October 3, 2013

Mr. Leonard Hoey

Program Manager

State Energy Office

1340 Mail Service Center

Raleigh, NC 27699-1340

Subject: Strategic Energy Plan – NCSSM

Dear Mr. Hoey:

Attached is a copy of the October 3, 2013 Strategic Energy Plan of the North Carolina School of Science and Mathematics.

Thank you for your outstanding support and advice to help NCSSM on this project. As a small institution, your efforts have made it a successful project.

If you have any questions or comments, please contact me at (919) 416-2667 or covington@ncssm.edu.

Sincerely,



Garry Covington

Director of Plant Facilities

Attachment

c: Dr. Todd Roberts – w/Attachment

 Mr. Robert Allen – w/Attachment

 Mr. Michael Mitchell III – w/Attachment

 Mr. Chris Taylor – w/Attachment

 Ms. Miriam Tripp – w/Attachment

 **North Carolina School of Science and Mathematics**

 **Strategic Energy Plan**

 **October 3, 2013** **Strategic Energy Plan**

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 **Executive Summary**

NCSSM Background

The North Carolina School of Science and Mathematics (NCSSM) opened in 1980 on the site of the former Watts Hospital in Durham, NC. Most of the buildings on campus were built between 1909 and 1953, which is the major cause of many of the energy-related problems, and regular maintenance and repair issues. NCSSM's campus is on the National Register of Historic Places because of the Watts Hospital.

NCSSM is the first residential public high school in the country for juniors and seniors with an interest in science and mathematics. NCSSM is a constituent high school member of the UNC System, and is a public high school. It does not charge tuition or student fees for students to attend the school. The legislation creating NCSSM was strongly advocated by Governor Hunt, and it was approved in 1978 with the Speaker of the House of Representatives casting the deciding vote since the NC House was evenly divided about NCSSM.

Since its fledgling start, NCSSM has continued to be under funded and neglected since it opened in 1980. NCSSM continues to direct its limited funding to the academic and student residential program. However, NCSSM’s physical plant infrastructure needs a significant infusion of additional funds to keep the plant facilities in operation. One explanation for the under funding of NCSSM is that there was significant doubt whether or not NCSSM would survive ten years. It should be noted that Durham County donated the Watts Hospital to the State of North Carolina with the provision that if the school closed within 12 years, the facility would be returned to Durham County.

There are over 350 other public high schools in North Carolina, but NCSSM is the only high school that has been required to absorb the various State of North Carolina budget reductions just like state agencies and the University of North Carolina institutions. In the past NCSSM has been required to absorb these cuts even though it has no student fees or tuition, or local funds to support it like the other public high schools or UNC System institutions.

Scorecard Results

Considering the impact of a growth of 31% student equivalents, 22% staff, and 21,633 (4.8%) square feet, NCSSM reduced its annual Total Energy Consumption since the base year of 2002-03. **Comparing energy consumption per student equivalent in 2012-2013 with the baseline year of 2002-2003, electricity usage decreased 17.4%, natural gas usage increased 8.7%, and water usage decreased 28%.** Total energy consumption per student equivalent decreased by 1.2% from the baseline year. In 2012 – 2013, there were 205 online, 400 distant learning students, and 228 workshop students. The on-line students stay on campus during extended weekends. The student equivalents are calculated using conservative estimates of 5% of a full time residential student for on-line students, 20% for workshop students, and 1% for distance learning students. The student equivalents are calculated as: number of residential students, plus .05 times the

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number of on-line students, plus 0.2 times the number of workshop students, plus .01 times the number of distance learning students: (680 + 205 X 0.05 + 134 X 0.2 + 400 X 0.01= 740).

Baseline Energy Use

The energy use mix of the North Carolina School of Science and Mathematics is approximately 52% electricity, 34% natural gas, 14% water and sewer, and 0% fuel oil. The mix in 2012-13 reflects the significant increase in natural gas. The natural gas is used to provide hot water and heat for the campus buildings and the 680 residential high school students from throughout North Carolina, and NCSSM staff members. In June 2013, significant steam leaks were repaired which should be reflected in the 2014 natural gas usage.

NCSSM’s Annual Utility Report is included in the Appendix. It identifies the usage and cost information for each type of energy source at NCSSM. As noted in the Scoreboard Results, NCSSM increased its annual Total Energy Consumption in 2012-13 compared to the base year of 2002-03, due to the increase in the number of students, staff, workshops, and online students coming to campus. However, comparing the total student equivalents in 2012 with 2003, total energy consumption per student equivalent decreased by 1.2%.

Key Actions

The following actions will help NCSSM reduce its overall net energy usage:

 ▪ Monitor natural gas usage

 ▪ Plan to Continue Utility Accounting

 ▪ Energy Management Awareness

 ▪ Conservation Awareness Team

 ▪ Long-Term Water Efficiency Plan – NCSSM

 ▪ Meter Survey

 ▪ Load Profile of Electrical Meters

 ▪ Verify Building Data at NCSSM Campus

 ▪ State Energy Office Recommendations

 ▪ HVAC – Chiller Repairs and Renovations

 ▪ Steam Leak Repairs

Savings Estimate & Financial Evaluation

A detailed review of the financial evaluation of the energy usage is included in Section 1 of the Strategic Energy Plan. NCSSM is continuing to develop and implement an energy conservation program. It is continuing to explore various energy management projects, and is planning to fund it with repairs and renovations funds. NCSSM has upgraded the lighting in the PEC, Reynolds E, Hill, and the Library with energy efficient T-8 fixtures. A lighting survey has been performed and NCSSM is participating in a system wide performance contract to replace old non-efficient lighting with energy efficient lighting.

Goals and Measures

NCSSM has an overall goal to reduce the annual Total Energy Consumption. The goal will reflect the impact of conservation activities, enrollment growth of NCSSM’s students, additional buildings on campus, and added staff members.

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**1. Baseline Energy Use**

Since the baseline year of 2002-03, NCSSM has only slightly reduced its annual Total Energy Consumption because of its growth of 31% in student equivalents, 22% in staff, 4.8% in square feet, and the impact of lack of needed R&R funds for campus to maintain its 60 – 103 year old buildings. Other items affecting NCSSM’s energy consumption is the addition of two emergency generators for student safety, students remaining on campus during the summer months for research, additional summer workshops with more residential participants, running one boiler during the summer months to maintain heat and reduce mold, and online students residing on campus during extended weekends.

|  |
| --- |
| **NCSSM Energy Consumption** |
|  | **2012-13** | **2002-2003** | **Increase/Decrease** | **Percentage** | **Increase/Decrease per Student Equivalent** |
| **Electricity Use (kwh**) | 8,421,353 | 7,774,573 | 646,780 | +8% | -17.4% |
|  |  |  |  |  |  |
| **Natural Gas Use (therms)** | 628,485 | 440,442 | 188,043 | +43% | +8.7% |
|  |  |  |  |  |  |
| **Water Use (1,000 Gal.)** | 15,790 | 16,714 | -924 | -6% | -28% |
|  |  |  |  |  |  |

As shown in the Annual Utilities Report in the Appendix, during 2012-13 electricity usage decreased by 12.2%, natural gas consumption increased by 17.7%, and water usage decreased by 17.8% over the previous year. The decreased water usage is due, in part, to a large underground chilled water leak discovered and repaired in June 2012. It is unknown how long this had been leaking. Since this leak was in the chilled water piping, it also contributed to the amount of electricity used. The increased gas usage is attributed to underground steam leaks. These leaks were repaired in June 2013, and should reflect a decreased usage in natural gas in 2014.

The budget reductions during the past several years have made it difficult to compare the usage and expenditure information between years. The Office of State Budget and Management’s required reversions forced NCSSM to carry over June 2003 expenditures to be paid in July 2003. The carry over caused the expenditures to be understated in 2002-03 and overstated in 2003-04. The energy consumption information above and in the Appendix has been restated to show the actual June 2003 expenditures and usage in 2002-03 and 2003-04. The adjustment shows the expenditures and usage in the year in which the consumption actually occurred.

The energy use mix of the North Carolina School of Science and Mathematics is approximately 52% electricity, 34% natural gas, 14% water and sewer, and 0% fuel oil.

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The natural gas is used to provide heat for the campus buildings, the 680 residential

high school students from throughout North Carolina, 205 online students, and 214 staff positions. Natural gas is also used to provide hot water and emergency power to the campus.

**2. Planned Actions & Projects**

2.1 Plan to Continue Utility Accounting

During 2013-14 NCSSM will continue to maintain the Utility Accounting process to track the cost and usage of electricity, water, natural gas, and fuel oil. The Utility Accounting database will follow the guidelines of the State Energy Office, and it will remain in an electronic spreadsheet format. The data will be used to prepare the Annual Utility Cost and Usage Summary Report on October 1, 2014 to the State Energy Office.

2.2 Energy Management Awareness

NCSSM will use various methods to make the NCSSM community (students and staff) aware of the impact of energy management, and the importance of reducing the energy consumption at NCSSM.

▪ The Sustainability Awareness Group will hang signs/posters in key locations encouraging people to conserve energy and water.

 ▪ Include energy management messages on “e-central,” which is on the

 main internal webpage for NCSSM’s students and staff.

▪ Provide electronic updates about energy management to all students and staff through the Sustainability Awareness Group.

 ▪ Include Energy Management as an All School Day Session at NCSSM / for all students and staff.

2.3 Conservation Awareness Team

The NCSSM Conservation Awareness Team will promote conservation education and behavioral changes for all facility users. Since NCSSM is a residential public high school for juniors and seniors, it is a continuing process since there is a 50% turnover in the student body each year. The team includes the following NCSSM staff and students:

Name Position

# Robert Allen Vice Chancellor for Finance and Operations

Garry Covington Director of Plant Facilities

Chris Taylor Assistant Director of Plant Facilities

Dr. Steve Warshaw Vice Chancellor for Academic Programs (Leader of Sustainability Group)

Michael Mitchell Utility Manager (Electrician)

Russell Williams Maintenance Mechanic IV

Todd Bollinger Grounds Supervisor

Emory Gregg Plumber

Barbara Johnson Alston Housekeeping Supervisor

NCSSM Faculty Faculty member

NCSSM Staff Staff Council member

NCSSM Students Student Sustainability Advisory Group

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See Section 5, Goals and Measures, for a listing of goals for the Conservation Awareness Team.

2.4 Long-Term Water Efficiency Plan – NCSSM

NCSSM developed a Long-Term Water Efficiency Plan in 2004 to reduce water usage.

2.5 Meter Survey

During the Third Quarter of 2012-13 NCSSM will conduct a Meter Survey to match the utility meters to State of North Carolina facilities asset numbers at NCSSM. It should be noted that NCSSM’s Asset 1 (Bryan) consists of approximately half of the buildings at NCSSM. The review will also ensure that none of the meters are multiplier meters.

2.6 Load Profile of Electrical Meters

During the Third Quarter of 2012-13 NCSSM will request a load profile from Duke Power of the major electrical meters at NCSSM.

2.7 State Energy Office Recommendations

NCSSM will implement any proposed rate change recommendations from the State Energy Office after the recommendations are provided.

2.8 HVAC - Chiller Repairs and Renovations Project

The HVAC - Chiller repairs and renovations project to add a new chiller was completed in 2007 and provided more efficient HVAC services since an inefficient 20+ year old chiller was replaced. An investigation was completed during 2004-05 that recommended building a closed loop chilled water system at NCSSM, which will provide cooling to all parts of the campus even if one chiller is not working. The closed loop portion of the project was completed in fall of 2008.

2.9 Steam Leak Repair

Numerous underground steam leaks were repaired in June 2013 and should reflect a reduction in gas usage for 2014.

**3. Savings Opportunity Assessment**

The combination of the planned actions and projects, and activities in Sections 2 and 3 will help NCSSM achieve its goal to reduce the annual Total Energy Consumption while considering the impact of a growth of 31% student equivalents, 22% staff, and 4.8% square feet since the base year of 2002-03.

## 3.1 FCAP Operation and Maintenance Energy Survey Recommendations

## NCSSM is continuing to implement the recommendations of the Operations and Maintenance Energy Survey. The recommendations included HVAC and Lighting-related issues

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1. **Modify Thermostat Settings.** In response to the survey recommendations, NCSSM adjusted the thermostat settings and reset the thermostats at the beginning of each year when the students return for the school year.
2. **Deduct Sewer Costs for Cooling Tower Make-Up Water.** NCSSM has contacted the City of Durham, but they are unwilling to consider a deduction based on sample data since there is not a separate meter for the cooling towers. They require an engineering study and one year of results before allowing reduced rates. At this time it is not cost effective to install a water meter and engage an engineer to prepare the study.
3. **Turn Off Lights in Unoccupied Rooms.** NCSSM will continue its efforts to have the lights turned off in unoccupied rooms. Occupancy sensors for classrooms and conference rooms are included in the system-wide lighting performance contract.
4. **Convert Incandescent Lighting to Compact Fluorescent.** NCSSM will continue to install compact fluorescent lights as funds permit. Complete: Incandescent lighting has been replaced with compact fluorescent lighting throughout the campus.
5. **Shut off Lights on Drink Machines.** All of the drink and food vending machines were delamped during 2002-03 after this recommendation was made. NCSSM staff coordinated with the various vendors to delamp the vending machines on campus.
6. **Replace Royall Heat Recovery Wheel.** This will use the building exhaust air to condition the fresh air intake before sending it to the coils. This was completed in 2010.
7. **Reduce Boiler Operating Pressures.** Reduce the operating pressures of the boilers to reduce the natural gas usage. - COMPLETE

**4. Financial Assessment**

NCSSM has delayed using its Repairs and Renovations projects to fund energy-related conservation projects since the primary focus has been on student safety for Electronic Access Upgrades Phase I and Phase II, and Sprinklers in Residence Halls Phase I and Phase II. See Section 6, Budgets, for a listing of various current and planned projects. NCSSM is considering the Performance Contracting as an additional option to fund energy-related projects, but there continues to be a major concern about how the “utility savings” will be achieved and passed back to NCSSM or other agencies. As a small under funded educational institution, NCSSM does not have reserves to pay for unforeseen utility or other maintenance and repair projects. Obligating NCSSM’s limited utility budget to reduce future “savings” that will be retained in the General Fund without NCSSM being able to share in the reduced energy costs is a concern. However, the

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UNC System lighting performance contract is an excellent approach that meets NCSSM’s needs.

**5. Goals and Measures**

NCSSM has an overall goal to reduce the annual Total Energy Consumption while considering the impact of a growth of 31% student equivalents, 22% staff, and 4.8% square feet since the base year of 2002-03. The goal will reflect the impact of conservation activities, enrollment growth of NCSSM’s students, additional square feet of new plant facilities, and added staff members.

5.1 Key Performance Indicators (KPI)

The tracking measures will be used to develop and compare the results for the following State Key Performance Indicators (KPI):

 ▪ Total Utilities Cost per Square Foot

 ▪ Total Utilities Cost per Student Equivalent

 ▪ Electric KWH Use per Square Foot

 ▪ Electric KWH Use per Student Equivalent

 ▪ Total Gallons Water per Square Foot

 ▪ Total Gallons Water per Student Equivalent

 ▪ Gas Btu Use per Square Foot

 ▪ Gas Btu Use per Student Equivalent

It is critical to note that due to the recent budget shortfall situations, NCSSM was forced to carryover its electrical utility costs for June 2003 into 2003-04 to be paid. The forced reversion continued to cause significant hardships to NCSSM, and have made it difficult to compare annual energy costs between years.

5.2 Conservation Awareness Team

NCSSM has established the goals and specific items listed below for the Conservation Awareness Team to encourage acceptance from the NCSSM community. Since NCSSM's 680 students are high school juniors and seniors in a residential program, it will include specific difficulties in getting teenagers to accept and follow utility savings measures. It is difficult enough for families to get teenagers in their home to make utility conservation measures, much less when the students are in a residential setting of 680 students.

1. Students and staff will be encouraged to turn off lights and equipment, other than computers, when leaving a room.
2. Turn off all lights and unnecessary equipment at the end of the day.
3. No space heaters are allowed at NCSSM.
4. Monitor management software has been installed on NCSSM’s computers by the Information Technology Services Department.
5. Vending machines were delamped in the Fall 2002 to reduce utility usage of vending machines.

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1. Incandescent lighting was replaced with compact fluorescent lighting throughout the campus.
2. Replace T-12 fluorescent lighting with T-8/LED energy efficient lighting. T-12 fixtures have been replaced with T-8 fixtures in the PEC, Library, Hill, and Reynolds E.

5.3 Sustainability Advisory Group

During 2012, NCSSM formed a Sustainability Advisory Group. This group consists of NCSSM administrators, faculty, staff, and students. The three main functions of this group is:

1. Coordinate sustainability-related activities on campus
2. Develop measures for success
3. Determine measures to disseminate NCSSM’s progress

The student led groups, Accept the Greener Challenge (AGC) and Sustainability Project Leaders (SPL) are a part of the group. Some of the activities include

* Publicity and educational awareness
* Construction of a rain garden
* Develop goals for composting and recycling
* Sustainability Cup – energy conservation contest between residence halls
* Greener Unitiative Challenge – year long competition in 3 categories (research, awareness, and outreach)

**6. Budget**

NCSSM has completed its two projects funded by the Higher Education Bond Program. Both the Royall Center (fully operational in 2003-04) and the Bryan Center (completed on July 27, 2004) included energy conservation design features in the $5.2 million projects. The projects resulted in a more effective use of energy since the Bryan Center converted the Physics area to the central HVAC system for cooling. Previously, the areas had either window air conditioning units or no air conditioning for the Physics Department. It was the only academic area on NCSSM’s campus that had not been renovated since NCSSM opened in 1980. Project effort in 2009-10 was student safety; therefore less spending was on utility projects than in previous years.

2011 – 2012 R&R funds, which were received in December 2012, allocated funds to repair underground steam leaks. Some of the small underground leaks were located and repaired in December 2012. The major leaks were located and repaired in June 2013. The repairs of these steam leaks should yield a savings in natural gas for 2013- 2014.

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