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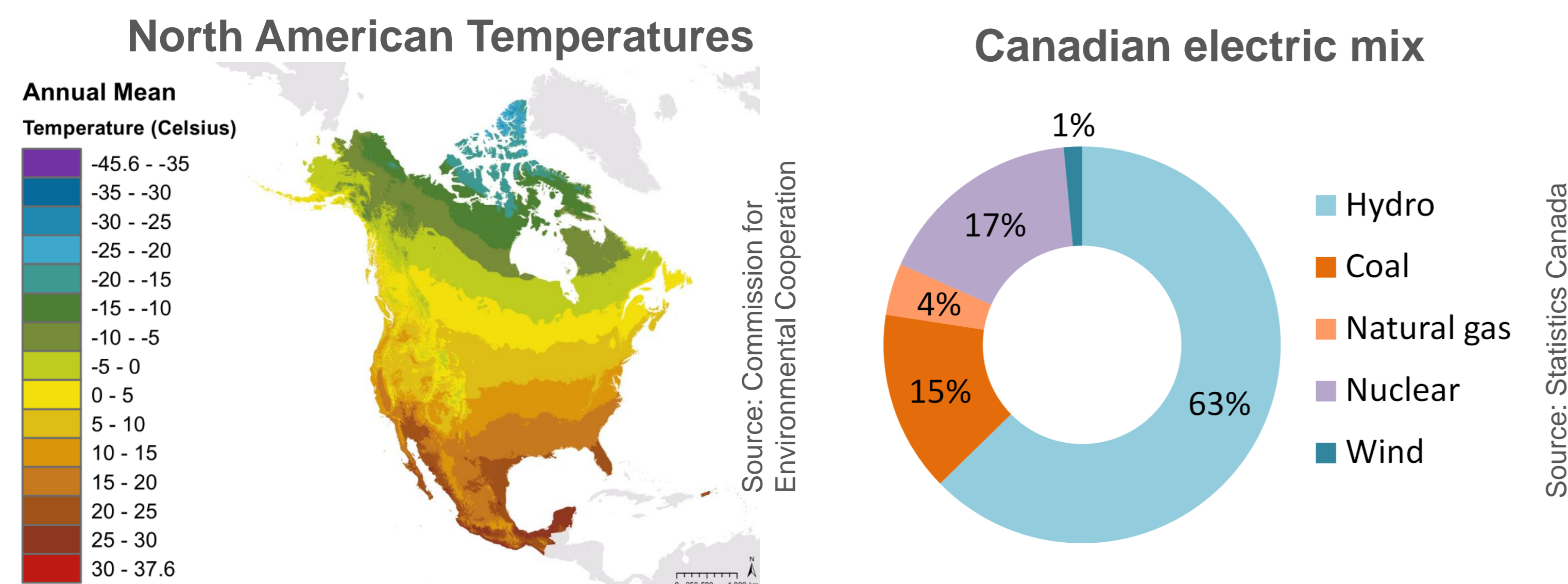
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1. CONTEXT

The need for data processing is growing rapidly and is not expected to slow down in the future. More data centres are needed to process the increasing amount of data.

Among ICT infrastructures, data centres are known to be very energy intensive and to use about one third of the electricity consumed by the whole ICT sector.

The environmental footprint of data centre is strongly linked to electricity generation. Data centre footprint can be reduced by implementing energy efficiency measures and powering equipment with renewable energy sources.



Canada is an attracting country for data centre investors:

- Great free-cooling opportunities thanks to the cold climate,
- Large share of renewable and low carbon electricity,
- Cheap electricity price

Canada is expected to host more data centres in the future

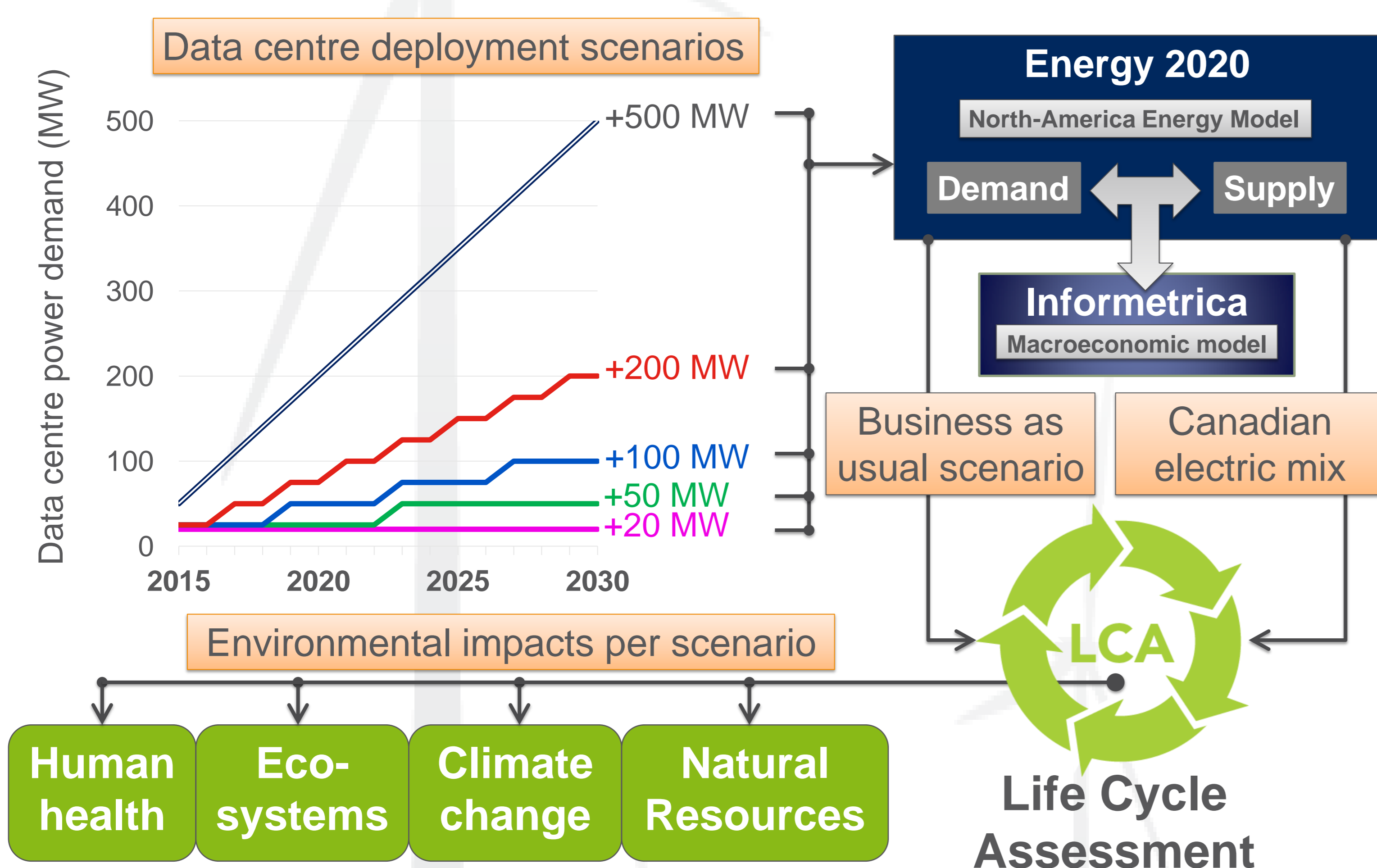
2. OBJECTIVE AND METHOD

Objective:

- Develop a methodological framework to evaluate environmental impacts caused by a large data centre deployment in Canada
- Identify the most efficient scenario of data centre deployment

Method:

- Define data centre deployment prospective scenarios
- Combine the partial equilibrium techno-economic model Energy2020 with the life cycle assessment methodology to evaluate the scenarios



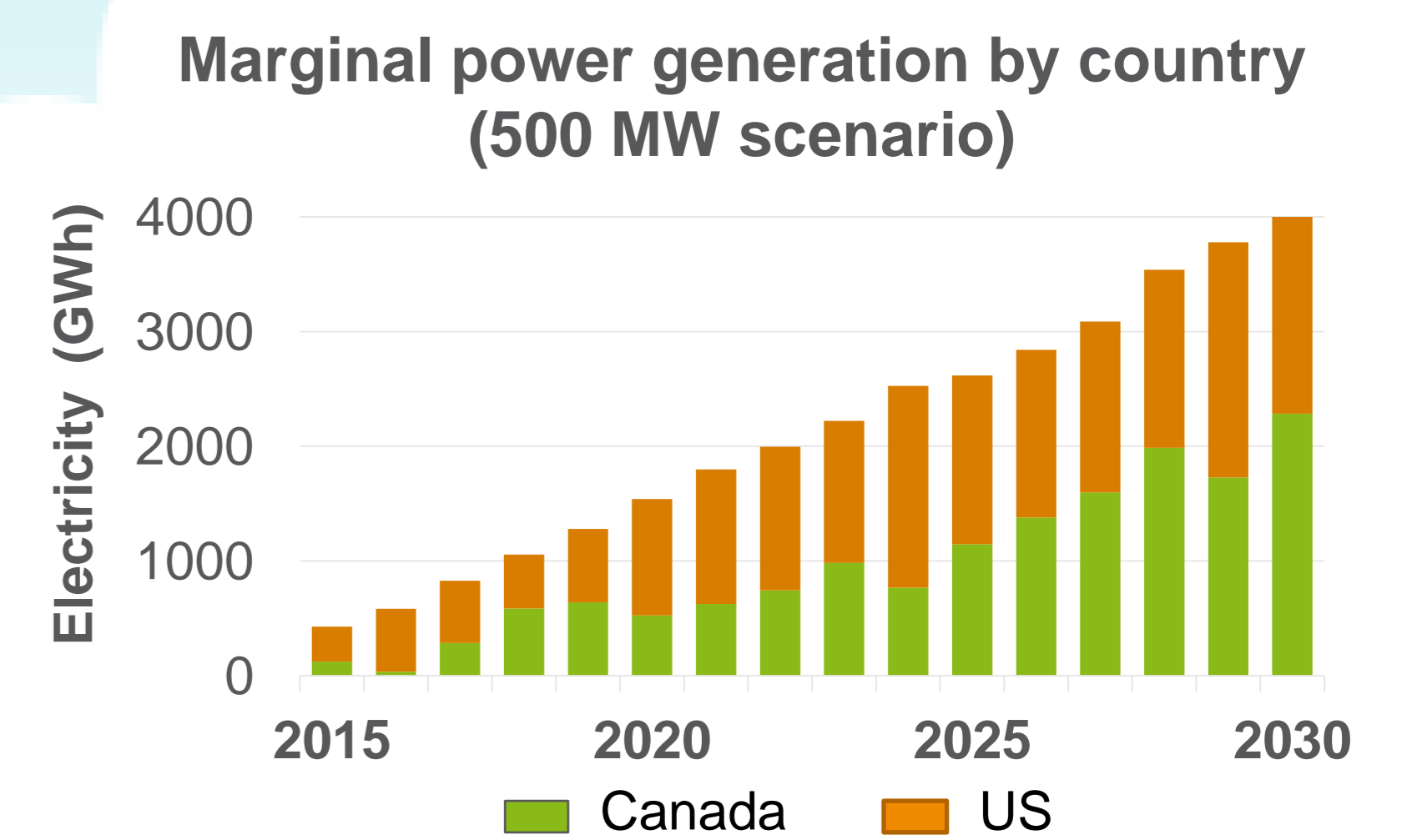
4. FUTURE WORKS

- Evaluate uncertainty of the Energy2020-LCA model.
- Include electricity consumption by ICT users and network.
- Model ICT services substitutions in other economic sectors.

3. RESULTS

Impacts on Canadian electricity exports

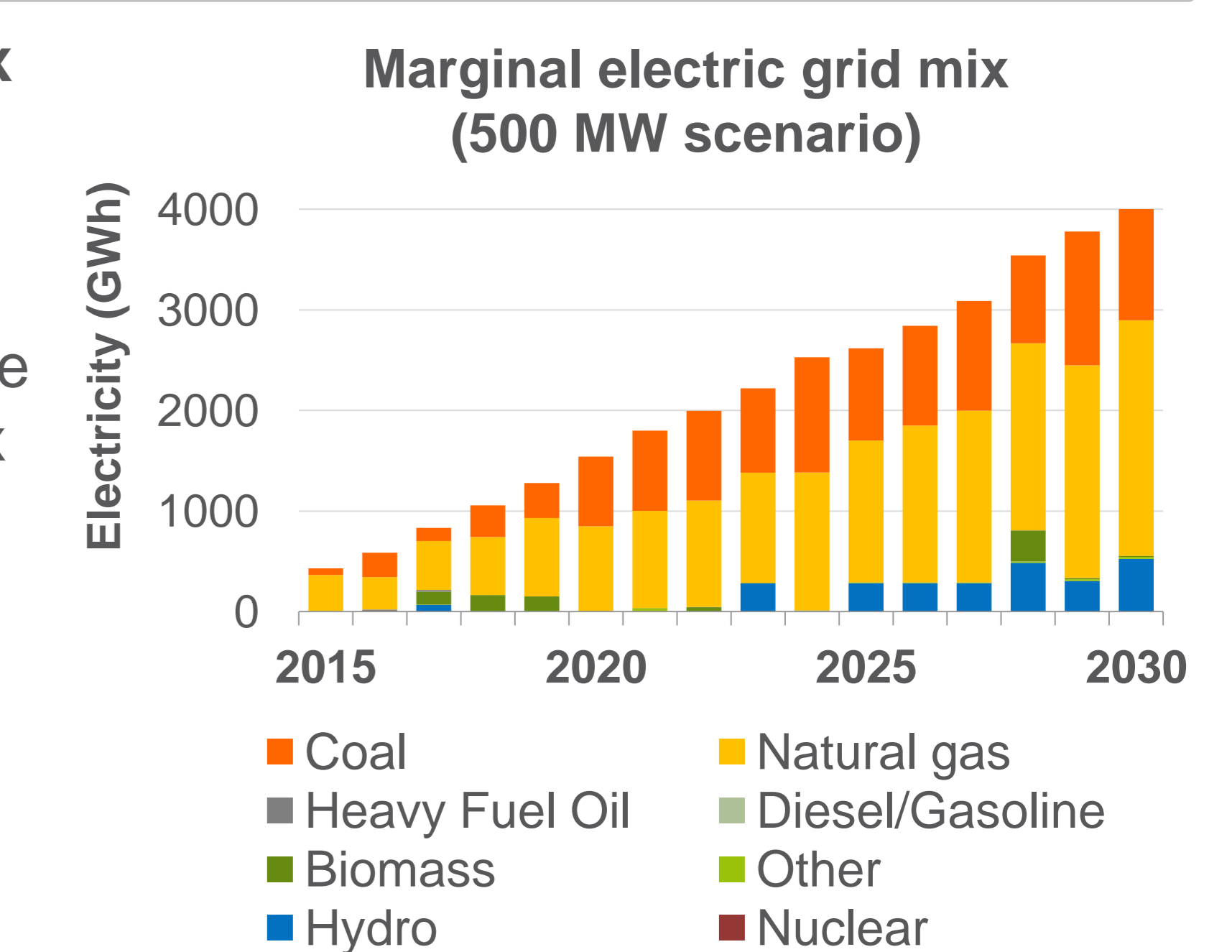
It is anticipated by Energy2020 that an increase in the Canadian data centres power demand will result in a decrease in the electricity exports from Canada to US. Consequently, US are anticipated to produce more electricity using their power plants.



The marginal power generation is obtained by comparing the North-American power generation for each data centre deployment scenario against the business as usual scenario.

Future marginal electric grid mix

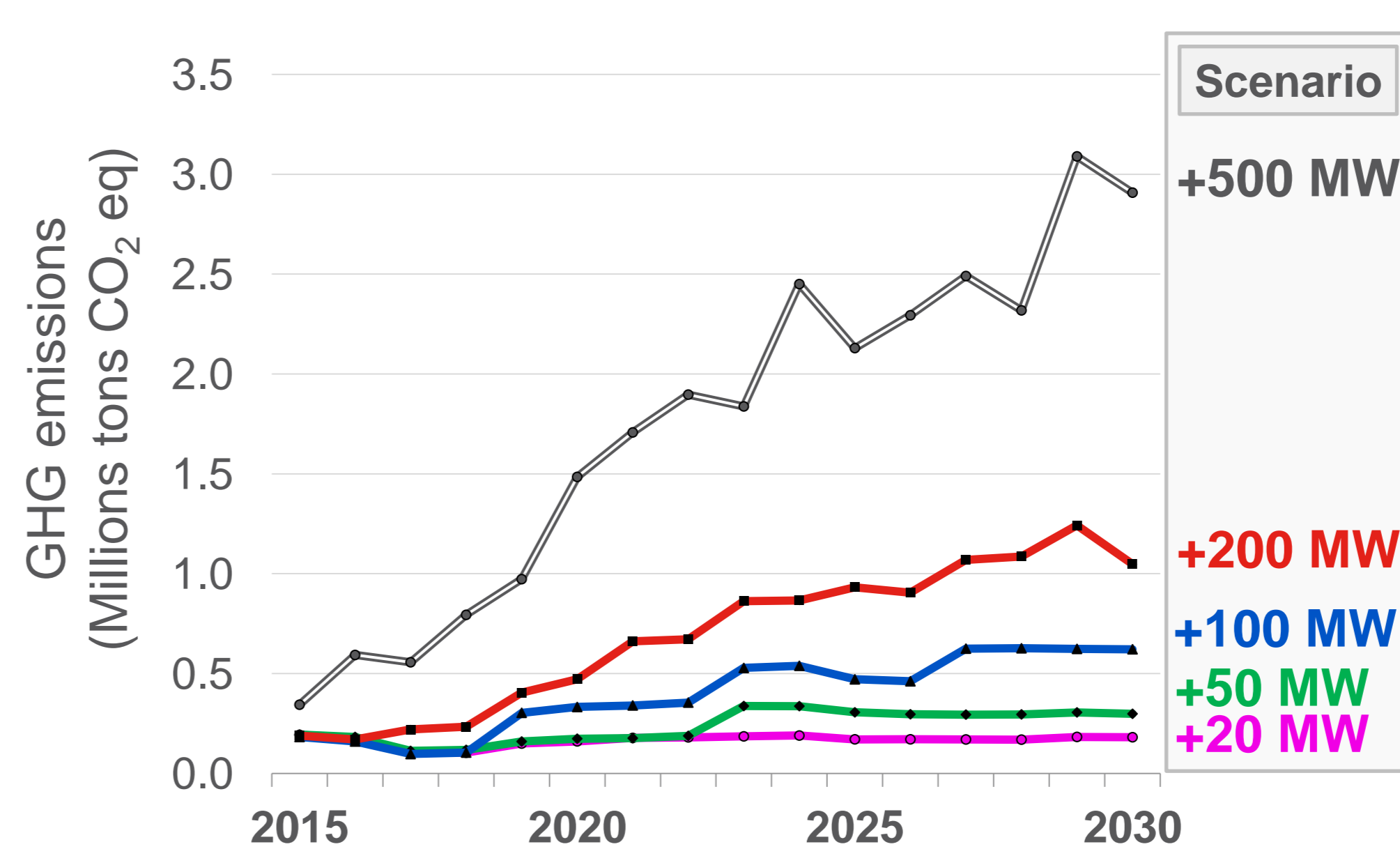
Both US and Canadian electricity generation is considered in the life cycle assessment of data centre deployment to take into account the changes in the US electric grid mix caused by the reduction of Canadian electricity exports.



Future marginal technologies

Coal and natural gas are the two main marginal sources of energy identified by Energy2020.

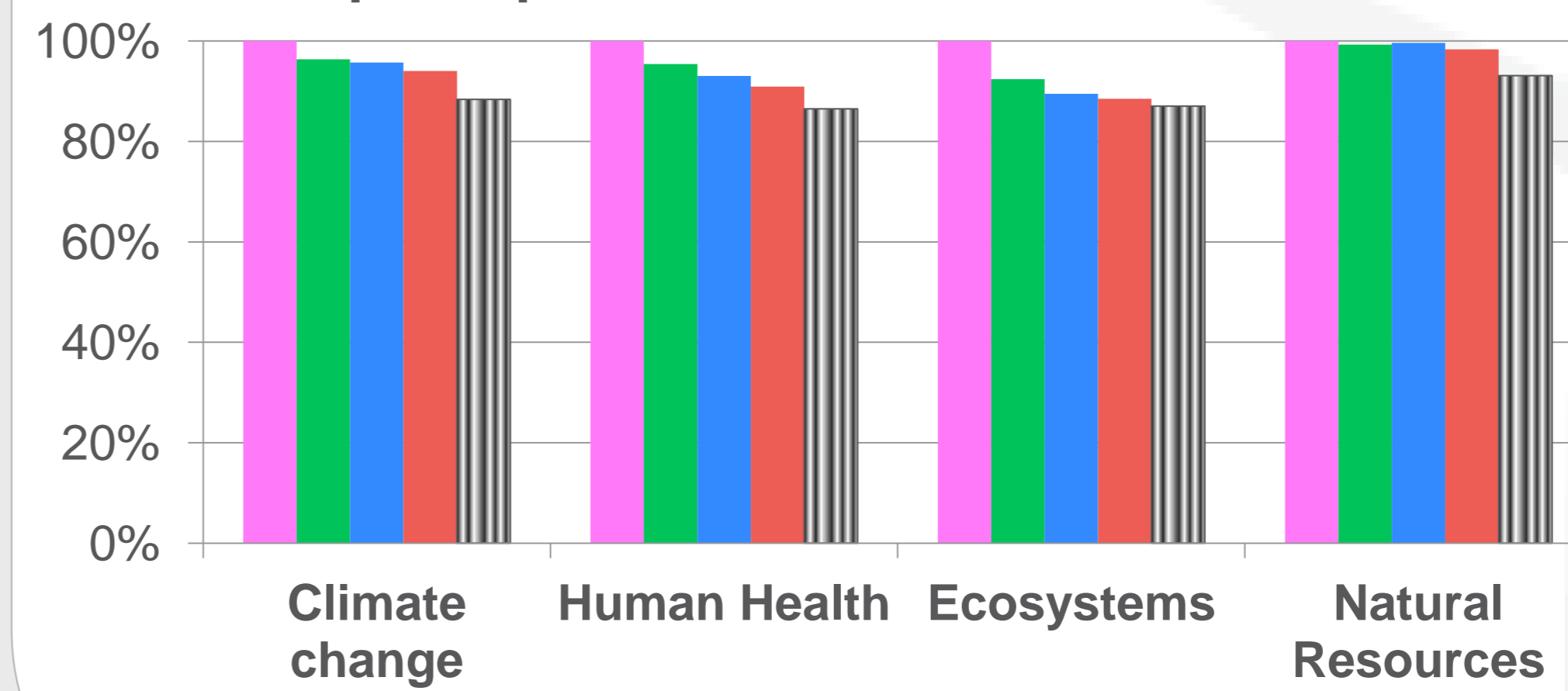
Marginal greenhouse gas emissions (US+Canada)



Scenario comparison

Marginal GHG emissions and other impacts on the environment are greater in the +500 MW scenario because more electricity is consumed by data centres in that scenario. It should be noted that data centres may provide ICT services enabling GHG reduction in other economic sectors.

Impacts per MW of installed data centres



Impacts normalization

The +500MW scenario is the less harmful for the environment when environmental impacts are normalized by MW of installed data centres.

5. CONCLUSION

A new **methodological framework** has been developed to enable studying large scale ICT deployments in Canada.

Future marginal sources of electricity in North America are expected to pollute more than the current Canadian electric grid mix due to US-Canada interconnections.

In this study, the largest data centre deployment scenario leads to more impacts on the environment but is also the most environmentally efficient.

Indirect ICT effects should also be taken into account. (GHG emissions avoided, rebound effect)

