Chinese Second National Communication (SNC) GHG Inventory of Waste Sector

Gao Qingxian

Chinese Research Academy of Environmental Science (CRAES)

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Current GHG Emissions in China

❑ According to the ***Initial National Communication on Climate Change of the People's Republic of China***, The national total amount of carbon dioxide emission in 1994 was 3,073 million tons, and carbon sink from land-use change and forestry was about 407 million tons. The net carbon dioxide was 2,666 million tons, and the per capita emission was about 0.6 ton carbon per year.

中华人民共和国
气候变化初始国家信息通报

The People's Republic of China
Initial National Communication on Climate Change

北京 2004
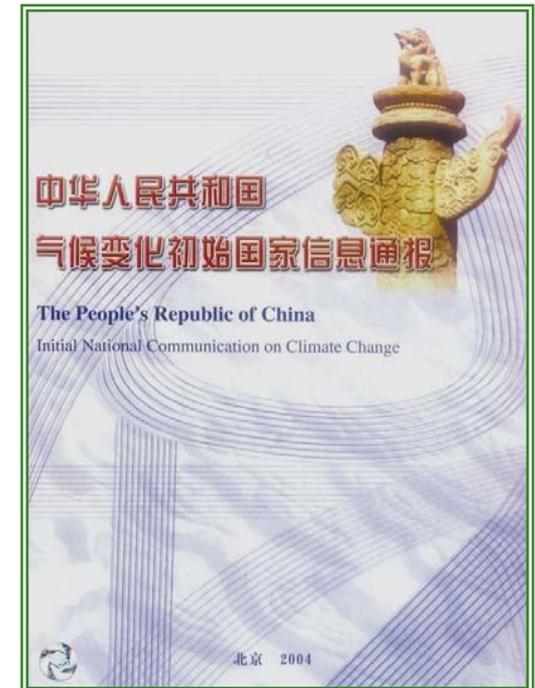
Current GHG Emissions in China

□ **The total GHG in China in 1994 was 3650 million tons of carbon dioxide equivalent, of which carbon dioxide, methane and nitrous oxide account for 73.05%, 19.73%, and 7.22% respectively.**
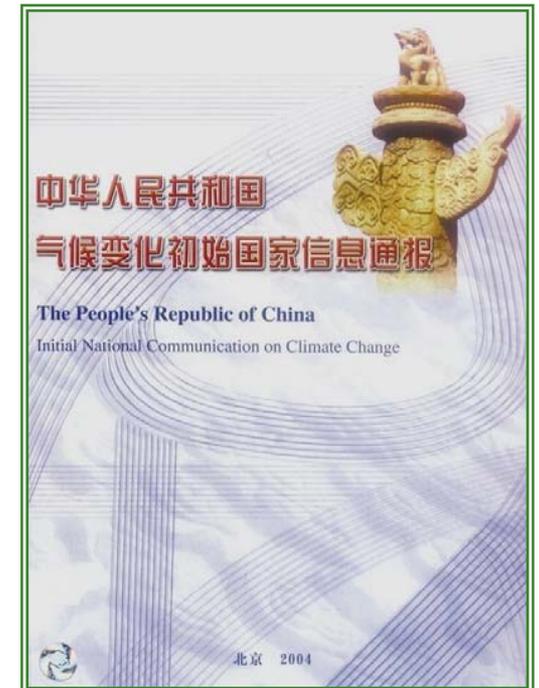
Current GHG Emissions in China

The GHG Emission in different sectors of China (1994)
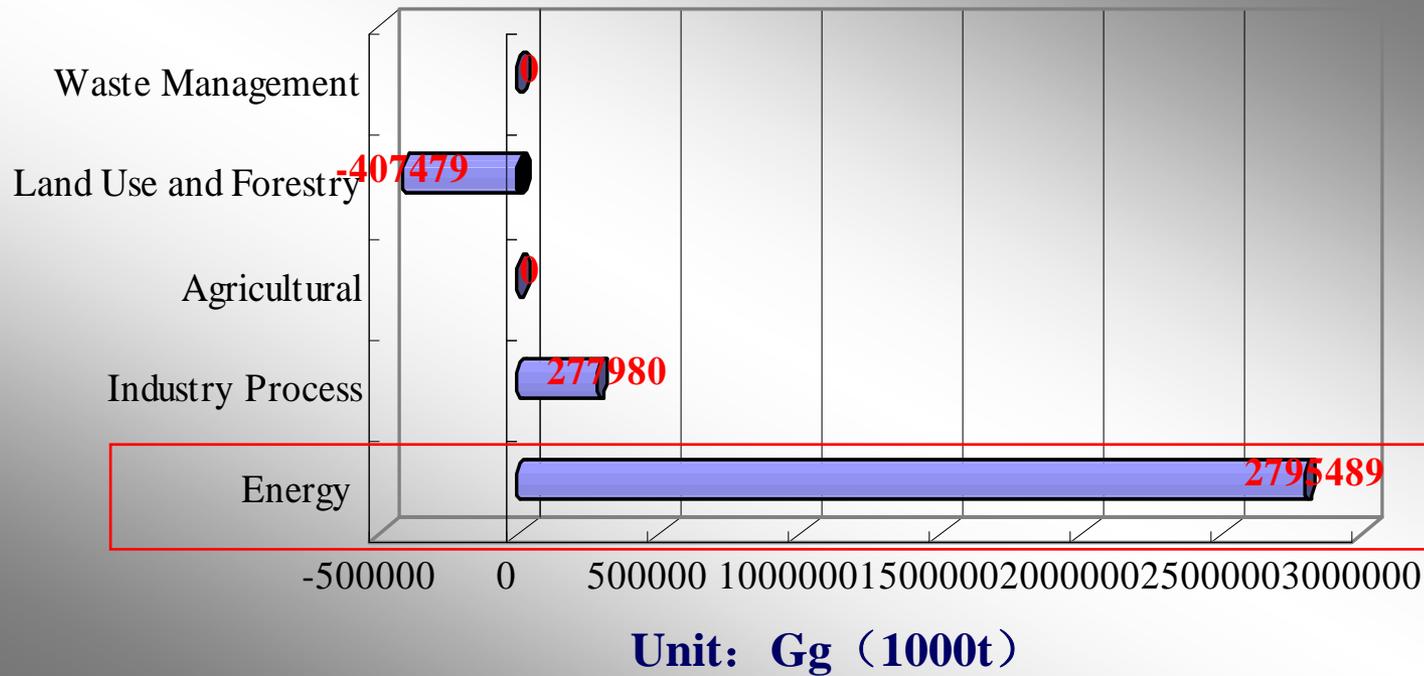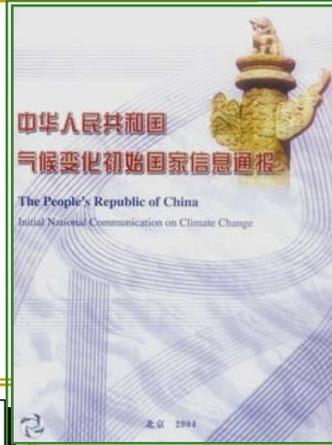
Current GHG Emissions in China

The CO_2 emission from energy sector was 2795 million tons in 1994.

2.72% 9.73% 3.47% 43.74% 5.94% 34.41%

☐ Industry ☐ Energy ☐ Transport ☐ Commercial ☐ Resident ☐ Others
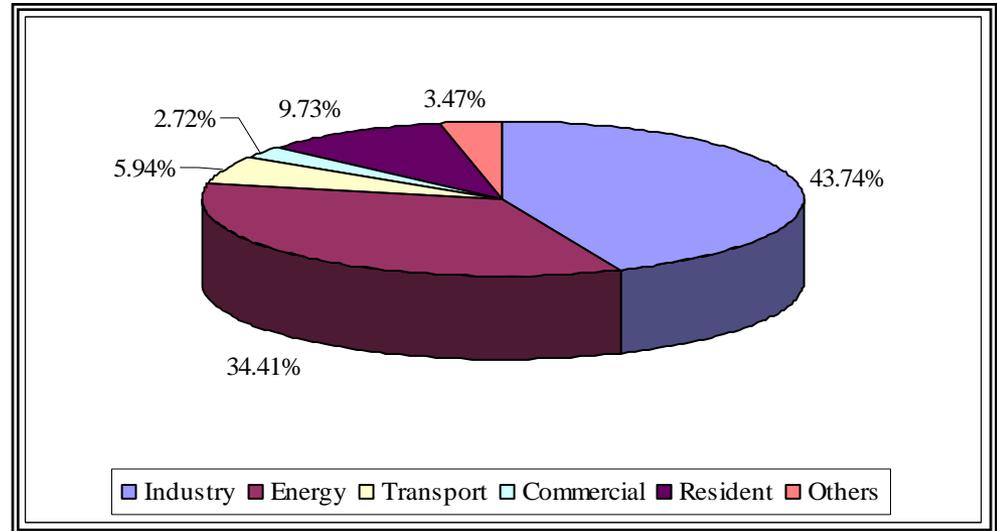
The CO_2 emission from industrial process was 278 million tons in 1994

8.16% 1.43% 56.76% 33.66%

☐ Cement ☐ Lime ☐ Iron & steel ☐ Calcium carbide
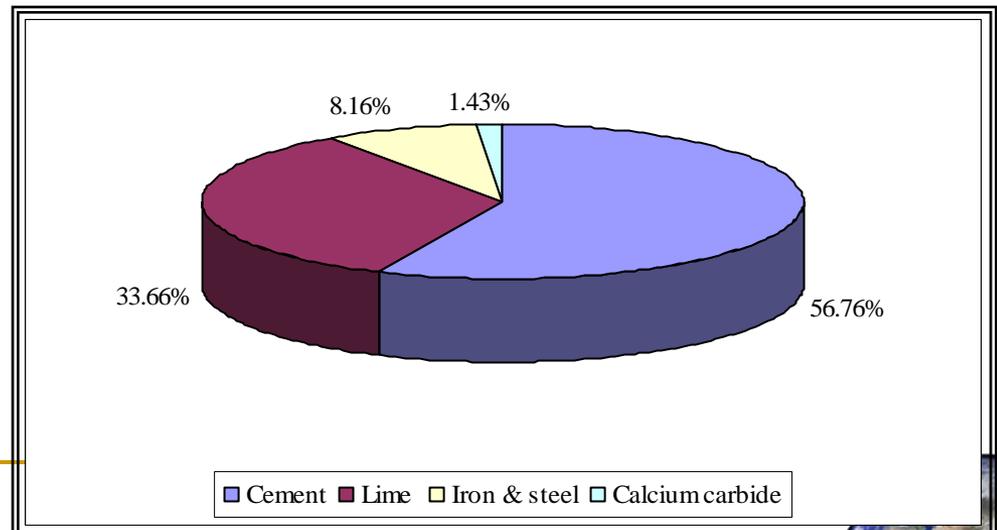
Current GHG Emissions in China

The methane emission was about 34.29 million tons in 1994
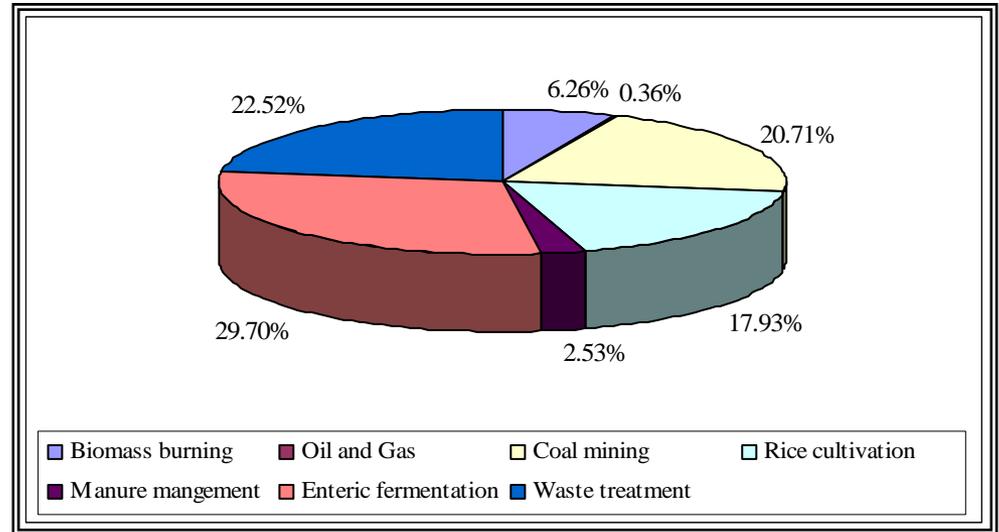
The nitrous oxide emission was about 850,000 tons in 1994.
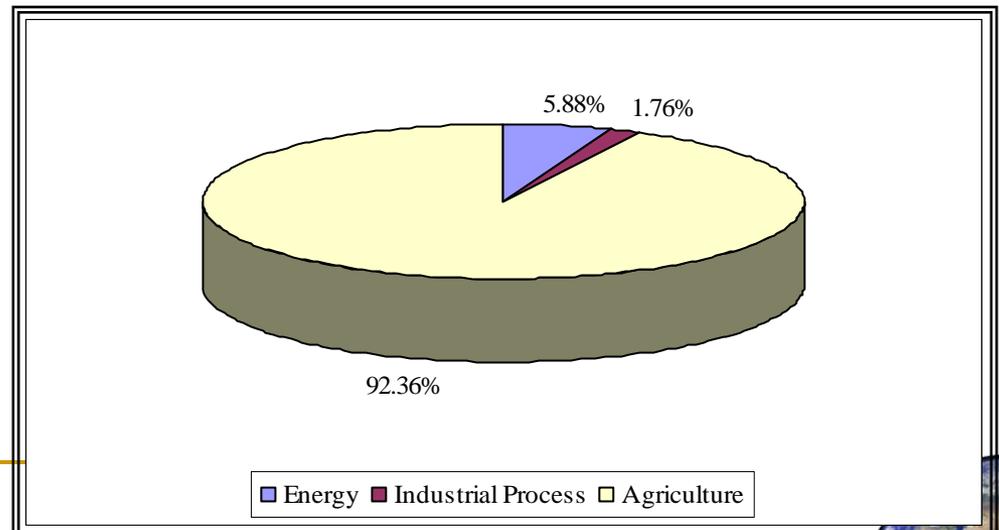
Current GHG Emissions in China

According to tentative estimates by experts from China, China's total GHG emission in 2004 is about 6,100 tCO_2e (5,600 million tons of net emissions), of which 5,050 million tons of CO_2, 720 million tCO_2e of CH_4 and 330 million tCO_2e of N_2O.
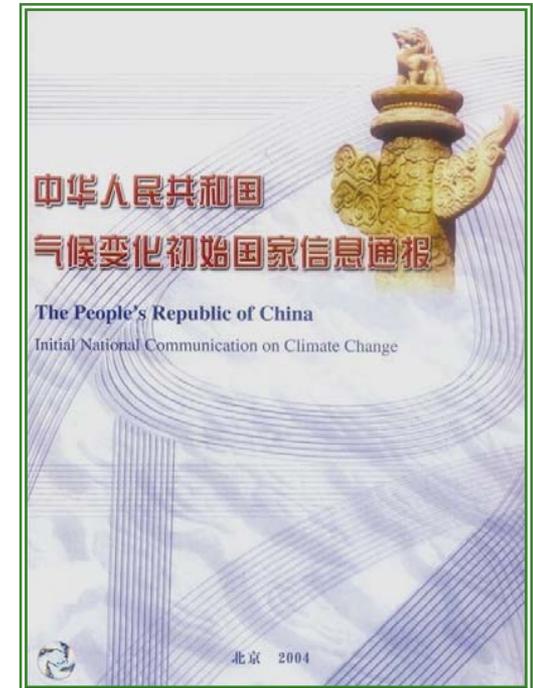
The review of waste sector in INC of China

EQUATION I

Methane emissions (Gg/yr)
=
$(MSW_T \times MSW_F \times MCF \times DOC \times DOC_F \times F \times 16/12 - R) \times (1-OX)$

Methane Emissions (Gg/yr)

MSW_T = Total production of MSW(Gg/yr)

MSW_F = The Ratio of treatment of MSW(%)

MCF = The methane correction factor

DOC = The Degradable Organic Carbon

DOC_F = The ratio of DOC in MSW

F = the ratio of methane in landfill gases(default value =0.5)

R = reused amount of methane (Gg/yr)

OX = oxidation factor(default value = 0)

The review of waste sector in INC of China

□ The default method will give a reasonable annual estimate of actual emissions if the amount and composition of deposited waste have been constant or slowly varying over a period of several decades. If the amount or composition of waste disposed of at SWDS is **changing more rapidly over time**, however, the IPCC default method will not provide an accurate trend. For example, if there is a reduction in the amount of carbon deposited at SWDS, the default method will underestimate emissions and overestimate reductions.

IPCC Good Practice Guidance
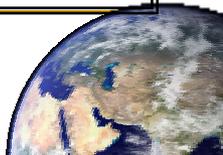
The review of waste sector in INC of China

- **Population Statistics Data**
- **Data of MSW Generation Rates**
- **The Disposed Rate of MSW to SWDSs**
- **The analysis Composition of MSW**
- **The Degradable Organic Carbon (DOC) Content of Waste**
- **Categories of Waste Disposal Sites**
- **Other Default Values Recommended by IPCC**

Total generation of MSW (Gg/yr)

For developing countries and countries with economies in transition, the population data may be the total urban population only, because the rural population is assumed to dispose of waste in such a way that CH_4 emissions are extremely low. **(revised 1996 IPCC Guidelines)**

P_T: Total population

P_C: Population in the City

P_R: Population in rural area

P_E: immigrated people in the City

The survey shows that there are about 70 million people from rural areas who worked in urban areas in recent 10 years

MSW$_T$

Revised 1996 IPCC Guidelines:
Total MSW can be calculated from Population (thousand persons) x <u>Annual MSW generation rate</u> (Gg/thousand persons/yr).

Weigh(metage)

Visual

Carrying Amount

But In China, we have <u>The Municipal Construction Statistics Yearbook</u>, in which have carrying amount and disposal percentage of municipal waste.

Categories of Waste Disposal Sites:

Locations of provinces, autonomous regions and municipalities.

1. **Northeast**
2. **Northwest**
3. **North of China**
4. **East of China**
5. **South of China**
6. **Southwest**
7. **Middle of China**
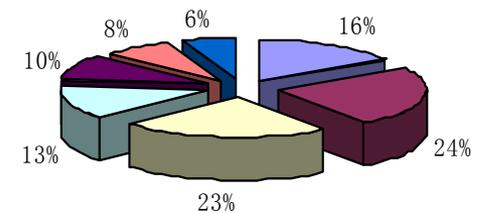
The Carrying Amount of Waste in 7 Regions of 1994

6% 16% 8% 10% 24% 13% 23%

NC NE EC MC SC SW NW

In different region, according the scope of the city, we classified the cities of China into 5 types:

- **Super City** 〔 > **2 Million** 〕, there **14** super cities in China and we survey 10 cities of them and got the real data of them;
- **Large City** 〔 **1~2 Million** 〕, there **23** lager cities in China and we survey 15 cities of them and go to site investigation for 6 larger cities;
- **Big City** 〔 **0.5~1 Million** 〕, there **47** big cities in China and we survey 21 cities of them and go to site investigation for 6 big cities;
- **Medium City** 〔 **0.2~0.5 Million** 〕, there **159** big cities in China and we survey 39 cities of them and go to site investigation for 11 big cities;
- **Small City** 〔 < **0.2 Million** 〕, there **425** small cities in China and we survey 52 cities of them and go to site investigation for 2 big cities;

For Region, To get investigation information of waste and its treatment from 47 cities in East region of China, 42 cities in North of China, 48 cities in West and Middle region of China; To carry out site survey in 15 cities in east region, 10 cities in north region and 10 cities in west and middle region.
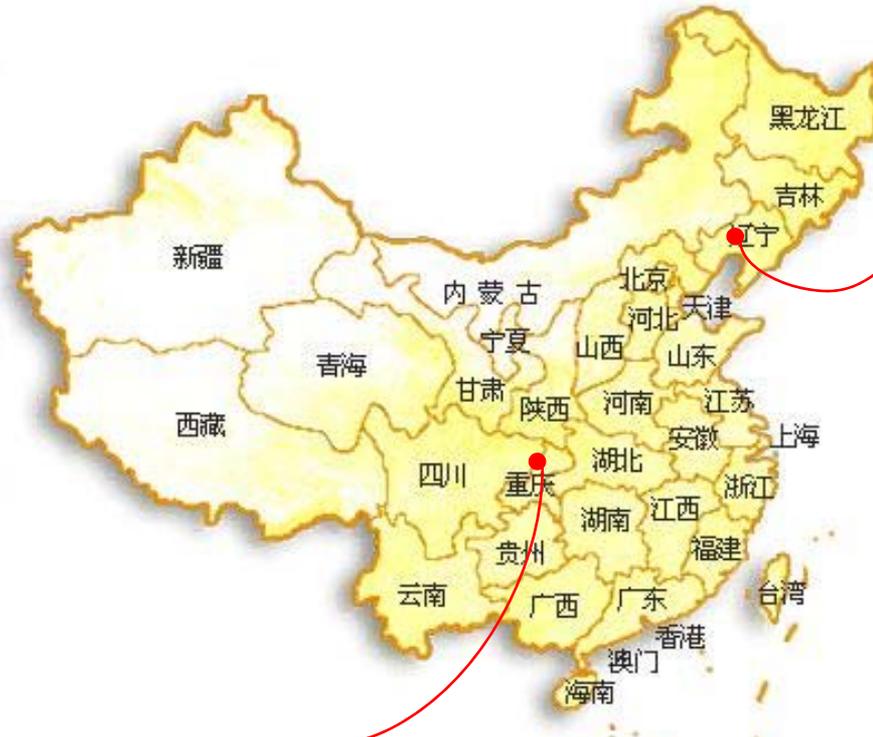
Northeast of China

To determine DOC from the composition of waste listed below:

     Kitchen Waste
     Papers
     Rubbers and Plastic
     Textile
     Woods and Straw
     Others

Notes: the dust include sweeping dust, dust, it account for almost 50% of total other waste composition.

Middle of China

（1）Synthesis Areas of Resident, Serving and Manufactory;
（2）New Developing Districts;
（3）Old Residential Districts;
（4）Synthesis Supermarket with foods stuffs;
（5）Modern Supermarket with daily article for use;
（6）a landfill with 1000 tone of daily input;

MSW Generation amount and population from 1970 to 2004
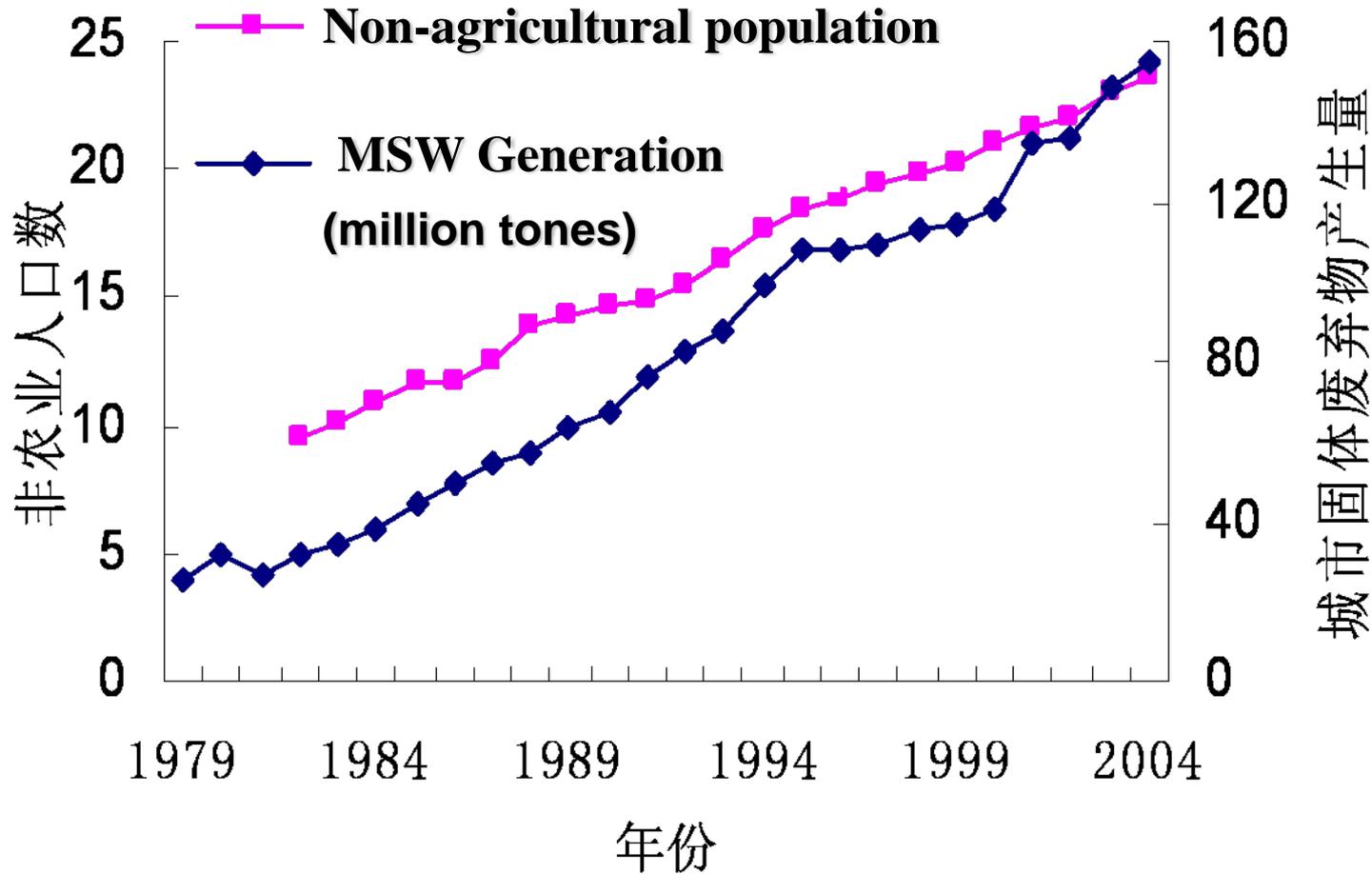
MSW Generation amount distribution (2000,2002,2004)
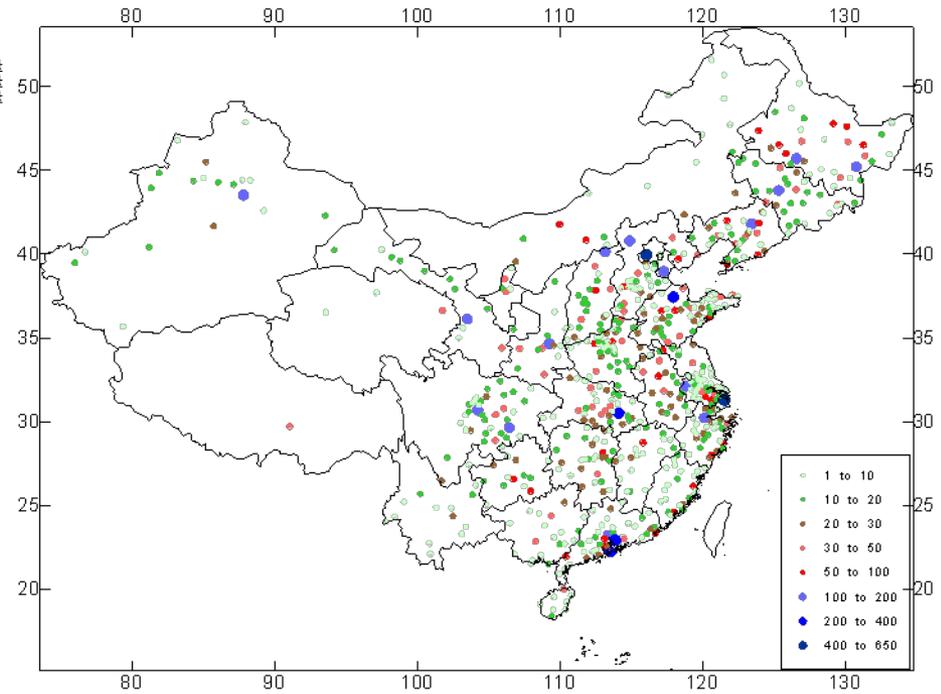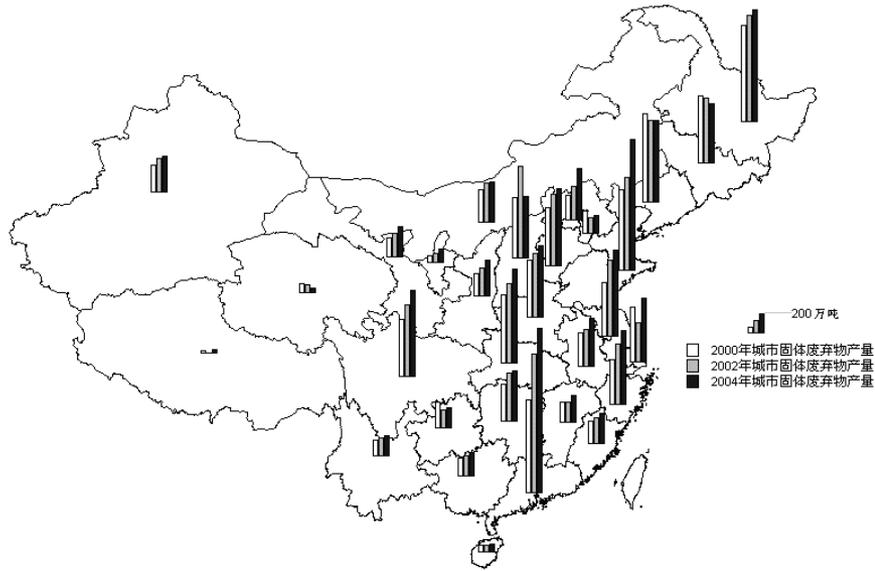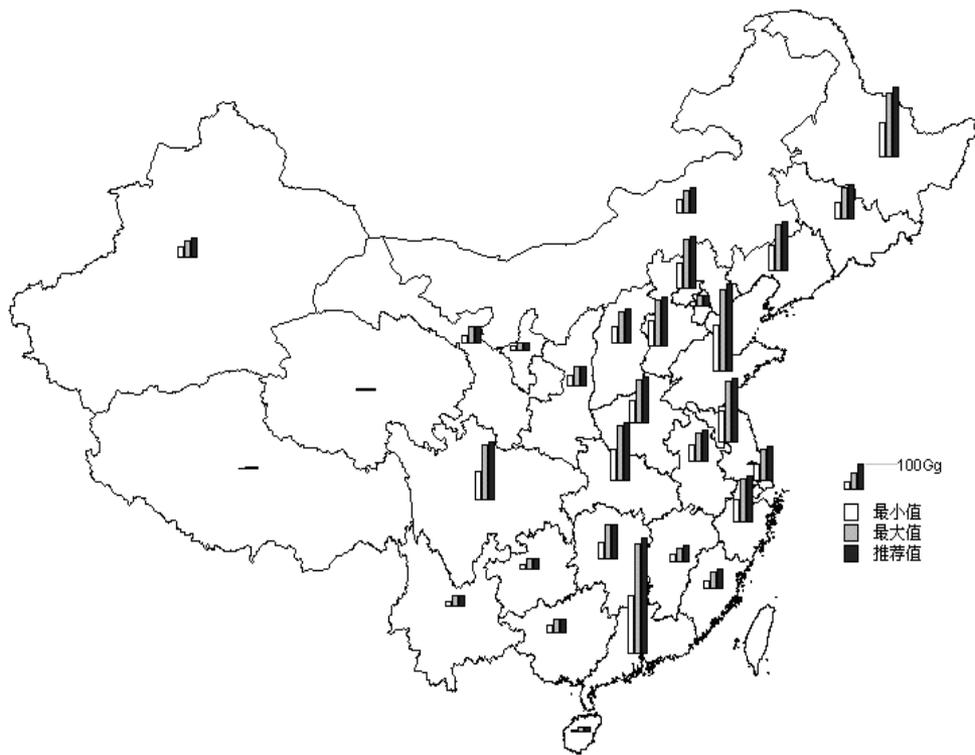
The methane emission of 2004
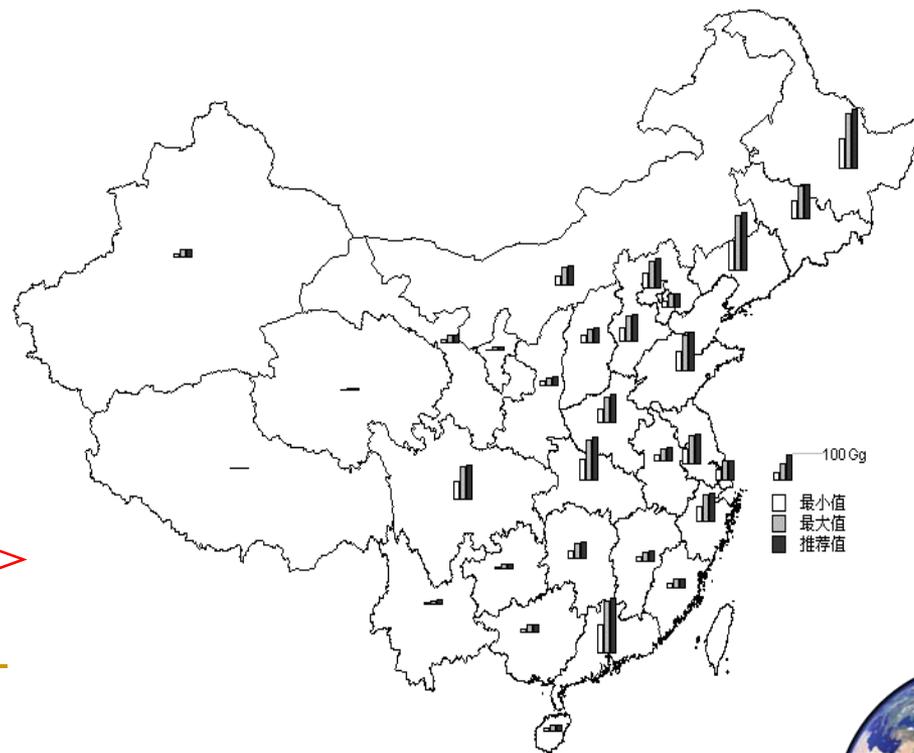
The methane emission of 1994

Newly progress of SNC

- To submit lately National Greenhouse gases inventory of China
  - *INC：1994*
  - *SNC：2005*
- To add new gases sources
  - *INC：CO_2、N_2O、CH_4*
  - *SNC： CO_2、N_2O、CH_4、 HFCs、 PFCs、 SF_6*

Newly progress of SNC

- **Geographic Region extending**
  - **INC：Mainland of China**
  - **SNC：Mainland of China, Hong Kong Special Administrative Region (SAR) of China and Macao SAR of China**
- **To Set up a *Target Research of Impact, vulnerability and adaptation of climate change***
  - **INC：Initial status with huge uncertainties in some sectors.**
  - **SNC：To reduce uncertainties with the support of TRIVACC.**

Newly progress of SNC：Institutional arrangement for SNC

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                    ┌──────────────────────────┐
                    │    Steering Committee     │
                    └──────────────────────────┘
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                    ┌──────────────────────────┐
                    │ Executive unit: CC Office of NDRC │
                    └──────────────────────────┘
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   ┌────────┐       ┌──────────────────────────┐         ┌────────┐
   │ CICETE │       │      Office Director       │         │  UNDP  │
   └────────┘       └──────────────────────────┘         └────────┘
                    ┌──────────────────────────┐
                    │  Manage Office of Project  │
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Mainland	Hong Kong and Macao SAR	Other Activities
TSU	**TSU**	Correspond and manage of Program
Basic situation related to CC	与气候变化相关的基本情况	Meeting / seminar
GHG Inventory	温室气体清单	Reviews of domestic experts
Impacts and Adaptation	影响与适应	compiling, translation and printing etc.
Mitigation Policies and measures	减缓的政策措施	Submitting
R&O、A&O	R&O、A&O	Issuing and publicizing
Needs for capacity building	能力建设需求	

Greenhouse Gases inventories preparation for waste treatment (SNC)

Purpose:

To Complete China's Greenhouse Gases emission inventories from the waste, including :

- ✓ China's landfill Methane emission inventory;

- ✓ China's waste incineration Carbon Dioxide emission inventory;

- ✓ China's industrial wastewater Methane emission inventory and living sewage water Methane emission inventory;

- ✓ China's wastewater / sewage treatment Nitrous Oxide emission inventory.

Greenhouse Gases inventories preparation for waste treatment (SNC)

Output:

- ☐ China's Methane emission inventory from waste landfill treatment
- ☐ China's Carbon Dioxide emission inventory from waste incineration treatment
- ☐ China's Methane emission inventory from industrial wastewater treatment
- ☐ China's Methane emission inventory from living sewage water treatment.
- ☐ China's Nitrous Oxide emission inventory from wastewater / sewage water treatment.
- ☐ Comprehensive study on China's waste inventories and Greenhouse Gases inventories preparation

Greenhouse Gases inventories preparation for waste treatment (SNC)

Output 1: China's Methane emission inventory from waste landfill treatment method

Methodology:　　Tier 2 from IPCC guideline

Activity Data:　　Data from statistics yearbook(1980-2007) and

　　　　　　　　Calculated data (1950 – 1979) based on the driving factors

Emission Factor:　Country specific data and IPCC default value

Future planning for 2nd NC

* **MSW sampling analysis for each region**

* **choose 3-5 landfills for monitoring methane emission and using Tier 2 to compare their results**

* **different scale cities compare (set up a reasonable calculating routine for each region)**

* **further survey for MSW and WW**

* **waste water sector (sampling analysis)**

* **industrial waste water**

Greenhouse Gases inventories preparation for waste treatment (SNC)

The relationship of MSW Generation amount and its driving forcing

$y = 12929.25 * \ln(x) - 116443.35$
$R^2 = 0.965$

Volume of Garbage Disposal(10,000tons)

Non-Agricultrue Population

$y = 3311.16 * \ln(x) - 25493.29$
$R^2 = 0.978$

Volume of Garbage Disposal(10,000tons)

GDP
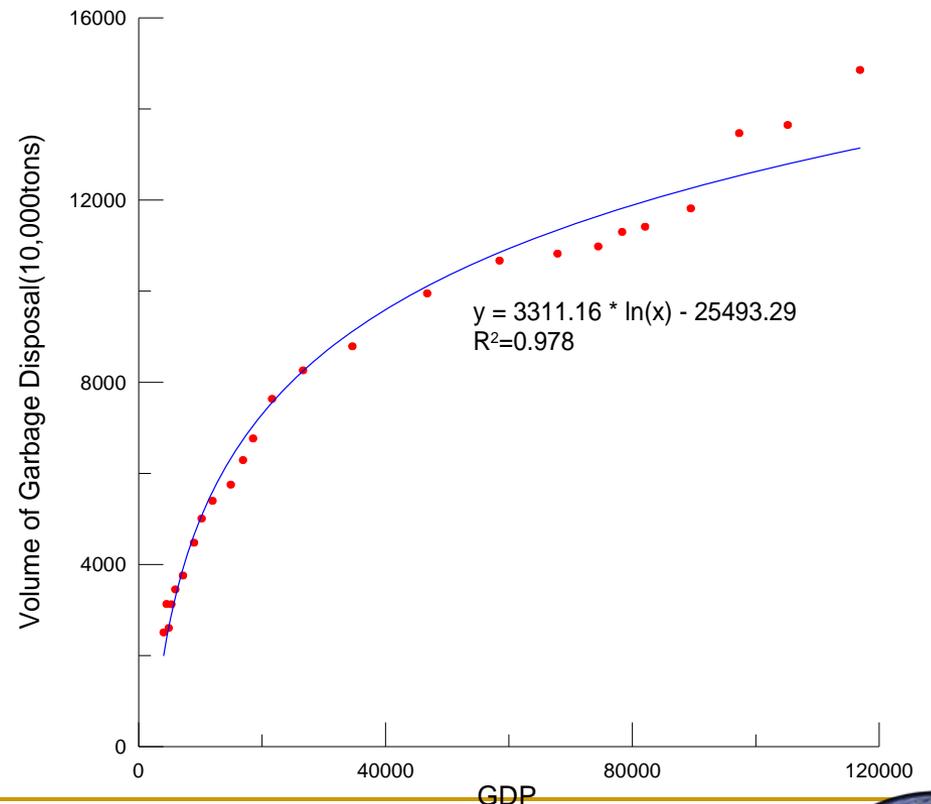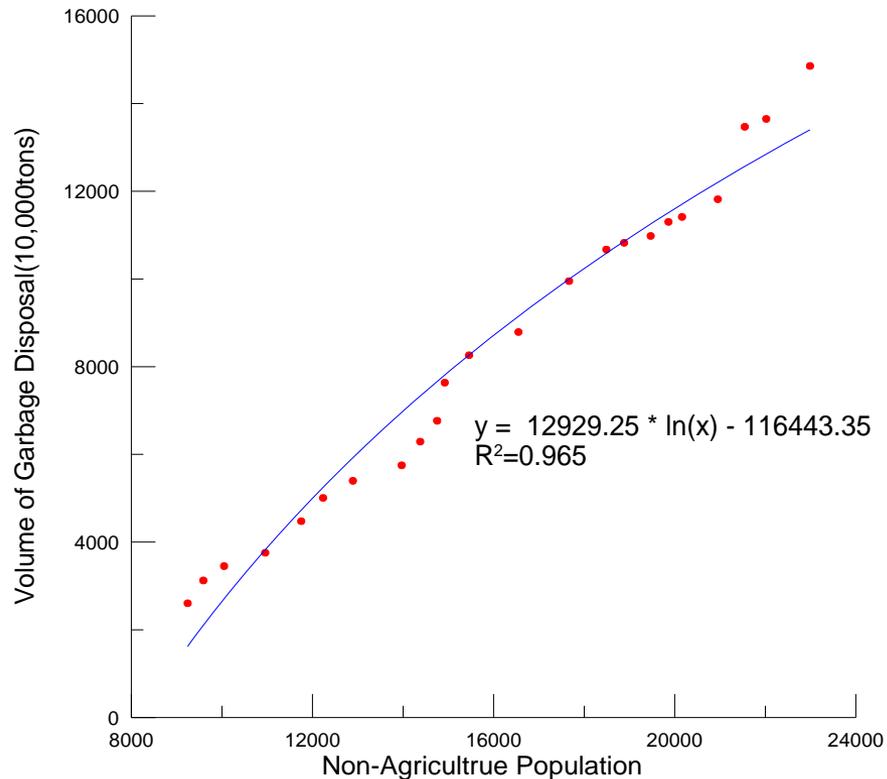
Greenhouse Gases inventories preparation for waste treatment (SNC)

The relationship of MSW Generation amount and its driving forcing

◆ Estimate model for MSW

   ❑ Non-agricultural population:

$$MSW = 12929.25\ln(x) - 116443.35$$

Where, x resprent non-agricultural population (ten thousand person)

   ❑ GDP:

$$MSW = 3311.16\ln(x) - 25493.29$$

Where, x resprent GDP (100 million Yuan RMB)

   ❑ GDP per capita

$$MSW = 3608.13\ln(x) - 19706.85$$

Where, x resprent GDP per capita (Yuan RMB)

Greenhouse Gases inventories preparation for waste treatment (SNC)

Output 2: China's Carbon Dioxide emission inventory from waste incineration treatment

Methodology: Default methodology of IPCC guideline
Activity Data: Data from survey in recent 5 years, and
                            Based on the expert judgment for AD
Emission Factor: Country specific data (expert judgment) and IPCC default value
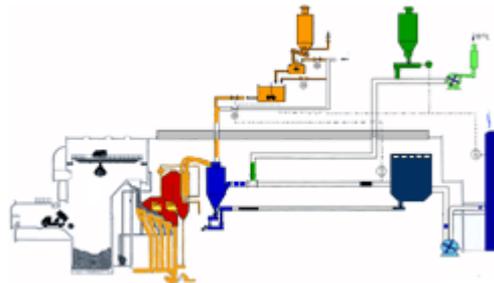
Greenhouse Gases inventories preparation for waste treatment (SNC)

Output 3: China's Methane emission inventory from industrial wastewater treatment

Output 4: China's Methane emission inventory from living sewage water treatment.

Output 5: China's Nitrous Oxide emission inventory from wastewater / sewage water treatment.

Methodology: Default methodology of IPCC guideline
Activity Data: Data from statistics yearbook and survey in and
                   Based on the expert judgment for AD
Emission Factor: Country specific data (expert judgment) and IPCC default value

Greenhouse Gases inventories preparation for waste treatment (SNC)

Output 6: Comprehensive study on China's waste inventories and Greenhouse Gases inventories preparation

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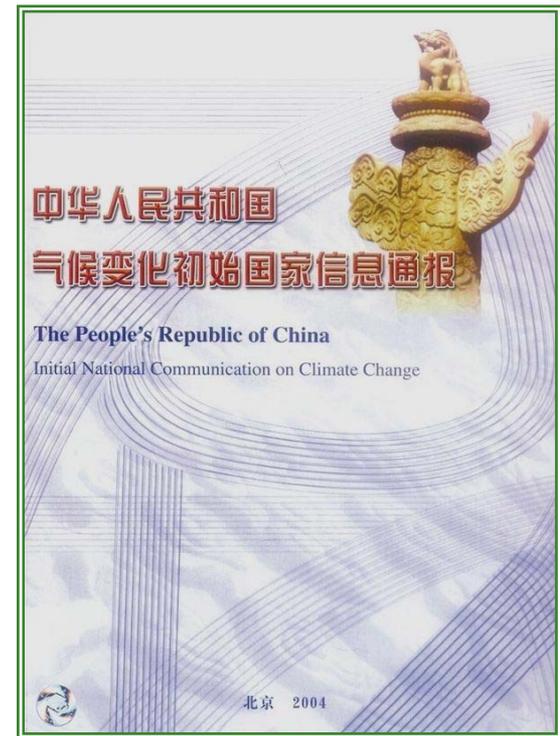
Comment and discussion

- ❑ **Any good practices form other Asia countries?**
- ❑ **EF data sharing?**
- ❑ **New & High technology for waste treatment?**
- ❑ **……**

THANKS