Agribusiness Executive Briefing:

An Introduction to Carbon Markets, Carbon Credits and Environmental Attributes

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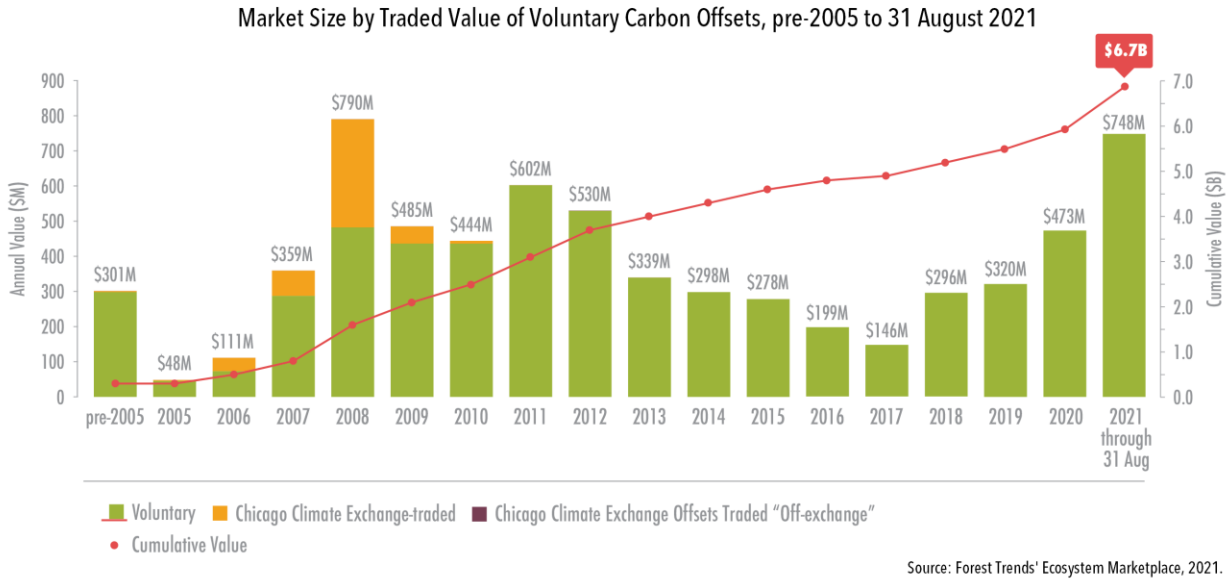
Preface/Introduction

Rapidly evolving carbon markets, global and local, present opportunities and challenges for the commodity and value-added/direct-to-market farming enterprises. On one hand, effective management of a commodity's carbon footprint enhances the value of that commodity without altering its physical characteristics. On the other hand, should carbon management practices and regulation meet the expectations of investors, executives and customers, carbon offsets resulting from farming activities may soon become tradable commodities all unto themselves, assuming they gain and retain the trust of the market. One of the keys to market success will the transparency, ease, effectiveness, and liquidity of carbon monetization.

The evolution has begun, but all stakeholders should understand, this market has much room to improve and grow. Yet, if recently developments are any indicator, the stakeholders in the carbon market are cautiously optimistic that lessons have been learned from past efforts/ mistakes. The improved understanding of the benefits from sustainable practices are forming a more structurally sound and resilient marketplace.



Source: Forest Trends' Ecosystem Marketplace, 2021.

This publication attempts to provide the reader a general understanding of the fundamentals underlying the current carbon market, the various carbon products, regulations, trading regimes and relevance of this market to agricultural producers, processors, and stakeholders. Natural climate solution "tools" are only as effective as they are understandable to those who would design, develop, and deploy – that is, the landowner, the farmer, and the forester. Hopefully, this publication contributes to that understanding.

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Fundamentals of Carbon Markets

Carbon Footprint; Environmental Attributes & Carbon Credits; and Carbon Offsets

The relevance and role of sustainability metrics is increasingly influencing corporate and institutional behaviors. Investment, credit, risk management, business-to-business and business-to-customer markets are all recognizing the impact of broad-based demands for reliable and accurate sustainability metrics. Consideration of product and service environmental attributes have seemingly crossed from niche markets (regulated and compliance driven sectors) to a more generally accepted and expected aspect of purchasing and investing practices.

Still, many decision-makers are only beginning to appreciate the scope and scale of the potential impacts of integrating greenhouse gas (GHG) considerations into their management efforts. One key aspect is understanding the terminology of carbon markets. This executive briefing seeks to provide insight into the most basic definitions and highlight the relevance of such metrics for management considerations.

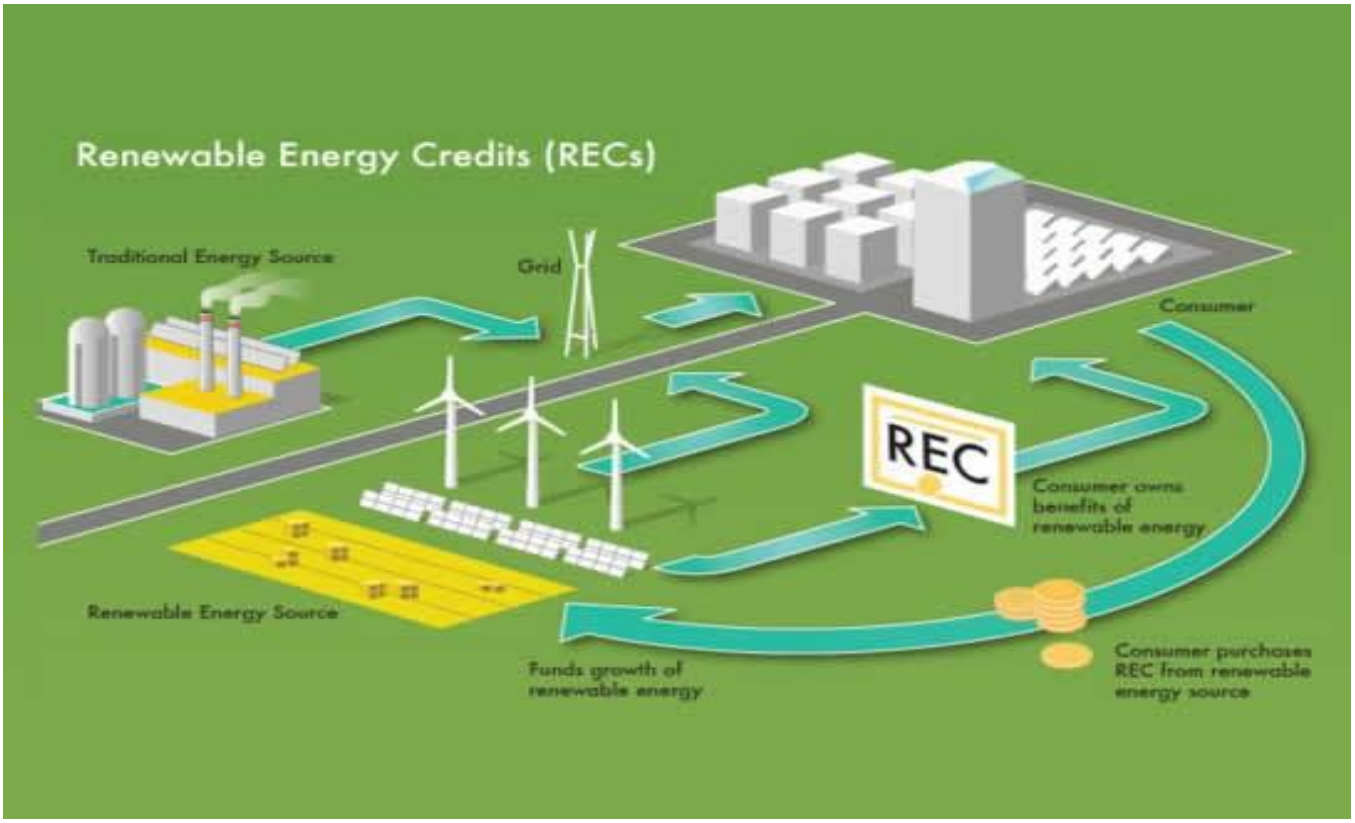
What Are Carbon Markets and Who Are Carbon Customers?

Carbon markets are conventionally described as either regulated (obligated) or voluntary. Regulated markets are populated by companies and organizations that generate either point-source emissions (from a specific location or series of locations) or contribute emissions through the use of their products, such as fossil transportation fuels. Voluntary markets are companies, organizations or individuals who seek to reduce their carbon footprint through practices or through purchase of carbon offsets generated by others. As national and international climate regulations develop and evolve, these market distinctions may no longer remain so distinct. However, given the current climate regulatory regimes in the United States, the regulated versus voluntary distinction holds and remains relevant to management considerations.

Regulated Carbon Markets

The **electric generation and distribution utility industry** has longest experience with "carbon" regulation. Requirements placed upon the power sector have not historically been tied directly to GHG emissions, but rather on the mix of renewable energy the utilities distribute and sell to their customers. These regulations are typically labeled "Renewable Portfolio Standards (RPS). State regulations, combining both statutory and administrative rules, define these markets and the obligated parties which must comply with the RPS.

Under a State RPS, the obligated party (OP) must demonstrate that it has generated or purchased Renewable Energy Certificates (REC) equal to the level prescribed in the regulation. A REC is typically equivalent to 1.0 megawatt hour (mWh) of renewable energy. In Wisconsin, the RPS on OPs is 10%. If a power generator produces more RECs than the utility (OP) requires, the utility may sell these RECs to other OPs or into the voluntary market.

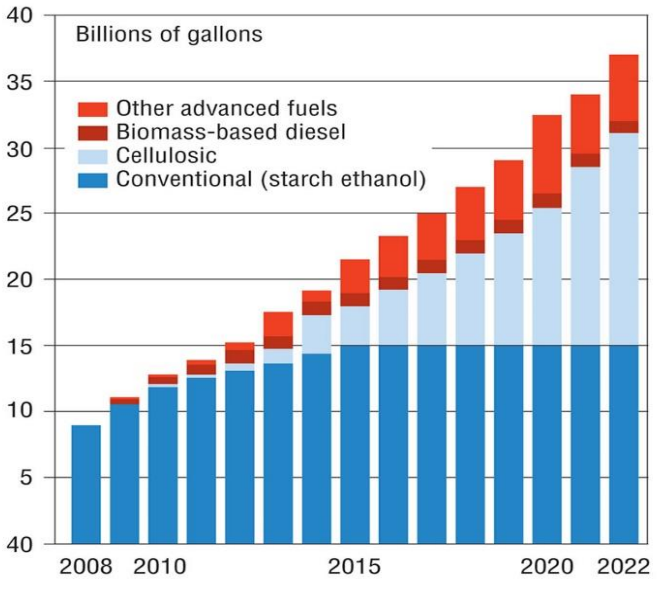


Source: PV Education

Transportation fuel manufacturers are also obligated parties (OPs). This sector is regulated by the U.S. EPA, and in some cases by States, too. The Federal Renewable Fuel Standard II requires that prescribed volumes of alternative (non-fossil hydrocarbon) fuels are included in each OP's annual distribution of fuels. Under theses Federal regulations, OPs must purchase a prescribed number of "Renewable Identification Number (RIN)" equivalents each year based upon the volume of fuels distributed by the company.

As with the power sector, if the RFS-II obligated party has more RINs than they require for their reporting period, they may hold onto those RINs or sell them to other OPs or into the voluntary market.

Figure 1. Renewable fuel standard volume requirements by year (2008-2022)



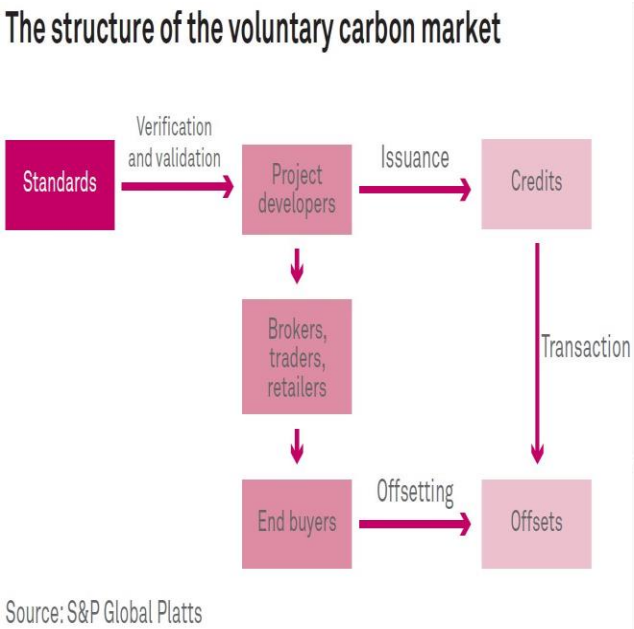
Source: https://www.afdc.energy.gov/laws/RFS.html

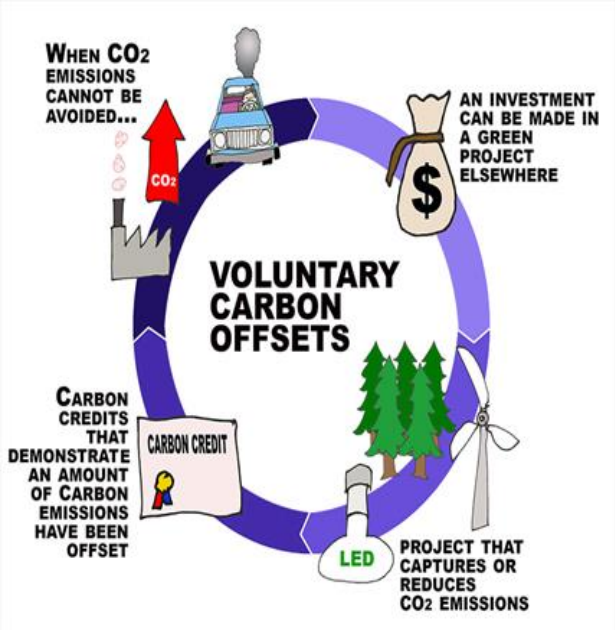
Voluntary Carbon Markets

> *"I believe the decarbonizing of the global economy is going to create the greatest investment opportunity of our lifetime. It will also leave behind the companies that don't adapt, regardless of what industry they are in. And just as some companies risk being left behind, so do cities and countries that don't plan for the future. They risk losing jobs, even as other places gain them. The decarbonization of the economy will be accompanied by enormous job creation for those that engage in the necessary long-term planning. I believe the decarbonizing of the global economy is going to create the greatest investment opportunity of our lifetime. It will also leave behind the companies that don't adapt, regardless of what industry they are in. And* ***just as some companies risk being left behind, so do cities and countries that don't plan for the future****. They risk losing jobs, even as other places gain them. The decarbonization of the economy will be accompanied by enormous job creation for those that engage in the necessary long-term planning."*

Larry Fink, CEO, Blackrock, Inc. Letter to CEOs, 2022 (Blackrock has $10 trillion assets under management, January 2022) (1)

According to S&P Global/Platts, five primary entities define and drive the voluntary carbon markets (2):

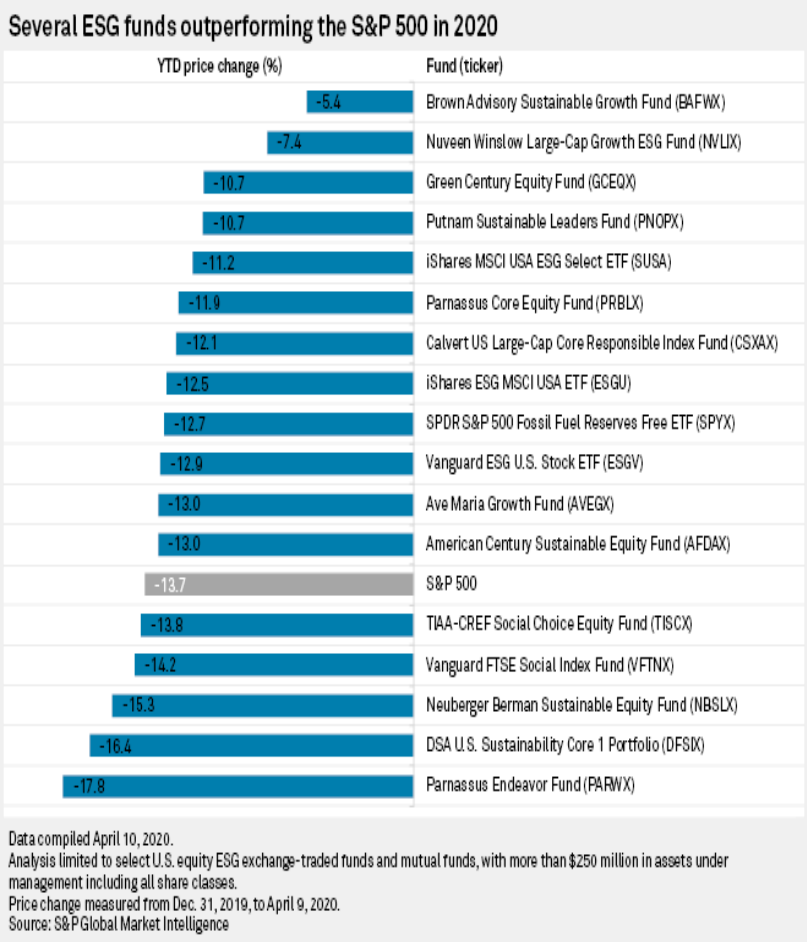




End buyers can be individuals, public or private organizations seeking to reduce their carbon footprint. To-date, most voluntary carbon transactions are self-supplied (developer is the eventual end-buyer) or conducted through private agreements and over-the-counter deals. The most active and largest voluntary carbon market are corporations and institutions. (3) Carbon exchanges, both U.S. and international, are evolving and will likely continue to enhance both the liquidity and the need for standards in the accounting and verification practices.

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

- **Additionality**: The project should not be legally required, common practice, or financially attractive in the absence of credit revenues.
- **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.
- **Permanence**: The impact of the GHG emission reduction should not be at risk of reversal and should result in a permanent drop in emissions.
- **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.
- **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 Sustainable Development Goals. (2)



Carbon Market Drivers

Corporate Sustainability Actions (ESG reporting/initiatives)

Shareholder/Stakeholder Initiatives

Governmental Regulations

- Renewable Fuel Standard
- Low Carbon Fuel Standard
- Regional Cap-n-Trade

Debt & Equity Markets

Consumer Expectations

Competitive Opportunity

Environmental, Societal and Governance (ESG) Reporting: Corporate and Organizational

> *"ESG offers (food companies) several value streams. Investors, acting out of self-interest, will reward sustainable firms for lowering risk with increased investment flows. Revenue streams from environmentally and socially conscious buyers will increasingly tie profitability to sustainability. Perhaps the most profound effect of ESG will be to differentiate socially and environmentally sustainable firms in the talent market, where green investment yields a strong, stable and talented workforce." (4) Food-**dive,** January 5, 2022*

Environmental, Societal and Governance (ESG) reporting reflects an organization's activities and performance in its role as corporate or institutional "citizen." Over ninety percent of the world's largest companies currently file environmental, societal and governance (ESG) reports. (5) Ninety-eight percent of investors conduct a review of non-financial, ESG disclosures when evaluating the performance of a company. Eighty-two percent state that it would be useful to have independent assurance of the impact of green investments (6).

According to McKinsey, the potential value of ESG for a firm can be attributed to performance in five general themes (7):

	Strong ESG Proposition (examples)	**Weak ESG Proposition** (examples)
Top-line Growth	Attract B2B and B2C customers with more sustainable products.	Lose customers through poor sustainability practices (eg. Human rights, supply chain) or a perception of unsustainable/unsafe products.
	Achieve better access to resources through stronger community and government relations.	Lose access to resources (including from operational shut-downs) as a result of poor community and labor relations.
Cost Reductions	Lower energy consumption	Generate unnecessary wate ans pay correspondingly higher waste disposal costs
	Reduce water intake	Expend more on packing costs
Regulatory and Legal Interventions	Achieve greater strategic freedom through deregulation	Suffer restrictions on advertising and point of sale
	Earn subsidies and government support	Incur fines, penalties and enforcement actions
Productivity uplift	Boost employee motivation	Deal with "social stigma" which restricts talent pool
	Attract talent through great social credibility	Lose talent as result of weak purpose
Investment and Asset Optimization	Enhance investment returns by better allocating capital for longer term projects	Suffer stranded assets as a result of premature write-downs
	Avoid investments that may not pay off because of longer term environmental issues	Fall behind customers that have invested to be less "energy hungry"

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How Food Industry Supply Chain Analysts View ESG:

LGC ASSURE BRCGS

London, U.K. Supply Chain Assurance Provider

Over the coming months and years, we predict growing pressure for greater ESG performance and transparency in the food and drink industry.

The oil industry has long been associated with having a damaging impact on our planet. In response, companies in this sector are mobilizing to address Environmental, Social and Governance (ESG) imperatives to meet growing public activism and government regulation. .Sustainability reporting is fast becoming the norm. In 2020, a KPMG Survey of Sustainability Reporting recorded a sustainability reporting rate of 96% for the world's largest 250 companies. Within the oil & gas sector, the rate was 100%. There's no doubt that food manufacturers will soon be faced with the same pressures.

The need to assume responsibility for sustainability

As an industry that accounts for 70% of global freshwater withdrawal and a quarter of all global greenhouse gas emissions, food production will almost certainly come under the same levels of scrutiny as the oil industry – with companies experiencing ever-increasing pressure to improve their sustainability.

This pressure will come from the growing cohort of contentious consumers, as well as from the investment community and from legislators. The Financial Times has reported that investors are currently finding it hard to incorporate food in their portfolios. The far-reaching impacts of food businesses have been difficult to measure, making it unclear whether they meet ESG criteria.

McKinsey cites more than 2,000 academic studies that conclude that better ESG scores translate to approximately 10% lower cost of capital. ESG is therefore becoming a strategic imperative.MSCI Inc, a provider of financial analysis tools, confirmed these benefits through a four-year study. Its research found that companies with high ESG scores experienced lower costs of capital, lower equity costs and lower debt costs compared with companies with poor ESG scores.

Poor performance to date

The food industry is currently behind the curve. According to Canopy Holdings, a New York-based food and agriculture holding company, there's a lack of ESG data in the sector, particularly in social and governance areas. A Wall Street Journal survey on ESG metrics identified that of 5,500 publicly traded companies, only one food business scored in the top 100.

A recent survey carried out by the World Benchmarking Alliance mirrored these findings. It found that, when ranking 350 of the world's largest food and agriculture companies on their contributions to transforming the global food system, there were significant gaps in the industry's preparedness for climate change, progress on human rights and contribution to nutritious diets.

Some food companies have taken a clear lead. Nestlé and General Mills have committed to a net zero pathway, while Danone is working with B Corp to demonstrate that its sites work to environmental and social standards….. (8)

ESG Impact in Agriculture & Food Industry

Within the agricultural and food sectors, a number of global brands have embraced the challenges of identifying, measuring and managing environmental footprints and associated risks to their valuation and continued performance. Nestle', Kraft-Heinz, Danone, Coca Cola, Cargill, Mars, PepsiCo, McCormick, General Mills, Olam International, Leprino Foods, Maple Leaf Foods, Smithfield, Tyson, Dole, Land-O-Lakes (and many others) are all firms challenging their suppliers to pursue Science-based Targets Initiative (SBTi) for emissions reductions. For instance, Leprino has published 2030 goals to:

1. Reduce absolute emissions from scope 1 and 2 (direct operations) by 30%
2. Reduce emission intensity by 30% for our milk and non-milk suppliers
3. Reduce water intensity by 20% in gallons of water per 1000 pounds of milk. (9)

Such developments have the attention of agricultural producers, ag finance, and the USDA. The National Milk Producers Federation, the National Corn Growers, and the corn-ethanol industry launched initiatives to promote reduction of carbon footprints of their products and are seeking to establish measurable standards for GHG-P/ESG reporting. (10)

Carbon Accounting at the Farm-level

In order for food companies to meet shareholder, stakeholder, financial market, customer and, likely, SEC reporting and disclosure standards – and to benefit from the value proposition ESG represents, these firms must implement traceable, standardized, and transparent metrics of data collection. This implies on-farm carbon accounting. Accounting systems that meet Global Reporting Initiative or Sustainability Standards Accounting Board criteria are likely to be required, with full traceability to the farm level.

Many ESG food companies have adopted and developed proprietary systems, in part based upon data and information already available at the farm-level. The National Milk Producers Federation has a carbon accounting system. USDA's Comet platform is currently used widely. However, the SEC's (2021-2022) investigation, prompted by the growing consensus that a standardized platform, with commonly available and scientifically validated conversion methods – SBTi, which reflect the carbon impacts of practice changes – is necessary to support long-term and widespread investment, profitability and to achieve climate goals.

Concerns over Validity of ESG Reports: The Quest for Standards & Transparency

As ESG reporting has become more common among publicly traded companies, scrutiny of the basis of claims made by same companies has also increased. While broad international standards and accounting practices have been developed by governance organizations (eg. Sustainability Standards Accounting Board), individual companies continue to establish their own practices and metrics as the basis for ESG claims and reports. This hodgepodge of standards and practices has prompted confusion in investment and stakeholder audiences, seriously eroding confidence in sustainability claims. (11)

There is a growing realization by asset owners and managers that ESG can be more than simply a marketing tool or a basis for a set of niche products, but also a viable way to ….manage risk across their portfolios. The primary challenge continues to be the lack of a normative and widely accepted definition of ESG and standards for companies to measure and report on ESG performance. (8)(12) Expanding on that challenge are a series of recent regulatory reviews of ESG claims, regarding both quality and quantity of actual carbon reductions, as compared to claims.(13)

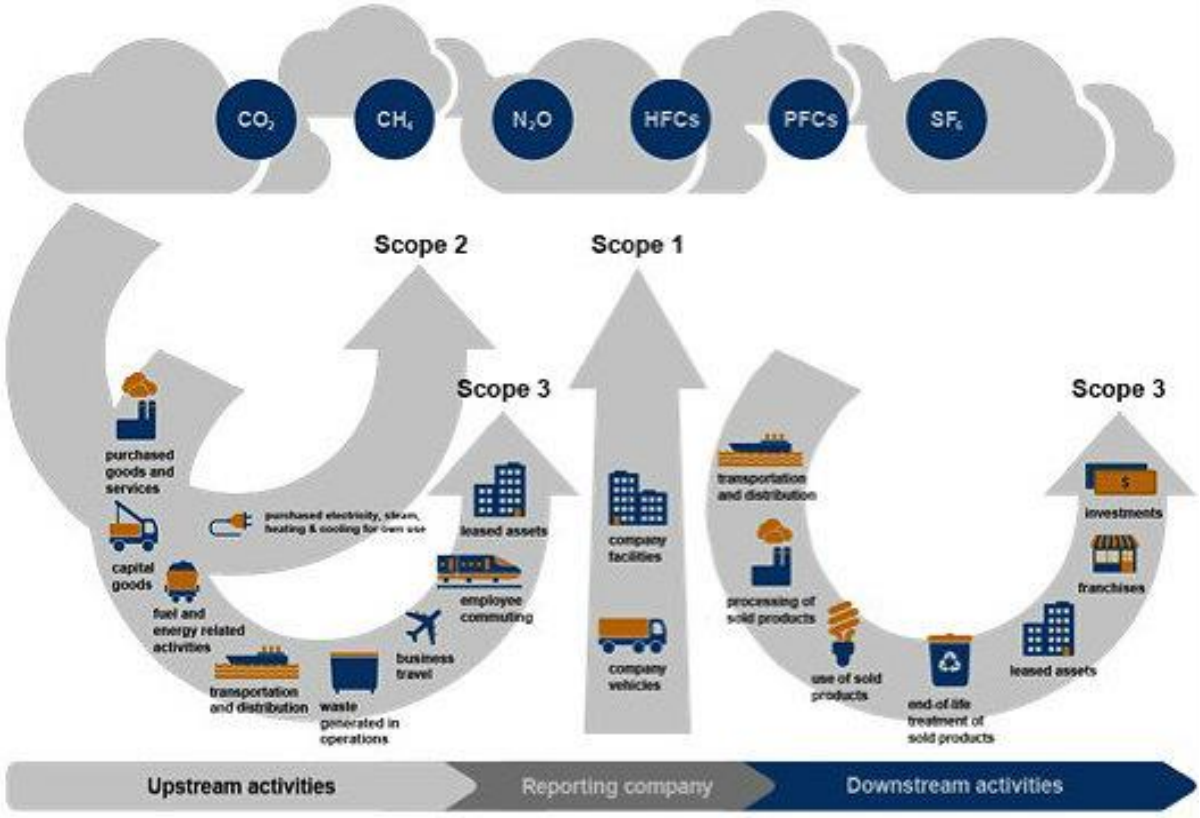
Investor and stakeholder expectations for sustainability disclosures will increasingly rely on widely recognized standards and methods of reporting. Investors want to see the connections between practices and performance in a trusted and reliable format. The International Capital Markets Association (ICMA) recommends third party review (TPR) of ESG claims. (14) In addition, investors/shareholders/stakeholders are expecting expanded transparency across all company activities. The Greenhouse Gas Protocol (GHG-P), developed by the World Resources Institute (WRI) and its partners, is the global standard guidance used by corporations to assess their GHG inventories and to subsequently account for emissions reductions achieved within their inventories.

An investigation of practices and disclosure of ESG claims was launch by the U.S. Securities and Exchange Commission (SEC) in September 2021 in an attempt to better understand the variability of carbon accounting practices and reporting. (15). The current SEC investigation builds upon a previous investor advisory report addressing ESG disclosure. In SEC's 2020 report, the authors found that, "standards are currently voluntary, which has led to varying degrees of compliance by corporate issuers. Second, both issuers and investors have been frustrated by the proliferation of voluntary disclosure standards, which differ in significant ways. Third, many of the standards still do not call for the information investors and other markets seek." (16)

The Center for American Progress proposes, "The SEC should write its own environmental, social and governance rules." (17) Doing so would clear the air, diminish concerns regarding "greenwashing" and establish a firm set of standards and facilitate wider and more robust expansion of voluntary sustainability-driven investment and management practices.

Carbon Footprint: Products

Condensed definition: Carbon content attributed to the raw materials, production, and delivery to end-user of a product or service.



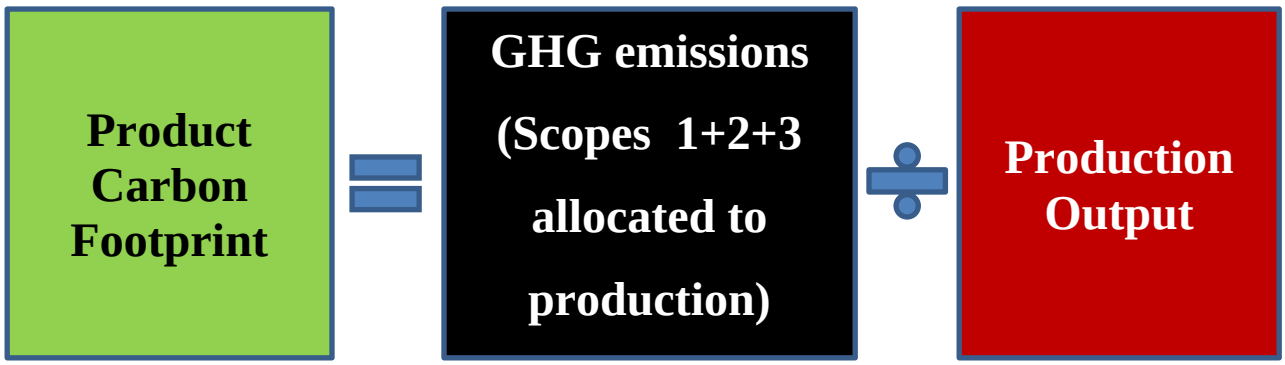
Expanded definition: The product carbon footprint (PCF) is most commonly calculated through utilizing the Greenhouse Gas Protocols (GHG-P) developed by the World Resources Institute (WRI) and its partners. These protocols are the global standard guidance used by corporations to assess their GHG emissions inventories and to subsequently account for emissions reductions achieved within their inventories. A corporate GHG inventory is categorized into 3 *scopes*, or categories, by GHG-P, as follows:

• **SCOPE 1:** Scope 1 emissions include GHG directly emitted by an organization's facilities or operations. Examples include GHG emitted from a company's own facilities and vehicles (or manure storage).

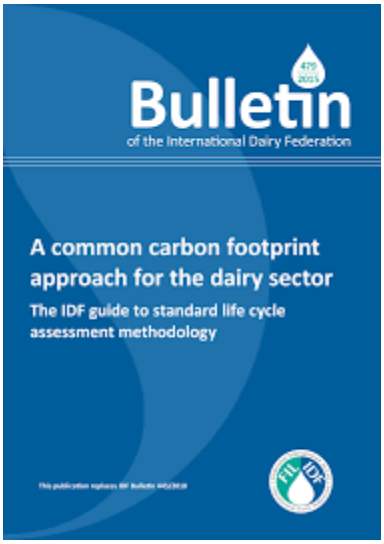
• **SCOPE 2:** Scope 2 emissions come from power generation, usually purchased from public utilities, to fuel a company's operations. This is a form of indirect GHG emissions for companies.

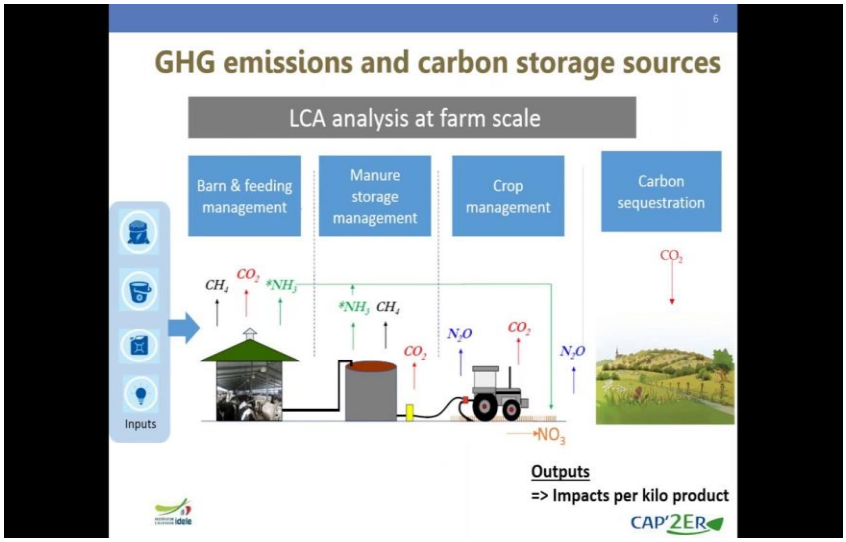
• **SCOPE 3:** Scope 3 emissions are those a company causes indirectly via its supply chain. A food company, for example, would include emissions generated in the production and transport of raw materials or ingredients it purchases such as wheat, flour, butter, and sugar as part of its Scope 3 emissions footprint.(18) (19)

Simplified Carbon Footprint Equation. For a fixed period of time (e.g., one year):



Carbon footprint is the most frequently requested carbon market metric for sustainability reporting. Carbon footprint, and the assumptions underlying its basis, also can supple a carbon labeling effort.



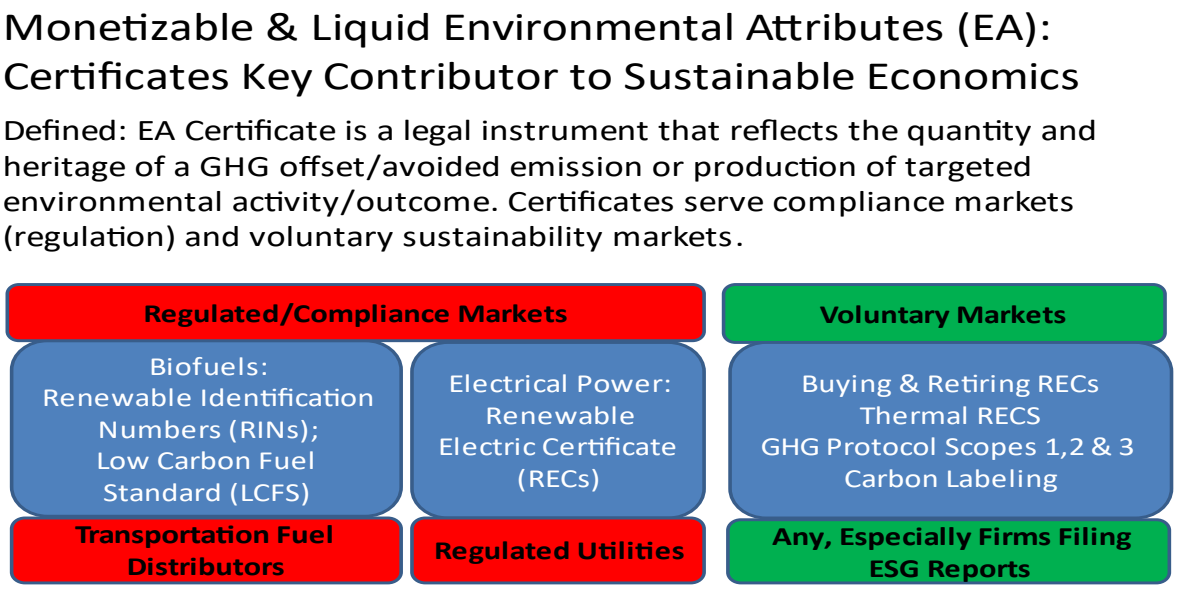


Environmental Attributes & Carbon Credits

Condensed definition: Carbon credit is the measurement of greenhouse gas reduction due to a change in practice. Environmental attribute is the formal instrument allowing for representation, compliance and trading of a carbon credit or another form of attribute as defined by a regulatory entity (e.g., RIN, REC).

Carbon Credit (definition): A generic term to assign a value to a reduction or offset of greenhouse gas emissions. A carbon credit is usually equivalent to one tonne of carbon dioxide equivalent (CO_2-e). A carbon credit can be used by a business or individual to reduce their carbon footprint by investing in an activity that has reduced or sequestered greenhouse gases at their own facility or at another site.(20)(21)

Environmental Attribute (definition): means any and all credits, benefits, emissions reductions, offsets, and allowances, howsoever entitled, attributable to the generation from the Unit(s), and its displacement of conventional energy generation. Environmental Attributes include but are not limited to: 1) any avoided emissions of pollutants to the air, soil or water such as sulfur oxides (SOx), nitrogen oxides (NOx), carbon monoxide (CO) and other pollutants; 2) any avoided emissions of carbon dioxide (CO2), methane (CH4) and other greenhouse gases (GHGs) that have been determined by the United Nations Intergovernmental Panel on Climate Change to contribute to the actual or potential threat of altering the Earth's climate by trapping heat in the atmosphere; and 3) the reporting rights to these avoided emissions such as Green Tag Reporting Rights. (22)



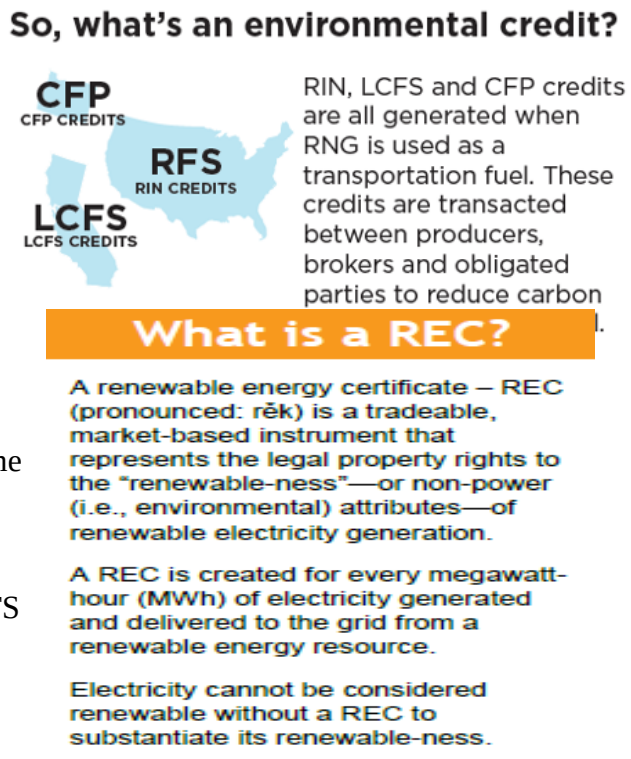
The following table provides a contrast/comparison of Offsets and Renewable Energy Credits, as defined by the U.S. EPA. (21) These two versions of environmental attributes can be used by the originator of the "Credit" to reduce their own Carbon Footprint (internally "retired" offset) or they can be sold/transferred to another entity, as an externally generated credit. The offset buyer then retires the credit/environmental attribute and claims the reduction in their carbon footprint.

Basic Differences	Offsets	RECs
Unit of Measure	Metric tons of CO_2 or CO_2 Equivalent	Megawatt hours (MWh)
Source	Projects that avoid or reduce greenhouse gas (GHG emissions to the atmosphere	Renewable electricity generators
Purpose	Represent GHG emissions reductions; provide support for emissions reduction activities; and lower costs of GHG emissions mitigation	Convey use of renewable electricity generation; underlie renewable electricity use claims; expand consumers' electricity service choices; and support renewable electricity development
Corporate GHG Inventories and Reporting	Reduce or "offset" an organization's scope 1, 2 or 3 emissions, as a net adjustment	Can lower an organization's gross market-based scope 2 emissions from purchased electricity
Consumer Environmental Claims	Can claim to have reduced or avoided GHG emissions outside their organization's operations	Can claim to use renewable electricity from a low or zero emissions source
Additionality Test Requirements	Required. Each project is tested for additionality to ensure that it is beyond business as usual. Tests include legal/regulatory, financial, barriers, common practice and performance tests. The combination of tests that is best suited to demonstrate additionality depends on the type of project.	Not required. Project additionality is not required for a renewable energy usage claim or to report use of zero-emissions power.

Measuring Carbon Credit and Environmental Attributes

Carbon credits and environmental attributes generated within the U.S. are currently defined within two broad categories: regulated markets and voluntary markets.

For biofuels, including ethanol, bio-diesel, "drop-in" fuels and renewable natural gas (biogas), two regulatory regimes are dominant influences regarding the measurement and value of the environmental attributes associated with the carbon impact (credit) of the fuel as compared to its fossil equivalent. The Federal EPA administered Renewable Fuel Standard II (RFS) program manages the compliance of transportation fuel distributors (oil & gas companies) to buy and blend an established volume of biofuels each year. The California Air Resources Board's Low Carbon Fuel Standards (LCFS) program also requires fuel distributors to reach GHG/Carbon goals but, does so on an overall carbon intensity basis. Both the RFS and the LCFS facilitates the creation and monetization of environmental attributes (aka "credits") that are used for compliance and traded among stakeholders.



Federal: Biofuel Regulated Market – Renewable Fuel Standards II

(https://www.epa.gov/renewable-fuel-standard-program) (23)

Enacted in 2007, the Energy Independence and Security Act (EISA) is a national policy that requires a certain volume of renewable fuel to replace or reduce the quality of petroleum-based transportation fuel, heating oil or jet fuel blended, distributed, and used in the U.S. The EPA sets volumetric targets by fuel class each year (Renewable Volume Obligation, RVO). The obligated parties (fuel refiners) meet their obligations by purchasing and blending renewable fuels or the environmental attribute (Renewable Identification Numbers, RINs). For each batch of renewable fuel manufactured a RIN is assigned and follows this fuel through the supply chain.

Each renewable fuel type is assigned a "D-code." Each class varies by feedstock used in production, fuel type produced, energy inputs, GHG intensity, and others. Each fuel manufacturer must follow a pre-approved processing pathway in order for their renewable fuel to qualify. The four categories of renewable fuels are:

Cellulosic-biofuels (e.g. gasoline or diesel), assigned a D3 or D7 RIN. Must be produced from cellulose, hemicellulose or lignin and meet/exceed 60% lifecycle GHG reduction (as compared to petroleum product). Renewable Natural Gas from animal wastes qualifies for this classification;

Biomass-based Diesel & Advanced Biofuel, assigned a D4 or D5 RIN, must be produced from non-starch qualified biomass (pathway approved) and meet 50% lifecycle GHG reduction.

Renewable fuels, including ethanol derived from corn starch, assigned a D6 RIN. Must meet a 20% GHG reduction.

CATEGORY	D CODE	GHG REDUCTION	SOURCE EXAMPLE	FUEL EXAMPLE
Cellulosic Biofuel	D3	60%	Biofuel derived from landfills, farms, and wastewater treatment facilities	Renewable CNG and LNG
Cellulosic Diesel	D7	60%	Crop residue, slash, switchgrass, biogenic components of separated MSW, and cellulosic components of annual covercrops	Renewable diesel
Biomass-Derived Diesel	D4	50%	Oil from annual covercrops	Biomass diesel
Advanced Biofuel	D5	50%	Sugarcane	Sugarcane ethanol
Renewable Fuel	D6	20%	Corn starch	Corn ethanol

California Low Carbon Fuel Standard

The state of California launched the most ambitious carbon management program in the U.S. in 2009. Through various modifications its Low Carbon Fuel Standard (LCFS) now represents the largest, most active, carbon market for transportation fuels in the country. According to a recent EcoEngineer's report (24): "The CA-LCFS has been successful because it is displacing high-carbon diesel and gasoline with low-carbon alternatives. The diesel alternatives are primarily biodiesel, renewable diesel, and renewable natural gas (RNG); gasoline alternatives are primarily electricity, hydrogen, and ethanol."

What is Carbon Intensity?

Carbon intensity is the amount of greenhouse gas (GHG) emitted in the production, distribution and combustion of fuel on a volume basis (e.g., the GHG emissions per litre of gasoline).

The objective of the LCFS is to progressively, year-to-year reduce the overall carbon intensity of the State's transportation fuel system and consumption. Through blending and distribution of lower carbon intensity (CI) fuels, the State requires significant reductions in the overall CI of its transportation sector. Leadfree gasoline assumed to have CI = 101 (gCO_2e/MJ). (25)

Carbon Intensity Benchmarks for Gasoline and Diesel Fuel and their Substitutes

Year	Gasoline Average CI (gCO_2e/MJ)	Diesel Average CI (gCO_2e/MJ)
2019	93.23	94.17
2020	91.98	92.92
2021	90.74	91.66
2022	89.50	90.41
2023	88.25	89.15
2024	87.01	87.89
2025	85.77	86.64
2026	84.52	85.38
2027	83.28	84.13
2028	82.04	82.87
2029	80.80	81.62
2030 onwards	79.55	80.36

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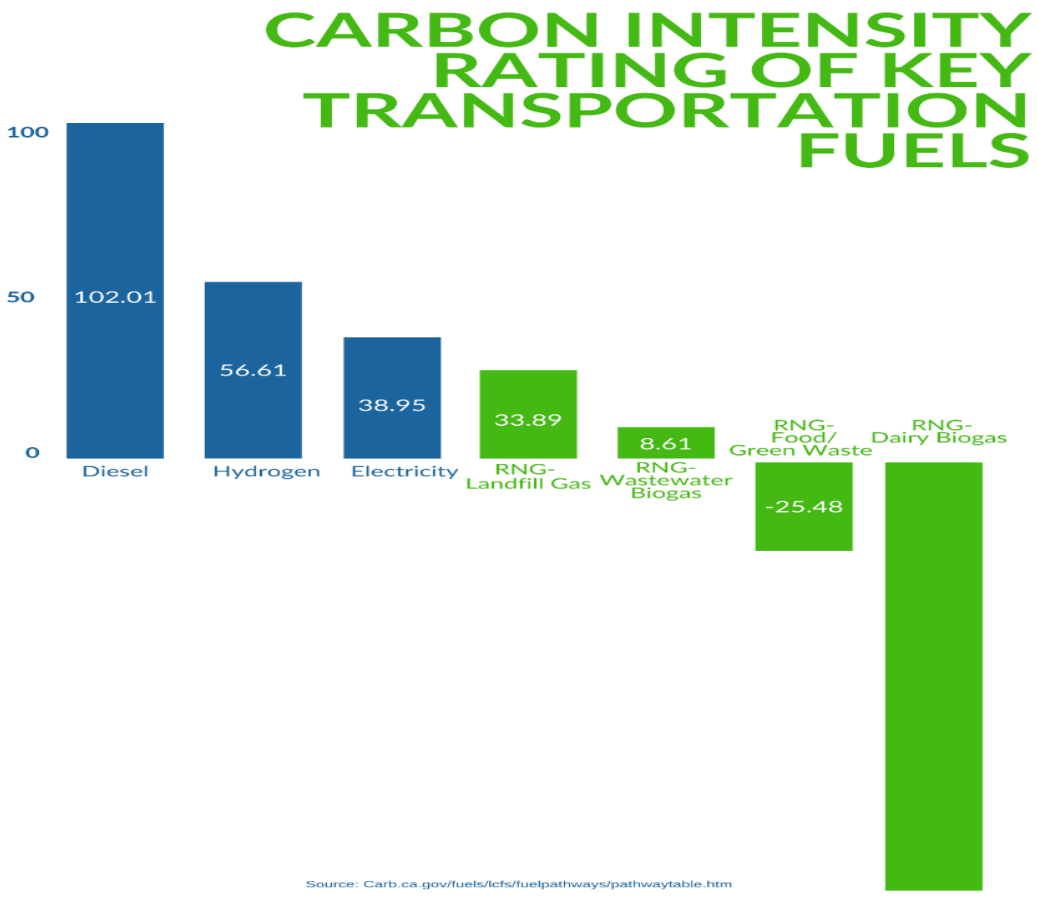
Each lower carbon fuel type marketed in California is required to submit a pathway (manufacturing process) application and have 3rd party verification in order to earn a CI score

and be eligible for receiving LCFS credits. The following illustration and table highlight the differences across various fuel types:

Table 1. Carbon intensity of transportation fuels in California LCFS program

Fuel type	Carbon Intensity (grams CO_2e/Megajoule)
Diesel	102
Gasoline	100
Corn ethanol	34-75
Natural gas	68
Fuel cell (nonrenewable hydrogen)	39
Electric vehicles (CA power grid)	31
Biodiesel	9 to 50
Landfill biogas	11 to 40
Biogas from forest waste	14
Wastewater biogas (large facilities)	8 to 30
Biogas from diverted food and green waste	-15 to -100
Dairy biogas	-276 to -330

Source: California Air Resources Board



Selling Low Carbon Fuels: From Wisconsin into California

Wisconsin has a number of low carbon fuel producers selling into the California LCFS market. While specific details are proprietary, each of Wisconsin's ethanol firms trade biofuels into the California market. As a recent report from USDA indicates, the emergence of LCFS's CI scoring and resulting credits have had a significant influence in motivating corn ethanol producers' pursuit of reducing carbon emissions.(10) Wisconsin-based Ace Ethanol (Stanley, WI) is cited as a current producer of cellulosic ethanol (D3 class fuel). (26)

For Wisconsin's biogas producers, the LCFS market has provided a windfall. While Wisconsin has been a leader in on-farm digester installations, the erosion of renewable electricity prices paid for power generation significantly hampered additional facility developments. (27) The LCFS market opportunity for renewable natural gas (RNG) has turned around the financial expectations for manure waste digesters. (28) (29)

While not a panacea, animal waste (manure) RNG facilities with access to a pipeline can earn significant returns by selling into the LCFS market. Manure RNG may qualify for both a D3 RIN and an LCFS credit, resulting in a delivered price/MMBtu in the $60-to-$85 range (Q4, 2021).

The LCFS program allows for a practice referred to as "Book-and-Claim." This practice, according to EcoEngineers: "CA-LCFS, which credits dairy digester gas with "methane offset credits" for closing methane leakage at manure lagoons. A key feature of the CA-LCFS that led to the successful launch of the RNG sector is the "book-and-claim" system for environmental attributes. Book-and-claim accounting refers to the chain-of-custody model in which decoupled environmental attributes are used to represent the ownership and transfer of transportation fuel without regard to physical traceability." (24)

Book-and-claim allows Wisconsin-based RNG to be sold into the CA-LCFS market.

Two significant trends are poised to contribute to increased demand in CA-LCFS (along with other States also adopting similar programs). As drawn from the EcoEngineers report:

"There is significant change coming in the RNG sector from the arrival of ultralow carbon RNG from dairy/swine manure and food waste biogas projects. In 2019, about 94% of RNG consumed in California was RNG derived from landfill gas, with an average CI of 45 gCO2e/MJ . However, RNG from animal manure with ultralow CI's (-100 to -300 gCO2e/MJ) is on track to be 43% California consumption by 2023."

"Ethanol use will remain at around 11% of gasoline demand. The average CI of ethanol continues to fall and will drop to about 52gCO2e/MJ in 2023. The ethanol industry's ability to sequester/reuse CO2 from ethanol plants, their ability to reduce process energy CI through a book-and-claim methodology for clean electricity and RNG and their ability to secure credits for low CI farming practices will all play a key role in their ability to lower their CI further and generate more credits." (24)

Both of these trends favor Wisconsin biofuel producers.

The following table is a recent report of RIN and LCFS credits. RIN prices are provided on a "per gallon basis." LCFS prices on a "per ton basis." These credits are applied additionally (stacked) to the energy value of the fuel.

ecoengineers
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Daily RIN, LCFS & CFP Update

3/4/2022

D-Code	Average Price			Closing Value		
	2020	2021	2022	2020	2021	2022
D3	$3.290	$3.310	$3.210	$3.290	$3.310	$3.210
D4	$1.530	$1.550	$1.420	$1.530	$1.550	$1.420
D5	$1.520	$1.530	$1.405	$1.520	$1.530	$1.405
D6	$1.140	$1.140	$1.135	$1.140	$1.140	$1.135
	Average Price			Closing Value		
California LCFS Credit	$134.00			$134.00		
Oregon CFP Credit	$125.00			$125.00		

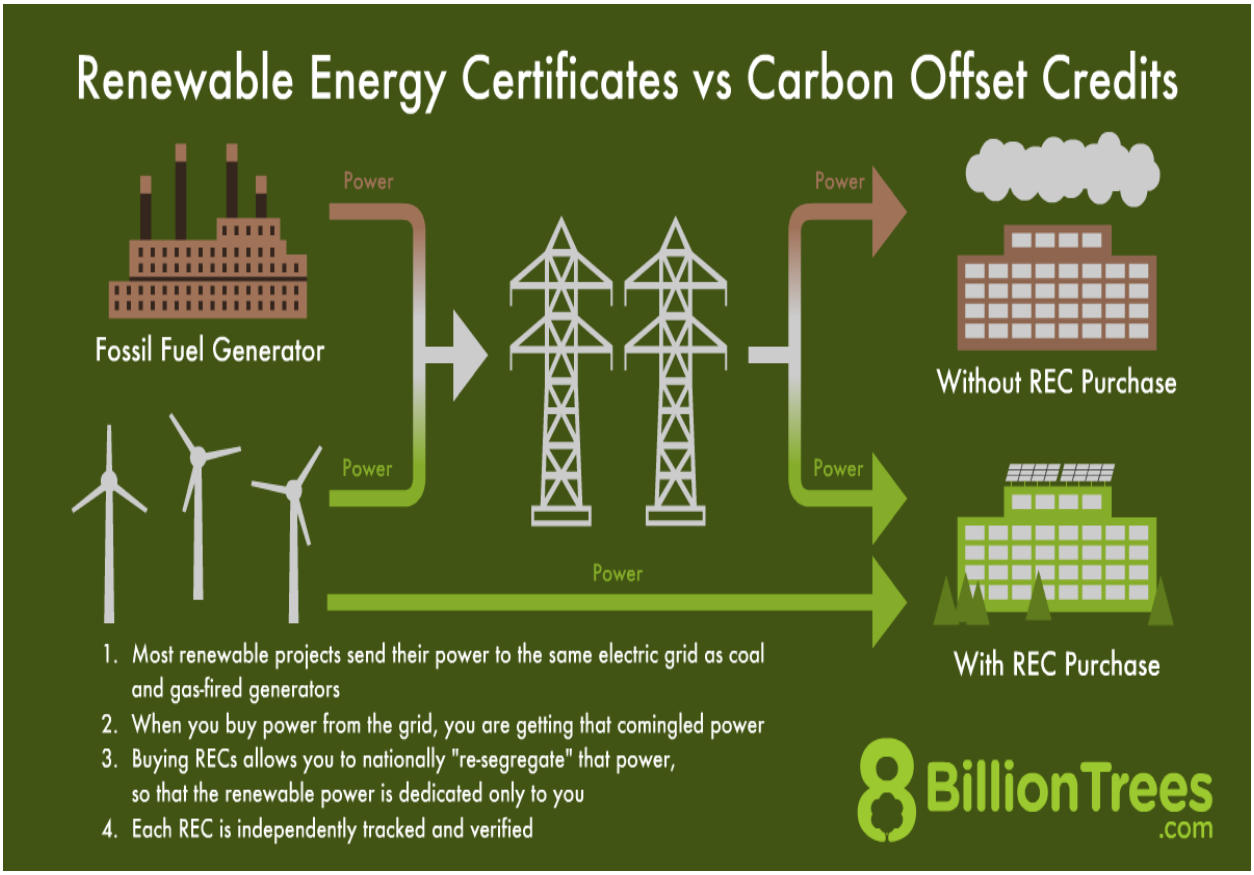
Data Provided in the EcoEngineers Daily RIN Price Update is intended for informational purposes only.

Renewable Energy Credits/Certificates (RECs)

(Adopted from U.S. EPA) Renewable Energy Certificates (RECs) are the legal instruments used in renewable electricity markets to account for renewable electricity and its attributes whether that renewable electricity is installed on the organization's facility or purchased from elsewhere. The owner of a REC has exclusive rights to the attributes of one megawatt-hour (MWh) of renewable electricity and may make unique claims associated with renewable electricity that generated the REC (e.g., using or being supplied with a MWh of renewable electricity, reducing the emissions footprint associated with electricity use).

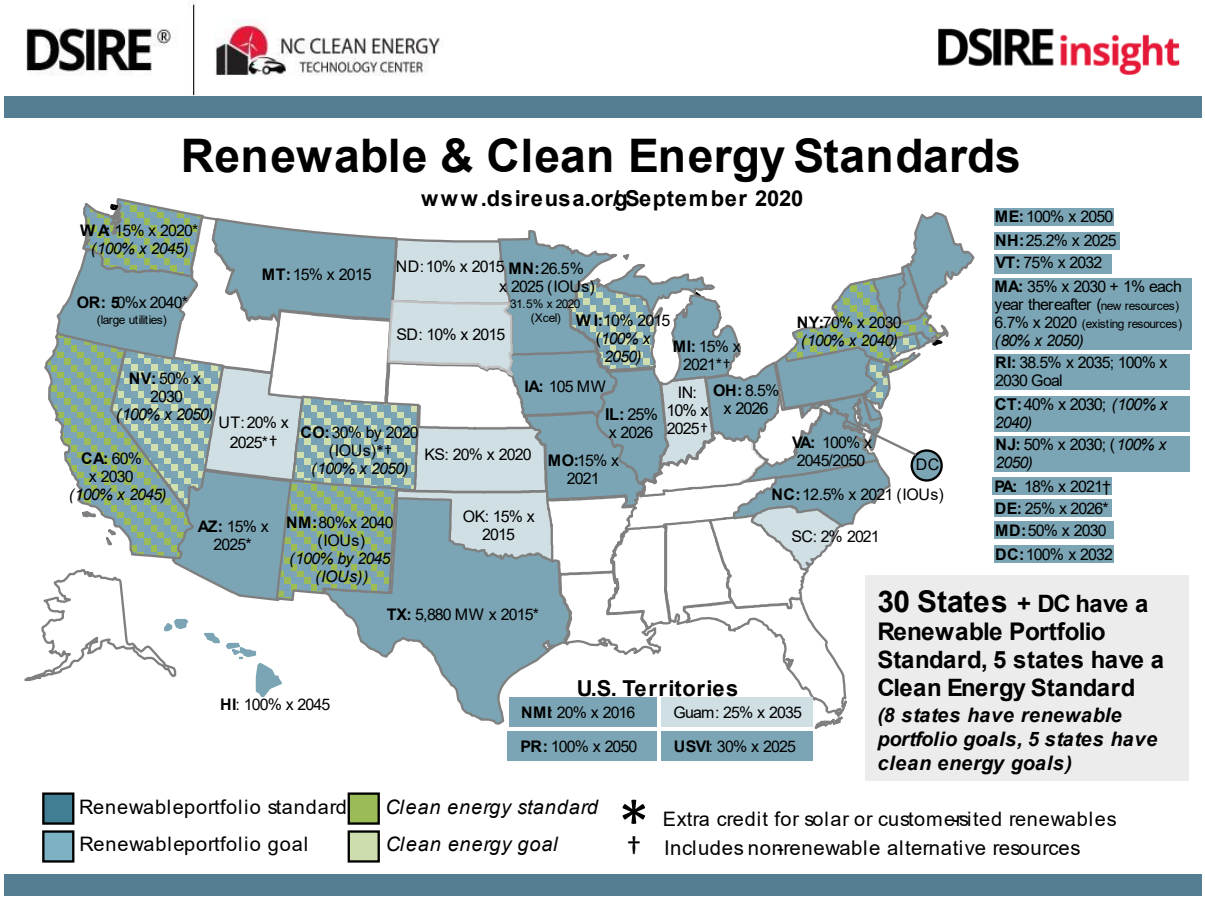
Claims to the attributes of the electricity from a REC can only be made by one party. The purchase or use of renewable energy, verified with RECs, is a decision an organization makes to ensure its electricity is provided from renewable sources that produce low-or zero-emissions, thereby reducing the organization's market-based scope 2 emissions.

As the physical electricity we receive through the utility grid says nothing of its origin or how it was generated, RECs play an essential role in accounting and assigning ownership to the attributes of renewable electricity generation and use. RECs legally convey the attributes of renewable electricity generation, including the emissions profile of that generation, to their owner and serve as the basis for a renewable electricity consumption claim. As such, the REC owner has exclusive rights to characterize the quantity of their purchased electricity associated with the RECs as zero-emissions electricity. (30)



Origin of RECs: State Renewable Portfolio Standards

Renewable portfolio standards (RPS), also referred to as renewable electricity standards (RES), are policies designed to increase the use of renewable energy sources for electricity generation. These policies require or encourage electricity suppliers to provide their customers with a stated minimum share of electricity from eligible renewable resources.



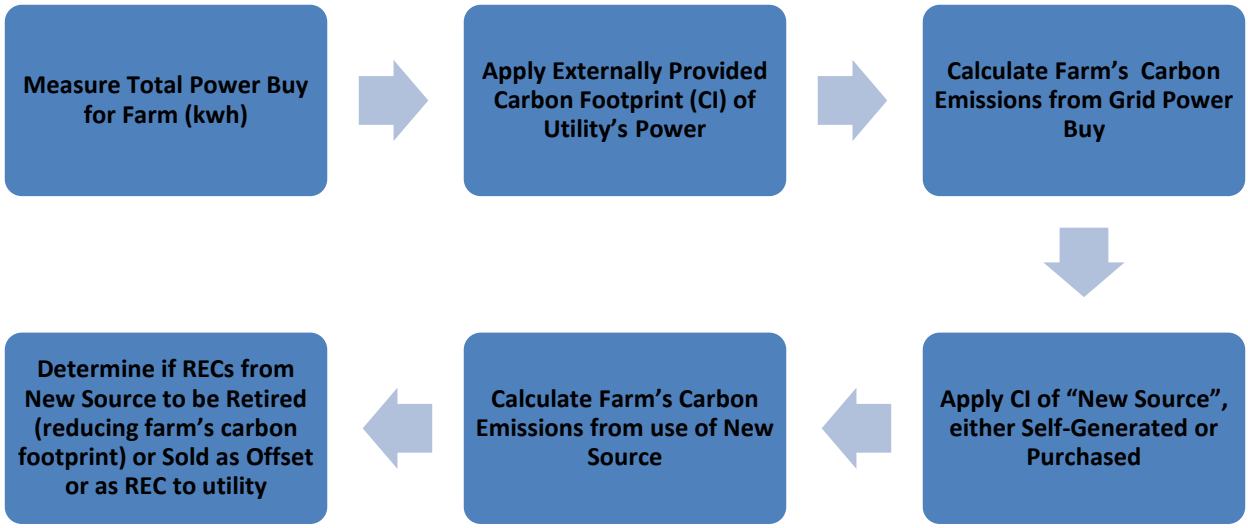
A common feature of RPS policies is a renewable electricity credit (REC) trading system that reduces the cost to comply with the RPS. A utility that generates more renewable electricity than the RPS requirement may either trade or sell RECs to other electricity suppliers who may not have enough RPS-eligible electricity to meet their RPS requirements. Some states make a certain number of credits available for sale. In general, only one entity—the generator or the REC holder—may take credit for the renewable attribute of generation from RPS-eligible sources. (31) RECs include several data attributes, including:

- Certificate Data
- Tracking system ID
- Renewable facility location
- Project name
- Certificate (generation) vintage
- Utility to which project is interconnected
- Emissions rate of the renewable resource

Certificate type
Renewable fuel type
Nameplate capacity of project
Project vintage (build date)
Certificate unique identification number
Eligibility for certification or RPS

Challenge of RECs: Measuring and Monetizing Emissions Actually Avoided in Each Renewable MWh

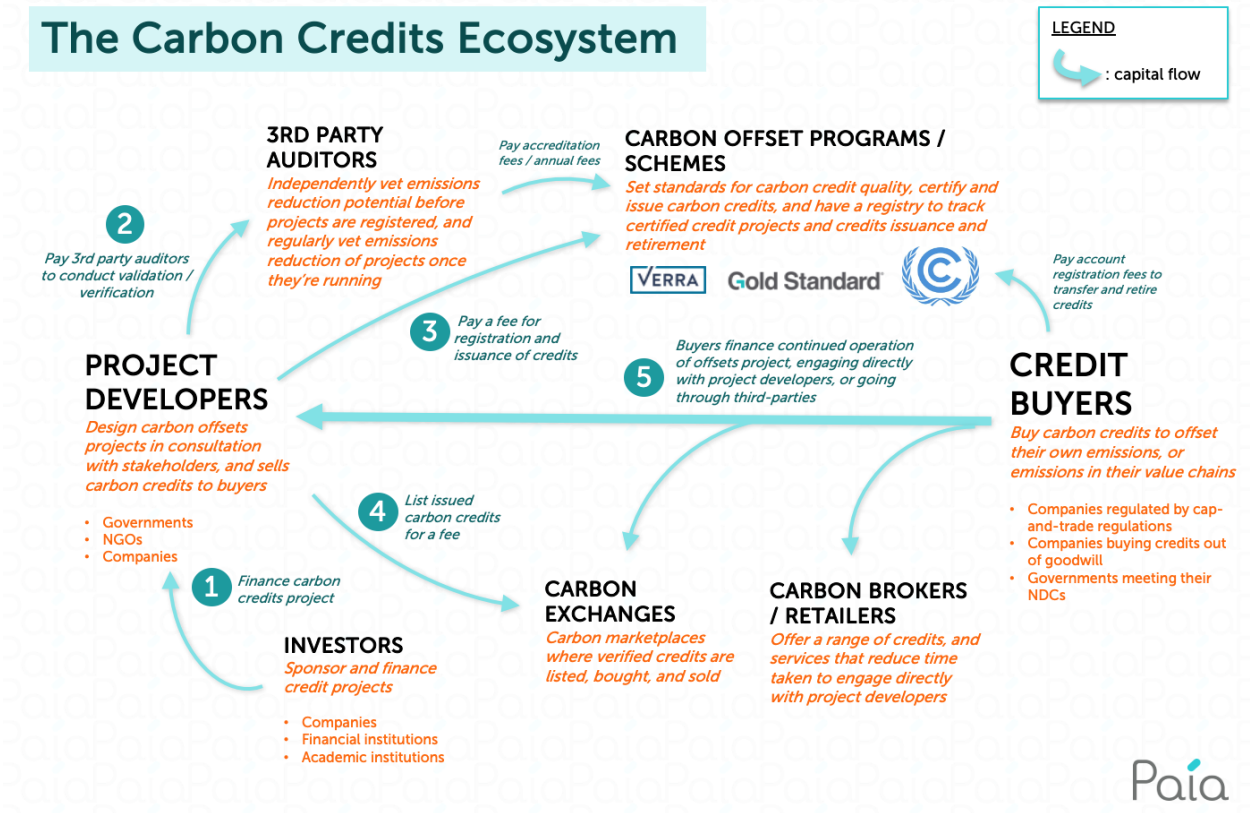
In order to determine the "carbon credit" (avoided emissions) of replacing power purchases from "the grid" with block of renewable power (MWh) the carbon footprint of the "grid" power must be known.



Carbon Offsets

A carbon offset is the practice of "retiring" a carbon credit or other GHG avoidance/mitigation reflected in an environmental attribute (e.g. REC, RIN) as a means of reducing an organization's carbon footprint. Carbon credits which are specifically produced for the purposes of creating carbon offsets are "a specific activity or set of activities intended to reduce GHG emissions, increase the storage of carbon, or enhance GHG removals from the atmosphere." (32) The practice of generating carbon credits for offset is commonly referred to as a Carbon Offset Project (COP).

The carbon credits produced by a COP must be deemed additional; the resulting emissions reductions must be real, permanent, and verified; and credits (ie. offsets) issued for verified emissions reductions must be enforceable. The offset may be used to address direct and indirect emissions associated with an organization's operations (e.g., emissions from a boiler used to heat your organization's office building). The reduction in GHG emissions from one place can be used to "offset" the emissions taking place somewhere else. Offsets can be purchased by an organization to address its scope 1, 2, and 3 emissions. Offsets can be used in addition to an organization taking actions within its own operational boundary to lower emissions. Offsets are often used for meeting voluntary commitments to lower GHG emissions where it is not feasible to lower an organization's direct or indirect emissions. (32)



(33) c/o Paia Consulting

Offsets vs. Credits

The terms offsets and credits are often used interchangeably, although they have slightly different meanings. A carbon offset broadly refers to a reduction in greenhouse gas (GHG) emissions - or an increase in carbon storage - that is used to compensate for emissions. A carbon credit is a transferrable instrument recognized via a carbon market to represent an emission reduction of one metric ton of CO2, or an equivalent amount of other GHGs. The purchaser of a credit can "retire" it to claim the underlying reduction towards their own GHG reduction goals. A "carbon offset" is shorthand for GHG emission reductions or removals that compensate for CO2 emissions that occur elsewhere. Additionally, the purchasers of carbon are more likely to refer to them as offsets (as viewed from their perspective), and the producers of carbon storage benefits are more likely to refer to them as credits (reflective of their role in the market).

For definitions of additional terms, see: Forest Carbon Primer (congress.gov). Also see the IPCC Glossary and Carbon Offset Guide

(34)

Are Offsets and RECs the Same?

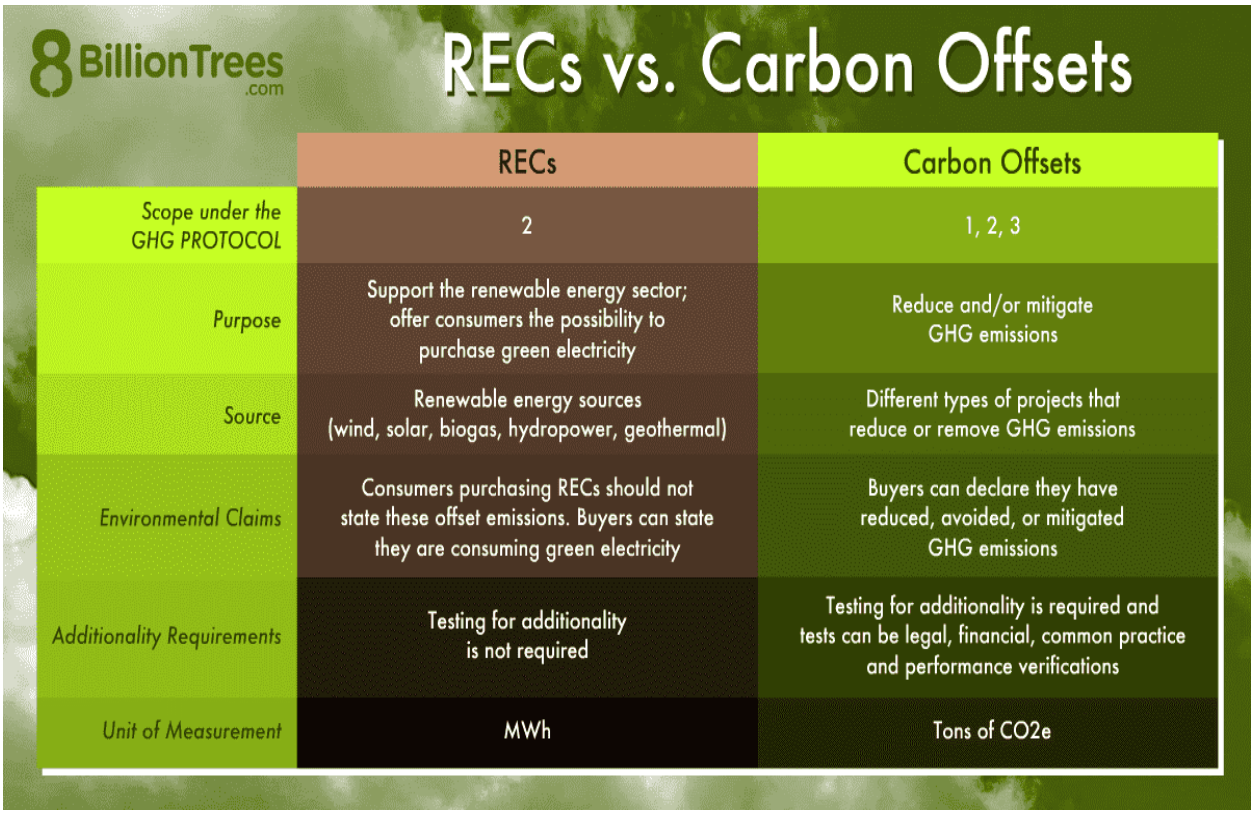
(Adopted from U.S. EPA.) No. While both offsets and RECs can help an organization lower its emissions footprint, they are different instruments used for different purposes. Think of offsets and RECs as two tools in your sustainability tool-box – like a hammer and a saw. They are not interchangeable. Each tool is used in building a house, but each is used to accomplish specific tasks. One is not more important or better than the other.

Using the term "offset" (even as a verb) when discussing your REC purchases can be confusing in the mind of many listeners – confusing the action of contractually fuel-switching to low-or zero-emissions electricity with having paid for a global emissions reduction. Rather than saying your purchase of RECs is offsetting your emissions, it would be better to claim that your purchase of RECs is renewable electricity from a low-or zero-emissions resource which reduces the emissions associated with your electricity use.

The major differences between these two instruments are:

- **Unit of Measure**: The unit of measure for an offset is typically one metric ton of CO2-equivalent emissions. A REC is based on 1 MWh of renewable electricity.
- **Purpose**: Offsets represent emissions reductions, provide support for emissions reduction activities, and may lower costs of GHG emission mitigation. RECs expand consumers' electricity service choices, convey environmental attributes and renewable electricity use claims, and support renewable electricity development. (30)

c/o 8billiontrees.com



Managing the Farm's Carbon Footprint

As with any business decision if you cannot measure, managing is nearly impossible. This applies to both new income opportunities and cost saving options. This requirement holds true with carbon as with any other product.

It is relatively easy to consider carbon as a stand-alone product, a commodity, such as an offset that can be bought and sold. In other cases, carbon, specifically CI, provides an indication of the "quality" of your product. In a dairy application a hundred weight's CI would be analogous to other product features, such as "butter fat" or sematic cell counts.

For farm operators seeking to both strategically and tactically manage carbon, sound financial tools and due diligence on the opportunity would apply – as with any other capital or operational decision.

Basic Criteria:

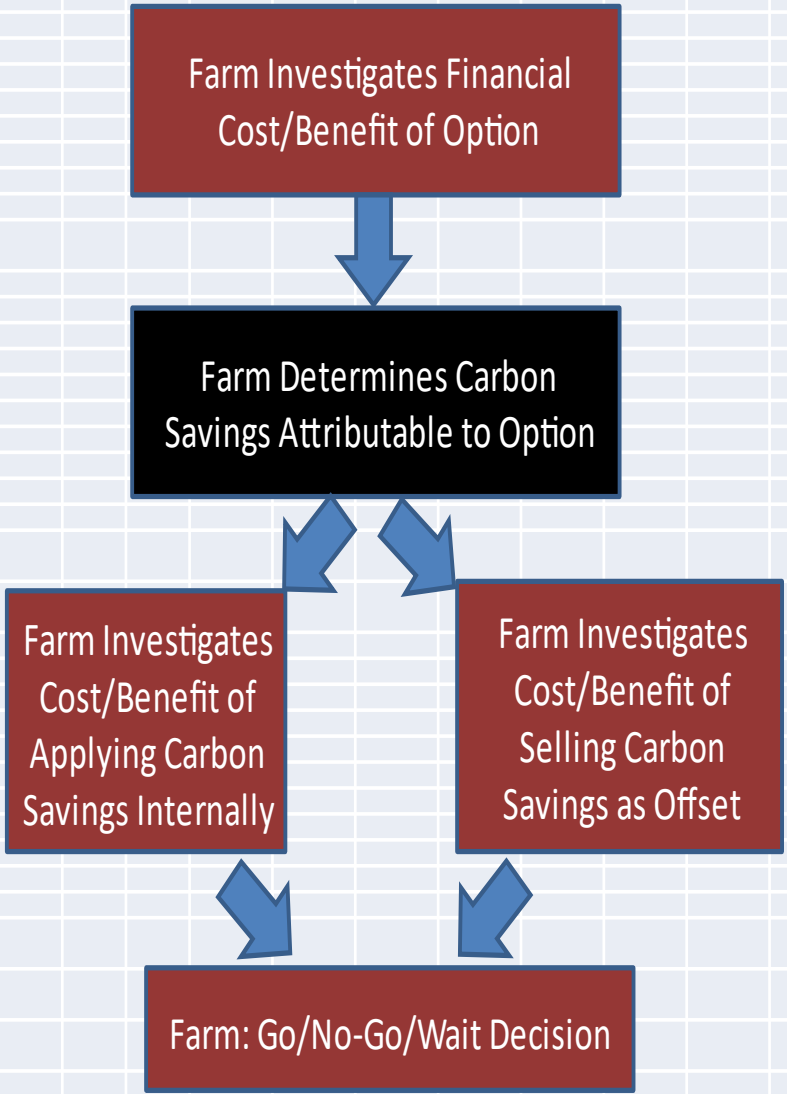
1. Will markets reward farm for managing/reducing the CI of its products?
2. Are CI related pricing premiums transparent, predictable and expected to be stable (at least during the timetable required of a project or practice change)?
3. Can reducing CI and affiliated sustainability practices enable the expansion of the faming operation?
4. Are there low-cost, easily accessible, trusted, and verifiable, independent sources of information for determining the carbon credit (emissions avoidance) expected to result from a capital project or practice change?**
5. Are the carbon related transaction and compliance practices and costs < financial benefits + monetized carbon benefits

****Critical Information Needs: Carbon Conversion Platform**

An obstacle to widespread carbon management practices and markets is the lack of trusted standards and indicative science supporting carbon reduction claims. The standard bearer in the market for performance-based carbon conversion is the California Air Resources Board's (CARB) adaptation of the Argonne Federal Lab's GREET model in the LCFS market. CARB's carbon conversion platform (CCP) utilizes information specific to the production of the fuel, applies available CCP's regarding feedstocks in a methodology estimating life-cycle costs (GREET) and generates a Carbon Intensity (CI) score. The value of the product in the LCFS market is thus determined, in large part, by this CI score.

This general approach: site specific information and **a transparent model/method of calculating the CI of the product** is crucial for individual farms to determine the value of carbon management for their own organization.

A-CEW	Proposed Farm Management System: Carbon Investment and Practice Decision Tool															
	Option	Savings	Revenue	CapEx	OpEx	EBDITA	ITC	Financial Return on Total Capital Deployed	Carbon Reduction Attributable to Option	Impact on Farm's Product CI if Carbon Reduction Internalized	Farm Revenue Impact from Reduced CI	Carbon Reduction Allowable as Offset	Additional Carbon Offset Verfication Costs	Carbon Offset Price	Farm Revenue from Carbon Offset Sale	Total Return on Capital From Option: Direct + Carbon
Power	On-site Solar															
	Solar + Storage															
	Biogas Genset															
	Biogas + Solar															
	Wind															
	Wind+Storage															
	Wind, Solar, Storage															
	Energy Efficiency															
	Utility Renewable Program															
	Other															
Fuels	Biodiesel Blending															
	CNG Retrofit for Heavy Equipment															
	Biogas for NG or Propane															
	Biomass for NG or Propane															
	Electification of Dryers/Boilers															
	EV for Combustion Engines															
	Other															
Nutrient Mgnt	Solids Seperator															
	Solids Seperator & Compost Tea Water Irrigation															
	Digester, RNG															
	Digester, Power/Genset w/o CHP															
	Digester, Power/Genset w/ CHP															
	Lagoon clarifier & Irrigation															
	Nutrient Recovery, precipitato															
	Nutrient Recovery, distillation															
	Nutrient Recovery, UF/RO															
	Manure practice: knifing															
	Manure practice: pumping															
	Manure practice: other															
	Fertilizer Switch (lower CI)															
	Precision Application System															
	Other															
Logistics	Reduction in Machine Hours: Tillage															
	Reduction in Produce-2-Market Miles															
	Reduction in Input-2-Farm Miles															
	Other															



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Conclusions

For agriculture and forestry there appears to be, beyond reasonable doubt, an opportunity to benefit from serving markets for whom the benefits of managing carbon are also beyond reasonable doubt.

The key is to reduce barriers for individuals to participate and to enable enhancing the value of the results.

Recognizing the features of established carbon markets is important to understanding what principals may be best suited for wider adaptation of carbon management. Farming and forestry practices, and the natural processes underlying food/fiber production need to be reflected in carbon accounting and data collection. Carbon accounting needs to be informed by expectations of both customer and financial markets in order to produce a trusted and valued carbon instrument, that is fungible and liquid.

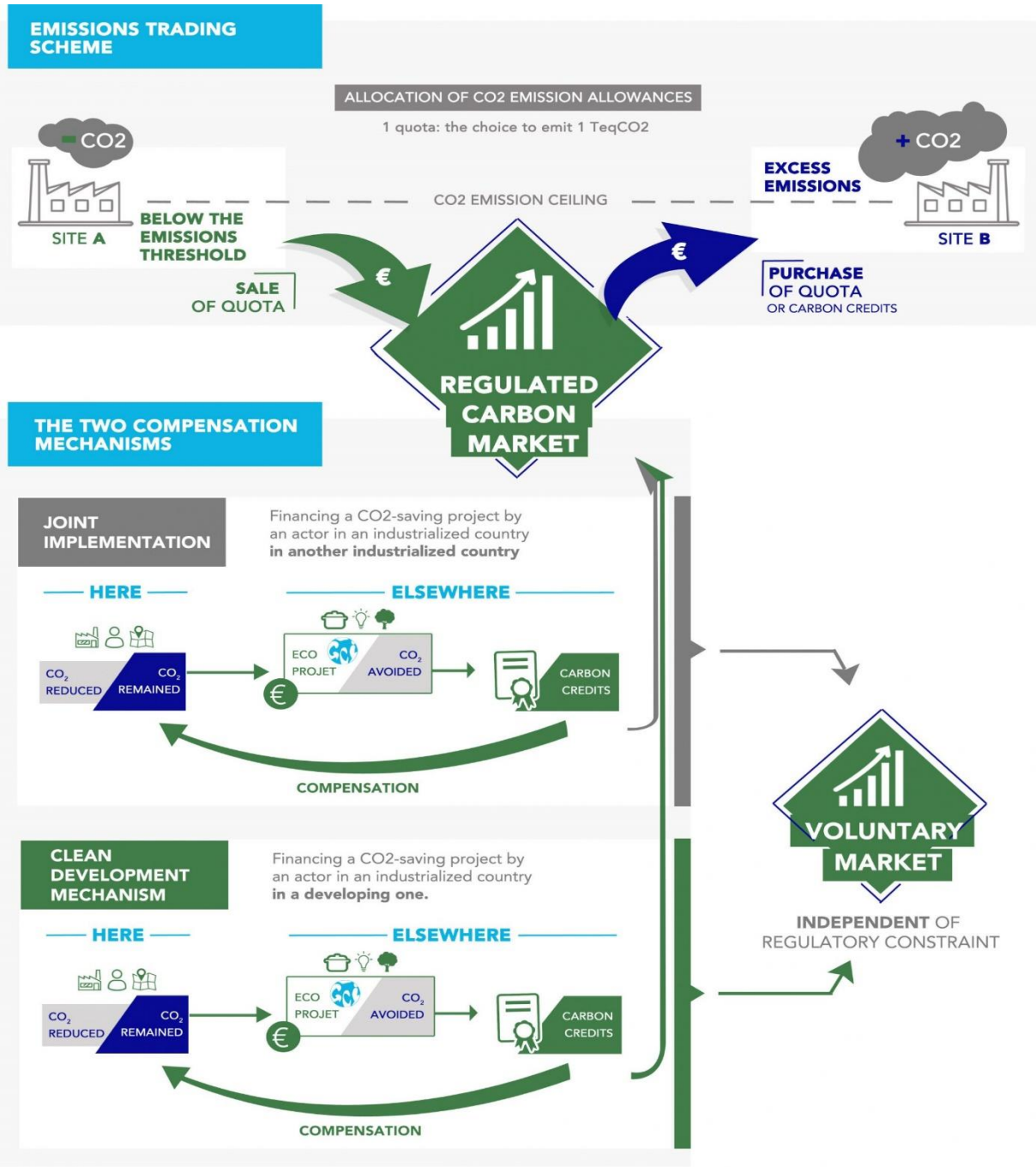
Crucial to this market is confidence by all stakeholders in the science and credibility of the registries and the checks/balances required by the rules. Commodity economics and carbon science need to be complementary. The process of participating clear and understandable. Trading regimes and verification of outcomes need to support carbon reduction practices, rewarding optimal behaviors by farms, foresters, their processors and customers, commercial investors and banks, and the regulators.

Public/private initiatives supporting improved carbon conversion science are crucial to an effective carbon market. Of immediate need is the publishing of continuously updated carbon conversion platform (CCP) information. Also needed is the development and widespread dissemination of site-specific tools which use local studies, methodologies, and data to support individual farming and forestry practices. Such a public CCP will improve the ability of all stakeholders to assess the value of options. This same type of information will also inform and improve the actions of carbon investors and carbon customers.

Thanks to the citizens of jurisdictions where early efforts to establish carbon market rules and demand has paved the way to wider adaptation and monetization of sustainability practices. The European Union, British and California lessons have provided nearly 20 years of experimentation and a sound basis for future policy and market development for others. Your investment is appreciated.

Tim Baye
University of Wisconsin – Madison/Extension

Illustrations of Conceptual Basis of Emissions Trading Systems



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