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Least-Cost Utility Planning and Demand-Side Management: A Bibliography

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Least-Cost Utility Planning and Demand-Side Management: A Bibliography

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I. Bibliography Introduction

The concept of satisfying consumer needs for electric services by using energy efficiency technologies, load management, cogeneration, and renewable resources as alternatives to building central station power plants has gained increasing acceptance since the idea first received widespread exposure in the late 1970's.¹ Today, energy efficiency technologies are often the cheapest, quickest, most flexible, most reliable, most secure and most environmentally benign of the resources available to meet consumer needs for heating and cooling, for lighting, and for running electric appliances and motors.² Thus, the nation's energy efficiency becomes particularly important in light of the critical role the issues of environmental quality, economic competitiveness, and energy security play in United States foreign and domestic policy.³

Despite the compelling policy arguments in favor of energy efficiency, implementation of energy efficiency in the United States has stalled. Although energy efficiency increased twenty-four percent between 1976 and 1986, recent government statistics show that efficiency stopped growing in 1986 with the collapse of oil prices, and declined in the first nine months of 1988.⁴ One recent analysis concludes that unless the nation makes a renewed commitment to improve energy efficiency, energy consumption will continue to rise at a

1. For a seminal exposition of this concept, see Lovins, *Energy Strategy: The Road Not Taken?*, 44 FOREIGN AFF. 65 (1976).

2. See generally W. CHANDLER, H. GELLER & M. LEDBETTER, *ENERGY EFFICIENCY: A NEW AGENDA* (1988).

3. See U.S. Energy Security, Part 2, *Oversight hearings before the Subcomm. on Energy and Power of the House Comm. on Energy and Commerce*, 100th Cong., 1st Sess. (1987) (Testimony on the role of conservation in the national energy supply).

4. Wald, *U.S. Progress in Energy Efficiency Is Halting*, N.Y. Times, Feb. 27, 1989, at A1.

moderate rate in the near future.⁵

During the same period that the United States' commitment to energy efficiency declined so dramatically, regional and global environmental problems associated with the burning of fossil fuels were becoming increasingly apparent to the public and well-documented in the scientific literature.⁶ Environmental problems associated with the generation of electricity include acid rain, global warming, and urban smog.⁷ For instance, carbon dioxide (CO₂) made a relative contribution of approximately forty-nine percent to the greenhouse effect in the 1980's.⁸ Although the United States has only five percent of the world's population, it produces more carbon dioxide emissions from the burning of fossil fuels than any other nation.⁹ Electric power plants are responsible for 33.4 percent of the total carbon emissions from fossil fuels in the United States.¹⁰ Consequently, the extent to which energy efficiency and renewable energy alternatives can satisfy this nation's electrical demand will be important elements in controlling global warming.¹¹ Electric utilities contribute even more significantly to acid rain pollution, contributing seventy-five percent of U.S. sulphur dioxide (SO₂) emissions, and twenty-eight percent of nitrogen oxide (NO_x) emissions, the principle acid rain precursors.¹²

The Pace University Center for Environmental Legal Studies has undertaken a major utility reform project, the Pace Energy Project, which seeks to address the environmental and efficiency issues associated with energy consumption.

5. H. GELLER, U.S. ENERGY DEMAND: BACK TO ROBUST GROWTH 14-15 (Feb. 1989) (Am. Council for an Energy Efficient Econ. Energy Efficiency Issues Paper No. 1).

6. See, e.g., *The Global Environmental Protection Act of 1988: Joint Hearings on S.2666 Before the Subcomm. on Hazardous Wastes and Toxic Substances and the Subcomm. on Environmental Protection of the Senate Comm. on Environment and Public Works*, 100th Cong., 2d Sess. (1988).

7. See J. MACKENZIE & M. EL-ASHRY, *ILL-WINDS* v-vi, 33-48 (1988).

8. S. MACHADO & R. PILTZ, *REDUCING THE RATE OF GLOBAL WARMING* 3 (1988).

9. *Id.* at 2.

10. *Id.*

11. N. RADER, K. BOSSONG, A. ANTYPAS & S. DENMAN, *TURNING DOWN THE HEAT: SOLUTIONS TO GLOBAL WARMING* 10 (1988).

12. MACKENZIE & EL-ASHRY, *supra* note 7, at 35, 37.

The Pace Energy Project has intervened in New York Public Service Commission proceedings to advocate that regulated utilities engage in integrated planning, institute bidding procedures, and acquire demand-side management (DSM) resources. The Pace Energy Project also advocates that these decisions should involve appropriate consideration of the relative environmental impacts of all energy resource acquisitions. The Project does related legislative research and has undertaken a study of the environmental costs associated with the generation of electric energy.

As a complement to these endeavors, the Pace Energy Project has undertaken to compile this annotated bibliography of books, articles and other research materials devoted to least-cost utility planning and demand-side management. This introduction describes the organization and methodology of the bibliography. To aid the user who may be unfamiliar with this field, these remarks also survey the factual background underlying the issues in each subsection of the bibliography, and the interrelationships between these utility reform issues.

A. *Methodology of Bibliography*

This bibliography should serve as a useful overview of the literature as well as an introduction to many of the principal researchers and participants in these exciting and important energy issues. Student researchers compiled the bibliography and prepared the annotations with editorial and topical guidance from faculty participants. Annotations were frequently based on summaries contained in the referenced works. Preparers of this bibliography attempted to hold editorializing to a minimum, although materials which appeared particularly useful are so identified.

The bibliography contains references for only those materials actually reviewed by Pace researchers. The starting point for this bibliography was material in the collection of the Pace Center for Environmental Legal Studies. Much of the material in the Center's collection was obtained at conferences and through personal contacts with active participants

in the energy efficiency debate. These references were supplemented by research in the collections of local public, university, and utility libraries. In addition, some outside experts were contacted for additional references. As a result of this method of compilation, the bibliography contains many materials which may not be readily identified by nonexperts using traditional research methods, as well as materials which may be available at local libraries.

Due to the broad scope of the bibliography, researchers found it necessary to exclude certain materials. With few exceptions, only materials published or circulated after 1979 are included. Publication deadlines unfortunately necessitated the exclusion of most works published after November 1988. At the end of the bibliography, researchers have provided a list of selected organizations that conduct research or publish in the field of energy efficiency and energy-related environmental impacts. This list may be helpful to the user who seeks more current sources.

This bibliography does not attempt to provide a comprehensive listing of relevant federal, state, and international documents. In general, federal and international documents referenced in the bibliography are from the Center's collection. The reader interested in national policy debates on energy efficiency and related subjects may find congressional materials such as hearings and committee reports a particularly valuable resource. Researchers focussed on identifying published descriptions of state programs, but did not comprehensively survey documents available from state agencies. State public utility commissions can be a good source for locally-oriented materials on least-cost utility planning, bidding, and state conservation materials. Although law review articles which researchers considered germane are included, the bibliography does not purport to comprehensively survey the legal literature, case law, and statutory bases related to least-cost utility planning, ratemaking incentives, and environmental regulation.

The bibliography is an ongoing project. The Pace Energy Project contemplates updating the bibliography from time to time and may prepare supplemental research guides for par-

ticular subjects introduced in this initial segment.¹³

B. *Organization of the Bibliography*

The bibliography is divided into six sections: Least-Cost Energy Planning; Environmental Costs and Consequences of Energy Production; Conservation (General); Energy Efficiency Technology (Equipment, Appliances, and Buildings); DSM Program Design, Incentives, and Pricing; Bidding, Wheeling, and Structural Reform. To a certain extent, materials may be related to more than one of the categories. References were categorized using the best judgment of the compilers. The following explication should help the user of this bibliography to understand the interrelationships of these categories.

Materials referenced in the first section of the bibliography, "Least Cost Energy Planning," describe a major trend in the regulation of public utilities. Least-cost planning, sometimes called integrated planning, is a method which regulators and public utilities can use to satisfy demand for energy services economically, reliably, and equitably while considering DSM acquisitions, such as energy efficiency investments and load management programs, along with more traditional supply-side options, such as central plant construction or power purchases.¹⁴

Least-cost utility planning has received support from regulators, utilities, and consumer advocates.¹⁵ The least-cost approach developed in part as a response to nuclear generating stations which utilities planned in the 1970's and early 1980's to satisfy a demand for electrical services that never materialized, and constructed at a dramatically higher cost than originally contemplated.¹⁶ The resulting rate increases, prudence reviews and disallowances, and cancelled plants have had seri-

13. Indeed, the *Pace Environmental Law Review* is planning to publish an energy issue in the near future.

14. See generally 1 NAT'L ASS'N OF REGULATORY UTIL. COMM'RS, LEAST-COST PLANNING (1988).

15. See NAT'L ASS'N OF REGULATORY UTIL. COMM'RS, 1988 NATIONAL CONFERENCE ON LEAST COST UTILITY PLANNING (proceedings of conference held Apr. 10-13 1988).

16. See Cavanagh, *Least-cost Planning Imperatives for Electric Utilities and Their Regulators*, 10 HARV. ENVTL. L. REV. 299, 301-304 (1986).

ous impacts on the public's perception of the electric industry and the financial well-being of some utilities.¹⁷ Although electric utilities have always had some type of long-range planning, least-cost planning initiatives have allowed for increased public participation, mandated the consideration of demand-side resources on an equal footing with supply resources, and provided a more articulated role for state regulators in the planning process.¹⁸

The least-cost planning approach also offers an excellent opportunity for consideration of environmental protection and enhancement possibilities in the energy production cycle. In making resource acquisition decisions State public utility commissions are beginning to require that utilities consider environmental consequences beyond the costs of complying with state and federal control requirements.¹⁹ Substituting energy efficiency for coal-fired generating stations could be the most cost-effective method of solving the acid deposition cri-

17. The ongoing saga of Long Island Lighting Company's (LILCO) Shoreham Nuclear Power Facility is one example of the tension between ratepayers and utilities. LILCO completed the facility in 1985 at a cost of \$5.5 billion but has been unable to obtain a full-power operating license from the Nuclear Regulatory Commission because of the refusal of state and local governments to participate in emergency planning. The New York Public Service Commission is likely to approve rate increases that will lead to the adoption of a plan to close the plant. Gutis, *Approval of Lilco Rate Increases Is Predicted*, N.Y. Times, Mar. 19, 1989, §1, at 33, col. 1. See also *County of Suffolk v. Long Island Lighting Co.*, No. 87-CV-646 (E.D.N.Y. Feb. 11, 1989) (dismissing RICO action against utility); *Re Long Island Lighting Company*, 71 Pub. Util. Rep. 4th (PUR) 262 (N.Y. Pub. Serv. Comm'n 1985) (prudency evaluation of Shoreham construction), *petition for reh'g denied*, 78 Pub. Util. 4th (PUR) 204 (1986), *determination modified and remitted for further proceedings*, 134 A.D.2d 135, 523 N.Y.S.2d 615 (2d Dep't 1987).

18. For a recent and detailed discussion of utility planning which includes a historical overview as well as examples from contemporary ratecases, see E. KAHN, *ELECTRIC UTILITY PLANNING AND REGULATION* (1988).

19. See, e.g., Investigation by the Dep't of Pub. Util. on its own motion, pursuant to sec. 76 of Ch. 164 of the General Laws into the pricing and ratemaking treatment to be afforded new electric generating facilities which are not Qualifying Facilities as defined in 220 C.M.R. 8.02, D.P.U. 86-36-F, slip op. at 64-65 (Mass. Dep't Pub. Util. Nov. 30, 1988); Proceeding on Motion of the Commission to Examine the Plans for Meeting Future Electricity Needs in New York State, Opinion and Order Concerning Bidding, Avoided Cost, and Wheeling Issues, Case 29409, Op. No. 88-15, slip op. at 19 (N.Y. Pub. Serv. Comm'n June 3, 1988), *clarified in* Op. No. 88-15(A), slip op. at 25 (Nov. 2, 1988).

sis.²⁰ The second section of the bibliography, "Environmental Costs and Consequences of Energy Production," includes references to materials which describe the environmental impact of the energy production cycle, attempt to assign costs to resulting environmental damage, and evaluate methods for considering these impacts in the energy planning process.

The section titled "Conservation (General)" references materials which deal with energy efficiency from broad perspectives, including evaluation of the United States' and the world's energy consumption and policy recommendations. In 1978, Congress adopted the Public Utilities Regulatory Policy Act (PURPA), the ground-breaking statute designed to encourage reliance on renewable resources, cogeneration, and conservation.²¹ The problems of environmental damage, national security, third world development, and conservation of scarce resources continue to occupy the national agenda. References in this section will direct the user to current overviews of conservation's role in the solution of these policy dilemmas and an introduction to the federal government's role in promoting energy efficiency. The section also includes references to several earlier treatments which may be helpful in providing a historical perspective.

Effective promotion of energy efficiency requires an understanding of two interrelated areas: energy efficiency technology and program design.²² Materials referenced in the fourth section of the bibliography, "Energy Efficiency Technology (Equipment, Appliances, Buildings)," review developments in energy efficiency technology. The section attempts to survey the types of available literature, which range from technical scientific and engineering works to consumer-ori-

20. See, e.g., Ohio Office of Consumer's Counsel, *Clearing The Air: Using Energy Efficiency to Reduce Acid Rain Compliance Costs in Ohio* (1988).

21. Public Utility Regulatory Policies Act of 1978, Pub. L. No. 95-619, 92 Stat. 3117 (1978) (codified as amended in scattered sections of Titles 15, 16, 30, 42, and 43 of the United States Code (1982)).

22. See Rosenfeld & Hafemeister, *Energy-efficient Buildings*, SCI. AM., (Apr. 1988); DEMAND-SIDE MANAGEMENT AND ELECTRICITY END-USE EFFICIENCY (A. De Almeida & A. Rosenfeld, eds. 1987) (a compilation of papers presented at a NATO Advanced Study Institute which comprehensively surveys the interaction of policy, program design, and technology).

ented guides. Because some materials referenced in this section include program design in addition to technology developments, the user may wish to use this section in conjunction with the section titled "DSM Program Design, Incentives, and Pricing."

One controversial aspect in the promotion of energy efficiency is the role regulatory commissions, utilities, consumers, and legislatures should play in both the cost and implementation burdens associated with conservation and load management programs. Materials referenced in the penultimate section of this bibliography, "DSM Programs, Incentives, and Pricing," deal with this debate from a variety of perspectives. Many references relate to the design and evaluation of utility-sponsored programs and the related issue of how costs associated with these programs should be recovered.²³ This section also includes references to materials dealing with appliance efficiency standards. The federal government has followed the lead of several states in pursuing this legislative route.²⁴

The opening of the electricity market to demand-side management and independent power producers has led to fascinating developments, such as the emergence of shared savings suppliers who will finance a customer's investment in conservation, and the formation of associations of cogenerators, independent power producers and renewable energy producers.²⁵ Several states have initiated bidding systems to require utilities to acquire these alternative resources at auc-

23. For a very recent survey of state cost recovery treatments of utility conservation and load management investments, see M. REID, *RATEBASING OF UTILITY CONSERVATION AND LOAD MANAGEMENT PROGRAMS* (1988).

24. See National Appliance Energy Conservation Act of 1987, Pub. L. No. 100-12, 101 Stat. 103 (1987) (codified as amended at 42 U.S.C.A. §§ 6291-6297 (West 1982 & Supp. III 1986)). For a survey of earlier state appliance standards, see Charo, Stearns & Case, *Overview of Legal Issues Arising in the Development of Federal and State Appliance Efficiency Standards*, 11 *COLUM. J. ENVTL. L.* 315, 335-352 (1986).

25. For instance, Central Maine Power Co. recently signed a five year performance bid contract with an energy service company, SESCO, Inc., for 6.5 megawatts of residential conservation savings. Under the contract, SESCO will provide an estimated 10,3000 Maine residents with free energy efficiency improvements worth approximately \$5.1 million. *Record Megawatt Purchase*, IRT: The Energy Newsbrief 1 (Mar. 2, 1989).

tion for least-cost.²⁶ The Federal Energy Regulatory Commission has issued Notices of Proposed Rulemakings (NOPR) to regulate bidding programs and other aspects of the changing electric industry structure.²⁷ The final section of the bibliography, "Bidding, Wheeling, and Structural Reform," contains references to materials dealing with these exciting issues and the role demand-side sources should have in these acquisition decisions.

II. Bibliography

A. *Least-Cost Energy Planning*

Berry, David. "Least-cost Planning and Utility Regulation." *Public Utilities Fortnightly* 121 (17 March 1988): 9-15. 7 pp.

This article describes the major regulatory institutions which have been developed to support least-cost planning and is based upon a survey of all states' least-cost planning programs.

Cavanagh, Ralph. "Least Cost Planning Imperatives for Electric Utilities and Their Regulators." *Harvard Environmental Law Review* 10 (1986): 299-344. 35 pp.

This article states that state regulators' and utilities' primary goal should be to sustain reliable electricity service for a growing economy at the lowest possible cost. The article reviews the impact which the future course of the utility industry has on the United States economy and

26. For the most recent developments in New York and Massachusetts, see *supra* note 18. See generally J. HAMRIN, H. WELLFORD, H. ROBERTSON & J. SMUTNY-JONES, PRICING NEW GENERATION OF ELECTRIC POWER: A REPORT ON BIDDING A1 TO A29 (1987); see also Walker, *New Jersey's Competitive Bidding System — An Attempt at a Balanced Energy Supply Policy*, PUB. UTIL. FORT. 34 (1989).

27. Regulations Governing Supply Independent Power Producers, 53 Fed. Reg. 9327 (1988); Regulations Governing Bidding Programs, 53 Fed. Reg. 9324 (1988); Administrative Determination of Full Avoided Costs, Sales of Power to Qualifying Facilities, and Interconnection Facilities, 53 Fed. Reg. 9331 (1988); see *FERC Electric Proposal, Hearing before the Senate Comm. on Energy and Natural Resources*, 100th Cong., 2d Sess. (1988) (differing perspectives of state regulators, F.E.R.C. commissioners, independent power producers, and utilities on draft rules).

environment; then assesses the increasing difficulties state regulators have in influencing the course of the utility industry given the increasing irrelevance of state boundaries to utility investment and operations. The article also includes the equivalent of a "how to" manual for preparing least-cost resource acquisition plans for utilities.

_____. "Responsible Power Marketing in an Increasingly Competitive Era." *Yale Journal on Regulation* 5 (1988): 331-366. 36 pp.

This article discusses the origins of the utility industry's competitive dilemma and the growing attraction of "least-cost" principles. The marketing advantages of efficiency strategies, obstacles to realizing these advantages, and some dangers associated with policies that promote increased electricity use are explored.

Electric Power Research Institute (EPRI). *Least-Cost Energy Planning in the Midwest: A Symposium*. Prepared by The Center for Regulatory Studies, Normal, Ill. Palo Alto, Calif.: Research Reports Center, 1988. 195 pp.

This report consists of a series of papers presented by economists, utility representatives, regulators, and consumer advocates at a conference entitled "Least-Cost Energy Planning in the Midwest: A Symposium" organized by the Center for Regulatory Studies and held on February 10-12, 1987, in Chicago, Illinois. The objective of the symposium was to summarize information on six key issues: (1) whom least-cost planning is intended to serve; (2) least-cost planning options; (3) operationalizing least-cost planning concepts; (4) demand-side issues and problems; (5) supply side issues and problems; and (6) integrated energy resource planning.

_____. *Moving Toward Integrated Value-Based Planning: The Issues*. Prepared by Barkart, Howard and Chamberlin, Inc. Palo Alto, Calif.: Research Reports Center 1988. 586 pp.

These proceedings are from an EPRI-hosted conference

held December 1-3, 1987. Integrated Value-Based Planning (IVP) is a planning tool developed by EPRI which uses value, as well as cost, as the common denominator for evaluating supply and demand resource options.

Haman-Guild, René. "State Involvement in Utility Resource Planning: Towards Partnership." *Public Utilities Fortnightly* 115 (18 April 1985): 22-28. 6 pp.

The utility resource planning process in the fast growing state of Nevada has already gone far in its implementation. This article describes the creation of that planning process through legislative and regulatory actions.

Hirst, Eric. "Integrated Resource Planning: The Role of the Regulatory Commissions." *Public Utilities Fortnightly* 122 (15 September 1988): 34-40. 7 pp.

This article analyzes the state utility commission role in assessing integrated resource planning and suggests that regulation should encourage better planning as a method of eliminating future resource allocation controversies. The article examines economic tests used by utilities and commissions assessing demand-side programs and discusses a utility's treatment of the costs associated with implementing these programs.

_____. "The Key Elements of Integrated Resource Planning for Electric Utilities." Oak Ridge, Tenn.: Oak Ridge National Laboratories, January 1988. Photocopy. 17 pp.

This paper discusses the fundamental elements of the integrated resource planning process, which combines a variety of demand and supply options to cost-effectively meet customer energy-service needs. This article is based on review of the literature and observations of planning activities at several utilities and includes a reference list.

_____. "Meeting Future Electricity Needs." *Forum for Applied Research and Public Policy* (Fall 1988): 26-34. 9 pp.

This article describes the elements of integrated resource planning and explains its evolution in the utility planning process.

_____. Regulatory Responsibility for Utility Integrated Resource Planning. ORNL/CON-249. Oak Ridge, Tenn: Oak Ridge National Laboratories, January 1988. 39 pp.

This report is based upon the assumption that integrated resource planning can yield substantial benefits to utilities, their customers, and to commissions. This report serves as an extended outline of issues that merit further consideration among commissions, the utilities they regulate, and other interested parties.

Hirst, Eric, and Corey Knutsen. "Integrated Resource Planning at Puget Power: Process and Results." Oak Ridge, Tenn.: Oak Ridge National Laboratories, December 1987. Photocopy. Unpaginated.

This paper discusses the planning process and initial plan of a program established at Puget Power called "Demand and Resource Evaluation" (DARE). The overall goals of the plan were to keep energy service costs low, improve customer service, increase flexibility for Puget Power and the Washington Utilities and Transportation Commission, and reduce controversies over future resource acquisitions. Mr. Knutsen is affiliated with Puget Sound Power and Light Company.

Kriesberg, Joseph. "A Legislative Approach to Least-Cost Electrical Planning: Proposals for the State of Pennsylvania." Washington, D.C.: Public Citizen, May 1986. 14 pp. plus appendix.

This report examines statutes from several states which have adopted legislation establishing comprehensive least-cost programs for their electric utilities. The report shows how other states can use these statutes as models when drafting least-cost legislation. The report includes specific proposals for establishing a least-cost program

through legislation in Pennsylvania.

Lovins, Amory B. "Least-Cost Electrical Services as an Alternative to the Braidwood Project." Prefiled Rebuttal Testimony for Petitioners, in Docket #82-0855, Petition to Consider Cancellation of One or More Nuclear Power Plants and Prefiled Testimony for Business and Professional People for the Public Interest (BPI) in Docket #83-0035, Energy Conservation Docket-Commonwealth Edison, before the Illinois Commerce Commission, 3 July 1985. Snowmass, Colo.: Rocky Mountain Institute, 3 July 1985. 160 pp.

The purpose of this testimony was to rebut several Commonwealth Edison Company (CECO) witnesses on the level of load and demand growth CECO was likely to experience under a variety of policy choices; how that load could best be forecast and influenced and the risk arising from its uncertainty minimized; and the implications of a reasonable range of load-growth scenarios for the economics and relative risks of completing, or cancelling, the Braidwood Nuclear project.

_____. "Least-Cost, Reliable Electrical Services As An Alternative Seabrook." Direct testimony for the Consumer Advocate of the New Hampshire Public Utilities Commission, in Docket #84-200, Investigation of PSNH Financing Plan to Complete Construction of Seabrook Unit No. 1 before the New Hampshire Public Utilities Commission, 15 October 1984. Snowmass, Colo.: Rocky Mountain Institute, 1984. 102 pp.

This testimony describes how a market-oriented program to provide electrical services in the cheapest way makes completion of a major power plant unnecessary and uneconomic, pays off the plant's sunk costs, maintains reliable service, and at the same time stabilizes or cuts customers' bills.

National Association of Regulatory Utility Commissioners (NARUC). *Least-Cost Utility Planning Handbook for*

Public Utility Commissioners. Vol. 1. Washington, D.C.: NARUC, October 1988.

This book provides a general introduction to least-cost planning. It briefly outlines the benefits, implementation, and monitoring of least-cost planning strategies. The handbook gives examples of how various states have handled particular least-cost planning issues. The second volume, a more technical work, is prepared by the Lawrence Berkeley Laboratory in California and was released in early 1989.

_____. *National Conference on Least-Cost Utility Planning: Proceedings*. Held 10-13 April 1988 in Aspen, Col. Washington, D.C.: NARUC, 1988. 424 pp.

The compilation of the 29 speeches and papers presented at the first annual Least-Cost Planning Conference sponsored by NARUC includes the perspectives of leading researchers and policy makers in the area of least-cost utility planning. It is an excellent introduction to the status of least-cost planning in the states and related theoretical and practical controversies. Of particular interest is the seminal paper by David Moskovitz, "Will Least-cost Planning Work Without Significant Regulating Reform." This paper has become the focus of discussions on rate design to promote least-cost energy planning.

Mitchell, Cynthia K. "Least-Cost Application and Utilization of Cost-Benefit Tests in the Evaluation of Competing Resources." Reno, Nev.: Nevada Consumer Counsel, undated. Photocopy. 12 pp.

This paper argues that existing subsidies in energy markets promote inefficient use of resources in the development and supply of energy to consumers. The paper discusses more appropriate utility resource planning and acquisition policies, criteria, and goals the paper also provides analyses and recommendations of several "tests" used to evaluate the economic costs and benefits of competing resource options.

Rosenfeld, Arthur H., Robert Mowris, and Jonathan Koomey. "Energy-Efficiency and Least-Cost Planning." Comments prepared for the California Energy Commission Conservation Programs Committee, Public Hearing on the Draft 1988 Conservation Report, Sacramento, Calif., 12 July 1988. Berkeley: University of California, Lawrence Berkeley Laboratory, Applied Science Division. 14 pp.

This paper proposes five least-cost planning solutions which could be easily implemented if utilities and California were convinced to go after the cheapest conservation alternatives: regulated rate of return for utility conservation, all-source bidding, sliding-scale fees and rebates, gasoline tax and Miles Per Gallon (MPG) fee/rebate, and a revenue neutral carbon dioxide fee/rebate program.

Ruff, Larry E. "Least-Cost Planning and Demand Side Management: Six Common Fallacies and One Simple Truth." *Public Utilities Fortnightly* 121 (28 April 1988): 19-26. 8 pp.

This article examines least-cost planning and the fundamental assumptions underlying its theory and claims that these assumptions are wrong as a matter of "simple economic logic." According to the author, utility conservation programs make sense when they help to reduce prices at which electric demand can be met. The author is concerned that regulators will adopt policies that force consumers to pay for conservation they would not buy if given a free and informed choice at efficient prices.

Sant, Roger, Dennis W. Bakke and Roger F. Naill. *Creating Abundance: America's Least-Cost Energy Strategy*. New York: McGraw Hill, 1984. 176 pp.

This book explains the hypothesis that energy should be treated as any other commodity, i.e., a commodity whose price and supply are uncertain, rather than continuing to deal with it under the aegis of a complex web of government controls and subsidies. The book also explains the

least-cost energy strategy analysis: how the energy system would function and evolve if it were to be guided by economic forces alone.

Shapiro, Lisa, Paul Markowitz, and Nancy Hirsh. *A Brighter Future: State Actions in Least-Cost Electrical Planning*. Washington D.C.: Energy Conservation Coalition, December 1987. 85 pp.

This report documents state actions from January 1986 through June 1987 in two elements of the least-cost electrical strategy, resource planning and utility conservation programs. The analytic sections highlight the variety of approaches being undertaken by different states and the issues that states have had to deal with in their least-cost electrical planning processes. Individual state descriptions are included.

Sillin, John O., and John R. Siegel. "With High Electric Demand Growth, Whither Least-Cost Planning?" *Public Utilities Fortnightly* 112 (21 July 1988): 16-21. 6 pp.

This article examines the concept of least-cost planning on the assumptions that in electric demand growth has increased, and that electricity prices, in constant dollars, have fallen. The authors claim that these premises differ from the common assumptions of least cost planning advocates, low electric demand growth and rising electric prices.

Wellinghoff, Jon B. "Cost Recovery in "Least-Cost" Utility Planning: The Forgotten Factor." Reno, Nev.: Nevada Office of Consumer Counsel, Undated photocopy. 27 pp.

The appropriate regulatory treatment for cost recovery of demand-side investments is the focus of this article. This issue is examined from a public policy perspective, with the objective of describing a regulatory mechanism which will provide optimum benefits to utilities and their rate-payers. Nevada is used as a paradigmatic example of a state which uses least-cost utility planning, but which gave little thought to cost recovery for demand-side

programs.

Wellinghoff, Jon B. "The Forgotten Factor in Least-Cost Utility Planning: Cost Recovery." *Public Utilities Fortnightly* 121 (31 March 1988): 9-16. 8 pp.

This article addresses methods for writing recovery of the costs associated with demand management and conservation measures used as part of an integrated resource planning.

Wisconsin Public Service Commission. *Organizational Barriers to the Performance of Least-Cost Planning-Related Research*. Vol. 2, Technical Application. Proposal submitted to the U.S. Department of Energy, Washington, D.C., March 1987.

The Wisconsin PSC proposed a project to study and help overcome organizational barriers to the performance of demand-side, least-cost planning-related research in Wisconsin. Two tasks are proposed: (1) a systematic review of the existing body of demand-side research conducted by Wisconsin utilities and agencies, and (2) an analysis of the potential for an independent, statewide organization to conduct demand-side research and development projects.

Woychik, Eric C. "Least-Cost Resource Plan Integration Under Uncertainty: A Standard Practice Approach." Sacramento, Calif., 21 August 1986. Photocopy. 43 pp. plus endnotes.

This paper provides a method for least-cost resource plan integration based upon the long-run avoided cost decision adopted by the California Public Utilities Commission. The method defines goals for supply and demand-side planning and an approach to reconcile the twin goals of efficiency (utility least-cost perspective) and equity (rate impact consumer perspective). This approach to cost effectiveness and to strategic resource planning is intended to provide for comparisons of various resource options and to consider uncertainty explicitly.

_____. "Toward a Standard Practice Approach to Integrated Least-Cost Utility Planning." *Public Utilities Fortnightly* 121 (3 March 1988): 27-33. 7 pp.

This article sets forth a generalized approach for the application of investment criteria and uncertainty analysis so that utilities and state regulators can pursue difficult issues in least-cost planning more rationally.

B. *Environmental Costs and Consequences of Energy Production*

Ackerman, Bruce, and William T. Hassler. *Clean Coal/Dirty Air: Or How the Clean Air Act Became a Multibillion-Dollar Bail-Out for High-Sulfur Coal Producers and What Should Be Done About It*. New Haven: Yale University Press, 1981. 193 pp.

Authors discuss the evolution of the Clean Air Act of 1970 and its impact on the future of coal-burning power plants. Types of coal-cleaning and coal-scrubbing are discussed in relation to the development and the administration of the Clean Air Act of 1970 as well as in relation to actual protection of the environment and practical aspects of installing these technologies.

Aigner, Dennis J.. "Externalities in Electricity Production." Sierra Club Economics Committee, September, 1987. Photocopy. 20 pp.

An externality is created when the actions of an economic agent affect the welfare of some other agent *not* through the market system (that is, no cost is incurred or price paid). This paper discusses the application of externalities to the production of electricity. Discussion includes measurement of externalities, of policy implications such as taxes and subsidies, and creation of markets to deal with externalities.

American Council for an Energy-Efficient Economy (ACEEE), Howard S. Geller, Eric L. Miller, Marc R. Ledbetter, and Peter M. Miller. *Acid Rain and Electricity Conservation*.

Washington, D.C.: ACEEE and Energy Conservation Coalition, June 1987. Paginated by sections.

This study demonstrates that cost effective, more efficient end-use technologies can reduce electricity consumption in the major acid rain emitting area of the midwest by 26% without lowering the level of energy services. The study uses an integrated analysis to review electricity conservation opportunities, electricity supply and acid rain abatement in the East Central Area Reliability Council Region. This region is very dependent on high-sulfur coal. The study proposes legislation which would give states and utilities an incentive to pursue efficiency investments as part of an acid rain abatement program.

Bassel, William E. "Capital and Operating Costs of Wet Scrubbers Installed on Coal-Fired Utilities Impacting the East Coast." *Journal of Air Pollution Control Association* 38 (March 1988): 327-332. 6 pp.

This paper is a description of a computer program that uses up to date information to determine the cost of installing wet limestone scrubbers at 83 utility sites. The capital costs of this installation for the top 50 sulfur oxide emitting plants will be about \$20 billion. Installation of these control devices will result in an increased cost of electricity of an average of 0.88 cents/kwh and a reduction of sulfur oxide emissions from 1980 levels of 7.1 million tons a year.

Bland, F. Paul. "Problems of Price and Transportation: Two Proposals to Encourage Competition from Alternative Energy Sources." *Harvard Environmental Law Review* 10 (1986): 345-416. 43 pp.

This article discusses arguments for encouraging competition in the electricity generating industry focusing on the success of PURPA. The article discusses the barriers qualifying facilities face in transmitting their energy, including the need for access to wheeling services and the transmission grid. The article contains a well-detailed in-

roduction to the importance of quantifying the external environmental costs of traditional central plant power production. The author advocates incorporating external costs into the PURPA determination of avoided costs.

Bonneville Power Administration (BPA). *Issue Background: Counting the Costs - How BPA Performs Environmental-Cost Analysis*. DOE/BP-405. Portland, Oreg., June 1985. 11 pp.

This booklet describes the cost-effectiveness analysis which BPA uses to evaluate environmental (or external) costs of power resources and the role public involvement can play in that evaluation. BPA is the first federal agency required to consider environmental costs so explicitly in its planning process.

Boyle, Kevin J. and Richard C. Bishop. "Valuing Wildlife in Benefit Cost Analyses: A Case Study Involving Endangered Species." *Water Resources Research* (American Geophysical Union) 23 (May 1987): 943-950. 8 pp.

This article assigns a dollar value to an endangered species. The theory and process of assigning a cost and actual estimates for the Bald Eagle and the Striped Shiner in Wisconsin are given.

California Air Resources Board. *The Benefits of Air Pollution Control in California*. Prepared by Energy and Resource Consultants, Inc., Robert D. Rowe, Project Manager. 2 vols. Boulder, Colo.: Energy and Resource Consultants, December 1986.

This study attempts to provide quantitative estimates of economic measures of benefits (or damage) to four air basins in California by controlling air pollution under five air pollution control scenarios. Physical and economic measures of air pollution control benefits are calculated for human health, agriculture, materials and soiling, forests, and visibility aesthetics. The focus of the effort was to use the best available literature, data, methods and professional judgment to estimate the economic measures

of air pollution control benefits, although conceptual and political limitations are discussed.

Ceraso, Jane, Charles B. Epstein, Sarah L. Clark, and Michael Oppenheimer. *New York City's Water Supply: Acid Deposition, Inorganic Pollution and the Catskill Reservoirs*. New York: Environmental Defense Fund, October. 1986. 138 pp.

This report gives an overall view of the New York City water supply and then concentrates on the Catskill watersheds. The report describes the Catskill watersheds, analyzes the quality of the water, and discusses health effects from chemicals such as nitrate, sodium, chloride, and aluminum. The report also includes an examination of the effects of acid deposition in soil. Predictions for the future and the importance of protecting the watersheds are discussed.

Center for Clean Air Policy. *Acid Rain: Road to a Middle Ground Solution, Report of the Dialogue on Acid Rain Policy Conducted by The Center for Clean Air Policy*. Prepared by Ned Helme and Chris Neme with quantitative analyses by ICF, Incorporated. Washington, D.C.: Center for Clean Air Policy, July 1987. 107 pp. plus appendices.

This report is a result of an analytic study of the cost of various acid rain control options for two major utilities, the American Electric Power (AEP) system and the Tennessee Valley Authority (TVA) as well as a series of discussions among major stockholders about key elements of an acid rain control program. The dialogue process addressed virtually all the aspects of acid rain control, from implementation strategies and the value of long range transport models to the role of clean coal technologies and energy conservation.

Cohen, Bernard L. "Impacts of the Nuclear Energy Industry on Human Health and Safety" *American Scientist* 64 (Sept.-Oct. 1976): 550-559. 10 pp.

This article estimates the effects on human health of radioactivity released into the environment by various aspects of the nuclear energy industry. It includes statistical comparisons of other risks that reduce life expectancy.

Commoner, Barry, Howard Boksenbaum, and Michael Corrs, eds. *Energy and Human Welfare - A Critical Analysis, Vol. I: The Social Costs of Power Production*. New York: MacMillan Information Press, 1975, for Scientists' Institute for Public Information, 1975. 217 pp.

A collection of articles concerning the environmental impact of power production, which includes articles on acid rain, oil spills, nuclear reactor safety, thermal pollution, and environmental problems caused by coal mining.

Congressional Quarterly, Inc. *Energy and Environment The Unfinished Business*. Washington, D.C.: Congressional Quarterly, 1985. 265 pp.

Part I examines environmental policies of the Reagan administration, including energy regulation, mineral leasing, and nuclear power. Part II discusses the problems and challenges that face the federal government: clean air, contaminated water, hazardous wastes, and the management of federal lands.

Critical Mass Energy Project of Public Citizen and Safe Energy Communications Council. *Turning Down the Heat: Solutions to Global Warming, An Analysis of Energy Efficiency, Renewable Resources, and Other Options Versus New Nuclear Power Development*. By Nancy Rader, Ken Bossong, Alex Antypas, and Scott Denman. Washington, D.C.: September 1988. 101 pp.

This study focuses on the generation of electricity as a contributor to the emerging global warming problem and critically evaluates the argument that nuclear power can provide a partial solution to the problem. The report concludes that other options, primarily energy efficiency, natural gas, and renewable energy technologies, are more attractive than new nuclear power development because of

their lower economic and environmental costs as well as shorter lead times.

Downing, Paul B. *Environmental Economics and Policy*. Boston: Little, Brown and Co., 1984.

This book explains the application of economic benefit/cost analysis to air and water pollution. Costs of pollution control as well as costs to health and the environment are discussed in a broad and theoretical manner. An extensive bibliography is included.

Electric Power Research Institute (EPRI). *Benefit of Environmental Controls: Measures, Methods and Application*. Prepared by Energy and Resource Consultants, Inc., Boulder, Colo. EPRI #EA-6030. Palo Alto, Calif.: Research Reports Center, October 1988. 98 pp.

This report is a useful introduction to the methods for assessing environmental damages and benefits of the economic costs of environmental controls. The report also reviews the use of these methods to assess air pollution damage and describes how underlying assumptions can significantly influence analysis results. Quantitative information is provided for illustrative purposes only.

Fisher, Anthony C. *Resource and Environmental Economics*. Cambridge: Cambridge University Press, 1981.

This book discusses the effect of energy use on the environment. The sections on computation of the economic costs of pollution are of special interest.

Fisher, Anthony C. and V. Kerry Smith. "Economic Evaluation of Energy's Environmental Costs with Special Reference to Air Pollution." *Annual Review Energy of Energy* (Palo Alto, Cal.) 7 (1982): 1-35. 36 pp.

A technical evaluation of the impact of energy on the environment accompanied by formulas for computing energy's environmental costs.

Flavin, Christopher, and Alan B. Durning. *Building on Suc-*

cess: *The Age of Energy Efficiency*. Worldwatch Paper 82. Washington, D.C.: Worldwatch Institute, March 1988. 74 pp.

This paper's premise is that energy efficiency is an economic opportunity for the nineties as well as an environmental necessity. Authors use a variety of interesting statistics and examples to demonstrate that improved efficiency means less fuels burned, a reduction in urban air pollution and acid rain, and "the only means available" to reduce carbon dioxide emissions from fossil fuel combustion as well as being a key ingredient to economic success.

Ford, D.F., T.C. Hollocher, H.W. Kendall, J.J. MacKenzie, L. Scheinman, and A.S. Schurgen. *The Nuclear Fuel Cycle: A Survey of the Public Health, Environmental and National Security Effects of Nuclear Power*. 2 vols. Washington, D.C.: Union of Concerned Scientists, 1973. 291 pp.

This report encompasses the storage and disposal of high level wastes, the health hazards of uranium, and the radiological impact on the area surrounding a nuclear reprocessing plant.

Freedman, Anne Kolker, and Jeffrey C. Cohen. *The Environmental Impact of Supplying Power to the Con Edison Service Territory: 1975 - 1990*. New York: Citizens for Clean Air, Inc., 1975. 155 pp.

This report is divided into five major topics: (1) an examination of electrical supply and demand in the Con Edison service area including history, background information, current data and projections; (2) nuclear power, including fuel-handling, plant operations and waste storage; (3) effects on water and aquatic life by thermal pollution and toxic substances; (4) air pollution: sulfur dioxide, particulates, oxides of nitrogen and future issues; and (5) present and future plant sites and the regulation of siting, and a discussion of transmission facilities, including environmental considerations. The report is dated but may still

be useful for the New York area.

Freeman III, A. Mvrick. *The Benefits of Environmental Improvement: Theory and Practice*. Baltimore, Md.: Johns Hopkins University Press, 1979; for Resources for the Future, Inc. 272 pp.

This book provides guidelines for placing a dollar value on the environmental effects of pollution, including changes in property values, morbidity, values for recreational benefits, and productivity benefits. Although this work is a theoretical and instructive treatment, specific references are given for each subtopic.

Gaines, Linda, R. Stephen Berry and Thomas Veach Long, II. *TOSCA: The Total Social Cost of Coal and Nuclear Power*. Cambridge, Mass.: Ballinger Publishing Co., 1979. 126 pp.

This book explains the calculation of costs associated with coal plants and nuclear energy. The "total social cost analysis" includes damage to property, health effects, damage to human life, and other environmental effects. Formulas for determining costs and examples are given.

Gibbons, John H., and William U. Chandler. *Energy - The Conservation Revolution*. New York: Plenum Press, 1981. 276 pp.

Of special interest in this thorough treatment of energy conservation is a discussion of the elements of demand analysis and a detailed examination of the environmental effects of power plants by pollutant.

Glass, Norman R., ed. *Environmental Effects of Increased Coal Utilization: Ecological Effects of Gaseous Emissions From Coal Combustion*. Washington, D.C.: U.S. Environmental Protection Agency, 1978. 50 pp.

This report was written at the request of the DOE in response to a Presidential environmental message. The report examines the ecological effects of oxides of sulfur

complex, oxides of nitrogen complex, the particulate complex, the photochemical oxidant complex, and acid precipitation. Effects on the ecosystem, effects on materials such as metals, textiles and paper, and effects on visibility are discussed.

Hill, Philip G. *Power Generation, Resources, Hazards, Technology and Costs*. Cambridge: Massachusetts Institute of Technology Press, 1977.

This book includes a chapter "Power and the Environment" which considers the hazards to the environment, which may also damage man. Human hazards due to power generation include occupational dangers in the mining, transporting, and processing of fuel. The chapter emphasizes local effects of fuel extraction, transportation, and utilization and also includes a discussion of global problems of environmental heating.

Hohmeyer, Olav. *Social Costs of Energy Consumption: External Effects of Electricity Generation in the Federal Republic of Germany*. Berlin: Springer - Verlag, 1988. 125 pp.

This study describes the environmental impacts of electricity generation based on fossil fuel combustion or nuclear power and compares the effects of electricity generated from wind and solar energy. Wherever possible, monetary values (in Deutschemark) are assigned to external effects such as the damage done to human health, agriculture, and materials. The effects of energy generation on climate and the anticipated rate of depletion of nonrenewable resources are also discussed. The study concludes that inclusion of external effects would improve the competitive position of renewable energy sources.

Holdren, John P. "Energy and the Human Predicament." Prepared as a chapter in *Earth and the Human Future: Essays in Honor of Harrison Brown*, edited by Kirk R. Smith, Fereidun Fesharaki, and John P. Holdren. Boulder, Colo.: Westview Press, 1985. Reprinted as Report No.

ERC-85-3. Berkeley, Calif.: University of California, Energy and Resources Group, May 1985. 25 pp. plus tables.

This paper reviews the reasons for supposing that energy remains a fundamental problem for human society. The author concludes that the world suffers simultaneously from the consequences of having too little energy, as may be the case in developing nations, and too much energy of a costly or risky kind, the risks of which include disruption of supply, environmental consequences, and nuclear proliferation. References and statistics supporting the author's argument include a table detailing environmental liabilities of energy opinions.

Jessup, Phillip. *Strategies for Reducing the Cost of Acid Rain Controls Electricity Demand-side Management and Clean Coal Technologies*. Washington, D.C.: Environmental and Energy Study Institute, January 1988. 53 pp.

This report is a response to concerns that acid rain controls will have potentially adverse effects upon electricity rates and jobs, especially in the midwest. The report explores alternatives to scrubbers and other conventional controls including clean coal technologies and electricity demand-side management strategies such as load management, conservation and cogeneration. These alternatives could present opportunities for reducing the overall cost of acid rain legislation.

Kaplan, Seymour. *Energy Economics: Quantitative Methods for Energy and Environmental Decisions*. N.Y.: McGraw-Hill, 1983. 352 pp.

This book explains various mathematical tools that can be used to quantify energy costs and help with decision-making. Topics covered include energy investment, risk analysis, allocation of limited energy resources, and environmental costing.

Kneese, Allen V. *Measuring the Benefits of Clean Air and Water*. Baltimore, Md.: Johns Hopkins Press, 1984; for Resources for the Future. 159 pp.

This book discusses benefit/cost analysis and its application to calculating the environmental effects of air and water pollution, and placing values on clean air and water. Effects on human life, wages, agriculture, and visibility are covered. There is an extensive bibliography.

- Lave, Lester B., and Lester P. Silverman. "Economic Costs of Energy Related Environmental Pollution." *Annual Review of Energy* (Palo Alto, Calif.) 1 (1976): 601-28. 28 pp.

This article presents the theory of benefit/cost analysis and explains its application to environmental decisions. Authors attempt to assign dollar values to the cost of environmental damage caused by air pollution resulting from the burning of fossil fuels. The damages assessed include damage to human health, visibility, quality of life, plants and animals, and water resources.

- Lovins, Amory. "Cost-Risk-Benefit Assessments in Energy Policy." *George Washington Law Review* 45 (August 1977): 911-943. 33 pp.

This article critically examines the then current methods for performing cost-risk-benefit assessments and concludes that those methods scientifically irredeemably defective, useless and dangerous. The author outlines the basis for his skepticism and examines the problems of evaluating benefits, risks, the monetary value of risks, and direct costs, the difficulty of comparing these quantities, and the use of these comparisons in decision-making.

- Lovins, Amory B., L. Hunter Lovins, Florentin Krause, and Wilfrid Bach. *Least-Cost Energy: Solving the CO2 Problem*. Andover, Mass.: Brick House Publishing Co., 1981. 184 pp.

This work is thorough discussion of the use of energy-efficiency as a necessary means of controlling carbon dioxide pollution and thus averting global warming. The chapters explain the forecasting of energy use, the kinds of energy needed, and sustainable sources of energy. Authors also examine strategies for implementing energy-efficiency and

the serious costs of failure to pursue energy efficiency.

MacKenzie, James J. and Mohamed T. El-Ashry. *Ill Winds: Airborne Pollution's Toll on Trees and Crops*. Washington, D.C.: World Resources Institute, September 1988. 74 pp.

This report presents evidence that air pollutants are contributing to current forest and agricultural losses in the United States and explores policy options to reduce these losses. The analysis shows that multiple pollutants, including acidic compounds and ozone, are contributing to the problem. Policy recommendations are made within a broad framework for national energy planning and not in terms of regulating individual sources of pollution to meet ambient air standards.

New York. Senate Committee on Environment, Conservation, and Recreation. *Acid Rain: An Intergovernmental Policy Forum, Summary Report of the Proceedings*. Held at Albany, NY, 7-8 February 1984. 94 pp.

This brief survey of the nature, sources, and environmental impact of acid rain focuses on New York and the Adirondack Mountain Region and discusses approaches to solving the acid rain problem.

Ohio Office of Consumers' Counsel. *Clearing the Air: Using Energy Conservation to Reduce Acid Rain Compliance Costs in Ohio*. By Paul A. Centolella. 2 vols. Columbus, Ohio: Ohio Office of Consumer Counsel, July 1988. 190 pp.

This study reports the potential for energy conservation and the impact it could have on sulfur emission reduction programs for Ohio electric utilities. Specific suggestions for legislation which would control acid rain through energy conservation are made. The separate volume of technical appendices includes detailed discussion of the methodology for conservation analysis and integrated electric utility planning model documentation.

Organization for Economic Co-operation and Development (OECD). *The Costs and Benefits of Sulphur Oxide Control: A Methodological Study*. Paris: OECD, 1981. 164 pp.

This report examines the effect of sulphur dioxide (SO₂) on health, materials, crops, and ecosystems. The study computes the annual costs of emissions for each member country and also gives the dollars per ton of SO₂ removed. Other costs are computed: the cost of agricultural crop damage, and the costs of damage to materials, health and ecosystems. The OECD member countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, the Federal Republic of Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

_____. *Environmental Effects of Electricity Generation*. Paris: OECD, 1985. 154 pp.

A thorough report of every aspect of the environmental effects of electricity generation that are associated with coal, gas, nuclear, and oil plants. The environmental effects of renewables such as solar, wind, hydro, geothermal, and biomass are also covered. Includes an extensive list of references.

Owens/Corning. "Energy Conservation and Indoor Air Quality," January 1981. 16 pp.

This paper concerns the quality of indoor air and how it relates to energy efficient homes. Indoor pollutants are discussed individually and in detail, along with explanations of their origins and effects on health.

Ramsay, William. *Unpaid Costs of Electrical Energy: Health and Environmental Impacts from Coal and Nuclear Power*. Prepared for the National Energy Strategies Project. Baltimore: John Hopkins University Press, 1979; for Resources for the Future, Inc. 180 pp.

This study explores the various environmental effects of coal and nuclear plants, including effects on health to workers and to the general public, climate and costs of control of hazards and clean-up.

Renew America. *Reducing the Rate of Global Warming: The States' Role*. Prepared by Sheila Machado and Rick Pitz. Washington, D.C.: Renew America, November 1988. 33 pp.

This report attempts to track and quantify individual state carbon dioxide emissions contributing to the greenhouse effect, as well as state policies that may help reduce the rate of global warming. Of particular interest are matrices summarizing carbon emissions resulting from electricity production and associated policy recommendations.

Ridker, Ronald G., and William D. Watson. *To Choose A Future: Resource and Environmental Consequences of Alternative Growth Paths*. Baltimore, Md.: Johns Hopkins University Press, 1980; for Resources for the Future. 463 pp.

This book presents scenarios of environmental problems that the United States may face during the next fifty years. One chapter covers world and domestic energy demand and supply, renewables, and nonrenewables. Other chapters survey United States energy policy, the effect of energy policy on the United States economy, costs of pollution control, and environmental problems associated with energy use.

Schurr, Sam H., *Energy in America's Future: The Choices Before Us: A Study by the Staff of the RFF National Energy Strategies Project*. Baltimore, Md. 2 vols. Johns Hopkins University Press 1979; for Resources for the Future, Inc. 555 pp.

This book discusses energy conservation at length, including its relationships to energy consumption and the United States economy. Projections are made for future

energy consumption and various sources of supply are examined, including renewables and synthetic fuels. Of special interest is Part IV, which concerns the health and environmental effects of electric power generation. Part IV includes references to studies that have assigned costs to the environmental and health effects of electric power generation. The impact of power generation on land use and water quality is also examined.

Scott, David, L. *Pollution in the Electric Power Industry: Its Control and Costs*. Lexington, Mass. D.C. Heath and Company, Lexington Books, 1973. 104 pp.

This book explains how economics can be used to examine the environmental effects of energy generation and of pollution control and includes an overview of the electric power industry.

Spencer, D.F., S.B. Alput, and H.H. Gilman. "Cool Water: Demonstration of a Clean and Efficient New Technology." *Science* 232 (2 March 1986): 609-612. 4 pp.

"Cool Water" is the world's first commercial scale (100 mw) integrated coal gasification combined cycle power plant that has been operating in Barstow, California since May 1984. The article shows that future baseload power plants using this technology can be built modularly and compete economically with much larger, conventional coal-fired power plants equipped for flue gas desulfurization. An elaborate environmental monitoring program has confirmed that Cool Water emissions are at a level comparable or superior to those of a power plant burning natural gas.

Stoloff, Jonathan, Karen L. Mallory and Lisa R. Stearns. "Legal Issues Raised by the Environmental Impacts of Photovoltaic Energy and Wind Energy Conservation Systems." *Columbia Journal of Environmental Law* 11 (1986): 379-416. 37 pp.

This article focuses on the potential environmental consequences of using the sun and wind as primary sources of

energy for generation of electricity. The article is part of a special symposium issue on legal issues arising from the Audubon Energy Plan 1984.

U.S. Congress. Office of Technology Assessment. *Acid Rain and Transported Air Pollutants: Implications for Public Policy*. OTA-0-204. Washington, D.C., June 1984. 323 pp.

This book contains a detailed exploration of air pollutants, including policy options and concerns, risks of damage and control relating to transport of air pollutants, and the regional distribution of risks. The book evaluates the legislative options available to Congress and makes some legislative proposals. Statistics and estimates of the costs of control of emissions are included, as well as outlines of major state regulatory policies. The book is summarized in a small booklet of the same title.

U.S. Department of Energy. *Report to Congress on Emerging Clean Coal Technologies*. Submitted in response to section 321 of the Department of the Interior and Related Agencies Appropriations Act for Fiscal Year 1985 as enacted by House Joint Resolution 648, Public Law 98-473, 98 Stat. 1874. Washington, D.C., 1 May 1985. 268 pp.

This report describes emerging clean coal technologies including fluegas cleanup, fluidized bed combustion, surface coal gasification, coal preparation, heat engines, advanced combustors, alternative fuels, fuel cells, coal liquefaction, underground coal gasification, gas stream cleanup, magnetohydrodynamics, and non-technology specific measures. The report discusses the environmental aspects of each technology and estimated costs of each technology.

Bonneville Power Administration (BPA). *Resource Analysis Documentation: 1987 Resource Strategy*. DOE/BP-823. Portland, Oreg.: BPA, May 1987. 221 pp.

This report discusses the economic effects of several resource alternatives and the impact of each alternative on the Pacific Northwest power system. An examination of the environmental costs of the various types of electric

power generation is included.

C. *Conservation (General)*

Center for Strategic and International Studies. *The Critical Link: Energy and National Security in the 1980s*. Project directed by Charles K. Ebinger. Rev. ed. Cambridge, Mass. Ballinger Publishing Co., 1983.

This book first discusses "the roots of the energy crisis" and "the role of conservation in reducing oil imports." Preparation for an emergency and both long-term and short-term solutions are discussed, as are the economic ramifications of United States dependence on imported oil, national security risks, and United States foreign policy.

Chandler, William U., Howard S. Geller, and Marc R. Ledbetter, eds. *Energy Efficiency: A New Agenda*. Washington, D.C.: American Council for an Energy Efficient Economy, July 1988. 76 pp.

This report describes six energy-efficient policies critical to meeting the goal of reducing the United States energy intensity (the rate of energy used per dollar of economic output) by 2.5 percent per year into the next century. While not advocating saving energy as an end in itself, the authors assert that energy efficiency makes sense only when it saves energy at less cost than new energy supplies. Environmental damage and security risks should be included in the comparison.

Claxton, John D., C. Dennis Anderson, J. R. Brent Ritchie, Gordon H. and G. McDougall, eds. *Consumers and Energy Conservation: International Perspectives on Research and Policy Options*. N.Y.: Praeger Publishers, 1981. 304 pp.

This compilation of reports from the International Conference on Consumer Behavior and Energy Use, includes analyses of household energy use in general and also as to subclasses of the population such as teenagers and the

elderly. Research data concerning consumer adoption of solar power and conservation measures along with overviews of various conservation, information, and incentive programs are also included.

Darmstadter, Joel, Hans H. Landsberg, and Herbert C. Morton with Michael J. Coda. *Energy Today and Tomorrow: Living with Uncertainty*. New York: Prentice-Hall, Inc., 1983; for Resources for the Future. 233 pp.

This book surveys energy conservation, resources, research and development, and environmental consequences of energy from an economic standpoint. The "energy problem" is examined from the perspectives of the private consumer, the commercial consumer, the utility, and the government.

Dukerley, Joy, William Ramsay, Lincoln Gordon, and Elizabeth Cecelski. *Energy Strategies for Developing Nations*. Washington, D.C.: Resources for the Future, 1981. 265 pp.

This book examines the impact of energy supply and use by developing countries on the world energy situation. Fossil fuels, renewable energy sources, and conservation are discussed in an effort to analyze energy crises in relation to economic development and explore possibilities for growth.

Flavin, Christopher. *Electricity's Future: The Shift to Efficiency and Small-Scale*. Worldwatch Paper 61. Washington, D.C.: Worldwatch Institute, 1984. 70 pp.

This report argues that small scale power production and energy efficiency and load management will replace the lack of competition hitherto seen in the industry. The report calls for a major fundamental structural changes in the electricity business, but primarily discusses the economic and environmental benefit of small power producers, renewables, and conservation.

Flavin, Christopher, Dennis Hayes, and James MacKenzie. *The Oil Rollercoaster: A Call to Action*. Washington,

D.C.: The Fund for Renewable Energy, April 1987. 21 pp.

The authors launch a vigorous attack on the failure of the Reagan Administration to ensure the nation's energy security. They emphasize that fuel efficiency standards, appliance standards and most credits for renewable energy have been abolished, opposed, or drastically curtailed despite the efforts of three previous administrations to support these critically important measures.

Ford Foundation. *Energy: The Next Twenty Years*. By a study group sponsored by The Ford Foundation and administered by Resources For The Future; Hans H. Landsberg, Chairman. Cambridge, Mass.: Ballinger Publishing Company, 1979. 628 pp.

This report encompasses energy policy, energy and its relationship to the economy, world energy resources, conservation, renewables, nuclear power, and plant siting and regulation. Of special interest are the chapters on coal and climate change, pollutants from coal and their connection with human health and the environment, air pollution control, and a chapter on energy research and development. A glossary of terms is included.

Geller, Howard S., Jeffery P. Harris, Mark D. Levine, and Arthur H. Rosenfeld. "The Role of Federal Research and Development in Advancing Energy Efficiency: A \$50 Billion Contribution to the U.S. Economy." *Annual Review of Energy*, Palo Alto, Calif., 12 (1987): 357-396. 42 pp.

This article discusses the consequences of proposed fiscal year 1987 budget cuts of 60% on top of previous budget reductions totalling nearly 50% since 1980. It explains the compelling economic and security reasons for maintaining federal energy conservation research and development at least at current funding levels. It then recounts the development of seven energy conservation technologies in lighting, windows, and appliances. In hastening the commercialization of these technologies by two to five years, federal conservation research and development will save

United States consumers \$68 billion over the next 25 years.

Gever, John, et al. *Beyond Oil: The Threat to Food and Fuel in the Coming Decades*. Cambridge, Mass.: Ballinger Publishing Company, 1986; for Carrying Capacity, Inc. 304 pp.

This book discusses the depletion of world energy resources, the concept of "carrying capacity," and how that concept relates to future food and energy needs of the United States and the world. The impact of declining resources on the domestic and world economy and the necessity to control population and energy use are discussed.

Goldemberg, José, Thomas B. Johansson, Amulya K.N. Reddy, and Robert Williams. *Energy for Development*. Washington, D.C.: World Resource Institute, September 1987. 89 pp.

This is a far-reaching study of the relationship between Third World development and future patterns of energy use. Over the next century, 95% of all projected population growth on the planet will take place in the developing world. Emphasizing the costs of energy growth - air and water pollution, land disturbance, nuclear proliferation and global climate change - the authors assert that developing countries need to adopt energy use strategies that are far more efficient than present or past practices in the industrialized world.

_____. *Energy for a Sustainable World*. Washington, D.C.: World Resource Institute, 1987. 119 pp.

This report presents the major findings of the End-Use Global Energy Project (EUGEP), of which the authors are co-organizers. The report addresses the question of how to satisfy economic goals without running up against severe environmental constraints. The authors detail a number of energy innovations that will come into wide use through the normal workings of the market, such as

new compact fluorescent light bulbs that are three to five times as efficient as incandescents, and suggest a number of public sector interventions, such as eliminating energy subsidies that would help implement an energy-efficient future.

Hirst, Eric, Robert Marlay, David Greene, and Richard Barnes. "Recent Changes in U.S. Energy Consumption: What Happened and Why." *Annual Review of Energy*, (Palo Alto, Calif.) 8 (1983): 193-245. 53 pp.

This article explains the difference in energy trends in the late 1970s and early 1980s as compared to the 1950s and 1960s. Charts compare energy use to GNP and energy use to energy price. Interesting data is presented on energy savings achieved through DOE conservation programs as well as the percent of residential and commercial buildings, industries, and transportation authorities that have utilized conservation methods and the respective changes in energy consumption.

Kelly, Henry C. "Testimony of Henry C. Kelly, Senior Associate Office of Technology Assessment, Before the House Budget Committee Task Force on Community and Natural Resources." 100th Cong. 1st Sess., 15 July 1987. Photocopy. Unpaginated.

The author's position is that energy productivity has become an important determinant of the United States' position in international trade. He demonstrates the direct role petroleum imports continue to play in United States trade; how the embodied cost of energy affects the cost of United States imports; and how the efficiency of foreign products can give foreign suppliers an advantage in domestic markets. He uses the specific problem of energy efficiency research and the home conservation industry to illustrate these points. This testimony is based on a 1986 study by the Office of Technology Assessment titled *Technology, Trade and the United States Residential Construction Industry*.

Kosmo, Mark. *Money to Burn? The High Costs of Energy*. Washington, D.C.: World Resources Institute, 1987. 68 pp.

This report is an analysis of government subsidies and pricing of oil, electricity, coal and natural gas consumption in thirty-two countries around the world. The author demonstrates how public subsidies of energy production and consumption drain government coffers, encourage resource depletion, and dampen prospects for economic growth.

Lovins, Amory B. *Soft Energy Paths: Toward a Durable Peace*. Cambridge, Mass.: Ballinger Publishing Company, 1977; for Friends of the Earth, Inc.

This book compares the soft energy path to the hard energy path, analyzing the economic, social, political and environmental aspects of each path.

Lovins, Amory B., ed. *An Energy Security Reader*. Snowmass, Colo.: Rocky Mountain Institute, 1987. Unpaginated.

This compilation of papers and articles by Mr. Lovins and his associate addresses the issues of energy security. The papers included are nontechnical in nature and range in issues from acid rain emissions to maintaining reliable access to affordable energy for all nations' energy development. The papers provide an overview of the positions and reasoning of the Rocky Mountain Institute.

Lovins, Amory B., and his critics. *The Energy Controversy*. Edited by Hugh Nash. Washington, D.C.: Friends of the Earth, Inc., 1979. 450 pp.

In December 1976, Mr. Lovins testified before a joint hearing of two joint U.S. Senate Committees. This testimony was based upon his article "Energy Strategy: The Road Not Taken?" This book juxtaposes Mr. Lovins' testimony against the comments of his critics and his rebuttals.

Mills, Evan and Arthur H. Rosenfeld. *Managed Versus Unmanaged 7-Year Electric Growth: Californians Needed 3 New Plants, Texans Needed 11*. LBL-22932, preprint submitted to *Physics and Society*. Berkeley: University of California, Lawrence Berkeley Laboratory, Applied Science Division, 11 February 1987.

California's mandatory building and appliance efficiency standards, aided by a few billion dollars of utility conservation programs, have greatly slowed projected growth of electricity demand in that state. Electricity demand is growing much more slowly in California than in Texas where almost no energy-efficiency standards have been imposed. Recently Texas has begun trying to control this growth.

Oak Ridge National Laboratory. *Conservation and Renewable Energy Program - Bibliography*. Compiled by Kathi H. Vaughan. ORNL/CON-254. Oak Ridge, Tenn., April 1988; available from National Technical Information Service, Springfield, Va. 90 pp.

This bibliography covers reports and papers issued by the ORNL Conservation and Renewable Energy Program from 1980 through February 1988. The bibliography indicates which sources are currently available from ORNL. Listings are grouped by topic but are not annotated. Topics include technology-based research such as building envelope and thermal energy storage, as well as analysis and evaluation and residential conservation service.

Organization for Economic Co-operation and Development (OECD). *Energy Conservation: The Role of Demand Management in the 1980s*. OECD, Paris, 1981. 68 pp.

A brief examination of demand-side management including both commercial and residential customers as well as transportation. The role of government in pricing and regulation is discussed. Charts include statistics from OECD member countries concerning the implementation of energy conservation measures and energy consumption.

Parker, Sybil R., ed. *Mcgraw-Hill Encyclopedia of Energy*. 2nd ed. New York: McGraw-Hill, 1981. 838 pp.

Part I, "Energy Perspectives", contains chapters on conservation, energy choices, the analysis of risks, energy consumption, the outlook for fuel reserves, and environmental protection. Part II, "Energy Technology", contains encyclopedic descriptions of energy terminology and concepts, including diagrams and charts.

Rosenfeld, Arthur H. "Conservation, Competition and National Security." Testimony at Hearing on Energy Security: The Role of Conservation in the National Energy Picture before the Subcommittee on Energy and Power, of the House Committee on Energy and Commerce, 4 November 1987, with some concluding remarks made at the 15th Illinois Energy Conference, University of Illinois at Chicago, 10-11 November 1987. LBL-24755, EEB 87-9. Berkeley: University of California, Lawrence Berkeley Laboratory, Applied Science Division. 28 pp.

This article discusses how far the United States and the OECD have come over the last fourteen years toward improving the efficiency of energy use. Although the United States spends "only" eleven percent of its GNP on energy, Japan spends only five percent of its GNP on energy. Conservation in general is discussed, but most of the examples focus on buildings, the sector accounting for thirty-eight percent of the 440 billion annual U.S. energy bill.

Rosenbaum, Walter A., ed. *Energy, Politics, and Public Policy*. 2d ed. Washington, D.C.: CQ Press, 1987. 221 pp.

An exploration of United States energy policy from a political standpoint. Topics covered include the history of federal energy policy from Nixon through Reagan, environmental and technological constraints, nuclear power, coal policy, and conservation policies.

Savitz, Maxine. "The Federal Role in Conservation Research and Development." In *The Politics of Energy Research*

and Development, edited by John Byrne and Daniel Rich. Vol. 3 Energy Policy Studies. New Brunswick, N.J.: Transaction Books, 1986. 181 pp.

This article stresses the need to view conservation not just as a means to avoid energy waste. Long-term conservation should lead to the production of more goods and services per unit of energy consumed. The article addresses the appropriate national strategy for encouraging conservation and the role of federal research and development funding.

Sawyer, Stephen W., and John R. Armstrong, eds. *State Energy Policy: Current Issues, Future Directions*. Boulder, Colo.: Westview Press, Inc., 1985. 307 pp.

This interesting discussion of state energy policy includes chapters on residential conservation programs, low-income conservation programs, renewable energy programs, and selected state programs with particular emphasis on California. Charts included contain statistics from various programs. The roles of the public utility commissions and the state energy institutions are also discussed.

Stobaugh, Robert and Daniel Yergin, eds. *Energy Future: Report of the Energy Project at the Harvard Business School*. N.Y.: Random House, 1979.

This book discusses energy issues such as price and supply of oil and supports conservation and solar energy as alternatives to coal, oil, gas, and nuclear power. It contains an extensive list of references.

U.S. Department of Energy (DOE). Office of Buildings and Community Systems (BCS). *Analysis and Technology Transfer Annual Report - 1987: Buildings and Community Systems*. Prepared by Brookhaven National Laboratory. DOE/CH/0016-H1. Washington, D.C.: DOE, July 1988; available from National Technical Information Service, Springfield, Va. Paginated by sections.

This report summarizes the analytical and technology

transfer activities undertaken on behalf of BCS during 1987. The report includes current information summarizing historical data on energy consumption patterns, prices and building characteristics and discusses BCS projections of residential and commercial energy consumption. Names of contact persons are included for activities described.

United States Department of Energy. *Energy Security: A Report to the President of the United States*. Washington, D.C., March 1987. 239 pp. plus appendices.

This report includes chapters on the energy outlook for the world, the status of United States oil resources, energy efficiency, the natural gas situation, coal and nuclear power as alternatives to oil, renewable energy sources, and preparedness for energy emergencies.

Yulish, Charles B., ed. *Soft vs. Hard Energy Paths: 10 Critical Essays on Amory Lovins' "Energy Strategy: The Road Not Taken?"* N.Y.: Charles Yulish Associates, Inc., 1977. 138 pp.

This book is a collection of critiques of the Lovins' essay "Energy Strategy: The Road Not Taken?" by economists, engineers, and other experts.

D. *Energy Efficiency Technology (Equipment, Appliances, and Buildings)*

American Council for an Energy-Efficient Economy (ACEEE). *ACEEE 1988 Summer Study on Energy Efficiency in Buildings*. 12 vols. Washington, D.C.: ACEEE, August 1988.

This Summer Study examines the role of energy conservation in today's changing economic and political environment. The study also examines the economic, political, social and environmental costs of not pursuing conservation strategies. It addresses the role that energy efficiency plays in ensuring economic health and competitiveness and mitigating global and regional environmental

problems. The conference proceedings include eleven volumes of technical papers and project summaries and an index volume. Each volume is organized by panel topic. The volumes are: I. Single-family Building Technologies (176 pp.); II. Multi-family Building Technologies (194 pp.); III. Commercial and Industrial Building Technologies (231 pp.); IV. Appliances and Equipment (143 pp.); V. National and Regional Conservation Programs (139 pp.); VI. Utility and Private Sector Conservation Programs (194 pp.); VII. Community and Local Government Conservation Programs (121 pp.); VIII. Planning and Forecasting (292 pp.); IX. Program Evaluation (222 pp.); X. Performance Measurement and Analysis (285 pp.); XI. Behavior and Lifestyle (164 pp.).

_____ . *The Most Energy-Efficient Appliances - 1988 Edition*. Washington, D.C.: ACEEE, 1988. 24 pp.

This listing of efficient freezers, refrigerators, dishwashers, clothes washers, water heaters, air conditioners, heat pumps, furnaces, and boilers, includes brand and model number of the appliance, amount of electricity used per year, and energy cost per year.

American Gas Association (AGA). Foreign Technology Assessment Task Force. *Report on Assessment of Foreign Residential and Commercial Appliance and Equipment Technology*. Arlington, Va.: AGA, July 1985.

This report surveys developments in gas heating and cooking appliances and specialized equipment in foreign countries and their advances over models produced in the United States. Countries covered are the United Kingdom, France, Germany, and the Netherlands.

Association of Energy Engineers. *Advances in Energy Productivity*. Based on presentations made at the Fifth World Energy Engineering Congress on 14-17 September 1982. Atlanta, Ga.: Fairmont Press, Inc., 1982. 508 pp.

A voluminous compilation of papers based upon presentations at the Fifth World Energy Engineering Congress

which was sponsored by the Association of Energy Engineers and supported by U.S. Department of Energy's Office of Industrial Programs. The papers encompass a wide range of topics; some topics are broad and general, such as cogeneration, load management, and energy policy. Other topics are very specific, such as "A Proposed Method for the Selection of Buildings with the Greatest Potential for Energy Conservation," "A Realistic Engineering Approach to Significant Retrofit Energy Conservation in Typical Medium-Sized Hospital Facilities," and "Improving Energy Productivity Through Better Manufacturing Processes."

California. Office of Appropriate Technology. *Present Value: Constructing a Sustainable Future*. By Gigi Coe. San Francisco, Calif.: Friends of the Earth, 1979. 81 pp.

This book contains many examples of energy-saving technologies and renewable sources of energy used in both residential and commercial buildings in California. The resume for each structure includes information on the cost to build the structure, its size, its special energy-saving systems, and the amount of the energy savings.

California Energy Commission. *Energy Efficiency in California's Commercial, Industrial and Agricultural Sectors: Progress and Prospects*. Sacramento, Calif., 4 November 1981. 155 pp.

This report summarizes the savings potential for energy in California's nonresidential sector. The report begins by showing that the goal of twenty percent savings by 1985 is possible, and shows that there is opportunity for further savings while pointing out the potential barriers to achieving more savings.

Center for Building Science. Lawrence Berkeley Laboratory. University of California. *1986 Annual Report*. Berkeley, May 1987. Paginated by section.

The report details the potential enormous savings for the United States society from energy efficient buildings. The

report is divided into the categories of work based on the Center's research: Building Energy Programs, Indoor Environment Programs, Windows and Lighting Program, and Energy Analysis Program.

Center for Energy and Environmental Studies. Princeton University. *Princeton at Asilomar - 1988*. PU/CEES Report No. 227. Princeton, N.J., 1988. 152 pp.

This compilation contains technical papers by researchers from the Center for Energy and Environmental Studies at Princeton University. These papers were presented at the Summer Study on Energy Efficiency in Buildings sponsored by American Council for a Energy-Efficient Economy. The topics include space heating, air conditioning, and office computer efficiency.

Center for Information Sharing. *How to Reduce Energy Costs in Your Building*. Boston, Mass: Center for Information Sharing, 1983.

This consumer-oriented guide includes information on lighting, heating and hot water, air conditioning, and building envelope.

Consumers Union of United States, Inc. *Consumer Reports Money-Saving Guide to Energy in the Home*. By the Editors of Consumer Reports Books. Mount Vernon, N.Y.: Consumers Union of United States, 1982. 141 pp.

This consumer-oriented book discusses various energy-saving methods for heating, cooling, and appliances. The book discusses the costs/savings and the advantages/disadvantages of each energy-saving suggestion. It includes a guide to dealing with contractors and a guide to federal and state conservation programs.

Geller, Howard S., American Council for an Energy-Efficient Economy (ACEEE), and Energy Conservation Coalition. *Energy Efficient Appliances*. Washington, D.C.: ACEEE, June 1983. 48 pp.

This report explains the benefits of using more efficient appliances, surveys the domestic and foreign appliance market, looks at the available government programs and utility programs, and discusses consumer education materials. It also outlines other important issues that need to be considered such as advertising and research and development.

Goldstein, David B., Peter M. Miller, and Robert K. Watson. "Developing Cost Curves for Conserved Energy in New Refrigerators and Freezers: Demonstration of Methodology and Detailed Engineering Results." Natural Resources Defense Council, San Francisco, Cal., and American Council for an Energy-Efficient Economy, Washington, D.C., 15 January 1987. Photocopy. 19 pp plus tables.

This paper develops and demonstrates a procedure for determining the cost of conserved energy for residential refrigerators and freezers, and for ranking conservation measures in economically and practically defensible orders of merit. It serves as a technical appendix to the paper "Developing Cost Curves for Conserved Energy in New Refrigerators and Freezers" presented at the American Council for an Energy-Efficient Economy, 1986 conference in Santa Cruz, CA. The Santa Cruz paper showed how energy savings of eighty percent or more compared to the energy use of a typical 1985 refrigerator could be achieved at a cost much lower than that of conventional energy supply.

Greenberg, Steve, Jeffery P. Harris, Hashem Akbari, and Anibal de Almeida. *Technology Assessment: Adjustable-Speed Motors and Motor Drives*. LBL - 25080. Berkeley: University of California, Lawrence Berkeley Laboratory, Energy Analysis Program, 1988.

This report analyzes information on the approximately sixty percent of the electrical energy generated in the United States that is consumed by electric motors in end-uses ranging from residential refrigerators to industrial

fans and pumps. The authors show that matching motor speed to the demands imposed in the driver load can result in significant energy savings: typically 20-25% for residential and commercial heating, ventilation and air conditioning (HVAC) fans. Similar savings are possible in refrigeration systems. [This annotation is based on a two page abstract.]

Hafemeister, David. "Science and Society Test X: Energy Conservation." *American Journal of Physics* 55 (April 1987): 307-314. 8 pp.

This technical article discusses the physics behind some improvements in end-use efficiency: (1) buildings (scaling laws, "free-heat", super-insulated houses, thermal storage in large buildings, off-peak cooling); (2) solar energy; (3) utility load management ("smart meters", capital recovery fees, voltage control); (4) appliances (life-cycle costs, refrigerators); and (5) lighting.

Hafemeister, David, Henry Kelly, and Barbara Levi, eds. *Energy Sources: Conservation and Renewables*. AIP Conference Proceedings, number 135. N.Y.: American Institute of Physics, 1985. 673 pp.

The chapters in this book were initially presented at a conference held at the Congressional Office of Technology Assessment in Washington, D.C., in April 1985. It presents the results of a decade of research since 1974, the year in which the physics community first responded to the "energy crisis" by conducting a summer study at Princeton University. Papers are categorized into chapters titled: Technical Progress and Policy Options; Energy and Buildings; Windows, Lighting, Appliances and HVAC; and Electricity and Renewables.

Harding, Jim, and the staff of International Project for Soft Energy Paths. *Tools for the Soft Path*. San Francisco, Calif.: Friends of the Earth Foundation, 1982. 288 pp.

This catalog of energy-efficient technologies from the United States and around the world includes information

on housing, heat exchangers, solar energy, appliances, lighting, transportation, biomass fuels, and motors. It includes some services, but is not intended as a list of suppliers.

Hirst, Eric, Jeanne Clinton, Howard Geller, and Walter Kroner. *Energy Efficiency in Buildings: Progress and Promise*. Edited by F.M. O'Hara, Jr. American Council for an Energy-Efficient Economy (ACEEE) Series on Energy Conservation and Energy Policy. Washington, D.C.: ACEEE, 1986. 328 pp.

This book explores the progress made in energy efficiency by explaining conservation measures used in new and existing commercial and residential buildings. Residential energy savings are explored in the most detail, and these chapters include multifamily dwellings and mobile homes. There is a chapter devoted to appliances and heating, as well as chapters which discuss government and utility conservation programs and the impact of efficiency measures in indoor air quality. The latter part of the book looks at energy research and development and future possibilities for more effective and efficient energy use.

Kenney, W.F. "Strategies for Conserving Energy." *Chemical Engineering Progress* (American Institute of Chemical Engineers) 84, no. 3 (March 1988): 43-49. 6 pp.

This article concerns the need for energy efficiency in chemical plants to lower operating costs. The article focuses on efficiency measures that require only a low investment or no investment at all and which can be installed during routine maintenance to minimize costs.

Knecht, B.L. "Residential Energy Conservation Strategy." *Energy Engineering* (Atlanta, Georgia) 82, no. 6 (1985).

This article details the conservation strategy used in a home in Ohio. The measures used include insulation and heating efficiency and improved ventilation and yield a savings of \$530 per year.

Lovins, Amory B. "Prepared Statement by Amory B. Lovins: In the Matter of the Application of the Potomac Electric Power Company for Changes to Electric Rate Schedules (Part II), February 19, 1987." Snowmass, Colo.: Rocky Mountain Institute, 1987. 38 pp. plus attachments.

This testimony briefly assesses opportunities for saving electricity and gas in the District of Columbia at below corresponding marginal costs. The analysis considers the technical measures which provide unchanged or improved services with less energy by using energy more productively through smarter techniques which preserve reliability and convenience. Numerous examples of devices now on the market are cited and their cost impacts are analyzed.

Massachusetts Audubon Society. Scientific Staff. *The Energy Saver's Handbook for Town and City People*. Emmaus, Pa.: Rodale Press, 1982.

A consumer-oriented book describing various energy efficient measures, such as insulation, windows, heating and cooling systems, appliances, lighting, renewable energy systems, and cogeneration. The authors explain how to calculate savings and how to make an energy survey of a building. Tables show energy savings and payback periods. Energy pricing, rate structures, and financing methods are also explained.

National Conference on Buildings Codes and Standards, Inc. *State Codes for Energy Conservation in New Buildings*. Washington, D.C.: Edison Electric Institute, 1982.

This report surveys state energy codes for one-family and two-family dwellings. Charts containing the standards for insulation, heating, and cooling in the various states are followed by explanatory notes and comments.

Patrick, Dale R., and Stephen W. Fardo. *Energy Management and Conservation*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982. 229 pp.

This book explains the cost savings and the technical workings of various energy-conserving measures. The chapters cover heating, cooling, lighting, windows, and insulation in technical detail. Other chapters cover the electrical power system, solar energy, and instrumentation and measurement for determining energy efficiency.

Payne, F. Williams, ed. and comp. *Advanced Technologies: Improving Industrial Efficiency*. Atlanta, Ga.: Fairmont Press, 1985. 188 pp.

This book describes various new energy-efficient technologies for industries. Part One contains projects such as recovery of waste heat which are applicable to a broad variety of industries. Part Two is geared toward specific industries, such as metal, paper, farm and food, and textiles, and describes a multitude of specialized energy-saving processes and systems.

Piette, M.A., E. Wyatt and J. Harris. *Technology Assessment: Thermal Cool Storage in Commercial Buildings*. Lawrence Berkeley Laboratory, Energy Analysis Program, LBL-24852. Berkeley, Calif.: University of California, 1988.

This report investigates the current and potential use of thermal storage systems for cooling commercial buildings. The aim of the report is to synthesize current information on thermal cool storage from published and unpublished sources so that utilities, state regulatory commissions, and others can better identify, evaluate and select demand-side resources to meet their needs.

Rocky Mountain Institute. *Advanced Electricity: Saving Technologies and the South Texas Project: Report to the City of Austin, Electric Utility Department*. Principal Investigator, Amory B. Lovins. 2 vols. Snowmass, Colo. Rocky Mountain Institute, 31 December 1986. 291 pp.

This report analyzes in detail how new techniques for using electricity more efficiently, and new ways to deliver that hardware to the people who need it, can provide a

no-losers solution to the South Texas Project. The study assesses hundreds of new ways to save power in 34 major uses. The main actions suggested included a "mass retrofit" to quintuple commercial lighting efficiency, making new buildings far more efficient, and helping people to thoroughly weatherize their houses.

Schipper, Lee, Stephen Meyers, and Henry Kelly. *Coming In From the Cold: Energy-Wise Housing in Sweden*. Washington, D.C.: American Council for an Energy Efficient Economy, 1985. 104 pp. plus index.

This impressive book is about the well-built, super-energy-efficient, and affordable housing that is being constructed in Sweden. Along with discussion of construction details, the authors also discuss houses built in factories, Swedish loan subsidies along with their interaction and impact on taxes, the Swedish building code and its effect on energy-efficient goals, and the government's policy of research. Swedish and American building practices and energy performances are compared and contrasted.

U.S. Department of Energy (DOE). Office of Buildings and Community Service (BCS). *Energy Conservation Goals for Buildings: A Report to the Congress of the United States*. Washington, D.C.: DOE, May 1988; available from National Technical Information Service, Springfield, Va. 64 pp.

This report provides an overview of the Office of Buildings and Community Service (BCS) role in improving the energy efficiency of buildings and presents overall goals for the program. It also provides a useful introduction to the BCS research program in areas including building envelope, equipment, lighting, retrofits, and indoor air quality.

U.S. Department of Energy. Office of Conservation. *Energy Conservation Multi-Year Plan 1990-1994*. DOE/CE-0024. Washington, D.C.: August 1988. 245 pp.

This report describes Department of Energy (DOE) pro-

grams and provides a technical assessment of research needs and priorities in light of changing technology conditions. The chapters are organized to correspond with a multi-year planning process. Chapters discuss the importance of energy efficiency to national security, DOE's Energy Conservation research and Development Program, and present technical assessments of programs addressing buildings and community systems, transportation, industry, and energy utilization research.

Williams, Robert H., Gautam S. Dutt, and Howard S. Geller. "Future Energy Savings in U.S. Housing." *Annual Review of Energy* 8 (1983): 269-332. 64 pp.

This article examines future costs of energy and future potential for savings in residential structures. Air conditioners, freezers, refrigerators, and heat pumps are covered. The article may be somewhat dated, but contains useful detail.

E. *DSM Program Design, Incentives, and Pricing*

American Council for an Energy-Efficient Economy (ACEEE). *Residential Conservation Power Plant Study, Phase I - Technical Potential*. Prepared for Pacific Gas and Electric Company (PG&E). Washington, D.C.: ACEEE, 1986. 265 pp.

This report evaluates the technical potential for cost-effective electricity savings in PG&E's residential sector. The potential savings are termed a "conservation power plant" to signify that improved end-use efficiency is one of the resource options available to the utility.

Barkovich, Barbara. "Changing Strategies in Utility Regulation: The Case of Energy Conservation in California." Ph.D. diss., 1987. 298 pp.

This dissertation posits a change in the 1970s from a traditional, unintrusive regulatory strategy to an interventionist approach, and explores the reasons for the interventionist trend. The California Public Utilities

Commission's approach to energy conservation during the period 1975-1984 is used as a case study.

Boston Edison Review Panel. "Final Report of the Boston Edison Review Panel." 2 vols. March 1987. Paginated section by section.

This report was completed at the request of Boston Edison Company (BECO) following a rate order sharply critical of BECO management. The Panel's findings and recommendations are grouped in three major areas: regulatory relations, conservation and load management (C&LM), and planning for change. With respect to C&LM the panel recommended that BECO should implement a comprehensive, aggressive program. Successful implementation of this program would help regulators to continue to support the financial health of BECO. Volume One contains an Executive Summary of the Panel's findings and recommendations and the detailed report. Volume Two contains supporting appendices: appendices VIII and IX deal specifically with CL&M and integrated supply and demand planning in the context of BECO and Massachusetts regulatory climate.

California Energy Commission. *Local Energy Planning Handbook*. By Eileen Baumgardner and Don Schultz. Sacramento, Calif., November 1981. 140 pp. plus reference list, appendices, and worksheets.

This handbook for developing local government energy programs to promote and utilize energy efficiency measures provides examples of programs undertaken by local governments in California. It contains worksheets and information to explain the methods, the creation of and the implementation of plans, and the potential savings.

Cavanagh, Ralph, and Eric Hirst. "The Nation's Conservation Capital." *The Amicus Journal*, Summer 1987, 38-42. 5 pp.

The authors are members of an advisory group that managed the Hood River Conservation Project from its incep-

tion in 1983. This brief article summarizes the nation's most ambitious and sophisticated test of "mass-produced" residential energy conservation's ability to eliminate the need for new power plants. The results reported are drawn from technical reports released in June 1987, following extensive analysis of initial data from the experiment.

Charo, Alta R., Lisa R. Stearns, and Michael Case. "Overview of Legal Issues Arising in the Development of Federal and State Appliance Efficiency Standards." *Columbia Journal of Environmental Law* 11 (1986): 315 -353. 138 pp.

This article provides an overview of the legal issues likely to arise in the development of both federal and state appliance efficiency standards. It contains a detailed analysis of the effects the *Herrington* decision will have on state appliance efficiency legislation. The article is part of a special symposium issue on legal issues arising from the Audubon Energy Plan 1984.

Committee for Economic Development and The Conservation Foundation. *Energy Prices and Public Policy, A Statement by the Research and Policy Committee of the Committee for Economic Development and the Conservation Foundation*. N.Y.: Conservation Foundation, July 1982. 89 pp.

This report is the joint work of business leaders and conservation groups. Energy prices and views on energy pricing, including an examination of their effect on low-income customers and the effect on inflation are discussed. Pricing of electricity and natural gas are treated separately and in detail. The report also includes views on dealing with oil emergencies.

Counihan, Richard H. "Adding Conservation to the Rate Base." *Governance: The Harvard Journal of Public Policy* (Summer-Fall 1986): 55.

This seminal article examines how utilities recover the

costs of conservation programs and how two different forms of cost recovery affect the amount of conservation they undertake. The article summarizes Mr. Counihan's research on cost recovery methods in conservation programs, examining the issue from the perspectives of rate-payers, stockholders, and society as a whole, using Pacific Gas and Electric Company's conservation programs as an example.

Darmstadter, Joel. *Conserving Energy Prospects and Opportunities in the New York Region*. Baltimore, Md.: Johns Hopkins University Press, 1975; for Resources for the Future, Inc.

Although the statistical information in this book is dated, two chapters of particular interest are "A Review of Energy-Conserving Practices", which covers residential, commercial, and transportation; and "Policies to Implement Energy Conservation", which discusses consumer education, the setting of efficiency standards, and pricing regulation.

Einhorn, Michael A. "Measuring the Costs and Benefits of Conservation Programs." *Public Utilities Fortnightly* 116 (25 July 1985): 22-26. 5 pp.

This article discusses the factors which utility economists should consider in designing and evaluating utility sponsored conservation programs. This analytical framework can be used to evaluate the form and size of conservation incentives.

Electric-Power Research Institute (EPRI). *A Compendium of Utility-Sponsored Energy Efficiency Rebate Programs*. Prepared by Consumer Energy Council of America Research Foundation and American Council for an Energy-Efficient Economy. Palo Alto, Calif.: Research Reports Center, December 1987. 273 pp.

This report contains detailed information on fifty-nine utility sponsored energy efficiency programs. Rebate programs strictly for loan management equipment were ex-

cluded. It attempts to gauge rebate programs and to facilitate the design and operation of these programs. Each program was analyzed to identify program characteristics, products included, efficiency levels, rebate amounts, finding levels, energy and peak power savings, and the cost of peak demand reduction.

_____. *DSM Residential Customer Acceptance*. 2 vols. Palo Alto, Calif.: Resource Reports Center, April 1988. Paginated by sections.

The purpose of this study is to identify levels of customer acceptance associated with a variety of demand-side management (DSM) programs, based on marketing methods, customer characteristics, and utility characteristics. Volume I (168 pages): details the conceptual model used to design the survey questionnaire and data analysis approach. This volume also describes the relationship between different characteristics of the DSM programs and participation levels. An appendix provides DSM program abstracts. Volume II (128 pages) is a database user's guide describing how to access and apply the PC compatible database which supports this report.

Geller, Howard S. *Analysis of Minimum Efficiency Standards and Rebate Incentive Programs for Domestic Refrigerators in the Pacific Northwest*. Prepared for Bonneville Power Administration (BPA), Portland, Oreg. Washington, D.C.: American Council for an Energy-Efficient Economy, 1985. 89 pp.

This report presents the results of an evaluation of both rebate incentive programs and minimum efficiency standards for refrigerator-freezers conducted by the BPA Office of Conservation. The energy savings potential and economic feasibility of rebate programs and efficiency standards are the primary issues considered.

_____. "Prospects for Residential Incentive Programs in Light of the National Appliance Efficiency Standards." Paper presented at *Managing the Shape of Tomorrow: A*

Symposium on Demand-Side Management Sponsored by New York's Seven Investor-Owned Electric Utilities, 3-5 March 1988, at Albany, N.Y. 7 pp.

This paper addresses the effect that national appliance efficiency standards will have on the desirability of utility incentive programs and the structure of future rebate programs.

Gellings, Clark W., and John H. Chamberlin. *Demand-Side Management: Concepts and Methods*. Lilburn, Ga.: Fairmont Press, Inc., 1988. 465 pp.

This current and technical book for energy planners explains what the demand-side management methods are and how they may be implemented. It includes chapters on various techniques of cost-benefit analysis, evaluating customer acceptance, and forecasting future demands.

Gellings, Clark W., and Dilip R. Limaye, eds. *Electric Utility Conservation Programs*. N.Y.: Praeger Publishers, 1986.

This collection of articles highlights methods of implementing demand-side measures. Topics covered include commercial, industrial, and residential conservation programs; the potential for savings; rebates and other incentives; predicting consumer response to conservation; and pricing methods.

Hennessey, Michael and Michael Sullion. "Implementing Dispatchable Load Management Projects." *Public Utilities Fortnightly* 121 (14 April 1988): 23-29. 7 pp.

This article presents a set of practical guidelines for implementing dispatchable load management and other demand side management projects in electric utilities. It outlines the strategic design of load management at Pacific Gas and Electric Company and the general approach used by the company to implement load management projects.

Hirst, Eric. "Creating Viable Utility Conservation/Load Man-

agement Programs." *Energy* 13 (1988): 33-44. 11 pp.

This article examines how an electric utility can determine the value of demand-side programs, conservation and load management, in its service territory by following a procedure that involves several steps. Some steps are general in nature, for instance identifying potential markets and end-use technologies while others are program specific, such as estimating program participation, energy-use effects, and costs over time.

_____. *The Hood River Conservation Project: Cooperation and Community Conservation*. Prepared for Pacific Power and Light Company and Bonneville Power Administration, U.S. Department of Energy. DOE/BP-11287-18. Portland, Oreg., June 1987. 53 pp.

This report presents the results of a five-year weatherization project which was aimed at reducing electric heating costs of residences in Hood River. The data compiled is analyzed and discussed in detail. The data quantifies the effectiveness of the Project, community participation in the Project, the cost of the Project, and the savings in annual energy use.

Hirst, Eric, Dennis White, and Richard Goeltz. "The Electricity saved in a Residential Weatherization Pilot Program." *Public Utilities Fortnightly* 116 (25 July 1985): 27-31. 53 pp.

The Bonneville Power Administration operated a residential weatherization pilot program from 1980 - 1982 which provided free home energy audits to 7,200 electrically heated homes in the Pacific Northwest and gave zero-interest loans to weatherize 4,100 of these homes at a total cost of almost \$11 million. This article provides an estimate of the net energy savings effect of the program - the electricity saving that can be directly attributed to the program - as well as the total energy saving.

Kelly, Henry, and Alan S. Miller. "Getting Serious About Utility Regulatory Reform." *Public Utilities Fortnightly*

108 (24 September 1981): 21-27. 8 pp.

This article compares the potential economy and efficiency which can be achieved from investments in a broad spectrum of energy-saving strategies as opposed to investments in traditional energy production and consumption projects.

Kempton, Willett, and Max Neiman, eds. *Energy Efficiency: Perspectives on Individual Behavior*. Washington, D.C.: American Council for an Energy Efficient Economy, 1987.

The chapters in this book, written by leading researchers, program analysts, and policy makers, present a variety of perspectives on the analysis of human behavior. The book is divided into four sections entitled, "Consumer Investment Decision Processes," "The Inference on Individual Behavior from Aggregate Data," "Home Management," and "The Interaction of Building Systems with Occupants."

Koomey, Jonathon, and Arthur H. Rosenfeld. "Promoting Efficiency Investments in New Buildings." Paper presented at the ACEEE 1988 Summer Study on Efficiency in Asilomar, Calif., 28 August - 3 September 1988. 13 pp.

This paper describes a new policy to encourage building efficiency that combines some of the best features of rebates, fees, and minimum efficiency standards. The sliding-scale, energy/demand target approach (SSED) sets a target peak demand and/or target energy consumption per square foot for a particular building type. Buildings using more than the target would pay a fee into an "efficiency fund", and buildings using less than the target would be given a rebate from the same fund.

Lovins, Amory B. "Negawatts: A Practical Remedy for Megagoofs." Address to Energy Conservation Panel, 97th Annual Convention, National Association of Regulatory Utility Commissioners, N.Y. 20 November 1985. 14 pp.

With an emphasis on the commercial and industrial sec-

tors, this address shows that it can be extremely cheap to save electricity (kilowatt-hours) through new end-use technologies, such as commercial lighting retrofits, passive thermal designs, advanced appliances and task lighting. According to Lovins, rate cuts, not rate hikes, may turn out to be the only way to increase utility long-run revenues; and rate cuts require major short-term cost reductions, which end-use efficiency can readily provide.

Michie, Preston. "Billing Credits for Conservation, Renewable, and Other Electric Power Resources: An Alternative to Marginal-Cost-Based Electric Power Rates in the Pacific Northwest." *Environmental Law* 13 (1982-83): 963-1029. 66 pp.

This article analyzes the concept of billing credits as written into the Northwest Power Act. It first delineates the Administrator's contractual obligations to customers and the corresponding authority to acquire resources to meet those obligations. The article compares the benefits of a billing credit with the benefits of other options available to a resource sponsor. This article is part of a "Northwest Power Act Symposium" issue.

Moskovitz, David, and Richard B. Parker. "How to Change the Focus of Regulation So As to Reconcile the Private Interest with the Public Goals of Least-Cost Electric Planning." Presented to the Sixth NARUC Biennial Regulatory Information Conference, Columbus, Ohio. September 1988. 14 pp.

This paper discusses distortions inherent in price regulation with particular emphasis on the interaction between fuel cost recovery and integrated least-cost planning. Authors propose an incentive mechanism based on minimizing customer bills, which should encourage utilities to use supply and demand options in the quantity and order which is most economic.

Norland, Douglas, and James L. Wolf. "Utility Conservation Programs: A Regulatory and Design Framework." *Public*

Utilities Fortnightly 116 (25 July 1985): 15-21. 7 pp.

This article highlights how the choice of regulatory tests and utility goals affect the value of financial incentives a utility can offer its customers for investment in conservation. Authors suggest that the "windfall effect," incentives paid to utility customers who do not alter their investment behavior, requires utilities to offer less than the maximum amount of financial incentive implied by certain regulatory tests.

Pickels, Steve J., and Philip Audat. "Second Generation Conservation Programs with an Increasing Utility Initiative." *Public Utilities Fortnightly* 120 (24 December 1987): 9-13. 5 pp.

This article describes a successful conservation program, now in place at a number of utility companies in the Southwest, which was developed independently of regulatory agencies.

Randolph, John. "Implementation and Effectiveness of State-Administered, Federally Funded Energy Conservation Programs." *Energy Systems & Policy* (Crane, Russak and Company, Inc., N.Y.) 9, no. 1 (1985): 49-87. 39 pp.

This article discusses the role of state governments in the implementation of the various federally funded state-administered energy programs, examines the methods used from state to state, and comments on possible improvements.

Rollin, Patricia and Jan Beyea. "US Appliance Efficiency Standards." *Energy Policy*, October 1985, 425-34. 10 pp.

This paper demonstrates the ability of efficiency standards to bring the imperfect appliance market closer to the economic optimum, reducing the amount of energy wasted by inefficient home appliances and protecting consumers from increased appliance costs associated with efficiency improvements and increased electricity costs. The authors insist that applicable standards should not

be based on cost minimization over the life of the appliance. Instead authors propose that standards should be based on the length of time over which appliances are bought on credit.

Sawhill, John C., and Richard Cotton, eds. *Energy Conservation: Successes and Failures*. Washington, D.C.: The Brookings Institution, 1986. 270 pp.

This collection contains essays evaluating the effectiveness of energy conservation measures initiated by the federal, state, and local governments, private industry, and utilities. The collection also discusses "patterns of energy use" and "financial barriers to investment in conservation."

Stearns, Lisa R. "Energy Savings in Residential Buildings: The Role of Investor-Owned Utilities." *Columbia Journal of Environmental Law* 11 (1986): 261-314. 53 pp.

This article looks at the major advantages and disadvantages associated with investor-owned utility participation in increasing residential energy conservation. The article is part of a special symposium issue on legal issues arising from the Audobon Energy Plan 1984.

U.S. Department of Energy. Bonneville Power Administration (BPA). *Conservation and Load Management Research Plans: 1989 North American Index*. Compiled by Jon Biemer, P.E. Freeman, and Douglas Freeman. DOE/BP-1103. Portland, Oreg.: BPA, November 1988. 144 pp.

This index is designed to facilitate cofunding and cooperation among organizations conducting conservation and load management research or programs. One hundred organizations participated in this area of emphasis Survey, including national, state and local governments, utilities, industry organizations, and public interest groups. The index includes brief descriptions of activities identified during Summer 1988 and includes contact names and addresses.

Weedall, Mike, Robert Weisenmiller, and Michael Shepard, eds. *Financing Energy Conservation*. American Council for an Energy-Efficient Economy Series (ACEEE) on Energy Conservation and Energy Policy. Washington, D.C.: ACEEE, 1986.

This book provides a thorough examination of creative ideas for financing energy conservation. The authors provide guidelines for structuring and implementing financing projects, case studies of specific plans, and extensive references.

Yankel, Anthony J. "The Respective Costs of Serving Large and Small Residential Customers." *Public Utilities Fortnightly* 121 (9 June 1988): 42-47. 5 pp.

The author looked at actual customer load patterns and found that larger residential customers take a greater portion of their usage on-peak than smaller residential customers. The article concludes that large residential customers are not cheaper to serve, as is commonly assumed in electric utility ratemaking.

F. *Bidding, Wheeling, and Structural Reform*

Cassaza, John A. "Free Market Electricity: Potential Impacts on Utility Pooling and Coordination." *Public Utilities Fortnightly* 122 (18 February 1988): 16-23. 8 pp.

This article describes changes that will be required in utility pooling and coordination arrangements if competition replaces regulation as the norm for electric power generation and bulk power supply. The article also suggests some costs associated with those changes, including costs of developing and utilizing new technologies required to achieve maximum benefits from a new free market system.

Chadbourne and Parke. "Testimony of Chadbourne & Parke on Implementation of the Public Utility Regulatory Policies Act." Before the Subcommittee on Energy Conservation and Power of the House Committee on Energy &

Commerce. 94th Cong., 2d sess., 30 June 1986. 81 pp.

Chadbourne and Parke is a law firm which represents many qualifying cogeneration and small power production facilities (QFs) throughout the country. The testimony discusses the efficiency and fairness of the relationship established by PURPA between QFs, utilities, and ratepayers. Among the topics addressed are the role of QF power in utility resource planning and concerns about institution of bidding procedures.

Cicchetti, Charles, and William Hogan. "Including Unbundled Demand-side Options in Electric Utility Bidding Programs." Discussion Paper E-88-07. Cambridge, Mass.: Harvard Environmental and Energy Policy Center, August 1988. 29 pp.

The article outlines an approach which authors believe permits the efficient inclusion of demand-side programs in a bidding system. Authors propose separating energy services from kilowatt hours and customers-as-consumers from customers-as-suppliers to provide proper incentives for energy conservation programs and a proper basis for comparison of such programs with supply-side options.

Federal Energy Regulatory Commission (FERC). Office of Economic Policy. "Regulating Independent Power Producers: A Policy Analysis." Washington, D.C., 13 October 1987.

This staff paper examines the FERC's regulatory policies toward one important class of nontraditional power producers: independent power producers (IPPs) and explores the advantages of relaxing the regulation of IPPs. It discusses related FERC orders and describes an alternative set of policies which would relax regulation. The report suggests that current regulation discourages the development of IPPs because it distorts price signals and does not provide the IPPs with the opportunities for financial reward commensurate with their risks.

Fels, Nicholas W. and David N. Heap. "Compulsory Wheeling

of Electric Power to Industrial Consumers." *Fordham Law Review* 52 (1983-84): 219-33. 14 pp.

This article briefly addresses the compulsory transmission, or "wheeling", of power from the standpoint of the industrial consumer. A utility may refuse to wheel cheaper power if it would find the wheeling transaction less profitable than a direct sale to the user. The discussion includes a review of the regulatory context, jurisdiction, and substantive standards governing wheeling. This article then discusses the grounds for compelling an unwilling utility to wheel power.

Haman-Guild, Renee', and Jerry L. Pfeffer. "Competitive Bidding for New Electric Power Supplies: Deregulation or Regulation?" *Public Utilities Fortnightly* 120 (17 September 1987): 9-20. 12 pp.

This article outlines some of the key issues in the debate over the use of bidding schemes to govern the acquisition of new power supplies with particular emphasis on the concerns of state regulators.

Harvard University. John F. Kennedy School of Government. *Rapporteur's Report: FERC-Harvard Executive Session on Pricing and Transporting Independent and Cogenerated Power*. Cambridge, Mass. 8 July 1987.

The executive session focussed on bidding for generating capacity, identifying potential participants in an auction, and on wholesale wheeling.

Energy and Environmental Policy Center (EEPC). *Rapporteur's Report: Second Annual Executive Session on Northeast Electric Power Policy*. Held 30 September - 2 October 1987 at Edgartown, Mass. Cambridge: EEPC, undated. 11 pp.

Participants at this meeting discussed structural and institutional changes in the utility industry and the potential role for government policy in accommodating or altering these changes. Many reached the paradoxical

conclusion that the future structure of the utility industry would be characterized both by more competition, resulting from the entrance of third-party generators, and by more coordination among utilities, resulting in part from the demands on the transmission system.

Howard, Jeffrey H., and Richard A. Westfall. "The FERC Opens Pandora's Box: Increased Competition and Heightened Antitrust Exposure for Electric Utilities." *Public Utilities Fortnightly* 121 (3 March 1988): 22-25. 5 pp.

This article explores how increased competition brought about by regulatory change could weaken existing antitrust protection for utilities and accelerate the risk of exposure to antitrust actions.

Lee, Henry. "Retail Wheeling: Problems and Possibilities." Paper presented at the Second Annual Harvard Executive Session on Northeast Electric Power Policy, 30 September - 2 October 1987, Edgartown, Mass. 10 pp.

Author reviews the key arguments for and against retail wheeling and concludes that for retail wheeling to work there must be buyers willing to go off the existing system and third-party generators who want to sell to those buyers. Retail wheeling is part of a deregulation process which will not occur all at once. As part of a deregulation process, the challenge will be to design wheeling policies that minimize the income transfers between switching customers and captive customers and stockholders. In conclusion he recommends that policy-makers not push retail wheeling because it would divert resources from areas with greater potential benefits.

Meade, William R. "Competitive Bidding and the Regulatory Balancing Act." *Public Utilities Fortnightly*. 120 (17 September 1987): 22-30. 9 pp.

This article traces the development of bidding by small power and other independent owners of electric generation facilities for contracts to supply power needs of

franchised electric utilities. Both programs already in place and others under consideration are analyzed for their impact on renewable and nonrenewable resource technologies and to suggest approaches which meet the objectives of PURPA and of state and federal energy policies.

National Independent Energy Producers (NIEP). *Pricing New Generation of Electric Power: A Report on Bidding*. By Jan Hamrin, Harrison Wellford, Hope Robertson, and Jan Smutny-Jones. Washington, D.C.: NIEP, September 1987. 108 pp.

This report investigates the pros and cons of competitive bidding as a means of allocating capacity and energy payments for the generation of electricity. It discusses the origins of bidding, the status of bidding as adopted or proposed in the various states, the relationship of bidding to a prudent national energy policy and the statutory goals of PURPA, as well as the technical issues that must be addressed in the implementation of bidding. The report includes recommendations for the design of a bidding program.

O'Connor, Philip R. and Gerald M. Keenan. "The Politics and Policy of Access to the Electric Utility Transmission System." *Public Utilities Fortnightly* 121 (7 July 1988): 11-17. 7 pp.

The use of the bulk transmission network in the North American electric power industry has been perceived by many as a key element in the possible formation of a more competitive electric utility industry. This article warns that a common carrier oriented structure will develop if a vertically integrated utility industry maintains its concerted opposition to allowing other power producers or customers who have been dependent on power supplied by owners of transmission facilities to have access to the transmission grid.

Rothkopf, Kahn, Teisberg, Eto, and Natuf. *Designing PURPA*

Power Purchase Auctions: Theory and Practice. LBL-23906. Berkeley, CA: University of California, Lawrence Berkeley Laboratory, Energy Analysis Program, August 1987. Unpaginated.

This report explores the design of auctions for the purchase power from QFs under PURPA, making recommendations where justified and identifying relevant factors and their effects when the design choices are difficult.

Stalon, Charles G. "Transmission Access and Evolving Regulation of the Electricity Power Industry." Address to the National Forum for Alternative Energy Generation, Washington, D.C., 30 November 1987. Unpaginated.

Commissioner Stalon of FERC singles out transmission access as a major regulatory problem. He addresses three major questions concerning transmission access issues facing FERC: (1) whether a greater degree of supplier transmission access is necessary to make competition in the wholesale bulk power markets adequately efficient; (2) to what degree is retail customer access a necessary ingredient to any FERC effort to improve the efficiency of the wholesale market; and (3) whether some level of supplier access is a necessary ingredient of the proposed PURPA reform package.

Whittaker, M. Curtis. "Conservation and Unregulated Utility Profits: Redefining the Conservation Market." *Public Utilities Fortnightly* 122 (7 July 1988): 18-22. 5 pp.

This article suggests the abandonment of efforts for demand-side electric capacity bidding. Instead, state utility commissions should encourage the unification of the electricity delivery and conservation markets. Electric utilities could meet their obligations to serve customers' energy requirements through a flexible combination of power deliveries and conservation measures installed or financed by utilities. They would bill at the same rates for delivered and conserved electricity, and realize for themselves the full difference between the costs of power deliv-

ery and conservation.

Zeren, Richard W., and Katherine A. Miller. *Electric Utilities: Structure and Regulation*. Proceedings of Energy Policy Forum held by the Aspen Institute for Humanistic Studies on 7-11 August 1985 in Aspen Colo.; Charles B. Curtis and Guy W. Nichols, Co-chairmen. Queenstown, Md.: Aspen Institute for Humanistic Studies, 1986. 54 pp.

At this forum, some 70 people, representing a broad spectrum of interested parties, discussed the implications of changes over the last decade in the price of and demand for electricity and the effect of competition in the relationship between utilities, regulators, and investors. Participants discussed various forms of compensation including third party generator, transmission issues, and structural alternatives such as bidding.

Zimmer, Michael J., Joseph A. Orlando, and Michael L. Kessler, eds. *Cogeneration: Current Prospects and Future Opportunities*. 6th ed. Rockville, Md.: Government Institutes, Inc., 1987.

A current and detailed report on cogeneration encompassing an update on legislation and federal regulations; information on financing and tax changes; an update on management; economics and technologies for cogeneration facilities; guidelines for co-ordination with utilities and power pools; and an examination of packaged cogeneration systems.

III. List of Selected Addresses

This list of addresses represents an overview of selected organizations conducting research or publishing in the fields of energy efficiency and energy-related environmental issues. The list should aid the reader who wishes to obtain materials referenced in the bibliography or who seeks to obtain more recent information than that contained in this bibliography. Preferred organization title, addresses, phone numbers, and organization leaders or preferred public information contact

were verified in April 1989. The user should note that review of materials referenced in the bibliography will yield other organizations involved in the fields of least-cost utility planning and demand-side management.

Alliance to Save Energy (ASE),
1925 K Street, N.W., Suite 206,
Washington, D.C. 20006
(202) 857-0666
James L. Wolf, Executive Director

American Council for an Energy-Efficient Economy (ACEEE),
1001 Connecticut Avenue, N.W., Suite 535,
Washington, D.C. 20036
(202) 429-8873
Howard Geller, Associate Director

Battelle Memorial Institute,
505 King Avenue,
Columbus, Ohio 43201-269
(614) 424-6424
Douglas E. Olesen, President and CEO

**Bonneville Power Administration (BPA),
United States Department of Energy,**
905 N.E. 11th Avenue, P.O. Box 3621,
Portland, Oregon 97208
(503) 230-5273
Contact Assistant to Administrator for External Affairs

Center for Clean Air Policy,
444 N. Capitol Street, Suite 526,
Washington, D.C. 20001
(202) 745-7709
Ned Helme, Executive Director

Conservation Law Foundation of New England, Inc. (CLF),

3 Joy Street,
Boston, Massachusetts 02108
(617) 742-2540
Douglas I. Foy, Executive Director

Cornell University, Department of Agricultural Economics,

Ithaca, New York 14853
(607) 255-4576
William G. Tomek, Chairman

Electric Power Research Institute (EPRI),

3412 Hillview Avenue, P.O. Box 10412,
Palo Alto, California 94304
(415) 855-2411
Contact EPRI Technical Information
Specialists

Energy Conservation Coalition (ECC),

1525 New Hampshire Avenue, N.W.,
Washington, D.C. 20036
(202) 745-4874
Nick Fedoruk, Director

Environmental Defense Fund, Inc. (EDF),

257 Park Avenue, South,
New York, New York 10010
(212) 505-2100
Fredric D. Krupp, Executive Director

Environmental Policy Institute (EPI),

218 D Street, S.E.,
Washington, D.C. 20003
(202) 544-2600
Brent Blackwelder, Vice President

Environmental and Energy Study Institute (EESI),

122 C Street, N.W., Suite 700,
Washington, D.C. 20001
Ken Murphy, Executive Director
(202) 334-9767

Fossil Fuels Policy Action Institute,

2217 Princess Anne Street,
Fredricksburg, Virginia 22401
(703) 899-3511
Jan Lundberg, Executive Director

Harvard University, John F. Kennedy School of Government, Energy and Environmental Policy Center,

79 John F. Kennedy Street,
Cambridge, Massachusetts 02138
(617) 495-1100
Dr. Irwin Stelzer, Director

INFORM,

381 Park Avenue South,
New York, New York 10016
(212) 689-4040
Joanna D. Underwood, Executive Director

Komanoff Energy Associates,

270 Lafayette Street, Suite 400,
New York, New York 10012
(212) 334-9767
Charles Komanoff, Director

National Association of Regulatory Utility Commissioners (NARUC),

1102 Interstate Commerce Commission Building,
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Paul Rodgers, Administrative Director

National Audubon Society (NAS),

950 Third Avenue,
New York, New York 10022
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Peter A.A. Berle, President

National Independent Energy Producers,

205 Metropolitan Square, 655 15th Street,
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Merribe Ayres, Executive Director

National Regulatory Research Institute (NRRI),

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Columbus, Ohio 43210
Douglas N. Jones, Director

Natural Resources Defense Council (NRDC),

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New York, New York 10011
(212) 727-2700
John H. Adams, Executive Director

North Carolina Alternative Energy Corporation (AEC),

P.O. Box 12699, Research Triangle Park,
North Carolina 27709
(919) 549-9046
Robert K. Koger, President and Executive
Director

Northwest Power Planning Council,

851 S.W. 6th Avenue, Suite 1100,
Portland, Oregon 97204-1337
(503) 222-5161
Edward Sheets, Executive Director

**Oak Ridge Associated Universities
(ORAU),**

P.O. Box 117,
Oak Ridge, Tennessee 37831
(615) 576-3150
Dr. Jon M. Veigel, President

**Oak Ridge National Laboratory, Conserva-
tion and Renewable Energy Program,**

P.O. Box 2008,
Oak Ridge, Tennessee 37831-6188
(615) 574-5204
R.S. Carlsmith, Program Director

**Office of Technology Assessment (OTA),
United States Congress,**

600 Pennsylvania Avenue, S.E.,
Washington, D.C. 20510
(202) 224-8996 (Publications Office)
John Gibbons, Director

**Organization for Economic Co-operation
and Development,**

Publication and Information Centre,
2001 L Street, N.W., Suite 700,
Washington, D.C. 20036
(202) 785-6323

**Princeton University, Center for Energy
and Environmental Studies,**

Engineering Quadrangle, P.O. Box CN 5263
Princeton, New Jersey 08544-5263
(609) 452-5445
Rob Soccolow, Executive Director

**Public Citizen's Critical Mass Energy Pro-
ject,**

215 Pennsylvania Avenue, S.E.,
Washington, D.C. 20003
(202) 546-4996
Ken Bossong, Director

Renew America,

1001 Connecticut Avenue, N.W., Suite 719,
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(202) 466-6880
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Resources for the Future,

1616 P Street, N.W.,
Washington, D.C. 20036
(202) 328-5000
Robert W. Fri, President

Rocky Mountain Institute,

1739 Snowmass Creek Road,
Snowmass, Colorado 81654-9199
(303) 927-3128
Amory B. Lovins, Director of Research

Rutgers University, RUTCOR,

Hill Center for the Mathematical Sciences,
New Brunswick, New Jersey 08903
(201) 932-3041
Peter L. Hammer, Director

**Scientists Institute for Public Information
(SIPI),**

355 Lexington Avenue, 16th Floor,
New York City, New York 10017
(212) 661-9110
Alan McGowan, President

Sierra Club,

730 Polk Street,
San Francisco, California 94109
(415) 776-2211
Michael Fischer, Executive Director

Solar Energy Research Institute,

1617 Cole Boulevard,
Golden, Colorado 80401
(303) 231-7111
Harold Hubbard, Director

United States Department of Energy, Conservation and Renewable Energy,

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Berkeley, California 94720

(415) 642-1640

Dr. Jeffrey Romm, Chairman

University of California, Lawrence Berkeley Laboratory, Applied Science Division,

Building 90-3026,

Berkeley, California 94720

(415) 486-5001

Elton J. Cairns, Director

Woods Hole Research Center,

P.O. Box 296,

Woods Hole, Massachusetts 02543

(508) 540-9900

George Woodwell, Director

Worldwatch Institute,

1776 Massachusetts Avenue, N.W.,

Washington, D.C. 20036

(202) 452-1999

Lester Brown, President

World Resources Institute,

1735 New York Avenue, N.W.,

Washington, D.C. 20006

(202) 638-6300