GREEN GLOBES
BUILDING CERTIFICATION

# 2020
# GREEN GLOBES FOR NEW CONSTRUCTION

Clemson University
Clemson School of Business
Clemson, South, Carolina

August 24, 2020

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Subject: Green Globes® NC Assessment
Clemson School of Business
Clemson University
235 Old Greenville Highway
Clemson, South Carolina 29634

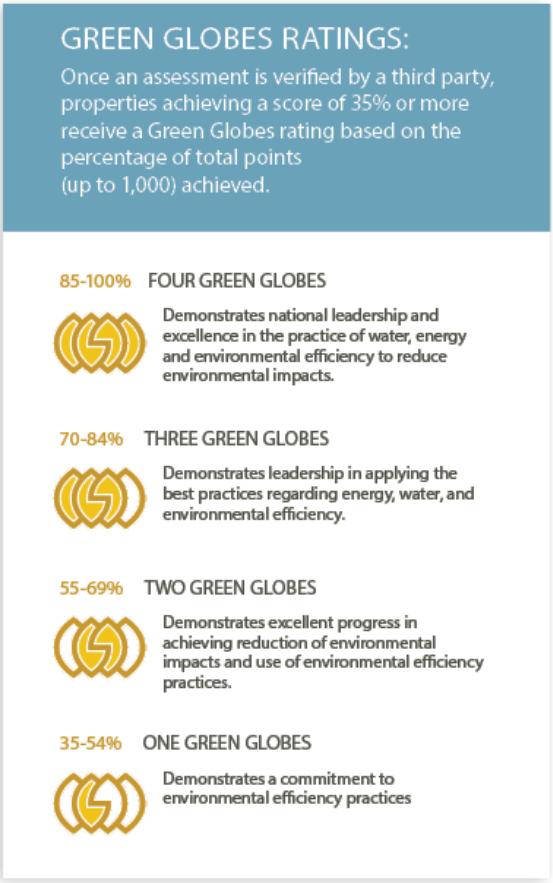
Thank you for the opportunity to complete a third-party Green Globes site assessment of the Clemson School of Business in Clemson, South Carolina.

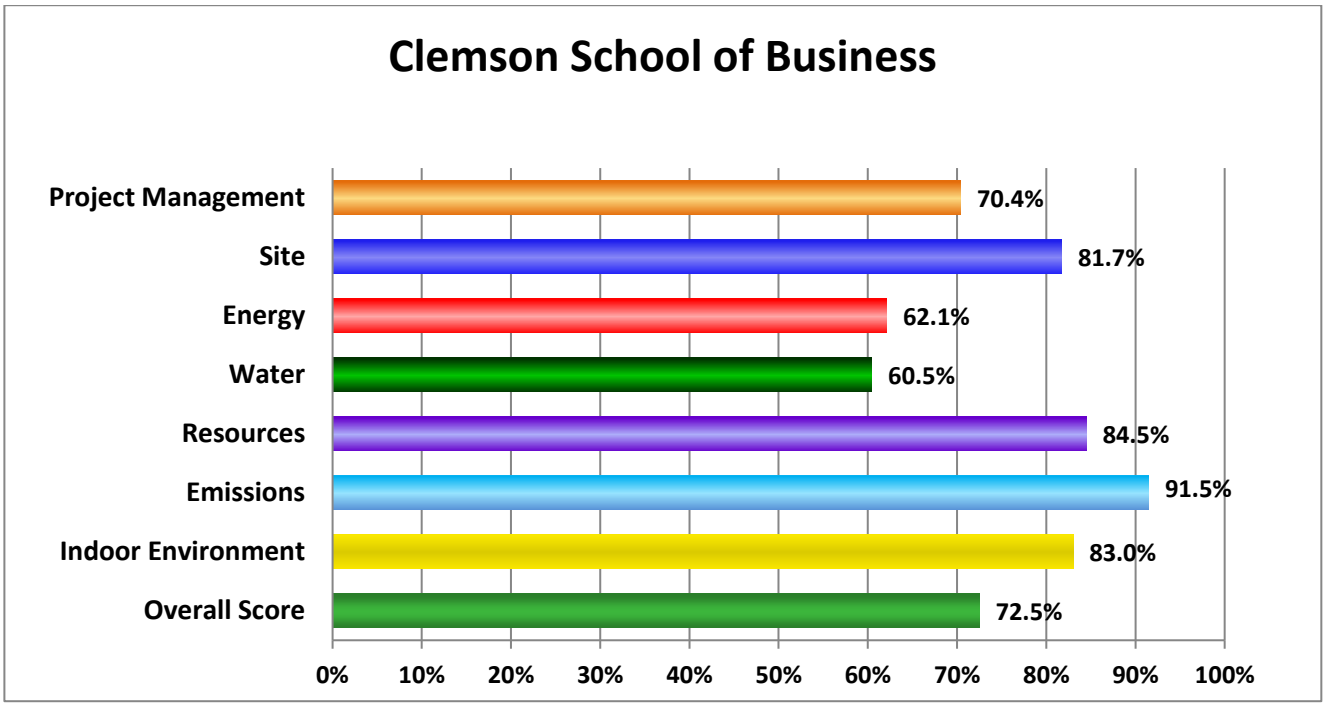
As your assigned Green Globes Assessor, I visited the site on August 7, 2020 to verify the information provided in the Green Globes online self-evaluation and to meet with the project team. The meeting began in the morning with:

- Paul Borick, Project Manager-Capital Projects, Clemson University
- Cindy Benjamin, AIA, LS3P
- Steve Hepler, AIA, LS3P
- Justin Floyd, Project Manager, DPR Construction
- Tehmina Husain, Sustainability Consultant, Merrick & Company
- Aldofo Salas, PE, Director High Performance Facilities, Merrick & Company

We toured the facility to verify installation and implementation of the features noted in the online evaluation and demonstrated by documentation provided during the design review phase. At the end, a closure meeting was conducted with the project team to review the tentative results of the assessment and identify additional information needed to complete the verification process.

Based on the site assessment and previous design review the project achieved a score of 651.5 points scored out of 898.5 applicable points for a total percentage 72.5% which is the equivalent of Three Green Globes.




## Point Summary Table Comparison

| Green Globes® NC Assessor Point Summary - Stage II | | | | | | |
|---|---|---|---|---|---|---|
| Building Name: | Clemson School of Business | | | | | |
| Assessor: | Lawrence Humphries | | | | | |
| Assessment Date: | 08/07/20 | | | | | |
| Report Date: | 08/01/20 | | | | | |
| **SECTION 1: PROJECT MANAGEMENT** | | | | | | |
| **Description** | **Max Points Possible** | **Total Applicable Points - Final** | **User Self-Evaluation Points - Post-Construction** | **Assessor Awarded Points - Final** | **Assessor to User Evaluation Points** | **Comment** |
| 1.1 Integrated design process | 9 | 9.0 | 8.5 | 8.5 | 0.0 | |
| 1.2 Environmental management | 12 | 12.0 | 10.0 | 8.0 | -2.0 | IAQ test results were unavailable |
| 1.3 Commissioning | 29 | 28.0 | 19.0 | 18.0 | -1.0 | Plumbing was not part of Cx scope |
| **Project Management Totals** | **50** | **49.0** | **37.5** | **34.5** | **-3.0** | **70.4%** |
| **SECTION 2: SITE** | | | | | | |
| **Description** | **Max Points Possible** | **Total Applicable Points - Final** | **User Self-Evaluation Points - Post-Construction** | **Assessor Awarded Points - Final** | **Assessor to User Evaluation Points** | **Comment** |
| 2.1 Development Area | 30 | 30.0 | 15.0 | 20.0 | 5.0 | Site was served by pre-existing utilities |
| 2.2 Ecological Impacts | 32 | 32.0 | 25.0 | 26.0 | 1.0 | Percentage of high SRI pavement < 49% & wall surface SRI > 29 |
| 2.3 Stormwater Management | 18 | 18.0 | 18.0 | 18.0 | 0.0 | |
| 2.4 Landscaping | 28 | 28.0 | 18.0 | 23.0 | 5.0 | Drought-tolerant plants are > 75% & courtyard is pervious paver |
| 2.5 Exterior Light Pollution | 7 | 7.0 | 7.0 | 7.0 | 0.0 | |
| **Site Totals** | **115** | **115.0** | **83.0** | **94.0** | **11.0** | **81.7%** |

| SECTION 3: ENERGY | | | | | | |
|---|---|---|---|---|---|---|
| Description | Max Points Possible | Total Applicable Points - Final | User Self-Evaluation Points - Post-Construction | Assessor Awarded Points - Final | Assessor to User Evaluation Points | Comment |
| 3.1 Energy Performance | 100 | 100.0 | 46.0 | 46.0 | 0.0 | |
| 3.2 Energy Demand | 35 | 35.0 | 3.0 | 17.0 | 14.0 | Greater than 20% of ext/int walls providee high heat capacity; There is a program in conjunction |
| 3.3 Metering, Measurement, and | 12 | 10.5 | 8.5 | 8.5 | 0.0 | |
| 3.4 Building Opaque Envelope | 31 | 31.0 | 26.0 | 26.0 | 0.0 | |
| 3.5 Lighting | 36 | 36.0 | 29.0 | 30.0 | 1.0 | Greater than 50% light control with occupancy sensors |
| 3.6 HVAC Systems and Controls | 59 | 50.0 | 33.0 | 34.0 | 1.0 | Efficient condensate recovery with campus steam system |
| 3.7 Other HVAC Systems and | 32 | 26.0 | 19.0 | 19.0 | 0.0 | |
| 3.8 Other Energy Efficient Equipment and Measures | 11 | 9.0 | 4.0 | 6.0 | 2.0 | Chiller plants are interlooped to optimize chiller efficiency |
| 3.9 Renewable Energy | 50 | 27.0 | 9.0 | 9.0 | 0.0 | |
| 3.10 Energy Efficient Transportation | 24 | 24.0 | 21.0 | 21.0 | 0.0 | |
| **Energy Totals** | **390** | **348.5** | **198.5** | **216.5** | **18.0** | **62.1%** |

| SECTION 4: WATER | | | | | | |
|---|---|---|---|---|---|---|
| Description | Max Points Possible | Total Applicable Points - Final | User Self-Evaluation Points - Post-Construction | Assessor Awarded Points - Final | Assessor to User Evaluation Points | Comment |
| 4.1 Water Consumption | 42 | 34.0 | 28.0 | 28.0 | 0.0 | |
| 4.2 Cooling Towers | 9 | 9.0 | 7.0 | 7.0 | 0.0 | |
| 4.3 Boilers and Water Heaters | 4 | 4.0 | 4.0 | 4.0 | 0.0 | |
| 4.4 Water Intensive Applications | 18 | 5.0 | 2.0 | 1.0 | -1.0 | Data for combo oven water consumption unavailable |
| 4.5 Water Treatment | 3 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.6 Alternate Sources of Water | 5 | 5.0 | 0.0 | 0.0 | 0.0 | |
| 4.7 Metering | 11 | 11.0 | 8.0 | 8.0 | 0.0 | |
| 4.8 Irrigation | 18 | 18.0 | 13.0 | 4.0 | -9.0 | All ext vegetation requires irrigation & there are efficient irrigation controllers and design |
| **Water Totals** | **110** | **86.0** | **62.0** | **52.0** | **-10.0** | **60.5%** |

| SECTION 5: RESOURCES | | | | | | |
|---|---|---|---|---|---|---|
| Description | Max Points Possible | Total Applicable Points - Final | User Self-Evaluation Points - Post-Construction | Assessor Awarded Points - Final | Assessor to User Evaluation Points | Comment |
| 5.1 Building Assembly (core and | 33 | 33.0 | 33.0 | 33.0 | 0.0 | |
| 5.2 Interior Fit-Out (including | 16 | 16.0 | 16.0 | 5.0 | -11.0 | Path B EPDs used in lieu of LCA Path A |
| 5.3 Reuse of Existing Structures | 26 | 4.0 | 0.0 | 4.0 | 4.0 | There is a requirement to incorporte salvaged materials |
| 5.4 Waste | 9 | 9.0 | 6.5 | 9.0 | 2.5 | Diversion rate for C&D waste was > 74% |
| 5.5 Building Service Life Plan | 7 | 7.0 | 7.0 | 7.0 | 0.0 | |
| 5.6 Resource Conservation | 6 | 6.0 | 3.0 | 4.0 | 1.0 | |
| 5.7 Building Envelope - | 10 | 10.0 | 8.0 | 8.0 | 0.0 | |
| 5.8 Envelope - Foundation, | 6 | 6.0 | 6.0 | 6.0 | 0.0 | |
| 5.9 Envelope - Cladding | 5 | 5.0 | 4.5 | 4.5 | 0.0 | |
| 5.10 Envelope - Barriers | 7 | 4.0 | 4.0 | 4.0 | 0.0 | |
| **Resources Totals** | **125** | **100.0** | **88.0** | **84.5** | **-3.5** | **84.5%** |

| SECTION 6: EMISSIONS | | | | | | | |
|---|---|---|---|---|---|---|---|
| Description | Max Points Possible | Total Applicable Points - Final | User Self-Evaluation Points - Post-Construction | Points Assessor Final Award | Assessor to User Evaluation Points | Comment | |
| 6.1 Heating | 18 | 18 | 18 | 18 | 0 | | |
| 6.2 Cooling | 29 | 26 | 16 | 22 | 6 | Predominant refrigerant is HFC-134a not R410a | |
| 6.3 Janitorial Equipment | 3 | 3 | 3 | 3 | 0 | | |
| **Emissions Totals** | **50** | **47.0** | **37.0** | **43.0** | **6.0** | **91.5%** | |

| SECTION 7: INDOOR ENVIRONMENT | | | | | | | |
|---|---|---|---|---|---|---|---|
| Description | Max Points Possible | Total Applicable Points - Final | User Self-Evaluation Points - Post-Construction | Assessor Awarded Points - Final | Assessor to User Evaluation Points | Comment | |
| 7.1 Ventilation | 37 | 37 | 32 | 32 | 0 | | |
| 7.2 Source Control and Measurement of Indoor Pollutants | 46 | 43 | 35.5 | 36.5 | 1 | There are cooling towers associated with utility CHW | |
| 7.3 Lighting Design and Systems | 30 | 30 | 21 | 21 | 0 | | |
| 7.4 Thermal Comfort | 18 | 15 | 10 | 10 | 0 | | |
| 7.5 Acoustic Comfort | 29 | 28 | 23.5 | 27.5 | 4 | Good STC door rating; low velocity duct airflow and duct sound isolation | |
| **Indoor Environment Totals** | **160** | **153.0** | **122.0** | **127.0** | **5.0** | **83.0%** | |
| **OVERALL TOTALS** | **1000** | **898.5** | **628.0** | **651.5** | **23.5** | **Overall Score** | **Overall Rating** |
| **FINAL ASSESSMENT SCORE AND RATING:** | | | | **651.5 Points Accumulated** | **898.5** | **72.51%** | **3 Green Globes** |

## VERIFIED BUILDING FEATURES

### Project Management

- An integrated project team includes owner's representative, architect, contractor, civil engineer, structural engineer, MEP engineers.
- Integrated design performance goals from concept were focused on green rating systems. Meeting minutes confirm adherence to the goals.
- There are provisions in the specification for protection of weather sensitive materials.
- There was an extensive commissioning effort with the building.
- Training was required for the project maintenance staff.
- Electronic O&M manuals are available for maintenance.

**Scored 34.5 out of a possible 49.0 for 70.4% of the available points**

**Site**

- The project is developed on a previously used portion of the campus served by existing utility infrastructure.
- Existing hardwoods on the site were harvested and used for millwork in the building for perpetuality.
- Professionally prepared ESC (Erosion and Sediment Control) design is shown in drawings L001 thru L202
- There are substantial portions of both native and drought-tolerant plants used in the landscape palette.
- LED lights are used throughout the property exterior.

**Scored 94.0 out of a possible 115.0 for 81.7% of the available points**

**Energy**

- An energy model predicts a significant energy savings for the building.
- There are numerous meters and measurements in the sophisticated building automation system (BAS).
- Thermal resistant envelope meets conservation criteria.
- Thermal transmittance and solar heat gain coefficient (SHGC) for the building fenestration meets the criteria.
- Lighting power density and automated lighting controls are good. There are lighting sensors to facilitate daylight harvesting.

- The electrochromic glazing in the atrium area significantly impacts the energy consumption.
- Energy recovery makeup air handlers are part of the HVAC system.
- The design provided for good ductwork installation details.

**Scored 216.5 out of a possible 348.5 for 62.1% of the available points**

**Water**

- Lo-flow plumbing fixtures are installed in the building.
- Drip irrigation is used on the project in conjunction with smart irrigation controllers.

**Scored 52.0 out of a possible 86.0 for 60.5% of the available points**

**Resources**

- Life Cycle Analysis (LCA) was used in evaluating core & shell options
- Environmental Product Declarations (EPD) were considered in conjunction with interior fitout.
- There are recycling provisions in the building.
- There are life cycle and O&M information for the building that comprise a building service life plan contained in the commissioning and Basis of Design documentation.
- Multi-functional assemblies are used which minimizes the use of raw materials.
- The various building envelope systems address air barrier, moisture barrier and weathering are specified in accordance with industry standards.

**Scored 84.5 out of a possible 100.0 for 84.5% of the available points**

**Emissions**

- The primary refrigerant at the central plant of HFC-134a with reasonable ODP and GWP scores.
- The janitorial areas meet the criteria.

**Scored 43.0 out of a possible 47.0 for 91.5% of the available points**

**Indoor Environment**

- Varies strategies, good practices and industrial standards have been incorporated in the project to provide adequate air exchange, good ventilation and emergency smoke evacuation.
- No smoking is permitted on the property.
- Low volatile organic compound emitting materials were specified for the building.
- Good indoor air quality is a high consideration.
- Exceptional lighting design is incorporated in the project including daylight harvesting.
- Thermal comfort strategies and zoning have been designed into the project.
- Acoustic comfort strategies have been considered in the project design.

**Scored 127.0 out of a possible 153.0 for 72.5% of the available points**

## RECOMMENDATIONS

Additional recommendations that may enhance the building and provide a better rating for the future include:

**Project Management**

Green building has proved to be more successful when there is a team effort rather than some imposed generic standards for which there is no localization effort or buy-in by the participants. The items in the Project Management section are aimed to encourage structured participation by the entire project team including designers, owners, contractors and major suppliers. The focus of this section is on sustainability decisions not typical OAC meeting items. Collaborative meetings with all key design and construction personnel should be held as early as possible in the design process and continued through building occupancy.

- Continue to promote collaborative design input to maximize sustainability solutions. Conservation method are an evolving set of practices and soliciting suggestions from varied skillsets should yield practical yet innovative ideas.

**Site**

A significant impact, of the project on the environment is the interface of our built surroundings to the natural physical environment. This interface is a focus of the Site section. Portions of this section include considerations prior to the site selection and enhancement of the site design. The facilities management team should have a complete set of civil and landscape/irrigation drawings to maintain or enhance the infrastructure and flora design.

- Consider lighter colors and texture with a higher SRI values for paved and vertical surfaces. Reducing the heat island effect in cooling required climates can reduce exterior water usage, increase comfort and reduce energy cost.
- Investigate enhancements to stormwater system to increase infiltration and minimize downstream erosion and associated water quality issues.
- Consider low-reflectivity glass and other strategies to reduce bird collisions to enhance the local bird population.
- Consider ways to expand pervious surfaces within the hardscape and integrate such drainage systems into the stormwater plan. Such provisions have the potential to retain more stormwater onsite and promote natural geohydrology.

**Energy**

Energy is a focus of many green building reviews. It tends to be more in the public eye due to debates about man influenced climate change. Beyond those considerations, it is a question about efficiency and economics. Building codes are on a progressive path to improving energy efficiency. Energy improvements can typically be shown as a wise investment depending on the time horizon used and method of financial analysis.

Energy savings achieved through equipment selection, building performance and performance prediction via an energy model are critical aspects in determining the sustainability of a facility. To ensure that the building continues to operate at the optimum level, continual monitoring and tracking of energy performance is essential. Additionally, the facility staff and maintenance personnel should receive regular training on the energy efficient aspects of the building and how individuals play a significant role in the energy efficiency of the facility.

- Extend the use of the energy model by calibrating to the actual consumption data contained in the BAS. A calibrated model is useful for building operations when evaluating planned energy efficiency modifications.
- Consider using the Energy Star Portfolio Manager, a free on-line tool that can normalize energy consumption data to weather. Such a tracking tool enables more accurate year-to-year comparison.
- Educate staff/students about daylight harvesting strategies to encourage maximize use of natural light.
- Review exterior lighting timer settings within the parameters of security and safety. Review exterior light spectrums as this can impact biodiversity in the area.

**Water**

Water is a resource that tends to be taken for granted due to the relative low cost and consistent availability over the recent decades. The water section of this review focuses on ways to conserve this irreplaceable finite resource both in the interior and exterior.

- Monitor water usage on a whole building basis to establish a baseline from which to improve conservation.
- Consider a water audit to identify areas of improvement for water conservation.
- A useful tool is the Green Globes Water Consumption Calculator. If the calculator is calibrated against actual usage data, it can assist to evaluate proposed water conservation measures.
- Consider the feasibility based on local plumbing codes to re-use graywater (or industrial sourced water) possibly supplemented by rainwater harvesting for non-potable purposes.

**Resources**

Energy, water, other resources and waste is embodied in various materials that is out of sight, thus out of mind. This section of the review looks at the material selection on a life cycle basis. This section is closely associated with the popular expression, “reduce, re-use, recycle”.

- Periodically review expendable materials purchases to ensure minimal pollutant materials are being used in as limited a manner as possible.
- Successful establishment of a sustainability team can assist with goals and keep such efforts fresh in the mind of all staff. Such efforts can be more productive than one-time employee orientations.
- Continued use of life cycle analysis (LCA) and/or evaluation of environmental product declarations (EPD) can help minimize cradle-to-grave environmental impacts and encourage a cradle-to-cradle perspective. Using the tools available enable the facilities management to optimize replacement material selection based on an overview of impacts in all sustainability areas (energy, water, toxicity, waste, etc) and not just a single consideration.
- Consider communication through onsite channels including video monitors, newsletter, online portal and personal interaction that will remind and encourage waste reduction and recycling.
- 20 years down the road it is challenging to appreciate the design decisions that were made and the service expectations of the project. For the benefit of current and future facilities managers be sure these design decisions have been formalized in the building life service plan while the information is relatively easy to obtain.

**Emissions**

Emissions have an impact whether to the atmosphere, to the waterways or the soil. The emissions water section of this review focuses on ways to minimize the impact of and to reduce the emissions.

**Indoor Environment**

Our built environment is meant to enhance our lives. To truly do so the interior or indoor environment should be healthy. This section of the review focuses on items to improve the healthy aspects of the indoor environment including ventilation, reduced pollutants, light levels while encouraging natural light, thermal comfort and acoustic considerations. These quantifiable elements synergistically contribute to the subjective perception of a comfortable, healthy indoor environment.

- Consider the development of a fungus, mold, and bacteria prevention plan that establishes the best management practices that should be used for air quality, cleaning, and material replacement.
- Communicate with the staff and encourage use of environmentally friendly products to minimize toxic load in the building
- Continue to use low VOC paints, adhesives, sealants and finishes to reduce off gassing and improve air quality. Extend review of products to all maintenance chemicals in an effort to reduce the toxic load from the building.

## SUMMARY

I am recommending to the Green Building Initiative that they award Three Green Globes to the project. This level of sustainability is an outstanding accomplishment and you can be proud of the design and construction of this facility.

Sustainability is a dynamic process and continues for the lifetime of a building. After 12-18 months of occupancy, the facility's operations & management policies can be evaluated under the Green Globes Continual Improvement of Existing Buildings (CIEB) program. The minimum length of occupancy mentioned above is required to evaluate utility bills and usage data and track building performance over time. Collection and analysis of operational data is essential to monitoring the achievement of building performance goals.

If you have any questions about this report, please contact me at (770) 324-0764 or buddy@effgreen.com.

Sincerely,

L.L. "Buddy" Humphries, PE, GGA
Principal, Efficient Green, LLC