Study on CH$_4$ Emission and Reduction Potential in Waste Treatment of China

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outline

- Background

- Methods and Data
  - Calculation of CH$_4$ emissions
  - Scenario analysis method
  - Data

- Results

- Mitigation measures
Background

Grants Funded
- GEF
- UNDP

National Communication
- INC
- SNC
- TNC

Subcontract 6 waste sector
- MSW landfill
- Wastewater
- Waste incineration
- Waste biochemical treatment
Methods and Data

☑️ Framework and steps
Methods and Data

- **Calculation of CH₄ emissions**

  The methodology used to estimate CH₄ emissions was obtained from:
  - The IPCC Revised Guidelines for National Greenhouse Gases Inventory (IPCC, 1996 Guidelines)
  - The IPCC Good Practice Guidance and Uncertainty Management in National greenhouse (IPCC, GPG 2000).

**Methods and Data**

- **Landfill:**
  \[ CH_4 \text{ Emission} = \left[ \sum CH_4 \text{ generated}_{x,T} - R_T \right] \cdot (1 - OX_p) \]

- **Domestic:**
  \[ E_D = \sum_i (T_{Di} \cdot E_F_i) - R_i, \]

- **Industry:**
  \[ E_I = \sum_i [(T_{li} - S_i)E_F_i - R_i], \]
Methods and Data

- **Scenario analysis method**

- Economic development and improvement of people's living conditions promotes an increase in MSW and wastewater activity data

- The relevant characteristic data and GDP data on MSW and wastewater treatment from 2000 to 2010 is used to analyze the relationship.
Methods and Data

☑ Baseline Scenario analysis method

Based on the literature GDP growth rate is predicted to be between 7% and 12%. (He, 2012; Guo and He, 2014; Pan, 2014; Liang et al., 2013)

Based on State policies, China’s economy is predicted to grow between 7% and 9%.

In this research, the GDP prediction is based on China's GDP from 2000 to 2012.

The growth rate of GDP is set as 7% prior to 2015 and 6% after.
## Methods and Data

### Reduction Scenario analysis method

By 2020, CH$_4$ emission reduction from MSW landfill disposal will be

- **A**: CH$_4$ recycling 5%
- **B**: CH$_4$ recycling 5% and DOC$_i$ = 0.5

<table>
<thead>
<tr>
<th>Emission reduction scenario</th>
<th>Assumptions</th>
<th>Evidences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario A</td>
<td>5% of domestic municipal solid waste landfill using landfill gas torch combustion or other recycling methods.</td>
<td>Municipal solid waste landfill pollution control standard is GB16889-2008; Annual total emission reduction of CDM project of landfill gas recovery and utilization in municipal solid waste landfill.</td>
</tr>
<tr>
<td>Scenario B</td>
<td>The ratio of emission factors to degradable organic carbon (DOC$_i$) was 0.5.</td>
<td>Present value is 0.6, With the improvement of the garbage classification level in our country, comprehensive utilization of landfill and incineration, the policy effect of garbage source classification is further enhanced and more choices for composting and incineration, the DOC$_i$ ratio will be reduced in the future.</td>
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Methods and Data

- **Reduction Scenario analysis method**

  by 2020, CH$_4$ emission reduction will be
  - domestic wastewater treatment: 7%
  - industrial wastewater treatment: 10%

<table>
<thead>
<tr>
<th>Emission reduction technology</th>
<th>Emission reduction control policy</th>
<th>CH$_4$ emission reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control the aerobic reaction percentage</td>
<td>Design and construction standard of urban wastewater treatment plant engineering project</td>
<td>7%</td>
</tr>
<tr>
<td>Anaerobic system with CH$_4$ recycling and combustion treatment function</td>
<td>Best feasible technology guide for prevention and governance of sludge treatment and disposal of city and town wastewater treatment plants</td>
<td></td>
</tr>
<tr>
<td>CH$_4$ recycling and utilization in sludge anaerobic assimilation</td>
<td>Notification of ministry of finance and state taxation administration on comprehensive resource utilization and value-added tax policies of other products</td>
<td></td>
</tr>
</tbody>
</table>
Methods and Data

Data

- The main emission parameters for calculating according to the research results from China's Second National Greenhouse Gas Inventory (DCC, 2014).
Results

- In China, CH$_4$ emissions from MSW landfill, domestic and industrial wastewater treatment respectively were 3.05 Mt, 0.61 Mt and 1.62 Mt in 2010. CH$_4$ emissions increased annually from 2005 to 2010.

- CH$_4$ emissions from 8 industries such as paper-making and paper products industry accounted for 92% of the total industries.
Results

In 2020, the emission baseline scenario, CH₄ emissions from:

- MSW landfill disposal: 5.59 Mt,
- Domestic wastewater treatment: 1.09 Mt,
- Industrial wastewater treatment: 2.60 Mt,

Respectively, resulting in an increase of 83%, 78%, and 60% compared to 2010.
Results

In 2020, after the emission reduction, CH$_4$ emissions from:

- MSW landfill disposal: 5.3Mt (scenario A), 4.4Mt (scenario B);
- Domestic wastewater treatment: 1.01 Mt;
- Industrial wastewater treatment: 2.3Mt;

Respectively, resulting in an increase of 74%, 45%, 66% and 44% compared to 2010.
Results

Under the reduction scenario by 2020, the CH\textsubscript{4} emission reduction potential:

- MSW landfill disposal: 0.28Mt (scenario A), 1.16Mt (scenario B);
- Domestic wastewater treatment: 0.08Mt;
- Industrial wastewater treatment: 0.26Mt.
Mitigation measures

✓ Waste sector

- To Promulgate a series of regulations, rules and standards
  - Measures on Household Waste Management in Cities
  - Promoting Industrialization of Municipal Sewage and Waste Treatment
- To formulate tax reduction or exemptions policies of waste treatment for power generation and utilization
- CDM project development: waste incineration power generation and recovery of landfill gas for power generation
Mitigation measures

- **Waste sector**

- Municipal waste treatment and disposal of technical policies and standards
  - Technical Standards for Civil Waste Landfill
  - The Standard on Burning of Civil Waste and Pollution Control
  - Discharge standard of pollutants for wastewater treatment plant
- Set up a payment system for waste discharge
- Accelerate reform of waste management system
- Introduce a competition mechanism
- Use bidding, select qualified enterprises for MSW treatment
Mitigation measures

- Monitoring experiment at landfill

The last five years, in order to better understand the uncontrolled GHG emissions, a quantitative in-situ measurement and evaluation of methane (CH$_4$), carbon dioxide (CO$_2$) and nitrous oxide (N$_2$O) emissions were conducted at Asuwei landfill in Beijing, China.
Mitigation measures

- Establish a perfect CH₄ recovery system
- Recycling is the main way to reduce CH₄ emissions
- According to the geospatial analysis with Inverse Distance Weighting (IDW) methods, in summer, the area whose fluxes ranged from 200 to 800 mg CH₄ m⁻² h⁻¹ accounted for the largest proportion of the monitoring area (40%) while 3300-14200 mg CH₄ m⁻² h⁻¹ of fluxes accounted for the monitoring area (44%) in winter.
Mitigation measures

- Increase the layer covering thickness of overlying soil

According to the results determined by the ratio of CH$_4$/CO$_2$ in the soil cover, OX generally increases with depth. Especially, there is a sharp increase in the depth of 60 cm under the landfill soil cover.
Mitigation measures

Coverage high density polyethylene film in the non-operation surface in landfill

Cooperate with the surface gathering pipeline makes the formation of negative pressure inside the membrane, is conducive to reducing CH₄ emissions.
Thanks for your attention!

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