UNITED STATES Carbon Sequestration Council

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Is Carbon Capture & Storage (CCS) Needed? How Can We Make It Happen Sooner?

Global Energy Demand Will Continue to Grow Rapidly

The world is currently experiencing a combination of both rapid growth in per capita energy use and growth in global population. This translates to very rapid growth in overall global energy demand. The U.S. Department of Energy's Energy Information Administration (DOE/EIA) projects a 60% increase in world energy use by 2030. As the global population continues to grow beyond 2030, energy demand will continue to grow through the mid-century and well beyond.

Energy is needed for all facets of our global civilization. It is needed to grow, harvest and transport our food. It is needed to improve our health, to power our medical diagnostic equipment and medical research tools. It is needed to build housing. It is needed to transport our people and to communicate with each other. It is needed to heat our homes and to power our modern world. Electricity is needed to give us light, to power our appliances, to power our televisions and computers, and to enable all of the work saving gadgets that we own. In order to meet these fundamental needs, we will need ever more energy, especially in the emerging economies of the world. This again translates to a very rapid growth in global energy demand, especially the demand for electricity. In the U.S. alone, electricity demand is expected to double by mid-century. Overseas, China already uses twice as much coal as the U.S., and China alone is adding electrical capacity equivalent to the entire U.S. coal-fired fleet every four years. The International Monetary Fund reports projections of 500 million new cars in China by 2050. This projected growth in energy use will lead to increases in CO_2 emissions. In 2004, CO_2 emissions by developed nations (OECD member countries) and developing countries were about equal. The DOE/EIA projects that by 2030, developed country emissions will increase by 30%, while developing countries will double their emissions. The challenge before us is large. The International Energy Agency (IEA) has called for a global "Energy Revolution."

No Single Energy Resource is Capable of Meeting the Growing Global Energy Demand

The large growth in global energy demand can only be met by relying on all of our energy resources. No single energy resource can meet such requirements. If we are to avoid energy shortages, we need to greatly expand our use of fossil fuels, nuclear energy, renewables and conservation. Such rapid global energy growth puts great pressure on the environment, on the economy, and on energy security, requiring creative technology solutions.

The IEA report cites nine supply-side technologies and eight demand-reducing technologies that are all needed to meet its stated energy goals. Demand side technologies include fossil systems with Carbon Capture and Storage (CCS), improved nuclear power plants, and all types of renewable energy. CCS tops the list. IEA states, "CCS development is critical to reducing CO_2 emissions." In its scenario to reduce green house gas (GHG) emissions by half by 2050, CCS technology is the largest single contributor to the needed reductions.

Other organizations have also recognized the need for CCS technologies. The IEA, the IEA Greenhouse Gas R&D Program (IEA GHG), the U.S. Environmental Protection Agency (EPA), the DOE/EIA, the World Coal Institute, the United Nations' Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol on Climate Change (KP), the Intergovernmental Panel on Climate Change (IPCC), the European Commission (EC), the U.S. Pew Centre on Global Climate Change, and others have endorsed CCS technology. The World Wildlife Fund (WWF) cites CCS as one of six key solutions to global warming. According to the 2005 IPCC *Special Report on Carbon Capture and Storage*, CCS is a critical GHG mitigation technology that can contribute up to 55% of the cumulative global mitigation effort. The report further notes that:

- **"**In most scenario studies, the role of CCS in mitigation portfolios increases over the course of the century and the inclusion of CCS in a mitigation portfolio is found to reduce the costs of stabilizing CO_2 concentrations by 30% or more."
- "The IPCC *Third Assessment Report* indicates that no single technology option will provide all of the emission reductions needed to achieve stabilization, but a portfolio of mitigation measures will be needed."
- "Most scenarios project that the supply of primary energy will continue to be dominated by fossil fuels until at least the middle of the century … most models also indicate that known technological options could achieve a broad range of atmospheric stabilization levels but that implementation would require socioeconomic and institutional changes. In this context, the availability of CCS in the portfolio of options could facilitate achieving stabilization goals."

CCS Is Key to any Global Energy Strategy

Petroleum, coal, and natural gas rank first, second, and third in global energy production, and are expected to remain so for the foreseeable future. The current and future use of fossil fuels will continue to generate CO_2. There simply is no alternative to using these fuels to meet our basic needs -- whether

for electricity generation, for manufacturing processes, for meeting our residential needs, or for transportation (including for petroleum refining, hydrogen production, and meeting plug-in power electricity needs). Hence, if we are to reduce GHG emissions significantly, there is no alternative to successful development and deployment of CCS technologies.

Steps To Accelerate Development and Deployment of CCS Technology

Current CCS technologies use a combination of known and emerging technologies and processes. Known storage technologies generally rely on our 25 years of experience injecting CO_2 into depleted oil fields for enhanced oil recovery (EOR). Emerging CO_2 storage approaches include the injection of CO_2 into very deep saline geological formations and a variety of other geologies, and are needed on a much larger scale than is the practice for EOR. Action in four areas will accelerate the development and deployment of CCS technology:

Adopt near-term financial incentives for "first generation" CCS systems. Various groups have agreed that we need the experience provided only by actually operating commercial-scale power plants equipped with CCS, even if the CCS technology is not the "ultimate" version of CCS. This is especially true for the existing global fleet of fossil (coal, gas, pet coke, and other fossil fuels) powered plants.

Continue RD&D. To achieve broad commercial deployment of CCS, CO_2 capture costs must be reduced from current levels. This can only happen via continued research, development and demonstration of improved CO_2 capture technology. The Coal Utilization Research Council (CURC) concluded that "although there is reasonable confidence in the viability of CO_2 storage, substantial financial, institutional, regulatory and technical challenges still remain. To overcome these challenges, an array of small, intermediate, and large scale CO_2 injection field tests are needed (and some are now under way) in diverse geologies to adequately validate this technology." We have both government and private sector technology roadmaps that show the path from our current technology suite to the knowledge base needed for broad commercial deployment of CCS.

Establish rules for CCS injection. The Interstate Oil and Gas Compact Commission (IOGCC), in an effort to assist in this matter, issued a report to provide a State or Province (Canadian) considering adoption of a legal and regulatory framework for the storage of CO_2 in geologic media, the resources needed to develop rules that meet the unique requirements of that particular state or Province. On a somewhat different path, the U.S. EPA is planning to propose Federal injection regulations by the end of June 2008, although promulgation of those rules could require several years.

Provide for long-term liabilities. For CCS to be effective, it must contain stored CO_2 for hundreds of years or longer. Careful monitoring and remediation of any leakage that occurs will be necessary, especially in the early decades of a CCS project. Generally, this initial period can be addressed by the project owner. However, the need to assure storage integrity for centuries is beyond the ability of a project owner, or even traditional insurance mechanisms. A new system for providing such assurance must be created. A number of proposals have been offered by informed groups. If a new, pragmatic system for dealing with these long-term liabilities is not developed quickly, CCS projects will be unable to obtain corporate commitments or financing.

In Summary

CCS is an emerging technology that is essential to the achievement of most long range GHG reduction goals. Current CCS technologies use a combination of known and emerging technologies and processes. Much work remains before we will be ready to broadly deploy this technology, but we have a wealth of information from knowledgeable public and private sector organizations on what needs to be done. As part of its mission to be an information resource for decision makers and the general public on CCS technology, the USCSC will draw from this body of knowledge, as well as the expertise of its own membership, and publish additional materials in the future further discussing the remaining barriers to such broad commercial deployment.

The U.S. Carbon Sequestration Council (www.uscsc.org) is a not-for-profit, 501(c)(3), organization established as an authoritative source of information to inform and to educate on all matters pertaining to carbon sequestration.