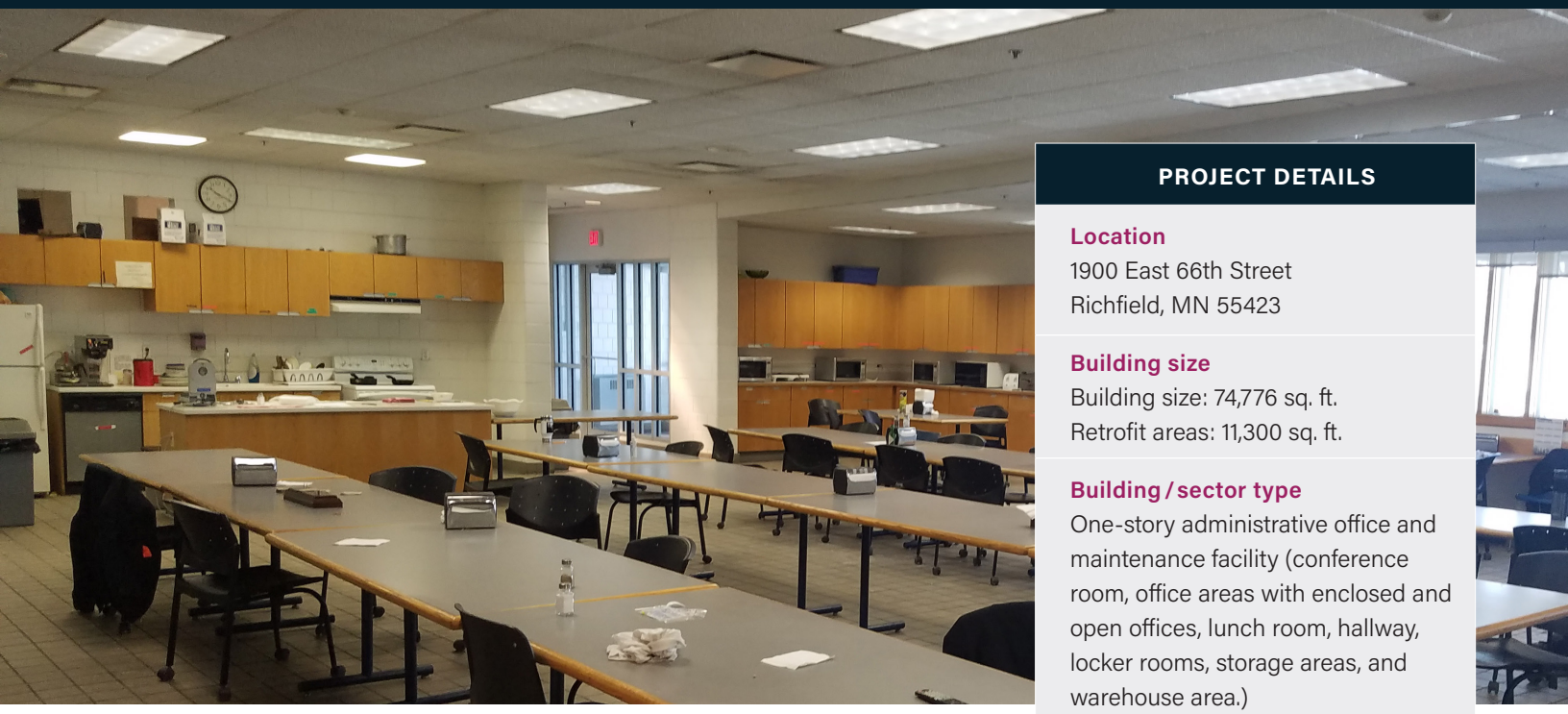
slipstream

INTEGRATED CONTROLS PILOT PROGRAM | **CASE STUDY**



Lunchroom before the retrofit.

State of Minnesota, Department of Transportation

PROJECT BACKGROUND

The Minnesota Department of Transportation (MnDOT) Cedar Avenue truck station is a key facility from which the department maintains the many state roads and highways in the Twin Cities metro area. Prior to the retrofit the building had an older fluorescent lighting system that was overlit and largely operated 24 hours a day without much automated lighting controls.

The Integrated Controls pilot program, co-funded by Xcel Energy and the US Department of Energy (DOE), could deliver deeper, more holistic energy retrofits. The MnDOT retrofit included a complete lighting retrofit with a luminaire-level lighting controls system, wireless outlet controls, and a tie from the lighting

PROJECT DETAILS

Location
1900 East 66th Street
Richfield, MN 55423

Building size
Building size: 74,776 sq. ft.
Retrofit areas: 11,300 sq. ft.

Building / sector type
One-story administrative office and maintenance facility (conference room, office areas with enclosed and open offices, lunch room, hallway, locker rooms, storage areas, and warehouse area.)

HVAC unit type
One single-duct, variable air volume (VAV) AHU serving 10 zones controlled by series fan-powered VAV terminal units with hot water reheat coils. The fan-powered VAV boxes have fan speed control regulators.

BAS system type
Distech Controls (Tridium Niagara framework)

Occupancy description
30 occupants, operating 24/7

Incentives
DOE incentive: $27,800
Xcel incentive: $11,224

PROJECT PARTNERS

CREE LIGHTING
A COMPANY OF IDEAL INDUSTRIES, INC.

legrand®

Pacific Northwest
NATIONAL LABORATORY

Xcel Energy®

Office in training room 131 before the retrofit.

Office 139 before the retrofit.

controls to the HVAC building automation system. This took advantage of the highly variable occupancy in the building to drive deeper energy savings.

MnDOT retrofitted approximately 11,300 sq. ft. with full design and commissioning services from Cree, and measurement and verification from PNNL. MnDOT received funding from the DOE and incentives from Xcel Energy for a portion of the retrofit.

The backbone of the new hardware for the retrofit was a luminaire-level lighting control system provided by Cree—their SmartCast platform. This system incorporates dimming control, photosensing, and occupancy sensing onboard each individual fixture. The existing fixtures were replaced with SmartCast on a one-for-one basis. Sensors communicate wirelessly with each other, creating a flexible, granular mesh network of sensing throughout the building. This lighting network is integrated with individual outlet control and HVAC zone control.

The project team, led by Slipstream, used this project as a demonstration of the impacts and trade-offs from integrating luminaire-level lighting control with plug load controls and HVAC controls. We assessed energy impacts, ease of installation and data retrieval, and obtained occupant feedback on the new technologies.

ENERGY SAVING CONTROL STRATEGIES
SmartCast lighting and all its associated energy-saving controls and features
Plug load controls in office spaces
Plug load controls on common area equipment like printers and chargers
Thermostat setback based on occupancy
VAV box shut off based on occupancy
AHU supply air temperature reset
Hot water supply temperature reset

LESSONS LEARNED

The concept of integrating controls across systems is relatively new, and lessons were learned along the way:

- Overall, the lighting control implementation and commissioning were straightforward for MnDOT, aided by Cree's representatives supporting field implementation. The control integration was done by the facility staff and there was no additional hardware/software upgrade cost.
- The outlet controls were costly to install and would likely only be cost-effective where very large plug loads are identified.

Training room before the retrofit.

Training room after the retrofit.

- Once lighting integration with HVAC is complete, alarms should be set to ensure that it remains functional; lighting systems will not alarm if that connection goes down.
- Mapping control points between lighting and HVAC involves coordination between multiple parties; zoning pairs should be planned in advance.
- Lighting high-end trim was implemented to tune light levels to just enough for the task in each space; photometric calculations were used to plan this tuning and decrease time spent in the field.
- Plan on training someone on the building owner's staff as commissioning is taking place so they have someone local who knows how to make any necessary adjustments.

IMPACT INFORMATION

The impacts table describes the savings, cost, and resulting payback for this project. **Note:** This building was studied at partially lowered occupancy due the COVID-19 pandemic.

IMPACTS	
Lighting savings	1.7 kWh/sq. ft.
Plug load savings	0.1 kWh/sq. ft.
HVAC savings	12.6 kWh/sq. ft. 0.02 therms/sq. ft.
Total cost savings	$1.59/sq. ft.
Cost (after incentives)	$5.85/sq. ft.
Payback	3.7 years
Payback, mature product*	2.1 years

*Based on system costs in more mature markets, and excluding plug load controls.

FOR MORE INFORMATION
info@slipstreaminc.org

ACKNOWLEDGMENT: "This material is based upon work supported by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) under the Building Technologies Office, Commercial Buildings Integration Program, Award Number DE-EE0001890."