Table 4A. Technology Comparisons

	Conventional Design	Thrivent's High Performance Design
Glazing		
Model	Typical insulated clear glass	Viracon VE6-40
Color	Blue green	Blue green
Shading coefficient	0.58	0.25
Visible light transmittance	67%	31%
UV light transmittance	26%	6%
U-value	0.48	0.31
Coating	uncoated	Low-e
Window-to-wall ratio	28% (A conventional building might use a higher percentage)	28%
Overhangs	None	4 feet
Window Coverings	Venetian blinds	Perforated roller screens
State Energy Code Compliance		19% better

Table 4B. Technology Comparisons: Lighting

	Conventional Design	Thrivent's High Performance Design
Perimeter Offices	2x4 T-8 fluorescent with manual switching, conventional light levels (75+ foot-candles) *Foot-candles = FC*	Litecontrol pendant mount direct-indirect T-8s, low ambient light levels (30-40FC) and task lighting, daylighting, and occupancy sensor control
Core offices/retail	Compact fluorescent for corridors, open office and retail, conventional light levels (75+FC), 2x4 fluorescent in individual offices, one level switching on accent lighting, occupancy sensor control in restrooms	Compact fluorescent for corridors, open office and retail, low ambient light levels with task lighting, 2x4 fluorescent in individual offices with occupancy sensors, two level switching on accent lighting, occupancy sensor control in restrooms
Lighting power density	Perimeter offices: 1.3 watts/sq.ft. Building total: 1.4 watts/sq.ft.	Perimeter offices: 0.88 watts/sq.ft. Building total: 1.25 watts/sq.ft.
State Energy Code Compliance		24% better for interior lighting, 42% better exterior lighting

Table 4C. Technology Comparisons: HVAC

	Conventional Design	Thrivent's High Performance Design
System Type	VAV rooftop system with gas heating and DX cooling, 8.5 EER, VAV reheating and most perimeter heating primarily hydronic, with electric heating in a few areas	VAV air handling system with hot water heating and chilled water cooling, no electric heating
Heating Plant	Boilers: 2-750 MBK, 80% efficient	Boilers: Thermal Solutions 2-750 MBH, 88% efficient and one 250 MBH, 88% for summer operation
Cooling Plant	Air-cooled DX associated with rooftop unit, 85 ton	Chiller: Trane, air-cooled rotary, 70 ton, 1.20 kW/ton
Air Distribution	VFD control on supply and return fans	Air Handler: Trane MCC50, VFD control on supply and return fans
Miscellaneous	Some electric heating, constant speed heating pumps standard "high efficiency" motors	No electric heating, VFD heating pumps, "premium efficiency" motors separate systems for areas with after-hours use
Cooling Density	370 sq.ft./ton	450 sq.ft./ton
Heating Density	31.7 Btu/sq.ft	27.8 Btu/sq.ft.
Supply Air Flow	1.03 cfm/sq.ft	0.86 cfm/sq.ft

Thrivent Financial Bank Facility Project Team

Building Owner/Operator	Director of Facilities	Architect/Engineers	Prime Contractor
Aid Association for Lutherans	Pete Rohe	Douglas Hursh, Mark M. Smith, Potter Lawson, Inc.	David Shoemaker, Oscar J. Boldt Construction

MM-1663-1002

NEW CONSTRUCTION
PROGRAMS

CASE STUDY

Smart Planning Yields "High Performance"

Energy Efficient Bank Building for Thrivent Financial Bank

Build it right the first time. Thrivent Financial Bank, created by the recent merger between the Aid Association for Lutherans and the Lutheran Brotherhood, took this guidance to heart when it constructed its new facility, located at 2000 Milestone Drive in Appleton. When the new facility was still on the drawing board, representatives from Thrivent, Potter Lawson (the architectural firm), Oscar J. Boldt Construction (the prime contractor), and Wisconsin's Focus on Energy program met and talked about the best ways to build a high performance, energy efficient building. Their mutual goal: construct a building that would provide low operating costs as well as remain comfortable for years to come.

"Thrivent was very innovative. They set goals for energy efficiency up front and worked with the design and construction teams to achieve their goals," said Abby Vogen, Manager of Focus on Energy's High Performance Buildings Program. "They represent a great role model for commercial establishments."

Potter Lawson worked closely with Focus on Energy and the Daylighting Collaborative to design an energy efficient building. The building design includes efficiency enhancing innovations such as sunscreens, light shelves, and occupancy sensors. These innovations will increase energy efficiency as well as the building occupant comfort over its lifetime.

"We are committed to doing what is best for our customers," said Thrivent Financial Bank President Richard Jodarski. "Working with Focus on Energy showed us ways that we could use energy wisely and save money. Both are good for the environment, our employees and our customers."

A TECHNICAL REVIEW: WHAT MAKES THIS FACILITY DIFFERENT?

The Thrivent Financial Bank facility incorporates many high performance building measures that yield greater energy efficiency and enhance occupant comfort and productivity. This technical case study:

- Summarizes the high performance building concepts that were incorporated,
- Details the facility's projected energy use, and
- Presents several measure-specific comparisons between today's "conventional" facility designs and the Thrivent facility's "high performance" design.

Highlights of the Thrivent facility's design include use of daylighting, high performance windows, and an efficient heating, ventilating and air conditioning (HVAC) system. This particular combination allows for reduced cooling equipment size and less electric-powered lighting. These two factors combine to reduce the facility's energy requirements. The design team predicts that Thrivent will save 20 percent on its energy bills for this high performance building, when compared with a conventional design.

Thrivent Financial Bank Facility Description

The Thrivent facility is a two story, open concept design. The southern exterior includes louvered overhangs that separate clerestory windows from view glass windows. A raised roof in the building core is also surrounded by clerestory windows. With the longer dimension in the east-west direction, daylight is allowed to enter most spaces. Lighting in perimeter offices is controlled with daylighting controls and enhanced by light shelves.

Table 1 summarizes the energy efficient components that were installed in the Thrivent Financial Bank facility. Table 2 offers a list of key project details.

Conventional Versus High Performance: Energy Use, Costs, and Savings Differences

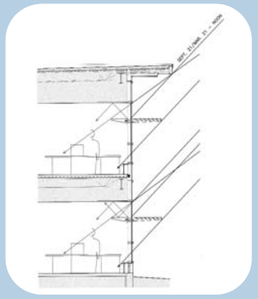
The design team studied the differences between a "conventional" and a "high performance" facility's energy use by using the computer simulation package MarketManager.™ Discussions with several architects and engineers helped quantify the elements that comprise a conventional design for this type of building.

Table 3 compares the projected energy use, costs and savings of a conventional design with a high performance building design.

Thrivent Financial Bank, Appleton, Wisconsin

800.762.7077 focusonenergy.com

focus on energy®
The power is within you.



The Environmental Benefits of Saving Energy
The Thrivent facility will use 78,000 fewer kWh of electricity and 3,000 fewer therms of natural gas than a conventionally built facility. These energy savings have positive environmental impacts. By using less energy, Thrivent is doing its part to decrease power plant emissions and the pollution released into the atmosphere. The total emissions savings from this project are:

- 209,000 fewer pounds of carbon dioxide (CO_2)
- 480 fewer pounds of nitrogen oxides (NO_X)
- 870 fewer pounds of sulfur dioxide (SO_2)
- 38 fewer pounds of carbon monoxide (CO)
- 4.8 fewer pounds of volatile organic compounds (VOC)
- 16 fewer pounds of particulate matter (PM10)

Table 1. Summary of Energy Efficient Components

Building Envelope	• Windows with low-e coating and high insulation and shading coefficient ratings • Solar shading overhangs and light shelves
Lighting	• Low ambient light levels in offices complemented with task lighting • Low power density and energy use building-wide • Controls: Daylighting controls and occupancy sensors for perimeter offices Occupancy sensors for individual offices and restrooms Dual switching on high ceiling accent lighting
Heating Ventilating and Air Conditioning (HVAC)	• Variable air volume (VAV) air handler, with hot water heating and chilled water cooling • High efficiency boilers • High efficiency domestic water heaters • Small, high efficiency boiler sized for summer operation • Controls: High-end direct digital control (DDC) system Airside temperature reset based on peak zone requirements Chilled and hot water reset based on outside air temperature Variable frequency drive (VFD) hot water pump control
Commissioning	• High level of testing of equipment operation • High level of owner/operator training • High level of design engineer interaction with construction, testing and equipment operation

Table 2. Project Details

Type	Bank building—office space
Construction completion date	April 2002
Location	Appleton, Wisconsin
Hours of operation	9 a.m. to 5 p.m. Mon. – Thurs., 9 a.m. to 6 p.m. Fri., 9 a.m. to 12 p.m. Sat.
Size, gross square footage	31,500 square feet
Peak electric demand	133 kW (conventional: 156 kW)
Annual electric energy use	287,000 kWh (conventional: 365 kWh)
Annual electric energy use per square foot	9.1 kWh/sq.ft. (conventional: 11.6 kWh/sq.ft.)
Annual natural gas use	15,000 therms (conventional: 18,000 therms)
Annual natural gas use per square foot	0.48 therms/sq.ft. (conventional: 0.57 therms/sq.ft.)
Energy use index (EUI) Site energy Source energy	 78.7 kBtu/sq.ft./year (conventional: 96.7 kBtu/sq.ft./year) 141 kBtu/sq.ft./year (conventional: 176 kBtu/sq.ft./year)
Annual energy cost	$31,000 (conventional: $38,800) *Based on current rates: $0.60/therm and $0.77/kWh*
Estimated annual utility costs per square foot	$0.98/sq.ft. (conventional: $1.23 sq.ft.)

Table 3. Comparison of Projected Energy Use, Costs and Savings

	Conventional Design	Thrivent's High Performance Design	Energy Savings	Percent Reduction
Electric End Uses				
Cooling (kWh)	81,000	61,000	20,000	25%
Heating (kWh)	22,000	0	22,000	100%
Fans (kWh)	44,000	34,000	10,000	23%
Lights (kWh)	143,000	117,000	26,000	18%
Equipment (kWh)	51,000	51,000	0	0%
Pumps/Auxiliary (kWh)	24,000	24,000	0	0%
Total Energy (kWh)	*365,000*	*287,000*	*78,000*	*21%*
Peak Power (kW)	156	133	23	15%
Electric Cost	$28,000	$22,000	$5,000	21%
Natural Gas End Uses				
Heating (therms)	17,000	14,000	3,000	18%
Hot Water (therms)	1,000	1,000	0	0%
Total (Therms)	*18,000*	*15,000*	*3,000*	*17%*
Fuel Cost	$10,800	$9,000		9%
TOTAL UTILITY COST	**$38,800**	**$31,000**		**20%**
TOTAL UTILITY SAVINGS		**$7,800**		

Conventional Versus High Performance: Actual Equipment Decisions
Based on the same building geometry and basic design used in the MarketManager™ analysis, the specific "conventional" versus "high performance" design and equipment choices (for the Thrivent facility's envelope, lighting and HVAC systems) are described in Tables 4A through 4C. In general, "conventional design" minimally meets Wisconsin State Energy Code.

Building simulations give an approximate projection for energy use. The Thrivent facility's actual energy use will be tracked and evaluated in the coming years and compared with the computer simulated values. In general, analysts estimate that the facility's projected total energy use will be accurate to within fifteen percent. They estimate that the percentage reduction in energy use (versus the conventional design), is accurate to within five percent.

Conclusions
Thrivent Financial Bank and its design team learned that a little extra time spent during the planning process yielded long-term benefits. "Don't design in haste and repent at leisure," noted Abby Vogen of Focus on Energy. "Thrivent had the foresight to give its design team the time to understand the building goals and design accordingly."

Doug Hursh of Potter Lawson agreed. "Thrivent wanted both quality and cost-effectiveness, which we achieved with this energy efficient, high performance building."

David Shoemaker of Oscar J. Boldt Company stressed the benefits of taking a team approach. "When we are involved from the beginning, we are able to work with the design team to meet our clients' goals. The process worked very well for this client."