Emission Estimation and Baseline Setting for Potential CDM Project in the Transport Sector

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1. Introduction

The Clean Development Mechanism (CDM) is one of three Kyoto mechanisms identified in the Kyoto Protocol that participating countries can use it to meet their Green House Gases (GHGs) reduction target. The purpose of CDM is to benefit both investor and host countries by contributing to sustainable development in the host developing countries and by allowing investor countries to get the GHGs reduction quotas at the lowest possible cost by taking advantage of the lower marginal cost of reducing GHGs emission in developing countries.

This paper briefly describes feasibility of bus operation project being pilot CDM project in the transport sector with a case study of bus fleet fuel shifting project in Bangkok, Thailand.

2. CDM in Transport Sector

Since the transport sector used to be a main emission source of GHGs, CDM projects in the transport sector is imperative. However, the framework of CDM in the transport sector has not been due prepared yet. One of the reasons of this is institutional incompleteness and another is technological problem concerning to project boundary certification, baseline setting and monitoring.

There are five general project categories to reduce GHGs emission in the transport sector, that is 1) Changing fuel efficiency of vehicle; 2)Changing type of fuel that vehicle use; 3) Diverting transport mode tone that is less GHGs intensive; 4) Reducing transport activities; 5) Increasing the load factor of vehicle. CDM projects within the transport sector must aim to affect at least of five elements above. However, projects which act to reduce potential GHG emissions from the transport sector are so diverse that the same goal can be reached using a variety of different policies and investment actions.

3. Priority of Bus Operation as a CDM Project

Bus fleet, as a main public transit mode in developing country, is identified as major polluters, the problems often appears to associated with the old, often overloaded, vehicles in order to meet a rapidly increasing demand. So it has been argued that the only option for environmental improvement is the enforcement of technological standard on vehicles and fuels. And packaging these actions with the CDM as projects of GHG mitigation will provide an economically viable way for bus fleet improvement. In addition, for baseline setting, boundary certification and monitoring, bus operation has advantages rather than other transport scenario due to more regularity of bus activity, as well as bus fleet is the most energy efficient mode compare to cars and bikes. Also, Compressed Natural Gas (CNG) and Liquid Petroleum Gas (LPG) vehicles are the least emission technologies so far. We would say that developing CNG buses is one of the best options to promote environmental friendly urban passenger transportation for those countries where domestic natural gas resources are available.

4. Baselines for Bus Fleet Project

Two types of baseline are available for bus fleet projects; one is technical baseline; using base year emissions data together with engineering estimates of future changes in transport technologies over time and another is historical baseline; using historical data to obtain an emission trend and continue the trend forward. And also, there are two types of emissions calculation method with the different available data respectively, that is top-down and bottom-up method.

5. Case Study

In 2003, Japan Transport Cooperation Association has reviewed CNG Technologies and evaluated the

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market prospects for CNG vehicles in Bangkok and be willing to pay the project of conventional diesel buses conversion to CNG buses, as a contribution to Japan Government's commitment on the Kyoto Protocol.

5.1 Basic Scenarios

Bangkok, the capital city of Thailand with the number of vehicles totals 6 million, at least 50% of inhabitants use buses for their commuting to work everyday. In 2002, 14,662 buses are operated daily in Bangkok Mass Transport Authority (BMTA). Out of this number, 3,655 buses are operated by BMTA itself while the other 11,007 are operated by contracted private companies who normally purchase out-of-operation buses from BMTA, these privately-operated buses are not usually in the good condition. In addition, political considerations have held the bus fare to low fare; most private bus companies face the difficulty in maintaining theirs buses in a good and clean operating condition.

5.2 Baseline Methodology

This project applies historic static baseline--uses averaged performance of buses in 2000-2002 to be future performance trend as static extrapolation of past behavior. And base on the fuel consumption of buses, uses top-down calculation method.

$$C = FC * VKT * EF \quad (1)$$

Here, C : Amount of emission (ton),

FC : Fuel Consumption (liter/km),

VKT : Vehicle Travel Time (km/time/vehicle),

EF : Emission Factor of Fuel (gram /liter or MJ).

In this project, as a scenario, have 250 CNG kits will retrofit to private large buses in Bangkok. CDM project activities starting after January 1, 2000. The project's crediting period is from 2005 to 2011.

5.3 Emission Reduction

The baselines applied data of buses which are from the Intergovernmental Panel on Climate Change (IPCC) guidance and BMTA Annual Report. The CO_2 emissions from Diesel engine buses are compared to that of CNG Kit buses in the terms of existing condition (baseline) and project scenario, respectively. As a result, the project get 13.89 kt-CO_2 reduction annually and 97.23 kt-CO_2 reduction in crediting period.

5.4 Cost Benefit Analysis

Certified Emission Reduction (CER) will be issued in the term of Credit (1 t-CO_2 one credit) after CDM project verified and certified; in the emission trade market CER can be commodity, base on the carbon

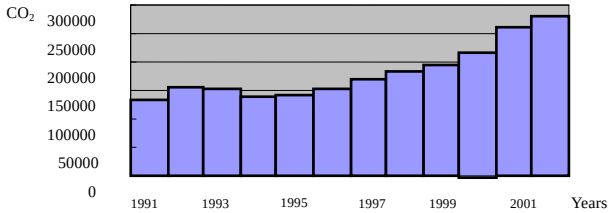

Fig.1 CO_2 Emissions from Private Buses

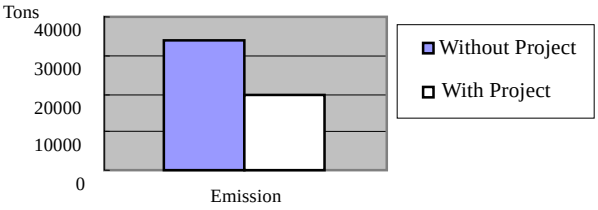

Fig.2 CO_2 Emissions Reduction

prices on past transactions, the price of CER is $20/t-C; since,97.23 kt-$CO_2$ (26.52 kt-C) from project will be $530.6 thousand dollars. The cost of technical transfer is total $5,000 thousand dollar (loan with 7% interest). The project can economize fuel cost of $1680 thousand dollars per year; assume 50% of fuel economize cost fund, within the project period, IRR will be 4%.

6. Conclusion and Discussion

CDM may change some financially distractive projects into attractive ones like the case study project in this paper where we used historical baseline and top-down calculate method which may leads to some uncertainties, therefore, emission calculation base on the driving pattern of vehicles is recommended, if data are available as much as possible. However, CDM in transport sector has been evolved; even in bus fleet projects, baseline setting and monitoring still need further discussion.

References

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