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ENERGY CONSERVATION AND HISTORIC PRESERVATION

NATIONAL PROGRAMS

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Energy conservation has become an important national objective. A major area President Carter mentioned in his national energy policy is heating and cooling buildings. Congress has already enacted legislation such as the Energy Policy and Conservation Act of 1975 and the Energy Conservation and Production Act of 1976, which, among other things, provide for establishing federal and state energy efficiency standards for new and existing buildings, and requirements and assistance for "weatherization" of structures. Weatherization means increasing the thermal efficiency of existing buildings by installing insulation and other devices. Property owners will be encouraged through increased federal incentives and pressure to carry out such work.

Programs that require or assist in weatherizing existing buildings, or that establish energy efficiency standards may affect historic structures in two ways. First, some materials and techniques recommended and often used may cause damage to the historic fabric of a building. Also, insensitive planning or installing weatherizing devices or materials may adversely affect the historic integrity of structures. Because our historic resources are irreplaceable and because of the risks to historic structures, it is important that preservationists be aware of new federal energy conservation programs and the provisions that may affect historic buildings.

The Office of Archeology and Historic Preservation has been monitoring federal energy conservation programs for potential impact on historic buildings. It has become clear that although the programs are initiated on the federal level, many are implemented through state energy planning offices, state or local building code officials, or other state agencies. State Historic Preservation Officers will want to keep informed about energy programs implemented in their states. Although new energy programs are likely to be developed, there are sveral already existing programs that might affect historic preservation.

State Energy Conservation Plans

Under part C of title III of the Energy Policy and Conservation Act of 1975, grants are available to develop and implement state energy conservation plans. The Federal Energy Administration (FEA) invited all state governors to submit a plan by March 28, 1977. Although many states requested and received extensions to the deadline, almost all states and territories either have prepared or are preparing energy conservation plans.

Plans must be designed to result in progress toward and achievement of the state's energy conservation goal, outlined in a preliminary "state energy conservation feasibility report" submitted to FEA. In order for states to receive federal assistance to implement their plans, they must include five energy conservation provisions, one of which is "mandatory thermal efficiency standards and insulation requirements for new and renovated buildings (except buildings owned or leased by the United States.)" These standards and requirements would be implemented through state or local building codes. Plans will be reviewed and approved by FEA regional officers.

Fifty million dollars was authorized for each of fiscal years 1976, 1977, and 1978 for this program, although only $23.5 million was actually appropriated for FY 1977.

State Historic Preservation Officers will want to monitor how the plan is implemented and how the energy efficiency standards are integrated into state or local building codes to assure these provisions are flexible enough to maintain the integrity of historic buildings.

Energy Conservation Standards for New Buildings

Title III of the Energy Conservation and Production Act (August 14, 1976) requires that the Secretary of housing and Urban Development in consultation with FEA, the Department of Commerce, the National Bureau of Standards, and the General Services Administration prepare and publish for comment performance standards for new commercial and residential buildings before August 14, 1979. After the regulations are finalized, a year after publication for comment, no federal financial assistance will be available or approved for the construction of new commercial or residential buildings unless 1) the state or local government implements a building code or other construction control that meets or exceeds the requirements of the final performance standards, or 2) the new building has been officially determined to comply with the final performance standards, even though it is located in a state or locality that is not implementing the performance standards. Areas where new construction is not sufficient to warrant the costs of implementing final performance standards may be exempted from this rule by the Secretary of HUD.

Although these performance standards are intended for new buildings, state and local codes meeting the requirements of the energy conservation performance standards may apply to renovated buildings, because in some jurisdictions, substantial renovations (those requiring building permits) must meet the same codes as new construction. The energy conservation performance standards are in early stages of development at HUD and are at least 2 years away from final promulgation. Because of potential future impact on historic buildings, OAHP will be encouraging HUD to consider historic buildings in the development of the energy conservation standards. In the

meantime, SHPOs might want to investigate existing codes in their state to determine if substantially renovated buildings must meet the same codes as new construction. If so, SHPOs may wish to explore mechanisms through which historic buildings can be exempted from these codes.

Weatherization Assistance for Low-Income Persons

A weatherization assistance program for low-income persons was established by FEA under title IV of the Energy Conservation and Production Act of 1976. Under the program, federal funds will be apportioned to the states based on a formula that considers the climate and number of low-income dwellings in each state. States will allocate their funds to community action agencies (established under the Economic Opportunity Act of 1964) or other qualified entities in the state to provide weatherization assistance to low-income persons. After final regulations for the program are published by FEA (expected in late May 1977), states will have 90 days to apply for funding. Before applying, however, the state must prepare and hold hearings on a proposed plan to implement the program. State Historic Preservation Officers may want to be involved with the preparation or review of these plans to assure that the special needs of historic buildings are taken into consideration. If a state does not apply, or if its application is not acceptable to FEA, local governments may apply directly for funding.

Up to $400 may be used under this program for the purchase of weatherizing materials for any one dwelling, but not for costs of labor to install them. Although this program has not been funded, FEA expects a supplemental appropriation of $27.5 million for the remainder of FY 1977.

Rural Housing Weatherization Program

Another weatherizing program was recently developed under the Farmers Home Administration (FmHA). The Rural Housing Weatherization Loan program, authorized by section 502 of title V of the Housing Act of 1949, as amended, provides loans through rural utility cooperatives to their customers. Such loans may be up to $1,500 and used to purchase and install items such as insulation, siding, caulking material, and storm windows and doors. The cooperatives receive, process, close, and service the loans; FmHA determines applicants' eligibility and approves the loans. Weatherization improvements must meet FmHA standards for existing housing, or meet standards set by the utility cooperative, whichever are stronger.

The Farmers Home Administration recently published proposed energy efficiency standards for comment in the *Federal Register* (March 17, 1977). The standards also apply to buildings purchased with rural housing loans. Weatherization undertaken with section 502 funds and which meet the standards as published could affect historic buildings in rural areas. State Historic Preservation Officers will want to contact rural utility cooperatives or FmHA local county offices to assure that weatherization of historic buildings is undertaken with consideration for the historic and architectural integrity of significant buildings.

TECHNICAL CONSIDERATIONS

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There is little question that owners and administrators of historic buildings must participate in the national energy conservation program. However, certain aspects of energy conservation and weatherization programs can cause permanent damage to these buildings. As with many modern construction methods and products, we must be very cautious about their use in historic buildings before accomplishing thorough performance testing and evaluation of possible damaging effects to adjacent existing materials. Additionally, some aspects of these programs require the alteration of certain building features to achieve a reduction in energy usage. These alterations should be undertaken only if they do not cause a negative impact on the historic character of features of the building, especially in the case of buildings used as historic house museums or for similar public educational purposes.

Owners of historic buildings should be aware of the considerations noted here. However, this article is not intended to be the definitive work on the subject, nor should these considerations be viewed as guidelines or standards for energy conservation in historic buildings. These are merely suggestions for attaining some degree of energy conservation in historic buildings without causing permanent damage to the early building materials or the historic features of the building.

Operational Controls and Replacement of Inefficient Equipment

Possibly the most effective means of conserving energy in any historic building, is to utilize operational controls, that is, controlling *how* and *when* the building is used. These do not require retrofitting or alterations of the building, but rather incorporate programmatic planning and scheduling efforts by the owner and the selected replacement of inefficient equipment.

The first step is to undertake a survey to quantify all the facets of energy usage in the building. Once this energy usage is recorded and analyzed, one will be able to pinpoint ways of conserving energy by initiating operational controls. Steps such as lowering the thermostat in the winter, raising it in the summer, controlling the climate in only the rooms which are actually used and reducing the level of illumination, are common operational controls. Additionally, a survey of the equipment used to heat and air condition a building may indicate that some of it is inefficient and could be replaced to save energy. These operational controls and the selected replacement of inefficient equipment can save 20–30% of the energy used in a building.

Weatherization

There are several Federal programs which are promoting the weatherization or retrofitting of existing buildings. These efforts typically require some alteration of the building to insulate the attics, walls, and floors, install storm windows or double pane glass and caulking all cracks and joints in the exterior building envelope. These actions have widespread application to existing buildings, but, as will be shown below, should be applied with extreme caution to historic buildings, especially those used as house museums.

General Considerations

- Many materials and products now being used to weatherize buildings have not been fully tested. There is no guarantee how long they will last, nor have they been tested to determine how, or if, they will react with and damage the adjacent existing building materials. A historic building is an irreplaceable historic and cultural

resource that should not be the testing ground for untried materials.

- Most weatherization efforts will require that the thermal resistance (R value) of the elements of the building envelope (principally the roof and walls) be increased to a higher value. This can be easily done with relatively new buildings because their thermal properties are well know. However, it is a fact that the thermal properties of many materials used in historic buildings are not accurately known. There is not an accurate method of calculating the thermal resistance of certain material such as heavy masonry walls. There are methods being developed to measure the thermal resistance of such materials *in situ* by using portable scientific instruments. These methods would be vastly superior to the common method of analytical calculations. Rather than undertaking an extensive and costly retrofitting effort on an historic building which is based on an inaccurate assessment of the thermal properties of the existing materials, one should wait until accurate information is available about these historic building materials.
- If new materials and products, such as caulking compounds, wall insulation, and storm windows are to be installed, ensure that the manufacturers instructions are closely followed by the workmen. If the product includes caution notices or identifies any known risks, do not use the material. For instance, if product information reports, "this product may cause moisture condensation problems," do not use it unless the problem can be completely mitigated. These risks may be acceptable with typical existing buildings, but not with historic buildings.
- Accumulation of moisture in insulation materials drastically reduces their insulating abilities. To rectify this problem, typically, insulation includes a moisture barrier, an aluminum foil facing, which precludes the passage of moisture. This barrier faces the inhabited (heated) portion of the building, based on the assumption that the heated air inside the building which contains moisture, passes from the inside to the outside, Thus, the moisture barrier, facing the interior, blocks the transfer of moisture and thereby inhibits moisture accumulation in the insulation. An additional source of moisture which affects the insulation comes from that present in the non-heated adjacent space, such as, attic, basement and crawl space. To reduce moisture accumulation in the insulation from these sources, it is vitally important to ensure that the space are fully ventilated, perhaps even with exhaust fans, to ensure that the moisture level in the air is kept as low as possible. (An expert should be consulted about moisture problems since some conditions in a given building may require exactly the opposite approach to that outlined above.)

Recommendations

Insulation: Attic insulation is very effective. Ensure that there is a moisture barrier and that it faces down. Also, the attic must be well ventilated to prevent the insulation from becoming saturated with moisture. (Any subsequent insulation layer should not include a moisture barrier.)

Wall insulations, which are injected or blown into existing wall cavities, are all known to collect moisture since there is no moisture barrier. This will cause deterioration of the wooden or masonry materials. All such insulations, including fiber glass, cellulose, urea-formaldehyde, polyurethane, or other organic foams, exhibit this same disadvantage. Insulating the walls of an historic building should not be undertaken without expert consulation and a carefully monitored installation.

Insulating basement ceilings or grade level crawl spaces is effective. Where the spaces are unheated, ensure that they are properly ventilated and that the moisture barrier of the insulation faces up.

Air Infiltration: Air infiltration through small openings, cracks, and pores of the exterior building envelope is a major source of heat gain and heat loss. This infiltration can be nearly eliminated by ensuring that the exterior paint is in good condition and that all visible openings and construction joints are caulked.

Correcting air infiltration problems with masonry walls is a little more complicated. If the masonry is painted, then, by all means, ensure that the paint is in good condition. Unpainted masonry should not be coated with waterproofing or water repellent materials. Manufacturers of these products are promoting them as energy savers, saying that they will reduce the moisture content of the wall and cause it to be a more efficient thermal barrier. This is only partially true and it is a known fact that these coatings actually trap moisture in the masonry and cause deterioration and spalling, hence, do not use waterproofing coatings on masonry. The best way to reduce air infiltration is to ensure that the mortar is in good condition. This may require selected repointing.

Windows and Doors: Do not replace historic architectural features, such as windows, doors, or dormer windows with modern counterparts, just to save energy. Obviously, these replacements would destroy portions of the historic character of the building.

To improve the thermal resistance of windows and doors, one can:

- Ensure that all construction joints and connections are properly caulked and that windows and doors are tightly held in their frames with the appropriate weatherstripping.
- The addition of storm windows and doors, either on the interior or exterior can be highly effective, nearly as effective as double pane glass. (These items should not be added to a building if they represent an inappropriate visual intrusion.)
- The addition of shade screens, canopies, and awnings can reduce the summer heat gain. (Again, if the addition of these items causes a negative impact to the historic character of the building, they should not be installed.)

Miscellaneous Recommendations

The following recommendations are intended for historic buildings which are not used as historic house museums or for similar public educational purposes where historic accuracy is the primary consideration.

- The exterior color of the walls and roof can cause increased usage of energy in the building. An expert should be consulted to determine whether a light or dark color would provide the best overall results. (This depends on whether the heating or the air conditioning loads create the largest energy usage.)
- Shade trees adjacent to southern building exposures, can be effective in reducing the summer heat gain and may prove to be a worthwhile investment.
- It is preferable to keep asphalt and concrete sidewalks and parking areas away from the building. These both reflect and radiate heat to the building and cause significant heat gain.

Suggested Reading

"Making the Most of Your Energy Dollars in Home Heating and Cooling." National Bureau of Standards Consumer Information Series 8. Washington: Government Printing Office, 1975. Price: 70¢, Stock Number: C13.53:8. •