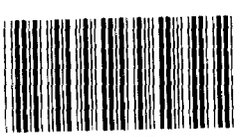
REPORT BY THE

Comptroller General

OF THE UNITED STATES

The Business Energy Investment Credit For Solar And Wind Energy

The Business Energy Investment Credit, which provides a 15-percent tax credit to owners of new solar and wind energy equipment, is scheduled to expire on December 31, 1985. This report presents (1) GAO's analysis of the credit's effect on the economics of four projects which were to employ solar and wind energy systems, (2) a summary of the views of a broad spectrum of organizations on the desirability of extending the credit past its currently scheduled expiration date, and (3) a discussion of the possible revenue loss to the Treasury resulting from an extension.



GAO/RCED-83-8
MARCH 7, 1983

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON D.C. 20548

B-209008

The Honorable Don Fuqua, Chairman
The Honorable Hamilton Fish, Jr.
Ranking Minority Member
Subcommittee on Energy Development
and Applications
Committee on Science and Technology
House of Representatives

As requested in your letter of June 7, 1982, this report discusses the possible effects of extending the 15-percent Business Energy Investment Credit for solar and wind energy systems to 1990, or alternatively to the mid-1990s. A second study is underway which addresses your concern on the Department of Energy's plans to terminate Federal support for test and research facilities.

We did not obtain agency comments. As arranged with your office, we are sending copies of this report to the Director, Office of Management and Budget; the Secretaries of Energy and of the Treasury; and interested committees of the Congress. Copies will also be made available to others upon request.

Charles A. Bowsher

Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE SUBCOMMITTEE ON
ENERGY DEVELOPMENT AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

THE BUSINESS ENERGY INVESTMENT CREDIT FOR SOLAR AND WIND ENERGY

D I G E S T

The Business Energy Investment Credit, which provides a 15-percent tax credit to owners of new solar and wind energy equipment, is scheduled to expire on December 31, 1985. GAO was asked by the Subcommittee to study the possible effects of extending the credit for these emerging solar technologies to 1990, or alternatively to 1995. (See app. I.) Emerging solar technologies are those that employ various solar and wind energy systems which are beginning to be introduced in the marketplace but are not yet commercialized (marketed by businesses for profit) on a widespread basis.

GAO (1) studied the credit's effects on the economics of four projects which were to employ solar or wind energy systems, (2) obtained the views of a broad spectrum of organizations concerning the desirability of extending the credit beyond 1985, and (3) explored the possible revenue loss to the Department of the Treasury that would result from an extension. (See p. 4.)

GAO analyzed the project economics and obtained views prior to tax law changes made by the Tax Equity and Fiscal Responsibility Act of 1982. The act reduces the amounts that can be depreciated for projects in which the credit is claimed. GAO notes that since the credit was not changed such a reduction should not significantly alter the results of GAO's analyses nor the views obtained. (See p. 5.)

EFFECT OF THE CREDIT ON THE ECONOMICS OF SELECTED PROJECTS

At the time of GAO's study, no privately financed projects had been completed and very few had been started or proposed. With data provided by industry, GAO analyzed the credit's effects on the economics of four projects that had been started or were being proposed. For purposes of this study GAO defined an "economically viable" project as one which would provide

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a sufficiently large return on investment to enable the project to economically compete with alternative investments, assuming an equal level of risk. To compete for funds a project would need to provide a return at least that large and GAO considered a project to be economically viable if its return to an investor was projected to be at least 12 percent. GAO notes, however, that the solar and wind projects involve new systems not yet commercially demonstrated and as such the private sector perceives them as being inherently more risky. In this regard, private investors say they need a rate of return on investment of about 25 percent or more.

GAO's analyses indicate that two of the projects would be economically viable with or without the credit but the other two projects would not be economically viable even with the credit. For the economically viable projects, the credit would improve the projects' financial attractiveness to investors--increasing the estimated return on their investment from about 19 to 25 percent. According to the parties involved in these two projects, without the credit private financing could not be obtained and these projects would not be undertaken. With respect to the projects that were not economically viable, the credit is expected to help the manufacturers reduce losses and establish an industrial capability while demonstrating their systems, but little or no profits will be made. (See p. 11.)

INDUSTRY AND OTHERS BELIEVED AN EXTENSION WOULD HELP COMMERCIALIZE SOLAR AND WIND ENERGY SYSTEMS

Almost all of the 56 companies, including systems suppliers and manufacturers, GAO interviewed believed that the credit for solar and wind energy systems needs to be extended to help make those systems commercial (suitable for a large market). About 95 percent of these companies believed a 5-year extension is needed and over 80 percent regarded a 10-year extension as helpful. One of the principal reasons given was that the long lead times required to plan and construct projects precluded these companies from completing those projects prior to the credit's expiration. They added that

without the credit, some projects would not be built because the return on investment would not be sufficient to attract investors. Other reasons cited by these companies pertained to the need to increase demand for solar and wind energy systems so that manufacturers of such systems can stay in business until systems' costs are economically competitive and a wider market for their products is established. (See p. 23.)

Most companies believed that an extension would provide little or no chance of windfalls. However, some indicated that a windfall might result, particularly with a 10-year extension, because cost reductions, technological breakthroughs, or reduced uncertainties could increase the commercial competitiveness of some systems. For the purpose of its study, GAO defined "windfall" as providing a credit to taxpayers for investments that would have been made anyway. (See p. 29.)

Investors, utilities, laboratories, and Department of Energy program officials generally agreed that a 5-year extension would help commercialize the solar and wind energy systems and would not result in windfalls. However, Department of Energy program officials would not state whether an extension is needed. (See p. 31.)

Department of the Treasury officials said that the credit for solar and wind energy, or any credit targeted toward specific investments, is not needed or appropriate. The Treasury believes tax credits are a highly inefficient mechanism for providing Government subsidies because taxpayers may claim such credits whether or not the investments would have been made anyway. Furthermore, these officials pointed out that such credits distort the market by providing preferential treatment to certain investments. They believed that if an energy technology could not survive without special treatment, it should be allowed "to die". (See p. 34.)

GAO notes that there are many factors and diverse viewpoints on whether a decision to extend the credit beyond 1985 is desirable from the standpoint of society as a whole. For example, future oil and gas prices could significantly affect the competitiveness of solar

and wind energy systems. GAO cautions that its study was not intended to provide a comprehensive assessment of all such factors and viewpoints, but rather to present information on the credit's effect on selected solar and wind energy projects and the views of industry and other parties concerning the extension of the credit beyond 1985. (See p. 4.)

REVENUE LOSS TO THE TREASURY IS UNCERTAIN

The possible revenue loss to the Treasury from extending the credit for solar and wind energy systems is uncertain. Uncertainties about the extent the credit will be used make impossible the development of estimates that are sufficiently precise to be meaningful. The extent of future private sector investment in these systems depends on several somewhat interrelated factors. The principal factors include (1) the extent to which the systems will be used by utilities, (2) the future price of conventional fuels such as oil and natural gas, (3) reductions in the cost of solar and wind energy systems, and (4) the ability of manufacturers of solar and wind energy systems to stay in business until costs are economically competitive and a wider market for their products is established. Each of these factors involves uncertainties, and assumptions would have to be made for them in order to project the amount of future private sector investment in solar and wind energy systems. (See p. 36.)

Department of Energy program officials believed that the credit's extension would actually result in a net gain--not loss--to the Treasury due to the tax revenues generated from increased business activity. (This assumes that the monies would not have been invested in alternative equipment or facilities, or any other income producing investment.) In addition, program officials believed that the increased generating capacity from solar and wind resulting from a 5-year extension would lead to reduced U.S. oil imports and other offsetting benefits in the longer term. They believed such benefits may make almost any revenue loss worthwhile. (See p. 38.)

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GAO did not obtain official agency comments on this report. However, GAO discussed the report's contents with Department of Energy program officials and Department of the Treasury officials. Their views are included where appropriate. (See p. 6.)

Contents

GLOSSARY

British thermal unit	The amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.
Central receiver	A type of concentrating solar thermal power system in which a single, tower-mounted receiver is heated by the solar rays reflected from a field of independent tracking mirrors.
Concentrating collector	A device which uses reflective surfaces to concentrate the solar radiation onto a small area, where the energy is absorbed and converted to (high temperature) heat.
Industrial process heat	Thermal energy used in the preparation and treatment of goods produced by manufacturing processes.
Market penetration	How much a product will be sold as it gains consumer acceptability over a specified time.
Megawatt	Power unit equal to one million watts or one thousand kilowatts.
Parabolic dish	A type of solar thermal power system in which a receiver is heated by solar rays reflected from a concentrating collector in the shape of a parabolic dish.

Payback	A traditional measure of economic viability of investment projects. A payback period is defined in several ways - one of which is the number of years required to accumulate income to equal the initial capital cost of a project. Payback often does not give an accurate representation of total value.
Photon	The carrier of a quantum (quantity) of electromagnetic energy. Photons have an effective momentum but no mass or electrical charge.
Photovoltaic	A solid-state electrical device capable of producing electric power when exposed to radiant energy, especially sunlight.
Quad	Quadrillion (10^{15}) British thermal units. Commonly used as a measure of energy consumption. For example, present U.S. consumption is about 75 quads.
Receiver	A device located at the focal point of the concentrator, which converts solar rays into heat.
Solar cell	The basic photovoltaic device which generates electricity when exposed to sunlight.

ABBREVIATIONS

A&E	architect and engineering
BEIC	Business Energy Investment Credit
DOE	Department of Energy
GAO	General Accounting Office
IRS	Internal Revenue Service

CHAPTER 1

INTRODUCTION

By letter dated June 7, 1982, the Chairman and Ranking Minority Member, Subcommittee on Energy Development and Applications, House Committee on Science and Technology, requested that we study the possible effects of extending the 15-percent Business Energy Investment Credit (BEIC) for solar and wind energy systems to 1990, or alternatively to the mid-1990s. The BEIC for solar and wind energy is one of the various tax incentives provided for by the Congress in the Energy Tax Act of 1978 (P.L. 95-618, Nov. 9, 1978) and the Crude Oil Windfall Profit Tax Act of 1980 (P.L. 96-223, Apr. 2, 1980) to encourage the conversion from oil and gas to new energy systems. This credit, which provides owners of new solar and wind energy equipment a tax credit equal to 15 percent of the cost of that equipment, is scheduled to expire on December 31, 1985. 1/ This is in addition to the 10-percent Investment Tax Credit available to a business investing in new machinery or equipment.

Solar and wind energy equipment qualifying for the BEIC include those used to heat or cool a structure, provide hot water for use in a structure, provide heat for industrial or agricultural processes, and generate electricity. Although owners of solar and wind energy equipment for generating electricity qualify for the BEIC, the legislation specifically precludes public utility property from qualifying for the credit. As a result, financing arrangements involving non-utility owners are being developed to take full advantage of the BEIC. Such non-utility owners are commonly called "third-parties" because they usually are neither the suppliers/manufacturers of the systems nor the buyers or consumers of the energy produced. The third-party arrangement is the primary mechanism for using the credit for solar and wind energy powerplants.

DESCRIPTION OF A THIRD-PARTY FINANCING ARRANGEMENT

In a typical third-party financing arrangement, an investor or group of investors provides the equity funding for the construction of a powerplant using a system purchased from a systems supplier or manufacturer and sells the electric power produced to a utility. The principal feature of such an arrangement is that the return on the investment from the sale of power is enhanced by the tax benefits available to the investors.

The diagram on the following page illustrates the structure of a third-party financing arrangement. The central element of the

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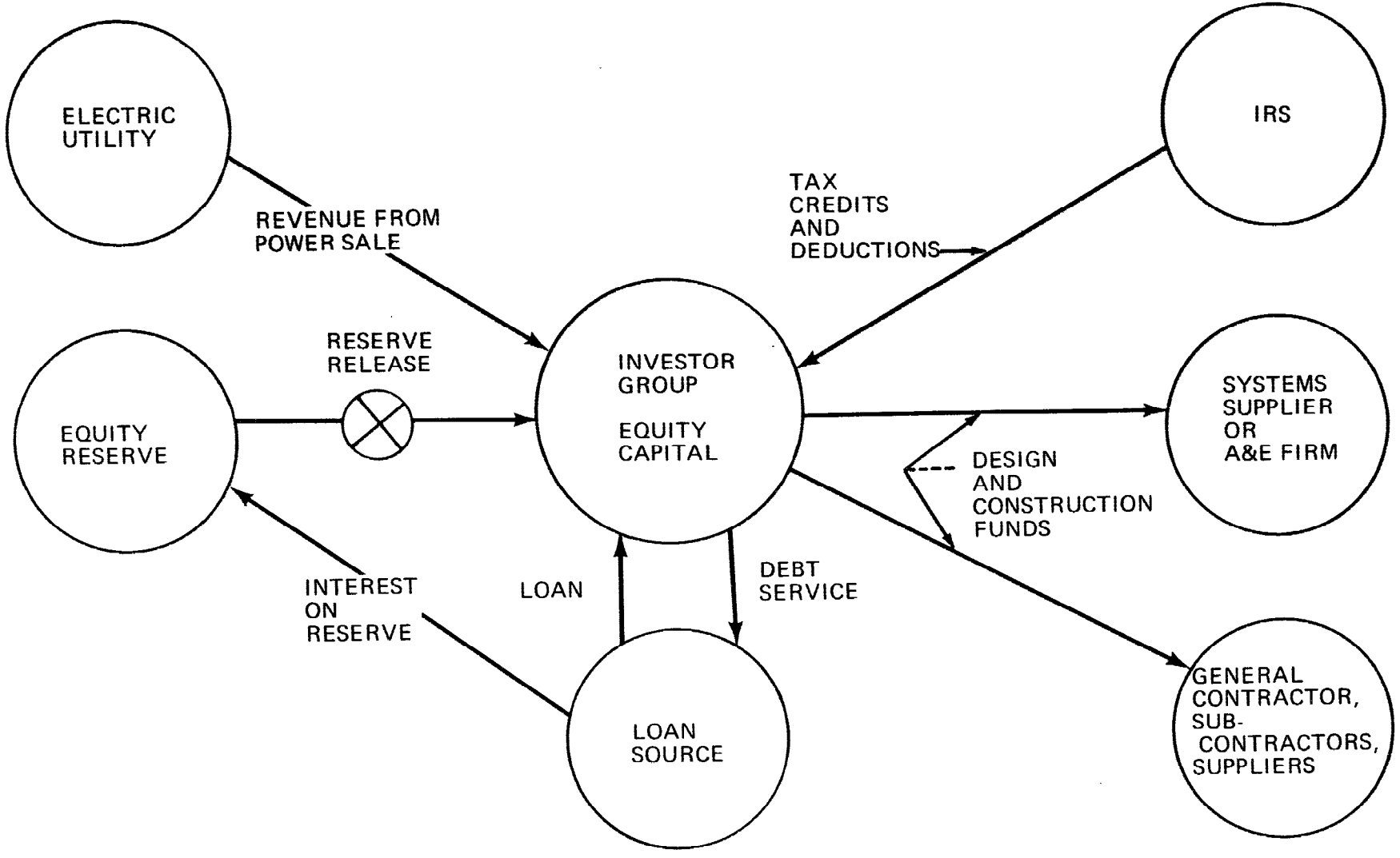
1/A tax credit is applied against a taxpayer's tax liability by an amount equal to a percentage of an expenditure or investment.

STRUCTURE OF THIRD-PARTY FINANCING ARRANGEMENT



Source: This diagram was adapted from a figure contained in a January 15, 1982 report by the Aerospace Corporation entitled "Third Party Financing of Photovoltaic Power Plants for Electric Utility Service."

structure is the source of the equity funding--a corporation or group of corporations, a partnership of individual investors, or some combination of these, with substantial tax liabilities and a concomitant ability to benefit from the tax credits and deductions allowed by the Internal Revenue Service. This investor group raises additional capital by borrowing and arranges for the construction of a solar or wind energy plant through a systems supplier or architect and engineering (A&E) firm, a general contractor, and the requisite subcontractors and suppliers. The sale of the power produced by the plant is accomplished through a long-term agreement with a utility.

The other principal element of the structure, the equity reserve, serves the purpose of preventing negative cash flows (before-tax or after-tax) that would otherwise arise during the early years of plant operation, before the revenue from electricity sales has grown large enough to cover the cost of paying off a loan. The equity reserve is contributed by the investor group as part of the initial equity investment and is kept on deposit (normally at the lending institution that provides the debt financing), earning interest until released as needed to offset negative cash flows.

USE OF BUSINESS ENERGY INVESTMENT CREDIT FOR SOLAR AND WIND ENERGY SYSTEMS TO DATE

The Congress enacted the BEIC as part of a comprehensive energy program to encourage energy conservation and the conversion from oil and gas to alternative energy sources. The credit was directed at a variety of alternative energy properties, including equipment which uses solar and wind. To qualify for the credit, solar and wind energy equipment must be installed by the statutory deadline of December 31, 1985. To date, only limited use of the credit for solar and wind energy systems has been made.

According to Department of the Treasury estimates, the use of the credit for solar and wind systems has been lower than previously anticipated and its use is not expected to increase significantly. In February 1982, the Treasury estimated that businesses would claim $18 million of the credit for solar and wind energy systems in 1982. It further projected that claims of the credit would increase to $23 million in 1983, level off in 1984, and then decline. Over the life of the credit, the Treasury estimated that $130 million would be claimed for solar and wind systems, down from its January 1981 estimate of $501 million.

Industry representatives point out that while even this limited use of the credit has helped the industry to grow, solar and wind energy systems have not been fully developed and/or economically demonstrated. Thus, through their trade associations and in congressional hearings, they have expressed concern that solar

and wind energy systems may not be able to economically compete with conventional energy sources after the BEIC expires.

OBJECTIVES, SCOPE, AND METHODOLOGY

As outlined in the June 7, 1982, request letter and clarified in discussions, we were requested to examine the possible effects of extending the BEIC for the following systems: solar photovoltaic, central receiver, solar parabolic trough, solar parabolic dish, and large and intermediate wind energy. Specifically, we were asked to (1) analyze the BEIC's effect on the economic viability of three or four selected solar and wind powerplant projects, (2) obtain views from private sector organizations on the desirability of extending the BEIC, and (3) if possible, estimate the revenue that would be lost to the Treasury if the BEIC was extended. The systems are briefly described in Chapter 2. A copy of the request letter is included as appendix I.

To respond to the request, we set out to answer the following four questions:

--What is the status of the selected systems?

--What has been the effect of the credit on the economic viability of selected projects?

--What are industry's and others' views regarding an extension of the credit?

--What revenue loss to the Treasury would result from an extension?

We conducted our study at the Department of Energy (DOE), Washington, D.C., and at Federal laboratories having major roles in developing the selected systems: the Jet Propulsion Laboratory, located at Pasadena, California; the National Aeronautics and Space Administration Lewis Research Center, near Cleveland, Ohio; and Sandia Laboratories, located at Albuquerque, New Mexico, and Livermore, California. At each of these locations, we interviewed officials involved in the development of the selected systems and examined documents they provided. We also contacted officials at the Rocky Flats Test Center, near Denver, Colorado, to obtain views on the desirability of extending the BEIC for wind energy systems and visited, or contacted by telephone, private sector organizations involved in solar and wind energy. We obtained from the Department of the Treasury, Washington, D.C., statistics on the revenue loss from the present credit.

We discussed the effect of the BEIC on project financing with each of the parties involved in our selected projects and examined documents those parties provided. We selected four projects for which private financing has been used or is being proposed to examine the effect the BEIC has had on the economics

of such projects. At the time we started our study in June 1982, no privately financed projects using any of the systems we had been requested to examine had been completed. Only one photovoltaic and two or three parabolic trough and intermediate wind projects had been started or proposed. Thus, as agreed with the Subcommittee, we selected the photovoltaic project and the parabolic trough and intermediate wind energy projects that had progressed the furthest. Although no privately financed central receiver project had been started or proposed, we examined a proposal that was being developed. Large wind energy systems and solar parabolic dishes have not been sufficiently developed for commercial applications and a privately financed project for using such systems had not yet been proposed. Thus, we could not analyze the effect of the BEIC on the economics of those systems. Most of the privately financed projects currently being proposed are in Southern California, and, the four projects we examined propose to provide energy in that area. However, because of the proprietary nature of the economic data, we were unable to obtain actual data for our economic analyses of those selected projects. Instead, we analyzed the credit's effect on the typical economics of identically sized powerplants using the selected solar and wind systems. Such economic data was compiled from information provided by solar and wind systems suppliers and manufacturers, investors, and utilities involved in those systems, and corroborated with data obtained from the laboratories. For each of the four projects, we made analyses of the credit's effect using economic indicators such as payback, return on investment, and return on equity.

While this report was being prepared, the Congress enacted the Tax Equity and Fiscal Responsibility Act of 1982 (P.L. 97-248, Sept. 3, 1982). The act reduced the amounts that can be depreciated for projects in which the BEIC is claimed and reduced the rates of accelerated depreciation allowed for 1985 and 1986. These changes were not considered in our analyses of the effect the BEIC has had on the economic viability of our four selected projects. Since the BEIC was not changed, the results of our economic analyses and the views obtained on the desirability of an extension would not be significantly affected.

To facilitate our collection and compilation of the views of solar and wind systems manufacturers and suppliers, we obtained their views through structured interviews.1/ In addition to companies involved in systems which we were requested to examine, we interviewed companies involved in the manufacture and supply of small wind systems. We included such companies because several of them have projects underway or planned which involve the use of the BEIC through third-party financing arrangements. Of 70 companies from which we solicited views, 56 (or 80 percent) participated in the interviews. In addition, we interviewed seven

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1/A structured interview is where a questionnaire is administered through an interview.

investors and financiers, four utilities, and seven other entities involved in solar and wind energy to obtain their views. The organizations are listed in appendix II.

While the information presented in this report can be useful to the Congress and others in deciding whether or not to extend the BEIC, we caution that there are other factors and viewpoints that may affect a decision on whether an extension is desirable from the standpoint of society as a whole. For example, the competitiveness of solar and wind systems could be significantly effected by future oil and gas prices. At the time Congress enacted legislation providing the BEIC for solar and wind energy property, price controls were in effect on crude oil and natural gas. As a result of these controls, prices were believed to be artificially low for fossil fuels and businesses had little incentive to invest in such property. The BEIC, in part, was intended to correct this situation. Since that time, however, oil prices have been decontrolled and price controls on most natural gas are scheduled to be phased out by 1985. Thus, decontrol may affect any consideration given to extending the BEIC beyond 1985 for solar and wind energy property. Our review was not intended to provide a comprehensive assessment of all the factors and viewpoints possibly affecting an extension of the BEIC but rather to present information on the existing BEIC's effect on selected solar and wind energy projects and the views of industry and other selected parties concerning the extension of the BEIC beyond 1985.

We did not obtain official agency comments on this report. We did, however, discuss matters presented with DOE program officials, including the Directors of Solar Thermal Technology and Solar Electric Technologies, and with Department of the Treasury officials. Their views are included in the report where appropriate. Our review was performed in accordance with generally accepted government auditing standards.

CHAPTER 2

WHAT IS THE STATUS OF THE SELECTED SYSTEMS?

Although DOE considers each of the selected solar and wind energy systems to be technically feasible, the closeness of those systems to commercialization 1/ varies with the state of commercial development and demonstration. To facilitate our description of the selected systems and their closeness to commercialization, we discuss them grouped by their basic technologies--wind energy, solar thermal energy, and solar photovoltaics. In general, the systems within those technologies that are closest to commercialization are small wind, parabolic troughs, and photovoltaic silicon cells, respectively.

WIND ENERGY SYSTEMS

Small wind systems are the most advanced and closest to commercialization of the wind energy systems, which also include intermediate wind and large wind systems. DOE, which has been primarily responsible for directing the Federal efforts to develop the systems, defines small wind systems as wind machines rated at 100 kilowatts or less, intermediate wind systems as machines rated at 100 to 1,000 kilowatts, and large wind systems as machines having a rated capacity of over 1,000 kilowatts. Intermediate wind systems have been demonstrated by DOE. One company that was involved in those demonstrations is negotiating to build a larger version of those systems with third-party financing. Large wind systems are currently being demonstrated by DOE, and although at least one company is considering the economic feasibility of producing such systems, no privately funded projects have yet been proposed. To date, most of the sales in the industry have come from small wind machines for use in rural and agricultural applications. Sales in the future are expected to be primarily for central power station production.

At this time, whether small, intermediate, or large wind systems will dominate wind power generation in the long run is unclear. With the BEIC, more than 20 companies are marketing small wind machines. One of the first small wind powerplants was at Crotched Mountain, New Hampshire. U.S. Windpower, a private company, installed twenty, 30-kilowatt machines at this site. Another plant to be built over the next 2 years is a U.S. Windpower project for Pacific Gas and Electric Company at Altamont Pass in Northern California. This project will use 100 windmills of 50-kilowatt rating and will be privately financed using a third-party arrangement. While small wind machines are being commercialized, the manufacturers of intermediate wind machines believe that they will

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1/Commercialization is where a system is marketed by businesses for profit.

have lower costs due to greater economies of scale in manufacturing. In addition, large wind machines are under development by four companies. At least one of these companies, Boeing Engineering and Construction Company, is considering beginning two systems per month production of large wind machines in late 1984. According to Boeing officials, the economic feasibility of such production is contingent on an extension of the BEIC beyond 1985.

SOLAR THERMAL SYSTEMS

As with wind energy systems, solar thermal systems vary in their closeness to economic commercial use. Solar thermal systems collect and concentrate solar radiation to a single receptor for heating a fluid which can be used to drive a standard heat engine attached to an electric generator. Solar thermal energy systems are either: (1) distributed systems which use individual solar collectors such as parabolic troughs and parabolic dishes or (2) centralized systems which collect energy by focusing mirrors, called heliostats, upon a central receiver set upon a tower. Most completely developed are parabolic trough systems which are envisioned to be applicable to the low- to mid-temperature (up to 600 degrees Fahrenheit) market which includes industrial process heat and many cogeneration opportunities. 1/ Central receiver systems for electricity production are nearing the end of technology development with the recent start-up of a 10-megawatt pilot plant in Barstow, California. Central receiver systems have been developed primarily for bulk electric power production, but also may be appropriate for larger scale industrial process heat applications. Parabolic dish electric systems are the least developed of the major solar thermal systems. The primary application envisioned for parabolic dish systems is small and remote electric power production on the order of 10 megawatts or less.

The technical feasibility of parabolic trough systems has been proven with a number of DOE-sponsored projects. The trough manufacturers are now seeking to generate enough sales to establish the large-scale manufacturing facilities which will enable them to build their collectors at competitive costs in the long run. This creates a dilemma--if there were more sales, the unit price for collectors would be lower; on the other hand, if the unit price was lower, there would be more sales.

Central receiver systems are viewed by DOE's Solar Thermal Program to be appropriate for bulk electric production and the larger industrial process heat applications. Because of the large size of these systems, the industry believes that a substantial risk exists in going straight from the current size at Barstow, to larger, commercial-sized applications. Therefore, industry holds the view that one or more large full system

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1/Cogeneration is the combining of industrial process heat production and mechanical or electrical power production at one site.

experiments are necessary before it can accept this technology as completely proven.

Parabolic dish systems lag behind central receiver systems in development. DOE, in a cost-sharing project with industry, will sponsor the construction of a 100-kilowatt, multi-module dish system to be built at Osage City, Kansas. Construction is scheduled for completion in 1984. In the long run, the DOE program expects the appropriate size of application for dishes to be on the order of 3 to 10 megawatts and, for the same reasons as discussed for the central receiver systems, an experiment of a size larger than that fielded at Osage City may be necessary before these systems are accepted as technically proven by potential private sector users.

PHOTOVOLTAIC SYSTEMS

Without a significant breakthrough to reduce cost and increase efficiency, photovoltaic systems appear farther from large-scale commercial development than the solar thermal systems. Photovoltaic systems are unique in that they convert sunlight directly into electricity. A photovoltaic system generally consists of photovoltaic cells (also known as solar cells), grouped together into collectors (also called modules), and the balance-of-system components, such as wiring, supporting structures, and power conditioners to make the electricity compatible with present electric systems. Photovoltaic cells represent the heart of a photovoltaic energy system and are produced from semi-conductor materials, primarily silicon. These materials create an electrical charge when struck by photons contained in sunlight. This action causes electrons to be freed from the atoms contained in the semi-conductor materials, thereby generating a flow of electrical charges which can be drawn off through externally connected wires.

Photovoltaic systems have the potential for widespread applicability and could be used in virtually any area of the country to produce electricity. However, to have a substantial effect on energy use, photovoltaic systems need to be used in areas normally served by conventionally generated electricity. Consequently, they are viewed as an energy source for

--distributed applications, such as residences, to replace conventionally generated electricity distributed over utility grids, and

--centralized utility applications to provide electricity for distribution through the grids.

Currently, however, the cost of photovoltaic systems is too high to permit their economical use in any of these grid-connected applications. As a result, photovoltaic systems are only economical in certain remote or unique applications not connected to the utility grid, such as communications relay stations in space as well as on the ground, and ocean signal buoys.

A key to achieving wider application of photovoltaic systems is predicated on a successful reduction in the cost of solar cell collectors, which is the most costly element of a photovoltaic system, and accordingly offers the most important opportunities for cost reduction. Flat-plate silicon modules made from sliced single-crystal silicon constitute the existing photovoltaic collector technology. Such modules currently sell for $7 to $15 per peak watt, 1/ which translates into a kilowatt hours cost approximately 10 times that of conventional electricity. In an effort to reduce collector costs, other collector concepts involving advanced silicon ribbon flat-plate collectors, advanced concentrator collectors, and advanced collectors made from thin film photovoltaic materials are being studied. Based on results to date, a significant reduction in collector costs to $.70 per peak watt is believed to be achievable in the mid-1990s. Thus, photovoltaic systems may become competitive with conventional sources of electricity at that time.

1/Because the output of photovoltaic systems varies depending on the time of day, weather conditions, and time of year, they are rated at their maximum, or peak, power production.

CHAPTER 3

WHAT HAS BEEN THE EFFECT OF THE CREDIT ON THE ECONOMIC VIABILITY OF SELECTED PROJECTS?

In accordance with the Subcommittee's request, we examined the effect the BEIC has had on the economic viability of four selected projects: (1) a 30-megawatt wind energy park which is to use 60 intermediate-sized wind systems of 500 kilowatts each, (2) a 12-megawatt parabolic trough system, (3) a 1-megawatt photovoltaic system, and (4) a proposal to build a 100-megawatt central receiver system. 1/ Our analyses indicated that the availability of the BEIC has little effect on the projects' overall economic viability. Two of the projects were already economically viable without the BEIC and the other two projects remained unprofitable even with the BEIC. However, the BEIC could help make investments in economically viable projects more financially attractive. For the wind project, the BEIC helped improve its financial attractiveness to investors. With respect to the photovoltaic and parabolic trough projects, the BEIC could help the manufacturers establish an industrial capability while demonstrating their systems. However, our analyses indicated little or no profits will be made. Finally, the credit may help make a 100-megawatt central receiver powerplant financially attractive and has stimulated the initiation of proposals.

Each of our four selected projects is to provide electricity for Southern California Edison Company's electrical grid. The suppliers'/manufacturers' primary reason for proposing the projects was to establish an industrial capability for producing the systems and/or system components. None of the selected projects had been completed and thus had not yet earned the credit. The photovoltaic project was under construction and a contract had been finalized for the parabolic trough project. A letter of intent had been signed by the utility, Southern California Edison, and an investor, First National Capital, for the intermediate wind

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1/ While this report was being prepared, the Congress enacted the Tax Equity and Fiscal Responsibility Act of 1982. The act reduces the cost basis for computing depreciation for projects in which the BEIC is claimed and reduces the rates of accelerated depreciation allowed for 1985 and 1986. These changes were not considered in our analyses of the effect the BEIC has had on the economic viability of our four selected projects.

project. 1/ The central receiver project was one of six proposals that were expected to be made to Southern California Edison.

Because of the proprietary nature of the information, companies involved would not provide us the specific economic data for our selected projects. However, some of the companies provided us economic data that they said could be considered to be typical for those projects in which they were involved. In other cases, firms familiar with each system's economics provided us data which they believed would approximate the projects' costs. We corroborated the data with economic data from the Federal laboratories involved in the related research and development and concluded that the typical data provided reasonably reflected the estimated costs and other economic parameters.

With this economic data, at our request Southern California Edison Company computed over the expected life of each selected project the annual income, annual cash flows, and annual taxes. In making these computations, Edison used a model it developed for evaluating the economic feasibility of proposed energy projects. Although we did not test the model, we noted that it was being used for providing economic data for use in making decisions on actual renewable energy projects. The typical economic data we had obtained from various firms constituted the input to the model.

Using the income, cash flow, and tax information computed by Edison, we analyzed the effect the BEIC will have on each project's economics. For purposes of our study we defined an "economically viable" project as one which would provide a sufficiently large return on investment to enable the project to economically compete with alternative investments, assuming an equal level of risk. According to Merrill Lynch White Weld Capital Markets Group, the return to investors in 30-year tax exempt bonds was about 12 percent in July 1982. Thus, to compete for funds a project would need to provide a return at least that large and we considered a project to be economically viable if our analyses indicated the return to an investor would be at least 12 percent. An important point to note, however, is that many of the solar and wind projects involve new systems not yet commercially demonstrated and as such the private sector perceives them as being inherently more risky. Because of this, for determining whether a given project would be economic, investors generally look to other economic indicators

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1/A letter of intent is a pre-contract document in which parties agree to pursue a common goal. It is not a contract and therefore does not contain contractually binding provisions.

such as estimated payback, return on total investment, and return on equity. 1/

While a number of different economic indicators could be examined, we chose these at the suggestion of an investor who has been extremely active in third-party financed energy projects. He told us that investors generally want a 3-year payback on amounts invested, a 14- to 17-percent per year after-tax return on total investment, and a 25-percent after-tax return on equity. 2/ We computed the return on net equity because with the tax credits from the BEIC and Investment Tax Credit the Government, in effect, provides part of the equity needed near the start of the project. In other words, the investors use monies which otherwise would have been paid to the Treasury as taxes as part of their equity investment. Thus, deducting the tax credits from the total equity required, in our opinion, better reflects the amount of equity provided by the investors.

The following sections briefly describe the selected projects and present our analyses of the BEIC's effect on the economic viability of those projects.

PROPOSED 30-MEGAWATT WIND PROJECT

The proposed 30-megawatt wind park appeared to be economically viable (provide at least a 12-percent return on investment) either with or without the BEIC. Thus, our analyses indicate that the BEIC will have little effect on the project's overall economic viability. On the other hand, it could increase the potential return to the investors. Our analyses indicated that the 25-percent return on investors' equity said to be generally needed could be attained with the BEIC. However, one of the prospective investment firms told us that they would like a higher return.

1/Payback generally indicates how fast monies invested will be returned, return on investment indicates whether the project is profitable enough to finance through loans, and return on equity indicates the profitability to the investor.

2/During July 13, 1982, hearings before the Subcommittee on Energy Development and Applications, House Committee on Science and Technology, several financial community energy analysts also stated that a 25-percent after-tax return to investors is generally needed to attract capital to renewable energy projects. Testifying were representatives of Sunlaw Energy, Inc.; Patton, Boggs and Blow; Renewable Energy Institute; Merrill Lynch White Weld Capital Markets Group; and First Boston Corporation.

Description of 30-megawatt wind park project

Southern California Edison Company and First National Capital, an equipment leasing company, have signed a letter of intent for a 30-megawatt wind park consisting of 60 wind-turbine generator systems of 500 kilowatts each. The project is estimated to cost $105 million. First National Capital plans to purchase the equipment from Westinghouse Electric Corporation and has entered into a joint venture relationship with Manley, Bennett, McDonald and Company, an investment banking firm, for support in financing the project.

Each of the wind-turbine generator systems will have a rated capacity of 500 kilowatts. The first of the 60 wind-turbine generators is scheduled to begin operating during the last quarter of 1983. Installation of the final generator system is to be completed by early 1985. Electric power from the wind-turbine systems will be fed into Southern California Edison's electrical grid. The 60 systems, operating together, would produce enough power for about 9,000 homes. According to Westinghouse officials, the proposed project will provide an excellent opportunity for demonstrating the commercial reliability of the 500-kilowatt wind-turbine system.

The credit helps make the project more attractive to investors

Our economic analyses of the 30-megawatt wind park project showed that payback and after-tax return on total investment would improve with the BEIC but both fell short of the levels generally sought by investors. The BEIC, however, helps make the project more financially attractive to investors. The availability of the BEIC near the start of the project reduces the investors' equity requirements and increases the investors' return over the estimated 30-year life of the project. The results of our analyses are shown on the following page.

Economic indicator	With BEIC	Without BEIC
Payback (years)	4.9	a/17.2
Average annual after-tax return on total investment	10.3%	9.9%
Average annual after-tax return on total equity	15.5%	14.9%
Average annual after-tax return on net equity	25.5%	19.2%

a/During the first 5 years of operations, 83.3 percent of total equity would be paid back without the BEIC; however, losses projected through the next 8 years would extend the payback period to 17.2 years.

Although the above indicates that the project would be economically viable with or without the BEIC, we caution that many uncertainties exist. For example, one of the assumptions in our analyses is that the oil prices on which the projected selling price of electricity is based will increase 11.5 percent annually. If the oil prices rise at a rate of only 6.5 percent annually, 1/ the project would be only about half as profitable. Thus, with a reduction of this assumption alone, the estimated after-tax return on net equity could be reduced to about 13 percent with the BEIC and about 10 percent without the BEIC. On the other hand, if oil prices increase more rapidly, greater profits would accrue to the investors.

In discussing the effect of the BEIC on the project's economics, officials from each of the parties involved--First National Capital; Manley, Bennett, McDonald and Company; Westinghouse Electric; and Southern California Edison--told us that the availability of the BEIC was essential to this project. Each of the parties told us that without the BEIC the project could not be undertaken. Given the uncertainties, they told us that investors need the higher rates of return. In this regard, one of the prospective investors--First National Capital--told us that they would like a 30- to 35-percent return.

INDUSTRIAL CAPABILITY FOR PRODUCING PARABOLIC TROUGHS

The BEIC might help a supplier/manufacturer establish an industrial capability for producing parabolic troughs. While our

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1/The 6.5 percent is the average annual energy price escalation rate forecasted by Data Resources, Inc. in a low case scenario for the period 1982 through 2005.

analyses indicated that the BEIC would have little effect on the overall economic viability of the project, it could help reduce losses sufficiently that a supplier/manufacturer may be willing to subsidize a project that will help build an industrial base for future sales. Our analyses indicated that even with the BEIC, the project would probably lose monies, but that the loss would be more if the credit did not exist.

Description of 12-megawatt parabolic trough project

Acurex Solar Corporation, a joint venture of Acurex Corporation and Phillips Petroleum Company, executed a contract in April 1982 with Southern California Edison Company for the construction of a $75 million, 12-megawatt parabolic trough powerplant to be located in Southern California. Acurex Solar planned to secure a construction loan from the Bank of America. In addition, the Bank of America was to assemble a group of investors to buy the powerplant from Acurex Solar.

Under the terms of the contract, Acurex Solar was to construct, maintain, and operate the facility for the investors. The investors were to sell the electricity produced to Edison at a price less than Edison's cost of electricity generated by fossil fuels. Edison was to provide land, water, metering, transmission, and substation facilities to connect the solar facility to the power grid. The facility was expected to provide enough power to service the electrical needs of more than 6,000 homes during peak daylight hours.

According to Acurex Solar officials, the principal benefit of this project was the establishment of an industrial production capability for producing parabolic troughs. In conjunction with this project, Acurex Solar was to build a new facility for producing the troughs. Those troughs can be used in systems designed for producing either electricity for utilities or thermal heat for industrial use. Accordingly, the project could help establish an industrial production capability for parabolic trough systems that could be used in either the utility or industrial process heat markets.

Project is not economic even with the credit

Our analyses of the 12-megawatt trough project indicate that over the estimated 20-year life the project would not be economically viable with or without the BEIC. However, the BEIC could reduce the losses from the project and a supplier/manufacturer willing to take those losses in order to build an industrial capability might be better able to proceed with the project. The results of our analyses are shown on the following page.

Economic indicator	With BEIC	Without BEIC
Payback (years)	a/ 3.1	(b)
Average annual after-tax return on total investment	- 1.0%	-1.6%
Average annual after-tax return on total equity	- 2.2%	-3.8%
Average annual after-tax return on net equity	-10.0%	-6.1%

a/Although payback would be made in 3.1 years, subsequent losses from operations would result in a net payback over the life of the project of only 76.8 percent of total equity.

b/Without the BEIC, 45.8 percent of the total equity would be returned over the life of the project.

As indicated above, the BEIC would reduce the losses over the life of the project. The higher percent of loss on net equity with the BEIC does not reflect a greater absolute dollar loss but a greater portion of the smaller amount invested being lost. In fact, the absolute dollar loss to an investor would be less with the BEIC.

Also, as indicated by the estimated payback, the project could be profitable during its early years of operations. According to our analyses, the BEIC and accelerated depreciation available would help make the project profitable during the first 5 years of operations. Starting with the sixth year of operations, our analyses indicated that the project would lose monies each year.

In discussing the effect of the BEIC on the project's economics, Acurex Solar officials told us that the availability of the BEIC is essential to this project. They explained that, to attract investors, Acurex Solar would have to provide at least a 20-percent return to the investors. This could be done by selling the system to the investors at less than cost. However, the losses would have to be absorbed by Acurex Solar or its parent companies. Without the BEIC, Acurex Solar officials told us they could not proceed with the project. 1/

1/In late August 1982, an Acurex Solar official informed us that the project has been terminated as a result of a lack of investor interest. Despite its termination, the project is included in this report because it provides some insight into the potential effect of the BEIC on solar and wind energy projects.

A COMMERCIAL DEMONSTRATION OF A 1-MEGAWATT PHOTOVOLTAIC POWERPLANT

While the BEIC will not improve the economics of the 1-megawatt photovoltaic powerplant enough to attract private investors, it could help to reduce the losses, or even possibly help make a small profit, while commercially demonstrating a new tracking system and the feasibility of using such a system in remote locations. Our analyses of the BEIC's effect on the economic viability of a photovoltaic powerplant of that size indicated that even with the credit the project would lose money over its estimated 20-year life. However, the credit and accelerated depreciation combine to provide a small profit in each of the first 5 years of operations.

Description of 1-megawatt photovoltaic project

In June 1982, Arco Solar, Inc. started construction of a photovoltaic powerplant in San Bernardino County, California. The facility, which is to be owned and operated by Arco Solar, was expected to be operational by December 1982. When completed, the rated capacity will be 1-megawatt, or 1 million watts at peak power. This is at least 3 times greater than any existing photovoltaic system in the world. The system is expected to provide enough power to service the electrical needs of 300 to 400 typical homes. The system is estimated to cost about $12 million.

A unique feature of the Arco Solar system is the mounting of the photovoltaic panels on approximately 100 double-axis trackers which are to orient the panels toward the sun as it moves throughout the day. These computer-controlled trackers, developed by another Atlantic Richfield operating group, Arco Power Systems, will increase the output of the photovoltaic panels, thus lowering the average cost of electricity produced at the facility. The cost reduction is not expected to be sufficiently large to make photovoltaic systems economic for the U.S. utility market. However, reduced costs could make photovoltaic systems more attractive for use in remote locations, particularly those in foreign markets. In addition, the use of the trackers in the photovoltaic project may demonstrate that this component is commercially ready and that it could be used in other solar systems, such as the parabolic trough or central receiver.

According to Arco Solar officials, still another benefit derived from this project is that it increases the demand for modules of photovoltaic cells. The photovoltaic modules used in this project are produced at the company's factory, which has 250 employees, in Camarillo, California. By using the modules, and thus increasing the demand, the project helps to keep the factory operating and the workers employed.

The project is not economic for the U.S. utility market

Using information provided on the typical cost of a 1-megawatt photovoltaic powerplant, our analyses indicated that even with the BEIC the project is not economic for the U.S. utility market. As with the parabolic trough project, the BEIC could help a supplier/manufacturer seeking to establish an industrial capability proceed with the project. The results of our analyses are shown below.

Economic indicator	With BEIC	Without BEIC
Payback (years)	(a)	(b)
Average annual after-tax return on total investment	- 3.5%	-4.2%
Average annual after-tax return on total equity	- 5.3%	-6.3%
Average annual after-tax return on net equity	-10.4%	-8.0%

a/No payback; operating through the estimated 20-year life of the project could result in a negative cash flow of $8.5 million, and a total loss of equity.

b/No payback; operating through the estimated 20-year life of the project could result in a negative cash flow of $10.1 million, and a total loss of equity.

As with the parabolic trough project, the higher percentage loss on net equity with the BEIC does not indicate a greater absolute dollar loss but a greater portion of the smaller amount invested being lost. Also, while the economic indicators do not disclose it, the projected annual incomes and cash flows from this project indicate that profits can be made during the early years of the project. Our analyses of those annual projections indicated that the project would be profitable in each of the first 5 years of operations. After that, losses would accumulate and the project would not be profitable.

In discussing the BEIC's effect on the project's economics, Arco Solar officials told us that the project would not have been undertaken without the credit. They pointed out that even with the credit, Arco Solar will realize little or no profit. They added, however, that the BEIC helps bring the project closer to breakeven.

PROPOSALS TO BUILD A 100-MEGAWATT CENTRAL RECEIVER POWERPLANT

Although firm proposals had not yet been made at the time of our review, proposals were being prepared for building a 100-megawatt central receiver powerplant to sell electricity produced to Southern California Edison Company. Using preliminary economic data from one of the proposals being developed, our analyses indicated that the project would be economically viable either with or without the BEIC and that with the credit the project might be financially attractive to investors. However, time is running out for using the credit, and a prospective manufacturer and an investor told us it would not be built without the credit.

Description of proposed 100-megawatt central receiver project

We selected one of six proposals that were expected to be submitted to Southern California Edison for the sale of electricity from a 100-megawatt central receiver powerplant. The plant, if built, would be the first commercially sized application of a central receiver system. In May 1982, Edison requested interested parties to submit proposals for selling electricity from such a plant. At the time of our review, six companies had expressed an interest; final proposals were due in September 1982. 1/

Although the proposals had not been finalized nor contractual agreements reached at the time of our study, McDonnell Douglas Corporation, one of the proposers, agreed to discuss with us some aspects of its conceptual design study of a 100-megawatt central receiver plant. The plant, as conceptually designed, consists of two fields of approximately 7,700 heliostats each. Each field will be focused on receivers at the top of 600-foot towers. Thermal heat will be transferred from the receivers and may be used immediately to generate steam for electricity production or stored in an insulated tank for later use. The turbine-generator, cooling towers, and other steam plant equipment are conventional. The entire plant will require about 1,000 acres. The plant could produce enough electricity to service about 60,000 homes.

A 100-megawatt central receiver plant is expected to cost about $400 million, assuming at least five such plants are built. In this regard, McDonnell Douglas' conceptual design study indicated that five plants are needed because mass production of heliostats, which account for a major portion of system costs, is needed to reduce the cost of heliostats through economies of

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1/ In late September 1982, a Southern California Edison Company official advised us that fewer than six companies submitted final proposals.

scale. The study further indicated that at least 75,000 heliostats, or enough for five 100-megawatt plants, need to be produced and sold to reduce heliostat costs enough to make central receiver systems economically feasible. A McDonnell Douglas official told us that the BEIC is essential for the first one or two of these plants to offset the high risks associated with the large capital investment that is needed.

Project might be attractive to investors

Our analyses indicated that the BEIC might help make the project financially attractive to investors. As with the wind project, the central receiver project is economically viable with or without the BEIC. However, the credit could increase the potential return to the investors. The results of our analyses are shown below.

Economic indicator	With BEIC	Without BEIC
Payback (years)	15.9	17.1
Average annual after-tax return on total investment	12.4%	12.0%
Average annual after-tax return on total equity	18.0%	17.4%
Average annual after-tax return on net equity	25.2%	19.5%

While the estimated after-tax return on net equity meets the 25 percent said to be generally needed by investors, the payback period of nearly 16 years reflects a great deal of uncertainty with respect to the project's economics. Our analyses of the projected annual after-tax incomes and cash flows for this project indicate that much of the project's profitability would be after the project has been operating 12 years or more. Relying on projected profits that far into the future involves a great deal of uncertainty.

Although the economic indicators appear somewhat favorable, the cost analyses presented presume the BEIC would be available throughout the construction of the project. However, with a lead time of at least 5 years the project is not expected to be completed until late 1987 or early 1988. With the BEIC scheduled to expire at the end of 1985, the project could not reap the full benefits of the credit and the return to investors would be reduced.

Further, as previously mentioned, the cost data on which our analyses are based assume that at least five 100-megawatt central receiver powerplants would be built. Without the full benefit of

the BEIC, it is unlikely that any of these plants would be undertaken. In this regard, a McDonnell Douglas official told us that it now looks as if the project would be pursued only if the BEIC were extended beyond 1985. He explained that the rate of return that would accrue to an investor would be too low, considering the high risks, without the credit and the economies of scale needed to reduce heliostat costs. An official of a prospective third-party financier for the project, Merrill Lynch White Weld Capital Markets Group, held similar views. He emphasized that an extension of the BEIC was absolutely essential not only for the continuation of the central receiver project but for all of the selected systems as well. As discussed in the following chapter, this view was shared by others.

CHAPTER 4

WHAT ARE INDUSTRY'S AND OTHERS' VIEWS REGARDING AN EXTENSION OF THE CREDIT?

Industry, including systems suppliers and manufacturers, generally believed that the BEIC for solar and wind energy systems needs to be extended to help make those systems commercial. Almost all of the 56 suppliers and manufacturers participating in our structured interviews said that a 5-year extension is needed and a 10-year extension would be helpful. Most also believed that a 5-year extension would provide little or no chance of a windfall, but many indicated that a 10-year extension may provide a greater chance of windfalls.1/ Others, including investors, utilities, laboratories, and DOE program officials, generally agreed that a 5-year extension would help commercialize the solar and wind energy systems and would not result in windfalls. However, Department of the Treasury officials do not believe the credit is needed or appropriate.

INDUSTRY BELIEVED AN EXTENSION OF THE CREDIT IS ESSENTIAL TO COMMERCIALIZATION

Industry believed an extension of the BEIC is essential to commercialize solar and wind energy systems. Almost all 56 companies interviewed told us that an extension of the credit would help accelerate the commercialization of the solar and wind systems for the utility market. To obtain insight into the extent that industry believed an extension of the credit is needed, we asked the companies whether they believed the various systems included in our study could, or could not be commercialized, without an extension of the BEIC. The percent responding are shown on the next page.

1/For purposes of our study we defined "windfall" as providing a credit to taxpayers for investments that would have been made anyway.

Selected system	Percent of responses	
	Could	Could not
Photovoltaic	37	63
Central receiver	19	81
Parabolic dish	29	71
Parabolic trough	41	59
Large wind	29	71
Intermediate wind	36	64
Small wind	56	44

As shown above, most believed small wind systems could be commercialized without an extension of the credit, but the majority of respondents believed the other selected systems could not be. Central receiver systems were considered to be the least likely to be made commercial with 81 percent responding that these could not be commercialized without an extension.

The principal reasons industry gave us for the need for an extension are categorized as follows:

--the long lead time required for companies to plan and construct projects precludes them from taking full advantage of the present credit;

--the barriers to commercialization preclude companies involved in some systems from reducing production costs through economies of scale;

--the opportunities for increased industrial growth are limited without an extension of the credit; and

--the efforts toward commercialization will be slowed without the credit, if they proceed at all.

These reasons are discussed further in the following sections.

A long lead time is needed to plan and build plants

Several companies told us that the long lead time (2 to 5 years) required to plan and build plants may preclude the use of the existing credit. With about 3 years remaining, they said most systems must already be planned or under construction to fully benefit from the credit. Thus, they said that without an

extension, some systems cannot be built because returns on investments would not be sufficient to attract private investors. Large wind, central receiver, and parabolic dish systems were most frequently cited as being adversely effected because the substantial resource commitments required necessitate longer lead times for planning.

With respect to large wind and central receiver systems, several companies pointed out that the present credit would expire before they could complete projects they are planning. Officials from a number of companies involved in these systems said it is almost impossible today to develop a market strategy which will produce completed systems before the expiration of the credit.

For example, officials from a wind company actively involved in developing large wind turbines for commercial power application said that the wind turbines must be in place by the end of 1985 to qualify for the credit. They said this does not allow enough time to complete mandatory testing, negotiate contracts, and produce and install large wind turbines in any significant quantities. Due to the lead times necessary for components, the delivery cycle for the first unit is approximately 2 years. Thus, it would be late 1984 before the first unit could be produced. These officials told us that at least a 5-year extension of the credit would be needed to produce enough units to make mass production worthwhile and allow some margin for delays.

Similarly, central receiver projects, which are usually large in scope, require several years from date of contract through construction and final operation. In this regard, industry officials told us that even if the project started now, 2 to 3 of the 5 years needed to construct the first privately funded 100-megawatt central receiver systems will occur after 1985. Thus, current proposals to build central receiver powerplants depend on an extension.

With respect to parabolic dishes, a company heavily involved in DOE's research and development efforts views the parabolic dish as having a potential for significant market entry in the late 1980s, provided DOE's development program is continued. However, even with this research and development, a company representative said it will be exceedingly difficult to make dishes commercial without some financial incentive, such as the BEIC.

Other industry officials pointed out that to attract investors now, companies need to point to an incentive beyond 1985. For example, one official said that the mere existence of the BEIC would demonstrate to the general public the continuing Federal commitment to solar and wind energy systems. Some said the industry is already experiencing adverse effects of the scheduled 1985 expiration. They explained that the credit must be stable and sufficiently long-term to allow for proper planning. Due to

the long lead time required for financing and constructing commercial solar and wind energy powerplants, they feel the expiration date for the credit should be reassessed and additional time provided not only for the lead time but for possible delays and further planning by industry.

Credit is needed until barriers to commercialization are removed

Many industry representatives told us that various barriers to commercialization need to be removed and costs reduced through economies of scale. As noted with the lead times, some systems have not yet begun to be mass-produced, and thus economies of scale have not yet been obtained. Therefore, the cost of production is still too high for the industry to economically compete with conventional energy sources.

With respect to the removal of barriers, several industry representatives said that the credit must be extended until privately financed commercial projects demonstrate a system is commercially competitive. Currently, there are a number of economic, social, and market barriers inhibiting the adoption of solar technologies, including limited public awareness of, and confidence in, the systems. They maintained each system needs to be demonstrated more than once to overcome these barriers.

After several plants are built and the production process is set in motion, systems' components can be mass-produced cheaper and the credit may become unnecessary. If the credit expires in 1985, however, additional plants may not be built. For example, as previously discussed, one manufacturer told us that central receiver systems are feasible for commercial applications, but the credit is needed to provide an incentive to increase demand so that heliostats, a central receiver component, can be mass-produced. He added that the credit helps to attract third-party investors essential for providing the funds needed to build multiple central receiver plants and thus create a need to mass produce heliostats. Such mass production is needed to lower costs through economies of scales. As noted in Chapter 3, at least 75,000 heliostats (enough for five 100-megawatt systems) need to be produced to make the central receiver economically feasible with the credit. Other manufacturers made similar arguments for the need to mass produce other solar and wind energy systems, such as parabolic troughs and large wind machines.

1/Solar Energy Industries Association, Solar Thermal Energy Division, brief on tax incentives for renewable energy systems, July 1982.

Credit is needed for industrial growth

Several companies said an extension of the credit is needed to provide the necessary opportunities for industrial growth. For example, some companies told us that an extension would help to broaden the market for small wind machines. Over 20 companies are already building small wind machines for commercial use. Many of these companies said that the credit is needed to increase demand by helping to offset the increased costs associated with using less ideal wind sites. They explained that such sites result in lower power-generating efficiencies and thus higher costs per unit of electricity produced.

This argument has also been advanced by the Solar Energy Industries Association. According to the Association, many companies depend on the continuation of the credit for industrial growth throughout all stages of product development and commercialization. 1/ Some examples cited were the following:

--A large corporation working with central receiver systems holds only about $3 million worth of solar thermal contracts. If incentives are extended, the company expects to attract $15 million worth of contracts by 1985. If the credit expires as scheduled, this opportunity for growth will be lost.

--A prominent company that has been involved in developing solar thermal systems for 10 years claims that the company is anticipating attracting $20 million to $25 million in sales for an industry which will create over 100,000 jobs. If the credit expires, the company doubts its solar thermal business will get off the ground.

--One company, involved in parabolic dish systems not yet marketed, largely attributes a $1 million allotment of its corporation's funds for market development to the existence of the credit. Based on its past experience, only about $300,000 would have been allotted if there were no credit for encouraging corporate commitment to solar. If the credit is extended, the company expects to be able to market its parabolic dish systems by 1985.

Commercialization efforts may cease or proceed at a slower pace

If the credit is not extended, several companies told us that efforts to make solar and wind systems commercial may cease or proceed at a slower pace. Without the credit, they said that commercialization efforts for central receivers and parabolic dishes would probably cease. With respect to other systems, they said those which are close to being economic or those with alternative markets may continue to be developed but at a slower pace.

As previously discussed, central receivers cannot be economically competitive until costs can be reduced. Without an extension of the credit, even the initial commercial-sized plant cannot fully benefit from the credit. Also, the economies of scale needed to make the costs competitive probably would not be attained and commercialization efforts would probably cease.

Similar problems may occur with the parabolic dish. This system is not as far down the development path, and DOE is still sponsoring its development. Nonetheless, some industry representatives expressed concern that the dish system might not be commercialized without the benefit of the BEIC after DOE completes its development efforts.

With respect to the other selected systems, some commercialization efforts will probably continue but at a slower pace. Industry representatives expressed concern that many of the small companies involved may not continue their efforts but pointed out that larger firms may be able to continue. For example, some small companies said that large companies involved in wind systems might be able to continue because those systems are nearing economic competitiveness. With respect to photovoltaic and parabolic trough systems, some industry representatives said that the large companies will be able to continue because alternative markets are currently available. In this regard, photovoltaic systems are economic for remote locations, particularly those in foreign markets, and parabolic trough systems may be suitable for the industrial heating market.

INDUSTRY BELIEVED A 5-YEAR EXTENSION IS NEEDED MORE THAN A 10-YEAR EXTENSION

We asked the participants in our study how helpful or needed 5-year and 10-year extensions would be. The percents responding "not at all" and "helpful or needed" are shown below.

	Percent of respondents			
	Helpful/needed		Not needed at all	
Selected system	5-year	10-year	5-year	10-year
Photovoltaic	98	90	2	10
Central receiver	95	89	5	11
Parabolic dish	95	91	5	9
Parabolic trough	95	82	5	18
Large wind	96	91	4	9
Intermediate wind	95	86	5	14
Small wind	96	80	4	20

As the table on the previous page indicates, , almost all of the respondents believed 5-year and 10-year extensions would be helpful or needed, but the percent responding in favor of a 10-year extension was lower.

We also asked the 56 industry representatives whether they believed commercialization of the selected systems would occur with a 5-year and with a 10-year extension of the credit. The results are shown below.

Selected system	Percent responding system could be commercialized with an extension	
	5-year	10-year
Photovoltaic	91	93
Central receiver	62	78
Parabolic dish	59	73
Parabolic trough	62	75
Large wind	89	93
Intermediate wind	95	98
Small wind	90	93

As shown above, most believed a 5-year extension would result in commercialization in all the selected systems. Under a 10-year extension, the respondents indicated an even greater likelihood of commercialization. Responses for a 5-year extension ranged from 59 percent to 95 percent depending on the system. Almost all respondents believed photovoltaic systems and the various sizes of wind systems could be commercialized with a 5-year extension. While more respondents believed that a 10-year extension would result in the commercialization of the central receiver, parabolic dish and parabolic trough systems, about one-fourth believed that these systems could not be commercialized even with a 10-year extension.

We also asked the companies if they would consider building a solar or wind energy powerplant under 5-year and 10-year extensions. Forty of the 56, or about 71 percent, responded that they would consider building such a powerplant if the BEIC were extended 5 years. Under a 10-year extension, no additional companies said they would consider building a powerplant. However, 1 of the 40 companies, a company involved in three of our selected systems, said it would consider building a large wind system with a 5-year extension and parabolic dish and photovoltaic systems only if the BEIC is extended 10 years.

WINDFALLS ARE UNLIKELY

Almost all industry representatives believed that there is little or no chance of windfalls if the BEIC is extended 5 years through 1990. However, many believed the chances of a windfall increase if the credit is extended to 1995.

We asked companies to estimate the probability, in terms of percentages, that windfalls would result from a BEIC extension of 5 years. The percents responding by 20-percent intervals of probability for the selected systems are shown below.

Selected system	Probability of a windfall occurring with 5-year extension				
	0-20	21-40	41-60	61-80	81-100
	----------percent (note a)----------				
Photovoltaic	90	8	--	--	3
Central receiver	87	3	10	--	--
Parabolic dish	97	--	--	--	3
Parabolic trough	79	17	--	--	3
Large wind	87	3	5	3	3
Intermediate wind	83	11	3	--	3
Small wind	80	10	7	--	2

a/Amounts may not total 100 percent due to rounding.

As shown above, the vast majority of respondents believed little or no chance of windfalls would result if the credit is extended 5 years. For instance, 90 percent believed there would be a 20-percent or less chance of windfalls for photovoltaic systems, and only 3 percent believed a greater than 80-percent chance of windfalls exists.

To compare the chances of windfalls under a 10-year extension to those of a 5-year extension, we asked companies to estimate the probability of a windfall resulting from a 10-year extension. The percents responding by 20-percent intervals of probability are shown on the following page.

Selected system	Probability of a windfall occurring with 10-year extension				
	0-20	21-40	41-60	61-80	81-100
	percent (note a)				
Photovoltaic	69	13	13	3	3
Central receiver	80	7	10	3	--
Parabolic dish	75	14	7	--	4
Parabolic trough	64	11	18	4	4
Large wind	71	11	11	5	3
Intermediate wind	71	11	11	--	6
Small wind	65	20	3	10	3

a/Amounts may not total 100 percent due to rounding.

Although the majority of respondents said there would be little or no chance of windfalls even if the credit is extended 10 years, the responses indicate that the likelihood of a windfall is greater than with a 5-year extension. To illustrate, 19 percent of the respondents indicated there is a greater than 20-percent chance that a windfall would occur for small wind systems with a 5-year extension, while 36 percent indicated that such chances would exist with a 10-year extension. Those indicating a windfall may result stated that within 5 to 10 years the uncertainties and risks associated with some solar and wind systems may be reduced and those systems may be able to economically compete without the BEIC.

While most companies believed the possibility of a windfall under a 5-year extension was slight, some expressed concern that small wind systems' investors may benefit from a windfall because the systems are close to being commercial now. Those directly involved in wind systems, however, said that there is no chance. They said that the credit will only broaden the market and will not provide windfalls. They pointed out that, as the market expands, the preferable wind sites will be exploited first, leaving only less than ideal sites for subsequent development. As a result, wind machines on these sites would be less efficient, thus offsetting any probable reductions in system production costs.

VIEWS OF OTHERS

The investors, utilities, and DOE program and laboratory officials we spoke with generally agreed that an extension of the BEIC would help commercialize solar and wind energy systems. Many officials said that a 5-year extension would help most of the

systems to become commercialized, while a 10-year extension would not be as greatly needed. They also agreed that windfalls are unlikely with a 5-year extension but are more likely with a 10-year extension. However, Department of the Treasury officials believed that the credit is not needed or appropriate.

Investors' views

The seven investment and financial firms we contacted told us that a 5-year extension of the BEIC for solar and wind energy systems is essential to private financing of powerplants using those systems. They said that solar and wind energy projects would not be undertaken because without the credit there would be insufficient returns to investors. Most of them said that the credit should not be extended for 10 years because by that time most of the solar and wind energy systems should be sufficiently developed to stand on their own. However, officials at one investment firm said that when the 5-year extension nears its expiration date, the Government may want to consider the need for a further extension for specific solar systems such as photovoltaic, central receiver, or large wind systems. Depending on the progress made with those systems, these officials thought that the Government may wish to continue to offer an incentive to help commercialize them.

With respect to the possibility of windfalls, investors generally did not believe windfalls were possible if the BEIC is extended 5 years. They said the extension is needed to provide sufficient returns to attract investors to investments in solar and wind energy powerplants. In general, they said an average of 25-percent return on equity is needed to attract investors to such powerplant investments because of the risks involved. However, depending on the system being proposed, some investors said they may want a return as high as 50 percent to provide for a "risk premium." They explained that solar and wind systems are of a high-risk nature, and investments are made in expectation of profit. Thus, the greater the risk presented, the larger the margin of potential profit required for financial participation.

Utilities' views

Officials from the four utilities we contacted also believed a 5-year extension would be needed to help commercialize powerplants using solar and wind energy systems, and such an extension would not result in windfalls. From a utility point of view, third-party investors are essential for those systems to make the transition from the experimental stage into the off-the-shelf stage for utility grids. To make investments in solar and wind energy systems sufficiently attractive to third-party investors, they believed the BEIC needs to be extended at least 5 years.

The utilities did not believe any of the solar and wind energy systems are sufficiently economic to gain widespread use

in the utility market without the BEIC. For example, Southern California Edison Company officials explained that due to investment constraints imposed upon utilities by public utility commissions, utilities must make only "prudent and wise" investment decisions. Since solar and wind energy systems are new and unproven, utilities would probably only invest in research and development in a slow and gradual process in order to minimize the risks involved. These officials said, however, that the BEIC makes some solar and wind systems attractive to third-party investors and commercial projects are being started and planned. Without an extension, they said that those projects using central receiver, large wind, parabolic trough, and parabolic dish systems would not be undertaken. Thus, they believed that at least a 5-year extension is needed, and that a 10-year extension would be helpful, particularly for parabolic dish systems.

The utilities saw little chance of any windfall resulting from a 5-year extension because of increased competition. For example, some utility officials explained that a 5-year extension, combined with cost reductions, might provide for increased profits to investors. However, they said the potential increased profits would attract more investors and competition would keep profits down to a reasonable level. These officials believed that a 5-year extension would provide sufficient time for new systems to establish themselves. With a 10-year extension, some officials said that windfalls may result. Some other utility officials said that a 10-year extension might result in some borderline solar or wind energy systems continuing to be used only because of the BEIC.

DOE program and laboratory views

Although DOE program officials would not state whether an extension of the BEIC for solar and wind energy systems is needed, they, along with laboratory officials, generally agreed that an extension of 5 years would help solar and wind energy systems toward commercialization. DOE program and some laboratory officials, however, pointed out that the various solar and wind systems are developed to various degrees of commercial readiness and an extension of the BEIC may lead to some inefficiencies. They explained that the systems which are closer to commercial readiness, such as small wind systems, would benefit more from an extension than systems, such as the parabolic dishes, still being developed. In carrying this reasoning a step further, one laboratory official said that a system still in the laboratory research and development stage will not be able to benefit from the credit because it may not be commercially ready for another 15 years. Thus, DOE program and laboratory officials stated that the credit does not distinguish among the systems which are most likely to be cost effective in the long run and those systems that are near commercial readiness now.

On the other hand, DOE program and laboratory officials told us that in the absence of federally funded demonstrations or an extension of the BEIC, present efforts to commercialize some of the systems, such as large wind, parabolic trough, and central receiver systems, would cease. One official said that this may conform to the philosophy that the free market is to decide the appropriate level of commercialization for new energy technologies, but much of the recent federally supported research and development would be wasted. He explained that 20 years from now the Nation may need energy from solar and wind energy systems, but much of the progress made to date would have to be redone because one cannot just stop for an extended period of time and pick up where work was left off.

DOE program and laboratory officials generally agreed that a 10-year extension would help the photovoltaic and parabolic dish systems, but that such an extension might result in windfalls to those involved in other solar and wind energy systems. However, if the credit is extended 5 years, neither DOE program nor laboratory officials believed any windfalls would result.

Department of the Treasury officials' views

Department of the Treasury officials told us that the Treasury does not believe the credit for solar and wind energy, or any credit targeted toward specific investments, is needed or appropriate because (1) tax credits are highly inefficient mechanisms for providing subsidies because taxpayers can claim them whether or not the investment would have been made anyway and (2) the subsidies distort the marketplace.

They pointed out that, in general, tax credits for specific investments are inconsistent with the Administration's philosophy of relying on the marketplace, rather than Federal management, to determine patterns of energy use and allocate resources efficiently. They added, however, that in those instances where some form of subsidy is needed, it should be in a form that is not targeted toward some specific form of investment over others. They cited, for example, the accelerated depreciation provided as part of the Economic Recovery Tax Act of 1981 as a mechanism which has removed tax impediments to business investment--including investments now eligible for energy tax credits--without dictating firms' choices among investment alternatives.

In addition, Department of the Treasury officials said the energy tax credits distort the allocation of resources, encouraging firms to undertake investments that are uneconomic at current market prices and to purchase higher cost fuels where a lower cost substitute is available. As a result, these credits divert workers, capital, and initiative from more productive uses elsewhere in the economy and lower net productivity.

Moreover, by reducing the cost of only specific energy alternatives, these officials said the credits discourage other, potentially more efficient alternatives. New inventions and refinements in existing technology not covered by the credit are at a disadvantage in the marketplace when the Government interferes to subsidize the competition. Therefore, they concluded that if a solar or wind energy technology needs a special subsidy such as a tax credit to survive, then that technology should be allowed "to die", thereby allowing use of the more efficient sources of energy to continue.

CHAPTER 5

WHAT REVENUE LOSS TO THE TREASURY WOULD RESULT FROM AN EXTENSION?

Projecting the amount of revenue loss to the Treasury that would result from an extension of the BEIC is largely a matter of guesswork. Uncertainties affecting the extent the credit will be used make impossible the development of estimates that are sufficiently precise to be meaningful. The amount of revenues that could be lost to the Treasury if the credit is extended would depend on how future events resolve those uncertainties. On the other hand, DOE program officials told us that in the long term, the credit would actually result in a net gain--not loss--to the Treasury due to the tax revenues that would be generated by increased business activity resulting from the credit. Assuming that the monies would not have been invested in alternative equipment or facilities, or any other income producing investment, this position has been supported by two studies conducted for DOE. Even if a loss is incurred, DOE program officials pointed out that some long-term benefits may make a revenue loss worthwhile.

REVENUE LOSS IS UNCERTAIN

The possible revenue loss to the Treasury from the BEIC for solar and wind energy systems if the credit is extended is uncertain. On the surface, the loss to the Treasury can simply be computed by multiplying the total expected investment in eligible solar and wind equipment times the BEIC rate of 15 percent. The problem is that the extent of future private sector investment in solar and wind energy systems is uncertain and dependent on several somewhat interrelated factors. The principal factors include (1) the extent to which the systems can penetrate the utility market, (2) the future price of conventional fuels such as oil and natural gas, (3) reductions in the cost of solar and wind energy systems, and (4) the ability of manufacturers of solar and wind energy systems to stay in business until costs are economically competitive and a wider market for their products is established. Each of these factors involves uncertainties, and assumptions would have to be made for them in order to project the amount of future private sector investment in solar and wind energy systems.

Two recent studies conducted for DOE examined, in part, the possible effect of extending the BEIC to 1990 for some solar and wind energy systems. One of these studies was conducted by Urban Systems Research and Engineering, Inc. 1/ This study

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1/"Analysis of the Impact of Federal Tax Incentives on Market Diffusion for Solar Thermal/WECS [Wind Energy Conversion Systems] Technologies: 1980-1990," October 15, 1981, Urban Systems Research and Engineering, Inc.

concluded that if the BEIC is extended through 1990, annual solar thermal output in the primary direct heat and process steam markets will total about 0.02 quads. 1/ Given this relatively low level of market penetration, the study further concluded that tax revenue losses were insignificant relative to total tax revenues or current budget deficits. The other study, conducted by Arthur D. Little, Inc., similarly projected only a limited penetration of solar and wind energy systems into the industrial market. 2/ Assuming an 11 percent escalation rate of conventional fuel prices and a continuation of the present BEIC, the study projected no investments would be made in solar thermal and wind energy systems through 1990. Hence, the two studies indicate that an extension of the credit to 1990 would result in little or no loss of revenues to the Treasury. However, if the fuel escalation rate increased to 17 percent, the Little study projected that about $2.6 billion would be invested. This would equate to a revenue loss to the Treasury of about $390 million from the BEIC--an increase of $260 million over the Treasury's estimate of $130 million for the credit scheduled to expire at the end of 1985.

While such estimates may be reasonable, we caution that these studies focused on the industrial markets and gave little or no consideration to the use of the BEIC through third-party financing of solar and wind energy systems for the utility market. Consideration of the utility market could increase the extent that the credit may be used to help finance solar and wind energy systems. As previously noted, 40 of the 56 companies we interviewed told us that they were considering producing solar and wind energy systems for the utility market should the credit be extended through 1990. Two of the large companies we contacted--McDonnell Douglas Corporation and Boeing Engineering and Construction Company--were considering producing multiple units. McDonnell Douglas was considering producing five 100-megawatt central receiver systems costing about $400 million each. Boeing Engineering and Construction was considering beginning two systems per month production of large wind systems, costing about $7.5 million each, in late 1984. We estimate that the BEIC applicable to the systems currently being considered by these two companies alone could total nearly half a billion dollars should the credit be extended to the end of 1990. In regard to the utility market, one DOE program official pointed out that the use of third-party financing has spurred the entry of solar thermal systems into the utility market sooner than he previously thought possible. Thus, due to the relative recency of the third-party financing phenomenon, he would not venture a

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1/One quad equals one quadrillion British thermal units, or the equivalent of 293 billion kilowatt hours of electricity.

2/"The Cost of Federal Tax Credit Programs to Develop the Market for Industrial Solar and Wind Energy Techniques," November 12, 1981, Arthur D. Little, Inc.

guess as to the extent solar or wind energy systems would be used if the BEIC is extended.

LONG-TERM BENEFITS MAY ACCRUE FROM AN EXTENSION

Each of the DOE program directors and staff we interviewed told us that in the long term the BEIC for solar and wind energy systems actually would result in a net gain--not loss--to the Treasury. Aside from the loss of tax revenues resulting from the credit, the Treasury's revenues are affected by (1) additional taxes generated by the increase in economic activity resulting from the investment in solar and wind systems, (2) additional tax revenues resulting from higher profits due to lower solar and wind system's operating and maintenance costs than the costs of conventional fuels, and (3) taxes lost due to reduced sales of conventional fuels. When such factors are considered, the Urban Systems and Arthur D. Little studies previously referred to concluded, in general, that while there will be a net decrease of tax receipts in the early years of any tax incentive program, the Treasury is likely to experience an increase in tax receipts as a result of investment credits. This assumes that tax credits lead to new investments and do not merely shift resources from an investment in solar and wind equipment to another investment in equipment or facilities, or any other income producing investment. If the credits merely shift resources among potential investments, any gain in revenues would be reduced by the revenues that would have accrued to the Treasury had an alternative investment been made.

In addition to considering the longer term gain in revenues to the Treasury, DOE program officials told us that to put any possible revenue loss in perspective, other benefits should be considered. Some of these officials said that the increased use of solar and wind energy systems from a 5-year extension of the BEIC would result in a reduction of imported oil. They explained that any increase in solar and wind energy generating capacity resulting from an extension would reduce the Nation's need to import foreign oil. Another said that such an extension would negate the need for the Government to incur the cost of carrying out the solar and wind energy development programs again if a national energy emergency should arise.

On this latter point, a DOE program official said that the cost of such programs would exceed $4 billion if the Government decides that such alternative energy is needed in the event a future national energy emergency arises after present development efforts cease. As discussed in Chapter 4, some DOE program and laboratory officials believed that without an extension of the BEIC, development efforts for some solar and wind energy systems would cease. If such efforts cease, one official had told us that much of the progress made would have to be redone because work could not be resumed at the same point where it was left off. This program official told us he believed that just to get back to the point where development efforts cease would cost at

least as much as has already been invested by the Government during the past 10 years. According to a recent estimate by the Congressional Research Service, the Government's spending for solar and wind energy over the past 10 years amounts to over $4 billion. 1/ The official further believed that in a national energy emergency, the Government would be willing to spend more than that amount to develop solar and wind energy in a "crash" program. Thus, he said that in the long term a 5-year extension may be worth almost any possible revenue loss to the Treasury.

1/"Solar Power Issue Brief Number IB 74059," September 20, 1982, Congressional Research Service, The Library of Congress.

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APPENDIX I

June 7, 1982

Hon. Charles A. Bowsher
Comptroller General
General Accounting Office
Washington, D.C. 20548

Dear Mr. Bowsher:

We would like to request that GAO conduct two studies related to solar energy research and development. /GAO Note 1./

The first study would be an examination of the possible effects of extending the existing 15% business investment tax credit for renewable energy systems to 1990. As you are probably aware, the solar business tax credit is currently scheduled to expire on December 31, 1985. However, the Subcommittee has had a great deal of testimony indicating that several solar technologies, including solar thermal central receivers, parabolic dishes, large wind energy systems and photovoltaics, will not reach the stage of technical readiness early enough to benefit from the Federal tax credits if they expire at the end of 1985. In light of this testimony, the Subcommittee would like GAO to examine the possible effect of extending the tax credits on the development of emerging solar technologies, such as the ones listed above, in the mid 1990s. We would like GAO to conduct an analysis of the economic viability of third party financing arrangements for these technologies, with and without the tax credit and also to conduct a survey of private sector organizations (equipment suppliers, utilities and financiers) currently involved in third party financing to determine their perceptions on the desirability of extending the tax credits. A list of such organizations is attached. If possible, we would also like GAO to estimate the revenues lost to the U.S. Treasury as a result of the extension of the credit. /GAO Note 2./

The second study would be an examination of DOE plans to terminate Federally-sponsored renewable energy and conservation test and research facilities. The Subcommittee has heard significant testimony indicating that these facilities have played an instrumental role in the research and development of solar energy technologies. However, the FY 1983 DOE budget request contains no funds to operate many of these facilities, and we understand termination plans are being developed by the Assistant Secretary for Conservation and

GAO Note 1: This report pertains to the study requested on the extension of the BEIC; a second study is underway which addresses DOE's plans to terminate Federal support for test and research facilities.

GAO Note 2: The Subcommittee's list of possible private sector contacts is not presented in this report, but the organizations contributing to GAO's study are listed in Appendix II.

APPENDIX I

Renewable Energy. As a result, we would like GAO to investigate the activities of the Assistant Secretary, his deputies and the task force on facility termination to determine whether any facilities are being closed prematurely from a programmatic standpoint, i.e., before the full data originally envisaged from the project are collected, and whether any Congressional options to continue R&D programs in 1983 are being foreclosed by the terminations.

Due to the timeliness of these issues, we must request a rapid response. It would be helpful if the funding of the tax credit study were available by September 1982. We would appreciate a discussion of the preliminary findings of the second study by June 30, 1982.

Thank you very much.

Sincerely,

DON FUQUA, Chairman
Subcommittee on Energy
Development & Applications

HAMILTION FISH, JR.
Ranking Minority Member
Subcommittee on Energy
Development & Applications

DF/HF:Kwm
Attachment

PRIVATE SECTOR ORGANIZATIONS

CONTRIBUTING TO THE STUDY

SOLAR AND WIND ENERGY COMPANIES

Acurex Solar Corporation
Advanco Corporation
Alcoa Building Products
Arco Solar, Incorporated
Automatic Power, Incorporated
Bell Industries Solar Division
The Bendix Corporation
Bergey Windpower Company
Boeing Engineering and Construction Company
E-Systems, Incorporated
Energy Conversion Devices
Energy Laboratory
Energy Sciences, Incorporated
Energy Technology Corporation
Energy Unlimited, Incorporated
Ethyl Corporation
Exxon Solar Power Corporation
General Electric Company
Genro Energy Systems
Hamilton Standard Division of United Technologies Corporation
Jacobs Wind Electric Company
La Jet Energy Company
Martin Marietta Corporation
McDonnell Douglas Corporation
North Wind Power Company
Owens-Illinois, Incorporated
Pacific Wind and Solar, Incorporated
Photon Power, Incorporated
Photovoltaic Energy Systems, Incorporated
Photowatt International, Incorporated
Pinson Energy Corporation
Product Development Institute
Pamada Energy Systems, Limited
RCA Laboratories
Revere Solar and Architectural Products, Incorporated
Reynolds Metals Company
Rockwell International Corporation
San Gorgonio Farms, Incorporated
Sanders Associates, Incorporated
Sencenbaugh Wind Electric Company
Solar Kinetics, Incorporated
Solar Steam, Incorporated
Solarex Corporation
Solavolt International
Solenergy Corporation

SOLAR AND WIND COMPANIES (cont.)

Spire Corporation
Texas Instruments
Unique Wind Power Company
United Stirling
U.S. Windpower, Incorporated
WFCS Technology
Westinghouse Electric Corporation
Winco Division of Dyna Technology
Wind Power Systems, Incorporated
Windfarms, Limited
Windtech, Incorporated

INVESTORS AND FINANCIERS

Bank of America
First Boston Corporation
First National Capital
Hambrecht and Quist Investment Bankers
Manley, Bennett, McDonald and Company
Merrill Lynch White Weld Capital Markets Group
Sunlaw Energy, Incorporated

UTILITIES

Arizona Public Services Company
Pacific Gas and Electric Company
San Diego Gas and Electric Company
Southern California Edison Company

OTHER ENTITIES

American Wind Energy Association
California Energy Commission
Electric Power Research Institute
Pasadena Utility Advisory Commission
Renewable Energy Institute
San Diego Association of Governments
Solar Energy Industries Association

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