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## AN ASSESSMENT OF THE INDUSTRIAL COGENERATION MARKET FOR PARABOLIC DISH SYSTEMS

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### APPROACH

The Federal Energy Regulatory Commission (FERC) acting under authority of the Public Utilities Regulatory Policies Act (PURPA), has ruled that electric utilities must purchase electric energy from qualifying cogenerators and small power producers at rates reflecting the costs the purchasing utility can avoid by obtaining energy and capacity from those sources. The FERC rules also require sale of back-up electricity at nondiscriminatory rates, interconnection of qualifying cogeneration facilities to the grid, and "wheeling" of cogenerated power outside the local service area if a contract cannot be achieved between the cogenerator and the local utility.

Science Applications, Inc. (SAI) is examining the value for parabolic dish solar thermal systems in cogeneration applications in the southwestern United States under these circumstances. In this sense, the study is an attempt to approximate the economic demand curve for parabolic dish cogeneration systems, showing a potential amount sold as a function of price. Price estimates will be based, insofar as possible, on analysis of the benefit streams created by a reference cogeneration system, serving industry-specific steam and electricity loads, under region-specific weather conditions. In addition, the rates for back-up power and electricity buyback used to monetize the energy flows from the cogeneration system will be based on utility-specific filings of intent where possible.

The estimation of potential quantity sold as a function of price is a famous problem in new technology market potential studies. This study does not try to develop support for the existence of a large cogeneration market, but instead tries to identify the "top" (in a price sense) of that market. Thus, SAI will look for the most advantageous (for dish system value) correspondence between steam-electric energy loads, dish system output, and expected rates for back-up and exported power. The credibility for these findings will rest on the ability to verify the relevance of the conditions modeled, and on the analysis technique used to derive system value from those conditions.

### METHODOLOGY

The value analysis technique used for this study is simple and straightforward. Maximum allowable life-cycle system cost for the cogeneration system is determined as the sum of the present value of fuels displaced plus the present value of revenues from exported power. Each conventional fuel displaced is described by a unit cost in the first year, a uniform annual consumption rate, and a uniform annual escalation rate for unit cost. Because the effects on after-tax earnings of a \$1 increase in revenues, are assumed to be the same as those of a \$1 decrease in costs, exported energy flows are treated the same as displaced energy.

The question of interest for this study is: how much can a cogeneration system cost and still be competitive with conventional energy technologies? An absolute upper bound to this question is defined by the "breakeven" system cost, defined as the highest installed system cost for which the cogeneration project can avoid a negative net present value (NPV) when all project-resultant cash flows are considered. All of the application-specific characteristics mentioned above, plus the operations and maintenance costs of the cogeneration system, are represented in the project NPV.

The technique for determining potential quantity sold is much more empirical than the discounted cash flow methods used to determine value. Subjective criteria were used to limit the survey population to service territories of eight investor-owned utilities in six major metropolitan of the southwestern United States. Use of the utility service territory as the basic unit of analysis has several operational advantages. First, the relevant rates for back-up and exported power will be utility-specific. Thus the utility service territory is a logical unit for the value analysis described above. Second, service territories are easily related to the regional manufacturing activity data used in estimating potential cogeneration system sales, and to other region- and site-specific influences on prospects for solar thermal cogeneration (insolation, projections of industrial growth, land availability, transmission line availability, etc.). Finally, the large utilities generally have substantial in-house knowledge of the load characteristics of their industrial customers. If this preliminary analysis were to be disaggregated and extended, visits to the eight utilities might be a cost-effective alternative to site visits to all prospective cogenerators.

Within a given service territory, the gross population of prospective cogenerators is determined from lists of local manufacturing activity as reported in state manufacturing registers. Initial screening is applied to eliminate manufacturing activities whose energy requirements are obviously incompatible with parabolic dish systems. The remaining plants are retained for further analysis. Performing this process for each service territory results in a matrix of "feasible" manufacturing establishments, tabulated by utility service territory.

Using energy load profiles typical of the industries selected, and local insolation and utility rate data, breakeven costs for parabolic dish cogeneration systems are computed for each application/service territory combination in the matrix. The results, ranked from high to low by breakeven value, represent a value-stratified list of potential cogeneration applications for the sample analysed. The last step is to estimate the quantities of potential sales of parabolic dish cogeneration systems corresponding to the respective value strata. This is done from local data on manufacturing sector energy use. This data is used to estimate, for each service territory, the total energy use by each manufacturing activity modeled. The portions of that total use corresponding to the process conditions modeled are estimated from "typical plant profiles" for the appropriate industries.

## EXPECTED RESULTS

Because they will be synthesized from average data, the potential sales data are obviously "soft." Furthermore, the important attrition mechanisms separating attainable sales from gross potential are not modeled at all. The value of the study must rest, therefore, on the value stratification results. From this perspective, the quantity results should be indicative of applications meriting the cost of gathering more detailed information on technical requirements and potential energy displacement.