

Global Environmental Policy

Lecture Plan

- Overview (April 8)
 - Background
 - The Road to Kyoto and Beyond
- Environmental Policy in Japan (April 15)
 - R&D policy
 - Toward Deep Reduction of GHGs
- Global Challenge towards Climate Change & Recent Topics (April 22)

Development of Environmental Policy

“Environmental Policy”

- The term in contemporary sense has been used since early 1970s, particularly after the establishment of Environmental Agency in 1971.

History of Environmental Administration

Local to Global

History of Environmental Topics and Administration (1/4)

1880's	Spread of mine pollution at Ashio copper mine
1897	Forest Law
1911	Factory Law
1955	Itai-itai (ouch-ouch) disease became an issue (Cd)
1956	Outbreak of Minamata disease (Hg)
1957	Natural Parks Law
1958	Law Concerning the Preservation of Water Quality in Public Waters Law Concerning Regulation of Industrial Effluent
1961	Air pollution and marine pollution in Yokkaichi-city
1962	Publication of “Silent Spring” Law Concerning the Emission Control of Smoke and Soot
1965	Outbreak of Minamata disease in Niigata
1968	Outbreak of Kanemi Oil Poisoning Symptoms (PCB) Air Pollution Control Law and Noise Regulation Law

History of Environmental Topics and Administration (2/4)

1969	Osaka Airport Pollution Suit Law Concerning Special Measures for the Relief of the Pollution-related Patients First “Annual White Paper on Environmental Pollution”
1970	Outbreak of health damage caused by photochemical smog
1971	Inauguration of the Environmental Agency Offensive Odor Control Law
1972	United Nations Conference on Human Environment (Stockholm) Nature Conservation Law
1973	Pollution-related Health Damage Compensation Law
1975	Hexavalent chromium pollution issue
1979	Convention on Wetlands of International Importance Especially as Waterfall Habitats (Ramsar Convention) Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington Convention)

History of Environmental Topics and Administration (3/4)

1984	Law Concerning Special Measures for the Preservation of the Water Quality of Lakes and Ponds
1988	Establishment of IPCC Vienna Convention for Protection of Ozone Layer Law for the Protection of the Stratospheric Ozone Layer
1989	Establishment of Council of Minister for Global Environmental Conservation
1990	Planning of the Action Program to Arrest Global Warming
1991	Law for the Promotion of Utilization of Recyclable Resources
1992	UN Conference on Environment and Development (Adoption of “Rio-Declaration on Environment and Development “ “Agenda 21”)
1993	Basel Convention on the Control of Trans-Boundary Movement of Hazardous Wastes and Disposal Convention on Biological Diversity

History of Environmental Topics and Administration (4/4)

1994	Effectuation of UNFCCC
1997	Environmental Impact Assessment Law COP3
1998	Law Concerning the Promotion of the Measures to Cope with Global Warming
1999	Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management Law Concerning Special Measures for Dioxins Control
2000	Basic Law for Establishing Recycling-Based Society Law on Promoting Green Purchasing Law for Promoting Effective Use of Resources Construction Waste Recycling Law Food Waste Recycling Law
2001	Inauguration of the Ministry of the Environment <i>M. Akai, AIST</i>

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Japan's Domestic Approach Government

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Road to Kyoto

1988	<ul style="list-style-type: none"> • Heat wave in U.S. granary • Testimony by Dr. Hansen • Toronto Conference • Establishment of IPCC
1990	• IPCC First Assessment Report
1992	• Earth Summit & UNFCCC
1995	<ul style="list-style-type: none"> • COP-1 (Berlin) & Berlin Mandate • IPCC Second Assessment Report
1996	• COP-2 (Geneva)
1997	• COP-3 (Kyoto) & Kyoto Protocol

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Kyoto Protocol to the UNFCCC

- 38 developed countries agreed to reduce their emissions of six GHGs by a total of 5.2% between 2008 and 2012 from 1990 levels
 - CO₂, CH₄, N₂O, HFCs, PFCs, SF₆
- Party quantified emission limitation or reduction commitment include (% reduction):
 - Austria (8); Canada (6); Japan (6); Romania (8); Russian Federation (0); Switzerland (8); USA (7); UK (8);
 - Australia (+8%)**

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Action Program to Arrest Global Warming

Decision made by the Council of Ministers for Global Environment Conservation
(October 1990)

- The action program covers the period from 1991 to 2010 with 2000 set at the intermediate target year.

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Action Program

Target

- The emissions of CO₂ should be stabilized on a per capita basis in the year 2000 and beyond at about the same level as in 1990
- Efforts should also be made to stabilize the total amount of CO₂ emission in the year 2000 and beyond at about the same level as in 1990

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Action Program

In Reality...

- The emissions of CO₂ should be stabilized on a per capita basis in the year 2000 and beyond at about the same level as in 1990
 - ▷ 00/90 = +7.2%
- Efforts should also be made to stabilize the total amount of CO₂ emission in the year 2000 and beyond at about the same level as in 1990
 - ▷ 00/90 = +10.2%

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IPCC TAR Recommendations

WG3: Mitigation-SPM



- **Earlier actions**, including a portfolio of emissions mitigation, technology development and reduction of scientific uncertainty, **increase flexibility** in moving towards stabilization of atmospheric concentrations of greenhouse gases,
- **Rapid near-term action would decrease** environmental and human risks associated with rapid climatic changes.

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After Kyoto

1998	<ul style="list-style-type: none"> • COP-4 (Buenos Aires) • The warmest year in the warmest decade of the warmest century of the millennium.
1999	• COP-5 (Bonn)
2000	• COP-6 (The Hague)
2001	<ul style="list-style-type: none"> • COP-6 Part II (Bonn) • COP-7 (Marrakesh) • IPCC Third Assessment Report
2002	<ul style="list-style-type: none"> • COP-8 (New Delhi, Oct 23-Nov 1) • Rio + 10: World Summit on Sustainable Development (Johannesburg, Sep 2-11)

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Guidelines of Measures to Prevent Global Warming

June 19, 1998

- Decision by “Global Warming Prevention Headquarters” chaired by Prime Minister
- Establish the basic policy to meet with the Kyoto Protocol

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The Guidelines

Energy Related Reductions

- In order to achieve a 6% reduction targets stated in the Kyoto Protocol:
 - Regarding CO₂, CH₄ and N₂O emissions, a 2.5% reduction will be achieved through steadfastly promoting measures relating to both energy supply and demand focusing on promoting **energy saving**, introduction of **new energy** and the construction of **nuclear power** plants with rigid nuclear safety measures, introducing **innovative technologies**, and accelerating the efforts of each social actor.

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The Guidelines - Summary - GHG reduction target of Japan for 2010

-2.5%	Emission reduction of CO ₂ , CH ₄ , N ₂ O
±0%	Energy related CO ₂
-0.5%	CH ₄ and N ₂ O
-2.0%	R&D and introduction of innovative technologies, and effort of each citizen
+2.0%	CFC alternatives, etc. (HFC, PFC and SF ₆)
-3.9%	Sinks such as Japan's forests and land use change
The Balance	Utilization of Kyoto mechanisms

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Reinforcement of Existing Law

- Top Runner Approach -

- Introduced as part of a package to further strengthen the Law Concerning the Rational Use of Energy.
- Promotes energy efficiency in consumer products, by setting a product of the **highest energy efficiency** as a standard in its product category, e.g. television, and establishing that as a goal for industry to come up with.

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Statement by Global Warming Prevention Headquarters after COP-7

November 12, 2001

- Japanese Government has decided to take the necessary measures and actions in order to ratify the Kyoto Protocol in FY 2002.

▷ Ratified in June 2002

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Research and Development

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R&D Policy on Global Warming in Japan (FY2002)

- In September 2001, the Council for Science and Technology Policy established "**Promotion Strategy in Prioritized Area based on the Science and Technology Basic Plan**"

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Global Warming Research Initiative

Above programs will be conducted in an integrated manner with the cooperation of Ministries.

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Global Warming Research Initiative

- The Initiative includes the following programs (FY 2002: 219.6 billion yen)
 - Global warming monitoring program
 - Global warming prediction and climate fluctuation research program
 - Global warming effects and risk evaluation program
 - GHG fixation(sequestration) and utilization program
 - Global warming prevention policy research program
 - New & renewable energy and energy conservation technology development programs

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Technological Options for Reduction of GHG Emissions

- Improvement of energy efficiency
- Switching to lower carbon fuels, e.g. coal to natural gas
- Use of non carbon fuels, e.g. renewables, nuclear
- Enhancement of natural sinks for CO₂, e.g. forestry
- Capture and sequestration of CO₂.

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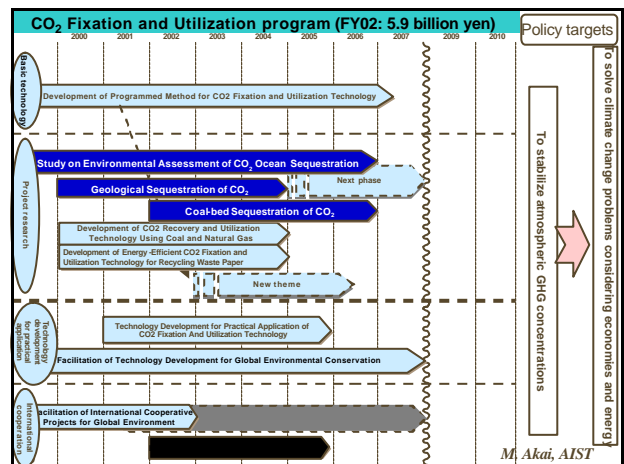
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R&D Program by METI

- New R&D programs from FY 2002
 - *R&D Program for Innovative Technologies to Prevent Global Warming* which includes 21 specific projects for the technologies that have a certain level of contribution in GHG reduction by 2010, and,
 - *R&D Program for CO₂ Fixation and Utilization* which deals with mid- and longer term technologies, including CO₂ sequestration technologies.

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Industry

Voluntary Action by KEIDANREN

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Keidanren

Japan Federation of Economic Organizations

- Keidanren was established in 1946 as a nationwide business association.
- The membership includes more than 1,000 of Japan's leading corporations, as well as more than 100 industry-wide groups:
 - manufacturing, trade, distribution, finance, and energy, etc.

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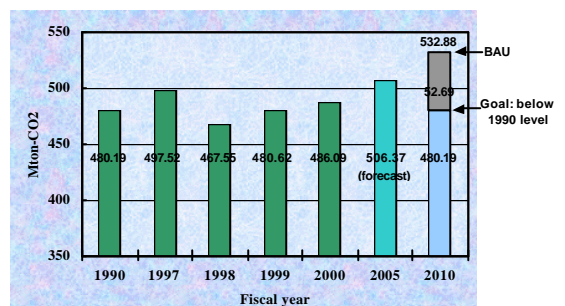
Keidanren Voluntary Action Plan

- In 1991, as part of its *Global Environment Charter*, Keidanren committed to seek positive and voluntary methods for promoting environmental conservation.
- By recognizing the importance of reducing CO₂ emission from the industrial sector, the member have agreed upon continued drafting voluntary action plans when possible and reviewing those periodically.

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CO₂ Emissions by 36 Industries in the Industrial and Energy Sectors



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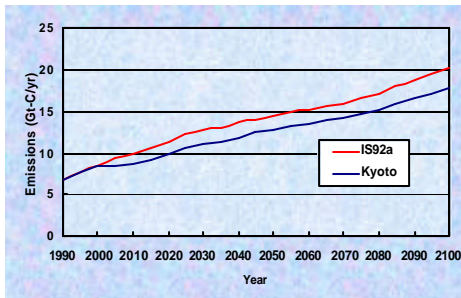
The results of fourth follow-up study

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Towards a Deep Reduction

Effect of Kyoto Protocol

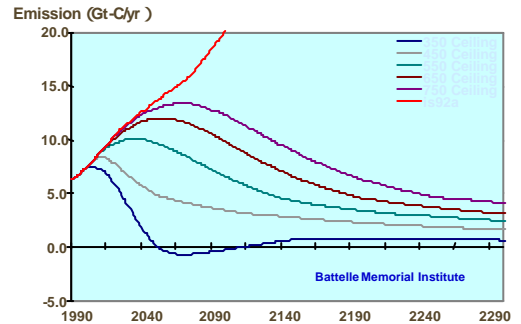
It's just an entrance to a sustainable society



(Pacific Northwest National Laboratory)

CO₂ Stabilization Profiles

- Atmospheric Emissions -



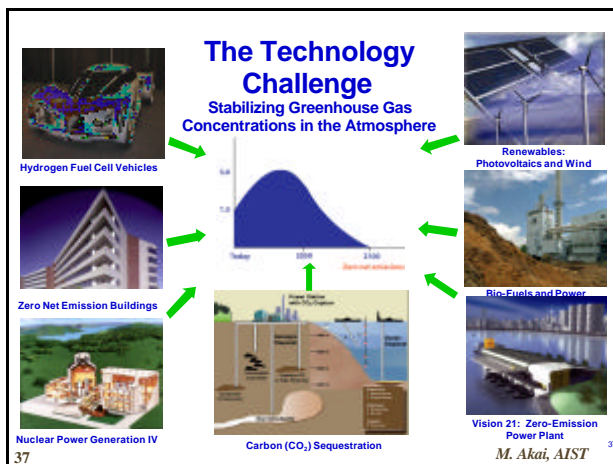
Battelle Memorial Institute

Technological Options for Deep Reduction of GHG Emissions

- Improvement of energy efficiency
 - Switching to lower carbon fuels, e.g. coal to natural gas
 - Use of non carbon fuels, e.g. renewables, nuclear
 - Enhancement of natural sinks for CO₂, e.g. forestry
 - Capture and sequestration of CO₂.
- β
- Importance of Technology Assessment

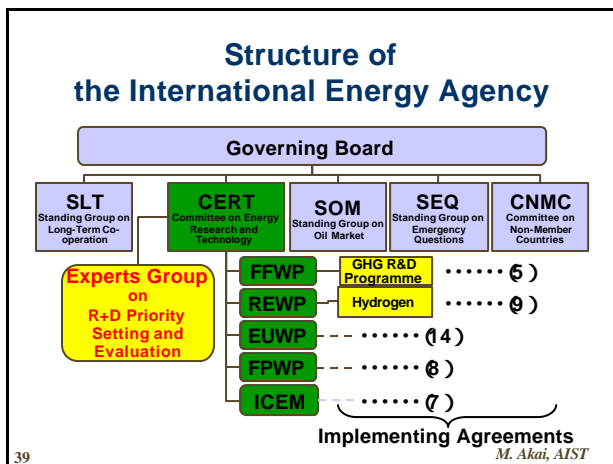
Possible Technology Areas

- Transforming Energy Supply
 - Hydrogen
 - Renewable Energy and Distributed Energy Resources
 - Nuclear Energy
 - Fossil Power Generation (ZEPP)
 - Infrastructure of the Electricity Delivery System (Energy Storage e)
- Transforming Energy End-Use
 - Transportation; Buildings; Industry
- Capturing and Sequestering GHGs
 - Geological; Ocean; and Terrestrial Sequestration
- Reducing non-CO₂ Greenhouse Gas Emissions
- Measuring and Monitoring GHG Emissions
 - Measurement, Monitoring and Verification



Discussion in IEA/CERT

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Strategy

- Transforming **energy supply**, via reduced GHG content of all forms of energy;
- Transforming **energy end-use**, via improved efficiency and fuel-use switching;
- **Capturing and sequestering** GHGs;
- Achieving substantial reductions in emissions of **non-CO₂ GHGs**; and
- Establishing a technical infrastructure for **measuring, monitoring and verifying** GHG inventories and fluxes in a hierarchy of geo-physical surfaces, media and boundaries.

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Technology Challenge

Target: UNFCCC Stabilization Goal

- Assess current R&D portfolios and climate change technology
 - Acknowledge “Core Programs”
 - Identify gaps and opportunities
- Assess supporting basic research needs
- Recommendations to policy makers from scientists:
 - Regarding Climate Change Portfolios
 - Regarding Supporting Basic Research
 - Regarding Supporting Policy Scenarios

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Technology Book

Technology Options for Achieving Significant Greenhouse Gas Emissions Reductions from Energy over the Long Term

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Gaps in Applied R&D for Stabilization

(1) GHG-Free Electricity

- Electricity will most likely be a keystone of any future with stabilised GHG concentrations and few or no GHG emissions.
- More emphasis is needed on novel concepts for this, including biotechnology, hydrogen-fed fuel cells and nuclear energy (fission and fusion). Improved technologies to use “new” renewable energy, especially PV technology, are also needed.

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Gaps in Applied R&D for Stabilization

(2) GHG-Free Fuels for Heat and Mobility

- Similarly, more R&D emphasis is required on novel approaches to GHG-free production of hydrogen, bio-fuels, and other carriers of stored chemical energy derived from GHG-free sources.

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Gaps in Applied R&D for Stabilization

(3) GHG-Free Feedstocks and Materials

- The processes of heavy industry, agriculture and construction will require feedstocks and material inputs to production.
- More R&D emphasis is needed in the areas of zero-emissions refineries, incorporating carbon into permanent building materials, and biotechnology to manufacture chemical feedstocks and intermediate inputs.

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Gaps in Applied R&D for Stabilization

(4) GHG-Free Infrastructure and Equipment

- Complementing the transformation of fuels and power, materials and feedstocks, there is the need to invent the equipment and infrastructure to use them effectively and efficiently in both the power-supply and end-use sectors.

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Gaps in Applied R&D for Stabilization

(5) CO₂ Capture and Sequestration

- Capture and sequestration of CO₂ could prove to be a profound and pivotal technological advance.
- Because of its potential importance in enabling deep reduction in emissions and providing time for a transition to a new energy system, all forms of sequestration should be pursued.
- More research is needed on capture.
- Storage of CO₂ still needs to be demonstrated since uncertainties concerning safety, leakage and environmental impacts remain.

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Gaps in Applied R&D for Stabilization

(6) Greenhouse Gases Other than CO₂

- Anthropogenic emissions of non-CO₂ GHGs, including methane, nitrous oxide, and several gases with high global warming potentials (GWPs), contribute to global warming in significant ways.
- In the near- to mid-term, emissions of these gases may be more amenable to capture and control than emissions from the major sources of CO₂.

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Gaps in Applied R&D for Stabilization

(7) Monitoring and Measurement of GHGs

- Technologies are needed for measuring and monitoring gross and net GHG emissions and inventories, a prerequisite to many other advances.
- Few R&D programmes support this high-priority technology development need.

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Gaps in Applied R&D for Stabilization

(8) End-Use and Transition Technologies

- These are technologies that can achieve significant reductions of GHG emissions in the near- and mid-terms. These technologies include:
 - net-zero-emissions or “energy producing” buildings,
 - new and integrated industrial processes,
 - low-GHG-emitting vehicles.
 - use of natural gas;
 - improve the security and extend the life of existing and next-generation nuclear plants;
 - improve technologies for the clean and highly-efficient uses of coal, such as gasification and fuel cells.

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Gaps in Applied R&D for Stabilization

(9) Enabling Technologies

- These are technologies that contribute to or enable the development of other important technologies.
- A modernised electricity grid, for example, is essential to a future characterised by high electricity dependence and demand and by high energy efficiency. It is also essential to the deployment of advanced end-use and distributed energy resources needed for reducing GHG emissions.
- Other enabling technologies encourage the use of GHG-emissions-reducing technologies, via sensors and controls.

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Gaps in Applied R&D for Stabilization

(10) Novel Concepts and Energy Systems

- These are concepts or technological approaches that could potentially represent a revolutionary contribution to the ultimate GHG goal, or cause a major shift in thinking about the global warming challenge. Such concepts include:
 - novel applications of bio-technology, photo- and electro-catalysis or photo-synthetic processes for splitting water into hydrogen and oxygen components via sunlight;
 - novel materials for energy storage;
 - means for mitigating or offsetting the effects of GHG build-up on global warming.

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Gaps in Applied R&D for Stabilization

– Summary –

- (1) *GHG-Free Electricity*
- (2) *GHG-Free Fuels for Heat and Mobility*
- (3) *GHG-Free Feedstocks and Materials*
- (4) *GHG-Free Infrastructure and Equipment*
- (5) *CO₂ Capture and Sequestration*
- (6) *Greenhouse Gases Other than CO₂*
- (7) *Monitoring and Measurement of GHGs*
- (8) *End-Use and Transition Technologies*
- (9) *Enabling Technologies*
- (10) *Novel Concepts and Energy Systems*

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Scenario Study Global Energy Network Model

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Appraisal of CO₂ Mitigation Technology

Approach

- Evaluation as a technology
 - Process evaluation for energy penalty and cost
 - Life cycle aspects of the technology
- Comparative evaluation of the technology among a resource and technology mix under CO₂ emission constraint
 - Energy Model
- Decision making
 - Cost-benefit relationship
 - Externality, etc.

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Global Energy Network Model

- Term: 1990 to 2100
- Area: Global
 - 18 world regions considering future energy demand, energy supply potential, geographical condition, etc.
- Energy technologies include:
 - Conventional energy technologies (production, transportation, power generation, etc.)
 - Hydrogen energy system
 - Global renewable energy transportation systems.
 - CO₂ mitigation technologies such as capture and sequestration
- Methodology: Optimization by LP

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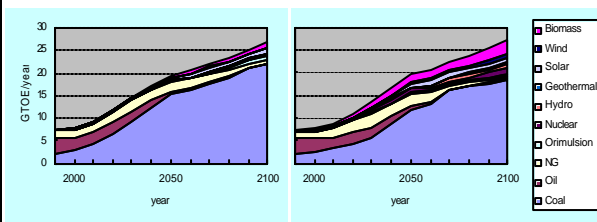
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Primary Energy Demand

- Secondary Energy Demand: IS92a -

Reference

550ppm



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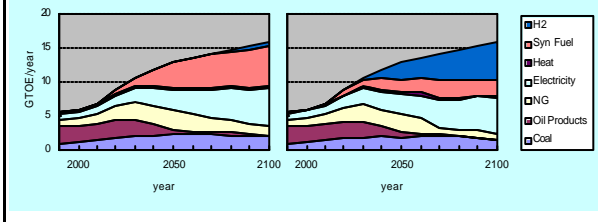
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Secondary Energy Demand

- Secondary Energy Demand: IS92a -

Reference

550ppm



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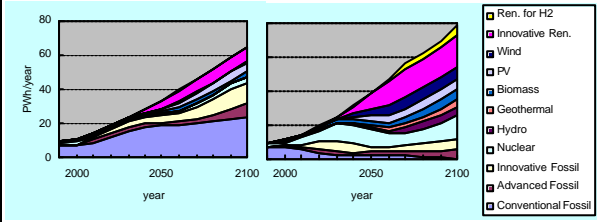
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Electric Power Generation

- Secondary Energy Demand: IS92a -

Reference

550ppm



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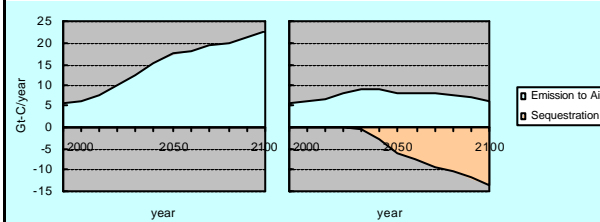
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CO₂ Emission and Sequestration

- Secondary Energy Demand: IS92a -

Reference

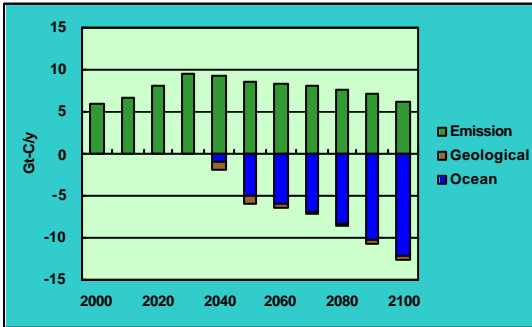
550ppm



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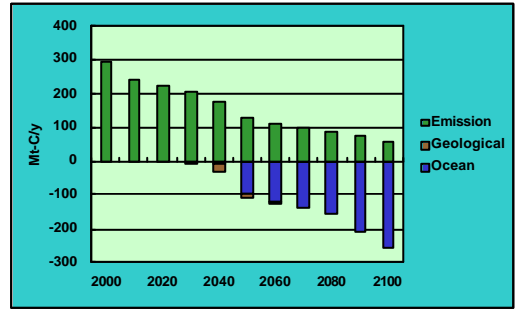
Stabilization and CO₂ Sequestration - Global -



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Stabilization and CO₂ Sequestration - Japan -



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