Draft

Measuring and Assessing Progress of Vermont's Climate Action Plan

Infrastructure Memo

Prepared for:

Vermont Agency of Natural Resources
Climate Action Office
1 National Life Drive, Davis 2
Montpelier, VT 05620

Prepared by:

Eastern Research Group, Inc.
561 Virginia Road
Building 4 – Suite 300
Concord, MA 01742

April 15, 2025

Contents

List of Tables

List of Figures

1 Introduction

The Global Warming Solutions Act (GWSA) requires the State of Vermont to reduce its gross greenhouse gas emissions (GHGs)[1] and consider how the State prepares for and responds to climate change through adaptation and resilience efforts. To help these achieve these requirements, the GWSA created the Vermont Climate Council (VCC)[2] and charged them with developing a Climate Action Plan (CAP) to provide a framework and planning process for reducing climate pollutants and preparing for the impacts of climate change.[3] In 2021, the initial CAP was adopted, and this plan set forth a range of activities (e.g., strategies, programs, policies, actions) to achieve the State's climate action goals that include reducing GHG emissions, increasing sequestration, building resilience and adaptation to address the changing climate's effects on the State's communities, infrastructure, and economy. A key component of this climate work is to ensure that equity is integrated into Vermont's climate progress. The CAP also requires the State to develop a framework that will measure its progress toward achieving its climate action goals and directs the VCC to identify a way to measure the "effectiveness of the initiatives, programs, and strategies set forth in the CAP."[4]

Under this project, Eastern Research Group, Inc. (ERG) worked with representatives from the Agency of Natural Resources (ANR) Climate Action Office (CAO), hereafter to referred to as the State team, to lay the foundation for the future development of a tool (under a subsequent RFP) that will measure and assess indicators of the State's progress toward its climate action goals (i.e., MAP tool or Tool). The scope of State climate actions of focus for this project are those under the State's control, and following preliminary discussions with the State team, it was determined that the scope should extend beyond the climate actions specified in the 2021 CAP to also includes activities articulated in other relevant current and future state plans. The goal is to develop indicators of climate action that can stay stable over time while the specific strategies, programs, policies, and actions being pursued by Vermont will change and adapt. With this focus in mind, ERG worked with the State team to:

- Review existing tools and data frameworks within and outside of Vermont to inform the development of the MAP Tool.
- Stand up a Data Governance Team (DGT) and develop a Data Governance Plan (DGP) to guide the development, implementation, and on-going maintenance of the supporting data management applications.
- Understand the State climate plans and activities being designed and implemented, determine qualitative and quantitative metrics, and the identify the data needed to measure them.
- Develop logic models and data maps that illustrate the connections between State's priorities, metrics, outcomes, and data and information to help inform the design of the MAP tool.

[1] The GWSA requires gross GHGs to be reduced to at least 26 percent below 2005 levels by 2025, 40 percent below 1990 levels by 2030, and 80 percent below 1990 levels by 2050.

[2] The 23 member Vermont Climate Council is comprised of state administration officials, legislative appointees, and various sector representatives: https://climatechange.vermont.gov/about

[3] Vermont Climate Action Plan: https://climatechange.vermont.gov/readtheplan; VECAN "Vermont Global Warming Solutions Act" Webpage: https://vecan.net

[4] Pg. 9, GWSA: https://outside.vermont.gov/agency/anr/climatecouncil/Shared%20Documents/ACT%20153%20As%20Enacted.pdf?_gl=1*o007c*_ga*MTA2MTkwMTM3NS4xNzIxNTcxODAx*_ga_V9WQH77KLW*MTc0NDM3NzA5OC45MS4wLjE3NDQzNzcxMDEuMC4wLjA.

- Engage the public, frontline communities, State partners, and others to gather input on the State's climate priorities, metrics, and data and information sources that should be included in the MAP tool and to understand their interest in the tool and possible uses for the tool (e.g., use cases).

Figure 1 shows the how the MAP Tool tasks fall within the broader project timeline.

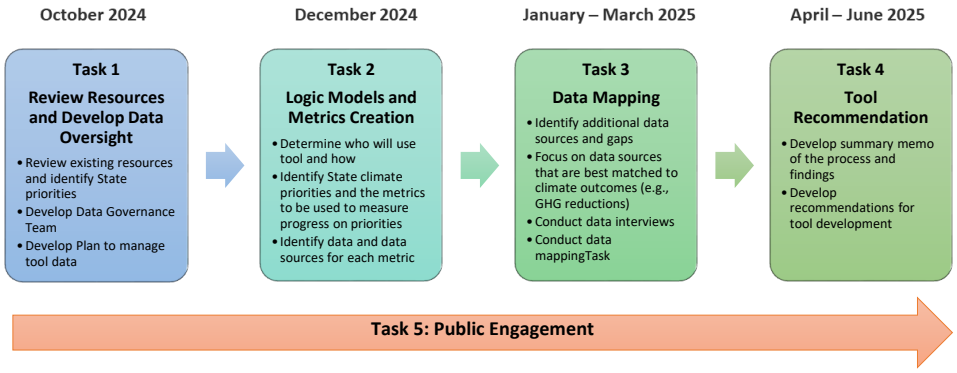


Figure 1: Project Task Timeline

The remainder of this report is laid out as follows: Section 1 provides an overview of the work conducted under this project, with each subsection covering the discreet project tasks conducted. Section 3 provides recommendations and consideration for the future development of the MAP tool and related future work.

2 Overview of Project Tasks Informing Tool Development

2.1 Review of Existing Tools and Frameworks

ERG reviewed and evaluated a series of tools, frameworks, and datasets relevant to measuring Vermont's climate progress on mitigation, adaptation, and equity, as well as how to measure engagement in climate efforts. The purpose of this task was to: 1) better understand the types of data and frameworks that are available to measure Vermont's progress as well as possible tools and/or approaches to integrate and convey this information and 2) leverage that understanding to identify, discuss, and develop recommendations on the type of information that would be useful in the MAP tool, how this information might be conveyed, and how to best facilitate future Tool development that will occur in the next phase of this work. ERG was tasked with reviewing the resources identified in the request for proposal, along with an additional three to five tools, frameworks, and or datasets identified by the State team. This list of resources reviewed includes:

- Vermont Greenhouse Gas Inventory Documentation
- Vermont DEC water quality monitoring data resources
  - Water Quality Monitoring Resources - Watershed Projects Database
  - Water Quality Monitoring Resources - Clean Water Interactive Dashboard
- Colorado Resiliency Dashboard and Colorado Resilience Framework Metrics Appendix C
- Lake Tahoe Climate Resilience Dashboard
- California Climate Dashboard
- Kent County – Community Engagement Dashboard
- San Francisco Climate Plan Dashboard
- New York City Climate Dashboard
- Wellesley, MA Climate Action Plan Dashboard
- St. Paul Climate Dashboard

ERG developed an Excel workbook to capture key information from the review and evaluation of these existing tools and frameworks with input from the State team. Information captured for each tool reviewed included:

- General information, including the tool's name, geographic coverage, responsible agency/organization, objectives, audience, and key functions.
- How climate progress or other objectives are measured, including how progress is depicted (i.e., is progress shown through numbers, graphs, maps, etc.) and example metrics.
- Information on data used for the tool, including data sources, geographic scale, whether data is qualitative or quantitative, and whether the data is measuring a process, funding levels, or an outcome.
- Any limitations or assumptions about the tool.
- How the tool is maintained and how often the data is updated.
- Topic areas covered by the tools (i.e., GHG emissions, carbon sequestration, resilience and adaptation, engagement, or equity).

ERG shared the completed results with State team and met to discuss key takeaways from the review.

Findings and Key Takeaways

Dashboards and tools that report on climate mitigation, adaptation, and equity progress range from simple, straightforward reporting of data and information to more complex sites that handle much of the data in the background and show only summary information and text to users. Considerations for the development of the MAP tool resulting from the review and comparison of existing tools and frameworks include:

- **Quantitative and qualitative information is helpful**. Of the tools reviewed, seven presented information using a combination of qualitative and quantitative information, whereas three presented only quantitative information. The integration of qualitative information provides an opportunity to expand the type of information shared with the user, such as progress on climate actions that are not currently able to be tracked with quantitative metrics and additional context about topics or metrics. Qualitative data can also provide a stronger connection to people's daily lives and an opportunity to educate and communicate in a way that resonates more than what is possible with quantitative data alone.
- **Direct navigation to topics of interest is helpful.** Tools that allow users to select specific topic areas from the main dashboard or webpage are preferable. This layout allows users to navigate directly to desired information and provides a helpful way of organizing content. This discussion prompted the project team to discuss the key topic areas that might be of greatest interest for inclusion in the MAP tool based on the effects these topics have on climate in Vermont. For the highest level of organization, the State team determined that MAP tool should present metrics on mitigation, resilience, adaptation, equity, and engagement (See also Section 2.3.2). Within these high-level categories, contributions from each sector would be the next level of organization in the tool.
- **Tool content is shaped by priorities and data availability.** The tools and frameworks reviewed tracked different types of climate actions. This is partly due to the selected climate action priorities and partly due to data availability for each tool. For example, of the ten tools reviewed, six tools report on GHG emissions, four report on carbon sequestration, seven report on resilience, adaptation, and equity, and one reports on engagement. In addition, the tools reviewed have different levels of historical data as well as a range of types of supplemental data that can be used to present information in a more meaningful way to users (e.g., demographic information, location/GIS data). Identifying Vermont's climate mitigation, adaptation, and equity priorities is the first step to determining the information to include in the tool. Understanding the availability of the data for each of these priorities is a crucial second step.
- **Metrics need to be easily identified and understood.** The MAP tool should be designed in a manner that allows the user to easily view and understand metrics of interest and how these metrics inform progress on Vermont's climate priorities. Dashboards and webpages that are text-heavy and require users to find data and information in links to documents make it difficult for them to understand how well Vermont is achieving progress toward its climate priorities. In addition, large amounts of raw data presented to the user can be overwhelming and can require additional analysis or interpretation. Tools that allow users to easily find topics of interest, and depict progress made in several, straightforward ways (e.g., graphs, maps, short paragraph with

definitions), will make a bigger impact on users and better tell the story of Vermont's progress toward its climate priorities.

- **Access to additional subject detail is useful.** Tools and dashboards that provide a way to access additional information within a particular topic or in support of metrics presented provide a helpful option for users to select the desired level of subject information (i.e., they can dig deeper into topics if they are interested in understanding the underlying research and findings, how the data was collected, related studies). This approach also allows the content presented within a given topic area to remain simple and clear on the main pages of the tool, while providing access to more detail for those that desire it.
- **Resources shape tool design.** Some of the more complex tools, such as the California Climate Dashboard, require more resources to develop, update, and maintain. The underlying data has been collected over many years and the dashboard relies on and links to existing data and mapping tools. The available budget, time, and data to develop, maintain, and update the initial MAP tool will shape the level of complexity, detail, and breadth of information included in the tool and how that information will be displayed in the user interface. Considerations of these factors will be discussed in more detail in the recommendations section of this memo.

2.2 Data Governance

Data management must be grounded in a thorough understanding of the sources of the data, the use cases for the data, and the technical requirements for managing the data needed for the MAP tool. An important consideration for the MAP tool is that the data needed to track progress on Vermont's climate priorities is collected and managed by many Vermont state agencies. Additionally, climate priorities require a range of different types of data across a range of sectors and topics. In order ensure that this data is reliable, suitable, and communicated correctly it is critical to develop both data governance standards and assemble a data governance team (DGT) to guide the MAP tool design, implementation, and maintenance. The DGT and the data governance plan (DGP) are described in further detail below.

2.2.1 Data Governance Team

The DGT functions as a collaborative oversight body to review and adopt data governance protocols and policies to ensure the value and use of data is maximized while providing for its quality, privacy, and security. Under this project, members of the DGT participated in six 90-minute meetings where they provided input and expertise on:

- Vermont's climate priorities to inform *what* the tool will track as well as the selection of metrics that will inform *how* this information will be measured (as described further in Section 2.3).
- Available data and information and data needs for identified and selected metrics, as well as helping to guide processes for the data management components of the tool.

Final tool recommendations stemming from work completed under this project.

In addition, DGT members participated in one-on-one discussions with the project team to provide more detailed information about agency and sector priorities, appropriate metrics to track progress on those priorities, and the data sources available within their agencies or through other sources. DGT members

also followed-up with links to data and information and provided recommendations on how to fill data gaps that had been identified in DGT meetings, during engagement for the project, and through working with the State team.

Beyond this project and following the development of the tool, the DGT will continue to have an important role in each phase of development, implementation, and maintenance of the MAP tool. The DGT will work with the Climate Action Office to oversee the DGP, continue to support identification and development of data, and establish data standards and update schedules for the MAP tool.

Membership

The State team selected members of the DGT based on their knowledge of Vermont's climate priorities, metrics to track progress on these priorities, and their agency's or organization's data sources for these metrics. Table 1 shows the list of DGT members that participated in this phase of the MAP tool development and their affiliation.

Table 1: Data Governance Team Members and their Organization Affiliation

Organization	Name
Agency of Natural Resources	CAO staff
Agency of Agriculture Food and Markets	Judson Peck
Agency of Commerce and Community Development	Bronwyn Cooke
Agency of Digital Services	Glen Ferrell and Erik Engstrom
Agency of Transportation	Ari Lattanzi
Department of Labor	Mat Barewicz
Energy Action Network	Lena Stier
Public Service Department	Claire McIlvennie
Public Utility Commission	Rowan Cornell-Brown
University of Vermont	Michael Moser
Vermont Center for Geographic Information	John Adams
Vermont Department of Health	David Grass
Vermont Emergency Management	Stephanie Smith
Vermont Energy Investment Corporation (VEIC)	Dave Westman
Vermont League of Cities and Towns	TBD

Commented [MS1]: Glenn: Was this slot ever filled?

The DGT will be coordinated by a staff member from CAO, and this individual will also serve a key role in managing the Map tool and its data for ANR. During the course of this project, CAO was in the process of identifying and hiring this individual, therefore, the role and responsibilities of this individual with respect to the DGT and data governance plan described in the next section have yet to be confirmed and documented.

2.2.2 Data Governance Plan

ERG worked with State team and DGT to develop an initial data governance plan (DGP) to guide data standards, management, and maintenance under the current project as well during the future phase of

work that will include the design and implementation of the MAP tool. The DGP addresses the following key areas:

- Structure, roles, and responsibilities of the data governance team.
- Data policies and standards, including standards for data quality and metadata.
- Data procedures, including standards for storing data and version control and standards and schedule for updates to the MAP tool.

To develop the DGP, ERG conducted the following steps:

- Developed a draft outline and provided it to the State team for review, discussion, and feedback.
- Developed a draft DGP and shared with the State team for initial feedback prior to sharing with the DGT.
- Provided the DGT with a draft DGP and presented an overview of its core topic areas at a working meeting to collect preliminary feedback for use in making plan revisions. This revised plan was provided to the State team and DGT for review and feedback and incorporated suggested changes.
- Held a meeting with the DGT to gather input following the identification of data sources and presentation on tool recommendations and incorporated feedback into the next iteration of plan as well as recommendations included in this report. This meeting covered discussion topics such as:
    - How should the process of data collection or data transfer from agency to CAO be designed?
        - Who is responsible for making data-related decisions at your agency?
        - Will data sharing agreements be necessary?
    - How frequently can the data in the tool be updated?
    - What is the process that your agency would need to take to agree to collect new data for the MAP tool?
    - What parameters should be included to determine data suitability?
    - How should the Data Governance Team support CAO in data collection, data suitability, data updates, and other aspects of data reporting, collection, and input into the MAP tool?

Commented [MS2]: May need removed, depending on whether we have the May DGT meeting

The DGP will likely be updated as additional information becomes available throughout the tool development, implementation, and maintenance process. For example, data sources for use in the tool were identified and the details about the data were collected, but the data was not collected by ANR or CAO as that stage of MAP tool development was not part of this first phase of the project. This may result in a need for additional clarification on data sharing agreements, protocols, and data transfer processes, and how data will be obtained and documented, with additional input from the new CAO staff person and the DGT. The role and responsibilities of the new CAO staff person with tool and data oversight will likely need to be further clarified and documented, and the DGT roles, responsibilities, and data management process will need to be updated to account for the specific role of this CAO position.

The most recent version of the data governance plan can be found in Appendix A.

2.3 Logic Models, Metrics, and Data

To identify a robust set of metrics that Vermont can use to measure climate mitigation, adaptation, resilience, and equity progress in the state, ERG undertook a series of activities in collaboration with the State team and the DGT:

- **Developed a set of use cases** for the tool to articulate the types of users that the tool will target and how these users will use the tool.
- **Created logic models** to illustrate the state's climate priorities (based on a review of existing state plans related to climate mitigation, adaptation, resilience, and equity) and activities that state agencies are undertaking to achieve these priorities.
- **Identified metrics** related to the climate priorities and activities (e.g. strategies, programs, policies, and actions).
- **Conducted a data mapping** exercise to determine the best available data sources for the proposed metrics and assess which metrics would be most appropriate to include in the tool based on its ability to measure outcomes on climate.

The sections below describe these steps and provide more detail including how ERG used these steps to arrive at a set of recommended metrics for inclusion in the tool.

2.3.1 Use Cases

ERG worked with the State team and the DGT to determine the potential uses of the tool and users linked to each use. Overall, we expect state, regional, and municipal staff; legislators; and climate focused organizations, including community-based organizations (CBO)s, non-governmental organizations (NGOs), and funders, to be the primary users of the tool. These groups are the most likely users because they have a vested interest in the progress of climate action in Vermont and/or the need to use the data generated from this tool in their work. We also expect that some climate-interested members of the public will use the tool, but to a lesser extent than the previously mentioned groups. The tool's users would likely use the tool for one or more of the following purposes:

Priority Use Cases

- **Demonstrating success:** The tool could be used to demonstrate climate progress, identify opportunities to adjust or amend targets to better reflect success, gain public support for actions, and show the pace and scale of progress toward targets.

  Audience: Legislators, Climate Councilors, state government leadership

- **Reporting and communications:** The tool could help these users report progress on climate mitigation, climate adaptation, engagement, or equity efforts to decision-makers, funders, or community members and the public on a monthly, quarterly, semi-annual or annual basis. Users developing communication material for the media, project and program managers, grant reporting, decision-makers, conferences and other venues could use the tool.

  Audience: Climate Action Office and other state agencies would be the primary users, developing reports for different audiences (legislators, State government leadership, public,

State programs, press and media). Members of the Inter-Agency Advisory Board of the Climate Council could also use the tool in a similar manner.

- **Education and outreach:** The tool could be used to inform the public about—or help those using the tool understand—progress made on climate priorities. Users may also want to inform others or learn about new efforts, initiatives, and metrics that the state will use to track climate progress. Users could use the tool to learn more about what actions are being taken to reduce GHGs, improve climate resilience, engage the public, and advance equity.

  Audience: Those that are the focus of agencies' current engagement efforts, including frontline, impacted, and marginalized communities—e.g., those that are highly exposed to climate risks, have less resources to adapt to climate and economic change, and bear the brunt of negative effects of climate change. Industries and businesses in Vermont that will be impacted by climate change. Community groups focused on climate adaptation and hazard mitigation may also use the tool for this purpose.

Secondary Use Cases

- **Planning and programming:** Users could use the tool for the purposes of planning and programming efforts, such as climate action planning, hazard mitigation and climate adaptation planning, capital planning processes, grant programs, technical assistance or incentives and initiating and updating other initiatives based on how the state is making progress on targets for climate mitigation, climate resilience, engagement, and equity. Users could use the tool to inform how they engage with state, region, and local planning and programming processes such as those listed above.

  Audience: State government, municipal government, Regional Planning Commissions, groups/entities that provide support to towns.

- **Decision-making:** The tool could be used to inform new or revised policy, projects, priorities, or other decisions related to advancing progress on climate mitigation, climate resilience, engagement, and equity. Non-governmental users, such as NGOs and CBOs, could use the tool to identify areas where they could partner with the state to increase the pace of progress toward climate targets or fill gaps in areas where the state is not currently focused.

  Audience: State government and legislature. Community-based organizations who serve frontline and impacted communities. Community-based organizations that work directly on climate action (e.g., CBOs focused on natural and working lands).

2.3.2 Logic Model Overview

A logic model is a framework or roadmap—usually in the tabular or visual form—that helps describe how a state, program, or organization will achieve its goals or intended outcomes, including the steps necessary to reach them. We developed a tabular logic model for the State to illustrate the activities that Vermont will undertake to reduce greenhouse gas (GHG) emissions and increase resilience and adaptation to a changing climate and meet its climate priorities. Logic model development was a critical first step in beginning to identify appropriate metrics to assess Vermont's climate progress on its priorities and ensure that the tool's metrics are suitable for measuring the progress of Vermont's climate and mitigation priorities.

In developing the logic models, we included the following components listed below and shown in **Error! Reference source not found.**.

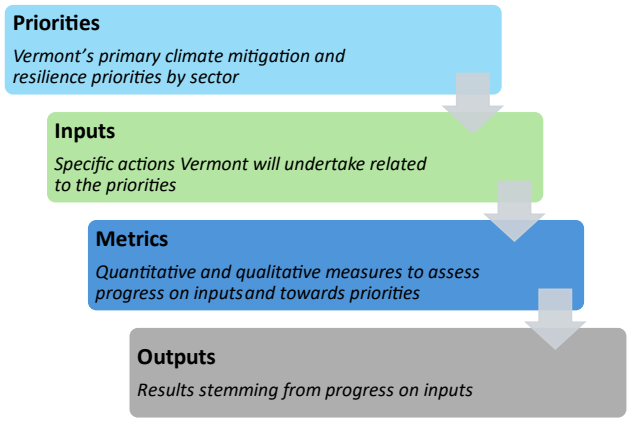


Figure 2. Logic Model Components

- **Priorities** capture Vermont's long-term objectives to advance climate mitigation, adaptation, and equity.
- **Inputs** are the activities (e.g., plans, funding programs, projects, actions, policies, programs) being performed to help Vermont achieve its climate action priorities, such as those outlined in the CAP, the State Hazard Mitigation Plan, and other relevant plans and strategies. Inputs will often be a qualitative description but may involve some quantities that serve as targets to achieve within a specific timeframe. (e.g., reduce energy use in buildings by at least 25% through cost-effective and affordable weatherization and energy efficiency improvements, as well as through use and enforcement of energy codes).
- **Outputs** are the tangible results that provide evidence that the activities achieved the desired results (e.g., GHG reduced, climate resilience built, equity advanced). Outputs typically use quantitative data and are often counts of activity data, or outcome measured, such as attendance or number of people served, that are useful for tracking program implementation. For example, if the activity is "facilitate mobility options that are more efficient and produce less GHG emissions", an activity output might be "number of new bike share programs implemented," and an outcome measured might be "amount of GHG reduced by switching to electric school buses."
- **Metrics** are quantitative and qualitative measures that assess the achievement of the outputs and inputs toward Vermont's climate adaptation, mitigation, resilience, equity priorities. As described further in the sections below, metrics can help track progress on both process (e.g., funding provided, number of participants, planning efforts) and outcomes (e.g., number of acres managed for wildfire risk reduction, amount of GHG reduced by building efficiency improvements).

2.3.3 Metrics Development Process

ERG reviewed the following Vermont climate mitigation, adaptation, resilience, engagement, equity, and public health plans to identify the sectors, priorities, and inputs for the logic model. Note that in addition to the 2021 Initial Vermont Climate Action Plan, ERG reviewed content that is currently being developed for the 2025 update to the Vermont Climate Action Plan. These plans were recommended by the State team and the DGT:

- 2021 Initial Vermont Climate Action Plan
- Climate Action Plan 2025 Recommended Priority Actions
- 2023 Vermont State Hazard Mitigation Plan
- 2022 Comprehensive Energy Plan
- Vermont Agency of Transportation Resilience Improvement Plan
- Vermont Transportation Equity Framework
- 2017 Vermont Forest Action Plan
- Vermont Conservation Design
- Vermont Department of Health State Health Assessment
- Vermont Department of Health State Health Improvement Plan

ERG grouped plan priorities, inputs, outputs, and metrics by **sector** in the logic model. ERG initially defined the sectors based on those used in the above plans. ERG originally identified five sectors and added five more sectors based on feedback from the DGT and the State team, resulting in a total of 10 sectors:

- Transportation
- Buildings and Thermal Energy
- Electricity
- Natural Lands and Open Space
- Working Lands
- Built Environment
- Response and Recovery
- Public Health
- Engagement
- Workforce and Economic Development

Within each of the 10 sectors, we developed a synthesized set of **priorities** and **inputs** drawing on the recommendations, goals, strategies, and actions from the Vermont plans listed above and removing what was duplicative across plans. The logic model includes a column (titled "Why was this priority selected?") that lists the plan or plans from which the priority was identified and any other information that explains why the priority was included, such as a note that the priority was suggested by a member of the DGT or recommended during engagement for the project.

After identifying the priorities and inputs, we developed **metrics** for each priority. Metrics were informed by the actions that Vermont is taking to work towards each priority (i.e., the inputs), as well as ERG's professional awareness of common climate metrics used in other states and nationally. ERG developed metrics to track progress on mitigation, adaptation, resilience, and equity within each sector. This means that one priority may have multiple metrics that measure progress on the same input from different priorities, such as GHG reduction and equity. For example, to measure progress on vehicle electrification, we recommended both "dollars of EV incentives distributed annually" and "dollars to EV incentives distributed annually to low-income households." Metrics can also inform multiple priorities. For example, a metric on the acres of wetland restoration can demonstrate progress on both increased climate resilience and carbon sequestration.

ERG included both outcome metrics and process metrics in the logic model. Outcome metrics refer to metrics that measure the impact of the measured activity. Process metrics track the progress of how activities or programs are implemented. An example of an outcome metric is "CO_2 sequestered annually on natural lands/open space," while a process metric that measures the same input is "$ provided through state funding to private forest landowners to implement practices to improve carbon sequestration opportunities." Outcome metrics are preferrable to process metrics as they help users understand the impact of climate actions. We used process metrics in addition to outcome metrics in some cases for a fuller picture of the inputs and how these inputs will help Vermont reach its climate priorities. We also used process metrics when outcome metrics were not available.

Outcome vs. Process Metrics

Outcome metrics refer to metrics that measure the impact of the measured activity.

Process metrics track the progress of how activities or programs are implemented.

When developing metrics, ERG considered the following criteria to ensure that metrics were appropriate and effective. We included a section in the logic model (titled "Why are we choosing this metric") that outlines how each metric aligns with these criteria:

- **Data availability:** Is data known or likely to be available for this metric? ERG proposed metrics that were commonly tracked or could be collected at the state level.
- **Impact**: Does this metric measure progress on an action that has a substantial impact in meeting Vermont's climate goals? ERG prioritized metrics that measured activities that are likely to have a meaningful impact on Vermont's climate goals.
- **Measurability**: Is the metric numeric? This tool is intended to provide quantitative measurements on the progress of climate action in Vermont to identify trends and the pace of progress. Where quantitative metrics were unavailable and the priority was important, we included qualitative metrics. In some cases, we recommended both quantitative and qualitative metrics to provide a fuller picture and context of the progress.
- **Relevance to future goals**: Will this metric be relevant as plans are updated and new Vermont plans developed? ERG selected metrics that were broad enough to be used over many years; even as inputs shift, the State priorities reflected will likely be stable.

ERG described each **output** in the logic model. The outputs explain the result of progress on each action. For example, the input "advance vehicle electrification" has an output of "fewer gasoline and diesel-

powered vehicles operating in Vermont, leading to a reduction in greenhouse gas emissions and other criteria pollutants from the transportation sector."

The logic model was reviewed by the State team, DGT members, and other state agencies and partners to ensure that the priorities and metrics aligned with those of each Vermont state agency and that there were no gaps in the state priorities. The reviewers suggested additional state plans to review, identified missing priorities in each sector, and helped ERG modify metrics based on their knowledge of data availability. Feedback collected through public engagement efforts was also incorporated into the logic model, as described in Section 2.4.

In addition to the State team and DGT review, ERG held interviews with representatives from Vermont state agencies and partners (some of whom sit on the data governance team) to discuss each sector in more detail and better understand Vermont's priorities, the climate and equity planning and implementation occurring in each sector, and the data currently being collected. ERG conducted a total of 10 interviews and further refined the logic model following these conversations.

Table 2 provides an example priority and metric for each sector. The complete logic model with all priorities, inputs, metrics, and outputs can be found here.

Commented [KF3]: State team: This link will be updated with final logic model for the final report.

Table 2: Sample Priority and Metric in Each Sector.

Sector	Example Priority	Example Metric
Transportation	Decrease greenhouse gas and other vehicle-based emissions from transportation sector	% of registered vehicles in the state that are EVs
Buildings and Thermal Energy	Reduce greenhouse gas emissions from the building/thermal energy sector	Average household energy use over time, BTU/year
Electricity	Protect critical infrastructure and improve resilience in Vermont's electric system	Electrical energy storage capacity
Natural Lands and Open Space	Increase opportunities for carbon sequestration on natural lands and open spaces	# of private forest landowners receiving funding for and implementing practices to improve carbon sequestration opportunities
Working Lands	Reduce greenhouse gas emissions from agricultural and forestry operations	Annual reductions in emissions from agricultural operations
Built Environment	Enhance the resilience of Vermont's built environment, communities, infrastructure, buildings and cultural assets to high priority hazards, including fluvial erosion, inundation flooding, heat, wildfire, and landslides.	# of properties removed from flood hazard zone
Response and Recovery	Ensure Vermont's infrastructure returns to normal operations quickly after damage from a natural disaster or other climate event.	Average length of road/bridge closure
Public Health	Reduce health impacts of high heat	# of emergency department visits for heat stress
Engagement	Conduct inclusive, transparent, and innovative climate engagement	# of climate action events in frontline and impacted communities
Workforce and Economic Development	Develop Vermont's workforce in clean energy, climate, and resilience fields	% of students in Vermont's Career and Tech Ed system that complete training

2.3.4 Data Mapping

After the State team approved the draft list of metrics, ERG began the process of identifying data sources for each of the metrics. The sections below outline this process.

Data Identification

ERG conducted an initial review of existing data sources for each metric based on the following:

- Knowledge of Vermont's available data from our work on the VT Climate Indicators Tool
- Sources suggested through DGT meetings
- Interviews with key sector experts
- Literature review and research

Through this initial review, ERG identified data for approximately 30 percent of the draft metrics. ERG then circulated the provisional list of data sources and gaps for metrics to DGT members and requested feedback on the sources we identified as well as on any suggestions for missing data sources. Through this process, the DGT provided more data sources and key contacts for other sources of data. Table 3 displays a summary of the percentage of metrics we were able to identify data sources for in each sector.

Table 3. Percent of metrics data sources were identified for in each sector.

Sector	Percent (%) of Metrics with Data Identified
Public Health	100%
Workforce and Economic Development	92%
Electricity	63%
Transportation	41%
Buildings and Thermal	33%
Built Environment	24%
Response and Recovery	14%
Working Lands	14%
Engagement	0%
Natural Lands and Open Space	0%

Commented [AM4]: Update once we have finalized numbers

Data Gaps

Through the process of identifying data sources for metrics, ERG recognized several types of recurring data gap themes. ERG presented and discussed these themes with the DGT at a meeting on March 28, 2025. Below, the data gap themes are presented, along with DGT member feedback, and ERG's recommendation for addressing the data gap in the future.

- **Many metrics will require cross agency coordination to track.** For example, metrics that track state funding for climate resilience practices (e.g., acres of agricultural lands conserved restored, and managed to support climate resilience, dollars available and distributed to support climate resilience practices in the agriculture and forestry sectors) will need multiple agencies to provide data on their climate resilience funding.
    - DGT feedback: Some cross-agency coordination already exists, such as for working and natural lands, but in cases where it does not exist the coordination will need to be funded,

as resources are not currently available to support it, or CAO will have to carry out the coordination. It will also be important to determine the flow of data and assign roles and responsibilities to ensure that the data is consistently coordinated.

  - Recommendation: Identify where cross-agency coordination already exists and identify how data collection for the MAP tool can be integrated into current collaboration. The DGT is one possible venue for this coordination to occur across agencies.

- **Some metrics will need to be changed to reflect data availability.** Comprehensive data and/or data at the appropriate scale is not currently available for all metrics. For example, the metric intended to track acres of wetland restored across the state does not have data readily available and ERG could only find one land trust that reports this information annually.
  - DGT feedback: While more data collection is preferable to fill known data gaps, it is also resource intensive. In instances where only partial data is available, it is important to include disclaimers for the metrics and within the metadata and acknowledge the gaps and where they exist.
  - Recommendation: In the near term, include in disclaimers and the metadata for metrics to reflect what is and is not included in the data. Work to close the gaps and build fuller data sets over time.
- **Some metrics have data available in reports that do not have a timeline for updating.** In a few cases, the data that is available was collected once and there is no schedule for updating the data.
  - DGT feedback: Single reporting instances should be addressed by identifying if it is possible to update the data on a timely basis. If updating isn't practical, it may be preferable to exclude the metric. However, if the metric is measuring an important priority, including it in the MAP tool and highlighting the need to update the data may increase support for consistent updates to the data.
  - Recommendation: In the near term, use the data that is available but include the data's age and lack of updates in the metadata and as a disclaimer in a footnote. This could help prioritize future data updates.
- **Some metrics require data that are not publicly available.** Based on data identification efforts, ERG believes that some agencies likely have data that could be used in the MAP tool based on their programs, but they do not currently report it publicly.
  - DGT feedback: One consideration is that the entity who publishes the data may be different than the data steward.
  - Recommendation: Reach out to agencies to confirm data availability as well as the roles of data publisher versus steward, where applicable. In some instances, this may identify gaps in data collection for agencies.

2.4 Engagement

To inform the priorities, use cases, and metrics to be used to design the MAP tool, ERG conducted engagement with the broader public and frontline communities. The main aims of engagement were to:

- Provide information about the project and the process to develop the tool.
- Provide general information about the tool content.
- Gather input on the climate priorities, use cases, and metrics.
- Understand interest in using the tool and for what purposes.

This section describes how participants were identified for engagement, the approach taken for engagement, and the key findings resulting from the engagement conducted.

2.4.1 Participant Identification

ERG worked with the State team to determine the groups to engage to gather input into the development of the MAP tool. Through a series of conversations with the State team, the following groups were identified:

- **Broader Public:** All Vermont residents, with increased engagement focus on municipal representatives and individuals who hold any of the following identities:
  - Vermonters who live and work rurally
  - Youth (teens and early 20s)
  - Vermonters with disabilities
- **Frontline Communities:**[5] "Communities who:
  - Are highly exposed to climate risks, such as health impacts, flooding, and extreme temperatures;
  - Experience oppression and racism, are excluded from opportunities, or have less resources to adapt to climate and economic change;
  - Bear the brunt of pollution and negative effects from today's fossil fuel and extractive economies; and
  - Are more likely to experience a job transition as Vermont addresses climate change."
- **MAP Tool partners:** Entities whose work is parallel to, or overlaps with, the MAP tool where there is a need to align efforts.
- **Vermont State staff responsible for MAP tool design and maintenance**: Staff that represent agencies within the State of Vermont that will assist in the tool's development and will be responsible for updating and maintaining the tool over time.

Input from MAP tool partners and State staff involved in tool design and maintenance was captured through our regularly scheduled bi-weekly project meeting as well as interviews conducted during the development of the logic model, metrics, and data (See Section 2.3 above). For purposes of this section,

[5] As defined in the Initial Climate Action Plan: https://outside.vermont.gov/agency/anr/climatecouncil/Shared%20Documents/Initial%20Climate%20Action%20Plan%20-%20Final%20-%2012-1-21.pdf?_gl=1*18l180a*_ga*MTA2MTkwMTM3NS4xNzIxNTcxODAx*_ga_V9WQH77KLW*MTcyNzA5NzMyMS45LjEuMTcyNzA5NzQ1OS4wLjAuMA.

we are considering these efforts to be outside of the engagement processes centered upon the broader public and frontline communities.

The scope of engagement efforts conducted under this project included three online meetings with the broader public, two in-person meetings with frontline community members in collaboration with CBOs, and one focus group of CBOs who serve frontline communities. Table 4 shows who was engaged by opportunity type.

Table 4: Engagement Representatives by Engagement Type

Engagement Type	Representative(s)	
Online Public Meetings (3)	• Broader Public	

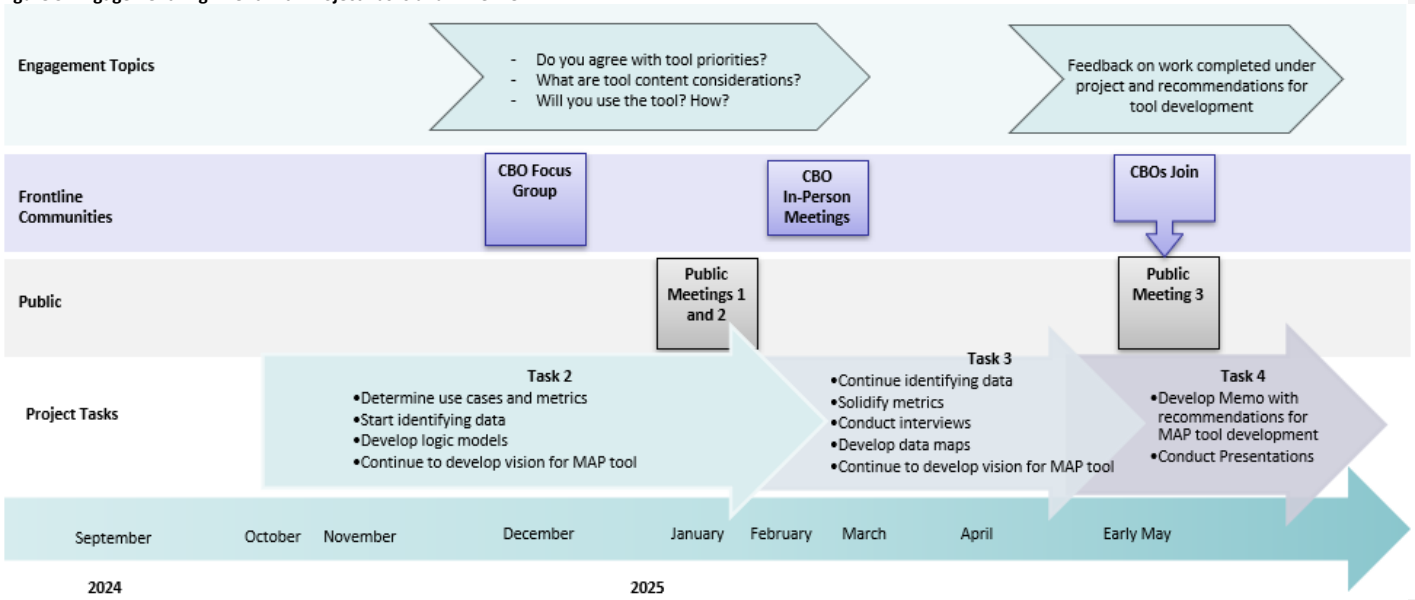
In-Person CBO Constituent Meetings	• Addison County Relocalization Network
	  ○ Farmacy program participants
	  ○ Farmers
	• Food and Agriculture-focused organizations (NOFA-VT, Liberation Ecosystems, Rural Vermont, Vermont Farm to Plate)	

	• Racial Justice Alliance • Organization members	
CBO Focus Group	• BROC Community Action • Capstone Community Action • Champlain Valley Office of Economic Opportunity • Community Resilience Organizations (CROs) • Intervale Center • Mosaic VT • NETO, Inc.	• Northeast Kingdom Community Action • Northeast Kingdom Organizing • Peer Plus • Shelburne Farms • Somali Bantu Association of Vermont • Vermont Council on Rural Development • Vermont Garden Network • Vital Communities

2.4.2 Approach to Engagement

Figure 3 shows when each type of engagement was conducted relative to project tasks and the broader project timeline. The topics covered in engagement can be found at the top of the figure. Below the engagement topics, the type of engagement (e.g., focus group, meeting) is listed for both the frontline communities and the broader public. These engagement activities informed the broader project tasks depicted toward the bottom of the figure. For example, during the CBO focus group conducted in December, input was gathered on the agreement with tool priorities, tool content considerations, and tool use. This information was used to inform project task 2 that includes the refinement of logic models and tool vision.

Figure 3: Engagement Alignment with Project Tasks and Timeline



Community-Based Organization Focus Group and Questionnaire

An online focus group was held on December 17, 2024, to gather input from CBOs work serve frontline communities. The State team selected and invited 40 organizations to join the focus group, and 15 organizations participated (See Table 4 for list of participating organizations). Participants who were not compensated for their meeting participation time by their employer were offered a $50 online gift card for their participation.

The two-hour Zoom meeting began by providing participants with an overview of the project (e.g., project impetus, purpose, timeline) and then transitioned to break-out groups for discussion. Each breakout-group was facilitated by an ERG or State team project members and accompanied by a notetaker from the project team. Breakout group discussion questions included:

- Which issues are the focus of your organization's work?
- How does climate change factor into your work?
- Do you currently track information and/or progress on climate (including resilience and adaptation) and/or climate equity/justice in your work?
    - If so, what information do you use to do so? Any specific datasets?
    - Are there datasets or information that you wish you had? What would you track if you could?
- What type of information would be most helpful for your organization to have about climate, resilience, and climate equity/climate justice issues?
- Do you envision your organization using the tool? Do you think any of the frontline community members that you work with or serve might use the tool?
    - If so, what type of information related to climate and climate equity/climate justice issues might they find most helpful?

Meeting participants reconvened to share key takeaways and highlights from their breakout group discussions prior to closing the meeting.

Following the meeting, project team notes from the breakout session were consolidated and reviewed for possible updates to the tool use cases, logic models, metrics, and/or data (See Section 2.3). These notes were also reviewed to develop the key engagement findings presented in Section 2.4.3 below.

Given the success of the first focus group, the project team attempted to hold a second focus group with CBOs who were invited but unable to attend the first focus group. There was not enough interest among invited CBOs to move forward with the focus group, and as an alternative, the project team offered the CBOs to watch a recording of the public meeting conducted on January 30, 2025 (described below) and provide feedback via a Google Forms questionnaire. The questionnaire mirrored questions asked of CBOs in the first focus group (See Appendix D for complete questionnaire).

One individual submitted feedback via the questionnaire, and ERG reviewed the responses for possible updates to the logic model as well as overarching key themes emerging from engagement.

In-Person Community-Based Organization Constituent Meetings

Two in-person meetings were held with CBOs in an effort to hear directly from their constituents. These meetings were held with the following organizations:

- The first meeting was held with the Addison County Relocalization Network (ACORN) on February 12, 2025. ACORN's mission is to promote and provide support for the growth and health of local food and agriculture in Vermont's Champlain Valley. This meeting was attended by 14 individuals comprised of farmers, Farmacy (Food is medicine) program participants, and Food and Agriculture-focused organizations, including NOFA-VT, Liberation Ecosystems, Rural Vermont, and Vermont Farm to Plate.
- The second meeting was held with the Racial Justice Alliance (RJA) on March 1, 2025. RJA aims to address the root causes and impact of systemic racism through Black leadership and approaches that range from "platforms and initiatives; outreach and education; community engagement and support; and, cultural empowerment programming". The meeting was attended by 26 individuals.

Commented [MS5]: Sophi---can you confirm this count? I tallied from our meeting notes (does not include ACORN staff)

The State team conducted initial outreach to the organizations to gauge interest in participating and invite them to a follow-up meeting to further discuss details of the engagement. Team members from ERG and the State team then met with each organization to provide an overview of the project, the type of engagement sought, and discuss event planning (e.g., location, timing, participant invitations). Each CBO was offered a stipend of $2,500 for helping coordinate and host engagement efforts, such as conducting outreach to constituents to secure meeting participants, handling meeting space logistics, and/or coordinating meeting refreshments. CBOs were able to use stipends as they saw fit (e.g., participant gift cards, meeting refreshments, meeting space costs, support organizational needs).

CAO's Community Engagement & Communications Coordinator who sat on the State team and ERG's project manager attended and facilitated each in-person meeting. Similar to the design of the CBO focus group, the meetings began with a presentation about the project's background and impetus, followed by break-out discussion. For the RJA meeting, an additional up-front portion of the meeting was expanded to include an overview of race and climate justice from the organization's leadership. Breakout group discussion covered the following questions:

- Did the climate priorities we described match those that you have for yourself and your community? If not, what are your climate priorities?
- To the extent that you are comfortable sharing: Have you or your community been impacted by climate change? If so, please briefly describe.
- Are you likely to use the type of information presented in the tool? Why or why not?
- What type of climate data and/or information would be most helpful for you to have in the tool?
- Are there any climate related resources or tools you have used that you have found helpful? If so, what are they?

Organizations attending the ACORN meeting were asked the same set of questions asked for the CBO focus group outlined in the previous section.

Meeting discussion and breakout group discussion was captured by notetakers from participating organizations and/or the project team. These notes were compiled after each meeting and reviewed for updates to the tool use cases, logic models, metrics, and/or data and also to establish key takeaways from overarching engagement efforts.

Online Public Meetings

Three, 90-minute online public meetings were held via Zoom. Meetings 1 and 2 were held on January 30, 2025, at two different times (11am and 5:30pm) in an effort to increase the likelihood that members of the public could attend. The content of both meetings was the same, with the first portion of the meeting being an overview of the current project and tool development process, followed by an overview of the tool content and an interactive activity to promote discussion around topics, including: whether current tool priorities align with participant climate priorities, climate tools and resources that participants find useful, and the likelihood of tool use. Individuals were also given the opportunity to respond to a post-meeting survey to provide additional input on the discussion topics beyond what was shared during the meeting (See appendix C for the complete questionnaire). A combined eighteen individuals attended meetings 1 and 2, and one individual submitted a questionnaire response.

Meeting 3 was held on May 28, 2025. The focus of this online meeting was to share the tool recommendations and next steps resulting from the work conducted under this project. The meeting was attended by [X number] individuals.

Commented [MS6]: This blurb to be updated after public meeting agenda confirmed and again after meeting conducted.

For each meeting, the State team conducted outreach through a set of public engagement mechanisms that are currently utilized for climate-related engagement. These outreach mechanisms included:

Commented [MS7]: Sophi, please tweak this list based on avenues that may/may not have been utilized

- ANR-wide weekly news email
- CAO website calendar
- CAO E-newsletter
- Community calendar postings (newspapers across VT)
- Emails to community-based organizations, Community Action/Capstone Agencies, community leaders from multi-lingual focus groups
- Emails to other relevant organizations, (e.g., VANCRO; Deaf, Hard of Hearing, Deafblind Services at DAIL; Vermont Center for Independent Living)
- Emails to Vermont Climate Council & subcommittees with request to share
- Front Porch Forums
- Press release
- Share with State of Vermont Comms & Marketing Team
- Social Media and Newsletters of Agency of Natural Resources (Food Waste, State Parks, Forests Parks & Rec, Fish & Wildlife, Clean Water Conversations)
- VT Department of Libraries calendar
- Email invitation to Vermont League of Cities and Towns to share via their Listserv
- Relevant listservs external to government (ex: Women in Energy, Flood Ready VT)

2.4.3 Key Findings

Key takeaways resulting from engagement include the following:

- **A user-friendly tool with centrally located data is welcome.** Participants commented that they currently refer to multiple sources of information in an effort to try to identify and distill climate action information. Participants voiced a desire for wide-spread, accessible information that is centrally located.
- **Additional tool information is desired.** In response to draft tool priorities and metrics presented during engagement, participants expressed interest in having the integrated data and information that measure and/or shows:
  - Food access and (in) security.
  - How climate actions are experienced by and impact different populations as well as the climate burden and impact on vulnerable communities.
  - The impact(s) of activities and activity dollars spent.
  - Practical information and resources for those most affected by the environment and environmental change (e.g., unhoused individuals).
  - Additional flood impact information, such as where buyouts are happening, flood-impacted households experiencing food insecurity.
- **Consider climate actions more comprehensively.** Several engagement participants conveyed that the tool should not just measure actions taken, but it should also consider *how* those actions were implemented to account for any adverse direct or indirect impacts of the action(s) being implemented.
- **Local level data is preferred.** Participants noted that understanding how the climate actions taken result in impacts at the community level is helpful to organizations and the public as they develop grants and prioritize projects and funding, for example. Farmers and food producers also conveyed that having climate information at more local scale relevant to their work would be beneficial.
- **Mixed response about likelihood of tool use.** There was a mixed response among participants about whether or not they were likely to use the tool. In general, individuals indicated that their use will be dependent on the tool content and ease of use. Some individuals felt that the current tool content is too heavily geared toward agencies while some town energy planners and organizations said they would find it very helpful and would use it.
- **Some community organization data collected at program level.** Some community organizations indicated that they are tracking climate information specific to their programs (e.g., housing needs of constituents, money saved related to weatherization, community needs, and food insecure constituents impacted by flooding). Other organizations noted that, given their limited resources, they are focused on completing mission-critical work and are not currently able to collect data. The type and amount of data being collected is not currently a viable data source for tool metrics; however, existing organizational data could be considered for future tool iterations, such as using the data collected to provide context or help tell the story of certain climate action priorities or population-specific needs and/or impacts.

- **Tool design considerations.** Participants shared a range of tool design considerations that they would like to see incorporated during the tool development phase, including:
  - Printable information and/or data preferred
  - Use of plain language
  - Accessible format
  - Auditory and/or spoken components in addition to writing
  - Integration of experiential knowledge into tool content (e.g., farmer perspectives)
  - Providing the tool user context for various topics through write-ups that set the stage for why climate action (broadly, or specific actions being measured) is important
  - Include GIS/mapping to help tell the story

3 Recommendations for Tool Development

ERG developed the following recommendations based on review of existing tools, DGT meetings, discussions with state agency staff and state agency partners, community and partner engagement, best professional judgement and expertise, and input from the State team, including the Agency of Digital Services (ADS).

3.1 MAP Tool Platform

ERG reviewed a range of platforms to identify the options suitable for the MAP tool. Key functions and attributes that we considered included geospatial component, user interface, ability to integrate a range of data and information types across sectors, data management, data visualization, ability to convey a story, interactivity, ability to handle large datasets, ease of updating and maintenance, and adaptability to add new elements over time as resources and needs warrant. Based on these considerations, the ERG team reviewed Microsoft Power BI, ESRI, Tableau, Excel, and custom-made platforms. While there are many software platforms that are used for the purposes of climate tools and dashboards similar to what is needed for the MAP tool, we felt that these platforms are the most likely to provide the elements that will be needed and that including platforms that are able to handle hourly or daily updates to data or large and complicated computations was not necessary based on the use cases, data, and metrics identified for the tool.

To confirm ERG's understanding of possible platforms, we met with a representative of ADS who is a member of the State team and DGT. The conversation included a discussion of the platforms that the State is already using for different projects and efforts, whether the platform is included in the State's suite of software, and if it requires a monthly or annual fee. The ability for state staff to be able to manage and maintain the MAP tool was also discussed, along with the need for a platform and tool that can be completely handed over to the State rather than a custom-made platform that may require longer term support from outside of the State. The final consideration was whether the MAP tool needed to have a geospatial element to it and whether building it on an ESRI platform was needed or if the mapping depictions provided by the other platforms would be sufficient.

ERG's recommendation for the MAP tool platform based on the information we have at the time of this report is to build the MAP tool on Microsoft Power BI or a similar platform. Microsoft Power BI has several benefits for the development of the MAP tool, including it:

- Is currently being used by the State
- Is easy to integrate into the software used by most state agencies,
- Provides flexibility to support both quantitative and qualitative data and information
- Has the functions and attributes that have been identified as important for the MAP tool

There are several other, similar platforms that the State team could explore, including Tableau, that could provide similar functions and attributes and may be worth evaluating prior to the final selection. ERG is not recommending that the State team use Excel to build the MAP tool or go to the challenge and expense of having a custom-made tool built. Excel is not versatile enough to manage the complexity and size of the data that will be included in the tool, and the user interface would be less visually appealing and easy to use. A custom-made platform would require time and resources to develop and does not appear to be necessary for the type of data and visualizations that are envisioned for the MAP tool at this time.

The one limitation of Microsoft Power BI is that the geospatial component is more limited than some platforms. To address this limitation, ERG recommends that the MAP tool and the Municipal Vulnerability Indicators Tool (MVI) be integrated into a single tool that provides a way to understand Vermont's climate and equity vulnerabilities, resilience, and progress in one place. Integrating the MVI into the MAP tool provides an existing platform for the geospatial component of the tool and allows the State to revisit and refine the MVI to include an index component of that tool. An additional benefit of this approach is that it addresses comments that we received during engagement for the MAP tool to have the climate information easily accessible in one place. Further recommendations on integration are shared below. Additionally, with Power BI Visual it is possible to integrate Power BI with ESRI data and mapping. With a dedicated connector, it is possible to integrate Tableau with ESRI data and mapping as well.

3.2 Integration With Related Tools and Processes

During the development of the recommendations for the MAP tool, the State had a number of climate and equity related process and tools in progress, including an update to the 2021 Climate Action Plan (CAP), the Resilience Implementation Strategy (RIS), and the Environmental Justice Mapping Tool (forthcoming). Due to the timing of the MAP tool project, ERG was unable to fully integrate the priorities and metrics of these efforts. The update to the CAP was far enough underway for ERG to identify priorities from draft versions, but we were unable to build off the EJ Mapping Tool or RIS. ERG recommends that tool priorities, inputs, and metrics be reviewed against these efforts when they are completed and refined where necessary to integrate these key components of Vermont's climate and resilience programs. While the priorities and metrics for the MAP tool were intentionally selected to be stable across plans and efforts, it is worth ensuring that nothing is missed once those plans and efforts are finalized. Additionally, ERG recommends that these efforts are integrated with the MAP tool to the maximum extent possible to make it easy for users both within state agencies as well as communities and CBOs to access and use this information.

3.3 Engagement

ERG recommends that the State team consider broadening the users of the MAP tool either prior to its development or in an update to the tool. Engaging the community, community-based organizations and those across Vermont that will be affected by climate, as well as by the strategies to address climate in a comprehensive way that includes the MAP tool, the MVI, the CAP update, the RIS, and possibly the EJ Mapping Tool would knit the story of the State's climate challenges and responses into a comprehensive approach. Additionally, conducting engagement more broadly during the development and implementation of the MAP tool would provide a way to obtain input on the update to the MVI to inform the indexing of that tool. At this phase of the work, there will be many ways to engage people who work on climate and resilience efforts and care about its impacts across the State—visually and from a policy and priorities basis that would address some of the input ERG heard in the engagement of this phase of the MAP tool.

3.4 Data Governance Team

Most of ERG's recommendations and findings on the DGT can be found in Section 2.2 above, and this section of the memo focuses on the unique cross-agency and cross-sector nature of the MAP tool data. The fact that most of the data needed for the tool is generated, managed, and/or updated by other state agencies and partners increases the importance of data sharing agreements, data management and maintenance standards, and protocols for data use. Best practices should be included in the Data Governance Plan for the following:

- **Documentation and metadata:** Document the relevant facts about the data, including who developed the data, who owns the data, information about the source of the data, reason it was collected, date and location it was collected, limitations and disclaimers around use of the data and what is included and not included in the data, and who to contact with questions or for further details and information.
- **Data quality:** Ensure that there are practices to verify data accuracy, completeness, and quality. Develop data validation processes among those sharing and using the data to reduce errors.
- **Standardization and integration:** To the extent possible standardize the data across agencies and partners through common protocols, and formats. Or agree upon a set of standards that will be applied by the CAO Map tool manager upon transfer of the data.
- **Security:** Agree upon security protocols to prevent unauthorized use and access of the data. Ensure privacy of data details when necessary.

3.5 Communicating Vermont's Climate Priorities and Progress

The tools reviewed by ERG and State team provided a range of options for how to communicate climate data and information. The input received from the State team, the DGT, and through the engagement process prioritized designing a tool that would be a single location for Vermont's climate data and information that was easy to use and understand. Based on this input, we recommend that the MAP tool priorities and metrics be communicated in a way that provides several ways into the data that serve users wanting to understand the overall story of Vermont's climate priorities and progress as well as

Commented [LL8]: We will lay this out over a few slides for the presentation and can share a version with the state team to walk you through it if this description is hard to understand.

those users that seek more detailed information on a particular sector or climate issue. With this in mind, ERG recommends the following organization for the MAP tool:

The **Landing page** presents summary-level information on the key topics areas**:**

- Climate Mitigation (rolled up data and information across sectors in charts and graphs)
- Climate Adaptation and Resilience (Progress on resilience across sectors)
- Equity (Progress on equity across sectors)
- Engagement (Overall state numbers of those engaged/geographies/plans for climate work)

Tabs along the side of the landing page or along the bottom that list all the sectors and one tab that is cross sector priorities. For each of the above landing page topic areas, sectors, and cross sector priorities you can click to go to a page that is provides specific data and information about larger category, the specific sectors, and the cross sector story of how priorities and metrics work together across sectors.

Links or integration with the MVI and possibly the EJ Mapping tool would be provided and for geospatial data and information you could click on a map icon that would take you to those tools and link you to the relevant data in the tool.

Appendix A: Data Governance Plan

Measuring and Tracking Progress (MAP) Tool
Data Governance Plan
December 6, 2024
Version 1.0

Commented [MS9]: Update to newest version available at time of final report

1. Purpose

This Data Governance Plan (DGP) will serve as a reference for all involved parties, with a focus on the Data Governance Team, to have a common understanding of the agreed upon approach to data governance as it pertains to the Measuring and Assessing Progress (MAP) tool. The MAP tool will be designed to track Vermont's progress on its climate goals and objectives by tracking metrics and indicators related to resilience, adaptation, equity, public engagement, as well as mitigation measures to track progress on greenhouse gas emissions reductions.

2. Goals and Objectives

The primary goals of this data governance plan are as follows:

- Identify the appropriate metrics to include in the MAP tool to support tracking progress on climate goals and objectives.
- Identify the sources of data and information to support the MAP tool metrics.
- Enhance the quality of the tool by developing standards for data suitability, completeness, and consistency.
- Foster a culture of data stewardship by establishing defined roles and responsibilities for data source management.
- Ensure that the data and information in the tool is communicated and reported in a way that is clear and actionable for all audiences.
- Outline a schedule and procedure for updating data and adding new data to the MAP tool.

3. Data Governance Structure

The roles and responsibilities of entities involved in the data production and management of MAP tool data are included in Table . The Data Governance Team membership is included in Appendix A.

Table 1. MAP Tool data roles and responsibilities

Entity	Role
Data Governance Team	• Function as a collaborative oversight body to help to identify the appropriate metrics to include in the MAP tool, help to identify data sources for the MAP tool, help to develop the schedule and procedure for new data and existing data updates, and consider how to communicate and report data and information in the tool so that it is clear and actionable for all audiences. As a critical component of all DGT roles and responsibilities,

Entity	Role
	the team will employ data governance protocols/policies outlined in this DGP to ensure the value and use of data is maximized while also ensuring its quality, privacy, and security.
Climate Action Office (CAO) MAP Data Manager	• Helps identify the appropriate metrics and data sources for the MAP tool • Responsible for ensuring the transfer of data from product owners. • Responsible for ensuring the best available data is included in the MAP tool. • Responsible for ensuring that data is updated in a timely fashion and that new data is included in the MAP tool when it is available. • Coordinates with ADS as needed on tool data requirements or requirements.
Product Owners	• Provide MAP tool data and data updates at intervals agreed upon with CAO. • Provide requested meta data and data dictionaries to accompany data provided.
Agency of Digital Services (ADS)	• Coordinate with the CAO DGT Liaison on data needs or requirements when maintaining the MAP tool, including data updates.

Figure 1 depicts the relationship between the entities described in Table .

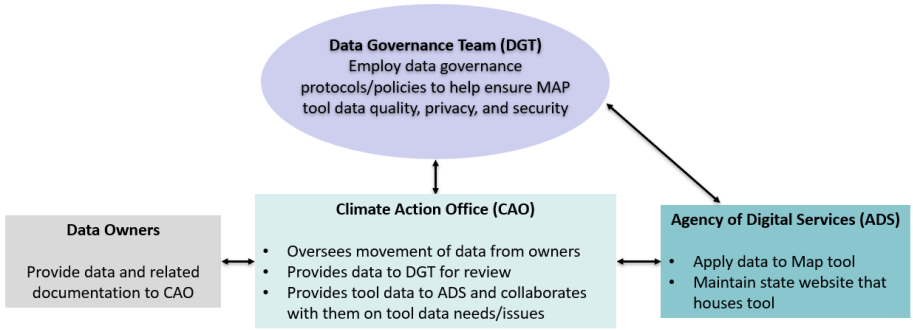


Figure 1: Overview of Data Governance Structure and Entities

3.1 Decision Making Process

The DGT will review and provide feedback on new data and metrics that will inform the final decisions made for tool development. Decisions will be captured by the notetaker for that meeting. Meeting notes and key decisions will be emailed to the DGT within 72 hours of the meeting.

3.1.1 Change Management

Any major changes to the development of the MAP tool overseen by the DGT will be brought forward to the DGT for a discussion and vote review.

4. Data Policies and Standards

4.1 Data quality

Having a clear data quality framework ensures that the data managed is reliable and fit for its intended use. This section outlines the standards and processes necessary to maintain high data quality across all data for this project.

4.1.1 Suitability

It is critical that the suitability and reliability of tool data be assessed before it is accepted for use in the tool. The data governance team will determine the best processes for determining this. However, an example policy may include documenting any feedback and issues with the data that a practitioner or subject matter expert can provide. If a dataset has error or uncertainty values attributed to it, the data governance team might also consider if the error or uncertainty bounds are acceptable for the determined use cases of the data.

4.1.2 Completeness

Data must be evaluated for completeness. For example, temporal data may be missing certain years, or the required geographic scale might not be present for a specific dataset. Any issues with missing data should be documented and the data governance team will determine how to address the missing information.

4.1.3 Consistency

The CAO data manager will format data and metadata (See Section 4.2 below) to meet consistency requirements so that, where possible, data is consistent in terminology and format. Any changes to the data should be clearly tracked. This includes:

- **Standard terminology:** Field names and definitions should be uniform across datasets where applicable. For example, any data that has a county column could be called “county” and have standardized county names in it.
- **Standard data schema:** Data should have consistent formats for data types such as dates, phone numbers, and addresses. See Section 4.2 for proposed metadata standards.
- **Version control:** Any changes made to the data should be tracked so that they can be replicated in future updates.

4.1.4 Maintenance

As relevant, data should be up-to-date and updated in a timely manner. This ensures that the data shared with the public reflects the most accurate and relevant data. The data manager will work with the data governance team and data providers to document what their agency’s update schedule is for the data so that the tool can be updated as that data is updated.

4.2 Metadata

The CAO Data Manager will ensure that all data used in the tool has appropriate metadata. Metadata refers to the overall information about the data itself but should be accompanied by a data dictionary, which describes each field in the data. The CAO DGT Data Manager will work to develop the set of

information to be included in the metadata and data dictionary with input from the DGT. The Vermont GIS Standards and Guidelines metadata template will serve as an initial starting point for a metadata template for the MAP tool.

4.3 Data Security

The tool is expected to primarily contain public data; however, should any private datasets be utilized, data security measures for the MAP tool should align with State and/or Agency data security requirements.

4.4 Data Access and Data Use

All data consolidated in this project will be accessible to view or download by the public through the MAP tool interface and accompanying documentation.

5. Procedures

5.1 Data Management

5.1.1 Data Acquisition

After data is received from the data owner, the CAO Data Manager will check the data for the quality requirements outlined in Section 4.1 above and formatted to have the appropriate metadata and data dictionary described in Section 4.2. The data will be kept track of in a data catalog that will have fields outlined in Table 5 below.

Table 5. Description of data catalog fields.

Data Catalog Field	Description
Data name	Name of the data
Data source	The name of the data owner.
Data contact	Email of the data owner
Date published	The date the data was published.
Date updated	The date of the most recent data update

5.1.2 Data Storage and Maintenance

Once data are acquired from their source, they need to be managed to ensure their quality and reliability remains effective, this includes considering:

- **Version control:** All changes to the data should be documented and tracked. Changes should be made as close to the source as possible to reduce the collection and storage of redundant data.
- **Backups:** Data should be regularly backed up to protect against data loss. Backups should be stored securely and tested periodically for recovery.
- **Archiving:** Archive data that is no longer actively used but must be retained for historical purposes. Ensure archived data is stored securely and is accessible when needed.

5.2 Compliance

The data governance team will discuss how to ensure data governance policies and standards are met through periodic reviews of data management.

6. Revision History

Ongoing record of plan revisions:

Date	Version	Description	Author

Appendix B: Data Governance Team Charter

Measuring and Tracking Progress (MAP) Tool
Data Governance Team Charter

Purpose

The Data Governance Team (DGT) for the Measuring and Assessing Progress (MAP) tool will be a critical component in the ongoing management and incorporation of data into the tool. The MAP tool will be used to track Vermont's progress towards meeting climate action requirements by tracking metrics and indicators related to resilience, adaptation, equity, public engagement, as well as mitigation measures to track progress on greenhouse gas emissions reductions.

The DGT will function as a collaborative oversight body to employ data governance protocols/policies to ensure the value and use of data is maximized while also ensuring its quality, privacy, and security.

Goals

Members of the DGT will be involved in the determination of key activity categories that will inform *what* the tool will track as well as the selection of metrics that will inform *how* this information will be measured. The DGT will also provide expertise on available datasets and dataset needs for identified and selected metrics, as well as helping to guide processes for the data management components of the tool.

Operation

Given the ongoing nature of this process of tracking climate action progress, the DGT will be a long-term obligation with the following commitments anticipated across three phases of tool development and maintenance:

- **Phase I (now through June 2025)** – This phase is expected to have the highest level of effort of the three phases and is focused on establishing the Data Governance Team, identifying the data and information that will be included in the tool, the standards and process for selecting that data and information, and determining a process for updating and revising the data and information over time. Under this phase:
  - The data governance team charter will be developed and data governance plan will be established with input from the DGT.
  - The DGT will provide input into what the tool will measure, how it will be measured (i.e., metrics), and the type and location of the data available for metrics identified.
  - The DGT will review and provide input on key tool development materials, such as use cases, logic models and data mapping.

  We currently anticipate a commitment of approximately 7-10 working meetings lasting up to 2 hours each, with several additional hours needed to develop material together and review and provide input (in writing or during meetings) on relevant work products.

- **Phase II (June 2025 – TBD [estimating 1-2 years])** – This phase will support the development of the tool, and a series of meetings is anticipated to support this effort. The number of meetings and their focus will be determined as the request for proposal for the tool development is developed in early 2025.

- **Phase III (after tool development)** – Following the development of the tool, the DGT will help to ensure that data management practices and datasets are maintained to certain established standards set forth in accordance with a tool data governance plan and to revise them if necessary. The forthcoming data governance plan will establish the process for reviewing and maintaining data.

Membership

Organization	Name
Agency of Natural Resources	CAO staff
Agency of Agriculture Food and Markets	Judson Peck
Agency of Commerce and Community Development	Bronwyn Cooke
Agency of Digital Services	Glen Ferrell and Erik Engstrom
Agency of Transportation	Ari Lattanzi
Department of Labor	Mat Barewicz
Energy Action Network	Lena Stier
Public Service Department	Claire McIlvennie
Public Utility Commission	Rowan Cornell-Brown
University of Vermont	Michael Moser
Vermont Center for Geographic Information	John Adams
Vermont Department of Health	David Grass
Vermont Emergency Management	Stephanie Smith
Vermont Energy Investment Corporation (VEIC)	Dave Westman
Vermont League of Cities and Towns	TBD

Authority

The Vermont Agency of Natural Resources, Climate Action Office is the lead agency for the development of the MAP tool and is requesting the participation of relevant members on the DGT.

Appendix C : Public Meeting Questionnaire

Thank you for attending the webinar on Vermont's Measuring and Assessing Progress on Climate Action Tool on 1/30/2025. Please use this form to share the top climate priorities for you/your community, the type of information that would be most useful for this tool to include, and any existing resources or tools that you use. Information from this survey will be used to inform the development of the tool.

Q1: Did you join the meeting today on behalf of an organization, or did you join as community member/member of the public?

A) Community member/member of the public
B) On behalf of an organization

Community Members/Public Questions

Q1: Do the priorities we described match the priorities for you and your community? If not, please list any others that you might have.

Q2: Has your community been impacted by climate? If so, please briefly describe.

Q3: Are there any climate related resources or tools you have used that you have found helpful? If so, please list them.

Q4: On a scale from 1 to 5, how likely are you to use the tool? 1 = Extremely unlikely and 5 = Extremely likely.

Q5: What type of climate information would you be most interested in/find most helpful?

Q6: How might you use the information provided in the tool?

Organization questions

Q1: Which issues are the focus of your organization's work?

Q2: How does climate change factor into your work?

Q3: What type of information would be most helpful for your organization to have about climate, resilience, and climate equity/climate justice issues?

Q4: Are there any climate related resources or tools you have used that you have found helpful? If so, please list them.

Q5: Do you currently track information and/or progress on climate (including resilience and adaptation) and/or climate equity/justice in your work?

Appendix D: CBO Questionnaire

Thank you for watching the recording of the webinar on Vermont's Measuring and Assessing Progress on the Climate Action Tool. Please use this form to share the top climate priorities for you, your organization, and your organization's constituents; the type of information that would be most useful for this tool to include; and any existing resources or tools that you use. Information from this survey will be used to inform the development of the Vermont's Climate Action Progress Tool.

Q1: Which organization are you representing?

Q2: Which issues are the focus of your organization's work?

Q3: How does climate change factor into your work?

Q4: Do the priorities shared in the presentation recording match the priorities for you, your organization, and your organization's constituents? If not, please list any others that you might have.

Q5: On a scale from 1 to 5, how likely are you to use the tool in your work? 1 = Extremely unlikely and 5 = Extremely likely.

Q6: How might you use the information provided in the tool?

Q7: What type of information would be most helpful for your organization to have about climate, resilience, and climate equity/climate justice issues?

Q8: Are there any climate related resources or tools you have used that you have found helpful? If so, please list them.

Q9: Do you currently track information and/or progress on climate (including resilience and adaptation) and/or climate equity/justice in your work?

If yes,

> Q1: What information do you use to track information and/or progress on climate (including resilience and adaptation) and/or climate equity/justice in your work?
>
> Q2: Are there datasets or information that you wish you had?
>
> Q3: What would you track if you could?