UNITED STATES SUBMISSION
TO THE
WORLD ENERGY COUNCIL
ENERGY AND CLIMATE CHANGE STUDY

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DRAFT ONE

A. Background

The United States has relied on voluntary efforts and research and development as the official U.S. Government policy in response to concerns over global climate change. The United States is a signatory to the U.N. Framework Convention on Climate Change but has not signed onto the Kyoto Protocol. Nevertheless, U.S. Government funding for climate change research is enormous and actions to reduce emission levels are significant. The United States has maintained that climate change issues can be most effectively addressed by promoting economic growth and that reducing the greenhouse gas intensity of the U.S. economy is a more effective approach than the targets and timetable regime imposed by the Kyoto Protocol.

B. Introduction to U.S. Emission Data

[This report will focus exclusively on U.S. energy related emissions of carbon dioxide]

In 2005 the United States emitted about 5,909 million tons of carbon dioxide related to energy. The U.S. Energy Information Administration's Annual Energy Outlook – 2006 projects emissions to rise to 6,365 million metric tons in 2010; to 7,587 million metric tons in 2025 and to 8,115 million metric tons in 2030. However, the EIA projects carbon dioxide emission intensity to drop significantly during this same period. Carbon dioxide emission intensity is the ratio of metric tons per million dollars of U.S. gross domestic product (GDP). Intensity, which was over 900 metric tons per dollar of GDP in 1980, falls to 503 in 2010; 411 in 2025 and down to 351 in 2030.

The 2005 emission level was only slightly higher than 2004, about one tenth of one percent. Petroleum and natural gas emissions fell 1.9 percent. Due to a two percent increase in electric power sales, emissions from coal rose 1.4 percent. Also, from 2004 to 2005, the U.S. economic grew 3.5 percent. However, energy intensity fell four percent. Total energy demand fell one half of one percent. Carbon intensity fell 3.3 percent from 2004 to 2005.

In the past 15 years, both carbon dioxide intensity and total greenhouse gas emissions intensity has dropped 1.8 percent and 1.9 percent per year respectively, albeit, total emissions of both have increased significantly.

In 2005, petroleum related carbon dioxide emissions were 2,585 million metric tons. Emissions from coal was 2,136 and from natural gas, 1,175 million metric tons.

Over the past 15 years, carbon dioxide emissions from the transportation sector grew 1.4 percent per year and passed the industrial sector as the largest source of end-use emissions in 1999. Industrial end-use emissions have remained flat since 1990. Meanwhile, emissions from residences have increased an average of 1.8 percent per year and the commercial sector has witnessed an average of two percent per year, the highest growth of all sectors. Please note that for end-use data points, emissions from electric power are spread across all of the sectors.

Electric power generation related carbon dioxide emissions have increased an average of 1.8 percent per year from 1990 to 2005. This represents a cumulative increase of 30.9 percent over the 15 year period. Since coal supplies over one half of U.S. electric power generation, it is no surprise that this is the dominate source of carbon dioxide emissions in the sector, accounting for 83 percent to 85 percent of total power sector emissions. Emissions from natural gas fired power generation are about 12 percent to 13 percent of the total and less than five percent is due to petroleum fired generation.

C. Summary of Relevant National Energy Related Climate Change Policies and Industry Measures

National Global Climate Policies as They Relate to Energy

C-1 Summary – The U.S. National Global Climate Change Policy

President George W. Bush announced the U.S. Global Climate Change Policy in February 2002, about 13 months after taking office. The policy is premised on:

- "Sustained economic growth being an essential part of the solution, not the problem;"

- "Harnessing the power of markets and technological innovation;"

- "Recognizes that climate change is a complex long-term challenge that will require sustained effort over many generations."

[Quotes from "Global Climate Change Policy Book" available on the White House web-site, www.whitehouse.gov.]

Specific Policies and Actions

1. Reduce the Greenhouse Gas Intensity of the U.S. Economy by 18% in the next 10 years.

   From 2002 to 2012, emissions per million dollars of GDP will fall from 183 metric tons to 151 metric tons.

2. Improve the Emission Reduction Registry

   The Energy Policy Act of 1992 established what is referred to as section 1605(b), which is a registry maintained by the U.S. Department of Energy (USDOE) for organizations to report their emissions reductions.

3. Protect and Provide Transferable Credits

   The USDOE is to develop recommendations that protect the "early actors" who choose to voluntarily reduce emissions if a mandatory reduction policy is later promulgated.

4. Review Progress

   If the U.S. does not achieve the reductions called for by 2012, additional science justified actions to accelerate technology development and deployment will be taken.

5. Increase Funding

   The Bush Administration proposed $4.5 billion in total climate change spending for federal fiscal year 2003 (October 1, 2002 – September 30, 2003). Within this is $1.7 billion for basic research and $1.3 billion on advanced technologies and sequestration.

6. Act on the Review of Science and Technology

   A new management structure is established to coordinate federal research efforts related to climate change, at the cabinet level, coming out of a comprehensive review of how the United States conducts research and technology development related to climate change.

7. Implement New and Expanded Domestic Policies

   Examples include tax incentives for renewable energy, challenge industry to take action, expand transportation partnerships with industry regarding fuel efficient vehicles, alternative fuels, fuel cells (i.e., Freedom Car – an effort with industry to develop hydrogen fuel cell vehicles), and carbon sequestration.

8. Implement New and Expanded International Policies

   Specifically, the policy calls for funding the Climate Observation Systems in developing countries, expand "debt for nature" initiatives, fund the Global Environment Facility and U.S. Agency for International Development, and to pursue joint research with Japan, Italy and Central America. While not announced as part of the Climate Change Policy in February 2006, several international initiatives support reducing greenhouse gas emissions. These include the Carbon Sequestration Leadership Forum, The International Partnership for the Hydrogen Economy, Methane to Markets and Gen Four Nuclear.

The National Goal

The Bush Administration's climate change policy establishes reductions in greenhouse gas intensity as the national goal rather than percentage reductions in over all greenhouse gas emissions. This is supportive of the concept that economic growth must be maintained to enable the United States to be able to afford to address climate change. It also clearly rejects the Kyoto Protocol approach of national targets and time tables.

The Administration has indicated that this approach, an 18% reduction in intensity by 2012, will provide the opportunity to achieve significant short-term reductions while supporting research and development in breakthrough technologies that are not today commercially available.

Examples of existing technologies that can be furthered by this policy include:

- Energy efficiency
- Renewables
- Methane recovery from landfills and coal mines
- Alternative fuels
- Cogeneration

Advanced technologies, which were not prepared for immediate, broad deployment/commercialization in 2002 might include:

- Carbon sequestration, particularly with integrated gasified combine cycle (IGCC)
- Advanced nuclear (maybe deployed now by the end of the decade)
- Hydrogen fuel cell automobiles

C-2 The Energy Policy Act of 2005 (EPACT '05)

The Energy Policy Act of 2005 was passed by the U.S. Congress and signed into law by President Bush in August 2005. It provides some specific authorization for programs consistent with the administration climate change policy announced in 2002. [It took four years for the energy legislation to be enacted.]

Specifically, Title 16 of EPACT '05 addresses climate change. Two major facets of this title are:

1. "Requires the preparation of a national strategy to promote the deployment and commercialization of greenhouse gas intensity reducing technologies and practices with 18 months of enactment" (this will be January 2007), and;

2. "Creates a program to assist deployment of technologies that will help reduce the emission of greenhouse gases in developing countries."

In addition to Title 16, several other provisions support the U.S. Climate Change Policy, even though they were enacted for reasons principally other than climate change. Key examples include:

- All of the energy efficiency provisions including requiring efficiency initiatives in federal operations; establishing efficiency standards, and certain tax incentives and rebates for energy efficiency buildings and appliances;

- All of the renewable energy provisions including required renewable purchases by the U.S. Government; establishes a renewable fuel standard; incentives for deployment of renewables, including a production tax credit;

- The Coal title authorizes $200 million a year for clean coal research in gasification and combustion technologies; and creates a program of loan guarantees for clean coal technologies;

- Certain of the nuclear provisions, particularly those encouraging deployment of advanced reactors. This includes a production tax credit of 1.8¢ per kilowatt hour. Also establishes a support framework to protect the first six new reactors from regulatory or judicial delays;

- Certain of the "Vehicles and Fuels" title that addresses alternative fuel vehicles, vehicle efficiency, and as it relates to the hydrogen title, encourages hydrogen fuel cells for both mobile and stationary application;

- The Research Development title that addresses lighting, buildings, renewables including bio-fuels, nuclear, carbon capture and storage and methane hydrates;

- The Energy Policy Tax Incentive title provides billions of dollars for renewables, energy efficiency in commercial buildings, homes and appliances, clean coal, fuel cells, bio-diesel and ethanol, and hybrid automobiles.

[Source: Energy Policy Act of 2005 – U.S. Senate Committee on Energy and Natural Resources.]

C-3 Energy Industry Actions – Two Examples

C-3a EEI Climate Challenge

The Edison Electric Institute (EEI) working with the U.S. Department of Energy established the Climate Challenge Program in 1994. Over 650 electric utilities have voluntarily implemented:

A. Improvements to nuclear and fossil plants;
B. Energy efficiency and demand side management projects;
C. Methane recovery, and
D. Renewable energy initiatives.

Climate Challenge resulted in reductions of 237 million metric tons of carbon dioxide in the year 2000.

In addition, other industry-wide programs under the climate challenge include creating venture capital investment funds for emerging technologies, utility partnerships, forest management, electric vehicles and geothermal heat pump promotion.

[Source: "The Climate Challenge" - Edison Electric Institute, www.eei.org]

C-3b API Climate Challenge Programs

The American Petroleum Institute (API) established the API Climate Challenge Program in January 2003. This initiative includes three major components:

- The API Climate Action Challenge – This includes a commitment by API member refiners to improve energy efficiency by 10% between 2002 and 2012.

- The API Climate Greenhouse Gas Estimation and Reporting Challenge - This initiative focuses on developing tools to measure emission reduction progress.

- The API Climate R&D Challenge - This initiative focuses on research and development leading to improved energy technologies and reduce greenhouse gas emissions.

Company specific examples of actions include:

- Chevron participates in cogeneration projects aimed at economic reduction of greenhouse gases. The company also has major flaring reduction projects in Angola and Kazakhstan.

- Shell reduced it's greenhouse gas emissions by 10% between 1990 and 2002.

- ExxonMobil improved energy efficiency in refineries by 10% since 1990, and reduced natural gas flaring at its Baytown, Texas refinery by 73% between 2002 and 2004. Also, greenhouse emissions from it's Nicaragua operations are expected to drop by 7 million metric tons per year.

- BP is focusing on energy efficiency company wide and specifically cogeneration.

- ConocoPhillips is also focusing on cogeneration.

Carbon Sequestration – BP, Chevron and Shell as well as others, are supporting carbon capture and storage demonstrations projects and research to develop new technologies.

Alternative Energy – BP, Chevron and Shell have invested and developed renewable energy business lines. These three companies in addition to ConocoPhillips and ExxonMobil are involved in a variety of hydrogen and fuel cell related initiatives.

University Research – A variety of API members (also members of the United States Energy Association) fund university research, development and dissemination efforts. These include as examples:

- Massachusetts Institute of Technology – BP, Chevron and ExxonMobil
- Stanford University – ExxonMobil (Also General Electric)
- Princeton University – BP

[Source: Climate Challenge – A Progress Report – American Petroleum Institute, www.api.org.]

D. Assessment of National Energy Policies and Industry Measures Against the World Energy Council "Three A's"

POLICY MEASURE	ACCESSIBILITY	AVAILABILTY	ACCEPTABILITY
1. Reduce GHG Intensity	No Impact	No Impact	Positive Impact
2. Improve Emission Reduction Registry	No Impact	No Impact	Positive Impact
3. Protect & Provide Transferable Credits	No Impact	No Impact	Positive Impact
4. Review Progress	No Impact	No Impact	Positive Impact
5. Increase Funding	No Impact	Unknown Impact	Positive Impact
6. Act on Review of Science & Technology	No Impact	No Impact	Unknown Impact
7. Implement New & Expanded Domestic Policies	No Impact	Potential Positive Impact	Positive Impact
8. Implement New & Expanded International Policies	No Impact in U.S. – May impact developing countries	Potential Positive Impact	Positive Impact

Narrative

The U.S. workshop in reviewing the World Energy Council Energy Policy Scenarios to 2050 concluded that, as defined by the WEC, Accessibility was not an issue relevant in the U.S. context. Americans have access to commercial energy supplies essentially on a universal basis. Availability is a concern in terms of reliability, primarily as relates to disruptions to infrastructure systems, i.e., power outages; hurricane damage to oil refineries, etc. Availability also is a concern as it relates to security of energy supply. For example, concerns continue to exist regarding disruption to oil imports; power generation capacity adequacy, etc.

In terms of energy related carbon dioxide emissions, Acceptability, as defined by WEC is a bit fuzzier in that there is nowhere near universal or even widespread consensus that carbon dioxide emissions will result in "damage to the environment compromising current and future welfare." Opinions in the United Sates range from those who believe dramatic changes to the earth's environment due to carbon concentrations in the atmosphere are already underway and are irreversible, to those who do not believe at all in the theory of climate change.

Many express a view that reductions in emissions are necessary, prudent and a responsible course of action if reductions can be accomplished while continuing economic growth and prosperity. This school of thought sees the deployment of advanced technology, particularly technologies not widely commercially deployed today, as the solution.

In that these technologies generally have other societal benefits, i.e., reduction of atmospheric pollutants; improved economic efficiency, fuel savings, etc., their deployment makes sense even if science later indicates that the impacts of increasing carbon concentrations are less of a concern than some believe today.

In reviewing the eight major policy measures, none really affect Accessibility in the U.S. context because they do not make commercially available energy sources any more or less available in a system that has had universal access for decades. One could argue that remote locations can be better served by photovoltaics in hunting cabins or along natural gas pipelines for monitoring purposes, but those applications exist now and reducing their costs to broaden their utilization really has little impact on carbon dioxide emissions.

Most of the policies are neutral or irrelevant regarding availability in that they do little if anything to improve energy security and reliability. The only policies that have any bearing are those related to technology deployment. However, those technologies developed to serve climate change goals do not necessary improve reliability or security. A new advanced nuclear plant or IGCC with carbon capture and storage offers no reliability or security advantage when compared with a pulverized coal plant. In fact, the

advanced technology plant presents more technological and economic risk than the pulverized coal plant. These risks can present a threat to reliability.

In terms of technologies that may displace oil imports, some energy security benefit is attainable, as is a climate change benefit. Domestic resource utilization for transportation fuels range from bio-fuels, to coal to liquid, to nuclear plants producing hydrogen to any electric source powering plug-in hybrids. While each of these examples (and plenty of others) are at some stage of development and/or deployment, the combination of the national security/energy security and carbon dioxide emissions reduction value may accelerate the commercialization of those technologies.

However, currently no price signal or economic value is placed on either the energy security or climate change attributes of advanced technologies. Consequently, the impact on availability/security concerns from a climate change perspective is weak at best. One can conclude that climate change concerns could help force deployment of these advanced, domestic fuel based technologies, but it would be an overstatement to assume that they will.

Acceptability also is impacted by the eight policies identified in the Global Climate Change Policy Book. All of the policies ultimately strive to reduce greenhouse gas emissions. However, in some circumstances, the impact is indirect. Most all of the impacts are positive, except for acting on the review of science and technology, in that new structures may or may not prove to be more effective and efficiency than prior structures.

In assessing the pros and cons of each of the eight policies, it appears that no real "cons" exist, in that the actions required by the energy industry are voluntary in nature. If an organization is severely negatively impacted by any of those policies or programs, they can choose not to participate. One can always argue that government expenditures could be used for higher priorities than the climate. One can also always argue that these policies are insufficient, that bolder measures are called for to meet the climate change challenge. These seem to be outside the purview of this study. It also would be possible to identify the pros and cons of individual technologies. However, the U.S. climate change/clean energy initiative is exploring dozens of technologies (see attached list) and a full technology assessment is beyond the scope of this study.

E. Fuels and Technologies Relevant to U.S. National and Climate Change Goals Corporate

Renewables

Solar – photovoltaics; concentrating solar; ocean energy

Wind

Biomass – power production and fuels

Geothermal

Hydropower

Efficiency

- Public awareness
- Cogeneration
- Water savings
- Motor vehicles/engines, drives, tire pressure monitoring systems, power trains
- Corporate average fuel economy
- Lighting
- Electric motors
- Building standards
- Appliance standards
- Hybrid vehicles
- Hydrogen fuel cells
- Flex fuel vehicles
- Celluosic ethanol and other bio-fuels
- Electric reliability/efficiency of grid

Methane

- Landfill gas conversion
- Coal bed emissions
- Animal waste management

Carbon Sequestration

- Geologic including enhanced oil recovery
- Forests and agriculture

Basic Climate Research

- Climate observation systems in developing countries
- Estimating and monitoring greenhouse gases
- Understanding the North American Carbon Cycle
- Define and evaluate the role of aerosols
- Computer modeling
- High quality, long-term data records
- Improve technologies for measuring and monitoring gross and net terrestrial greenhouse gas emissions

Clean Coal Technology Development

- IGCC
- Combustion
- Future Gen

Nuclear

- Advanced reactor development
- ITER
- Test reactor for hydrogen product

Methane Hydrates

Trash Combustion

Natural Gas Flaring

Industrial Efficiency Improvements

Resource Recycling

F. List of Referenced Sources

Section A: No specific reference.

Section B: "U.S. Carbon Dioxide Emissions from Energy Sources – 2005 Flash Estimate" – June 2006 – U.S. Energy Information Administration.

Section C:

C1: "Global Climate Change Policy Book" – Executive Office of the President of the United States, www.whitehouse.gov

C2: "Energy Policy Act of 2003" – United States Senate Committee on Energy & Natural Resources, www.energy.senate.gov

C3a: "The Climate Challenge" – Edison Electric Institute, www.eei.org.

C3b: "Climate Challenge" – A Progress Report – American Petroleum Institute, www.api.org.

Section D: No specific reference.

Section E: All of the above.

Section F: No References