



NAU Green Fund

Sky Dome Lighting Improvements Impact Report

Green Fund Mission Statement: “The NAU Green Fund promotes student participation in and provides funding for projects that reduce NAU’s negative impact on the environment and create a culture of sustainability on-campus.”

Project Lead Information		Project Advisor Information	
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Approval Date:	Initial Approval: Fall 2019 Addendum Approval: Spring 2022	Department:	Facility Services
Project Cost:	NAU Green Fund: \$50,000 NAU Revolving Fund: \$250,000 Total Cost: \$600,000	Project Category:	Capital Investment

Problem Statement

Initially approved in Fall 2019, the athletic infrastructure at the Skydome relied on outdated light fixtures that lacked energy efficiency, leading to unnecessarily high energy consumption and operational costs. However, following COVID-19 delays, unforeseen increases in material costs created a financial barrier to upgrading the lighting system by the time of its final implementation in Spring 2022. This required collaborative funding to bridge the gap, ensuring the university did not miss a critical opportunity to reduce its environmental impact.

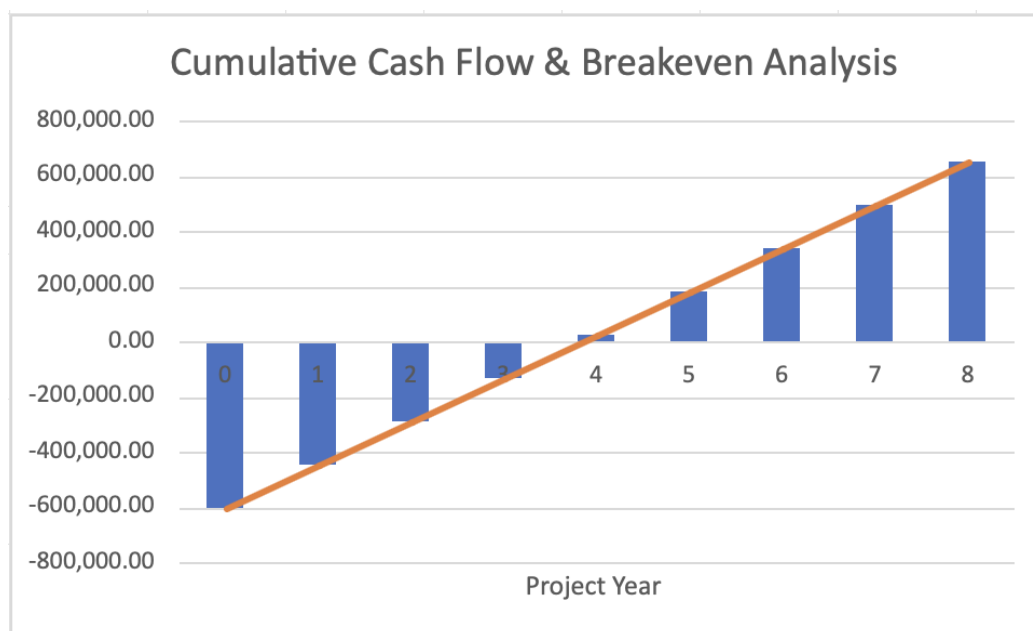
Project Overview

The Skydome LED Lighting Conversion Project is designed to upgrade the athletic infrastructure on campus by replacing outdated light fixtures with energy-efficient LED technology. Due to rising material costs, a partnership between the university and the Green Fund was formed to provide the necessary funding for this conversion. This initiative acts as a critical steppingstone for establishing a permanent Energy Renewal Fund. By capturing the annual financial savings generated from the new, efficient lighting, the university will be able to fund future energy efficiency improvements across the campus. Ultimately, this targeted intervention significantly reduces energy consumption, aligning with the Green Fund's mission and supporting the university's Climate Action Plan by demonstrating how large-scale utility upgrades can create sustainable funding models for ongoing environmental progress.

Quantitative Impact

The Skydome LED Lighting Conversion Project demonstrates the power of targeted infrastructure upgrades, pairing measurable operational efficiencies with significant carbon abatement. Modernizing the arena's fixtures to high-efficiency LEDs delivers immediate, recurring performance gains:

- **Energy Conservation:** Eliminates **1,268,544 kWh** in grid electricity demand annually.
- **Carbon Mitigation:** Avoids **895,832 lbs of CO₂ e** (approx. 406.3 metric tons) per year, calculated using a regional grid intensity factor of 706.189 lbs CO₂ e/MWh.
- **Fiscal Stewardship & Circular Funding:** Generates **\$156,792.24** in recurring annual utility cost reductions, achieving full capital recovery on the initial \$600,000 investment within **3.8 years**. These savings are channeled directly back into the Sustainability Revolving Fund, creating an evergreen financing mechanism for future campus climate projects.



Qualitative Improvements

While utility savings and carbon abatement provide the baseline return on investment, the most immediate operational impact of the LED retrofit is the near-total elimination of high-bay lighting maintenance in the Skydome.

- **Reduction in Component Failure and Repair Cycles:** Traditional high-intensity discharge (HID) systems involve multiple mechanical points of failure, including aging magnetic ballasts, capacitors, and degrading lamp sockets subject to extreme heat cycling. Solid-state LED luminaires have no fragile filaments or pressurized arc tubes, eliminating the recurring cycle of diagnostic troubleshooting, ballast replacements, and emergency work orders.
- **Elimination of Secondary Maintenance Costs & Logistics:** Maintaining the legacy system required recurring operational expenses that fell outside standard utility billing, including lift equipment staging, specialized bulb disposal (handling hazardous mercury content in HID lamps), and keeping large inventories of replacement ballasts and lamps in stock. The long operational lifespan of LEDs removes these recurring materials and logistical costs.
- **Prevention of Facility Scheduling Disruptions:** Changing burned-out lamps in the arena previously required coordinating around academic classes, athletic practices, and campus events to clear the turf or track surface for lift access. Eliminating unplanned bulb outages ensures uninterrupted facility availability and frees up skilled campus maintenance technicians to focus on proactive preventative maintenance across other university facilities.

Future Outlook

- **Evergreen Reinvestment via the Sustainability Revolving Fund:** The \$156,792.24 in recurring annual utility savings does not simply disappear into general operational overhead. Channeled into NAU's Sustainability Revolving Fund (SRF), these recovered utility dollars establish an active, self-replenishing capital pipeline. Once the initial \$600,000 capital outlay is recovered in Year 3.8, the project will generate over \$150,000 annually in unencumbered liquidity dedicated strictly to seeding future campus decarbonization and energy-efficiency initiatives.
- **Campus-Wide Retrofit Blueprint:** As one of the largest single-facility electrical loads on campus, the Skydome project serves as a proving ground and administrative model for modernizing high-bay athletic and recreational infrastructure, including the Wall Aquatic Center and fieldhouse facilities.

- **Long-Term Financial Resilience:** While the financial model assumes a conservative, flat utility rate, commercial power rates historically face upward pressure. Every avoided kilowatt-hour provides an escalating hedge against future electric rate increases, ensuring the real-dollar value of the project expands over its operational lifecycle.

Methodology

Energy Reduction Calculations

The annual energy savings of **1,268,544 kWh** are based on pre-installation technical models and facility run-hour estimates developed by the project's consulting engineering firm, rather than representing live metered data which is not available for this project.

Emissions Accounting

Avoided greenhouse gas emissions were calculated by converting modeled electrical savings to metric megawatt-hours (1,268.544 MWh) and applying the regional subregion output emission rate from the U.S. Environmental Protection Agency's Emissions & Generation Resource Integrated Database (eGRID):

Annual Emissions Avoided = 1,268.544 MWh × 706.189 lbs CO₂ e/MWh = 895,832 lbs CO₂ e

Using the subregion factor accounts directly for the generation fuel mix (natural gas, coal, solar, wind, and hydro) serving the regional grid, accurately reflecting the Scope 2 indirect emissions eliminated at the generation source.

Financial and Payback Valuation

The simple payback period of **3.83 years** (presented as ~3.8 years) represents the timeframe required for cumulative avoided electricity costs to equal the initial capital investment:

Simple Payback Period = Initial Capital Expenditure / Annual Utility Cost Savings = \$600,000.00 / \$156,792.24/year = 3.827/years

This calculation evaluates pure energy cost avoidance based on current contracted utility

tariff schedules. It conservatively excludes secondary operational cost reductions—such as avoided scissor-lift rentals, contracted maintenance labor, and replacement ballast inventory—which will yield additional unmodeled bottom-line savings over the life of the system. Future reporting phases will incorporate post-retrofit utility submetering to calibrate these engineering projections against empirical electrical consumption.