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 second 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 40-75. 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 new generation 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
considerations is that they place implicit constraints
on spatial design because of assumptions of aspect
ratio, wall to floor ratios, ceiling to floor
ratio, etc. Earlier versions of the Florida Energy
Code which used that concept resulted in larger
houses completing more easily than smaller homes.
The custom baseline budget methodology allows
more flexibility and freedom in the design of living
spaces and thereby meets a valued regulation goal.

Baseline 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
corresponding to equipment efficiencies are
different. The resulting sum of estimated annual
energy consumption for space heating and cooling
domestic hot water are compared to the baseline
budget. Compliance is demonstrated if the as
built energy budget is less than the baseline energy
budget.

The baseline calculations of the performance
procedure involve estimations of energy use for
heating and cooling characteristic of the perfor-
mance of insulation levels, shading coefficients,
etc. and seasonal equipment efficiencies. These
estimations represent the state of the art in
equipment 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
techs like those reported early by credit point
multipliers which reduce the total estimated load
for space heating or cooling or domestic water
heating. Examples are ceiling fans, cross ventila-
tion, 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 more complex
for its audience. A simple procedure was therefore
developed for quick analysis to facilitate the
compliance process. That procedure was developed
from the prescriptive compliance procedure and is
referred to as the Section 10 Prescriptive
Compliance Procedure.

RESIDENTIAL PRESCRIPTIVE COMPLIANCE PROCEDURE
PROCEDURE 20

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

The packages do not establish minimum building
equipment component or equipment efficiencies allowed
by the Code. Those minimums are established
separately. They do represent combinations of
equipment which when used together in the
performance compliance procedure result in
compliance by that primary methodology. The
package minimum efficiencies set by the Code are
more 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
techs 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. SUPPORT

The second generation of the Residential
Sections of the Florida Energy Efficiency
Building Code has tied compliance to better estimations of
equipment for space heating and cooling and
domestic water heating. The use in the
performance compliance 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-effective 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 in 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
achieving compliances can be more attractive.

This version of the Code will serve as a better tool for
education of energy awareness.

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