Bennett College

Ida H. Goode Gymnasium Energy Efficiency/Sustainable Energy Project

Award Number DE-EE0002250

Final Report to the

U.S. Department of Energy

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Table of Contents

1. PROJECT INFORMATION

DOE award number: DE-EE0002250

Name of Recipient: BENNETT COLLEGE

Project Title: **IDA GOODE ENERGY EFFICIENCY/SUSTAINABLE ENERGY PROJECT**

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2. DISCLAIMER

Acknowledgment: This material is based upon work supported by the Department of Energy and Bennett College under Award Number(s) DE-EE0002250.

3. EXECUTIVE SUMMARY

The Ida H. Goode Gymnasium was constructed in 1964 to serve as a focal point for academics, student recreation, and health and wellness activities. This 38,000 SF building contains a gymnasium with a stage, swimming pool, eight classrooms, a weight room, six offices and auxiliary spaces for the athletic programs. The gym is located on a 4-acre greenfield, which is slated for improvement and enhancement to future athletics program at Bennett College. The available funding for this project was used to weatherize the envelope of the gymnasium, installation of a new energy-efficient mechanical system, and a retrofit of the existing lighting systems in the building's interior. The envelope weatherization was completed without disturbing the building's historic preservation eligibility. The existing heating system was replaced with a new high efficiency condensing system. The new heating system also includes a new Building Automation System which provides additional monitoring. Proper usage of this system will provide additional energy savings. Most of the existing interior lighting fixtures and bulbs were replaced with new LED and high efficiency T-8 bulbs and fixtures. Occupancy sensors were installed in applicable areas. The Ida Goode Gymnasium should experience high electricity and natural gas savings as well as operational/maintenance efficiency increases. The aesthetics of the building was maintained and the overall safety was improved.

4. PROJECT ACCOMPLISHMENTS

At the beginning of the project, the objectives below were identified. It was determined if these objectives were met, then the project would be a success.

1. The development of a comprehensive energy efficient program for the facility.
2. The facility will serve as a model to other facilities managers of the benefits of converting existing facilities by incorporating energy-efficient measures.
3. The project will demonstrate the use of various energy efficiency measures as well as sustainable energy products to the community.

Bennett College hired ENPULSE Energy Conservation, a local engineering firm with a heavy concentration in sustainability to program and design the project. Phase I of the project was the programing and planning phase where the subtasks below were successfully executed.

- Phase I Task 1.0 Initial Project Planning
- Phase I Task 2.0 Coordinate with City of Greensboro Better Buildings Program
- Phase I Task 3.0 Comprehensive Building Evaluation
- Phase I Task 4.0 Weatherization
- Phase I Task 5.0 Natatorium
- Phase I Task 6.0 Structural Analysis of Roof
- Phase I Task 7.0 Facility Audit
- Phase I Task 8.0 Mechanical/Geothermal Options Feasibility
- Phase I Task 9.0 Develop Demonstration and Educational Value for the Program
- Phase I Task 10.0 Develop Interior Construction Design Basis/Scope
- Phase I Task 11.0 Develop Building Management and Lighting System Controls Design Basis/Scope for Documentation of Savings
- Phase I Task 13.0 Tunnel Investigation
- Phase I Task 14.0 Campus Controls Master Planning
- Phase I Task 15.0 Architectural / Usage Assessment
- Phase I Task 16.0 Develop Final Program Scope, Schedule, Financial Plan, Budget and Construction Plan

The project budget was reduced due to a lack of matching funds. The subtasks below were selected from the entire project program, developed in Phase I, because of budget, schedule

and effectiveness. Through the execution of these subtasks, Bennett would still meet the previously identified objectives.

- Phase II Subtask 4.3 - Window & Door restoration
- Phase II Subtask 4.4 - Window & Door painting
- Phase II Subtask 5.6 - Pool Cover
- Phase II Subtask 10.1 - Pool Painting
- Phase II Subtask 10.4 - Pool Filtration Room Door
- Phase II Subtask 5.5 - Floor Radiant Heating
- Phase II Subtask 5.7 - Ventilation Fans in Natatorium
- Phase II Subtask 7.4 - HVAC - Boilers
- Phase II Subtask 7.5 - HVAC - Domestic Hot Water
- Phase II Subtask 7.12 HVAC - Existing HW Piping Insulation
- Phase II Subtask 7.14 - Fire Protection
- Phase II Subtask 11.4 - Lighting Design (Lighting Retrofit) - Building T12 & Pool Area
- Phase II Subtask 11.5 - Lighting Design (Lighting Retrofit) - Pool LEDs

With the exception of subtasks 5.7 and 10.1, all tasks were successfully installed. It was determined subtasks 5.7 and 10.1 were not feasible due to the amount of available funding. All other previously mentioned subtasks were executed per the specification. Although the full grant amount was not Utilized, all previously mentioned project objectives were met through the execution of the tasks and subtasks.

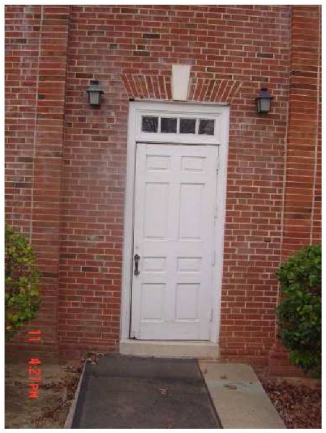
5. SUMMARY OF PROJECT ACTIVITIES

The subtasks below were executed during the renovation.

Phase II Subtask 4.3 - Window & Door restoration

- Prior to the renovation, there was a significant amount of air infiltration coming through the windows or doors. The existing window were restored to significantly reduce air infiltration and to protect the historic preservation status of the building.

Phase II Subtask 4.4 - Window & Door painting



- Since the historic preservation requirements prevent replacement of exterior doors and windows, all restored windows and door were painted to reflect the buildings original look.

Phase II Subtask 5.6 - Pool Cover

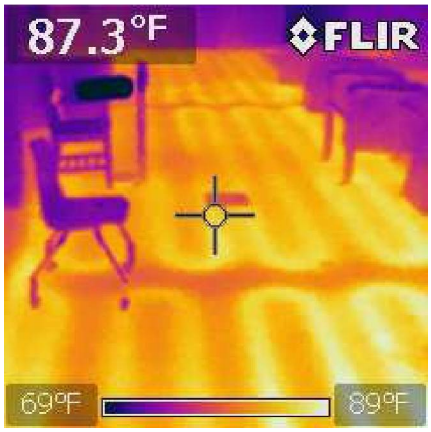
- The existing pool cover was replaced with a new pool cover. The use of the pool cover will reduce the amount of energy it takes to heat the pool.

Phase II Subtask 10.4 - Pool Filtration Room Door

- The gallery door leads to an unconditioned mechanical room. The existing door did not seal properly and was not properly weather stripped. The new weather-stripped door will reduce the amount of heat loss in the pool gallery.

Phase II Subtask 5.5 - Floor Radiant Heating

01. Must block car port and porch area from insulation



02. Example of air sealing needs to stop attic infiltration of conditioned air.

- A three way control valve was installed on the floor radiant heating loop. Previously there was no way to control the temperature of the hot water flowing through this loop. The controls valve will allow the college to control the temperature of the loop which reduces the amount of wasted heat.

Phase II Subtask 7.4 - HVAC – Boilers

- The existing primary boiler was replaced with a new high efficient condensing boiler. The new boiler is 97% efficiency and will energy cost tremendously.

Phase II Subtask 7.5 - HVAC - Domestic Hot Water

- A domestic hot water heater was installed to provide hot water to the building. Prior to the renovation hot water was produced by the existing boiler. The new efficient water heater will prevent year round usage of the old hot water boiler.

Phase II Subtask 7.12 HVAC - Existing HW Piping Insulation

- New piping insulation was installed on existing hot water piping. This will reduce heat loss as hot water travels through the system.

Phase II Subtask 7.14 - Fire Protection

- The existing piping penetrations were fire-caulked and new fire rated doors were installed in the mechanical room. This provides a safer mechanical room.

Phase II Subtask 11.4 - Lighting Design (Lighting Retrofit) - Building

- New LED light fixtures were installed in the gymnasium. Also T8 fixtures were installed to replace existing T12 fixtures. Occupancy sensors were installed in applicable areas. Not only will the new lights reduce energy costs, but they are providing addition light in most areas.

Phase II Subtask 11.5 - Lighting Design (Lighting Retrofit) - Pool

- The existing pool lights were replaced with new energy efficient lights, similar to the rest of the building.

6. APPENDIX

Entire Program

Ida M. Goode Program Development & Design Scope

Item	Phase I Scope Items (Programming)	Phase II Scope Items (Design)
0.0	Program scope development / pre-programming (Phase 1)	
1.0	Review campus master plans. Incorporate master plans into program objectives. Update master plans per developed mechanical, energy and sustainability direction	
1.1		Asbestos & lead paint study (mech & interior)
1.2		Pool - Asbestos & lead abatement
2.0	Coordinate with City of Greensboro Better Buildings Program	
3.0	Building envelope evaluation	
4.0	Weatherization (roofing and glazing) study, recommendations & scope	
4.1		Roofing repairs
4.2		Window & door restoration
4.3		Window & door painting
4.4		Spray foam insulation on Attic
4.5		Pool Walls Insulation
4.6		Roof Insulation
4.7		Suspended Ceiling Remove & Reinstall
5.0	Pool area HVAC/humidity evaluation, recommendations & scope	
5.1		HVAC, Pool - Pool HVAC with Humidity Control
5.2		HVAC, Pool - Solar design (ECM)
5.3		Pool - Pool pumping - filtration system
5.4		Pool HVAC - Floor Rad and Heating
5.5		Pool Cover
5.6		Pool Heating
5.7		Ventilation Fans in Natatorium
6.0	Roofing (structural) evaluation for solar feasibility study & recommendations	
6.1		Structural design
7.0	Perform facility audit, review historical energy consumption & develop energy conservation measures list for gym. Inspection of potential central plant connected buildings (evaluation of gym and approximately six (6) buildings will be required during the study of central heating and cooling options). Evaluate existing buildings, domestic hot water, pool heating equipment and renewable energy options.	
7.1		HVAC - Boilers
7.2		HVAC - Domestic Hot Water
7.3.1		HVAC - Chilled Water System, A/C Chiller
7.3.2		HVAC - Chilled Water System, Chiller structure
7.3.3		HVAC - Chilled Water System, Civil
7.4		HVAC - Electrical Service Upgrades for cooling
7.5		HVAC - AHUs
7.6		HVAC - Unit Ventilators
7.7		HVAC - Ductwork insulation & HW Piping (add 4 pipe)
7.8		HVAC - Existing HW Piping insulation
7.9		Water Conservation Retrofits
7.10		Fire protection
8.0	Develop, present and discuss decentralized mechanical (option 7), centralized mechanical (option 8), renewable/geothermal options and budget costs. Develop mechanical & electrical design scope.	
		Geothermal
9.0	Develop demonstration and educational value for the program	
9.1		Educational program
9.2		
10.0	Develop interior construction design basis/scope	
2.0		Pool Painting (Gallery, Walls, Ceiling)
10.2		Pool Tile
10.3		Pool Office door
		Pool Filtration Room Door
11.0	Develop building management and lighting system (controls) design basis/scope	
11.1		BMS design
11.1.1		Energy monitoring instrumentation - Building
11.1.2		Energy monitoring instrumentation - Pool
11.2		Lighting design (Lighting retrofit) - Building T12 & Pool Area
11.3		Lighting design (Lighting retrofit) - Pool LED's
12.0	Develop final program scope, schedule, financial plan, budget and construction plan. Gain approval.	
13.0	Historical perservation updates to the masterplan	
13.1		Masterplan Update
14.0	Tunnel investigation	
14.1		Tunnel evaluation - mapping
15.0	Commissioning	
15.1		Commissioning
16.0	Energy Model	
16.1		Energy Model
17.0	Campus controls master planning	
17.1		Masterplan Update
18.0	Architectural / Usage assessment	
18.1		Architectural / Usage assessment

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