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TITLE: ATTACHED-SUNSPACE DESIGNS: A NATIONWIDE ECONOMIC APPRAISAL

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ATTACHED-SUNSPACE DESIGNS: A NATIONWIDE ECONOMIC APPRAISAL

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ABSTRACT

Performance estimates for attached-sunspace passive solar heated residences have recently been incorporated into the Los Alamos/UNM EASE III model. These estimates are used to analyze the economic performance of a fixed dimension sunspace design when attached to a pre-existing single family residential unit. The sunspace is a passive design which can be easily and effectively adapted to a retrofit situation. Several key parameters are carefully evaluated for the sunspace retrofit design. These include loan or mortgage terms, ownership period, resale potential and competing conventional fuel prices. General economic and design parameters are combined in a variant of life cycle costing to evaluate the feasibility of both owner-built and contractor-built attached sunspaces for 220 regions in the contiguous United States. This evaluation is made for two conventional fuel types--natural gas and electric resistance--and for three resale values--0%, 100%, and 200%. Results show that the prospect for conventional fuel displacement through retrofit of attached sunspaces is very good with the design's economic performance enhanced in regions with expensive conventional fuel alternatives.

1. INTRODUCTION

Sunspace designs, in general, offer very high potential for passive solar retrofit. This becomes important when it is realized that 70% to 80% of the homes which will exist in the year 2000 will be of pre-1980 vintage. The potential for home space heating fuel reduction through the use of passive solar designs is greater for these older homes than it will be for post-1980 homes.* The reasons for concentrating on older homes are three-fold. The first is the fact that these homes will out number post-1980 homes for the foreseeable future. The second reason is that because older homes have larger space heating fuel requirements than new homes of comparable size, there is more potential for fuel displacement. The third reason is the lower furnace efficiency associated with older homes. This is true for homes using natural gas, heating oil, some types of electric heating and heat pumps. The heating oil analysis is presented elsewhere [1] due to space limitations and the more prevalent use of both natural gas and electricity on a nationwide basis. New home natural gas furnaces have, on the average, an efficiency of about 75%. The natural gas analysis presented here assumes a 55% furnace efficiency; this figure is believed to approximate

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* That is not to say that post-1980 homes shouldn't be considered for passive solar retrofits in the ensuing years.

the average situation. The electricity fuel alternative here assumes electric resistance space heating at 100% efficiency. These reasons support concentration on the retrofit market.

The Los Alamos/UNM EASE III code [2] is used to evaluate the economic performance of a sunspace design. Performance estimates for eight sunspace configurations based on two distinct geometries are now included in the model. The performance estimates have been developed by the Solar Energy Group (Q-11) at LASL [3]. The sunspace configuration evaluated here is a fixed dimension unit of the lean-to variety. It has insulated end-walls and includes an owner operated night insulation option. The sunspace is assumed to be retrofitted to the south wall of a pre-existing single family residence.

The EASE III code uses performance estimates for 220 regions in the contiguous United States, thermal integrity characteristics, and residence design parameters to calculate the solar savings fraction associated with the fixed dimension sunspace under consideration. Region specific design and conventional energy costs are used as the basis for the economic evaluation reported here. Only the natural gas and electric resistance space heating alternatives are examined in this analysis. Other fuel comparisons can be found in [1].

Economic feasibility or competitiveness can be defined in many ways. The discounted solar savings or net present value is one measure of the feasibility of a passive solar design. This measure defines the benefits to the investor for switching from a conventional residential heating system to a sunspace heating system with a conventional back-up. All one time and recurring costs and benefits over the period of analysis are taken into account in this type of life cycle costing. The nonquantifiable benefits are only indirectly taken account of through the resale value variable (discussed in the following section).

Two design costs are evaluated here; one of which corresponds to an owner-built design, the other corresponds to a contractor-built unit. The difference between the two is in the estimated cost of labor; no labor cost is incurred in the owner-built unit. Standard sizes and types of construction materials are assumed.

Results are presented in both mapped and tabular form. Maps showing the 220 regions are included to highlight the types of relationships found in this retrofit sunspace evaluation. The regions are defined as distinct multicounty units with climatic conditions similar to the 220 SOLMET locations [4] used in the solar performance analysis [5]. They are an exhaustive description of the 48 contiguous states and the District of Columbia. Tables displaying the full results for all scenarios are included in the Appendix. The results serve to emphasize the importance of the resale value parameter. Very few regions have positive net present values for either the owner-built or contractor-built sunspace against natural gas when a 0% resale value is assumed. The picture is only marginally improved when the comparison is made for the electric resistance alternative. The introduction of 100% and 200% resale values greatly improves the outcome of the analysis under either fuel type. Using the assumption of 100% resale, mapped results are presented to show the extent to which contractor-built sunspace fares less well than the owner-built design. It can also be said that regions which have relatively inexpensive conventional fuels are difficult areas for either the contractor-built or owner-built option to compete. These results are examined in detail in Section 4.

2. NON-ECONOMIC BENEFITS

The economic evaluation of a sunspace design involves an added dimension when compared to evaluation of a direct gain or thermal mass wall (e.g., Trombe wall) design [5]. The question of non-quantifiable benefits is of greater concern. The life cycle costing approach normally employed in such analysis can only be made to include these benefits with some difficulty. The quantitative analysis presented in this paper only partially addresses these concerns. The impact of these benefits on the economic results presented is an important issue. The retrofit analysis undertaken here necessitates a rethinking of the definition of certain key financial parameters generally used in solar economic assessment. For a complete discussion of past assessments and the underlying parameter assumptions see [5].

The method of financing the solar investment differs from that used for new home purchase when retrofit is being considered. Ignoring the case where the builder/home owner pays cash for his attached sunspace, there are two methods generally available--a home improvement loan or a second mortgage. The former usually involves a short repayment period (5-10 years) with actual terms varying from region to region. Second mortgage terms are somewhat more consistent across a broad geographic area with the repayment period being longer than that for a home improvement loan. Interest rates tend to be lower for a second mortgage than for a home improvement loan. A second mortgage is used as the method of financing in the analysis reported here. The values of the appropriate parameters are detailed in Section 3.

Another key parameter with a major impact on the outcome of the analysis is the assumed resale value. The value given this variable hinges on market and non-market concerns. As the resale value of the sunspace increases, so does the value of the investment. The actual resale value that might be associated with a sunspace is partly dependent upon the structure of the real estate market at the time of the resale. This, in turn, is a function of a great many things (some of them economic, some of them not) and will not be dealt with at length here.

The resale value will be affected in part by the degree to which an appreciation of the non-market benefits is shared by seller and buyer. When the sunspace has been transformed into a greenhouse it has been changed from a room containing storage barrels and a double-glazed south wall to a lush, plant-filled living space or year-round vegetable garden. This transformation carries over into the residence where the feel and smell of the air is changed by the moisture and fragrance associated with the greenhouse.

For many people the appeal of a greenhouse goes far beyond the heat it may supply to the house. The heat may, in fact, be a secondary reason for making the investment. A greenhouse can be used to extend the growing season and to provide year round fresh vegetables. Certain people value this quite highly. For these types of buyers the resale value would be quite high and the seller recoups his entire first cost.

The response of buyers to a retrofit greenhouse will not be consistent. Some parts of the country already appear to be centers of passive solar enthusiasm. In a place such as Davis, California, the resale value would be high; in other areas there may be no resale value associated with a sunspace. When a high degree of acceptance is encountered it is almost impossible to separate the sunspace affect (heat supply) from the greenhouse affect (amenity value).

In exploring the impact of the resale parameter on the economic results, three polar values--0%, 100%, and 200%--are used. This allows for a bracketing of reasonable consumer expectations. A true minimum benefits analysis is associated with the 0% resale scenario; this implies that none of the initial or continuing cost is recovered when the home is sold. The 100% resale value assumption or scenario approaches a conventional benefits analysis where individuals recoup their investment through the proceeds from the sale of the home. There may very well be cases where greater than 100% resale value could and will be experienced. This possibility is dealt with by the assumption of a 200% resale value; in this case it is assumed that the owner recoups twice his initial investment when the home is sold. The results associated with these three resale values serve to demonstrate the importance of the parameter.

Another aspect that will influence the attractiveness of the solar retrofit is the availability of tax credits/rebates for the adoption of passive solar designs. A federal law designed to give such tax credits has been proposed several times. That part of the legislation was deleted from larger energy bills before enactment. The Solar Bank has become law but the inclusion of passive designs must await formal rule making procedures from DOE and HUD. Therefore, in the following analysis, no federal credits are assumed. Several states do offer tax credits/rebates for passive designs. Although the model used in this analysis does allow incorporation of state level incentives, inadequate information necessitates that they also are not included as part of the overall assessment presented in this paper. Incentives, of course, enhance the solar investment. The greater the incentive, the greater the benefit to the homeowner. The existence of federal and state incentive packages could have a positive impact on the rate of retrofit adoption if their nature were well known.

3. METHODOLOGY

3.1 Design Description

The specific sunspace design evaluated in this paper is portrayed as Figure 1 [3]. The sunspace has insulated end walls and ceiling. The south-facing plane is double-glazed. The unit is 9 ft. (2.74m) high at the back wall, 11.5 ft. (3.52m) wide and 30 ft. (9.5m) long. The ceiling extends 4 ft. (1.23m) out from the south wall of the residence. The night insulation (RI) is in place from 5:00 PM to 8:00 AM. The thermal storage water containers extend the full length of the sunspace.

The sunspace unit is attached to the south wall of a pre-existing 1536 square foot ranch style home. Heat is transferred to the residence almost exclusively by thermocirculation through the vents. The wall of the residence is presumed to be of wood frame construction with insulated walls; little if any radiant heat is transferred to the living space. There are vents at the top and bottom of the back wall with back draft dampers. The vents account for approximately 6% of the back wall area. The thermal storage containers are coupled to the sunspace floor and wall by radiation and convection. Heat losses occur through the glazings, insulated ceiling and end walls, and from infiltration with some perimeter losses.

The design cost has been estimated for owner-built and contractor-built units. The costing procedure is detailed in Table 1.

The fixed cost components of the design under consideration are the two insulated end walls. The cost recorded for this element is a straight dollar

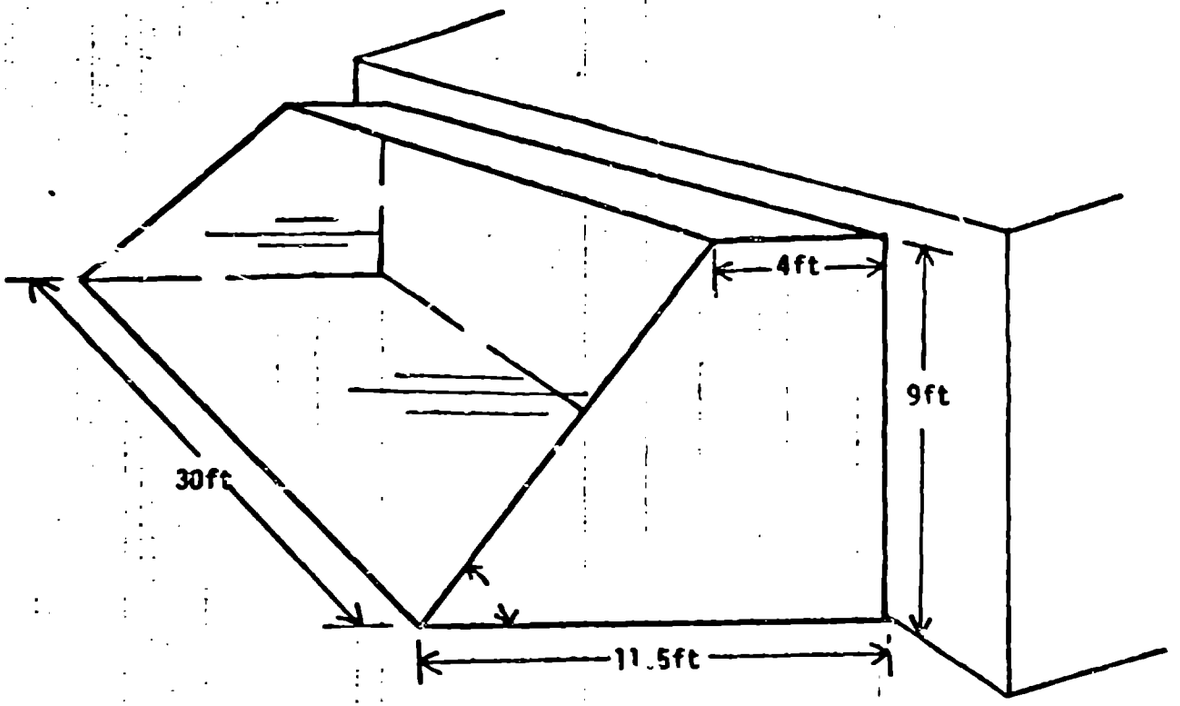

FIGURE 1: Sunspace Geometry

TABLE 1

SUNSPACE DESIGN COST*

Elements	Owner-Built	Contractor-Built
Fixed Cost Component		
1. Insulated end walls	$268	$487
Variable Cost Components		
1. Glazing and framing	$2.88/ft^2	$ 4.72/ft^2
2. Insulated roof	.42/ft^2	.83/ft^2
3. Slab	.95/ft^2	1.90/ft^2
4. Barrels (thermal storage containers)	1.84/ft^2	2.30/ft^2
5. Night insulation	1.50/ft^2	2.00/ft^2
Total Variable Cost	$7.59/ft^2	$11.75/ft^2

* All variable cost components reported in dollars per square of floor area ($/ft$^2_f$).

cost. The variable cost components include glazing and framing (plus necessary caulking), the insulated roof section, the concrete floor or slab, the metal barrels used for thermal storage, and the night insulation. The variable costs have been translated from their unit prices into a "dollars per square foot of floor area" ($/ft$^2_f$) cost. This is the more common way in which costs for attached sunspaces and greenhouses are expressed. Use of these cost component figures results in contractor-built sunspace costs of $4541, and owner-built system costs of $2887. These prices represent a national average. They are modified by a region specific cost adjustment index [5] to yield a sunspace cost for each of the 220 regions included in the analysis.

The cost figures reported in Table 1 were estimated from contractor and builder supplied costs for each of the structural components of the sunspace. The materials are all assumed to be standard sizes and to be readily available throughout the country. The arithmetic relationship between the quantities of each element necessary for the design and the total floor area of the design was used to translate the actual cost of each element into a cost per unit of floor area.*

3.2 Methodological Detail

The basis of the economic evaluation undertaken here is a comparison of the

* When the sunspace design costs reported in Table 1 are combined with region specific cost adjustment factors the resulting $/ft$^2_f$ cost is generally lower than those being reported by contractors today. As the number of installed, attached sunspace units increases, the cost will rapidly approach the costs used in this study. Labor and materials estimates used here generally reflect representative dollar costs for 1980.

costs involved in the use of the attached sunspace and auxiliary heating systems with that of a conventional heating system in pre-existing residences throughout the contiguous United States. Six types of information are used in the economic analysis. Five are specific to each of the 220 regions examined. The sixth is comprised of a set of general economic and design parameters shown in Table 2. These parameter values are, for the most part, consistent with previous evaluations of solar potential in residential applications [5, 6].

The actual analysis undertaken here differs from previous efforts in one respect. This paper deals exclusively with the case of a sunspace retrofit design. It is assumed that the solar retrofit is being financed through a second mortgage.* The second mortgage terms used in the ensuing analysis are a 15% nominal interest rate with a 15 year loan period. Resale values of 0%, 100%, and 200% are used to examine the affect of this parameter on the total value of the investment. It has been demonstrated elsewhere that the value of the solar investment, as measured by discounted savings, increases as the resale proportion or percent increases [7]. The use of three resale values in this analysis allows for specification of the impact of this effect on each of the regions.

The fuel price data is used as the basis of the comparison between the conventionally heated home and the home heated by attached sunspace and conventional back-up. Discounted solar savings, the primary measure of economic competitiveness of the sunspace, is defined as the present worth of the difference between the cost of these two types of home heating strategies over the period of analysis. The primary cost of the conventionally heated home is fuel--natural gas and electricity; the primary costs of the solar home are the initial sunspace cost and the back-up fuel cost. It is obvious that both the present and future fuel prices are an important piece of basic information. Maps 1 and 2 geographically portray 1980 natural gas and electricity prices for the 220 regions. The fuel price data has been collected from personal communication with the utilities [8]. Future year fuel costs are estimated using an escalation rate for each fuel. At the present time equivalent uniform escalation rates are used for each year of the period of analysis [9]. These rates are included as part of Table 2.

Three other region specific types of inforamtion are used; these include heat loss factors (expressed in Btu's per degree day per square foot of residence--Btu/DD/ft^{2}res), heating degree days, and design cost adjustment factors. The heat loss factor is used as a measure of the thermal integrity of the residence. It is based on our interpretation of [10] the National Conference of States on Building Codes and Standards Model Code. This factor is a measure of the maximum allowable heat loss from floors, walls and ceilings of the residence. The heating degree days are used as a measure of climatic severity in heating load calculations. The design cost adjustment factors are used to transform the sunspace cost from a national average (see Table 1) into a region specific cost. These adjustment factors are based on Mean's Construction Cost Data [11] for all regions.

The principle source of costs associated with the sunspace are the initial construction cost and the cost of the conventional (back-up) fuel. The largest monetary benefit is the value of the conventional fuel displaced by the design.

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*As previously discussed, a home improvement loan is a second financing option available to home owners. The terms, both interest rate and time period, are usually less favorable than those for a second mortgage. Use of a home improvement loan financing option, would in fact, degrade the results reported in Section 4. If the difference in financing options had been very slight, major findings and conclusions would be unchanged.

TABLE 2

ECONOMIC AND DESIGN PARAMETERS

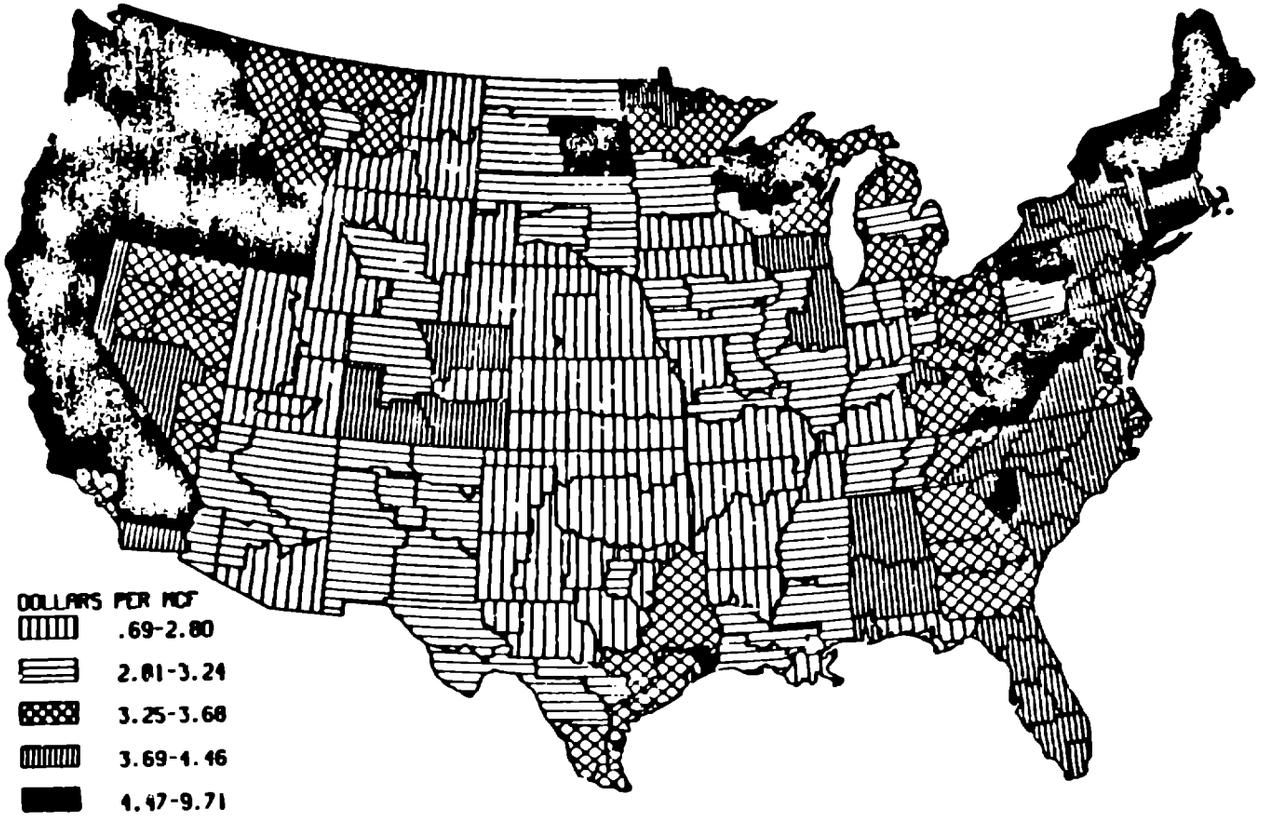
Economic Parameters for Retrofit Sunspace Analysis	
Loan Interest Rate (Nominal)	15 %
Discount Rate (Real)	3.5%
Down Payment	0 %
Property Tax Rate	2 %
Federal, State, Local Income Tax Bracket	25 %
Resale Value or Rate	0%, 100%, 200%
Annual Inflation Rate	8 %
Fuel Price Escalation Rates (Real)	
Natural Gas	3.6%
Electricity	1.4%
Loan Period	15 years
Period of Analysis	15 years
Design Parameters for Attached Sunspace	
Length	30 feet
Height at back wall	9 feet
Width	11.5 feet
Floor area	345 sq. ft.
Effective collector area	270 sq. ft.
Glazing plane tilt from horizontal	50^{o}
Room temperature control range	$65^{o}F$-$75^{o}F$
Sunspace temperature control range	$45^{o}F$-$95^{o}F$
Thermal resistance of night insulation	R9

The value of the displaced fuel is calculated by applying the region's fuel price to the amount of fuel displaced. For those years beyond year one (1980) this value is calculated by using fuel specific escalation rates. Secondary costs include interest payments, property taxes incurred because of the presence of the sunspace, and maintenance costs. Property tax and interest charge income tax deductions are secondary benefits. The details of the methodology used in the analysis can be found in [12].

The Los Alamos/UNM EASE III model combines sunspace performance estimates with the basic data inputs in a variant of life cycle costing to evaluate the economic performance of the design. Four aspects of the design must be carefully analyzed to make such an evaluation--the heat displacement capability of the design, the heating load of the home without its solar component, the cost of the design, and the cost of the conventional fuel alternative. The heat displacement capability of the attached sunspace is embodied in the solar savings fraction (SSF). This defines the proportion of the home's heating load which can be supplied by the sunspace. The SSF is calculated from performance

NATURAL GAS PRICES BY REGION

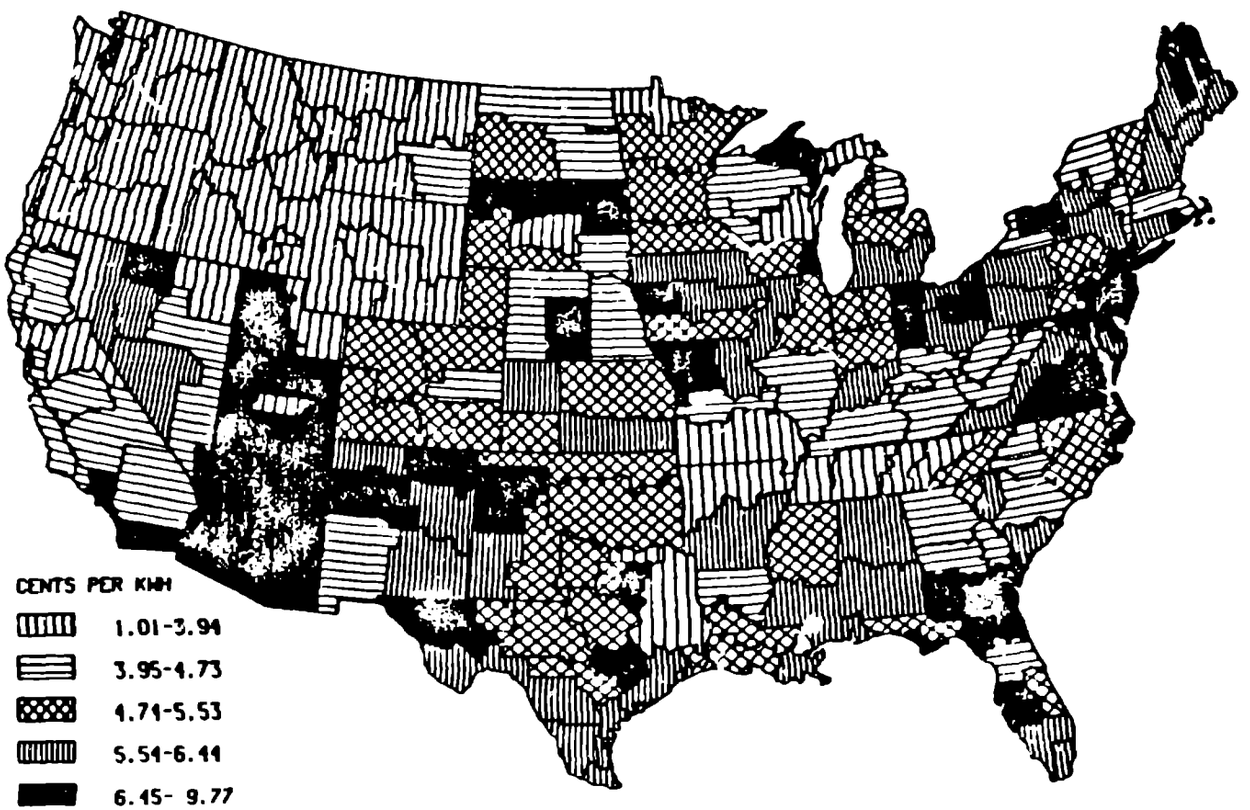
PRICES REFLECT MAY 1980 CONDITIONS



MAP 1

ELECTRICITY PRICES BY REGION

PRICES REFLECT MAY 1980 CONDITIONS



MAP 2

estimates made elsewhere by McFarland and Jones [3]. These estimates are provided as solar load to collector area ratios (LCR's) and are used in conjunction with region specific heat loss factors and residence design specifications to calculate the projected collector area requirement for a range of solar fractions. The projected collector area of the specific design (270 sq. ft.) analyzed here is then used to identify, by interpolation, the SSF for each region.

The solar savings fraction is then combined with the home heating load to calculate the energy savings in millions of Btu(MMBtu) per year associated with the retrofit sunspace. The home heating load is calculated as the sum of the load other than the south wall load and the load on the south wall. This sum represents the total Btu heating requirement of the residence under consideration. The solar savings fraction represents the proportion of this heating load which is provided by the sunspace. The value of the fuel which is displaced is the basis of the economic evaluation.

The primary measure of the benefits derived from the use of the sunspace design is the discounted solar savings (also known as net present value). It is defined as the present value of the difference between heating a home with conventional fuel and heating the same home with the sunspace and back-up systems.*

The costs of the attached sunspace design and the cost of the conventional fuel alternative are expressed as dollars per unit of energy figures ($/MMBtu). The design's energy cost is the sum of the one-time and recurring sunspace costs and back-up system costs over the 15 year period of analysis. This is then annualized into equal yearly payments. The conventional alternative cost is also annualized over 15 years. These measures are then used to calculate the net present value of the design as follows:

$$NPV = \frac{(AFP - DCH) * HHL}{CRF}$$

where:

AFP = cost of conventional fuel annualized over 15 years ($/MMBtu)

DCH = cost of combined sunspace and back-up systems annualized over 15 years ($/MMBtu)

HHL = home heating load (MMBtu)

CRF = capital recovery factor

4. RESULTS

The results presented here include a series of intermediate calculations used in the life cycle costing procedure and discounted solar savings for 220 regions in the contiguous United States. Twelve combinations of sunspace construction options, resale values, and alternative fuel types were analyzed (Table 3).

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* The cost of the traditional furnace has been excluded from the heating costs of the conventional and "solar-assisted" homes. While this exclusion may affect the numerical results in new home analysis, general findings and conclusions aren't affected. In an analysis of retrofit applications the homeowner probably wouldn't consider changing his conventional home heating system simultaneously with his consideration of solar retrofit. In light of this consideration, exclusion of furnace costs are not inappropriate.

TABLE 3

CASES INCLUDED FOR ANALYSIS

(All Combinations)

Resale Values	0%, 100%, 200%
Construction Options	Owner-Built, Contractor-Built
Alternative Fuels	Natural Gas, Electric Resistance

Full tabular results are included as Table 1 through 3 in the Appendix. Selected mapped results are presented in this section. The intermediate calculations are presented to aid in understanding the physical performance of the design and the relationship between the physical performance and the economic performance. Map 3 shows the reference home heating load for each region. The heating loads range from 4 million Btu (MMBtu) in Miami, Florida, to 99 MMBtu in International Falls, Minnesota. The heating load is a general indicator of climatic severity. Homes in coastal locations have lower loads than those of like latitude interior locations. This is in part a function of the moderating influence of water. Regions in Northern Mid-America have the highest heating loads in the United States. This area occupies a mid-continental position and experiences severe winter conditions. The northern Rocky Mountain area also exhibits very high heating loads. The lowest loads are experienced by low elevations, low latitudes such as the lower Mississippi Valley, the Gulf Coast and the lower Southwestern desert areas.

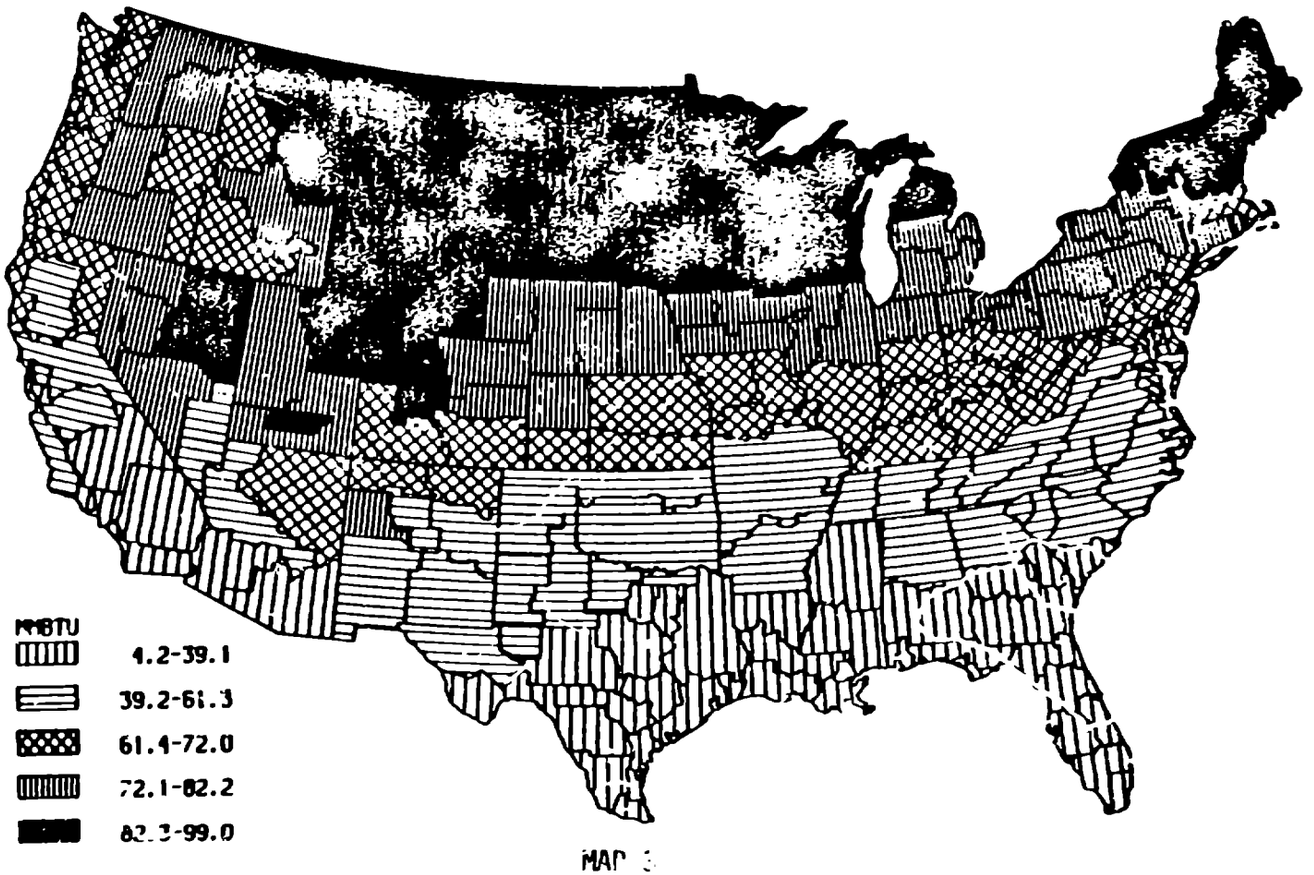
Map 4 portrays the solar savings fraction (SSF) associated with the fixed dimension sunspace design defined in Section 3.2. The solar savings fraction represents the proportion of the home heating load which is offset by the fixed dimension sunspace design. The SSF ranges from a high 95% for West Palm Beach and Miami, Florida, to a low of 22% for Vermont, three regions in New York, and Houghton, Michigan. The extreme SSF values are not always associated with the extreme values of home heating loads. While International Falls does have the highest home heating load it does not have the lowest SSF. The climatic factors which result in excessive heating demands are not identical with those which limit the performance of the sunspace. This difference is primarily related to the incidence of overcast days and, thus, the availability of sunshine.

Map 5 geographically portrays the result of combining Maps 3 and 4. The total energy savings (expressed in MMBtu) associated with the sunspace design is simply the product of the reference home heating load and the per home energy saving potential for each region. The greatest energy savings will be experienced in the Intermountain West, regions of Utah, Nevada, Colorado and New Mexico. These regions exhibit moderate to moderately high heating loads and moderately high solar savings fractions. These areas do have severe winters but are typified by a high percentage of available sunshine in the winter. This combination of attributes results in a high energy saving potential. The areas with the highest SSF values do not have very high heating loads. These areas have a fairly small energy saving potential.

Maps 6 and 7 portray the first year (1980) dollar value of the conventional energy saved by the retrofit sunspace design when natural gas and electricity, respectively, are used as an alternative (back-up) fuel. This is one important

CONVENTIONAL HOME HEATING LOADS IN MMBTU

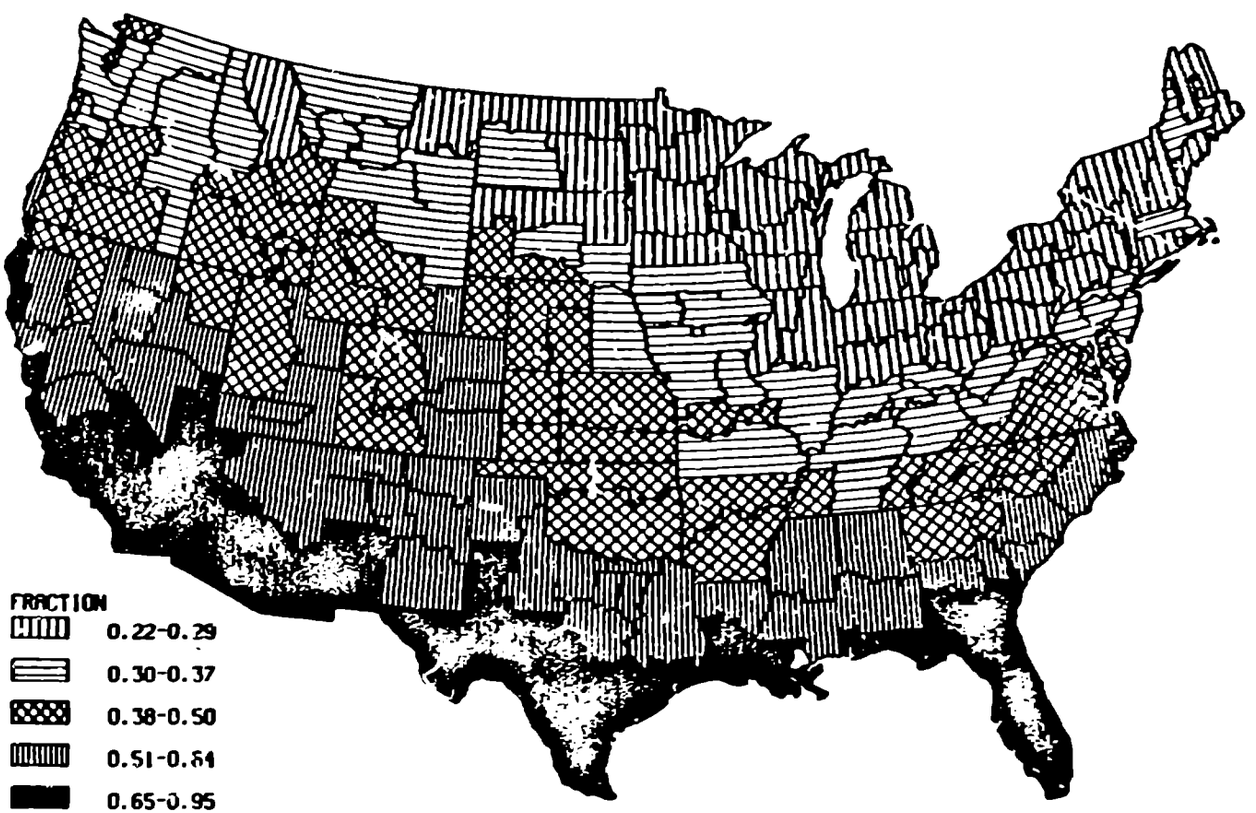
(SEE TEXT FOR COMPUTATIONAL ASSUMPTIONS)



MAP 3

ATTACHED SUNSPACE SOLAR SAVINGS FRACTION

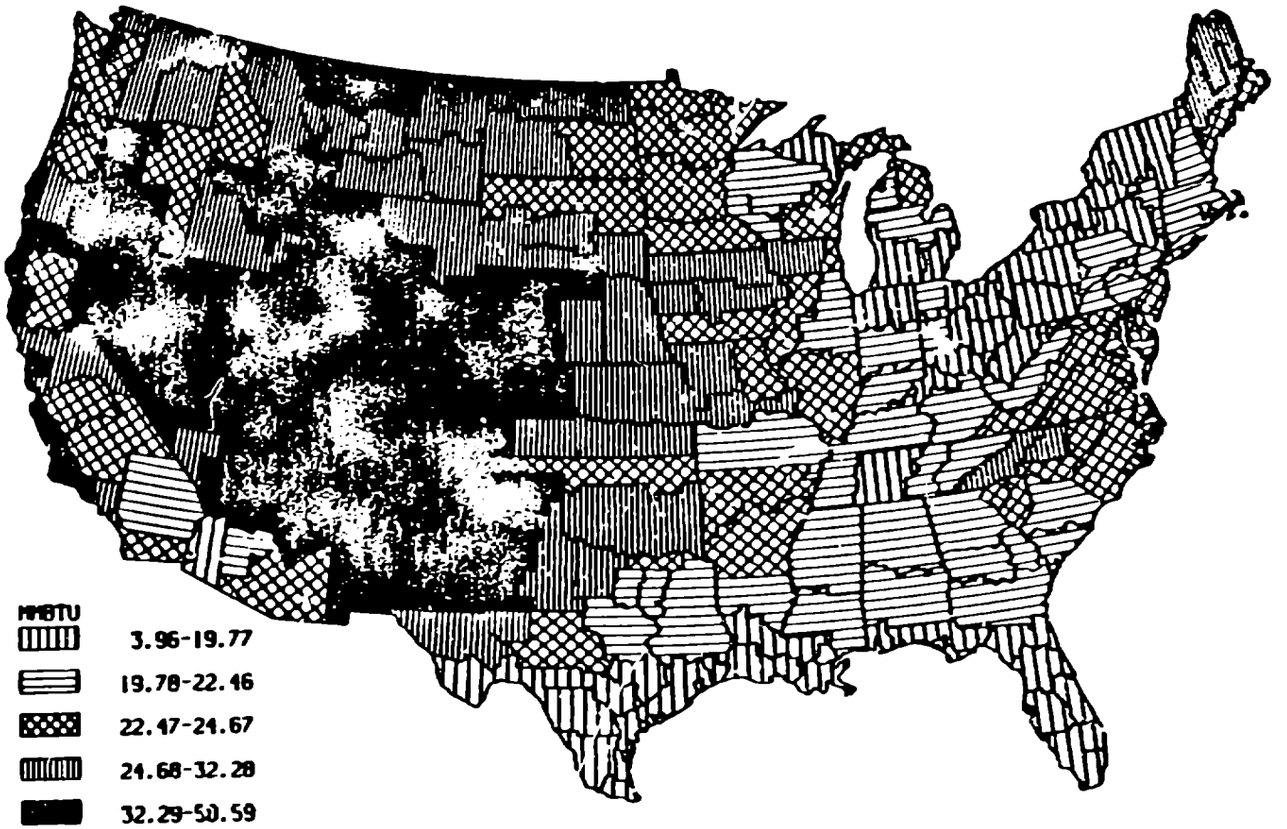
SUNSPACE DESIGN INCLUDES NIGHT INSULATION



MAP 4

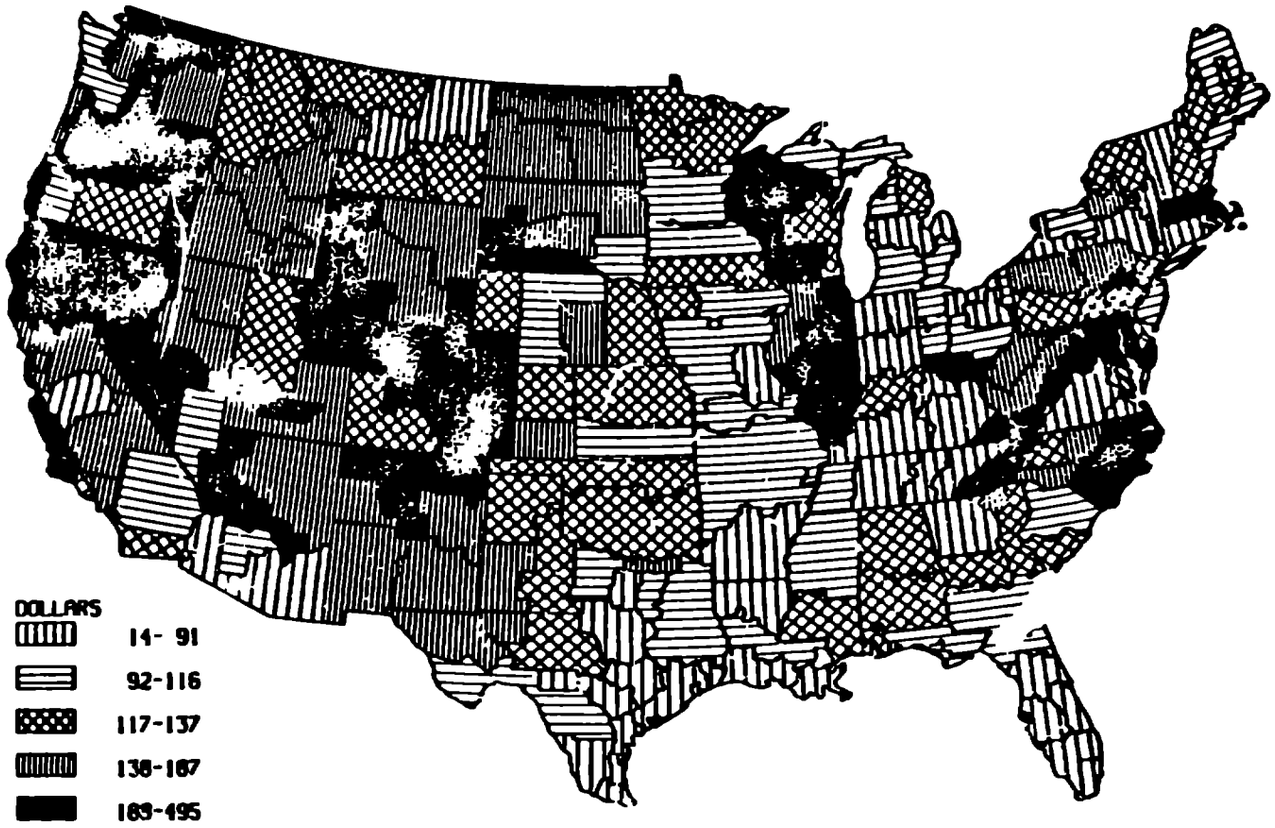
ATTACHED SUNSPACE SOLAR SAVINGS IN MMBTU

SUNSPACE DESIGN INCLUDES NIGHT INSULATION



MAP 5

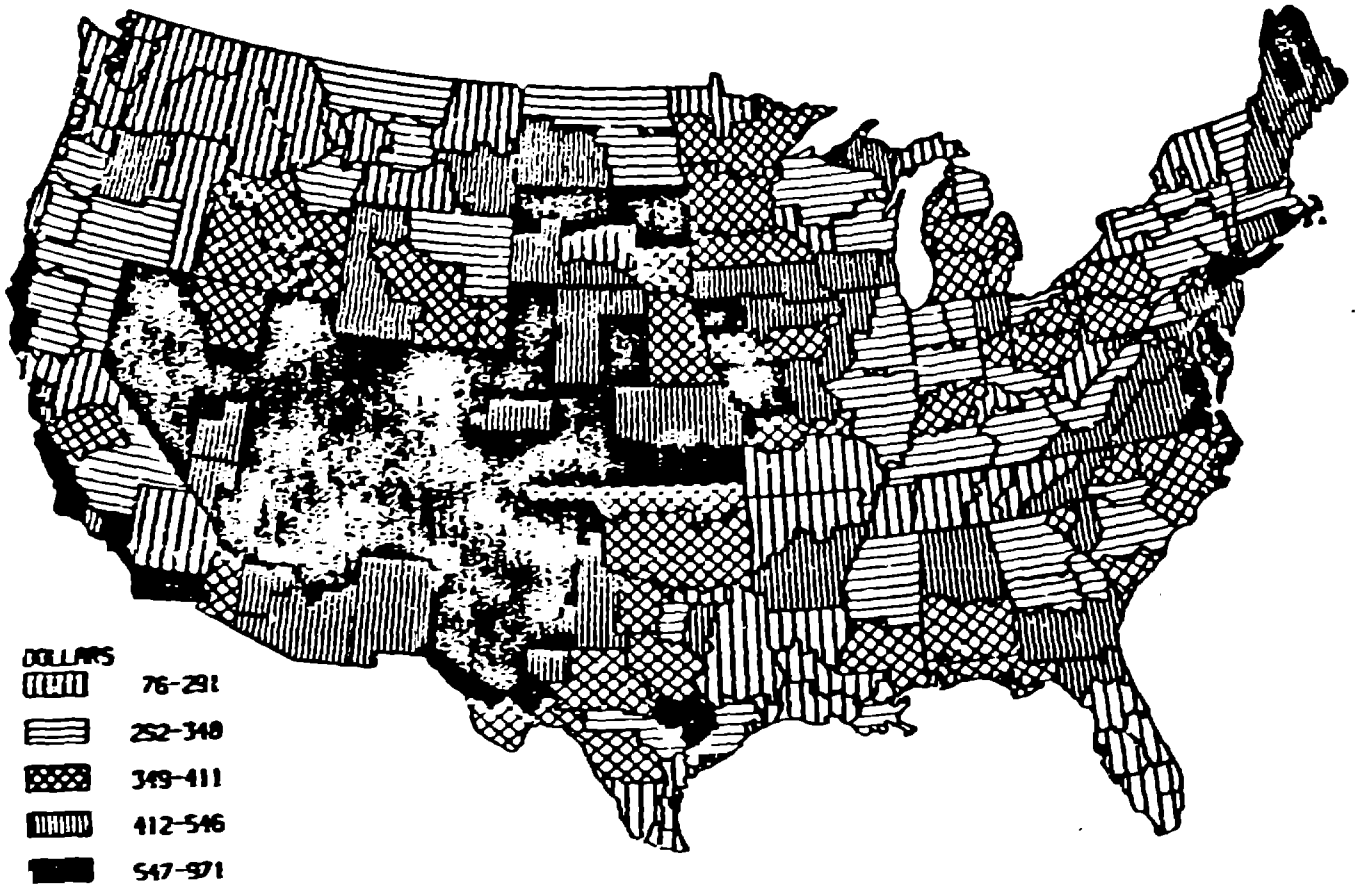
DOLLAR VALUE OF NATURAL GAS REPLACED
SUNSPACE DESIGN INCLUDES NIGHT INSULATION
ANNUAL VALUE FOR MAY 1980 PRICES



MAP 6

DOLLAR VALUE OF ELECTRICITY REPLACED
SUNSPACE DESIGN INCLUDES NIGHT INSULATION

- ANNUAL VALUE FOR MAY 1980 PRICES



MAP 7

measure of the economic performance of the sunspace design. The dollar value figures contained in Maps 6 and 7 are the product of the total energy savings (MMBtu) and the price of the fuel ($/MMBtu equivalent). The regional fuel prices were previously displayed as Maps 1 and 2. While this dollar value of the energy saved figure is equivalent to the first year savings, it is fairly indicative of the level of total discounted savings which could be achieved over the period of analysis.

Regions with low fuel prices will have low dollar value figures regardless of the physical performance of the design. For example; Atlanta, Georgia, has a SSF of 49% and a total energy savings of 22 MMBtu. Natural gas prices are low and the dollar value of that 22 MMBtu in the first year is only $89. The dollar value of the same amount of displaced energy in Chicago is $262. The SSF in Chicago is only 29% and yet the value is almost three times higher. The physical performance of the design is not a good indicator of the sunspace's economic performance. In general, the regions demonstrating the best economic performance have moderate to high levels of fuel displaced and high fuel prices.

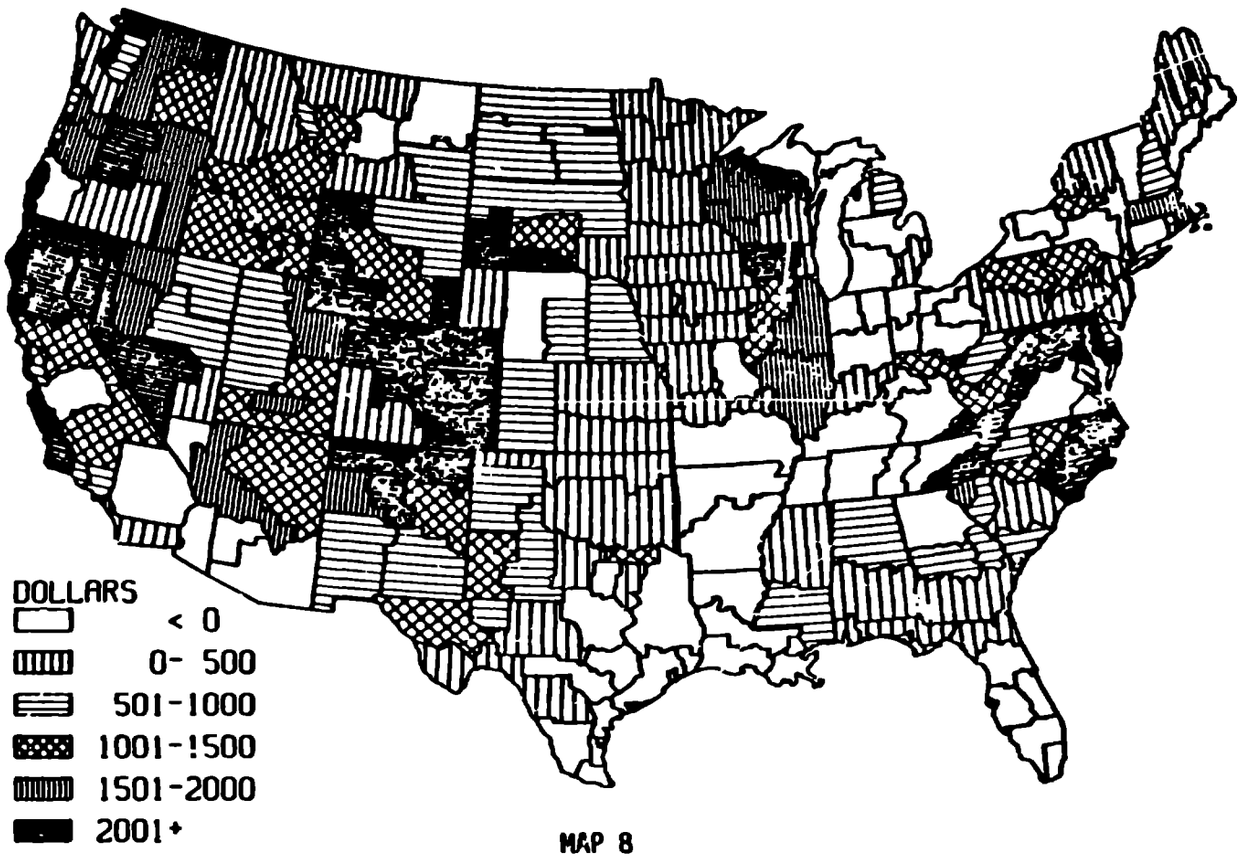
The West and Pacific Northwest generally have high natural gas prices; this is reflected in high dollar value figures against natural gas in most portions of these broad areas. Maryland, Massachusetts, and Illinois also tend to have very high natural gas prices. Because the cost of the fuel tends to dominate the physical performance of the design, regions with mediocre physical performance and very expensive fuels show good economic performance.

Electricity prices are always higher per unit of energy ($/MMBtu) than natural gas prices. Regions in the state of Washington are the only exceptions to this rule. This means that the dollar value of energy saved is always greater (with noted exceptions) when the conventional alternative is electric resistance than it is when natural gas is the alternative fuel. Electricity prices are more a function of individual utility rate structures than are natural gas prices. This results in a less well defined nationwide pattern of dollar value saved against electricity than against natural gas. This leads to a situation where nearly identical total energy savings for two adjacent regions results in very different dollar values for that energy. For example, New York City and Messena, New York experience 19.5 MMBtu and 19.6 MMBtu savings with this retrofit design. The dollar value of that level of energy saving against electricity is $609 in New York City and only $260 in Messena. The patterns of 1980 dollar value of displaced energy closely approximates the patterns seen on the fuel price maps (Maps 1 and 2).

Discounted solar savings for both owner-built and contractor-built sunspace against the natural gas and electric resistance alternatives are displayed on Maps 8 through 11. A 100% resale value is assumed for all four maps. The more expensive contractor-built design ($11.75/$ft^2$ of floor area variable cost) doesn't fare as well as the owner-built design ($7.50/$ft^2$ of floor area). When the alternative fuel is electricity, the more expensive of the two fuels, the differences are primarily between levels of solar savings and not between a presence or absence of positive savings. In the case of the contractor-built design fewer than twenty regions exhibit a negative saving characteristic. These are primarily in the Pacific Northwest, Florida and Tennessee; these specific areas have unusually inexpensive electricity. Only four regions exhibit large (-$1000 or more) negative savings for the owner-built design--Miami and West Palm Beach, Florida, Springfield, Missouri and Seattle-Tacoma, Washington.

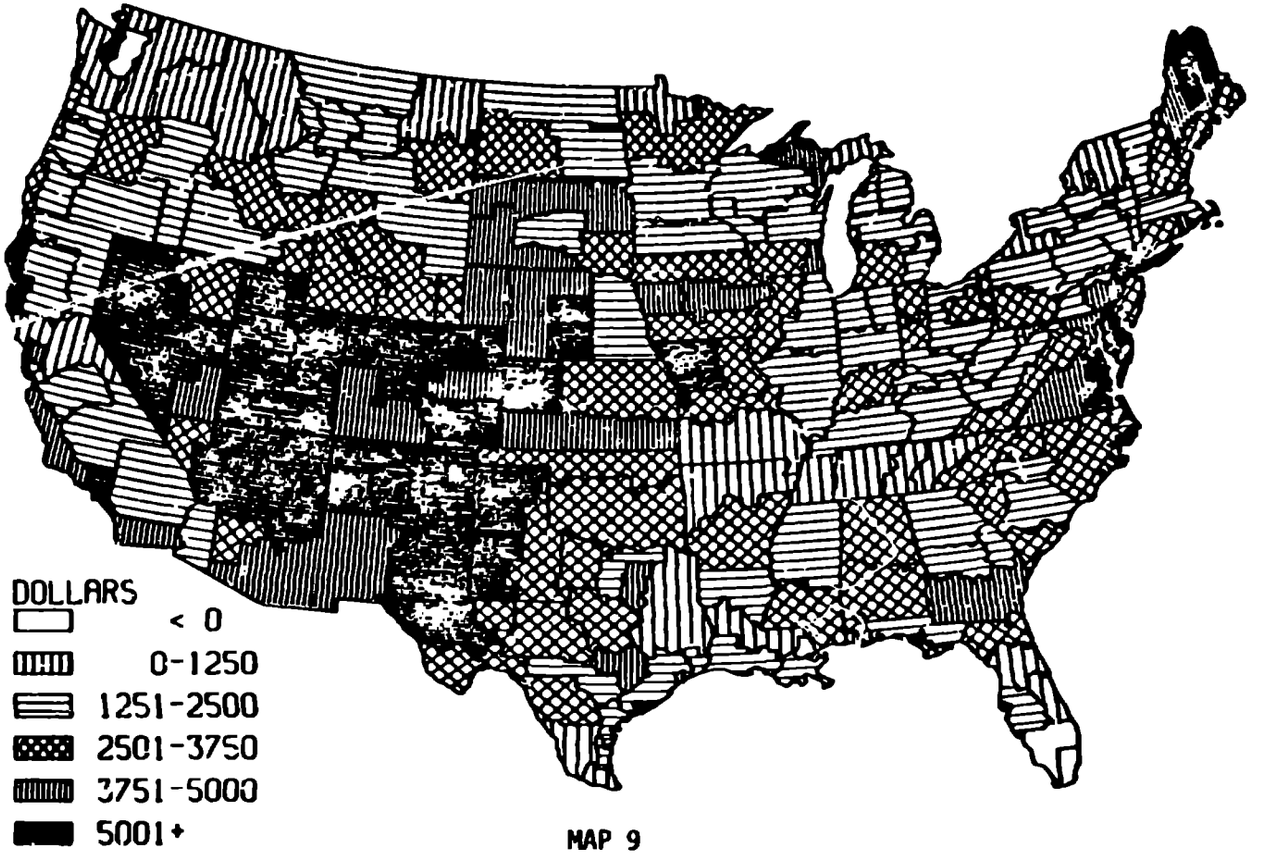
The differences are more striking in the case of the natural gas conventional alternative. Less than 50 regions exhibit positive savings for the contractor-built sunspace; these are primarily located in the West. The owner-built design

DISCOUNTED DOLLAR VALUE OF NATURAL GAS REPLACED BY SOLAR
OWNER-BUILT--100 PCT. RESALE RECOVERY
SUNSPACE DESIGN INCLUDES NIGHT INSULATION



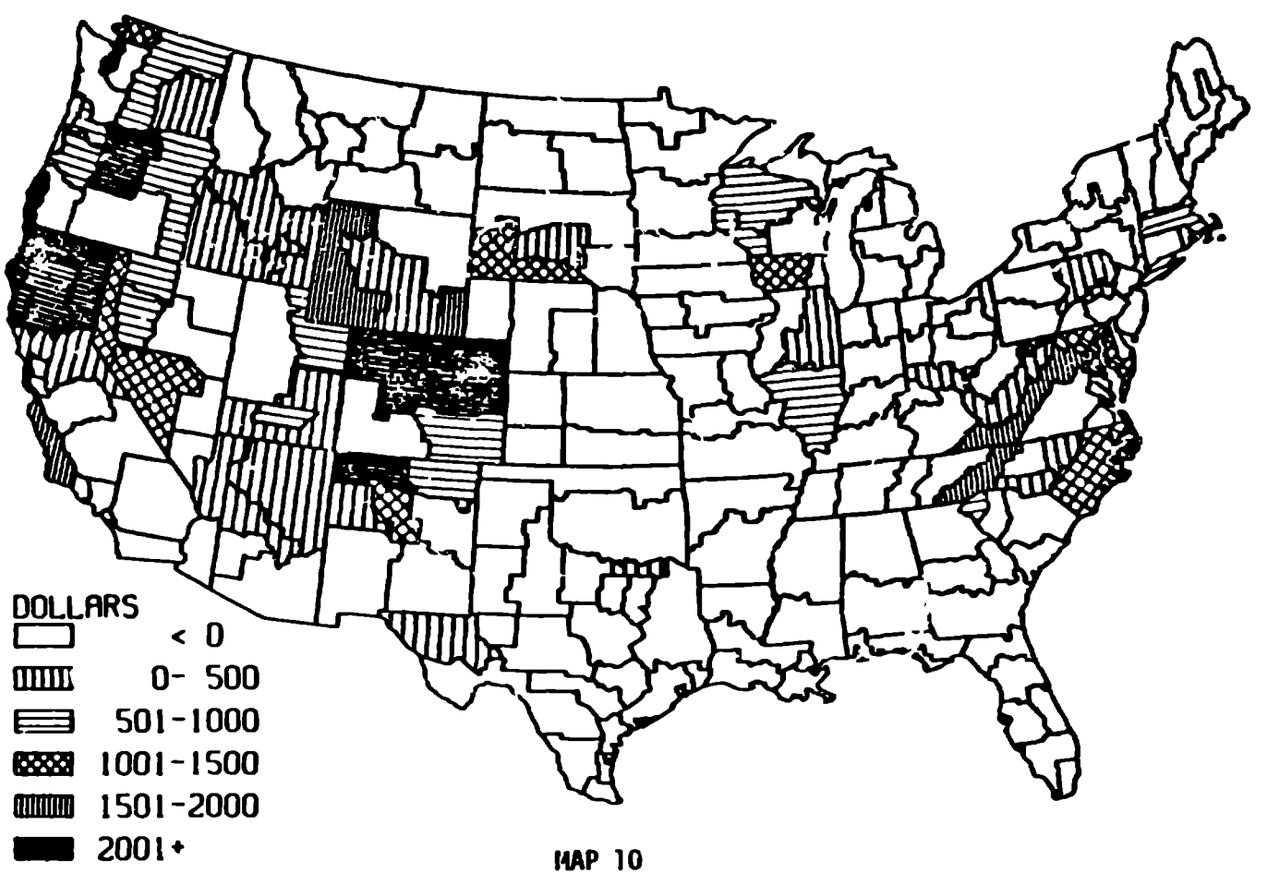
MAP 8

DISCOUNTED DOLLAR VALUE OF ELECTRICITY REPLACED BY SOLAR
OWNER-BUILT--100 PCT. RESALE RECOVERY
SUNSPACE DESIGN INCLUDES NIGHT INSULATION



MAP 9

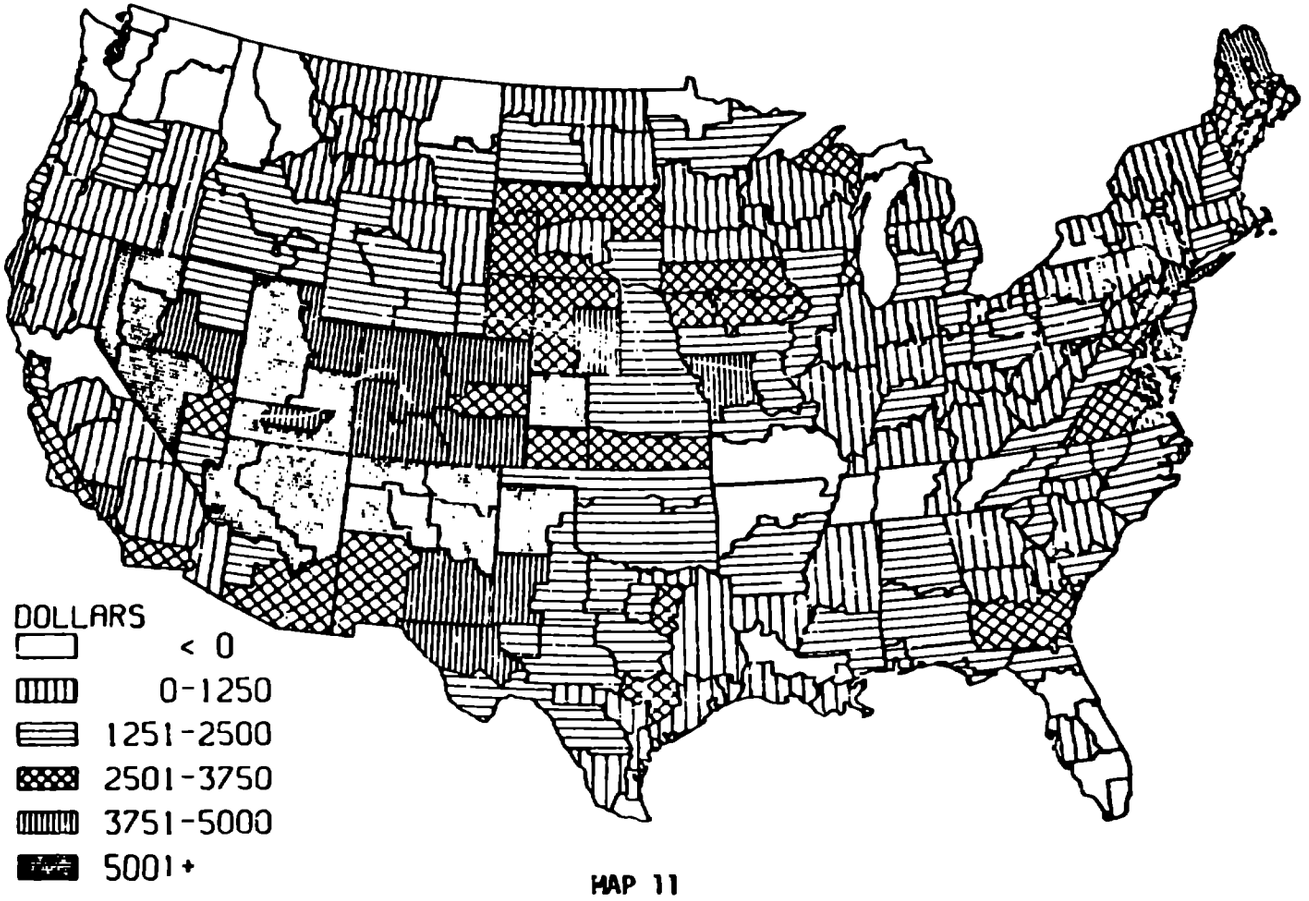
DISCOUNTED DOLLAR VALUE OF NATURAL GAS REPLACED BY SOLAR
CONTRACTOR-BUILT--100 PCT. RESALE RECOVERY
SUNSPACE DESIGN INCLUDES NIGHT INSULATION



MAP 10

DISCOUNTED DOLLAR VALUE OF ELECTRICITY REPLACED BY SOLAR CONTRACTOR-BUILT--100 PCT. RESALE RECOVERY

SUNSPACE DESIGN INCLUDES NIGHT INSULATION



MAP 11

is feasible in more than 120 regions. It should be noted that many regions are fairly close to a positive savings level for the owner-built sunspace. Slightly higher fuel prices or slightly lower solar costs would be enough to push these regions to a positive position. Many of the regions in which the sunspace design can compete against natural gas today are in the West. This is indicative of the dominance of the natural gas pricing structure on the results of this analysis. Regions with very high levels of discounted solar savings (Map 8 through 11) are the same regions with moderate to high levels of displaced fuel (Map 5) and high fuel prices (Maps 1 and 2). The nationwide pattern of discounted solar savings mirrors the pattern of the dollar value of energy savings (Maps 6 and 7).

The effect of varying the resale value from 0% to 200% is quite dramatic Figure 2 shows the discounted solar savings experienced in three locations for the owner-built sunspace design against a natural gas conventional alternative. The difficulty of empirically addressing this parameter has been examined elsewhere [7]. The resale value of a retrofit sunspace varies from region to region, making the job of identifying the increase in sale value of the home which is attributable to the design a tedious and difficult task. It is necessary to make some assessment of the real resale value that may be associated with the retrofit sunspace design before definitive statements can be made about the overall economic feasibility of such a design.

The changes in the nationwide pattern of discounted solar savings with variation of the resale parameter are impressive. Less than 75 regions have positive discounted solar savings for the contractor-built sunspace with an electric resistance back-up at the 0% resale value. When 200% resale value is assumed, 210 regions have positive discounted solar savings. This comparison can be made by examining Table 2 and 3 in the Appendix. Discounted solar savings are displayed for all three resale values in these tables.

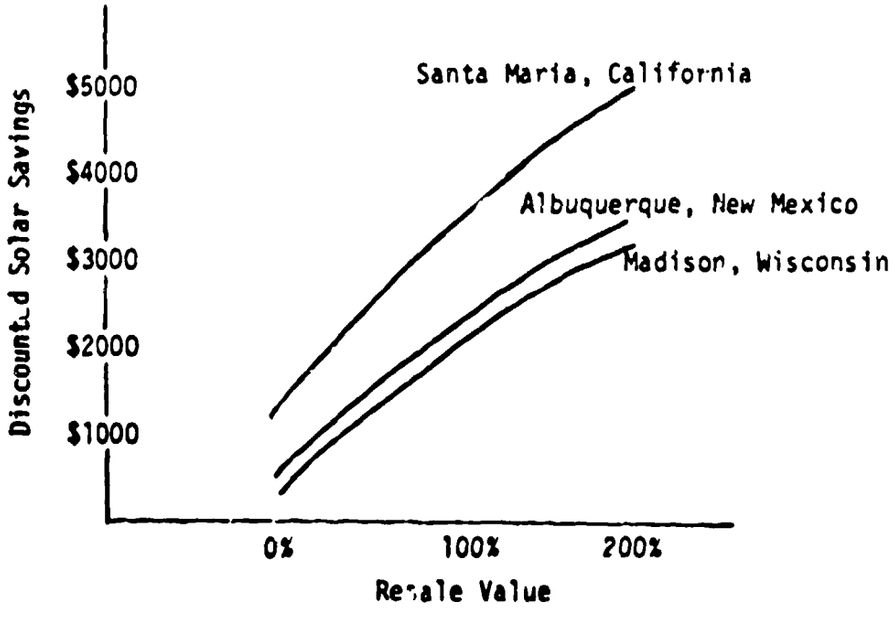


Figure 2

Discounted Solar Savings Under Various Resale Value Assumptions

5. CONCLUSIONS

- The physical performance of the fixed dimension retrofit sunspace is best in the areas of the Intermountain West which have fairly high heating loads and high levels of available sunshine.
- Regional fuel price levels tend to dominate the outcome of the economic analysis. Regions with high fuel prices show good economic performance even if the physical performance of the sunspace is not particularly good.
- The resale value of the retrofit sunspace design is an extremely important parameter. The results presented here should be used as lower (0%), middle (100%), and upper bounds (200%) of the final appraisal of the design. The 100% resale assumption represents owner recovery of initial costs.
- The owner-built design offers the homeowner ample opportunity to recoup his first cost and maximize savings.
- The sunspace design has a high potential for partially offsetting the residential space heating demands of the nations' older homes.

ACKNOWLEDGEMENTS

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APPENDIX

TABLE 1: SUNSPACE PERFORMANCE CHARACTERISTICS

TABLE 2: ECONOMIC INDICATORS FOR OWNER-BUILT SUNSPACE

TABLE 3: ECONOMIC INDICATORS FOR CONTRACTOR-BUILT SUNSPACE

TABLE 1: SUNSPACE PERFORMANCE CHARACTERISTICS

	CHLM	SSF	TSV	TSVDG	TSVDE
ALABAMA					
BIRMINGHAM	42.8	0.51	21.69	165.	415.
MOBILE	27.7	0.69	19.03	161.	364.
MONTGOMERY	35.6	0.56	20.85	159.	399.
ARIZONA					
PHOENIX	26.1	0.83	21.79	140.	460.
PRESCOTT	60.1	0.66	39.53	258.	857.
TUCSON	28.9	0.84	24.40	122.	536.
WINSLOW	62.8	0.60	37.60	246.	815.
YUMA	18.2	0.91	16.49	106.	357.
ARKANSAS					
FORT SMITH	48.5	0.47	22.99	129.	233.
LITTLE ROCK	48.8	0.47	22.83	107.	415.
CALIFORNIA					
ARCATA	61.5	0.66	40.49	415.	601.
BAKERSFIELD	35.1	0.65	22.70	233.	337.
EL TORO	31.0	0.86	26.63	273.	396.
FRESNO	40.9	0.58	23.61	121.	350.
LOS ANGELES	31.2	0.89	27.68	197.	678.
MOUNT SHASTA	68.9	0.50	34.26	675.	300.
NEEDLES	24.5	0.84	20.54	126.	270.
OAKLAND	44.6	0.75	33.24	233.	493.
POINT MUGU	36.9	0.89	32.83	183.	487.
RED BLUFF	51.7	0.55	23.05	454.	342.
SACRAMENTO	43.4	0.57	24.85	255.	146.
SAN DIEGO	26.7	0.90	24.09	109.	577.
SAN FRANCISCO	46.4	0.74	34.38	352.	510.
SANTA MARIA	46.0	0.83	38.37	393.	569.
SUNNYVALE	38.4	0.73	28.13	220.	417.
COLORADO					
COLORADO SPRINGS	77.0	0.56	42.89	440.	543.
DENVER	73.9	0.55	40.30	413.	678.
EAGLE	84.0	0.49	41.26	423.	626.
GRAND JUNCTION	70.2	0.50	34.88	177.	579.
PUEBLO	69.1	0.54	37.20	288.	583.
CONNECTICUT					
HARTFORD	76.1	0.27	20.55	120.	419.
DELAWARE					
WILMINGTON	64.5	0.35	22.80	175.	603.
DIS OF COL					
WASHINGTON	65.0	0.34	22.37	170.	389.

CHLM - Reference home space heating load (10^6 Btu).

SSF - Solar saving fraction - proportion of reference home space heating load supplied by sunspace.

TSV - Total energy saved per year (10^6 Btu).

TSVDG - 1980 dollar value of fuel savings when natural gas is the conventional fuel alternative.

TSVDE - 1980 dollar value of fuel savings when electric resistance is the conventional fuel alternative.

All performance characteristics are detailed in the text.

Table 1 (continued)

	CHLM	SSF	TSV	TSVDG	TSVDE
FLORIDA					
APALACHICOLA	22.9	0.77	17.60	137.	375.
DAYTONA BEACH	16.0	0.90	14.36	124.	207.
JACKSONVILLE	22.5	0.80	18.03	151.	439.
MIAMI	4.2	0.95	3.96	30.	76.
ORLANDO	13.2	0.92	12.21	100.	202.
TALLAHASSEE	25.9	0.74	19.04	148.	350.
TAMPA	13.1	0.92	12.09	96.	258.
WEST PALM BEACH	5.8	0.95	5.54	45.	99.
GEORGIA					
ATLANTA	45.8	0.49	22.39	89.	337.
AUGUSTA	39.4	0.56	21.79	168.	325.
MACON	35.3	0.60	21.09	172.	315.
SAVANNAH	31.4	0.65	20.27	143.	462.
IDAHO					
BOISE	72.0	0.43	30.88	218.	361.
LEWISTON	69.0	0.33	22.96	162.	172.
POCATELLO	81.5	0.42	34.31	242.	401.
ILLINOIS					
CHICAGO	74.9	0.29	22.04	262.	336.
MOLINE	77.1	0.29	22.55	221.	412.
SPRINGFIELD	70.2	0.33	23.18	276.	302.
INDIANA					
EVANSVILLE	61.9	0.34	21.18	159.	386.
FORT WAYNE	75.1	0.26	19.75	124.	345.
INDIANAPOLIS	70.4	0.28	19.97	118.	333.
SOUTH BEND	77.1	0.26	19.72	114.	344.
IOWA					
BURLINGTON	75.1	0.32	24.27	159.	380.
DES MOINES	79.3	0.32	25.25	143.	486.
MASON CITY	87.1	0.31	26.59	174.	478.
SIOUX CITY	91.2	0.31	25.42	160.	567.
KANSAS					
DODGE CITY	65.7	0.49	32.28	201.	553.
GOODLAND	74.6	0.46	35.47	187.	671.
TOPEKA	67.5	0.39	26.33	161.	458.
WICHITA	62.4	0.46	28.76	138.	561.
KENTUCKY					
COVINGTON	65.8	0.30	19.72	78.	291.
LEXINGTON	62.8	0.33	20.71	112.	312.
LOUISVILLE	62.0	0.33	20.66	104.	306.
LOUISIANA					
BATON ROUGE	27.5	0.66	18.20	137.	286.
LAKE CHARLES	25.2	0.66	16.62	116.	262.
NEW ORLEANS	24.9	0.73	18.18	100.	332.
SHREVEPORT	34.3	0.60	20.43	117.	290.
MAINE					
BANGOR	86.5	0.30	26.31	163.	531.
CARIBOU	91.7	0.26	25.23	135.	654.
PORTLAND	83.7	0.28	23.31	132.	472.
MARYLAND					
BALTIMORE	64.7	0.36	22.82	305.	500.
PATUXENT RIVER	55.1	0.40	22.10	295.	397.
MASSACHUSETTS					
BOSTON	70.4	0.31	21.58	288.	309.
MICHIGAN					
ALPENA	85.4	0.27	22.93	180.	340.
DETROIT	75.0	0.26	19.77	155.	377.
FLINT	80.7	0.25	20.03	113.	355.
GRAND RAPIDS	78.9	0.25	19.73	137.	395.
HOUGHTON	85.0	0.22	18.63	135.	527.
SAULT STE MARIE	89.1	0.25	22.64	134.	254.
TRAVERSE CITY	84.0	0.24	20.50	142.	363.

Table 1 (continued)

	CHLM	SSF	TSV	TSVDG	TSVDE
MINNESOTA					
DULUTH	92.2	0.25	23.44	164.	396.
INTERNATIONAL FA	99.0	0.24	23.45	162.	246.
MINNEAPOLIS	85.6	0.27	22.73	157.	358.
ROCHESTER	86.3	0.27	22.92	155.	368.
MISSISSIPPI					
JACKSON	35.9	0.57	20.63	181.	378.
MERIDIAN	37.1	0.56	20.92	130.	339.
MISSOURI					
COLUMBIA	66.1	0.35	23.39	122.	436.
KANSAS CITY	68.4	0.37	24.97	149.	619.
SPRINGFIELD	61.3	0.37	22.46	134.	178.
ST LOUIS	63.0	0.41	25.55	158.	374.
MONTANA					
BILLINGS	83.2	0.37	31.01	176.	291.
CUT BANK	90.3	0.36	32.54	174.	325.
DILLON	87.3	0.42	36.78	217.	345.
GLASGOW	90.6	0.29	26.03	102.	244.
GREAT FALLS	86.6	0.35	30.73	214.	269.
HELENA	86.2	0.35	30.17	211.	283.
LEWISTOWN	88.1	0.36	31.75	124.	298.
MILES CITY	87.8	0.33	28.62	186.	418.
MISSOULA	86.4	0.29	24.93	175.	234.
NEBRASKA					
GRAND ISLAND	77.3	0.38	29.20	204.	651.
NORTH PLATTE	79.3	0.42	32.96	169.	498.
OMAHA	78.5	0.34	26.59	186.	371.
SCOTTSBLUFF	79.8	0.42	33.92	165.	555.
NEVADA					
ELKO	84.6	0.49	41.16	209.	384.
ELY	85.6	0.54	46.62	202.	640.
LAS VEGAS	40.0	0.73	29.18	127.	423.
LOVELOCK	73.0	0.57	41.78	276.	860.
RENO	73.1	0.60	43.88	320.	903.
TONOPAH	72.2	0.61	44.24	323.	910.
WINNEMUCCA	78.0	0.52	40.74	269.	859.
YUCCA FLATS	49.3	0.70	34.50	150.	500.
NEW HAMPSHIRE					
CONCORD	83.8	0.26	21.94	174.	424.
NEW JERSEY					
LAKEHURST	65.2	0.35	22.67	150.	477.
NEWARK	65.3	0.34	22.14	162.	603.
NEW MEXICO					
ALBUQUERQUE	58.6	0.62	36.25	330.	831.
CLAYTON	67.0	0.59	39.82	297.	916.
FARMINGTON	71.2	0.56	40.15	446.	829.
ROSWELL	52.5	0.64	33.46	203.	596.
TRUTH OR CONSEQU	49.1	0.70	34.51	209.	499.
TUCUMCARI	56.1	0.63	35.44	215.	684.
ZUNI	72.5	0.58	42.07	255.	964.
NEW YORK					
ALBANY	79.9	0.26	20.50	125.	292.
BINGHAMTON	82.2	0.22	17.93	109.	326.
BUFFALO	79.7	0.22	17.82	108.	248.
MASSENA	86.2	0.23	19.64	177.	260.
NEW YORK	63.7	0.31	19.46	147.	609.
ROCHESTER	78.5	0.23	17.94	140.	321.
SYRACUSE	78.6	0.22	17.68	216.	325.
NO. CAROLINA					
ASHEVILLE	58.0	0.46	26.97	345.	437.
CAPE HATTERAS	41.4	0.55	22.73	341.	618.
CHARLOTTE	47.2	0.50	23.51	213.	344.
CHERRY POINT	40.9	0.56	23.08	295.	374.
GREENSBORO	53.8	0.47	25.09	180.	370.
RALEIGH	50.5	0.47	23.52	204.	381.

Table 1 (continued)

	CHLM	SSF	TSV	TSVDG	TSVDE
NORTH DAKOTA					
BISMARCK	90.7	0.30	27.14	194.	419.
FARGO	91.2	0.26	23.61	205.	337.
MINOT	92.2	0.27	24.86	191.	348.
OHIO					
AKRON	75.1	0.26	19.53	119.	408.
CINCINNATI	65.8	0.30	19.72	256.	299.
CLEVELAND	74.6	0.25	18.39	112.	345.
COLUMBUS	71.2	0.27	19.13	130.	362.
DAYTON	70.8	0.28	19.87	142.	411.
TOLEDO	76.3	0.26	20.04	137.	441.
YOUNGSTOWN	76.5	0.23	17.94	125.	375.
OKLAHOMA					
OKLAHOMA CITY	52.4	0.50	26.00	171.	395.
TULSA	52.2	0.45	23.65	170.	377.
OREGON					
ASTORIA	66.3	0.43	28.50	195.	341.
BURNS	82.0	0.40	33.17	168.	300.
MEDFORD	64.1	0.40	25.59	129.	306.
NORTH BEND	61.9	0.58	35.65	413.	426.
PENDLETON	67.3	0.34	23.08	269.	276.
PORTLAND	62.8	0.36	22.82	266.	276.
REDMOND	78.2	0.45	35.37	410.	423.
SALEM	63.4	0.38	24.30	268.	294.
PENNSYLVANIA					
ALLENTOWN	72.3	0.31	22.30	258.	362.
AVOCA	75.5	0.27	20.34	225.	330.
ERIE	78.5	0.24	19.17	224.	352.
HARRISBURG	67.0	0.31	21.00	170.	341.
PHILADELPHIA	63.9	0.34	21.79	168.	525.
PITTSBURGH	72.7	0.28	20.80	182.	387.
RHODE ISLAND					
PROVIDENCE	73.0	0.32	23.07	184.	567.
SO. CAROLINA					
CHARLESTON	34.3	0.60	20.53	165.	388.
COLUMBIA	39.7	0.56	22.38	141.	333.
GREENVILLE	46.6	0.50	23.42	245.	382.
GREER	46.6	0.50	23.43	187.	431.
SOUTH DAKOTA					
HURON	85.4	0.29	24.67	197.	559.
PIERRE	85.9	0.32	27.90	216.	286.
RAPID CITY	83.5	0.38	31.70	295.	529.
SIOUX FALLS	86.9	0.30	26.44	159.	381.
TENNESSEE					
CHATTANOOGA	50.4	0.41	20.64	124.	244.
KNOXVILLE	50.0	0.42	20.94	116.	201.
MEMPHIS	47.3	0.45	21.50	137.	230.
NASHVILLE	52.4	0.37	19.25	120.	222.
TEXAS					
ABILENE	39.8	0.64	25.41	178.	412.
AMARILLO	57.5	0.59	34.08	174.	715.
AUSTIN	28.4	0.69	19.58	112.	548.
BROWNSVILLE	12.0	0.89	10.70	51.	205.
CORPUS CHRISTI	16.5	0.83	13.72	19.	266.
DALLAS	35.8	0.60	21.50	148.	486.
DEL RIO	25.4	0.75	19.09	128.	370.
EL PASO	40.9	0.73	29.86	221.	656.
FORT WORTH	37.0	0.59	21.81	115.	336.
HOUSTON	24.2	0.68	16.36	107.	310.
KINGSVILLE	17.9	0.83	14.88	90.	289.
LAREDO	15.6	0.85	13.25	78.	257.
LUBBOCK	50.7	0.65	32.97	218.	607.
LUFKIN	31.3	0.64	19.96	132.	252.
MIDLAND	40.0	0.72	28.66	190.	446.
PORT ARTHUR	25.5	0.70	17.82	101.	290.
SAN ANGELO	35.2	0.69	24.30	161.	389.

Table 1 (continued)

	CHLM	SSF	TSV	TSVJG	TSVDE
SAN ANTONIO	26.1	0.72	18.77	107.	318.
SHERMAN	43.1	0.53	22.84	220.	289.
WACO	32.8	0.63	20.80	104.	361.
WICHITA FALLS	43.4	0.57	24.93	153.	384.
UTAH					
BRYCE CANYON	85.2	0.59	50.59	264.	624.
CEDAR CITY	74.5	0.56	41.56	217.	971.
SALT LAKE CITY	73.2	0.46	34.02	177.	846.
VERMONT					
BURLINGTON	86.7	0.22	18.90	82.	297.
VIRGINIA					
NORFOLK	50.3	0.48	23.99	104.	604.
RICHMOND	55.0	0.41	22.70	85.	546.
ROANOKE	58.7	0.42	24.66	325.	439.
WASHINGTON					
OLYMPIA	68.5	0.35	24.00	158.	228.
SEATTLE-TACOMA	60.1	0.36	23.56	194.	76.
SPOKANE	79.4	0.32	25.19	232.	193.
WHIDBEY	66.0	0.42	27.63	286.	220.
YAKIMA	73.3	0.35	25.86	279.	215.
W. VIRGINIA					
CHARLESTON	61.4	0.31	19.24	195.	269.
HUNTINGTON	61.7	0.33	20.57	241.	293.
WISCONSIN					
EAU CLAIRE	86.7	0.26	22.26	261.	309.
GREEN BAY	84.8	0.28	23.71	166.	292.
LA CROSSE	84.3	0.26	22.18	265.	286.
MADISON	85.7	0.29	24.79	316.	419.
MILWAUKEE	83.7	0.29	24.39	169.	512.
WYOMING					
CASPER	84.7	0.48	40.42	235.	399.
CHEYENNE	82.6	0.51	41.81	368.	381.
ROCK SPRINGS	85.0	0.50	42.93	347.	420.
SHERIDAN	85.8	0.37	32.08	195.	309.

TABLE 2: ECONOMIC INDICATORS FOR OWNER-BUILT SUNSPACE

	0% Resale		100% Resale		200% Resale	
	NPVG	NPVE	NPVG	NPVE	NPVG	NPVE
ALABAMA						
BIRMINGHAM	-1075.	1589.	515.	3179.	2104.	4769.
MOBILE	-1146.	983.	447.	2576.	2039.	4168.
MONTGOMERY	-1305.	1176.	312.	2873.	2008.	4569.
ARIZONA						
PHOENIX	-1742.	1797.	-0.	3539.	1742.	5281.
PRESCOTT	-157.	6489.	1606.	8231.	3348.	9973.
TUCSON	-2206.	2470.	-359.	4322.	1447.	6173.
WINSLOW	-308.	5993.	1424.	7735.	3177.	9478.
YUMA	-2197.	590.	-465.	2332.	1207.	4074.
ARKANSAS						
FORT SMITH	-1675.	-666.	-36.	973.	1603.	2612.
LITTLE ROCK	-1955.	1492.	-320.	3127.	1315.	4762.
CALIFORNIA						
ARCATA	1739.	3223.	3599.	5082.	5458.	6941.
BAKERSFIELD	-738.	94.	1126.	1957.	2989.	3821.
EL TORO	65.	3411.	1805.	5151.	3545.	6891.
FRESNO	-2228.	278.	-376.	2130.	1476.	3982.
LOS ANGELES	-968.	4390.	772.	6130.	2512.	7850.
MOUNT SHASTA	5267.	-332.	7126.	1527.	8985.	3386.
NEEDLES	-1900.	-414.	-172.	1314.	1556.	3042.
OAKLAND	-776.	1894.	1411.	3781.	2998.	5669.
POINT MUGU	-1149.	2128.	591.	3868.	2331.	5608.
RED BLUFF	2272.	166.	4731.	2025.	5990.	3884.
SACRAMENTO	-430.	-1562.	1429.	297.	3288.	2157.
SAN DIEGO	-1508.	3017.	313.	4838.	2134.	6659.
SAN FRANCISCO	854.	2093.	2721.	3980.	4608.	5867.
SANTA MARIA	1264.	2690.	3221.	4627.	5157.	6563.
SUNNYVALE	-953.	997.	934.	2884.	2821.	4772.
COLORADO						
COLORADO SPRINGS	2384.	2851.	4094.	4561.	5804.	6271.
DENVER	1934.	4357.	3687.	6110.	5440.	7864.
EAGLE	2067.	3766.	3820.	5520.	5573.	7273.
GRAND JUNCTION	-1202.	3186.	492.	4939.	2245.	6693.
PUEBLO	327.	3324.	2037.	5034.	3747.	6744.
CONNECTICUT						
HARTFORD	-1691.	1633.	-101.	3224.	1490.	4814.
DELAWARE						
WILMINGTON	-1217.	3540.	502.	5258.	2220.	6977.
DIS OF COL						
WASHINGTON	-1320.	974.	415.	2709.	2150.	4444.
FLORIDA						
APALACHICOLA	-1553.	1029.	92.	2658.	1717.	4294.
DAYTONA BEACH	-1603.	-920.	-68.	695.	1547.	2310.
JACKSONVILLE	-1339.	1794.	286.	3415.	1911.	5044.
MIAMI	-2942.	-2453.	-1337.	-848.	268.	757.
ORLANDO	-2019.	-986.	-404.	629.	1210.	2244.
TALLAHASSEE	-1402.	799.	233.	2434.	1868.	3069.
TAMPA	-2142.	-361.	-477.	1274.	1188.	2909.
WEST PALM BEACH	-2741.	-2180.	-1136.	-575.	469.	1030.

NPVG - Net present value of the design when natural gas is the conventional fuel alternative.

NPVE - Net present value of the design when electric resistance is the conventional fuel alternative.

Economic indicators are detailed in the text.

Table 2 (continued)

	0% Resale		100% Resale		200% Resale	
	NPVG	NPVE	NPVG	NPVE	NPVG	NPVE
GEORGIA						
ATLANTA	-2151.	449.	-531.	2246.	1008.	3848.
AUGUSTA	-947.	819.	601.	2166.	2148.	3714.
MACON	-929.	470.	630.	2030.	2190.	3569.
SAVANNAH	-1209.	2232.	258.	3776.	1805.	5317.
IDAHO						
BOISE	-572.	745.	1117.	2434.	2807.	4124.
LEWISTON	-1349.	-1489.	360.	200.	2050.	1890.
POCATELLO	-244.	1219.	1446.	2909.	3135.	4599.
ILLINOIS						
CHICAGO	-146.	265.	1627.	2039.	3401.	3813.
MOLINE	-714.	1169.	1060.	2943.	2834.	4717.
SPRINGFIELD	122.	-43.	1856.	1691.	3590.	3425.
INDIANA						
EVANSVILLE	-1277.	1135.	368.	2780.	2012.	4425.
FORT WAYNE	-2039.	357.	-255.	2141.	1530.	3925.
INDIANAPOLIS	-2140.	192.	-346.	1985.	1448.	3779.
SOUTH BEND	-2140.	387.	-374.	2153.	1393.	3919.
IOWA						
BURLINGTON	-1529.	819.	233.	2582.	1996.	4344.
DES MOINES	-1723.	2072.	34.	3830.	1791.	5587.
MASON CITY	-1343.	1985.	444.	3742.	2202.	5500.
SIOUX CITY	-1500.	3036.	257.	4794.	2014.	6551.
KANSAS						
DODGE CITY	-727.	3080.	927.	4734.	2581.	6388.
GOODLAND	-916.	4477.	738.	6131.	2392.	7785.
TOPEKA	-1538.	1700.	243.	3482.	2025.	5263.
WICHITA	-1577.	3184.	77.	4837.	1731.	6491.
KENTUCKY						
LOVINGTON	-2536.	-144.	-816.	1576.	904.	3296.
LEXINGTON	-2068.	100.	-348.	1820.	1372.	3540.
LOUISVILLE	-2330.	-117.	-541.	1672.	1248.	3461.
LOUISIANA						
BATON ROUGE	-2947.	-1423.	-643.	882.	1602.	3187.
LAKE CHARLES	-1704.	-188.	-131.	1385.	1441.	2957.
NEW ORLEANS	-2039.	521.	-410.	2150.	1219.	3778.
SHREVEPORT	-1702.	142.	-130.	1714.	1443.	3286.
MAINE						
BANGOR	-1247.	2850.	427.	4497.	2071.	6117.
CARIBOU	-1598.	4304.	46.	5948.	1669.	7591.
PORTLAND	-1762.	2026.	-57.	3730.	1647.	5435.
MARYLAND						
BALTIMORE	701.	2480.	2343.	4122.	3983.	5764.
PATUXENT RIVER	569.	1262.	2212.	2904.	3854.	4547.
MASSACHUSETTS						
BOSTON	-21.	-277.	1859.	1604.	3740.	3485.
MICHIGAN						
ALPENA	-1173.	408.	555.	2136.	2283.	3864.
DETROIT	-1710.	650.	115.	2475.	1940.	4300.
FLINT	-2304.	361.	-466.	2200.	1372.	4038.
GRAND RAPIDS	-2033.	782.	-172.	2643.	1689.	4505.
HOUGHTON	-2050.	2348.	-189.	4210.	1673.	6071.
SAULT STE MARIE	-1794.	-619.	-66.	1109.	1662.	2837.
TRAVERSE CITY	-1902.	412.	-100.	2273.	1701.	4134.
MINNESOTA						
DULUTH	-1303.	997.	342.	2492.	2068.	4408.
INTERNATIONAL FA	-1402.	-694.	324.	1032.	2049.	2757.
MINNEAPOLIS	-1625.	481.	175.	2281.	1975.	4081.
ROCHESTER	-1657.	595.	142.	2395.	1942.	4195.

Table 2 (continued)

	0% Resale		100% Resale		200% Resale	
	NPVG	NPVE	NPVG	NPVE	NPVG	NPVE
MISSISSIPPI						
JACKSON	-895.	1120.	708.	2729.	2341.	4332.
MERIDIAN	-1584.	579.	18.	2182.	1621.	3794.
MISSOURI						
COLUMBIA	-1904.	1598.	-203.	3300.	1499.	5002.
KANSAS CITY	-1810.	3477.	28.	5315.	1866.	7153.
SPRINGFIELD	-2013.	-1732.	-175.	106.	1603.	1944.
ST LOUIS	-1409.	873.	293.	2575.	1995.	4276.
MONTANA						
BILLINGS	-1237.	-181.	500.	1556.	2257.	3293.
CUT BANK	-1250.	245.	477.	1971.	2203.	3698.
DILLON	-660.	481.	1066.	2208.	2793.	3934.
GLASGOW	-2242.	-734.	-505.	1003.	1232.	2740.
GREAT FALLS	-705.	-190.	1021.	1534.	2748.	3263.
HELENA	-742.	-253.	985.	1474.	2711.	3200.
LEWISTOWN	-1917.	-77.	-191.	1650.	1536.	3376.
MILES CITY	-1107.	1321.	630.	3058.	2367.	4795.
MISSOULA	-1298.	-834.	489.	893.	2215.	2619.
NEBRASKA						
GRAND ISLAND	-871.	4059.	874.	5804.	2618.	7548.
NORTH PLATTE	-1890.	2242.	-146.	3987.	1598.	5731.
OMAHA	-1216.	646.	576.	2437.	2367.	4228.
SCOTTSBLUFF	-1402.	2915.	343.	4659.	2067.	6403.
NEVADA						
ELKO	-841.	899.	933.	2643.	2677.	4387.
ELY	-804.	3954.	865.	5682.	2593.	7410.
LAS VEGAS	-1869.	1391.	-151.	3120.	1508.	4848.
LOVELOCK	104.	6522.	1848.	8266.	3592.	10010.
RENO	702.	7032.	2446.	8776.	4190.	10520.
TONOPAH	770.	7153.	2499.	8881.	4227.	10609.
WINNEMUCCA	11.	6516.	1755.	8260.	3499.	10004.
YUCCA FLATS	-1576.	2303.	152.	4031.	1860.	5759.
NEW HAMPSHIRE						
CONCORD	-1157.	1504.	525.	3185.	2206.	4866.
NEW JERSEY						
LAKEHURST	-1705.	1846.	55.	3665.	1874.	5485.
NEWARK	-1750.	3179.	139.	5069.	2028.	6958.
NEW MEXICO						
ALBUQUERQUE	840.	6196.	2576.	7933.	4313.	9669.
CLAYTON	404.	7207.	2140.	8943.	3876.	10680.
FARMINGTON	2411.	6171.	4147.	7908.	5804.	9644.
ROSWELL	-873.	3425.	863.	5161.	2600.	6898.
TRUTH OR CONSEQU	-767.	2273.	949.	4009.	2686.	5746.
TUCUMCARI	-711.	4459.	1026.	6196.	2702.	7932.
ZUNI	-166.	7771.	1570.	9508.	3307.	11244.
NEW YORK						
ALBANY	-1993.	-232.	-228.	1534.	1538.	3299.
BINGHAMTON	-2104.	273.	-389.	1988.	1326.	3703.
BUFFALO	-2523.	-1050.	-612.	854.	1300.	2765.
MASSENA	-1282.	-605.	481.	1158.	2294.	2921.
NEW YORK	-1769.	3437.	35.	5242.	1839.	7046.
ROCHESTER	-1803.	33.	-58.	1838.	1747.	3643.
SYRACUSE	-753.	167.	1010.	1930.	2773.	3693.
NO. CAROLINA						
ASHEVILLE	1207.	1758.	2397.	3388.	4587.	5018.
CAPE HATTERAS	700.	4147.	2292.	5658.	3804.	7170.
CHARLOTTE	-520.	669.	1110.	2299.	2740.	3929.
CHERRY POINT	841.	1261.	2352.	2773.	3804.	4284.
GREENSBORO	-701.	1178.	771.	2709.	2302.	4241.
RALEIGH	-394.	1345.	1117.	2857.	2629.	4369.

Table 2 (continued)

	0% Resale		100% Resale		200% Resale	
	NPVG	NPVE	NPVG	NPVE	NPVG	NPVE
NORTH DAKOTA						
BISMARCK	-821.	1502.	835.	3157.	2490.	4813.
FARGO	-602.	528.	973.	2189.	2628.	3836.
MINOT	-871.	662.	784.	2317.	2459.	3972.
OHIO						
AKRON	-2109.	1039.	-355.	2853.	1459.	4667.
CINCINNATI	-306.	-305.	1475.	1535.	3315.	3375.
CLEVELAND	-2298.	264.	-467.	2094.	1304.	3925.
COLUMBUS	-1810.	700.	-95.	2414.	1619.	4128.
DAYTON	-1859.	1074.	-47.	2687.	1766.	4700.
TOLEDO	-2049.	1316.	-180.	3185.	1609.	5054.
YOUNGSTOWN	-1994.	741.	-225.	2510.	1594.	4278.
OKLAHOMA						
OKLAHOMA CITY	-1200.	1074.	444.	2798.	2107.	4521.
TULSA	-1402.	758.	373.	2533.	2148.	4308.
OREGON						
ASTORIA	-919.	479.	785.	2184.	2490.	3889.
BURNS	-1476.	-202.	320.	1594.	2145.	3390.
MEDFORD	-1995.	-129.	-199.	1666.	1597.	3462.
NORTH BEND	1846.	1291.	3642.	3087.	5438.	4883.
PENDLETON	50.	-295.	1795.	1410.	3500.	3115.
PORTLAND	49.	-297.	1754.	1408.	3459.	3113.
REDMOND	1992.	1442.	3697.	3146.	5402.	4851.
SALEM	76.	-86.	1781.	1619.	3486.	3324.
PENNSYLVANIA						
ALLENTOWN	-148.	638.	1606.	2382.	3349.	4125.
AVOCA	-596.	262.	1147.	2006.	2890.	3749.
ERIE	-621.	511.	1128.	2261.	2878.	4011.
HARRISBURG	-1329.	400.	409.	2138.	2147.	3876.
PHILADELPHIA	-1405.	2522.	362.	4289.	2130.	6056.
PITTSBURGH	-1356.	757.	473.	2586.	2301.	4414.
RHODE ISLAND						
PROVIDENCE	-1034.	3128.	630.	4842.	2344.	6556.
SO. CAROLINA						
CHARLESTON	-1041.	1306.	529.	2875.	2098.	4445.
COLUMBIA	-1315.	713.	229.	2257.	1774.	3802.
GREENVILLE	94.	1296.	1638.	2841.	3183.	4385.
GREER	-685.	1873.	859.	3418.	2404.	4962.
SOUTH DAKOTA						
HURON	-702.	3153.	873.	4805.	2548.	6464.
PIERRE	-532.	-70.	1124.	1585.	2779.	3240.
RAPID CITY	536.	2809.	2191.	4459.	3847.	6115.
SIOUX FALLS	-1302.	1054.	353.	2709.	2008.	4364.
TENNESSEE						
CHATTANOOGA	-1601.	-454.	-60.	1147.	1541.	2748.
KNOXVILLE	-1746.	-917.	-145.	664.	1435.	2245.
MEMPHIS	-1716.	-857.	-1.	858.	1713.	2573.
NASHVILLE	-1744.	-745.	-132.	867.	1480.	2480.
TEXAS						
ABILENE	-805.	1650.	739.	3194.	2203.	4737.
AMARILLO	-945.	5159.	635.	6739.	2214.	8319.
AUSTIN	-1700.	3179.	-199.	4759.	1302.	6340.
BROWNSVILLE	-2842.	-1106.	-1148.	588.	546.	2282.
CORPUS CHRISTI	-3273.	-388.	-1579.	1308.	1240.	3000.
DALLAS	-1301.	2929.	286.	4015.	1873.	5474.
DEL RIO	-1506.	1073.	17.	2656.	1690.	4239.
EL PASO	-3049.	4384.	1243.	5596.	2836.	7609.
FORT WORTH	-1608.	745.	-124.	2285.	1449.	3833.
HOUSTON	-2018.	197.	-357.	1959.	1305.	3527.
KINGSVILLE	-2311.	-123.	-617.	1571.	1077.	3266.
LAREDO	-2478.	-498.	-784.	1197.	910.	2891.
LUBBOCK	-5913.	3624.	1108.	5324.	2807.	7023.
LUFKIN	-1619.	-488.	-17.	1114.	1645.	2836.
MIDLAND	-977.	1721.	722.	3421.	2421.	5120.

Table 2 (continued)

	0% Resale		100% Resale		200% Resale	
	NPVG	NPVE	NPVG	NPVE	NPVG	NPVE
PORT ARTHUR	-2103.	-105.	-469.	1589.	1225.	3283.
SAN ANGELO	-1308.	1058.	331.	2758.	2051.	4457.
SAN ANTONIO	-1654.	459.	-275.	2043.	1308.	3426.
SHERMAN	-259.	197.	1305.	1741.	2849.	3284.
WACO	-1814.	1050.	-270.	2594.	1273.	4137.
WICHITA FALLS	-1145.	1312.	399.	2856.	1943.	4400.
UTAH						
BRYCE CANYON	223.	4029.	1829.	5634.	3434.	7239.
CEDAR CITY	-415.	8126.	1191.	9731.	2796.	11337.
SALT LAKE CITY	-947.	6650.	659.	8256.	2264.	9861.
VERMONT						
BURLINGTON	-2424.	-27.	-729.	1668.	966.	3363.
VIRGINIA						
NORFOLK	-2071.	3651.	-402.	5320.	1267.	6989.
RICHMOND	-2172.	3129.	-580.	4721.	1011.	6312.
ROANOKE	1113.	1910.	2687.	3484.	4261.	5058.
WASHINGTON						
OLYMPIA	-1094.	-530.	455.	1015.	2004.	2547.
SEATTLE-TACOMA	-602.	-2329.	946.	-780.	2495.	769.
SPOKANE	-450.	-1426.	1272.	296.	2994.	2019.
WHIDBEY	642.	-634.	2190.	915.	3739.	2462.
YAKIMA	131.	-1112.	1880.	659.	3630.	2387.
W. VIRGINIA						
CHARLESTON	-1019.	-479.	734.	1274.	2407.	3027.
HUNTINGTON	-501.	-295.	1302.	1509.	3106.	3312.
WISCONSIN						
EAU CLAIRE	-89.	34.	1646.	1769.	3300.	3503.
GREEN BAY	-1336.	-141.	385.	1580.	2107.	3302.
LA CROSSE	-34.	-240.	1700.	1495.	3435.	3229.
MADISON	667.	1332.	2401.	3066.	4135.	4800.
MILWAUKEE	-1298.	2462.	423.	4183.	2144.	5904.
WYOMING						
CASPER	-521.	1008.	1257.	2786.	3035.	4563.
CHEYENNE	1270.	789.	3054.	2567.	4832.	4345.
ROCK SPRINGS	985.	1251.	2763.	3029.	4541.	4807.
SHERIDAN	-1065.	-51.	713.	1727.	2491.	3505.

TABLE 3: ECONOMIC INDICATORS FOR CONTRACTOR-BUILT SUNSPACE

	0% Resale		100% Resale		200% Resale	
	NPVG	NPVE	NPVG	NPVE	NPVG	NPVE
ALABAMA						
BIRMINGHAM	-3074.	-429.	-536.	2129.	2042.	4586.
MOBILE	-3107.	-1039.	-506.	1523.	1936.	4085.
MONTGOMERY	-3530.	-969.	-805.	1756.	1720.	4481.
ARIZONA						
PHOENIX	-3941.	-402.	-1145.	2354.	1652.	5191.
PRESCOTT	-2336.	4290.	461.	7087.	3258.	9683.
TUCSON	-4534.	141.	-1566.	3110.	1402.	6078.
WINSLOW	-2507.	3794.	290.	6561.	3006.	9388.
YUMA	-4396.	-1609.	-1600.	1187.	1197.	3984.
ARKANSAS						
FORT SMITH	-3702.	-2743.	-1117.	-109.	1548.	2526.
LITTLE ROCK	-4027.	-580.	-1399.	2049.	1230.	4677.
CALIFORNIA						
ARCATA	-598.	886.	2382.	3866.	5302.	6846.
BAKERSFIELD	-3000.	-2249.	-94.	738.	2873.	3725.
EL TORO	-2131.	1215.	662.	4008.	3455.	6801.
FRESNO	-4527.	-2051.	-1588.	518.	1380.	3886.
LOS ANGELES	-3104.	2183.	-371.	4976.	2422.	7770.
MOUNT SHASTA	2930.	-2670.	5909.	310.	8809.	3290.
NEEDLES	-4083.	-2597.	-1308.	173.	1407.	2953.
OAKLAND	-3140.	-476.	-122.	2548.	2901.	5571.
POINT MUGU	-3345.	-69.	-552.	2725.	2241.	5518.
RED BLUFF	-65.	-2171.	2915.	808.	5874.	3788.
SACRAMENTO	-2707.	-3899.	213.	-919.	3173.	2061.
SAN DIEGO	-3800.	725.	-830.	3645.	2040.	6565.
SAN FRANCISCO	-1537.	-277.	1497.	2747.	4520.	5770.
SANTA MARIA	-1144.	262.	1957.	3363.	5037.	6464.
SUNNYVALE	-3323.	-1373.	-299.	1651.	2724.	4674.
COLORADO						
COLORADO SPRINGS	243.	690.	2949.	3436.	5745.	6182.
DENVER	-279.	2145.	2536.	4955.	5330.	7773.
EAGLE	-146.	1554.	2669.	4359.	5433.	7162.
GRAND JUNCTION	-3474.	974.	-660.	3783.	2134.	6602.
PUEBLO	-1853.	1163.	913.	3910.	3659.	6656.
CONNECTICUT						
HARTFORD	-3711.	-387.	-1152.	2172.	1407.	4731.
DELAWARE						
WILMINGTON	-3308.	1369.	-628.	4128.	2131.	6888.
DIS OF COL						
WASHINGTON	-3510.	-1216.	-725.	1565.	2000.	4354.
FLORIDA						
APALACHICOLA	-3626.	-1049.	-997.	1580.	1632.	3914.
DAYTONA BEACH	-3731.	-2968.	-1134.	-371.	1433.	2226.
JACKSONVILLE	-3379.	-266.	-786.	2347.	1827.	4960.
MIAMI	-4979.	-4490.	-2398.	-1509.	104.	673.
ORLANDO	-4008.	-3034.	-1471.	-437.	1146.	2160.
TALLAHASSEE	-3474.	-1744.	-846.	1295.	1703.	4209.
TAMPA	-4104.	-2434.	-1556.	195.	1073.	2824.
WEST PALM BEACH	-4778.	-4216.	-2196.	-1635.	305.	947.

NPVG - Net present value of the design when natural gas is the conventional fuel alternative.

NPVE - Net present value of the design when electric resistance is the conventional fuel alternative.

Economic indicators are detailed in the text.

Table 3 (continued)

	0% Resale		100% Resale		200% Resale	
	NPVG	NPVE	NPVG	NPVE	NPVG	NPVE
GEORGIA						
ATLANTA	-4101.	-1382.	-1588.	1192.	905.	3765.
AUGUSTA	-2915.	-1350.	-424.	1142.	2007.	3633.
MACON	-2913.	-1513.	-402.	997.	2108.	3503.
SAVANNAH	-3256.	263.	-767.	2755.	1725.	5246.
IDAHO						
BOISE	-2709.	-1392.	5.	1322.	2749.	4036.
LEWISTON	-3406.	-3626.	-752.	-912.	1952.	1802.
POCATELLO	-2381.	-917.	333.	1797.	3048.	4511.
ILLINOIS						
CHICAGO	-2363.	-1971.	463.	875.	3310.	3721.
MOLINE	-2950.	-1067.	-104.	1779.	2742.	4625.
SPRINGFIELD	-2067.	-2232.	716.	552.	3500.	3335.
INDIANA						
EVANSVILLE	-3301.	-949.	-717.	1695.	1947.	4339.
FORT WAYNE	-4207.	-1892.	-1425.	971.	1457.	3833.
INDIANAPOLIS	-4400.	-2068.	-1522.	809.	1356.	3687.
SOUTH BEND	-4307.	-1841.	-1533.	994.	1301.	3828.
IOWA						
BURLINGTON	-3752.	-1403.	-924.	1425.	1905.	4253.
DES MOINES	-3940.	-144.	-1120.	2676.	1701.	5496.
[illegible] CITY	-3530.	-232.	-710.	2589.	2111.	5409.
SIOUX CITY	-3717.	819.	-897.	3640.	1923.	6460.
KANSAS						
DODGE CITY	-2821.	986.	-163.	3644.	2475.	6302.
GOODLAND	-3010.	2383.	-352.	5041.	2306.	7699.
TOPEKA	-3704.	-546.	-926.	2313.	1953.	5171.
WICHITA	-3672.	1089.	-1014.	3747.	1645.	6405.
KENTUCKY						
COVINGTON	-4708.	-2316.	-1947.	445.	815.	3207.
LEXINGTON	-4240.	-2072.	-1479.	689.	1283.	3451.
LOUISVILLE	-4504.	-2371.	-1714.	499.	1156.	3369.
LOUISIANA						
BATON ROUGE	-5811.	-4287.	-2133.	-605.	1545.	3069.
LAKE CHARLES	-3702.	-2186.	-1172.	345.	1359.	2875.
NEW ORLEANS	-4103.	-1544.	-1485.	1075.	1154.	3694.
SHREVEPORT	-3700.	-1857.	-1170.	674.	1361.	3204.
MAINE						
BANGOR	-3299.	767.	-657.	3409.	1985.	6051.
CARIBOU	-3680.	2222.	-1038.	4864.	1604.	7506.
PORTLAND	-3917.	-129.	-1175.	2609.	1559.	5347.
MARYLAND						
BALTIMORE	-1380.	399.	1260.	3039.	3900.	5679.
PATUXENT RIVER	-1511.	-818.	1129.	1821.	3766.	4461.
MASSACHUSETTS						
BOSTON	-2364.	-2639.	630.	374.	3643.	3388.
MICHIGAN						
ALPENA	-3395.	-1774.	-581.	1000.	2174.	3775.
DETROIT	-4007.	-1647.	-1080.	1279.	1846.	4206.
FLINT	-4616.	-1951.	-1670.	596.	1277.	3943.
GRAND RAPIDS	-4373.	-1597.	-1390.	1426.	1583.	4409.
HOUGHTON	-4309.	9.	-1406.	2992.	1577.	5975.
SAULT STE MARIE	-3976.	-2802.	-1202.	-27.	1573.	2747.
TRAVERSE CITY	-4301.	-1928.	-1318.	1055.	1665.	4038.
MINNESOTA						
DULUTH	-3502.	-1222.	-792.	1548.	1978.	4318.
INTERNATIONAL FA	-3501.	-2873.	-810.	-102.	1960.	2668.
MINNEAPOLIS	-3892.	-1786.	-1005.	1101.	1862.	3988.
ROCHESTER	-3925.	-1672.	-1038.	1215.	1849.	4102.

Table 3 (continued)

	0% Resale		100% Resale		200% Resale	
	NPVG	NPVE	NPVG	NPVE	NPVG	NPVE
MISSISSIPPI						
JACKSON	-2929.	-908.	-351.	1670.	2227.	4246.
MERIDIAN	-3618.	-1455.	-1040.	1129.	1538.	3701.
MISSOURI						
COLUMBIA	-4056.	-553.	-1322.	2180.	1411.	4914.
KANSAS CITY	-4122.	1165.	-1175.	4111.	1771.	7059.
SPRINGFIELD	-4325.	-4044.	-1379.	-1098.	1508.	1649.
ST LOUIS	-3500.	-1279.	-827.	1455.	1907.	4188.
MONTANA						
BILLINGS	-3430.	-2373.	-642.	415.	2147.	3203.
CUT BANK	-3430.	-1936.	-658.	836.	2114.	3608.
DILLON	-2841.	-1699.	-69.	1073.	2703.	3845.
GLASGOW	-4435.	-2926.	-1647.	-138.	1142.	2650.
GREAT FALLS	-2806.	-2371.	-114.	401.	2058.	3173.
HELENA	-2922.	-2433.	-150.	335.	2642.	3111.
LEWISTOWN	-4098.	-2257.	-1326.	515.	1496.	3287.
MILES CITY	-3299.	-872.	-511.	1917.	2277.	4705.
MISSOULA	-3418.	-3014.	-646.	-242.	2126.	2530.
NEBRASKA						
GRAND ISLAND	-3072.	1858.	-272.	4658.	2528.	7456.
NORTH PLATTE	-4092.	41.	-1292.	2841.	1508.	5641.
OMAHA	-3472.	-1611.	-599.	1262.	2275.	4136.
SCOTTSBLUFF	-3603.	713.	-803.	3513.	1997.	6313.
NEVADA						
ELKO	-3012.	-1302.	-212.	1497.	2507.	4297.
ELY	-3046.	1771.	-271.	4546.	2503.	7321.
LAS VEGAS	-4072.	-701.	-1297.	1984.	1478.	4758.
LOVELOCK	-2097.	4321.	703.	7120.	3502.	9920.
RENO	-1499.	4831.	1300.	7630.	4059.	10429.
TONOPAH	-1412.	4970.	1363.	7745.	4137.	10520.
WINNEMUCCA	-2150.	4315.	609.	7114.	3409.	9914.
YUCCA FLATS	-3759.	120.	-984.	2895.	1751.	5670.
NEW HAMPSHIRE						
CONCORD	-3204.	-624.	-582.	2078.	2119.	4779.
NEW JERSEY						
LAKEHURST	-4055.	-444.	-1137.	2473.	1700.	5391.
NEWARK	-4123.	807.	-1096.	3834.	1930.	6860.
NEW MEXICO						
ALBUQUERQUE	-1352.	4004.	1435.	6792.	4263.	9579.
CLAYTON	-1709.	5015.	999.	7802.	3757.	10593.
FARMINGTON	219.	3979.	3006.	6767.	5774.	9554.
ROSWELL	-3055.	1233.	-278.	4020.	2510.	6808.
TRUTH OR CONSEQU	-2979.	81.	-192.	2868.	2586.	5656.
TUCUMCARI	-2903.	2267.	-115.	5055.	2672.	7842.
ZUNI	-2358.	5579.	429.	8367.	3247.	11154.
NEW YORK						
ALBANY	-4240.	-2459.	-1337.	375.	1447.	3208.
BINGHAMTON	-4271.	-1893.	-1517.	860.	1237.	3614.
BUFFALO	-4922.	-3457.	-1860.	-395.	1202.	2667.
MASSENA	-3500.	-2829.	-676.	1.	2153.	2830.
NEW YORK	-4041.	1165.	-1148.	4055.	1746.	6952.
ROCHESTER	-4137.	-2241.	-1241.	655.	1654.	3550.
SYRACUSE	-2977.	-2057.	-148.	772.	2602.	3602.
NO. CAROLINA						
ASHEVILLE	-800.	-308.	1821.	2313.	4402.	4934.
CAPE HATTERAS	-1146.	2220.	1289.	4456.	3725.	7091.
CHARLOTTE	-2506.	-1398.	35.	1223.	2636.	3844.
CHERRY POINT	-1046.	-665.	1350.	1770.	3705.	4205.
GREENSBORO	-2711.	-772.	-244.	1694.	2242.	4101.
RALEIGH	-2321.	-581.	115.	1854.	2550.	4290.

Table 3 (continued)

	0% Resale		100% Resale		200% Resale	
	NPVG	NPVE	NPVG	NPVE	NPVG	NPVE
NORTH DAKOTA						
BISMARCK	-2917.	-594.	-256.	2066.	2404.	4727.
FARGO	-2778.	-1568.	-118.	1092.	2542.	3752.
MINOT	-2967.	-1434.	-307.	1226.	2353.	3886.
OHIO						
AKRON	-4454.	-1246.	-1544.	1664.	1306.	4574.
CINCINNATI	-2650.	-2619.	270.	330.	3220.	3280.
CLEVELAND	-4601.	-2040.	-1666.	895.	1269.	3831.
COLUMBUS	-3976.	-1466.	-1223.	1286.	1550.	4039.
DAYTON	-4142.	-1209.	-1235.	1699.	1673.	4606.
TOLEDO	-4398.	-1033.	-1402.	1962.	1543.	4957.
YOUNGSTOWN	-4224.	-1489.	-1386.	1349.	1452.	4187.
OKLAHOMA						
OKLAHOMA CITY	-3456.	-1102.	-689.	1665.	2017.	4431.
TULSA	-3640.	-1479.	-792.	1369.	2056.	4216.
OREGON						
ASTORIA	-3074.	-1675.	-336.	1063.	2402.	3801.
BURNS	-3738.	-2464.	-858.	416.	2023.	3297.
MEDFORD	-4257.	-2392.	-1376.	489.	1504.	3369.
NORTH BEND	-416.	-971.	2465.	1909.	5345.	4790.
PENDLETON	-2065.	-2450.	673.	288.	3411.	3027.
PORTLAND	-2106.	-2451.	632.	287.	3371.	3025.
REDMOND	-1062.	-713.	2576.	2025.	5314.	4763.
SALEM	-2079.	-2240.	659.	498.	3397.	3236.
PENNSYLVANIA						
ALLENTOWN	-2358.	-1562.	460.	1237.	3259.	4035.
AVOCA	-2797.	-1938.	2.	860.	2800.	3659.
ERIE	-2829.	-1697.	-21.	1112.	2768.	3920.
HARRISBURG	-3523.	-1794.	-733.	996.	2057.	3786.
PHILADELPHIA	-3633.	293.	-797.	3129.	2038.	5965.
PITTSBURGH	-3657.	-1544.	-725.	1388.	2207.	4320.
RHODE ISLAND						
PROVIDENCE	-3250.	962.	-497.	3714.	2255.	6467.
SO. CAROLINA						
CHARLESTON	-3035.	-689.	-509.	1837.	2017.	4363.
COLUMBIA	-3260.	-1253.	-794.	1234.	1693.	3721.
GREENVILLE	-1872.	-669.	615.	1818.	3102.	4305.
GREER	-2650.	-92.	-164.	2395.	2323.	4882.
SOUTH DAKOTA						
HURON	-2878.	1057.	-218.	3718.	2442.	6378.
PIERRE	-2628.	-2166.	33.	494.	2093.	3154.
RAPID CITY	-1500.	708.	1100.	3368.	3701.	6028.
SIOUX FALLS	-3398.	-1042.	-738.	1618.	1922.	4278.
TENNESSEE						
CHATTANOOGA	-3693.	-2486.	-1117.	89.	1438.	2665.
KNOXVILLE	-3734.	-2925.	-1191.	-381.	1353.	2162.
MEMPHIS	-3803.	-3023.	-1129.	-270.	1645.	2484.
NASHVILLE	-3789.	-2790.	-1197.	-197.	1396.	2396.
TEXAS						
ABILENE	-2709.	-314.	-283.	2171.	2202.	4657.
AMARILLO	-2952.	3153.	-410.	5695.	2132.	8236.
AUSTIN	-3708.	1171.	-1244.	3714.	1299.	6258.
BROWNSVILLE	-4985.	-3248.	-2263.	-527.	428.	2195.
CORPUS CHRISTI	-5415.	-2530.	-2694.	191.	47.	2912.
DALLAS	-3317.	417.	-763.	2570.	1790.	5524.
DEL RIO	-3577.	-938.	-1029.	1609.	1548.	4157.
EL PASO	-2415.	2338.	178.	4931.	2772.	7525.
FORT WORTH	-3632.	-1219.	-1147.	1266.	1359.	3752.
HOUSTON	-4122.	-1907.	-1452.	769.	1219.	3494.
KINGSVILLE	-4453.	-2265.	-1732.	456.	940.	3178.
LAREDO	-4620.	-2640.	-1999.	82.	823.	2803.
LUBBOCK	-2740.	1476.	-10.	4206.	2719.	6935.
LUFKIN	-3702.	-2591.	-1112.	79.	1529.	2750.
MIDLAND	-3146.	-427.	-396.	2302.	2353.	5032.

Table 3 (continued)

	0% Resale		100% Resale		200% Resale	
	NPVG	NPVE	NPVG	NPVE	NPVG	NPVE
PORT ARTHUR	-4305.	-2247.	-1584.	474.	1158.	3195.
SAN ANGELO	-3516.	-1090.	-787.	1639.	1943.	4369.
SAN ANTONIO	-3809.	-1591.	-1321.	996.	1266.	3543.
SHERMAN	-2203.	-1767.	283.	718.	2708.	3204.
WACO	-3778.	-914.	-1293.	1571.	1193.	4057.
WICHITA FALLS	-3109.	-652.	-623.	1834.	1852.	4319.
UTAH						
BRYCE CANYON	-1814.	1991.	768.	4574.	3350.	7156.
CEDAR CITY	-2492.	6089.	130.	8671.	2743.	11253.
SALT LAKE CITY	-2984.	4613.	-402.	7195.	2101.	9777.
VERMONT						
BURLINGTON	-4507.	-2170.	-1844.	553.	878.	3275.
VIRGINIA						
NORFOLK	-4183.	1539.	-1501.	4221.	1101.	6903.
RICHMOND	-4193.	1108.	-1632.	3669.	928.	6229.
ROANOKE	-867.	-91.	1646.	2443.	4179.	4976.
WASHINGTON						
OLYMPIA	-3064.	-2500.	-571.	-7.	1923.	2497.
SEATTLE-TACOMA	-2573.	-4299.	-79.	-1805.	2414.	688.
SPOKANE	-2625.	-3801.	140.	-836.	2905.	1979.
WHIDBEY	-1329.	-2604.	1185.	-111.	3638.	2382.
YAKIMA	-2077.	-3319.	731.	-511.	3539.	2297.
W. VIRGINIA						
CHARLESTON	-3241.	-2691.	-417.	123.	2387.	2937.
HUNTINGTON	-2773.	-2564.	120.	926.	3042.	3219.
WISCONSIN						
EAU CLAIRE	-2278.	-2156.	506.	629.	3240.	3413.
GREEN BAY	-3540.	-2315.	-747.	445.	2017.	3213.
LA CROSSE	-2224.	-2429.	560.	355.	3345.	3139.
MADISON	-1523.	-858.	1261.	1926.	4046.	4711.
MILWAUKEE	-3473.	287.	-709.	3051.	2055.	5815.
WYOMING						
CASPER	-2702.	-1233.	90.	1619.	2943.	4471.
CHEYENNE	-905.	-1452.	1887.	1400.	4740.	4253.
ROCK SPRINGS	-1256.	-990.	1597.	1863.	4449.	4715.
SHERIDAN	-3306.	-2292.	-453.	560.	2349.	3413.