

Global Carbon Market Model



No matter whether the choice is a carbon tax or emissions trading scheme, a global price on carbon is the best chance for the international community to address climate change successfully to limit global warming to 2 degrees.

Trac-Car is releasing its [Global Carbon Market UML Domain Model for Sparx Systems Enterprise Architect Version 13](#). It can be freely downloaded, adapted and used.

It is intended for an automated cloud deployment of carbon credits from energy efficiency and renewable energy replacement of fossil fuels for electricity and transport.

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Summary

A Carbon Credits Market can be based on CO₂ emissions reduction algorithms applied to real-time metrics from the national electricity grid. An international carbon market based on accurate metrics can stimulate new investment in emissions reduction activities.

The UNFCCC COP21 Paris in December 2015 ratifies the replacement for the Kyoto Protocol to address climate change. It is likely that countries agree on emission reduction strategies that trigger national carbon pricing regimes.

A major reason for the current low and wildly fluctuating price on carbon, and therefore the low incentive to invest in carbon emission reduction technologies like renewable energy, is the lack of accuracy in estimation of CO₂ savings. Markets dislike uncertainty.

A strategic approach can target the largest source of emissions, electricity and transport. Vehicle manufacturers are increasingly investing in electric vehicles, and this further emphasizes the role of the electricity grid in reducing emissions. A country with the market structure and regulatory framework in place is required to provide the initiative to kick start an international carbon market. An accurate emissions reduction measurement regime is key to engaging investors in carbon credits.

A carbon market comprising carbon credits from replacing fossil fuel electricity generation with renewable energy is a compelling place to start, as CO₂ emissions reduction can be accurately measured based on real-time metrics from power transmission grids.

A global market can be established, based on a market mechanism, in the first instance applied to CO₂ emissions reduction metrics from the replacement of fossil fuel generated electricity with renewable energy. Subsequently other emissions reductions activities can be rated by a rating mechanism indexed to the emissions abatement from fossil fuel replacement at the electricity grid.

Realtime carbon credits assigned by proven, demonstrable activities for replacement of emissions provides the practical application context for stimulating investor confidence, as well as providing a 'gold' standard for all CO₂e abatement activities registered with an international, standard ratings agency for real greenhouse gas emissions reduction from Earth's atmosphere.

International Carbon Market

Policy

The objective is to exchange energy that plays havoc with the climate systems and the carbon cycle, to energy cycles that do not pour greenhouse gases into the atmosphere.

A simple and effective public policy may be to mandate that electricity transmission authorities nationally are asked to provide a 5 to 10 year plan to reduce fossil fuel electricity generation to zero. However it is recognized that policy takes time to implement, and that in parallel a market mechanism can provide for early adopters of new baseload renewable energy.

As this is liable to be a measure that can only be implemented with an accompanying compensatory mechanism, it is proposed that a reasonable initial price for trading in carbon credits can be offered by engaging an international market. With a decent price on carbon, exchanging renewable energy for energy produced from fossil fuels can provide a reasonable commercial framework in which the electricity industry can undertake

transformation.

In Principle

The principle behind the market is that in many parts of the world there is a regulatory requirement (as well as voluntary activity) to engage in emissions reduction. This means there are buyers for carbon credits that can be used to offset emissions.

Demonstrated emissions reduction activities can provide sellers with an outlet for carbon credits. Being assured of a value in carbon credits, there is an incentive to invest in low carbon technologies to earn the carbon credits that can be offered to international buyers.

Providing a framework around a carbon price in which emissions reduction regimes including China, India, US and Europe can engage can supply the missing piece of the international carbon price jigsaw puzzle. A regulator involved in certification of the accuracy of carbon credits can provide a confidence in the carbon market, attract international trade, as well as providing a strong basis for a stable national carbon price.

In Practice

A prime target for market engagement is the replacement of fossil fuel generators with renewable energy generators. To defray the start up costs, carbon credits backed by a stable carbon price is an attractive proposition. It means that there is an incentive to invest, because there is a return on the investment.

The more participants in a carbon credits market, the better the return for investors in carbon emissions reduction activities. As the market gets going, more activities can qualify for carbon credits, attracting more players into the market.

There is now a sufficient number of potential buyers globally, and sufficient interest in improving the market mechanisms, to set up an international operation. What is required is an accurate measurement system to warrant high quality carbon credits, based on certified, guaranteed emissions reduction activities.

This accuracy is what is currently missing from the carbon credits market, and this is reflected in the fluctuating price. There is a strong latent demand, and an accurate regime for certifying carbon credits can entice participants to invest in the carbon credits market.

Currently the calculations are a manual process calculated by governments reporting to the UN. A Carbon Credits Market replacing this process with metrics based on information provided directly from electricity transmission authorities in near real-time can be a success.

Authorities already collect this information as part of electricity pricing, so the technology is already in place to measure the energy generated on a daily basis. Information and Communications Technology can be used to provision data intelligence.

A Carbon Credits Market pilot can be funded by venture capital. Once the pilot proves successful, and companies sign up as market participants, the market can be capitalized by a public offering. A Carbon Credits Market would then facilitate both buyers and sellers of carbon credits to participate in the market.

To expand market operations, a Carbon Credits Market can use new investment and profits to eventually include all registered, accurately measured approved CO₂ emissions reduction activities endorsed by the UNFCCC and ratified by the IPCC.

A Carbon Credits Market can seek endorsement from the UNFCCC to engage with participants in the new Kyoto Protocol agreement to be signed in Paris at the UNFCCC COP21 in December. The Carbon Credits Market operations can provide the technology and emissions monitoring and data insight to participating parties, issuing one carbon credit

certificate for every metric ton of demonstrated CO₂ emissions reduction.

The objective is to provide a high standard for carbon credits approved by the Intergovernmental Panel on Climate Change (IPCC) in a global market to bring carbon credit buyers and sellers together. Carbon credits registered with the CCM can be traded internationally, and the carbon price regulated by supply and demand.

The market is expected to operate on a commission basis in addition to membership fees and charges. Once the market is established, an initial public offering can be made to potential investors so that shares in the CCM can be publicly traded.

While the initial metrics can be established with the replacement of fossil fuels for electricity, by engaging with the IPCC, a set of governance mechanisms can be established. Assessments can approve carbon reducing activities based on standard metrics, using expertise in emissions monitoring from specialist organizations, universities and research institutes.

Re-afforestation projects in South America and South-East Asia, crop replacement soil regeneration, industrial waste, and ocean plastic disposal could all be targeted as measurable emissions reduction activities qualifying for the Carbon Credits Market.

This market can provide the missing link between government regulation and the lack of certainty for a private sector that wants to develop clean technology, currently lacking in investment confidence.

An accurate carbon credits market can bridge the transition gap as the world changes the way it conducts business from placing no value on natural resources and the biosphere, to a new paradigm of incorporating the thinking of sustainable development into corporate sector investment.

A program engaging appropriate stakeholders can demonstrate the demand for a market for carbon credits, and establish a base price. The waters can be tested and interest gauged from potential market participants and investors, in parallel with a pilot program to set up the market and the carbon credits trading mechanism.

The market is to operate by publishing and offering carbon credits initially based on real-time data collected from the electricity grid. A bid can be entered for metric tons of CO₂ reduction from renewable energy replacing fossil fuels. The lifetime of emissions reduction activities can be established in order to determine a period of eligibility over which to calculate the carbon credits. For example, replacement of fossil fuel energy with renewable energy may be deemed to be valid for perhaps five to ten years from commencement, depending on factors such as the cost of the technology and the payback period for the investment.

Data

A Global Carbon Credits Market can provide a standard carbon pricing mechanism. This would enable the corporate sector to develop a low carbon economy, independent of domestic and regional carbon market bias. The market can be developed on distributed cloud technology using a UML Global Carbon Market Model. The objective is to increase the accuracy of carbon metrics, and provide an international standard for monitoring emissions reduction.

Initially, data about power transmission by generator type can be collected from Transmission Network Operators, both in real-time, and from forecast demand schedules. Data can be collected from scheduled transmissions, as well as from smart grid network devices to supply near real-time metrics of supply of renewable energy generation replacing what was formerly supplied by fossil fuel energy generation.

The metric tons of CO₂e reduction can be calculated using standard IPCC algorithms, and

the emissions reduction translated into carbon credits can be offered to buyers on the open market.

A pilot for the carbon credits market can be set up in parallel with a replacement renewable energy generation capability engaging a regional Transmission Network Service Provider to replace fossil fuel electricity generation supply with a local renewable energy plant.

Liaison with the IPCC can provide the basic algorithms to apply to the data gathered from the TNSP. Based on the energy metrics, business rules can be applied to automate the emissions calculation algorithms.

A national electricity regulator can be engaged to monitor and manage the regulation of the electricity metrics from the electricity grid.

Specialists with knowledge of IPCC algorithms and emissions factors can be engaged to determine the rules for carbon pricing for the Carbon Credits Market. Automated computing systems can be established to apply the business rules for carbon credits prior to offering them online to buyers.

As well as earning carbon credits for replacing fossil fuels with renewable energy, carbon credits can be bought by companies obliged to demonstrate emissions reduction at the going carbon price. This approach would attract customers with all types of emissions regulations, both taxes and emissions trading.

Data gathering mechanisms can provide a sufficient level of accuracy for market spot pricing, and the accuracy can only increase as electricity monitoring and demand forecasts improve.

This provides an enormous downstream opportunity to apply carbon emissions monitoring algorithms to demand and consumption data, providing carbon pricing discounts on the spot to wholesale and retail buyers of electricity. This approach is an organic way to encourage companies with an innovative approach to carbon emissions reduction.

In parallel, there is a market incentive to develop accurate monitoring mechanisms for other carbon emissions reducing activities that would be fostered by the presence of a Carbon Credits Market.

The establishment of a pilot program to set up the market mechanisms, and engage in a proof-of-concept with the electricity industry and the UNFCCC can be conducted over a year, including evaluation of the outcomes and promotion to investors, and market participants.

Market operations can then be fully deployed, with appropriate improvements based on the experiences of set up and deployment of the technology, and engaging with stakeholders.

The initial carbon trading stakeholders are the current electricity generators and transmission authorities. (They already have real-time metrics in place for demand management. The electricity market is a zero sum game, supply has to meet demand, and algorithms can be applied to these metrics).

Investment

Investment is required to start the ball rolling, and private and institutional investors are to be approached to provide the initial finance.

The policy mechanism has to be determined, and policy specialists engaged to form the policy and lobby for support and adoption through the channels for public policy legislation.

In parallel, market expertise has to be engaged to establish a clearing mechanism for trades in carbon credits. The processes themselves can be set up from scratch using specialist knowledge of market operations and information technology.

Cloud based Information and Communications Technology (ICT) can supply a visual interface on a public website monitoring the replacement of fossil fuel electricity, and automatically calculating and displaying carbon credits from replacing fossil fuel energy with renewable energy. This provides some interesting opportunities for engagement with new parties interested in reducing emissions, as well as providing public interest information.

At the outset, electricity market regulatory bodies can be engaged to promote the market to the electricity industry, and this, allied with a reasonable initial price, can ensure the ongoing stability of the market.

Electricity authorities can accurately provide provable metrics of electricity generated from

renewables to replace electricity generated from fossil fuels. This certainty and the accuracy of the data is the fillip required to stimulate investor interest.

The UNFCCC and the IPCC have already developed algorithms for calculation of CO₂ emissions reduction per tonne, other verified emissions reduction activities can be registered for carbon credits, monitoring mechanisms developed so that all major sources of carbon credits can eventually be traded in a global carbon marketplace.

The challenge is to replace fossil fuel electricity with renewable energy. Political and economic barriers can be overcome by legislation. Electricity networks can roadmap decommissioning of fossil fuel generators. It simply requires political will.

CO₂e Emissions Reduction

The United States is the second largest emitter on the planet, topped only by China. US statistics are readily available, and they are cited here as an indication of the potential for global emissions reduction:

In 2014 4,093 billion kilowatt hours of electricity was consumed in the United States. About 67% of the electricity generated was from fossil fuels (coal, natural gas, and petroleum).

Savings over 5 years assuming an average attrition rate of fossil fuel generators from electricity grid of 5% per annum would be of the order of 520 M tonnes of CO₂e emissions saved. These figures can be extrapolated into a global context.

Of course the basic assumption is that there is a strong initial carbon price set by an international regulator, and that market players do not sabotage a reserve price.

A second factor in assuring emissions reduction is public opinion. Ongoing public campaignsput pressure on global governments to make fossil fuel electricity unpalatable politically.

Assuming participation by electricity stakeholders, an international carbon market is viable. The costs of renewable generators can be defrayed by a stable carbon price attractive to investment by electricity market stakeholders.

Other emissions reduction activities would augment the level of emissions reductions over the same period.

Key benefits

Electricity stakeholder expectations can be met by providing a financial incentive to develop baseload renewable energy, which in turn stimulates the investment in renewable energy and storage technology.

A Carbon Credits Market technology provides for the new carbon pricing regimes being mandated in every part of the globe.

Lower cost of electricity results from increasing demand for renewable energy generators which in turn reduces the costs and stimulates technology improvements.

The market can provide further economic stimulus in all technologies that are deemed to reduce the planet's carbon footprint.

Market redeemable carbon credits can provide competitive pricing regime for energy consumers, as well as a robust market for investors who want to finance low carbon technologies.

Timeframe

Short term, a pilot project can be delivered within one year. By year five, a significant number of regional electricity grids can reasonably be expected to participate in a Carbon Credits Market, given that strong global support for an international carbon pricing regime is expected to emerge from the new UN Kyoto Protocol replacement agreement to be signed in Paris in December 2015.

By year three, the ratification of governance mechanisms to address the other major sources of CO₂ emissions, transport and deforestation, can be standardized. Over

subsequent years, activities from agriculture, ocean regeneration, and plastic replacement can be included as standard measured ways to reduce emissions.

In 20 years time, 100% of energy has to be renewable, and technologies to stabilize the carbon cycle to manageable levels. to have any chance of averting critical loss and damage, large scale disasters and catastrophic climate change putting the world on the footing of survival management. Reduction in energy consumption would otherwise be by attrition as social breakdown of infrastructure is bound to result.

By 2100 we have to have contained temperature rises to around 2 degrees.

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