Testimony of

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Good morning Mr. Chairman and distinguished members of the Select Committee on Energy Independence and Global Warming.

Thank you for inviting me here today. Thank you for this opportunity to offer the views of American Electric Power (AEP) on electricity generation and technologies for the reduction of greenhouse gas emissions.

My name is Gary Spitznogle, and I am the Manager of IGCC and CO_2 Capture and Storage Engineering for American Electric Power. Headquartered in Columbus, Ohio, we are one of the nation's largest electricity generators -- with more than 36,000 megawatts (MW) of generating capacity -- and serve more than five million retail consumers in 11 states in the Midwest and south central regions of our nation. AEP's generating fleet employs diverse fuel sources – including coal, nuclear, hydroelectric, natural gas, oil, and wind power. But of particular importance for the Committee members here today, AEP uses more coal than any other electricity generator in the Western hemisphere and our company is an industry leader in developing advanced

electrical generation and emission reduction technologies, including carbon capture and storage (CCS).

AEP's Commitment to Renewable Energy

We applaud your efforts to explore new energy technologies that can help achieve energy independence while reducing or eliminating emissions of greenhouse gases. AEP believes that renewable energy technologies, including those being developed by the other members of this panel, are an important part of that effort. Our company has increased its renewable portfolio significantly in recent years. Our wind energy portfolio currently includes 1,783 MW of installed capacity and long-term power purchase agreements. We also recently signed our first long-term power purchase agreement for all of the electrical output from a 10 megawatt solar energy facility being developed in Wyandotte County, Ohio. AEP plans to add another 1,100 MW of renewable energy resources by the end of 2011. While we strongly believe renewable energy will play an important and increasing role in our nation's energy future, renewable generation is just part of the answer. We must maintain a fleet of baseload power plants, including coal-fueled plants, which can be relied on 24/7 to generate the electricity that our economy requires.

AEP's Leadership in Technology Development

AEP has a long and proud history as a leader in our industry for the development and deployment of new technologies. The first high- and extra-high voltage transmission lines at 345 kilovolt (kV) and 765 kV were developed for and serve as the framework for our interstate transmission system. AEP was among the first to develop large central

station power plants and to deploy more efficient supercritical generating technologies. AEP recently celebrated its centennial by reflecting on its century of firsts.

Most recently, we have built upon this history of innovation by focusing our efforts on new clean coal technologies. These technologies will enable AEP and our industry to meet the challenge of reducing GHG emissions while optimizing the use of our nation's plentiful indigenous coal resources. Construction currently is underway in southwest Arkansas on the 600-megawatt Turk Plant that will employ new "ultra-supercritical" coal-fired generating technology. "Ultra-supercritical" technology uses high steam pressure and temperature to increase operational efficiency. The Turk Plant represents a new generation of power plant design that uses less fuel to produce each MWh of electricity. This means that all emissions, including SOx, NOx, and CO_2, will be lower than conventional coal-combustion processes per unit of electricity produced. Once we have obtained all necessary regulatory approvals, finished construction, and begun operation, the Turk Plant will be one of the first commercial-scale "ultra-supercritical" plants to operate in the United States.

AEP also has pursued the development of Integrated Gasification Combined Cycle (IGCC) technology. IGCC represents a major breakthrough in our work to improve the environmental performance of coal-based electric power generation. IGCC technology integrates two proven processes - coal gasification and combined cycle power generation - to convert coal into electricity more efficiently and cleanly than any existing uncontrolled power plant. IGCC also has the potential to be equipped with carbon capture technology at a lower capital cost and with less of an energy penalty than traditional power plant designs, but only after the carbon capture technology has been

proven at a commercial scale. Although the Virginia state commission declined to approve rate recovery for the IGCC plant that we proposed to serve our West Virginia and Virginia customers, but we still strongly endorse the technology and hope to move forward with an IGCC plant at an appropriate time as part of our future capacity plans.

AEP's Commitment to the Development of GHG Reduction Technologies

AEP has also been an industry leader in furthering the development of GHG reduction technologies. Anticipated future mandates for reducing greenhouse gas emissions necessitates the demonstration of CO_2 capture and storage technologies that can be retrofit on the existing fleet of coal-fired power plants in the U.S. and around the world. The technologies for effective carbon capture and storage from coal-fueled facilities are developing, and AEP is on forefront of this effort. One notable AEP project, that will begin startup operations in September of this year, will demonstrate Alstom's ammonia-based CO_2 capture technology, known as the Chilled Ammonia Process, at a 20 MW scale on our 1300 MW Mountaineer Power Plant in New Haven, West Virginia. This demonstration project will capture 100,000 tons per year of CO_2, compress it to a supercritical liquid state, and inject it into deep saline aquifers more than 8000 feet beneath the Mountaineer Plant site. This project is the nation's first integrated CO_2 capture, compression, pipeline, and storage project at an existing coal-fired power plant. After successful operation at the 20 MW scale for a period of five years, our plan is to invest in a commercial-scale 230 MW unit at the same site. The commercial scale unit will be capable of removing and injecting CO_2 at a rate of 1.5 million tons per year.

AEP believes that this dual commitment is essential to meet the challenges of generating electricity in a carbon-constrained future. Clearly, we must develop a new

generation of coal-fueled plants that generate electricity with maximum efficiency, to minimize their carbon footprint and other impacts to the environment. However, the challenge does not stop there. Substantial effort also must be placed on the development and demonstration of **retrofit** technologies for the reduction of CO_2 from existing coal-fired generating units. The United States currently obtains approximately half its electricity from a large fleet of baseload coal-fired power generation facilities and the majority of these facilities will be in operation for decades to come. Only with a portfolio that includes effective CO_2 retrofit technologies will the United States be able to achieve the substantial GHG reductions called for in recent legislative proposals and maintain a strong and vibrant economy.

Recent Supportive Measures Must be Supplemented to Assure the Technology is Ready When Needed

United States Secretary of Energy, Dr. Steven Chu, recently has directed the DOE to invest significantly in the area of post-combustion CO_2 capture. The changes made to the Clean Coal Power Initiative (CCPI) Round III Funding Opportunity Announcement (FOA) reflect the kind of support necessary to make commercial scale GHG reduction technologies available when needed. The FOA has removed its previous requirement of directing a minimum 70% of its funds toward IGCC projects, in favor of post-combustion technologies that are amenable to retrofit applications. Additionally, the DOE-funded Power Systems Development Facility (PSDF) in Wilsonville, Alabama, has recently focused more on post-combustion applications (which can be retrofitted on existing generating units) and is now renamed the National Carbon Capture Center.

These measures, together with the Regional Carbon Sequestration Partnerships and private efforts like those being undertaken by AEP, must be supplemented and continued if the extraordinarily-high costs currently associated with CCS technologies are to be mitigated and promising demonstration technologies like the Alstom process are to be commercialized. Without adequate federal support, we will not be able to overcome the significant technical challenges necessary to achieve dramatic reductions in GHG emissions.

Challenges to Commercialization

CO_2 capture and storage using current inhibited monoethanolamine (MEA) technology is expected to increase the cost of electricity from a new coal-fired power plant, at a minimum, by about 60-70 percent. Even the newer Chilled Ammonia CO_2 capture technology being tested by AEP will require significant amounts of energy and therefore result in higher costs for coal-fueled electricity. It is only through the steady and judicious development of commercial scale applications during the course of the next decade that we can start to bring these costs down, and avoid substantial electricity rate shocks and undue harm to the U.S. economy as the result of cutting greenhouse gas emissions.

If technology research and development remained stagnant over the next decade, there would be no choice but to retrofit the existing fleet with commercially-available MEA technology for CO_2 capture. The energy consumed by this conventional technology, at high capture levels, would result in the loss of approximately one third of a generating unit's power output. That means a typical 600 MW generating station would

be able to deliver only 400 MW of electricity to the grid after being retrofit with current CCS technology

New technologies, such as Alstom's Chilled Ammonia process, offer the promise of reducing this parasitic power loss to far lower levels. However, these technologies are not yet ready for commercial deployment; rather they must be advanced in a systematic and step-wise manner. AEP's 20 MW project at Mountaineer Plant represents the next step in the evolutionary progress of the technology. However, even with the start-up of the demonstration project this year, commercial-scale applications of the Chilled Ammonia process in a first-of-a-kind unit will not be in service before 2015. These first projects, including the planned 230 MW commercial scale unit at Mountaineer, will not be installed with commercial guarantees from vendors and they run the risk of not continuously or reliably meeting high CO_2 capture levels. Our expectation is that 2020 is the earliest date when a reliable commercial-scale carbon capture system will be available to be deployed across the industry.

Other technical hurdles present challenges to the wide-spread deployment of CCS technology. Most notably, the scale of capture technology installations and the ultimate disposition of CO_2 remain topics of intense evaluation.

In addition to energy demand, physical placement of the capture process equipment will be a constraint at many existing power plants. As a rule of thumb, the capture system, on a per-megawatt basis, will require a real estate footprint equivalent to the existing generating plant. In other words, it is likely that the installation of a system to treat the entire plant flue gas output would double the land space occupied. Some plants can accommodate this requirement, but many plants cannot. Consequently,

companies may be able to deploy CO_2 capture systems on only a portion of a plant's output due to siting constraints.

Another significant challenge is the permanent storage of CO_2 after it is captured from a power plant. While the oil and gas industry may be able to utilize a portion of the captured CO_2 for use in Enhanced Oil Recovery (EOR) activities, the supply of CO_2 from the power generation industry will quickly overwhelm the demand from EOR operations. In short order, CO_2 will have to be permanently sequestered or stored in saline formations located many thousands of feet below the surface. The extent of available saline formations, injection pressure limitations, and ultimate capacity are all factors that are currently the subject of intense study. While help from the oil exploration industry is certainly beneficial, there is no substitute for the electric power industry undertaking numerous large-scale demonstration projects involving CO_2 injection into saline or other non-EOR formations. AEP's CCS demonstration program again is an example of the systematic nature of these projects, taking the technology in step-wise fashion from small-scale to commercial-scale deployment. The timeline for this work again points toward 2020 as a reasonable date for wide-scale application of the technology.

In summary, the current state of CCS technology is not yet ready for wide-scale and large CO_2 capture mandates. Continued research, development, and demonstration must be supported and is essential to make CCS technologies a reality. Simply put, our nation cannot wait a decade or longer to begin the development and commercialization of advanced coal generation and carbon capture and sequestration technologies. The need for new electric generating capacity is upon us now and will grow as high energy-consuming CO_2 capture technologies are deployed. The need is real and it is pressing.

Unfortunately, the deployment of advanced coal electric generation technology, such as CCS, ultra-supercritical pulverized coal, and IGCC generation, is expensive now and will only become more so if development is postponed.

Technology is A Critical Component to Meeting Our Climate Challenge

Changing consumer behavior by buying efficient appliances and cars, by driving less, and by similar steps, is helping to reduce the growth of greenhouse gas emissions. But, however important these steps are to reducing our carbon footprint, they are not sufficient to achieving substantial greenhouse gas reduction levels that are now called for under the Waxman-Markey bill. For that, we need major technological advances to effectively capture and store CO_2. The Congress and indeed all Americans must come to recognize the gigantic undertaking and significant sacrifices that this enterprise is likely to require. It is unrealistic to assume, and wrong to argue, that the market will magically respond simply by the imposition of stringent CO_2 emissions caps on our economy. Without the proper federal support for the demonstrating CCS technologies, the result will not be a positive response by the market, but rather a severe impact on the economy.

CCS technologies must play an important role in attaining our nation's future greenhouse gas reduction goals. Achieving such stringent reduction goals may not be realistic until and unless CCS technologies have been demonstrated to be effective and the costs have significantly dropped so that it becomes commercially engineered and available on a widespread basis. Until that threshold is met, it would be technologically unrealistic and economically unacceptable to impose stringent greenhouse gas emissions caps that require the widespread installation of carbon capture equipment.

The electric power industry faces many difficult technical and regulatory challenges for achieving widespread commercial deployment of CCS technologies. The use of deep saline geologic formations as the primary long-term geologic formations for CO_2 storage has not yet been sufficiently demonstrated. There are no national standards for permitting such storage reservoirs; there are no widely accepted monitoring protocols; and the standards for long-term stewardship are uncertain. While industrial insurance companies may be willing to write insurance policies for operational and post-closure periods of CO_2 storage, such insurance coverage is not readily available following active site management. In response to this potential insurance gap, AEP has been actively working to solve these and other potential barriers to CCS deployment and applauds the recent legislative efforts of many within Congress, including the members of this committee in the House and Senator Bingaman, just to name a few.

Conclusion

AEP has made a commitment to demonstrate and deploy new generating and emission reduction technologies. The goal of our Mountaineer project is to demonstrate the effectiveness of the CCS technology in an incremental set of first-of-a-kind commercial projects. However, AEP and its partners in the utility industry cannot do this on our own. We need the financial and policy support of Congress and the nation. Widespread deployment also requires that a host of other important issues be resolved. Only when these technologies have been commercially demonstrated, will commercial orders be placed on a widespread basis to implement CCS at coal-fueled power plants. With your support and our commitment, we believe this can be accomplished so that large scale retrofit applications can begin in 2020.

In the end, the only sure path to stabilizing GHG concentrations over the long term is through the development and utilization of advanced generation and CCS technologies. And we must do more than simply call for it. Our nation must prepare, inspire, guide, and support our citizens and the very best and the brightest of our engineers and scientists; private industry must step up and start to construct the first commercial plants; and our country must devote adequate financial and technological resources to this enormous challenge. AEP is committed to being a part of this important process, and to helping achieve the best outcome at the most reasonable cost and timelines possible. Thank you again for this opportunity to share these views with you.

I will be happy to answer any questions that you may have.