An Inconvenient Truth—Global Warming on Greenhouse Gas (GHG) Reduction under Kyoto Protocol Regime to Post Kyoto Protocol in ASIA

Koichi KAKU a*
National Institute of Livestock and Grassland Science, Ikenodai 2, Tsukuba, Ibaraki 305-090, Japan

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Abstract

Global regime on Greenhouse Gas (GHG) reduction has changed at the end of 2009. Clean Development Mechanism (CDM) has revealed some critical defects and all participants recognize less profit than they had expected and are disappointed with agricultural fields. There are 2 issues that brought less profit - Price of GHG and Verification before Certified Emissions Reductions (CERs) would be issued by the CDM Executive Board and credited to the participants of a project. Therefore, at the end of 2009, Bilateral Offset Mechanism has launched, which could be considered to be revised CDM. However, in the agricultural field, no precedent has been shown between Japan and Asian countries. Under Kyoto Protocol Regime, United Nation CDM executive board has adopted baseline method and not adopted Life-cycle Assessment (LCA) method. Under Bilateral Offset Mechanism, however, LCA method might be adopted, if 2 participants agreed LCA method in stead of baseline method. 5 scenarios would be compared on GHG reduction by LCA method, because LCA method might be used under Bilateral Offset Mechanism or Post Kyoto Protocol Regime. Reduced greenhouse gas (GHGs; CO2, CH4, and N2O) emissions of the alternative systems instead of conventional systems were estimated by using LCA method preparing for Bilateral Offset Mechanism or Post Kyoto Protocol (post-Kyoto) regime. If GHG from the agricultural sector in developed countries would be taken into account on Bilateral Offset Mechanism or post-Kyoto Protocol Regime, reduced GHG from the agricultural sector in developed countries could be available.

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1. Introduction

The Kyoto Protocol ratified by Japan in June 2002 came into force since February 2005. This Protocol, an international and legally binding agreement to reduce greenhouse gases (GHGs) emissions worldwide. Quantified targets for reductions in emissions of GHGs have been set for each of the developed nations.

Within the agricultural sector, especially in the livestock industry, CO2, CH4, and N2O are identified as GHG emissions mainly from enteric fermentation, manure management, and agricultural soils, etc., while in the domestic transport sector, CO2 is identified as GHG emissions from the mobile combustion of liquid fuels (Ministry of the Environment Japan, 2005). Therefore, CO2, CH4 and N2O are targeted in this study as greenhouse gases, and baseline methods for evaluating environmental pollutions have been adopted on Clean Development Mechanism (CDM).

However, there has been neither regulatory standard nor reduction target on GHG reduction in the Japanese domestic agriculture, because GHG emissions from agricultural sector has tendency of decreasing and insignificant volume in comparison with total volume of domestic GHG emission within 2%. That means no reduction is required on GHG emission in Japanese domestic agriculture, as far as Japanese domestic padd field area and livestock heads would be decreasing in the future. Therefore, compiling GHGs inventories in Japanese domestic agriculture regardless of the true state could be considered as an ‘Inconvenient Truth’ on GHG reduction.

Global regime on Greenhouse Gas (GHG) reduction has changed at the end of 2009. CDM has revealed some critical defects and all participants recognize less profit than they had expected and are disappointed with agricultural fields.

CDM has already shown 2 issues that brought less profit - Price of GHG and Verification before Certified Emissions Reductions (CERs) would be issued by the CDM Executive Board and credited to the participants of a project.

Therefore, at the end of 2009, Bilateral Offset Mechanism has launched, which could be considered to be revised CDM.

Life-cycle assessment (LCA) method has not been adopted under CDM as methodology. Under Bilateral Offset Mechanism, however, LCA method might be adopted as methodology, if the participants would agree.

In this study, the effects of reductions of GHG emissions by adoption of five alternative systems on Japanese livestock industry were investigated.

The objective of this study was to evaluate and compare the effects of reduced GHG emissions from alternative systems instead of conventional systems using LCA method, under Bilateral Offset Mechanism or Post-Kyoto Protocol Regime.

2. Materials and Methods

It was estimated, using LCA method, that the alternative systems (System 1, System 2, System 3, System 4 and System 5) used instead of conventional systems in Japanese livestock industry would have reduced emissions of three greenhouse gases (GHGs): CO2, CH4 and N2O. LCA is an ISO standardized method (ISO 14040-14043) for evaluating the environmental impact of products, processes, or activities throughout their life cycle. LCA framework used in this study is described as follows:

System 1 in this study focused on effect of shortening overseas transportation distance over the international waters. GHG emissions from overseas transportation over the international waters are not targeted under Kyoto Protocol regime until 2012, but global warming potential on GHG emissions from transportation over the international waters should be widely noticed preparing for post-Kyoto regime. System 2 was the total Japanese beef industry with an abbreviated beef-fattening period, which was a modified Japanese beef-fattening system (Ogino et al., 2004). System 3 was the total Japanese livestock industry with its concentrate feed supply system, which was a modified system (Kaku et al., 2004, 2005) as focused especially on GHGs. System 4 was the reduction of GHGs from Pork industry with introduction of swine waste management system with the intermittent aeration. System 5 was the estimation of reduction on GHGs in Japan with imported ethanol made of sugar cane from Brazil in stead of 500 thousand kilo litter of crude oil.
System 1 description

The functional unit of System 1 is defined as the total frozen meat import system for pork and broilers to Japanese domestic consumers with overseas shorter-haul transportation replacing that by long-haul over the international waters in 2000. Impact category is global warming. The alternative system analyzed in this study is presented in Figure 1.

System 2 description

The functional unit of System 2 is defined as the total Japanese beef industry, such as the 576,833 heads of Japanese beef cattle slaughtered in 2000, together with a Japanese beef-fattening system (Ogino et al., 2004); the total number of such cattle slaughtered in 2000 was obtained from the Statistical Yearbook published by MAFF(2005). Impact category is global warming. The alternative system analyzed in this study is presented in Figure 2, which was based on the preceded study (Ogino et al., 2004) and modified to the total Japanese beef industry’s GHGs emissions.
System 3 description

The functional unit of System 3 is modified and based on the total Japanese livestock industry with its concentrate feed supply system in 2000 (Kaku et al., 2005). The system 3 component of LCA method was the definition of the goal and the scope of the analysis. The goal of this study was to evaluate the environmental impacts of two different concentrate feed supply systems to Japanese domestic livestock industry, and to consider the effects of emissions trading with the new concentrate feed supply system. The functional unit was defined as the total Japanese livestock industry with its concentrate feed supply system.

System 4 description

The functional unit of System 4 is defined as the Japanese pork industry. The alternative system analyzed in this study is introduced with swine waste management system with the intermittent aeration.

System 5 description

The functional unit of System 5 is defined as Japanese industry altogether. The alternative system analyzed in this study is estimated of imported ethanol made of sugar cane from Brazil instead of 500 thousands kilo litter of crude oil.

3. Results and Conclusion

Environmental impacts of system 4 and system 5: introduction of swine waste management system with the intermittent aeration and introduction of half million ethanol from sugar cane. The effect of system 4 and system 5 are shown in figure 4. Japanese pork industry could reduce GHG emission from pork waste management system with intermittent aeration. In case of more than 2000 heads of pork in Japanese farm, 50% of pork heads with intermittent aeration swine waste management system could reduce 0.43 million tons of GHG and 100% of pork heads with this technology could reduce 0.87 million tons of GHG. But, introduction of half million ethanol from sugar cane planned to import could reduce 1.3 million tons of GHG emission. Therefore, in agricultural sector, the introduction of bio-ethanol refined from sugar cane or corn could reduce GHG most effectively.
Figure 4. Reduction of N₂O (CO₂ equivalent) between swine waste management system with intermittent aeration and other scenarios

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