State of Vermont Seeking Expertise in Lifecycle Greenhouse Gas Emissions from Energy Use

Response to Request for Information (RFI)

March 4, 2022

Submitted to:
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Submitted by:
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9300 Lee Highway
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March 4, 2022

Jane Lazorchak
State of Vermont
Department of Environmental Conservation

Subject: Response to RFI – Seeking Availability of Environmental Consultants with Expertise in analysis of Lifecycle Greenhouse Gas (GHG) Emissions from Energy Use

Dear Jane Lazorchak:

ICF is pleased to submit our response to the Request for Information (RFI) from the State of Vermont, Agency of Natural Resources (ANR) relating to the Vermont Lifecycle Analysis of GHG emissions from energy use for the State of Vermont. This RFI response provides considerations from ICF about the services that are described by the Agency and State to perform a Lifecycle Analysis of GHG Emissions Related to the Energy Supply and Usage in the State of Vermont.

ICF Incorporated, L.L.C. (an ICF company hereafter referred to as ICF) is a global consulting and technology services provider with more than 7,500 professionals focused on making big things possible for our clients. Our climate experts have conducted hundreds of public sector climate and energy action planning projects, and GHG inventories for the states of Delaware, Oregon, Pennsylvania, and New York. ICF combines decades of experience working on various aspects of climate change with solutions for evaluating life-cycle-related impacts. Our team includes staff with extensive life-cycle inventory (LCI) experience, particularly as it relates to material choices, energy use, transportation, emerging technologies, and the impact of waste disposal decisions on GHG emissions and energy consumption. As an international firm, we bring expertise in climate change emission inventory, mitigation, adaptation, and resilience as well as best practices from other states. And because we work for a wide range of government, industry, and NGO clients, we can maintain an independent, rigorous data-driven approach that will help ANR navigate competing interests.

For these reasons, and our technical working knowledge on GHG emissions accounting for a wide variety of analyses, we are well prepared to help ANR meet its challenges in completing an energy centric LCA analysis for the State of Vermont. Please contact Ajo Rabemiarisoa for any technical questions at (703) 677-3083 or Ajo.Rabemiarisoa@icf.com for contractual questions please contact Ken Pujdowski at (703) 225-5824 or Ken.Pujdowski@icf.com.

Sincerely,
ken pujdowski
Ken Pujdowski
Associate Manager, Contracts

Cc: Deb Harris
Senior Director, Climate Planning

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BACKGROUND

The State of Vermont, Agency of Natural Resources (ANR) has issued a Request for Information (RFI) to gather input and obtain information for ANR about the services needed and related considerations for ANR to better understand the value of performing a supplemental analysis of lifecycle emissions related to energy use for the State, and its role in future updates of the State's Climate Action Plan (CAP).

As a company that has helped numerous state and local governments develop their climate action plans, and build estimates for scope 3 emissions, ICF appreciates the Agency's questioning regarding building an energy focused LCA analysis for the State of Vermont. We appreciate the desire to approach life cycle assessments proactively as it relates to Vermont's multi-sector statewide energy usage.

ICF's response to this RFI is grounded in our experience working with state, local governments, and private energy companies that vary widely in their:

- Emissions inventories, including sources and sinks, from a narrow focus on the energy sector to economy-wide;
- Policy and regulatory environments, from the most progressive jurisdictions to those with more moderate agendas;
- Stakeholder ecosystems and engagement processes;
- Lifecycle assessments and analysis boundaries and considerations;
- Plan scope ambitions, including sectoral coverage, binding vs. aspirational provisions, co-benefits, readiness for implementation, and timeframes; and
- Emissions reduction ambitions, including carbon neutrality goals.

We believe the breadth of our experience, coupled with the depth of our sectoral and analytical expertise, make ICF a very strong partner for ANR in navigating the challenges in this project.

RESPONSES TO QUESTIONNAIRE

1. Qualifications and experience with conducting lifecycle GHG emissions analyses

ICF offers an outstanding group of professionals with expertise in using life-cycle assessment (LCA) as a tool to evaluate alternative production, packaging, and waste management strategies. Our team includes staff with extensive life cycle inventory (LCI) experience, particularly as it relates to GHG emissions, energy use, transportation, and the impact of waste disposal decisions on emission levels and energy consumption. We also draw upon a broader group of affiliated experts in ICF's groups focused on fuels, transportation, buildings, environmental impact analysis, and climate change impacts and adaptation.

ICF has been building lifecycle GHG emissions analyses for multiple national assessments, through our work with federal U.S. agencies, and by developing data-centric lifecycle GHG analyses for a wide diversity of clients, including the development of specific pathways for submission to California Air Resources Board under its Low Carbon Fuel Standard (LCFS) program.

Below are two examples of ICF's contribution to national level LCA assessments[1].

Assessment of Life-Cycle GHG Impacts from the U.S. Renewable Fuels
For the Environmental Protection Agency's Office of Transportation and Air Quality, ICF evaluated the life cycle GHG impacts of the U.S. Renewable Fuel Standard (RFS) due to resulting changes in global agricultural land use. ICF estimated emissions from increased fertilizer application, agricultural energy use, and rice cultivation due to projected changes in crop production and land use through 2022 for all major countries. For this effort, ICF compiled and assessed data from a wide variety of international agricultural and energy datasets, and estimated GHG emissions using IPCC methodologies.

U.S. EPA Life-cycle GHG emission factor development to inform materials management
Since 1993, ICF has provided analytical support for the U.S. Environmental Protection Agency's (EPA) Climate Change and Waste program, which seeks to reduce GHG emissions by stimulating source reduction, recycling, composting, and energy recovery. For this program, ICF develops and applies life-cycle emission factors to quantify the GHG impacts of alternative waste management practices for a broad range of material types. These factors populate the Waste Reduction Model (WARM), Recycled Content (ReCon) Tool, and iWARM, available online on EPA's Climate Change website. These emission factors are widely recognized as the leading analytical tool for assessing life-cycle GHG impacts of waste management practices and have been applied in both the public and private sectors (e.g., Wal-Mart Sustainability Scorecard).

A limited number of states have started to integrate the concept of LCA in their GHG emissions analyses, however ICF believes that integrating this concept is a proactive way to paint a more complete picture of the GHG emissions at the state level, and further develop state GHGs mitigation ambitions and targets.

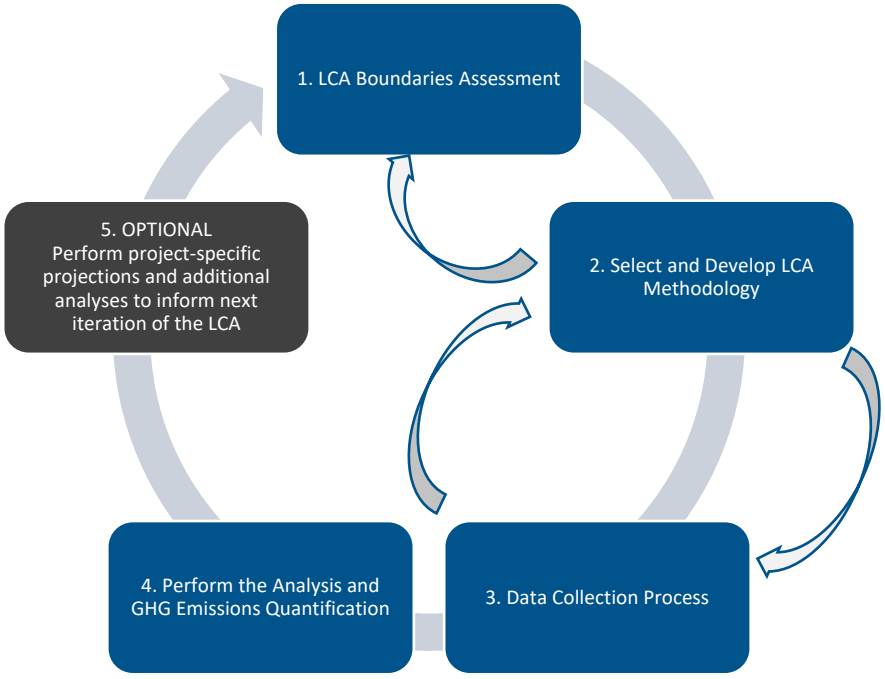
ICF believes that through our work helping federal agencies build LCA analyses, and a variety of Clients understand their product- or project-specific lifecycle GHG emissions, we are well positioned to help the State of Vermont build their initial energy-focused analysis of lifecycle emissions. Our

[1] Please refer to Appendix A for additional project descriptions

experience has taught us that the Life Cycle Assessment Analysis process varies widely from one project to another, depending on the project needs and its objective for the assessment. In this optic, ICF can help guide Vermont into the different steps required to establish a comprehensive LCA analysis that will be objective-specific and valuable to the State and its future GHG inventory and mitigation strategies' analyses.

To do so, ICF can help the State analyze their GHG emissions of energy use by going through the following high-level steps:

Figure 1: Illustration of the High-Level Steps Required to build a LCA



As illustrated by the arrows with a blue outline, the LCA process is most likely going to be an iterative one, as progress in steps 2 and 3 may imply modifications to upstream steps. ICF understand the intricacies of building a comprehensive LCA and tailoring the first 3 steps illustrated in Figure 1, to best address the needs of the specific analysis.

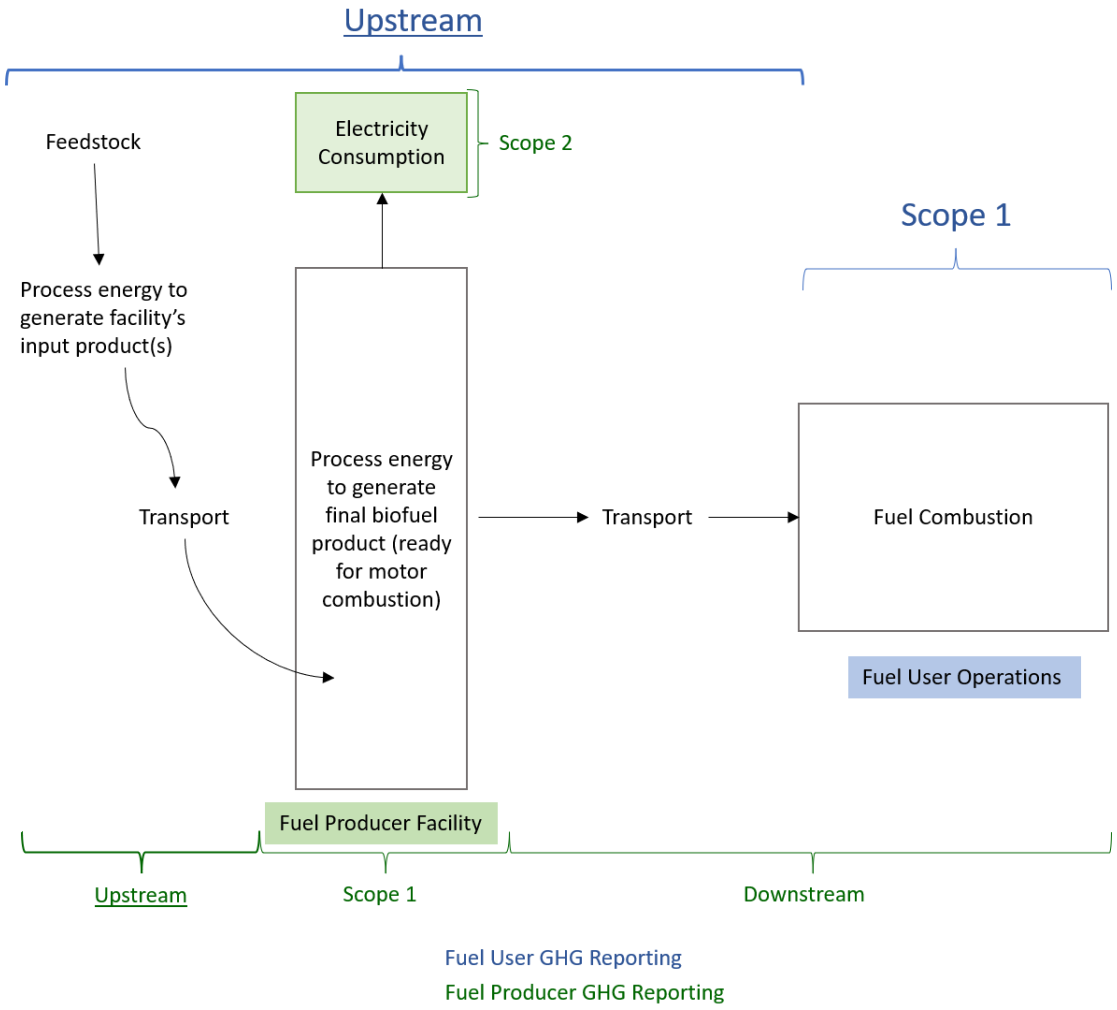
2. GHG emissions "lifecycle" versus "upstream" analysis

In the context of building a GHG emissions analysis, the term "lifecycle" captures all activities and operations occurring from resource extraction through end-of-life of the unit of the analysis (material, product, fuel , service, etc.). For example, a lifecycle analysis of a liquid fuel such as gasoline should capture all activities and operations from the crude oil sourcing and extraction phase, the production (refining operations) and distribution phase, the use phase (fuel combustion), and all transportation activities between the different phases. A lifecycle is also often referred to as a cradle-to-grave analysis.

In the same context, "upstream" refers to all activities and operations that are part of the lifecycle of the subject or unit of the analysis, and that occur prior to a specific phase in the lifecycle (often the Production phase or the Use phase). Thus, upstream activities are more often than not a subset of the lifecycle activities and vary depending on the perspective of who is performing the analysis. For

example, the "upstream" activities will vary between a fuel producer and a fuel user, when looking at the same fuel's LCA. This difference is illustrated in Figure 2 below.

Figure 2: Illustration of Differences in Upstream Boundaries, between two parties analyzing the same biofuel LCA



As Illustrated, focusing on "upstream" emissions can limit the picture of the analysis, as this can exclude multiple activities of interest in a full lifecycle. For example, in the LCA activities illustrated in Figure 1, upstream reporting for the fuel producer will exclude all of the following activities:

- Emissions associated with the energy use to process and refine the final fuel (ready for motor combustion)
- Emissions associated with the distribution and transportation of the final fuel to the retailer (gas station)
- Emissions associated with the use of the fuel

Additionally, when looking at product lifecycle analysis will also include end-of-life activities and operations, which are almost systematically excluded from "upstream" considerations. These end-of-life considerations can include:

- Emissions associated with the dismantling of the equipment and related materials
- Emissions associated with the transportation of the material/equipment to the disposal site
- Emissions associated with the energy use and disposal process for the end-of-life of the product or material/equipment

In the context of building a Vermont energy supply LCA for the State of Vermont we recommend considering emissions across all lifecycle phases, with the understanding that the Vermont GHG inventory will play a part in quantifying the use phase GHG emissions. Evaluating emissions across the lifecycle can provide valuable insights on emissions from the different energy sources at different phases of the lifecycle; the analysis can also be broken down further to focus on upstream emissions.

3. Vermont's energy supply versus comprehensive energy impact of goods and services

Building a LCA of the energy emissions impact of goods and services, sold or consumed in Vermont would require additional discussions and a potential stakeholder engagement process to help inform the boundaries setting of the analysis. However, breaking down the energy LCA to be consistent with the Vermont GHG Inventory sectors has value, as it will help the State integrate this effort into their future inventory work and GHG mitigation strategies, and also build consistency around its climate communications.

To do so, ICF can help the State frame the LCA based around the sectorial activities of the Vermont GHG Inventory [2], including:

- Industry energy use
- Electricity generation energy use
- Waste treatment energy use
- Agriculture energy use
- Transportation energy use
- Residential & commercial energy use
- Fossil fuel industry energy use

Building an LCA analysis of the Vermont energy supply as an initial step can be preferable in terms of simplicity, as it will involve less data collection, and assumptions. It would also allow the Vermont State Staff to gain an understanding of the LCA process and build capabilities internally. Before expanding to a more complex analysis, such as a goods- and services-focused LCA.

4. States, provinces, or nations that developed energy-related lifecycle GHG emissions analysis

Our understanding is that the most comprehensive program through which a State has developed comprehensive lifecycle assessments and analysis is the California Low Carbon Fuel Standard (LCFS) Program which assess the carbon intensities of transportation fuels sold in California for compliance with the Program. The technical support documentation and tools used to develop (and help entities comply with this program or submit their own fuel lifecycle pathway analyses) can be useful for the State of Vermont to review, as it looks towards developing this initial energy focused LCA effort.

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[2] Vermont Department of Environmental Conservation. May 2021. Vermont Greenhouse Gas Inventory and Forecast 1990-2017. Accessible here: https://dec.vermont.gov/sites/dec/files/aqc/climate-change/documents/_Vermont_Greenhouse_Gas_Emissions_Inventory_Update_1990-2017_Final.pdf

Additional project descriptions for which ICF has collaborated to or develop lifecycle GHG emissions analysis are detailed in Appendix A.

5. List of recommended software, datasets, methodologies, and protocols

Many tools exist and are also currently being developed to frame and help quantify GHG emissions from a lifecycle perspective. Based on the process illustrated in Figure 1, once the scope and boundaries of the Vermont Energy Supply and Usage LCA are defined (step 1), ICF will be able to help the State of Vermont identify the most appropriate methodology (step 2) and data collection process (step 3) to perform the LCA. This will also include the details on the resources, models, and tools required to build calculate GHG emissions for the selected LCA boundaries.

In terms of methodology and protocols, examples of existing frameworks that can help build this LCA are:

- ISO 14044:2006 Environmental Management – Life Cycle Assessment – Requirements and Guidelines
- Greenhouse Gas Protocol LCA protocols and documentation, including
  - Public Sector Protocol
  - Product Lifecycle Protocol
  - Corporate Value Chain (Scope 3) Protocol
- Climate Disclosure Project (CDP) Climate Guidance documents
- Science-Based Targets Initiative (SBTi) Sector Guidance protocols (many are upcoming)

In terms of tools, datasets and software that can help in building a Vermont Energy Supply and Usage GHG emissions LCA, ICF anticipates the following resources to inform the analysis:

- All datasets and GHG emissions calculations (spreadsheets) developed to inform the State of Vermont's latest GHG Emissions Inventory
- Argonne National Laboratory Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies (GREET) Model
- U.S. EPA GHG Emissions Factor Hub and Waste Reduction Model (WARM)
- National Renewable Energy Laboratory Life Cycle Assessment Harmonization documentation
- Additional Protocols or References that can help quantify emission factors for energy sourced outside of the U.S., for use in the State of Vermont. Examples include:
  - International Energy Agency data on countries' electricity generation mixes and emission factors
  - Environment Canada National Inventory Report: Greenhouse Gas sources and sinks in Canada and associated emission factors.
- Additional proprietary datasets may be needed, based on the methodology developed to gather the energy supply data, and subsequently calculate the GHG emissions.

6. Additional software, datasets, methodologies, protocols available

Depending on the granularity desired for the analysis, and the final boundaries and methodology selected by the State of Vermont, additional datasets, whether public or proprietary may be recommended by ICF. For example, Specialized LCA software, such OpenLCA or SimaPRO, may be needed if specific industry considerations need to be integrated in the analysis. The latter may involve proprietary software or datasets, and ICF can help ANR evaluate these choices in the context of the state's needs.

Additionally, the State of Vermont may want to complement this LCA analysis with future years' projections of the State's energy supply, to help use this LCA in additional energy communications

efforts or GHG emissions mitigation planning. This would require additional discussions to set the boundaries and future policies and GHGs reduction scenarios. Following these discussions, and based on the agreed-upon approach, ICF can use additional resources to inform these LCA projections analyses.

7. Staff training, software licensing, and need for consultant services

LCA analyses are complex analyses that integrate multiple considerations, and often requires making a series of multiple decisions (methodology, data sources, purchasing proprietary data, etc.) that may involve carefully selected tradeoffs. For these reasons, ICF recommends pursuing consultant services to help build the LCA analysis, by following the steps illustrated in Figure 1, but also to facilitate the technical process, including the following:

- Developing a data needs list in line with the selected methods and prepare a data collection strategy, including recommendations for purchases of licenses, subscriptions, or software
- Developing an analysis tool that is intuitive and user friendly.
- If desired, building some lifecycle emissions projections, which can be integrated into the analysis tool.,
- Developing a plan for training and building capacity of Vermont staff to use, interpret and build on the GHG LCA (whether for projections, or additional sectors considerations).

Understanding the value of routine communication with Vermont Staff to keep work on track and produce deliverables that meet defined goals for the LCA, (if selected for consultant services) ICF would propose a communications strategy that includes check-in meetings with key Project Team staff at a regular interval. These check-ins will focus primarily on project status, key decisional items, schedule, and next steps. The goal would be to create an open-channel communication that encourages Vermont State staff to ask questions about the deliverable development on an ongoing basis, and provide inputs and preferences. There will also be an emphasis on helping to build capacity of Vermont State staff for the GHG emissions LCA, which can be addressed via technical trainings and workshops, along with on-demand requests.

8. Tasks and person hours

Table 1 below summarizes a high-level description of the anticipated tasks, and an estimated number of person hours expected to produce the initial State of Vermont Energy supply LCA analysis. Hours for specific tasks will be dependent on more clearly defined needs from ANR. The table below provides information for ANR consideration and is provided for advanced planning purposes only using assumptions that may or may not be part of a final requirement.

Table 1: High-level task descriptions and associated level of effort estimates

Task Description	Estimates of Person Hours
1. Assessing the LCA Boundaries	30-40
2. Establishing a process and methodology for the analysis	50-60
3. Data Collection	100-250 depending on the scope of the analysis
4. Performing the Analysis and the LCA GHG Emissions Quantification	250-500 depending on the scope of the analysis
5. Preparing a Report	100
6. Performing Additional GHG emissions projections or breakdown	Depending on specific request

At this time, ICF doesn't anticipate that the same level of effort would be required every year if the State wanted to update their Energy supply and usage LCA analysis yearly. Most of the effort will be focused on the steps 1,2, and 3 identified above, as we anticipate these steps to be highly iterative, and to necessitate strong collaboration with Vermont State staff, to make sure we align on the analysis scope boundaries, data needs, and assumptions. Step 4 implies the development of a LCA Tool (in an Excel workbook for example), and the analysis will be followed by the preparation of a technical report that will document the methodology, process, challenges, assumptions, and results of this lifecycle analysis. ICF will also put an emphasis on helping the State of Vermont build their internal capabilities in updating the tool and analysis, during the development of this first version, the yearly update should constitute lesser efforts.

9. Data on Vermont's energy imports

As a first step in evaluating the data needs and data gaps to inform the LCA analysis, and for consistency with the Vermont GHG emissions Inventory, ICF would review the datasets, assumptions and tools that were used to build the latest iteration on the Vermont GHG emissions inventory. From there, ICF will be able recommend additional datasets (whether publicly available or proprietary) needed to complete the LCA analysis.

Some of the data sources that ICF anticipates using for the lifecycle analysis include, but are not limited to:

- U.S. EPA National Emissions Inventory
- U.S. EPA GHG Reporting Program
- U.S. EPA State Inventory Tool
- U.S. EIA State Energy Data System
- U.S. EIA State Profile and Energy Estimates
- Vermont State Departments and Public Utility Commission
- National Inventory Report: Greenhouse Sources and Sinks in Canada
- All datasets and GHG emissions calculations (spreadsheets) developed to inform the State of Vermont's latest GHG Emissions Inventory and Climate Action Plan

At this time, ICF is not able to discern if sufficient data are available, with the proper granularity, to inform on the comprehensive energy supply profile for the State of Vermont. That being said, ICF will be able to help the State make data-driven, and historically informed assumptions on the energy imports for the State, if there are gaps in the data available.

10. Time lags in data availability

This question can be specifically answered once the LCA boundaries and the LCA methodology have been discussed and agreed-upon. ICF anticipates that discussions and decisions will be needed for prioritizing datasets, based on their accuracy, timeliness, and consistency with the Vermont GHG inventory.

11. Anticipated challenges, limitations, and data gaps

Evaluating the data available to inform the analysis, and identify the data gaps, and select methodology and associated data collection (which may include purchasing proprietary data) process, will need to be established in collaboration with the State of Vermont, with clear explanations of the pros and cons of selecting specific data.

ICF anticipates that challenges are likely to occur when quantifying the following activities with accurate data:

- Specific breakdown of the sources, specific generation mix and location of the electricity generation sourced from out of State
- Disaggregation of energy consumption by activity sector, or sub-sectors (goods and services-level), if this is the path chosen by the State of Vermont
- Varying level of granularity between energy data sources

Achieving consistent emissions calculations rigor across all energy sources can be challenging, as can consistency in data sources throughout a variety of historical years. For these reasons, the feasibility and relevance of building a comparable analysis for a baseline year (or multiple historical years) would have to be evaluated once the boundaries and framework of the analysis is selected.

12. Interaction with Vermont's existing annual statewide GHG emissions inventory

A LCA analysis of the State of Vermont's energy supply and usage is a valuable analysis that can act as a complementary tool to the GHG emissions inventory to help paint the overall picture of GHG emissions in the State. It can help the State frame its goals GHG emissions reduction goals in terms of a lifecycle emissions, and potentially help the State integrate additional GHG emissions considerations into its energy supply chain.

13. Recommendations to maximize the usefulness of this analysis

ICF can help the State of Vermont to evaluate and identify what are the desired outcomes and objectives of building this LCA analysis for policymakers. Based on this discussion, ICF will be able to build a tailored methodology to meet the needs identified. Setting the outcomes and results expectations up front for how and what will be included in the calculations is critical for policy decisions.

To increase the usefulness of the analysis, ICF recommends presenting the results for the energy sources side-by-side and by lifecycle stage. The latter will help for understanding the relative impacts and opportunities for further reductions of GHG emissions.

ICF recommends updating the analysis periodically, in a frequency that is informed by the availability of updated data, and the feasibility of collecting this data. Because the energy supply and generation mix in the U.S., and in Vermont, is undergoing a continuous transition (increasing renewable energy generation), ICF anticipates leaning towards a recommendation to update as frequently as feasible, for the near future. ICF can help the data collection process for future year updates or analysis.

Additional considerations, such as lifecycle GHG mitigation strategies identification, costs, and implementation considerations are additional elements that ICF can add to this analysis.

14. Additional relevant information

There are a number of steps that can be taken to ensure that there is consistency between the State GHG emissions inventory, its GHG mitigation strategies' accounting methods, and the LCA methodology selected. These steps focus around better understanding and mapping available data into the LCA analysis, and the existing GHG inventories (e.g., considering top down and bottom up data and methods) and considering potential changes or improvements to GHG accounting methods in both the GHG inventory and in evaluating emission control scenarios. Alignment between

accounting methods and data sources as much as possible at the start of scenario analysis is critical, but also understanding the resources required to follow the methods and the frequency and available of data to update the GHG inventory and scenario analysis over time are critical.

As a general note, a critical part of collecting accurate data for this analysis can be to conduct a detailed stakeholder engagement with some or multiple Vermont State energy suppliers. ICF can help design and facilitate a stakeholder engagement process that will help to inform the data collection process for the State.

15. Availability and capacity to provide assistance

Using a blended staffing approach of support and expert staff ICF can meet the fluctuating needs of the clients we work with. ICF can commit to making the staff needed available for this effort, subject to ANR's needs. ICF has a team of 10 full time staff whose project portfolios are fully or partially dedicated to LCA work. Augmenting this group is a much deeper bench of staff, which includes a mix of senior sectoral experts in climate and energy and junior researchers and analysts to who support various project needs.

APPENDIX A – ADDITIONAL MATERIALS

About ICF

ICF is a global consulting and technology services provider with more than 7,000 professionals focused on making big things possible for our clients. ICF is internationally recognized for our leadership in climate change policy, research, and technical analysis. We have deep sectoral understanding across all GHG-emitting sectors, along with decades of experience in designing efficient and cost-effective market-based programs, conducting economic and health analyses, quantifying emissions and emission reduction potentials, conducting climate vulnerability assessments, and developing GHG emission reduction plans for cities, regions, states, and nations. Engage with us at icf.com.

Life Cycle Assessment

Our team is equipped with in-house and commercial LCA tools, including SimaPro and openLCA LCA software. We offer extensive services to support a wide variety of clients build and tailor LCA analyses. ICF has a proven track record in the following areas:

- Emission factor development in the context of Life Cycle Assessment services.
- Life Cycle Inventory (LCI) data collection, Life Cycle Impact Assessment, critical reviews, product carbon footprinting.
- Tool development. Planning, development, refining, and reviewing customized tools and models for decision-support and to help stakeholders prioritize and evaluate the benefits of complex systems from a life-cycle perspective.
- Research and synthesis. Technical literature reviews, developing reports and synthesis to fully detail and assess the challenges, methodological issues, and limitations.

Project Examples

- Climate Change and Waste Program Support for life-cycle and energy emission factors, U.S. EPA (1993 - present)
- Waste Reduction Model (WARM) LCA development, U.S. EPA (tool development and ongoing maintenance)
- LCA Suport for ENERGY STAR program, U.S. EPA (ongoing support)
- Low Carbon Fuel Standard Pathways for Landfill Gas Biomethane, Multiple Clients (for submission to CARB LCFS), (2013-present)
- LCA of U.S. production pathways for corn ethanol. USDA (2016)
- Literature review of lifecycle environmental impacts (including GHG emissions) for multiple vehicle considerations (materials, technologies, fuels, and more). U.S. NHTSA (2014-present)
- Lifecycle GHGs analysis of Canadian oil sands crude oil compared with reference crude oil for Keystone XL environmental impact study. U.S. Department of State(2011-2014)
- Hawaii Greenhouse Gas Emissions Report for 2016, Hawaii Department of Health (2019)
- State, Local and Tribal Inventory Tools Support, U.S. EPA (tool development and ongoing maintenance)
- Inventory of U.S. Greehouse Gas Emissions and Sinks, U.S. EPA (since the first inventory developed)
- Pennsylvania Climate Action Plan, Pennsylvania Department of Environmental Protection (2019)
- Municipal Energy Master Plan and City Wide Energy Vision for the built environment, City of Philadelphia (2017)

- Multi-Sector Approach to Reducing Greenhouse Gas Emissions in the Metropolitan Washington Region, Metropolitan Washington Council of Governments (2016)
- Delaware Climate Action Plan Technical Support, Delaware Department of Natural Resources and Environmental Control (2020)
- Modeling Study on Program Options to Reduce Greenhouse Gas Emissions, Oregon Department of Environmental Quality (2021)
- Quantifying the Multiple Benefits of Energy Efficiency and Renewable Energy, U.S. EPA (2018)
- Ongoing power sector and economic modeling support for the Regional Greenhouse Gas Initiative (RGGI) since program inception