Ever Heard of Retrofit?

A Guide for the Home Remodeler

MASTER

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All the items mentioned in this manual will contribute to efficient energy use. There is no way to guarantee a specific dollar saving on fuel bills. Since fuel costs will continue to rise and lifestyles and conditions of existing houses differ widely, only average estimated percentages of savings can be indicated for each retrofit item. However, a properly retrofitted house will require a smaller energy input than the same house before it was retrofitted.

Contributors

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What is Retrofit?

The word retrofit is used to cover all those renovations that are done to save energy.

What are the Seven Retrofit Items?

These seven items have been selected because, generally, across the country, they have been found to be cost beneficial retrofit items.

- 1—Caulking and weather-stripping
- 2—Storm windows and storm doors
- 3—Attic insulation
- 4—Wall insulation
- 5—Underfloor insulation
- 6—Maintenance of mechanical systems
- 7—Maintenance of water heating system

What does Retrofit Have to do with Your Home Remodeling Business?

There are very few "one-stop" retrofit contractors. Today many home remodelers handle some of the retrofit items along with a typical remodeling job. There are many more homes in need of retrofit than of remodeling. A home remodeling business could easily be expanded to include all the retrofit items and sell them as a package. This package could also be included in any remodeling job.

Thirty-five million homes were built before 1960 when fuels were cheap and energy conservation was not an issue. Today with fuel prices increasing monthly, many homeowners will look to retrofit for relief. The average retrofit job will cost between \$1,000 and \$1,500. This represents an enormous market both in volume and dollars.

What Does a Contractor need to know about Retrofit?

What does the Contractor need to tell his Customer about Retrofit?

That is what this manual is all about. It is written in two sections.

How to Use This Manual

Section 1 gives detailed information about each retrofit item, what to look for during the energy inspection, and how to solve specific energy-related problems with the most up-to-date methods and materials and technical know-how.

Section 2 brings you up to date on the energy situation: the energy crisis, energy concepts, and the energy business. The contractor must become the "energy expert" in order to tell the homeowner how to save energy in his home. The section spells out very simply the energy concepts you need to know when discussing energy in the home. It also covers the energy inspection of the home and provides inspection worksheets.

This manual was developed under the direction of the Department of Energy as a useful tool to accomplish retrofit in the residential sector on a large scale to help achieve the national goal of energy conservation. The contractor is encouraged to reproduce any pages, diagrams, charts, or worksheets in this manual that may be of help in the development of his retrofit business.

SECTION 1

Energy Inspection

The energy inspection is your major meeting with the homeowner. It is here that you establish the need for retrofit, help the homeowner examine his home, determine the job to be done, and negotiate a contract to do the job.

During the energy inspection you should do the following:

1. Establish the need for retrofit. Use the material in the section on energy. Reproduce any pages that you can use as handouts to the homeowner.
2. Check the home for specific items listed on the measurements worksheet. Fill out the measurements worksheet.
3. Fill out the recommendations worksheet and the cost worksheet.
4. Discuss with the homeowner which jobs need to be done. Discuss cost and financing.
5. Negotiate a contract with the homeowner.

The energy inspection is critical. You must convince the homeowner of your sincerity and your competence to do the job. If he has confidence in you, the energy expert, you will be off to a good start.

CAULKING AND WEATHERSTRIPPING

Technical Data Caulking

Caulking compound comes in cartridge or knife grade. Filler, such as oakum, caulking cotton, sponge rubber, and glass fiber, can be put in large cracks before caulking compound is applied.

CAULKING COMPOUNDS

TYPE	RELATIVE COST	DURABILITY	COMMENTS
White lead-based	Least expensive.	1 to 2 years.	Allows for little expansion or compression.
Latex or butyl	Moderate.	5 years.	Can be painted.
Elastomeric Hypalon Polysulfide Silicon	Most expensive.	Indefinite.	Cannot be painted, but comes in colors.

What does this Retrofit Item Do?

Heat loss through cracks and loose-fitting windows and doors can account for 55 percent of the heating load on a windy day! This can be corrected by weatherstripping windows and doors and caulking cracks and construction joints.

What are the Savings?

Caulking joints and cracks and weatherstripping windows and doors can save 5 percent to 15 percent of the heating cost depending on the condition of the house.

Energy Inspection

Check the following areas for caulking:

- 1—Joints between window frames and siding
- 2—Joints between door frames and siding
- 3—Joints where chimney meets siding
- 4—Joints where porch meets siding
- 5—Joints between foundation wall siding

If old caulking is cracked it should be replaced. If there are storm windows they should be caulked.

Check doors and windows for weatherstripping and tight fit. If weatherstripping is loose, it should be replaced.

Check window panes for loose putty.

Weatherstripping

TYPE	COST AND DURABILITY	WINDOW APPLICATION	DOOR APPLICATION	COMMENTS
Foam Rubber	Least expensive. Will last 1 to 2 years.			Will not stand friction. Use only at top and bottom of windows.
Rolled Vinyl	Moderate cost. Will last indefinitely.			Visibility is the only disadvantage.
Thin Spring Metal	Most expensive. Will last indefinitely.			Permanent, not visible. Gives most complete seal.

Doors to unheated living spaces, attics, basements, and garages should be weather-stripped.

Doors need thresholds to close off the space between the bottom of the door and the door sill.

WEATHERSTRIPPING UNDER DOOR THRESHOLDS

TYPE		COST	DURABILITY	COMMENTS
Sweep		Least expensive.	1 to 2 years.	Visible, for use on flat thresholds. May drag on rug.
Door Shoe		Moderate cost.	Indefinite. Vinyl insert replaceable.	Useful on wood, unworn threshold. Note drip cap to shed rain.
Vinyl Bulb Threshold		Moderate cost.	Indefinite. Vinyl insert replacement.	Useful where there is no threshold. With wear, vinyl bubble will flatten and tear. Can be replaced.
Interlocking Threshold		Most expensive.	Permanent.	Exceptionally good seal. Should be recommended.

STORM WINDOWS AND DOORS

What does this Retrofit Item Do?

Storm windows and doors provide insulation by creating an air space between them and the existing doors and windows. This keeps heat inside the house in winter and outside the house in summer.

What are the Savings?

The addition of storm windows and doors can save 10 percent to 19 percent of heating cost depending on the condition of the windows and the severity of climate.

Energy Inspection

Check all windows and doors for storm windows and doors. Be sure to include all basement windows. If there are existing storm windows and doors, check them for tight fit. Caulking may be needed. If there are no storm windows or doors, decide with the owner the type of window and door to install.

Technical Data

Storm windows and doors come with aluminum or wood frames. Wood frames are more energy efficient because they do not conduct as much heat through the frame as metal.

Thermal resistance, the R-value, is a measure of heat retardation. The higher the R-value the greater the heat retardation.

WINDOWS—THERMAL RESISTANCE

Single glass no storm window	R-0.88
Double glass window plus standard storm window	R-1.54
Triple glass window plus double glass storm window	R-2.13

Some lumber yards sell frames for storm windows. The glass can be purchased separately, and the windows can be made in the contractor's shop.

Many aluminum windows have vinyl coatings. Also, there are now vinyl frame windows available.

If the existing windows are in very poor condition and in need of replacement, and if the homeowner can afford it, double-glazed replacement windows with their own storm windows should be considered.

Metal-clad weatherproof doors have an R-value similar to that of a conventional door plus a storm door and should be considered especially if the outside doors are in poor condition and in need of replacement.

STORM WINDOWS

TYPE	COST	COMMENTS
Wood frame, single panel glass.	More expensive.	Must be removed and stored in summer.
Aluminum frame, double glazed.	More expensive.	Must be removed and stored in summer. Double glass gives greater thermal resistance.
Aluminum frame with replacable screen.	Most expensive.	Comes with triple or double track. Can be left in place year round. Most durable, less breakage.
Aluminum frame, single pane glass.	Moderate cost.	Must be removed and stored in summer.

DOORS—THERMAL RESISTANCE

1¾ inch exterior door.	R-2.04
1¾ inch exterior door and aluminum storm door (50 percent glass).	R-3.03
1¾ inch exterior door and wood storm door (50 percent glass).	R-3.70
Metal clad insulated door.	R-3.70

Doors not used during the winter should be tightly sealed, even taped or caulked shut.

An unheated vestibule will provide even more energy savings than a storm door.

ATTIC INSULATION

What does this Retrofit Item Do?

The attic represents a large surface area of the house. Heated air rises and is lost through the roof. Insulation in the attic slows down this heat transfer and keeps more heat inside the house. Insulation is rated with an R-value. The higher the R-value the greater the heat retardation of the material. During the hot summer, attic insulation slows down the transfer of heat from the outside and the house stays cooler.

What are the Savings?

Insulating an uninsulated attic can save 18 percent to 23 percent of energy cost.

Energy Inspection

- 1—Determine the kind and amount of existing insulation, if any.
- 2—Check the vapor barrier on existing insulation.
- 3—Determine the type of attic and its current and future use by the homeowner.
- 4—Check for ventilation.

Technical Data

The amount of insulation depends on the climate of the area. This is measured by degree-days and has been plotted on a map of the United States showing climate zones. Since it is unlikely that a contractor will work in more than one zone, find your zone and use sufficient insulation to achieve the R-value recommended for that zone.

The type of insulation you use will depend on the attic conditions of your individual house.

R-VALUE FOR:	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5
CEILING	R-26	R-26	R-30	R-33	R-38
WALLS	R-13	R-19	R-19	R-19	R-19
FLOORS	R-11	R-13	R-19	R-22	R-22

Do not cover electric boxes or recessed ceiling fixtures with insulation.

ATTIC CONDITION		RECOMMENDED INSULATION
	Open unfinished unfloored unheated	Batts, blankets or loose fill can be placed between ceiling joists. Loose fill can be added on top of batts or blankets.
	Truss roof structure unfinished unfloored unheated	Blown-in loose fill is best. Batts or blankets can be used but are difficult to install.
	Unfinished floored unheated	Loose fill can be blown under floor between ceiling joists. If attic will ever be heated or used as living space, insulate with batts or blankets between roof rafters and on end walls.
	Heated used as living space	Use batts or blankets on vertical walls. Blow or pour in loose fill between ceiling joists and outer attic rafters.
	Cathedral ceiling	Batts or blankets can be placed between roof rafters and supported by sheets of finish material. Be sure to leave air space between insulation and roof decking.
	Flat roof	Same as cathedral ceiling.

R-VALUE RELATED TO INCHES OF INSULATION

R-VALUE	BATTS OR BLANKETS		LOOSE FILL		
	GLASS FIBER	ROCK WOOL	GLASS FIBER	ROCK WOOL	CELLULOSIC FIBER
R-11	3½"	3"	5"	4"	3"
R-19	6-6½"	5½"	8-9"	6-7"	5"
R-22	7"	6"	10"	7-8"	6"
R-30	9½"-10½"	9"	13-14'	10-11"	8"
R-38	12-13"	10½"	17-18"	13-14"	10-11"

Polyurethane foams are not included on this chart because R-values vary with the product and the installation conditions. Check with a foam contractor for these figures.

Vapor Barrier

When installing insulation, be sure the vapor barrier is toward the living space. If you are blowing in insulation, a polyethylene sheet can be used as a vapor barrier. Determine the joist or rafter spacing so you will know the width of the batt or roll of insulation to use.

Ventilation

Ventilation is very important in an insulated attic to keep the moisture down. Ventilation area should be equal to $1/150$ of the attic area. This can be reduced to $1/300$ if an adequate vapor barrier is present. If you cannot provide this amount of free vent opening, you must install power ventilation equipment.

When placing insulation in the attic, be sure to leave open space above the eave vents so that air can circulate.

Ventilation louvers should be equally distributed between the eaves and the gables. They should be kept open at all times. Do not block the ventilation path with insulation. All vent spaces should be screened.

Good ventilation can be achieved in several ways. Soffit vents used in combination with eave, ridge, or gable vents provide good air circulation.

WALL INSULATION

What does this Retrofit Item Do?

Exterior walls are the second largest area of the house where heat is lost. To insulate exterior walls of existing houses insulation must be blown in.

What are the Savings?

Insulating the exterior walls can save 14 percent to 20 percent of the fuel bill.

Energy Inspection

To see if there is insulation in the walls, remove the plate cover from a convenience outlet on an exterior wall. If there is any insulation in the walls, it is generally not technically feasible nor economical to add more. If you did that, you not only would have the cost of the insulation but also the cost of repairing and restoring the holes in the exterior walls where it is blown in.

Technical Data

Insulation is blown into existing walls through holes cut in the wall surface between the studs. These may be inside or outside depending on the construction and wall finish. Bricks, shingles, or siding can be removed from the outside wall and replaced. Painted sheetrock can be cut and then patched on the inside.

Insulation is blown in by a contractor with special equipment. The amount of insulating material is calculated for the wall area. When the job is completed, you can count the empty bags to be sure all the area is filled. Care must be taken to be sure insulation falls below electrical conduits, switch boxes, and cross bracing.

Holes in the wall inside or outside must be patched and restored.

Instead of blowing insulation into the walls, two other options are available. First, insulated siding may be applied to the outside of the house. Or, insulation may be applied to the outside of the house when new siding is being

put on. However, the additional cost of new siding cannot be justified in the area of retrofit. If the homeowner wants new siding and can afford it, the energy savings from either of these options would be the same as if he insulated the walls.

UNDERFLOOR INSULATION

What does this Retrofit Item Do?

Most older homes have basements or crawl spaces. Under-floor or basement insulation saves fuel and also adds to comfort by bringing the floor temperature closer to the indoor room temperature.

What are the Savings?

Insulating the basement or crawl spaces under a house can save 4 percent to 8 percent of the fuel bill.

Energy Inspection

Check on the type of basement (heated or unheated) and foundation. Note the height of the basement above grade. Check for crawl spaces under garage or recent additions.

Technical Data

If the basement is heated, insulate the walls. Do not place insulation under the first floor. Insulation should extend at least 2 feet below the outside grade.

To insulate unheated basements, crawl spaces, or the underfloor of a house on piers, place insulation batts between floor joists, vapor barrier to the floor.

This can be secured with wire mesh. If the crawl space is the source of furnace make-up air, this method should be used so that crawl space can be ventilated from outside.

Enclosed crawl spaces can be insulated at the exterior walls. Be sure the vapor barrier is continuous with the vapor barrier on the ground under the crawl space. If there is none, use 4 mil or thicker polyethylene sheeting lapped 3 inches.

Ventilation

Two openings should be provided at opposite ends of the crawl space, 1 square foot for every 1,500 square feet of crawl space.

MAINTENANCE OF MECHANICAL SYSTEMS

What does this Retrofit Item Do?

Heating and air-conditioning systems must be kept clean and properly adjusted for efficient energy use. One-quarter inch of soot on a boiler can reduce its efficiency 25 percent. Insulating heat pipes and ducts prevents heat loss. Fuel can be saved by lowering the nighttime temperature automatically with a clock thermostat.

What are the Savings?

Lowering the nighttime room temperature 5 degrees with the use of a clock thermostat can save 10 percent to 12 percent of the fuel bill.

Energy Inspection

Check out the heating and cooling systems. If you are qualified, you may, with the homeowner's approval, clean and adjust the heating and cooling systems, replace filters, and so forth. Make a note of any uninsulated ducts or pipes running through unheated or uncooled areas of the house. Measure them for insulation.

Technical Data

Carbon build-up on forced air heaters lowers efficiency. It must be cleaned off.

Nozzles on oil-fired furnaces will enlarge with wear and should be replaced yearly.

Air-conditioner filters should be changed or cleaned regularly.

Thermostat Setting Devices

One type of setback device is placed below the regular thermostat. It works on a timer and heats the thermostat just enough to prevent it from turning on the heat. This produces the same results as turning the thermostat down at night.

This device can be plugged into an existing convenience outlet. It can only be used if there is an existing thermostat on the heating system.

Clock Thermostat

A clock thermostat installation requires an electric connection to the boiler or furnace.

Duct Insulation

Rigid and flexible duct insulation is available. All joints should be taped to prevent heat leakage.

MAINTENANCE OF WATER HEATING SYSTEM

What does this Retrofit Item Do?

Fourteen percent of the energy used in a house is used to heat water. Most water heaters are set much higher than necessary. Lowering the temperature to 120 degrees provides enough hot water for household use. If there is a dishwasher, it will be necessary to set the water heater at 140 degrees. Proper insulation of the water heater storage tank and the pipes coming from it will cut down heat loss. Flow restrictor valves installed at showerheads and hot water faucets will decrease the amount of hot water used.

What are the Savings?

Setting the water heater to 120 degrees can save 5 percent of the fuel bill.

Energy Inspection

- 1—Check water heater. If you are qualified and if the owner approves, set the temperature to 120 degrees (140 degrees if there is a dishwasher).
- 2—Check the tank and water pipes for insulation.
- 3—Check for leaky faucets.
- 4—Count showerheads and hot water faucets.

Technical Data

Kits are available for insulating water heaters.

Precut sections of pipe insulation are also available.

Adjust temperature of water heater. All new water heaters have an adjustable thermostat. Older water heaters have a switch labeled hot, hotter, or colder.

Water heater should be drained to remove accumulated sediment which causes inefficient heating.

ADDITIONAL RETROFIT ITEMS

Flow Restrictor Valves

Flow control devices can be placed behind showerheads and water faucets to reduce the volume of water used.

Volume can be reduced from the normal 7 to 10 gallons per minute to 3 gallons per minute with no change in water pressure.

Since flow control devices are very inexpensive and can be installed easily, it is recommended that the contractor install them in his own home. His own experience will help to explain flow control devices to the homeowner.

- 1—**Draperies on windows**, especially large plate glass windows.
- 2—**Exterior window shading devices**, such as shutters or awnings.
- 3—**Exterior planting** to shade house.
- 4—**Fluorescent lights** instead of incandescent lights. A 25-watt fluorescent bulb gives as much light as a 100-watt incandescent bulb.
- 5—**Timer or photocell** on exterior lights.
- 6—**Electric igniters** for gas ranges eliminate the constantly burning pilot light.
- 7—**Damper and glass doors** on fireplace.
- 8—**Water heating device** to reclaim heat given off by air-conditioning condenser.
- 9—**Exhaust fan** in attic for use during hot weather, in appropriate climates.

SECTION 2

Yesterday's Home

In yesterday's home energy was visible. The earliest homes were heated with wood and lit by candles and oil lamps.

By looking at the size of the wood pile the homeowner could see the amount of energy available. The log burning showed energy being used. The source of energy used for heating, cooking, and lighting was visible.

In yesterday's home the homeowner was the worker as well as the natural conserver. He brought in as much wood as he needed, and he seldom wasted it since he would have to chop more if he did. The lamp had to be refilled when it was empty so he was careful to turn it off when it was not needed. He was part of the energy cycle. More important, the cycle was one that he could visualize.

Today's Home

Let's look at the mechanical revolutions that have occurred in housing in the last 70 years. First came central heating fired by coal furnaces with hot water and steam radiators.

Then came natural gas piped into the house to fire stoves and hot water heaters as well as central heating systems.

Finally, the development of electricity as an energy source led us to today's use of an ever-increasing range of appliances from air-conditioners to electric toothbrushes.

Even with the coal furnace, energy was still visible and the homeowner was still a participant.

He shoveled the coal from the bin, saw it burn, and banked the fire at night. When the furnace was converted to oil or natural gas, a drastic change took place. The energy source was not visible anymore, nor was the homeowner needed in the energy cycle. More importantly, he was no longer the natural conserver. All he had to do was to pay the bills, and they seemed very modest.

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THE PAYEE BILL FOR YOUR RECORDS

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228 EMERSON #2		
METER READING	WH USED	BILL CODE
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GROSS AMOUNT		NET AMOUNT DUE NOW
SEP 30 5612		5124

SEE REVERSE SIDE FOR BILL CODES

Today with the cost of fuels increasing and the supply of those fuels decreasing, the homeowner must once again become the conservator. By building or retrofitting his home to conserve energy, and by using and

maintaining the mechanical systems in it efficiently, he can keep his energy costs down.

By understanding how the utility meters work he will know what the bills are for.

Energy Language

Many energy-related terms have become commonplace today. To do a good retrofit job you do not have to be an engineer, but it is a good idea to know what the terms mean. Here is a list of the most used terms in the residential energy business today.

Btu (British Thermal Unit).

The heat needed to raise 1 pound of water 1 degree Fahrenheit.

Therm. 100,000 Btu's.

Volt. The measure of the quantity of electricity.

Amp. The measure of the flow of electricity.

Watt. The measure of electric power. Watts = amps $\times$ volts.

Kilowatt. 1,000 watts.

Kilowatt-Hour. The measure of electric power in a given time.

Fossil Fuels. Fuels such as oil, natural gas, and coal, made up of organic material which existed on the earth millions of years ago.

Degree-Days. 65 degrees minus the average of the high and low temperature for the day equals the number of degree-days for that day. The total of all the degree-days for a year is used to calculate the heat loads for a particular climate.

Summer Cooling Hours. The number of hours the temperature is over 80 degrees per summer.

Heating Factor. A figure determined by the number of degree-days related to the type and cost of fuel used for heating.

Cooling Factor. A figure determined by the number of cooling hours related to the type and cost of fuel used for cooling.

Infiltration. The air flow in and out of a building.

Chimney Effect. Infiltration due to a pressure differential caused by lower temperatures outside a building and higher temperatures inside a building.

K. Thermal conductivity. The amount of heat that passes through 1 square foot of 1 inch thick material in 1 hour with a temperature differential of 1 degree Fahrenheit.

U. The coefficient of heat transmission. This is expressed in Btu's per square foot of area per degree of temperature difference. The lower the U, the higher the insulating value of the material.

R. The measure of thermal resistance or the ability to retard heat flow. The higher the R, the greater the insulating value of the material.

Vapor Barrier. A moisture-proof covering on one side of insulation. It always faces toward the living space.

EER. The energy-efficiency ratio. It is expressed as Btu's per watt. The higher the EER, the more efficient the appliance.

The Energy Crisis: Why has It Happened to Us?

The homeowner has a built-in suspicion of conservation because he is asking himself, "Why has this happened to us? If insulation is so important, why wasn't it put in our house in the first place? If I'm supposed to use energy-efficient appliances, why weren't they manufactured before?"

These are candid questions, and they need candid answers. The view the homeowner constructed of the world from all he or she read gave the impression that increased use of appliances meant prosperity and the source of energy was unlimited. Now we are trying to tell the homeowner that increased use of appliances is wasteful and that the

sources of energy we use to fire the whole society are going to run out in a few years. Some homeowners resent the idea that their home has some deficiencies, energy related or not. If the earlier view of the world proved false, how is the homeowner to react to this "crisis"? The homeowner remembers the fallout shelter and wonders if the whole "crisis" is not a new promotional venture to promote the rise in fuel costs, the sale of materials, and the need for an energy specialist—you!

The only "answer" is to look at the energy problem from all sides. The earlier view of the world, just 5 years ago, was based on a limited look at the problem of energy. Some people have been telling

about the end of fuel oil for decades, but the climate of opinion wasn't ready to hear them. Sure, purchasing more appliances still helps the economy, sure there will be sufficient fuel for the foreseeable future, so these two facts still remain true. What has been added to the equation are the additional facts, not acknowledged properly until now, that the production of fuel will peak in 1990 and then diminish through the year 2050, when we will have depleted our oil resources. The energy crisis did not begin with the Arab boycott of 1973; it has been with us from the beginning of industrialization. Mankind will be forced to develop alternative energy sources, and the number of years remaining before these alternative sources of energy must be fully operative is strictly dependent on our use of the fossil fuel reserves we have.

Americans, 6 percent of the world population, use 36 percent of the world's energy. This oft-quoted fact will have political and economic implications, and it is frankly a good thing that they are being discussed openly today. It will have a direct bearing on the cost of fuel, for much of the additional cost of finding fuel and creating new fuel sources will be borne by the users. Power companies are routine-

**PROJECTED U.S. ENERGY
SUPPLY AND CONSUMPTION**

ly placing extra charges on fuel bills to cover the construction of new power-plants and to cover increased costs of fuel.

With every confidence that our grandchildren will have alternative energy sources, it becomes clear that our fuel bills will continue to be higher. There is really only one opportunity the homeowner has to save energy and money. That is to retrofit his home. Older homes were not built for energy conservation. Considerable savings in fuel costs are possible through retrofit, and these savings will go with the house year after year, helping with each energy bill. More importantly, the retrofit will add to the resale value of the house. Frankly, older houses without retrofit will have an increasingly difficult time competing with new houses that have much higher energy conservation standards. For America the issue is critical because residential use accounts for 20 percent of the energy used, and proper retrofit can cut this figure by a third.

GLOBAL OIL OUTPUT

MEASUREMENTS WORKSHEET

owner _____ salesperson _____
address _____

1. WINDOWS AND DOORS

Number of windows requiring storms no. _____ avg. _____ sf
Fit of windows average _____ loose _____
Existing glazing single _____ double _____ double _____
sealed _____ unsealed _____
Picture window yes _____ no _____ size _____ sf
Number of doors requiring storms no. _____
Fit of door avg. _____ loose _____
Existing door type wood _____ wood _____ metal _____
solid _____ hollow _____ insulated _____
Comments _____

2. CEILING/ATTIC

Existing insulation _____ inches
Gross area _____ sf
Attic access _____
Attic condition pitch _____
flooring _____ %
storage _____
ventilation _____
existing _____
Comments _____

3. EXTERIOR WALLS

Existing insulation _____
Siding type _____
Sheathing _____
Gross wall area _____ sf
Glass and door area proportion: normal _____ higher _____
Comments _____

4. BASEMENT/CRAWL SPACE

Gross exterior wall area _____ sf
Percentage exposed to outside $\frac{1}{4}$ _____ $\frac{1}{2}$ _____ $\frac{3}{4}$ _____
Gross basement area _____ sf
Gross crawl space area _____ sf
Number of windows requiring storms no. _____
Comments _____

5. HEATING/COOLING SYSTEM

Furnace Description _____
Filter size _____
Tune-up req's. _____
A/C Description _____
Tune up req's. _____
Ducts lineal feet and size _____
insulated: yes _____ no _____
Humidifier yes _____ no _____
Thermostat setting winter: day _____ night _____
summer: day _____ night _____

6. MISCELLANEOUS

COSTS WORKSHEET

owner _____ salesperson _____
 address _____

ITEMS	SPECIFICATIONS	COST
WINDOWS AND DOORS		
1. STORM WINDOWS	Install _____ storm windows, model _____ cost _____ each	\$ _____
2. PICTURE WINDOW	Install storm sash _____	\$ _____
3. STORM DOORS	Install _____ storm doors, model _____ cost _____ each	\$ _____
4. EXTERIOR DOORS	Weatherstrip _____ exterior doors _____	\$ _____
CEILING ATTIC		
5. CEILING INSULATION	Add _____ inches _____ insulation for certified R- _____ value cost (\$ _____ /sf) $\times$ (_____ sf) = _____	\$ _____
6. ATTIC VENTILATION	Describe _____	\$ _____
7. ATTIC ACCESS	Add insulated opening _____ sf _____	\$ _____
EXTERIOR WALLS		
8. INSULATION	Add _____ insulation for certified R- _____ value cost (\$ _____ /sf) $\times$ (_____ sf) = _____	\$ _____
OTHER	Describe _____	\$ _____
BASEMENT/CRAWL SPACE		
9. FLOOR INSULATION	Install insulation over unconditioned spaces _____	\$ _____
10. EXTERIOR WALLS	Seal all openings and cracks _____	\$ _____
11. BASEMENT WINDOWS	Install _____ storm windows, model _____ cost _____ each	\$ _____
OTHER	R-batts between joists (\$ _____ /sf) $\times$ (_____ sf) = _____	\$ _____
FURNACE/AC		
12. UNCONDITIONED AREAS	Tape joints and insulate ducts _____	\$ _____
13. FURNACE/AC	Tune up cost _____, 1-year supply filters cost _____	\$ _____
14. CLOCK THERMOSTAT	Install thermostat model _____	\$ _____
15. HUMIDIFIER	Install model _____	\$ _____
16. WATER HEATER	Replace with new model _____	\$ _____
17. AC UNIT	Replace with new unit _____	\$ _____
18. CEILING FAN	Install _____	\$ _____
19. FURNACE	Replace with proper unit _____	\$ _____
20. MISCELLANEOUS	_____	\$ _____
21. CUSTOM	_____	\$ _____
TOTAL COST		\$ _____

RECOMMENDATIONS WORKSHEET

owner _____ salesperson _____
 address _____

YOUR HOME LIES IN CLIMATE ZONE _____. WE RECOMMEND THE FOLLOWING
 BALANCED PACKAGE FOR YOUR HOME

SPECIFICATIONS	RECOMMENDED ITEM	TO BE INCLUDED	
1. STORM WINDOWS	Install _____ storm windows, model _____	YES	NO
2. PICTURE WINDOW	Install storm sash _____	YES	NO
3. STORM DOORS	Install _____ storm doors, model _____	YES	NO
4. EXTERIOR DOORS	Weatherstrip _____ exterior doors _____	YES	NO
5. CEILING INSULATION	Add insulation to achieve a certified R-_____ value	YES	NO
6. ATTIC VENTILATION	Add _____ sf of attic ventilation, type _____	YES	NO
7. ATTIC ACCESS	Install insulated opening, size _____ sf	YES	NO
8. EXTERIOR WALLS	Insulate to achieve certified R-_____ value	YES	NO
9. FLOOR INSULATION	Install insulation over unconditioned spaces R-_____	YES	NO
10. EXTERIOR WALLS	Seal all openings and cracks _____	YES	NO
11. BASEMENT WINDOWS	Install _____ storm windows in basement, model _____	YES	NO
12. UNCONDITIONED SPACES	Tape joints and insulate ducts _____	YES	NO
13. FURNACE/AC	Tune up with 1-year supply filters _____	YES	NO
14. CLOCK THERMOSTAT	Install clock thermostat, model _____	YES	NO
15. HUMIDIFIER	Install humidifier, model _____	YES	NO
16. WATER HEATER	Replace with new efficient model _____	YES	NO
17. AC UNIT	Replace central AC unit _____	YES	NO
18. CEILING FAN	Install ceiling fan _____	YES	NO
19. FURNACE	Replace with proper-size unit _____	YES	NO
20. MISCELLANEOUS ITEMS	_____		

21. CUSTOM OPTIONS	_____

Energy
Conservation
Now