
Carbon Solutions Group & GHG Markets Overview

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Carbon Solutions Group Qualifications & Highlights

Carbon Solutions Group is an environmental asset management and engineering firm owned by international chemical trading firm TCO International. CSG is headquartered in Chicago, Illinois. Carbon Solutions Group Europe S.L. has its offices in Granada, Spain.

Our staff consists of financial traders, engineers, environmental scientists, and business/policy analysts. This diverse group of varying backgrounds enables CSG to deliver well-rounded solutions within our specific core competencies of environmental asset valuation, trading, and forecasting.

Carbon Solutions Group's clients include both public and private entities and represent a variety of economic sectors including oil distribution, insurance, power generation, transmission, and distribution, waste management, and other commercial interests.

Carbon Solutions Group's core competencies reside in its background in traditional energy derivatives trading, renewable energy trading, and carbon related asset trading.

CSG is a certified Green-e Renewable Energy Certificate provider, a member of the United States Green Building Council, and a member the United States Department of Energy's Green Power Network, Chicago Sustainable Business Council, and founding member of Green Hospitality Alliance.



Highlights | 2007

January 2007

- Provided Renewable Energy Certificates for international construction corporation
- International trading company TCO International acquires stake in Carbon Solutions Group

March 2007

- Presented as founding sponsor at Green Hospitality Conference in Dallas
- Provided offsets for Shedd Aquarium

April 2007

- Provided environmental attributes for a global leader in professional services Earth Day stewardship claims.
- Provided offsets from Tamil Nadu, India for a major league baseball team's carbon neutral claim
- Retained as carbon consultant by a global insurance firm.

May 2007

- Provided RECs for Ellis Island Welcome Center.
- Provided offsets from Tamil Nadu, India for Mid-Atlantic based investor owned utility.

June 2007

- Provided offsets to make CleanBusiness 2007 carbon neutral in Manama, Bahrain.
- Prepared 20 Million Gallon Molasses Ethanol Plant feasibility study in Maharashtra, India for private client.

July 2007

- Provided wholesale RECs to major Mid-Atlantic investor owned utility.
- Prepared Solar PV feasibility study for 1.3 MW installation in Southern California for major shopping center developer.
- Prepared Swine Biogas to Power feasibility study for 4 MW community digester project in Western Iowa for mid market livestock operator.
- Partnered with engineering firm GDS Associates Madison, WI to offer on-site manure management project & biomass fuel switch feasibility studies.
- Provided RECs for a national leading financial institution
- Responded to national telephony provider RFP for GHG consulting services (TBA by August 31)



August 2007

- Advised University of Chicago on RFP for GHG consulting services
- Contributed environmental asset feasibility for Los Angeles Municipal Solid Waste-to-Energy proposal
- Co-paneled presentation at GovEnergy 2007 in New Orleans with Chevron on emissions trading
- Submitted RFP to Abu Dhabi National Oil Company (ADNOC) on GHG project development opportunities
- Submitted RFP to Gangwon Province, South Korea for GHG consulting services
- Commissioned to author white paper on environmental asset trading by Mid-Atlantic investor owned utility.
- Established Carbon Solutions Group Europe S.L. offices in Granada, Spain via joint venture with Eneryet Renovables S.L. This partnership allows CSG to offer solar thermal, solar photovoltaic, and biomass projects.
- Transacted first direct purchase of carbon offsets for commercial client with the acquisition of tonnes from 3MW Seville, Spain biomass district heating and cooling project.

September 2007

- Provided Landfill Gas GHG reduction project development consulting and brokerage services to Delaware County Electric Cooperative (NY)

November 2007

- Retained by Almeida Oil Company of New York as carbon consultant and US/India project developer.

December 2007

- Consulted Kingdom of Bahrain's Ministry of Environment on carbon trading



Greenhouse Gas Market Overview

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Carbon Preface

Carbon dioxide and equivalent Greenhouse Gas emissions offset trading (carbon finance) is largely misunderstood and in many circles considered a “black box” concept. Carbon Solutions Group has the experience and expertise to simplify the complexities of the nascent carbon market while connecting carbon projects with interested carbon buyers.

It is widely understood that the United States has lagged behind in the transition to the valuation and monetization of carbon dioxide reductions as is evidenced by the price disparity between the US (\$7.00) and European (\$32.00) markets. The accompanying knowledge gap has provided an opportunity for early US movers to invest in low-carbon assets ahead of what will likely be a domestic US carbon market post 2012.

In order to understand what the US carbon market might one day look like CSG draws on experiences in China, India, United Arab Emirates, South America and Europe to educate clients with regard to low-carbon investments. The following section will provide details and understanding of the Kyoto Market and the practicalities of its operation in Europe in order to lay the groundwork for a discussion of the US Regional, Voluntary and potentially US Federal carbon markets.



Kyoto Protocol Overview

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (“UNFCCC”) is an amendment to the international treaty on climate change, assigning mandatory emission limitations for the reduction of greenhouse gas emissions to the signatory nations. It was established December 11, 1997 in Kyoto, Japan.

The objective of the protocol is the “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.”

As of December 2006, a total of 169 countries and other governmental entities have ratified the agreement (representing over 61.6% of emissions from Annex I countries). Notable exceptions include the United States and Australia. Other countries, like India and China, which have ratified the protocol, are not required to reduce carbon emissions under the present agreement.

Annex I Kyoto countries are those that are required to limit and reduce emissions, while non-Annex I Kyoto countries are not limited. Non-Annex I countries such as Brazil, China and India play an important part in Kyoto as they are able to host environmental projects that serve as compliance mechanisms for Annex I countries. These compliance projects are generally described as Kyoto Flexible Mechanisms.

Flexible Mechanisms

The Marrakech accords in 2001 established the rules and mechanisms for Kyoto’s cap-and-trade system. Three flexible mechanisms were established to allow regulated polluting entities in capped countries (Annex I) to acquire rights to pollute beyond their assigned limits. These mechanisms are Clean Development Mechanism (“CDM”), Joint Implementation (“JI”) and Emissions Trading.

The CDM and JI are project-based mechanisms while Emissions Trading means that an Annex I polluting entity can trade with another Annex I polluting entity for their rights to pollute.

The benefits of the project-based mechanisms are two-fold. They serve as a flexible option for compliance under a Cap-and-Trade program. When marginal pollution results in an entity or government exceeding its GHG equivalent emissions cap they have the choice between doing nothing (and paying a alternative compliance tax at the end of the period), trading for an emissions allowance with a cleaner entity with permits to spare or investing in the development of an offset project. Both offsets and pollution rights are quantified in tonnes of carbon dioxide equivalent and are currently valued in the market at €17.00 - € 25.00 per tonne.



Market Benefit

CDM and JI projects are considered “offset projects.” Market experiences suggests that the cost of purchasing an offset from a project tends to be 15-32% lower than trading for an allowance in the open market.

To illustrate this concept we will take a power generator in Germany as an example. Let us say that it is a very warm summer in Germany and this has caused the power generator to burn more coal to sell more electricity to its clients (who use it to cool their homes). Now, let's assume that the German power generator reaches its limit August 31st (its Kyoto Cap). The generator has contracts with its clients to sell them electricity for the rest of the year, but they have used all their pollution rights. The generator will now consider its options.

1. Do nothing - Pay 100 Euros/tonne tax at the end of the compliance period
2. Emissions Trading - Find an Annex 1 power generator with pollution rights left over and purchase those rights for market prices (currently 23 Euros/tonne)
3. CDM/JI - Find an environmental project that has proven it has reduced carbon dioxide in a Non-Annex 1 country and purchase those rights for market prices (currently 10-15 Euros/tonne)

The obvious choice financially would be option 3 - for the generator to buy “carbon credits” from the environmental project in a Non-Annex 1 country. However, because the ease of transaction is much higher for option 2 – most power generators currently pay the accompanying higher marginal cost.

Option 3's project based credits are resultant of the CDM or JI mechanisms and involve considerably more rigor than buying a pollution right allocated by Kyoto for Emissions Trading (Option 2). As we will see, the project developer of a CDM/JI project must do more to earn its credits, but if it does complete the necessary rigors of the UNFCCC credit creation process it will be a much more competitive option for the German power generator.



Developer Benefit

The second benefit of a reduction project is that the funds go towards the development of an environmentally beneficial project that would not have been able to go forward without the additional stimulus resulting from concern for climate change mitigation. For many projects that involve renewable energy the benefit is both in needed energy generation and carbon credit revenue.

The credits produced by CDM projects are called Certified Emission Reductions (“CERs”) and credits produced by JI projects are called Emission Reduction Units (“ERUs”). The credits are monetized when the project developer sells them to a third party (possibly a power generator in an Annex I country). This is considered a primary market transaction and makes up 85% of the current CER/ERU market.

The difference between CDM and JI is geographical and procedural. A CDM project involves an Annex I entity investing in a project in a Non-Annex I country. A JI project involves one Annex I country investing in a carbon project in another Annex I country.

The CDM is overseen by the CDM Executive Board, which is essentially a panel of UNFCCC appointed experts. JI will allow for more autonomy in the creation of projects, as the host country will be responsible for project certification. The procedures for creating credits will vary from country to country. The CDM is a much larger and more mature mechanism as it has been generating credits since 2004, whereas JI will begin generating credits in 2008.

The lower economic and political risks are likely to make JI an attractive method for the creation of compliance offsets. According to the World Bank, in 2006 the CDM market was worth \$5.2 Billion and the JI market was worth \$141 Million. Both of these markets grew by 300% compared to 2005. Initial estimates by the World Bank have found that transactions for the first 3 months of 2007 were equivalent to all transactions in 2006.



Project Example

Guangdong Nan'ao Huaneng 45.05 MW Wind Power Project

The objective of Guangdong Nan'ao Huaneng 45.05 MW Wind Power Project, a grid-connected renewable project, is to utilize the wind power for generating electricity that will be sold into the Shantou Power Grid, part of the Southern China Power Grid. The Project activity will achieve GHG emission reductions by avoiding CO₂ emissions from the business-as-usual scenario electricity generation of those fossil fuel-fired power plants connected into the Southern China Power Grid.

The Project is sited in the east of Nan'ao Island, Shantou City, Guangdong Province in Southern China. The Project involves the installation of 53 sets of turbines, each of which has a capacity of 850 kW, providing a total installed capacity of 45.05 MW. According to the anemometry data collected during the past years, the Project site has excellent wind resources. It is estimated that the feed-in electricity to the Southern China Power Grid from the 53 sets of turbines of the Project is 100.965 GWh per year.

By annually displacing 100.965 GWh of fossil fuel powered electricity the project results in a reduction of approximately 83,000 tonnes of carbon dioxide and equivalent Greenhouse Gases in the environment each year. The project is located in China, which is considered a Non-Annex I country under Kyoto Protocol. This enables a project developer to generate Certified Emission Reductions under the Clean Development Mechanism rules for up to 21 years. The net effect of the project is therefore (83,000 tonnes/year * 21 years) equating 1.73 Million carbon credits for trade under Kyoto Protocol.

The capital costs of the project are estimated to be approximately 60 million USD. Traditionally, electricity sales revenues would be the sole revenue stream for this type of project. However, with the availability of carbon financing opportunities the 83,000 tonnes per year could be sold for between 830,000 USD and 1.6 Million USD per year of additional project finance. This additional carbon finance revenue makes an otherwise average opportunity, significantly above average. Thus, a project that might not have been undertaken in the course of business-as-usual will be undertaken with the benefit of carbon financing and environmental stewardship.

Carbon financing has been established over the last three years as a viable means for securing investment necessary for moving a renewable energy/environmental project forward when the necessary returns are insufficient or traditional financing is unavailable.

Carbon reduction credit pricing is based on bi-lateral and exchange traded Certified Emission Reduction (CER) trading. Regulatory certainty has been established through 2012 under Kyoto's first compliance



US/Voluntary Carbon

U.S. Compliance Markets

RGGI (Regional Greenhouse Gas Initiative)

Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont and Maryland have agreed to cap emissions resulting from installations of >25 Megawatt capacity beginning January 1, 2009. With the first RGGI trade occurring the second week of June of this year it is clear that utilities are starting to figure in their exposure for 2009 compliance. The RGGI draft model was originally issued August 15, 2006 with the final corrections being issued January 5, 2007. This market is currently trading around \$7.00/ton of CO₂ equivalent.

The GHG reduction project types that have initially been deemed “additional” by the RGGI Model Rule are as follows:

- Livestock Manure Management
- Forestry
- Landfill Gas
- Building Efficiency
- Sulfur Hexafluoride

Assembly Bill 32 (California, Western States, Canadian Provinces)

California Assembly Bill 32 was signed September 26, 2006 by Governor Schwarzenegger. It calls for its cap and trade program to begin January 1, 2012. Initial analysis suggests that the final US Cap & Trade legislation will take a form similar to the AB-32 market. This is important because of the importance of offset projects in the determination of price, and therefore flexibility of compliance. This market is trading slightly higher than RGGI at \$6.50/ton. Currently, offset projects can be accepted from livestock manure management, forestry and landfill gas only. The market is also important as many of the architects of the European Union Emissions Trading Scheme are advising the development of the rules of the AB-32 market.

Voluntary Markets

Voluntary Emission Reductions (VERs) are metric tonnes of Greenhouse Gas reductions that cannot currently qualify as compliance offsets under CDM, RGGI, or AB-32. These assets are purchased by corporations and other entities interested in making a carbon neutral environmental stewardship claim. The market for VERs is largely dependent on the quality of the offset offering and the story behind the reduction. Projects that exemplify beyond business as usual practices or technologies demand higher prices. VERs must qualify for a standard such as the Voluntary Carbon Standard (VCS) or CDM Gold Standard in order to monetize at levels above \$7.00/metric tonne. CSG can provide the expertise to assure that projects have the required documentation to register the resulting offsets as robust CO₂ offsets.



CSG Offering & CDM Methodologies

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CSG Offering

Carbon Solutions Group offers global market access for GHG reduction project proponents. We provide turnkey carbon project support ranging from pre-feasibility to forward curve-credit brokerage and trading.

CSG enables project proponents to model and estimate the quantity and resulting value of voluntary emission reductions (VERs), UNFCCC Certified Emission Reductions (CERs) and North American Compliance credits (RGGI & California AB-32).

Depending on the stage of project development it may be appropriate to engage CSG to accomplish one or all of the following tasks:

Environmental Asset Report	Determines the quantity, appropriate registration program and market value of emission reductions resulting from the environmental project	5-20 Hours
Project Idea Note	Necessary trading document for both voluntary and compliance markets	10-30 Hours
Project Design Document	The compilation of baseline/additionality studies, monitoring/verification procedures, sustainable development analysis and other information required by a carbon buyer	50-100 Hours
Project Marketing & Sales Support	CSG will include your project in its marketing portfolio of projects which is presented to over 50 dedicated environmental project financiers (Hedge Funds, Utilities Private Equity, High Net Worth Individual Investors)	Included with any of the above

Collaboration Process

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Collaborate	Research	Deliver Model	Refine Assumptions	Feasibility Study	Project Idea Note	Begin Project

Step 1: Collaborate

This stage of GHG emission reduction project development involves the determination of sector, project type and prior project methodology precedent. The stage varies in duration depending upon the complexity of project type or business process, as well as the availability of technical information to the client's dedicated personnel.

Step 2: Research

The next stage in project development involves CSG researching precedent, market penetration studies, and other information related to the additionality of the project. At this stage the client may be asked to further ascertain project specific technical data.

Step 3: Deliver Model

Once initial additionality has been ascertained emission reductions and financial analysis will be paired to deliver a carbon project model. This model is used by the client to determine the initial feasibility of obtaining carbon finance for the project.

Step 4: Refine Assumptions

If the client decides that they intend on obtaining carbon finance for the proposed project the model constructed in Step 3 will be refined to include actual project quotations for technology and updated market prices for emission reductions.

Step 5: Feasibility Report

The feasibility report is composed in order to best represent the traditional benefits of the project to a prospective investor if one is desired for the project. If the project is to be financed by the client the document will serve as an internal document only.

Step 6: Project Idea Note

The Project Idea Note (PIN) is composed in order to represent the emission reductions aspect of the market to prospective carbon financiers. This document is also required by the host country DNA in order for a Letter of Approval (LoA) to be issued for the project.

Step 7: Begin Project

This stage represents day of project development. The Certified Emission Reduction (CER) process is set in motion with the undertaking of Step 7. Responsibilities and general time horizons for the CER process are as follows:

Methodologies



Methodologies Introduction

The following list shows the various project types that have precedent within the Clean Development Mechanism framework and thus projects of these types have a high likelihood of generating Certified Emission Reductions if the CDM process is completed. The methodology listing is broken into major CDM sectors. Project types not listed here does not preclude them from generating CERs, however it is important to work with a carbon consultant to determine the best way to move forward. In many cases a new CDM methodology must be written for new project types.



Biofuels

- Production of biodiesel based on waste oils and/or waste fats from biogenic origin for use as fuel
- Production of ethanol from corn or sugar feedstocks
- Production of Fischer-Tropsch fuels from syngas

Chemical Industries

- Decomposition of N₂O from existing adipic acid production plants
- Substitution of CO₂ from fossil or mineral origin by CO₂ from renewable sources in the production of inorganic compounds
- Catalytic N₂O destruction in the tail gas of Nitric Acid or Caprolactam Production Plants
- Catalytic reduction of N₂O inside the ammonia burner of nitric acid plants
- Flare reduction and gas utilization at oil and gas processing facilities
- Feed switch in integrated Ammonia-urea manufacturing industry
- Secondary catalytic N₂O destruction in nitric acid plants
- Biogenic methane injection to a natural gas distribution grid

Energy Demand

- Steam system efficiency improvements by replacing steam traps and returning condensate
- Building Energy Conservation Measures
- Baseline methodology for steam optimization systems
- Baseline methodology for water pumping efficiency improvements
- Distribution of efficient light bulbs to households

Fugitive Emissions from Fuels (Solids, Oil, Gas)

- Recovery and utilization of gas from oil wells that would otherwise be flared
- Leak reduction from natural gas pipeline compressor or gate stations
- Flare reduction and gas utilization at oil and gas processing facilities
- Leak reduction from a natural gas distribution grid by replacing old cast iron pipes or steel pipes with out cathodic protection with polyethylene pipes

Fugitive Emissions from Production & Consumption of Halocarbons & Sulfur Hexafluoride

- Incineration of HFC 23 waste streams
- SF₆ Emission Reductions in Electrical Grids



Energy Industries (renewable/non-renewable)

- Renewable energy projects replacing part of the electricity production of one single fossil fuel fired power plant that stands alone or supplies to a grid (Co-fire)
- Avoided emissions from organic waste through alternative waste treatment processes (Cattle, Swine, Industrial Wastewater, Municipal Wastewater, Municipal Solid Waste)
- Grid Connected Electricity Generation Plants using Natural Gas
- Energy efficiency improvement projects: boiler rehabilitation or replacement in industrial and district heating sectors
- Grid connection of isolated electricity systems
- New cogeneration facilities supplying electricity and/or steam to multiple customers and displacing grid/off-grid steam and electricity generation with more carbon-intensive fuels
- Increased electricity generation from existing hydropower stations through Decision Support System optimization
- Energy efficiency improvement of a boiler by introducing oil/water emulsion technology
- Introduction of a new primary district heating system
- Baseline methodology for conversion from single cycle to combined cycle power generation

Manufacturing Industries

- Natural Gas Cogeneration
- Waste heat recovery and utilization for power generation at cement plants
- Use of non-carbonated calcium sources in the raw mix for cement processing
- Fuel switch from fossil fuels to biomass residues in boilers for heat generation
- Use of alternative raw materials that contain carbonates in clinker manufacturing in cement kilns
- Mitigation of Methane Emissions in the Wood Carbonization Activity for Charcoal Production
- Recovery and utilization of waste gas in refinery facilities
- Avoided emissions from biomass wastes through use as feedstock in pulp and paper production
- Emissions reduction through partial substitution of fossil fuels with alternative fuels or less carbon intensive fuels in cement manufacture
- Consolidated Baseline Methodology for Increasing the Blend in Cement Production
- Fuel switching from coal or petroleum fuel to natural gas
- Emission reductions for waste gas or waste heat or waste pressure based energy system

Metal Production

- PFC emission reductions from anode effect mitigation at primary aluminum smelting facilities
- Improved electrical energy efficiency of an existing submerged electric arc furnace used for the production of SiMn
- Reduction in GHG emissions from primary aluminum smelters

Mining & Mineral Production

- Coal bed methane, coalmine methane and ventilation air methane capture and use for power (electrical or motive) and heat and/or destruction by flaring or catalytic oxidation

Transportation Industry

- Baseline Methodology for Bus Rapid Transit Projects