Lessons Learned from Carbon Certificates Program in Korea and Suggestions for the Future

Kyoung Hee Kim

Department of Energy Systems Engineering

Seoul National University

599 Gwanak-ro, Gwanak-gu

Seoul 151-744, Republic of Korea

Phone: +82-2-880-8284, Fax: +82-2-882-2109

E-mail: kkh30248@snu.ac.kr

Yeonsang Lee

Greenhouse Gas Registration Office

Korea Energy Management Corporation

#298 Sujidae-ro, Suji-gu, Yongin city

Geonggi-Do 448-994, Republic of Korea

Phone: +82-31-2604-526, Fax: +82-31-2604-559

E-mail: lys@kemco.or.kr

1. Introductions

Korea is not included in ANNEX I or ANNEX B, and it is the world's 10th largest energy consumer and emitter of greenhouse gases (GHGs). Energy consumed in Korea in 2010 was 257 million t, and GHG emitted in 2007 was 620 million t of carbon dioxide (tCO_2). Since 97% of GHG emissions are caused by energy use, GHG reduction policies can be said to be energy policies.

Energy policy began when a crisis in the stability of the energy supply occurred during the first and second oil shocks, as it did in other countries. The Energy Usage Conservation Act was established in the 1980s to improve energy efficiency and to develop and disseminate renewable energy and energy technology. Since then, a variety of energy programs have been implemented based on this law, such as providing information on energy technology, loans for investment in energy equipment, and R&D for energy efficiency technology and renewable energy.

Although many GHG reduction projects have been undertaken, UNFCCC required additional efforts to improve energy policies in order to minimize climate change; therefore, existing energy policy needs to be structurally changed.

However, more aggressive and effective measures for GHG reduction have to be adopted to reduce GHG dramatically, so a carbon tax, emission trading, and joint reduction projects are being proposed as market-based policies. These market-based policies can work under a carbon credit authorization system that is credible and transparent. For a well-developed GHG crediting program, there need to be reasonable criteria for processes and reporting systems, and for building the compliance capacity of stakeholders.

If this were to be adapted to a carbon credit-based program, there is considerable risk for compulsory domestic allocation without fair burden sharing to achieve a national GHG emission target. Therefore, Korea adopted a carbon credit program based on this project for the industrial sector, and the Korean Voluntary Emission Reduction (KVER) program was introduced in June 2005. This paper will address lessons learned from adopting and managing this GHG crediting program.

The program evaluates the voluntary reduction efforts for six greenhouse gases and includes the verification and certification of the actual volume reduction, the designation and management of the verifier, and the purchase of reduction credits by the government. By August 2011, 299 projects were registered, and a reduction of 10,980,000 t of CO_2 was certified.

2. Program Methods

KVER followed the operation and the procedure of ISO 14064-2 and 3, while the methodology of the Clean Development Mechanism (CDM) project was used to establish the baseline and to monitor the project design documents (PDD); however, the additional testing step was excluded. The program procedure was as follows (Figure 1):

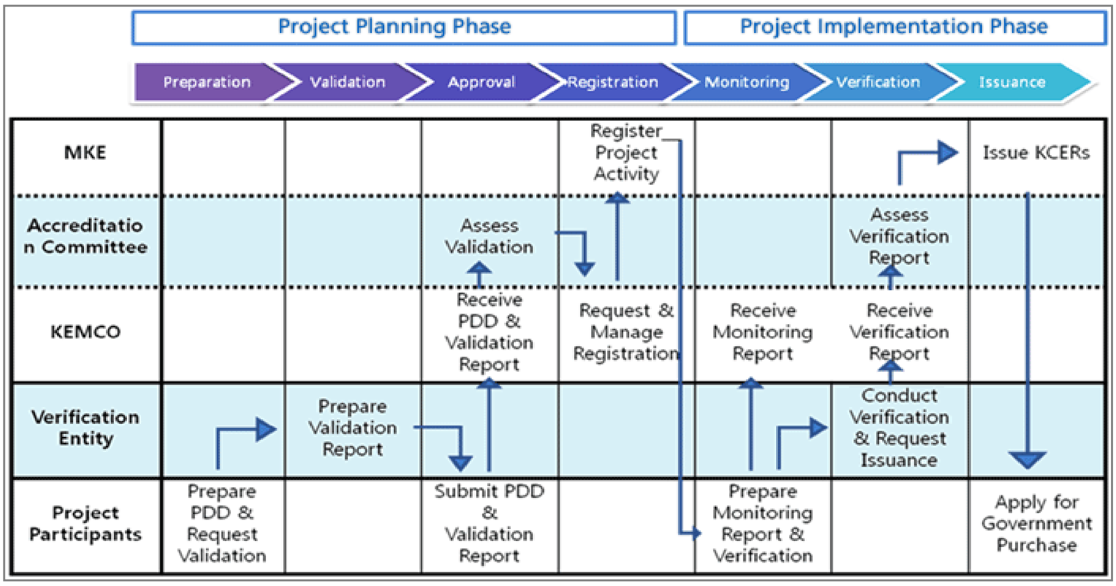

Figure 1. Project Procedure

Key requirements for the program are as follows:

- Registration scope: More than 500 t of CO_2 from GHGs should be eliminated annually, and from 2011 onward, the scope should be expanded to include small-sized projects of 100 t of CO_2 or more. (Small-scale projects are allowed to be bundled).
- Calculation of reduction: The before and after scenarios of the project are compared using emission intensity and activity. However, where outdated facilities are replaced, benchmarked options should be used as the baseline. The impact of increased loading is excluded in all projects (refer to baseline).

- Credit purchasing: Banking is not allowed. Projects that are implemented under RPS (Renewable Energy Portfolio Standards) and are non-CO_2 are excluded.
- Crediting period: 5 years.

Baseline and calculation

The concept of baseline emission is the same as that in the CDM, and it will be based on the GHG emissions before the projects. However, when obsolete equipment is replaced, the baseline should not be the previous emissions; rather, benchmarking or some other methodology should be used. Such a baseline methodology was defined conceptually and can be applied to any kind of project that is not in consolidated format. If the project is similar to one of the CDM projects, CDM methodology could be used; otherwise, the PDD should be designed to fit the new methodology.

The activity data of the project should be chosen as the amount of the main product or feedstock based on the project boundary. Additionally, the activity data and the boundary should be fixed before and after the projects. The amount of GHG reduction can be obtained as the product of the activity data and the difference in GHG intensity.

The calculation of the emission reduction is as performed according to equations (1), (2), and (3):

$$Er = (Eib-Eip) \times \text{Activity data\_baseline} \quad (1)$$

$$Eib = \text{Activity data\_baseline} / Eb \quad (2)$$

$$Eip = \text{Activity data\_post} / Ea \quad (3)$$

Here, Er is the GHG emission reduction the baseline activity data, Eib is the baseline GHG intensity divided by the baseline activity data, and Eib is the post-project GHG intensity divided by the post activity data.

Transaction cost

Multilateral stakeholders are involved in the GHG credit system as opposed to the conventional energy program, which is a mutual reporting system by participants and authorities.

Conventional energy programs, such as voluntary agreement (VA), can be described as merely a mutual protocol between the two parties. In such programs, there are no restrictions, penalties, or verification processes; rather, there is only a check of whether the plans are implemented, and so the decision-making structure is simple.

However, GHG credits from energy-efficiency projects should be transparent and credible so that they have the same monetary value as determined by a third-party verifier designated by the appropriate authority. For the PDD to have validity, a participant might require time and manpower that may come from inside or outside the organization. For these reasons, KVER has for a limited time been a source of support to participants for part of the transaction costs. Participants can get $2,000–5,000 for a project to establish a methodology for determining a baseline and monitoring. Participants will pay for validation and verification to the third party verifier; however, the registration is free.

Purchasing of credits

The government purchases carbon credits for about $5 per ton of CO_2 and takes ownership of the credits. Carbon credits are not bankable, and non-CO_2 projects implemented under RPS (Renewable Energy Portfolio Standards) are excluded.

With regards to the purchase price, it was decided that the CO_2 credits be purchased at a variable price ($4–6) per tCO_2, which takes into account factors such as the EUA price, the EUA's fluctuation ratio, and the non-risk interest rate. As of 2010, the government has bought 6.9 Mt of certified CO_2 emission reductions and paid $37 million.

KVER has so far purchased a total of 6,791 $TtCO_2$ at an average price of $5.3/$tCO_2$ (Table 1).

Table 1. Status of Purchasing KVER

Year	‘07	‘08	‘09	‘10	Total
Number	37	82	141	121	381
Amount ($TtCO_2$)	940	1,577	2,229	22,244	6,971
Unit price ($/$tCO_2$)*	5.36	5.03	5.23	5.56	5.31
Total purchasing (M$)*	5.05	7.93	11.67	12.35	37.00

*929.2 WON/US$ (refer to CDM pipeline from RISO)
**Refer to Korea Energy Management Corporation (KEMCO)

3. Results

Since 2005 (up to Aug. 2011), a total of 528 projects have been applied for; of these, 311 projects have been registered, and the rest were denied or rejected. The total estimated GHG emission reduction is about 5,328 $TtCO_2$/yr; of these, 10,980 $TtCO_2$ was certified to be KVER (Table 2).

Table 2. Status of KVER

Year	'05	'06	'07	'08	'09	'10	'11	Total
Request*	28	60	169	60	79	30	13	**439**
Validation*	-	55	112	143	122	70	26	**528**
Approved*	-	41	62	86	66	44	12	**311**
Expected reduction ($TtCO_2$/yr)	-	1,022	1,037	1,263	1,269	484	254	**5,328**
Investment (M$**)	-	645	578	593	286	218	121	**2,441**
Certificates ($TtCO_2$)	-	941	1,927	2,720	3,200	204	2,192	**10,980**

*Unit is number of projects.
**929.2 WON/US$ (refer to CDM pipeline from RISO)
***Refer to Korea Energy Management Corporation (KEMCO)

When this program was adopted in pilot stage, VA program was be considered as affordable projects to register, only few of these were selected; the selection was made such that multiple projects were implemented at a given installations. There is some gap between KVER and typical energy programs due to the absence of unified standards as follows:

- Case 1: Reduction effects cannot be verified because the baseline cannot show past data and monitoring data, so reductions are estimated without proof.

- Case 2: Reduction effects are overestimated due to increased loads, or reductions can be double–counted when recovered heat is transferred to another process or off site.
- Case 3: Reduction effects are not permanent but variable, for example, they can be changed by adjusting operational parameters.
- Case 4: Statistical precision is limited in some cases, for example, when the amount of reductions is below 5 % of the total GHG emission.

The average reduction cost borne by the participating projects was \$117.3/tCO_2, which is smaller than that of the CDM project (\$416.7/tCO_2). In renewable energy, KVER is \$624.5/tCO_2, which is similar to CDM (\$532/tCO_2). The average issuance success of CDM was 79.84% and that of KVER was 92.43%, so KVER has a higher success ratio. Table 3 shows the characteristics of each category.

In this program, the registered projects were classified into four main categories: electricity, heat efficiency, renewable energy, and non-CO_2. Thermal efficiency project occupied a large proportion in registered projects, the amount of the total reduction ratio was over 66%, and heat recovery projects were the most frequent. One of the reasons for this is that it has the smallest investment per unit of GHG reduction. Another reason is that the data system related to GHG by process or by equipment has been well managed though the on-line system compared to that of electricity. Therefore, GHG reductions could be demonstrated in a transparent manner.

Table 3. Characteristics of Registered Projects

Category	Subtechnology	Average reduction cost (\$/tCO_2)	Issuance success ratio (%)	Proportion of total reductions (yr)* (%)
Electricity	Electricity Utility	317.4	142%	14.2%
	Facility Replacement	173.2	142%	4.1%
	Heat Recovery	398.4	140%	0.9%
	Installation(inverter)	115.4	79%	1.0%
	Process Improvement	125.9	82%	0.1%
Total electricity		**226.1**	**122%**	**20.3%**

Heat	Facility Replacement	293.2	113%	6.9%
	Supplementation Installation	72.7	79%	0.7%
	Fuel Replacement	36.9	90%	13.2%
	Optimization	60.4	98%	2.5%
	Heat Recovery	58.0	108%	37.8%
	Process Improvement	63.2	133%	5.2%
Total heat		**121.6**	**104%**	**66.3%**
Renewable energy		**624.5**	**109%**	**2.1%**
Non-CO_2, etc.		**16.3**	**46%**	**11.4%**

*Korea Energy Management Corporation. (KEMCO)
*Non-CO_2 projects are excluded
*Issuance (%) = projected GHGs reduction/certified GHGs reduction
* Proportion of total reductions is based on total expected emission reductions per year

4. Implications

KVER is a type of the GHG crediting program that determines what the procedures, criteria, responsibilities, and obligations for each stakeholder, authority, verifier, and applicant to the registry shall be. Each stakeholder involved with this program will have an additional load and opportunity for the future through this program (Table 4).

Table 4. Benefit and load for each stakeholder

	Benefit	**Load**
Authority (government)	• Increased effectiveness of energy policies due to rea l energy and GHG data	• Responsibility for certified GHG credits • Increased transaction costs due to to management pro gram

Direct project participants	● Additional carbon credits ● Increasing capacity and re ducing risk to prepare for future regulations	● Increasing transaction costs in manpower and capital
Other GHG experts (consultants, etc.)	● Opportunities for new mar kets or business	● Responsible for the credibi lity of GHG emission redu ctions

KVER has shown that it is difficult to supply credits actively to the carbon market, because investment in energy saving equipments often does not happen. Also, KVER is designed to avoid overlapping with existing support schemes, and it is more stringent than typical programs.

For this certificate program, the government offers an incentive with a credit-based approach instead of a market-based approach. However, variations in the range of the purchase amount per certified emission reduction (CER) unit are rather small and fixed. Therefore, this is regarded to be an actual result-based incentive system. The purchase amount used by the government is 4.3% of the investment cost. This amount is small, and the increase in investment is difficult to calculate. Above all, KVER projects will be the supply side of the emission permit transactions market in the future. One of the keys to the success of the program is to increase the capacity of relevant authorities, project participants, verification experts, and consulting entities. The government has developed 11 standard methodologies for reducing the cost of calculation and monitoring emissions so as to lower entry barriers such as transaction costs compared with existing projects. Therefore this crediting program will work effectively to implement market-based measures as an infrastructure.

As of 2011, the number of requested projects in KVER has decreased over time due to long turnover periods for energy efficient facilities and uncertainties about the future of carbon markets and policies. Even then, KVER will play a key role in the supply side of the carbon market and be used as an appropriate level to establish efficient CO_2 rebates or penalties in the future and building differential incentive for various resources, finding free riders or double supporting among in incentive system, and so on. Therefore, it should be studied further though a more detailed analysis of KVER compared to other energy programs.

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