ENERGY EFFICIENCY FIRST

RESOLVING ENERGY LOSSES BEFORE TRANSITIONING TO ELECTRIC HEATING EQUIPMENT

Before considering any major electrification projects such as heat pumps, it's important to explore energy-efficiency measures that focus on resolving energy losses in the building.

A more energy-efficient building allows for smaller, less expensive HVAC systems. This can help minimize the need to upgrade to a higher electrical service capacity to support the electrification of HVAC systems. Let's take a closer look at each energy-efficiency measure.

Top strategies to minimize energy loss and increase overall building and HVAC efficiency include:

1. **Improving the building envelope by adding insulation and sealing air leaks.**
2. **Introducing automation and control systems for optimal operation.**
3. **Installing energy recovery systems to reclaim energy that is otherwise exhausted.**

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SAVE ON ENERGY POWER WHAT'S NEXT

INSULATION

Insulation plays a critical role in maintaining a consistent indoor temperature by slowing the rate of heat transfer between the outside and the inside of a building. The effectiveness of insulation is measured by its R-value. The higher the R-value, the better the insulation. For existing buildings, insulation can be improved in different ways:

- **Over-cladding** – adding a layer of insulation to exterior walls.
- **Attic and roof insulation** – in smaller buildings, up to 35 percent of heat loss can occur through the roof. Adding insulation here can be a very cost-effective strategy.
- **Basement insulation** – insulating below-grade areas can prevent further heat loss and improve overall efficiency.

AIR SEALING

Air leakage can represent up to 15% to 30% of the thermal load in a high-rise commercial building.[1] Leaks significantly increase heating and cooling loads, waste energy and reduce indoor comfort.

Solutions for enhancing airtightness in existing buildings include:

1. Applying caulking around joints and windows.
2. Replacing weatherstripping on doors.
3. Conducting an energy audit with a blower door test to identify air leaks.

Find more information on comprehensive air leakage control and retrofits in existing buildings from Natural Resources Canada.

[1] Practical guidelines for designers, contractors, and developers on the installation of air leakage control measures in new and existing high-rise commercial buildings

WINDOW UPGRADES AND SOLAR SHADING

Upgrading old, leaky windows to double- or triple-pane high-efficiency windows can drastically reduce heat transfer. These windows have insulated frames and gases between the panes for low thermal conductivity and air sealing benefits. Despite a significant upfront cost, the long-term benefits of improved occupant comfort and lower heating loads can make window upgrades a smart investment.

Simple strategies like solar shading can significantly reduce heating and cooling loads by either blocking or allowing sunlight during the summer and winter seasons.

CONTROLS AND AUTOMATION

Integrating smart controls and building automation systems can greatly improve the building's energy efficiency and performance as follows:

- Automatically adjusting temperature settings based on schedules or occupancy sensing, reducing unnecessary energy use.
- Reducing fresh air intake to minimum requirements for each space type using dampers and controls.
- Allowing for zone control, enabling different areas of a building to be heated or cooled independently.
- By providing energy tracking and insights, controls help users understand their energy consumption patterns.

REGULAR PREVENTATIVE HVAC MAINTENANCE

Regular HVAC maintenance is essential to maintaining equipment efficiency. Preventative maintenance helps to:

- **Improve efficiency:** Clean, well-maintained systems operate more efficiently and consume less energy.
- **Prolong equipment lifespan:** Regular checks can identify potential issues before they become serious, extending the life of equipment and avoiding costly emergency repairs or quick replacement purchases that overlook energy efficiency.
- **Improve air quality:** Clean filters and ductwork ensure that indoor air quality remains high, which is beneficial for occupant health.

HEAT RECOVERY: HRVS AND ERVS

UNITS	PURPOSE
HRV (HEAT RECOVERY VENTILATORS)	Recover heat energy from exhaust air and precondition incoming fresh air.
ERV (ENERGY RECOVERY VENTILATORS)	Recover both heat and moisture from exhaust air and precondition fresh air.

Both types of recovery ventilators can also function in reverse, extracting heat and moisture out of the incoming air and transferring it to the outgoing air stream. Overall, use of this equipment reduces heating loads in buildings, allowing for a more energy-efficient HVAC system.

PRIORITIZING ENERGY EFFICIENCY

First, prioritize eliminating energy waste through no-cost operational changes. This includes opportunities such as updating setpoint temperatures for unoccupied periods, reducing fresh air intake in ventilation systems and taking advantage of opportunities for solar shading.

Next, explore lower-cost opportunities to optimize efficiency, including more advanced control systems, maintaining existing HVAC equipment and reducing air leakage in the building envelope. Last, explore the feasibility of improvements to the thermal envelope and opportunities for heat recovery. Work with experts as necessary.

MEASURE	COST RANGE	IMPACT ON HEATING AND COOLING LOAD REDUCTION	OPERATIONAL OR TECHNOLOGICAL
AIR SEALING	Low	Low to medium	Operational
SOLAR SHADING	Low	Low	Operational
SOLAR SHADING	Low	Low	Operational
INSULATION	Medium to high	Medium to high	Technological
HEAT/ENERGY RECOVERY VENTILATORS	Medium	Medium to high	Technological
WINDOW UPGRADES	High	Low to medium	Technological

Values presented are estimations only. A high level of variability in both cost and impact exists, depending upon building type, age, location, envelope condition, existing equipment and layouts, and new materials and technologies. It is recommended to conduct energy audits at your facility to assess the feasibility of capital projects.

THE RESULT: RIGHT-SIZING EQUIPMENT

Selecting the correct size HVAC system is critical to ensuring building energy efficiency. An improperly sized system—whether too large or too small—can lead to issues:

- Undersized systems struggle to meet the building's heating and cooling demands, which can lead to higher energy consumption as the system works harder.
- Oversized systems often cycle on and off more frequently, which can lead to increased wear and tear, higher maintenance costs and inefficient operation.

After completing energy-efficiency improvements, building owners can move on to considering high-efficiency upgrades such as heat pumps. Heat pumps can provide significant, long-term energy reduction and environmental benefits.

To ensure heat pumps are properly sized, it's essential to have a professional perform accurate load calculations before installation. These calculations should consider building size and layout, insulation levels, airtightness, window performance and occupancy patterns.

CONCLUSION

Implementing some or all of the energy-efficiency opportunities in this guide will help building owners significantly reduce heating and cooling loads, optimize HVAC performance and right-size their systems.

By prioritizing energy efficiency and minimizing losses, building owners can successfully transition to efficient, electrified systems and better align with Canada's net-zero goals for 2050.