Revenues from Ancillary Services and the Value of Operational Flexibility

October 31, 2002

LCG Consulting

Research Highlights

The Issue

In a restructured electricity industry, markets govern the operation and expansion of electricity generation, and power plants make profits from markets for energy and ancillary services. Maximum profits are achieved not only through correctly bidding a plant's opportunity cost but also through the optimal allocation of its output between energy and the various market-based ancillary services, such as Regulation Reserve, Spinning Reserve, Non-spinning Reserve, and Replacement Reserve markets. A proper assessment of ancillary services' contribution to a generator's revenues requires a comprehensive understanding of the different ancillary services markets, as well as an integrated modeling environment for simulating all the energy and ancillary services commodities based on temporal and geographical variations.

This research study, a collaborative work between LCG Consulting and Electric Power Research Institute (EPRI), takes a lead role in revealing the strategic operation of power plants in order to maximize the profits of a generator through participation in both energy and ancillary service markets. The quantitative methodology assumed in this study is implemented by deploying UPLAN-E, LCG's proprietary power market simulation model. In addition to quantitative insight into generator's revenue streams, a detailed overview of different ancillary service markets and current market protocols in different ISO's are also provided. In this study, the impact of flexibility in plant operations through measures such as reducing the minimum load capability of a generator has been analyzed to highlight the associated optionality involved in the plant operations.

Methodology

The main focus of the study is on the Regulation Reserve, the highest quality ancillary service. For this purpose some representative generators are selected with Regulation capability. Using UPLAN, the proprietary software of LCG, we conduct a simulation of hourly power markets for 2003 and 2004 in Texas (ERCOT), New England (ISO-NE), and the Midwest ISO (MISO), in order to calculate the revenue streams of the representative generating units for a "Base Case" and "Alternative Cases". These generation units are assumed to have Spinning Reserve capability and Regulation Reserve capability in the Base Case and Alternative Cases respectively. These scenarios are designed to highlight the optionality embedded in ancillary service market participation, and allow us to analyze the change in revenue contribution between the Base Case and Alternative scenarios. The objective is to identify the patterns in revenue profiles across the simulation results in order to formulate strategies for enhancing profitability, reliability, and risk management protocols for a generator.

Key Findings

The simulation results are generally encouraging. The addition of Regulation capability enhances both revenue and income, and decreases losses or cost. The assumption of ceteris paribus implies that only the plants under scrutiny are given Regulation capability, and that other plants already possessing Regulation are not altered in any way. The two key drivers of the promising results are lower variable cost and higher profitability. Participation in Regulation Reserve markets entails a lower capacity factor for a generator. This results in lower variable cost as well as fuel cost. In other words, a generator does not have to run (to serve load) as much as it has to if it has to participate only in energy markets. Therefore, the participation in the Regulation Reserve market incurs less cost, resulting in higher profitability. Both the revenue increase and the capacity payment from Regulation Reserve significantly contribute to the rise in profitability.

The findings from additional analysis done to study the implications of decreasing the minimum plant load exhibit similarly positive results. Reduction in minimum load enhances both revenue and income, and decreases losses or cost. A reduction in the minimum block of the generator has several implications in terms of plant profitability. Equipping the generator with an ability to run at a lower load is not sufficient by itself unless the "break-even" heat rate is achieved. Once this lower heat rate is achieved along with the minimum load size, a significant cost cut can be achieved through the judicious operation of the plant. For example, if a plant has a higher start up cost, it would be prudent to equip the plant with a minimum load capability. This could significantly reduce the operating cost of the plant by simply running it at a low load at night instead of shutting it down.

Discussion

As required under FERC Standard Market Design (SMD), Security Constrained Unit Commitment (SCUC) requires all network constraints in the resource commitment. SCUC alters the day-ahead schedule to ensure that all energy and ancillary service requirements are met at any location. It credits the generating units for no-load, start-up costs and real-time energy for SCUC dispatch. Moreover, reliability itself becomes market-based, and reliability improvements will be forthcoming only with enough incentives. The locational and temporal patterns of ancillary service prices are to reflect the market's valuation of reliability, and depending on the pricing procedures, strategically located plants can expect to enjoy handsome earnings. Similarly, contracts for Reliability-Must-Run (RMR) could be another source of revenues for the utility. In other words, the new era of SMD and RTO opens up several new avenues for enhancing profitability.

In addition, generation asset owners can formulate a variety of strategies to deal with energy and ancillary service markets under SMD. For example, a power plant that participates in ancillary service markets can avoid exclusive reliance on energy revenues, and gain operating optionality. It can be highly versatile and creative in its ancillary service offer strategies, and can design innovative hedges between energy and ancillary service markets. The enhancement of a plant's product line implies that a contribution to capital cost can be obtained from both energy and ancillary service markets.

Report contents are provided on the next page. Questions regarding this research and customized consulting services are truly welcomed by LCG and should be directed to:

LCG Consulting
4962 El Camino Real, Suite 112
Los Altos, CA 94022
650.962.9670. Ext 110
Info@energyonline.com

CONTENTS