

HOW DO YOU DO?

Makoto Akai

National Institute of
Advanced Industrial Science and Technology (AIST)

- **Background: Nuclear Engineering**
- **Research Area:**
 - Two Phase Flow Dynamics; MHD; etc.
 - CO₂ Sequestration; H₂ Energy System
 - Technology Assessment
 - Energy Modeling; Life Cycle Assessment; Externality
 - Public Communication
- **Other Activities:**
 - R&D Projects under METI
 - International Collaboration
 - IEA: Technology Assessment; Hydrogen Agreement; GHG Programme
 - Bilateral and Multilateral Projects

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Global Environmental Policy

Lecture Plan

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

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Background

Recent Findings on Climate Change

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IPCC TAR Suggestions

WG1: Scientific Basis-SPM



- An increasing body of observations gives a collective picture of a **warming world** and other changes in the climate system,
- There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to **human activities**,
- Human influences **will continue** to change atmospheric composition throughout the 21st century.

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IPCC TAR Recommendations

WG3: Mitigation-SPM



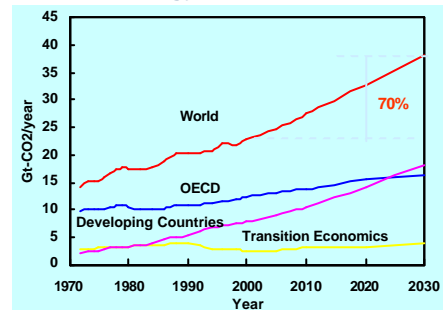
- **Earlier actions**, including a portfolio of emissions mitigation, technology development and reduction of scientific uncertainty, **increase flexibility** in moving towards stabilization of atmospheric concentrations of greenhouse gases,
- **Rapid near-term action would decrease** environmental and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

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Energy-Related CO₂ Emissions by Region

World Energy Outlook 2002 (IEA)



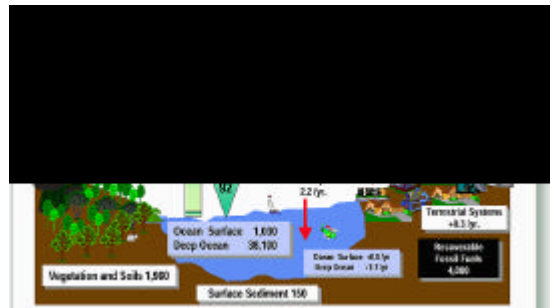
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Findings - World Energy Outlook 2002

- Fossil fuels will continue to dominate the world's energy mix over the next decades.
 - Hence, even under the international climate policies, emissions of GHGs from the energy sector are expected to continue growing, reaching 38 billion tones-CO₂ by 2030.
- Emissions will shift from the industrialized countries to the developing world.
 - The developing countries' share of global emissions will jump from 34% now to 47% in 2030, while the OECD's share will drop from 55% to 43%.

Global Carbon Cycle



Carbon Fluxes in Gigatons

The Road to Kyoto

History of Global Warming (1/2)

1827	French mathematician Jean-Baptiste Fourier suggests the existence of an atmospheric mechanism keeping the Earth warmer than it would otherwise be. He likens it to a greenhouse.
1863	Irish scientist John Tyndall publishes a paper describing how atmospheric water vapor could contribute to this mechanism.
1890s	Swedish scientist Svante Arrhenius and American P.C. Chamberlain independently investigate the potential problems that could be caused by carbon dioxide (CO ₂) building up in the atmosphere. They both suggest that burning fossil fuels could lead to global warming, but neither suspect the process might already have started.
1890s - 1940	Average surface air temperatures increase by about 0.25 C. Some scientists see the American Dust Bowl (a devastating, persistent drought in the 1930s) as a sign of the greenhouse effect at work
1940 - 1970	Global temperatures cool by 0.2 C. Scientific interest in global warming declines. Some climatologists predict a new ice age.

History of Global Warming (2/2)

1957	U.S. oceanographer Roger Revelle warns that people are conducting a "large-scale geophysical experiment" on the planet by releasing greenhouse gases. Colleague David Keeling establishes the first continuous monitoring of atmospheric CO ₂ . He rapidly confirms a regular year-on-year rise.
1970s	A series of studies by the U.S. Department of Energy increases concerns about possible long-term effects of global warming.
1979	First World Climate Conference adopts climate change as major issue and calls on governments "to foresee and prevent potential man-made changes in climate".
1985	First major international conference on global warming in Villach (Austria) warns that average global temperatures in the first half of the 21 st century could rise significantly more than at any other time in human history. Warmest year on record. The 1980s is the warmest decade on record, with seven of the eight warmest years of the century.
1987	Global temperatures cool by 0.2 C. Scientific interest in global warming declines. Some climatologists predict a new ice age.

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 P UNFCCC
1995	<ul style="list-style-type: none"> • COP-1 (Berlin) P Berlin Mandate • IPCC Second Assessment Report
1996	• COP-2 (Geneva)
1997	• COP-3 (Kyoto) P Kyoto Protocol

1988 - Year of Breaking Out

- Dr. Hansen testified before the U.S. Senate
 - 99 percent sure ... the greenhouse effect has been detected and it is changing our climate now.
- *World Conference on the Changing Atmosphere: Implications for Global Security (Toronto)* called for 20 % cuts in global CO₂ emissions by the year 2005
- WMO and UNEP established the Intergovernmental Panel on Climate Change (IPCC).

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Earth Summit

UN Conf. on Environment and Development

- The centerpiece was the ratification of the UNFCCC and was signed by 154 nations.
- UNFCCC does not contain binding targets for GHG emission reductions, but recognizes the importance of reducing GHG emissions in order to prevent “**dangerous interference**” with the climate system.

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UNFCCC

- Sets an initial target for industrialized countries to reduce their GHG emission to 1990 levels by the year 2000.
- Demanded each industrialized nation to submit national communication on GHG emission inventory, and to provide financial and technical assistance to developing countries for the reporting.
- Came into force on 21 March 1994.

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COP-1

Conference of the Parties on its First Session

- **Berlin Mandate**
 - To initiate a process to enable Governments to take appropriate action for the period beyond 2000, including a strengthening of developed country commitments.
 - The work should be completed as early as possible so that the results can be adopted at COP-3 in 1997.
 - Developing countries are explicitly exempted from these new commitments.

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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);

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Kyoto Mechanisms

- Kyoto Protocol provided the basis for **mechanisms** to assist Annex I Parties in meeting their targets cost effectively, i.e.
 - Emissions trading system,
 - Joint implementation (JI) of emissions reduction projects between Annex I Parties,
 - Clean Development Mechanism (CDM) to encourage joint projects between Annex I and non-Annex I Parties. However,
 - It was left for subsequent meetings to decide on most of the rules and operational details that will determine how these cuts in emissions are achieved, measured and assessed.

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Towards Effectuation of Kyoto Protocol

- In order for the Kyoto Protocol to enter into force, it must be ratified by 55 Parties to the UNFCCC, including Annex I Parties representing at least 55% of the total carbon dioxide emissions for 1990.

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Continued Negotiations

- Carbon sink --- **What is Kyoto Forest?**
 - Land Use, Land Use Change and Forestry (LULUCF)
- Rules and operational details of Kyoto Mechanisms
- Involvement of and assistance to developing countries
- Compliance, etc.

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IPCC Special Report on LULUCF - SPM -



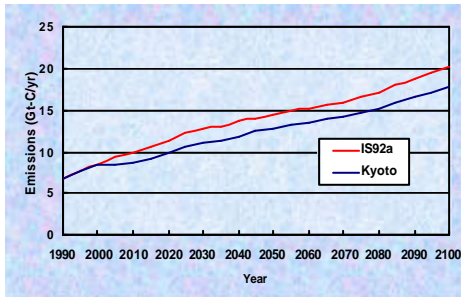
1. Introduction
2. Global Carbon Cycle Overview
3. Issues Associated with Definitions
 - 3.1. Forests, Afforestation, Reforestation, and Deforestation
 - 3.2. Additional Activities
4. Carbon Accounting
5. Methods for Measuring and Monitoring
6. Estimates of Average Annual Carbon Stock Changes /Accounted for ARD Activities and Some Additional Activities
 - 6.1. Afforestation, Reforestation, and Deforestation
 - 6.2. Additional Activities
7. Project-Based Activities

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Effect of Kyoto Protocol

It's just an entrance to a sustainable society



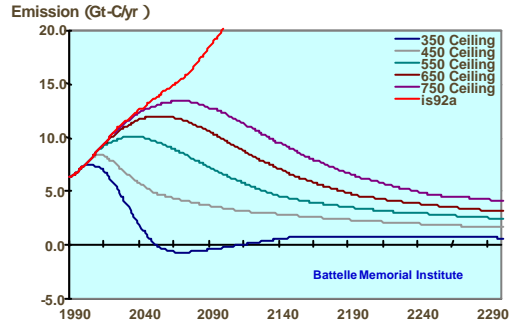
(Pacific Northwest National Laboratory)

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CO₂ Stabilization Profiles

- Atmospheric Emissions -



Battelle Memorial Institute

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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.

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- Importance of Technology Assessment

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Questions?

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