

Heat Loss and Air Filtration

This white paper deals with infiltration of air into buildings and the associated heat loss from this air infiltration. This paper will be directed toward existing church facilities and Christian school buildings. New church plants will not be addressed as new construction technologies and best building practices demand a much higher level of addressing energy and must meet current building and energy codes.

Air leakage through the building envelope into the building interior has a significant impact on the energy loads and energy demands which directly affect the energy cost of buildings. This infiltration is mostly unwanted and happens through various openings in the church or Christian education building. These may be large openings such as doors and windows to very small cracks and apertures. These issues again affect the energy use and energy cost of maintaining facilities, but infiltration also affects building comfort and indoor air quality, which can have long term effects on human performance, and the health and welfare of the building occupants.

Energy loss from buildings also occurs from radiation and conduction. Although this paper will not specifically address heat loss due to radiation and conduction, it is important in the full analysis of an existing buildings energy performance to do so. Radiation and conduction are a bit more complex and involves a temperature difference, information about the building geometry, and the characteristics of the building materials.

Basics of Air Leakage or Air Infiltration

Air leakage, sometimes called air infiltration, is again the unintentional or accidental introduction of outside air into a building. These are commonly through cracks in the building envelope and through the doors for passage. In the summer, infiltration can bring humid outdoor air into the building. Whenever there is infiltration there is corresponding exfiltration elsewhere in the building. In the winter, this can result in warm, moist indoor air moving into cold envelope cavities. In either case, condensation can occur in the structure, resulting in mold or rot. Infiltration is caused by wind, what is known as the stack effect, and mechanical equipment in the building.

Wind creates a positive pressure on the windward face and a negative pressure on the non-windward facing walls. This pulls the air out of the building. Wind thus causes infiltration on one side of a building and exfiltration on the other. Wind effects can vary by surrounding terrain, shrubs, and trees.

Controlling air leakage has many advantages. They include:

1. Have lower heating bills due to less heat loss.
2. Have fewer drafts and be more comfortable.
3. Reduce the chance of mold and rot because moisture is less likely to enter and become trapped in cavities.
4. Have a better performing ventilation system.
5. Potentially require smaller heating and cooling equipment capacities.

Creating a plan for your existing church or school to reduce air infiltration and create a healthier and energy efficient facility.

Attacking air infiltration can certainly be done independently, however, a more prudent and holistic approach is to gain a full picture of how your church or school is performing. This can be achieved through an **energy audit**. An energy audit is a thorough accounting of the energy use of a building. Because all buildings are unique, energy audits help to identify and prioritize specific areas for efficiency improvement. The audit may provide projected cost for doing the work. These audits can generally be provided by your local energy providers, such as City and Rural electric and gas providers, or independent providers such as Excel Energy.

The typical elements of an energy audit are:

1. Blower Door Test.
2. Infrared Scans. These show air leakage and thermal defects of your church or school building.
3. Safety Check. These ensure proper venting of combustibles and CO₂.

Reducing air infiltration is often the first action item of a weatherization plan once the audit has been completed. Caulking cracks, sealing around miscellaneous penetrations, and adding weather stripping are simple low-cost improvements that can reduce air infiltration. Typical places to check for air infiltration include:

- Electric outlets and switches, ceiling fixtures
- Operable features of windows and doors, checking for loose fit, etc.
- Window and door frames where they meet the wall
- Baseboards
- Fireplace dampers

- Attic hatches
- Chimney flashing and flues
- Wall or window-mounted air conditioners
- Plumbing, electrical, cable, and telephone penetrations
- Ducts in unconditioned spaces

These items and probably more will be recommended in your energy audit. Again, these recommendations are mostly low cost and relatively easy things to do. The energy benefit can be quite substantial.

Contact LCEF to find an Architectural Advisory Committee member near you for additional information.



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