行政院所屬各機關因公出國人員出國報告書

(出國類別：研習)

經濟部 96 年度台日技術合作計畫--------

「溫室氣體(CO_2)通量監測技術與估算方法參訪研習」出國報告書

服務機關： 行政院環境保護署 經濟部工業局

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出國地點：日本東京

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報告日期：96 年 12 月 14 日

摘　要

本次參訪爲經濟部 96 年度台日技術合作計畫，主要目的在於瞭解日本因應京都議定書的具體作法，包括溫室氣體估算、減量及通量監測等，以提供國內推動參考。參訪期間共參訪經濟產業省產業技術環境局環境政策課山澄克課長補佐、製造產業局化學物質管理課遠藤秀雄課長補佐、產業技術環境局京都機制推進室橋本覺課長補佐、獨立行政法人產業技術綜合研究所環境化學技術研究部門關屋章博士、環境管理技術研究部門近藤裕昭博士、村山昌平博士、三枝信子博士、獨立行政法人國立環境研究所地球環境研究中心田邊清人研究員、地球環境研究中心梁乃申主任研究員、橫濱火力發電廠、東京都環境局都市地球環境部山本名課長。

日本對於全球暖化議題採由上而下之決策模式，結合經產省及環境省共同努力，於 2002 年成立 CO_2 辦公室，與環境省及專家群著手建立排放清冊。本於京都議定書承諾 2010 年溫室氣體排放量將較 1990 年減量 6%，但因經濟成長導致 2006 年排放量反而較 1990 年成長 6.4%。日本因應京都議定書目標之達成計畫，具體行動計畫目標分爲 3 部分：以 2006 年排放量計算，國內溫室氣體減量(佔 7%)、森林吸收(佔 3.8%)及京都機制(佔 1.6%)。日本因應全球暖化最具特色及成效者，包括產業界自主行動計畫、改進車輛能源效率、建築物節能、能源設備效率、推動核能及新能源、管制 3 項含氟氣體之替代物質、促進森林吸收量等。爲估算森林碳匯之貢獻，日本已有多個部門投入長期研究，有助建立森林在溫室氣體之影響關聯。

日本溫室氣體減量著重產業界自主行動及提升能源使用效率等，提升競爭力，或藉由京都機制，促進產業境外發展，均可兼顧經濟發展及環境保護，值得國內借鏡。溫室氣體減量須全國上下共同努力，故勢必涉及各部會相關事務，建議宜有專責辦公室負責，進行跨部會業務推動，形成全國共識，以收減量之宏效。森林碳匯之貢獻須有林業部門參與研究，宜結合國內相關資源，全盤規劃及觀測。

雖然工業部門因大規模生產，使用的能資源及污染排放多居首位，又以其資金規模及人才觀之，亦爲最有能力解決環境問題者，溫室氣體排放減量的議題亦然。各國莫不從工業部門的減量著手規劃執行，一般減量的成果亦以工業部門爲

佳。然而應當增加關注的是住商部門及交通運輸部門排放量的成長，日本從統計數字觀察到該等部門成長迅速，並採取對應的因應措施，如 2007 年 10 月新增要求建物拆除前需先確認是否有需回收的相關設備（碳氟化合物回收破壞法）、東京都政府強調對新舊建築物新增環境計畫書制度等。我國應加強溫室氣體排放相關統計分析，並以之發展各排放源適合國情的對應措施。

溫室氣體排放的議題絕對是全球需共同面對的議題，後京都時期開發中國家將被要求共同負擔減量的責任，此行日本甚爲強調全球努力的必要性，96 年 12 月 4 日在印尼峇里島召開的聯合國氣候變化綱要公約締約國會議 COP13 亦會論及。台灣未來不可避免的會在此議題上扮演一定的角色，故保持高度持續的關注並積極參與國際合作事務，仍屬必需。

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第一章 研習目的

1.1 出國計畫名稱

經濟部 96 年度台日技術合作計畫之「溫室氣體(CO_2)通量監測技術與估算方法參訪研習」

1.2 出國人員

環保署監資處張順欽簡任技正

環保署空保處黎楊輝技士

工業局李碧玲技正

1.3 出國日期

96 年 11 月 11 日至 11 月 17 日

1.4 研習目的

我國環保署關心全國溫室氣體排放與減量，除推動溫室氣體減量法，進行溫室氣體排放量調查，同時自 2005 年起開始規劃溫室氣體(二氧化碳)通量監測網，於台灣宜蘭縣棲蘭山設置了一個二氧化碳通量監測站，藉以估算台灣森林吸收二氧化碳的貢獻。

2006 年 11 月透過台日技術合作計畫申請日本京都大學谷誠教授(Dr. Tani Makoto)來台指導，提供二氧化碳通量監測技術相關的寶貴意見，以加強台灣在二氧化碳通量監測技術的引進。

日本國立環境研究所以及相關學術機構在二氧化碳通量監測技術及估算方法開發已有多年經驗，並已陸續建立二氧化碳通量監測網，希能透過實地參訪，借鏡日本相關技術及經驗，引進溫室氣體(二氧化碳)通量監測與估算方法等相關技術，以供台灣建立二氧化碳通量監測網之參考。

本次參訪爲經濟部 96 年度台日技術合作計畫，主要目的在於瞭解日本因應京都議定書的具體作法，包括溫室氣體估算、減量及通量監測等，以提供國內推

動參考。

第二章、研習過程

2.1 出國行程與內容摘要

本次參訪爲經濟部 96 年度台日技術合作計畫，主要行程與內容摘要說明如下：

11 月 11 日 啓程：台北至東京

11 月 12 日 上午 拜會有限責任中間法人臭氧層、氣候保護產業協議會上村茂弘事務局長及渡边幸郎先生：介紹此次參訪行程安排。

11 月 12 日 下午 拜會經濟產業省產業技術環境局環境政策課山澄克課長補佐：說明日本預防全球暖化之溫室氣體減量目標與產業自主行動計畫等具體作爲。

11 月 13 日 上午 拜會經濟產業省製造產業局化學物質管理課遠藤秀雄課長補佐：說明日本對於同屬溫室氣體之臭氧層破壞物質管制與減量的做法。

11 月 13 日 下午 拜會經濟產業省產業技術環境局京都機制推進室橋本覺課長補佐：說明日本因應全球暖化之京都機制作業方式，透過協助開發中國家進行溫室氣體減量的具體成果。

11 月 14 日 上午 拜會獨立行政法人產業技術綜合研究所環境化學技術研究部門關屋章博士：介紹全球暖化指標之檢討，建議一併考慮冷煤或 CO_2 的短、長期效應，避免高估冷煤短期衝擊。

11 月 14 日 下午 拜會獨立行政法人產業技術綜合研究所環境管理技術研究部門近藤裕昭博士、村山昌平博士、三枝信子博士：介紹日本高山 CO_2 通量監測多年觀測成果及相關技術。

11 月 15 日 上午 拜會獨立行政法人國立環境研究所地球環境研究中心田邊清人研究員：介紹日本溫室效應氣體排放清冊之盤查、建立過程。

11 月 15 日 下午 拜會獨立行政法人國立環境研究所地球環境研究中心梁乃

申主任研究員：介紹亞洲 CO_2 通量觀測現況及發展趨勢，及日本關於碳循環研究成果。

11 月 16 日 上午 參觀橫濱火力發電廠：發電技術改進提升熱能轉換效率，由 40%提升到 49%，持續供應東京都穩定電力，同時有效減少 CO_2 排放。

11 月 16 日 下午 東京都環境局都市地球環境部山本名課長：講解東京都因應地球暖化之具體做法，包括各產業的自主行動計畫、新舊建築物節能評鑑方式及民眾改用省電燈具等。

11 月 17 日 返程：東京至台北

2.2 重要參訪心得摘要

1.日本對於全球暖化議題採由上而下之決策模式，結合經產省及環境省共同努力，於 2002 年成立 CO_2 專責辦公室，與環境省及專家群著手建立排放清冊，提供了日本全國溫室氣體減量的重要參考依據。

2.日本於京都議定書承諾 2010 年温室氣體排放量將較 1990 年減量 6%，但因經濟成長導致 2006 年排放量反而較 1990 年成長 6.4%。

3.日本因應京都議定書目標之達成計畫，具體行動計畫目標分爲 3 部分：以 2006 年排放量計算，國內温室氣體減量(佔 7%)、森林吸收(佔 3.8%)及京都機制(佔 1.6%)。

4.日本因應全球暖化最具特色及成效者，包括產業界自主行動計畫、改進車輛能源效率、建築物節能、能源設備效率、推動核能及新能源、管制 3 項含氟氣體之替代物質、促進森林吸收量等。

5.爲估算森林碳匯之貢獻，日本已有多個部門投入長期研究，有助建立森林在溫室氣體之影響關聯。

6.橫濱火力發電廠透過發電技術改進，有效將熱能轉換效率由 40%提升到 49%，持續供應東京都穩定電力，同時有效減少 CO_2 排放，值得國內參考。

7.日本溫室氣體減量著重產業自主行動及提升能源使用效率等，不僅提升了

競爭力，也對溫室氣體減量有所貢獻；日本藉由京都機制，透過該國產業協助開發中國家發展，均可兼顧經濟發展及環境保護，值得國內借鏡。

第三章、研習內容

3.1 日本溫室氣體防止政策(李碧鈴)

3.1.1 日本的溫室氣體減量目標

日本於 2002 年 6 月正式成爲京都議定書的簽署國，議定書生效後日本承諾在 2008 至 2010 年間，以 1990 年爲基準年將溫室氣體排放量(總二氧化碳相當排放量)減少 6%。

該減量承諾將從 3 方面著手：

1.運用降低國內排放源方法減少溫室氣體排放量 0.6%；

2.經由森林碳吸收減少溫室氣體排放量 3.8%；及

3.運用京都機制減少溫室氣體排放量 1.6%。

然而從 1990 年起日本的溫室氣體排放量持續增加，2004 年溫室氣體排放量爲 1,358 百萬噸，較 1990 年的 1,261 百萬噸成長 7.7%，2005 年溫室氣體排放量爲 1,359 百萬噸，較 1990 年成長 7.7%，2006 年略減，該年溫室氣體排放量爲 1,341 百萬噸，仍較 1990 年成長 6.4%，故若爲達成京都議定書 2010 年所承諾的減量目標，則整體需減少的排放量將提高到 12.4%，在森林碳匯及運用京都機制減量目標不變的情形下，則需將國內削減量提升，即由原來的 0.6% 提高爲 7%，此爲一極大的挑戰，日本政府雖表現強烈的企圖心，但國內對是否能達成目標仍有疑慮。日本檢討近年溫室氣體排放量不減反增情形，主要歸因於 GDP 成長加速，產值增加所致，並認爲除應持續積極降低國內排放量外，應致力於發展新技術。

3.1.2 日本的溫室氣體排放情形

京都議定書所管制的 6 項溫室氣體分別爲二氧化碳、甲烷、氧化亞氮、氫氟碳化合物（HFCs）、全氟碳化合物（PFCs）與六氟化硫（SF_6），日本統計 2006 年溫室氣體排放情形如表 3.1。

表 3.1、日本 2006 年溫室氣體排放情形統計

CO_2當量(百萬噸)	減量基準年 (1990年)	2006 年排放量	2006年較基準年變動率	2006 年較 2005 年變動率
CO_2	1144(91%)	1275(95%)	+11.4%	-1.3%
源自能源者	1059(84%)	1184(88%)	+11.8%	-1.4%
非源自能源者	85.1(7%)	91.1(7%)	+7.1%	+0.5%
甲烷	33.4(3%)	23.8(2%)	-28.7%	-0.8%
氧化亞氮	32.6(3%)	25.4(2%)	-22.0%	-0.1%
三項含氟氣體	51.2(4%)	17.3(1%)	-66.2%	-3.8%
合　　計	1261(100%)	1341(100%)	+6.4%	-1.3%

日本 2006 年源自能源者的 CO_2 排放源如表 3.2。

表 3.2、日本 2006 年源自能源者的 CO_2 排放源

單位：CO_2當量百萬噸

排放源	減量基準年 (1990年)	2006年排放量	2006 年較基準年變動率	2006 年較 2005 年變動率
工業部門	482(46%)	455(38%)	-5.6%	+0.6%
運輸部門	217(21%)	254(21%)	+17.0%	-0.9%
商業及其他部門	164(16%)	233(20%)	+41.7%	-2.6%
住戶部門	127(12%)	166(14%)	+30.4%	-4.4%
能源部門	67.9(6%)	75.5(6%)	+11.3%	-4.4%
合　　計	1059(100%)	1184(100%)	+11.8%	-1.4%

由以上表 3.1 及表 3.2 分析日本 2006 年溫室氣體排放情形不難發現，映證其經濟發展情況(2006 年經濟成長率爲 2.17%)，CO2 排放量呈現上漲趨勢，住商部門成長迅速而工業部門則努力減少排放。在 6 項管制氣體中，三項含氟氣體大幅減少排放，而甲烷及氧化亞氮的排放亦有不錯的減量成果，研判除部分係因產業外移外，其積極開發替代物質仍具成果。

3.1.3日本京都議定書目標達成計畫

日本爲達成京都議定書所允諾的溫室氣體減量目標(2010 年較基準年 1990 年減少 6%，相當於 1311 百萬噸 CO_2 當量)，內閣於 2005 年 4 月提出「京都議定書目標達成計畫（The Kyoto Protocol Target Achievement Plan，詳附錄）」，在既存的「防止地球暖化促進綱要」而外採取更多的方法，並訂在 2007 年進行

計畫的評估，日方表示要在 2008 年才會有具體的評估結果及更新。茲簡介該計畫如下：

1. 目標

運用降低國內排放源方法減少溫室氣體排放量 0.5%；經由森林碳吸收減少溫室氣體排放量 3.9%；及運用京都機制減少溫室氣體排放量 1.6%。詳如表 3.3。

表 3.3、日本達成京都議定書承諾的減量內涵

目標達成方式	2010年減少量(百萬噸CO_2當量)	與1990年相較
溫室氣體排放量	1230	-0.5%
1.CO_2源自能源者	1056	+0.6%
2.CO_2非源自能源者	123	-1.2%
3.甲烷		
4.氧化亞氮		
5. 三項含氟氣體	51	+0.1%
森林碳吸收	-48	-3.9%
京都機制	-20	-1.6%
合　　計	1163	6.0%

2. 機構

日本推動溫室氣體減量的機構主要是經產省及環境省，經產省著重在能源及產業計畫，環境省則負責整體的協調(含目標的設定)，而所有的行政機關均參與目標的訂定。

3. 策略措施

該計畫涵括約 60 項策略措施，詳如表 3.4。

表 3.4、日本溫室氣體減量計畫內容

	部門別	措　　施
CO_2 排放源自能源者	商業部門	**自主行動計畫**
		能源管理(能源使用法)
		多家企業協同保存能源
		引進高效率工業用暖爐
		宣導高效率鍋爐

		引進2次產出焦炭爐
		宣導建物使用的高效率能源設備
	運輸部門	提高大眾運輸工具的利用
		宣導客貨運業者
		引進停止空轉車輛
		調整交通車輛的需求
		引進智慧運輸系統
		引進智慧運輸系統(中央交通號誌控制)
		減少馬路施工
		改善交通安全設施
		促進交通替代方式(如運用通訊等)
		整合海運綠化措施
		鐵路貨運規格化
		提高卡車運輸效率
		減少國際航運和陸運的距離
		運用標竿企業標準提升能源效率
		宣導車輛使用清潔能源
		降低高速公路大卡車高速限
		引進不含硫燃料
		改善鐵路的能源效率
		改善飛機的能源效率
	非商業部門	能源管理(能源使用法)
		改善建築物節能成效
		宣導企業用高效能空調
		宣導企業用節能冰櫃
		改善住宅能源效率
		BEMS/HEMS
		運用標竿企業標準改善設備效率
		促進採購新的節能設備
		提供能源資訊
		宣導高效能水加熱器
		宣導高效能LED照明
		減少備用電力
	能源部門	擴大使用生物量
		促進核能
		開發新能源
		汽電共生
		燃料電池
CO_2排放非源自能源者		擴大使用混合水泥
		減少廢棄物焚化產生的CO_2排放量
CH_4及N_2O		減少廢棄物最終處理量
		已二酸製程安裝去除N_2O設備
		污泥焚化設備精密燃燒

	一般事業廢棄物焚化設備精密燃燒
三項含氟氣體	**鼓勵工業協同努力及開發替代物質**
	轉換使用HFC冷媒
森林碳吸收	**提升森林和林業管理的碳吸收**
	都市綠化
京都機制	發展政府取得減量信用機制

上開措施中日本因應全球暖化最具特色及成效者，包括產業界自主行動計畫、運用標竿企業標準提升能源效率、BEMS/HEMS、改善建築物節能成效、運用標竿企業標準改善設備效率、改進車輛能源效率、推動核能、開發新能源、汽電共生、開發 3 項含氟氣體替代物質、轉換使用 HFC 冷媒、促進森林吸收量等。囿於時間，本次研習僅提及其中幾項重要措施，又上開措施均有預估 CO_2 削減量，相關數據係由政府相關部門、公用事業或公會團體等彙送。日本政府並未提供業者補助等獎勵措施，主要採取鼓勵業者自願減量方式配合政府因應，業界的自主行動計畫因會向社會大眾公開，故其目標設定較政府更爲嚴格，政府運用社會輿論的力量，促使產業自主因應(無處罰及獎勵規定)，此爲日本的特色，有別於歐盟採取的法律強制規範。日方同時強調核能發電是解決 CO_2 的重要手段。目前國際間推動溫室氣體減量最積極者爲歐盟及日本，日方認爲 2010 年以後光靠歐盟及日本無法解決溫室氣體問題，若 2050 年溫室氣體排放量不能減到 2010 年的一半，則無法解決溫室氣體問題，故呼籲全球應共同努力，包括新興國家。

3.2 日本 3 項含氟氣體抑制對策及冷媒回收政策(李碧鈴)

3.2.1 國際臭氧層和氣候保護架構

國際上臭氧層保護規範主要爲 1987 年的蒙特婁議定書。蒙特婁議定書(Montreal Protocol on Substances that Deplete the Ozone Layer)是由聯合國環境規劃署於 1987 年召集各國開會通過的國際公約，其內容乃根據維也納公約(Vienna Convention for the Protection of the Ozone Layer)的精神及要求而制訂的。其秘書處下設有 TEAP 機構負責處理技術性及經濟性事項。氣候保護規範則爲 1997 年京都議定書，甫獲得 2007 年諾貝爾和平獎的 IPCC 機構爲其相關的研究機構，因臭氧層破壞物質與溫室氣體具關連性，故由上開 2 機構進行合作。

蒙特婁議定書所管制的臭氧層破壞物質包括：CFC、HCFC、1,1,1-三氯乙烷、Halon、溴化甲烷等。HFC、PFC、SF_6 爲管制及降低破壞臭氧層物質排放有關替代技術之一，現爲京都議定書所管制的 3 項含氟氣體。

3.2.2 日本碳氟化合物使用情形與國際比較

日本 1996 年已禁用 CFC，2003 年開始減用 HCFC(預訂 2030 年禁用)，HFC 爲發展的替代物質，主要用途在清洗、噴塗、隔熱及冷媒等。其碳氟化合物的使用量自 1989 年以來呈大幅下降趨勢，明顯的轉換過程爲 CFC→HCFC→HFC，就用途而言，其用於清洗、噴塗及隔熱均大幅削減，作爲冷媒使用仍爲大宗。若就臭氧層破壞係數觀之，其使用碳氟化合物所造成的臭氧層破壞已減少 99.3%，成效斐然。其 HCFC 係採階梯式的減量目標，即 2015 年較新基準年(2009 年及 2010 年平均值)減少 10%，2020 年減少 35%，2025 年減少 67.5%，至 2030 年禁用。此外，日本觀察到全球 HCFC 使用量有增加的趨勢，主因爲開發中國家大量採用，SAP(蒙特婁議定書科學評估小組)2006 年報告中指出，因開發中國家持續採用 HCFC 及隨著冰箱空調等設備廢棄排放增加的 CFC_S 及 $HCFC_S$，將使臭氧層修護的進展延長 5 至 15 年。日本雖以 HFC 取代 HCFC，但因 HFC 爲溫室氣體管制物質，故未來目標仍需減少 HFC 的使用量。

日本使用 3 項含氟氣體主要作爲冷媒使用，因尚無替代物質故難以減少使用量，其若不排放即不會影響溫室效應，故主要抑制對策在加強回收。日本進行國際比較時發現，其 HCFC 使用量歷年來均屬低水準並呈減少趨勢，反觀中國大陸則呈現高水準及增加趨勢。同時，3 項含氟氣體的使用，只有日本呈減少趨勢，其他國家則呈增加趨勢(引用 UNFCCC 統計，日本 2004 年用量爲 1900 萬噸，較 1995 年減少 48%，反觀美國成長 51%，歐盟維持原水準)。目前中國大陸已超越美國成爲全球 CO_2 的最大排放國，印度、巴西等開發中國家的 CO_2 排放持續增加中，故 CO_2 減量亟需加強已開發國家及開發中國家的國際合作方能奏效。

3.2.3 日本 3 項含氟氣體抑制對策

日本對 3 項含氟氣體的抑制對策包括：

1.產製該等氣體者，加裝去除設備。

2.作爲隔熱用途者，改用無CFC隔熱，如HC等。

3.作爲噴霧劑者，從134a改用152a。

4.作爲冷媒者，減少填充量、加強回收及氣體轉換。

5.作爲清洗用途者，使用替代物質。

6.用於半導體製造者，引進減少有害物質的設備、使用替代氣體。

7.作爲絶緣體者，於製造及檢驗時加以收集。

8.作爲鎂的防燃劑，減少使用並使用替代氣體。

3.2.4 日本碳氟化合物回收方案

日本碳氟化合物回收方案主要架構在 3 個法案中，分別爲「碳氟化合物回收破壞法」(2007 年 10 月 1 日修訂採取更嚴格的規範)、「車輛回收法」及「家電回收法」。

「碳氟化合物回收破壞法」管制對象涵括臭氧層破壞物質及溫室氣體，主

要規範工商業使用的特殊設備、空調、冰箱，要求碳氟化合物使用業者，必需交由回收業者處理。2007 年 10 月修訂時，新增要求建物拆除前需先確認是否有需回收的相關設備，建物所有人需委託建築業者或碳氟化合物回收業者進行回收，並應取回收處理結果(回收量)的回報單。費用係由建物所有人負擔。該法對最終使用者、回收業者、破壞者、地方政府及執法者均有規範其應盡的義務。回收業者、收集者及破壞者未經政府認可執行業務，將處 50 萬日幣以下罰款，隨意排放碳氟化合物爲該法所禁，違者處 50 萬日幣以下罰款。該法實施前係由業界自願減量，2001 年碳氟化合物的回收量爲 1225 MT，2002 年該法施行後，回收量增加爲 1958 MT，2006 年回收量已達 2541 MT，其中以 HCFC 的回收量最大。

「家電回收法」主要由銷售商店負責交由處理業者回收，回收對象包括空調、冰箱、電視及洗衣機。2006 年碳氟化合物的回收量爲 1933 公噸，回收率尚非百分之百，但稍加努力即可提升回升率。

「車輛回收法」於 2004 年 1 月開始執行，回收費用在新車購入時已預付，每 2 年車輛檢驗 1 次，均要求出示已付費證明，凡註冊有案者，回收費用由日本汽車回收促進中心支付。近年來車輛總破壞量持續增加(由 2002 年的 389 公噸成長到 2006 年的 771 公噸)，但因執行碳氟化合物的回收具有成效，故其使用量呈減少趨勢。

日本碳氟化合物的回收涉及所有者、破壞者及回收者等，層面廣泛，該國評估到目前爲止相關回收處理費用已高達 1000 億日幣，相較於回收量，其成本效益實待商榷，但因人民期待政府有所作爲，故日本政府仍努力朝回收再利用方向努力，以壓低成本。

3.3 日本參與京都機制概況(李碧鈴)

3.3.1 日本目標

依據內閣於 2005 年 4 月提出的「京都議定書目標達成計畫」，日本政府需運用京都機制減少溫室氣體排放量 1.6%，相當於 2008 年至 2012 年 5 年間需取得 1 億公噸 CO_2 排放量。

3.3.2 京都機制概要

京都議定書有鑑於各國對溫室氣體減量空間有限或有其困難，故提供了跨國合作的彈性減量 3 種機制，分別於京都議定書第 6 條、第 12 條及第 17 條提供跨合作減量的管道，即爲「共同減量（Joint Implementation, JI）」（第 6 條）、「清潔發展機制（Clean Development Mechanism, CDM）」（第 12 條）與「排放交易（Emissions Trading，ET）」（第 17 條）。以下就 3 種彈性減量機制簡要介紹：

1.共同減量（JI）

爲議定書附件 1 國家之間的跨國技術合作溫室氣體減量機制。一個已開發國家提供資金技術予另一個已開發國家實施共同減量計畫所得到的削減量（Emission Reduction Units, ERU）可以轉讓給原提供資金技術的國家。

2.清潔發展機制（CDM）

爲議定書附件1國家(已開發國家)與非附件1國家(開發中國家)之間的減量技術合作機制。一個已開發國家提供資金技術予另一個開發中國家實施共同減量計畫所得到的削減量，經由「排放減量認證（Certified Emission Reductions，CER）」轉回給原提供資金技術的國家。CDM 被認爲是一項「雙贏」機制，一方面開發中國家可透過合作獲得資金和技術，有助於國家的永續發展；另一方面已開發國家可以大幅度降低其在國內推行排放減量所需的高昂費用。

此外，京都議定書第 12 條對「清潔發展機制」的其他規定尚包括:1.鼓勵與允許政府與民間實體的參與；2.所減少的排放減量，須要符合「額外性」的原則，也須要符合實際的、可測量的及長期的氣候變遷減緩效益；3.議定書締

約國會議的公約締約國大會(COP/MOP)可以指定經營實體來驗證所達成的排放減少量，並進行獨立的審計與查核活動；4.由「清潔發展機制」計畫所得到收入的一部份，將用以支付行政理費用與協助易受氣候變遷不利影響國家支付適應費用；5.「清潔發展機制」的管理將由議定書締約國會議的公約締約國大會（COP/MOP）來指導，並由執行理事會來監督。

3.排放交易（ET）

也爲議定書附件 1 國家之間的跨國技術合作機制，係由附件 1 國家在 2008 至 2012 年間若有高初期指定削減限量（AAU）之排放量，則可將其以貿易的方式賣給其他未能完成減量排放義務的附件 1 國家，以達成京都議定書規範的減量目標。排放交易允許附件 1 國家間以減量信用的買賣，幫助各締約國達到其減量目標。與 JI 不同，ET 並不需要提出合作計畫，而是直接進行國家與國家間的移轉交易。

活用京都機制具有 2 大意義，即 1.協助締約國達成減量目標，2.以全球角度協助開發中國家共同減量。

3.3.3 CDM 開發情形

日本強調該國推行節約能源多年，已具成效，然而持續削減的成本已較歐盟及美國高很多，故該國積極參與運用京都機制，藉以降低國內溫室氣體減量的成本。另一方面，日本認爲運用京都機制協助開發中國家如印度、中國等，可兼顧開發中國家及本國的經濟發展，同時照顧到溫室氣體的減量，經由雙方的努力，減量的效果會更好。

日本產經省和環境省非常支持日本企業的清潔發展機制。自「京都議定書」生效以來，獲批准的清潔發展機制專案直線上升。這些清潔發展機制在包括馬來西亞、印度、南韓、中國和越南等在內的亞洲國家展開。不少專案已在聯合國清潔發展機制執行理事會註冊，受其監督和管理。在此趨勢下，日本企業將加快它們的清潔發展機制專案投資。同時，日本政府通過修改兩項法律，保障「京都議定書」的三大機制能全面運行。在新法下，環境省和經濟產業省把京都機制排放權的工作委託給新的獨立行政法人「新能源與產業技術綜合開發機構」（NEDO）執行，由其向聯合國申請登記代表日本政府採購。

申請登錄爲 CDM 計畫的簡要流程如下：由 NEDO 進行技術可行性調查→由事業主體提計畫草案→經已開發國家及開發中國家雙方政府承認＋第三者審查機關進行審查→CDM 理事會審查→CDM 理事會登錄→計畫實施並進行中長期監測→CDM 理事會進行削減量檢驗認證→CDM 理事會對已認證的削減量進行排放權 CER 的發行及事業者分配→分配給計畫申請業者。日本 2005 年及 2006 年間由 NEDO 進行技術可行性調查的計畫數爲 39 件，目前日本政府承認的 CDM 計畫計有 242 件，第三者審查機關進行審查中的案件計有 1666 件(合計 10 億 4200 萬噸 CO_2 當量)。依據聯合國環境規劃署(UNEP)2007 年 11 月 1 日資料顯示，已經聯合國登錄的 CDM 計畫共有 827 件，共約 10 億 8800 萬噸 CO_2 當量；登錄申請中的計畫共有 2701 件，共約 22 億 8800 萬噸 CO_2 當量。其中日本政府承認的 CDM 計畫，已經聯合國 CDM 理事會登錄者計約 2 億 7175 萬噸 CO_2 當量；登錄申請中者約 1 億 8924 萬噸 CO_2 當量。CDM 計畫的地域分佈主要在中國(占 52.8%)、印度(占 15.5%)；技術區分主要爲 HFC 及 PFC 減量(占 21.9%)、CH4 回收(占 16.3%)、水力發電(占 12.6%)、省能(占 11.4)%。

3.3.4 日本政府取得溫室氣體排放權概況

日本政府認爲取得溫室氣體排放權的相關作法應從「成本效益」及「協助開發中國家」的角度思考，應盡最大的努力取得排放權，惟應嚴格評估及管理、注意分散、原則公開招募，且需進行國際風險評估及對當地居民的影響等詳加考量，並善用 NEDO 機構。

NEDO 機構爲日本負責取得國際排放權的執行機關，其爭取排放權的費用來自政府的一個專門帳戶，預算來源包括下列 2 項，爲 1.由環境省及經濟產業省分別編列預算；2.國庫負擔。日本 2006 年上開 2 項預算分別爲 49 億日元及 122 億日元；2007 年爲 122 億日元及 407 億日元；2008 年爲 316 億日元及 836 億日元。該經費明顯成長。由 NEDO 與環境省及經濟產業省簽訂委託契約，公開招募民間業者辦理清潔發展機制的審核、簽約、撥款與取得排放權等工作。

NEDO 取得國際排放權的途徑有 3 種，分別爲 1.直接取得：即直接參與 CDM 計畫取得聯合國 CDM 理事會排放權分配；2.間接取得：爲最簡單的方式，係以公開招募方式徵求開發中國家擁有聯合國 CDM 理事會發行排放權的計畫

業者，並與之簽訂購買契約方式取得；3.直接向排放權擁有者採購：聯合國預訂 2008 年開始進行交易。NEDO 公開招募 CDM 計畫係在日本國內進行，訂有各項評估項目等以確保制度的透明性，其價格的評定須考慮諸多因素審慎評估。2006 年及 2007 年 NEDO 經由間接取得及直接取得的案件數有 6 件(部分已認證，部分尚在審議中)，合計總量爲 857.4 噸 CO_2 當量。

3.3.5 當前京都議定書存在的問題

當前運用京都機制，由已開發國家提供資金、技術等協助開發中國家的作法，其效果已獲質疑。主要原因在於開發中國家的排放量一直呈增加趨勢。日本認爲光靠 CDM 機制已無法解決問題，京都議定書應檢討將開發中國家一併納入減量要求。

3.4 亞洲地區碳通量研究現況與趨勢(張順欽)

聯合國開發計畫署發表的報告開宗明義指出「氣候變化已是經科學證明的事實」，該報告說明氣候變化可能爲全球貧窮人口帶來浩劫，要對付這個問題，必須減少溫室效應氣體，所需經費占全球每年國內生產總值(GDP)的 1.6%。UNDP 在這份名爲「對抗氣候變化」的報告中，描繪了氣候變化問題令人心驚的景況，並敦促富有國家在 2050 年前至少減排溫室效應氣體 80%，而在 2020 年前應減少 30%。聯合國建議的減排量雖然「吃力，但做得到」。從現在到 2030 年，每年減排所需經費平均將達全球 GDP 的 1.6%，但報告中指出：「這雖然是不小的投資，但還不到全球軍事支出的三分之二，如果不採取行動，付出的代價會高出很多。」

爲深入瞭解碳循環，以因應全球暖化議題，東亞地區目前約有 120 餘個通量塔，其中大約有 50 餘個係日本興建，這些通量塔有一半是固定設施，其餘則是進行短期研究。最早二個站是農林水產省於 1992 至 1993 年間建造，針對水稻田及草地進行研究。經產省則於 1993 年於高山建站進行研究。1997 年京都議定書簽署後，日本開始進行森林碳匯相關研究，其中海道建造的通量塔最具代表性。林野廳森林綜合研究所 1997 年也在北海道由北至南建了五個通量塔。此外，在日本南方二個小島建立了背景站，進行空氣中二氧化碳背景濃度長期觀測。

3.4.1 碳循環研究背景

根據美國 NOAA 位於夏威夷 Mauna Loa 背景測站的長期觀測發現，CO_2 濃度除了明顯的季節性變化之外，長期濃度呈現上升趨勢。從 1955 年低於 320 ppm 到 2006 年已經超過 380 ppm，已成爲全球暖化議題中最受到關注的問題。美國 NOAA 位於夏威夷 Mauna Loa 背景測站 CO_2 濃度長期變化如圖 3.1。

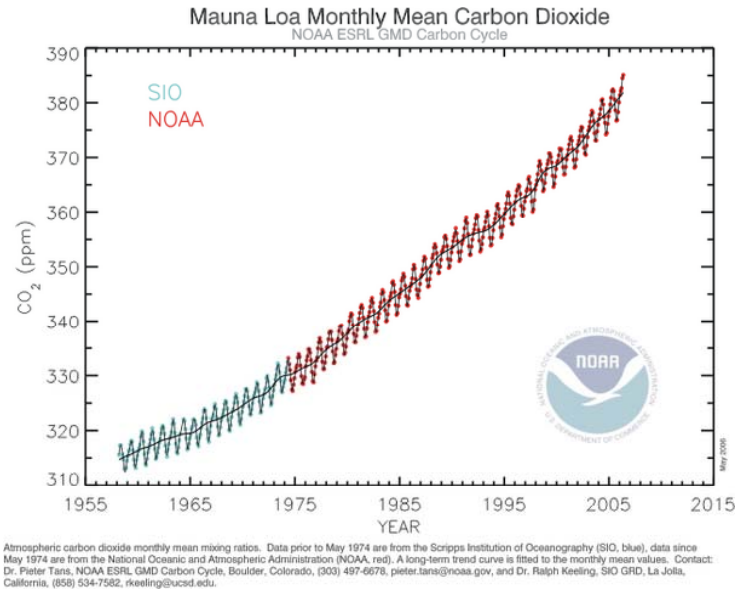


圖 3.1、夏威夷 Mauna Loa 背景測站 CO_2 濃度長期變化趨勢

大氣中 CO_2 濃度的變動包括了地域性的變化、物候變化等，由於人爲干擾日趨嚴重，全球碳平衡產生很大影響。

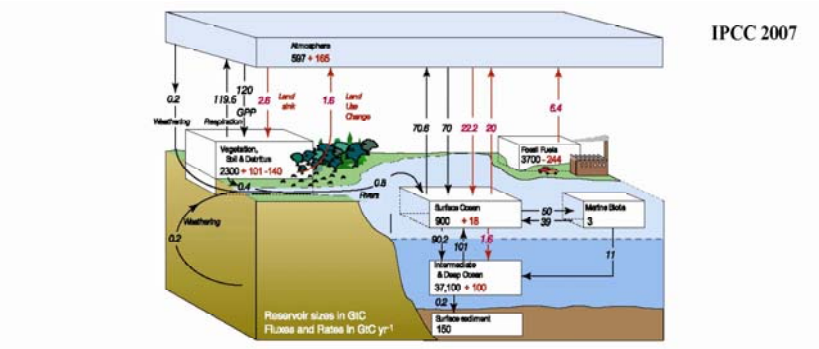


Figure 7.3. *The global carbon cycle for the 1990s, showing the main annual fluxes in GtC yr⁻¹: pre-industrial 'natural' fluxes in black and 'anthropogenic' fluxes in red (modified from Sarmiento and Gruber, 2006, with changes in pool sizes from Sabine et al., 2004a). The net terrestrial loss of ~39 GtC is inferred from cumulative fossil fuel emissions minus atmospheric increase minus ocean storage. The loss of ~140 GtC from the 'vegetation, soil and detritus' compartment represents the cumulative emissions from land use change (Houghton, 2003), and requires a terrestrial biosphere sink of 101 GtC (in Sabine et al., given only as ranges of ~140 to ~80 GtC and 61 to 141 GtC, respectively; other uncertainties given in their Table 1). Net anthropogenic exchanges with the atmosphere are from Column 5 'AR4' in Table 7.1. Gross fluxes generally have uncertainties of more than ±20% but fractional amounts have been retained to achieve overall balance when including estimates in fractions of GtC yr⁻¹ for riverine transport, weathering, deep ocean burial, etc. 'GPP' is annual gross (terrestrial) primary production. Atmospheric carbon content and all cumulative fluxes since 1750 are as of end 1994.*

圖 3.2、1990 年全球碳循環示意圖

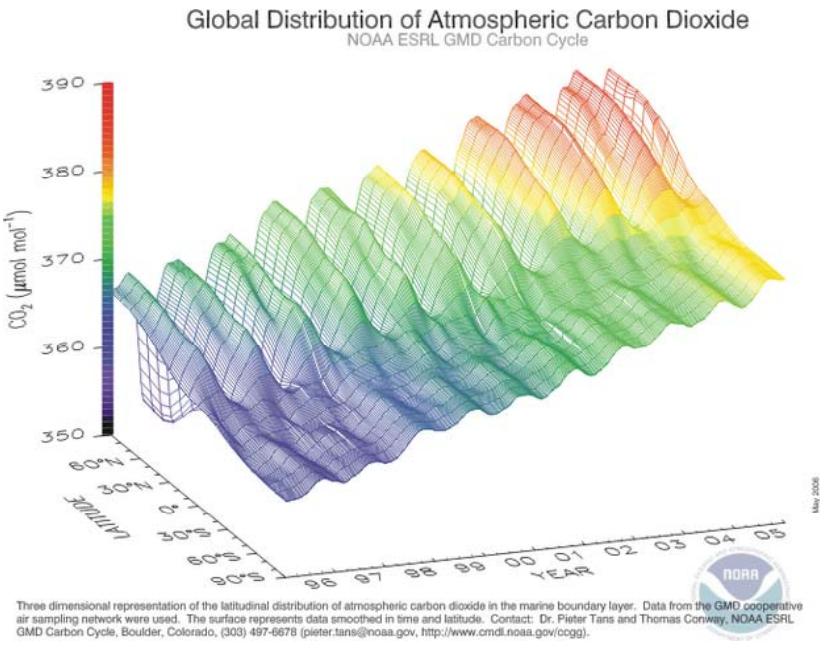


圖 3.3、1990 年全球 CO_2 濃度分布圖

對於未來 CO_2 濃度預估，七個國家 11 個模式估算結果，2100 年 CO_2 濃度可能上升至 730 至 1020 ppm 之間，其間差異性相當大。

這些預估指出氣溫可能上升 2 至 4ºC，根據 IPCC2007 年預估則大約 1.1 至 6.4ºC。CO_2 濃度上升的原因包括化石燃料大量使用、大面積森林伐採及土地利用變更等。氣溫的改變將造成陸域生態的系統的反饋作用，其中之一則是促進土壤呼吸作用，使得土壤中有機碳大量釋出，結果則是造成空氣中 CO_2 濃度大幅增加。

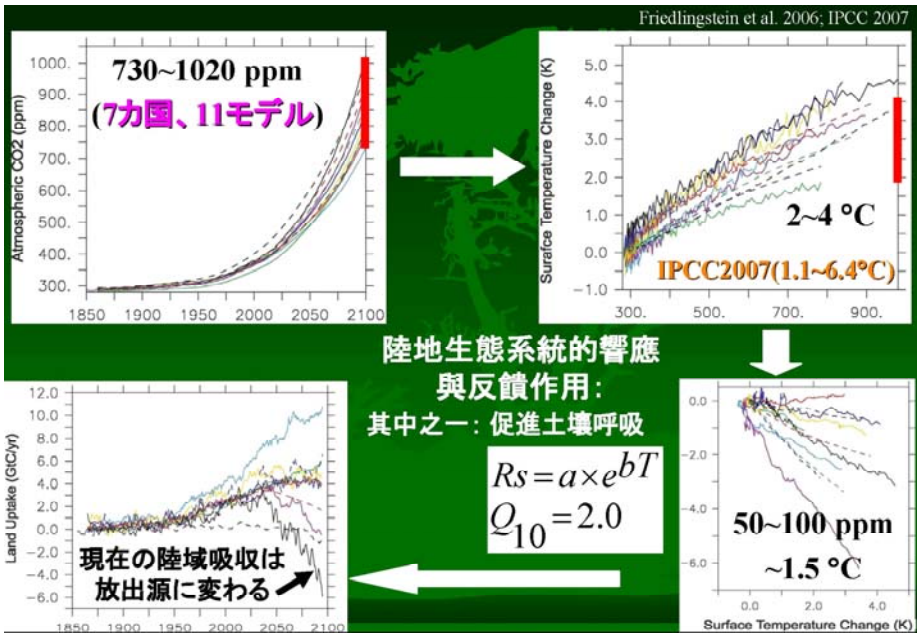


圖 3.4、全球 CO_2 未來濃度推估及陸域生態之影響

1.京都議定書(Kyoto Protocol)

1992 年各國政府聯合國氣候變化框架公約，又稱 UNFCCC，UNFCCC 自地約之日起已有 185 個國家參與，爲目前全球現存唯一關於抑制全球暖化的公約。歷經八屆會議，1997 年終於形成了關於限制二氧化碳排放量的成文法案。當該屆會議大會結束後，該公約已初具雛形，並以當屆大會舉辦地點命名，稱之爲京都議定書。

京都議定書(Kyoto Protocol)規定工業化國家將在 2008 年至 2012 年之間，使他們的全部溫室氣體排放量比 1990 年減少 5%。限制排放的溫室氣體包括二氧化碳、甲烷、氧化亞氮(N_2O)、氫氟碳化物(HFCS)、全氟化碳(PFCS)、六氟化硫(SF_6)。爲達到限排目標，各參與公約的工業化國家都被分配到了一定數量的減少排放溫室氣體配額。如歐盟分配到的減排配額大約是 8%。

表 3.5 各國森林在 CO_2 吸收能力

國　別	減排目標	吸收源
Australia	8%	-3.0%
Canada	-6%	-7.5%
Russia	0	-2.0
America	-7%	0(?)
Japan	-6%	-3.9%
EU-15	-8%	-0.5%

2.溫室氣體對全球溫暖化之影響

各種溫室氣體對於全球暖化的影響如圖 1，以 CO_2 佔 64%最大，其次爲甲烷佔 19%，氟化物則佔了約 10%。

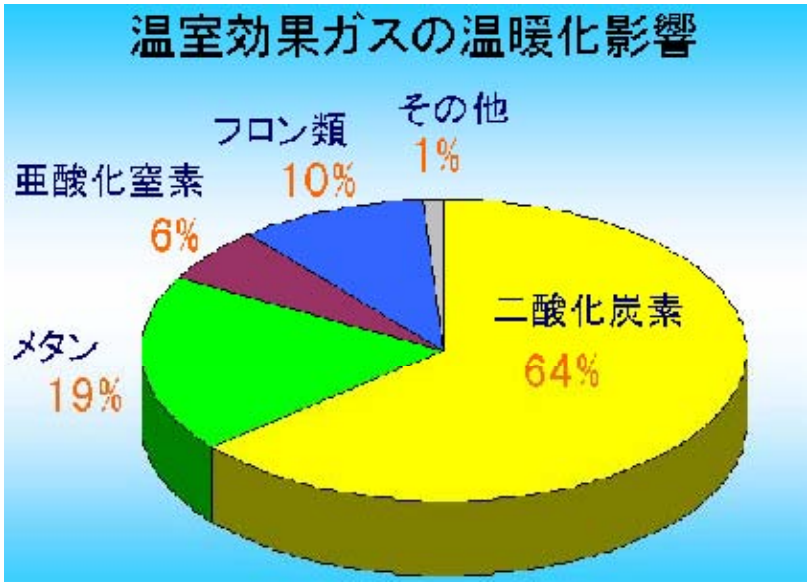


圖 3.5、溫室效應氣體對全球暖化之影響比例

以 1994 年 CO_2 排放量比較，日本大約占全球 4.9%，位居全球第四位，僅次於美國 22.4%，中國 13.4%及俄國 7.1%。次於日本的包括印度 3.8%、德國 3.5%、非洲 3.4%等。

3.日本溫室氣體減量 6%目標之達成方式

日本氣候變化對策推進總部 2002 年 3 月 19 日根據聯合國氣候變化框架公約第七次締約會議(COP-7)達成之馬拉喀什協議，對 1998 年氣候變化對策大綱進行修改，推出氣候變化對策新大綱，新大綱制定了日本氣候變化對策的基本方針， 並對實現京都議定書 6%的削減目標進行分配，新大綱推出後受到了日本各界廣泛關注，也受到非政府組織及新聞媒體的質疑。比較日本新舊大綱中對於實現溫室氣體減量 6%目標的差異如表 1。

表 3.6、2002 年日本調整後之 CO_2 減量策略

	新大綱	舊大綱
與能源相關的 CO_2 排放削減對策	±0 %	±0 %
(節能對策/核電廠建設/新能源對策)	產業-7 %	產業-7 %
	民生-2 %	民生±0 %
	運輸+17 %	運輸+17 %
技術創新及社會各界進一步努力	-2 %	-2 %
吸收匯(最大限度利用)	-3.9 %	-3.7 %
利用京都機制	-1.6 %	±0 %
非能源領域的排放削減策略	-0.5 %	±0 %
(CO_2/N_2O/CH_4)		
代替海龍等三種氣體的排放削減對策	+2 %	±0 %
合計	-6 %	-6 %

對於森林吸收源的定義，京都議定書也有所規範，包括植生回復(revegetation)、森林管理(forest management)、農地管理(cropland management)、牧草地管理(grazing land management)等，如下表。依據聯合國食糧農業機關(FAO: Food and Agriculture Organization of the United Nations)給予森林的定義則須面積 0.5~1.0 公頃，且樹冠率 10%以上。

日本政府爲了達成京都議定書 6%的減量目標，在植林上面下了很大工夫，包括重新造林，或者農村人口減少後，將原有農地逐漸改爲林地，或者加強林地管理等。也因此集中邀請全國各單位進行相關研究，其中成立 Asia fluxnet 就是用來進行碳循環的研究。另一方面也是中、日、韓三國過去針對黃沙現象的研究已經多有所了解，碳循環研究爲目前較受矚目的研究方向。

表 3.7、京都議定書 CO_2 吸收源之定義

表 3　3 条 3 項吸収源の定義一覧

活動名	定義	イメージ
植林（新規）	少なくとも 50 年間は森林状態になかった土地を、直接人為的に森林に転換する活動。	
再植林	一旦は森林地帯であった土地を再度直接人為的に森林に転換する活動。第一約束期間に関しては、1989 年 12 月 31 日の時点で森林状態でなかったことが条件となる。	
森林減少	森林を非森林に転換する直接人為的活動。	

注）定義は石井・山形『プロンタ COP6 議長の包括的合意文書提案（2001 年 6 月 18 日）：吸収源の分析―速報版―』（2001）の仮訳に拠った。図は山形・山田（2000）から転載した。

表 4　3 条 4 項吸収源の定義（暫定）

活動名	定義
植生回復 (revegetation)	0.05 ヘクタール以上の植生回復を行うことによって炭素蓄積量を増加させる直接人為的な活動。ただし、当該活動は 1990 年 1 月 1 日以降に開始され、上記の植林、再植林の定義に当てはまらないもののみに限定される。
森林管理 (forest management)	環境（生物多様性を含む）、経済、社会的機能を発揮させることができるように森林を持続的に管理する取り組み。当該活動は 1990 年 1 月 1 日以降に開始されたものに限定される。
農地管理 (cropland management)	農作物耕地や農作物の休耕地を管理する取り組み。ただし、1990 年 1 月 1 日以降に開始されたものに限定される。
牧草地管理 (grazing land management)	植物や家畜生産の量と種類を管理する取り組み。ただし、1990 年 1 月 1 日以降に開始されたものに限定される。

出典：UNFCCC (2001), p.6.

3.4.2 森林功能

世界森林面積約爲 35 億公頃，佔陸地面積約 27%。在木材生產、森林大火、森林病蟲害、土地利用改變或者氣候變遷等等，都使得森林減少。印尼開墾原始森林以發展生質燃料造成氣候威脅，印尼急於砍伐其種植的棕櫚樹及利用棕櫚油或其產生生質燃料的印尼，將會可能導致 146 億噸的碳當量從泥炭地中被釋放的風險，此二氧化碳釋放量相當於全球一整年的總排放量。該國已將 140 萬公頃的原始森林改種植生質燃料的農林地，而且爲了加速生質燃料的利用與開發，還打算再開墾 300 萬公頃，這將會對全球氣候變遷造成巨大威脅。

圖 3.6、煉製棕櫚油之棕櫚樹

森林的演替過程其實就是碳的蓄積過程，一般估算方式，植物的乾重大約有一半的重量是碳。草地碳吸存則多蓄積在土壤。不過研究結果也顯示，原始森林對於碳的吸存幾乎爲零。

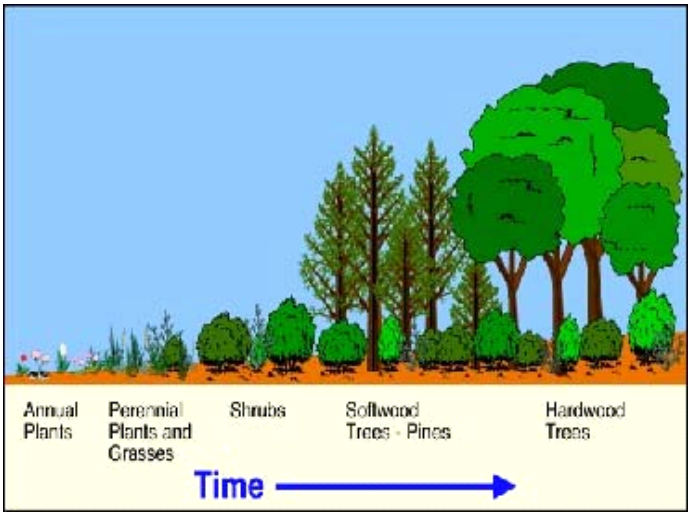


圖 3.7、森林演替過程示意圖

日本森林增加的效益，根據京都議定書大約可以達到每年一兆 2391 億円。北半球森林碳匯大約 0.6~0.7 Pg/yr，其中北美大約 0.24 Pg/yr (~40%)，歐亞大陸約 0.33 Pg/yr (~60%)，然而全球森林面積持續減少，對於全球暖化將有不良

的效應

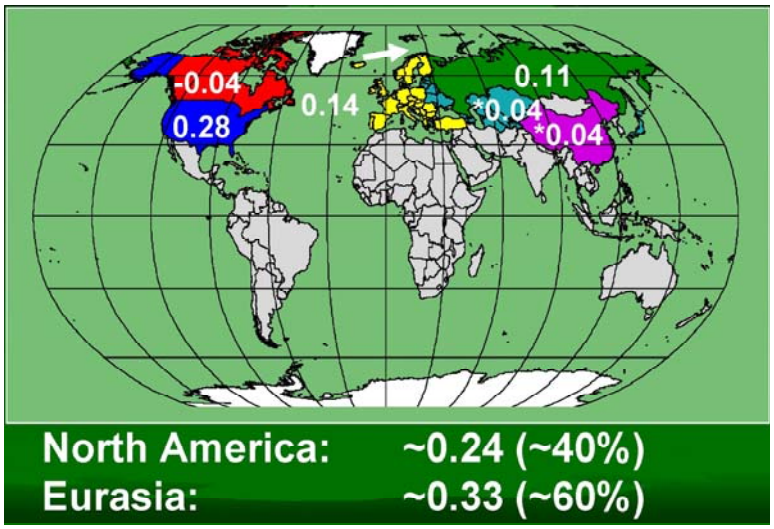


圖 3.8、森林碳吸存全球分布圖

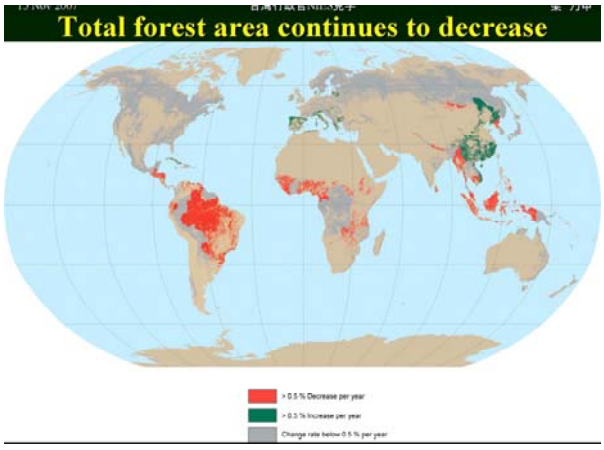


圖 3.9、森林增減全球分布圖

3.4.3 森林碳素收支之測定方法

森林對於碳吸收扮演全球碳循環重要的角色，因此，在京都議定書的 CO_2 減量目標下，測定森林的碳收支也相形重要，陸地生態系統碳循環的研究方法如圖 3.10。常用的森林碳素收支之測定方法包括生物量測定法、微氣象法、生態生理法、衛星遙測法及數學模型計算等。

圖 3.10、陸地生態系統碳循環的研究方法示意圖

1.生物量測定法

生物量測定法爲森林碳循環估算的最基本方式，也是最傳統的方法。針對特定林區進行林木成長的調查，如圖 3.11，以及落葉蒐集計算，如圖，以及地下樹根，如圖。針對林區內每棵樹木每年成長情形，及整棵樹木的生質增長情形調查等，如圖 3.12~圖 3.15，可以計算森林固碳的量。

圖 3.11、生物量測定法(樹木成長情形調查)

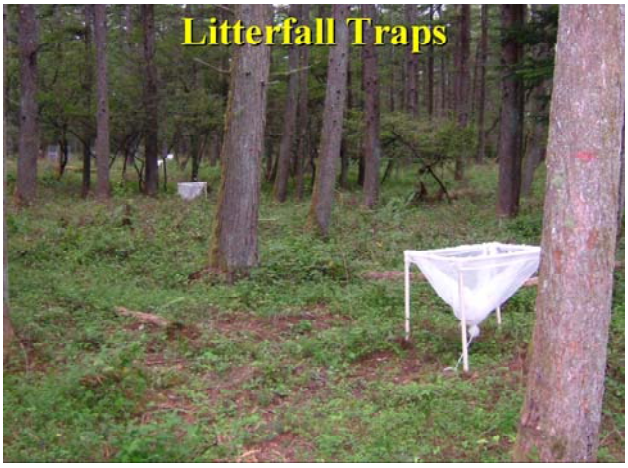


圖 3.12、生物量測定法(樹木落葉調查)

圖 3.13、生物量測定法(樹木落葉調查)

圖 3.14、生物量測定法(逐棵樹木調查)

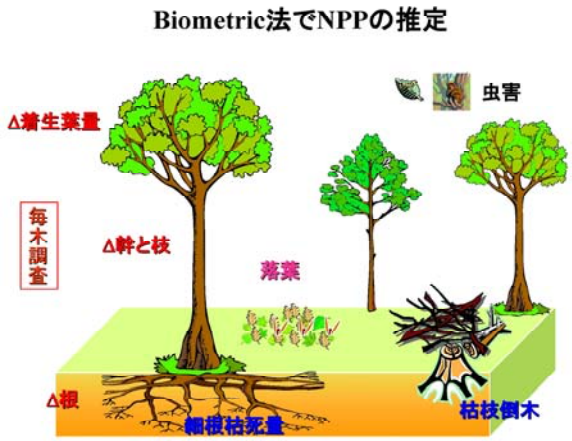


圖 3.15、生物量法測定淨生成量示意圖

生物量調查方式是以樹木的淨生產量計算之，如圖 3.16，說明如下：

淨生產量(NPP)=光合成(GPP)-生物體呼吸(Ra)

=光合成(GPP)-葉群呼吸-地上木部呼吸-根呼吸

=生質改變量+枯死量

=樹葉改變量+樹枝幹改變量+樹根改變量+枯枝落葉+枯死木+細根枯死量+蟲或動物消耗量

圖 3.16、淨生成量計算方式

日本在不同緯度地區進行多項生物量調查研究，圖 3.17 爲 Pasoh 原始林碳平衡計算示意圖。生物量調查於大約 500 公尺*1000 公尺的林區進行，初次完成調查後，約 2 至 3 年再進行一次。雖然直接但是屬於勞力密集，當林區樹種多樣性高，也就是相當不均質的情形，或者單一樹種密度低時，對於各樹種都需要掌握，調查工作也更加困難，調查的不確定性也相對提高。

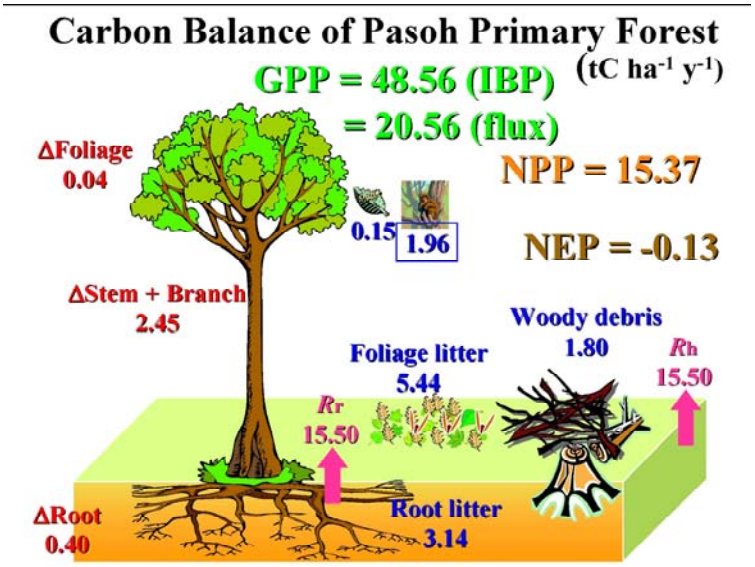


圖 3.17、碳平衡示意圖

此外，研究結果發現熱帶雨林的生物量會隨著氣候變化而改變，如圖 3.18，這些都需要長期的研究數據才能進一步探索其間的變動情形。

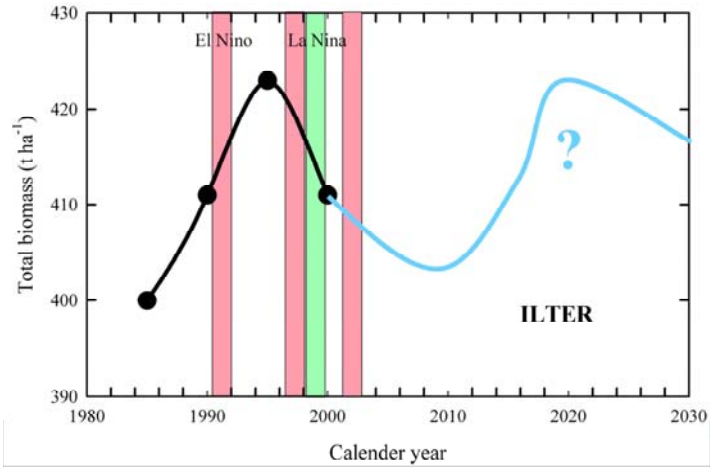


圖 3.18、熱帶雨林單位面積生物量歷年變化

2.微氣象法

傳統以生物量測定法計算碳循環雖然直接，但是相當耗費人力，而且也有許多限制，拜現代科技之賜，可以在樹冠層量測直接 CO_2 及風向、風速等即時變化(約 10 Hz)，以渦度相關法計算 CO_2 通量，圖 3.19 爲日本國立研究所在北海道的通量觀測塔。通量觀測塔的設置要求地勢平坦的林區，該站址爲不錯的地點，不過受到颱風侵襲，已經嚴重受損，包括森林亦已受到嚴重破壞。

圖 3.19、日本北海道 CO_2 通量觀測塔

渦度相關法計算 CO_2 通量的觀測因子，包括三維度風向、風速計，一般使用超音波原理進行觀測；CO_2 濃度觀測則有二種選擇，包括開徑式(Open-Path)及閉徑式(Closed-Path) CO_2 分析儀，如圖 3.20。開徑式(Open-Path)CO_2 分析儀的觀測設備直接安裝在觀測塔頂，可以快速、直接觀測 CO_2 濃度瞬時變化，省去採樣管路及分析儀站房的需求，不過儀器觀測數據容易受到霧氣或者下雨的影響，常造成資料可率降低的缺憾。閉徑式(Closed-Path) CO_2 分析儀則透過採樣管將空氣樣本採集進入儀器分析，對於天候變化的適應性較佳。

圖 3.20、三維度風向、風速計、Open-Path 及 Closed-Path CO_2 分析儀

渦度相關法(eddy covariance technique)的原理，主要針對林分尺度(大約 100 m^2~1 km^2)，以即時的 CO_2 量測搭配風向、風速等參數，計算觀測儀器下方植物的二氧化碳通量(CO_2 Flux)，如圖 3.21、圖 3.22 及圖 3.23。使用這種方法須要有一套具有快速反應的觀測儀器，架設在植物的上方，一般使用高塔，進行包括風速、CO_2、H_2O 及溫度等，隨渦流輸送的情形。不過設置這種觀測塔須要考慮渦度相關法的基本假設，包括地勢平坦、水平方向植被均質、渦流變化強度相對小於水平風速及垂直通量傳送以渦流爲主等。爲了計算二氧化碳通量，研究調查區域另須同步進行生態相關研究，包括土壤呼吸、植物光合作用、生態生產量等，如圖 3.24。

渦度相關法早先係在平坦、均質、短矮的植被上開發應用，由於水平方向具有平坦均質、渦流變化強度小於平均風速、垂直通量輸送爲渦流主導等特性，在觀測的範圍內沒有二氧化碳暫存的情況下，三維的渦流傳送，可以簡化成一維。因此可以藉由快速的觀測數據，計算、推估該區域內二氧化碳通量。

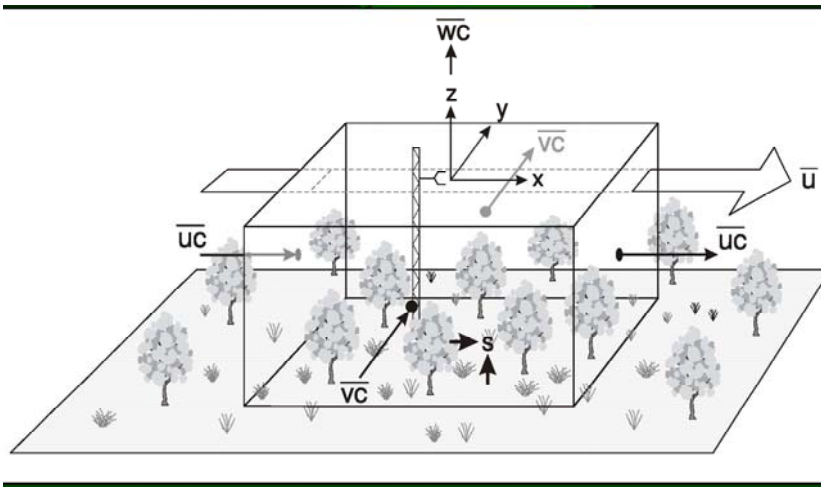


圖 3.21、渦度相關法觀測示意圖

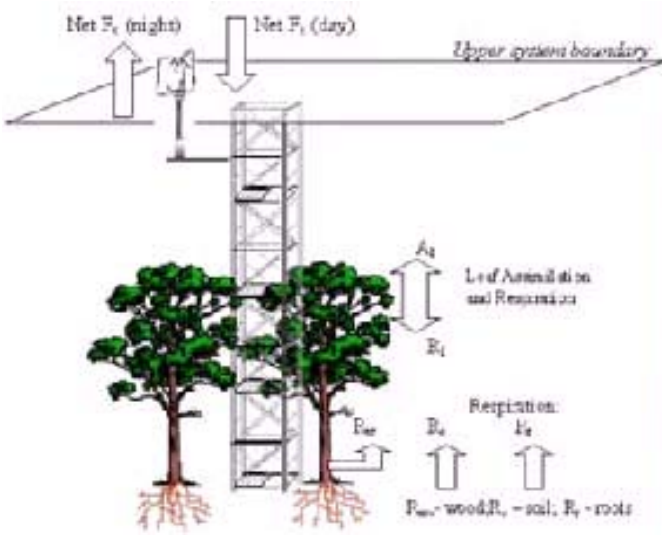


圖 3.22、渦度相關法觀測假設

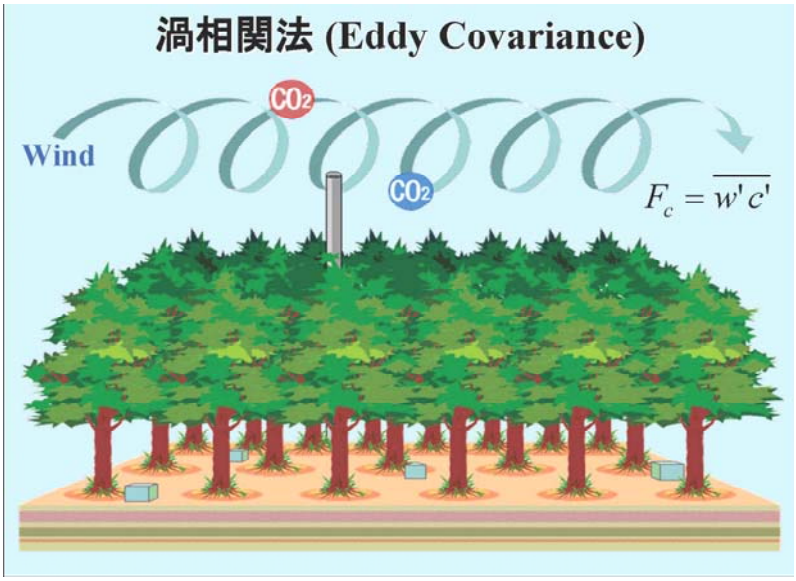


圖 3.23、渦度相關法示意圖

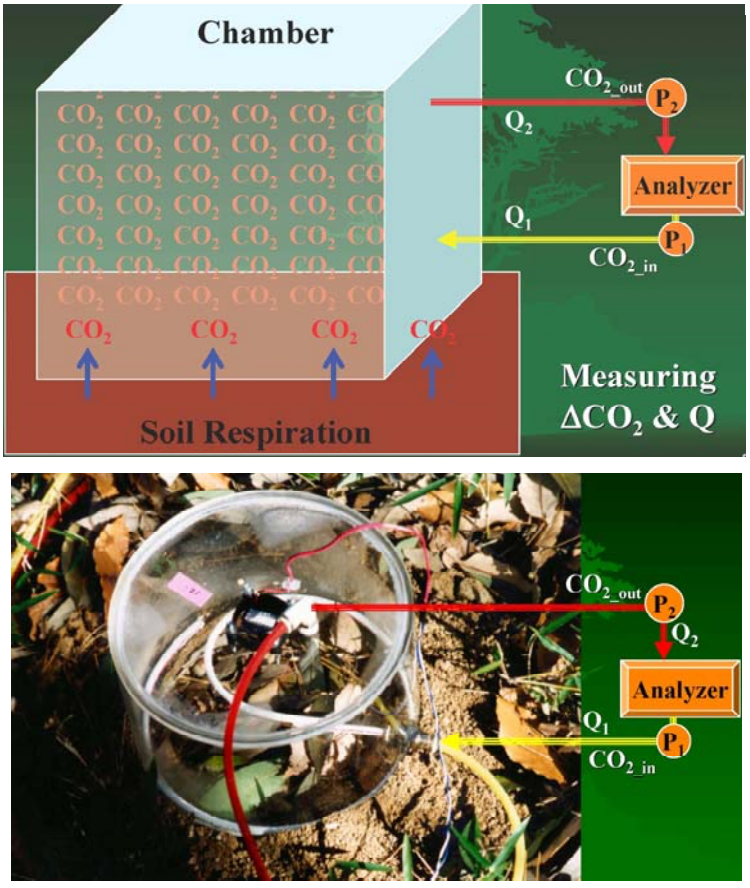


圖 3.24、土壤呼吸作用箱式觀測

這個方法應用到森林碳循環的研究時，在架設觀測塔時就必須多加考慮地形，如地勢平坦的要求是否滿足，通常山區地勢起伏少有平坦地形，是否影響水平通量？山區地形是否造成風場變化，如山風、谷風、或海陸風？甚至山區雲霧、季節性風場變化等等。這些考慮因素對於台灣的山區地形通常很難滿足。

3.4.4 亞洲 CO_2 通量觀測網

全球通量觀測網架構如圖 3.25，可以分成美洲、歐洲、亞洲、大洋洲等觀測網，以及其他非網路的觀測點。自 1990 年代開始快速成長，全球開始著手興建 CO_2 通量觀測塔，目前大約有 467 個觀測點，其中 68 個觀測塔位於亞洲，全球通量塔分布如圖 3.26。日本亞洲通量事務局在東亞各地進行的通量觀測地點分布如圖 3.27，大約有 100 至 120 個點，其中國立環境研究所有 9 個測點，中國通量觀測網已超過 60 個分布如圖 3.28。。

亞洲 CO_2 通量觀測網係結合亞洲地區大學及相關研究機構，進行陸域生態與大氣間碳、水及能量循環的逐日與季節性變化研究，以及對氣候之影響。這些研究成果在提供亞洲陸域生態碳源/匯之強度、時間特徵、對於氣候影響，作爲後京都時代(post-Kyoto protocol)各國協商的參考資訊。

亞洲 CO_2 通量觀測網已建立相關資訊網頁，提供資訊交流平台如圖 3.29 及圖 3.30。各國可以透過這個網站登錄觀測塔站及進行觀測資料交換。由於二氧化碳通量觀測受氣象條件影響，觀測資料常有中斷，如大雨、濃霧等，對於資料補遺方法的研究，方興未艾。

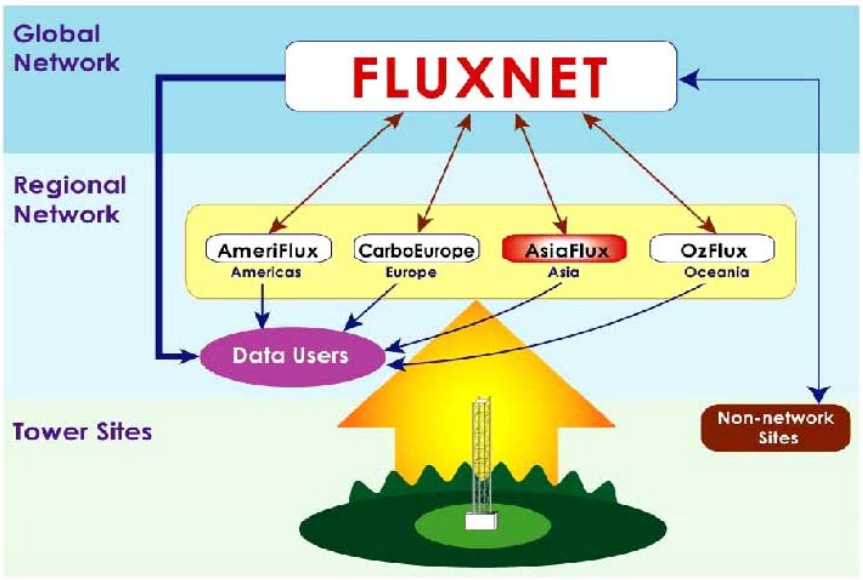


圖 3.25、全球通量觀測網架構

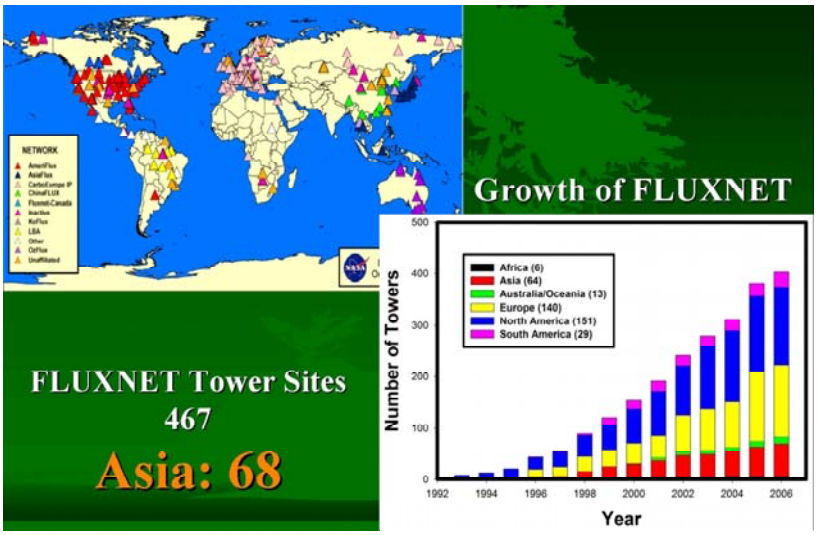


圖 3.26、全球通量塔分布圖

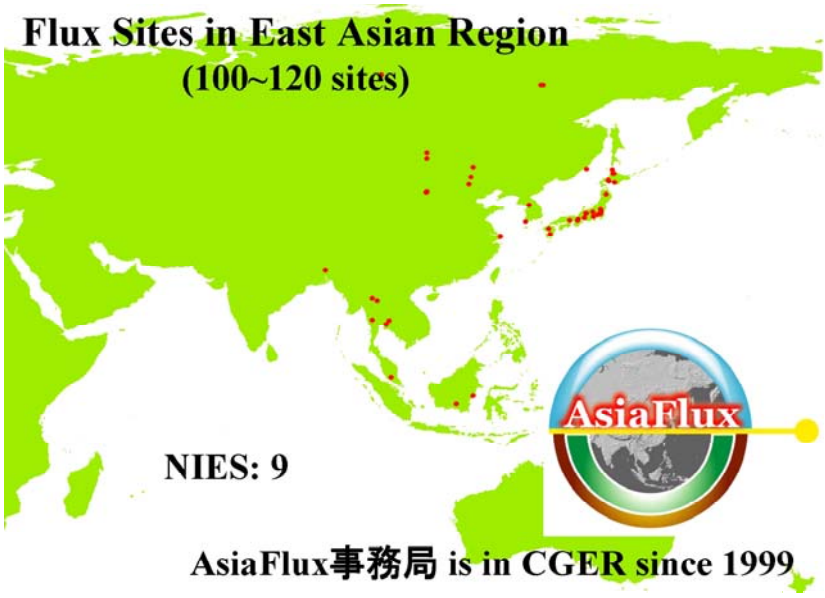


圖 3.27、國立環境研究所通量塔分布圖

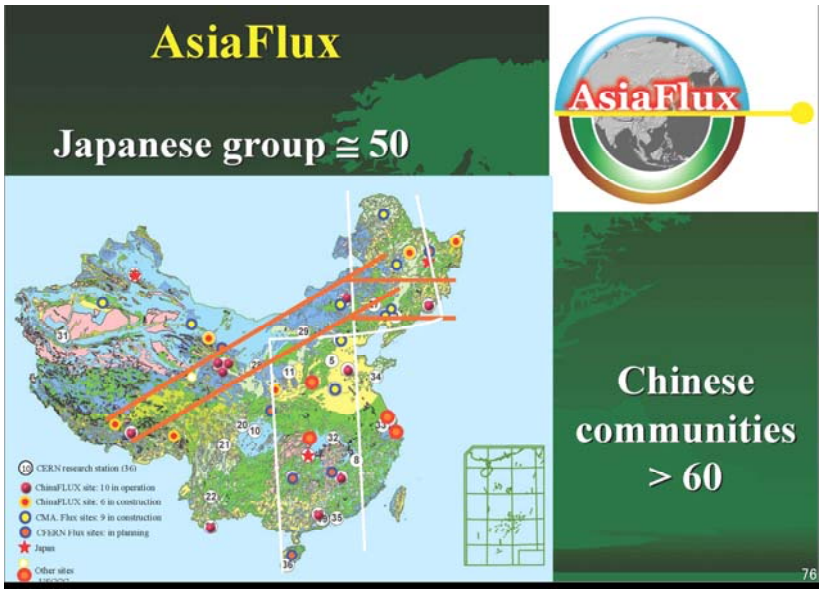


圖 3.28、中國二氧化碳通量觀測網分布圖

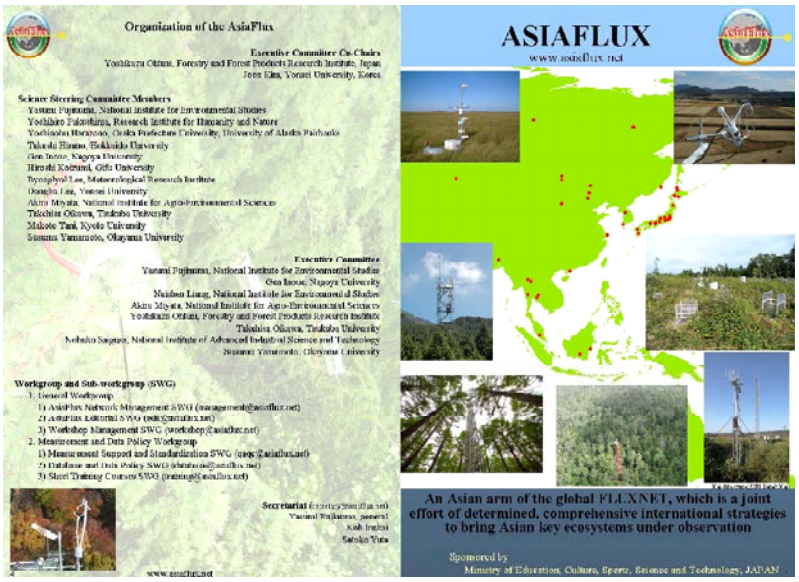


圖 3.29、亞洲二氧化碳通量觀測網

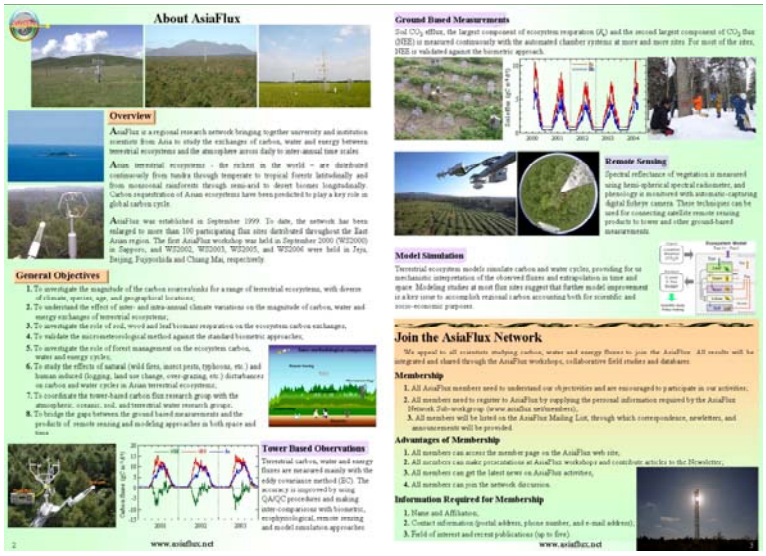


圖 3.30、亞洲二氧化碳通量觀測網研究內容

3.4.5 日本在亞洲進行之 CO_2 通量觀測研究

日本投入大量研究經費在亞洲地區進行不同緯度地區的碳循環研究，中高緯度森林的研究地點如圖 3.31，低緯度森林研究地點如圖 3.32。研究使用儀器如圖 3.33，研究結果計算示意如圖 3.34。

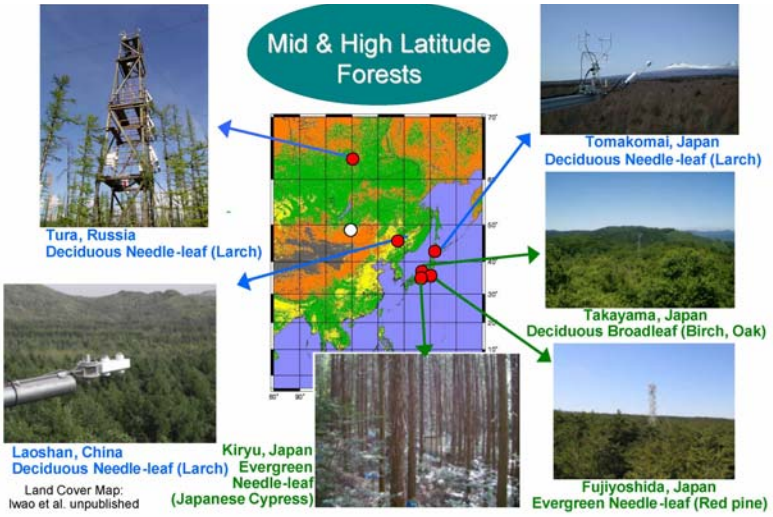


圖 3.31、中高緯度森林碳循環研究地點分布

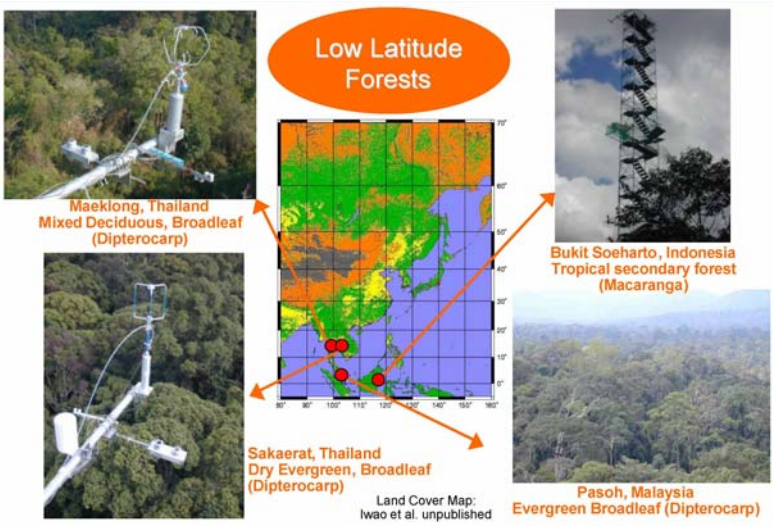


圖 3.32、低緯度森林碳循環研究地點分布

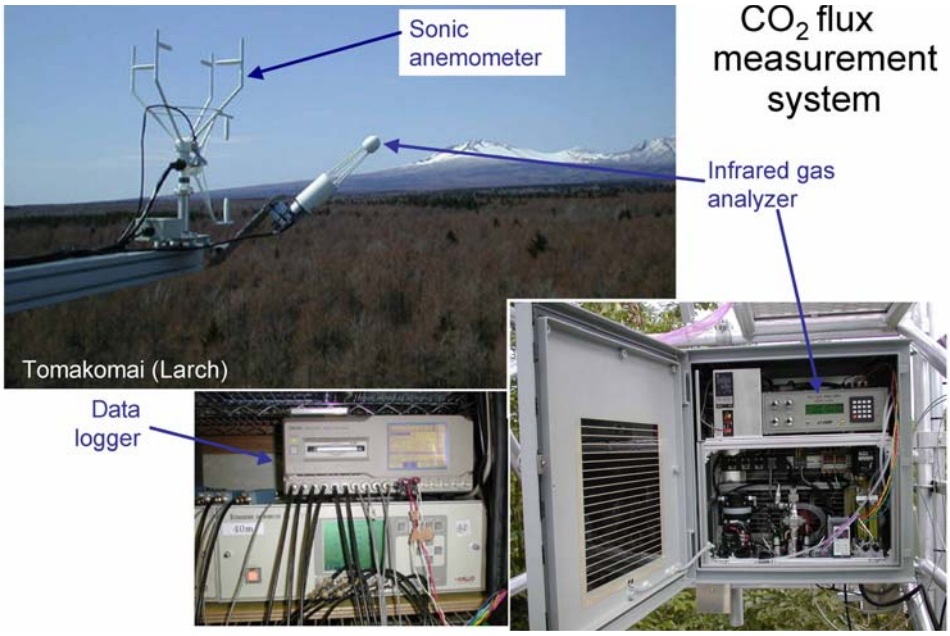


圖 3.33、碳循環研究使用觀測儀器

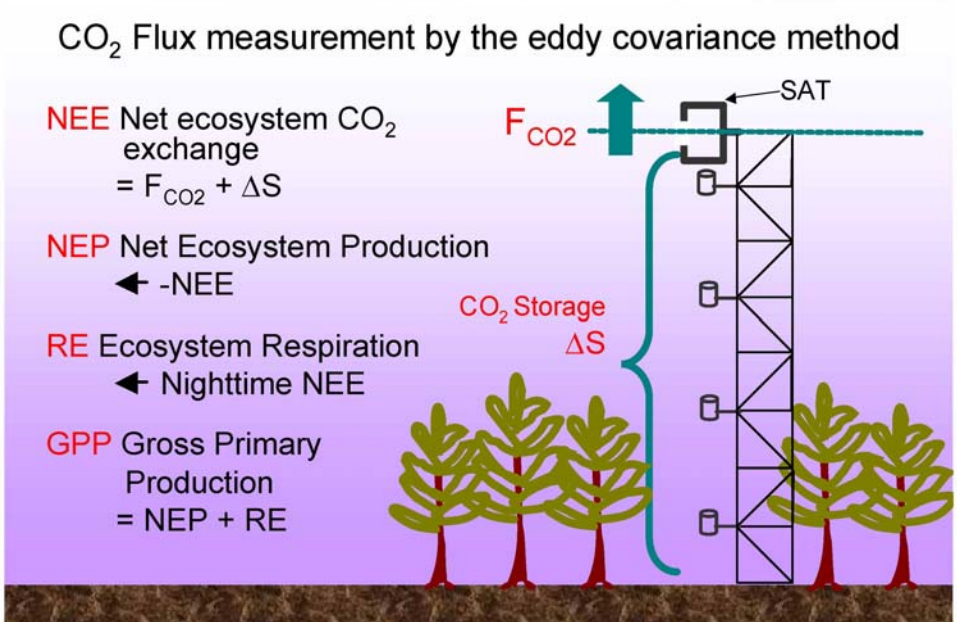


圖 3.34、碳循環研究結果計算示意圖

不同緯度森林碳循環研究結果顯示，光合作用自高緯度向低緯度遞增，高緯度的針葉林甚至僅在夏季出現微量的光合作用。光合作用季節性變化相當明顯，以夏季最高，低緯度熱帶雨林季節性變化最小，如圖 3.35。

不同緯度呼吸作用變化與光合作用相似，自高緯度向低緯度遞增，高緯度

的針葉林甚至僅在夏季出現微量的呼吸作用。呼吸作用季節性變化相當明顯，以夏季最高，低緯度熱帶雨林季節性變化最小，如圖 3.36。

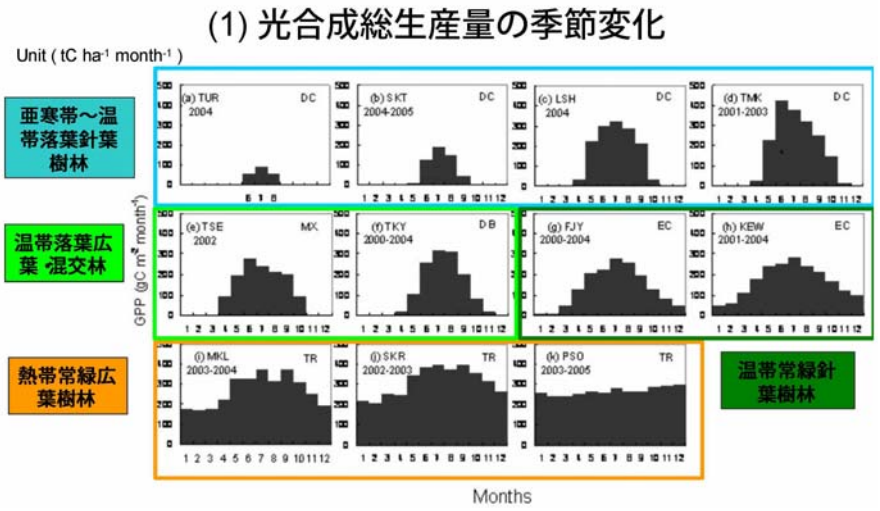


圖 3.35、不同緯度森林光合作用季節性變化

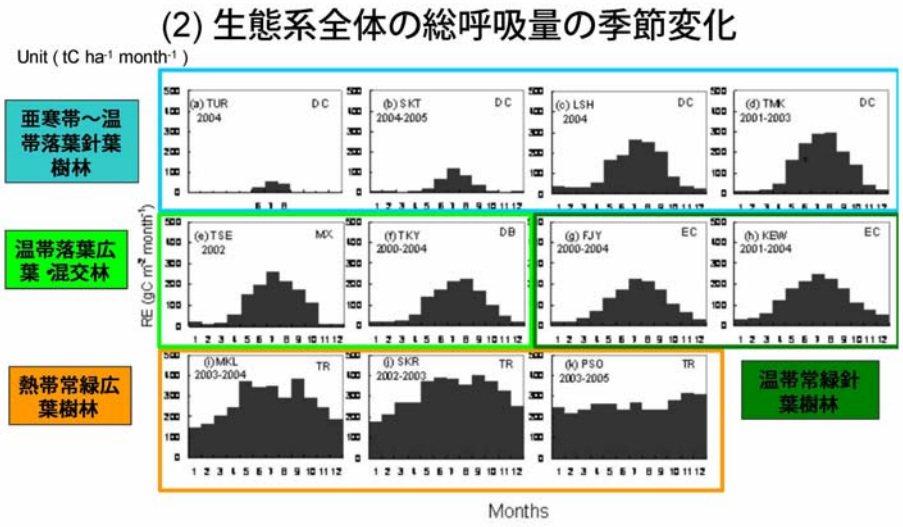


圖 3.36、不同緯度森林呼吸作用季節性變化

比對不同緯度光合作用與呼吸作用之差異，可以發現淨碳吸收量(或生態淨生產量)，也是有明顯的季節性變化。不同緯度的不同森林數種，對於淨碳吸收量存在相當大的差異。高緯度針葉林在夏季有微量淨碳吸收量，因爲光合作用及呼吸作用在冬季幾乎靜止，因此冬季淨碳吸收量爲 0。隨著緯度降低，因爲冬季呼吸作用高於光合作用，因此冬季淨碳吸收量爲負值，亦即冬季的森林爲

二氧化碳排放源。直到夏季，光合作用高於呼吸作用，淨碳吸收量轉爲正值，亦即夏季森林成爲二氧化碳吸收匯。值得留意的是熱帶原始雨林，雖然冬季光合作用依然旺盛，但是呼吸作用也不小，使得冬季的熱帶雨林反而出現淨碳吸收量爲負值，亦即爲二氧化碳排放源；夏季光合作用與呼吸作用均旺盛，淨碳吸收量不大，如圖 3.37。因此，在生態系統幾乎達成平衡的熱帶雨林對於碳匯貢獻並不是很明顯。

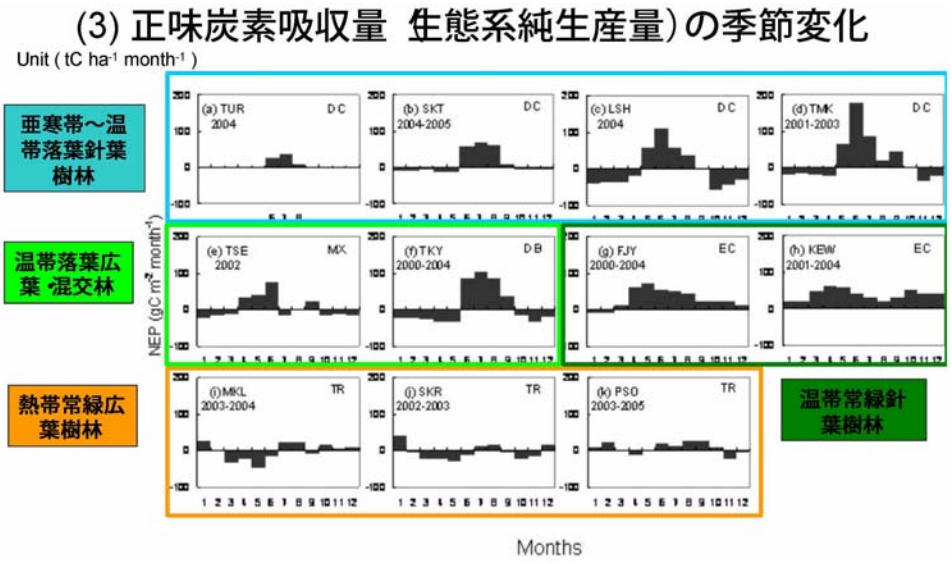


圖 3.37、不同緯度淨碳吸收量(或生態淨生產量)之季節性變化

3.6 日本溫室氣體國家通訊之建置(黎揚輝)

3.6.1 日本溫室氣體國家通訊建置之目的及原則

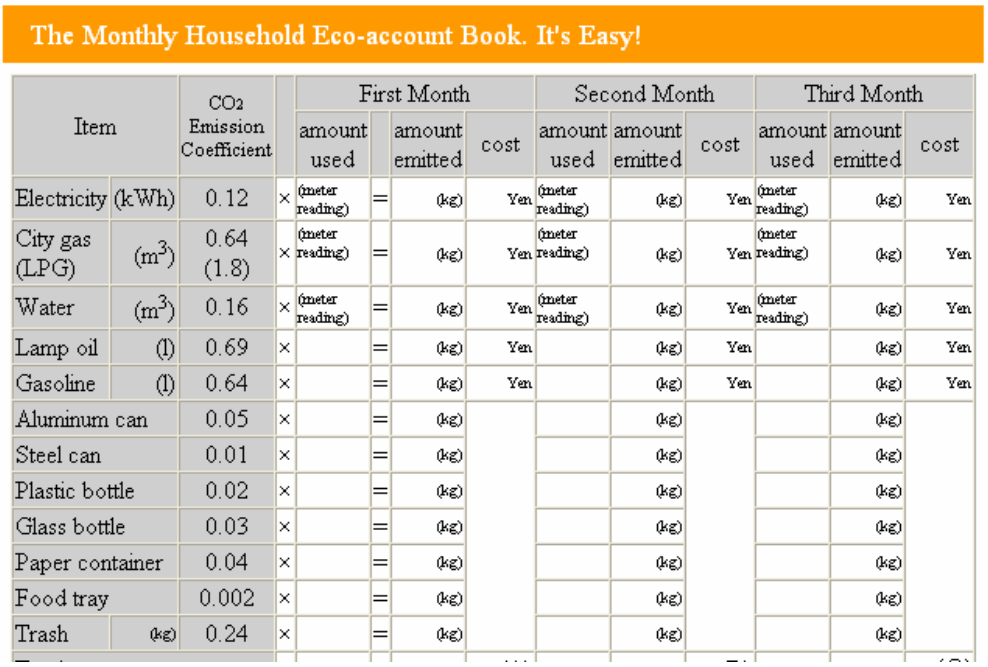
有效解決溫室氣體問題之首要工作必須先掌握溫室氣體來源及排放量，因此聯合國要求各國應公布溫室氣體國家通訊（排放量目錄清冊），由於氣候變遷與溫室氣體排放問題屬於國際環保議題，溫室氣體排放清冊必須建置一套透明公開，爲大部分國家普遍接受的方法及指引，供各國參考使用，日本建置之溫室氣體國家通訊除符合前述國際規範外，亦作爲其溫室氣體管制策略及全球氣候變遷相關問題因應調適之基礎。

現今，大部分的溫室氣體排放量還停留在估算的階段並不能被確實的測量。以致於在登錄排放量時，日本相關政府單位會更注重估算排放量所使用的方法學、係數和測量工具，以確保其估算值的準確性。

日本溫室氣體排放量估算方法的基本原理都是以活動強度乘以排放係數得出排放量，但也會因活動因子和層級而有不同的計算規範，以下爲日本各種層級之計算參考方法：

1.住家

小家庭可以使用日本環境省規劃的”家庭環保會計本”(圖 3.38)。從環境省的網站上下載這份 Excel 檔案，以簡單的填表模式來估算出日常生活中所產生的二氧化碳排放量，並鼓勵以資源回收、節省用電等方式減少碳排放。



The Monthly Household Eco-account Book. It's Easy!

Item		CO_2 Emission Coefficient		First Month				Second Month				Third Month			
				amount used		amount emitted	cost	amount used	amount emitted	cost		amount used	amount emitted	cost	
Electricity	(kWh)	0.12	×	(meter reading)	=	(kg)	Yen	(meter reading)	(kg)	Yen		(meter reading)	(kg)	Yen	
City gas (LPG)	(m^3)	0.64 (1.8)	×	(meter reading)	=	(kg)	Yen	(meter reading)	(kg)	Yen		(meter reading)	(kg)	Yen	
Water	(m^3)	0.16	×	(meter reading)	=	(kg)	Yen	(meter reading)	(kg)	Yen		(meter reading)	(kg)	Yen	
Lamp oil	(l)	0.69	×		=	(kg)	Yen		(kg)	Yen			(kg)	Yen	
Gasoline	(l)	0.64	×		=	(kg)	Yen		(kg)	Yen			(kg)	Yen	
Aluminum can		0.05	×		=	(kg)			(kg)				(kg)		
Steel can		0.01	×		=	(kg)			(kg)				(kg)		
Plastic bottle		0.02	×		=	(kg)			(kg)				(kg)		
Glass bottle		0.03	×		=	(kg)			(kg)				(kg)		
Paper container		0.04	×		=	(kg)			(kg)				(kg)		
Food tray		0.002	×		=	(kg)			(kg)				(kg)		
Trash	(kg)	0.24	×		=	(kg)			(kg)				(kg)		

圖 3.38、家庭環保會計本

2.企業

參考世界永續發展協會和世界資源協會擬定的”溫室氣體議定書”或歐盟排放交易體系的”監督和報告指導方針”規劃企業內部的排放管理系統。

3.減量計畫

參照京都議定書的共同減量機制(JI)或清潔發展機制(CDM)。

4.地方社區/市政當局-

使用 ICLEI 規劃的”城市氣候保護運動”軟體或參考美國環保署與各州政府合作編寫的”溫室氣體清冊計算法”。

5.國家

參考聯合國跨政府氣候變遷小組（IPCC）制定的”國家溫室氣體排放清冊指引”。

依據 IPCC 指引，溫室氣體種類包含二氧化碳(CO_2)、甲烷(CH_4)、氧化亞氮(N_2O)、全氟碳化物(PFCs)、氫氟碳化物(HFCs)及六氟化硫(SF_6)等六種人為產生的氣體，屬於 VOC 等前驅物亦可納入申報，未來可能納入三氟化氮(NF_3)

和五氟化硫三氟化碳(SF_5CF_3)。

日本係依循 TCCCA 原則建置其溫室氣體國家通訊，即透明性(Transparency)、一致性(Consistency)、可比較性(Comparability)、完整性(Completeness)、和準確性(Accuracy)，並與其他國家機制建立互通管道。

3.6.2 建置國家溫室氣體清冊機制

聯合國跨政府氣候變遷小組(IPCC)是由世界氣象組織(WMO)和聯合國環境規劃署(UNEP)合作成立於 1988 年，此組織致力於研究與制定國家溫室氣體排放庫存量的計算方法學，定期從科學、社會和經濟層面評估氣候變遷的影響。圖 3.39 標示聯合國跨政府氣候變遷小組的組織結構以及負責相關技術指導領域之國家。

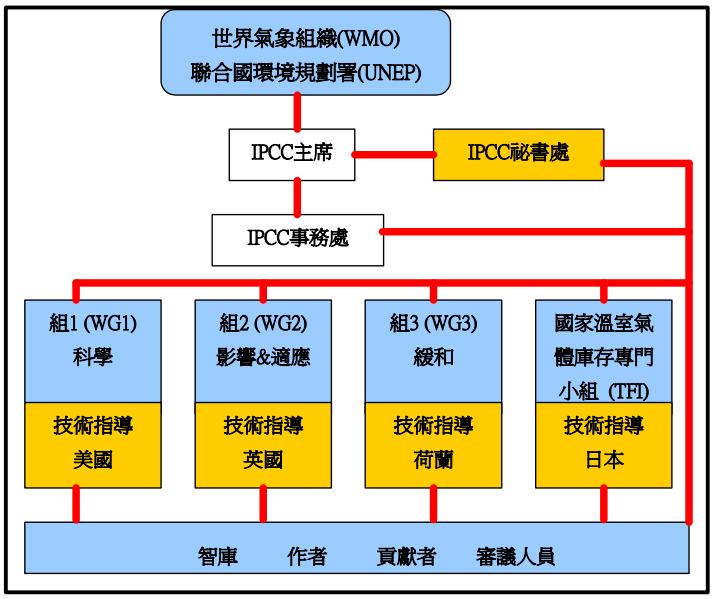


圖 3.39、聯合國跨政府氣候變遷小組的組織結構

聯合國跨政府氣候變遷小組發表過的方法學研究報告和輔助工具包括：

- 1996初版和2006年改版的聯合國跨政府氣候變遷小組指引
- 不確定性管理和操作指導方針(GPG2000)
- 土地使用，土地使用改變和山林活動操作指導方針(GPG-LULUCF)

■ 溫室氣體排放係數資料庫。

這些指導方針針對不同的領域，搭配適用的軟體工具，以最實際與可行性最高的方案幫助國際組織和各國政府部門估算出最準確的排放量，將不確定性降至最低，並建置一套完整清冊數據品質管理措施，如圖 3.40。

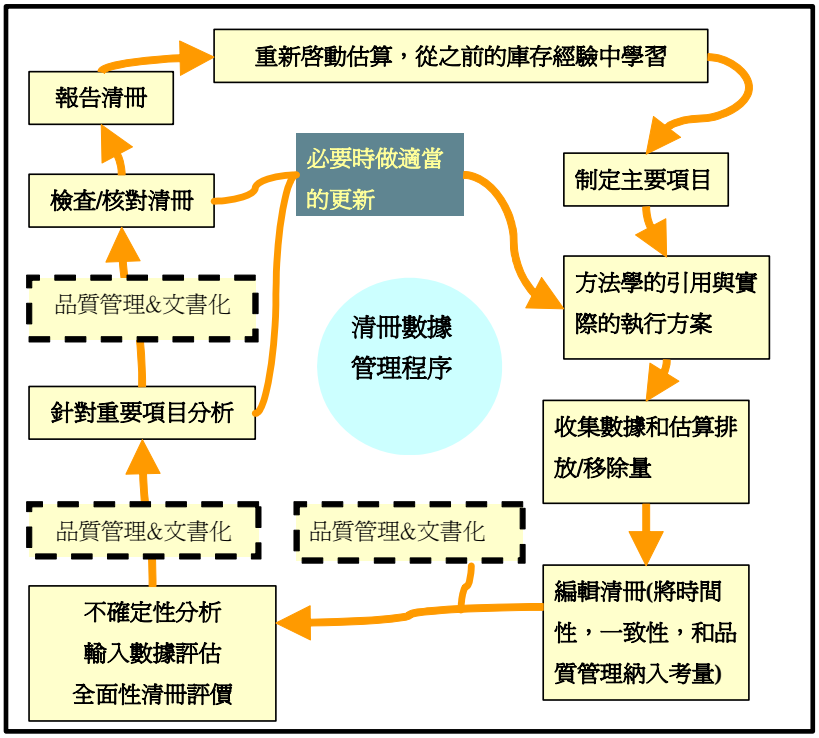


圖 3.40、清冊數據管理程序

1996 年版的指引共分成三冊：申報步驟、排放估算使用手冊(包含估算步驟、計算軟體和預設值)、和參考手冊(參考文獻、科學背景)，並在隔年製成一套溫室氣體庫存軟體，如今已被廣泛的使用於京都議定書附件一的國家。

2006 年改版的指導方針增加至五冊，包含指導方針導覽、能源、產業、農業、和廢棄物。手冊內容延續探討和改進 1996 年版的方法學，並增加多項新的方法學研究，以及更新原版所引用的數據。

日本溫室氣體國家通訊即依循前述 IPCC 的指引，並選擇合適的盤查方法所據以編製的。

3.6.3 溫室氣體排放源與碳匯量化

溫室氣體主要來自人爲的排放，包括來自於燃燒而產生的溫室氣體如二氧化碳、甲烷、氧化亞氮；運輸部門燃料所產生的二氧化碳、甲烷及氧化亞氮；礦業開採所產生甲烷；以及石油或天然氣煉製等過程中產生的甲烷等等。

若將排放源依產業部門分類，則可分爲 1.工業：來源包括礦業、化學、金屬、氟氯碳化物消耗等；2.農業：畜牧、耕種、肥料及傳統生質能燃燒；3.土地利用變遷與森林：森林等原有碳匯的移除、森林大火及伐木等；4.廢棄物：掩埋、廢水處理、垃圾焚化等。

排放量計算可利用下列簡易公式推估：

排放量=排放係數*活動強度

但實際上計算時卻會有許多困難，如計算時有諸多參數、有些計算方法是基於質能平衡但如氟氯碳化物有洩漏問題、森林的碳匯計算、或排放量隨時間改變(如掩埋場的甲烷)等狀況，都造成了計算上的複雜性，而 IPCC 既無提供這方面的指引也無明列清單，更加造成了計算上的困難，因此日本應用各政府部門統計數據建立其本土化的排放係數及發展出複雜但合適的排放量計算公式。

3.6.4 日本政府溫室氣體盤查之組織架構

日本的溫室氣體盤查組織架構發展可分爲 4 個階段。

1.第一階段(1992~1994)：

日本爲提交聯合國氣候變化綱要公約(UNFCCC)撰寫溫室氣體國家通訊而組織小組，小組成員是由日本環境廳及顧問公司擔任，主要成員約 1~2 名，而當時並無盤查之專家，撰寫所需資訊是由環境廳向政府各部門要求提供。

2.第二階段(1996~1998)：

當時日本依據 IPCC 對第一版國家通訊之建議，進行 1997 年的國家通訊撰寫工作，當時 IPCC 並要求會員國於 1998 年後需每年執行盤查工作。當時小組

成員仍以環境廳及顧問公司爲主，另增加由 9 位不同領域的成員組成專家會議，協助修訂盤查資料之內容。而政府部門間的合作管道比第一階段更爲暢通。

3.第三階段(1999~2002)：

日本在此階段中的盤查工作，又有了更大的進步，不僅制訂溫室氣體相關法令且環境聽升格爲環境省，負責人員編制強化很多，溫室氣體國家通訊由直屬環境省的國立環境研究所負責撰寫，專家會議亦由 9 名增加爲 60 名成員並組成委員會負責研究如何改進盤查工作。而政府部門間的合作機制更爲成熟，前兩階段，是由環境聽要求相關部門提供資料，而在此階段中，則增加各相關部門藉由相關會議進行討論，明列主動提供給環境省之資料。

4.第四階段(2002 之後)：

日本於 2002 年成立溫室氣體盤查中心(GIO)及溫室氣體排放清冊專用辦公室，主要成員是環境省(MoE)、溫室氣體盤查中心及顧問公司，而委員會仍舊扮演著舉足輕重的角色。政府部門間的聯繫也更爲明確及具組織。

目前日本政府組織間分工如圖 3.41：

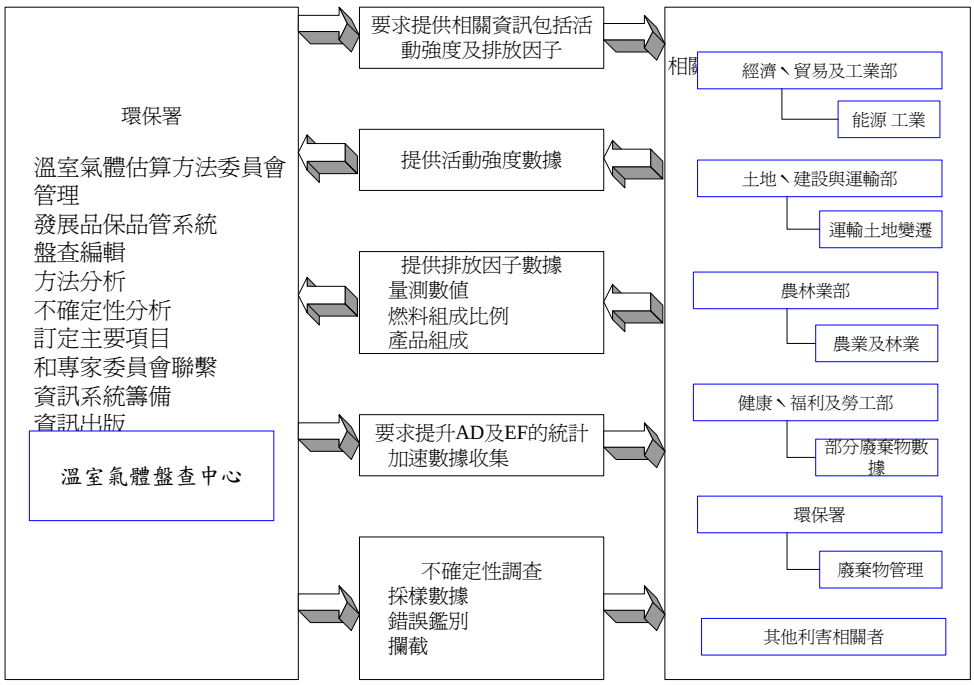


圖 3.41、日本政府間溫室氣體減量之分工

爲推動部會間的合作，日本是採由上至下的組織層級方式進行，如圖 3.42 所示。

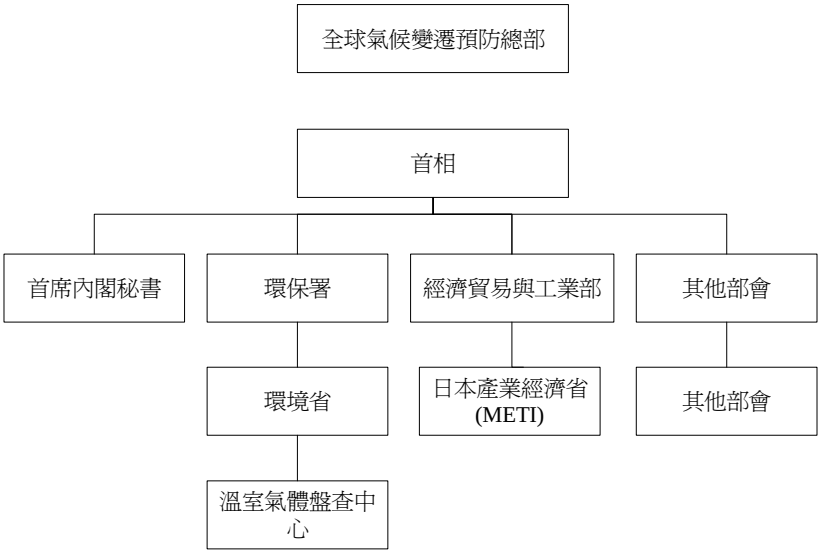


圖 3.42、日本政府溫室氣體減量決策流程

日本亦於 1999 年建立溫室氣體估算方法委員會，由約 60 名的外部專家組成，旨在發展盤查方法，如圖 3.43。

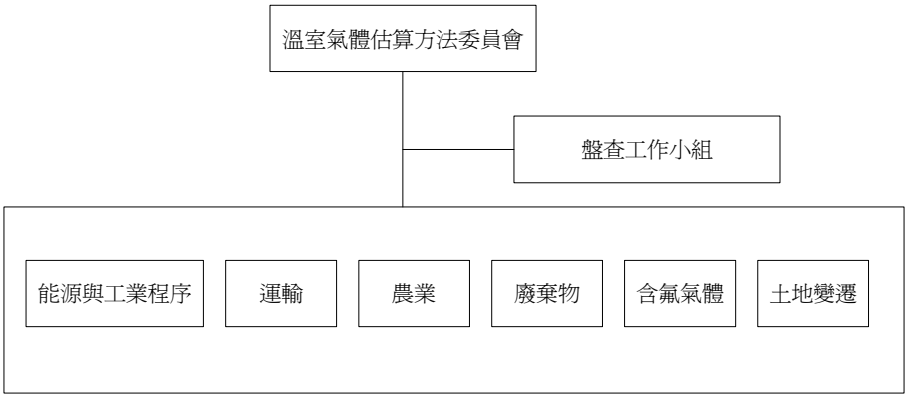


圖 3.43、溫室氣體盤查估算方法委員會

日本爲加強盤查程序，而設立了盤查改進程序，由環境省及溫室氣體盤查

中心主導，並根據 2006 年 IPCC 的指引，以及依據經由研究及檢視的結果，呈交環境省及溫室氣體盤查中心以做出調整。

此程序目的在於呈現出最新國際協商結果、UNFCCC 所制定的溫室氣體盤查技術、盤查實務經驗以及利害相關者所提供的資訊。而以上的資訊則由科學研究單位及溫室氣體估算方法學委員會提供。研究結果將用以改進未來的盤查方式。

溫室氣體盤查程序之時程及規劃，如圖 3.44：

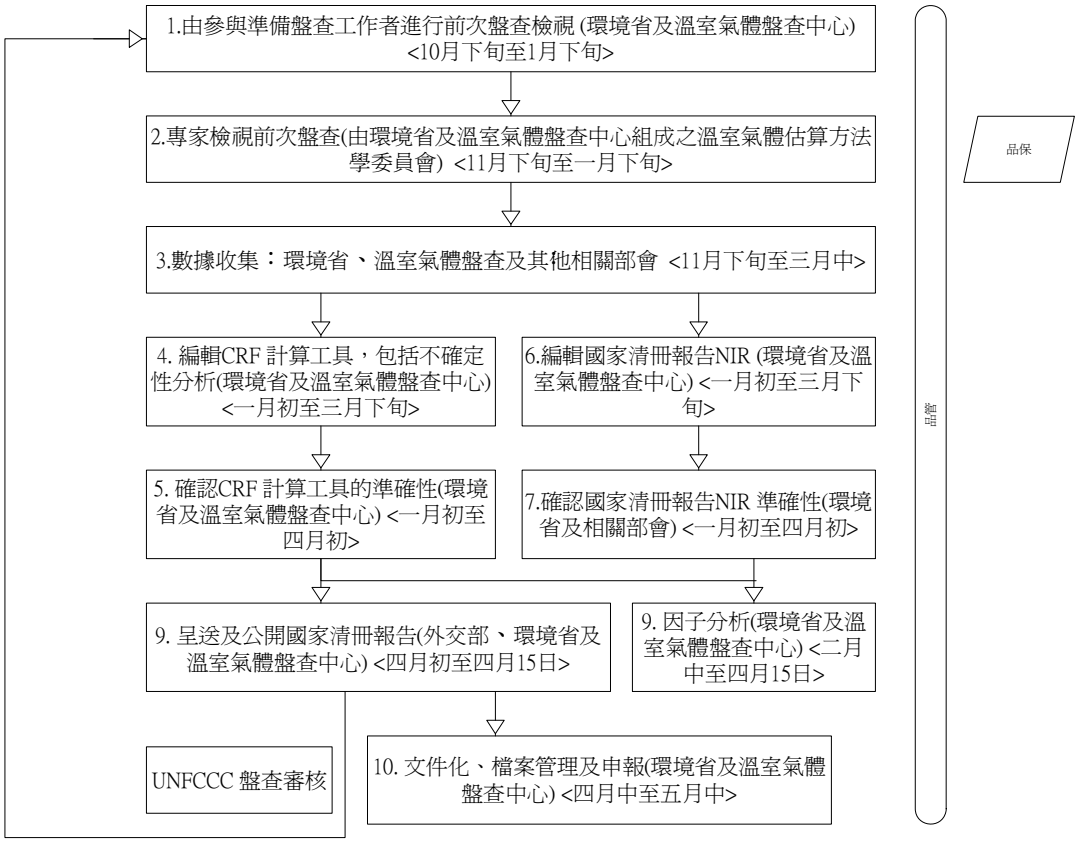


圖 3.44、溫室氣體盤查程序之時程及規劃

在數據的收集上，主要是透過出版品，或是由環境省要求相關部會收集數據。在排放量計算方法的選擇上盡量達到仔細兼顧日本本土化的原則。在排放因子上，是按日本在其國內實際量測而得，另外排放因子及方法都會經由溫室氣體估算方法學委員會測試及認可。

目前日本溫室氣體管制是建立一套由上而下(top-down)的指導權，由內閣總理擔任溫室效應推動總部指揮政府各部門分工負責，其溫室氣體國家通訊則已建立相當完整之編制及發布程序，值得國內參考借鏡。

3.7 日本東京都的地球溫暖化因應對策(李碧鈴)

3.7.1 東京溫室氣體排放情形

東京人口 1200 萬人，與台灣人口相當，其能源的消耗相當於丹麥一國的消耗量。最近 100 年來地球整體年平均氣溫約上升 0.6℃，但東京的年平均氣溫則上升約 3℃，與日本其他都市相比較亦明顯偏高，主要受到地球溫室效應及熱島效應所造成。2004 年東京都內溫室氣體排放量約 65.9 百萬公噸 CO_2 當量，爲全日本排放量(1286 百萬噸 CO_2 當量)的 5%，與 1990 年相較約增加 15%，仍有增加的趨勢。在排放量分布方面，辦公商務部門最高(34.5%)，其次爲運輸部門(30.9%)、家庭部門（24.1%）、產業部門（8.8%）、其他（1.5%）。東京產業部門排放的比例（8.8%）遠較全國產業部門排放量 36.1%爲低，故加強管制的重點在辦公商務部門及運輸部門。

3.7.2 東京都地球溫暖化的因應對策

東京都政府 2000 年制定確保都民健康安全環境相關條例(簡稱環境確保條例)，2002 年推動「地球溫暖化對策計畫書制度」及「建築物環境計畫書制度」。2005 年 3 月修訂環境確保條例，除將 2002 年 2 項制度修正納入外，另創設「大廈環境性能標示」、「能源環境計畫書制度」及「省能制度」等 3 項新措施。以下簡要說明：

1.「地球溫暖化對策計畫書制度」:

係對既有的辦公大樓，課業者提供溫室氣體減量計畫的義務，2005 年 3 月修訂時增加由東京都政府給予指導、評估及公開評估結果。在以下章節中會有較詳盡的說明。

2.「建築物環境計畫書制度」:

係對地積超過 1 萬平方公里的大規模新設建築物，課業者提出環境計畫書的義務，2005 年 3 月修訂時增設大廈環保性能標籤。在以下章節中會有較詳盡的說明。

3.「能源環境計畫書制度」:

爲一創設的制度，係要求能源業者提出具環境效益的能源環境計畫書，訂定計畫書的目標爲降低溫室氣體排放係數及引進再生能源等。

4.「省能制度」:

爲另一創設的制度，目的在降低家庭部門的能源使用量，對電視冰箱等家電販賣店要求標示節能標籤(目前全日本已有一致的節能標籤)。

3.7.3 東京都對抗地球溫暖化的十年計畫

2006 年 12 月東京都政府提出十年後的東京願景，內容包括環境、安全、文化、觀光及產業等，希望東京成爲世界最環保的都市，2020 年 CO_2 排放量較 2000 年減少 25%。東京都十年計畫由政府、民間企業及居民全力參與，2007 年 1 月設置相關執行機構，並編列 500 億日幣設立「地球溫暖化對策推進基金」。

緊接著，東京都政府於 2007 年 6 月發布「東京都氣候變動對策方針」，提出 5 大方針，分別爲：1.推動 CO_2 排放大戶的 CO_2 減量(含導入排放量交易制度)；2.家庭 CO_2 減量(使用節能燈泡及產品)；3.都市建築物 CO_2 削減有明確的規則，包括都設施引用最高效率的規格、大規模新建築物應負節能義務，並引入節能功能的證書等；4.加速汽車 CO_2 排放的削減；5.建構獨特的組織架構支應各部門。接下來會舉行「東京都氣候變動對策方針」意見交換會議、召開東京都環境審議會、修訂環境基本計畫（2007 年底）及環境確保條例（2008 年）。

上開方針 1「推動 CO_2 排放大戶的 CO_2 減量」，預計 2010 年引進排放量交易制度，將透過東京都環境審議會蒐集各界意見研擬推動草案，俟確定後再進行相關條例的修訂。而現行節約能源法主要以 CO_2 排放量大者爲規劃對象，環保電力證書爲交易的對象，企業間的交易多爲中小企業賣給大企業，都廳採不干涉的立場。該等排放交易未來將納入東京都 2010 年引進排放量交易制度中。

3.7.4 東京都「地球溫暖化對策計畫書制度」概要

1.法源及規範對象：

「地球溫暖化對策計畫書制度」係以日本節約能源法所規範的既有大規模辦公大樓爲規範對象，2005 年 3 月修訂、4 月開始執行，2006 年 4 月又擴大規

範對象，將每年使用燃料、熱、電氣等用量換算原油在 1500kl 以上的辦公大樓納入。該制度的基本理念是東京都政府應提供基本對策指導方針，並提供指導建議、進行評估，最後要公開評價結果，以獲得社會上高度的評價。

2.執行期程及作法：

執行期程爲 6 年，管制點有 3 個，作法分述如下：

(1)第 1 年度：

業者依東京都政府指導方針於 12 月底前提出行動計畫書並公開，由都政府提供指導及建議(對評價爲 B 及 C 的不良業者，都政府會進行現地調查)，再由業者檢討修訂計畫書向都政府提出，最後由都政府進行評價，3 月份都政府會將評價爲 A 以上的定稿計畫書及評價結果公布。

(2)第 3 年度(中間年度)：

由業者於 6 月底前提送中間報告書，一樣由都政府給予適當的指導建議，事業針對都政府的指導建議內容可考量後進行計畫書的修正，修正後的計畫書送由都政府評價並公布定稿計畫書及評價結果。

(3)第 6 年度(計畫結束年度)：

事業要制作結果報告書於 6 月底前提出並發表，由都政府給予評價，並連同結果報告書發表評價結果。

3.計畫書內容：

主要包括(1).計算基準年排放量(以計畫提出前 3 年爲基準年度)；(2).訂定基本方針；(3).推動組織；(4).選定削減對象(運用檢查表)；(5).設定具體削減對策目標。東京都政府針對削減對策加以分類並製成一覽表公布供業者採用。

4.削減對策及評價：

東京都政府係依據計畫書所設定的削減對策目標進行評價。

削減對策分爲「基本對策」（都政府規定要提出的項目）及「目標對策」2 類（企業自訂政府規定以外的項目）。基本對策又分爲「運用對策」(屬不用花錢購置設備者)及「設備導入等對策」（屬一般性 3 年可以回收者）。

都政府針對計畫書的削減對策給予不同的評價，評價等級區分爲 AA、A＋、A、B、C 等 5 級，詳如表 3.8：

表 3.8、東京都不同削減對策評價等級

對策範圍	削減對策目標設定	評價等級
目標對策	目標削減率達 5%以上	AA
	目標削減率達 2%以上	A＋
基本對策	基本對策全部納入	A
	不含設備導入等對策	B
	不含運用對策	C

中間報告書依實際達成情形作成不同評價並擇優表揚，詳如表 3.9：

表 3.9、東京都削減對策不同達成情形評價等級

對策範圍	削減對策達成情形	評價等級
	成立遴選委員會擇優表揚	AAA
	計畫書目標削減率達 6%以上且實質削減率達 3%以上	AA＋
目標對策	事業總削減率＞0%且計畫目標實質削減率>＝1%	AA
基本對策	計畫書評價 A 級以上且基本對策全部執行	A
	計畫書評價 A 級以上但未執行	B
	計畫書評價 B 級以下	C

結果報告書同樣依實際達成情形作成不同評價並擇優表揚，詳如表 3.10：

表 3.10、東京都削減策略達成之評價等級

對策範圍	削減對策達成情形	評價等級
	成立遴選委員會訂定評估標準擇優表揚	AAA
目標對策	事業總削減率＞計畫削減率且計畫目標實質削減率>＝1%	AA
基本對策	計畫書評價 A 級以上且基本對策全部執行	A
	計畫書評價 A 級以上、運用對策全部執行但未執行設備導入等對策	B
	計畫書評價 B 級以下且基本對策未執行	C

5.執行成果：

東京都執行地球溫暖化對策計畫書制度，其特色包括 1.由都政府提示事業可採用的 CO_2 削減對策；2.由都政府指導事業設定較高的 CO_2 削減目標；3.由都政府評價表揚減量績優事業。

2005 年計有 1065 家事業提出計畫書，評價 A 級以上事業有 1049 家(佔 98%以上)，評價 B 級及 C 級者共 16 家，主要係考慮成本。最高的 AA 級有 275 家，佔四分之一以上，表示事業的反應良好。2005 年 1065 家事業的溫室氣體排放量爲 1233 萬噸，總計畫削減量爲 75 萬噸，總削減率爲 6.1%。2006 年計有 209 家事業提出計畫書，溫室氣體排放量爲 86 萬噸，總計畫削減量爲 4 萬噸，總削減率爲 4.3%。事業可委託 ESCO 業者協助研提計畫書，迄 2006 年 4 月登錄有案的 ESCO 業者計有 60 家，約有 29%事業委託 ESCO 業者辦理。

3.7.5 東京都「建築物環境計畫書制度」概要

1.法源及規範對象：

「建築物環境計畫書制度」係依據「環境確保條例」，規範對象爲地積超過 1 萬平方公里的大規模新設建築物，業者應向都政府提出建築物環境計畫書。該規範對象已涵括東京都 31%以上的新設建築物。計畫書內容尚涉及省能源法及住宅品質確保等相關法規。東京都政府對該計畫書應進行評估，最後要公布評價結果，以獲得社會上高度的評價。

2.執行期程及作法：

建築業者應於確認申請 30 日前向東京都政府提出，並由都政府予以公告。若有變更，須在施工 15 日前提出並由都政府公告。施工完成後 15 日內應向都政府報告，再由都政府加以評估並公告結果。

3.評價基準：

評價基準主要針對建築物的環境配置，從節約能源、資源最適利用、自然環境的保護、改善熱島現象等面向訂定細部評估項目。評價分 3 階段進行，第 1 階段爲超過省能源法法定水準者，第 2 階段爲高於第 1 階段者，第 3 階段爲優於第 2 階段者。舉例而言：建築物的熱負荷評估項目 PAL 值，第 1 階段爲削

減率小於 15%，第 2 階段爲削減率大於等於 15%且小於 25%，第 3 階段爲削減率大於 25%。又如能源設備的節能評估項目 ERR 值，第 1 階段爲 ERR 小於 25，第 2 階段爲 ERR 大於等於 25 且小於 35，第 3 階段爲 ERR 大於 35。

4.執行成果：

該制度自 2002 年 6 月實施以來，迄 2006 年止計有 889 家事業提出，其中以住宅件數(503 件)最多佔 57%，辦公室件數（147 件）居次佔 17%。東京都政府對計畫書所提的各項數值加以分析後以圖表具體表示該計畫執行已具有成效，但爲達到東京都十年願景 2020 年 CO_2 排放量較 2000 年減少 25%的目標，仍需不斷檢討改進相關作法。

5.大廈環境性能標示：

大廈環境性能標示計有 4 個項目，即建物的隔熱性、設備的省能性、建物的壽命及綠化。依評價 3 階段的結果給予不同的星號，標示圖如圖 3.45 所示。若每項都獲 3 顆星，滿分即爲 12 顆星。

圖 3.45、東京都環境性能標誌

大廈環境性能標示的目的有 3 項，包括：鼓勵民眾購買對環保有益的大樓；建立企業形象；3.促進建築業者自主推動環保對策。建商在傳單、廣告等需附上大廈環境性能標示。該標示內容需經東京都政府認可後才能送交廣告媒體製作。政府同時促成金融機構視建築個案獲得的星星數量，提供不同程度的住宅優惠貸款。

「大廈環境性能標示」爲 2005 年 3 月修訂環境確保條例時新增的措施，

實施迄今評估星號的平均數量已由 2005 年的 8.8 顆星（25 件數），成長到 2006 年的 9.2 顆星（65 件數），各個項目獲得星星數的情形，可以一窺制度實施的成效。

第四章、心得與建議

(一)溫室氣體減量須全國上下共同努力，涉及各部會相關事務，建議宜有專責辦公室負責，進行跨部會業務推動，形成全國共識，以收減量之宏效。

(二)森林碳匯對於溫室氣體減量之貢獻，須有林業部門參與研究，宜結合國內相關資源全盤規劃，進行相關之觀測與研究，逐步建立國內本土資訊。

(三)我國目前正在研訂「温室氣體減量法」，國人對是否訂定具體的減量目標一直欠缺共識。此行觀之日本國內刻正進行京都議定書承諾至 2010 年，較 1990 年減量 6%目標進行檢討。日方 2006 年温室氣體排放量較 1990 年成長 6.4%，經檢討主因爲經濟成長所致。該國承認雖努力減量仍面臨目標嚴格的挑戰。我國雖非京都議定書簽署國，但一直積極參與温室氣體減量相關事務並著手因應，日方甚或其他國家尚無犧牲經濟發展以求温室氣體減量者，國人面對減量的壓力應採取更積極的減量對策，而非消極的限制投資，否則將不利於國家整體經濟發展，亦易喪失未來在國際間談判的空間。

(四)日本自 2005 年 4 月開始執行「京都議定書目標達成計畫」(Kyoto Protocol Target Achievement Plan)，爲達成 2010 年較 1990 年減量 6%，具體行動目標分爲 3 部分：國內温室氣體減量佔 0.5%、森林吸收佔 3.9%及京都機制佔 1.6%。計畫內容包括約 60 項策略及方法，最具特色及成效者包括業界自主行動計畫、運用標竿企業標準提升車輛能源效率、改進建築物節能成效、運用標竿企業標準提升能源設備效率、推動核能及新能源、推動管制 3 項含氟氣體之替代物質、促進森林吸收量等。以上作法可供我國參考，目前本部持續推動無悔策略，積極建構國內減量能力，未來應善用温室氣體減量此一國際新興低碳經濟之契機，促進節約能源與再生能源的推動，並藉由市場機制促使我國產業結構朝低耗能、高附加價值方向發展。

(五)此行蒐集很多日方提供的寶貴資料，前二天的課程重點在介紹日方整體參與及因應溫室氣體的整體概貌，其後二天則從技術面深入，介紹指標、全國目錄製作、通量作法等研究，最後一天安排參訪及東京都廳的實際作法，短短五天的研習，讓吾等對日本的因應作法已有概略的認識，獲益良多。除了感謝相關單位的安排外，希望將來在業務上能多加交流。又本次研習時間甚短，未來若有機會，建議安排瞭解公會或企業如何進行溫室氣體的實際盤查作業。此外，未來日本如何克服國內溫室氣體不斷成長、達成減量目標的高難度任務，及是否採取更有效的因應策略等，值得我們持續關注。

(六)研習期間詢及日本國內是否有排放權交易，日方表示日本推行的自主行動計畫，若企業無法達成自訂的減量目標，政府並無罰責，有些企業會自行設法購買，企業直接交易的行爲政府並未過問，大多由該等產業團體自行管理。又東京都預計 2010 年引進排放量交易制度，東京都都廳是否改變現行對 CO2 排放量大的環保電力交易業者採不干涉的立場不得而知。吾人以爲排放權交易問題相當複雜且涉及層面廣泛，排放權交易在國際間進行有其特殊的意義及實質的需要，但在國內企業間進行排放權交易存在相當程度的困難，我國目前溫室氣體減量法草案已將國內排放交易納入，未來推動應放眼國際，國內交易應多加審慎評估，不宜貿進。

(七)吾人向來認爲工業部門因大規模生產，使用的能資源及污染排放多居首位，又以其資金規模及人才觀之，亦爲最有能力解決環境問題者，溫室氣體排放減量的議題亦然。各國莫不從工業部門的減量著手規劃執行，一般減量的成果亦以工業部門爲佳。然而應當增加關注的是住商部門及交通運輸部門排放量的成長，日本從統計數字觀察到該等部門成長迅速，並採取對應的因應措施，如 2007 年 10 月新增要求建物拆除前需先確認是否有需回收的相關設備（碳氟化合物回收破壞法）、東京都政府強調對新舊建築物新增環境計畫書制度等。我國應加強溫室氣體排放相關統計分析，並以之發展各排放源適合國情的對應措施。

(八)溫室氣體排放的議題絕對是全球需共同面對的議題，後京都時期開發中國家將被要求共同負擔減量的責任，此行日本甚爲強調全球努力的必要性，今(96)年 12 月 4 日在印尼峇里島召開的聯合國氣候變化綱要公約締約國會議 COP13 亦會論及。台灣未來不可避免的會在此議題上扮演一定的角色，故保持高度持續的關注並積極參與國際合作事務，仍屬必需。

第五章、研習照片

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附錄

日本政府

Kyoto Protocol Target Achievement Plan

Kyoto Protocol Target Achievement Plan

April 28, 2005

Contents

Introduction

The global warming issue is one of the most important environmental issues that impacts on the very foundations of human survival. The global warming issue forces us to make efforts to use resources and energy efficiently and to reconsider socioeconomic activities and lifestyles that involve large volumes of production, consumption and waste. To that end, the adoption of the 1997 Kyoto Protocol was a major turning point.

The Kyoto Protocol entered into force in February 2005. Under the Protocol, Japan makes a legally binding promise to reduce its greenhouse gas emissions by 6%.

The government has already developed a number of global warming countermeasures. These include the Action Program to Arrest Global Warming (1990), Basic Policy on Measures to Tackle Global Warming (1999), and Outline for Promotion of Efforts to Prevent Global Warming (1998, 2002).

The 2002 Outline for Promotion of Efforts to Prevent Global Warming underwent evaluation and review in 2004. The Law Concerning the Promotion of Measures to Cope with Global Warming (Law No. 117 of 1998) stipulates that the Kyoto Protocol Target Achievement Plan is to be formulated when the Kyoto Protocol enters into force.

Therefore, based on the Law Concerning the Promotion of Measures to Cope with Global Warming, the "Kyoto Protocol Target Achievement Plan" was formulated which carries on the Outline for Promotion of Efforts to Prevent Global Warming, Action Program to Arrest Global Warming, and Basic Policy on Measures to Tackle Global Warming based on the results of the evaluation and review of the Outline in order to stipulate the measures necessary to reliably achieve the target of a 6% reduction promised by Japan under the Kyoto Protocol.

Moreover, under this plan, Japan will produce a report to show the clear progress toward achievement of its promise under the Kyoto Protocol and submit it to the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) sometime during 2005.

○ Scientific Knowledge Concerning Global Warming

The global warming issue is one which will have a serious impact on the natural ecosystem and humans as greenhouse gases released as a result of human activities increase the concentration of atmospheric greenhouse gases and this leads to an incremental increase in the surface and air temperatures of our entire planet. In view of the expected scale and seriousness of the impact of global warming, it can be concluded that this issue is one of the most important environmental issues that impacts on the very foundations of human survival.

The Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report used observational data to show that the global average surface temperature increased by 0.6±0.2°C and the global average sea level rose by between 10 cm and 20 cm during the 20th century. Moreover, the report concluded that the influence of global warming such as the retreat of glaciers and melting of permafrost causes regional climate changes and is already having an impact on a wide variety of physical and biological systems in many regions around the world. The report claims to have obtained new and more solid evidence that the majority of

the global warming which occurred over the past 50 years was caused by human activities.

The report forecasts that during the 21st century the global average surface temperature will increase in a range between 1.4°C and 5.8°C, and that an increase in the amount of seawater and other factors will lead to a rise in the sea level of between 9 cm and 88 cm by the end of the 21st century. It further concludes that the impacts of these changes will include an increasing number of extreme weather events, increased negative impacts on the ecosystem, and an increase in the number of people suffering from infectious diseases such as malaria, flood damage, etc. The report also noted that even a minute temperature increase leads to economic losses for developing countries and that a temperature increase of at least a few degrees Celsius leads to economic losses in developed countries, so that as a result the North-South divide would expand.

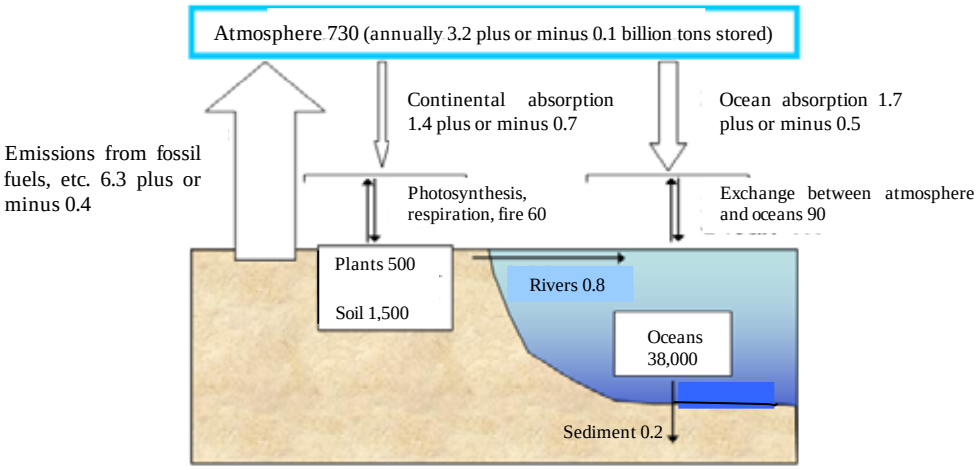
In Japan, the average temperature increased approximately 1°C during the 20th century. In recent years changes in the distribution of the ecosystem have appeared, such as a reduction in the habitats of certain species of alpine flora, changes in the habitats of insects and animals, as well as changes in the dates that cherry blossoms bloom and maple leaves change color in autumn, and an increase in the frequency of heavy rain has also been observed.[1]. Global warming has been suggested as one of the causes of these changes in the weather and the ecosystem, but at the present point in time sufficient scientific evidence concerning the cause-and-effect relationship between specific phenomena that have occurred to date and climate change resulting from human-induced factors has not been established, and further research developments are expected in future. Even though this scientific uncertainty remains, some researches indicate that climate change and its impact will be more serious in Japan in the future[2]. Therefore, based on the precautionary principle, we must continue to push ahead with measures on a global scale to deal with the climate change issue.

In order to achieve the ultimate objective of the United Nations Framework Convention on Climate Change (hereafter "Framework Convention on Climate Change"), namely "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system," it is necessary to get to a situation in which such a level is maintained, there is a balance between the volume of greenhouse gases emitted and the volume of greenhouse gases absorbed, and in which the earth's stock of atmospheric greenhouse gases does not change. Currently, worldwide emissions of greenhouse gases into the atmosphere are approximately twice the amount that can be absorbed by the oceans and forests, and as a result the concentration of atmospheric greenhouse gases has been increasing. In order to stabilize the concentration of greenhouse gases, it is necessary to greatly reduce current emissions to the level that can be absorbed.

[1] References: Japan Meteorological Agency (2005) Press Release *Annual Average Surface Temperature in the World and in Japan in 2004*; Japan Meteorological Agency (2002) *Japan's Climate in the 20th Century*; and Ministry of the Environment (2001) *The Impacts of Global Warming on Japan 2001*.

[2] References: Center for Climate System Research, University of Tokyo; National Institute for Environmental Studies; Frontier Research Center for Global Change, Japan Agency for Marine-Earth Science and Technology: September 16, 2004 Press Release *The Latest Global Warming Projection Using the Earth Simulator Has Been Completed*; and Japan Meteorological Agency (2003) *Global Warming Projection, Volume 5*.

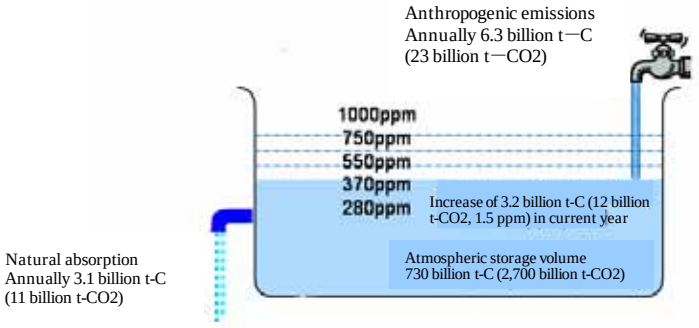
Figure 1 Relationship between Carbon Dioxide Emissions and Removal (Pattern Diagram)



Note 1: The unit for the figures in the boxes is billion ton C and for the figures by the arrows is billion ton C / year.
Note 2: The plus or minus figures show the degree of uncertainty.

Source: A Special Report of the IPCC *Land Use, Land-use Change, and Forestry* (2000) modified with additional data from the *IPCC Third Assessment Report* (2001).

Figure 2 Image of Stabilization of the Concentration of Carbon Dioxide (Pattern Diagram)



Since industrialization in the second half of the 18th Century, natural circulation has been balanced at 280 ppm.

Note: In order to show the image of the stabilization of concentration in an easy-to-understand manner, the continental and oceanic storage volumes and carbon exchange like those shown in Figure 1 is omitted.

Source: Based on data in the *IPCC Third Assessment Report* (2001).

○ The Series of Events Leading Up to the Entering into Force of the Kyoto Protocol

1. Adoption and Entering into Force of the Framework Convention on Climate Change

In order to respond to the global warming issue, the Framework Convention on Climate Change was adopted in May 1992 and entered into force in 1994. Japan signed it at the June 1992 United Nations Conference on Environment and Development (UNCED) and concluded it in May 1993.

The Framework Convention on Climate Change made its ultimate objective to achieve "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" and stated that such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

The Framework Convention on Climate Change noted that per capita emissions in developing countries are still relatively low compared to those in developed countries, that the largest share of historical and current global emissions of greenhouse gases has originated in developed countries, and that there were differences between each country with respect to the state of their global warming countermeasures and capacity to implement them. Based on the principle of "common but differentiated responsibilities," it was agreed to divide the State Parties to the Convention into three groups: 1) all signatory countries including the developing countries, 2) Annex I countries (OECD countries and countries undergoing transition to a market economy), and 3) Annex II countries (OECD countries), and to formulate global warming countermeasures at different levels for each group.

2. Adoption of the Kyoto Protocol

As a first step toward the long-term, continuous emissions reduction required to achieve the ultimate objective of the Framework Convention on Climate Change, the Kyoto Protocol, under which developed countries make a legally binding commitment to reduce their greenhouse gases, was adopted at the Third Conference of the Parties to the United Nations Framework Convention on Climate Change (COP3) held in Kyoto in December 1997.

The Kyoto Protocol determined that the following greenhouse gases would be subject to quantified commitments concerning limitation and reduction of emissions: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulphur hexafluoride (SF6).

With the objective of reducing emissions of these greenhouse gases by at least 5% below 1990 levels in all developed countries in the first commitment period (2008-2012), legally binding and quantified commitments were stipulated for each country. For Japan an emissions reduction of 6% was determined.

Furthermore, under the Kyoto Protocol, carbon sinks can also be counted toward achievement of commitments and the Kyoto Mechanisms were provided as well to add flexibility in the achievement of the commitments by each country.

3. Entering into Force of the Kyoto Protocol

The Kyoto Protocol contains a provision stating that it will enter into force on the ninetieth day after the date on which not less than 55 Parties to the Convention, incorporating Parties included in Annex I which accounted in total for at least 55% of the total carbon dioxide emissions for 1990 of the Parties included in Annex I, have deposited their instruments of ratification, acceptance, approval or accession.

With the ratification of the Kyoto Protocol by Russia in November 2004, the Kyoto Protocol met the above conditions for entering into force and thus entered into force on February 16, 2005.

○ Efforts by Japan to Date

Japan formulated the Action Program to Arrest Global Warming in October 1990 in a Cabinet Meeting of ministers related to conservation of the global environment. The action program set targets such as stabilization of carbon dioxide emissions at the 1990 level in and after 2000 and formulated a variety of global warming countermeasures.

Subsequently, with the adoption of the Kyoto Protocol in December 1997, in June 1998 the Global Warming Prevention Headquarters approved the Outline for Promotion of Efforts to Prevent Global Warming, a compilation of global warming countermeasures that had to be urgently promoted toward 2010.

Through the establishment of the Law Concerning the Promotion of Measures to Cope with Global Warming, the Cabinet Decision on the Basic Policy on Measures to Tackle Global Warming, etc., the basic framework for promotion of global warming countermeasures in Japan has been built, and Japan has implemented a variety of domestic countermeasures such as the amendment of the Law Concerning the Rational Use of Energy (Law No. 49 of 1979; hereafter "Energy Conservation Law").

With the adoption in November 2001 of the Marrakesh Accords, which established rules, procedures and institutions for implementing the Kyoto Protocol, an environment was in place to enable ratification of the Kyoto Protocol by each country.

In March 2002 Japan revised the Outline for Promotion of Efforts to Prevent Global Warming with a view to ratifying the Kyoto Protocol. Japan amended the Law Concerning the Promotion of Measures to Cope with Global Warming to stipulate the Kyoto Protocol Target Achievement Plan, etc. for when the Kyoto Protocol entered into force. With the development of this domestic framework, Japan ratified the Kyoto Protocol in June 2002.

Russia held the key to meeting the conditions required for bringing the Kyoto Protocol into force, and a number of other countries have not ratified the protocol, including the United States which has announced a policy of withdrawal from the protocol. Japan, the conference chair of COP3, continuously called on these countries to ratify the protocol with a view to bringing it into force as soon as possible.

Chapter 1 Basic Direction of Promotion of Global Warming Countermeasures

Section 1 Direction of Japan's Global Warming Countermeasures

Japan will steadily achieve its 6% reduction commitment under the Kyoto Protocol. In addition, Japan will further aim at long-term and continuous reduction of emissions.

The 21st century is known as the "century of the environment" and responding to the global warming issue is becoming an important issue shared by all humans. In this context, Japan, as a leading environmentally advanced nation that is a model for other countries, will take the role of leading the world with respect to the global warming issue.

1. Steady Achievement of the 6% Reduction Commitment under the Kyoto Protocol

Japan is promoting the measures necessary to achieve its commitment under the Kyoto Protocol to reduce its total greenhouse gas emissions by 6% from the level of the base year in the first commitment period (2008-2012).

There are already only three years remaining until the commencement of the first Kyoto Protocol commitment period. The slower Japan is to take countermeasures, the more it will have to formulate measures to achieve large reductions over a short period in order to achieve the 6% reduction commitment. Thus, Japan intends to steadily reduce emissions by promptly implementing the countermeasures and policies that are feasible to be introduced at the present stage.

2. Further Long-term and Continuous Reduction of Greenhouse Gas Emissions on a Global Scale

Achievement of the reduction commitments of developed countries stipulated in the Kyoto Protocol is a significant step toward achieving the ultimate objective of the Framework Convention on Climate Change: stabilization of the atmospheric concentration of greenhouse gases. Japan will work to achieve its 6% reduction commitment under the Kyoto Protocol and will further take the lead on long-term and continuous reduction of emissions.

From this perspective, Japan will position countermeasures and policies to achieve the 6% reduction commitment among its medium- and long-term measures, and will aim to build a society which incorporates reduction of greenhouse gas emissions while ensuring the consistency of efforts to achieve the Kyoto Protocol commitment and medium- and long-term measures. Through this process, Japan will aim to develop a vigorous and sustainable socioeconomy and advance the development and dissemination of technology for medium- and long-term global warming countermeasures, the development of social infrastructure, etc.

Furthermore, because the causes and impacts of global warming are on a global scale, Japan will continue efforts to ensure international collaboration on global warming countermeasures.

Section 2 Basic Philosophy of Global Warming Countermeasures

The emission of greenhouse gases is closely related to economic activities and the lives of the citizens. Therefore, Japan will boldly implement global warming countermeasures founded on the basic philosophy of "compatibility between the environment and the economy."

Aiming to be an environmental nation that leads the world, Japan will promote technological innovation, encourage the participation and collaboration of central and local governments, corporations and citizens, ensure the transparency necessary to achieve it, and share information.

Japan will promote countermeasures utilizing diverse policy instruments and steadily achieve the 6% reduction commitment by carrying out quantitative evaluations and reviews of countermeasures. Japan will also ensure international collaboration on global warming countermeasures.

1. Compatibility between the Environment and the Economy

In order for efforts to achieve the 6% reduction commitment under the Kyoto Protocol to also lead to Japan's economic revitalization, employment creation, etc., Japan will take full advantage of technological innovation and its originality and ingenuity to develop and build mechanisms that contribute to compatibility between the environment and the economy.

Specifically, to realize sound economic development with a small environmental burden and a high quality of life for the citizens while at the same time reducing the emission of greenhouse gases, Japan will develop and disseminate energy-conserving equipment, improve the efficiency of energy use, further accelerate technology development, and raise environmental awareness. In addition, Japan will boldly implement global warming countermeasures which entail wide-ranging transformations to socioeconomic systems.

2. Promotion of Technological Innovation

In order to achieve the Kyoto Protocol commitment and also the long-term and continuous reduction of emissions with a view to becoming a "society that exits from inducing global warming," ultimately it is necessary to reduce our dependency on fossil fuels.

In order to work toward compatibility between the environment and the economy and achieve these targets, Japan will accelerate technological innovations such as energy conservation, utilization of unused energy, etc., work to disseminate efficient equipment and cutting-edge systems, and aim to be an environmental nation which leads the world.

3. Promotion of the Participation and Collaboration of all Stakeholders and Ensuring of Transparency and Sharing of Information to that End

The global warming issue is deeply involved with all aspects of socioeconomic activities and the lives of the citizens, so it is necessary for all stakeholders including central and local governments,

corporations, and citizens to participate and collaborate in efforts on this issue.

For this reason, the Government of Japan will promote the active participation of all stakeholders in countermeasures and policies, and strengthen collaboration between each stakeholder by actively providing and sharing information concerning the progress of global warming countermeasures.

The Government of Japan will actively provide and share, in as visible a manner as possible, knowledge about the increasingly serious global warming issue, the specific actions for which enormous efforts are needed in order to achieve the 6% reduction commitment, and information about what each individual must do, as well as carry out public relations and dissemination activities on these topics in order to improve the awareness of households and businesses and rouse them to take action.

4. Utilization of Diverse Policy Instruments

In order to meticulously take into account the conditions in each sector, realize the potential for emissions reductions as much as possible, fully mobilize all types of policy instruments, and work toward effective and efficient limitation, etc. of greenhouse gases, the Government of Japan will consider the fairness of the cost burden on each stakeholder and will effectively utilize diverse policy instruments, such as voluntary methods, restrictive methods, economic methods, informational methods, etc., while taking advantage of their special characteristics.

Furthermore, in order to ensure wide-ranging emission limitation effects, the Government of Japan will place importance on incentive policies utilizing economic methods which encourage technology development which overcomes cost constraints and the introduction of countermeasures.

5. Placing of Importance on the Evaluation and Review Process (PDCA)

In FY2007, the year before the commencement of the first commitment period, the Government of Japan will comprehensively evaluate the progress of countermeasures and policies stipulated in the Kyoto Protocol Target Achievement Plan and the level of emissions, etc. and will formulate the necessary countermeasures and policies for the first commitment period beginning in FY2008.

Furthermore, in order to constantly assess the effectiveness of the Kyoto Protocol Target Achievement Plan and make it reliable, the Government of Japan will strengthen the policies as necessary by checking each year after formulation of the plan, with reference to the evaluation indicators of the measure, the progress, etc. of policies formulated by the government for each countermeasure.

The FY2007 comprehensive evaluation and review must evaluate the preconditions at the time the Kyoto Protocol Target Achievement Plan was formulated, the projected greenhouse gas emissions, countermeasures and policies, etc., and carry out a comprehensive review.

For this reason, the Kyoto Protocol Target Achievement Plan clearly specifies targets for greenhouse gases and in other categories, individual countermeasures and their evaluation indicators, the expected extent of greenhouse gas emissions reduction, the roles and measures to be taken by each stakeholder for the countermeasures, and the policies of the central and local governments. (Details are in Chapter 4, Section 1.)

6. Ensuring of International Collaboration on Global Warming Countermeasures

Since the causes and impacts of global warming are on a global scale, it is essential for all countries to endeavor to reduce greenhouse gases in order to ensure the effectiveness of the global warming countermeasures. Not only efforts by each country but also further efforts through international coordination are indispensable. For this reason, Japan will unceasingly continue to put in its utmost efforts to make it possible for common rules to be built that will be participated in by all countries, including the United States and developing countries.

Moreover, carbon dioxide emissions are projected to rapidly increase as a result of future increases in the world population and economic development. Therefore, Japan, which has outstanding technological capabilities and has accumulated a lot of experience in environmental conservation, will take a leading role in the world's efforts to combat global warming through international cooperation.

Chapter 2 Targets for the Limitation and Removal of Greenhouse Gases

Section 1 Emissions Projections Based on Current Countermeasures and the 6% Reduction Commitment

Japan's base year emissions of all greenhouse gases (hereafter "base year total emissions") were 1.237 billion t-CO2. In order to achieve the 6% reduction commitment, it is necessary to reduce annual average total emissions to 1.163 billion t-CO2 per year in the first commitment period.

On the other hand, Japan's total emissions of greenhouse gases in FY2002 were 1.331 billion t-CO2, a 7.6% increase over the base year, so that Japan now has to reduce emissions by 13.6% to achieve its reduction commitment.

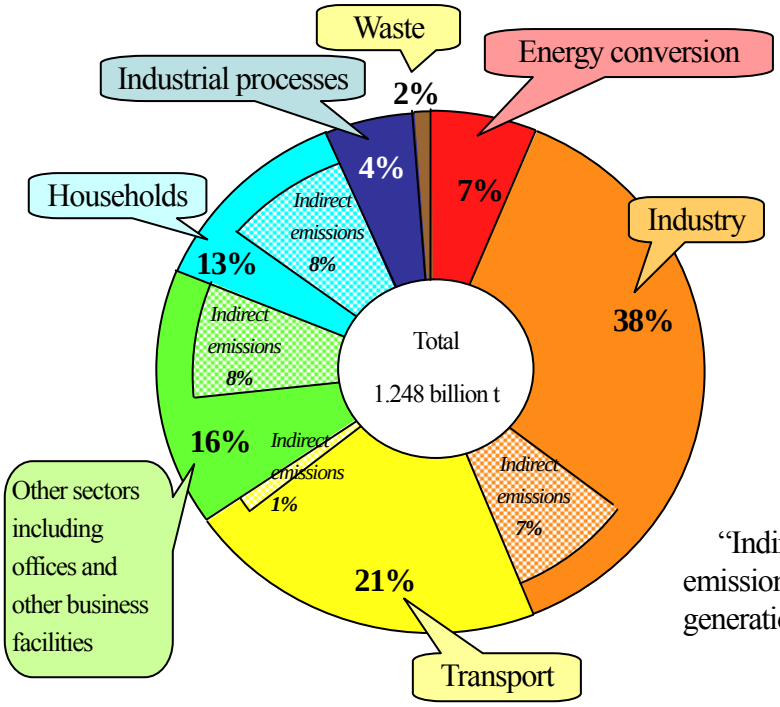
This happened because even though there has been progress in the reduction of non-energy-originated carbon dioxide, methane, nitrous oxide and the three substitute chlorofluorocarbon gases, emissions of energy-originated carbon dioxide, which account for approximately 90% of Japan's greenhouse gas emissions, greatly increased (by FY2002, an increase of 10.2% over the base year total emissions). Factors behind the increase in emissions of energy-originated carbon dioxide include the cessation of nuclear power generation in the second half of 2002 and other one-off factors, the economic expansion of China, the transformation of the industrial structure, an increase in energy consumption in offices and households due to factors such as increase in the floor area of office buildings, etc., and increased numbers of personal computers, home appliances, etc. In addition, due to an increase in passenger demand, etc., although emissions from the commercial sector, which accounts for approximately 40% of carbon dioxide emissions, and from the transport (trucks and public transport systems, etc.) sector, which accounts for approximately 10%, did not show much change, emissions greatly increased from the other sectors including offices and other business facilities, which account for approximately 20%, the residencial sector, which accounts for approximately 10%, and the transport (passenger cars for personal use) sector, which accounts for approximately 10%.

Carbon dioxide emissions in FY2002 by sector are shown in Figure 3.

The projection of total emissions of greenhouse gases as of FY2010 if the Government of Japan continues to implement the various countermeasures to date in the same way based on the Outline for Promotion of Efforts to Prevent Global Warming (hereafter "existing measures scenario") is approximately 1.311 billion t-CO2, an increase of approximately 6% over the base year. (Refer to Table 1 for the projections of emissions by type of greenhouse gas and emissions of energy-originated carbon dioxide by sector.)

Therefore, in order to achieve its 6% reduction commitment under the Kyoto Protocol, it is necessary for Japan to implement countermeasures based on the Kyoto Protocol Target Achievement Plan and policies to promote these countermeasures in addition to the countermeasures and policies it has already been implementing, if it wants to achieve a further incremental emissions reduction of approximately 12% (approximately 148 million t-CO2).

Figure 3 Japan's Carbon Dioxide Emissions by Sector (FY2002)



"Indirect emissions" refers to emissions resulting from power generation by power suppliers, etc.

Figure 4 Japan's 6% Reduction Commitment under the Kyoto Protocol and Japan's Greenhouse Gas Emissions

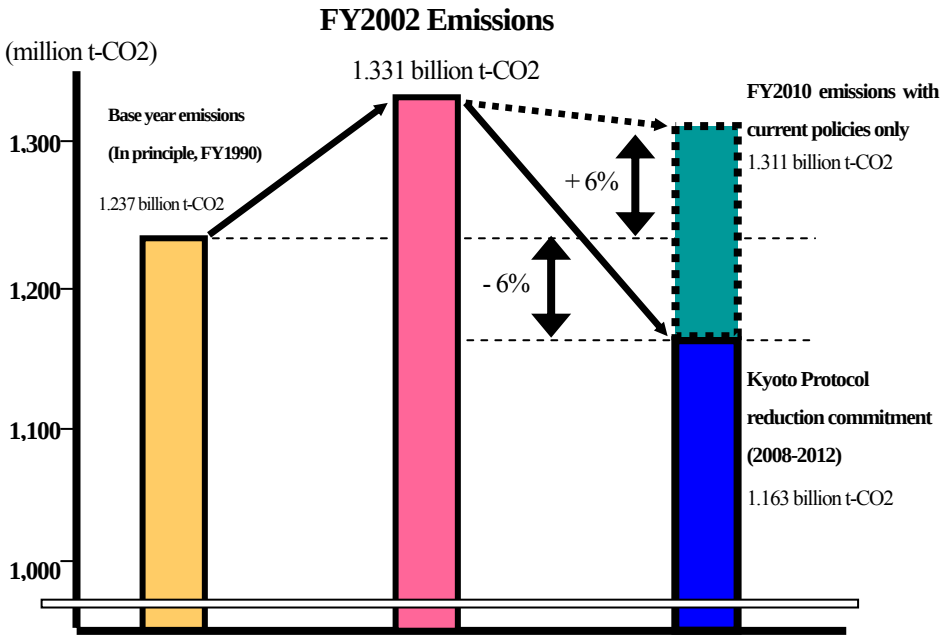


Table 1 Estimated Greenhouse Gas Emissions in FY2010

	Base year	FY2002		Existing measures scenario	
	Million t-CO2	Million t-CO2	Ratio to base year total emissions	Million t-CO2	Ratio to base year total emissions
Energy-originated CO2	1,048	1,174	**+10. 2%**	1,115	**+5. 4%**
Commercial sector	476	468	-0. 7%	450	-2. 1%
Non-commercial sector	273	363	+7. 3%	333	+4. 9%
(Other sectors including offices and other business facilities)	144	197	+4. 3%	178	+2. 8%
(Residencial sector)	129	166	+3. 0%	155	+2. 1%
Transport sector	217	261	+3. 6%	259	+3. 4%
Energy conversion sector	82	82	-0. 0%	73	-0. 8%
Non-energy originated CO2, CH4, N2O	139	128	**-0. 9%**	130	**-0. 8%**
CO2 not generated from energy	74	73	-0. 1%	74	+0. 0%
CH4	25	20	-0. 4%	20	-0. 3%
N2O	40	35	-0. 4%	35	-0. 4%
Three fluorinated gases	50	28	**-1. 7%**	67	**+1. 4%**
HFC	20	13	-0. 6%	46	+2. 1%
PFC	13	10	-0. 2%	9	-0. 3%
SF6	17	5	-0. 9%	12	-0. 4%
Greenhouse gas emissions	1,237	1,331	**+7. 6%**	1,311	**+6. 0%**

* Due to rounding, the totals in the table above may not match the sum of the columns.

Section 2 Targets in Other Categories by Type of Greenhouse Gas

The Government of Japan has established the following targets for limitation and removal of greenhouse gas emissions.

1. Greenhouse Gases

The Kyoto Protocol determined that the following greenhouse gases would be subject to quantified commitments concerning limitation and reduction of emissions: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulphur hexafluoride (SF6). The Kyoto Protocol Target Achievement Plan established the following targets for the limitation of emissions in the first commitment period for each greenhouse gas.

The targets for each greenhouse gas shown below were basically determined as a standard for emission limitation that can be achieved through implementation of the Kyoto Protocol Target Achievement Plan taking into account rational and transparent projections of the volume of activities and the improvement effect of basic units such as energy use efficiency and the substitutes for chlorofluorocarbon emission basic unit, etc.

* Greenhouse gas emissions are decomposed by factors to the "basic unit," which is energy consumption and greenhouse gas emissions per unit of activity, and the "volume of activities," which includes the volume of production of businesses, the number of households, etc.

(Examples) Basic units: automobile fuel efficiency, per household energy consumption in households, energy consumption per unit of production in factories, carbon dioxide emissions per unit of energy consumption for each type of energy such as gasoline, coal, electric power, etc., HFC emissions per unit of production, etc.

Volume of activities: Index of Industrial Production, number of households, floor area, transport volume, etc.

Table 2 Global Warming Potential[3] and Major Sources of Gases Subject to the Kyoto Protocol

	Global warming potential	Major sources
Energy-originated CO2	1	Generated through the burning of fuel. In addition to direct consumption of heating oil, gas, etc., when electricity, etc. is obtained from fossil fuels the consumption of those fuels leads to indirect emissions.
Non-energy-originated CO2	1	Generated from consumption of limestone, incineration of waste, etc. in industrial processes.
Methane (CH4)	21	Generated by anaerobic fermentation, etc. of organic matter in paddy fields and waste disposal sites.
Nitrous oxide (N2O)	310	Generated in some manufacturing processes for raw materials for chemical products, the decomposition process of microorganisms in livestock manure, etc.
Hydrofluorocarbons (HFC)	1,300 (HFC-134a)	Used in the refrigerant in refrigeration appliances and air conditioning appliances, and in foaming agents such as heat insulation materials, etc.
Perfluorocarbons (PFC)	6,500 (PFC-14)	Used in manufacturing processes for semiconductors, etc.
Sulphur hexafluoride (SF6)	23,900	Used in the cover gas when making a magnesium solution, manufacturing processes for semiconductors, etc., and electrical insulation gas, etc.

(1) Energy-originated Carbon Dioxide

The target for energy-originated carbon dioxide[4] is a level of total emissions relative to the base year of +0. 6% from the FY1990 level (approximately 1.056 billion t-CO2).

Emissions of energy-originated carbon dioxide, which accounts for 90% of Japan's greenhouse gas emissions, in statistical terms can be divided into five sectors: the commercial sector[5], the other sectors including offices and other business facilities[6], the residencial sector, the transport sector, and the energy conversion sector[7]. It is also possible to look at the effects of countermeasures and policies in each of these sectors. The targets in each of these sectors are as in Table 3, but these targets have been established as rough ideas that provisional calculations show can be achieved if Japan records the currently forecast level of economic growth[8], countermeasures on the energy supply side produce the anticipated results, and countermeasures in each sector on the energy demand side also produce the anticipated results.

* It is expected that if countermeasures and policies are not formulated, emissions will increase through economic growth and other major factors. Thus, the targets provisionally calculated and established in

[3] Global Warming Potential expresses the extent of the global warming effect caused by each greenhouse gas relative to the global warming effect caused by a similar mass of carbon dioxide.
[4] Energy-originated carbon dioxide refers to carbon dioxide generated as a result of the use of energy.
[5] Factories, etc.
[6] Office buildings, retail stores, hospitals, schools, etc.
[7] Self-consumption such as power plants, petroleum processing facilities, etc.
[8] January 21, 2005 Cabinet Decisions *Economic Outlook for FY2005 and Basic Economic and Fiscal Management Measures* and *Structural Reform and Medium-Term Economic and Fiscal Perspective - FY2004 Revision.*

each sector will be realized through countermeasures and policies to reduce emissions from FY2002 levels by 33 million t-CO2 in the commercial sector, 31 million t-CO2 in the other sectors including offices and other business facilities, 29 million t-CO2 in the residencial sector, 11 million t-CO2 in the transport sector, and 13 million t-CO2 in the energy conversion sector.

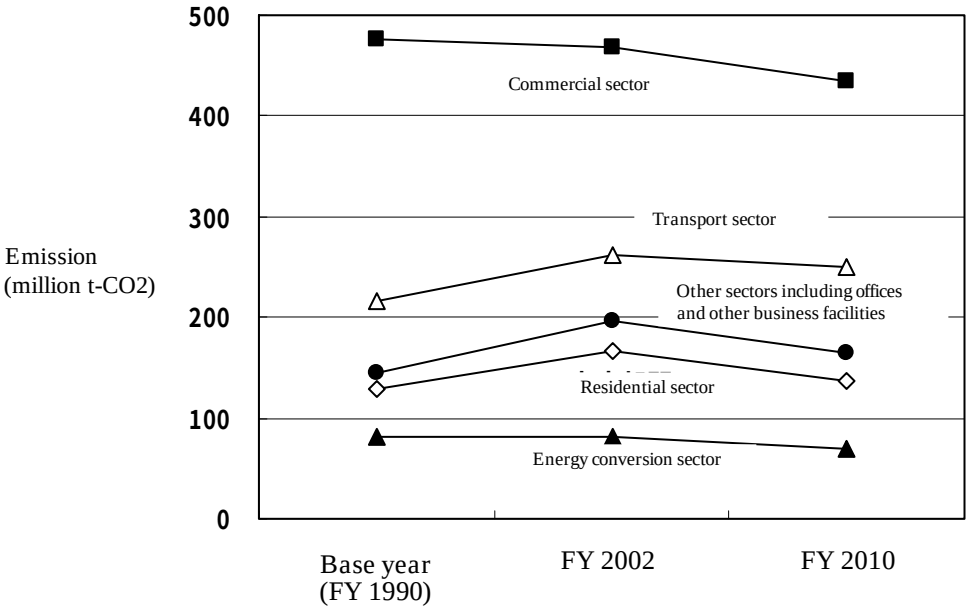
Table 3 Target as rough ideas in Each Sector for Energy-originated Carbon Dioxide

Estimated results	Base year (FY1990)	FY2002 level of emissions		Targets in each sector for FY2010		<Reference> Difference between the FY2010 targets and the FY2002 level of emissions
	A	B	(B-A)/A	C	(C-A)/A	
	million t-CO2	million t-CO2	(Percentage change relative to base year in each sector)	million t-CO2	(Percentage change relative to base year in each sector)	
Energy-originated CO2	1,048	1,174		1,056		
Commercial sector	476	468	(-1. 7%)	435	(-8. 6%)	It is expected that if countermeasures and policies are not formulated, emissions will increase through increases in the volume of production resulting from economic growth, etc. Provisional calculations show that emissions can be reduced by 33 million tons from FY2002 levels through countermeasures and policies.
Civilian sector	273	363	(+33. 0%)	302	(+10. 7%)	
(Other sectors including offices and other business facilities)	144	197	(+36. 7%)	165	(+15. 0%)	It is expected that if countermeasures and policies are not formulated, emissions will increase through increases in the floor area in buildings, etc. Provisional calculations show that emissions can be reduced by 31 million tons from FY2002 levels through countermeasures and policies.

		(Residencial sector)	129	166	(+28. 8%)	137	(+6. 0%)	It is expected that if countermeasures and policies are not formulated, emissions will increase through increases in the number of households and the per household device ownership rate, etc. Provisional calculations show that emissions can be reduced by 29 million tons from FY2002 levels through countermeasures and policies.
	Transport sector		217	261	(+20. 4%)	250	(+15. 1%)	It is expected that if countermeasures and policies are not formulated, emissions will increase through increases in the number of automobiles owned, etc. Provisional calculations show that emissions can be reduced by 11 million tons from FY2002 levels through countermeasures and policies.
	Energy conversion sector		82	82	(-0. 3%)	69	(-16. 1%)	This is self-consumption such as at power plants, petroleum processing facilities, etc. Provisional calculations show that by continuing to steadily develop efficient energy use in these facilities, etc., emissions can be reduced by 13 million tons from FY2002 levels.

* Due to rounding, the totals in the table above may not match the sum of the columns.

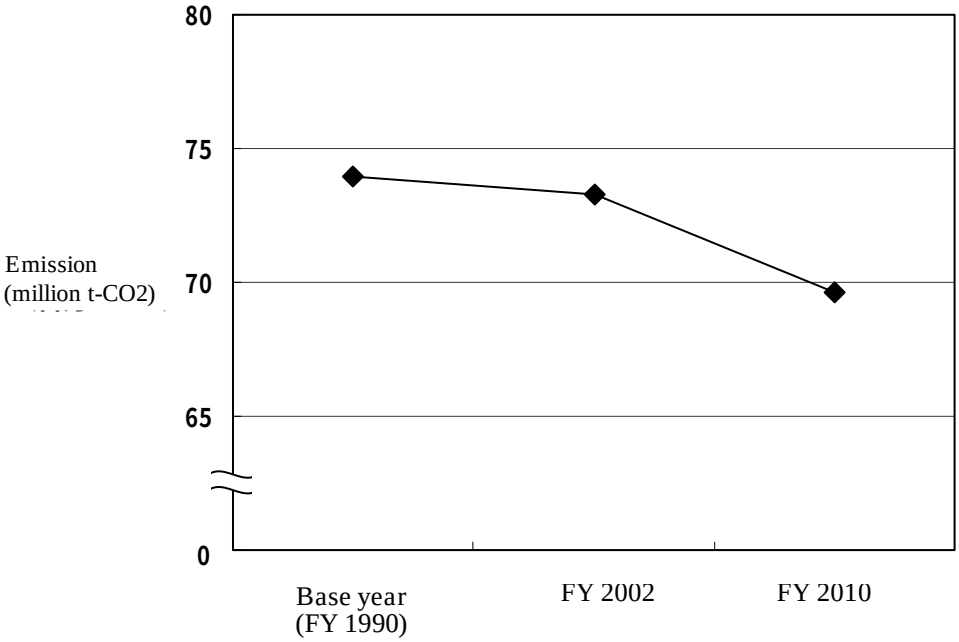
Figure 5 Emissions and Target as rough ideas in Each Sector for Energy-originated Carbon Dioxide



(2) Non-energy-originated Carbon Dioxide[9]

The target for non-energy-originated carbon dioxide is a level of -0. 3% from the FY1990 level as the ratio to the base year total emissions (approximately 70 million t-CO2).

Figure 6 Emissions and Targets for Non-energy-originated Carbon Dioxide

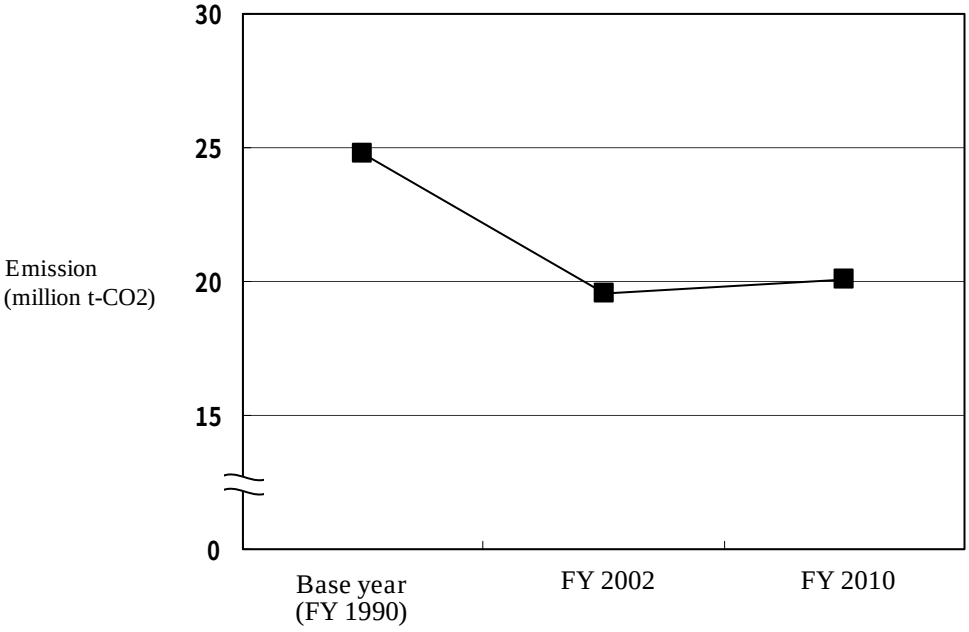


[9] For example, when promoting countermeasures it is sometimes necessary to strike a balance between carbon dioxide not generated from energy, methane and nitrous oxide, as when effective countermeasures for reducing methane emissions in the treatment of human waste increase emissions of nitrous oxide, etc.

(3) Methane[9]

The target for methane is at a level -0. 4% from the FY1990 level (approximately 20 million t-CO2) as the ratio to the base year total emissions.

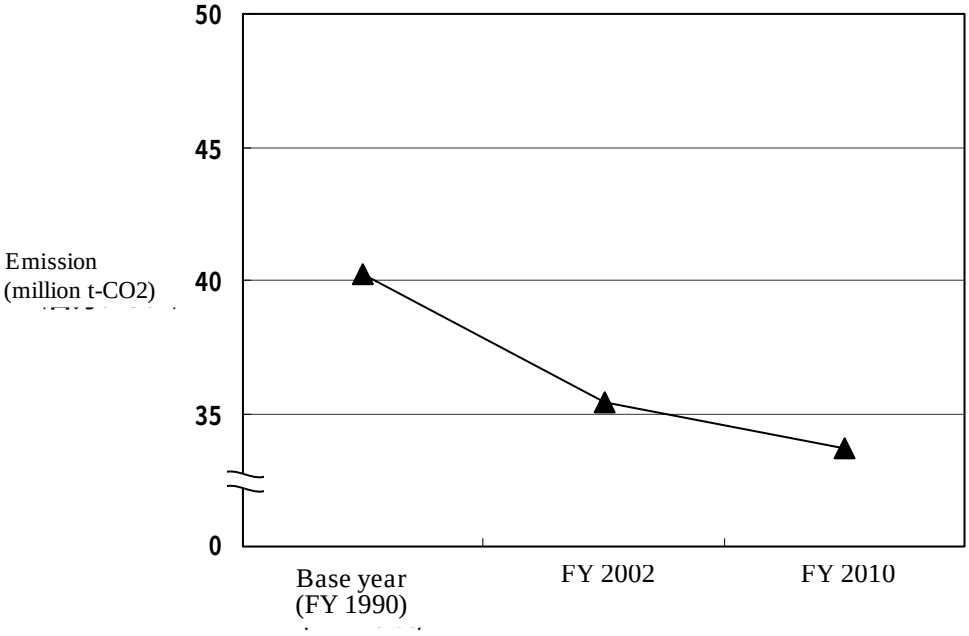
Figure 7 Emissions and Targets for Methane



(4) Nitrous Oxide[9]

The target for nitrous oxide is a level of -0.5% from the FY1990 level (approximately 34 million t-CO2) as the ratio to the base year total emissions.

Figure 8 Emissions and Targets for Nitrous Oxide



(5) Three Fluorinated Gases

The target for the three fluorinated gases (HFC, PFC, SF6) is a level of total emissions relative to the base year of +0.1% from the base year (1995) level (approximately 51 million t-CO2).

In some case, these three fluorinated gases are interchangeable, and because countermeasures and policies are sometimes implemented for all of these three gases, it is appropriate to combine countermeasures and policies according to technology and market conditions that minimize the social cost while at the same time obtaining the maximal results. For this reason, the figures shown for each gas are the rough breakdown to more steadily achieve the target of "+0.1%" for the three flruorinated gases collectively, on the assumption of technology and market conditions, etc. at the present time. It is necessary to keep in mind the fact that these figures would fluctuate depending on future chages in these conditions.

Table 4 Emissions and Targets for the Three Fluorinated Gases and Target Goals for Each Gas

	Base year (1995)	2002		Targets for the three substitute chlorofluorocarbon gases and target goals for each gas	
	million t-CO2	million t-CO2	Ratio to the base year total emissions	million t-CO2	Ratio to the base year total emissions
Three fluorinated gases	50	28	-1. 7%	51	+0. 1%
HFC	20	13	(-0. 6%)	34	(+1. 1%)
PFC	13	10	(-0. 2%)	9	(-0. 3%)
SF6	17	5	(-0. 9%)	8	(-0. 7%)

Figure 9 Emissions and Targets for the Three Fluorinated Gases and Target Goals for Each Gas

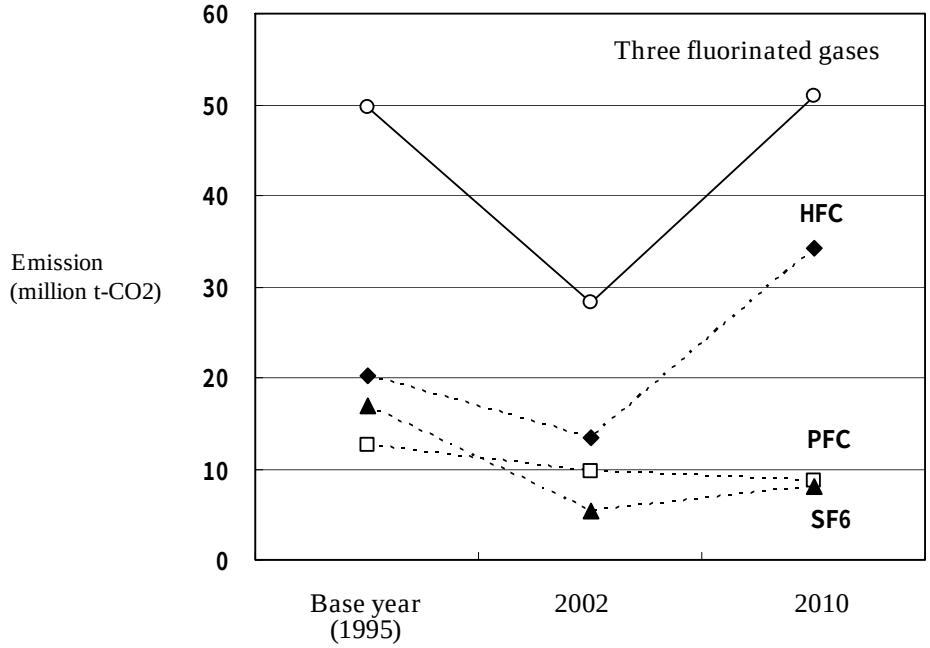
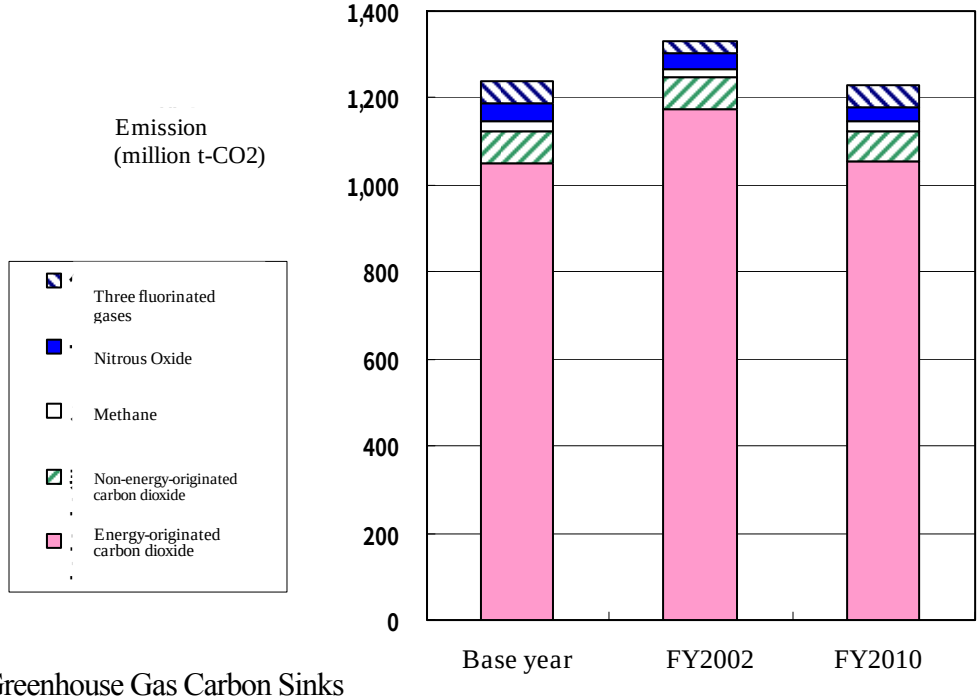


Figure 10 Emissions and Targets by Type of Greenhouse Gas



2. Greenhouse Gas Carbon Sinks

The target of the Government of Japan is to ensure removal of the 13 million t-C (47.67 million t-CO2, approximately 3.9% compared to the total emissions of the base year), agreed to at the Seventh Conference of the Parties to the UN Framework Convention on Climate Change (COP7) as the amount of removal by Japan's forest management, by all forests subject to Article 3, Paragraph 3 and 4 of the Kyoto Protocol.

3. Kyoto Mechanisms

Concerning the difference between emissions equivalent to the reduction commitment in the first commitment period of the Kyoto Protocol and actual greenhouse gas emissions (this refers to emissions after deduction of greenhouse gas removal) in the same period, the target is to utilize the Kyoto Mechanisms.

Even if any of the targets for greenhouse gases and greenhouse gas carbon sinks are confidently expected to be achieved in the first commitment period, the Government of Japan will not rest but rather will continue to steadily promote countermeasures.

* If it is based on the emissions projections for each gas from the results of each kind of countermeasure being undertaken at the present time, the difference is 1.6% of total emissions in the base year but fluctuations may occur due to the results of various countermeasures and policies, economic trends, etc.

Section 3 Targets of Individual Countermeasures

In order to give an overall picture of countermeasures with a specific grounding to achieve the 6% reduction commitment under the Kyoto Protocol, the Kyoto Protocol Target Achievement Plan addresses the individual countermeasures to achieve the targets for each greenhouse gas and for other categories and approximate targets for each sector for energy-originated carbon dioxide described in Section 2. It stipulates nationwide countermeasures evaluation indicators, expected emissions reductions, national policies to promote countermeasures, and examples of policies that local governments are expected to implement, and shows this information in tabular form for each sector and category. (Refer to Attached Tables 1-5.)

Countermeasures evaluation indicators are stipulated as targets of individual countermeasures designed to achieve targets for each greenhouse gas and approximate targets for each sector of energy-originated carbon dioxide.

The expected reduction in greenhouse gas emissions (carbon dioxide equivalent) resulting from countermeasures is calculated by combining factors other than the results of the countermeasures in question. By clarifying the premise of cumulation at the time of the formulation of the Kyoto Protocol Target Achievement Plan, it becomes possible to carry out ex-post verification.

Chapter 3 Countermeasures and Policies to Achieve the Targets

Section 1 Basic Roles of Central and Local Governments, Corporations, and Citizens

The central government has the role of comprehensively promoting global warming countermeasures and implementing measures undertaken on its own initiative. Local governments, corporations, and citizens are expected to undertake roles appropriate for their respective positions.

Concerning the promotion of global warming countermeasures, the central government is to have the following basic role and local governments, corporations and citizens are expected to undertake the following roles.

If all the stakeholders are aware of their roles and closely collaborate with each other to promote the countermeasures, it is expected that synergistic results exceeding those of efforts by each stakeholder alone can be obtained.

1. Basic Role of the Central Government

(1) Comprehensive Promotion of Global Warming Countermeasures that Mobilize Diverse Policy Instruments

Taking into account the fact that in order to reduce the emission of greenhouse gases, etc. it is essential to reconsider socioeconomic activities and lifestyles that involve large volumes of production, consumption and waste, the central government has the role of forming the overall framework of Japan's global warming countermeasures and comprehensively implementing global warming countermeasures through promotion of the Kyoto Protocol Target Achievement Plan. Furthermore, all central government agencies are to promote the countermeasures by sufficiently collaborating in line with the overall framework and mobilizing diverse policy instruments including the utilization of measures such as voluntary methods, restrictive methods, economic methods, informational methods, environmental impact evaluation, development of social capital, etc.

In addition, when implementing policies for which the major objective is not prevention of global warming, all central government agencies are to design the policies so that they contribute to the limitation, etc. of the emission of greenhouse gases.

(2) Implementation of Measures Undertaken on the Central Government's Own Initiative

The central government shall take the lead in implementing measures to reduce the emission of greenhouse gases and to conserve and strengthen the removal effect for its own administration and projects while placing importance on dissemination and promotion of measures to society as a whole.

2. Basic Role of Local Governments

(1) Implementation of Countermeasures Tailored to the Characteristics of the Regions

Local governments shall endeavor to formulate and implement comprehensive and well-planned policies tailored to the natural and social conditions in their area to reduce the emission of greenhouse gases, etc.

For example, local governments will develop pioneering, highly original, and ingenious countermeasures tailored to the natural and social conditions in their regions including CO2-saving[10] town planning, promotion of the use of public transport systems and bicycles, and the introduction of new forms of energy including biomass energy, etc.

(2) Implementation of Measures Undertaken on the Initiative of Local Governments

Local governments themselves are expected to be a model for the regions by carrying out measures on their own initiative. To this end they will formulate and implement a plan of action for their administration and projects based on the Law Concerning the Promotion of Measures to Cope with Global Warming.

(3) Information Provision and Activities Promotion for Local Residents, etc.

When prefectural centers for the promotion of activities to stop global warming, volunteers to promote activities to mitigate global warming, and global warming countermeasures regional councils have been designated, commissioned, and organized, local governments shall endeavor to utilize them to provide education and support for private organizations, introduce pioneering measures, and provide advice.

3. Basic Role of Corporations

(1) Highly Original and Ingenious Measures

Each corporation shall utilize its originality and ingenuity in order to autonomously and actively implement appropriate, effective and efficient global warming countermeasures in a wide range of sectors based on the nature of its business activities, etc. Each corporation shall promote measures contributing to the limitation, etc. of the emission of greenhouse gases of other stakeholders to the extent possible. Such measures include development of CO2-saving products, reduction of the amount of waste, etc.

(2) Measures Based on the Social Role of Corporations

Corporations are members of society and, individually or in cooperation with others, shall autonomously formulate plans and examine their state of implementation. Furthermore, they shall provide environmental education to employees and collaborate with labor unions, consumer groups and community groups, etc. to work toward the limitation, etc. of greenhouse gases. In addition, they shall cooperate with the policies of central and local governments.

(3) Reduction of the Environmental Burden through the Life Cycle when Providing Products and Services

Corporations providing final-consumption products shall monitor greenhouse gas emissions, etc. throughout the life cycle of products and services, and provide products and services that contribute to

[10] In the Kyoto Protocol Target Achievement Plan, CO2-saving refers to the limitation and reduction of carbon dioxide emissions through countermeasures on the energy demand side, such as promotion of energy conservation, etc. or countermeasures on the energy supply side such as promotion of nuclear power, introduction of new forms of energy, etc.

the reduction of these environmental burdens. Moreover, they shall provide information concerning the reduction of greenhouse gases through their products and services.

4. The Basic Role of Citizens

(1) Limitation of the Emission of Greenhouse Gases in Daily Life

Citizens need to be aware that the increase in greenhouse gas emissions in recent years is closely related to the lives of the citizens, namely households and transport (passenger cars for personal use), and must actively work toward reforming lifestyles that involve large volumes of consumption and waste.

Specifically, citizens should monitor their own energy consumption and greenhouse gas emissions, and choose a CO2-saving lifestyle. For example they should install heat insulation in their homes, switch to energy-conserving equipment, promote the use of public transport systems and bicycles, etc.

Citizens should also carry out meticulous measures such as using standby electric power and adopting other power saving measures, refraining from non-essential automobile use, etc.

(2) Participation in Global Warming Countermeasures Activities

Citizens should further deepen their understanding of the global warming issue and implement measures in collaboration with all stakeholders, such as endeavoring to actively participate in recycling campaigns, forest-building and other tree-planting campaigns, and other global warming countermeasures activities.

Section 2 Global Warming Countermeasures and Policies

1. Countermeasures and Policies Concerning Reduction, Removal, etc. of Greenhouse Gas Emissions

(1) Countermeasures and Policies Concerning Reduction of Greenhouse Gas Emissions

1) Energy-originated Carbon Dioxide

The Government of Japan will implement all of the countermeasures and policies based on the following five basic philosophies.

○ Shift from patchwork measures to an integrated approach

> The Government of Japan will continue to promote previous countermeasures for individual energy-related equipment and workplaces, and at the same time will rethink Japan's energy supply and demand structure from an integrated, wide-ranging perspective in order to change the structure itself into a CO2-saving structure. In other words, it will maximize CO2-saving through such measures as reform of Japan's socioeconomic structure, including the structure of cities and regions and public transport infrastructure, the design of CO2-saving cities and transport systems, etc.

○ Transcend the individual boundaries of each stakeholder

> Each stakeholder involved in energy supply and demand should be appropriately aware of their own role and aim to further improve energy efficiency in collaboration with other suppliers and users of energy, not just within the areas they directly manage, and should work to limit carbon dioxide emissions in as wide a range of sectors as possible. For example, industry could actively contribute to a switch to a CO2-saving approach in non-industrial and transport sectors.

○ Combined supply and demand side approaches placing the priority on demand countermeasures

> In order to effectively implement CO2-saving countermeasures it is necessary to take measures on both the energy supply and demand sides. However, if the countermeasures are to produce results by the first commitment period, first of all, the Government of Japan must place the priority on countermeasures on the energy demand side and set a target for Japan to become an "energy conservation nation that is a model for the world." Although a certain amount of time is required for infrastructure development and reform, the Government of Japan will make every effort to continue steady promotion of energy supply side countermeasures.

○ Approaches placing priority on improvement of basic units

> In order to steadily advance CO2-saving countermeasures, the Government of Japan will place priority on improving the energy intensity and the carbon dioxide emission per unit of energy consumption basic unit by increasing the efficiency of energy use.
> Specifically, it will work on the autonomous action plans of industry, the utilization of a framework such as the Energy Conservation Law, the Top-runner Program, the

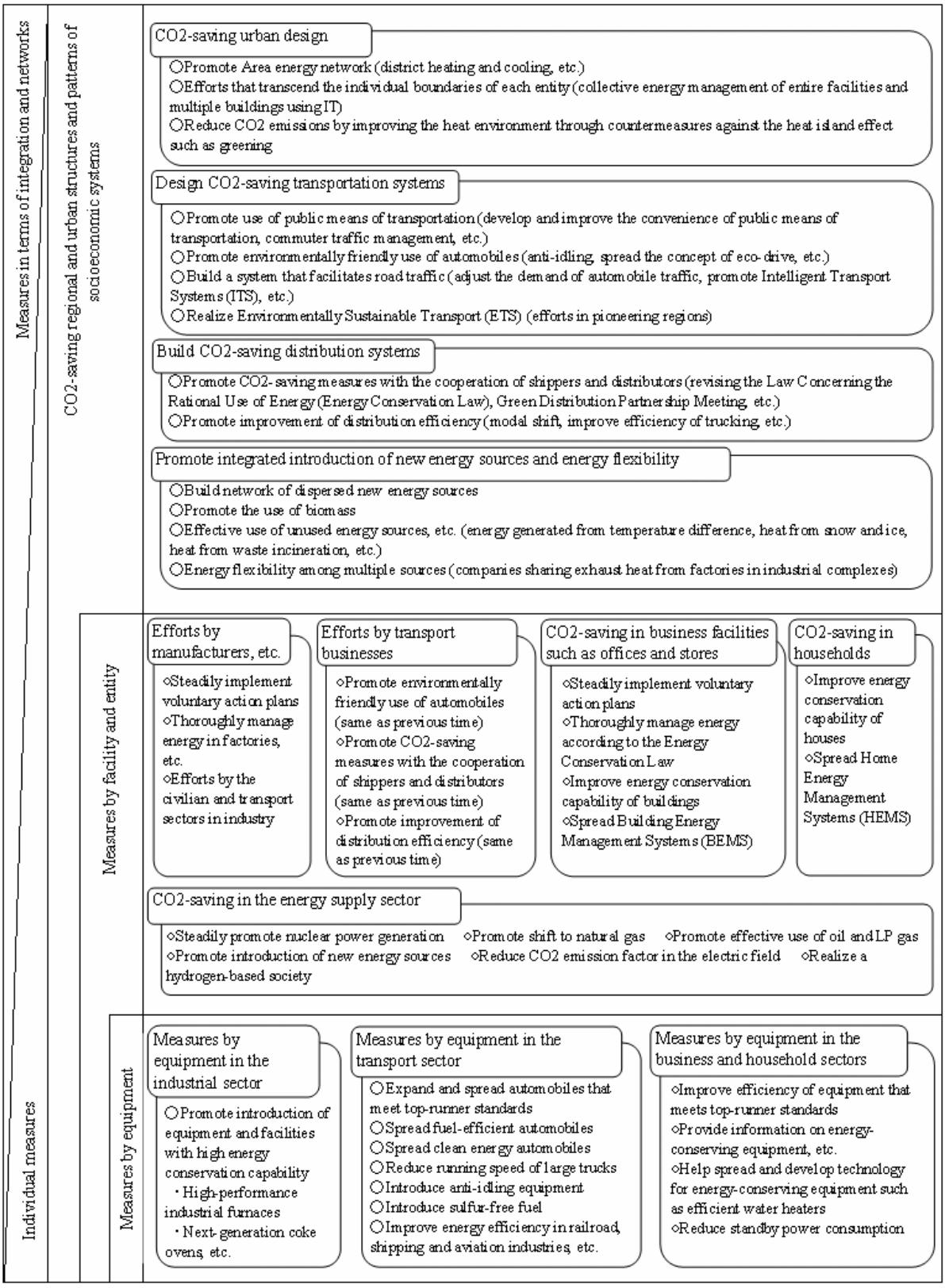
dissemination of energy-conserving equipment and automobiles, the introduction of architectural structures and homes with high energy efficiency, traffic flow countermeasures and measures to make distribution more efficient, the mutual energy interchange at the regional level, etc.

In order to improve the carbon dioxide emission basic unit in the energy supply sector, the Government of Japan will steadily advance promotion of nuclear power and the introduction of new forms of energy, etc.

○ Effective measures to respond to the factors behind increases in emissions

Looking at carbon dioxide emissions trends by sector, although emissions from the commercial sector, which accounts for approximately 40% of emissions on the demand side, and from the transport (trucks and public transport systems, etc.) sector, which accounts for approximately 10%, did not show much change, emissions greatly increased from the other sectors including offices and other business facilities, which account for approximately 20%, the residencial sector, which accounts for approximately 10%, and the transport (passenger cars for personal use) sector, which accounts for approximately 10%. For this reason, the Government of Japan will steadily promote countermeasures in the commercial sector and the transport (trucks and public transport systems, etc.) sector and will place priority on formulating effective countermeasures in other sectors including offices and other business facilities, the residencial sector and the transport (passenger cars for personal use) sector.

Table 5 Overview of Measures Concerning Energy-Originated Carbon Dioxide Sources



A. Forming CO2-saving Regional and Urban Structures and Socioeconomic Systems

Through sweeping reviews of regional and urban structures and transport systems, and reviews of socioeconomic systems through collaboration, etc. among energy consumption entities, structural incorporation of efficient energy use has a profound impact.

Therefore, the Government of Japan will work toward building a "society that exits from inducing global warming" by commencing the transformation of regional and urban structures and socioeconomic systems from a medium- and long-term perspective at the earliest possible time.

In particular, the form of cities has a big impact on global warming and so, while taking into account the aims of the Urban Renaissance Project, the Government of Japan will promote sweeping and structural countermeasures with urban renaissance as a turning point.

Furthermore, the Government of Japan will formulate and improve policies taking into account regional voices through special zones for structural reform and the process of calling for public submissions concerning revitalization of the regions.

a. CO2-saving Urban Design

As improving energy use efficiency in urban areas with highly concentrated energy demand is very effective, the Government of Japan will improve the energy environment of cities and promote the creation of CO2-saving regions through the Area energy network, heat island countermeasures, etc.

○ Promotion of the Area Energy Network

Efficient Area energy network includes the supply of efficient energy to multiple facilities and buildings, energy interchange between facilities and buildings, utilization of unused energy, etc. and can be expected to produce large CO2-saving benefits in regions. The Government of Japan will therefore actively introduce and disseminate environmentally outstanding direct heating and cooling, etc. while keeping in mind the characteristics of each region, the promoting entity, feasibility, etc.

For this reason, the Government of Japan will implement policies such as those indicating regions in which Area energy network is feasible, implementing pioneering model projects, utilizing the city planning system, and reviewing the operation of the Heat Supply Business Law to encourage energy conservation awareness in users. This will be done with a view to promoting collaboration among a wide range of stakeholders including central and local governments, energy supply corporations, regional development corporations, etc., the selection by the regions of efficient energy based on evaluations from the perspectives of the global environment, city environment, etc., and on the consumer side improving the understanding and promoting the cooperation of users of architectural structures, etc.

○ Measures Transcending the Individual Boundaries of Each Entity

In order to promote CO2-saving in general buildings such as buildings and housing complexes, etc., the Government of Japan will take more vigorous measures transcending the individual boundaries of each entity involved, namely, building owners, tenants and energy supply corporations.

For this reason, the Government of Japan will utilize IT to promote measures such as energy management for entire facilities and collective management of energy for multiple architectural structures.

○ Promotion of CO2-saving by Improving the Thermal Environment through Urban Greening and Other Heat Island Countermeasures

The Government of Japan will promote CO2-saving through improvements to the thermal environment of cities by utilizing the knowledge obtained from scientific observations, studies and research concerning the heat island phenomenon to implement comprehensive heat island-related policies.

To this end, the Government of Japan will work to reduce the amount of heat artificially emitted from air conditioning units, automobiles, etc. by promoting highly efficient energy consuming equipments, etc. and promoting the use of unused energy, etc. In addition, it will improve city lifestyles and working styles in order to alleviate the heat island phenomenon, for example, by adjusting the temperature of cooling and heating units to more appropriate levels, etc.

As a larger proportion of the earth's surface is covered by artificial materials, the evapotranspiration effect is declining and the surface temperature is increasing. From the perspective of preventing this and improving the situation, the Government of Japan will take measures to improve the coverage of land throughout the cities, including ensuring green areas through the creation of urban parks, etc., greening of public spaces and at facilities including public offices, etc., greening in the premises of architectural structures through utilization of the greening region system, etc., utilization of spring water, reclaimed wastewater, etc., utilization of road paving materials that are very effective in reducing road surface temperatures, conservation of agricultural land, etc.

In addition, with a view to forming and utilizing green islands that are sources of cold air and ensuring passages for wind from green areas and water surfaces, etc., the Government of Japan will improve the form of cities by conserving the green areas remaining in cities, creating urban parks, and promoting the formation of a water and greenery network through collaboration among projects such as parks, roads, rivers, *sabo* (erosion and sediment control), ports, sewage systems, etc., and promoting the building of cities with a small environmental burden.

b. Design of CO2-saving Transportation Systems

In order to increase the efficiency of transportation systems, etc., the Government of Japan will not only implement measures for automobiles; it will also implement comprehensive countermeasures including the development of traffic safety facilities such as traffic signals, etc., introducing Transportation Demand Management (TDM) and promotion of the use of public transport systems, etc.

○ Promotion of the Use of Public Transportation

The Government of Japan will make ongoing efforts to develop public transportation systems such as new railway lines, medium-capacity transit systems[11], Light Rail Transit (LRT)[12], etc., promote

[11] These are iron tracks of new transport systems, etc. with a carrying capacity midway between that of railways and buses.

informatization through the introduction of IC cards, etc., improve transit, and improve service and convenience through park and ride schemes, etc. and will also promote measures toward the realization of seamless public transport.

In addition, the Government of Japan will promote independent measures such as commuter transit management by corporations collaborating with the above policies and the implementation of car sharing using low-emission vehicles, etc. and will use enlightenment activities for citizens to promote a move away from passenger cars for personal use in passenger transport and a switch to public transport systems such as railways, buses, etc. Furthermore, in order to promote these kinds of independent measures by businesses, the Government of Japan will launch councils at the nationwide level and regional level made up of people from transport corporations, the business world, etc., and advance specific measures.

○ Promotion of Environmentally-friendly Use of Automobiles

The Government of Japan will disseminate and promote eco-drive, which includes anti-idling of stationary vehicles, and driving at a safe and constant speed appropriate for the traffic conditions, etc.

To this end, the Government of Japan will raise the awareness of citizens through public relations activities, etc. led by the Eco-drive Dissemination Liaison Meeting of four related government ministries and agencies[13], and develop the environment for the dissemination of eco-drive.

In order to promote eco-drive with business use automobiles, etc., the Government of Japan will build and disseminate Eco-drive Management Systems (EMS)[14] for transportation companies, etc.

In addition, the Government of Japan will continue to provide support, etc. for the introduction of anti-idling equipment, and develop the environment by encouraging automakers, etc. to increase the number of models fitted with such equipment and make efforts to promote sales of those models, etc. Furthermore, the central and local governments will take the lead in introducing this equipment.

○ Building of a System to Realize Smooth Road Traffic

As improving traveling speeds by smoothing the traffic flow improves effective fuel consumption and reduces carbon dioxide emissions from automobiles, the Government of Japan will promote the development of trunk road networks such as ring roads, etc., the construction of continuous flow intersections using an overpass or underpass, improvements of railroad crossings through construction of successive two-level crossing, etc., and implement traffic flow measures including management of the demand for automobile traffic, promotion of Intelligent Transport Systems (ITS) and provision of traffic information and measures to promote proper parking on roads, reduction of road constructions, and development of traffic safety facilities.

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[12] Next-generation tram system which is friendly to people and the environment and has the characteristics of being easy to get on and off, and being outstanding with respect to punctuality, speed, carrying capacity, comfort, etc., achieved through improvements in the running space and vehicle performance.

[13] The National Police Agency, the Ministry of Economy, Trade and Industry, the Ministry of Land, Infrastructure and Transport, and the Ministry of the Environment.

[14] Measures to implement well-planned and continuous eco-drive of automobiles and evaluate and provide guidance in an integrated manner.

○ Realization of Environmentally Sustainable Transport (EST)

To limit excessive dependence on passenger cars for personal use which is a major cause of increases in carbon dioxide emissions in the passenger sector, and to realize Environmentally Sustainable Transport (EST), the Government of Japan will recruit pioneering regions aiming to promote EST, and take measures focused on support for promotion of the use of public transport systems, measures to improve traffic flow, promotion of the introduction of low-emission vehicles, and dissemination and enlightenment, etc. Related ministries and agencies will collaborate to strengthen policies for specific ambitious measures tailored to the characteristics of the regions.

c. Building of CO2-saving Distribution Systems

In order to promote the greening[15] of the overall distribution system, the Government of Japan will strengthen and expand measures based on cooperative efforts among shippers and distributors and will promote modal shifts[16], greater efficiency in trucking, etc.

○ Promotion of CO2-saving through the Cooperative Efforts of Shippers and Distributors

The Government of Japan will promote the greening of the entire distribution system by strengthening collaboration between shippers who request delivery and distributors who undertake delivery, and by expanding measures related to global warming countermeasures.

For this reason, the Government of Japan will provide support to advanced model projects in which shippers and distributors collaborate on modal shifts and greater efficiency of trucking through the Green Distribution Partnership Meeting[17]. In order to facilitate collaboration between shippers and distributors, the government will formulate integrated methods (guidelines) for the calculation of carbon dioxide emissions in the distribution sector that can be utilized jointly by both parties to enable them to objectively evaluate the effects of each measure.

In addition, the Government of Japan has established the Law Concerning the Promotion of the Integration and Efficiency of Distribution Operations and is supporting integrated and efficient implementation of transportation, storage, distribution processing and other distribution operations through the introduction of 3rd Party Logistics (3PL)[18] projects, a switch to joint transportation and delivery, utilization of IT, etc.

In combination with this, the Government of Japan has amended the Energy Conservation Law and has introduced countermeasures in the transport sector which include imposing an obligation on freight transport businesses, passenger transportation businesses and shippers above a certain size to formulate an energy conservation plan and report the amount of energy used, etc.

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[15] This refers to building a distribution system which imposes a smaller burden on the environment through modal shifts, improving efficiency of trucking, the integration and improved efficiency of distribution operations, improving the low-emission of transportation systems, etc.

[16] "Modal shift" means a change (shift) in transportation system (mode) through utilization of railway freight transport and domestic shipping, which is the mass transit systems with a small environmental burden, for freight transport.

[17] The Green Distribution Partnership Meeting is an organization established to promote autonomous measures by industry toward the greening of distribution, and consisting of shipping businesses, distribution businesses, the government, and the concerned member businesses and groups. It is operated through cooperation with the Ministry of Economy, Trade and Industry, the Ministry of Land, Infrastructure and Transport, and concerned groups.

[18] 3PL is a high-quality service which performs all or part of a company's logistics functions.

○ Promotion of Greater Efficiency in Distribution through Modal Shifts, Improving Efficiency of Trucking, etc.

In order to promote the greening of the entire distribution system, the Government of Japan will promote a switch transportation from trucking to using domestic shipping and railways which produces low carbon dioxide emissions.

As a part of these efforts, in order to increase the competitiveness of domestic shipping, which is essential to this approach, the Government of Japan will cut transportation costs and improve services through the development of domestic trade terminals able to handle combined multimodal transportation, and develop and disseminate new technologies with good energy efficiency, such as next generation domestic vessels (super eco-ships), etc., and review regulations, etc. Furthermore, the government will make efforts to electrify and improve the efficiency of cargo-handling equipment, etc. in port terminals, which are centers of distribution, for example, by studying the development of land-based facilities for supplying electricity to ships in port, etc.

In the same way, in order to increase the competitiveness of railway freight transport, the Government of Japan will improve the convenience of freight railways by expanding and enhancing transportation capabilities and reducing the costs of terminal transportation, etc. through expansion of the carrying capacity of railway transportation, development of better train schedules, and enhancement of transportation equipment and materials such as containers, etc.

The Government of Japan will also promote greater efficiency in trucking. To this end, it will promote a switch from trucks for personal use to business use trucks and the use of bigger trucks with more trailers, and will advance the development of roads able to handle the bigger vehicles. In combination with this, it will improve loading efficiency through elimination of congested transportation, and ensuring back-hauling, etc.

In addition, the Government of Japan will promote the development of international marine container terminals, the development of multipurpose international terminals, and the development of infrastructure that deepens collaboration among each mode, etc. in core and hub international ports that contribute to reducing the over-land transportation distances of international freight.

d. Promotion of Integrated Introduction of New Energy and Energy Interchange

The Government of Japan will aim at CO2-saving in the regions as a whole through the efficient utilization of distinctive energy resources, such as biomass resources and unused energy sources, etc., for local production.

○ Building of a Network of Dispersed New Energy Sources

In order to introduce new energy sources, the Government of Japan will combine multiple dispersed power sources such as wind power, biomass, photovoltaic power generation, cogeneration systems (systems with high energy efficiency), fuel cells, etc. with IT control units, etc. to create a network, and introduce small-scale systems (micro-grids) designed for efficient energy use taking into account technological challenges, etc. related to connection to the existing network. Through this approach, the government will promote the introduction of new energy sources, etc. in the regions as a whole and

realize CO2-saving energy systems. To this end, the Government of Japan will implement leading model projects and will advance the development and demonstration, etc. of technology.

○ Promotion of the Use of Biomass

In order to build biomass towns possessing systems that efficiently and comprehensively utilize the various biomass resources with which the regions are endowed for thermal and electric power, fuel, materials, etc., the Government of Japan will provide information and promote regional activities, while at the same time developing facilities for utilization of biomass resources and technology for conversion, use, etc. of biomass energy.

○ Effective Use of Unused Energy Sources, etc.

The Government of Japan will provide an efficient energy supply in the regions by taking full advantage of the characteristics of the regions to promote the use of unused energy sources (energy using the differences in temperature such as sea water and sewage, heat from snow and ice, etc.) and the use of heat from waste incineration, etc.

○ Energy Interchange Among Multiple Entities

In order to promote energy interchange through the collaboration of multiple entities, including the interchange among businesses of factory exhaust heat in areas with a high concentration of industry, such as industrial complexes, etc., the Government of Japan will develop an environment that encourages collaboration among entities and will provide support to collaborative projects with large energy conservation effects.

B. Measures by Facility and Entity

Each entity that consumes energy, including businesses, individuals, etc. will take various measures aimed at limiting the overall levels of carbon dioxide emitted in relation to their own activities.

In doing so, each entity shall be appropriately aware of its own responsibilities and role, and the measures it can take. Power-consuming entities can contribute to the limitation of carbon dioxide emissions in a wide range of sectors. Such measures include measures for the civilian and transport sector by manufacturers and the provision of information to consumers by retailers, etc.

Furthermore, in the energy supply sector as well, energy-consuming entities will utilize energy sources with a small carbon dioxide emission basic unit and improve the efficiency of supply.

a. Efforts in the Commercial Sector (Manufacturers, etc.)

Carbon dioxide emissions in the commercial sector were 1.7% lower in FY2002 than in FY1990 and *Keidanren* Voluntary Action Plan on the Environment and other countermeasures will continue to be steadily promoted. In combination with this, businesses in this sector will contribute to CO2-saving in the civilian and transport sectors.

○ Steady Implementation of *Keidanren* Voluntary Action Plans on the Environment

In the industrial and energy conversion sectors, in 1997 the *Keidanren* took the lead in formulating *Keidanren* Voluntary Action Plan on the Enviornmnent, and established the target of limiting carbon dioxide emissions in FY2010 to under ±0% of FY1990 levels. To date 34 industries have formulated voluntary action plans on the environment establishing quantitative targets for each industrial classification. These action plans now cover approximately 80% of the industrial and energy conversion sectors.

* Each industrial classification voluntarily decides which of four indicators—energy intensity, energy consumption, carbon dioxide emissions intensity, carbon dioxide emissions—it will select as targets of the voluntary action plan for their own industrial classification.

These voluntary action plans by businesses have currently produced results and are occupying a central role in countermeasures in the industrial and energy conversion sectors. The advantages of these voluntary methods include the ability of each entity to use its originality and ingenuity to select outstanding countermeasures, the likelihood of incentives to attempt to reach more difficult targets, and having no procedural costs for both the government and the implementing entity. It is expected that these advantages will be further exploited in voluntary action plans by businesses.

In order for Japan to achieve its reduction commitment under the Kyoto Protocol, it is extremely important for industry to advance efforts to limit emissions, including efforts to improve the energy consumption basic unit and the carbon dioxide emission basic unit, so that these targets of voluntary action plans in the industrial and energy conversion sectors are achieved. Therefore, concerning the targets and content of voluntary action plans of industry, while taking into account the fact that the voluntary nature of the plans must be respected, it is also important that they meet social demands and

fully achieve *Keidanren* voluntary action plan targets, that individual industrial classifications are encouraged to make active efforts toward achievement of their own voluntary targets, and that the transparency, reliability, and probability of achieving the targets is improved. The Government of Japan will thus continue to regularly conduct follow-ups in related councils, etc.

It is expected that businesses that have not yet formulated such voluntary action plans will formulate one and take effective CO2-saving countermeasures tailored to their own special characteristics.

○ Thorough Management of Energy in Factories, etc.

In addition to the above voluntary measures, measures are being taken in the commercial sector to strengthen the voluntary management of energy through measures based on the Energy Conservation Law.

In order to encourage more thorough and meticulous voluntary management of energy in future, it is necessary to amend the Energy Conservation Law and adopt comprehensive energy conservation countermeasures for both heat and electricity.

○ Measures by Industry in the Civilian and Transport Sectors

Industry will contribute to CO2-saving in the civilian and transport sectors through the development of lighter and more functional materials, etc., providing products that are highly energy-efficient and have greater efficiency in distribution by moving away from personal use trucks to business use trucks and modal shifts, etc. It will also contribute to CO2-saving in those sectors through promotion of the use of public transport systems, etc. for the daily commute of company employees.

In particular, in order to strengthen measures in the transport sector, the Government of Japan will amend the Energy Conservation Law and introduce countermeasures in the transport sector which include imposing an obligation on shippers above a certain size to formulate an energy conservation plan and report the amount of energy used, etc.

b. Efforts by Transport Businesses

Carbon dioxide emissions in the transport sector have increased by approximately 20% over FY1990 levels, but in recent years emissions from the transport (trucks and public transport systems, etc.) sector have been on a declining trend. In order to make this a steadier trend, the Government of Japan will promote the greening of transportation. For example, it will promote the limitation of carbon dioxide emissions through cooperative efforts by shippers and distributors, etc.

Furthermore, the Government of Japan will promote the dissemination of the Green Management Certification System which certifies transport businesses implementing certain levels of outstanding environmental measures, such as measures to improve fuel consumption, etc.

In addition, the Government of Japan will improve the efficiency of operation of business use automobiles by promoting the introduction of systems making the efficient dispatch and operation of taxis, etc. possible through utilization of information technology such as GPS, etc.

○ Promotion of Environmentally-friendly Use of Automobiles (Same as last time)

○ Promotion of CO2-saving Through the Cooperative Efforts of Shippers and Distributors (Same as last time)

○ Promotion of Greater Efficiency in Distribution through Modal Shifts, Improving Efficiency of Trucking, etc. (Same as last time)

c. CO2-saving in Business Facilities such as Offices and Stores, etc.

Carbon dioxide emissions in the business sector of offices, etc. (including members of the service industry such as stores, etc.) have increased by approximately 40% over FY1990 levels along with the increase in floor area. The Government of Japan will limit these emissions through steady implementation of energy management and voluntary action plans according to the Energy Conservation Law.

○ Steady Implementation of Voluntary Action Plans

Efforts to formulate voluntary action plans on the environment that establish targets for each classification in commercial sector have also been expanded to 10 classifications in the commercial sector, other than the industrial and energy conversion sectors. Concerning the targets and content of voluntary action plans, while taking into account the fact that the voluntary nature of businesses must always be respected, it is extremely important to meet social demands and to improve the transparency, reliability, and probability of achievement of targets, so it is necessary to regularly conduct follow-ups in related councils, etc.

In classifications in commercial sector that have not yet formulated environmental voluntary action plans, such as private hospitals, private schools, etc., it is expected that voluntary action plans will be formulated, and effective CO2-saving countermeasures tailored to the characteristics of each sector will be taken.

○ Thorough Management of Energy According to the Energy Conservation Law

In order to encourage energy management in office buildings and other buildings with high energy consumption, the regulations of the Energy Conservation Law were strengthened in April 2003 and an obligation was imposed on such buildings to make a regular report and formulate a medium- and long-term plan for energy use.

In future, in order to further encourage energy management, it will be necessary to amend the Energy Conservation Law and adopt comprehensive energy conservation countermeasures for both heat and electricity.

In order to ensure further measures in offices, etc., comprehensive examinations, etc. by the central government will be implemented.

○ Improvement of the Energy Conservation Capability of Buildings

As the energy conservation capability of buildings has a large impact over the long term on carbon

dioxide emissions from other sectors including offices and other business facilities through energy consumption, the Government of Japan will continue to advance energy conservation countermeasures at the time a new building is constructed and in addition promote improvement in energy conservation by improving the energy conservation capability of the existing stock of buildings.

To this end the Government of Japan will amend the Energy Conservation Law and take measures such as imposing an obligation to notify the responsible government agency of the energy conservation measures taken when newly constructing, extending, or reconstructing buildings above a certain size or when carrying out large-scale repairs, etc.

Furthermore, the Government of Japan will provide support through financing, etc., develop and disseminate the Comprehensive Assessment System for Building Environmental Efficiency (CASBEE[19]), promote the provision of information concerning the design, construction, etc. of energy conservation features in buildings such as energy conservation improvement, etc., provide support to model projects aiming at the collaboration of building owners and tenants on energy conservation countermeasures, promote the development of green government buildings[20], promote green assessments and renovations[21], and carry out thorough and appropriate operation and management of existing government office facilities, etc.[22]

In addition, the Government of Japan will promote the introduction of energy-conserving equipment and facilities utilizing ESCO[23], etc.

○ Spread of Building Energy Management System (BEMS)

In order to spread BEMS, an energy demand management system which utilizes IT to display the state of use of energy in real time and ensures the most appropriate operation of lighting, air conditioning, etc. based on the indoor conditions, the Government of Japan will support its introduction.

d. CO2-saving in Households

Carbon dioxide emissions in the residencial sector have increased by approximately 30% over FY1990 levels even though the increase in the number of households is gradually slowing down due to the increase in energy consumption resulting from the increase in the number of household appliances, etc.

For this reason, the Government of Japan will work to improve the energy conservation capability of houses, etc. and will encourage citizens to think of the global warming issue as their own issue,

[19] CASBEE is a comprehensive environmental capacity assessment system for houses and buildings which gives an overall assessment in a unified manner of the improvement of comfort of houses (indoor environment) and energy conservation countermeasures and other efforts to reduce the environmental burden, etc. in terms of comprehensive environmental capability and presents the results as easy-to-understand indicators.

[20] Green government buildings are government office facilities that aim to reduce the environmental burden throughout the life cycle of a building from planning, construction and operation to abolishment.

[21] Green assessments are diagnostics to assess the environmental efficiency of existing government office facilities. Green renovations aim to reduce the environmental burden throughout the life cycle of a building from the renovation plan to the renovation, operation, and abolishment.

[22] When using heat insulation materials in order to achieve energy conservation in houses and buildings, heat insulation materials containing chlorofluorocarbons tend to increase total greenhouse gas emissions rather than decrease them when the greenhouse effect of the chlorofluorocarbons is taken into account. Thus, it is necessary to promote the use of heat insulation materials that do not contain chlorofluorocarbons.

[23] ESCO stands for Energy Service Company, a type of business that offers a comprehensive energy conservation service.

constantly review their lifestyles, and endeavor to take energy conservation countermeasures.

○ Improvement of the Energy Conservation Capability of Houses

The energy conservation capability of houses has a large impact over the long term on the carbon dioxide emissions of the residencial sector through energy consumption, so in addition to thorough implementation of energy conservation measures at the time a new building is constructed, the Government of Japan will promote energy conservation renovation work that improves the energy conservation capability of the existing stock of houses.

To this end the Government of Japan will amend the Energy Conservation Law and take measures such as imposing an obligation to notify the responsible government agency of the energy conservation measures taken when newly constructing, extending, or reconstructing houses above a certain size or when carrying out large-scale repairs, etc., the same obligations as for buildings.

Furthermore, the Government of Japan will provide support through financing, etc., develop and disseminate the Comprehensive Assessment System for Building Environmental Efficiency (CASBEE) for houses, etc., promote the provision of information concerning energy conservation improvement and building facilities by enhancing energy conservation standards, etc., support the development of leading technology by private businesses, etc., and provide support for the introduction of model houses which combine the introduction of heat insulation materials and the installation of photovoltaic power generation systems, etc.[24]

In addition, in order to encourage the wider use of window glass and sashes with a high energy conservation capability, the Government of Japan will establish a system under which manufacturers, etc. have to state the energy conservation capability of their products on product labels and will thoroughly publicize the energy conservation effects of products utilizing all forms of media.

In addition, the Government of Japan will provide information to the residents of stand-alone houses concerning the advantages of introducing energy-conserving equipment, facilities and building materials tailored to their state of use of energy and will promote the introduction of energy-conserving equipment, facilities and building materials utilizing leases and ESCO in housing complexes.

○ Spread of Home Energy management System (HEMS)

In order to spread HEMS, an energy demand management system which utilizes IT to display the state of use of energy in real time and ensures the most appropriate operation of lighting, air conditioning, etc. based on the indoor conditions, the Government of Japan will conduct experiments to test the system.

e. CO2-saving in the Energy Supply Sector

Although a certain amount of time is required for infrastructure development and reform in the energy supply sector, the Government of Japan will commence countermeasures at the earliest possible time, work toward utilization of energy sources with low carbon dioxide emissions intensity, and improve the efficiency of supply by working toward the environmentally conscious use of fossil fuels while also keeping in mind the stable supply of energy.

[24] Refer to footnote 22.

○ Steady Promotion of Nuclear Power Generation

Nuclear power does not produce carbon dioxide in the generation process, so it occupies an extremely important position with respect to the promotion of global warming countermeasures. In future, with the assurance of safety as the major premise, the Government of Japan will work toward the further utilization of nuclear power generation and will steadily promote public sector-private sector cooperation for nuclear power generation as a mainstay power source for the nation. When doing so, the Government of Japan will steadily advance the establishment of the domestic nuclear fuel cycle as the fundamental principle of the country with a view to further improvement in the characteristics of nuclear power generation such as its outstanding supply stability, etc.

In addition to the 53 nuclear power plants currently in operation, the Government of Japan is following up on the efforts of the businesses to ensure the three new plants under construction (Tomari Unit 3, Higashidori Unit 1 (Tohoku), Shika Unit 2) will steadily go into operation by FY2010.

The Government of Japan will develop an investment environment in order to ensure investment in nuclear power generation (rules to ensure power transmission capacity which make the operation of long-term and stable nuclear power generation feasible, etc.)

With a view to steady implementation of the nuclear fuel cycle, the Government of Japan will develop laws for the external funding for the spent fuel reprocessing. It will also provide active support to ensure that the reprocessing, the utilization of MOX fuels in LWRs, the high-level radioactive waste final disposal projects, etc. being advanced by businesses are steadily promoted.

The Government of Japan will realize scientific and rational operation and management of nuclear power plants with the assurance of safety as the major premise.

○ Promotion of the Introduction of New Energy

As new energy utilizing sunlight, wind power, biomass[25], etc. makes a big contribution to global warming countermeasures and contributes to improvement of the energy self-sufficiency ratio, the Government of Japan will promote its introduction.

* Heat sector
The Government of Japan will take measures including promotion of the formulation, implementation and evaluation of comprehensive plans for the introduction of new energy by local governments, strengthening of the promotion of the use of biomass heat in collaboration with the promotion of the Biomass Nippon Strategy, promotion of the use of solar heat (development of cutting-edge technology using solar heat, etc.), and promotion of the use of heat from waste incineration, etc.

Furthermore, concerning the use of fuel derived from biomass for transportation-use fuel (gasoline and diesel oil), the Government of Japan will respond to challenges related to fuel

[25] The carbon dioxide emissions of renewable energy including biomass are not counted under the Framework Convention on Climate Change.

economy, safety, the impact on the atmospheric environment and stable supply, and continue testing of these types of fuel as well as study the most appropriate methods of introducing them taking into account these challenges in order to facilitate their smooth introduction.

* Power Generation Sector
The Government of Japan will take measures including expanded introduction of new energy in the public services, development of photovoltaic power generation and other technology which promotes the reduction of costs and improved efficiency, carry out smooth coordination of network connection countermeasures for wind power generation and all types of land use regulations, promotion of the introduction of power generation from waste, steady implementation of the Renewables Portfolio Standard (RPS) Law[26], etc.

○ Promotion of a Shift to Natural Gas

Natural gas is a clean form of energy which has a relatively small environmental burden compared to other fossil fuels and the earth is endowed with plentiful supplies of natural gas dispersed widely throughout all its regions, including the Middle East. Therefore, the Government of Japan will promote acceleration in the shift to natural gas while taking into account the balance with other energy sources such as nuclear power, etc.

* In order to revitalize domestic gas distribution, the Government of Japan will comprehensively promote the development of an environment for the building of a natural gas supply infrastructure by private entities.
* The Government of Japan will advance the fuel conversion of industrial-use boilers, etc. to natural gas, and the conversion of the type of gas of city gas businesses to natural gas.
* In order to promote the efficient use of natural gas, the Government of Japan will promote the efficiency of gas turbines and gas engines and also promote the introduction of natural gas cogeneration and highly efficient gas air conditioning which contributes to the leveling of electrical load.
* The Government of Japan will promote the development of technology related to Gas-to-Liquid (GTL)[27], Dimethyl ether (DME)[28], made from natural gas, etc. as their raw materials, and methane hydrate. The Government of Japan will also advance the introduction of above mentioned energies.

○ Improvement of Carbon Dioxide Emissions Intensity in the Electric Power Sector

It is important to reduce carbon dioxide emissions intensity in the power generation sector, which accounts for a large part of Japan's energy-originated carbon dioxide emissions, and the Government of Japan will take the countermeasures below.

[26] The law requiring Japanese electric power companies to use electricity of new energy sources for a certain percentage of their sales.
(Promulgated in June 2002, came into full force in April 2003.) RPS stands for Renewables Portfolio Standard.
[27] Gas-to-Liquid: new fuels substitute diesel oil, etc. manufactured using synthetic gas made from natural gas, etc.
[28] Dimethyl ether: a fuel gas manufactured using synthetic gas made from natural gas, etc. It has similar properties to liquefied petroleum gas (LPG) and can be liquefied easily. In the wider sense it is one type of GTL product.

* Follow-up on the achievement of the autonomous targets of the business efforts, etc. listed below.
→ Improvement of the nuclear power plant's capacity factor through realization of scientific and rational operation and management.
→ Further improvement of the heat efficiency of thermal power generation, adjustment of the operational methods of thermal power sources that consider environmental characteristics, etc.
→ Obtaining of credits under the Kyoto Protocol (volume of emissions reduction) through utilization of the Kyoto Mechanisms by businesses.
* Promotion of measures for electrical load leveling that result in CO2-saving by disseminating and promoting thermal storage systems, etc.
* Steady enforcement of the RPS Law and promotion of the conversion of obsolete coal thermal power generation to natural gas (same as last time).

○ Promotion of the Efficient Use of Petroleum

Petroleum will continue to be an energy source occupying an important position in the primary energy supply in future, and the Government of Japan will use it efficiently while considering the environment.

For this reason, the Government of Japan will disseminate and promote petroleum systems with a smaller environmental burden, such as petroleum cogeneration systems, highly efficient boilers with low NO_X, etc. as energy conservation systems that contribute to CO2-saving.

○ Promotion of the Efficient Use of LPG

The Government of Japan will promote the use of LPG, which has a relatively low environmental burden and is a clean energy along with natural gas. To this end, the government will promote the highly efficient use of LPG systems such as LPG cogeneration systems, gas engine boilers, etc.

○ Realization of a Hydrogen Society

As hydrogen is an energy medium which does not emit carbon dioxide at the use stage, and as manufacturing from non-fossil fuels is also possible, it is a desirable secondary energy from the energy security perspective.

For this reason, the Government of Japan will promote technology development of fuel cells and hydrogen production, key technologies of the hydrogen society, establish codes and standards, review regulations, etc. and will also promote the leading introduction of the technologies and make efforts to disseminate them.

C. Measures by Equipment

Energy conservation capability for all types of equipment, including refrigerators, air conditioning equipment, equipment related to the supply of hot water, etc., is dramatically improving, but the Government of Japan will work to further improve energy conservation capability in future and will introduce and disseminate a wide range of equipment with a high energy conservation capability.

a. Commercial Sector

○ Introduction and Promotion of Equipment and Facilities with a High Energy Conservation Capability

In addition to the introduction of various kinds of energy-conserving equipment based on the voluntary action plans, in order to promote the dissemination of high capability industrial furnaces, etc. which make a wider range of energy conservation possible than with conventional equipment, the Government of Japan will give priority to measures to support them and will provide support for the introduction of next-generation coke ovens.

Furthermore, the Government of Japan will promote the reduction of CO2 emissions from the construction works. For example, it will promote the dissemination of fuel-efficient construction machinery by encouraging the use of fuel-efficient construction machinery and actively utilizing such machinery in public construction projects, etc.

b. Transport Sector

(a) Automobile Sector

The majority of energy consumption in the transport sector is accounted for by the automobile sector, so the Government of Japan will promote measures such as further improvements in fuel consumption technology of a world-class standard, and as automobile-based countermeasures the dissemination of automobiles with outstanding fuel efficiency and vehicles with anti-idling equipment installed.

○ Expansion and Dissemination of Models Conforming to Top-runner Standards

Top-runner standards were introduced in FY1998 based on the Energy Conservation Law and the scope of the law has been successively expanded. For example, in FY2003 LPG passenger automobiles became subject to the provisions of the law. As a part of that process, heavy vehicles (trucks with a total body weight exceeding 2.5 tons and passenger automobiles with a passenger capacity of 11 persons or more) also became subject to top-runner standards.

As of FY2003 approximately 80% (shipment basis) of gasoline passenger automobiles had already achieved the top-runner standards for gasoline passenger vehicles of FY2010 due to active efforts by major domestic automakers, etc. to achieve the standards ahead of schedule and the effects of the automobile green tax, etc.

Taking this into account, in order to further improve fuel efficiency, the Government of Japan will formulate top-runner standards for new gasoline passenger automobiles after FY2010 taking into

account future trends, etc.

○ Dissemination of Automobiles with Outstanding Fuel Efficiency

In addition to models conforming to top-runner standards, in order to promote the dissemination of automobiles with outstanding fuel efficiency, the Government of Japan will take measures such as tax incentives and the utilization of an evaluation and public disclosure system concerning automobile fuel efficiency.

Furthermore, the Government of Japan will advance the building of mechanisms to provide appropriate information concerning energy conservation to retailers, who are the link between manufacturers and consumers.

In addition, diesel automobiles are more fuel-efficient than gasoline automobiles, so in future when clean diesel passenger automobiles possessing emission gas capability no worse than that of gasoline passenger automobiles are developed, the Government of Japan will study the dissemination of those automobiles.

○ Spread of Clean Energy Vehicles (CEV)

In order to promote the dissemination of Clean Energy Vehicles (CEV)[29] that contribute to CO2-saving, such as hybrid automobiles, natural gas automobiles, etc., the Government of Japan will take support measures including a subsidy system and tax incentives, etc.

○ Limitation of the Traveling Speed of Large Trucks

The Government of Japan will work to achieve CO2-saving through improved fuel consumption efficiency by imposing an obligation to install speed limiting device for large trucks and limiting their maximum speed on highways.

○ Promotion of Environmentally-friendly Use of Automobiles (Same as last time: section related to the introduction of anti-idling equipment)

○ Introduction of Sulphur-free Fuel

Taking into account the introduction of sulphur-free (sulphur content of no more than 10ppm) petroleum fuel, the Government of Japan will work to improve fuel consumption efficiency through the most appropriate combination with automobile technology.

(b) Railway, Ship and Aviation Sectors

In the railway sector, the Government of Japan has introduced vehicles with good energy efficiency. For example, it has introduced light vehicles and vehicles equipped with VVVF equipment[30]. The government will continue to promote the introduction of these types of vehicles.

[29] Here CEV is a general name for electric automobiles, hybrid automobiles, fuel cell automobiles, natural gas automobiles, methanol automobiles, and automobiles using LP gas instead of diesel fuel.

[30] Vehicles equipped with VVVF equipment are vehicles equipped with a mechanism that efficiently controls the revolutions per minute of the motor without using electrical resistance.

In the ship sector, the Government of Japan has worked to construct ro-ro ships[31], container ships, etc. that contribute to modal shifts. In addition to these, in future it will promote the dissemination of ships introducing new technology, such as electrical propulsion ships and ships equipped with electronically-controlled engines[32], etc.

In the aviation sector, the Government of Japan has supported airline's introduction of new energy-efficient aircraft and as a result the targets of the environmental voluntary action plans of the industry and the government's Guideline for Measures to Prevent Global Warming had already been achieved as of FY2002. The Government will continue to promote the introduction of these energy-efficient aircraft.

c. Other Sectors Including Offices and Other Business Facilities and the Residencial Sector

Attempts are being made to limit energy consumption in the other sectors including offices and other business facilities and the residencial sector by improving the efficiency of equipment used in households, offices, etc. and disseminating more energy-efficient equipment. The Government of Japan will promote further improvements in the energy efficiency of equipment by aiming for the world's highest standard of energy efficiency.

○ Improvement of Efficiency of Equipment that Meets Top-runner Standards

Top-runner standards were introduced in FY1998 based on the Energy Conservation Law and to date 18 types of equipment have been designated under the Top-runner Program. In order to further improve the efficiency of individual types of equipment in future the Government of Japan will expand the range of products subject to top-runner standards and expand the range of applications, and toughen up the standards for types of equipment already designated.

(Reference: The 18 types of equipment designated under the Top-runner Program)
Air conditioners, fluorescent lights, video cassette recorders, TVs, copy machines, electronic calculators, magnetic disk units, electric refrigerators, electric freezers, space heaters, gas cooking appliances, gas water heaters, oil water heaters, electric toilet seats, vending machines, transformers, passenger vehicles, and freight vehicles

○ Provision of Information Concerning Energy-conserving Equipment, etc.

The Government of Japan will encourage industry to supply equipment that contributes to energy conservation and will sufficiently provide information and methods related to energy conservation to users of energy-conserving equipment.

To this end, in addition to the Energy Conservation Labeling System introduced in FY2000 to enable consumers to easily identify the energy efficiency of equipment, etc., the Government of Japan will disseminate and enhance the System for Evaluation of Businesses Selling Energy-conserving Products and will promote the purchase and use of products with low energy consumption through

[31] "Ro-ro ships" is an abbreviation for roll-on, roll-off ships. These are ships using a freight-handling method in which trailer chasses and vehicles for sale are automatically driven onto and off the ship.
[32] Electronically-controlled engines are diesel engines that optimize combustion by electronically controlling the timing, etc. of initial injection of air into the cylinders, fuel injection, and opening and closing of the air release valve after combustion.

dissemination and enlightenment, etc. such as holding Energy-conserving Home Appliances Dissemination Lectures, etc., in order to promote the active sale of energy-conserving products by retailers.

In combination with this, the Government of Japan will amend the Energy Conservation Law to promote the active provision of energy conservation information to consumers by retailers of home appliances, gas appliances, oil appliances, etc. and energy supply businesses.

○ Support for Dissemination and Technological Development of Energy-Conserving Equipment such as Efficient Water Heaters, etc.

In the hot water supply sector, which accounts for approximately 30% of energy consumption in households, equipment with particularly outstanding energy conservation capability compared to traditional types of equipment such as CO2 refrigerant heat pump water heaters, latent heat recovery type water heaters and gas engine water heaters are being developed and commercialized. In order to accelerate the dissemination of these new types of equipment, the Government of Japan will support their introduction, promote their further dissemination by businesses and promote technological developments such as miniaturization of the new types of water heater or facilitating their installation.

Furthermore, recent years have seen the development of highly-efficient commercial-use air conditioners utilizing heat pump technology[33], commercial-use water heaters and low temperature natural refrigerant freezer units that do not use chlorofluorocarbons and are highly energy-efficient, as well as integrated systems combining energy-efficient refrigerators and freezers, and air conditioning for the use of small- and medium-scale retail stores that consume a lot of energy, such as convenience stores. The Government of Japan will work to accelerate the dissemination of these appliances in the commercial-use sector through measures to support their introduction, etc.

In addition, by introducing energy-efficient lighting utilizing light emitting diodes (LEDs) it is possible to achieve major energy conservation compared to traditional incandescent and fluorescent lights, so the Government of Japan will promote technological development toward further improvements in the efficiency of these kinds of lights and work to accelerate their dissemination.

○ Reduction in Standby Power Consumption

In order to reduce standby power consumption, to date the Government of Japan has provided technological development support for voluntary measures by industry. The targets of industry (1W or less: audio components, televisions, air conditioners, etc.; 0W: clothes washing machines, microwave ovens, etc.) are being achieved as per the initial plan, but the Government of Japan will continue to follow up on the voluntary measures of industry.

[33] Heat pump is a collecting renewable energy technology that exchanges heat between the outside air and the indoor air by condensing and evaporating the refrigerant.

2) Non-energy-originated Carbon Dioxide

To date the Government of Japan has implemented various measures for promoting the expanded use of blended cement which generates fewer carbon dioxide emissions in the production process, the reduce, reuse and recycle of wastes, the effective use of timber which has a smaller impact on the environment as a reproducible raw material or biomass energy source, the cultivation of green manure on farmland, recycling through composting, the use of biomass plastics, etc., among others.

Emissions of carbon dioxide from industrial processes such as consumption of limestone and manufacturing of ammonia in FY2002 (49 million t-CO2) were 14.0% lower than FY1990 emissions in the same sector. Factors responsible for this reduction include the 16.7% reduction in the volume of production of cement in FY2002 compared to FY1990.

Moreover, FY2002 emissions of carbon dioxide resulting from the combustion, etc. of waste (waste oil, waste plastics), which accounts for approximately 2% of carbon dioxide total emissions (24 million t-CO2), were approximately 1.4 times higher than emissions in the same sector in FY1990.

○ Expanded Use of Blended Cement

The Government of Japan will expand the production ratio and use of cement which blends clinker, an intermediate product of cement, with blast-furnace slag, etc.

In addition, the Government of Japan will promote the use of blended cement, for example, by taking the lead in using blended cement in public construction projects carried out by the central government and other entities through promotion of leading use based on the Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and other Entities (Law No. 100 of 2000, hereafter "Green Purchasing Law").

○ Promotion of Measures to Reduce Carbon Dioxide Emissions Deriving from Waste Incineration

The Government of Japan will promote measures toward the achievement of the waste volume reduction targets based on the Waste Disposal and Public Cleansing Law (Law No. 137 of 1970, hereafter "Waste Disposal Law") and the targets determined in the Basic Plan for Establishing the Recycling-based Society (hereafter "Recycling Plan") approved in a Cabinet Decision in March 2003 under the Basic Law for Establishing the Recycling-based Society (Law No. 110 of 2000, hereafter "Basic Framework Law"). Specifically, the Government of Japan will promote the reduce, reuse and recycle of wastes, and advance the reduction of carbon dioxide emissions resulting from incineration, by implementing measures based on the individual recycling laws and evaluating and studying them, providing support to projects such as the development of facilities that contribute to global warming countermeasures, and formulating guidelines, etc. for separated garbage collection and a switch to paid garbage collection in municipalities.

3) Methane and Nitrous Oxide

A. Methane

To date the Government of Japan has promoted the reduce, reuse and recycle of wastes, upgraded combustion in waste incineration facilities through such measures as the promotion of the introduction of continuous furnaces, improved management of cultivated fields and improved livestock manure treatment methods, among other measures.

Emissions of methane in FY2002 (20 million t-CO2) were 21.1% lower than in FY1990. A big contributor to this was the reduction of emissions from coal mining.

○ Reduction in Amount of Final Disposal of Waste, etc.

The Government of Japan will promote measures toward the achievement of the waste volume reduction targets based on the Waste Disposal Law and the targets determined in the Recycling Plan under the Basic Framework Law. Specifically, the Government of Japan will promote the reduce, reuse and recycle of wastes, and advance the reduction of methane emissions resulting from direct burial of waste in landfills by implementing measures based on the individual recycling laws and evaluating and studying them, providing support to projects such as the development of facilities that contribute to global warming countermeasures, and formulating guidelines, etc. for separated garbage collection and a switch to paid garbage collection in municipalities. Furthermore, the Government of Japan will promote the upgrading of combustion in general waste incineration facilities.

B. Nitrous Oxide

To date the Government of Japan has promoted measures for emissions reductions in industrial processes and has advanced the upgrading of combustion in incineration facilities for waste, sewage sludge, etc. through the promotion of the introduction of continuous furnaces, etc., along with other efforts.

Emissions of nitrous oxide in FY2002 (35 million t-CO2) were 11.9% lower than in FY1990. The introduction of equipment to decompose nitrous oxide in manufacturing processes in workplaces manufacturing adipic acid, a raw material for some chemical products, largely contributed to this result.

○ Installation of Equipment to Decompose Nitrous Oxide in the Adipic Acid Manufacturing Process

Equipment to decompose nitrous oxide will continue to be introduced to recover and destroy the nitrous oxide that is emitted as a by-product when adipic acid is manufactured.

○ Upgrading Combustion in Sewage Sludge Incineration Facilities

The Government of Japan will reduce the emission of nitrous oxide resulting from incineration of sewage sludge by upgrading the combustion in incineration facilities. To this end, the government will establish standards concerning the upgrading of combustion of sewage sludge and promote the thorough implementation of these standards.

○ Upgrading Combustion in General Waste Incineration Facilities, etc.

The Government of Japan will advance the upgrading of combustion in general waste incineration facilities by providing support to projects such as the development of facilities that contribute to global warming countermeasures and promoting the installation of incineration facilities with continuous furnaces by switching to waste disposal over a broader area. The government will also promote the reduce, reuse and recycle of wastes, and advance the reduction of nitrous oxide emissions resulting from waste incineration in order to achieve the waste volume reduction targets based on the Waste Disposal Law and the targets determined in the Recycling Plan under the Basic Framework Law.

4) Three Fluorinated Gases

The three fluorinated gases account for approximately 2.1% of total greenhouse gas emissions (FY2002 carbon dioxide equivalent). There are now a number of factors that are increasing the emissions of these gases. For example, it is prospected that HFC emissions will increase as they are substituted for ozone-depleting substances (CFCs and HCFCs are outside the scope of the Kyoto Protocol but these gases also have a strong greenhouse effect) whose production and consumption is being reduced under the Montreal Protocol. The Government of Japan will move to limit the increase in emissions of these gases.

○ Promotion of Planned Efforts Made by Industry

In response to the February 1998 Guidelines for Measures to Limit Emissions of HFCs, etc. by Industry (Ministry of International Trade and Industry notification), as of the present date, voluntary action plans have been formulated by 22 organizations in eight sectors. The Government of Japan will continue to follow up on the progress of the action plans of industry in the Industrial Structure Council and work to improve the transparency and reliability of the voluntary action plans and improve the certainty of target achievement.

Furthermore, the government will take measures to support efforts made by businesses to limit emissions and will urge commercial sectors that have not yet formulated action plans to do so and to publicize them.

○ Promotion of Development, etc. of Substitute Materials and Use of Substitute Products

The Government of Japan will promote the use of new substitute materials for the three fluorinated gases, technologies that do not use the three fluorinated gases, and technologies and products for recovering and destroying the three fluorinated gases.

To this end, the government will carry out research and development of new substitute materials and substitute technologies.

Furthermore, taking into account safety, economy, energy efficiency, etc., the Government of Japan will provide information concerning technology and products using substitute materials and those products using the three fluorinated gases which have a smaller impact on global warming. The government will disseminate these products and technology, and educate the public about them.

In particular, it is expected that measures to improve the energy conservation capability of buildings and houses will result in increased use of heat insulation materials and from the beginning of 2004 the production and import of a major HCFC (HCFC 141b), which was formerly used as a foaming agent, was restricted and this has led most businesses to switch to HFCs. Therefore, as the emissions into the atmosphere of HFCs used as foaming agents in heat insulation materials is prospected to increase, the Government of Japan will formulate policies to limit these emissions, for further promoting the use of foaming and heat insulation materials which do not contain fluorinated gases.

Moreover, as it is prospected that SF6 emitted when magnesium solutions are made and HFCs emitted as a result of the use of aerosol products using HFCs will increase, the Government of Japan will promote the development of substitute materials and substitute technology in these sectors, disseminate

these materials and technology, and educate the public about them.

○ Recovery of HFC Charged as Refrigerant in Equipment in Accordance with Laws, etc.

The Government of Japan will thoroughly implement the recovery and destruction of HFCs in the refrigerant sector through appropriate operation of laws including the Law for Recycling of Specified Kinds of Home Appliances (Law No. 97 of 1998, also known as the Home Appliances Recycling Law), the Law for Ensuring the Implementation of Recovery and Destruction of Fluorocarbons concerning Specified Products (Law No. 64 of 2001, also known as the Fluorocarbons Recovery and Destruction Law) and the Law for the Recycling of End-of-Life Vehicles (Law No. 87 of 2002, also known as the End-of-Life Vehicle Recycling Law).

Furthermore, as manufacturers of commercial-use refrigeration and air conditioning appliances in particular are increasingly substituting HFCs for HCFCs for the refrigerant and the fluorocarbons refrigerant recovery rate at disposal remains low, it is prospected that HFC emissions will rapidly increase in future. Therefore, the Government of Japan will take countermeasures to improve the recovery rate, including a drastic review of systematic aspects concerning recovery of fluorocarbons refrigerant from industrial-use refrigeration and air conditioning appliances.

(2) Greenhouse Gas Sink Measures

1) Forest Sink Measures

The Forests and Forestry Basic Plan was approved in a Cabinet Decision in October 2001 under the Forests and Forestry Basic Law (Law No. 161 of 1964). It is estimated that if the plan's targets are achieved with respect to full utilization of multiple functions of forests and to supply and use of forest products, it will be possible to ensure removals close to the upper limit of removal by Japan's forest management in all forests subject to Article 3, Paragraphs 3 and 4 of the Kyoto Protocol (47.67 million t-CO2, approximately 3.9% compared to the total emissions volume of the base year).

The amount of removal by forests is an estimate based on the Forests and Forestry Basic Plan, and careful examination and study is necessary in future as to the calculation methodologies, etc. Furthermore, if the estimate is calculated for the case in which forest management and conservation and the supply and use of timber, etc. remains close to current levels, it is expected that the amount of removal that could be ensured will be much lower than 3.9% of the total amount of emissions of the base year.

In order to ensure removal at the upper limit to be obtained through Japan's forest management, it is important to further management and conseve forests, etc. Therefore, the current challenge is to come up with measures to achieve this, and united efforts of the government, including studies of cross-sectoral policies, and cooperation and strenuous efforts of all entities, including local governments, forest owners, businesses in the forestry and timber industries and citizens, etc. are necessary.

To this end, taking into account the progress of studies on cross-sectoral policies, through the policies shown below the Government of Japan will make united efforts to steadily and comprehensively manage and conserve forests, timber supply, effective use of timber, etc. necessary for achieving the targets of the Forests and Forestry Basic Plan, and will continue to develop systems for reporting and verifying the amount of removal.

○ Development of Sound Forests

A. Promotion of efficient and effective thinning of forests by strengthening collective thinning operations and promoting greater use of thinned wood, etc.
B. Engineering a shift toward forests with longer cutting cycles and multistoried forests
C. Countermeasures to eliminate the land allowed to be left denuded
D. Programs to secure and foster essential personnel responsible for forest development

○ Promotion of Appropriate Management and Conservation, etc. of Protection Forests, etc.

A. Appropriate operation of the land use conversion regulations and logging regulations and planned designation of protection forests under the protection forests system, as well as promotion of appropriate forest conservation management under the protected forest system, etc.
B. Planned promotion of forest conservation projects in mountain regions with a high disaster risk and denuded forests in the hinterland, etc.
C. Promotion of countermeasures to prevent and control damage caused by pine weevils and other forest pests and wild birds and animals; promotion of countermeasures to prevent forest fires

D. Expansion and enhancement of natural parks and nature conservation areas and strengthening of conservation management within these areas

○ Promotion of Forest Establishment with the Participation of Citizens, etc.

A. Promotion of forest establishment activities by a wider range of actors, including promotion of the participation of corporations, etc. in forest creation
B. Improvement of the skills of forest volunteers, etc. and upgrading of safety systems
C. Promotion of forest environmental education
D. Promotion of the green worker program in national parks, etc. that aims to protect flora and fauna, including forests

○ Promotion of the Use of Timber and Wood Biomass

In order to contribute to the promotion of sustainable forest management and to work toward the active utilization of reproducible timber that will contribute to the reduction of the carbon dioxide emissions by limiting the amount of fossil fuels used, the Government of Japan will promote the following measures.
A. Promotion of utilization of locally supplied timber in houses, public facilities, etc.
B. Promotion of consumer-focused programs to expand the user base for locally supplied timber, which will lead to actual demand
C. Development of production, distribution and processing systems closely coordinated from forestry to consumers, to make them capable of meeting consumer needs
D. Promotion of the utilization of low-grade timber and wood biomass for energy and products

2) Promotion of Urban Greening, etc.

Urban greening, etc. are the sink measures that have the most impact on the daily lives of the citizens of Japan. Promotion of such measures is not only effectual as an actual sink measure but also very effective for educating the public on the purpose of the global warming countermeasures.

Furthermore, urban greening, etc., could add to the amount of removal as "Revegetation" subject to Article 3, Paragraph 4 of the Kyoto Protocol, outside the framework of the upper limit of the amount of removal to be obtained through Japan's forest management (47.67 million t-CO2, approximately 3.9% of the total emissions volume of the base year).

To this end, concerning urban greening, etc., the government will continue to actively promote the creation of urban parks, the greening of roads, rivers, *sabo* (erosion and sediment control) facilities, harbors and other public facilities, the conservation of existing privately owned green areas, and the creation of new green space, such as on the rooftops or wall surfaces of buildings, etc. based on comprehensive central and local government plans for the conservation and creation of greenery such as the Green Policy Outline and the green basic plans drawn up by the municipalities.

Furthermore, as a part of these efforts, the government will educate all sectors and strata of society on the value and effects of urban greening, etc., and will actively promote support, etc. for the creation of new greenery in urban areas, etc. enlisting different actors and approaches, including urban greening with wide-ranging participation including citizens, corporations, NPOs, etc., conservation of privately owned green areas, utilization of the Greening Region System and multi-level city parks system.

It is estimated that if these countermeasures are implemented according to plan, an annual average removal volume of about 0.02% of the total emissions volume of the base year (280,000 t-CO2) will be ensured in the first commitment period.

This is an estimate based on the plan for planting trees in the urban greening, etc. program; careful examination and study is necessary in future as to the calculation methodologies, etc. in conformity with the Good Practice Guidance for Land Use, Land-Use Change and Forestry that was decided at the Tenth Conference of the Parties to the United Nations Framework Convention on Climate Change (COP10) held in December 2004.

Furthermore, the government will continue to promote in a planned manner development of a system for reporting and verification of the amount of removal in the urban greening programs, etc.

(3) Measures and Policies Related to the Kyoto Mechanisms

○ Value of Promotion and Utilization of the Kyoto Mechanisms

In order to achieve the reduction commitments and at the same time to prevent warming on a global scale and support the sustainable development of developing countries, the Kyoto Protocol approves the Kyoto Mechanisms[34] (Joint Implementation (JI), the Clean Development Mechanism (CDM) and emissions trading) to be utilized[35] as flexible mechanisms that enable a party to this Protocol to use a part of greenhouse gas emission reduction or removal in another party or the emissions quota of another party toward achievement of their own reduction commitments.

In order to certainly and cost-effectively achieve the Kyoto Protocol commitment, it is necessary to appropriately utilize the Kyoto Mechanisms while bearing in mind the general rule that the Kyoto Mechanisms are supplementary to domestic measures.

Furthermore, given that greenhouse gas emissions in developing countries, etc. are expected to dramatically increase in the future, it is important for Japan to promote and utilize the Kyoto Mechanisms with a view to contributing to prevent warming on a global scale.

1) Government Efforts toward the Promotion and Utilization of the Kyoto Mechanisms

○ Approach to Achieve Commitments

All sectors of society will have to make every effort to achieve the Kyoto Protocol commitment on the basis of the domestic measures for reduction of greenhouse gas emissions countermeasures and domestic sink measures (hereafter "domestic measures"). These efforts notwithstanding, Japan will fall short of achieving its Kyoto Protocol commitment by 1.6% of the total emissions volume of the base year. It will be necessary to make up for this difference by utilizing the Kyoto Mechanisms while respecting the general rule that the Kyoto Mechanisms are supplementary to domestic measures.

When utilizing the Kyoto Mechanisms, it is necessary to proceed while taking the following into account. First, if utilization of the Kyoto Mechanisms is commenced after 2013 when the final confirmation of any shortfalls in the achievement of the Kyoto Protocol commitment will be made, the risk that the amount of credits necessary to achieve the commitment cannot be obtained is very high.

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[34] Joint Implementation (JI) is a mechanism under which greenhouse gas emissions reduction or removal resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in developed countries, etc. can be received as emission reduction units (ERUs) by project participants from other developed countries, etc. that contributed to the project. The Clean Development Mechanism (CDM) is a mechanism under which greenhouse gas emissions reduction or removal resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in developing countries can be received as certified emissions reductions (CERs) by project participants from developed countries, etc. that contributed to the project. Emissions trading is a mechanism under which trading of assigned amount units (AAUs) issued to each developed country, etc. under the protocol and/or, removal units (RUs) for forests subject to the protocol, etc. is carried out. One form of emissions trading which is conducted under the condition that funds resulting from the transfer of assigned amount units, etc. are used for emissions reduction or other environmental policy objectives is called the Green Investment Scheme (GIS). (Hereafter emission reduction units, certified emissions reductions, assigned amount units and removal units will be referred to by the general name of "credits".)

[35] "Utilization" of the Kyoto Mechanisms means obtaining credits generated by CDM, JI and such projects and credits of developed countries, etc. and counting them toward achievement of the Kyoto Protocol commitment (transferring them to the retirement account of the national registry).

Second, it takes three to five years for CDM and JI projects, which contribute to incremental greenhouse gas emissions reduction and removal, and similar projects under the Green Investment Scheme (GIS), which is an emissions trading mechanism linked to specific environmental countermeasures (hereafter "CDM/JI, etc.") to progress from planning to implementation and obtainment of credits. In addition, other countries, in which achievement of the Kyoto Protocol commitment through domestic measures alone is expected to be difficult, have already commenced utilization of the Kyoto Mechanisms and are advancing the selection, etc. of high-quality projects in a systematic manner with a view to ensuring that they obtain the credits necessary to achieve their own commitments. It is important for Japan to monitor the status of such efforts in other countries.

Taking all this into account, the government will endeavor to fully utilize the Kyoto Mechanisms from FY2005 and systematically take the necessary measures in order to make the utmost effort toward achievement of the Kyoto Protocol commitment.

A. Support for the Forming of Projects, etc.

It is important to make efforts placing the priority on the implementation of a large number of specific emission limitation, reduction and removal projects, such as CDM/JI, etc. projects to increase the amount of credits Japan could obtain in the future.

Specifically, the Government of Japan will advance development of a foundation for the promotion and utilization of the Kyoto Mechanisms, as well as efforts to support the discovery of projects and project formation.

a. Development of a Foundation

Japan will develop the foundation necessary for utilizing the Kyoto Mechanisms and will advance efforts to make it possible for CDM/JI, etc. projects to be implemented in a broad range of countries, regions and project sectors, etc.

* The Government of Japan will continue to give approval for CDM and JI projects as necessary based on the provisions of the Kyoto Protocol. Furthermore, in order to be qualified to utilize the Kyoto Mechanisms from 2008, the year the first commitment period begins, the Government of Japan will develop the national registry system for the monitoring and recording of the transfer of credits, etc., and the domestic system for calculating greenhouse gas emissions and removals. The government aims to report the outline of these systems, etc. to the United Nations Framework Convention on Climate Change secretariat by the summer of 2006. In addition, the Government of Japan will appropriately operate Japan's national registry based on international agreements, etc.

* In order to make the international rules related to CDM/JI, etc. versatile and rational, the Government of Japan will actively contribute to improving their formulation and operation. Furthermore, the Government of Japan will deepen understanding of the Kyoto Mechanisms in host countries through the holding of intergovernmental talks and seminars, etc., as well as technical cooperation, etc., and will provide support for the development of structures related to domestic systems, etc. so that host countries can meet the qualifying standard for participation in the Kyoto Mechanisms.

b. Support for Discovery of Projects and Project Formation

The Government of Japan will promote the discovery and formation of CDM/JI, etc. projects and will advance efforts to ensure that Japan can obtain credits from these CDM/JI, etc. projects.

* The Government of Japan will support human resources development, etc. to ensure that Japan's private businesses, etc. can be designated as CDM/JI independent entities or operational entities. Furthermore, concerning CDM/JI, etc. projects, the government will work to discover promising energy and environmental technology and projects, enhance feasibility studies, etc. and promote their implementation. In addition, the government will make efforts to hold negotiations with the host country government and form agreements, and work to transfer credits to Japan.

* Through such means as intergovernmental talks and support for structural development in the host country, the Government of Japan will work to strengthen relations with the host country and monitor priority sectors. At the same time, the Government of Japan will advance the development of conditions to facilitate the smooth transfer of credits to Japan from the host country as necessary, for example, by concluding, as necessary, agreements, etc. with the government and other entities of the host country.

B. Full Utilization of the Kyoto Mechanisms

It is expected that even if the best possible efforts are made through domestic measures, there will still be a shortfall of 1.6%. In order for Japan to make utmost effort toward achievement of its Kyoto Protocol commitment, it is necessary for the public and private sectors to collaborate appropriately and effectively utilize a variety of methods to obtain credits through the Kyoto Mechanisms.

To this end, from FY2005 the public and private sectors will cooperate to steadily promote support projects for the promotion of CDM/JI, etc. projects implemented by private businesses, etc. in order to facilitate smooth obtaining of credits.

In addition, in order to appropriately advance the obtaining of credits for the achievement of Japan's Kyoto Protocol commitment, it is necessary to study and build specific mechanisms for the smooth obtaining of credits, at the earliest possible time in the second step period. The concerned ministries and agencies are to collaborate to conduct studies with a view to implementation from FY2006 and promptly take the necessary measures. In doing so, consideration will be given to cost-effectively obtaining the necessary number of credits.

Furthermore, when promoting and utilizing the Kyoto Mechanisms, the Government of Japan will advance the effective utilization of ODA in conformity with international rules and on the premise of the agreement of the recipient country. In addition, the government will advance the effective utilization of official flows.

C. Development of a Structure for Promotion and Utilization of the Kyoto Mechanisms

It is important for all of the concerned ministries and agencies within the government to unite to make efforts for measures and policies concerning promotion and utilization of the Kyoto Mechanisms. The Government of Japan will develop the structures of internal government agencies and government-affiliated organizations in order for concerned ministries and agencies to cooperate to

efficiently advance their efforts.

In order to strengthen collaboration among concerned ministries and agencies for the promotion and utilization of the Kyoto Mechanisms and to promote the measures and policies to be implemented, the current Liaison Committee for Utilization of the Kyoto Mechanisms, which has the objective of giving government approval to CDM/JI projects, will be reorganized and promptly reestablished as the Council for Promotion and Utilization of the Kyoto Mechanisms (provisional name) which will be composed of the concerned ministries and agencies with the objective of comprehensive promotion and utilization of the Kyoto Mechanisms.

The council will promptly study the ideal form of mechanisms to smoothly obtain credits, the division of roles among concerned ministries and agencies, and other modes with the aim to work out specific policies for the period from FY2006.

The concerned ministries and agencies will actively and at their own initiative advance their respective efforts, particularly in the following sectors.

(Ministry of the Environment)
* For achieving Japan's Kyoto Protocol commitment, the Ministry of the Environment, as a Deputy-Chief of the Global Warming Prevention Headquarters, will make independent efforts with regard to all aspects of promotion and utilization of the Kyoto Mechanisms by the government.

* With a view to promoting efforts toward project formation by private businesses, etc., and contributing to the sustainable development of the host country through CDM/JI, etc. projects, among other aims, the Ministry of the Environment will make independent efforts for promotion and utilization of the Kyoto Mechanisms.

(Ministry of Economy, Trade and Industry)
* For achieving Japan's Kyoto Protocol commitment, the Ministry of Economy, Trade and Industry, as a Deputy-Chief of the Global Warming Prevention Headquarters, will make independent efforts with regard to all aspects of promotion and utilization of the Kyoto Mechanisms by the government.

* With a view to promoting efforts toward project formation by private businesses, etc., disseminating Japan's energy and environmental technology worldwide, and alleviating energy use restrictions, among other aims, the Ministry of Economy, Trade and Industry will make independent efforts for promotion and utilization of the Kyoto Mechanisms.

* The Ministry of Economy, Trade and Industry will make independent efforts for promotion and utilization of the Kyoto Mechanisms utilizing ODA in conformity with international rules and on the premise of agreement of the recipient country.

(Ministry of Foreign Affairs)
* With a view to complying with international treaties, the Ministry of Foreign Affairs will make independent efforts for achieving Japan's Kyoto Protocol commitment with regard to all aspects of promotion and utilization of the Kyoto Mechanisms by the government.

* The Ministry of Foreign Affairs will make independent efforts with regard to coordinating negotiations and formation of agreements, etc. with foreign governments necessary for promoting and utilizing the Kyoto Mechanisms, building cooperative relations with foreign governments concerning the Kyoto Mechanisms, implementing the necessary studies, and promoting and utilizing the Kyoto Mechanisms through participation in international organizations, etc.

* The Ministry of Foreign Affairs will make independent efforts for promotion and utilization of the Kyoto Mechanisms utilizing ODA in conformity with international rules and on the premise of agreement of the recipient country.

(Ministry of Land, Infrastructure and Transport)
* The Ministry of Land, Infrastructure and Transport will make independent efforts for promotion and utilization of the Kyoto Mechanisms in the transport sector and the social capital development sector.

(Ministry of Agriculture, Forestry and Fisheries)
* The Ministry of Agriculture, Forestry and Fisheries will make independent efforts for promotion and utilization of the Kyoto Mechanisms in the forest sector.

(Ministry of Finance)
* The Ministry of Finance will make independent efforts for promotion and utilization of the Kyoto Mechanisms from the perspective of international financing. For example the ministry will support the vigorous activities of multilateral development banks and utilize the Japan Bank for International Cooperation.

* The Ministry of Finance will make independent efforts for promotion and utilization of the Kyoto Mechanisms utilizing ODA in conformity with international rules and on the premise of agreement of the recipient country.

Furthermore, government-affiliated organizations, etc. responsible for implementing measures and policies for the promotion and utilization of the Kyoto Mechanisms, such as independent administrative institutions, government-affiliated financial institutions and diplomatic missions abroad, are to collaborate in making united efforts for the promotion and utilization of the Kyoto Mechanisms.

2) Utilization of the Kyoto Mechanisms by Private Businesses, etc.

Efforts by private businesses, etc. to limit domestic greenhouse gas emissions in order to achieve their voluntary action plans and other targets, and their voluntary utilization of the Kyoto Mechanisms at their own expense can be positively evaluated from the perspective of emissions reduction on a global scale using outstanding technology and from a cost-benefit perspective.

In order to promote such utilization of the Kyoto Mechanisms by private businesses, etc., in addition to the measures in 1) above, the Government of Japan will carry out policies including the development of human resources, provision of consultations and information, development of instruction manuals, etc. on the use of the Kyoto Mechanisms, provision of support at the project discovery and project formation stage, effective utilization of systems of lending for the formation of so-called carbon funds, etc., measures to facilitate the obtaining of credits, and development of the institutional base for voluntary repayment of credits, among others.

Reference: Accounting and Tax Treatment of Private Businesses, etc. when Utilizing the Kyoto Mechanisms

The accounting and tax treatment of private businesses, etc. when voluntarily utilizing the Kyoto Mechanisms is as follows.

1) Accounting Treatment of Corporations
Based on Working Report No. 15 of the Accounting Standards Board of Japan Current Treatment Concerning Account Processing for Emissions Trading (November 30, 2004), credits are counted as "intangible fixed assets" or "investments and other assets" when they are obtained and are processed as "selling costs and general management costs" in the fiscal year in which they are redeemed.

2) Treatment under the Corporation Tax Law
Taxable income, unless otherwise stipulated by law, "is to be calculated in compliance with the standards of accounting processes generally recognized to be fair and reasonable" (Corporation Tax Law (Law No. 34 of 1965) Article 22, Paragraph 4). Concerning the tax treatment of credits, in principle, they are to be handled in compliance with the above accounting standards.

2. Cross-sectoral Policies

(1) Systems for Calculation, Reporting and Public Disclosure of Greenhouse Gas Emissions

The Government of Japan will promote the building of a foundation for efforts by citizens of all levels toward voluntary warming countermeasures by having entities that emit greenhouse gases calculate their emissions themselves. In addition, with a view to increasing incentives and motivation for the promotion of voluntary measures by all citizens and corporations through the publication and visibility of emissions information, the government will introduce a system under which entities that emit a certain volume of greenhouse gases or above are obliged to report their emissions to the central government responsible for collating and publishing the reported information. In so doing, in order to further advance understanding of the published emissions information, the Government of Japan will allow entities that emit greenhouse gases to report information related to the published emissions information if they so wish.

To this end, the Government of Japan proposes to amend the Law Concerning the Promotion of Measures to Cope with Global Warming, etc.

(2) Promotion of Environmental Consideration in Business Activities

The Government of Japan will promote efforts by businesses to voluntarily and actively engage in environment-conscious business activities.

Based on the stipulation in the Law Concerning Promotion of Business Activities that Consider the Environment by Specified Businesses, etc. through Promotion, etc. of the Provision of Environmental Information (Law No. 77 of 2004), large corporations are to endeavor to publish environmental reports. Taking this into consideration, among other things, the Government of Japan will promote the use of environmental information by businesses and citizens and work to develop the conditions for environment-conscious business activities to be highly evaluated by society and the market, among other measures.

Furthermore, the Government of Japan will promote the inclusion of information about greenhouse gas emissions and progress on efforts to limit emissions in the environmental report. Concerning the small- and medium-sized enterprises as well, the government will promote environment-conscious efforts, such as monitoring of carbon dioxide emissions.

(3) Development of National Campaigns

In order to promote the understanding of all sectors of society, including businesses, citizens, etc. and to make the realization of specific warming prevention actions certain, the government will collaborate with the business circle, NPOs, the labor circle, researchers, etc. to disseminate knowledge and develop national campaigns.

Furthermore, the Government of Japan will further strengthen the role of the Japan Center for Climate Change Actions, the prefectural centers for promotion of activities to stop global warming, the Global Warming Countermeasures Regional Councils, the volunteers to promote activities to mitigate global warming and other organizations, etc. promoting global warming prevention activities.

1) Provision of Information and Education of the Public

The Government of Japan will encourage voluntary actions by each individual citizen by strongly appealing to the awareness of citizens through the appropriate provision of information using diverse methods. In doing so, the government will work to foster a sound sense of crisis through the provision of the latest scientific knowledge, and to provide information and educate the public concerning what specific actions or purchases will contribute to the limitation of greenhouse gas emissions or the promotion of sink measures.

○ Presentation of the Actions and Standards Expected of Citizens

Currently the central and local governments as well as businesses are establishing targets in their respective action plans and voluntary action plans, etc. and are advancing specific measures. It is thought that informing each individual citizen of the specific actions and standards expected, in other words specifically what kinds of efforts they are expected to make and to what degree, is also effective for encouraging efforts to reduce greenhouse gases.

As a part of this process, with a view to encouraging each individual citizen to constantly review their lifestyle and working style, the Government of Japan will formulate and present the specific actions expected of citizens and other details such as the amount of energy consumption including electric power, gas and petroleum expected of each household taking into account the characteristics of the regional climate, the number of people in the household, etc. as standards of actions of citizens and endeavor to educate the public about them.

In addition, the Government of Japan will implement the following measures.

* Promote green purchasing efforts by businesses and citizens through such means as the provision of information concerning environmental products, etc.
* Promote the practice in offices, etc. during the summer season of wearing light clothes that are more suitable in hot weather.
*Promote information provision and public education activities by the private sector for the private sector, such as public relations activities by corporations.
* Require electric power businesses and gas businesses to publicize on the implementation of energy conservation promotion projects and their progress, such as providing information on the promotion of the dissemination of highly-efficient devices and the state of energy use.
* Promote voluntary restraint from non-essential use of passenger cars for personal use and dissemination of eco-drive.
* Spread public education activities to promote cooperative efforts among transport businesses, the business circle, etc. concerning promotion of the use of public transport systems.
* Spread public education activities to promote cooperative efforts between shippers and distributors.
* Spread public dissemination and education activities to raise awareness of railway freight transport that is friendly to the environment.
* Develop citizen participation greening campaigns including national greening campaigns in Greenery Week, Urban Greening Month, etc. and the promotion of private sector forest establishment and greening activities through the utilization of charity collections for greenery and urban greening funds, etc., in order to widely disseminate and educate the public on the

importance of greening as a sink measure.
* Develop public dissemination and education activities concerning the value of utilizing locally harvested timber, etc.

2) Environmental Education, etc.

In order to ensure that the awareness and understanding of the citizens of the importance of the global warming issue and that citizens take habitual actions to prevent global warming, the Government of Japan will promote environmental conservation activities and environmental education based on the Law for Enhancing Motivation on Environmental Conservation and Promoting of Environmental Education (Law No. 130 of 2003) as well as taking into account the United Nations Decade of Education for Sustainable Development commenced in 2005.

Specifically, the Government of Japan will promote policies concerning environmental education, human resources development and development of centers, etc. being advanced in collaboration among all entities in various locations such as schools, regions, workplaces, etc.

In particular, the Government of Japan will promote the implementation of hands-on environmental education and energy conservation activities in school facilities that play a central role in regions, through such measures as renovations including the introduction of heat insulation materials and the use of locally harvested timber, etc. that would contribute to global warming countermeasures and the introduction of new energy devices, etc., and will utilize the Internet, etc. to promote support for global warming countermeasures, etc. in households.

In combination with these measures, the Government of Japan will continue to advance the development of teaching materials and programs that would encourage understanding and actions by citizens in collaboration with concerned entities such as NPOs.

Furthermore, the Government of Japan will promote various hands-on activities, etc. in forests, parks and green areas, etc. in order to deepen understanding of the role of forests in preventing global warming, necessity of forest development and cyclical use of timber resources and the value of urban greening, among others.

(4) Basic Items of Measures to be Undertaken on the Initiative of Public Institutions

1) Measures to be Undertaken on the Central Government's Own Initiative

The government intends to formulate a new government action plan to succeed the "Plan for Measures the Government Must Implement in Order to Limit, etc. the Emission of Greenhouse Gases in its Work and Projects" (hereafter "Government Action Plan") approved in a Cabinet Decision in July 2002. The new Government Action Plan incorporates the following content in addition to the measures described in the former plan.

The progress of the Government Action Plan will be examined annually in a meeting of the Global Warming Prevention Headquarters, and the results will be published.

Furthermore, for the period after FY2006 as well, which is the target fiscal year of the Government Action Plan, the Government of Japan will promptly formulate a plan for the implementation of

measures to be undertaken on its own initiative bearing in mind the first commitment period (FY2008-FY2012).

In addition, the central government will take the initiative in procuring environmental products, etc. based on the Green Purchasing Law in order to encourage a switch to demand for products that contribute to reduction of greenhouse gas emissions and other environmental products, etc.

○ Promotion of CO2-saving Model Projects in the Kasumigaseki Government Office Area

The Government of Japan will work to form a "CO2-saving government office area" around Kasumigaseki through taking the initiative in introducing new technology and systems and organic collaboration with individual ministries and agencies.

Specifically, the government will advance the following items, etc.

* Accelerated introduction of fuel cells
* Further introduction of new energy, etc. such as photovoltaic power generation and wind power generation.
* Selection of energy sources that contribute to CO2-saving
* Introduction of thermal storage systems and gas air conditioning, etc. that contribute to electric power load leveling
* Introduction of water-retaining materials, etc. for pavements upon their replacement in government office sites
* Thorough implementation of appropriate operation and management of facilities
* Upgrading of common-use bicycle systems
* Further promotion of greening

○ Formulation of Implementation Plans by Each Ministry and Agency

Each ministry and agency will formulate an implementation plan which stipulates the measures it will implement to reduce the emission of greenhouse gases and conserve and strengthen the removal effect. The implementation plans formulated by the ministries and agencies are to establish FY2006 as the target fiscal year and incorporate the following targets.

* In all ministries, implement a feasibility study on the introduction of ESCO projects and introduce them as widely as possible.
* Based on the green assessments, focus on implementing energy conservation renovations by the end of FY2006. Furthermore, thoroughly implement appropriate operation and management of facilities that contribute to CO2-saving.
* Introduce photovoltaic power generation, efficient water heaters, highly-efficient air conditioning, fuel cells, etc. as widely as possible in government offices and housing for government workers.
* Promote the use of public transport systems such as railways and buses for commute and work-related travel.
* Maintain 100% use of low-emission vehicles for general official vehicles. For official vehicles other than general official vehicles as well, establish numerical targets for switching to the use of low-emission vehicles.
* Install Electronic Toll Collection (ETC) devices in official vehicles using toll roads.

* Introduce a purchasing method that considers CO2-saving factors when purchasing electric power for use by government offices.
* Formulate and implement "rules for CO2-saving actions," for example, for everyone to turn off the lights during lunch breaks.
* Solicit employees for ideas that contribute to CO2-saving (eco-ideas), and implement the effective ones.
* Achieve a reduction of 7% compared to FY2001 through the above measures, etc.

In the implementation plans each ministry will clearly specify the department responsible for formulation, evaluation and examination and will introduce the PDCA (plan-do-check-action) cycle. Furthermore, responsible departments in each ministry are to share CO2-saving experience, know-how and technology with one another. With a view to ensuring transparency, the government will publish the results of the examination, evaluating not only total emissions but also the efforts in comparison with target values and past recorded figures, etc. concerning the progress on each item and in each organization, with all this information included.

2) Plans of Action, etc. of Local Governments

Based on Article 21 of the Law Concerning the Promotion of Measures to Cope with Global Warming, prefectures and municipalities are obliged to formulate a Plan Concerning Measures to Reduce the Emission of Greenhouse Gases and Conserve and Strengthen the Removal Effect in its Work and Projects (hereafter "Local Government Action Plan").

Local governments must formulate these plans with reference to a manual formulated by the central government and in compliance with the provisions of the Government Action Plan. In particular, they are expected to keep the following points in mind.

○ Targets
* The plan should specify quantified targets concerning total emissions of greenhouse gases and deadlines for achieving them.
○ Scope
* For local governments, not only energy consumption in government offices, etc. but also emissions from waste treatment operations, water supply and sewage systems, local government-managed public transport systems, the operation of public schools and public hospitals, etc. and other operations sometimes account for a large proportion of total emissions. For this reason, these kinds of operations should also be included within the scope of the plan.
* In particular, local governments should work toward CO2-saving with respect to electric power use in government offices, etc.
○ Evaluation Structure
* A regular examination of the status of implementation should be carried out and the results of the examination published.
* When publishing the results of the examination, the local government should evaluate not only total emissions but also the efforts in comparison with target values and past recorded figures, etc. concerning the progress on each item and in each organization, and will publish all this information together.

With a view to ensuring transparency, the central government is to compile the results published by the

local governments and publish them in the form of a list.

In addition, the local governments are to work on green purchasing efforts based on the Green Purchasing Law, such as drawing up guidelines for the promotion of procurement of environmental products, etc.

3) Promotion of Actions Undertaken on the Initiative of Public Institutions Other than Central and Local Governments

The central and local governments are to provide information to public institutions such as independent administrative institutions concerning effective global warming countermeasures tailored to the characteristics of that institution and are to encourage efforts undertaken on the initiative of such institutions. The central government is to regularly monitor the status of these efforts to the extent possible.

(5) Introduction of Daylight Saving Time

The Government of Japan will work to encourage a public debate concerning the introduction of summer time (daylight saving time), including the ideal form of lifestyles and working styles, and will endeavor to foster environmental awareness and reach public consensus.

(6) Utilization of a Policy Mix

In order to advance the effective and efficient reduction of greenhouse gas emissions, and to reduce the cost burden on the nation as a whole as much as possible while taking fairness into consideration and achieving the multiple policy objectives of environmental conservation and economic development at the same time, the Government of Japan will utilize the policy mix approach of fully mobilizing all policy methods, including voluntary methods, restrictive methods, economic methods and informational methods, taking advantage of their respective characteristics and organically combining them. The Government of Japan will comprehensively study the most appropriate form for this approach while monitoring the progress of the measures and policies of the Kyoto Protocol Target Achievement Plan.

(6-1) Economic Methods

Economic methods rely on market mechanisms and provide economic incentives to induce actions for emission limitation, etc. based on the economic rationality of each entity. They are expected to be effective as economic support policies for global warming countermeasures as well. When utilizing economic methods it is important to maximize their effects and minimize the burden on citizens and the administrative and fiscal costs in line with the policy mix approach. When providing fiscal support, the Government of Japan will endeavor for efficient utilization of the budget, etc. while taking into account the cost-benefit performance.

(6-2) Environment Tax

The environment tax, which is being discussed in related councils, etc. as a method for imposing a tax according to the amount of carbon dioxide emissions or consumption of fossil fuels, is one of the economic methods. Studies are being carried out from various perspectives in related councils, etc. with a view to tax leading to a wide range of entities being encouraged to take warming countermeasures through price incentives and as a source of funds to implement carbon dioxide emissions reduction measures, forest sink measures, etc., among other aims.

Since the environment tax would impose a burden on wide range of citizens, it is an issue for which comprehensive studies must be seriously advanced. In so doing, efforts must be made to obtain the understanding and cooperation of citizens, companies, etc., while keeping in mind studies of the various policy methods related to global warming countermeasures conducted in related councils and elsewhere, and taking into account the specific position of the tax within overall global warming countermeasures, its effects, its impact on national economy and the international competitiveness of the industry as well as the current state of warming measures in foreign countries, etc.

(6-3) Domestic Emissions Trading System

In order to accumulate knowledge and experience concerning cost-efficient emissions reductions and trading, etc., the Government of Japan provides economic incentives for the corporations that make efforts to achieve reduction targets they have determined themselves and implements voluntary participation domestic emissions trading utilizing the trade of emissions quotas.

The domestic emissions trading system is an issue that must be comprehensively studied about the wide range of discussion points includes a comparison of the domestic emissions trading system with other methods and their effects and the impact on industrial activities and the national economy.

* The domestic emissions trading system is the system that first set the total emissions quotas to be issued, then allocates emissions quotas to individual entities and allows such options as trading of emissions quotas with other entities and utilization of Kyoto Mechanism credits.

3. Basic Policies

(1) Development of a Domestic Framework for Calculating Greenhouse Gas Emissions and Removal Based on the United Nations Framework Convention on Climate Change and the Kyoto Protocol

The Kyoto Protocol includes an obligation to develop domestic systems for the calculation of greenhouse gas emissions and removal by one year before the first commitment period. Therefore, the Government of Japan will promptly develop a domestic framework for calculating emissions and removal in compliance with the guidelines of the plan to be decided in the First Conference of the Parties of the protocol (COP 1).

Specifically, the related ministries will cooperate, led by the Ministry of the Environment, to put in place structures for the prompt submission of a greenhouse gas emission and removal catalog by the stipulated deadline, quality control of data, the catalog study and approval process, the response to examinations of expert study teams to be dispatched based on the Kyoto Protocol, etc.

Furthermore, when calculating emissions, the Government of Japan will advance studies and research concerning the development of statistics used as volume of activities, calculation of the energy consumption basic unit and carbon dioxide emission basic unit, greenhouse gas measurement methods, etc., promote standardization (development of Japanese Industrial Standards (JIS)) based on the results of these studies and work to further refine the calculation of greenhouse gas emissions and removal. This is to more accurately monitor the state of emissions for each sector and to meticulously examine the methods of evaluating implementation of countermeasures by each entity.

On the other hand, when measuring, monitoring and reporting removals by carbon sinks (in some cases emissions), the Government of Japan will establish methods that are transparent and have a high degree of scientific verifiability in conformity with the Good Practice Guidance for Land Use, Land-Use Change and Forestry that was adopted at COP10. In order to carry out continuous measurement, monitoring and reporting, the government will promote the development of information concerning the volume of activities and land use changes, as well as studies and research concerning greenhouse gas removal and emission mechanisms in forests, etc.

(2) Promotion of the Development of Global Warming Countermeasures Technology

It could be expected that development of technologies will help achieve compatibility between the environment and the economy and that their wide dissemination will greatly contribute to the reduction of greenhouse gases into the future. Taking into account the Council for Science and Technology Policy's Promotion of Technical Research and Development for Prevention of Global Warming (decision and opinion offered of April 21, 2003) and global warming research initiatives, etc., the related ministries and agencies will collaborate to comprehensively promote technology development through cooperation among the government, industry and academia.

○ Promotion of the Practical Application and Commercialization of New Technologies

Realizing technology development will lead to further improvement of the efficiency, cost reduction and miniaturization, etc. and make it possible to promote carbon dioxide emissions reduction countermeasures such as the introduction and dissemination of new energy and highly-efficient devices. However, whether the benefits of technology development lead to a reduction in greenhouse gases

within the first commitment period will depend on how quickly the new technology can be practically applied and commercialized.

For this reason, through collaboration among the government, industry and academia, the Government of Japan will strongly promote:
* Clear specification and sharing of a road map for commercializing the results of research and development
* Development and demonstration of technology that promotes practical application
* Support for pioneering efforts toward commercialization
In so doing, the Government of Japan will work in conjunction with policies, etc. for the dissemination of development results in the market.

○ Promotion of Cross-sectoral Efforts

As can be seen in the case of the battery technology supporting hybrid automobiles, innovative and promising global warming countermeasures technologies are being practically deployed through the application of elemental technologies of a certain sector to other sectors and through joint work across the boundaries of commercial sectors. In order to increase the number of such success stories as much as possible, the Government of Japan will strongly promote efforts through cross-sectoral collaboration among the government, industry and academia.

○ Promotion of Technology Development from a Medium- and Long-term Perspective

Concerning global warming countermeasures, even if benefits of the technology development should take a long time to appear, the Government of Japan will take the medium- and long-term view from an early stage and provide sufficient support for the development if sustained benefits can be expected from that development.

For example, it is necessary to break the cycle in which economic growth and improved quality of life results in increased energy demand and therefore increased carbon dioxide emissions by reforming the energy supply and demand structure, etc. To that end, the Government of Japan will support breakthrough energy conservation technologies, technologies utilizing the vast unused energy sources, carbon dioxide recovery, storage and isolation technologies that recover carbon dioxide emitted through the use of fossil fuels and reduce emission of carbon dioxide into the atmosphere, etc. from an early stage.

Furthermore, the Government of Japan will focus on promoting technology for encouraging reform of regional and urban structures and reform of socioeconomic systems to form the foundation for medium- and long-term global warming countermeasures and technology for the provision of cross-sectoral underlying support for all kinds of countermeasures.

In addition, the Government of Japan will promote basic research in universities contributing to global warming countermeasures also from the perspective of continuously developing human resources in sectors in which Japan possesses strength, while at the same time respecting the voluntary efforts in universities.

The Government of Japan will moreover meticulously promote warming countermeasures technologies in various sectors, including development of substitute materials for the three substitute

chlorofluorocarbon gases and other emissions limitation technologies and greenhouse gas emissions limitation technology, etc. in the agriculture, forestry and fisheries sectors.

(3) Promotion of Research on Climate Change and Strengthening Systematic Observation and Monitoring

Concerning research on global warming, the Government of Japan will promote research to elucidate the climate change mechanism, monitor the present state of global warming and make future projections, evaluate the impact of global warming on the environment, society and the economy, and to develop policies for greenhouse gas reduction and policies to adapt to global warming, among other ends, taking into account global warming research initiatives, etc. in the Council for Science and Technology Policy. It will promote such research strategically and in a focused manner while working to cooperate with the international community.

Concerning systematic observation and monitoring of global warming, the Government of Japan will strengthen the comprehensive scientific observation and monitoring systems to monitor greenhouse gases, climate change and their impacts, etc., taking into account the Global Earth Observation System of Sytems (GEOSS) 10-Year Implementation Plan endorsed at the Third Earth Observation Summit (February 2005, Brussels) and the Council for Science and Technology Policy's Earth Observation Promotion Strategy (decision and opinion offered of December 27, 2004), etc.

In particular, Japan's efforts will include observations of atmospheric, continental and marine greenhouse gases primarily in the Asia and Oceania region, observations of the continental and marine carbon cycle and ecosystems and observations of the impact of warming in regions vulnerable to climate change such as snow and ice zones and coastal zones as well as the integration of observational data and socioeconomic data.

(4) Ensuring of International Partnership on measures against Global Warming and Promotion of International Cooperation

Long-term efforts to reduce greenhouse gas emissions not only by Japan but also by the entire world working together are indispensable for implementation of measures against global warming . The Kyoto Protocol is an important first step and it is necessary for the entire world to steadily implement it.

To that end, Japan will continue to call on the ratification of the countries that have not yet concluded the protocol. At the same time, the Government of Japan will play a leading role in the global efforts by utilizing our outstanding technological capabilities and accumulated experience of environmental conservation to carry out a wide range of international cooperation with developing countries, including the transfer of environmentally-appropriate technology and know-how, through such means as implementation of the Kyoto Initiative,[36] conservation and restoration of forests, as well as holding of various meetings and seminars, and by endeavoring to meet the Kyoto Protocol commitments in a way that would minimize negative impacts on society, the environment and the economy of developing countries.

[36] The Kyoto Initiative is a package of measures to support the measures against global warming of developing countries which was announced by Japan at the Third Conference of the Parties to the United Nations Framework Convention on Climate Change (December 1997). It consists of three pillars: (1) cooperation for human resources development (3,000 people trained over five years beginning in FY1998), (2) yen loans provided under concessional terms, and (3) utilization and transfer of Japan's technology and experience.

Furthermore, in order to achieve the ultimate target of the United Nations Framework Convention on Climate Change, it is absolutely necessary for the Parties to the Convention to certainly achieve their Kyoto Protocol commitments. At the same time, it is also considered necessary for world greenhouse gas emissions to subsequently shift from an increasing trend to a decreasing trend at an early stage, and to reduce emissions to below half their current levels and maintain them at that level.

To this end, it is important to establish a balanced and effective framework (the so-called commitments for subsequent periods) beyond 2012, the year of the completion of the first commitment period of the Kyoto Protocol, and to build common rules for the participation of all countries including the US and developing countries in the framework, taking into account the principle in the United Nations Framework Convention on Climate Change stating that the Parties should protect the climate system in accordance with their common but differentiated responsibilities and respective capabilities.

Article 3, Paragraph 9 of the Kyoto Protocol provides that consideration of the commitments for subsequent periods is to be initiated this year. Japan will show leadership concerning consideration of the future framework, for example, by holding international conferences to promote dialogue among the countries concerned.

Furthermore, the Government of Japan will continue to provide support for appropriate measures against global warming, etc. in vulnerable countries with a low capacity to respond to it, such as island countries and least developed countries.

Section 3 Items Expected of Local Governments in Particular

In order to promote global warming countermeasures it is important to bring out the initiative of local governments, the bodies responsible for environmental administration in the regions. It is expected that local governments will promote measures conceived in the regions and most suited to the conditions there.

1. Implementation of Comprehensive and Well-planned Policies

Local governments are expected to formulate and implement comprehensive and well-planned policies tailored to the natural and social conditions of their area (regional promotion plans) based on Article 20 of the Law Concerning the Promotion of Measures to Cope with Global Warming and taking into account the basic philosophy concerning global warming countermeasures in the Kyoto Protocol Target Achievement Plan.

Specifically, it is expected that each region will exercise its originality and ingenuity to advance the building of cutting-edge model regions (global warming countermeasures cutting-edge model regions) that can serve as examples for other regions and that incorporate regional development such as development of cities, etc. that contribute to the reduction of greenhouse gas emissions, development of social capital, introduction of new energy, etc. utilizing the local region's resources. It is expected that they will also contribute to the promotion of the active use of timber resources, etc., conservation and development of forests, use of timber and woody biomass, and the promotion of greening campaigns, etc. and that these policies will spread to other regions. In making these efforts, it is expected that each region will incorporate utilization of the Special Zone for Structural Reform system and the regional revitalization plan system.

Local governments, as the part of the public sector most accessible to businesses and residents, are expected to advance policies closely tied to the regions such as education and dissemination of information for local residents, and support for the activities of private organizations.

When promoting policies they are expected to appropriately ensure the cooperation and participation of businesses, private organizations and residents.

When local governments formulate policies it is expected that they will base them on respect for the voluntary nature of each local government, collaborate with the policies of the central government in this Kyoto Protocol Target Achievement Plan, and contribute to the reduction of greenhouse gas emissions on a national scale while considering improvements to the effective energy efficiency on a national scale of businesses.

2. Items Expected of Prefectures in Particular

In particular prefectures, as a part of the local public sector covering a wider area, are mainly expected to promote wide-area large-scale regional global warming countermeasures such as traffic flow countermeasures and promotion of efforts by commercial buildings and businesses in that area, and to provide support for efforts by municipalities including support for formulation of the action plans, in cooperation with the prefectural centers for promotion of activities to stop global warming, the Global Warming Countermeasures Regional Council and the volunteers to promote activities to mitigate global warming.

The prefectures are to utilize the Regional Committees on Energy Supply and Demand and Prevention of Global Warming (refer to Chapter 4, Section 3) established in regional blocks throughout Japan to back up the global warming prevention efforts of local governments and other regional entities.

3. Items Expected of Municipalities in Particular

In particular municipalities, as the part of the public sector in the region most accessible to the businesses and residents in that area, are mainly expected to cooperate with the Global Warming Countermeasures Regional Council, analyze the natural and social conditions of their region and advance policies more closely tied to the region and most effectively tailored to the characteristics of the region such as education and dissemination of information for local residents, support for the activities of private organizations, projects to study and introduce new energy utilizing the resources of the local region, etc. in collaboration with the central government, prefectures, regional businesses, etc.

Section 4 Items Expected of Businesses with High Emissions in Particular

In businesses with significantly high total emissions of greenhouse gases the types of greenhouse gases, greenhouse gas sources, and emission limitation countermeasures are diverse. In order to promote effective countermeasures taking this fact into account, such businesses are expected to individually or jointly formulate plans that include quantitative targets for measures for emission limitation, etc.

Although the content of the plans is left to independent of the businesses, they are expected to pay attention to the following points in order to make their best effort to exercise their originality and ingenuity to create a plan.

○ As the target of specific efforts, limit emissions by advancing improvement of the energy consumption basic unit and carbon dioxide emission basic unit and carry out analyses of performance.

○ Carry out an international comparison of the basic unit taking into account the characteristics of each commercial sector.

○ To the extent possible incorporate measures in the plan to contribute to the limitation, etc. of the greenhouse gas emissions of other entities, such as the development of products with low greenhouse gas emissions, reduction of the volume of waste, etc. and carry out a quantitative evaluation of their contribution to emissions limitation in other sectors including offices and other business facilities, the residencial sector and the transport sector, etc.

○ Businesses that have formulated a plan shall publish it and shall endeavor to publish the status of implementation of measures taken based on it.

○ Businesses shall endeavor to improve the transparency and reliability of their plan, by undergoing an objective evaluation of the plan by a related council of the government or a third-party institution and shall endeavor to make efforts toward improving the probability of accomplishing the plan, taking into account the results of the evaluation.

Chapter 4 To Promote Global Warming Countermeasures in a Sustained Manner

Section 1 Evaluation Methods for Emissions, Removal, and Individual Countermeasures

1. Basic Philosophy

In order to ensure the effectiveness of the Kyoto Protocol Target Achievement Plan and reliably achieve the 6% reduction commitment under the Kyoto Protocol, it is essential to develop and collect comprehensive data concerning the status of achievement of targets for each greenhouse gas and for other categories as well as data concerning the progress of individual measures and policies. It is also essential to carry out an appropriately transparent ex-post evaluation, and flexibly review and supplement measures and policies.

In order for individual measures and policies to produce results, government policies alone are not enough. It is essential for each entity involved in the countermeasures to make active efforts. With a view to encouraging such efforts, it is necessary to carry out ex-post evaluations of the status of efforts by each related entity for each countermeasure contained in this Kyoto Protocol Target Achievement Plan.

To this end, every year the Global Warming Prevention Headquarters will strengthen policies as necessary by examining the progress of policies formulated by the government for individual countermeasures, etc., with reference to the countermeasures evaluation indicators established for each countermeasure.

Furthermore, in FY2007 the Global Warming Prevention Headquarters will carry out a quantitative evaluation and review of this Kyoto Protocol Target Achievement Plan and from FY2008 will implement the measures and policies necessary for the first commitment period.

When carrying out the annual examination and the FY2007 quantitative evaluation and review, the views of members of the Joint Conference of Relevant Advisory Councils on Domestic Measures Addressing the Global Warming Issue will be sought.

When carrying out the quantitative evaluation and review of this plan, public comments will certainly be sought and opportunities will also be created so that the participation of citizens in the evaluation and review process is substantially ensured.

At the earliest possible time, the Government of Japan will establish appropriate evaluation methods for policy areas in which countermeasures evaluation indicators and other evaluation methods are not sufficiently established at the present time, such as measures and policies leading to reform of socioeconomic systems.

2. Overview of Quantitative Evaluation and Review Methods

(1) Evaluation Methods Concerning Targets for Each Greenhouse Gas and for Other Categories

1) Evaluation Methods Concerning Targets for Greenhouse Gas Emissions

Greenhouse gas emissions, in principle, are decomposed by factors to the product of the “volume of

activities"—the number of households, floor area, etc. —and "greenhouse gas emissions per unit of activities."

In the FY2007 evaluation of this Kyoto Protocol Target Achievement Plan, emissions and removal projections are to be evaluated by decomposing greenhouse gases into the factors of the volume of activities and greenhouse gas emissions per unit of activities.

Based on these evaluation results, in order to reliably achieve the 6% reduction commitment under the Kyoto Protocol, as necessary the Government of Japan will comprehensively review the targets for each greenhouse gas and for other categories, individual countermeasures, countermeasures evaluation indicators for those countermeasures, expected emissions reduction, policies for the promotion of the role and countermeasures of each entity, etc.

A. Emissions Projection for Energy-originated Carbon Dioxide

The emissions projection for energy-originated carbon dioxide is decomposed into three factors:
1) "Volume of activities" – the Index of Industrial Production, the number of households, floor area, transport volume, etc.
2) "Energy consumption per unit volume of activities" – automobile fuel efficiency, etc.
3) "Carbon dioxide emissions per unit of energy consumption for each energy type" – gasoline, coal, electric power, etc.
A comprehensive evaluation of the emissions projection must be carried out based on the above points and taking into account changes in economic conditions in Japan and the impact of those changes, changes in the recorded figures of each type of indicator used on the assumption that the effects of countermeasures have been accumulated, and the progress of all countermeasures on the demand side and supply side and their effects, etc. during the period between the time of formulation of the Kyoto Protocol Target Achievement Plan and the time of the FY2007 evaluation and review.

B. Emissions Projection for the Three Fluorinated Gases

The three fluorinated gases are the substitutes for the ozone depleting substances, and are widely used in a diverse range of sectors including the commercial sector, residencial sector, other sectors including offices and other business facilities and the transport sector. An evaluation of the emissions prospection for the three fluorinated gases must include an estimate of the volume of activities and in addition must be carried out taking into account the progress of countermeasures to protect the ozone layer, emissions and their trends based on the voluntary action plans of industry, the status of development of substitute materials and substitute technology, and the effects of improvements in the basic unit and recovery rate, etc. for each application.

C. Emissions Projection for Non-energy-originated Carbon Dioxide, Methane and Nitrous Oxide

Emissions in the industrial processes sector are estimated based on estimates of the volume of products manufactured and raw material consumption, etc. for each emissions category. In the waste sector, taking into account related policies, the future burial volume and incineration volume for each type of waste will be estimated and emissions will be calculated by multiplying this estimate by the emission factors.

In addition to the above, taking into account fuel consumption, the number of livestock, paddy field

area, etc., future emissions will be estimated for non-energy-originated carbon dioxide, methane, and nitrous oxide separately to evaluate the emissions projection.

2) Evaluation Methods for Utilization of Sinks

Removal in the first commitment period which is subject to calculation in the Kyoto Protocol is estimated and evaluated based on trends in forest area for each category (managed forests, naturally regenerated forests, protection forests, etc.), forestry practices area, the tall tree planting area in public interest facilities, etc. in the year the evaluation is carried out, and on the latest scientific knowledge concerning the volume of removal.

3) Evaluation Methods Concerning Promotion and Utilization of the Kyoto Mechanisms

Promotion and utilization of the Kyoto Mechanisms will be evaluated with respect to the status of development of the foundation for promotion and utilization of the Kyoto Mechanisms domestically and internationally and the formation of projects, the number of Kyoto Mechanism credits planned to be transferred or already transferred to the government account, the status of development of the structures of internal government agencies and government-affiliated organizations, and the status of development of an environment for utilization of the Kyoto Mechanisms by private businesses, etc.

(2) Evaluation Methods for Countermeasures Concerning Reduction, Removal, etc. of Greenhouse Gas Emissions

Indicators that are the subject of evaluation are to be stipulated for each of the various countermeasures concerning the limitation, etc. of greenhouse gas emissions which are specified in this Kyoto Protocol Target Achievement Plan and at the time of the evaluation every effort is to be made to evaluate the countermeasures based on these indicators.

In order for individual measures to produce results government policies alone are not enough; it is essential for each entity involved in the countermeasures to make active efforts. With a view to encouraging such efforts, the status of efforts by related entities for each countermeasure contained in this Kyoto Protocol Target Achievement Plan will be quantitatively monitored as much as possible.

By clarifying the premise of cumulation at the time of the formulation of the Kyoto Protocol Target Achievement Plan, it was made possible to carry out ex-post verification of the expected reduction in greenhouse gas emissions (carbon dioxide equivalent) resulting from countermeasures.

The evaluation indicators, etc. for each measure are as in Attached Tables 1-5.

Section 2 Evaluation Methods for Efforts of Citizens and Technology Development

1. Evaluation Methods for Efforts of Citizens

Efforts of each individual citizen, such as reform, etc. of lifestyles and working styles, are the driving force for realization of global warming countermeasures effects.

Emissions reduction effects achieved through the efforts of citizens appear as a part of energy-originated carbon dioxide emissions reduction effects. The status of promotion of items that can be quantitatively evaluated, such as the dissemination of energy-conserving equipment, etc., is to be examined utilizing appropriate countermeasures evaluation indicators, just as for other CO2-saving countermeasures.

On the other hand, it is difficult to evaluate independently the effects of efforts regarding human actions and ways of using things, such as reform of the lifestyles and working styles of citizens through citizens' campaigns, dissemination of information and educational activities, the realization of eco-drive, etc. because of the technological difficulty of monitoring, etc. Therefore, the effects are examined in an integrated manner as a part of CO2-saving countermeasures. In order to ensure the sustainability and continuity of efforts and to use the PDCA cycle to lead to strengthening of policies, however, quantitative evaluations of related policies will be implemented as much as possible by monitoring the level of understanding of the importance of global warming countermeasures and the level of implementation of efforts of each individual citizen, etc. through questionnaire studies, warming countermeasures diagnostics, utilization of standards for actions of citizens, etc.

2. Evaluation Methods for Technology Development

It is thought that the benefits of research and development on environmental and energy technologies, such as energy conservation technology, etc. will be realized along with the benefits of other policies among the greenhouse gas emissions reduction countermeasures.

For this reason, with a view to implementation of more appropriate evaluations of policies, the benefits of strengthening research and development on environmental and energy technologies should not be independently quantitatively evaluated, but rather examined in an integrated manner as a part of greenhouse gas emissions reduction countermeasures. Appropriate follow-up will continue to be implemented, including making clear the indicators that will be the targets for individual technologies and implementing PDCA based on those indicators, etc.

Section 3 Development of a Promotion Structure

In order for each entity to continuously advance measures and policies to realize a society that exits from inducing global warming, it is important to develop a systematic promotion structure.

The Government will flexibly establish working groups tailored to each issue, centering on the Global Warming Prevention Headquarters with the Prime Minister as its chief and all ministers as its members. The Steering Committee of the Global Warming Prevention Headquarters, a conference of Director-Generals from each ministry, and the concerned ministries and agencies also are to closely collaborate to make efforts to develop the promotion structure.

Concerning countermeasures in cities, the Global Warming Prevention Headquarters and the Urban Renaissance Headquarters are to collaborate. In the working groups of concerned ministries and agencies, the government will collaborate in promoting global warming countermeasures through urban renaissance projects, taking into account the decision of Urban Renaissance Projects.

In the regions, the government will establish Regional Committees on Energy Supply and Demand and Prevention of Global Warming in each regional block in order for concerned ministries and agencies to cooperate to back up efforts in the regions for global warming countermeasures, in collaboration with local governments, etc.

Members of the Regional Committees on Energy Supply and Demand and Prevention of Global Warming will be of an appropriate number for each region and are to be drawn from local governments within the region, in particular local branch offices of the central government and prefectural governments, with additional members including energy officials, economic organizations, consumers, prefectural centers for promotion of activities to stop global warming and NGOs. The Regional Committees will also collaborate with the Local Council for Global Warming Measures, Regional Biomass Councils, etc.

Conclusion

(The Global Warming Issue)

The global warming issue is an environmental issue that impacts on the very foundations of human survival.

In order to achieve the ultimate objective of the Framework Convention on Climate Change, that is, the stabilization of the concentration of greenhouse gases to prevent the progress of global warming, it is necessary to reduce worldwide carbon dioxide emissions to at least below half of their current levels at an early stage. Nonetheless, greenhouse gases, in particular carbon dioxide, are, in a manner of speaking, a by-product generated from socioeconomic activities and the daily lives of the citizens, and it is not easy to reduce them.

Furthermore, efforts by Japan alone are insufficient; it is necessary to reduce the total emissions of greenhouse gasses on a global scale.

(Japan's Position as it Makes Efforts to Tackle the Global Warming Issue)

Taking into account these issues, it is necessary for Japan itself to make efforts for technological innovation that makes sustainable development possible, reform of social systems, and improvement of the environmental awareness of each individual citizen, and, as an environmentally advanced nation, to take the lead for efforts toward global warming prevention based on international collaboration.

Japan is a resources-poor country in which the foundations of the citizens' lives and industrial activities are dependent on overseas natural resources and which has developed technologies to overcome energy and environmental issues. Moreover, it possesses a lifestyle and history in harmony with nature represented by the concept of "mottainai" (literally translated as "don't waste what is valuable). This adds even more to the reasons why Japan should contribute to the world by presenting a vision of an attractive society which uses natural resources efficiently, making more effort than any other country to achieve the safety and reassurance of the human race and producing results.

(Aims of the Kyoto Protocol Target Achievement Plan)

From this perspective, in this Kyoto Protocol Target Achievement Plan the focus is simultaneously on certain achievement of the immediate target of the Kyoto Protocol commitment and on approaches to take after the completion of the first commitment period toward achievement of long-term, continuous emissions reduction. An effort was made to incorporate a variety of measures and policies that would lead to the realization of a society that enables sustainable development.

Furthermore, in order to overcome the various social conditions, and historical and environmental differences, etc. among countries and work together to advance efforts toward building a sustainable world, the Government of Japan will promote technological innovation from a long-term perspective and the dissemination of that technology on a global scale, and will make efforts to ensure that reform of awareness, reform of social systems, as well as development and dissemination of technology and investment for them are carried out in all regions of the world.

(Responsibility of the Current Generation)

It is thought that the impact of climate change is already becoming apparent in regions throughout the world, so the actions of humans over the next few decades will affect the future of this planet. Whether or not the global warming issue is successfully resolved indeed depends on the decisions and actions of those of us living in the world now.

The important thing is that we ourselves know past history, accurately monitor present conditions and look to the future. By knowing present realities and projecting into the future we can discover the value of protecting the global environment, reform the structure of society and change our daily actions.

(Message to the Citizens of Japan)

Currently Expo 2005 Aichi is being held. The theme of the Expo is "Nature's Wisdom." So that "Nature's Wisdom" will be of lasting benefit to the entire world and in light of Japan's ancient wisdom of coexistence with nature, we would like all citizens to make efforts to protect the planet.

Appendix 1 List of Measures and Policies Concerning Energy-originated Carbon Dioxide

*When estimating the projected amount of emissions reductions resulting from the effect of each measure, the projections are based on assumed factors other than the evaluation indicators of the measure and the projection at the time the plan is formulated

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
1. Forming CO2-saving regional and urban structures and socioeconomic systems a. CO2-saving urban design						
Promote Area energy network (Table 1－1a(1))	<Improving efficiency by Area energy network (partly includes "Promote New Energy Measures," "Promote the Introduction of Cogeneration and Fuel Cells, etc.," "Spread High-efficiency Air Conditioning for Commercial Use," etc.)>	Businesses: ・Promote businesses that meet consumers' needs ・Promote the improvement of efficiency by introducing high-efficiency equipment ・Promote technological development such as improving system efficiency ・Promote examination of the energy efficiency and environmental friendliness, etc. of systems to be introduced	・Framework-building by promoting the establishment of committees ・Promote pioneering model projects ・Formulate introduction manuals ・Promote environmental improvement ・Implement assistance by low-interest loan systems and subsidy systems, etc.	・Promote Area energy network through urban planning systems	・<Improving efficiency by Area energy network (partly includes "Promote New Energy Measures," "Promote the Introduction of Cogeneration and Fuel Cells, etc.," "Spread High-efficiency Air Conditioning for Commercial Use," etc.)>	
Promote global warming countermeasures for tenanted buildings, etc. at the regional level (Table 1-1a(2))	<Numbers included in "Improve energy conservation capability of buildings," "Spread BUMS">	Building owners, tenants, etc: Promote cooperative efforts	・Implement model projects that support cooperation between building owners and tenants, etc.	・Publicize excellent examples through regional councils, establish consultation services ・System to assist small- and medium-sized enterprises	・Numbers included in "Improve energy conservation capability of buildings," "Spread BEMS"	

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
1. Forming CO2-saving regional and urban structures and socioeconomic systems b. Design CO2-saving transportation systems						
Promote use of public transportation (Table 1—1b(1))	Number of people transported by public transportation <improvement effect of approximately 2.5 billion people>	Transport businesses: Develop public transportation, improve services and convenience Businesses: Promote use of public transportation among employees, customers, etc. The public: Use public transportation	・Promote development of new railway lines ・Promote development of medium-capacity transit systems such as new transportation systems in urban areas and LRT ・Promote use of public transportation by improving services and convenience, such as promotion of informatization including the introduction of IC cards, improving transit and realizing seamless public transportation ・Implement Comprehensive Measures Projects to Facilitate Urban Transportation ・Promote development of transport nodes such as station squares ・Implement and support social experiments that contribute to promoting use of public transportation ・Promote use of public transportation according to the Law Concerning the Rational Use of Energy (Energy Conservation Law) ・Spread and raise awareness about measures ・Promote development of Public Transportation Priority Systems (PTPS) to give the priority signal for bus, etc.	・Develop public transportation ・Promote use of public transportation by improving services and convenience ・Spread and raise awareness about measures	Approximately 380	・Cumulate figures are calculated by region. This assumes that among the people transported by public transportation, in which an improvement effect is expected due to the development of new railway lines, a certain proportion would have switched from using their own cars. ・Assumes that of those who work in businesses with 100 or more employees and commute using their own cars, approximately 10% would have switched from using their own cars.
Promote environmentally friendly use of automobiles (Improve environmental friendliness of automobile transport businesses, etc. by promoting spread of eco-drive) (Table 1—1b(2))	Number of eco-drive-related equipment in use <200,000 units> Penetration rate of vehicles with advanced GPS-AVM systems <16%>	Manufacturers: Develop and sell eco-drive-related equipment Transport businesses: Introduce eco-drive-related equipment, put eco-drive into effect, develop taxi pools, effectively allocate vehicles using advanced GPS-AVM systems, create and implement medium- and long-term plans according to the Energy Conservation Law Consumers: Introduce eco-drive-related equipment, put eco-drive into effect	・Spread and promote eco-drive efforts by assisting EMS model projects ・Conduct demonstration experiments on anti-idling by developing taxi pools ・Support development of advanced GPS-AVM systems ・Spread and raise awareness about eco-drive including anti-idling ・Ensure that the Energy Conservation Law is applied to automobile transport businesses ・Promote efforts through the Green Distribution Partnership Meeting	・Spread and raise awareness about measures ・Promote measures to ensure compliance with anti-idling regulations	Approximately 130	・Effect of CO2 emissions reduction per vehicle due to the introduction of eco-drive-related equipment <approximately 15%> ・Amount of reduction of allocated distance using advanced GPS-AVM systems <approximately 1km>

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Promote environmentally friendly use of automobiles (Support introduction of anti-idling automobiles) (Table 1－1b(3))	Number of anti-idling automobiles in use <approximately 2.8 million units>	Manufacturers: Expand the types of automobiles that have the anti-idling function Distributors: Actively sell automobiles that have the anti-idling function	・Measures to support the purchase of automobiles with the anti-idling function ・Develop technology to improve automobile air conditioning systems ・Promote efforts through the Green Distribution Partnership Meeting ・Take initiative in introduction	・Spread and raise awareness about measures ・Take initiative in introduction	Approximately 60	・Effect of reduced fuel consumption resulting from automobiles with the anti-idling function <approximately 5-10%>
Adjust the demand of automobile traffic (Table 1－1b(4))	Develop bicycle tracks <Develop bicycle tracks totaling approximately 30,000km between FY1995 to FY2010>	Transport businesses: Promote traffic demand management (TDM) policies, implement Comprehensive Measures Projects to Facilitate Urban Transportation The public: Use bicycles, staggered commuting, etc.	・Promote traffic demand management (TDM) policies ・Implement Comprehensive Measures Projects to Facilitate Urban Transportation ・Develop and support an environment for bicycle use ・Implement and support social experiments that contribute to promoting bicycle use	・Promote traffic demand management (TDM) policies ・Implement Comprehensive Measures Projects to Facilitate Urban Transportation ・Develop an environment for bicycle use ・Implement and support social experiments that contribute to promoting bicycle use	Approximately 30	・Develop and extend bicycle tracks ・Number of km an automobile travels with a trip length of 5km or less ・Rate of conversion to bicycle use ・CO2 emission factors

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Promote Intelligent Transport Systems (ITS) (Table 1－1b(5))	Electronic Toll Collection System (ETC) utilization rate <Raise to approximately 70% by spring 2006> Vehicle Information and Communication System (VICS) penetration rate Centralized control of traffic signals <Put approximately 40,000 traffic signals under centralized control between FY1995 and FY2010>	The public, businesses: Introduce vehicles that can use ETC, VICS and mobile operation control systems (MOCS), etc.	・Implement measures to promote ETC use (put various discounts, etc. into effect, enable motorcycles to use ETC) ・Spread and promote VICS ・Promote collection and provision of traffic information ・Develop system to support safe and comfortable driving by providing information and warning, etc. to drivers ・Promote initiatives for introduction based on the Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Law on Promoting Green Purchasing) ・Promote area control of traffic signals ・Develop traffic control centers by upgrading central processing system and introducing a new traffic signal controlling system ・Promote real-time traffic signal control models ・Promote Environment Protection Management Systems (EPMS), etc. ・Develop Mobile Operation Control Systems (MOCS) for commercial vehicles, etc. ・Promote provision of accurate, appropriate traffic information by private companies ・Appropriately manage traffic information examination systems ・Promote creation of a traffic regulation and information database	・Promote collection and provision of traffic information ・Promote initiatives for introduction based on the Law on Promoting Green Purchasing	Approximately 360	・ETC utilization rate ・Amount of traffic congestion by toll gate ・Number of vehicles passed by toll gate ・Improved speed due to the nonstop effect ・CO2 emission factors by speed ・VICS penetration rate ・Improved speed due to VICS penetration ・CO2 emission factors by speed ・Amount of reduced CO2 emissions per traffic signal under centralized control (2002 standards) ・Number of improved traffic signals
Reduce road construction (Table 1－1b(6))	Annual number of hours of road construction per 1km of road <reduce by approximately 20% by 2007 (compared with 2002)>	Occupant companies: Implement focused construction and joint construction	・Maintain common ducts, implement focused construction and joint construction ・Hold Road Construction Coordination Council meetings, etc. and implement adjustment of focused construction and joint construction	・Maintain common ducts, implement focused construction and joint construction ・Hold Road Construction Coordination Council meetings, etc. and implement adjustment of focused construction and joint construction ・Appropriately administer road permits	Approximately 50	・Annual number of hours of road construction per 1km of road ・Difference in speed with or without traffic congestion ・Length of traffic congestion due to construction ・CO2 emission factors by speed

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Develop traffic safety facilities (Table 1—1b(7))	Upgrade traffic signals <upgrade approximately 20,000 traffic signals between FY1995 to FY2010>		・Promote coordinated and actuated traffic signals ・Sophisticate traffic control ・Develop illegal parking prevention system ・Develop parking guidance system ・Promote measures against the bottleneck by developing traffic signals at railroad crossings and guide traffic using traffic information boards	・Establish traffic signals	Approximately 50	・Amount of reduced CO2 emissions per upgraded traffic signal (2002 standards) ・Number of improved traffic signals
Promote traffic alternatives using information and communications such as teleworking (Table 1—1b(8))	Teleworking population <applies to 25% of the number of employees, or approximately 16.3 million people>	Companies, economic and labor circles: Spread and raise awareness to promote teleworking, conduct survey research activities, etc.	・Provide information, conduct survey research and spread and promote teleworking and SOHO ・Conduct a trial run and implement teleworking for public servants		Approximately 340	・Teleworking population <applies to 25% of the number of employees, or approximately 16.3 million people>
Realize Environmentally Sustainable Transport (EST) (Table 1—1b(9))	Number of regions involved in EST efforts, CO2 reduction rate of regions participating in EST model projects	Transport businesses: Develop public means of transportation, improve services and convenience, reduce environmental burden on means of transport Businesses: Promote use of public means of transportation among employees, clients, etc. Local governments: Projects to promote use of public means of transportation, develop transport infrastructure, countermeasures against illegal parking, establish bus-only lanes, etc. Users: Voluntarily refrain from using automobiles, use public means of transportation and bicycles, promote walking	・Implement model projects (select regions in which to implement them, implement focused assistance) ・Provide information on target setting and evaluation methods, etc. for efforts ・PR activities	・Regional projects to promote use of public means of transportation, etc. ・Develop transport infrastructure that will contribute to reducing the environmental burden ・Environment building ・Spread and raise awareness about measures	・Numbers included in "Spread and promoting clean energy automobiles," "Adjust the demand of automobile traffic," "Promote use of public means of transportation," etc.	

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
1. Forming CO2-saving regional and urban structures and socioeconomic systems c. Build CO2-saving distribution systems						
Comprehensive Measures to Improve the Environmental Friendliness of Marine Transport (Table 1－1c(1))	Increase in marine transport volume (cargo volume (general merchandise) that can easily be exported by automobiles: ton-km) <5.4 billion ton-km>	Marine transport businesses: Create and implement medium-term plans according to the Energy Conservation Law Cargo owners: Cooperate with marine transport businesses and actively use domestic shipping	・Promote policies to develop, spread and promote new technology, such as the Super Eco-Ship ・Revitalize marine transport by reviewing regulations ・Ensure that the Energy Conservation Law is applied to cargo owners and marine transport businesses ・Assist introduction of new ships and equipment ・Promote efforts through the Green Distribution Partnership Meeting ・Promote modal shift through the Law Concerning the Promotion of the Integration and Efficiency of Distribution Operations	—	Approximately 140	・Basic unit of the ship-to-truck ratio <approximately 13%>
Modal shift to railway freight (Table 1－1c(2))	Amount of railway container transport (in ton-km) that increases as a result of switching from trucks to railway containers <3.2 billion ton-km>	Railway businesses: Effectively use transport capability by take advantage of IT Promote use of large container transport systems by developing them Improve transport efficiency by developing stations with Effective and Speedy Container Handling System (E&S) method Create and implement medium-term plans according to the Energy Conservation Law Forwarders: Promote use of enhanced transport equipment such as large containers Cargo owners: Actively use environmentally friendly railway freight transport	・Project to Strengthen Transport Capability of Railway Freight on the Sanyo Line ・Promote efforts through the Green Distribution Partnership Meeting ・Assist introduction of new high-performance trains that will contribute to strengthening transport capability ・Ensure that the Energy Conservation Law is applied to cargo owners and marine transport businesses ・Promote modal shift through the Law Concerning the Promotion of the Integration and Efficiency of Distribution Operations ・Promote raising awareness of environmentally friendly railway freight transport (spread and promote eco-rail mark, etc.)	・Spread and raise awareness about measures	Approximately 90	・Basic unit of the railway freight transport-to-truck ratio <approximately 8%>

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Improve efficiency of trucking (Table 1－1c(3))	Number of owned vehicles with a total vehicle weight of over 24 tons and 25 tons or below <120,800 units>, number of trailers owned <68,800 units>, rate of shift of trucks from private use to business use <improved by approximately 1%>, load efficiency <improved by approximately 1%>	Freight businesses: Enlarge vehicles, shift to trailers, promote efficiency of trucking, create and implement medium-term plans according to the Energy Conservation Law	・Promote enlargement of vehicles and shift to trailers ・Reinforce bridges so they can withstand larger vehicles ・Ensure that the Energy Conservation Law is applied to cargo owners and marine transport businesses ・Promote efforts through the Green Distribution Partnership Meeting ・Promote modal shift through the Law Concerning the Promotion of the Integration and Efficiency of Distribution Operations	・Spread and raise awareness about measures ・Reinforce bridges so they can withstand larger vehicles	Approximately 760	・Effect of reduced fuel consumption resulting from introduction of 25-ton vehicles <approximately 9,000L/unit> ・Effect of reduced fuel consumption resulting from introduction of trailers <approximately 24,000L/unit> ・Basic unit of ratio of business-use trucks to private-use trucks <approximately 17%>
Reduce land transport distance of international freight (Table 1－1c(4))	Reduce land transport of international freight (in ton-km) <reduction of approximately 9.2 billion ton-km>	Cargo owners, distributors: Use optimal ports that are closest to the sites of production and consumption	・Develop international maritime container terminals at central and core international ports ・Develop hubs at multipurpose international terminals ・Promote efforts through the Green Distribution Partnership Meeting	—	Approximately 270	・Shorten land transport distance of international freight

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
1. Forming CO2-saving regional and urban structures and socioeconomic systems b. Promote integrated introduction of new energy and energy interchange						
Build network of dispersed new energy sources (Table 1－1d(1))	<Numbers included in "Promote New Energy Measures">	Businesses: Promote use of new energy sources, etc. through business activities	・Develop and demonstrate technology, assist introduction, etc. ・Assist advanced businesses in regions	・Promote use of new energy sources through local governments' business activities	・Numbers included in "Promote New Energy Measures"	
Promote use of biomass (build biomass town) (Table 1－1d(2))	Number of biomass towns <500>	Agriculture, forestry and fisheries businesses, businesses, etc.: Actively use biomass resources Local residents: Actively cooperate to gather and use biomass resources	・Promote concept of biomass towns ・Assist formulation of plans, develop facilities, develop technology, provide information, etc. on regional efforts to use biomass	・Formulate and promote concept of biomass towns ・Build system for production, collection, transport, conversion and use of regional biomass	Approximately 100 (Partly includes "New Energy Measures")	・Use 90% of biomass from industrial waste and 40% of unused biomass in approximately 500 municipalities nationwide ・Use approximately 100,000 tons of biomass plastic
Effective use of unused energy sources (Table 1－1d(3))	<Numbers included in "Promote New Energy Measures">	・Actively introduce through businesses, etc.	・Policies to introduce and promote new energy sources	・Introduce and promote through public facilities, etc.	・Numbers included in "Promote New Energy Measures"	
Energy conservation through cooperation among multiple businesses (Table 1－1d(4))	Amount of energy conserved through cooperation among multiple businesses in industrial complexes, etc. <Approximately 1 million kL (crude oil equivalent)>	Businesses: Introduce energy-conserving equipment	Measures to assist businesses in introducing energy-conserving equipment and feasibility studies	・Spread and raise awareness about measures	Approximately 320	・Scheduled to successively implement approximately 3 or 4 projects of priority per year in major industrial complexes

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
2. Measures according to facility and by entity a. Efforts in the industrial sector (manufacturers, etc.)						
Steadily implement and follow up on voluntary action plans (Table 1－2a(1))	Follow up appropriately from the perspective of improving transparency, reliability and probability of achieving targets of voluntary action plans of Nippon Keidanren and individual industries	Nippon Keidanren, various industry groups: Efforts to reduce amount of emissions by improving unit energy consumption, etc. and achieving those targets by steadily implementing voluntary action plans	Follow up in relevant councils, etc.	—	Approximately 4,240	・Expect targets set by industry groups in voluntary action plans to be achieved (Compared to the absence of such measures, energy consumption per industrial activity (IIP) is improved by 5.9% on average)
Thoroughly manage energy according to the Energy Conservation Law (industry) (Table 1－2a(2))	Improve energy efficiency in factories, etc. ・Improve unit energy consumption in factories that will newly become type 2 designated factories ・Improve unit energy consumption in factories that are currently type 2 designated factories but will be upgraded to type 1 designated factories	Businesses: Thoroughly manage energy such as the integrated management of heat and electricity	Appropriately administer the Energy Conservation Law, etc.	—	Approximately 170	・Estimate changes in factories covered by the legal amendment (Approximately 1,800 factories will newly become type 2 designated factories, and approximately 1,200 factories which are currently type 2 designated factories will be upgraded to type 1 designated factories)

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
2. Measures according to facility and by entity b. Efforts by transport businesses						
○Promote environmentally friendly use of automobiles (Improve environmental friendliness of automobile transport businesses, etc. by promoting spread of eco-drive) (same as last time) ○Promote environmentally friendly use of automobiles (Support introduction of anti-idling automobiles) (same as last time) ○Comprehensive measures to improve the environmental friendliness of marine transport (same as last time) ○Modal shift to railway freight (same as last time) ○Improving efficiency of trucking (same as last time) ○Reduce land transport distance of international freight (same as last time)						

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
2. Measures according to facility and by entity c. CO2-saving in business facilities such as offices and stores						
Thoroughly manage energy according to the Energy Conservation Law (civilian business) (Table 1－2c(1))	Improve, etc. energy efficiency of office buildings, etc. ・Improve unit energy consumption in factories that will newly become type 2 designated factories ・Improve unit energy consumption in factories that are currently type 2 designated factories but will be upgraded to type 1 designated factories	Businesses: Thoroughly manage energy such as the integrated management of heat and electricity	・Appropriately administer the Energy Conservation Law, comprehensively inspect business establishments, etc.	—	Approximately 300	・Estimate changes in business establishments covered by the legal amendment (Approximately 1,000 business establishments will newly become type 2 designated factories, and approximately 600 business establishments which are currently type 2 designated factories will be upgraded to type 1 designated factories) ・Past record of energy conservation diagnoses of business establishments by energy conservation centers, etc.

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Improve energy conservation capability of buildings (Table 1－2c(2))	・Percentage of new buildings that have achieved energy conservation standards (1999 standards) <80% (FY2006)>	Clients: Build buildings with high energy conservation capability when building new buildings or expanding or renovating buildings, use comprehensive capability evaluation Owners: Improve energy conservation capability through repair, maintenance, conservation, etc. and use comprehensive environmental capability evaluation Architects: Implement and use comprehensive environmental capability evaluation, provide information to clients, etc. Builders: Develop and use technology, use comprehensive environmental capability evaluation, provide information to clients, etc. Building material and equipment manufacturers: Promote technological development, provide information to clients, etc.	・Oblige clients, etc. to make efforts toward energy conservation measures based on the Energy Conservation Law, make notification of energy conservation measures mandatory when building or making large-scale repairs, etc. of buildings (non-residential) exceeding a certain size ・Promote the development of green government buildings, promote green assessments and renovations ・Carry out thorough and appropriate operation and management of existing government office facilities ・Develop and spread comprehensive environmental capability evaluation methods ・Support in the form of loans from the Development Bank of Japan, tax system, etc. ・Support advanced technological development ・Foster design and construction engineers ・Subsidize efforts to improve energy conservation in office buildings, etc. ・Make eco-friendly repairs at schools ・Promote voluntary efforts among relevant industries	・Use guidance and advising, designation, disclosure and recommendation system for clients, etc. based on the Energy Conservation Law ・Use comprehensive environmental capability evaluation ・Implement energy conservation measures for buildings owned by local governments	Approximately 2,550	・Expect effects outlined in the amended Energy Conservation Law, submitted to the 2005 ordinary Diet session, to be achieved, and assume further improvements to be made in the energy conservation capability of new and existing buildings <Percentage of buildings that have achieved energy conservation standards (1999 standards): 80% (FY2006)><Amount of energy conserved: approximately 5.6 million kL (crude oil equivalent)>

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Spread Building Energy Management Systems (BEMS) (Table 1－2c(3))	Amount of energy conserved through spread of BEMS and HEMS <Approximately 2.2 million kL (crude oil equivalent)>	Introduce to businesses, etc.	・Measures to support HEMS demonstration experiments and introduction of BEMS by businesses ・Support business models concerning energy conservation services for households, etc.	・Take initiative in introduction of BEMS and HEMS	Approximately 1,120	・Because BEMS and HEMS have many aspects in common such as the technological aspect and fields where they can be introduced, as for the measure evaluation indicator and projected volume of emissions reduction, the total amount of energy conservation for BEMS and HEMS and projected volume of emissions reduction is used.

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
2. Measures according to facility and by entity d. CO2-saving in households						
Improve energy conservation capability of houses (Table 1－2d(1))	・Percentage of new houses that have achieved energy conservation standards (1999 standards) <50% (FY2008)>	Clients: Build houses with high energy conservation capability when building new houses or expanding or renovating houses, use comprehensive environmental capability evaluation Owners: Improve energy conservation capability through repair, maintenance, conservation, etc. and use comprehensive environmental capability evaluation Architects: Implement and use comprehensive environmental capability evaluation, provide information to clients, etc. Builders and housing suppliers: Develop and use technology, use comprehensive environmental capability evaluation, provide information to clients, etc. Building material and equipment manufacturers: Promote technological development, provide information to clients, etc.	・Oblige clients, etc. to make efforts toward energy conservation measures based on the Energy Conservation Law, make notification of energy conservation measures mandatory when building or making large-scale repairs, etc. of houses exceeding a certain size ・Spread and promote housing performance indication system ・Develop and spread comprehensive environmental capability evaluation methods ・Support energy conservation measures for public housing, etc. ・Encourage energy-conserving houses using frameworks for finance corporation loans and securitization loans ・Support advanced technological development ・Foster design and construction engineers ・Promote voluntary efforts among relevant industries	・Use designation, disclosure and recommendation system of the Energy Conservation Law ・Spread and promote housing performance indication system ・Use comprehensive environmental capability evaluation ・Implement energy conservation measures for public housing, etc. ・Provide information to clients, architects, etc.	Approximately 850	・Expect effects outlined in the amended Energy Conservation Law, submitted to the 2005 ordinary Diet session, to be achieved, and assume that further improvements will be made in the percentage of new houses that have achieved the 1999 energy conservation standards as well as in the energy conservation capability of existing houses <Percentage of buildings that have achieved energy conservation standards (1999 standards): 50% (FY2008)> <Amount of energy conserved: approximately 3 million kL (crude oil equivalent)>

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Model efforts for CO2-saving in houses undertaken with the cooperation of housing manufacturers, consumers, etc. (Table 1－2d(2))	<Numbers included in "Improve energy conservation capability of houses," "Improve efficiency of equipment that meets top-runner standards">	Housing manufacturers, building contractors, housing exhibits: Provide energy conservation information concerning housing Consumers: Actively improve energy conservation when building new houses	・Spread and promote energy-conserving houses, energy-conserving materials and facilities, etc.	・Provide energy conservation information using prefectural centers	・Numbers included in "Improve energy conservation capability of houses," "Improve efficiency of equipment that meets top-runner standards"	
Spread Home Energy Management Systems (HEMS) (Table 1－2d(3))	Amount of energy conserved through spread of BEMS and HEMS <Approximately 2.2 million kL (crude oil equivalent)>	Introduce to businesses, etc.	・Measures to support HEMS demonstration experiments and introduction of BEMS by businesses ・Support business models concerning energy conservation services for households, etc.	・Take initiative in introduction of BEMS and HEMS	Approximately 1,120	・Because BEMS and HEMS have many aspects in common such as the technology and fields where they can be introduced, as for the measure evaluation indicator and projected volume of emissions reduction, the total amount of energy conservation for BEMS and HEMS and projected volume of emissions reduction is used.

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
2. Measures according to facility and by entity e. CO2-saving in the energy supply sector						
Reduce unit CO2 emissions in the electric field by promoting nuclear power, etc. (Table 1－2e(1))	Rate of improvement of unit CO2 emissions among electric power suppliers: (Federation of Electric Power Companies of Japan: Environmental Action Plan targets) Reduce emission of carbon dioxide per 1 kWh of electric power generation in FY2010 by approximately 20% from the FY1990 level <Reduce to approximately 0.34kg-CO2/kWh>	(Federation of Electric Power Companies of Japan) Efforts aimed at achieving the targets of the Environmental Action Plan through the following measures, etc. (1) Improve nuclear power plant's capacity factor by realizing scientific and rational operations management (2) Further improve the thermal efficiency of thermal power plants, adjust thermal power operation methods bearing in mind environmental characteristics, etc. (3) Attain credit (amount of CO2 emissions) according to the Kyoto Protocol using the Kyoto Mechanisms	Conduct the following measures, etc. to reduce unit CO2 emissions in the electric field. Follow up on the status of progress of achieving the targets of the Environmental Action Plan by the Japanese Electric Utility Industry (Federation of Electric Power Companies of Japan). With ensuring safety as the major premise, promote nuclear power with mutual public and private sector cooperation while attaining the people's understanding. Support measures to make thermal power plants highly efficient, such as subsidizing costs to convert antiquated coal-fired thermal power plants into those powered by natural gas. Assist steps to make use of the Kyoto Mechanisms. Continue to promote measures for electrical load leveling by spreading and promoting thermal systems, etc.	—	Approximately 1,700	･Raise the nuclear power planned capacity factor from 85% to 87-88% ･Reduce unit CO2 emissions by approximately 1% through operation and adjustment of thermal power plants ･Reduce unit CO2 emissions by approximately 1% using the Kyoto Mechanisms

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Promote measures for new energy sources (expand use of heat from biomass, photovoltaic power generation, etc.) (Table 1－2e(2))	Amount of new energy introduced <Approximately 19.1 million kL (crude oil equivalent)>	Promote use of new energy sources, etc. through business activities of businesses Manufacturers: Develop technology to improve efficiency of new energy facilities, etc. Consumers: Actively introduce new energy sources, including photovoltaic power generation in houses and system for intensive solar power use	・Provide assistance in the introduction stage ・Provide assistance in technological development and demonstration stage ・Spread and raise awareness about measures ・Facilitate implementation of the Special Measures Law Concerning the Use of New Energy by Electric Utilities (RPS Law), etc. ・Promote taking initiative in introduction based on the Law on Promoting Green Purchasing ・Build biomass towns ・Build network of dispersed new energy ・Effectively use unused energy sources (fields related to new energy sources) ・Subsidize development of model regions in which renewable energy sources are introduced in a focused manner ・Subsidize introduction of facilities that use bioethanol fuel ・Subsidize development of facilities that use highly efficient energy from waste and facilities that use biomass, etc. ・Subsidize local governments to take initiative in introducing new energy technology	・Promote formulation, implementation and evaluation of comprehensive plans to introduce new energy sources ・Promote introduction in public facilities, etc. ・Assist introduction of new energy sources ・Promote taking initiative in introduction based on the Law on Promoting Green Purchasing	Approximately 4,690	・Photovoltaic power generation: 1.18 million kl, wind power generation: 1.34 million kl, waste power generation + biomass power generation: 5.86 million kl, solar power use: 900,000 kl, use of energy from waste: 1.86 million kl, use of biomass heat: 3.08 million kl (includes fuel derived from biomass in fuel for transport (500,000 kl)), unused energy: 50,000 kl, black liquor and waste wood, etc.: 4.83 million kl * Breakdown indicates tentative targets
Promote introduction of co-generation and fuel cells, etc. (Table 1－2e(3))	Cumulative amount of natural gas co-generation introduced (including power generated from fuel cells) <approximately 4.98 million kW> Cumulative amount of fuel cells introduced <approximately 2.2 million kW>	Manufacturers: Develop technology for natural gas co-generation and fuel cells Distributors: Sell natural gas co-generation and fuel cells, provide information to consumers Consumers: Actively introduce fuel cells and natural gas co-generation	・R&D concerning natural gas co-generation and fuel cells ・Subsidy system to introduce natural gas co-generation and fuel cells ・Subsidize introduction of fuel cells (local governments, regional councils) ・Promote taking initiative in introduction based on the Law on Promoting Green Purchasing	・Take initiative to introduce natural gas co-generation and fuel cells ・Support introduction ・Promote taking initiative in introduction based on the Law on Promoting Green Purchasing	(1) Natural gas co-generation: Approximately 1,140 (2) Fuel cells: Approximately 300	・Cumulative amount of natural gas co-generation introduced <approximately 4.98 million kW> ・Cumulative amount of fuel cells introduced <approximately 2.2 million kW> ・Annual operating hours ・Generating efficiency, thermal efficiency

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
3. Measures and policies, etc. by equipment a. Industrial sector						
Promote introduction of high-performance industrial furnaces (Table 1－3a(1))	Number of units introduced (small- and medium-sized enterprises) <approximately 2,000 units>	Businesses: Introduce energy conserving facilities	・Measures to support introduction of energy conserving facilities in businesses	・Support introduction ・Spread and raise awareness of measures	Approximately 200	・Amount of energy conserved by high-performance industrial furnaces (small- and medium-sized enterprises)
Spread high-performance boilers (Table 1－3a(2))	Number of units introduced (small- and medium-sized enterprises) <approximately 11,000 units>	Businesses: Actively introduce high-performance boilers	・Measures to support introduction of energy conserving facilities in businesses	・Support introduction ・Spread and raise awareness of measures	Approximately 130	・Amount of energy conserved by high-performance boilers
Promote introduction of next-generation coke ovens (Table 1－3a(3))	Number of units introduced <1 unit>	Businesses: Install next-generation coke ovens	・Measures to support introduction of energy conserving facilities in businesses	—	Approximately 40	・Amount of energy conserved by next-generation coke ovens <approximately 100,000 kl/unit>

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Spread fuel-efficient construction machinery in the construction field (Table 1－3ａ(4))	Penetration rate of fuel-efficient construction machinery <approximately 30%>	Manufacturers: Provide information to construction businesses and distributors that sell fuel-efficient construction machinery Construction businesses: Use fuel-efficient machinery	・Use fuel-efficient construction machinery for public works ・Measures to support the spread of fuel-efficient construction machinery	・Use fuel-efficient construction machinery for public works	Approximately 20	・Amount of total emissions from construction machinery <11.11 million t-CO2/year> ・Percentage of emissions from construction machinery covered by policies aimed at the amount of total emissions <60% (back hoe, tractor shovel, loader, bulldozer)> ・Percentage of reduction of CO2 emissions from construction machinery covered by policies <10%> ・Penetration effect (projected) <30%>

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
3. Measures and policies, etc. by equipment b. Transport sector						
Improve fuel efficiency of automobiles according to top-runner standards (Table 1－3b(1))	Status of achievement of top-runner standards of manufacturers and importers in the target fiscal year (depends on each business and on categories designated in the Energy Conservation Law)	Manufacturers, importers, etc.: Develop, produce, sell and import fuel-efficient automobiles Distributors: Actively sell fuel-efficient automobiles Consumers: Introduce fuel-efficient automobiles	・Establish top-runner standards ・Prefential tax treatment ・Acclerate development and spread of low-emission vehicles, triggered by the move to replace general official vehicles of the government with low-emission vehicles ・Provide information on fuel to consumers through an evaluation and disclosure system concerning automobile fuel efficiency and through vehicle body indications, etc. ・Promote taking initiative in introduction based on the Law on Promoting Green Purchasing ・Promote introduction of fuel-efficient vehicles through a low-interest loan system ・Newly introduce top-runner standards for heavyweight automobiles in the future ・In the future, formulate new top-runner standards for passenger cars running on gasoline after 2010 ・Promote efforts for automobile transport businesses to introduce fuel-efficient vehicles according to the amended Energy Conservation Law ・Promote development and practical use of low-emission vehicles bearing the next generation in mind	・Spread and promote measures ・Promote taking initiative in introduction based on the Law on Promoting Green Purchasing	Approximately 2,100	・Average theoretical fuel consumption of new automobiles in 2010 ・Average theoretical amount of fuel conserved if measures are taken for automobiles that have already established fuel efficiency standards ・Average theoretical amount of fuel conserved if no measures are taken ・Total volume of transportation (ton kilo) Note: The amount achieved ahead of time by fuel efficiency standards established by domestic manufacturers is expected to be seen in the effect of improved fuel consumption of gasoline passenger cars

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Spread and promote clean energy automobiles (Table 1－3b(2))	Cumulative number of electric vehicles, hybrid cars, natural gas cars, methanol cars, cars using LP gas instead of diesel fuel and fuel cell cars introduced <Total: 2.33 million units>	Manufacturers, importers: Import, produce and develop technology for clean energy automobiles Distributors: Actively sell clean energy automobiles Consumers: Introduce clean energy automobiles	・Support introduction of clean energy automobiles ・Preferential tax treatment ・Accelerate development and spread of low-emission vehicles, triggered by the move to replace general official vehicles of the government with low-emission vehicles ・Develop high-output secondary batteries for hybrid cars ・Promote technological development, demonstration experiments, etc., leading the world in the early practical application of fuel cell cars ・Promote development and practical use of low-emission vehicles bearing the next generation in mind ・Promote taking initiative in introduction based on the Law on Promoting Green Purchasing ・Promote introduction of fuel-efficient vehicles through a low-interest loan system ・Promote efforts for automobile transport businesses to introduce fuel-efficient vehicles according to the amended Energy Conservation Law	・Support introduction ・Promote taking initiative in introduction based on the Law on Promoting Green Purchasing ・Spread and raise awareness about measures	Approximately 300	・Cumulative number of hybrid cars, cars using LP gas instead of diesel fuel, natural gas cars and electric cars introduced <Total: 2.33 million units> ・Energy conservation rate by type of clean energy automobile

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Limit the maximum speed for large trucks on highways (Table 1－3b(3))	Number of large trucks that have installed a speed limiting device <approximately 800,000 units>	Businesses: Install speed limiting devices on large trucks	・Oblige large trucks to install speed limiting devices in accordance with the Road Vehicles Act	—	Approximately 80	・Reduce fuel consumption by limiting the maximum speed on highways <approximately 13%>
○Promote environmentally friendly use of automobiles (Support introduction of anti-idling automobiles) (same as last time)						
Introduce sulfur-free fuel and cars that can run on sulfur-free fuel (Table 1－3b(4))	Rate of improvement of fuel consumption due to direct-injection lean-burn engines <Gasoline cars: approximately 10%> Rate of improvement of fuel consumption due to the decline in purge frequency to eliminate catalyst poisoning <Diesel cars: approximately 4%>	Oil refiners, oil wholesalers: Provide sulfur-free fuel Automobile manufacturers, etc.: Develop cars that can run on sulfur-free fuel Automobile dealers: Actively sell cars that can run on sulfur-free fuel Consumers: Introduce cars that can run on sulfur-free fuel, purchase sulfur-free fuel	・Provide support to ensure energy conservation in oil refinery facilities, etc. that produce sulfur-free fuel ・Support provision of sulfur-free fuel	・Take initiative to introduce cars that can run on sulfur-free fuel	Approximately 120	・Ratio shipments of cars with direct-injection lean-burn engines that can run on sulfur-free fuel to diesel cars <gasoline cars: 8%, diesel cars: 100%> ・Amount of energy consumed by gasoline cars and diesel cars
Improve energy consumption efficiency in railway (Table 1－3b(5))	Unit energy consumption <approximately 7% improvement>	Railway businesses: ・Voluntary action plans ・Create and implement medium- to long-term plans according to the Energy Conservation Law	・Support introduction of new vehicles ・Apply the Energy Conservation Law to railway businesses	—	Approximately 40	・Introduce energy-saving vehicles <approximately 75%>
Improve energy consumption efficiency in aviation (Table 1－3b(6))	Unit energy consumption <approximately 15% improvement>	Airline businesses: ・Voluntary action plans ・Create and implement medium- to long-term plans according to the Energy Conservation Law	・Support introduction of new aircraft ・Improve Air Traffic System and upgrade facilities for precision approach ・Promote eco-airports ・Apply the Energy Conservation Law to airline businesses	—	Approximately 190	・Domestic air traffic volume in FY2010 <101.9 billion person kilo>

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
3. Measures and policies, etc. by equipment c. Other sectors including offices and other business facilities, and household sector						
Improve efficiency of equipment that meets top-runner standards (Table 1－3c(1))	Status of achievement of top-runner standards of manufacturers and importers in target fiscal years (depends on categories set for each business and in the Energy Conservation Law)	Manufacturers, importers: Import, produce and develop energy-efficient equipment Distributors: Actively sell energy-efficient equipment	・Establish top-runner standards ・Add equipment, review standards ・Promote spreading and raising awareness about "Course on Spreading Energy Conserving Household Appliances," etc. ・Provide information on "Stores Cooperating in the Spread of Energy Conserving Household Appliances" ・Create a scheme to provide information to retailers on the amended Energy Conservation Law ・Promote taking initiative in introduction based on Law on Promoting Green Purchasing	・Actively provide information on energy conservation through energy conservation labels, etc. ・Spread and raise awareness about measures ・Promote taking initiative in introduction based on Law on Promoting Green Purchasing	Approximately 2,900	・Energy consumption efficiency of equipment, etc. ・Number of households (household sector), floor area (business sector) ・Equipment ownership rate ・Average number of years equipment has been used

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Promote replacement with energy conserving equipment (Table 1－3c(2))	Number of electric pots, dishwashers, electric bulb-type fluorescent lamps and other energy-conserving equipment introduced <approximately 78 million units>	Household appliance manufacturers, mass retailers, etc.: Provide information on energy conservation, explain effects of energy conservation (especially regarding electric pots, dishwashers and electric bulb-type fluorescent lamps) Consumers: Actively select energy-conserving equipment when replacing abovementioned equipment	･Promote spreading and raising awareness about "Course on Spreading Energy Conserving Household Appliances," etc. ･Provide information on "Stores Cooperating in the Spread of Energy Conserving Household Appliances"	･Spread and raise awareness about measures	Approximately 560	･Cumulative number of units introduced: Electric pots <approximately 10 million units>, dishwashers <approximately 17 million units>, electric bulb-type fluorescent lamps <approximately 51 million units>, water-saving showerheads <approximately 15 million units>, energy conserving control apparatus for air conditioner compressors <approximately 14,000 units> ･Energy conservation effect by replacing equipment: Electric pots <approximately 54%>, dishwashers <approximately 56%>, electric bulb-type fluorescent lamps <approximately 80%>, water-saving showerheads <approximately 20%>, energy-conserving control apparatus for air conditioner compressors <approximately 13%>

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Have energy supply businesses, etc. provide energy information to consumers (Table 1－3c(3))	Record of energy supply businesses having provided information, etc.	Energy supply businesses, etc.: Provide information that will contribute to rationalizing energy use for general consumers	・Systematize provision of information by energy supply businesses, etc. to general consumers in accordance with the amended Energy Conservation Law ・Actively provide energy information to consumer through the energy conservation labeling system and evaluation system for distributors of energy conservation products, etc. ・Support energy conservation businesses by energy supply businesses, etc.	・Spread and raise awareness about measures	Approximately 420	・Energy conservation effects, etc. by energy conservation navigation, etc. <approximately 5-20%>
Model efforts undertaken in collaboration with household appliance manufacturers, distributors and consumers, etc. to spread energy-conserving household appliances (Table 1－3c(4))	<Numbers included in "Improve efficiency of equipment that meets top-runner standards" and "Promote replacement with energy conserving equipment">	Household appliance manufacturers: Provide information on energy conservation Mass retailers, small- and medium-sized retailers: Explain effects of energy conservation in in-house training and sales floor Consumers: Actively select energy-conserving household appliances when replacing them	・Support the spread and promotion of energy-conserving products	・Provide energy conservation information by way of prefectural centers	・<Numbers included in "Improve efficiency of equipment that meets top-runner standards" and "Promote replacement with energy conserving equipment">	

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Spread efficient water heaters (Table 1－3c(5))	Number of units of CO2 refrigerant heat pump water heaters that have spread <approximately 5.2 million units> Number of latent heat recovery-type water heaters that have spread <approximately 2.8 million units>	Manufacturers, etc.: Develop technology for, produce and sell efficient water heaters Businesses, consumers: Actively introduce efficient water heaters	・Measures to support the introduction of efficient water heaters ・Subsidize the introduction of housing for which the amount of CO2 emissions is significantly lower than that of regular housing ・Promote taking initiative in introduction based on the Law on Promoting Green Purchasing	・Spread and raise awareness about measures ・Promote taking initiative in introduction based on the Law Concerning the Promotion of Eco-Friendly Goods and Services by the State and Other Entities (Law on Promoting Green Purchasing)	Approximately 340	・Cumulative number of units of CO2 refrigerant heat pump water heaters that have spread <approximately 5.2 million units> ・Cumulative number of latent heat recovery-type water heaters that have spread <approximately 2.8 million units> ・Performance of latent heat pump water heaters, heat recovery water heaters and conventional water heaters (coefficient of performance (COP)) Note: In addition to CO2 refrigerant heat pump water heaters and latent heat recovery-type water heaters, efficient water heaters include gas engine water heaters, but the prospect of the introduction of gas engine water heaters is calculated as part of cogeneration.
Spread efficient air conditioners for commercial use (Table 1－3c(6))	Number of units of efficient air conditioners introduced <approximately 12,000 units>	Manufacturers, etc.: Develop, produce and sell efficient air conditioners Owners of commercial facilities: Actively introduce efficient air conditioners for commercial use	・Measures to support the introduction of efficient air conditioners by businesses ・Subsidize efforts to make commercial buildings, etc. conserve energy (regional councils) ・Promote taking initiative in introduction based on the Law on Promoting Green Purchasing	・Promote taking initiative in introduction based on the Law on Promoting Green Purchasing ・Spread and raise awareness about measures	Approximately 60	・Energy conservation efficiency of conventional combustion-type air conditioners ・Energy conservation efficiency of electric air conditioners ・Annual operating hours of air conditioners, etc.

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Spread energy-conserving refrigerators and freezers for commercial use (Table 1－3c(7))	Number of units of energy-conserving refrigerators and freezers for commercial use that have spread <approximately 16,300 units>	Manufacturers, etc.: Develop technology, produce and sell energy-conserving refrigerators and freezers Businesses using commercial-use refrigerators and freezers: Actively introduce energy-conserving refrigerators and freezers	・Spread energy-conserving refrigerators and freezers ・Subsidize efforts to make small- to medium-sized commercial facilities conserve energy	・Spread and raise awareness of measures	Approximately 60	・Number of units of energy-conserving refrigerators and freezers for commercial use that have spread <approximately 16,000 units>, number of units of refrigerated storage, etc. introduced <approximately 275 units> ・Amount of power consumption reduced per unit of energy-conserving refrigerator and freezer for commercial use <approximately 62,000 kWh> ・Amount of power consumption reduced per unit of refrigerated storage, etc. <approximately 188,000 kWh (if freezing capacity is 500W)>
Spread of efficient lighting (LED lights) (Table 1－3c(8))	Penetration rate of efficient lighting <approximately 10%>	Manufacturers, distributors, etc: Develop technology, produce and sell Businesses, consumers: Actively introduce efficient lighting	・Support development of technology aimed at making efficient lighting more efficient and less costly ・Support introduction by Global Warming Measures Regional Council, support initiatives taken by local governments	・Spread and raise awareness of measures ・Take initiative in introduction	Approximately 340	・Amount of energy conserved by using LED lights <4/5 of energy consumed by fluorescent lights, 1/5 of incandescent light bulbs>
Reduce standby power consumption (Table 1－3c(9))	Status of achievement of standby power consumption by equipment (less than 1W)	Manufacturers: Reduce standby power consumption of equipment Distributors: Actively sell equipment with low standby power consumption	・Spread and raise awareness of measures	・Spread and raise awareness of measures	Approximately 150	・Penetration rate per household

Appendix 2 List of Measures and Policies Concerning Non-energy-originated Carbon Dioxide

*When estimating the projected amount of emissions reductions resulting from the effect of each measure, the projections are based on assumed factors other than the evaluation indicators of the measure and the projection at the time the plan is formulated

Concrete measures	Evaluation indicators of the measure ＜FY2010 projections＞	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement		Effect of measure	
						Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Expand use of blended cement (Table 2－(1))	Production volume of blended cement as a share of cement production volume <24.8%>	Manufacturers: Supply blended cement, provide information to consumers	・Promote initiatives for introduction based on the Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Law on Promoting Green Purchasing)	・Promote initiatives for introduction based on the Law on Promoting Green Purchasing		Approximately 111	Projected cement production for FY2010 <68.004 million t> ・Regular cement <51.119 million t> ・Blended cement <16.885 million t> ・Amount of CO2 emissions per ton of limestone <415kg-CO2/t-limestone> ＊Projected figures based on past cement production volume

Concrete measures	Evaluation indicators of the measure ＜FY2010 projections＞	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement		Effect of measure	
						Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Promote measures to reduce CO2 emissions deriving from waste incineration (Table 2－(2))	Amount of general waste (plastic) incinerated <approximately 4.5 million t> Amount of industrial waste (waste plastics) incinerated <approximately 2 million t> Amount of industrial waste (waste oil) incinerated <approximately 2.3 million t>	Businesses: Improve durability of and enhance repair system for products, etc. that are manufactured and sold, promote voluntary collection, handover and recycling of products, etc. that have become waste Consumers: Give consideration when buying or using products, etc. (use of recycled products, long-term use, etc. of products, etc.), give consideration to disposing of products, etc. (handover products, etc. that have become waste to businesses, cooperate in municipal efforts to separate and collect such products, etc.), etc.	・Efforts aimed at attaining the targets (March 2003 onward) established in the Basic Plan for Establishing the Recycling-based Society in accordance with the Basic Law for Establishing the Recycling-based Society ・Efforts aimed at attaining the targets (May 2001 onward) to reduce the amount of waste in accordance with the Waste Disposal Law ・Support municipal projects such as the development of waste recycling facilities, etc. ・Implement, evaluate and consider measures in accordance with individual recycling laws (Containers and Packaging Recycling Law, etc.) ・Formulate guidelines on separated garbage collection and establishing paid services in municipalities ・Promote initiatives for introduction based on the Law on Promoting Green Purchasing, etc.	・Promote, spread and raise awareness about residents' voluntary activities to limit waste generation and promote reuse and recycling, promote environmental education ・Promote initiatives for introduction based on the Law on Promoting Green Purchasing, etc.		Approximately 550	Amount of CO2 emissions per ton of waste incinerated (kg-CO2/t) ・General waste (plastic): 2,670 ・Industrial waste (waste plastics): 2,600 ・Industrial waste (waste oil): 2,900

Appendix 3 List of Measures and Policies Concerning Methane and Nitrous Oxide

*When estimating the projected amount of emissions reductions resulting from the effect of each measure, the projections are based on assumed factors other than the evaluation indicators of the measure and the projection at the time the plan is formulated

Concrete measures	Evaluation indicators of the measure ＜FY2010 projections＞	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
1. Methane						
Reduce amount of final disposal of waste, etc. (Table 3－1(1))	Amount of final disposal of general waste (food waste, paper waste, textile waste, wood waste) <approximately 310,000 t/year> Amount of final disposal of industrial waste (livestock carcasses, animal and plant residual, paper waste, textile waste, wood waste) <approximately 120,000 t/year> Percentage by type of incinerator <continuous furnace: 84%, semi-continuous furnace: 11%, batch furnace: 5%> Amount of general waste incinerated <approximately 33.3 million t>	Businesses: Improve durability of and enhance repair system for products, etc. that are manufactured and sold, promote voluntary collection, handover and recycling of products, etc. that have become waste Consumers: Give consideration when buying or using products, etc. (use of recycled products, long-term use, etc. of products, etc.), give consideration when disposing of products, etc. (handover products, etc. that have become waste to businesses, cooperate in municipal efforts to separate and collect such products, etc.), etc.	・Efforts aimed at attaining the targets (March 2003 onward) established in the Basic Plan for Establishing the Recycling-based Society in accordance with the Basic Law for Establishing the Recycling-based Society ・Efforts aimed at attaining the targets (May 2001 onward) to reduce the amount of waste in accordance with the Waste Disposal Law ・Support municipal projects such as the development of waste recycling facilities, etc. ・Implement, evaluate and consider measures in accordance with individual recycling laws (Containers and Packaging Recycling Law, etc.) ・Formulate guidelines on separating and collecting and establishing paid services in municipalities ・Promote initiatives for introduction based on the Law on Promoting Green Purchasing, etc.	・Promote, spread and raise awareness about residents' voluntary activities to limit waste generation and promote reuse and recycling, promote environmental education ・Promote initiatives for introduction based on the Law on Promoting Green Purchasing, etc.	Approximately 50	Amount of CH4 emitted per ton of landfill waste (kg-CH4/t) ・Food waste: 143 ・Paper, textiles: 140 ・Wood waste: 136 Amount of CH4 emitted per ton of waste incinerated (g-CH4/t) ・Continuous furnace: 7.3 ・Semi-continuous furnace: 68 ・Batch furnace: 73

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
2. Nitrous Oxide						
Install equipment to decompose nitrous oxide in the adipic acid manufacturing process (Table 3－2(1))	Number of business offices that have introduced equipment (1) (the only office in Japan that produces adipic acid) Operating rate of equipment that decomposes nitrous oxide <94%>	Manufacturers: Introduce equipment to decompose nitrous oxide (completed)	－	－	Approximately 874	・Amount of adipic acid produced <120,000 t> ・Rate of N2O generated <250kg-N2O/t> ・Rate of N2O decomposition <99.9%>
Upgrade combustion in sewage sludge incineration facilities (Table 3－2(2))	Dissemination rate of upgraded combustion in fluidized bed furnace for the incineration of polymer-added sludge <100%>	Local governments: Implement the upgrading of combustion of sewage sludge	・Standardize the upgrading of combustion of sewage sludge	・Implement the upgrading of combustion of sewage sludge	Approximately 130	Amount of N2O emitted per ton of incinerated sewage sludge in fluidized bed furnace for the incineration of polymer-added sludge (g-N2O/t) ・Regular combustion: 1,508 ・High-temperature combustion: 645

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Upgrade combustion in general waste disposal facilities, etc. (Table 3－2(3))	Percentage by type of incinerator <continuous furnace: 84%, semi-continuous furnace: 11%, batch furnace: 5%> Amount of general waste incinerated <approximately 33.3 million t>	Businesses: Improve durability of and enhance repair system for products, etc. that are manufactured and sold, promote voluntary collection, handover and recycling of products, etc. that have become waste Consumers: Give consideration when buying or using products, etc. (use of recycled products, long-term use, etc. of products, etc.), give consideration when disposing of products, etc. (handover products, etc. that have become waste to businesses, cooperate in municipal efforts to separate and collect such products, etc.), etc.	・Support municipal projects such as the development of waste recycling facilities, etc. ・Promote the installation of incineration facilities with continuous furnaces in response to the widening scope of waste disposal ・Strengthen and enforce structural standards and operation and management standards for waste disposal facilities (March 2001 onward) ・Efforts aimed at attaining the targets (March 2003 onward) established in the Basic Plan for Establishing the Recycling-based Society in accordance with the Basic Law for Establishing the Recycling-based Society ・Efforts aimed at attaining the targets (May 2001 onward) to reduce the amount of waste in accordance with the Waste Disposal Law ・Implement, evaluate and consider measures in accordance with individual recycling laws (Containers and Packaging Recycling Law, etc.) ・Formulate guidelines on separated garbage collection and establishing paid services in municipalities ・Promote initiatives for introduction based on the Law on Promoting Green Purchasing, etc.	・Promote, spread and raise awareness about residents' voluntary activities to limit waste generation and promote reuse and recycling, promote environmental education ・Promote initiatives for introduction based on the Law on Promoting Green Purchasing, etc.	Approximately 20	Amount of N2O emitted per ton of waste incinerated (g-N2O/t) ・Continuous furnace: 52 ・Semi-continuous furnace: 53 ・Batch furnace: 64

Appendix 4 List of Measures and Policies Concerning Three Fluorinated Gases

*When estimating the projected amount of emissions reductions resulting from the effect of each measure, the projections are based on assumed factors other than the evaluation indicators of the measure and the projection at the time the plan is formulated

Concrete measures	Evaluation indicators of the measure ＜FY2010 projections＞	Measure by each entity	Government policy	Examples of policy that local governments are expected	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Promote planned efforts made by industry (Table 4—(1))	Achieve targets and forecasts set by each industry group in voluntary action plans	Groups that have formulated voluntary action plans (22 industries in 8 sectors): Comply with voluntary action plans	・ Follow up at the Global Warming Prevention Measures Subcommittee, Chemicals and Bio-industry Committee, Industrial Structure Council ・Subsidize model projects that will contribute to limiting emissions of the three fluorinated gases, etc.	・Support efforts made by businesses	Approximately 4,360 of which ◯Amount of emissions reduced resulting from the recovery of HFC23, of the amount of emissions reduced due to the planned efforts made by industry (included added amount): Approximately 1,510 ◯Amount of emissions reduced as a result of measures to substitute aerosol, etc., SF6 measures concerning magnesium and measures to eliminate chlorofluorocarbon in foam and insulating material: Approximately 1,390	・Project a reduction of approximately 1 million t-CO2 as a result of targets and forecasts set by each industry group in voluntary action plans as well as from the added amount resulting from subsidies (add amount recovered from HFC23, etc.)
Promote development, etc. of substitute material and use of substitute products (Table 4—(2))	[Eliminate fluorocarbons in such products as aerosol] Shipment volume of HFC of aerosol products <HFC-134a: 1,300t, HFC-152a: 1,500t> Emissions of HFC that are used for MDI <405 net tons> [Eliminate fluorocarbons in foam and insulating material] Amount of HFC used in foam <Urethane foam: 7,800t, extruded polystyrene foam: 1,500t, highly expanded polyethylene foam: 680t, phenolic foam: 290t> [Develop and spread SF6-free magnesium alloy technology] Rate of introduction of SF6-free technology in rolling <70%> Rate of introduction of substitute gases in casting <40%>	Manufacturers of three fluorinated gases: Develop substitute material, etc. Manufacturers of products that use three fluorinated gases: Develop and sell substitute products, provide information to consumers Businesses and consumers that use products, etc. that use three substitute fluorinated gases: Select substitute products Manufacturers of magnesium alloys: Develop and spread SF6-free magnesium alloy technology Businesses that use magnesium (manufacturers of automobile parts, electronic devices, electric equipment, etc.): Use magnesium alloy manufactured using SF6-free technology	[Common policies regarding foam, insulating material and aerosol, etc.] ・Support technological development, etc. of substitute material, etc. ・Promote initiatives for introduction based on the Law on Promoting Green Purchasing ・Spread and raise awareness about substitute products [Develop and spread SF6-free magnesium alloy technology] ・Support development of magnesium alloy technology that does not use SF6 as protective gas [Eliminate fluorocarbons in refrigeration and air conditioning equipment for commercial use] ・Develop and spread fluorocarbon-free, energy -conserving refrigeration and air conditioning equipment	・Promote procurement of substitute products ・Spread and raise awareness about substitute products ・Promote initiatives for introduction based on the Law on Promoting Green Purchasing		[Eliminate fluorocarbons in such products as aerosol] Prospected 2010 BAU emissions of aerosol products: 3.3 million t-CO2 Prospected 2010 BAU emissions using MDI: 540 net tons [Eliminate fluorocarbons in foam and insulating material] Prospected amount of HFC used in foam in 2010 BAU emissions: (Urethane foam: 14,500t, extruded polystyrene foam: 3,550t, highly expanded polyethylene foam: 1,450t, phenolic foam: 900t) [Develop and spread SF6-free magnesium alloy technology] Magnesium melting capacity is expected to increase at an annual rate of 32.0% (annual rate of increase has been calculated based on the increase in magnesium melting capacity between 1996 to 2003)

Concrete measures	Evaluation indicators of the measure ＜FY2010 projections＞	Measure by each entity	Government policy	Examples of policy that local governments are expected	Effect of measure	
					Projected emissions reduction (10,000t-CO2)	Premise of forecast at the time of cumulating the amount of emissions reductions*
Recover HFC packed as refrigerant in equipment in accordance with laws, etc. (Table 4－(3))	Recovery rate of refrigerants in car air conditioners <80%> Recovery rate of refrigerants in refrigeration and air conditioning equipment for commercial use <60% on average for the five-year period beginning FY2008> Recovery rate of refrigerants used as filling <30% on average for the five-year period beginning in FY2008>	People: Cooperate to recover and destroy chlorofluorocarbons without fail	・Appropriately implement and apply laws ・Spread and raise awareness of measures ・Consider measures to improve the recovery rate, including a fundamental review from the systemic aspect concerning the recovery of chlorofluorocarbons in refrigeration and air conditioning equipment for commercial use	・Appropriately implement and apply laws ・Spread and raise awareness of measures	Approximately 1,240	[Car air conditioners] Initial amount of refrigerant packed: 582 g/unit, number of units produced: hypothesize increase based on the economic growth rate every year [Refrigeration and air conditioning equipment for commercial use] Initial amount of refrigerant packed: 3kg-420kg/unit, number of units produced: hypothesize increase based on the economic growth rate every year

Appendix 5 List of Measures and Policies for Greenhouse Gas Sinks

*When estimating the projected amount of emissions reductions resulting from the effect of each measure, the projections are based on assumed factors other than the evaluation indicators of the measure and the projection at the time the plan is formulated

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected amount absorbed by sinks (10,000t-CO2)	Premise of forecast at the time of cumulating the amount absorbed by sinks *
1. Measures for forest sinks						
Promote measures for greenhouse gas sinks by promoting forest and forestry measures (10-year policy on forest sinks to prevent global warming) (Table 5—1(1))	Area of forest maintained (average annual project volume until 2012) Renewal <60,000 ha> Weeding <350,000 ha> Thinning <450,000 ha> Cutting to induce the creation of multilayered forests <30,000 ha> Develop countryside forests, etc. <40,000 ha> Develop roads for conducting forest services, etc. <2,790 km> Wood supply and amount used <25 million m3>	・Develop policy based on the Basic Law on Forest and Forestry and Basic Plan on Forest and Forestry ・During the 10-year period from 2003 to 2012 when the first commitment period ends, strongly and systematically promote forest maintenance, etc. in accordance with the Basic Plan. Also develop a system for examining the report on the amount absorbed by sinks. (Develop 10-year policy on forest sinks to prevent global warming)			Approximately 4,767 (If the plan is achieved according to targets on the supply and use of forest products and targets concerning the full use of multiple functions of forests as indicated in the Basic Plan on Forest and Forestry. However, if forest maintenance, etc. stays around the current level, then it is forecasted that the results will fall well below targets.)	・If the plan is achieved according to targets on the supply and use of forest products and targets concerning the full use of multiple functions of forests as indicated in the Basic Plan on Forest and Forestry, it has been projected that it will be possible to secure approximately 47.67 million t-CO2 in terms of the amount absorbed. ・Targets concerning the full use of the multiple functions of forests (2010) <Forest area> Single-layered managed forests 10.2 million ha Multilayered managed forests 1.4 million ha Naturally regenerated forests 13.5 million ha Total 25.1 million ha (Total accumulated area) 4.41 billion m3 ・ Targets on the supply and use of forest products <Wood supply and amount used> 25 million m3

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure	
					Projected amount absorbed by sinks (10,000t-CO2)	Premise of forecast at the time of cumulating the amount absorbed by sinks *
Develop sound forests	Area of forest maintained (average annual project volume until 2012) Renewal <60,000 ha> Weeding <350,000 ha> Thinning <450,000 ha> Cutting to induce the creation of multilayered forests <30,000 ha> Develop countryside forests, etc. <40,000 ha> Develop roads for conducting forest services, etc. <2,790 km> Wood supply and amount used <25 million m3> (same as above)	National and local governments, etc.: Promote forest maintenance necessary for achieving the targets of the Basic Plan on Forest and Forestry Local governments, parties involved in forestry, NPOs, etc.: Steadily and efficiently carry out maintenance of inadequately managed forests	・Promote appropriate forest maintenance including necessary thinning, multilayered managed forests and lengthening the period until a tree is cut ・Eliminate areas where afforestation is incomplete by investigating the renewal status of such areas, etc. ・Promote appropriate maintenance of broadleaf forests and promote broadleaf and coniferous mixed forests ・Eliminate treeless areas in remote water source forests, etc. and restore devastated countryside forests, etc. ・Reduce costs by combining effective networks, etc. and develop networks that consider conservation of the natural environment ・Promote commissioning, etc. of operation and management to motivated personnel and promote development by public bodies ・Promote efforts to nurture and secure core forest and forestry personnel responsible for forest maintenance	・In accordance with the basic principles of the Basic Plan on Forest and Forestry, promote forest and forestry policy that meets an area's various natural, economic and social conditions, bearing in mind an appropriate division of labor with the government	Approximately 4,767 (If the plan is achieved according to targets on the supply and use of forest products and targets concerning the full use of multiple functions of forests as indicated in the Basic Plan on Forest and Forestry. However, if forest maintenance, etc. stays around the current level, then it is forecasted that the results will fall well below targets.) (same as above)	・If the plan is achieved according to targets on the supply and use of forest products and targets concerning the full use of multiple functions of forests as indicated in the Basic Plan on Forest and Forestry, it has been projected that it will be possible to secure approximately 47.67 million t-CO2 in terms of the amount absorbed. ・Targets concerning the full use of the multiple functions of forests (2010) <Forest area> Single-layered managed forests 10.2 million ha Multilayered managed forests 1.4 million ha Naturally regenerated forests 13.5 million ha Total 25.1 million ha (Total accumulated area) 4.41 billion m3 ・Targets on the supply and use of forest products <Wood supply and amount used> 25 million m3 (same as above)
Appropriately manage and protect forest reserves, etc.		National and local governments, etc.: Appropriately implement measures to develop conservation facilities and protect forest reserves, etc.	・Promote natural vegetation protection and recovery measures in coordination with appropriate conservation management and NPO, etc. by the fair administration of regulations set by the forest reserve system, systematic designation of forest reserves, forest protection system, etc. ・Promote development of mountainside facilities that fit the specific characteristics of the basin ・Prevent damage from forest disease pests, etc. and promote measures to prevent forest fires ・Expand natural parks and nature environment conservation areas and strengthen conservation management in these areas			
Promote forest-building, etc. with the participation of the people		National and local governments, businesses, NPOs, etc.: Promote spreading and raising awareness about measures, forest volunteer activities, forest environmental education, diverse forest use, etc.	・Promote spreading and raising awareness by launching the National Land Afforestation Campaign, etc. ・Promote afforestation activities by a more wide-ranging group of bodies, such as having companies, etc. promote participation in afforestation ・Improve technology possessed by forest volunteers, etc. and develop safety systems ・Promote forest environmental education ・Promote green worker programs that protect animals and plants, including those in forests found in national parks, etc.			

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement	Effect of measure		
						Projected amount absorbed by sinks (10,000t-CO2)	Premise of forecast at the time of cumulating the amount absorbed by sinks *
Use wood and woody biomass		National and local governments, businesses, NPOs, etc.: Promote expanded use of wood and diversified use of wood resources in the housing and public sectors, etc. by spreading and raising awareness about the use of wood and structural reform of the lumber industry, etc.	・Promote use of regional materials for housing and public facilities, etc. by developing model facilities using regional materials ・Promote measures for consumers aimed at expanding the actual demand for regional materials by enhancing environmental education on the use of wood, etc. ・Through computerization, etc., develop a production, distribution and processing system, coordinated from upstream to downstream, which can meet consumer needs ・Promote use of low-quality material and woody biomass as energy and products ・Develop new technology for using forest products and new wood materials, etc. and put them to practical use ・Promote use of and spreading and raising awareness about new uses of charcoal, etc. used in water quality purification and humidity, etc.				

Concrete measures	Evaluation indicators of the measure <FY2010 projections>	Measure by each entity	Government policy	Examples of policy that local governments are expected to implement		Effect of measure	
						Projected amount absorbed by sinks (10,000t-CO2)	Premise of forecast at the time of cumulating the amount absorbed by sinks *
2. Promote urban greening, etc.							
Promote urban greening, etc. (Table 5—2(1))	Number of trees planted in public and common facilities, etc. <Assume that the increase in the number of trees planted is 75 million>	National and local governments: Promote greening in public and common facilities, etc., spread and raise awareness about greenery creation, promote greening through a wide range of bodies Citizens, companies and NPOs, etc.: Proactively participate in greenery activities, etc. in various facilities and land, etc.	・In accordance with the Green Policy Outline, promote the creation of urban parks, greening on roads, rivers, *sabo* (erosion and sediment control) facilities, harbors, etc., preserve existing privately-owned green spaces and promote the creation of new green spaces, etc. ・Closely examine and consider methods of calculating the amount absorbed by sinks, etc. through urban greening, etc. and develop a reporting and verification system of those methods ・Promote spreading and raising awareness about greenery generation and greening through a wide range of bodies such as citizens, companies and NPOs	・In accordance with green basic plans, promote the creation of urban parks, greening on roads, rivers, erosion control facilities, harbors, etc., preserve existing privately-owned green spaces and promote the creation of new green spaces, etc. ・Provide information that will contribute to calculating the amount absorbed by sinks through urban greening, etc. and reporting and verification, etc. ・Promote spreading and raising awareness about greenery generation and greening through a wide range of bodies such as citizens, companies and NPOs		Approximately 28	・Assume that the increase in the number of trees planted in public and common facilities, etc. is 75 million after FY1990 and until FY2010