Title: **Evaluating the thermal-optical trade-off of enclosed-aperture solar thermal collectors**

Solar thermal collectors operating in cold climates must withstand snow, wind, and extremely cold ambient air temperatures. Placing a parabolic trough collector inside a transparent enclosure may improve resilience, but introduces a fundamental trade-off. The enclosure creates a warmer, microclimate that suppresses heat loss, while its transparent envelope and structural frame reduce the solar radiation reaching the collector through transmission losses and shading.

This seminar explores how these competing thermal and optical effects can be measured, modelled, and incorporated into collector performance evaluations. The research centres on a pilot-scale enclosed parabolic trough collector operating in Ottawa. Field measurements show that passive solar gains can elevate enclosure air temperatures substantially above outdoor conditions during cold, sunny periods. Preliminary simulations suggest that this temperature increase may compensate for part of the optical penalty. However, predicting the net benefit requires separating optical attenuation, natural convection, longwave radiation, thermal storage, and air leakage.

A combined methodology using ray tracing, controlled heat-loss experiments, infrared thermography, heat-flux measurements, and computational fluid dynamics is proposed. The resulting physics-based relationships will support annual simulations and establish when enclosed-aperture collectors improve net thermal yield in cold climates.

Speaker Bio:

Dylan Bardy is a research engineer at CanmetENERGY-Ottawa and a part-time PhD candidate under the supervision of Professor Cynthia Cruickshank. He holds both B.Eng. and M.A.Sc. degrees from Carleton University. Dylan's research at Canmet involves testing innovative renewable energy technologies for resilient operation in cold climates. His work aims to reduce fossil fuel consumption for heat and power in northern and remote communities in Canada.