The Coal Chain Industries Envision the Future of Electricity Generation in a Carbon-Constrained World

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Climate change policy (whether in the states, at the federal level, or in a global context) cannot be separated from broader energy security, economic development, and environmental policies. They are inextricably linked.

1. Linkage between energy, economic, and environmental policies

Low-cost, reliable energy produced from domestic energy resources is vital to America's economic growth and our national security. It is inappropriate and unwise to debate proposals through the solitary lens of environmental policy. Doing so will hinder America's ability to fully rely on its most domestically abundant energy resource — coal — and will make the entire energy supply chain less reliable and the cost of energy drastically more expensive.

Growing electricity demand

Policies to achieve the goal of reducing or avoiding greenhouse gas emissions manifest themselves at a time when electricity demand in the U.S. continues to mount. This growth in electricity demand might be slowed, but likely cannot be reversed. Our nation's growing population and expanding economy — along with myriad new consumer electronic products entering the marketplace every day — trigger increased demand for more electricity despite ongoing efforts to dramatically improve energy efficiency. The increased electrification of America is a significant contributor to longer life expectancy and to an enhanced quality of life for millions of Americans.

According to the U.S. Energy Information Agency (EIA), growth in consumer demand for electricity in the United States will nearly double within twenty years and coal's role as the dominant fuel for electricity generation in the U.S. (accounting for more than 50% of current generation) will continue for the foreseeable future.[i] Anything that

significantly reduces coal's place in this projection will have serious, negative implications for both our economy and our energy security.

Reliable electricity supply

Nationwide, the ability to provide a reliable supply of electricity presents a difficult challenge, according to the National Electricity Reliability Council. In 2006, NERC projected the nation's available capacity margin would decline from approximately 18% in 2005 to about 7% in 2015. A year later, although the overall committed capacity margins had improved by approximately 2%, margins in some regions had decreased and long-term margins remained inadequate. For general reliability planning purposes, NERC recommends an 11% *reserve margin* to ensure a safe and stable supply of electricity to meet the need for reliability of electricity supply. While adding "uncommitted resources"[ii] to the available capacity margin increases the *potential* capacity margin to just over 20%, NERC predicts that even that potential will drop well below 20% by 2016.[iii]

NERC notes that adding uncommitted resources presents its own set of challenges, including 1) the cost of new transmission, 2) transmission constraints, and 3) a lack of adequate transmission emergency transfer capability or transmission service agreements that could limit the ability to deliver available resources from areas of surplus to areas of need. Further, the supply and price volatility challenges confronting natural gas impede adding uncommitted resources to reserve capacity.

Some regions of the country are better positioned to meet this challenge. Some already are being severely tested. Others will slip under the desired safe reserve margins within the next few years. New England has all but used up its uncommitted resources, outstripping the region's ability to reliably deliver electricity to consumers. California, Arizona, New Mexico, and southern Nevada are not far behind.[iv]

One can expect that regulation of utility greenhouse gas emissions will further exacerbate this situation. Any decrease in electricity supply at a time when demand is projected to grow is a major concern for our nation's energy security.

Fuel sources

Currently, the U.S. relies on domestic energy supplies to produce the vast majority of electricity. The nation has a 250-year supply of coal reserves at current consumption rates. Coal is America's most abundant, reliable, and affordable energy resource, with reserves available for electricity generation in most regions of the country.

Under its 2009 reference case, EIA recognizes that growing concerns about greenhouse emissions are affecting investment decisions in the electricity sector. Instead of relying on the construction of new coal-fired plants, EIA expects the power industry mostly will build new natural-gas-fired plants between 2007 and 2030. Even so, according to EIA, coal will continue to provide the largest share of U.S. electricity generation at 47% in 2030 while natural gas will contribute 20% (about what it was in 2007) despite an absolute increase in kWh generated by both to meet growing demand.[v]

Assuming there will be a 100% increase in use of renewable resources by 2030, EIA estimates wind generation's contribution to the nation's electricity supply only would be 2.5% with biomass adding another 4.5%. Solar and geothermal resources would make negligible contributions.

Nuclear power, while a baseload option for producing large amounts of electricity without air emissions, continues to encounter permitting and construction impediments due in large part to the unresolved issue of long-term storage of nuclear waste.

Cost of energy

It is important to recognize that shifting demand among fuel sources affects energy prices. Early in 2009, the cost of coal (per million Btus of energy output) was 58% less than that of natural gas — and 69% less than petroleum.[vi]

Analysis of data compiled by the Energy Information Administration consistently shows how states that rely on coal to generate electricity enjoy lower retail costs of electricity. Electricity, meanwhile, has evolved into the primary source of energy in all sectors of the economy except transportation. As a consequence, lower electricity prices benefit the residential, commercial, and industrial sectors and thereby stimulate a state's economy.

Lower energy costs translate into stronger state economic development. According to a March 2007 study by Management Information Services, Inc., the ten states with the lowest retail energy costs[vii] enjoyed 60% higher average employment growth from 2000-2005 than the ten states with the highest costs.[viii] Further, four of the ten states with the highest business energy costs experienced net job losses during the same period.

The cost of electricity not only promotes economic development, it profoundly affects the lives of millions of Americans. For the one in three American households living on low- or fixed-incomes of $30,000 a year or less, energy costs consume 20% to 47% of total after-tax income.[ix]

The cost of energy is profoundly important to both economic growth and human health. According to a 2006 Annapolis Center report, "Strong and convincing evidence exists in the public health literature that economic growth-development and inexpensive energy drive worldwide improvement in health and longevity." Additionally, a 2005 study by Dr. M. Harvey Brenner of Johns Hopkins University found that, if coal were removed from the energy mix, approximately 170,000 to 368,000 premature deaths would occur in the U.S. in 2010.

Global issue

China and India are quickly surpassing the U.S. with their GHG emissions. While China and India will produce a third again more emissions than the United States within

25 years, according to a recent International Energy Agency report, China's emissions of GHG surpassed the U.S. in 2008. Both China and India already rely heavily on coal for their electricity generation and both countries will further increase their reliance on coal. Neither has agreed to reductions in their domestic GHG emissions during international negotiations.

If the U.S. unilaterally adopts policies that significantly reduce coal use, fewer incentives will exist for new investments in research, development, demonstration, and deployment (RDD&D) of technologies that will make increased domestic coal use possible in a carbon-constrained environment. Absent these technologies, the developing world is "on its own" in bringing about the necessary GHG reductions. The U.S. would, therefore, abdicate global leadership on this important issue and forego opportunities for technology sales and export.

The technology solution

Technology advances have met every emissions challenge from the utility sector that the United States has faced since Congress passed the Clean Air Act in 1970. Emissions of gaseous criteria pollutants from coal-based electricity (nitrogen oxide or NOx, sulfur dioxide or SO_2, and carbon monoxide) have dropped by two-thirds over the past three decades, even as coal use has doubled.

The U.S. is steadily closing in on an objective of ultra-low emissions from electricity generation. This is an important shared goal of energy producers, consumers, and environmental organizations and can be met through 1) innovations in coal-gasification technology for electricity generation (IGCC), 2) a transition from super-critical to ultra-supercritical pressure boilers firing coal in a new generation of power plants, and 3) development of technologies that capture and store carbon dioxide (CO_2). All are key components of research pursued as part of the FutureGen project and related proposals for further evolution of coal-use technologies.

In the case of technology to capture and store greenhouse gas emissions, we will need to refine new power generation technologies as well as retool the nation's fleet of existing power plants. That effort will require billions of dollars in public and private sector funding invested over a reasonable amount of time.

2. State-mandated controls on greenhouse gases

Every proposed environmental policy — and especially those intended to address global climate change — must be examined with an eye to its linkage with energy and economic development policies. In this regard, many regional and state policymakers are considering whether to mandate controls on utility GHG emissions and whether viable alternatives to government mandates exist.

Given the global nature of the climate change issue and the increased focus on the issue at the federal level, it is increasingly important that state and regional policymakers take prudent action and refrain from enacting climate change mandates before the outcome and consequences of the current intense federal policy debate can be determined.

If states act precipitously, a patchwork of conflicting state and regional programs is the likely result. The potential environmental benefits on global GHG emissions, if any, from such a patchwork pale in comparison with the prospect of inducing sharply rising energy prices and economic dislocation for millions of Americans.

3. Alternatives to state government mandates

It is apparent that many state policymakers are eager to identify actions (other than government GHG regulation) they can support to address climate change concerns in a meaningful way. Various additional or enhanced energy measures provide prudent alternatives to state-mandated controls on utility GHG emissions.

As an initial point, the coal-based electricity sector has taken significant voluntary action to lessen or avoid GHG emissions over the past decade. As a result,

according to the U.S. Department of State, there has been only a 1.8% increase in U.S. greenhouse gas emissions, which is far lower than the nation's 4.2% annual economic growth in the same timeframe.

Energy efficiency

The experience of recent years has been that many consumers need more education and incentives to make the up-front investments in the more energy-efficient products that will result in energy savings over the long term. However, current regulatory impediments sometimes prevent utilities from fulfilling this fitting role. Adjustments in state policies could make a positive difference in this area.

First, states could offer direct incentives to consumers (both residential and businesses) for qualifying energy savings purchases and installations. These programs could run the spectrum from purchases of compact fluorescent light bulbs; appliance upgrades; modernizing heating, ventilating, and air conditioning (HVAC) systems; making industrial process improvements; to purchases of hybrid and plug-in hybrid vehicles.

Second, government facilities (including schools) are major consumers of electricity and energy-related devices. States could emphasize increased efficiency and promote new markets for energy-saving products through "green government" programs.

Third, states could alter cost recovery and regulatory rate-setting structures so that utilities in regulated states are more easily able to help customers reduce energy consumption. Many states do not allow utilities to include such efficiency-enhancing efforts in their rate base. Therefore, energy efficiency measures often perversely result in decreased electricity sales and lower profits, removing any financial incentive to pursue them. With appropriate changes in the regulatory framework, states could reverse this "spend money to lose money" scenario, and develop sound efficiency programs that will

achieve economic and environmental goals related to greater efficiency and energy conservation.

Power plant modernization

On the supply side, utilities have tremendous financial motivation to increase their generation efficiency in order to reduce the enormous capital outlays of new power plant construction. Modernization and upgrades of power plants and equipment often are not undertaken because of federal New Source Review (NSR) regulations and other statutes that have the unintended consequence of impeding efficiency improvements. If the significant CO_2 emission reductions that are made possible with plant upgrades are to be realized,[x] NSR regulations must no longer be applied to efficiency improvements at power plants. For example, as a rule-of-thumb, every percentage increase in power plant electricity generation efficiency results in 100,000 tons of avoided CO_2 emissions, annually.

Also, given the public's interest, states could provide direct incentives to in-state generators making investments for efficiency upgrades or call upon Congress to fully fund provisions in the Energy Policy Act of 2005 that would provide incentives for coal-based power plant efficiency upgrades.

Both demand-side and supply-side efficiency upgrades are able to provide measurable, near-term reductions against the projected rate of growth in GHG emissions. Shaping the development of a state's electricity generating fleet also will provide options for further reducing GHG emissions growth.

Increasing energy supply

Building new, advanced coal-based generation facilities is a key component of meeting the growing demand for electricity and increasing the carbon efficiency of the nation's electricity generation fleet. Although federal tax incentives and loan guarantees can reduce the cost of new plants, only through the state regulatory process can power

plant operators be assured of timely recovery of their multi-billion dollar investments. Necessary investments in power plant construction therefore depend on 1) regulatory certainty, 2) regulators' pre-approval of power plant designs that by their nature are not the lowest cost, and 3) timely recovery of the pre-approved expenditures.

Additionally, some efforts to site generation facilities have engendered discussions about "co-siting" coal plants with renewable technologies where such synergies appear to be cost effective. Such projects could reduce the carbon footprint of the new facilities and provide the transmission access necessary for renewable energy to reach the marketplace.

Finally, a few states are considering incentives for building new, more efficient plants when coupled with the retirement of older, less efficient generating units. In addition to more efficient use of fuel, the newer plants would result in substantially fewer emissions (including GHGs) than the facilities they replace. Given the importance of coal-fueled generation to America's energy security, any such incentive should, however, discourage fuel switching away from coal.

Carbon capture and storage

The potential for carbon dioxide sequestration (or safe storage) in suitable geologic formations across the U.S. is a vast and generally underappreciated natural resource. A comprehensive study for the Global Energy Technology Strategy Program prepared by Battelle Memorial Institute concludes that an aggressive program of carbon capture and storage in the U.S. over the next 100 years would tap less than 10% of available potential domestic geological storage capacity. It is entirely probable that the U.S. enjoys nearly 600 years of storage potential to meet increased demand for fossil fuel energy. Additionally, Europe, Australia, Canada, India, Latin America, and the Middle East have sufficient capacity in geologic formations for GHG storage to meet their needs for hundreds of years.[xi]

While carbon capture and storage is critical to an effective strategy for global efforts to address climate change, several issues must be resolved at local, state, and federal levels of government. Examples include — but are not limited to — 1) ownership of the stored carbon dioxide, 2) eminent domain for CO2 pipelines, 3) liability in the event of CO2 leakage, 4) mineral trespass indemnification, 5) responsibility for monitoring and verification, and 6) assignment of regulatory control over CO2 injection.

Important demonstration projects are underway involving states and individual companies. All but a few northeastern states have joined with the U.S. Department of Energy, businesses, and non-government organizations (including universities, research facilities, and ACCCE) to fund seven regional carbon sequestration partnerships. The partnerships are an important bridge to an era of net carbon-free electricity generation using coal through demonstration of the practicality and potential of CO2 sequestration.

Efforts to stimulate early action on carbon storage by taking advantage of terrestrial carbon sequestration similarly require resolution of several important issues. Policymakers must decide 1) who owns the emissions sequestered (farmer or forester, tonnage aggregator, or entity claiming carbon offsets), 2) who is liable for release of carbon from soils/vegetation back into the atmosphere, 3) the appropriate system of storage verification, and 4) suitable methods of monitoring and quantifying carbon storage.

The coal-based electricity sector in partnership with federal, state, and international governments is pursuing strategies that will ensure the availability of carbon control technologies for both 1) advanced pulverized coal systems[xii] and 2) Integrated Gasification Combined Cycle (IGCC) plants. Currently, more than 80 projects are underway demonstrating either capture or storage of CO_2 emissions nationwide. These near-term demonstrations of carbon capture and storage technologies for

pulverized coal and gasification units mean that the U.S. likely will be able to capture and store CO_2 without requiring a sector-wide transition solely to gasification technology.

4. Federal Carbon Management Legislation

In order to address climate change concerns as well as to meet the nation's economic, energy, and environmental goals and interests, ACCCE's diverse membership supports timely adoption of federal carbon management legislation (and recognizes that a mandatory cap-and-trade program is one option for such legislation) so long as the principles set out below are appropriately addressed.

- Guarantee, through public-private sector partnerships, aggressive, near-and long-term investments in new, advanced technologies that 1) avoid or reduce CO_2 emissions; 2) capture, transport, and safely store CO_2; and 3) use CO_2 in beneficial ways whenever practical.
- Establish a legal, regulatory and long-term liability framework to safely store CO_2.
- Promote the deployment to other nations of advanced U.S.-developed technologies to avoid, reduce, capture, transport, and safely store CO_2.
- Ensure that any mandatory requirements (cap levels, compliance deadlines, etc.) be reasonable and recognize that many of the technologies needed to reduce manmade greenhouse gas emissions from new or existing fossil-fueled generating stations are not yet commercially available.
- Protect American consumers and the U.S. economy through effective cost-containment measures. For example, if a cap-and-trade program were to be implemented, it would be essential to have fair and equitable allocation of emissions allowances, as well as to establish a ceiling price for carbon that is certain and reasonable.

- Allow broad use of verifiable actions to offset manmade greenhouse gas emissions.
- Afford full credit for verifiable early actions that avoid, reduce, or capture and store manmade greenhouse gases.
- Avoid a patchwork of conflicting standards or duplicative programs through the adoption of a uniform federal program.
- Encompass economy-wide domestic actions and cover all major manmade greenhouse gases.
- Preserve reliability of the electricity generation, transmission, and distribution system.
- Promote energy security and reliability by encouraging maximum utilization of domestic resources to generate electricity.
- Maintain America's competitiveness in a global economy.

Conclusion

It important that policymakers embrace the inextricable linkage between energy, economic, and climate policies so that they do not exacerbate emerging energy supply challenges leading to unnecessarily higher costs for electricity consumers. Wise climate policy requires action by business, government, and individual citizens.

The United States and nations around the world can achieve meaningful reductions in greenhouse gases by employing advanced clean coal technologies

References:

[i] Schnapp, Robert. "National Energy Supply and Fuel Outlook," Energy and Environmental Sustainability in a Carbon Constrained Future conference, New York, NY. September 11, 2008.

[ii] "Uncommitted resources" means sources of electricity that lack firm contracts or a legal or regulatory requirement to serve load, do not have firm transmission service or a transmission study to determine availability for delivery, are designated or classified as energy-only resources, or are in mothballed status because of economic considerations.

[iii] North American Electricity Reliability Corporation, *2007 Long-term Reliability Assessment 2007-2016*, Princeton, NJ. October 2007. p. 22.

[iv] Ibid., page 11.

[v] Energy Information Administration. *Annual Energy Outlook 2009 with Projections to 2030* [DOE-EIA-0308(2009)]. March 2009.

[vi] Ibid. *Short-term Energy Outlook - June 2009*, Table 7a. "U.S. Electricity Industry Overview." June 2009.

[vii] Kentucky, West Virginia, Idaho, Wyoming, Washington, Nebraska, Indiana, North Dakota, Utah, and Missouri.

[viii] Hawaii, New York, New Hampshire, Maine, Connecticut, Rhode Island, Alaska, California, Vermont, and New Jersey.

[ix] Trisko, Eugene. *Energy Cost Impacts on American Families.* Americans for Balanced Energy Choices. 2007.

[x] "Retrofitting of Coal-Fired Power Plants for CO_2 Emissions Reductions," an MIT Energy Initiative Symposium. Massachusetts Institute of Technology. March 23, 2009. p. 24.

[xi] Dooley, J.J., R.T. Dahowski, C.L. Davidson, M.A. Wise, N. Gupta, S.H. Kim, and E.L. Malone, *Carbon Dioxide Capture and Geologic Storage*, Global Energy Technology Strategy Program (Battelle Memorial Institute), April 2006.

[xii] Advanced pulverized coal systems are understood to include appropriate supercritical, ultra-supercritical, fluidized bed, and oxyfuel technologies.