February 16, 2022

Ms. Jane Lazorchak
Vermont Agency of Natural Resources
103 South Main St.,
1 South Commissioners Office
Waterbury, VT 05671-0401
(802) 505-0561

RE: Request for Information dated February 1, 2022

Dear Ms. Lazorchak,

Per the Request for Information released by the Vermont Department of Environmental Conservation on February 1, 2022, Co2Action LLC is providing information in response to the issued Statement of Need.

Request for Information	Seeking Availability of Environmental Consultants with Expertise in analysis of Lifecycle Greenhouse Gas (GHG) Emissions from Energy Use for the State of Vermont
Name of Firm	Co2Action, LLC
Address and Telephone Number of Firm	201 S. Heights Blvd. #1713 Houston, Texas 77007 (832) 983 7052
Single Point of Contact and Email Address	Jacob Chu Jchu@co2action.us
Date of Submission	February 16, 2022

Should you have any questions, please do not hesitate to reach out.

Thanks,

Jacob Chu
VP of Sustainability Solutions

Response to Statement of Need

The questions listed in the Statement of Need issued on February 1, 2022 can be found below with responses provided for each.

1. Please detail your qualifications and experience with conducting lifecycle GHG emissions analyses for national or sub-national jurisdictions.

   Co2Action is comprised of individuals with backgrounds in Geophysics, Environmental Engineering, and Geology, who have spent most of their careers working for global corporations in the sustainability and energy fields.

   Our primary business is providing consulting services related to lifecycle GHG emission calculation for small to medium enterprises, but we have deep experience from working in the private sector, managing environmental data for Federal and State reporting under Title V, GHGRP, RCRA, and other programs.

2. Please define and explain the term “lifecycle” and “upstream” for purposes of a GHG emissions analysis.

   A “lifecycle” greenhouse gas emissions analysis would identify, calculate, and assess the emissions associated with a given frame (i.e., product, object, region) from cradle to grave. This analysis would require qualitative review when setting scope boundaries appropriately and would require quantitative analysis of available data to identify total quantities of Greenhouse Gas emissions.

   “Upstream” greenhouse gas emissions are those that are associated with a given frame (i.e., product, object, region), but occur prior to the processes being reviewed by the reporting entity. As an example – upstream emissions resulting from fuel combustion incorporate the emissions associated with the production, processing, and transportation of those fuels prior to their end use within the State.

   “Downstream” greenhouse gas emissions are also vital in understanding the lifecycle emissions of a given frame. These emissions occur after the processes being reviewed by the reporting entity. As an example, forestry products such as firewood may be combusted by the end user in another state, causing emissions not directly related to Vermont.

   The largest source of emissions in Vermont is associated with the combustion of fossil fuels. Viewing the State of Vermont as the frame, a lifecycle analysis would need to account for emissions along the value chain of a petroleum product. For this example, the chart on the next page provides a visual to assist in understanding the concepts of “Lifecycle”, “Upstream”, and “Downstream” emissions.

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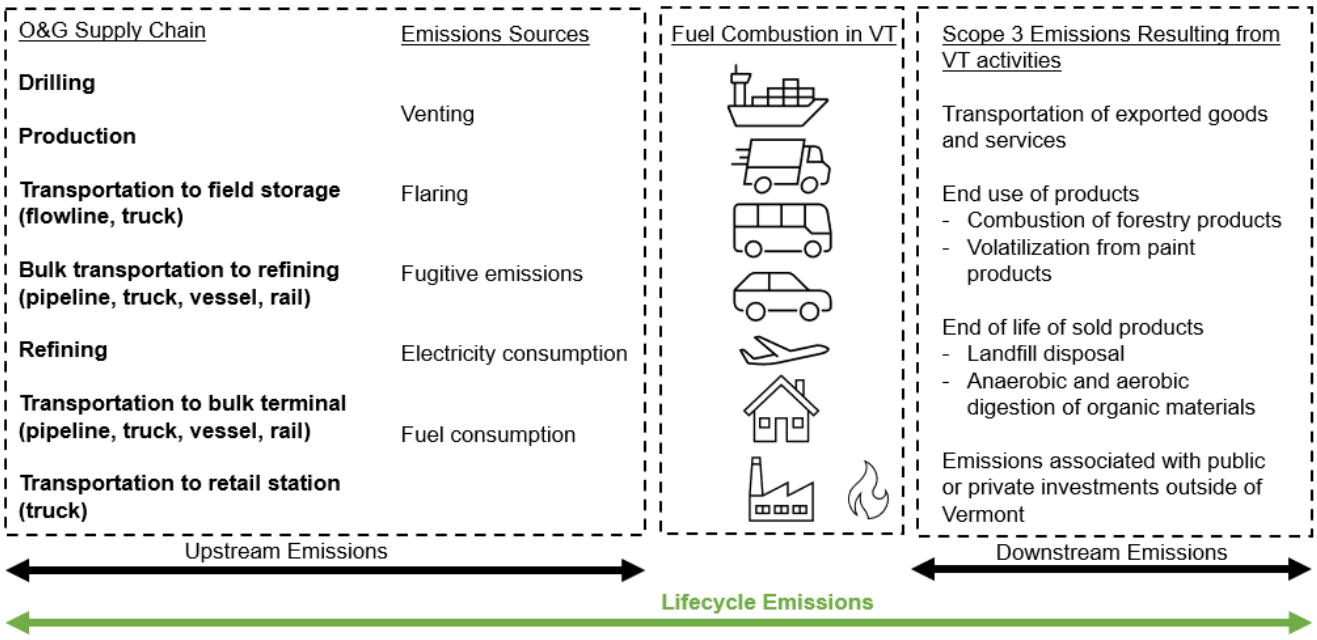

3. Based upon your definition of "lifecycle" and "upstream" in (2), do you foresee any issues in focusing on either lifecycle or upstream emissions solely related to Vermont's energy supply (including but not limited to electricity including renewable, hydro, solar, wind and nuclear generation; liquid fuels for transportation and heating including biofuels, gaseous fuels including renewable fuels, and solid fuels including wood) versus a more comprehensive consumption based or lifecycle analysis of the energy emissions impact of goods and services?

   As a small consumer of both electricity and petroleum products, Vermont is in a unique position among US States in that specific accounting for the energy supply chain for the entire state can likely be conducted with relative ease, but data availability will limit the depth at which a review may be conducted for both lifecycle and upstream assessments.

   A precursory review of VT's existing GHG Emissions Inventories suggests that the State does not have sufficient access to data from the State's largest emitters, and therefore does not have a quantitative baseline with which it can track its Net Zero aspirations.

   Without data from reporters and a more in-depth analysis of upstream and downstream emissions from sources within Vermont, the current Climate Action Plan and GHG inventory fails to appropriately address lifecycle emissions resulting from activities in the State.

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Without legislation requiring appropriate data reporting in the GHG space, Vermont's goals to go Net Zero by 2050 can at most be considered a qualitative target that does not appropriately address lifecycle emissions incorporative of Scope 3 emissions.

To appropriately account for lifecycle and upstream emissions, the State should conduct another review of its GHG Inventory methodology and conduct additional reviews. Below are some recommendations should Vermont seek to bolster its net zero aspirations:

- GHG Accounting should be conducted in line with the standards provided by Greenhouse Gas Protocol. Emissions should be categorized as Scope 1 (Direct emissions), Scope 2 (Indirect emissions from supplied utilities), and Scope 3 emissions (indirect emissions associated with Vermont activities)

- Lifecycle Review of petroleum products being consumed in VT. The current GHG Inventories account for direct combustion of these fuels, but do not account for their supply chain emissions. Depending on where the raw materials are extracted for fuels imported into the State, the Scope 3 (supply chain) emissions may be significantly larger.

- A Carbon Sink Study for Vermont forests may be conducted with experts in vegetative sequestration to ensure that carbon emissions from logging activities do not outweigh the sinks in non-commercial forests within the state. The current GHG Inventory relies heavily on National survey data, and does not appear to include state-level data from the VT Department of Forests.

- Legislative Action for Emitters should be considered to require the largest emitters in the State to report their Scope 1, 2, and 3 emissions for activities related to the State of Vermont. Flat rate carbon taxation should be considered for purposes of incentivizing carbon reduction initiatives in industrial emitters. As Act 153 is written, it depends on the State to decarbonize its electricity, but does not propose methods to reduce industrial emissions.

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4. Please identify any other states, provinces, or nations that have undertaken a similar jurisdiction-wide energy-related lifecycle or upstream GHG emissions analysis that might serve as a useful guide to Vermont's efforts.

Vancouver, Canada: Climate Emergency Action Plan.

The city of Vancouver is trying to cut 50% of its emissions by 2030, after the baseline from 2007; reduce its dependence on fossil fuels; keep energy affordable in the long term; and achieve 100% of its energy needs from renewable sources before 2050. To achieve those goals, the city is working on different initiatives:

- Zero emission buildings: The plan establishes specific targets and actions to achieve zero emissions in all new buildings by 2030.
- Neighborhood Energy Strategy: Neighborhood renewable energy systems supply centralized heating, hot water, and sometimes cooling for multiple buildings. These systems use low-carbon renewable energy sources, to reduce the use of fossil fuels.
- Transportation 2040 Plan: The plan provides a vision for how people and goods move in and around Vancouver for the next years.
- Electric vehicles: The city is supporting people and businesses in Vancouver to use electric vehicles, by accelerating the expansion of the public EV charging network and adding incentives to accelerate the transition to EVs.

Uppsala, Sweden: Environment and Climate Programme.

The city of Uppsala is aiming to be fossil fuel free by 2030 with renewable energy, and climate positive by 2050.

Paris, France: Climate Action Plan

The city of Paris is aiming to become the greenest city in Europe, by adopting several measures, such as the creation of around 900 miles of bike lanes across the city; the banning of all diesel cars from 2024, and all petrol cars by 2023; the implementation of car-free areas; the planting of four new urban forests; the planting of more than 170,000 trees across the capital by 2026, with 50 percent of the city covered by planted areas by 2030; and the creation of new pedestrian and green areas.

London, United Kingdom: 1.5C Compatible Plan

The city of London has a 1.5C compatible plan that focuses on power decentralization, electrification of natural gas systems, and introduction of a hydrogen network in lieu of natural gas.

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5. Please provide a list of recommended software, datasets, methodologies, protocols, etc. that would be required to perform a lifecycle or upstream GHG emissions analysis for Vermont.

Protocols/methodologies:
- GHG Protocol for Cities
- Science-Based Targets Net Zero Standard
- ISO 37122:2019 Sustainable cities and communities – Indicators for smart cities
- ISO 14040:2006 Environmental management – Life cycle assessment – Principles and framework.

Software providers:
- ClimateView
- Sphera
- UL 360
- Workiva
- Eco-OS
- Persefoni

Datasets:
- Carbon Disclosure Project Cities and Regions Data www.data.cdp.net
- USDA Forest Inventory and Analysis (FIA) Program https://fpr.vermont.gov/forest-inventory-and-analysis-fia

6. Are there other software, datasets, methodologies, protocols available? If so, please describe the rationale for your recommended selections.

GreenClimateCities initiative: The International Council for Local Environmental Initiatives, ICLEI, is a global network of local governments that has developed standards, tools, and programs to reduce greenhouse gas emissions, improve lives and livelihoods, and protect natural resources in the communities. The mission of ICLEI is to achieve measurable progress towards more economically, socially, and environmentally sustainable forms of development and management.

Naturvation Project: Nature-based urban innovation, NATURVATION, is a project funded by the European Commission and involving 14 institutions across Europe in the fields of urban development, geography, innovation studies and economics. The project seeks to develop the understanding of what nature-based solutions can achieve in cities. Nowadays, 6 European cities are involved in NATURVATION, but the group is aiming to develop new studies across the world and include as many cities as possible. The city of Boston, MA, is already on its way to be a part of the initiative.

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7. Would any of the components you recommend require specialized training of staff, purchase of software licensing or subscriptions, purchase of specialized hardware, an ongoing need for consultant services, etc.? If so, please elaborate.

   To understand an appropriate methodology to approach VT's carbon targets with, we recommend the Greenhouse Gas Protocol. Without specialized training, VTANR staff may be able to learn sufficiently by reading the resources provided. Co2Action can assist the VTANR in increasing its organizational capability in the climate space, should such services be required.

   Beyond GHG protocol, all recommended software requires licensing or subscription fees. Should VT seek to manage data within State servers, the VTANR may choose to collaborate with other States that may have existing data structures for guidance.

   Should more specific geographic or temporal modeling be required, the State may seek out a consultancy that specializes in air and climate modeling.

8. Please describe the tasks and estimate the anticipated number of person hours required to produce a lifecycle or upstream analysis for a single calendar year, and whether a similar level of effort would be required annually in future years to compile a comparable analysis.

   Each task of analysis below is intended to identify relevant data, emission factors, and calculation methodologies so that a GHG Protocol internal to the State of Vermont may be developed. This protocol will serve as a guidance for future emission calculations and will dictate where data is sourced and how emissions are calculated. *

   - Vermont GHG Protocol Development & GHG Inventory Data Reclassification (120 hours + consultant time)
     - Begin developing a VT GHG Protocol that appropriately categorizes emissions according to the standards defined by The GHG Protocol.
     - Categorize all emission sources as Scope 1, Scope 2, or Scope 3 emissions.
     - Determine how to include assets shared between states or other entities (equity or operational)

   - Lifecycle Assessment Research (40 hours)
     - Identify data used in existing VT GHG inventories, identify whether any analysis is completed on a lifecycle bases
     - Review the methodology used to calculate Scope 2 (indirect from supplied utilities) emissions, identify if USEPA best practices are being utilized
     - Identify studies and public data that would support a lifecycle assessment of energy consumption emissions specific to Vermont or the Northeastern US
     - Identify data sources and emission factors required for conducting future calculations

- Industry GHG Emissions Gap Analysis (60 hours)
    - Review methodologies currently used in VT to track GHG emissions from industry (manufacturing, heavy industries, waste management, etc.), identify opportunities for improvement
    - Cross reference data from the EPA GHGRP for emitters in VT, identify whether these direct combustion emissions are accounted for in the existing GHG inventories (As of 2/14/2022, 11 facilities reported emissions of 436,000+ metric tons of GHGs in 2020)
    - Identify data sources and emission factors required for conducting future calculations

- Carbon Sink Study (40 hours + consultant/expert time)
    - Work with state experts (regulatory, research) to review previously used methodologies for estimated carbon emission sinks in Vermont, primarily associated with forestry. Ensure that prior inventories accounted for logging activities and the associated loss of sequestered carbon with each felled tree.
    - Identify data sources and emission factors required for conducting future calculations

- Data Management Framework Development (100 hours + consultant time)
    - Meet with software providers and/or other State agencies to identify a GHG data management software provider
    - Work with software provider to set up ecosystem for calculating emissions
    - Categorize emissions by sector and scope (1, 2, or 3)
    - Develop key dashboards to visualize trends in data

- Data Entry and Validation (40 hours + consultant time)
    - Enter data and source citations into emissions calculation software
    - Conduct QA/QC on deviations of more than 10% year over year

- Recurring Analyses on Annual Basis (80 hours + consultant time)
    - Review data sources for new emission points in VT
    - Collect and enter data and source citations into calculation software
    - Conduct QA/QC on deviations of more than 10% year over year

- Retroactive Data Analysis (240 hours + consultant time)
    - Conduct a retroactive analysis factoring in new lifecycle-based methodologies for each year in which GHG data was collected to ensure that trend review can be conducted with equivalent methodologies.

9. Do data of sufficient detail exist to describe the diverse and variable nature of Vermont's energy imports with reasonable accuracy for a given year?

This response will focus on the primary emitter categories for VT – electricity and fuel combustion. Data is available in sufficient detail, but will require cross-agency coordination, as well as voluntary participation from industry representatives. Without regulatory drivers, Vermont would likely be challenged to acquire much of the information below on a voluntary basis. Based on my experience in industry, requests for voluntary disclosure of environmental data are generally ignored based on legal guidance that agencies do not have the statutory authority to require companies to respond to such requests.

Below are some suggestions on potential leads for finding sufficient data. Though significantly more difficult, Vermont may be able to pass additional legislation to encourage data disclosure.

Electricity Imports

GHG emissions can quickly be calculated with EPA data on the EPA eGRID New England (NEWE) subregion. A more thorough approach would be to acquire electricity import data from electricity providers and regulators within the State. Based on their agreements with baseload and excess power providers, emissions can be estimated by identifying the powerplant types feeding electricity into VT.

Petroleum Products (Fuel, Heating Oil)

Direct Combustion

Total volumes of petroleum products sold in the State should be accessible through the Vermont Agency of Administration's Department of Taxes.

Total vehicle miles traveled can be estimated by the Vermont Agency of Transportation.

Supply Chain

To better understand supply chain emissions associated with these fuels, it may be relevant to conduct a voluntary survey with petroleum businesses within VT. As a company with experience in integrated oil & gas, we can provide the perspective that:

- Each fuel retail station knows which fuel terminal their products are sourced from (of which there is one in VT, and less than 20 supplying the state).
- Each fuel terminal can identify where they are receiving goods from based on USDOT shipping papers if by Rail or Vessel, or by identifying the pipeline from which fuel was delivered.
- By observing from what region, the refined products originated, it can then generally be inferred where raw materials were sourced from. This is because most refineries are designed to process a specific type of crude oil. Many

refineries along the Gulf of Mexico source Venezuelan crude, while those along the West Coast may import from the Middle East.

- Understanding the region from which oil was sourced can imply what method was used to extract the raw materials (i.e., conventional production, horizontal production, steam flooding, etc.)
- A comprehensive review of the data above could support a study that provides a better estimated lifecycle emissions rate from fuels consumption in VT.

10. Please identify the time lags in the availability of the underlying data for a lifecycle or upstream GHG emissions analysis (e.g., when would sufficient data to conduct an analysis for calendar year 2021 become available and is this later than data availability for the current inventory approach?).

    Data from the Energy Information Administration (EIA) appears to lag by timescales from months to years. A precursory search of vehicle fuel sales shows lag times of around 3-4 months, while data on fuel oil sales appears to lag around 1-2 years. As this follows a similar approach to prior studies, a 2021 inventory may not be completed until 2023.

    Faster approaches may be available to Vermont if the VT Department of Taxes maintains timely and accurate data.

11. Please describe any methodological challenges, limitations, data gaps, etc. that are likely to be encountered during the preparation of a statewide lifecycle GHG analysis related to energy use. In addition, please state your opinion regarding the feasibility and usefulness of conducting a comparable analysis for historical years, including the baseline years 2005 and 1990.

    Due to the empirical nature of conducting GHG emission calculations, one of the most important aspects of conducting GHG studies is to ensure that methodologies, emission factors, data sources are consistently implemented to identify trends.

    As prior studies conducted by VT do not address upstream, downstream, or lifecycle emissions, the State must decide whether to keep a consistent methodology with past reports, or to conduct a new study and retroactively find data.

    Given the data gaps in prior reports, the latter methodology is recommended. A revamp of the methodology will allow the inventory to meet internationally recognized standards (i.e., GHG Protocol). Retroactive application of a lifecycle analysis may be more difficult, but scientific journal articles detailing LCAs of energy may be able to fill data gaps.

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12. Please describe if / how this analysis might inform or interact with Vermont's existing annual statewide GHG emissions inventory.

    As mentioned in prior responses, the existing GHG emissions inventory should include more detailed data and should account for lifecycle emissions. Much of the existing methodology can be expanded upon by accounting for associated Scope 3 emissions.

13. Do you have recommendations that would maximize the usefulness of this analysis to policymakers? Specifically: what aspects or components should be included or excluded in the analysis to facilitate effective prioritization and development of GHG emissions reduction actions. Should this analysis be periodically repeatable, and if so on what periodic basis should the analysis be conducted?

    Though climate legislation is always introduced with positive intent, it is often done without consulting experts in climate science. This results in legislation and regulation that may not help a given government achieve their goals.

    As a small consumer of electricity and petroleum products, Vermont may not have as much common knowledge of energy systems in the US, which requires that such an analysis define key terms consistent with GHG Protocol and other International agreements on climate.

    The most pertinent piece for policy makers will be describing the concepts of lifecycle emissions (as well as upstream and downstream emissions). Building this understanding will help policy makers more effectively implement new regulations and/or policies to drive Vermont toward its climate aspirations.

    An effective analysis should be conducted on an annual basis to best identify data trends that indicate whether the State is on target to reach its goals. With an appropriate framework for this reporting, an annual analysis of GHG emissions in the state would not require significant additional resources.

14. Please provide any additional relevant information you believe is key to conducting this analysis.

    As referenced in response number 8, an initial analysis will require more effort to define the framework for future reporting. Once an effective framework is developed, the State will be able to conduct annual analyses with ease.

    Regarding organizational capability within the VT Department of Environmental Conservation, I strongly recommend that the Department leverage the knowledge of more junior employees for this analysis, as they tend to have a more robust and modern background in climate science than more senior employees.

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15. Please indicate your availability and capacity to provide assistance to the ANR over the time period of XXXX to YYYY

    Co2Action LLC is available to assist the Vermont Agency of Natural Resources in professional consulting services pertaining to GHG accounting, legislative advising, etc. to help the State of Vermont meet its carbon reduction goals.

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