Energy Efficiency and Sustainable Construction Standards for State Buildings

Georgia Peach

Green Building Rating System

In Accordance with the

Energy Efficiency and Sustainable Construction Act of 2008 (O.C.G.A. § 50-8-18)

July 1, 2009

Contents

Forward

The Energy Efficiency and Sustainable Construction Standards for State Buildings in accordance with the Energy Efficiency and Sustainable Construction Act of 2008 provide a resource for state agencies, design professionals, contractors, and building operators. The Standards were developed by the 2008 Energy Efficiency and Sustainable Construction Task Force. The Task Force was authorized under Senate Bill 130 to develop policies, procedures and guidelines to provide more stringent energy efficiency requirements for future buildings that will be constructed by the State.

The Energy Efficiency and Sustainable Construction Standards for State Buildings serve as a set of instructions for state agencies, design professionals, contractors, and building operators. The Standards are organized into six sections. Section One, *Requirements*, outlines the requirements of Senate Bill 130 and provides potential technologies and strategies in addition to a recommended timeline and scope. Section Two, *Commentary and Checklists*, provides supplementary recommendations in achieving the requirements and examples of the deliverable checklists for the project team to demonstrate compliance with the requirements. Section Three, *Resources*, provides additional resources to the team to research further information about each requirement. Section Four, *Recommendations*, outlines additional strategies to pursue energy efficiency and sustainable construction standards. Although achieving specific energy efficient thresholds is not required, optimizing energy performance, conserving energy, and utilizing local and renewable energy sources is encouraged and incentivized. Section Five, *Incentives*, provides a point scale for the Standards and an opportunity to achieve further incentives in adhering to The Energy Efficiency and Sustainable Construction Standards for State Buildings. Lastly, Section Six, *Submittals,* provides the deliverable checklists that must be submitted to the agency owner to demonstrate compliance with the requirements. The project team will not need to submit documentation beyond the deliverable checklists. However, the agency owner has the authority to audit each requirement and recommendation pursued by the project team to ensure compliance. Accordingly, project teams should keep all relevant documentation to prove compliance if the project is to be audited. The deliverable checklists in Section Six, *Submittals*, also serve to provide the necessary data to determine the level achieved in the Georgia Peach Green Building Rating System.

Senate Bill 130 Background:

On April 4, 2008 the Georgia General Assembly passed Senate Bill 130, which was signed by Governor Perdue on May 6, 2008. Section 4 of this bill is known as the *Energy Efficiency and Sustainable Construction Act of 2008* and is codified in O.C.G.A. § 50-8-18. Sub-section (b) of Section 4 states:

> *The General Assembly finds that the welfare of this state is enhanced by the promotion of effective energy and environmental standards for construction, rehabilitation, and maintenance of state-funded facilities and that such standards in turn improve this state's capacity to design, build and operate high-performance buildings, contributing to economic growth, promoting job development, and increasing energy conservation.*

This Act directs the Department of Community Affairs (DCA) in consultation with the Georgia State Finance and Investment Commission (GSFIC) to adopt policies and procedures as recommended standards for all buildings owned or managed by the state to be more energy and water efficient, and encourage the use of Georgia-based building materials.

Adoption:

The Act shall become effective on July 1, 2010, and shall apply to design agreements for major facilities projects entered into on or after such date.

Scope

The provisions of these Standards shall apply to the construction, rehabilitation and maintenance of state-funded facilities that meet any one of the following criteria:

1) New construction building projects exceeding 10,000 square feet;

2) A renovation project that is more than 50 percent of the replacement value of the facility[1];

3) A change in occupancy;

4) Any roof replacement project exceeding 10,000 square feet; or

5) A commercial interior tenant fit-out project exceeding 10,000 square feet of leasable area where the state is intended to be the lessor of such property.

Exception: Any building, regardless of size, that does not have conditioned space as defined by ASHRAE or a state owned building that is on the historical registry or any local, county or municipal building.

**For additional clarification on the requirements for existing buildings, reference Chapter 34 'Existing Buildings' and any Georgia Amendments to Chapter 34 of the International Building Code.*

[1] As determined by the Department of Administrative Services Risk Management Division.

Acknowledgements

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Task Force Members:

James Vaseff, AIA, Department of Community Affairs – Chairman
Robert Buscemi, RA AIA, LEED AP, Georgia State Finance and Investment Commission – Vice-Chairman
Bill Abballe, AIA, LEED AP, Profession of Architecture
Greg Adams, Board of Regents of the University System of Georgia
Abim Durojaiye, LEED AP, Georgia State Finance and Investment Commission
David Freedman, PE, LEED AP, Department of Natural Resources
Alan Krieger, Georgia Department of Education
S. Gregg Johnson, PE, LEED AP, Department of Community Affairs
Thomas Mann, Technical College System of Georgia
Ron Nawrocki, Governor's Office of Planning and Budget
P.J. Newcomb, Georgia Environmental Facilities Authority
Beth Studley, LEED AP, General Contractors
Neil Wyche, PE, Profession of Engineering

Georgia Department of Community Affairs (DCA) Staff:

Ted Miltiades, Director, Construction Codes
Ryan Meres, LEED AP, Building Codes Consultant/Task Force Coordinator
Anthony Claffey, Building Codes Consultant

Private Consultants – Energy Ace, Inc.:

Wayne Robertson, PE, LEED AP, President
Lauren Gloster, LEED AP, Senior Sustainability Consultant
Ben Taube, LEED AP, Southeast Energy Efficiency Alliance
R. Alfred Vick, ASLA, LEED AP, University of Georgia, College of Environment & Design

Definitions

ASHRAE – The American Society of Heating, Refrigerating and Air-Conditioning Engineers

Basis of Design (BOD) – A document completed by the design team that includes design information necessary to accomplish the owner's project requirements, including system descriptions, indoor environmental quality criteria, other pertinent design assumptions (such as weather data), and references to applicable codes, standards, regulations and guidelines.

Building – A structure wholly or partially enclosed within exterior walls, or within exterior and party walls, and a roof, affording shelter to persons, animals, or property.

Building Envelope – The elements of a building which enclose conditioned spaces through which thermal energy is capable of being transferred to or from the exterior or to or from unconditioned spaces.

Building Material – Any element of the building envelope through which heat flows and that is included in the component U-factor calculations other than air films and insulation.

Certify – An expression of the Consultant's professional opinion to the best of their information, knowledge, and belief; and does not constitute a warranty or guarantee by the Consultant.

Change in Occupancy – A change in the purpose or level of activity within a building that involves a change in the application of the requirements of the Georgia State Minimum Standard Codes.

Commissioning – A quality assurance process that ensures that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the owner's project requirements and the project design documents.

Commissioning Agent – The party responsible for the commissioning process. (See "Preferred Qualifications" in the *State Building Commissioning Guide* at http://gsfic.georgia.gov/).

Construction – The fabrication and erection of a new building or any addition to or alteration of an existing building.

Construction Documents – Drawings and specifications used to construct a building, building systems, or portions thereof.

Commissioning Specification – The contract document that details the commissioning requirements of the construction contractors.

Efficiency – Actual performance compared to ideal performance at specified rating conditions.

Energy – The capacity for doing work. It takes a number of forms that may be transformed from one into another such as thermal (heat), mechanical (work), electrical, and chemical. Customary measurement units are British thermal units (Btu) and watt hours (Wh) where 1 Wh = 3.413 Btu.

Energy Efficiency Ratio (EER) – The ratio of net cooling capacity in Btu/h to total rate of electric input in watts under designated operating conditions.

Energy Performance Rating – The energy use of the proposed building under actual operating conditions. Projected energy use targets can be used for buildings in the design or construction process.

Environmentally Preferable Products- Goods that have a lesser or reduced effect on human health and the environment when compared to competing products that serve the same purpose. Environmentally preferable products include, but are not limited to, those that reduce toxicity and waste, contain recycled materials, those derived from renewable sources, minimize waste, conserve energy or water, and reduce the amount of toxins either disposed of or consumed.

Equipment – Devices for comfort conditioning, electric power, lighting, transportation, or service water heating including, but not limited to, furnaces, boilers, air conditioners, heat pumps, chillers, water heaters, lamps, luminaires, ballasts, elevators, escalators, or other devices or installations.

Facility – A building or a group of buildings that share one or more common utility systems.

Fenestration – All areas (including the frames) in the building envelope that let in light, including windows, plastic panels, skylights, glass doors that are more than one-half glass, and glass block walls.

First or Capital Cost - The sum of the design, construction, and financing costs necessary to provide a finished building or building component ready for use.

Historic Building - A building recognized as being of particular architectural or historic interest. A building of local importance included on the National Register of Historic Places, State of Georgia: http://www.nationalregisterofhistoricplaces.com/ga/state.html

HVAC – Heating, Ventilating and Air Conditioning

HVAC System – The equipment, distribution systems, and terminals that provide, either collectively or individually, the process of heating, ventilating, or air conditioning to a building or portion of a building.

Life Cycle Cost Analysis – An economic method of project evaluation in which all costs arising from owning, operating, maintaining, and ultimately disposing of a project are considered to be potentially important to that decision.

Major facility project – A state-funded:

(1) New construction building project of a building exceeding 10,000 square feet;

(2) A renovation project that is more than 50 percent of the replacement value, as determined

by the Department of Administrative Services Risk Management Division, of the facility, a change in occupancy, or any roof replacement project exceeding 10,000 square feet; (3) A commercial interior tenant fit-out project exceeding 10,000 square feet of leasable area where the state is intended to be the lessor of such property.

Occupant Sensor – A device that detects that presence or absence of people within an area and causes lighting, equipment, or appliances to be regulated accordingly.

Operating Cost – The expenses incurred during the normal operation of a building or a building system or component, including labor, materials, utilities, and other related costs.

Orientation – The direction an envelope element faces, i.e., the direction of a vector perpendicular to and pointing away from the surface outside of the element.

Owner's Project Requirements (OPR) – A document that details the functional requirements of a project and the expectation of how it will be used and operated

Proposed Design – A computer representation of the actual proposed building design or portion thereof used as the basis for calculating the design energy cost.

Roof – The upper portion of the building envelope, including opaque areas and fenestration, that is horizontal or tilted at an angle of less than 60% from horizontal.

Seasonal Energy Efficiency Ratio (SEER) – The total cooling output of an air conditioner during its normal annual usage period for cooling (in Btu) divided by the total electric energy input during the same period (in Wh).

Space – An enclosed space within a building. Spaces are defined as follows for the purpose of determining building envelope requirements.

(a) *conditioned space* – a heated or cooled space, or both, within a building and, where required, provided with humidification or dehumidification means so as to be capable of maintaining a space condition falling within the comfort envelope set forth in ASHRAE 55.

(b) *unconditioned space* – a space other than a conditioned space.

Rating System Point Scale

The Energy Efficiency and Sustainable Construction Standards for State Buildings' Georgia Peach Green Building ratings are awarded according to the following scale –

Requirements

1.1 – Commissioning	Mandatory
1.2 – Water-Use Reduction	Mandatory
1.3 – Georgia-based Materials & Products	Mandatory

Incentives

5.1 – Commissioning	10 Points
5.2 – Water-Use Reduction	2-20 Points
5.3 – Georgia-based Materials & Resources	2-20 Points
5.4 – Energy Modeling and Life Cycle Cost Analysis	5-50 Points

(Note: Section 4.1 Recommendation = 30 Points)

Total Point Certification Level

12-30 Points = 

31-50 Points = 

51-70 Points = 

71-100 Points = 

The Georgia Association of State Facilities Administrators (GASFA) will recognize state-funded facilities that achieve one of these rating levels with a formal letter of certification and a plaque.

Section 1:

Requirements

Section 1: Requirements

1.1 – Commissioning

Requirement:

A professional engineer, design professional, or commissioning agent shall certify that the building project's systems for heating, ventilating, air conditioning, energy conservation, and water conservation are installed and working properly to ensure that each building project performs according to the building's overall environmental design intent and operational objectives.

Potential Technologies & Strategies:

Engage a member of the design team, a member of the design firm, or an independent third-party commissioning agent. Commissioning activities should be completed for the mechanical systems (heating, ventilating, air conditioning, and refrigeration equipment and controls, heat recovery and renewable energy systems, laboratory systems, test and balance verification), electrical systems (lighting and daylighting controls and renewable energy systems), and plumbing systems (domestic hot water systems). Other systems that may be considered in the commissioning process include the building envelope, normal, standby and emergency power systems, potable water and booster pump systems, and irrigation systems. The commissioning agent should verify the installation and performance of all commissioned systems to ensure that the systems perform in accordance with the intended design requirements.

Timeline & Scope:

Section 2.1 – Commissioning, *Commentary and Checklists*, provides the checklist template for the project team to demonstrate compliance with the requirement. The completed and signed off checklist serves to certify compliance with the requirement of Section 1.1 – Commissioning, *Requirements*. The Commissioning Checklist provided in Section 6.1, Commissioning*, Submittals* should be completed at the end of the construction phase of the project. The form must be submitted to the agency owner at completion.

The project team may engage the commissioning agent during the advance planning or Schematic Design Phase of the project. The commissioning agent should verify the installation and performance of all commissioned systems no later than 10 months after substantial completion of the project.

The design team and the state agency should determine the appropriate level of commissioning based on the size and complexity of the building and/or its energy and water system components.

The commissioning agent should ensure proper start-up of the HVAC systems, monitor the Testing, Adjusting and Balancing (TAB) to ensure that HVAC systems are operating at their specified capacities, and witness the functional performance testing by the contractor to ensure the systems respond to variations and that controls are operating properly.

Section 1: Requirements

1.2 – Water-Use Reduction

Requirement:

All major facility projects shall be designed, constructed, and commissioned or modeled to achieve a 15 percent reduction in water use when compared to water use based on plumbing fixture selection in accordance with the Energy Policy Act of 1992.

The Water-Use Reduction requirement should be taken into consideration with the Governor's Water Conservation Challenge. The Challenge commits all state agencies and authorities in Georgia to implement practices that help reduce water usage by 5% over the next two years and 2% annually thereafter through the year 2020. Reductions will be calculated on a per square foot basis, using fiscal year 2007 as the baseline.

Potential Technologies & Strategies:

Utilize high-efficiency plumbing fixtures and fittings, such as low-flow fixtures, and other devices to reduce water use by 15 percent as compared to a baseline design complying with the Energy Policy Act of 1992.

Refer to the supplementary form provided in Section 2.2 – Water-Use Reduction, *Commentary and Checklists* for alternative plumbing fixture and fitting options to determine the most highly-efficient plumbing system.

Timeline & Scope:

Section 2.2 – Water-Use Reduction, *Commentary and Checklists*, provides the checklist template for the project team to demonstrate compliance with the requirement. The completed and signed off checklist serves to certify compliance with the requirement of Section 1.2 – Water-Use Reduction, *Requirements*. The Water-Use Reduction Checklist provided in Section 6.2, Water-Use Reduction*, Submittals* should be completed at the end of the Design Document phase of the project. The form must be submitted to the agency owner at completion.

Early planning in the Schematic Design Phase or Design Document Phase is encouraged. The design team may specify the installation of low-flow plumbing fixtures such as dual-flush water closets and ultra-low flush urinals and the installation of flow restrictors and/or reduced flow aerators on lavatory, sink, and shower fixtures as effective methods to reduce water use.

Section 1: Requirements

1.3 –Georgia-based Materials & Products

Requirement:

All major facility projects shall include Georgia products such that not less than 10 percent of all building materials used in a project are harvested, extracted, or manufactured in the State of Georgia where such products are commercially available.

The following sections of the Official Code of Georgia Annotated (O.C.G.A) contain laws referencing the purchase of Georgia products. Additional information regarding these laws may be obtained through the Department of Administrative Services.

50-5-[60-61] "Preference for Georgia Supplies, materials, equipment and agriculture products."
50-5-62 "Preference for Local Sellers of Georgia Products"
50-5-63 "Preference for Georgia Forest Products"

Potential Technologies & Strategies:

Establish a project goal for implementing Georgia-sourced building materials. Identify materials and material suppliers that can assist in achieving the 10 percent minimum requirement. The 10 percent minimum should be applied in terms of materials and products cost. During construction, ensure that the specified Georgia-sourced materials are being installed.

Timeline & Scope:

Section 2.3 – Georgia-based Materials and Products, *Commentary and Checklists*, provides the checklist template for the project team to demonstrate compliance with the requirement. The completed and signed off checklist serves to certify compliance with the requirement of Section 1.3 – Commissioning, *Requirements*. The Georgia-based Materials & Products Checklist provided in Section 6.3, Georgia-based Materials & Products, *Submittals* should be completed at the end of the construction phase of the project. The form must be submitted to the agency owner at completion.

The design team should include the 10 percent minimum requirement in the specifications to ensure that sufficient Georgia-based materials and products are incorporated into the building project. Using the deliverable checklist provided in Section 2.3 of the *Energy Efficiency and Sustainable Construction Standards for State Buildings*, the general contractor shall track the materials and costs of each Georgia-based product used on the project. The contractor shall provide documentation to ensure compliance with this guideline and obtain product data sheets.

Project teams may determine their materials cost for the project in two ways; the Default Materials Value or the Actual Materials Value. The Default Materials Value is based on the total construction costs, hard costs for CSI Master Format 2004 Divisions 2-10 only. In order to calculate the Default Materials Value, the project team may apply a 45% factor to the total construction cost (including labor and equipment) to establish a default total materials cost for the project, i.e. total construction cost * 0.45 = Default Materials Value. The Actual Materials Value is based on the actual materials cost, hard costs for CSI Master Format 2004 Divisions 2-10 only. The Actual Materials Value excludes labor and equipment.

Section 2:

Commentary & Checklists

Section 2: Commentary and Checklists

2.1 – Commissioning

1) Commissioning Agent action items during the Design phase:

   a. Review the Owner's Project Requirements (OPR) document

   b. Review the Basis of Design (BOD) document and ensure that the BOD is consistent with the OPR

   c. Incorporate commissioning requirements into project specifications

   d. Review project drawings, specifications, and equipment submittals for the equipment to be commissioned

   e. Provide the design team with a draft of the commissioning plan

   f. Create commissioning issues log to be revised throughout commissioning

   g. Complete checklist verifying that Commissioning Agent has received the latest versions of the design documents

2) Commissioning Agent action items during the Construction phase:

   a. Perform installation verification walk through(s)

   b. Review completed copies of factory or contractor provided pre-start up and start up test forms

   c. Write the functional performance tests (FPT) for the systems requiring commissioning

   d. On-site validation of successful completion of FPTs

   e. Review Test, Adjust and Balance (TAB) report

   f. On-site validation of at least 10% of the results contained in the TAB report

   g. Review O&M manuals, as built documentation, and training documentation

   h. Complete checklist verifying that Commissioning Agent has received the latest versions of the construction documents

3) Commissioning Agent action items during the Occupancy phase:

   a. Complete final commissioning issues log that includes resolved and unresolved issues

   b. Complete a 10-month warranty walk-through to ensure systems are performing as designed

   c. May assist the owner with 12-month Measurement & Verification of energy performance

Commissioning Checklist

Note: The Commissioning Checklist serves to certify compliance with the requirement of Section 1.1 – Commissioning, *Requirements*

Commissioning Task	Responsible Team Member	Typical Time Frame	Seasonal Climate Conditions	Responsible Team Member Sign Off	Completion Date
Prepare OPR	Owner	Prior to beginning Design Documents.			
Prepare BOD	A/E Team	During the Design Phase.			
Prepare a Cx Plan	CxA	During the Design Phase.			
Incorporate Cx Requirements into Construction Documents	CxA	CxA will review existing project specifications and incorporate commissioning requirements.			
Introduction and task assignment meeting, i.e. Cx kickoff	CxA	When all contractors have been selected. This meeting is to introduce everyone needed in the Cx process and define roles and responsibilities.			
Verification of Installation	CxA	CxA will be walking the job periodically as the job progresses looking for system wide issues that may prove to be functional problems later.			
Completion of start-up test sheets	CxA	This should happen when the equipment begins to arrive on the job. It is the contractor's responsibility to properly fill them out and return to the CxA. Factory start-up sheets are preferable. If the contractor does not have anything to use, the CxA will supply the sheets for them.			
Functional performance tests and verification of TAB Reports	CxA / Contractors	Require the participation of all sub contractors and CxA designated personnel. This should take place prior to the CO. If any problems arise during testing, some amount of time may be required to correct the problems and this should also be considered before CO date.			
Summary (final) commissioning report	CxA	Provided by the CxA after substantial progress has been made with resolving the discrepancies and deficiencies identified during functional performance testing.			

Additional Commissioning – Checklist

Note: The commissioning tasks listed on the following checklist include the additional tasks that must be completed and signed off on to earn the incentive points, outlined in Section 5.1 – Commissioning, *Incentives.*

Commissioning Task	Responsible Team Member	Typical Time Frame	Seasonal Climate Conditions	Responsible Team Member Sign Off	Completion Date
Conduct a commissioning design review prior to mid-construction documents	CxA	CxA will conduct a second design review at 50% to 95% of Construction Documents			
Review contractor submittals applicable to systems being commissioned	CxA	During construction phase, CxA will review submittals for compliance with OPR and construction documents			
Develop a systems manual for the commissioned systems	CxA	During construction phase, prior to occupancy			
Verify that the requirements for training are completed	CxA	End of construction phase, prior to occupancy			

Section 2: Commentary and Checklists

2.2 – Water-Use Reduction

The following table provides the water usage requirements of the Energy Policy Act of 1992.

Energy Policy Act 1992 Requirements		
Fixture	Flow Rate	
Water Closets	1.6	gal/flush
Urinals	1	gal/flush
Showerheads	2.5	gal/min
Faucets	2.5	gal/min
Replacement Aerators	2.5	gal/min
Metering Faucets	0.25	gal/cycle

The following table provides typical plumbing fixtures and fittings flow rates that may be specified to comply with the requirement.

Plumbing Fixtures and Fittings Chart		
Fixture	Flow Rate	
Conventional Water Closet	1.6	gal/flush
High-Efficiency Toilet (HET)	1.2	gal/flush
Low-Flow Water Closet	1.1	gal/flush
Ultra Low-Flow Water Closet	0.8	gal/flush
Dual-Flush Toilet	1.6/0.8	gal/flush
Conventional Urinal	1	gal/flush
High-Efficiency Urinal	0.5	gal/flush
Waterless Urinal	0	gal/flush
Showerhead	2.5	gal/min
Low-Flow Showerhead	1.8/1.5/1.0	gal/min
Conventional Faucet/Lavatory	2.5	gal/min
Low-Flow Faucet/Lavatory	1.8/1.0/0.5	gal/min
Kitchen Sink	2.5	gal/min
Low-Flow Kitchen Sink	1.8	gal/min

For both the design case and the baseline case, the default for both male and female occupants is 3 uses per day of flush and flow fixtures (1 water closet use and 2 urinal uses for males and 3 water closet uses for females), 0.1 uses for showers, and 1 use for kitchen sinks. The total fixture uses by all occupants must be consistent in the design and baseline cases.
The default value for total annual work days is 260 days. This value must be consistent in the design and baseline cases.

Water-Use Reduction EXAMPLE Calculation:

Design Case

Flush Fixture	Daily Uses	Flow Rate (GPF)	Duration (flush)	Occupants	Water Use (gal)
Ultra low-flow water closet (male)	*1*	*0.8*	*1*	*150*	*120*
Ultra low-flow water closet (female)	*3*	*0.8*	*1*	*150*	*360*
Waterless urinal (male)	*2*	*0*	*1*	*150*	*0*
Waterless urinal (female)	*0*	*0*	*1*	*150*	*0*

Flow Fixture	Daily Uses	Flow Rate (GPM)	Duration (seconds)	Occupants	Water Use (gal)
Conventional Lavatory	*3*	*2.5*	*12*	*300*	*450*
Kitchen Sink	*1*	*2.5*	*12*	*300*	*150*
Shower	*0.1*	*2.5*	*300*	*300*	*375*
			Total Daily Volume (gal)		*1455*
			Annual Work Days		*260*
			Total Annual Volume (gal)		*378,300*

Baseline Case

Flush Fixture	Daily Uses	Flow Rate (GPF)	Duration (flush)	Occupants	Water Use (gal)
Conventional Water Closet (male)	*1*	*1.6*	*1*	*150*	*240*
Conventional Water Closet (female)	*3*	*1.6*	*1*	*150*	*720*
Conventional Urinal (male)	*2*	*1*	*1*	*150*	*300*
Conventional Urinal (female)	*0*	*0*	*1*	*150*	*0*

Flow Fixture	Daily Uses	Flow Rate (GPM)	Duration (seconds)	Occupants	Water Use (gal)
Conventional Lavatory	*3*	*2.5*	*15*	*300*	*563*
Kitchen Sink	*1*	*2.5*	*15*	*300*	*188*
Shower	*0.1*	*2.5*	*300*	*300*	*375*
			Total Daily Volume (gal)		*2386*
			Annual Work Days		*260*
			Total Annual Volume (gal)		*620,360*

Water Use Reduction (%)	

Water-Use Reduction Calculation - Template:

Design Case

Flush Fixture	Daily Uses	Flow Rate (GPF)	Duration (flush)	Occupants	Water Use (gal)
_____ *(male)*	_____	_____	_____	_____	_____
_____ *(female)*	_____	_____	_____	_____	_____
_____ *(male)*	_____	_____	_____	_____	_____
_____ *(female)*	_____	_____	_____	_____	_____

Flow Fixture	Daily Uses	Flow Rate (GPM)	Duration (seconds)	Occupants	Water Use (gal)
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Total Daily Volume (gal)	_____
Annual Work Days	*260*
Total Annual Volume (gal)	

Baseline Case

Flush Fixture	Daily Uses	Flow Rate (GPF)	Duration (flush)	Occupants	Water Use (gal)
_____ *(male)*	_____	_____	_____	_____	_____
_____ *(female)*	_____	_____	_____	_____	_____
_____ *(male)*	_____	_____	_____	_____	_____
_____ *(female)*	_____	_____	_____	_____	_____

Flow Fixture	Daily Uses	Flow Rate (GPM)	Duration (seconds)	Occupants	Water Use (gal)
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Total Daily Volume (gal)	_____
Annual Work Days	*260*
Total Annual Volume (gal)	

Water Use Reduction (%)	

Section 2: Commentary and Checklists

2.3 –Georgia-based Materials & Products

Utilize the following spreadsheet to document the percentage of Georgia-based materials and products (building materials used in a project that are harvested, extracted, or manufactured in the State of Georgia). The general contractor shall track the materials and costs of each Georgia-based product used on the project and provide documentation to ensure compliance and obtain product data sheets. To comply, one of the three options below must be checked, "Yes" (Harvested, Extracted and/or Manufactured in Georgia). Determine if the project will use the Default Materials Value or Actual Materials Value to assess compliance with the 10% minimum guideline requirements.

Default Materials Value: Based on the total construction costs (hard costs for CSI Master Format 2004 Divisions 2-10 only)
Default Materials Value:_____ = total construction cost * 0.45

Actual Materials Value: Based on actual materials cost (excluding labor and equipment) (hard costs for CSI Master Format 2004Divisions 2-10 only)
Actual Materials Value: _____

Product	Total Product Cost	Harvested in Georgia Yes or No	Extracted in Georgia Yes or No	Manufactured in Georgia Yes or No

Total Product Cost (Sum): _____

Georgia-based Materials & Products Calculations

Total value ($) of Georgia-based Materials & Products harvested, extracted, or manufactured: _____

Georgia-based Materials & Products as a percentage of total materials cost: _____

Section 3:

Resources

Section 3: Resources

3.1 – Commissioning

Commissioning Resources & Hyperlinks

American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE): www.ashrae.org

- ASHRAE Guideline 0-2005: The Commissioning Process, American Society of Heating, Refrigerating and Air-Conditioning Engineers, 2005
- ASHRAE Guideline 1-1996: The HVAC Commissioning Process, American Society of Heating, Refrigerating and Air-Conditioning Engineers, 1996
- ASHRAE Guideline 4-1993: Preparation of Operations & Maintenance Documentation for Building Systems, American Society of Heating, Refrigerating and Air-Conditioning Engineers, 1993

Building Commissioning Association (BCxA): www.bcxa.org

Building Commissioning Guide, Office of Energy Efficiency and Renewable Energy Federal Energy Management Program, U.S. Department of Energy: www.eere.energy.gov

California Commissioning Collaborative (CCC): www.cacx.org/

Cx Assistant Commissioning Tool: www.ctg-net.com/edr2002/cx/

Georgia State Financing and Investment Commission (GSFIC) Commissioning Guidelines: http://gsfic.georgia.gov/

The Building Commissioning Handbook, Second Edition by John A. Heinz & Rick Casault, The Building Commissioning Association, 2004: http://www.bxca.org/resources/index.shtm

U.S. General Services Administration (GSA), *The Building Commissioning Guide:* http://www.wbdg.org/ccb/GSAMAN/buildingcommissioningguide.pdf

Portland Energy Conservation, Inc. (PECI): http://www.peci.org/

Section 3: Resources

3.2 – Water-Use Reduction

- The Environmental Protection Agency's "Water Sense" Label identifies plumbing fixtures and fittings that effectively meet the 15 percent reduction in water use when compared to water use based on plumbing fixture selection in accordance with the Energy Policy Act of 1992:

  http://epa.gov/watersense/pp/index.htm

- U.S. Environmental Protection Agency's Water Use Efficiency Program:

  http://www.epa.gov/owm/water-efficiency/

Section 3: Resources

3.3 –Georgia-based Materials & Products

- Georgia Department of Economic Development Manufacturing Homepage:

  http://www.georgia.org/Business/Industries/Manufacturing.htm

- Georgia Department of Economic Development Manufacturing Directory:

  http://georgiafacts.net/net/location/manufacturing.aspx?s=0.0.5.3013

- Georgia Department of Economic Development's Manufacturing Directory with Environmentally Preferable Purchasing designations:

  http://georgiafacts.net/net/location/manufacturing.aspx?s=0.0.5.3013&TypeIDs=70200

- Georgia Forestry Commission's Forest Marketing and Forest Products Directory:

  http://www.gfc.state.ga.us

Section 4:

Recommendations

Section 4: Recommendations

4.1 – Energy Modeling and Life Cycle Cost Analysis

Recommendation:

All major facility projects may be designed, constructed, and commissioned or modeled to exceed the standards set forth in ASHRAE 90.1-2004 by 30 percent where it is determined by the department that such 30 percent efficiency is cost effective based on a life cycle cost analysis with a payback at no more than ten years. At a minimum, all buildings shall comply with the Georgia State Energy Code which is the International Energy Conservation Code or ASHRAE 90.1 as adopted and amended by the Department of Community Affairs.

Although 30% is the threshold for this recommendation, all state-funded facility projects are encouraged to optimize energy efficiency, conserve energy and utilize local and renewable energy sources at any level. Section 5.4 – Energy Modeling and Life Cycle Cost Analysis, *Incentives*, lists the points awarded for achieved thresholds of energy efficiency.

The Energy Modeling and Life Cycle Cost Analysis recommendation should be taken into consideration with the Governor's Energy Challenge. The Challenge commits all state agencies in Georgia to reduce energy consumption in state facilities 15 percent below 2007 levels by the year 2020. Reductions will be calculated on a per square foot basis, using fiscal year 2007 as the baseline. The Governor's Energy Challenge is administered by the Georgia Environmental Facilities Authority (GEFA). It is based on recommendations included in the State Energy Strategy for Georgia, which is a comprehensive energy plan developed to address Georgia's energy issues. GEFA, which houses the State Energy Office, tracks the state government's progress toward the 15 percent reduction goal.

Potential Technologies & Strategies:

Energy Modeling:

Employ energy modeling software to assist in the design of the building systems and envelope to maximize energy efficiency and performance. The design team may use a computer simulation model and/or the supplementary forms provided below for alternative design options. The energy performance and costs of the various building systems and envelope designs may be compared to a baseline building design to determine the most energy efficient and cost effective building design. The design alternative that has the lowest cost to purchase and own, or the lowest life cycle cost, should be selected.

Life Cycle Cost Analysis:

The design team may employ a simple payback calculation to determine whether it is necessary to complete a life cycle cost analysis for the project. The energy savings and first costs must be utilized to calculate the simple payback for the baseline building design in comparison with the proposed design alternative. If the simple payback is seven years or less for the design alternative, the proposed design may be considered cost-effective without performing further analysis. If the simple payback results are greater than seven years for the design alternative, a life cycle cost analysis should be performed. Refer to the Life Cycle Cost Analysis Software recommendations on page 22 of the Standards for approved resources.

Timeline & Scope:

This section, Section 4.1 – Energy Modeling and Life Cycle Cost Analysis, *Recommendations*, provides the checklist template for the project team to demonstrate compliance with the recommendation. The completed and signed off checklist serves to certify compliance with this recommendation. The Energy Modeling Checklist provided in Section 6.4, Energy Modeling and Life Cycle Cost Analysis*, Submittals* should be completed at the end of the Design Document phase of the project. The form must be submitted to the agency owner at completion if this recommendation will be pursued.

Energy modeling may begin in the Schematic Design Phase or Design Document Phase to provide insights for cost-effective energy efficient design strategies. It can also be useful in providing an early indication of the necessary steps to achieve certain levels of energy cost reductions for each project.

Increasing efficiency can be accomplished with more efficient envelope, lighting and HVAC systems, and by appropriately sizing HVAC systems. Energy demands can be reduced by optimizing building form and orientation, by reducing internal loads through shell and lighting improvements, and by shifting load to off-peak periods. Free energy can be harvested from the site with daylight, ventilation cooling, solar heating and power, and wind energy to satisfy needs for space conditioning, service water heating and power generation. Waste energy may be recovered via exhaust air energy recovery systems, graywater heat recovery systems, and cogeneration.

Effective life cycle cost analysis steps to determine the cost effectiveness of alternative design elements include; compute the first cost associated with the design alternative; determine the annual operating cost and/or maintenance cost for the design alternative; establish the economic life, in years, for the design alternative; compute the total cost to purchase and operate each design alternative over a common economic period or life cycle; and select the design alternative with the lowest cost to purchase and own.

Refer to Checklist 4.1.a for Design Alternative Comparison Chart – Baseline Design

Refer to Checklist 4.1.b for Design Alternative Comparison Chart – Proposed Design

Checklist 4.1.a - State of Georgia Energy Performance Comparison Chart

Baseline Design

Building Information

Orientation		Roof SRI (Solar Reflective Index)	
Shading Devices			

Envelope Information: (List R-Values for the following components)

Flat Ceiling/Roof		Slope/Vault Ceiling	
Exterior Wall		Attic Knee Wall Sheathing	
Attic Knee Wall		Basement Continuous	
Basement Stud Wall		Crawlspace Continuous	
Crawlspace Stud Wall		Above Grade Mass Wall	
Foundation Slab		Floor Over Unconditioned Space	
Cantilevered Floor		Other Insulation	

Fenestration:

Window U-Factor		Window SHGC	
Skylight U-Factor		Skylight SHGC	
Glazed Door U-Factor		Opaque Doors U-Factor (<50% glazed)	

Mechanical Summary		**Electrical Summary**	
Water Heater Type		Lighting Controls	
Gas		Daylighting & Controls	
Electric		Lighting Power Density (wsf)	
Other (explain)		Efficient Lighting Fixtures	

Number of Heating & Cooling Systems (Air Handlers)

Heating Type:	Efficiency:	
Gas		AFUE
Air Source Heat Pump		HSPF
Other		

Cooling System Type (Direct Expansion, Heat Pump, Geothermal, Etc.)

Cooling System SEER:

Total Heating Load (Btu/h based on ACCA Man. J or other approved methodology)	
Total Cooling Load (Btu/h based on ACCA Man. J or other approved methodology)	
Cooling Sensible Load (Btu/h)	
Cooling Latent Load (Btu/h)	
Total Air Handler CFM (Based on Design/Calculations)	

TOTAL ENERGY CONSUMPTION OF DESIGN ALTERNATIVE:

*This form may be used to compare design alternatives to exceed the standards set forth in ASHRAE 90.1-2004 by 30% where it is determined that such 30% efficiency is cost effective based on a life cycle cost analysis with a payback at no more than ten years.

Checklist 4.1.b - State of Georgia Energy Performance Comparison Chart

Proposed Design

Building Information

Orientation		Roof SRI (Solar Reflective Index)	
Shading Devices			

Envelope Information: (List R-Values for the following components)

Flat Ceiling/Roof		Slope/Vault Ceiling	
Exterior Wall		Attic Knee Wall Sheathing	
Attic Knee Wall		Basement Continuous	
Basement Stud Wall		Crawlspace Continuous	
Crawlspace Stud Wall		Above Grade Mass Wall	
Foundation Slab		Floor Over Unconditioned Space	
Cantilevered Floor		Other Insulation	

Fenestration:

Window U-Factor		Window SHGC	
Skylight U-Factor		Skylight SHGC	
Glazed Door U-Factor		Opaque Doors U-Factor (<50% glazed)	

Mechanical Summary		**Electrical Summary**	
Water Heater Type		Lighting Controls	
Gas		Daylighting & Controls	
Electric		Lighting Power Density (wsf)	
Other (explain)		Efficient Lighting Fixtures	

Number of Heating & Cooling Systems (Air Handlers)

Heating Type:	Efficiency:	
Gas		AFUE
Air Source Heat Pump		HSPF
Other		

Cooling System Type (Direct Expansion, Heat Pump, Geothermal, Etc.)

Cooling System SEER:

Total Heating Load (Btu/h based on ACCA Man. J or other approved methodology)	
Total Cooling Load (Btu/h based on ACCA Man. J or other approved methodology)	
Cooling Sensible Load (Btu/h)	
Cooling Latent Load (Btu/h)	
Total Air Handler CFM (Based on Design/Calculations)	

TOTAL ENERGY CONSUMPTION OF DESIGN ALTERNATIVE:

*This form may be used to compare design alternatives to exceed the standards set forth in ASHRAE 90.1-2004 by 30% where it is determined that such 30% efficiency is cost effective based on a life cycle cost analysis with a payback at no more than ten years.

Energy Modeling and Life Cycle Cost Analysis Hyperlinks

- DOE process for commercial energy code compliance: www.energycodes.gov/implement/determinations_com.stm

- Energy Modeling Software:

eQuest: http://www.doe2.com/equest/

DOE-2: http://www.doe2.com/

e+ Energy Plus (http://apps1.eere.energy.gov/buildings/energyplus/)

Trane Trace 700: http://www.trane.com/CPS/Uploads/UserFiles/CDS%20files/TRACE/CDS-SLB005-EN.pdf

Carrier "Hourly Analysis Program" (HAP): http://www.commercial.carrier.com/commercial/hvac/general/0,,CLI1_DIV12_ETI11936,00.html)

Energy Soft/EnergyPro (http://www.energysoft.com/)

- Life Cycle Cost Analysis Software:

ASTM standard for LCC: http://www.astm.org/Standards/E917.htm

ATHENA® EcoCalculator for Assemblies: http://www.athenasmi.org/tools/ecoCalculator/

Building Life-Cycle Cost (BLCC): http://www1.eere.energy.gov/femp/program/lifecycle.html

Building for Environmental and Economic Sustainability (BEES): http://www.wbdg.org/tools/bees.php

ECOTECT: http://ecotect.com/products/ecotect

Facility Energy Decision System (FEDS): http://www.pnl.gov/FEDS/

Federal Energy Management Program (FEMP), Building Life-Cycle Cost (BLCC) Programs: http://www1.eere.energy.gov/femp/information/download_blcc.html#blcc5

Handbook 135, the *Life-Cycle Costing Manual for the Federal Energy Management Program (FEMP)*, explains in detail the principles of life-cycle cost analysis and integrates them with the FEMP criteria:

> Building and Fire Research Laboratory (BRFL) - "Life Cycle Costing Manual for the Federal Energy Management Program" http://www.bfrl.nist.gov/oae/publications/handbooks/135.pdf

Section 5:

Incentives

Section 5: Incentives

5.1 – Commissioning

The project will be recognized for exemplary performance in pursuing additional commissioning for the building beyond the scope of the commissioning guideline in Section 1 of the *Energy Efficiency and Sustainable Construction Standards for State Buildings*. In addition to engaging a professional engineer, design professional, or commissioning agent to certify that the building project's systems for heating, ventilating, air conditioning, energy conservation, and water conservation are installed and working properly, additional commissioning that includes the following will be eligible for this recognition:

- Conduct a commissioning design review prior to mid-construction documents
- Review contractor submittals applicable to systems being commissioned
- Develop a systems manual for the commissioned systems
- Verify that the requirements for training are completed

The project will be awarded 10 points toward the Georgia Peach Green Building Rating System for completing this incentive.

Section 5: Incentives

5.2 – Water-Use Reduction

The project will be recognized for exemplary performance in achieving the next incremental percentage threshold for water-use reduction. All major facility projects that are designed, constructed, and commissioned or modeled to achieve between a 25 percent to 95 percent reduction in water use when compared to water use based on plumbing fixture selection in accordance with the Energy Policy Act of 1992 will be eligible for this recognition.

The project will be awarded points toward the Georgia Peach Green Building Rating System according to the threshold achieved in water-use reduction. Refer to the following table to determine eligible points earned for this incentive.

Water-Use Reduction Percentage	Points Earned
15%	0 (Requirement)
25%	2
35%	4
45%	6
55%	8
65%	10
75%	12
85%	14
95%	16
100%	20

Section 5: Incentives

5.3 – Georgia-based Materials & Products

The project will be recognized for exemplary performance in specifying and installing the next incremental percentage threshold for Georgia-based materials and products. All major facility projects that include Georgia products such that not less than 20 percent and up to 100 percent of all building materials used in a project are harvested, extracted, or manufactured in the State of Georgia where such products are commercially available will be eligible for this recognition.

The project will be awarded points toward the Georgia Peach Green Building Rating System according to the threshold achieved in including Georgia-based Materials & Products. Refer to the following table to determine eligible points earned for this incentive.

Georgia-based Materials & Products Percentage	Points Earned
10%	0 (Requirement)
20%	2
30%	4
40%	6
50%	8
60%	10
70%	12
80%	14
90%	16
100%	20

Section 5: Incentives

5.4 – Energy Modeling and Life Cycle Cost Analysis

The project will be recognized for exemplary performance in achieving incremental percentage thresholds for energy efficiency based on the standards set forth in ASHRAE 90.1-2004. All major facility projects may be designed, constructed, and commissioned or modeled to exceed the standards set forth in ASHRAE 90.1-2004. Any such project that exceeds the standards set forth in ASHRAE 90.1-2004 by 30 percent or more must demonstrate that such efficiencies are cost effective based on a life cycle cost analysis with a payback at no more than ten years.

The project will be awarded points toward the Georgia Peach Green Building Rating System according to the threshold achieved in energy cost savings based on the standards set forth in ASHRAE 90.1-2004. Refer to the following table to determine eligible points earned for this incentive.

Energy Cost Savings Percentage	Points Earned
0%	0
5%	5
10%	10
15%	15
20%	20
25%	25
30%	30
35%	35
40%	40
45%	45
50%	50

Section 6:

Submittals

Section 6: Submittals

6.1 – Commissioning

Commissioning Checklist

Project Name:_____

Project Number:_____

Note: The Commissioning Checklist serves to certify compliance with the requirement of Section 1.1 – Commissioning, Requirements. This Checklist should be completed at the end of the construction phase of the project, as outlined in the Typical Time Frame column below. The form must be submitted to the agency owner at completion.

Commissioning Task	Responsible Team Member	Typical Time Frame	Seasonal Climate Conditions	Responsible Team Member Sign Off	Completion Date
Prepare OPR	Owner	Prior to beginning Design Documents.			
Prepare BOD	A/E Team	During the Design Phase.			
Prepare a Cx Plan	CxA	During the Design Phase.			
Incorporate Cx Requirements into Construction Documents	CxA	CxA will review existing project specifications and incorporate commissioning requirements.			
Introduction and task assignment meeting, i.e. Cx kickoff	CxA	When all contractors have been selected. This meeting is to introduce everyone needed in the Cx process and define roles and responsibilities.			
Verification of Installation	CxA	CxA will be walking the job periodically as the job progresses looking for system wide issues that may prove to be functional problems later.			

Completion of start-up test sheets	CxA	This should happen when the equipment begins to arrive on the job. It is the contractor's responsibility to properly fill them out and return to the CxA. Factory start-up sheets are preferable. If the contractor does not have anything to use, the CxA will supply the sheets for them.			
Functional performance tests and verification of TAB Reports	CxA / Contractors	Require the participation of all sub contractors and CxA designated personnel. This should take place prior to the CO. If any problems arise during testing, some amount of time may be required to correct the problems and this should also be considered before CO date.			
Summary (final) commissioning report	CxA	Provided by the CxA after substantial progress has been made with resolving the discrepancies and deficiencies identified during functional performance testing.			

I have complied with the Energy Efficiency and Sustainable Construction Standards for State Buildings requirements for commissioning.

Signed (Responsible Team Member):_____ Date:_____

Printed Name:_____ Organization:_____

Additional Commissioning – Checklist

Project Name:_____

Project Number:_____

Note: The commissioning tasks listed on the following checklist include the additional tasks that must be completed and signed off on to earn the incentive points, outlined in Section 5.1 – Commissioning, Incentives. This Checklist should be completed at the end of the construction phase of the project, as outlined in the Typical Time Frame column below.
The form must be submitted to the agency owner at completion.

Commissioning Task	Responsible Team Member	Typical Time Frame	Seasonal Climate Conditions	Responsible Team Member Sign Off	Completion Date
Conduct a commissioning design review prior to mid-construction documents	CxA	CxA will conduct a second design review at 50% to 95% of Construction Documents			
Review contractor submittals applicable to systems being commissioned	CxA	During construction phase, CxA will review submittals for compliance with OPR and construction documents			
Develop a systems manual for the commissioned systems	CxA	During construction phase, prior to occupancy			
Verify that the requirements for training are completed	CxA	End of construction phase, prior to occupancy			

I have complied with the Energy Efficiency and Sustainable Construction Standards for State Buildings recommendations for additional commissioning.

Signed (Responsible Team Member):_____ Date:_____

Printed Name:_____ Organization:_____

Section 6: Submittals

6.2 – Water-Use Reduction

Water-Use Reduction Checklist

Project Name:_____

Project Number:_____

Note: The Water-Use Reduction Checklist serves to certify compliance with the requirement of Section 1.2 – Water-Use Reduction, Requirements. Utilize the following spreadsheets to determine water use reduction from baseline design to proposed design alternatives. This Checklist should be completed at the end of the Design Document phase of the project. The form must be submitted to the agency owner at completion.

Design Case

Flush Fixture	Daily Uses	Flow Rate (GPF)	Duration (flush)	Occupants	Water Use (gal)
_____ *(male)*	_____	_____	_____	_____	_____
_____ *(female)*	_____	_____	_____	_____	_____
_____ *(male)*	_____	_____	_____	_____	_____
_____ *(female)*	_____	_____	_____	_____	_____

Flow Fixture	Daily Uses	Flow Rate (GPM)	Duration (seconds)	Occupants	Water Use (gal)
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Total Daily Volume (gal)	_____
Annual Work Days	*260*
Total Annual Volume (gal)	

Baseline Case

Flush Fixture	Daily Uses	Flow Rate (GPF)	Duration (flush)	Occupants	Water Use (gal)
_____ *(male)*	_____	_____	_____	_____	_____
_____ *(female)*	_____	_____	_____	_____	_____
_____ *(male)*	_____	_____	_____	_____	_____
_____ *(female)*	_____	_____	_____	_____	_____

Flow Fixture	Daily Uses	Flow Rate (GPM)	Duration (seconds)	Occupants	Water Use (gal)
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Total Daily Volume (gal)	_____
Annual Work Days	*260*
Total Annual Volume (gal)	

Water Use Reduction (%)	

I have complied with the Energy Efficiency and Sustainable Construction Standards for State Buildings requirements for water-use reduction.

Signed (Responsible Team Member):_____ **Date:**_____

Printed Name:_____ **Organization:**_____

Section 6: Submittals

6.3 – Georgia-based Materials & Products

Georgia-based Materials & Products Checklist

Project Name:_____

Project Number:_____

Note: The Georgia-based Materials & Products Checklist serves to certify compliance with the requirement of Section 1.3 – Georgia-based Materials & Products, Requirements. This Checklist should be completed at the end of the construction phase of the project. The form must be submitted to the agency owner at completion.
Utilize the following spreadsheet to document the percentage of Georgia-based materials and products (building materials used in a project that are harvested, extracted, or manufactured in the State of Georgia). The general contractor shall track the materials and costs of each Georgia-based product used on the project and provide documentation to ensure compliance and obtain product data sheets. To comply, one of the three options below must be checked, "Yes" (Harvested, Extracted and/or Manufactured in Georgia). Determine if the project will use the Default Materials Value or Actual Materials Value to assess compliance with the 10% minimum guideline requirements.

Default Materials Value: Based on the total construction costs (hard costs for CSI Master Format 2004 Divisions 2-10 only)
Default Materials Value:_____ = total construction cost * 0.45

Actual Materials Value: Based on actual materials cost (excluding labor and equipment) (hard costs for CSI Master Format 2004Divisions 2-10 only)
Actual Materials Value: _____

Product	Total Product Cost	Harvested in Georgia Yes or No	Extracted in Georgia Yes or No	Manufactured in Georgia Yes or No

Product	Total Product Cost	Harvested in Georgia Yes or No	Extracted in Georgia Yes or No	Manufactured in Georgia Yes or No

Total Product Cost (Sum): _____

Georgia-based Materials & Products Calculations

Total value ($) of Georgia-based Materials & Products harvested, extracted, or manufactured: _____

Georgia-based Materials & Products as a percentage of total materials cost: _____

I have complied with the Energy Efficiency and Sustainable Construction Standards for State Buildings requirements for Georgia-based Materials & Products.

Signed (Responsible Team Member):_____ Date:_____

Printed Name:_____ Organization:_____

Section 6: Submittals

6.4 – Energy Modeling and Life Cycle Cost Analysis

Energy Modeling Checklist

Project Name:_____

Project Number:_____

Note: The Energy Modeling Checklist serves to certify compliance with the recommendation of Section 4.1 – Energy Modeling and Life Cycle Cost Analysis, Recommendations. Utilize the following spreadsheets to determine energy savings from baseline design to proposed design alternatives. This Checklist should be completed at the end of the Design Document phase of the project. The form must be submitted to the agency owner at completion if this recommendation will be pursued.

Checklist 4.1.a - State of Georgia Energy Performance Comparison Chart

Baseline Design

Building Information

Orientation		Roof SRI (Solar Reflective Index)	
Shading Devices			

Envelope Information: (List R-Values for the following components)

Flat Ceiling/Roof		Slope/Vault Ceiling	
Exterior Wall		Attic Knee Wall Sheathing	
Attic Knee Wall		Basement Continuous	
Basement Stud Wall		Crawlspace Continuous	
Crawlspace Stud Wall		Above Grade Mass Wall	
Foundation Slab		Floor Over Unconditioned Space	
Cantilevered Floor		Other Insulation	

Fenestration:

Window U-Factor		Window SHGC	
Skylight U-Factor		Skylight SHGC	
Glazed Door U-Factor		Opaque Doors U-Factor (<50% glazed)	

Mechanical Summary		**Electrical Summary**	
Water Heater Type		Lighting Controls	
Gas		Daylighting & Controls	
Electric		Lighting Power Density (wsf)	
Other (explain)		Efficient Lighting Fixtures	

Number of Heating & Cooling Systems (Air Handlers)

Heating Type:	Efficiency:	
Gas		AFUE
Air Source Heat Pump		HSPF
Other		

Cooling System Type (Direct Expansion, Heat Pump, Geothermal, Etc.)

Cooling System SEER:

Total Heating Load (Btu/h based on ACCA Man. J or other approved methodology)	
Total Cooling Load (Btu/h based on ACCA Man. J or other approved methodology)	
Cooling Sensible Load (Btu/h)	
Cooling Latent Load (Btu/h)	
Total Air Handler CFM (Based on Design/Calculations)	

TOTAL ENERGY CONSUMPTION OF DESIGN ALTERNATIVE:

*This form may be used to compare design alternatives to exceed the standards set forth in ASHRAE 90.1-2004 by 30% where it is determined that such 30% efficiency is cost effective based on a life cycle cost analysis with a payback at no more than ten years.

Checklist 4.1.b - State of Georgia Energy Performance Comparison Chart

Proposed Design

Building Information

Orientation		Roof SRI (Solar Reflective Index)	
Shading Devices			

Envelope Information: (List R-Values for the following components)

Flat Ceiling/Roof		Slope/Vault Ceiling	
Exterior Wall		Attic Knee Wall Sheathing	
Attic Knee Wall		Basement Continuous	
Basement Stud Wall		Crawlspace Continuous	
Crawlspace Stud Wall		Above Grade Mass Wall	
Foundation Slab		Floor Over Unconditioned Space	
Cantilevered Floor		Other Insulation	

Fenestration:

Window U-Factor		Window SHGC	
Skylight U-Factor		Skylight SHGC	
Glazed Door U-Factor		Opaque Doors U-Factor (<50% glazed)	

Mechanical Summary		**Electrical Summary**	
Water Heater Type		Lighting Controls	
Gas		Daylighting & Controls	
Electric		Lighting Power Density (wsf)	
Other (explain)		Efficient Lighting Fixtures	

Number of Heating & Cooling Systems (Air Handlers)

Heating Type:	Efficiency:	
Gas		AFUE
Air Source Heat Pump		HSPF
Other		

Cooling System Type (Direct Expansion, Heat Pump, Geothermal, Etc.)

Cooling System SEER:

Total Heating Load (Btu/h based on ACCA Man. J or other approved methodology)	
Total Cooling Load (Btu/h based on ACCA Man. J or other approved methodology)	
Cooling Sensible Load (Btu/h)	
Cooling Latent Load (Btu/h)	
Total Air Handler CFM (Based on Design/Calculations)	

TOTAL ENERGY CONSUMPTION OF DESIGN ALTERNATIVE:

*This form may be used to compare design alternatives to exceed the standards set forth in ASHRAE 90.1-2004 by 30% where it is determined that such 30% efficiency is cost effective based on a life cycle cost analysis with a payback at no more than ten years.

I have complied with the Energy Efficiency and Sustainable Construction Standards for State Buildings recommendation for Energy Modeling and Life Cycle Cost Analysis.

Signed (Responsible Team Member):_____ **Date:**_____

Printed Name:_____ **Organization:**_____