4, a Member State may also cancel allowances from their auction share in the event that they take additional policy measures that result in closure of electricity generation capacity. The quantity of allowances cancelled shall not exceed the average verified emissions of the installation from five years preceding the closure.

Compliance

Compliance Period : One year (1 January to 31 December): every year, operators must submit an emissions report. Data for a given year must be verified by an accredited verifier by 31 March of the following year. Once verified, operators must surrender the equivalent number of allowances by 30 April of that year.

Monitoring, Reporting, Verification (MRV)

REPORTING FREQUENCY: Annual self-reporting based on harmonized electronic templates prepared by the European Commission.

VERIFICATION: Verification by independent accredited verifiers is required before 31 March each year.

MRV FRAMEWORK: Since Phase 3, the MRV framework for the EU ETS has been further harmonized. European Commission regulations now apply for emissions monitoring and reporting, as well as verification and accreditation of verifiers. A monitoring plan is required for every installation and aircraft operator. MRV procedures were updated in 2020 in preparation for Phase 4.

Enforcement : Regulated entities must pay an excess emissions penalty of EUR 100/tCO2 (USD 114.22/ tCO2) for each tonne of CO2 emitted for which no allowance has been surrendered, in addition to buying and surrendering the equivalent amount of allowances. The name of the non-compliant operator is also made public. Member States may enforce different penalties for other forms of noncompliance.

Revenue

Since beginning of program: EUR 69.7 billion (USD 80.7 billion)

Collected in 2020: EUR 19.2 billion (USD 21.8 billion)

In the EU ETS, revenues from the auctioning of allowances accrue to Member States. At least 50% of revenues should be used for climate- and energy-related purposes. Member States are obliged to inform the European Commission about how they use the revenues. In 2019, on average, Member States spent ~77% of their revenues on domestic and international climate-related purposes.

PHASE FOUR (2021-2030):

The latest revision of the EU ETS set up two new funds to support EU stakeholders in the low-carbon investment challenge.

Innovation Fund: supports demonstration of innovative breakthrough technologies in industry, as well as carbon capture and storage/use and renewable energy. The fund is monetized through the sale of at least 450 million allowances, and the remaining budget from the NER300. In 2020, the first batch of 50 million allowances was auctioned to capitalize the Fund.

Modernisation Fund: Supports investments in modernizing energy systems and improving energy efficiency in 10 lower-income Member States, including investments to support a socially just transition to a low-carbon economy (e.g., upskilling/reskilling of affected workers). The Modernisation Fund is capitalized with the auction revenues of 2% of total allowances for Phase 4. Subject to the allowance price, up to EUR 14 billion (USD 16 billion) may be injected into the Fund over 2021-2030.

Implementing Legislation

Directive 2003/87/EC of the European Parliament and of the Council establishing a scheme for GHG emission allowance trading within the Community and amending Council Directive 96/61/EC.

Decision concerning the establishment and operation of a market stability reservefor the Union GHG emission trading scheme and amending Directive 2003/87/EC (6 October 2015).

Consolidated Auctioning Regulation (25 February 2014): Commission Regulation EU No 176/2014 amending Regulation (EU) No 1031/2010 in particular to determine the volumes of GHG emission allowances to be auctioned in 2013-2020 (26 February 2014).

12. The EU Emissions Trading System trends and projections

National projections indicate insufficient reductions to meet the proposed new targets.

Current ETS projections do not show the reductions in emissions needed to bring the ETS into line with the new 2030 target and to set EU emissions on a path to achieve climate neutrality in 2050. In 2021, EU Member States reported their own greenhouse gas emission projections in accordance with EU legislation. According to their projections, ETS emissions are expected to decrease by between 41% and 48% by 2030, and by between 55% and 62% by 2040, relative to 2005. This will depend on the implementation of additional measures reported by some Member States. The current EU ETS target of reducing emissions by 43% by 2030 would therefore be within reach.

However, in July 2021, the European Commission unveiled a comprehensive policy package aimed at achieving at least a 55% reduction in net greenhouse gas emissions for 2030, compared with 1990. This paves the way for achieving carbon neutrality by 2050. A key part of this package was a proposal for the revision of the EU ETS. This proposal represents a major update of the EU ETS, namely a new overall ETS target of a 61% reduction by 2030, compared with 2005, including ETS aviation and the newly integrated ETS shipping. This is accompanied by a revised target of a reduction of 40%, relative to 2005, under the Effort Sharing Regulation.

It is proposed that the increased ambition of the EU ETS will be achieved by:

- a one-off reduction in the cap
- a steeper linear reduction factor
- updated parameters for the Market Stability Reserve (MSR)

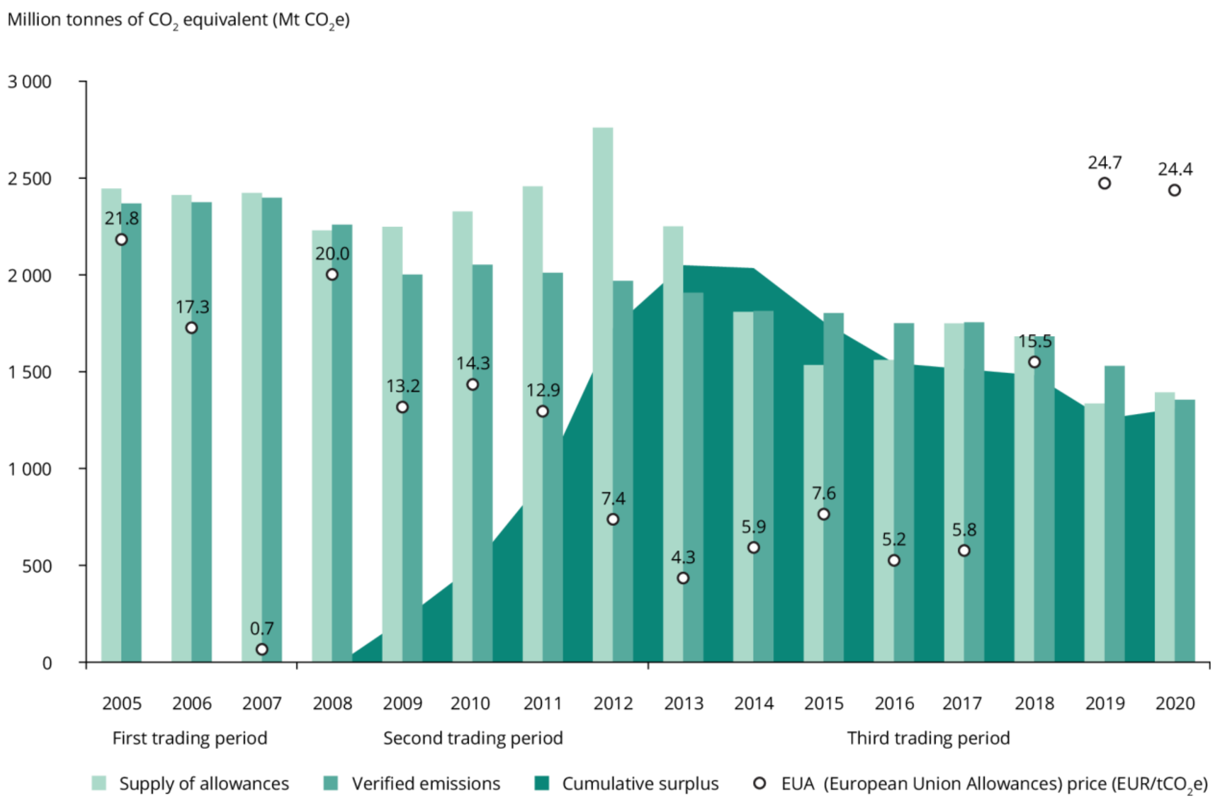
A separate emissions trading system for fuels used in buildings and road transport was also proposed, as was as a carbon border adjustment mechanism. Other proposed key introductions are new regulations around the the use of the revenue use that aim to stimulate innovation and address distributional effects.

In the short term, Member States must take action to avoid a rebound in emissions linked to the pandemic. These should be backed with medium- and long-term measures to achieve the new and more ambitious target for 2030. According to recent greenhouse gas projections submitted to the EEA, the majority of Member States anticipate a decrease in their ETS emissions between 2020 and 2030 (Figure 2). This is mainly due to growth in the use of renewable energy and the phasing out of carbon-intensive power generation capacity.

However, six countries (Belgium, Estonia, Iceland, Ireland, Malta and Poland) project that their ETS emissions will increase. This is the result of the planned phasing out of nuclear production capacity, being replaced by fossil fuel capacity, or an increase in carbon-intensive energy production or other processes.

Supply of allowances higher than demand. For the first time since 2013, **the total supply of EU allowances (EUAs) for stationary installations was higher than the demand.** Two factors played a role in this:

- Reduced electricity demand and industrial activity lowered the demand for emission allowances.
- There was an increase of 1.4 billion (6%) in the supply of allowances in 2020 relative to 2019.



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Source: EEA (2021a); EEX (2021); ICE (2021).

The 1.4 billion increase includes free allocation, auctioned allowances and the exchange of international credits.

The supply of allowances allocated for free was 4.3% lower than in 2019, as the free allocation to existing installations is being reduced every year. By contrast, the number of allowances auctioned in 2020 was noticeably higher than during the previous year. The main reason for this increase is the additional volumes auctioned by the United Kingdom, compensating for those withheld in 2019 because of the Brexit negotiations.

In the case of aviation, the difference between supply and demand was even more stark. In previous years, the total supply of EU aviation allowances (EUAAs), including both freely allocated and auctioned amounts, was only covering around half of the demand. This forced operators to purchase the rest in the carbon market. In 2020, as demand crashed, freely allocated allowances were enough to cover the entire demand for aviation.

The initial difference between demand and supply caused the price of allowances to drop significantly during the first months of the pandemic, reaching a low of EUR14.6 in March. However, it quickly recovered in the following months, ending the year above EUR30 per tonne (EEX, 2021).

Another reason for the potential increase in ETS emissions is an anticipated higher demand for electricity due to electrification in the transport and buildings sectors. If this additional demand, which reduces emissions in accordance to the Effort Sharing Regulation, is not backed by similar growth in renewable electricity production, it might lead to an increase in ETS emissions.

13. **Emission Trading Schemes and "complementary" policies – role, links and eco-schemes**

The design and introduction of an ETS will invariably take place in a broader context of climate and energy policies, as well as other public policies that will either support or run counter to mitigation objectives (collectively called "companion" policies).

Policymakers will therefore face trade-offs between the benefits of an ETS and those of other policies, and must choose the role of the ETS within the wider policy mix to best suit their jurisdictional context, with potential policy interactions on four key areas:

- the role of the ETS in the climate policy mix;
- the impact of companion policies on ETS outcomes;
- the impact of the ETS on the attainment of companion policy objectives; and
- understanding where additional companion policies may be needed to achieve overarching climate targets and drive sustainable development.

Complementary companion policies enhance the impact of an ETS in constructive ways. For instance, they can:

- provide greater policy certainty to participants about the transition to a low-emission economy;
- facilitate the pass-through of carbon prices across the supply chain to change behavior;
- put in place enabling infrastructure;
- reduce the disproportionate or regressive impacts of emission pricing;
- provide incentives for innovation and early commercialization of mitigation technologies; or
- reduce other non-price barriers to mitigation (for instance information problems, skills gaps, or non-price behavioral barriers).

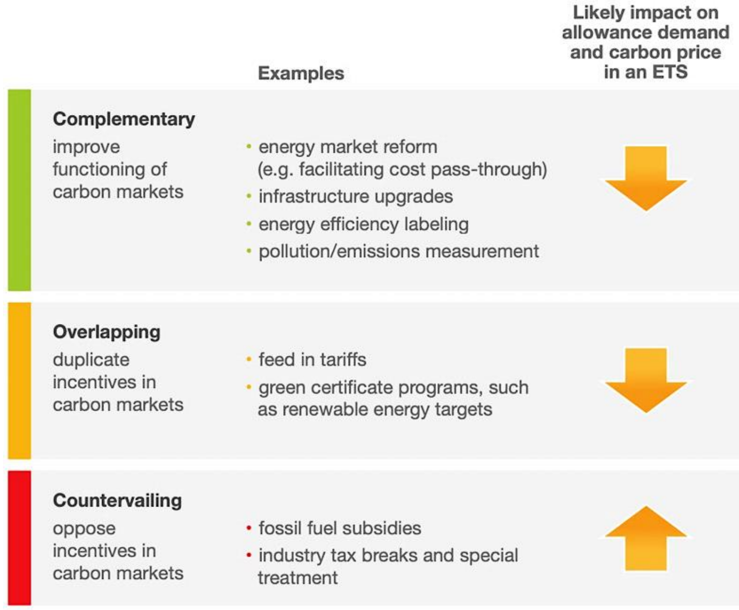
Existing and new companion policies can affect the operation of the ETS, including the level of emissions reductions, the emissions price, and the system's distributional impacts. These policies can help improve the effectiveness of carbon markets (complementary policies), duplicate incentive provided by carbon markets (overlapping policies), or in some cases, counteract incentives in carbon markets (countervailing policies).

Different types of intersection of companion policies:

13.1 Overlapping policies

Companion policies may be overlapping, particularly if they are not reflected appropriately in the design of the ETS. This is most likely to be a challenge in relation to energy-sector policies and regulations, especially those addressing energy efficiency, low-carbon energy, or technology innovation.

Policies that significantly overlap with the EU ETS typically occur at the EU level where the scale is such that interference with carbon market supply and demand balance can become material.



If these policies lead to emission reductions in sectors already covered by the ETS and not accounted for in the cap, then this causes the allowance price to fall (as demand for allowances will be lower) and dilutes the price signal.

It also allows emissions from other covered sectors under the emissions cap to rise. This stops the ETS from delivering short-term, least-cost mitigation.

There are often good reasons for operating overlapping policies in parallel with an ETS, including supporting the penetration of certain transformational technologies, addressing behavioural biases, or avoiding lock in of capital in assets that may be stranded in the future.

Policies that majorly overlap with the EU ETS:

- Energy Efficiency Directive (EED)
- Renewable Energy Directive (RED)
- Energy performance legislation
  - *Eco Design and Energy Labeling*
  - *Energy Performance of Buildings Directive (EPBD)*
- Air quality plant level legislation including the Large Combustion Plant Directive (LCPD), the Industrial Emissions Directive (IED), and Medium Combustion Plant Directive
- Carbon tax
- Emissions Performance Standard on CO2

Policy/Indicators to assess policies	ETS	EED	RED	Direct regulation (IED, Eco-design, Air quality directive, etc.)	Carbon tax
Cost-effectiveness	High	Low	Low	Low	Low
Environmental outcome	High	unclear	High	unclear	unclear
Internal energy market	High	Low	Low	Low	Low
Transparency on the impact on emissions	High	Low	Medium	Low	Low

13.2 Countervailing policies

In general, jurisdictions should try to avoid countervailing policies (like fossil fuel subsidies) that oppose carbon market incentives. However, this too requires careful analysis, as these policies may achieve other policy objectives that may be of value. Policymakers must trade off achieving emissions reductions with the importance of other objectives. As such it is important that countervailing policies are considered on a case-by-case basis.

13.3 ECO-SCHEMES

A reformed Common Agricultural Policy (CAP) will enter into force in 2023. The two most important changes in this new CAP are on one hand the shift to implementation through national CAP Strategic Plans (CSP), which are being prepared by EU countries and due for submission to the Commission by Q1 2022, and on the other hand, the addition of a new form of direct payments for environmentally-friendly farming: **eco-schemes**.

Eco-schemes are **one of the few novel instruments** available in the toolbox of the future Common Agricultural Policy (CAP).

These schemes for the climate, the environment and animal welfare will be **fully funded by the EU** and take the form of **yearly payments to farmers who voluntarily enrol**.

Rather than using CAP direct payments to farmers as just income support, the **aim of eco-schemes is to reward those farmers who manage land in a nature- and climate-friendly way**, and to **incentivise the adoption of specific farming practices with higher environmental and animal welfare benefits**.

High expectations are now set on eco-schemes.

The European Green Deal mentions that CAP "measures such as eco-schemes should reward farmers for improved environmental and climate performance", and the Farm to Fork Strategy says that they should "offer a major stream of funding to boost sustainable practices"

<u>Areas of action for eco-schemes as described in the CAP regulation for Strategic Plans</u>

- **climate change mitigation**, including reduction of GHG emissions from agricultural practices, as well as maintenance of existing carbon stores and enhancement of carbon sequestration;
- **climate change adaptation**, including actions to improve resilience of food production systems, and animal and plant diversity for stronger resistance to diseases and climate change;
- protection or improvement of water quality and reduction of pressure on water resources;
- prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management and soil biota;
- protection of biodiversity, conservation or restoration of habitats or species, including maintenance and creation of landscape features or non-productive areas;
- actions for a sustainable and reduced use of pesticides, particularly pesticides that present a risk for human health or environment;
- actions to enhance animal welfare or address antimicrobial resistance.

Now, **are Eco-Schemes to be considered complementary companion policies** with EU ETS?

Going back to our criteria above:

- May provide greater policy certainty to Carbon Farming participants about the transition to a low-emission economy?
- May facilitate the pass-through of carbon prices across the agriculture supply chain?
- May put in place enabling infrastructure in Carbon Farming?
- May reduce the disproportionate or regressive impacts of emission pricing?
- May provide incentives for innovation and early commercialization of mitigation technologies; or
- May reduce other non-price barriers to mitigation?

14. "Linking different ETSs" as opportunity for the development of carbon projects – takeaways for Ukraine?

Linking occurs when an **emissions trading system (ETS) allows regulated entities to use allowances from one or more other systems** for compliance purposes.

What does it mean? A jurisdiction *(e.g., let's assume for a moment the "Ukrainian ETS")* can consider various types of linkages, along two dimensions of choice — the direction of flow of allowances and whether there are restrictions placed on allowances from the linked system.

Earlier in the study, a series of steps to be done to establish an Emission Trading System (Ukraine?) were elaborated. One of them is "*Step 9: Consider Linking*". And we also mentioned some lessons learned by some implemented cases (or ongoing to be).

Linking can be **bilateral (or multilateral)**, where all systems recognize the allowances of the other system(s), or **unilateral**, where the flow of allowances goes in only one direction. Additionally, systems may or may not place qualitative or quantitative restrictions on allowances from the linked system(s).

There are several economic, environmental, political, and administrative benefits to linking. First, it reduces aggregate compliance costs: allowing two systems to trade allowances increases efficiency in the same way as trade between two companies. The larger the difference in allowance prices between the systems prior to linking, the greater the potential for economic gains from trade.

Linking also increases market liquidity and depth, **promotes price stability**, and **can reduce the risk of carbon leakage.**

Linking can increase the political momentum for climate action, allowing jurisdictions to demonstrate climate leadership on a global level and build domestic support for mitigation policies.

It may also help lock in the ETS, making it more politically challenging for subsequent administrations to undo carbon pricing policies or walk back climate ambition.

Finally, the lower aggregate compliance and administrative costs resulting from linkage may also help with the political sustainability and durability of an ETS.

However, for linkages to work, jurisdictions may need to find compromises to make their systems compatible and to guarantee the environmental integrity of allowances across systems. If prices differ significantly between jurisdictions prior to linking, their subsequent convergence can be challenging — either because high-price jurisdictions will be concerned that their climate ambition is being diluted and co-benefits are reduced, or because low-price jurisdictions will be concerned about the higher prices they will experience.

To address these potential disadvantages, **jurisdictions should choose linking partners carefully and consider safeguards,** such as restricting the extent to which they link or defining conditions under which the link is terminated. These restrictions will reduce the cost-effectiveness of an ETS but may be useful if there is a need to trade off some of the advantages of linking with a reduction of potential risks.

Clearly identifying the objectives of linking can help in the search for an appropriate linking partner.

In some cases, ETSs were designed from the outset to link with a larger market or operate as a multi-jurisdictional system.

When a jurisdiction has identified a potential linking partner or partners, an in-depth review of the respective systems helps identify the design elements that need to be discussed and possibly aligned.

Linking requires clear understanding and acceptance of the current and future levels of ambition, standards for environmental integrity, strategies for stabilizing prices, and direction of future ETS policy in partnering jurisdictions.

Specific design features that require compatibility include the **voluntary or mandatory nature of the system**, the **type of cap**, **price or supply adjustment measures (PSAMs),** the use and environmental integrity of offset credits, rules on borrowing and banking allowances, and the potential for linking with further systems.

Certain key design features require not strict compatibility, such as the stringency of the cap, the robustness of monitoring, reporting, and verification (MRV) systems, capacity of regulators to manage risks of misconduct in the secondary market, the administration of registry and tracking allowances, and ability and willingness to enforce ETS rules.

14.1 Different types of linking

A jurisdiction can consider various types of linkages, with two dimensions of choice — the direction of flow of allowances and the restrictions placed on allowances from the linked systems.

The direction of flow of allowances can be:

- **Unilateral**. Under unilateral or one-way linkage, a system accepts allowances from one or more other systems, but not vice versa. One-way linkages may represent the starting point for a potential two-way link. Norway had a one-way link with the European Union (EU) *(where Norwegian entities could buy EU allowances but not vice versa)* as a first step to a two-way link. A similar staged accession was planned for the intended link between the EU ETS and the Australian ETS.
- **Bilateral or multilateral.** Allowances from one or more markets are eligible for use in the others and vice versa. Linkages may be bilateral or multilateral. An example of bilateral linkage is that between California and Québec. The Regional Greenhouse Gas Initiative (RGGI) launched as a multilateral linked system of almost identical ETSs, each enacted at the state level, but operating from the beginning as a single, unified system.

Indirect linkages may also be created when two separate systems (A and B) each link to a common, third system (C). Although they are not formally linked, activity in system A could then impact the market in system B and vice versa through impacts on the allowance price in the common shared partner system, C. Linkages to C could be one- or two-way.

An example of this is New Zealand's ETS, which was linked indirectly to the EU ETS through their mutual acceptance of Certified Emission Reductions (CERs) generated under the Clean Development Mechanism (CDM).

Additionally, systems may place qualitative criteria or quantitative limits on allowance flows from the linked system(s).

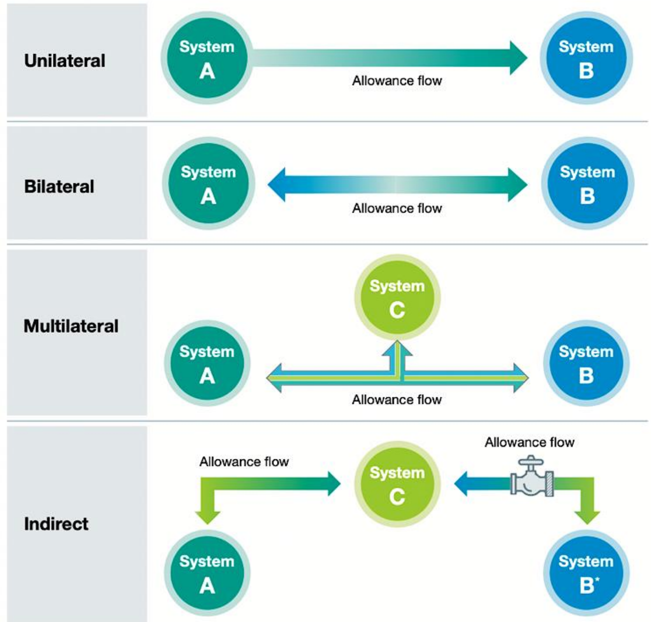
- **Full or unrestricted linkages.** Allowances from all systems are mutually recognized and equivalent for compliance purposes without any restrictions, effectively creating a unified market.
- **Restricted linkages.** Limits are placed on the flow of allowances from the linked system. These may be quantitative or qualitative, similar to the limits most ETSs have on the use of offset credits.

While not a formal link, **collaboration among systems may be an important step along the way to full linkage —** or may be considered desirable in itself → **Ukraine?**

By coordinating on and promoting alignment of program objectives, enforcement mechanisms, or other features, systems can share information and best practices, increase comparability of effort, provide political support, reduce competitiveness and leakage concerns, and simplify administrative procedures for companies operating across the systems.

Collaboration can also be an opportunity for an established ETS to share information with a new system, streamlining technical, legal, and administrative burdens and lowering costs while also smoothing the potential path toward eventual full linkage.

In the figure, the valve illustrates qualitative and/or quantitative restrictions imposed by System B on allowance inflows from System C.



14.2 Past, present, and future of linkages between ETSs

Linkage can provide economic, political, and administrative benefits that help support the design objectives of an ETS.

Linkage between ETSs may also be a strategic step toward a more integrated global carbon market and the resultant cost savings.

Systems involved	Main characteristics	Key events
California and Québec (current)	Two-way link Separate caps Similar design features Joint auction and registry system	– California and Québec adopt design recommendations of Western Climate Initiative (WCI) – California and Québec independently adopt regulatory changes to recognize each other's programs – California and Québec programs link
California and Québec with Ontario (past; active onlyduring the first half of 2018)	Linked and then de-linked with California and Québec Separate caps Similar design features Joint auction and registry system	– Linking agreement reached between all three jurisdictions – Link becomes operational (linkage occurred from January–June 2018) – Ontario withdraws from linked market following election of new provincial government, but new linking agreement remains valid for California and Québec
EU and Australia (past; planned but never took effect)	Eventual two-way link beginning with one-waylink in which Australian entities could use EU allowances Separate caps Some design features were in process ofalignment	– Agreement to enter negotiations on eventual two-way link starting 2018 – Australia repeals its Carbon Pricing Mechanism (CPM), which ends discussion of possible EU link
EU and Norway (past; active between 2005 and 2012)	Began as a one-way link with Norway acceptingEU Allowances (2005–2007) and evolved into a two-way link (2008–2012) Common cap Similar design features Separate auctions and registry systems	2005 — One-way link starts 2007 — Agreement reached on two-way link2008 — Two-way link starts 2012 — Directive establishing third phase of EU ETS (2013–2020) incorporated into revised European EconomicArea agreement, making Norway part of the EU ETS

EU and Switzerland (current)	Two-way link Separate caps Similar design features after Switzerland undertook actions to align its ETS with the EU Separate auctions	2011 — Negotiations on linking agreement formally begins2017 — Linking agreement signed 2020 — Link enters into force
RGGI (current)	Multilateral link among participating states Set of participating states evolves over time asstates join/leave Common cap Similar design features Joint auctions Same registry systems	2005 — Agreement reached among original seven signatorystates 2006 — Model Rule establishing regulatory frameworkpublished 2009 — Operations begin in 10 states 2017 — Model Rule for 2021–2030 published
RGGI and New Jersey (current)	De-linked and then re-linked with RGGI Common cap Similar design features Joint auctions Same registry systems	2005 — New Jersey is among the original signatories to RGGI2009 — RGGI operations begin 2011 — New Jersey exits RGGI under new governor 2019 — New Jersey passes legislation to rejoin RGGI 2020 — New Jersey rejoins RGGI
RGGI and Pennsylvania (under consideration)	In the process of designing regulation withintention to link with RGGI from 2022 Common cap Similar design features Joint auctions Same registry systems	2019 — Executive order by Pennsylvania governor requests development of ETS regulation proposal aligned withRGGI 2020 — Pennsylvania proposes first draft ETS regulation aligned with RGGI with the aim to link from 2022
RGGI and Virginia (current)	Adopted legislation to link with RGGI from 2021 Common cap Similar design features Joint auctions Same registry systems	2017 — Virginia proposes ETS regulation aligned with RGGI with aim to link by 2020 2018 — Virginia releases revised and final ETS regulation 2019 — Virginia adopts ETS regulation incl. RGGI linkage by 2020 - state legislature adopts budget blocking RGGI linkage 2020 — Newly elected state legislature adopts ETS legislationincluding RGGI linkage from 2021
Tokyo and Saitama (current)	Two-way link Separate caps Similar design features Separate allocation mechanisms and registrysystem	2011 — Link is operational immediately at the launch ofSaitama's ETS
Transportationand Climate Initiative (TCI) (under consideration)	Currently finalizing a memorandum of understanding (MoU) to establish a multilaterallink among participating states from 2022 Common cap Similar design features Joint auctions Same registry systems	2018 — Subset of TCI jurisdictions announce development ofcarbon pricing mechanism for transport sector 2019 — Subset of TCI jurisdictions propose draft frameworkand draft MoU for transport sector ETS

15. Result-based carbon farming mechanisms in the EU – Design principles of a Carbon Farming *Schemes in support of the Farm2Fork & FitFor55 objectives*

As already anticipated in Part 1 of this study, agriculture directly generates more than 10% of Europe's greenhouse-gas emissions. At the same time, by sequestering carbon in soils, peatlands, and agro-forestry systems, agriculture offers significant potential to mitigate climate change.

Actions to reduce agricultural emissions and increase on-farm carbon sequestration is referred to as carbon farming.

Carbon farming offers **real climate mitigation potential** – but care must be taken to ensure mitigation is **additional, real, permanent, and delivers co-benefits**.

Carbon farming offers significant potential for climate change mitigation and also delivers other societal co-benefits, including for biodiversity, soil health and water quality. Promoting the widescale implementation of agricultural climate mitigation should be a European priority. Care must be taken to ensure that carbon farming delivers **permanent mitigation** and delivers co-benefits without encouraging actions that contradict other EU Green Deal objectives (such as animal welfare).

A key challenge is **cost-effective**, **accurate monitoring**, while the **risks of non-permanence** and **non-additional mitigation** need to be carefully managed.

While carbon farming is being promoted as a climate mitigation strategy, soil carbon sequestration has the potential to bring considerable benefits for ecosystems and biodiversity and water protection, as well as to farmers themselves through increased resilience and profitability. **This could be a win-win-win scenario.**

Existing EU policies on climate, biodiversity, and agriculture offer **many potential sources of funding** and opportunities to encourage farmers to take mitigation actions.

Voluntary carbon markets and supply chain-financing could play a role in upscaling carbon farming, though given its scope and influence, the Common Agricultural Policy (CAP) offers the most significant opportunities (but also barriers) for widescale carbon faming uptake.

To foster a sustainable transition of EU agricultural and food systems aligned with the Green Deal's objectives, a **Carbon Farming Scheme (CFS)** should target systemic transitions of farming systems, through the adoption of a multi-dimensional approach (beyond a carbon-focused one).

A **Carbon Farming Scheme (CFS)** is defined as *a green business model that rewards land managers for taking up improved land management practices, resulting in the increase of carbon sequestration and/or reducing the release of carbon to the atmosphere*.

The following criteria would need to be considered in such a perspective:

- an absolute reduction in all GHG emissions
- enhance carbon sequestration in soils and agroecological infrastructures
- foster the diversification of agroecosystems from plot to landscapes
- reduce the overall dependency of farming systems to external and synthetic inputs.

In that perspective, five areas of action have been identified (that are however partially cross cutting):

- better management of peatland
- development of agroforestry
- maintain and enhance soil organic carbon
- better management of livestock (feed and manure management) and
- better nitrogen/fertilization management.

The first three areas encompass actions whose objective is to *sequester* carbon in different compartments of agroecosystems, while the others two have more to do with emission reductions in particular through *efficiency gains* and technological uptake.

In parallel, reaching the objectives of the Farm2Fork and Biodiversity strategies (F2F & BDS) will be necessary to maintain the productive capacity of our agroecosystems, already affected by climate change and biodiversity collapse.

These targets include an absolute reduction in the use of synthetic inputs (both fertilizers and pesticides) and a strong (re)diversification of agroecosystems–from plots to landscapes (through the 10% target of landscape features and the 25% target of organic farming). At the same time, reaching such targets will also be favorable to soil carbon sequestration and, to a large extent, to an increase in the efficiency of nitrogen use. They are, as such, fully supportive of the climate objectives.

On the other hand, changes targeting only/mostly carbon efficiency such as those falling within the two last areas of action above outlined–livestock and fertilization management – can have detrimental effects on ecosystems' health. This is in particular the case of the use of nitrification inhibitors or feed additives, whose widespread use is sometimes hypothesized as a corner- stone of highly ambitious climate scenarios:

- Following the IPCC (Intergovernmental Panel on Climate Change) recommendation, the use of nitrification inhibitors aims at limiting the emission of N_2O resulting from N application. However, it also contributes to increase the emission and then the redeposition of ammonia in natural ecosystems–which has critical side effects on natural ecosystems–while this very same process is also responsible to indirect N_2O emissions undermining the overall climate effect of this technology.
- Feed additives aim at increasing feed conversion efficiency while reducing enteric fermentation for ruminants and can lead to a 10-15% reduction of methane emission without impacting cow productivity. Yet, how these additives affect the quality of the manure and in turn agroecosystems (and in particular soils) where this manure is applied remains relatively unknown.

Below an overview of carbon farming options:

Assessment criterion	Managing peatlands	Agroforestry	Maintain and enhance SOC on mineral soils	Livestock and manure management	Nutrient management on croplands and grasslands
Carbon farming actions	Peatland rewetting / maintenance / management	Creation, restoration, and management of woody features in the landscape	Cropland and grassland management	Technologies to reduce enteric methane, manure management, increased herd and feed efficiency	Improved nutrient planning, timing and application of fertilisers; reduction in fertilisers
Total EU mitigation potential (Mt CO2-e/yr)	51 - 54 Mt CO2-e/yr	8 – 235 Mt CO2-e/yr	9 – 70 Mt CO2-e/yr	14 – 66 Mt CO2-e/yr	19 Mt CO2-e/yr
Per hectare mitigation potential (t CO2-e/ha/yr)	3.5 - 29	0.03 – 27	0.5 - 7	Not available	Not available
Mitigation mechanism	Avoided emissions	Removal	Removal and avoided emissions	Reduced emissions	Reduced emissions
Type of change	Land use	Management	Management and land use	Management	Management
Co-benefits for farmers	Potential for paludiculture (productive use of wet peatlands)	Diversification of outputs protects against single crop failure	Improved water holding capacity and workability of soils, productivity	Lower input costs (feed, fertiliser, energy), soil health, productivity	Lower input costs
Societal co-benefits	Biodiversity, flood regulation, water quality	Improved water retention, microclimate, soil health, biodiversity	Improved water retention, soil health, biodiversity	Decreased nutrient runoff; Decreased ammonia emissions	Decreased nutrient runoff; decreased ammonia emissions
Risks	CH4 emissions (although net GHG benefit), decrease in production	Non-native species' impact on biodiversity	Biochar and off-farm compost impacting soil health/biodiversity	Animal welfare; water quality impacts of feed additives	Water quality impacts of nitrification inhibitors

Carbon farming initiatives should therefore prioritize practices that yield multiple benefits (e.g., climate and biodiversity ones) while minimizing risks.

Yet, a significant reduction in the use of external inputs and a strong diversification of agroecosystems, as required by the F2F & BDS, are also likely to lead in the short run and under the current state of our knowledge to a slight reduction of the overall agricultural production.

In a context where long-term climate strategies also target increases in the supply of biomass for substituting fossil carbon (either for energy or industrial purposes), a CFS can only be successful if accompanied by a reduction in the production and consumption of animal products within the EU.

Animal production indeed absorbs as of today 43% of the biomass consumed in the EU, *vs* only 13% directly used as food, 23% for industrial purposes and 20% for energy production. Since fossil carbon today constitutes 55% of the total carbon consumed in the EU or 550 Mt of C, and since this amount is to drop dramatically if we are to meet our climate targets, less carbon derived from biomass should be directed to livestock and priority should be given to "low opportunity cost biomass".

In that perspective, extensive livestock systems relying on non-food competing feedstuff - and in particular extensive grasslands – should be prioritized over other sorts of systems for both the ecosystem services they render (nutrient cycling and landscape management) and their contribution to climate goals.

In order to help evaluate carbon farming perspectives and **develop a roadmap to provide Ukrainian farmers with carbon market opportunities,** it is important to synthesise experiences from global and EU initiatives to identify good practices, barriers and potential solutions for implementation of result-based payments. In particular, lessons learned along different design dimensions, including: scheme governance, coverage and eligibility, baseline and additionality, measurement, monitoring and verification, reward mechanism, transparency and reporting, permanence, risk and flexibility mechanisms, and acceptance and barriers could explain first how **result-based schemes differ from action-based schemes** and then by focusing on results rather than prescribing the actions how these schemes have the potential to offer flexibility to farmers.

The need for a CFS that would simultaneously set climate targets for the agricultural sector and translate them into concrete objectives for farmers is clearly established. Beyond the stated goal of the Commission to make such a scheme a way to diversify land manager's income, it has to be designed to support sustainable transitions of farming systems. This has several implications for its design and its governance.

Three aspects in particular need to be addressed: what is the scope and the perimeter of its deployment? How should it be financed? How should its implementation be monitored/followed?

15. 1 What is result-based schemes for carbon farming?

EU farmers have long been offered ***action-based payments*** for compliance with very specific farming practices or technologies which have been selected by the managing authority for the assumed environmental benefits. Simply put, farmers receive a set payment for taking a particular action, e.g., complying with a defined farming practice or implementing specific technologies. **Action-based payments are commonly applied in CAP** (e.g., agri-environmental-climate payments under Pillar 2). Payments are relatively simple, with low monitoring requirements for farmers and administrators. However, the actual **mitigation impact of action-based payments is uncertain**, as payment depends only on the action, not the result.

On the other hand, few schemes or projects have offered ***result-based payments*** (*schemes that require that a direct and explicit link is established between the results delivered (e.g., GHG emissions avoided, or CO2 sequestered) and the payments made to the land manager)* where the incentive **payment is linked to**

measured outcomes on the farm, irrespective of the precise farming practices that are applied. Simply put, farmers receive a payment that depends on the actual mitigation outcome that they deliver (typically in tCO2-e that are either sequestered or not emitted), regardless of the specific actions taken. **Result-based payments require that the mitigation outcome can be quantified and verified,** which requires costly and complex MRV, and if prices and mitigation are uncertain also poses uncertainty for farmers. A strength is that environmental certainty and credibility are high due to the explicit link between the mitigation contribution and payment, also, the flexibility can encourage farmers to innovate and adapt mitigation measures to the local context.

Recent on-farm pilots have provided valuable insights into using result-based payments for carbon farming, water quality and soil functionality. Nonetheless, there are valuable experiences also available from non-EU schemes such as voluntary carbon market standards, as well as emerging projects within the EU, that offer lessons to be learned and inspiration.

Result-based incentives offer several advantages, compared to action-based incentives, but also have challenge and limitations, as summarised below:

Advantages of a result-based scheme for carbon farming:

- flexibility for the farmer – encouragement of adaptability, innovation and entrepreneurship.
- clearer link between payment and carbon impacts for buyers – higher credibility/appeal and potential for higher additionality.
- carbon impacts are an objective, and not a side-effect of sustainable agriculture – potentially higher effectiveness.
- lower adverse selection of parcels with lower yields by farmers (i.e. with lower opportunity costs);
- educational role for farmers and wider society.

Challenges and limitations of a result-based scheme for carbon farming:

- potential higher financial risks/uncertainty for farmers.
- potential higher transaction costs for developers.
- challenges related to monitoring, reporting and verification of climate mitigation results (costs, degree of reliability/robustness);
- challenges of ensuring additionality and of securing permanence of the carbon impacts.
- the time needed for change in reliable measurements is potentially long, and in some cases the change is appreciable only after the project life span.
- higher flexibility given to farmers also means that strong advisory support needs to be built into scheme design; however, capacity or resources for this may be lacking.

One factor that distinguishes carbon-based farming schemes from the more well-established result-based biodiversity schemes is the **potential for the scheme to be funded by the carbon market.**

The majority of the non-EU schemes reviewed for this study derive their funding from the ability to sell carbon credits on either the compliance or voluntary markets. Credits are issued by a registry after the results are monitored and verified. The credits can be sold either as fungible emissions offset credits or (non-tradeable) emissions reduction certificates.

Additional national and regional sources of public finding are also available in some Member States. One of the key factors likely to guide the choice of available funding sources is the stringency requirements that the source of funding places on the system of MRV.

Hybrid payments: It is important also to note the so-called **hybrid payments**, a mix action- and result-based payments, combining low-risk, up-front or guaranteed payment for farmers for implementing specific farm management actions, with additional payments based on actual measured mitigation results.

Upfront payments can be used to cover implementation costs, or to reduce the financial risk for farmers. Hybrid models can increase farmer uptake by lowering risk and removing upfront financial barriers, whilst still providing flexibility to farmers to implement optimal actions for their farms and guarantee real climate results for society.

15.2 Design elements of a result-based carbon farming scheme

Objective setting and eligibility:

- Is the focus on emission reduction, carbon storage or a combination of both?
- What geography is covered?
- What farming systems are covered?
- Who can participate in the scheme?
- Is the whole farm concerned ?
- How is adverse selection and moral hazard avoided?

Baseline and additionality:

- What is the baseline against which additionality is measured?
- The scheme has to ensure that results are produced that would not otherwise have happened.
- Environmental additionality
  - Carbon leakage must be avoided, i.e. carbon removals in one area must not be shifted to another area Can encompass the retention of carbon stocks that would otherwise have been released
- Financial additionality
  - Is this something that farmers would have done anyway, perhaps to achieve improved productivity?
  - Is it something farmers are being paid to do form another source and therefore a risk of double funding?
- Regulatory additionality
  - Do the measures go beyond those required under EU (GAEC Standards), national or local legislation?

Permanence

- A widely used standard is that any reductions in GHG emissions And removals of atmospheric carbon should last for at least 100 years
- How is permanence ensured? What buffers, insurance, or other mechanisms are set up t address natural disturbances?

Result indicators

- Result-based carbon farming schemes need a measurement of climate benefit in terms of mtCO2eq of net reductions in carbon emissions or a net increase in stored carbon in soil and biomass.
- One can also choose between the measurement of absolute reductions in emissions, reductions in emission intensity, or a combination of both
- One can choose between direct and proxy measurements of emission reduction
- It is clear that there is a trade-off between certainty of the indicator measurement and the cost

Monitoring, Reporting and Verification (MRV)

- Monitoring, reporting, and verification (MRV) refers to how participants' climate actions and emissions are reliably measured, how they are required to report to authorities, and how authorities verify their accuracy. MRV is integral to result-based carbon farming schemes, as it is the step that quantifies the impact of the climate actions, i.e. the results.

- Monitoring refers to the quantification of GHG emissions or removals, and includes collection of data as well as calculation methods
- Reporting establishes how participants are required to record and communicate monitoring data to relevant authorities and/or government entities
- Verification refers to the process of establishing the truthfulness and accuracy of reporting

Reward mechanism

- Market based reward
- Non-market-based reward
- Payments based on costs
- How is the reward calculated and related back to levels of achievement based on the reward indicator?
- Are co-benefits rewarded? the reward in the form of a monetary payment, or property title (i.e. carbon credit)?
- When is the payment awarded?

Governance & approaches to non-compliance and fraud

- What entity owns / operates the scheme?
- What are the operational structures and responsibilities?
- What type of independent supervision / audits are in place?
- Is the integrity of the MRV-system secured?
- Are procedures in place to avoid double counting, i.e. the accidental or deliberate multiple use of the same unit of emission reduction or carbon sequestered?
- What types of advisory services are provided to support farmers?

Situation today

There is clearly an inherent tension, at least in the short to medium term, between the need to upscale rapidly the widespread adoption of carbon farming across all farmland in the EU to meet climate targets, and the immaturity of result-based payment schemes for carbon farming and the carbon markets available to farmers.

Clearly developing and piloting a range of locally or regionally tailored result-based pilot schemes for carbon farming is an urgent priority, which promoted not only by various private initiatives but also the Horizon programmes. Nevertheless, it will be necessary to focus also on more widespread adoption of well-designed, action-based or hybrid schemes, to make the initial step towards a real shift in the agriculture sector’s contribution to EU climate targets. This will support later uptake by increasing awareness and knowledge of farmers, as well as that of farm advisers and other stakeholders.

Overall, the case studies put in place so far suggest that **peatland restoration and re-wetting and agroforestry represent the two carbon farming approaches that are arguably the most mature and ready for developing and testing a large-scale result-based carbon farming mechanism in an EU context**.

The huge area of grassland in the EU, and the existence of many existing result-based grassland management mechanisms, mean that it is also worth exploring how a carbon farming element could be incorporated into these schemes to maintain and enhance Soil Organic Carbon.

The scale of livestock farming in the EU suggests that livestock farming carbon audits also have the potential for large-scale deployment, but such mechanisms will need to tolerate the moderate levels of uncertainty associated with current farm carbon audit tools.

In addition, these mechanisms must avoid supporting and therefore locking in high emissions food production methods on land that could be more efficiently used.

Existing Result-Based Schemes

Existing schemes are funded through public funding such as the EU Common Agricultural Policy (CAP), LIFE programme, national or regional funds such as Rural Development Programmes, or Agri-environmental measures, most of them through EIP (European Innovation Partnership) operational groups in the sense of Art. 56 of Reg. 1305/2013, as well as private initiatives like in the Austrian Humus-Program. Several RBPS have more than one funding source.

There are many agri-environmental RBP schemes and projects already implemented by several EU member states, covering various environmental problems and using several kinds of indicators.

They maybe implemented through collective approaches, such as in the Netherlands, involve local or native communities, such as the Sami reindeer herders in Sweden, or via individual farmers and land managers. Central to all of these approaches is engaging the knowledge of farmers in managing their land in a way that helps to improve biodiversity delivery as well as other environmental outcomes on the ground alongside their other agricultural activities.

Takeaways for Ukrainians farmers and stakeholders

The "Fit for 55%" package will create an “Agriculture, Forestry and Other Land Use (AFOLU)” sector (i.e. a policy architecture) combining Agriculture, Forestry and Land Use in a single legal instrument that will facilitate the design of efficient and effective policies in these sectors and better align them with EU agricultural policy instruments.

In this way, **the agriculture and forestry sectors will become the first net greenhouse gas-free sector by 2035.**

It would then generate from 2036 onwards carbon credits to balance remaining emissions in other sectors on the basis of a robust carbon credit certification system.

To achieve sustainable food production, the **Commissions’ Farm To Fork Strategy** relies on **product** (new varieties of seed, new breeding techniques, new balance between animal and vegetable proteins, …), **process** (nature-based technological and digital solutions, reduced input use, carbon sequestration by farmers and foresters, production of renewable energy, anaerobic digesters for biogas production from agriculture waste and residues, …) **and system innovation** (circular bio-based economy, creative reuse of waste, …).

An example of a new green business model is **carbon sequestration by farmers and foresters**. Farming practices that remove CO2 from the atmosphere contribute to the climate neutrality objective and should be rewarded, primarily through the creation of a well-functioning carbon market that recognises the effort from farmers and foresters.

The Common Agricultural Policy (CAP) remains the main tool for such recognition when this carbon market is not yet in place and for practices that are not covered in carbon farming schemes.

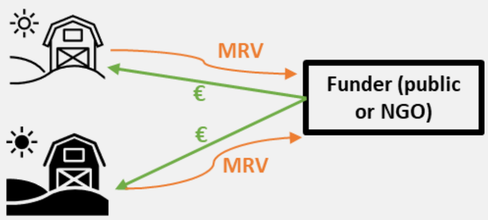
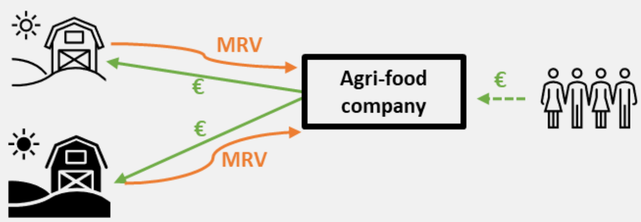
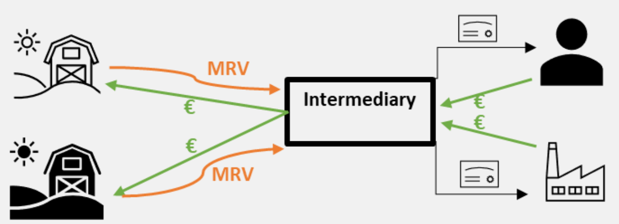
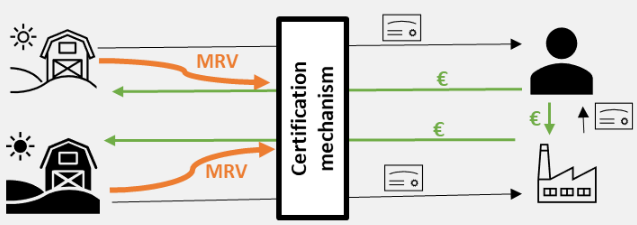
The Commission sets out a new green architecture for the CAP, featuring strengthened mandatory requirements and increased funding opportunities for green farming. Enhanced conditionality links EU-funded income support to environment- and climate friendly farming practices and schemes.

The **new eco-schemes** have the potential to **boost funding for sustainable practices**, such as **precision agriculture, agroecology (including organic farming), carbon farming and agroforestry**.

Agri-environment-climate measures and investments financed through pillar II rural development support will enhance ecosystems, promote resource efficiency, help to move towards a low-carbon, climate resilient economy.

Models for carbon farming mechanisms to be evaluated in Ukraine

Carbon farming payments are paid to farmers through a carbon farming mechanism. Below, 4 common carbon farming mechanism structures, which could be applied for activities in Ukraine (if regulators will follow EU mechanisms) are summarized.

<table>
<tr><td rowspan="2">Land-management practice payments</td><td>
</td><td>MRV requirements: Low -medium
Funder: Public or NGO
Example: CAP Greening payments, CAPPillar 2 payments
Payment: Cash (generally action-based; hybrid/result-based possible)</td></tr>
<tr><td colspan="2">A central funder pays farmers a reward for implementing climate carbon farming management actions (related to crops, soil, land use, livestock)</td></tr>
<tr><td rowspan="2">Corporate supply chain</td><td>
</td><td>MRV requirements: Low - high
Funder: Agri-food company
Example: Arla Climate Check, SPAR Austria Healthy Soils for Healthy Foods
Payment: Cash (generally action-based; hybrid/result-based possible)</td></tr>
<tr><td colspan="2">Agri-food companies pay farmers within their own supply chain to reduce their impact on the climate, motivated by the possibility of price premiums from customers, or to meet own company climate objectives. Also known as "insetting" or managing "scope 3 emissions".</td></tr>
<tr><td rowspan="2">Voluntary carbon market with intermediary</td><td>
</td><td>MRV requirements: Medium - high
Funder: Private companies/individuals
Example: MoorFutures, Label bas Carbone CarbonAgri, Woodland Carbon Code, Peatland Code
Payment: Offset certificate - non- fungible, only traded once then retired (result/hybrid/action-based)</td></tr>
<tr><td colspan="2">A central intermediary pays farmers for implementing mitigation measures, monitors and verifies mitigation impact, and sells offset credits to private buyers. The intermediary can be the private or public mechanism developer or a project developer. They often provide farmer training/support.</td></tr>
<tr><td rowspan="2">Voluntary carbon market - exchange-based</td><td>
</td><td>MRV requirements: High
Funder: Private companies/individuals
Example: Verra VCS, Gold Standard, puro.earth
Payment: Freely tradeable offset credit (result-based)</td></tr>
<tr><td colspan="2">Farmers implement mitigation measures in accordance with approved methodologies to produce offset credits that they trade directly with buyers. A certification mechanism aims to ensure that the offset credits produced are matched by high quality, unique climate mitigation/sequestration (i.e., equivalent to removals/reductions in other sectors and therefore tradable).</td></tr>
</table>

These differ in terms of who ultimately pays the farmers, what form of payment the farmer receives (i.e., cash or an offset credit tradeable for payment), and, most significantly, the level of monitoring, reporting and verification that is required.

The extent and stringency of MRV and the overall complexity of the mechanism determine the cost of participation for farmers, as well as the administrative costs borne by operators of the mechanism. These elements also determine the environmental certainty of mitigation, with associated risks for farmers and society we mentioned before.

Note: it is evident that these <u>models for carbon farming mechanisms</u> are more linked to voluntary carbon markets and ESG strategies implementation for SMEs, MidCaps and Large Enterprises.

15.3 Carbon farming costs and barriers

Costs vary widely depending on the mechanism type, carbon farming sub-category, specific mitigation measures implemented, and the local context.

An illustrative example is the LIFE Carbon Farming Scheme (2021), which evaluated seven potential carbon farming actions, **all result-based voluntary carbon market models with stringent MRV**. They considered farmer baseline setting, implementation, and transaction costs, finding that **the total cost per tCO2-e range from €20 (for afforestation) to €84 (for peatland actions).**

MRV costs can make some carbon farming mechanisms uneconomic for farmers.

In mechanisms with high MRV requirements, **the costs of quantifying emissions/removals and proving this to administrators can be prohibitively expensive, outweighing the potential carbon farming payments and therefore reducing farmer uptake** *(COWI, Ecologic Institute, and IEEP, 2021b).*

This is a particular issue where mechanisms require on-site visits and sampling to measure baselines and changes in e.g., soil carbon stocks. This varies considerably by carbon farming mechanism model: Label bas Carbone CarbonAgri estimates that cost of consultant site visits is €2000 per farm every 5 years; Gold Standard projects face USD67,500-87,500 of verification, validation, and registry costs in the first 5 years *(COWI, Ecologic Institute, and IEEP, 2021b)*; the LIFE Carbon Farming Scheme (2021) estimates project validation, verification, and market registration costs of €110,000-240,000 within the first five years.

In addition to reducing net benefits, **these high MRV costs can mean that only large farms or farmers can participate in high-MRV mechanisms**. Accordingly, carbon farming MRV should only be as stringent as it needs to be. However, the trade-off – lower MRV and lower environmental certainty – may not be acceptable in many cases.

	Cost types	Determinants
Administrator Set-up costs	Mechanism design: Development of the methodology (i.e., how to quantify mitigation, how to monitor, report and verify mitigation measures); developing all governance and operating rules. Scientific research/data collection: Calculating mitigation depends on locally appropriate research and data. Baseline setting and validation: Administrators may bear the cost of setting participant baselines (e.g., sampling, consultant visits) and validating new participants/projects. Outreach, training: Costs of attracting farmer participants.	Set-up costs are generally fixed costs, so will be lower per t/CO2-e or per participant in larger mechanisms. They will be higher for more complex mechanisms. Research and baseline costs will be lower when there is existing data and research to support implementation, and where scheme design builds on existing examples.

Administrator: Ongoing costs	Monitoring and verification: Assessment of farmer mitigation measures to ensure they comply with the methodology and verify results, any auditing costs. Mechanism administration: Administrative costs e.g., contracting, registry management, governance, system evaluation etc. Funding: Costs associated with getting funding e.g., marketing and selling offset credits to buyers.	Ongoing costs are variable, i.e., higher the more participants are involved (though with some economies of scale). More complex mechanisms will have higher MRV costs and administrative costs.
Farmer Set-up costs	Learning costs: Carbon farming requires additional knowledge and potentially training. Farmers must also learn how to operate within the carbon farming mechanism. Baseline setting: Farmers may bear baseline-setting costs. Implementation costs: Farmer costs of implementing carbon farming action (e.g., technology purchase costs, tree planting, rewetting).	To maximise farmer uptake, administrators can support farmers to reduce these set-up costs (e.g., through training, consultant support). Set-up costs are fixed costs, so larger participants have lower average costs.
Farmer Ongoing costs	Implementation costs: Direct ongoing costs of implementing the mitigation measure (including time costs, additional equipment, running costs). Opportunity costs: Income foregone due to implementing mitigation measures. Transaction costs: Farmer MRV and administrative costs.	Transaction costs depend principally on MRV requirements: complex schemes and high MRV pose significant costs for farmers.

In addition to costs, non-financial barriers can also pose a significant cost to upscaling carbon farming. Farmer barriers include:

- **Learning costs** – Carbon farming and interacting with new mechanisms requires new knowledge and skills, requiring training, support, outreach, and practical examples (and potentially up-front payments)
- **Risks** – Result-based mechanisms and the price uncertainty of exchange-based markets pose risks for farmers.

Administrator barriers include:

- **MRV cost and uncertainty** – Carbon farming MRV is often relatively uncertain or expensive (or both).
- **Other design challenges** –issues of permanence and defining additionality (especially with leakage and land-competition) and interactions with existing agricultural and environmental regulations make carbon farming challenging for administrators.
- **Administrator knowledge** – Carbon farming requires administrator knowledge, ability, and a baseline of data and scientific understanding.

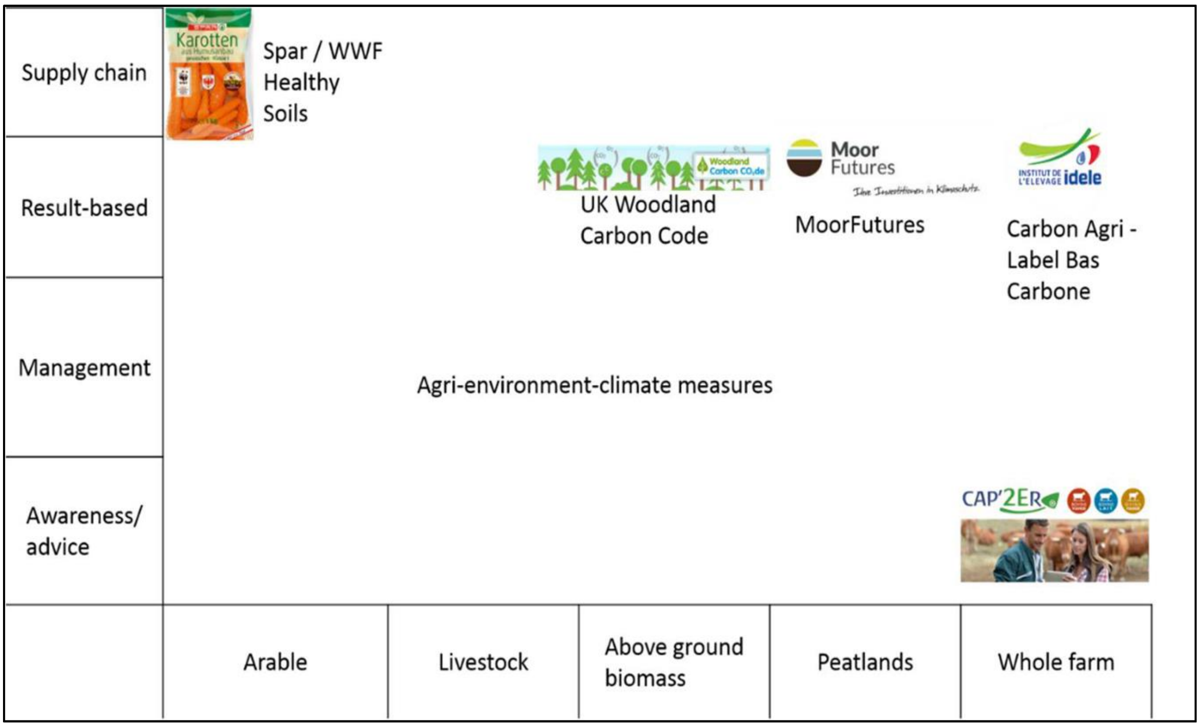
15.4 EU result-based carbon farming examples: classification of existing schemes

A number of pioneer initiatives within Europe have developed or started to develop payment schemes addressing GHG emissions/removals in agriculture.

These initiatives can provide ideas and lessons learned for the future development of result-based payment carbon farming schemes. The focus and scope of these projects ranges in terms of the degree to which they consider and provide reward / payments for results.

At the same time, these projects / initiatives also range in terms of the components of the farming systems that are included. Specifically:

- Purely **informational / non-result-based** farm-advice scheme focusing on awareness raising
- **Under the Common Agricultural Policy (CAP),** farmers are not paid for verified improvements against a specified result indicator, but rather encouraged and/or rewarded for management-focused changes.
- Several projects **funded under the LIFE+ funding instrument**, as well as under the EIP Agriculture, develop elements and methods relevant for result-based carbon farming schemes (e.g., OLIVE4CLIMATE, AGRESTIC projects)
- Some projects in the EU have also been **developed for the voluntary carbon market**, where farmers receive carbon credits equivalent to their mitigation impact in accordance with an approved methodology, which private actors and business wishing to reduce their climate footprint can purchase (e.g., MoorFutures, UK Woodland Carbon Code; Carbon AGRI).
- Finally, there are also existing initiatives or initiatives in pipeline developed by retailers or agri-food companies as part of their supply-chain management, whereby farmers in their supply chains are rewarded for changes that contribute to improved climate outcomes (e.g., SPAR/WWF Healthy Soils for Healthy Food project).
- Going even one step further, there are initiatives pulling desired carbon farming food products and ingredients through (often shorter than usual) supply chains to meet **sustainable, often organic food demand** for healthier eating (LIFE Organiko project).



To develop effective guidance for scaling up carbon farming schemes in Europe, it is necessary to explore options and draw conclusions on design elements that are fundamental to the delivery of effective results- based carbon farming schemes. Examples of the main choices that need to be made are outlined in the box below.

It is also important to reflect on different enabling mechanisms to scale up carbon farming schemes.

Governance

- What entity owns / operates the scheme?
- What are the operational structures and responsibilities?
- What type of independent supervision / audits are in place?
- What types of advisory services are provided to support farmers?
- How does the scheme link with national GHG inventories and LULUCF accounting?

Coverage and eligibility

- What GHG stocks and fluxes, geographies, farming systems are covered?
- Who can participate in the scheme?
- What activities are eligible?
- What eligibility criteria should be applied?
- What result indicator will be applied, how will this be defined and how does this link to GHG emission reduction?
- What are the risks associated with the definition of the coverage boundaries and where do these lie i.e. for other environmental knock on consequences, risks of failure, risks of unexpected responses?

Baseline and additionality

- What is the baseline against which additionality is measured?
- How is additionality ensured?
- What is counted towards additionality: total emissions reductions and/or emissionsintensity, and/or CO2 sequestration?

Monitoring, reporting and verification mechanisms

- How is change against the results indicator to be monitored? i.e. based on measurements (of what) or modelling / using default factors? Or both?
- What are the reporting and record-keeping obligations?
- Is an external audit conducted? And what should this check?
- Who is validating and evaluating overall scheme integrity?

Reward mechanism

- How is the reward calculated and related back to levels of achievement based on the reward indicator? Are co-benefits rewarded?
- Is the reward in the form of a monetary payment, or property title (i.e. carbon credit)? How are reward payments calculated e.g. GHG emissions avoided, effort required to deliver change, …?
- When is the payment awarded?

Transparency & reporting

- What information is publicly available?
- How are payment rates and resulting outcomes communicated to those within the
- scheme and external to it?
- What mechanisms for information sharing and transparency are in place?
- What analysis of scheme effectiveness and performance are kept and communicated
- to ensure ongoing learning/information to others developing similar approaches?

Permanence, risk and flexibility mechanisms

- How is permanence ensured? What buffers, insurance, or other mechanisms are set up to address natural disturbances?

15.5 Description of some existing EU Carbon Farming schemes + UK

French Label Bas Carbone – CARBON AGRI (France)

The *Label Bas Carbone (*French Carbon Standard) is a framework for voluntary carbon reduction project that was adopted by the French Government in November 2018.

It provides a transparent framework for guaranteeing the integrity of carbon reduction projects. Environmental integrity is ensured through the utilisation of standardised methodologies in line with the overarching rules set in the regulation. To date, it includes approved methodologies for forestry (afforestation, coppicing, and restoration) and for agriculture (CARBON AGRI). Companies, public organisations or individuals that wish to compensate their emissions can voluntarily acquire the emission reductions determined thanks to these methodologies to offset their emissions.

Individuals or sectors can propose methodologies, which the regulator must approve.

These methodologies set guidelines for how to do the following: establish eligibility criteria, calculate baseline scenario and demonstrate additionality of the project, demonstrate environmental integrity (i.e., co-benefits), requirements on identifying and managing non-permanence risks, calculate emissions reductions relative to baseline, and MRV requirements and methods.

The specific methodologies differ, but the general steps for implementing remain the same:

- project developers register their project that applies an approved methodology and meets its quality requirements
- they then request the *Label Bas Carbone* approval by submitting project description and required documents/evidence
- the regulator reviews and asks any clarifying questions/requests additional evidence and denies the project or approves it for recording in the register.

Only projects that are additional will be approved (i.e. the carbon credits would shift the Net Present Value of the project from negative to positive and the project would not otherwise occur without credits).

To date French government has approved methodologies for afforestation, coppicing, forest restoration and one in agriculture named CARBON AGRI.

For explanatory purposes for Ukrainian farmers, here we introduce the methodology for monitoring emission reductions in cattle and crops productions in compliance with the Label Bas Carbone.

CARBON AGRI provides a method for project developers to account for emissions reductions on cattle (beef and dairy) or field crop farms in France.

These validated emissions reductions can then be traded for payment from an external party voluntarily offsetting their emissions.

The method includes six types of actions:

- herd management and feeding,
- animal manure management,
- crop & grassland management,
- consumption of fertilisers and energy, and
- carbon storage (in total 40 low carbon practices).

It quantifies both reductions on farm as well as associated upstream emissions, applying life cycle assessment. Emissions change is calculated using the national tool CAP2'ER®, a whole farm calculator.

Change in emissions is calculated based on change in emissions intensity (i.e. kg GHG per kg of output). Each project runs for 5 years and can be renewed.

MRV: CARBON AGRI allows farms to calculate their baseline either using a conservative generic reference (using default inputs values coming from CAP'2ER® national database) or a more accurate specific reference per farm calculated with CAP'2ER® level 2 which requires approx. 150 activity data. To account for higher uncertainty of using generic reference, reductions are discounted by 10%. Following the initial project development and validation, the farm can also do a simple assessment (CAP'2ER® level 1) to track expected progress at some point in the first 5 years (this is optional). Then at the end of the 5 years period, a final accurate level 2 run of CAP2'ER® is required to calculate new carbon intensities and with CARBON AGRI to determine the net emissions gains relative to the baseline.

Reward mechanism: The Label bas Carbone is result-based, that is project developers receive 1 "credit" (recognized reduction that can be sold to voluntary financers) per t CO2 sequestered/avoided. The reward is paid at the end of the 5-year project period, upon verification (i.e. ex post).

Permanence/risk mechanisms: As most GHG reductions associated with CARBON AGRI are avoided emissions, there is low non-permanence risk. For farms that sequester carbon in biomass or soil (where non-permanence risk exists), a 20% discount is applied to their payments.

Healthy Soils for Healthy Food (Austria)

Healthy Soils for Healthy Food is a producer-retailer-consumer initiative led by the Austrian retail chain SPAR with support from WWF Austria focused on GHG sequestration through soil carbon on agricultural land.

Since its beginning in 2015, SPAR and WWF have worked with approximately 60 farmers to build up soil carbon in their horticultural land (covering 1052 ha). While not exclusively results-based, farmers were initially rewarded per ton of carbon stored on their land through soil carbon actions, though this is now being shifted to **activity-based payment**.

The project offers support/training to farmers, expert sampling and MRV of soil carbon, and rewards for participation.

Activities covered by the project relate to management of Austrian soils and entail fertilization with compost; reduced tillage; cover crops; and crop rotation and intercropping. The programme does not monitor the activities that farmers implement, but merely gives them recommendations. An independent certified specialist body samples and analyses soil for monitoring purposes.

MRV: The project uses soil sampling to measure the climate impacts. Soil sampling is done prior to project start and after 2-3 years (max. 5 years) after joining the initiative. Per 5ha block, external certified experts take and evaluate 25 soil samples. Farmer activities are not monitored, only the impact on soil carbon.

Reward:

The project is **partially results-based**. Along with education and support, SPAR guarantees the sale of produced vegetables (on the basis of 3-year contracts). In addition, initially, farmers receive a bonus of EUR 30 per ton of stored carbon (CO2e). However, following resistance from farmers, who would have to pay this back if soil carbon later decreased, the payment system has changed to be activities based, where they are paid a price increase per product unit based on the additional effort associated with soil friendly production.

Permanence/risk mechanisms:

There are currently no mechanisms in place to mitigate risk of long-term reversal, apart from the education and support provided, and the incentive to stay in the scheme.

UK Woodland Carbon Code

The UK Woodland Carbon Code incentivizes UK woodland planting for carbon sequestration through a voluntary standard.

The Code sets out how to plant and manage woodlands, and how to robustly measure, report, verify and govern the resulting sequestration. As a reward, landowners receive voluntary emissions credits that can then be sold through the Woodland Carbon Code Registry to companies/private individuals to offset their emissions. Since its launch in 2011, 187 projects covering 8,261ha have been validated, with expected carbon sequestration of 3.4million tC02. Scottish Forestry, along with the other forestry authorities in the UK, governs the project, with support from an expert advisory group.

The Woodland Carbon Code sets out a step-by-step process with guidelines for planning and planting woodlands, registering and validating your project, verifying expected sequestration, receiving and selling carbon credits, and ongoing monitoring, verification, and verification (MRV). Any UK land previously not forested (i.e. for the last 25 years) and not deep peatland is eligible, subject to normal planning and environmental constraints.

Projects first register on the UK Woodland Carbon Code Registry, either individually or as a combined group of projects. They project must submit a project design document in accordance with the guidance (and necessary evidence). This sets out a baseline (i.e. carbon stock without woodland planting) and the planned woodland planting and management (and quantifies expected project carbon sequestration), as well as carbon leakage. All of this is used to calculate the expected net sequestration (in terms of tCO_2 sequestered). The Project Design Document also sets out all administrative information, MRV plans, etc. An accredited independent body then assesses and validates this Project Design Document, after which the project can be implemented. Upon validation, projects receive Pending Issuance Units, which they can sell to buyers or retain to sell at a later date. Regulators convert these into Woodland Carbon Units upon verification.

Small projects (<5ha) can apply optional streamlined validation and verification processes.

MRV: Expected carbon sequestration (and baseline storage) are calculated using a WCC Carbon Look-up Tables and a Calculation Spreadsheet. This calculates expected sequestration based on factors including timing of planting, species, woodland management, soil type etc.

Landowners' project plans must be validated ex ante and then verified ex post at least at year 5 and then every ten years.

Monitoring at year five includes a visit by the external verifier and verifies that the woodland has been successfully established in line with the project plan (including density, species mix, tree health/protection). Monitoring at subsequent 10 years intervals will assess actual carbon sequestration and tree growth rates (included sampling measurements of tree density etc.).

Reward mechanism:

The Woodland Carbon Code is **results-based,** i.e. landowners receive 1 **voluntary carbon credit** for each t of sequestered carbon, which can then be sold to buyers as voluntary offsets for their emissions. Landowners will receive credits ex ante in the form of Pending Issuance Units, which they can sell to buyers, or they can sell the credits once verified at a later date. As the expected sequestration is verified, the registry will convert these into verified Woodland Carbon Units, which the buyer can then use to offset their own emissions.

Permanence/risk mechanisms:

To minimize risks of impermanence, landowners must identify and mitigate risks. They are required to restock if wood is harvested and replant if woodland is lost (e.g. through fire, pest, wind etc.).

They are also contractually obliged to manage in accordance with their project plan, as are subsequent landowners. Initial carbon sequestration estimates are reduced by 20% to cover any modelling errors.

In addition, all projects must contribute a further 20% of credits to the Woodland Carbon Code shared buffer. These cover any losses of verified credits over the project duration (which if drawn down must be replenished (e.g. through replanting) and are then retired at the end of project life.

MoorFutures (Germany)

MoorFutures is a **results-based voluntary scheme** to incentivize the rewetting of peatlands to decrease GHG emissions. Projects are rewarded in the form of voluntary carbon credits for the decrease in GHG fluxes that arises from rewetting.

The MoorFutures scheme is based in three states in Germany and has been selling voluntary carbon credits from peat rewetting since 2010 (the five existing or completed projects have expected lifetime GHG flux reductions of 68889t/CO2-e).

With the support of consultants, projects develop a forward-looking project baseline and project plan. The baseline identifies the expected land use that would occur without the project, and quantifies the expected associated GHG fluxes (i.e. sequestration – emissions) that would occur over the lifetime of the project (minimum 30-100 years). A project plan is then developed, which sets out how the project area will be managed for the life of the project (i.e. under rewetting, retirement of land), as well as MRV requirements, and quantifies the expected GHG fluxes under rewetting. The impact of the rewetting is calculated as the difference in GHG fluxes (i.e. t CO2-e) between the baseline and project plans, making conservative assumptions.

MRV: GHG fluxes are calculated ex ante. Primarily, an observational method (GEST) is applied, where the calculation of expected GHG fluxes is based on different observable land characteristics (e.g. peat type, climatic conditions, site characteristics, vegetation, land use/land cover), which are then associated with emissions factors. This is supported by an initial site visit to support calculations. Ongoing MRV plans are set out in the project plan. At a minimum they include external monitoring every 5-10 years to ensure project plan is being followed and at least one recalculation of the estimated emissions. External third-parties carry out this verification.

MoorFutures 2.0 also proposes methodologies for monitoring and reporting impact on other ecosystem services (e.g. water quality, flood prevention, groundwater enrichment, evaporative cooling, biodiversity), either through observatory methods equivalent to GEST or modelling.

Reward mechanism:

MoorFutures is **results-based** i.e. the actual climate impact determines the reward. **For each t CO2-e reduced, projects receive one voluntary carbon market certificate**. Private companies/households purchase these as voluntary offsets. Certificate prices are based on the costs of their production, i.e. calculated by dividing the costs of implementation by the total amount of emission reductions over the project crediting period (EUR per t CO2e); existing projects are selling certificates for prices of €35-80/t-CO2-e. Projects receive these credits ex ante upon project verification.

Permanence/risk mechanisms:

To decrease risk of projects reversing (and releasing all carbon sequestered through rewetting), MoorFutures requires minimum project lengths of 30 years and requires that they set out how permanence will be ensured (e.g. through legal contracts, change of title etc.). In addition, MoorFutures includes a "buffer" to ensure that rewards are at minimum matched by GHG impact, even considering uncertainty: Projects are rewarded for the difference between project scenario (which is conservatively estimated, i.e. highest likely emissions) and the baseline scenario (which is also conservatively estimate, i.e. lowest likely emissions). This creates a buffer equivalent to the difference between the conservative and (less conservative but more likely) expected emissions. In addition, MoorFutures retains 30% of generated credits in a buffer reserve to cover risks.

16. Carbon farming scheme options – Example of Scheme Options for Ukraine?

16.1 Scheme option: Whole farm audit

Numerous climate actions have been identified that can reduce agricultural GHG emissions through on-farm management, including herd management and feeding, animal waste management, crop management, consumption of fertilizer and energy, and carbon storage actions, among others.

With the help of consultants, farmers apply this tool to identify actions to avoid GHG emissions or increase carbon storage (relative to a baseline), which when implemented, are verified and can be sold as voluntary GHG reductions. Reductions are measured in terms of carbon intensity per unit of output. International examples are generally project-based that reward farmers/projects who apply specific pre-approved methodologies (e.g. the Australian Carbon Farming Initiative's Beef Cattle Herd Management methodology or numerous VCS projects). Projects and regulations managing agricultural nutrient pollution (e.g., New Zealand's Taupo Nutrient Trading Scheme, numerous USA examples) also offer models for monitoring and governing dispersed agricultural pollution.

Key challenges for the scheme include:

- the development of reliable farm audit tools that cover the range of biophysical conditions and farming systems
- establishing cost-effective MRV across different geographies/contexts
- Identifying "fair" baselines upon which to reward additional reductions.

Proposed Approach

This scheme proposes decreasing GHG emissions through a whole farm audit for livestock farms, targeting livestock dairy and beef producers with intensively managed cropland and grassland. The scheme is voluntary.

A farm carbon audit tool is applied to estimate the GHG emissions, and to identify management options to reduce GHG and sequester C on the farm. A management plan is prepared with an independent consultant that outlines which management practices / measures should be priorities.

The farmer freely choses to apply the management options relevant and feasible to them.

The requirement is that the audit is repeated after 3 – 5 – 7 years to monitor the changes. Tools such as (CAP'2ER, Cool Farm Tool) calculate emissions based on the whole farm system, capturing climate actions including feed efficiency, herd management, manure management, and sequestration.

The farm unit-based scheme could have different levels of ambition:

OPTION 1 - **Purely informational / non-result-based** farm-advice scheme focusing on awareness raising for a particular result to be achieved in terms of % or total amount of emission reductions / or sequestration achieved. Farmers are rewarded to cover their (and the advisor's) time.

OPTION 2 - **Management-based scheme**. Following the audit (i.e., OPTION 1), the farmer is required to implement a minimum number of management practices, or those practices which show the most potential for mitigation. Farmers are compensated to cover the additional costs for the management practices. The payment level depends on the number of management options that are chosen and applied (i.e., is activity not results-based).

OPTION 3 – **Hybrid scheme** – Farmers are compensated for the actions taken, but also receive an additional payment per ton of CO_2-e emissions reduced.

OPTION 4 - **Result-based scheme**: farmers are rewarded equivalent to the difference in emissions between baseline and after actions taken. Note that this is likely still to be a calculation based on effort/compensation but differently structured i.e., expected effort to reach a certain threshold.

For avoided emissions (e.g., reduction of livestock, nitrogen emissions, farm operations), there are no permanence risks. However, for carbon storage (e.g., through afforestation/agroforestry/soil carbon), reversibility concerns exist. Options to manage this risk:

- Only pay farmers for avoided emissions
- Pay actions that sequester carbon separately, with requirements for long-term project plans and farmer liability for reversal.

16.2 Scheme option 2: Soil carbon sequestration

Potential for soil carbon sequestration: evidence shows that soil carbon levels vary across Ukrainian farms and soil management approaches (e.g., permanent pasture, irrigation, managing grazing etc.), indicating real potential to manage farmland to increase soil carbon.

- As we have briefed before, some result-based soil carbon schemes already exist: in Europe, this includes the Healthy Soil for Healthy Food project in Austria, a cooperation between SPAR (a private supermarket chain), 59 farmers, and WWF Austria: farmers receive rewards for growing produce in a manner that increases soil carbon.

In Finland, more than 100 farmers have been involved in the Carbon Action project, which aims to identify soil-carbon accumulating practices effective on all farms, with monitoring. The French 'Ferme Laitière Bas Carbone' project also promotes soil carbon on dairy farms. Internationally, the Australian Emissions Reduction Fund has developed a measurement-based soil carbon methodology, building in part on VCS project examples.

Key challenges for Soil Carbon include:

- Expense and uncertainty of measuring soil carbon
- Difficulty of monitoring soil carbon
- Reversibility of soil carbon gains (e.g., to changes in management and/or changes in climatic conditions. In general, there are relatively high knowledge gaps relative to the other schemes.

Approach: The aim of the scheme is to incentivize additional soil carbon sequestration on mineral soils. **The focus is on arable land (cropping systems), but the approach can also be applied on livestock and mixed farms that manage grasslands and on horticultural land**.

Net soil carbon sequestration measures on agricultural lands applicable on this scheme:

Measure category	Measure	Land type	
		Cropland	Grassland
Carbonation	Mineral carbonation of soil	✓	✓
Erosion control	Prevent / control soil erosion	✓	✓
Fire management	Fire management	✓	✓
Grazing land management	Optimize stocking density		✓
	Pasture renovation		✓
	Sward management, bio nitrogen fixation		✓
Improved rotations	Perennial crops	✓	
	Catch crops	✓	
	Cover cropping	✓	
	Cover cropping with legumes	✓	
	Cultivated crops to increase soil carbon e.g. deep-rooted		✓
Management of organic soils	Restoration of cultivated organic soils	✓	
	Prevent degradation of organic soils	✓	
Nutrient management	Optimize nutrient inputs	✓	✓
Organic resource	Residue retention	✓	

management	Organic amendments	✓	✓
	Biochar	✓	
pH management	Keep pH at optimum for plant growth e.g. liming	✓	✓
Tillage management	Reduced tillage / no till	✓	
Water management	Soil water management	✓	✓

17. Agriculture and ESG: linkages and implications

The global farming industry is innovating to cut heavy carbon emissions, and institutional investors are starting to play a role. **Agriculture is implicated in multiple aspects of environmental, social, and governance (ESG) investing.**

As pressure to produce more food for the world's growing population intensifies carbon emissions, deforestation, exhaustion of fresh water supply and soil degradation, the agriculture industry is seeking innovative ways to reduce its carbon footprint. Global food production faces a challenging landscape of rising input costs, climate change, health concerns, social inequality, resource competition and ecosystem degradation. These are some of the challenges many in the sector are trying to get their heads around.

More investors are looking at their exposure to ESG issues in all aspects of their investments, and managers are seeking out managers whose farming practices are aligned with the Paris Accord on climate change. **Investor mindset has changed from one focused on yield to one now questioning how yields are generated.**

Industrial agriculture can affect the environment, with particular risks from deforestation and the use of pesticides. Yet the agricultural sector can also have a positive environmental impact, such as the creation of alternative fuels — when plant products are used in biofuels, gasoline, or diesel that is mixed with oils from certain agricultural products as a way to reduce the total consumption of fossil fuels.

Considering **agriculture's impact in social risks and opportunities of ESG**, trade tensions can often strain agriculture sectors, alongside unpredictability and shifting prices causing potential damage to the industry.

Industrialized farming practices cause $3 trillion per year in environmental impact worldwide (source: Trucost). For example, notably the effect of corn production on the environment is equal to 170% of its production value — highlighting how the cost to the environment is greater than the price of the corn itself.

Agriculture can in some ways be environmentally beneficial. Trade tensions and the volatility that accompanies them yield uncertainty for farmers and the rest of the agriculture industry, in which decisions are made months or years in advance. Technological innovations in the fourth industrial revolution might turn agriculture into a more transparent industry, which could increase trust and accountability in the sector.

One example of this transition has been the use of **alternative financial technologies in agribusiness**. Blockchain software was developed for anonymous cryptocurrencies, but additional potential lies in its ability to maintain an unalterable distributed ledger of transactions. An agricultural purchase was made using blockchain for the first time in 2016. Continued use of blockchain within agriculture could decrease transaction fees, reduce processing times for payment, and eliminate additional risks in transactions.

The environmental and social factors of ESG and agriculture can often be intertwined. Those seeking environmental and social sustainability within agriculture, and engaging in ESG investing overall, are motivated by more than moral concerns.

Ten major corporations and nonprofits with agricultural interests, including McDonald's, Cargill, General Mills, and the Nature Conservancy, joined together in 2019 to create new initiatives to promote environmentally friendly agriculture and soil health. A private equity fund designed to invest in technologies around sustainable agriculture raised more than $300 million a few months later. Overall, many companies appear to have come to the conclusion that they will need to adopt new and less damaging agricultural practices for future success.

In agriculture, sustainability is not a preference – it is a sign of vitality. Food manufacturers, farmers, and land investors across the globe who understand that have already begun to reap the benefits.

As in other industries that have prioritized environmental social governance, companies that ethically source the resources to develop and produce crops and livestock see substantial financial benefits and boost their long-term productivity and longevity. For reasons that differ across continents, **consumers and regulators alike have placed enormous value on sustainable farming and land maintenance**, and companies and investors that fail to meet the standards they set are being excluded in the market.

It is first important to note that "sustainable agriculture" does not stop with organic production methods. Rather, in the last few years, historic concerns about labor practices, long-term environmental costs both within and beyond the four corners of a farm, and human health have come together in a renewed focus on agriculture as a fundamental part of human existence and society and, therefore, the pressing need to foster long-term availability and economic sustainability of food systems.

A pronounced trend has emerged, oriented toward stewardship of land and water, biodiversity as a key ingredient in crop health and success, conservation and growth of human capital, and incentivizing compliance with robust and practical governance regimes.

Emphasizing these factors ultimately moves toward the broader goal of increasing efficiency and reducing waste in agricultural operations while also making it more affordable to farm. **In other words, sustainable agriculture is a complete ESG-oriented package.**

Numerous concepts are discussed in the context of sustainable agriculture, and there are many different perspectives on which of these concepts should be included under the sustainable agriculture umbrella. For example, whether sustainable agriculture encompasses only food and textile products, or whether it should also include animal production. In addition, sustainable agriculture can be interpreted broadly to include the concept of regenerative agriculture, which is primarily concerned with regenerating soil nutrition and tilth, conserving water, and in some cases, encouraging biodiversity. Regenerative systems can also accomplish carbon removal or sequestration.

It is important to note also that sustainable agriculture is not limited to matters of production: it also includes the reduction of waste. For example, **upcycling is the use of waste to produce new or different products**: e.g., sugarcane waste, or bagasse, may be used in a variety of processes, including food packaging. These factors underlie the concept of sustainable agriculture. As with the concept of ESG itself, the conversation around sustainable agriculture will continue to evolve as our practices and goals in this area change over time.

17.1 How governments can foster ESG policy in Agriculture

Governments in developing nations have a long history of intervention in agricultural markets through trade regulation and farm support policies such as the EU's Common Agricultural Policy (CAP) and the US Farm Bill. However, these policies are being reshaped to move towards encouraging more **sustainable farming systems** and to reflect societies priorities for biodiversity, food safety and animal welfare.

The CAP is now subject to a greater focus on climate action and biodiversity protection, with social aims to foster vibrant rural communities and generational renewal.

The UK's post-Brexit Environmental Land Management scheme also places **ESG** factors at the heart of its policy. As part of a wider push for ESG regulation in the US, several proposed new bills will drive climate-related reporting by food producers and suppliers.

Governments worldwide have set top-level targets, such as in the Paris agreement, to tackle the global climate crisis and its associated externalities, however, in practice is the private sector, guided by government policies, incentives and regulations, that must implement them.

As **agriculture accounts for approximately 25% of global GHG emissions**, it has become an area of scrutiny in the climate debate, as the sector seeks to reduce its existing carbon footprint.

Given agriculture's potential capacity to mitigate climate change through the sequestration of carbon in soil, ESG investors are increasingly interested in the sector as a means to counteract climate change.

Barriers to ESG in Agriculture

Despite growth in ESG investing in the agriculture sector significant barriers remain. Agriculture and farming operations have the ability to participate in the carbon offset market, helping the planet and growing their revenue by using innovative techniques to capture carbon in their soil. Unfortunately, carbon sequestration practises within the farming and agriculture industry have been largely untapped, mainly due to barriers-to-entry that farmers face.

Regulations regarding ESG vary with locality, which means companies lack a universal mandate to report ESG information. The scramble to capture market share in the ever-growing ESG investment segment has fuelled a proliferation of voluntary non-governmental standards that have filled the vacuum left by an absence of regulation. It has also led to an entire ESG data and analytics industry springing up to service the needs of the investment community.

Today, **one of the largest challenges ESG investors face is the lack of standardized reporting and low transparency in ESG rating methodologies**, which limits comparability and the integration of sustainability factors into the review of investment performance.

Currently, **regulations mandating corporate disclosure of ESG information vary with location**. Corporate disclosure regimes vary substantially in terms of what data must be reported and how it should be calculated. **Reporting requirements are usually voluntary and do not set out the methods or metrics to be used. This means that data is incomplete and not directly comparable across companies, sectors, and countries.**

Within the EU, ESG regulations ultimately all stem from the European Council's Sustainable Finance Policy, which sets out the blocks high-level policy ambitions. This Policy is complemented by a suite of corresponding European Commission Green Finance Initiatives, the most immediate of which is the Sustainable Finance Action Plan, which has four key elements:

- The Pending Taxonomy Regulation
- The Sustainability Disclosure Regulation
- The Climate Benchmarks Regulation
- A Proposed Green Bond Standard.

Regulators themselves need confidence that institutional investors meet the required standards of prudence and care when they include ESG considerations in their portfolio decisions.

Greenwashing is a real problem, referring to companies' promotion of environmental concerns as an advertising gimmick.

Other potential measures to aid agricultural ESG include public lending, insurance and guarantee schemes to aid the transition to sustainable food systems; financial training schemes; changes to regulations to account for the financial risks of non-sustainable farming; alongside a bolder approach to ESG investment of public funds and steps to expand green and sustainable bond markets.

Government plays a significant role in the farm sector, and further government action will be needed to drive the move towards sustainable farming systems.

Measures to encourage and facilitate ESG investing in the sector will go some way to help transform the sector and meet societies environmental and climate goals.

17.2 Investing in sustainable farming: financing through "total portfolio activation"

As an **impact investment theme**, food and agricultural systems provide numerous entry points for financing much more sustainable, long-term solutions to feed a crowded planet while generating community health and wealth within ecological limits.

Taking a **total portfolio approach** to sustainable agriculture provides investors with a constructive way to grapple with the widest array of investment opportunities because each asset class presents its own specific opportunity set related to food and agriculture — whether financing small-scale local food systems or intervening in large-scale global supply chains.

Let's focus on **five core asset classes** where sustainable agricultural investment can be most readily and responsibly pursued:

- cash and cash equivalents,
- fixed income (both public bond markets and private debt),
- public equities,
- private equity and venture capital, and
- real assets, such as farmland and timberland

Working across these asset classes allows investors to **pursue positive impact** on food and agricultural systems more holistically, activating a fuller range of investment assets, at different scales, in various geographies, and in **pursuit of "multiple returns" — financial, social, and environmental.**

Examples of cases (per asset class):

- Making **cash and money market deposits in mission-oriented community banks** and credit unions provides low-risk, market-rate capital for depository institutions to lend to farms and enterprises in local food economies, often in highly targeted regions.

  Many private debt options, through intermediaries such as community loan funds or microfinance organizations, provide high social and environmental impact in specific places, often at concessionary financial rates of return, when adjusted for risk.

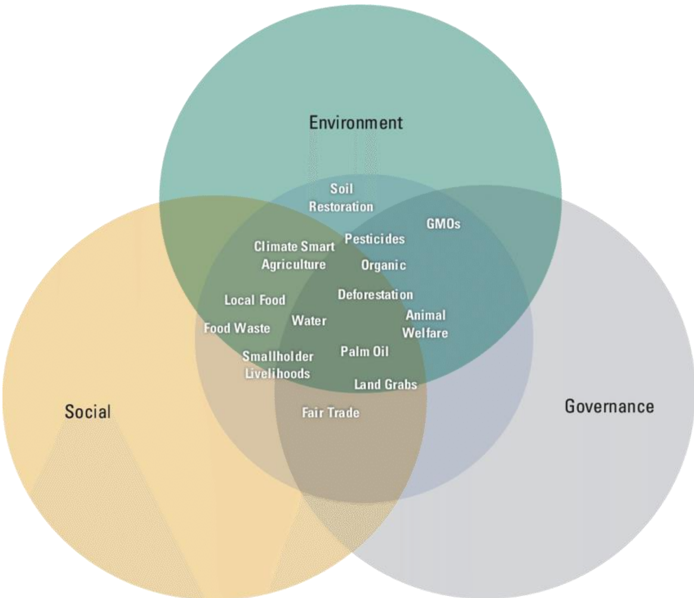
- Although gaining concentrated, direct exposure to high-impact food and agricultural themes remains more challenging in the **public bond markets** than through **private debt**, investors can nevertheless pursue market-rate opportunities with skilled, impact-oriented fixed-income investment managers that actively seek corporate, municipal, or government agency bonds that finance specific links in wider food and agricultural value chains.
- **Equity investment** can help finance sustainable agricultural technology (AgTech) companies and other businesses in the food and agriculture sector. **Private equity and venture capital investors** can provide critical seed and growth equity financing to private companies in the sector, and they can often become highly engaged with management to ensure that positive social and environmental impact is being measured, managed, and maximized.
- As for **public equity managers**, they can invest in small and midcap companies working on AgTech innovations, assess their portfolios for climate, water, and other sustainability risks, or use shareholder engagement strategies to hold companies accountable for their often large-scale social and environmental impacts across the value chain. Highly engaged public equity managers have had meaningful, positive impacts on a wide range of corporate social and environmental

issues, from pesticide use and animal welfare to deforestation and human rights abuse in supply chains related to commodities such as cotton and palm oil.

- Finally, **in real assets**, investors can finance the **acquisition of farmland** and forests that are managed sustainably with strong conservation features, often in specific regional geographies. **Farmland opportunities vary from investing in real estate investment trusts (REITs) that are acquiring conventional farmland and converting it into certified organic farms to financing ranch land conservation and holistically managed, pastured livestock.** In forestry-related investment, sustainable timberland investment management organizations (TIMOs) apply techniques of conservation finance to acquire and improve forestland at a variety of scales, from community forests to larger-scale working landscapes. AN more exhaustive case of farmland investment in next paragraph.

17.3 Leading ESG Investing Themes in Sustainable Agriculture – Example of a Farmland investment

Several converging trends have moved food and agriculture up the sustainable investment agenda. The risks of climate change, to which investors have become particularly attuned over the last decade, magnify the challenges that food and agriculture systems face. Global warming and more frequent extreme weather events, from severe droughts and wildfires to flooding, hurricanes, and tornadoes, intensify the climatic uncertainty that farmers have long faced.



As an impact investment theme, food and agricultural systems therefore provide numerous entry points for financing much more sustainable, long-term solutions to feed a crowded planet while generating community health and wealth within ecological limits.

The ESG considerations for investors is widely acknowledged.

However, a lack of broadly accepted, standardized ESG definitions and metrics creates a broad spectrum for tracking, measuring and discussing ESG. For our purposes, we refer to ESG in its most fundamental form, as a consideration of how certain environmental, social, and governance factors can influence the long-term value and performance of an investment.

Over the past decade, we have seen increased interest among the investment community in **agriculture and farmland as an asset class**. Not only are large, sophisticated, institutional investors across the globe evaluating (or already invested in) farmland and agricultural investments, so too, are increasing numbers of non-institutional investors.

Alongside a rapidly growing global population and demand for food, farmland offers a truly diversified investment opportunity with attractive long-term returns *(as the chart below shows, 10,000 USD invested in farmland in 1991 would be worth over $215,800 today).*

Source: Acretrader

Farmland (focusing on cropland) offers a diverse set of characteristics that can appeal to a broad number of investors as they look to optimize their portfolio construction. Farmland's low correlation with traditional equity or fixed income markets and its historically positive performance during times of high and rising inflation form the foundation for investor interest in the asset class.

Increasingly, ESG and climate change considerations are also driving potential investors towards farmland. **Farmland is a compelling asset class for investors looking to track the ESG characteristics of their investments because it has a natural set of value drivers that align with an ESG framework**. The fact that the long-term productive capacity of farmland is predicated on having the necessary environmental conditions to support crop growth (i.e. supportive weather conditions, access to fresh water, etc.), highlights the natural relationship with the 'E' in ESG. As a result, operators and owners of farmland can implement monitoring of characteristics like soil erosion, water issues (pooling, poor draining, etc.), and organic matter in the soil, to provide a set of qualitative and quantitative metrics to monitor the asset's value drivers over time.

With respect to relevant Social and Governance metrics, these are likely to vary depending on the geography and political environment within which the asset is located.

In a country which has a strong regulatory environment and well-established governance structure around land ownership, the action of conducting a title search on a property is often considered perfunctory and would rarely return a surprise result.

However, there may be other jurisdictions where ownership records are less well developed and it becomes highly important to investors that the manager provide ongoing reporting on the proper evaluation of ownership records. **Depending on the specific investment model, the full suite of relevant ESG metrics will vary, but the core foundational relationship between farmland and the environment exists.** It is important to note that despite the primary importance of environmental factors as they relate to farmland, the ability to effectively measure performance and quantify its importance is still developing and there is no widely implemented set of reporting metrics that apply across the asset class yet.

However, **regulatory actions such as the development of the EU taxonomy for sustainable activities, technological enhancements for tracking and reporting onfarm metrics, and ongoing investor and manager activity will result in significant enhancements to reporting over the coming years**.

17.3 ESG risks in agriculture and carbon farming

ESG risks permeate the agricultural supply chain. From deforestation to child labor to unfair labor renumeration, companies that source from downstream suppliers are at risk.

ESG challenges **– illegal logging, misuse of water or land, greenhouse emissions and crop burning –** can occur anywhere across the supply chain.

No ethical company, or trusted brand, wants to be engaged in the inappropriate or illegal practices. Unfortunately, monitoring remote locations and enforcing ESG compliance is challenging.

Most companies invest enormously in managing and mitigating these risks. For large multinationals, this investment does not significantly impact the company's bottom line. However, for other companies, the cost of doing business can be enormous. To reduce these costs, it is important for companies to have a better understanding of their downstream suppliers.

Farming is often criticized for its environmental credentials – it consumes over 70% of the entire worlds freshwater supply, over 30% of the Earth's land is taken up for crops and it associated with greenhouses gases such as carbon dioxide (CO_2), methane (CH_4) and Nitrous Oxide (N_2O).

Farming will always produce a significant volume of waste. The challenge is understanding the comparative scale of this waste, its proportionality, and how best to monitor and address this.

Not all farming practices are equal – with some products having a surprising environmental impact, and not just beef. Some vegan products have an outsized impact on sustainability. Understanding this wider environmental picture is as important for individuals as it is for corporations.

Water Use

Rice and Soy are examples of crops that require huge volumes of water. Soy needs 2 to 3 times as much water as potatoes and rice needs almost 10 times as much water – all to produce just 1 kg of food. Even the "inefficient" rice is far more efficient when compare to nuts (almonds, pistachios, etc). Nuts require around 15,000 liters of freshwater to produce a single kilo of nuts. This is 30 to 60 times more than potatoes and around the same amount as a kilo of beef.

The inefficiencies of the water system are just one challenge for farmers, corporate investors and consumers – all of whom are looking to improve their ESG credentials – for economic and ethical reasons.

Another challenge facing agriculture is how to monitor and detect inefficient or illicit farming practices for the purposes of ESG – how to address the "data gap". As the process is never quite simple. Even in the simple example above with nuts consuming far more water than potatoes, there are other factors – nuts contain around 10 times more calories than potatoes.

These data points, combined with typical farming practice, acceptable practice, and historical data can provide deep insights across entire countries, as well as at the farm level.

There are several satellite missions that have dedicated sensors to measure water and how it's changing, including NASA's MODIS and ESA's Sentinel-2.

Deforestation

Deforestation has long been associated with cattle ranching in Brazil. – with 10,000s hectares cleared for cattle. This is compounded by the fact that land in rainforests is also poor quality for beef production – so it takes around 10 times the amount of land per head of cattle.

While the situation is dire in terms of loss of forests – there are fantastic systems available to monitor forests and detect both macro and micro trends.

Global Forest Watch provides an excellent dashboard showing how forests are disappearing and the rate of change – using satellite data to power the results

Satellite data is already used to identify changes in forests, even down to a single tree. Recently the Norwegian government made this even more accessible as they provided £40million in funding for public access to high-resolution satellite data on rainforests.

Pesticides and Pollution

Farming's environmental cost is reported to be $3 trillion a year. Pesticides, which impact soil quality, water quality and biodiversity pose a real challenge. Farmers, especially in the developing world, are often economically incentivized to use banned or dangerous pesticides, for short term gains. Detection of this is not possible through audits or deployment of local sensors. Satellite data provides the ability to monitor crops, rivers, and lakes.

Crops that have been treated with illegal pesticides and fertilizer can be identified as outliers due to their unusual yield. Pollution in streams and rivers can be identified as seen in the images below.

Data Vs Information

There is a significant gap in data within ESG, especially amongst farming. The scale and complexity of the challenge mean that it's just not possible for a single source of data to bridge that gap.

Satellites can fill many of these "data gaps" providing key metrics on pollution, pesticides, and misuse of land and water. However, the true value of the satellite data is when it is combined with additional data sources and analyzed effectively to provide a richer and more informative picture.

Satellite data can address many challenges with ESG that are simply not possible with traditional methods – either due to costs or risks.

Monitoring pollution from plants and factories – is challenging if they are in remote and/or dangerous locations. Validating practices on all farms and third-party suppliers is not viable with traditional methods. The gloal scale, remote location and a number of suppliers – means this is just not possible.

Satellites solve this by monitoring the entire world – every day. Satellites are able to detect pollutants at a global scale and at a farm level – spotting changes in behaviour, identifying risks and providing constant vigil. .

Satellite data can address many challenges with ESG that are simply not possible, at scale, with local monitoring:

Examples of risks that satellites can monitor:

- Land and Biodiversity
- Deforestation
- Green House Emissions
- Atmospheric Pollutants
- Water Misuse
- Burning Stubble/Crops
- Coastal eutrophication

And provide data and indicators for the following areas:

- Water Pollution:
  - Pollution run off
  - Pollution in large rivers and estuaries
  - Costal eutrophication
  - Algal blooms
  - Solids in Water
- Deforestation:
  - Macro Deforestation
  - Changes in forests associated with farming Soil Quality

  - Crop Rotation Protecting Land and Biodiversity
- Deforestation:
  - Macro Deforestation
  - Changes in forests associated with farming
- Soil Quality
  - Crop Rotation
- Protecting Land and Biodiversity Monitoring designated/protected areas:
  - Rare or endangered species
  - Ecosystems
  - Native peoples
- Atmospheric Pollution
  - Burning of crops:
    - Crop residues, land/forests, crops for harvest preparation
  - Changes in air pollution
    - Ozone (O3), nitrogen dioxide (NO2), sulphur dioxide (SO2), carbon monoxide (CO), methane (CH4), formaldehyde (CH2O)
- Water Use
  - Water Extraction

18. WRAP-UP Part 2 – Common Questions and Answers

How does the EU emissions trading scheme work?

The EU Emissions Trading System (ETS) works on the principle of 'cap-and-trade'. It sets an absolute limit or 'cap' on the total amount of certain greenhouse gases that can be emitted each year by the entities covered by the system. This cap is reduced over time so that total emissions fall.

What does the revision of the EU Emissions Trading System involve?

The EU Emissions Trading System (EU ETS) is the EU's key tool for reducing greenhouse gas emissions, in line with the Paris Agreement. The EU ETS covers almost half of the emissions from the European economy.

The agreement reached between the European Parliament and Council brings changes in three key areas that are needed to make the system ready for the period 2021-2030: strengthening the system, ensuring robust safeguards against the risk of carbon leakage for industry, and providing funding instruments for low-carbon investments. The revised EU ETS Directive builds on the European Commission proposal from July 2015, which followed conclusions adopted by European leaders in October 2014.

How and when will the agreement strengthen the European carbon market in order to address the existing oversupply?

Several measures have been agreed to substantially strengthen the EU ETS, notably to increase the annual emissions reductions from 2021 and to tackle the existing surplus of allowances on the market more quickly from 2019. The surplus will be addressed by doubling the pace at which surplus allowances are removed from the market and placed in the Market Stability Reserve (MSR) for the first five years of operation, i.e., until 2023.

How will the EU ETS contribute to Europe's climate objectives for 2030?

A faster annual decrease in the overall number of EU ETS allowances ("cap") – 2.2% per year from 2021, compared to the current 1.74% – will contribute to the EU's overall goal to reduce emissions by at least 40% by 2030, consistent with its commitment under the Paris Agreement. This reduced "cap" will ensure the necessary emissions cuts in sectors covered by the system.

What is greenwashing?

Greenwashing is a form of marketing that misrepresents a product, service or practice as having positive environmental effects, such as a company claiming to be carbon neutral when it isn't.

How will Europe's industrial competitiveness be safeguarded while ensuring a sufficient reduction in greenhouse gas emissions?

The agreement includes several key measures to safeguard the competitiveness of European industry, through the continuation of free allocation of allowances to sectors at risk of carbon leakage, with a higher share to be given to those sectors deemed most exposed to this risk.

The number of free allowances is limited. In order to reduce the risk of insufficient availability of free allowances and the need for a correction factor, the agreement foresees a "free allocation buffer" of over 450 million allowances initially earmarked for auctioning can be made available as an extra safeguard, if the initial amount is fully used up for the period 2021-2030 (thereby avoiding or reducing a correction factor).

The existing possibility to compensate sectors for indirect carbon costs will continue. Moreover, a new Innovation Fund will help European industry to maintain its competitive edge, by providing support for pioneering low-carbon technologies.

What are examples of carbon offsetting projects?

Nature-based carbon sequestration. Biological sequestration absorbs CO2 emissions through the growth of vegetation and the continued storage of some of the carbon in plant tissues and organic materials derived from plant tissues (e.g. stored in the soil). Other examples include biochar (long term carbon storage from biological sources), and afforestation initiatives (e.g. tree planting on degraded landscapes).

Renewable energy. Renewable Energy projects include hydro, wind, and photovoltaic solar power, solar hot water and biomass power and heat production. Many renewable energy projects have high up-front capital costs, although they may offer high rates of return, and their operating costs are often minimal once built. Carbon offsets help support these projects by providing an additional revenue stream to offset their high up-front capital costs.

Methane capture. Methane's global warming potential is about 28 times greater than that of CO2, and thus preventing methane emissions can have significant environmental benefits. Methane is emitted by landfills, during wastewater treatment, in natural gas and petroleum systems, from agricultural activities (livestock and rice cultivation), and during coal mining. Methane is basically 'natural gas' and can therefore be captured and used as a source of energy. Such projects include those that capture and purify methane in wastewater treatment plants or landfills and use it for electricity production or the production of another form of energy.

Will there be compensation for indirect carbon costs?

Yes, compensation by Member States will continue to be possible, subject to EU state aid rules. The agreement reached by the Parliament and Council will also substantially enhance rules on transparency and reporting related to such support by Member States.

What measures have been agreed to promote industrial innovation and the low-carbon transition?

The agreement foresees the creation of a new Innovation Fund, with a size of at least 450 million allowances (representing a value of over € 3 billion at market prices in late 2017). The fund will provide financial support for low-carbon innovation in industries covered by the EU ETS, to aid the development of breakthrough technologies, as well as carbon capture and storage/use and renewable energy.

In addition, the Innovation Fund will be supplemented by any remaining resources from the existing NER300 fund which supports carbon capture and storage and renewable energy. Furthermore, up to 50 million additional allowances may be made available for the fund during the second half of the period 2021-2030, if these allowances are not needed for free allocation to prevent or lower a correction factor.

What measures have been agreed to support the low-carbon transition and modernisation of energy systems in low-income Member States?

Two funding instruments have been agreed to support the transition and modernisation of energy systems in 10 Member States with incomes below 60 % of the EU average in 2013 (Bulgaria, Estonia, Latvia, Lithuania, Hungary, Romania, Poland, the Czech Republic, Slovakia and Croatia).

Firstly, a Modernisation Fund with at least 310 million allowances will support investments in modernizing energy systems, such as the improvement of energy efficiency in installations for power and heat that use natural gas or renewable energy sources, and investments to support a socially just transition to a low-carbon economy (such as retraining for affected workers). The fund will be supplemented by up to 75 million additional allowances during the second half of the period 2021-2030, if these are not needed for free allocation to prevent or lower a correction factor.

Secondly, the 10 Member States listed above also have the option to continue providing a limited number of free allowances to modernize the power sector, after investments to modernize the energy sector have taken place. The Parliament and Council have agreed robust safeguards to ensure that funding instruments contribute to the EU's climate and energy goals while operating in a fully transparent manner.

Have any changes been agreed on emissions in the shipping sector?

The agreement recalls that all sectors of the economy should contribute to emissions reductions, mandates the Commission to report at least annually to the Parliament and the Council on progress made in the International Maritime Organisation (IMO) and emphasises that action by the IMO or the EU should start in 2023, including preparatory work on the adoption and implementation of measures.

What are the next steps for implementing the agreed changes to the EU ETS?

The provisional agreement must now be formally approved by the European Parliament and the Council. Once it has been endorsed by both EU co-legislators, the revised EU ETS Directive will be published in the EU's Official Journal and enter into force 20 days after publication.

Once the revised Directive is in force, further work will be needed for its implementation. For example, the necessary data will need to be collected by Member States and industry in order to prepare the steps related to free allocation of allowances. Necessary steps will also need to be taken in order to operationalize the Modernisation Fund and the Innovation Fund, in terms of governance and project selection.

Which is the most effective strategy to remove carbon from the atmosphere?

Carbon can be removed from the atmosphere and be sustainably sequestered through both nature-based and technological solutions. Improved land management practices enhancing carbon capture and/or reducing the release of carbon to the atmosphere qualify as carbon farming, as they result in the increase of carbon sequestration in ecosystems. Technological solutions aim to capture carbon from the production process or directly from the air, and transport it from the point of source to an adequate storage site where it can be stored for a long period.

Both carbon farming and industrial solutions are necessary to remove several hundred million tons of CO2 per year from the atmosphere and will play an important role in achieving the EU's 2050 climate neutrality objective.

What is carbon farming?

Fundamentally, carbon farming involves managing land to drawdown carbon out of the air and store it in plants and soils. It can also include the adoption of practices that reduce the emission of greenhouse gases.

How effective is carbon farming?

The benefits of Carbon Farming (along with Carbon Sequestration) include less erosion and soil loss; better soil structure and fertility; less soil salinity, healthier soils, vegetation and animals; more biodiversity; buffering against drought; and **greater water efficiency**.

What does carbon farming depend on?

Carbon sequestration is dependent on several factors which can include **forest age, forest type, amount of biodiversity**, the management practices the forest is experiences and climate.

How much does it cost to carbon farm?

Studies estimate that carbon farming costs **US$10-$100 per ton of CO2 removed**, compared with $100-$1,000 per ton for technologies that mechanically remove carbon from the air. Carbon farming is also a potential revenue stream for farmers and ranchers, who can sell the credits they earn in carbon markets.

How do farmers store carbon in soil?

As plants grow, they pull carbon from the atmosphere, and **soil soaks it up and stores it**. The amount of carbon stored varies significantly across soil type and climate. Traditional farming methods that sequester carbon have existed for millennia.

What are the methods of carbon farming?

Activities include **thinning out, selective harvest, regeneration and planting, and fertilization** to enable productive and sustainable forest growth. Similar to forestry, native grasses and other vegetation provide a natural source of greenhouse gas (GHG) absorption and sequestration.

What crops sequester the most carbon?

The greatest C allocation to roots was in **grasses** ($Rc/Sc = 1.19 \pm 0.08$), followed by cereals (0.95 ± 0.03), legumes (0.86 ± 0.04), oil crops (0.85 ± 0.08), and fibre crops (0.50 ± 0.07).

How is the EU Commission planning to stimulate the uptake of carbon farming in the EU?

To reach the proposed 2030 climate target of 310 Mt CO2eq of net removals in the EU land sector, as proposed by the Commission in the revision of the Land Use Land Use Change and Forestry Regulation (LULUCF), carbon removals have to be appropriately incentivised.

A system needs to be established and promoted at land manager level in order to reward farmers and foresters for additional carbon sequestration they achieve. Currently, implementation challenges such as the financial effort required to put in place new management practices and the absence of robust monitoring, reporting and verification systems, limit the uptake of carbon farming across the EU. The complexity of measuring carbon sequestration combined with insufficiently tailored advisory services also leads to uncertainty about revenue possibilities for land managers.

To address these challenges, the Commission will promote the role of EU public funding, in particular from the Common Agricultural Policy (CAP), support access to advisory services and finance several costs inherent to carbon farming schemes and practices, and reduce the risks for land managers. The Commission will also support research and innovation under Horizon Europe, including through the “Soil Deal for Europe” mission, to further develop monitoring and reporting tools and digital solutions, and to promote combined approaches for carbon farming where public funding is complemented with revenues generated through the selling of carbon credits on voluntary carbon markets, with participation of private funding. Among other key actions, the Commission will also set up an expert group to exchange best practices on carbon farming with stakeholders and to support the development of EU standards for the certification of carbon removals.

Part 3

Summary report with analysis of existing carbon farming potential in Ukraine.

Existing and needed carbon trading elements, including GHG footprint calculation methodologies, data verification, carbon credit/certificate issuance, carbon credit sellers and potential buyers, other components.

19. Overview of preparation (and potential) for Carbon Trading in Ukraine

For any emissions trading system (ETS) to be successful – including the Ukrainian one - it should meet certain criteria:

- **Environmental rationale** – the trading system must, and must be seen by all parties to be achieving a valid environmental objective.
- **Economic rationale** – the trading system must, and must be seen by all parties to be more flexible and cost-effective than other ways of achieving the environmental objective.
- **Credible** – the system **must be credible** since only credible systems succeed. Hence, the administrative procedures must be adequate to ensure compliance with the climate change goals. Appropriate monitoring and verification will enhance credibility.
- **Simplicity** – simplicity is essential and deviations from simplicity should only be introduced when demonstrably necessary. Multitudes of academic and institutional studies, of ever increasing complexity, have been undertaken seeking illusionary perfection. No system will be perfect, and good simple, pragmatic solutions will succeed where more complex ones will fail.
- **Equity** – without perfect knowledge (in which case there would be no need for trading) any system will be inequitable particularly during the early years. In a successful system there will be something for everyone and inequities will rapidly diminish with time.
- **Transparency** – the system must be transparent so that there is national and international confidence in the system. An imperfect system with good transparency is to be preferred to any system with poor transparency.
- **Certainty** – in order to inspire business confidence, and to encourage innovation and investment, there must be a high degree of certainty so that business can invest. This means that allocation must be as far into the future as possible and that permits must have long validity.
- **Inclusive** – the process should be as inclusive as possible in the long term, though some restrictions will be necessary in the short term.

Getting a Ukrainian company ready to take part in an ETS can seem to be a daunting task and this Carbon Market study will try to help.

There are few preliminary steps that all companies should take as soon as possible in order to make the process of implementing an ETS as smooth as possible:

- Establish an inclusive forum where companies, verifiers, market makers, regulators and government officials can discuss issues from all angles and then develop practical ways forward
- Establish a structure within the company organization to manage the procedures required to operate within an ETS.
- Ensure that all roles within the carbon management team are well defined and understood with no overlaps or ambiguities. *Since an ETS sets a price/ value on carbon it should be managed as carefully as other financial products*.
- Ensure that the managing board takes a holistic view so that all aspects of carbon management are integrated fully into the company strategy.
- Ensure that the company obtains good data as soon as possible about its carbon emissions and the locations where these emissions come from. This will enable the company to formulate a robust carbon abatement and trading strategy.
- Ensure that all functions in the company are aware of the implications of carbon management and use their expertise whenever possible.
- Treat the ETS as an opportunity and not as a threat in order to gain competitive advantage.

Despite latest economic and political challenges, Ukraine recognizes climate change as the most consequential factor this century, affecting the economy and future generations. The country updated its Nationally Determined Contribution (NDC) in 2021 and recently affirmed its commitment to the European Green Deal.

Ukraine's climate has changed significantly over the last 60 years, with accelerating warming since the 1980s resulting in the rates of 0.4-0.6°C per decade that exceed the mean value in Europe and are higher than the global rate by a few times.

The strongest annual temperature increases of over 4°C are projected for RCP 8.5 (RCP 8.5 refers to **the concentration of carbon that delivers global warming at an average of 8.5 watts per square meter across the planet**) at the end of the century with the largest effect on the east and northeast of Ukraine (Kharkivska, Luhanska, Sumska oblasts) and the smallest in the west (Ivano-Frankivska, Lvivska, Volynska oblasts).

The frequency and intensity of extreme weather and climate events, including heat- waves, thunderstorms, heavy precipitation, pluvial and river flooding, droughts, hail-storms, squalls, tornadoes, heavy snowfalls, freezing rains, accumulation of wet snow, icing, etc., are expected to rise with higher warming**.**

With no adaptation interventions, the range of possible yield outcomes is large as is the risk of outcomes below expectations in any given year. Yields of selected crops (winter wheat, barley, maize, soybean, and sunflower) were modeled with a probability distribution for low and high projection: i.e., the 5th percentile of the distribution and the 95th percentile, respectively. Under RCP 8.5 yields of all crops, except wheat and soybean, face significant decline in 2030 and in 2050. In percentage terms, the decline is greater for barley followed by maize. However, the projected decline in maize yield is more important, since it is a critical export commodity.

While climatic conditions become favorable for higher productivity of winter wheat in the near future period and up to the mid-century under both RCP 4.5 and 8.5, the unpredictability of precipitation patterns make oblast-level adaption planning very essential to prepare the agriculture sector for this climatic shift.

20. Corporate governance and organisation on emissions trading – path for Ukraine

An Emissions Trading System (ETS) creates new demands on a Ukrainian (or International based in Ukraine) company, and it's important to consider at the outset how to respond to these additional obligations.

For example: **should carbon management and trading be outsourced, or should a new internal organisation be created to address the new regulations?**

Organizing the carbon topic internally

To succeed in managing such a cap-and-trade system, an Ukrainian company will need strategic, technical and financial skills.

First rule: **find the appropriate department to coordinate the organisation: emissions trading is linked to climate change strategy**. Climate strategy often lies between the sustainable development and finance functions.

Emissions trading is about financial management, but it also implies a deep understanding of regulation, CO2 management strategy and a good technical knowledge of industrial installations which fall under the cap.

Whichever the appropriate department is, **the most important thing is to have a project manager.**

Second rule: **start a working group which should be able as a first step to define whether or not emissions trading could be managed internally or outsourced**. A cost/benefit analysis should be carried out to evaluate the choice between delegating trading to a specialised broker or to carrying it out internally. Such an approach gives the opportunity to create a "CO2 network" within the company.

Centralize versus decentralise

Assess possible optimisation among installations: if entities are spread geographically, a centralised option could be considered.

For example, in the European emissions market it is often the case that installations of one company are spread across a number of member states. Local exchanges with local brokers co-exist with European CO2 exchange platforms and may be able to offer more targeted solutions.

Companies frequently choose a centralised approach for several reasons:

- Centralised emissions allocation across many installations;
- Central management of emissions purchases or sales, which reduces external transactions costs;
- Managing risk exposure at a group level;
- Capitalising on relationships with counterparties;
- Ability to manage CO2 data with one single software solution. All relevant data from each installation can be aggregated. That enables a company to build a single unified picture of emissions, to forecast emissions and evaluate different scenarios.

Establishing an internal carbon team

To enable a carbon team to succeed in emissions trading, companies require several functions.

The best option may be to create a dedicated entity for carbon trading.

Having an independent structure enables key functions to be performed:

- The front office is the dealing room from where traders purchase or sell CO2 allowances. The front office is responsible for managing the company's CO2 position and establishing the best trading strategy;
- The middle office monitors the risk exposure of the company, ensures that deals negotiated by the front office are correctly recorded, processed and paid for, check traders' limits and positions, and track deals' profits and losses;
- The back office provides administrative and support services to front office. The back office team ensures that deal payments are made, takes care of deal confirmations, and can also manage margin calls with a clearing provider.

Decision-making processes

The dedicated CO2 management entity must have a governance structure in place. It must have the authority to make all decisions related to the various transactions.

A steering committee, composed of technical experts, the front office and the middle office, meeting every month can be the strategic decision-making body.

The decision-making process can thus be structured as follows:

- The sites are in charge of submitting their CO2 emissions data to the front and the middle offices;
- The front and the middle offices aggregate the data and identify the company's overall position before making proposals for a strategy of purchase or sale;
- The Management Committee decides and adopts the strategy for managing the trading;
- The front office executes the strategy.

Carbon Pricing Preparation fundamentals for Ukrainian developers

The key points for companies to prepare for carbon pricing are:

1. Assess possible optimisation among their installations: if entities are spread geographically, the centralised versus decentralised option could be raised.
   For example, in the EU ETS it may happen that installations of one company are spread around more countries. Local exchanges with local brokers occur and co-exist with European CO2 stock exchanges platforms.
2. Establish an internal carbon team with a dedicated entity that allows to manage main functions: front office, middle office, back office

3. Put in place a dedicated decision-making process including all persons concerned to centralise and optimise choices.

The key challenges companies should consider when preparing for carbon pricing include:

1. Convince all sites that centralising the CO2 decision-making and trading is the best option;
2. Manage the CO2 risk regarding the possible gap between trading and actual emissions;
3. Manage the pass through rate towards clients regarding CO2 cost;
4. Face potential low liquidity on the market and a high price volatility that makes your hedging harder.

Simplified Case Study for Carbon Pricing Preparation Simulation for Ukrainian enterprise

Let´s have an example of a company (e.g. UKR4GREEN, *invented name*) that successfully managed to prepare for carbon pricing compliance.

What were the key success factors/decisions? For example:

Establish a team

1. UKR4GREEN anticipated Phase I of the ETS by establishing a team of expert from all the company's departments.
2. This team discussed the launch of a steering committee about CO2;
3. They launched a CO2 expert network to have representative on sites;

Analyse

1. They invest in an appropriate software to deal and manage all CO2 data

Start trading

1. They launch a dedicated trading entity to start to trade enough time in advance their CO2 allowances, to anticipate several years ahead their cost and to manage their risk

21. Carbon Accounts and Risk Management

When participating in carbon pricing schemes, Ukrainian companies need to understand the legal requirements for capturing data about their carbon emissions and how that data then informs compliance obligations.

If a company has compliance obligations under a carbon pricing scheme and the regulated emissions are not appropriately captured and reported, possible ramifications include severe penalties and in some jurisdictions criminal prosecution or liability for breaching corporate governance requirements including director's fiduciary duties.

The **greatest risk of noncompliance with carbon pricing schemes is typically inaccurate data collection and emissions accounting**. In order to accurately measure and report emissions data, companies should develop a sound understanding of regulations governing emissions accounting and reporting and put in place systems to accurately capture data.

Regulatory requirements for accounting

The first step in any risk management strategy is to understand the legal frameworks that govern the carbon pricing scheme and associated accounting requirements. In many cases, these obligations will be dispersed through a number of instruments.

Regulated companies need to ensure that they understand the scope of their accounting and reporting requirements, including:

- Whether their sector is required to report;
- Any applicable thresholds for reporting;
- Whether their emissions are covered (e.g. all or only some GHGs)
- Whether data is reported at the unit, facility or entity level;

- What types of data must be collected and in what units of measure (e.g. tonnes of CO2-e of emissions or Tj of energy);
- What calculation methodologies are required;
- What emission factors must be used
- What carbon contents and global warming potentials the regulations utilise;
- What verification and quality assurance or control approaches are required;
- Whether consistent GHG calculation methodologies are required across reports;
- How frequently data must be provided (e.g. quarterly or annually);
- Which staff should have access to data and reporting platforms;
- Whether any of the data collected is confidential and the laws, regulations and/or internal policies applicable (e.g. con dentiality or competition laws); and
- Whether there are any amendments to the regulations pending or likely to be introduced in the near future that may affect reporting requirements

21.1 Risk management and legal compliance

Once the regulatory framework is accurately understood, a new player (for example, Ukrainian) need to ensure that any risks posed within the regulatory framework are effectively managed. Although the exact strategies to employ will depend upon the jurisdiction and the regulatory framework applicable, the following is a high-level approach to general risk management in carbon accounting:

Step One: Delineate responsibility

Decide who is responsible for data reporting at each of the facility level and corporate level.

Companies should also consider also whether responsibility for reporting can be transferred to someone better placed to manage the accounting obligations.

Step Two: Develop data collection systems

Develop data collection systems for GHG emissions that are robust, transparent and accurate.

For example, in the EU companies must submit monitoring plans, annual emission reports, verification reports and improvement reports at regular intervals to ensure MRV integrity.

3.3 Step Three: Appoint representatives

Companies with compliance obligations should appoint nominated representatives with responsibilities su cient to meet the obligations under the relevant scheme - see chapter 1 above for further details.

Step Four: Know the timeframes

It is essential that regulated entities understand the required timeframes under applicable legislation for reporting their emissions. These deadlines need to be worked into internal timelines which take account of the internal processes required to obtain audits and sign-offs from executive offcers so that these are obtained in a timely manner.

This can be done, for example, through matrices which set out key dates for reporting and surrender under all applicable schemes.

Step Five: Engage external auditors

To ensure the integrity of information being submitted to regulators, it is recommended that companies have their carbon accounts audited prior to submission for compliance purposes to confirm their processes are robust. Under some regulatory schemes, this will be a mandatory requirement, particularly for very large facilities or corporate groups. However, for others it can be a useful risk management tool, particularly where regulators have the power to conduct spot audits.

Step Six: Build relationships with key regulators

It is always useful to develop good working relationships with the key regulators of carbon accounting schemes. In some cases, relationship managers will be appointed to assist companies with queries they have about reporting and often technical working groups are established to address systemic issues that arise with measurement and data management across industries (e.g. fugitive emissions from coal mines).

Step Seven: Linking with carbon market compliance

In many instances, a carbon accounting and reporting obligation is linked to further compliance obligations under a carbon pricing mechanism. Once the emissions and energy profile of a facility is properly understood, the regulated entity can look at:

- whether it can reduce liable emissions at covered facilities and therefore reduce compliance costs;
- the number of eligible units it requires to surrender to offset all or part of its emissions;
- whether it is able to create o sets through activities at its own facilities or on land it owns or occupies; and
- whether it is able to pass through costs associated with its compliance with carbon schemes through its supply chain.

The **key points for companies to address** carbon risk management include (but not limit):

1. Understand regulatory frameworks for carbon accounting, in particular how they address:
   a. Covered sectors and activities
   b. Thresholds
   c. Types of GHGs covered
   d. Responsibility for accounting
   e. Extent of data collection required
   f. MRV requirements
   g. Timing for reporting
   h. Penalties for non-compliance
2. Delineate responsibility between corporate entities
3. Develop data collection systems
4. Appoint representatives
5. Know the time frames
6. Develop working relationships with regulators

The **key challenges** companies should consider for carbon risk management are:

7. Insufficient understanding of regulatory ambit
8. Accurate and robust data collection
9. Timely and correct emissions reporting

22. Allowances: carbon management strategies

Since 2005, the GHG emissions of a large number of companies in Europe have been regulated by the EU Emissions Trading System (ETS).

For most of the companies covered under the EU ETS, this new restriction on GHG emissions represented, at least at the beginning, a new cost in their operations.

A common question for all these companies was: **how do I comply with the new regulation in the most cost effective manner?**

In the early days of the EU ETS, there was no professional expertise or even broad academic research on the subject of compliance under an ETS. Moreover, each company was affected differently. Therefore, **companies started to address the issue empirically and individually**.

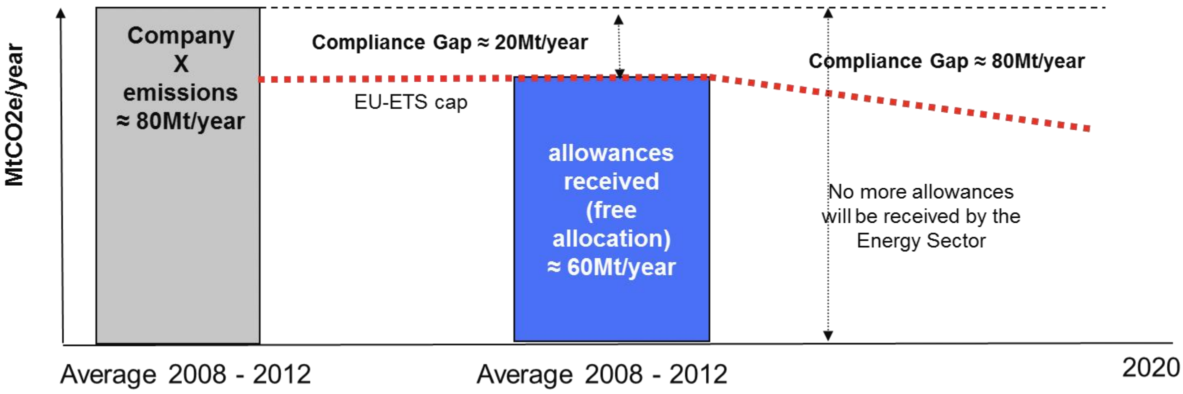
Throughout the years and based on each company's circumstances, carbon management evolved in different ways, and each company adopted gradually a strategy that would suit it best. For example, in some cases, complying with the EU ETS has always been a matter of **cost reduction**, while for other companies it became also a **new business opportunity**.

Today, it is possible to identify some important characteristics shared by most of the largest companies:

- The **cost of emitting CO2** (or its avoidance) has become a **cost of production** and a part of the financial analyses for new investments.
- As such, companies have started calculating their economic exposure to carbon as basis for determining the best way to manage it.

Carbon exposure example

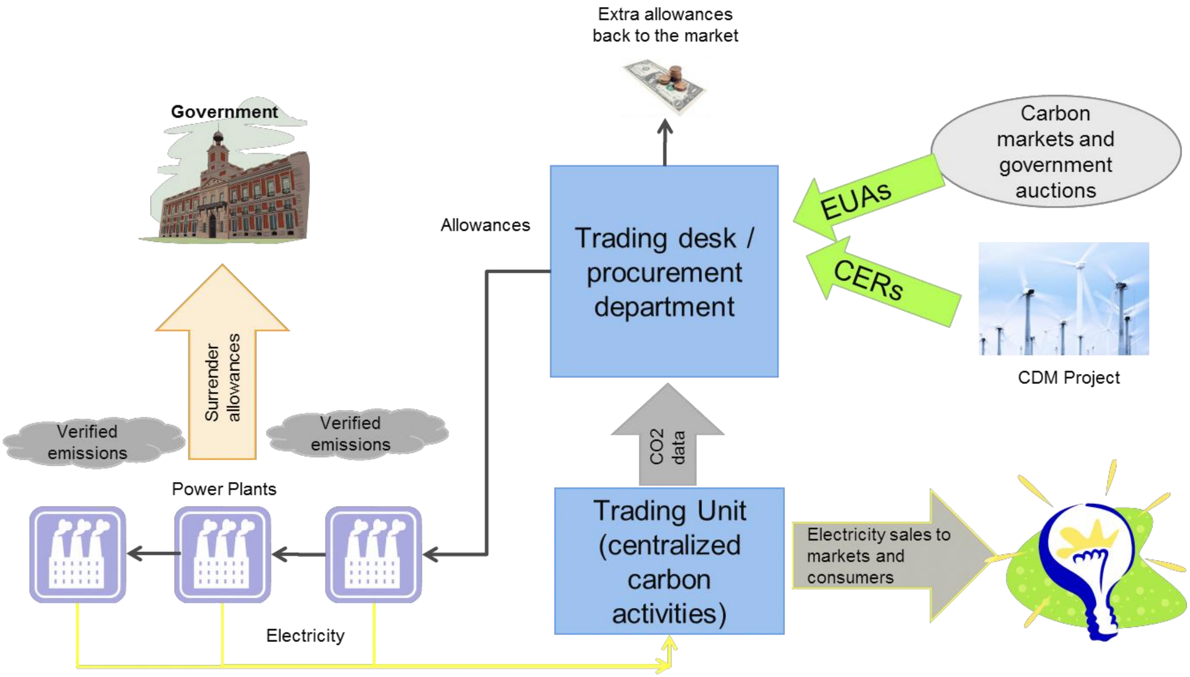
- 2008-2012 Company X, is short by 20 $MtCO_2$ per year
- In 2008, average expected cost of carbon allowances = €10/tCO_2
- Therefore, compliance cost estimated to be in the range **of €200 M per year until 2012**.
- After 2012, no more allowances are received for free. Compliance gap will be around 80 $MtCO_2$ per year (if no actions are taken) with a potential liability **of €800 M per year**.



- Initially, most companies adopted a bottom-up approach to carbon management due to:
  - Inertia
  - the way the EU ETS was enforced (at installation level) and c) a lack of knowledge at higher management levels. Each individual facility had its own way of managing its position and allowances independent of its sister facilities.
- Because of the economic importance of carbon costs and the complexity of the EU ETS itself, corporations began to think more strategically and efficiently in terms of carbon, and started centralizing their activities around carbon management.

Some of the most important activities involved in carbon management are:

- Managing the compliance position of allowances, which in the specific case of the EU ETS could be EUAs or o set credits such as CERs.
- Procurement or sale (trading) of such allowances as needed and determined by production levels and the companies own strategy.
- Continuous analysis of carbon policies and markets, and their implications on the company's operations. The centralization of carbon activities gave corporations a better control of carbon assets and resulted in better hedging strategies.



Takeaways

1. Determining your potential carbon exposure before anything else is key in designing the proper carbon strategy. There is no one size fits all solution; each company is affected differently by an emissions trading system. The results of carbon exposure analysis will define the main objective of the strategy and the resources that will be need for its implementation.
2. The best carbon management strategy is the one that will provide most operational certainty and lower compliance costs (or increase carbon revenues).
3. When trading carbon allowances, nobody can predict exactly the direction of carbon prices in the future. Because carbon markets are highly influenced by political decisions, not even the best analysts can always get it right → Do your market analysis and create your own price scenarios.
4. When centralizing carbon activities, it is very important to assign clear roles and responsibilities and define boundaries between business units.
5. Waiting for the last day before the compliance deadline to balance your carbon position is not a proper carbon management strategy.

22.1 Allowances allocation: how to navigate benchmarking

In designing free allocation methodologies, key design principles that should be prioritized include:

- Collection and validation of installation emissions data, and if required, installation activity data.
- Providing sufficient free allocation, representing a full assistance so that an industry sector and its installations are not disadvantaged by carbon or investment leakage to competitors that are not subject to a price on emissions.
- Rewarding rather than penalizing firms who have been 'early movers' in investing in lower GHG technologies and plan to expand their efficient business models in the future.

<u>Grandfathering allocation</u>

An installation's financial exposure must be de-risked to avoid permanent economic damage due to financial exposure to a new and untested ETS market in contrast to non-exposed competitors.

Since the market price, as a function of supply and demand and market participant behaviors, cannot be initially predicted in such a nascent market setting, a high percentage of free allocation is required to reduce installation exposure to an ETS. This is to avoid unintended and economically damaging consequences to installations and the wider economy.

Lessening exposure to the market price gives participants time to gain confidence and learn from their experiences, without quitting the sector.

To give a rational basis to allocation in a new ETS, “***grandfathering***” (free allocation based on historic emissions) is a popular tool.

However, grandfathering free allocation has a downside in that it does not reward early GHG reduction actions: indeed it could result in withheld investment because of the perverse free allocation incentive to be gained by not reducing emissions in the baseline setting period.

Why benchmarking in an ETS?

As a dynamic ETS matures, the total amount of free allocation and any auctioning must decline with any progressive reductions in the cap. But with auctioning (and its revenue stream) being ring-fenced for government use, the quantity of free allocation may be constrained. Because it is determined by historical data, there is likely to be a shortfall that must be addressed.

There are other emission trajectory scenarios that mean no shortfall: these include that emissions will decline as an economy becomes more energy efficient (impacting CO2 emissions), that there are or can be overlapping policies and incentives that reduce emissions at installations in addition to an ETS (e.g., renewable energy targets), or that a dip in economic activity results in lower emissions.

But these scenarios cannot accurately be predicted in a modern and open internationally trading economy.

While **revising the auction share is one policy solution**, another is to use a **common free allocation reduction factor** to be applied across all installations. But under grandfathering allocation, there is no differentiation between carbon efficient and less carbon efficient production installations, as a reduction factor would apply across all allocation facilities.

One solution is to benchmark installations against sector best-in-class peers, as a way of further rewarding more carbon efficient producers. By focusing on a CO2 efficiency of industrial production metric using peer installations, it can also drive better mitigation behaviours. Care must also be taken that, at the level of the benchmark, these best-in-class installations receive sufficient allocation to offset the risk of carbon leakage from outside the ETS. Finally, when done transparently, benchmarking can be used to quantify sector relevant GHG reduction benefits of new technologies and techniques and allow comparisons with competitor installations beyond the ETS.

Choosing Benchmarking

In reality, **demonstrating best-in-class performance is more difficult**. It a balance of effort between defining sectors and sourcing their relevant data vs allocation to less efficient installations. If the same technology and standards of operation are employed homogeneously across a sector, then the best-in-class installations will have the same characteristics as the remainder of the sector. No point in benchmarking! But, in most sectors, there are well-known leaders and laggards – including on product production carbon efficiency! And until the sector data is collected and analysed, this point is difficult to predict.

Benchmarking in practice - Sector definition

An ETS with large stationary emitters (typically 25,000 tCO2e per annum) will capture almost all combustion installations in the electricity generation and energy intensive industry sectors such as cement production, iron and steel manufacture, mineral oil refining, the chemical industry, paper and pulp, non-ferrous metals, lime, ceramics, building materials, and glass manufacturing sectors. However, within these sectors there may be several different product sub-sectors. These need to be defined and assessed to ensure a sector benchmark is representative of the sector installations – not just one or two.

Defining sectors/sub-sectors is not always simple – there are sometimes different processes for manufacturing the same product, and products can be coproduced (e.g., in the chemicals sector) There is a trade-off to be struck between the quantity of sectors in the ETS, and the level of aggregation/sector populations. The balance is between reasonably and accurately describing a sector/sub-sector in terms of product commonality and data availability, while still keeping sufficient sector population for ease of administration.

If the benchmark is to be set by a best-in-class members of a sector/sub-sector, then **these must be representative of the sector in terms of embodying emission characteristics** (including technologies and production organisation techniques) which are replicable by other installations. This means that there must be a sufficient number of installations to form the benchmark, and special/unusual characteristics in benchmark installations must be defined and isolated.

Further issues occur when a sector's emissions by installation bear little relevance to their production. This typically occurs in mineral extraction sector where the resource base declines with reserve production whilst emissions remain constant or even increase with the increased difficulty of extraction. Here a sector benchmark would be difficult to define, thus a different approach is needed. Similarly, where a sector is either too small or too heterogeneous for a sector benchmark to be set realistically, a fall-back approach to allocation must be employed to also encourage and incentivise improvement fairly in comparison with benchmarked sector installations.

<u>Sector data to determine the benchmark</u>

Sector data collection is key. It is unlikely that national administrations will have installation level production data coupled with emissions data. A sector survey is needed, and since the data will define free allocation, and thus determine financial benefit, some verification assurance will be required. **Production data handling probably requires use of an external consultant to ensure the confidentiality of production data**.

The baseline for determining production and emissions data is important – a longer period requires more data but is more likely to average out issues that affect emissions. These include economic recession, installation production turnaround and capacity replacement/upgrading/debottlenecking, and the introduction of new technologies and techniques. **However, while less representative, a shorter period allows benchmarking to start earlier with less onerous data sourcing requirements.**

Finally, the level of the sector benchmark needs to be defined. Setting it at the sector average probably gives insufficient incentive for improvement for less efficient installations, and risks overallocation to the most efficient producers compared to their given emissions. However, a benchmark at the level of the first quartile or decile reduces the risk of overallocation, while still demonstrating increased ambition levels for a sector's performance. However, these are relatively small adjustments – the overall aim of free allocation is to protect installations and sectors against the risk of carbon leakage.

<u>Allocation and updating frequency</u>

Output benchmarks are often set in terms of tonnes of CO2e per unit of product production over a baseline period. But **free allocation still needs to be determined**. If, under a benchmark, installation emissions data is updated frequently, then those installations that suffered a reduction in allocation (because of, for example, production gaps or other issues affecting production but not emissions), can apply the more recent data. **This also serves to ensure that free allocation is given to protect against actual carbon leakage from recent emissions and not to installations that are simply shrinking production.**

On the other hand, **the benefit of reducing emissions and selling allocation to provide additional installation investment funding is diminished by more regular allocation data updating**.

It is possible to also update the data determining which installations form a benchmark. But the incremental change on a sector installation's allocation is likely to be small because installation emission profiles in energy intensive sectors don't radically change year-on-year, due to the capital intensive nature of industrial investment. So perhaps **recalculating the data to determine which installations form the revised benchmark is best considered on a longer time horizon**.

Tools

One useful tool is to plot installations sequentially on a CO2e emissions vs production basis to look for anomalies. Should the relationship between separate installations be scalar and thus consistent, then a production vs emissions benchmark probably is possible. Such a chart also serves to identify outliers where data may be inconsistent, and/or different processes are involved.

One example is whether emissions associated with electricity generation should be considered in the sector benchmark. Because electricity generation is not usually associated with carbon leakage, some ETS programmes give no free allocation for it. If so, this feature should be embodied in the benchmark by excluding emissions associated with electricity generation. **This allows sectors to compete on emissions vs production rather than site electricity generation efficiency** - which is irrelevant for benchmarking when electricity is imported. The aim is to keep installation allocation neutral regardless of imports or auto-generation. Note that, for heat production, this is generally integrated into the installation via boilers, furnaces, heaters and/or CHP, and is often assessed using a fallback approach that looks at an efficiency standard across all sectors as the combustion equipment is generally not sector specific.

22.2 Case studies on benchmarking: EU ETS Vs California

EU ETS

From 2012, the EU ETS Directive required that benchmarks are based on tonnes CO2e per unit of production, and set at the level of average of the top 10% of a sector/sub-sector.

In the EU ETS, industrial sector thresholds were partially defined in Annex I of the Directive by way of entry thresholds. Further sectors were defined in conjunction with EU trade associations, leading to the publication of some 54 product benchmarks. For those sectors/sub-sectors which were too small, or lacked homogeneity, or where emissions fell outside the process boundary, simple fallback approaches of allowances per GJ of heat or fuel use or 97% of the historical process emissions were developed.

In Phase III (2013-20), when benchmarking was introduced, there was no free allocation for electricity generation, with these allowances being auctioned for the benefit of member states. With the ETS cap decreasing at 1.74% per annum, an artificial ceiling was imposed on free allocation to the non-electricity generation sectors, and enforced by way of a cross-sectorial correction factor (CSCF) reducing allocation to even top performing efficiency installations at the level of the sector benchmark; this, in spite of the majority of allowances being auctioned for the benefit of member states.

Due to installation allocation baselines for emissions and allocation data being set prior to the 2008 global economic crisis, some installations received an overallocation compared to their more recent activity. Where overallocation was due to activity reduction, the requirement for free allocation quantities to protect against carbon leakage is diminished in proportion to emissions. Hence, there was not only overallocation in some sectors but others received a smaller allocation due to the shape of the sector benchmark performance curves which were not corrected between sectors. While there were corrections for installations that declined their activity below a 50% threshold, most were above this mark. Thus, an incentive to reduce activity and so emissions was introduced. With overallocation causing the industrial cap to be breached, all installations had their allocation cut by a factor of 5.73%. New rules are being developed for Phase IV that hopefully will better align an installation’s activity with allocation informed by recent data. **This is to ensure the CSCF is only deployed as a last resort.**

California

In 2011, California developed an output-based benchmarking programme paired with its industry assistance policy to distribute allowances. **Output-based benchmarking prevents windfall profits**. Free allowances are distributed to covered facilities within the sector based on benchmarks that are set to recognise early action and energy efficiency.

The California benchmarks are based on California industry specific data and set at a higher level than average in order to incentivise higher performance. California adopted a refining benchmark similar to the EU's, called Complexity Weighted Barrel. The benchmark, industry assistance factor and the cap factor determine the free allowances an energy-intensive trade-exposed facility covered by the ETS receives. California began implementing the industry assistance and benchmarking programme in 2012.

On data collection, because the EU's Eurostat statistical service data is not generally available at installation level, sectors have had to collect their own data and usually employ a consultant verify the data. Each sector produced a rule book that showed how benchmark levels were defined and determined while preserving anonymity at installations level.

23. The Exchange: how carbon is traded and the importance of liquidity

Not just keeping emissions under a pre-defined cap, but **reducing them where it's most efficient, is the key promise of emissions trading**. This is achieved through trading allowances in well-functioning markets, established in the EU Emissions Trading System (ETS) and other systems. Although often overlooked, **liquidity is central to these markets** and exchanges play the key role in organising them.

How is carbon traded?

There are **three ways to trade allowances – bilateral trades, through over-the-counter (OTC) brokers, and on exchanges**.

Each of them has specific characteristics, and they **differ on four main levels – liquidity, transparency, level of regulation and credit risk.**

Bilateral trading is the simplest form of trading. It refers to a deal directly negotiated between buyer and seller without the involvement of a third party. It is most suitable when parties have a close and established business relationship, as transaction costs are rather high. Buyer and seller first have to find each other, and then establish all details of their trade. Most importantly, they need to be able to assess the financial stability of their counterpart to minimise credit risk. This in particular can be a challenge, and increases risk of the trade.

Use of a broker can reduce these high transaction costs. Brokers act as intermediaries between many different buyers and sellers. This means that they can pool different orders and facilitate trades. They can advise their clients and pass on information. This 'market talk' supports clients in making choices, and means they do not have to continuously monitor the market. As brokers pool different market players, they may also provide some degree of anonymity and may publish prices. Importantly, brokers by themselves do not cover the credit risk of a transaction which stays with buyer and seller. Brokered deals may however be cleared at a clearing bank to minimise credit risk.

OTC deals with brokers already show some of the characteristics of exchange trading. However, they're much less regulated. This may be beneficial, as it gives them more freedom for instance to offer tailor-made products and can decrease costs. **Trading at exchanges however may offer additional benefits we'll look into next.**

What's the role of exchanges in emissions trading?

The first characteristic of exchange trading is transparency. Exchanges are obliged to publish price data and volumes at all times for the public. This is highly beneficial for the market's development, as it establishes a 'fair market price' for a commodity. It also lowers entry barriers to the market, making it more accessible for participants from diverse backgrounds.

Second, an important characteristic is **standardization.** Trading takes place under transparent rules and conditions, within clearly defined trading hours, and is defined by contract specifications (e.g., quantity/quality, place of delivery and others) which are openly published. Standardization also makes it possible for exchanges to pool a great number of market participants, creating products with high liquidity which in turn are attractive for market participants to trade.

Third, **exchanges offer increased security of transactions**. All transactions are financially settled through a clearing bank. The bank acts as a central counterparty to both sides of the trade. Thorough assessment of companies and individual traders, and collateral, ensures the bank can reduce counterparty risk to the absolute minimum. The bank stepping in between buyer and seller guarantees anonymity of trading, adding an additional layer of security. Upon conclusion of a deal, the clearing bank initiates the transfer of allowances in the emissions registry.

Another building block for security is in-depth market surveillance. An extensive legal framework of rules and regulations governs this fundamental requirement of exchange trading applied to all transactions. Exchanges operate market surveillance departments which constantly monitor the market for any irregular behavior. These teams are fully separate from the exchanges' other business activities, and report any findings directly to the relevant authorities. This general and direct surveillance by public authorities is a distinctive element of exchange trading.

Exchanges' membership base reflects the diversity of the carbon market. On EEX, a total of 95 market participants are admitted to trade carbon. They include power producers, compliance entities and financial players. Financial players may trade both on their own account and on behalf of firms outside the exchange. The scale of involvement in the carbon market, as well as the professionalization of trading at a company determines whether they become a direct member. Trading in other commodities also makes it more attractive to join, as pooling trading in one marketplace means lower total collateral requirements. A company already trading power on the exchange can easily add carbon as an asset class.

How can market participants trade on the exchange?

There are **two main forms of participation** – **primary market auctions** and **continuous trading**. In the EU Emissions Trading System (ETS), more than 50% of new allowances are released into the market through auctions. Governments award contracts for the operation of auction platforms through competitive tenders. Twenty-seven EU member states and the European Commission have selected EEX as their auction platform, adding up to more than 90% market share. **Participation in auctions is considered by some market players as the simplest way of buying allowances**, and numerous provisions are in place to facilitate access for the diverse range of companies affected by the EU ETS, including small- and medium-sized enterprises.

Continuous trading on the other hand allows buying and selling of allowances. It consists of spot and derivatives markets. Spot trading refers to trading in the very short term ('on the spot'), for delivery within two days. Spot trades are relatively easy to handle, as they have lower margin requirements. However, immediate payment and delivery may not be most efficient strategy if allowances are only needed later on. This is when market participants can use the derivatives market, allowing trading up to six years ahead. **Most market participants are active both on the spot and derivatives markets**, combining long-term management of price risk with short-term optimization of their portfolio.

In emissions markets, exchanges have always played an even more important role than in other commodities markets. In the EU ETS, more than 60% of allowances are traded on exchanges. The main reason for this is that EU emission allowances, as a fully standardized, electronic commodity, ideally lend themselves to trading and pooling of liquidity on exchanges.

Why is liquidity central to an efficient market?

We've mentioned liquidity several times as it's the key to an efficiently functioning market. It is the possibility to buy and sell a commodity at any time, in any volume, without significant influence on price. Liquid markets are attractive for participants, as they allow them to efficiently fulfil their hedging needs for the future and optimize their portfolio in the short term. This decreases both the cost to market participants and the system costs of the trading programme.

How can we design liquid carbon markets?

The fundamental principle for liquidity is standardization. Identical specifications for emission allowances create one universal 'currency' for carbon, laying the groundwork for a liquid market. Ideally, there is just one type of credit that all companies use. In the EU ETS, emission allowances are identical, and entities only need to know what volume to surrender in a compliance period. Standardized credits in turn facilitate the development of standardized trading arrangements which further add to liquidity.

A large market combined with standardization is the key to achieve broad and diverse participation in the carbon market. The EU ETS, covering a broad range of industrial sectors, has successfully attracted major liquidity providers from the financial and commodity industry. Diversity in turn increases liquidity, as different actors have different but complementary motivations to trade. As one example, financial players can offer long-term hedging opportunities to compliance entities. Any cooperation between different emissions trading systems further promotes interest in the market and liquidity. Linking of systems is the most obvious example to be further encouraged, but interim steps are also valuable. As an example, market participants are often active in several different emissions trading systems. With direct exposure to several systems, they are able to compare them and provide valuable ideas for development. What's even more important, these companies become drivers for the simplification and harmonization of rules in those systems. This facilitates further cooperation, lowers entry barriers for market participants, and makes it possible to broaden the range of market participants.

Auctioning of allowances also contributes to higher liquidity in the market. Through participation in auctions, compliance entities directly engage in the market and build up experience with trading. Auctioning also leads to price discovery and transparency, which further increases liquidity. On a more general level, policy certainty is fundamental for liquidity. Market participants have to trust the framework conditions under which they operate, in particular for them to engage in long-term hedging.

Exchanges and liquidity – central to the market

In short, successful emissions trading systems offer a large and diverse range of market participants different and complementary channels for trading. Exchanges play a central role by pooling trading in one marketplace, thereby creating liquidity. They contribute to the market's efficiency through transparency of price data and volumes, and are able to monetize new allowances efficiently via primary market auctions. Well-functioning, liquid markets are the basis for emissions trading to fulfil its key promise – not just keeping emissions under a cap, but reducing them where it is most efficient.

23.1 The key points for companies to address membership and trading on an emissions exchange

Assuming for a moment that a Ukrainian enterprise is intending to participate to trade on an emission exchange, it is important to remind again that **membership and trading on any exchange is governed by a framework of rules and regulations defined by both the exchange's rules and the legal framework**.

In the case of EEX, preconditions for admission as a trading participant are laid down in article 14 of the EEX Exchange Rules and in article 19 (4) of the German Exchange Act (BörsG).

Admission can be applied for separately for the individual markets and products traded on the exchange. A company can only begin to trade on the EEX markets and register trades once it has been successfully admitted to the exchange. Proper settlement and collateralisation of transactions requires recognition as a trading participant by European Commodity Clearing AG (ECC), the EEX clearing house.

Preconditions for admission are:

- Proof of personal reliability and professional qualifications of the person/s holding management authority
- Liable equity of at least € 50,000
- Admission of at least one trader who has proven personal reliability and who has provided proof of the required professional qualification (by means of a trader examination)
- Technical connection to the trading systems
- Recognition as a trading participant by the clearing house of EEX, ECC

23.2 Key challenges firms should consider for membership and trading on an emissions exchange

The **main challenges** to be considered by companies depend on their **market, connectivity, location and nature**. This is so because of the multiple factors that are required to be admitted. In our experience, issues like technical connection to the trading systems (just to mention one) have proven a bigger challenge than presenting the needed equity.

Nevertheless, **other key issues** that can impose challenges (apart from the fulfillment of the admission requirements) are related to **compliance rules** imposed by article 19 of the German Exchange Act. Another factor to be considered is the different requirements that apply for different markets and products. This often leads to companies operating in different markets and different products having to follow particular steps depending on each market/product.

Another challenge when addressing membership is **successful time-management when going through the procedure**. A company that successfully fulfills all the pre-requisites is often one that has addressed all the fore-mentioned issues in a timely and coordinated manner

24. GHG footprint calculation methodologies – application in UKRAINE

The Ukraine's Greenhouse Gas (GHG) Inventory Report (National Inventory Report, NIR) is submitted for consideration of the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC).

As per today, the National Inventory Report contains the balance of GHG emissions and removals for the period from 1990 through 2019 with a detailed description of the methods applied and findings of scientific research of national circumstances.

The NIR was prepared in the framework of the national inventory system, which includes the complex of all the organizational, legal, and procedural mechanisms adopted by Ukraine for estimating anthropogenic GHG emissions and removals, as well as for the purpose of reporting in accordance with the revised Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories (FCCC/CP/2013/10/Add.3).

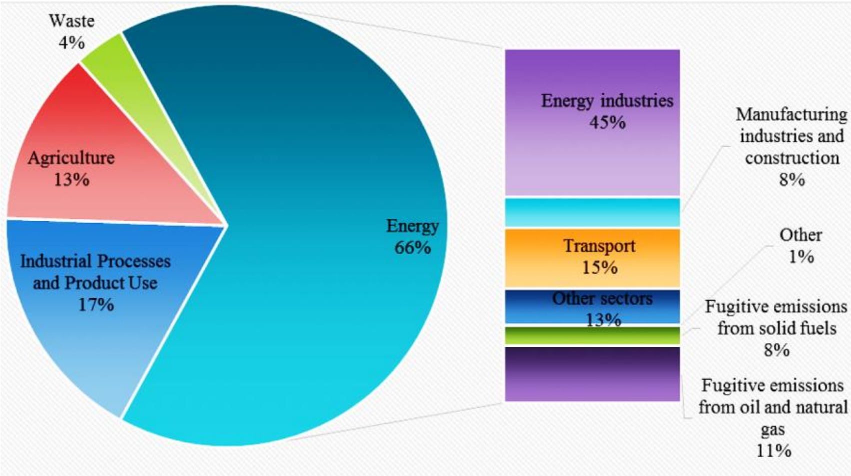
The state authority responsible for preparation, approval, and submission of the National Inventory Report is the Ministry Environmental Protection and Natural Resources of Ukraine (MEPR).

24.1 Background information on greenhouse gas inventories, climate change in Ukraine

In Ukraine, GHG emissions occur in the following sectors:

- Energy;
- Industrial Processes and Product Use (IPPU);
- Agriculture;
- Land Use, Land Use Change and Forestry (LULUCF);
- Waste.

The largest GHG emissions in Ukraine take place in the Energy sector. In 2019, the share of this sector accounted for around 66 % without the LULUCF sector. About 78% of emissions in this sector account for emissions in the Fuel Combustion category, which include the categories of Energy Industries, Manufacturing Industries and Construction, Transport, Other Sectors, and Other, as well as 22% - emissions in the category of Fugitive Emissions from Fuels.



It should be noted that the share of GHG emissions in the category of Fugitive Emissions from Fuels in total GHG emissions in the Energy sector gradually increased in the period of 1990-2000: from 17.6% in 1990 to 28.7% in 2000. This period is characterized by aging of the infrastructure and industrial capital of the country. Since 2001, the proportion of emissions associated with fugitive fuels was gradually decreasing to 21.9 % in 2019, which is due to activities in the field of energy efficiency and energy source replacement implemented in the country.

The share of the **Agriculture** sector in total GHG emissions without LULUCF (*Land-use, Land-use Change, and Forestry*) was 12.8 % in 2019.

The **major sources of emissions in the Agricultural sector are enteric fermentation and agricultural soils**, 20.9 % and 72.2 % of the total emissions in the sector in 2019, respectively. **Emissions in this sector decreased by 51.1 % compared to the base year, and by 4.0 % as compared to previous year**.

Changes in emissions over the reporting period in category Enteric Fermentation is associated with the change in the number of livestock, herd structure and gross energy values.

The significant rate of methane emissions fluctuation in the category Manure Management in comparison with emissions in the other categories in the period of 1990-2018 is first of all directly related to partial replacement in the structure of manure distribution at cattle breeding enter-prises of liquid slurry with solid storage.

Nitrous oxide emissions change in category Agricultural Soils by 2019 is due to the changes in the amount applied fertilizers, areas under certain crops and their productivity.

The contribution of the Waste sector in 2019 in total emissions is 3.7 %. The main source of CH4 emissions is landfills of municipal solid waste (MSW), and that of emissions of N2O - human sewage. In relation to the base year, emissions in the sector increased by 2.5 % in 2019.

The main manifestations of regional climate changes in Ukraine within the global warming processes include significant rise of air temperatures, changes of thermal regime and structure of precipitation, increased number of hazard meteorological phenomena and extreme weather events, which all result in losses for country's population and various economy sectors.

Unfortunately, it is not possible to obtain reliable meteorological data for the whole territory of Ukraine since 2014 (Crimea events). Information on hydrometeorological parameters from observation stations is not transmitted to Ukrainian Hydrometeorological Center, and, as a result, unavailable for aggregation. Therefore, the data on regional effects of the global climate change in Ukraine are limited by the year 2013.

To carry out a comprehensive analysis of possible regional differences of climatic conditions in Ukraine in the 21st century, the ensembles of **ten regional climate models (RCMs) for air temperature and of four RCMs for precipitation sums from the European project FP-6 ENSEMBLES for the scenario of greenhouse gas emissions IPCC SRES A1B have been elaborated**.

Absolute values for the forecast periods have been adjusted based on the simulated changes and the data of the gridded dataset E-Obs for the recent period of 1991-2010, employing the additive and multiplicative methods. The RCM ensembles have been developed by researchers of the Ukrainian Hydrometeorological Institute and identified as being optimal for the analysis and forecasting of the regional features of respective climate characteristics over the territory of Ukraine.

Three 20-year forecast periods have been examined: 2011-2030, 2031-2050, and 2081-2100.

The analysis of projections of average air temperatures has shown that in the nearest period of 2011-2030, the average temperature over the territory of Ukraine will rise by 0.4-0.5oC, ranging from 0.1oC in the western region in spring and up to 0.8oC in the northeast in summer. In the next 20-year period (2031-2050), the average temperature for the territory will increased by 1.2-1.5oC against the present climate, ranging from 0.7oC in the west in spring and to 1.9oC in the northeast in winter. By the end of the century (2081-2100), the average temperature for the territory will rise by 2.9-3.3oC, with the minimum value of 2.1oC in the western region in spring, and the maximum temperature increase by 4.3oC in the southern region and in the south of the eastern region in summer. The smallest changes are projected for the western region in all seasons, as well as for all regions in spring for the whole century

The existing inventory covers emissions of seven GHGs:

- carbon dioxide (CO_2);
- methane (CH_4);
- nitrous oxide (N_2O);
- hydrofluorocarbons (HFCs);
- perfluorocarbons (PFCs);
- sulfur hexafluoride (SF_6);
- nitrogen trifluoride (NF_3).

As well as following precursor gases:

- carbon monoxide (CO);
- nitrogen oxides (NO_x);
- non-methane volatile organic compounds (NMVOCs);
- sulfur dioxide (SO_2).

In order to ensure regulatory and organizational support for GHG inventory, the President Decree was signed, and several Resolutions of the Cabinet of Ministers of Ukraine were adopted.

According to Decree of the President of Ukraine of September 12, 2005 of No. 1239/2005 the MENR is authorized as the coordinator of activities for the implementation of Ukraine's commitments under the UNFCCC and Kyoto Protocol to it. To execute the Decree, the Cabinet of Ministers of Ukraine adopted two Resolutions. Resolution of the Cabinet of Ministers of Ukraine of April 21, 2006 of No. 554 established procedures for the national anthropogenic GHG emissions and removals not controlled by Montreal Protocol evaluation system, and defined its objectives and functions. Later this Resolution of the Cabinet of Ministers of Ukraine was amended (in line with the new Resolution of the Cabinet of Ministers of Ukraine of July 16, 2012 No. 630). The changes mainly concerned the ways of the national system's functioning – additional information (data) request procedure for estimation of anthropogenic GHG emissions and removals, indicating the limited timing for data transfer (provision) by providers (in this case, these are public authorities and institutions, plants, etc.) – within 30 days from the date of receipt of the request.

In turn by the Order of the MENR of January 31, 2017 No. 35 «*On approval of the Structure of the Ministry of Ecology and Natural Resources of Ukraine*», amendments were introduced that influenced the structure of the central apparatus of the MENR, namely the Department of Climate Change and Ozone Layer Protection was set up.

According to Resolution of the Cabinet of Ministers of Ukraine of September 02, 2019 No. 829 «*Some Issues of Optimization of the System of Central Executive Government Bodies*», the decision was made to rename of the MENR to the Ministry of Energy and Environmental Protection of Ukraine (MEEP).

In turn by the Order of the MEEP of February 11, 2020 No. 83 «*On approval of the Structure and number of independent structural units of the MEEP*», amendments were introduced that influenced the structure of the central apparatus of the MEEP, namely the Directorate of Climate Change and Ozone Layer Protection was set up.

According to Resolution of the Cabinet of Ministers of Ukraine of May 27, 2020 No. 425 «*Some Issues of Optimization of the System of Central Executive Government Bodies*», the decision was made to rename of the MENR to the Ministry of Energy of Ukraine and create a Ministry of Environmental Protection and Natural Resources of Ukraine (hereinafter – MEPR).

In turn by the Order of the MEPR of July 08, 2020, the new structure was approved, namely the Department of Climate Policy and Ozone Layer Protection was set up.

Estimates GHG and pre-cursor emissions were performed using the first, second, and third level approaches. Thus, volumes of emissions in key categories were determined mostly using second-level approaches.

Table below presents generalized information about assessment methods for estimation of GHG emissions and removals in this inventory.

CRF category	Name of the emission category	Comment on the method applied
1.A	Fuel Combustion Activities	T1, T2, T3
1.A.1	Energy Industries	T1, T2, T3
1.A.2	Manufacturing Industries and Construction	T1, T2
1.A.3	Transport	T1, T2, T3
1.A.4	Other sectors	T1, T2
1.A.5	Other (not elsewhere specified)	T1
1.B	Fugitive Emissions from Fuels	CS, T1, T2, T3
1.B.1	Solid Fuels	CS, T1, T2, T3
1.B.2	Oil and natural gas and other emissions from energy production	T1, T2
1.C	CO_2 Transport and storage	The category is not calculated
2.A	Mineral industry	T1, T2, T3
2.B	Chemical Industry	T1, T2, T3, EMEP/EEA
2.C	Metal Industry	T1, T3, EMEP/EEA
2.D	Non-energy products from fuels and solvent use	T1, EMEP/EEA
2.E	Electronics industry	The category is not calculated
2.F	Product uses as substitutes for ODS	T1a, T1, T2
2.G	Other product manufacture and use	CS, T2,T3
2.H	Other	EMEP/EEA
3.A	Enteric Fermentation	T1, T2
3.B	Manure management	CS, T1, T2
3.C	Rice Cultivation	T1
3.D	Agricultural Soils	CS, T1, T2
3.E	Prescribed burning of savannas	The category is not calculated
3.F	Field burning of agricultural residues	The category is not calculated*
3.G	Liming	T1
3.H	Urea Application	T1
4.A	Forest Land	CS, T1, T2

4.B	Cropland	CS, T1, T3
4.C	Grassland	CS, T1, T3
4.D	Wetlands	T1
4.E	Settlements	T1
4.F	Other Land	T1
4.G	Harvested Wood Products	T1
4.H	Other	The category is not calculated
5.A	Solid waste disposal	T3
5.B	Biological Treatment of Solid Waste	T1
5.C	Incineration and open burning of waste	T1, T2
5.D	Wastewater Treatment and Discharge	CS, T1, T2
5.E	Other	The category is not calculated

Legend:
T1, T2, T3 – Tiers 1, 2, and 3, respectively, according to 2006 IPCC
M model-based methodology
CS – national methodology
EMEP/CORINAIR – methodology for GHG inventory

* The Burning of agricultural residues in Ukraine is prohibited under the Code of Administrative Offenses (Art. 77-1) and the Law of Ukraine On Air Protection (Art. 16, 22). Fires that occur in agricultural areas are defined as natural fires (wild fir es).Therefore, the emissions from them accounted for in LULUCF.

Uncertainty estimate was performed using the first level approach, provided in 2006 IPCC Guidelines.

The results indicate that the net emissions in 2019 year including the sector Land use, land-use change and forestry (LULUCF) is 383535.89 kt CO2 equivalent with an uncertainty of 8.50 %; excluding the LULUCF sector – 332091.66 kt CO2 equivalent with an uncertainty of 7.69 %. Based on totals of years 1990 and 2019, the average trend including the LULUCF sector is 59.52 % reduction of emissions; excluding the LULUCF sector – 64.77 % reduction of emissions.

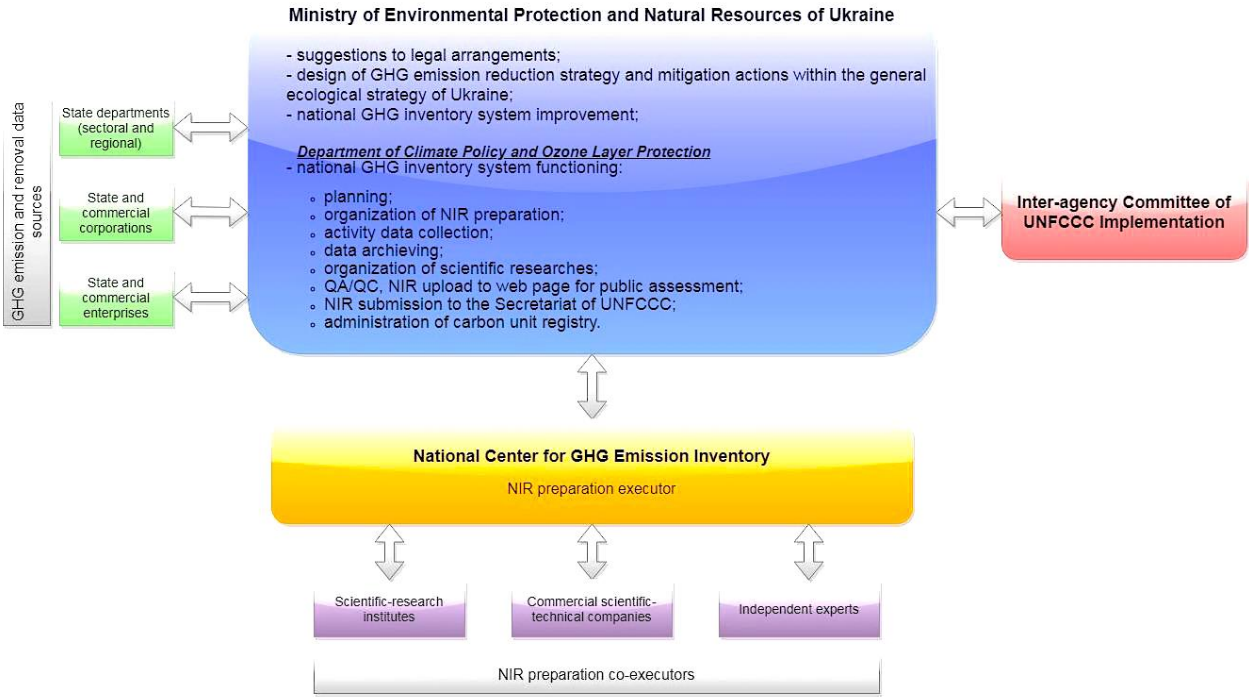
The uncertainty of the trend including the LULUCF sector is 2.99%; excluding the LULUCF sector 2.08%.

24.2 The National Inventory System

The **National Inventory System** includes:

- State and private organizations and enterprises, as well as private entrepreneurs and individuals who being primary subjects of holding or control of GHG sources and sinks shall submit activity data for GHG inventory, as well results of its production activities by type of products;
- Public and private corporations being primary subjects of holding or control of GHG sources and sinks, or including primary subjects of primary subjects of holding or control of GHG sources and sinks, which submit activity data for GHG inventory within the corporation by individual GHG sources or sinks and their categories, as well as results of its production activities by type of products;
- Industrial, regional, and local governmental agencies, which in line with the acting regula-tory framework of Ukraine and within their authority shall collect statistical information and submit to the request of the MEPR respective aggregated activity data for GHG inventory in accordance with the forms agreed with the Department of Climate Policy and Ozone Layer Protection of MEPR;
- Research institutions involved into collection and preliminary processing of data on GHG emissions and removals or into development of calculation methods;
- independent experts and organizations involved in public discussion of the inventories;
- civic and non-governmental organizations involved in public discussion of inventories;
- the Budget Institution «National Center for GHG Emission Inventory», which in cooperation with other actors in the systems, conducts inventory of anthropogenic GHG emissions by sources and removals by sinks at the national level;
- Inter-Agency Commission on implementation of the UNFCCC, which reviews and ap-proves reporting documents submitted to the UNFCCC Secretariat;

- MEPR is the main body in the system of central executive authorities regarding development and enforcement of the national policy in the field of environmental protection, provides legal regulation within this area, reviews and approves reporting documents submitted to the UNFCCC Secretariat. Within its assigned tasks, the MEPR provides is responsible for inventory of anthropogenic GHG emissions by sources and removals by sinks at the national level in order to prepare the NIR, as well as approval and submission to the UNFCCC Secretariat of the NIR. As a structural unit of the MEPR, the Department of Climate Policy and Ozone Layer Protection is still performing its duties.



Quality Assurance (QA) and Quality Control (QC) in the national inventory system are based on planning, preparation, quality control and subsequent improvements, and is an integral part of the inventory process.

For this purpose, regular checks of transparency, consistency, comparability, completeness of data, calculations, measures to identify and eliminate errors, as well as to store inventory information are conducted (performed), which represent the QA/QC system.

The system complies with Tier 1 procedures of «Quality Assurance/Quality Control and Verification» of 2006 IPCC Guidelines, and expanded with a number of QA/QC procedures specially designed taking into account sector specifics in accordance with Tier 2.

In the framework of the National Inventory System, throughout the NIR development cycle, including its final submission to the UNFCCC Secretariat, implementation of QA/QC procedures is an important component, compliance with which is provided and clearly defined by the internal documents – the general plan of measures for the development of NIR and additional plan for QA/QC.

It should also be noted that in Ukraine there are further efforts being made to implement requirements of International Standards (IS) ISO 9000 into the National Inventory System.

24.3 Emission methodologies and calculations by main sector: Energy, Industry, Agriculture

Energy

The "Energy" sector includes emissions from combustion of carbonaceous fuels (category 1.A "Fuel Combustion Activities"), as well as greenhouse gases produced as a result of leaks in extraction, processing, storage, transportation, and consumption of fuels (category 1.B “Fugitive Emissions from Fuels”).

#	Fuel	Groups of fuels*	Fuel code	
			2015	2016 - 2019
1	Hard coal	S	100	110
2	Briquettes, pellets from hard coal	S	110	140
3	Brown coal	S	115	120
4	Briquettes, pellets from brown coal	S	120	150
5	Non-agglomerated fuel peat	P	130	130
6	Briquettes, pellets from peat	P	140	160
7	Crude oil, including Oil from bituminousmaterials	L	150	410
8	Gas condensate	L	160	415
9	Natural gas	G	170	310
10	Charcoal	B	185	720
11	Firewood	B	190	740
12	Fuel briquettes and pellets from wood and other natural materials	B	195	730
13	Of these, briquettes from scobs	B	196	731
14	Biodiesel from oils, sugar and starch crops, and animal fats	B	198	782
15	Other types of source fuels	B	200	750,760,770,790
16	Coke and semi-coke from hard coal, gaseous coke	S	220	170
17	Hard, brown coal, and peat resins	S	225	200
18	Pitch and pitch coke	S	226	190
19	Aviation gasoline	L	230	450
20	Motor gasoline	L	240	430
21	Mixed motor fuel containing bio-ethanol ... 5-30%	B	245	435
22	Fuel for jet engines of the gasoline type	L	250	460
23	Oil distillates, other light fractions	L	260	510
24	White spirit and other special gasoline	L	261	511
25	Light oil distillates for production of motor gasoline	L	262	512
26	Fuel for jet engines of the kerosene type	L	270	470
27	Kerosene	L	280	480
28	Gas oils	L	300	440
29	Medium oil distillates, other medium fractions	L	310	520
30	Heavy fuel black oils	L	320	490
31	Petroleum oils, heavy oil distillates	L	330	530
32	Propane and butane, liquefied	L	430	540
33	Ethylene, propylene...	L	440	580
34	Petroleum coke (including shale)	L	460	570
35	Other types of oil products	L	500	650
36	Other fuel processing products	Oth	630	800
37	Coke oven gas produced as a byproduct	S	600	220

CRF category	Determining the volume of fuel burned
1.A.1. Fuel and Energy Industry	
1.A.1.a Public Electricity and Heat Production	
1.A.1.ai Electricity Generation	Form No.4-MTP total, Section 2, Column 8
1.A.1.aii Combined Heat and Power generation (CHP)	Form No.4-MTP total, Section 2, Columns 9,10, 11;
1.A.1.aiii Heat Plants	Form No.4-MTP total, Section 2, Column 12
1.A.1.b Petroleum Refining	Data on the total fuel consumption for oil refining by fuel types from form No.11-MTP (fuel); Refinery in take from IEA
1.A.1.c Manufacture of Solid Fuels andOther Energy Industries	Summary of: Form No.4-MTP total, Section 2, Columns 13,14; The difference between Field 2 and Fields 3,4 of section 3 of form No.4-MTP for TEA with the codes: 05 "Production of lignite and hard coal"; 06 "Oil and Natural Gas"
1.A.2. Manufacturing Industries and Construction	
1.A.2.a Iron and Steel	Form No.4-MTP kved, TEA Division 24 "Metallurgical Industry", Sec-tion, Column 2 minus Columns 3,4; Minus: fuel consumed under form No.4-MTP kved, TEA Division 24.4 "Production of precious and other non-ferrous metals"
CRF category	**Determining the volume of fuel burned**
1.A.2.b Non-Ferrous Metals	Form No.4-MTP kved, TEA Division 24.4 "Production of precious and other non-ferrous metals", Section 3, Column 2 minus Columns 3,4
1.A.2.c Chemicals	Form No.4-MTP kved, TEA Division 20 "Production of chemical sub-stances and chemical products", Section 3, Column 2 minus Columns 3,4
1.A.2.d Pulp, Paper and Print	Summary of: Form No.4-MTP kved, TEA Division 17 "Manufacture of paper and paper products", Section 3, Column 2 minus Columns 3,4; Form No.4-MTP kved, TEA Division 18 "Printing and reproductionof information", Section 3, Column 2 minus Columns 3,4
1.A.2.e Food Processing, Beverages and Tobacco	Summary of: Form No.4-MTP kved, TEA Division 10 "Manufacture of food products", Section 3, Column 2 minus Columns 3,4; Form No.4-MTP kved, TEA Division 11 "Manufacture of bever-ages", Section 3, Column 2 minus Columns 3,4; Form No.4-MTP kved, TEA Division 12 "Manufacture of tobacco products", Section 3, Column 2 minus Columns 3,4
1.A.2.f Non-metallic minerals	Form No.4-MTP kved, TEA Division 23 "Production of other non-fer-rous mineral products", Section 3, Column 2 minus Columns 3,4
1.A.2.g Other Industrial Products and Construction	Summary of: Form No.4-MTP kved, TEA Division BCDE "Industry", Section 3, Column 2 minus Columns 3,4; Form No.4-MTP kved, TEA Division F "Construction", Section 3, Column 2 minus Columns 3,4. Minus: Volume of fuel burned in categories 1A2a – 1A2f; The difference between Field 2 and Fields 3,4 of section 3 of form No.4-MTP for TEA with the codes: 05 "Production of lignite and hard coal"; 06 "Oil and Natural Gas"
1.A.4. Other Sectors	

1.A.4.a Commercial/Institutional	Summary of: Form No.4-MTP kved, TEA Divisions G,H,I,J,K,L,M,N,O,P,Q,R,S, Section 3, Column 2 minus Columns 3,4
1.A.4.b Residential	Form No.4-MTP total, Section 3, Column 5
1.A.4.c Agriculture/Forestry/Fishing	Summary of: Form No.4-MTP kved, TEA Division A “Agriculture, forests, fishing”, Section 3, Column 2 minus Columns 3,4

In the reporting year, GHG emissions in the “Energy” sector amounted to 219.17 mln tons of CO2-eq. or approximately 66.0% of all GHG emissions in Ukraine (excluding sinks in the “LULUCF” sector), and decreased by 69.8% vs the baseline 1990. Compared with 2018, emissions in the sector decreased by 3.2%.

Category	2000	2005	2010	2012	2014	2015	2016	2017	2018	2019
1 Energy total, including:	311.34	315.11	286.38	290.29	246.74	210.82	224.76	217.75	226.30	219.17
1.A Fuel Combustion Activities	222.13	239.41	223.70	232.60	198.76	169.69	178.81	174.75	180.59	171.24
1.B Fugitive Emissions from Fuels	89.21	75.70	62.68	57.69	47.98	41.14	45.96	43.00	45.71	47.93

In the period of 2000-2007, there was a slight increase of GHG emissions along with a faster rate of capacity buildup in the production sector. Over the reporting period, GHG emissions increased by 7.1%, due to a number of macro-economic, political, administrative, and social factors. Among the key reasons, the following should be noted: opening of new international markets with tough competition, political and economic measures to improve energy efficiency in the energy sector in Ukraine, international economic and personnel cooperation on energy efficiency and energy saving, energy price trends, transition to private property management.

Since 2007, the key influence on the trend of annual GHG emissions was exerted by the global economic crisis of 2008, which affected the non-production sector mostly, as well as the situ-ation in the global markets of energy-intensive products (e.g. metallurgy), and the policy of natural gas substitution with coal by introducing the pulverized coal injection technology.

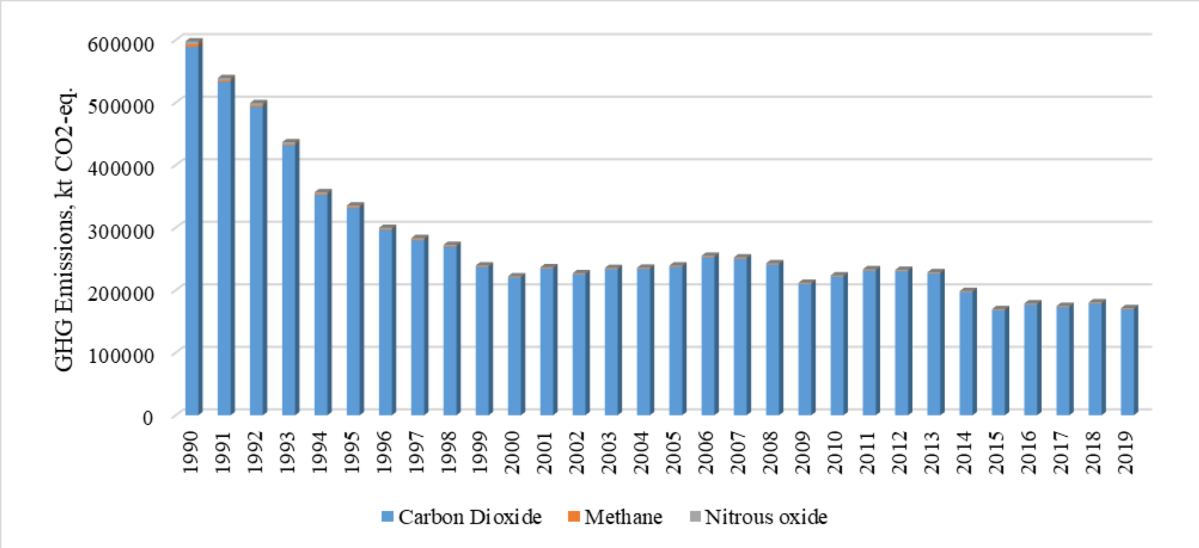
Recent years are characterized by general decline in industrial production and corresponding reduce of production and GHG emissions in the energy sector.

<u>Fuel Combustion Activities (CRF category 1.A)</u>

Category 1.A “Fuel Combustion Activities” includes emissions from combustion of carbonaceous fuels.

The estimation of CO2 emissions in accordance with CRF 1 was performed by two methods – sectoral and baseline. Estimation of other GHG emissions was held with the sectoral approach.

In 2019, emissions from fuel combustion amounted to 171.24 mln tons of CO2-eq. and decreased as compared to 1990 by 71.4%, while in comparison with 2018 decreased by 5.2%.



The key source of greenhouse gases is category 1.A.1 "Energy Industries", which in 1990 accounted for 45.6% of all emissions in the category and in 2019 – 53.86%; the share of 1.A.2 "Manufacturing Industries and Construction" was 18.6% in 1990 and 10.87% in 2019; 1.A.3 "Transport" – 18.7% and 22.02%, respectively; 1.A.4 "Other sectors" – 17.1% and 13.04%, respectively, the contribution of 1.A.5 "Other" is negligible until 2013, in 2019 it amounted to 0.21%.

Category	1995	2000	2005	2010	2012	2014	2015	2016	2017	2018	2019
1.A Fuel Combustion Activities total, including:	335.35	222.13	239.41	223.70	232.60	198.76	169.69	178.81	174.75	180.59	171.24
1.A.1 Energy Industries	194.73	115.78	120.79	121.41	131.21	109.35	90.16	98.86	90.45	98.75	92.22
1.A.2 Manufacturing Industries and Construction	24.99	31.23	36.79	22.60	22.92	20.39	19.03	18.40	18.05	18.42	18.61
1.A.3 Transport	49.22	34.55	39.19	40.20	39.36	35.89	31.10	32.89	34.94	34.96	37.73
1.A.4 Other sectors	66.35	40.50	42.55	39.46	38.99	32.73	28.98	28.12	30.78	27.99	22.32
1.A.5 Other	0.06	0.06	0.08	0.03	0.12	0.40	0.41	0.53	0.53	0.48	0.36

<u>International Bunker Fuels (CRF category 1.D.1)</u>

The approach applied to distribution of GHG emissions between domestic and international aviation is consistent with the approach described in [1]. Emissions from international aviation in-clude emissions from aircraft operations where the departure or destination airports are located out-side Ukraine.

GHG emissions from international aviation in 2019 amounted to 1737.46 kt of CO2-eq., which is 12.0% higher than the same indicator in 2018 and 29.6% lower than in 1990.

<u>International Waterway Navigation (CRF category 1.D.1.b)</u>

National statistics do not include data on international bunker waterway transportations. In this connection, the indirect estimation method was used, which is based on use of data on total consumption of fuels by water transport and the sea transport cargo turnover (coastal/international transportation) plus the river one (domestic/foreign traffic).

The distribution of fuels for international transportation was performed based on the formula:

$FC_{1.d.1.b}=FC_{H50}\cdot k_{1.d.1.b}$

where $FC_{1.d.1.b}$ is consumption of fuels by international waterway transport (gasoil, fuel oil), tons;

FC_{H50} - consumption of fuels by TEA H50 “Water Transport” for transportation needs (gasoil, fuel oil), tons;

$K_{1.d.1.b}$ - the factor of fuel distribution into international/coastal transportation, in relative terms, which is defined by the following expression:

$k_{1.d.1.b}= PR_{int}+PS_{int}/PR+PS$

where,

PRint is the volume of cargo transportation by international river transport, thd tons;

PSint is the volume of cargo transportation by international sea transport, thd tons;

PR - total volume of cargo transportation by river transport, thd tons;

PS - total volume of cargo transportation by sea transport, thd tons.

The volumes of cargo transportation were taken from statistical yearbooks [3-10], [29-32].

The method used for estimating the emissions corresponds to Tier 2 for CO2 emissions from diesel combustion and Tier 1 – for fuel oil and non-CO2 gases.

GHG emissions from international water transport in 2019 amounted to 52.92 kt of CO2-eq., which is 0.7% higher than the same indicator in 2018 and 30.2 times lower than 1990.

Use of fuels as a raw material and non-energy use of fuels

Emissions in category 1.A “Fuel Combustion Activities” include emissions from fuel combustion for heat and electricity production in industrial processes, transportation, etc.

However, fuel is also used for non-energy needs (for example, as solvents, lubricants, etc.; as feedstock for ammonia, rubber, plastic production, etc.; as a reducing agent – coke in the blast furnaces).

Emissions from non-energy fuel use are presented in the sector “IPPU” in the following sub-categories:

2.B.1 “Ammonia Production” – natural gas as a raw material in production of ammonia;

2.C.1 “Iron and Steel Production” – non-energy use of coke in production of pig iron in the blast furnace process;

2.C.2 “Ferroalloys Production” – coke in production of ferroalloys

2.B.8 “Petrochemical and Carbon Black Production” – coal raw material for carbon black production;

2.D.1 “Lubricants Use” – non-energy use of oils;

2.D.2 “Paraffin Wax Use” – non-energy use of paraffin in manufacture of industrial products.

To improve transparency of accounting for emissions from coke use, the balance of coking coal, coke, and coke gas was built.

The amount of fuel that was used for non-energy needs was determined on the basis of statistical reporting form 4-MTP, where enterprises enter information on fuel quantities used as raw materials for chemical, petrochemical, and other non-fuel production. The exception is natural gas and coke, where the volumes of their use as raw materials were determined according to data of companies producing ammonia, cast iron, steel and carbon black, respectively.

Thus, fuel used for non-energy purposes were not considered in calculation of GHG emis sions in category 1.A “Fuel Combustion Activities”.

Energy Industries (CRF category 1.A.1)

In 2019, emissions in category 1.A.1 "Energy Industries" amounted to 92.22 mln tons of CO2-eq., or about 53.9% of the total emissions in category 1.A "Fuel Combustion Activities", and de-creased by 66.2% compared with the baseline 1990 (see Table), they decreased by 6.6% compared to 2018.

Emission category	1995	2000	2005	2010	2011	2012	2014	2015	2016	2017	2018	2019
1.A.1 Energy Industries, total	194.73	115.78	120.79	121.41	128.29	131.21	109.35	90.16	98.86	90.45	98.75	92.22
1.A.1.a Electricity andHeat Production	187.77	108.07	111.58	111.75	118.45	123.07	103.31	85.91	94.50	86.83	93.57	87.83
1.A.1.b Petroleum Re-fining	1.88	1.40	1.23	0.87	0.90	0.57	0.35	0.30	0.29	0.34	0.37	0.35
1.A.1.c Manufacture of Solid Fuel and OtherEnergy Industries	5.08	6.31	7.98	8.79	8.92	7.57	5.69	3.96	4.07	3.28	4.81	4.04

Electricity and Heat Production (CRF category 1.A.1.a)

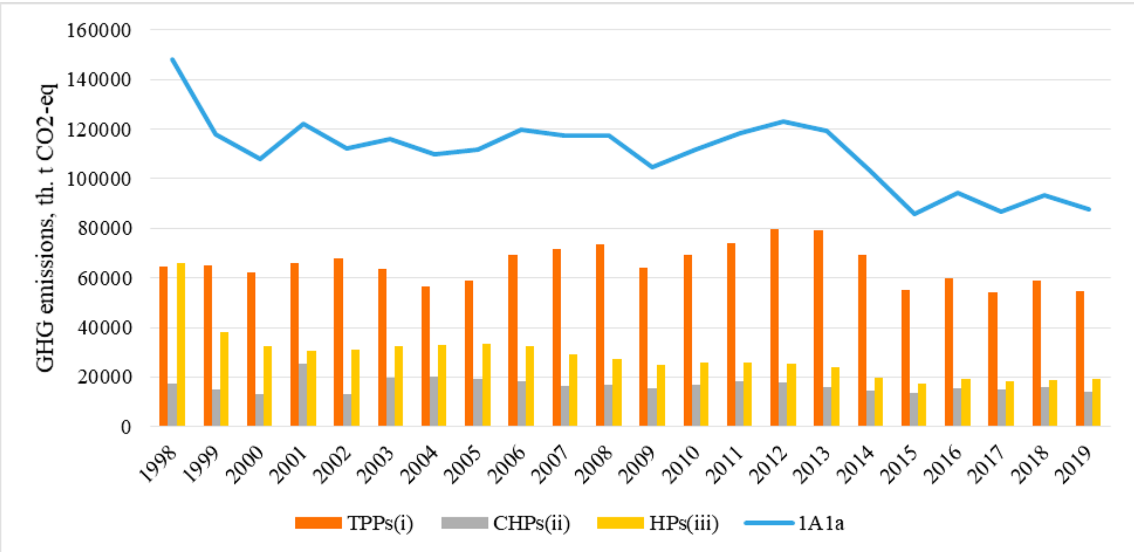
This category includes emissions from stationary fuel combustion in production of electricity and heat by TPPs, CHPs, HPs, heat power plants of enterprises, waste incinerators.

In view of the fact that in the constantly changing structure of the Ukrainian economy lots of power generation facilities of industrial enterprises have been repeatedly transferred to the balance sheet of other companies, thus without changing the actual technological components they were ac-counted for in other types of economic activities, so with the view of harmonizing the time series category 1.A.1.a "Electricity and Heat Production" also includes activities of enterprises.

In the category "Electricity and Heat Production", GHG emissions in 2019 amounted to 87.83 mln tons of CO2-eq., having decreased with respect to 2018 by 6.1%, and decreased by 65.6% com-pared with the baseline 1990. Since acceleration of electricity production volumes occurred mainly due to the higher load on capacity of large TPPs, which are the key consumers of coal in the country, the share of this type of fuel in the balance increased.

Another factor influencing the structure of fuels consumed in the category is reduction of natural gas consumption and its corresponding replacement with coal after 2006.

For the whole period 1998-2019, the largest share of GHG emissions in the category corresponds to TPPs – from 42.8% to 62.1%, for the rest: CHPs – from 11.9% to 15.8%, HPs – from 45.3% to 22.1%.



Petroleum Refining (CRF category 1.A.1.b)

Enterprises in this category include **petroleum refineries and gas processing plants**.

This category accounts for burning fuels directly for technological processes. The key types of fuels in this category are natural gas, refinery feedstock and fuel oils.

In this category, GHG emissions decreased by 5.5% in 2019 compared to 2018 and amounted to 0.35 mln tons of CO2-eq. Compared to 1990, GHG emissions reduced by 18.1 times.

Manufacture of Solid Fuels and Other Energy Industries (CRF cate-gory 1.A.1.c)

This category includes emissions from fuel combustion at the enterprises that are engaged in production of energy materials and other energy industries.

The current inventory in the category takes into account emissions from coal bed methane recovery (with generation of heat and power). Emissions in this category in 2019 amounted to 4.04 mln tons of CO2-eq, which is 16.1% lower than the same indicator in 2018 and 62.6% lower than the baseline 1990.

The method to determine GHG emissions from stationary fuel combustion

GHG emissions from fossil fuel combustion in all categories were calculated using this methodology:

$$B_{gfi} = FC_{fi} \bullet KB_{gfi}, \qquad \text{(A1)}$$

where:

Bgfi — The amount of emissions of a particular type of GHG (index *g, g=1÷G)* at burning of a particular type of fuel, which corresponds to the index *f, f=1÷F* in the emission source category under the CRF corresponding to index *i, i=1÷I,* (kg);

FCfi — The amount of fuel burned *f* in the *i* emission source category in accordance with the CRF (TJ);

KBgfi — The default ratio of GHG emissions or the national coefficient at combustion (kg of GHG/TJ). This factor for CO_2 takes into account carbon content in fueland its degree of oxidation.

The total amount of emissions *Bg* under the *i* emission source category for individual types of GHGs is determined as follows:

$$B_{gi} = \sum_{f=1}^{F} B_{gfi}, \qquad \text{(A2)}$$

The total amount of emissions *Bi* under the *i* emission source category for all types of GHGsis determined as follows:

$$B_i = \sum_{g=1}^{G} B_{gi}, \qquad \text{(A3)}$$

Carbon content factors (t/TJ) and NCV (GJ/t) in different fuels for 2019

Fuel	Code	Carbon Content factor	NCV	Fuel	Code	Carbon Content factor	NCV
Brown coal	120	27.6	8.62	Mixed motor fuel containing bio-etha-nol ... 5% -30%	435	19.65	43.04
Briquettes, pellets from brown coal	150	26.6	16.53	Fuel for jet engines of the gasoline type	460	19.65	43.04

Non-agglomerated fuel peat	130	28.9	9.44	Oil distillates, other light fractions	510	19.65	43.04
Briquettes, pelletsfrom peat	160	28.9	14.65	Light oil distillates for production of motor gasoline	512	20.0	40.20
Crude oil, including oil from bituminousmaterials	410	20	41.55	Fuel for jet engines ofthe kerosene type	470	19.5	44.10
Gas condensate	415	17.5	37.97	Kerosene	480	19.6	43.80
Natural gas	310	15.22	48.13	Gas oil	440	20.12	43.05
Charcoal	720	30.5	27.26	Medium oil distil-lates, other medium fractions	520	20.12	43.05
Firewood	740	30.5	11.10	Heavy fuel black oils	490	21.1	40.15
Fuel briquettes andpellets from wood and other natural materials	730	27.3	11.60	Petroleum oils, heavyoil distillates	530	20	39.81
Briquettes from made of scobs	731	27.3	11.60	Propane and butane, liquefied	540	17.2	46.01
Biodiesel from oils,sugar and starch crops	782	19.3	27.00	Ethylene, propylene, petroleum gases, other...	580	15.7	43.67
Other types of source fuels	750,760, 770,790	27.3	11.6	Petroleum coke (in-cluding shale)	570	26.6	31.65
Coke and semi-coke from hard coal, gaseous coke	170	29.2	28.20	Other types of oil products	650	20	40.5
Hard, brown coal, and peat resins	200	22.0	28.00	Other fuel processing products	800	20	40.2
Pitch and pitch coke	190	29.2	28.20	Coke oven gas pro-duced as a byproduct	220	12.1	35.61
Hard coal	110	25.8*	21.98 *	Aviation gasoline	450	19.1	44.30
Briquettes, pelletsfrom hard coal	140	26.6	17.20	Motor gasoline	430	19.65	43.04

Methane emission factors that were applied for estimation of emissions from mobile fuel combustion

Name of fuel	**Fuel code**	**1.A.3.a - Civil Aviation**	**1.A.3.b - Road Transport**	**1.A.3.c - Railway transport**	**1.A.3.d - Water transport**	**1.A.3.e.i - Pipeline transport**	**1.A.3.e.ii - Off-road transport**
	Methane emission factors by fuel consumption domains, kg/TJ						
Natural gas	310					1	
Biodiesel from oils...	782		18.4				115
Aviation gasoline	450	see A2.7					
Motor gasoline	430		18.4				115
Motor fuel composite	435		18.4				115
Jet gasoline-type fuel	460	see A2.7					
Oil distillates, other light fractions	510		18.4				115
Light oil distillates for production of motor gasolines	512		3.9				
Jet kerosene-type fuel	470	see A2.7					

Kerosene	480		18.4				115
Gasoil (diesel fuel)	440		3.9	4.15	7		4.15
Oil medium distillates	520		3.9				4.15
Heavy fuel black oils	490				7		
Petroleum oils...	530		18.4				4.15
Propane and butane, liquefied	540		92				

Nitrous oxide emission factors that were applied for estimation of emissions from mobile fuel combustion

Name of fuel	**Fuel code**	**1.A.3.a - Civil Aviation**	**1.A.3.b - Road Transport**	**1.A.3.c - Railway transport**	**1.A.3.d - Water transport**	**1.A.3.e.i - Pipeline transport**	**1.A.3.e.ii - Off-road transport**
	Nitrous oxide emission factors by fuel consumption domains, kg/TJ						
Natural gas	310					0.1	
Biodiesel from oils...	782		5.6				1.2
Aviation gasoline	450	see A2.7					
Motor gasoline	430		5.6				1.2
Motor fuel composite...	435		5.6				1.2
Jet gasoline-type fuel	460	see A2.7					
Oil distillates, other light fractions	510		5.6				1.2
Light oil distillates for production of motor gasolines	512		3.9				
Jet kerosene-type fuel	470	see A2.7					
Kerosene	480		5.6				1.2
Gasoil (diesel fuel)	440		3.9	28.6	2		28.6
Oil medium distillates...	520		3.9				28.6
Heavy fuel black oils	490				2		
Petroleum oils...	530		5.6				28.6
Propane and butane, liquefied	540		3				

Industrial Processes and Product Use (CRF Sector 2)

Greenhouse gas emissions in the category Industrial Processes and product use, kt CO2-eq.

Gas	CO2	CH4	N2O	HFCs	PFCs	SF6	Total
1990	110687.58	1393.13	5671.54	0.00	235.82	0.0076	117988.08
1991	94725.80	1147.55	5016.39	0.00	188.20	0.0191	101077.96
1992	91695.63	1064.10	4320.85	0.00	142.35	0.0305	97222.96
1993	74550.79	809.70	3662.54	0.00	143.57	0.0591	79166.66
1994	63223.84	628.23	2976.58	0.00	161.22	0.0649	66989.95
1995	54917.44	519.37	2370.74	0.00	178.06	0.0677	57985.68
1996	52789.56	502.24	2778.20	0.00	143.24	0.0696	56213.31
1997	58099.28	587.18	3054.92	6.43	146.99	0.128	61894.94

1998	56701.93	598.13	2459.18	13.02	120.64	0.194	59893.10
1999	59159.95	638.23	2633.97	14.14	101.81	0.307	62548.41
2000	63310.89	698.79	3005.28	15.73	115.74	0.421	67146.85
2001	67044.94	1464.65	2928.35	29.05	112.08	0.463	71579.53
2002	68535.14	2193.47	3579.39	64.27	98.66	1.070	74472.00
2003	71209.95	2873.93	3815.51	105.20	77.15	1.991	78083.75
2004	74053.20	3665.84	3264.40	187.26	93.34	3.078	81267.11
2005	73295.70	3130.25	3765.06	285.07	142.33	4.467	80622.88
2006	77594.47	3046.32	3801.67	402.28	111.16	4.274	84960.18
2007	83454.82	3028.88	4946.64	561.13	154.71	5.198	92151.37
2008	81796.22	1711.28	4482.69	647.25	174.24	9.338	88821.01
2009	64758.41	695.66	2203.16	663.76	53.95	9.366	68384.31
2010	69642.62	1124.14	2934.70	743.86	26.67	9.710	74481.70
2011	73715.35	2579.32	3724.32	820.00	0.00	8.414	80847.401
2012	70766.31	2196.90	3491.63	840.76	0.00	10.990	77306.580
2013	67968.30	951.57	2605.90	881.24	0.00	12.543	72419.546
2014	58051.92	683.58	2264.50	847.84	0.00	16.726	61864.571
2015	53373.52	596.84	1697.46	775.37	0.00	19.642	56462.827
2016	54566.84	648.54	2022.39	887.36	0.00	24.312	58149.442
2017	47771.767	1510.79	1578.05	1 009.54	0.00	28.461	51898.599
2018	50889.576	3094.75	1497.52	1 350.04	0.00	33.291	56865.167
2019	50934.688	3437.18	2202.53	1 625.79	0.00	38.518	58238.707

KP-LULUCF, AGRICULTURE

Implementation of activities under paragraphs 3 and 4, Article 3 KP (Kyoto Protocol) leads to a change in carbon stocks as a result of:

- increasing in carbon stocks (removals) accumulated in the processes of:
  - afforestation and reforestation;
  - forest management.
- decreasing in carbon stocks (emissions) resulting from:
  - deforestation;
  - harvesting;
  - fires occurring not due to human-induced activity.

The category Afforestation and Reforestation in the context of paragraph 3, Article 3 KP includes volumes of net carbon emissions/removals as a result of activities of afforestation and further forest management on these areas. The report provides data for the second KP reporting period.

The category Deforestation in the context of paragraph 3, Article 3 KP count the territories, which were deforested with aim to use it in other land-use categories. The report provides information for the years 2013-2019. For afforestation activities, an assessment of carbon stock changes for all required pools was conducted separately. In addition, in accordance with requirements of 2006 IPCC Guidelines, nitrogen losses were estimated at land conversion to other land-use types.

In the context of paragraph 4, Article 3 KP, changes in carbon stocks in the pool of living biomass and dead organic matter in forest territories constantly covered with forest vegetation are accounted for. The report presents data for 2013-2019. For forest management activities, carbon stocks reduction in the pool of living biomass as a result of harvesting in managed forests is accounted for. Estimation of changes in carbon stocks was held for all required pools separately (an exception is estimation of carbon losses in the below-ground biomass pool, which is accounted for in the above-ground, as well as a proof of absence of emissions from the pool is offered for the pool of mineral forest soils under managed forests).

Separate assessment was conducted for carbon stock changes in harvested wood products for afforestation and forest management activities. Wood from deforestation-related harvesting was reported as loss of biomass with the instantaneous oxidation approach.

Agriculture

The following emission source categories considered in the Agriculture sector:

- 3.A Enteric Fermentation;
- 3.B Manure Management;
- 3.C Rice Cultivation;
- 3.D Agricultural Soils;
- 3.E Prescribed Burning of Savannas;
- 3.F Field Burning of Agricultural Residues;
- 3.G Liming;
- 3.H Urea Application.

Total emissions of direct GHG (CO2, CH4, N2O) in the sector and by categories are reported in Table below:

Category	**Emissions, kt CO2-eq.**			**Trend, %**	
	1990	***2018***	***2019***	***by 1990***	***by 2018***
3.A Enteric Fermentation	39 311.34	8 310.15	7 876.15	-79.96	-5.22
3.B Manure Management	6 774.76	2 068.80	1 996.89	-70.52	-3.48
3.C Rice Cultivation	216.43	93.58	77.81	-64.05	-16.85
3.D Agricultural Soils	37 678.18	33 466.29	32 176.15	-14.60	-3.86
3.E Prescribed Burning of Savannas *	NO	NO	NO	–	–
3.F Field Burning of Agricultural Residues**	NO	NO	NO	–	–
3.G Liming	2 592.08	163.74	141.37	-94.55	-13.66
3.H Urea Application	270.14	201.18	208.84	-22.69	3.81
Total for the sector	**86 842.92**	**44 303.73**	**42 477.21**	**-51.09**	**-4.12**

* – the emissions not estimated;
** – field burning of crop residues prohibited by the Ukrainian legislation.

In categories 3.E Prescribed Burning of Savannas and 3.F Field Burning of Agricultural Residues, emissions not estimated, since the savannas ecosystem does not exist in the territory of Ukraine, and burning of crop residues in Ukraine is legally prohibited under the Code of Administrative Offenses (art. 77-1) and the Law of Ukraine On Air Protection (art. 16, 22).

Inventory of **methane emissions from enteric fermentation in Ukraine includes such types of farm animals as cattle, sheep, swine, and other animals** (goats, horses, mules and asses, rabbits, fur-bearing animals, camels and buffaloes).

Ruminants (such as cattle) produce a largest part of CH4 emissions from enteric fermentation. Emissions from poultry are not estimated, as 2006 IPCC Guidelines [1] offer no methodology for their calculation.

Category	**Method applied**	**Emission factor**	**Gas**	**The key category**	**Emissions, kt**		**Trend, %**
					1990	**2019**	
3.A.1 Cattle	T 2	CS	CH4	Level/Trend	1 461.46	287.11	-80.35
3.A.2 Sheep	T 2	CS			60.91	7.66	-87.43
3.A.3 Swine	T 1	D			29.53	9.19	-68.86
3.A.4 Other animals:	T 1	D			20.55	11.08	-46.08
fur-bearing animals	T 1	D			0.14	0.11	-23.15
rabbits	T 1	D			4.27	3.49	-18.19
camels	T 1	D			0.03	0.04	39.33
mules and asses	T 1	D			0.19	0.12	-37.43
buffaloes	T 1	D			0.05	0.01	-87.06
horses	T 1	D			13.43	4.30	-67.97
goats	T 1	D			2.45	3.02	23.14

Land Use, Land Use Change and Forestry (CRF Sector 4)

Calculation of total annual GHG emissions/removals in the forestry sector was held for the two categories of Forest and: a) for Forest land remaining forest land; b) for Land converted to forest land.

Activity data for the Forest land category were obtained from national statistical reporting form 16-zem (previously 6-zem). For afforestation (Land converted to forest land), the land-use change matrix was used and the actual data of afforestation (database). The land-use change matrix is used to determine "conversion vectors" of land areas at change of land-use catego- ries, since there is no data in national statistics on the land-use categories from which conversion takes place.

In the table below the areas of Forest land remaining Forest land are presented with subdi- vision on actually covered with forest vegetation and unstocked (temporary or permanently). In the right part actually covered areas with forest vegetation are presented with unstocked lands in the FM category. In both sectors actually covered with forest vegetation areas (stocked) were used to calculate C-gains due to forest growth.

Year	Area of Forest land remaining Forest land, kha				Area of Forest Management, kha		
	Total area of the category	Unmanaged forests	Areas of managed Forestland		Total area of the category	Area covered by forest vegetation (stocked)	Unstocked areas
			Stocked	Unstocked and other			
1990	10 211.95	30.45	9 202.68	1 009.27	-	-	-
1991	10 230.85	30.45	9 229.20	1 001.65	-	-	-
1992	10 282.73	30.45	9 225.90	1 056.83	-	-	-
1993	10 299.97	30.45	9 263.80	1 036.17	-	-	-
1994	10 314.62	30.45	9 290.45	1 024.17	-	-	-
1995	10 312.69	30.45	9 315.00	997.69	-	-	-
1996	10 317.84	30.45	9 319.30	998.54	-	-	-
1997	10 318.63	30.45	9 328.80	989.83	-	-	-
1998	10 331.65	30.45	9 330.50	1 001.15	-	-	-
1999	10 333.10	30.45	9 360.28	972.82	-	-	-

2000	10 338.40	30.45	9 389.42	948.98	-	-	-
2001	10 345.95	30.45	9 397.37	948.58	-	-	-
2002	10 351.79	30.45	9 422.84	928.95	-	-	-
2003	10 365.21	30.45	9 434.29	930.92	-	-	-
2004	10 376.16	30.45	9 442.38	933.78	-	-	-
2005	10 396.29	30.45	9 467.30	928.99	-	-	-
2006	10 411.90	30.45	9 499.45	912.45	-	-	-
2007	10 403.65	30.45	9 511.75	891.90	-	-	-
2008	10 389.16	30.45	9 506.40	882.76	-	-	-
2009	10 373.12	30.45	9 513.24	859.88	-	-	-
2010	10 368.55	30.45	9 518.41	850.14	-	-	-
2011	10 364.11	30.45	9 527.66	836.45	-	-	-
2012	10 362.35	30.45	9 532.61	829.74	-	-	-
2013	10 358.38	30.45	9 522.38	836.00	9 540.10	9 491.35	48.75
2014	10 365.60	30.45	9 507.88	857.71	9 537.97	9 470.30	67.67
2015	10 373.36	30.45	9 490.02	883.34	9 538.10	9 444.91	93.19
2016	10 382.40	30.45	9 459.74	922.66	9 543.77	9 405.58	138.19
2017	10 389.81	30.45	9 448.01	941.80	9 543.35	9 386.44	156.90
2018	10 394.19	30.45	9 467.01	927.18	9 599.63	9 401.06	198.57
2019	10 397.04	30.45	9 452.51	944.53	9 601.09	9 382.31	218.78

From the database of activities regulated by Article 3.3 of the Kyoto Protocol, actual data on afforestation and deforestation were used.

Land areas **converted to and from the land-use category Forest land** on cumulative basis, kha

To forests						
Year	Cropland	Grassland	Wetlands	Settlements	Other land	Total
1990	9.55	0.00	0.00	0.00	0.00	9.55
1991	15.92	0.00	0.00	0.61	0.83	17.35
1992	15.92	0.51	0.00	3.52	3.92	23.87
1993	21.08	0.51	0.00	3.52	5.92	31.03
1994	26.77	0.51	0.00	3.52	6.78	37.58
1995	28.83	0.51	0.00	8.99	6.78	45.11
1996	36.97	0.51	0.18	8.99	7.50	54.16
1997	43.94	0.51	0.18	8.99	7.94	61.57
1998	45.37	0.51	0.18	8.99	10.89	65.95
1999	48.35	0.51	0.18	8.99	12.16	70.20
2000	53.19	0.51	0.27	9.07	12.16	75.20
2001	57.37	0.51	0.27	9.94	12.16	80.25
2002	62.70	0.51	0.51	9.94	13.46	87.11
2003	67.21	0.51	0.51	10.32	13.73	92.29
2004	74.29	0.58	0.51	10.63	13.73	99.74
2005	78.84	3.70	0.51	10.63	13.73	107.41
2006	94.52	8.61	0.51	10.63	13.73	128.00
2007	110.78	13.18	0.51	10.63	17.55	152.65
2008	119.18	28.05	0.51	10.63	22.57	180.94
2009	133.20	48.64	0.51	10.63	25.79	218.78
2010	138.80	55.32	0.51	10.63	27.29	232.54
2011	141.41	62.72	0.51	10.03	32.52	247.18
2012	145.52	75.31	0.51	7.11	30.60	259.05
2013	140.37	88.93	0.51	7.11	28.87	265.78
2014	136.52	91.03	0.51	7.11	29.51	264.68
2015	134.25	93.73	0.61	1.64	29.51	259.74
2016	134.40	98.98	0.43	1.64	45.95	281.40
2017	129.77	104.27	0.43	1.64	49.02	285.14
2018	128.35	111.82	0.49	1.64	49.08	291.37
2019	125.36	113.79	0.89	1.64	48.08	289.75

From forests to other categories						
Year	Cropland	Grassland	Wetlands	Settlements	Other land	Total
1990	0.04	0.01	0.00	0.08	0.01	0.14
1991	0.14	0.02	0.00	0.28	0.04	0.48
1992	2.94	0.50	0.04	5.98	0.93	10.39
1993	2.94	0.54	0.04	6.00	0.93	10.46
1994	2.95	0.54	0.04	6.01	0.93	10.47
1995	2.96	0.55	0.06	6.03	0.98	10.58
1996	3.07	2.32	0.22	7.48	1.49	14.58
1997	3.09	2.35	0.22	7.48	1.52	14.66
1998	3.09	3.75	2.63	27.51	1.52	38.50
1999	3.09	3.77	2.65	27.53	1.52	38.56
2000	3.11	3.90	2.65	27.53	1.62	38.81
2001	3.16	3.98	2.66	27.56	1.65	39.02
2002	3.16	4.17	2.67	27.96	1.65	39.61
2003	3.26	4.17	2.73	27.96	1.73	39.85
2004	3.85	4.17	2.73	28.21	1.83	40.80
2005	3.86	4.19	2.75	28.29	1.83	40.93
2006	3.86	4.27	2.75	28.37	1.86	41.10
2007	3.86	4.28	2.86	28.46	2.01	41.47
2008	3.86	4.28	2.86	36.41	2.01	49.41
2009	3.87	4.28	2.86	36.43	2.01	49.45
2010	3.83	4.27	2.86	36.35	2.00	49.31
2011	3.73	4.25	2.86	36.25	1.97	49.06
2012	0.93	3.77	2.83	30.94	1.09	39.55
2013	0.93	3.73	2.82	31.01	1.08	39.57
2014	0.92	3.73	2.82	31.00	1.12	39.59
2015	0.91	3.72	2.80	30.98	1.09	39.50
2016	0.80	1.95	2.64	29.53	0.58	35.50
2017	0.78	1.92	2.64	29.53	0.61	35.49
2018	0.78	0.53	0.23	9.50	0.62	11.65
2019	0.78	0.50	0.22	9.48	0.90	11.89

Special attention should be paid to the situation regarding determination of data of the area of land converted to Forest land.

Ukraine is working on filling in the database for the activity features in accordance with paragraph 3, Article 3 of the Kyoto Protocol.

Description of the database development process is presented in Chapter 11. This chapter presents the areas of land taken for the estimation.

In order to reflect actual values of converted areas to and from forests, the decision was made to use for both cases information from the database. This improves reliability of the results, since the primary data was collected at the level of individual plots of the territory on which the respective activity was implemented by quarter by every forestry enterprise in Ukraine (the so-called plot-wise information database). Moreover, the conservative principle is thus ensured, because form 16-zem takes into account only the legal fact of a change in attribution to a certain land-use category, which is not in line with the actually performed afforestation or deforestation activities.

Thus, information about the area of land converted to forest land from the land-use change matrix was used to determine proportional ratios among donor categories for the land-use category Forest Land. This was done because national statistical reporting, as well as land plot logs at forestry enterprises for the period since 1990 do not reflect information on the land-use categories from and/or into which plots of forest land were converted. Based on those ratios, the values from the database were distributed. Thus, special attention was paid to maintaining the balance of territories with use of the forest land not covered in the estimation.

Donor categories are defined annually based on comparison of total areas of every category in year X-1 and X of form 16-zem. Consequently, donor categories might change from year to year.

For all the other land-use categories (including the categories Cropland and Grassland) for land converted to categories, information on the areas from statistical reporting form 16-zem, as well as the land-use change matrix was used.

Estimations of carbon emissions/removals were made in the context of sub-categories 4.A.1 Forest land remaining forest and 4.A.2 Land converted to forest land.

In sub-category 4.A.1, emissions/removals were estimated only for managed forests in living biomass based on age structure of stands. Since databases with detailed information about forest features are available mostly for the forests under management of the State Forest Resources Agency of Ukraine, the calculations were performed based on that data and then extrapolated to entire area of forest covered lands excluding unmanaged forests.

The annual increase in carbon stocks in living biomass of Forest land remaining forest land was estimated under equation 2.9 of the 2006 IPCC Guidelines [1] in the context of the key forest tree species, climatic zones and with consideration of age structure.

The classification (Table below) was used for distribution of areas into natural zones.

Regions	Polissia (Woodland)	Forest Steppe	North Steppe	South Steppe	Carpathian Mts.	Crimean Mts.
AR Crimea				0.1		0.9
Vinnytska		1.0				
Volynska	0.8	0.2				
Dnipropetrovska			0.9	0.1		
Donetska			1.0			
Zhytomyrska	0.8	0.2				
Transcarpathian					1.0	
Zaporizhska			0.5	0.5		
Ivano-Frankivska		0.2			0.8	
Kyivska	0.7	0.3				
Kirovohradska		0.5	0.5			
Luganska			1.0			
Lvivska		0.3			0.7	
Mykolaivska			0.6	0.4		
Odesska		0.2	0.3	0.5		
Poltavska		1.0				
Rivnenska	0.8	0.2				
Sumska	0.2	0.8				
Ternopilska		1.0				
Kharkivska		0.5	0.5			
Khersonska				1.0		
Khmelnytska		1.0				
Cherkaska		1.0				

Chernivetska		0.3			0.7	
Chernihivska	0.8	0.2				

For estimation of carbon emissions in the pool of mineral soils, the nitrogen flow estimation balance method was used with subsequent recalculation for carbon.

The method is based on estimation of the balance between the amount of nitrogen outflow from soil, its removal from the field, and nitrogen inflow into the soil surface, taking into account theintensity and vectors of flows, its further movement. Removal of nitrogen from soil takes place withmain products (harvest), side products, post-harvest crop residues, and plant roots. Inflow of nitrogenon the soil surface (or into the upper soil horizon) occurs with post-harvest crop residues, roots, organic and nitrogen mineral fertilizers, as a result of nitrogen fixation by legume crops, with precipitations.

Formation of the nitrogen balance indicating the link between the amount of carbon and nitrogen for agricultural land is explored in detail in national studies and originates from the soviet practice of the soil science. Also, prior to application of this method for preparation of the GHG inventory for the pool of mineral soils in the land use Cropland category, it was presented at workshops, and also was published. Before moving from application of IPCC Tier 2 methods to the national method of balance estimations, consultation with industryexperts were held. The method was approved.

Thus, determination of the dynamics of nitrogen during agricultural land cultivation was held based on the following components of the credit and debit sides of balance estimations:

- components of the nitrogen debit part are soil inflows from:
  - humification of plant residues processes;
  - humification of organic fertilizers processes;
  - nitrogen-fixation by legumes;
  - precipitations;
- components of the credit part of the nitrogen is its removal with:
  - the yield of main products;
  - post-harvest crop residues;
  - by-products;
  - roots.

Beside, in the total amount of nitrogen removed with plants, it is necessary to determine thepart that consumed by the plants due to humus mineralization processes. For this purpose, from the total nitrogen content in plants is reduced by the amount of nitrogen that entered the plant from:

- crop residues (above- and below-ground);
- organic fertilizers (the effect of leaching processes is taken into account);
- nitrogen mineral fertilizers (the effect of run-off processes is taken into account).

The amount of nitrogen that consumed by the plants due to processes of soil humus mineralization and led to carbon emissions into the atmosphere is estimated as the difference between the credit and debit sides of the balance calculation. If as a result of the estimations a value more than zero (>0) is obtained, it indicates accumulation of nitrogen and humus in soil, and, as a result, presence of carbon removal processes in mineral soils. In the NIR preparation, the described calculation scheme was applied taking into account the effect of climatic conditions and soil differences.

To perform estimations based on data of the carbon in soil inventory, the assumption was made that humification processes take place one year after the harvest and introduction of the mate- rials into the soil. Thus, the amounts of nitrogen input from crop residues, for example, for 1990, were calculated on the basis of data the harvest of 1988. The assumption makes it possible to more accurately take into account the features of the dynamics of nitrogen flows and does not introduce a substantial error into the calculations, because the increment adopted is covered by the estimation period (from 1990 to the inventory year).

Regression equation to determine the mass of crop residues based on the main product yield

Crop	Yield of the main products	Weight determination regression equation		
		for by-products	for above-ground residues	for roots
Winter rye	10-25 26-40	x=1.8y+3.8 x=1.0y+25	x=0.3y+3.2 x=0.2y+3.6	x=0.6y+8.9 x=0.6y+13.9
Winter wheat	10-25 26-40	x=1.7y+3.4 x=0.8y+25.9	x=0.4y+2.6 x=0.1y+8.9	x=0.9y+5.8 x=0.7y+10.2
Spring wheat	10-20 21-30	x=1.3y+4,2 x=0.5y+19,8	x=0.4y+1.8 x=0.2y+5.4	x=0.8y+6.5 x=0.8y+6.0
Barley	10-20 21-35	x=0.9y+6.5 x=0.9+7.2	x=0.4y+1.8 x=0.09y+7.6	x=0.8y+6.5 x=0.4y+13.4
Oats	10-20 21-35	x=1.5y-1.2 x=0.7y+16.2	x=0.3y+3,2 x=0.15y+6.1	x=1.0y+2 x=0.4y+16
Millet	5-20 21-30	x=1.5y+4.5 x=2.0y-7.1	x=0.2y+5 x=0.3y+3,3	x=0.8y+7 x=0.56y+11.2
Maize for grain	10-35	x=1.2y+17.5	x=0.23y+3.5	x=0.8y+5.8
Peas	5-20 21-30	x=1.3y+4,5 x=1.2y+3	x=0.14y+3.5 x=0.20y+1.7	x=0.66y+7.5 x=0.37y+12.9
Buckwheat	5-15 16-30	x=1.7y+4.7 x=1.3y+10,3	x=0.25y+4.3 x=0.2y+5.2	x=1.1y+5.3 x=0.54y+14.1
Sunflower	8-30	x=1.8y+5.3	x=0.4y+3.1	x=1.0y+6.6
Potato	50-200 201-350	x=0.12y+2 x=0.1y+3.9	x=0.04y+1 x=0.03y+4.1	x=0.08y+4 x=0.06y+8.6
Sugar beet	100-200 201-400	x=0.14y-1.7 x=0.1y+10	x=0.02y+0.8 x=0.003y+2.3	x=0.07y+3.5 x=0.06y+5.4
Vegetables	50-200 250-400	x=0.12y+0.5 x=0.12y+0.0	x=0.02y+1.5 x=0.006y+3.6	x=0.06y+5 x=0.04y+6
Feed root crops	50-200 200-400	x=0.08y+0.1 x=0.11y-4.6	x=0.01y+1 x=0.003y+2.4	x=0.05y+5.5 x=0.05y+5.2
Flax	3-10	x=5y+15	-	x=1.3y+9,4
Hemp	3-10	x=5y+30	-	x=2.2y+9.1
Silage crops (with-out maize)	100-200	-	x=0.04y+4	x=0.09y=7
Maize for silage	100-200 201-350	- -	x=0.03y+3.6 x=0.02y+5	x=0.12y+8.7 x=0.08y+16.2
Annual grasses (vetch, peas, oats)	10-40	-	x=0.13y+6	x=0.7y+7.5
Perennial grasses	10-30 30-60	- -	x=0.2y+6 x=0.1y+10	x=0.8y+11 x=1y+15

25. Carbon markets today, credits sellers and potential buyers

The Russian invasion of Ukraine roiled financial markets across the world, and the European carbon credit market was no exception. As the price of oil surged, **carbon credit prices plummeted**.

After the invasion, the European Union Allowance (EUA) crashed, going from €95/t to €55/t in five days, a 35% drop in value.

The initial steep price drop was most likely due to the liquidation of EUA positions to cover margin calls due to fast-rising energy prices.

Carbon pricing is the foundation of the EU's climate policy to curb carbon emissions across high-energy sectors — part of its Fit-for-55 package, which aims to reduce those emissions by 55% by 2030.

The excessive downward move seemed to be a bit overdone, but it seemed little willingness to stop the 'falling knife', also surprising to participants that even what is seen to be strong technical level, 200-day moving average did not provide any support at all. The downward move stopped at €55/t.

It has since **recovered to around €89/t in the EU <u>mandatory</u> carbon credit market**.

Mandatory Compliance Market Carbon Pricing

Mandatory (Compliance) Market: Mandatory (compliance) markets are governed by national, regional, or provincial law and compel emission sources to meet GHG emission reduction targets. Because compliance program offset credits are generated and traded for regulatory compliance, they typically act like other commodity pricing. Data below could be delayed by as much as 24hrs.

European Carbon Credit Market

EU ETS – is the European carbon credit contract which is exchange traded. It is a Futures contract for the purposes of trading and delivering EUAs (European Union Allowance – the official name for the region's emission allowances). One EUA allows the holder to emit one ton of CO2 or C02 equivalent greenhouse gas.

California Carbon Credit Market

Known simply as the "California Cap and Trade Program", CCA Futures is the physically delivered greenhouse gas emissions allowances for the California Carbon Allowance (CCA) program. One CCA credit represents one metric ton of C02 equivlanet under California Assembly Bill 32 "California Global Warming Solutions Act of 2006".

While the EUA market has recovered some already, it could continue to push higher, as countries consider burning more coal to substitute for higher-priced gas. Coal-burning increases CO2 emissions, and consequently the need for credits.

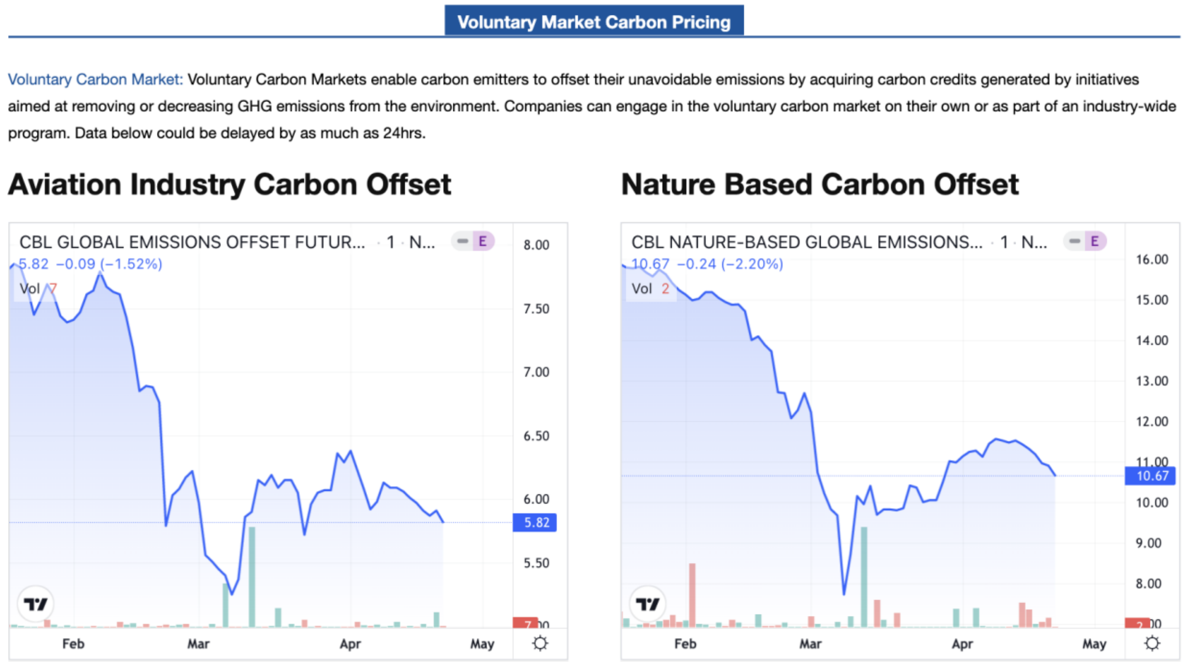
The volatility impacted sentiment in carbon markets around the world, including the voluntary market and regional carbon markets.

Coal demand and prices have surged dramatically since the invasion. Yes, another bullish signal for the carbon market is an increase in coal-fired generation. Not only have high gas prices dating back to last autumn encouraged coal plants to run flat out, but policymakers are also considering bringing coal-fired generation back online to reduce the use of Russian gas. Given that electricity generated with coal requires twice as many allowances as the same volume produced with gas, this would increase demand for EU allowances (EUAs).

The expectation is we will see a bump in emissions this year because of the rebound in fossil fuel demand. **There will be more carbon that we have to remove. There will be an acceleration of looking for carbon removal solutions. And there will be more focus on really high-quality carbon removals with co-benefits**.

There will be more demand for carbon credits, and we will see a more realistic price for carbon globally.

For carbon market veterans, recent events have brought back unwelcome memories of 2008-09. Then, as the global financial crisis roiled the world's markets, the price of carbon dioxide (CO2) allowances in the EU's flagship Emissions Trading System (ETS) collapsed from almost €30 a tonne (/t) of CO2 in June 2008 to barely €9/t by the following February, only to languish in single digits for the next decade.



Russia's invasion of Ukraine has forced Europe to recalibrate its energy dependency, mainly natural gas supply, and alternatives likely mean shipping in more seaborne LNG and ramping up coal-fired power generation, all of which are more emission intensive options. While Europe is expected to accelerate its move to cleaner energy in the long term, it may end up burning more coal in the short term.

European Union's cross-border carbon adjustment mechanism, which puts a carbon price on imports of goods and material, is an example of how carbon prices around the world are getting linked and will be relevant for international trade.

Growing linkages among carbon markets around the world, including markets like China, India, US and elsewhere, mean global carbon exchanges will become increasingly relevant, and provide important price signals to people who want to reduce emissions.

25.1 Carbon Tax system in Ukraine

CARBON TAX in Ukraine was introduced in 2011 with the aim to reduce GHG emissions. Since 2011 the rate was increased from 0,2 UAH to 10 UAH (0,36 US dollars) per tonne of CO2. TAX BASE is for CO2 emissions from stationary sources above 500 tonnes per year.

Among the countries that implemented a carbon tax, Ukraine's carbon price is one of the lowest. Studies have shown that it was virtually ineffective in strengthening energy efficiency and reducing carbon emissions, thus it does not support meeting international climate obligations.

The country's current efforts to introduce a range of measures to achieve emission reduction goals call for a revision of Ukraine's carbon pricing strategy. A poorly designed carbon tax can have negative effects on employment, competition and economic growth.

Therefore, the OECD advised to respect the following principles:

- The carbon price should be phased-in over time in a predictable manner to support long-term investment decisions.

- The carbon policy should be transparent and fair. And it should be supplemented by measures that address the policy´s income effects as well as additional measures to support deeper emission reductions over time. In line with these recommendations, a gradual phase-in of the tax, starting in 2022 with a rate of EUR 4.3 /tCO2 is suggested.

Different projects have already evaluated **potential carbon pricing strategies** for Ukraine.

The 'Preparedness for Emissions Trading in the EBRD Region 1 (PETER I) evaluated how the current carbon tax can be improved while PETER II prepares a road map for a transition towards an ETS. For an improved carbon tax they propose a scheme with two tax bands. They neglect, however, mobile sources and rely on the current downstream2 tax (EBRD, 2014).

The Partnership for Market Readiness (PMR) compares different scenarios: a carbon tax, an ETS and a combination of a tax and an ETS. They find that an extended carbon tax covering all sectors has a larger negative effect on output and competitiveness than the ETS with similar emission reductions. However, they neglect the addressed institutional drawbacks of an ETS. While a carbon tax leads to larger costs for companies, it might provide easier access to capital to improve efficiency and install less emission-intensive technologies.

Moreover, as in the EBRD (2014) study, the IPMR neglects the transport sector, which makes up 10% of Ukraine's emissions. The most recent study (Kantor & E3M, 2021) evaluates carbon pricing for Energy Community Contracting Parties, including Ukraine. This study proposes the introduction of a cap-and-trade system in the power and heat sector, while country's could consider a carbon tax in the transport and building sector. The authors assess different policy options for this cap-and-trade system and conclude that a scenario encompassing a transitional period for carbon pricing and integrated power and gas markets with the EU presents the best policy option.

Ukraine needs to establish plans for an ETS to meet obligations under the Ukraine-EU Association Agreement (icap, 2020).

As a first step towards an ETS, in December 2019, a law on Monitoring, Reporting and Verification (MRV) of greenhouse gases (GHG) was adopted and should has come into force in 2021.

However, establishing an ETS is connected to a high administrative burden, as credible institutions have to be set up and market manipulation needs to be countered. As the design should be well thoughtthrough, the implementation might take some time. Nevertheless, Ukraine should act rather sooner than later which is why this Chapter focuses on the easier-to-implement measure – an upstream carbon tax. In the long-run though, this should be complemented by an ETS to meet international obligations.

Introducing a substantial carbon price in Ukraine could lead to carbon leakage, which means that **a carbon tax imposed in Ukraine could lead to an increase in emissions in other jurisdictions**. In theory, this could result if consumers turn to producers from countries where no tax is applied, as these face lower input-costs especially for carbon-intensive products, such as steel, electricity, or cement.

To avoid a shift from locally produced goods to imports, a border carbon adjustment could be implemented. A standard border carbon adjustment corresponds to an estimation of how much higher goods prices would be, if the same carbon tax was applied in the country of production. It would apply the carbon tax to imports, based on an estimation of how much GHGs are emitted during the production of these products. This, however, is connected to high computational efforts, high administrative burden and legal risks. Moreover, there is no empirical study showing carbon leakage to actually occur and whether the carbon tax could not even have positive effects in the long-run through increased competitiveness. Furthermore, the two most important trading partners of Ukraine, Europe and China, already imply (at least partly) a price for carbon in the form of emission trading schemes. Therefore, the benefits of introducing a border tax adjustment might be small.

<u>Ukraine ETS in 2025?</u>

On 19 January 2021, Ukrainian Minister of Environmental Protection and Natural Resources Roman Abramovsky said that Ukraine was planning to introduce an ETS in 2025. While Ukraine has previously committed to establishing an ETS and taken substantive steps, this was the first announcement of a potential launch date.

The statement that Ukraine was revising its emissions reduction objective for 2030 and the timeframe for reaching carbon neutrality in the process of developing its second Nationally Determined Contribution (NDC) was made. At the same time, the country was also revisiting its approach towards its carbon tax and targeted use of the funds it raises.

Ukraine has already stated an intention to launch an ETS as part of its obligations under the "Ukraine-EU Association Agreement", which took effect in 2017. So far, the country has taken steps to establish a MRV system, which entered into force in 2020. From the start of 2021, reporting is required annually for fuel combustion in installations over 20 MW, oil refining, production of coke, metal ores, pig iron, steel, ferrous alloys if the total nominal thermal capacity of combustion units exceeds 20 MW (including ferroalloys), cement clinker, lime or calcination of dolomite or magnesite (with a production capacity exceeding 50 tons per day), nitric acid, and ammonia.

To establish its ETS, Ukraine plans to develop separate legislation based on at least three years of data from the MRV system.

25.2 Has Joint Implementation projects in Ukraine reduced GHG emissions?

Joint Implementation is one of two offsetting mechanisms under the Kyoto Protocol, along with the **Clean Development Mechanism (CDM).** It enables countries with emission reduction commitments under the Kyoto Protocol to generate Emission Reduction Units (ERUs) from greenhouse gas (GHG) reduction projects and transfer them to other countries.

In principle, **offsets are a zero-sum game for the atmosphere**. Buyers of offsets can increase their emissions by a corresponding amount above the target level, while emissions are reduced by that amount in the host country, keeping global emissions the same.

If offsets come from non-additional or overcredited projects, however, using them will lead to an increase in global emissions relative to a scenario without the use of offsets. The design of JI should, in theory, avoid that outcome.

Under the Kyoto Protocol, each country with an emissions target receives allowances (called Assigned Amount Units, AAUs) equivalent to its total emissions budget for the commitment period. For every ERU (Emission Reduction Unit) it issues, a host country must cancel one AAU. Thus, if a JI project is overcredited or not additional, the host country would have to make up the difference and engage in more mitigation action. However, in the first commitment period, several countries had emissions targets well above their BAU emissions, resulting in large AAU surpluses. In such cases, host countries can use surplus AAUs to cover their ERUs, and will not have to engage in additional mitigation action. Thus, non-additional or overcredited JI projects in those countries will lead to higher global emissions.

A study of the STOCKHOLM ENVIRONMENT INSTITUTE indicates that at about **three quarters of ERUs are unlikely to represent additional emissions reductions**, and about **95% of the total ERUs were from countries with a significant AAU surplus**. This suggests that the use of JI may have enabled global GHG emissions to be about 600 million tCO_2e higher than they would have otherwise been.

The implications for the European Union's Emissions Trading System (EU ETS) are particularly serious.

The experts assessed the plausibility of additionality claims of JI projects through an in-depth review of the information available for a **sample of 60 projects**, drawn in a representative manner taking into account the host countries, project types and project scale. While this approach has clear limitations it is based on a careful analysis applied in a consistent manner across projects, assessing the plausibility of the timeline of project implementation and registration under JI as well as the information on the main additionality tests used to determine additionality (investment analysis, barrier analysis, common practice analysis, reference to a comparable project).

They used three broad categories to classify each project:

- "Plausible" means that based on the available information, the claims for demonstrating additionality seem plausible.
- "Questionable" means that the available information raises questions or doubts about the additionality.
- "Not plausible" means that the available information suggests that the projects are unlikely to be additional

RESULT: 43% of the projects and 73% of the ERUs the additionality claims were not plausible based on the available information.

Of the six largest project types assessed in more detail, only one – *N_2O abatement from nitric acid production* – had overall high environmental integrity.

For many JI projects, either additionality seems unlikely, or unrealistic assumptions are used that grossly overestimate the actual emission reductions.

80% of all ERUs come from project's types with questionable or low environmental integrity: **most of them in Ukraine** (and Russia).

The environmental integrity of the six project types with the highest ERU issuance was also examined in more detail. These project types represent 84% of the ERUs issued and 53% of registered projects in the first commitment period.

Table below provide an overview of the results.

<table>
<tr><td>Project types</td><td>Registered projects</td><td>Share of ERUs</td><td>Main countries</td><td>Overall environmental integrity</td></tr>
<tr><td>Spontaneous ignition of coal piles</td><td>78</td><td>26%</td><td>all in Ukraine</td><td>Low</td></tr>
<tr><td colspan="5">This project type avoids GHG emissions from uncontrolled fires from coal waste piles. Most JI projects extractcoal from the piles, leaving bare rock which does not ignite; others extinguish the fires.
• Additionality not plausible: The timeline of project implementation shows that almost all projects were registered in 2012 but were implemented at least four years earlier. Additionallity is usually demonstrated bylong chains of reference to a similar project.
• Overcrediting likely to be very significant: Baseline emissions are overstated due to unrealistic assumptions. All coal waste pile JI projects together implicitly claim that they have produced around 30% of allcoal in Ukraine. This is a highly unrealistic scenario.</td></tr>
<tr><td>Energy efficiency in industry and power production and distribution</td><td>164</td><td>23%</td><td>mainly Ukraine and Russia</td><td>Questionable</td></tr>
<tr><td colspan="5">This project type includes a large variety of energy efficiency improvement measures in diverse sectors, such as large industrial facilities, and power and heat plants.
• Additionality questionable: Projects of this type are in many cases financially attractive without JI and JI may only have sped up implementation. The additionality claims do not seem plausible for the majority of projects, questionable for some, and plausible for a few.
• Overcrediting not assessed: Because of the wide variety of technologies and sectors that make up thisproject type, we were unable to assess the overall validity of emission reduction claims.</td></tr>
<tr><td>Associated petroleum gas (APG) utilization</td><td>22</td><td>14%</td><td>all in Russia</td><td>Low</td></tr>
</table>

This project type utilizes associated petroleum gas that would otherwise be flared at oil field operations. • Additionality not plausible: The timeline of project implementation shows that most projects, accounting for almost 80% of ERUs, were implemented 6–9 years before their auditing and were registered even later. • Overcrediting likely to be significant: The claimed reductions do not match Russia's GHG inventory data, suggesting overcrediting or inaccuracies in Russia's inventory: The JI projects implicitly claim that in their absence, Russian emissions from APG flaring in oil production would have increased well above any historical values observed since 1990.				
Natural gas transportation/distribution	32	10%	mostly Ukraine	Low
This project type involves reducing methane leaks from natural gas transportation and distribution or expandingnatural gas networks in order to replace coal or oil. • Additionality not plausible: The project starting dates of the 30 projects located in Ukraine were between 2003 and 2006, while most projects received their Letter of Endorsement only in 2012. • Some overcrediting likely: The network expansion projects assume that they solely replace fossil fuels such as coal and heavy oil. But in rural areas newly available gas would also substitute biomass. The exclusion of theuse of biomass may inflate the baseline emissions. For projects addressing methane leaks, the implied leakage rates in the absence of JI exceed historical emission rates reported in Russia's GHG inventory, which suggests that either in the absence of the JI projects Ukraine's emissions from this activity would have risen, or emission reductions claimed by the projects are overestimated.				
Abatement of HFC-23 and SF6	4	7%	mainly Russia	questionable
These projects incinerate HFC-23 and SF_6 waste gas streams in industrial facilities. • Additionality plausible: In the absence of regulations or other policies, this project type can be regarded as likely to be additional because plant operators do not save costs or generate revenues from the installation ofabatement technology. • Overcrediting likely to be very significant: Two of the four projects initially implemented a conservative approach to calculate emission reductions. In 2011, safeguards to prevent perverse incentives were removed, leading to significant over-crediting. One project assumed a baseline emission rate by far exceeding commonlevels.				
N_2O abatement from nitric acid	43	5%	EU	high
These projects abate unwanted N_2O that is generated as a by-product in nitric acid plants. • Additionality plausible: In the absence of regulations or other policies such as the EU ETS, this project type can be regarded as likely to be additional because plant operators do not save costs or generate revenues fromthe installation of abatement technology. • Overcrediting unlikely: Ambitious emission benchmarks based on European regulations (1.4–2.5 kg N_2O/t nitric acid) were used in Western Europe except Sweden. Higher values (4.3–13.5 kg N_2O/t nitric acid) were used in Eastern Europe and Sweden.				

Lessons learned for the design of crediting mechanisms

A key finding is that crediting mechanisms need to be very carefully designed to ensure environmental integrity:

- **Crediting mechanisms should adopt project cycle procedures which ensure full transparency and make all documentation publicly available.** Lack of transparency is an important concern in some JI host countries, where key project documentation, such as project design documents (PDDs), monitoring reports, and determination and verification reports are not available or incomplete for a number of projects. To avoid this problem, crediting mechanisms need rules and enforcement to ensure timely and complete reporting. However, **it is important to note that transparency, though crucial for ensuring environmental integrity, is not enough by itself**. One host country, **Ukraine, ensured a high degree of transparency but nevertheless issued mostly ERUs of very questionable environmental integrity**.
- **Only internationally accepted methodologies should be eligible for use:** Many projects applied their own, JI-specific approaches for additionality demonstration and the calculation of emission reductions. In many cases, these projects used inappropriate approaches, made unrealistic assumptions, or applied questionable values for key parameters, often leading to overcrediting and significantly higher emission reductions estimates than if, for example, Clean Development Mechanism (CDM) methodologies had been applied. We therefore recommend that only

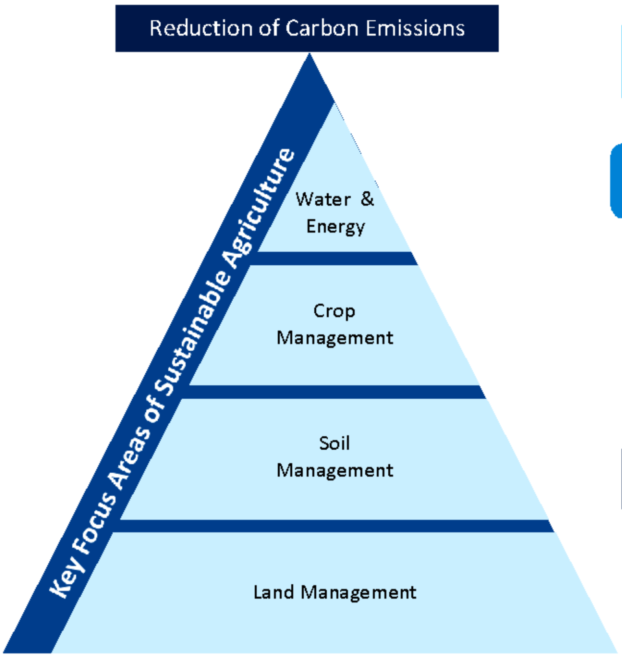
internationally accepted methodologies that have undergone thorough review by experts and which were developed for specific and defined project types be used, and that any deviations from such methodologies, before or after registration, be assessed using appropriate regulatory oversight.

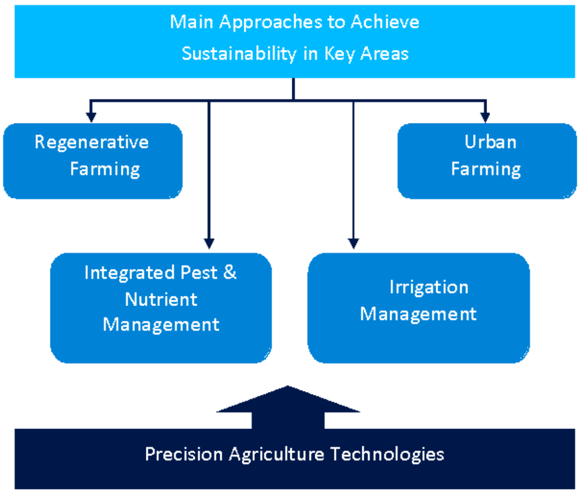
- **Auditors should be fully accountable for all their activities to the authority regulating the mechanism**: We recommend that crediting mechanisms adopt accreditation systems which continuously monitor the performance of auditors and which apply sanctions in the case of non-performance, including the suspension or withdrawal of accreditation. Merging the JI and CDM accreditation systems could further improve the oversight of the operations of AIEs.
- **Retroactive crediting should not be allowed**: Retroactive crediting of emission reductions has seriously undermined the integrity of JI. We recommend that current and future crediting mechanisms avoid any retroactive crediting and provide for procedures which ensure that projects must be approved or pre-approved (e.g., through a letter of endorsement) prior to the decision to proceeding with their implementation.
- **Investors should have reasonable certainty**: In several JI host countries, project developers faced considerable uncertainty as to whether their projects would ultimately be approved and ERUs issued. This uncertain environment may have favoured projects that did not rely on ERU revenues, thereby also negatively affecting the overall environmental integrity of the project portfolio. We recommend establishing a stable and predictable regulatory environment for crediting mechanisms.

26. Profile of relevant market participants to support pilot carbon sales from carbon farming

The launch of a Ukrainian carbon market appears uncertain as the country examines several options to put an adequate price on emissions while averting political opposition and the EU's border measures.

However, at the same time the Ukrainian Ministry of Agrarian Policy and Food is currently developing a concept framework of low-carbon farming and agriculture, which will envisage governmental methodologies to facilitate the calculation of carbon dioxide emissions in AgriFood companies, the introduction of low-carbon technologies to ramp up climate adaptation and mitigation activities to boost carbon credit markets.





The intended measures will promote sustainable agricultural development, as well as allow farmers to be granted new income streams from the sale of carbon credits.

For the sake of this part of the study, we will consider multinationals such as NESTLE, Bayer, Corteva, Syngenta, Coca Cola, Pepsico, Metro, Astarta, MHP and others as potential partners to facilitate partnerships along the supply chain, both for efficient methodologies to calculate carbon footprint and setting up remuneration mechanisms for farmers and developers.

Key Drivers of Adoption—Sustainable Agriculture

Drivers	1–2 Years	3–4 Years	5–6 Years
Climate change due to GHG emissions is driving the need for the adoption of sustainable farming practices.	**High**	**High**	**High**
Overexploitation of land and other natural resources, such as water, calls for the adoption of sustainable crop production methods.	**Medium**	**High**	**High**
Loss of biodiversity and the rise in pesticide-resistant species is driving sustainable agriculture adoption.	**Medium**	**High**	**High**
Consumer trends and sustainability targets of stakeholders across the F&B value chain will drive adoption of sustainable farming practices.	**Medium**	**Medium/ High**	**High**

<u>Driver 1: Climate Change due to GHG Emissions is Driving the Need for the Adoption of Sustainable Farming Practices</u>

Approximately 34% of total greenhouse gases produced were from the FMCG, agriculture, and nutrition industry sector. Almost 50% of food industry GHG emissions are from agriculture production and associated land use. Carbon neutrality is a target set under SDG 13, and climate change is one of the top drivers for sustainable agricultural practices adoption.

<u>Driver 2: Overexploitation of Land and Other Natural Resources, Such as Water, Calls for the Adoption of Sustainable Crop Production Methods</u>

Agricultural production is responsible for 70% of the freshwater withdrawal leading to water scarcity. The withdrawal rates vary between regions. For example, several countries across South Asia, Africa, and Latin America use more than 90% of water withdrawals for agriculture, creating water stress. Further, agriculture is one of the key sources of river and stream pollution. OECD estimates the environmental and social cost of water pollution caused by agriculture to be more than a billion dollars per year.

In addition, per FAO, more than 33% of the soil is already degraded, and more than 90% could degrade by 2050. Intensive agriculture practices, deforestation, overgrazing, and improper land use can accelerate soil erosion 100 to 1,000 times. Soil erosion can lead to a 50% loss in crop yield and has far-reaching implications beyond agriculture.

To ensure responsible consumption and production goals (SDG 12), sustainable crop production methods need to be adopted. For example, drip irrigation techniques that conserve water while increasing crop yield combined with digital technologies could offer sustainable solutions.

<u>Driver 3: Loss of Biodiversity and the Rise in Pesticide-resistant Species is Driving Sustainable Agriculture Adoption</u>

Loss and fragmentation of natural habitats due to land clearing activities associated with cropland expansion, intensive agricultural practices, and construction activities are the key drivers of biodiversity loss.

Land clearing activities have led to a drastic decline in the population of pollinators and other invertebrates and micro-organisms that aid in soil fertility, pollination, water, air purification, and pest and disease management. Loss of biodiversity is a threat to food security recognized under SDG 15.

Further, overreliance on chemical pesticides and insecticides has led to an increase in pesticide-resistant species that have caused several outbreaks and impacted crop yield over the years. Excessive use of pesticides harms biodiversity and the environment, driving the need for sustainable management practices.

Driver 4: Consumer Trends and Sustainability Targets of Stakeholders Across the F&B Value Chain will Drive Adoption of Sustainable Farming Practices

The **demand for organic fruits, vegetables, and food products** has increased significantly in the last decade. Demand for organic fruit and vegetables will offer higher opportunity compared to organic dairy or meat products.

In addition to the demand for organic food products, products with sustainably sourced ingredients are gaining consumer attention. Consumer awareness of the product label claims is rising steadily, driving stakeholders across the value chain to focus more on raw material sourcing and sustainable farming practices.

Across the value chain, stakeholders have set their sustainability goals and targets to reduce carbon footprint across the whole value chain. It will drive the adoption of sustainable farming practices.

The trend aligns with the goals listed under SDG 13, which also highlights the challenges of the rise of single-use plastics and food wastage. To ensure sustainability across the value chain, stakeholders need to take action in their production and processing technologies.

Note: this is the driver enabling most the pilot case with Arnika Organic Group

Key Restraints of Adoption — Sustainable Agriculture

Restraints	1–2 Years	3–4 Years	5–6 Years
Reluctance to shift from conventional practices, especially from smallholder farmers, remains a key challenge for adoption.	**High**	**High/ Medium**	**Medium**
The lack of awareness and limited reach of digital technologies impact the adoption potential of sustainable farming practices.	**High**	**High/ Medium**	**Medium**
Government initiatives are yet to catch up across several developing countries, restraining adoption.	**High**	**Medium**	**Medium**

Restraint 1: Reluctance to Shift from Conventional Practices, Especially from Smallholder Farmers

Farmers, especially smallholder ones, are reluctant to shift from conventional farming practices. It is primarily due to the initial impact on yield and profitability.

Farmers are under constant pressure to reduce costs, which intensified due to the ongoing COVID-19 crisis. Shift to sustainable farming practices, such as no-till farming, chemical input reduction, or more natural alternative usage like biochar, have impacted production yield in the short term. It is directly affecting adoption.

Though government and non-government initiatives and subsidies are expected to boost adoption, the reach of such policies will remain limited, especially in countries where the percentage of smallholder farmers is much higher.

Restraint 2: The Lack of Awareness and Limited Reach of Digital Technologies Impact the Adoption Potential of Sustainable Farming Practices

Lack of awareness of the benefits of different sustainable agricultural practices, especially among small farmers in developing countries, remains a key constraint. The lack of knowledge and capital required for investment in different technologies prevents farmers from making the shift.

Lack of infrastructure limits penetration of digital technologies across rural areas, making it difficult for the farmers to adopt precision agriculture technologies.

The cost of adoption of digital technologies is another key challenge, especially for small farmers. Though cost reduces with scale, government intervention is required at a much wider scale to boost adoption.

In addition, innovative business and service models tapping into the IT infrastructure can increase access and address affordability challenges.

Restraint 3: Government Initiatives are yet to Catch Up Across Several Developing Countries, Restraining Adoption

Though governments across developing countries aim to expand knowledge and incentives for farmers to drive adoption, significant impact is yet to be seen.

In addition, governments need to create opportunities for different sustainable practices. For example, in India, most of the policy addresses organic farming practices and precision irrigation techniques, such as micro-irrigation. Thus, the adoption of other sustainable farming practices lags far behind.

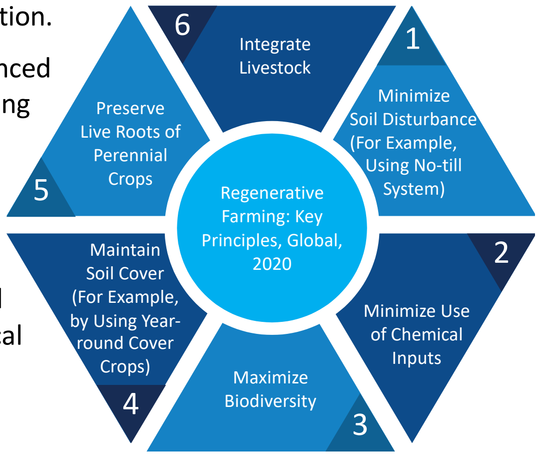
The similar trend can be seen in other agricultural countries, such as Brazil, where a significant focus is on no-till farming practices. However, the same is not the case for organic farming practices in the country.

Overview — Regenerative Farming in Ukraine

Regenerative farming is a concept focused on soil rehabilitation.

In the last few years, large corporations have announced initiatives to promote the adoption of regenerative farming practices.

The industry has identified 6 core principles of regenerative farming and their potential impact on climate change (reduction of GHG emissions or increasing carbon sequestration in soil), natural resources (maintaining soil health and preventing water loss), biodiversity, and chemical inputs (reducing the need for pesticides and fertilizers).



Sustainable Agriculture: Qualitative Environmental Impact Analysis of Key Regenerative Agriculture Practices

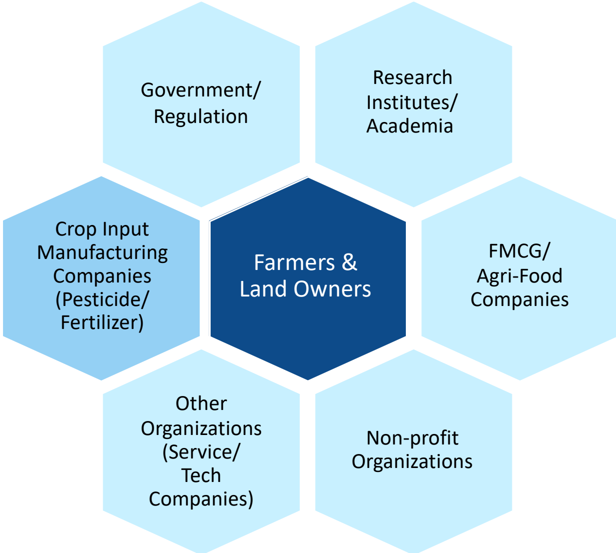
Key Regenerative Agriculture Practices	Definition	Impact					Attributes
		Biodiversity	GHG Emissions	Soil Health	Water Loss	Chemical Inputs	
Conservation farming/No-till Farming	Growing crop or pasture without or minimum tillage.					NA	High impact of no-till practices on maintaining soil health and improving water retention, and maintaining soil biodiversity, to an extent. However, the role in carbon sequestration and GHG emission remains limited.
Cover Cropping	This process keeps soil protected with plants that are not used as cash crops.		NA				The main attribute of cover crops is to prevent soil erosion and increase soil fertility. The crops also play a role in water management by preventing run-off and weed and pest management.
Crop Rotation	The practice of planting different crops sequentially on same land.				NA		It improves soil health and nutrients, increases biodiversity, and combats pests and weeds.
Organic Annual Cropping	It advocates use of non-chemical fertilizers, pesticides and limited use of GMOs, hormone, and chemical inputs.		NA		NA		Organic farming plays a small role in reducing GHG emissions. The concept is focused on reducing chemical inputs to foster soil quality.

High Impact	Medium Impact	Low Impact

Sustainable Agriculture: Key Stakeholders, Regenerative Farming

Farmers are at the front line to implement regenerative agricultural practices in Ukraine.

Several stakeholders aim to collaborate with farmers at different levels across the value chain to accelerate adoption.



Key Stakeholders Initiatives/Projects with interest in Ukraine — Regenerative Farming

General Mills, Inc.

- The company announced its plan to expand regenerative agriculture to more than 1 million acres of farmland by 2030.
- In 2019, the company launched its first pilot focused on regenerative farming with oat farmers in the US.
- In 2020, the company launched two more regenerative agriculture pilots, one with wheat farmers in Kansas' watershed to improve water quality and the other with dairy farms to integrate regenerative practices for herd and manure management.

Danone S.A.

- Among the first proponents of regenerative agriculture, the company, since 2017, has been focusing on regenerative agriculture practices to meet its net-zero emissions target by 2050.
- As of 2021, the company has implemented regenerative agriculture on more than 150,000 hectares of land, which represents 12% of their ingredient sourcing across key geographies, including the US, France, Spain, Mexico, Algeria, Morocco, Egypt, and Romania.

PepsiCo, Inc.

- The company announced its plan to advance regenerative agriculture across 7 million acres of land, equivalent to 100% of its agricultural footprint, by 2030. It is expected to reduce 3 million tons of GHG emissions by 2030.
- In the US, the company planted cover crops on almost 85,000 acres of land, and it plans to expand this to 500,000 acres by 2021. The company has many similar ongoing and planned initiatives to spread regenerative farming practices.

Nestlé S.A.

- The company announced its plan to invest CHF 1.2 billion in the next five years to push regenerative agriculture practices across its food supply chain.
- The company plans to work with its network of 500,000 farmers and 150,000 suppliers to help adopt regenerative farming practices by providing required investment, technology and technical assistance, and premium for regenerative agriculture goods.

Cargill, Inc.

- The company has announced its plan of expanding regenerative agriculture to more than 10 million acres of land in North America by 2030.
- The company launched a program in 2020 called RegenConnect™, which will connect farmers to the carbon marketplace and aid the adoption of regenerative agriculture practices.
- The company is also supporting and investing in several initiatives to advance and promote sustainable agriculture practice adoption. The company has committed to reducing carbon emissions by 30% across its supply chain by 2030.

Archer-Daniels-Midland Company (ADM)

- The company, in collaboration with farmers, peers, customers, NGOs, and governments, is launching projects to reduce the environmental impacts of the agricultural value chain.
- In India, the company has partnered with the MOA to promote more sustainable soybean production and has benefited 25,000 smallholder farmers. In Europe, the company partnered with the Cool Farm Alliance to help growers identify where the majority of greenhouse gases are being emitted at the farm level using new technology.

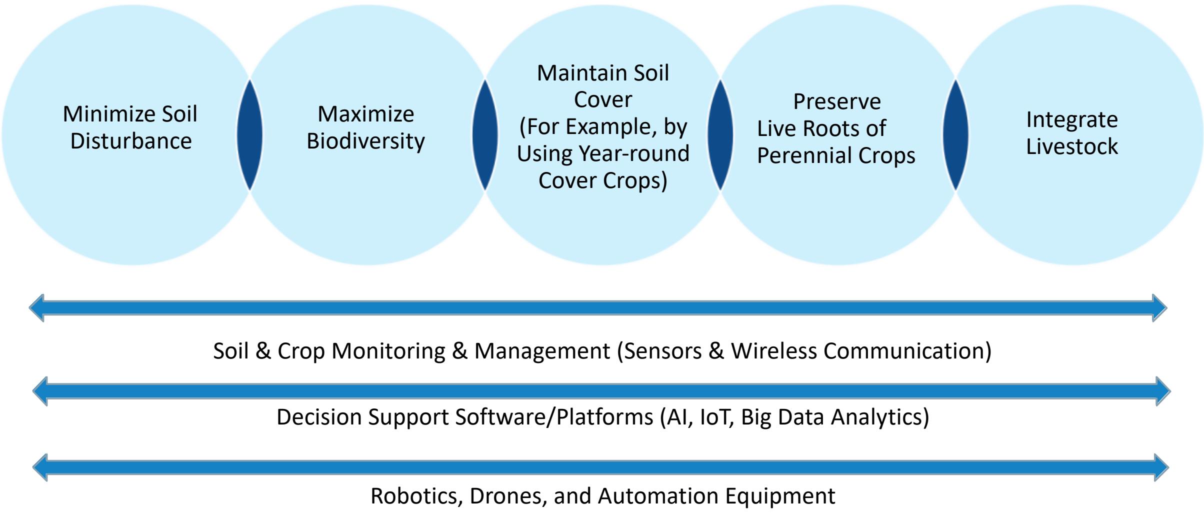
Ingredion, Inc.

- The company, as part of the AgWater Challenge, has announced to adopt regenerative farming practices on 500,000 acres of corn, tapioca, potato, pulses, and stevia farms grown in high-risk watersheds by 2027 and across 1 million acres by 2030, representing about 30% of its total global sourcing.
- The company also plans to work with Sustainable Agriculture Initiative Platform to develop F&B industry regenerative agriculture standards for 2022.

Moreover, most non-profit or other non-governmental organizations involved focus on offering required training to help farmers transition from conventional to regenerative farming practices.

Areas of Technology Convergence—Regenerative Farming

Technological convergence is present across the whole agricultural value chain. Smart technologies could play a significant role in speeding up the adoption of regenerative farming practices. Key areas where digital technologies penetrate include soil & crop mapping to detect water stress, moisture levels, pest infestation, microbiome levels, carbon levels, and decision support platforms to facilitate adoption.



Opportunity 1: Investment in Enabling Technologies and Infrastructure to Boost Adoption of Sustainable Farming Practices

Context and Definition

The lack of infrastructure and incentive for the farmers to shift from conventional farming is the key adoption barrier to sustainable practices.

In addition, the cost of implementation, risk of lower yield, and a slower return on investment (ROI) are other challenges limiting the adoption of sustainable practices.

Though precision technologies can overcome some challenges, the reach and awareness of enabling technologies are limited, especially in smallholder farmers.

Farmers are under pressure to reduce costs while ensuring higher yields. The farmers are scouting for opportunities that will aid in reducing costs. These might further limit their intentions of adopting sustainable practices unless these can offer similar yields at lower costs

Call to Action

Stakeholders across the whole F&B value chain realize the need to reduce the carbon footprint of agricultural practices. However, to reach the carbon footprint goals, value chain participants need to create due awareness and offer incentives to farmers to boost adoption.

- A good example would be FMCG vendors, such as Nestle and Cargill, that are running awareness and incentive programs to drive the adoption of regenerative farming practices.
- The carbon farming concept offers incentives to farmers adopting regenerative farming practices. It could be a good opportunity.

Investment in enabling technologies is required to boost the adoption.

- For example, the set-up cost of indoor commercial urban farms is significantly higher, limiting its growth.
- Investments in the development of energy-efficient lighting systems and the infrastructure to boost the adoption of renewable energy will make indoor farming more cost-efficient and sustainable.
- Developing more efficient soil, pest, and weather monitoring solutions is required to boost the adoption of integrated pest management and regenerative farming practices.

Development of precision agriculture technologies that can ensure higher yield while reducing the cost of adoption of sustainable agricultural practices will be the future. For example, smart irrigation solutions have been shown to reduce water usage while improving crop yield and reducing the cost of adoption.

Opportunity 2: Value Chain Participants Need to Invest, Innovate and Pivot to Cater to Demand for Sustainable Farming Solutions/Platforms

Context and Definition

Climate change and challenges associated with overexploitation of land and other natural resources drive the need for agricultural practices that are not dependent on land and resources.

In addition, the push from government and non-government organizations will drive the adoption of sustainable farming practices.

Farmers have reservations to make the transition, but they have started taking steps to limit their carbon footprint globally.

For example, the use of bio-pesticides, bio-fertilizers, and bio stimulants has increased over the last few years. Though the penetration between regions varies a lot, awareness among farmers is growing that will impact the chemical agricultural input manufacturers.

Agricultural model is changing fast, with more farms and farmers understanding the need for precision technology to reduce input requirements while increasing yield.

At the same time, going back to natural farming practices, such as organic farming, is expected to impact stakeholders significantly.

Call to Action

Chemical agricultural input manufacturers are expected to be significantly impacted if they do not innovate and pivot from their standard offering to meet the changing consumer requirements.

Most of the vendors in the space are already responding to the changing industry trend, either through organic or inorganic growth strategies. However, the opportunity lies to develop solutions/products that limit the need for chemical inputs (bio stimulants) or natural resources, such as water (crops with lower water requirements), while improving overall crop yield.

Technology companies have a growth opportunity to develop solutions that cater to changing agricultural models globally. For example, there is a need to make indoor farms smarter to make them cost- and energy-efficient, especially for developing countries.

Large vertical farming companies and start-ups are developing integrated turnkey modular vertical farms that combine IoT, robotics, smart sensors, and data analytics to offer highly efficient solutions. Supplemental lighting is another area of opportunity to make operations sustainable.

Technology start-ups should offer an all-in-one solution integrating data analytics, data management, smart wireless sensors, and next-gen communication solutions. It will help achieve higher efficiency and precision, reducing resource need.

Opportunity 3: Focus on Increasing Affordability of Different Sustainability Approaches to Boost Adoption

Context and Definition

In agriculture, the affordability of any solution is determined by the cost of implementation versus ROI and crop yield. The major challenge in most regenerative farming practices is low crop yields, limiting their adoption.

Similarly, a reduction in the use of chemical pesticides impacts crop yields. In addition, biological solutions are relatively costly compared to chemical counterparts.

Precision agriculture technologies enable improved utilization of limited resources to attain increased yields from farmland. However, farmers, especially smallholder farmers in developing countries, do not have the resources to invest in farm management solutions and data analytics technologies. Reducing the cost of technology platforms is required to boost adoption.

Another challenge in adoption is the lack of information shared with smallholder farmers and insufficient support. It specifically limits the adoption of digital technologies.

Call to Action

Technology companies can reduce the cost of digital technologies and equipment available to farmers. Prices of sensors have seen a significant decline in the last 5 years. Advancements in technology and the rise in competitiveness can aid in providing cost-effective solutions.

Stakeholders need to scale offerings and reduce costs while increasing technology convergence to make digital technologies more affordable and accessible to all types of farmers across all countries.

In the case of indoor farming systems, initial set-up costs can be reduced by the scale of economies, and operation costs can be reduced by managing labor costs and input chemical costs. The choice of energy mix can make the systems cost-effective and more sustainable.

Several participants offer biological alternatives to chemical pesticides and fertilizers. Manufacturers and start-ups should focus on solutions with similar or better crop yields at the same cost as chemical inputs.

To drive awareness, companies and start-ups should engage with farmers to share knowledge and technical know-how of technology integration in farming activities. Companies should demonstrate how technology convergence can make sustainable farming practices more efficient and increase ROIs.

27. Pilot case with Arnika Organic Group – analysis of potential carbon credits emissions for voluntary markets

We have already explained that carbon programmes support carbon markets for farmers in various ways including engaging both buyers and sellers of carbon credits (see Par. 5 Part 1).

Carbon programmes differ and it is wise to connect with providers that:

- Track science-based **results and measurements**
- With clear **permanence** and **additionality** guidelines
- Issues **high-quality offset credits** for units of emission reductions or removal that have been **verified and certified.**

For farmers, carbon programmes work best when there is expert guidance that can be provided by the programme. This ensures that measures are done properly from the beginning and the right carbon farming practices are recommended on a per-farm basis.

Pre-purchasing of credits are also made available by providers to help with initial overheads, including disruptive blockchain infrastructure for pre-purchased carbon credits designed with institutions in mind. One of them is Solid World, which is rethinking the mechanics of carbon markets with the addition of pre-financing options, and this will all be made possible by blockchain and web3 technologies.

Why this introduction? Because for new developers there are (at least) 4 challenges to face:

- **Hard to finance new carbon projects**. It takes years to certify credits. Even quality projects struggle to find appropriate financing to scale their operations.
- **Forward deals are illiquid assets**. The ability for market participants to sell or leverage their forward deals means it is less attractive to make them.
- **Quality credits are not a commodity**. High quality credits do not have a price signal for what their credits are worth. Institutions struggle to identify these projects.
- **Voluntary market credits differ** in price based on project charisma and potential for marketing, project type, location, and co-benefits beyond climate impact that match with buyers' preferences.

Voluntary markets serve as a niche for projects that are too small to warrant the administrative burden of compliance offset programs or for projects currently not covered under compliance schemes.

Probably the case of Arnika Organic Group. Agroindustrial Group Arnika is considered the biggest producer and exporter of organic commodities from Ukraine, the second largest organic company in Europe.

We are certified in accordance with international, national and private organic standards and conduct our business in a sustainable and climate mitigated way.

However, because voluntary offset credits cannot be used in compliance markets, they tend to be cheaper.

<u>WHAT MAKES A HIGH-QUALITY CARBON OFFSET?</u>

The central idea behind a carbon offset is that it can substitute for GHG emission reductions that an organization would have made on its own. For this to be true, the world must be at least as well off when you use a carbon offset credit as it would have been if you had reduced your own carbon footprint.

When people talk about the "quality" of a carbon offset credit, they are referring to the level of confidence one can have that the use of the credit will fulfil this basic principle.

This concept of "environmental integrity" sounds straightforward, but it is challenging to guarantee in practice.

Quality has two main components:

- First and foremost, a quality offset credit must represent at least one metric tonne of additional, permanent, and otherwise unclaimed CO2 emission reductions or removals.
- Second, a quality offset credit should come from activities that do not significantly contribute to social or environmental harms.

A variety of terms are frequently used to define quality criteria for carbon offsets, but the "quality" should be simplified down to five criteria. In short, quality carbon offset credits must be associated with GHG reductions or removals that are:

1. **Additionality**: The project should not be legally required, common practice, or financially attractive in the absence of credit revenues.
2. **No overestimation**: CO2 emissions reduction should match the number of offset credits issued for the project and should take account for any unintended GHG emissions caused by the project.
3. **Permanence**: The impact of the GHG emission reduction should not be at risk of reversal and should result in a permanent drop in emissions.
4. **Exclusive claim**: Each metric ton of CO2 can only be claimed once and must include proof of the credit retirement upon project maturation. A credit becomes an offset at retirement.
5. **Provide additional social and environmental benefits**: Projects must comply with all legal requirements of its jurisdiction and should provide additional co-benefits in line with the UN's SDGs.

This is what we need to remind for a business case with regards to Arnika Group.

Carbon Credits in Organic Farming

There is a great amount of research regarding the benefits of organic matter or soil carbon in improving soil quality and the sustainability of balanced agriculture productivity.

Less research has been done to quantify and measure the benefits of using the soil as a carbon bank.

The consensus on the benefits of organic matter or soil carbon is far from being agreed upon. Climate mitigation projects in the agriculture sector, particularly those focused on storing carbon in soils, are increasingly being tied to carbon markets. But the impact of these initiatives is highly questionable.

There are numerous sources of information on carbon credits. Opinion on soil's potential to sequester carbon has mixed reviews and scientific consensus. There are those who believe soil carbon is the future of the planet's climate mitigation. Others say the numbers are too little too late. As is often the case, the truth likely lies somewhere in between. As a consultant, I believe soil carbon in agriculture to be a much-needed tool and at least a partial solution to sustainable agriculture.

Much of the farm and agriculture industry still asks the basic questions: What is carbon credit? Is there a return on investment (ROI) for expenses incurred? How do I get started? Can I sell the credits, where, who buys them, and what are they worth? What approaches are there for entering a carbon marketplace?

Carefully consider all marketplaces and the terms and conditions of participating. There are typically two approaches for farmers entering carbon markets: using an **aggregator** or a **data manager**.

Aggregator

Farmer sells entire project, control and credits to the aggregator in terms and conditions set up in a contract. The aggregator then has complete control over carbon credits, when to sell, price and data shared.

Data Manager

Farmer pays a data manager to help them enter the marketplace for a fee or revenue percentage. The farmer has not sold real interests in the projects or carbon credits. How much will the farmer actually get seems like an important question. Some companies may have a price floor.

Many have asked if organic farming has a fit in the new wave of potential income generation on a farm.

Organic farmers try to increase the organic and biological matter in their soil. Since soil is one of the biggest sinks, or storage units, for carbon, this alone makes it important. Some studies claim that organic farming does not improve soil health over conventional farming. A new study from Northeastern University and nonprofit research organization The Organic Center (TOC), though, has reached a different conclusion: Soils from organic farms had 26% more potential for long-term carbon storage than soils from conventional farms, along with 13% more soil organic matter.

Having consulted on organic farms and personally looked at soil samples and the soil itself, I have to report I have seen a notable change.

Another key point is that it will take incentive funding to get enough acres involved to make any major impact. We need technical assistance from multiple levels, from implementation of long-term plans to conclusive and quantitative data through monitoring and measurement. We need a **more uniform direction so the various aggregators and data management organizations are on the same playing field.**

Therefore, are carbon programs a good idea for organic farmers? The answer is yes.

We need healthier soils and reduced inputs where possible. We need sustainable farm practices to ensure food production for years to come. We have an obligation to be better stewards of the land.

Regenerative agriculture is not a whim but a necessity. We need to reduce CO2 emissions, and using plants and farm soils to do this makes environmental sense.

Organic vs. Regenerative vs. Carbon Farming: What's the Difference?

In order to tackle down effectively the case of Arnika Group, a crucial understanding is needed.

Alternatives exist beyond conventional farming that provides various paths to achieving farm targets: three of the most popular ones are **organic, regenerative, and carbon farming**.

While these three approaches to land management are very often used interchangeably, there are **crucial differences** that set them apart from each other.

Out of the three, **organic agriculture has the most defined set of regulations**, **standards, and certification processes** across different countries, with international guidelines. Apart from regulations, it is also largely consumer driven. Growing more conscious of the environment and human well-being, buyers attribute health and happiness as primary reasons for choosing organic produce.

While exact regional regulations provide nuanced definitions, by and large, organic farming can be defined based on what it shouldn't have — synthetic inputs.

Carrying an organic label on products and farm means that prohibited substances are avoided for crop production, and only natural (plant or animal-derived) inputs are used. The most important factor for certified organic farms and products is the absence of substances that are chemically or industrially manufactured.

Beyond chemical inputs used on farms, **regenerative agricultural systems** prescribe diverse methods to achieve wider agro-ecosystem benefits.

Some regenerative farming practices are:

- Low to no-tillage
- Cover cropping
- Crop rotations
- No or limited external inputs
- Organic inputs (no synthetic, only on-farm animal or plant-derived)
- Integrating livestock
- Agroforestry
- Incorporating local or indigenous knowledge

Regenerative farming emphasizes natural methods to veer away from conventional farming that's become synonymous with resource-intensive procedures that deplete and disregard biological processes.

There is a general consensus that **regenerative farming results in restoring ecological balance in agricultural lands**. These outcomes are some of the ways regenerative practices can positively influence croplands:

- Improves soil health
- Increases soil carbon through carbon sequestration
- Reduces greenhouse gas emissions
- Increases biodiversity
- Maintains or improve farm productivity
- Develops farm resilience
- Reduces farm waste

There is definitely some **overlap between organic, regenerative, and carbon farming**.

Organic focuses on the outcome and **regenerative farming** represents a **move from conventional into restorative** farming processes.

Carbon farming is both outcome-based and process-oriented. It has the primary goal of sequestering carbon and storing that carbon in agricultural soils and vegetation. Reducing greenhouse gas emissions can also be another goal of carbon farming.

Soils are major carbon sinks. As high levels of CO_2 continue to accumulate in the atmosphere, managing lands in a way that promotes soil carbon storage is a unique ecosystem service from agriculture.

<u>Carbon farming co-benefits</u>

Consequently, improving soil carbon in farms also provides other co-benefits that are similar to regenerative farming such as improved soil health, biodiversity, productivity, and resilience, to name a few.

<u>Profiting with carbon farming</u>

Perhaps **what sets carbon farming apart from the other two farming systems are financial incentives**. Farmers who shift to carbon farming get paid for successful soil carbon sequestration that is recognized in the form of certified carbon credits.

<u>MRV and carbon credits</u>

While results can be ambiguous with regenerative agriculture, measurements in carbon farming are required, starting with baseline figures to understand changes in soil carbon over time.

Monitoring, reporting, and verification (MRV) are integral to scale carbon farming. In fact, the EU is developing a standard framework to make the system robust.

Finding a carbon program

A carbon program provides guidance to farmers on how they can get paid through carbon farming. Expert services are usually provided by a top-tier carbon program.

From baseline measurement, monitoring, reporting, and certification; planning the right farming practices specific to a farm, all the way to receiving income from carbon credit buyers.

SEQUESTERING ATMOSPHERIC CARBON INTO THE SOIL THROUGH CARBON FARMING

Example of application - Arnika Group and eAgronom Carbon Program

Farming is complex and unpredictable. It’s hard to make long term commitments when the future seems uncertain.

That’s why it is important to identify a flexible program that makes participating in the Carbon Program as hassle-free as possible.

Among a few available, **eAgronom Carbon Program** enables farmers to monetize for carbon credits generated through environment-friendly farming practices.

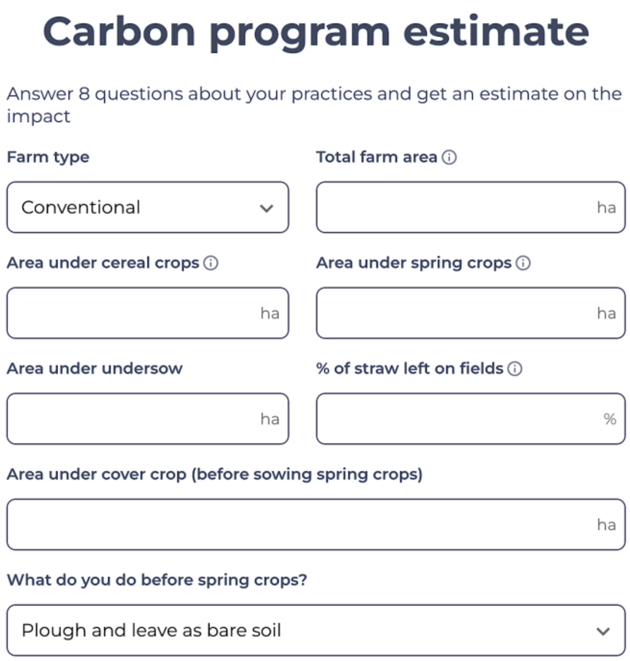
In principles, companies such as Arnika can offset their carbon emissions to meet the climate goals and support sustainable farming.

- Future-proof the farm with diversified income streams
- Richer soils
- Lower emissions
- Lower input costs
- Higher profit
- Stronger local communities

By participating in the eAgronom Carbon Program, Arnilka potentially can:

- Improve your soil quality – Keep more nutrients in the soil and improve water holding capacity
- Reduce the cost of inputs – Optimize fuel and fertilizer use
- Get paid for the Carbon Credits generated

The methodology to be used is fairly simple and envisage some data provision:


Carbon program estimate

Answer 8 questions about your practices and get an estimate on the impact

Farm type: Conventional

Total farm area: ha

Area under cereal crops: ha

Area under spring crops: ha

Area under undersow: ha

% of straw left on fields: %

Area under cover crop (before sowing spring crops): ha

What do you do before spring crops?: Plough and leave as bare soil

Important to remind is that a carbon removal represents one mt of carbon dioxide (CO2) that has been removed from the atmosphere for a minimum of 10 years.

After the high-level estimation, how does eAgronom Carbon Program work in principles?

1. Farmer confirms the interest to join the program by signing a pre-agreement.
2. eAgronom performs the initial farm carbon audit.
3. Record historical data and make a plan to add new practices. eAgronom Agronomic Advisory Team works with the farmer to develop a holistic plan with a goal to achieve the best financial results, reduce carbon emissions and increase soil carbon levels. The farmer decides to go with the proposed plan or adopt his own choice of practices.
4. New practices are implemented on the farm and recorded with eAgronom Software.
5. Calculate impact – eAgronom calculates the carbon credits generated on your farm, based on reduced CO2 emissions and increased carbon levels in the soil.
6. Farmer receives payment – Credits are sold to corporate buyers and other organisations. Farmer gets paid for the carbon credits.

Main Q&As for Arnika to consider the opportunity:

<u>How are carbon credits created?</u>

Carbon credits are created when the carbon project can demonstrate it generated carbon benefits over the baseline, and the results are verified.

<u>What will I need to do to be eligible for carbon credit payments?</u>

Adopt or advance at least one new carbon farming practice: adding cover crops, increasing cover crop diversity or growth period, reducing tillage or fertilizer use, or diversifying your rotation.

Experience an increase in overall carbon sequestered and reduce greenhouse gas emissions on your farm, as determined by eAgronom using your management information.

<u>What kind of practices would I need to change in the farm?</u> *(example list , not exhaustive)*

- Adding cover crops (for the first time, extending the duration, or diversifying your mix)

- Diversifying your crop rotation
- Reducing or eliminating tillage
- Reducing fertiliser (reducing N or switching to injection)

Will there be a full carbon footprint audit of my farm?

Yes, this is done by specialists trained in carbon agronomy

What kind of information will I be required to submit?

Management practice information for 3 years of historical as well as current season's data about planting and harvest dates, fertilizer types, amounts, and application dates, and tillage types and dates, as well as information on cover crop types, dates, and planting and termination methods, and organic amendments where applicable.

How much is a carbon credit worth?

Carbon credit price depends on supply and demand. The Aggregator or Data Manager (e.g., eAgronom) will target potential buyers and negotiates the price. The price depends on what the buyers are willing to pay and on verification and administration costs.

It depends on the individual farm situation how many CO2 offsets a farm can create. In addition, farms save money from optimized fertilizer and fuel use. Arnika would find out its estimated earnings during the audit.

But **putting a price on carbon credits is far from a straightforward operation**, mostly because of the **wide variety of credits** in the market and the number of **factors influencing the price**.

The nature of the underlying project is one of the main factors affecting the price of the credit.

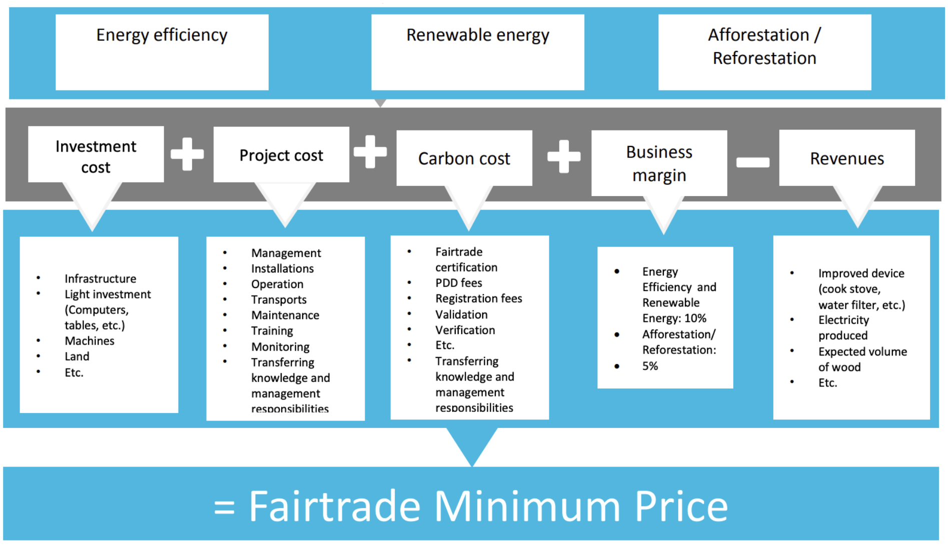
Pricing based on market dynamics

The voluntary carbon market today is primarily driven by supply and demand, regardless of the implications to the project in terms of long-term viability.

Pricing based on project cost:

A cost-based model takes into account the implementation costs of a project and is used to help ensure the ongoing viability of projects.

The **Fairtrade minimum pricing model** – explained in Par. 3 Part 1 - is an example of how this works in practice.



A cost-based model is a step toward ensuring project sustainability, yet it does not specifically account for the additional value these projects deliver in sustainable development.

Pricing based on value delivered

Using a value driven model to set a price for carbon credits can truly account for the full environmental, social and economic impacts of a specific project — that is, both in emissions reductions plus the additional development benefits that can transform lives.

<u>What happens once Arnika have joined the carbon program?</u>

It will create a soil sampling plan (which fields and how many samples) with a soil sampling company for the carbon project.

Baseline soil samples will be taken from the fields that are enrolled into the project.

Relevant data and tasks (such as crop rotation, fuel & fertilizer use) are entered into the eAgronom farm management software, which will report how Arnika progress in creating Carbon Removal Units (CRU's).

Arnika will start implementing its project (as outlined in the carbon practice plan) based on its best effort. In the end, it's its choice which practices it will implement.

Arnika will have the option to also take the Carbon Consulting service from eAgronom. It will help it get the best results across 1) farm profitability, 2) crop yield and 3) carbon credit income.

Carbon credits can only be generated after each round of soil sampling (every 3-5 years), but certain buyers may be willing to pre-purchase credits.

To sum up, benefits of adopting regenerative farming practices would be:

- Higher levels of soil organic matter.
- More nutrients in the soil for crops to grow (healthy soils capture more nutrients from your applications).
- Potential to further optimize fertilizer use and therefore reduce costs.
- Improved water holding capacity (humidity stays in the soil for longer).
- Healthy soil is less compact.
- A carbon credit is a bonus on top of everything else.

The process of Verification & Selling Process of Carbon Credits for Carbon Offsets has been explained through an example (LandGate) in the warp up section Part 1.

28. Carbon Farming concept in Ukraine HOW TO DEVELOP A REAL OPPORTUNITY FOR AN UKRAINIAN FARMER

How can the Project definitely operationalize a carbon farming concept on the basis of this study and the opportunity with Arnika Organic Group?

And promote sustainable agricultural practices and responsible investments through the introduction of an Environmental, Social and Governance (ESG) approach in organic agriculture that would integrate carbon emission data along with other non-financial disclosures?

The proposed solution will enhance corporate climate risk management and should enable future access to green finance.

The Project has been active in promoting the subject of carbon farming and new opportunities in this field with agricultural producers, and relevant partnerships have been established to facilitate relevant initiatives, and pursuing climate-resilient and low greenhouse gas emissions development pathways in line with Nationally Determined Contributions (NDCs).

In order to supports the Ministry of Agrarian Policy and Food to develop a concept of carbon farming and carbon markets in Ukraine, and establish the basis for a legal framework for:

- the transfer of Mitigation Outcome (*defined as one ton of emission reductions or removals measured in metric tons of carbon dioxide equivalent (C02eq) in accordance with the guidance on methodologies and metrics pursuant to Article 4.13 of the Paris Agreement*) for use towards Nationally Determined Contribution achievement or for mitigation purposes other than achievement of the NDC,
- the basis for a framework for Commercial Agreements between the Acquiring Entity and the Entity Authorized to Transfer, and
- implementing joint-agreements in line with Art. 6.2 of the Paris Agreement with other countries partners,

UNDP is developing a concept of low-carbon agriculture, which will include proposal for state measures to support calculation of carbon dioxide emissions in agricultural enterprises, the introduction of low-carbon agricultural practices to reduce gas emissions or absorb into the soil and promote participation of businesses in carbon credit markets.

These measures will promote sustainable agricultural development, as well as enable farmers to receive additional income from the sale of carbon credits markets.

Environmental integrity of the Carbon Farming concept

Minimal principles and criteria relevant for ensuring the environmental integrity of Mitigation Outcomes for which transfer, and use are authorized, are the following:

- real;
- verified;
- additional to any that would otherwise occur and
- permanent or achieved under a system that ensures permanence, including by appropriate compensation of any material reversals;

A Mitigation Outcome may be used within the NOC implementation period that covers its Vintage Year; and shall originate from activities that:

- do not lead to an increase in global emissions;
- are in line with the low emission development strategy of each Party;
- foster the transition to low emission development;

- do not include activities based on nuclear energy and avoid locking in carbon-intensive technologies or practices, not compatible with the achievement of the long-term goal of theParis Agreement
- promote enhanced climate action and safeguard against incentives for low ambition by the
- Parties involved
- mitigate the risk of carbon leakage
- include consideration of the most conservative setting in the baseline

Carbon sales at voluntary markets

The Project will support carbon sales pilot with its partner Arnika to demonstrate benefits to farmers as well as new opportunities when applying low-carbon business models. The Project will support making independent footprint data verification and searching best carbon credit sales options at voluntary carbon market.

28.1 Operationalization

Phase 1 – finalise voluntary co-operation agreements with other interested countries

The Paris Agreement promotes voluntary cooperation between countries to reduce greenhouse gas emissions. Under the Paris Agreement, the term Mitigation Outcomes (MOs) replaces most forms of international carbon credits. MOs generated in a country could be transferred to another country, thereby becoming Internationally Transferred Mitigation Outcomes (ITMOs).

Ideally, the Phase I of the implementation would be addressed to establish – between Ukraine and another interested partner country, for example Switzerland, or Sweden – a “Co-operation Agreement”, or a “Joint Statement on bilateral Cooperation under the Article 6 of the Paris Agreement”, or “Implementing Agreement to the Paris Agreement”.

Main benefits:

1. The agreement would **facilitate joint action to reduce greenhouse gas emissions**, will establish a standard for international climate projects, respecting strict safeguards for the environment as well as for human rights.
2. More importantly, this bilateral Agreement will **establish the legal basis for transferring reductions of greenhouse gases between the country signatories.** For example, if signed between Switzerland and Ukraine, from 2022 onwards it provides the foundation for enhanced Swiss investments in climate action in Ukraine.
3. The agreement would be mutually beneficial: Ukraine will benefit from accelerated low-carbon development with environmental and social benefits and it will allow Switzerland to implement its enhanced reduction ambition, as defined in its Nationally Determined Contribution under the Paris Agreement. The Paris Agreement sets conditions for the international transfer of mitigation outcomes. A set of criteria to ensure environmental integrity, the promotion of sustainable development and the respect of human rights would be defined in the Agreement.
4. Likewise, **the avoidance of double counting of internationally transferred mitigation outcomes (ITMOs) is at the heart of the bilateral Agreement**. At the same time, the Agreement ensures that the investments under Article 6 are additional to international climate finance.
("Corresponding Adjustment'' is an element in the reporting under the Paris Agreement ensuring avoidance of double counting of ITMOs, implementing Articles 4.13, 6.2, and 13.7.b of the Paris Agreement)
5. Finally, **commonly agreed monitoring and verification procedures will ensure that the ITMOs are real and additional** to any that would otherwise occur.

Phase 2 – Identify the best project to consider (from practice, technology and soil perspective)

Carbon farming is a broad set of agricultural practices across a variety of farm types that result in increased storage of atmospheric carbon in the soil.

Many of these practices are common in organic farming, regenerative agriculture, permaculture, and other approaches to food production. When plants photosynthesize, they remove carbon dioxide from the atmosphere and store it. When they die, this carbon is either released back into the atmosphere or it is stored for long periods of time in the soil.

Many conventional agriculture practices result in the release of carbon, while practices classified under carbon farming aim to do the opposite.

Some projects we can select with farmers in Ukraine include:

- Leftover biomass is returned to the soil as mulch after harvest instead of being removed or burned.
- Conventional tillage practices are replaced by conservation tillage, no till, and/or mulch farming.
- Cover crops are grown during the off-season instead of leaving croplands bare.
- Continuous monocultures are replaced by high diversity crop rotations and integrated farming practices.
- Intensive use of chemical fertilizers is replaced by integrated nutrient management and precision farming.
- Intensive cropping is replaced by croplands integrated with trees and livestock.
- Surface flood irrigation is replaced by drip, furrow, or sub-irrigation.
- The indiscriminate use of pesticides is replaced by integrated pest management techniques.
- Marginal and degraded soils are restored to their natural states instead of being used as cropland.

Many of these practices can be used in combination with one another or applied one at a time.

Almost all croplands can be improved with these practices and more. We have the science and technology; the real barriers to changing our agricultural system are economic, social, and political barriers.

Group	Mitigation actions
Land Use	Conversion of arable land to grassland to sequester SOC
	New agroforestry
	Wetland/peatland conservation/restoration
	Woodland planting
	Preventing deforestation and removal of farmland trees
	Management of existing woodland, hedgerows, woody buffer strips and farmland trees
Cropland Management	Improved crop rotations
	Reduced and minimum tillage
	Leaving crop residues on the soil surface
	Ceasing to burn crop residues and vegetation
	Use of cover/catch crops
	Livestock health management
	Use of sexed semen for breeding dairy replacements

Livestock Management	Choosing breeds with lower methane emissions
	Feed additives for ruminant diets
	Optimised feeding strategies for livestock
Nutrient and Soil management	Soil and nutrient management plans
	Improved nitrogen efficiency
	Biological N fixation in rotations and in grass mixes
	Improved on-farm energy efficiency

<u>Phase 3 - Determine if the economics are right for the farmer</u>

Costs and potential revenue will vary between carbon farming projects and depend on the size, location, and complexity of your project.

<u>Costs to running a carbon farming project</u>.

A carbon farming project involves costs incurred at different stages:

• Planning and establishment costs (including professional advice and applications)

• Ongoing project compliance and maintenance, reporting and auditing

• The cost of your time running the project

• The opportunity cost of the land used by the project.

<u>Potential revenue</u>

The direct revenue from participating in carbon markets depends on how many credits the project generates, and at what price these are sold. Indirect revenue may be generated through improved agricultural productivity.

The number of carbon credits a project can generate depends on the method used, and a number of other factors including location, soil type and rainfall.

<u>Estimating carbon potential</u>

Online tools are available to help estimate the carbon sequestration potential of the project. Also, there are consultants who can do an independent carbon assessment using these and other tools.

It is possible to sell carbon credits to the voluntary (non-ERF) market, subject to the requirements and methodologies of carbon schemes, such as Verified Carbon Standard or Gold Standard.

<u>Carbon farming co-benefits</u>

A carbon farming project can also deliver a range of additional, positive benefits or 'co-benefits" for the farm. The co-benefits generated will depend on the type of carbon farming activities and the nature of your farming enterprise. Farm co-benefits include:

- improving soil quality
- providing habitat for birds, pollinators, and other wildlife
- providing shade and windbreaks to protect stock
- alleviating dryland salinity through water table effects
- improving fertilizer use efficiency
- improving the amenity and aesthetics of the local environmentt

<u>**Phase 4: Understand the options available for funding**</u>

It means understanding which funding streams (if any) are available.

In European Union, Carbon farming initiatives can be financed via the Common Agricultural Policy, other public funding instruments such as State aid, private initiatives linked to carbon markets, or through a combination of these funding options.

The Commission also offers financial support for pilot initiatives on carbon farming through the LIFE programme and the European Regional Development Fund, among others.

LIFE Carbon Farming Scheme (LIFE programme)

The goal of the project is to identify and accelerate the development and adoption of novel incentives for carbon sequestration and the increase and maintenance of the organic carbon stock in soil and biomass in Europe. With the aim of promoting a well-functioning voluntary carbon market, the project will uncover the key factors in supply and demand measures to invite the private sector to accelerate climate action. The results of the project will feed into the development of the EU agricultural and climate policies.

INTERREG Carbon Farming project (European Regional Development Fund)

The project aims at mitigating climate change whilst improving agricultural soils, by implementing carbon sequestration techniques on the farm. It focuses not only on carbon sequestration, but also facilitates collaboration between farmers and interested parties, in- and outside the food chain.

<u>Ukrainian concept</u>

One factor that distinguishes carbon-based farming schemes from the more well-established result-based biodiversity schemes is the potential for the scheme to be funded by the carbon market.

The majority of the non-EU schemes derive their funding from the ability to sell carbon credits on either the compliance or voluntary markets. Credits are issued by a registry after the results are monitored and verified. The credits can be sold either as fungible emissions offset credits or (non-tradeable) emissions reduction certificates.

These funding methods have the obvious benefits that the costs of mitigation are borne by a party other than the scheme designer and operator (e.g., by credit/certificate buyers).

Switzerland, among few others, could be a partner also for funding purposes.

Why?

Peru, Ghana, Senegal, Georgia, Vanuatu, and Dominica each signed carbon trading plans with Switzerland that will provide frameworks for them to produce verifiable carbon reduction credits that the Swiss will purchase and use as part of meeting their emissions reduction obligations under their nationally determined contribution (NDC). Some of the agreements were signed prior to COP26, and others were inked at the climate meeting.

The use of these credits—in which carbon reduction is carried out in a least-cost manner anywhere in the world and then used to offset emissions generated somewhere else—could remove an additional 5 billion metric tons/year of CO2 by 2030, according to a study from the International Emissions Trading Association (IETA).

Switzerland's program

Switzerland's NDC, updated in September 2021, makes an explicit connection between its environmental goals and the use of Article 6 credits.

The country raised its commitment to reducing GHG emissions "by at least 50%" below 1990 levels by 2030 and net zero by 2050. It also states that "internationally transferred mitigation outcomes (ITMOs) from cooperation with Article 6 of the Paris Agreement will partly be used." By law, Switzerland limited itself to using ITMOs for no more than 25% of its GHG cuts, and it also committed to using offsets to compensate for the emissions of imported goods, which countries typically do not consider part of their NDC.

The nations generating credits are known as "**transferring countries**" because they are transferring carbon reduction credits to another nation. Ukraine, in case, would be one of them.

The agreements signed by the parties demonstrate that the Article 6.2 framework can be enacted and operated in a transparent way.

The Paris Agreement laid out a model in Article 6.2 that Ukraine can adopt, and Switzerland made it clear several years ago that it would pursue bilateral agreements on the Article 6 principles. It's the first country to run with that model and actually sign agreements, but **Japan and Sweden have announced intentions to set up programs along similar lines.**

Countries like Ukraine will need long-term cooperation on emissions reductions, regardless of Article 6. There is enough guidance in Article 6.2 already, and the Swiss example is a manifestation of that fact.

Principles to follow

The single-most important aspect of the Swiss deals is that they have safeguards to ensure that credits are not double-counted. In other words, after a credit is generated and transferred to Switzerland, it will be retired by both countries and cannot be used again. Should there be any evidence of double-counting or other violations, Switzerland will not be able to claim any emissions reductions.

Many nongovernmental organizations support these types of voluntary carbon market programs, but they are wary about how they are managed. In addition to avoidance of double-counting, there are (at least) three other principles by which these programs must be guided:

1. Using carbon markets to further mitigation goals should only happen once the buyer country has an NDC that is aligned with the 1.5-degree trajectory
2. These transactions would likely lead to cost savings for the buyer country. These savings must be reinvested in climate action
3. These bilateral agreements must observe the highest social and environmental standards in all of the host countries ... and get credits only from highly valuable projects.

Partnerships

It is not always possible to develop the full range of institutional capacities needed to design and run a successful scheme within one organisation, and most of the schemes reviewed have been developed by partnerships.

Projects aimed at setting up a result-based carbon farming schemes should seek to involve several parties that fulfil complementary roles:

- an organisation that takes responsibility of the overall coordination of the project;
- an advisory branch that recruits farmers and accompanies them in developing the management strategy for their farm;
- an auditing / monitoring branch that takes the samples and monitors the results;
- a scientific partner that provides guidance on the use of appropriate sampling protocols and supporting potential estimates;
- one or more funding partners that provide funding for project development, and depending on the payment scheme, also the financing for farm payments;
- advisory parties to the project (for example, farmers' groups or environmental stakeholders).

Phase 5 - Developing and running the MRV system

Developing and running the MRV system is likely to be the biggest single cost for a result-based carbon farming scheme. The greater the degree of precision required, the greater the cost is likely to be.

Developing a system of MRV from scratch can be costly, depending on the amount of research needed. If no proven indicators exist, then there is also a risk that this will not be possible. In these cases, it would be sensible to keep open the possibility of developing an action-based scheme instead.

Monitoring, reporting, and auditing are all likely to require substantial funding throughout the life of the scheme. If an external verifying authority is involved in the maudit, then their costs also need to be considered.

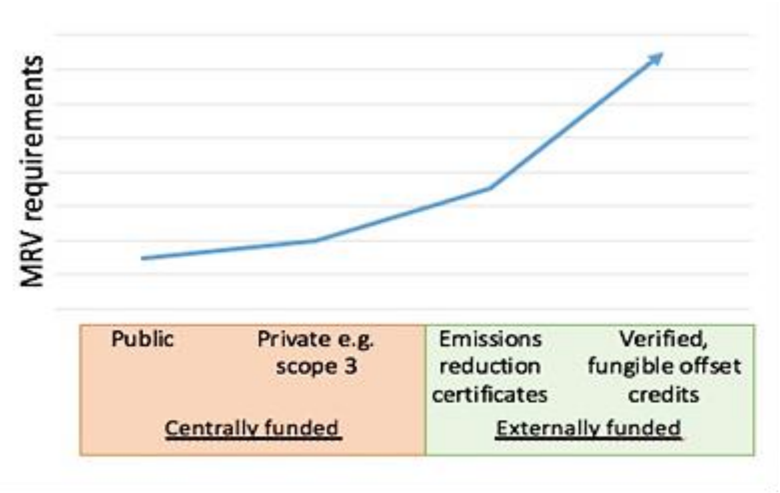
As an example, the costs of compliance with the Gold Standard system are the following (indicative):

Item	**Amount**	**Comments**
Methodology approval (new method	€50,000	Takes about 5 months
Methodology (existing method, previously approved elsewhere)	€7,500	Takes about 2 months
Certification (desk review)	€5,000	
Certification (audit)	€30-40,000	
Verification	€30-40,000	Required within two years of the start of the project and then every five years
Verification review	€1,500	
Registry – opening account	€1,000	
Registry - charge per credit sold	€0.30	

The requirements for fungible emissions offset credits are extremely stringent. The 'Gold Standard' offset management system, for example, requires scheme developers to first have their methodology approved , then obtain a scheme certification from an independent reviewer and finally to submit to regular cycles of third-party verification.

The requirements for voluntary emission reduction credits can be rather less stringent. The requirements for private company supply chain and publicly funded schemes are at the discretion of the body developing the scheme, but are usually rather more relaxed.

Generally, it can be concluded that MRV requirements are higher the greater the distance between the regulator of carbon removals/reductions (the scheme administrator) and the user (the purchaser or funder).



Other set-up costs

Apart from the cost of developing and testing the MRV system and recruiting and paying the development team, there are many other aspects of scheme development that will need to be budgeted for.

- baseline setting;
- training; publicity and media management;
- production of guidance material, handbooks and manuals for those participating in and running the scheme.

For larger schemes with complex system of cross-checks and land eligibility rules, bespoke IT systems may be needed to run them.
The development costs of such systems can be very high. Off-the-peg systems are available, but great care is needed when assessing their suitability for a particular scheme.

Other running costs

The most obvious running cost is that of rewarding farmers for the GHG emission reductions or carbon sequestration that they achieve through their management.

The cost of the management, and hence the cost of the reward, can vary greatly. With some forms of carbon farming, especially those focusing on resource efficiency or improvements to livestock management, there may be productivity benefits and the additional cost may be small, or even negative. In other cases, it can be substantial.

Peatland re-wetting and restoration is an example. Peatland restoration costs differ significantly between the restoration of upland peatland (around €4,900/ha on average) and lowland peatland (around €6,240/ha), but farmers may suffer a continuing loss of income (i.e. an opportunity cost) too, especially if the re-wetting makes the land ineligible for direct payments.

Aside from payments to farmers, staff costs and the cost of contractors are also likely to be substantial. Finally, there are likely to be other ongoing costs including those for administration, IT and communication.

Supply chain financing or value chain financing

Opportunities to apply this type of financing arise when a **commercial organisation, usually in the food processing or retailing sectors, wants to take measures to reduce the carbon footprint of its products**.

Some of the GHG emissions comprising that footprint will arise directly from the organisation's activities, but other emissions will arise indirectly from the actions of its suppliers (e.g. farmers). The latter are sometimes referred to as a company's "scope 3" emissions. Financing a carbon farming scheme for its suppliers is one way for the organisation to reduce its carbon footprint.

An example is the example is the Coop support programme for agroforestry in Switzerland.

This scheme has been set up by the Swiss food retailer Coop to encourage agricultural businesses in its supply chain to plant and care for trees on their arable and pastureland. The focus is on timber and wild fruit trees (e.g. walnut, oak, wild pear, and sweet chestnut) that can be planted in combination with standard fruit trees.

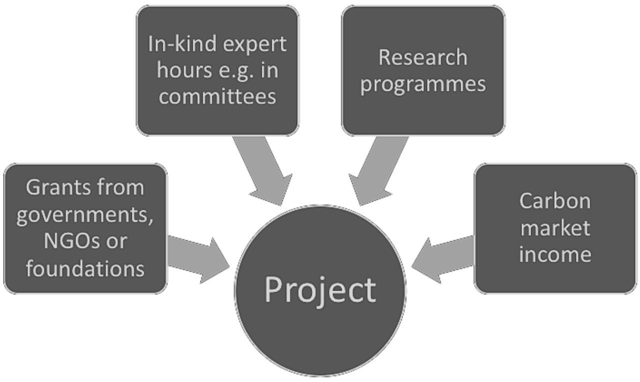
Participating farmers receive free advice on the choice, location, and regular care of the trees, and receive a payment of CHF 75 per tree (for a minimum of 20 trees per farm). Payments are additional to any other form of agricultural support.

The aim is to provide emission reductions of 4,500 t CO2/yr over 50 years, which are accounted exclusively to the Coop climate protection project. It uses the independent *myclimate* foundation to validate commitments made and provide oversight.

Combining different sources of financing

Even if the aim is to develop a scheme that, once set up, can be funded from the sale of carbon credits, it may be necessary to consider multiple sources of funding to cover all costs. In particular, **covering upfront development costs may require additional sources of funding**, as these can be significant.

This could be a scheme →



Phase 6 - Establishing the payment

At this point, it is fundamental to understand how payments can be determined and looks especially at the extent to which payments may be influenced by the co-benefits that a carbon farming scheme produces.

Most schemes analysed in this study generate income through selling the achieved emission reductions /removal enhancements (credits worth one metric tonne of carbon dioxide equivalent - mtCO2eq). The prices obtained can be determined by markets, set through negotiation or fixed in advance.

Market-based reward determination

The price that project developers can attain varies greatly. As already mentioned, whether credits are sold in compliance or voluntary markets has a major impact on the prices. In addition, the expected rise in demand for carbon removals from international airlines after the recognition of REDD+ and similar approaches in the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) will certainly have an impact on prices.

In 2019, prices for Land Use and Forestry credits in the voluntary markets ranged from USD 0.5 to more than USD 50 per mtCO2eq with an average price of USD 4.3 per mtCO2eq. In total, global issuance of credits in the Forest and Land Use segment amounted to 159 million USD. The most relevant compliance markets for the schemes included in this study however achieved carbon prices between USD 6 and USD 13 per mtCO2eq.

The prices obtained in the compliance market will depend to a significant extent on the balance between supply and demand. National and regional governments and supranational bodies such as the EU have a key role in determining this balance through the compliance requirements that they impose on organisations operating within their authority. Policy makers can either decide to impose stronger caps or change the percentage of allowance that can be offset. Market participants are

typically only allowed to offset a certain share of their allowance, as most policy makers would like to encourage them to reduce their own emissions, as well as buying offsets.
Imposing a stronger cap on emissions but maintaining or increasing the percentage that can be offset, should have the effect of increasing the market price of carbon credits on the compliance market.

The prices obtained on voluntary markets have been much lower than on compliance markets, but there is more opportunity to boost both demand and prices by factoring in co-benefits.

The research done for this study suggests that for many types of result-based carbon farming schemes, markets alone are unlikely to generate sufficient returns to fully reward farmers and cover the cost of project development.
In most schemes that aim to sell carbon credits in the markets, the scheme shields individual farmers from at least some of the complexities of carbon credit trading.

Three approaches have been found in schemes focussing on peatland restoration and rewetting and maintaining and enhancing SOC in mineral soils (perhaps the most promising options for Ukraine).

Scheme platform – The scheme operates an exclusive sale platform, selling the credits generated from different projects to different customers. This approach is used by Moor Futures, which assembles batches of credits from individual peatland restoration projects and offers them for sale at a price reflecting the cost of delivery for that project.

Intermediary driven – Individual project developers or credit off-takers help to develop the project and cover early phase costs, while securing the mandate and right to market and sell credits when these are issued. In this decentralised system, the scheme may operate a registry to help keep track of the credits, but the responsibility for ensuring their integrity is delegated. This approach has been used by the max.moor and Peatland Code schemes.

Exchange based – Under this approach, project developers from different schemes use a central registry and issuer to keep track of uniquely identified credits, which can be traded between buyers. This approach is applied by the Green Deal scheme in the Netherlands and allows for aggregation and selling of credits from many different sectors alongside peatland restoration.

Model	**Examples**	**Strengths**	**Weaknesses**
Scheme platform	MoorFutures	If demand is strong, this allows for better price premium. Also, for farmers an all- serving scheme organization eases administration and reduces transaction costs.	Only one marketing channel and weak pricing influence. Would not meet VCS, CDM, JI or EU-ETS standards for independency. Difficult to grow scheme as it is entirely dependent on willing and able experts.
Intermediary driven	Peatland Code and max.moor	Flexible setup, with reduced centralized costs of operating the scheme. Model creates opportunities for experts and businesses, thus it is easier to scale and grow.	Almost all landowners will have to contract advisers, developers and manage this work. More contracts and legal arrangements are necessary.

Exchange based	The Dutch Green Deal scheme	Transparent price setting and national level cost effectiveness. Performs better with increasing scale and allows for transparent price setting.	Limited or no opportunity to ensure price premium for co- benefits. Typical peatland credit development cost levels cannot compete with Energy Efficiency or other industrial credits. Depending on scheme and exchange rules, project aggregation may be difficult and create costly project preparation, including contracts and legal arrangements.

Non-market-based reward determination – reverse auctions

For result-based carbon farming, the distinction between market and non-market schemes is not entirely clear, as all such schemes involve a reward given in return for a defined product.

However, in this context, it is taken to mean cases where governments or other public bodies are directly purchasing carbon credits (e.g. to meet national emission reduction targets).

One approach sometimes taken to determine the rewards payable to farmers is through reverse auction, which allows governments or regulators to purchase GHG sequestration/reductions at the lowest price.

A problem found with this approach in other contexts is that encouraging competition on price alone can lead those bidding to take short cuts on quality, so it is important that bids are only accepted from projects that can demonstrate that their protocols meet the required standard to ensure the integrity of their credits and the absence of negative externalities.

Payments based on costs

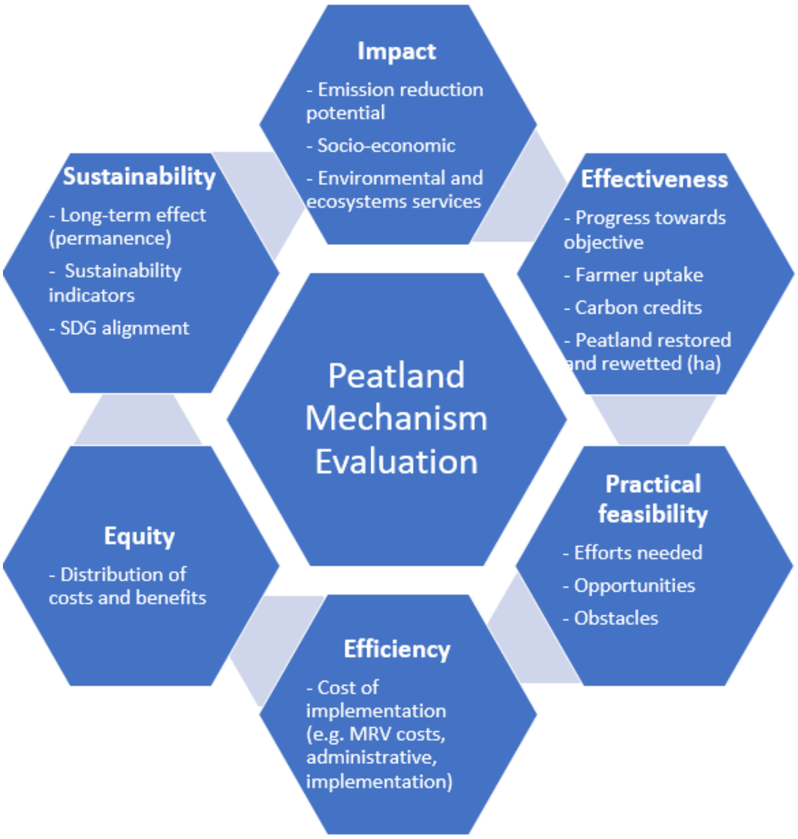
An alternative approach is to determine the level of reward based on costs.

The EU environmental land management payments made through the CAP have been set using the principle that payments to farmers should cover the costs they incur and any income they forgo (or their opportunity costs) and can include the farmer's transaction costs.

This method of determining payments is accepted by the World Trade Organisation (WTO) as non-trade distorting and so qualifies the payments made as 'green box' under the state aid rules. Considerable flexibility is possible when determining payments using this method. In the case of CAP result-based payments, the level of reward can be based on assumed cost of achieving a specific level of result indicator, while considering MRV costs borne by the farmer as transaction costs.

The CAP is an obvious source of non-market funding for result-based (and action based) carbon farming schemes.

29. WRAP UP CARBON FARMING CONCEPT – Peatland case/example



Scheme design

The design of the scheme is likely to be the most crucial factor in securing and retaining farmer participation.

Flexibility is a major potential advantage of 'pure' result-based schemes. Unlike in action-based schemes, there is no need to specify the actions that farmers should and should not be taking, nor is there a need for intrusive systems of control and verification of these actions.

However, if ex-ante rewards are also to be offered, this will involve some departure from a pure result-based approach.

Features of a result-based carbon farming scheme to encourage and retain farmer participation

Early recognition of efforts. It takes a long time before results can be verified. For this reason, it is important to recognize, and award, the efforts made by the farmers. The scheme should reward farmers not only for concrete results, but also for taking the decision to change towards enhanced agri-environmental practices, as well as for the actions and management changes before the desired end result can be verified.
Simple plans and agreements. Plans prepared as part of contracts with farmers should be visual and simple, relevant, and compelling.
Simple reporting requirements. Reporting should not be an excessive administrative burden for the farmers, though they should have some involvement in it.
Flexibility of approach. Giving farmers the freedom to choose the most appropriate management and changes of practice when deciding how to reach agreed climate mitigation and wider sustainability results.
Free advice. Free access to advisory services from an authoritative and trusted adviser, but this must be advice, not direction. The farmer must still feel in charge.

A **supportive ministry or agency**. Farmers need to be assured that participation in the scheme will not prejudice other forms of agricultural support or put them in breach of any rules or regulations.
Systems that reinforce trust and reliability. Any system of penalties that is necessary to ensure compliance and prevent abuse of the scheme needs to be seen to be fair and to be fairly applied. An appeal scheme may be needed to resolve disputes. Administrative systems also need to be robust and reliable, ensuring that farmers receive timely and accurate payments.

Learning from existing projects and methodologies:

1. **Overcoming farmer resistance adopting new agroforestry**
2. **Improving policy awareness of the significance of existing, traditional agroforestry systems**
3. **Improving institutional co-operation on policy and capacity to support the development of agroforestry**
4. **Learning from existing projects:** scheme designers should draw on experience from ongoing initiatives and projects (e.g., UNDP in Ghana?)
5. **Eligibility**
6. **Farmer engagement and advisory support**
7. **Additionality**
8. **Result indicators**
9. **Reward**
10. **Governance**

SUMMARY - Recommended scheme for maintaining and enhancing SOC in Mineral Soils

Objective: Incentivise increases in SOC stocks while ensuring that the overall GHG balance is improved as well.

Scale/coverage: arable land, grassland, horticultural use, or permanent crops on any type of farm, with the provision that all applicable land on the farm is included in the scheme.

Climate actions: actions that maintain and increase SOC levels and benefit soil health

Overarching considerations: (1) the selection of monitoring, reporting and valuation (MRV) approach (measurement or estimate) and (2) the acceptable level of environmental uncertainty.

Scheme types and governance: Existing schemes can be grouped in four main types:

1. Scheme where farmers are offered a menu of measures from which to choose, but where payments are calculated based on the expected result of the measure rather than the income foregone or additional costs. At the same time, monitoring of SOC levels is done on a subsample of farms so that the overall project impact and measure impact can be estimated. This is a learning-by-doing approach, where experience is gathered on results aspects.

2. Hybrid scheme: where farmers are paid up-front with a guaranteed payment (thus acting similarly to an action-based payment), the monitoring is done at regular intervals, and the farmers receive a top-up at the end of the commitment period which rewards the difference between the upfront payment and the total result.

3. Certified credits or pure result-based schemes: where farmers are paid solely for the measured or estimated result in changes in SOC levels on an ex-post basis.

4. Company efforts as part of reducing carbon footprint in supply chains

The governance and **MRV requirements** vary across these schemes.

Monitoring, reporting and valuation (MRV): Farm-level monitoring quantifies improvements in SOC levels (tCO2eq) as a minimum; mechanisms should demonstrate steps taken to quantify the full GHG balance associated with soil management (i.e. GHG emissions associated with tillage or fertiliser application are accounted for) since SOC sequestration also has an emission component to it.

Typical project steps include:

> **Step 1**: Baseline level of SOC on the farm is established via sampling and/or calculation that is sufficiently robust. There is strong preference for sampling and where calculation approaches are used, these should be robustly ground trothed;
>
> **Step 2**: Farm advisers/consultants assist farmers to identify management actions to maintain/enhance SOC levels and develop a SOC management strategy for the project period as a minimum;
>
> **Step 3**: Farmers implement the actions and keep records;
>
> **Step 4**: Farms are visited by farm advisers in selected intervals (a minimum one time during the project); a second sampling is conducted; an evaluation discussion takes place to adjust management if needed; a payment is issued depending on the sequestration that has occurred; or a second guarantee payment is issued;
>
> **Step 5**: At the end of the project duration, a final measurement takes place;
>
> **Step 6**: Farmer commits to maintaining the levels for a minimum of 5 years after receiving the last payment. To buffer against short commitment periods, discounting and buffers are applied. Schemes should strive to increase the commitment period to at least 10 – 15 years and include robust buffers.

Rewards: Farmers are rewarded at a set rate of € per tonne of sequestered carbon, as long as they meet eligibility criteria. To reduce the risk for farmers and increase the rates of uptake, a hybrid model may be necessary, whereby farmers are paid for management changes topped up with a bonus for amount of t CO2eq sequestered.

Design principles: 1) *reduce MRV costs* while maintaining robustness (2) *shift costs away from farmers* (to maximise farmer uptake and decrease overall scheme costs); *learning-by-doing* through refinement of MRV as improved or more cost-efficient methods become available.

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Annex 1 – Carbon Markets Initiatives in the World

Data last updated April, 01 2021

Note: Carbon pricing initiatives are considered "scheduled for implementation" once they have been formally adopted through legislation and have an official, planned start date. Carbon pricing initiatives are considered “under consideration” if the government has announced its intention to work towards the implementation of a carbon pricing initiative and this has been formally confirmed by official government sources. Jurisdictions that only mention carbon pricing in their NDCs are not included as different interpretations of the NDC text are possible. The carbon pricing initiatives have been classified in ETSs and carbon taxes according to how they operate technically. ETS does not only refer to cap-and-trade systems, but also baseline-and-credit systems such as in British Columbia. However, systems operating like a baseline-and-offsets program, such as Australia Safeguard Mechanism, fall outside the scope of the definition of ETS. Carbon pricing has evolved over the years and initiatives do not necessarily follow the two categories in a strict sense. Due to the dynamic approach to continuously improve data quality, changes to the map do not only reflect new developments, but also corrections following new information from official government sources.

Name of the initiative	Type	Status	Type of juridiction covered	Jurisdiction covered	World Bank region	Year Start	Year End	GHGs covered [MtCO2e]	Proportion of global GHG emissions covered	Government income, previous year	Value [billion US$]
Alberta TIER	ETS	Implemented	Subnational	Alberta	North America	2007	0	153.87512	0.002840319	0.341225627	2.783371811
Argentina carbon tax	Carbon tax	Implemented	National	Argentina	Latin America and the Cari	2018	0	88.1248	0.00162666	0.000488279	0.180258345
Austria carbon tax	Carbon tax	Under consideration	National	Austria	Europe and Central Asia	2022	0	N/A	N/A	N/A	0
BC GGIRCA	ETS	Implemented	Subnational	British Columbia	North America	2016	0	0	0	N/A	0
BC carbon tax	Carbon tax	Implemented	Subnational	British Columbia	North America	2008	0	46.3749	0.000856016	1.265817748	1.374762505
Baja California carbon tax	Carbon tax	Implemented	Subnational	Baja California	Latin America and the Cari	2020	0	N/A	N/A	N/A	0
Beijing pilot ETS	ETS	Implemented	Subnational	Beijing	East Asia & Pacific	2013	0	69.65343	0.001285704	0	0.610211026
Brazil undecided	Undecided	Under consideration	National	Brazil	Latin America and the Cari	TBC	0	N/A	N/A	N/A	0
Brunei undecided	Undecided	Under consideration	National	Brunei	East Asia & Pacific	TBC	0	N/A	N/A	N/A	0
California CaT	ETS	Implemented	Subnational	California	North America	2012	0	352.64	0.006509239	1.698315586	5.11326
Canada federal OBPS	ETS	Implemented	National	Canada	North America	2019	0	73.52361	0.001357143	0.203541584	0
Canada federal fuel charge	Carbon tax	Implemented	National	Canada	North America	2019	0	179.72438	0.00331746	3.406685237	3.010831877
Catalonia carbon tax	Carbon tax	Under consideration	Subnational	Catalonia	Europe and Central Asia	TBC	0	N/A	N/A	N/A	0
Chile ETS	ETS	Under consideration	National	Chile	Latin America and the Cari	TBC	0	N/A	N/A	N/A	0
Chile carbon tax	Carbon tax	Implemented	National	Chile	Latin America and the Cari	2017	0	58.10493	0.001072535	0.165	0.1655
China national ETS	ETS	Implemented	National	China	East Asia & Pacific	2021	0	3996.904164	0.073777236	N/A	0
Chongqing pilot ETS	ETS	Implemented	Subnational	Chongqing	East Asia & Pacific	2014	0	21.20448	0.000391405	0	0.530538721
Colombia ETS	ETS	Under consideration	National	Colombia	Latin America and the Cari	TBC	0	N/A	N/A	N/A	0
Colombia carbon tax	Carbon tax	Implemented	National	Colombia	Latin America and the Cari	2017	0	44.3532	0.000818698	0.029319679	0.116589315
Cote dIvoire carbon tax	Carbon tax	Under consideration	National	Cote dIvoire	Sub-Saharan Africa	TBC	0	N/A	N/A	N/A	0
Denmark carbon tax	Carbon tax	Implemented	National	Denmark	Europe and Central Asia	1992	0	22.0087	0.00040625	0.575428418	0.534777077
EU ETS	ETS	Implemented	Regional	EU, Norway, Iceland, L	Europe and Central Asia	2005	0	1725.77348	0.031855354	22.5476216	33.6623297
Estonia carbon tax	Carbon tax	Implemented	National	Estonia	Europe and Central Asia	2000	0	1.6059472	2.96E-05	0.001667932	0.00274603
Finland carbon tax	Carbon tax	Implemented	National	Finland	Europe and Central Asia	1990	0	40.29444	0.000743779	1.5246308	1.419629896
France carbon tax	Carbon tax	Implemented	National	France	Europe and Central Asia	2014	0	171.723904	0.003169782	9.63172	8.9675225
Fujian pilot ETS	ETS	Implemented	Subnational	Fujian	East Asia & Pacific	2016	0	76.008	0.001403001	0	0.256190096
Germany ETS	ETS	Implemented	National	Germany	Europe and Central Asia	2021	0	398.6204	0.007357973	N/A	0
Guangdong pilot ETS	ETS	Implemented	Subnational	Guangdong (except Sh	East Asia & Pacific	2013	0	163.30875	0.00301445	0.001716529	1.921109004
Hawaii carbon tax	Carbon tax	Under consideration	Subnational	Hawaii	North America	TBC	0	N/A	N/A	N/A	0
Hubei pilot ETS	ETS	Implemented	Subnational	Hubei	East Asia & Pacific	2014	0	138.37428	0.002554195	0.007506772	0.913140331
Iceland carbon tax	Carbon tax	Implemented	National	Iceland	Europe and Central Asia	2010	0	2.6158	4.83E-05	0.052695749	0.046959019
Indonesia carbon tax	Carbon tax	Scheduled	National	Indonesia	East Asia & Pacific	2022	0	N/A		N/A	0
Indonesia ETS	ETS	Under consideration	National	Indonesia	East Asia & Pacific	TBC	0	N/A	N/A	N/A	0
Ireland carbon tax	Carbon tax	Implemented	National	Ireland	Europe and Central Asia	2010	0	32.16115	0.00059365	0.5802524	0.579608162
Israel carbon tax	Carbon tax	Under consideration	National	Israel	Europe and Central Asia	TBC	0	N/A	N/A	N/A	0
Jalisco carbon tax	Carbon tax	Under consideration	Subnational	Jalisco	Latin America and the Cari	TBC	0	N/A	N/A	N/A	0
Japan carbon pricing mecha	ETS	Under consideration	National	Japan	East Asia & Pacific	TBC	0	N/A	N/A	N/A	0
Japan carbon tax	Carbon tax	Implemented	National	Japan	East Asia & Pacific	2012	0	1008.9135	0.018623126	2.364834371	2.438185863
Kazakhstan ETS	ETS	Implemented	National	Kazakhstan	Europe and Central Asia	2013	0	156.52129	0.002889163	0	0.180217114
Korea ETS	ETS	Implemented	National	Korea, Republic of	East Asia & Pacific	2015	0	513.41955	0.009477004	0.21923009	17.9672244
Latvia carbon tax	Carbon tax	Implemented	National	Latvia	Europe and Central Asia	2004	0	0.53556	9.89E-06	0.005000272	0.018120264
Liechtenstein carbon tax	Carbon tax	Implemented	National	Liechtenstein	Europe and Central Asia	2008	0	0.054184	1.00E-06	0.00635273	0.002082039
Luxembourg carbon tax	Carbon tax	Implemented	National	Luxembourg	Europe and Central Asia	2021	0	7.03365	0.000129831	N/A	0
Malaysia ETS	ETS	Under consideration	National	Malaysia	East Asia & Pacific	TBC	0	N/A	N/A	N/A	0
Manitoba ETS	ETS	Under consideration	Subnational	Manitoba	North America	TBC	0	N/A	N/A	N/A	0
Manitoba carbon tax	Carbon tax	Under consideration	Subnational	Manitoba	North America	TBC	0	N/A	N/A	N/A	0
Massachusetts ETS	ETS	Implemented	Subnational	RGGI	North America	2018	0	11.8849	0.000219379	0.01578	0.06968782
Mexico carbon tax	Carbon tax	Implemented	National	Mexico	Latin America and the Cari	2014	0	188.191055	0.003473743	0.229892368	0.254477281
Mexico pilot ETS	ETS	Implemented	National	Mexico	Latin America and the Cari	2020	0	328.718	0.006067673	N/A	0
Montenegro ETS	ETS	Under consideration	National	Montenegro	Europe and Central Asia	TBC	0	N/A	N/A	N/A	0
Netherlands carbon tax	Carbon tax	Implemented	National	Netherlands	Europe and Central Asia	2021	0	25.63644	0.000473213	EU ETS	0
New Brunswick ETS	ETS	Implemented	Subnational	New Brunswick	North America	2021	0	N/A	N/A	N/A	0
New Brunswick carbon tax	Carbon tax	Implemented	Subnational	New Brunswick	North America	2020	0	5.52318	0.00010195	0.098925587	0.068052327
New Zealand ETS	ETS	Implemented	National	New Zealand	East Asia & Pacific	2008	0	45.25383	0.000835322	0	0.480839591
Newfoundland and Labrador	ETS	Implemented	Subnational	Newfoundland and Lab	North America	2019	0	4.58767	8.47E-05	0	0
Newfoundland and Labrador	Carbon tax	Implemented	Subnational	Newfoundland and Lab	North America	2019	0	5.01443	9.26E-05	0.04643852	0.064347519
Northwest Territories carbo	Carbon tax	Implemented	Subnational	Northwest Territories	North America	2019	0	1.33273	2.46E-05	0.015089534	0.018384894
Norway carbon tax	Carbon tax	Implemented	National	Norway	Europe and Central Asia	1991	0	49.33104	0.000910582	1.758378397	1.45477404
Nova Scotia CaT	ETS	Implemented	Subnational	Nova Scotia	North America	2019	0	13.244	0.000244466	0.022839634	0
Ontario EPS	ETS	Scheduled	Subnational	Ontario	North America	TBC	0	N/A	N/A	N/A	0
Oregon ETS	ETS	Under consideration	Subnational	Oregon	North America	TBC	0	N/A	N/A	N/A	0
Pakistan ETS	ETS	Under consideration	National	Pakistan	South Asia	TBC	0	0			0
Pennsylvania ETS	ETS	Under consideration	Subnational	Pennsylvania	North America	TBC	0	N/A	N/A	N/A	0
Poland carbon tax	Carbon tax	Implemented	National	Poland	Europe and Central Asia	1990	0	16.103025	0.000297239	0.001181901	0.001117735
Portugal carbon tax	Carbon tax	Implemented	National	Portugal	Europe and Central Asia	2015	0	23.56424	0.000434963	0.276031	0.520365678
Prince Edward Island carbon	Carbon tax	Implemented	Subnational	Prince Edward Island	North America	2019	0	0.96936	1.79E-05	0.0103462	0.012121315
Quebec CaT	ETS	Implemented	Subnational	Quebec	North America	2013	0	60.90162	0.001124158	0.549064863	0.837522
RGGI	ETS	Implemented	Subnational	RGGI	North America	2009	0	160.263024	0.00295823	0.4163	0.448362
Saitama ETS	ETS	Implemented	Subnational	Saitama	East Asia & Pacific	2011	0	7.44	0.000137332	N/A	0.006587145
Sakhalin ETS	ETS	Under consideration	Subnational	Russia	Europe and Central Asia	TBC	0	N/A	N/A	N/A	0
Saskatchewan OBPS	ETS	Implemented	Subnational	Saskatchewan	North America	2019	0	8.65238	0.000159711	0	0
Senegal carbon tax	Carbon tax	Under consideration	National	Senegal	Sub-Saharan Africa	TBC	0	N/A	N/A	N/A	0
Serbia ETS	ETS	Under consideration	National	Serbia	Europe and Central Asia	TBC	0	N/A	N/A	N/A	0
Shanghai pilot ETS	ETS	Implemented	Subnational	Shanghai	East Asia & Pacific	2013	0	104.195	0.001923293	0.012849621	0.80088684
Shenyang ETS	ETS	Under consideration	Subnational	Shenyang	East Asia & Pacific	TBC	0	N/A	N/A	N/A	0
Shenzhen pilot ETS	ETS	Implemented	Subnational	Shenzhen	East Asia & Pacific	2013	0	24.38409	0.000450096	0.000404784	0.074993739
Singapore carbon tax	Carbon tax	Implemented	National	Singapore	East Asia & Pacific	2019	0	44.7824	0.00082662	0.143642305	0.134295162
Slovenia carbon tax	Carbon tax	Implemented	National	Slovenia	Europe and Central Asia	1996	0	10.645914	1.97E-04	0.14729484	0.080870257
South Africa carbon tax	Carbon tax	Implemented	National	South Africa	Sub-Saharan Africa	2019	0	512.248	0.009455379	0.043314417	0.097281635
Spain carbon tax	Carbon tax	Implemented	National	Spain	Europe and Central Asia	2014	0	9.22398	0.000170262	0.129206	0.120296034
Sweden carbon tax	Carbon tax	Implemented	National	Sweden	Europe and Central Asia	1991	0	44.1486629	0.000814922	2.283956265	2.295169193
Switzerland ETS	ETS	Implemented	National	Switzerland	Europe and Central Asia	2008	0	6.0415476	0.000111518	0.007716294	0.116563086
Switzerland carbon tax	Carbon tax	Implemented	National	Switzerland	Europe and Central Asia	2008	0	18.1246428	0.000334555	1.238835157	1.214004592
TCI-P ETS	ETS	Scheduled	Subnational	TCI	North America	TBC	0	N/A	N/A	N/A	0
Taiwan undecided	Undecided	Under consideration	Subnational	Taiwan	East Asia & Pacific	TBC	0	N/A	N/A	N/A	0
Tamaulipas carbon tax	Carbon tax	Implemented	Subnational	Tamaulipas	Latin America and the Cari	2021	0	N/A	N/A	N/A	0
Thailand ETS	ETS	Under consideration	National	Thailand	East Asia & Pacific	TBC	0	N/A	N/A	N/A	0
Tianjin pilot ETS	ETS	Implemented	Subnational	Tianjin	East Asia & Pacific	2013	0	53.757	0.000992279	0.008637429	0.464520504
Tokyo CaT	ETS	Implemented	Subnational	Tokyo	East Asia & Pacific	2010	0	13.18	0.000243284	N/A	0.010150587
Turkey ETS	ETS	Under consideration	National	Turkey	Europe and Central Asia	TBC	0	N/A	N/A	N/A	0
UK ETS	ETS	Implemented	National	United Kingdom	Europe and Central Asia	2021	0	192.426201	0.003551917	N/A	0
UK carbon price support	Carbon tax	Implemented	National	United Kingdom	Europe and Central Asia	2013	0	134.115231	0.002475579	0.94772	0.85218852
Ukraine ETS	ETS	Under consideration	National	Ukraine	Europe and Central Asia	TBC	0	N/A	N/A	N/A	0
Ukraine carbon tax	Carbon tax	Implemented	National	Ukraine	Europe and Central Asia	2011	0	221.58319	0.004090114	0.030847584	0.047692308
Uruguay carbon tax	Carbon tax	Under consideration	National	Uruguay	Latin America and the Cari	TBC	0	N/A	N/A	N/A	0
Vietnam ETS	ETS	Under consideration	National	Vietnam	East Asia & Pacific	TBC	0	N/A	N/A	N/A	0
Virginia ETS	ETS	Implemented	Subnational	Virginia	North America	2020	2021	0	N/A	N/A	0
Washington ETS	ETS	Scheduled	Subnational	Washington	North America	TBC	0	65.861	N/A	N/A	0
Zacatecas carbon tax	Carbon tax	Implemented	Subnational	Zacatecas	Latin America and the Cari	2017	0	N/A	N/A	N/A	0