FY2007 CDM/ JI Study

Study on Programmatic CDM for Promotion of Energy Saving measures at TEDA, Tianjin, China

Summary

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Summary

1. Fundamental elements of the project

1.1 Project objectives

This project is planned as a part of a comprehensive energy saving measure in Tianjin Economic-Technological Development Area (TEDA) and intended to promote energy conservation and energy efficiency measures as programmatic CDM. In TEDA, steam is supplied to each plant from coal fired boiler and large amount of energy is lost through the condensate that is discarded. In this project, condensate is collected to recover the energy otherwise lost as CDM to achieve TEDA's energy conservation target.

1.2 Project background

In the 11th 5 year plan, China has announced to reduce energy consumption by 20% from 2005 standard by 2010. TEDA as a "National Ecological Industrial Park", is expected to contribute. However, due to the rapid economic growth and lack of infrastructure for investment and support system for energy conservation, not much has been achieved in the energy conservation field.

TEDA administrative committee, an administrative and operational management body of TEDA, is currently seeking energy conversation strategy in TEDA. Responding to their request to provide consultation for energy conservation and CDM, EES and EIJ proposed a comprehensive energy conservation strategy that is closely linked to CDM.

1.3 Project detail

Part of the revenue from CER obtained from this condensate collection CDM is to be fed back to the "Energy Conservation Fund" to further promote energy efficiency throughout the steam distribution system including the demand side (factories) in TEDA.

Currently, steam is supplied to each factory from coal fired boilers as a source of heat

and the condensate is discarded without any means of heat recovery and large amount of energy is wasted.

To effectively collect condensate, first the steam supply system and consumption must be analysed then the steam supply lines are modified and condensate collection pump and tanks to be installed. This requires factory authorisation as well as thorough planning and technologies to keep the effect to the production activity minimal.

By registering the condensate collection activity as CDM, above issues are resolved and with the revenue from CER, “Energy Conservation Fund” is set up to promote comprehensive energy conservation activities including the demand side (individual factories) energy efficiency in TEDA.

Activities include capacity building, development of energy conservation monitoring system, partial subsidiary and incentives including partial tax exemption for installation of energy conservation equipment.

1.4 Contribution to the sustainable development of the host country

Energy conservation is placed as one of the top priority by the Chinese government. This project aims to achieve large scale energy conservation at a national level economic and technological development area, including variety of industrial facilities. Therefore, this project would highly regarded by the Chinese government as a large contribution to the sustainable development.

The revenue from CER obtained is to be fed back to the promotion of energy conservation activities, partial subsidiary for installation of energy conservation equipment, capacity building, development of energy conservation monitoring scheme and other activities to promote comprehensive energy conservation. Therefore, this is not simply an implementation of energy conservation measures but contributes to establishment of policies and systems that encourage sustainable development.

TEDA is one of the industrial parks that were designated as Ecological Industrial

Model Parks to promote environmental protection at economic and technological development areas. TEDA was designated by Ministry of Environmental Protection of China as an "Ecological Industrial Model Park" April 2004. This project, therefore, is closely related to the intention of the Chinese government to promote energy saving measures at TEDA so to establish a system to encourage energy conservation measures industrial level. By setting an example of such systems, this project contributes largely to the sustainable development of China.

1.5 Chinese policies and organisational structures for CDM

CDM projects are reviewed and approved by National Development and Reform Committee (NDRC) under National Climate Change Coordination Committee which serves as the Designated National Authority (DNA) for CDM in China.

With the population it holds, China is behind in the development of its energy infrastructure. In such situation, promotion of small scale onsite renewable energy and energy conservation activities with an assistance of international scheme is considered the most promising means to promote stable supply of energy in the remote area and to extinguish poverty so to improve the living standard of the remote area. This has drawn attention to the potential of Programmatic CDM.
Lead by the Chinese Academy of Social Science, China is investigating strategies that would work in favour for programmatic CDM.

1.6 Project Implementation Organisational Structure

The project study was carried out by EES in cooperation with EIJ. EES evaluated the energy conservation potential at the subjected facilities and investigated the detail of the scheme as well as preparing necessary documents and plans. EES was also involved in discussion of detailed plan for the execution of the project with the TEDA administrative committee. Simultaneously, EIJ performed a study on the energy consumption and other necessary issues at heat supply facility (steam generator) and the factory that are involved in the case study.

Chinese counterpart for this project is TEDA administrative committee which is one of the branch offices of Tianjin people's committee and is in charge of public administration and management operation in TEDA.

2. CDM Project Plan

2.1 Project boundary

The project site is TEDA. TEDA is located 45 km south east of the Tianjin city centre, China. TEDA is one of the first national class development area in China that are established in 1984. The main area occupies 33 km^2 and the total area including chemical and microelectronic park is 78.1 km^2.

This PoA includes all facilities in the TEDA premises therefore the boundary is the physical boundary of TEDA.

The first specific case planned as a CPA (CDM Programme Activity) in the PoA boundary is an activity at a power and energy supplier and a consumer within the area targeted in this study. This will be carried out as a case study of the PoA. The activity will include energy audit, detailed study and preparation of document required for CDM registration.

By reflecting the result of this case study, a foundation is built for this PoA to promote energy conservation activities.

Currently (2007), 9,892 domestic and 74 overseas and 4,299 Hong Kong, Taiwanese and Macau enterprise are situated in TEDA. Main industrial sectors in TEDA are IT, manufacturing, biomedical, chemical and food processing industry. In addition, tertiary industry such as transport and hotels are also well established.

In the recent years, TEDA has shown an exceptional growth. GDP in 2006 was 780.56 RMB which is 28.8% imcrease from the previous year.

The location of Tianjin city is indicated in fig 1. and the geological boundary of PoA, which is the physical boundary of TEDA is indicated in fig 2.

Fig 1　Location of Tianjin city

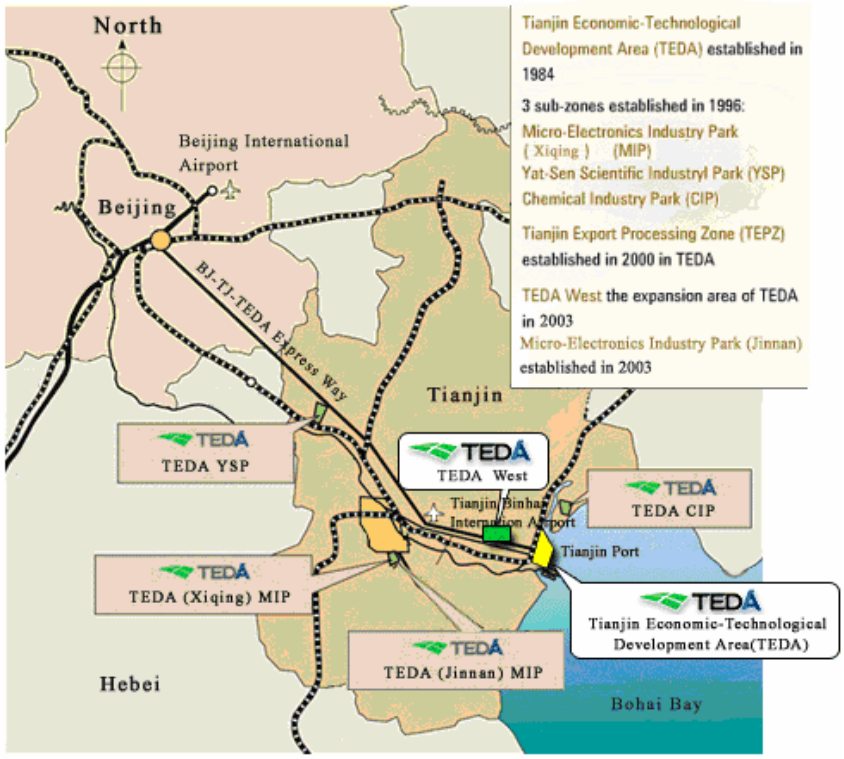

Fig 2　Lay out of TEDA

2.2 Applied methodology

Condensate collection rate at an individual factory in TEDA is expected to have annual average of 10 t/h at most in which case, the activity is expected to be categorised as small scale. ”AMS II. B. Supply side energy efficiency improvements -generation (Version 09)” is a methodology for small scale demand side energy conservation project. The project fulfils the applicability conditions of the methodology therefore, this methodology can be employed to this project.

2.3 Baseline selection and demonstration of Additionality

The objective of this PoA is to construct a condensate collection system to recover heat from condensate therefore improving the overall heat efficiency of the steam generation. Baseline scenario of CPAs under this PoA is steam generation without condensate collection. The additionality of the PoA as a whole is demonstrated by the investment, technological and other barriers listed below:

【Investment barrier】

- Many of steam consumers and regional heat supply plant in TEDA has no or very little experience in condensate collection. Therefore, collection pipe line needs to be newly laid in many parts and facilities installed which requires additional investment.
- Only steam generator will directly benefit financially from collecting condensate. Therefore, without CER, it is not financially beneficial to the factories where condensate collection system needs to be actually installed.

【Technological barrier】

- Most of the heat supply plants, steam distributors and steam consumers have no experience in condensate collection therefore requires installation of new facilities as well as new employment of technical staff and training of existing staff. This creates a significant burden to the parties involved.
- There is a risk that the quality of boiler feed may deteriorate by reintroducing the condensate as feed water which causes to fouling, corrosion and other

【Other barriers】

- As the steam generator, the distributor and the consumers are all separate organizations, exchange of information and cooperation among them are difficult. To create a sound condensate collection system, sharing of information and cooperation among them are essential.
- There is a conflict between the regional heat supply plant (steam generator) and steam consumer over the ownership of the condensate. This makes the cooperation between them difficult without any external influence. By registering the activity as CDM, external influence such as TEDA managing committee becomes available.

From above barriers, it can be stated that it is unlikely for the condensate collection system is constructed without the presence of this PoA. Those barriers are removed by executing the activity as CDM in which case, the PoA's Additionality is confirmed.

2.4 Project participants

TEDA Environmental Protection (TEDA EP) is nominated to act as the coordinating/ managing entity of the PoA. TEDA EP was established by TEDA holdings and Environment Bureau of Tianjin City n November 2001. TEDA EP is a government owned company specialised in operation and structuring of infrastructure and in this project, acts as a mediator between the steam generator, distributor, consumer and by providing an appropriate technology, promotes the condensate recovery programme.

Energy conservation/ GHG emission reduction by condensate collection activity is registered as a programmatic CDM and CER is acquired.

NEDO and EIJ are also PoA participants as CER buyers. On the other hand, implementers of small scale CPA (SSC-CPA) under the PoA, TBE, THPC and factories for this specific PoA are not considered project participants.

Table 1 PoA Project participant

Participating country	Project participant
China (Host country)	TEDA Environmental protection
Japan	Energy Initiative Japan Ltd.

2.5 Crediting period

The PoA is in effect for 28 years, starting in June 2008. Crediting period of each CPA is 10 years and that 10 years must fall within the period which the PoA is in effect.

2.6 GHG emission reduction and leakage

Emission reduction of each CPA is calculated as follows:

$$ER_y = \frac{(h_{dr,y} - h_{fw,y}) * Q_{dr,y}}{\eta_{BL}} * EF_{CO2,i}$$

Where:

ER_y: Total emission reductions during the year y in tonnes of CO_2 (tCO_2/yr)

h_{dr}: Specific enthalpy of the condensate（TJ/t）

h_{fw}: specific enthalpy of the boiler feed（TJ/t）

$Q_{dr,y}$: Condensate collection rate（t/yr）

η_{BL}: Baseline boiler efficiency (%)

$EF_{CO2,i}$: CO_2 emission factor for fuel i（tCO_2 /TJ）

As in the equation above, emission reduction is proportional to the condensate collection rate and the difference between specific enthalpy of condensate and boiler feed which are functions of condensate temperature and feed temperature respectively. Therefore, emission reduction is greater for condensate collected at higher temperature.

Being a programmatic CDM, it is difficult to estimate the emission reduction by all

participants. For a particular SSC-CPA which is relatively large in its scale , condensate is collected at an average rate of 120 t/hr and estimated emission reduction is 22,876 tCO2e per annum.

2.7 Monitoring plan

The monitoring for this PoA will be carried out according to the monitoring method specified in the methodology employed ”II. B. Supply side energy efficiency improvements – generation”. Parameters for calculation of emission reduction by SSC-CPA under this PoA are baseline boiler efficiency, specific enthalpy of condensate and feed water and condensate collection rate.

2.8 Environmental and other Impact

SSC-CPAs under this PoA employ similar technology and are all situated within the industrial area. Therefore, environmental impact assessment at PoA level is sufficient enough. Tanks and pipes installed for the condensate collection system for a SSC-CPA under this PoA are to be installed within the industrial area in TEDA and do not involve any movement therefore unlikely to cause any noise or vibration. The filtration equipment and pumps for condensate recirculation may cause certain level of noise. However, since those are installed within the facility premise, by being in compliance with the Chinese standards, the effect to the surrounding area can be minimised. Therefore, it is unlikely that the implementation of this PoA would cause any major negative environmental effect to the area outside TEDA. Further, China and Tianjin city does demand environmental impact assessment for construction of condensate collection system proposed in this PoA.

This leads to a conclusion that all SSC-CPAs under this PoA are incompliance with all federal and regional environmental legislations and regulations therefore major environmental impact by implementation of SSC-CPA under the PoA is unlikely.

2.9 Stakeholders comment

Since SSC-CPAs under this PoA is executed within the industrial and commercial area in TEDA, no residence who are affected by the execution of the SSC-CPA. All SSC-CPAs under this PoA employ similar technologies therefore stakeholder

comment at the PoA level is considered sufficient.

Stakeholders of this PoA are TEDA administration, regional heat supply plant, steam distributor and consumer and residence, schools and hospitals in the surrounding area. Stakeholder comments are planned to be collected at an appropriate timing. At this stage, TEDA administration, regional heat supply plant, steam distributor and consumer have been interviewed to reach an agreement. All parties at this moment approve of the condensate collection activity to be executed as CDM.

3. CDM Project execution

3.1 Project administration structure

Project administrative structure is presented in fig. 3. CPA implementers are manufacturing facilities (steam consumer) in TEDA. Steam generated at Tianjin Binhai Energy & Development Co. Ltd. (BHE), a subsidiary of TEDA Holdings, is distributed by TEDA heat and Power Company (THPC), also a subsidiary of TEDA Holdings, to the steam consumer and the steam consumer is to collect the condensate generated from the steam used and pump it back to the steam generator.

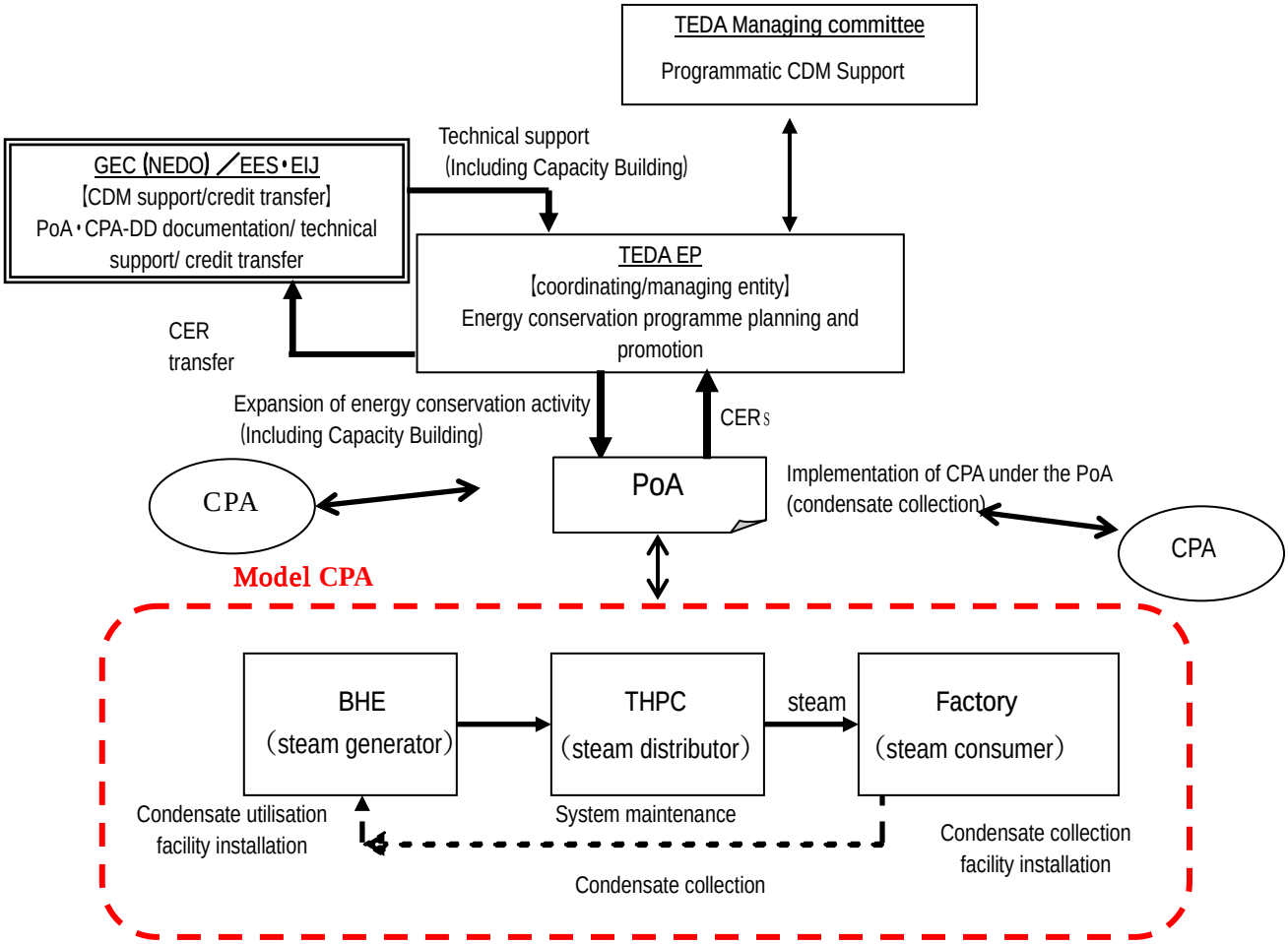

Fig. 3 Projec administration structure

CER acquired by the project is to be transferred to Japan by emission trading system to NEDO through EES and EIJ. EIJ plans to purchase part of the CER acquired while EES purely intend to provide support in CDM registration.

3.2 Economic analysis

Facility cost for steam generator, distributor and the consumer for the CPA at was estimated and presented in table 2 to 4.

BHE, THPC and steam consumer (factories) are to bear the facility cost and TEDA EP, the managing/ operating entity, bears the cost related to the execution of CDM.

Table 2. Facility cost for demand side condensate utilization

facility	Spec and number	Unit cost (RMB)	cost (RMB)
Filter	30t/h×4	374,000	1,496,000
Tank	50m³× 1		176,000
Tank	100m³× 1		264,000
Insulation			248,000
RO unit	30 m³/h×1		4,400,000
Pipe work			413,000
Insulation			220,000
Pump	0.5 m³/m×30m×6	16,000	96,000
Electric work			281,000
Foundation			385,000
Instruments	Level sensor, thermometer, flow meter, conductivity meter for 12 lines	33,000	396,000
Instrumentation	12 lines	22,000	264,000
Sub total	Per factory		8,639,000
Total	**Guohua & Factory V**		**17,278,000**

Table 3. Cost for demand side condensate collection pipe line

Condensate flow rate	specification	Unit cost (RMB)	Cost (RMB)
120 m^3/h	200 A×2,000 m	300 RMB/m	4,800,000
	insulation	1,320 RMB/m	2,640,000
total			**71,240,000**

Table 4 Cost for condensate collection system implementation at Company A (condensate collection rate: 120 m^3/h)

Facility	Specification	Unit cost (RMB)	Cost (RMB)
Tank	40 m^3×1		165,000
Insulation			110,000
Pump, electric work	1.0 m^3/m×11 kW×3	110,000	330,000
Foundation work			132,000
Pipe work			88,000
Insulation			55,000
Instrumentation			154,000
Instruments	Level sensor, thermometer, flow meter, conductance meter		44,000
Valves			132,000
Dissolved oxygen remover	2 m^3/h×5	184,000	920,000
Others			11,000
Total			**2,141,000**

3.3 Further improvements

Followings are the issues left for this project:

【Distribution of incentive and profit】

Since the condensate collection facility will not gain any direct benefit from the energy conservation by the condensate collection programme and there are not many successful case of condensate collection in TEDA, factory owners are reluctant to partake in the condensate collection programme.

Once the distribution of incentive and profit is regulated, it could encourage the even relatively small steam consumers to partake in the PoA.

【Capacity building for technology related to condensate collection】

Since condensate collection is currently not a common practice in TEDA, technical staff at the factories are thought to lack of knowledge and technologies in condensate collection. Furthermore, neither TEDA administrative committer or TEDA EP have enough experience in programmatic CDM registration, assistance is necessary.

Although the revenue from CER is intended to be fed back to promotion of technology transfer, there may not be a steady flow of income until the project stabilises. Therefore, public funding to some extent may be necessary.

【Expansion of CDM activity】

Initially, the condensate collection programme targets the main area of TEDA. However, in the future, it is intended to expand to all areas. Further, the energy conservation activities can be expanded to energy efficiency improvement especially at large manufacturing facilities such as where large amount of energy in consumed in lighting, ventilation and air conditioning.

4. Project schedule

Project plan is shown in table 5.

Table 5. Project Schedule