SEDAC CASE STUDY

Woodridge Park District ARC New Construction

August 2018

FISCAL RESPONSIBILITY + ENVIRONMENTAL SUSTAINABILITY

The Woodridge Park District's mission is to "enhance quality of life by providing superior parks, facilities, and recreational services in a fiscally responsible and environmentally sustainable manner, in partnership with the community."

This mission is exemplified in their recently constructed Athletic Recreation Center in Woodridge, IL. The Park District involved the community every step of the way to make sure that the facility would meet the community's needs. By bringing affordable athletic programming to users, the Athletic Recreation Center benefits the community in numerous ways. Users are healthier, leading to reduced health care costs. The beautiful new facility attracts home buyers and businesses. Programming decreases loneliness and prevents youth crime.

Not only that, the Athletic Recreation Center was constructed--and is operated--in a fiscally responsible and environmentally sustainable way. Indeed, environmental sustainability and fiscal responsibility often go hand in hand: an energy efficient design will reduce operating costs, and funding from energy efficiency programs makes constructing an efficient building more affordable. In this case study, we explore how SEDAC helped the district achieve its goals.

> "In all our buildings, we consistently look for energy efficiency. We are always open to any green initiatives that have a good return on investment, especially if those initiatives can be subsidized through grants."
> --Mike Adams, Woodridge Park District Executive Director

IDENTIFYING SOURCES OF FUNDING

In 2012, the Woodridge Park District determined that existing facilities had reached capacity and were unable to meet increased program offering demands. Numerous surveys and public forums indicated that residents supported building an indoor athletic recreation center. "It was important for us to get the support of the community and to be transparent about the process," says Mike Adams, Executive Director of the Park District.

The Park District did not want to fund the construction of the ARC through a property tax referendum, but instead decided to use alternative means of funding. They applied for as many grants and programs as possible to help defray the cost. By choosing to locate the facility in an area in need of redevelopment, they were able to take advantage of Tax Increment Financing (TIF) subsidies. They applied for a State of Illinois' Park and Recreation Facility Construction (PARC) grant and green infrastructure and energy efficiency grants and programs--including the state-funded Public Sector New Construction Program SEDAC administered. "We'd worked with SEDAC in the past and so we were aware of their energy efficiency programs," Mr. Adams explained.

ENERGY EFFICIENCY TO REDUCE OPERATING COSTS

To keep program and membership costs reasonable for users, Woodridge Park District wanted to find ways to reduce the building's operating costs through energy efficient designs.

Mr. Adams reached out to SEDAC to review the design development phase drawings and suggest ways to make the building more energy efficient. SEDAC provided energy cost savings data and identified incentives that could cover some of the cost of the energy efficiency upgrades. SEDAC provided this service to the park district at no cost, through state-funded energy efficiency programs.

SEDAC RECOMMENDATIONS

Envelope Measures

- Enhanced insulation for wall and roof assemblies
- Eliminate thermal bridging by paying attention to transition details
- Insulated transparent wall system for windows and skylights
- Reduced west-facing glazing area

Mechanical Measures

- Energy recovery wheels and Demand Control Ventilation for all rooftop units
- Radiant slab heating and high efficiency condensing boilers

Lighting Measures

- Reduced interior lighting power density
- Tubular skylights with daylight sensors

Many of these recommendations consist of going ***beyond code*** in envelope construction, equipment selection, and lighting standards. Illinois mandates that all new buildings and major renovations meet current energy code requirements, but going beyond code can lead to additional energy savings. An added bonus: going beyond code makes buildings eligible for energy program incentives. SEDAC estimated that by following these recommendations, the park district would be eligible for over $200,000 in incentives.

SEDAC modeled the energy and cost savings for the recommendations, and provided an economic analysis for all measures to show the return on investment.

Table 1: Initial Savings and Economic Analysis

Annual electricity savings	262,000 kWh
Annual natural gas savings	30,000 therms
Annual energy cost savings	$39,000
Incentives available for measures	$217,000
Capital cost (including incentives)	$338,000
Simple payback	< 9 years

Mr. Adams worked with the architects (Williams Architects) and engineers (WT Mechanical/Electrical Engineering) to prioritize recommended measures. The Park District received new bids for energy efficient equipment and designs. They were most interested in implementing measures that had a payback of 7 years or less. Based on SEDAC's economic analysis, the Park District decided to implement all but two of the recommendations.

INCENTIVE REVIEW

After decisions were made, the SEDAC team reviewed the revised design plans to determine energy cost savings and to update incentive information. SEDAC's estimation of cost savings are summarized in Table 2.

Table 2: Updated Annual Energy Cost Savings

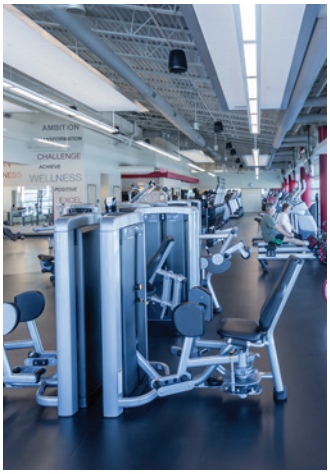
	Electricity	Natural Gas	Energy Cost Savings
Energy Savings	57,000 kWh	63,000 therms	$40,000

Note: The costs of energy ($0.086/kWh and $0.66/therm) are based on the average costs for the region.

SEDAC identified incentives totaling $158,688 (see Table 3). About 70% of the incentives came from envelope measures; Mechanical, lighting, and water heater measures accounted for 30% of the total incentives.

Table 3: Updated Incentives

Measures	Incentives
Lighting Measures	$4,349
Envelope Measures	$116,383
Mechanical Measures	$36,206
Water Heater Measures	$1,750
Total Incentives	$158,688



The Athletic Recreation Center was completed in 2017, and users are enjoying the facility's many amenities: a fitness center, a large indoor field with artificial turf, a multi-court gymnasium, a walking/running track, a ropes course, and program rooms. The improvements recommended by SEDAC have reduced energy costs and made the facility more comfortable for users. Take a virtual tour of the facility at https://www.wpdarc.org/

"SEDAC is a great resource. They give you a laundry list of energy efficiency measures, calculate the cost savings, and help you compare measures to get the best possible outcome. I recommend working with SEDAC from the beginning of a planning cycle." --Mike Adams

ENVELOPE MEASURES

Continuous Insulation. Continuous insulation (a layer of insulation unbroken by structural framing) is now required for walls and roofs. A designer should be able to draw an unbroken line of insulation around the building envelope, leaving no hidden gaps to leak energy dollars. Energy codes require minimum levels of insulation. SEDAC recommended exceeding code minimums to make the building more efficient and comfortable.

Continuous insulation also helps prevent thermal bridging. Thermal bridging occurs when insulation is interrupted, and highly conductive materials like metal studs or concrete allow heat to move freely from one side of the wall to the other. The result is thermal bridging every 16 inches, which results in heat loss and moisture problems.

SEDAC recommended installing an **insulated transparent wall system** in place of glass for windows in the turf area (see image above). These panels can be selected at desired thickness and light transmission levels to improve the overall thermal performance of the building envelope and the quality of daylighting in the facility.

MECHANICAL MEASURES

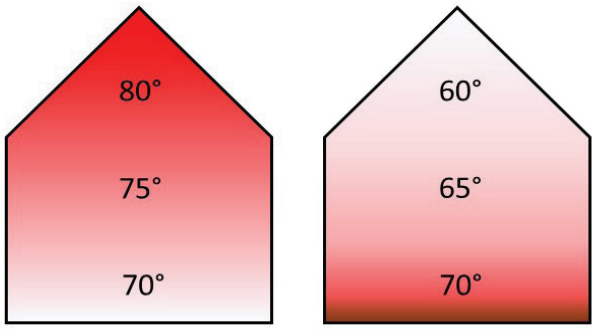
Ventilation filters outside air into a building to provide building occupants with fresh air, while exhausting contaminated air. Depending on weather conditions, ventilation air must usually be either heated, cooled, or humidified/dehumidified. Because of this, ventilation represents a significant portion of HVAC energy consumption.

Demand Control Ventilation (DCV) systems save energy by reducing the amount of outdoor air brought in that requires conditioning. DCV systems employ automated controls to reduce outdoor air intake below the rates required for maximum design occupancy—when, as is frequently the case, actual occupancy is lower than the maximum.

SEDAC recommended that the ARC place CO_2 sensors in the return air duct system to monitor the concentration of CO_2. The sensors signal the outdoor air dampers when to adjust the amount of air to be introduced into the air-handler so that fresh air requirements are met.

Exhaust Air Energy Recovery reduces waste and saves energy by capturing thermal energy from a building's outgoing exhaust air stream—instead of simply rejecting it from the building. SEDAC recommended installing an enthalpy wheel on the ARC's rooftop units to capture exhausted energy and release it to pre-heat, precool, humidify, or dehumidify the incoming air. Enthalpy wheels are more efficient than other energy recovery technologies.

SEDAC recommended **Radiant Slab Heating** to heat the gyms and field turf area. Unlike conventional HVAC systems that use warmed air for space heating, in-slab radiant heating systems radiate heat directly to occupants. This is particularly beneficial in large spaces like gyms where the volume of air to heat is huge, and occupants only really need warmth in the lowest 6 feet of these spaces.



Conventional Heating | Radiant Slab Heating

Because occupants will experience warmth directly through radiation rather than convection, the space temperature settings can be greatly reduced. A high-efficiency condensing boiler is needed to serve the radiant heat system.

LIGHTING MEASURES

Lighting Power Density. The lighting system represents the largest single component of the ARC's energy cost (27%). The energy code sets requirements for lighting power density, but advances in the development of lighting technologies have stayed well ahead of minimum requirements. SEDAC recommended at minimum a 10% reduction in the maximum lighting power density for the facility. Reducing the lighting wattage has the additional benefit of reducing cooling loads.

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TOP 10 RECOMMENDATIONS FOR NEW CONSTRUCTION

1. **Orientation and Form.** Orient building on east-west axis, minimize west glazing and shade south glazing.
2. **Insulation.** Insulate beyond code: min. assembly R-14 for mass wall, min. assembly R-22 for steel-framed wall, min. assembly R-35 for roof above deck. Use low-E gas-filled insulated glazing with max. assembly U-0.35 including frame.
3. **Air Sealing.** Add air sealing standards as a part of the specification. Require performance testing at completion of construction. Consider envelope commissioning.
4. **Lighting.** Target lower lighting power density (LPD: W/sf) than code allowed maximum, while meeting IESNA lighting level recommendations. Choose high efficacy (lumen/W), long lasting lamps with good Color Rendering Index (CRI). Implement effective lighting control strategies based on schedule (timers), occupancy (occupancy sensors), and available daylight (photocells).
5. **Reduce loads.** Use ventilation heat recovery. Modulate ventilation rates based on occupancy with demand control ventilation. Shade glazed surfaces.
6. **Heating.** Use high efficiency boilers and furnaces of 92% efficiency or better. Consider using a geothermal heat pump. Consider a hydronic system with a dedicated outdoor air system.
7. **Cooling.** Use high efficiency (SEER 14+, EER 11.5+) air conditioning equipment with an outdoor air economizer. A geothermal heat pump is also recommended.
8. **Commissioning.** Commission HVAC and mechanical systems to de-bug and ensure systems operate according to design.
9. **Motors and Pump.** Use variable frequency drives on electric motors with variable loads. Use premium efficiency equipment.
10. **Building automation.** Use automatic controls to adjust temperature settings, ventilation, and system operation according to time of day and building loads. Use BAS trend logs to assess system performance.

After implementing all of these, consider renewables such as solar and wind.

SAVE ENERGY AND MONEY WITH SEDAC

TECHNICAL ASSISTANCE

SEDAC provides technical assistance to help new and existing buildings become more energy efficient. We offer:

- Quick advice and implementation assistance
- Design assistance for new construction and renovation
- Energy assessments for existing buildings
- Retro-commissioning
- Benchmarking
- Long-term energy planning
- Help navigating energy efficiency programs and incentives

Find out how SEDAC can help your facility save energy and money at **apply.sedac.org**.

EDUCATION AND TRAINING

SEDAC is the Illinois Energy Efficiency Code Training Provider, on behalf of the Illinois EPA. Let SEDAC assist you in navigating code compliance for your new construction or renovation project. Training opportunities include:

- Workshops
- Webinars
- Online courses
- Information center (call us with technical questions)

Find out more at **sedac.org/energy-code**.

WHO WE ARE

The Smart Energy Design Assistance Center assists buildings and communities in achieving energy efficiency, saving money, and becoming more sustainable. SEDAC is an applied research program at the University of Illinois at Urbana-Champaign working in collaboration with the 360 Energy Group.

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