ENSPIRE

SESSION 4

Deeper Retrofits Through Building Envelope Upgrades

This webinar explored building envelope theory, focusing on energy efficiency, diagnostic tools and technologies, as well as practical solutions and strategic investment opportunities to enhance building envelopes while reducing energy use and costs. It covered topics like the basics of heat transfer, R-value (effective & nominal), air tightness, thermal bridging, building envelope diagnostics, and more.

Presenters debunked the myth that adding more insulation alone is enough to improve the building envelope, emphasizing that real improvements come from looking at the entire envelope system. Tools were introduced such as RETScreen Expert for envelope modeling and thermal imaging for identifying hidden issues. The session concluded with implementation considerations including embodied carbon, the importance of future-proofing building envelopes for a changing climate, and more.

Building Envelopes & Why A Good One Matters

The building envelope is the physical barrier that separates a building's interior from the external environment. Simply put, the purpose of the building envelope is to keep the outside out, and the inside in. It plays a critical role in energy efficiency, occupant comfort, structural integrity, and climate resilience, and can be considered as both the first and last line of defense in achieving deep energy savings and emissions reductions. Responsible for up to 40% of a building's heating and cooling energy losses or gains, the envelope acts like a building's "clothing", regulating temperature, moisture, and air flow. Improving the thermal-resistance layer of a building envelope by increasing the R-value is only one aspect of improving envelope performance. Additionally, the weather barrier, the vapor barrier, and air tightness all need to be considered in unison as a complete envelope system in order to achieve maximum performance.

The Benefits of a Good Building Envelope

- Minimize thermal losses and gains, reducing overall energy consumption and improving operational performance
- Reduced greenhouse gas emissions associated with building heating, providing an effective path to decarbonization
- Enhance indoor air quality and occupant comfort due to improved insulation, ventilation, and moisture control
- Improved structural reliability of building due to effective moisture control
- Enable alignment with building performance standards and compliance with regulatory frameworks, e.g., BC Energy Step Code
- Provide long-term financial returns on investment due to enhanced durability, reduced maintenance, and increased asset value
- Lower utility costs due to the building's thermal efficiency and reduced reliance on mechanical systems

Building Envelope Tools

Thermal Imaging

Infrared cameras are a useful, low-cost diagnostic tool for identifying thermal bridges and envelope deficiencies. Thermal images use variable temperature scales, where warmer surface areas typically appear yellow and cooler areas appear purple, highlighting areas of heat transfer across the building envelope.

RETScreen Expert

RETScreen Expert is an effective and intelligent decision-making support tool developed by the Government of Canada to rapidly identify, assess, optimize, and monitor the performance of projects over their entire lifecycle. The online tool has a virtual energy analyzer and a building envelope calculator. It enables energy and financial analysis of building envelope projects, performance tracking post-implementation, facility and building benchmarking, and portfolio management across multiple buildings. New users can link their accounts to Energy Star Portfolio Manager (ESPM) for streamlined data integration.

Areas of Opportunity – Practical Wins & Strategic Investments

Adding weather stripping, vestibules to entranceways, insulation to roofing, and films to windows are all practical ways to enhance the building envelope. Long-term, capital investments can involve introducing exterior cladding to the envelope to help reduce heat loss even further. Strategic investments might also include alternative roofing, such as cool-roof installations or coatings and green roof systems - both which help to reduce heat absorption into the building during the summer and lower roof surface temperatures.

Implementation Considerations

Embodied Carbon

Embodied carbon is the total greenhouse gas emissions associated with the lifecycle of a building's materials, including extraction, manufacturing, transportation, installation, maintenance, and disposal. Compared to operational emissions, embodied carbon is a frequently overlooked, yet significant source of emissions from a building. NRCan's Material Carbon Emissions Estimator (MCE2) Tool is a resource that can be used for assessing embodied carbon from building materials and components.

Climate Resilience

As climate change leads to more extreme conditions, designing and upgrading building envelopes for long-term resilience is essential for sustainable, future-ready building.

Impact on HVAC Systems

Air tightness directly influences how much outside air enters a building unintentionally (infiltration) and therefore affects how controlled and effective the mechanical ventilation system is. When exterior cladding is upgraded with better insulation and airtightness, it reduces the overall demand on the HVAC system to maintain comfort and pressure.

Alignment with Asset Renewal

Facility Condition Assessments (FCA) will typically inform you of the state of your building envelope and recommendations for replacement or repair. Use this information to align any major capital upgrades and plan strategic envelope upgrades around asset renewal timelines.

Access Resources and the session tool kit here:

Access the Session recording here:

September 10, 2025 Presented by

Sam Thomas, Principle & Team Lead – Strategic Energy Management, Prism Engineering Limited
Stephen Dixon, Energy Consultant & President, TdS Dixon Inc./Knowenergy

ENSPiRE
A BOMA Initiative

Funded by Natural Resources Canada's Deep Retrofit Accelerator Initiative | Canada | BOMA Canada