Agriculture Sector

Manure Management(4.B.)

- The reasons that composting is widely practiced in Japan
  - ➢ To facilitate transportation and handling
    - ✓ lack of space required for the on-site reduction of manure
  - ➢ Higher demand as a fertilizer than is slurry or liquid manure
    - ✓ fertilizers tend to be lost by heavy rain
    - ✓ the expectations of the protection of water quality, prevention of odor, and sanitary management are high.

Paddy field (Ogata village, Akita Pref.)

Agriculture Sector

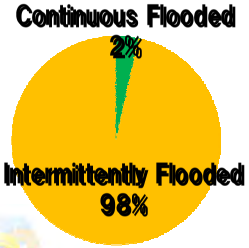
Rice Cultivation (4.C.)

(Emissions) = (Emission Factor) × (Cultivated Area)

Scientific Articles researched by NIAES (Country-specific EF)

Statistics Cultivated and Planted Area by MAFF

➢ **In Japan, all paddy field is irrigated.**



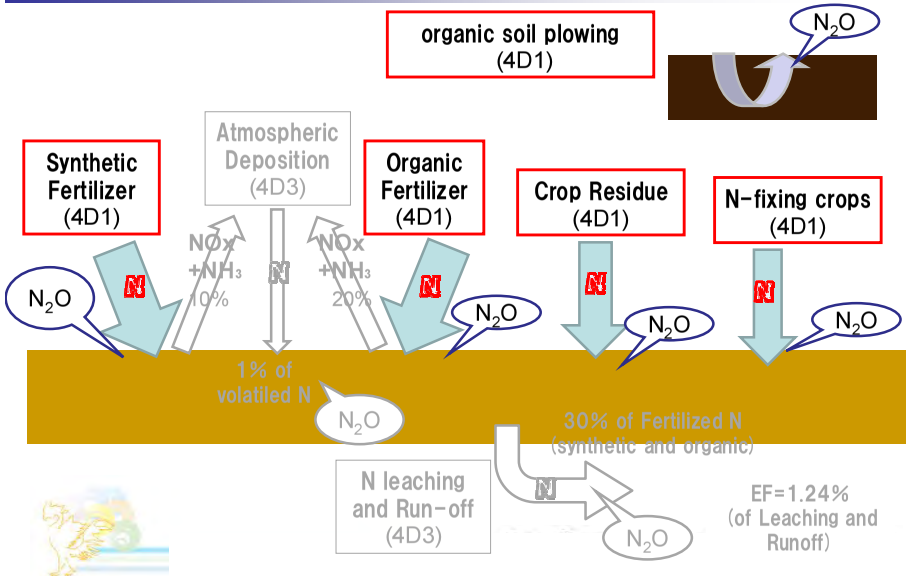
Ratio of cultivation method

Japan's standard style for rice cultivation

Tono-furusato villages (Iwate Pref.)

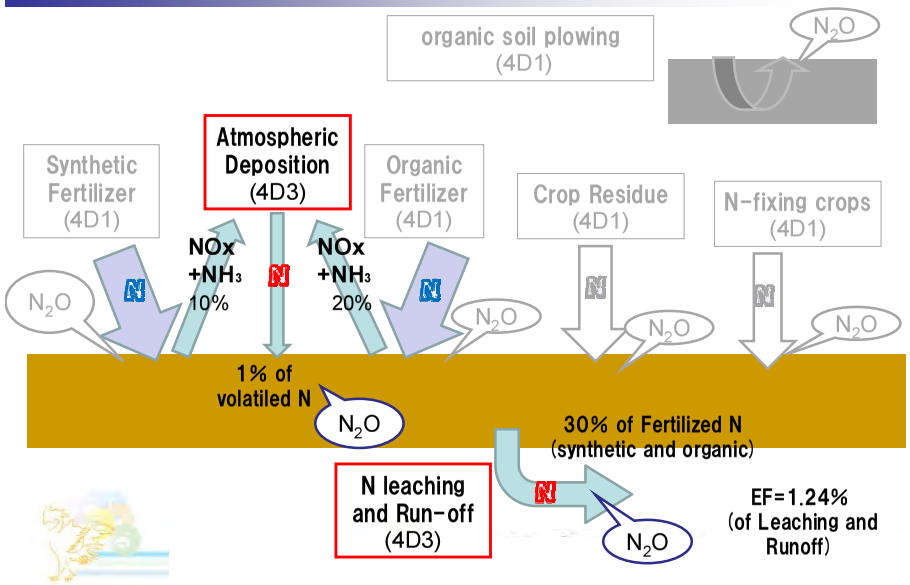
Agriculture Sector

Agricultural Soil(4.D.) -Direct emission-



Agriculture Sector

Agricultural Soil(4.D.) -Indirect emission-



Agriculture Sector

Agricultural Soil(4.D.) -Direct emission-

N_2O from Synthetic Fertilizer = Σ (EF by crop type × Amount of synthetic fertilizer used in each crop field)

EF(kgN_2O-N/kgN)

Paddy Rice	0.31%
Tea	2.9%
Other crops	0.62%

CS-EF by NIAES

Yearbook of Fertilizer Statistics

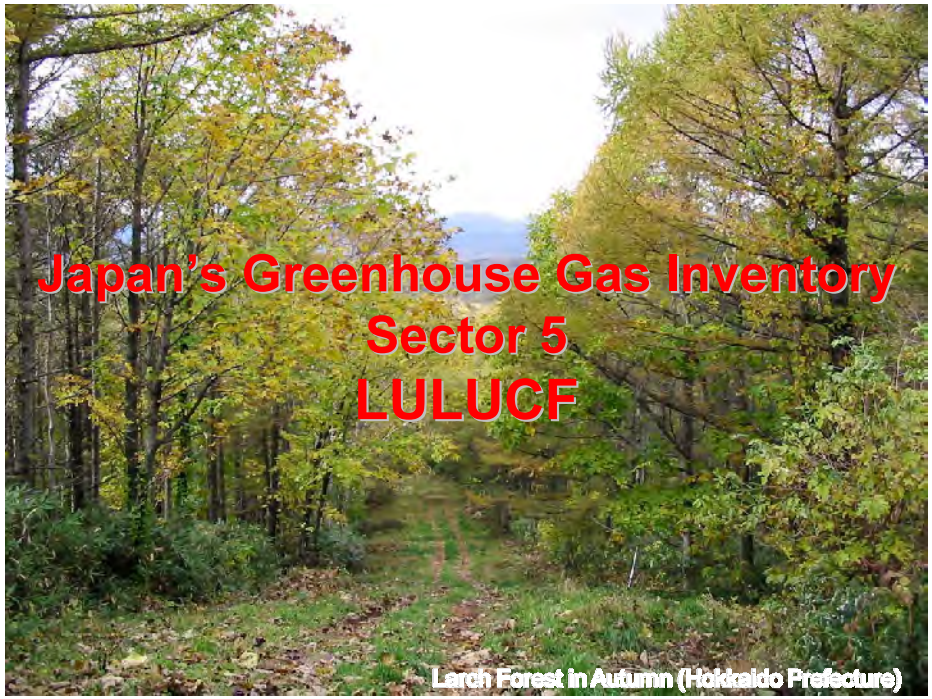
N_2O from Organic Fertilizer = Σ (EF by crop type × (Volume of N applied by crop type × Cropland Area)

Paddy Rice: Yearbook of Fertilizer Statistics
Tea: Nonaka *et al.* (2005)
Other Crops: Project Report

Statistics by MAFF

Crop type	Vegetables, Fruit, Potatoes, Pulse, Feed crops, Sweet potato, Wheat, etc.

A Measurement of GHG
(National Institute for Agro-Environmental Sciences)

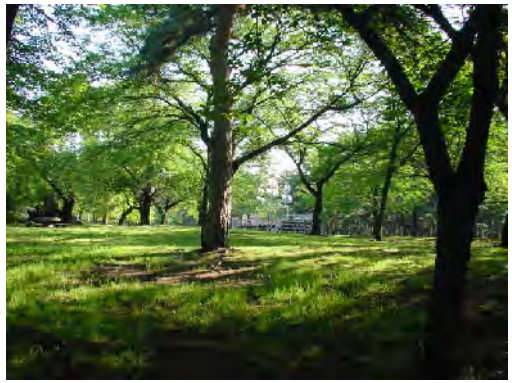


Japan's Greenhouse Gas Inventory
Sector 5
LULUCF

Larch Forest in Autumn (Hokkaido Prefecture)

Photo: Rice terrace surrounded by intensively managed forest in Mie pref.

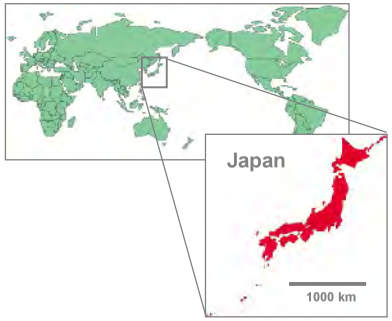
Photo: Urban park in Japan



LULUCF

National Conditions of Japan

- Japan consists of 4 main and many small islands which extend over about 3,000km from South-West to North-East.
- Four climatic zones:
  - Sub-tropic zone
  - Warm temperate zone
  - Cool temperate zone
  - Boreal zone
- Large amount of precipitation (about 1,700 [mm/yr]), concentrating in rainy season (June ~ July) and typhoon season (July ~ October).
- A large proportion of land is occupied by steep mountains with forest cover. Highest peak is Mt. Fuji.

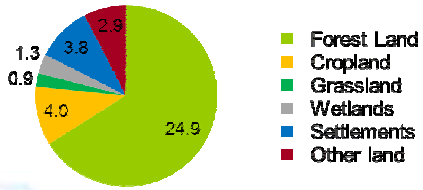


LULUCF

Land Area of Japan

- Japanese territory as of FY 2009 extends over 37.8 million ha.
- About 80 percent is either Forest land (24.9 million ha [66 %]) or Cropland (3.8 million ha [12%]).
- In recent years, the total area devoted to forestry or agricultural purposes has diminished, while that used for buildings and roads has increased.

Land area in FY 2009 [Mha]



Land use category	Change since 1990 (%)
Total	0.05
5.A. Forest land	-0.00
5.B. Cropland	-15.19
5.C. Grassland	-2.81
5.D. Wetlands	0.75
5.E. Settlement	14.39
5.F. Other land	3.60

"Land use category" is after the GPG-LULUCF (IPCC, 2003)

A4-250

LULUCF – Land Area of Japan

Definition & Statistics

Land use category	Definition	Statistics
5.A. Forest land	Forests under Law Article 5 and 7.2 Intensively managed forests, semi-natural forests, forests with less standing trees, bamboo	*Forestry Status Survey* [-2004] *National Forest Resources Database* [2005-] (Forestry Agency)
5.B. Cropland	Rice fields, upland fields and orchard.	*Statistics of Cultivated and Planted Area* (MAFF)
5.C. Grassland	1) Pasture land, 2) grazed meadow land, 3) grassland other than pasture land and grazed meadow land.	1) *Statistics of Cultivated and Planted Area* (MAFF) 2) *World Census of Agriculture and Forestry* (MAFF), *A Move and Conversion of Cropland* (MAFF) 3) *Land Use Status Survey* (MLITT)
5.D. Wetlands	Bodies of water (dams), rivers, and waterways.	*Land Use Status Survey, Survey of Forestry regions* (MLITT)
5.E. Settlement	1) Urban areas that do not constitute land, Cropland, Grassland or Wetlands: roads, residential land, school reservations, park and green areas, road sites, environmental facility sites, golf courses, ski courses and other recreation sites. 2) Urban green areas are all wooded and planted areas that do not constitute land.	1) *Land Use Status Survey* (MLITT) 2) *Urban Parks Status Survey, Road Tree Planting Status Survey, Sewage Treatment Facility Status Survey, Urban Greening Status Survey, Survey on Carbon Dioxide Absorption at Source in River Works, Progress Survey on Tree Planting for Public Rental Housing* (MLITT)
5.F. Other land	Any land that does not belong to the above land use categories.	(Total) – (summed area of other land use categories)

MAFF: Ministry of Agriculture, Forestry and Fisheries
MLITT: Ministry of Land, Infrastructure, Transport and Tourism

LULUCF

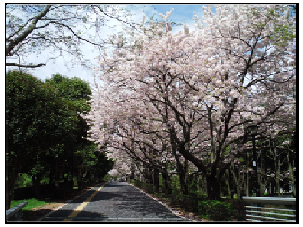
Land use category

5.A. Forest land

5.B. Cropland

5.C. Grassland

5.D. Wetlands



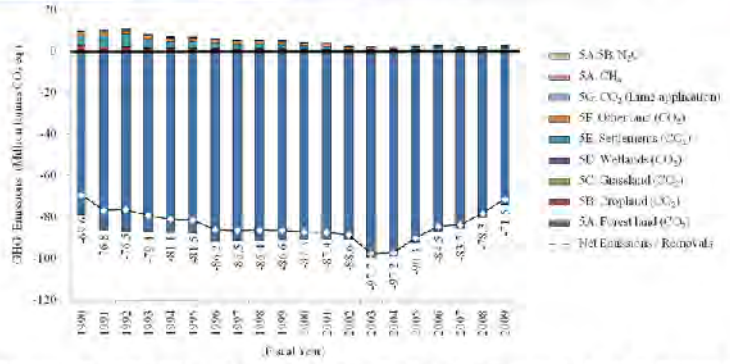
5.E. Settlements

Any land that does not belong to 5.A. – 5.E.

5.F. Other land

LULUCF

Emissions and Removals



- Net Removals (incl. CO_2, CH_4 and N_2O emissions) from the LULUCF sector in FY 2009 was 71.5 million tonnes (in CO_2 eq.). They increased by 2.8% since FY 1990 and decreased by 8.7% compared to the previous year.
- CO_2 removals in the Forest land was 73.7 million tonne-CO_2, accounting for 103% of net removals of the LULUCF.

LULUCF

Estimation targets

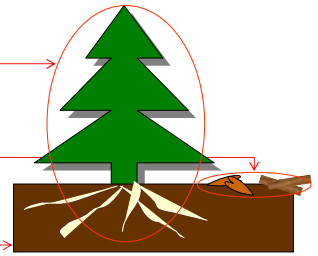
Carbon stock changes are estimated under 12 sub-categories (i.e., 6 land use categories x 2 sub-categories)

Subcategories: In the case of "Forest land"

- **Land use category remaining land use category over 20 years (e.g., Forest land remaining Forest land)**
- **Land converted to other land use category in an inventory year (e.g., Cropland converted to Forest land)**

Carbon pools:

- **Living biomass**
  Above-ground biomass
  Below-ground biomass
- **Dead organic matter**
  Litter
  Dead wood
- **Soil**
  Mineral & Organic soils



LULUCF

Basic estimation approach

Living biomass & Dead organic matter

Carbon stock change = (Per unit area of carbon stock change) * Area
(Per unit area of carbon stock change: Parameter; Area: Activity data)

Soil

Carbon stock change = (Per unit area of carbon stock change) * Area / 20 years
Note: It is assumed that the C stock transition completes within 20 years.

Exceptional: Forest land (Dead organic matter & Soil)

CENTURY-jfos model is used.

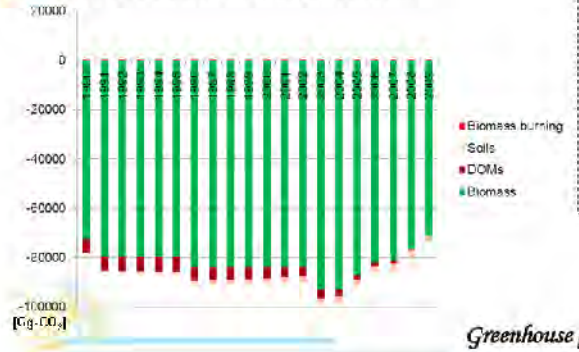
Parameters: Mostly country-specific parameters are used.
Activity data: National statistics are used.

LULUCF

5.A. Forest Land

- **5.A.1. Forest land remaining Forest land**
  - Living Biomass: Estimated
  - DOM : Estimated
  - Soils : Estimated
  - Biomass burning : Estimated
- **5.A.2. Land converted to Forest land**
  - Living Biomass: Estimated
  - DOM : Estimated
  - Soils : Estimated

- Trends in emission and removal

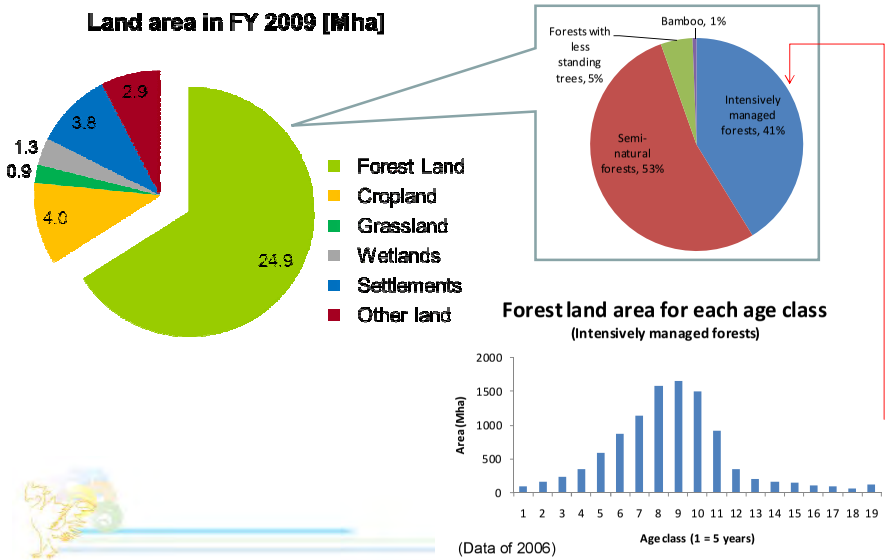


There were only limited statistics (of around every 5 years) for estimation before 2005.

Now Japan measures amount of biomass stock every year.

LULUCF

Forest land area and distribution



(Data of 2006)

LULUCF

5.B. Cropland

- 5.B.1. Cropland remaining Cropland
  - Living Biomass: NA (Tree growth is limited by trimming trees for low height and high production, and managed by pruning branches and improving tree shape.)
  - DOM: NE
  - Soils: NA (Applied Tier 1)
- 5.B.2. Land converted to Cropland
  - Living Biomass: Estimated
  - DOM: Estimated
  - Soils: Estimated

Trends in emission and removal

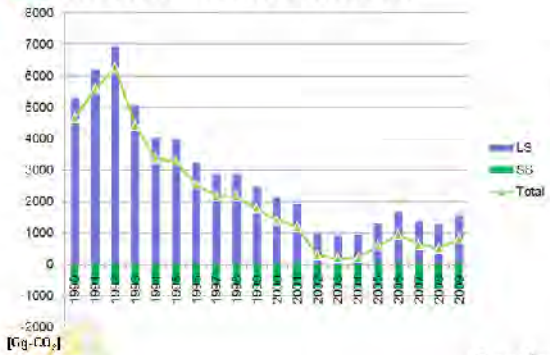
The reason for decrease in emission is that area of land converted to Cropland (= activity data) has been decreased. (Especially from Forest land)

LULUCF

5.E. Settlements

- 5.E.1. Settlements remaining Settlements
  - Living Biomass: Estimated
- 5.E.2. Land converted to Settlements
  - Living Biomass: Estimated
  - DOM: Estimated
  - Soils: NE

Trends in emission and removal



Area of land converted from Forest land to Settlements (= activity data) has been decreased, although total area for Settlements has increased since 1990.

Subject to Revegitation.

KP-LULUCF

KP-LULUCF

Reporting requirements

Convention	Kyoto Protocol
UNFCCC Articles 4 and 12	KP Articles 3.3 and 3.4
UNFCCC reporting guidelines (FCCC/SBSTA/2006/9)	Decision 6 / CMP.3 (FCCC/KP/CMP/2007/9/Add.2)

Japan reports GHG emissions and removals associated with these activities.

KP 3.3 (Mandate):
- Afforestation,
- Reforestation,
- Deforestation

KP 3.4 (Elected):
- Forest Management,
- Cropland Management,
- Grazing land Management,
- ReVegetation

As part of supplementary information under KP article 7.1.(Decision 15/CMP.1)

KP-LULUCF

Emissions & Removals in FY 2009

(Mt-CO_2, 2009)

KP-3.3	Afforestation		-0.4
	Reforestation		
	Deforestation		3.1
KP-3.4	Forest Management (elected)	Managed forest	-49.0
	Revegetation (elected)	Urban parks, Green area on road, etc.	-0.8
	Cropland Management		--
	Grazing land Management		--

-46.3 (Mt-CO_2)

-47.1 (Mt-CO_2)

Equivalent to **3.7%** of GHG emissions of the KP base year

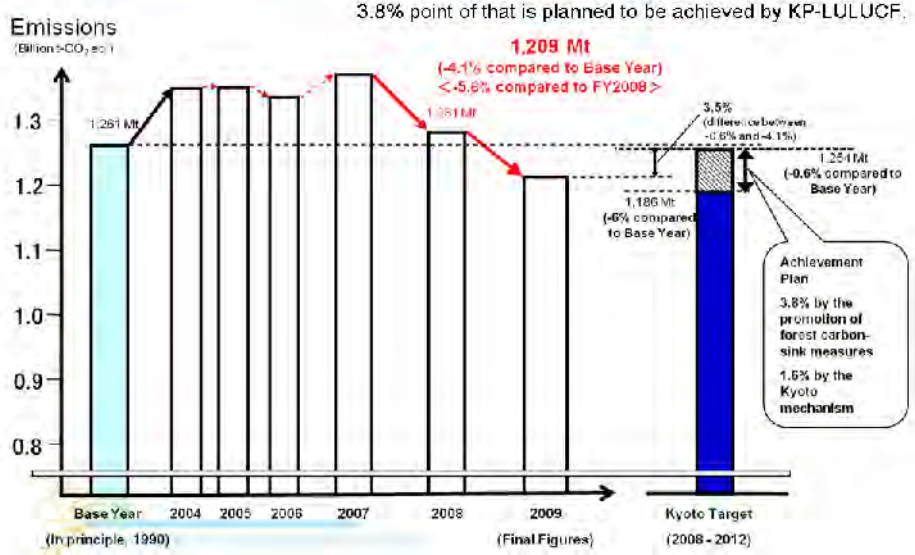
Plus: Emission, Minus: Removal

Note: These are provisional values, since Japan will report the final values for 5 years (2008 - 2012) in the end of the KP first commitment period (i.e., 2014).

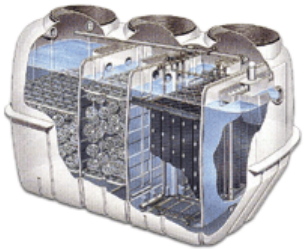
KP-LULUCF

Contribution to the KP target

Japan's commitment target is 6% below 1990.
3.8% point of that is planned to be achieved by KP-LULUCF.



Japan's Greenhouse Gas Inventory



Gappei shori johkasou

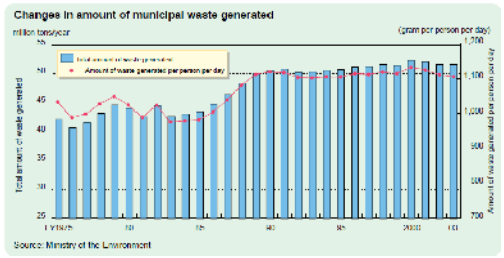
Waste Sector

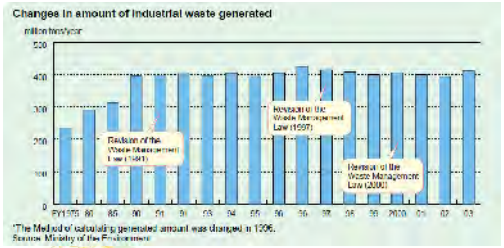
Background Information

- Waste are classified into “municipal waste” and “industrial waste”, in accordance with Japanese regulations.
- Industrial waste is categorized into twenty types of waste under the Waste Management Law from business activities.
- Municipal waste is other waste to be treated by municipalities and is classified into “municipal solid waste” and “human excrement”.

Waste Sector

Amount of Waste generated in Japan





- Until around FY1990, the amount of generated municipal and industrial waste had increased.
- From FY1990, the amount of generated waste have remained roughly unchanged.

Municipal waste

	Recycling rate	Final disposal amount
FY1990	5.3%	16.8 Mt
FY2007	20.3%	6.3 Mt

Waste sector

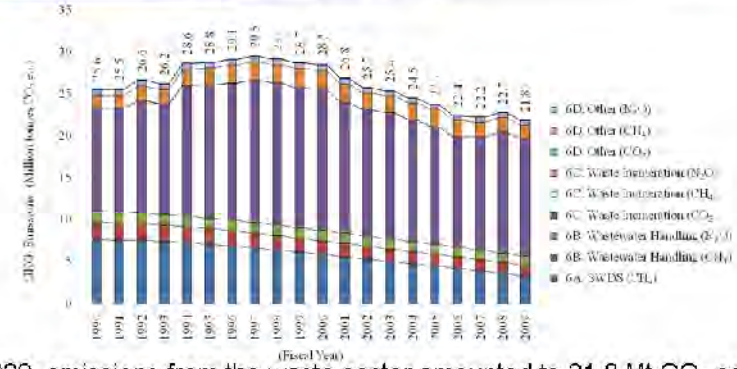
Categories

■ GHG (CO_2, N_2O, CH_4) emissions resulting from waste management and treatment activities (except CO_2 emissions of biogenic origin)

- 6.A Solid Waste Disposal on Land (CH_4)
  - 6.A.1 Managed Waste Disposal on Land
  - 6.A.3 Other
- 6.B Wastewater Handling (CH_4, N_2O)
  - 6.B.1 Industrial Wastewater
  - 6.B.2 Domestic and Commercial Wastewater
- 6.C Waste Incineration (CO_2, CH_4, N_2O)
  - 6.C.1 Incineration
  - 6.C.2 Used as Alternative Fuels or Raw Materials
- 6.D Other (CO_2, CH_4)
  - Decomposition of Petroleum-Derived Surfactants
  - Composting

Waste sector

GHG Emissions (Total)



■ In 2009, emissions from the waste sector amounted to 21.8 Mt CO_2 eq. and represented 1.7% of the Japan's total GHG emissions.
■ GHG Emissions have decreased by 14.6% compared to 1990
■ Emissions from "Waste Incineration (6.C.)" accounted for 64% of the total emissions from waste sector.
■ Emissions from waste incineration had increased in the late 90's in line with incineration ratio.

Waste sector
6A. Solid Waste Disposal on Land (CH_4)

1. IPCC guideline
   - ➢ Managed landfill

◎Identify disposal sites
◎Managed scavenging
◎Managed fire disaster
○Coverture, Mechanical compression, Land leveling

   - ➢ Un-managed landfill

Absent in Japan

1. Managed landfill
   - ➢ Aerobic
   - ➢ Semi-aerobic
   - ➢ Anaerobic
2. Japan specific sub-category
   - ➢ Inappropriate disposal
     - ✓ Regarded as a managed landfill
     - ✓ Anaerobic
     - ✓ Reported for identified amount

Managed landfill
(Anaerobic, in Korea)

Waste sector
6B. Wastewater Handling (CH_4, N_2O)

Category	Type Estimated	Forms of Treatment		CH_4	N_2O
6.B.1. (8.3.1)	Industrial wastewater	(Sewage treatment plants)		○	○
6.B.2. (8.3.2)	Domestic/commercial wastewater	Sewage treatment plants (8.3.2.1)		○	○
		Domestic wastewater treatment facilities (mainly septic tanks) (8.3.2.2)	Community plant	○	○
			Gappei-shori johkasou	○	○
			Tandoku-shori johkasou	○	○
			Vault toilet	○	○
		Human waste treatment facilities (8.3.2.3)	High-load denitrification treatment	○	○
			Membrane separation	○	○
			Anaerobic treatment	○	○
			Aerobic treatment	○	
			Standard denitrification treatment	○	
			Other	○	
	Degradation of domestic wastewater in nature (8.3.2.4)	Discharge of untreated domestic wastewater	*Tandoku-shori johkasou*	○	○
			Vault toilet	○	○
			On-site treatment	○	○
		Sludge disposal at sea	Human waste sludge	○	○
			Sewage sludge	○	○

- ➢Various emission source
  - •Industrial wastewater
  - •Sewage treatment plants
  - •*Johkasou*
  - ・・・etc.
- ➢Japan specific estimation method
  - •Use BOD method for Industrial wastewater handling
  - ・・・etc.

Waste Sector
6C. Waste Incineration (CO_2)

□ Emission factor: Amount of CO_2 emitted per unit of waste incinerated, kg CO_2/t

EF_{CO2} = 1000 [kg] × Carbon content × Combustion rate × 44/12

- ➢ C content: country-specific data
- ➢ Combustion rate: a default value in the GPG2000

□ Activity data: Amount of waste incinerated, t

$AD_{MSW\ plastics}$ (dry basis) = amount of plastics incinerated x percentage of solids

$AD_{MSW\ synthetic\ textile\ scraps}$ (dry basis) = amount of textile scraps incinerated x percentage of solids x percentage of synthetic fiber content in textile scraps

- ➢ Data are derived from domestic statistics and survey

Part II: Summary

Agriculture Sector

Since country-specific EFs are applied to the estimation, GHG emissions from this sector should reflect Japan's condition well.

LULUCF Sector

Country-specific estimation methodologies are applied to the estimation. Data collection of biomass stock in forest has been conducted annually since 2005.

Waste Sector

Policy for waste management triggered the decrease in amount of final disposal and alternatively the increase in amount of waste incinerated.

Appendix
How to handle “lack of data”

What would we do if Activity Data could not be obtained?

- Estimate from other statistics
  - Waste Incineration – composite fiber
- Establish new statistics
  - New energy balance sheet
  - National Forest Resource Data Base
  - Digestion of sewage sludge for biogas

What would we do if Activity Data could not be obtained?

- Consult with experts

⇩

- Consult with relevant ministries/companies
  - Establish/improve statistics
  - Direct data submission

⇩

- The committee approves the data collection system

Who pays for establishing Emission Factors?

- Funds from MoE
  - General
  - Waste
- Funds from other ministries
  - Agriculture
  - Forestry
- Cooperation of private companies
  - Industrial Processes

Thank you for your attention

ขอบคุณ มาก ครับ

GIO Website: http://www-gio.nies.go.jp/index.html
NIR of Japan: http://www-gio.nies.go.jp/aboutghg/nir/nir-e.html
WGIA: http://www-gio.nies.go.jp/wgia/wgiaindex-e.html

Inventory and Mitigation

For TGO (Thailand), 31 August 2011

Keizo Hirai
Greenhouse Gas Inventory Office of Japan (GIO)
Center for Global Environmental Research (CGER)
National Institute for Environmental Studies (NIES)
www-gio@nies.go.jp

Relationship between Inventory and Mitigation

Green House Gases have been increasing due to human activities

↓

Climate changes on a global scale: Averaged surface-temperature rises, sea-level rises and global precipitation-pattern changes etc.

↓

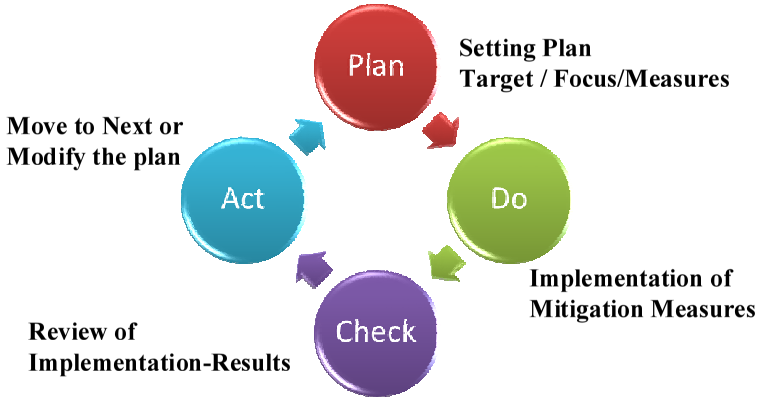
Developing and Implementing Mitigation Measures are necessary, and *GHG Inventory provides data for Developing Mitigation Measures and Reviewing Implementation-Results*

Relationship between Inventory and Mitigation

➢For acting as *Indices* of Mitigation Measures, National GHG Inventory should be:
Transparent, Consistent, Comparable, Complete and Accurate

➢National / State goal is to reduce GHGs not to submit a report

Mitigation Actions in a sustainable manner
Inventory=Index (Indices)



One year for one Cycle is recommended / Annual Inventory is recommended

Case Study-1 (Industrial Process, HFCs)

"Montreal Protocol"

Halocarbons	Abbreviated Name	ODP, Ozone Depletion Potential	GWP	Abolition Due-Date for Developed Countries	Abolition Due-Date for Developing Countries
CFC, Chloro Fluoro Carbon	11	1.0	3,800	Before 1996	Before 2010
	12	1.0	8,100		
	113	0.8	4,800		
	114	1.0	–		
	115	0.6	–		
Halon, Alkyl Halide with Br	1211	3.0	–	Before 1994	Before 2010
	1301	10	5,400		
	2402	6.0	–		
Bromomethane	–	0.60	–	Before 2005	Before 2015
HCFC, Hydro Chloro Fluoro Carbon	22	0.055	1,500	Before 2020	After 2030
	142b	0.065	1,800		
	123	0.020	90		
	124	0.022	470		
	141b	0.11	–		
	225ca	0.025	–		
	225cb	0.033	–		

Reference: "UN Environment Programme", "White Paper on Environment by Japanese Ministry of Environment", "Second Assessment Report by IPCC"

Case Study-1 (Industrial Process, HFCs)

Below Green House Gases are Fluorinated Substitutes for Ozone Depleting Substances

Green House Gas		GWP
SF_6		23,900
PFC-14 (CF_4)		6,500
PFC-116(C_2F_6)		9,200
HFCs, Hydro Fluoro Carbon	23	11,700
	32	650
	125	2,800
	134a	1,300
	143a	3,800
	152a	140
	227ea	2,900
	236fa	6,300
	43-10mee	1300

IPCC Revised 1996 Guidelines

Tier 1=Potential or Basic

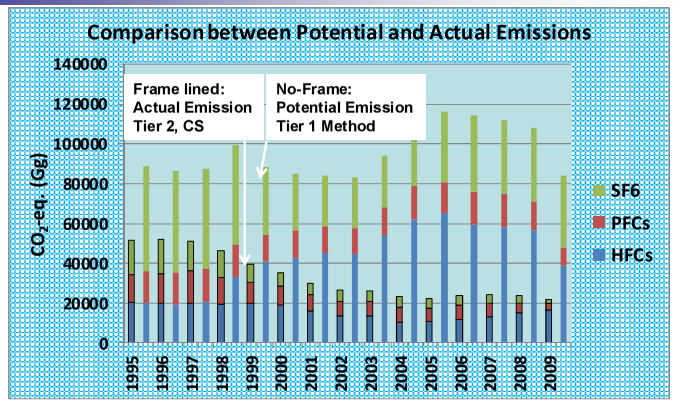
Tier 1 a: Emission=Produced + Imported-Exported in bulk
Tier 1 b: Imported = Imported in bulk + Quantity in imported products which contains HFCs
Exported= Exported in bulk + Quantity in exported products which contains HFCs

Tier 2=Actual Emission= Σ (1),(2) and (3)

(1)Emissions during system manufacture/assembly in year
(2)Emissions during system operation in year
(3)Emissions at system disposal in year

Reference: "Second Assessment Report by IPCC", "IPCC-Guide Line"

Case Study-1 (Industrial Process, HFCs)



The potential method is likely to overstate emissions
In case of using 1996 Revised Guide Lines, Tier 2 Method should be taken

Reference: National Greenhouse Gas Inventory Report and CRF of JAPAN

Case Study-1 (Industrial Process, HFCs)

1996 IPCC Revised Guidelines:

Tier 1 method = Potential Emission / Tier 2 method = Actual Emission

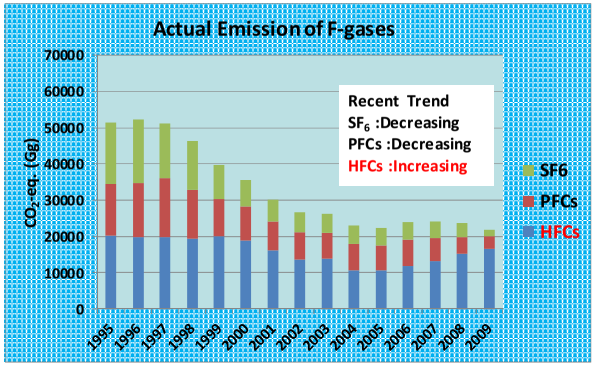
➢**Tier 1 method: No taking into account the time lag between consumption and emission even though a chemical placed in a new product (equipment) may only slowly leak.**

2006 IPCC Guidelines:

Both Tier 1 & Tier 2 method = Actual Emission

➢**For Tier 1, composite emission factors are shown as defaults on Table 7.9 on page 7.52.**

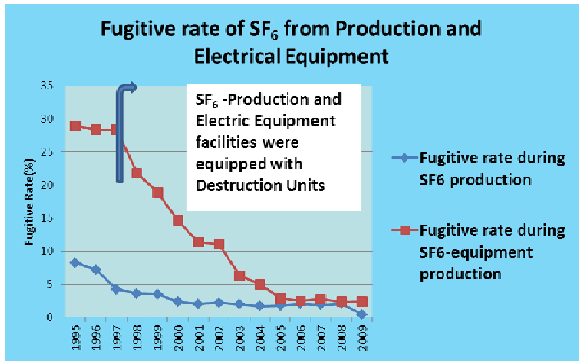
Case Study-1 (Industrial Process, HFCs)



HFCs are the most concerned Fluorinated-gas for JAPAN

Reference: National Greenhouse Gas Inventory Report and CRF of JAPAN

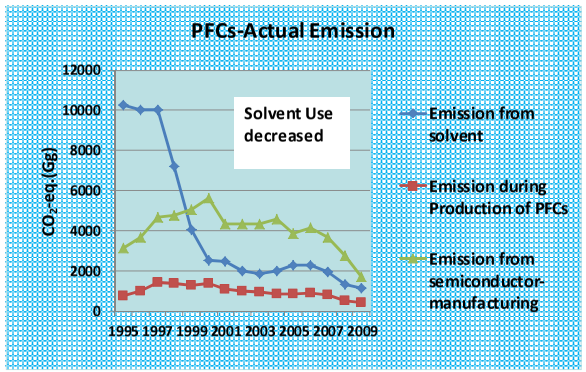
Case Study-1 (Industrial Process, HFCs)



SF_6 had already decreased by Industries' taking actions

Reference: National Greenhouse Gas Inventory Report and CRF of JAPAN

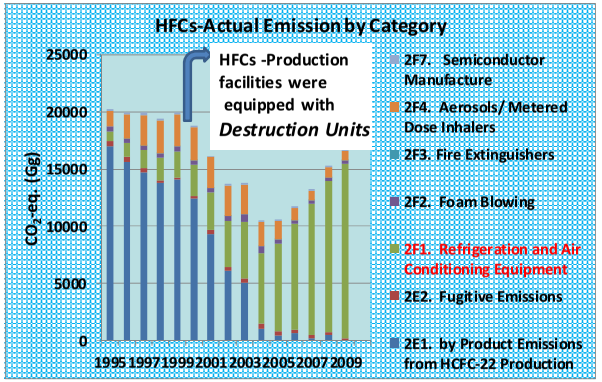
Case Study-1 (Industrial Process, HFCs)



PFCs had already decreased by Industries' taking actions

Reference: National Greenhouse Gas Inventory Report and CRF of JAPAN

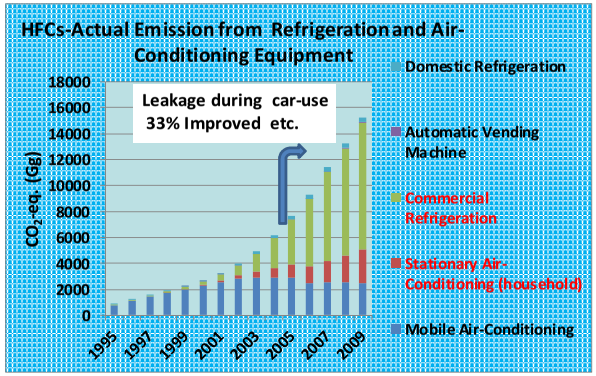
Case Study-1 (Industrial Process, HFCs)



Concerning HFCs,
"Refrigeration and Air-Conditioning" is the most concerned Category

Reference: National Greenhouse Gas Inventory Report and CRF of JAPAN

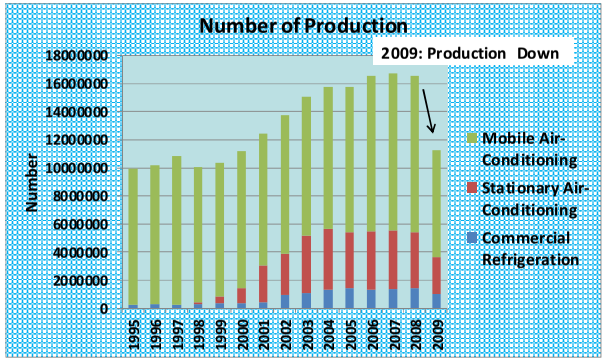
Case Study-1 (Industrial Process, HFCs)



"Commercial Refrigeration (Big scale, Not House Hold)" is the most Concerned Sub-Category

Reference: National Greenhouse Gas Inventory Report and CRF of JAPAN

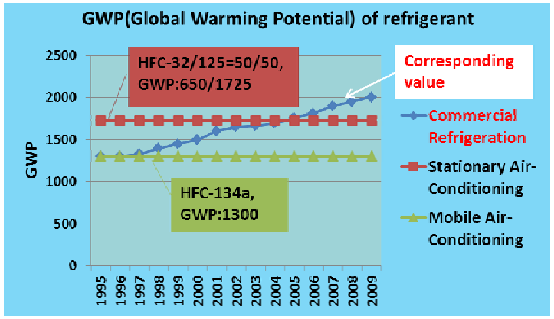
Case Study-1 (Industrial Process, HFCs)



The number of "Commercial Refrigerator" is the smallest, however
The emission is the largest because it has a lot of refrigerant per equipment

Reference: National Greenhouse Gas Inventory Report and CRF of JAPAN

Case Study-1 (Industrial Process, HFCs)



2nd Reason why emission from Commercial Refrigeration is so high: Substitution from HCFC to HFC R404A (ODP=0, GWP=3750)etc. has been On Going

"Substituting HCFC to Low GWP Refrigerant" should be done promptly
By "Global Warming, Chemical and Bio Sub-Group, INDUSTRIAL STRUCTURE COUNCIL" in "Ministry of Economy Trade and Industry"

Reference: National Greenhouse Gas Inventory Report and CRF of JAPAN

Case Study-1 (Industrial Process, HFCs)

Mobile Air-Conditioning

Country Specific Index for calculating HFCs-Emissions from Cars

Index	Unit	
Car production with HFC-Air-Conditioning	1,000 vehicles	
Emission during production	g / vehicle	Emission during Production
All Cars having HFC-Air-Conditioning	1,000 vehicles	
Average filled refrigerant per car	g / vehicle	
Fugitive refrigerant per car during usage	g/vehicle	Emission during Usage
Repairing ratio	%	
Fugitive refrigerant rate per repaired car	%	Emission from Repairing
Completely collapsed car	1,000 vehicles	
Fugitive refrigerant per completely collapsed car	g / vehicle	Emission from Completely Collapsed
Scrapped car	1,000 vehicles	
Fugitive refrigerant per scrapped car	g / vehicle	Emission from Scrap
Recycled amounts	t	
Emissions of HFC-134a	t	
GWP	——	

Reference: National Greenhouse Gas Inventory Report and CRF of JAPAN