

Electricity system modelling for Canada's net zero future with PyPSA

The Canada Energy Regulator (CER) recently published long term net zero scenarios for Canada's energy infrastructure in its report *Canada's Energy Future 2023: Energy Supply and Demand Projections to 2050*. The electricity projections in the model were created using a CER-developed model based on an electric power system planning and simulation model called Python for Power System Analysis (PyPSA).

PyPSA is an open source toolbox for simulating and optimising modern power and energy systems that include features such as conventional generators and links with unit commitment, variable wind and solar generation, storage units, coupling to other energy sectors, and mixed alternating and direct current networks.

The CER model simulates how the future electricity demand of the different Canadian economic sectors is satisfied by a combination of electricity-generating units and delivery systems. It models electricity-generating and storage units (including their technical and economic attributes), electricity transmission infrastructure, energy resource availability, electricity demand, and applicable regulations. The model simulates the operation of electric power systems at hourly intervals.

Proposal :

The student will:

- 1) Produce a summary of the history and capabilities of the PyPSA modelling toolkit and describe its use by electricity system modellers around the world
- 2) Install the software and re-produce basic examples from the User Guide, accompanied by an explanation of the underlying theory represented by each of the introductory examples
- 3) Replicate the results from the CER for a province of the student's choice
- 4) Model an additional scenario not contemplated in the CER report (*bonus*).

References :

<https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2023/index.html>

<https://pypsa.readthedocs.io/en/latest/index.html>

Supervision :

Geoff Wright (geoff.wright@brookfieldrenewable.com)
SVP, Head of Development