THE FLORIDA ENERGY EFFICIENCY BUILDING CODE, THE SECOND GENERATION

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ABSTRACT

This paper discusses the Revision of the Residential Sections of the Florida Energy Efficiency Code for Building Construction. The procedures utilized in the Revision and the concepts integrated into the 2nd Generation of the Florida Specific Energy Code are presented in general terms. The conceptual operation of the performance and prescriptive compliance procedures are discussed.

INTRODUCTION

The first version of the Florida Energy Efficiency Building Code was a code form of ASHRAE 90-75. The inadequacies of that standard in dealing with cooling dominated climates lead to the first development of the Florida Specific Building Code. That version took the form of a Performance Code where points relating to energy use were calculated and a maximum number of points equal to 100 was allowed for compliance. The energy use estimations for residential construction on which that first Code was based were the simplified degree day and full load equivalent operating hours methods. These procedures are based on design load calculations rather than dynamic performance and apply to average rather than specific building stocks.

Specific issues dealing with the inadequacies of those energy use estimation methods and a legislative mandate that the Code be cost effective to the consumer lead to the development of the second generation of the residential sections of the Florida Specific Code. This generation was developed through use of the dynamic simulation modeling of space heating and cooling loads and seasonal performances of equipment. Baseline performance levels were established for envelope components and equipment through criteria determined in economic analyses. The Performance Compliance procedures were modified to more directly relate to energy use calculations and to provide flexibility to the builders in meeting the required energy budget.

A prescriptive compliance procedure was also developed for the new generation of the Code. Increased complexity of the performance procedure lead to development of combinations of building envelope components and equipment which would meet the performance compliance criteria. These prescriptive packages were selected to be characteristic of Florida construction practices.

RESIDENTIAL PERFORMANCE COMPLIANCE PROCEDURES, SECTION 9

The Residential Section of the Florida Energy Efficiency Code for Building Construction regulates construction practices which potentially affect space heating and cooling and domestic hot water heating. The Section 9 Performance compliance procedures involve calculations of estimated annual energy consumption characteristic of building envelope components and equipment. This annual energy consumption is compared to a baseline energy budget in order to determine compliance. The baseline energy budget is specific to the complying house and is determined by using its envelope component areas, loads per unit dimension corresponding to baseline insulation levels, glass type, etc., and seasonal equipment efficiencies for baseline equipment. See Appendix I.

The baselines were determined through economic analyses as efficiency levels which were cost effective to the consumer over a time period characteristic of the structure's life. Those baseline levels for envelope components were determined independently using minimum life cycle cost principles. The estimated energy use resulting from the combination of the baseline envelope components was then used to optimize equipment efficiencies. Maximization of the savings to investment ratio was used as the criteria for baseline equipment selection. All component loads used in the economic analyses were determined by extensive computer simulations using the BLAST (Building Loads Analysis and System Thermodynamics) Program and WYEC (Weather Year for Energy Calculations, ASHRAE) hourly weather data for three characteristic climate zones of Florida. Cost data specific to those regions were also used. Compliance criteria are therefore specific to three climate regions.

The loads per unit area corresponding to baseline component efficiency levels, the areas, geometries and orientations of the house attempting compliance, and the baseline equipment efficiencies are used to calculate a custom baseline energy budget. The calculated energy consumption of the

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house as built is compared to this budget to determine compliance. Such a procedure eliminates the need for comparison to a conceptual standard house. A drawback of such standard house comparisons is that they place implicit constraints on spatial design because of assumptions of aspect ratios, wall to floor ratios, ceiling to floor ratios, etc. Earlier versions of the Florida Energy Code which used that concept resulted in larger houses complying more easily than smaller houses. The custom baseline budget methodology allows more flexibility and freedom in the design of living spaces and thereby meets a valued regulation goal.

Parallel calculations of estimated energy use for the house as it is to be built accompany the baseline calculations. The areas used in the calculations are the same and only load multipliers for envelope components and system multipliers corresponding to equipment efficiencies are different. The resulting sum of estimated annual energy consumption for space heating and cooling and domestic hot water are compared to the baseline equivalent. Compliance is demonstrated if the as built energy budget is less than the baseline energy budget.

The mainline calculations of the performance procedure involve estimations of energy use for heating and cooling characteristic of the performance of insulation levels, shading coefficients, etc. and seasonal equipment efficiencies. These estimations represent the state of the art in engineering modeling and analysis. A separate category of construction practices and equipment whose performance is not modeled as well is treated differently in a more approximate manner.

The category of new and emerging technologies incorporates construction practices and equipment whose potential effect on energy consumption is recognized to be significant but whose performance is not yet fully characterized or modeled by a general methodology. Incentives for the use of items within this category is given by credit point multipliers which reduce the total estimated load for space heating or cooling or domestic water heating. Examples are ceiling fans, cross ventilation, heat recovery units, and solar water heaters.

The Performance Compliance Procedure is a comprehensive energy use estimation methodology. It is design oriented and as such is moderately complex for its audience. A simple procedure was therefore developed for quick analysis to facilitate the compliance process. That procedure was developed from the performance compliance procedure and is referred to as the Section 10 Prescriptive Compliance Procedure.

RESIDENTIAL PRESCRIPTIVE COMPLIANCE PROCEDURE, SECTION 10

The Prescriptive Compliance Procedure evolved as a simplification of the Section 9 Compliance Procedure. It was designed to address a large part of the residential construction occurring in Florida. The compliance form used in this procedure consists of fifteen packages representing combinations of component efficiency levels which if met or exceeded would result in compliance. Levels of added R-value to specific wall, ceiling and floor types, window glazing types, glass to floor area percentages, and overhangs and equipment efficiencies are specified for each package. See Appendix II.

The packages do not establish minimum building envelope component or equipment efficiencies allowed by the Code. Those minimums are established separately. They do represent combinations of components which when used together in the performance compliance procedure, result in compliance by that primary methodology. The equipment minimum efficiencies set by the Code are generally lower than those specified by the prescriptive packages. This occurs because the use of the minimum efficiencies is atypical to Florida construction. Therefore, packages incorporating them are not heavily represented. The general trend in Florida construction is to increase glass areas and maintain moderate R-values then make up for the additional loads with higher equipment efficiencies. Packages reflecting this trend are heavily represented.

SUMMARY

The second generation of the Residential Sections of the Florida Energy Efficiency Building Code has tied compliance to better estimations of energy use for space heating and cooling and domestic water heating. The data used in the performance calculation procedures was developed using advanced computer programs which simulate dynamic building loads thereby generating much more data than was previously available. The equipment efficiency parameters are based on seasonal performance as determined by DOE appliance test procedures and modified to reflect local climate conditions where possible.

The Baseline performance levels for building components and systems were determined through cost effectiveness methodologies. They are implemented through calculation of a baseline energy budget specific to the complying house. These custom baseline budgets set the criteria for Code compliance and, because they are specific to the house, they allow more freedom and flexibility in design.

The performance procedure is the fundamental approach to determining compliance. In addition, a quasi-prescriptive procedure was developed as a simplified approach to compliance for standard Florida construction. This procedure gives combinations of construction practices which if used in the Section 9 calculations would result in compliance by that procedure. The levels prescribed in each package represent only the minimums allowed for use of that package as a vehicle to compliance. They do not represent the minimum efficiencies allowed by the Energy Code for use in the State.

The new generation of the residential procedures of the Code are refinements of past procedures. They represent a new direction toward economic justification of performance requirements and a more technically accurate representation of energy use. Incentives are based on energy performance in a more balanced manner such that trade-offs can be made more intelligently. This version of the Code will serve as a better tool for education of energy awareness.