

Speaker Bio:

Remi Penarreta is pursuing a Ph.D. in the Department of Mechanical and Aerospace Engineering at Carleton University, where his research focuses on developing next-generation capacity expansion planning models for low-carbon energy systems. Specifically, he is developing and validating methods that improve the representation of thermal and other energy technologies in these models, and his case study involves optimizing the future pan-Canadian electricity system. Remi is applying his extensive industrial experience to these power system planning models: he has two decades of field experience in large-scale power generation—from project development to operations and maintenance. He is an electrical engineer with an M.Sc. in Electrical Engineering from Odesa Polytechnic University in Ukraine. He also holds a master's degree in Technology Management from Universidad San Francisco in Ecuador, as well as diplomas in advanced management, finance, and logistics.

Abstract

Canada faces a geopolitical moment that is both precarious and auspicious. Seizing the benefits of this moment requires large investments in critical infrastructure projects, including the electricity system, which must double in size (at least) to address multiple growing challenges. The first is increasing electricity demand, including through electrification of space heating and personal transportation—two large services that currently depend on fossil fuels. A second is the climate emergency, which requires low-carbon generation and transmission. Third is affordability and reliability, which are placing pressure on capital investment plans. Fourth is aging infrastructure and the need to replace assets that were built decades ago. Fifth and finally is resilience in the face of growing physical and cyber risk.

This doctoral thesis research is providing relevant enhancements to power system planning models; the backbone of these efforts is the Pan-Canadian Electricity System model (PaCES), which achieves several methodological advances that have challenged previous models, including the need for high temporal resolution; accurate demand profiles; and technically correct representation of thermal generators—something that existing models mischaracterize. The model is being applied to timely, policy-relevant questions, including the cost and technical performance of a truly pan-Canadian electricity grid that would replace or augment today's poorly integrated, provincially delineated system. The model enables more accurate modelling and quantification of the cost of such power system integration and identifies the effect of policy and politics on total system costs: policymakers can adjust these policies or challenge these politics, as the current government is doing, to deploy better technical solutions. This research also advances stochastic programming in power system planning by integrating cost and scheduling uncertainties into long-duration power system planning models.

