China and the United States Environmental Protection Agency Training Partnership
Renewable Energy Utilization of Landfill in China and Reduction of GHGs

CDM and GHG Emissions Trading

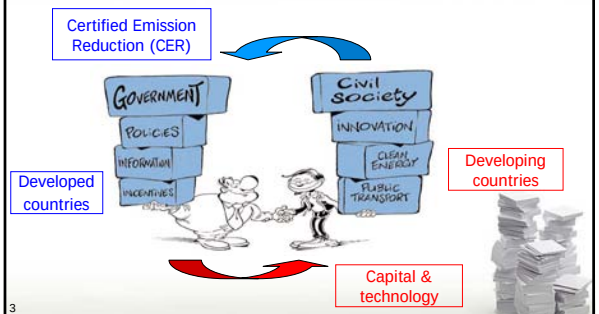
Lu Guoqiang
Foreign Economic Cooperation Office
Ministry of Environmental Protection of China
April 1st, 2008

Kyoto Protocol

- Climate Change, global warming
- *United Nations Framework Convention on Climate Change* (UNFCCC)
- Green House Gases (GHGs)
- *Kyoto Protocol*
- Clean Development Mechanism（CDM）

2

Clean Development Mechanism (CDM)



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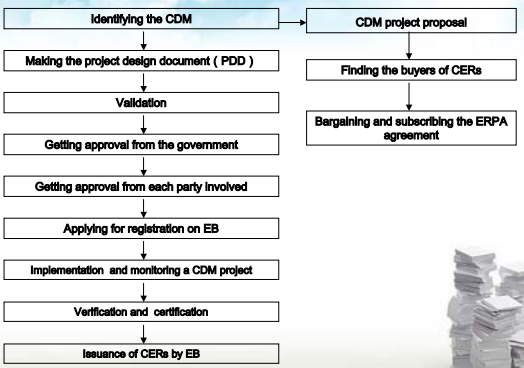
The 15 fields of CDM

1. Energy industries
2. Energy distribution
3. Energy demand
4. Manufacturing industries
5. Chemical industries
6. Construction
7. Transport
8. Mining/mineral production
9. Metal production
10. Fugitive emissions from fuels
11. Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride
12. Solvent use
13. **Waste handling and disposal**
14. Afforestation and reforestation
15. Agriculture

4

Cycle of CDM Projects



5

Landfill Gas CDM Projects

Requirement on capture and utilization of landfill gas

1. The captured landfill gas is used to produce energy （e.g. electricity/thermal energy).
2. The captured landfill gas is used to supply consumers through gas distribution network.
3. The captured landfill gas is flared.

- Consolidated CDM methodology：ACM0001 (Version 08)
（Replace：AM0002、AM0003、AM0010、AM0011）
- Small-scale methodology：AMS-I.D. (Version 09)

6

The CDM methodology for LFG projects

UNFCCC/CCNUCC

CDM – Executive Board

ACM0001 / Version 06
Sectoral Scope: 13
EB 32

Revision to the approved consolidated baseline methodology ACM0001

"Consolidated baseline methodology for landfill gas project activities"

Sources

This methodology is based on elements from the following approved proposals for baseline methodologies:

- AM0002: Greenhouse Gas Emission Reductions through Landfill Gas Capture and Flaring where the Baseline is established by a Public Concession Contract (approved based on proposal NM0004 rev: Salvador da Bahia landfill gas project, whose project design document and baseline study, monitoring and verification plans were developed by ICF Consulting (version 03, June 2003));
- AM0003: Simplified financial analysis for landfill gas capture projects (approved based on proposal NM0005: Nova Gerar landfill gas to energy project, whose project design document and baseline study, monitoring and verification plans were developed by EcoSecurities Ltd. (version 14, July 2003) for the Carbon Finance Unit of the World Bank);
- AM0010: Landfill gas capture and electricity generation projects where landfill gas capture is not mandated by law (approved based on proposal NM0010 rev: Durban-landfill-gas-to-electricity project, whose project design document and baseline study, monitoring and verification plans were developed by Prototype Carbon Fund of the World Bank (April 2003));
- AM0011: Landfill gas recovery with electricity generation and no capture or destruction of methane in the baseline scenario (approved based on proposal NM0021: Ceramt methodology for

7

Statistics of the LFG CDM Projects in China

Status of the projects	Amount of the projects	Annual Average CERs（tCO_2e/year）
Approved by DNA	22	4,443,650
Registered	8	2,649,799
Requested for Review	1	130,444
CERs Issued	3	104,579

(By March 20th,2008)

8

Approved LFG CDM Projects by DNA in China

Ref	Name of the Project	Registration date	Project Owner	CER Buyers	Annual Average CERs
71	Nanjing Tianjingwa Landfill Gas to Electricity Project	18-Dec-05	Nanjing green renewable resources Engineering Co., Ltd	EcoSecurities Group Ltd	246,107
176	Meizhou Landfills Gas Recovery and Utilization as Energy	3-Mar-06	Shenzhen Phased Technology Co., Ltd	Austrian JI/CDM Programme,Kommunalkredit Public Consulting Gmbh	286,525
296	Anding Landfill Gas Recovery and Utilisation Project	21-May-06	Beijing Second Qing Environment Sanitation Engineering Group Co.,Ltd	ESI Energy Service Investment Corporation	75,557
887	Shenzhen Xiaping Landfill Gas Collection and Utilization Project	4-May-07	Shenzhen City Lisai Industry Development Ltd	Climate Change Capital Carbon Fund s.a.r.l	471,619
1120	Jiaozishan Landfill Gas Recovery and Utilisation Project	30-Nov-07	Nanjing Yunsheng New Energy Development Ltd	CAMCO International Limited	153,244
856	Wuxi Taohuashan Landfill Gas to Electricity	9-Apr-07	Wuxi Tianshun Environmental Technology Ltd	Toyota Tsusho Corporation	75,343
1075	Guangzhou Xingfeng Landfill Gas Recovery and Electricity Generation CDM Project	19-Sep-07	Guangzhou City Environmental Technology Ltd	British ICECAP Carbon Investment combination Ltd	909,857
933	Jinan Landfill Gas to Energy Project	13-May-07	Shandong Shifang New Energy Ltd	Ecosecurities Ltd	112,908
1505	Nanning Landfill Gas to Energy Project	Registration requesting	Guangxi Jietong Technology Ltd	Biogas Technology Ltd(Britain)	188,195
1406	Tianjin Shuangkou Landfill Gas Recovery and Gas Utilization Project	Requested for Review	Tianjin Clean Energy Environmental engineering Ltd	World Bank Spanish Carbon Fund	130,444

(Till March 20th,2008)

9

Advantages of the LFG CDM projects

1. Environment improvement and pollution control
2. Generation of renewable energy
3. Provide more job opportunities, and benefit the economy
4. Appropriate size and time period for development
5. Mature technology
6. Approved methodologies and many successful cases

10

History of LFG CDM Project Development

- LFG - the Pioneer CDM projects
  - The 1st CDM project in the world：Brazil NovaGerar Landfill Gas to Energy Project, registered on November 18, 2004
  - The first consolidated CDM methodology: ACM0001
  - The earliest approved CDM methodologies：AM0002、AM0003、AM0010、AM0011
  - The 2nd CDM project approved by the Chinese DNA: Nanjing Tianjingwa Landfill Gas to Electricity Project
  - Once as the flagship of the global CDM projects

11

Problems of the LFG CDM Projects(1)

1. The volume of landfill gas is difficult to estimate

   It's mainly a technical problem, but difficult to solve.

2. Usually the LFG volume is much lower than estimated

   Impact on the generation and transaction of CERs.

   Impact on extensive development of LFG CDM projects.

   It may need to be well considered for the ERPA.

12

CER Issuance of LFG CDM Projects in China

Ref	Name	Annual Average CERs	Issued CERs	Issued Date	Starting date of the crediting period	Ending date of the crediting period
71	Nanjing Tianjingwa Landfill Gas to Electricity Project	246,107	15,523	22-12-2006	30-5-2006	19-10-2006
			26,921	3-7-2006	1-5-2005	29-5-2006
176	Meizhou Landfills Gas Recovery and Utilization as Energy	286,525	48,840	7-6-2007	1-9-2005	31-12-2006
296	Anding Landfill Gas Recovery and Utilisation Project	75,557	13,295	5-11-2007	1-1-2005	30-4-2006

(By March 20th, 2008)

13

The Volume of Issued CERs are 15% ~ 42% of the Estimated ER Volume *ex-ante*

Ref	Name	Annual Average CERs Expected	Actual Annual Average CERs *	Rate of Issuance
71	Nanjing Tianjingwa Landfill Gas to Electricity Project	246,107	37,255.2	15%
		246,107	64,610.4	26%
176	Meizhou Landfills Gas Recovery and Utilization as Energy	286,525	11,7216	41%
296	Anding Landfill Gas Recovery and Utilisation Project	75,557	31,908	42%

(By March 20th, 2008) *Calculated by the actual CERs issued.

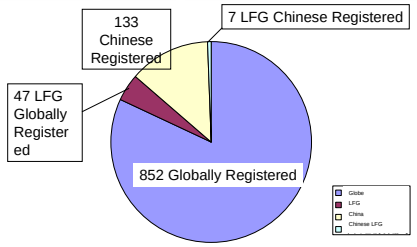
14

Statistics of CDM Projects in the World

Fields	Numbers of Approved and Applying Projects	Numbers of Projects	CERs of the Issued Projects	Rate of Issuance
Hydropower	612	41	2,701,000	86%
Biomass	462	74	7,053,000	89%
Wind Power	311	33	2,186,000	75%
Efficiency of Power Generation	235	13	6,278,000	106%
Agriculture	177	29	1,974,000	48%
Landfill Gas	177	11	2,296,000	35%
Biogas	145	3	274,000	87%
Industrial Energy Efficiency	119	9	387,000	82%
Fuel switching	80	8	923,000	83%
N2O	44	4	16,051,000	118%
Cement	28	4	703,000	83%
Efficiency of Electricity Supply	27	2	30,000	83%
Fugitive Gas	20	1	378,000	80%
HFCs	19	11	41,570,000	93%
Geothermal	10	2	102,000	20%
Traffic	6	1	59,000	51%
Services Energy Efficiency	4	1	2,000	63%
Total	2,551	247	82,867,000	89%

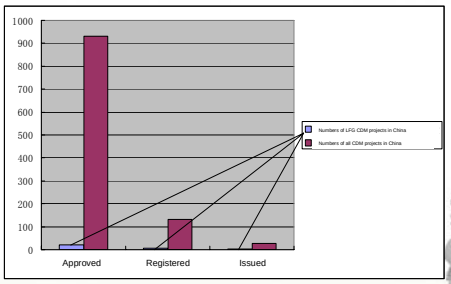
15

Numbers of LFG CDM Projects



16

Numbers of LFG CDM Projects in China



(Till Nov 28th, 2007)

17

Problems of the LFG CDM Projects(2)

1. Too long time for validation, approval and registration

   It's very common, due to efficiency, performance and institutional reasons.

2. There might be some problem on the additionality.

   National standard for pollution control on the landfill site for domestic waste (GB16889-2008) will be effective on August 1st, 2008.

   It was issued by the Ministry of Environmental Protection and the Administration of Quality Supervision, Inspection and Quarantine of China.

   "Landfill sites with designed volume more than 2.5 million tons of waste and thickness is more than 20 meters should recovery and utilize landfill gas or build flaring facilities. Smaller landfills shall adopt waste disposal process to reduce landfill gas emission".

18

"5.15 Landfill sites with designed volume more than 2.5 million tons of waste and thickness is more than 20 meters should recovery and utilize landfill gas or build flaring facilities. Smaller landfills shall adopt waste disposal process to reduce landfill gas emission".


GB

中华人民共和国国家标准

生活垃圾填埋场污染控制标准

Standard for Pollution Control on the Landfill Site of Municipal Solid Waste

国家环境保护总局
国家质量监督检疫总局

19

Improvement of Technical Aspects

1. Improve the accuracy of estimation for landfill gas generation.
   - Current calculation models need to be improved, parameters need to be revised and modified for better application for the specific landfill sites in China.
   - Over-estimate of landfill gas generation is not wise, and more accurate estimation is a better solution.
2. Improve reliability and stability of the equipment and operating system
   - High quality management of operation and maintenance of equipment

20

Problems on CERs Transactions

1. Emissions Reduction Purchase Agreement
   - Contract volume shall based on accurate estimation, over-estimation of contracted CERs will hurt the deal.
   - Carefully arrange relevant terms such as committed volume of CERs and remedy on default.
2. Uncertainty and risk shall be considered seriously by both the CER buyers and sellers
   - Accurate estimation of CERs, rational expectation, reasonable ERPA terms, sustainable CDM projects

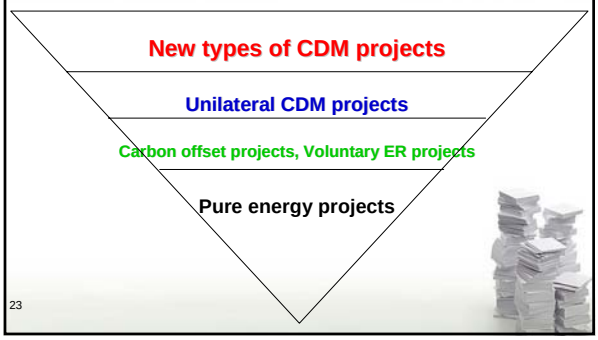
21

Problems Regarding CDM

1. Size of CDM projects
   - CER buyers prefer large-scale projects.
   - The number of large-scale projects is limited.
   - Many small-scale projects need technical and financial supports.
2. Rules and procedures of CDM
   - More complicated, slower and more difficult.
   - The risk and cost is increasing.

22

New Idea, New Opportunity



23

A. New Type of CDM Projects

1. Programmatic（P—CDM）
   - 28 years, many sub-projects, flexible
2. Bundling of small-scale CDM projects
   - Greater CERs, simpler procedures, lower cost
3. Sectored CDM projects
   - After 2012, being discussed
3. Policy based CDM projects
   - After 2012, being discussed

24

B. Unilateral CDM

1. No participants from Annex I parties.
   - Very popular in other countries, but very few in China.
   - Comparatively high-risk and high return for investment.
2. The income of selling CERs could be higher than that of "bilateral" CDM projects.
3. Simple and fast approval and registration process, no risks for the futures contract.
4. Hosting party need to cover the pre-costs by itself and take the risk of price change in the future.

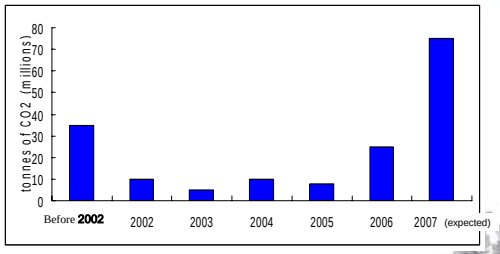
25

C. Voluntary Emission Reduction (VER) projects

- GHG emissions trading for non-compliance purpose
  - Emissions trading not under Kyoto Protocol, CDM and EU-ETS
  - The pre-emerging market (mainly in the United States, Australia)
- There are many standards but no mandatory rules
  - e.g., Voluntary Carbon Standard (VCS), Gold Standard, VER+, etc.
- Just started, grow fast, limited size, immature market
  - The volume in 2007 is around 70 million tons CO2e, is two times than the volume in 2006
  - U.S. market accounted for about 60%, and the price is between US$2 to US$16/ tCO2e

26

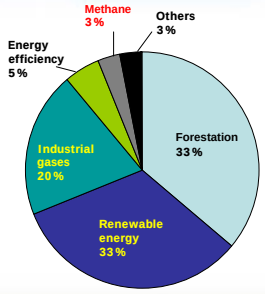
Volume of the VER Market



Source: *New Energy Finance, Point Carbon*

27

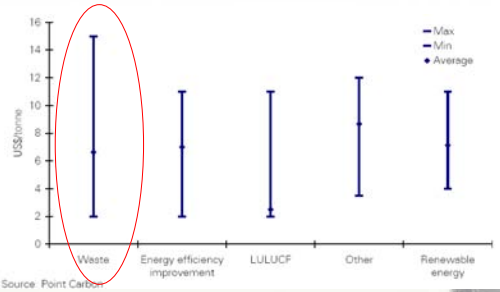
Types of the VER Market



Source:
New Energy Finance, Point Carbon

28

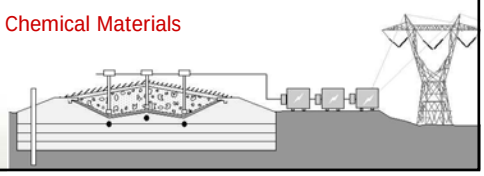
VER Prices for Different Types of Projects



29

D. Pure energy projects

- Power generation to the grid; power generation as a captive plant
- Provide gas through pipeline
- Heating boilers
- Alternative Fuel Vehicles
- Chemical Materials



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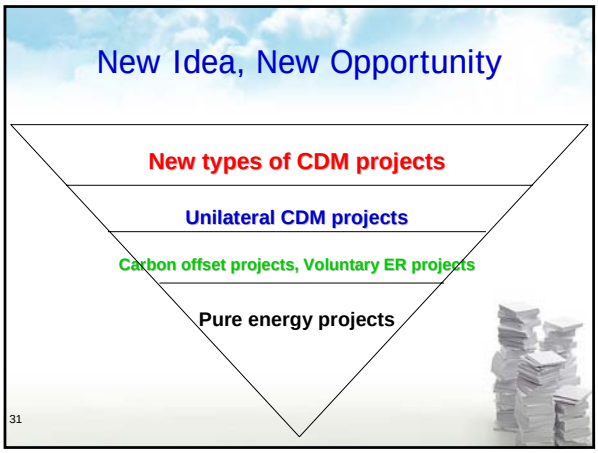
New Idea, New Opportunity
New types of CDM projects
Unilateral CDM projects
Carbon offset projects, Voluntary ER projects
Pure energy projects
31


Thank you !
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