

Global Environmental Policy Lecture Plan

- May 11: Overview
 - International aspects
 - Background
 - The Road to Kyoto and Beyond
 - Recent topics
- May 18: Energy and Environmental Policies
 - Japan, US, etc.
- May 25: Challenge towards Deep GHG Reduction

Questions and Answers

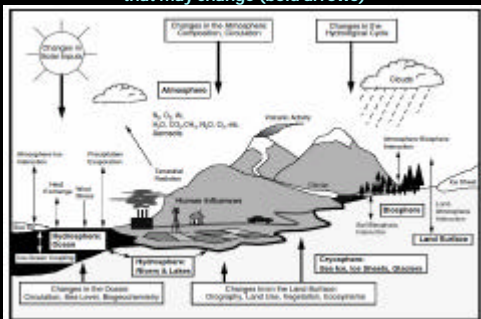
Question - 1

- **Scientists also predict that global warming is not only caused by manmade issues but also by natural phenomena. The earth was rather warmer some centuries ago than now. Is it true?**
- **Few decades ago, some climatologists predicted the times of a new ice age will come. But nowadays researchers think about global warming. What was the turning point?**

History of Global Warming (1/2)

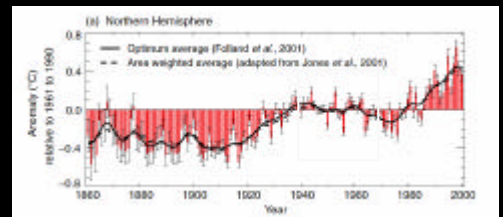
1827	French mathematician Jean-Baptiste Fourier suggests the existence of an atmospheric mechanism keeping the Earth warmer than it would otherwise be. He likens it to a greenhouse.
1863	Irish scientist John Tyndall publishes a paper describing how atmospheric water vapor could contribute to this mechanism.
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.

Components of the global climate system (**bold**), their processes and interactions (thin arrows) and some aspects that may change (**bold arrows**)



Anomalies of temperatures ()

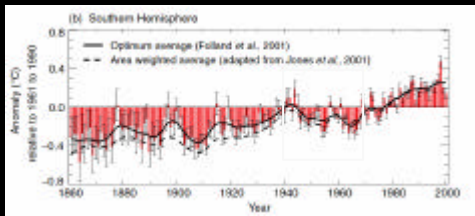
Combined land-surface air and sea surface temperatures (relative to 1961 to 1990)



Climate Change 2001: The Scientific Basis, IPCC

Anomalies of temperatures ()

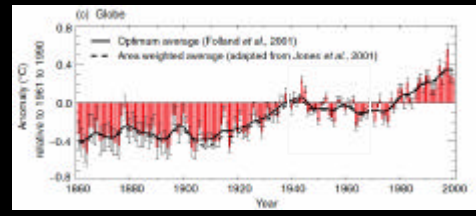
Combined land-surface air and sea surface temperatures



Climate Change 2001: The Scientific Basis, IPCC

Anomalies of temperatures ()

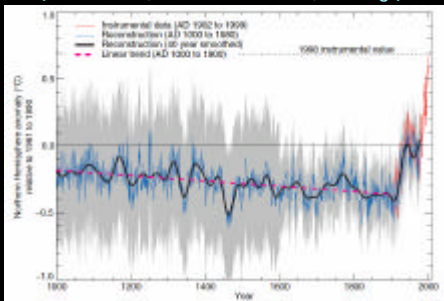
Combined land-surface air and sea surface temperatures



Climate Change 2001: The Scientific Basis, IPCC

Temperature trends for 1000 years

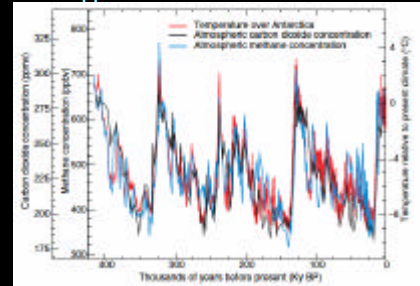
(from ice core, lake sediment cores, tree rings)



Climate Change 2001: The Scientific Basis, IPCC

Variations of temperature, CH₄, and CO₂ concentrations

(from air trapped within ice cores from Antarctica)



Climate Change 2001: The Scientific Basis, IPCC

Question - 2

- Why did global warming become issue in 1988 - it seems one nation's issue

History of Global Warming (2/2)

Precursors of Global Warming Issues

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.

1988 - Year of Breaking Out

- Heat wave in U.S. granary
- 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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Question - 3

- **Why is 1990 baseline year for CO₂ and GHG reduction?**
 - Result of political negotiations among JUSSCANNZ (A group of countries comprising Japan, US, Switzerland, Canada, Australia, Norway and New Zealand), CEIT (Countries with Economies in Transition), EU, NGOs, etc.

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Question - 4

- **Why is Russia hesitating to ratify Kyoto Protocol?**
 - Concern on damage to the domestic economy
 - Using ratification as a political tool, e.g. for gaining membership in WTO

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Question - 5

- **What is the implication on world economics if Russia ratify Kyoto Protocol and USA stay out?**
 - **What will happen if developing countries become the major CO₂ releasing countries?**
- β
- Topics to be covered next week

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Energy and Environmental Policies

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Japan

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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 (1/6)

1880's	• Spread of mine pollution at Ashio copper mine
1897	• Forest Law
1911	• Factory Law
1955	• Itai-itai (ouch-ouch) disease became in 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

History of Environmental Topics and Administration (2/6)

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
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

History of Environmental Topics and Administration (3/6)

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 (4/6)

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

History of Environmental Topics and Administration (5/6)

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
1994	• Effectuation of UNFCCC
1997	• Environmental Impact Assessment Law • COP3
1998	• Law Concerning the Promotion of the Measures to Cope with Global Warming

History of Environmental Topics and Administration (6/6)

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

Approach towards Climate Change Government

Road to Kyoto

1988	• 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	• COP-1 (Berlin) ⊃ Berlin Mandate • IPCC Second Assessment Report
1996	• COP-2 (Geneva)
1997	• COP-3 (Kyoto) ⊃ Kyoto Protocol

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.

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

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

$$\text{▷ } 00/90 = +7.2\%$$

- 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

$$\text{▷ } 00/90 = +10.2\%$$

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	<ul style="list-style-type: none"> COP-5 (Bonn)
2000	<ul style="list-style-type: none"> 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)

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

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.

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

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.

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

Research and Development

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"

β

Global Warming Research Initiative

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

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

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.

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.

Industry

Voluntary Action by KEIDANREN

Keidanren

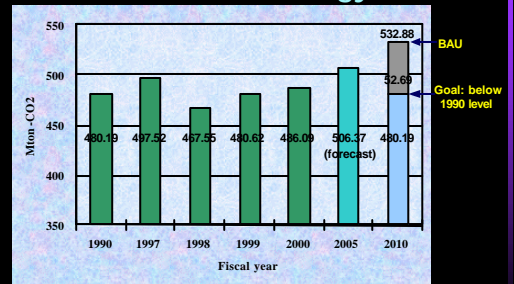
Japan Federation of Economic Organizations

- 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.

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.

CO₂ Emissions by 36 Industries in the Industrial and Energy Sectors



The results of fourth follow-up study

Revision of Guidelines of Measures to Prevent Global Warming

- To be discussed within 2004
 - CO₂ reduction through introduction of new technologies
 - Non-CO₂ gases
 - Mechanisms
 - Lifestyle
- In conjunction with the ongoing revision of 'Long-term Energy Supply/Demand Outlook' by METI

United Kingdom

Key Points in UK Policy (1/2)

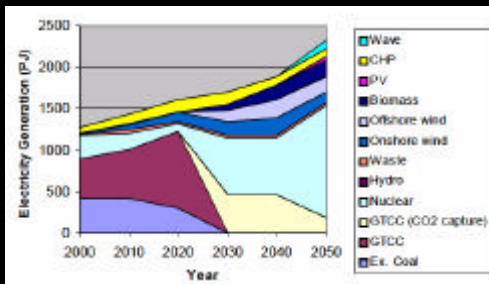
- UK Energy White Paper : environment issues at heart of Energy Policy - desire to put UK on a path to reduce CO₂ levels by 60% in 2050 (compared to 1990 levels)
- No one single winning technology; broad portfolio approach required
- Clean use of fossil fuels world-wide becoming increasingly recognized as a key transitional issue in getting to a sustainable energy future

Key Points in UK Policy (2/2)

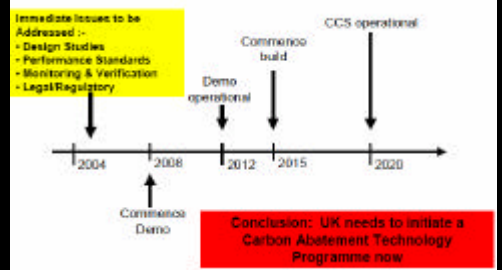
- Desire for a Carbon Abatement Strategy that includes fossil fuels
- CCS considered as one key element in such a strategy; recognized link to "hydrogen economy" needs
- International co-operation recognised as an essential element

UK Fuel Mix in Electricity Generation

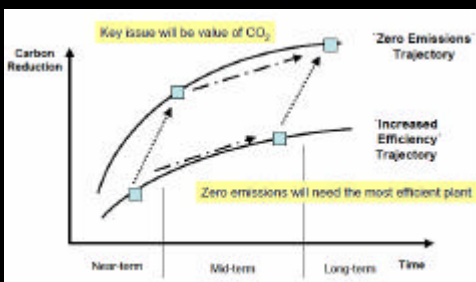
60% CO₂ Reduction in 2050 (limited Energy Efficiency)



UK Roadmap for Carbon Capture and Sequestration



UK Strategy Trajectories

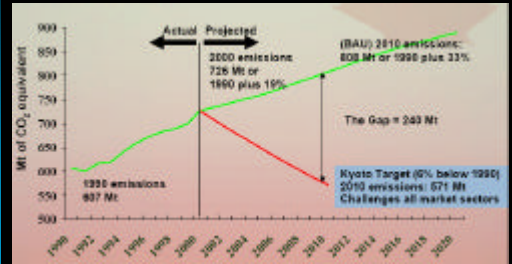


Canada

The Canadian Context

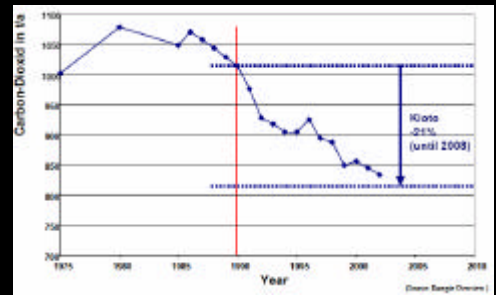
- Canadian energy policy is framed within the context of **Sustainable Development**
- Sustainable development – pursuit of a balanced portfolio of **environmental, economic and social** goals
- For energy, sustainable development aims to:
 - Reduce energy use, intensity (and carbon content), emissions
- A major driver is climate change
- CO₂ capture and storage is the natural evolution of leading Canadian initiatives in AGI and EOR in place since the 1980's

Canada's Kyoto Challenge

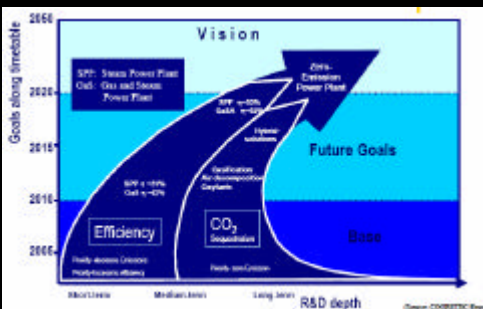


Germany

CO₂ Emissions in Germany



Emission Reduction Roadmap



Italy

GHG Emissions in Italy

- Italy committed to reduce its total GHG emissions by 6.5% in 2008-2012 compared to 1990 levels
 - 93 million tonnes by 2010 from the projected level in 2010 without any measures
- Energy-related CO₂ emissions have been growing gradually and were 6.5% above the 1990 level in 2001 reaching 437 Mt-CO₂
 - Power sector: 155 Mt-CO₂ (1/3 total)
- Italian Carbon intensity: 0.35 kg-CO₂/\$GDP in 2000 (IEA av. 0.43, EU av. 0.37)
 - β
 - Policy measures (voluntary agreements, carbon tax, regulations, international agreements, ...)
 - R&D initiatives

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Three Horses of the "Troika"

- Energy efficiency
 - Renewable energy
 - Emission free fossil fuels
 - β
 - Carbon Capture and Storage (CCS), is a crucial issue in energy policy: as the third horse of the troika
- Sometimes operate simultaneously

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United States

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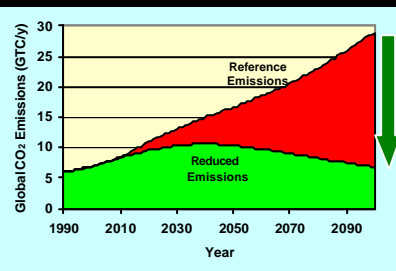
President's Key Policy Addresses:

- June 11, 2001
 - Committed U.S. to Work Within UN Framework
 - Directed U.S.G. to Develop Flexible, Science-Based Response
 - Supported UNFCCC to Stabilize GHG Concentrations
 - Established National Climate Change Technology Initiative
 - Established Climate Change Research Initiative
- February 14, 2002
 - Reaffirmed Long-Term UNFCCC Central Goal
 - Established U.S Goal to Reduce GHG Intensity by 18% by 2012
 - Encouraged Business Challenges and Voluntary Reporting
 - Directed Improvements to the EPACT Emissions Registry
 - Supported Transferable Credits
 - Valued GHG Avoidances by Supporting Financial Incentives

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Global Climate Change – The Role for DOE and New Technology



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Technology Pathways

- Closing the Loop on Carbon**
 - Introduction of Carbon Sequestration and Hydrogen Technologies Augment the Standard Suite of Energy Technologies
- Renewables and Nuclear Succeed**
 - Major Technological Advances in Renewable and Hydrogen Technologies are Coupled with a New Generation of Nuclear Reactors
- Beyond the Standard Suite**
 - Dramatic Breakthroughs in "New and Advanced Technologies – e.g., Fusion, Bio-X" – Create a Fundamentally Changed Energy System

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Current Climate Change Technology R&D Initiatives

- FreedomCAR
- FreedomFuel
 - Hydrogen Technology
 - Nuclear-Based Hydrogen Initiative
 - Large-Scale Hydrogen Production From Fossil Fuels
- Fuel Cell Systems
- Regional Carbon Sequestration Partnerships
- Carbon Sequestration Leadership Forum
- Nuclear Power Generation IV
- Nuclear Power 2010
- International Thermonuclear Experimental Reactor (ITER)
- National Climate Change Technology Initiative Competitive Solicitation Program

Significance of CCTP

- Leadership in climate change science can:
 - Reduce uncertainty
 - Illuminate risks and benefits
 - Guide and pace strategy
- Leadership in climate change technology can:
 - Create a robust set of technological options
 - Improve their performance and reduce costs
 - Facilitate society's ability to effect change

U.S. Initiatives for International Activities

- Carbon Sequestration Leadership Forum (CSLF)
- International Partnership for the Hydrogen Economy (IPHE)

Carbon Sequestration Leadership Forum

- CSLF is an international climate change initiative that is focused on development of improved cost-effective technologies for the separation and capture of CO₂
- The purpose is to make these technologies broadly available internationally; and to identify and address wider issues relating to carbon capture and storage.
- This could include promoting the appropriate technical, political, and regulatory environments for the development of such technology.

The First Ministerial-level Meeting June 23-25, 2003



- Attended by delegations from 16 countries and the European Commission.
- The CSLF charter was signed by representatives of 13 countries and EC.
 - Stay in effect for 10 years
 - Additionally, Germany and South Africa have joined

CSLF Activities

- Framework for international cooperation in research and development for the separation, capture, transportation and storage of CO₂.
- The activities will be conducted by:
 - Policy Group
 - Governing the overall framework and policies of the CSLF
 - Technical Group
 - Reviewing the progress of collaborative projects and makes recommendations to the Policy Group on any needed actions.

CSLF Collaborative Projects

Review by Technical Group

- Information exchange and networking,
- Planning and road-mapping,
- Facilitation of collaboration,
- Research and development,
- Demonstrations,
- Public perception and outreach,
- Economic and market studies,
- Institutional, regulatory, and legal constraints and issues,
- Support to policy formulation, or
- Other issues as authorized by the Policy Group.

FutureGen – Goals (1/2)

A Sequestration and Hydrogen Research Initiative

- Design, construct, and operate a nominal 275MW (net equivalent output) prototype plant that produces electricity and H₂ with near-zero emissions. The size of the plant is driven by the need for producing commercially-relevant data, including the requirement for producing one million metric tons per year of CO₂ to adequately validate the integrated operation of the gasification plant and the receiving geologic formation.
- Sequester at least 90 % of CO₂ emissions from the plant with the future potential to capture and sequester nearly 100 %.

FutureGen – Goals (2/2)

A Sequestration and Hydrogen Research Initiative

- Prove the effectiveness, safety, and permanence of CO₂ sequestration.
- Establish standardized technologies and protocols for CO₂ measuring, monitoring, and verification.
- Validate the engineering, economic, and environmental viability of advanced coal-based, near-zero emission technologies that by 2020 will: (1) produce electricity with less than a 10% increase in cost compared to nonsequestered systems; (2) produce hydrogen at \$4.00 per million Btus (wholesale), equivalent to \$0.48/gallon of gasoline, or \$0.22/gallon less than today's wholesale price of gasoline.

International Partnership for the Hydrogen Economy (IPHE)

Purposes:

- To serve as a mechanism to organize and implement effective, efficient, and focused international research, development, demonstration and commercial utilization activities related to hydrogen and fuel cell technologies.
- To provide a forum for advancing policies, and common codes and standards that can accelerate the cost-effective transition to a global hydrogen economy to enhance energy security and environmental protection.

Questions?

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