

Duke Sustainability

Baldwin Auditorium

Building Information

Tenant: Department of Music

Architect: Pfeiffer Partners Architects

Construction: LeChase Construction Services

Purpose: Performances

Footprint: 42,000 sq ft

Built in 1927 to resemble Rome's grand Pantheon, Baldwin Auditorium underwent two years of renovations starting in 2011 and ending with the building's reopening in September of 2013. The renewed Auditorium maintains its original Georgian architectural style, while incorporating significant sustainable design features, earning Silver Certification under the LEED™ for New Construction 2.2 Rating System.

[View the Baldwin Auditorium LEED™ Scorecard](#)

Sustainable Site Features

Located on Duke's East Campus, Baldwin Auditorium is within half mile walking distance of at least 10 community services and a developed residential zone. In this way, the building does not contribute to urban sprawl and also provides occupants with the opportunity to walk or bike to nearby services rather than drive. Onsite bike storage facilities and showers further encourage users to consider pushing themselves rather than the gas pedal. In accordance with this idea, no additional parking has been provided for the Auditorium.

The location of Baldwin Auditorium on Duke's East Campus positions its users in close proximity to the University's transportation service that regularly circulates through the various campuses. The building's location has also been classified by the EPA as a former brownfield, or contaminated site, making it a high priority for redevelopment. This remediation was successfully accomplished by project leaders who further demonstrated a devotion to environmental preservation by maximizing the amount of undeveloped open space surrounding the Auditorium to two times the area of the building.

The new walkways leading towards the building were designed with a high Solar Reflective Index, so as not to contribute to urban heating.

Water Efficiency

Both indoors and outdoors, water savings were made a high priority in the Baldwin Auditorium renovation. By installing low-flow systems in all facilities, project leaders managed to reduce the building's water consumption by over 35 percent.

In addition to the reduction of indoor water use, potable water use for landscape irrigation is entirely eliminated.

Energy Efficiency

Upgraded with a host of energy efficiency measures that include an improved thermal envelope, high efficiency glazing, and occupancy sensors, Baldwin Auditorium has achieved an energy cost savings of nearly 15 percent. Low energy-use LED lighting and low-velocity forced air conditioning based on occupancy, contributed significantly to these energy savings.

In order to quantify energy consumption by specific systems within the building, a measurement and verification plan was developed and implemented. Enhanced commissioning was also performed to ensure that each system functioned as designed and successfully met its energy-use targets.

In addition to reducing energy consumption, Baldwin Auditorium 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.

Indoor Air Quality

Prior to occupancy of Baldwin Auditorium, sensitive construction materials were protected from moisture, so as to avoid the harboring of microbes. Further prevention measures taken to minimize the contamination of indoor air during construction activities included using air handlers to filter the indoor air of particulates.

Occupant health was also made a priority in the decision to use low-emitting materials that include adhesives, sealants, paints, and carpeting. In addition, ventilation of indoor spaces is carefully controlled based on data collected from carbon dioxide sensors distributed throughout the Auditorium.

In order to ensure the comfort of audience members, staff and performers, project leaders installed a perforated stage floor that evenly distributes low-velocity air to performers as well as 200 swirl diffusers beneath auditorium seats to produce an upward flow of air. Indoor temperature and lighting in each part of the building is largely under occupant control, so that settings can be adjusted to match user preferences.

Resource Management

Although the renovation of Baldwin Auditorium yielded many significant improvements in functionality and aesthetics, the core of the building was largely reused, with over 75 percent of the walls, floors and roof left in their original state. In this way, the amount of additional materials required for the project was minimized.

During the construction process, recyclable waste materials were organized into five categories, and designated collection areas were established for each type. This careful practice resulted in a landfill diversion rate of over 75 percent. In order to further promote the reuse of materials, project leaders ensured that over 10 percent of the total building materials content, by value, had been manufactured using recycled materials. Over 10 percent of the project materials were also extracted, processed and manufactured within a 500 mile radius of the site.

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-NC Version 2.2
 Duke University
 Baldwin Auditorium Renovation
 PPA Project 6062



Steven Winter Associates Inc
 www.swinter.com

Key:
 Yes - Project either currently complies or can easily comply with minimal cost.
 Likely - Project can easily comply with minimal cost, but verification or minimal changes to current design are needed.
 Less Likely - Compliance will have significant impact on cost, design, and/or schedule.
 No - Either not applicable or cost prohibitive.

Yes	Likely	Less Likely	No
8	0	0	6

Sustainable Sites				Status / Comments:	Party:	Due by:	
C	Y			Prerequisite SS 1 Construction Activity Pollution Prevention Implement an Erosion and Sedimentation Control (ESC) Plan.	Complete	PPA Civil	Awarded
D	1			Credit SS 1 Site Selection Do not develop on farmland; undeveloped land lower than 5' above 100-year flood plain; habitat for endangered or threatened species; within 100' of a wetlands; undeveloped land within 50' of a body of water; or public parkland.	Confirmed by architect. SWA has documented on LEED Online.	SWA	Awarded
D	1			Credit SS 2 Development Density & Community Connectivity Opt 1: Previously developed site within a community with a minimum density of 60,000 sf/acre. Opt 2: Previously developed site within 1/2 mile of residential zone (10 units/acre) and 10 basic services with pedestrian access.	Complete. Compliant with option 2	SWA	Awarded
D	1			Credit SS 3 Brownfield Redevelopment Develop on a contaminated site as defined by ASTM E1903-97 or by local, state or federal governmental agency.	EEC has documented and provided a statement confirming that testing was done according to EPA's 40 CFR.	SWA LeChase EEC	Awarded
D	1			Credit SS 4.1 Alternative Transportation: Public Transportation Within 1/4 Mile of 2 bus line stops or 1/2 mile of rail stop.	Achieved	SWA	Awarded
D	1			Credit SS 4.2 Alternative Transportation: Bicycle Use Provide bicycle racks for 5% of peak building users and shower facilities for 0.5% of Full-Time Equivalent (FTE) occupants.	Achieved	LeChase SWA	Awarded
D			1	Credit SS 4.3 Alternative Transportation: Low-Emitting and Fuel-Efficient Vehicles Opt 1: Provide LE/FE vehicles for 3% of FTE and preferred parking. Opt 2: Provide 5% preferred parking for LE/FE vehicles. Opt 3: Alternative-fuel refueling stations for 3% vehicle parking.	Credit not targeted.	Owner	
D	1			Credit SS 4.4 Alternative Transportation: Parking Capacity Opt 1 Non Residential: Meet but not exceed local requirements and provide 5% preferred parking for carpools or vanpools. Opt 2 Non Residential: For projects that provide parking for less than 5% of FTE, provide 5% preferred parking for carpools or vanpools. Opt 3 Residential: Do not exceed local requirements and provide infrastructure and support for shared vehicle usage. Opt 4 All: Provide no new parking.	Option 4 met.	SWA Duke	Awarded
C			1	Credit SS 5.1 Site Development: Protect or Restore Habitat Greenfield sites: Limit site disturbance. Previously developed sites: Restore or protect 50% of site area (excluding building footprint) with native or adaptive vegetation.	Credit not targeted.		
D	1			Credit SS 5.2 Site Development: Maximize Open Space Opt 1: Exceed local open space requirement by 25%. Opt 2: Campus: Provide open space equal to building area. Opt 3: For zero requirement, provide open space of 20% site area.	Option 2 met.	SWA Duke	Awarded
D			1	Credit SS 6.1 Stormwater Design: Quantity Control Opt 1 (Existing <50% Impervious) Reduce peak discharge or protect stream channels. Opt 2 (Existing >50% Impervious) Reduce volume by 25%.	Credit not targeted.	Landscape architect	
D			1	Credit SS 6.2 Stormwater Design: Quality Control Treat 90% of average annual rainfall using BMPs.	Credit not targeted.	Landscape architect	
D	1			Credit 7.1 Heat Island Effect: Non-Roof Opt 1: Shade, pave with SRI > 29, or open grid for 50% hardscape. Opt 2: 50% of parking under cover.	Option 1 met.	SWA	Awarded

D				1	Credit SS 7.2 Heat Island Effect: Roof Opt 1: 75% high albedo: Low <2:12 SRI>78; High >2:12 SRI>29. Opt 2: 50% green roof. Opt 3: Combination: $Area_{SRI} / 0.75 + Area_{Green} / 0.50 \geq Area_{Total}$	Credit not targeted.	Architect	
D				1	Credit SS 8 Light Pollution Reduction Limit interior lighting exiting building and limit site lighting.	Credit not targeted.	PPA Lighting engineer	

Yes	Likely	Less Likely	No
4	0	0	1

Water Efficiency					Party:	Due by:
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D	1				Credit WE 1.1 Water Efficient Landscaping: Reduce by 50% Reduce potable water consumption for landscaping by 50%.	Complete	PPA	Awarded
D	1				Credit WE 1.2 Water Efficient Landscaping: No Potable Use or No Irrigation Eliminate all potable water use for irrigation.	Complete. No irrigation other than to establish new growth.	PPA	Awarded
D				1	Credit WE 2 Innovative Wastewater Technologies Opt 1: Reduce potable water use for sewage conveyance 50%. Opt 2: Treat 50% of wastewater to tertiary standards and infiltrate or use on site.	Credit not targeted.		
D	1				Credit 3.1 Water Use Reduction: 20% Reduction Reduce water consumption by 20%.	35.9% savings calculated.	SWA	Awarded
D	1				Credit 3.2 Water Use Reduction: 30% Reduction Reduce water consumption by 30%.	Complete	SWA	Awarded

Yes	Likely	Less Likely	No
5	0	0	3

Energy & Atmosphere					Status / Comments:	Party:	Due by:
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C	Y				Prerequisite EA 1 Fundamental Commissioning Implement a commissioning plan using an independent agent.	Template has not been uploaded yet.	Cx	
D	Y				Prerequisite EA 2 Minimum Energy Performance Design the building to comply with ASHRAE/IESNA Standard 90.1-2004.	See EAc1 comments	RMF	Awarded
D	Y				Prerequisite EA 3 Fundamental Refrigerant Management Use no CFC based-refrigerants (or phase out current use).	Complete	RMF	Awarded
D	2			1	Credit EA 1 Optimize Energy Performance Improve energy performance beyond ASHRAE/IESNA 90.1-2004. As of June 2007, a minimum 2 credits are required (14% new, 7% existing). One addit. credit for each addit. 3.5% improvement.	13.6% improvement beyond ASHRAE 90.1-2004	RMF	Awarded
D				1	Credit EA 2 On-Site Renewable Energy Produce energy to offset 2.5, 7.5 or 12.5% of bldg. energy cost.	Credit not targeted.		
C	1				Credit EA 3 Enhanced Commissioning Begin process in DD and provide follow up after construction.	Achieved		Awarded
D	1				Credit EA 4 Enhanced Refrigerant Management Opt 1: Use no refrigerants. Opt 2: Minimize emission and no CFC, HCFC, or Halon fire systems.	Complete	RMF	Awarded
C	1				Credit EA 5 Measurement & Verification Implement a M+V Plan in accordance with <i>IPMVP Volume III: Concepts and Options for Determining Energy Savings in New Construction</i> , April 2003.	Uploaded and Complete. Will submit during Construction Review.	Duke Cx RMF	Awarded
C				1	Credit EA 6 Green Power Provide 35% of the building's electricity from renewable sources.	Credit not targeted.	SWA RMF Duke	

Yes	Likely	Less Likely	No
6	0	0	7

Materials & Resources					Status / Comments:	Party:	Due by:
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D	Y				Prerequisite MR 1 Storage & Collection of Recyclables Dedicated space for the storage and collection of recyclables.	Duke Sustainability Office has provided narrative for campus wide recycling collection program.	PPA Duke	Awarded
C	1				Credit MR 1.1 Building Reuse: 75% of Existing Walls, Floors & Roof Applies to building structure and envelop (excluding windows).	PPA to perform calculations and document compliance based on demolition drawings.	PPA	Awarded
C	1				Credit MR 1.2 Building Reuse: 95% of Existing Walls, Floors & Roof Applies to building structure and envelop (excluding windows).	See comment above	PPA	Awarded
C				1	Credit MR 1.3 Building Reuse: 50% of Interior Non-Str. Elements Includes interior walls, doors, floor coverings and ceiling systems.	Not feasible	PPA	

C	1				Credit MR 2.1 Construction Waste Management: Divert 50% Waste can be sorted off site. Exclude soil and land-clearing debris.	CM to manage process, calculate totals and provide documentation to SWA. Waste to be sorted on site.	LeChase	Awarded
C	1				Credit MR 2.2 Construction Waste Management: Divert 75% As above. Divert 95% for Exemplary Performance Credit.	See comment above	LeChase	Awarded
C				1	Credit MR 3.1 Materials Reuse: 5% Use salvaged, refurbished or reused materials for 5% of cost.	PPA/CM to account for reused material such as marble. If 5% cannot be reached the material can be applied to MRc2	PPA LeChase	
C				1	Credit MR 3.2 Materials Reuse: 10% As above. Use 15% for Exemplary Performance Credit.	Credit not targeted.		
C	1				Credit MR 4.1 Recycled Content: 10% (post + ½ pre-consumer) Based on cost. Recycled content of materials based on weight.	Narrative uploaded to clarify cost and material consistency across credits.	PPA LeChase	Awarded
C				1	Credit MR 4.2 Recycled Content: 20% (post + ½ pre-consumer) As above. Use 30% for Exemplary Performance Credit.	See comment above	PPA LeChase	
C	1				Credit MR 5.1 Regional Material: 10% Extracted, Processed & Manufactured Regionally Based on material cost. Fractions of content are based on weight.	Awarded	PPA LeChase	Awarded
C				1	Credit MR 5.2 Regional Material: 20% Extracted, Processed & Manufactured Regionally As above. Use 40% for Exemplary Performance Credit.	See comment above	PPA LeChase	
C				1	Credit MR 6 Rapidly Renewable Materials: 2.5 % Use materials with ten-year cycle (based on cost).	Credit not targeted.		
C				1	Credit MR 7 Certified Wood Use FSC certified wood for 50% of all wood components.	Unattempted due to non compliant invoices. Also wood workers did not hold COC certificates.	PPA LeChase	Denied

Yes	Likely	Less Likely	No
9	0	0	6

Indoor Environmental Quality				Status / Comments:	Party:	Due by:
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D	Y				Prerequisite EQ 1 Minimum IAQ Performance Meet minimum requirements of ASHRAE 62.1-2004 (Sections 4 - 7) and approved Addenda (see ASHRAE 62-2001, Appendix H) using the Ventilation Rate Procedure.	Complete	RMF	Awarded
D	Y				Prerequisite EQ 2 Environmental Tobacco Smoke (ETS) Control	Confirmed that designated exterior smoking areas have been located at least 25 feet away from entries, outdoor air intakes and operable windows.	Duke SWA	Awarded
D	1				Credit EQ 1 Outdoor Air Delivery Monitoring Provide permanent monitoring of CO2.	CO2 sensors will be installed per LEED guidelines.	RMF	Awarded
D				1	Credit EQ 2 Increased Ventilation Increase mechanical ventilation 30% over ASHRAE 62.1-2004 or demonstrate effective ventilation for naturally ventilated buildings.			
C	1				Credit EQ 3.1 Construction IAQ Mgmt. Plan: During Construction Implement IAQ plan per SMACNA Guidelines, protect absorptive materials from moisture and use MERV 8 filters during construction.	IAQ management plan is updated with LEED language and has been implemented	LeChase	Awarded
C				1	Credit EQ 3.2 Construction IAQ Mgmt. Plan: Before Occupancy Opt 1: Flush out. Opt 2: Air quality testing.	The additional documentation provided states that the calculations were based on occupied space which is, in total, less than 15,000 square feet. However, the additional documentation does not demonstrate compliance because documentation for IEQp1: Minimum IAQ Performance indicates that AHU-2 serves 11,646 square feet which all seem to be occupiable area. The documentation for this credit calculates AHU-2's requirements based on 7,000 square feet which, when recalculated, the actual flush out hours of 168 for AHU-2 are not enough to meet the minimum requirement	Cx	Denied
C	1				Credit EQ 4.1 Low-Emitting Materials: Adhesives & Sealants In accordance with SCAQMD Rule #1168.	CM to review submittals and assemble documentation.	LeChase	Awarded
C	1				Credit EQ 4.2 Low-Emitting Materials: Paints & Coatings Limit VOCs for interior paints and coatings applied on site.	CM to review submittals and assemble documentation.	LeChase	Awarded
C	1				Credit EQ 4.3 Low-Emitting Materials: Carpet Systems Per Carpet and Rug Institute's Green Label Plus program.	CM to review submittals and assemble documentation.	LeChase	Awarded
C				1	Credit EQ 4.4 Low-Emitting Materials: Composite Wood & Agrifiber No urea-formaldehyde resins including adhesives.	Unattempted due to non compliant material	LeChase	Denied
D				1	Credit 5 Indoor Chemical & Pollutant Source Control Install permanent entryway systems, separate and exhaust point sources of air contaminants, and use MERV 13 filtration.	Credit not targeted.		
D	1				Credit 6.1 Controllability of Systems: Lighting Provide control for 90% occupants and control for shared spaces.	The auditorium provides appropriate controls for the occupants.	SWA Lighting Designed	Awarded
D	1	LEED NC	CHECK		Credit 6.2 Controllability of Systems: Thermal Comfort Provide control for 50% occupants and control for shared spaces.	The auditorium provides appropriate controls for the occupants.	RMF	Awarded

D	1					Credit 7.1 Thermal Comfort: Design Design in accordance with ASHRAE 55-2004.	The design meets AHRAE 55-2004	RMF	Awarded
D	1					Credit 7.2 Thermal Comfort: Verification Implement verification survey within 6 to 18 months of occupancy.	SWA has provided Thermal Comfort Survey, and corrective action template to Duke. Survey could be distributed to occupant either by: paper handout to students/faculty/visitors etc.	Duke SWA	Awarded
D					1	Credit 8.1 Daylight & Views: Daylight 75% of Spaces Opt 1: 2% of daylight in 75% of spaces. Opt 2: Computer simulation of 25 foot-candles in 75% of spaces. Opt 3: Direct measurement of 25 foot-candles in 75% of spaces.	Credit not targeted.		
D					1	Credit 8.2 Daylight & Views: Views for 90% of Spaces Provide direct line of sight.	Credit not targeted.		

3 0 0 2

Innovation & Design Process Status / Comments: Party: Due by:

C					1	Credit ID 1.1 Innovation in Design Exemplary performance or use of new innovative technologies.	Greencleaning was not pursued.	Owner	
D	1					Credit ID 1.2 Innovation in Design Exemplary performance or use of new innovative technologies.	Site achieves exemplary performance for SSc5.2 Open Space by providing open space equal to twice the area of the building footprint.	Duke SWA	Awarded
C					1	Credit ID 1.3 Innovation in Design Exemplary performance or use of new innovative technologies.	Green Education was not pursued.	PPA Owner	
D	1					Credit ID 1.4 Innovation in Design Exemplary performance or use of new innovative technologies.	Mercury reduction in lighting EBOM template completed.	LeChase PPA RMF	Awarded
C	1					Credit ID 2 LEED® Accredited Professional At least one LEED® AP on the project team.			Awarded

Yes Likely Less Likely No
35 0 0 25

Project Totals (pre-certification estimates) 35
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points