

### **A Comparison of U.S. and Canadian Industry Environmental Performance Using Economic Input-Output Life Cycle Assessment Models**

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The U.S. and Canadian economies are intrinsically linked. While the Canadian economy is approximately one-tenth of the size of that of the U.S., the two countries are each others' largest trading partner. Production methods and environmental concerns in the two countries are similar, and many businesses are actively engaged in cross-border trade. However, there are many differences in the countries, including environmental regulatory systems. Comparing the environmental performance of industrial sectors in the two countries is of significant interest from economic, technical and public policy perspectives. However, comparisons are difficult due to many factors and have been limited in practice. Important in any comparison is a 'life-cycle' approach, where the economy-wide implications of production by the industrial sectors are included. Additionally of key importance is the analysts' understanding of the limitations of the comparison. We discuss this issue in detail in this work.

Economic input-output life-cycle assessment (EIO-LCA) models for the U.S. have been developed by the Green Design Initiative at Carnegie Mellon University. We have developed a similar model for Canada. These models allow the inclusion of the economy-wide economic and environmental impacts resulting from demand for products/services from sectors of the economy. An important consideration in life-cycle assessment is the inclusion of the set of indirect effects that do not lie along the main industrial supply chain. EIO-LCA models allow these indirect effects to be considered, which can enhance our understanding of the 'true' benefits and disadvantages of product production and associated environmental programs and policies. Our model estimates the increases in National Pollutant Release Inventory (NPRI) contaminant releases, greenhouse gas emissions, energy and non-renewable resource extraction and use that can be expected from increases in demands for goods or services in Canada.

In this work, we present an EIO-LCA model for the Canadian economy and determine the sectors of the economy which have the largest impacts on the environment with respect to energy and non-renewable resource use, greenhouse gas and pollutant emissions. In addition, we compare a number of key sectors in the Canadian economy with corresponding sectors in the U.S. economy with respect to the above environmental metrics. Finally, we investigate the sources of differences in the results (i.e., differences in the structure of the economies, the environmental performance of the sectors, differing regulations, technologies, etc.). Future research using the Canadian and U.S. models will attempt to address the economic and environmental linkages between the two countries.