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"Kolevar, Kevin" <Kevin.Kolevar@hq.doe.gov>
04/09/2001 09:29:04 AM

Record Type: Record

To: John L. Howard Jr./CEQ/EOP

cc:
Subject: Two-pager and charts

John, here it is. Ari Patrinos is one of our top scientists. He has his hands in everything. Jim Decker is the Director of the Office of Science at DOE.

Kevin

> -----Original Message-----
> From: Patrinos, Ari
> Sent: Sunday, April 08, 2001 3:55 PM
> To: Kolevar, Kevin
> Cc: Decker, James; Patrinos, Ari
> Subject: Two-pager and charts
>
> Kevin:
> I am attaching the two-pager you requested on the "State of the Scientific
> Research on Climate Change" along with the charts showing emissions by
> prominent nations.
> I have consulted with some of my colleagues at other agencies in the
> preparation of the document and I believe it is a fair representation of
> the consensus views. However, I accept the responsibility for its
> content.
> I will be at the Forrestal on Monday morning for a meeting with Jim Decker
> so perhaps we can chat a bit about any next steps.
> Ari <<climate.a08.doc>> <<emit.a08.ppt>>

- climate.a08.doc

- emit.a08.ppt

State of Scientific Research on Climate Change

1. What do we know?
   - The amounts of carbon dioxide, other gases (e.g., methane, nitrous oxide), and small particles (aerosols) in the atmosphere have increased as a result of human activities, primarily combustion of fuels. Evidence: composition of air from bubbles trapped in ice over the last 300,000 years and measurements of trends in the atmosphere.
   - Carbon dioxide and the other gases have a warming influence on climate (the "greenhouse effect"), while some aerosols may cool the atmosphere. Evidence: theory and observations in physics and chemistry.
   - Global average surface temperature has increased over the 20th century by about 1.1 degrees F; the last decade has been the warmest in 1000 years. Evidence: past temperatures reconstructed from tree rings, corals, air bubbles in ice, and temperature records; melting of some glaciers, and rising sea levels; some of the warming can be attributed to human causes. Evidence: observations and computer modeling studies.
   - Our best climate models project that continued growth in carbon dioxide, other gases, and aerosols in the air could lead to further increases in global average temperature and sea level. For a range of emissions, global temperatures could rise from 2.5 to 10 F by 2100, exceeding natural changes over the past 10,000 years. Evidence: computer modeling studies.
   - Over the last 100,000 global climate has changed suddenly, and some changes have lasted for a century or more; however our understanding of the cause of these changes is limited. Evidence: bubbles in ice, lake sediments, and corals.

2. What key factors remain unknown?

   - The future concentrations of carbon dioxide, other greenhouse gases, and aerosols in the atmosphere and the amounts of these substances that will be removed by both natural processes and technological means.
   - The combined effects of climate change and other environmental changes (e.g., increased ozone in the lower atmosphere, increased nitrogen deposition, and changes in land use) on natural resources.
   - How temperature changes will affect atmospheric water vapor and whether cloudiness will change as a result of changes in atmospheric composition and temperature. Such changes may contribute to further warming or cooling.
   - How climate will change in different regions, whether storms such as hurricanes will become more frequent or powerful, and what conditions may cause climate to change suddenly.
   - What economic benefit or harm will result from the interplay between multiple global environmental changes, and how can we increase the potential for benefits through planned adaptation to these changes.

3. What is being researched today?
   - *Changes in the composition of the global atmosphere* from human activities and natural processes.
   - *Variability and changes in the climate factors most important to natural resources and the economy* such as temperature, precipitation, clouds, winds, and storminess.
   - *Effects of human activities on the "carbon cycle"*— how carbon dioxide is removed from and again released to the atmosphere from land and ocean ecosystems by natural processes --- including developing options for enhanced removal of carbon dioxide from the atmosphere
   - *Changes in the flow of water in the atmosphere, the land, and the oceans*, and the effects of these changes on water resources and climate.

- *Potential impacts* of global change on plants, animals, landscapes, natural resources, and climate-sensitive human endeavors and infrastructure such as agriculture, forestry, energy supply and demand, tourism, coastal settlements, and transportation.

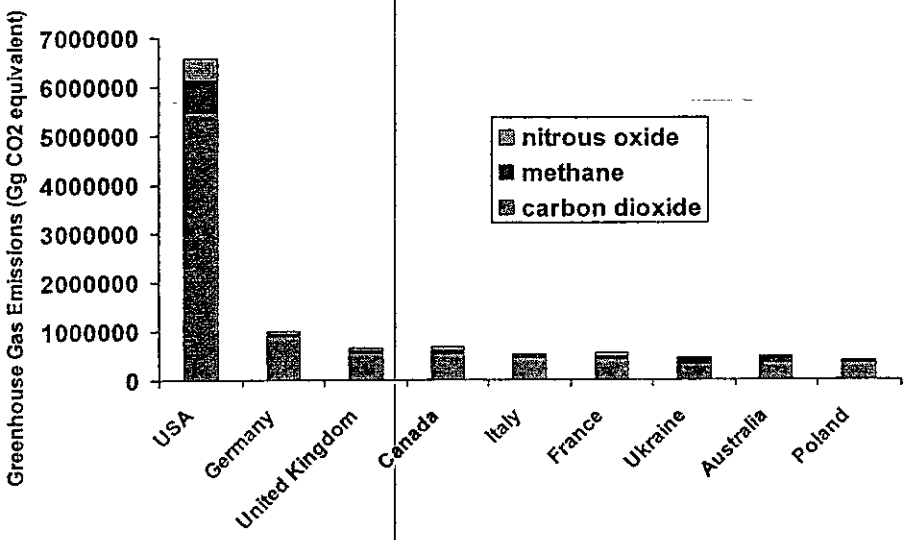
4. Who is conducting the research?
   - In the U.S., the research is conducted by the multi-agency U.S. Global Change Research Program (USGCRP). The FY 2001 funding is $1.7 billion of which almost $1 billion is allocated annually for satellites and other observations of the Earth by contractors through competitive grants from NOAA and NASA.
   - Of the $700 million for other research activities, 80% falls within four Federal agencies: NASA, NSF, DOE, and NOAA, with the remainder distributed across USDA, USGS, EPA, HHS, the Smithsonian Institution, and DOD. All research is subject to rigorous peer review.
   - The United States accounts for one-half of the total expenditure for research on global change.

5. What is not being researched but should be?
   - Understanding the causes and consequences of global environmental change, including climate change requires combined contributions from many scientific disciplines ranging from basic physics to social sciences to economics. We should integrate the research of relevant disciplines and study global change as a "system" to develop reliable predictions of risks and opportunities at the regional level, e.g. the Midwest or the Gulf States.
   - Additional unknowns and questions requiring research have been identified in studies conducted by the National Research Council such as *Global Environmental Change: Research Pathways for the Next Decade* (National Academy Press, 1999).

6. What are the key questions facing us?
   - What are major natural and human-induced forces causing changes in Earth systems that sustain life on this planet?
   - How do human-induced and natural forces affect Earth systems such as climate and the global cycling of water and essential nutrients?
   - How sensitive are natural resources to the combined effects of multiple environmental changes and what are the potential long-term consequences of human-induced and natural changes on Earth systems (e.g., climate change and variation, increased carbon dioxide and tropospheric ozone, and land fragmentation)?
   - How will humans respond to these changes, and what are the feedbacks resulting from potential human responses?

7. How can we best accelerate answers to key questions?
   - Undertake sustained observations and focused research to detect climate change and understand the causes. For example, mapping the distribution and properties of aerosols and refining estimates of changes in clouds and water vapor.
   - Expand efforts to determine the amount of carbon sequestered annually in North American "sinks" and in the oceans and explore approaches for removing more carbon from the atmosphere.
   - Expand the capacity to conduct complex numerical experiments that integrate atmosphere, ocean, and surface processes, including many multi-year simulations of climate change for various emission scenarios.
   - Strengthen methods and models that integrate information from many lines of research to analyze the costs and benefits of different levels of change and alternative response strategies.

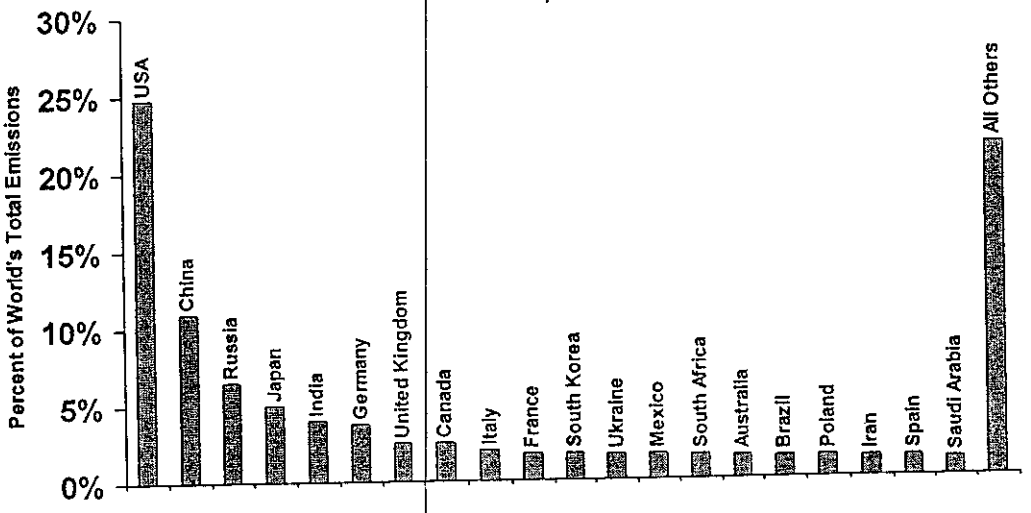
Selected important greenhouse-gas contributors



Note: 1 Gg (gigagram) = 1,000,000,000 grams; CO2 equivalent is based on the Global Warming Potential of the various greenhouse gases relative to carbon dioxide

Data for 1998 from United Nations Framework Convention on Climate Change database

Top 20 national contributors to global total carbon dioxide emissions from fossil-fuel combustion



Data for 1999 from Energy Information Administration