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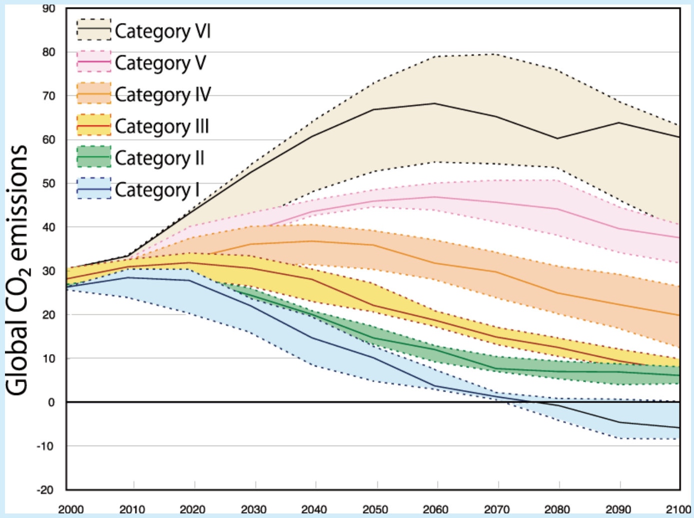
Greenhouse Gases Emissions Scenarios Database
- Contribution to the IPCC Assessment Reports -

Tatsuya Hanaoka, Mikiko Kainuma,
Kazutaka Oka, Hisaya Ishii



Category	Radiative forcing	CO_2 concentrations	CO_2-equivalent of GHG concentrations	Global temperature increase after the industrial revolution	Peaking year for CO_2 emissions	Change in global CO_2 emissions in 2050 (percent of 2000 emissions)	Number of assessed scenarios
	W/m²	ppm	ppm	℃	Year	%	
I	2.5 ~ 3.0	350 ~ 400	445 ~ 490	2.0 ~ 2.4	2000 ~ 2015	-85 ~ -50	6
II	3.0 ~ 3.5	400 ~ 440	490 ~ 535	2.4 ~ 2.8	2000 ~ 2020	-60 ~ -30	18
III	3.5 ~ 4.0	440 ~ 485	535 ~ 590	2.8 ~ 3.2	2010 ~ 2030	-30 ~ +5	21
IV	4.0 ~ 5.0	485 ~ 570	590 ~ 710	3.2 ~ 4.0	2020 ~ 2060	+10 ~ +60	118
V	5.0 ~ 6.0	570 ~ 660	710 ~ 855	4.0 ~ 4.9	2050 ~ 2080	+25 ~ +85	9
VI	6.0 ~ 7.5	660 ~ 790	855 ~ 1130	4.9 ~ 6.1	2060 ~ 2090	+90 ~ +140	5
						Total	177

Source: IPCC 4th Assessment Report, Working Group III

Center for Global Environmental Research

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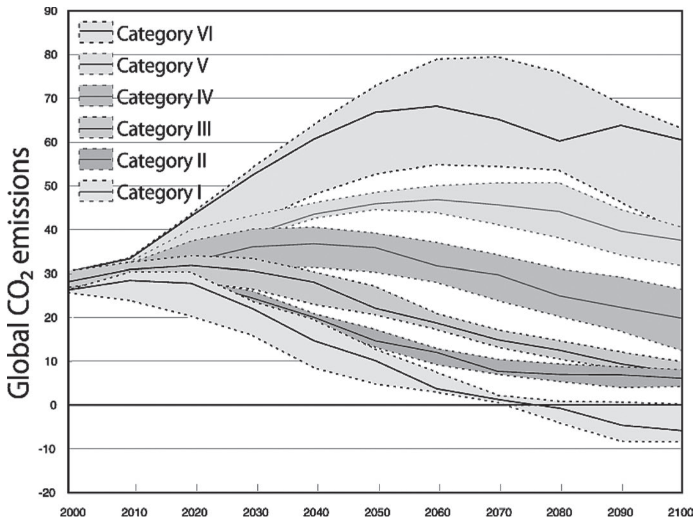

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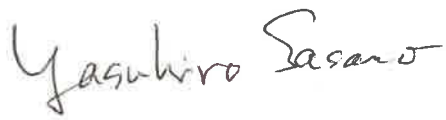
Foreword

The Center for Global Environmental Research (CGER) of the National Institute for Environmental Studies (NIES), Japan was established in October 1990. The main objectives of CGER are to make a broad contribution to the scientific understanding of global environmental changes, and to elucidate and provide solutions for pressing environmental problems. CGER conducts global environmental research with interdisciplinary and international cooperation, provides research support facilities such as a supercomputer and databases, and offers to the public its own data derived from long-term monitoring of the global environment.

The Greenhouse Gas Emissions Scenarios Database was first developed by Professors Matsuoka and Morita in 1992 and published on the internet in 1997 through the CGER website. This database, which is also called “the Morita Database”, is one of the distinguished contributions to the Intergovernmental Panel on Climate Change (IPCC) of Dr. T. Morita, who passed away in 2003. Since 1997, the database has been continuously updated by the Asia-Pacific Integrated Modeling team, with relevant information such as the driving forces for emissions scenarios and projections of GHG emissions. This report is the latest version of the Greenhouse Gas Emissions Scenarios Database as one of global environmental database projects supported by the CGER.

We will continue to support the global environmental research and activities of the GHG Emissions Scenarios Database, which give us an important insight into future climate changes.

July 2011



Yasuhiro Sasano
Director
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Preface

This is the third report on the Greenhouse Gas Emissions Scenarios Database in a series of surveys conducted every year to review global greenhouse gas emissions scenarios and the reference information required for assessment of impacts of climate change drivers such as economic growth, technological change, and demographic development. By the Center for Global Environmental Research (CGER) of the National Institute for Environmental Studies (NIES) in Japan, the first report was published in 1994 and the basic information was used to assess the IPCC 1992 emission scenarios. The second report, which focused on emissions scenarios that have emerged since the IPCC Third Assessment Report, was published in 2006 and most of information was used for preparing the IPCC Forth Assessment Report. This is the third report to elaborate all information stored in the database, which can duplicate figures on GHG emissions and mitigations scenarios in the IPCC Third Assessment Report and the IPCC Forth Assessment Report.

We greatly appreciate the efforts and cooperation of the model developers and their colleagues who kindly sent their data to this database. We hope that the publication of this report will also make a useful contribution not only to the IPCC but also to the work of climate change experts and policymakers.

July 2011

花岡達也

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Acknowledgements

We would like to thank all corresponding authors of various journal papers who kindly sent their original data to this database.

Greenhouse Gas Emissions Scenarios Database
- Contribution to the IPCC Assessment Reports -

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Appendix A

Appendix B

Greenhouse Gases Emissions Scenarios Database

- Contribution to the IPCC Assessment Reports -

Tatsuya Hanaoka[1], Mikiko Kainuma[1],
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Abstract

A number of greenhouse gas (GHG) emissions scenarios have been published for the purpose of analyzing the effects of global warming and mitigation policies, and stringent GHG emission pathways consistent with a global temperature limit at a certain level (e.g. at 2 degrees Celsius) above pre-industrial levels or a 50 % reduction target by the year 2050 compared to the 1990 level have attracted the attention of stakeholders to reduce and adapt the impacts of climate change. However, the trajectories of future GHG emissions vary according to the methodologies of the studies and features of driving forces such as population change, economic growth, and energy demand and supply. In addition, various mitigation scenarios are conceivable, depending on the employed mitigation strategies, policy requirements, and GHG stabilization targets. It is therefore important to organize the relevant and available information on emissions scenarios and driving forces both on a national and a global scale, analyze the differences among various scenarios, examine the range of results regarding GHG emissions, energy consumption and socio-economic assumptions. For the purpose of providing common information to researchers and policy makers, this Emissions Scenarios Database was developed by reviewing various papers and reports. This database especially contributed to the process of publishing the assessment reports by the Intergovernmental Panel on Climate Change (IPCC) and stores scenarios reviewed in the IPCC reports such as the Special Report on Emissions Scenarios (SRES), the Third Assessment Report (TAR), the Fourth Assessment Report (AR4) and the Representative Concentration Pathways (RCP).

In the database, the latest relevant information has been stored to assess perspectives on future GHG emissions and their driving forces. This report shows the results of main driving forces such as population growth, economic growth, energy consumption, and GHG emissions (i.e. CO_2, CH_4, N_2O and fluorocarbon emissions) reviewed in the SRES, the TAR and the AR4. There is a large diversity in the emissions scenarios due to various factors, thus this report shows the results in the median and the interquartile range between maximum and minimum changes, i.e. the range between a 75 % upper boundary and a 25% lower boundary, in the SRES, the TAR and the AR4 respectively. In addition, it is also important to pay attention to the differences between non-intervention and intervention scenarios, thus this report shows the results of these emissions scenarios disaggregated into non-intervention scenarios (i.e. reference scenarios) and intervention scenarios (i.e. mitigation scenarios). In all the figures, there is a large diversity, due to not only the differences in driving forces assumed for calculations but also the different methods and models used for calculations, different coverage of the targeted GHGs, different resolutions of sectoral coverage and energy-type coverage, and differences in conversion factors such as conversion from electricity to primary energy and conversion from non-CO_2 GHG to CO_2 equivalent amount. This report also introduces examples of analyses of regional mitigation scenarios and global GHG stabilization scenarios at different stabilization levels based on the database.

In the Appendix, this report explains how to utilize the database, shows procedures for reproducing figures in the IPCC assessment reports and compares the results of this database with figures in the IPCC assessment reports to confirm the reproducibility of figures in the SRES, the TAR and the AR4. In addition, data contents and scenario sources stored in this database are summarized to provide background information to users of the database.

Keywords: *IPCC Emissions Scenarios Database, Emissions Scenarios, Mitigation Scenarios, the Special Report on Emissions Scenarios (SRES), the Third Assessment Report (TAR), the Fourth Assessment Report (AR4)*

1. Introduction

1. Introduction
1.1. Objective of the Emissions Scenarios Database

Climate change and its impacts have been the focus of international attention for decades, and mitigation and adaptation policies have been discussed among international negotiators and scientists. A number of greenhouse gas (GHG) emissions scenarios have been published for the purpose of analyzing the effects of global warming and mitigation policies, and during the international negotiation process under the United Nation Framework Convention on Climate Change (UNFCCC), mid-term targets for reducing GHG emissions on a national scale have been focused on in the context of long-term GHG emissions projections and climate change stabilization on a global scale. Stringent GHG emission pathways consistent with a global temperature limit at a certain level (e.g. at 2 degrees Celsius) above pre-industrial levels or a 50 % reduction target by the year 2050 compared to the 1990 level have attracted the attention of policy makers and scientists in order to reduce and adapt the impacts of climate change in the future. Thus, it is important to carefully analyze stringent GHG emissions reduction targets for the long-term future on a global scale and examine the feasibility of short- to mid-term scenarios to achieve a low-carbon society or a green-growth economy on a national scale.

However, the trajectories of future GHG emissions vary according to the methodologies of the studies and features of driving forces such as population change, economic growth, and energy demand and supply. In addition, various mitigation scenarios are conceivable, depending on the employed mitigation strategies, policy requirements, and GHG stabilization targets. For example, different features in GHG emission pathways are derived from different assessment methodologies; a bottom-up approach that deals with distinct and detailed technology information such as the costs of technologies, energy efficiency of technologies, the diffusion rate of technologies, and a top-down approach that applies macroeconomic theory, econometric and optimization techniques to aggregate economic variable and deals with the monetary value added of goods and services and the scale of human activities by taking into account the interrelationships between a specific sector and the overall economy. Approaches adopted for regional aggregations in world regions, resolutions of target sectors and definitions of driving forces differ from one assessment model to the other, and these key settings have a large effect on different features in emissions scenarios. It is an indispensable issue to discuss the wide diversity of mitigation scenarios derived from various differences.

It is therefore important to organize the relevant and available information on emissions scenarios and the driving forces both in a national and a global scale, analyze the differences among the various scenarios, examine the range of results regarding GHG emissions, energy consumption and socio-economic assumptions, and discuss the feasibility of these scenarios and the reliability of their data. For the purpose of providing common information to researchers and policy makers throughout the world, this Emissions Scenarios Database was developed by reviewing various journal papers and reports. This database especially contributed to the process of publishing the assessment reports by the Intergovernmental Panel on Climate Change (IPCC) and covered the data on GHG emissions as well as the relevant information about energy consumption and driving forces. This database especially includes scenarios reviewed in the IPCC assessment reports such as the Special Report on Emissions Scenarios (SRES), the Third Assessment Report (TAR), the Fourth Assessment Report (AR4) and the Representative Concentration Pathways (RCP).

1.2. What is a "scenario"?

Scenarios are defined as "alternative images of how the future might unfold and an appropriate tool with which to analyze how driving forces may influence future emission outcomes and to assess the associated uncertainties" (IPCC, 2000) surrounding climate change. Thus, a scenario is a coherent, internally consistent and plausible description of a possible future state. A baseline scenario (or a reference scenario) is defined as "a non-intervention scenario used as a base in the analysis of intervention scenarios" (IPCC 2001b) and so "the reference for measurable quantities from which an alternative outcome can be measured" (IPCC 2007b). A mitigation scenario is then defined as "a description and a quantified projection of how GHG emissions can be reduced in comparison to respective baseline scenarios" (IPCC, 2001b), and thus mitigation potentials are defined as "the scale of GHG reductions that could be achieved, relative to emission baseline, for a given carbon price (expressed in cost per unit of carbon dioxide equivalent emissions avoided or reduced)" (IPCC 2007b).

The IPCC first developed a set of three long-term reference emissions scenarios in 1990 and designated it the 1990 Business-As-Usual Scenario named SA90 (IPCC, 1990). In 1992, the IPCC updated the SA90 scenarios and provided a set of six scenarios including a wider range of driving forces and emissions, called the IS92 Reference Emissions Scenarios (IPCC, 1992). The IS92 scenarios have provided the reference information required for assessment of the impact of climate change drivers such as economic growth, technological change, and demographic development. In 1995, the IPCC Second Assessment Report (SAR) (IPCC, 1996b) reviewed the IS92 scenarios, and subsequently in 1996, a team of writing new reference scenarios were approved and appointed, and the IPCC published the SRES scenarios (IPCC, 2000). One of the main objectives of the SRES was to review the literature related to emissions scenarios and create a new set of reference scenarios to supersede the IS92 scenarios. The SRES scenarios then became the principle source of emission profiles for climate change and impact assessments. However, the SRES scenarios were only reference scenarios and did not cover any mitigation scenarios that take into account the impact of deliberate climate policies. The IPCC TAR (IPCC, 2001b) then addressed mitigation scenarios as one of its objectives. TAR reviewed mitigation scenarios and discussed the characteristics of the scenarios and factors involved in mitigation. The IPCC AR4 (IPCC, 2007b) reviewed mitigation scenarios that have emerged since TAR, and summarized these emissions and mitigation scenarios into six different stabilization scenario categories (Categories I - VI) by considering the range of radiative forcing and CO_2 equivalent concentration, and provided information of peaking year for CO_2 emissions and global mean temperature increase above pre-industrial levels.

1.3. Contribution to the IPCC Assessment Reports

As a contribution to the IPCC Assessment Reports, the Emissions Scenarios Database has been developed. The current database is available on the following website (http://www.cger.nies.go.jp/db/scenario/index.html). The database is designed using Microsoft Access and offers a user-friendly information extraction facility. The latest database holds the data that were utilized in the IPCC reports, such as the SRES, the TAR and the AR4. As part of the Emissions Scenarios Database updating process, this database organized the available research from a wide variety of modeling teams. Thus, it is possible to analyze the similarities and differences between various mitigation scenarios, in particular, to examine the range of results and their reliability, and to analyze emission reduction factors in different regions.

2. Emissions Scenarios Database

2. Emissions Scenarios Database

2.1. Background of the database

Trajectories of future GHG emissions in scenarios depend on a number of driving forces, such as population change, economic growth, and energy supply. In addition, a variety of mitigation scenarios is possible, depending on the mitigation strategies employed. Matsuoka and Morita (1994) first developed the Emissions Scenarios Database in 1992 to store data relating to these scenarios. In order to contribute to the IPCC Assessment Reports, Morita and Lee (1998) updated the Database, also called Morita's Database, and first published it on the Web in 1997. Since 1997, the database has been continuously updated with relevant information such as the driving forces for emissions scenarios and projections of GHG emissions.

The first paper to review output from the Emissions Scenarios Database was published in 1998 (Nakicenovic, et al. 1998) and was used as a basis for discussion in the SRES (IPCC, 2000). This paper reviewed 428 scenarios of global and regional GHG emissions collected from 176 literature sources. It analyzed the main driving forces such as population growth, economic growth, energy consumption, and energy and carbon intensities, and presented the predicted GHG emissions ranges linked to these drivers. Subsequently, the second paper reviewing the database was published in 2000 (Rana and Morita, 2000) and the results were reviewed in TAR. This paper reviewed 75 post-SRES scenarios of global and regional GHG emissions collected from 25 literature sources. In this paper, the descriptions of types of integrated assessment models (IAM) and mitigation policies were summarized and the characterization of mitigation scenarios was discussed in detail. There have been some scenario-evaluation activities such as the Energy Modeling Forum, the International Energy Workshop, and the Innovation Modeling Comparison Program. However, significant work has not been conducted to review baseline and mitigation scenarios systematically in the SAR (IPCC, 1996b) and the SRES (IPCC, 2000). Therefore, as part of the TAR process, nine modeling teams which participated in the SRES process (Morita et al., 2000a; 2000b) undertook a special comparison program to quantify the SRES-based mitigation scenarios. These SRES-based scenarios were reviewed by TAR and called "Post-SRES Mitigation Scenarios" (IPCC, 2001b). As part of TAR, the detailed SRES-based mitigation scenarios data were stored in the Emissions Scenarios Database and many aspects of the post-SRES scenarios were examined.

The third paper reviewing the database was published in 2006 (Hanaoka et al. 2006a, and Nakicenovic et al. 2006) and analyzed various mitigation scenarios, called "Post-TAR mitigation scenarios", at the regional and global levels. Hanaoka et al. (2006a, 2006b) reviewed 240 scenarios from 53 literature sources reporting global emissions and 122 scenarios from 29 literature sources presenting regional or country emissions, such as for USA, EU, Japan, India, China and other countries, and examined prominent factors that have emerged since the TAR. The AR4 used the database to review and summarize the post-TAR mitigation scenarios in the context of the GHG stabilization categories. The AR4 pointed out that the lower the stabilization level, the more quickly the peak and decline of GHG emissions would need to occur, and mitigation efforts over the next two decades will have a large impact on opportunities to achieve lower stabilization levels.

However, the AR4 could not provide more in-depth analyses of the crosscutting issues related to the role of energy efficiency, the roles of fuel switching, the use of CO_2 capture and storage (CCS), or other aspects of climate change mitigation. Moreover, the AR4 analysis was on a global scale, not regional. Thus, the fourth paper reviewing the database was published in 2009 (Hanaoka et al. 2009) and focused on the role of energy intensity improvement in the short-term (to the year 2020) to mid-term (to the year 2050) as seen in the context of long-term AR4 GHG stabilization scenarios. This paper provided in-depth analyses of the relationship between energy intensity improvement and other major indicators, and assessed the feature of different categories of the AR4 GHG stabilization scenarios.

2.2. Basic structure of the Database

It is desirable that the database can be distributed all over the world. Therefore, considering general versatility, the database is designed using Microsoft Access and provides a user-friendly interface to browse data in a certain form, add new data, edit the existing data, retrieve data and output them to external files. It is built from a relational database that can integrate various kinds of data. In the database using Microsoft Access, the collected data are categorized into six different data-tables: SOURCE, REGIONDEF, SCENARIO, VARIABLE, REGION and DATAMOM, as shown in Figure2.1. These data-tables are linked to each other by using four key terms: Source ID, Scenario ID, Region ID and a variable. The DATAMOM table contains all numeric time-series values and the other tables contain related information on emissions scenarios such as reference, scenario type, regional classification, and so on.

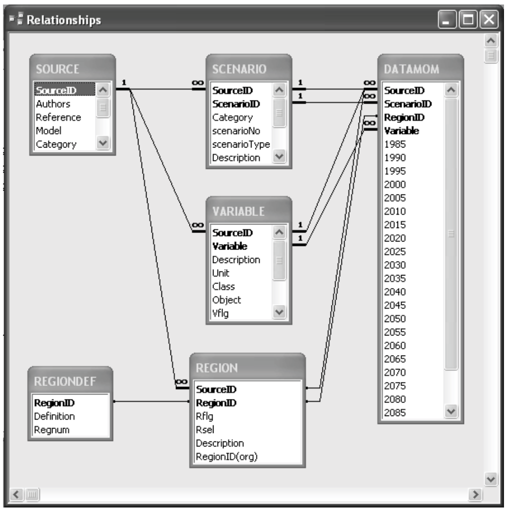

Figure 2.1 The relationship of the data-tables.

Figure 2.2 shows the start-up screen of the database system. The total number of data sources and emissions scenarios contained in this database is displayed on the start-up screen. Figure 2.3 shows the main screen that appears after the start-up screen. The basic functions of browsing and extracting data can be selected on the main screen. On the main screen, there are four different functions: “Information”, “Data Browser”, “Data Selection and Graph Wizard”, and “Others”. By using the “information” function, basic information on data source such as authors, model types, literature reference, scenario types, regional aggregations and so on can be obtained. With the “Data Browser” function, one can browse all the data in the database and figures of these results. Using the “Data Selection and Graph Wizard” function, one can select some specific scenarios and extract the target data that you want to analyze. The “Others” function includes two sub-function, 1) “Maintenance” takes care of all the information in the data-tables in the database, and 2) "Previous Functions" offers access to specific datasets in previous versions. For details on how to use the database, please see the Appendix A.

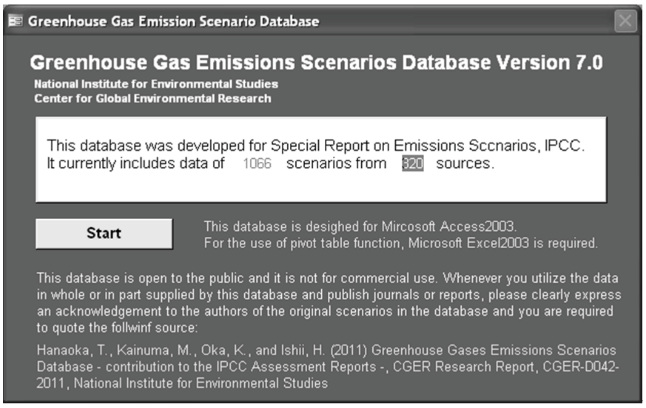

Figure 2.2 Start-up screen of the database.

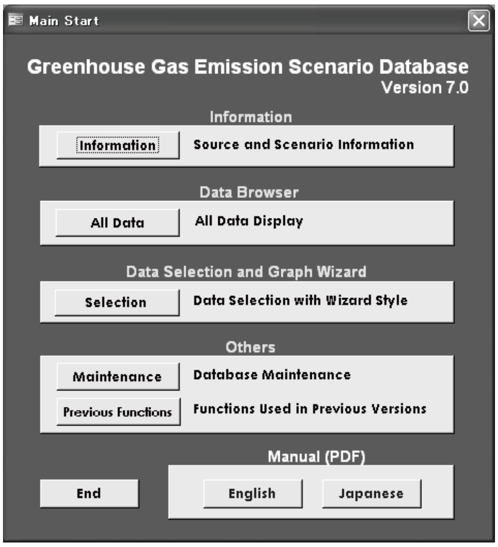

Figure 2.3 Main screen of the database.

Table 2.1 Number of sources and scenarios in the latest Database

Categories in the Database	Number of source	Number of scenario
Sources reviewed in the IPCC Second Assessment report (1995)	40	62
Sources published between 1992-1999, but not reviewed by the IPCC assessment report	113	192
The IPCC SRES (1999)	6	40
Sources reviewed in the IPCC Third Assessment report (2001)	36	330
Sources reviewed in the IPCC Fourth Assessment report (2007)	45	239
Sources published between 2000-2006, but not reviewed by the IPCC assessment report	22	85
Scenarios named as "RCP (Representative Concentration Pathways) which will be reviewed in the next IPCC Fifth Assessment report (2013)	4	4
Others (TGICA、UNFCCC etc.)	55	115
Total	322	1066

3. Overview of indicators

3. Overview of indicators

Diverse emissions scenarios have been developed for many different purposes. Features of future GHG emissions depend on various driving forces such as population growth, economic growth, and energy consumption. In the database, the latest relevant information has been stored to assess recent perspectives on future GHG emissions and their driving forces. This section shows the range of main driving forces such as population growth, economic growth, energy consumption, and the results of GHG emissions and the level of carbon pricing which is one of the main mitigation measures. In addition, this section compares the results of this database with figures in the SRES, the TAR and the AR4, and clarifies the reproducibility of figures in the IPCC assessment reports by using this scenario database.

3.1. Population

Population is one of the fundamental driving forces used to estimate future emissions. Most modelers refer to existing literature and use population as an exogenous variable. With regard to global population projections, there are four major sources of literature published by the following groups: The United Nations (UN, 2002; UN, 2004; UN, 2006; UN, 2008; UN, 2010), The World Bank (Bos, et al. 1994; Health, Nutrition & Population Stats, 2010), The US Census Bureau (US Census Bureau, 2010) and IIASA (Lutz et al., 2001; Lutz et al., 2004).

Figure 3.1 shows global population projections reviewed in the SRES, the TAR and the AR4, and Table 3.1 shows the summary of the results in the median and the interquartile range between maximum and minimum changes, i.e. the range between a 75 % upper boundary and a 25% lower boundary. Global population projections for 2100 in the interquartile range of all scenarios increase by a factor of 1.2 to 1.9 times relative to figures in the year 2000, where global population is around 6 billion people. The estimated median population in 2100 is 10.2 billion people in the IPCC AR4, which is 1.7 times larger than the global population relative to the 2000 level. It is interesting to note that Table 3.1 shows that compound annual growth rates (CAGR) of population of all scenarios decline toward the end of the century, but the major characteristic between the different IPCC Assessment reports is that the median value in the SRES and the TAR dwindle after 2050, whereas the value in the AR4 still keep increasing slightly even after 2050. This feature reflects the current trends of literature sources of the latest population prospects.

Table 3.1 Global population projections.

	range	2000	2010	2020	2030	2050	2100	CAGR 2000-2020	CAGR 2020-2050	CAGR 2050-2100
SRES	75%	6,117	6,891	7,672	8,362	9,367	10,414	1.14%	0.67%	0.21%
	50%	**6,117**	**6,888**	**7,618**	**8,182**	**8,704**	**7,137**	**1.10%**	**0.45%**	**-0.40%**
	25%	6,100	6,856	7,616	8,122	8,704	7,056	1.12%	0.45%	-0.42%
TAR	75%	6,168	7,089	7,972	8,751	10,055	11,455	1.29%	0.78%	0.26%
	50%	**6,122**	**6,892**	**7,672**	**8,343**	**8,926**	**7,239**	**1.13%**	**0.51%**	**-0.42%**
	25%	6,117	6,888	7,617	8,182	8,704	7,056	1.10%	0.45%	-0.42%
AR4	75%	6,097	6,891	7,672	8,372	9,383	10,444	1.16%	0.67%	0.21%
	50%	**6,068**	**6,886**	**7,617**	**8,270**	**9,322**	**10,231**	**1.14%**	**0.68%**	**0.19%**
	25%	6,055	6,826	7,529	8,182	8,919	9,937	1.10%	0.57%	0.22%

Note1: in units of million people

Note2: CAGR is an abbreviation of Compounded Annual Growth Rate.

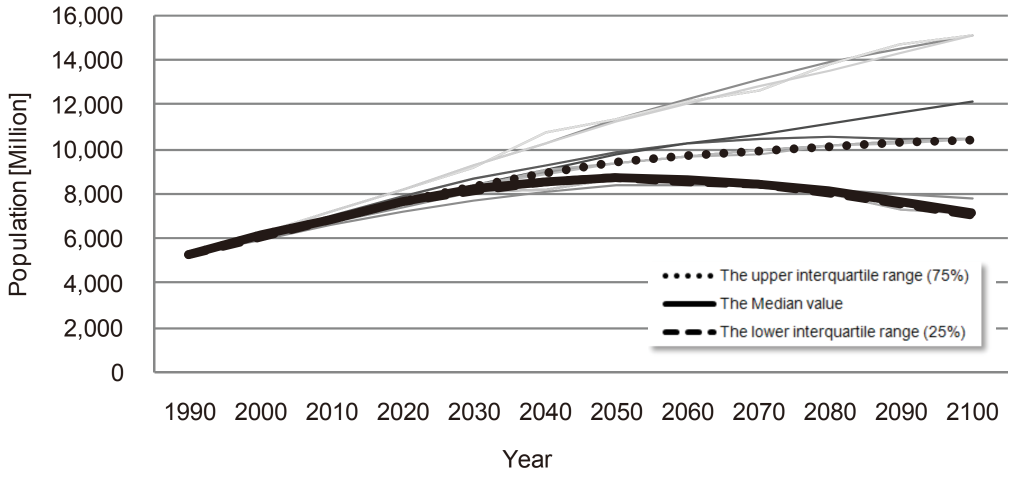

Figure 3.1.a Global population projections (SRES).

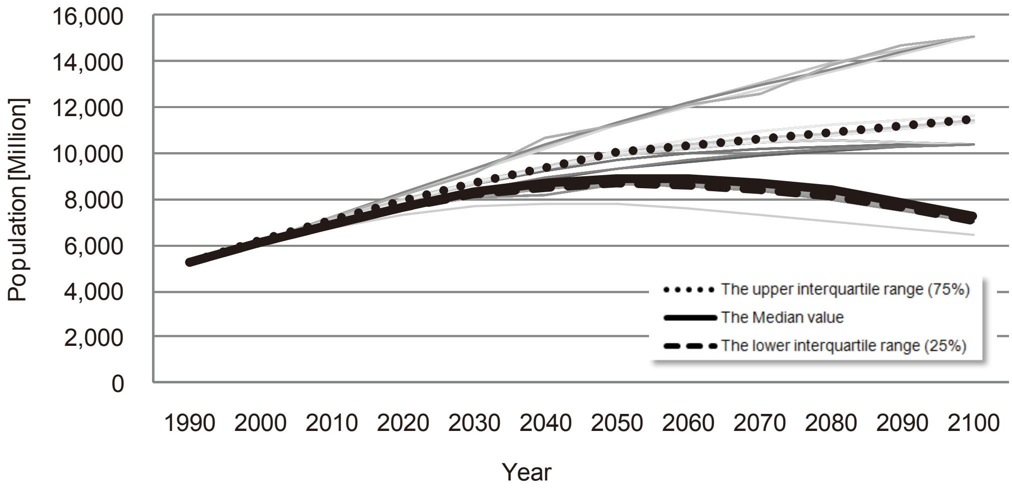

Figure 3.1.b Global population projections (TAR).

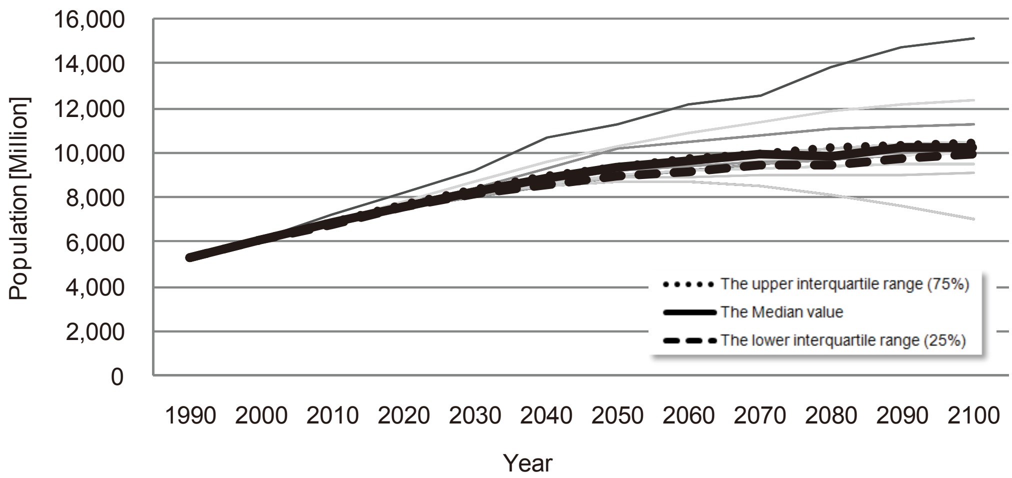

Figure 3.1.c Global population projections (AR4).

3.2. GDP

GDP is another fundamental factor in projecting future GHG emissions. High GDP may imply higher consumption of goods and services, investment at higher rates in some domestic sectors, and more international trade. Therefore, assumptions about economic growth are an important determinant of emissions projections.

Figure 3.2 shows a very wide range of economic development pathways assumed in the different scenarios in the SRES, the TAR and the AR4 and Table 3.2 shows the summary of the results in the median and the interquartile range (i.e. 25^{th}–75^{th} percentile range) on the upper and the lower boundaries. The GDP projections are disaggregated by non-intervention scenarios (i.e. reference scenarios) and intervention scenarios (i.e. mitigation scenarios) in the TAR and the AR4 in Table 3.2. Even in the year 2000, there is a relatively wide range across all scenarios, where the interquartile values of GDP range between US$26.7 to US$32.5 trillion. But it is important to note that submitted GDP values in this database are in different currency units; GDP in the SRES (i.e. Figure 3.2.a) and the TAR (i.e. Figure 3.2.b) is shown at constant 1990 prices but GDP is stored at different constant prices in 1990, 1995, 1997 or 2000 depending on different literature in the AR4 (i.e. Figure 3.2.c), which is one of the reasons for the diverse results even in 2000. GDP projections for 2100 between a 75% upper and a 25% lower boundaries of all scenarios show growth by a factor of 8.3 to 19.3 times that of GDP in the 2000 level. However, it is interesting to note in Table 3.2 that, in 2100, the interquartile range narrows and the median value declines along with the update of the IPCC assessment reports from the SRES to the AR4; for example, the global GDP values in 2100 in the interquartile range in the AR4 are narrowed, 8.3 to 9.1 times larger than the GDP values in 2000, where the global median GDP in 2000 is around US$27 trillion at constant 1990 prices. The global median GDP in intervention scenarios is lower than non-intervention scenarios that indicate a certain amount of the GDP loss due to mitigation measures. The CAGR of GDP declines toward the end of the century, but it still keeps on increasing in the range from 1.7 to 1.9 percent per year from 2050 to 2100 in the AR4 with intervention scenarios.

Table 3.2 Global GDP projections.

	range	2000	2010	2020	2030	2050	2100	CAGR 2000-2020	CAGR 2020-2050	CAGR 2050-2100
SRES	75%	27.4	37.9	56.0	86.2	175.1	528.7	3.64%	3.87%	2.23%
	50%	**26.8**	**36.9**	**52.0**	**73.5**	**135.0**	**336.8**	**3.37%**	**3.23%**	**1.85%**
	25%	26.7	36.2	47.3	64.0	108.0	245.7	2.91%	2.79%	1.66%
TAR (nINT)	75%	28.5	38.0	51.9	73.1	127.9	329.6	3.05%	3.05%	1.91%
	50%	**27.4**	**36.8**	**49.6**	**63.6**	**101.5**	**287.0**	**3.01%**	**2.41%**	**2.10%**
	25%	26.8	36.0	46.8	58.7	92.8	241.0	2.83%	2.30%	1.93%
TAR (INT)	75%	28.5	38.1	52.6	75.0	134.1	501.4	3.11%	3.17%	2.67%
	50%	**27.4**	**37.1**	**49.8**	**63.5**	**100.5**	**267.7**	**3.03%**	**2.37%**	**1.98%**
	25%	26.8	35.4	46.0	58.0	89.9	234.0	2.74%	2.26%	1.93%
AR4 (nINT)	75%	32.5	42.9	57.8	73.3	121.7	295.9	2.92%	2.51%	1.79%
	50%	**29.9**	**38.6**	**52.1**	**66.7**	**109.5**	**248.8**	**2.81%**	**2.51%**	**1.66%**
	25%	27.1	36.1	48.5	60.7	92.1	231.8	2.94%	2.16%	1.86%
AR4 (INT)	75%	32.5	42.8	57.5	73.2	118.5	295.5	2.90%	2.44%	1.85%
	50%	**30.3**	**39.4**	**50.7**	**65.9**	**106.7**	**242.8**	**2.61%**	**2.51%**	**1.66%**
	25%	27.3	36.2	48.8	60.4	91.5	226.6	2.95%	2.12%	1.83%

Note1: in units of trillion US$

Note2: nINT and INT are abbreviations of non-intervention scenarios and intervention scenarios, respectively.

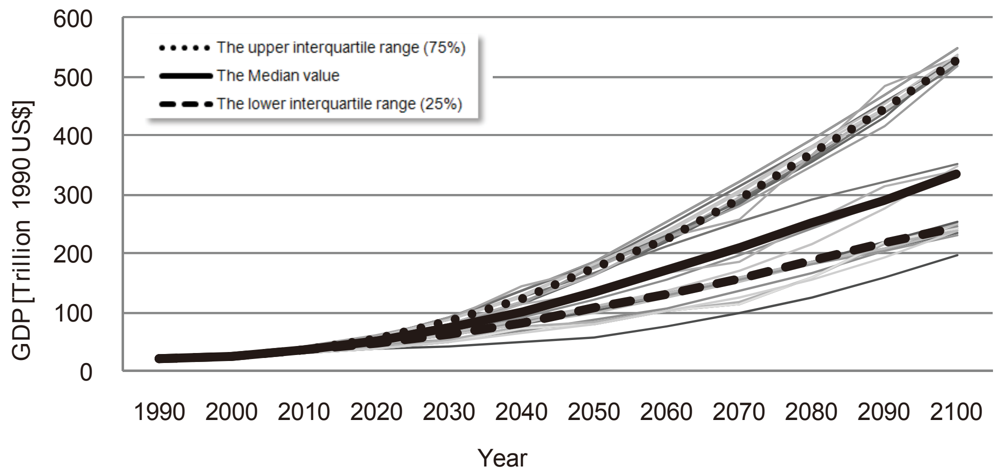

Figure 3.2.a Global GDP projections (SRES).

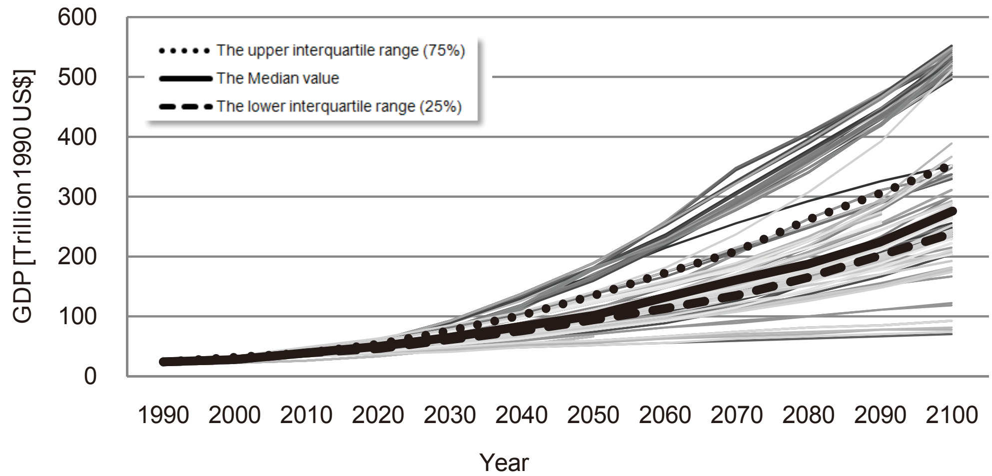

Figure 3.2.b Global GDP projections (TAR).

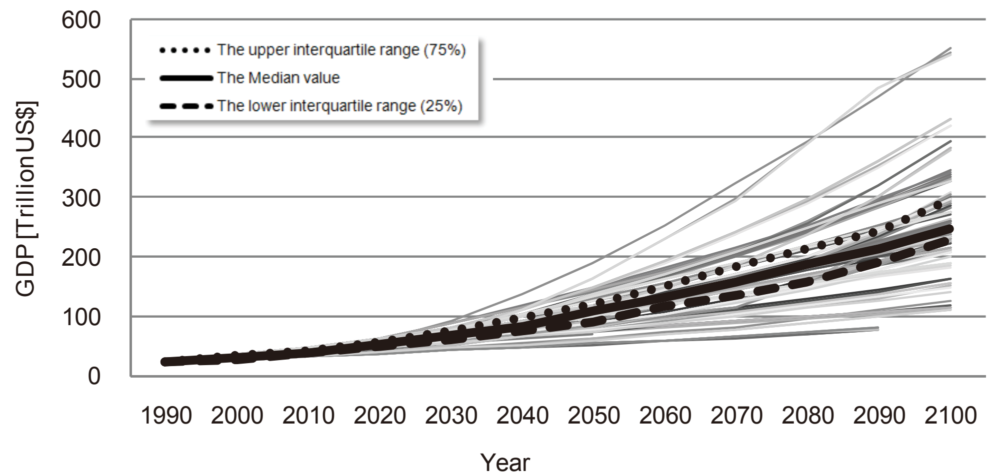

Figure 3.2.c Global GDP projections (AR4).

Note: GDP is shown at constant 1990 prices in Figure 3.2a and Figure 3.2b. But it is necessary to note that GDP is shown at different constant prices in 1990, 1995, 1997 or 2000 depending on different literature sources in Figure 3.2.c.

3.3. Total primary energy supply

Primary energy supply is another key index in coherent correspondence with GHG emissions. The amount of energy consumption directly affects the results of future GHG emissions. Moreover, the structure of energy systems is another important consideration when discussing GHG emission pathways. For example, transitions toward lower carbon intensities, which are measured by the ratio of CO_2 emissions to the primary energy supply, are associated with an energy shift from high-carbon content fossil fuels to less carbon-intensive fossil fuels or non-fossil fuels such as renewables and nuclear.

Figure 3.3 shows the primary energy supply pathways resulting from different emissions scenarios in the SRES, the TAR and the AR4, and Table 3.3 shows the summary of the results in the median and the interquartile range (i.e. 25^{th}–75^{th} percentile range) on the upper and the lower boundaries. The results of global total primary energy supply are disaggregated by non-intervention scenarios (i.e. reference scenarios) and intervention scenarios (i.e. mitigation scenarios) in the TAR and the AR4 in Table 3.3. Even in the year 2000, there is a relatively wide range across all scenarios from 371 to 437 EJ in the interquartile range. There are several reasons for the diverse results. Firstly, in some emissions scenarios, the base-year 1990 is used for an integrated assessment model and the value in the year 2000 is an output of model runs; therefore, the results may differ from the realities of the observed value of energy consumption in 2000. Secondly, some emissions scenarios only cover primary energy consumption of fossil fuels (i.e. coal, oil and natural gas), but many other scenarios also take into account renewables and nuclear power too; therefore, the coverage of energy types causes differences in the amount of primary energy consumption. Thirdly, conversion factors from electricity to primary energy may be different from one model to another, with regard to the electricity generation from nuclear power, hydro power, geothermal heat and renewables. For example, the International Energy Agency (IEA) recommends calculating the primary energy equivalent of nuclear electricity from the gross generation by assuming a 33 % conversion efficiency, i.e. 1 TWh = (0.0036 / 0.33) EJ, but some models may use a different conversion efficiency.

Table 3.3 shows that the interquartile range of global primary energy supply of all scenarios for 2100 is between 771 and 2032 EJ, which shows growth by a factor of 2.1 to 4.8 times that of the figures in the year 2000, where the median primary energy supply in 2000 ranges from 385 to 412 EJ. The CAGR of total primary energy supply for 2100 descends in the latter half of the century, which ranges from 0.51 to 1.29 percent per year in the interquartile range of all scenarios in 2100, with the range of the median value of 0.54 to 1.09 percent per year. Both the amount of primary energy supply and the CAGR of primary energy supply in intervention scenarios in the TAR and the AR4 are lower than those in non-intervention scenarios, because the amount of energy generated is sufficient to meet demand due to the decline of energy consumption in response to efficiency improvements in energy consumption and service demands due to the effects of mitigation measures. It is interesting to note that Table 3.3 shows that the interquartile range of primary energy supply narrows along with the update of the IPCC assessment reports from the SRES to the AR4, and besides, the median value in non-intervention scenarios in the AR4 is almost equivalent to the median value in intervention scenarios in the TAR. This implies that, in the TAR, most of intervention scenarios were SRES-based mitigation scenarios, that it to say, intervention scenarios were assessed based on the baseline (i.e. non-intervention) scenarios using the SRES scenarios; however, in the AR4, many non-intervention scenarios were assumed as modelers' reference scenarios based on the experience of studies in the TAR.

Table 3.3 Global primary energy supply.

	range	2000	2010	2020	2030	2050	2100	CAGR 2000-2020	CAGR 2020-2050	CAGR 2050-2100
SRES	75%	416	511	660	869	1,255	2,014	2.33%	2.17%	0.95%
	50%	**395**	**489**	**593**	**713**	**970**	**1,364**	**2.05%**	**1.65%**	**0.68%**
	25%	381	455	554	671	858	1,105	1.88%	1.47%	0.51%
TAR (nINT)	75%	437	539	660	818	1,070	2,032	2.08%	1.62%	1.29%
	50%	**412**	**504**	**623**	**745**	**996**	**1,714**	**2.09%**	**1.58%**	**1.09%**
	25%	393	459	556	650	833	1,256	1.75%	1.36%	0.82%
TAR (INT)	75%	409	500	616	717	1,018	1,823	2.07%	1.69%	1.17%
	50%	**392**	**454**	**546**	**619**	**806**	**1,274**	**1.67%**	**1.31%**	**0.92%**
	25%	375	424	474	519	637	962	1.17%	0.99%	0.83%
AR4 (nINT)	75%	402	478	599	721	925	1,558	2.02%	1.46%	1.05%
	50%	**385**	**458**	**561**	**659**	**868**	**1,290**	**1.90%**	**1.46%**	**0.80%**
	25%	373	443	522	601	816	1,169	1.70%	1.50%	0.72%
AR4 (INT)	75%	402	474	571	669	832	1,319	1.77%	1.26%	0.93%
	50%	**392**	**450**	**536**	**602**	**751**	**981**	**1.57%**	**1.13%**	**0.54%**
	25%	371	427	484	533	592	771	1.33%	0.67%	0.53%

Note1: in units of EJ (Exajoule).
Note2: nINT and INT are abbreviations of non intervention scenarios and intervention scenarios, respectively.

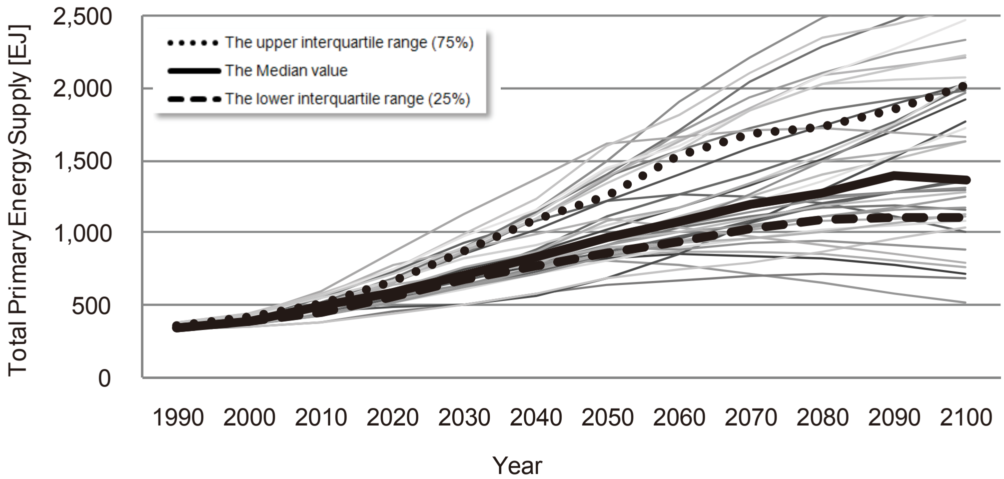

Figure 3.3.a Global total primary energy supply (SRES).

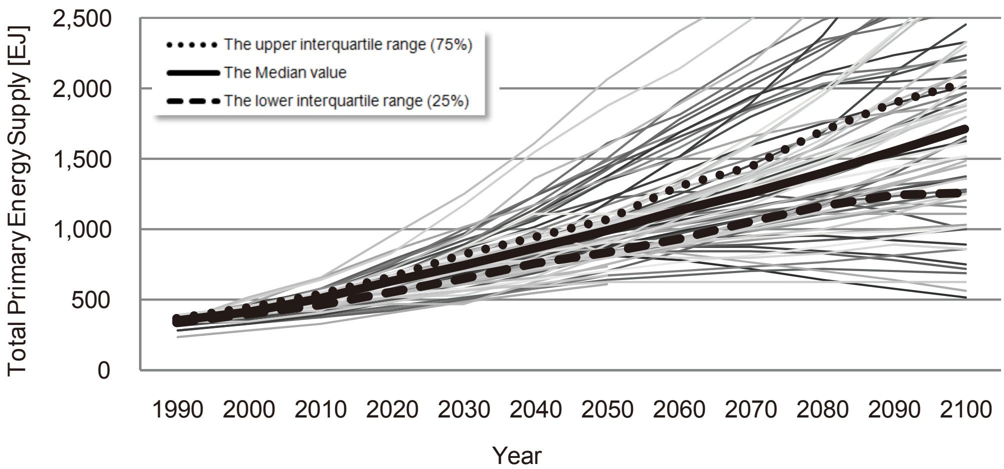

Figure 3.3.b Global total primary energy supply (TAR without intervention).

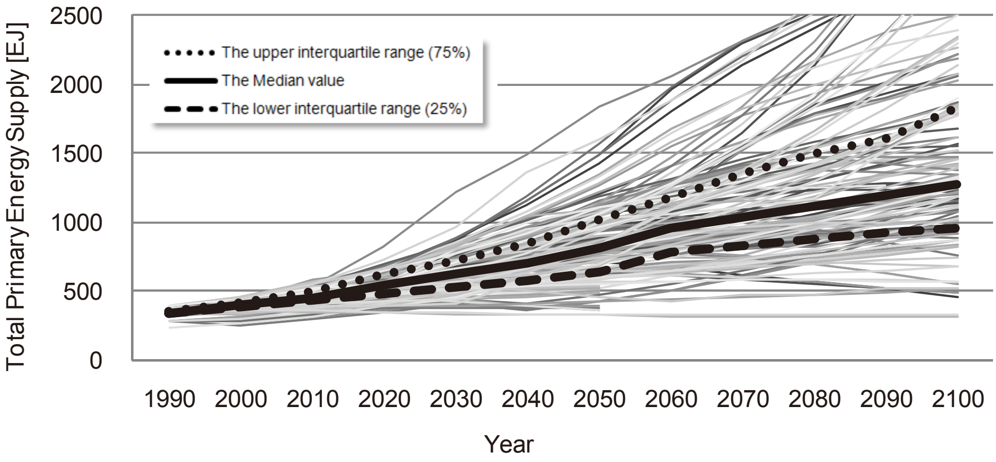

Figure 3.3.c Global total primary energy supply (TAR with intervention).

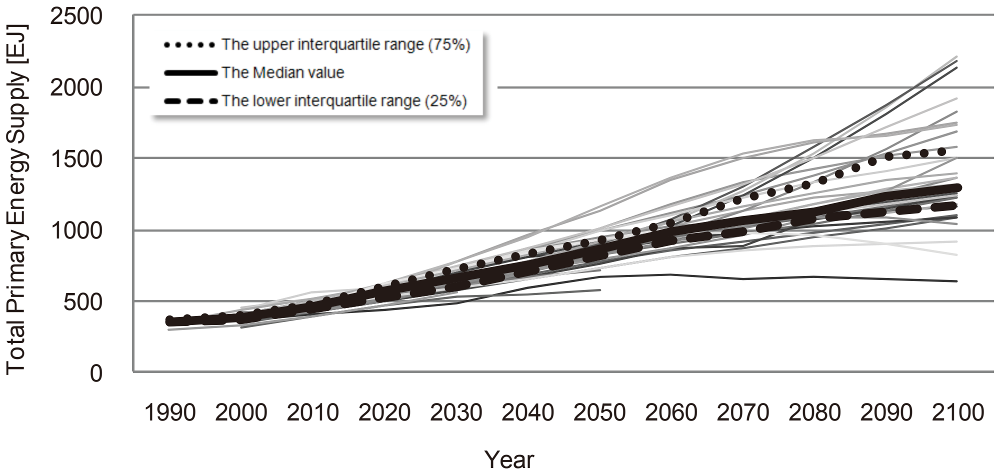

Figure 3.3.d Global total primary energy supply (AR4 without intervention).

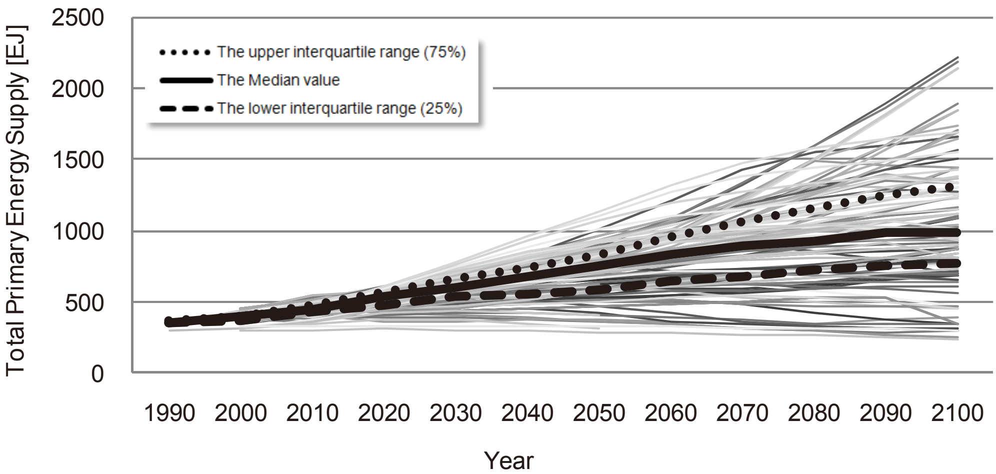

Figure 3.3.e Global total primary energy supply (AR4 with intervention).

3.4. Total final energy consumption

Final energy consumption is the other key index in coherent correspondence with GHG emissions. The amount of energy consumption directly affects the results of future GHG emissions, as does the total primary energy supply. Energy efficiency improvements have a large effect on the results of the total final energy consumption and GHG emission pathways. Energy efficiency plays a key role in many scenarios for most regions and timescales, and transitions toward the improvement of energy intensity, which is measured by the ratio of the amount of total primary energy supply to economic activity, are associated with the effects of changes of final energy consumption resulting from energy efficiency improvements at the end-use points and energy-saving activities derived from changes in the social structure.

Figure 3.4 shows the final energy consumption pathways from different emissions scenarios in the SRES, the TAR and the AR4, and Table 3.4 shows the summary of the results in the median and the interquartile range (i.e. 25^{th}–75^{th} percentile range) on the upper and the lower boundaries. The results of global total final energy consumption are disaggregated by non-intervention scenarios (i.e. reference scenarios) and intervention scenarios (i.e. mitigation scenarios) in the TAR and the AR4 in Table 3.4.

Table 3.4 shows that the interquartile range of global final energy consumption of all scenarios for 2100 is between 580 and 1433 EJ, which shows growth by a factor of 2.2 to 4.6 times that of the figures in the year 2000, where the median final energy consumption in 2000 ranges from 280 to 311 EJ. The CAGR of total final energy consumption for 2100 descends in the latter half of the century as does the primary energy supply, which ranges from 0.55 to 1.22 percent per year in the interquartile range of all scenarios in 2100, with the range of the median value of 0.60 to 0.82 percent per year. The amount of final energy consumption in intervention scenarios in the TAR and the AR4 are lower than those in non-intervention scenarios, because the amount of energy consumption decline in response to efficiency improvements in energy consumption and service demands due to the effects of mitigation measures. It is also interesting to note that Table 3.4 shows, as does the case in total global primary energy supply, that the interquartile range of primary energy supply narrows along with the update of the IPCC assessment reports from the SRES to the AR4, and besides, the median value in non-intervention scenarios in the AR4 is much lower than the median value in intervention scenarios in the TAR after 2030. This suggests that, in the AR4, many non-intervention scenarios considered more efficiency improvements in energy consumption and service demands than those in intervention scenarios in the TAR, based on the experience of the latest studies since the TAR. When comparing results of non-intervention scenarios, i.e. comparisons between the SRES, non-interventions in the TAR and non-intervention in the AR4 in Table 3.4, the median value in non-intervention scenarios in the TAR is almost the same as the median value in the SRES, but the median value in non-intervention scenarios in the AR4 is much lower than the SRES and the TAR. This indicates that most of non-intervention scenarios in the TAR were based on the SRES-based scenarios, however, many non-intervention scenarios in the AR4 were modelers' reference scenarios which had already taken into account a certain level of the effects of energy efficiency improvements in the baseline scenario.

Table 3.4 Final energy consumption.

	range	2000	2010	2020	2030	2050	2100	CAGR 2000-2020	CAGR 2020-2050	CAGR 2050-2100
SRES	75%	315	398	498	634	896	1,433	2.32%	1.98%	0.94%
	50%	**306**	**374**	**451**	**536**	**733**	**1,105**	**1.96%**	**1.63%**	**0.82%**
	25%	300	355	429	508	635	879	1.80%	1.32%	0.65%
TAR (nINT)	75%	317	394	488	599	779	1,431	2.18%	1.57%	1.22%
	50%	**311**	**379**	**462**	**552**	**719**	**1,054**	**2.01%**	**1.48%**	**0.77%**
	25%	299	355	420	481	608	799	1.71%	1.24%	0.55%
TAR (INT)	75%	311	389	486	596	779	1,383	2.24%	1.59%	1.15%
	50%	**304**	**368**	**455**	**536**	**730**	**1,019**	**2.05%**	**1.59%**	**0.67%**
	25%	297	347	411	451	600	816	1.65%	1.27%	0.61%
AR4 (nINT)	75%	290	354	451	543	712	1,030	2.25%	1.53%	0.74%
	50%	**282**	**342**	**421**	**493**	**630**	**903**	**2.02%**	**1.36%**	**0.72%**
	25%	263	315	379	443	579	852	1.85%	1.43%	0.77%
AR4 (INT)	75%	290	352	433	515	661	907	2.03%	1.42%	0.63%
	50%	**280**	**333**	**396**	**453**	**544**	**736**	**1.75%**	**1.06%**	**0.60%**
	25%	262	300	340	386	430	580	1.31%	0.79%	0.60%

Note1: in units of EJ (Exajoule).
Note2: nINT and INT are abbreviations of non intervention scenarios and intervention scenarios, respectively.

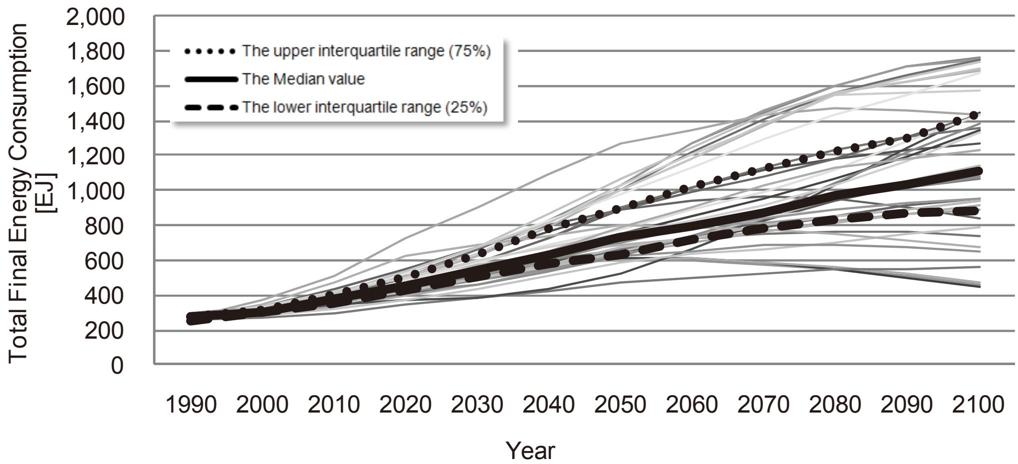

Figure 3.4.a Final energy consumption (SRES).

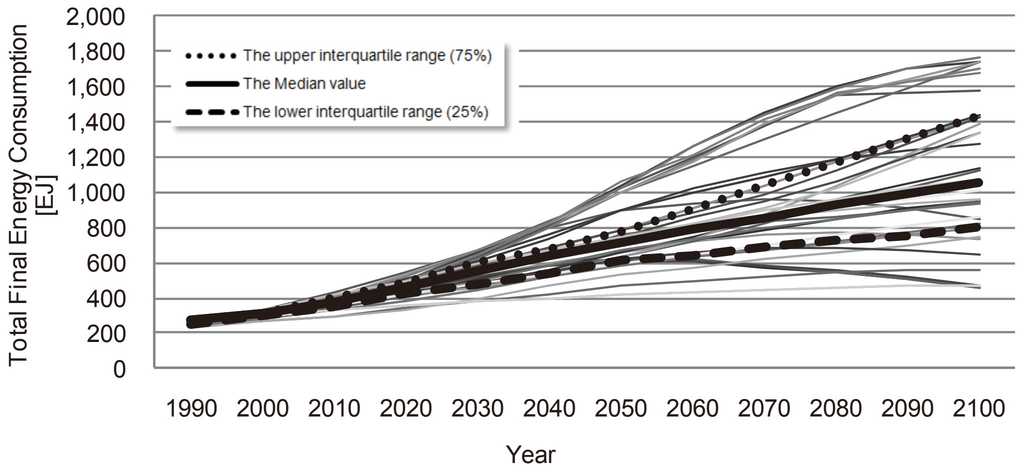

Figure 3.4.b Final energy consumption (TAR without intervention).

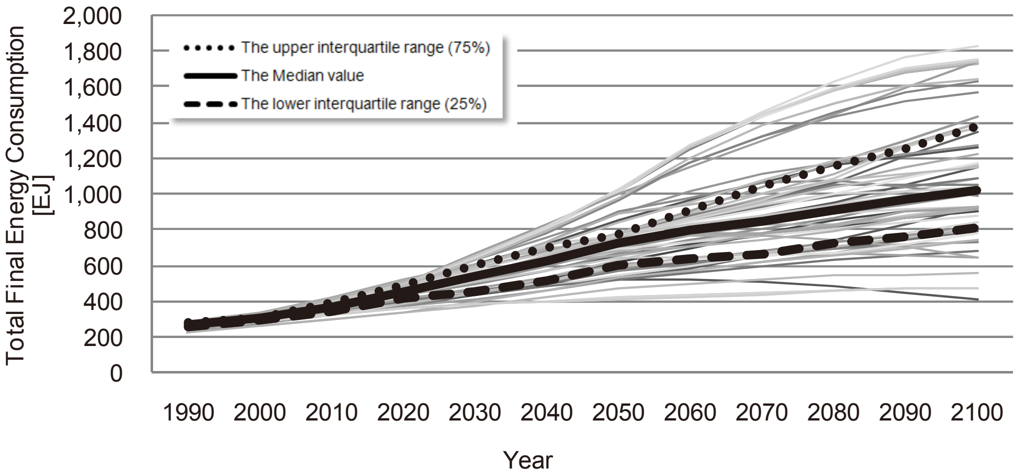

Figure 3.4.c Final energy consumption (TAR with intervention).

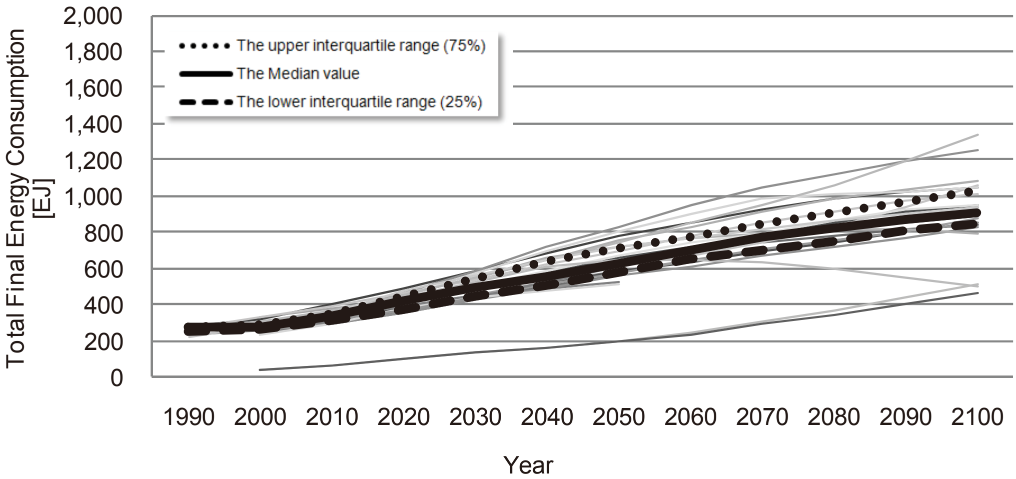

Figure 3.4.d Final energy consumption (AR4 without intervention).

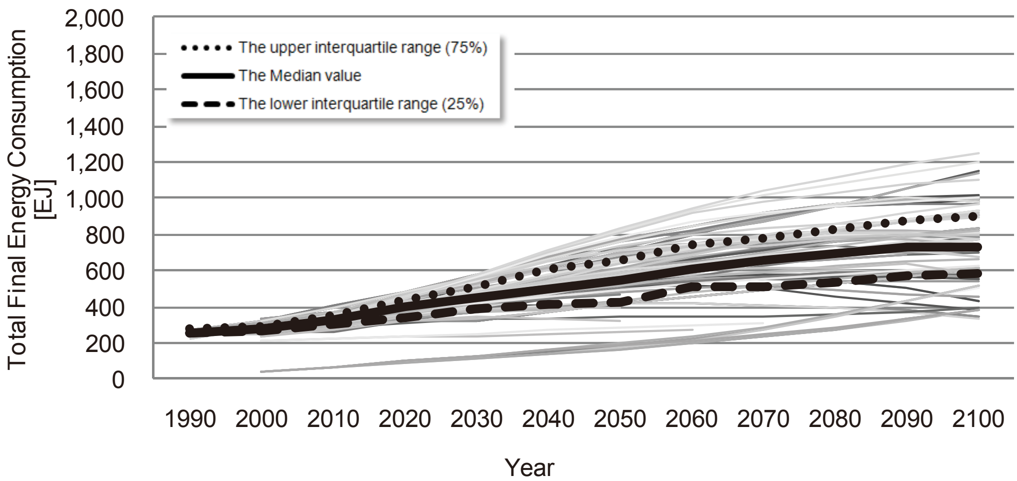

Figure 3.4.e Final energy consumption (AR4 with intervention).

3.5. GHG emissions (CO_2, CH_4, N_2O, fluorocarbons)

Figure 3.5, Figure 3.6, Figure 3.7 and Figure 3.8 show the results of CO_2, CH_4, N_2O and fluorocarbon emissions pathways respectively, and these figures are shown in the SRES, the TAR and the AR4 respectively; Table 3.5, Table 3.6, Table 3.7, and Table 3.8 show the summary of the results of CO_2, CH_4, N_2O, and fluorocarbon emissions in the median and the interquartile range (i.e. 25^{th}–75^{th} percentile range) on the upper and the lower boundaries, respectively. The results of these emissions pathways are disaggregated by non-intervention scenarios (i.e. reference scenarios) and intervention scenarios (i.e. mitigation scenarios) in the TAR and the AR4 in Table 3.5, Table 3.6, Table 3.7 and Table 3.8. In all the figures, there is a large diversity in the future GHG emissions. These variations are due to not only the differences in driving forces assumed for calculations but also the different methods and models used for calculations, different conversion factors in CO_2 equivalent used for calculations and different coverage of emission sources.

CO_2 emissions are closely correlated with the results of energy consumption of fossil fuels. In Table 3.5, CO_2 emissions in 2100 in the interquartile range of all scenarios are between 11.1 and 103.4 Gt-CO_2, which shows growth 0.5 to 3.4 times larger than CO_2 emissions in 2000, where the range of median CO_2 emissions in 2000 of all scenarios are from 25.4 to 29.2Gt-CO_2. Even in the year 2000, a relatively wide range of CO_2 emissions can be seen due to the difference of the coverage of CO_2 emissions sources. For example, some scenarios only took into account CO_2 emissions related to fossil fuel consumption, but other scenarios included all emission sources, i.e. not only energy-related CO_2 emissions but also non energy-related CO_2 emissions from industry and from Land-Use, Land-Use Change and Forestry (LULUCF). It is interesting to note that as seen in Figure 3.5 the median CO_2 emissions in non-intervention scenarios in the TAR and the AR4 show continuous increase toward the end of the century, but the median CO_2 emissions in intervention scenarios in the TAR and the AR4 decline in the latter half of the century, which shows a decrease in 2100 by a factor of 0.8 to 0.9 times that of the 2000 level. In intervention scenarios in the TAR and the AR4, diversities of CO_2 emissions are observed because of the wide variety and different intensity of mitigation measures. The higher the level of CO_2 emissions increase in CO_2 concentration in the atmosphere is, the more significant is the impact on climate change. An important point to note is that, when discussing intervention scenarios, scenarios were categorized in the different levels of an index of radiative forcing or CO_2 equivalent concentrations in order to compare scenarios with different stabilization metrics in the TAR and the AR4, for example 550 ppmv CO_2 equivalent and 450 ppmv CO_2 equivalent in the index of CO_2 equivalent concentrations or 4.5 W/m^2 and 6.0 W/m^2 in the index of radiative forcing. However, the results of median values in intervention scenarios in Figure 3.5 and Table 3.5 are the averaged values across all intervention scenarios in the TAR and the AR4. The median value of intervention scenarios in the TAR and the AR4 is far from the stringent GHG emission pathways to achieve a 50 % reduction target by the year 2050 compared to the 1990 level or to achieve a 2 degree global temperature limit above pre-industrial levels, which attracted the attention of policy makers.

Table 3.5 Global CO_2 emissions.

	range	2000	2010	2020	2030	2050	2100	CAGR 2000-2020	CAGR 2020-2050	CAGR 2050-2100
SRES	75%	29.2	35.5	45.5	53.3	67.6	86.7	2.13%	1.40%	0.50%
	50%	**29.2**	**34.2**	**39.9**	**47.5**	**58.7**	**57.0**	**1.56%**	**1.30%**	**-0.06%**
	25%	29.2	33.0	37.3	40.5	43.8	33.0	1.23%	0.54%	-0.57%
TAR (nINT)	75%	30.1	35.9	41.9	50.2	62.3	103.4	1.67%	1.34%	1.02%
	50%	**27.1**	**31.2**	**36.7**	**43.2**	**53.8**	**72.4**	**1.53%**	**1.29%**	**0.60%**
	25%	25.3	28.6	33.1	36.8	43.6	50.2	1.35%	0.93%	0.28%
TAR (INT)	75%	27.8	32.3	37.4	39.6	42.2	28.4	1.49%	0.40%	-0.79%
	50%	**25.8**	**29.0**	**31.9**	**34.1**	**34.1**	**22.0**	**1.08%**	**0.22%**	**-0.87%**
	25%	22.7	24.9	26.7	27.7	24.9	14.6	0.80%	-0.22%	-1.06%
AR4 (nINT)	75%	28.7	33.4	39.5	44.7	56.5	88.1	1.61%	1.20%	0.89%
	50%	**25.4**	**31.2**	**36.7**	**42.3**	**52.1**	**74.4**	**1.84%**	**1.18%**	**0.72%**
	25%	23.7	28.9	34.9	39.5	47.1	53.1	1.95%	1.00%	0.24%
AR4 (INT)	75%	28.6	32.4	36.6	39.6	39.9	30.1	1.24%	0.29%	-0.56%
	50%	**25.5**	**29.8**	**32.7**	**35.3**	**35.0**	**20.0**	**1.26%**	**0.22%**	**-1.11%**
	25%	23.7	27.3	30.3	30.8	27.6	11.0	1.23%	-0.31%	-1.82%

Note1: in units of $GtCO_2$.
Note2: nINT and INT are abbreviations of non intervention scenarios and intervention scenarios, respectively.

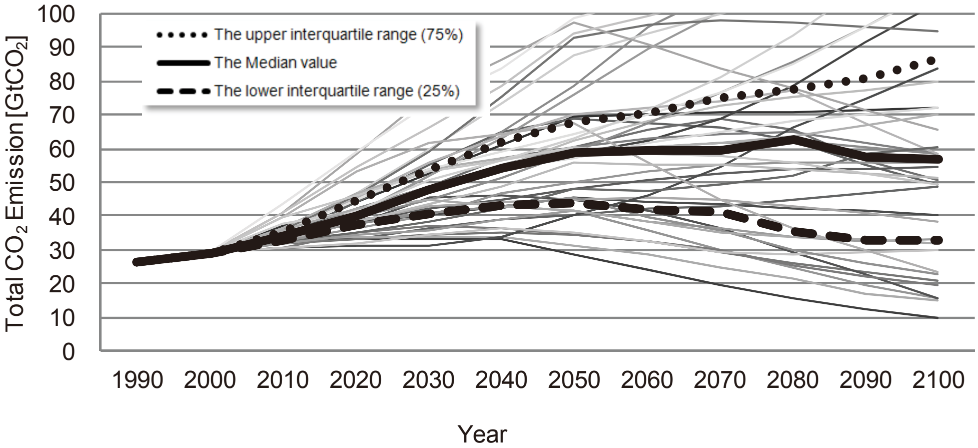

Figure 3.5.a Global CO_2 emissions (SRES).

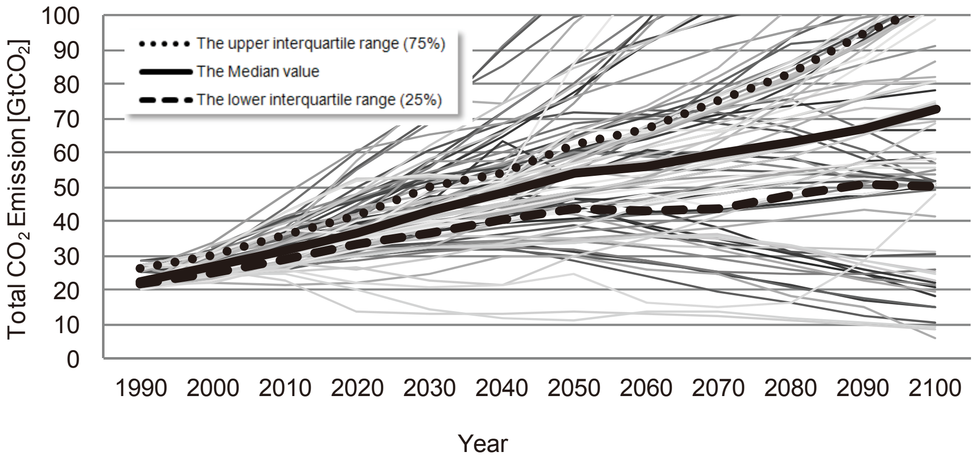

Figure 3.5.b Global CO_2 emissions (TAR without intervention).

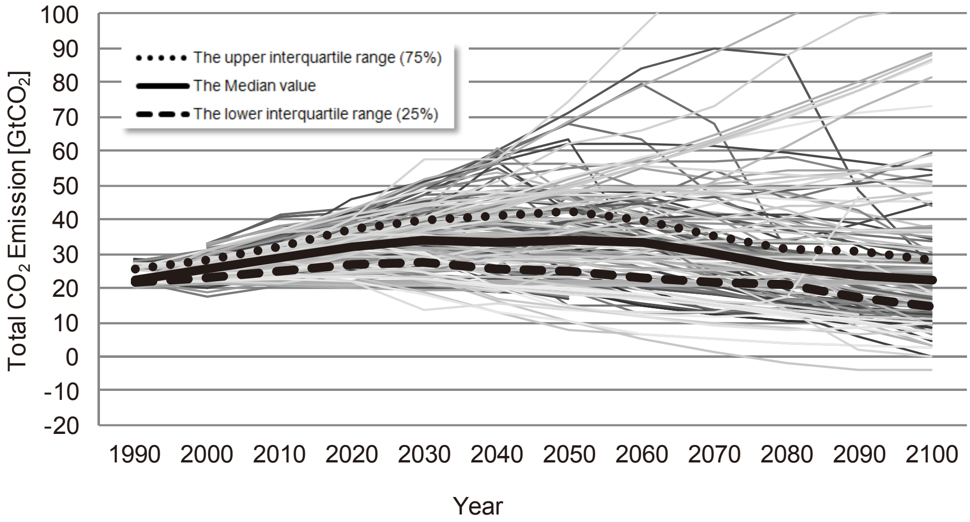

Figure 3.5.c Global CO_2 emissions (TAR with intervention).

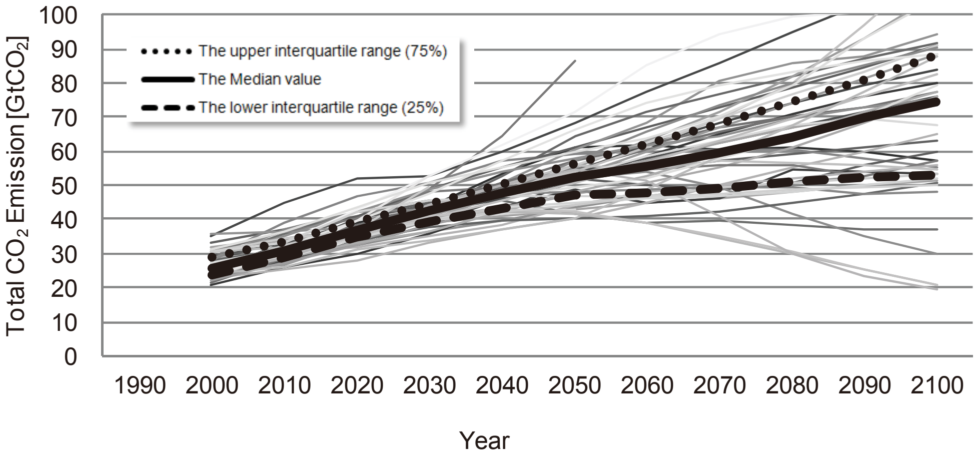

Figure 3.5.d Global CO_2 emissions (AR4 without intervention).

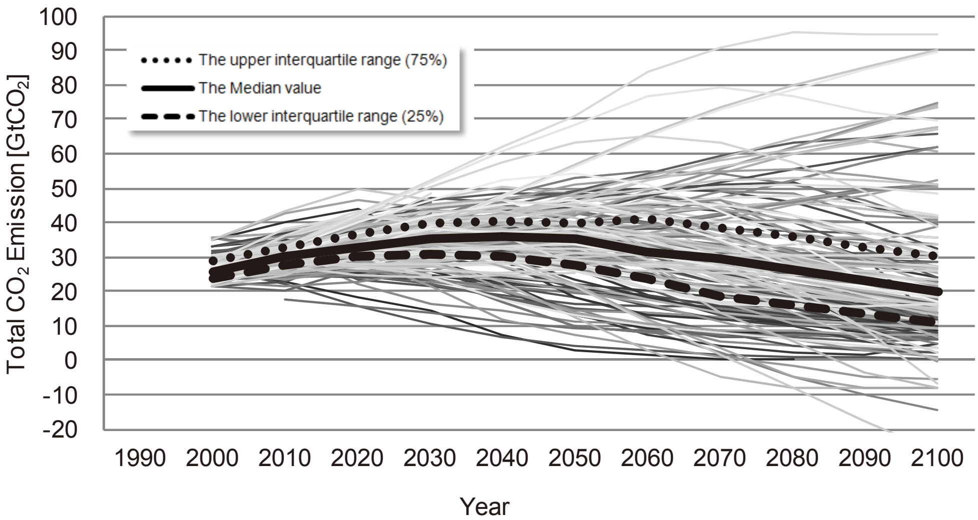

Figure 3.5.e Global CO_2 emissions (AR4 with intervention).

The global warming impacts of non-CO_2 GHGs are described in tons of CO_2 equivalent, by using the value of Global Warming Potential (GWP) which represents "the time-integrated radiative forcing from the instantaneous release of 1 kg of a trace gas expressed relative to that of 1 kg of a reference gas"(IPCC, 2001a). CO_2 is used as the reference gas, so that these GWP values represent the direct global warming potentials relative to CO_2 by emitting infrared absorbing gases into the atmosphere. These values do not include indirect effects, that it to say other warming or cooling effects caused by the chemical transformations of greenhouse gases in the atmosphere. A proviso of GWP is that the GWP values of different GHGs vary widely according to the time horizon over which the calculation of remaining gas in the atmosphere is considered, because atmospheric lifetimes of different GHGs vary from several dozen years to tens of thousands years and the levels of infrared absorption of different GHGs are also different. The IPCC defined these GWP values in the three different time horizon of 20 years, 100 years, and 500 years, and GWP of each GHG in the time horizon of 100 years is normally used as the standardized value for submitting the national GHG inventory of each country under the framework of the Kyoto Protocol in the United Nation Framework Convention on Climate Change (UNFCCC).

CH_4 emissions largely derive from non-energy emission sources such as agriculture, livestock, municipal solid waste and fugitive emissions from fuel productions. Thus features of CH_4 emission pathways in the unit of CO_2 equivalent by using GWP have less relationship with the characteristics of energy consumption and CO_2 emissions. In Figure 3.6, the interquartile range of CH_4 emissions of all scenarios in 2100 show growth by a factor of 1.0 to 2.1 times that of the figures in 2000, which ranges between 5.7 to 18.1 Gt-CO_2 eq in 2100, where the global median CH_4 emissions range from 5.9 to 9.2 in 2000. There can be seen a wide range of CH_4 emissions even in the year 2000. It is difficult to find out apparent causes, but several reasons are expected for the diversity. The first reason may derive from the coverage of CH_4 emissions; some models covered limited emission sources but other models included all emission sources. Another reason may be caused by the values of GWP of each GHG used for calculations. It is important to point out that the different GWP values of GHGs are revised and determined along with the update of the IPCC assessment reports from the SAR (IPCC, 1995a), where GWP of CH_4 in the time horizon of 100 years is 21, the TAR (IPCC, 2001a), where GWP of CH_4 in the time horizon of 100 years is 23, to the AR4 (IPCC, 2007a), where GWP of CH_4 in the time horizon of 100 years is 25. The GWP values reported in the AR4 (IPCC, 2007a) are scientifically the latest; however, the Kyoto Protocol stipulates using the GWP values in SAR (IPCC, 1995a) for the submission of the national greenhouse gas inventory of each country to the UNFCCC. Thus, most models followed the same stipulation under the UNFCCC but some others may have used the different GWP values reported in the latest IPCC assessment reports. An interesting feature in CH_4 emissions which is different from CO_2 emissions is that, even in intervention scenarios in the TAR and the AR4, the pathways of the median CH_4 emissions do not decline much even in the latter half of the century and the median CH_4 emissions in 2100 is still 1.2 to 1.5 times larger than the level of year 2000.

N_2O emissions derive partly from energy-related emission sources such as industry, transport and partly from non-energy emission sources such as agriculture, industry and livestock. The diversity of different emission sources is observed; thus, as shown in Figure 3.7, N_2O emissions are unsteady and do not show a certain feature relative to other GHGs. Table 3.7 shows that N_2O emissions in 2100 in the interquartile range of all scenarios are between 2.8 to 8.1 Gt-CO_2, which show growth by a factor of 0.9 to 2.4 times that of N_2O emissions in 2000, where the range of global median N_2O emissions in 2000 of all scenarios are from 3.2 to 3.4 Gt-CO_2. There is a particularly wide range across the N_2O scenarios even in 2000 in the TAR and the AR4. The variation might be mainly due to the differences in driving forces and data assumptions used for calculations in different types of models. Another reason may derive from the difference of GWP values used for calculations, as explained in the case of CH_4 emissions. For example, GWP of N_2O in the time horizon of 100 years is 310, 296, and 298 in the SAR (IPCC, 1995a), the TAR (IPCC, 2001a) and the AR4 (IPCC, 2007a), respectively.

Fluorocarbons are the most difficult non-CO_2 GHGs to be compared across different scenarios, because there are various types of fluorocarbons such as chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6) and these anthropogenic gases have different GWP values per unit of weight, which range from a few dozen to a hundred thousand times larger than that of CO_2, due to the wide differences in their atmospheric lifetimes from several dozen years to tens of thousands years. Thus, it is difficult to compare fluorocarbon emissions scenarios by gas type using this Emissions Scenarios Database. In the database, there are several difficulties for comparisons across all scenarios in the same manner, as follows.

1) Methods and models used for calculations

These fluorocarbons are consumed for various purposes such as refrigerants, aerosol propellants, opened foams, closed foams, and solvents in a wide variety of devices and usages. Emission sources and gas species are diverse and complicated, thus there are various way to aggregate fluorocarbons depending on different methods and models used for calculations. For example, when submitting data to this database, some models aggregated detailed fluorocarbons emissions sources simply into "long-lived" fluorocarbons in the atmosphere including PFCs, SF_6 and HFC-23 and "short-lived" fluorocarbons including all HFCs except for HFC-23, which have relatively shorter atmospheric lifetimes compared to other fluorocarbons but longer atmospheric lifetimes compared to N_2O and CH_4. For another example, some models sorted them simply by GHG type such as HFC, PFC, SF_6.

2) Coverage of fluorocarbon species

There are a lot of types of fluorocarbons such as CFC-11, CFC-12, CFC-13, HCFC-22, HCFC-141b, HFC-23, HFC-134a, HFC-152a, CF_4, C_2F_6 and so on. Thus, the coverage of types of fluorocarbons for model calculations is another complicated element for comparisons across different scenarios. For example, some models took into account only fluorocarbons regulated under the Kyoto Protocol, that is to say HFCs, PFCs, SF_6; but other models cover HFCs, PFCs, SF_6 as well as other fluorocarbons under the regulation of the Montreal Protocol such as CFCs and HCFCs. In the latter case, some models aggregate CFCs, HCFCs and HFCs into one category because HFCs are used as alternative gases for CFCs and HCFCs.

3) GWP values used for calculations

A large variety of GWP values of different fluorocarbons is another complex factor for comparisons across all fluorocarbon emissions scenarios. In addition, these GWP values are also largely revised along with the update of the IPCC assessment reports from the SAR (IPCC, 1995a), the TAR (IPCC, 2001a), to the AR4 (IPCC, 2007a). For example, the GWP of HFC-134a in the time horizon of 100 years is 1300, 1300, and 1430 in the SAR, the TAR and the AR4, respectively; the GWP of HFC-23 is 11700, 12000, and 14800 in the SAR, the TAR and the AR4, respectively; the GWP of CF_4 is 6500, 5700, and 7390, in the SAR, the TAR and the AR4, respectively; the GWP of SF_6 is 23900, 22200, and 22800 in the SAR, the TAR and the AR4, respectively. Resolution of gas species is different from one model to another. Thus, when aggregating fluorocarbon emissions into a certain group, some models used several different GWP values according to different gas species but other models used only one representative value, for example the GWP value of HFC-134a as a representative gas.

Thus, in this Emissions Scenarios Database, it is not possible to compare all scenarios in the same manner accurately because the boundary of the coverage of fluorocarbons are different and data assumptions used for CO_2 equivalent calculation by using GWP values also differ from one model to another. It is important to understand these provisos when comparing the range of fluorocarbon emissions pathways.

Table 3.8 shows the median and the interquartile range of the total fluorocarbon emissions of all scenarios, and Figure 3.8 shows the variety of fluorocarbon emissions pathways. As explained above, the coverage of fluorocarbon species is different; fluorocarbon emissions scenarios in the SRES (i.e. Figure3.8a) and the TAR (i.e. Figure3.8b, Figure3.8c) cover not only fluorocarbons regulated under the Kyoto Protocol (i.e. HFCs, PFCs and SF_6) but also fluorocarbons regulated under the Montreal Protocol (i.e. CFCs and HCFCs), whereas the AR4 (i.e. Figure3.8d, Figure3.8e) only takes into account fluorocarbons under the Kyoto Protocol (i.e. HFCs, PFCs and SF_6). This is the main reason for the different features of emissions pathways, especially in the first half of the century, comparing the SRES, the TAR and the AR4. The Montreal Protocol regulates the phase-out schedule of the production and consumption of CFCs and HCFCs. For example, production and consumption of CFCs in the developed countries was already abolished by 1996, but those of CFCs in the developing countries are permitted until 2010. Those of HCFCs which are alternatives of CFCs are still permitted but must be abolished by 2030 and 2040 in the developed and developing countries respectively, at the time when scenarios were developed in the SRES and the TAR[1]. This is the reason why the total fluorocarbon emissions decrease from 1990 to 2030 in the SRES and the TAR. However, the total fluorocarbon emissions in the SRES and the TAR rise gradually from 2030 due to the increase of HFCs, PFCs and SF_6 emissions. With regard to the AR4 considering HFCs, PFCs and SF_6 emissions, the median value of non-intervention scenarios increases slightly after 2030 and shows the similar feature with the median value of non-intervention scenarios in the SRES and the TAR. The median value in 2100 of the AR4 is 2.0 Gt-CO_2 eq by a factor of 4.5 times that of the figure in 2000 in non-intervention scenarios and 0.8 Gt-CO_2 eq which is still 1.9 times larger than the figure in 2000 in intervention scenarios.

[1] The Montreal Protocol amended the phase-out schedule and brought forward by 10 years the schedule for reducing production and consumption of HCFCs, that is to say, those HCFCs that need to be abolished by 2020 and 2030 in the developed and developing countries respectively. These latest amendments are not considered in the results of the SRES and the TAR.

Table 3.6 Global CH_4 emissions.

	range	2000	2010	2020	2030	2050	2100	CAGR 2000-2020	CAGR 2020-2050	CAGR 2050-2100
SRES	75%	6.8	7.7	8.9	10.3	11.9	13.0	1.36%	0.98%	0.18%
	50%	**6.8**	**7.5**	**8.7**	**9.8**	**10.9**	**11.5**	**1.25%**	**0.76%**	**0.11%**
	25%	6.8	7.4	8.2	9.0	10.2	6.8	0.96%	0.71%	-0.79%
TAR (nINT)	75%	9.2	10.5	11.6	12.3	13.7	18.1	1.16%	0.57%	0.55%
	50%	**7.0**	**8.0**	**8.9**	**10.3**	**11.4**	**11.9**	**1.20%**	**0.82%**	**0.10%**
	25%	6.7	7.5	8.4	9.2	10.3	7.1	1.12%	0.70%	-0.74%
TAR (INT)	75%	7.9	8.4	9.2	10.3	11.6	12.7	0.78%	0.78%	0.18%
	50%	**6.8**	**7.5**	**8.6**	**10.0**	**10.4**	**10.1**	**1.20%**	**0.64%**	**-0.07%**
	25%	6.7	7.4	8.3	9.0	9.7	7.2	1.05%	0.55%	-0.60%
AR4 (nINT)	75%	7.1	7.7	8.8	10.0	12.2	14.9	1.11%	1.09%	0.40%
	50%	**6.4**	**7.4**	**8.3**	**9.2**	**10.6**	**12.5**	**1.31%**	**0.83%**	**0.33%**
	25%	5.9	6.7	7.7	8.5	9.7	9.5	1.28%	0.80%	-0.05%
AR4 (INT)	75%	7.1	7.5	8.6	9.4	10.5	12.1	0.95%	0.67%	0.29%
	50%	**6.4**	**7.1**	**7.4**	**8.1**	**9.2**	**7.4**	**0.76%**	**0.70%**	**-0.43%**
	25%	5.9	6.5	6.4	6.6	7.1	5.7	0.41%	0.32%	-0.45%

Note1: in units of $GtCO_2$ eq.
Note2: nINT and INT are abbreviations of non intervention scenarios and intervention scenarios, respectively.

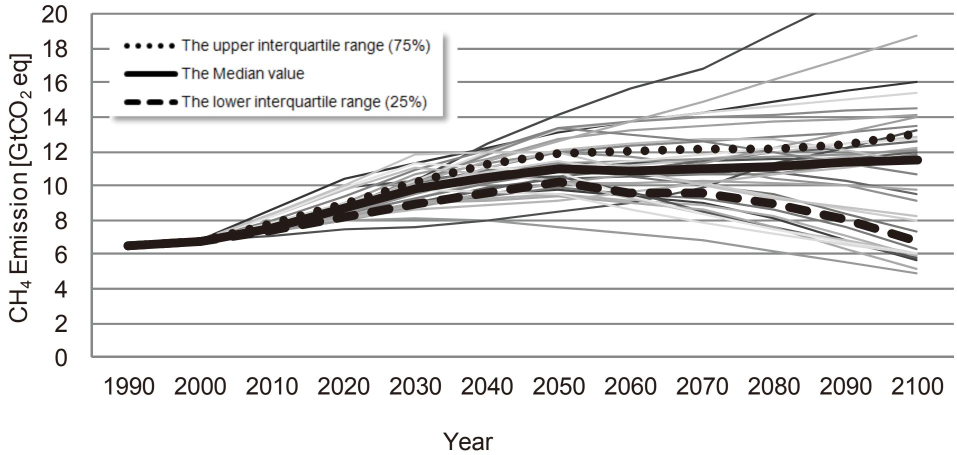

Figure 3.6.a Global CH_4 emissions (SRES).

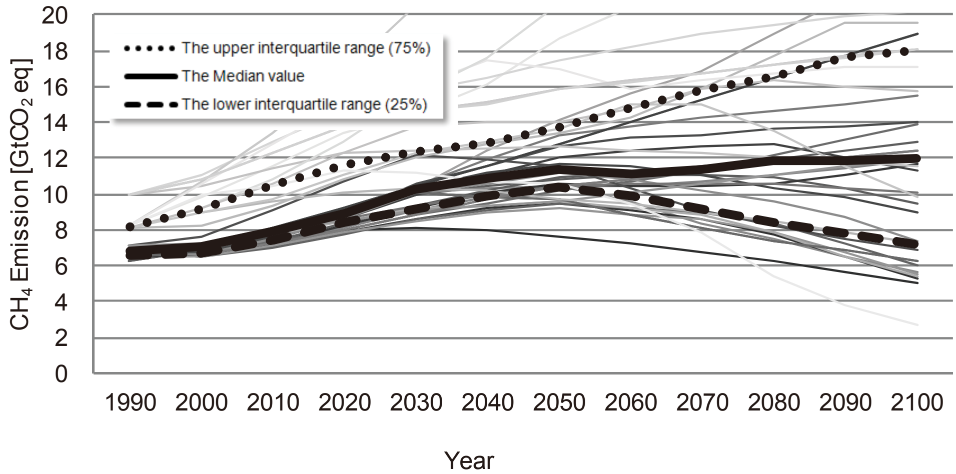

Figure 3.6.b Global CH_4 emissions (TAR without intervention).

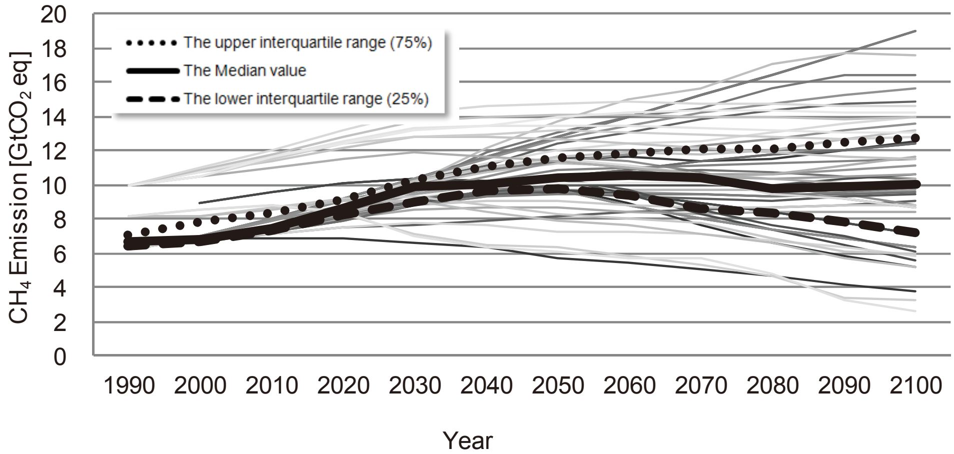

Figure 3.6.c Global CH_4 emissions (TAR with intervention).

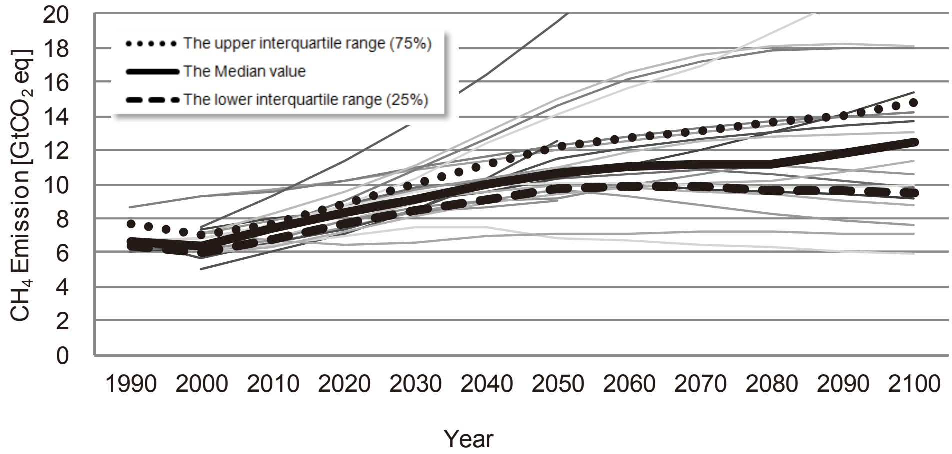

Figure 3.6.d Global CH_4 emissions (AR4 without intervention).

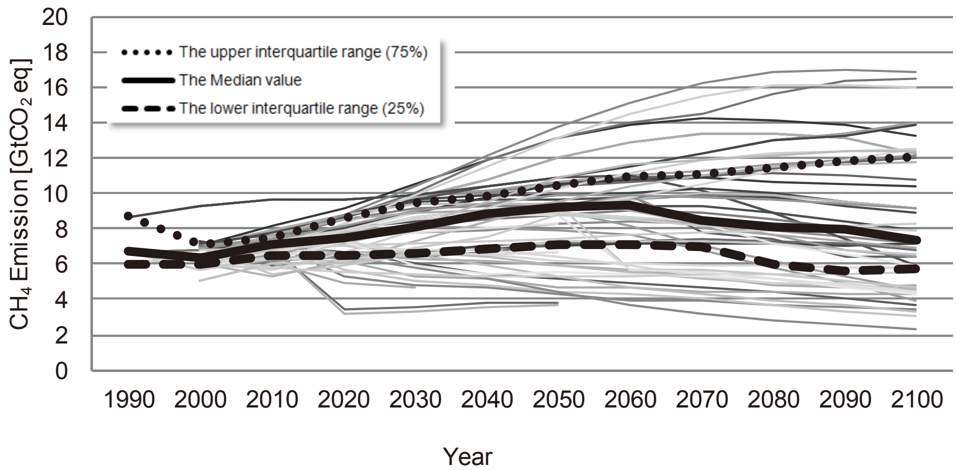

Figure 3.6.e Global CH_4 emissions (AR4 with intervention).

Table 3.7 Global N_2O emissions

	range	2000	2010	2020	2030	2050	2100	CAGR 2000-2020	CAGR 2020-2050	CAGR 2050-2100
SRES	75%	3.4	3.9	4.5	5.2	6.4	8.1	1.43%	1.17%	0.45%
	50%	**3.4**	**3.7**	**4.2**	**4.4**	**5.0**	**4.5**	**1.03%**	**0.60%**	**-0.20%**
	25%	3.4	3.2	3.2	3.2	3.3	3.0	-0.29%	0.07%	-0.19%
TAR (nINT)	75%	3.4	3.8	4.4	4.9	6.3	7.9	1.18%	1.21%	0.46%
	50%	**3.2**	**3.2**	**3.7**	**3.8**	**3.8**	**4.1**	**0.64%**	**0.10%**	**0.15%**
	25%	3.0	2.8	2.8	2.8	2.9	2.8	-0.46%	0.12%	-0.07%
TAR (INT)	75%	3.8	4.3	5.0	5.4	6.2	7.2	1.42%	0.70%	0.29%
	50%	**3.2**	**3.2**	**3.7**	**4.4**	**5.6**	**6.6**	**0.78%**	**1.32%**	**0.35%**
	25%	2.7	2.8	2.8	2.8	2.9	3.1	0.11%	0.18%	0.09%
AR4 (nINT)	75%	3.5	4.0	4.6	5.2	6.3	7.4	1.41%	1.05%	0.32%
	50%	**3.4**	**3.7**	**4.0**	**4.3**	**4.9**	**4.5**	**0.83%**	**0.67%**	**-0.20%**
	25%	2.9	3.2	3.4	3.5	3.6	3.5	0.77%	0.23%	-0.03%
AR4 (INT)	75%	3.5	4.0	4.6	5.1	6.1	7.7	1.36%	0.97%	0.47%
	50%	**3.3**	**3.5**	**3.5**	**3.7**	**4.2**	**3.7**	**0.20%**	**0.65%**	**-0.24%**
	25%	2.8	3.0	3.2	3.3	3.3	2.8	0.64%	0.11%	-0.34%

Note1: in units of $GtCO_2$ eq.
Note2: nINT and INT are abbreviations of non intervention scenarios and intervention scenarios, respectively.

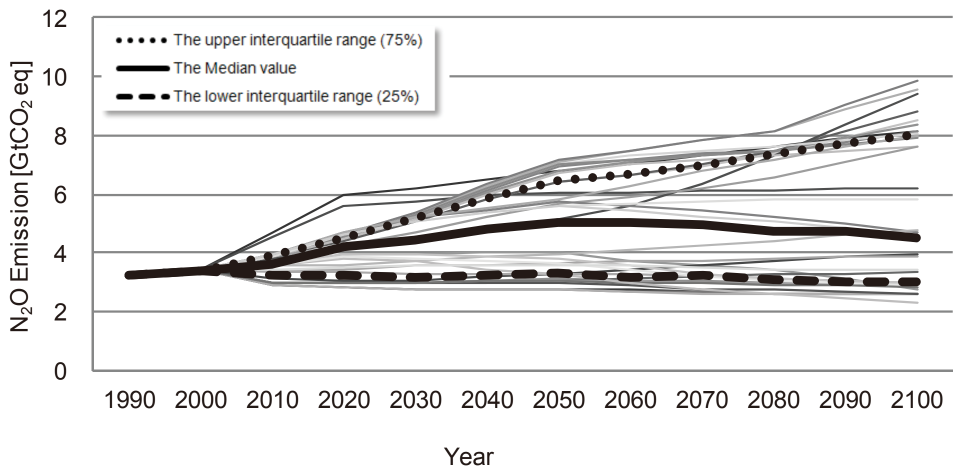

Figure 3.7.a Global N_2O emissions (SRES).

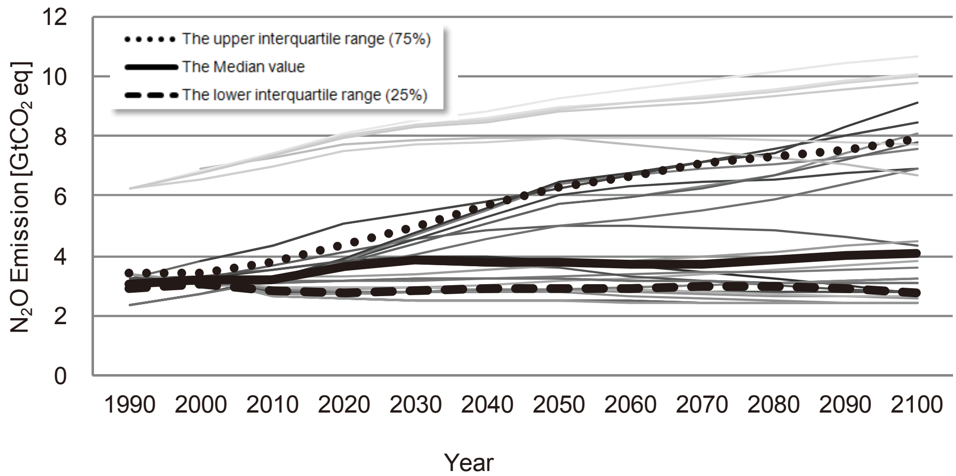

Figure 3.7.b Global N_2O emissions (TAR without intervention).

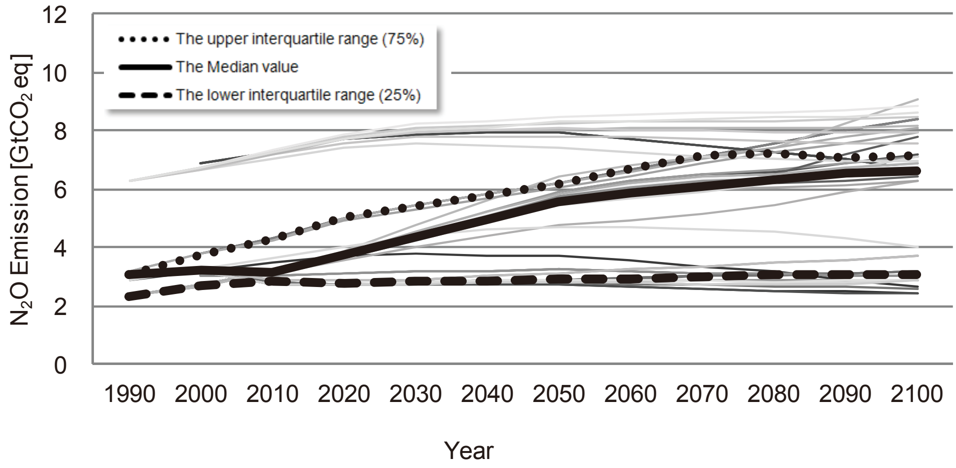

Figure 3.7.c Global N_2O emissions (TAR with intervention).

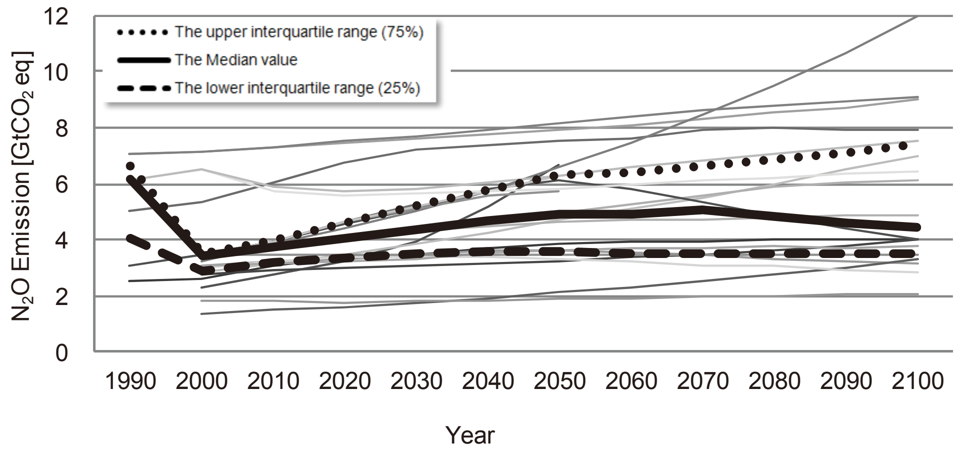

Figure 3.7.d Global N_2O emissions (AR4 without intervention).

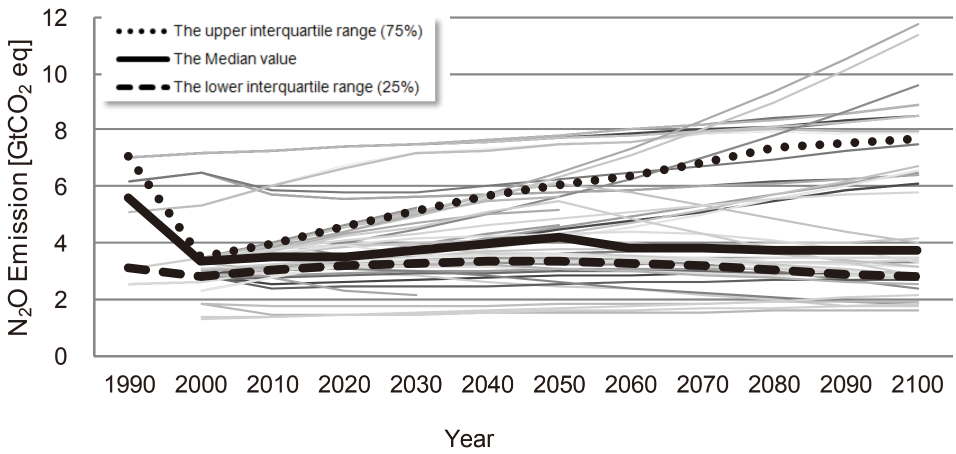

Figure 3.7.e Global N_2O emissions (AR4 with intervention).

Table 3.8 Global fluorocarbon emissions

	range	2000	2010	2020	2030	2050	2100	CAGR 2000-2020	CAGR 2020-2050	CAGR 2050-2100
SRES	75%	3.5	3.2	1.6	1.8	2.8	3.1	-3.90%	1.99%	0.16%
	50%	**3.5**	**3.2**	**1.5**	**1.5**	**2.0**	**3.0**	**-4.12%**	**0.88%**	**0.88%**
	25%	3.5	3.2	1.5	1.5	1.9	3.0	-4.14%	0.74%	0.97%
TAR (nINT)	75%	7.6	4.1	3.7	2.1	3.4	3.7	-3.55%	-0.32%	0.19%
	50%	**4.1**	**3.8**	**1.8**	**1.8**	**2.2**	**3.5**	**-3.99%**	**0.69%**	**0.87%**
	25%	4.1	3.7	1.7	1.6	2.0	1.8	-4.29%	0.44%	-0.20%
TAR (INT)	75%	7.6	4.1	3.8	2.4	3.6	3.7	-3.42%	-0.15%	0.04%
	50%	**5.9**	**3.9**	**2.8**	**2.0**	**2.9**	**3.4**	**-3.61%**	**0.15%**	**0.30%**
	25%	3.8	3.4	1.9	1.8	2.1	3.4	-3.34%	0.23%	0.99%
AR4 (nINT)	75%	0.5	0.8	1.1	1.5	2.1	3.1	4.59%	2.21%	0.71%
	50%	**0.4**	**0.8**	**1.1**	**1.3**	**1.7**	**2.0**	**4.66%**	**1.50%**	**0.29%**
	25%	0.2	0.3	0.3	0.4	0.6	0.8	1.67%	2.44%	0.56%
AR4 (INT)	75%	0.6	0.8	1.1	1.4	1.7	1.6	3.53%	1.49%	-0.12%
	50%	**0.4**	**0.8**	**0.8**	**1.0**	**1.4**	**0.8**	**2.87%**	**1.93%**	**-0.97%**
	25%	0.3	0.2	0.2	0.2	0.3	0.3	-1.99%	2.06%	-0.21%

Note1: in units of $GtCO_2$ eq.
Note2: nINT and INT are abbreviations of non intervention scenarios and intervention scenarios, respectively.
Note3: the coverage of fluorocarbon species is different; SRES and TAR cover HFCs, PFCs, SF_6 as well as CFCs and HCFCs, whereas the AR4 considers only HFCs, PFCs and SF_6.

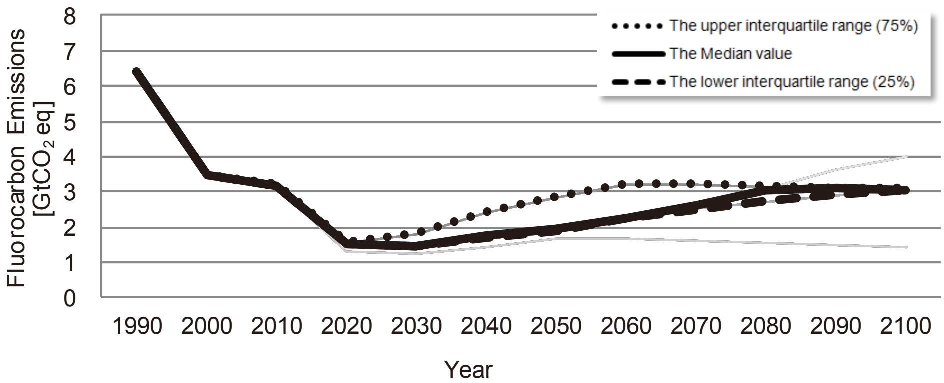

Figure 3.8.a Global fluorocarbon emissions (SRES).

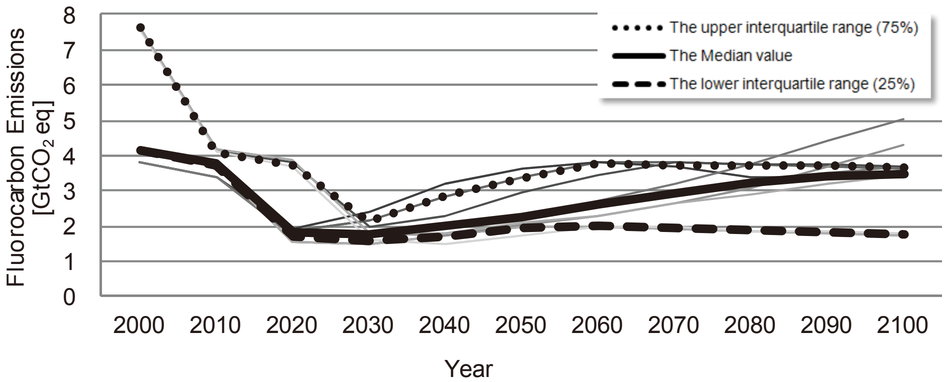

Figure 3.8.b Global fluorocarbon emissions (TAR without intervention).

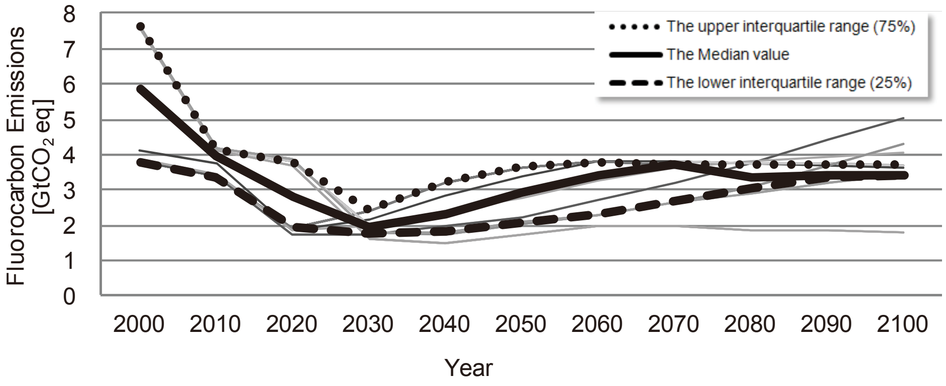

Figure 3.8.c Global fluorocarbon emissions (TAR with intervention).

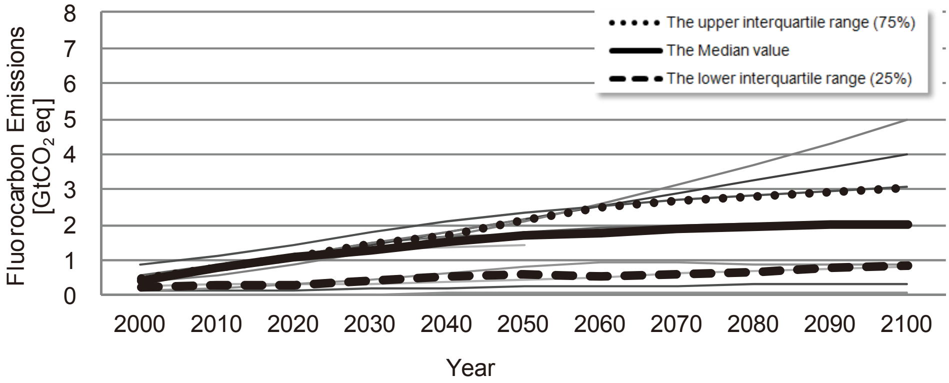

Figure 3.8.d Global fluorocarbon emissions (AR4 without intervention).

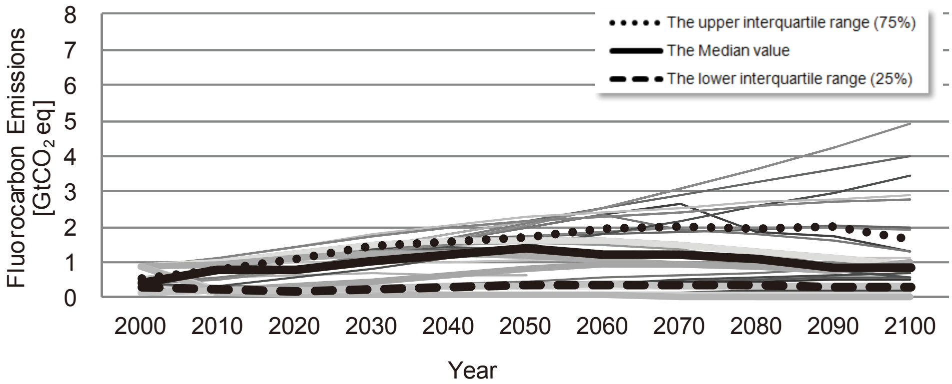

Figure 3.8.e Global fluorocarbon emissions (AR4 with intervention).

3.6. Carbon price and its impact

Figure 3.9 shows the results of carbon prices (i.e. marginal abatement costs) in intervention scenarios in the TAR and the AR4. In non-intervention scenarios, no mitigation measures are considered, thus the abatement cost does not occur. Table 3.9 shows the summary of the results of carbon prices in the median and the interquartile range (i.e. 25^{th}–75^{th} percentile range) on the upper and the lower boundaries.

The marginal abatement cost represents the abatement costs of a unit reduction of CO_2, and the marginal abatement cost can be interpreted as a certain carbon pricing measure such as the level of a carbon tax or the price of an emissions trading. In this context, the results of carbon pricing in this database can be translated as carbon tax scenarios. The level of marginal abatement costs varies widely depending on the settings of different strength of global GHG emissions constraints. The more stringently constrained a global GHG stabilization level becomes, the higher the marginal abatement cost required is. In Table 3.9, the interquartile range of marginal abatement cost of all scenarios in 2100 are between 367 to 1882 US$/t-$CO_2$. The pathways of median values of carbon pricing in the TAR and the AR4 are quite similar, though it is not inevitable but coincidental, because the number of mitigation scenarios and the strength of emissions constraints in these mitigation scenarios differed between the TAR and AR4. The effect of carbon pricing on CO_2 emissions reductions is discussed in Section 4.2.

Table 3.9 Global carbon tax scenarios as a mitigation measure.

		2000	2010	2020	2030	2050	2100	CAGR 2000-2020	CAGR 2020-2050	CAGR 2050-2100
TAR (INT)	75%	128	242	468	686	901	1723	6.68%	2.21%	1.31%
	50%	**51**	**92**	**167**	**209**	**458**	**971**	**6.15%**	**3.42%**	**1.51%**
	25%	23	40	65	82	139	458	5.33%	2.58%	2.41%
AR4 (INT)	75%	55	93	225	367	653	1882	7.27%	3.61%	2.14%
	50%	**51**	**56**	**124**	**199**	**367**	**925**	**4.49%**	**3.69%**	**1.87%**
	25%	43	22	49	80	198	367	0.73%	4.75%	1.24%

Note1: in units of US\$/tCO_2.
Note2: nINT and INT are abbreviations of non intervention scenarios and intervention scenarios, respectively.
Note3: Carbon price is shown at constant 1990 prices in the TAR. But it is necessary to note that carbon price is shown at different constant prices in 1990, 1995, 1997 or 2000 depending on the different literature sources in the AR4.

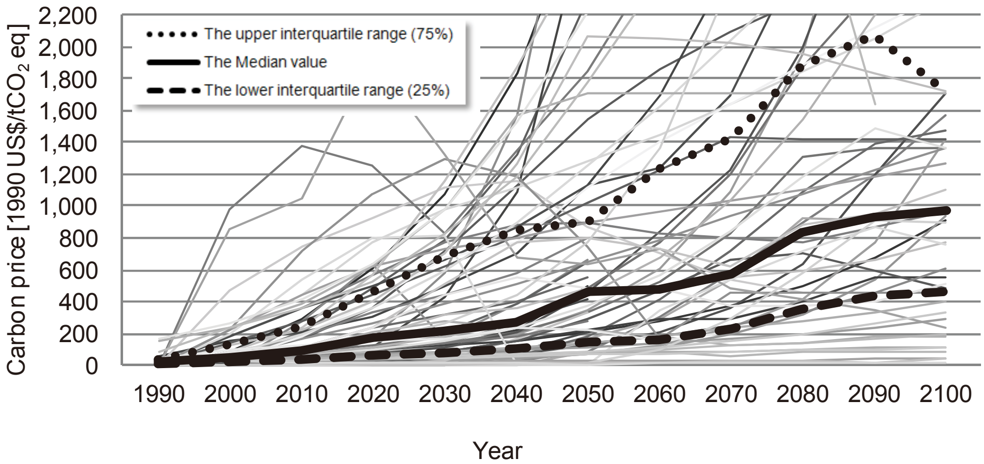

Figure 3.9.a Global carbon pricing(TAR).

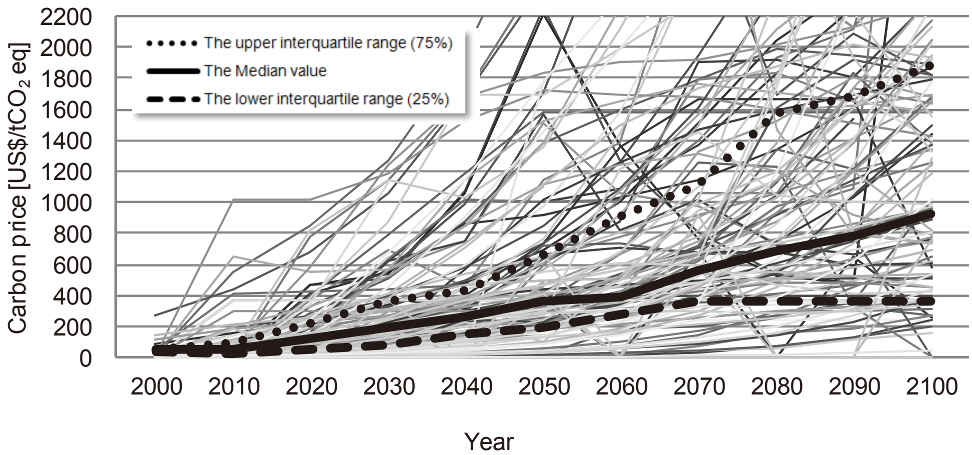

Figure 3.9.b Global carbon pricing (AR4).

3.7. Reproducibility of the IPCC assessment reports

This database includes emissions scenarios data reviewed in the IPCC assessment reports of the SRES, the TAR and the AR4. Thus, it can be confirmed that the charts and diagrams in the IPCC reports can be reproduced using this database. As for the procedure for reproducing figures in the IPCC assessment reports, please see Section 2 in Appendix A in detail.

Figure 3.10 shows the reproducibility of Figure 6-5 on page 304 of the SRES (IPCC, 2000), as an example of one of results shown in the SRES. Figure 3.11 shows the reproducibility of Figure 2-3 (Global Emission from Mitigation Scenarios for 500ppm Stabilization) shown on page 130 of the TAR (IPCC, 2001). Figure 2-2 on page 130, Figure 2-13 on page 150 and Appendix 2.1 on page 166 in the TAR can also be reproduced using the information in this database. Figure 3.12 shows the reproducibility of Figure 3-17 (Category I Global CO_2 Emissions) on page 199 in the AR4. Analysis of the information of this database also enables reproduction of various graphs and tables contained in the AR4.

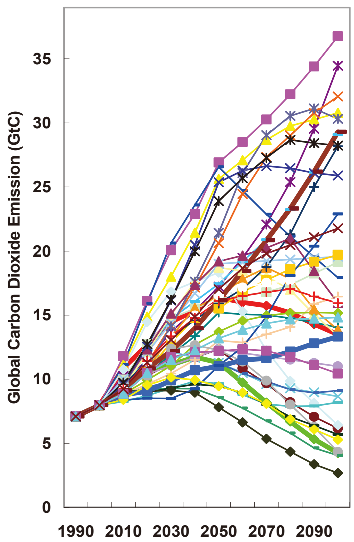

Figure 3.10a
Filtered results from the database[2].

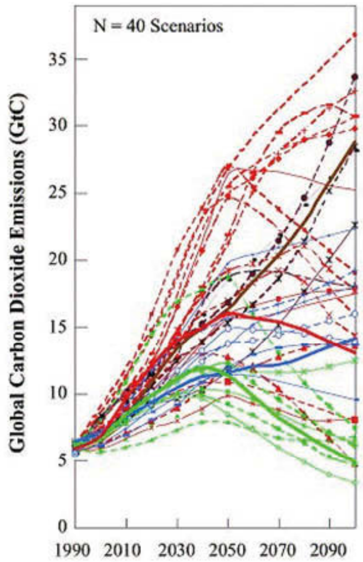

Figure 3.10b
Figure 6-5 in the SRES.

[2] The filtered results were converted to graph form for comparison with Figure 6-5 of the SRES.

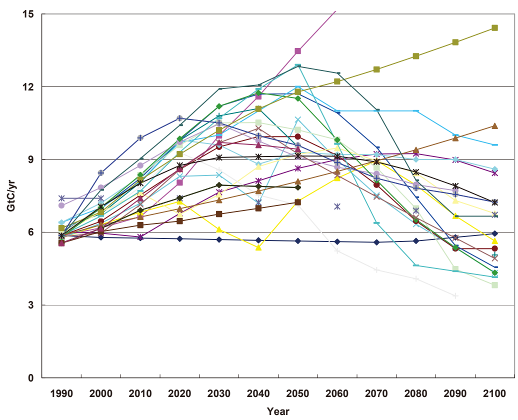

Figure 3.11a
Filtered results from the database[3].

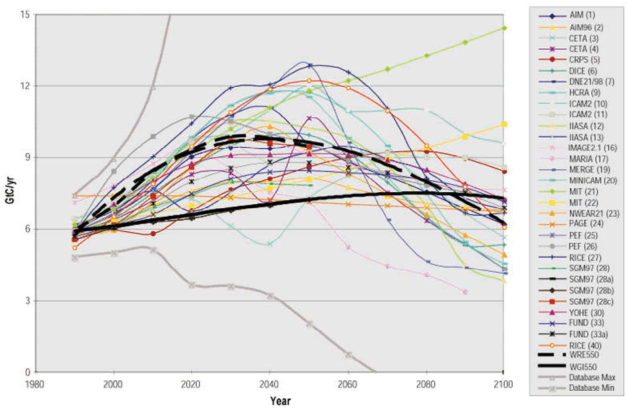

Figure 3.11b
Figure 2-3 in the TAR.

Note: Global CO_2 Emission from Mitigation Scenarios for 550ppmv Stabilization

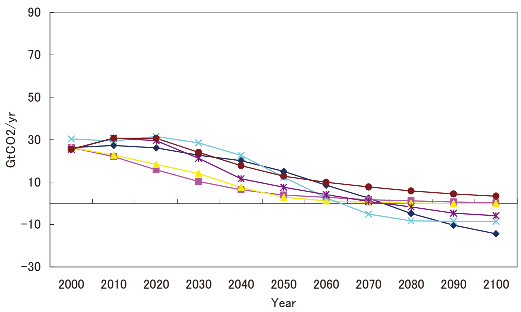

Figure 3.12a
Filtered results from the database[4].

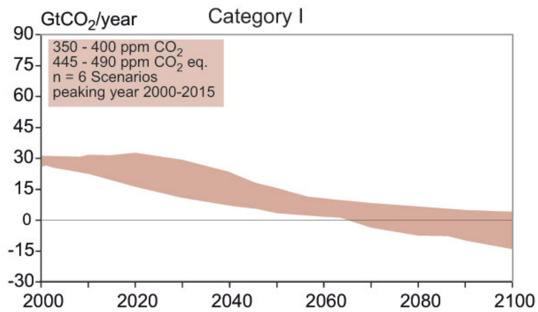

Figure 3.12b
Figure 3.17 (Category I) in the AR4.

[3] The filtered data was converted to graph form for comparison with Figure 2-3 of the TAR.
[4] The filtered results were converted to graph form for comparison with Figure 3.17 of the AR4.

4. Mitigation Scenario Analysis based on the Database

4. Mitigation Scenario Analysis based on the Database

4.1. Characterization of mitigation scenarios

In this chapter, taxonomic classification of scenarios is summarized based on the previous studies from the IPCC assessment reports. Emissions scenarios can be broadly divided into two main types: “non-intervention (i.e. reference or baseline)” and “intervention” scenarios (IPCC, 1995). However, in certain cases, there is no clear-cut distinction between intervention and non-intervention scenarios. Intervention scenarios are often referred to as mitigation scenarios that consider the effects of climate measures.

Since the IPCC developed the first set of non-intervention emissions scenarios in 1990, the reference scenarios have been updated by considering the circumstances of the moment, and the SRES scenarios became the principle source and the most broadly utilized reference scenarios to date. Many mitigation scenarios have since been discussed based on the SRES scenarios, and there were some attempts to classify these mitigation scenarios. Rana and Morita (2000) and the TAR (IPCC, 2001b) are two prominent studies that reviewed post-SRES scenarios using this Emissions Scenarios Database. In these studies, mitigation scenarios are broadly classified into four categories according to the relevant climate policy goals they examine at that time. The four categories are as follows:

1) concentration stabilization scenarios
2) emission stabilization scenarios
3) safe emission corridor (tolerable windows / safe landing) scenarios,
4) other mitigation scenarios.

However, since the TAR, various types of mitigation scenarios have been developed both on a global and a national scale, and both from short-term to long-term aspects. Thus it is not suitable to apply the previous TAR classification to mitigation scenarios developed since the TAR, because other parameters or characteristics are not taken into account, and aspects other than climate policy goals cannot be considered.

Hanaoka et al. (2006a; 2006b) reclassified the post-TAR mitigation scenarios in a different systematic manner, by taking the previous TAR classification of mitigation scenarios a step further and considering additional contributing factors broadly. The post-TAR mitigation scenarios are classified in two different ways, according to "scenario characteristics" and "climate policy goals". Mitigation scenarios are firstly classified into four characteristics and their sub-categories according to the characteristics of the scenario, and secondly, in terms of the climate policy goals, mitigation scenarios are further classified by two categories of climate policy goals and sub-categories, as shown in Table 4.1. These sub-categories may be further subdivided depending on the type of the study.

Table 4.1 Classification of the post-TAR mitigation scenarios.

	Category	Sub-category
scenario characteristics	Geographical coverage	Single global scenario, multiregional global scenario, single regional scenario, multinational regional scenario, or national scenario
	GHG coverage	CO_2 only scenario, six Kyoto GHGs (CO_2, CH_4, N_2O, HFC, PFC, SF_6) scenario, or all GHGs scenario including other anthropogenic gases (CFCs, HCFCs, SOx, NOx, CO, NMVOC, black carbon, etc.) scenario
	Sectoral scale	Specific sector scenario (for instance, energy, transport, agriculture) or multi-sectors scenario
	Time horizon	Short term scenario (~ 2030), medium term scenario (~ 2050), or long term scenario (~ 2100 or more)
climate policy goals	Target setting approach	Concentration stabilization target, emission stabilization target, climate change target (e.g. temperature rise target or sea level rise target), direct impact target (e.g. food production or ecosystem), indirect impact target (e.g. economic activities), political target based on international agreement (e.g. the Kyoto Target), political target based on multilateral agreement or national action plan, or other targets.
	Non-target approach	Best available technologies, best economically feasible technologies, best practicable environmental options, or other criteria

Thus, a certain scenario is ideally classified in terms of combinations of the above-mentioned characteristic sub-categories. For example, a set of scenarios might be described as "multiregional global level scenarios dealing with six Kyoto GHGs in multiple sectors with a time horizon of 2100, targeting the GHG concentration stabilization constraint at 450 ppmv-CO_2 equivalent". The same methodology can also be applied to other types of mitigation scenarios.

In the IPCC AR4 (IPCC, 2007b), GHG emissions scenarios on a global scale under a certain climate policy target were focused upon, and the post-TAR mitigation scenarios were summarized into six different stabilization scenario categories (Categories I - VI) by considering the range of radiative forcing, CO_2 equivalent concentration, and a global mean temperature increase above pre-industrial levels, as shown in Table 4.2, in order to simply compare emission pathways and peaking year for CO_2 emissions among different GHG stabilization categories.

Table 4.2 Categorization of post-TAR stabilization scenarios in the AR4.

Category	Radiative forcing	CO_2 concentrations	CO_2-equivalent of GHG concentrations	Global temperature increase after the industrial revolution	Peaking year for CO_2 emissions	Change in global CO_2 emissions in 2050 (percent of 2000 emissions)	Number of assessed scenarios
	W/m²	ppm	ppm	℃	Year	%	
I	2.5 ~ 3.0	350 ~ 400	445 ~ 490	2.0 ~ 2.4	2000 ~ 2015	-85 ~ -50	6
II	3.0 ~ 3.5	400 ~ 440	490 ~ 535	2.4 ~ 2.8	2000 ~ 2020	-60 ~ -30	18
III	3.5 ~ 4.0	440 ~ 485	535 ~ 590	2.8 ~ 3.2	2010 ~ 2030	-30 ~ +5	21
IV	4.0 ~ 5.0	485 ~ 570	590 ~ 710	3.2 ~ 4.0	2020 ~ 2060	+10 ~ +60	118
V	5.0 ~ 6.0	570 ~ 660	710 ~ 855	4.0 ~ 4.9	2050 ~ 2080	+25 ~ +85	9
VI	6.0 ~ 7.5	660 ~ 790	855 ~ 1130	4.9 ~ 6.1	2060 ~ 2090	+90 ~ +140	5
						Total	177

Source: IPCC 4th Assessment Report, Working Group III

4.2. Example of regional mitigation analysis of the post-TAR scenarios

Global emissions scenarios to achieve sustainable development globally and reduce the impacts of climate change have been focused upon by scientists as well as policy makers. Features of regional GHG emissions pathways in the context of the multi-regional global scenarios have also attracted the attention of stakeholders. In this Emissions Scenarios Database, various multi-regional global scenarios developed by multi-sectoral and multi-regional global models were collected and stored. However, geographical breakdowns and regional classifications differ from one model to another, and it was not applicable to compare all mitigation scenarios in a detailed regional classification in the same manner. Thus, based on the Emissions Scenarios Database, Hanaoka, et al (2006a) provided quantitative analyses on relationships between CO_2 reductions and other factors such as socio-economic aspects, strength of mitigation measures, and conducted regional mitigation analyses of the post-TAR scenarios that have emerged since the TAR, at the regional level in the SRES four regional aggregations (i.e. ASIA, ALM, REF and OECD90) which is the most aggregated geographical definition used in the IPCC SRES.

Figure 4.1 is one example of the figures in Hanaoka, et al (2006a), which shows a scatter plot of carbon intensity reduction versus energy intensity improvement at 550 ppmv stabilization scenarios. Figure 4.1.a demonstrates that, in ASIA, ALM and REF, i.e. developing regions, energy intensity improvement is relatively larger than carbon intensity reduction in the first half of the 21st century, but carbon intensity reduction becomes more dominant in the latter half of the century as shown in Figure 4.1.b. Therefore, this previous study concluded that, in the first half of the century, the role of energy efficiency improvements of technologies will lead to significant advancements in energy use to reduce CO_2 emissions; in contrast, in the latter half of the century, CO_2 reductions in developing regions would be induced more relatively by reductions in carbon intensity due to an energy shift from high-carbon content fossil fuels to less carbon-intensive fossil fuels or non-fossil fuels such as renewables and nuclear.

For more details, please refer to Hanaoka, et al 2006a.

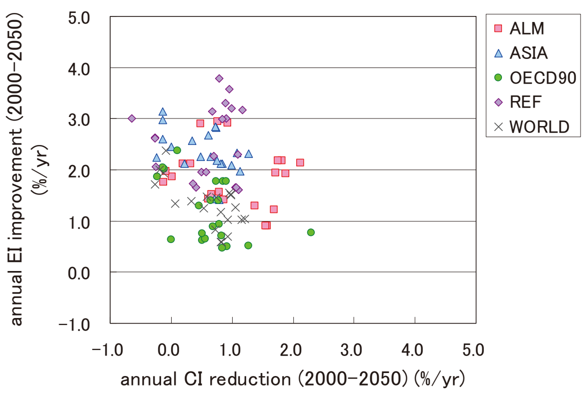

Figure 4.1.a 2000 – 2050.

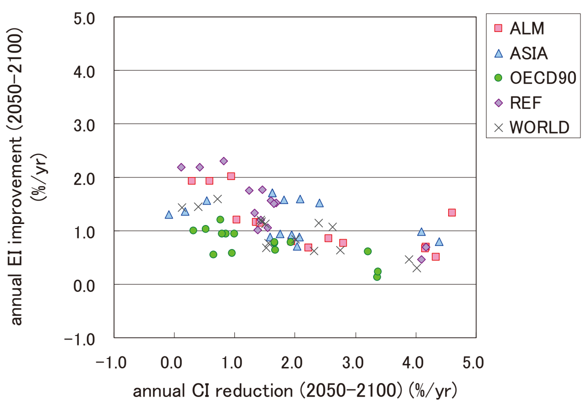

Figure 4.1.b 2050 – 2100.

Figure 4.1. Scatter plot of carbon intensity reduction versus energy intensity improvement under 550 ppmv stabilization scenarios for time horizon of (a) 2000-2050 and (b) 2050-2100.

4.3. Example of global mitigation analysis of AR4 GHG stabilization scenarios

The IPCC AR4 (IPCC, 2007b) reviewed GHG emissions scenarios on a global scale under six different stabilization scenario categorizations (Categories I - VI) as shown in Table 4.2. Figure 4.2 reproduces the target-specific global CO_2 emissions under the same stabilization categorizations in the AR4, by using this Emissions Scenarios Database. The solid lines indicate the median values in each category, and the dashed lines indicate the upper and lower boundaries of the interquartile range (between the 25th - 75 percentile) in each stabilization scenario category. Depending on differences in assumptions such as model characteristics and socio-economic growth, the emissions scenarios and the related results will vary considerably even in the same stabilization category. For example, in order to achieve the most stringent stabilization targets (i.e. categories I), a large amount of emissions reductions is required and even CO_2 emissions need to become negative after 2070 by considering the effect of carbon absorption measures such as carbon capture and storage (CCS) and afforestation.

The AR4 indicated GHG emissions pathways in the long term under the different stabilization scenario categorizations, however, it did not assess the effects of underlying mitigation measures in each stabilization scenario category. In addition, it is important to assess the effects of energy savings and understand the relationships between energy efficiency improvement and other factors such as economic growth, reduction potentials and the rate of these transitions, in the short-term (to the year 2020) and the mid-term (to the year 2050) in the context of the long-term (to the year 2100). Thus Hanaoka, et al (2009) provided in-depth analyses of the role of energy intensity improvement in the short- to mid-term in the context of the long-term GHG stabilization scenarios using the latest Emissions Scenarios Database. This paper applied quantitative decomposition analyses using the extended Kaya identity to the stabilization scenarios in Categories I to IV on a global scale, and also to Category IV scenarios on a national/regional scale for major GHG-emitting countries, such as the U.S., Western EU, China, and India, utilizing the large number of reports in the database. This study provided in-depth analyses of the relationship between energy intensity improvement and other major indicators, and Figure 4.3 and Figure 4.4 are major example results on a global scale, in Hanaoka, et al (2009). Figure 4.3 shows the relationship between change of energy intensity and cumulative CO_2 emissions from the year 2000. The more stringent the stabilization target sets, the higher the required level of energy intensity improvement becomes; however, it can be seen that energy intensity is expected to improve at a certain standard rate even in the baseline scenario under the current business as usual trends. Figure 4.4 shows the relationship between change of carbon intensity and cumulative CO_2 emissions from the year 2000. The more stringent the stabilization target becomes, the greater the reduction rate of carbon intensity becomes during the first half of the 21st century. However, in the most stringent stabilization targets (i.e. categories I - II), the level of carbon intensity settles in the latter half of the century along with the stabilization of the cumulative CO_2 emissions. Therefore, this previous study concluded that energy intensity improvement plays the most important role in reducing CO_2 emissions in the short term in any stabilization category and the rate of improvement is assumed around 2%/year as a median value across Category I-III; however, the more stringent the stabilization target becomes, the more important is the role played by carbon intensity reductions.

For more details, please refer to Hanaoka, et al 2009.

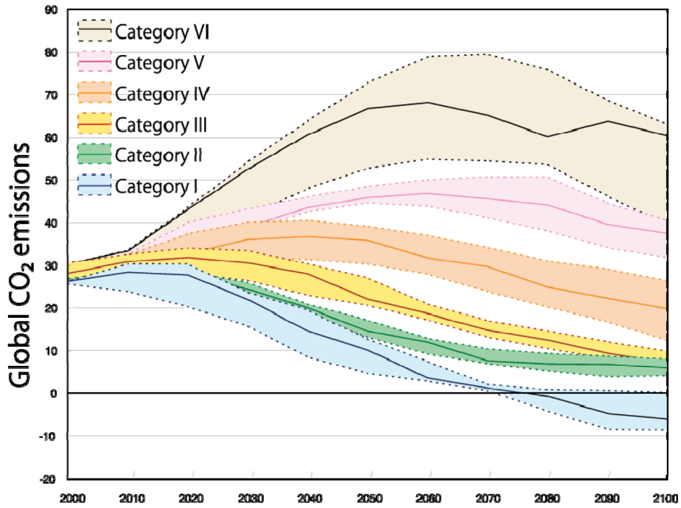

Figure 4.2 Target-specific Global CO_2 emissions.

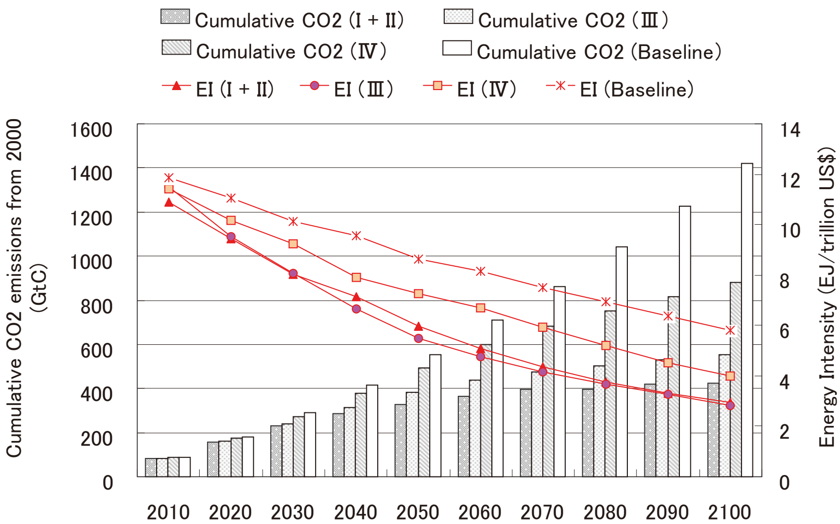

Figure 4.3 Relationship between change of energy intensity and cumulative CO_2 emissions from the year 2000.

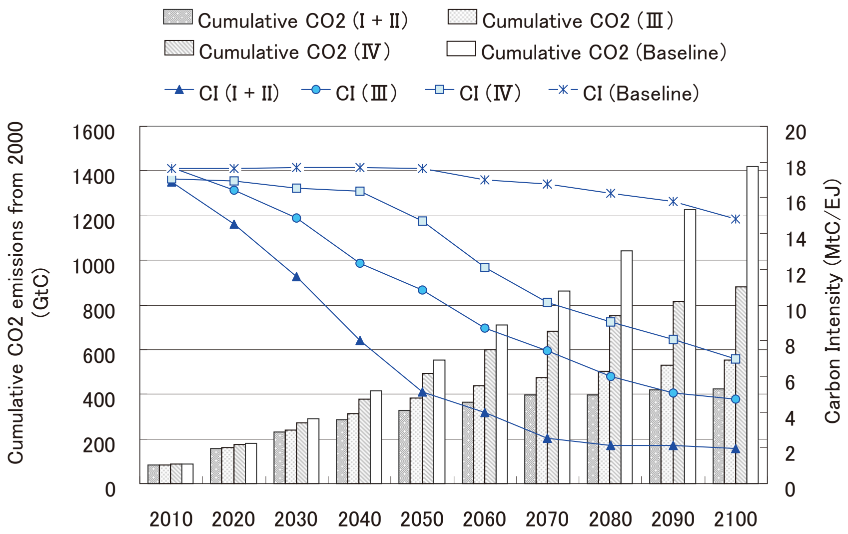

Figure 4.4 Relationship between change of carbon intensity and cumulative CO_2 emissions from the year 2000.

5. Conclusion

5. Conclusion

The Emissions Scenarios Database has been developed by reviewing various journal papers and reports and contributed to the process of publishing the IPCC assessment reports. The latest database covers the data on GHG emissions as well as relevant information such as driving forces and energy consumption, and especially includes scenarios reviewed in the IPCC SRES, the TAR, the AR4 and the Representative Concentration Pathways (RCP) which will be reviewed in the IPCC Fifth Assessment Report. Using the database, any users can reproduce the same figures related to this database, shown in the SRES, the TAR and the AR4.

This report briefly provided and explained the different features between the SRES, the TAR and the AR4 with regard to major indicators such as GDP, population, energy consumption, and GHG emissions. The results of mitigation scenarios vary widely due to various factors such as data assumptions and methodologies, thus this report analyzed the characteristics of emissions scenarios in the median value and also in the interquatile range (i.e. 25^{th}–75^{th} percentile range) on the upper and the lower boundaries.

Based on the database, it is possible to analyze regional mitigation scenarios and also global GHG stabilization scenarios at different stabilization levels. This report introduced some example results showing how to utilize the database by conducting regional mitigation analysis and global mitigation analysis. By using the database, a decomposition analysis of CO_2 emissions can be conducted and it is possible to quantitatively analyze the relationships between CO_2 reductions, energy efficiency improvement, carbon intensity reduction, and other factors such as economic growth, population growth from the short-term to the mid- and the long-term. Thus, factors involved in mitigation scenarios for different groups of stabilization concentrations are analyzed.

There are several provisos that must be kept in mind while interpreting the results of the database. Firstly, approaches adopted for geographical regional aggregations in the world's regions differ from one model to another. It is sometimes not applicable to compare scenarios in the same geographical manner in detailed regional classifications. For example, even though the database shows the data in Annex I or OECD, some models do not accurately fit into the regional classification of Annex I or OECD. The original regional classifications of each model are aggregated approximately in order to fit more closely to the regional definition of Annex I or OECD. Secondly, the number of studies is not enough for conducting analyses in some GHG stabilization categories. For example, the number of studies classified as Categories I and II scenarios in the AR4 are inadequate for extended detailed decomposition analysis due to lack of data. Other provisos are the difference of definitions and coverage such as coverage of target GHGs, resolutions of sectoral coverage and energy-type coverage, definitions of driving forces, and difference of conversion factors such as conversion from electricity to primary energy and conversion from non-CO_2 GHG to CO_2 equivalent amount. These key settings also have a large effect on different features in emissions scenarios. Discussing the wide diversity of mitigation scenarios derived from various differences is an indispensable issue.

Finally, it is necessary to continue developing the database, review the various types of scenarios – especially scenarios in more stringent stabilization categorizations – and conduct more precise and comprehensive comparisons of the emissions and mitigation scenarios. This report provides useful information for understanding the results of the IPCC assessment reports, and it is expected to support the development of new scenarios in order to contribute to the process of publishing the IPCC Fifth Assessment Report, and supply meaningful mitigation policy strategies for policymakers.

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APPENDIX A　Database Operation Manual

APPENDIX A Database Operation Manual

1. Database Basic Operations

1.1. Overview of Database Function Selection

This database was created using Microsoft Access and stores a wide range of information on emissions scenarios. This section describes the basic operations of this database. An overview of selecting the database functions is shown in the figure below.

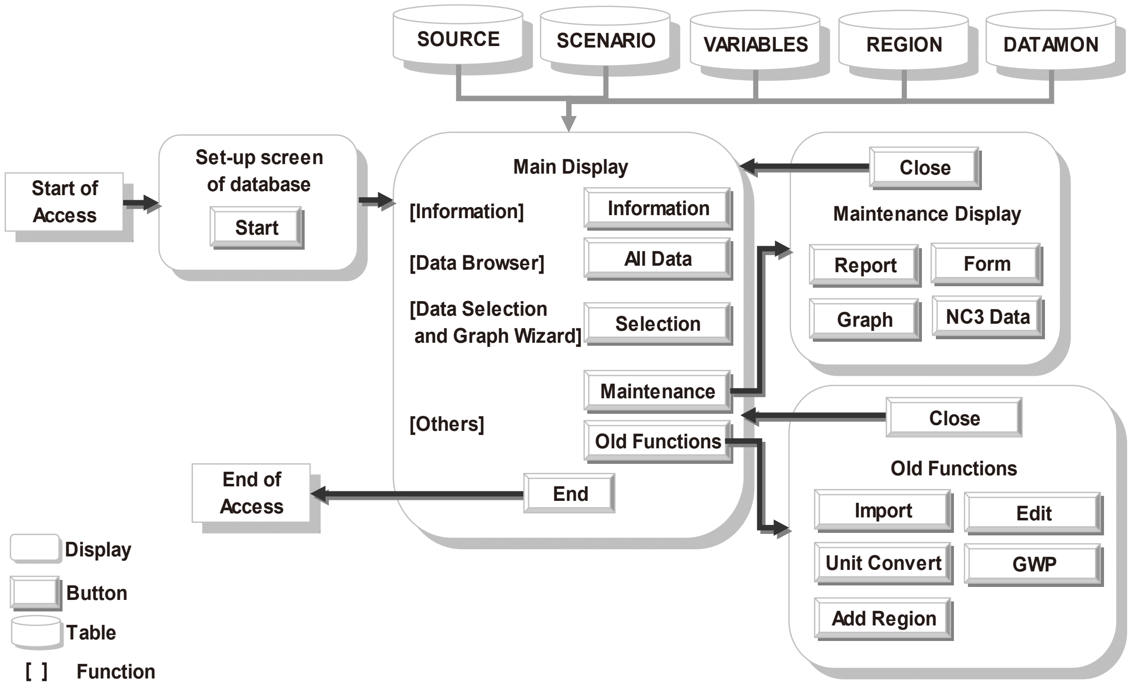


Figure A.1.1 Overview of Database Function Selection.

When the database is opened, the Welcome screen is displayed (Figure A.1.2). Pressing the [Start] button in this screen opens the Main screen (Figure A.1.3). In the Main screen, this database can be used by selecting [Information] to view scenario information, selecting [Data Browser] to view a list of overall data, selecting [Data Selection and Graph Wizard] to select specific data, and selecting [Others] to use other functions or perform maintenance.

1.2. Basic Operation

This section describes the primary functions of the database, namely, the [Information], [Data Browser], [Data Selection and Graph Wizard], and [Others] functions.

1.2.1. Welcome Screen

When Microsoft Access for this database is started, first, the screen shown below is opened (Figure. A.1.2). The Welcome screen shows the total number of sources and scenarios that are currently stored in the database. The database shown in the figure below currently has 320 sources and 1066 scenarios. Clicking the [Start] button opens the Main screen.

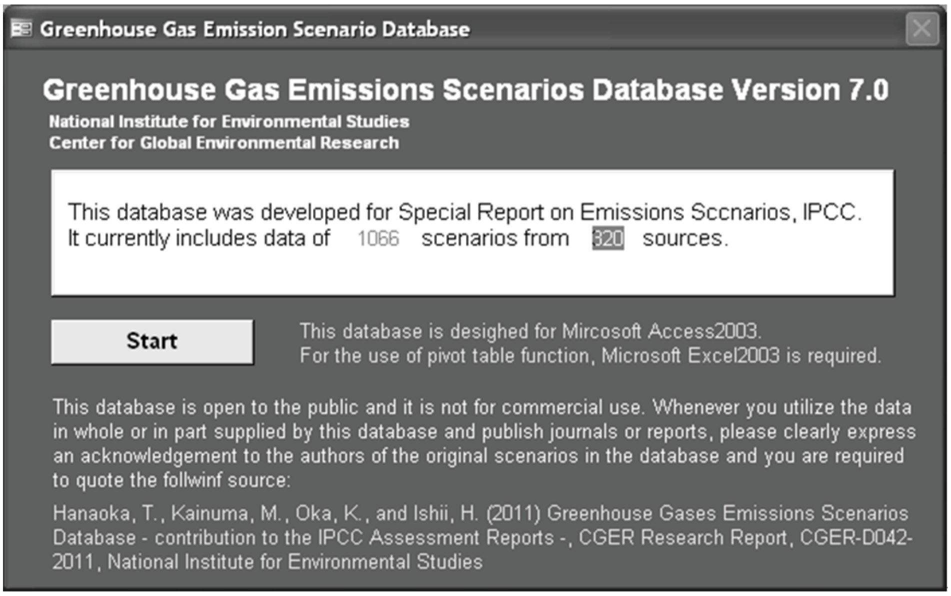


Figure A.1.2 Welcome Screen.

Table A.1.1 Functions in Welcome Screen.

Button	Function Description
[Start]	Moves to Main screen

1.2.2. Main Screen

In the Main screen, [Information] is used to view scenario information, [Data Browser] is used to view data, [Data Selection and Graph Wizard] is used to select data, [Others] is used to execute other functions and maintenance, and the [Manual] button is used to view the basic manual for the database.

The [Information] function for viewing scenario information is described in section Appendix A.1.2.3, [Data Browser] for viewing data is described in Appendix A.1.2.4, [Data Selection and Graph Wizard] for selecting data is described in section Appendix A.1.2.5, [Others] for other functions and maintenance is described in section Appendix A.1.2.6, and the operating manual is described in section Appendix A.1.2.7.

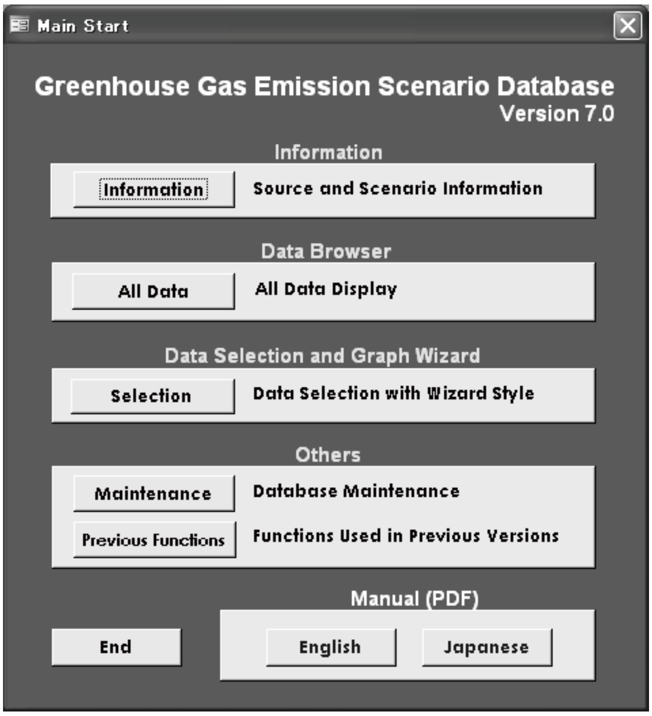


Figure A.1.3　Main Screen.

Table A.1.2　Main Screen Functions/

Button	Function Description	Notes
[Information]	Moves to Basic Information screen	This shows the basic information of the stored scenario.
[All Data]	Moves to All Data screen	This shows all stored data.
[Selection]	Moves to Data Selection screen	This uses a wizard format to select, view, filter, and graph data based on specified conditions.
[Maintenance]	Moves to Maintenance screen	This screen uses auxiliary functions to make changes to the data content. Normally, this screen is not used.
[Previous Functions]	Moves to Other Functions screen	This provides other functions that were stored in previous versions.
[End]	Exits the database	This exits the database
[English]	Shows the English-language manual	This displays the English-language manual.
[Japanese]	Shows the Japanese-language manual	This displays the Japanese-language manual.

1.2.3.　[Information] Function for Viewing Scenario Information

Pressing the [Information] button in the Main screen in Figure A.1.3 starts the [Information] function for viewing scenario information, where the basic information for various sources is displayed (Figure A.1.4). The Source ID field is a number for organizing the sources in this database. In addition to the authors (Authors field), source title (Reference field), and publication name and date (Source DB field), as much as possible, this screen also contains information for fields used in scenario analysis, such as the model name (Model field), assessment region (Regions field), and a description of the assessment scenario (Scenarios field).

Also, the Series field indicates the classification category (see Appendix A 1.2.5 for details) of the source in this database. Pressing the [Show type of Variables and units] button in Figure A.1.4 displays a variable list which shows what type of data is stored in the source (Figure A.1.5).

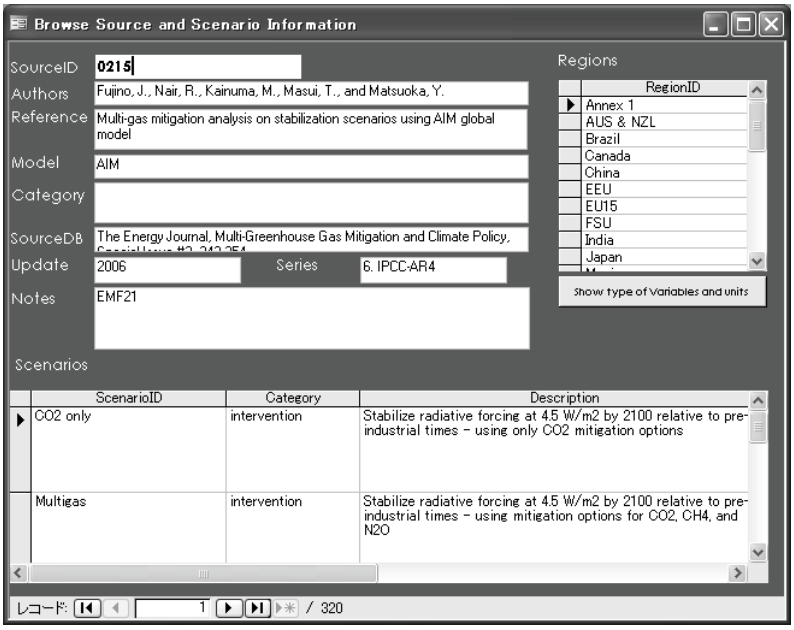


Figure A.1.4 Information Screen

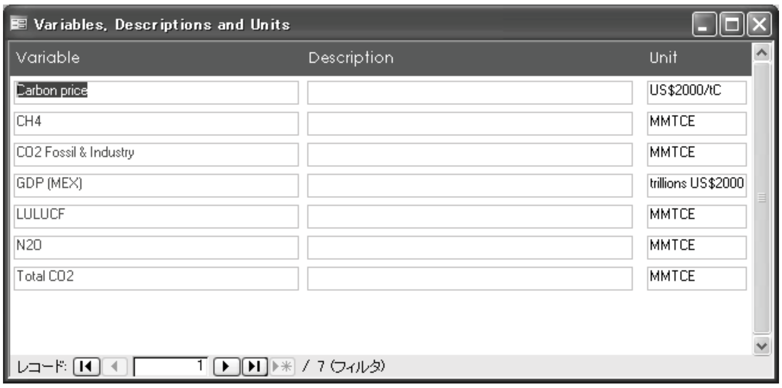


Figure A.1.5 Show Type of Variables and Units Screen

Table A.1.3 Information Screen Functions

Button	Function Description	Notes
[Show Variables]	Moves to [Variables] screen	This displays a list of the variables stored in the scenario.

1.2.4. [Data Browser] Function for Viewing Data

To display all the data stored in this database, press the [All Data] button in the Main screen in Figure A.1.3. This starts the [Data Browser] function for viewing data and opens the

All Data screen (Figure A.1.6). To select certain data for viewing by filtering the entire data, the Filter function in Microsoft Access (Right-click over the data, and select Filter) can be used to narrow down the displayed data based on specified conditions. For details on the types of data that are stored in the database, see Appendix B.2.

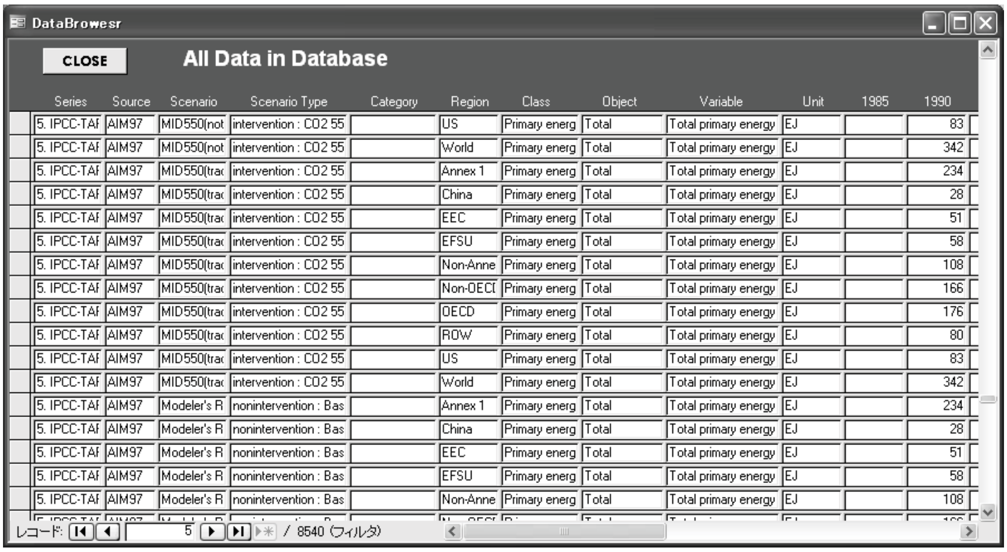


Figure A.1.6　All Data Screen.

Table A.1.4　All Data Screen Functions.

Button	Function Description	Notes
[Close]	Exits [All Data] screen	This exits the All Data screen.

1.2.5.　[Data Selection and Graph Wizard] Function for Selecting Data

To view certain data only, instead of all data stored in this database, press the [Selection] button in the Main screen in Figure A.1.3. This starts the [Data Selection and Graph Wizard] for data selection and opens the Selection screen (Figure A.1.7). Data can be selected in one of two ways depending on the purpose of the selected data.

1)　Selection screen – Method 1: Using specific conditions to filter data

For instance, to divide all stored data into types of GHG stabilization scenario (such as 550ppm CO_2, 450 ppm CO_2, and so on), in the Selection screen in Figure A.1.7: (1) Select the series → (2) Select the source → (3) Select the region → (4) Select the scenario → (5) Select the [Class] and [Object], in that order, and then click the [Next] button to display the results that match the selection conditions.

In this screen, Series refers to the data class based on the IPCC report classification (Figure A.1.8). Source refers to the ID assigned in this database for each source. Region refers to the target region that is selected from the database. Scenario refers to the GHG stabilization scenario or other scenarios. The “*” character is a wildcard, and it means that the data selection filters are not applied for this field.

All variables are defined by the [Class] and [Object] functions, and the required variables are selected based on a combination of these two. Combinations of [Class] and [Object] pertaining to important variables are filled in the displayed screen by pressing the [Selection Example] button (Figure A.1.9). For details on [Class] and [Object], see Tables B.2.9 and B.2.10 in Appendix B.

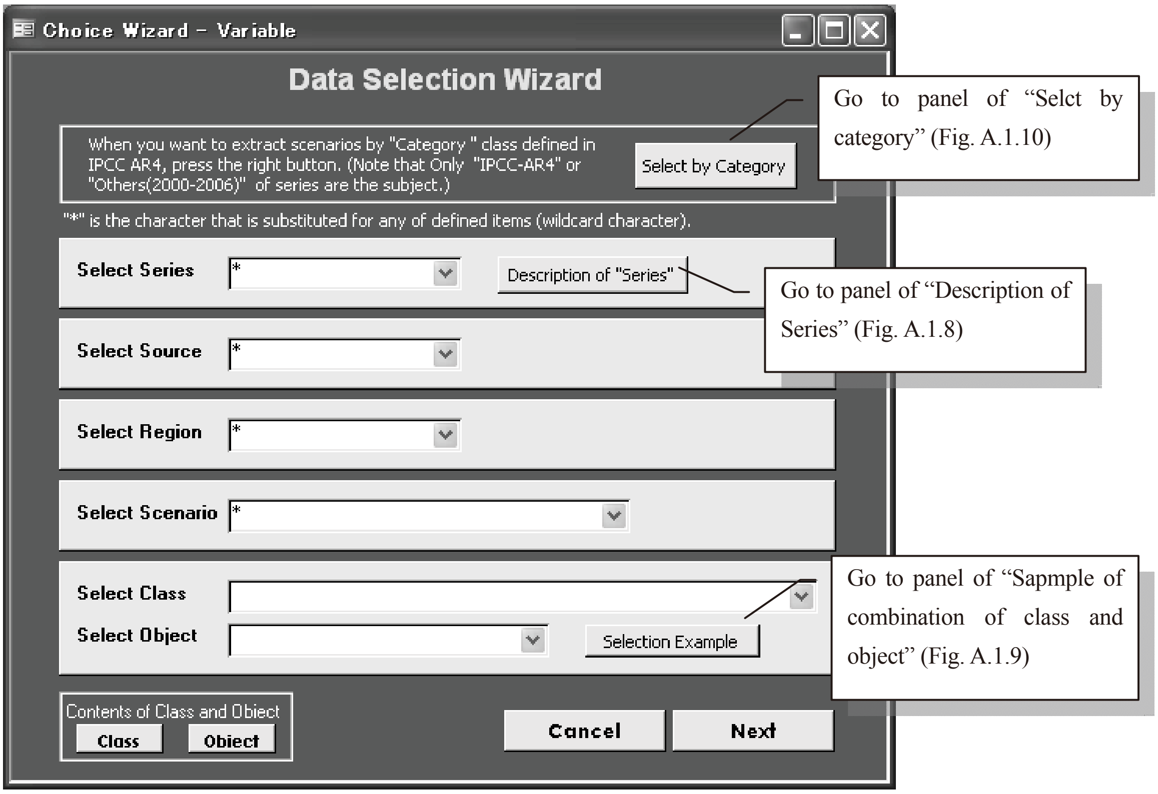


Figure A.1.7 Data Selection Screen (Selection by Stabilization Concentration Scenario).

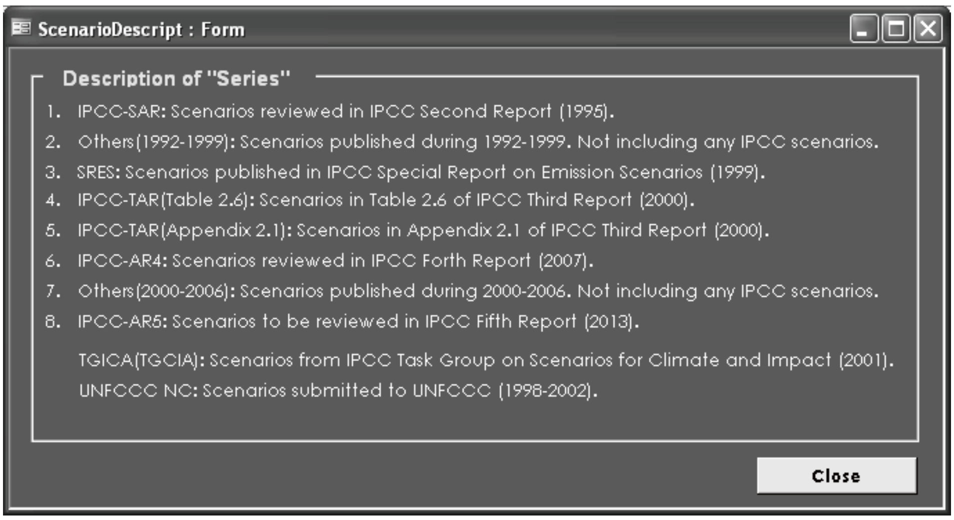
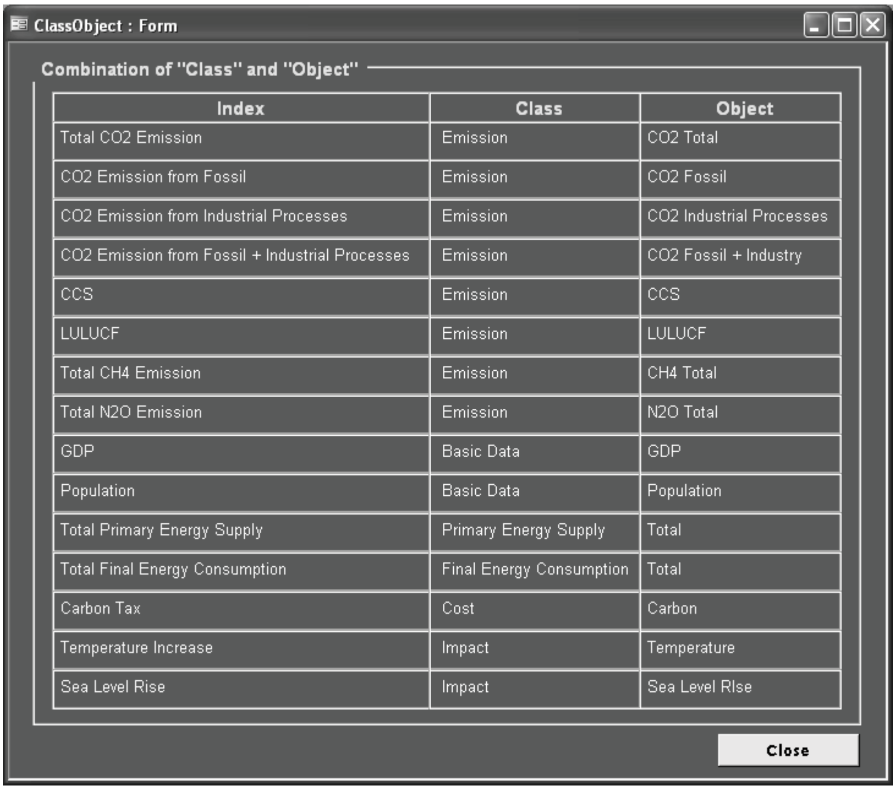


Figure A.1.8 Scenario Description.


ClassObject : Form

Combination of "Class" and "Object"

Index	Class	Object
Total CO2 Emission	Emission	CO2 Total
CO2 Emission from Fossil	Emission	CO2 Fossil
CO2 Emission from Industrial Processes	Emission	CO2 Industrial Processes
CO2 Emission from Fossil + Industrial Processes	Emission	CO2 Fossil + Industry
CCS	Emission	CCS
LULUCF	Emission	LULUCF
Total CH4 Emission	Emission	CH4 Total
Total N2O Emission	Emission	N2O Total
GDP	Basic Data	GDP
Population	Basic Data	Population
Total Primary Energy Supply	Primary Energy Supply	Total
Total Final Energy Consumption	Final Energy Consumption	Total
Carbon Tax	Cost	Carbon
Temperature Increase	Impact	Temperature
Sea Level Rise	Impact	Sea Level RIse

Close

Figure A.1.9　Example of Combining the Important Variables of "Class" and "Object."

Table A.1.5　Data Selection Screen Functions.

Button	Function Description	Notes
[Cancel]	Exits the Selection screen	
[Next]	Exits the Data Selection screen	
[Select by Category]	Selects the scenario by category	This moves to the screen for selecting scenarios contained in the AR4 by the [Category] designation.
[Description of "Series"]	Shows the series description panel	This opens the panel that contains the [Series] description.
[Selection Example]	Shows an example of Class and Object combinations	For example, if the "CO_2 Total" data is selected, this selects Class = "Emission" and Object = "CO_2 total".
[Class]	Shows a list of classes	This displays a list of classes of variables registered in the database.
[Object]	Shows a list of objects	This displays a list of objects of variables registered in the database.

2)　Selection Screen- Method 2: Selecting data based on the AR4 categories

For instance, to filter data from all stored data based on IPCC AR4 categories (Category I to VI), press the [Select by Category] button in the Selection screen in Figure A.1.7 to change the screen shown in Figure A.1.10. In the same way as the screen shown in Figure A.1.7, data is selected as follows: (1) Select the series → (2) Select the source → (3) Select the region → (4) Select the category → (5) Select the [Class] and [Object], in that order, and then click the [Next] button to display the results that match the selection conditions. In this screen, the available Series are "IPCC-AR4" and "Others[2000-2006]" only. The only available Categories are Category I to VI, which are based on the IPCC AR4 categories, and the reference scenarios that correspond to them. The “*” character is a wildcard, and it means that the data selection filters are not applied for this field. For details on [Class] and [Object], see Tables B.2.9 and B.2.10 in Appendix B.

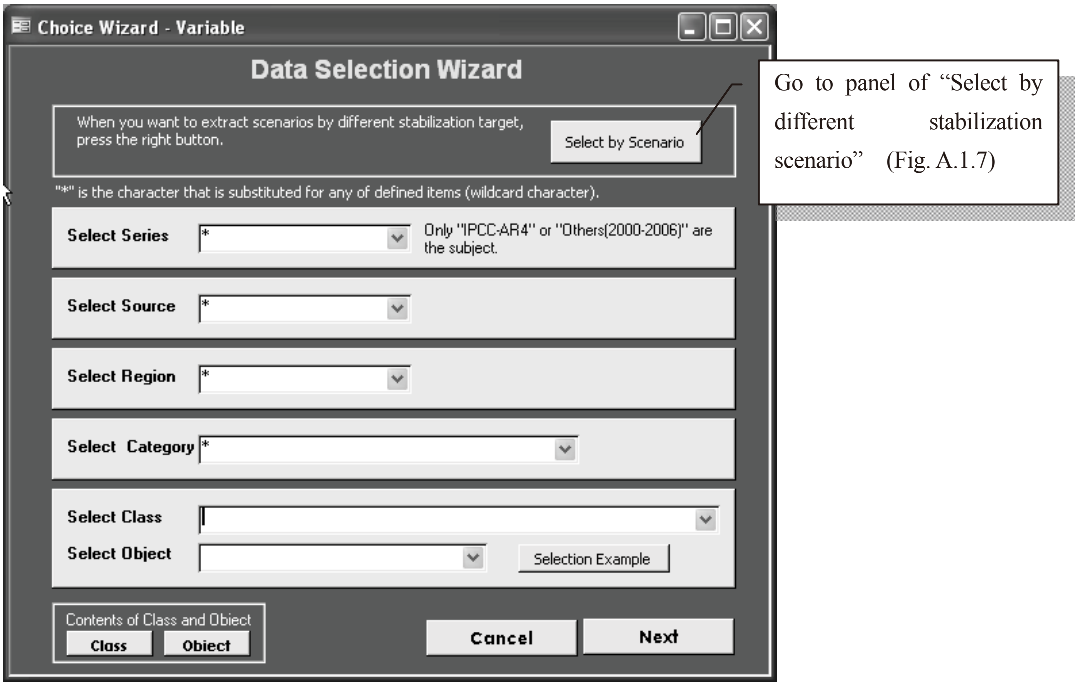


Figure A.1.10 Data Selection Screen (Selection by IPCC AR4 Categories).

Table A.1.6 Data Selection Screen Functions.

Button	Function Description	Notes
[Cancel]	Exits the Selection screen	
[Next]	Exits the Data Selection screen	
[Select by Scenario]	Selects the scenario based on the stabilization concentration scenario classification	This returns to the screen for selecting scenarios based on the stabilization concentration lassification.
[Description of “Series”]	Shows the series description panel	This opens the panel that contains the [Series] description.
[Selection Example]	Shows an example of Class and Object combinations	For example, if the “CO_2 Total” data is selected, this selects Class = “Emission” and Object = “CO_2 total”.
[Class]	Shows a list of classes	This displays a list of classes of variables registered in the database.
[Object]	Shows a list of objects	This displays a list of objects of variables registered in the database.

Pressing [Next] in Figure A.1.7 or Figure A.1.10 displays the selected data (Figure A.1.11). In Figure A.1.11, pressing the [Export] button enables output of the data to Excel or other program. Pressing the [Graph] button displays the Pivot Table (Figure A.1.12).

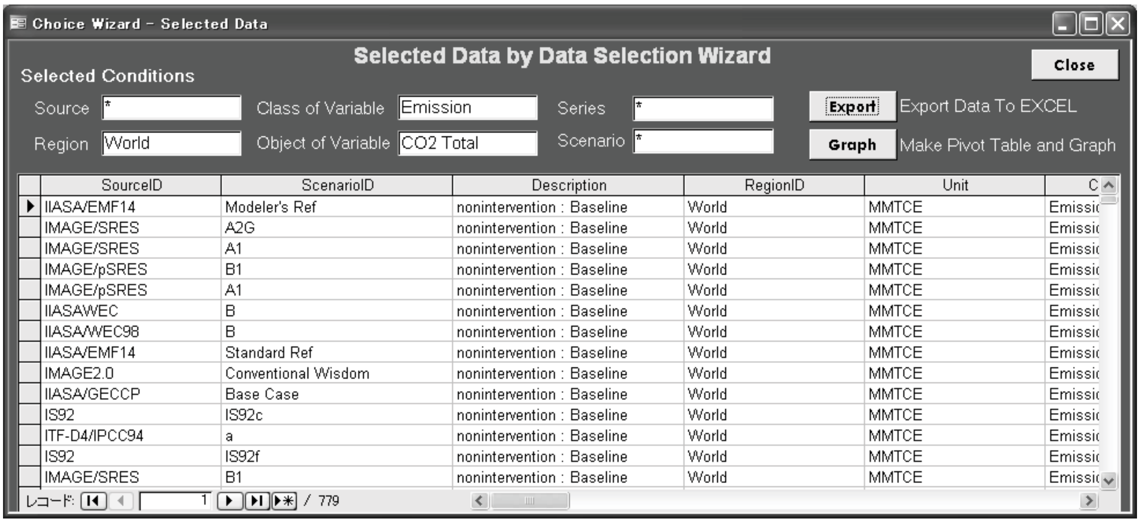


Figure A.1.11　Data Selection Screen.

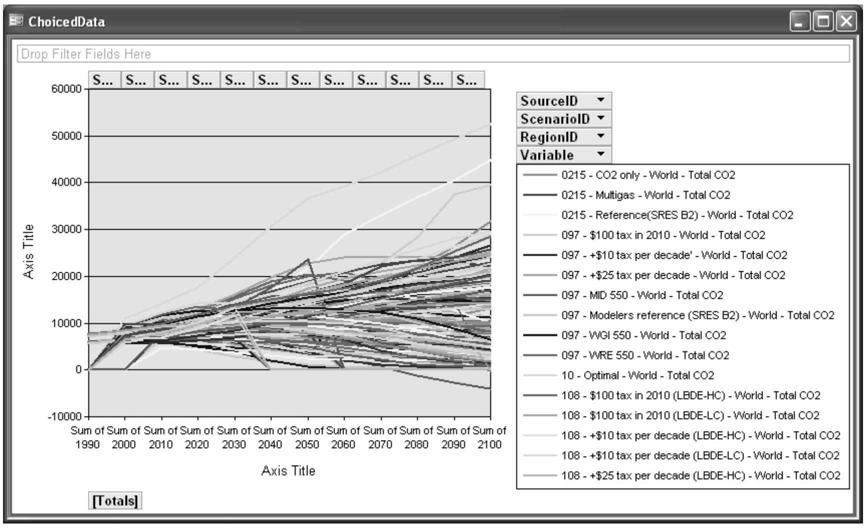


Figure A.1.12　Pivot Graph Screen.

Table A.1.7　Pivot Graph Screen Functions.

Button	Function Description	Notes
[Export]	Outputs the selected data	This outputs the selected data to Excel or other program.
[Graph]	Displays a pivot graph for the selected data	This displays the selected data as a pivot graph.
[Close]	Exits the Data Selection screen	

1.2.6. [Others] Function for Maintenance and Previous Functions

This section describes the [Others] function for executing other functions and maintenance in the database displayed in the Main screen (Figure A.1.3). This function requires a high degree of understanding about the content and structure of the database, and its use is not recommended for general users. (General users may skip reading this section.)

The [Others] function includes a [Previous Functions] button and [Maintenance] button. The [Previous Functions] button is mainly used for advanced selection of data. The [Maintenance] button, on the other hand, is mainly used for editing and other operations on the database.

1) Maintenance function

Pressing the [Maintenance] button in the Main screen (Figure A.1.3) displays the panel shown in Figure A.1.13. This panel provides commands for [Import], [Edit], [Unit Convert], [GWP Convert], and [Add Region].

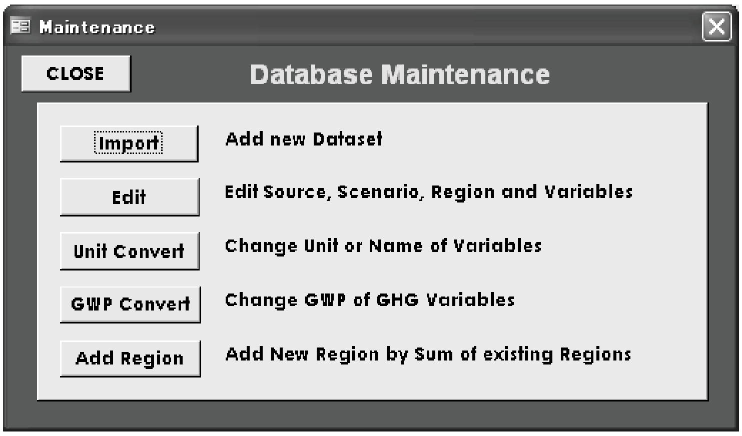


Figure A.1.13 [Maintenance] Screen.

Table A.1.8 [Maintenance] Screen Functions.

Button	Function Description	Notes
[Import]	Moves to [Add New Data] screen	This is used when adding new data.
[Edit]	Moves to [Edit Source Information] screen	This is used when editing source information that is already registered in the database.
[Unit Convert]	Moves to [Unit Convert] screen	This is used to convert units for data that is already registered in the database.
[GWP Convert]	Moves to [GWP Convert] screen	This is used to convert the GWP values for data that is already registered in the database.
[Add Region]	Moves to [Add Region] screen	

1-1) Import Data function

Pressing the [Import Data] button in the Maintenance screen (Figure A.1.13) enables adding of new data. In Figure A.1.14, select the [Import] button, and then specify the data file that you want to import. The data file is created in a worksheet in Microsoft Excel, and it must be set to the same format as the DATAMOM table beforehand. Enter the created Excel file in the [filename] field, and then select the [Import] button.

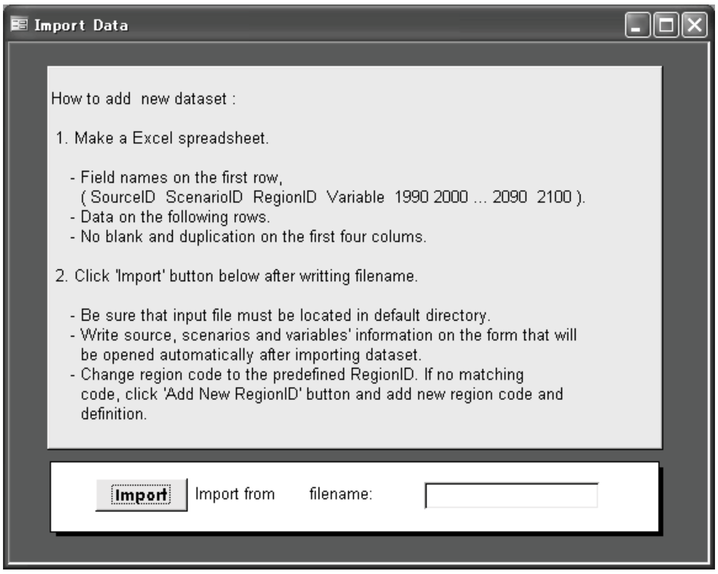


Figure A.1.14　[Import Data] Screen.

Table A.1.9　[Import Data] Screen Functions.

Button	Function Description	Notes
[Import]	Adds data to the database	

1-2) Edit function

Pressing the [Edit] button in the Maintenance screen (Figure A.1.13) enables editing of the source information registered in the database. The information is displayed in a format that is nearly identical to the [Information] screen in Figure A.1.4, but the difference is that the items in the table can be edited. The basic information, scenarios, and other data in the database can be edited in this screen.

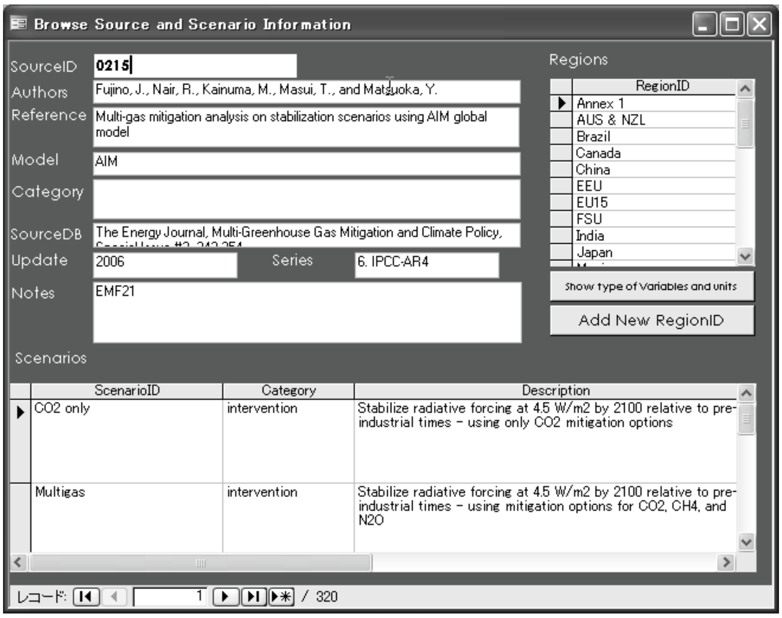


Figure A.1.15 [Edit] Screen.

1-3) Unit Convert function

Pressing the [Unit convert] button in the Maintenance screen (Figure A.1.13) enables conversion of the units for the data registered in the database. Variables that have the same name and units can be converted by source, by scenario, or for all data. Next, an example of how this is used is described below.

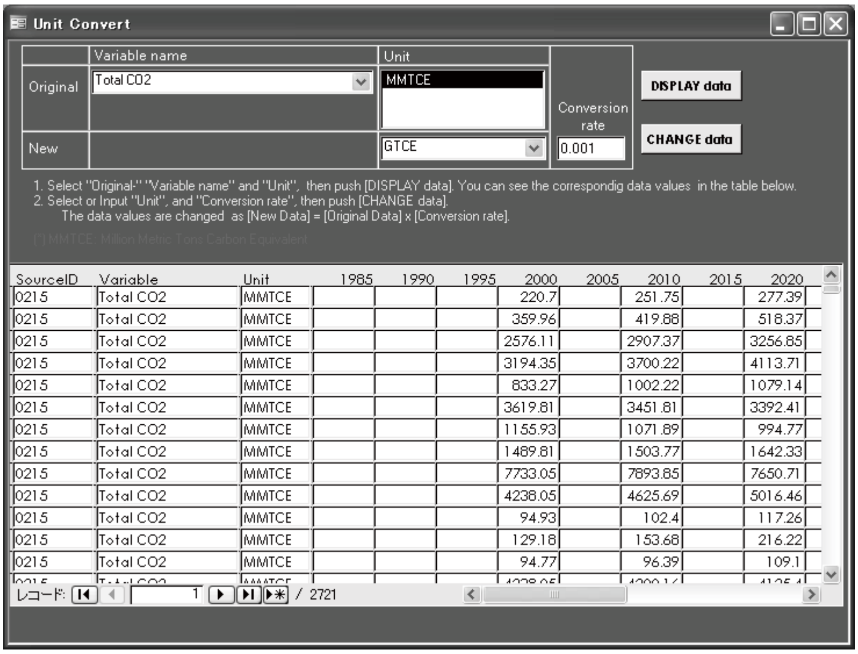


Figure A.1.16 [Unit Convert] Screen.

Table A.1.10 [Unit Convert] Screen Functions.

Button	Function Description	Notes
[Display Data]	Displays data that matches the selected conditions	
[Change Data]	Converts data values based on conversion	

First, click the Variable name - Original list box. The variable names in the data are listed in alphabetical order, and so select the variable name that you want to change.

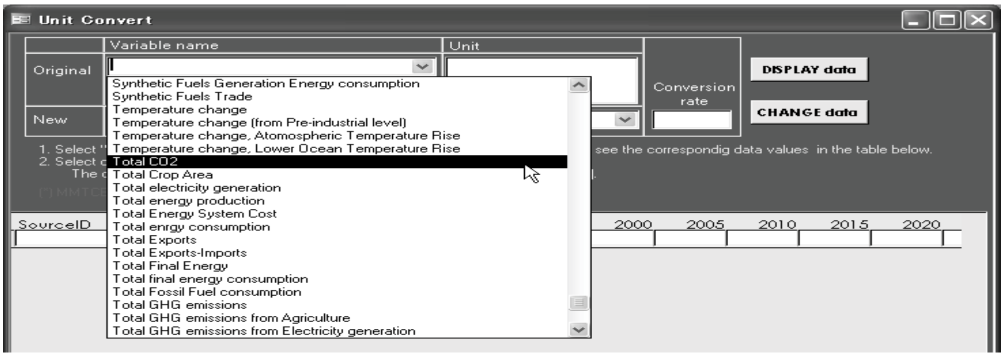


Figure A.1.17 [Unit Convert] Screen (1).

Once a variable name is selected, the unit corresponding to this variable appears in the Unit – Original box. Also, if there are different units with the same name, multiple units are displayed. Select the target units here. A value must be selected from the Unit box even if only one is displayed. After selecting from the Unit box, the same value as the top box is displayed in the New box in the bottom section.

Figure A.1.18 [Unit Convert] Screen (2).

At this point, clicking the [DISPLAY data] button displays all data that has the specified variable name and unit in the Data Value box in the bottom section.

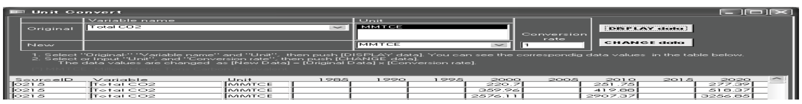


Figure A.1.19 [Unit Convert] Screen (3).

In this screen, to change the units, either directly overwrite the text in the Variable Name – Unit box in the bottom section, or select from the list. After changing the units, the Conversion rate at the right side is multiplied with all the data displayed in the Data Value box. Normally, 1 is entered, but enter the correct numerical value if needed. For example, if the units are changed from [MMTCE] to [GtC], the Conversion rate becomes 0.001.

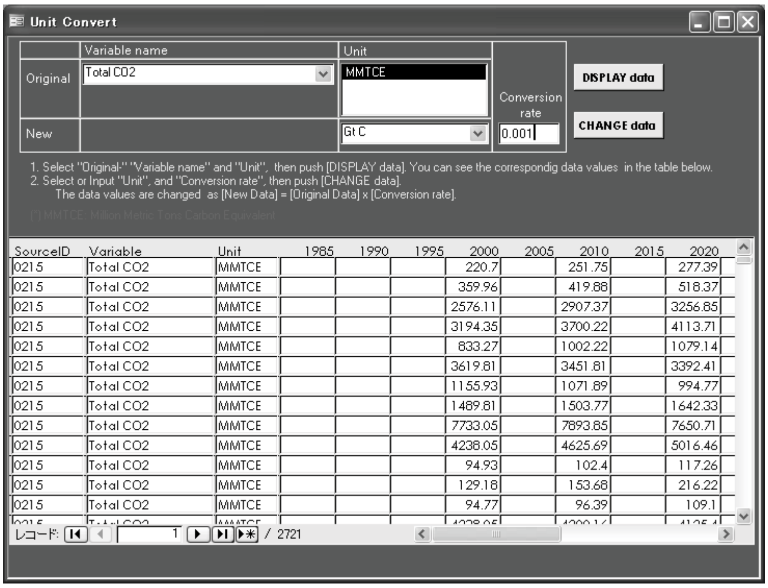


Figure A.1.20 [Unit Convert] Screen (4).

When all preparation is complete, pressing the [CHANGE data] button changes the Units system. Note that, however, once a name or numerical value is changed, it cannot be restored to its original value. Therefore, be particularly careful when performing this procedure.

1-4) GWP Convert function

Pressing the [GWP convert] button in the Maintenance screen (Figure A.1.13) enables conversion of the GWP values of the registered data. This procedure is shown below.

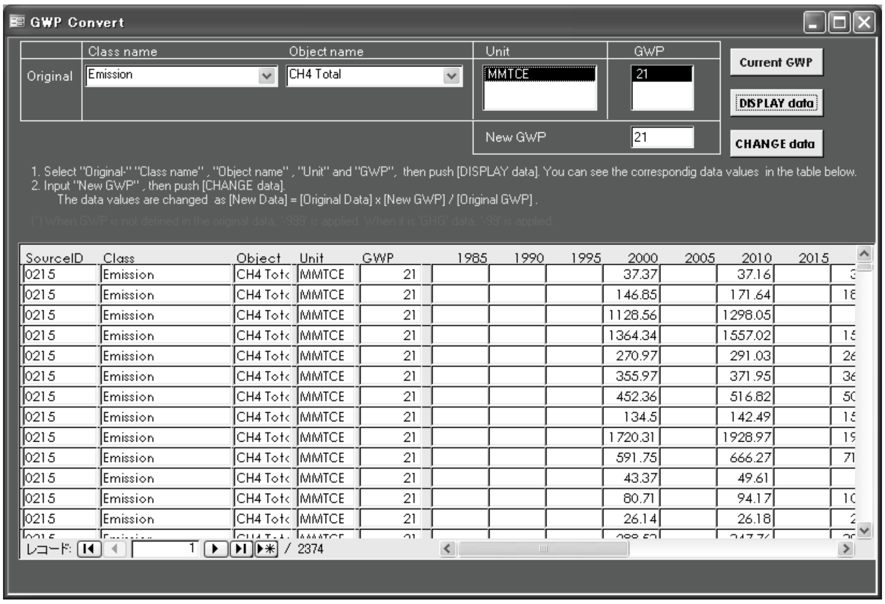


Figure A.1.21　[GWP Convert] Screen.

Table A.1.11　[GWP Convert] Screen Functions.

Button	Function Description	Notes
[Display Data]	Displays the data matching the selected conditions	
[Change Data]	Converts data values based on the new GWP	

First, click the Object name - Original list box. The object names are listed in alphabetical order, and so select the object that you want to change from the list. Note that "Emission" is the default value for Class name.

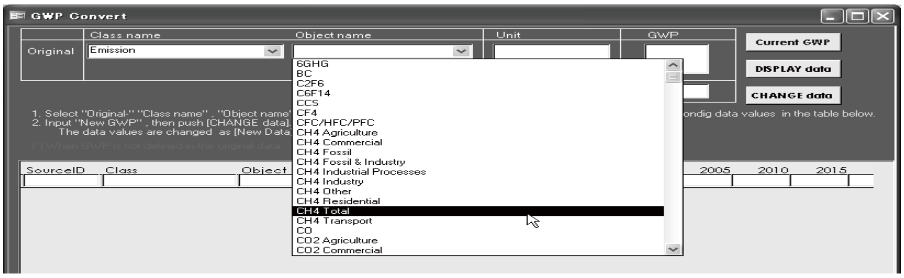


Figure A.1.22　[GWP Convert] Screen (1).

Once an object name is selected, the currently-used unit corresponding to that object is displayed. Also, if there are various units used for the same object name, multiple units are displayed. Select the target units here. A value must be selected from the Unit box even if only one is displayed. After selecting from the Unit box, the GWP is displayed in the box. If different GWP are available for the same unit, multiple GWPs are displayed. Select the target GWP here. A value must be selected from the GWP box even if only one is displayed.

Figure A.1.23 [GWP Convert] Screen (2).

Pressing the [DISPLAY data] button displays all data having the specified object and GWP in the Data Value box at the bottom.

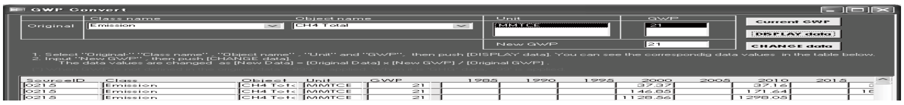


Figure A.1.24 [GWP Convert] Screen (3).

In this screen, to change the GWP value, enter the new GWP in the New GWP box. By default, the original GWP is already entered.

When all preparation is complete, pressing the [CHANGE data] button performs the change process. Note that, however, once a numerical value is changed, it cannot be restored to its original value. Therefore, be particularly careful when performing this procedure.

1-5) Add region function

Pressing the [Add region] button in the Maintenance screen (Figure A.1.13) enables registration of a new region by merging registered regions.

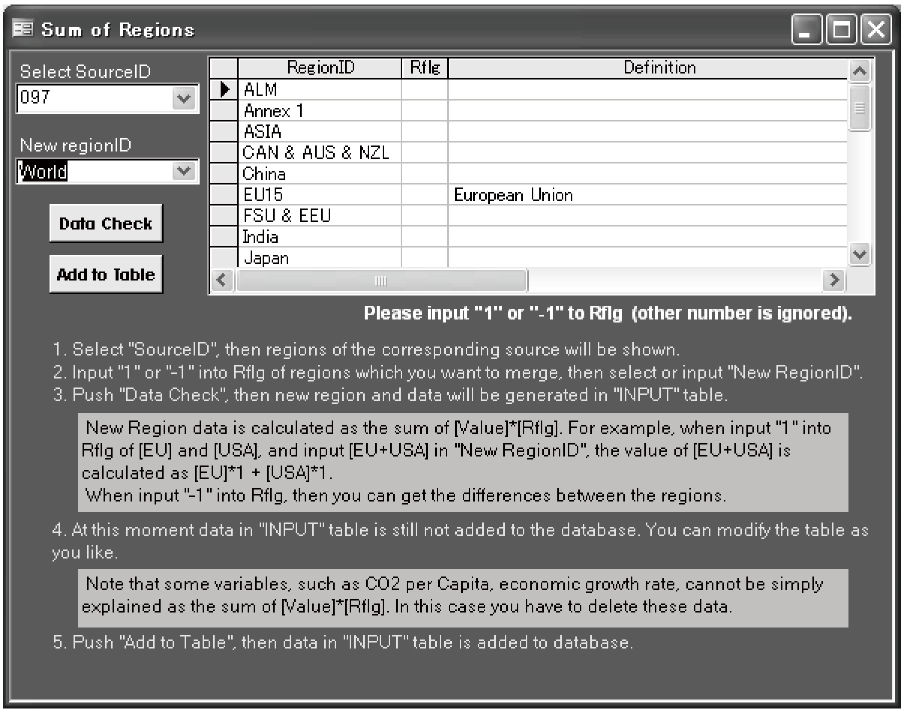


Figure A.1.25 [Sum of Region] Screen.

Table A.1.12 [Sum of Region] Screen Functions.

Button	Function Description	Notes
[Data Check]	Shows data based on the merged content	
[Add to Table]	Adds data to the database based on the merged content	

2) Previous Functions

Pressing the [Previous Functions] button in the Main screen (Figure A.1.3) displays the panel shown in Figure A.1.26. The available options are [Report], [Form], [Graph], [NC3 data], and [SRES data].

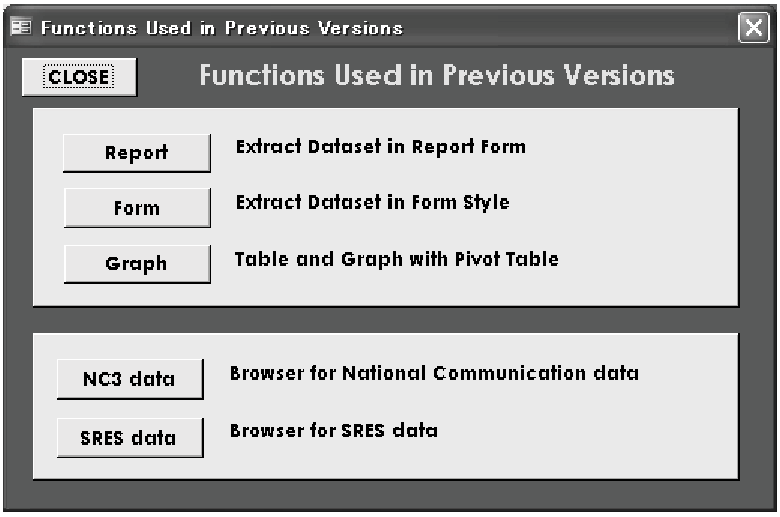


Figure A.1.26 Previous Function Screen.

Table A.1.13 Previous Functions Screen Functions.

Button	Function Description	Notes
[Report]	Moves to [Report] screen	This displays the selected data in report format.
[Form]	Moves to [Form] screen	This displays the selected data as a form.
[Graph]	Moves to [Graph] screen	This displays a pivot table for all data, GDP, population, CO_2, SRES data.
[NC3 Data]	Moves to [NC3 Data] screen	This displays the data for the Third National Communication on UNFCCC only.
[SRES data]	Moves to [SRES Data] screen	This displays data for the SRES only.
[Close]	Exits the [Previous Functions] screen	

2-1) Report button

Pressing the [Report] button in the Previous Functions screen (Figure A.1.13) displays the selected data in report format (Figure A.1.27). This is performed by: (1) Select source → (2) Select scenario → (3) Select region → Select variable. Each field is enabled by selecting the check box on the left side.

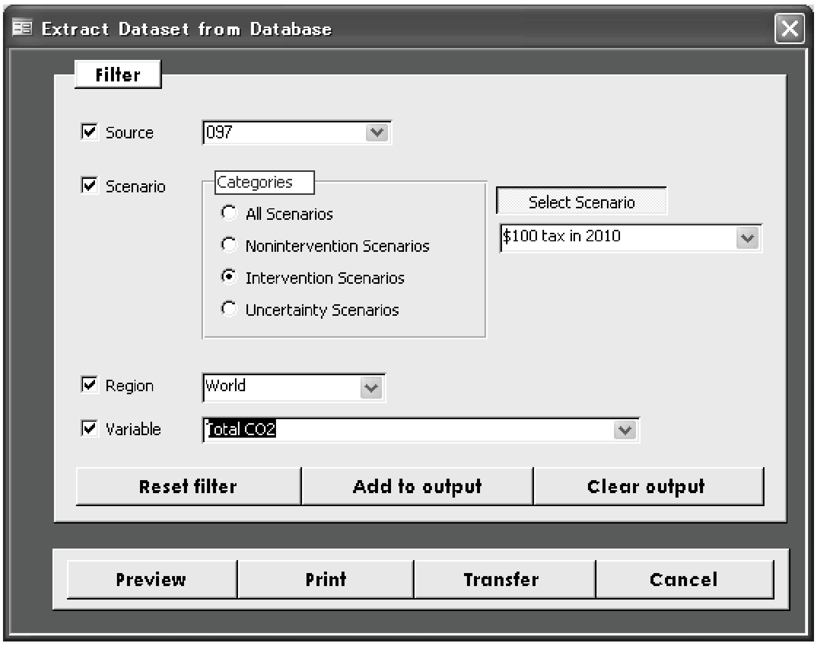


Figure A.1.27 Report Screen.

Table A.1.14 Report Screen Functions.

Button	Function Description	Notes
[Reset filter]	Resets the current filtering conditions	
[Add to output]	Adds new selected data to the currently selected data	
[Clear output]	Clears all selected data	
[Preview]	Shows a preview of the selected data	
[Print]	Prints the selected data	
[Transfer]	Converts the selected data to another format	
[Cancel]	Closes the Report screen	

2-2) Form button

Pressing the [Form] button in the Functions screen (Figure A.1.26) enables selection of individual filtering conditions for [Scenario], [Region], and [Variable], and it allows multiple conditions to be specified for one filtering operation (Figure A.1.28). Because the filtering operation is a logical AND operation on the data specified by each condition, if nothing is selected for any one of the conditions, the selected data results will be zero. Therefore, conditions must be specified for each of the three fields (Figure A.1.29). Also, the selected data can be output to a graph or file by pressing the [Display] button or [Output] button in the Form screen (Figure A.1.28). For example, the screen in Figure A.1.30 shows the case when Baseline scenario is selected for [Scenario], World is selected for [Region], and CO_2 emissions is selected for [Variable], and the [DISPLAY] button is pressed.

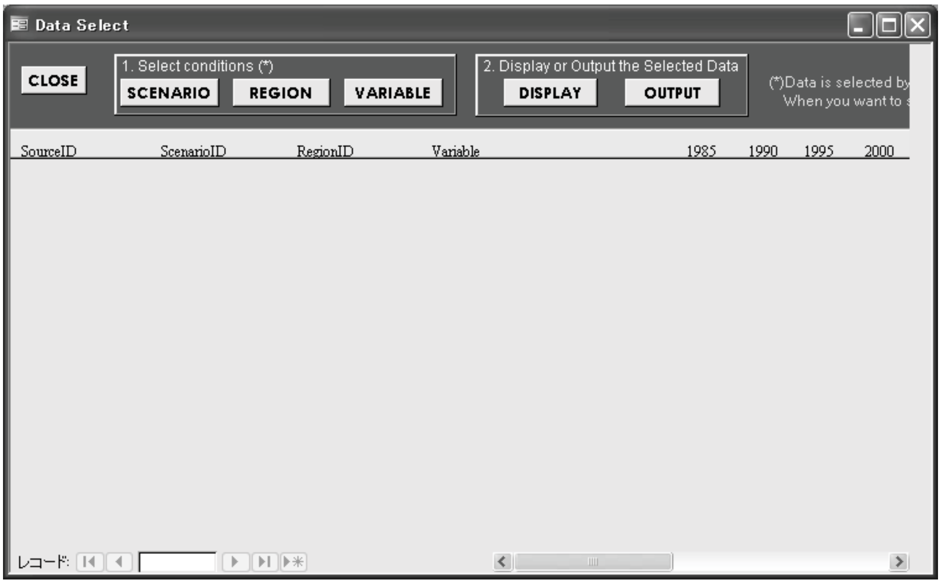


Figure A.1.28　Form Screen.

Table A.1.15　Form Screen Functions.

Button	Function Description	Notes
[Scenario]	Shows the screen for specifying the conditions for the scenario	
[Region]	Shows the screen for specifying the conditions for the region	
[Variable]	Shows the screen for specifying the conditions for the variable	
[Display]	Shows the data selected based on the specified conditions on the screen	
[Output]	Outputs the data selected based on the specified conditions to a file	
[Close]	Returns to the [Main] screen	

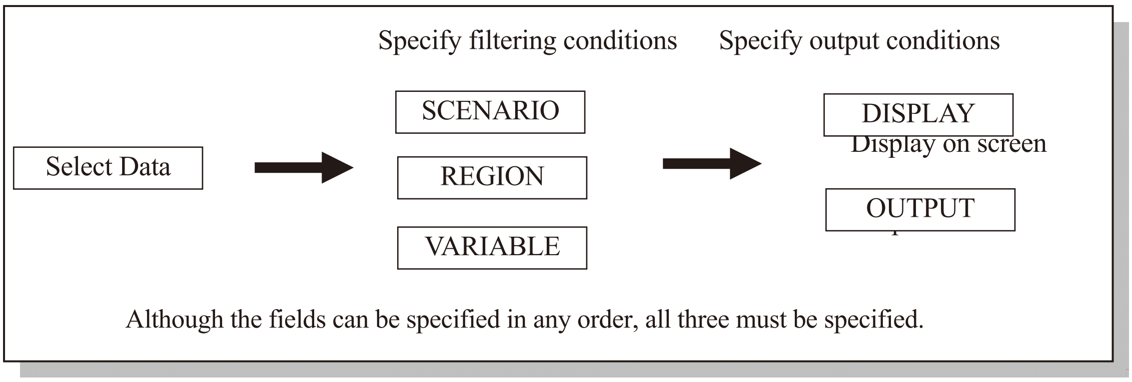


Figure A.1.29　Flow Chart When Using [Form] Screen.

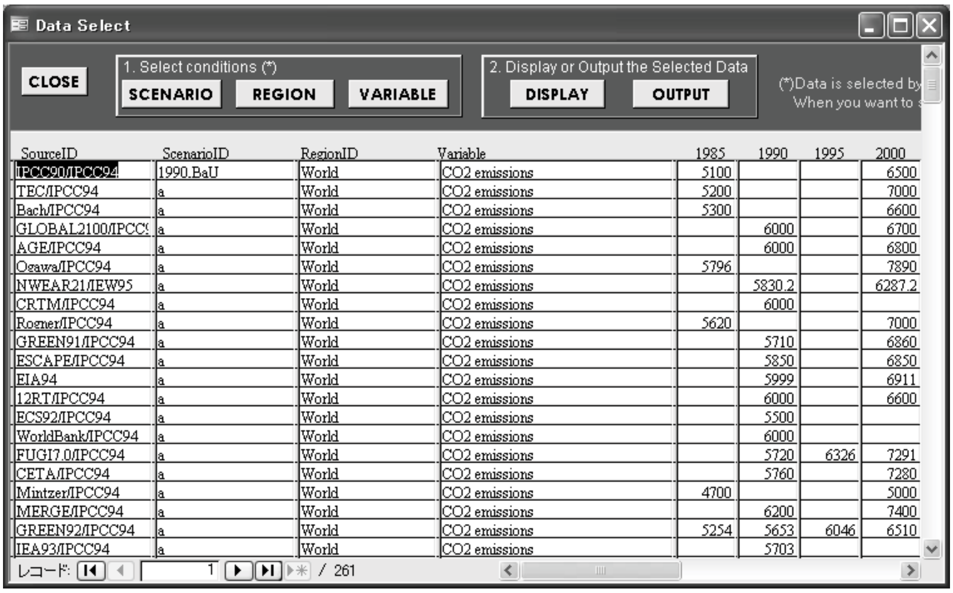


Figure A.1.30 Form Screen (After Selecting Conditions).

Methods for specifying the filtering conditions are described below.

a) Specifying the filtering conditions (setting the scenario conditions)
Selecting the [Scenario] button from the Form screen (Figure A.1.28) displays the [Select Source & Scenario] screen. Specific sources and scenarios can be selected from all available ones on this screen. Scenarios are selected by specifying individual scenarios using the check boxes on the left side (Figure A.1.31). To select all scenarios, select the [ALL CHECK] button, and to deselect all scenarios, select the [ALL CLEAR] button. Also, filters can be specified for limiting the scenarios that are shown on the screen. The two types of available filters are [by Source], which filters based on the source type, and [by Scenario Type], which filters based on the scenario type. Each filter is activated by selecting the respective check box on the left of the option (Figure A.1.32).

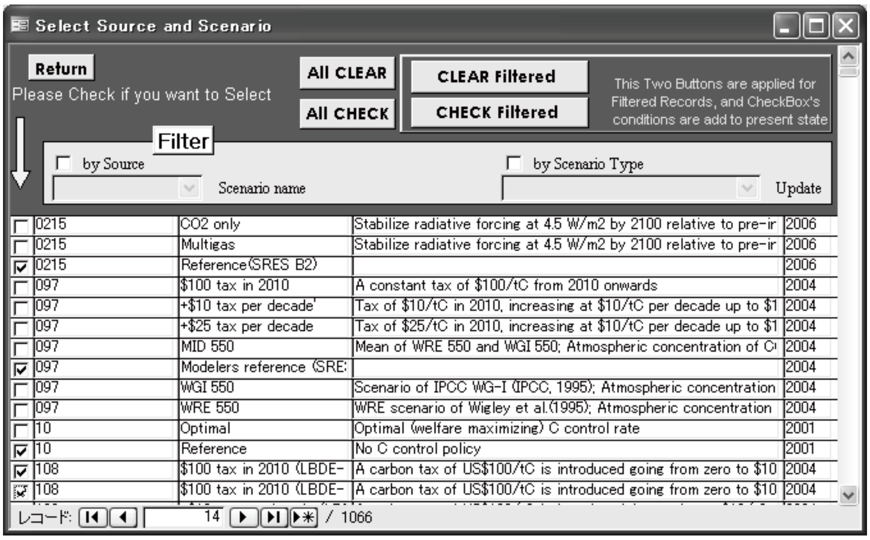


Figure A.1.31 [Select Source & Scenario] Screen.

Table A.1.16　[Select Source & Scenario] Screen Functions.

Button	Function Description	Notes
by Source	Filtering of scenarios by source. This is enabled when the check box is selected.	
by Scenario Type	Filtering of scenarios by scenario type. This is enabled when the check box is selected.	
[All CHECK]	Selects all scenarios	
[All CLEAR]	Deselects all scenarios	
[Check Filtered Records]	Selects all scenarios shown on the screen (filtered scenarios	
[Clear Filtered Records]	Deselects all scenarios shown on the screen (filtered scenarios	

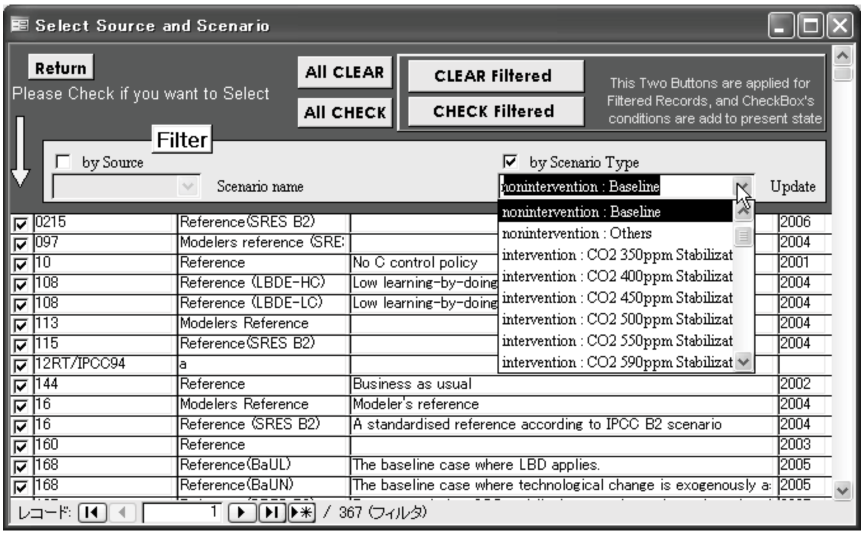


Figure A.1.32　Specifying Filtering Conditions using [by Scenario Type].

After changing the scenarios displayed by the filter, all scenarios shown on the screen only can be selected ([Check Filtered Records]) or deselected ([Clear Filtered Records]). Selection ([Check Filtered Records]) or deselection ([Clear Filtered Records]) of the displayed data applies to the data shown on the screen only. In other words, selected data that is not displayed remains selected, and deselected data that is not displayed remains deselected. This means that scenarios can be specified with multiple complex conditions by first deselecting all scenarios ([ALL CLEAR]) and then applying various conditional filters and selecting only the data that is displayed ([Check Filtered Records]).
Also, operations such as selection of only data that is displayed ([Check Filtered Records]) can also be used for selection using the filtering function in Access. When right-clicking the mouse over a specific record, a pop-up menu like that shown in the figure below (Figure A.1.33) appears. If [Filter by Selection], [Filter Excluding Selection], [Sort Ascending], or other option is selected to change the displayed data on the screen, [Check Filtered Records] and other operations are applied to the new displayed results. In other words, the filter function in this database and the filter function provided in Access can be used in combination for even more detailed specifying of conditions.

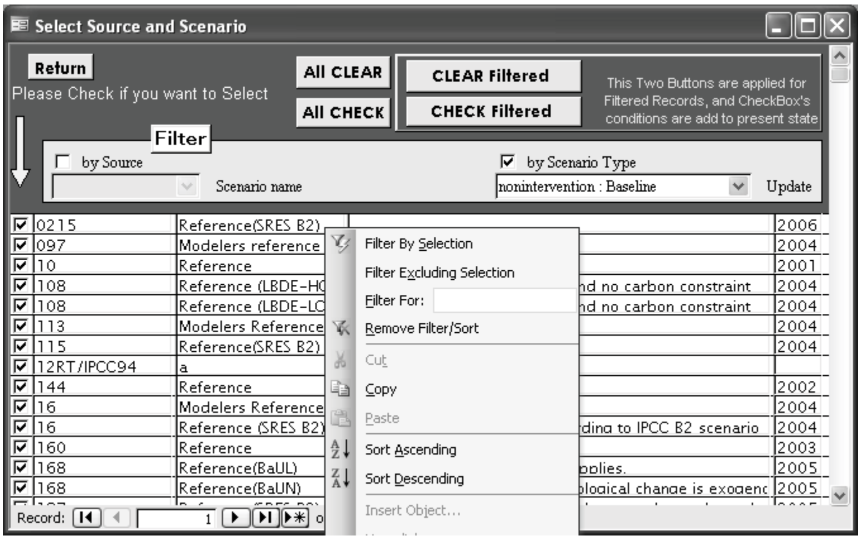


Figure A.1.33 Using the Filter Function in Access.

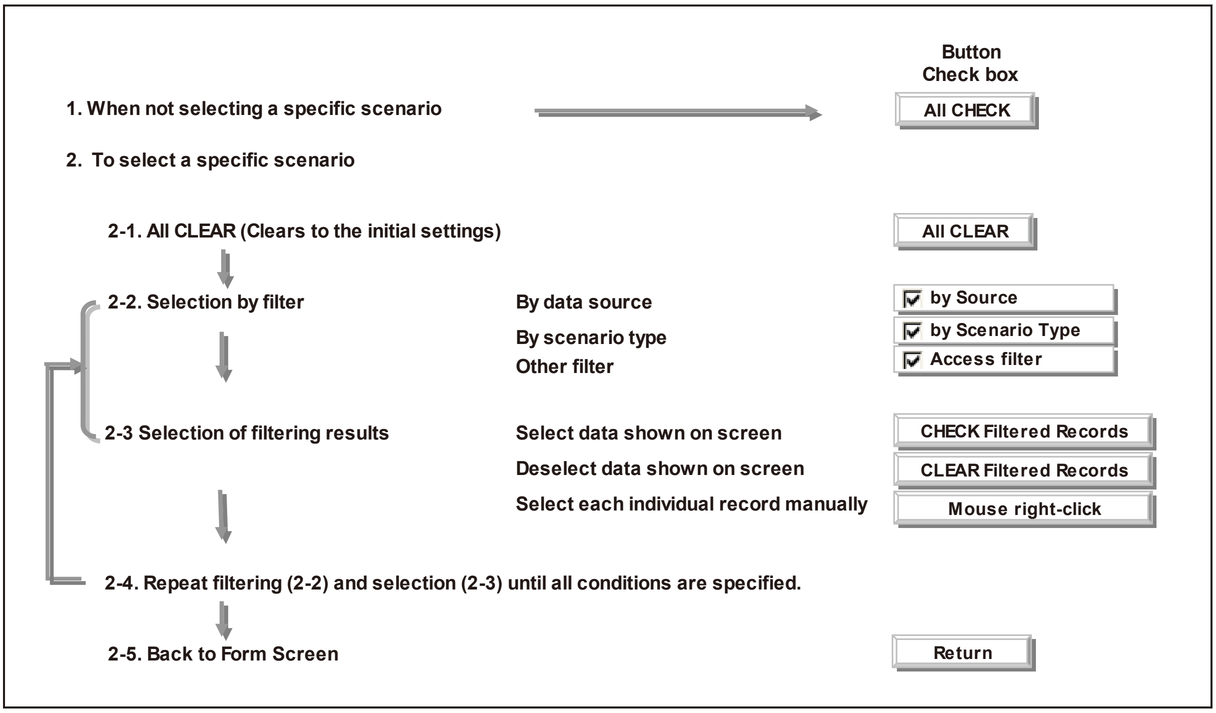


Figure. A.1.34 Operation Flowchart for [Select Source & Scenario] Screen.

b) Specifying the filtering conditions (setting the region conditions)
Selecting the [Region] button from the Form screen (Figure A.1.28) displays the [Select Region] screen. In this screen, any specific region can be selected from all available regions. The basic operating procedure is identical to that for selecting the scenario conditions. The filters include [by Source] for specifying the source type, [by Region Name] for specifying the region name, and [by Region Type] for specifying the region type. Each of these functions is enabled by selecting the check box to the left of the option.

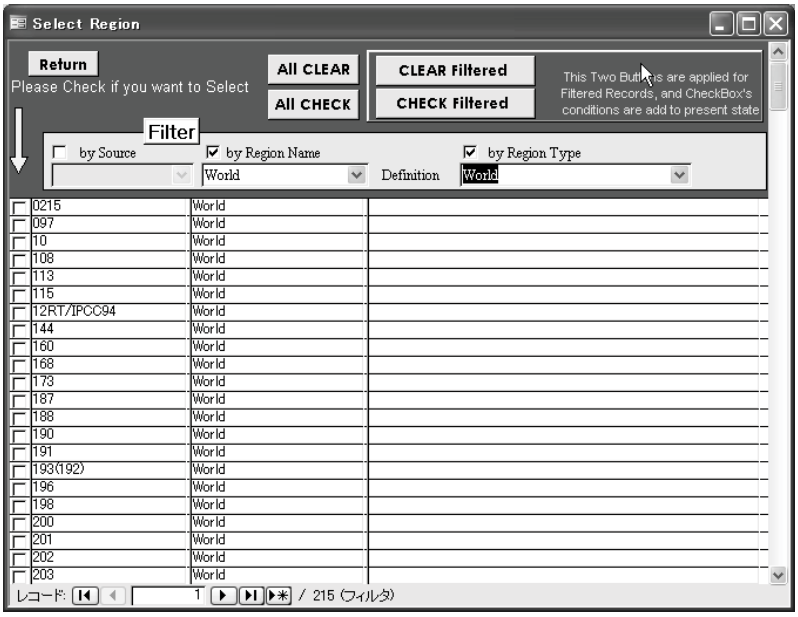


Figure. A.1.35　[Select Region] Screen Functions.

Table A.1.17　[Select Region] Screen Functions.

Button	Function Description	Notes
by Source	Filtering by source. This is enabled by selecting the check box.	
by Region Name	Filtering by region name. This is enabled by selecting the check box.	
by Region Type	Filtering by region type. This is enabled by selecting the check box.	
[All CHECK]	Selection of all variables	
[All CLEAR]	Deselection of all variables	
[Check Filtered Records]	Selects all variables shown on the screen (filtered variables)	

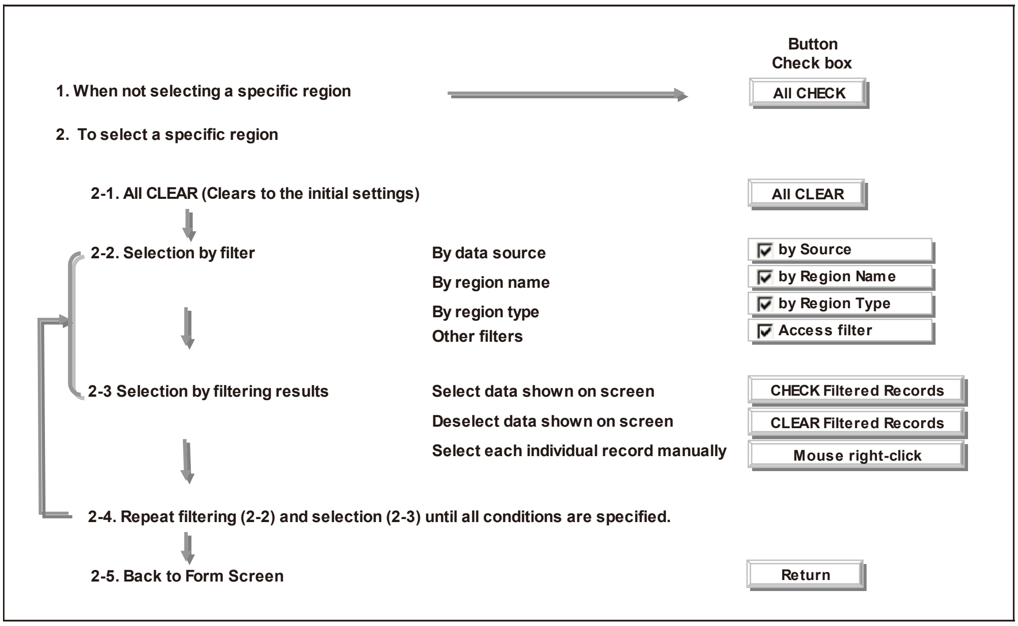


Figure. A.1.36　Operation Flowchart for [Select Region] Screen.

c) Specifying the filtering conditions (setting the variable conditions)

Selecting the [Variable] button from the Form screen (Figure A.1.28) displays the [Select Variable] screen. In this screen, any specific variables can be selected from all available variables. The basic operating procedure is identical to that for selecting the scenario conditions. The filters include [by Source] for specifying the source type, [by Class] for specifying the class, [by Object] for specifying the object, and [by Level] for specifying the importance ([Vflg]). Each of these functions is enabled by selecting the check box to the left of the option. For details on [Class], [Object], and [Vflg], see the descriptions in the [Variable] table (Table B.2-8).

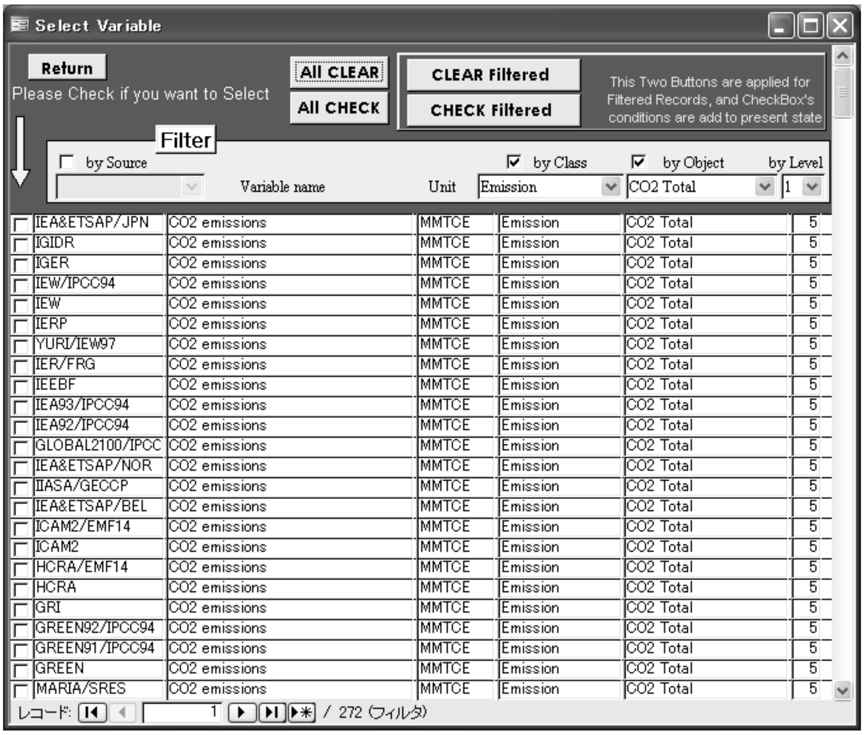


Figure. A.1.37 [Select Variable] Screen.

Table A.1.18 [Select Variable] Screen Functions.

Button	Function Description	Notes
by Source	Filtering of variable by source. This is enabled by selecting the check box.	
by Class	Filtering of variable by class. This is enabled by selecting the check box.	
by Object	Filtering of variable by object. This is enabled by selecting the check box.	
by Level	Filtering of variable by importance. This is enabled by selecting the check box.	
[All CHECK]	Selection of all variables	
[All CLEAR]	Deselection of all variables	
[Check Filtered Records]	Selects all variables shown on the screen (filtered variables)	
[Clear Filtered Records]	Deselects all variables shown on the screen (filtered variables)	

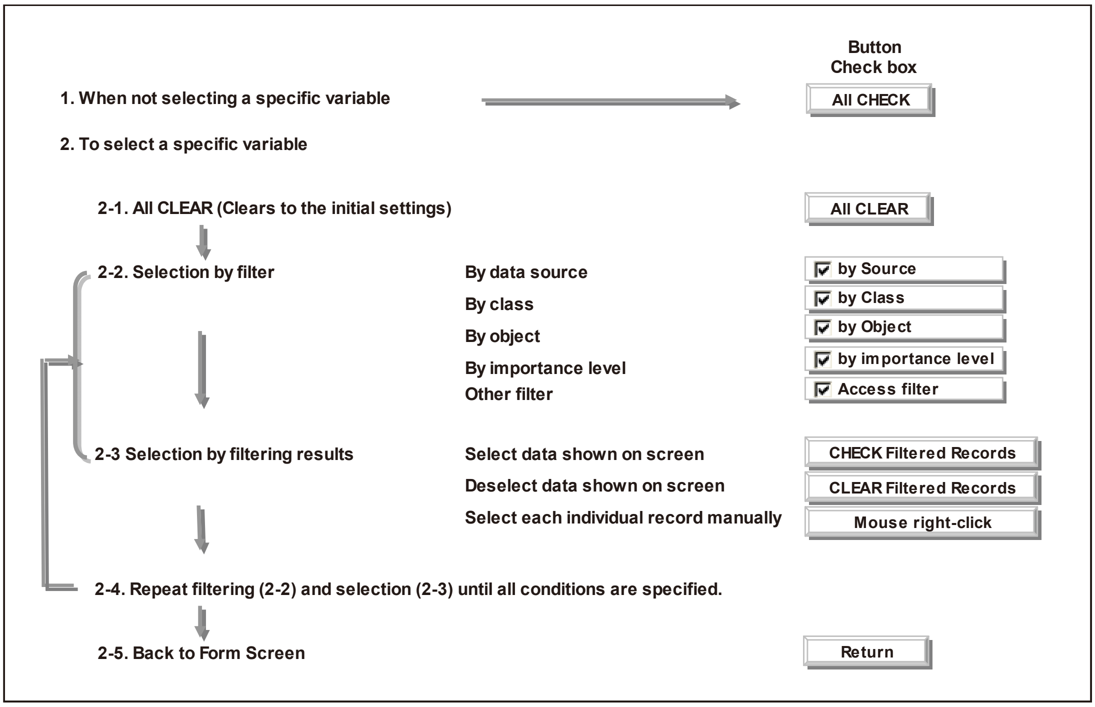


Figure. A.1.38　Operation Flowchart for [Select Variable] Screen.

2-3) Graph button

Pressing the [Graph] button in the Functions screen (Figure A.1.26) displays the pivot table for all selected data, GDP, population, CO_2, or the SRES data (Figure A.1.39).

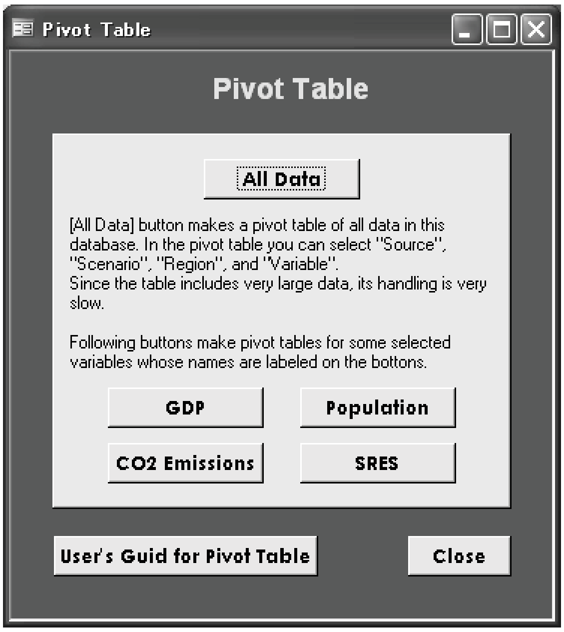


Figure. A.1.39　[Pivot Table] Screen.

Table A.1.19 [Pivot Table] Screen Functions.

Button	Function Description	Notes
[All Data]	Moves to [All Data] screen	This displays the pivot table for all data.
[GDP]	Moves to [GDP] screen	This displays the pivot table for GDP.
[Population]	Moves to [Population] screen	This displays the pivot table for population.
[CO_2 Emission]	Moves [CO_2 Emissions] screen	This displays the pivot table for CO_2 emissions.
[SRES]	Moves to [SRES] screen	This displays the pivot table for the SRES data.
[User's Guide for Pivot Table]	Moves to [User's Guide] screen	This displays the User's Guide for Pivot Table.
[Close]	Exits [Report] screen	

2-4) NC3 data button

Pressing the [NC3 Data] button in the Functions screen (Figure A.1.26) selects the information from the Third National Communications. The Third National Communications are reports submitted by each member country to the United Nations Framework Convention on Climate Change (UNFCCC), and these contain the current state and future trends on greenhouse gas (GHG) emissions for the respective country. Although the reported data items vary by country, according to the guidelines provided by the UNFCCC on forecasting, these reports contain the items in the table below (UNFCCC Guidelines on Reporting and Review). [NC3 data] can be used to view the GHG and forecasts contained in the Third National Communications.

For the data contained in the collected Third National Communications, the items shown in the table are compiled into a unified format for display on the screen. The user can browse through the data records using the navigation buttons displayed at the bottom left. Although no selection or other special functions are provided on the screen, the standard database functions can be used to filter, arrange, and perform other operations on the records.

Table A.1.20 Recommended Items Included in Third National Communications.

Period	Every 5 years from 1990 to 2020
Target	Forecast values for various types of GHG emissions (By gas type for CO_2, CH_4, N_2O, HFCs, PFCs, and SF6)
Type	With Measures: Forecast based on currently-implemented policies and measures
	With Additional Measures: Forecast incorporating planned policies and measures
	Without Measures: Forecast without implementing any policies or measures

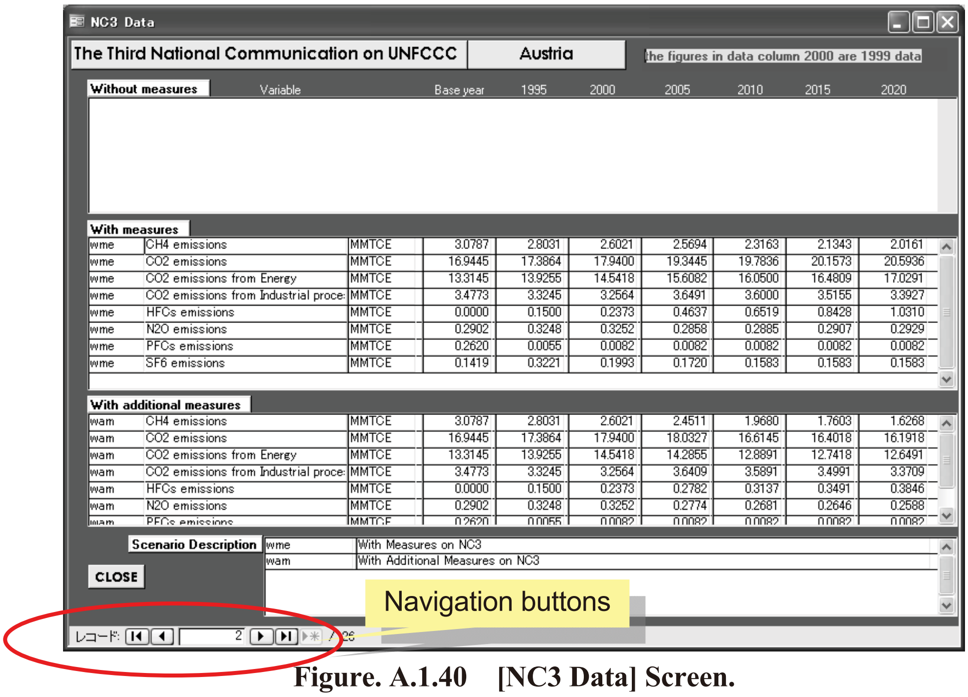


Figure. A.1.40　[NC3 Data] Screen.

Table A.1.21　[NC3 Data] Screen Functions.

Button	Function Description	Notes
[Close]	Exits the [NC3 Data] screen	

2-5) SRES data button

Pressing [SRES data] in the Functions screen (Figure A.1.26) displays the SRES data. The SRES are emissions scenarios using the assumptions found in the Special Report on Emissions Scenarios (SRES) prepared by the Intergovernmental Panel on Climate Change (IPCC), and these scenarios play a key role as standard scenarios and are also used for deriving a large number of scenarios. In SRES-related projects, generally, the parameters shown in the table below are presented by researchers. An image of the browsing screen is shown in Figure. 3.1-43. The user can browse through the displayed records of the emission scenarios using the navigation buttons shown at the bottom left. Although no selection or other special functions are provided on the screen, the standard database functions can be used to filter, arrange, and perform other operations on the records.

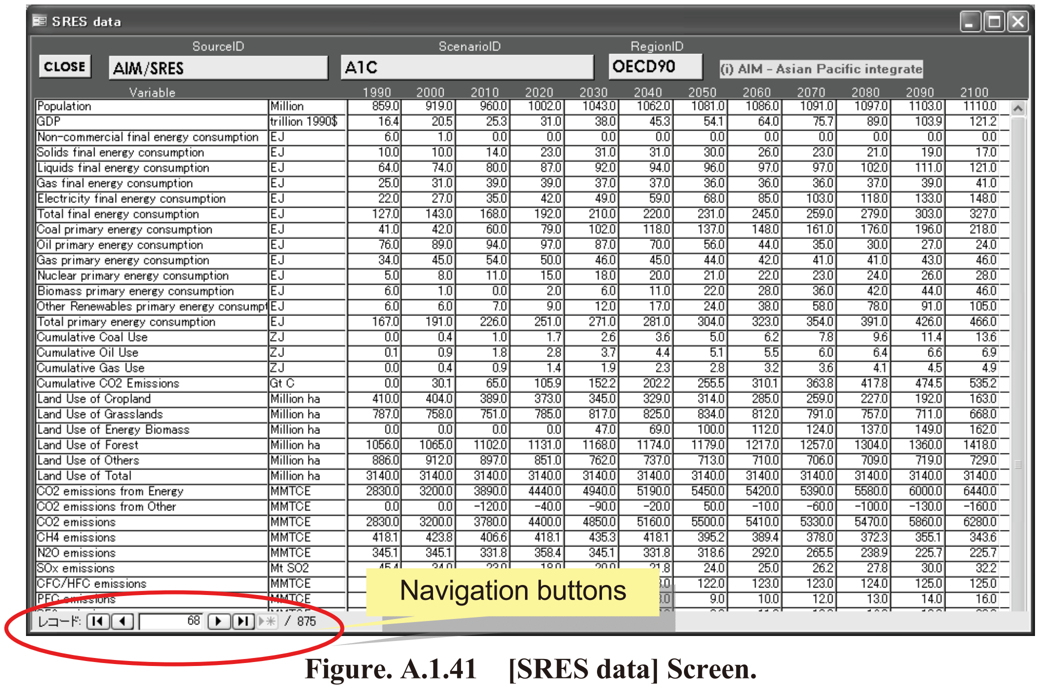


Figure. A.1.41 [SRES data] Screen.

Table A.1.22 [SRES data] Screen Functions.

Button	Function Description	Notes
[Close]	Exits [SRES data] screen	

1.2.7. Operating Manual

Pressing [English] in the Main screen (Figure A.1.3) displays the English-language Operating Manual (Figure A.1.42), and pressing [Japanese] displays the Japanese-language Operating Manual.

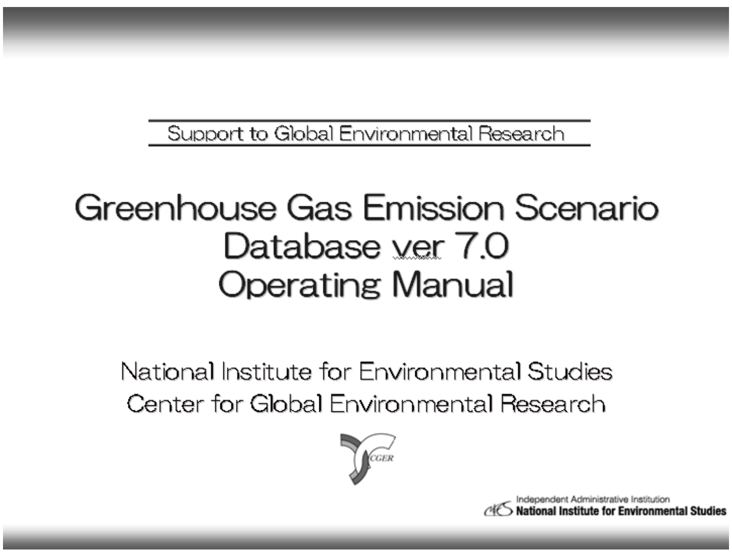


Figure. A.1.42 English-language Manual.

2. Database Usage Examples and Data Filtering Examples

This section shows how to filter specific variables.

2.1. Reproducibility of the IPCC Special Report on Emissions Scenarios (SRES)

First, an example of filtering is shown for demonstrating the reproducibility of the results shown in the SRES. This confirms the reproducibility of Figure 6-5 shown on page 304 of the SRES. The procedure is explained in steps 1 to 3 below.

Step 1: Opening the database

When Access is started, first, the Welcome screen (Figure A.2.1) is opened. Next, pressing the [Start] button opens the Main screen (Figure A.2.2).

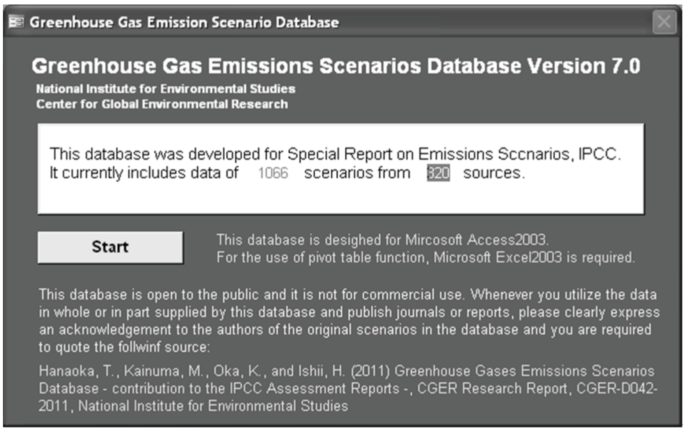


Figure. A.2.1　Welcome Screen.

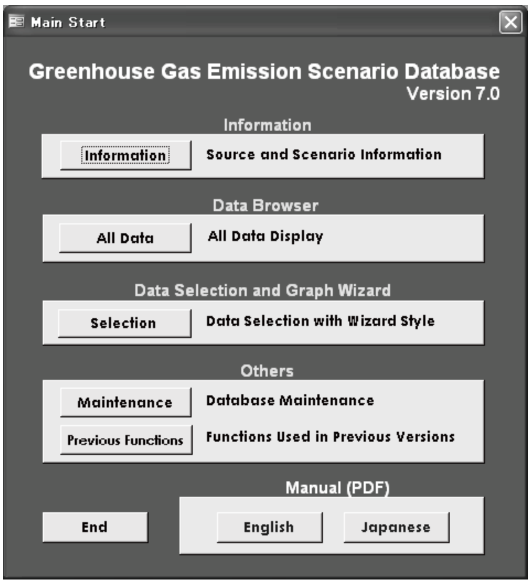


Figure. A.2.2　Main Screen.

Step 2: Selecting the data filtering module

Press the [Selection] button in the Data Selection and Graph Wizard in the Main screen (Figure A.2.2) to open the Data Selection screen (Figure A.2.3). The data selection is filtered using the variables of (1) Series, (2) Source, (3) Region, (4) Scenario, and (5) Class and Object (Table 1.2-23).

In this example, "3. SRES" is selected for (1) Series, all sources (in other words, the “*” wildcard) is selected for (2) Source, “World” is selected for (3) Region, all scenarios (in other words, the “*” wildcard) is selected for (4) Scenario, and "Emission” and “CO_2 Total” for CO_2 emissions are selected for (5) Class and Object (Table A.2.1). The screen when all variables are selected is shown in Figure A.2.4. When all the selections are completed, press the [Next] button.

Table A.2.1 Variable Descriptions.

Button	Description
(1) Series	Selection of classification for IPCC assessment report (Figure. A.1.8)
(2) Source	Selection of source for data filtering target
(3) Region	Selection of region for data filtering target
(4) Scenario	Selection of scenario (such as stabilization concentration) for data filtering target
(5) Class and Object	Selection of variables for data filtering target by class and object (Figure. A.1.9)

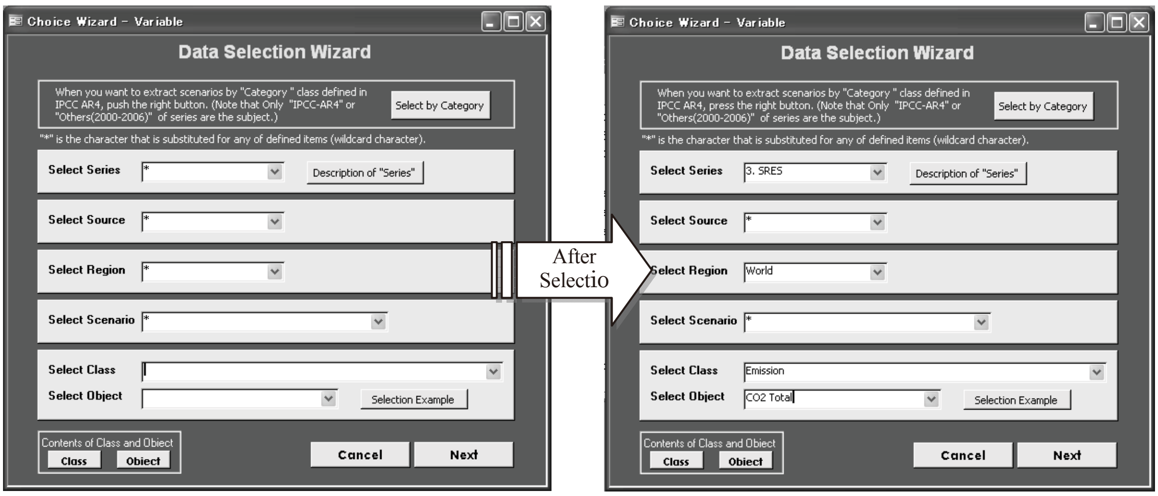


Figure. A.2.3 Data Selection Screen.

Figure. A.2.4 Data Selection Screen. (Selected Completed)

Step 3: Output of filtered results to a file and graphing

The screen showing the filtered results is displayed (Figure A.2.5). When the [Export] button is pressed, the filtered results are output to a file, and pressing the [Graph] button displays the filtered results in graph form (Figure A.2.6). This procedure is identical to that shown in section A.2.1 As shown in Figure. A.2.6, it is clear that Figure 6-5 shown on page 304 of the SRES is roughly reproduced here.

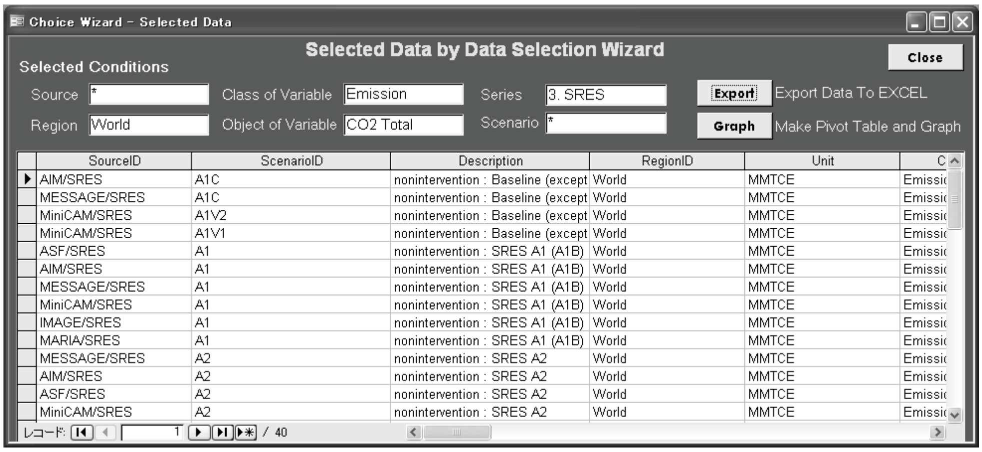


Figure. A.2.5　Filtered Results Display Screen.

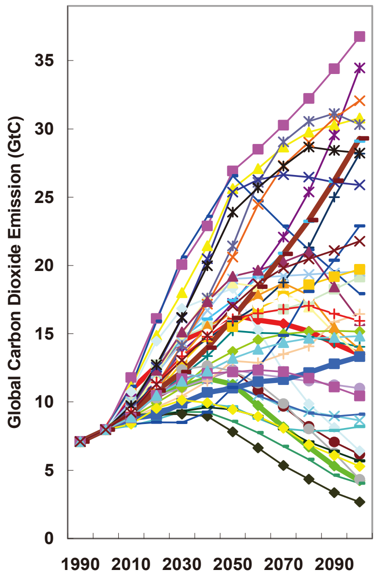


Figure. A.2.6　Filtered Results[1] from the database.

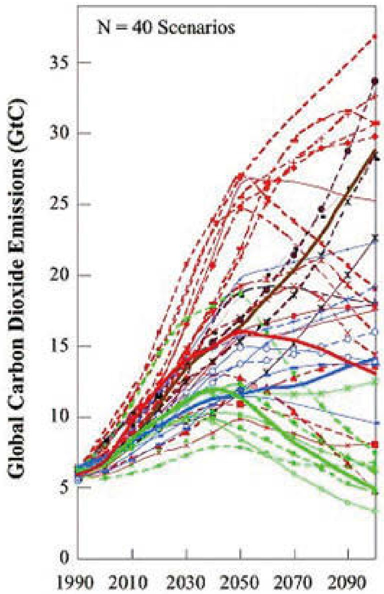


Figure. A.2.7　Figure 6-5 in the SRES.

[1] The filtered results were converted to graph form for comparison with Figure 6-5 of the SRES.

2.2. Reproducibility of the IPCC Third Assessment Report (TAR)

This section shows an example of filtering for demonstrating the reproducibility of the results shown in the IPCC Third Assessment Report (TAR) Working Group III (WG III). This confirms the reproducibility of Figure 2-3 (Global Emission from Mitigation Scenarios for 500ppm Stabilization) shown on page 130 of TAR WG III. The procedure is explained in steps 1 to 3 below.

Because step 1 (Opening the database) and step 3 (Output of filtered results to a file and graphing) are identical to section 2.1, this section describes Step 2 (Selecting the data filtering module) only.

Step 1: Opening the database

Identical to Appendix A.2.1.

Step 2: Selecting the data filtering module

Press the [Selection] button in the Data Selection and Graph Wizard in the Main screen (Figure A.2.2) to open the Data Selection screen (Figure A.2.3). The data selection is filtered using the variables of (1) Series, (2) Source, (3) Region, (4) Scenario, and (5) Class and Object (Table 1.2-23).

In this example, "5. IPCC-TAR (Appendix A.2.1)" is selected for (1) Series, all sources (in other words, the “*” wildcard) is selected for (2) Source, “World” is selected for (3) Region, all scenarios (in other words, the “*” wildcard) is selected for (4) Scenario, and "Emission” and “CO_2 Total” for CO_2 emissions are selected for (5) Class and Object (Table A.2.1). The screen when all variables are selected is shown in Figure A.2.9. When all the selections are completed, press the [Next] button.

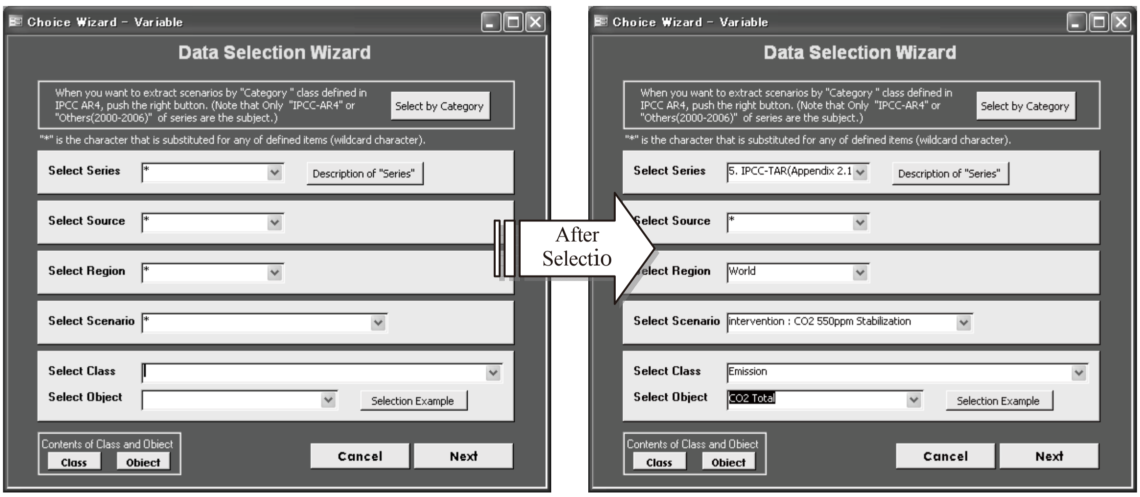
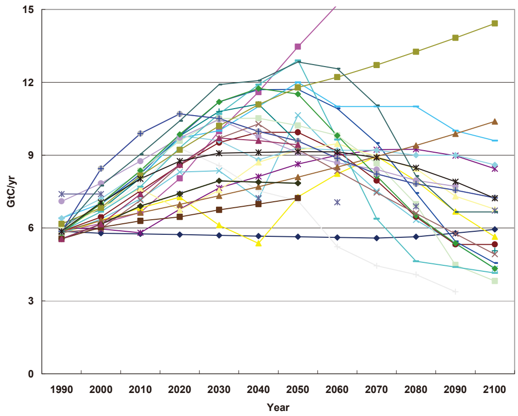


Figure. A.2.8 Data Selection Screen.

Figure. A.2.9 Data Selection Screen. (Selected Completed)

Step 3: Output of filtered results to a file and graphing

This procedure is identical to that shown in section A.2.1. As shown in Figure A.2.10, Figure 2-3 shown on page 130 of the TAR WR III is roughly reproduced here.



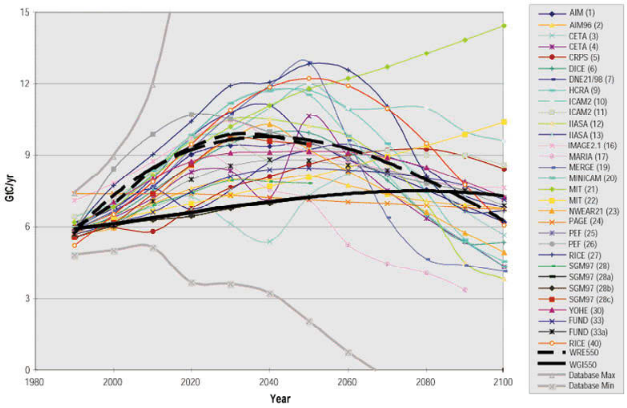


Figure. A.2.10
Filtered Results[2] from the database.

Figure. A.2.11
Figure 2-3 in the TAR.

Note: Global CO_2 Emission from Mitigation Scenarios for 550ppmv Stabilization

Also, Figure 2-2 shown on page 130 of the TAR WR III can also be roughly reproduced using the information in this database, and Figure. 2-13 shown on page 150 can also be roughly reproduced.

For the scenarios contained in the sources classified in Appendix 2.1 shown on page 166 of the IPCC-TAR WG III, the filtered results corresponding to baseline scenarios in this database are shown in Table A.2.2. Not all of these scenarios are used in Figure 2-2 shown on page 130 of the TAR WG III, and instead, only the scenarios marked with a circle in the Mark column in the table below are used. The Legend Key column in the table below is the scenario name in Figure 2-2 of TAR WG III.

For the scenarios contained in the sources classified in Appendix 2.1 shown on page 166 of the IPCC-TAR WG III, the filtered results corresponding to stabilization scenarios are shown in Table A.2.3. Not all of these scenarios are used in Figure 2-3 shown on page 130 of the TAR WG III, and instead, only the scenarios marked with a circle in the Mark column in the table below are used. The Legend Key column in the figure below is the scenario name in Figure 2-3 of TAR WG III.

Table A.2.2 Baseline Scenarios.

Legend Key	SourceID	ScenarioID	Description	Mark
	AIM/EMF14	Accel Tech/STD	nonintervention : Others	
AIM(1)	AIM/EMF14	Standard Ref	nonintervention : Baseline	✔
	AIM/EMF14	Modeler's Ref	nonintervention : Baseline	
AIM96(2)	AIM96	Standard_Scenario	nonintervention : Baseline	✔
	AIM97	Modeler's Ref	nonintervention : Baseline	
	CETA/EMF14	Accel Tech/STD	nonintervention : Others	
	CETA/EMF14	Accel Tech/MOD	nonintervention : Others	
	CETA/EMF14	IPCC Carb Ems	nonintervention : Others	
CETA(3)	CETA/EMF14	Modeler's Ref	nonintervention : Baseline	✔
CETA(4)	CETA/EMF14	Standard Ref	nonintervention : Baseline	✔
	CETA99	Reference	nonintervention : Baseline	
CRPS(5)	CRPS/EMF14	Standard Ref	nonintervention : Baseline	✔
DICE(6)	DICE/EMF14	Modeler's Ref	nonintervention : Baseline	✔

[2] The filtered data was converted to graph form for comparison with Figure 2-3 of TAR.

Legend Key	SourceID	ScenarioID	Description	Mark
DNE21/98(7)	DNE21/98	ref	nonintervention : Baseline	✔
HCRA(9)	HCRA/EMF14	Standard Ref	nonintervention : Baseline	✔
	ICAM2/EMF14	Accel Tech/MOD	nonintervention : Others	
	ICAM2/EMF14	Accel Tech/STD	nonintervention : Others	
ICAM2(10)	ICAM2/EMF14	Modeler's Ref	nonintervention : Baseline	✔
ICAM2(11)	ICAM2/EMF14	Standard Ref	nonintervention : Baseline	✔
	IIASA/EMF14	Modeler Choice	nonintervention : Others	
	IIASA/EMF14	Accel Tech/STD	nonintervention : Others	
IIASA(12)	IIASA/EMF14	Modeler's Ref	nonintervention : Baseline	✔
IIASA(13)	IIASA/EMF14	Standard Ref	nonintervention : Baseline	✔
	IIASA/WEC98	A1	nonintervention : Others	
	IIASA/WEC98	A3	nonintervention : Others	
	IIASA/WEC98	A2	nonintervention : Others	
	IIASA/WEC98	B	nonintervention : Baseline	
	IIASAWEC	A1	nonintervention : Others	
	IIASAWEC	A2	nonintervention : Others	
	IIASAWEC	A3	nonintervention : Others	
	IIASAWEC	B	nonintervention : Baseline	
	IMAGE2.1	No SO2 Protocol	nonintervention : Others	
	IMAGE2.1	SO2 Protocol	nonintervention : Others	
	IMAGE2.1	Baseline-C	nonintervention : Baseline	
	IMAGE2.1	Baseline-B	nonintervention : Baseline	
IMAGE2.1(16)	IMAGE2.1	Baseline-A	nonintervention : Baseline	✔
	MARIA/EMF14	Accel Tech/STD	nonintervention : Others	
MARIA(17)	MARIA/EMF14	Standard Ref	nonintervention : Baseline	✔
	MARIA/EMF14	Modeler's Ref	nonintervention : Baseline	
	MARIA95	ref	nonintervention : Baseline	
MERGE(19)	MERGE/EMF14	Standard Ref	nonintervention : Baseline	✔
	MINICAM/EMF14	Accel Tech/STD	nonintervention : Others	
MINICAM(20)	MINICAM/EMF14	Standard Ref	nonintervention : Baseline	✔
	MINICAM/EMF14	Modeler's Ref	nonintervention : Baseline	
MIT(21)	MIT/EMF14	Modeler's Ref	nonintervention : Baseline	✔
MIT(22)	MIT/EMF14	Standard Ref	nonintervention : Baseline	✔
	NWEAR21/EMF14	Modeler's Ref	nonintervention : Baseline	
	PAGE/EMF14	IPCC Carb Ems	nonintervention : Others	
	PAGE/EMF14	Accel Tech/STD	nonintervention : Others	
PAGE(24)	PAGE/EMF14	Standard Ref	nonintervention : Baseline	✔
	PEF/EMF14	IPCC Carb Ems	nonintervention : Others	
PEF(25)	PEF/EMF14	Modeler's Ref	nonintervention : Baseline	✔
PEF(26)	PEF/EMF14	Standard Ref	nonintervention : Baseline	✔
RICE(27)	RICE/EMF14	Modeler's Ref	nonintervention : Baseline	✔
SGM97(28)	SGM97	reference	nonintervention : Baseline	✔
	SGM99	Modeler's Reference	nonintervention : Baseline	
	WEC	B1	nonintervention : Others	
	WEC	a	nonintervention : Others	
	WEC	B	nonintervention : Baseline	
YOHE(30)	YOHE/EMF14	Modeler's Ref	nonintervention : Baseline	✔

Table A.2.3　550 ppm Stabilization Scenarios.

Legend Key	SourceID	ScenarioID	Description	Mark
AIM(1)	AIM/EMF14	Stblz Ems/STD	intervention : 1990 Stabilization	✔
AIM96(2)	AIM96	Scenario_3	intervention : Others	✔
	AIM96	Scenario_2	intervention : Others	
	AIM96	Scenario_2a	intervention : Others	
	AIM96	Scenario_2b	intervention : Others	
	AIM96	Scenario_2c	intervention : Others	
	AIM96	Scenario_2d	intervention : Others	
	AIM96	Scenario_1	intervention : 1990 Stabilization	
	CETA/EMF14	Ltd dTemp/MOD	intervention : Others	
	CETA/EMF14	Ltd dTemp/STD	intervention : Others	
	CETA/EMF14	Opt Ems/MOD	intervention : Others	
	CETA/EMF14	Opt Ems/STD	intervention : Others	
CETA(3)	CETA/EMF14	Stblz ppm/MOD	intervention : CO_2 550ppm Stabilization	✔
CETA(4)	CETA/EMF14	Stblz ppm/STD	intervention : CO_2 550ppm Stabilization	✔
	CETA/EMF14	Stblz Ems/MOD	intervention : 1990 Stabilization	
	CETA/EMF14	Stblz Ems/STD	intervention : 1990 Stabilization	
	CRPS/EMF14	Ltd dTemp/STD	intervention : Others	
CRPS(5)	CRPS/EMF14	Stblz ppm/STD	intervention : CO_2 550ppm Stabilization	✔
	CRPS/EMF14	Stblz Ems/STD	intervention : 1990 Stabilization	
	DICE/EMF14	Ltd dTemp/MOD	intervention : Others	
	DICE/EMF14	Opt Ems/MOD	intervention : Others	
DICE(6)	DICE/EMF14	Stblz ppm/MOD	intervention : CO_2 550ppm Stabilization	✔
	DICE/EMF14	Stblz Ems/MOD	intervention : 1990 Stabilization	
DNE21/98(7)	DNE21/98	550 ppmv	intervention : CO_2 550ppm Stabilization	✔
	HCRA/EMF14	Ltd dTemp/STD	intervention : Others	
	HCRA/EMF14	Opt Ems/STD	intervention : Others	
HCRA(9)	HCRA/EMF14	Stblz ppm/STD	intervention : CO_2 550ppm Stabilization	✔
	HCRA/EMF14	Stblz Ems/STD	intervention : 1990 Stabilization	
	ICAM2/EMF14	Ltd dTemp/MOD	intervention : Others	
	ICAM2/EMF14	Ltd dTemp/STD	intervention : Others	
	ICAM2/EMF14	Opt Ems/MOD	intervention : Others	
	ICAM2/EMF14	Opt Ems/STD	intervention : Others	
ICAM2(10)	ICAM2/EMF14	Stblz ppm/MOD	intervention : CO_2 550ppm Stabilization	✔
ICAM2(11)	ICAM2/EMF14	Stblz ppm/STD	intervention : CO_2 550ppm Stabilization	✔
	ICAM2/EMF14	Stblz Ems/MOD	intervention : 1990 Stabilization	
	ICAM2/EMF14	Stblz Ems/STD	intervention : 1990 Stabilization	
	IIASA/EMF14	Scenario#18	intervention : Others	
IIASA(12)	IIASA/EMF14	Stblz ppm/MOD	intervention : CO_2 550ppm Stabilization	✔
IIASA(13)	IIASA/EMF14	Stblz ppm/STD	intervention : CO_2 550ppm Stabilization	✔
	IIASA/EMF14	Stblz Ems/MOD	intervention : 1990 Stabilization	
	IIASA/EMF14	Stblz Ems/STD	intervention : 1990 Stabilization	
IIASA/WEC98(14)	IIASA/WEC98	C1	intervention : Others	✔
	IIASA/WEC98	C2	intervention : Others	
IIASAWEC(15)	IIASAWEC	C1	intervention : Others	✔
	IIASAWEC	C2	intervention : Others	
	IMAGE2.1	LESS BI Changed Trade	intervention : Others	
	IMAGE2.1	LESS BI No Biofules	intervention : Others	
IMAGE2.1(16)	IMAGE2.1	Stab 550 All	intervention : CO_2 550ppm Stabilization	✔
	MARIA/EMF14	Ltd dTemp/STD	intervention : Others	
	MARIA/EMF14	Opt Ems/STD	intervention : Others	
MARIA(17)	MARIA/EMF14	Stblz ppm/STD	intervention : CO_2 550ppm Stabilization	✔

Legend Key	SourceID	ScenarioID	Description	Mark
	MARIA/EMF14	Stblz Ems/STD	intervention : 1990 Stabilization	
MARIA95(18)	MARIA95	a	intervention : CO_2 550ppm Stabilization	✔
	MERGE/EMF14	Ltd dTemp/STD	intervention : Others	
	MERGE/EMF14	Opt Ems/STD	intervention : Others	
MERGE(19)	MERGE/EMF14	Stblz ppm/STD	intervention : CO_2 550ppm Stabilization	✔
	MERGE/EMF14	Stblz Ems/STD	intervention : 1990 Stabilization	
MINICAM(20)	MINICAM/EMF14	Stblz ppm/STD	intervention : CO_2 550ppm Stabilization	✔
	MINICAM/EMF14	Stblz Ems/STD	intervention : 1990 Stabilization	
MIT(21)	MIT/EMF14	Stblz ppm/MOD	intervention : CO_2 550ppm Stabilization	✔
MIT(22)	MIT/EMF14	Stblz ppm/STD	intervention : CO_2 550ppm Stabilization	✔
	MIT/EMF14	Stblz Ems/MOD	intervention : 1990 Stabilization	
	MIT/EMF14	Stblz Ems/STD	intervention : 1990 Stabilization	
NWEAR21(23)	NWEAR21/EMF14	Stblz ppm/MOD	intervention : CO_2 550ppm Stabilization	✔
	PAGE/EMF14	Ltd dTemp/STD	intervention : Others	
PAGE(24)	PAGE/EMF14	Stblz ppm/STD	intervention : CO_2 550ppm Stabilization	✔
	PAGE/EMF14	Stblz Ems/STD	intervention : 1990 Stabilization	
	PEF/EMF14	Ltd dTemp/MOD	intervention : Others	
	PEF/EMF14	Ltd dTemp/STD	intervention : Others	
	PEF/EMF14	Opt Ems/MOD	intervention : Others	
	PEF/EMF14	Opt Ems/STD	intervention : Others	
PEF(25)	PEF/EMF14	Stblz ppm/MOD	intervention : CO_2 550ppm Stabilization	✔
PEF(26)	PEF/EMF14	Stblz ppm/STD	intervention : CO_2 550ppm Stabilization	✔
	PEF/EMF14	Stblz Ems/MOD	intervention : 1990 Stabilization	
	PEF/EMF14	Stblz Ems/STD	intervention : 1990 Stabilization	
	RICE/EMF14	Ltd dTemp/MOD	intervention : Others	
	RICE/EMF14	Opt Ems/MOD	intervention : Others	
RICE(27)	RICE/EMF14	Stblz ppm/MOD	intervention : CO_2 550ppm Stabilization	✔
	RICE/EMF14	Stblz Ems/MOD	intervention : 1990 Stabilization	
SGM97(28)	SGM97	MID550 (full trade)	intervention : CO_2 550ppm Stabilization	✔
SGM97(28a)	SGM97	MID550 (partial trading)	intervention : CO_2 550ppm Stabilization	✔
SGM97(28b)	SGM97	WGI550 (trade)	intervention : CO_2 550ppm Stabilization	✔
SGM97(28c)	SGM97	WRE550 (trade)	intervention : CO_2 550ppm Stabilization	✔
WEC(29)	WEC	C	intervention : Others	✔
	YOHE/EMF14	Ltd dTemp/MOD	intervention : Others	
	YOHE/EMF14	Opt Ems/MOD	intervention : Others	
YOHE(30)	YOHE/EMF14	Stblz ppm/MOD	intervention : CO_2 550ppm Stabilization	✔
	YOHE/EMF14	Stblz Ems/MOD	intervention : 1990 Stabilization	
	YOHE/EMF14	Stblz Ems/STD	intervention : 1990 Stabilization	
AIM97(31a)	AIM97	MID550(trade)	intervention : CO_2 550ppm Stabilization	✔
AIM97(31b)	AIM97	MID550(notrade)	intervention : CO_2 550ppm Stabilization	✔
AIM97(31c)	AIM97	WRE550(trade)	intervention : CO_2 550ppm Stabilization	✔
AIM97(31d)	AIM97	WRE550(notrade)	intervention : CO_2 550ppm Stabilization	✔
AIM97(31e)	AIM97	WGI550(notrade)	intervention : CO_2 550ppm Stabilization	✔
	AIM97	WGI550(trade)	intervention : CO_2 550ppm Stabilization	
CETA(32)	CETA99	550_stab	intervention : CO_2 550ppm Stabilization	✔
	SGM99	MID550 (no trade)	intervention : CO_2 550ppm Stabilization	
	SGM99	MID550 (partial trading)	intervention : CO_2 550ppm Stabilization	
	SGM99	MID550 (trade)	intervention : CO_2 550ppm Stabilization	
	SGM99	WGI550 (no trade)	intervention : CO_2 550ppm Stabilization	
	SGM99	WGI550 (trade)	intervention : CO_2 550ppm Stabilization	
	SGM99	WRE550 (no trade)	intervention : CO_2 550ppm Stabilization	
SGM(41)	SGM99	WRE550 (trade)	intervention : CO_2 550ppm Stabilization	✔

2.3. Reproducibility of the IPCC Fourth Assessment Report (AR4)

This section shows an example of filtering for demonstrating the reproducibility of the results shown in the IPCC Fourth Assessment Report (AR4) Working Group III (WG III). This confirms the reproducibility of Figure 3-17 (Category I Global CO_2 Emissions) shown on page 199 of the AR4 WG III. Because step 1 (Opening the database) and step 3 (Output of filtered results to a file and graphing) are identical to section 2.1, this section describes Step 2 (Selecting the data filtering module) only.

Step 1: Opening the database
Identical to Appendix A.2.1.

Step 2: Selecting the data filtering module
Press the [Selection] button in the Data Selection and Graph Wizard in the Main screen (Figure A.2.2) to open the Data Selection screen (Figure A.2.8). The data selection is filtered using the variables of (1) Series, (2) Source, (3) Region, (4) Scenario, and (5) Class and Object.
The (4) scenarios in the AR4 can be selected by the category designation. To select based on the category designation, first, press the [Select by Category] button in the Data Selection screen (Figure A.2.12) to open the screen shown in Figure A.2.13
Next, in the screen shown in Figure A.2. 13, “6. IPCC-AR4” is selected for (1) Series, all sources (in other words, the “*” wildcard) is selected for (2) Source, “World” is selected for (3) Region, “1. Category I” is selected for category, and "Emission” and “CO_2 Total” for CO_2 emissions are selected for (5) Class and Object. The screen when all variables are selected is shown in Figure. A.2.13.

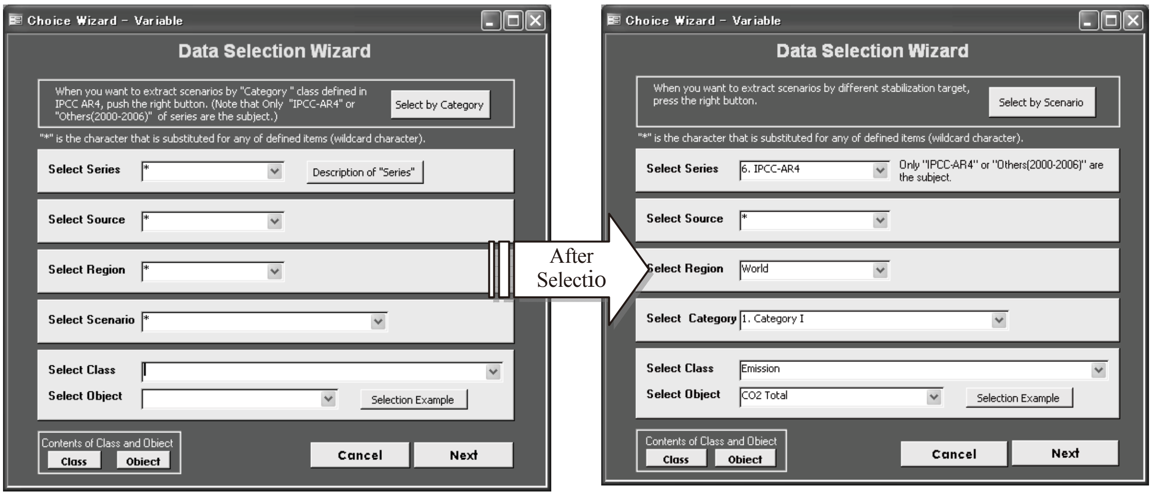


Figure. A.2.12　Data Selection Screen.

Figure. A.2.13　Data Selection Screen (Selected Completed).

Step 3: Output of filtered results to a file and graphing
This procedure is identical to that shown in section A.2.1. As shown in Figure. A.2.14, it is clear that Figure 3-17 shown on page 199 of the TAR WG III is roughly reproduced here.

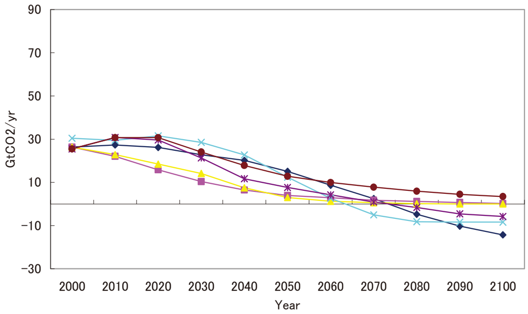


Figure. A.2.14 Filtered Results[3] from the database.

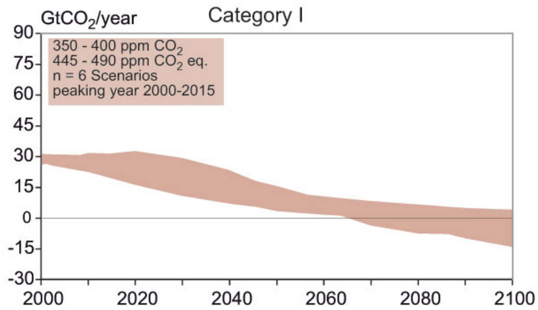


Figure. A.2.15 Figure 3.17 (Category I) in the AR4.

Also, analysis of the information of this database enables rough reproduction of various graphs and tables contained the AR4 WG III.

[3] The filtered results were converted to graph form for comparison with Figure 3.17 of AR4.

APPENDIX B　Database Content

APPENDIX B Database Content

1. Number of Sources and Scenarios

When the database is first started, the Welcome screen is displayed. The Welcome screen shows the total number of data sources and scenarios that are currently stored in the database. The database shown in the figure below currently has 320 sources and 1066 scenarios (Figure B.1.1). The number of sources and scenarios by publication are shown in Table B.1.1.

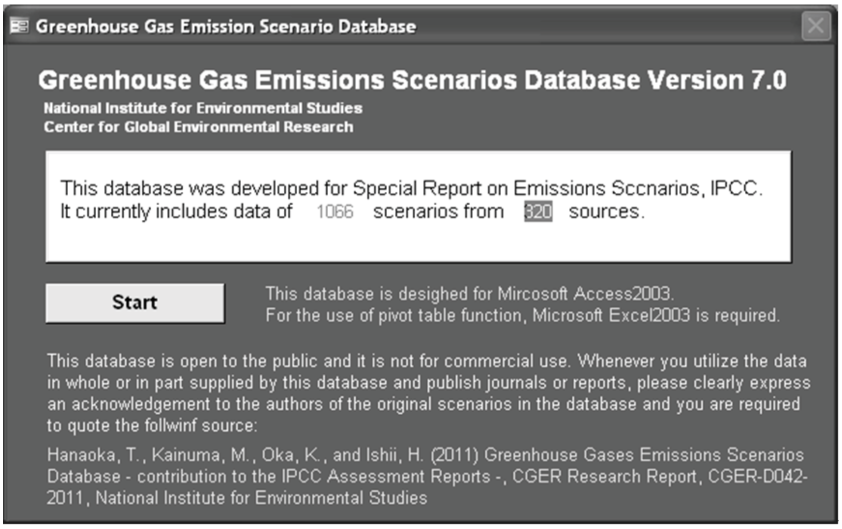


Figure. B.1.1 Database Welcome Screen.

Table B.1.1 Number of Source and Scenarios Registered in Database.

Publication	No. of sources	No. of scenarios
Sources reviewed in the IPCC Second Assessment Report (1995)	40	62
Sources published between 1992 to 1999 but not reviewed by the IPCC	113	192
SRES Scenarios (1999)	6	40
Sources reviewed in the IPCC Third Assessment Report (2000)	36	330
Sources reviewed in the IPCC Fourth Assessment Report (2007)	45	239
Sources published between 2000 to 2006 but not reviewed by the IPCC	22	85
Scenarios named as "RCP (Representative Concentration Pathways)" which are expected to be reviewed in the IPCC Fifth Assessment Report (2013)	4	4
Other publications (TGICA, UNFCCC, etc.)	55	115
Total	322	1066

2. Database Files

The data stored in this database is classified in the five tables entitled “SOURCE”, “SCENARIO”, “REGION”, “VARIABLE”, and “DATAMON”. The content of each table is shown in Table B.2.1. The content of each sheet and the data items are shown on the following pages. In Microsoft Access, these tables are linked by the relationship shown in Figure B.2.1.

Table B.2.1 Information Contained in Tables.

Item Name	Content
SOURCE	Abbreviation indicating the data source, research agency name, predictive model name, etc.
SCENARIO	Emission scenario name
REGION	Region where the scenario is applied
VARIABLE	Data variables defined as assumptions and forecast targets in the scenario. CO_2 emissions, GDP, population, primary energy amount, etc.
DATAMON	Stores numerical data

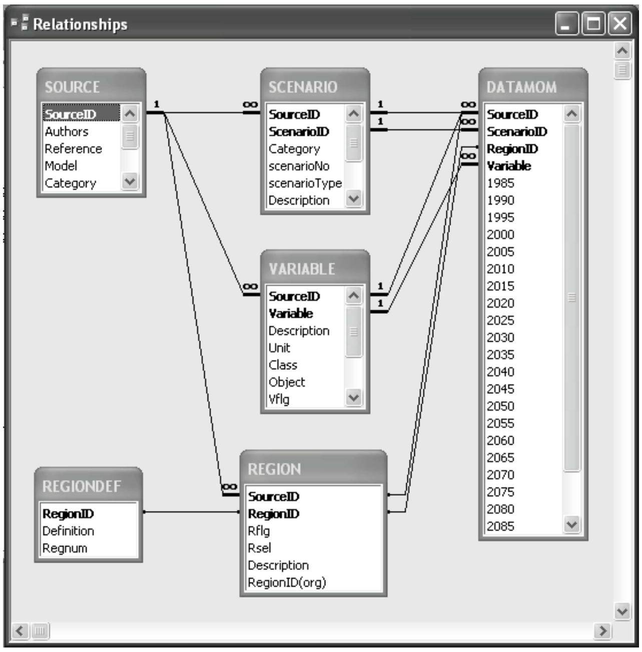


Figure. B.2.1 Database Relationship.

2.1. SOURCE table

The SOURCE table compiles the information shown in data sources.

Table B.2.2 SOURCE Table Content.

Item name	Content
SourceID	Abbreviation indicating the data source. One of the main keys.
Authors	Source authors
Reference	Reference
Model	Model name
Category	Model type
Update	Publication year
SourceDB	Publication
Series	Data classification based on IPCC Report classification
Notes	Notes

2.2. SCENARIO table

The SCENARIO table is a table showing the emissions scenario content and type. In this database, selection is possible based on the emissions scenario type. The available emissions scenario classifications are shown in Tables B.2.4 and B.2.5.

Table B.2.3 SCENARIO Table Content.

Item name	Content
SourceID	Abbreviation indicating the data source. One of the main keys.
ScenarioID	Name of the emissions scenario. One of the main keys.
Category	Emissions scenario type. This is primarily divided into the two types below. Non-intervention: Reference scenario or scenario without policy intervention Intervention: Scenario assuming policy intervention
ScenarioNo	If scenarios based on different baselines are found within the same source, they are assigned different scenario numbers. This is set to enable easy comparison of reference scenarios and mitigation scenarios.
ScenarioType	Shows the scenario type. This is primarily set for classifying mitigation scenarios. For details, see Table B.2.4.
Description	Scenario description
ScSel	Flag that is set ON/OFF for display and output of records in a target scenario. This is a newly established parameter for enabling detailed selection in each individual scenario.
ScenarioID (Org)	Name of original emissions scenario
Category AR4	Shows the relevant category classification of the scenario from sources in the AR4 (Table B.2.5).

Table B.2.4 Stabilization Concentration Scenario Types in This Database.

No.	Content	No.	Content
0	*	22	intervention : Others
1	nonintervention : SRES A1 (A1B)	23	Uncertainly
2	nonintervention : SRES A2	24	intervention : with measures on NC3
3	nonintervention : SRES B1	25	intervention : with additional measures
4	nonintervention : SRES B2	26	intervention : Tax
5	nonintervention : SRES A1FI (A1G)	27	intervention :2.6W/m2
6	nonintervention : SRES A1T	28	intervention :2.8W/m2
7	nonintervention : Baseline	29	intervention :2.9W/m2
8	nonintervention : Others	30	intervention :3.2W/m2
9	intervention : CO_2 350ppm Stabilization	31	intervention :3.7W/m2
10	intervention : CO_2 400ppm Stabilization	32	intervention :3.9W/m2
11	intervention : CO_2 450ppm Stabilization	33	intervention :4.0W/m2
12	intervention : CO_2 500ppm Stabilization	34	intervention :4.5W/m2
13	intervention : CO_2 550ppm Stabilization	35	intervention :4.6W/m2
14	intervention : CO_2 590ppm Stabilization	36	intervention :5.3W/m2
15	intervention : CO_2 600ppm Stabilization	37	intervention :5.6W/m2
16	intervention : CO_2 640ppm Stabilization	38	intervention :6.0W/m2
17	intervention : CO_2 650ppm Stabilization	39	intervention :6.5W/m2
18	intervention : CO_2 750ppm Stabilization	40	intervention :7.1W/m2
19	intervention : Temp. constraint 2°C	41	intervention :8.4W/m2
20	intervention : 1990 Stabilization	42	intervention :8.5W/m2

21	intervention : Other Stabilization		

Table B.2.5 IPCC AR4 Category Type.

Category	Additional radiative forcing (W/m2)	CO_2 concentration (ppm)	GHS concentration (CO_2 equivalent) (ppm)	Temperature rise above pre-industrial level (°C)
I	2.5～3.0	350～400	445～490	2.0～2.4
II	3.0～3.5	400～440	490～535	2.4～2.8
III	3.5～4.0	440～485	535～590	2.8～3.2
IV	4.0～5.0	485～570	590～710	3.2～4.0
V	5.0～6.0	570～660	710～855	4.0～4.9
VI	6.0～7.5	660～790	855～1130	4.9～6.1

2.3. REGION table

The REGIONDEF table indicates the region classifications.

Table B.2.6 REGION Table Content.

Item name	Content
SourceID	Abbreviation indicating the data source. One of the main keys.
RegionID	Region for target scenario of the SourceID
Rflg	Flag used for region merging and other calculation processes
Rsel	Flag that is set ON/OFF for display and output of records in a target region. This is set for enabling detailed selection in each region.
Description	Notes
RegionID (Org)	Name of original region

2.4. REGIONDEF table

The REGIONDEF table indicates the region classifications.

Table B.2.7 REGION Table Content.

Item name	Content
RegionID	Region for target scenario of the SourceID
Definition	Range defined by RegionID
Regnum	Region classification. Used for compiling data and other operations. 0 Nature 1 World 2 Large Region (ex. OECD, FSU, ASIA) 3 Developed Countries 4 Economy in Transition Countries 5 Developing Countries

2.5. VARIABLE table

The VARIABLE table contains data items that serve as the assumptions or estimates of the scenario. The [Class] field indicates the classification for the item, and the [Object] field indicates the object. The [Class] and [Object] content of data that is currently stored in the database are shown in Tables B.2.9 and B.2.10, respectively. Table B.2.11 indicates examples of combining [Class] and [Object] for important variables.

Table B.2.8   VARIABLE Table Content,

Item name	Content
SourceID	Abbreviation indicating the data source. One of the main keys.
Variable	Data item defined by the scenario. One of the main keys.
Description	Description of the variable
Unit	Unit of the variable
Class	Variable classification. Provided for enabling better searching and filtering.
Object	Variable object. Provided for enabling better searching and filtering.
Vflg	Variable importance. A ranking of importance is assigned to data required for searching and filtering. In the default state, 1 to 5 are input based on the data consistency. This can be changed based on user preferences. Raising the importance of data that is referenced frequently can enable more effective searches. 1 (Data with low usage frequency) ↑ Low Importance ↓ High 5 (Representative data or data that is referenced frequently)
Vsel	Flag that is set ON/OFF for display and output of records in target variable. This is set for enabling detailed selection for each variable.
Variable (Org)	Name of the original variable
Notes	Notes
GWP	GWP value used when converting to the equivalent weight of carbon dioxide

Table B.2.9   Class Field Content.

	Class	Content
1	Atmosphere	Atmospheric-related data such as the CO_2 concentration
2	Basic data	Socioeconomic and other basic data such as the population, GDP, and so on
3	Cost	Cost-related data such as the marginal costs and energy price
4	Cumulative Emission	Cumulative emission data such as cumulative CO_2 emissions
5	Cumulative Use	Cumulative use data such as the cumulative use of fossil fuels
6	Emission	Emission data such as CO_2 emissions
7	Electricity Generation	Electricity Generation
8	Final Energy Consumption	Final energy consumption amount
9	Impact	Impact-related data such as the rise in sea levels and temperature increase
10	Index	Indexed data such as carbon intensity
11	Primary Energy Supply	Primary energy supply amount
12	Primary Energy Production	Primary energy production amount
13	Trade	Trade-related data

Table B.2.10 Object Field Content.

Class	Object	Contents
Atmosphere	CFC/HFC/PFC	CFC/HFC/PFC concentration
	CH_4	CH_4 concentration
	CO_2	CO_2 concentration
	N_2O	N_2O concentration
Basic data	AEEI	Autonomous energy efficiency improvement rates
	Agriculture	Production related to agriculture, number of animals
	Biomass	Death biomass, Living biomass
	Capacity	Installed capacity
	CO_2	Emission Coefficient of Gas, Coal, Oil CO_2
	Economic	Data related to economy such as Reduction Rate of Macroeconomic Consumption
	Forest	Per capita Forest Products consumption
	GDP	GDP
	GDP ppp	GDP at purchasing power parities
	GDP Related	Data related to GDP such as GDP of agriculture
	Industry	Cement production, Crude steel production
	Population	Population
	Radiation	Radiative forcing
	Residential and Commercial	Data such as average area of house, Floor areas for commercial sector
	Transport	Passenger transport, Freight transport
	Water	Fresh water supply
Cost	Agriculture	Livestock prices, Per capita value of food consumed
	Biomass	Biomass commercial average cost
	Carbon	Carbon price, Carbon tax, Carbon permit, Marginal CO_2 reduction costs
	Coal	Price of Coal to electric utilities, Coal average cost
	Control	Control costs
	Economic	Present discounted value
	Electricity	Electricity investments
	Energy	Total energy system cost
	Gas	Price of Gas to electric utilities, Gas average cost
	Oil	Price of Oil to electric Utilities, Oil average cost
	Others	Other investments
	Shadow price	Shadow prices of Biomass commercial, Coal, Gas, Oil
	Total	Total investments
Cumulative Emission	CO_2	Cumulative CO_2 emissions
Cumulative Use	Coal	Cumulative Coal use
	Gas	Cumulative Gas use
	Oil	Cumulative Oil use
Emission	6GHG	6GHG emission
	BC	BC emission
	C2F6	C2F6 emission
	C6F14	C6F14 emission
	CCS	CCS emission
	CF4	CF4 emission
	CFC/HFC/PFC	CFC/HFC/PFC emission
	CH_4 Agriculture	CH_4 emission in agriculture

Class	Object	Contents
	CH_4 Commercial	CH_4 emission in commercial
	CH_4 Fossil	CH_4 emission from fossil
	CH_4 Fossil & Industry	CH_4 emission from fossil & industry
	CH_4 Industrial Processes	CH_4 industrial processes emission
	CH_4 Industry	CH_4 emission from industry
	CH_4 Other	CH_4 emission from other
	CH_4 Residential	CH_4 emission in residential
	CH_4 Total	Total CH_4 emission
	CH_4 Transport	CH_4 emission in transport
	CO	CO emission
	CO_2 Agriculture	CO_2 emission in agriculture
	CO_2 Commercial	CO_2 emission in commercial
	CO_2 Fossil	CO_2 emission from fossil
	CO_2 Fossil & Industry	CO_2 emission from fossil & industry
	CO_2 Industrial Processes	CO_2 emission from industrial processes
	CO_2 Industry	CO_2 industry emission
	CO_2 Other	CO_2 emission from other
	CO_2 Residential	CO_2 emission in residential
	CO_2 Total	Total CO_2 emission (Fossil fuel + LULUCF + CCS)
	CO_2 Transport	CO_2 emission in transport
	GHG	GHG emission
	HFC/PFC/SF6	HFC/PFC/SF6 emission
	LULUCF	LULUCF emission
	N_2O Agriculture	N_2O emission in agriculture
	N_2O Commercial	N_2O emission in commercial
	N_2O Fossil	N_2O emission from fossil
	N_2O Fossil & Industry	N_2O emission from fossil & industry
	N_2O Industrial Processes	N_2O emission from industrial processes
	N_2O Industry	N_2O emission from industry
	N_2O Other	N_2O other emission
	N_2O Residential	N_2O emission in residential
	N_2O Total	Total N_2O emission
	N_2O Transport	N_2O emission in transport
	NH_3	NH_3 emission
	NMVOC	NMVOC emission
	NO_2	NO_2 emission
	NOx	NOx emission
	ODS	ODS emission
	Organic Carbon	Organic carbon emission
	SO_2	SO_2 emission
	VHC	VHC emission
Final energy consumption	Biomass	Final energy consumption of Biomass
	Coal	Final energy consumption of Coal
	Electricity	Final energy consumption of Electricity
	Gas	Final energy consumption of Gas
	Gaseous	Final energy consumption of Gaseous

Class	Object	Contents
	Grids	Final energy consumption of Grids
	Hydrogen	Final energy consumption of Hydrogen
	Industry	Final energy consumption in Industry
	Liquid	Final energy consumption of Liquid
	Non-commercial	Final energy consumption in Non-commercial
	Oil	Final energy consumption of Oil
	Others	Final energy consumption of Others
	Residential and Commercial	Final energy consumption in residential and commercial
	Solar	Final energy consumption of Solar
	Solid	Final energy consumption of Solid
	Total	Total final energy consumption
	Transport	Final energy consumption in transport
Electricity Genaration	Electricity	Electricity genaration
Impact	Economic	Climate change costs
	Others	Other impact such as Area lost to sea rise
	Sea level	Sea level rise
	Temperature	Temperature increase
Index	Carbon Intensity	Carbon intensity of 1990=100
	CO_2	CO_2 emission of 1990=100
	Energy Intensity	Energy intensity of 1990=100
	GDP	GDP of 1990=100
Primary energy production	Biomass	Primary energy production of Biomass
	Coal	Primary energy production of Coal
	Gas	Primary energy production of Gas
	Hydropower	Primary energy production of Hydropower
	Indigenous	Primary energy production of Indigenous
	Liquid	Primary energy production of Liquid
	Nuclear	Primary energy production of Nuclear
	Oil	Primary energy production of Oil
	Others	Primary energy production of Others
	Renewables	Primary energy production of Renewables
	Solar	Primary energy production of Solar
	Solid	Primary energy production of Solid
	Total	Total primary energy production
Primary energy supply	All-Fossil	Primary energy supply of All-Fossil
	Biomass	Primary energy supply of Biomass
	Biomass Modern	Primary energy supply of Biomass Modern
	Biomass Traditional	Primary energy supply of Biomass Traditional
	Coal	Primary energy supply of Coal
	Electricity	Primary energy supply of Electricity
	Gas	Primary energy supply of Gas
	Hydrogen	Primary energy supply of Hydrogen
	Hydropower	Primary energy supply of Hydropower
	Liquid	Primary energy supply of Liquid
	Non-Fossil	Primary energy supply of Non-Fossil
	Nuclear	Primary energy supply of Nuclear

Class	Object	Contents
	Oil	Primary energy supply of Oil
	Other Res	Primary energy supply of Other Renewable Energy
	Others	Primary energy supply of Others
	Solar	Primary energy supply of Solar
	Synthetic fuel	Primary energy supply of Synthetic fuel
	Total	Total primary energy supply
	Total Res	Primary energy supply of Total Renewable Energy
	Wind	Primary energy supply of Wind
	Wind&Solar	Primary energy supply of Wind&Solar
	Wind,&Solar,&Geoth.	Primary energy supply of Wind, Solar & Geoth.
Trade	Agriculture	Crop trade (t)
	Biomass	Biomass trade
	Carbon	Carbon permits sold or purchased (Mt)
	Coal	Coal export or Import
	Electricity	Electricity export or import
	Gas	Gas export or import
	Hydrogen	Hydrogen export or import
	Hydropower	Hydropower net trade
	Liquid	Methanol export or import
	Nuclear	Nuclear energy net trade
	Oil	Oil export or import
	Others	Other net trade
	Renewables	Other renewables net trade
	Solar	Solar energy net trade
	Total	Total export or import
	Synthetic Fuels	Synthetic fuels trade

Table B.2.11　Examples of [Class] and [Object] Combinations for Important Variables.

Variable	Class	Object
Total CO_2 emissions	Emission	CO_2 Total
Fossil fuel-related CO_2	Emission	CO_2 Fossil
Industrial-related CO_2	Emission	CO_2 Industrial
Fossil fuel + Industry-related CO_2	Emission	CO_2 Fossil & Industry
CCS-related CO_2	Emission	CCS
LULUCF-related CO_2	Emission	LULUCF
Total CH_4 emissions	Emission	CH_4 Total
Total N_2O emissions	Emission	N_2O Total
GDP	Basic data	GDP
Population	Basic data	Population
Total primary energy supply amount	Primary Energy Supply	Total
Final total energy consumption	Final Energy consumption	Total
Carbon tax	Cost	Carbon
Temperature rise	Impact	Temperature
Sea level rise	Impact	Sea Level Rise

2.6. DATAMON table

The DATAMON table contains actual records. It is associated with other tables using the four main keys of [SourceID], [ScenarioID], [RegionID], and [Variable].

Table B.2.12 DATAMOM Table Content.

Class	Content
SourceID	Abbreviation indicating the data source. One of the main keys.
ScenarioID	Name of the emissions scenario. One of the main keys.
RegionID	Region of target scenario. One of the main keys.
Variable	Data item defined by the scenario. One of the main keys.
1985	1990 value of the variables for SourceID, ScenarioID, and RegionID
|	The values for each 5-year interval to 2100 are provided here.
2100	

3. List of the IPCC Assessment Report Scenarios stored in the Database

The correspondence between the information in the main reports by the IPCC, namely, the SRES (Special Report on Emissions Scenarios), the TAR (Third Assessment Report) and the AR4 (Fourth Assessment Report) and the sources stored in this database (source ID, source title, etc.) is shown in the list below.

3.1. The IPCC Special Report on Emissions Scenarios

The sources for the SRES scenarios stored in this database are shown below.

Table B.3.1 SRES Scenario Sources Stored in This Database.

Source ID	Authors	Year	Title	Jounal	Model Name
AIM/SRES	Morita, Y., Matsuoka, Y., Kainuma, M., and Harasawa, H.	1994	AIM - Asian Pacific integrated model for evaluating policy options to reduce GHG emissions and global warming impacts.	Global Warming Issues in Asia, S. Bhattacharya et al. (eds.), AIT, Bangkok, pp. 254-273	Asian-Pacific Integrated Model (AIM)
	Kainuma, M., Matsuoka, Y., and Morita, Y.	1998	Analysis of Post-Kyoto Scenarios: The AIM Model.	Economic Modeling of Climate Change: OECD Workshop Report, Organisation for Economic Co-operation and Development, Paris.	Asian-Pacific Integrated Model (AIM)
	Kainuma, M., Matsuoka, Y., Morita, T., and Hibino, G.	1999	Development of an End-Use Model for Analyzing Policy Options to Reduce Greenhouse Gas Emissions.	IEEE Transactions on Systems, Man and Cybernetics, Part C: Applications and Reviews, 29(3), 317-324.	Asian-Pacific Integrated Model (AIM)
	Kainuma, M., Matsuoka, and Y., Morita, Y.	1999	Analysis of Post-Kyoto Scenarios: the Asian-Pacific Integrated Model.	The Costs of the Kyoto Protocol: A Multi-Model Evaluation, Special Issue of The Energy Journal. J.P. Weyant (ed.), pp 207-220.	Asian-Pacific Integrated Model (AIM)
ASF/SRES	EPA	1990	Policy Options for Stabilizing Global Climate.	EPA, Washington, DC.	ASF
	Pepper, W.J., Legett., J., Swart, R., Wasson, J., Edmonds., J., and Mintzer, I.	1992	Emissions Scenarios for the IPCC. An Update: Asssumptions, Methodology, and Results.	Climate Change 1992. The Supplementary Report to the IPCC Scientific Assessment, J. Houghton. B. Callander, S. Varney (eds.), Cambridge University Press, Cambridge.	ASF
IMAGE/SRES	Alcamo, J.	1994	IMAGE 2.0: Integrated Modeling of Global Climate Change.	Kluwer Academic Press, Dordrecht/Boston, 314 pp.	IMAGE

Source ID	Authors	Year	Title	Jounal	Model Name
	Alcamo, J. and Nakicenovic, N (eds.)	1998	Long-Term Greenhouse Gas Emissions Scenarios and Their Driving Froces.	Mitigation and Adaptation Strategies for Clobal Change, 3(2-3), 95-466.	IMAGE
	De Vries, H.J.M., Janssen, M., Beusen, A.	1999	Perspectives on Global Energy Futures - Simulations with the TIME model.	Energy Policy, 27, 477-494.	IMAGE
	CPB Netherlands	1999	WorldScan — the Core version.	Bureau for Economic Policy Analysis (CPB), The Hague, December.	IMAGE
MARIA/SRES	Mori, S. and Takahashi, M.	1998	An Integrated Assessment Model for New Energy Technologies and Food Production — An Extension of the MARIA Model.	International Journal of Global Energy Issues, 11(1-4), 1-17.	MARIA
MESSAGE/SRES	Messner, S., Golognikov, A., and Gritsevskii, A.	1996	A Stochastic Version of the Dynamic Linear Programming Model MESSAGE III.	RR-97-002, International Institute for Applied Systems Analysis, Laxenburg, Austria.	MESSAGE
	Riahi, K. and Roehrl, R.A.	2000	Robust Energy Technology Strategies for the 21st Century - Carbon dioxide mitigation and sustainable development.	Environmental Economics and Policy Studies, 3(2).	MESSAGE
MiniCAM/SRES	Edmonds, J., Wise, M., Pitcher, H., Richels, R., Wigley, T., and Maccracken., C.	1996	An Integrated Assessment of Climate Change And The Accelerated Introduction of Advanced Energy Technologies.	Pacific Northwest National Laboratory, Washington, DC.	MiniCAM

3.2. The IPCC Third Assessment Report

1) IPCC TAR WG III Table 2.6

The sources that were reviewed in Table 2.6 on page 148 of the IPCC TAR WG III and stored in this database are shown below.

Table B.3.2 IPCC TAR (Table 2.6) Sources Stored in This Database.

Source ID	Authors	Year	Title	Jounal	Model Name
AIM/pSRES	Jiang, K., Morita, T., Masui, T., and Matsuoka, Y.	2000	Global Long-term GHG Mitigation Emission Scenarios based on AIM.	Environmental Economics and Policy Studies, 3(2).	Asian-Pacific Integrated Model (AIM)
ASF/pSRES	Sankovski, A., Barbour, W., and Pepper, W.	2000	Climate Change Mitigation in Regionalized World.	Environmental Economics and Policy Studies, 3(2).	ASF
IMAGE/pSRES	—	—	—	—	IMAGE

Source ID	Authors	Year	Title	Jounal	Model Name
LDNE/pSRES	Yamaji, K., Fujino, J., and Osada, K.	2000	Global Energy System to Keep the Atmospheric CO_2 Concentration at 550	Environmental Economics and Policy Studies, 3(2).	LDNE
MARIA/pSRES	Mori, S.	2000	Effects of Carbon Emission Mitigation Options under Carbon Concentration Stabilization Scenarios.	Environmental Economics and Policy Studies, 3(2).	MARIA
MESSAGE/pSRES	Riahi, K. and Roehrl, R.A.	2000	Robust Energy Technology Strategies for the 21st Century - Carbon dioxide mitigation and sustainable development.	Environmental Economics and Policy Studies, 3(2).	MESSAGE
MiniCAM/pSRES	Pitcher, H.M.	2000	An Assessment of Mitigation Options in a Sustainable Development World.	Environmental Economics and Policy Studies, 3(2).	MiniCAM
PETRO/pSRES	Kverndokk, S., Lindholt, L., and Rpsemdahl, K.E.	2000	Stabilisation of CO_2 concentrations: Mitigation scenarios using the Petro model.	Environmental Economics and Policy Studies, 3(2).	PETRO
WorldScan/pSRES	Bollen, J., Manders, T., and Timmer, H.	2000	The Benefits and Costs of Waiting - Early action versus delayed response in the post-SRES stabilization scenarios.	Environmental Economics and Policy Studies, 3(2).	WorldScan

2) IPCC TAR WG III Appendix 2.1

The sources that were reviewed in Appendix 2.1 on page 166 of the IPCC TAR WG III and stored in this database are shown below. The EMF14 data is featured in “Energy Policy 23(4-5), 1995”. When the relevant sources and table of contents were compared[1], only a portion of the data matched, and unmatched data was also found. In particular, “unpublished data” is also stored in this database.

Table B.3.3 IPCC TAR (Appendix 2.1) Sources Stored in This Database.

SourceID	Authors	Update	Title	Jounal	Model Name
AIM/EMF14	Matsuoka et al.	1997	Energy Modeling Forum (EMF) 14		Asian-Pacific Integrated Model (AIM)
AIM96	Matsuoka, Y., Kainuma, M., and Morita, T.	1995	Scenario analysis of global warming using the Asian-Pacific integrated model.	Energy Policy, 23(4/5), 357-372.	Asian-Pacific Integrated Model (AIM)

[1] http://www.sciencedirect.com/science?_ob=PublicationURL&_tockey=%23TOC%235713%231995%23999769995%23155862%23FLP%23&_cdi=5713&_pubType=J&_auth=y&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=8e917ecf3a28eb80bb7f855400f887e8

SourceID	Authors	Update	Title	Jounal	Model Name
AIM97	Matsuoka, Y. et al.	1997	Prof. Matsuoka's unpublished data file		Asian-Pacific Integrated Model (AIM)
CETA/EMF14	Peck, S.C. and Teisberg, T.J.	1995	International CO_2 Emissions Control: An Analysis Using CETA.	Energy Policy, 23(4-5), 297-208.	CETA
CETA99	Peck, S.C. and Teisberg, T.J.	1999	Prof. Teisberg's unpublished data file		CETA
CRPS/EMF14	Hammitt, J.K.	1997	Energy Modeling Forum (EMF) 14		Climate Research and Policy Synthesis Model
DICE/EMF14	Nordhaus, W.D.	1995	The ghosts of climates past and the specters of climate change future.	Energy Policy, 23(4-5), 269-282.	Dynamic Integrated Climate and Economy Model (DIES)
DNE21/98	Fujii, Y. and Yamaji, K.	1998	Assessment of Technological Options in the Global Energy System for Limiting the Atmospheric CO_2 Concentration.	Environmental Economics and Policy Studies, Vol.1, 113-139,	Dynamic New Earth 21 Model (DNE21)
HCRA/EMF14	Hammitt, J.K.	1997	Energy Modeling Forum (EMF) 14		
ICAM2/EMF14	Dowlatabadi, H.	1996	Integrated assessment models of climate change: An incomplete overview	Global Environmental Change. 6(4):261-303	Integrated Climate Assessment Model 2.0 (ICAM)
IIASA/EMF14	IIASA	1997	Energy Modeling Forum (EMF) 14		
IIASA/WEC98	IIASA & WEC	1998	World Energy Council, 1998.		
IIASAWEC	IIASA & WEC	1995	WEC/IIASA: Global energy perspectives to 2050 and beyond		
IMAGE2.1	RIVM	1996	Baseline scenarios of global environmental change.	Global Environmental Change. 6(4):261-303.	IMAGE 2.1.
MARIA/EMF14	Mori, S.	1997	Energy Modeling Forum (EMF) 14		MARIA
MARIA95	Mori, S.	1997	Long-term interactions among economy, environment, energy, and land-use changes - An extension of MARIA Model	Technological Report IA-TR-95-04, Science University of Tokyo, Japan	MARIA
MERGE/EMF14	Manne, A.S. and Richels, R.G.	1995	On Stabilizing CO_2 Concentrations — Cost-Effective Emission Reduction Strategies.	Environmental Modeling and Assessment, 2, 251-265.	MERGE
MINICAM/EMF14	Edmonds, J., Wise, M., and Barns, D.W.	1995	Carbon coalitions : The cost and effectiveness of energy agreements to alter trajectories of	Energy Policy, Vol.23(4-5), 309-335	MiniGlobal Change

SourceID	Authors	Update	Title	Jounal	Model Name
			atmospheric carbon dioxide emissions		Assessment Model (MiniCAM)
MIT/EMF14	Center for Global Change Science and Center for Energy and Environmental Policy Research	1997	Energy Modeling Forum (EMF) 14		MIT
NWEAR21/EMF14	Fujii, Y. et al.	1997	Energy Modeling Forum (EMF) 14		New Earth 21
PAGE/EMF14		1997	Energy Modeling Forum (EMF) 14		
PEF/EMF14		1997	Energy Modeling Forum (EMF) 14		
RICE/EMF14	Nordhaus et al.	1997	Energy Modeling Forum (EMF) 14		Regional DICE (RICE)
SGM97	Edmonds, J. and Ronald, D.S.	1997	Dr. Ronald D Sands's unpublished data file		SGM
SGM99	Edmonds, J. and Ronald, D.S.	1999	Prof. Sands's unpublished data file		SGM
WEC	WEC	1993	World Energy Council, September 1993.		
YOHE/EMF14	Gary Yohe, Wesleyan University	1997	Energy Modeling Forum (EMF) 14		Connecticut Model

3.3. The IPCC Fourth Assessment Report

The sources that were reviewed in the IPCC AR4 and stored in this database are shown below.

Table B.3.4 IPCC AR4 Sources Stored in This Database.

Source ID	Authors	Year	Title	Jounal	Model Name
0215	Fujino, J., Nair, R., Kainuma, M., Masui, T., and Matsuoka, Y.	2006	Multi-gas mitigation analysis on stabilization scenarios using AIM global model.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 343-354	AIM
097	Kainuma, M., Matsuoka, Y., Morita, T., Masui, T. and Takahashi, K.	2004	Analysis of Global Warming Stabilization Scenarios: the Asian-Pacific Integrated Model.	Energy Economics, 26, 709-719	AIM
108	Manne, A. and Richels, R.	2004	The Impact of Learning-by-Doing on the Timing and Costs of CO_2 Abatement.	Energy Economics, 26, 603-619	MERGE

Source ID	Authors	Year	Title	Jounal	Model Name
113	Sands, R.D.	2004	Dynamics of Carbon Abatement in the Second Generation Model.	Energy Economics, 26, 721-738	AMIGA
115	Mori, S. and Saito, T.	2004	Potentials of Hydrogen and Nuclear towards Global Warming Mitigation-Expansion of an Integrated Assessment Model MARIA and Simulations.	Energy Economics, 26, 565-578	MARIA
168	Kypreos, S.	2005	Modeling Experience Curves in MERGE (Model for Evaluating Regional and Global Effects).	Energy, 30, 14, 2721-2737	MERGE-ETL
187	Akimoto, K., Homma, T., Kosugi, T., Li, X., Tomoda1, T., and Fujii, Y.	2004	Role of CO_2 Sequestration by Country for Global Warming Mitigation after 2013.	Proceedings of 7th International Conference on Greenhouse Gas Control Technologies. Volume 1: Peer-Reviewed Papers and Plenary Presentations, IEA Greenhouse Gas Programme, Cheltenham, UK, 2004	DNE21+
188	Azar, C. Lindgren, K. Larson, E., and Mollersten, K.	2005	Carbon capture and storage from fossil fuels and biomass - Costs and potential role in stabilizing the atmosphere	Climatic Change, 74, 1-3, 47-79	
190	Rao, S. and Riaihi, K.	2006	The role of non-CO_2 greenhouse gases in Climate Change Mitigation:Long-term scenarios for the 21st century.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 177-200	MESSAGE
196	Kemfert, C., Truong, T.P., and Bruckner, T.	2006	Economic Impact Assessment of Climate Change-A Multi-gas Investigation with WIAGEM-GTAPEL-ICM.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 441-460	WIAGEM-ICM
198	Kurosawa, A.	2006	Multigas Mitigation: An Economic Analysis Using GRAPE Model.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 275-288	GRAPE
200	Manne, A. and Richels, R.G.	2006	The Role of Non-CO_2 Greenhouse Gases and Carbon Sinks in Meeting Climate Objectives.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 393-404	MERGE
201	Barker, T., Pan, H., Kohler, J., Warren, R., and Winne, S.	2006	Decarbonizing the global economy with induced technological change: scenarios to 2100 using E3MG.	The Energy Journal, Endogenous Technological Change and the Economics of Atmospheric Stabilisation, Special Issue #1, 241-258	E3MG
202	Fawcett, A.A. and Sands, R.D.	2006	Non-CO_2 Greenhouse Gases in the Second Generation Model.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 305-322	SGM

Source ID	Authors	Year	Title	Jounal	Model Name
203	Jiang, K., Xiulian, H., and Songli, Z.	2006	Multi-Gas Mitigation Analysis By IPAC.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 425-440	IPAC-Emission
204	Smith, S.J. and Wigley, T.M.L.	2006	Multi-gas forcing satabilization with MiniCAM.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 373-392	MiniCAM
205	Bernard, A., Vielle, M., and Viguier, L.	2006	Burden Sharing Within a Multi-Gas Strategy.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 289-304	GEMINI-E3
235	Reilly, J., Sarofim, M., Paltsev, S., and Prinn R.G.	2006	The Role of Non-CO_2 GHGs in Climate Policy : Analysis Using the MIT IGSM.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 503-520	EPPA 3.0
251	Sarofim, M., Forest, C.E., Reiner, D.M., and Reilly, J.M.	2005	Stabilization and Global Climate Policy.	Global and Planetary Change, 47, 2-4, 266-272	EPPA 3.0
253	Van Vuuren, D.P., Eickhout , B., Lucas, P.L., and Den Elzen, M.G.J.	2006	Long-term multi-gas scenarios to stabilise radiative forcing - Exploring costs and benefits within an integrated assessment framework.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 201-234	TIMER/IMAGE 2.2
260	Gerlagh.R	2006	ITC in a Global Growth-Climate Model with CCS: The Value of Induced Technical Change for Climate Stabilization.	The Energy Journal, Endogenous Technological Change and the Economics of Atmospheric Stabilisation, Special Issue #1, 223-240	DEMETER1 CCS
262	Masui, T., Hanaoka, T., Hikita, S., and Kainuma, M.	2006	Assessment of CO_2 Reductions and Economic Impacts Considering Energy-Saving Investments.	The Energy Journal, Endogenous Technological Change and the Economics of Atmospheric Stabilisation, Special Issue #1, 175-190	AIM/Dynamic-Global
263	Popp, D.	2006	Comparison of Climate Policies in the ENTICE-BR Model.	The Energy Journal, Endogenous Technological Change and the Economics of Atmospheric Stabilisation, Special Issue #1, 163-174	ENTICE-BR
264	Bosetti, V., Carraro, C., and Galeotti, M.	2006	The Dynamics of Carbon and Energy Intensity in a Model of Endogenous Technical Change.	The Energy Journal, Endogenous Technological Change and the Economics of Atmospheric Stabilisation, Special Issue #1, 191-205	FEEM-RICE v.3

Source ID	Authors	Year	Title	Jounal	Model Name
266	Edenhofer, O., Lessmann, K., and Bauer, N.	2006	Mitigation Strategies and Costs of Climate Protection: The Effects of ETC in the Hybrid MIND.	The Energy Journal, Endogenous Technological Change and the Economics of Atmospheric Stabilisation, Special Issue #1, 207-222	MIND 1.1
268	Aaheim, A., Fuglestvedt, J.S., and Godal, O.	2006	Costs Savings of a Flexible Multi-Gas Climate Policy.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 485-502	COMBAT
269	Jensen, J.	2006	Flexible multi-gas climate policies.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 163-175	EDGE
270	Hanson, D. and Laitner "Skip", J.A.	2006	Technology Policy and World Greenhouse Gas Emissions in the AMIGA Modeling System.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 355-372	AMIGA
271	Jakeman, G. and Fisher, B.S.	2006	Benefits of Multi-Gas Mitigation: an application of the Global Trade and Environment Model (GTEM).	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 323-342	GTEM
273	Rao, S., Keppo, I., and Riahi, K.	2006	Importance of Technological Change and Spillovers in Long-Term Climate Policy.	The Energy Journal, Endogenous Technological Change and the Economics of Atmospheric Stabilisation, Special Issue #1, 123-139	MESSAGE
274	Crassous, R., Hourcade, J.-C., and Sassi, O.	2006	Endogenous Structual Change ans Climate Targets in the exporation and extraction sector of fossil fuels.	The Energy Journal, Endogenous Technological Change and the Economics of Atmospheric Stabilisation, Special Issue #1, 259-276	IMACLIM-R
275	Hedenus, F., Azar, C., and Lindgren, K.	2006	Induced technological change in a limited foresight optimization model.	The Energy Journal, Endogenous Technological Change and the Economics of Atmospheric Stabilisation, Special Issue #1, 109-122	GET-LFL
277	Sano, F., Akimoto, K., Homma, T., and Tomoda, T.	2006	Analysis of Technological Portfolios for CO_2 Stabilizations and Effects of Technological Changes.	The Energy Journal, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue #3, 141-161	DNE21+
3	Azar, C., Lindgren, K., and Andersson, B.A.	2003	Global energy scenarios meeting stringent CO_2 constraints -- cost-effective fuel choices in the transportation sector	Energy Policy, Vol.32, 20, 961-976	

Source ID	Authors	Year	Title	Jounal	Model Name
42	Kurosawa, A.	2004	Energy Economics, 26, 675-684	Energy Economics, 26, 675-684	GRAPE
51	Van Vuuren, D.P., de Vries, B., Eickhout, B., and Kram, T.	2004	Responses to Technology and Taxes in a Simulated World.	Energy Economics, 26, 579-601	GRAPE
66	McFarland, J.R., Reilly, J.M., and Herzog, H.J.	2004	Representing energy Technologies in Top-Down Economic Models Using Bottom-Up Information.	Energy Economics, 26, 685-707	EPPA
67	Edmonds, J., Clarke, J., Dooley, J., Kim, S.H., and Smith, S.J.	2004	Stabilization of CO_2 in a B2 World: Insights on the Roles of Carbon Capture and Disposal, Hydrogen, and Transportation Technologies.	Energy Economics, 26, 517-537	MiniCAM
80	Akimoto, K., Tomoda, T., Fujii, Y., and Yamaji, K.	2004	Assessment of Global Warming Mitigation Options with Integrated Assessment Model DNE21.	Energy Economics, 26, 635-653	DNE21
84	Riahi, K., Rubin, E.S., Taylor, M.R., Schrattenholzer, L., and Hounshell, D.	2004	Technological Learning for Carbon Capture and Sequestration Technologies.	Energy Economics, 26, 539-564	MESSAGE
959	Fisher	2004	Dr. Fisher's unpublished data file	unpublished data file	GTEM
974	Nakicenovic, N. and Riahi, K.	2003	Model Runs With MESSAGE in the Context of the Further Development of the Kyoto-Protocol	Climate Protection Strategies for the 21st Century. Kyoto and Beyond	MESSAGE
976	Riahi, K., Grubler, A., and Nakicenovic, N.	2007	Scenarios of Long-term Socio-economic and Environmental Development under Climate Stabilization	Technological Forecasting and Social Change, Vol.74, 887-935	MESSAGE
982	Clarke, l., Edmonds, J., Jacoby, H., Pitcher, H., Reilly, j., and Richels, R.	2006	CCSP Synthesis and Assessment Product 2.1		IGSM, MERGE, MiniCAM
983	Van Vuuren, D.P., Den Elzen, M.G.J., Lucas, P.L., Eickhout, B., Strengers, B.J., Van Ruijven, B., Wonink, S., and Van Houdt, R.	2007	Stabilizing greenhouse gas concentrations at low levels: an assessment of reduction strategies and costs	Climate Change, 89, 119-159	IMAGE 2.3

3.4. Representative Concentration Pathways for the IPCC Fifth Assessment Report

The sources that are going to be reviewed in the IPCC AR5, so called "Representative Concentration Pathways (RCPs)", and stored in this database are shown below.

Table B.3.5 RPCs for the IPCC AR5 Sources Stored in This Database.

Source ID	Authors	Year	Title	Jounal	Model Name
R26	van Vuuren, D.P., Stehfest, E., den Elzen, M.G.J., Kram, T., van Vliet, J., Deetman, S., Isaac, M., Goldewijk, K.K., Hof, A., Beltran, A.M., Oostenrijk, R., van Ruijven, B.	2011	RCP2.6: exploring the possibility to keep global mean temperature increase below 2°C.	Climatic Change, Volume 109, Numbers 1-2, 95-116	IMAGE
R45	Thomson, A.M., Calvin, K.V., Smith, S.J., Page Kyle, G., Volke, A., Patel, P., Delgado-Arias, S., Bond-Lamberty, B., Wise, M.A., Clarke, L.E., and Edmonds, J.A.	2011	RCP4.5: a pathway for stabilization of radiative forcing by 2100	Climatic Change, Volume 109, Numbers 1-2, 77-94	MiniCAM
RCP60	Masui, T., Matsumoto, K., Hijioka, Y., Kinoshita, T., Nozawa, T., Ishiwatari, S., Kato, E., Shukla, P.R., Yamagata, Y., and Kainuma, M.	2011	An emission pathway for stabilization at 6 Wm−2 radiative forcing	Climatic Change, Volume 109, Numbers 1-2, 59-76	AIM
R85	Riahi, K., Rao, S., Krey, V., Cho, C., Chirkov, V., Fischer, G., Kindermann, G., Nakicenovic, N., and Rafaj, P.	2011	RCP 8.5—A scenario of comparatively high greenhouse gas emissions	Climatic Change, Volume 109, Numbers 1-2, 33-57	MESSAGE

4. List of Other Scenarios Stored in the Database

The others sources stored in this database are shown in Table B.4.1.

Table B.4.1. Complete List of Sources Stored in Database.

SourceID	Authors	Year	Title	Journal	Model Name	Series
10	Khanna, N.	2001	Energy Efficiency and Petroleum Depletion in Climate Change Policy	The Long-Term Economics of Climate Change: Beyond a Doubling of Greenhouse Gas Concentrations, 239-264	Khanna-Chapman model	7. Others(2000-2006)
12RT/IPCC94			From Dr. Grubler	IPCC94		1. IPCC-SAR
144	Buchner, B., Carraro, C., and Cersosimo, I.	2002	Economic Consequences of the US Withdrawal from the Kyoto/Born Protocol	Climate Policy, 2, 273-292	FEEM RICE	7. Others(2000-2006)
16	Smekens-Ramirez Morales, K.E.L.	2004	Response from a MARKAL technology model to the EMF scenario assumptions	Energy Economics, 26, 655-674	MARKAL	7. Others(2000-2006)
160	Gerlagh, R. and Van der Zwaan, B.	2003	Gross World Product and Consumption in a Global Warming Model with Endogenous Technological Change	Resource and Energy Economics, 25, 35-57	DEMETER	7. Others(2000-2006)
173	Van der Zwaan, B.C.C.	2002	Nuclear energy: tenfold expansion or phase-out?	Technological Forecasting & Social Change, 69, 287-307	DEMETER	7. Others(2000-2006)
191	Barreto, L., Makihira, A., and Riahia, K.	2003	The hydrogen economy in the 21st century: A sustainable development scenario	Energy Economics, 28, 3, 267-284	SGM	7. Others(2000-2006)
193(192)	Riahi, K., Barreto, L., Rao, S., and Rubin, E.S..	2004	Long-term Perspectives for Carbon Capture in Power Plants: Scenarios for the 21st Century	IIASA Interim Report	MESSAGE	7. Others(2000-2006)
214	Mori, S.	2003	Global warming issues from long term - food supply and energy	Journal of the Japan Institute of Energy, 82, 1, 25-30	MARIA	7. Others(2000-2006)
230	Gerlagh, R.	2004	Impacts of CO_2 taxes when there are niche markets and learning by doing	Environmental and Resource Economics, 28, 367-394	DEMETER	7. Others(2000-2006)

SourceID	Authors	Year	Title	Journal	Model Name	Series
234	Felzer, B., Reilly, M., Melillo, J., Kicklighter, D., Wang, C., Prinn, R., Sarofim, M., and Zhuang, O.	2002	Past and Future Effects of Ozone on Net Primary Production and Carbon Sequestration Using Biogeochemical Model	MIT Joint Program on the Science and Policy of Global Change, Report No. 103	EPPA 3.0 model	7. Others(2000-2006)
247	Buchner, B., Carraro, C., Cersosimo., T., and Marchiori, C.	2002	Back to Kyoto? US Participation and the Linkage between R&D and Climate Cooperation.	CESifo Working Paper, 688, 8	FEEM RICE	7. Others(2000-2006)
248	Buchner, B. and Carraro, C.	2004	Emission Trading Regimes and Incentives to Participate in International Climate Agreements	Climate Policy after 2012, European Environment, 14, 4, 276-289	FEEM RICE	7. Others(2000-2006)
249	Buchner, B. and Fondazione, E.E.M.	2006	US, China and the Economics of Climate Negotiations	International Environmental Agreements: Politics, Law and Economics, Vol.6, Num.1, 63-89	FEEM RICE	7. Others(2000-2006)
250	Buchner, B. and Carraro, C.	2005	Economic and Environmental Effectiveness of a Technology-based Climate Protocol	Climate Policy, 4, 3, 229-248(20)	FEEM RICE	7. Others(2000-2006)
254	Carpenter	2005	Millennium Assessment - Scenarios	Millennium Assessment	IMAGE 2.2/TIMER	7. Others(2000-2006)
255	IMAGE-team	2001	IMAGE 2.2 Impementation of the IPCC SRES scenarios	IPCC SRES	IMAGE 2.2/TIMER	7. Others(2000-2006)
258	Turton, H.	2007	Automobile Technology, Hydrogen and Climate Change: A Long-Term Modelling Analysis	International Journal of Energy Technology and Policy, 1, 4, 397 - 426	MESSAGE	7. Others(2000-2006)
259	Kemfert, C.	2002	AN INTEGRATED ASSESSMENT MODEL OF ECONOMY-ENERGY-CLIMATE – THE MODEL WIAGEM	Integrated Assessment, 3, 4, 281-299	WIAGEM	7. Others(2000-2006)
43	Kurosawa, A.	2000	Long term nuclear power role under CO_2 emission constraint	Progress in Nuclear Energy, 37, 1-4, 101-106	GRAPE	7. Others(2000-2006)
44	Van der Zwaan, B.C.C., Gerlagh, R., Klaassen, G., Schrattenholzer, C.	2002	Endogenous technological change in climate change modelling	Energy Economics, 24, 1-19	DEMETER	7. Others(2000-2006)

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50	Van Vuuren, D.P., De Vries, H.J.M.	2001	Mitigation Scenarios in a World Oriented at Sustainable Development: the Role of Technology, Efficiency and Timing	Climate Policy, 1, 189-210	IMAGE/TIMER	7. Others(2000-2006)
69	Hanson, D. and J.A. "Skip" Laitner	2004	An Integrated Analysis of Policies that Increase Investments in Advanced Energy-Efficient/Low-Carbon Technologies	Energy Economics, 26, 739-755	AMIGA	7. Others(2000-2006)
ABARE	Australian Bureau of Agriculture and Resource Economics	1995	Australian energy consumption and production: historical trends and projections to 2009-10, Canberra, February 1995.	IEW Poll Results, 1997		2. Others(1992-1999)
ADLMN94	Center for Energy & Environmental Policy Research, MIT	1994	World Oil History, March 1994.	IEW Poll Results, 1995		2. Others(1992-1999)
ADLMN95	Center for Energy & Environmental Policy Research, MIT	1995	M.A.Adelman, "The Genie Out of the Bottle: World Oil Since 1970", Cambridge, Massachusetts, MIT Press, 1995.	IEW Poll Results, 1997		2. Others(1992-1999)
AGE/IPCC94	Manne et al.	1993		IPCC94		1. IPCC-SAR
AIM/EMF16	National Institute for Environmetal Studies(NIES-Japan), Kyoto University	1998	Energy Modering forum 16, 1998 August, Stanford University	EMF16, 1998	Asian-Pacific Integrated Model (AIM)	2. Others(1992-1999)
AIM/IPCC94	Matsuoka et al.	1993		IPCC94		1. IPCC-SAR
AIM/JAPAN97	Matsuoka et al.	1997	Projections of carbon dioxide emission and its reduction in Japan, NIES report, 1997.	NIES report, 1997.	Asian-Pacific Integrated Model (AIM)	2. Others(1992-1999)
AIM_pSRES2001	Matsuoka et al.	2002	Post-SRES for IPCC-TGCIA 2001	unpublished data file	AIM	TGICA (TGCIA)
AIM94	Matsuoka et al.	1994	Matsuoka et al., 1994: Scenario analysis of global warming using the Asian-Pacific integrated model, Energy Policy, 23(4/5), 357-372.	IEW Poll Results, 1997	Asian Pacific Integrated Model (AIM)	2. Others(1992-1999)

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AIM95	Matsuoka et al.	1996	Prof. Matsuoka's unpublished data file	unpublished data file	Asian-Pacific Integrated Model (AIM)	2. Others(1992-1999)
AMOCO	Amoco Corporation	1993	World Oil and Energy Outlook, May 1993.	IEW Poll Results, 1996		2. Others(1992-1999)
Anderson/IPCC94	Bird	1992		IPCC94		1. IPCC-SAR
ASF_pSRES2001	ICF Corporation, USA	2002	Post-SRES for IPCC-TGCIA 2001	unpublished data file	ASF	TGICA (TGCIA)
Bach/IPCC94	Bach	1991		IPCC94		1. IPCC-SAR
BNL93	Brookhaven National Laboratory	1993	submitted to CHALLENGE, October 1993	IEW Poll Results, 1995	MARKAL-MAKRO	2. Others(1992-1999)
BNL95	Brookhaven National Laboratory	1995	Photovoltaic Energy Impacts on U.S. CO_2 emissions, June 1995.	IEW Poll Results, 1997	MARKAL-MAKRO	2. Others(1992-1999)
CECO	Cambridge Econometrics	1994	United Kingdom Energy and the Environment, July 1994.	IEW Poll Results, 1995		2. Others(1992-1999)
CERD	Centre for Energy Research and Development, Nigeria University	1992	Submitted for CHALLENGE, 1992.	IEW Poll Results, 1995		2. Others(1992-1999)
CETA/IPCC94	Peck et al.	1993		IPCC94		1. IPCC-SAR
CETA95	Peck and Teisberg	1995	CETA: A Model for Carbon Emissions Trajectory Assessment, Energy Journal, Vol. 13, No. 1(1992), pp 55-77. Projection submitted June 1995.	IEW Poll Results, 1996	CETA	2. Others(1992-1999)
CETA95/EMF	Peck and Teisberg	1995	Peck and Teisberg, 1995: Optimal CO_2 control policy with stochastic losses from temperature rise, Climatic Change, 31, 19-34.	IEW Poll Results, 1997	Carbon Emissions Trajectory Assessment Model (CETA)	2. Others(1992-1999)
Challenge/IPCC94				IPCC94		1. IPCC-SAR
CHEE	Centre for Human Ecology, Edinburgh, UK.	1994	Slesser, King, Crane: "Non-Monetary Indicators of Sustainability Edinburgh, 1994.	IEW Poll Results, 1997		2. Others(1992-1999)
CRPS	Hammitt, J.K.	1995	Hammitt, J.K., 1995: Outcome and value uncertainties in global change	IEW Poll Results, 1997	Climate Research and Policy Synthesis	2. Others(1992-1999)

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			policy, Climatic Change, 30(2), 125-145.		Model	
CRTM/IPCC94	Rutherford	1992		IPCC94		1. IPCC-SAR
CUTEC93	Chalmers University of Technology	1993	Submitted to CHALLENGE, April 1993	IEW Poll Results, 1995		2. Others(1992-1999)
CUTEC95	Chalmers University of Technology	1995	Markal-Macro Studies for Sweden, May 1995	IEW Poll Results, 1997	MARKAL-MACRO	2. Others(1992-1999)
DICE	Nordhaus, W.D.	1994	Nordhaus, W.D., 1994: Managing the global commons: The economics of the greenhouse effect, MIT Press, Cambridge, MA.	IEW Poll Results, 1997	Dynamic Integrated Climate and Economy Model (DIES)	2. Others(1992-1999)
DICE/IPCC94	Nordhaus et al.	1993		IPCC94		1. IPCC-SAR
DRI	DRI	1993	World Energy Forecast Report - December 1993	IEW Poll Results, 1995		2. Others(1992-1999)
ECCO	M. Slesser, Edinburgh University	1994	UK-ECCO model, M. Slesser, Edinburgh University, 1994.	IEW Poll Results, 1997	UK-ECCO	2. Others(1992-1999)
ECS92/IPCC94	ECS	1992	1992 LP model, read from Dr. Naki	IPCC94		1. IPCC-SAR
EIA94	EIA/U.S. Department of Energy	1994	International Energy Outlook, 1994.	IEW Poll Results, 1995		2. Others(1992-1999)
EIA96	EIA/U.S. Department of Energy	1996	International Energy Outlook, 1996 (May 1996).	IEW Poll Results, 1997		2. Others(1992-1999)
EIS/IPCC94				IPCC94		1. IPCC-SAR
EMF14 Assumptions	EMF14	1997	Energy Modeling Forum (EMF) 14	EMF14		2. Others(1992-1999)
EPA/IPCC94	Global US			IPCC94		1. IPCC-SAR
EPA98	Sankovski, Alexei	1998	ICF's unpublished data file.	ICF's unpublished data file.	ASF	2. Others(1992-1999)
ERM/IPCC94	Edmonds et al.	1991		IPCC94		1. IPCC-SAR
ESCAP	UNESCAP, Bangkok	1995	State-of-the-Environment Report, October 1995.	IEW Poll Results, 1997		2. Others(1992-1999)
ESCAPE/IPCC94	Rotmans et al.	1994		IPCC94		1. IPCC-SAR
EU	European Commission DG XVII	1995	European Energy to 2020: A scenario approach Energy in Europe, special	IEW Poll Results, 1997		2. Others(1992-1999)

SourceID	Authors	Year	Title	Journal	Model Name	Series
			issue, forthcoming, submitted in December 1995.			
EWC	Ease-West Center	1994	Presented at the IEW meeting, June 1994.	IEW Poll Results, 1997		2. Others(1992-1999)
EWC/IEW95	Russia Energy Project, East-West Center, Honolulu.	1995	Asia-Pacific Energy Outlook-Honolulu: PREM EWC, January 1995.	IEW Poll Results, 1995		2. Others(1992-1999)
EWC/IEW97	Russia Energy Project, East-West Center, Honolulu and Gapmer	1995	Update of Pacific Energy Outlook: EWC, Honolulu, May 1995.	IEW Poll Results, 1997		2. Others(1992-1999)
FUGI7.0/IPCC94	Onishi.	1993		IPCC94		1. IPCC-SAR
GLOBAL2100/92	Alan Manne	1992	Alan Manne, October 1992.	IEW Poll Results, 1995	Global 2100	2. Others(1992-1999)
GLOBAL2100/93	Alan Manne and Leo Schrattenholzer	1993	Harmonized Conventional CHALLENGE Scenario Alan Manne and Leo Schrattenholzer, April 1993	IEW Poll Results, 1996	Global 2100	2. Others(1992-1999)
GLOBAL2100/IPCC94	Manne et al.	1994		IPCC94		1. IPCC-SAR
GOTO	Noriyuki Goto	1995	Macroeconomic and Sectoral Impacts of Carbon Taxation, Noriyuki Goto, forthcoming in Energy Economics, December 1995.	IEW Poll Results, 1997		2. Others(1992-1999)
GREEN	GREEN	1993	submitted to CHALLENGE, July 1993.	IEW Poll Results, 1996	OECD GREEN model	2. Others(1992-1999)
GREEN/IPCC94	OECD			IPCC94	GREEN	1. IPCC-SAR
GREEN91/IPCC94	Burniaux at al.	1991		IPCC94		1. IPCC-SAR
GREEN92/IPCC94	Burniaux at al.	1992		IPCC94		1. IPCC-SAR
GRI	Gas Research Institute	1993	GRI Baseline Projection of U.S. Energy Supply and Demand to 2010, 1994 edition, December 1993.	IEW Poll Results, 1996		2. Others(1992-1999)
HCRA	Hammitt, J.K.	1995	Hammitt, J.K., 1995: Harvard Center for Risk Analysis	IEW Poll Results, 1997		2. Others(1992-1999)
IAEA	IAEA	1995	Energy, Electricity, and Nuclear Power Estimates for the Period up tp 2015, July 1995.	IEW Poll Results, 1997		2. Others(1992-1999)

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ICAM2	Dowlatabadi, H.	1995	Dowlatabadi, H., 1995: Integrated assessment climate assessment model 2.0, technical documentation, Department of Engineering and Public Policy, Carnegie-Mellon University, Pittsburgh.	IEW Poll Results, 1997	Integrated Climate Assessment Model 2.0 (ICAM)	2. Others(1992-1999)
IEA	IEA	1994	World Energy Outlook, 1994.	IEW Poll Results, 1997		2. Others(1992-1999)
IEA&ETSAP/BEL	VITO and CES/KU Leuven, IEA-ETSAP/Annex IV	1993	Submitted to CHALLENGE, September 1993.	IEW Poll Results, 1996		2. Others(1992-1999)
IEA&ETSAP/JPN	JAERI, IEA-ETSAP/Annex IV	1992	Submitted to CHALLENGE, November 1992	IEW Poll Results, 1995		2. Others(1992-1999)
IEA&ETSAP/NOR	Ife Kjeller, IEA-ETSAP/Annex IV	1992	Submitted to CHALLENGE, November 1992.	IEW Poll Results, 1995		2. Others(1992-1999)
IEA&ETSAP/SWI	PSI, IEA-ETSAP/Annex IV	1992	Submitted to CHALLENGE, November 1992.	IEW Poll Results, 1995		2. Others(1992-1999)
IEA/IPCC94	IEA	1991	Energy is calculated with EMF Base Case, Table A1 in Aug.1991	IPCC94		1. IPCC-SAR
IEA92/IPCC94	Vouyoukas et al.	1992		IPCC94		1. IPCC-SAR
IEA93/IPCC94	Vouyoukas et al.	1993		IPCC94		1. IPCC-SAR
IEA98	Dr. Fatih Birol	1998	IEA's unpublished data file.	IEA's unpublished data file.	IEA	2. Others(1992-1999)
IEEBF	Institute of Energy Economics, Bariloche Foundation	1993	Submitted to CHALLENGE, March 1993.	IEW Poll Results, 1996		2. Others(1992-1999)
IER/AU&GE	Balandynowicz H. W.	1995	Balandynowicz H. W., The Cost of CO_2 Emissions Reduction: Case Study for Austria, Stuttgart University, 1995.	IEW Poll Results, 1997		2. Others(1992-1999)
IER/FRG	Egbert Laege	1993	Egbert Laege, CO_2 Reduction Strategies for Germany, submitted to CHALLENGE, June 1993.	IEW Poll Results, 1995		2. Others(1992-1999)

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IER/POL	Balandynowicz, H.W. et al.	1992	Balandynowicz, H.W. et al. (1992), "CO_2 Reduction Strategies for Poland", submitted to CHALLENGE	IEW Poll Results, 1995		2. Others(1992-1999)
IERP	Institute of Energy Research, Prague	1992	Submitted to CHALLENGE, November 1992.	IEW Poll Results, 1995		2. Others(1992-1999)
IEW	IEW	1997	Mr. Leo's unpublished data file	unpublished data file		2. Others(1992-1999)
IEW/IPCC94	IEW	1991		IPCC94		1. IPCC-SAR
IGER	Institute of General Energy Research	1993	Submitted to CHALLENGE, January1993.	IEW Poll Results, 1996		2. Others(1992-1999)
IGIDR	Indiria Gandhi Institute of Development Research, Mumbai	1994	Simulation of Macroeconomic Scenarios (SIMA), January 1994.	IEW Poll Results, 1997	SIMA	2. Others(1992-1999)
IIASA/ECS	IIASA	1992	Long-Term Strategies for Mitigating Global Warming, 1992.	IEW Poll Results, 1995		2. Others(1992-1999)
IIASA/GECCP	IIASA	1992	Yuri Sinyak, January 1992.	IEW Poll Results, 1995		2. Others(1992-1999)
IIASA/IPCC94	Rogner	1983		IPCC94		1. IPCC-SAR
IIASA96		1996	Population data form Mr. Stuart Gaffin	unpublished data file		2. Others(1992-1999)
IMAGE_pSRES2001	RIVM	2002	Post-SRES for IPCC-TGCIA 2001	unpublished data file	IMAGE	TGICA (TGCIA)
IMAGE2.0	Alcamo, J.	1994	Alcamo, J. (ed.), 1994: Image 2.0: Integrated modeling of global climate change, Kluwer, Dordecht, The Netherlands.	IEW Poll Results, 1997	IMAGE 2.0	2. Others(1992-1999)
INET	Institute for Nuclear Energy Technology, Beijing	1995	Long-Term Energy Demand and CO_2 Emissions of China, December 1995.	IEW Poll Results, 1997		2. Others(1992-1999)
IPCC90/IPCC94	IPCC1990, 1990EIS Ref	1990		IPCC94		1. IPCC-SAR
IS92	J. Leggett, W.J. Pepper and R.J. Swart	1992	1. J. Leggett, W.J. Pepper and R.J Swart, "Emissions Scenarios for the IPCC: an Update", Climate Change 1992: The Supplementary Report to	IPCC	Atmospheric Stabilization Framework (ASF)	1. IPCC-SAR

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			The IPCC Scientific Assessment, 68-95, 1992. 2. W. J. Pepper, R.J. Leggett, R.J. Swart, J. Wasson, J. Edmonds and I.			
ITF-D4/IPCC94	Shishido	1992		IPCC94		1. IPCC-SAR
ITRI	R.T. Young	1996	R.T. Young, "Final Report on Energy Strategies for the Reduction of CO_2 Emissions", Energy Commission of MOEA, June 1996.	IEW Poll Results, 1997		2. Others(1992-1999)
IW	Institut fuer Waermetechnik	1993	Submitted to CHALLENGE, April 1993.	IEW Poll Results, 1996		2. Others(1992-1999)
KEEI93	Korea Energy Economics Institute (KEEI)	1993	Outlook for Energy Demand and National Energy Policy Toward the 21st Century, December 1993	IEW Poll Results, 1995		2. Others(1992-1999)
KEEI94	Korea Energy Economics Institute (KEEI)	1994	Long-Term Energy Forecast through the Year 2030, November 1994	IEW Poll Results, 1997		2. Others(1992-1999)
KFASTE	Juelich Research Center	1994	Energy Use and Air Pollution in Indonesia, December 1994.	IEW Poll Results, 1997	KFA-STE	2. Others(1992-1999)
LBL95	Lawrence Berkeley Laboratory	1993	Cost of Limiting Carbon Emissions - China Case Study, December 1993.	IEW Poll Results, 1995		2. Others(1992-1999)
LBL96	Lawrence Berkeley Laboratory	1993	Cost of Limiting Carbon Emissions - China Case Study, December 1993.	IEW Poll Results, 1996		2. Others(1992-1999)
LDNE_pSRES2001	Tokyo Univ., Japan	2002	Post-SRES for IPCC-TGCIA 2001	unpublished data file	LDNE	TGICA (TGCIA)
LYNCH	Center for International Studies, MIT, MOE	1994	Submitted to the IEW, January 1994.	IEW Poll Results, 1997		2. Others(1992-1999)
MACAS	Macedonian Academy of Sciences	1995	Pop-Jordanov, Presentation at the 16th WEC Congress, October 1995.	IEW Poll Results, 1997		2. Others(1992-1999)
MANNE	Alan S. Manne	1993	Alan S. Manne, "International Trade - the Impact of Unilateral Carbon Emission Limits", July 1993.	IEW Poll Results, 1996		2. Others(1992-1999)
Manne&Richels/IPCC94		1992		IPCC94		1. IPCC-SAR
MARIA_pSRES2001		2002	Post-SRES for IPCC-TGCIA 2001	unpublished data file	MARIA	TGICA (TGCIA)

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MARIA95/IEW	Mori Shunsuke	1995	Mori, S., 1995: Long-term interactions among economy, environment, energy, and land-use changes - An extension of MARIA (Multiregional Approach for Resource and Industry Allocation Model), Technical Report IA-TR-95-04, Science University of Tokyo, Japan.	IEW Poll Results, 1997	MARIA	2. Others(1992-1999)
Markal_Europe98	J. R. Ybema	1998	Prof. Ybema's unpublished data file.	Prof. Ybema's unpublished data file.	MARKAL	2. Others(1992-1999)
Markal_JAERI98	JAERI (Japan Atomic Energy Research Institute)	1998	JAERI's unpublished data file.	JAERI's unpublished data file.	MARKAL	2. Others(1992-1999)
MERGE/IEW96	MERGE model	1995	MERGE; A.S. Manne and R.G. Richels, "The Greenhouse Debate: Economic Efficiency, Burden Sharing and Hedging Strategies", The Energy Journal, vol. 16, no. 4, pp. 1-37, 1995.	IEW Poll Results, 1996	MERGE	2. Others(1992-1999)
MERGE/IEW97	A.S.Manne and R.G. Richels	1995	Manne,A.S., and R.G. Richels, 1995: "The Greenhouse Debate: Economic Efficiency, Burden Sharing and Hedging Strategies", The Energy Journal, 16 (4), 1-37.	IEW Poll Results, 1997	MERGE	2. Others(1992-1999)
MERGE/IPCC94	Manne et al.	1993		IPCC94		1. IPCC-SAR
MERGE3.0	A.S.Manne and R.G. Richels	1997	A.S.Manne and R.G. Richels, MERGE 3, preliminary reference case results, January 1997.	IEW Poll Results, 1997	MERGE 3	2. Others(1992-1999)
MERGE94	A.S.Manne and R.G. Richels	1994	Noncooperative scenario - no carbon limitations, November 1994.	IEW Poll Results, 1995	MERGE	2. Others(1992-1999)
MESSAGE_pSRES2001	IIASA	2002	Post-SRES for IPCC-TGCIA 2001	unpublished data file	MESSAGE	TGICA (TGCIA)
MethaneEconomy/IPCC94	METHAN E.	1988		IPCC94		1. IPCC-SAR
MiniCAM_pSRES2001	Edmonds et al.	2002	Post-SRES for IPCC-TGCIA 2001	unpublished data file	MiniCAM	TGICA (TGCIA)

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MINICAM94	Edmonds et al.	1994	Design for the global change assessment model, proceedings of the International Workshop on Integrative Assessment Mitigation, Impacts, and Adaptation to Climate Change, IIASA, Laxenburg, Austria, 13-15 October.	IEW Poll Results, 1997	MiniGlobal Change Assessment Model (MiniCAM)	2. Others(1992-1999)
MINICAM97	Edmonds et al.	1997			MiniGlobal Change Assessment Model (MiniCAM)	2. Others(1992-1999)
Mintzer/IPCC94	WRI	1987		IPCC94		1. IPCC-SAR
MIT	Center for Global Change Science and Center for Energy and Environmental Policy Research	1994	MIT,1994: Center for Global Change Science and Center for Energy and Environmental Policy Research, "Joint program on the science and technology of global climate change". Cambridge, MA.	IEW Poll Results, 1997	MIT	2. Others(1992-1999)
MR/IPCC94	Manne et al.	1991		IPCC94		1. IPCC-SAR
NC1_ARGENTINA	Secretariat for Natural Resource and Sustainable development	1999 Oct.	Revision of the first national communication	UNFCCC web site		UNFCCC NC
NC1_ARMENIA	MINISTRY OF NATURE PROTECTION OF THE REPUBLIC OF ARMENIA	1998 Oct.	FIRST NATIONAL COMMUNICATION OF THE REPUBLIC OF ARMENIA	UNFCCC web site		UNFCCC NC
NC1_AZERBAIJAN	State Hydrometeorological Committee	2000 May	Initial National Communication of Azerbaijan Republic	UNFCCC web site		UNFCCC NC
NC1_BOLIVIA	Ministry of Sustanaible Development and Planning	2000 Nov.	FIRST NATIONAL COMMUNICATION	UNFCCC web site	LEAP	UNFCCC NC

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NC1_EL SALVADOR	Ministry of the Environment and Natural Resources	2000 Apr.	First National Communication	UNFCCC web site		UNFCCC NC
NC1_GEORGIA	Department of Hydrometeorology National Climate Research Centre	1999 Aug.	GEORGIA'S INITIAL NATIONAL COMMUNICATION	UNFCCC web site		UNFCCC NC
NC1_GHANA	Ministry of Environment, Science and Technology	2000 Dec.	First National Communication	UNFCCC web site		UNFCCC NC
NC1_Indonesia	Ministry of the Environment	1999 Oct.	The First National Communication on Climate Change Convention	UNFCCC web site	MARKAL	UNFCCC NC
NC1_Kazakhstan		1998 May	Initial National Communication of the Republic of Kazakhstan	UNFCCC web site		UNFCCC NC
NC1_Korea	The Government of the Republic of Korea	1998 Dec.	National Communication of the Republic of Korea	UNFCCC web site		UNFCCC NC
NC1_MALAYSIA	MINISTRY OF SCIENCE, TECHNOLOGY AND THE ENVIRONMENT	2000 Jul.	Initial National Communication	UNFCCC web site		UNFCCC NC
NC1_MONGOLIA	Minister for Nature and the Environment of Mongolia	2001 Nov.	Mongolia's Initial National Communication	UNFCCC web site		UNFCCC NC
NC1_MOROCCO	Ministère de l'Aménagement du Territoire	2001 Oct.	First National Communication	UNFCCC web site		UNFCCC NC
NC1_Nicaragua		2001 Jul.	Primera Comunicación Nacional	UNFCCC web site		UNFCCC NC
NC1_SEYCHELLES	Ministry of Environment and Transport	2000 Oct.	Seychelles Initial National Communication	UNFCCC web site		UNFCCC NC
NC1_THAILAND	Ministry of Science, Technology and Environment	2000 Oct.	Thailand's Initial National Communication	UNFCCC web site		UNFCCC NC

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NC1_TUNISIA	MINISTRY OF ENVIRONMENT AND LAND PLANNING	2001 Oct.	Initial Communication of Tunisia	UNFCCC web site		UNFCCC NC
NC1_UZBEKISTAN	Main Administration of Hydrometeorology at the Cabinet of Ministers of the Republic of Uzbekistan	1999 Oct.	Initial Communication of the Republic of UZBEKISTAN	UNFCCC web site		UNFCCC NC
NC1_ZIMBABWE	Ministry of Mines, Environment and Tourism	1998 May	ZIMBABWE'S INITIAL NATIONAL COMMUNICATION ON CLIMATE CHANGE	UNFCCC web site		UNFCCC NC
NC3_Australia	Commonwealth of Australia	2002	AUSTRALIA'S THIRD NATIONAL COMMUNICATION ON CLIMATE CHANGE	UNFCCC web site		UNFCCC NC
NC3_Austria	Austrian Federal Government	2001 Nov.	Third National Climate Report of the Austrian Federal Government	UNFCCC web site		UNFCCC NC
NC3_Belgium	FEDERAL DEPARTMENT OF THE ENVIRONMENT STUDIES AND COORDINATION OFFICE	2002 Apl.	Belgium's Third National Communication under the United Nations Framework Convention on Climate Change	UNFCCC web site		UNFCCC NC
NC3_Bulgaria	REPUBLIC OF BULGARIA	2002 Sofia.	Third National Communication on Climate Change	UNFCCC web site		UNFCCC NC
NC3_Canada	Government of Canada	2002 Feb.	2001 CANADA'S THIRD NATIONAL REPORT ON CLIMATE CHANGE	UNFCCC web site		UNFCCC NC
NC3_Czech	Ministry of the Environment of the Czech Republic, Czech Hydrometeorological Institute	2001 Dec.	THE CZECH REPUBLI'S THIRD NATIONAL COMMUNICATION	UNFCCC web site		UNFCCC NC

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NC3_Estonia	Estonia, Ministry of the Environment	2001 Nov.	ESTONIA'S THIRD NATIONAL COMMUNICATION	UNFCCC web site		UNFCCC NC
NC3_EU	COMMISSION OF THE EUROPEAN COMMUNITIES	2001 Nov.	THIRD COMMUNICATION FROM THE EUROPEAN COMMUNITY UNDER THE UN FRAMEWORK CONVENTION ON CLIMATE CHANGE	UNFCCC web site		UNFCCC NC
NC3_Finland	Finland, Ministry of the Environment	2001 Nov.	2001 Finland's Third National Communication	UNFCCC web site		UNFCCC NC
NC3_France	Republic France	2001 Nov.	France 2001 Third National Communication	UNFCCC web site		UNFCCC NC
NC3_Germany	Government of the Federal Republic of Germany		Third Report by the Government of the Federal Republic of Germany in accordance with the Framework Convention of the United Nations	UNFCCC web site		UNFCCC NC
NC3_Greece			THIRD NATIONAL COMMUNICATION TO THE UNFCCC	UNFCCC web site		UNFCCC NC
NC3_Hungary	Systemexpert Consulting Ltd.	2002	3rd National Communication for the UNFCCC	UNFCCC web site		UNFCCC NC
NC3_Italy	Ministry for the Environment and Territory	2003	Third National Communication under the UN Framework Convention on Climate Change	UNFCCC web site		UNFCCC NC
NC3_Japan	Government of Japan	2002	Japan's Third National Communication Under the United Nations Framework Convention on Climate Change	UNFCCC web site		UNFCCC NC
NC3_Latvia	MINISTRY OF ENVIRONMENTAL PROTECTION AND REGIONAL DEVELOPMENT	2001 Nov.	THE THIRD NATIONAL COMMUNICATION OF THE REPUBLIC OF LATVIA	UNFCCC web site		UNFCCC NC
NC3_Liechtenstein	Government of the Principality of Liechtenstein	2001 Oct.	Liechtenstein National Climate Report	UNFCCC web site		UNFCCC NC

SourceID	Authors	Year	Title	Journal	Model Name	Series
NC3_Netherlands	Ministry of Housing, Spatial Planning and the Environment	2001 Nov.	THIRD NETHERLANDS' NATIONAL COMMUNICATION ON CLIMATE CHANGE POLICIES	UNFCCC web site		UNFCCC NC
NC3_NewZealand	Ministry for the Environment as part of the New Zealand Climate Change Programme	2001 Nov.	National Communication 2001	UNFCCC web site		UNFCCC NC
NC3_Norway	Ministry of the Environment, Norway	2002 Jun.	Norway's third national communication under the Framework Convention on Climate Change	UNFCCC web site		UNFCCC NC
NC3_Poland	REPUBLIC OF POLAND	2001 Warsaw	THIRD NATIONAL COMMUNICATION TO THE CONFERENCE OF THE PARTIES TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE	UNFCCC web site		UNFCCC NC
NC3_Slovak	Slovak Republic	2001 Oct.	The Third National Communication on Climate Change	UNFCCC web site		UNFCCC NC
NC3_Sweden	Ministry of the Environment, Sweden	2001 Nov.	Sweden's third national communication on Climate Change	UNFCCC web site		UNFCCC NC
NC3_Switzerland	SWISS CONFEDERATION	2001 Nov.	Third National Communication of Switzerland 2001	UNFCCC web site		UNFCCC NC
NC3_UK	Department for Environment, Food and Rural Affairs	2001 Oct.	The UK's Third National Communication under the United Nations Framework Convention on Climate Change	UNFCCC web site		UNFCCC NC
NC3_USA		2002	U.S. Climate Action Report	UNFCCC web site		UNFCCC NC
NEA	NEA,Nuclear Energy Agency	1994	Nuclear energy data and other non-published documents, May 1994.	IEW Poll Results, 1997		2. Others(1992-1999)
Nordhaus/IPCC94	Yoh	1983		IPCC94		1. IPCC-SAR

SourceID	Authors	Year	Title	Journal	Model Name	Series
NSUWG	NEPA(China), SPC (China), UNDP, GEF	1994	China: Issues and Options in GHGs Emission Control, Summary Report, December 1994; transscribed at IIASA by Wei Zhihong.	IEW Poll Results, 1997		2. Others(1992-1999)
NWEAR21/IEW95	Yasumasa Fujii et al	1994	Yasumasa Fujii et al., "Global Energy System and CO_2 Emissions Control Policies", June 1993 (revised March 1994).	IEW Poll Results, 1995	New Earth 21	2. Others(1992-1999)
NWEAR21/IEW97	Yasumasa Fujii et al.	1994	Yasumasa Fujii et al., "Global Energy System and CO_2 Emissions Control Policies", June 1993 (revised March 1994).	IEW Poll Results, 1997	New Earth 21	2. Others(1992-1999)
N-Y/IPCC94		1983		IPCC94		1. IPCC-SAR
ODELL	Peter Odell	1994	Global Energy Prospects, 1994.	IEW Poll Results, 1997	EURICES/PRO	2. Others(1992-1999)
Ogawa/IPCC94	Ogaswa	1990		IPCC94		1. IPCC-SAR
OLADE/IEW95	OLADE	1993	Energy Prospects, Phase~II, Final Results, March 1993.	IEW Poll Results, 1995		2. Others(1992-1999)
OLADE/IEW96	OLADE	1993	Energy Prospects, Phase~II, Final Results, March 1993.	IEW Poll Results, 1996		2. Others(1992-1999)
OWEM/IEW95	OPEC World Energy Model	1993	Submitted to CHALLENGE, September 1993.	IEW Poll Results, 1995	OPEC World Energy Model (OWEM)	2. Others(1992-1999)
OWEM/IEW97	OPEC World Energy Model	1995	Submitted to the IEW Poll, December 1995.	IEW Poll Results, 1997	OPEC World Energy Model (OWEM)	2. Others(1992-1999)
PEFM	Cohan et al.	1994	Cohan et al., 1994: The global climate policy evaluation framework, proceedings of the 1994 A&WMA Global Climate Change Conference: Phoenix, 5-8 April, Air & Waste Management Association, Pittsburgh.	IEW Poll Results, 1997	Policy Evaluation Framwork Model	2. Others(1992-1999)
PETRO_pSRES2001	Statisitcs Norway	2002	Post-SRES for IPCC-TGCIA 2001	unpublished data file	PETRO	TGICA (TGCIA)
PLASY	W. Bojarski, J. Cofala et al.	1992	W. Bojarski, J. Cofala et al., "Energy Policy in Poland and Development Program up to 2010", October 1992.	IEW Poll Results, 1995		2. Others(1992-1999)

SourceID	Authors	Year	Title	Journal	Model Name	Series
PLMCP	Polish Ministry for Central Planning, Poland	1993	Submitted by J.S. Michna, February 1993.	IEW Poll Results, 1996		2. Others(1992-1999)
PLMIT	Polish Ministry for Industry and Trade, Poland	1993	Institute for Fundamental Technical Problems "Energy Policy and Draft Program for Poland up to 2010", July 1993.	IEW Poll Results, 1996		2. Others(1992-1999)
PSI	Paul Scherrer Institute	1995	MARKAL-MACRO runs for Switzerland. Swiss country study submitted to the CHALLENGE project, September 1995.	IEW Poll Results, 1997	MARKAL-MACRO	2. Others(1992-1999)
RAND/EMF14		1997	Energy Modeling Forum (EMF) 14	EMF14		2. Others(1992-1999)
RICE	Nordhaus et al.	1995	Nordhaus and Yang, 1995: RICE: A regional dynamic general equilibrium model of optimal climate change policy, Yale University Press, New Haven, CT.	IEW Poll Results, 1997	Regional DICE (RICE)	2. Others(1992-1999)
RICE99	Nordhaus	1999	Prof. Nordhaus's unpublished data file	unpublished data file	RICE	2. Others(1992-1999)
RIGES/IPCC94				IPCC94		1. IPCC-SAR
Rogner/IPCC94	Rogner	1986		IPCC94		1. IPCC-SAR
SNEA	National Energy Administration	1994	Submitted to the IEW in June 1994.	IEW Poll Results, 1997		2. Others(1992-1999)
TARGET	RIVM	1995	Rotmans, J., 1995: TARGETS (Tool to Assess Regional and Global Environmental and Health Targets for Sustainability) in transition, RIVM Report, Rijksinstitut Voor Volksgezondheid En Milieuhygiene (National Institute for Public Health and Environment), Bi	IEW Poll Results, 1997	TARGETS	2. Others(1992-1999)
TARGETS/EMF14	RIVM	1997	Energy Modeling Forum (EMF) 14	EMF14	TARGETS	2. Others(1992-1999)

SourceID	Authors	Year	Title	Journal	Model Name	Series
TEC/IPCC94	Okada et al.	1991		IPCC94		1. IPCC-SAR
TEESE/IEW96	Tata Energy Research Institute	1995	TERI Energy Economy Evaluation and Simulation (TEESE) Model, June~1995.	IEW Poll Results, 1996	TEESE	2. Others(1992-1999)
TEESE/IEW97	TataEnergy Research Institute, New Delhi	1996	Structural Transformation Processes toward Sustainable Development in India and Switzerland, INFRAS, Zurich, May 1996. Results are based upon TEEESE (energy, environment, economics) model for India, October 1996.	IEW Poll Results, 1997	TEESE	2. Others(1992-1999)
TSUNI	INET/ITEESA, Tsinghua University, Beijing	1993	Submitted to CHALLENGE, September 1993.	IEW Poll Results, 1996		2. Others(1992-1999)
UN 92 LR		1996	Population data form Mr. Stuart Gaffin	unpublished data file		2. Others(1992-1999)
UN 96		1996	Population data form Mr. Stuart Gaffin	unpublished data file		2. Others(1992-1999)
US Cens.Bur.		1996	Population data form Mr. Stuart Gaffin	unpublished data file		2. Others(1992-1999)
UTRUNI	Utrecht University, Dept. of Science, Technology and Society, Reference case	1992	ICARUS, "The Potential for Energy Conservation in the Netherlands up to the Year 2000, May 1992.	IEW Poll Results, 1995		2. Others(1992-1999)
VEIKI/IEW95	Veiki	1993	Submitted to CHALLENGE, February 1993.	IEW Poll Results, 1995		2. Others(1992-1999)
VEIKI/IEW96	Veiki	1993	Submitted to CHALLENGE, February 1993.	IEW Poll Results, 1996		2. Others(1992-1999)
WEC/IPCC94	WEC	1993	World Energy Council REFERENCE, 1993	IPCC94		1. IPCC-SAR
World Bank		1996	Population data form Mr. Stuart Gaffin	unpublished data file		2. Others(1992-1999)
WorldBank/IPCC94	Anderson et al.	1992		IPCC94		1. IPCC-SAR
WorldScan/EMF14	Johannes Bollen, Arjan Gielen	1997	WorldScan by the CPB Netherlands Bureau for Economic Policy	EMF14	WorldScan	2. Others(1992-1999)

SourceID	Authors	Year	Title	Journal	Model Name	Series
			Analysis			
WorldScan_pSRES2001	Johannes Bollen, Arjan Gielen	2002	Post-SRES for IPCC-TGCIA 2001	unpublished data file	WorldScan	TGICA (TGCIA)
YOHE/IEW97	Gary Yohe, Wesleyan University	1995	Yohe, G., 1995: Exercises in hedging against extreme consequences of global change and the expected value of information, Department of Economics, Wesleyan University, CT.	IEW Poll Results, 1997	Connecticut Model	2. Others(1992-1999)
YOHEU	Gary Yohe, Wesleyan University	1995	Integrated Assessment Model, results submitted to the IEW Poll, December 1995.	IEW Poll Results, 1997		2. Others(1992-1999)
YURI/IEW96A	Siberian Energy Institute	1993	Yuri Kononov, October 1993.	IEW Poll Results, 1996		2. Others(1992-1999)
YURI/IEW96B	Siberian Energy Institute	1993	Yuri Kononov, October 1993.	IEW Poll Results, 1996		2. Others(1992-1999)
YURI/IEW97	YuriSinyak, ECS, IIASA	1995	TEPCO Study, May 1995.	IEW Poll Results, 1997		2. Others(1992-1999)

Acronyms and Abbreviations

AR4	Fourth Assessment Report (IPCC)
CAGR	Compound Annual Growth Rates
CCS	CO_2 Capture and Storage
CFC	Chlorofluorocarbon
CH_4	Merthane
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GWP	Global Warming Potentials
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
IAM	Integrated Assessment Models
IEA	International Energy Agency
IIASA	International Institute for Applied System Analysis
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land-Use, Land-Use Change and Forestry
N_2O	Nitrous oxide
PFC	Perfluorocarbon
RCP	Representative Concentration Pathways
SAR	Second Assessment Report (IPCC)
SF_6	Sulfur hexafluoride
SRES	Special Report on Emissions Scenarios (IPCC)
TAR	Third Assessment Report (IPCC)
TGICA	Task Group on data and scenario support for Impact and Climate Analysis (IPCC)
UNFCCC	United Nation Framework Convention on Climate Change
WG III	Working Group III (IPCC)