

An overview of greenhouse gas
reduction systems and the
global carbon economy

Carbon Economy in a Changing Environment



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Whitepaper Overview

This paper gives an overview of environmental credits and their uses in mandatory and voluntary greenhouse gas reduction systems across the globe. It describes uses of environmental credits, particularly carbon credits, in financial trading markets. It discusses current initiatives in the US and the future impacts that the carbon market will have in the US.

Contents

About the Author	3
Climate Change	4
Greenhouse Gases and the Greenhouse Effect.....	4
GHG Reduction	4
Solutions to Climate Change	5
Environmental Credits.....	5
Carbon Credits	5
Renewable Energy Credits	7
Reduction Systems	7
Mandatory Systems	7
Voluntary Systems	10
Market Principals and Brokers.....	11
The Future of the US Carbon Market.....	11
Examples from Current Initiatives	11
Government Leaders	12
Conclusion.....	12

About the Author

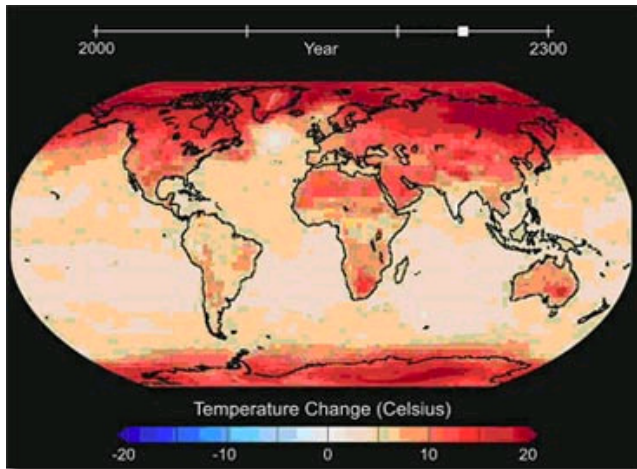
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BIOFerm™ Energy Systems, a Viessmann Company, is a world leader in the development of dry fermentation anaerobic digestion renewable energy facilities. BIOFerm™ technology produces high quality biogas through a specialized industrial scale process that harnesses biogas captured from organic waste and biomass inputs. Biogas production from low cost organic waste streams enables customers to generate on-demand, carbon neutral energy while controlling rising energy costs and reducing their carbon footprint by reducing methane gas released into the atmosphere. BIOFerm™ plants provide owners with TÜV certified carbon credits, usable in the Chicago Climate Exchange and other carbon markets internationally.

Viessmann is a leading manufacturer energy efficient of heating and energy technologies. Viessmann provides proven environmentally responsible heating and energy technologies.

Climate Change

Anthropogenic activities have been altering the earth's atmosphere since the Industrial Revolution. The release of gas emissions, from sources such as the burning of fossil fuels like coal and oil and changes in land use like the elimination of forest cover, has steadily increased for the last 200 years causing an accumulation of these gases in the atmosphere (US Environmental Protection Agency)¹. Climate scientists have all but proven that human activity is the major cause of gas build up in the atmosphere, "Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations 12" (A report of Working Group of the Intergovernmental Panel on Climate Change p. 10), and that result is a severe change in global climate, "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level"².



These changing weather patterns have had, and will continue to have, great impact for life on the earth's surface. Warmer oceans are generating stronger hurricanes that overwhelm shorelines³. The loss of drastic seasonal temperature variances are wreaking havoc in natural ecosystem cycles, like the pine beetle over population in Colorado that is decimating forests of white bark pine⁴. Arctic ice is at the second lowest recorded level (only behind last year's record breaking low), and has receded so severely that its restoration during the winter months will not bring it back up to normal levels⁵. From all corners of the globe, climate change is an evident reality. People everywhere are beginning to understand that the great atmospheric shift is going to affect their everyday lives and their future.

¹ (US Environmental Protection Agency)

² (Working Group I of the International Panel on Climate Change - Solomon, 2007, p. 5)

³ (Ekwurzel, 2006)

⁴ (Connelly, 2008)

⁵ (World Wildlife Federation, 2008)

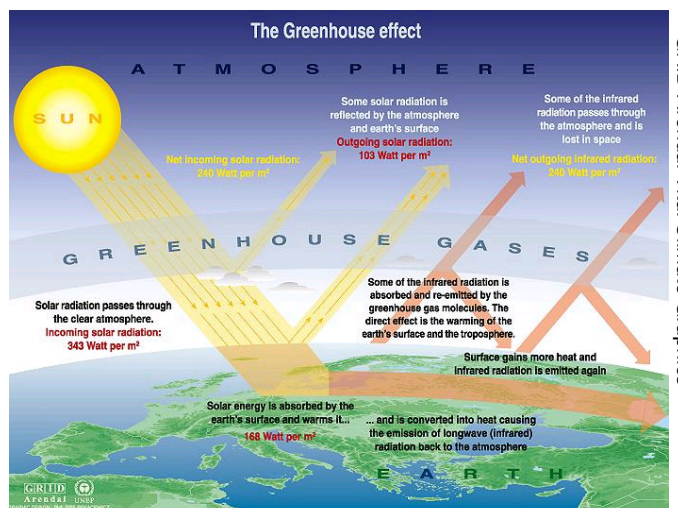
Greenhouse Gases and the Greenhouse Effect

Six gases have been identified by the **United Nations Framework Convention on Climate Change (UNFCCC)** whose concentrations in the atmosphere have been altered drastically by human activity and which have great impact on the atmosphere: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆)⁶. Some of these gases, namely carbon dioxide and methane, as well as other naturally occurring gases, like water vapor, are released by natural ecosystem cycles. For example, volcanic eruptions discharge large amounts of carbon dioxide and wetlands naturally release methane. Human activity, however, has disturbed the rhythm of earth's natural cycles, and anthropogenic exploits have significantly increased the accumulation of these gases in the atmosphere.

All of these gases create a **greenhouse effect**, and thus are termed **greenhouse gases (GHGs)**. "Greenhouse gases effectively absorb thermal infrared radiation, emitted by the Earth's surface, by the atmosphere itself due to the same gases"⁷. Heat from the sun travels through space and hits the earth's surface. Some of this heat is absorbed while the rest of it is reflected, a characteristic of reflection known as **albedo**⁸. Before the influx of amassed GHGs, the reflected heat exited the atmosphere and returned to space to keep the earth stable. Now, as heat bounces away from the earth's surface, it is trapped in the atmosphere and causes an increase greenhouse effect that has an overall warming impact on the planet.

GHG Reduction

The reality of climate change and its cause has been established through rigorous scientific exploration. Doubts remain about the extent to which it will shape the future of society, but many scientists, government leaders, corporate heads and research institutions agree that it must be mitigated. Numerous methods of slowing climate change have been explored; some with sound,



Source: Changian university college in Canada, Department of geography, University of Oxford, school of geography, United States Environmental Protection Agency (EPA), Washington; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

⁶ (International Carbon Bank and Exchange, 2008)

⁷ (Working Group III of the International Panel on Climate Change - Verbruggen, 2007)

⁸ (Working Group III of the International Panel on Climate Change - Verbruggen, 2007)

realistic backing, others as innovative radical ideas meant to push the envelope of possibility rather than to be an actual solution. The common backbone to all approaches of combating climate change is the necessity of reducing GHG emissions.

Solutions to Climate Change

The majority of international scientists and policy makers conclude that climate change can only be mitigated by a significant reduction of GHG emissions. Several systems, both mandatory and voluntary, currently exist to promote the reduction of emissions in different parts of the world. Most schemes work on the basis of a **cap-and-trade** budget. This type of system sets a maximum, or cap, on the allowed amount of emissions for each emitting source covered by the budget. To enforce the cap, permits to emit, or allowances, are distributed to the emissions sources covered by the budget. Emitters must identify, calculate and report emissions to a controlling body and then surrender enough allowance units to cover their emissions over a certain length of time, typically one year. To reduce the total amount of GHG emissions, an insufficient number of allowances are distributed to cover the existing emissions level, and the amount of allowances is decreased by a set reduction schedule. Because emitters have a shortage of allowances, they must reduce gas emissions through internal changes or by purchasing **environmental credits** to compensate for what they cannot reduce. Environmental credits are generated from projects outside of the cap-and-trade program or by emitters that reduce their own emissions enough to have excess allowances.

Environmental Credits

Environmental credit is a broad term that refers to two categories of tradable commodities that hold environmental attributes. Environmental credits can be traded throughout various emission reduction systems.

Carbon Credits

One category of environmental credits signifies the physical reduction, destruction or prevention of GHG emissions. These types of credits are often referred to as **carbon credits**. Carbon credits are created by projects that physically reduce the amount of GHG that enters the atmosphere. They are issued under varying names according to the system the credit is created and used under. Currently, carbon credits receive validation through the varying systems and there is no single global standard for verification, though work is ongoing to create one⁹. The term **offset** is typically when an entity purchases carbon credits to offset emissions that they cannot reduce themselves.

Reduction of GHGs other than carbon dioxide can also create this type of credit. They are typically issued using the **carbon dioxide equivalent** of the gas, meaning the amount of carbon dioxide it would take to equal the heat trapping ability of the other GHG¹⁰. This is determined by multiplying the amount of GHG reduced by its respective **Global Warming Potential (GWP)**.

Carbon credits, and the projects that produce them, created under both mandatory and voluntary reduction systems are verified and certified to ensure that they meet a certain criteria of environmental benefits. Credits produced from projects under mandatory reduction systems are typically verified through guidelines established by the authoritative body of their reduction scheme or by third parties registered by the authoritative body as verifiers. Carbon credits generated from projects participating in voluntary programs are often certified by independent certifying bodies and receive labels identifying their particular environmental attributes (see p.9). Verifications and certifications throughout the carbon market, under both mandatory and voluntary systems, are often based on consistent themes. A particularly important aspect of a carbon credit is that it incorporates the idea of **additionality**. This means that the project generating the GHG reductions and carbon credits is something that would have not otherwise occurred in normal activity. Many organizations refer to this as going “beyond business-as-usual”.

Other criteria often include permanence of emissions reductions, sustainable development propagation and beneficial social impacts, verifiability of the carbon credit by third parties, registration within designated registries to avoid double-counting, reliability within the registry so that the credit is not sold twice and monitoring and reporting guidelines.

⁹ See Voluntary Carbon Standard

¹⁰ (Working Group III of the International Panel on Climate Change - Verbruggen, 2007)

BOX 1**Global Warming Potential¹⁰**

All GHGs trap heat in the atmosphere but do so to different degrees. The composition of the gas affects its heat capturing ability. Differing decay rates determine how long the gas will exist in the atmosphere. Carbon dioxide is the most significant anthropogenically caused GHG, due to its sheer abundance as well as its heat trapping capacity and slow decay rate. All other GHGs are valued on a system with carbon dioxide as the baseline. This system refers to a gas' **global warming potential (GWP)**. "The GWP represents the combined effect of the differing times these gases remain in the atmosphere and their relative effectiveness in absorbing outgoing thermal infrared radiation", and is analyzed over a specific time period, typically 100 years. Carbon dioxide has a GWP of 1, and all other GHGs have GWP comparing their potential to affect climate change compared to carbon dioxide.

Table 1: GWP of 6 Greenhouse Gases

Gas	GWP
CO ₂	1
CH ₄	23
N ₂ O	296
HFCs	1,300 to 11,700
PFCs	6,500 to 9,200
SF ₆	23,900

Renewable Energy Credits

A separate type of environmental credit is known as a **renewable energy credit (REC)**, also referred to as **Green Tags, Renewable Energy Certificates** and **Tradable Renewable Certificates**. These credits are produced by the generation of 1 mWh of electricity from renewable sources. The REC is specifically the package of environmental benefits that comes from the generation of the electricity, not the electricity itself¹¹. The purchaser of a REC might not be using the actual power generated from renewable sources but does own the benefits, such as a reduction of GHG emissions and decreased dependence on the non-renewable energy source, created from producing clean power. By treating these two entities separately, individuals and organizations are able to accrue the benefits of utilizing renewable energy even if they are unable to obtain the actual energy or produce renewable energy themselves.

The most used and trusted certification for RECs is the **Green-e** certification. This certification is administered by the Center for Resource Solution in California¹² and guarantees that certified RECs are from new renewable generation sources (constructed after 1997), that generation sources and facilities are verified and review, that the RECs are not being used for a state **Renewable Portfolio Standard** and that the REC is generated from a an eligible generation source¹³.

Both carbon credits and renewable energy credits are distinct commodities, tradable in markets across the globe. Different markets and trading schemes use different specific unit names, verification procedures and trading policies.

Reduction Systems

The cap-and-trade budget system is being used in many mandatory and voluntary reduction programs across the globe. These systems create varying reduction schedules, focus on different sectors of emitters and allow for different environmental credit trading options. All have their own terminology and rules, but many work in conjunction with each other to allow for a global carbon economy. Some of the most prevalent and established systems are described below.

Mandatory Systems

Kyoto Protocol¹⁴

In 2005, the first significant international system to reduce the abundance of carbon dioxide emissions became operational. The **Kyoto Protocol** is an international agreement born from the UNFCCC treaty that sets obligatory reduction targets for participating countries, functioning as a cap-and-trade budgeting system. Countries that have signed the Kyoto Protocol, termed "**Annex B countries**" have made binding agreements to reduce their emissions

by an average of 5% below their own 1990 national levels during the first phase of the protocol (2008-2012). The protocol requires that each Annex B country must "...have in place...a national system for the estimation of anthropogenic emissions by sources and removals of all greenhouse gases..."¹⁵. This directs each nation to accurately quantify their anthropogenic GHG emissions so that they can have a basis to compare future emission levels.

The Kyoto Protocol functions primarily on a system of **Assigned Amounts Units (AAUs)**. These are tradable commodities that represent the right to emit 1 metric ton of CO₂. According to their baseline emissions levels and binding reductions target, each country is issued a certain number of AAUs by the Kyoto Protocol guiding authority, the UNFCCC. At the end of the year, each Annex B country must turn in AAUs accounting for their total reported GHG emissions amount. If a country finds that they have excess AAUs at the end of the year, they can trade or sell these units directly to other Annex B countries that might not have enough AAUs to cover their own emissions.

In order for countries to reach their Kyoto Protocol emissions reductions targets without causing great burden on economic systems, the UNFCCC developed other flexible methods by which Annex B countries could engage in projects that create, sell and obtain GHG emissions reductions¹⁶. Carbon credits created within these methods can be traded between Annex B countries or to other countries, companies or organizations that participate in another type of GHG reduction program.

Clean Development Mechanisms (CDMs)

CDM projects are implemented by a Kyoto Protocol member country in the locality of a developing country (the hosting country). By instigating projects in these poorer countries, CDMs promote positive development in poorer countries spreading access to higher technology and sustainability information. Working in developing countries also provides access to numerous GHG emissions projects that are not available in developed nations. Standards on the methodologies and verifications of these projects exist that ascertain an actual reduction in GHG emissions is achieved that would not have otherwise occurred in the developing country. Projects are verified by **Designated Operational Entities**, listed by UNFCCC. For verified projects, carbon credits are issued as **Certified Emissions Reductions (CER)**, which belong to the Annex B country that implements the project. These carbon credits can be used by countries to reach their own emissions reductions goals, or they can be sold and traded to other entities.

Joint Implementation (JI)

JI projects are developed to reduce GHG emissions which are implemented by an Annex B country in the locality of another Annex B country. These projects produce real reductions in

¹¹ (Kotas, 2001)

¹² (Center for Resource Solutions, 2008)

¹³ (Center for Resource Solutions, 2008)

¹⁴ (Kyoto Protocol Text - United Nations Framework Convention on Climate Change)

¹⁵ (Kyoto Protocol Text - United Nations Framework Convention on Climate Change)

¹⁶ (Kyoto Protocol Text - United Nations Framework Convention on Climate Change)

emissions of GHGs and generate carbon credits called **Emissions Reductions Units (ERUs)**. Like CDMs, these projects must be evaluated and verified by **Accredited Independent Entities** listed by UNFCCC to ensure that they create actual reductions in GHGs that would have not otherwise occurred without the added value of carbon credits. ERUs can be used by the implementing country to meet their own requirements or they can be sold and traded like other carbon credits.

GHG emissions reductions are mandatory for Annex B countries. The protocol is held compulsory by national governments and international agreements. The primary goal of the Kyoto Protocol is to encourage companies, and countries on a larger scale, to make changes in their operations to increase energy efficiency, reduce waste and conserve resources. Through these internal changes, the majority of GHG reductions are reached. Sometimes, it is technically or economically impossible for an organization to reduce emissions by internal changes, and in these cases, carbon credit trading options provide additional means for reducing GHGs.

European Union Emissions Trading System (ETS)¹⁷

As signers of the Kyoto Protocol, the "EU-15 nations agreed to meet their commitment of an 8% GHG emissions reduction collectively (under the EU-15 'Bubble')"¹⁸. To assist in reaching this group reductions goal, the EU created a multi-national company level GHG emissions trading program focused on the high polluting industry and energy sectors. The EU ETS is another cap and trade system that was created to help EU member nations lower emissions without causing a large strain on the EU economy. Under the EU ETS, each member nation is allotted a certain amount of GHG emissions per year. Similar to the Kyoto Protocol, allotments for emissions are issued as **EU Emissions Unit Allowances (EUAs)**, which were created to be interchangeable with the Kyoto Protocol AAU.

EUAs are distributed to member nations who then apportion them to companies within their countries. The amount of EUAs given to each entity is capped at a level slightly lower than baseline emissions. At the end of the year, companies surrender the amount of their own EUAs that is equivalent to amount of GHG emitted by their operations. The EUAs are then surrendered by each nation to the EU. If a company has not internally reduced their CO₂ emissions enough so that they can cover their emissions with their EUAs, they can buy EUAs that another company has. Additionally, since the EU ETS was created to be compatible with Kyoto Protocol reduction methods, credits from CDM and JI projects can be purchased and used to meet emissions reduction targets.

The Western Climate Initiative (WCI)

Launched in February of 2007, the **Western Climate Initiative** was developed by a consortium of seven US governors and four Canadian premiers in the western portion of North America to address global climate change and measures that could be adopted by these governments to mitigate it. A mandatory cap-and-trade

program approach was recommended to reach the overall goal of GHG emission reductions 15% below 2005 levels by 2020¹⁹. The cap covers many sectors that create GHG emissions, including: all electric generation, industrial and commercial fossil fuel combustion, industrial process emissions, gas and diesel consumption due to transportation and residential fuel use²⁰. Together, the covered sectors account for 90% of the regions GHG emissions²¹. Each participating partner of the WCI will be allocated an emissions allowance budget that can then be distributed to emitting sources under their own governments direction²². The program will be implemented in two phases beginning in 2012. The first obligatory emissions reporting will be at the start of 2011, accounting for all covered emissions in the year 2010²³. The program is designed to drive momentum towards future national GHG reduction programs and "...is designed in such a way that it can provide a model for, be integrated into, or work in conjunction with any future U.S. or Canadian emissions-reduction programs"²⁴.

The Regional Greenhouse Gas Initiative (RGGI)²⁵

The **Regional Greenhouse Gas Initiative** is a mandatory cap and trade emissions reduction program that works through the cooperation of northeastern and mid-Atlantic states and will be the first mandatory CO₂ emissions reduction program in the US at its start in 2009. The initiative is focused specifically on the electric power generation industry and the emissions that they produce. The RGGI mandates that each state "stabilize power sector CO₂ emissions over the first six years of the program implementation (2009-2015) at a level roughly equal to current emissions, before initiating an emissions decline of 2.5% per year". By 2018, the initiative will reduce CO₂ emissions from the power production industry by 10%.

Each of participating states runs and regulates an individual emissions reduction program, though all programs follow parameters set up by RGGI rules so that all programs can work within reciprocity and in conjunction with each other. "A 'Model Rule' drafted jointly by the states provided a coordinating framework as individual states developed their laws, rules or regulations" (website). Allowances are given to each state according to their baseline emissions and reduction schedule. The allowances are then auctioned off to power generation companies and are used as permits to emit carbon dioxide. In this system, one allowance is equivalent to one metric ton of carbon dioxide. The RGGI system also allows for flexibility in meeting reduction requirements through the use of emission offsets created by projects outside the electricity sector as well as use of carbon credits from other mandatory GHG reduction systems, namely CERs from CDMs. Allowances and other carbon credits are tradable commodities for power companies in the RGGI.

¹⁹ (Western Climate Initiative)

²⁰ (Western Climate Initiative)

²¹ (Western Climate Initiative)

²² (Western Climate Initiative, 2007)

²³ (Western Climate Initiative, 2007)

²⁴ (Western Climate Initiative)

²⁵ (The Regional Greenhouse Gas Initiative, 2005)

¹⁷ (European Commission, 2005)

¹⁸ (Pew Center on Global Climate Change)

BOX 2

Additionality

The UNFCCC has created a tool to help projects assess whether or not their GHG reduction project holds the key characteristic of additionality¹. To ensure that project is “beyond business-as-usual”, it must illustrate that incorporating GHG reduction is not the easiest way to accomplish the project. Typically, there must be some sort of challenge that the GHG reduction project must have to overcome.

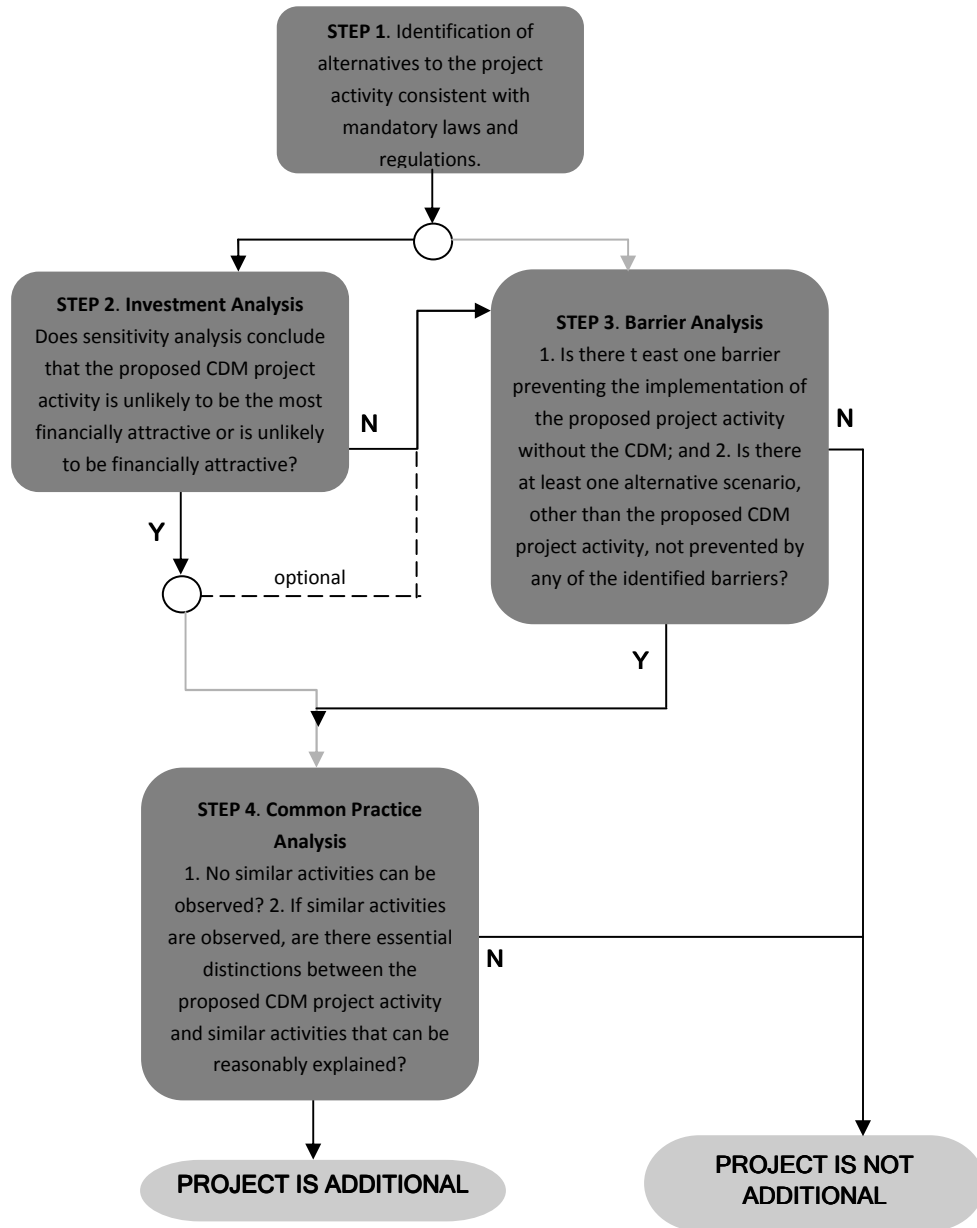


Image adapted from UNFCCC CDM Executive Board Methodological Tool “Tool for the demonstration and assessment of additionality”

The Midwestern Greenhouse Gas Reduction Accord

The **Midwestern Greenhouse Gas Reduction Accord** is an agreement that was reached by nine Midwestern US governors and two Canadian premiers in late 2007 during the Midwestern Energy Security and Climate Stewardship Summit to participate in and/or observe a GHG reduction system. "Through the Accord, these governors agreed to establish a Midwestern greenhouse gas reduction program to reduce greenhouse gas emissions in their states, as well as a working group to provide recommendations regarding the implementation of the Accord"²⁶. The accord establishes a mandate for members to join the Climate Registry for tracking, management and crediting of GHG emissions (see p. 11). It also sets the directive of developing a market-based, multi-sector cap-and-trade mechanism for achieving set reduction targets and time frames²⁷. Preliminary goals of 15-25 percent reductions from 2005 levels by 2020 and 60-80 percent reductions by 2050 have been suggested by the GHG advisory group the accord²⁸.

Voluntary Systems

Other GHG reduction systems exist that are not mandated by government. Parties participate in these systems and are not held to GHG emission reduction levels through national or international law. Instead, these systems rely on the self-motivation of companies, state and local governments and other groups to initiate the desire for reducing GHG emissions. Some voluntary systems do, however, require legally binding agreements for once participants have joined. These agreements are mandated through the voluntary system itself, rather than by a governmental organization.

Voluntary Systems Carbon Credit Units

The typical unit used in markets outside the Kyoto Protocol and thus voluntary markets is the **Verified Emissions Reduction (VER)**. VERs are carbon credits which have been produced by projects that have been certified to reduce GHG emissions and promote local sustainability efforts in the project area. Projects are verified by independent third parties to ensure the validity of the carbon credits they create.

Voluntary Emissions Reduction Certification Labels

Different verifying organizations produce labels based on their own criteria of certifying standards. Labeled carbon credits have a higher financial value than VERs without a specific certification and label. These labels are typically used to assure quality of credits generated by projects under voluntary systems and which are not subject to guidelines and rules of mandatory programs. However, these certification labels can also be applied to carbon credits created within mandatory systems and used as an extra layer of quality insurance.

Voluntary Carbon Standard (VCS)

The VCS label was developed through joint work by an organization comprised of the Climate Group, the International Emissions Trading Association, the World Economic Forum and

the World Business Council for Sustainable Development "... to provide a rigorous, trustworthy and innovative global standard and validation and verification program for voluntary greenhouse gas offsets"²⁹. The goal of the VCS organization is to create a label that can be trusted by purchasers to guarantee the carbon credit they are purchasing comes from a verified source that creates real GHG reductions. "Projects that are approved under the VCS are issued with **Voluntary Carbon Units (VCUs)** which must be held in an authorized VCS Registry"³⁰. All VCUs are issued, held and surrendered in the four approved VCS registries (APX Inc., Bank of New York Mellon, Caisse des Depots and TZ1)³¹. These registries will begin function in early October, 2008. Verifiers approved by the VCS validated projects that can enter one of these registries. Currently, all verifiers that work on CDM and JI projects under the UNFCCC can validate projects for VCU certification. The VCS is reviewing certifying bodies associated with California Climate Action Registry for VCS verifier status.³²

Voluntary Gold Standard

The Gold Standard Label was originally developed by a consortium of the WWF, SSN and Helio International to provide an assurance label for carbon credits generated by CDM and JI projects. Later, a methodology for VER labeling was also established. It is now run by the non-profit Swiss Gold Standard Foundation³³. The label is received after rigorous and transparent third party verification by UNFCCC approved Designated Operational Entities or Accredited Independent Entities (like TÜV) who ensure real GHG reductions are taking place after project implementation³⁴. This label specifically designates a sustainable development portion of carbon credit generating projects³⁵.

VER+

The VER+ label has been launched by TÜV SÜD in order to provide robust validation for projects that do not fall under a mandatory system and will not be registered as CDM or JI projects. However, the criteria for the VER+ certification fall closely in line with CDM and JI requirements³⁶. VER+ project validation and certification for labeling of carbon credits is typically done within TÜV SÜD.

ISO 14045 Label

The ISO 14045 label is currently accepted and preferred by some exchanges and brokerages in US, but is not widely accepted in international markets.

²⁶ (Midwestern Greenhouse Gas Reduction Accord)

²⁷ (Midwestern Governors Association, 2007)

²⁸ (MGA Governors Energy Steering Committee, 2008)

²⁹ (Voluntary Carbon Standard Program, 2007)

³⁰ (TZ1 Registry, 2008)

³¹ (Voluntary Carbon Standard, 2007)

³² (Voluntary Carbon Standard, 2007)

³³ (The Gold Standard, 2008)

³⁴ (The Gold Standard, 2008)

³⁵ (The Gold Standard, 2008)

³⁶ (TUV SUD, 2008)

Chicago Climate Exchange (CCX)³⁷

The **Chicago Climate Exchange** is a financial institution and integrated trading system for voluntary reduction of emissions. Companies, organizations and individuals join this system and make legally binding agreements to track, report and reduce their GHG emissions. A system-wide reduction schedule dictates that signed members reduce their emissions by 4.5-6% below their recorded baseline. A baseline is determined by calculating the average emissions per year from 1998-2001 or by the single emissions by a new member during 2000. Members must reduce their GHG emissions either by direct reduction from their own internal processes or by acquiring credits that are equivalent to their reduction needs.

The trading system of the CCX is based on a **CCX Carbon Financial Instrument (CFI)**. Each CFI represents 100 metric tons of carbon dioxide or carbon dioxide equivalent and can be generated from several sources. CFIs are verified by CCX-approved verifiers. **Exchange Allowance CFIs** are created when a member organization reduces their own emissions below their designated level through internal process changes. These can be traded, sold or stockpiled for later use. Conversely, members who are not able to reduce their GHG emissions within their own organization have the option to purchase these CFIs to reach their binding reduction targets. **Exchange Offset CFIs** are generated by projects that qualify under the CCX standards and involve the sequestration, destruction or reduction of GHG emissions. Forestry practices, methane capture and renewable energy projects can all generate exchange offsets. CERs created by CDMs, energy efficiency and fuel switching projects are also usable for the generation of exchange offsets and qualified on a project-by-project basis. Owners of projects that generate offsets at levels of 10,000 metric tons of CO₂e are considered **offset providers** and can sell their CFIs directly on the CCX. Smaller projects generating exchange offsets must be collectively traded on the CCX through an **offset aggregator**. VERs created by voluntary emissions reductions projects are also tradable on the CCX.

The Green Exchange³⁸

The Green Exchange, slated to become operational in 2009, has been formed from a partnership between NYMEX and Evolution Markets, a financial and brokerage services firm that specializes in environmental and energy markets. The exchange is a separate designated contract market and futures exchange that facilitates trading of EUAs, CERs and RGGI allowances between brokerages, companies, organizations and individuals.

Market Principals and Brokers

Other options exist for those who want to engage in carbon credit markets but do not want to be directly involved in exchanges. Market principals procure different types of carbon credits from varying projects and offer them to purchasing clients as a way to voluntarily reduce GHGs. Brokerages do not purchase credits, instead finding a direct buyer and charging a commission. Through these types of market systems, individuals and organizations not directly involved with a carbon reduction program can reduce their

net carbon emissions or participate in **green investing** and **carbon financing**. Through green investing or carbon financing economic plans, entities are able to invest in projects that will produce tradable carbon credits. In turn, investors then own all or a portion of the created carbon credits.

The Carbon Neutral Company³⁹

Carbon Neutral exists "...to enable clients to cut carbon emissions in ways that deliver environmental, social and business benefits"⁴⁰. The company offers carbon offset and climate consulting services, creating customized carbon reduction portfolios for individual and business clients. The Carbon Neutral Company sources carbon credits following rigorous requirements of carbon verification, registration and validation. When a group or individual purchases an environmental credit through Carbon Neutral, that credit is retired from the Carbon Neutral collection by on behalf of that client, ensuring that the credit is not used twice.

Eco Securities⁴¹

Eco Securities is an Irish environmental trading company that's one of the world's largest developers and suppliers of emissions reduction credits. The company sources, develops and trades carbon credits and maintains a substantial portfolio of CERs, EUAs, ERUs and VERs that clients can choose to buy. Eco Securities also participates in Emissions Reductions Purchase Agreements which are long term contracts to buy carbon credits generated by projects. This helps project developers be protected from fluctuating carbon credit prices.

The Future of the US Carbon Market

As a global leader in most sectors of society, the US uncharacteristically has taken a backseat in the charge to fight climate change. The next few years will determine the position the US will take in the global carbon economy and will fundamentally change the environmental attitude in America. Several local and regional organizations have already stepped up to take the reins on America's environmental journey. The state of California has been a leader in establishing legislation that mandates GHG emissions reporting and in organizing registries that promote emission reductions. The RGGI, as its merits and downfalls are analyzed through its operational lifetime, will essentially be the regional experiment for a national cap-and-trade budget program. It is apparent that a carbon economy is rapidly forming in the US and that the national government leaders will soon began mandatory programs that are in line with international standards already accepted and applied.

Examples from Current Initiatives

Initiatives and organizations that already exist in the US are another indication of its coming paradigm shift on GHG emissions. The **Climate Registry (CR)** and the **California Climate Action Registry**

³⁹ (The Carbon Neutral Company, 2009)

⁴⁰ (The Carbon Neutral Company, 2009)

⁴¹ (EcoSecurities Group plc)

³⁷ (Chicago Climate Exchange, 2007)

³⁸ (NYMEX, 2007)

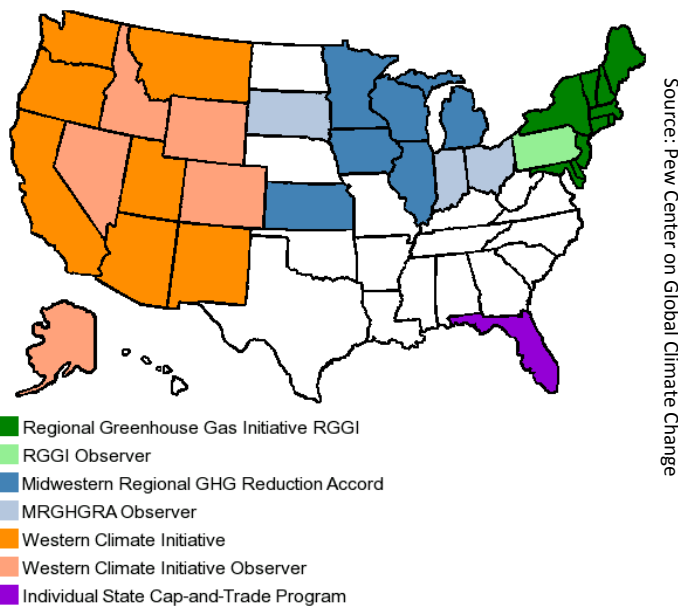
(CCAR) are sister organizations who develop voluntary GHG emissions reporting programs⁴². The Climate Registry is working “to standardize and centralize high quality GHG data into a North American GHG registry to support voluntary and mandatory reporting programs”⁴³, while that goal has already been achieved for California by the CCAR. Currently, the Climate Registry includes 9 Canadian provinces, 39 US states, 6 Mexican states and 3 tribal nations, who all voluntarily commit to track and report all of their GHG emissions in all parts of North America. Though the registry remains officially policy neutral, meaning it does not require emissions reductions, it does support legislation in favor of mandatory reporting.

California, at the forefront of GHG reduction policy in the US, passed Assembly Bill 32, the Global Warming Solutions Act of 2006, with Governor Schwarzenegger in 2006. The bill requires California to reduce GHG emissions to 1990 levels by 2020⁴⁴ (www.arb.ca.gov news release) and calls on the California Air Resources Board, part of the state’s EPA, to implement a plan to attain this goal. The plan is currently in drafting stage and will go into effect starting in 2012, but current plans already involve a mandatory cap-and-trade system that will allow California to become to develop an effective carbon trading market along with other entities in western North America⁴⁵ (Climate Change Draft Scoping Plan, June 2008, www.arb.ca.gov).

reduce GHG missions as part of a global agreement in which all major economies similarly undertake binding international commitments”⁴⁶. In congress, the Lieberman-Warner Climate Security Act, originally introduced in 2007, pushes the EPA to establish a program for national GHG monitoring and reduction systems. “The bill will establish the core of a federal program to reduce US greenhouse gas emissions enough between 2008 and 2050 to avert catastrophic global warming”⁴⁷. Analysts predict that following passage of such laws, the price of carbon dioxide and carbon dioxide equivalents will easily reach \$49/metric ton⁴⁸.

In December of 2007, the US along with over 180 other countries participated in a United Nations Climate Change conference in Bali, Indonesia. The result of these meetings was the affirmation of the Bali Road Map, which sets out plan for negotiating a final climate deal by 2009⁴⁹. The final climate deal will be in the form of another treaty that must be ratified by individual governments before it comes into effect. It will replace the Kyoto Protocol after its conclusion at the end of 2012⁵⁰. After not ratifying the Kyoto Protocol, mere participation in these talks planning future climate change negotiations demonstrates a paradigm shift in the way the US sees itself in the global fight against climate change.

The upcoming administration change will also drastically alter US GHG emission allowances and reduction schemes. Obama and his organization strongly support new legislation that requires mandatory reporting and reductions of GHG emissions. Obama plans to further re-engage with the UNFCCC and implement a cap-and-trade policy that will reduce GHG emissions by 80% by 2050⁵¹.



Conclusion

Environmental credits and the carbon market are poised to become major aspects of the US economic and political spheres. Environmental markets already exist in many other countries and produce significant reductions of GHG emissions and aid in the fight against climate change. Through carbon financing, it becomes possible to economically and effectively generate enormous reduction in GHG emissions, something that is absolutely necessary to mitigate anthropogenic effects on the climate. Not only does the carbon economy make it possible for industrialized nations to reduce GHG emissions without great economic burden, but it also fosters a global trend of sustainable technology, interaction and development. As the US becomes more involved in legally binding reduction systems, carbon credits, RECs and the projects that generate them will become increasingly financially lucrative.

Government Leaders

Though on a national level the US currently only has voluntary markets, impending mandatory reduction systems are an almost certainty. Examples can be seen in all positions of government.

As stated their fact sheet “US Actions to Address”, the US Department of State has already determined that “The United States is prepared to entire into binding international commitments to

⁴⁶ (US Department of State, 2008)

⁴⁷ (US Senator Joe Lieberman; Climate Change)

⁴⁸ (Kintisch, 2007)

⁴⁹ (Science Daily, 2007)

⁵⁰ (La Moshi, 2007)

⁵¹ (Obama)

⁴² (California Climate Action Registry, 2008)

⁴³ (The Climate Registry)

⁴⁴ (Young, 2008)

⁴⁵ (California Air Resources Board, 2008)

A

Accredited Independent Entities...Third parties registered with UNFCCC to validate JI project carbon credits (Currently, Designated Operational Entities act as AIEs and applications for new AIE status are being accepted)

Additionality...A quality of carbon credits that ensures the greenhouse gas reduction project provides further reductions than what would have happened during usual activity

Albedo...Reflection of sunlight away from the earth's surface

Annex B country...A country that has signed the Kyoto Protocol and follows its mandatory emission reduction schedule

Assigned Amount Units...The unit representing the allowance to emit 1 metric ton of CO₂

B

C

California Climate Action Registry...Organization that developed greenhouse gas reporting program for California

Cap-and-Trade...A GHG reduction budgeting program that sets maximum level on GHG emissions from a given source and allows trading mechanisms to reach GHG reduction needs

Carbon Credit...An environmental credit holding environmental benefit of GHG reductions (1 carbon credit = 1 metric ton CO₂ or CO₂e)

Carbon Dioxide Equivalent...The amount of carbon dioxide that it would take to equal the heat trapping ability of a different greenhouse gas

Carbon Financing/Green Investing...Investment in projects producing environmental credits through which investors obtain tradable commodities

Certified Emissions Reduction...The tradable commodity unit produced from greenhouse gas emission reductions from a CDM project

Clean Development Mechanism...A mechanism of the Kyoto Protocol that allows production of greenhouse gas emission reduction units from projects implemented by an Annex B country in a non-signing, and typically third world, country

Climate Registry... Organization developing a transparent and standardized greenhouse gas emissions reporting and analysis program for North America

D

Designated Operational Entities...Third parties registered with UNFCCC to validate CDM project carbon credits (e.g. TÜV)

E

Emissions Reductions Unit...The tradable commodity unit produced from greenhouse gas emission reductions from a JI project

Environmental Credit...A tradable commodity that encompasses environmental attributes

EU Emissions Unit Allowance...Tradable emission allowance unit used in the EU ETS

EU Emissions Trading Scheme...Mandatory company-level cap-and-trade greenhouse gas reduction and carbon finance program implemented by the EU in order to reach Kyoto Protocol emission reduction targets of all the EU countries as a whole

Exchange Allowance...CCX units created by CCX members that reduce emissions by altering internal processes and operations

Exchange Offsets...CCX units created by projects implemented outside of members internal operations

F

G

Global Warming Potential...A metric that characterizes the ability of a greenhouse gas to trap infrared thermal radiation and its lifespan in the atmosphere, together determining its potential to trap heat in the atmosphere

Greenhouse Gas...Gas component of the atmosphere that absorbs infrared thermal radiation (include CO₂, CH₄, N₂O, HFCs, PFCs and SF₆)

Greenhouse Gas Effect...Trapping of infrared thermal radiation in between the atmosphere and the earth's surface due to greenhouse gases

Green Exchange...A financial market that facilitates carbon credit trading

H

I

J

Joint Implementation... A mechanism of the Kyoto Protocol that allows production of greenhouse gas emission reduction units from projects implemented by an Annex B country in another Annex B country

K

Kyoto Protocol... A legally binding agreement produced from UNFCCC that creates legally binding agreements for greenhouse gas reduction targets for signatory countries

L

M

Midwestern Greenhouse Gas Reduction Accord...An accord between governmental leaders of the Midwestern United States and Canada that establishes a schedule of mandatory reductions in GHG emissions in several sectors through a market-based cap-and-trade program. Participating

members include: Iowa, Illinois, Kansas, Manitoba, Michigan, Minnesota and Wisconsin. Observers include: Indiana, Ohio, Ontario and South Dakota.

N

O

Offset Aggregator...Collector of CFIs from many projects that generate less than 10,000 metric tons of CO₂e

Offset Provider...Owner of CFIs generating project holding more than 10,000 metric tons of CO₂e

Offsets... A term used for carbon credits that are purchased to offset lack of internal greenhouse gas emission reductions

P

Q

R

Renewable Energy Credit... A credit that holds the environmental benefits from producing renewable energy

Renewable Portfolio Standard...A policy regulated on the state level that requires electricity providers to obtain a certain amount (usually a percentage or MWh number) of power generated from renewable resources

X,Y,Z

S

T

U

United Nations Framework Convention on Climate Change...An international treaty that creates a framework of action for beginning to address climate change on an intergovernmental level

V

W

Western Climate Initiative...A state province level mandated GHG cap-and-trade emissions reduction program with the likely target of reducing emissions 15% below 2005 levels by 2020. Participating partners include: Arizona, British Columbia, California, Manitoba, Montana, New Mexico, Ontario, Oregon, Quebec, Utah and Washington. Observers include: Alaska, Baja California, Chihuahua, Coahuila, Colorado, Idaho, Kansas, Nuevo Leon, Nevada, Sonora, Saskatchewan and Tamaulipas.

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