

## Testimony of Dr. Gregory P. Kunkel, Ph.D.

Vice President of Environmental Affairs  
Tenaska, Inc.

Before the United States House of Representatives  
Select Committee on Energy Independence and Global  
Warming

July 28, 2009

Thank you, Chairman Markey, Ranking Member Sensenbrenner and Members of the Select Committee for inviting me to discuss carbon capture and storage (CCS) technologies and Tenaska's two commercial-scale electric generation projects using CCS –Trailblazer in Texas ([www.tenaskatrailblazer.com](http://www.tenaskatrailblazer.com)) and Taylorville in Illinois ([www.cleancoalillinois.com](http://www.cleancoalillinois.com)).

My name is Greg Kunkel. I am Vice President of Environmental Affairs for Tenaska ([www.tenaska.com](http://www.tenaska.com)). I am pleased to report two exciting recent developments: (1) the Department of Energy's selection of the Taylorville project in Illinois to proceed into the term sheet negotiation phase for a DOE loan guarantee, and (2) a new Texas law providing incentives and regulatory structure for Trailblazer and other CCS projects

### **Tenaska Background**

Tenaska, headquartered in Omaha with offices in Dallas, Denver and Calgary, is one of the largest independent power producers in the United States. Guided by conservative business practices - which include securing long-term contracts for its generation facilities, Tenaska has developed approximately 9,000 megawatts (MW) of natural gas-fired electric generating capacity across the United States. Tenaska affiliates also market natural gas, electric power and biofuels. Additionally, our affiliates are also involved in private equity fund and acquisition management focused on the energy space, including renewable energy, infrastructure development, natural gas pipelines and storage, and electric transmission.

The company currently has more than 700 employees and 2008 gross operating revenues were \$16 billion. Tenaska has grown steadily and now ranks among the top 25 largest privately-held US companies based on 2007 revenues.

In recent years, Tenaska has expanded beyond its traditional power production technology base.

- Tenaska Solar has invested in Soltage ([www.soltage.com](http://www.soltage.com)), a Jersey City, New Jersey-based full-service renewable energy company that develops and operates solar energy stations at client sites across the US. These power stations supply a significant portion of client long-term energy needs at below retail rates.

- Tenaska’s employee-owners have invested in the Elkhorn Ridge Wind project which, at nearly 80 MW, is the largest wind project in Nebraska, producing renewable energy for about 25,000 Nebraska homes.
- Tenaska Power Fund owns InfrastruX Group, a leading national provider of utility infrastructure construction and maintenance service which is well-positioned to assist in strengthening US energy infrastructure. InfrastruX ([www.infrastrux.com](http://www.infrastrux.com)), is headquartered in Seattle, Washington, with offices in New Mexico, New York, Pennsylvania, Wisconsin and Texas.
- In recognition of Tenaska’s modern electric generation fleet, the Natural Resources Defense Council ranks Tenaska as having the lowest carbon footprint of any of our peers – less than half of the national average emission rate of greenhouse gases.

As developers, rather than researchers or inventors, Tenaska is focused on environmentally responsible power projects that use available, reliable, cost-competitive technologies that are commercially financeable and that attract conservative investors requiring a reasonable assurance of success.

With this context in mind, I now turn to CCS and Tenaska’s Trailblazer and Taylorville projects.

### **Carbon Capture and Storage in General**

Commercial-scale CCS, utilizing geologic sequestration and enhanced oil recovery (EOR) technologies, has many important benefits, including:

- (1) The US leads the world in proven coal reserves, and coal powers 49% of US electricity. Continued use of coal with CCS is necessary to meet US environmental, economic and national security objectives while providing inexpensive and reliable baseload power.
- (2) The use of American coal by the power sector in an environmentally responsible way decreases overall demand for natural gas. This helps both hard-pressed manufacturers facing foreign competition that use natural gas as a feedstock and consumers in both coal-dependent and non-coal-dependent areas who choose clean-burning natural gas for heating their homes and other purposes.
- (3) Enhanced oil recovery utilizing CO<sub>2</sub> boosts oil and gas reserves and production from existing US fields –strengthening US energy security,

reducing imports, and offering an attractive alternative to exploitation of new fields in environmentally sensitive onshore and offshore areas.

- (4) Commercial-scale CCS may be the most effective way to curb greenhouse gas emissions in China, India and other coal-dependent developing countries, and its widespread adoption here in the US will make it possible for the US to lead the world in deployment of this technology.

President Obama summed up the case for CCS last year –

*“... I am a big proponent of clean-coal technology and I want us to move rapidly in developing those sequestration technologies....We're not going to immediately move off coal. A huge percentage of our electricity is generated by coal. What we need to do though is to put clean-coal technology on the fast track and that means money.... We're the Saudi Arabia of coal, and the sooner we can figure out how to burn it cleanly, not only are we going to benefit but we can license that technology to countries like China and India that are putting up new coal facilities every week.”*

“Obama, Clinton Make Closing Arguments as Montana Primary Looms,”  
Flathead Beacon, May 29, 2008

### **Tenaska’s Carbon Capture and Storage Projects**

I am pleased to report significant progress for the two CCS projects Tenaska has in advanced development – Trailblazer in Texas and Taylorville in Illinois.

Trailblazer is a 600 megawatt (MW) net-output coal-fueled, baseload power facility that, unlike any currently in operation anywhere, would capture 85 to 90 percent of its potential carbon dioxide (CO<sub>2</sub>) emissions and deliver that CO<sub>2</sub> via pipeline for use in enhanced oil recovery operations and geologic storage in Texas’ Permian Basin.

Taylorville in Illinois is a 500 MW net-output hybrid Integrated Gasification Combined-Cycle (IGCC) facility that will convert coal to methane either for sale into the natural gas pipeline system or for the generation of electricity. In the process, the project will capture 50 to 60 percent of the CO<sub>2</sub> that the facility otherwise would emit. Emissions will be comparable to a natural gas generation facility.

The two Tenaska projects may give the Select Committee some sense of the CCS projects that our nation’s power sector can build with today’s proven technologies.

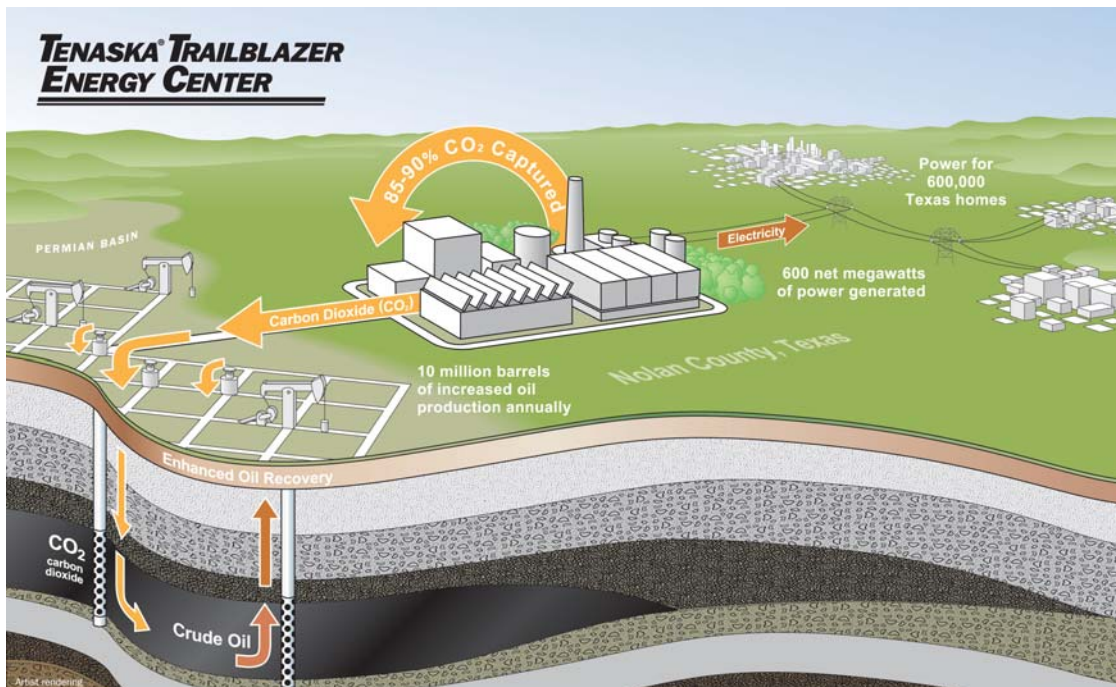
When Tenaska embarked on the process of developing these utility-scale CCS projects, high and volatile natural gas prices, combined with oversupply of natural gas generation facilities, encouraged us to consider the continuing need for baseload power facilities fueled by coal. At the same time, our management recognized that new federal, regional and state laws and regulations to control emissions of greenhouse gases from power facilities were certainly very likely during the 50-year life of these facilities. Given that new baseload projects cost as much as \$2-3 billion and the highly-publicized cancellations and postponements of many proposed conventional coal-fueled projects due to environmental and other challenges, we decided that we would only be comfortable if we tackled the climate issue directly.

The Supreme Court's Massachusetts v. EPA decision, the ensuing EPA endangerment finding, and federal and state law and legislation underscore the need for all of us in the power sector to come to grips with the climate change challenge.

Since we were not willing to invest in solid fuel projects without addressing the climate change challenge, the question before us was how to reduce greenhouse gas emissions in the design of projects today. To accomplish this goal, we needed to assure ourselves that carbon capture technologies are ready for utility-scale application, a secure home is available for captured CO<sub>2</sub>, and the economics and long-term financing arrangements for such projects can work. I am pleased to report considerable progress in each of these areas.

### **Trailblazer Energy Center**

On February 19, 2008, Tenaska publicly announced the Trailblazer Energy Center, a 765 MW gross-output and 600 MW net-output supercritical pulverized coal electric generation facility with the capability to capture and deliver to the enhanced oil recovery markets 85 to 90 percent of CO<sub>2</sub> produced in the boiler. On the same day, we closed the purchase of the site, filed an air permit application with the Texas Commission on Environmental Quality (TCEQ), and submitted a transmission interconnect request with the Electric Reliability Council of Texas (ERCOT). The Trailblazer idea is all about neighborhood. The strategically located site is near pipeline infrastructure that can connect the facility to the world's largest market for CO<sub>2</sub> – Permian Basin enhanced oil recovery. Two railroads serve the site, and the electrical interconnection is also nearby.



The Tenaska Trailblazer Energy Center would be the first coal-fueled power plant to capture the carbon dioxide it produces and transport it via pipeline for use in enhanced oil recovery and geologic storage.

The TCEQ issued Trailblazer's draft air permit on February 2, 2009, the public comment period on the draft air permit closed on April 17, and the TCEQ is working toward issuing a final permit.

A very significant development is our selection of Fluor Corporation as the engineering, procurement and construction (EPC) contractor for the facility. Tenaska has signed a memorandum of understanding with Fluor that is the basis of a joint Tenaska-Fluor limited engineering scope of work to support financial closing and initiation of construction as early as 2010, provided that there is an established economic price signal for CO<sub>2</sub>. With construction requiring about four and half years, commercial operation could begin as early as 2015.

The State of Texas is doing its part as well. Earlier this year, Texas enacted legislation that provided state and local incentives, including tax incentives, for up to three power generating projects that capture and sequester at least 70 percent of CO<sub>2</sub> emissions and provide the captured CO<sub>2</sub> for enhanced oil recovery. The legislation also established responsibility for regulation of CO<sub>2</sub> sequestration and storage among state agencies. Still needed to make projects economically feasible is some form of federal incentive in addition to the existing commercial value for CO<sub>2</sub>.

Tenaska is in the business of developing power generation facilities, and the Trailblazer project represents what we believe is a commercially viable approach to building a baseload project within current development parameters. However,



from a more global perspective, the importance of a project like Trailblazer is that it will demonstrate that post-combustion capture technology can work – on a utility-scale – for many of the 5,000 existing coal-fueled power stations worldwide that currently contribute as much as 10 billion metric tons of CO<sub>2</sub> annually to global emissions.

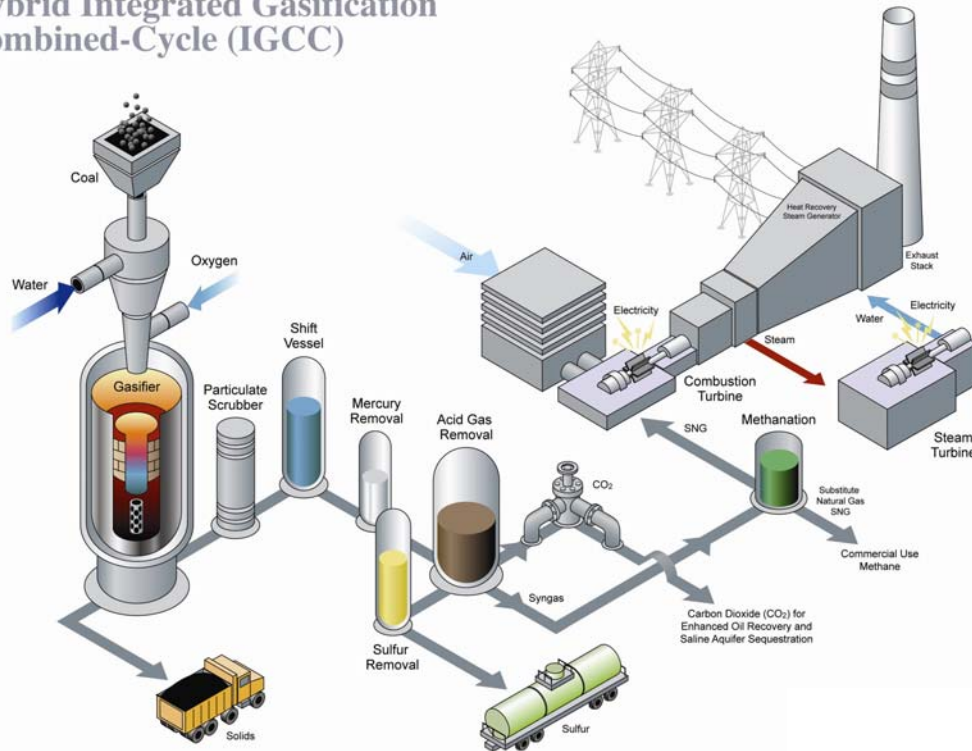
In addition, and beyond the implications for CO<sub>2</sub> mitigation from coal, projects like Trailblazer will help the US maximize domestic oil and gas production from existing fields, thereby enhancing national fuel security. CO<sub>2</sub> captured at Trailblazer will increase Permian Basin oil production by more than 10 million barrels per year, strengthening the West Texas economy.

Not to be overlooked, Trailblazer will boost the local economy with more than \$2 billion in construction spending out of a total estimated project cost of more than \$3 billion, provide 1,500 to 2,000 jobs at peak construction, and create more than 100 well-paying permanent positions to sustain operations.

### **Taylorville Energy Center**

The Taylorville Energy Center is a Hybrid Integrated Gasification Combined-Cycle (IGCC) electric generation facility. The developer is Christian County Generation, LLC (CCG) and Tenaska is the managing partner. The project will manufacture pipeline-quality substitute natural gas (SNG), which is methane, from Illinois bituminous coal. The SNG will fuel a power block with two combustion turbines, two heat recovery steam generators (HRSGs), and one steam turbine. The amount of SNG produced will significantly exceed the requirements of the power block, annually freeing up 10 billion cubic feet (bcf) of SNG for transport offsite via a natural gas pipeline for eventual sale to commercial and residential natural gas customers. The facility will use 2.5 million tons per year of Illinois coal, employ 1,500 construction workers, and create hundreds of permanent jobs in the coal and power sectors.

**TAYLORVILLE ENERGY CENTER**  
 Hybrid Integrated Gasification  
 Combined-Cycle (IGCC)



The Taylorville Energy Center will use hybrid Integrated Gasification Combined-Cycle (IGCC) technology to convert coal into methane, either to sell into the natural gas pipeline or to fuel power production.

Taylorville will capture 50 to 60 percent of the CO<sub>2</sub> that the facility would otherwise emit, remove moisture and sulfur compounds, and compress the CO<sub>2</sub> stream for pipeline transport either to nearby geologic sequestration wells in the Mt. Simon geologic formation (within Christian County, Illinois) or for use in EOR operations elsewhere. Tenaska and others in the power sector are working with the State of Illinois and the US Department of Energy on development of the Mt. Simon geologic formation, and on July 13 Denbury Resources announced a feasibility study for a pipeline transporting CO<sub>2</sub> from the Midwest to the oil patch ([www.denbury.com](http://www.denbury.com)).

The power island will have criteria pollutant emission levels equal to those of a combined-cycle natural gas generation facility. No electric generation facility utilizing coal or coal-derived fuel operating anywhere in the world approaches the proposed emission performance of the Taylorville Energy Center, yet the project relies exclusively on proven technologies for coal gasification, gas processing and power generation.

The Hybrid IGCC process of producing marketable SNG (methane) will result in greater operational flexibility than a more typical IGCC model, in which only synthesis gas is produced exclusively for consumption on site. In contrast,



Taylorville's SNG production will enable its power generation function and gasification processes to operate more independently, creating the means to respond to electricity demand and commodity price volatility. By making CO<sub>2</sub> available for EOR, Taylorville offers important contributions to petroleum as well as electric and natural gas supplies. By demonstrating the technical and economic feasibility of coal-based power generation with CCS technologies, the project provides a model that the US power sector can replicate in support of our nation's domestic energy strategy.

I am pleased to report that DOE has selected Taylorville to proceed into the term sheet negotiation phase under the DOE Loan Guarantee Program. The amount of the guarantee will be up to \$2.579 billion, depending on the final project costs and capital structure. Upon completion of due diligence and negotiations, the Taylorville project expects to receive a federal government guarantee of its debt, enabling financing and greatly reducing costs – resulting in significant savings that will accrue directly to Illinois ratepayers.

Because the Taylorville project makes a great deal of sense for Illinois, it has enjoyed a broad range of supporters, including the Illinois AFL-CIO, the American Lung Association, the Clean Air Task Force, the Illinois Citizens Utility Board and the Illinois Coal Association.

Perhaps the most important thing Congress could do to facilitate the development of Trailblazer, Taylorville and similar projects is to provide **regulatory certainty**, and in particular, a regulatory framework within which a market can develop that values greenhouse gas emission reductions. Absent regulatory certainty, we foresee an EPA rulemaking process with ensuing lengthy litigation. Without regulatory certainty, the financial markets will remain reluctant to provide necessary project financing, or the financing they do provide will remain at a very high cost, stifling investment in CCS deployment, as well as wind, solar and other innovative projects and related transmission necessary for our nation to move ahead.

The Waxman-Markey ACES bill as passed by the House addresses several needs facing the developer of clean coal projects with CCS. ACES advances the critical requirement for regulatory certainty, and includes important mechanisms that could materially benefit the development and utilization of CCS technologies.

- Section 115 - Commercial Deployment of Carbon Capture and Sequestration Technologies – The bonus allowance provisions of the legislation are among the most important to development of projects utilizing CCS. The range of allowance values should be adequate to create meaningful incentives for CCS project associated with a variety of technologies. Tenaska appreciates

the leadership of Chairman Markey and others on section 115, and respectfully offers some suggestions to make the provisions even more effective in achieving the goal of encouraging early deployment of CCS.

First, consider expanding the current six gigawatts (GW) of generation eligible for bonus allowance treatment to perhaps ten gigawatts at current ACES values, and substitute additional tranches at declining pre-set values for the reserve auction mechanism to foster the development of an additional 62 gigawatts of CCS capacity.

Second, create a mechanism for reserving allowances that assures that projects meeting defined pre-construction permitting requirements are guaranteed a sufficient quantity of bonus allowances based upon successful project completion. Under the current structure, projects cannot count the value of bonus allowance toward their revenues for financing purposes, as there is no assurance the allowances will be available upon achieving commercial operation, making project financing much more difficult. Accordingly, one of the most significant benefits the bonus allowances offer – revenue support and certainty – may not be realized without a reservation system. A well-structured reserve mechanism, coupled with an expanded pool of allowances, would remedy this limitation.

- Section 114 - Carbon Capture and Sequestration Demonstration and Early Deployment Program – This program could prove to be useful in advancing CCS provided that the awards are available to all classes of applicants and that the projects receiving grants are of commercial scale and employ a variety of capture technologies and geologic sequestration settings.

Tenaska asks that, as the ACES legislation moves forward, the House and Senate work together on addressing the complex regulatory and tax structures needed to govern CO<sub>2</sub> sequestration. Protection of early mover projects deserves consideration while the issue of long-term liability at sequestration sites is under study. Tenaska has supported a variety of tax incentives for CCS, most importantly modifications to the existing Internal Revenue Code section 45Q sequestration tax credit to increase the number and value of the credits and enable reservation of a credit stream similar to the wind production tax credit, with an adjustment in the credit as the carbon emission allowance market develops within a cap-and-trade regime.

I want to express Tenaska's special appreciation to the members of Congress who represent our Nebraska headquarters, Trailblazer and Taylorville, as well as all the other Members on both sides of the aisle who have been supportive of our CCS efforts.

Thank you again for your interest and for the opportunity to discuss CCS technologies and provide this update on Trailblazer and Taylorville. I would be pleased to respond to any questions you may have.



Greg Kunkel, Ph.D.  
Vice President of Environmental Affairs

AS THE VICE PRESIDENT OF ENVIRONMENTAL AFFAIRS FOR TENASKA, DR. GREG Kunkel is engaged in development of the company's strategic responses to climate change and other environmental issues of primary concern. Tenaska is an independent energy company that develops, constructs, owns and operates non-utility generation and cogeneration plants; provides marketing services for natural gas, electricity, and biofuels; and provides acquisition management services for private equity funds in the energy sector.

Dr. Kunkel leads environmental permitting and development for Tenaska's clean energy projects, including: the Tenaska Trailblazer Energy Center in Texas, the first proposed coal-fueled facility to capture 85 to 90 percent of the carbon dioxide (CO<sub>2</sub>) it produces for use in enhanced oil recovery; and the Taylorville Energy Center in Illinois, a hybrid integrated gasification combined-cycle plant (IGCC) that will convert coal into pipeline quality natural gas that will fuel power production or be sold, capturing at least 50 percent of its CO<sub>2</sub> emissions.

Dr. Kunkel supervises Tenaska's corporate environmental team to assure compliance with environmental requirements and directs environmental commodity transactions for Tenaska affiliates, including domestic and international carbon credits.

In 2008, Tenaska was listed in benchmarking studies by the Natural Resources Defense Council as having the best record among thermal US electric generation companies for fleetwide average emissions of CO<sub>2</sub>.

Dr. Kunkel earned bachelor of arts and master of arts degrees from the University of Colorado at Boulder. He received his doctorate from the University of California at Davis.