

Mapping and Assessing Industry Clusters for Green Innovation in Newfoundland and Labrador

Database and Search Tool Development-Phase II

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Abstract

The “Mapping and Assessing Industry Clusters for Green Innovation” project is a partnership between Grenfell Campus of Memorial University and the Newfoundland and Labrador Environmental Industry Association (NEIA), in collaboration with and with funding support provided by the Department of Natural Resources Centre for Forest Science and Innovation. Its purpose is to develop an online searchable database with geo-spatial capabilities to support the development of the province’s green economy. The database hosts firm-level information for businesses linked to the provision and purchasing of green products and services throughout the province.

The interactive mapping tool’s early design was developed in the spring of 2013 and demonstrated to sector stakeholders in June of 2013 as Phase 1 of the project. This report represents the results of the second phase of the project and provides specific recommendations related to further database and search tool development. This report will detail a number of topics that will be important as the project matures and expands its scope. The report includes:

- Examples of green databases from other jurisdictions nationally and internationally;
- Potential uses and users of the database;
- Proposed additional information fields that can be included in the database;
- Potential data sources that can be used to inform and update the database;
- Recommendations for how to ensure the database is maintained; and
- An outline of the intellectual property issues and rights associated with the project. A proposed Memorandum of Understanding (MOU) between project partners is also being prepared as part of the project and will be forwarded to project partners upon final review.

The database will be of significant value in the development of the environmental sector in this province. Its search capabilities and visual representation of search results will be an important resource for the province’s decision makers including government, industry, academics, professionals, and consumers. The database will provide decision-makers with a much greater understanding of the sector’s size and capacities, which can be used to benchmark the local green economy and develop strategies to foster its growth.

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I. Introduction

The Green Economy

The green economy is typically associated with any business that practices sustainable development, with particular emphasis on environmental protection. However, Environment Careers Organization Canada (ECO Canada) identifies the complexities within a broader green economy, which they define as: *“The aggregate of all activity operating with the primary intention of reducing conventional levels of resource consumption, harmful emissions, and minimizing all forms of environmental impact. The green economy includes the inputs, activities, outputs and outcomes as they relate to the production of green products and services.”*¹ Expanding on this definition, the European Commission on the Environment defines a green product or service as: *“products and services that have a reduced environmental impact throughout their life cycle, from the extraction of raw material through to production, use and disposal.”*² This is, however, an ambiguous term that may apply to a host of products in practice.

The Globe Advisors, a division of the Vancouver-based not-for-profit Globe Foundation, conducted a study on the Newfoundland and Labrador green economy in 2011 in partnership with AMEC, St. John’s. The study was commissioned by the Department of Innovation, Trade, and Rural Development and the Office of Climate Change, Energy Efficiency, and Emissions Trading within the Government of Newfoundland and Labrador. The resulting report comments on the growing agreement that measures must be taken to protect the environment as well as foster economic development activities.³

*“Greening the economy is a concept that is gaining considerable public interest and political attention around the globe as business and government leaders seek new opportunities in a carbon- and resource-constrained world. Many factors are driving the global shift toward a greener economy, most notably the need to address the impacts of climate change and reduce greenhouse gas (GHG) emissions, to better manage scarce resources, to weather fluctuations in commodity, fuel, and food prices, and to generate new economic and employment opportunities.”*⁴

Not only is greening the economy of growing importance for policy makers, it is becoming a major contributor to the global marketplace. The global green economy is estimated to be worth \$5.2 trillion (US dollars), growing faster than the economy

¹ ECO Canada. “Defining the Green Economy.” 2010: [http://www.eco.ca/publications/Defining-the-Green-Economy-\(2010\)/5/Green-Jobs-&-Emerging-Areas/](http://www.eco.ca/publications/Defining-the-Green-Economy-(2010)/5/Green-Jobs-&-Emerging-Areas/): 4.

² European Commission. “The EU Ecolabel.” Accessed 24 July 2014: http://ec.europa.eu/environment/ecolabel/index_en.htm

³ Globe Advisors. “An Analysis of the Economic Development Opportunities Associated with the Green Economy in Newfoundland & Labrador.” September 2011: http://www.exec.gov.nl.ca/exec/ccee/publications/Green_Economy_NL.pdf: i.

⁴ Ibid: i.

as a whole, with the United States of America (USA) and China constituting 20.61% (\$1.05 trillion) and 13.47% (\$686 billion) respectively. Canada ranks 13th in the world with an estimated value of \$89 billion (1.78% of the global green economy). According to the Globe Foundation, Canada's most notable strength in the green economy is the production of hydroelectric energy.⁵ In terms of employment, an estimated 1,799,695 workers dedicate some of their time to the environmental sector (this includes both public and private employees) constituting 10.3% of the Canadian labour force.⁶

The Globe Advisors' 2011 report estimates that in Newfoundland and Labrador (NL), the environmental sector employs 10,300 people in over 1,100 public and private organizations.⁷ This figure is expected to expand to include 13,450 by 2020.⁸ This growth is largely related to four sectors of the NL green economy: "Sustainable Resource Management, Green Building, Waste Management and Recycling, and Sustainable Tourism."⁹ The Sustainable Resource Management sector was defined in the report as green commodity supply firms, including the management and harvesting of fish, forestry and agricultural products as well as silviculture. For an unspecified reason NAICS codes 1133 (Logging) and 114113 (Salt Water Fishing) were, however, not included in this report and the related employment calculations despite being identified as components of the green economy.

Given the growing importance of the province's green economy, it is critical to understand how it functions, what supports are needed, and where there is potential for improvement/expansion. While the Globe report provides a valuable overview of the current and potential future green economy opportunities in NL in key green sectors, it does not provide information on individual firms that could be useful to better understand specific economic characteristics of various sectors and sub-sectors, products and services offered or environmental practices, for example.

Further, adding a spatial component to the understanding of the green economy will allow people to better understand concentrations and gaps within the industry as well as strengths, weaknesses, values, and other characteristics. The creation of a database that visualizes the green economy will be instrumental in providing support in several areas: infrastructure development, supply chain integration, new opportunities for business development, labour market initiatives, networking, research sharing, etc. to foster innovation and growth. This project will contribute to the creation of this searchable database in an attempt to support the growing green economy in the province.

⁵ Globe Foundation. "British Columbia's Green Economy: Building a Strong Low-Carbon Future." February 2010: http://globe.ca/wp-content/uploads/2012/10/bcge_report_feb_2010.pdf: 7

⁶ ECO Canada. "Profile of Canadian Environmental Employment." 2013: <http://www.eco.ca/publications/pdf/2013-Profile-Canadian-Environmental-Employment-ECO-Canada.pdf>: 14.

⁷ Globe Advisors. September 2011: i.

⁸ Ibid: v.

⁹ Ibid: vi.

Background and Purpose of the Project

The Newfoundland and Labrador Environmental Industry Capability Database and Interactive Tool will be an online searchable database with spatial capabilities designed to support the development of the environmental industry and broader green economy. The project will assist in the identification of regional clusters and strengths, weaknesses, and opportunities for innovation and development within the green economy. It will enhance the capacity of industry, government, and academia for outreach, research and to make targeted interventions at the firm level as well as by firm type, firm capability, firm markets, and/or geographic proximity in order to assess and promote economic development.

This phase of the project will further advance the prototype database and basic search tools created in Phase 1 (by College of the North Atlantic and Grenfell Campus in partnership with NEIA and CFSI)¹⁰, build consensus around the specific content and functionality deemed necessary for a more comprehensive industrial capacity database, as well as the roles and responsibilities of the parties involved. During Phase 1, a prototype database was created and basic search tools were designed to build consensus around the specific content and functionality deemed necessary for a more comprehensive industrial capacity database. This initial iteration (mock-up) used two industrial member groups to create the database prototype: NEIA and firms listed in the NL Wood Products Business Directory (a text based guide for the industry that is updated regularly). The database was first compiled by Grenfell Campus, and then followed by the creation a mock-up geospatial visualization tool by the College of the North Atlantic Geospatial Research Facility. The mock-up was then presented to the project team and key industry officials for initial feedback on specifications for a comprehensive operational database describing the environmental industrial capabilities throughout NL (discussed further below). Phase 2 of the project builds on the initial development of the online searchable database mock-up in support of the development of the environmental sector and broader green economy.

¹⁰ Following the completion of Phase 1 the College of the North Atlantic encountered circumstances that prevented any further involvement in the project. As a result none of their contributions will be used in subsequent phases and Compusult will be responsible for producing the visualization tool based on a database provided by Grenfell Campus and NEIA.

II. Examples of Green Databases from other Jurisdictions

Part of the research for Phase 2 of the project was to review other green economy databases with a special focus on other jurisdictions. In order to identify the best-practice examples provided in this report, intensive literature review and online research was conducted, along with consultations at the Globe 2014 international environmental industry conference held in Vancouver. One major challenge was the accessibility of databases as some databases mentioned in the media or publications could not be found or accessed online. Some databases, such as the database on the mapping of the Green Economy in California conducted in 2009 by the Environmental Defence Fund, have not been maintained and could therefore not be accessed.

Best practice examples have been identified based on their potential to inform completion of the project NL. Examples were selected because, together, they demonstrate multiple approaches to the creation, publication, and continuity of green databases. These examples are extremely useful in understanding how to define and categorize green businesses. Furthermore, they demonstrate how databases are used post-creation to better understand regional/national trends as a tool for informing decisions.

Canadian Examples

Three best-practice examples were drawn from within Canada; one database draws from regional information (the Waterloo area of Ontario) and two present national data. These Canadian examples focus on using databases to achieve a better understanding of meso/macro trends in the regional/national green economy. A significant drawback for these databases is that they are not completely accessible to the public nor are they assigned a spatial context. Producing a publicly accessible interactive visualization that allows users to harness information about the green economy in NL represent an advancement of these existing examples.

Table 1: Waterloo Green Business Database

Waterloo Green Business Database	
Where	Greater Waterloo Region, Ontario, Canada
What	The database was created by the EverEco Management team to help inform an effective climate action plan in the Waterloo region. The goal of the initiative was to measure the region’s green economy in an attempt to fill a knowledge gap so policy makers can make informed decisions. The database was not publicized nor entered into a geospatial interactive device, but rather referenced and discussed from a meso-level perspective in a research report. Waterloo’s green economy was sized at having \$1.04 billion and provides a total of 3,043 jobs.
Objectives, users, and uses	The research team outline three objectives in their report: 1. “Develop a replicable methodology that can measure a local green economy

	<ol style="list-style-type: none"> 2. Quantify the green economy of Waterloo region using economic indicators 3. Conduct an initial exploration of green business views on the green economy”¹¹ <p>The EverEco Management team designed the database and report for a specific government department that would in turn influence environmental policy in the province/region based on the report’s findings.</p>
Methodology and Content	<p>The database was created by following a series of steps to identify businesses in the region that contribute to the green economy. The research team’s initial database of firms in the area was obtained from Dun and Bradstreet and refined to match green industry standards. The team retrieved a list of ‘green’ North American Industry Classification System codes from Statistics Canada and the Bureau of Standards. Using the codes, the team narrowed the number of firms in the region to those classified as green then refined their search with the following criteria:</p> <ul style="list-style-type: none"> • The firm must have a website • The firm must have an environmental policy • The firm must provide a green product or service <p>Firms that lacked any of these criteria were not included in the database or the overall study.</p> <p>Of the 22,984 firms that were identified from Dun and Bradstreet as operating in the Waterloo region, 196 were classified as green businesses according to these criteria. The team used information on these firms to determine the size and extent of the region’s green economy with the following components in mind:</p> <ul style="list-style-type: none"> • Percentage of revenue that stays in the region • Business conducted in the region • Reason for providing a green service • Receipt of any incentives for being green • Possible benefits of an environmental network • How could the environmental sector perform better • Challenges
Ownership and Maintenance	<p>The ownership of the database belongs to the EverEco Management team (a student led research group) and the School of Environment, Enterprise, and Development in the University of Waterloo. The creators have not maintained the database nor produced any new reports on the data reflecting its use as a tool that informed policy formation.</p>
Visualization	<p>The database is not publicly available and is only conveyed through the technical report. There are, however, two case studies in the report that provide firm-level information for two businesses in the waterloo region.</p>
Advantages	<ul style="list-style-type: none"> • Provides a comprehensive meso-level description of Waterloo’s green economy • Provides an overview of the NAICS codes categorized under the green economy • Provides an overview of existing literature on green databases and green economy

¹¹ Basan et al, 2013.

Disadvantages	<ul style="list-style-type: none"> • Does not provide public access to the database • Fails to address extensive firm-level analysis
Web address	http://uwaterloo.ca/school-environment-enterprise-development/sites/ca.school-environment-enterprise-development/files/uploads/files/Measuring the Green Economy Waterloo Region.pdf

Table 2: The Canadian Environmental Resource Guide

The Canadian Environmental Resource Guide	
Where	Canada
What	The Canadian Environmental Resource Guide provides a comprehensive overview of operatives in the national green economy and key environmental events. The Guide condenses information drawn from more than 900 libraries and resource centres from across the country. It is available to all individuals and organizations inquiring into the Country's green economy.
Objectives, uses, and users	The Guide is the only national listing of environmental actors and events; including public and private organizations/individuals. It attempts to be the most comprehensive guide in the country and is stated as being a useful reference for academics conducting research on the Canadian environmental sector. The resource guide is primarily targeted towards individuals conducting further research as both source and a reference for information. Its comprehensive nature is an asset when creating macro-level analysis.
Methodology and Content	<p>The Guide compiles information gathered from over 900 libraries across Canada. This information includes data on 7,258 environmental associations, 21,639 environmental executives, and 281 environmental resource centres. Each entry presents basic information:</p> <ul style="list-style-type: none"> • Company Name • Address • Phone/Fax • E-mail • Web Address • Firm Type • Contact Names (and Titles) • Product and Service Information • Affiliations • Trade Information • Branch and Affiliate Data
Ownership and Maintenance	The Guide is produced by Grey House Publishing Canada and is updated regularly (the guide 2013 guide is the fifth edition).
Visualization	The Resource Guide is presented in a book. Each individual/business is listed alphabetically with some personal information.
Advantages	<ul style="list-style-type: none"> • Extensive resource for the Canadian green economy • Not limited to firms, government, or resource centres but also includes events • Updated regularly to ensure some level of relevance
Disadvantages	

	<ul style="list-style-type: none"> • Substantial cost for use (\$384) • Does not provide a spatial context • Not interactive nor does it have a search function and using the text is likely time consuming
Web address	http://www.greyhouse.ca/environ.htm

Table 3: ECO Canada Business Directory

ECO Canada Business Directory	
Where	Canada
What	Environmental Careers Organization Canada (ECO Canada) hosts a business directory for firms that are considered part of the green economy. Registration with the directory is voluntary and firms are given a searchable profile and can use the tools ECO Canada provides to upload their own company information. Information drawn from the directory allows ECO Canada to report on available opportunities and comment on ongoing trends in the green economy.
Objectives, uses, and users	ECO Canada's principal objective is to spread awareness of employment opportunities in the Canadian green economy. This involves creating a link between the business community and individuals with specialized skills in the environmental sector. The business directory also informs the reports ECO Canada generates demonstrating trends in the national green economy. ECO Canada targets professionals, student, educators, and employers with the intent of ensuring employment and job matching in Canada's green economy.
Methodology and Content	The directory allows users to search businesses and provides a link to the firm's individual profile. All information is submitted by the firm and includes: <ul style="list-style-type: none"> • A brief description • An overview of the company's services • Industry • Area of work • Address • Contact information
Ownership and Maintenance	The business directory is owned and operated by ECO Canada a federal government-funded agency. It is updated by the businesses that register as green businesses with the organization. ECO Canada regularly posts job openings and produces reports that draw on information in the directory; therefore its ongoing maintenance is necessary.
Visualization	ECO Canada's business directory consists of an advanced search function that allows users to search for businesses within set criteria. People can search for firms alphabetically, by industry, area of work, keyword, city, or by province. This will provide a list of firms that match the criteria and links users to the business' profile.
Advantages	<ul style="list-style-type: none"> • Direct link with the firm (directory consists of registered firms) • Directory information is used to obtain general trends within the green economy • Emphasis is placed on providing green jobs • Firms self-report and update their own information

Disadvantages	<ul style="list-style-type: none"> • Imposes a fee on firms wishing to use the directory beyond listing in the business directory • Does not provide a spatial context (other than the listing of firm addresses) • Does not capture all green businesses (only those who are registered). For example, only two NL firms were included in the business directory.
Web address	http://www.eco.ca/businessdirectory/

International Examples

Three international best-practice examples were identified from three different geographic jurisdictions: United States of America (USA), USA and Canada, and Germany. Both the USA and Germany are considered to be leaders in the development of the green economy. Similar to the Canadian examples the international databases were not designed for their intrinsic value and rather had dual purposes and informed broader decisions. These databases do reflect key qualities that could be integrated into the NL database (map layers, changing scale, etc.).

Table 4: The Competence Atlas

The competence atlas for environmental technologies and resource efficiency¹²	
Where	Baden-Württemberg, Germany
What	The competence atlas is a comprehensive, web-based information system and consists of two levels: the company's information and their specific business practices. Approximately 200 companies are registered within the database and their information is updated frequently.
Objectives, uses, and users	Environmental technology/resource efficiency is one of Baden-Württemberg's most affluent sectors. The goal of the atlas is to support the industry's potential by providing clearly structured company profiles of products, processes and services, the main foci of research and development, innovative successes, and experiences of activities abroad. This all contributes to greater transparency in the green economy. The atlas' goal is business promotion among government, the private sector, and consumers. In addition, it offers important industry information to research institutes focusing on the green economy.
Methodology	The atlas was created by gathering information on clearly defined categories. Each category contained further, more detailed sub-questions/information fields: <ul style="list-style-type: none"> • Lead market affiliation and the creation of a company profile • Geographical focus/international dimension • Selected corporate indicators

¹² The competence atlas is currently under review and will be updated and is expected to be republished in May 2014. Therefore, new outcomes, designs, visualization or any change in methodology could not be integrated in this report.

	<ul style="list-style-type: none"> • Innovation management • Competitive position • Use of networks/cluster initiatives <p>The answers from the companies were then compiled and put into the competence atlas.</p>
Ownership	The atlas was initiated, funded, and initially owned by the Ministry of the Environment, Climate Protection, and the Energy Sector of Baden-Württemberg. The database and the development is now maintained by Umwelttechnik BW, a 100% state-owned company responsible for the promotion of the green industry in the state.
Visualization	The database is divided into two parts: internal (more detailed information, further analysis, management and adjustment of funding sources) and external (open to the public and accessible online). The webpage provides further information about the study that led to the creation of the database. The database consists of different layers with flexible searches, including an open text search for company profiles, lead markets, international markets, and districts. The database provides the user with a structured overview on companies, products, R&D initiatives, and innovation success stories in a text-based format. The updated database will also include data on certification and awards companies may hold. Each result is hyperlinked to the respective company's profile.
Advantages	<ul style="list-style-type: none"> • Platform for businesses to present themselves and their products • Contributes to the formation of partnerships and cooperation • Building of a strong community to promote themselves on a domestic and international level • United and strong representation of the state as a region with key competences in the field of environmental technology and resource efficiency
Disadvantages	<ul style="list-style-type: none"> • Not spatially oriented • Influence on decisions in regards to new funding guidelines <p>According to our research, the number of companies has barely increased since the database has been created. This is likely related to the maintenance and marketing of the database associated with changing ownership.</p>
Web address	http://www.umwelttechnikportal.de/uta/index.php (in German)

Table 5: Wood to Energy User Facility Database

Wood to Energy User Facility Database	
Where	Canada and USA
What	The database includes major forest product industries that produce residues, users of residues for energy (boilers, ethanol producers, etc.) and related firms.
Objectives, uses, and users	<ul style="list-style-type: none"> • The project aimed to accomplish two primary objectives related to the state of the science in wood to energy research and industrial practices. First, to provide a complete literature review on the state of the science

	<p>and second to develop a database of Wood to Energy related industries in the USA and Canada. The database contains data that is of particular interest to consumers of wood fuel (both private sector and residential), government managers, and researchers seeking engagement in this field. Expected users include industry, researchers, students and policy makers.</p>
Methodology	<p>The sources used for data generation include, but are not limited to, industry related magazines, industry publications, technical reports, United States Department of Agriculture (USDA) profiles for softwood sawmills, forest industry directories, state forestry division publications, wood-using industries directories, Timber Buyers guides, etc.</p> <p>The database includes major forest product industries that produce residues, users of residues for energy (boilers, ethanol producers, etc.), and related industries. The database is regularly updated as new data is received. As of April 2014, Wood to Energy (W2E) database has 23,427 facilities located in USA and Canada. The W2E data set has 10 data tables/information fields (excel worksheets) that constitute the databases information. The data tables are:</p> <ol style="list-style-type: none"> 1. Facility 2. Facility Type 3. System Type 4. Product Type 5. Wood Energy Use Type 6. Wood Fuel Type 7. Backup Fuel Type 8. Energy Output Type 9. Wood Residues Type Produced 10. Energy Used Produced
Ownership	<p>The Wood to Energy (W2E) project was funded by the Endowment for Forestry and Communities Inc., which was initially brought together through a collaboration among partners including The University of Tennessee (UT), Centre for Renewable Carbon (CRC), Forest Products Laboratory, and Southern Research Station of the USDA Forest Service, as well as five regional centres of the national Sun Grant Initiative. The data was entered and continues to be monitored and updated by Research Associate (RA), a private firm. The data is regularly validated with the help of partners and collaborators on State level. RA also updates the data at data users' requests. To update the data RA replaces outdated information with current information.</p>
Visualization	<p>The system is being continuously updated to ensure that it is as comprehensive as it is practical. The primary method to access the database is through one of the search options (Search, Clickable Map, Search by State/Province, Map Search Tool). Information is available in tabular as well as map form and data can also be downloaded as a file for further use.</p>
Advantages	<ul style="list-style-type: none"> • Useful tool to increase awareness of the wood to energy scale • The most comprehensive database that could be used for wood to energy market analysis and projections

	<ul style="list-style-type: none"> • Combined information on wood to energy users and producers is of a great benefit to supply and demand analysts, policy makers and facility managers.
Disadvantages	<ul style="list-style-type: none"> • Does not provide details on broader economic impacts of the industry (markets, exports, expenditures, etc.).
Web address	http://www.wood2energy.org/Database%20Connection.htm

Table 6: Sizing the Clean Economy

Sizing the Clean Economy	
Where	USA
What	The Metropolitan Policy Program at Brookings, associated with Brookings Institute - a private nonprofit organization devoted to research and policy development, has developed an interactive web-based mapping and downloading tool designed to provide in-depth access to the Brookings-Battelle Clean Economy Database. The database includes data from 2003 to 2010 for every county in the USA.
Objectives, uses, and users	The Metropolitan Policy Program at Brookings worked with Battelle's Technology Partnership Practice, a scientific firm, to develop, analyze, and comment on a detailed database of establishment-level employment statistics pertaining to clean economy industries in the USA and its metropolitan areas. This is the first comprehensive nationwide database on green establishments in the USA based on data from every district to ensure further analysis. The primary function of the map is to provide an overview of clean industry data from a regional and national level. This is of particular interest to researchers and professionals seeking to operate within the clean economy.
Methodology	<p>Green establishments were identified through the use of industry identification codes, such as NAICS, and a second set of green establishments were identified through the use of a master clean economy list, which included information from known industry associations, certification patents, etc. Brookings-Battelle Clean Economy Industry Categories and Segments lists the green industry along the following categories/information fields:</p> <ul style="list-style-type: none"> • Agricultural and Natural Resources Conservation • Education and Compliance • Energy and Resource Efficiency • Greenhouse Gas Reduction, Environmental Management, and Recycling • Renewable Energy <p>The whole database is based on secondary, available data from a variety of sources.</p>
Ownership	Metropolitan Policy Program and the database by Brookings-Battelle
Visualization	Both map- and spreadsheet-oriented, the new tool allows users to visualize, or simply download data on, the geography of the clean economy at the state and metropolitan levels. Available on the site are jobs data—totals, shares, and growth—for the aggregate clean economy, five broad clean economy categories, and 39 narrower industry segments. Among the many possibilities users of the tool can

	disaggregate and study clean economy segments of interest, see where particular segment specializations exist, or find out where the clean economy is fastest growing. Furthermore, the tool allows users to visualize education data in the clean economy's workforce as well as general wage characteristics, exports, and age of establishments. The goal is to make the majority of the new information as available as possible while providing the greatest flexibility to users in its output and display.
Advantages	<ul style="list-style-type: none"> • First comprehensive database mapping green establishments and green jobs in this way in the US • Visualisation enables the viewer to see clusters in metropolitan areas and on different levels
Disadvantages	<ul style="list-style-type: none"> • Lacks significant firm-level information • Relies on older data (2010)
Web address	http://www.brookings.edu/metro/clean_economy/map.aspx

Lessons from Other Jurisdictions

This review of databases in other jurisdictions has provided the research team with insight into best-practice examples and ideas that can be transferred to this project. Both Canadian and international examples were consulted to obtain a broader knowledge of databases and representations of green economies. Lessons from the exercise include:

- The appropriate content of a database is dependent on the reasons it is being created and what type of agency is creating it (government, universities, etc.). The intent of the creating agency may restrict database utility, particularly where agencies opt to limit access. Making a database broader in its scope and more accessible will attract more users with a variety of intentions.
- Databases in this review tended to rely only on green practices and its multiple components (e.g. energy use, waste reduction, etc.). This restricts users from understanding the larger capacity of the green economy by omitting important information such as innovative practices, income, and other market information.
- Many projects that relied on data compiled based on interviewing companies had troubles with finding the right channel to distribute their survey and securing an adequate response rate. Coordinating this effort through industry associations should yield better results but secondary data may be necessary to supplement the data for companies that do not participate in the survey.
- The benefit for companies to participate in such a database is to be able to promote and advertise themselves on a new platform, but also to identify possible partnerships and co-operations for future projects.

- Governments can make use of such databases as it provides them with important data on future key industries. This can inform policy and formation or program distribution
- An accessible database can promote businesses or companies and their products or practices, as well as promote the whole region or country (e.g. promotion of Baden-Württemberg, Germany for its green economy efforts).
- Spatially oriented databases are particularly useful as they help identify regional gaps or strengths. This may help inform government investment as well as initiate new business opportunities from incoming firms seeking to fill a niche or contribute to an industry cluster.
- It was a rare occurrence for a database to be publicly available and have an advanced search, comprehensive data, and spatial capabilities. Furthermore, firm-level data was not always available as the intention of some databases was to convey macro-level analysis. Ensuring the database has extensive, detailed information will allow users to assess multiple aspects from the firm level to estimates of the green economy's value.
- Initiating and implementing a database is only the beginning of a project. It is important to maintain and constantly update the data as well as advertise its availability. This will make the database more relevant and appealing to a wider variety of users include public and private operatives.
- The party responsible for the maintenance of the database has to not only update the database on an ongoing basis but also keep an eye on future developments within the green economy and therefore possible additional data fields and industries. Some databases require participating firms to update their own information/register with the database, alleviating some responsibility from the host. In other cases, a database fails to stay maintained and therefore becomes inactive or outdated. This typically occurs when the database has a single purpose (e.g. informing policy).

III. Assessment of Database

Part of Phase 2 involves making recommendations that will assist the team to collect/process data, create the visualization, and maintain the database. The previous section provided an overview of other databases in Canada, the USA, and Germany to gain lessons from best-practise examples. Based on lessons learned from those findings, the following sub-sections provide detailed guidance on how to proceed with the creation of the Newfoundland and Labrador Environmental Industry Capability Database and Interactive Tool and how it may be used.

Potential Uses and Users of the Database

The Newfoundland and Labrador Environmental Industry Capability Database and Interactive Tool is envisioned as publicly available to anyone who has Internet

access and an interest in NL's green economy. Fields identified as sensitive by industry partners may be password protected and available only to the project partners or even to the participating associations themselves. ECO Canada outlines four target groups their publications/directory would benefit: professionals, employers, educators, and students.¹³ The other databases primarily targeted Government, research agencies, and the private sector. Similarly, the research team suspect the majority of users can be categorized into five groups:

Government: The Government of NL (Department of Innovation, Business, and Rural Development) has recently released 'the green roadmap' indicating a renewed interest in "fostering growth in strategic "green" sectors of the Newfoundland and Labrador economy."¹⁴ Furthermore, the Department of Natural Resources is adopting a focus on the green economy in its approach to sustainable forest management. This database would provide these and other government agencies with an overview of the capabilities of the province's green economy, regional strengths, key areas for investment, and opportunities for improvement. Access to specific firm level information could assist with targeting investments and fostering growth where it is needed.

Industry: Existing businesses in the green economy can avail of the database by identifying other firms for networking, supply chain integration, and other partnerships. Incoming businesses can use the database to determine ideal locations for their operations (i.e. fill a gap as a service provider or near to complementary firms). Industry associations can use the database to identify potential additions to their membership as well as to visualize concentrations that may benefit from partnerships/knowledge sharing.

Consumers: individuals with a concern for the environment may uphold preferential purchasing towards green products and services. This database will provide consumers with information on all firms within the green economy, including the products and services they offer. Furthermore, intended map layers include certifications and environmental initiatives so consumers can identify the businesses that uphold superior practices. The spatial component of the database will also allow consumers to identify the firms that are within their region and therefore most accessible.

Professionals: The database will provide exceptional utility to people who work in the environmental and natural resource sectors and/or are seeking related employment in NL. The database will allow professionals to identify the firms that would benefit from someone with their educational background as well as the businesses in their desired location. The database will be particularly useful to

¹³ ECO Canada. "Search Results: Publications." Accessed 21 July 2014:
<http://www.eco.ca/publications/searchResults.aspx?type=1>

¹⁴ Department of IBRD. "The Green Roadmap." Accessed 21 July 2014:
<http://www.nlgreeneconomy.ca/>

graduates who are pursuing employment in NL and have training/ experience that would benefit the environmental sector.

Scholars: Sustainable development and the green economy is a key area of research in academic institutions. Those studying the green economy in NL would benefit from the database as it will provide firm-level insights into the sector and allows for aggregate meso-level analysis (regional/provincial or industry trends). The database can be used as a means of identifying firms for applied research as well as for teaching purposes.

Current and Additional Fields

A key task of Phase 2 is describing a final set of information fields that will be used as a guide to form a survey for subsequent phases. This survey will be sent to all participating firms and industry associations to collect the data that will populate the database. Given the potential of this database to be used for multiple purposes, it is important to include information that a variety of users will deem important to the province's green economy.

The fields will be used to format the interactive map layers in the final visualization. During the initial demonstration in Phase 1, data was collected on 112 businesses (the NEIA membership) and categorized into 31 information fields. The current fields contain basic data including contact information (contacts, phone, website, location, etc.), basic firm descriptors (partnerships, association membership, number of employees, products, and age of the firm), market details, and profile/classification details (NAICS, profile, identification, Globe categories). These initial fields provide a general overview of the firms and some insight into the firm's services and market performance.

Based on research into other databases and a literature review of themes in the green economy, the research team recommends an additional 19 fields.¹⁵ These fields fall into three categories: business practices, green initiatives, and green recognitions (for a detailed list and description of all fields see appendix 1).

Business Practices: These additional fields will allow users to explore business activities in the environmental sector beyond green initiatives and to enhance understanding of the challenges faced in the green economy. Inclusion of these fields will allow firms to detail their experiences working with others and the challenges they face while operating in the green economy.

- Network/Cluster Initiatives
- Research and Development Projects
- Challenges (this field may be restricted to the research team as firms may not want this sensitive information to be publicly shared)

¹⁵ Globe Advisors: iii.

Green Initiatives: These additional fields will allow firms to provide an overview of their participation in green activities and how they fit into the environmental sector. This will provide users of the database an overview of the green practices of firms and trends throughout the province in the following areas:

- Sustainability Reporting
- Design and Construction of Buildings and Infrastructure
- Developing New Green Technologies and Practices
- Installing Green Technologies
- Marketing and Branding Green Features
- Green Economy Skills and Education
- Green Energy and Utilization
- Expanding/Diversifying Green Production
- Waste Reduction, Reuse, or Recycling
- Reducing Environmental Impact of Travelling or Touring
- Reducing Environmental Impact of Goods Transport
- Waste Production

Green Recognitions: Many firms and practices in the green economy receive recognition of their contributions or successes in environmental performance. These additional fields will provide an overview of the awards and certifications that have been given to NL firms but also create an awareness of the opportunities available to green firms.

- Grants Awarded
- Green/Environmental Certifications (see appendix 2 for a list of relevant certifications)
- Notable Awards/Recognitions

Combined, these additional fields will provide users an insight into the operations of firms in the green economy, their best practices, recognitions, but also the challenges they have faced. This represents a broad range of information that will likely attract a broad range of map users. Due to the sensitive nature of some of this information, participating businesses may request that some information be concealed from the public and therefore could be restricted to the research team.

Data Sources

An essential component of any database is superior sources of information. Based on the findings from research on databases in other jurisdictions and a review of literature and data in the green economy, data is not always readily available from secondary sources. In most cases, data had to be purchased or collected through primary methodologies (surveys, interviews, etc.). In the event a government or not-for-profit agency was involved, access to business registration tended to be more accessible than a private firm that required a fee for accessing its database. However, in all cases, firm-level data was often restricted due to privacy conditions

and was only made available if a firm consented or provided their own information. For example, ECO Canada's business directory requires firms to register and provide an overview of the company. However, due to the lack of outreach/awareness of and participation in their directory it is not representative of the Canadian green economy (i.e. only two firms are listed for NL). This is a limitation of self-registration that can be addressed in part through collaboration with industry associations.

Identification of comprehensive data sources was a difficult task for the research team largely due to the privacy restrictions associated with firm-level data. However, there are three sources of information that would offer the best results despite some limitations:

Primary Data (Survey): The best method of obtaining accurate, up-to-date firm-level data is directly from the firms that are willing to participate in the database. This effort can be coordinated through industry associations to reach firms in particular sectors of the green economy. This method will provide accurate data that can be updated in the future with the help of associations to maintain the database's relevance. However, some firms may be averse to sharing their business information or may not participate in industry associations. This will create gaps in the database that may be addressed, at least in part, with other methods. Regardless of these gaps, collection of primary data will ensure the most relevant information is housed in the database and is available with the consent of each firm. This process will require an ethics application to ensure the survey questions comply with ethical research principles.

The Canadian Environmental Resource Guide: This publication, offered by Grey House Publishing Canada, appears to be one of the most comprehensive resources surrounding information on Canada's green economy. It not only charts public and private organizations/individuals but also key events in the country related to environmental activity (e.g. conferences, trade shows, etc.). The guide is in the form of a book with listings of names, contact information, and brief descriptions of the organizations. Using this guide would be labour intensive, as research would have to transfer information from the text to the database and search for provincial actors amongst national data. Furthermore, use of the Guide requires payment of \$384 and does not include all of the suggested fields.¹⁶

Canadian Company Capabilities, Industry Canada: Industry Canada maintains a search tool on its website that allows users to search for firms by industry (using NAICS codes) or through an advanced search (location and service oriented). Firms voluntarily register with Industry Canada to create a profile for their business containing contact information, company description, product/service description, technology profile, market profile, key clients, and success stories. Ensuring the

¹⁶ Greyhouse Publishing. The Canadian Environmental Resource Guide: Fifth Edition 2013-2014. July 2013: <http://www.greyhouse.ca/environ.htm>

accuracy of this information is the responsibility of the firms and therefore may be inadequate. Industry Canada's data is publicly available and user friendly but requires knowledge of industry information and the green economy (applicable NAICS Codes, key sectors, specific firms, etc.) and does not provide a complete picture of NL green industry firms due to its voluntary nature.¹⁷

Company Websites: Many firms maintain their own website to display information about their products and services to consumers as well as contact information. This is a valuable source of information as it provides basic details about the firm and is a starting point for further inquiry. For the database, initial assessment of a firm's website may determine whether it is appropriate to include the firm in the project's database. This will be particularly useful in the event key firms are not part of any industry associations.

Dun and Bradstreet Business Database: Dun and Bradstreet is a business information firm that provides business consultations on industry, marketing, and credit. Their service includes credit checking and providing market analysis. The firm maintains a database that contains over 900 industry segments and countless firms and organizations. The database categorizes firms by North American Industry Classification System (NAICS) and Standard Industry Classification (SIC) codes. Access to this database requires an undisclosed fee and is not spatially oriented.¹⁸ This database provided the EverEco Management team with their industry information in the Waterloo region.

Provincial Government Business Register: The provincial government upholds a registry of all businesses in the province for policy and program purposes. Partnership with provincial agencies may allow insights through this database but its access is likely to be limited for confidentiality reasons.

The Newfoundland and Labrador Wood Products Business Directory: The directory is published every 2-3 years by the Department of Natural Resource to showcase the firms operating in that industry. The directory is categorized based on products and services (sawmills, stairs, caskets, etc.) and offers the firms contact information and a brief company profile. The directory provides the foundational informational information that future research (through the primary survey) will build upon. Other industries may have similar directories that can be drawn upon.

Maintenance and Updating

The success of any database is contingent on its relevance to those using it. Users are likely to disregard a database that relies on outdated information or neglects

¹⁷ Industry Canada. "Canadian Company Capabilities." Accessed 22 July 2014: <http://www.ic.gc.ca/eic/site/ccc-rec.nsf/eng/home?Open&src=mm1>

¹⁸ Dun and Bradstreet. "First Research-Industry Analysis." Accessed 14 August, 2014: http://www.dnb.ca/sales-marketing/industry-analysis-industry-trends.html#.U-zM8_ldVcs

significant information. Owners of a publicly available database assume a level of responsibility to ensure that the data is accurate and reliable, particularly if it is to remain useful for decision makers.¹⁹ The maintenance of this database must include regularly updating data and map layers, compliance with current boundaries and statistics, and monitoring of changes in the environmental sector that may change the design requirements for the database and interactive visualization tool.

Once the database is operational it must be continually monitored to ensure the data it presents is relevant. Ensuring this quality may require an agreement with participating firms that requires them to make the research team aware of any new developments in their business that should be reflected in the database. Alternatively, surveys will need to be completed at regular intervals (e.g. annually or bi-annually) in conjunction with participating industry associations.

Future funding arrangements ought to include a budget that accounts for the future maintenance and expansion of the database. This will include costs incurred by researchers collecting, compiling, and consulting the data as well as the organization creating/maintaining the visualization. It is expected that the costs of creating and maintaining this database will be outweighed by the benefits multiple stakeholders can yield from its continued use. Monitoring of the use of the interactive database tool will be essential to demonstrate this return on investment; therefore monitoring use will be an important function in the design of the tool.

Potential Partners and Consultations

A key task for Phases 1 and 2 of this project was consultation of key stakeholders within the green economy regarding potential use of the database and interactive tool and desired information. During Phase 1, NEIA and CNA presented the initial mock-up to industry stakeholders who expressed great interest in the project's continuity. Representatives from the Department of Natural Resources (CFSI), Memorial University, NEIA board members and staff, Atlantic Canada Opportunities Agency, Department of Innovation, Business, and Rural Development, and College of the North Atlantic (CNA) were in attendance. While stakeholders agreed on the project's potential, it was realized that more information would make the tool more applicable to users.

Following the completion of Phase 1, discussions continued between the project partners regarding development of the database and the design of this Phase 2 initiative. In the spring of 2014 Research Assistant Sanja Schulke travelled to Vancouver with NEIA and other parties to attend the Globe 2014 Conference and engage in dialogue with industry stakeholders including the Globe Foundation and the provincial Department of Innovation, Business, and Rural Development (IBRD) about the initiative. IBRD was a sponsor of the Globe delegation and is an additional stakeholder with interests in the province's green economy demonstrated by their

¹⁹ Basan et al. 2013: 1

release of the green roadmap and green programs. In addition to partner meetings, team members have engaged in follow-up discussions with IBRD about potential future support for the project (together with continued support and involvement from CFSI). Atlantic Canada Opportunities Agency is also a prospective partner given their investment in the Atlantic economies and emphasis on innovative approaches to business/regional development.

We have drawn from the information gained from these discussions to formulate the recommendations presented in this report, which will provide the foundation for future phases of the project. As the project matures, it will be important to gain further input from industry stakeholders and users of the database to ensure its functions represent possible inquiries and maximum benefit to the sectors involved. An initial step in Phase 3 prior to the collection of data will involve partner discussions to finalize the information fields and the survey as well as the mapping tool features. Furthermore, following the release of the visualization tool it will be valuable to further consult industry stakeholders to obtain their feedback on the tool and its current and potential uses.

As the project expands and more industries are included in the database, the research team will need to partner with other industry associations in addition to NEIA and the Lumber Producers Association.

Potential Industries for Future Inclusion

Currently there are only two industries included in the database: forest products (as listed in the NL Wood Products Business Directory) and the environmental industry (as reflected by the NEIA membership). This does not, however, adequately represent all firms in the NL green economy. As the project matures, other industries should be included to provide users with a more accurate and comprehensive representation of the province's green economy and to comply with the categories proposed by the Globe Advisors.

The following eight industries were identified as potential future partners based on Globe categories coupled with the potential to collaborate with industry associations for data collection. These additions will require partnerships with industry associations to collect data, which must then be transferred into the database and visualization tool. Further consultation will be necessary to determine the limits of the green economy regarding what industries and firms to include in the database.

Sustainable Tourism: Tourism is a growing industry in Newfoundland and Labrador and provides opportunity for individuals in multiple areas including accommodations, sightseeing, outfitting, sales, transportation, etc. There are countless opportunities for green tourism in the province that can avail of natural sites such as the national and provincial parks, and the scenic coastlines. Further,

there is a growing environmental awareness in the tourism industry as reflected by various certifications (e.g. Green Tourism Business Scheme). Data collection for the tourism industry can be done in partnership with Hospitality Newfoundland and Labrador (HNL) who advertise and facilitate the provincial tourism industry.²⁰ HNL also has a commitment to preserving and showcasing Newfoundland and Labrador's beautiful environment.

Aerospace and Defence Industry: The Globe report places significant emphasis on the role of science and technology in the green economy. Furthermore, green transportation, energy efficiency, and green knowledge were identified as key areas. The aerospace and defence industry in NL is limited but is the site of tremendous technological advancement and environmental impact reduction. A key example from this industry is Quality Matters Incorporated. This firm specializes in equipment and operational safety within the aerospace, marine, and petroleum industries offering key environmental services such as risk assessment, environmental knowledge, and loss prevention. Data collection for firms in this industry can be done in partnership with the Aerospace and Defence Industry Association of Newfoundland and Labrador (ADIANL) who represents and coordinates activity within the industry.²¹

Technology: The Globe report's emphasis on the importance of technologically advanced firms and their potential to contribute to the environmental sector. The province's technological firms operate across an array of sectors (communications, finance, etc.) and contribute heavily to the province's innovative culture. Data collection for firms in this industry can be done in partnership with the Newfoundland and Labrador Association of Technology Industries (NATI) who represent and oversee the growth and outreach of the province's technology sector.²² A key example of the NATI membership would be eSonar Incorporated, a firm that provides technological equipment and applications for underwater research. Their products and services have been used for oil and gas exploration, marine navigation, and aquaculture surveys.²³

Agriculture: The Globe report identified sustainable resource management as a key area within the province's green economy. While agricultural production does not constitute a significant portion of the province's economy it is critical for food security, renewable resources, and sustainability. Data collection for agricultural firms can be done in partnership with the Newfoundland and Labrador Federation of Agriculture (NLFA). NLFA represents all farmers in the province and unites industry specific associations (sheep farmers, dairy producers, etc.) to advocate on

²⁰ HNL. "Advocacy: Policy Priorities." Accessed 23 July 2014: <http://hnl.ca/advocacy/>

²¹ ADIANL. "Welcome To The Aerospace and Defence Industry Association of Newfoundland and Labrador" Accessed 23 July 2014: <http://www.adianl.ca/>

²² NATI. "Our Mission." Accessed 23 July 2014: <http://www.nati.net/about-us/our-mission.aspx>

²³ NATI. "NATI Member Profile: eSonar Inc." Accessed 14 August 2014: <http://www.nati.net/membership/member-directory/nati-member-profile.aspx?id=1397>

behalf of the industry, secure opportunities, and facilitate continued sustainable agricultural growth in NL.²⁴

Aquaculture: Sustainable resource management is a key area within the province's green economy given Newfoundland and Labrador's historic reliance on natural resources. Finding green alternatives to unsustainable levels of resource extraction is a vital role in the environmental sector. Aquaculture is a key industry that supports demand for seafood within the province, complementing traditional fish harvesting activity. A key green initiative within the industry is organic fish farming. Green Seafoods, for example, has received the Canadian Organic Certification for Cultivated Mussels. Data collection for firms in the aquaculture industry can be done in partnership with the Newfoundland Aquaculture Industry Association (NAIA). NAIA is committed to overseeing the growth and expansion of the commercial aquaculture industry in the province by working with firms, government, and academic institutions.²⁵

Fisheries: Inclusion of fishery enterprises in the database is essential given the province's historic reliance on the industry and the renewed emphasis on sustainable resource management. This is evident in the creation of certifications such as the Marine Stewardship Council and SeaChoice. Data collection for firms in the fishery could be completed in partnership with the NL Association of Seafood Producers and the Seafood Processors of Newfoundland and Labrador Inc. These industry association maintains an extensive membership directory and places key emphasis on sustainability of the industry.²⁶

Manufacturing: The manufacturing industry within Newfoundland and Labrador includes firms from multiple backgrounds. Data collection for firms in the manufacturing sector can be done in partnership with the Newfoundland branch of Canadian Manufacturers and Exporters (CME). CME regularly works with individual firms to improve their business practices but targeting efficiency, marketing, and general production.²⁷

Construction: The Globe report acknowledged the growing importance of Green Building in Newfoundland and Labrador, largely driven by energy efficient buildings. The Newfoundland and Labrador construction and home building industry employs thousands and generates approximately \$5 million in economic activity. Data collection can be completed in partnership with the Newfoundland and Labrador division of the Canadian Homebuilders Association. The association

²⁴ NLFA. "About the Federation." Accessed 23 July 2014: <http://www.nlfa.ca/#!about/cjg9>

²⁵ NAIA. "NAIA Online." Accessed 23 July 2014: <http://naia.ca/>

²⁶ Association of Seafood Producers. "Welcome to the association of Seafood Producers." Accessed 14 August 2014: <http://www.seafoodproducers.org/>

²⁷ CME. "The Newfoundland and Labrador Team." Accessed 23 July 2014: <http://nfl.cme-mec.ca/newfoundland/about/the-cme-nl-team.html>

upholds a directory of member firms and also fosters industry best practices such as energy efficient building and job creation.²⁸

IV. Intellectual Property

The research team determined that a Memorandum of Understanding (MOU) was necessary for this project due to the amount of data, research, and technology needed to produce a superior geo-spatial tool. This task has been completed through extensive collaboration with administrative representatives from MUN's Department of Research Grant and Contract Services. The final copy of the MOU will be completed as part of this project phase and circulated amongst the project team to ensure the protection of IP and clear understanding of each actor's role. This will ensure that intellectual property (IP) is well defined. The research team agreed that the IP can be viewed in four distinct aspects of ownership:

Ownership of the Data: Data collection will be a coordinated effort between researchers at MUN and the industry associations selected to participate in the project (and CFSI in the case of the forest sector). The industry association (initially NEIA) will issue a survey to its member firms designed by MUN researchers containing questions that relate to the fields in appendix 1. Firms willing to participate in the project and make their information available to the public can complete the survey and return it to their association executive. This data will then be used by MUN researchers, in collaboration with NEIA, to populate the central database. Because MUN researchers will be handling, and, if necessary collecting the data, the team will apply for ethics approval. Ownership of this data will technically rest with the industry association as they carried out the data collection with their member firms. The partnership of each industry association will be verified in subsequent data-sharing agreements.

Ownership of the Database: The database refers to a spreadsheet containing information on all participating firms categorized to reflect the information fields in appendix 1. MUN researchers created these fields and the overall structure of the database in collaboration with NEIA and, therefore, they are joint owners and jointly responsible for ensuring the maintenance of the database and locating a service provider to create a visualization based on the database. This joint ownership is in compliance with MUN's IP policy: "All Joint Intellectual Property shall be jointly owned by the Parties which have made an inventive contribution to such Intellectual Property" (see section 6b of the MOU). If funding cannot be secured for future phases then the database will remain with MUN and NEIA.

²⁸ Canadian Home Builders Association Newfoundland and Labrador. "Members." Accessed 14 August 2014: <http://chbanl.ca/members/>

Ownership of the Visualization: The visualization will be the product of multiple contributions from various agencies. The data will be supplied by industry associations and other potential sources noted above and the map layers/information fields will be the product of MUN researchers and NEIA. The service provider will use their software to create an interactive spatially-oriented visualization with search capabilities based on the information provided by MUN and the industry associations. Since the service provider will be given a fee for the service they are providing they will enter into a service agreement with MUN, NEIA, and any other participating industry associations stating they have no ownership of the data or the database. If an agreement with the service provider can no longer be continued the service provider will return all materials to MUN and NEIA and the project partners will identify another service provider to create and maintain the visualization.

Ownership of Subsequent Publications: The information contained in the visualization and database will be of such value it will likely lead to multiple publications related to the NL green economy. The ownership of such publications will not be influenced by the ownership of the database or visualization. Publications using this data will belong to the individuals that contribute to the creation of the written document. Any specific information that is drawn from the database or visualization must reference this research team but this project team will maintain no ownership of publications they did not write.

The project partners will enter into further agreements that will address confidentiality, intellectual property, ownership of results, utilization/storage of data, publication, liability, and sub-contracting as the project matures.

V. Conclusions and Next Steps

The Newfoundland and Labrador Environmental Industry Capability Database and Interactive Tool will be the first of its kind in the province and will offer significant insight into the function of the green economy. The 19 information fields identified in this report, in addition to those used in the Phase 1 mock-up will create a comprehensive search tool that offers a variety of uses to countless users. As this project matures and includes more firms from different industries, the database and interactive tool will become more representative of the province's green economy. This will require extensive research into firm-level data and continued collaboration among project partners to ensure the database is kept relevant and up-to-date and is used for its intended purpose of fostering growth in the province's green economy.

The recommendations and lessons learned from similar examples in other jurisdictions can guide the future phases of the project. The Newfoundland and

Labrador Environmental Industry Capability Database and Interactive Tool will reflect the objectives and comprehensive attention to data reflected in the German Competence Atlas. Furthermore, creating a visualization tool that resembles the W2E database or the Clean Economy Map at the Brookings Institute would be a superior method of representing this information compared to text-based databases. However, consulting industry stakeholders on the nature and extent of information and utility of the visual tool will be essential to maintain its quality and function.

The research team can use the recommendations of this report to inform discussions with organizations such as IBRD and other industry associations for Phase 3 of the project. If funding is secured, we recommend that Phase 3 consist of five essential tasks:

- Finalize data sharing agreements
- Survey industry organizations to gather data
- Organize the data into a central database (spreadsheet)
- Create a visual tool based on the information contained in the database
- Obtain feedback from partners and industry stakeholders on the capabilities of the database and interactive tool

Once the interactive tool is available to the public it will become imperative to maintain the relevance of its content (the data, map layers, etc.). This will require the continued collaboration of project partners with industry and the service provider.

Depending on the feedback from industry stakeholders further additions to the database may need to be considered. Furthermore, inclusion all of the industries recommended in this report will likely require work beyond Phase 3 and is therefore contingent on future project funding and partnerships. This expansion is necessary to ensure the database represents the NL green economy and meets the needs of its users.

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Appendix 1: Proposed Information Fields

Data Field	Rationale
Company Name	Descriptive Purposes
Contact	For continued database maintenance
Title	For continued database maintenance
Mailing Address	For continued database maintenance
City	Needed to place the firm in the map
Province	For continued database maintenance
Postal Code	For continued database maintenance
Other Offices in NL	Some firms may uphold multiple facilities (beyond the location of their mailing address) that can be mapped on the final GIS
Telephone	For continued database maintenance
Fax	For continued database maintenance
E-mail	For continued database maintenance
Website Address	Firm websites are key sources of information that can be used to gain more information about a firm, especially during future maintenance
Social Media Links	This will allow map users to learn more about green businesses through informal media output. Furthermore, how firms engage the public in their operations is often essential for successful networking and production.
Identification	This will allow researchers to sort organizations based on their affiliation: municipality, university, service provider, etc.
Product/Service Description	This will allow firms to provide a general overview of the products and services they offer and how they are related to the green economy
Profile	A company profile will provide map users a brief overview of each firm regarding their operation. Profiles will likely be drawn from the individual business' website to ensure adequate representation of the business
Green Economy Category	The Globe report identifies 9 categories that compose the province's green economy: green energy supply, sustainable resource management, green building, sustainable tourism, waste management and recycling, environmental protection, green knowledge and support, energy efficiency and conservation, and green transport. This will provide another method of categorizing firms.
NAICS Code	Using this industry classification, firms can be grouped to display which sectors constitute the province's green economy. Furthermore, grouping firms will allow map users to search for firms in specific industries
Environmental Products and Services Sold	This will allow map users to understand what firms in the province supply green products and services (e.g. efficient energy sources, low carbon production, etc.)
Environmental Products and Services Purchased	This will allow map users to identify firms that purchase green products and services contributing to their own

	green business efforts and providing insights into market opportunities for green suppliers.
Membership Type	This refers to the firm's membership with one or more industry associations. This will convey which industries have significant levels of green businesses and which industry associations are active within the green economy.
Network/Cluster Initiatives	This will allow firms to identify other organizations that they work with to better their green business. This will provide map users with an understanding of where regional green clusters may be located and how businesses interact.
Year Company Started	This will allow map users to better understand the age of green businesses in the context of the industry more broadly. Initiatives in support of green businesses may target firms of different ages or pair new and established firms, for example.
Year Company Started in NL	This will allow map users to better understand the age of individual firms and the green economy in NL more broadly.
Number of Employees	This will allow map users to understand the extent of the green economy in terms of employment and firm size (as measured by # of employees).
Range or Average Gross Annual Revenue	This data will provide some idea of the economic impact of the green economy and its contributions to the overall NL economy. It also provides a measure of firm size.
Domestic Markets Served	This will allow map users to understand what domestic markets (within Canada) each firm services. This also reflects the extent of domestic markets served by the green economy in NL overall.
Domestic Markets Interested In	This will allow map users to understand potential expansion of the province's green economy into new markets and other parts of the country.
International Markets Served	This will allow map users to understand what international markets (global) each firm services. This also reflects the global extent of markets services by the NL green economy.
International Markets Interested In	This will allow map users to understand potential expansion of the province's green economy into new markets across the world.
R&D Projects	This will allow firms to explain any research initiatives it has conducted. This may include product testing or market surveys. This gives map users an understanding of the research agendas the support the provinces green economy.
Partnerships for R&D	This will allow map users to understand what organizations support green businesses by participating in research activities. This is important for new organizations seeking to green their business as well as for current firms seeking new research opportunities. An important driver of innovation, this also indicates engagement of green

	economy firms in R&D.
Other Institutional Partnerships	This will allow map users to understand what organizations firms are partnering with for the purposes of networking, funding, or other initiatives. This outlines what organizations are key supporters of the green economy as well as the willingness of green businesses to partner with institutional actors.
Grants Awarded	By understanding what grants green businesses have applied for/received map users will also have a general idea of the support programs available to members in the green economy.
Green/Environmental Certifications	Does the company in question have any certifications or qualifications that support its classification as a green company? This variable will become more important to the database over time and will be of interest to green consumers wishing to use the tool in purchasing decisions.
Sustainability Reporting	Firms that participate in sustainability reporting can provide the public with a better understanding of how the firms maintains its social, economic, and environmental sustainability.
Green Initiatives	This will allow firms to provide examples of their green practices, including and beyond the services and products they provide. We envision a checklist with the items shaded in grey below with an opportunity to elaborate for each item checked.
Design and Construction of Buildings and Infrastructure	This will reflect a firm's efforts to make their facility green thus reducing energy consumption or excess waste
Developing New Green Technologies and Practices	This will allow map users to identify firms that provide green technologies and services as well as those that innovate to develop new technologies and practices.
Installing Green Technologies	This will allow map users to identify what firms use green technologies as well as the extent of green technology in the province
Marketing and Branding Green Features	This will provide map users with examples of how green practices are marketed to consumers.
Green economy Skills Training and Education	This will allow map users to visualize which firms participate in training initiatives for their employees in skills related to the green economy. This will also allow insight into the training programs that are available and specifically target green practices.
Green Energy and Utilization	This will allow map users to identify firms that employ energy efficient practices in their operations.
Expanding/Diversifying Green Production	Map users may be interested in searching for the new products that have recently been created by green businesses. This will become more important as the database matures and includes more firms with a greater variety of products.
Waste Reduction, Reuse and/or Recycling	This will allow firms to explain how they deal with waste and the values that can be yielded if it is recycled.
Reducing Environmental Impact	This will allow firms to explain their efforts towards

of Travelling and Touring	reducing the impact of activities such as travelling abroad and using vehicles
Reducing Environmental Impact of Goods Transport	This allows firms to identify their efforts to reduce the environmental impact associated with shipping/exporting products
Waste Production	Industrial waste counts for a significant portion of NL's overall landfill makeup. Having this type of information will help identify where waste is coming from and where it could potentially go.
Notable Awards/recognitions	Map users may be interested to see what awards are available to green businesses and what awards NL firms receive. This also reflects the quality of green business in the province based on set criteria.
Challenges	This will allow firms to share any challenges they have faced during their operation and may identify challenges within the green economy

Note: Developed in collaboration with Kieran Hanley, NEIA.

Appendix 2: Relevant Green Certifications

Certification schemes	Green Economy Checklist ²⁹									
	Environmental Protection	Recycling Systems	Green Energy Supply	Energy Efficiency & Conservation	Green Building & Sustainable Communities	Green Transportation	Sustainable Resource Harvesting	Sustainable Tourism	Green Knowledge & Support	Corporate Environmental Responsibility
Animal Welfare Approved							✓	✓		
Audubon International	✓									✓
B Corporation										✓
Bio Quebec							✓	✓		
Bio Suisse							✓	✓		
Bird Friendly Coffee							✓	✓		
Blue Flag								✓		
bluesign® standard										✓
BOMA Go Green - BOMA BEST					✓					
BREEAM					✓					
British Columbia Certified Organic							✓	✓		
Built Green					✓					
C.A.F.E. Practices							✓			
California Certified Organic Farmers - CCOF							✓	✓		
Canada Organic							✓	✓		
Canadian Certified Environmental Professional									✓	
CarbonFree® Certified	✓									
Carbon Reduction Label	✓									
Certified Envirodesc					✓					

²⁹ When certifications apply to businesses in general or if they apply to a broad variety of produced products ticks will appear in the column of Environmental Protection and Corporate Responsibility.

Certified Green Restaurant®							✓		
Certified Naturally Grown						✓			
Cleaner and Greener Certification	✓								✓
Cleaning Industry Management Standard (CIMS)									✓
Clean Marine Green Leaf Eco-Rating Program						✓	✓ 30		✓
Climate Registered	✓								
Compostability Mark of European Bioplastics									
Compostable: Biodegradable Products Institute Label									
CSA Energy Efficiency									
CSA Sustainability									
CSA Sustainable Forest Management						✓			
Degree of Green®	✓					✓			
Design for the Environment (DFE)						✓			
DIN-Geprüft	✓								✓
Dolphin Safe / Dolphin Friendly						✓			
EarthCheck							✓		
EarthRight Business Certification									✓
Earthsure	✓								✓
Ecocert						✓			
EcoLogo									✓
EnerGuide for Appliances				✓					
EnerGuide Rating System (New Homes)				✓					
ENERGY STAR: Canada				✓					
Environmentally Preferable Product (EPP) Downstream						✓			
EPEAT				✓					✓

³⁰ If the Marine industry is involved in the tourism industry

e-Stewards Certification		✓								
EU Ecolabel										✓
Fairtrade							✓	✓		✓
FairWild							✓			✓
Food Alliance Certified							✓	✓		
Forest Stewardship Council (FSC) Chain of Custody Certification							✓			
Forest Stewardship Council® (FSC) Forest Management Certification							✓			
GEO Certified								✓		✓
GEV-Emicode					✓					
Global Organic Textile Standard	✓									✓
Green Business Bureau										✓
Green Business League Certification	✓									✓
GreenCircle	✓			✓	✓	✓	✓			✓
Green-e Climate	✓									
Green-e Energy			✓							
Green-e Marketplace			✓							
Green Globes					✓					
GREENGUARD					✓					
Green Key Eco-Rating Program								✓		
Greenlist – SC Johnson										✓
Green Office Champions: Seal of Good Practice										✓
Green Products Standard										✓
Green Seal	✓									✓
GreenSure - Sherwin Williams	✓									✓
Green Table								✓		
Green Tourism Business Scheme								✓		
HAND IN HAND										✓

Home Depot Eco Options	✓									
ISO 14000 series										
ICMA EcoLabel Standard Program	✓									✓
Leadership in Energy and Environmental Design										
Label STEP										✓
LEAF							✓			
Leaping Bunny										✓
level				✓						
LFP Certified							✓			
Marine Stewardship Council						✓				
Natrue-Label										✓
Naturally Sephora										
Non-GMO										✓
Ocean Wise							✓			
Oregon Tilth							✓			
Passivhaus			✓	✓						
Processed Chlorine Free	✓									✓
Programme for the Endorsement of Forest Certification (PEFC) schemes						✓				
R-2000 Certificate				✓						
Rainforest Alliance Certified						✓				
RSPO Certified Sustainable Palm Oil							✓			✓
SCS FloorScore®				✓						
SCS Recycled Content		✓								
SeaChoice						✓				
SFC Member Seal				✓						
SMaRT Consensus Sustainable Product Standards				✓						
SPCA Certified						✓				

STARS									✓	
Sustainable Agricultural Network								✓		
Sustainable Forestry Initiative (SFI)							✓			
Sustainable Green Printing Partnership	✓									✓
TCO Certified										✓
TerraCycle		✓								
Totally Chlorine Free	✓									✓
UL Energy Efficiency Verified				✓						
UPS Carbon Neutral										✓
VeriFlora										
Whole Trade™ Guarantee								✓		✓
WQA Gold Seal	✓									✓