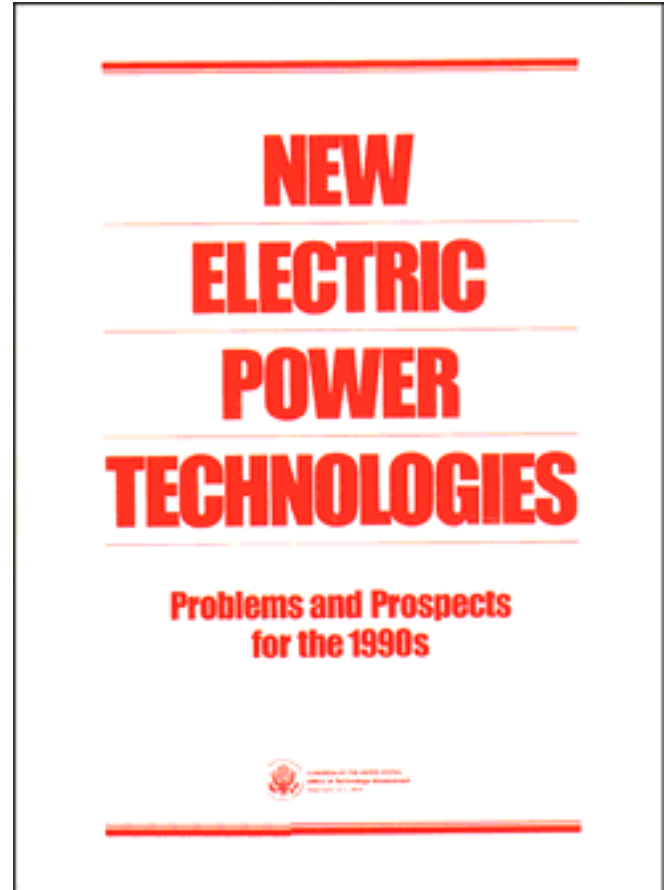


*New Electric Power Technologies:  
Problems and Prospects for the 1990s*

July 1985

NTIS order #PB86-121746



Recommended Citation:

*New Electric Power Technologies: Problems and Prospects for the 1990s* (Washington, DC: U.S. Congress, Office of Technology Assessment, OTA-E-246, July 1985).

Library of Congress Catalog Card Number 85-600568

For sale by the Superintendent of Documents  
U.S. Government Printing Office, Washington, DC 20402

# Foreword

This report responds to a request from the House Committee on Science and Technology and its Subcommittee on Energy Development and Applications to analyze a range of new electric power generating, storage, and load management technologies.

OTA examined these technologies in terms of their current and expected cost and performance, potential contribution to new generating capacity, and interconnection with the electric utility grid. The study analyzes increased use of these technologies as one of a number of strategies by electric utilities to enhance flexibility in accommodating future uncertainties. The study also addresses the circumstances under which these technologies could play a significant role in U.S. electric power supply in the 1990s. Finally, alternative Federal policy initiatives for accelerating the commercialization of these technologies are examined.

OTA received substantial help from many organizations and individuals in the course of this study. We would like to thank the project's contractors, who prepared some of the background analysis, the project's advisory panel and workshop participants, who provided guidance and extensive critical reviews, and the many additional reviewers who gave their time to ensure the accuracy of this report.



JOHN H. GIBBONS  
*Director*

OFFICE OF TECHNOLOGY ASSESSMENT  
U.S. CONGRESS  
WASHINGTON, D.C. 20540

## Related OTA Reports

- *Nuclear Power in an Age of Uncertainty.*  
OTA-E-216; February 1984. GPO stock #052-003-00941-2.
- *Industrial and Commercial Cogeneration.*  
OTA-E-192; February 1983. NTIS order #PB 83-180 547.
- *Energy From Biological Processes.*  
OTA-E-124; July 1980. NTIS order #PB 80-211 477.
- *U.S. Vulnerability to an Oil Import Curtailment: The Oil Replacement Capability.*  
OTA-E-243; September 1984. GPO stock #052-003-00963-3.
- *U.S. Natural Gas Availability: Gas Supply Through the Year 2000.*  
OTA-E-245; February 1985. GPO stock #052-003-00986-2.
- *Industrial Energy Use.*  
OTA-E-198; June 1983. GPO stock #052-003-00915-3.
- *Direct Use of Coal: Prospects and Problems of Production and Combustion.*  
OTA-E-86; April 1979. NTIS order #PB 295 797.
- *Acid Rain and Transported Air Pollutants: Implications for Public Policy.*  
OTA-O-204; June 1984. GPO stock #052-003-00956-1.

NOTE: Reports are available through the U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402, (202) 783-3238; and the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4650,

# OTA Project Staff—New Electric Power Technologies

Lionel S. Johns, *Assistant Director, OTA  
Energy, Materials, and International Security Division*

Richard E. Rowberg, *Energy and Materials Program Manager*

## **Project Staff**

Peter D. Blair, *Project Director*

Mary Procter

David Kathan (Economic and Financial Analysis)

Robert Lempert (Solar Technologies)

Lynn Luderer (Regional Analysis)

David Strom (Interconnection)

Nicholas Sundt (Technologies and Industry Structure)

## **Administrative Staff**

Lillian Chapman     Edna Saunders

## **Contractors and Consultants**

Gibbs & Hill, Inc., New York, NY

Battelle Memorial Institute, Columbus, OH

Investor Responsibility Research Center, Inc., Washington, DC

Lotus Consulting Group, Palo Alto, CA

Peter Hunt Associates, Alexandria, VA

Electrotek Concepts, Inc., Mountain View, CA

Strategies Unlimited, Inc., Palo Alto, CA

E. S. Pechan Associates, Washington, DC

Howard Geller, Washington, DC

Paul Maycock, Arlington, VA

David Sheridan, Chevy Chase, MD

## **Other OTA Contributors**

Jenifer Robison     Robert M. Friedman     Eugene Frankel     Paula Wolferseder

---

<sup>1</sup> Project Director through May 1984

# New Electric Power Technologies Advisory Panel

George Seidel, *Chairman*  
Brown University

Edward Blum  
Merrill Lynch Capital Markets

Byron R. Brown  
El. du Pent de Nemours & Co.

Bill D. Carnahan  
City of Fort Collins Light & Power

Mark Cooper  
Consumer Federation of America

Brian E. Curry  
Northeast Utilities

Janice G. Hamrin  
Independent Energy producers

William B. Harrison  
Southern Co. Services, inc.

Eric Leber  
American Chemical Society<sup>1</sup>

Paul Maycock  
Photovoltaic Energy Systems

Charles McCarthy  
Southern California Edison Co.

Anne F. Mead  
New York State Public Service Commission

Alan Miller  
World Resources Institute

Bruce W. Morrison  
Westinghouse Electric Corp.

Fred Schweppe  
Massachusetts Institute of Technology

Jon Veigel  
North Carolina Alternative Energy Corp.

---

<sup>1</sup>Formerly with the American Public Power Association.

NOTE: OTA appreciates and is grateful for the valuable assistance and thoughtful critiques provided by the advisory panel members

## **Workshop on Regulatory Issues Affecting Developing Electric Generating Technologies**

Sam Brown  
Virginia Electric Power Co.

George Knapp  
Nixon, Hargrove, Devans &  
Doyle

Therrell Murphy, Jr.  
Southern Co. Services, Inc.

David Owens  
Edison Electric Institute

Elizabeth Ross  
Birch, Horton, Bittner,  
Pestinger & Anderson

Richard Schuler  
Cornell University

Andrew Varley  
Iowa Commerce Commission

Jon Wellinghoff  
Office of the Attorney General  
State of Nevada

## **Workshop on Investment Decisions for Electric Utilities**

James Stukel, *Chairman*  
University of Illinois

Jack Davey  
Middle South Utilities

Scott Fenn  
Investor Responsibility  
Research Center, Inc.

Jerry Huck  
Illinois Power Co.

Sally Hunt  
Consolidated Edison Co.

Jim Liles  
Federal Energy Regulatory  
Commission

Lynn Maxwell  
Tennessee Valley Authority

Charles Mengers  
Philadelphia Electric Co.

Thomas Mockler  
Standard & Poor's

James Mulvaney  
Electric Power Research  
Institute

Dave J. Roberts  
General Public Utilities  
Service Corp.

John L. Seelke  
Florida Power & Light

Sam Shepard  
Southern Co. Services, Inc.

Dwain F. Spencer  
Electric Power Research  
Institute

Rodney Stevenson  
University of Wisconsin

Carl Weinberg  
Pacific Gas & Electric Co.

H.D. Williamson  
Hawaiian Electric Co., Inc.

David R. Wolcott  
New York State Energy  
Research & Development  
Authority

## **Workshops on Cost and Performance of New Electric Power Technologies**

James W. Bass, III  
Tennessee Valley Authority

Robert A. Bell  
Consolidated Edison Co.

Elliott Berman  
ARCO Solar, Inc.

Chris Bluemle  
Southern California Edison Co.

Peter B. Bos  
Polydyne Corp.

J.J. Buggy  
Westinghouse Electric

Jay Carter, Jr.  
Carter Systems

Thomas A.V. Cassel  
Technecon Consulting Group,  
Inc.

G.P. James Dehlon  
Zond Wind Resource  
Development

Carel DeWinkel  
Wisconsin Power & Light

John Dorsey  
Maryland Public Service  
Commission

Charles M. Finch  
McDonnell Douglas  
Astronautics

Richard W. Foster-Pegg  
Westinghouse Electric

Robert Greider  
Geothermal Resources  
International

Ray Hallett  
McDonnell Douglas  
Astronautics

Waker A. Hansen  
Babcock & Wilcox

Bernard Hastings  
Detroit Edison Co.

Robert Lacy  
San Diego Gas & Electric Co.

Janos Laszlo  
ASME Congressional Fellow  
Senator Hecht's Office

Peter Lewis  
public Service Electric & Gas

Roger Little  
Spire Corp.

William J. McGuirk  
Arizona public Service Co.

Tom Morton  
Fluor Engineers & Constructors,  
Inc.

Lawrence M. Murphy  
Solar Energy Research Institute

Eric J. Oakes  
Pyropower Corp.

Nick Patapoff  
Southern California Edison Co.

Don I. Plumley  
General Electric Co.

Ted J. Pollaert  
Lurgi Corp.

Dick Preston  
Scientifica Atlanta

Veronika Rabl  
Electric Power Research  
Institute

J. Lynn Rasband  
Utah Power & Light

Jeff Serfass  
Fuel Cell Users Group

Tom Stickels  
San Diego Gas & Electric Co.

Stan Stys  
Brown-Boveri Corp.

John Tengdin  
General Electric Co.

Russell A. Thompson  
United Technologies

William Vachon  
W.A. Vachon & Associates

Henry Vadie  
Houston Lighting & Power

Charles J. Warde  
Energy Development Associates

Kyle Wilcutt  
Southern Co. Services, Inc.



# Acknowledgments

In addition to panel members and workshop participants, many institutions and individuals contributed to this report by providing information, advice, and substantive reviews of draft materials. **OTA** thanks the following who took the time to provide information or review all or part of the study.

## Institutions

Applied Economics, Inc.	Gas Research Institute	Potomac Electric Power Co.
ARCO Solar Inc.	General Electric Co.	Public Service Electric & Gas
Argonne National Laboratory	General Public Utilities Services Corp.	Pyropower Corp.
Arizona Public Service Co.	Geothermal Resources International	Renewable Energy Institute
American Public Power Association	Hawaiian Electric Co., Inc.	San Diego Gas & Electric Co.
Babcock & Wilcox	Houston Lighting & Power	Sandia Laboratories
Battelle Pacific Northwest Laboratories	Illinois Power co.	Scientific Atlanta
Birch, Horton, Bittner, Pestinger & Anderson	Investor Responsibility Research Center, Inc.	Solar Energy Research Institute
Brown-Boveri Corp.	Iowa Commerce Commission	Solar Energy Industries Association
California Energy Commission	jet Propulsion Laboratories	Southern California Edison Co.
Carter Systems	Lurgi Corp.	Southern Co. Services, Inc.
California Energy Commission	Maryland Public Service Commission	Spire Corp.
Congressional Research Service	Massachusetts Institute of Technology	Standard & Poor's
Consolidated Edison Co.	McDonnell Douglas Astronautics	State of Alaska
Consumer Energy Council of America	Merrill Lynch Capital Markets	State of Nevada
Cornell University	Middle South Utilities	Technecon Consulting Group, Inc.
Detroit Edison Co.	National Regulatory Research Institute	Tennessee Valley Authority
Edison Electric Institute	New York Consumer Protection Board	Texas Public Service Commission
Electric Power Research Institute	New York State Energy Research & Development Authority	U.S. Department of Commerce
Electrotek Concepts, Inc.	New York State Public Service Commission	U.S. Department of Energy
Energy Conversion Alternatives, Ltd.	Nixon, Hargrove, Devans & Doyle	U.S. Wind power
Energy Development Associates	North American Electric Reliability Council	United Technologies
Energy Information Administration	Oak Ridge National Laboratory	University of Illinois
Environmental Policy Institute	Oregon Department of Energy	University of Wisconsin
Environmental Protection Agency	Pacific Gas & Electric Co.	Utah Power & Light
EXXON	Philadelphia Electric Co.	W.A. Vachon & Associates
Federal Energy Regulatory Commission	Photovoltaic Energy Systems	Virginia Power
Florida Power & Light	Polydyne Corp.	Westinghouse Electric
Fluor Engineers & Constructors, Inc.		Wisconsin Power & Light
Fuel Cell Users Group		Zond Wind Resource Development

## Individuals

Marshall Alper	Marie Corio	Thomas Key	Tom Reddoch	Ian Straughan
Seymour Alpert	George Crane	Ron Kukulka	Joe Reeves	David Streets
Bob Annan	David Curtice	Albert Landgrebe	David Rigney	Fred Strnisa
James Arnett	Mike DeAngeles	L. Lilleleht	Edward Sabinsky	Tom Tanton
C.J. Aulisio	Edgar DeMeo	E. Lin	Dick Salkov	Stratos Tavoulaareas
Shimon Awerbach	Bruce Edelston	Bert Louks	Robert San Martin	Roger Taylor
Don Bain	Walter Esselman	Bob Lynette	Bob Schainker	James Todd
Robert Barber	Sherman Faire	Larry Markel	Peter Schaub	William Vaughn
Richard Bellows	Merrilee Fellows	Bill Meade	Martin Schlect	Stan Vejtasa
Michael Bennet	Arnold Fickett	William Miles	Ralph Scott	Herman Velasquez
Sandra Bodmer-Turner	Tony Fung	James Mulvaney	Jeff Serfass	Blaine Vincent
James Bresee	Dom Geraghty	James Neely	Bob Sherwin	William Wagers
Sam Brown	Tom Gray	John Otts	Harold Sielstad	Byron Washon
Larry Bruneel	Leon Green	David Owens	Fereidoon Sioshansi	Michel Wehrey
Doug Carter	Robert Hayden	John Parkes	Fred Sissine	Richard Woods
Don Cerini	Evan Hughes	James Phillips	Jeff Skeer	F.R. Zaloudek
Bill Coleman	Robert Johnson	Edward Pope	Al Skinrod	
Wilfred Comtois	Alvin Kaufman	Kevin Porter	Art Soinski	
Alice Condren	Kevin Kelly	Margaret Rands	Bruce St. John	