



Prospects of carbon trading in India agriculture

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Global climate change is becoming an alarming problem of the 21st century with global warming as the biggest challenge. Man made activities have added significant quantities of green house gases (GHG) to the atmosphere ever since the Industrial Revolution. According to the Intergovernmental Panel on Climate Change (2001), the atmospheric concentration of CO₂, CH₄ and N₂O has risen by about 31%, 151% and 17%, respectively between 1750 and 2000. This International concern about climate change led to the Kyoto Protocol in 1997, which consists of legally binding emission target for industrialized countries to be achieved during the Kyoto commitment period *i.e.* 2008-2012. Until August 2011, 191 countries have signed/ratified the Kyoto Protocol.

Kyoto protocol : The Protocol provides various flexibility mechanism to mitigate the climate change. This includes International Emission Trading (IET), Joint Implementation (JI) and Clean Development Mechanism (CDM).

International emission trading or emission trading: It is also known as cape and trade. It is a market based approach used to control pollution by providing economic incentives for achieving reduction in GHG emission. It allows Annex I countries to trade their emissions Assigned Amount Units (AMU's).

Joint implementation (JI): Under Article of the Protocol, any Annex. I country can invest in emission reduction project on any other Annex. I country where investment on GHG emission reduction is cheaper. It is done as an alternative of reducing emission domestically.

Clean development mechanism (CDM): This mechanism under Article 12 of the Protocol allows developed industrialized countries (Annex. I) to meet their emission reduction targets by developing or designing projects to reduce emission in developing countries (Non-Annex. I) that are signatory to Kyoto Protocol. This project could be started wherever it is cheapest globally. This helps the developing countries to adapt newer technology, emit less GHG and save energy. These reductions are produced and then subtracted against a hypothetical baseline of emissions that are predicted to occur in the absence of a particular CDM project. The CDM is supervised by the CDM Executive Board (CDM EB) and

is under the guidance of the conference of the Parties (COP / MOP) of the United Nations Framework Convention on Climate Change (UNFCCC). All the major GHG's are sold within carbon market, not just CO₂. The other gases are converted to their CO₂e (Carbon dioxide equivalent) using their global warming potential (GWP). CO₂e is how much carbon dioxide it would take to cause the same amount of global warming. The GWP of major GHGs is given in Table 1.

Table 1 : Global warming potential (GWP) of the major GHG's	
Gas	Global warming potential
CO ₂	1
Methane	23
Nitrous oxide	296
HFC-125	3,400
HFC-134a	1,300
HFC-143a	4,300
HFC-152a	120
HFC-227ea	3,500
HFC-236f	9,400
Perfluoromethane (CF ₄)	5,700
Perfluoroethane (C ₂ F ₆)	11,900
Sulfur hexafluoride (SF ₆)	22,200

Source – IPCC (2001)

Carbon credits and trading : Carbon credits are a key component of National and International emission trading schemes. These are certificates awarded to the countries that are successful in reducing emission of GHGs. They serve the dual purpose of protection of nature as well as source of revenue generation for the developing and underdeveloped countries. It encourages to reduce GHG emission by capping total annual emission and letting the market assign a monetary value to any shortfall through carbon trading. For trading purpose, one carbon credit is equivalent to one tonne of CO₂ emitted. These credits can be exchanged between businesses or bought and sold in international market at the prevailing market price. There are two ways by which a company can reduce emission. Firstly, it can adopt new technology or improve upon the existing technology to reduce GHG. Secondly, it can tie up with developed nation and help them in setting up new

eco-friendly technology, which reduce emission and are less energy consuming ultimately helping them to earn credits.

In India, carbon is traded on India's Multi-Commodity Exchange. It is the first exchange in Asia to trade carbon credits. Other region specific markets are Chicago Climate Exchange (United States), Blue Net (France), European Climate Exchange (London), The London Energy Brokers' Association (London), NordPool (Norway), The NYMEX Green Exchange (United States), European Energy Exchange (Germany), Montreal Climate Exchange (Canada), Australian Climate Exchange (Australia), and Climex (The Netherlands).

According to the Kyoto Protocol, three types of

project based credits are granted.

– **Emission Reduction Units (ERU's)**: These are the credits created from project undertaken under the joint Implementation (JI) of the Protocol.

– **Certified Emission Reduction (CER's)**: These are the credits created under Clean Development Mechanism.

– **Removal units (RMU's)**: These are credit created from project that involves land use, land use change and forestry.

India is a developing country that has ratified the Kyoto protocol on 26th August 2002. Whereas, it signed and ratified the Climate Change Convention on 10th June 1992 and 1st November 1993, respectively. It has vast

Table 2 : Summary of GHG emission from the agriculture sector (million tonnes)

Sr. No.	Source	CH ₄	N ₂ O	CO ₂ e
1.	Livestock			
	Enteric fermentation	10.09	-	212.09
	Manure management	0.12	0.00007	2.44
2.	Rice cultivation	3.33	-	69.87
3.	Soils	-	0.14	43.40
4.	Crop residue burning in field	0.23	0.006	6.61
	Total	13.77	0.146	334.41

Source – India: Green House Gas Emissions (2007)

Table 3 : Greenhouse gas emission in 2004 (mt CO₂e)

	CO ₂	CH ₄	N ₂ O	PFC	HFC	SF ₆	Total
World	28,485	6408	3286	108	381	60	38726
India	1222	548	71	3	8	2	1853
Indian Agriculture	0	317	58	0	0	0	375

Source: World Resources Institute (2009)

Table 4 : CDM projects related to agriculture in India

Sr. No.	Project Title	Annual CERs (Emission Reductions)	Date of registration
1.	3 MW Poultry litter based power generation project, Hyderabad	65794	30 Jun 06
2.	SIDPL Methane extraction and power generation project	31966	03 Sep 06
3.	Methane avoidance by municipal solid waste processing, Chandigarh	40308	04 Sep 06
4.	Avoidance of waste water and on-site energy use emission and renewable energy generation in IFB Agro distillery plant	70760	08 Sep 06
5.	Methane recovery and power generation in a distillery plant	44729	29 Sep 06
6.	Methane recovery from waste water generated from wheat straw wash at paper manufacturing units of Shreyans Industrial Limited (SIL)	12578	02 Apr 07
7.	SESL 6 MW Municipal solid waste based power project at Vijayawada and Guntur in Andhra Pradesh	64599	15 Apr 07
8.	Methane capture and use as fuel at Rajaram Maize Products, Chattisgarh	4609	05 Jun 07
9.	Forced methane extraction from organic wastewaters at Mandya District, Karnataka by M/s Sri Chamundeswari Sugar Ltd.	34424	27 Jul 07
10.	3.76 MW Electricity generation project from poultry litter in Tamil Nadu	55858	04 Mar 09
11.	Rice husk based cogeneration projects of Nahar Spinning Mills, Ltd.	10948 (CER's earned)	-
12.	24 MW Bagasse based cogeneration power project of The Godavari Sugar Mills Ltd.	170103 (CER's earned)	-
13.	Bagasse based power project of Rajshree sugars	80000 (CER's earned)	-

Source- Pande, (2011) <http://www.greenleanguide.com/2011/09/13/cdm-and-agriculture/> and CDM and Carbon credits-A Primer. Professional Development Committee, The Institute of Chartered Accountants of India. April, 2009.

opportunity to explore in terms of CDM and carbon credits. Up to August 2010, India has registered 2313 projects. In the past few years, India has emerged as a world leader in the reduction of greenhouse gases by adopting CDM. According to the report on National Action Plan for operationalising CDM by Planning Commission, Govt. of India, the total CO₂e emissions in 1990 were 1001352 Gg (Gigagram) which is approximately 3% of global emission. Thus, if India captures 10% share of the global CDM market, annual CER revenues to the country could range from US \$10 million to 300 million.

Since the establishment of Indian Designated National Authority (DNA) in December 2003, it has approved a significant number of projects. According to the basic information provided by www.igesorg.in the number of CDM projects registered with the executive board in India is 738 and 1022 projects are at and after validation stage up to 1 November 2011. The total average annual emission reduction is 82,915 t of CO₂. 82% of the projects (*i.e.* 603) are unilateral projects developed by Indian stakeholders without the involvement *i.e.* finance and technology of Annex. I countries. In India, Himachal Pradesh is the state with maximum number of projects whereas 40% of the projects in Tamil Nadu are based on wind power generation due to availability of wind resource. Most of the projects in Karnataka are renewable energy generation, especially by wind and small or mini hydro energy. In Andhra Pradesh, about 30% is biomass projects utilizing residue generated from agricultural activities. Refrigerant gas manufacturer Gujarat Fluoro Chemical (GFL) based in Vadodara, Gujarat is the first Indian company and third in the world to have an emission reduction CDM execution board in 2005.

GHG emission from Indian Agriculture: Agriculture is the backbone of Indian economy and along with its allied sectors like Fishery and Forestry it contributes 14.2% to the GDP during 2010-2011. It is by far the largest source for emission of nitrous oxide (from chemical fertilizers) and methane (from enteric fermentation in livestock and paddy fields). The total net Greenhouse Gas (GHG) emissions from India in 2007 were 1727.71 mt of CO₂e of which CO₂ emissions were 1221.76 mt, CH₄ emissions

were 20.56 mt and N₂O emissions were 0.24 mt. Agriculture sector emits 334.41mt of CO₂e (22% of the total emission) of which 13.77 mt is CH₄ and 0.15 mt is N₂O. The summary of GHG emission from the agriculture sector is given in Table 2.

Agriculture practices account for about 20% of India's total emission, hence cost-effective reduction from this sector could significantly reduce India's total emission. Table 3 gives the estimation of GHG emissions from the world, India as a whole and Indian agriculture. Even though agriculture is a high priority sector but a very few projects have been registered so far. This is because of the major uncertainties in measuring and verifying the performance of soil carbon stores and agriculture in our country is highly unorganized which leads to difficulty in providing evidences under the CDM.

By September, 2011, only 147 CDM projects are registered worldwide under the Agriculture category. Table 4 shows registered CDM projects in Indian Agriculture.

Conclusion : India is a developing country hence it has no restrictions to be followed in case of carbon emission. CDM is gaining momentum in our country. Wide spectrum of projects can be started because India is having vast technical human resource and strong industrial base. One of the areas in which CDM projects can be initiated is the biomass projects. The total CO₂e emitted due to field burning of crop residues is 6.61 mt and along with emission from soils it reaches nearly 50.00 mt. Hence, instead of burning crop residues it should be used to generate electricity. Researches are also being conducted on generating electricity from biogas. The Government of Punjab and Haryana are providing subsidies to farmers for establishing biomass projects. In case farms are of small size such that not enough residues are generated to feed the biomass project then CDM provides the option to bundle up several such small projects and seek carbon credit collectively. Apart from reducing GHG emission, Agriculture CDM projects offer a profitable option for revenue collection through carbon credits for farmers.

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