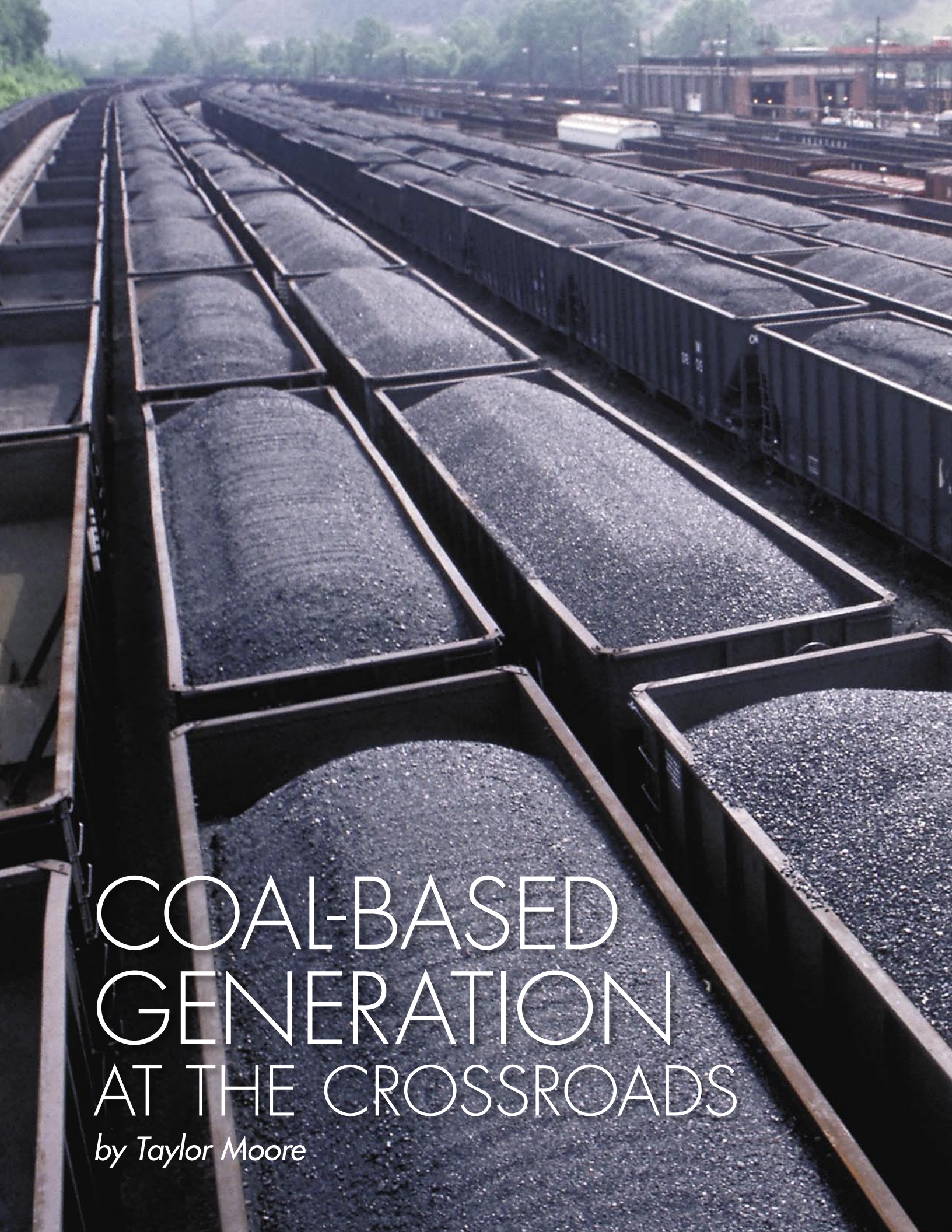


COAL-BASED GENERATION AT THE CROSSROADS

by Taylor Moore

The Story in Brief

Offering clean electricity generation from an abundant fuel, advanced coal technologies seem tailor-made for a power industry facing ever-tighter environmental regulations. But committing to new approaches—and the inevitably higher cost of first-of-a-kind units—is always a difficult business proposition. To help break through the final barriers to market acceptance, EPRI is leading an industry-driven initiative to speed the deployment of new clean coal plants and support the development of next-generation designs.

Long the workhorse of electric generating systems around the world, coal-based power plants are increasingly seen as one of the most economic choices for meeting future growth in demand for power. But while today's units operate *far* more cleanly than when air-quality rules were ramped up in the 1970s, coal-burning plants are still constantly chasing tighter regulatory limits on emissions through the refinement of add-on cleanup technologies. Now a new generation of advanced, clean coal power plants that integrate emissions reduction into their basic designs stands at the threshold of commercial deployment. These plants not only address the sulfur and nitrogen oxides at the center of today's air quality regulations more efficiently, but also carry advantages in removing carbon dioxide (CO_2), which may be regulated in the future because of its role as a greenhouse gas associated with global climate change.

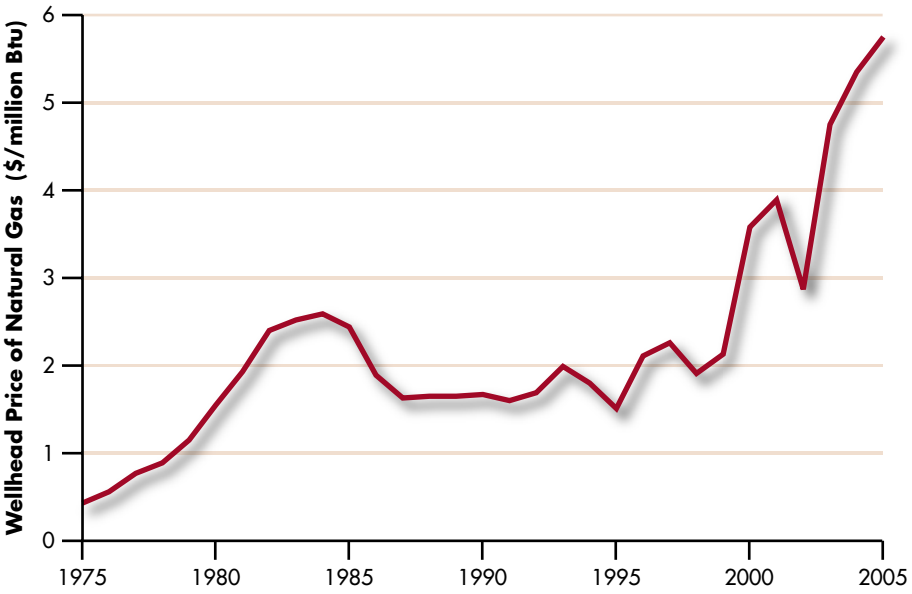
Such clean coal technologies have been evolving for more than two decades; the last major hurdle to reaching technological maturity and, in turn, economic competitiveness with conventional coal plants is the demonstration of their commercial viability and reliable operation at full-scale by utilities and power generators. Expanded operating experience with advanced coal generating systems is essential for convincing prospective investors that the costs and risks are well understood and manageable. And getting more such plants built and operating is critical for the necessary engineering development that will take the technology from first-of-a-kind plants to fully optimized, "learned out" units with costs as low as designers can eventually drive them.

To accelerate commercial deployment of advanced clean coal power systems, the electric utility industry is leading a broad-based collaborative program encompassing the development, demonstration, and deployment of technologies including integrated gasification combined-cycle (IGCC), ultra-supercritical pulverized coal (USC PC), and supercritical circulating fluidized-bed combustion (SC FBC).

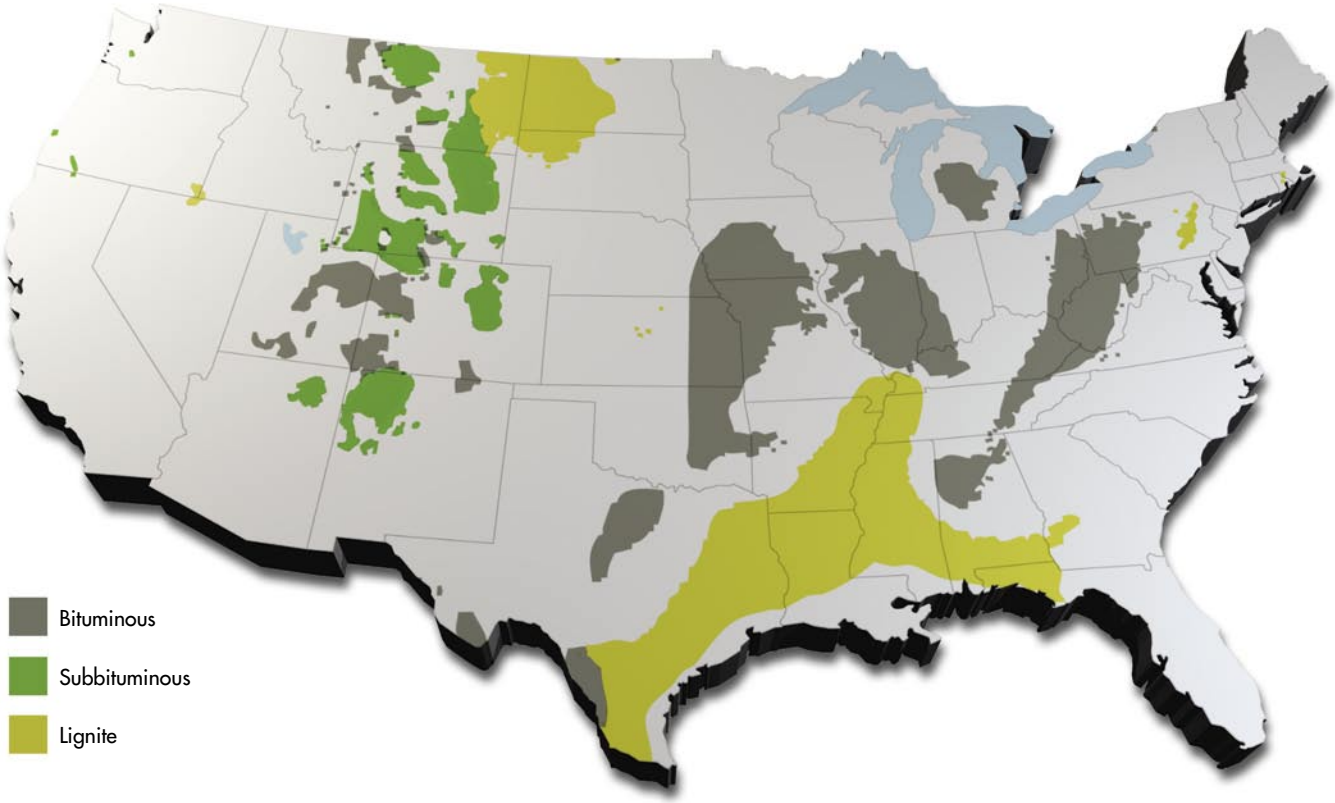
Known as CoalFleet for Tomorrow, or simply "CoalFleet," the initiative aims to tackle the technical, economic, and institutional challenges to making clean coal power systems a prudent investment option for both the short run and the long run. By collaborating across all sectors of the power industry, CoalFleet is focused on breaking through the impasse of the longstanding conundrum of advanced clean coal technologies: despite wide agreement on their ultimate need and value—and on the magnitude of investment and long lead time required to reach commercial maturity—there is still inadequate commitment of resources to bring these advanced systems to fruition. EPRI organized the CoalFleet initiative with broad input from and on behalf of the industry as a vehicle for mutual cooperation in speeding the deployment of advanced clean coal plants and in introducing next-generation designs.

Hank Courtright, EPRI's vice president for generation, explains: "CoalFleet's goal is to preserve this abundant source of fuel as a vital component in the electricity generation mix. Work must begin now to ensure that the advanced coal technologies can establish a solid track record—before large numbers of coal plant replacements become necessary. We see the need to get plants built and operating soon in order to gain experience with and reduce the cost of advanced coal plant technology."

In the near term, CoalFleet is focused on incorporating user-defined requirements and lessons learned from existing advanced plants into new designs that will be developed for commercial orders anticipated over the next decade. To accomplish this, the initiative has assembled teams of engineers and other technical experts to advise and provide input to early deployers of new advanced coal technologies and their technology suppliers. In turn, the early deployers have agreed to make general design basis and nonproprietary engineering information available to all CoalFleet participants with the aim of helping spur reductions in capital costs and risks for subsequent orders as well as improvements in plant availability and performance.



The low capital cost, quick construction, and relatively straightforward permitting of gas-fired power plants made them by far the top choice for new generation capacity over the past decade. However, a near tripling of the wellhead price of natural gas in recent years has changed the cost equation substantially, making advanced coal generation options more attractive for strategic additions.



Economic and engineering studies have shown that costs and performance for advanced coal technologies vary significantly with the type of coal they use. Because there are substantial regional differences in coal type, several advanced technologies—IGCC, USC PC, and SC CFBC—must be developed to fully utilize the nation's tremendous coal reserves. (Source: USGS)

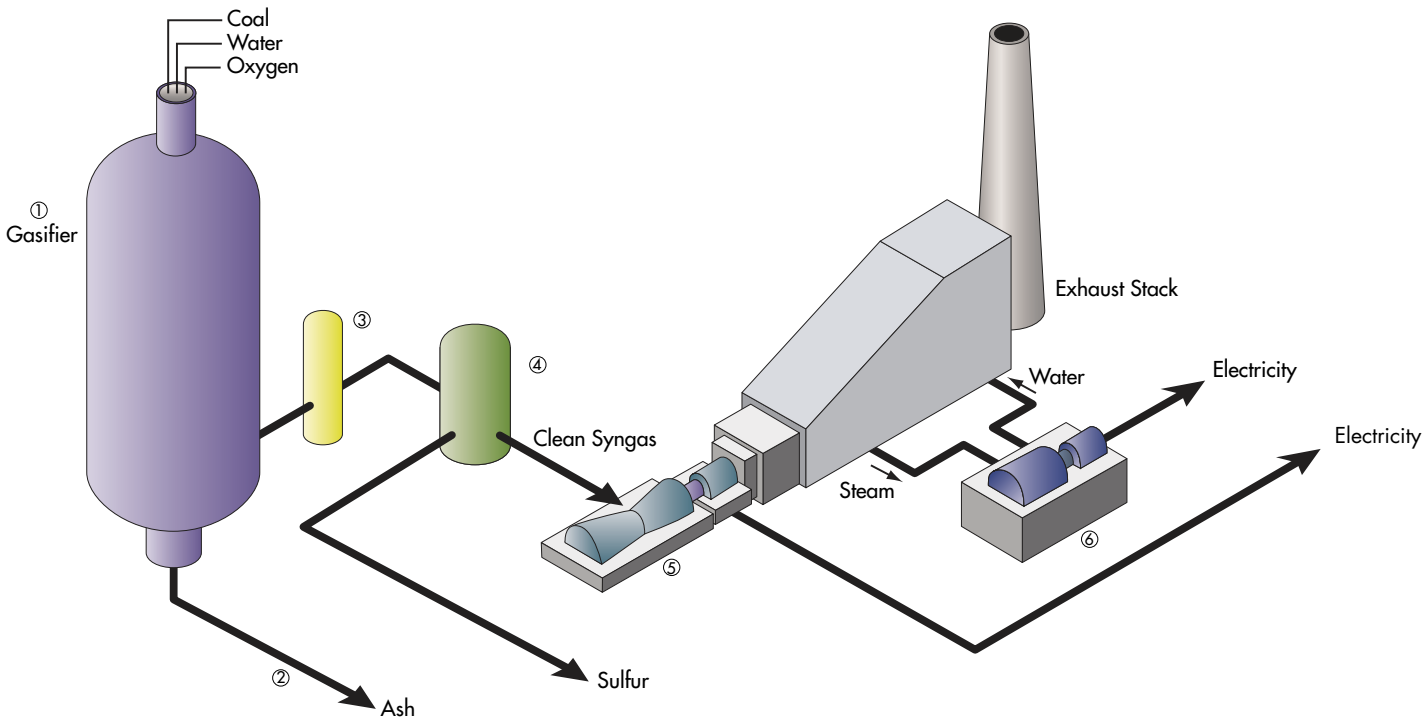
CoalFleet for Tomorrow is already gaining a high degree of visibility among the utility and power generation technology industry. Over 40 organizations have committed so far to support the initiative, including energy companies representing more than half of all presently installed U.S. coal-fired generating capacity, major coal-based European generators, leading power equipment manufacturers, technology suppliers, and the U.S. Department of Energy (DOE).

Policymakers are taking notice as well. Earlier this year, the U.S. Congress took under consideration various possible financial incentives that may help close the current gap in the levelized cost of electricity (COE) between conventional coal plants, which produce much of the nation's lowest-cost electricity, and the 15–20% higher COE expected for the next several advanced coal plants that may be built. EPRI provided valuable data and insight as input for congressional deliberations.

Changing Times Turn the Tables

Despite the abundance and consistently low cost of coal as a generating fuel, few coal-fired power plants have been built around the world for well over a decade, except in Asia. Instead, the lower capital costs, quicker construction, and more straightforward permitting for natural gas–fired plants led utilities and generating companies that needed additional capacity to favor these units, at least while natural gas prices remained relatively low. In the past seven years, over 200 GW of gas-fired generating capacity have been built in the United States, compared with about 15 GW of coal-fired capacity. A similar preference was followed in Europe.

Today, far different economic conditions apply: oil and natural gas prices have both set new record highs in recent years. As a result, many gas-fired combined-cycle plants are being called on to generate at only a fraction of their planned capacity factor. The average capacity factor for such plants in 2003 was 32% and continued to decline into 2004, making many of the units poor performers as financial assets. Gas prices are forecast to remain high as a result of supply and demand imbalances and transportation bottlenecks. Increases in imports of oil and liquefied natural gas, while potentially reducing the volatility of natural gas prices, are also heightening concerns over energy security and international trade balance. Together, these factors are making the economics of coal power appear more attractive to both power generators and government agencies.



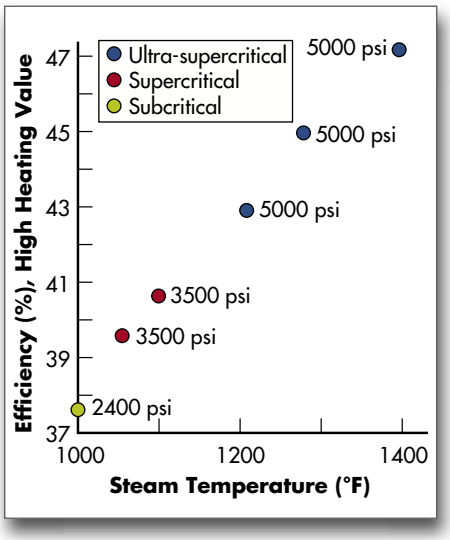
In IGCC plants, coal is not burned directly, but rather is processed with oxygen and water in a high-pressure gasifier (1) to form a synthesis gas. Ash forms a slag (2) that is removed from the gasifier for disposal or commercial use. The syngas is cooled (3) and stripped of sulfur compounds (4), which are converted to elemental sulfur that can also be sold commercially. The clean syngas is then combusted in a gas turbine/generator (5), which generates most of the electricity the plant produces. The waste heat is recovered and used to produce steam that drives a smaller turbine/generator (6) in a combined-cycle configuration to produce additional electricity.

Meanwhile, environmental advocates and regulators are maintaining pressure on coal plant operators to further reduce emissions. As a result, new coal plants will need to have substantially lower emissions, despite the industry's impressive achievements in reducing emissions from the current fleet of plants. Future requirements for controls on CO_2 emissions from new plants under consideration today could significantly influence decisions on technology selection and design.

Conventional coal plant technologies offer lower capital costs and lower projected costs of electricity than today's handful of advanced generating systems; however, looming environmental restrictions that could lead to requirements to retrofit emissions control equipment or to purchase emission allowances creates uncertainty over which coal technologies will actually be the most economical over various design lifetimes. The answer is also influenced by location and the economics of fuel supplies. Given the diversity of regional electricity markets and the variability in the properties of economical coals among regions, a portfolio of advanced coal power systems—including IGCC, USC PC, and SC CFBC—is needed to comprehensively meet the needs of the market.

IGCC systems combine the high efficiency and low emissions of gas turbines with the ability to run on syngas, which is coal-derived, or other low-cost solid or heavy liquid fuels. But as Stu Dalton, EPRI director for generation, told the Senate Energy and Natural Resources Committee's Coal Conference last April, "Electricity from initial IGCC plants without CO_2 capture and storage will cost 15–20% more than electricity from conventional coal power units with SO_2 and NO_x emission controls. Additional experience with full-scale IGCC plants will likely reduce or eliminate this cost differential. Incentives will be needed to deploy these initial IGCC plants in order to overcome higher capital costs and technology risks," Dalton told the conference.

IGCC's relative competitiveness with conventional, pulverized-coal plants firing bituminous coal improves if CO_2 removal is required, but such a requirement significantly reduces the power output and increases the cost of both plant types. Studies by EPRI, DOE, and others have found that the incremental cost penalty for removing CO_2 from high-pressure IGCC syngas is about 25% on a levelized COE basis, whereas the cost penalty for removing it from the flue gas of a conventional coal plant is about 70%. Additional costs for transporting and storing captured CO_2 are not included in the calculation, but would be comparable for both plant types.



Improvements in materials are allowing pulverized coal plants to operate at higher temperatures and pressures, which increases plant efficiency and reduces the release of CO_2 and other emissions. Ultra-supercritical plants are already in use in Europe and Japan, with steam temperatures of 1120°F and pressures of 4200 psi. Units with steam temperatures up to 1400°F and pressures up to 5000 psi are expected to be demonstrated in the United States within 10–15 years.

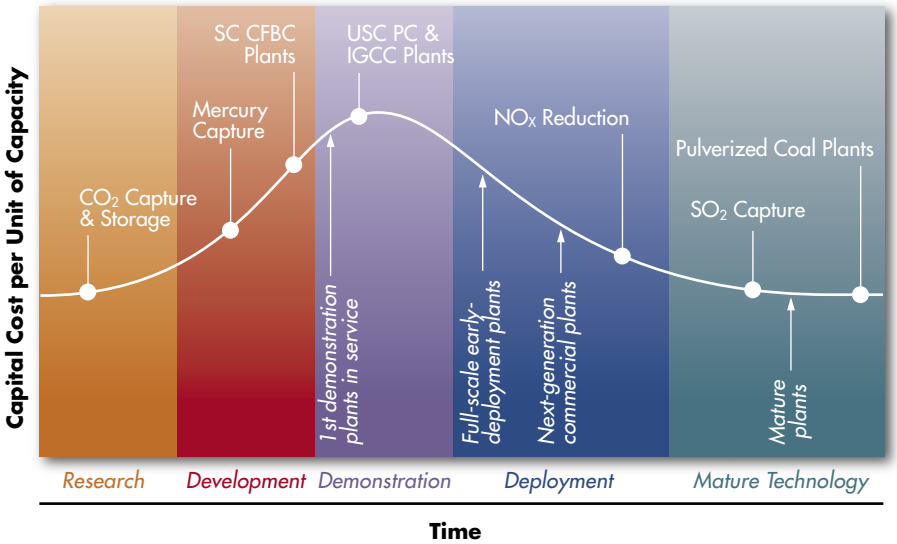
The economics of IGCC technologies demonstrated so far in the United States are less favorable for lower-rank coals such as subbituminous or lignite that predominate the resource in certain regions, as the technologies currently work best using the higher-rank bituminous coal typical of many commercially mined coal deposits east of the Mississippi River. Design changes or success with the advanced, dry-feed compact gasification systems now under development by DOE and industry partners may eventually make IGCC more economical for low-rank fuels.

For regions where low-rank fuels predominate, USC PC and SC CFBC may be the most cost-effective advanced coal options. For large-scale coal plants burning very low-grade fuels, new supercritical CFBC designs are a high-performance, cost-effective option. Meanwhile, worldwide advances in boiler and turbine materials that have greater strength at high temperatures and less susceptibility to thermal creep and fatigue have enabled the emergence of reliable pulverized-coal plants operating with main steam conditions in the ultra-supercritical range. Such plants are already in operation in Japan and parts of Europe, where high fuel prices place a premium on efficiency.

"Limits on CO_2 emissions in the United States would have a comparable price-driver effect on the cost of electricity from conventional coal-fired plants," explains Dalton. "DOE, EPRI, and other organizations are working to develop long-lived, reliable components for ultra-supercritical PC units with main steam temperatures up to 1400°F (760°C) and pressures up to 5000 psi (340 bar). Plants operating at such steam conditions are expected to achieve generating efficiencies topping 45% on a higher heating value basis and to reduce CO_2 and other emissions by 15–22% compared with current conventional plants."

Strategy for Deploying Advanced Coal Technologies

To provide technical input and advice to a slate of task working groups and early-deployment project owners under the CoalFleet for Tomorrow Initiative, EPRI formed the CoalFleet World-Class Expert Working Group, composed of key EPRI personnel, independent industry experts in advanced coal technologies, and utility representatives with advanced coal plant operating experience. The expert working group is developing a comprehensive strategy for surmounting the so-called "mountain of death" (high cost of market-entry units) that new technologies in general and advanced coal technologies in particular must overcome before reaching technological maturity and the lowest achievable cost. According to Jack Parkes, EPRI's area manager for CoalFleet, "The strategy is closely examining ways to remove barriers that have hindered the implementation of advanced coal systems, including high capital and construction costs, inadequate reliability, long project schedules, lack of standardization, and difficult environmental permitting procedures. Optimizing, modularizing, and standardizing plant designs for a range of technologies, coal types, regional issues, and types of owner/deployer organization are the keys to reducing the time,



The difficult—and costly—process of bringing a new technology into the marketplace has been called the "mountain of death." Advanced coal technologies are nearing the crest of the curve, but the high cost of first-of-a-kind plants can often stall a new technology in the demonstration stage. The primary focus of the CoalFleet initiative is to get the first group of full-scale advanced coal plants deployed as early as possible.

Incentives for Advanced Coal Plant Deployment

The current estimated cost of electricity from initial IGCC plants is about 15-20% more than that from a conventional pulverized-coal plant when higher capital and fixed costs are accounted for and an allowance is included for the risk of potential shortfalls in the IGCC plant's availability. In light of this, CoalFleet members expect that financial incentives will be needed to spur initial plant deployment and provide the design and operational experience necessary to reduce cost and demonstrate reliable performance.

EPRI and CoalFleet participants have analyzed financial incentives that potentially could reduce the incremental cost gap of IGCC plants for early deployers. In particular, the CoalFleet Incentives Task Working Group examined eight types of federal financial incentives: loan guarantees, direct federal loans, federal cost-sharing grants, investment tax credits, production tax credits, tax-exempt financing, accelerated depreciation, and the new concept of federal availability insurance. Their analysis considered three types of power producers—regulated investor-owned utilities (IOUs), independent power producers (IPPs) with contracts for their plants' generating output, and public power producers (cooperatives, municipal utilities, and federal and state entities)—and accounted for differences among them in borrowing costs and tax obligations. The findings were tabulated in terms of the effect of an incentive on an IGCC plant's levelized cost of electricity (COE).

No single type of fully evaluated incentive bridged the COE gap between IGCC and PC plants for all company types. Moreover, variation in the value of different incentives to various types of power producers was substantial. For example, public power producers receive no direct benefit from tax-based incentives, and loan guarantees provide much greater benefit to IPPs than they do to other producer types. "As a result, CoalFleet members have concluded that combinations of incentives, or tailored packages of incentives, will be necessary to significantly lower the cost barrier to IGCC deployment and to give relatively equal incentive to all power producers," says EPRI's Jack Parkes. "Particularly interesting with respect to the equitability aspect is the newly developed concept of availability insurance." In this type of incentive, the federal government would provide insurance for covered plants that are unable to meet a specified target for availability. Although analyses showed that availability insurance alone would not close the cost gap and make IGCC competitive with conventional pulverized coal, such an incentive may be valuable and effective in combination with other incentives.

Tom Wilson, EPRI senior technical manager for climate change, who conducted the analyses along with Charles Clark, an analyst working with EPRI for the CoalFleet for Tomorrow Initiative, explored how various combinations of incentives might work. In an article for *Public Utilities Fortnightly,* the two noted, for example, that doubling the base-case investment tax credit from 10% to 20% and combining it with accelerated depreciation would come close to closing the cost gap for IOUs and IPPs. Alternatively, doubling the production tax credit to equal that currently available for wind energy facilities could actually make IGCC's COE less than that of conventional PC for taxable entities. A third package of incentives—tripling the federal government's cost-sharing to 30% without repayment and adding availability insurance—would provide public power producers and cooperatives with sufficient cost-reduction to make IGCC attractive compared with conventional PC. The gap would still not be closed for IOUs and IPPs, "but the difference is small enough that other considerations might well determine their choice," Wilson and Clark note.

"In the end, however, it must be remembered that any incentives such as those just discussed are intended only to get IGCC 'over the hump' of initial commercial deployment," the analysts point out. "After that, commercial attractiveness of this prototypical clean coal technology will depend on a variety of other factors. Foremost among these will be resolution of the technical risks involved, specifically by showing that IGCC plants can achieve sufficiently high availability to compete with conventional coal plants. Initial capital costs should also decline with design and operational experience and as the infrastructure for building, maintaining, and utilizing IGCC facilities develops. Additional factors that may influence the long-term attractiveness of IGCC technology include the potential need to capture and sequester CO_2 to mitigate global warming or to produce hydrogen for future fleets of fuel-cell vehicles. Because of this potential, the ultimate value of IGCC may be its importance as a hedging strategy—a way to keep using the nation's most abundant energy resource while providing options to deal with long-term environmental hazards."

EPRI is coordinating CoalFleet's deployment incentives analyses with DOE to ensure that the impact of incentives on federal budgets is properly calculated. CoalFleet plans to update its incentives analyses on the basis of peer review comments, evaluate additional types of incentives, and extend the analysis to address a broader range of technology options.

costs, and risks of building advanced coal plants."

To start the process, EPRI and the CoalFleet world-class experts have assembled an Advanced Coal Technologies Knowledge Base, the core of which presently comprises more than 50 design cases from eight recent state-of-the-art studies conducted by EPRI, DOE, utility companies, consultants, and technology supplier teams. Each case study details vital characteristics in up to 450 defined fields. CoalFleet will continue to add data as they become available from new feasibility studies by members and from design decisions made by companies undertaking early plant deployment projects. The knowledge base will also include papers from key conferences and lessons learned from IGCC demonstration units at Cinergy Corp.'s Wabash River Generating Station and Tampa Electric Co.'s Polk Power Station.

"EPRI, the CoalFleet independent experts, and a CoalFleet participants' task working group are drawing on the knowledge base to assemble a clear and complete User Design Basis Specification (UDBS) for IGCC plant designers," says Parkes. CoalFleet's initial version of the UDBS will include three 600-MW bituminous coal–fired IGCC plants, one for each of the three commercial entrained-flow gasifiers (i.e., GE Energy, ConocoPhillips, and Shell). For utilizing low-sulfur Powder River Basin (subbituminous) coal, the UDBS will include an 800-MW IGCC plant from Shell and a 600-MW transport-gasifier plant from Kellogg, Brown & Root.

For each plant, the UDBS will estimate availability with and without a spare gasifier and will specify three cooling options—wet tower, dry cooling, and parallel wet-dry. Also included are heat rate targets, back-up fuel considerations, time-to-build targets, emission limits for start-up and off-design operation, and expected supplier performance guarantees. Subsequent CoalFleet UDBS documents will cover USC PC and SC CFBC plants.

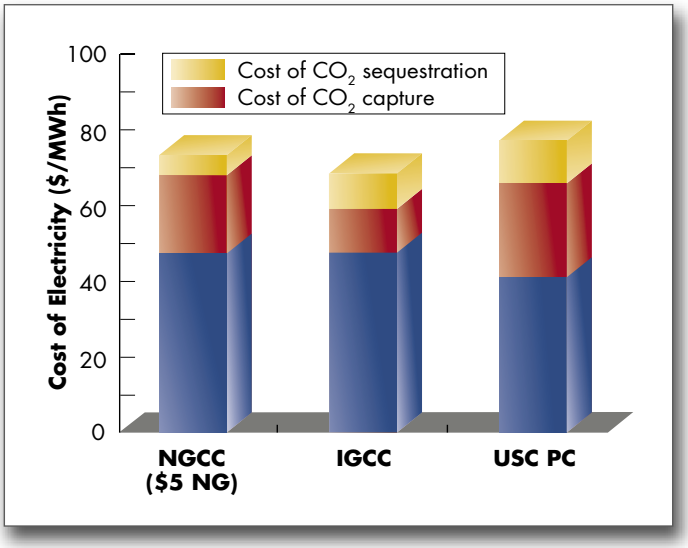
Supporting Early-Deployment Projects

The operating concept for CoalFleet is "learning by doing," with EPRI and the independent experts participating directly in the site-specific engineering feasibility studies being conducted by the owners of three to five CoalFleet companies that have pledged to build IGCC or other advanced coal plants. The early-deployment project owners will benefit from the knowledge, design, and operations and maintenance experience in CoalFleet, while the broader CoalFleet membership will benefit from the rapid, real-life feedback from the early-deployment projects. This symbiotic relationship will continue as early-deployer companies select a supplier and commit to the development of a process design package and front-end engineering design, followed by detailed design and construction.

As the early-deployment projects progress, CoalFleet will form teams for each project that will translate project-specific, nonproprietary information into a CoalFleet Pre-Design Specification and a Generic Design Specification. The Pre-Design Specification is essentially a generic version of the project's feasibility study, and the Generic Design Specification corresponds to approximately the first 50% of front-end engineering design. Nonproprietary costs and project financial proformas for different organizational types will also be derived, allowing CoalFleet participants to see the anticipated benefits of standard, or reference, designs for IGCC and other advanced coal plants.

As with the UDBS documents, CoalFleet's goal is to create standard plant design guidelines for each major IGCC gasifier technology and its applicable fuels and for USC PC and SC CFBC technologies. These CoalFleet specifications, based on the real-world experience of early-deployment projects, should reduce the time and cost for plant engineering considerably and result in plants with improved performance and availability.

While IGCC is inherently very clean, obtaining environmental permits for an IGCC plant is a critical-path item in the project development process, and applications often must be submitted before front-end engineering is under way. The limited experience of regulators with IGCC permitting and a dearth of reference information from previous permits compound the challenge. As a result, obtaining permits for a new IGCC plant can be highly complex and pose a significant risk for delays in plant construction. CoalFleet's IGCC Permitting Task Working Group



In comparisons of the 30-year levelized cost of electricity from new plants of similar capacity (500–600 MW), IGCC and USC PC compete effectively with conventional natural gas–fired combined-cycle (NGCC) plants when the price of natural gas reaches $5/million Btu—a level already exceeded today. And when the cost of capturing and sequestering CO_2 becomes a factor, as many believe it will in the future, IGCC appears to have a clear economic advantage.

Two demonstration projects supported by DOE and the industry have paved the way for the deployment of IGCC technology. Cinergy was host to a 262-MW IGCC repowering demonstration at its Wabash River Generating Station near Terra Haute, Indiana, in 1995. Tampa Electric's 250-MW Polk County IGCC demo is a green-field unit that began operation in 1996.

is attempting to significantly reduce the time to permit an IGCC plant through identification of the critical technical, regulatory, and procedural issues that must be addressed up-front and through the plant design and equipment selection process. The group's findings will guide the development of design recommendations for enhancing and streamlining the permitting process.

Columbus-based American Electric Power Co. announced in 2004 that it plans to build a large-scale, commercial 600-MW IGCC plant. The company contracted with GE Energy and Bechtel Corp. for a scoping study of the parameters of an IGCC facility at one of three sites in Ohio, Kentucky, and West Virginia.

"Continuing significant environmental investments in our current fleet and building a commercial-scale IGCC plant are the right steps going forward to ensure that we can continue to burn coal economically while reducing our emissions," says Michael G. Morris, AEP's chairman, president, and chief executive officer. "AEP is taking significant steps to keep coal in the picture as a low-cost, low-emissions energy source. We must be able to rely on our vast coal resources to generate electricity if America and the world are to continue to have growing economies."

Adds Robert Powers, AEP's executive vice president for generation, "The CoalFleet initiative is important to the industry's ability to help resolve many of the new environmental issues and challenges we face in a cost-effective manner. We're at a crossroads. After the demonstrations of IGCC in the 1990s, we're now working to answer how the technology will perform at large scale and whether it can compete as new baseload capacity. Achieving the low capital cost and low cost of electricity demanded by today's customers will be an exciting challenge. CoalFleet reflects the recognition by EPRI's membership that it's time to make something happen and to move ahead with advanced coal power systems."

Meanwhile, Cincinnati-based Cinergy Corp., under an agreement with GE Energy and Bechtel, is studying the feasibility of building a commercial 500- to 600-MW IGCC generating station at one of several possible sites, including the 50-year-old coal-fired station of its subsidiary Public Service of Indiana at Edwardsport, Indiana. PSI earlier was host and cosponsor with DOE of a $417 million IGCC repowering demonstration at PSI's Wabash River Generating Station near Terre Haute. The project's new 262-MW IGCC plant successfully demonstrated 40% efficiency and plant availability as high as 79% from 1995 to 1999. Akron-based FirstEnergy Corporation has also announced interest in the development and commercial deployment of IGCC technology within the next several years. And a team led by Southern Company was selected for a DOE Clean Coal Power Initiative (CCPI) Round 2 award to build a 285-MW transport-gasifier IGCC plant in Orlando, Florida.

"We face the need for additional generation in Indiana, and as the demand for electricity increases in the future, we will need to build more power plants," says James E. Rogers, Cinergy's president, chief executive officer, and chairman. "Coal is our most practical, economical option. But the key to building more coal plants will be to develop zero-emission, clean coal technologies. Our central challenge is to find ways to use an abundant energy resource—of which our country has a more than 250-year supply in reserve—in an economic and environmentally clean way," adds Rogers. "Coal gasification has proven to be efficient, and there is no cleaner coal generating technology. It is critical for our country to commercialize IGCC, from the standpoint of greater energy independence and from that of the international balance of payments. We need to get to work now deploying and optimizing the current generation of commercial IGCC so that even more economical generations of the technology will be available over the next 10 to 15 years."

Linking R&D and Deployment to Reduce Costs

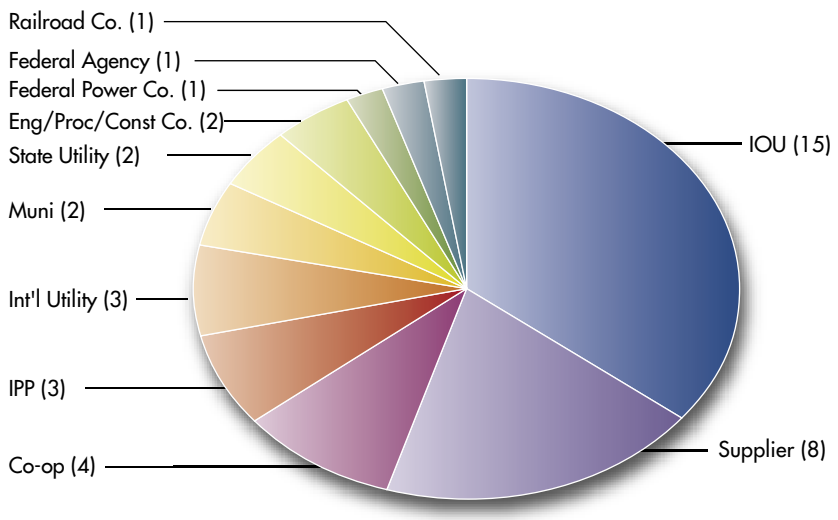
CoalFleet participants believe that collaborative research, development, and demonstration among power industry

stakeholders can both hasten the deployment of current state-of-the-art advanced coal plants and spur the development of technical and operational improvements. Such advances promise to boost availability or lower heat rate and emissions in the near term and ultimately lead to the commercial introduction of next-generation plant designs that are approximately 20–25% lower in capital cost.

The initiative's strategy simultaneously addresses the RD&D needs for three major timeframes:

- Near-term refinements or evolutionary technologies for IGCC, USC PC, and SC CFBC plants coming on-line around 2010–2012—the early-deployment projects.
- Mid-term R&D requiring demonstrations that will conclude after the earliest commercial projects are built; this work will produce technologies that can be readily incorporated in plants coming on-line around 2012–2015.
- Longer-term R&D on advanced concepts for IGCC, USC PC, and SC CFBC plants—including integration of CO_2 capture systems—for plants coming on-line after 2015–2020.

DOE is currently supporting fundamental materials research, coal plant–related RD&D, and new coal technology plant demonstrations through the CCPI. FutureGen, a large IGCC demonstration project initiative of the DOE, will involve approximately $1 billion when fully funded. These efforts represent a substantial contribution to the development of advanced coal systems. EPRI is actively participating in many of these programs to help ensure the suitability and transferability of results to users. Technology from DOE's RD&D programs, along with CoalFleet results and industry RD&D, must be incorporated and proven in both early-deployment and next-generation units. Coordination with relevant programs in other countries will also help CoalFleet accelerate advanced coal plant deployment, especially for USC PC units.



The CoalFleet for Tomorrow Initiative is supported by an extremely broad range of stakeholders. At the time of publication, 42 participants were on-board, representing more than 50% of the coal-fired generation in the United States.

In 2005, CoalFleet is creating an industry-focused RD&D plan with projects that augment and accelerate current RD&D activities; the initial emphasis is on technology that could be ready for inclusion in early-deployment plants. Some needs are well understood, and plans are already being developed for collaborative RD&D projects that address longer gasifier feed nozzle and refractory life and reliability improvements for syngas-fed combustion turbines. Other projects will explore heat rate improvement and lower-cost CO_2 separation and capture processes. Human performance capability enhancement projects will also be developed, including efforts involving training simulators, instrumentation and control systems, and operation and maintenance guidelines. Private and public partners will be identified to help launch high-priority projects over the next year.

Pushing Forward to a New Generation

CoalFleet has attracted a great deal of industry support, and for good reason. "CoalFleet for Tomorrow is an extremely important initiative for our energy and environmental future, considering that our nation generates half of its electricity from coal, which is really the only generating fuel we have in ample, long-term supply," notes Barry Pulskamp, Cinergy's vice president for power operations. "The CoalFleet initiative is bringing all the players in advanced coal systems technology into the fray to reduce the cost of these systems for producing electricity. We've seen tremendous improvement in the reliability of IGCC technology and the resolution of many technical issues over the past decade. Now the industry must take advanced clean coal technologies to the next generation and further drive costs down through plant standardization. Chevrolet has improved its V-8 engine enormously over 50 years, and the company has produced around 100 million units. I would hope that our industry could achieve the same degree of improvement in advanced coal systems in terms of cost efficiency and emissions. I'm excited about our prospects for the future."

Background information for this article was pro-vided by Stu Dalton (sdalton@epri.com), Jack Parkes (jparkes@epri.com), Neville Holt (nholt@epri.com), and Tom Wilson (twilson@epri.com).