6th Workshop on Greenhouse gas inventories in Asia

Development of Waste Sector GHG Inventory in Japan

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17th July 2008

Objective of presentation

- **To find solutions for problems each country is facing / will face, by sharing experiences of Japan in development of waste sector GHG inventory.**

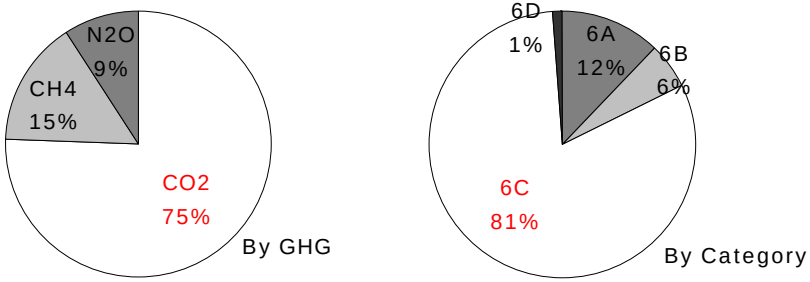
  - **Japan's experience:**
    - Japan's waste sector inventory has been revised 3 times between 1999 to 2006.
    - Japan has organized expert committee for efficient improvement of waste sector.
    - Japan has constructed a new waste material flow statistics for inventory improvement.
  - **Lessons from Japan's experience:**
    - Importance of early and planned improvement of waste sector GHG inventory.
    - Importance of construction of statistics that covers all waste material flow.
    - Importance of practical use of IPCC documents.

Japan's waste sector inventory

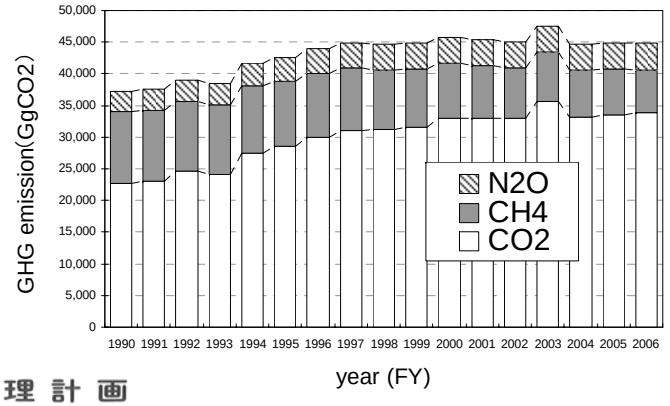
2006 GHG emissions (GgCO2)

Category			CO2	CH4	N2O
6.A.1 Managed waste disposal on land	MSW	Kitchen garbage		367	
		Waste paper		1,652	
		Waste textile		89	
		Waste wood		519	
		Human waste treatment sludge and Septic tank sludge		104	
	ISW	Kitchen garbage		372	
		Waste paper		231	
		Waste textile		31	
		Waste wood		569	
		Sewage sludge		363	
		Waterworks sludge		58	
		Organic sludge from industries		341	
		Livestock waste		636	
	MSW	CH4 recovery		-8	
	ISW	CH4 recovery			
6.A.3 Other	ISW	Inappropriate disposal		47	
	MSW	Composting		8	8
	ISW	Composting		14	16
6.B.1 Industrial wastewater				103	122
6.B.2 Domestic / Commercial wastewater	Sewage treatment plant			250	678
	Septic tank	Community plant		2	7
		Gappei-shori septic tank		297	105
		Tandoku-shori septic tank		76	114
	Vault toilet			57	86
	Human waste treatment facilities	High-load denitrification		19	0
		Membrane separation		0	0
		Anaerobic treatment		1	0
		Aerobic treatment		0	6
		Standard denitrification		0	1
		Other		1	0
	Discharge of untreated domestic wastewater	Tandoku-shori septic tank		337	33
		Vault toilet		256	25
		Household treatment		5	0
	Human waste Sludge disposal at sea			4	2
6.C. Incineration of waste	MSW	Waste plastics	12,377	2	104
		Synthetic textile scraps	709	0	0
		Other biomass-derived waste		14	653
	ISW	Waste oil	5,887	0	7
		Waste plastic	6,092	1	111
		Waste paper and wood		1	17
		Waste textile		0	0
		Waste food		0	1
		Sludge		2	1,974
		Hazardous waste	1,865	0	13
6.C. Incineration of waste derived fuel	MSW	Waste plastics	477	0	0
	ISW	Waste oil	3,549	1	13
		Waste plastic	1,167	3	4
		Waste wood		57	10
	Waste tire		945	1	3
	Refuse derived fuel	Refuse derived fuel	322	0	2
		Refuse plastic and paper fuel	888	0	5
6.D Petroleum-derived surfactants discharged into wastewater treatment facilities and			521		
Total			33,800	6,885	4,119

- **51 sub categories, including 7 sub categories for energy use.**
- **The dominant GHG is CO2 and the dominant category is 6C.**



- **GHG emissions have increased by 21% from 1990 to 2006.**



Inventory improvement system

Established in 1999

Breakout group on Waste

- Organized under the "Committee for the Greenhouse Gases Emissions Estimation Methods"
- 6 waste and GHG experts
- Secretariat : MOE / GIO / Consultant

- Japan's waste sector inventory has been revised 3 times under this improvement system between 1999 to 2006.
  - 1st (1999 - 2000) : Preparation for future improvement
  - 2nd (2001 - 2002) : Establishment of main framework
  - 3rd (2005 - 2006) : Fixing all major problems

1st Improvement in 1999 to 2000

- **Preparation for future improvement**
  - **"The Committee for the Greenhouse Gases Emissions Estimation Methods" and "Breakout Group on Waste" were established to develop / improve methodologies, EFs and AD.**

Under the Breakout group on waste

  - **Consistency between former GHG emissions estimation method and IPCC GPG and 1996 revised GL was reviewed.**
  - **All problems to be solved in the future were identified and they were classified according to importance, to promote domestic research and statistical arrangement.**

- Lack of statistics and data for country specific EFs
- Lack of methodology (at NE source categories)
- Lack of TCCCA

TCCCA : transparent, consistent, comparable, complete, accurate

2nd Improvement in 2001 to 2002

- **Establishment of main framework**

  Amount of waste goes to intermediate treatment, landfill, recycled for material / energy …

  - **New statistics prepared for waste sector GHG inventory was introduced.**
    - To complete whole emission sources of waste sector, it was important to grasp waste material flow. Therefore, MOE constructed statistics that covers all waste material flow from existing waste and waste-relating statistics.

  - Waste used for energy
  - Untreated household wastewater
  - Landfilled organic sludge

  - **Important problems like NE source categories were solved.**
  - **Remaining or new problems to be solved before submission of the initial report under the Kyoto Protocol were identified.**
    - According to the new statistics, NE sources categories were still identified.
  - **Uncertainty analysis for improvement of accuracy of waste sector GHG inventory was conducted.**

3rd Improvement in 2005 to 2006

Some source categories are difficult to estimate emissions without 2006 IPCC GL.

- **Fixing all major problems**
  - **New methodology and EFs from 2006 IPCC GL were introduced for estimating emissions from some NE source categories.**
  - **Almost all of existing problems identified in former improvement were settled.**
  - **The Initial Report under the Kyoto Protocol was submitted in August 2006.**
  - **But some new problems to be solved before the commitment period were identified through domestic research outputs and expert's comments.**

- Data quality and accuracy
- Inappropriate EFs and parameters
- NE source categories

→ Next improvement

6.A Landfill

EF : Emission Factor
AD : Activity Data
M : Method

● : Newly introduced
○ : Revised
NE: Not estimated
--- : Not changed

Source categories			emissions in 2006 GgCO2			1st revise 1999-2000			2nd revise 2001-2002			3rd revise 2005-2006			Remarks
			CO2	CH4	N2O	EF	AD	M	EF	AD	M	EF	AD	M	
6.A.1 Managed waste disposal on land	MSW	Kitchen garbage		367		○	---	---	---	○	---	○	○	○	- Method is revised to 2006 IPCC in 3rd rev.
		Waste paper		1,652		○	---	---	---	○	---	○	○	○	- Method is revised to 2006 IPCC in 3rd rev.
		Waste textile		89		○	---	---	---	○	---	○	○	○	- Method is revised to 2006 IPCC in 3rd rev.
		Waste wood		519		○	---	---	---	○	---	○	○	○	- Method is revised to 2006 IPCC in 3rd rev.
		Human waste treatment sludge Septic tank sludge		104		NE	NE	NE	NE	NE	NE	●	●	●	- EF and Method were introduced from 2006 IPCC.
	ISW	Kitchen garbage		372		○	---	---	---	○	---	○	○	○	- Method is revised to 2006 IPCC in 3rd rev.
		Waste paper		231		○	---	---	---	○	---	○	○	○	- Method is revised to 2006 IPCC in 3rd rev.
		Waste textile		31		○	---	---	---	○	---	○	○	○	- Method is revised to 2006 IPCC in 3rd rev.
		Waste wood		569		○	---	---	---	○	---	○	○	○	- Method is revised to 2006 IPCC in 3rd rev.
		Sewage sludge		363		NE	NE	NE	NE	NE	NE	●	●	●	- EF and Method were introduced from 2006 IPCC.
		Waterworks sludge		58		NE	NE	NE	NE	NE	NE	●	●	●	- Method was introduced from 2006 IPCC.
		Organic sludge from industries		341		NE	NE	NE	NE	NE	NE	●	●	●	- Method was introduced from 2006 IPCC.
		Livestock waste		636		NE	NE	NE	NE	NE	NE	●	●	●	- EF and Method were introduced from 2006 IPCC.
	MSW	CH4 recovery		-8		NE	NE	NE	NE	NE	NE	●	●	●	
	ISW	CH4 recovery		NE		NE	NE	NE	NE	NE	NE	NE	NE	NE	- AD is not available.
6.A.3 Other	ISW	Inappropriate disposal		47		NE	NE	NE	NE	NE	NE	●	●	●	- AD and Method were developed with domestic experts.
	MSW	Composting		8	8	NE	NE	NE	NE	NE	NE	●	●	●	- Method was introduced from 2006 IPCC.
	ISW	Composting		14	16	NE	NE	NE	NE	NE	NE	●	●	●	- Method was introduced from 2006 IPCC.

MSW : Municipal Solid Waste
ISW : Industrial Solid Waste

6.B Wastewater

EF : Emission Factor
AD : Activity Data
M : Method

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○ : Revised
NE: Not estimated
--- : Not changed

Source categories			emissions in 2006 GgCO2			1st revise 1999-2000			2nd revise 2001-2002			3rd revise 2005-2006			Remarks
			CO2	CH4	N2O	EF	AD	M	EF	AD	M	EF	AD	M	
6.B.1 Industrial wastewater				103	122	NE	NE	NE	●	●	●	○	---	○	- CH4 emission was estimated in 2nd rev. - N2O emission was added in 3rd rev.
6.B.2 Domestic and commercial wastewater	Sewage treatment plant			250	678	○	---	---	○	○	○	---	---	---	- N2O emission was added in 2nd rev.
	Septic tank	Community plant		2	7	NE	NE	NE	●	●	●	---	---	---	- Method was introduced from domestic research output in 2nd rev.
		Gappei-shori septic tank		297	105	NE	NE	NE	●	●	●	---	---	---	- Method was introduced from domestic research output in 2nd rev.
		Tandoku-shori septic tank		76	114	NE	NE	NE	●	●	●	---	---	---	- Method was introduced from domestic research output in 2nd rev.
	Vault toilet			57	86	NE	NE	NE	●	●	●	---	---	---	- Method was introduced from domestic research output in 2nd rev.
	Human waste treatment facilities	High-load denitrification		19	0	NE	NE	NE	●	●	●	○	---	---	- N2O EF was revised in 3rd rev.
		Membrane separation		0	0	NE	NE	NE	●	●	●	○	---	---	- N2O EF was revised in 3rd rev.
		Anaerobic treatment		1	0	NE	NE	NE	●	●	●	---	---	---	- Method was introduced from domestic research output in 2nd rev.
		Aerobic treatment		0	6	NE	NE	NE	●	●	●	---	---	---	- Method was introduced from domestic research output in 2nd rev.
		Standard denitrification		0	1	NE	NE	NE	●	●	●	---	---	---	- Method was introduced from domestic research output in 2nd rev.
		Other		1	0	NE	NE	NE	●	●	●	---	---	---	- Method was introduced from domestic research output in 2nd rev.
	Discharge of untreated domestic wastewater	*Tandoku-shori* septic tank		337	33	NE	NE	NE	NE	NE	NE	●	●	●	- Method was introduced from 2006 IPCC.
		Vault toilet		256	25	NE	NE	NE	NE	NE	NE	●	●	●	- Method was introduced from 2006 IPCC.
		Household treatment		5	0	NE	NE	NE	NE	NE	NE	●	●	●	- Method was introduced from 2006 IPCC.
	Human waste Sludge disposal at sea			4	2	NE	NE	NE	NE	NE	NE	●	●	●	- Method was introduced from 2006 IPCC.

6.C Incineration

EF : Emission Factor
AD : Activity Data
M : Method

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○ : Revised
NE: Not estimated
--- : Not changed

Source categories			emissions in 2006 GgCO2			1st revise 1999-2000			2nd revise 2001-2002			3rd revise 2005-2006			Remarks
			CO2	CH4	N2O	EF	AD	M	EF	AD	M	EF	AD	M	
6.C. Incineration of waste	MSW	Waste plastics	12377	2	104	○	---	---	---	○	---	○	---	---	- AD was revised to new statistics in 2nd rev.
		Synthetic textile scraps	709	0	0	NE	NE	NE	NE	NE	NE	●	●	●	
		Other biomass-derived waste		14	653	○	---	---	○	○	---	---	---	---	- AD was revised to new statistics in 2nd rev.
	ISW	Waste oil	5,887	0	7	○	---	---	---	○	---	---	---	---	- AD was revised to new statistics in 2nd rev.
		Waste plastic	5,092	1	111	○	---	---	---	○	---	---	---	---	- AD was revised to new statistics in 2nd rev.
		Waste paper and wood		1	17	○	---	---	○	○	---	---	---	---	- AD was revised to new statistics in 2nd rev.
		Waste textile		0	0	NE	NE	NE	NE	NE	NE	●	●	●	
		Animal residue		0	1	NE	NE	NE	NE	NE	NE	●	●	●	
		Sludge		2	1,974	○	---	---	○	○	---	---	---	---	- AD was revised to new statistics in 2nd rev.
		Hazardous waste	1,865	0	13	NE	NE	NE	NE	NE	NE	●	●	●	
6.C. Incineration of waste derived fuel	MSW	Waste plastics	477	0	0	NE	NE	NE	NE	NE	NE	●	●	●	
	ISW	Waste oil	3,549	1	13	NE	NE	NE	NE	NE	NE	●	●	●	
		Waste plastic	1,167	3	4	NE	NE	NE	NE	NE	NE	●	●	●	
		Waste wood		57	10	NE	NE	NE	NE	NE	NE	●	●	●	
	Waste tire		945	1	3	NE	NE	NE	NE	NE	NE	●	●	●	
	Refuse derived fuel	Refuse derived fuel	322	0	2	NE	NE	NE	NE	NE	NE	●	●	●	
		Refuse plastic and paper fuel	888	0	5	NE	NE	NE	NE	NE	NE	●	●	●	

6.D Other

EF : Emission Factor
AD : Activity Data
M : Method

● : Newly introduced
○ : Revised
NE: Not estimated
--- : Not changed

Source categories	emissions in 2006 GgCO2			1st revise 1999-2000			2nd revise 2001-2002			3rd revise 2005-2006			Remarks
	CO2	CH4	N2O	EF	AD	M	EF	AD	M	EF	AD	M	
6.D Petroleum-derived surfactants discharged into wastewater treatment facilities and nature decompose	521			NE	NE	NE	NE	NE	NE	●	●	●	- EF, AD and Method were developed with domestic experts.

Outcome and comment

- **Importance of early and planned improvement of waste sector GHG inventory.**
  - **It took long time and considerable effort to make accurate waste sector GHG inventory (Japan spent 7 years).**
- **Importance of establishment of statistics that covers all waste material flow.**
  - **Japan identified many NE source categories by this new statistics.**
- **Importance of practical use of IPCC documents.**
  - **Some source categories are difficult to estimate emissions without 2006 IPCC Guidelines.**

Waste inventory in Asia

GHG Emissions from Waste Sector in Asian Countries in 1994

Source : **UNFCCC Non-Annex I national communications**
http://unfccc.int/national_reports/non-annex_i_natcom/items/2979.php

	CO2 (Gg)		CH4(Gg)				N2O(Gg)		
	Industrial Wastewater	Waste Incineration	Solid Waste Disposal	Domestic and Commercial Wastewater	Industrial Wastewater	Waste Incineration	Human Sewage	Industrial Wastewater	Waste Incineration
Cambodia	-	-	6	1	0	-	0	-	-
China	-	-	2,030	1,530	4,160	-	-	-	-
India	-	-	582	359	62	-	7	-	-
Indonesia	-	-				402[1)]	-	-	-
Japan	-	26,742	416	86	5	3	4	0	7
Lao P.D.R.[2)]	-	-	11		0	-	-	-	-
Malaysia	318[3)]	-	1,043	4	220	-	-	-	-
Mongolia	-	-	3	0	0	-	-	-	-
Myanmar	Not Available[4)]								
Philippines	-	-	203	46	44	-	3	-	-
Republic of Korea[5)]	-	4,756	461	2	2	0	3	-	1
Singapore	-	152	NO[6)]		NO[7)]	NO	0	-	NO
Thailand	-	-	20	2	14	-	-	-	-
Viet Nam	-	-	66	1	1	-	4	-	-

1) Only the total CH4 emissions from waste sector are reported.
2) Emissions in 1990
3) The production mechanism of CO2 from this source is not explained by the party in the National Communication.
4) The Initial National Communication is not yet submitted.
5) Emissions in 2001
6) All organic wastes are incinerated.
7) The biogas produced at the wastewater handling sites is used as fuel and the fugitive CH4 emissions are negligible.

Japan's next improvement

- **More accurate waste sector GHG inventory**
  - **Some new problems to be solved before the commitment period were identified in 3rd improvement. Therefore, Japan is planning to revise waste sector inventory in 2008 – 2009.**
    - Statistics that covers all waste material flow constructed for waste sector inventory has some problems regarding accuracy.
    - Domestic research outputs for new EFs and parameters will become available in few years.
    - Some NE source categories may still exist.

  - **Solutions :**
    - New EFs / parameters could be introduced through close relation with experts.
    - Information from waste industry could be useful for some parameters.
    - Constructing waste and carbon flow at every type of waste, the accuracy of statistics may be improved.
    - …

Information from waste industry

- **Industrial waste treatment association established self action plan for reducing GHG in 2007.**
  - **The association established “12 GHG Reducing Actions”.**
  - **The association begins to collect annual information of GHG emissions data and result of GHG reducing actions from each member company. Hopefully, these information will be available at the end of 2008FY.**

- Semi-aerobic landfill rate in ISW
- Rate of high efficiency incinerator
- …

12 GHG Reducing Actions

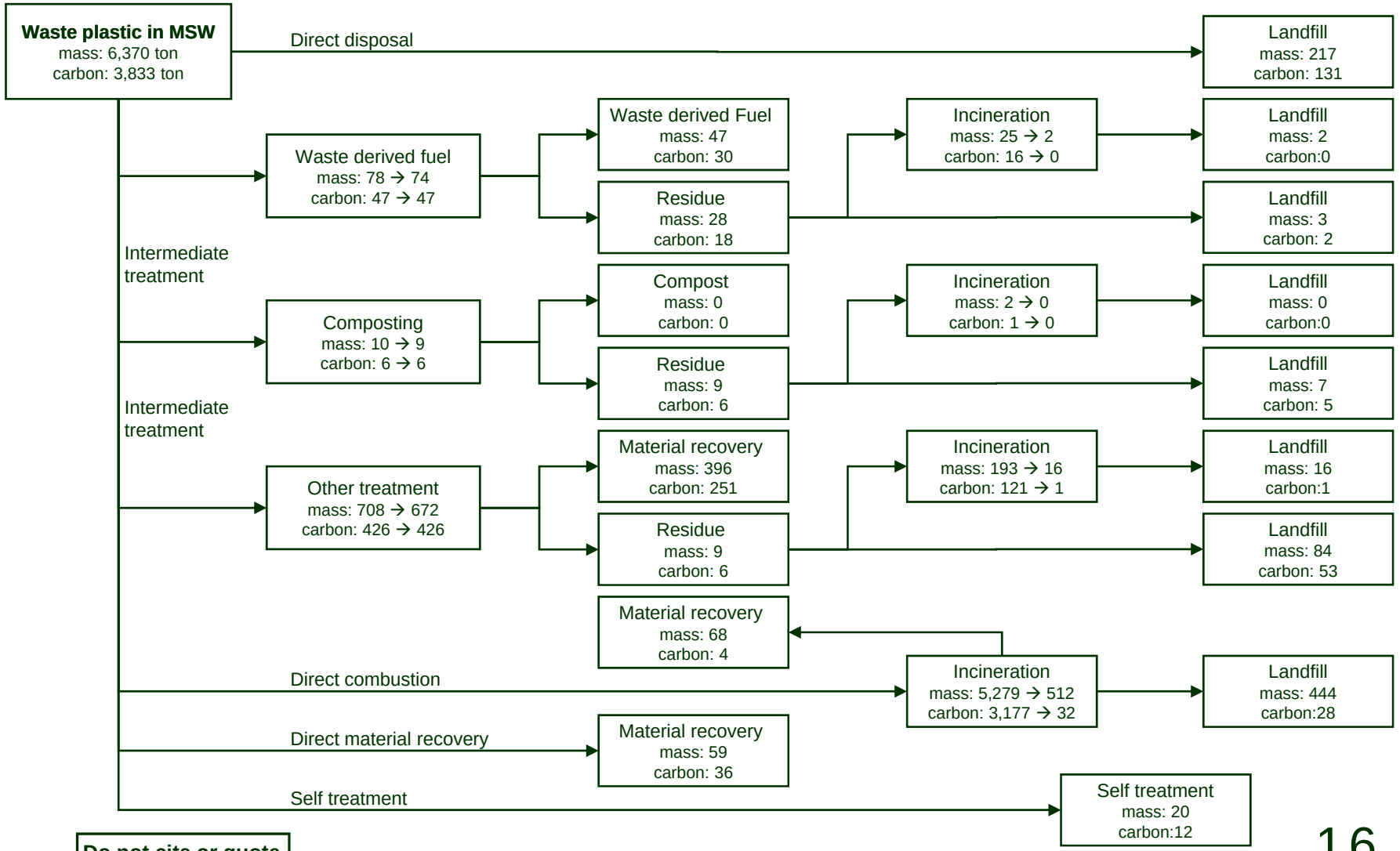
1. Promotion of 3R
2. Promotion of energy recovery at combustion plant
3. Introduction of high-efficiency incinerator
4. Introduction of semi-aerobic landfill
5. Appropriate management of landfill site
6. Reduction of biomass waste without incineration
7. Forestation / reforestation at landfill site
8. Reduction of fuel consumption at waste transportation
9. Efficient transportation management
10. Introduction of biofuel (bio-ethanol and bio-diesel)
11. Low energy action at office
12. Introduction of high efficiency device at office

About the association

- National Federation of Industrial Waste Management Associations
- There are over 15,000 members of industrial waste treatment companies including landfill, combustion and transportation.
- http://www.zensanpairen.or.jp/

Waste and carbon flow (1)

Example of waste plastic in MSW, 2003FY



Waste and carbon flow (2)

- **By constructing waste and carbon flow:**
  - **It could be possible to identify NE source categories in the waste sector / between waste sector and other sectors.**
  - **It could be possible to identify AD that needs further improvement of accuracy.**
  - **It will become easy to explain accuracy, transparency and completeness of waste sector GHG inventory.**

Thank you for your attention.

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