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Vermont Transportation Greenhouse Gas Policy Analysis

Work Plan

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Objective

The objective of this work assignment is to provide an understanding of transportation emissions reduction policies, including policies affecting other emissions sources, with a focus on economic modeling to understand and compare the impacts of Vermont participating in a cap and invest program, such as the Western Climate Initiative or the forthcoming New York Cap and Invest Program, as well as possible other complementary emission reduction programs including a low-carbon or clean transportation fuel standard. The analysis will determine the effects on the state's emissions and economy of participation in cap-and-invest programs, evaluating scenarios for coverage of transportation only, coverage of all fuels, and coverage of all fuels and larger stationary sources. The work will also provide for opportunities for public engagement to hear from key stakeholders, and will make recommendations for a path forward for a policy approach to achieve Vermont's transportation greenhouse gas (GHG) emission reduction targets. The analysis will consider horizon years of 2030 and 2035.

Project Approach

Task I - Project Initiation and Work Plan

The Cambridge Systematics (CS) team will prepare for, schedule, facilitate, and document the following project initiation meetings:

- A pre-project meeting with the State Project Team (SPT) to review the proposed work plan.
- A kick-off meeting with the Transportation Advisory Committee (TAC).
- A follow-up meeting with the State Project Team.

The CS team will develop a draft work plan and finalize the work plan considering input from the State Project Team and TAC. The work plan will include the scope, approach, milestones, schedule, roles, and lines of communication.

Because our work approach will rely in part on obtaining information from other states with experience planning for, implementing, and/or evaluating cap-and-invest and low-carbon fuels programs, as we develop the work plan we will confirm with the Vermont Agency of Transportation (VTrans) and the Agency of Natural Resources (ANR) our ability to contact and obtain information from these states. If needed, we will make initial contacts to confirm the specific types of information that may or may not be available (beyond anything publicly available on web sites), and will adjust the work plan in consideration.

Deliverables:

- TAC and SPT meeting agendas, materials, and notes.
- Draft and final work plan.

Task IIa - Scenario Analysis

This task will be led by CS with support from Resources for the Future (RFF). In this task the CS team will review the policy approaches of the Western Climate Initiative (WCI) and New York Climate Initiative (NYCI) cap and invest programs, as currently implemented or proposed, as well as the low carbon fuel standard (LCFS) programs implemented or proposed in California, Oregon, British Columbia, and New York. The team will analyze these programs under six scenarios, with the following three scenarios evaluated for each of the two programs (WCI and NYCI):

1. Cap-and-invest covering transportation petroleum fuels (motor gasoline and diesel).
2. Cap-and-invest covering all fossil fuels (gasoline, diesel, fuel oil, natural gas, propane, kerosene).
3. Cap-and-invest covering all fossil fuels and larger stationary sources (fuel and process emissions), not including electricity generation.

The following key inputs will be identified for each scenario, in consultation with the SPT:

1. First compliance year.
2. Emissions budget (cap).
3. Allocated and auctioned share of allowances.
4. Investment scenario(s), i.e., how revenues could be reinvested in clean transportation.

The following are the key outputs or considerations for each scenario, to be compared with and without the additional policies:

1. Projected cost per ton/per pollution allowance over time in each scenario.
2. Projected additional cost per gallon of gasoline and per gallon of fuel oil.
3. Projected revenue generation.
4. Anticipated emission reductions in 2030 and 2035 in covered sectors within Vermont; discussion of the likelihood of achieving the required emissions reductions in each covered sector in accordance with the GWSA 2030 target year; discussion of the likelihood of achieving long-term (2050) required emission reductions.
5. Macroeconomic effects by sector of the economy (e.g., jobs, output).

6. Economic benefits and costs accruing to Vermonters by income range/bracket and county geography. The impact on environmental justice populations will be inferred based on state-defined geographical descriptions and income groups.

7. Social cost of carbon reductions.

8. Monetized health benefits.

The team will also evaluate:

9. Projected implementation/administrative costs to the State and to covered entities, including auction process, allowance compliance and tracking platform, and increased capacity.

10. Consideration will be given to potential emissions leakage scenarios in the transportation sector associated with changes in fueling location.

11. Recommended timeline for program participation, implementation, and the timing of making investments with resulting revenue.

For each scenario, the team will first provide a high-level assessment of these outputs, including quantitative estimates that pivot from available data, combined with qualitative assessment where available information from other analysis is insufficient to support quantitative estimates. The six scenarios will also be evaluated qualitatively for interaction with a low-carbon-fuel standard (clean transportation standard), with quantitative descriptive information provided as available from other states' analysis. The evaluation will consider, for example, whether an LCFS would increase the certainty of being able to obtain the statutorily required emissions reductions, and what would be the cost implications.

After the high-level evaluation of the six cap-and-invest scenarios and LCFS interactions, the team will work with SPT and the TAC to identify a single preferred scenario for more detailed evaluation using the team's evaluation tools, and considering criteria that will be developed in collaboration with the SPT and TAC. This more detailed evaluation will include quantification of additional items, including economic benefits and costs to Vermonters (item 6) and monetized health benefits (item 8). It will also include a more detailed evaluation of the benefits and impacts of transportation sector investments made using allowance proceeds. At the discretion of the SPT it may include the modeling described in the Optional Task IIb for allowance prices, emission reductions, and economic benefits and costs.

Given the size of Vermont relative to other state cap-and-invest programs (and given the state's unique emissions profile), Vermont's participation in an existing cap-and-invest program is not anticipated to drastically alter those program's performances. As a result, our analysis will primarily focus on using existing data and estimates from analysis of other state programs. These analyses will provide projected allowance costs, which will be used to estimate emissions reductions and revenues using reduced-form estimates of the sensitivity of sectoral emissions to a carbon price or low carbon fuel standard. The reduced-form estimates will be derived from existing modeling by team member RFF of the price sensitivity of emissions in other states (for example, New York State and California). Existing estimates will also be used to project the effectiveness (and timeliness) of investments on emission reductions and these two estimates will be combined to estimate the likelihood of achieving 2030

emissions targets in regulated sectors across each scenario. Macroeconomic impacts (primarily, job impacts by sector) will also be estimated based on modeling conducted for other states.

To project the economic benefits and costs to Vermonters, we will estimate the distribution of costs across income groups and regions (not income groups by region) using RFF-SWIM, a microsimulation model that can map changes in prices due to the cap-and-invest program on household budgets. We will incorporate available county-level data on household energy expenditures and other information to access the heterogeneity of effects across the state.

We will use the TEA-CART tool (or VTrans' early version of it) to evaluate how reinvestment of proceeds from cap-and-invest revenues into transportation projects and programs could further reduce emissions. These impacts are expected to be modest compared to the overall size of emission reductions needed to meet statutory requirements and therefore would not be expected to substantially impact our ability to transfer program information from other states. We will also estimate consumer savings (i.e., reduced vehicle operating costs) related to the additional transportation investment. Finally, we will consider how different investment strategies might affect Vermont's ability to leverage federal funding provided through existing programs established under the Infrastructure Investment and Jobs Act and the Inflation Reduction Act.

We will provide estimates of the social cost of carbon (SCC) (benefits associated with GHG reductions) in addition to direct monetary costs and savings. We will use the latest Federal guidance on SCC unless Vermont has an alternative, preferred assumption. We will confirm the appropriate discount rate with the TAC.

A cap-and-invest program should provide health benefits based on reduced air pollutant emissions from fossil fuel combustion and increased physical activity from greater investment in active transportation. Health benefits of a regional Transportation and Climate Initiative cap-and-invest program were studied through the Transportation, Equity, Climate and Health (TRECH) Project; we will scale benefits for Vermont as estimated in that study based on the relative emissions reductions expected under the scenarios reviewed here. We will also review any information other states may have developed on health benefits of multi-sector cap-and-invest programs. Depending upon the extent of this available information, we will also look at national studies that include the health benefits of emission reduction programs (e.g., U.S. Environmental Protection Agency Regulatory Impact Analysis documents for powerplant emissions regulation) and scale findings to Vermont based on relative emissions reductions anticipated in different sectors.

Projected implementation/administrative costs to the State and to covered entities will be estimated based on experience from other states and program requirements. For example, the WCI emissions trading service publishes an annual budget and allocates costs to each participating jurisdiction in proportion to the size of its allowance cap. States participating in cap-and-invest and LCFS programs will also be consulted regarding their own administrative costs for the programs based on the number of staff positions and any other contracted costs. Costs will be scaled to Vermont considering fixed program costs (irrespective of entity size) and variable costs (proportionate to the size of the covered sectors).

The recommended timeline for program participation, implementation, and investments will be based on the lead time needed to develop and adopt state regulations, identifying a target start year for the program(s), the potential timeline for alignment or linking with other programs, and then identifying timelines for revenue generation and

investments based on programming cycles in affected sector(s). Timelines for the various activities needed in each sector will be informed by input from staff from relevant state agencies.

The project team will organize and facilitate TAC meetings. The TAC meetings are proposed as follows. Up to three meetings will be held as part of Task 2; meetings for Task 1 and 4 are also shown for context. Draft presentations will serve as pre-meeting deliverables and will be shared with the State Project Team in advance of each TAC meeting and the Cross-Sector Mitigation Committee (CSM) meeting. The TAC may be invited to the CSM meeting.

- TAC Meeting #1 (Task 1) – Review of draft work plan – 1 month into project.
- TAC Meeting #2 (Task 2) – Review and receive input on proposed scenarios, models, and methodologies – 2 – 2.5 months into project.
- TAC Meeting #3 (Task 2) – Review and provide input on draft analysis findings – 4 months into project.
- TAC Meeting #4 (Task 2) – Initial discussion of policy recommendations – 6.5 months into project.
- TAC Meeting #5 (Task 4) – Review of draft policy recommendations – 7.5 months into project

Deliverables:

- Status reports including tasks completed, tasks in progress, review of the schedule, and budget status (if determined to be needed for sharing with TAC and/or interim reporting in weeks when check-in meetings are not held).
- Presentation materials and written summaries for TAC meetings.
- Presentation for CSM of analysis findings.

Task IIb - Scenario Analysis (Optional Modeling)

If requested by VTrans and ANR, RFF will provide Vermont-specific modeling analysis to further inform the key questions. This optional analysis will use the Haiku model to analyze the interaction of cap-and-invest programs including potential investments in electrification of buildings and transportation with power markets and with the existing Regional Greenhouse Gas Initiative, and the DR-GEM model to provide new and novel estimates of the emissions reduction potential and corresponding revenue generation, allowance trade, and flow of allowance value resulting from of linking Vermont to two different existing carbon pricing programs.

Historically, Haiku has been used as a simulation model of regional electricity markets and interregional/interstate electricity trade in the continental United States. The model reports how investments in energy efficiency and electrification through the cap-and-invest programs would interact with existing state and federal environmental regulations and relevant policies, and power market policies including the Regional Greenhouse Gas Initiative (RGGI), and these analyses will be updated for this project. Assumptions on energy demand across sectors and increasing demands for electricity (through electrification of buildings and transportation) will be modified accordingly in the different scenarios. Attention will be given to sector-based policies to promote an energy

transformation, and to the investments to facilitate that transition. We will use county-level data on expenditures for residential buildings, if available from the state, to enable the analysis.

In this project, the Haiku model will be augmented with reduced form representations of the transportation and buildings sector to provide integrated accounting of changes in energy use and emissions resulting from the carbon price and associated investments of carbon proceeds. The transportation module will involve a reduced form vehicle inventory provided by CS for the various transportation vehicle submarkets (e.g. light-duty, medium truck, short-haul and long-haul heavy truck, bus) and calculate associated changes in expenditures in transportation including electricity demand. The building sector module will account for investment-driven and price-driven electrification of residential buildings and estimate associated emissions and expenditure changes.

Haiku model outputs include allowance prices and emissions pathways over time; however, for this project we may rely on parametric price paths drawing on assumptions about linking with other large programs. For a parametrically given price path or for one determined endogenously, the Haiku model will account for allowance banking over time. The model will also account for changes in the state and regional electricity sector capacity and generation mix and changes to the costs of meeting demand projections. Changes in prices and costs will be mapped to the SWIM model (the incidence model) to describe the expenditure impacts on households based on consumption of primary fuels and electricity. Sensitivity analyses will be developed in consultation with the project manager and will include natural gas price scenarios, and policy evolution at the regional and state level.

The DR-GEM model is a regional computable general equilibrium (CGE) model. The model will directly inform the economic costs of the policy and also provide an additional estimate of the likelihood of achieving sectoral emissions targets in each scenario. The current version of the model uses state-level input-output tables (non-proprietary) that represent the flow of goods and services (in value terms) across the economy. The data will be used to benchmark demands for goods and services and factor inputs such as capital and labor by households, governments, and production sectors (we have flexibility in the number of production sectors, and they can be chosen through consultation with VTrans/ANR). Assuming that households and firms engage in utility/profit maximization decisions, we will solve for a new equilibrium in which households and firms must participate in a cap-and-invest program. We will make a comparison between equilibria with and without the policy to determine its economic and environmental impacts. Inputs into the model include the input-output tables mentioned above, model parameters such as elasticities of substitution in energy and non-energy use by households and firms, and assumptions for how energy demand is expected to change dynamically over time. The latter assumptions on future energy demand may be adjusted accordingly to reflect different assumptions on energy policies and to take input from other models. Outputs include emissions and energy demand by sector by region and economic activity by sector by region (output, trade, prices, labor demand, etc.) which will be aggregated into state-level economic measures such as state GDP.

Deliverables:

- Included as part of Task IIa deliverables, with additional information as part of these deliverables.

Task III - Stakeholder and Public Engagement

This task will be led by FHI Studio. Stakeholder outreach methods will include:

- Focus group meetings (12) – 2 rounds with no less than 4 (CSM included) and up to 6 stakeholder groups for a total of 12 focus group meetings; 3 staff (facilitator, recorder, tech); virtual, with up to 2 of the 12 meetings in-person (if requested in conjunction with a previously scheduled in-person meeting). The first round will gather input on issues and concerns; this round will be held approximately 3 months into the project. The second round will present findings of the analysis and gather comments on draft recommendations; this round will be held approximately 7.5 months into the project.

- Statewide public meetings (2) – Hybrid with 2 FHI staff attending in person. Assumes no responsibility for tech setup and use of meeting facilities at no cost. Two rounds of public meetings held in the same timeframe as the focus groups.

- Develop and maintain website content – Production of content only; no web development.

- Distribute public engagement materials, press releases and social media posts – Post project announcements to VTrans social media accounts (Facebook, Twitter, Instagram, and YouTube) up to 6 times per month.

- Vermont General Assembly update - written status report (1).

The outreach conducted by the CS/FHI Studio team for the 2023 Transportation Carbon Reduction Strategy included focus groups with 6 sets of stakeholders: 1) businesses; 2) community groups with an equity and/or environmental justice focus; 3) freight and rail transportation; 4) public transportation providers and regional planning agencies; 5) environmental interests; and 6) elected officials. For this effort which potentially covers multiple sectors, we will start with this basic list but update and expand participant lists to ensure representation of any organizations or interests specific to sectors other than transportation that may be affected by regulation of fuels (e.g., transportation and heating fuel distributors, agriculture, renewable fuel suppliers, manufacturing, utilities). This list may be adjusted based on the sectoral coverage of the preferred approach that is selected for detailed evaluation. The project team will also review outreach activities by other states to identify any key interests that were included in those efforts, as well as outreach efforts conducted by Vermont ANR in support of Climate Action Plan development to ensure that key stakeholders are included. We will use a variety of methods to engage participants in public meetings and stakeholder focus groups. These may include live polling, facilitated brainstorming, directed questioning, and visual notetaking.

At the outset of the project we will meet with the Climate Action Office to review their planned activities so that we can schedule our activities to avoid any conflicts and avoid excessive requests to any of the same parties, and to coordinate on communication and messaging regarding the relationship between our activities and those of the Climate Action Office. The project team will also offer review of messaging related to any of the Climate Action Office's activities that involve communication of our findings.

Public meetings will be promoted through existing VTrans and ANR contact lists for climate change planning efforts, general media channels, and social media platforms. Stakeholder organizations included in the focus groups will be encouraged to spread the word about events, similar to how the project team relied on stakeholder organizations to help publicize meetings for the Carbon Reduction Strategy. To support stakeholders and the public in amplifying project messages and advertisements, all promotional materials will be visually appealing, use

plain language, and be produced in formats that can be easily shared with a broader audience through their typical communication channels.

All presentations will be provided in draft form to the State Project Team and TAC for review and input.

Deliverables:

- Stakeholder database
- Discussion guides (2)
- Focus group meeting summaries (12)
- Public meeting press releases (2)
- Public meeting materials (2)
- Public meeting summaries (2)
- Project website content
- Social media content development and posting

Task IV - Recommended Policy Approach

In this task the project team will finalize the analysis and develop a draft and final Scenarios Report providing a preferred policy approach. We will hold an initial discussion of policy options with the TAC before delivering the draft report. The TAC will then review the draft report and findings and recommendations will also be presented to stakeholders and the public for comment.

The project team will make or support up to four presentations of the final report and recommendations. One of those would be the final presentation to the legislature in early 2025.

Deliverables:

- Draft and Final Scenarios Report
- Presentation materials (4 meetings)
- Meeting summaries for presentation of final report and recommendations (4)

Schedule

An overall schedule for the work is shown in Figure 1.

Figure 1 Schedule