

# Duke Sustainability

## Duke Cancer Center

### Building Information

Tenant: Duke Cancer Institute

Architect: Perkins + Will

Construction: BE&K Building Group

Purpose: Patient Services and Clinical Research

Footprint: 267,000 sq ft

The Duke Cancer Center was built with the intention of providing its patients and staff with maximum convenience and comfort by housing all cancer services under a single roof. A major expansion of the Duke Cancer Institute, the Center earned Gold Certification under the LEED™ v2 Rating System upon opening in February of 2012.

[View the Duke Cancer Center LEED™ Scorecard](#)

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### Sustainable Site Features

The location of the Duke Cancer Center is such that at least 10 different community services and a residential district are within a half mile walking distance from the building. This convenience allows building occupants the opportunity to substitute walking or biking in the place of personal automobile use for many daily needs. In order to further encourage alternative transportation, additional parking facilities are not provided, while bike storage facilities and showers are made available. In addition, all occupants have ready access to the University transit system.

Along with minimizing hardscapes by not providing additional parking, Cancer Center designers avoided contributing to the urban heat island effect by installing SRI compliant roofing that includes an extensive vegetated area.

Project leaders demonstrated their commitment to preserving local water sources by taking measures to reduce runoff and sedimentation that included implementing a stormwater management plan, and following local erosion and sedimentation control standards.

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### Water Efficiency

A 100,000-gallon rainwater catchment cistern located at the Duke Cancer Center collects and treats stormwater runoff from 90 percent of the average annual rainfall. This reserve is used to offset potable water use for landscape irrigation at the Cancer Center and nearby buildings, resulting in a potable water use reduction of 63 percent for irrigation needs. An efficient irrigation system and landscape design also contributed to this water use reductions.

Water is also conserved within the walls of the Cancer Center through the installation of efficient water closets as well as low-flow urinals, lavatory faucets, shower heads and kitchen sink faucets. Combined, these technologies result in a water use reduction of 42 percent.

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### Energy Efficiency

By implementing energy efficiency measures that include an improved thermal envelope, high efficiency glazing, and occupancy sensors, the Duke Cancer Center has achieved an energy cost

savings of 21 percent. In addition to these features, the extensive use of south-facing windows facilitates natural lighting as a substitute for artificial interior lighting. Project leaders further demonstrated their commitment to sustainable energy consumption by purchasing Green-e accredited Tradable Renewable Certificates equal to 100 percent of the predicted annual electrical consumption over a two-year period.

In addition to reducing energy consumption, the Cancer Center earned LEED™ points for enhanced refrigerant management by eliminating CFC-based refrigerants and minimizing the use of other compounds that contribute to ozone depletion and global warming.

In order to verify energy consumption reductions, a measurement and verification plan based on an advanced sub-metering system was developed. An enhanced commissioning plan was also implemented to ensure that each building system operated as designed and met its energy reduction goals.

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### **Indoor Air Quality**

A comfortable and healthy indoor environment is maintained at the Duke Cancer Center through a host of sensors that adjust HVAC operations based on temperature measurements, carbon dioxide levels, and occupancy. As a result of high quality insulation, ventilation rates to occupied spaces are increased by 30 percent above minimum standards. In order to further improve occupant comfort, lighting controls are provided to 95 percent of occupants.

Low-emitting materials that include adhesives, sealants, paints, and carpeting are used to promote occupant health, and a complete building flush-out was performed prior to occupancy, which, in combination with air filtration throughout the construction process, ensured a complete removal of particulates.

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### **Resource Management**

Extending material life was made a priority in the construction of the Duke Cancer Center as well as in the selection of building materials. As a result, nearly 93 percent of on-site generated construction waste was diverted from landfills by dedicating collection areas for five types of recyclable materials. In addition, over 18 percent of the total building materials content, by value, has been manufactured using recycled materials like aluminum, glass and steel.

In order to support local business while minimizing the life cycle impact of the Cancer Center's building materials, project leaders sourced 18 percent of the total building materials value from within a 500 mile radius of the project site.

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### **Integration of Sustainability in Design & Construction Process**

A holistic approach that stressed communication and task coordination amongst project teams was implemented throughout the design and construction process in order to meet sustainability targets.

A continuous cycle of goal setting and reevaluation helped project members to reach important milestones within time constraints.



# LEED for New Construction

## How to Interpret this Report

Purpose	The Leadership in Energy and Environmental Design (LEED) Rating System was designed by the US Green Building Council to encourage and facilitate the development of more sustainable buildings.
Environmental Categories	The report is organized into five environmental categories as defined by LEED including: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environm
LEED Prerequisites	Prerequisites must be achieved. Non-compliant prerequisites must be resolved before a certification can be awarded.
LEED Credits	The environmental categories are subdivided into the established LEED credits, which are based on desired performance goals within each category. An assessment of whether the credit is earned or denied is made and a narrative describes the basis for the assessment.
Achieved	The applicant has provided the mandatory documentation which supports the achievements of the credit requirements, achieving the associated points. Currently the project has scored the adjacent points in this category.
Denied	The applicant has applied for a point in a particular credit, but has misinterpreted the credit intent or cannot substantiate meeting the requirements. Currently the project has the adjacent points in this category.
Rating	This Project has achieved enough points for Gold Rating.
Official Scores	Official LEED v2 Scores: Certified: 26-32 Silver Rating: 33-38 Gold Rating: 39-51 Platinum Rating: 52+

Earned	Denied		
8	1	<b>Sustainable Sites</b>	<b>Possible Points 14</b>
0	0	<b>Construction Activity Pollution Prevention</b>	<b>Prerequisite 1-Version 2.2</b>

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that the project has followed local erosion and sedimentation control standards and codes, which are more stringent than the NPDES program requirements. A narrative describing the implemented erosion and sedimentation control measures, specific documentation demonstrating that the local standard is equal to or more stringent than the referenced NPDES program, and a copy of the project's erosion and sedimentation control plan have been provided.

1	0	<b>Site Selection</b>	<b>Credit 1-Version 2.2</b>
		<b>Design Application</b>	9/25/2012
		The LEED Submittal Template has been provided stating that the project site does not meet any of the prohibited criteria.	

1	0	<b>Development Density and Community Connectivity</b>	<b>Credit 2-Version 2.2</b>
		<b>Design Application</b>	9/25/2012
		The LEED Submittal Template has been provided stating that the project site is located within one half mile of a minimum of ten community services and an existing residential district with a minimum density of ten units per acre. Additionally, a listing of the neighborhood services has been provided on the template. The required site map showing the one half mile radius and the locations of the community services and the existing residential district has also been provided.	

0	0	<b>Brownfield Redevelopment</b>	<b>Credit 3-Version 2.2</b>
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1	0	<b>Alternative Transportation: Public Transportation Access</b>	<b>Credit 4.1-Version 2.2</b>
		<b>Design Application</b>	9/25/2012
		The LEED Submittal Template has been provided stating that the project is served by at least two bus lines within one quarter mile walking distance of the project site. A scaled drawing showing the location of the transit stops has been provided.	

1	0	<b>Alternative Transportation: Bicycle Storage and Changing Rooms</b>	<b>Credit 4.2-Version 2.2</b>
		<b>Design Application</b>	9/25/2012

2/14/2013

## Construction Application Review

The LEED Submittal Template has been provided stating that the project is non-residential. The template states that bicycle storage facilities have been provided to serve 5% of FTE occupants and shower facilities for 0.5% of the FTE building occupants in this healthcare facility. (The LEED Reference Guide for Green Building Design and Construction - Healthcare Supplement, 2009 Edition provides a compliance path that requires that bicycle storage spaces be provided only for FTE occupants.) Plans have been provided showing the location of the bicycle storage and the shower and changing facilities.

However, it appears that the bicycle storage facilities will be shared with occupants in the Morris and Reception buildings. In order to meet the requirements of this credit, the use of bicycle storage and shower facilities must be exclusive to occupants of the LEED-NC project, or a sufficient quantity of bicycle storage and shower facilities must be provided for all occupants using the amenities.

**TECHNICAL ADVICE:**

Please provide a statement signed by the building owner representative to verify that the use of the bicycle storage and shower facilities are exclusive to the occupants of the LEED-NC project. Alternatively, demonstrate that sufficient bicycle storage and shower facilities have been provided to serve all occupants, including occupants that are not part of the LEED-NC project, that use the amenities.

**Construction Application**

12/6/2012

The LEED Submittal Template has been revised to address the issues outlined in the Preliminary Review. A signed statement has been provided by the project owner demonstrating credit achievement.

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**Alternative Transportation: Low-Emitting and Fuel Efficient Vehicles**

Credit 4.3-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that the project has provided a campus bus service that burns ultra low sulfur diesel fuel. Drawings showing the location of bus stops, as well as a narrative and additional documents in support of this alternative compliance path have been provided.

While it is recognized that credit achievement for this compliance path was granted for the (Duke) School of Nursing (USGBC Project Number 10002378) in 2008, previous approval of an alternative compliance path is not precedent setting.

Ultra low sulfur diesel fuel was mandated in 2006, as such this approach does not represent a variance from standard practice. Additionally an on-campus bus fleet is also standard practice and does not likely contribute to significantly reduced pollution or land development impacts from automobile use. It should also be noted that diesel exhaust is classified by the International Agency for Research on Cancer (IARC) as "carcinogenic to humans" while the US EPA classifies diesel exhaust as "likely to be carcinogenic to humans".

**TECHNICAL ADVICE:**

Should the Project Team choose to re-submit a standard or alternative compliance path for this credit it will be reviewed once upon submittal. If credit achievement is not granted during that review an appeal will be necessary.

**Construction Application**

12/6/2012

A revised LEED Submittal Template and area map have been provided stating that the project is included on existing campus bus service that runs on ultra low sulfur diesel fuel.

As noted in the preliminary review comments previous approval of an alternative compliance path is not

precedent setting.

Ultra low sulfur diesel fuel and campus bus systems are standard practice on campuses of this size. Credit achievement cannot be awarded for this proposed alternative compliance path.

1	0	<b>Alternative Transportation: Parking Capacity</b>	Credit 4.4-Version 2.2
		<b>Design Application</b>	9/25/2012
		The LEED Submittal Template has been provided stating that no new parking has been provided.	
0	0	<b>Site Development: Protect or Restore Habitat</b>	Credit 5.1-Version 2.2
0	0	<b>Site Development: Maximize Open Space</b>	Credit 5.2-Version 2.2
1	0	<b>Stormwater Management: Quantity Control</b>	Credit 6.1-Version 2.2
		<b>Design Application</b>	9/25/2012
		The LEED Submittal Template has been provided stating that the project has implemented a stormwater management plan that results in no net increase (rate and quantity) in runoff from calculated pre-project conditions, for the one- and two-year, 24-hour storm events. Calculation results have been provided in the template to demonstrate compliance with the requirements of this credit.	
1	0	<b>Stormwater Management: Quality Control</b>	Credit 6.2-Version 2.2
		<b>Design Application</b>	9/25/2012
		The LEED Submittal Template has been provided stating that stormwater runoff from 90% of the average annual rainfall is captured or treated such that 80% of the average annual post-development Total Suspended Solids (TSS) is removed. The template refers to a cistern and describes its contribution to stormwater filtration, including its TSS removal rate and percent of annual rainfall volume treated.	
0	0	<b>Heat Island Effect: Non-Roof</b>	Credit 7.1-Version 2.2
1	0	<b>Heat Island Effect: Roof</b>	Credit 7.2-Version 2.2
		<b>Design Application</b>	9/25/2012
		The LEED Submittal Template has been provided stating that the weighted average roof area for combined SRI compliant and vegetated roofing surfaces meets the requirements defined in the LEED-NC v2.2 Reference Guide. A roof plan has been provided in support of this credit.	

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**Light Pollution Reduction**

Credit 8-Version 2.2

Earned	Denied
3	1
1	1

Water Efficiency	Possible Points	5
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**Water Efficient Landscaping**

Credit 1.1-1.2-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that the installed irrigation systems reduce potable water consumption by 63% from a calculated baseline case. A narrative and supporting documents have been provided describing the landscape and irrigation design strategies employed by the project.

**Construction Application**

12/6/2012

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**Innovative Wastewater Technologies**

Credit 2-Version 2.2

2	0
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**Water Use Reduction**

Credit 3.1-3.2-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that the project has reduced potable water use by 50.1% from a calculated baseline design through the installation of efficient water closets, urinals, lavatory faucets, showers and kitchen sink faucets.

However there are a number of issues with the provided calculations. For future submittals please note that EPA Act 1992 does not include janitor's sinks in its regulation, therefore, they should be removed from the template calculations. When using a dual-flush water closet the men's once daily use must be the full-flush (1.6 gpf) and women's use must be the average flush, rounded up to the nearest tenth gallon (1.3 gpf).

When recalculated, the project has reduced design water use by 42.9%.

Earned	Denied
8	0
0	0

Energy and Atmosphere	Possible Points	17
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**Fundamental Commissioning of the Building Energy Systems**

Prerequisite 1-Version 2.2

2/14/2013

## Construction Application Review

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that the fundamental commissioning requirements have been completed. In addition, a narrative describing the commissioned systems, as well as the results of the commissioning process, has been provided.

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**Minimum Energy Performance**

Prerequisite 2-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that the project complies with the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) of ASHRAE 90.1-2004, and has used a computer simulation model to document improved building energy performance under EA Credit 1.

However, insufficient information has been provided to verify confirmation of at least two points achieved under EA Credit 1. Since the project was registered after 06/27/2007, it is required to achieve a minimum of 2 points to qualify for LEED certification based on the following document (<http://www.usgbc.org/ShowFile.aspx?DocumentID=2303>).

**TECHNICAL ADVICE:**

Please address the comments raised under EA Credit 1 to document a minimum of two points achieved under EA Credit 1.

**Construction Application**

12/6/2012

Additional documentation has been provided for EAc1. However, the clarifications provided are not sufficient to verify achievement of at least two points under EAc1.

This prerequisite is denied pending the achievement of at least two points in EAc1.

As this prerequisite is denied solely due to issues with EAc1, please note that should the project wish to appeal EAc1, this prerequisite does not need to also be appealed. The status of this prerequisite will be updated based on the results of the appeal of that credit.

**Construction Application Appeal**

1/24/2013

Sufficient information has been provided to confirm at least two points in EAc1 Optimize Energy Performance. Therefore, this prerequisite has been marked as awarded.

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**Fundamental Refrigerant Management**

Prerequisite 3-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that base building HVAC systems use no CFC-based refrigerants.

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**Optimize Energy Performance**

Credit 1-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template and supporting documentation have been provided stating that the project has



## Construction Application Review

achieved an energy cost savings of 20.1% using the ASHRAE 90.1-2004 Appendix G methodology. The optional narrative within the template indicates that the actual cost savings is 16.1% when taking into account process energy. Energy efficiency measures include an improved thermal envelope, high efficiency glazing, reduced interior lighting power density, and occupancy sensors.

However, the following four review comments requiring a project team response (marked as "Mandatory") must be addressed for the final review. For the remaining review comments (marked as "Optional"), a project team response is optional.

Please post the original documentation for this credit (including the original EAc1 template) to LEED online in a zip file (e.g. "Preliminary EAc1 Submittal.zip") for comparison in the next review phase. Please also upload a summary document that includes a narrative response to each preliminary review comment that has been addressed by the project team, and a narrative describing any additional changes made to the energy models between the preliminary and final review phase.

Please note that the project was registered after 06/27/2007, and is therefore required to achieve a minimum of 2 points to qualify for LEED certification based on the following document (<http://www.usgbc.org/ShowFile.aspx?DocumentID=2303>).

## TECHNICAL ADVICE:

## REVIEW COMMENTS REQUIRING A PROJECT TEAM RESPONSE (Mandatory):

1. Based upon the optional narrative within the template and the calculations provided in Table 2 of the Energy Modeling Report, it appears that the project team removed the receptacle end-use of 1,116,063 kWh, as well as the cost associated with this end-use, for both buildings and manually added in a default process cost of \$245,301 based upon the baseline building requiring 25% process cost. Please note that it is not a requirement that the baseline building have 25% process loads. The requirement is that project teams must provide a narrative justification when the process cost is less than 25%, in accordance with the note at the end of Table 1.8.1. Please note that Table G3.1.12 indicates that receptacle and process loads shall be estimated based on the building type. Additionally, page 5 of the Energy Modeling Report indicates that the energy consumption associated with the process chilled water usage is not modeled. This end-use must be modeled.

Please note that it is possible that this building type may have significantly higher process loads than 25%. Update both models to include receptacle and process loads, both electricity and process chilled water, as accurately as possible and provide a list of assumptions (watts per square foot, chilled water load, schedule, etc.) for each space type to verify that these loads have been modeled correctly. Additionally, ensure that all end-uses, including receptacle energy and process chilled water, are entered into Tables 1.8.1 and 1.8.2, ensure that the costs of these end-uses are included in Table 1.8.2(b), and that the information in the tables is consistent with the BEPU and ES-D reports. Please note that the project team may manually enter additional end-uses as needed within Tables 1.8.1 and 1.8.2.

2. The chilled water rate of \$0.14 per ton-hour appears to be very high and the steam rate of \$11.63 per MBtu appears to be a little low. As noted on page 8 of the document "Required Treatment of District Thermal Energy in LEED?NC version 2.2 and LEED for Schools, version 1.0" (DES v1) dated May 28, 2008, DES supplied energy must be modeled using the actual purchased energy rates. Please update the purchased energy rates to be based on the actual purchased energy rates, and provide backup documentation for how these rates were determined.

3. It is unclear whether Exhaust Air Energy Recovery should be modeled in the baseline case per Section G3.1.2.10. It appears likely that AHU-2 will require energy recover since this is a 100% outdoor air unit in the

## Construction Application Review

proposed building. For each baseline system, list the supply air and outdoor air rates. As necessary, revise the model to reflect energy recovery, or describe the applicable exception that applies to this project.

4. The baseline building fan power does not appear to be modeled in accordance with G3.1.2.9. Please address the following:

a. Page 8 of the Energy Modeling Report indicates that the exhaust fans run whenever the air handling units run. Additionally, the return fans operate in conjunction with the main air handling units. Therefore, all of these fans are considered part of the main HVAC system, and separate fan power calculations cannot be applied to each individual fan. Please revise the sum of the supply, return, exhaust and relief fans for each HVAC system to be equal to the power calculated in G3.1.2.9, where CFM refers to the supply cfm for each HVAC system.

b. Page 8 of the Energy Modeling Report indicates that a filter pressure credit was given to the fans in the baseline building. It appears that the project team is applying addendum ac, which is acceptable. For each baseline HVAC system, provide fan power calculations, clearly showing which pressure credits have been applied. Provide SV-A reports to verify that the correct baseline fan power has been modeled.

REVIEW COMMENTS THAT DO NOT REQUIRE A PROJECT TEAM RESPONSE FOR THIS PROJECT, BUT SHOULD BE CONSIDERED AS EDUCATIONAL NOTES FOR FUTURE PROJECTS (Optional):

5. Table 1.4 indicates that the proposed building has a roof absorbance of 0.186. According to Table G3.175(c), the roof surface should be modeled with a reflectance of 0.45 if the reflectance of the proposed roof is greater than 0.7 and its emittance is greater than 0.75. Otherwise, the proposed reflectance should be 0.3. Please revise the energy models in accordance with Table G3.175(c) and update the Submittal Template, as necessary.

6. The Baseline SHGC does not meet the requirements of Table G3.1#5(Baseline)(c), which requires that all Baseline Vertical Fenestration (both North and Non-North facing glass) be modeled using the SHGCall values from Table 5.5-3 (0.39). Please revise all Baseline fenestration to reflect the SHGCall value for both North and non-North facing glass. Please update the LEED Submittal Template and simulation accordingly.

**Construction Application**

12/6/2012

Revised documentation has been provided including a narrative response to Preliminary Review comments, updated simulation input and output summary files, utility rate information, and an updated LEED Submittal Template claiming a performance improvement of 14.5% using the ASHRAE 90.1-2004 Appendix G methodology. Energy efficiency measures incorporated into the building design include improved thermal envelope, high efficiency glazing, reduced interior lighting power density, and occupancy sensors. However, three issues remain outstanding.

For future submittals, please post the preliminary and Final Review documentation for this credit (including the EAc1 templates) to LEED online in a separate zip file for each round of review (e.g. "Preliminary EAc1 Submittal.zip", "Final EAc1 Submittal.zip") for comparison in the next review phase. Please also upload a summary document that includes a narrative response to each Final Review comment, and a narrative describing any additional changes made to the energy models between the preliminary and Final Review phase.

**OUTSTANDING ISSUES:**

1. (Preliminary Review Item #4a) The narrative response included the baseline fan power calculations. It appears that the project team used the proposed building HVAC unit supply fan airflow rates in the baseline calculations. Please note that the baseline HVAC units supply fan airflow rate must be used when calculating the baseline fan power.

2/14/2013

## Construction Application Review

If appealing this credit, please update the baseline fan power calculations to use the baseline fan supply airflow rate. Note that this outstanding issue may give the project team a higher fan power allowance.

2. (Preliminary Review Item #4b) Based upon the preliminary review information, it appeared that the project team was using addendum ac, which gives a set allowance for different filter types. However, the narrative response indicated that the project team took a filter pressure credit in accordance with Exception 3.1.2.9. The project team has claimed a pressure drop allowance of 2.1 in. w.g. for all air handling units in the baseline building. Based upon the mechanical schedule, provided in EQp1 Minimum IAQ Performance, it is not clear if this pressure drop allowance is correct.

If appealing this credit, please provide additional documentation (e.g. revised mechanical schedule, AHU submittals, etc.) to substantiate a 2.1 in. w.g. pressure drop for all air handling units, and note that the pressure drop used are based upon clean filters. Update the baseline fan power calculations and models as necessary.

Additionally, the following new issues surfaced as a result of the response to Preliminary Review comments:  
3. Preliminary Comment #4 requested SV-A reports to verify that the correct baseline fan power had been modeled. Based upon these reports, the baseline outdoor air rates modeled for AHU-1, AHU-2, and AHU-3 are approximately 55,000 cfm, 78,000 cfm, and 37,000 cfm, respectively. This is not consistent with the mechanical schedule provided in EQp1, which indicated that the outdoor air rates for AHU-1, AHU-2, and AHU-3 are 24,000 cfm, 120,000 cfm, and 14,000 cfm, respectively. Please note that Table G3.1.10 (b) requires that the proposed model be consistent with the design documents, and G3.1.2.5 requires that the outdoor air ventilation rates must be identical between both the proposed and baseline buildings.

If appealing this credit, update both models so that the outdoor air ventilation rates are consistent with the design documents, and that the same rate is modeled in both buildings. Provide revised SV-A reports from both buildings to verify that the outdoor air ventilation rate has been correctly modeled.

Due to these issues, the predicted energy savings could not be confirmed.

**Construction Application Appeal**

1/24/2013

Revised documentation has been provided including a narrative response to Final Review comments, updated simulation input and output summary files, and an updated LEED Submittal Template claiming a performance improvement of 21.0% using the ASHRAE 90.1-2004 Appendix G methodology. Energy efficiency measures incorporated into the building design include improved thermal envelope, high efficiency glazing, reduced interior lighting power density, and occupancy sensors. Sufficient information has been provided to address all issues raised in the Final Review. The total predicted annual energy consumption for the project is 3,085,178 kWh/year of electricity, 831,649 ton-hours/year of chilled water, and 53,609 MBtu/year of steam.

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**On-Site Renewable Energy**

Credit 2-Version 2.2

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**Enhanced Commissioning**

Credit 3-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that the enhanced commissioning requirements have been completed. In addition, a narrative describing the enhanced commissioning processes that were employed

on the project has been provided.

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## Enhanced Refrigerant Management

Credit 4-Version 2.2

### Design Application

9/25/2012

The LEED Submittal Template has been provided stating that the project selected refrigerants and HVAC equipment that minimize or eliminate the emission of compounds that contribute to ozone depletion and global warming. The completed Refrigerant Impact Calculation indicates that the project's total refrigerant impact is 86.7 per ton, which is less than the maximum allowable value of 100.

It appears that the project has taken credit for the entire capacity of the chiller plants. For future projects, please note that only the portion (i.e. capacity) of the chiller plant devoted to the individual building may be included in the template.

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## Measurement and Verification

Credit 5-Version 2.2

### Design Application

9/25/2012

The LEED Submittal Template has been provided stating that the project has developed and implemented a measurement and verification plan consistent with Option D of the IPMVP. A copy of the project's M and V plan and the required narrative have been provided to support achievement of this credit.

However, the uploaded M and V plan does not confirm compliance with Option D of the IPMVP.

#### TECHNICAL ADVICE:

Please update and resubmit the M and V plan and narrative to show compliance with Option D of the IPMVP as follows:

1. Section 2.3 of the M and V plan indicates that AWE will be responsible for calibrating the simulation, but there is insufficient information discussing model calibration. Show and/or explain how the baseline and as-built models have been calibrated, and what the calibration results were. Refer to Section 3.2 and 4.5 of IPMVP Volume III for guidance.
2. Section 2.3 indicates that metering at the building level will be used for monitoring, but insufficient information has been provided with regard to calibration and sub-metering. Identify how the inputs of the calibrated model are determined including the inputs for schedules. Provide further evidence that whole building metering alone is sufficient to develop the Baseline, and that no submetering or data logging is required (in most cases, at least some submetering or data logging is necessary in order to appropriately identify operating schedules, and to verify that the other building energy model inputs (such as lighting power density, HVAC fan operation, etc.) accurately represent the as-built operation).
3. Identify the Monitoring and Verification period (dates, triggers, etc.), and the means of collecting data and frequency of data collection.
4. Identify the acceptable range(s) of error (generally there is a different range allowable for both monthly and annual data).

2/14/2013

## Construction Application Review

5. Section 5.4 indicates Correct Actions that may be applied if energy savings are not realized. One of the corrective actions indicates to change the equipment operating schedules, but this appears to be a calibration procedure. Another one of the corrective actions is to confirm efficient operation of the mechanical equipment, but this action does not include sufficient detail. Explain the corrective action plan that will be applied if Monitoring and Verification determines that the building does not perform as anticipated.

6. Identify the means for ongoing accountability.

**Construction Application**

12/6/2012

The LEED Submittal Template has been revised to indicate additional documentation that was provided, including an updated Measurement and Verification Plan as well as a narrative response to the Preliminary Review comments. The revised M and V plan and narrative response sufficiently addressed all issues raised in the Preliminary Review.

The documentation demonstrates credit compliance.

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**Green Power**

Credit 6-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that the project has purchased Green-e accredited Tradable Renewable Certificates (RECs) equal to 100% of the predicted annual electrical consumption over a 2-year period. The submitted documentation states that Sterling Plant will provide RECs equal to 100% of the building's total annual electric energy usage and includes the term of the contract and a narrative.

However, EAc1 Optimize Energy Performance is denied pending clarifications. As such, the total annual electricity usage of the building cannot be confirmed.

**TECHNICAL ADVICE:**

Please see the comments within EAc1. Revise this template and supporting documentation as necessary to confirm that at least 35% of the total annual electricity usage is provided by green power.

**Construction Application**

12/6/2012

Additional documentation has been provided for EAc1. However, the clarifications provided are not sufficient to verify achievement of EAc1.

This credit is denied pending the achievement of EAc1.

As this credit is denied solely due to issues with EAc1, please note that should the project wish to appeal EAc1, this credit does not need to also be appealed. The status of this prerequisite will be updated based on the results of the appeal of that credit.

**Construction Application Appeal**

1/24/2013

Sufficient information has been provided to confirm achievement in EAc1 Optimize Energy Performance. Therefore, this credit has been marked as awarded.

Earned	Denied		Possible Points
4	0	<b>Materials and Resources</b>	13
0	0	<b>Storage and Collection of Recyclables</b>	Prerequisite 1-Version 2.2
		<b>Design Application</b>	9/25/2012
		The LEED Submittal Template has been provided stating that the project has provided appropriately sized dedicated areas for the collection and storage of recycling materials, including cardboard, paper, plastic, glass, and metals.	
		<b>Building Reuse</b>	Credit 1.1-1.2-Version 2.2
		<b>Building Reuse, Non-Structural</b>	Credit 1.3-Version 2.2
2	0	<b>Construction Waste Management</b>	Credit 2-Version 2.2
		<b>Design Application</b>	9/25/2012
		The LEED Submittal Template has been provided stating that the project has diverted 2,765.14 tons(92.57%) of on-site generated construction waste from landfill. Calculations have been provided to document the waste types and receiving agencies for recycled materials. A narrative has been provided describing the project's Construction Waste Management Plan.	
0	0	<b>Resource Reuse</b>	Credit 3-Version 2.2
1	0	<b>Recycled Content</b>	Credit 4-Version 2.2
		<b>Design Application</b>	9/25/2012
		The LEED Submittal Template has been provided stating that 18.37% of the total building materials content, by value, have been manufactured using recycled materials.	
1	0	<b>Regional Materials</b>	Credit 5-Version 2.2
		<b>Design Application</b>	9/25/2012
		The LEED Submittal Template has been provided stating that 18.15% of the total building materials value includes building materials and/or products that have been extracted, harvested or recovered, as well as manufactured within 500 miles of the project site.	

2/14/2013

Construction Application Review

0	0	<b>Rapidly Renewable Materials</b>	Credit 6-Version 2.2
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0	0	<b>Certified Wood</b>	Credit 7-Version 2.2
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Earned	Denied		
11	1	<b>Indoor Environmental Quality</b>	Possible Points 15
1	0	<b>Minimum IAQ Performance</b>	Prerequisite 1-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that the project complies with the minimum requirements of ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality, using the Ventilation Rate Procedure. A supplemental narrative, calculations, and mechanical drawings have been provided to describe the project's ventilation design. The submitted documentation also includes specific information regarding design outside air intake volumes.

Please note the following two issues for future reviews. Neither of these issues affect compliance with this prerequisite or the credit:

1. The values used for zone air distribution effectiveness (Ez) do not appear to be substantiated based on the type of system, and the mode of operation. Note that this value is most often 0.8 for an overhead distribution system in heating mode.

2. The area reported in the VRP calculations, approximately 179,000 square feet, is significantly less than the conditioned area reported in EAc1 Optimize Energy Performance of 228,000 square feet. It is not clear if all occupiable spaces have been included in the calculations.

0	0	<b>Environmental Tobacco Smoke (ETS) Control</b>	Prerequisite 2-Version 2.2
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**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that smoking is prohibited on the Duke medical campus.

1	0	<b>Outdoor Air Delivery Monitoring</b>	Credit 1-Version 2.2
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**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that carbon dioxide concentrations are monitored within all densely occupied spaces and that direct airflow measurement devices have been provided for each mechanical ventilation system serving non-densely occupied spaces. The template further states that

monitoring equipment has been configured to generate an alarm when conditions vary by 10% or more from the setpoint. A narrative describing the project's ventilation design and CO2 monitoring system has been included, as required. Drawings have been provided documenting the location and type of installed sensors.

1

0

**Increased Ventilation**

Credit 2-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that the project has increased breathing zone outdoor air ventilation rates to all occupied spaces by 30% above the minimum rates required by ASHRAE Standards 62.1-2004 as determined by EQp1 Minimum Indoor Air Quality Performance. A detailed narrative and mechanical drawings has been provided describing the project's ventilation system design. Specific information regarding the design outside air intake volumes for each occupied zone has been provided.

1

0

**Construction IAQ Management Plan: During Construction**

Credit 3.1-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that the project developed and implemented a construction IAQ Management Plan that followed the referenced SMACNA Guidelines, that all air handlers operating during construction had filtration with a rating of at least MERV-8 present while operational and that the filtration media was replaced prior to occupancy. A copy of the project's IAQ Management Plan and photos highlighting the implemented IAQ measures have been provided.

For future LEED NC v2.2 submittals please be certain to provide photographs documenting all of the SMACNA guidelines.

1

0

**Construction IAQ Management Plan: Before Occupancy**

Credit 3.2-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that, prior to initial occupancy, baseline IAQ testing was conducted. A copy of the project's IAQ testing report has been provided to confirm that all sampling points were tested confirming that the allowable concentration limits have not been exceeded.

1

0

**Low-Emitting Materials: Adhesives and Sealants**

Credit 4.1-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that all indoor adhesive and sealant products comply with the VOC limits of the referenced standards for this credit. The template includes a list of the required product details.

1

0

**Low-Emitting Materials: Paints and Coatings**

Credit 4.2-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that all indoor paint and coating products comply with the VOC limits of the referenced Green Seal and SCAQMD standards. The template includes a list of the required product details.



1

0

**Low-Emitting Materials: Carpet Systems**

Credit 4.3-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that the installed carpet complies with the testing and product requirements of the CRI Green Label Plus Program, there are no installed carpet cushions, and all carpet adhesives comply with the requirements of EQc4.1 Low-Emitting Materials-Adhesives and Sealants. The template includes a list of the required product details.

1

0

**Low-Emitting Materials: Composite Wood and Agrifiber**

Credit 4.4-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that all indoor composite wood and agrifiber materials used on the project contain no added urea-formaldehyde. The template includes a list of the required product details.

1

0

**Indoor Chemical and Pollutant Source Control**

Credit 5-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that the project has installed the required indoor chemical and pollutant source control measures required by this credit. A listing of each entryway product installed for the building has been provided. Copies of the project's construction drawings have been provided to show the installed entryway systems, room separations and required ventilation systems. The template also confirms that MERV 13 filtration media has been installed in all HVAC systems prior to occupancy.

For future submittals please be certain to upload legible versions of all documents. "PartitionTypes.pdf" is a low resolution document.

0

1

**Controllability of Systems: Lighting**

Credit 6.1-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided indicating that supplemental documentation has been provided. The supplemental calculations indicate that lighting controls are provided to enable 95.1% of occupants to make adjustments to suit individual task needs and preferences, and to permit transient groups to share lighting controls in all shared multi-occupant spaces. External calculations, the lighting control specification, and lighting plans have been provided.

However, three issues are pending:

1. The first page of the supplemental calculations indicate "Multiple Mode Switching" for 21 individual controls (first line item) which is not associated with any space or group ID.
2. The lighting control type of "Other" constitutes many individual and multi-occupant space controls. It is not clear what control type this represents.
3. In the Open Workstation, Multiple Mode Switching constitutes 93 lighting controls. Please note that general area illumination controls for large open areas with individual workstations may not be counted towards this credit.

**TECHNICAL ADVICE:**

1. Indicate which space(s) these 21 controls pertain to, or remove these from the calculations.

2. Provide a more specific indication of the lighting control type labeled "Other" for both individual and multi-occupant spaces. Additionally, note that only conference rooms, classrooms, and other indoor spaces used as a place of congregation for functions such as presentations and trainings are considered shared multi-occupant spaces, and only these spaces need to be included in the credit calculations.

3. Provide a more specific indication of the lighting control type labeled "Multiple Mode Switching" for the Open Workstations. If these are general illumination controls, please remove them from the calculations.

**Construction Application**

12/6/2012

No further information has been provided.

<input type="checkbox"/>	<input type="checkbox"/>	<b>Controllability of Systems: Thermal Comfort</b>	Credit 6.2-Version 2.2
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<input type="checkbox"/>	<input type="checkbox"/>	<b>Thermal Comfort: Design</b>	Credit 7.1-Version 2.2
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**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that the HVAC systems and building envelope have been designed to meet the requirements of the ASHRAE Standard 55-2004. The project has provided a narrative describing the method used to establish thermal comfort criteria for the project and how the systems address the design criteria. Data have also been provided regarding the specific seasonal temperature and humidity design criteria. Additional documentation consists of an ASHRAE 55 documentation narrative, control points list, letter, psychrometric charts, sequence of operation, and mechanical plans.

<input type="checkbox"/>	<input type="checkbox"/>	<b>Thermal Comfort: Verification</b>	Credit 7.2-Version 2.2
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**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that a thermal comfort survey will be distributed to building occupants within the first six to 18 months of occupancy. The narrative includes an appropriate corrective action plan if the survey results indicate that 20% of the building occupants are dissatisfied with thermal comfort based on the environmental variables outlined in ASHRAE 55-2004.

<input type="checkbox"/>	<input type="checkbox"/>	<b>Daylighting and Views: Daylight 75% of Spaces</b>	Credit 8.1-Version 2.2
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<input type="checkbox"/>	<input type="checkbox"/>	<b>Daylighting and Views: Views for 90% of Spaces</b>	Credit 8.2-Version 2.2
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Earned	Denied	Innovation and Design Process		Possible Points	5
5	0				
1	0	<b>Innovation in Design</b>		Credit 1.1-Version 2.2	
		<b>Design Application</b>		9/25/2012	
		The LEED Submittal Template has been provided stating that the project team has developed and implemented an ID credit proposal in compliance with the Green Guide for Healthcare: Design and Construction Guide v2.2 EQc8.2, Daylight and Views: Connection to the Natural World: Indoor Places of Respite.			
		The credit requires providing patient and visitor accessible outdoor places of respite equal to 5% of the net usable program area of the building. A narrative and drawings documenting the places of respite in the project have been provided to demonstrate compliance. The qualifying areas meet the detailed credit requirements.			
1	0	<b>Innovation in Design</b>		Credit 1.2-Version 2.2	
		<b>Design Application</b>		9/25/2012	
		The LEED Submittal Template has been provided stating that the project team has developed and implemented a green housekeeping program. Green cleaning is detailed in LEED-NC v2.1 IDC1.1 CIR ruling dated 4/8/2004 (LEED Interpretation 766). To receive an innovation point, the project team must demonstrate that a comprehensive green cleaning / housekeeping program is in place with clear performance goals including: a statement of purpose; custodial training; the contractual or procedural requirements for operations staff; a clear set of acceptable performance standards by which to measure products, progress, and achievement of goals; and documentation of the program's housekeeping and environmental cleaning solution specifications. The provided documents comply with the LEED Interpretation requirements.			
1	0	<b>Innovation in Design</b>		Credit 1.3-Version 2.2	
		<b>Design Application</b>		9/25/2012	
		The LEED Submittal Template has been provided stating that the project achieves exemplary performance for WEc3 Water Use Reduction as specified in the LEED Reference Guide for New Construction v2.2, Third Edition. The requirement for exemplary performance in WEc3 is 40%. The project team and independent reviewer calculations demonstrate a reduction of 42.9% which meets the exemplary performance requirement.			
1	0	<b>Innovation in Design</b>		Credit 1.4-Version 2.2	
		<b>Design Application</b>		9/25/2012	
		The LEED Submittal Template has been provided stating that the project achieves exemplary performance for EAc6 Green Power as specified in the LEED Reference Guide for New Construction v2.2, Third Edition. The requirement for exemplary performance in 70% over a two-year period.			

2/14/2013

## Construction Application Review

However, the base credit is denied pending clarifications.

**TECHNICAL ADVICE:**

Please see comments within EAc6.

**Construction Application**

12/6/2012

Additional documentation has been provided for EAc1. However, the clarifications provided are not sufficient to verify achievement of EAc1.

This credit is denied pending the achievement of EAc1.

As this credit is denied solely due to issues with EAc1, please note that should the project wish to appeal EAc1, this credit does not need to also be appealed. The status of this prerequisite will be updated based on the results of the appeal of that credit.

**Construction Application Appeal**

1/24/2013

Sufficient information has been provided to confirm achievement in EAc1 Optimize Energy Performance. Therefore, this credit has been marked as awarded.

1

0

**LEED Accredited Professional**

Credit 2-Version 2.2

**Design Application**

9/25/2012

The LEED Submittal Template has been provided stating that a LEED AP has been a participant on the project development team. A copy of the LEED AP award certification for Eric Blake Jackson has been included as required.

Earned

Denied

0

0

Administrative Inquiries

Possible Points

0