ENERGY PERFORMANCE MODELING AND REPORTING

by the

Sustainable, Energy Efficient Buildings Advisory Committee

in re:

NC GS 143-135.35 thru 143-135.40 (Senate Bills 668 and 1946)

2-2. ENERGY PERFORMANCE MODELING AND REPORTING

In order for compliance with the energy performance goals to be demonstrated, specific methodologies and reporting is required, as follows:

Energy Modeling Simulation

Computer simulations must be performed for energy modeling comparisons. ASHRAE Standard 90.1-2004, *Appendix G – Performance Rating Method*, must be used as the calculation methodology to establish a percentage improvement of the proposed building over the baseline model.

Pre-approved energy modeling simulation software includes "DOE-2", "Blast", "EnergyPlus", "eQUEST", "EnergyPro", Carrier's "Hourly Analysis Program (HAP)", and Trane's "Trace".

Designers wishing to utilize other simulation software must submit documentation to the State Construction Office for approval in the pre-planning stage indicating how the software complies with ANSI/ASHRAE *Standard 140*-2004, *Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs*.

Energy model reports must be submitted beginning in the Schematic Design Phase and are to be completed no later than the Design Development Phase. (Refer Appendix A, Section 300 of the *State Construction Manual*.)

Energy strategies shall be utilized for variable building elements as applicable for each project. Each of the following categories shall be evaluated and decisions on which items will be pursued shall be defined in the Energy Model summary:

1. Building envelope.

2. Lighting design and control.

3. HVAC systems design and control.

4. Service hot water heating systems design and control.

Simulation Conditions and Constraints

The following constraints shall apply to the energy modeling at each program run:

1. Only one building geometry shall be used for a given project analysis.

2. Process energy, including "plug load" energy, is exempt for the requirements of ASHRAE Standard 90.1-2004 and, therefore, is exempt from the performance requirements of the legislation. Process energy should not be included in either the baseline or design building analysis if these loads will be identical in both the baseline building and the energy efficient building option(s). *However, plug and process loads must be included in the analysis if they differ between the baseline*

and the energy efficient building option(s) in a documented way and result in building energy use reduction.

3. The cost of energy (energy rate) must be the same for all modeled options.

4. The same energy simulation software program shall be used for each phase (SD, DD, CD) of the project submittal, as well as for each energy conservation strategy.

Exceptions are allowed for the above constraints provided those exceptions are requested in writing from SCO during the schematic design submittal phase, and written approval has been granted.

An unlimited number of options can be modeled for each building, but the designers must use good professional judgment to determine those options resulting in the best energy savings and lowest first costs to compare in the required LCCA to provide an overall lowest building cost for the long term.

Submittal Information and Forms

The energy model information and the life cycle cost analysis shall be submitted at each phase as a stand-alone document. This should not be bound with the soils report, cost estimate, comment responses, or other documentation items.

Designer shall submit the following information at each project submittal, starting at the schematic design phase:

1. Cover Sheet and fly sheet with the following information at a minimum:

   a. Indicate this is an Energy Model and a Life Cycle Cost Analysis for "Agency Name" and "Project Name".
   b. Date of Report and Project Phase (SD, DD, CD)
   c. SCO ID#
   d. Code and Item
   e. Project Location
   f. Design Team company names, addresses, telephone numbers and email addresses. Provide company web address if available.
   g. Seals and Signatures of Designers of Record
   h. Optional:
      (1) Design Team firm logos
      (2) Agency Logos

2. Table of Contents

3. Narrative: Discuss the project criteria, design recommendations and decision rationale, and the building elements that are modeled in the energy model, and how those elements are combined to create a composite building that is compliant with requirements of the Statute. Building Elements shall include at least two options for each of the following components:

a. Building Envelope: The base case shall be labeled A-1, and the options shall be numbered A-2, A-3, etc.
b. Domestic Water Heating Systems: The base case shall be labeled P-1 and the options shall be numbered P-2, P-3, etc.
c. HVAC systems and controls:
(1) Primary Systems: The base case shall be labeled H1-1 and the options shall be numbered H1-2, H1-3, etc.
(2) Secondary Systems: The base case shall be labeled H2-1 and the energy strategies shall be numbered H2-2, H2-3, etc.
d. Lighting control and lighting design: The base case shall be labeled E-1 and the energy strategies shall be numbered E-2, E-3, etc.
e. Additional strategies may be required to meet the energy efficiency requirements: Use sequential numbering for additional strategies.
f. Name and version of the simulation program utilized to model the building energy use, as well as the life cycle cost analysis.

4. Completed calculation forms are located at the end of this Section.

5. Software reports indicating base building compliance with ASHRAE 90.1-2004.

6. Software reports for all strategies indicating compliance with the requirements of the Statute.

7. Life Cycle Cost Analysis for base ASHRAE Standard 90.1-2004 compliant building and the two or more alternate buildings with varying strategies resulting in required energy savings:
b. Include and use Table 2-1 from the LCCA manual.
c. Use the same numbering system noted above for the design alternatives.
d. Provide a "General Building Energy Model Information" sheet for each building with all alternate energy strategies.
e. Provide a "Baseline And Proposed Design Input Parameters" sheet for each alternate building.
f. Provide a LCCA spreadsheet for each alternate building.
g. Provide a SIR (Savings-to-Investment) Analysis for the base case and alternate building designs.

8. Provide Summary of the selected design approach.

The following forms should be used as described above to demonstrate that the energy performance goals of the legislation are met: