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REQUEST FOR INFORMATION

TO MODERNIZE THE INTEGRATED ENERGY, EMISSIONS AND ECONOMY SIMULATION MODEL FOR CANADA

FOR ENVIRONMENT CANADA

TABLE OF CONTENTS

A. 1 Background and Purpose of this Request for Information (RFI)	2
A. 2 Nature of Request for Information	3
A. 3 Nature and Format of Responses Requested	3
A. 4 Response Costs	3
A. 5 Treatment of Responses	3
A. 6 Contents of this RFI	3
A. 7 Question to Industry	4
A. 8 Volumetric Data	4
A. 9 Format of Responses	4
A. 10 Enquiries	4
A. 11 Submission of Responses	5

Annex A: Statement of Work

Annex B: Format of Response

REQUEST FOR INFORMATION

TO MODERNIZE THE INTEGRATED ENERGY, EMISSIONS AND ECONOMY SIMULATION MODEL FOR CANADA

FOR

ENVIRONMENT CANADA

A. 1 Background and Purpose of this Request for Information (RFI)

The intent of this Request for Information (RFI) is to solicit feedback from industry on all aspects detailed in the draft Statement of Work (SOW) - Annex A.

Overview

The Government of Canada has a requirement to modernize the integrated energy, emissions economy simulation model. This modernization focuses on several key elements:

- a) Acquisition of a 10-province and 3-territory Canadian dynamic macroeconomic model with foreign/regional linkages and that is fully aligned with Statistics Canada's Canadian National System of Accounts -2012.
- b) Full and dynamic integration of the new macroeconomic model (10-province and 3-territory) to create a new Canadian ENERGY 2020-macroeconomic model (E3MC).
- c) Acquisition of a US open economy dynamic macroeconomic model with an appropriate level of regional disaggregation that can be fully integrated with the US Energy 2020 model to create a US ENERGY 2020-macroeconomic model (E3US). Full and dynamic integration of the E3MC to E3US to create a North American integrated energy, emissions and economy model (i.e., a US Canadian ENERGY 2020-macroeconomic model).

As such, this requirement would involve the acquisition of a Canadian and US dynamic macroeconomic model which then would be linked the ENERGY 2020 (Environment Canada's in-house energy model) to create an integrated energy, emissions and economy model that could be run in various regional levels (i.e., as North American model, as a Canada or US model or as stand-alone provincial/territorial or US regional/state model).

The objective of this Letter of Interest (LOI) is to:

- a) Advise industry of this potential forthcoming requirement and provide industry with general information on the requirements of this modernization project.
- b) Provide industry with a preliminary set of high level specifications, deliverables, schedule, and project scope information.

c) Enable Environment Canada to engage industry and obtain information regarding existing, in-service, Canadian and US macroeconomic models, including detailed, indicative, non-binding cost information for project planning purposes.

A. 2 Nature of Request for Information

The material in this RFI package is for the solicitation of feedback only. Responding to this RFI is not a prerequisite to receiving any resulting Request for Proposal to modernize the integrated energy, emissions and economy simulation model for Canada. The industry is encouraged to indicate their level of interest by responding to the questions, in order to facilitate a better understanding of requirements and capabilities from both Environment Canada and industry perspectives.

This is not a bid solicitation. This RFI will not result in the award of any contract. As a result, potential suppliers of any goods or services described in this RFI should not reserve stock or facilities, nor allocate resources, as a result of any information contained in this RFI. Nor will this RFI result in the creation of any source list. Therefore, whether or not any potential supplier responds to this RFI will not preclude that supplier from participating in any future procurement. Also, the procurement of any of the goods and services described in this RFI will not necessarily follow this RFI. This RFI is simply intended to solicit feedback from industry with respect to the matters described in this RFI.

A. 3 Nature and Format of Responses Requested

Respondents are requested to provide their comments, concerns and, where applicable, alternative recommendations regarding how the requirements or objectives described in this RFI could be satisfied. Respondents are also invited to provide comments regarding the content, format and/or organization of any draft documents included in this RFI. Respondents should explain any assumptions they make in their responses.

A. 4 Response Costs

Canada will not reimburse any respondent for expenses incurred in responding to this RFI.

A. 5 Treatment of Responses

- (a) **Use of Responses:** Responses will not be formally evaluated. However, the responses received may be used by Canada to develop or modify procurement strategies or any draft documents contained in this RFI. Canada will review all responses received by the RFI closing date. Canada may, in its discretion, review responses received after the RFI closing date.
- (b) **Review Team:** A review team composed of representatives of the client (where applicable) and PWGSC will review the responses. Canada reserves the right to hire any independent consultant, or use any Government resources that it considers necessary to review any response. Not all members of the review team will necessarily review all responses.
- (c) **Confidentiality:** Respondents should mark any portions of their response that they consider proprietary or confidential. Canada will handle the responses in accordance with the *Access to Information Act*.
- (d) **Follow-up Activity:** Canada may, in its discretion, contact any respondents to follow up with additional questions or for clarification of any aspect of a response.

A. 6 Contents of this RFI

- (a) This RFI contains a draft Statement of Work - Annex A. This document remains a work in progress and respondents should not assume that new clauses or requirements will not be added to any bid solicitation that is ultimately published by Canada. Nor should respondents assume that none of the clauses or requirements will be deleted or revised. Comments regarding any aspect of the draft document are welcome.
- (b) This RFI also contains specific questions addressed to the industry.

A. 7 Question to Industry

- (a) Respondents are requested to review the draft Statement of Work (Annex A); and
- (b) Respondents are requested to respond to the questions and provide comments on the information in (Annex B - Format of Response).

A. 8 Volumetric Data

The data found at Annex A is being provided to respondents purely for information purposes. Although it represents the best information currently available to PWGSC, Canada does not guarantee that the data is complete or free from error.

A. 9 Format of Responses

- (a) **Cover Page:** If the response includes multiple volumes, respondents are requested to indicate on the front cover page of each volume the title of the response, the solicitation number, the volume number and the full legal name of the respondent.
- (b) **Title Page:** The first page of each volume of the response, after the cover page, should be the title page, which should contain:
 - (i) the title of the respondent's response and the volume number;
 - (ii) the name and address of the respondent;
 - (iii) the name, address and telephone number of the respondent's contact;
 - (iv) the date; and
 - (v) the RFI number.
- (c) **Numbering System:** Respondents are requested to prepare their response using a numbering system corresponding to the one in this RFI. All references to descriptive material, technical manuals and brochures included as part of the response should be referenced accordingly.
- (d) **Number of Copies:** Canada requests that respondents submit three (3) hard copies and one (1) USB key of their responses.

A. 10 Enquiries

Because this is not a bid solicitation, Canada will not necessarily respond to enquiries in writing or by circulating answers to all potential suppliers. However, respondents with questions regarding this RFI may direct their enquiries to:

Contracting Authority: Angela Durigan

E-mail Address: angela.durigan@pwgsc-tpgsc.gc.ca

Telephone: (819) 956-5879

A. 11 Submission of Responses

- (a) **Time and Place for Submission of Responses:** Suppliers interested in providing a response should deliver it to the following location by the time and date indicated on page 1 of this document:
- Department of Public Works and Government Services Bid Receiving Unit
Portage III, 0A1
11 Laurier Street
Gatineau, Quebec K1A 0S5
- Responses should not be sent directly to the Contracting Authority.**
- (b) **Responsibility for Timely Delivery:** Each respondent is solely responsible for ensuring its response is delivered on time to the correct location.
- (c) **Bid Receiving Unit Address Solely for Delivery of Responses:** The above address is only for bid submission. No other communications are to be forwarded to this address.
- (d) **Identification of Response:** Each respondent should ensure that its name and return address, the solicitation number and the closing date appear legibly on the outside of the response.

ANNEX A – STATEMENT OF WORK

Modernization of Environment Canada’s Integrated Energy, Emissions and Economy Modeling Framework

A. Introduction

A rigorous analytical approach to long-term planning helps ensure that policy development at Environment Canada (EC) and Natural Resources Canada (NRCan) effectively addresses the challenges and opportunities that Canada will face as a global energy leader. There is an important role for analysis and modelling to underpin the country’s policy decision-making in this area. Analysis and modelling also facilitates the regulatory mandate of the National Energy Board (NEB), especially in understanding how Canada’s energy future could unfold, and the context in which regulatory decisions are made.

EC and NRCan currently apply a range of tools to establish an analytical foundation for policy development in the respective departments. The analytical tools being applied are those which are best suited to address the issues at hand. Issues that will impact many different sectors of the economy, with feedback loops and system effects arising from the interactions between producers and consumers of various goods, are being addressed using a comprehensive and fully integrated energy, emissions and economy model. Issues that are more limited in their potential feedback effects and cross-linkages between sectors or firms are being analyzed using micro or 'partial equilibrium' models or spreadsheet tools.

Since 2006, EC has used a comprehensive and fully integrated energy, emissions and economy model to support the development of environment policy – the Energy, Emissions and Economy Model for Canada (E3MC). The NEB has used a variant of E3MC since 2006 and prior for its periodic long term projections of energy demand and supply. NRCan has been using energy models for the preparation of long-term energy projections for the last 30 years. Over the years, the emphasis among topics and the use of models has changed depending on changing and emerging issues in the Canadian energy markets. Recently, NRCan has switched to using the same modelling platform as EC and NEB, although an alternative system had been used for many years prior.

The E3MC model is considered one of the premier integrated energy, emissions and economy modeling frameworks used in Canada. The E3MC model consists of two key proprietary models which are licensed to the Government of Canada (i.e., EC, NRCan and NEB):

- a) ENERGY 2020, a highly detailed and technology-rich end-use technology model that simulates energy supply and demand and associated emissions, is maintained by Systematic Solutions, Inc.
- b) The Informetrica Model (TIM), a highly detailed macroeconomic model that was, until recently, maintained by Informetrica Limited.

ENERGY 2020 is a commodity-based model with a detailed industry and household classification system. TIM is fully integrated with ENERGY 2020 and is also highly detailed. The E3MC model is currently configured in a manner in which the two proprietary models – ENERGY 2020 and TIM – operate in a fully integrated and dynamic manner to arrive at an equilibrium solution at an annual level. This means that there is a technical endogeneity between the two models, where the macroeconomic model responds

to changes in assumptions generated by the energy model as it iterates to meet a specified set of policy actions.

In the current configuration, the macroeconomic link provided by TIM is essential for influencing the manner in which ENERGY 2020 resolves the energy and emissions impacts of a specific policy action. ENERGY 2020 determines the response of the energy market to changes in events or policies. Energy markets are detailed by the consuming and producing sectors, with energy demand detailed by fuel type and capital and other spending that is consistent with the change in energy demand. Policy impacts include a variety of direct effects on industry and consumer price formation, capital spending and both industry and consumer current spending. The energy impacts (prices, quantities and energy-related expenditures) must be passed to the macro model to estimate how the economy will react (i.e. to produce an altered set of macroeconomic responses). These altered macro responses (variables) are then passed back to ENERGY 2020 to fully estimate the impact of the policy. This interaction is done dynamically and instantaneously.

The E3MC model is used to generate a baseline forecast and to then undertake policy analysis where the question posed is: what are the economic impacts of an initiative or policy change? To this end, the modeling requirements are:

1. A Base Case (typically a “business as usual” scenario),
2. Model-based tools that represent measures/initiatives (e.g., changes to regulations, standards, information and enforcement programs, and/or changes to markets exercised through changes to market rules [permit systems] or government tax and subsidy rules), and
3. Model-based tools that translate the measures/initiatives into direct impacts on specified sources of economic demand (e.g., consumers, businesses and governments) and economy-wide impacts that reflect the interactions of all internal and external sources of demand, production, price formation, and these in the context of effects on the financial system.

The combination of ENERGY 2020 and a macro-economic model allows EC, NRCan and the NEB to carry out environment and energy-related simulations in an integrated fashion, capturing the complex interactions between the economy, the energy sector and the environment. The E3MC tool provides each user with a unique capacity to allow for environmental consideration into the development and implementation of federal economic policies while at the same time ensuring that economic considerations are factored into environmental regulations and policies. The E3MC model is utilized to enhance the government’s ability to develop answers to questions such as:

- a) How will industry/consumers respond to various environmental issues (e.g. climate change, air quality, toxics and others) that directly impact economic sectors?
- b) What are the economic impacts to industry and consumers in achieving environmental policies such as Canada’s greenhouse gas emissions reduction objectives and policies aimed at reducing air pollutants and improving air quality and human health?
- c) What are the national and provincial/territorial impacts of various policy initiatives in both the near and longer term?
- d) What are the benefits (e.g., reduced health costs and reduced damage to infrastructure) of addressing climate change and clean air?

- e) What are the economic implications of Canada-US action to address climate change and clean air issues? What are the competitiveness implications of harmonized actions? What are the benefits of harmonized GHG and CAC emissions trading systems?
- f) What are the economic impacts of changes in North American or Global wholesale energy prices (natural gas, crude oil, coal)? What are the impacts of changing global trade patterns?
- g) What are the economic impacts of growth in energy production, for both producing regions (such as Alberta and B.C.) as well as spillover impacts for other provinces?
- h) What are the economic impacts of changing demographics, emerging urban development trends, changing consumer preferences or technological development on the energy demand side (e.g., increased investment in energy efficient technology, alternative fuels, or changes in driving frequency)?
- i) What is the impact of regional energy price differentials resulting from changing flow/infrastructure/demand issues?
- j) What are the economic impacts of the development of major energy projects (e.g. Hydro projects, LNG export terminals and oil exporting terminals).

In order to ensure that the E3MC model continues to be one of the premier integrated energy, emissions and economy modeling frameworks used in Canada, EC, working with NRCan and the NEB, has initiated work towards its modernization. With respect to ENERGY 2020, the structure and databases are updated annually to reflect the best available information and to accommodate the sector-by-sector regulatory agenda. With respect to the macroeconomic model, TIM is anchored in the 1997 input/output tables and Statistics Canada has discontinued publishing chain-weighted 1997 data. Moreover, Statistics Canada is revising all data associated to the Canadian System of National Accounts due to the implementation of the new international standards published in System of National Accounts 2008. As such, there is an urgent need to modernize E3MC's macroeconomic module.

B. Objective

In order to ensure continued operation of the E3MC modeling framework and enhance its capabilities, the Government of Canada is seeking to modernize its E3MC modeling framework. This work will be performed by a consortium that must include Systematic Solutions, Inc. and the successful macroeconomic provider.

This modernization principally focuses several key elements:

- a) Acquisition of a 10-province and 3-territory Canadian dynamic macroeconomic model with foreign/regional linkages and that is fully aligned with Statistics Canada's Canadian National System of Accounts -2012.
- b) Full and dynamic integration of the new macroeconomic model (10-province and 3-territory) to create an integrated Canadian ENERGY 2020-macroeconomic model (E3MC).

- c) Acquisition of a US open economy dynamic macroeconomic model with an appropriate level of regional disaggregation that can be fully integrated with the US Energy 2020 model to create a US ENERGY 2020-macroeconomic model (E3US).
- d) Full and dynamic integration of the E3MC to E3US to create a North American integrated energy, emissions and economy model (i.e., a US Canadian ENERGY 2020-macroeconomic model).

The main objectives of this contract are to acquire a dynamic Canadian and US macroeconomic model and to link ENERGY 2020 to this model to create an integrated energy, emissions and economy models that could be run in various regional levels (i.e., as North American model, as a Canada or US model or as stand-alone provincial/territorial or US regional/state model).

As an essential requirement of this contract, the ENERGY 2020 and the macro-model will endogenously interact through changes in energy production, prices, energy intensities, investments in energy industries, and macroeconomic variables. For each iteration period¹, energy supply and demand outcomes from ENERGY 2020 would be automatically read by the macro-model. The macro-model would then incorporate the energy information into a new macroeconomic projection for the period. The new macroeconomic data is then returned to ENERGY 2020 to create a new energy projection for the next iteration. This iteration is undertaken to achieve an integrated annual equilibrium in all energy markets and the economy.

The integrated model would capture both direct and indirect/induced impacts on the Canadian industries and consumers of the Canadian and the US climate change and clean air policy initiatives. A key technical objective is to ensure accounting and behavioural consistency between the “micro” representation of energy markets in E2020 and the macro and industrial organization detail of the macroeconomic model at each single regional level. As well, this integrated model would provide the Government of Canada with a capacity to:

- a) Analyze the regional/provincial and aggregate macroeconomic impacts (e.g., Gross Domestic Product, industry gross output, employment, personal disposable income, tax interaction, government revenues/expenditures, sector-specified competitiveness effects) of a range of energy and environment policy initiatives.
- b) Develop alternative long-term energy and emissions scenarios for each representative region as well as for the nation.
- c) Analyze the spillover effects in Canada of environmental policy initiatives taken in the US.
- d) Analyze joint Canada-US environment policy initiatives
- e) Analyze alternative provincial and/or industry proposals for achieving environmental goals.

In general, energy and emissions models such as ENERGY 2020 are characterized as “partial equilibrium models” in the sense that the economics of demand, supply, and price formation focus on specific details of the energy system and limit interaction to that which occurs within the energy system. Development of a Base Case for ENERGY 2020 requires information that is exogenous to its framework including measures of the income and activity of industries and households, detailed expenditure and revenue flows of federal/provincial governments, and potentially, a number of domestic and foreign

¹ As the ENERGY 2020 produces at projection at the annual level, ideally the macroeconomic should also produce annual projections. If the macroeconomic model is only capable of producing a quarterly projection, then the integration process must develop a capable protocol to achieve an integrated energy, emissions and economy equilibrium.

prices and financial market variables. Development of impacts of initiatives requires that these measures that are exogenous to the energy model should be adjusted to reflect economy-wide interactions and foreign linkages so that reporting from the energy model reflects these. In addition, implications for general measures of effect (on total output, employment, incomes, and prices, and on government and other saving) would have to be reported from a macroeconomic modelling framework with which the energy model is integrated.

The foregoing description implies several important requirements.

1. The Government of Canada requires a dynamic macroeconomic model with foreign linkages that can be formally integrated into the ENERGY 2020 framework. There are several significant dimensions to this:
 - a. the data framework and structure of behaviour in the two models should be compatible if not necessarily the same, and
 - b. the dimensions and levels of the capital stocks and flows should be comparable in both ENERGY 2020 and the macro-model. This means that the historical level of investment in equipment, buildings and production processes should be comparable, and that the future capital flows/investments should be identical to allow for robust policy analysis.
 - c. technically, data measures and/or executable code must be exchanged between the two models. The Request for Proposal requires that the software used to execute ENERGY 2020 will be the “command” program. It should be noted that this does not mean that the macro model must be written in the same language as ENERGY 2020.
2. The macroeconomic model data framework, and ideally, the modelling structure, should be compatible with energy and other modelling frameworks employed by the National Energy Board and Natural Resources Canada. Currently, both NEB and NRCan use ENERGY 2020 as their energy model.
3. Introduction of policy initiatives (e.g., regulatory, market based, fiscal, etc.) as direct impacts on the two models (i.e., ENERGY 2020 and macroeconomic model) will take forms that are distinct for each of the two models, but coordination to ensure that the initiatives are the same and that direct impacts are equivalently introduced into the two models will be important.

To meet the requirements of the RFP three core activities are required of the macroeconomic component of the models’ integration.

1. ENERGY 2020 requires development of macroeconomic projection mechanisms and reporting variables at the provincial level, and a selected set of nationally measured variables. These should be sensitive to analysis of energy, environment, and other environment-related proposals and other candidate initiatives of the Government of Canada.
2. Formal integration of the two models, with ENERGY 2020 providing the “command program” requires software development. This will provide for an ability to project ENERGY 2020 variables using executable code of the macroeconomic module(s) developed by successful bidder. To provide the Government of Canada with capacity to execute both models on a stand-alone basis, this will have to include model development components for anticipated impact statements.

Providing the Government of Canada with capacity to execute the integrated model on a stand-alone basis will require documentation of the integrating software, documentation of the macroeconomic module, and training of Environment Canada staff on the behaviour and running of the macroeconomic module. This should include “dry runs” for forecasting and impact statement purposes.

C. Requirement Summary

The objective of this requirement is to construct a dynamic and integrated energy, emissions and economy model for North America. The table below provides an overview of the key tasks for addressing the requirements. The table also provides a notionally distribution of efforts between the “successful macro model providers” and the provider of the services for the ENERGY 2020 model (i.e., Systematic Solutions, Inc).

Tasks	"Macro-Modeler Providers"	Systematic Solutions, Inc
Task 1.1a: Acquire/Develop a Canadian dynamic macroeconomic model	x	
Task 1.1b: Calibrate Canadian Macro Model reference forecast to Government of Canada's official energy forecast	x	
Task 1.2a: Write code to transfer data from ENERGY 2020-Canada to Canadian Macro Model	x	
Task 1.2b: Write code to transfer data from the macro-model to ENERGY 2020	x	x
Task 1.3a: Developing an Interface to enable execution of ENERGY 2020-Canada and Canadian macro models	x	x
Task 1.3b: Test the Interconnection of Canadian macroeconomic model to ENERGY 2020-Canada	x	x
Task 2.1a: Acquire a US dynamic macroeconomic model	x	
Task 2.1b: Calibrate US Macro Model reference forecast to US official energy forecast	x	
Task 2.2a: Write code to transfer data from ENERGY 2020-US to US Macro Model	x	x
Task 2.2b: Write code to transfer data from the US macro-model to ENERGY 2020-US	x	x
Task 2.3a: Developing an Interface to enable execution of US macro model and ENERGY 2020-US	x	x
Task 2.3b: Test the Interconnection of US macroeconomic model to ENERGY 2020-US	x	x
Task 3a: Establish capability in historical and projection investment levels between the US macro and ENERGY 2020_US model		x
Task 3b: Exchange Rate capability		x
Task 3c: Iteration Speed		x
Task 4: Develop Interface between US and Canadian Macroeconomic Model	x	
Task 5a: Develop policy test case for varying values into US and CN macro models	x	

Task 5b: Review US and CN macro model impacts on each other; make revisions as necessary	x	
Task 5c: Resolve issues of non-convergence as necessary	x	
Task 6: Test the fully integrated model	x	x
Task 7: Document the interface of full Integrated E3MC (ENERGY2020-Canadian Macro model) to E3US (Energy2020-US macroeconomic model)	x	x
Task 8: Providing on-demand and as required technical support	x	
Task 9: Provision of semi-annual macroeconomic reference cases aligned with the most recent macroeconomic consensus projection	x	

D. Statement of Work

The statement of work has several distinct, but interrelated elements. These include:

1. Development, integration, and testing of the Canada macro-ENERGY 2020 model:
 - a) Developing a dynamic Canadian macro model with foreign linkages and developing a baseline macro forecast;
 - b) Calibrating the macro reference forecast to an official common reference energy forecast; and
 - c) Developing and testing the interface with ENERGY 2020.
2. Development, integration and testing of the US macro-ENERGY 2020 model:
 - a) Obtaining/developing a US open economy dynamic macro model;
 - b) Calibrating the US macro reference forecast to the official US energy forecast; and
 - c) Developing and testing the interface with ENERGY 2020.
3. Modernizing ENERGY 2020 to accommodate linkages with new macro model.
4. Development and testing of the interface between the US and Canadian dynamic macroeconomic model.
5. Testing the fully-integrated interface.
6. Documenting the Canadian and US macro models and interface linking modules.
7. Providing on-demand and as required technical support.
8. Provision of semi-annual macroeconomic reference cases aligned with the most recent macroeconomic consensus projection. For Canada, the reference cases must reflect to the most recent Finance Canada Budget or Fiscal and Economic Update parameters.

Task 1: Development, integration, and testing of the Canada macro-ENERGY 2020 model

Task 1.1: Acquire Canadian macroeconomic model and calibrate forecast

Task 1.1a: Acquire/Develop a Canadian dynamic macroeconomic model

Under this task, the contractor will provide Environment Canada with a stand-alone Canadian macroeconomic model with options to run a stand-alone provincial/regional economic model. The contractor shall provide a diagram that shows the flow and linkages of information within the model and the contractor shall also provide the detail used for the model's equations/blocks.

In general, the standard features of the model will include, but not be limited to:

- a) Base year = \$2007 or \$2010
- b) Millions of Canadian Dollars
- c) Energy demand distinguished by type detailed by energy-using sector
- d) Aligned with Statistics Canada's new System of National Accounts which are now aligned to the International 2008 System of National Accounts
- e) NAICS 2007
- f) Forecast/simulation period: from most current historical year to 2050 or 2075.

The 10 province and 3 territory macroeconomic models, with aggregation to Canada, will capture at the very least the following elements:

- a) Demography
- b) Foreign Linkages
- c) Government Saving and Finance Sector
- d) Stocks of Wealth
- e) Labour Force
- f) Disposable Incomes
- g) Final Demand
- h) Final Demand prices
- i) Major Aggregates
- j) Industry Prices and Wages
- k) Industry Output, Employment and Capital Stock
- l) Government Revenue
- m) Government Expenditure
- n) Government Redistribution
- o) Earned Income

The dynamic province-specific macroeconomic models shall include:

- a) Household Expenditures – variables to be disaggregated at the most detailed level as available. Information shall include real, nominal and relative prices for personal consumption.
- b) Investment – business investment, residential construction and government investment.
 - Business Investment – structures and machinery & equipment; structures by buildings and engineering type; machinery and equipment by type of equipment available; intellectual property products. (Due to the analysis undertaken by Environment Canada, bids that are deemed to be compliant must report and forecast investments by asset and by industry)

- Residential Construction and Housing – new construction, renovations, ownership transfer costs, housing starts, housing stock and sales of new and existing dwellings.
 - Government Investment - investment in structures, machinery and equipment; intellectual property products and residential.
- c) Inventory Change – farm and non-farm (e.g., manufacturing, wholesale & retail and government). For manufacturing the inventory cases should be at the same level of disaggregate as GDP, Gross Output and Investment.
 - d) Government Expenditures – net current expenditure on goods and services and sales of goods and services by level of government (including health expenditure) at the most detailed level as available in the provincial economic accounts.
 - e) Non-profit institutions serving households’ consumption expenditure.
 - f) Exports and Imports – by goods and services, by direction with the US and the Rest of World at the level of detail available in the SNA.
 - g) Vehicle Sales by Type.
 - h) Current and capital accounts, by province and territory (where available), for Households, Non-profit institutions serving households, Corporations (including undistributed corporate profits), General government and Non-Residents. Also by province and territory: revenue, expenditure and budgetary balances for governments. This information is available from the System of National Accounts on the CANSIM web-site. An example is *CANSIM Table 384-0040 - Current accounts - Households, provincial and territorial, annual*. Other information sources include the Provincial and Territorial governments.
 - i) Detailed government revenues and expenditures, by province and by type of government entity, as available in the Government Financial Statistics. Note that detailed taxation items may need to be acquired from provincial and territorial governments.

The industrial detail in the model will be commensurate with the industrial detail in ENERGY 2020. At the minimum, it will represent NAICS industries or sectors listed in Annex 2. In the macroeconomic model it will be desirable to distinguish a finer level of detail to aid in pinpointing direct impacts from policy initiatives.

The model should be able to provide, at minimum, the following indicators:

- a) GDP Price Index
- b) Long-term Bond Rate
- c) Consumer Price Index
- d) Exchange Rates
- e) Interprovincial migration
- f) International migration
- g) Population
- h) Commercial Floor Space by Building
- i) GDP by sector and by province
- j) Gross Output by NAICS sector by province
- k) Employment by NAICS sector by province
- l) Wage indicators by NAICS sector by province
- m) Major purchased inputs by sector
- n) Price of machinery and equipment
- o) Taxes – corporate, personal and indirect (HST, GST and PST) and transfer payments
- p) Household expenditures

- q) Real Disposable Income
- r) Housing Starts by Type

The stand-alone macroeconomic model currently used by EC, NRCan and the NEB has the ability to generate a wide variety of reports at the national, provincial/territorial and industry level. The stand-alone macro model to be supplied by the successful bidder must have an ability to generate reports on key statistics. Ideally, the new macro model should have the ability to generate a variety of reports both pre-defined and user generated.

The Canadian macroeconomic model would have, but not be limited to the following features.

1. Provincial/Territorial Dimension: 10 provinces and 3 territories. Ideally, the model would solve uniquely for each province and territory using distinct input/output tables. The provincial and territorial models would be required to sum-up to Canada. As such, the provincial/territorial models must be capable of capturing all inter-provincial and international trade flows. While not the preference, consideration would be given to using a national model based on the most recently available input/output tables and then share-weighting to the provinces/territories based on their respective input/output tables. If this share weight approach is used, then the successful bidder must ensure that when policy touches only one sector in a specific province (e.g., petroleum refining in Nova Scotia), the direct effect is focused on that province. The model should also capture the indirect, induced and multiplier effects that could affect other sectors and provinces. In the case of share-weighting, the sum of the provincial macroeconomic parameters, including the province with the impact, must equal the national macroeconomic parameters.
2. Sector Dimension: Environment Canada's current macro-economic model contains more than 150 sector categories covering agricultural and forest activities, energy resource extraction, manufacturing, business services, government and others. Given most recent changes to Statistics Canada National System of Accounts, Environment Canada acknowledges that the current level of sector dimension will be more limited in scope. As such, Environment Canada is prepared to discuss a more restricted set of regions and sectors that will still provide the functionality required to provide the prerequisite analysis. Having said this, the ideal national, provincial and territorial models must have at least the sectors listed in Annex 2 and these sectors must be fully aligned to Statistics Canada's new System of National Accounts. As the macro model must be able to address a variety of regulatory and incentive policies, proposals which do not provide the required level of sectoral definition at the provincial and national level will be deemed non-compliant and will be screened-out of the competitive bidding process. Statistics Canada's Cansim Table 379-0030 provides the level of sector detail at the provincial level.
3. Energy Sectors: The current system of national accounts provides information for key energy sectors at various NAICS levels. For example,
 - Oil and gas extraction [211]
 - Conventional oil and gas extraction [211113]
 - Non-conventional oil extraction [211114]
 - Coal mining [2121]
 - Electric power generation, transmission and distribution [2211]

As part of its impact assessment, Environment Canada requires a more disaggregated representation of the key energy sectors. For example, a separate tracking of oil and gas extraction and a separate tracking within oil extraction (e.g., light and heavy). The successful bid will be one that proposes a macro model which captures this sub-sector disaggregation either directly or indirectly.

The model's structure shall be organized such that concepts included in the model are organized and one can diagrammatically describe the model and its equations in an orderly manner. For the reviewers of the model, its structure must be presented diagrammatically that is consistent with the model's equations/blocks.

Task 1.1b: Calibrate Canadian Macro Model reference forecast to Government of Canada's official energy forecast

The Canadian macro model reference forecast should be calibrated in two ways: i) Aligning the short-term simulation with the projections outlined in Finance Canada's most recently available Budget or Fiscal and Economic Update projections, and ii) calibrating the long-term Canadian forecast to Finance Canada's long-term forecast. The detailed industry and demand variables should be fine-tuned for near-term expectations. This macroeconomic forecast would then be used to send initial parameters to ENERGY 2020. As ENERGY 2020 contains energy-related information, when it is linked to the macro model and the two models iterate, a new integrated equilibrium will be established. This new equilibrium will result in integrated projections values for the macro-economy, energy and emissions.

Task 1.2: Develop Interface between Canadian macroeconomic model and ENERGY 2020 (Canadian Module)

Task 1.2a: Write code to transfer data from ENERGY 2020-Canada to Canadian Macro Model

ENERGY 2020 uses macroeconomic data to drive energy demands in the residential, commercial, industrial, and transportation sectors. The linkages between ENERGY 2020 and the Canadian macroeconomic model will allow for simulation of the real-time impact of energy and environmental concerns on the economy and vice versa. Annex 2 provides a description of the current sector structure of the Environment Canada's integrated energy, emissions and economy model.

Transferring data from ENERGY 2020 to the macro model requires files that are read by both models. These files will contain the changes caused by a specific energy or emissions policy to a set of model variables as calculated by ENERGY 2020. The files will then be imported into the Canadian macroeconomic model, and the macroeconomic model would be executed to obtain a revised macroeconomic forecast given these new assumptions. The specific variables that are sent from ENERGY 2020 to the macro model will vary based on the policy being analyzed. The proposal must identify which variables will be included. While the list does not need to be exhaustive, it must be comprehensive enough to provide an indication of the model's capabilities.

The variables in ENERGY 2020 will need to be aggregated into the macro model regions and mapped to the macro model economic categories before sending them as input. The contractor has the option to exchange information as changes from the base case or from levels relative to the base case. In either case, the proposal must clearly articulate how this information exchange from will be performed.

Task 1.2b: Write code to transfer data from the macro-model to ENERGY 2020

Output from the macroeconomic model must be interactively transferred to ENERGY 2020. A routine will be required to parse the output from the macro model output files and read the economic variables into a Promula database (ENERGY 2020 programme language). The code for the data transfers must be incorporated into the current interface between ENERGY 2020 and macro model. The initial list of macroeconomic variables that should be passed from the macro model to ENERGY 2020 should include but not be limited to:

1. Economic output and GDP by Economic Category
2. Total Personal Income
3. Real Disposable Personal Income
4. Consumer Price Index
5. GDP Deflator
6. Exchange Rates
7. Government Compensation

The initial list of ENERGY 2020 variables that should be passed from ENERGY 2020 to the macro model should include but not be limited to:

1. Energy production for each energy sector (electricity, oil, gas, coal, etc.)
2. Energy expenditures by economic category (fuel and capital)
3. Energy use per \$ of economic output by economic category and fuel
4. Emissions permit costs by economic category and fuel
5. Investments related to energy production or to meet environmental or energy related policies.
The macro model must be capable of receiving investments by structure, by equipment, by process for each economic category
6. An exchange rate information used for energy related trade flow in ENERGY 2020 (see Task 3.b)

The proposal should outline to the greatest detail possible the approach which will be taken to extract data from macro model and transfer it to ENERGY 2020. This includes elements such as: i) creation of custom output tables which will be created during each execution of the macro model; and ii) the post process to map the data from the macro model industry structure to the ENERGY 2020 industry structure. The macro model provider must work closely with Systematic Solutions, Inc. to ensure this task meets Environment Canada's expectations.

Task 1.3: Developing and Testing an Interface to enable execution of ENERGY 2020-Canada and Canadian macro models

Task 1.3a: Developing an Interface to enable execution of ENERGY 2020-Canada and Canadian macro models

ENERGY 2020 and the macro models could be operating in distinct software systems. For the current E3MC model (i.e., ENERGY 2020 linked to TIM), Systematic Solutions, Inc. and Informetrica Limited developed an interface written in Visual Basic to maneuver data between the different components of E3MC. As this is a generalized interface that allows for integration with third-party software, the successful bidder and Systematic Solutions, Inc. can either explore its use or develop a new and distinct interface.

Working with the developers of ENERGY 2020, create an automated link between the ENERGY 2020 model and the macroeconomic model. ENERGY 2020 will be the “command” program, controlling the execution of ENERGY 2020 and the macroeconomic model. The macroeconomic model “base case” will be run beforehand probably off-line. Each iteration of the system will then include extracting the data from the macroeconomic model, transferring the data to ENERGY 2020, executing ENERGY 2020, extracting data from ENERGY 2020, transferring the data to the macroeconomic model, and executing the macroeconomic model. This is a single “iteration” which can be repeated as many times as needed.

While not being prescriptive, elements of this task will likely include the following steps:

- a) Review the macroeconomic model to determine how to execute it and how to extract data. Create a test case of output data generated by modifying the macroeconomic input data.
- b) Determine the location in the macroeconomic database/model for the inserting and extracting the data for ENERGY 2020.
- c) Write code to insert data, extract data, and execute the macroeconomic model. Debug and test this code to insure the results match the test case.
- d) Revise the code which currently extracts data from the “macroeconomic model spreadsheets” to extract data from the macroeconomic model directly to the transfer routine.
- e) Generate code for ENERGY 2020 to insert data into the macroeconomic model directly via the selected transfer routine and language². The data in general needs to be transformed into percent changes from the Base Case before being sent to the macroeconomic model.
- f) Combine the code which inserts data, extracts data, and executes the macroeconomic model with the code which inserts data, extracts data, and executes ENERGY 2020 to create an integrated iterated flow with convergence rules if needed.

Task 1.3b: Test the Interconnection of Canadian macroeconomic model to ENERGY 2020-Canada

Once the interconnections are established between the macro model and ENERGY 2020, the integrated macro model-ENERGY 2020 tandem must undergo extensive testing to ensure that new structure can assess the impact of multiple policy options. The testing should ensure that each model is responding reasonably to signals being sent from the other model. The stress testing should ensure that there will be no break-downs between the two models.

For the stress testing, it is imperative that the Government of Canada officials be involved at all stages to ensure that the model meets expectations. This includes design of the test and review of output from both the ENERGY 2020 and the macro model.

Once the development and testing of the integrated Canadian macro-ENERGY 2020 model and integrated US macro-ENERGY 2020 model is complete the next set of task will focus on:

- a) developing and testing the interface between the US and Canadian macroeconomic model;
- b) testing the fully-integrated interface;
- c) documenting the interface; and
- d) exploring the inclusion of natural capital using the approach outlined in the System of Environmental and Economic Accounts

² The point here is that the macro model is now imbedded in the micro model as a callable routine.

Task 2: Development, integration, and testing of the US macro-ENERGY 2020-US model

Task 2.1: Acquire US macroeconomic model and calibrate forecast

Task 2.1a: Acquire a US dynamic macroeconomic model

The contractor will facilitate Environment Canada's acquisition of a US dynamic macroeconomic model. Ideally, the US macroeconomic model will simulate 9 regions (US Census Divisions) and 160-Sectors. Annex 4 provides an example of the regional and sector breakdown for the US macroeconomic model. While the ideal is a 9-region and 160 sector model, Environment Canada is prepared to discuss a more restricted set of regions and sectors that will still provide the functionality required to provide the prerequisite analysis. The model must function on a standalone basis and be able to generate a variety of reports both pre-defined and user generated.

Task 2.1b: Calibrate US Macro Model reference forecast to US official energy forecast

The US macro model reference forecast should be calibrated in two ways: i) Aligning the short-term simulation, and ii) calibrating the long-term US forecast to the most recently available US Energy Information Administration's (EIA) official energy forecast. This forecast is appropriate for the overall macroeconomic activity. The detailed industry and demand variables should be fine-tuned for near-term expectations.

Task 2.2: Develop Interface between US macroeconomic model and ENERGY 2020-US

Task 2.2a: Write code to transfer data from ENERGY 2020-US to US Macro Model

ENERGY 2020 uses macroeconomic data to drive energy demands in the residential, commercial, industrial, and transportation sectors. The linkages between ENERGY 2020 and US macroeconomic model will allow for simulation of the real-time impact of energy and environmental concerns on the economy and vice versa.

Transferring data from ENERGY 2020 to the macro model requires files that are readable by both models. These files will contain the changes caused by a specific energy or emissions policy to a set of model variables as calculated by ENERGY 2020. The files will then be imported into the US macroeconomic model, and the macroeconomic model would be executed to obtain a revised macroeconomic forecast given these new assumptions. The specific variables that are sent from ENERGY 2020 to the macro model will vary based on the policy being analyzed. The proposal must identify which variables will be included. While the list does not need to be exhaustive, it must be comprehensive enough to provide an indication of the model's capabilities.

The variables in ENERGY 2020 will need to be aggregated into the macro model regions and mapped to the macro model economic categories before sending them as input. The contractor has the option to exchange information as changes from the base case or from levels relative to the base case. In either case, the proposal must clearly articulate how this information exchange will be performed.

Task 2.2b: Write code to transfer data from the US macro-model to ENERGY 2020-US

Output from the macroeconomic model must be interactively transferred to ENERGY 2020-US. A routine will be required to parse the output from the US macro model output files and read the economic variables into a Promula database (ENERGY 2020 programme language). The code for the data transfers must be incorporated into the current interface between ENERGY 2020-US and the US macro model. The initial list of macroeconomic variables that should be passed from the US macro model to ENERGY 2020-US should include but not be limited to:

- 1 Inflation Rate (Index)
- 2 Private Nonfarm Employment
- 3 Government Non-civilian Employment
- 4 Gross Regional Product
- 5 Total capital output
- 6 Government Compensation
- 7 Population
- 8 Total Personal Income
- 9 Real Disposable Personal Income

The proposal should outline to the greatest detail possible the approach which will be taken to extract data from the US macro model and transfer it to ENERGY 2020-US. This includes elements such as: i) creation of custom output tables which will be created during each execution of the US macro model; and ii) the post process to map the data from the macro model industry structure to the ENERGY 2020 industry structure. The macro model provider must work closely with Systematic Solutions, Inc. to ensure this task meets the Government of Canada's expectations.

Task 2.3: Developing and Testing an Interface to enable execution of US macro model and ENERGY 2020-US

Task 2.3a: Developing an Interface to enable execution of US macro model and ENERGY 2020-US

ENERGY 2020 and the macro models could be operating in distinct software systems. For the current E3MC model (i.e., ENERGY2020-Canada linked to TIM), Systematic Solutions, Inc. and Informetrica Limited developed an interface written in Visual Basic called to maneuver data between the different components of E3MC. As this is a generalized interface that allows for integration with third-party software, the successful bidder and Systematic Solutions, Inc. can either explore its use or develop a new and distinct interface.

Task 2.3b: Test the Interconnection of US macroeconomic model to ENERGY 2020-US

Once the interconnections are established between the US macro model and ENERGY 2020-US, the integrated macro model-ENERGY 2020 tandem must undergo extensive testing to ensure that new structure can assess the impact of multiple policy options. The testing should ensure that each model is responding reasonably to signals being sent from the other model. The stress testing should ensure that there will be no break-downs in the interaction between the two models.

For the stress testing, it is imperative that Government of Canada officials be involved at all stages to ensure that the model meets expectations. This includes design of the test and review of output from both the ENERGY 2020-US and the US macro model.

Once the development and testing of the integrated Canadian macro-ENERGY 2020 model and integrated US macro-ENERGY 2020 model is complete the next set of task will focus on:

- a) developing and testing the interface between the US and Canadian macroeconomic model;
- b) testing the fully-integrated interface;
- c) documenting the interface; and
- d) exploring the inclusion of natural capital using the approach outlined in the System of Environmental and Economic Accounts

Task 3: Modernizing ENERGY 2020 (Canada and US) to accommodate linkages with new macro model (Canada and US)

Task 3a: Establish capability in historical and projection investment levels between the macro and ENERGY 2020 model.

Systematic Solutions, Inc. will reconcile their historical and forecast values for process and device/equipment investments with the outputs of the macroeconomic model to ensure consistency between the two models. This is expected to require adjustments to the process and device capital costs in ENERGY 2020. Research will be needed to support these changes since the ENERGY 2020 model contains more detail on the end-use and technology level than the macroeconomic model. A calibration procedure will be developed to enable the direct transfer of process and device investments to the macroeconomic model.

Task 3b: Exchange Rate capability

Currently ENERGY 2020 internally executes with all prices in US dollars. Systematic Solutions, Inc. will revise ENERGY 2020 to internally execute the Canada areas in Canadian dollars while the US areas will continue to execute with US dollars. Therefore, the exchange rate will only be needed for energy related trade flows between the two countries (electricity, natural gas, oil, and coal imports and exports). This task will require adjustments to all financial input variables, adjustments to all financial output files, revision of the electricity and natural gas dispatch routines, and a review of all the code to insure the consistent treatment of the financial variables including international cap and trade simulations. Consistency is of utmost importance so the inputs and outputs will need to be checked thoroughly.

Task 3c: Iteration Speed

Given the two models will need to iterate to find a consistent solution between ENERGY 2020 and the macroeconomic model, Systematic Solutions, Inc. will explore options to reduce the execution time by identifying procedures which only need to be executed during the first iteration of the model and by passing emission allowance permit information between iterations. The procedure which constructs new electric generating capacity requires a significant amount of execution time and only needs to be executed once per iteration (since changes to the current year macroeconomic variables do not have a

significant impact on the procedure). Systematic Solutions, Inc. will isolate this (and any other procedures identified) so it is only executed during the first iteration. Based on current experience when ENERGY 2020 is linked to a macroeconomic model, the longest runs are, by far, the emission cap and trade runs where the model must iterate to find the emission permit prices and must also iterate with the macroeconomic model. In the past, the macroeconomic model required 5 iterations while the GHG cap and trade runs required up to 12 iterations of ENERGY 2020. This resulted in 60 iterations to complete one run. Systematic Solutions, Inc. will explore and test a range of options aimed at reducing the ENERGY 2020 iterations. The options to be explored could include an automated process to provide the model with an emission permit price which is close to the solution in the previous iteration.

Task 4: Develop Interface between US and Canadian Macroeconomic Model

This task is aimed at dynamically linking the Canadian and US macroeconomic models developed in Tasks 1 and 2. Given the importance of the US economy to Canada, the successful bidder must deliver an integrated model which is capable of developing “macroeconomic” forecasts that captures the Canada-US trading relationship, as well as other key Canada-US macroeconomic relationships.

A key deliverable of this proposal is the development of a fully integrated Canadian and US macro, the successful bidder will undertake the following actions:

- a) Review model structure to map variables across the two models
- b) Establish the responsive of Canada-US exchange rates, export/import dynamics and other key macroeconomic relationships
- c) Modify structure to enable transfer of data and input across the models
- d) Write code to transfer data from US to Canadian macro model
- e) Develop interface to enable execution of the Canadian and US models

To integrate the Canada and US macroeconomic model the successful bidder will develop an automated platform that will iterate variables between the Canadian and US models until the models reach convergence. This integration includes a two-way flow of information between the US and Canadian energy models. Results from any region in the Canada or the US model will ripple across the Canadian and US economy, and will incorporate industry and labor force responses between sub-national regions and cross border effects. The fully integrated Canada and US macroeconomic, demographic, and energy modelling system will allow for simultaneous convergence to provide industry, governmental, and demographic responses to changes not only in a specific region or country but in response to actions made in other regions within or across national borders.

The integrated model should be capable of dynamically capturing the impact of policy changes whether the policy change originates in Canada or the US. Once the policy change has been introduced the “models” must have the capacity to adjust to reach equilibrium in both countries. For example, if the policy results in a reduced demand for steel in the US, the integrated must have the capacity to capture the direct, indirect and induced effects in the US economy. Also, if Canada exports steel to the US, the model must have the capacity to capture the impacts of this US policy on the Canadian steel industry and the associated indirect and induced impacts on the Canadian economy. In so doing, the model will establish protocols for convergence. As the origins of the policy shock could be energy-related, emission regulated, fiscal or otherwise, the integrated model must be designed to address all possibilities.

If the successful bidder already has an integrated Canada-US model which fully meets the requirements outlined in this proposal, then the challenges of meeting this proposal's requirements could be less onerous. If an integrated model exists, then the successful bidder must provide sufficient information (e.g., model structure, equations, model blocks, interaction, and others) to allow for the assessment of the model.

Task 5: Test the Interconnection of US and Canadian Macroeconomic Model

This task focuses on testing the interactions between the US and Canadian macro modules. The previous task ensured that we have the process in place to send over variables from US and Canadian macro models to ENERGY 2020. In this task, the consultant will test to see if the Canadian macro model responds as expected to changes sent over from the US macro model.

Task 5a: Develop policy test case for varying values into US and CN macro models

To anticipate the details of environment and energy policy analysis, these will include changes in world/Continental energy prices, changes to fiscal and monetary policy, US exchange rates with its major trading partners and Canada's, with the US, major shocks to the costs of production in energy-intensive industries, where these occur on a US-only, Canadian-only, and joint basis.

Task 5b: Review US and CN macro model impacts on each other; make revisions as necessary

The testing is expected to be an iterative process completed when "tested" simulations do not fail "technically" but also produce reasonable a priori results.

Task 5c: Resolve issues of non-convergence as necessary

Convergence issues should be minimal in this testing as there is only a one way flow of new information.

Task 6: Test the fully integrated model

In this task, both energy markets and both macro modules interact simultaneously. The objective is to develop the system so that all information flows are operating simultaneously.

Essentially, this task will follow the same process as the individual model testing in that the system will be "stress tested". Testing will be an iterative process completed when "tested" simulations do not fail "technically" but also produce reasonable a priori results. It should be noted that this testing should be designed to minimize the chances of simulation failure when the system is being used operationally by Environment Canada. This task will jointly require inputs from the macro model and ENERGY 2020 teams.

Task 7: Document the interface of full Integrated E3MC (ENERGY2020-Canadian Macro model) to E3US (Energy2020-US macroeconomic model)

In collaboration with Systematic Solutions, Inc. the successful bidder will prepare documentation of the interface between the three modules (ENERGY 2020, Canada-Macro and US-Macro) as well as provide instructions on setting up a base case or policy runs. The interface documentation will detail the inputs and outputs to each model, the primary uses of this data in each model, and the execution process including the order the models are called and the flow of data between the models. A Users' Guide will provide step-by-step instructions on the operation of each model individually and the operation of the integrated model.

In the case of policy development, alternative variables may need to be sent over to the macro model. The documentation will provide a description of how to incorporate new policies using the macro models including instructions for determining which macro model variables will be impacted by a new policy.

Task 8: Providing on-demand and as required technical support

For the main requirements for this task will, in all probability, be undertaken during the options associated with the request. The main elements of this task are as follows:

1. **Macroeconomic Base Case Development** – This task is designed to support the development of an initial macroeconomic base case which will serve as the economic driver to the Government of Canada's Energy and Emissions Outlooks. For this initial macroeconomic base case, the successful bidder will use a predefined consensus macroeconomic forecast. Starting from this macroeconomic projection, the successful bidder will then proceed to make revisions to key assumptions. These revisions will ensure that the macroeconomic base case reflects advice provided to the Government of Canada by its stakeholders. As part of this task, the successful bidder will:
 - a. Participate in discussions with selected industry associations and companies. The purpose of these discussions will be to review and modify short-term and long-term view of economic growth.
 - b. Modify economic parameters based on industry consultations.
 - c. Develop and test the macro assumption files to ensure that they are correctly reflecting the advice provided by the industry association and that they are properly interacting with the Energy2020 module of E3MC.
2. **On-line Support** – This task is designed to access the successful bidder's staff on an "on and as required basis". Through this task, on-line support will be provided to Environment Canada's Analysis and Modeling Division, as well as to the modeling teams at the NEB and NRCan. As part of this task, the successful bidder will:
 - a. Respond in a time dependent manner to requests for support
 - b. Make recommendations/suggestions on how best to implement specific changes to macroeconomic variables and policy assumptions
 - c. Provide advice on the interpretation of specific results
 - d. Make "selected" modifications to model code to ensure that the policy impacts are being correctly modeled and interpreted.

3. **Alternative Macroeconomic Scenario Development** – Provide technical support and advice on issues related to development of alternative baselines and on the running of the model. As this task is required, Government of Canada staff will provide direction to the successful bidder's staff.
4. **Analytic Approach Development** – Provide technical support and advice on the development of a methodology for translating \$ value gross output into physical values (i.e., tonnes of steel or cement). As this task is required, Government of Canada staff will provide direction to successful bidder's staff.
5. **In-house Training** – Upon request provide in-house training to officials within Environment Canada's Analysis and Modeling Division, as well as modeling teams at the NEB and NRCan.
6. **Advise on Modeling Infrastructure** – Advise and consult on the strategic development of modeling infrastructure required by the Government. For example, the Analysis and Modeling Division has developed an economic analysis strategy to guide its modeling activities. As this strategy is implemented, the Government officials may require the assistance of outside modeling experts. As such, this task is designed to access the successful bidder's staff expertise and advice on an "as needed or requested basis".

With respect to the on-demand and as required support, this requirement may range from intensive support (i.e., up to 500 hours per year) to less intensive (i.e., up to 200 hours per year).

Task 9: Provision of semi-annual macroeconomic reference cases aligned with the most recent macroeconomic consensus projection.

For Canada, the reference cases must reflect to most recent Finance Canada Budget or Fiscal and Economic Update parameters.

For the US, the reference cases must reflect most recent US consensus or the case used in the most currently up-to-date Energy Information Administration's Annual Energy Outlook or Early Release.

ANNEX 1

Sector Structure

To meet the analytical demands required to support the Government's policy agenda with respect to energy, environment and environment-energy related policy objectives and the developed of an integrated energy, emissions and economy forecast, a highly disaggregated model is required. The ideal disaggregated is one that is aligned to Statistics Canada's CANSIM Table 379-0030 Gross domestic product (GDP) at basic prices, by North American Industry Classification System, provinces and territories.

Statistics Canada's CANSIM Table 379-0030

Statistics Canada's CANSIM Table 379-0030 Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS), provinces and territories, annual (dollars x 1,000,000)(1,2)

North American Industry Classification System (NAICS)

All industries [T001] (3)

Goods-producing industries [T002] (4)

Service-producing industries [T003] (5)

Industrial production [T010] (6)

Non-durable manufacturing industries [T011] (7)

Durable manufacturing industries [T012] (8)

Information and communication technology sector [T013] (9)

Information and communication technology, manufacturing [T014] (10)

Information and communication technology, services [T015] (11)

Energy sector [T016] (12)

Agriculture, forestry, fishing and hunting [11]

Crop and animal production [11A] (13)

Crop production [111]

Greenhouse, nursery and floriculture production [1114]

Crop production (except greenhouse, nursery and floriculture production) [111A] (14)

Animal production [112]

Forestry and logging [113]

Fishing, hunting and trapping [114]

Support activities for agriculture and forestry [115]

Support activities for forestry [1153]

Support activities for crop and animal production [115A] (15)

Mining, quarrying, and oil and gas extraction [21]

Oil and gas extraction [211]

Conventional oil and gas extraction [211113]

Non-conventional oil extraction [211114]

Mining and quarrying (except oil and gas) [212]

Coal mining [2121]

Metal ore mining [2122]
 Iron ore mining [21221]
 Gold and silver ore mining [21222]
 Copper, nickel, lead and zinc ore mining [21223]
 Other metal ore mining [21229]
 Non-metallic mineral mining and quarrying [2123]
 Stone mining and quarrying [21231]
 Sand, gravel, clay, and ceramic and refractory minerals mining and quarrying [21232]
 Diamond mining [212392]
 Potash mining [212396]
 Other non-metallic mineral mining and quarrying (except diamond and potash) [21239A] (16)
 Support activities for mining and oil and gas extraction [213]
 Support activities for oil and gas extraction [21311A] (17)
 Support activities for mining [21311B] (18)
 Utilities [22]
 Electric power generation, transmission and distribution [2211]
 Natural gas distribution, water, sewage and other systems [221A] (19)
 Natural gas distribution [2212]
 Water, sewage and other systems [2213]
 Construction [23]
 Residential building construction [23A] (20)
 Non-residential building construction [23B] (20)
 Engineering construction [23C] (20)
 Transportation engineering construction [23C1] (20)
 Oil and gas engineering construction [23C2] (20)
 Electric power engineering construction [23C3] (20)
 Communication engineering construction [23C4] (20)
 Other engineering construction [23C5] (20)
 Repair construction [23D] (20)
 Other activities of the construction industry [23E] (20)
 Manufacturing [31-33]
 Food manufacturing [311]
 Animal food manufacturing [3111]
 Sugar and confectionery product manufacturing [3113]
 Fruit and vegetable preserving and specialty food manufacturing [3114]
 Dairy product manufacturing [3115]
 Meat product manufacturing [3116]
 Seafood product preparation and packaging [3117]
 Miscellaneous food manufacturing [311A] (21)
 Grain and oilseed milling [3112]
 Bakeries and tortilla manufacturing [3118]
 Other food manufacturing [3119]
 Beverage and tobacco product manufacturing [312]

Soft drink and ice manufacturing [31211]
 Breweries [31212]
 Wineries and distilleries [3121A] (22)
 Tobacco manufacturing [3122]
 Textile and textile product mills [31A] (23)
 Clothing and leather and allied product manufacturing [31B] (24)
 Wood product manufacturing [321]
 Sawmills and wood preservation [3211]
 Veneer, plywood and engineered wood product manufacturing [3212]
 Other wood product manufacturing [3219]
 Paper manufacturing [322]
 Pulp, paper and paperboard mills [3221]
 Converted paper product manufacturing [3222]
 Printing and related support activities [323]
 Petroleum and coal product manufacturing [324]
 Petroleum refineries [32411]
 Petroleum and coal products manufacturing (except petroleum refineries) [3241A] (25)
 Chemical manufacturing [325]
 Basic chemical manufacturing [3251]
 Resin, synthetic rubber, and artificial and synthetic fibres and filaments manufacturing [3252]
 Pesticide, fertilizer and other agricultural chemical manufacturing [3253]
 Pharmaceutical and medicine manufacturing [3254]
 Miscellaneous chemical product manufacturing [325A] (26)
 Paint, coating and adhesive manufacturing [3255]
 Soap, cleaning compound and toilet preparation manufacturing [3256]
 Other chemical product manufacturing [3259]
 Plastics and rubber products manufacturing [326]
 Plastic product manufacturing [3261]
 Rubber product manufacturing [3262]
 Non-metallic mineral product manufacturing [327]
 Cement and concrete product manufacturing [3273]
 Non-metallic mineral product manufacturing (except cement and concrete products) [327A] (27)
 Primary metal manufacturing [331]
 Iron and steel mills and ferro-alloy manufacturing [3311]
 Steel product manufacturing from purchased steel [3312]
 Alumina and aluminum production and processing [3313]
 Non-ferrous metal (except aluminum) production and processing [3314]
 Foundries [3315]
 Fabricated metal product manufacturing [332]
 Forging and stamping [3321]
 Architectural and structural metals manufacturing [3323]
 Boiler, tank and shipping container manufacturing [3324]
 Hardware manufacturing [3325]

Spring and wire product manufacturing [3326]
Machine shops, turned product, and screw, nut and bolt manufacturing [3327]
Coating, engraving, heat treating and allied activities [3328]
Cutlery, hand tools and other fabricated metal product manufacturing [332A] (28)
Machinery manufacturing [333]
Agricultural, construction and mining machinery manufacturing [3331]
Industrial, commercial and service industry machinery manufacturing [333A] (29)
Industrial machinery manufacturing [3332]
Commercial and service industry machinery manufacturing [3333]
Ventilation, heating, air-conditioning and commercial refrigeration equipment manufacturing [3334]
Metalworking machinery manufacturing [3335]
Engine, turbine and power transmission equipment manufacturing [3336]
Other general-purpose machinery manufacturing [3339]
Computer and electronic product manufacturing [334]
Computer and peripheral equipment manufacturing [3341]
Communications equipment manufacturing [3342]
Semiconductor and other electronic component manufacturing [3344]
Other electronic product manufacturing [334A] (30)
Electrical equipment, appliance and component manufacturing [335]
Electric lighting equipment manufacturing [3351]
Household appliance manufacturing [3352]
Electrical equipment manufacturing [3353]
Other electrical equipment and component manufacturing [3359]
Transportation equipment manufacturing [336]
Motor vehicle manufacturing [3361]
Automobile and light-duty motor vehicle manufacturing [33611]
Heavy-duty truck manufacturing [33612]
Motor vehicle body and trailer manufacturing [3362]
Motor vehicle parts manufacturing [3363]
Motor vehicle gasoline engine and engine parts manufacturing [33631]
Motor vehicle electrical and electronic equipment manufacturing [33632]
Motor vehicle steering and suspension components (except spring) manufacturing [33633]
Motor vehicle brake system manufacturing [33634]
Motor vehicle transmission and power train parts manufacturing [33635]
Motor vehicle seating and interior trim manufacturing [33636]
Motor vehicle metal stamping [33637]
Other motor vehicle parts manufacturing [33639]
Aerospace product and parts manufacturing [3364]
Railroad rolling stock manufacturing [3365]
Ship and boat building [3366]
Other transportation equipment manufacturing [3369]
Furniture and related product manufacturing [337]
Household and institutional furniture and kitchen cabinet manufacturing [3371]

Office furniture (including fixtures) manufacturing [3372]
 Other furniture-related product manufacturing [3379]
 Miscellaneous manufacturing [339]
 Medical equipment and supplies manufacturing [3391]
 Other miscellaneous manufacturing [3399]
 Wholesale trade [41]
 Farm product wholesaler-distributors [411]
 Petroleum product wholesaler-distributors [412]
 Food, beverage and tobacco wholesaler-distributors [413]
 Personal and household goods wholesaler-distributors [414]
 Motor vehicle and parts wholesaler-distributors [415]
 Building material and supplies wholesaler-distributors [416]
 Machinery, equipment and supplies wholesaler-distributors [417]
 Miscellaneous wholesaler-distributors [418]
 Wholesale electronic markets, and agents and brokers [419]
 Retail trade [44-45]
 Motor vehicle and parts dealers [441]
 Furniture and home furnishings stores [442]
 Electronics and appliance stores [443]
 Building material and garden equipment and supplies dealers [444]
 Food and beverage stores [445]
 Health and personal care stores [446]
 Gasoline stations [447]
 Clothing and clothing accessories stores [448]
 Sporting goods, hobby, book and music stores [451]
 General merchandise stores [452]
 Miscellaneous store retailers [453]
 Non-store retailers [454]
 Transportation and warehousing [48-49]
 Air transportation [481]
 Rail transportation [482]
 Water transportation [483]
 Truck transportation [484]
 Transit, ground passenger and scenic and sightseeing transportation [48Z] (31)
 Urban transit systems [4851]
 Taxi and limousine service [4853]
 Other transit and ground passenger transportation and scenic and sightseeing transportation [48A]
 (32)
 Support activities for transportation [488]
 Pipeline transportation [486]
 Pipeline transportation of natural gas [4862]
 Crude oil and other pipeline transportation [486A] (33)
 Postal service and couriers and messengers [49A] (34)

Postal service [491]
 Couriers and messengers [492]
 Warehousing and storage [493]
 Information and cultural industries [51]
 Publishing industries (except internet) [511]
 Newspaper publishers [51111]
 Periodical, book and directory publishers [5111A] (35)
 Software publishers [5112]
 Motion picture and sound recording industries [512]
 Motion picture and video exhibition [51213]
 Motion picture and video industries (except exhibition) [5121A] (36)
 Sound recording industries [5122]
 Broadcasting (except internet) [515]
 Radio and television broadcasting [5151]
 Pay and specialty television [5152]
 Telecommunications [517]
 Data processing, hosting, and related services [518]
 Other information services [519]
 Finance and insurance [52]
 Depository credit intermediation and monetary authorities [52B] (37)
 Monetary authorities - central bank [521]
 Local credit unions [52213]
 Banking and other depository credit intermediation [5221A] (38)
 Non-depository credit intermediation [5222]
 Activities related to credit intermediation [5223]
 Insurance carriers and related activities [524]
 Insurance carriers [5241]
 Agencies, brokerages and other insurance related activities [5242]
 Financial investment services, funds and other financial vehicles [52A] (39)
 Real estate and rental and leasing [53]
 Real estate [531]
 Lessors of real estate [5311] (40)
 Owner-occupied dwellings [5311A] (41)
 Offices of real estate agents and brokers and activities related to real estate [531A] (42)
 Rental and leasing services [532]
 Automotive equipment rental and leasing [5321]
 Rental and leasing services (except automotive equipment) [532A] (43)
 Lessors of non-financial intangible assets (except copyrighted works) [533]
 Professional, scientific and technical services [54]
 Legal, accounting and related services [541A] (44)
 Legal services [5411]
 Accounting, tax preparation, bookkeeping and payroll services [5412]
 Architectural, engineering and related services [5413]

Other professional, scientific and technical services including scientific research and development [541B] (45)

Specialized design services [5414]

Management, scientific and technical consulting services [5416]

Scientific research and development services [5417]

Other professional, scientific and technical services [5419]

Computer systems design and related services [5415]

Advertising, public relations, and related services [5418]

Management of companies and enterprises [55]

Administrative and support, waste management and remediation services [56]

Administrative and support services [561]

Office administrative services [5611]

Employment services [5613]

Business support services [5614]

Travel arrangement and reservation services [5615]

Investigation and security services [5616]

Services to buildings and dwellings [5617]

Facilities and other support services [561A] (46)

Waste management and remediation services [562]

Educational services [61]

Universities [6113]

Educational services (except universities) [611B] (47)

Elementary and secondary schools [6111]

Community colleges and C.E.G.E.P.s [6112]

Other educational services [611A] (48)

Health care and social assistance [62]

Health care [62X] (49)

Ambulatory health care services [621]

Offices of physicians [6211]

Offices of dentists [6212]

Miscellaneous ambulatory health care services [621A] (50)

Hospitals [622]

Nursing and residential care facilities [623]

Social assistance [624]

Arts, entertainment and recreation [71]

Performing arts, spectator sports and related industries, and heritage institutions [71A] (51)

Amusement, gambling and recreation industries [713]

Gambling industries [7132]

Amusement and recreation industries [713A] (52)

Accommodation and food services [72]

Accommodation services [721]

Traveller accommodation [7211]

RV (recreational vehicle) parks, recreational camps, and rooming and boarding houses [721A] (53)

Food services and drinking places [722]
 Other services (except public administration) [81]
 Repair and maintenance [811]
 Automotive repair and maintenance [8111]
 Repair and maintenance (except automotive) [811A] (54)
 Personal services and private households [81A] (55)
 Personal and laundry services [812]
 Funeral services [8122]
 Dry cleaning and laundry services [8123]
 Personal care services and other personal services [812A] (56)
 Private households [814]
 Religious, grant-making, civic, and professional and similar organizations [813]
 Religious organizations [8131]
 Grant-making, civic, and professional and similar organizations [813A] (57)
 Public administration [91]
 Federal government public administration [911]
 Defence services [9111]
 Federal government public administration (except defence) [911A] (58)
 Provincial and territorial public administration [912]
 Local, municipal, regional and aboriginal public administration [91A] (59)
 Local, municipal and regional public administration [913]
 Aboriginal public administration [914]

Footnotes

- For the gross domestic product (GDP) by industry refer to CANSIM tables 379-0027 and 379-0031 for Canada in chained dollars, 379-0029 for Canada in current dollars, 379-0028 for provinces and territories in percentage share.
- For the chained dollars, the aggregates are not equal to the sum of their components.
- This combines the North American Industry Classification System (NAICS) codes 11-91.
- This combines the North American Industry Classification System (NAICS) codes 11-33.
- This combines the North American Industry Classification System (NAICS) codes 41-91.
- This combines the North American Industry Classification System (NAICS) codes 21, 22, 31-33, 562.
- This combines the North American Industry Classification System (NAICS) codes 311-316, 322-326.
- This combines the North American Industry Classification System (NAICS) codes 321, 327-339.
- This combines the North American Industry Classification System (NAICS) codes 334 excl. 3345, 4173, 5112, 517, 518, 5415, 8112.
- This combines the North American Industry Classification System (NAICS) code 334 excl. 3345.
- This combines the North American Industry Classification System (NAICS) codes 4173, 5112, 517, 518, 5415, 8112.
- This combines the North American Industry Classification System (NAICS) codes 211, 2121, 212291, 213111, 213118, 2211, 2212, 32411, 486.

13 This combines the North American Industry Classification System (NAICS) codes 111, 112.
14 This combines the North American Industry Classification System (NAICS) code 111 excl.
15 1114.
16 This combines the North American Industry Classification System (NAICS) codes 1151, 1152.
17 This combines the North American Industry Classification System (NAICS) codes 212393,
18 212394, 212395, 212397, 212398.
19 This combines the North American Industry Classification System (NAICS) codes 213111,
20 213118.
21 This combines the North American Industry Classification System (NAICS) codes 213117,
22 213119.
23 This combines the North American Industry Classification System (NAICS) codes 2212, 2213.
24 Special hybrid: corresponds to sections of the North American Industry Classification System
25 (NAICS) code 23.
26 This combines the North American Industry Classification System (NAICS) codes 3112, 3118,
27 3119.
28 This combines the North American Industry Classification System (NAICS) codes 31213,
29 31214.
30 This combines the North American Industry Classification System (NAICS) codes 313, 314.
31 This combines the North American Industry Classification System (NAICS) codes 315, 316.
32 This combines the North American Industry Classification System (NAICS) code 324 excl.
33 32411.
34 This combines the North American Industry Classification System (NAICS) codes 3255, 3256,
35 3259.
36 This combines the North American Industry Classification System (NAICS) code 327 excl.
37 3273.
38 This combines the North American Industry Classification System (NAICS) codes 3322, 3329.
39 This combines the North American Industry Classification System (NAICS) codes 3332, 3333.
40 This combines the North American Industry Classification System (NAICS) codes 3343, 3345,
41 3346.
This combines the North American Industry Classification System (NAICS) codes 485, 487.
This combines the North American Industry Classification System (NAICS) codes 4852, 4854,
4855, 4859, 487.
This combines the North American Industry Classification System (NAICS) codes 4861, 4869.
This combines the North American Industry Classification System (NAICS) codes 491, 492.
This combines the North American Industry Classification System (NAICS) codes 51112,
51113, 51114, 51119.
This combines the North American Industry Classification System (NAICS) codes 51211,
51212, 51219.
This combines the North American Industry Classification System (NAICS) codes 521, 5221.
This combines the North American Industry Classification System (NAICS) codes 52211,
52219.
This combines the North American Industry Classification System (NAICS) codes 523, 526.
Special hybrid: corresponds to sections of the North American Industry Classification System
(NAICS) code 5311 and to Input-Output code BS531100.
Special hybrid: corresponds to sections of the North American Industry Classification System
(NAICS) code 5311 and to Input-Output code BS5311A0.

- 42 This combines the North American Industry Classification System (NAICS) codes 5312, 5313.
43 This combines the North American Industry Classification System (NAICS) code 532, excl.
44 5321.
45 This combines the North American Industry Classification System (NAICS) codes 5411, 5412.
46 This combines the North American Industry Classification System (NAICS) codes 5414, 5416,
47 5417, 5419.
48 This combines the North American Industry Classification System (NAICS) codes 5612, 5619.
49 This combines the North American Industry Classification System (NAICS) code 61 excl.
50 6113.
51 This combines the North American Industry Classification System (NAICS) codes 6114-6117.
52 This combines the North American Industry Classification System (NAICS) code 62 excl. 624.
53 This combines the North American Industry Classification System (NAICS) codes 6213, 6214,
54 6215, 6216, 6219.
55 This combines the North American Industry Classification System (NAICS) codes 711, 712.
56 This combines the North American Industry Classification System (NAICS) codes 7131, 7139.
57 This combines the North American Industry Classification System (NAICS) codes 7212, 7213.
58 This combines the North American Industry Classification System (NAICS) codes 8112, 8113,
59 8114.
This combines the North American Industry Classification System (NAICS) codes 812, 814.
This combines the North American Industry Classification System (NAICS) codes 8121, 8129.
This combines the North American Industry Classification System (NAICS) code 813 excl.
8131.
This combines the North American Industry Classification System (NAICS) code 911 excl.
9111.
This combines the North American Industry Classification System (NAICS) codes 913, 914.

Source:

Statistics Canada. Table 379-0030 - Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS), provinces and territories, annual (dollars)

ANNEX 2

E3MC and NAICS Sector

Detailed E3MC Sectors	NAICS
Single Family	NA
Multi Family	NA
Other Residential	NA
Wholesale Trade	Wholesale (41)
Retail Trade	Retail (44-45)
Warehousing and Storage	Postal Services & Couriers & Messengers (491-492) Warehousing & Storage (493)
Information and Cultural Industries	Information & Culture Industries (51)
Offices	FIRE (52-53, 55) Professional, Scientific & Technical Services (54) Administrative & Support, Waste Management & Remediation (56) Public Administration (91)
Educational Services	Educational Services (61)
Health Care and Social Assistance	Health Care & Social Assistance (62)
Arts, Accommodation, Food, Other	Scenic & Sightseeing & Support Activities (487-488) Arts, Entertainment & Recreation (71) Accommodation & Food Services (72) Other Services (excl. Public Administration) (81)
Natural Gas Distribution	Natural Gas (2212)
Oil Pipelines	Pipeline Transportation: Oil and Other (4861, 4869)
Natural Gas Pipelines	Pipeline Transportation: Gas (4862)
Petroleum Products	Refineries & Other Petroleum & Coal Products (32411, 32419)
Light Oil Mining Heavy Oil Mining Frontier Oil Mining	Oil & Gas Mining (211)
Sweet Gas Production Sour Gas Production Sweet Gas Processing Sour Gas Processing	Oil & Gas Mining (211)
Primary Oil Sands SAGD Oil Sands CSS Oil Sands Oil Sands Mining Oil Sands Upgraders	Oil & Gas Mining (211)

Iron Ore Mining	Iron Ore (21221)
Non-Metal Mining	Non-metallic Minerals & Quarrying (2123) Support Activities for Mining (213)
Pulp and Paper Mills	Pulp, Paper & Paperboard (3221)
Petrochemicals	Petrochemical (32511)
Industrial Gas	Industrial Gas (32512)
Other Chemicals	Synthetic Dye & Pigments (32513) Other Basic Chemicals (32518-32519) Pharmaceutical & Medicine (3254) Other Chemicals (3252,3255-3259)
Fertilizer	Pesticide,Fertilizer & Other Agriculture Chemicals (3253)
Cement	Cement (32731)
Lime & Gypsum	Lime & Gypsum Product (3274)
Iron & Steel	Iron & Steel Mills (3311) Iron & Steel Pipes & Tubes from Purchased Steel (33121) Rolling & Drawing of Purchased Steel (33122) Ferrous Metal (33151)
Aluminum	Primary Alumina & Aluminum (331313)
Other Nonferrous Metal	Smelting & Refining (33141)
Food & Tobacco	Food (311) Beverage & Tobacco Products (312)
Textiles	Textile Mills (313) Textile Product Mills (314)
Apparel	Clothing (315)
Lumber	Wood (321)
Furniture	Furniture & Related Product (337)
Converted Paper	Converted paper Products (3222)
Printing	Printing & Related Support Activities (323)
Rubber	Plastics & Rubber Products (326)
Leather	Leather & Allied Products (316)
Glass	Glass (3272)
Other Non-Metallic	Ready-mix Concrete (32732) Other Concrete Product (32732, 32733, 32739) Clay Product & Refractory (3271) Other Non-metallic Mineral Products (3279)
Fabricated Metals	Fabricated Metal Product (332)
Machines	Machinery (333)
Computers	Computer & Electronic Product (334)
Electric Equipment	Electrical Equipment, Appliances & Components (335)
Transport Equipment	Transportation Equipment (336)
Other Manufacturing	Rolling, Drawing, Extruding & Alloying (331317)

	Rolling, Drawing, Extruding (33142-33149) Non-Ferrous Metal (33152) Miscellaneous (339)
Other Metal Mining	Gold & Silver Ore (21222) Copper, Nickel, Lead & Zinc Ore (21223) Other Metal Ore (21223, 21229)
Coal Mining	Coal (2121)
Construction	Construction (23)
Forestry	Forestry & Logging (113) Support Activities for Agriculture & Forestry (115)
Solid Waste Waste Water Incineration	Water, Sewage & Other Systems (2213)
On Farm Fuel Use	Agriculture incl. Crop & Animal(111-112)
Crop Production	Crops (ex. Greenhouse, Nursery & Floricult. (1111-1113, 1119) Greenhouse, Nursery & Floriculture (1114)
Animal Production	Animal Aquaculture (1125) Animal Production (excpt. Animal Aquaculture)(1121-1124, 1129) Fishing, Hunting & Trapping (114)
Passenger	Transit & Ground Passenger Transportation (485) Rail (482)
Freight	Rail (482) Water (483) Truck (484)
Air Passenger Air Freight	Air (481)
Foreign Passenger	Air (481)
Foreign Freight	Air (481) Water (483)
Residential Off Road	Transit & Ground Passenger Transportation (485)
Commercial Off Road	Truck (484)
Utility Electric Generation Industry Electric Generation Steam Generation	Electric Power Generation, Transmission & Distribution (2211)

ANNEX 3

US Macroeconomic Model Regions and Sector Specifications

Regional Dimensions

One possible options for regional specification is to adopt the United States' Energy Information Administration Census Regions

- New England
- Middle Atlantic
- South Atlantic
- East South Central
- East North Central
- West North Central
- West South Central
- Mountain
- Pacific

Industry Sector Dimension

US Department of Commerce (2013): Regional Economic Accounts: GDP by State, Bureau of Economic Analysis (web-site). <<http://www.bea.gov/regional/downloadzip.cfm>.

101	All industry total
102	Private industries
103	Agriculture, forestry, fishing, and hunting
104	Crop and animal production (Farms)
105	Forestry, fishing, and related activities
106	Mining
107	Oil and gas extraction
108	Mining (except oil and gas)
109	Support activities for mining
110	Utilities
111	Construction
112	Manufacturing
113	Durable goods
114	Wood product manufacturing
115	Nonmetallic mineral product manufacturing
116	Primary metal manufacturing
117	Fabricated metal product manufacturing
118	Machinery manufacturing
119	Computer and electronic product manufacturing
120	Electrical equipment, appliance, and component manufacturing
121	Motor vehicle, body, trailer, and parts manufacturing
122	Other transportation equipment manufacturing

123	Furniture and related product manufacturing
124	Miscellaneous manufacturing
125	Nondurable goods
126	Food and beverage and tobacco product manufacturing
127	Textile mills and textile product mills
128	Apparel and leather and allied product manufacturing
129	Paper manufacturing
130	Printing and related support activities
131	Petroleum and coal products manufacturing
132	Chemical manufacturing
133	Plastics and rubber products manufacturing
134	Wholesale trade
135	Retail trade
136	Transportation and warehousing
137	Air transportation
138	Rail transportation
139	Water transportation
140	Truck transportation
141	Transit and ground passenger transportation
142	Pipeline transportation
143	Other transportation and support activities
144	Warehousing and storage
145	Information
146	Publishing industries, except Internet
147	Motion picture and sound recording industries
148	Broadcasting and telecommunications
149	Information and data processing services
150	Finance and insurance
151	Federal Reserve banks, credit intermediation and related services
152	Securities, commodity contracts, investments
153	Insurance carriers and related activities
154	Funds, trusts, and other financial vehicles
155	Real estate and rental and leasing
156	Real estate
157	Rental and leasing services and lessors of intangible assets
158	Professional, scientific, and technical services
159	Legal services
160	Computer systems design and related services
161	Other professional, scientific and technical services
162	Management of companies and enterprises
163	Administrative and waste management services
164	Administrative and support services
165	Waste management and remediation services

166	Educational services
167	Health care and social assistance
168	Ambulatory health care services
169	Hospitals and nursing and residential care facilities
170	Social assistance
171	Arts, entertainment, and recreation
172	Performing arts, spectator sports, museums, and related services
173	Amusement, gambling, and recreation
174	Accommodation and food services
175	Accommodation
176	Food services and drinking places
177	Other services, except government
178	Government
179	Federal civilian
180	Federal military
181	State and local
199	Natural resources and mining
200	Trade
201	Transportation and utilities
202	Financial activities
203	Professional and business services
204	Education and health services
205	Leisure and hospitality
206	Information, Communication, and Technology (ICT)
208	Private goods-producing industries
209	Private services-providing industries

Annex B – Format of Response

Respondents are requested to review the Statement of Work and respond to the following questions and provide comments.

- A. Respondents are requested to provide an overall narrative in response to the general requirements found in the Statement of Work - Annex A, including but not limited to:
1. Provide a rough order of magnitude of costing estimates (i.e., a range of +/- \$100,000) for:
 - a) Acquisition of a 10-province and 3-territory Canadian dynamic macroeconomic model that is fully aligned with Statistics Canada's Canadian National System of Accounts -2012 and linking of this macroeconomic model to ENERGY 2020-Canada to create a simultaneous integrated energy, emissions and economy model for Canada from the most current historical year to 2050 or 2075.
 - b) Acquisition of a US dynamic macroeconomic model and linking of this macroeconomic model to ENERGY 2020-US to create a simultaneous integrated energy, emissions and economy model for the USA from the most current historical year to 2050 or 2075.
 - c) Linking of the Canadian and US integrated models to US to create a simultaneous integrated energy, emissions and economy model for the USA.
 - d) Development of a i) US national model, or ii) regional model (e.g., 9 Census region model).
 2. Ability to create a comprehensive provincial dynamic macroeconomic model to cover the sectors listed in Environment Canada's requirement. This will include, but not be limited to, a discussion of technique for estimating "undisclosed" data and the respondents experience with imputing confidential data and their ability to impute confidential data.
 3. Ability to create client specified macroeconomic forecasts that will serves as the initial input for the integrated model and a rough order of costs
 4. Service Support set-up and yearly estimated maintenance and technical support cost. A rough order of magnitude cost (i.e., a narrow range) should be provided for requirements ranging from intensive support (i.e., up to 500 hours per year) to less intensive (i.e., up to 200 hours per year).
 5. An estimate for time required to deliver a modeling system that fully meets the requirements outlined in the Statement of Work (i.e., from contract award to delivery of the modeling system).

Note - Respondents are also requested to state any relevant information or assumptions that were made regarding the development of their estimates and identify any areas that could be potential cost risks.

- B. Respondents are requested to provide proposed high level Schedule showing major milestones (i.e., review of model parameters, beta testing of integrated system, final testing of the integrated system).
- C. Respondents are requested to provide a proposed level of effort for on-going maintenance, support and potential enhancement of the integrated system;
- D. Respondents are requested to provide recommendations against the proposed Statement of Work – Annex A. In this case, including but not limited to means that respondents also have this opportunity to comment on the adequacy and clarity of the requirement as currently expressed, and may offer suggestions regarding potential alternative solutions that would meet the general requirements.