
KIM YONGKWAN

# Westwood Community Church Recommissioning

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**Built in 2003 and added to in 2013, Westwood Community Church in Excelsior, Minn., is a 115,000 ft² (10 684 m²) building that consumes approximately $140,000 on electricity and gas annually. A recommissioning study began in May 2023 on the church. This Level 2 ASHRAE Energy Audit and the subsequent ASHRAE BEQ effort identified electric savings of nearly 493,500 kWh, about 36.5% of the yearly consumption, or $24,670. The identified gas savings were 21,500 therms. However, the gas estimate was conservative; in just 9 months, 31,000 therms have been saved (weather-normalized), approximately 45% of the yearly gas consumption, and equivalent to $43,000. The audit cost was paid for in utility savings in under two months, and the implementation of the energy conservation opportunities (ECOs) was essentially free because the changes were completed during the study through programming adjustments by SES, an energy engineering consulting firm, and the controls contractor.**

## PROJECT SUMMARY

The recommissioning study highlighted several areas for improvement, by following the process outlined in Procedures for Commercial Building Energy Audits 2nd Edition, 2011:

- Heating system – The boilers have a major effect on the entire energy profile and consumption. Inappropriate setpoints for the building had caused the boilers to send unnecessary heat throughout the building so much so that the chiller had to compensate during the summer.
- Cooling System – High setpoints resulted in overcooling in many spaces.
- Ventilation – Variable air volume (VAV) box flow rate setpoints were elevated, over-

ventilating spaces significantly above those determined by ASHRAE Standard 62.1-2010.

## ENERGY EFFICIENCY

Several ECOs were identified and implemented during the recommissioning study. Both electric and gas consumption dropped noticeably due to the changes. Electric dropped over 60,000 kWhs (22% from 2022) during June and July (*Figure 1*).

The gas reductions are visible in *Table 1* and *Figure 2*.

1. The boilers were originally enabled at 130°F (54.4°C) outside air temperature, which caused year-round operation. This resulted in significant gas consumption in the summer that required additional cooling for the system to meet space temperature setpoints. The enable sepoint was adjusted to 55°F (12.8°C), a more reasonable enable point.

2. Both boilers also were set to provide 185°F (85°C) water during the coldest outside temperatures, even though the variable air volume (VAV) reheat coils the boilers served were designed to need no more than 140°F (60°C) water. Reducing the temperature reset to a high of 140°F (60°C) will improve the efficiency of the boilers without affecting the performance of the VAVs.

3. HVAC equipment schedules were optimized to match building occupancy more closely. This included the air-handling units (AHUs), exhaust fans (EFs) and chillers.

4. Minimum airflow setpoints were adjusted for VAVs across AHUs 1, 2 and 3 to reduce fan speed while still supplying sufficient air when minimal air is needed. Many VAV minimum flow setpoints were originally higher than design values.

5. Maximum and minimum reheat airflow setpoints were adjusted for VAVs across AHUs 1, 2 and 3 to reduce fan speed while still supplying sufficient air when minimal air is needed. Many VAV minimum flow setpoints were originally higher than design values. Several setpoints matched the maximum setpoint. Adjusting to a minimum flow that still meet Standard 62.1-2010 for fresh air will result in energy

**FIGURE 1** Westwood electric consumption.

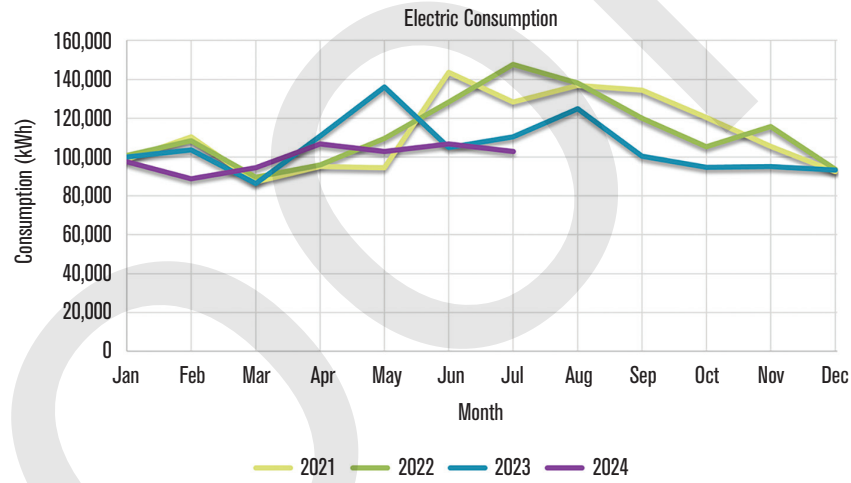
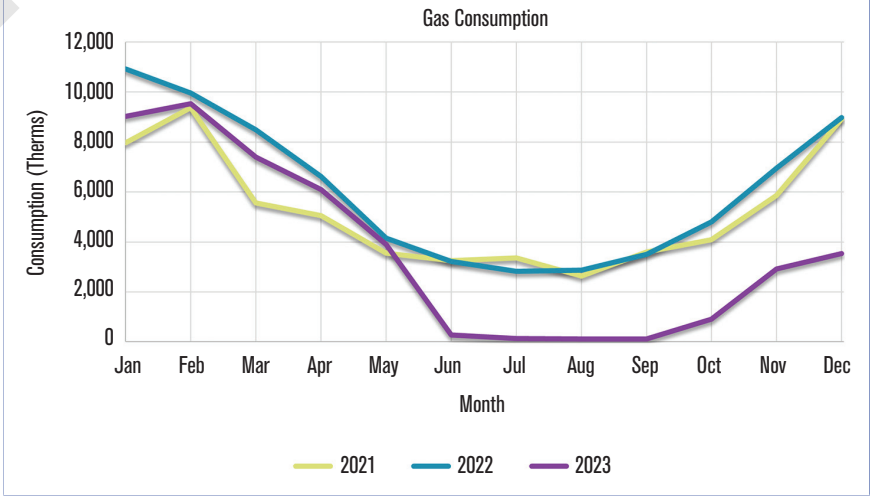



**TABLE 1** Westwood monthly gas usage.

| | JAN | FEB | MAR | APR | MAY | JUNE | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2024 | 5,943 | | | | | | | | | | | |
| 2023 | 9,022 | 9,527 | 7,390 | 6,099 | 3,902 | 270 | 138 | 124 | 119 | 908 | 2,921 | 3,533 |
| 2022 | 10,923 | 9,949 | 8,481 | 6,626 | 4,158 | 3,213 | 2,828 | 3,503 | 3,503 | 4,796 | 6,946 | 8,977 |
| 2021 | 7,968 | 9,365 | 5,565 | 5,059 | 3,551 | 3,243 | 3,353 | 3,596 | 3,596 | 4,093 | 5,854 | 8,909 |

**FIGURE 2** Westwood gas consumption.



efficiency without sacrificing air quality.

6. The chillers are enabled based on outside air enthalpy. The original low enable setpoint was 15 Btu/lb, which resulted in the chillers running in temperatures as cold as 42°F (5.5°C). Increasing the enthalpy enable setpoint would reduce chiller runtime when mechanical cooling is unnecessary.

## INDOOR AIR QUALITY (IAQ), THERMAL COMFORT, AND ASHRAE BUILDING EQ

Inappropriate VAV flow rate setpoints caused several issues ranging from occupant complaints about being too hot or cold to an oft unnoticed consequence of insufficient fresh air for the level of occupancy. Some setpoints were too low, and some were too high. In both cases, occupants complained of temperature issues. In the case of winter over-ventilation, for example, the cooling air upstream sometimes overpowered the heating coil. It wasn't a matter of insufficient heat capacity, only that the VAV heating airflow setpoint was too high.

Carbon dioxide readings were taken following the setpoint adjustments during the ASHRAE Building EQ effort. No readings exceeded 1,000 ppm and the building scored 94, moving it up a whole grade level.

## COST EFFECTIVENESS

The weather-normalized gas savings alone is approximately $41,800 over nine months (June 2023–February 2024). Surprisingly, 47% of the savings occurred in the summer and fall.

**PHOTO 1** Westwood cafe.

WESTWOOD CHURCH

The annual electric consumption and demand in July 2023 were both down 22% with nearly identical cooling degree days.

The study cost was subsidized over 57% by utility rebates. The result was just under a two-month payback.

## INNOVATION

This building is a newer build and is already equipped with high-efficiency equipment like condensing boilers. The Level 2 ASHRAE Audit approach followed ASHRAE procedures and is also not inherently novel or innovative; however, the dive into the building revealed opportunities to update the building automation system to run more efficient programming strategies. For example, the air handlers' supply temperature reset routines used archaic programming and were not based on VAV loads. This contributed to heating and cooling issues throughout the building and negatively impacted the worship area.

## OPERATION AND MAINTENANCE

The building is reaching the age where more maintenance is required. We discovered significant blockages in the condensate line of one boiler, preventing drainage. The HVAC equipment is over 15 years old, and the large 200 ton (703 kW) chiller already needs replacement. As a result of the changes in the summer loads and outcome of the audit, a smaller chiller like the adjacent 150 ton (528 kW) unit may be able to replace the 200 ton (703 kW) unit as the building operated at just 60% of the large unit this past summer.

## ENVIRONMENTAL IMPACT

The heating project strikes a positive environmental note by reducing over 178,600 kg of carbon emitted by burning natural gas at the boilers (5.3 kg/therm). The electric savings were also significant, with a combined June and July reduction of approximately 19,000 kg of carbon from lower electricity use (Minnesota Valley Electric conversion factor estimated at 0.31 kg/kWh).

Additional reductions are anticipated as more projects are implemented, including a chiller replacement. ■