

CCT'S IN A DEREGULATED ENVIRONMENT:

A PRODUCER'S PERSPECTIVE

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ABSTRACT

The U.S. electric industry will be deregulated (or substantially re-regulated) within 5 years. Several states, including California, Rhode Island, and New Hampshire, already have passed legislation to introduce competition into the electric markets before the year 2000. As this trend sweeps across the country, the resulting competitive market for generation will reward the lowest cost producers and force high cost producers out of the market. As a result, at least in the short run, it may be very difficult for new power plants employing Clean Coal Technologies (CCTs) to compete. This paper discusses a producer's perspective of the new competitive market, and suggests several short and long term strategies and niches for CCTs.

I. INTRODUCTION

For more than 60 years, the electric utility industry has been highly regulated, as were industries like banking, trucking, telecommunications, and natural gas. But starting in the early 1970s, the United States began witnessing a transition from an environment of regulation to one in which market forces held greater sway. One by one over the next 20 years, these industries saw the regulatory veil lifted, exposing them and their customers to the benefits and uncertainties of market competition.

Throughout this period, many continued to believe that utilities were different and that deregulation was impractical and unnecessary. In the 1990s, however, the same forces that nurtured change in other industries — customer expectations of lower cost, more choice, greater innovation and better service — began to affect the electric utility industry. Today, the transition to a more competitive environment is well under way.

Global competition, coupled with rate disparities that can exist between assigned service territories, is the primary force behind the push for a market-driven electricity utility industry. As U.S. industries find themselves competing toe-to-toe with not only domestic but foreign enterprise, the pressure to keep production costs down is intensifying. As a result, industries are leading the call for a competitive electric market in the U.S. Many

views exist of how a competitive market might function. Duke Power believes(1) a national market will evolve and that it will look much like the one now being developed in California.

Regardless of the form, there are a number of significant issues that can affect customers and the shareholders of publicly held utilities like Duke Power Company. These issues include:

- Maintaining fairness and equity between customer classes (e.g. residential, commercial, and industrial)
- Ensuring the world's most reliable electric system remains so
- Maintaining parity among competing suppliers (e.g. subsidized generators are not allowed to compete with unsubsidized generators)
- Redefining the monopoly-based obligation to build generation to serve all assigned customers
- Recovering stranded investment
- Allocating equitable sharing of societal costs

These are difficult, critical issues, but if they can be fairly and appropriately resolved Duke Power supports the concept of electric utility deregulation. Duke advocates federal legislation to provide guidance to the states for implementing deregulation, including a time frame under which it would be instituted. Following federal action, each state should then be allowed to design its own specific solutions. Duke Power's position on restructuring the industry is based upon the simple premise that deregulation should offer equal treatment of all customers, provide a level playing field for all competitors, and maintain the current high reliability of the electric system.

II. ONE VIEW OF A DEREGULATED INDUSTRY

While there are three primary functions of the electricity utility business (generation, transmission, and distribution), most proposals for deregulation are limited to the generation business because of its present level of competitiveness. Even in a competitive environment, the transmission and distribution businesses would most likely be separate entities under the regulation of the Federal Energy Regulatory Commission (FERC) and state regulatory commissions.

A number of proposals have been made concerning deregulation. Among the many competitive market proposals considered, one promising idea for restructuring calls for creating a new structure built on two fundamental concepts:

- The primary source of electricity for all customers could be through a regional power pool. Participants in the power pool would primarily be generators, customer representatives referred to as "aggregators" or "retail companies", and end-use customers.
- A secondary source of electricity could be through bilateral contracts between willing generators and end-use customers or aggregators.

A power pool could be comprised of two new regulated organizations: the Power Exchange (PX) and the Independent System Operator (ISO). Both would be independent businesses that would be governed and managed separately from the financial interests of market participants. Whether management of the PX and ISO would be separate entities is still an open question, but the roles and responsibilities of each are best described separately.

The Power Exchange

The role of the PX could be to facilitate trading in a visible spot market in which generating resources compete by:

- Taking supply bids from generators and demand bids from utilities, retail companies, power marketers and others;
- Allowing power producers to compete using non-discriminatory and transparent rules for bidding into the exchange;
- Ranking bids and submitting to the ISO a preferred least-cost dispatch schedule for delivering power; and
- Providing a visible market clearing price to permit customers to make efficient purchasing decisions and to adjust consumption.

Independent System Operator

The ISO would provide daily transmission system information to all market participants and collect bids by market participants to provide ancillary services for the next day. The ISO would control the transmission system and coordinate the hourly dispatch of the generation system in a reliable manner. The ISO could:

- Provide non-discriminatory open access to the transmission network;
- Coordinate day-ahead scheduling for all transmission network users;
- Control operation of the combined transmission facilities of the participating transmission owners;

- Obtain ancillary services, (reserves, for example) for all transmission network users on a competitive basis;
- Perform a settlement function to account for actual operating conditions ;
- Provide transparent information flow to all transmission network users;
- Facilitate bilateral contracts between generators and customers;
- Comply with all operating and reliability standards; and
- Manage transmission congestion and constraints on a network basis with all users subject to the same terms of access, protocols and prices.

Transmission congestion charges could be administered by the ISO (in accordance with FERC approved tariff provisions) to provide pricing signals as inducements to market participants to build congestion-relieving transmission upgrades in needed areas. A separate mechanism or regulatory "backstop" may be put in place if generation or transmission is needed for the sake of reliability and the market fails to react appropriately. The ISO will not own any transmission or generation resources, but could have compelling incentives to help ensure system reliability.

Figure 1 illustrates the basic concept of a power pool.

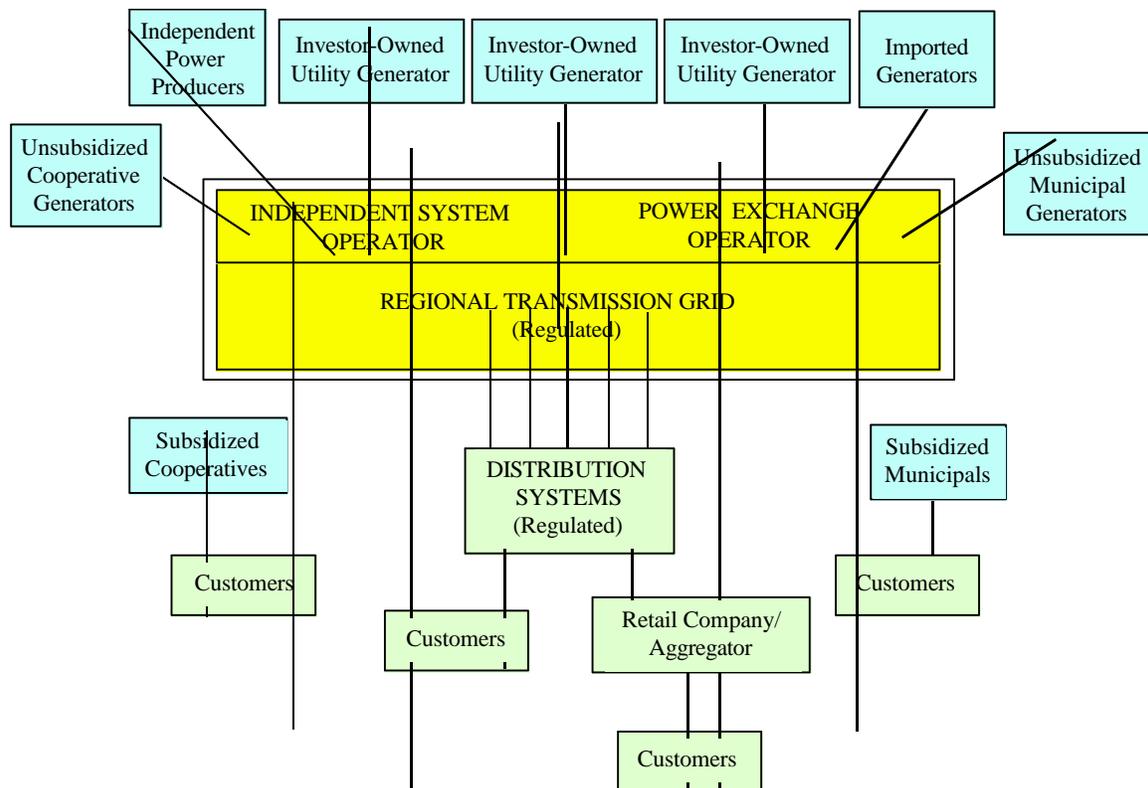


Figure 1. Basic Power Pool Operation

This combination of a PX, an ISO, and bilateral contracts is sometimes referred to as a

"flexible pool" because it is designed to provide flexibility in contracting and trading arrangements. The flexible pool could offer all consumers electricity at competitive prices and also give all generators an equal chance to serve the available customer base. In some cases, an aggregator or a retail company could procure and provide these competitively bid generation services to customers.

While many details must still be resolved, the basic concept for the flexible pool could provide the foundation for advancing competition without compromising reliability or giving any competitor an unfair advantage.

III. CCTs IN THE DEREGULATED MARKETPLACE

If the marketplace described above comes to pass, it will have a number of impacts on the use of CCTs, some positive, but most negative--at least in the short run.

Lowest Operating Cost Wins

First, the competitive generation market will be more difficult for any new entrant, but especially so for plants with higher capital and operating cost. If existing plants are allowed to recover their *stranded costs*--i.e. that portion of their fixed costs not otherwise recovered by the competitive price of power--then any new plant will have difficulty competing with existing generators. This will hold true until the existing excess generating capacity is depleted. (Note: Depletion could be the result of demand growth, obsolescence of older plants, environmental/regulatory action against an existing technology, etc.) Then, when new generation is needed anyone considering entering the market will ask themselves these questions:

Which technology will produce power for the least overall cost?

- High cost = non-competitive
- No more automatic cost recovery in utility rates

Which technology has the least risk--technical and financial?

- Risk translates into higher cost

Which technology can be brought on line quickest?

- Time is money
- Competitive markets can be fickle, change rapidly

Currently the answer to all these questions would be combined cycle gas turbines in either a stand-alone power plant or in a cogeneration mode. As long as gas prices remain reasonably low, gas turbines will continue to be the technology of choice.

Technology Risk is a Killer

Technology risk associated with new CCT-based generators will cause these plants to suffer in the competitive market for two reasons. First, the equipment cost will have a “technology premium” to cover development costs and performance risk. Second, and probably more critical, the project owners will pay a risk premium on any borrowed funds. Lenders have shown little appetite for risk in the independent power market that has dominated the placement of new capacity for the last decade. There will be even less appetite for risk where the payment stream used for debt coverage comes from the competitive marketplace and not a “secure” long term contract with a utility, as existed in the recent past.

The “Level Playing Field” Issue

A potential obstacle to new CCT-based generation is the notion that in a competitive generation market, no generator should be allowed to compete if it receives a subsidy--such as tax-exempt bonds or government loans--that is not available to all generators. This position is held by most investor-owned utilities, including Duke Power. And, since approximately 80% of all generation in the US is owned by investor-owned utilities, this position is likely to prevail. If it does, it would mean that CCT projects which received DOE grants or loans would either have to seek special status or find ways to mitigate their competitive advantage.

Fuel Diversity is a Wild Card

Potentially the greatest advantage CCTs have in the deregulated marketplace is that they provide fuel diversity. But it is unlikely that producers, left to their own devices, will place much emphasis on fuel diversity, especially in the near term. However, two things could change that likelihood. First would be a near-term spike in gas prices. The US has seen a decade of stable, even falling, gas prices. This has caused a widespread shift away from coal and toward gas-fired technologies. Another oil embargo, a Gulf crisis, or a natural disaster in a major gas-producing region could push gas prices up to the point where generators will choose an alternative fuel.

Alternatively, the federal or state governments could weigh into the utility deregulation debate with their concerns about fuel diversity. It will likely take government intervention to force fuel diversity arguments to be heard. It appears, based on positions published before the recent election, that while the Clinton Administration is lukewarm toward electric deregulation, it will insist that fuel diversity be considered in future rules. States also, to the extent they are involved in setting the deregulation rules, may insist on fuel diversity and, possibly, use of indigenous fuels like coal.

Environmental Issues--Mixed Bag

Environmental issues are a mixed bag in terms of their impact on deployment of CCTs. Emissions limitations could force owners of older coal-fired plants to retrofit CCTs to comply with more stringent limits. This could be particularly true where older plants, many with minimal emissions controls, are pressed into service in the competitive marketplace. Capacity factors could increase dramatically on these plants as the competitive price of energy increases due to increased demand. Indeed, there is a fear among many environmentalists that this is precisely what will happen. CCTs could mitigate that fear.

But while environmental issues could increase the use of CCTs retrofitted to older plants, there does not appear to be a similar beneficial impact on new CCT-based plants. This is true because currently even the best CCT environmental emissions are no better than those from similar-sized gas turbine plants. The impressive environmental records of many of the new CCTs can certainly be used to *support* their use (for example to mitigate fuel diversity concerns) but environmental records alone will not endow a marketplace advantage on CCTs vis-à-vis gas plants.

IV. CCT OPPORTUNITIES

The major cost drivers for a new power plant are capital cost and fuel (including transportation) cost. It is currently a universally recognized fact that there are few, if any, places in the US where a coal plant can produce power cheaper than a gas-combined cycle plant, provided gas is available. And there are only two states, Hawaii and Maine, where natural gas is not available. Therefore, unless promoted for fuel diversity reasons, coal must either find ways to reduce the all-in cost of power or find niche opportunities.

Reducing Conventional Coal Plant Costs

Although the focus of this paper is on the future of CCTs, it is instructive to look at the competitiveness of a conventional coal plant in today's environment. One of the most recent conventional coal-fired plants to be brought into service in the US was Cope Generating Station, completed in late 1995 by Duke/Fluor Daniel, a Duke Power affiliate.⁽²⁾ This plant, built for South Carolina Electric and Gas, is the least cost coal plant built in recent years. The \$411 million plant generates 385mw at 95% valves open. At full valves open, this equates to a little over \$1000/kw of capacity.

In building the Cope plant, Duke/Fluor Daniel utilized a number of cost cutting measures which had been developed in several recent international plants. Most effective were (1) world-wide sourcing of equipment, and (2) a sophisticated Computer Aided Design

package developed by Duke/Fluor Daniel called PowerSuite. These and other cost saving techniques can keep the cost of coal plants down, but, as illustrated below, more is needed if coal is to compete with gas.

In contrast to the \$1000/kw price for coal plants, similar sized gas combined cycle capital costs are approximately \$500/kw. Assuming roughly equal O&M costs (a generous assumption for coal), approximately a 50% to 35% efficiency advantage for gas, and gas at \$3.00/mmBTU, then coal prices per million BTU must be around \$1.00 to be competitive. See Table 1 below.

	Coal Plant	Gas Combined Cycle Plant
Capital Cost	\$1000/kw	\$500/kw
Efficiency	35%	50%
Fuel Cost*	\$1.05/mmBTU	\$3.00/mmBTU

*For power cost from coal to equal gas at \$3.00, coal must be this

Table 1. Comparison of Coal And Gas Plants

Therefore, with existing capital cost and efficiencies for coal and gas plants, coal prices must be less than gas by a 3:1 margin to make the generation owner indifferent to technology. Put another way, gas prices would have to suffer a 50% increase before coal at \$1.50/mmBTU would become cost competitive.

The only place in the US where coal can currently be obtained for \$1.00/mmBTU is at the mine. Consequently, mine-mouth coal plants can be competitive. In the fully competitive marketplace described above, i.e. open, boundary-less transmission access, mine-mouth power plants may be an attractive option.

CCTs as Backup to Gas

As noted above, gas combined cycle plants have a significant advantage over conventional coal today. Gas can also beat any known CCT including coal gasification and PFBC. But that doesn't mean there is no place for CCTs. In fact some gas combined cycle plants being built today have included space to convert to coal gasification-combined cycle later. But one shouldn't look for CCT hardware orders soon, because no generation owner can afford to invest capital in a backup technology until there is a clear pricing signal that the fuel price advantage of gas is on the verge of changing.

Co-Production

Among the CCT's that are demonstrated and nearing commercial availability, coal gasification-combined cycle (CGCC) technologies may have a slight market edge over others since they are capable of co-production. CGCC plants are, in the simplest terms, a chemical plant that produces synthetic natural gas along with other useful byproducts such as steam, hydrogen, ammonia, sulfur and re-useable ash products. Therefore, in addition to producing useful steam and electricity in a classical cogeneration configuration, CGCC plants are capable, with additional capital investment in the gas production portion of the plant, of producing revenue-producing byproducts. Revenues from the co-production of useful chemicals and solid byproducts, to the extent they are greater than the carrying cost of the extra capital employed to produce them, can be used to reduce electricity costs. This scheme may be particularly effective if co-located with a major petrochemical plant or other chemical-based manufacturing facility.

Alternative Fuels

Although not a new idea, the concept of using alternative fuels as a substitute or supplement to coal in a CCT may allow the CCT to penetrate the market earlier than a plant fueled by coal only. Fuels like petroleum coke, sewage sludge or waste coal have been proposed by others.

V. CONCLUSIONS

The coming deregulated electric market will reward the lowest cost producers of power and punish all others. CCTs that allow older, lower cost coal plants to continue operating without pushing their production costs above the competitive price of electricity will have a bright future. New coal plants that employ CCTs must be able to generate at lower production costs than gas in order to be considered by any producer wishing to stay in business. It is not a question of "Will CCTs be a player in the deregulated marketplace?", but rather a question of "when". Or more precisely, "When will electricity prices, gas prices, and capital cost of CCTs converge favorably to the point where a generation owner will invest in the CCT?" But, in the meantime, there are some strategic reasons and some niche opportunities that may work to allow CCT-based capacity to penetrate the market earlier.

VI. REFERENCES

- (1) "Restructuring the Electric Utility Industry: A Position Paper", Duke Power Company, November 1996.
- (2) "Electricity Flows from New SCE&G Generating Plant", News Release, South Carolina Electric and Gas Company, January 15, 1996.