



COGENERATION

& SMALL POWER PRODUCTION MANUAL

Second Edition

Scott A. Spiewak

Cogeneration and Small Power Production Manual

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Scott A. Spiewak.

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PREFACE

Shortages of electricity are the likely results of the decisions being made today by many utilities to defer capacity expansion. As the economy improves, and demand returns to normal levels, there will not be enough powerplants to fulfill that demand.

At the very least, we are in for staggering increases in the prices of electricity. At worst, we can look to the possibility of rationing, and curtailments of service.

Curtailments, if needed, are most likely to hit the "nonessential" sectors of the economy. Cogeneration is a hedge against the possibility of being declared nonessential.

In addition, under the Public Utility Regulatory Policies Act of 1978, cogeneration can be profitable, as utilities are required under that Act to purchase power at their avoided costs.

The Cogeneration & Small Power Production Manual is designed for the plant manager or others with the ability to initiate corporate investment decisions. It is not intended exclusively for the expert engineer or attorney, although both might benefit from it. Rather, the Manual will provide the manager with detailed, timely and understandable materials which might serve as the basis of a cogeneration feasibility study.

ACKNOWLEDGEMENTS

The Manual owes much to the work of others. The Editors would like to acknowledge the use of the following sources:

Section A is drawn from a monograph originally published by Prentice-Hall as a part of their Energy Controls series, authored by Mr. Scott Spiewak and Dr. Donald Kreps (Editors).

Section B draws materials from the State of California Air Resources Board Cogeneration Technology and Resource Recovery Status Report, July 29, 1981, and from a Handbook of Industrial Cogeneration prepared for the Department of Energy by Oak Ridge National Laboratory and the TRW Energy Engineering Division in McLean, Virginia, with the assistance of Thermo-Electron Corporation of Waltham, Massachusetts.

Section C includes materials from an article, Cogeneration for the Industrial End User, first appearing in the magazine, Cogeneration, a Pequot Publication, and authored by Dr. Heinz A. Gorges, P.E. (Editor); from the Guidelines prepared by the National Rural Electric Cooperative Association to assist its membership in fulfilling the requirements of Sections 201 and 210 of PURPA for cogeneration and small power production, prepared by Theodore Barry and Associates, a TB&A Company, and from the Final Report on the Department of Energy's Industrial Cogeneration Optimization Program, prepared by TRW, Inc., McLean, Virginia with assistance from Thermo-Electron Corporation, for the Assistant Secretary for Conservation and Solar Energy, Division of Industrial Energy Conservation. The Appendix to Section C was originally prepared by ESC Energy Corp. for the California Energy Commission in 1980, was updated in 1981 by Kuhn & Kuhn, and is updated on an ongoing basis.

Section D includes materials from contracts too numerous to mention here, but which are listed at the end of that Section. However, note should be made that the basis for this section was research done by the staff of the American Public Power Association in compiling contracts, and that this section is the result of a combination of that compilation, and a number of other contracts made available from utilities listed at the end of Section D.

Section E owes much to materials appearing in the Waste Heat Management Guidebook, edited by Kenneth G. Kreider and Michael B. McNeil for the U.S. Department of Commerce and the Federal Energy Administration. Also, as noted in the text, the model illustrated for implementing the discounted cash flow method is available from Argonne Code center, Argonne National Laboratory, 9700 Cass Avenue, Argonne, Illinois, 60439.

Section A
**Regulation of Cogeneration and
Small Power Production**

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REGULATION OF COGENERATION AND SMALL POWER PRODUCTION

Background

Under section 201 of the Public Utility Regulatory Policies Act of 1978 (PURPA), cogeneration facilities and small power production facilities which meet certain standards and which are not owned by electric utilities are eligible for special incentive rates to be paid them by the utilities as required under section 210 of PURPA.

Cogeneration facilities simultaneously produce two forms of useful energy, such as electric power and steam. Cogeneration facilities use significantly less fuel to produce electricity and steam (or other forms of energy) than would be needed to produce the two separately. Thus, by using fuels more efficiently, cogeneration facilities can make a significant contribution to the Nation's effort to conserve its energy resources.

Small power production facilities use biomass, waste or renewable resources, including wind, solar and water, to produce electric power. Reliance on these sources of energy can reduce the need to consume traditional fossil fuels to produce electric power.

Prior to the enactment of PURPA, a cogenerator or small power producer seeking to establish interconnected operations with a utility faced three major obstacles. First, a utility was not generally required to purchase the electric output at an appropriate rate. Secondly, some utilities charged discriminatorily high rates for back-up service to cogenerators and small power producers. Thirdly, a cogenerator or small power producer which provided electricity to a utility's grid ran the risk of being considered an electric utility and thus being subjected to State and Federal regulation as an electric utility.

Sections 201 and 210 of PURPA are designed to remove these obstacles. Each electric utility is required under section 210 to offer to purchase available electric

energy from cogeneration and small power production facilities which obtain qualifying status under section 201 of PURPA. For such purchases, electric utilities are required to pay special incentive rates to cogenerators and small power producers. Section 210 also requires electric utilities to provide electric service to qualifying facilities at rates which are "just and reasonable, in the public interest, and which do not discriminate against cogenerators and small power producers." Section 210(e) of PURPA provides that the Commission can exempt qualifying facilities from most regulations, including State regulation regarding utility rates and financial organization, from Federal regulation under the Federal Power Act, and from the Public Utility Holding Company Act.

The incentive rates which utilities are obligated to pay to qualifying facilities are not required directly by PURPA, but rather by rules promulgated by the Federal Energy Regulatory Commission (FERC).

These rules provide that electric utilities must purchase electric energy and capacity made available by qualifying cogenerators and small power producers at a rate reflecting the cost that the purchasing utility can avoid as a result of obtaining energy and capacity from these sources, rather than generating an equivalent amount of energy itself or purchasing the energy or capacity from other suppliers. To enable potential cogenerators and small power producers to be able to estimate these avoided costs, the rules require electric utilities to furnish data concerning present and future costs of energy and capacity on their systems.

In 1982 the D.C. Circuit vacated this portion of the rules. Its rationale was that FERC had "not adequately justified its adoption of the full avoided cost standard." Specifically, the court stated that it would expect FERC to consider a "percentage of avoided cost approach" under which, for example, the FERC rules might call for 80% of avoided costs to be paid to the qualifying facility, with the rest of the avoided costs inuring to the benefit of the utility ratepayers (American Electric

Power Service Corporation v. FERC. No. 80-1789 (D.C. Cir. Jan. 22, 1982) (AEP).

On May 16, 1983, the Supreme Court overturned the decision of the D.C. Circuit, ruling that FERC did not act arbitrarily or capriciously in promulgating the full avoided cost rule, ending the uncertainty which had plagued contract negotiations as a result of the D.C. circuit ruling. The full text of this landmark decision may be found in Appendix II to section A. With the question of whether full avoided costs is the appropriate standard for sales settled, the implementation of the rule is the next key issue for determining the economic viability of many cogeneration/small power projects. Implementation of the rules is reserved to the State regulatory authorities. Most have either established rate schedules, or are in the process of doing so. However, the states need not implement PURPA by rule. In ruling on the constitutionality of PURPA, the Supreme Court has said that no issue as to interference with the state legislative function is implicated by PURPA because the states are free to implement PURPA in an adjudicatory fashion, i.e., through case by case rate proceedings before the state public utility commissions. FERC v. Mississippi, No. 80-1749 (U.S. June 1, 1982).

Rates for Purchases

Section 210(b) of PURPA provides that in requiring utilities to purchase electric energy from a qualifying facility, FERC must ensure that the rates for the purchase are just and reasonable to the electric consumers of the purchasing utility, in the public interest, and nondiscriminatory to qualifying facilities, but that they not exceed the incremental costs of alternative electric energy (the costs of energy to the utility, which, but for the purchase, the utility would generate itself or purchase from another source).

FERC has provided that in the case of new facilities, the rate for purchases meets these statutory requirements if it equals the costs which the utility "avoids" by purchasing electricity from the qualifying facility rather than obtaining it elsewhere or generating it itself.