Service Report

Energy Information Administration
Office of Energy Markets and End Use
U.S. Department of Energy
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An Economic Evaluation of Energy Conservation and Renewable Energy Tax Credits

Prepared by

The Energy Information Administration

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PREFACE

This study was undertaken at the request of Congressman Edward J. Markey, U.S. House of Representatives, Chairman, Subcommittee on Energy Conservation and Power, Committee on Energy and Commerce. The purpose of this study is to assess the impact of a proposed extension and change to the current energy tax credits as specified in H.R. 2001 on energy consumption, revenue to the Treasury, and project profitability. The first part of the study compares the specific changes proposed in H.R. 2001 with the current law and the President's Tax Proposal. The next section discusses the use of the residential energy tax credit and analyzes the proposed changes. The following section presents a similar but more limited discussion of the business energy tax credit. The last section compares the energy tax credits with the incentives provided by the President's Tax Proposal to the oil and natural gas industry.

EXECUTIVE SUMMARY

This report presents an analysis of H.R. 2001, a bill designed to extend and modify the present set of residential and business energy tax credits. For the most part, both the current law and the President's Tax Proposal allow the energy tax credits to expire on December 31, 1985.

- The current energy tax credit law established:
  - A residential energy conservation tax credit of 15 percent with a maximum credit of $300 and a residential renewable energy tax credit of 40 percent with a maximum credit of $4,000, both of which expire on December 31, 1985.
  - A business tax credit of 10 percent for most energy conservation items with no credit limit. Most of these credits have already expired, with the remainder ending on December 31, 1985.
- H.R. 2001 proposes to:
  - Increase the residential energy conservation tax credit to 25 percent but only allow $175 as the maximum credit. This tax credit would expire on December 31, 1988.
  - Phase out the residential solar and renewable energy tax credit by 5 percentage points a year from the current 40 percent to 15 percent by 1990, after which time the credit would expire.
  - Require that the residential energy conservation tax credit be used only by households with incomes below $30,000.
  - Modify current law to extend past December 31, 1985, the business tax credits at the existing rates or phased-out rates for use of wind, geothermal, ocean thermal, hydroelectric, and biomass.
- It is estimated that the residential energy conservation tax credit proposed in H.R. 2001 would cost the Treasury between $300 and $340 million (discounted present value, 1984 dollars). This equates to a cost to the Treasury of between $23 and $70 per barrel of oil equivalent saved.

- The major reason for the relatively high cost per barrel of oil equivalent saved is that, based on two recently completed studies, only a small number of households undertake energy conservation measures as a result of the existence of a tax credit. These studies indicate that most households would have undertaken these types of projects even without the tax credit. Therefore, the Treasury effectively subsidizes a large number of households that would have undertaken energy conservation measures anyway. At the same time, those few households affected by the tax credit would save only a small amount of energy in the aggregate.

- The aggregate incremental energy savings attributable to the proposed conservation legislation over the life of the equipment (12 years), would amount to about 2 1/2 days of petroleum imports, or 9 million barrels of oil equivalent. However, most of these savings would be in terms of natural gas (at least in the short run), as this is by far the most widely used fuel for home heating.

- It is estimated that the residential renewable energy tax credit proposed in H.R. 2001 would cost the Treasury between $385 and $660 million (present discounted value, 1984 dollars), depending on the number of households that undertake investments in response to the tax credit. This credit is estimated to result in a Treasury cost of between $70 and $140 per barrel of oil equivalent saved.

  - The resulting high cost per barrel of oil equivalent saved reflects the relatively high cost (to the individual and to the Treasury) of installing solar hot water heaters compared with the amount of energy saved. This analysis assumes that these units save about 65 percent of the energy used to heat water. However, the energy used for water heating accounts for less than 20 percent of total residential energy use.

  - The aggregate incremental energy savings attributable to the proposed renewable energy legislation over the life of the equipment (12 years) would amount to about 1 1/2 days of petroleum imports, or 5 million barrels of oil equivalent. Most of the savings are expected to be in terms of natural gas or electricity.

- The proposed extension of the business energy tax credits for selected renewable energy projects would have a minimal impact on Treasury costs, as there appears to have been little use by businesses of these credits while they were available. As a result, little energy would be saved by businesses. However, limited partnerships make some use of these credits, which then appear on personal tax forms. Data are not available to determine the magnitude of this use.

- H.R. 2001 leaves intact the current use of the alcohol fuels tax exemption. The President's Tax Proposal would eliminate the current excise tax exemption, but would grandfather the use of the alcohol production tax credit for those facilities currently producing alcohol fuels.

- Energy tax credits provide an incentive for households to invest in conservation and renewable energy. A convenient way to measure the magnitude of that incentive is to calculate the energy prices that would be required to make energy conservation and renewable energy investments as profitable without H.R. 2001 (i.e., with no tax credit) as they would be with H.R. 2001. For residential conservation projects, a price increase of $10 to $15 per barrel of oil equivalent (in the absence of tax credits) would be required to provide as great an incentive for conservation as is provided by H.R. 2001. For residential renewable projects, the equivalent price increase is estimated to be $20 to $35 per barrel of oil equivalent.

- In contrast, the President's Tax Proposal maintains the incentives for oil and gas exploration and development essentially the same, on balance, as those provided by current law.

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1. DESCRIPTION OF THE CURRENT LAW, H.R. 2001, AND THE PRESIDENT'S TAX PROPOSAL

The basis of the current Energy Tax Credit law for conservation and renewable energy sources consists of two legislative acts, in addition to many interpretations by the Internal Revenue Service. The first piece of legislation was the Energy Tax Act of 1978, which was passed as part of a larger National Energy Act and amended the Internal Revenue Code of 1957. The second piece of legislation, the Crude Oil Windfall Profits Tax Act, was passed in 1980 and amended the Energy Tax Act. (Appendix A provides a detailed description of the provisions of these energy tax credit laws.)

Two new proposals are now under consideration: H.R. 2001, titled "Renewable Energy and Conservation Transition Act of 1985," which revises and extends the energy tax credits currently available for both businesses and homeowners; and "The President's Tax Proposals to the Congress for Fairness, Growth, and Simplicity," which would allow the energy tax credits to homeowners and businesses to expire and would modify the tax treatment of various facets of domestic energy production. This section focuses on energy tax credits to businesses and homeowners. Discussion of the President's Tax Proposal will be limited to Chapter 9 of the proposal, "Revisions of Energy and Natural Resource Tax Laws."

The major points of the current law and these two proposals with respect to energy tax credits are summarized below.

Current Law:

- Allows a credit of 15 percent of up to $2,000 of conservation-related expenditures in the residential sector
- Allows a credit of 40 percent of up to $10,000 of expenditures related to the use of renewable energy sources in the residential sector
- Specifies no income limit on households taking the conservation and renewable credits
- Defines renewable energy sources as wind energy, solar energy, or energy from geothermal deposits
- Excludes structural or decorative components (for example, awnings, carpeting, drapes) from allowable conservation items. Excludes from renewable energy source equipment wood-burning stoves and most passive solar systems.

- Allows a 10-percent business tax credit for conservation property and between a 10-percent and 15-percent business tax credit for alternative energy sources (including renewables).

- Expires December 31, 1985, for the residential energy tax credits.

- Expired December 31, 1982, for the business energy tax law, although projects that qualify for the affirmative commitment rules[1] can receive credit until December 31, 1990.

H.R. 2001:

- Increases the residential tax credit to 25 percent of conservation-related expenditures.

- Decreases the maximum tax credit allowed to $175.

- Restricts eligibility for residential conservation credits to households with adjusted gross incomes of less than $30,000. No income ceiling is proposed for the renewable or business energy tax credits.

- Excludes storm doors or thermal doors from allowable conservation items.

- Extends residential tax credits for conservation-related expenditures through December 31, 1988.

- Extends residential tax credits for wind and geothermal energy to December 31, 1988. Extends residential credits for solar energy to December 31, 1990.

- Increases the current business tax credit for photovoltaics to 25 percent.

- Includes wood-gasification equipment and anaerobic digestion equipment in the definition of biomass equipment.

- Extends business tax credits for geothermal energy to 1988 with another 2 years extension under affirmative commitment rules, and extends credits for wind energy and biomass to 1988.

- Extends business tax credits for ocean thermal energy to December 31, 1990. Extends business credits for solar energy to 1990 with another 3 years extension under affirmative commitment rules.

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[1]Affirmative commitment rules allow for the carry forward of deductions for projections requiring 2 or more years to completed.

President's Tax Proposal:

- Allows the residential energy tax credits to expire December 31, 1985, and maintains current carryover.

- Allows the business tax credits to expire on December 31, 1985, with affirmative commitment rules applying only to credit for hydro-electric generation.

- Terminates the excise tax exemption on alcohol mixtures and alcohol fuels on December 31, 1985. However, the alcohol fuels use credit is grandfathered for those production facilities completed before January 1, 1986.

Tables 1 and 2 compare the provisions of current law and the two proposals for allowable residential tax credits for renewable energy sources and conservation. Table 3 summarizes the differences among the current law, H.R. 2001, and the President's Tax Proposal with respect to business conservation and alternative energy source tax credits.

Table 1. Summary Comparison of Residential Conservation Tax Credits

	Current Law	H.R. 2001	President's Tax Proposal
Tax Value	15 Percent	25 Percent	None
Maximum Expenditures	$2,000	$700	Not applicable
Maximum Credit	$300	$175	Not applicable
Minimum Credit	$10	$10	Not applicable
Income Ceiling	None	$30,000	Not applicable
Carryover of Excess Credit from Year to Year	Through 1987	Through 1990	Through 1987
Qualifying Rules	Expenditures made on or after 1977; Dwelling located in United States and completed prior to April 20, 1977; Principal residence	Same as current law	Not applicable
Definition of Conservation Items	Insulation, replacement burner device for modifying flue openings, electrical or mechanical furnace ignition, storm or thermal windows or doors, set-back thermostat, caulking, weatherstripping	Excludes storm or thermal doors	Not applicable
Expiration	12/31/85	12/31/88	12/31/85

Sources: • Energy Tax Act of 1978, Crude Oil Windfall Profit Tax Act of 1980, Internal Revenue Service rulings. • Tax Reform Proposals: Taxation of Capital Income, Joint Committee on Taxation, August 1985. • H.R. 2001--Renewable Energy and Conservation Transition Act of 1985. • The President's Tax Proposals to the Congress for Fairness, Growth, and Simplicity.

Table 2. Summary Comparison of Residential Renewable-Energy-Source Tax Credits

	Current Law	H.R. 2001	President's Tax Proposal
Tax Value	40 Percent	Depends on energy source: see below	None
Solar	40 Percent	1986--35 Percent 1987--30 Percent 1988--25 Percent 1989--20 Percent 1990--15 Percent 1991--+0 Percent	
Photovoltaics	40 Percent	40 Percent	
Wind	40 Percent	1986--35 Percent 1987--30 Percent 1988--25 Percent 1989--0 Percent	
Geothermal	40 Percent	1986--40 Percent 1987--30 Percent 1988--20 Percent	
Maximum Expenditures	$10,000		Not applicable
Solar Hot Water		$6,000	
Wind		$20,000	
Other		$10,000	
Maximum Credit	$4,000		Not applicable
Solar		Depends on year	
Wind		Depends on year	
Geothermal		Depends on year	
Other		$4,000	
Minimum Credit	$10	$10	Not applicable
Carryover of Excess Credit from Year to Year	Through 1987	Through 1987	Through 1987
Solar		Through 12/92	
Wind		Through 12/90	
Geothermal		Through 12/90	
Income Ceiling	None	None	Not applicable
Qualifying Rules	Principal dwelling; In United States; Expenditures in 1977 or after	Same as current law	Not applicable
Definition of Renewable Energy	Solar energy, energy from geothermal deposits, energy from other renewables (specified by regulations) that provide hot water or electricity; wind energy for nonbusiness residential purposes	Same, except removes temperature restriction for geothermal energy	Not applicable
Expiration	12/31/85	Wind and geothermal: 12/31/88; Solar: 12/31/90	12/31/85

Sources: • Energy Tax Act of 1975, Crude Oil Windfall Profit Tax Act of 1980, Internal Revenue Service rulings. • Tax Reform Proposals: Taxation of Capital Income, Joint Committee on Taxation, August 1985. • H.R. 2001--Renewable Energy and Conservation Transition Act of 1985. • The President's Tax Proposals to the Congress for Fairness, Growth, and Simplicity.

Table 3. Summary Comparison of Tax Credits for Business--Conservation and Alternative Energy Sources

	Current Law	H.R. 2001	President's Tax Proposal
Tax Value			
Conservation	10 Percent	None	None
Renewable-Energy Sources			Not applicable
Solar			
Low-temperature	15 Percent	15 Percent	
High-temperature	15 Percent	25 Percent	
Photovoltaics	15 Percent	25 Percent	
Wind	15 Percent	1986: 10 Percent 1987: 10 Percent 1988: 5 Percent 1989: 0 Percent	
Geothermal	15 Percent	15 Percent	
Ocean thermal	15 Percent	15 Percent	
Hydroelectric	11 Percent	11 Percent	
Biomass	10 Percent	1986: 10 Percent 1987: 10 Percent 1988: 5 Percent 1989: 0 Percent	
Maximum Expenditures	None	None	Not applicable
Income Ceiling	None	None	Not applicable
Expiration Date and Affirmative-Commitment Rule (A-C)			
Specially-defined Energy Property	12/31/82, extended through 1990 under affirmative-commitment rules	Same as current law	12/31/82; current affirmative-commitment rules apply
Cogeneration Equipment	12/31/82, extended through 1990 under affirmative-commitment rules	Same as current law	12/31/82; current affirmative-commitment rules apply
Intercity Buses	12/31/85	12/31/85	12/31/85

Table 3. Summary Comparison of Tax Credits for Business--Conservation and Alternative Energy Sources (Continued)

	Current Law	H.R. 2001	President's Tax Proposal
Expiration Date and Affirmative-Commitment Rule (A-C)			
Alternative Energy Property	12/31/82, extended through 1990 under affirmative-commitment rules	Same as current law	12/31/82; current affirmative-commitment rules apply
Geothermal	12/31/85	12/31/88; extended to 1990 under affirmative-commitment rules	12/31/85
Ocean Thermal	12/31/85	12/31/90	12/31/85
Wind	12/31/85	12/31/88	12/31/85
Solar	12/31/85	12/31/90, extended through 1993 under affirmative-commitment rules	12/31/85
Biomass	12/31/85	12/31/85	12/31/85
Shale Oil Equipment	12/31/82, extended through 1990 under affirmative-commitment rules	Same as current law	12/31/85
Equipment for Producing Natural Gas from Geopressurized Brine	12/31/82, extended through 1990 under affirmative-commitment rules	Same as current law	12/31/85
Hydroelectric Generating Equipment	12/31/82, extended through 1988	12/31/85, extended through 1990 under affirmative-commitment rules	12/31/85, extended through 1988
Recycling Equipment	12/31/82, extended if equipment was added after 1982	Same as current law	12/31/85

Sources: • Energy Tax Act of 1975, Crude Oil Windfall Profit Tax Act of 1980, Internal Revenue Service rulings. • H.R. 2001--Renewable Energy and Conservation Transition Act of 1985. • The President's Tax Proposals to the Congress for Fairness, Growth, and Simplicity. • Tax Reform Proposals: Taxation of Capital Income, Joint Committee on Taxation, August 1985.

2. RESIDENTIAL SECTOR ENERGY TAX CREDITS

Data

The Energy Tax Act of 1978 provided tax credits for two kinds of residential energy investments. One credit is applicable to expenditures for conservation improvements made to residences built before mid-1977. The second credit is for investments in renewable energy sources, such as solar, wind or geothermal. These credits have been available to households since the tax year 1978.

Table 4 shows the total number of returns that have claimed a residential tax credit for the tax years 1978 through 1983.[1] The data shown for 1978 include investments for the 20-month period from April 20, 1977 through December 31, 1978. Table 4 also shows the total tax credits available and the total energy expenditures listed on the returns that were the basis for the tax credits. These data also are given separately for conservation improvements and for renewable energy investments.

The data indicate that there has been a fairly persistent decline in the number of returns that claim an energy tax credit, from 6.0 million in 1978 (although this figure does include data for 8 months of 1977) and 4.8 million in 1979 to 2.4 million in 1983.

Table 4 also shows that most of the households taking tax credits did so for conservation improvements. In 1978, only about 1 percent of the households taking credits claimed renewable energy expenditures. However, the relative number claiming renewable energy investments had increased to 7 percent of the total by 1983. The number of households claiming credits for conservation improvements declined consistently from 1978 to 1983, in line with the decline in the total number taking credits. However, the number of households taking credits for renewable investments climbed from 69,000 households in 1978 to a peak of 229,000 in 1982; this figure then dropped to 169,000 in 1983.

The total dollar amount of tax credits taken has not changed nearly as dramatically as has the number of households taking the credits. In 1983, total credits taken were $486 million, which is less than the $592 million

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[1] A very small number of returns list energy conservation or renewable energy expenditures for more than one housing unit. This number is sufficiently small that the number of returns can be considered equal to the number of housing units that have made conservation improvements or renewable energy investments.

Table 4. Residential Energy Tax Credits and Expenditures

Year	Energy Credit			Conservation			Renewable		
	Number of Returns (Millions)	Credit Amount (Millions)	Energy Expenditures (Millions)	Number of Returns (Millions)	Credit Amount (Millions)	Energy Expenditures (Millions)	Number of Returns (Thousands)	Credit Amount (Millions)	Energy Expenditures (Millions)
1978[a]	6.0	592	4,226	5.9	559	4,101	69	32	125
1979	4.8	481	3,492	4.8	437	3,302	77	44	190
1980	4.7	584	3,648	4.6	419	3,200	155	166	448
1981	3.9	628	3,088	3.7	365	2,440	225[b]	263[b]	658[b]
1982	3.2	614	2,761	3.0	292	1,956	229	322	805
1983	2.4	486	2,325	2.3	243	1,687	169	242	638

[a]The year "1978" covers the 20-month period from April 20, 1977 through December 31, 1978.
[b]In 1981, the residential solar credit was increased from 25 to 40 percent.

Source: Data for 1978-1980: Thompson and Hillelson, "Residential Energy Credit 1979-1980," Internal Revenue Service Statistics of Income Bulletin, Fall, 1982, various tables.

Data for 1981: Internal Revenue Service, 1981 Statistics of Income Individual Income Tax Returns, 1984, Table 3.2.

Data for 1982, 1983: Unpublished data supplied by Internal Revenue Service, Statistics of Income Division, Individual Returns Analysis Section.

taken in 1978 (for a 20-month period). However, the total credits taken for conservation have declined by more than a factor of two, from $559 million in 1978 to $243 million in 1983. On the other hand, total credits for renewable investments have increased from $32 million in 1978 to $322 million in 1982, followed by a decline to $242 million in 1983. In terms of dollar amounts, total credits for conservation were about the same as for renewable investments in 1983.

These data do not provide an explanation for the changes occurring over time. However, one important fact about the credits affecting their use over time is that the tax law placed a limit on the total cumulative credit that could be claimed per family: The maximum is $300 for conservation improvements and $4,000 for renewable energy sources. One likely reason for the decline in the use of conservation tax credits is the fact that many of the households most likely to benefit from the credit already may have made all the appropriate conservation improvements for their house or may have reached the maximum tax credit. Because newly constructed homes are not eligible, the stock of housing eligible for the tax credits is fixed (with the exception that a household moving into a house may take credits for new investments even if the previous owner also took credits). Thus, the eligible pool of households has declined over time, although it is not possible to determine the magnitude of this decline with any precision using the available data.

Because the tax credit for renewables has been taken by a small number of homes and it is not limited to those homes constructed prior to April 1977, most households are still eligible. However, the decline in the number taking this credit from 1982 to 1983 may reflect the possibility that only a limited number of households find investments in renewable energy feasible or profitable, even with the tax benefits. In this case, the pool of households which would consider further investments may be declining.

The growth in the number of households claiming credits for renewable energy investments probably was enhanced by the increase in the available credit in 1980. In 1978 and 1979, the credit was 30 percent of the first $2,000 of expenditures and 20 percent of the next $8,000. In 1980, the credit was increased to 40 percent of qualified expenditures up to $10,000. All homes (not just those built before 1978) also were eligible for the credit, so the pool of eligible homes has increased each year as new houses are built.

Table 5 shows the total energy expenditures claimed on returns by category of investment for conservation and for renewable energy. Among the returns taking credits for conservation, most of the credits are for insulation and for storm windows/doors. These expenditures combined constitute about 85 percent of the total conservation expenditures. Total expenditures for storm windows/doors are slightly higher than for insulation in the four years shown in the table. However, slightly more households take credits for insulation than for storm windows/doors. Smaller numbers of households claim credits for caulking and other relatively inexpensive items.

Table 5. Number of Tax Returns with Residential Energy Expenditures and Amount of Expenditures by Category, 1978-1981

Category	1978		1979		1980		1981	
	Number of Returns (Thousands)	Amount (Millions)	Number of Returns (Thousands)	Amount (Millions)	Number of Returns (Thousands)	Amount (Millions)	Number of Returns (Thousands)	Amount (Millions)
Energy Conservation								
Insulation	3,900	1,760	2,900	1,332	2,700	1,218	2,200	1,116
Storm Windows/ Doors	3,400	1,797	2,500	1,403	2,500	1,455	2,000	1,432
Caulking	1,600	89	1,400	100	1,200	84	1,000	62
Other	NA	454	NA	467	NA	444	600	306
Total	5,900	4,101	4,800	3,302	4,600	3,200	3,700	2,915
Renewable Resources								
Solar	NA	120.3	NA	171.2	NA	399.0	212.5	678.6
Geothermal	NA	3.1	NA	9.7	NA	21.2	4.8	21.9
Wind	NA	1.6	NA	9.4	NA	27.4	10.7	17.1
Total	69	125.0	78	190.3	155	447.6	225	718.6

NA = Not available.

Source: Data for 1978-1980: Thompson and Hillelson, "Residential Energy Credit 1979-1980," Internal Revenue Service Statistics of Income Bulletin, Fall, 1982, various tables.

Data for 1981: Internal Revenue Service, 1981 Statistics of Income Individual Income Tax Returns, 1984, Table 3.2.

Data for 1982, 1983: Unpublished data supplied by Internal Revenue Service, Statistics of Income Division, Individual Returns Analysis Section.

Data from the Residential Energy Consumption Survey can be used to examine the rate at which households make conservation improvements and to estimate the percentage that takes the tax credit. The Residential Energy Consumption Survey is a national survey of residences that collects detailed information about the characteristics of the housing unit that are related to energy consumption, the characteristics of the household living in the unit, and the consumption and expenditures for all energy sources used in the home. The surveys have been conducted annually from 1978 through 1982, in 1984, and are scheduled to be conducted every 3 years in the future. The data from these surveys provide a good picture of the number and types of improvements made in recent years.

Table 6 shows the types of conservation improvements made in single-family homes from 1978 through 1982. A higher percentage of homes made the less expensive conservation improvements, such as caulking and weatherstripping, than made the more expensive improvements, such as roof or ceiling insulation and storm doors and windows. The peak of residential conservation activity appears to have occurred in 1980. In almost all categories there was a substantial decline between 1980 and 1982 in the percentage of homes that made conservation improvements.

In the 1984 Residential Energy Consumption Survey, households that made conservation improvements in 1983 were asked whether or not they took a tax credit on their 1983 returns. For those not making a claim, further questions probed for the reasons. For those making a claim, a further question sought to reveal if the conservation item would have been installed in the absence of a tax credit. Responses to these questions are shown in Table 7.

The data in Table 7 indicate that a substantial majority of all households that made conservation improvements claimed no tax credit for them. Also, there is a substantial variation by income in the percentage of households that claim a tax credit, even among those households that installed conservation items. Less than 10 percent of households with incomes under $15,000 who made some conservation improvement claimed a tax credit. On the other hand, among households with incomes over $30,000, about 26 percent claimed a tax credit. Of those households that claimed the credit in 1983, about 43 percent had incomes under $30,000.

The reasons given by households for not claiming a tax credit further underscore the differences between lower- and higher-income households. Lower-income households less often claimed tax credits for the energy saving improvements made to their homes because they did not know about the tax credit or did not file the long income tax form. Higher-income households, on the other hand, in more cases indicated they did not claim a tax credit because the amount was too small to bother with, although other reasons were also cited.

Also shown on Table 7 are the responses to the question about whether or not households would have made the improvements if the tax credit had not been available. An overwhelming majority of households said that they would have made the same investment without the credit. Almost all households

Table 6. Single-Family Homes Making Conservation Improvements, 1978-1982 (Percent)

Conservation Improvements	1978	1979	1980	1981	1982
Caulking	18.6	(a)	19.1	10.8	10.7
Weatherstripping	7.6	(a)	13.6	6.1	5.8
Closeable Shutters, Reflective Film, Plastic Coverings, or Insulating Drapes[b]	8.3	(a)	9.6	4.3	5.0
Roof/Ceiling Insulation	5.1	5.8	6.1	3.9	2.6
Storm Doors	4.4	6.3[c]	5.8	4.0	3.8
Storm Windows	4.3	(c)	4.3	3.1	3.0
Wall Insulation	2.6	2.9	3.5	2.3	1.7
Basement/Crawl Space Insulation	2.1	(a)	1.6	0.9	0.9
Hot Water Pipe Insulation	1.6	(a)	2.4	1.5	1.6
Water Heater Insulation	0.7	(a)	2.5	2.3	2.3
Automatic Set-back Thermostat	1.4	(a)	2.0	1.7	0.7
Heat Pump	0.1	(a)	0.3	0.2	0.3

[a]Not asked.
[b]This category did not include film or drapes in 1978 or film in 1980.
[c]Storm doors and storm windows were combined into one category in the 1979 survey.

Note: The 1979 Screener Survey collected very limited data on conservation improvements.

Source: Energy Information Administration, 1978 through 1982 Residential Energy Consumption Surveys.

Table 7. Factors Related to Tax Credits Claimed for Residential Energy Conservation Projects by Income Groups, 1983
(Percent)

Category	Less than $5,000	$5,000 to $9,999	$10,000 to $14,999	$15,000 to $19,999	$20,000 to $29,999	$30,000 and More
Percent of Homes Installing One or More Items in 1983 Who Claimed a Tax Credit on 1983 Return	9	7	11	17	21	32
Percent of Homes Claiming a Tax Credit Who Would Have Made Same Improvements If the Tax Credit Had Not Been Available	100	100	100	88	84	89
Homes Not Claiming a Tax Credit for Particular Reasons[a]						
• Didn't Know About the Credit ...	50	27	37	21	19	11
• Didn't File the Long Form	45	49	21	36	13	11
• Amount Too Small to Claim	10	20	19	20	24	37
• Too Much Trouble to File Tax Credit Forms	5	17	13	14	14	21
• Ineligible Because House was Built After April 1977	5	2	3	*	1	1
• Took the Maximum Credit in Previous Years	*	2	3	*	11	7
• No 1983 Tax Filed	15	*	1	5	1	*

[a]More than one reason may have been selected.
*Less than 0.5 percent.
Source: Energy Information Administration, 1984 Residential Energy Consumption Survey.
Note: The percentages reported in this table are based on the unweighted tabulations of data which have not been fully edited to check for inconsistencies and other errors. The final numbers can be expected to differ from these numbers, although the overall pattern is not expected to change.

with incomes under $15,000 would have made the investment without the credit being available. For households with higher incomes, only 10 to 15 percent said they would not have made the same improvements without the tax credit.

The proportion of households making conservation improvements that takes a tax credit varies with the type of improvement. Table 8 indicates that between 30 and 40 percent of all households that added insulation to their homes from 1980 through 1983 claimed a tax credit. For those adding storm windows or doors, the percentage was higher, ranging from 40 to 50 percent. For caulking and other conservation items, a relatively small share of households (generally less than 10 percent) claimed a tax credit.

The data in Table 8 for 1980 through 1982 were calculated by combining Internal Revenue Service data on the number of households claiming a credit with Residential Energy Consumption survey data on the number of households that made the improvement. The 1983 data, however, are based solely on the Residential Energy Consumption Survey which contained a question asking whether or not a tax credit was taken. Since the Internal Revenue Service data and the Residential Energy Consumption Survey data both are based on samples and hence have sampling variance, these figures are uncertain and should be viewed as orders of magnitude rather than precise estimates.

H.R. 2001 extends the residential tax credit only for households with incomes under $30,000. The data in Table 8 are shown for households with incomes below and above this income level. In all categories, households making conservation improvements with higher income are more likely to take the credit. For most categories of improvements and for most years, the percentages taking a tax credit are higher by about a factor of two for the higher income households.

The final issue to be considered is the energy consumption of households making conservation improvements. Table 9 gives the average consumption and expenditures per household for all fuels used in the home. These data are given for the homes making different types of conservation improvements for the years 1980 through 1982. Households that make conservation improvements do consume more energy and pay more for it than the average household. This is true for households with incomes both above and below $30,000. Households that install insulation consume less energy on average than households that make other types of conservation improvements.

Because the conservation credits were designed to reduce energy use for space heating, the historical level of this portion of energy demand is also an important factor in this analysis. The average residential energy consumption for all major fuels used in the household in 1978 was 138 million Btu. Sixty-six percent of this amount, or 91 million Btu, was used for space heating. (This figure included both primary and secondary heating.) By 1980, the amount of energy used for space heating had decreased to 63 million Btu, or 55 percent, of the average consumption per household. Space heating energy consumption increased slightly to 66 million Btu in 1981, followed by a decrease in 1982 to 57 million Btu. The percent of households taking a residential energy tax credit for conservation items by main heating fuel in 1983 were as follows:

Table 8. Number of Households that Make Conservation Improvements and Percent that Take Tax Credit by Category of Improvement and by Income
(Millions of Households)

Conservation Category/Income	1980		1981		1982		1983	
	Number Making Improvement	Percent Take Credit	Number Making Improvement	Percent take Credit	Number Making Improvement	Percent Take Credit	Number Making Improvement	Percent Take Credit
Insulation								
Total	6.4	42	6.0	37	5.4	NA	NA	31
Less than $30,000 ...	4.9	33	4.1	29	3.6	NA	NA	22
$30,000 or more	1.4	79	2.0	50	1.7	NA	NA	46
Storm Windows/Doors								
Total	5.1	49	4.5	44	4.5	NA	NA	44
Less than $30,000 ...	4.1	37	3.3	33	3.0	NA	NA	33
$30,000 or more	1.0	100	1.2	75	1.5	NA	NA	60
Caulking								
Total	12.0	10	8.4	12	7.4	NA	NA	18
Less than $30,000 ...	9.3	8	5.9	8	4.9	NA	NA	12
$30,000 or more	2.6	19	2.5	20	2.5	NA	NA	32
Other								
Total	11.4	NA	7.3	8	6.6	NA	NA	19
Less than $30,000 ...	8.8	NA	5.0	6	4.1	NA	NA	14
$30,000 or more	2.6	NA	2.3	13	2.4	NA	NA	28

NA = Not available.

Source: Energy Information Administration, Residential Energy Consumption Surveys for 1980, 1981, 1982, and 1984; special tabulations. The 1983 estimates from the 1984 Residential Energy Conservation Survey are based on preliminary unweighted data and are subject to change. Internal Revenue Service data from sources cited in Table 4.

Table 9. Average Energy Consumption and Expenditures per Household by Conservation Improvement Category and by Income

Conservation Category/Income	1980 Consumption (Million Btu)	1980 Expenditures (Dollars)	1981 Consumption (Million Btu)	1981 Expenditures (Dollars)	1982 Consumption (Million Btu)	1982 Expenditures (Dollars)
All Households						
Total	117	924	117	1,032	106	1,060
Less than $30,000	112	875	109	960	98	976
$30,000 or more	142	1,164	146	1,283	129	1,334
Households That Install:						
Insulation						
Total	123	991	130	1,136	113	1,135
Less than $30,000	117	936	115	993	104	1,036
$30,000 or more	147	1,177	161	1,430	131	1,342
Storm Windows/Doors						
Total	135	1,016	133	1,166	130	1,274
Less than $30,000	130	974	124	1,052	118	1,147
$30,000 or more	159	1,186	159	1,483	155	1,522
Caulking						
Total	135	1,051	149	1,240	121	1,173
Less than $30,000	129	998	133	1,116	111	1,082
$30,000 or more	160	1,241	186	1,530	139	1,347
Other						
Total	132	1,054	149	1,298	130	1,290
Less than $30,000	127	999	136	1,157	116	1,124
$30,000 or more	149	1,243	177	1,608	155	1,573

Source: Energy Information Administration, Residential Energy Consumption Surveys for 1980, 1981, and 1982; special tabulations.

Main Heating Fuel of Households that Took the Credit in 1983[a]	Percent
Natural Gas	67
Electricity	7
Fuel Oil or Kerosene	13
LPG	2
Wood	11
Total	100

[a]Data are limited to eligible homes and households that indicated some conservation activity occurred in 1983, but exclude renewable items. The percentages are based on unweighted tabulations of data which have not been fully edited to check for inconsistencies and other errors. The final numbers can be expected to differ from these numbers, although the overall pattern is not expected to change.

Analysis

This section analyzes the extension of the energy conservation tax credit proposed in H.R. 2001. Current law and the President's Tax Proposal both allow the credits to end on December 31, 1985. The extension of the credits would no doubt induce some consumers to make conservation investments that they otherwise would not have undertaken, although the actual number of additional investments is highly uncertain. The following analysis attempts to quantify how many of these types of investments would be made and the loss of revenues to the Treasury from such investments.

Methodology and Assumptions

The basic methodology used to assess the effectiveness of Treasury dollars spent in the form of residential energy tax credits was to compare the present value of the Treasury revenue losses due to extension of the program with the (discounted) additional energy savings estimated to be forthcoming from the program. The critical assumptions in this analysis relate to: (1) how much energy is likely to be saved by a typical residential energy conservation or renewable project, and, (2) how many additional residential energy conservation and renewables projects are induced by the availability of the credit.

Energy savings of 15 percent of space heating energy use were assumed for a typical conservation project, although sensitivity cases using 10 percent and 20 percent savings also were examined (see Appendix C). This savings percentage is in the range of savings observed for households participating

in the Department of Energy's Low Income Weatherization Program.[1] For solar hot water installation, energy savings were assumed to be 65 percent of hot water energy use.[2]

Evidence is limited concerning the degree to which individuals actually have been induced by the Federal energy tax credits to undertake residential renewable and conservation projects. Some studies do suggest that those who undertake residential conservation projects are not fundamentally influenced by the existence of the credit.[3] It appears that when the conservation tax credit was set at 15 percent of eligible expenditures, some 10 to 15 percent of households undertaking such projects were induced to do so by the availability of the credit. As H.R. 2001 raises the credit to 25 percent, it is necessary to make some assumptions about how eligible households might respond to the higher credit. Lacking any other information, three alternative assumptions are made: that 12.5 percent, 25 percent, and 37.5 percent of eligible households will be induced to undertake conservation projects by the credits available under H.R. 2001. These assumptions can be summarized by a proportionality factor, which is the ratio between the fraction of eligible households which undertake conservation measures because of the credit and the tax credit rate. Thus, the H.R. 2001 tax credit of 25 percent would induce participation of 12.5 percent, 25 percent, and 37.5 percent, assuming proportionality factors of 0.5, 1.0, and 1.5, respectively. It is also assumed that each eligible household makes $700 worth of conservation expenditures, the average expenditure in the past and also the maximum allowable under H.R. 2001.

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[1] See Energy Information Administration, Weatherization Program Evaluation, Service Report, SR-EEUD-84-1 (August 1984). For the 568 households surveyed in the weatherization program evaluation which used natural gas as the primary heating fuel, an estimated 11-percent savings (relative to total energy use) was achieved (p. 25). Relative to space heating only, savings were about 14 percent on average.

[2] Science Applications, Incorporated, "Comprehensive Review of Renewable Sources of Energy, Active Solar Heating and Cooling in the United States," for U.S. Department of Energy, Office of Solar Heat Technologies.

[3] A survey conducted by H. Craig Petersen, of Utah State University, indicated that approximately 12 percent of the people surveyed who claimed conservation tax credits on their Federal income tax returns were induced to undertake conservation measures because of the availability of the credit. Data from the Residential Energy Consumption Survey provided in the beginning of this chapter tend to confirm the Petersen findings.

These assumptions result in an estimated range of 1.7 to 2.0 million households using the conservation tax credit between 1986 and 1990. Of these households, 0.2 to 0.8 million households were induced by the credit to undertake projects. The cost to the Treasury comprises the credits taken by the entire 1.7 to 2.0 million households, while the incremental energy savings attributed to H.R. 2001 include only savings from the 0.2 to 0.8 million households induced to invest by the credit.

Proportionality factors of 1.0 and 2.0 were assumed for residential renewable projects (principally solar hot water projects) because it was assumed that these relatively expensive projects are more likely to require tax credits for significant participation. In this case, the range of participation was between 370,000 and 680,000 households assumed to use the residential renewable tax credit between 1986 and 1990. A more detailed description of these and other assumptions involved in this analysis is provided in Appendix B.

The calculations include the present value of Treasury costs per (discounted) barrel of oil equivalent of energy saved over the life of the projects under the various assumptions about credit-induced activity. Both the units of energy saved and the Treasury payments over the life of the project are discounted to allow the calculation of a cost per barrel of oil equivalent on a present value basis that can be used to compare the various tax credit proposals. A 4-percent real discount rate is assumed in this analysis. Also reported are internal rates of return for residential projects, as well as calculations of the value to consumers of the energy credit in terms of equivalent prices. The equivalent price for a project is defined as the expected energy price that would make the internal rate of return on the project without the credit as favorable as the rate calculated with the credit and market prices, all other assumptions remaining the same. In the analyses of internal rates of return, energy savings are assumed to be in the form of natural gas, the dominant fuel used for home heating.

Cost to the Treasury per barrel of oil equivalent saved is a measure that can be used to compare different energy policies in terms of their impact on the budget deficit. The larger the Treasury cost per barrel of oil equivalent saved or produced is, the greater the loss in tax revenues (or increase in expenditures) required to achieve any particular reduction in demand or increase in supply will be. As mentioned previously, a large proportion of those taking energy tax credits would have made conservation investments even if the credits did not exist. Thus a large component of the cost to Treasury is transferred to households whose behavior is unaffected by the credit. The smaller is the proportion of households taking the credit that are induced to undertake conservation investments by the credit, the larger will be the Treasury cost per barrel of oil equivalent saved.

The equivalent price plays a role in a different kind of analysis. It is a measure of how great an incentive is provided for undertaking a particular kind of activity. A convenient way to measure the magnitude of the incentive provided by conservation and renewable energy tax credits is to calculate the energy prices that would be required to make investments in

energy conservation and renewables as profitable without H.R. 2001 (i.e., without the credits) as they would be with H.R. 2001. The equivalent price measure gives an indication of how the allocation of economic resources, rather than the size of tax collections, is affected by the credits. The larger is the equivalent price, the greater would be the amount of conservation engendered by the credit.

Results

The results of this analysis are presented in Tables 10 through 14. Tables 10 and 11 show the results for residential conservation credits assuming that the energy savings average 15 percent of space heating use. More detailed tables and tables assuming 10- and 20-percent energy savings are presented in Appendix C. Tables 12 and 13 show the results for residential renewable projects (assumed to be all solar hot water) at an energy savings of 65 percent. More detailed residential renewable tables are also presented in Appendix C. These results show:

- Reasonable upper estimates for total Treasury losses under the time horizon for H.R. 2001 range between $300 and $340 million dollars on a present value basis for residential conservation tax credits.

- Behind these estimates are total estimated conservation credit claims ranging from 1.7 million to 2.0 million households between 1986 and 1988, depending on the responsiveness of consumers to the tax credit. (See Appendix B.)

- Cumulative additional energy savings attributable to the conservation tax credit are very sensitive to assumptions about what proportion of those taking the credit are induced to undertake conservation because of the credit. However, assuming 15 percent energy savings from "typical" conservation projects, a likely upper limit to total credit-induced savings under H.R. 2001 would be 86 trillion Btu (on a discounted basis), or the energy equivalent of 15 million barrels of fuel oil. Therefore, the treasury cost is estimated to be at least $23 per barrel of oil equivalent saved, although it could be as high as $70 per barrel of oil equivalent, depending on the participation rate.

- Assuming 15 percent energy savings, the internal rate of return for "typical" conservation projects under H.R. 2001 is 10.4 percent with constant real energy prices. These rates of return are exclusive of consideration of any State tax credits.

- The conservation tax credit under H.R. 2001 would have the same impact on project profitability as a one-time, permanent 33-percent increase in real energy prices. This is a measure of the degree to which conservation projects would be subsidized for those eligible under H.R. 2001.

Table 10. Residential Conservation Tax Credit Analysis Under H.R. 2001: Treasury Losses and Incremental Energy Savings

Assumptions	Total Cumulative Households Participating (thousands)	Present Value of Treasury Losses[a] (millions of 1984 dollars)	Discounted Incremental Energy Saved[b]		Treasury Cost per Barrel Oil Equivalent[c] (dollar per barrel of oil equivalent)
			Trillion Btu	Million Barrels Oil Equivalent	
Proportionality Factor[d]					
0.5	1,740	294	24.6	4.23	69.64
1.0	1,920	327	54.6	9.38	34.64
1.5	2,030	342	85.9	14.74	23.21

[a]Value in 1984 dollars discounted at 4 percent over the period 1986 to 1988.
[b]Cumulative quantity of energy saved by conservation measures taken in 1986 through 1988 by those induced to do so by the availability of the tax credit, discounted at 4 percent over the period 1986 to 1999.
[c]The discounted incremental energy saved is converted to barrels of oil equivalent by dividing by the number of Btu per barrels of fuel oil (5.826 million).
[d]The proportionality factor is the assumed ratio between the proportion of total households claiming credits that were induced to undertake conservation measures because of the credit and the tax credit rate. (See Appendix B.)

Table 11. Residential Conservation Tax Credit Analysis Under H.R. 2001: Project Profitability (Energy Savings = 15 Percent)

Real Energy Price Inflation	Internal Rate of Return Under H.R. 2001	Assumed Average Price With Credit	Equivalent Price Without the Credit
	(percent)	(1984 dollars per barrel of oil equivalent)	
0 Percent			
Project Year 1986-1988	10.4	35[a]	47

[a]The average 1984 residential price of natural gas expressed in dollars per barrel of oil equivalent.

Table 12. Residential Renewable Tax Credit Analysis Under H.R. 2001: Treasury Losses and Incremental Energy Savings

Assumptions	Cumulative Households Participating (thousands)	Present Value of Treasury Losses[a] (millions of 1984 dollars)	Discounted Incremental Energy Saved[b]		Treasury Cost per Barrel Oil Equivalent[c] (dollars per barrel of oil equivalent)
			Trillion Btu	Million Barrels Oil Equivalent	
Proportionality Factor[d]	(results for natural gas-displacing solar units)				
1.0	680	659	27.9	4.79	137.58
2.0	372	385	32.6	5.59	68.79

[a]Value in 1984 dollars discounted at 4 percent over the period 1986 to 1988.
[b]Cumulative quantity of energy saved by conservation measures taken by those induced to do so by the availability of the tax credit, discounted at 4 percent over the period 1986 to end of project life, assumed to be 12 years.
[c]The discounted incremental energy saved is converted to barrels of oil equivalent by dividing by the number of Btu per barrel of fuel oil (5.826 million).
[d]The proportionality factor is the assumed ratio between the proportion of total households claiming tax credits that were induced to make renewable investments because of the credit and the tax credit rate. (See Appendix B.)

Table 13. Residential Renewable Tax Credit Analysis Under H.R. 2001: Profitability of Solar Heaters Displacing Natural Gas and Electricity (Energy Savings = 65 Percent)

Real Energy Price Inflation	Internal Rate of Return Under H.R. 2001		Assumed Average Price With Credit		Equivalent Price Without the Credit	
	Gas[a]	Electric[b]	Gas[a]	Electric[b]	Gas[a]	Electric[b]
	(percent)		(1984 dollars per barrel of oil equivalent)			
0 Percent						
Project Year						
1986	-7.9	5.4	35	114	55	177
1987	-8.8	4.0	35	114	50	163
1988	-9.5	2.8	35	114	47	153
1989	-10.3	1.7	35	114	43	140
1990	-10.9	0.8	35	114	41	134

[a]Solar units displacing natural gas.
[b]Solar units displacing electricity.

- For residential solar hot water projects, Treasury losses could range from about $385 million to $659 depending upon the responsiveness to the credit.

- These estimates are based on the estimate that between 400,000 and 700,000 households would take the renewable energy tax credit over the 1986 to 1990 period. (See Appendix B.)

- Assuming a 12-year project life, estimated maximum cumulative additional energy savings would be 33 trillion Btu (on a discounted basis), or the energy equivalent of about 6 million barrels of oil. Therefore, the Treasury cost is estimated to be at least $69 per barrel of oil equivalent saved, although it could be as high as $148 per barrel of oil equivalent, depending on the participation rate.

- In contrast to conservation credit rates (which increase under H.R. 2001 relative to current law), the residential renewable credits (which decrease over time under H.R. 2001 relative to current law) will have a lesser impact on the Treasury if individuals are very responsive to the credits. This result stems from the assumption that if individuals are very responsive to the availability of the tax credit, the number of investments made will decline more rapidly as the credit decreases.

- Real internal rates of return for residential solar hot water projects are considerably lower than those for conservation projects, even with the tax credit under H.R. 2001. The calculated rates of return are exclusive of State tax credits.

- Rates of return and equivalent prices are shown for two kinds of solar hot water heaters: solar units that displace natural gas and solar units that displace electricity. Because of the relatively high price of electricity delivered to residential customers, internal rates of return are considerably higher for electricity-displacing solar units. See Appendix B for project profiles for both the gas- and electricity-displacing residential solar hot water heaters.

- For residential solar projects installed in 1986 and displacing natural gas, the value to the consumers of the energy tax credit under H.R. 2001 would be equivalent to a rise in energy prices of more than 55 percent (to about $55 per barrel of oil equivalent) in 1986, dropping to about $40 per barrel of oil equivalent by 1990.

Focusing on project profitability, Table 14 provides estimates of internal rates of return for "typical" residential conservation and renewable projects. Rates of return are reported for the current law 1985 case (i.e., with 15-percent conservation credit and 40-percent renewable credit), the President's Tax Proposal or current law after 1985 (i.e., no tax credit),

Table 14. Internal Rates of Return for Residential Conservation and Renewables Projects Under Alternative Tax Regimes[a]

	Conservation Project (Energy Savings = 15 Percent)			Solar Hot Water (Energy Savings = 65 Percent)					
	Current Law and President's Tax Proposal		H.R. 2001	Current Law and President's Tax Proposal				H.R. 2001	
	Through 1985 (15 percent credit)	After 1/1/86 (0 percent credit)	(25 percent credit)	Through 1985 (40 percent credit)		After 1/1/86 (0 percent credit)		(35 to 15 percent credit)	
				Gas[b]	Electricity[c]	Gas[b]	Electricity[c]	Gas[b]	Electricity[c]
Without 10 Percent State Credit									
Constant Real Energy Prices									
Project Date:									
1986	7.4	3.9	10.4	-6.9	6.9	-12.6	-1.7	-7.9	5.4
1987	7.4	3.9	10.4	-6.9	6.9	-12.6	-1.7	-8.8	4.0
1988	7.4	3.9	10.4	-6.9	6.9	-12.6	-1.7	-9.5	2.8
1989	--	--	--	-6.9	6.9	-12.6	-1.7	-10.3	1.7
1990	--	--	--	-6.9	6.9	-12.6	-1.7	-10.9	0.8
With 10 Percent State Credit									
Constant Real Energy Prices									
Project Date:									
1986	10.4	6.1	14.3	-4.6	10.7	-11.5	-0.1	-5.8	8.7
1987	10.4	6.1	14.3	-4.6	10.7	-11.5	-0.1	-6.9	6.9
1988	10.4	6.1	14.3	-4.6	10.7	-11.5	-0.1	-7.9	5.4
1989	--	--	--	-4.6	10.7	-11.5	-0.1	-8.8	4.0
1990	--	--	--	-4.6	10.7	-11.5	-0.1	-9.5	2.8

[a] These internal rates of return reflect computations for average households. For households with higher energy costs, greater overall consumption patterns, or in certain climates there may be positive or higher rates of return than shown in this table.

[b] Solar units displacing natural gas.

[c] Solar units displacing electricity.

and H.R. 2001. In addition, rates of return under all cases were calculated including current California State Tax Credits.[5] This was done to provide a somewhat more complete picture of the profitability of these projects under fairly realistic conditions.

The rate of return analysis presented in Table 14 shows:

Conservation:

- Under current law prior to 1986, a typical conservation project (with 15 percent energy savings assumed and constant real energy prices) would have yielded a 7.4-percent internal rate of return with no State tax credit, rising to 10.4 percent with a 10-percent State credit.

- The President's Tax Proposal (equivalent to current law after 1985) would, by removing Federal residential energy tax credits, reduce the rate of return on typical conservation projects by 3 to 4 percentage points compared to current law prior to 1986, assuming constant energy prices.

- H.R. 2001 would increase rates of return on conservation projects by 6 to 8 percentage points over the rates implied by the President's Tax Proposal and current law, assuming constant energy prices.

- The rate of energy savings assumed for the typical conservation project is crucial in determining a probable level for the internal rate of return under H.R. 2001. Increasing the energy savings rate from 15 percent to 20 percent increases the rate of return by about 8 percentage points, assuming no real energy price inflation (see Appendix B).

Renewables (Solar Hot Water):

- Assuming 65 percent energy savings, a typical residential installation for solar hot water heating (where the solar unit is displacing natural gas) would not yield a positive internal rate of

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[5]Until August 1, 1985, California allowed a credit for residential conservation and renewable investments of 35 percent and 50 percent, respectively. These credits, however, were inclusive of Federal tax credits, the State making up the difference between the Federal contribution and the allowed State maximum percentage credit (subject to expenditure limits). As of August 1, 1985, California allows a flat 10 percent credit on residential conservation and renewables investment, with expenditure limits of $750 and $1,000, respectively. Source: California State Franchise Tax Board.

return under constant real energy prices, even if a 10-percent State tax credit, such as that now allowed in California, were in effect. This result is true for H.R. 2001 and the President's Tax Proposal, and would appear to have been true under current law for 1985. However, if the installation displaces electricity, positive internal rates of return are found (Table 13).

- Under H.R. 2001, the return on a typical residential solar installation would decline by 3 to 4 percentage points between 1986 and 1990, as the allowable credit is phased down from 35 percent in 1986 to 15 percent in 1990.

Evidence suggests that, with regard to residential energy saving investment, real consumer discount rates could range from about 10 percent to over 100 percent, depending upon the type of investment and financing arrangements.[6] For investments in homes that use natural gas for space heating, consumer discount rates probably range from at least 10 percent (under zero real energy price escalation) to about 20 percent for expectations of real energy price escalation of more than 4 or 5 percent.[7]

Under either current law or the President's Tax Proposal, fewer individuals are likely to invest in conservation measures than would do so under H.R. 2001. However, no attempt is made here to explicitly relate how observed behavior in making residential conservation retrofits has been influenced by changing economic conditions (i.e., energy price or regulatory environment effects on rates of return). It is simply noted that, under the assumptions of this analysis, the elimination of residential tax credits may have the potential of reducing the return on conservation investments below the hurdle rate for some consumers. However, the effect on total energy consumption would likely be very small.

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[6] See Dennis L. O'Neal, et al., "An Estimate of Consumer Discount Rates Implicit in Single-Family Housing Construction Practices," Oak Ridge, Tennessee (1981), ORNL/CON-62, pp. 25-30. Also see J. A. Hausman, "Individual Discount Rates and the Purchase and Utilization of Energy-Using Durables," The Bell Journal of Economics, Volume 10, No. 1, Spring 1979, pp. 35-54.

[7] In O'Neal, et.al., the average real discount rate calculated for observed purchases of energy saving investments in new residences for 11 cities was 9.8 percent for gas-heated homes, assuming the investment costs were not financed over time and assuming zero real energy price escalation. The same calculation assuming about 5-percent real price escalation yielded an average discount rate of 14 percent.

It is interesting to note that, while the elimination of the credit, as would be done under current law and the President's Tax Proposal, would have a significant impact on the rate of return for residential solar hot water projects relative to H.R. 2001, neither proposal yields a calculated internal rate of return that seems close to typical consumer discount rates, when the assumptions of this analysis are applied. This situation is certainly true when the solar unit is displacing natural gas. As noted above, rates of return for solar units displacing electricity are noticeably higher. There may be a number of considerations (some of them noneconomic in nature) that influence the type of individuals who install solar hot water heaters that are not taken into account using a cross-section of the population. This does not mean that the existence of the credit for this type of investments has not induced a large number of people to make the investment, relative to the number who would have invested anyway, but suggests that the potential market for these projects may be limited to households whose energy expenditures (and thus potential savings) are greater than average or to households located where costs or performance of the solar heating systems are better than average. The negative rates of return shown in Table 14 could be positive if either energy prices increased more rapidly than assumed (constant real prices are assumed here) or if equipment costs were lower. However, these factors do not affect the comparison between current law and H.R. 2001 in terms of the incentives provided for renewable energy investments, because this analysis is based on equalizing the rates of return given the two different tax provisions. The level at which the rates of return are equalized has not been found to have a significant effect on the results.

3. BUSINESS SECTOR ENERGY TAX CREDITS

The business energy tax credits effects of H.R. 2001 are much more difficult to assess than the residential energy credits because of the more complex nature of the types of investments involved and the lack of comprehensive data in this area.

Data

Table 15 summarizes the Internal Revenue Service data on business energy tax credits claimed from 1978 through 1982. These data show:

- The total tax credits claimed by businesses rose dramatically between 1978 and 1982, reaching a total of almost $800 million in 1982.
- In 1979 (the latest year for which detailed data are available), the bulk of the credits were used for alternative energy properties and specially-defined energy properties.
- In 1982, credits for renewable types of investments (those mostly qualifying for the 11- and 15-percent credit) were very small, amounting to only about $20 million.

Analysis

The type of analysis undertaken for the residential tax credits was not possible in the business area because of the complex nature of the investments being considered. However, some information from the data cited above and other sources can be used to make some tentative conclusions about the impact of H.R. 2001 on business energy investments.

Most of the business energy investments appear to be made for alternative energy properties and specially-defined energy properties, areas where credits expired at the end of 1982. H.R. 2001 does not reinstitute credits in these areas and therefore will have little effect on business energy investments. There will be some impact as a result of the proposed change to the affirmative commitment rule, although this change is expected to be relatively small. However, H.R. 2001 does extend tax credits for wind, geothermal, ocean thermal, hydroelectric, and biomass projects which would

Table 15. Number and Amount of Income Tax Returns for Business Energy Tax Credits, 1978-1982

Category	1978		1979		1980		1981		1982	
	Qualified Investment Energy Credit (million $)	Number of Returns	Qualified Investment Energy Credit (million $)	Number of Returns	Qualified Investment Energy Credit (million $)	Number of Returns	Qualified Investment Energy Credit (million $)	Number of Returns	Qualified Investment Energy Credit (million $)	Number of Returns
10 Percent Energy Investment Property										
Total	67.0	1,969	280.0	5,585	386.9	6,590	469.5	5,686	671.8	5,849
Alternative Energy Property	24.8	485	111.6	979	NA	NA	NA	NA	NA	NA
Specially-Defined Energy Property	16.5	680	81.2	2,458	NA	NA	NA	NA	NA	NA
Recycling Equipment	13.4	549	65.8	1,643	NA	NA	NA	NA	NA	NA
Shale Oil Equipment	.7	5	.9	11	NA	NA	NA	NA	NA	NA
Equipment for Producing Natural Gas from Geopressurized Brine ...	7.2	166	5.7	21	NA	NA	NA	NA	NA	NA
Solar and Wind	.4	44	4.2	544	NA	NA	NA	NA	NA	NA
11 Percent Energy Investment Property	NA	NA	NA	NA	3.4	24	5.9	171	6.7	78
15 Percent Energy Investment Property	NA	NA	NA	NA	10.1	545	6.2	1,068	15.1	784
Tentative Business Investment Credit	67.0	1,969	280.0	5,585	422.2	7,748	484.2	8,801	766.3	7,610
Carryover or Carry Back of Unused Credits	NA	NA	NA	NA	21.0	443	51.9	1,482	64.5	2,341

NA = Not available.
Source: Unpublished data supplied by Internal Revenue Service, Statistics of Income Division, Individual Returns Analysis Section.

not be extended under either the current law or the President's Tax Proposal. This change could likely have a major impact on the relative economics of these types of projects, but so little use has been made of these credits that the impacts on Treasury revenues and energy consumption are not likely to be significant.

A study completed by the Department of Energy's Office of Policy, Safety, and Environment on September 5, 1985, in a memorandum from Carmen Difiglio, calculated the internal rate of return for six typical types of business renewable energy projects. For wind, geothermal, small hydroelectric, and electricity produced from wood waste, the internal rate of return drops significantly when the tax credit is eliminated under current law and drops further under the President's Tax Proposal, due primarily to the elimination of the investment tax credit. Based on this information, the extension of the credit under H.R. 2001 would be expected to have an impact on the number of these types of projects undertaken. However, from the standpoint of Treasury losses, the effect of H.R. 2001 would likely be very small, as the data in Table 15 indicate that very few of these types of investments are undertaken by businesses. It is likely that many of these types of projects (in particular wind) are undertaken by limited partnerships and therefore are not accounted for in the business tax submissions because these tax credits are passed on to individuals. Because there are no known data on the extent of limited partnership filings, this factor is not considered in the analysis.

Alcohol Fuels

This section discusses the potential impact on the Treasury of the President's Tax Proposal with respect to its treatment of alcohol fuels, in comparison with current law. H.R. 2001 does not specifically address alcohol fuels; it can be presumed that they would be treated based on current law. Gasohol, a blend of ethanol and gasoline, is currently by far the most important segment of the alcohol fuels market, and, therefore, the segment with the most significant impact on Federal revenues.

Description of Tax Treatment of Alcohol Fuels. There are three major tax incentives provided under current law for the production and consumption of alcohol fuels:

(1) Excise tax exemptions for motor fuel blends : A 6-cent per gallon exemption on the Federal motor fuel excise tax is provided for gasohol (at least a 10-percent alcohol content). This provision requires that the alcohol be derived from a source other than petroleum, natural gas, or coal. The provision terminates after December 31, 1992.

(2) Alcohol fuel use tax credit: An income tax credit of 60 cents per gallon is allowed for alcohol used in gasohol mixtures. The credit drops to 45 cents per gallon for alcohol between 150 and 190 proof. As with the excise tax exemption, the alcohol must be derived from a source other than petroleum, natural gas, or coal.

This provision also terminates after December 31, 1992, but may be carried forward for up to 15 years, but not to a tax year beginning after December 31, 1994. If the credit is taken, the excise tax exemption is not allowed.

(3) Motor fuel excise tax exemption: Special motor fuels consisting of at least 85 percent alcohol, derived from a source other than petroleum, natural gas, or coal, are eligible for a 9-cent-per-gallon exemption from the Federal excise tax. Alcohol derived from natural gas (methanol) is eligible for a 4.5-cent-per-gallon exemption.

Under the President's Tax Proposal, the excise tax exemption on alcohol mixtures and alcohol fuels would terminate on December 31, 1985. However, the alcohol fuels use credit would be "grandfathered" for those production facilities completed before January 1, 1986, and for alcohol fuel sold before January 1, 1993. Facilities planned under the assumption of a tax exemption or credit would therefore not be penalized, but additional alcohol-production or blending plants would not receive a subsidy.

No specific mention is made of alcohol fuels in H.R. 2001. Consequently, this legislation would not affect current provisions if enacted.

Analysis of Proposed Tax Changes

This section concentrates on current law compared with the President's Tax Proposal. Enactment of H.R. 2001 is assumed to result in continuation of current law provisions as related to alcohol fuels.

From January 1, 1978, through March 31, 1983, gasohol was exempt from the 4-cent-per-gallon motor fuels excise tax. From April 1, 1983, through December 31, 1984, gasohol was exempt from 5 cents of the 9-cent-per-gallon motor fuels excise tax. On January 1, 1985, the exemption was increased to 6 cents per gallon. Table 16 shows annual gasohol sales from 1980 through 1984, together with estimated losses to the highway trust fund as a result of the exemptions. The Federal Highway Administration, the source for the sales data in this table, only began publishing gasohol information in 1980. As the table shows, gasohol sales have increased substantially over the last 5 years. Some of the increase may be attributed to improved reporting, as more States are separating gasohol sales from total gasoline in their submissions to the Federal Highway Administration. Nevertheless, the market for gasohol over this period was viable and growing, given the Federal subsidy (and the subsidies provided by the States).

Currently, nearly all gasohol marketers have chosen to take the excise tax exemption as opposed to the fuel use credit. This is probably due to the fact that the exemption is an immediate source of revenue, subtracted directly from excise taxes otherwise due, while the income tax credit is not available until the filing of income tax returns and must then be netted against taxes due (if any). Thus, the impact of the President's Tax

Proposal would be to transfer revenue losses due to alcohol fuels from the highway trust fund (recipient of motor fuels excise tax revenues) to the Treasury (recipient of income tax revenues). This transfer would occur because the President's Tax Proposal eliminates the excise tax exemption but does not eliminate the fuel use credit.

Table 16. Gasohol Sales and Federal Excise Tax Exemptions, 1980-1984

Year	Sales (million gallons)	Federal Excise Tax Exemptions (million dollars)
1980	497	20
1981	713	29
1982	2,259	90
1983	4,134	197
1984	5,178	259

Source: Sales--Federal Highway Administration.
Exemptions--Energy Information Administration estimates.

Even with the phaseout of favorable tax treatment, alcohol-blend use may rise in the future. Additional impetus for growth is the Environmental Protection Agency lead-phasedown regulations, which have increased the demand for alcohol as an octane-enhancer. Given the high price of alcohol (currently about $1.48 per gallon), its use is dependent upon the amount of its subsidy. However, as the demand for nonlead octane additives grows, the spread between alcohol and such other octane boosters as MTBE (methyl tertiary butyl ether) and toluene may decrease. How much the price of these substitutes will increase is not yet known, but to the extent that they do increase, the market for ethanol could improve even with reduced subsidies.

Future projections of gasohol sales are highly uncertain, given the limited nature of the data and the uncertainty surrounding future subsidies. However, based on several assumptions, a comparison of the losses under current law and the President's Tax Proposal can be made. Given the speculative nature of the projections, this comparison is considered preliminary at best. Table 17 gives estimated gasohol sales through 1992 under both current law and the President's Tax Proposal. Under current law, two scenarios are provided: a low-growth and a high-growth scenario. The low-growth scenario assumes that gasohol sales increase at the same rate as motor gasoline consumption, or by about 1 percent a year through 1992. Under the high-growth assumption, gasohol sales are assumed to grow by 10 percent per year.

Table 17. Projected Gasohol Sales and Revenue Losses, 1985-1992

Year	Current Law				President's Tax Proposal	
	Low-Growth		High-Growth			
	Sales (million gallons)	Revenue Losses[a] (million dollars)	Sales (million gallons)	Revenue Losses[a] (million dollars)	Sales (million gallons)	Revenue Losses[b] (million dollars)
1986	5,230	314	5,696	342	5,500	330
1987	5,282	317	6,265	376	5,500	330
1988	5,335	320	6,892	414	5,500	330
1989	5,388	324	7,581	455	5,500	330
1990	5,442	327	8,339	500	5,500	330
1991	5,497	330	9,173	550	5,500	330
1992	5,552	333	10,090	605	5,500	330

[a]Highway trust fund losses. These losses reflect excise tax losses only. Net revenue losses could be lower because of increased income taxes due to higher taxable income stemming from the reduction in excise taxes.

[b]Treasury general revenue losses. These losses represent maximum losses in that all companies are assumed to be able to take the production credit in the years shown.

Under the President's Tax Proposal, gasohol sales are assumed to be flat at just above their 1985 levels through 1992. This is due to the elimination of the excise tax exemption, and of the alcohol fuel use credit, except for those facilities in operation before January 1, 1986. A factor for slightly increased utilization of existing capacity is included, together with assumed additional capacity brought on line in 1985.

As Table 17 indicates, under the current law, losses to the highway trust fund could be as high as $605 million by 1992, assuming 10-percent annual growth in gasohol sales and continuation of the 6-cent per gallon Federal excise tax exemption. This amount compares to general revenue losses of about $330 million under the President's Tax Proposal, assuming full utilization of the 60-cent per gallon ethanol tax credit and relatively flat sales of gasohol. These estimates do not take into account State tax treatment of gasohol, which could have effects opposite those of the Federal tax proposals. In the agricultural states of the Midwest, for instance, substantial pressure exists to offset any losses in the Federal subsidy to avoid adverse impact on farmers.

4. A COMPARISON OF TAX BENEFITS FOR CONVENTIONAL ENERGY SUPPLY WITH TAX BENEFITS FOR CONSERVATION AND RENEWABLES

This chapter compares the effects of H.R. 2001 on investments in energy conservation and renewable resource investments with the effects of the President's Tax Proposal on conventional oil and gas investments.[1] This comparison is made because H.R. 2001 explicitly provides tax incentives for investments in energy conservation, while the President's Tax Proposal provides tax incentives for conventional oil and gas development. This chapter attempts to quantify the relative magnitude of these tax incentives. The method used to quantify the relative size of the subsidy consists of computing the change in the price of oil (or its equivalent) that would be necessary to make the energy investment without the subsidy as profitable as it would be with the subsidy. Table 18 summarizes the impacts on internal rates of return for "typical" oil and gas drilling prospects, comparing the profitability of each prospect under current law to that obtainable under the President's Tax Proposal.

Real internal rates of return on "typical" drilling prospects in the Williston Basin and Permian Basin would improve under the President's Tax Proposal, compared to current law, for most oil companies. The improved profitability would not be very substantial and would not extend to small independents. The latter group of companies currently benefits relatively more from provisions allowing write-offs for depleteable oil and gas investments (i.e., lease acquisition and other related costs). Because the President's Tax Proposal includes a phasing out of these provisions (with some exceptions), small independents would find drilling prospects like those depicted in Table 18 less attractive.

That the outcome of oil and gas projects under the President's Tax Proposal is generally a positive one is the net result of a number of changes implied in the President's Tax proposal, some of which tend to increase the profitability of drilling prospects and some of which decrease profitability.

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[1] The source of the results provided on oil and natural gas projects is the Energy Information Administration, Analysis of the Impacts of the President's Tax Proposal on Major Sectors of the Energy Industry (August 1985), Service Report), Chapter 2. The cited report was prepared in response to a request by Congressman John D. Dingell, U.S. House of Representatives, Chairman, Subcommittee on Oversight and Investigations of the Committee on Energy and Commerce.

Details on the impacts of particular proposals on oil and gas drilling can be found in an earlier tax study prepared by the Energy Information Administration.[2] In general, however, it is the combined effect of lower corporate tax rates and certain indexing provisions relating to depreciation and depletion of oil and gas assets that more than compensates for tax increasing provisions, particularly the loss of the investment tax credit.

Table 18. Internal Rates of Return for Selected Oil and Gas Drilling Prospects: Current Law and President's Tax Proposal (Percent)

	Current Law	President's Tax Proposal	Assumed Average Wellhead Oil Price[a]	Equivalent Price Under The President's Tax Proposal[b]
Williston Basin Project				
Majors[c]	8.2	8.8	27.00	27.64
Large Independents[d]	8.5	9.1	27.00	27.54
Small Independents[e]	11.9	9.1	27.00	24.64
Permian Basin Project				
Majors[c]	11.7	13.2	27.00	27.90
Large Independents[d]	12.0	14.2	27.00	28.33
Small Independents[e]	15.2	14.2	27.00	26.41

[a]This is the (constant) real oil price assumed in calculating the internal rates of return shown.

[b]The equivalent price is the change in oil prices under current law that would have the same impact on rates of return as a change to the President's Tax Proposal.

[c]The term "Majors" refers to major integrated oil companies, which are for certain cost items allowed a less generous schedule of write-offs in oil and gas exploration and development.

[d]Nonmajor oil companies with greater than 1,000 barrels per day average production of oil (and gas equivalents).

[e]Nonmajor oil companies with less than 1,000 barrels per day of oil (and gas equivalents).

[2]Op. cit.

In terms of equivalent prices, going from current law to the President's Tax Proposal would be the equivalent of an increase in real oil prices received by producers of $1 to $2 per barrel for oil companies other than small independents, depending on the project being considered. For small independents, the President's Tax Proposal is equivalent to a price reduction of about $0.50 to $2.50 per barrel. However, it is important to note that both the current law and the President's Tax Proposal have additional write-offs and taxes affecting oil and gas exploration and development that the energy conservation and renewable resource industries do not face. These additional write-offs mainly consist of intangible drilling costs and resource depletion, while the additional taxes consist of the Windfall Profit Tax and Federal and State taxes on petroleum products such as gasoline and diesel fuel. These factors have not been considered in the above analysis because they are unaffected by the proposals being analyzed, although they are nevertheless significant.

In Chapter 2, it was shown that the effect on typical conservation projections of going from a situation in which no conservation credit was allowed (i.e., current law after 1985 and President's Tax Proposal) to one in which a 25-percent credit was allowed (i.e., H.R. 2001) was equivalent to an increase in "avoided costs" (i.e., price of energy saved) to the consumer of about $12 per barrel of oil equivalent. In the case of the residential renewable energy tax credit, these figures are between $6 and $20 per barrel of oil equivalent, depending on when the project is started.

From Chapter 3, it was evident that the impact on business sector renewable energy investments of moving from current law to the President's Tax Proposal was decidedly negative. It was not possible to quantify the extent to which these types of changes would retard the development of renewable energy resources because of the lack of personal tax data. As mentioned earlier, many of these projects are undertaken by limited partnerships, with the tax credits being passed to individuals.

APPENDIX A. SUMMARY OF ENERGY TAX CREDITS

The Energy Tax Credits are divided into two main parts: (1) Residential Energy tax credits and (2) Business energy tax credits. Within each main part a comparison is made among current tax credit law, a congressional tax credit proposal to revise and extend the energy tax credit, and the President's Tax Proposal as it pertains to energy tax credits.

The first three sections describe the residential energy tax credits under current law, under H.R. 2001, and under the President's Tax Proposal, respectively. The last three sections discuss the energy tax credits for business under the same three sets of tax laws.

Residential Energy Tax Credit--Current Law

For the residential sector, there are two kinds of energy tax credits: (1) credits for expenditures for conservation, and (2) credits for using renewable energy sources. These residential tax credits are discussed below.

Conservation. Current energy tax law allows a credit of 15 percent for up to a limit of $2,000 worth of conservation-related expenditures. Thus, the maximum credit that can be claimed for conservation expenditures is $300. Current law allows a minimum credit of $10.

The law defines energy-conservation expenditures as expenditures the taxpayer incurs on or after April 20, 1977, for installing or adding either insulation or other energy-conserving items in or on a dwelling. The dwelling must fulfill two requirements: (1) it must be a principal residence of the taxpayer, and (2) it must have been constructed before April 20, 1977. The energy-conservation equipment must also fulfill two conditions: (1) it must be new, and (2) it must have a minimum useful life expectancy of 5 years.

Conservation items are categorized in one of two forms: (1) insulation and (2) other energy-conserving components. As defined by the Internal Revenue Service, insulation can be composed of any of the following materials: fiberglass, rock wool, cellulose, foam materials, urethane, vermiculite, perlite, and polystyrene. For tax purposes, the list of allowable conservation items excludes structural and decorative items like awnings, exterior siding, carpeting, and drapes.[1] The category "other

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[1] U.S. Library of Congress, Congressional Research Service, 1982. An Economic Evaluation of Federal Tax Credits for Residential Energy Conservation. Washington, DC., p. 17.

energy-conserving components" includes devices such as replacement burners for furnaces; devices for modifying flue openings; electrical or mechanical ignition systems designed to replace a gas pilot light in furnaces; exterior storm windows and doors or thermal windows and doors; automatic-setback thermostats; caulking or weatherstripping for exterior windows or doors; meters that display the cost of energy usage; and energy-efficiency items that are specified by regulations.

Renewable Energy Sources. Current tax law allows a tax credit of 40 percent for up to $10,000 of expenditures related to the use of renewable energy sources. Under this law, the maximum energy credit that can be claimed is $4,000; the minimum credit allowed is $10. The term "renewable-energy-source expenditures" refers to any expenditures a taxpayer made on or after April 20, 1977, for renewable-energy-source property installed for a dwelling that (1) is located in the United States, and (2) is the taxpayer's principal residence. This credit is not limited to houses built before 1977.

Credit for renewable energy sources includes not only the cost of equipment but also (1) labor; (2) other costs of preparing, assembling, or installing for the first time the renewable-energy-source property; and (3) expenditures for an onsite well drilled to tap geothermal deposits. Excluded from the list of allowable expenditures are costs for storage mediums not primarily used to store energy (e.g., swimming pools).

Under current law, renewable-energy-source property is defined as equipment or technologies, installed for a dwelling, that transmit or use any of the following types of energy: wind energy, solar energy, energy from geothermal deposits, or other forms of renewable energy specified by regulations to provide space heating, space cooling, hot water, or electricity. The Energy Tax Act originally allowed credits only for providing hot water. The Crude Oil Windfall Profits Tax Act broadened the provision to include the generation of electricity, thus allowing photovoltaics to be included under the category of solar equipment.

Properties that do not qualify for the renewable-energy tax credit are: (1) most passive solar systems, which usually either (a) have a dual function, or (b) are structural components of a dwelling (solar roof panels included under the Crude Oil Windfall Profits Tax Act amendment are the only exception); and (2) wood-burning stoves.

Parts of current law apply to energy credits for both conservation and renewable sources. Year-to-year carryover is one of these aspects. If all of the allowable credit is not taken in a particular year, the excess credit may be carried over to the next taxable year. If the maximum allowable credit has not yet been used, such excess credit may be claimed through December 31, 1987.

Another aspect of the law that applies to expenditures for both conservation and renewable-energy sources consists of four limitations on the amount of available credit. First, the amount of credit is reduced by other tax

credits that the taxpayer must claim before claiming the residential energy tax credit. Second, the amount of credit available under the Energy Tax Act is limited by the availability and amount of alternative governmental subsidies for conservation-related home improvements. Third, credit can be claimed only for residence in one dwelling (although a taxpayer can claim maximum credit if he moves to a new dwelling that he then retrofits). Fourth, credit refunds are precluded because the credit is limited to the extent of the taxpayers' tax liability. Under the current law, the tax credits for conservation and renewable energy sources for residences are scheduled to expire on December 31, 1985.

Residential Energy Tax Credit--H.R. 2001

The treatment of tax credits for residential energy in H.R. 2001 is subdivided into a discussion of its provisions on conservation and its provisions on renewable-energy sources.

Conservation. This bill would increase the energy-conservation credit available for conservation-related expenditures from 15 percent to 25 percent. However, maximum expenditures allowed for these improvements would decrease from $2,000 to $700. Under this bill, the maximum allowable tax credit would decrease from the current $300 to $175. The minimum tax credit would remain at $10. H.R. 2001 also introduces an income ceiling: The energy-conservation tax credit could not be claimed by any taxpayer with an adjusted gross income of more than $30,000 for the taxable year.

Most of the equipment classified as allowable conservation items in the current law is also included in H.R. 2001. The one point of divergence is that in H.R. 2001, storm doors or thermal doors are removed from the list of allowable items.

Renewable-Energy Sources. Under H.R. 2001, the primary changes in residential energy credits for renewable energy sources would be in the areas of tax-credit percentage, the carryover limitations, and the expiration dates.

(a) Tax-Credit Percentage--The proposed credit percentages for renewable energy sources differ by type of energy source and by taxable year. Table 18 shows the percent of energy tax credit available for renewable energy sources by year and by type of energy. The bill proposes 35 percent of solar-energy expenditures as the initial allowable amount of credit, beginning in 1986. This credit then decreases by 5 percent a year to 15 percent in 1990 and is phased out the following year. Credit for wind-energy expenditures begins at 35 percent in 1986 and decreases by 5 percent a year to 25 percent in 1988, after which time, it would be phased out. Credit for geothermal-energy expenditures begins at 40 percent in 1986 and decreases by 10 percent each year to 20 percent in 1988. (The bill does not specify when the geothermal credit would be phased out.)

H.R. 2001 would exclude solar energy from photovoltaics from the phaseout schedule shown in Table 19. Under the House bill, the credit available for photovoltaics would remain at 40 percent. Most expenditures for renewables would not be allowed to exceed $10,000. Two forms of renewable energy deviate from this ceiling: solar hot-water systems and wind property. For wind property, credit would be allowed for up to $20,000 of expenditures. However, for heating water by solar energy, credit would be allowed only up to $6,000 of expenditures.

(b) Carryover Limitations--Another area in which H.R. 2001 differs from current law is in the number of years a taxpayer can carry over excess credit. After December 31, 1990, excess credit for expenditures attributable to wind renewable-energy resources, geothermal renewable-energy resources, and energy conservation may not be carried over to the next taxable year. Excess credit for expenditures attributable to solar renewable-energy resources may not be carried over to any taxable year after December 31, 1992.

(c) Expiration Dates--Under H.R. 2001, credits for conservation expenditures and for wind and geothermal expenditures would expire December 31, 1988. Credits for solar energy would expire December 31, 1990.

Table 19. Percent of Energy Tax Credit Available for Renewable Energy Sources by Year and Type of Energy Under H.R. 2001

For Taxable Year Beginning	Solar Energy	Wind Energy	Geothermal Energy
1986	35	35	40
1987	30	30	30
1988	25	25	20
1989	20	*0	--
1990	15		
Post-1990	0		

*For 1989 and thereafter.

A new requirement of H.R. 2001 is that solar-energy systems providing space heating, space cooling, or hot water would have to meet the quality standards of a recognized organization. The bill also removes the restrictions on the geothermal temperature of systems that may qualify.

Similar to current law, parts of H.R. 2001 apply to both conservation and renewable-energy sources. For example, the dwelling must be located in the United States, it must be the taxpayer's principal residence, and the

expenditures associated with either conservation or renewables must have occurred on or after April 30, 1977. Other limitations cited in the section, "Current Law," remain the same in H.R. 2001, except for the income-ceiling limitation discussed under the H.R. 2001 subsection "Conservation," above.

Residential Energy Tax Credit: "The President's Tax Proposals to the Congress for Fairness, Growth, and Simplicity"

Under the President's proposal for tax simplification, the residential energy tax credits for conservation and renewable energy sources would be allowed to expire on December 31, 1985. They would not be renewed, although carryover of any unused credits would continue through 1987, as under current law.

Business Energy Tax Credits--Current Law

Under current law, energy property can qualify for the Business Energy Investment Tax Credit by meeting certain requirements set forth in the Energy Tax Act of 1978 and the Crude Oil Windfall Profit Tax Act of 1980. There are two major classes of property: (1) property that conserves energy, and (2) property that uses alternative energy sources (including renewable energy) and property that uses alternative technologies. Each class has its own regulations, expiration dates, and allowable extensions for projects that qualify under the affirmative commitment rules. Affirmative commitment rules apply to projects requiring 2 or more years for completion, if: (1) all the engineering studies for a project are completed and all the necessary permits are filed prior to January 1, 1983; (2) binding contracts for 50 percent of specially designed equipment occur before 1986; and (3) the project is completed and operating prior to 1991.

Conservation. Current law includes three types of energy-conservation property for the Business Energy Investment Tax Credit: (1) specially defined energy property; (2) cogeneration equipment; and (3) intercity buses. The existing law allows a 10-percent business tax credit for each of the three types of conservation property.

"Specially defined energy property" includes: recuperators, heating wheels, heat exchangers, waste-heat boilers, heat pipes, automatic energy-control systems, turbulators, and preheaters, combustible-gas recovery systems, economizers, modifications to alumina electrolytic cells and to chloralkali electrolytic cells, and any property specified by the Secretary of the Treasury by regulations that, when installed in an existing industrial or commercial facility, would reduce the amount of energy consumed in the industrial or commercial process. (Energy Tax Act, Crude Oil Windfall Profits Tax Act) Any items or parts of an item of the above list that the taxpayer can prove to be necessary are also eligible for the Business Energy Investment Tax Credit. Current law stipulates that specially defined energy property must be used in connection with an industrial or a commercial process only. This stipulation restricts using the tax credit for a business activity or facility that does not include some type of process.

Hence, conservation items used in retrofitting a building are usually excluded from the Business Energy Investment Tax Credit.[2] The expiration date for tax credits for specially defined energy property was December 31, 1982; however, under the affirmative-commitment rules, all items (except chloralkali electrolytic cells) included in the list can qualify for credit through December 31, 1990, if they are part of a long-term project.

The second category of energy-conservation property--cogeneration equipment--is defined by the Crude Oil Windfall Profits Tax Act amendment as any industrial or commercial property that is an integral part of a system that uses the same fuel to simultaneously produce both electricity and steam heat or other forms of energy besides electricity. To qualify for the credit, an industrial or commercial facility has to meet two requirements: (1) it had to produce either electricity or a qualified form of energy as of January 1, 1980, and (2) it has to increase its capacity to produce either electricity or a qualified form of energy through cogeneration. Under current law, cogeneration equipment excludes (1) property that is part of a system using oil or natural gas (or a product of the two) as a fuel for any purpose other than startup, flame control, or backup, and (2) property that derives more than 20 percent of its yearly energy for such a system from oil or natural gas (or a product of the two). (Crude Oil Windfall Profits Tax Act)

The expiration date for credits for cogeneration equipment was December 31, 1982. Under the affirmative-commitment rules, this credit can be extended through 1990.

The third type of conservation property that can qualify for a business tax credit is intercity buses. The expiration date for this credit is December 31, 1985. There is no extension for intercity buses under the affirmative-commitment rules.

Alternative Energy Sources (Including Renewables) and Alternative Technologies. This classification is subdivided into several types of property and technology. Current energy tax laws provide businesses with a series of tax credits designed to stimulate the use of alternative energy sources and technologies. Included in the definition of "alternative energy sources" are renewable energy sources. The following types of alternative energy sources or energy technologies are included and described in current energy tax law: (a) alternative-energy property; (b) solar and wind-energy property; (c) hydroelectric generating property; (d) biomass property; and (e) recycling equipment, shale-oil equipment, and equipment for producing natural gas from geopressurized brine.

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[2]Library of Congress, Congressional Research Service, 1985, An Explanation of the Business Energy Investment Tax, Washington, DC, p.28.

Under current law, the percent of tax credit allowed and the time period of eligibility vary by the type of alternative energy and the category of renewable energy.

(a) Alternative-Energy Property--Current law allows a 15-percent tax credit for geothermal and ocean thermal properties and a 10-percent credit for all other types of alternative-energy properties. Alternative-energy property is defined as equipment designed to produce alternative types of energy. Equipment qualifies if it uses or converts an alternative substance (i.e., coal, wood, peat, wastes, landfill, sewage, sludge, agricultural crops, and crop residues) into synthetic fuel or feedstocks. Other types of qualifying equipment are coke ovens, pollution-control equipment, and collateral equipment.[3] For geothermal and ocean thermal properties, the expiration date is December 31, 1985. There is no extension under the affirmative-commitment rules for these two types of property. Credit for other types of alternative energy-source equipment can be extended from December 31, 1982, to 1990 by the affirmative-commitment rules.

(b) Solar and Wind Energy Property--Current law allows a 15-percent credit for expenditures for energy-producing equipment that uses solar or wind power. Such equipment is defined as any equipment that uses solar or wind energy to generate electricity, to provide space heating or space cooling in a structure, to provide hot water for use in a structure, or to provide solar process heat. (Energy Tax Act, Crude Oil Windfall Profits Tax Act) Under this definition, photovoltaic equipment can qualify for the tax credit. Current energy law limits the type of solar equipment that can qualify for the credit: the equipment must be used in active (rather than passive) solar systems, and the equipment can not use another source of energy as well as solar power.

Wind-energy equipment is equipment that generates electricity, that provides hot water, or that is used for heating or cooling a structure. Business tax credits for wind or solar energy expire December 31, 1985, with no extensions through affirmative-commitment rules.

(c) Hydroelectric Generating Property--Current tax law specifies an 11-percent energy credit for hydroelectric generating equipment that yields up to 25 megawatts of power. However, if the 25 megawatt limit is exceeded, only a portion of the 11 percent credit can be claimed. As the generating capacity increases to 125 megawatts, the amount of credit available decreases to zero. Hydroelectric property is defined as either (1) equipment that

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[3] Ibid p.12.

increases the capacity to generate electricity by means of water at a qualified hydroelectric site or, (2) a structure that houses the equipment. (Crude Oil Windfall Profits Tax Act) Although credit for hydroelectric power expires December 31, 1985, if a business applied for long-term investments before 1986, the credit could be extended through December 31, 1988.

(d) Biomass Property--Biomass is defined as any organic substance except oil, natural gas, and coal or their products. Current tax law allows a 10-percent energy credit for any equipment (including equipment used in preparing and transferring biomass and in storing synfuels) that either uses biomass or converts biomass into a synfuel or alcohol fuel. The credit for biomass property expires December 31, 1985. Under the current tax law, no extension is available.

(e) Recycling Equipment, Shale-Oil Equipment, and Equipment for Producing Natural Gas from Geopressurized Brine--Recycling equipment is any equipment used exclusively for sorting and preparing solid waste for recycling, any equipment used in recycling solid waste, or any equipment used in converting solid waste into a fuel, into a usable form of energy such as steam and electricity, or into hot water. Recycling equipment does not include any equipment used in a process after the first marketable product is produced or any equipment used to reduce waste from iron or steel to the molten state. Current law excludes equipment that uses more than 10 percent virgin material in the recycling process. (Energy Tax Act)

Shale-oil equipment is restricted to equipment for producing or extracting oil from oil-bearing shale. (Energy Tax Act) Equipment for producing natural gas from geopressured brine includes equipment used in separating the natural methane gas from the brines and purifying the gas. To receive credit for equipment used for producing natural gas from brine, (1) a business must meet verification guidelines of the Natural Gas Policy Act of 1978, and (2) a well must have been drilled between September 30, 1978 and January 1, 1984.[4]

A 10-percent tax credit is now available for recycling equipment, shale-oil equipment, and equipment for producing natural gas from geopressurized brine.

The expiration date for recycling equipment, shale-oil equipment, and equipment for producing natural gas from geopressurized brine was December 31, 1982. For long-term projects, the expiration date can be extended to 1990 if the equipment is used either to produce natural gas from

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[4]Ibid. pp 20-21.

geopressurized brine or to extract oil from shale. The expiration date for recycling equipment can be extended for long-term projects if the equipment was added after 1982.

The total amount of energy tax credit available for both conservation and alternative fuels is the sum of credit allowed under the Business Energy Investment Tax Credit plus a 10-percent investment credit available to all businesses, as well as a 0.75-percent credit if an employer contributes to an employee stock-ownership plan.

The amount of excess energy credit a business can carry over from one year to the next is determined by adding the amounts of five credits: the energy tax credit, the investment tax credit, an alcohol-fuel credit, an employee stock-ownership plan credit, and a targeted-jobs credit. The total carryover is limited to 100 percent of the first $25,000 and 85 percent of the remaining tax liability of the business.

To qualify for energy tax credits, businesses must comply with more regulations and limitations than those required for residences. These limitations include affirmative-commitment rules, at-risk rules, double-dipping rules, recapture rules, utility regulations, and Internal Revenue Service statutes. (For a discussion of the specific limitations, see: Library of Congress, Congressional Research Service, 1985. An Explanation of the Business Energy Investment Tax Credits.)

Business Energy Tax Credit--H.R. 2001

This section discusses the changes in the current business energy tax credits proposed in H.R. 2001. These changes have only a minimal affect on the energy tax credit that businesses can receive for using conservation-related equipment. However, the regulations do affect the tax credit for renewable energy sources. H.R. 2001 proposes to (1) change the amount of credit that can be claimed, (2) further define some renewable energy sources, and (3) extend the expiration date.

Under H.R. 2001, the amount of credit that can be claimed by businesses for renewable energy sources varies by the type of renewable energy, by the year and by the type of equipment. For example, the allowable tax credit would depend on whether the solar equipment was low-temperature (below 300 degrees Fahrenheit) or high-temperature. The tax value for low-temperature solar property would remain at 15 percent. However, for high-temperature solar equipment and photovoltaics, the tax value would increase from 15 percent of expenditures to 25 percent of expenditures.

The available amount of credit for wind-energy equipment or for equipment pertaining to biomass varies by year, as shown in Table 20.

Table 20. Percent of Energy Tax Credit Available for Wind-Energy and Biomass Equipment by Year Under H.R. 2001

Year Beginning	Percent
1986	10
1987	10
1988	5
Post-1988	0

Available credit for geothermal or ocean thermal energy, or for hydroelectric generation, would remain at the current level of 10 percent, 10 percent, and 11 percent, respectively. H.R. 2001 would amend current tax law to include wood-gasification equipment and anaerobic-digestion equipment among types eligible for the credits.

Under H.R. 2001, the expiration date for credit is extended through 1988 for the following renewables: geothermal, wind, and biomass. Credit could be extended through 1990 by the affirmative-commitment rules only for geothermal-energy property. Credit for hydroelectric generating equipment could be extended through 1990 instead of expiring December 31, 1985, if an application for a permit, license, or license exemption is filed with the Federal Energy Regulatory Commission before January 1, 1986. Credit for ocean thermal property would expire in 1990, with no extensions. Credit for solar-energy property (including photovoltaics) would expire in 1990 but could be extended to 1993 under the affirmative-commitment rules.

Business Energy Tax Credit--The President's Tax Proposals to the Congress for Fairness, Growth, and Simplicity

The President's tax proposal would allow all renewable-energy investment tax credits for businesses to expire in 1985, with the affirmative-commitment rules applying only to credit available for hydroelectric generation. Tax credits for conservation and other alternative energy sources would expire on December 31, 1985, although the current extensions under the affirmative-commitment rules would continue to apply.

APPENDIX B. DETAILED ASSUMPTIONS AND CALCULATIONS FOR RESIDENTIAL ENERGY TAX CREDITS UNDER H.R. 2001

Residential Conservation Projects

Participation: It was assumed that some proportion of those who would take the conservation tax credit would undertake conservation measures because of the availability of the tax credit. Survey results indicate that for conservation projects, this proportion may have been on the order of 15 percent in the past.[1] For simplicity, it was assumed that the proportion of tax credit claims representing credit-induced conservation is proportional to the effective credit rate (i.e., average credit taken divided by average project cost). Although the cited survey results seem to suggest a proportionality factor of about 1.0 for conservation projects, no particular significance is attributed to this. Rather, it is assumed that some reasonable range for the proportionality factor brackets the degree of consumer responsiveness to the tax credit with an acceptably high probability. Values of 0.5, 1.0, and 1.5 are assumed for low, medium, and high responsiveness cases for residential conservation projects.

For each assumption about incremental participation (i.e., for each of the three assumed proportionality factors), a baseline number of individuals who claimed the conservation tax credit, but who would have made the associated conservation investments anyway, was calculated for 1979 through 1983 from the Internal Revenue Service data. These baseline numbers were trended through 1988 at the rate of decline derived from the values calculated between 1979 and 1983. The reasons for the underlying downward trend are presumed to be that:

(1) As more and more retrofits are made, fewer of the eligible residences (i.e., built prior to 1978) would need retrofits and more individuals would have used up the maximum credit

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[1] See H. Craig Petersen, "Survey Analysis of the Impact of Conservation and Solar Tax Credits" (draft), Utah State University, Logan, Utah, 1982. Results from the Energy Information Administration's Residential Energy Consumption Survey indicate that between 10 and 20 percent of individuals claiming residential conservation tax credits were apparently induced to undertake conservation measures because of the tax credit in 1983. (See Table 7 in Chapter 2 of this report).

(2) Falling real fuel prices in recent years have changed the expected return on conservation investments.

The following summarizes the method for calculating baseline participation and credit-induced participation (termed incremental participation):

$$IP = k \times TP \quad (1)$$

$$TP = BP + IP \quad (2)$$

Thus:

$$IP = kxBP/(1-k) \quad (1)'$$

$$k = PxR \quad (3)$$

where:

IP = Incremental participation
BP = Baseline participation (calculated for three assumed proportionality factors for 1979-1983; then, based on these calculations, trended through 1988)
TP = Total participation
P = Proportionality factor (0.5, 1.0, 1.5)
R = Effective credit rate (15 percent currently).

For the period 1979 through 1983, during which total participation was known, IP was calculated using formula (1). Baseline participation (BP) was then calculated for this period by subtraction. These baseline numbers were trended, at the 1979 to 1983 rate, through 1988.

Given the trended numbers for BP for the period 1984 to 1988, equations (1)' and (2) were used to calculate IP (needed to calculate incremental energy savings) and TP (needed to calculate total Treasury losses due to the credit) for 1986 to 1988. The period of greatest interest here is the years 1986 through 1988, during which time H.R. 2001 would be in effect.

Table 21 summarizes the data and calculated values for participation (households) in residential conservation tax credit claims under H.R. 2001. The results in Table 21 yield ranges for assumed participation rates (credit claims) for residential conservation prior to accounting for the income limitation (maximum of $30,000 per year gross income for eligibility). It was assumed (based on 1983 Internal Revenue Service data) that 50 percent of the households otherwise eligible for and inclined to use the conservation tax credit would become ineligible under the income limitation. This assumption was applied for all 3 years (1986, 1987, and 1988) of the credit extension under H.R. 2001. Therefore, the number of households claiming credits for residential conservation measures shown in Table 20 for 1986 to 1988 was cut in half for the analysis. Thus, for the calculations in Chapter 2, a cumulative range of 1.7 million to 2.0 million total claims was assumed for the period 1986 through 1988.

Table 21. Participation Rates in Residential Conservation Energy Tax Credit Claims Under H.R. 2001 Before Application of the Income Limitation (Millions of Claims)

Year	R	Total Participation			Assumed Baseline Participation			Assumed Incremental Participation		
		P=0.5	P=1.0	P=1.5	P=0.5	P=1.0	P=1.5	P=0.5	P=1.0	P=1.5
	(percent)		(actual)			(calculated)[a]			(calculated)[a]	
1979	15	4.8	4.8	4.8	4.4	4.1	3.7	0.4	0.7	1.1
1980	15	4.6	4.6	4.6	4.3	3.9	3.6	0.3	0.7	1.0
1981	15	3.7	3.7	3.7	3.4	3.1	2.9	0.3	0.6	0.8
1982	15	3.0	3.0	3.0	2.8	2.6	2.3	0.2	0.4	0.7
1983	15	2.3	2.3	2.3	2.1	2.0	1.8	0.2	0.3	0.5
			(calculated)[b]			(trended)[b]			(calculated)[b]	
1984	15	1.9	1.9	1.9	1.7	1.7	1.5	0.2	0.2	0.4
1985	15	1.6	1.6	1.6	1.5	1.4	1.2	0.1	0.2	0.4
			(calculated)[b]			(trended)[b]			(calculated)[b]	
1986	25	1.38	1.53	1.65	1.21	1.15	1.03	0.17	0.38	0.62
1987	25	1.14	1.26	1.38	1.00	0.95	0.86	0.14	0.31	0.52
1988	25	0.95	1.05	1.04	0.83	0.79	0.71	0.12	0.26	0.43

[a]For the period 1979 through 1983, incremental participation was calculated by the formula IP = kxTP, where TP = total participation, IP = incremental participation, and k=PxR, where R = credit rate, and P = proportionality factor (assumed). Baseline participation (BP) was calculated by subtraction.

[b]Baseline participation under the various proportionality assumptions was trended through 1988 at the compound rate of change derived from the 1979 to 1983 calculated values for BP. Total participation and incremental participation were then calculated for the period 1984 through 1988 as follows: IP = kxBP/(1-k), IP = incremental participation, BP = baseline participation, and k=PxR, where R = credit rate, and P = proportionality factor (assumed). Total participation was then calculated by adding the resultant IP to the trended values of BP.

Project Profile

Table 22 summarizes the assumptions about the "typical" project undertaken for residential conservation during the period 1986 to 1988. In the analysis, everyone is assumed to undertake a "typical" project and spends the same amount on installation. Thus, since relatively little is known about the actual distribution (i.e., variance) in project expenditures, the variance in expenditures per household is assumed to be zero. Furthermore, everyone is assumed to enjoy the maximum effective credit rate on the conservation project, which is 25 percent under H.R. 2001. Because the average project costs are assumed to be $700 in 1984 dollars (approximately the observed average, based on Internal Revenue Service data from 1978 to 1983), and because the maximum expenditure allowed under H.R. 2001 is $700 (nominal) for 1986, the effective rate is very likely an overestimate. Inflation and the existence of an "upper tail" in the distribution of expenditures would tend to make the effective rate less than 25 percent. Estimates indicate that, assuming a uniform distribution of expenditures, the effective rate would be approximately 20 percent under H.R. 2001. However, the higher estimates for the effective value (and the related assumption of zero variance) serve to produce estimates of Treasury losses that tend to be upper limits, given all other assumptions.

Table 22. Profile of Residential Energy Conservation Project Assumed for Analysis of H.R. 2001

Assumptions	Values
Pre-Retrofit Energy Consumption for Heating (MMBtu/Household)	80
Project Costs (1984 dollars)	700
Energy Price--Constant Real Price Case (1984 dollars per million Btu)	6.00
Energy Savings Rate (percent of pre-retrofit total)	10,15,20
Project Life (Years)	12

It should be noted that the typical conservation project assumed for this analysis is a household which uses natural gas for space heating. The pre-retrofit energy consumption figure of 80 million Btu per year is derived from Energy Information Administration estimates for gas use in space

heating prior to 1980.[2] Thus, although many of those households that would make conservation investments under H.R. 2001 would not have gas-fired heat, for this analysis it is assumed that all use gas. This assumption avoids the problem of aggregating across fuels explicitly in deriving an aggregate fuel-savings number. Moreover, the project evaluations are not complicated by the problem of delivered prices for different fuels, partially reflecting different end-use efficiencies. In addition, this approach avoids the rather difficult problem of converting electricity into equivalent barrels of oil in a meaningful way.

The $700 project cost is approximately the average price observed between 1978 and 1983 using IRS data on conservation credit claims. The energy savings rate of 10 to 20 percent was taken from results found in an evaluation by the Energy Information Administration of the Department of Energy's Low-income Weatherization Program.[3]

In that study, the average energy savings for surveyed households installing insulation and storm windows was 12 percent of total energy consumed. The average gas-heated house under the weatherization program experienced 11-percent savings. Assuming that energy for space heating is two-thirds of total energy consumed, these figures translate into a saving of 15 or 16 percent.

It should be noted that potential savings for space cooling are not accounted for in this analysis. Typically, this would involve taking into account electricity used for compressors and fans in air conditioning units. However, where significant fuel use for space heating is found, as in the typical project for this analysis, relatively little energy is used for air conditioning. In any case, the high energy savings case might be thought of as a possible means for looking at the effect of including space cooling energy savings in the analysis.

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[2]See Energy Information Administration, Residential Energy Consumption and Expenditures by End Use for 1978, 1980, and 1981, DOE/EIA-0458 (1984), Tables 3, 15, and 27. The average for gas-heated houses built prior to 1978 was about 85 million Btu per year. Because of somewhat higher gas prices since 1980, 80 million Btu was assumed to be the appropriate consumption level in 1986.

[3]See Energy Information Administration, Weatherization Program Evaluation, Service Report SR-EEUD-84-1 (August 1984), pp. 21-25. The percentage energy savings reported in this report were based on total energy consumption, and were adjusted to space-heating savings only by assuming a share in total energy of from 50 to 67 percent for space heating.

Residential Renewable Projects

Participation. A method completely analogous to that for conservation projects was employed to estimate incremental participation in residential renewable projects. Although no evidence was available as to past responsiveness to the residential renewable credit per se, it was assumed that, in general, the credit probably plays a larger role in inducing individuals to undergo such projects. This assumption is related to the fact that very high capital costs are involved in installing residential solar units, relative to the value of potential energy savings. Therefore, a range for the proportionality factor for residential renewable projects of 1.0 to 2.0 was assumed. (For this analysis, all residential renewable projects are assumed to be installation of solar hot water heating units).

Internal Revenue Service data show that, from the beginning of the residential renewable credit program in 1978 to 1981, credit claims increased rapidly (Table 23). However, by 1982, claims leveled off and dropped significantly in 1983. For this analysis, it was assumed that baseline participation in residential renewable credit claims will remain at the 1983 level through 1990. Table 22 summarizes the participation assumptions for residential renewable credits through 1990 under H.R. 2001.

Project Profile

Table 24 summarizes the assumptions about the "typical" project undertaken for residential renewables utilized in this analysis. As was the case for conservation, everyone is assumed to undertake a typical project, spending the same amount on the investment and all receiving the maximum allowable credit. Since the average project cost is assumed to be $4,000 (1984 dollars) and the maximum expenditure allowed is $6,000 under H.R. 2001, it is relatively safe to assume that everyone receives the maximum credit. Although the analysis mainly examines the case of a solar unit displacing natural gas, an alternative profile is provided in Table 23 for a solar unit displacing electricity.

Calculations

Table 25 summarizes the nature of the key calculations made in the residential energy credit analysis. Internal rates of return were calculated using the INTRR function contained in the Statistical Analysis System (SAS) software package available at the computer installation of the Energy Information Administration. The information in Table 24 applies generically to both conservation and renewables projects.

Table 23. Participation Rates in Residential Renewable Energy Tax Credit Claims Under H.R. 2001
(Thousands of Claims)

Year	R	Total Participation		Assumed Baseline Participation		Assumed Incremental Participation	
		P=1.0	P=2.0	P=1.0	P=2.0	P=1.0	P=2.0
	(percent)	(actual)		(calculated)[a]		(calculated)[a]	
1979	40	77	77	46	15	31	62
1980	40	155	155	93	31	62	124
1981	40	225	225	135	45	90	180
1982	40	229	229	137	46	92	137
1983	40	169	169	101	34	68	135
		(calculated)[b]		(assumed)[b]		(calculated)[b]	
1984	40	169	169	101	34	68	135
1985	40	169	169	101	34	68	135
		(calculated)[b]		(assumed)[b]		(calculated)[b]	
1986	35	156	113	101	34	55	79
1987	30	144	85	101	34	43	51
1988	25	134	68	101	34	33	34
1989	20	126	57	101	34	25	23
1990	15	119	49	101	34	18	15

[a]For the period 1979 through 1983, incremental participation was calculated by the formula IP=kxTP, where TP = total participation, IP = incremental participation, and k=PxR, where R = credit rate and P = proportionality factor (assumed). Baseline participation (BP) was calculated by subtraction.

[b]Baseline participation under the various proportionality assumptions was held constant for 1984 through 1988 at the calculated 1983 levels. Total participation and incremental participation were then calculated for the period 1984 through 1988 as follows: IP = kxBP/(1-k), IP = incremental participation, BP = baseline participation, and k=PxR, where R = credit rate, and P = proportionality factor (assumed). Total participation was then calculated by adding the resultant IP to the assumed values of BP.

Table 24. Profile of Residential Renewable Energy Project Assumed for Analysis of H.R. 2001 (Solar Hot Water Heater)

Assumptions	Values	
	Gas[a]	Electricity[b]
Expected Energy Consumption Without Solar Installation (MMBtu/Household)	26.7	20.0
Project Costs (1984 dollars)	4,000	4,000
Energy Price--Constant Real Price Case (1984 dollars per million Btu)	6.00	19.62
Energy Savings Rate (percent of expected consumption without solar installation)	65	65
Projet Life (Years)	12	12

[a]Refers to solar units that displace natural gas.
[b]Refers to solar units that displace electric.

Table 25. Summary of Formulae and Variable Definitions for Residential Energy Tax Credit Analysis

Calculations

$$DES_t^0 = \frac{1}{(1+r)^{(t-1986)}} \sum_{j=t}^{t+T} \frac{(H_t \times d \times p \times E \times s)}{(1+r)^{(j-t)}}$$

$$DES^0 \text{ (total)} = \sum_{t=1986}^{Y} DES_t^0$$

$$PVR^0 \text{ (total)} = \sum_{t=1986}^{Y} \frac{(H_t \times C_t \times d)}{(1+r)^{(t-1986)}}$$

Variable and Parameters

H_t = Number of households using a particular conservation credit, period t

C_t = Assumed average investment cost of a particular conservation measure, period t

p = Assumed value (range) of proportionality factor for participation

s = Assumed value (range) of percentage(s) for energy savings for a particular conservation activity

E = Average baseline per-household energy consumption for those claiming the energy tax credit

d = Credit taken as a percent of total investment cost

r = Discount rate

T = Average project life

t = Year tax credit is taken

Y = Final year credit is available

DES_t^0 = Discounted value in 1986 of cumulative incremental energy savings due to credit extension for conservation renewable measures taken in year t

DES^0 = Discounted value in 1986 of total cumulative energy savings due to credit extension

PVR^0 = Present value in 1986 of Treasury losses incurred due to credit extension.

APPENDIX C. DETAILED REPORTS ON ESTIMATES OF INCREMENTAL ENERGY SAVINGS AND TREASURY LOSSES UNDER H.R. 2001

This appendix provides detailed reports of incremental energy savings estimates and treasury losses for residential conservation and renewable projects undertaken under H.R. 2001. Tables 26 and 27 give year-by-year and summary estimates for incremental energy savings for conservation and renewable projects, respectively. Table 28 provides year-by-year and summary estimates of Treasury losses for the residential conservation and renewable projects under H.R. 2001. Table 29 shows the sensitivities for project rates of return for conservation projects, where the energy savings percentage varies from 10 to 20 percent.

The energy savings estimates are discounted because it is assumed that the economy (or society) as a whole is better off having all of the benefits of energy conservation (increased productivity, lower energy prices, etc.) now rather than later.

Note that, under each joint assumption about savings percentage and proportionality factor, incremental energy savings by year increase until savings from the last project year comes on-line (1988 for conservation, 1990 for renewables). These incremental savings then remain steady and decline as the ends of project lives are reached.

Table 26. Detailed Sensitivity Cases for Incremental Energy Saved[a] for Residential Conservation Projects under H.R. 2001

	Cumulative Incremental Energy Saved								
	S=10 Percent			S=15 Percent			S=20 Percent		
	P=0.5	P=1.0	P=1.5	P=0.5	P=1.0	P=1.5	P=0.5	P=1.0	P=1.5
	(trillion Btu)								
Discounted Value[b] ...	16.42	36.42	57.3	24.62	54.63	85.90	32.83	72.84	114.53
1986	0.69	1.54	2.49	1.04	2.31	3.74	1.38	3.08	4.98
1987	1.26	2.80	4.56	1.89	4.20	6.84	2.52	5.60	9.12
1988	1.74	3.86	6.06	2.61	5.79	9.09	3.48	7.72	12.12
1989	1.74	3.86	6.06	2.61	5.79	9.09	3.48	7.72	12.12
1990	1.74	3.86	6.06	2.61	5.79	9.09	3.48	7.72	12.12
1991	1.74	3.86	6.06	2.61	5.79	9.09	3.48	7.72	12.12
1992	1.74	3.86	6.06	2.61	5.79	9.09	3.48	7.72	12.12
1993	1.74	3.86	6.06	2.61	5.79	9.09	3.48	7.72	12.12
1994	1.74	3.86	6.06	2.61	5.79	9.09	3.48	7.72	12.12
1995	1.74	3.86	6.06	2.61	5.79	9.09	3.48	7.72	12.12
1996	1.74	3.86	6.06	2.61	5.79	9.09	3.48	7.72	12.12
1997	1.74	3.86	6.06	2.61	5.79	9.09	3.48	7.72	12.12
1998	1.05	2.32	3.57	1.58	3.48	5.36	2.10	4.64	7.14
1999	0.48	1.06	1.50	0.72	1.59	2.25	0.96	2.12	3.00

[a]Average household consumption of energy for space heating (without conservation) assumed to be 80 million Btu per year.

[b]Quantities discounted at 4 percent over the period 1986 to 1999.

S = Percentage of space heating energy saved from conservation measures.

P = Credit rate proportionality factor used to determine incremental credit-induced conservation.

Note: • Average project cost assumed to be $700 (in 1984 dollars).

Table 27. Detailed Sensitivity Cases for Incremental Energy Saved[a] for Gas-Displacing Residential Solar Hot Water Projects Under H.R. 2001
(Energy Savings Assumed = 65 Percent)

	Cumulative Incremental Energy Saved	
	P=1.0	P=2.0
	(billion Btu)	
Discounted Value[b]	27.89	32.59
1986	0.94	1.37
1987	1.69	2.26
1988	2.28	2.85
1989	2.71	3.24
1990	3.02	3.50
1991	3.02	3.50
1992	3.02	3.50
1993	3.02	3.50
1994	3.02	3.50
1995	3.02	3.50
1996	3.02	3.50
1997	3.02	3.50
1998	2.08	2.13
1999	1.33	1.24
2000	0.75	0.65
2001	0.31	0.26

[a]Average household consumption of energy for space heating (without solar hot water heater) assumed to be 26.7 million Btu per year.
[b]Quantities discounted at 4 percent over the period 1986 to 2001.
P = Credit rate proportionality factor used to determine incremental credit-induced installation of solar hot water heaters.
Note: Average project costs assumed to be $4,000 in 1984 dollars.

Table 28. Detailed Treasury Loss Estimates for Residential Conservation and Renewable[a] Projects under H.R. 2001 (Millions of 1984 Dollars)

	Conservation Projects			Renewable Projects	
	P= 0.5	P=1.0	P=1.5	P=1.0	P=2.0
	(solar units displacing gas only)				
Discounted Value[b]	294.3	326.5	342.3	658.6	384.8
1986	120.8	134.8	145.2	217.0	158.2
1987	99.8	110.2	120.8	172.8	102.0
1988	84.0	92.8	87.5	135.0	68.0
1989	--	--	--	100.8	45.6
1990	--	--	--	71.4	29.4

[a]Renewable projects assumed all solar hot water projects displacing natural gas.

[b]Values in 1984 dollars discounted at 4 percent over the relevant periods.

P = Credit rate proportionality factor used in determine incremental credit-induced conservation.

Table 29. Sensitivity of Residential Conservation Project[a] Internal Rates of Return under H.R. 2001 to Alternative Energy Savings Rates

Energy Savings Rate	Internal Rates of Return	
	Real Energy Price Inflation = 0 percent per year	Real Energy Price Inflation = 10 percent per year
10 percent	1.5	14.4
15 percent	10.4	25.0
20 percent	18.8	35.1

[a]Project cost assumed to be $700 in 1984 dollars. Energy use for space heating assumed to be 80 million Btu per household (without conservation measure).

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