

The Repowering



In the U.S. power market, prices have fallen dramatically in the last year, new plant development costs have increased, maintenance and insurance costs have risen and environmental demands are increasing. These factors all make repowering existing power assets compelling for electric utilities.

Power prices have decreased steadily over the last year, yet the general expectation is that electricity demand and prices will increase in the long run. Still, the current downward pressure on electric power prices and uncertainty over the timing of any price increases, makes new plant development very difficult to justify. A significant level of delays and cancellations of new plant projects may

Gainesville Regional Utilities increased capacity of its Kelly plant from 40 to 110 megawatts.

help to create a cycle of power price increases and decreases.

While the new plant market has been depressed, many owners of older, existing power plants are struggling with decreasing plant efficiency, increasing operation and maintenance costs and growing public pressure to reduce emissions. These owners want to improve their power plant operations in the most timely and capital-efficient method possible. Load-serving entities that have not properly planned for new generation requirements will be vulnerable to volatile power and natural gas prices. Companies with outdated plants will also find it in-

creasingly difficult to compete in a deregulated market.

One of the best methods to increase generating capacity and plant efficiency, from an economic standpoint, is to improve the operating efficiency of existing plants through repowering. In this context, repowering is defined as a transformation of an existing steam plant into a combined-cycle plant by replacing the boiler and adding a gas turbine and a heat recovery steam generator. This differs from a repair, retrofit or rehabilitation of an existing plant. Repowering is applicable to a wide range of existing power plants.

Solution

Many generators are considering repowering existing assets as a primary capacity expansion alternative. Most projects involve load-serving utilities, but merchant power companies and industrial cogenerators are also active with repowering.

Ten generating units have been repowered in the last three years, with another 40 planned or under construction by 2005, according to a Beacon Energy analysis of data from Platt's Utility Data Institute and the California Energy Commission. These projects are in nine states and involve more than 10 GW of capacity. The level of repowering activity may be higher since some repowering projects are referred to as "modernizations." In fact, repowering projects may now be under consideration in nearly half of the states.

California, the power crisis of 2000-2001 pushed many in-state generators to find ways to increase power generating capacity quickly. The municipal utilities in Burbank, Glendale and Pasadena are all considering repowering projects. The short lead-time of a repowered plant compared to new plant development was a significant competitive advantage for capturing the value of the price spike and the expected higher price levels after the initial crisis.

In Florida, utilities use repowering to increase capacity or for environmental compliance (coal-to-gas conversion). Lakeland Electric and Gainesville Regional Utilities have implemented repowering projects, as has FPL Energy. Since Florida's regulations restrict development of new, large-scale combined-cycles, merchant generators have proposed repowering projects to help local munic-

Benefits Of Repowering

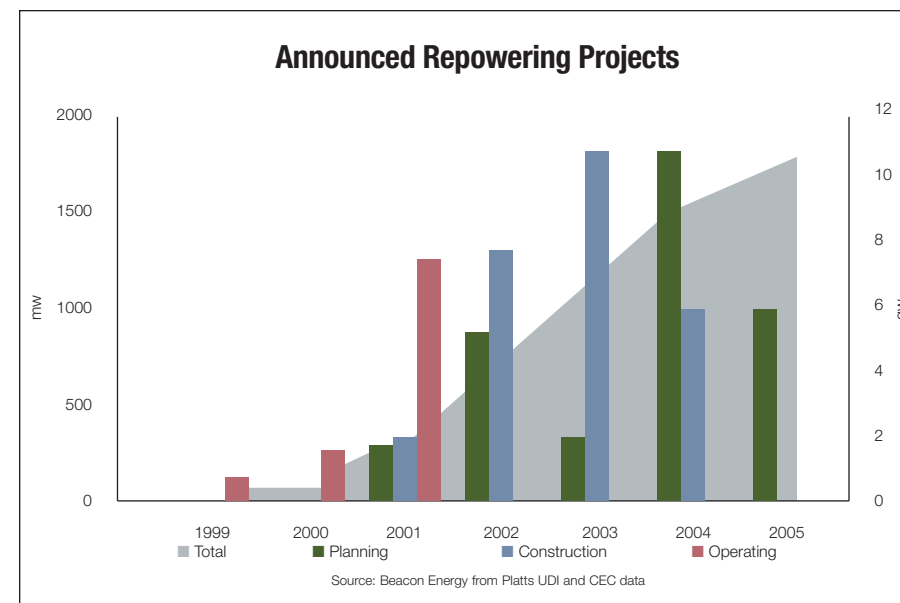
- Boost performance of existing generators
- Lower cost way to increase generating capacity
- Short lead-time compared to building a new plant
- Enhanced environmental compliance
- Reduces or eliminates land-use and other siting challenges
- Faster payback on capital investment than new plant construction
- More efficient fuel use from a lower heat rate

Various levels of local opposition to power plant construction has cropped up in all three states, but repowering seems to be viewed as a positive, environmentally friendly way to increase generation. Increased local support can contribute greatly to a shorter project development cycle.

Perhaps because most of the announced projects involve companies with load-serving obligations, the timetable for these projects seems relatively unaffected at a time when the merchant power market is rife with delays or cancellations of new plants.

There are two main reasons power generators should consider repowering. First, it can increase the performance of existing assets by decreasing heat rate (potentially up to 50 percent). Second, it can increase generating capacity at a cost that is typically 10 to 30 percent less than new plant construction. Gas-to-gas repowerings can also provide environmental benefits through improved heat rate, while coal-to-gas and oil-to-gas repowerings can realize even more substantial environmental benefits from the combination of fuel switching and heat rate improvement.

Because repowering increases the ca-



Almost two-thirds of ongoing or planned repowering projects are in California, Florida or New York. Differences in these states' power markets illustrate the varied benefits of repowering. In Cal-

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capacity of an existing plant, typically by a ratio of 2-2.5 times, and provides a lower net heat rate to the overall resulting capacity, the potential fuel benefits of repowering are significant. For example, a 100-mw, boiler/steam turbine plant with a 10,000 Btu/kwh heat rate might be repowered to a 250-mw combined-cycle with a 7,000 Btu/kwh heat rate. Depending on gas prices, repowering a plant could save \$13 to \$24 million per year, versus expanding the plant at the pre-existing heat rate.

Repowering effectively yields a more than 40 percent increase in capacity (from 100 to 143 mw in this hypothetical case) with no increase in fuel expenditures.

In addition to improving the fuel efficiency of existing assets, repowering is a cost-effective means to expand capacity. Repowering projects can routinely be implemented for capital costs that are 10 to 30 percent less than new plant construction. Such cost reductions are real-


ized by the value of existing structures, fuel supply access, cooling water infrastructure and electricity transmission interconnections.

In today's financial environment, repowering should be one of the primary expansion options considered, since it can often produce a higher rate of return and yield a positive net present value much sooner than new construction. In the example below, repowering yields a positive net present value in eight years, while new construction would not achieve a positive NPV for at least 17 years.

While fuel savings and lower cost capacity expansion are two important potential benefits of repowering, the potential environmental benefits also merit significant consideration. Municipal utilities, investor-owned utilities and independent power producers have cited the environmental benefits of repowering.

Examples from consumer-owned utilities include Arkansas Electric Cooperative, Gainesville Regional Utilities and SaskPower. In the repowering of Arkansas Electric Cooperative's Fitzhugh station, capacity will increase from 59 to 170 mw and the repowered plant will have lower emissions than the existing plant. Repowering of Gainesville Regional Utilities' Kelly plant increased capacity from 40 to 110 mw, but the new unit will produce about one-fifth the emissions of the unit it replaced. Canadian provincial utility SaskPower is adding six turbines to repower its Queen Elizabeth power station. The project capacity will increase by 150 mw, yet reduce CO2 emissions by nearly 35,000 tons/year.

Outside of the consumer-owned power sector, the environmental benefits of repowering can be found in the recent repowering of FPL Energy's Fort Myers power plant. FPL Energy, a private utility in Florida, expanded its Fort Myers plant from 540 to 1,400 mw, yet the repowering is projected to result in a four-fold reduction in NOx emissions and a nearly 160-fold reduction in SO2 emissions as the result of the repowered plant's higher efficiency and the conver-



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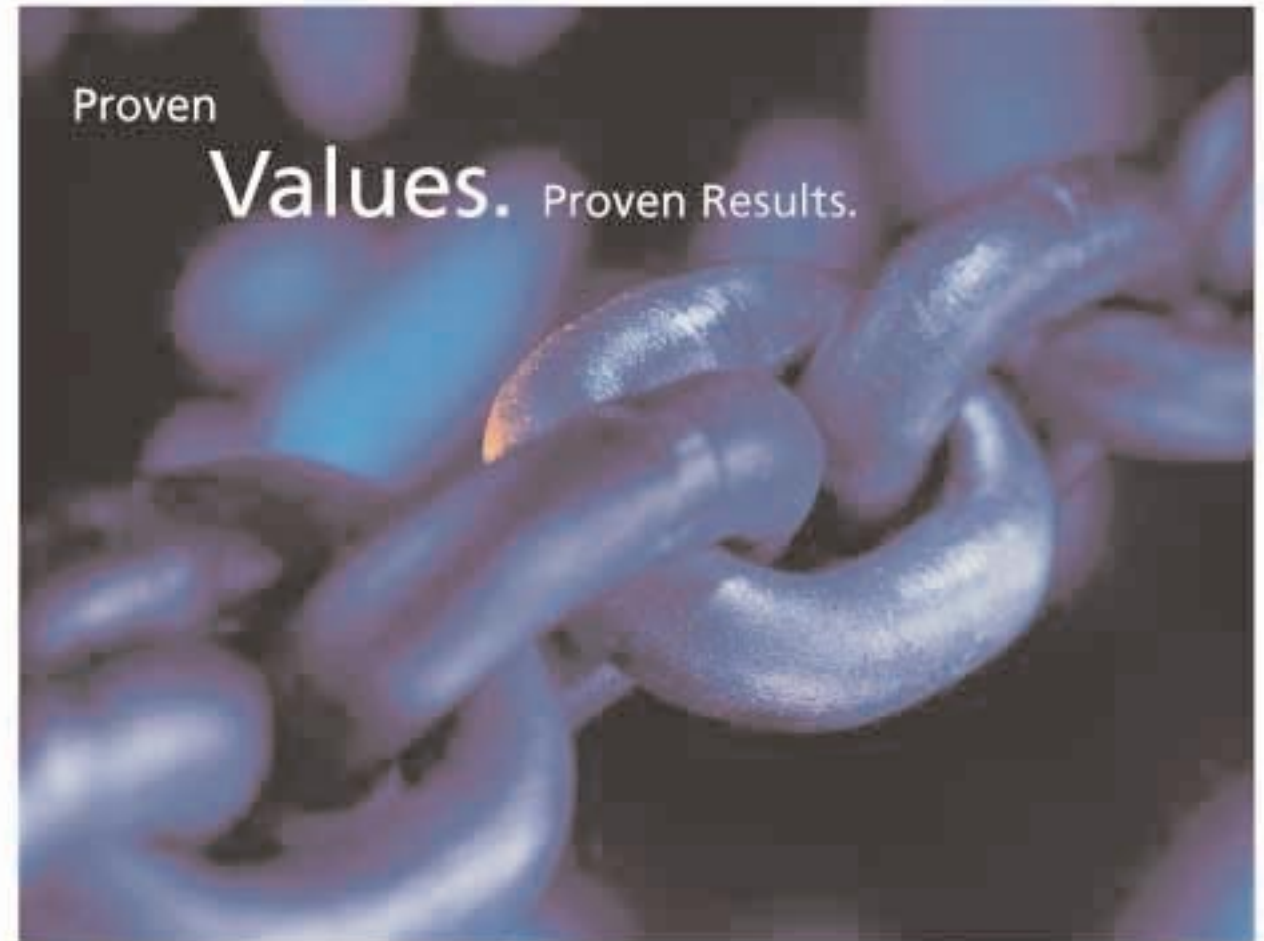
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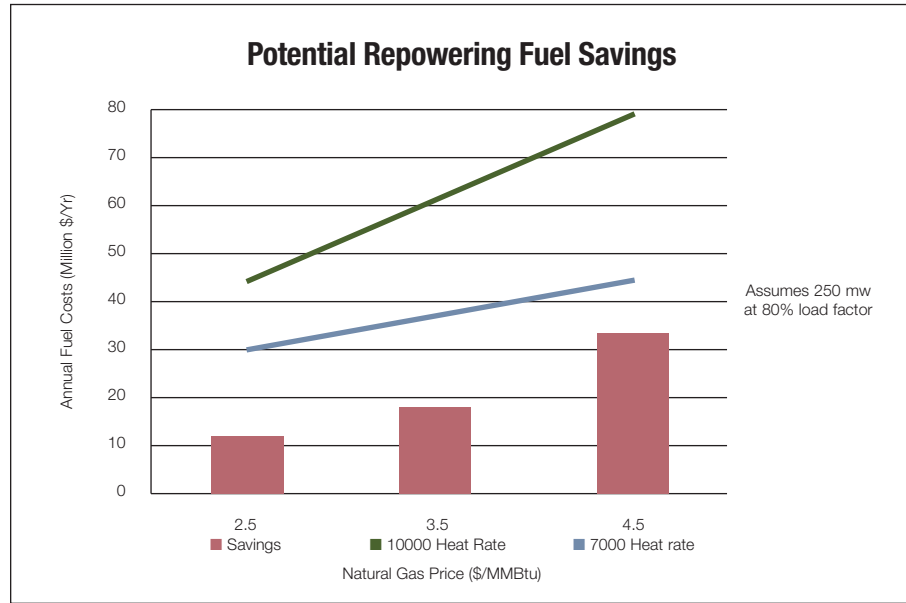
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sion from oil to natural gas. Orion Power's planned Astoria repowering will increase output nearly 45 percent (from 1,254 mw to 1,816 mw), yet NOx and SOx emissions will be reduced by more than 90 percent, again from the combination of increased plant efficiency and conversion from oil to natural gas.

The potential benefits of repowering are not limited to fuel savings, lower capital costs and emissions reductions. By definition, the repowered plant will be on the site of an existing power plant. This reduces the time and cost associated with new site selection and development. In addition, existing site permits may be applicable or easily modified to accommodate the repowering. The lower emissions profile of the new equipment should aid the permitting process and help garner public acceptance of the project. Usually, a repowering project can be implemented on a shorter construction schedule than new plant construction.

Repowering can also yield operational benefits. The newly installed heat-recovery steam generator will reduce operation and maintenance costs compared with the older equipment, and existing personnel can continue to be used without interruption. In a hybrid repowering, power plant owners can realize fuel and output flexibility. Finally, in a repower-

ing project the existing power station is still in operation while the new unit is under construction, which reduces down time and loss of revenue.

NB Power, the provincial utility in New Brunswick, Canada, awarded a contract to Bayside Power to repower the 100-mw, oil-fired, Courtenay Bay plant. ALSTOM Power supplied the new turbine and heat recovery steam generator,

as well as engineering, procurement and construction. When the project was conceived, the plant's owners wanted to be more competitive in deregulated markets by improving the efficiency, flexibility and availability of generating units.

With the installation of a GT24 gas turbine, the existing 100 mw plant was repowered to a combined-cycle plant that now produces 265 mw. The Courtenay Bay plant's efficiency was raised substantially from typical Rankine cycle levels (about 30 to 35 percent) to more than 50 percent. The plant is now configured to supply power to NB Power during the winter and into ISO New England during the summer.

The ultimate viability of repowering will be site-specific, but it is technically applicable to almost all existing boiler/steam turbine plants and its economic viability is likely to be compelling in many instances. ●

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