

# CARBON MARKETS FOR LANDFILL GAS AND WASTE SECTOR PROJECTS: CURRENT STATUS AND POST-2012 OPPORTUNITIES

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**SUMMARY:** As the Kyoto Protocol nears the end of its first phase in 2012, there is rampant speculation about the future of the carbon markets, climate change regulation and especially the CDM. In December 2007, the parties to the Kyoto Protocol and the US (which is not a signatory to the Protocol) signed on to The Bali Roadmap which called for worldwide agreement on an extension or a successor to the Kyoto Protocol by December 2009. The Bali Roadmap calls for this goal to be reached by the time of the annual meeting of the parties to the UN Framework Convention on Climate Change in Copenhagen in December 2009. One of the most significant uncertainties is the role the US will play. In this paper, we summarize the current status of carbon projects, markets, and opportunities.

## 1. INTRODUCTION

The Clean Development Mechanism (CDM) is a flexibility mechanism of the Kyoto Protocol which assists industrialized countries to meet their Kyoto commitments to reduce their GHG emissions through investment in GHG reduction projects in developing countries. In exchange for their investment in such projects, the investors take ownership of the GHG emission reductions created by the project (called Certified Emission Reductions or CERs). In 2006, there were 200 CDM projects registered under the Kyoto Protocol. Today there are approximately 1600 registered projects and more than 4700 projects in the pipeline from 80 countries. In addition to the CDM, there are voluntary carbon market opportunities for landfill gas and other waste sector projects. In this paper, we summarize the current status of carbon projects, markets, and opportunities. Especially, the untapped potential in certain geographic regions of the world and in certain sectors, including the waste sector.

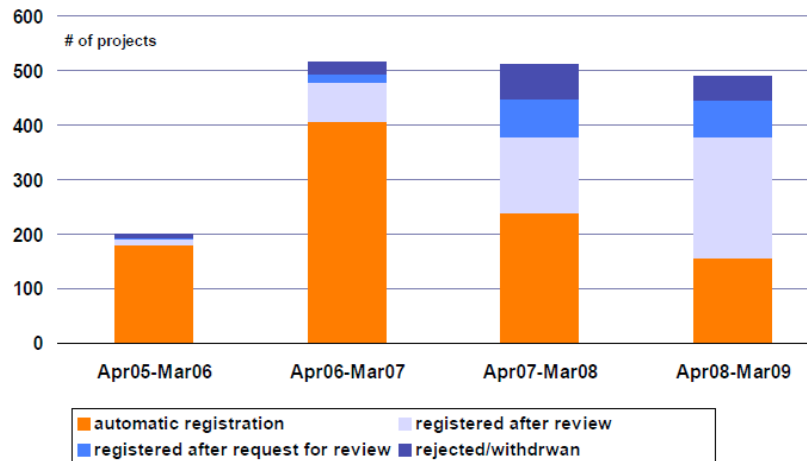
## 2. PROJECTS

### 2.1 Projects and CERs

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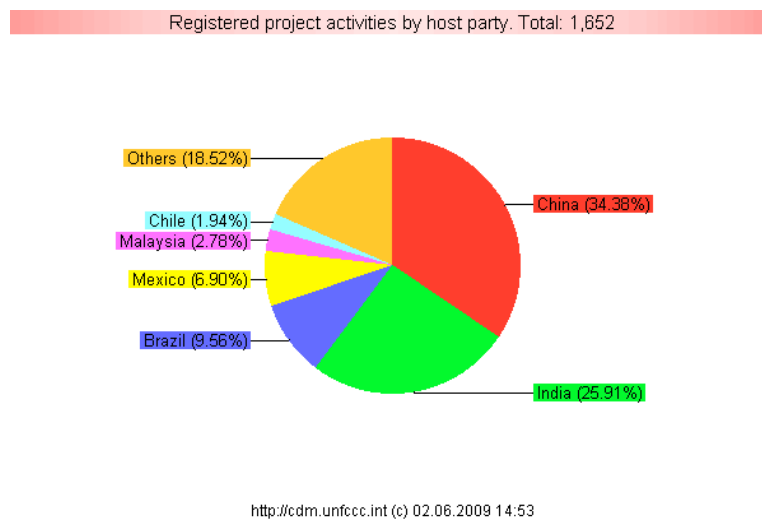
Figure 1 summarizes recent trends for CDM projects. The total number of projects registered has remained relatively static for the last three years. In addition, for reasons to be discussed below, the “automatic registration” fraction of those projects has decreased in the last three years.



Source: UNFCCC.

Figure 1: Registered projects (Capoor and Ambrosi, 2009).

The geographic distribution of registered CDM projects by host country is shown in Figure 2. Note that more than 75% of the projects are in four countries: China, India, Brazil, and Mexico.



<http://cdm.unfccc.int> (c) 02.06.2009 14:53

Figure 2. Geographic distribution of registered CDM projects by host country as of this writing (UNFCCC 02 June 09).

Figure 3 shows expected annual carbon credits from project-based transactions (including CDM projects and voluntary markets) during recent years. The peak year was 2007. The percentage of CDM credits dwarfs the number of credits from voluntary markets.

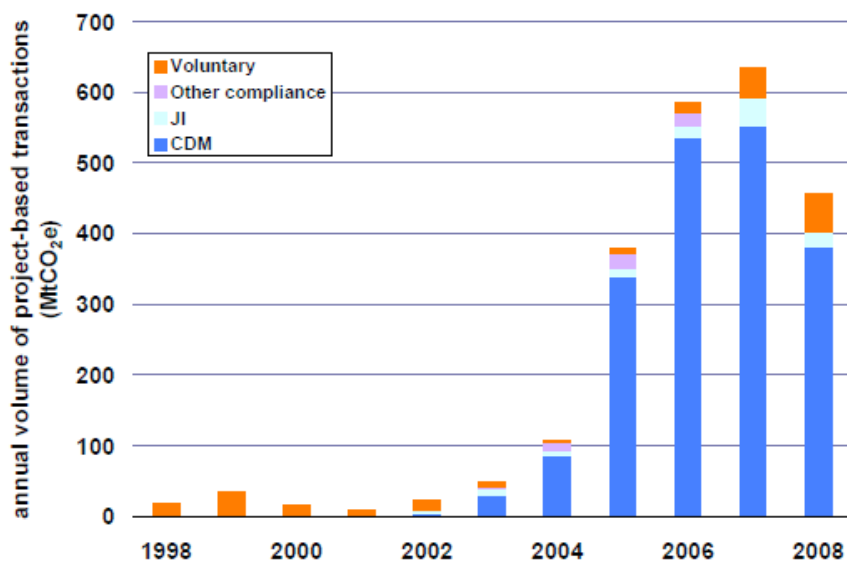


Figure 3. Annual volume of project-based transactions (Capoor and Ambrosi, 2009).

## 2.2 The carbon market: who's selling and who's buying

The waste sector has been relatively active under the CDM and currently accounts for approximately 9 % of the total number of CDM projects. The greenhouse gases that are reduced or avoided by these waste projects include carbon dioxide, methane and nitrous oxide. The quantity of greenhouse gases avoided or reduced by any given project is defined by Approved Methodologies and associated Tools established by the CDM Executive Board which require each CDM project to be developed and monitored strictly in accordance with methodologies that it accepts.

In 2008, the carbon compliance market totaled \$126 billion dollars (Capoor and Ambrosi, 2009). The primary drivers for this market have been the Kyoto Protocol and the EU Emissions Trading Scheme. To date the CDM of the Kyoto Protocol has generated a significant number of projects and is expected to create significant greenhouse gas reductions by the end of 2012, with reductions trading continuing despite the current economic downturn. The EU Emissions Trading Scheme, which started in 2005 on a pilot basis, is now in its first full phase (2008-2012). It accepts emission reductions from registered CDM projects for compliance by the approximately 11,000 entities it regulates. The EU recently extended this scheme through climate and energy legislation which requires a reduction in greenhouse gas emissions of 20% below 1990 levels by 2020. The EU has promised to require a 30% reduction if an acceptable international agreement is reached. In addition, there is a smaller but growing worldwide voluntary market which we will discuss in more detail below.

The historical data shown in Figure 4 indicate that European buyers remain the dominant buyers in the compliance market with most of the buyers coming from the private sector (90%) and the balance (10%) from governments (Capoor and Ambrosi, 2009). Pension funds and other institutional buyers are present in the market, and there are reports of purchases being made by eventual compliance buyers from the US and Australia, even though those programs are not yet in effect.

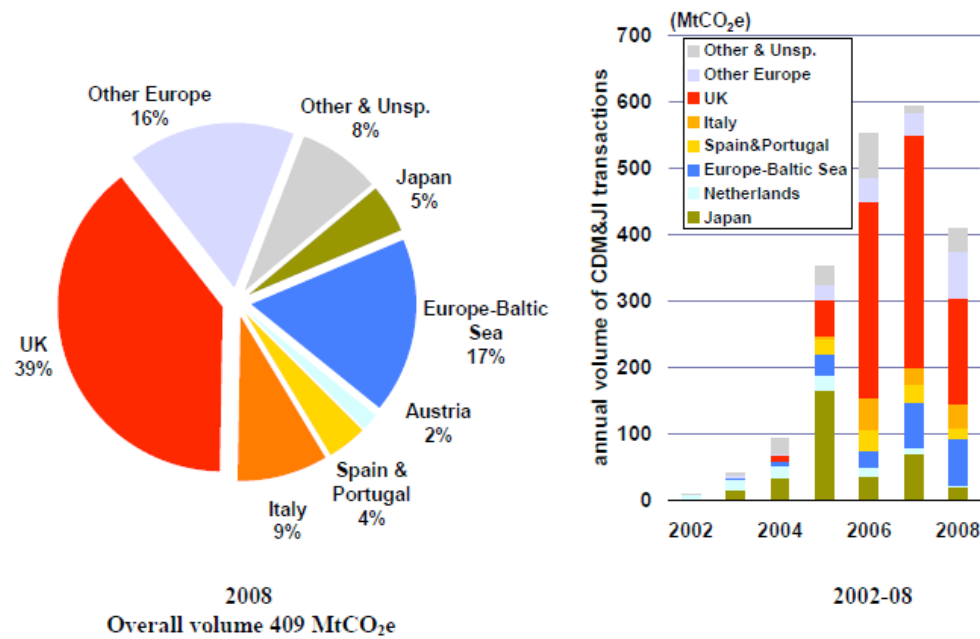


Figure 4. Primary CDM/JI Buyers (as shares of volumes purchased, vintages up to 2012) (Capoor and Ambrosi, 2009).

With respect to sellers, Figure 5 shows that China continues to dominate as the primary seller with 84% of the market in 2008 (Capoor and Ambrosi, 2009). China's share increased significantly in 2008 and 2009, from 66% to 84%. Most of the new Chinese projects are wind and hydroelectric projects; however, these projects are facing significant obstacles in the market as questions continue to be raised about their additionality. Although the CDM has been largely unsuccessful in some regions of the world, including in Africa in general, a number of projects have recently entered the CDM pipeline from Sub-Saharan Africa. There have also been new transactions in several countries in the Middle East. Despite the uncertainty post-2012 and the economic decline across the world, the carbon market has continued to stimulate sustainable development in the developing world.

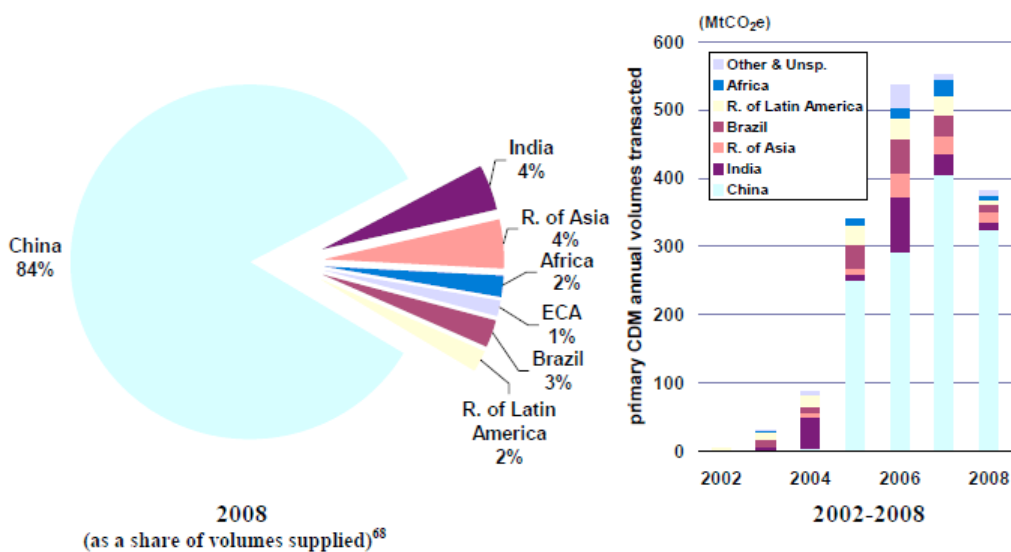


Figure 5. Location of CDM projects (Capoor and Ambrosi, 2009).

Even though prices in 2008 were 16% higher than in 2007, prices have dropped substantially due to the recent economic collapse. The EU allowance prices, which have always been higher than CER (from CDM projects) prices, were at a high of 28.73 euros per tonne in July of 2008 and a low of 7.96 euros in February 2009. The spot market for CERs went from 19.90 euros per tonne in August 2009 to a fraction of that in recent months with the current (June 2009) average price being at about 9-11 euros per tonne for emission reductions from CDM projects.

### **3. REFORMING THE CDM**

The CDM has improved considerably since it was first introduced, including for waste projects. However, there is no doubt that the continued success of the CDM and the entire compliance system of the Kyoto Protocol depends on the implementation of reforms, both short term and long term. Many of the long term reforms that will be required if the CDM is to continue post-2012 are already under discussion. It is also clear that the CDM is not, in its current form, capable of achieving the level of reductions required to address the problem of climate change at the level required, according to the Intergovernmental Panel on Climate Change (IPCC). Informed participants in the carbon market are predicting that the CDM will continue but not in its current form.

#### **3.1 What's working in the CDM?**

The positive aspects of the CDM are as follows:

- Significant source of financing for GHG reduction projects.
- Ability for further growth.
- Framework to engage in socially responsible and sustainable investment.
- Responsive to expanding call for private sector involvement in climate change.
- Increases capital flow to developing world.
- Creation of jobs and new markets within developing countries.
- Environmental benefits.
- Average issuance success rate of over 97%.

#### **3.2 What's not working in the CDM?**

Some of the problematic aspects of the CDM are:

- Lack of access to capital and high transaction costs.
- Lack of access and lack of transparency with the CDM Executive Board.
- Lack of availability of verifiers (DOE's) for validation and verification of projects.
- Conflicting interpretations of methodologies.
- Excessive delays of more than a year between the start of validation and registration. Up to three years from start of validation to issuance of CERs.
- Additionality criteria that are confusing and often subjectively applied.

### **4. SIGNIFICANT REFORMS NECESSARY**

Significant CDM reforms are needed in three broad areas. These include:

#### **Environmental Integrity**

- The CDM must produce additional and real emissions: it must address the real and even

greater perceived problem of environmental additionality, now widely spoken of based on recent studies.

- There are real problems with some of the approved methodologies. Certain aspects are unsupported by sound science, including methodologies for reductions from waste projects.

### **Accessibility**

- There is inadequate capacity building at least in the case of Africa and insufficient accessibility in certain sectors.
- Certain types of projects are under represented and not being developed as they could be. This includes waste projects outside of landfill gas.
- Excessive transaction costs must be reduced.
- Energy efficiency programmatic approaches must be available and workable.

### **Procedural integrity**

- The rules must be clear and applied in a transparent manner so they are in fact and are also perceived to be rational and fair.
- Transparency:
  - Participants must have an absolute right to unbiased decisions.
  - There should be a published code of ethics for Executive Board members re: conflicts of interest.
  - There must be a right to know the basis for Executive Board decisions which should be in writing and available to all based on specific rules interpreted in a consistent manner.
  - All Executive Board meetings should be open.
  - There should be a right to be heard before the Executive Board.
  - There should be an absolute guarantee that private parties will be informed about deliberations affecting their projects
  - There must be an independent tribunal to which parties that feel they have been aggrieved by Executive Board decisions have recourse.
- Predictability
  - There need to be more robust administrative procedures.
  - Written administrative rules are needed regarding communication between Executive Board members, panel members and project participants.
  - Clear rules and regulations should be codified.
  - There needs to be more predictability and accountability for DOE's.
  - Interpretation of Executive Board requirements and rules by DOE's need to be consistent and practical. There must be recourse if a DOE is uncertain about how a rule should be interpreted.
  - Methodologies should be streamlined.
  - Professionalize the CDM. The Executive Board serves as a defacto regulatory body and must have incorporated into its procedures the necessary attributes of a regulatory body in order to maintain its credibility. Full time Executive Board members with the necessary technical qualifications, experience and time available to deal with the increasing demands and complexity of the job are essential.
  - Executive Board decisions should be recorded in writing.

There is a strong push to reform the CDM and in fact as of this writing some of the problems discussed above have begun to be addressed. However, more fundamental reforms are still under discussion and needed to make this mechanism workable, not only for waste projects but for all sectors in all regions of the world.

## 5. VOLUNTARY CARBON MARKET

The voluntary carbon market continues to grow in volume and value. This is a global market that operates separately from the compliance market. It includes carbon emission reductions, also referred to as “carbon offsets” that are generated and purchased without a regulatory mandate. In the early stages of the market’s development (prior to 2002), the voluntary market was valued at \$171 million. From 2002-2005, the market remained relatively constant, but since 2005 this rapidly growing market has more than doubled in value each year. To date in the United States, the majority of carbon transactions occur within the voluntary market since there is not yet a legally binding federal carbon regulatory system in effect (see below).

There is one existing mandatory carbon reduction program in the US and that is the Regional Greenhouse Gas Initiative (RGGI). It is a regional compliance-based cap-and-trade programme in ten New England and Mid-Atlantic states (northeast USA). Under the program, each participating state has a cap on its emissions from electrical generation from power plants that produce more than 25 MW. By 2018, the cap will be reduced by 10%. During the true-up period at the end of each compliance period, the regulated power plants must have sufficient allowances to cover their greenhouse gas emissions. These allowances are available through auctions and through the purchase of offsets from projects approved by RGGI. The auction revenues are allocated to the participating states and reinvested in electricity and fossil fuel efficiency programs and other carbon reduction projects, all in accordance with the decisions made by each state.

The demand for voluntary carbon offsets was driven initially by companies and organizations seeking to improve their public image by showing their commitment to environmental sustainability and climate change. More recently however, in the United States, companies and entities are seeking to purchase voluntary offsets from projects developed under RGGI or a recognized carbon standard with the hope that these offsets will be “pre-compliance quality” and eventually recognized under a US national cap and trade programme.

With the expectation that a US federal cap will be adopted, companies, organizations and high-energy users want to minimize the risk of having any early actions becoming null and void in the near future. The view in the market is that purchasing offsets developed under a regional mandatory program or a widely recognized carbon standard reduces that risk. A recent report (Hamilton et al., 2009) states that there has been a “flight to standards” that indicates that the quality of carbon offsets is an important factor in the market value.

There are more than twelve recognized carbon standards that compete for projects, and the growing demand for offsets developed under them reflects the market desire for carbon offsets that are subject to stringent rules, as well independent verification and registration. These standards are intended to ensure that the offset purchased is real, verifiable, permanent, additional, and enforceable. In 2008, there was a dramatic increase in the use of carbon standards and third party verifiers with 96% of available offsets verified by an independent third party. The growth in the use of these carbon standards reflects the general awareness that emission reductions need to be real to be worth anything as well as the hope that the offsets will be recognized as “early action credits” under an eventual US national program.

While there are more than a dozen carbon standards that compete for projects, four carbon standards have emerged as widely recognized standards comprising the majority of the volume of offsets available; the Voluntary Carbon Standard (48%), the Gold Standard (12%), the Climate Action Reserve (10%) and the American Carbon Standard (9%) (Hamilton et al., 2009). The Voluntary Carbon Standard has become the preferred carbon standard and was used for the majority of voluntary projects. All four of these standards are rigorous, cover multiple sectors, and require third party verification. The Climate Action Reserve (CAR), based in the state of California in the US, is developing sector wide protocols for landfill gas, forestry, coal bed

methane, livestock, and other project types, all intended for use across the US. The CAR offsets are viewed as desirable because the protocols are applicable nationwide, and are viewed as likely pre-compliance offsets that may be grandfathered into a national compliance program in the US.

In addition, data from 182 carbon offset suppliers from twenty-eight different countries indicates that the majority of the available offsets are derived from projects in Asia and the United States and are either sold on the Chicago Climate Exchange (CCX) or on various over-the-counter (OTC) exchanges and markets (Hamilton et al., 2009). In 2008, the OTC market reached 54.0 MtCO<sub>2</sub>e, and was valued at \$396.7 million dollars (\$7.34/t). For the first time since the inception of the voluntary carbon market, the CCX surpassed the OTC market in volume, trading 69.2 MtCO<sub>2</sub>e. However, offsets on the CCX continue to fetch a lower price, so the value of the CCX market fell slightly below the OTC market in 2008. The total volume of the market reached 123.4 MtCO<sub>2</sub>e and was recently valued at \$705 million dollars.

The type of offset projects in the voluntary market as a whole varies by region. Overall, during the last year, there was an increase in renewable energy and landfill gas projects, and a decrease in energy efficiency, fuel switching and coalbed methane projects. Of the available offsets, 51% were generated from renewable energy projects located primarily in Asia and the Middle East. In the United States, 50% of the offsets generated were from landfill gas projects. Overall, landfill gas projects represented 16% of the entire voluntary market. The increase in landfill gas projects is partly due to the reliability of methodologies to measure and monitor reductions from landfill projects. Despite this recent rash of landfill gas projects, there is still tremendous scope for more such projects in the US and elsewhere.

The voluntary market will continue to exist, even if a new agreement for a post-2012 compliance scheme is reached in Copenhagen in December 2009. Companies will continue to purchase offsets in order to maintain a positive image and market their commitment to sustainable development. The volume and value of the voluntary market are predicted to continue to increase.

## **6. POST 2012 ISSUES**

Analysts have begun to revise downward the number of emission reductions now expected from the CDM due to regulatory delays, unavailability of finance for projects and the fact that some carbon contracts are being canceled as prices have fallen and demand has slackened. As the Kyoto Protocol nears the end of its first (and so far only) phase in 2012, there is rampant speculation about the future of the carbon markets, climate change regulation and especially the CDM. In December 2007, the parties to the Kyoto Protocol and the US (which is not a signatory to the Protocol but is a signatory to the UNFCCC) signed onto The Bali Roadmap which called for worldwide agreement on an extension or a successor to the Kyoto Protocol. The Bali Roadmap calls for this goal to be reached by the annual meeting of the parties to the UN Framework Convention on Climate Change in Copenhagen in December 2009. One of the most significant uncertainties is the role of the US. At the 2009 annual Meeting of the Parties to the UNFCCC held in December in Poznan, Poland there was very little movement because George W. Bush was still President of the United States. The new US President, Barack Obama, who is a vocal supporter of climate change regulation and cap and trade, was sworn in as president only on 20 January 2009 after the Posnan meeting. While on the campaign trail and since his inauguration, President Obama has promised to do his best to reach a new global agreement by December 2009. Negotiations, in which the US has been an active participant, have been ongoing between the parties to the UNFCCC since President Obama took office but it is too soon to predict whether the Bali Roadmap goal will be reached by December 2009. The debate on climate change regulation is unfolding in the US at a very rapid pace and with very disparate

views being expressed by different influential constituencies. This ongoing debate will clearly influence the outcome of the negotiations over a successor treaty between the writing of this paper and December 2009. In the meantime, negotiations are ongoing and parties are working hard to address the many issues involved. These include whether developing countries that are large emitters (especially China, India, Brazil) should have targets, what can be done to scale up reductions under the CDM (see CDM reform below), and new mechanisms to create emission reductions that can be linked to new national regulatory programs in the US, Australia and elsewhere.

There is little doubt at this point that a federal compliance based carbon program is coming to the US. Optimists say the legislation may be passed soon with a cap put in place as soon as 2012. President Obama has been outspoken in his support for a mandatory national cap and trade law in the US. He does have the ability to impose climate regulation through the US Environmental Protection Agency, which the US Supreme Court has ruled can regulate greenhouse gases. However, the President clearly prefers to have widespread endorsement for climate change regulation from the US Congress. In addition, the US Senate must ratify any post-Kyoto climate change treaty agreed in Copenhagen in order for the US to become a signatory. The debate has been intensifying in recent months, and there is now a proposed piece of legislation pending before the US Congress entitled “The American Clean Energy and Security Act of 2009” (Waxman-Markey bill). It was introduced into the US House of Representatives on 15 May 2009. Recognizing that “*global warming poses a significant threat to the national security, economy, public health and welfare, and the environment of the United States, as well as of other nations*” the stated goal of the bill is to “*create clean energy jobs, achieve energy independence, reduce global warming pollution and transition to a clean energy economy.*” The bill as presented is 934 pages. This proposed bill mandates that the Environmental Protection Agency (EPA) Administrator design and implement two cap and trade programs to limit GHG emissions from the electrical generation and other industrial processes. One program would be dedicated to reducing hydrofluorocarbons (HFCs) and the other would focus on emission reductions of all other GHGs. The bill proposes to reduce US GHG emissions as a percentage of 2005 emissions, rather than 1990 emissions as under the Kyoto Protocol and the EU Emissions Trading Scheme. The bill provides for the free allocation of a certain number of allowances to regulated entities under the cap and trade programs. Additionally, the EPA Administrator is required to create a “strategic reserve” of about 2.7 billion allowances. Reserved allowances will only be available for auction if the market price exceeds a predetermined price. The cap and trade program will take effect in 2012 with auctions occurring four times per year with the first auction to take place no later than March 31, 2012. Of the emission allowances established for this program less the amount set aside for the strategic reserve (4,581 million mtCO<sub>2</sub>e in 2012), almost 30% would initially be auctioned. Allowances not specified for action in the bill would be distributed free-of-charge to covered entities, states, and other specified recipients, who could use, sell, or retire them. The bill does allow a portion of the compliance obligation to be met by purchasing domestic or international offsets. In the current version of the proposed bill, RGGI allowances can be traded for federal allowances during the first year of the compliance period. It is predicted that CAR offsets will also be eligible offsets in the new compliance scheme. The legislation calls for 2 billion national and international offsets to be available in the market in order to reduce the near-term impact. It is interesting to note that the CDM is projected to deliver far fewer offsets during the course of its existence (2008-2012) than the US legislation calls for in each year. Therefore, it is apparent that significant reform and additional mechanisms will be required to “scale up” the potential for offsets to come close to what is proposed in the current version of the US legislation.

At this writing, eligible offsets are expected to include activities certified by the EPA that reduce GHG emissions or increase the amount of such gases that are captured from the

atmosphere and sequestered. Examples include reducing emissions of landfill gas from landfills. There is a possibility that this legislation will lower the current threshold for the size of landfills required to install a gas collection and control system and thus lower the number of landfills that can generate voluntary offsets accepted for eventual compliance. This is still to be the subject of significant debate and lobbying. The restraint imposed on non-US offsets is that the US must be a party to a bilateral or multilateral agreement approved by the EPA. The current economic crisis has energized the opposition to the bill and the emission reduction goals will undoubtedly be weakened before the bill is passed. However, a cap and trade program, in some variation, is clearly expected to survive.

## **7. LESSONS LEARNED FOR CDM WASTE PROJECTS**

There have been waste projects under the CDM since the beginning of the mechanism, however, they have been limited in large part to landfill gas projects which have had some problems as discussed below. There have been several large scale projects involving advanced municipal solid waste treatment technologies including incineration, gasification, and anaerobic digestion and composting, however, these large scale projects have been limited in number for various reasons. These technologies are capital-intensive, have high operating costs, are more complicated than landfilling and small-scale composting, and are often not sustainable in the developing world.

To date, landfill gas CDM projects have been plagued by a low issuance rate of CERs compared to initial projections. This under-delivery can be attributed to a number of factors including over-optimistic estimation of emission reductions and site-specific technical issues (high leachate levels which reduce efficient gas extraction, operational problems, lack of adequate cover materials, and problems with monitoring and verification). Experienced developers of CDM projects have suggested these problems can be addressed by using highly conservative assumptions when modeling CH<sub>4</sub> generation, assuming low gas capture rates at old landfills, implementing appropriate designs including dual extraction (leachate + gas) as needed, and supplementing final cover materials for more efficient gas extraction.

## **8. CONCLUSIONS**

All eyes are on Copenhagen and the US Congress. The US, which produces 25% of the global GHG emissions, appears to be finally accepting responsibility to join the rest of the world in regulating GHGs. Despite a current downturn in the GHG markets due to the economic slump, all indications are that the compliance and voluntary carbon markets will grow significantly in the years to come. There will be significant opportunities for additional offset projects including projects in the waste sector.

## **ACKNOWLEDGEMENTS**

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