

RESIDENTIAL ENERGY CONSERVATION AND  
IMPACTS OF RESIDENTIAL CONSERVATION PROPOSALS

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## SUMMARY

In 1977, U.S. households used the equivalent of 3.8 million barrels per day of oil and natural gas for space heating and cooling. Conservation improvements to the existing housing stock could save up to one million barrels per day oil equivalent by 1990. Half these savings will be achieved by conservation improvements stimulated by rising energy prices and current federal **policies--that** is, conservation improvements under current policy will save an equivalent of 500 thousand barrels of oil per day (MBD) by 1990.

The remaining potential conservation **savings--that is**, 500 MBD by 1990--**is** the target of recent legislative proposals to stimulate residential conservation investment. These conservation proposals are intended to both **stimulate** new conservation improvements and accelerate the conservation improvements that would eventually occur under current policy. Though these conservation proposals differ considerably in their costs to the government, the additional conservation savings under the various proposals range from 100 to 150 MBD by 1990. However, by accelerating the conservation improvements that would occur under current policy, the proposals would produce additional savings by 1985 of 300 to 350 MBD. The additional savings over current policy and costs to the government of each conservation proposal are as follows:

- o Kennedy Proposal. (Amendment Number 388 to S. 1308) Cash grants from residential conservation improvements would save an additional 365 MBD by 1985 and 165 MBD by 1990. The total net cost to the government of the conservation grants would be \$18.8 billion.
- o Tsongas Proposal. (S. 1748) Subsidized loans for residential **conservation** investment through the Conservation Bank would save an additional 295 MBD by 1985 and 95 MBD by 1990. The loan subsidies would cost the federal government \$6.1 billion.
- o Compromise Proposal. (Bradley et. al.) A combination of lower cash grants and subsidized loans targeted on **lower-** and middle-income households would save an additional 326 MBD by 1985 and 126 MBD by 1990. The grant and loan program would cost the federal government \$9.3 billion.

Additional energy savings from the various proposals are smaller than might be expected for several reasons:

- o **The** cash grants or loans would go to many households that would have invested in conservation anyway.
- o The timing of financial assistance and uncertainty and lack of information regarding the institutional arrangements for obtaining grants and loans would discourage many low-income households from participating in the conservation program. These **are** precisely the households with the greatest potential energy savings.
- o Lending institutions making subsidized conservation loans would attempt to minimize the number of loans processed and favor applicants willing to take on larger loans. These larger loans would generally go to higher income applicants **who** would invest in conservation anyway and go for less cost-effective improvements rather than to low-income households with cost-effective though smaller cost conservation improvements such as insulating the attic.
- o Only the Compromise proposal has a pre-audit to **determine** necessary conservation improvements and none of the proposals have a post-audit to assure that the conservation installations are done properly.
- o Renters have little economic incentive to invest in conservation because they are generally not long-term occupants of their dwelling units and many do not pay directly for their utilities. Though renters could benefit under the conservation proposals, the incentives to invest in conservation would probably remain inadequate.
- o Though estimated savings under the conservation proposals assume an acceleration of improvements that would eventually occur under current policy, excessive demand in early years may result in supply bottlenecks for installed **work**. Moreover, proposals requiring **pre-audits** may slow down the rate at which grants and loans would be processed and may actually delay conservation improvements that would have occurred without the program.

Additional energy savings could be achieved in the various conservation proposal by improving the program's targeting and institutional arrangements through the following:

- o Emphasizing the subsidized loan program in order to provide needed "**up-front**" **financing** to low-income households or **providing**

a mechanism to avoid low-income individuals from waiting 30 days for repayment.

- Limiting the maximum loans to \$1,000 to encourage the small, low-income investor or limiting the loan subsidies to households with incomes below, say, \$15,000 a year.
- Instituting a rigorous pre- and post-audit program through the utilities, for example, both to protect consumers from fraud and to insure that installations are done properly.
- Centralizing financing perhaps through the utilities and including loan repayments in monthly utility bills.
- Encouraging additional conservation by higher income households by eliminating subsidies of obviously desirable improvements or first dollars of conservation investment and focusing on truly incremental improvements (e.g., do not **subsidize** the first \$500 to \$1,000 in conservation investment for higher income households).
- Engaging in a vigorous information program to educate the public regarding the cost-effectiveness of conservation investment.

## RESIDENTIAL ENERGY CONSERVATION AND IMPACTS OF RESIDENTIAL CONSERVATION PROPOSALS

This **paper** provides an overview of present energy consumption in the residential sector and background information on potential energy savings from conservation. Specifically, it does the following:

- o Reviews the present level of oil and natural gas consumption in the residential sector.
- o Evaluates the potential energy savings from retrofitting the present housing stock by 1990.
- o Evaluates how much of the potential **conservation** will take place as a result of normal market forces and existing federal incentives.
- o Estimates how much additional savings might take place as a result of three major legislative initiatives as developed by Senators Kennedy, Tsongas, and Bradley **et.al.**
- o Discusses the advantages and disadvantages of each conservation proposal.
- o Identifies measures that could further add to energy savings **from** conservation proposals.

### POTENTIAL FOR RESIDENTIAL CONSERVATION

Rapidly rising energy prices and threats of supply interruptions due in large part to our dependence on imported oil have focused attention on conservation as one way to reduce the demand for energy. Recent studies **indicate** that relatively inexpensive conservation measures such as adding attic insulation, storm windows, **weatherstripping**, reducing air infiltration, and caulking would reduce residential energy usage for the typical house in need of **weatherproofing** by 30 to 50 percent. Many of these houses are older and generally heat with oil or natural gas. In 1977, U.S. households used the equivalent of 3.8 million barrels per day of oil and natural gas for space heating and cooling. 1/ Since oil is considered a swing ~~fuel~~—that is, filling the gap when other resources are in short ~~supply~~—and natural gas is

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1/ **Includes** oil used to generate electricity but excludes other electricity used for heating and cooling since homes that heat with electricity are generally newer and relatively energy efficient. See Office of Technology Assessment, Residential Energy Conservation, Volume I, U.S. Congress, August 1979.

generally the preferred fuel, improving the **energy** efficiency of existing housing would reduce the demand for imported oil directly through **residential** reductions in the use of fuel oil and indirectly through reductions in the use of natural gas which would be substituted for oil elsewhere in the **economy**.

How much savings could be achieved through vigorous efforts to improve the **energy** efficiency of residential units? Not all units that heat and cool with oil or gas are in need of **weatherproofing**. One indicator of *the* energy efficiency of today's housing stock is the number of units with adequate attic insulation. According to an industry study of the 1978 housing stock, 37 percent of existing single- and multi-family (**2-4**) units had more than 5 inches of attic insulation, which in most cases is considered adequate (see Table 1). These homes would most likely not be the primary target of residential retrofit efforts since the cost-effectiveness of additional insulation would be small. However, more than half of single- and multi-family occupied households had less than 5 inches of attic insulation and a third of these units had no insulation at all. Thus, about 33 million residential units could realize significant energy savings through weatherproofing such as adding attic **insulation**. <sup>2/</sup> Assuming that each of these units uses 100 million **BTUs** of energy a year and all 33 million units in need of weatherproofing took measures to conserve, then a 40 percent reduction in residential energy needs would lead to an aggregate oil and natural gas savings of 600 thousand barrels of oil per day oil equivalent (**MBD**). In addition to this 600 MBD savings from improved insulation of inadequately insulated existing housing, an estimated 400 MBD savings could be achieved by conservation measures taken across the entire housing stock such as caulking and **weatherstripping** of new and existing housing, more costly conservation investment such as heat pumps and wall insulation, and simply turning down thermostats. Thus, the total potential savings from comprehensive conservation efforts could be about 1,000 MBD.

#### SAVINGS UNDER CURRENT POLICY

In the future, much of this potential energy savings will be achieved as a result of **economic** factors (specifically, higher energy prices from the decontrol of domestic oil and the deregulation of natural gas) and a continuation of current government policies to stimulate conservation investment. Anticipated increases in real energy prices will make **weatherproofing** a "**good**" investment for more and more households. Furthermore, the attractiveness of conservation investment will be enhanced by the current conservation tax credit which is available through the **mid-1980s**. The federal weatherization program for the low-income elderly should also add to conservation savings under a continuation of current policies.

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<sup>2/</sup> Excluded from this figure are six million units without attics.

TABLE 1. INSULATION INVENTORY AMONG SINGLE AND MULTI-FAMILY (2-4 UNIT) OCCUPIED HOUSEHOLDS IN 1978

Insulation Status	Total Occupied Units (thousands)	Percent Distribution
No Insulation	10,628	17.1
1-5 Inches	22,467	36.2
Above 5 Inches	22,761	36.7
Households Without Attics	<u>6,216</u>	<u>10.0</u>
Total Occupied Households (Excluding mobile homes, and 5 or more unit <b>multi-family</b> structures)	62,072	100.0

SOURCE: "Summary from 1978 National Insulation Inventory Study," Owens-Corning Fiberglass, July 31, 1979.

Residential energy audits provided through the utility companies will also motivate improvements leading to energy savings.

Nevertheless, many of the households in need of **weatherproofing** are occupied by members with low incomes and such households may not have the necessary "**up-front**" financing to respond to economic incentives. For example, 54 percent of the units with inadequate insulation had household incomes of less than \$15,000 a year. Moreover, such low-income households may neither qualify for **weatherization** assistance nor have sufficient tax liabilities to benefit from the **nonrefundable** conservation tax credit. Also, some 9 million renters with inadequate insulation may not have significant long-term economic incentives to retrofit their dwellings. By 1990, and assuming the decontrol of domestic crude oil, deregulation of natural gas and that future **OPEC** prices remain at least constant in real terms, it is assumed that approximately one half of the potential conservation will take place. Alternatively stated, consumption of oil and natural gas for space heating and cooling for the current housing stock will fall to 3.3 MMBD in 1990, a savings from existing conservation incentives of 500 MBD (see Table 2). This estimate assumes that existing housing currently in need of weatherproofing is not retired from the housing stock by 1990, that new housing building standards result in adequate weatherproofing for **new dwellings**, and that savings rates from conservation expenditures decline through the decade as the most **productive** improvements are completed.

#### ADDITIONAL SAVINGS FROM CONSERVATION PROPOSALS

Several proposals are designed to stimulate and accelerate residential conservation investment. These proposals range from cash **grants**, to expanded tax credits, to subsidized loans, and vary in the amount of government subsidy. Since significant future conservation savings will be realized under a continuation of current policies, these conservation **proposals** will inevitably provide windfalls to those individuals who would **have** taken measures to conserve without the subsidy. Additional savings will result from these proposals if new conservation investment is stimulated beyond what would occur under current policy and if those who plan to weatherproof their homes over the next decade do so earlier than planned. Thus, the maximum potential savings from proposals to stimulate conservation investment beyond current policy would be 500 MBD by 1990 and if all retrofits were completed by 1985 the total additional energy saved from 1980-1990 would be 1,370 million barrels of oil over current policy. Three major conservation proposals are described below along with estimated additional energy savings, and costs to the government. A discussion of the advantages and disadvantages of each proposal is **included**. Measures to improve energy savings under the conservation proposals are also identified.

**TABLE 2. RESIDENTIAL CONSUMPTION OF OIL AND NATURAL GAS FOR SPACE HEATING AND COOLING BY EXISTING RESIDENTIAL UNITS UNDER CURRENT POLICY AND CONSERVATION PROPOSALS IN 1977, 1985 AND 1990**

	1977	1985	1990
<u>Million Barrels Per Day</u>			
<u>Current Policy</u>			
Baseline	3.8	3.8	3.8
With Conservation	3.8	3.5	3.3
<u>Additional Savings With:</u>			
Kennedy Proposal		.37	.17
<b>Tsongas</b> Proposal		.30	.10
Compromise Proposal		.33	.13
<u>Millions of Barrels</u>			
<u>Total Additional Oil Savings From 1980-1990 From Conservation Under:</u>			
Kennedy Proposal			725
Tsongas Proposal			625
Compromise Proposal			709
<u>Billions of Dollars</u>			
<u>Total Cost to the Government</u>			
Kennedy Proposal			18.8
Tsongas Proposal			6.1
Compromise Proposal			9.3

Kennedy Proposal (Amendment Number 388 to S. 1308)

Description. The Kennedy plan for residential conservation would provide cash grants to owners and renters for conservation investment. The grant would pay for actual conservation expenditures of up to \$750 (labor not to exceed \$200) for single unit residences; \$500 (labor \$150) per unit for small apartment houses (three floors and no more than six units); \$300 (\$100 labor) per unit for larger apartment houses (three floors and more than six units); \$200 (\$50 labor) per occupant space in non-profit or government hotels (less than three stories); and nothing for residents of high rises or mobile homes. To recover a portion of the subsidy from affluent citizens, the cash grants would be counted as income for income tax purposes. Thus, the subsidy would be income conditioned; that is, declining as income rises.

The program would be administered by a Residential Energy Conservation Office in the Department of Energy and grants would be paid within 30 days after completion of work. The program would be authorized to spend \$25 billion, though the cost to the government may be less because of insufficient demand and because of the tax treatment of the grant.

Energy Savings and Government Costs. By 1990, the Kennedy proposal would save an additional 165 MBD. However, by accelerating the conservation improvements that would eventually occur under current policy, the Kennedy proposal would be saving 365 MBD over current policy by 1985. Thus, from 1980-1990, the total additional savings over current policy would be 725 million barrels. These savings assume that from 1980 to 1990 about a third of potential conservation beyond current policy is stimulated by the cash grant and that all of this potential is realized by 1985. Assuming that the \$25 billion authorized under this program is exhausted and an average marginal income tax rate of 25 percent, the net cost to the government would be \$18.8 billion.

Major Advantages;

- o The grant would accelerate the conservation savings that would eventually occur under current policy.
- o The grant level is probably adequate to capture relatively large savings from cost-effective initial conservation investments. At today's prices, attic insulation could be installed for many inadequately insulated units. Moreover, with a fixed ceiling on the grant the incentive is to retrofit sooner rather than later and therefore it would produce greater energy savings during the first few years of the program.

- o Including the cash grant as income for tax purposes improves targeting. This targeting not only relates benefits to need but also reduces windfalls that would occur for higher income units that would invest without the grant.
- o Though the **grant** would be paid within 30 days after the conservation expenditure and some families may have difficulty in financing the investment for a month, the speed with which the grant is disbursed will provide needed "**up-front**" financing for many units with insufficient funds.
- o The **program** is relatively easy to administer though administrative **savings** and the responsiveness of the program may be offset by the lack of quality control in monitoring conservation activity (discussed below).

Major Disadvantages;

- o The **size** of the grant may encourage some units to undertake the relatively inexpensive conservation measures and not undertake investments such as heat pumps and wall insulation which require much larger investments (subsidized loans may be more **successful** in achieving savings from such measures).
- o The grant will represent a windfall to many households that would have made small initial weatherization investments anyway. If grants are regarded as "free **money**" buyers may unwittingly contribute to rapid price increases for covered items.
- o Many low-income households may still find it difficult to finance the conservation improvement for one month and may be uncertain that they will be reimbursed.
- o The lack of a pre- and post-audit means that anticipated energy savings may not be achieved. Without the pre-audit there is no assurance that the most cost-effective measures are undertaken and without a post-audit there is no assurance that work is done properly.
- o The proposal, as written, would allow individuals to take advantage of the grant and the current law conservation tax credit. Receipt of benefits under the tax credit would offset some of the savings achieved by taxing the cash grant.

### Tsongas Proposal (S. 174S)

Description. The Tsongas proposal would establish a "Conservation Bank" to make lump-sum payments to lending institutions to compensate them for lending at below market interest rates or providing principal-deferred loans. Loans for installing conservation measures cannot exceed \$5,000 per unit for residential structures with one to four units, \$2,500 per unit for larger structures, and up to \$200,000 for commercial structures. At least 75 percent of the subsidy must go to residential structures.

Energy Savings and Government Costs. The proposal would authorize \$6.1 billion through 1984 for the loan subsidies. At current rates, the subsidy would lead to \$24.3 billion in conservation expenditures. Assuming that households would borrow, on average, \$1,250 (in 1980 dollars) and all loans were for residential structures, 16.5 million units would receive subsidies. With a 50 percent savings from conservation improvements, these units would save an additional 95 MBD over current policy by 1990. With an acceleration of savings that would occur under current policy, the proposal would save 295 MBD by 1985 and total energy savings from 1980-1990 would be 625 million barrels over current policy. This assumes that 75 percent of these units would undertake conservation investment without the subsidy.

#### Major Advantages:

- o By not requiring "up-front" financing, the loan would accelerate the conservation savings that would eventually occur under current policy.
- o Households without "up-front" financing can take advantage of the loans and might be induced to engage in more extensive conservation investment than under a partial subsidy scheme or a flat grant of a lesser amount.
- o Households, in general, might engage in more costly and a larger volume of conservation activities. Price increases may be less than with outright grants.

#### Major Disadvantages:

- o The program would be administered essentially through lending institutions that will vary in the quality of administration. Without a mandatory pre- and post-audit, there would be no assurance that

appropriate conservation measures were undertaken and the improvements were done properly. Moreover, though penalties exist, there will be opportunities for both fraud and abuse.

- o The subsidized loans are not targeted on lower-income households but rather are available to households across the income distribution. Yet, lower-income families generally live in **precisely** those units most in need of **weatherproofing**. Moreover, these are also the households which find it most difficult to obtain **up-front** financing.
- o The loan program would result in windfall subsidies for many households that would have invested in conservation anyway. Moreover, without targeting, much of the windfall would go to high-income households most likely to invest even without **subsidies**.
- o Excessive demand in the early years of the program may result in lenders concentrating on applications for larger loans rather than processing many smaller loans. As a result, many low-income households, which would generally borrow smaller amounts to finance the less costly but more cost-effective improvements, may find it difficult to obtain funds.
- o Higher income recipients of loan subsidies may also qualify for the current 15 percent conservation tax credit and thus receive a multiple subsidy from the government for the same investment.
- o There is no incentive for renters to participate directly in the loan program though landlords would have the opportunity to participate in the **program**.

#### Compromise Proposal (Bradley et.al.)

Description. Major features of the Committee proposal include the establishment of a Conservation Bank (Title ID similar to the Tsongas plan and a Residential **Energy** Conservation grant program (Title **III**) similar to the Kennedy plan. <sup>3/</sup> The combined plans would differ, however, from the Kennedy and Tsongas proposals in several important areas. First, applicants under either the loan or grant programs would be required to have a "**qualifying** residential energy audit." Second, applicants qualifying for both the grant and loan programs could only participate in one program and recipients of the grant would not be eligible for the current law conservation tax credit. Third, eligibility for the loan **program** would be limited to

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<sup>3/</sup> Not considered in this discussion are Titles I and IV of the Compromise proposal.

applicants with taxable incomes of less than 130 percent of median income (i.e., less than \$20,000 in 1979). Fourth, the benefit levels under the grant program would decline with higher conservation expenditures and the overall maximum grant per unit would be reduced; e.g., owners of small residential structures would receive a maximum of 50 percent of the first \$600 in conservation expenditures, a \$300 subsidy (compared to \$750 under the Kennedy proposal). Renters would receive a larger subsidy than owners; e.g., 75 percent of the first \$600 in expenditures, a \$450 subsidy. Fifth, the grant program would be administered by the states. Sixth, authorization under the grant program would be for \$6.8 billion through fiscal year 1984.

Energy Savings and Government Costs. By 1990, the Compromise proposal would save an additional 126 MBD. By accelerating conservation improvements that would eventually occur **under current policy**, the proposal would be saving 326 MBD over **current policy** by 1985. From 1980-1990, the total additional savings over current policy would be 709 million barrels. **Estimates** under the loan program assume that limiting loans to households with taxable **incomes** below 130 percent of median income will probably result in units borrowing smaller sums of money (about \$800 per unit) and engaging **in** less ambitious conservation improvements. With 40 percent energy savings from these conservation improvements and 50 percent of the savings attributed to current policy, the additional energy savings from Title n would be 60 MBD at a cost of \$4.2 billion, \$1.9 billion less than authorized (assumes that 50 percent participation rate among loan program eligibles). Additional energy savings from Title **III** would be 66 MBD by 1990. **Estimates** under the grant program assume about 15 percent potential conservation savings beyond current policy (and the loan program) would be stimulated by the cash grant and that this potential would be realized by 1985. The net cost of the grant program to the government would be \$5.1 (assuming a 25 percent average effective marginal tax rate). Combined with actual outlays for residential conservation under the loan program, the net costs of Titles n and **III** to the government would be **\$9.3** billion from 1980 to 1985.

#### Major Advantages;

- o The loan program is targeted on the **lower-income** population which live in generally less energy efficient households and promises greater energy savings per dollar of conservation expenditure than the unrestricted Conservation Bank **proposal**. The grant program continues to target benefits by including the grant as taxable income.
- o By subsidizing only a portion of initial conservation investment, the grant program reduces the windfall for those who would invest in

conservation anyway and encourages judicious concern for value received.

- o The higher subsidy for renters rather than owners may encourage **more** renters to engage in conservation improvements. Nevertheless, the small overall subsidy relative to renter tenure in the unit would leave the investments **less** attractive to many renters than owners.
- o The administration of the grant program by states may improve the program's efficiency and ability to penetrate the retrofit market. Also, optimal improvements vary by region as well as among specific **dwellings**.

#### Major Disadvantages:

- o Smaller grants under the grant program may discourage some residents from second stage conservation measures.
- o Many recipients will still receive windfall payments for work that would be done anyway.
- o Demand for conservation investment may be excessive in the early years and result in supply **bottlenecks--mainly** for installed work. The required energy audit may slow down the rate at which grants and loans are processed and may actually result in delaying conservation investment by some households which would have made improvements without the program.
- o The lack of a post-audit means there will still be no assurance that the conservation improvement is done properly.
- o **Since** recipients of the grant program cannot also qualify for the current law conservation tax credit, the higher subsidy rate for lower levels of conservation investment under the Compromise proposal may reduce the level of investment for some taxpayers that would occur under current policy. The proposed grant subsidies first dollar outlays more heavily than a loan or tax credit. Therefore, grants may not encourage citizens to buy *as* many improvements and save as much energy as other subsidy forms.

#### Measures That Would Increase Energy Savings

**Estimated** additional energy savings for these proposals remain similar and relatively small. The following modifications to these proposals might **increase** the potential energy savings:

- o Improve the targeting in the loan program by lowering the income eligibility limit to \$15,000 a year and by limiting the loan size to a maximum of \$1,000.
- o Administer the loan program through the utilities. Utilities could handle the financing of conservation improvements and include repayment of loans in the monthly utility bill. This would address the **"up-front"** financing problem of the low-income population and utilize an existing institutional structure with which the general public is familiar.
- o Make the utilities also responsible for administering a rigorous **pre-and** post-audit to **access** conservation needs and assure proper installation. The current residential energy audits provided through the utility companies equip the utilities with the experience and expertise to perform the audit function.
- o **Engage** in a vigorous public information program to educate the public as to cost-effectiveness of conservation investment. Require utilities to perform residential energy audit on all units.
- o Restrict 100 percent subsidy grants to low-income households. For **higher** income households, change the cash grant program to subsidize last dollar rather than first dollar conservation investment. That is, do not subsidize the obviously desirable conservation improvements which are relatively inexpensive such as insulating the attic and concentrate on truly incremental improvements. For example, do not subsidize the first \$500 to \$1,000 of conservation investment, but rather subsidize some portion of the conservation investment above these amounts. Such a grant would generally favor **higher-income** households which are precisely those that enjoy a windfall from the cash grant under the Compromise proposal. This last dollar subsidy would offer an incentive for such households to engage in "second stage" conservation investment to obtain the incremental, more costly energy savings.