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Nuclear Power Options Viability Study

Volume IV, Bibliography

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NUCLEAR POWER OPTIONS VIABILITY STUDY

VOLUME IV, BIBLIOGRAPHY

Editors:

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CONTENTS

ABSTRACT

Documents in the Nuclear Power Options Viability Study (NPOVS) bibliography are classified under one of four headings or categories as follows:

- Nuclear Options,
- Light Water Reactors,
- Liquid Metal Reactors, and
- High Temperature Reactors.

The collection and selection of these documents, beginning early in 1984 and continuing through March of 1986, was carried out in support of the study's objective: to explore the viabilities of several nuclear electric power generation options for commercial deployment in the United States between 2000 and 2010. There are approximately 550 articles, papers, reports, and books in the bibliography that have been selected from some 2000 surveyed. The citations have been made computer accessible to facilitate rapid on-line retrieval by keyword, author, corporate author, title, journal name, or document number.

1. INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The Nuclear Power Options Viability Study (NPOVS) was initiated at the beginning of calendar year 1984 by Oak Ridge National Laboratory (ORNL). The objective of NPOVS was to explore the viabilities of several nuclear electric power generation options for commercial deployment within the United States beginning in the 2000-2010 time frame. Important efforts included the identification and development of criteria and characteristics for evaluating new reactor concepts. Innovative concepts were identified that may be marketable at the time when the demand for new electrical energy capacity is expected to increase significantly. These concepts were considered and evaluated, with respect to the criteria and with emphasis on cost, safety features, operability, constructibility, regulation, research needs, and market acceptance. Nuclear reactors are recognized as a vital resource to meet future energy demands.

The NPOVS proceeded in steps: (1) a literature search and development of a bibliography; (2) development of criteria for evaluation of nuclear plant designs and plans; (3) evaluation of selected design concepts using these criteria as a guide; and (4) recommendations for areas of research and development (R&D) needed to reduce uncertainties in the viabilities of options. The approach used in evaluation was to compile detailed information on the various reactor concepts of interest, synthesize that information in accordance with specific technical areas, develop an understanding of how design features influence the overall cost of generating power, and consider how changes in the design might accomplish improved economic performance and acceptance by regulators and the public. In addition to technical evaluations, assessments were made of the various nontechnical factors that influence commercial use such as regulatory requirements, industry perspectives on future technologies, market acceptance, electric power growth needs, and economic conditions.

The report of the NPOVS is organized into four volumes, as follows:

- Volume I, Executive Summary[1]
- Volume II, Reactor Concepts, Descriptions, and Assessments[2]
- Volume III, Nuclear Discipline Topics[3]
- Volume IV, Bibliography.

The evaluative criteria established in this study are as follows:

1. The calculated risk to the public due to accidents is less than or equal to the calculated risk associated with the best modern LWRs.

2. The probability of events leading to loss of investment is less than or equal to 10^{-4} per year (based on plant costs).

3. The economic performance of the nuclear plant is at least equivalent to that for coal-fired plants. (Financial goals for the utility are met, and busbar costs are acceptable to the public utility commissions.)

4. The design of each plant is complete enough for analysis to show that the probability of significant cost/schedule overruns is acceptably low.

5. Official approval of a plant design must be given by the U.S. Nuclear Regulatory Commission (NRC) to assure the investor and the public of a high probability that the plant will be licensed on a timely basis if constructed in accordance with the approved design.

6. For a new concept to become attractive in the marketplace, demonstration of its readiness to be designed, built, and licensed and to begin operations on time and at projected cost is necessary.

7. The design should include only those nuclear technologies for which the prospective owner/operator has demonstrated competence or can acquire competent managers and operators.

These criteria obviously are not independent since items 1 and 2 deal with the probabilities for successful operation or failure, items 3 to 6 are primarily economic, and item 7 relates to demonstrated operational experience. However, we deem each criterion to have sufficient stand-alone merits to justify separate consideration.

The criteria are augmented by a list of characteristics that provide further guidance for properties judged to be of importance to nuclear power viability. The characteristics chosen are not as quantifiable or demonstrable as are the criteria and have been chosen to include features that complement and amplify the criteria.

In selecting the concepts to be studied, three ground rules were used:

1. The nuclear plant design option should be developed sufficiently that an order could be placed in the 2000-2010 time period.

2. The design option should be economically competitive with environmentally acceptable coal-fired plants.

3. The design option should possess a high degree of passive safety to protect the public health and property and the owner's investment. ("Passive safety" refers to the reliance on natural physical laws and properties of materials to effect shutdown and radioactive decay heat removal.)

The concepts selected are considered advanced and have various degrees of innovation as compared to current concepts. For convenience, the selected concepts were classified in the traditional way by their coolants and respective generic names. The concepts selected are

1. Light-Water Reactors (LWRs)

   - PIUS (Process Inherent Ultimate Safety) - promoted by ASEA-ATOM of Sweden

   - Small BWR (Boiling Water Reactor) - promoted by General Electric (GE)

2. Liquid Metal Reactors (LMRs)

   - PRISM (Power Reactor Intrinsically Safe Module) - The GE advanced concept supported by DOE
   - SAFR (Sodium Advanced Fast Reactor) - The Rockwell International (RI) advanced concept supported by DOE
   - LSPB (Large-Scale Prototype Breeder) - The Electric Power Research Institute-Consolidated Management Office (EPRI-CoMO) concept supported by EPRI and DOE

3. High-Temperature Reactors (HTR)

   - Side-by-Side Modular - The core and steam generator in separate steel vessels in a side-by-side configuration. The concept is supported by DOE and promoted by Gas-Cooled Reactor Associates (GCRA) and industrial firms.

1.2 SELECTION AND UTILIZATION OF APPROPRIATE DOCUMENTS

Information pertinent to the study was gathered by participants through discussions with organizations in the nuclear field and by collecting appropriate documents from the open literature. Discussions were held with 31 companies including reactor vendors, architect-engineers, utility companies and utility associations, laboratories, institutions, and universities. From the approximately 2,000 documents collected, some 550 were selected for inclusion in the bibliography. The collection consists of journal articles, reports, papers, presentations, and books covering Nuclear Options, Light Water Reactors, Liquid Metal Reactors, and High Temperature Reactors.

The selected documents were assigned keywords, categorized, and cataloged utilizing a computer. Current listings were distributed periodically to the NPOVS staff with additions to the collection flagged for their attention. New documents with particular relevance to the study or providing timely input were also routed to the concept leaders and other appropriate members of the staff. In addition, staff members visited the physical collection to access material pertinent to their area of the study. In these ways, the document collection has been utilized extensively in the course of the study.

1.3 DESCRIPTION OF THE COLLECTION

The types of documents in the collection range from newspaper clippings to books, and their length varies from one to several hundred pages. Approximately 30% of the documents are reprints of articles from journals such as Nuclear Engineering International, Power Engineering, Electrical World, Energy Policy, Science and Public Policy, and Technology Review. Reports and presentations produced by the 31 companies and laboratories in the nuclear field and which were contacted by NPOVS staff comprise another 20% of the collection. A wide spectrum of topics from broad overviews to specific assessments are covered in the collection.

2. ORGANIZATION AND RETRIEVAL

2.1 PHYSICAL COLLECTION

The physical collection is arranged by NPOVS access number and is housed in the NPOVS office at Oak Ridge National Laboratory. There are four major divisions:

- Nuclear Options,
- Light Water Reactors,
- Liquid Metal Reactors, and
- High Temperature Reactors.

Within these divisions, entries are listed by first author or corporate author. Each entry includes in order: name(s) of author or corporate author; title; publication description; corporate author(s); address of corporate author(s); publication date; NPOVS access code (in parentheses); and keywords assigned (in parentheses at the end of the entry).

The documents are filed in a series of notebooks and file boxes numbered sequentially under each major heading. The notebooks are divided into sections, and sections are divided with a tab for each document.

Subjects of interest may be found by using the keyword index (Chapter 4) or referring to the alphabetical listings by author presented in the four major classifications: Nuclear Options (Chapter 5); Light Water Reactors (Chapter 6); Liquid Metal Reactors (Chapter 7); and High Temperature Reactors (Chapter 8).

The NPOVS access code is an alphanumeric key to the physical location of the document. The code consists of two or three letters followed by three sets of two-digit numbers such as NO-03-02-05. The letters refer to the heading (NO = Nuclear Options, LWR = Light Water Reactors, LMR = Liquid Metal Reactors, and HTR = High Temperature Reactors). The first set of digits refers to the notebook number within the heading, the second set of digits to the section within the notebook (when these digits are preceded by the letter "B," the document is found in the appropriate file box rather than in a notebook), and the third set of digits to the item number within the section. The coding is illustrated below for NO-03-02-05.

NO = Nuclear Options

03 = Notebook No. 3 (or File Box No. 3 if coded "B03")

02 = Section No. 2 of the notebook

05 = Item No. 5 in the section.

2.2 KEYWORDS

The keywords selected and used in this collection are shown in Chapter 3, Table 3.1.

To facilitate locating citations or documents by subject, a keyword index is provided as Chapter 4. Please refer to Chapter 4 for details and instructions for utilizing the keyword index.

2.3 COMPUTER SEARCHES

The bibliographic data base resides in the ORNL IBM 3033 mainframe computer (System 2 on ORNL'S System Select Network) and is accessible to ORNL staff via a search program called ORLOOK. After log on and initialization of ORLOOK, the user makes the following selections: "private" data base, named "NPOVS," and file number "1."

Searches may be made of the fields <AUTHOR>, <TITLE>, <PUB DES> (publication description), <CORPAUTH> (corporate author), and <KEYWORDS> or a blanket search (covering all fields) might be made. A blanket search for, as an example, "ASEA-ATOM" would produce citations where ASEA-ATOM is the author or corporate author as well as citations where ASEA-ATOM is a part of the title.

Combination searches for a maximum of 4 words are also possible, thereby tailoring the search to fit the needs of the user. For example, a search might be made for 'costs', 'international', 'construction'. Combination searches limit the area searched and produce a shorter list of citations.

For information on other search combinations and detailed information about ORLOOK searches, please refer to ORNL-4951 (Rev. 1) by V. A. Singletary.[4]

Results of computer searches may be transmitted rapidly via the ITT DIALCOM electronic mail network to ITT DIALCOM subscribers at DOE Headquarters.

2.4 ASSISTANCE OR ADDITIONAL INFORMATION

For assistance in using the collection or with computer searches contact Jackie W. Sims, and for further information regarding the bibliography contact Donald B. Trauger. Both may be reached at the following address and phone:

Nuclear Power Options Viability Study
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P. O. Box X, Building 4500-N, Room I-208
Oak Ridge, TN 37831
PHONE: (615) 576-6730 or FTS 626-6730.

3. KEYWORD LIST

An alphabetical listing of the keywords used in this bibliography is given in Table 3.1. Acronyms used as keywords are defined in Table 3.2.

Table 3.1 Keywords used in NPOVS bibliography[a]

accidents	future	pool
advanced reactors	GAT	prefabrication
air ingress	GCRA	priorities
analysis	GCRs	project management
ANL	GE	project organization
ASEA-ATOM	Germany	projections
attitudes	graphite	proliferation
availability factor	growth	public acceptance
breeders	heat exchangers	PWRs
BWRs	HTRs[b]	pyrochemical
CANDU	human resources	rates
capacity	IAEA	recycling
capacity factor	IFRs	regulation
capital	innovation	reprocessing
CNSS	INPO	requirements
coal	instruments	research
codes	international programs	resources
cogeneration	Japan	risk
commercialization	labor	Rockwell
construction	large reactors	safety
controls	licensing	SECURE
costs	LMRs[b]	shop fabrication
decisions	loop	small reactors
demand	LWRs[b]	standardization
deployment	maintenance	steam generators
design	management	steam-cooled reactors
development	markets	strategy
district heating	materials	supply
DOE	metal fuel	Three Mile Island
economics	Mitsubishi	utilities
electricity	modular reactors	waste
engineering	MSRs	Westinghouse
environment	NASAP	
EPRI	NRC	
ERAB	nuclear options[b]	
fast reactors	NUPACK	
financing	OECD	
fission	operations	
fossil	pebble bed	
France	performance	
fuel	PIUS	
fuel cycle		

[a]Acronyms are defined in Table 3.2.

[b]The bibliographic citations are already sorted by heading as either Nuclear Options, Liquid Metal Reactors, High Temperature Reactors, or Light Water Reactors. Searches for these keywords will generate those citations plus any under other headings utilizing the keyword. For Example, a search for the keyword "HTRs" will generate all the citations under the High Temperature Reactors heading plus documents from other headings with HTRs as an assigned keyword.

Table 3.2 Acronyms and definitions used in NPOVS bibliography

Acronym	Definition
ANL	Argonne National Laboratory
ASEA-ATOM	Atomic division of ASEA, Vasteras, Sweden
BWRs	Boiling Water Reactors
CANDU	Canadian Deuterium Uranium Reactor
CNSS	Consolidated Nuclear Steam Supply
DOE	U.S. Department of Energy
EPRI	Electric Power Research Institute
ERAB	Energy Research Advisory Board
GAT	GA Technologies, Inc.
GCRA	Gas-Cooled Reactor Associates
GCRs	Gas-Cooled Reactors
GE	General Electric Company
HTRs	High Temperature Reactors
IAEA	International Atomic Energy Agency
IFRs	Integral Fast Reactors
INPO	Institute of Nuclear Power Operations
LMRs	Liquid Metal Reactors
LWRs	Light Water Reactors
MSRs	Molten Salt Reactors
NASAP	Nonproliferation Alternative Systems Assessment Programs
NRC	U.S. Nuclear Regulatory Commission
NUPACK	Nuclear Package
OECD	Organisation for Economic Co-Operation and Development
PIUS	Process Inherent Ultimate Safety
PWRs	Pressurized Water Reactors
SECURE	Selfprotecting, Eversubmerged Core, Utility Reactor

4. KEYWORD INDEX

In the index beginning on the following page, each keyword is listed alphabetically, followed by an alphabetical list of the first author of document(s) assigned that keyword. The NPOVS access code, an alphanumeric code for the physical location of the document (see Section 2.1), follows the author's name. Multiple NPOVS access codes will appear when there is more than one document with the same first author.

Once the NPOVS access code and the first author are determined, the complete citation can be located by referring to the appropriate chapter indicated by the code, locating the author, and then locating the specific code:

NO (Nuclear Options)	=	Chapter 5
LWR (Light Water Reactors)	=	Chapter 6
LMR (Liquid Metal Reactors)	=	Chapter 7
HTR (High Temperature Reactors)	=	Chapter 8

For retrieval of the document itself from the physical collection, the NPOVS access code (as explained in Section 2.1) serves as an alphanumeric location guide.

Keyword Index

Keyword Index

Keyword Index

Keyword Index

Keyword Index

Keyword Index

decisions

demand

Keyword Index

deployment

design

Keyword Index

development

district heating

DOE

economics

Keyword Index

Keyword Index

electricity

Keyword Index

Keyword Index

Keyword Index

Keyword Index

Keyword Index

Keyword Index

Japan

labor

large reactors

Keyword Index

Keyword Index

loop

LWRs

Keyword Index

Keyword Index

Keyword Index

Keyword Index

nuclear options

Keyword Index

Keyword Index

Keyword Index

NUPACK

OECD

operations

Keyword Index

Keyword Index

Keyword Index

Keyword Index

reprocessing

requirements

research

Keyword Index

Keyword Index

Keyword Index

Keyword Index

Keyword Index

Keyword Index

Westinghouse

5. NUCLEAR OPTIONS CITATIONS

Nuclear Options

Abernathy, W. J., and B. S. Chakravarthy, "Government Intervention and Innovation In Industry: A Policy Framework," *Sloan Management Review*, pp. 3-18, Spring 1979 (NO-15-02-01).

(Keywords: commercialization, innovation, markets, nuclear options, strategy)

American Nuclear Society, "The Improving Power Market: Positive Implications for Nuclear Power," American Nuclear Society Topical Meeting, Financial and Economic Bases for Nuclear Power, Washington, D.C., American Nuclear Society, April 1984 (NO-11-01-06).

(Keywords: nuclear options, economics, demand, regulation, future, fossil)

American Physical Society Study Group, *Report of the Study Group on Radionuclide Release from Severe Accidents at Nuclear Power Plants*, American Institute of Physics, New York, New York, date unknown (NO-17-03-01).

(Keywords: accidents, nuclear options, risk, safety, Three Mile Island)

Anonymous, *Energy and the Need for Nuclear Power*, INIS-mf--8497, F61, gb8307197, date unknown (NO-09-01-01).

(Keywords: nuclear options, resources, economics)

Anonymous, *International Cooperation for Establishment and Use of Nuclear Energy in Developing Countries*, INIS-MF-8001, date unknown (NO-05-01-10).

(Keywords: nuclear options, international programs)

Anonymous, "The Quasi-Legislative Process of State Utility Regulation and Alternative Cost Recovery Methods," Workshop on Alternative Electric Power Plant Financing and Cost Recovery Methods, National Science Foundation, Division of Pol. Res. and Analysis, Tech. and Resource Pol. Section, May 7-8, 1984 (NO-11-01-08f).

(Keywords: nuclear options, regulation, costs, economics, capacity, regulation, future)

Anonymous, "Utility 'Near-Paranoid'--PSC Staff Questions Detroit Ed Safety Expenditures at Fermi 2," *INFO 188,* date unknown (NO-13-01-03).

(Keywords: nuclear options, safety, costs, public acceptance, attitudes)

Applied Decision Analysis, Inc., *An Analysis of Power Plant Construction Lead Times, Volume 1: Analysis and Results*, EPRI EA/2880, Volume 1, Applied Decision Analysis, Inc., Menlo Park, California, February 1983 (NO-B04-01-01).

(Keywords: project management, project organization, nuclear options, costs, construction, EPRI, licensing, regulation)

Applied Decision Analysis, Inc., *An Analysis of Power Plant Construction Lead Times, Volume 2: Supporting Documentation and Appendices*, EPRI EA-2880, Volume 2, Applied Decision Analysis, Inc. for the Southern States Energy Board, Menlo Park, California, February 1984 (NO-B03-01-01).

(Keywords: construction, EPRI, licensing, management, nuclear options, regulation)

Argonne National Laboratory, *Meeting Our Need for Electric Energy, The Role of Nuclear Power*, DOE/NE-0054, ANL, Argonne, Illinois, July 1984 (NO-06-01-10).

(Keywords: nuclear options, ANL, capacity, coal, DOE, electricity, future, priorities, projections)

Nuclear Options

Arnold, W. H., *Statement Before the U.S. House of Representatives Committee on Science and Technology Subcommittee on Energy Research and Production*, 0783M-83M:2(54523), Westinghouse Electric Corporation, February 8, 1984 (NO-03-01-10).

(Keywords: nuclear options, Westinghouse, economics, attitudes, safety)

Arnott, D., "The Nuclear Falling Out," *Management Today*, pp. 46-51 and 117-119, April 1983 (NO-09-02-04).

(Keywords: nuclear options, attitudes, international programs, economics, resources, LWRs)

Asseltine, J. J., "Regulating in an Environment of Uncertainty," Twelfth Water Reactor Safety Research Information Meeting, U.S. Nuclear Regulatory Commission, Washington, D.C., October 22, 1984 (NO-01-02-23).

(Keywords: nuclear options, licensing, NRC, regulation, standardization)

Atomic Industrial Forum, *Nuclear Power in America's Future*, Atomic Industrial Forum, Inc., Bethesda, Maryland, June 1984 (NO-13-01-13).

(Keywords: nuclear options, future, economics, costs, safety, public acceptance, attitudes, construction)

Atomic Industrial Forum, Inc., *A Comparison of Future Costs of Nuclear and Coal-Fired Electricity*, AIF, Inc., Bethesda, Maryland, November 1984 (NO-05-01-02).

(Keywords: nuclear options, availability factor, capacity factor, coal, construction, costs, economics, electricity, fuel, future)

Australian Institute of Nuclear Science and Engineering, *Third Australian Institute of Nuclear Science and Engineering (AINSE) Engineering Conference*, AINSE Theater, Lucas Heights, N.S.W., Australian Institute of Nuclear Science and Engineering, November 12-13, 1981 (NO-07-01-03).

(Keywords: nuclear options, international programs, research, engineering)

Avenhaus, R., W. Hafele, and P. E. McGrath, "Considerations on the Large-Scale Deployment of the Nuclear-Fuel Cycle," *Energy 2*, pp. 323-363, November 1976 (NO-05-01-09).

(Keywords: nuclear options, fuel cycle, markets, international programs, development)

Bainerman, J., "Generating Nuclear Power," *Newsview*, p. 8, September 18, 1984 (NO-12-01-05).

(Keywords: nuclear options, fuel cycle, proliferation)

Barkenbus, J. N., *An Assessment of Institutional Alternatives for Nuclear Power Generation* (draft), Institute for Energy Analysis, Oak Ridge Associated Universities, Oak Ridge, Tennessee, February 1983 (NO-08-01-02).

(Keywords: nuclear options, international programs, decisions)

Barkenbus, J. N., *Prospects and Opportunities for Nuclear Power Regulatory Reform*, ORAU/IEA-83-5(M), Institute for Energy Analysis, Oak Ridge Associated Universities, Oak Ridge, Tennessee, April 1983 (NO-B01-01-07).

(Keywords: nuclear options, regulation, licensing, public acceptance, attitudes, NRC, international programs)

Bean, E., "Going It Alone: Duke Power Succeeds Building Nuclear Units Without Outside Help," *The Wall Street Journal*, p. 1, Wednesday, October 17, 1984 (NO-02-01-01).

(Keywords: construction, nuclear options, costs, financing, LWRs, utilities)

Bechtel Corporation, "Electricity and the Economy," Bechtel Corporation, 1983 (NO-B02-01-06).

(Keywords: nuclear options, electricity, economics, future)

Behrens, C. E., *Economic Potential of Smaller-Sized Nuclear Plants in Today's Economy*, (prepared at the request of P. Tsongas), Congressional Research Service, Library of Congress, Washington, D.C., January 20, 1984 (NO-06-01-05).

(Keywords: nuclear options, economics, small reactors)

Berlin, E., "Excess Capacity, Plant Abandonments and Prudence, the Appropriate Regulatory Standard," Workshop on Alternative Electric Power Plant Financing and Cost Recovery Methods, National Science Foundation, Division of Pol. Res. and Analysis, Tech. and Resource Pol. Section, May 7-8, 1984 (NO-11-01-08e).

(Keywords: nuclear options)

Berton, L., "Utilities Face Rule Changes on Profits," *The Wall Street Journal*, Tuesday, November 20, 1984 (NO-14-01-01).

(Keywords: nuclear options, attitudes, construction, costs, financing, LWRs, markets, PWRs, public acceptance, rates, regulation, utilities)

Bhaneja, B., J. Lyrette, T. W. Davies, and R. M. Dohoo, "Technology Transfer from Government Laboratories to Industry: Canadian Experience in the Communications Sector," *R&D Management 12*(2), 53-59, 1982 (NO-15-02-02).

(Keywords: commercialization, deployment, innovation, management, nuclear options, strategy)

Blumenthal, M., and J. Dray, "The Automated Factory: Vision and Reality," *Technology Review 88*(1), 29-37, January 1985 (NO-15-02-03).

(Keywords: nuclear options, shop fabrication)

Bower, R. S., "The Capital Recovery Question: An Overview," Workshop on Alternative Electric Power Plant Financing and Cost Recovery Methods, National Science Foundation, Division of Pol. Res. and Analysis, Tech. and Resource Pol. Section, April 1984 (NO-11-01-08c).

(Keywords: nuclear options, rates, regulation, economics)

Bowers, H. I., L. C. Fuller, and M. L. Myers, *Trends in Nuclear Power Plant Capital Investment Cost Estimates - 1976 to 1982*, NUREG/CR-3500, ORNL/TM-8898, Prepared for the U.S. Nuclear Regulatory Commission by the Oak Ridge National Laboratory, Oak Ridge, Tennessee, September 1983 (NO-10-01-03).

(Keywords: nuclear options, economics, costs, LWRs, fossil)

Bradshaw, D. T., T. B. Jenkins, and J. E. Simmons, "Preliminary Probabilistic Incremental System Economic Evaluation of Base Load Generation Alternatives for 2005 Startup," presentation to Gas-Cooled Reactor Associates (TAC), Tennessee Valley Authority, Chattanooga, Tennessee, undated (NO-18-01-02).

(Keywords: capital, coal, economics, fuel cycle, HTRs, nuclear options)

Braun, C., "Comparative Review of U.S. and French Power Plant Construction Projects," ANS/ENS International Conference, Washington, D.C., Electric Power Research Institute, Palo Alto, California, November 1984 (NO-13-01-11).

(Keywords: nuclear options, construction, costs, economics, EPRI, France, labor, licensing, LWRs, regulation, standardization, engineering, large reactors)

Braun, C., "Economics of Small Reactors," Presentation to the American Nuclear Society Annual Meeting, New Orleans, Louisiana, June 3-7, 1984 (NO-14-01-05).

(Keywords: nuclear options, small reactors, economics, standardization, construction, labor, costs)

Braun, C., "Evaluation of Small Reactors Economics," presentation to ANS 1985 Winter Meeting, San Francisco, California, Electric Power Research Institute, Palo Alto, California, November 10-14, 1985 (NO-17-03-02).

(Keywords: advanced reactors, analysis, costs, economics, France, nuclear options, shop fabrication, small reactors)

Braun, C., "Nuclear and Fossil Power Plants Economics," Presentation to the American Nuclear Society Topical Meeting on Financial and Economic Bases for Nuclear Power, Washington, D.C., April 8-11, 1984 (NO-14-01-03).

(Keywords: nuclear options, economics, fossil, demand, growth, regulation, construction, costs, materials)

Braun, C. et al., "Comparative Review of U.S. and French Power Plant Construction Projects," presentation at the University of Paris Conference on International Nuclear Cost Comparisons, Paris, France, Electric Power Research Institute, Palo Alto, California, February 1985 (NO-15-02-04).

(Keywords: construction, costs, EPRI, France, labor, large reactors, materials, nuclear options, standardization)

Braun, C., and K. E. Stahlkopf, "The Arguments for the Implementation of a Small Reactor Program," presentation at the American Nuclear Society 1985 Annual Meeting, Boston, Massachusetts, Electric Power Research Institute, Palo Alto, California, June 1985 (NO-18-01-01).

(Keywords: capital, costs, economics, financing, nuclear options, shop fabrication, small reactors, standardization)

Bray, P., "What Are the Trends Which Will Shape Future Designs," McGraw-Hill Nuclear Power Services Conference, Washington, D.C., Atomic Industrial Forum, Bethesda, Maryland, May 1, 1984 (NO-14-01-22).

(Keywords: nuclear options, BWRs, economics, electricity, financing, France, international programs, Japan, licensing, LWRs, NRC, PIUS, regulation, safety, standardization)

Brigham, E. F., and T. C. Tapley, "Comments on the Capital Recovery Question: An Overview," Workshop on Alternative Electric Power Plant Financing and Cost Recovery Methods, National Science Foundation, Division of Pol. Res. and Analysis, Tech. and Resource Pol. Section, May 7, 1984 (NO-11-01-08d).

(Keywords: nuclear options, capacity, economics, regulation, future)

Brightsen, R. A., "The Way to Save Nuclear Power," *Fortune*, pp. 126-132, September 10, 1979 (NO-05-01-11).

(Keywords: nuclear options, attitudes, future, economics)

Brunings, J. E., et al., "Compact Reactor Power Systems," *Nuclear Engineering Technology 22*, pp. 237-250, May 1974 (NO-01-02-19).

(Keywords: nuclear options, small reactors)

Budwani, R. N., "The Data Base for U.S. Power Plants," *Power Engineering*, pp. S-1 through S-24, January 1985 (NO-07-01-12).

(Keywords: nuclear options, BWRs, coal, construction, costs, engineering, labor, licensing, materials, PWRs, utilities)

Burke, R. P., D. C. Aldrich, and N. C. Rasmussen, *Economic Risks of Nuclear Power Reactor Accidents*, NUREG/CR-3673 (SAND84-0178), Sandia National Laboratories, Albuquerque, New Mexico, and Livermore, California, April 1984 (NO-15-02-05).

(Keywords: costs, economics, LWRs, nuclear options, public acceptance, risk)

Burwell, C. C., and D. B. Reister, *Electricity Use and Use Trends in the Production of Chemicals*, ORAU/IEA-85-4(M), Institute for Energy Analysis, Oak Ridge, Tennessee, August 1985 (NO-B04-01-03).

(Keywords: cogeneration, demand, electricity, nuclear options)

Business Week, "Downsizing Nuclear Plants," *Business Week*, pp. 144, November 10, 1980 (NO-15-02-06).

(Keywords: LWRs, nuclear options, safety, small reactors)

Caldwell, L. S., "Looking at CWIP," *Nuclear News 28*(8), 74-75, June 1985 (NO-15-02-07).

(Keywords: costs, electricity, financing, nuclear options, regulation, utilities)

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