Annex 1: Methodology for Calculations for Green Economy Network Common Platform

Renewable Energy

The calculations for the actual and expected greenhouse gas (GHG) emission reductions were based on the Government of Canada's ecoENERGY for Renewable Power program. The ecoENERGY for Renewable Power program was designed to increase Canada's supply of electricity generated from renewable sources: wind, solar photovoltaic, geothermal, biomass, tidal and low-impact hydro.[1] GHG emission reductions were estimated using the following equation:

GHG emission reductions = Renewable energy production × GHG emission factor[2]

This equation is based on estimates from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories[3] and Environment Canada's Greenhouse Gas Emissions Indicators.[4]

The cross-Canada emission factor for all renewable energy sources was determined to be 465.88 t/GWh[2]

To calculate GHG emission reductions for future years, "renewable energy production" is estimated based on total capacity deployed from various renewable sources, multiplied by the expected capacity factor of each technology.[2]

Table 1. Greenhouse Gas Emission Reductions from Investment in Renewable Power

$ Billion Investment	Mt CO_2 eq 1st Year	Mt CO_2 eq 2nd Year	Mt CO_2 eq 3rd Year	Mt CO_2 eq 4th Year	Mt CO_2 eq 5th Year
1.48 (GC)	1.35	2.6	3.44	6.0	7.0
23.3 (GEN)	21.25338	40.93243	54.15676	94.45946	110.2027
1.0	0.912162	1.756757	2.324324	4.054054	4.054054

Energy Efficiency

The calculations for the actual and expected GHG emission reductions were based on data from the following initiatives: ecoENERGY for Renewable Heat, ecoENERGY for Buildings and Houses, and ecoENERGY Retrofit Initiative.[1,2]

- ecoENERGY for Renewable Heat

GHG emission reductions were estimated based on the number of expected projects, associated energy savings, and an emission factor for displaced fuel.

---

[1] Government of Canada (2010). A Climate Change Plan for the Purposes of the Kyoto Protocol Implementation Act
[2] Government of Canada (2010). A Climate Change Plan for the Purposes of the Kyoto Protocol Implementation Act: Annex 2- Methodology for Estimating the Expected Greenhouse Gas Emissions Reductions
[3] International Panel on Climate Change (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories
[4] Environment Canada (2015). Canadian Environmental Sustainability Indicators: Data Sources and Methods for the Greenhouse Gas Emissions Indicators

- ecoENERGY Efficiency for Buildings and Houses

New Buildings – GHG emission reductions were estimated on the energy efficiency gains of the new energy code, anticipated floor space, and compliance rate. Energy savings are estimated based on the number of buildings expected to participate in the program, average floor space, and average expected energy savings per unit of floor space.

Existing Buildings – GHG emission reductions were estimated based on the number of buildings expected to participate in the program, average energy use, and the expected percentage of improvement in energy efficiency.

New Housing – GHG emission reductions were calculated by comparing the average energy consumption of new houses with the energy consumption of houses rated under the R-2000 and EnerGuide labelling categories for energy-efficient homes. The energy savings per house was multiplied by the number of houses expected to participate in the program.

Existing Housing – GHG emission reductions were calculated by taking the average energy savings per evaluated home and multiplying by the number of homes expected to be evaluated each year.

- ecoENERGY Retrofit

Homes Component – GHG emission reductions were estimated based on the expected energy savings per house multiplied by the number of houses expected to participate in the program. Energy savings were based on historical information from Natural Resources Canada. The expected number of houses was based on past participation rates and level of funding.

Buildings Component – GHG emission reductions were estimated based on the expected average energy savings per project multiplied by the expected number of projects. The expected number of buildings was based on past participation rates and level of funding.

Table 2. Greenhouse Gas Emission Reductions from Investment in Energy Efficiency

$ Billion Investment	Mt CO_2 eq 1st Year	Mt CO_2 eq 2nd Year	Mt CO_2 eq 3rd Year	Mt CO_2 eq 4th Year	Mt CO_2 eq 5th Year
0.901 (GC)	0.973	1.658	2.996	3.455	3.775
30.0 (GEN)	32.39734	55.20533	99.75583	115.0388	125.6937
1.0	1.079911	1.840178	3.325194	3.834628	4.189789

Public Transit

GHG emission reductions for investment in public transit were calculated based on actual and projected data from Transport Canada's ecoMOBILITY program. The program focused on Transportation Demand Management (TDM), which is the application of strategies and policies to reduce automobile travel demand, or to redistribute this demand to other modes. The program was intended to achieve GHG emission reductions by funding TDM initiatives that reduce the distance in vehicle kilometers traveled

(VKT) by passenger vehicles in urban areas. It can be a cost-effective alternative to increasing road infrastructure capacity, and can help maximize the benefits of existing infrastructure. The GHG emission reduction effect achieved through the ecoMOBILITY program is dependent on the availability of alternatives to personal vehicles. Certain transit-based TDM strategies must be implemented in close collaboration with transit investments, while other strategies such as teleworking and other workplace programs can be implemented more independently.[2]

These calculations were based on the assumption that both transit and non-transit TDM measures would be implemented by municipalities in combination with significant transit infrastructure investments. The GHG emission reductions were applied to historical VKT data available from Natural Resources Canada, the results were translated into reductions in fuel use and subsequently, GHG reductions using Environment Canada conversion factors.[4]

In the first two years of the initiative, there will be no GHG emission reductions resulting from investment in public transportation. This is due to the fact that the system and infrastructure will not be fully operational in the first two years. It should also be noted that an increase in urban density coevolving with better public transportations systems may result in GHG reductions up to four times as great as the calculations below. This "lag effect" is explained in the Common Platform.

Table 3. Greenhouse Gas Emission Reductions from Investment in Public Transportation

$ Billion Investment	Mt CO_2 eq 1st Year	Mt CO_2 eq 2nd Year	Mt CO_2 eq 3rd Year	Mt CO_2 eq 4th Year	Mt CO_2 eq 5th Year
0.01 (GC)	N/A	N/A	0.0064	0.0064	0.0112
17.6 (GEN)	N/A	N/A	11.264	11.264	19.712
1.0	N/A	N/A	0.64	0.64	1.12

<u>High-Speed Rail</u>

GHG emission reductions for investment in High-Speed Rail (HSR) were calculated based on the diversion of GHG emissions from other modes of transportation. The net emission reduction was calculated by subtracting the GHG emissions generated from HSR operation from the GHG emissions savings obtained through diversion from other modes of transportation.

GHG emission reductions = Emissions Saved $_{diversion}$ – Operating Emissions

- Québec City – Windsor Corridor (Québec and Ontario)

The calculations for the GHG emission reductions from the Québec City – Windsor HSR were based on the emission factors for each transportation mode: conventional passenger trains, airplanes, light duty vehicles, intercity buses, and the F200+ (diesel option HSR).

Emission factors for the HSR E300+ (electric option HSR) were calculated in kilograms of pollutants emitted per kW-hr of electricity used.[5]

- Calgary – Edmonton Corridor (Alberta)

The calculations for the GHG emission reductions for the Alberta HSR are based on the assumption that the emissions savings are proportional to the number of diverted vehicle miles. Separate factors were used for air, bus and auto vehicle miles. The estimation of emissions benefit is then multiplied by the number of vehicle miles saved by implementation of the Alberta HSR, yielding an estimate of total emission benefit.[6]

- California

Using passenger projections and diversion rates, GHG emission reductions were calculated based on the GHG emissions saved from passengers switching to HSR from other modes: air, conventional rail, automobile, and bus. The estimated emissions generated by high-speed rail were subtracted from this value to estimate high-speed rail's net emissions impact.[7,8]

Table 4. Canada's Historical Greenhouse Gas Emissions and Projections to 2025 (Mt CO_2 eq)

Year	Historical Emissions	Business as Usual	Current GC Measures	GEN Measures
1990	591	-	-	-
1991	583	-	-	-
1992	600	-	-	-
1993	602	-	-	-
1994	622	-	-	-
1995	639	-	-	-
1996	661	-	-	-
1997	676	-	-	-
1998	683	-	-	-
1999	696	-	-	-
2000	721	-	-	-
2001	714	-	-	-
2002	720	-	-	-
2003	740	-	-	-

[5] Transport Canada (2011). Updated Feasibility Study of a High Speed Rail Service in the Québec City – Windsor Corridor

[6] Alberta Infrastructure and Transportation (2008). Economic Benefits for Development of High-Speed Rail Service in the Calgary-Edmonton

[7] California High-Speed Rail Authority (2008). Addendum/Errata to Final Program EIR/EIS for the Bay Area to Central Valley Portion of the California HST System, Sacramento

[8] The Center for Clean Air Policy and the Center for Neighborhood Technology (2006). High Speed Rail and Greenhouse Gas Emissions in the U.S.

2004	744	-	-	-
2005	736	736	-	-
2006	728	732	-	-
2007	749	767	-	-
2008	731	753	-	-
2009	689	740	-	-
2010	699	760	-	-
2011	701	755	-	-
2012	699	751	-	-
2013	726	758	685	-
2014	-	770	691	691
2015	-	783	691	638
2016	-	797	699	621
2017	-	814	704	604
2018	-	826	710	587
2019	-	845	718	570
2020	-	857	727	553
2021	-	869	731	535
2022	-	883	737	517
2023	-	897	743	499
2024	-	911	749	481
2025	-	924	755	465

The data presented for the historical GHG emissions, emissions scenario if no measures are taken and emissions scenario under current measures to 2020 were obtained from Environment and Climate Change Canada.[9,10] The predictions from 2020-2025 for the total annual GHG emissions of both the 'Business as Usual' and 'Current Government of Canada Measures' scenarios were calculated using linear regression.

The calculations for the annual GHG emission reductions for the initiatives proposed by the Green Economy Network were performed for the One Million Climate Jobs Challenge and have been previously explained in this document.

Job Creation

The method used by the Green Economy Network in forecasting job creation is based on research by Robert Pollin, Heidi Garrett-Peltier, James Heintz, and Bracken Hendricks, Centre for American Progress and the University of Massachusetts Amherst.[11] The formula covers jobs created per each billion dollars

[9] Environment Canada (2014). Canada's Emissions Trends 2014

[10] Environment Canada (2014). National Inventory Report 1990–2012: Greenhouse Gas Sources and Sinks in Canada

[11] Robert Pollin, Heidi Garrett-Peltier, James Heintz, and Bracken Hendricks (2014). Centre for American Progress and University of Massachusetts Amherst, *A U.S. Program for Controlling Climate Change and Expanding Job Opportunities*

of investment in three categories: direct employment in the primary industry [ies]; indirect employment in secondary industries and suppliers; and induced employment in retail and service industries.

The particular method for induced job creation is based on the input-output model of employment through increased demand of final products for industries. Induced job creation was estimated assuming spending is designed to generate a large induced expansion of jobs based on high levels of unemployment, spending on domestic industries over imports and the encouragement of private sector investment.

Table 5. Total Person Job Years Created (Millions)

	1st Year	5th Year	10th Year
Renewable Energy	0.058	0.29	0.583
Energy Efficiency	0.09	0.438	0.88
Public Transit	0.136	0.223	0.68
High Speed Rail	0.065	0.1016	0.326
Total	0.349	1.0526	2.469