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BUILDING RETROFIT FOR CITIES

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BUILDING RETROFIT FOR CITIES

A. INTRODUCTION

During the 1950's and 1960's, energy efficiency was increasingly overlooked in new construction, due to the relatively low price and easy availability of fuel. This neglect has been decreasing in light of rising energy prices, but since the turn-over of building stock is so slow, new design trends will also be slow to significantly affect energy consumption.

Increasing energy prices and the real possibility of future shortages represent a significant economic burden to consumers and businesses alike. In attempting to relieve this burden special emphasis should be placed on building retrofit because:

- 1) space heating and cooling represent 20 percent of U.S. energy demand;
- 2) many buildings needlessly waste almost half of their energy consumption;
- 3) high heating bills hurt consumers; and
- 4) substantial energy savings can be easily effected.

High prices for fuels place a special burden on cities in the building sector. The reasons:

-- A city's building stock is often less efficient than the detached single-family and commercial structures characteristic of suburban areas because of the age of the structures. These older buildings often have little or no insulation because they were constructed during a time when decreasing real energy prices did not cause architects and builders to focus on energy efficiency features.

-- Much of the city population is poorer and older than suburban populations. Consequently, financing energy efficiency home improvements

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is more difficult for city residents than for their suburban counterparts, even though the investment may be economically justified in the long run.

- Most tenants (residential and commercial) have no direct control over the energy efficiency of their spaces. Landlords do not regard efficiency improvements as worthwhile investments because utility costs are generally passed on to tenants in the form of increased rent.
- A significant number of city residents and business establishments occupy buildings which have only master utility meters. These occupants are not directly billed for their energy use and, therefore, do not receive proper signals to change their consumption patterns.

Despite these problems, cities, more than any other sector of the economy, can expect to experience economic benefits from a vigorous national retrofit program. Certain characteristics unique to urban buildings make them prime candidates for retrofitting:

- Attached (high and low rise) buildings are potentially more energy efficient per square foot of floor space than detached buildings. Very simple, multi-story buildings have less exposed surface area (walls, roofs) per square foot of floor area than detached buildings through which heat loss can occur.
- Economies of scale make automated (computerized) HVAC control techniques feasible for apartments and office buildings.
- The close proximity of many units (dwellings, offices) make an auditing program feasible and cost-effective.
- Cities have existing building standards or codes which may need modification or restructuring to reflect efficiency concerns.
- A system of building inspection and enforcement of codes is already in existence.

- The proximity (e.g., row-houses and high-rise developments) of city building stocks and the uniformity of possible conservation options allows for a standardization of retrofit packages which can improve the effectiveness and bring down the cost of a widespread retrofit program.

Thus, in the residential and commercial sectors, the Nation's cities have vast buildings stocks which were constructed over many years and which meet low levels of energy efficiency. In reality, the energy use per capita in buildings may be less in the city than in outlying areas due to less square footage and lower income per capita levels. Nevertheless, the potential to save energy and money is enormous because many structures have little or no insulation, overall efficiency is poor, and the city's spatial configuration is conducive to widespread standardized retrofit, taking advantage of vast economies of scale.

B. BENEFITS OF A STRONG URBAN RETROFIT PROGRAM

Retrofitting existing residential and commercial buildings can stimulate urban revitalization. It lowers the consumer's energy cost for space conditioning, making the city a more attractive place to live relative to the suburbs. Energy savings will reduce the life cycle operating costs of a building. Thus, it is likely that building energy efficiency will become a more important factor in underwriting loans and assessing the value of buildings. Investment security, the quality of mortgages, and profits in general will be related to energy efficiency, an

important concern for financial institutions and builders in the city. In addition, job opportunities, especially for those in building trades and local conservation materials fabrication, and also for those of limited skills, will be increased. In short, the city's tax base will be preserved and enhanced by an effective retrofit program.

The individual energy consumer stands to gain from a residential and commercial retrofit. While many conservation actions in building have significant first costs, they are cost-effective in the long run because they decrease fuel costs and, in effect, pay for themselves from the energy savings. The payback period differs between particular conservation measures, and in many cases the simplest, least costly measures provide the quickest, surest return on investment. Furthermore, as energy efficiency increasingly becomes an important factor in determining a building's value, conservation retrofit will be perceived as a home improvement or building renovation. Therefore, a retrofit program will decrease operating costs and increase the value of the urban building stock. These two economic benefits are strong incentives for establishing an effective program.

B.1 Retrofit and Employment Benefits

The employment-energy conservation link is an important issue associated with retrofit. Historically, there has been a strong correlation between energy growth and growth in key economic indicators, such as GDP and per capital income. Thus,

it is thought that a declining energy demand growth rate means a slower economic growth rate, leading to job losses and an eroding tax base. There does not seem to be substantial evidence for this paradigm, however, especially in an urban context. In fact, energy conservation has been shown to improve the competitive standing of many individual industries. Conservation activities in general can have a beneficial impact on a city's economic vitality by making it more attractive to outsiders, by reducing further economic losses caused by rising energy costs, and by generating new employment to meet the needs of energy conservation implementation.

Retrofit itself is perhaps the greatest opportunity to link energy conservation with increased employment in the city. The job creation potential is substantial. A 1976 FEA study provides breakdowns of cost and resulting employment associated with installing limited energy efficiency measures in 34,372 private homes. These measures consist of the installation of ceiling insulation and automatic thermostats, and the retrofit or replacement of inefficient furnaces. The analysis concluded that by 1985:

- an amount of natural gas equivalent to the output of 39 1,000 Megawatt power plants would be conserved;
- the residential consumer would save \$1.7 - \$2.3 billion in heating costs;
- the work would cost \$7 - \$10 billion (compared to \$17 - \$20 billion for 39 1,000 Mw plants);

- 487,000 jobs would be created over 7 years: 122,000 in manufacturing, 366,000 in local installations.

The study emphasized that this employment, and that associated with energy conservation techniques in general, is local in the low to moderate skill levels, and concentrated in or near urban areas which currently are experiencing the highest unemployment levels. If 487,000 jobs over 7 years are created by a project of this magnitude, the potential exists for many more.

Further support for the job creating potential of building retrofit:^{2*}

- The Senate Commerce Committee Staff has estimated that \$1.6 billion in interest subsidies and loan guarantees for conservation retrofits would generate 400,000 jobs.
- A proposal which the same Committee sent to President Carter ("An Energy Conservation Public Works Program", Washington, D.C., 1976) describes a program which retrofits schools, colleges, hospitals, federal buildings, HUD-owned single family houses, and constructs bicycle paths. A \$1.65 billion investment, using public service workers, would create a total of 100,470 jobs: 9,600 at \$15,000/yr; 74,600 at \$10,000/yr.; and 16,279 jobs in manufacturing. Each

\$40,000 investment in materials would create one job in the materials manufacturing industry.

More support is lent by analyses performed by the American Institute of Architects, the State of Colorado, and others.

The overriding message seems to be that a city-wide retrofit program, besides revitalizing urban neighborhoods, saving energy and heating costs, improving urban air quality and upgrading the city's building stock, has the potential to provide jobs at many skill levels. Employment for energy specialists, construction of energy efficient equipment, jobs for architects and engineers all will increase, as will jobs in fitting insulation, fitting storm doors and windows, installing thermostat controls and furnace improvements.

But the retrofitting of cities' buildings is a very different job from that of constructing new buildings. There is no easy procedure for having buildings upgraded to a higher level of energy efficiency. Not only are there many institutional and informational barriers that must be overcome, but there is concern over the fact that the composition of the urban labor force, as well as banks, builders, utilities and utility commissions are not oriented to the huge task of rebuilding the cities' residential and commercial structures. This is where a city-initiated jobs training program would enter the picture.

There is a need not only to assure adequacy of the labor supply but also to assure adequacy of the capital resources, standardization of procedures, and understanding of the market

potential for retrofit. In addition, the certification of retrofitters is necessary to assure that the work done is performed according to energy savings expectations. These are all the responsibility of city and Federal functions which themselves require manpower and increase public sector employment.

B.2 Skills Level

It should be noted that different energy conservation retrofit operations have different job skill requirements and labor intensities. Consider building retrofit as an example. The application of conservation options to homes can be a relatively low-skill operation involving simple installation of weather stripping, caulking, storm doors, and windows, and attic and floor insulation. These are comparatively inexpensive measures (vs. major HVAC system alternations) which often provide the greatest energy savings return on conservation investment. They are also labor-intensive at the lower skill ranges, where the overwhelming portion of unemployment occurs.

An example of this approach is the Community Services Administration's (formerly Office of Economic Opportunity) Weatherization program for low income homes. This program hires public service labor (CETA employees) to perform the home installations in the most energy inefficient sector - low income residences. Typically, 40-45% of the program's funding is for wages, a high wage-to-investment ratio which indicates labor intensity. Under the National Energy Act this program is to be expanded and parts of it are to be moved to DOE.

By contrast, many of the tasks required to conserve energy in the commercial buildings sector demand higher skill levels and greater capital intensity. A large modern office building, for instance, does not lend itself so readily to insulation and other building envelope modifications. Rather, energy conservation efforts must be directed at HVAC systems, such as electronic energy management devices, requiring high skill, technical alterations. This approach decreases the labor intensity and has less influence on employment levels. An alternative might be to employ personnel to conduct the building's energy management project, often a more cost-effective and flexible scheme to conserve energy dollars.

Clearly a choice of approach must be made depending on the situation. The most important factors entering into this consideration will be the retrofit market, the available job skills, level of technology, and the unemployment levels. Alternatives should be given priority depending on degree of labor intensity, fit with local labor supply or capacity to generate secondary employment. Thus, support should be given for use of materials which could be produced locally over those which would need to be "imported". Similarly, materials requiring high labor inputs in their manufacture (such as insulation manufactured from shredded newspaper) should be given a higher priority than those produced by capital-intensive processes (such as fiberglass). Opportunities to create markets for locally produced supplies or stimulate new business development would be extremely important.

Rising energy prices and the necessity of energy conservation represent a somewhat hidden but outstanding opportunity for city revitalization. The most significant job creation potential occurs in step with the city's progress toward economic stabilization and expansion, a general effort in the city of which energy conservation projects are an important element. In addition, some conservation activities are expected to create employment directly. The potential for both indirect and direct job creation from energy conservation is enormous.

C. BARRIERS TO RETROFIT

A retrofit program can have many positive results, but a number of factors stand in the way of widespread implementation of energy conservation retrofit for residential and commercial buildings. Barriers are institutional, financial, informational and attitudinal, and will require large-scale efforts to remedy. The most significant barriers are discussed here.

Lack of Trained Labor

Conservation activities are difficult for existing commercial and residential structures in that there is no established set of professional skills for retrofit as with new construction. A large-scale retrofit program would require the training and re-orientation of personnel at various skill levels to the retrofit market. This involves a complex series of planning and implementation steps in cooperation with local labor institutions in order to insure program success.

- Energy Pricing

Current pricing policies for energy tend to discourage individual investment in energy conservation measures for homes and buildings. A utility charges for electricity, gas or fuel oil on the basis of the average cost of that energy from the current supply and delivery system. If energy were priced according to the replacement cost of energy installations (replacement cost pricing), and not according to the lower initial investment on existing systems (average cost pricing), consumers would have strong incentives to conserve. Similarly, if externalities (social and environmental costs) were quantified and included in the price of energy, the real cost of energy would rise and consumers would be encouraged to invest in building energy conservation measures. The unpopularity of marginal cost pricing and incorporating externality costs for energy stems from the inflationary effects these policies would have on energy prices, although many feel that these policies merely reflect the true cost of energy. This is an issue of much controversy which requires more attention in order to determine the direct impacts of pricing policies on retrofit activities.

Time-of-day metering is a utility-sponsored practice which has received much attention recently and which is expected to result in more balanced time usage of an electric generating system. By this practice, higher rates would be charged for electricity during peak daytime hours, thus encouraging home electricity use in periods of low demand. This saves the utility from having to invest in expensive and less efficient peak-load generating capacity. But more importantly for a retrofit program, time-of-day

metering provides a signal to customers of the necessity to conserve and charges for the true cost of energy from the existing system. The absence of time-of-day metering acts only as a postponement of consumer recognition of the real cost of energy.

- Capital Shortages

The inaccessibility to capital is a major obstacle to individual investment in retrofit measures. This is especially true for the middle and lower-middle income populations of our cities who have difficulty locating funding and gaining credit from any source. Traditionally, banks have not been oriented towards providing funds for energy efficiency improvements but this situation is improving.

Many banks have implemented energy - related changes in their policies. A good example is the Seattle Trust and Savings Bank in Washington which offers cheaper mortgage rates on energy-efficient homes. Some banks also offer more generous terms on loans for energy efficient homes. (Consumer response to this has been varied; excellent in some areas, minimal in others). Home improvement loans for retrofit are also becoming more available. A state of Massachusetts program involving 115 savings, commercial and cooperative banks and credit unions offers discounts of up to 2 percent on home improvement loans for retrofit. While such innovative programs are beginning to ease the credit problem, many more such programs should be encouraged.

On the Federal level these funding problems are being addressed by Part 3, Title II of the 1978 National Energy Conservation Policy Act; "Secondary Financing and Loan Insurance for Energy Conserving Improvements and Solar Energy Systems," which sets up

Federal loan guarantees and should do much to encourage loan availability.

- Data Base

A lack of information about city buildings stocks could hinder or delay a retrofit program. Characteristics of existing, buildings vary widely throughout the residential and commercial sectors; thus, there is no easy procedure for having buildings upgraded to a higher level of energy efficiency. Existing data bases for a city's building stock do not always reflect detailed energy use characteristics. The data base would need to show how much energy various building systems use for various functions (heating, cooling, lighting, water heating and appliances) to determine what technical opportunities exist for reducing the energy intensity of these functions.

In almost all cases, energy-saving improvements will be possible at various levels of investment and projected energy savings. But in order to implement an effective city-wide retrofit program, this body of information would have to be located, collected, and organized. Currently, the Department of Housing and Urban Development is conducting such a data exercise for public housing, however such data on the private sector remains to be collected.

- Lack of Metering

As mentioned earlier, many consumers in buildings do not pay the direct costs of their energy use. This occurs because they rent their living or commercial space, their individual units are not metered for the energy they use, and they do not pay a separate utility bill. When utility costs are simply averaged into all tenant's rent, individuals have little understanding

and often feel no direct responsibility for the quantity of energy they consume. Individual metering and billing often remedies this situation and is likely to induce consumers to investigate the potential for retrofits and other conservation measures. Installing individual meters could be an important component of a retrofit program; but the capital requirements would be substantial. A Federal program to encourage or support such installation could result in significant energy savings.

- Preference for Amenities

In the commercial sector, many building owners and managers prefer investments in amenities which make their building more attractive to potential tenants, rather than in materials and devices which make them more energy efficient. Energy costs are simply passed on to the tenant or tenant's customer. This emphasis on appearance will continue, but there are signs that a recognition of the need to reduce building energy consumption is growing. In the interests of an effective retrofit program, this need must be continually emphasized.

- Lack of Knowledge

A more general impediment to retrofit programs in both the residential and commercial sectors is the lack of education in energy conservation issues and practices. There are increasing signs that the American public is becoming more sophisticated in this, but consumers are often still unaware of the specific technical opportunities available to them in energy conservation. They instinctively (and often justifiably) distrust new contractors appearing in an immature trade or they are simply too busy to conduct individual research into the matter. Since energy

consumption depends as much upon the use patterns of the consumer as it does upon building thermal construction or the performance of space heating and air conditioning systems, continuing consumer education is probably the most important element of any retrofit program.

D. FEDERAL POLICY INITIATIVES

Over the past several years federal policy agencies have focused their efforts on increasing conservation. During this time it has become increasingly apparent that the main barrier to conservation is not the lack of technical know-how or hardware but instead the inability of our institutions to implement and commercialize these technologies. The single-family homeowner and the retail store operator face similar problems in retrofitting their structures for energy efficiency--namely lack of financing and capital availability, and especially an overall unfamiliarity with conservation options and efficiency standards. Broad powers and tools exist to facilitate market penetration of conservation measures in residential and commercial buildings. These include: tax credits, loan guarantees, forgiveness of additional real estate taxes, building standards relating to efficient design, education and public information programs, promoting municipality-utility cooperation, job training and public works jobs on city and non-profit buildings.

The role of DOE should be to overcome the institutional and economic barriers that hamper the effort to retrofit residential and commercial buildings for energy conservation.

The requirements for an effective program are:

- sufficient labor supply;
- adequate capital resources;
- increased public understanding of the purpose of an energy conservation retrofit program;
- standardization of retrofit procedures and certification of contractors;
- an understanding of the potential and variations of the prospective retrofit market; and
- an understanding of the institutional mechanisms available for initiating a retrofit program.

This will require a much higher degree of cooperation among the institutional players than at the present time. However, designing and carrying out an effective retrofit program could establish a city as a leader in the innovation and implementation of a crucial national policy as well as providing a link between energy policy and the long-standing goal of increased employment.

Many laws providing incentives for building energy conservation have been enacted at all levels of government over the past several years. This conservation-oriented legislative activity is partly attributable to the reluctance of the private sector to voluntarily make cost-effective energy efficient improvements in buildings. There is some feeling that a detailed national building code containing strict thermal integrity requirements would do much to stimulate conservation activities if applied. However, the regional variation necessary in

building codes, to reflect climatic differences and building materials supplies, seems to make this an unrealistic proposal.

Until recently, most federal legislation concerning energy efficiency in buildings was directed at the new housing and building market. Federal authorities felt that new construction is an important economic sector that could be adversely affected by the rising costs of energy. Consequently, the FEA, and then DOE, encouraged the serious consideration by lending institutions of building energy consumption characteristics in the normal lending process. This consideration will necessarily extend to loan underwriting for existing residential and commercial structures, although the energy efficiency criteria will not be as clear as for new buildings. Nevertheless, a growing recognition of the importance of energy efficiency in both new and existing buildings is apparent, with concomitant influence on the construction and lending industries, city property values, the tax base, and trends in urban revitalization.

The Energy Conservation and Production Act (ECPA), enacted by Congress on August 14, 1976, requires HUD to develop wide-ranging energy efficiency performance standards for all new construction by February 1980. The Act also includes provisions for existing buildings - Title IV, or Energy Conservation and Renewable Resource Assistance for Existing Buildings. (A \$200 million demonstration program to upgrade the energy efficiency of existing residential buildings and a \$2 billion loan guarantee program for general building energy conservation measures were authorized). The financial incentives include low-interest loans, loan guarantees, and interest subsidies and grants (\$400

limit). Section 451 of ECPA authorized the FEA to guarantee loans used to finance energy conservation measures in multiple dwelling units, industrial plants, and other commercial buildings.

The Energy Policy and Conservation Act, enacted December 22, 1975, required states to develop energy conservation plans that reduce statewide energy use 5 percent from projected 1980 consumption levels in order to qualify for federal funding assistance. While the bulk of required measures for buildings applies to new and "renovated" buildings, the states have flexibility in their definition of "renovated" buildings. To accomplish the required reduction in energy demand, many states have proposed building codes which include existing stock. Mandatory lighting efficiency standards apply to all public buildings, including any building open to the public (not just publicly-owned buildings). This requirement, as well as restrictions on decorative and non-essential lighting, will affect existing commercial establishments in cities.

The recent National Energy Conservation Policy Act brought the previous legislation up to date, strengthening the DOE weatherization grant program, providing for the establishment of the Farmers Home Administration Weatherization Grant Program, and providing further secondary financing and loan insurance for retrofitting. The weatherization programs are providing valuable assistance, especially to low-income and handicapped people, for retrofit. However, an aggressive program especially aimed at widespread urban retrofit is needed.

Finally, the Energy Tax Act of 1978 established a 15% tax credit for energy-related home improvements. While some feel that a larger credit would be a much better signal to homeowners,

entrepreneurs, and manufacturers, of a serious Federal commitment to retrofit, this is nevertheless an encouraging step.

Thus, a significant body of Federal and state programs for retrofit does exist, and would have substantial impact on energy conservation if accepted. However, to a large degree, the legislated incentives are voluntary and have yet to assume widespread implementation. An extremely vigorous educational effort, along with ever-increasing incentives, will be necessary in order to realize retrofit's vast energy conservation potential. In addition, a comprehensive catalog on all programs and public information applying to retrofit should be prepared and disseminated.

E. SOME PROMISING STRATEGIES

To some extent, Federal measures to encourage energy conservation have been hampered by an undeserved faith that the market will regulate itself. However, adequate energy saving actions have not been undertaken, in spite of increased energy prices. Very active programs are necessary if the great potential of conservation is to be realized. As this becomes more apparent more active programs must be, and are being, developed.

A number of the most promising strategies for implementing an urban energy conservation retrofit program are described here.

• Tax Incentives

The 1978 National Energy Tax Act establishes a 15 percent tax credit on investments in residential conservation, but not to exceed \$300. Further tax credits should be established, possibly on the state and local level through local taxes on income, sales or real estate.

Taxes on the cost or property value of retrofit installations could be "deferred" for a certain period of time or can simply be written off. "Forgiveness" of real estate taxes means that the increase in property value due to energy efficiency improvements are "forgiven" or discounted from the anticipated higher property value. Programs to provide "negative" tax incentives for conservation measures, whereby the cost of additional insulation or heating system improvement is actually deducted from the property value, should be considered. The purchase of energy conservation materials and devices could also be exempted from sales taxes.

While these measures provide city residents and building owners with real and visible economic incentives to invest in retrofit, they also may reduce the potential tax revenue. If an objective of the retrofit program is to preserve and perhaps expand the tax base, these tax incentives might be perceived as counter-productive. However, unless cities makes more efficient use of energy, economic deterioration will result as energy prices increase.

Furthermore, a city's commitment to energy efficient, cost-effective building operation and preservation of the physical urban environment could make cities more attractive to residential and commercial investors. Retrofit can thus play an important role in a urban revitalization effort, attracting middle and professional classes back to the city and encouraging a similar return of commercial and service industries. With successful economic revitalization, the tax effect over the long-run is expansion.

- Financing Schemes

Banks are increasingly willing to provide loans for weatherization with a slightly lower than average interest rate (as previously mentioned). Retrofit funding could be further facilitated by encouraging financial pooling arrangements among local banks, which would have specific criteria for making such retrofit loans. Cities could also provide energy conservation loan guarantees by backing the bank loans or providing funds directly through a municipal bond issue.

In reality, cities will not be able to provide direct financing at a significant level. Financing will have to be provided by local lending institutions or utilities or a combination of the two. The role of the Federal Government, then, would be to promote cooperation between the potential sources of funding for a retrofit program. This could involve establishing special financing pooling arrangements and passing legislation exempting them from current ordinances.

- Building Codes

In most cities and states, building codes that include thermal efficiency standards pertain only to new construction and buildings undergoing renovation. Modification of building codes to include existing structures, or apply certain standards for all energy conservation alterations (rehabilitation standards) could become important energy conservation strategies. Such regulations (to apply mandatory energy efficiency standards to all housing) are under consideration but are not now

in force.

Associated with modified building codes is the issue of energy audits. Utilities will now be required to provide an audit service for any homeowner on request. (Whether or not there will be a fee is to be established separately in each state). This will be useful, but mandatory energy audits should also be considered, as a further measure to educate homeowners.

- Pre-Sale Home Weatherization

Despite the benefits of lower fuel bills resulting from home weatherization investments, many home owners would still not voluntarily make all potential cost-effective conservation investments. To encourage conservation by taking advantage of the turnover in a city's housing stock, programs to promote certain standards of insulation prior to resale could be developed. This action will promote market penetration of home insulation retrofits through legal necessity as well as through public recognition of the eventual necessity for upgrading their homes.

As with building code modifications, several institutional uncertainties must be clarified. The city's building codes administration would have to develop new weatherization standards with the input of realtors who know the local housing resale market. Municipal operations would have to be expanded to include city-certified inspection teams familiar with home weatherization. Standardized financing arrangements would have

to be available for such a mandatory program. Realtors could play an important role in this area, since they are involved in a high percentage of house turnovers. A program of this nature is likely to encounter some resistance due to the large, mandatory expenditures it would require, so it is important that the details of the regulatory and financing programs be finalized before presenting of such a proposal to the public.

- Education/Public Information

Residential and commercial levels of energy consumption are nearly as much a function of occupant action as it is of construction integrity or performance of the heating and cooling system. Therefore, a knowledgeable energy consumer is essential to promote effective energy conservation. Although a large body of information regarding energy conservation already exists, it is not being practically and systematically applied to the energy consuming public.

Educational programs and public information campaigns can take various forms. Cooperative extension, continuing education and adult education establishments should be encouraged to add courses on energy conservation retrofitting to their curricula, emphasizing the life-cycle economic benefits realized by the consumer. Retrofit information packages for residences and commercial buildings should be prepared and distribution through a utility's billing system could be arranged. Cooperative extension programs could also be administered on the local level. DOE could develop workshops focusing on commercial sector con-

servation opportunities which could be organized locally by building owners and managers associations. These workshops would provide detailed information on potential energy savings for different commercial operations (e.g., supermarkets, restaurants, office buildings, etc.), and would summarize available financing methods for retrofits.

All education programs would introduce the concept of life cycle costing for buildings and equipment, instruction on how to audit building energy consumption (many utilities are doing this already), tips on weatherization, and information on how to take advantage of federal and local conservation programs and tax incentives.

It is important that programs provide explicit consumer information about energy conservation opportunities. The recent inundation of generalized information tends to cause confusion and uncertainty about energy conservation investments and often hinders widespread measures to increase fuel-use efficiency in buildings. Any information packages distributed should include guidance in:

- 1) Choosing a reputable retrofit contractor;
- 2) Various methods of retrofit and their cost-effectiveness;
- 3) Available sources of financing;
- 4) Alternative financing arrangements;
- 5) Relative merits of different brands of retrofit equipment; and

- 6) Appliance efficiency choices (e.g., significance of EER's (energy efficiency ratio) and appropriate size selection).

All programs should stress the benefits to individual consumers and society that result from conservation efforts. These benefits include money and energy savings, increased property values, creation of new jobs and the additional local sales of retrofit equipment.

In all cases, duplication and conflict with other conservation efforts, whether at local, state or federal levels, must be avoided. A large variety of initiatives currently exist which could serve as useful models or form the basis for any additional federal ventures into this important conservation area. In particular, local or state programs which address needs specific to their area are those that should be enhanced by federal programs. These should also be studied so that needed flexibility can be designed into federal efforts directed at urban areas.

CONCLUSION

High energy prices represent a special burden for cities in their commercial and residential building sectors, which are perhaps the least efficient users of energy in the city's and nation's economies. Despite these inefficiencies, these sectors have the potential to be highly energy efficient because

of certain structural characteristics of agglomeration and shared/walls unique to urban buildings. The retrofitting of a city's commercial and residential buildings saves energy and dollars, and serves an important function in urban revitalization.

However, a variety of real impediments to retrofit--institutional, financial, and technical--must be overcome before the city can realize the benefits of a retrofit program. The policy tools which can be used to implement a retrofit program are equally varied, and consist of tax breaks, financing arrangements, mandatory building efficiency standards, education programs, etc. A careful assortment of policy options, with particular attention given to a proper balance of various tax incentives, and a strong educational campaign could bring substantial saving through a wide-ranging retrofit program. A successful retrofit program helps to maintain and expand the city's tax base by insuring building value, creating retrofit employment, and giving the city a comparative attractiveness in its energy use characteristics.