Date: October 17, 2016

To: Chatham County Board of Commissioners

From: Climate Change Advisory Committee

Re: R**recommendations for sustainable facilities**

The Climate Change Advisory Committee presented to you recommendations for building standards on May 16, 2016 in the public citizen input in relationship to the proposed 2016-2017 budget. Further discussion by the Committee, however, suggested that we should send this follow-up memorandum for your discussion at the October meeting.

A primary charge of this committee is to identify areas where the county can reduce its carbon footprint and to recommend ways to mitigate and/or adapt to global warming. One such area identified by this board is **Building Standards**. Today we typically concentrate on *energy use* in buildings. Buildings exist in context, however; they are parts of neighborhoods, communities, and cities. Buildings are also tools for businesses and organizations. **High-performing green buildings provide the best value for the taxpayer and for the public through both life cycle cost benefits and positive effects on human health and performance.**

The Climate Change Advisory Committee recommends the following:

1. That the BOC implement specific reduction targets regarding ***energy use***, water use, transportation and waste for the county buildings included in the 2016-2017 budget as well as in the future.

   - A new Health Sciences Building for Central Carolina Community College ($14.3 million)
   - A new elementary school in Northeast Chatham ($30.6 million)
   - A new high school in the northeast for 1000 students

2. That the BOC adopt and implement a 70% reduction standard below the regional 2003-2004 fiscal year average/median for fossil-fuel operating energy consumption.
   The fossil-fuel reduction standard for Chatham County shall be increased to:
   80% in 2020
   90% in 2025
   Carbon-neutral in 2030 (using no fossil fuel GHG emitting energy to operate or construct)

   These targets can be accomplished by implementing innovative sustainable design strategies (See Appendix B for further explanation).

3. That the BOC adopt for County buildings and schools the life-cycle cost analysis standards that were adopted by the NC General Assembly for state, university and community colleges buildings. Application of the state law shall commence at the schematic design phase of all existing and future construction or renovation projects, updated or amended as needed at the design development phase, updated or amended again as needed at the construction document phase.

A life-cycle cost analysis includes, but should not be limited to, all of the following elements:

1) Coordination, orientation, and positioning of the facility on its physical site;
2) Amount and type of fenestration and the potential for daylighting employed in the facility;
3) Thermal characteristics of materials and the amount of insulation incorporated into the facility design;
4) Variable occupancy and operating conditions of the facility, including illumination levels;
5) Architectural features that affect the consumption of energy, water, and other utilities.

4. Adopt the use of third party certification Leadership in Energy and Environmental Design (LEED) for all county facilities and schools (See Appendix A for suggested language).

5. Benchmark all existing and new facilities and schools with Energy Star Portfolio Manager.

EPA recommends designing to earn the ENERGY STAR. By taking this approach, the designer and the owner can compare design intent with the property's actual whole-building energy performance once occupied.

2003 CBECS[1] National Median Source Energy Use and Performance Comparisons by Building Type			
Building Use Description[2]	**Median Source EUI[3] (kBtu/Sqft)**	**Average Percent (%) Electric Use**	**Median Site EUI (kBtu/Sqft)**
Education	144	63%	58
K-12 School	*Use EPA's Target Finder / Portfolio Manager*		
College/University (campus level)	244	63%	104

Recommendation to reduce energy use by 70% means the **target goal** for
K-12 School should be 17.4 kBtu/Sqft
College/University 31.2 kBtu/Sqft

6. Create a position to oversee future projects from RFQ and RFP through building operations and maintenance

Appendix A: Recommendations for sustainable facilities

Policy Statement:

The County of Chatham ("County") is committed to environmental, economic, and social stewardship of County buildings and facilities and continues to demonstrate environmental leadership in the community. Effective _____, 2016 all newly constructed County-owned, County-managed and County-funded occupied buildings and major renovations (5,000 sq.ft. & greater) and any size renovation impacting major building systems associated with energy consumption will be designed and constructed to meet LEED Version 4 Certification Level, as a minimum, and where applicable, be formally LEED certified, and achieve Designed to Earn ENERGY STAR Certification. In addition, through consultation with _____, county Staff will choose existing County-owned facilities to become LEED Existing Building: Operations & Maintenance (EBOM) certified and achieve ENERGY STAR Certification over a 10-year phased approach.

The County made the determination to require a certification recognizing the value the process will bring to the County's goal of being a global environmental leader. LEED or an equivalent third party certification process brings several benefits to the building and renovation process; these certifications have become customary practice in the building community as entities have seen the proven benefits and reduction of associated premium costs. Recognized benefits include:

- A comprehensive industry-accepted process and framework to guide design, building, renovation, operation and maintenance;
- A community of professionals to offer support, guidance and practical experience;
- Access to the latest technologies and practices;
- A vehicle to measure the County against other municipal environmental leaders globally;
- A rigorous third party commissioning process;
- An ongoing method to assist with measurement, verification, recording and reporting of sustainable features;
- Cost savings and improved working conditions; and
- A consistent county-wide method by which the County will design, construct, renovate operate and maintain its occupied facilities.

However, recognizing that no system is perfect, Chatham County has written the policy to allow for flexibility where a certification process conflicts with the County's environmental, economic or societal values.

Policy Purpose:

This Policy for Sustainable Facilities ("Policy") is intended to direct County staff to locate, design, construct, operate and maintain sustainable County-owned, County-managed, and County-funded facilities, which meet the functionality and service delivery needs of the citizens of Chatham County while minimizing environmental impacts and conserving and protecting all resources, now and in the future. Sustainable facilities not only provide environmental benefits to the community, they result in economic savings to the County, support the region's

sustainable building industry, and protect occupant health, maximize productivity and encourage sustainable employee behaviors. All these elements are crucial for staff to address when striving to achieve the County's goal of becoming a global leader in environmental sustainability.

Definitions:

***County-owned, managed, and/or funded*:** Facilities owned, managed or provided funding by the County.

***Designed to Earn ENERGY STAR*:** Recognizes a design project that meets strict EPA criteria for estimated energy performance. It signifies that, once built, the building is poised to achieve top energy performance and will be eligible to earn ENERGY STAR certification.

***ENERGY STAR Certification*:** Recognizes an existing building that meets strict EPA criteria for estimated energy performance. It signifies the building achieves top energy performance.

***LEED (Leadership in Energy and Environmental Design)*:** Consensus based generalized point rating system for locating, designing, constructing, operating and certifying sustainable buildings. Rating system addresses environmental predetermined categories that include sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental policy, design and process innovation, and LEED Accredited Professional.

***LEED-EBOM*:** Consensus based generalized point rating system for ongoing operations and maintenance of existing commercial and institutional buildings. The certification system identifies and rewards current best practices and provides an outline for building's to use less energy, water and natural resources; improve the indoor environment; and uncover operating inefficiencies.

***Major Renovation*:** A renovation of at least 5,000 square feet of internal occupied space involving significant Mechanical, electrical & plumbing features of the facility.

***New Construction*:** County-owned buildings and facilities that are to be planned and constructed on a new or existing site, including, but not limited to, new office, arena, and fire and police stations.
Occupied facility/space: A facility or enclosed space providing for human activity on a regular basis, including parking decks.

***Uniquely cost prohibitive*:** A cost premium greater than a 5% of the total project budget, due to the inclusion of sustainable features & associated design fees per certification of new and existing facilities

Appendix B: Explanation and issues related to recommendation #2:

Meeting the 70% % energy use reduction standard below the regional 2003-2004 fiscal year average/median for fossil-fuel operating energy consumption, is challenging and requires more efforts than doing business as usual. Here are the essentials.

1. ***Obtain building owner buy-in***. There must be strong buy-in from the owner/operator and facility staff. The more they know about and participate in the planning and design process, the better they will be able to help achieve the 70% goal after the building becomes operational. The building owner must decide on the goals and provide the leadership to make the goals reality.

2**. *Assemble an experienced, innovative design team*.** Interest and experience in designing energy-efficient buildings, innovative thinking, and the ability to work together as a team are all critical to meeting the 70% goal. The team achieves this goal by creating a building that maximizes daylighting; minimizes process, heating, and cooling loads; and has highly efficient lighting and HVAC systems. Energy goals should be communicated in the request for proposal and design team selection, based in part on the team's ability to meet the goals. The design team implements the goals for the owner.

3. ***Adopt an integrated design process***. Cost-effective, energy-efficient design requires tradeoffs among potential energy-saving features. This requires an integrated approach to building design. A highly efficient lighting system, for instance, may cost more than a conventional one, but because it produces less heat, the building's cooling system can often be downsized. The greater the energy savings are, the more complicated the trade-offs become and the more design team members must work together to determine the optimal mix of energy-saving features. Because many options are available, the design team will have wide latitude in making energy-saving trade-offs.

4. ***Hire a daylighting consultant*.** Daylighting is an important strategy for achieving the 70% energy-savings goal; however, it requires good technical daylighting design. If the design team does not have experience with a well-balanced daylighting design, it may need to add a daylighting consultant.

5. ***Conduct energy modeling***. Whole-building energy modeling programs can provide flexibility to evaluate the energy-efficient measures for an individual project. These simulation programs have learning curves of varying difficulty, but energy modeling for building design is highly encouraged and is considered necessary for achieving energy savings of 70%. Part of the key to energy savings is using the simulations to make envelope decisions first and then evaluating heating, cooling, and lighting systems. Developing HVAC load calculations is not energy modeling nor is it a substitute.

6. ***Use building commissioning***. Studies verify that building systems, no matter how carefully designed, are often improperly installed or set up and do not operate as efficiently as expected. The 70% goal can best be achieved through building commissioning (Cx), a systematic process

of ensuring that all building systems—including envelope, lighting, and HVAC systems perform as intended. The Cx process works because it integrates the traditionally separate functions of building design; system selection; equipment start-up; system control calibration; testing, adjusting, and balancing; documentation; and staff training. The more comprehensive the commissioning process, the greater the likelihood of energy savings. A commissioning authority should be appointed at the beginning of the project and work with the design team throughout the project. Solving problems in the design phase is more effective and less expensive than making changes or fixes during construction. The perceived value of the Cx process is that it is an extension of the quality control processes of the designer and contractor.

7. ***Train building users and operations staff*.** Staff training can be part of the building Cx process, but a plan must be in place to train staff for the life of the building to meet energy savings goals. The building's designers and contractors normally are not responsible for the building after it becomes operational, so the building owner must establish a continuous training program that helps occupants and operations and maintenance staff maintain and operate the building for maximum energy efficiency. This training should include information about the impact of plug loads on energy use and the importance of using energy-efficient equipment and appliances.

8**. *Monitor the building*:** A monitoring plan is necessary to ensure that energy goals are met over the life of the building. Even simple plans, such as recording and plotting monthly utility bills, can help ensure that the energy goals are met. Buildings that do not meet the design goals often have operational issues that should be corrected.

Fundamental Design Strategies

In order for a building to achieve 70% energy use reduction, without over reliance on renewable energy, it must get all the basics of sustainable design right. The checklist consists of the following elements. Every one of these design components has the capability of reducing building energy use by 10% or more. Conversely, if the design team ignores any one of these, it may have to overcompensate with excessive design or cost on one or more of the others. Each of the main points is followed by a brief explanation.

- **Orientation/Massing**: While not every new building can be optimally oriented, it is almost always possible to orient the main axis of the building within 15 degrees of east-west. Doing so results in energy savings by reducing heat load on the building in the summer, and by facilitating daylight harvesting. Whenever possible try to obtain a reasonable ratio of surface area to volume, without denying daylight access to regularly occupied spaces. Seek to utilize two and even three story construction in lieu of single floor designs. Combining optimum orientation and massing can easily yield 15% energy savings.
- **Envelope**: Current building codes require continuous insulation, which is a significant improvement over previous codes without that provision. The goal for exterior walls shall be an effective R-value of 25, for roof insulation R-38 minimum. With both wall and roof insulation, it is still important to understand there is a definite point of diminishing returns, beyond which increasing insulation may be a poor investment compared to other possible

energy conserving measures. Providing a well designed, constructed, and insulated envelope can yield energy savings of 15% over minimal code compliant construction.

- **Daylighting**: Because electric lighting can consume as much as 20% of total site energy use, it is important to do everything possible to minimize that. The best place to start is by substituting free daylight for costly electric light during the day. When the building schedule coincides well with daylight hours (schools more so than office building or hospital schedules), it is easily accomplished. The reduction in electric lighting energy use can be at least half through daylight harvesting.

- **HVAC and controls**: The combination of space heating, ventilation, and air conditioning consume more energy than any other single component in a school building. Design and integration of these systems is therefore critical to improved energy performance. Air delivery through displacement ventilation has the potential to reduce energy use slightly while greatly improving both indoor air quality and acoustics. Geothermal systems have become quite popular. They can reduce site energy use substantially. Energy recovery, natural ventilation, and radiant heating are HVAC strategies rapidly growing in popularity and all have the potential to reduce energy use. The most important issues in HVAC design are to integrate the system selection with basic building design and to align the systems with owner expectations and maintenance capabilities

- **Electrical lighting and controls**: The first step to reduce energy use related to electric lighting is to minimize lighting power density (LPD) while still maintaining comfortable interior lighting. This is done through careful fixture selection and placement. If this is achieved, energy use is limited even without sophisticated controls or occupant acceptance. Automated controls that turn off electric lights such as occupancy/vacancy sensors, timed sweeps, and dimming in response to daylighting all can be used to reduce the time during which electric lights are turned on, further reducing energy use for lighting.

- **Occupant Behavior and Plug Loads**: Designers and administrators are well aware of the challenges posed by occupant behavior. Nowhere is this more evident than in the effort to control potentially excessive and wasteful plug loads.

- **Renewable energy**: Renewable energy sources on a building or site are necessary in order to achieve Net Zero Energy (which will be the goal for 2030), but the selection should be made in consideration of other building systems, local climate, and financial constraints such as rebate availability. Installing PV panels in very cloudy climates, or wind turbines in poor wind energy areas, is simply not good decision making and in the end will only harm the movement toward Net Zero Energy Schools. One other form of renewable energy popular in sunny climates is pre-heated ventilation air. This strategy utilizes wall mounted panels on the east and south to deliver pre-heated air to the HVAC system, or exhaust it directly in the cooling season.