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An Interagency Pilot of Greenhouse Gas Accounting Tools: Lessons Learned

A. Carpenter, E. Hotchkiss, and A. Kandt

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Abbreviations and Acronyms

CACP	Clean Air Climate Protection
CCAP	Center for Clean Air Policy
CEQ	White House Council on Environmental Quality
CH_4	methane
CLIP	Client Leadership in Parks
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CRIS	Climate Registry Information System
CSV	comma-separated values
E.O.	executive order
EPA	U.S. Environmental Protection Agency
FEMP	Federal Energy Management Program
FWS	U.S. Fish and Wildlife Service
FY	fiscal year
GHG	greenhouse gases
GREET	Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation
GSA	General Services Administration
GWP	global warming potential
GYA	Greater Yellowstone Area
GYCC	Greater Yellowstone Coordinating Committee
HFCs	hydrofluorocarbons
ICLEI	International Council for Local Environmental Initiatives
LEAP	Long-Range Alternatives Planning System
$MTCO_2e$	metric tons of carbon dioxide equivalent
N_2O	nitrous oxide
NPS	National Park Service
NREL	National Renewable Energy Laboratory
OMB	Office of Management and Budget
PFCs	perfluorocarbons
ROI	return on investment
SF_6	sulfur hexafluoride
USFS	U.S. Forest Service
WARM	Waste Reduction Model
WRI	World Resources Institute

Executive Summary

The Greater Yellowstone Area (GYA) and Tongass National Forest (Tongass) partnered with the National Renewable Energy Laboratory (NREL) to conduct a pilot study of three greenhouse gas (GHG) inventorying tools. The pilot partners identified a need for this study for a number of reasons. Past experiences with GHG inventorying indicated a need for one tool to be used across land management agencies in order to consistently report GHG emissions. The U.S. Environmental Protection Agency's Climate Leaders tool and the National Park Service's Climate Leadership in Parks tool had both been used previously by the GYA, which presented challenges in terms of consistently collecting data and reporting information relating to GHG activities. Also, annual data collection is burdensome, and reporting is resource intensive. In order to streamline the process and ease the burden, an effective tool was sought for multiagency GHG accounting.

The GYA is one of the largest, intact ecosystems in the continental United States. Land managers within the GYA have recognized the importance of compiling and understanding agency GHG emissions. The 10 federal units within the GYA have taken an active role in compiling GHG inventories on a unit- and ecosystem-wide level, setting goals for GHG mitigation, and identifying mitigation strategies for achieving those goals. Building on efforts from previous years, and extending the boundaries of collaboration to include Tongass in Alaska, the GYA undertook a pilot study of various GHG inventorying and action planning tools available to the federal sector.

Within the United States, there are vast areas of public land, with multiple natural resources, under federal management. Management occurs across the jurisdiction of many agencies performing work under agency-specific mandates and objectives. Yet, there are few other case studies on record that have taken such a quantitative and collaborative approach to environmental emissions management across so many federal agencies, or across such a large land base. This case study of the participating units within the GYA and Tongass represents a unique opportunity to examine a broad, complex, social-ecological system that shares characteristics, advantages, and limitations with many other land-based cross-agency efforts. This knowledge and experience can be expected to become increasingly sought and valuable as federal agencies seek unifying principles, criteria, and approaches for responding to and moderating the intensifying environmental management pressures on national lands. The challenge of collecting accurate GHG accounting data, establishing goals, and monitoring progress towards GHG reductions is one where agencies of all types could use assistance.

Additionally, land management agencies are not alone in their desire to manage data to reduce GHG emissions. The goals established for all federal agencies in Executive Order 13514 result in large datasets that are aggregated on a national scale, making management of GHG emissions at a regional or local level challenging due to lack of granularity of data or resources required to collect and manage the data. The aim of the pilot study is to identify tools and resources that alleviate the burden of the process, and streamline it for land management agencies, as well as provide granular data to allow units the opportunity to collect and manage data for reporting and decision making to reduce GHG emissions.

Staff determined that an ideal tool would feature:

- Comprehensive and readily available technical support, available in a variety of formats
- A familiar, transparent, and reliable operating platform
- Both inventorying and action planning modules useable at a unit, regional, or agency-wide level
- A variety of standardized reporting formats and flexibility for creating non-standard reporting
- An intuitive, user-friendly design with simple navigation
- A tracking system, with the ability to make notes, for capturing where data came from, the data's relevant time period, and additional data points as well as points of contact and calculation assumptions
- An error-checking system for identifying and highlighting erroneous or missing data points
- Data entry options including manual data input and template/batch uploads
- Compatibility with other tools and reporting requirements and mechanisms
- Access control and accountability to enable differing levels of access
- Low or no costs associated with tool use
- Direct data population into the U.S. Department of Energy Federal Energy Management Program GHG and Sustainability Reporting Workbook.

In working to identify tools that best meet the above-outlined needs, the pilot teams tested three different tools. While the pilot project's goal was to identify one tool that could address the needs of the land management agencies involved in the project to inventory and prioritize actions to reduce GHG emissions, no single tool provided all of the functionality that the agencies required. During the project, the team identified that lack of granular data, lack of resources, and the burden of reporting are all challenges. In order to address these challenges, a federally sponsored GHG reporting and action planning tool could be created. This would require collective cooperation and resourcing, but could be the answer that many federal agencies are looking for in terms of a single tool to meet their needs.

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1 Introduction

The Greater Yellowstone Area (GYA) is one of the largest intact ecosystems in the contiguous United States. This region encompasses 18 million acres across three states and contains six national forests, two national parks, and two fish and wildlife refuges. The GYA is one of the most highly visited natural regions in the United States, with more than 4 million visitors each year.

The multiple land-management agencies that operate within the GYA have a long history of working together to reduce the environmental impact of their operations. In 1964, the U.S. National Park Service (NPS) and the U.S. Forest Service (USFS) formed the Greater Yellowstone Coordinating Committee (GYCC), joined in 1999 by the U.S. Fish and Wildlife Service (FWS). The goal of the GYCC is to allow representatives from the three agencies to pursue opportunities of mutual cooperation and coordination in the management of core federal lands in the GYA.[1]

In 2007, the USFS was the first federal land management agency to join the U.S. Environmental Protection Agency (EPA) Climate Leaders program. As part of this affiliation, USFS agreed to develop a greenhouse gas (GHG) emissions inventory for seven pilot projects, including inventories for the six national forests in the GYA. USFS staff also applied the EPA Climate Leaders protocol to the two FWS refuges. These inventories conducted by USFS staff only represented agency operations; they did not incorporate emissions associated with visitors. NPS compiled its own agency inventories, and in 2008 and 2009, the National Renewable Energy Laboratory (NREL) consolidated the three agency inventories into one GYA-wide inventory for Fiscal Year (FY) 2007. The consolidated GYA GHG inventory captures emissions associated with anthropogenic activities on all federal lands in the GYA. The GYCC website is available to the public to show progress on inventories and reducing GHG emissions for units within the GYA, as well as the Tongass National Forest (Tongass).[2]

In 2010, the GYA again worked with NREL to create a collaborative process to determine actions to reduce GHG emissions associated with the agency activities. The three federal agencies used the inventory and action planning process to collaboratively set comprehensive emission reduction goals for the 18-million-acre ecosystem. For the purposes of this pilot project, an action plan consists of identifying areas where GHG emissions could be reduced and identifying actions that could potentially reduce said emissions. The "action plan" is a tool or a document that summarizes a collective set of actions to reduce emissions in different categories. This project is one of many actions the agencies are taking to understand and reduce their environmental footprint and to satisfy the requirements of Executive Order (E.O.) 13423, E.O. 13514, and the Energy Independence and Security Act of 2007 (often referred to as EISA) to lower petroleum, energy, and water consumption, and to reduce GHG emissions.

[1] "Greater Yellowstone Coordinating Committee." NPS, USFS, FWS, and Bureau of Land Management (undated). Accessed Oct. 19, 2012: http://fedgycc.org/.

[2] "Sustainable Operations: Greenhouse Gas (GHG) Inventories." USFS, 2011. Accessed Oct. 19, 2012: http://www.fs.fed.us/sustainableoperations/climate-change-greenhouse-gas-inventories.shtml.

The GYA and NREL continued the collaborative process in 2011. A pilot program was designed to determine whether a GHG inventorying and action planning tool exists that will help land management agencies with collecting data, reporting, and determining actions to reduce emissions. The pilot partners identified a need for a pilot study for a number of reasons. Past experiences with GHG inventorying indicated a need for one tool to be used across land management agencies in order to consistently report GHG emissions. Annual data collection is burdensome, and reporting is resource intensive. In order to streamline the process and ease the burden, an effective tool was sought for multiagency GHG accounting. In 2011, the GYA efforts were expanded to include Tongass National Forest (Tongass). The Tongass is located in Alaska and encompasses nearly 17 million acres surrounding the Inside Passage. The Tongass is the nation's largest national forest and is unique in its remoteness, as well as its terrain, which includes glaciers, fjords, coastlines, forests, and protected heritage sites. The Tongass is not only the largest national forest, but its geographical location means remote facilities and camps exist; and motor vehicles, aircraft, and watercraft are used to access those sites. The Tongass was one of the first national forests to conduct a GHG emissions inventory and action plan in 2008, prior to the requirements established in E.O. 13514. Due to the size, unique challenges, and GHG inventorying experience, the Tongass was invited to participate in a pilot project to provide a different perspective within the USFS. More information about the Tongass sustainability inventories and efforts can be found in its environmental footprint report.[3]

This "lessons learned" report outlines the pilot project designed and undertaken by NREL, the GYA, and the Tongass in 2011 and 2012. It details the processes, methodologies, challenges, and solutions realized by the federal units within the GYA and Tongass throughout this ongoing effort.

[3] USFS. *First Tongass National Forest Environmental Footprint Report.* (undated). Accessed Oct. 19, 2012: http://www.fs.fed.us/sustainableoperations/documents/tongass-footprint.pdf.

2 Greenhouse Gas Basics

Greenhouse Gases are trace gases that exist in the Earth's lower atmosphere that trap heat through a natural process known as the "greenhouse effect." The greenhouse effect allows sunlight to freely enter the atmosphere and strike the Earth's surface. Some of the energy is radiated back toward space as infrared radiation, or heat. GHGs in the atmosphere then capture some of this radiation, warming the Earth's surface and lower atmosphere. GHGs are emitted through a variety of both natural and human processes. The six commonly accepted and monitored GHGs are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

Although all GHGs can trap heat in the Earth's atmosphere, different gases have varying heat-trapping abilities and atmospheric lifetimes. For comparison, a global warming potential (GWP) value is assigned to each gas. GWP represents the heat-trapping impact of a gas relative to CO_2, which has a GWP of 1 and functions as a warming "index." GWP is generally calculated over a certain time interval (often 100 years). For example, N_2O has a 100-year GWP of 310, meaning that 1 ton of N_2O will trap 310 times more heat than 1 ton of CO_2 over 100 years.

A single metric capable of describing all GHG emissions is metric tons of CO_2 equivalent ($MTCO_2e$). To calculate $MTCO_2e$, the mass of emissions from each gas emitted is multiplied by the GWP for that gas. For instance, methane has a GWP of 21, meaning that 1 ton of CH_4 is 21 times more potent than 1 ton of CO_2. One ton of CH_4 emissions is therefore equal to 21 $MTCO_2e$.

2.1 Federal Greenhouse Gas Context

In response to the growing scientific concern over the increase in GHGs in the atmosphere and their negative impact on natural environmental interactions, reporting and mitigation activities have begun on an international scale. Within the United States, two presidential E.O.s—E.O. 13423 and E.O. 13514—were created to begin focusing on GHG emissions within the federal sector. E.O. 13423—"Strengthening Federal Environmental, Energy, and Transportation Management"—was signed on January 24, 2007. It set more challenging goals than the Energy Policy Act of 2005 (often referred to as EPAct 2005) and superseded E.O. 13123 and E.O. 13149.

Under E.O. 13514, agencies must "…establish and report to the White House Council on Environmental Quality (CEQ) Chair and Office of Management and Budget (OMB) Director a comprehensive inventory of absolute GHG emissions, including Scope 1, Scope 2, and specified Scope 3 emissions." [4] Absolute emissions refer to "…total GHG emissions without normalization for activity levels and includes any allowable consideration of sequestration." Definitions of each emissions scope are shown in Figure 1.

[4] U.S. President. E.O. 13514, "Federal Leadership in Environmental, Energy, and Economic Performance." Section 2(c). *Federal Register* 74, no. 194 (8 October 2009). Accessed Oct. 19, 2012: http://www.gpo.gov/fdsys/pkg/FR-2009-10-08/pdf/E9-24518.pdf.

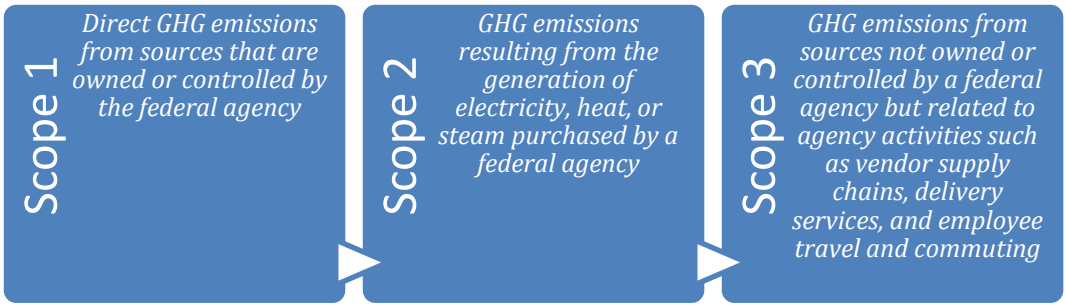

Figure 1. Definitions of federal GHG inventorying scopes

Examples of emissions sources within each scope are:

- **Scope 1** – stationary combustion, fleets, vehicles, and equipment, fugitive refrigerants and fluorinated-gases, agency-operated wastewater treatment facilities, agency-operated landfills, and process emissions

- **Scope 2** – purchased electricity, purchased steam and hot water, purchased chilled water, and purchased steam or hot water from combined heat and power facilities

- **Scope 3** – transmission and distribution losses associated with purchased electricity, employee business travel (air and ground), employee commuter travel, contracted wastewater treatment, and contracted waste disposal.

Creating a GHG inventory is the first step in developing a plan to reduce GHG emissions. A GHG inventory is a comprehensive and quantified accounting of an agency's GHG emissions and sources. A reliable GHG inventory embodies five core principles of GHG accounting and reporting: relevance, completeness, consistency, transparency, and accuracy.[5]

The instructions for preparing federal GHG inventories are detailed in the *Federal Greenhouse Gas Accounting and Reporting Guidance* and its associated Technical Support Document *(TSD),* which were released by the CEQ.[6] Per E.O. 13514, agencies were first required to submit inventories in January 2011 for their baseline year (FY 2008) and for their first year of reporting (FY 2010). E.O. 13514 also requires that federal emissions inventories are reported annually each January for the preceding FY. As such, agencies have been challenged with learning about GHG emissions, their sources, and how to collect and aggregate the data. The additional reporting requirement has placed an added burden on agencies for collecting and reporting data without additional resources to support such an effort.

[5] The GHG accounting and reporting principles were first established in the GHG Protocol Corporate Accounting and Reporting Standard, which was developed by the World Resources Institute and the World Business Council for Sustainable Development through the Greenhouse Gas Protocol Initiative. The Corporate Standard, along with a variety of other GHG protocols, was accessed August 2012: http://www.ghgprotocol.org/.

[6] "CEQ: Guidance for Federal Greenhouse Gas Accounting and Inventories." The White House (undated). Accessed Oct. 19, 2012: http://www.whitehouse.gov/administration/eop/ceq/sustainability/fed-ghg.

On a broader federal level, there are two methods to report GHG emissions. Agencies have the option of reporting in a top-down or a bottom-up approach. Top-down reporting is where data are aggregated and analyzed, calculated, and entered at a headquarters level. Bottom-up reporting is done at a facilities level from acquisition, calculations, and entry. Agencies must report through the U.S. Department of Energy's Federal Energy Management Program (FEMP) *Annual GHG and Sustainability Data Report*. This FEMP report is a federal GHG reporting workbook serving as a foundation for annual energy and GHG emissions reporting under E.O. 13514. The Excel-based workbook is available from FEMP for annual submission by each agency.

The FEMP GHG report is submitted to both FEMP and CEQ, and used by the OMB for scorecard reporting. Scorecards are reports that allow comparisons between agencies; and allow agencies to track performance internally year-on-year in the areas of energy, water, pollution, and waste. More information on OMB Scorecards and the agencies involved in annual reporting can be found on the White House's website.[7]

Within the context of the GYA and Tongass pilot project, the federal GHG inventorying requirements are important to consider because there are a number of global methodologies for GHG reporting. For the sake of consistency and to ease the burden for reporting requirements, the team identified the need to use tools that have the capability to report GHG emissions in a format consistent with federal requirements under E.O. 13514. GYA and Tongass staff identified the need to determine ways in which the reporting burden could be lessened and to provide consistency across land management agencies. The process outlined in Section 3 of this report provides more context pertaining to GHG reporting and mitigation, specifically for land management agencies.

[7] "CEQ: OMB Sustainability and Energy Scorecards." The White House (undated). Accessed Oct. 19, 2012: http://www.whitehouse.gov/administration/eop/ceq/sustainability/omb-scorecards.

3 Pilot Study

The GYA and Tongass worked with NREL to conduct a pilot study of three GHG inventorying tools. The pilot partners identified a need for a pilot study for a number of reasons. Past experiences with GHG inventorying indicated a need for one tool to be used across land management agencies in order to consistently report GHG emissions. The EPA's Climate Leaders tool and the NPS's Climate Leadership in Parks (CLIP) tool had both been used previously by the GYA, which presented challenges in terms of consistently collecting data and reporting information relating to GHG activities. Annual data collection is burdensome, and reporting is resource intensive. In order to streamline the process and ease the burden, this pilot aimed to identify an effective tool for multiagency GHG accounting.

3.1 Pilot Structure

A number of factors influenced the design of this GHG tool pilot project with the land management agencies. Resourcing, timing, and predictable needs were the major factors that influenced the project. The pilot was also structured around the constraints of the participating land management agencies because this was a volunteer-based pilot for those participating agencies.

NREL worked with the pilot participants to identify key activities for a successful pilot program. The activities were broken out by pre-pilot, pilot and post-pilot categories:

- **Pre-Pilot**. Pre-pilot activities included identifying criteria for tools, identifying tools that met the criteria, narrowing the tools down, selecting tools for the pilot and designing a pilot program, identifying a launch date and team members, establishing the measures of success and outlining expectations, creating data collection sheets to populate the tools, and identifying methods for collecting data. Feedback forms were also created to analyze the tools after the inventory and action planning modules had been used.
- **Pilot.** The pilot activities included training and launching each of the three tools while allowing enough time for the team members to become familiar with each tool and populate each tool with data for GHG inventories. The action planning modules were also included in the pilot activities. Evaluating the tools and discussing what worked well or what could be improved upon occurred during the pilot and post-pilot phases.
- **Post-Pilot.** The lessons learned from the experiences were documented during the post-pilot phase and reviewed by the team in order to share the experiences with a larger audience to further adoption or development of tools.

3.2 Pre-Pilot Phase

The Gantt chart in Figure 2 shows a very linear progression of scheduled activities; however, this is not necessarily reflective of the actual pilot project. While activities were outlined to take place sequentially, the reality is that activities often happened concurrently. Tool criteria were developed while a team was being created to pilot different tools. Tools were being reviewed and assessed for possible inclusion in the pilot study while the pilot program was being designed.

Activities occurred in tandem and provided a more informative process than if the team had stuck to a stringent timeline.

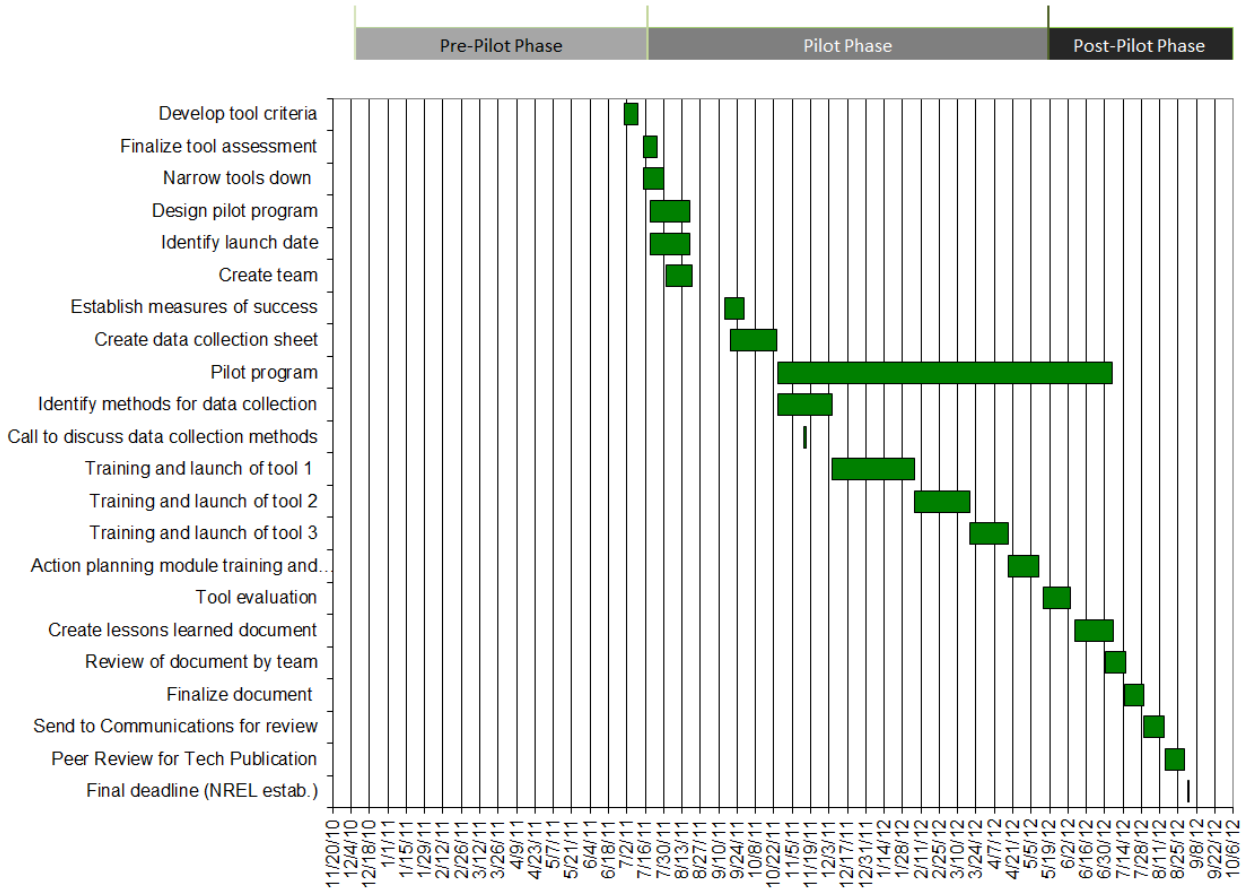

Figure 2. Gantt chart showing activities within each phase

The following section details the activities in the pre-pilot phase.

Team Creation

The pilot team was comprised of four different land management units: one NPS unit (Grand Teton National Park) and three USFS units (Shoshone National Forest, Rogue-River Siskiyou National Forest, and the Tongass' Ketchikan Ranger District).

The GYA includes various units from NPS, USFS, and FWS. Those units are shown in Table 1. In an effort to collaborate with other entities outside of the GYA, the Tongass was asked to participate due to the size of the forest and its experience with GHG inventories and action planning, as previously mentioned.

Table 1. GYA Agencies and Units

Agency	Unit
USFS	Shoshone National Forest Gallatin National Forest Custer National Forest Bridger-Teton National Forest Caribou-Targhee National Forest Beaverhead-Deerlodge National Forest
NPS	Grand Teton National Park Yellowstone National Park
FWS	Red Rock Lakes Wildlife Refuge National Elk Refuge

The GHG pilot project was structured to allow the input of land management agencies that had the time and staff to dedicate resources to the project. The pilot was scheduled over the winter months to alleviate impacting field season and mission critical activities. The pilot project participants strongly influenced the structure of the project through available resources, timing and needs. Therefore, some background information on each of the participating units may prove useful. The GYA had previously worked with NREL to compile GHG inventories and conduct workshops to identify measures to include in an interagency action plan.[8] NREL also produced a report on the workshop results and the formation of the action planning process.[9]

While land management agencies are faced with similar challenges in terms of data collection and GHG emissions mitigation, there are different challenges for different agencies. In general, land management agencies are faced with minimal staff and resources to collect data. These agencies also struggle with how to appropriately quantify and incorporate GHG emissions associated with seasonal staff and associated housing, remote facilities and management areas, and visitor and concessionaire activities.

Land management agencies are unique in that they have a "field season," which requires additional staff to support their missions. Because staff may be contracted or part-time, their patterns of behavior and routines may be different from full-time staff. One example is that seasonal staff may live in remote cabins or at campsites for management and operation of seasonal visitation and facilities or for research. These remote locations may be difficult to reach by vehicle, so staff may drive, ride, or fly in once a week and stay the entire week, as opposed to commuting on a daily basis. These accommodations may be fueled by propane with tanks being filled once per season. Quantifying the amount of resources used to staff these locations for three months every year is a challenge due to billing processes. Records of fuel consumption may also be kept by the site, but not necessarily communicated to those responsible for sustainability and GHG reporting. Therefore, while the overall impact of the GHG emissions associated with these

[8] Fiebig, M. *Sustainability Across Boundaries: The Greater Yellowstone Area Climate Action Plan.* GYCC, 2011. Accessed Oct. 31, 2012: http://fedgycc.org/documents/GYAClimateActionPlanFinal.pdf.

[9] Kandt, A.; Hotchkiss, E. *Beyond the Inventory: An Interagency Collaboration to Reduce Greenhouse Gas Emissions in the Greater Yellowstone Area.* NREL/TP-7A20-49291. Golden, CO: NREL, 2010. Accessed Oct. 31, 2012: http://www.nrel.gov/docs/fy11osti/49291.pdf.

remote, seasonal activities may seem of little importance, they do present a challenge of accurately tracking data and identifying potential areas for reduction.

The FWS faced challenges related to dedicating staff to collect data. The FWS within the GYA manages the Red Rock Lakes Wildlife and the National Elk refuges. These are the smallest agency units within the GYA; however, they do have an impact on the GYA's GHG emissions as a whole, in particular through irrigation and harvesting of winter feed for elk. While the wildlife population is large, there are only seven staff members to oversee the operations of the refuge. Dedicating staff to a pilot project was not possible for the efforts of this project; therefore, the FWS opted not to participate in the pilot during 2011-2012. In an effort to expand the pilot area and determine if there were differences between different forest units on a regional scale, the team approached other regional operations staff to solicit involvement.

Pilot Project Organization

The pilot was designed to be conducted outside of field season so as not to overburden the agencies during their busiest time of year. Many land management agencies have busy summer seasons—from May through September—when many ground-based management, use, and activities occur in support of agency missions. As such, the pilot was designed to take advantage of the quieter winter season when USFS and NPS staff had more time to focus on collecting and reporting data, as well as providing feedback to the pilot team.

Coordination occurred every other week to determine progress and whether there were any questions or concerns relating to tools, or GHG inventorying or action planning in general. Calls were organized to allow pilot participants to share problems and brainstorm solutions. The outcome was that many participants had similar problems, mostly with data collection and where to find data. Those participants who had been able to find the necessary data were able to provide solutions to the other participants.

Data collection sheets were created to allow the tools to be populated with consistent data and to allow for ease of data collection. NREL designed the sheets to allow participants to enter granular data that were required by each tool for alleviating the number of times data needed to be collected. Rather than starting to populate a tool and then having to pause to go find additional data, the user could gather all necessary data from the onset, and then go to the tool for data entry of all available data. The data collection sheets were used as reference points for data entry for each individual GHG tool. The sheets were created in Excel workbooks, and comments were added to explain what kind of data were required and where the data could be potentially located. Examples of where data can be found are shown in Table 2. Descriptions for units and conversions between units were also provided. Appendix C features examples of the data collection sheets used.

Table 2. Examples of Where to Find GHG Data

Category	Data Source
Building energy and water consumption (BTU, kWh, gallons, etc.)	Energy bills from utilities Financing officer Facility or energy managers
Employee commuting	Surveys HR staff
Business travel	GSA Travel Trax HR Staff Surveys Financing officer (reimbursement)
Fugitive emissions	Equipment inventories Environmental management systems Environmental audit reports

Tool Criteria and Selection

In general, agencies had a need to reduce the burden and streamline the process for collecting data from numerous sources for multiple reporting purposes. Manual, time-consuming data collection processes are common for agencies; and the annual requirement for resource reporting places an additional burden and high level of focus on agencies to collect data, transcribe them from their sources, and translate the data into reporting requirements.

Multiple GHG inventorying tools exist in the public domain. Nineteen different tools were reviewed to determine their capabilities, level of access, and cost to use. All tools analyzed in the pilot are available for download or use via the internet. The tools included in the review are summarized in Table 3.

Table 3. Compilation of the GHG Tools Initially Considered for Use in the Pilot Project

Tools Reviewed for the GYA and Tongass			
Tool Name	**Cost**	**Description**	**Applicability**
The Center for Clean Air Policy (CCAP) Transportation Emissions	Free	Transportation specific	Scope 1 and 3 for employee commuting, business travel and fleet only
Cintellate	Paid	Available online, may not align with federal reporting requirements	All scopes
Climate Leadership in Parks (CLIP) Tool	Free	Available for download, NPS specific, but aligns with federal reporting	All scopes, in development for version 2
Climate Registry Information System (CRIS)	Paid	Limited in that it assists with creating a baseline, but not necessarily other implementation phases, may not align with federal reporting requirements	All scopes
Credit 360	Paid	Online tool, potentially able to modify to align with federal sector reporting	All scopes
EPA Climate Leaders	Free	Available for download, federal tool	All scopes, program is being phased out, but the tool will be kept
Footprinter	Paid	Available online, a UK tool that can be modified to align with federal reporting requirements	All scopes
GHG Protocol Initiative	Free	Online, federal tool	All scopes
The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Calculator	Free	Transportation specific	Scope 1 and 3 for employee commuting, business travel, and fleet only
GSA (General Services Administration) Carbon Footprint and Green Procurement Tool	Free	Online tool, may be limited in applicability across all data collection areas, federal tool	Developing to include all scopes; is not currently comprehensive
ghgTrack	Paid	Available online, can be modified to align with federal reporting requirements	All scopes
ICLEI CACP, (ICLEI-Local Governments for Sustainability Clean Air Climate Protection Software)	Free	Available online, communities-based tool, may not align with federal reporting requirements	Community level tool – all scopes
IHS-ESS	Paid	Available online, may not align with federal reporting requirements	All scopes
IHS GHG and Energy Management Solution	Paid	Custom tools that can be designed to align with federal reporting requirements	All scopes
LEAP (Long-Range Energy Alternatives Planning System)	Paid, Free for government agencies	Online tool that helps with projections	All scopes
Portfolio Manager (EPA Energy Star)	Free	Online tool, site-level/buildings specific	Scope 1 and 2 for buildings only
WAste Reduction Model (WARM)	Free	Online tool, waste specific	Scope 1 and 3 only
World Resources Institute (WRI) Tools	Free	Online tools, each tool for data collection is separated out (e.g., one specific tool for waste, one specific tool for water, etc.)	Tools are individual and would have to be packaged for all scopes

Many of the tools available at the time of the initial review did not use GHG emissions factors or accounting methodologies applicable to federal agencies, and were therefore eliminated from consideration for the pilot. The agencies within the GYA and Tongass are geographically separated, and required remote access to software or data collection tools. The pilot team's needs dictated the use of online tools, which allowed for batch uploads, Internet accessibility, report generation outputs, etc. As such, initial criteria were established to prioritize tools for consideration:

- Tools must be aligned with federal reporting requirements in a bottom-up approach.
- Tools must be accessible for download or use on the Internet.

The tools were narrowed to those that best met the initial criteria: 1) ghgTrack, 2) Footprinter, 3) General Services Administration (GSA) Carbon Footprint Tool, 4) Long-Range Energy Alternatives Planning System (LEAP), 5) National Park Service's (NPS) Climate Leadership in Parks (CLIP) tool, and 6) IHS tools. The four tools that are private (ghgTrack, Footprinter, LEAP, and IHS) have the option of assigning federal emissions factors. The other tools are publicly available as they are provided by federal agencies, using federal emissions factors; although, at the time of the pilot, they were being updated to incorporate federal methodologies and updates.

NREL conducted an analysis of data requirements based on the climate action plans created by the GYA and Tongass. The analysis included: 1) determining what data are required to measure progress in achieving targets established in the action plans, 2) where data are being collected within each agency currently, and 3) a gap analysis of where data are necessary, but not currently being collected. The information gleaned from the analysis was used to select three tools for piloting and to design a pilot project to determine which tools best meet the pilot team's needs as a whole. After the tools were narrowed down, NREL conducted an analysis of the data requirements for the GYA and Tongass to determine whether the tools addressed the data collection requirements and whether the tools needed to be tailored to assist with the project's objectives.

The tools selected for the GHG accounting and action planning pilot project with the GYA and Tongass were chosen for specific reasons, and each tool is described in detail in the following sections. In no way was this pilot project intended to condone or endorse the use of one specific tool. The project was designed to identify which parameters work well within a tool, where there are gaps in usability or functionality; and what the ideal tool would be for a federal land management agency undertaking a GHG inventory and action planning exercise. The tools that were identified for this pilot may or may not be successful tools for other agencies undertaking similar activities. The tools were further scaled down to the CLIP tool, the GSA Carbon Footprint tool, and the ghgTrack tool. The CLIP tool was selected because it did provide functionality that was very specific to the NPS and met its needs. The GSA Carbon Footprint tool was selected because it is a publicly available tool and was designed to accommodate FEMP reporting for federal agencies. The ghgTrack tool was selected as a private alternative that had management support that is not restricted by federal funding and proposed a flexibility that could meet the varying needs of different agencies.

CLIP Tool

The CLIP tool is an Excel-based workbook that has been designed through a partnership between the EPA and NPS. The CLIP tool was developed by ICF International under contract with NPS. The tool is free of charge and available for download from the NPS website.[10]

The CLIP tool has two different modules: the inventory tool and the action planning tool. The inventory module allows agencies to prepare a baseline emission inventory specifically for national parks and to include concessionaires and contractors within park boundaries. The emissions sources included cover agency activities related to stationary combustion, purchased electricity, mobile combustion, landfilled waste, wastewater treatment, fertilizer application, forest management, and oil and natural gas activities. The inventory portion of the CLIP tool is designed only for data input, but does provide tabular results with total emissions by sector and park unit (i.e., park operations, visitors, concessionaires, and other permitted activities) for total CO_2e, by individual GHG, by scope, and from biofuel consumption. It provides graphs for total CO_2e emissions by scope, park unit, and sector. The action planning module imports the data from the inventory module and allows the user to assess different mitigation actions. The action planning module allows agencies to set emission reduction targets and compare activities that will help them achieve their reductions. As activities are selected, the tool calculates the progress towards achieving reduction goals, along with calculating the cost and CO_2e savings. The CLIP tool also includes sections for agencies to include education and outreach activities to engage staff and the public related to climate change issues and actions on site. The CLIP tool has a quality control feature to verify data input and automatically check inventories for quality assurance.

GSA Carbon Footprint Tool

GSA is a federal agency that manages the majority of the federal government's building stock through leases to individual agencies. The GSA has developed an online tool free of charge for agencies to use for inventorying.[11] This tool was developed by Noblis under contract with GSA. The tool is designed to calculate an agency's baseline by scope and individual building, assist with developing reduction targets, and compile reports for annual GHG reporting (through the FEMP GHG report). The tool is intended to populate data fields using other federal reporting tools, such as tools associated with GSA's E-Gov Travel Program, Public Building Services, and Fleet Program. The Carbon Footprint Tool follows the World Resources Institute's GHG Protocol, which is based upon the International Organization for Standardization's (often referred to as ISO) 14064-1.

ghgTrack

A proprietary tool was selected for comparison with the free tools available to the federal government in order to determine how it compared to the other tools. The team searched for a simple, online tool that was easily accessible and customizable. The tool selected for the pilot was ghgTrack, which is designed by First Carbon Solutions. The tool costs vary depending on the type of license, how many licenses are purchased, and how many additional modules are

[10] "The Climate Leadership in Parks (CLIP) Tool." NPS, 2012. Accessed Oct. 31, 2012: http://www.nps.gov/climatefriendlyparks/CLIPtool/index.html.

[11] "GSA Carbon Footprint Tool." GSA (undated). Accessed Oct. 31, 2012: https://www.carbonfootprint.gsa.gov/.

included. The cost for an office building/nonindustrial facility license ranges from $450/site (single license) to $97.50/license (>100 licenses). Additional modules are available for audit, corrective action; and health, safety, and environmental compliance. There is also an additional fee of $143.58 per hour for maintenance of software as a service that involves any customized changes. In order for the tool to have all the desired action planning functionality, some customized changes would be required initially. The software is on the GSA schedule, and the full breakdown of the costs is available on the GSA website.[12]

The tool is customizable to allow for accounting and reporting of GHG emissions, along with some other environmental metrics, such as water, waste, recycling, etc. ghgTrack is an online repository for utility bills and other documents, and allows for batch uploads of data to be entered into the tool. Data entry pages, dashboards, and reports are available and customizable. First Carbon Solutions was willing to work with the pilot team to establish the necessary infrastructure and provide support during the pilot.

Agency GHG emissions reporting has only been required since January 2011, therefore, improvements are being made to update many tools. Both of the free, federal-specific tools were being modified during the pilot; therefore, the older versions of the tools were piloted.

Criteria for Measuring Success

In order to determine the success of each tool, the team identified criteria that would measure the impact and effectiveness of the tools. The criteria were broken up into basic information (e.g., name of the reviewer and the name of the tool being evaluated), criteria, and feedback on the tool. The criteria categories were identified by the needs of the pilot participants. Criteria included:

- Level of user-friendliness
- Whether technical assistance was available from the tool developers
- Level of straightforwardness of the data input navigation
- Whether the tool allowed the user to track the data source points or reference points
- Whether the emissions factors within the tool were consistent with federal reporting requirements
- Whether the tool was able to generate useful and tangible results
- Cost of the tool
- Whether the tool aligned with federal reporting requirements overall
- Number of hours required to input data into the tool and utilize the tool to generate results.

The feedback category included numerical ranking for the criteria related to user-friendliness, navigation, data input, and the results section. The participants were also asked to comment on

[12] "GSA eLibrary." GSA (undated). Accessed Oct. 31, 2012: http://www.gsaelibrary.gsa.gov/ElibMain/home.do.

what they thought functioned well within the tool, what they did not like, and what needed improvement; and to provide any additional comments or feedback.

Similar criteria were developed for the action planning modules because action planning is crucial to GHG mitigation and monitoring. All criteria were the same for the action planning module as they were for the inventory modules within each tool, except for the addition of two additional criteria: consistency with current action plans and whether the tool would help with mitigation efforts. A successful tool would rank highly in both the qualitative and quantitative portions of the evaluations using the criteria outlined above.

3.3 Pilot Phase

Federal agency GHG reporting has been, up to the point of the pilot project, at the agency or headquarters level. The top-down data collection methodology precludes providing more concise reporting for the agencies; the agency-level data are highly aggregated with assumptions applied across all units where data are not easily available. There are generalizations made around agency emissions when data are not available. For example, when data are not available for agency-owned housing, fuel estimates based on one person's energy consumption are aggregated across the entire residential portfolio. This may not be the most accurate approach, and there is room for discrepancies. These generalizations prevent any understanding of what the emissions are at the unit level (e.g., forest or park). In addition, units are also not able to conduct realistic action planning around their operations. Numerous federal agencies are exploring how to report GHGs annually through the use of various tools to reduce the burden of collecting, reporting, and monitoring data. The participating pilot teams took on the challenge of conducting inventories from the unit level using the agency-level tools. The challenges arose mostly from the time and resources required to collect granular data, trying to translate an agency-level tool to unit-level reporting, and the functionality of the tool in general.

Appendices A and B provide detailed results from the pilot project by inventory module, action planning module, and specific tool. Pilot teams were asked to provide feedback in terms of whether they would want to use the tool again, what they liked or disliked, what needed improvement, what functioned well, and any other additional comments they might have.

The time requirements for data entry for each of the tools varied. Manual uploading of the data ranged from four to six hours per unit for each of the tools. The batch upload accelerated the data input, reducing the time requirement to around 1 hour per unit; however, this was dependent upon whether the users were able to operate the upload correctly. Some of the pilot participants had used the CLIP tool in previous inventories, so the level of familiarity with the specific tool also helped reduce the time requirement associated with data entry.

Pilot Launch

The pilot activities included training and launching each of the three tools. The trainings were Web-based, interactive sessions, which introduced the team to each tool and allowed time for dialogue and questions. The schedule was created such that one tool was launched at a time, and enough time was allotted to allow for the team members to become familiar with each tool and populate it with data for GHG inventories. Regular conference calls were scheduled throughout

each of the data input periods for the three tools, so team members could ask questions, share successes and problems, and brainstorm solutions.

Inventory Modules

The inventory modules of the selected tools were evaluated based on the criteria mentioned previously and full results from the feedback process are provided in Appendix A. Appendix A provides the feedback from the team members with regards to the project criteria. This inventory module section summarizes the success of each tool, based on the pilot participants' feedback.

CLIP Tool

The pilot participants noted that the CLIP tool was both easy and challenging to use in terms of user-friendliness. The disagreement in usability is most likely due to the level of experience with the tool. Unlike the other two tools, the CLIP tool had been used previously by some of the participants. Familiarity with the tool likely resulted in positive feedback, whereas those who had never used the tool may have found it initially challenging. The CLIP tool operates in a Microsoft Excel-based platform, which does not allow for direct access to remote data because data are stored on a hard drive on a local computer. The tool is designed with extensive macros and background calculations; it allows for ease of moving between different sections of the tool, as is demonstrated in the control sheet (Figure 3).

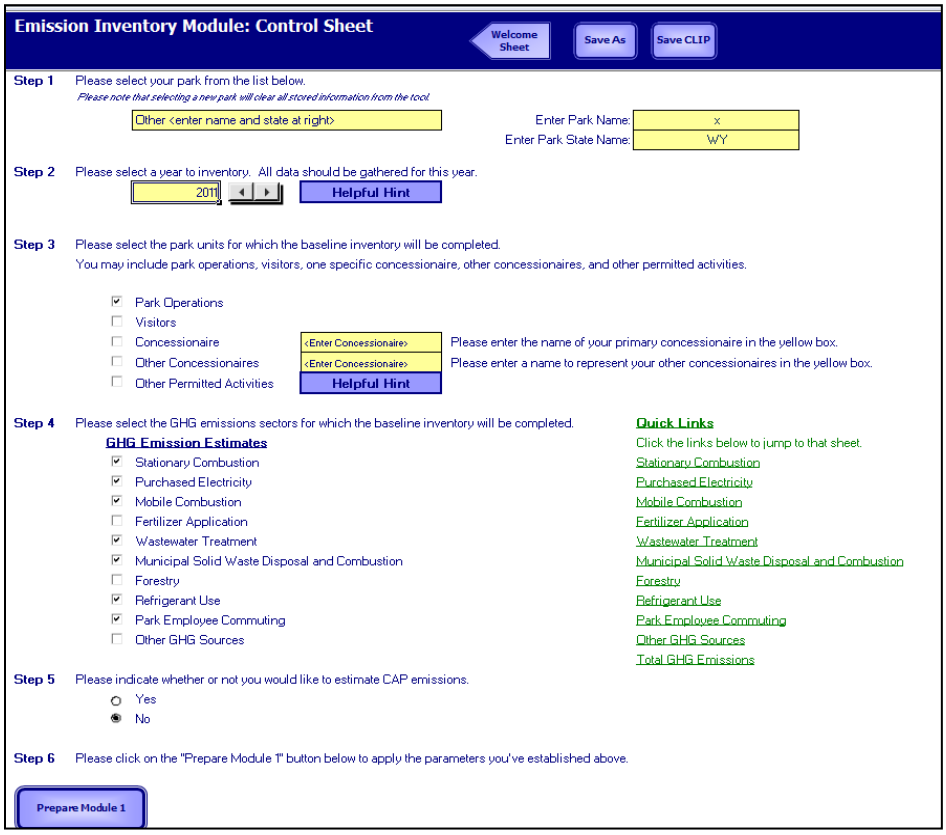

Figure 3. CLIP tool inventory control sheet.

Image from NPS

The pilot teams found that the Excel-based platform was relatively easy to navigate. The formulas in the tool are protected to prevent changes to calculations; however, this precluded users from seeing any of the calculations, as well as understanding why errors occurred. Additionally, the CLIP tool was designed specifically for NPS, and drop-down menu options are limited to specific parks. This narrow selection limited the usability of the tool by USFS units.

The CLIP tool was designed for full-park reporting. If the units wanted to track regions or districts separately in the CLIP tool, they would need to report them in separate copies of the tool and then aggregate the information to the unit level manually. This is demonstrated in Figure 4, which shows an example of a data entry page for stationary combustion, where the data inputs are lumped by fuel type for all park operations, but do not allow for separate data inputs for different buildings or activities within the park.

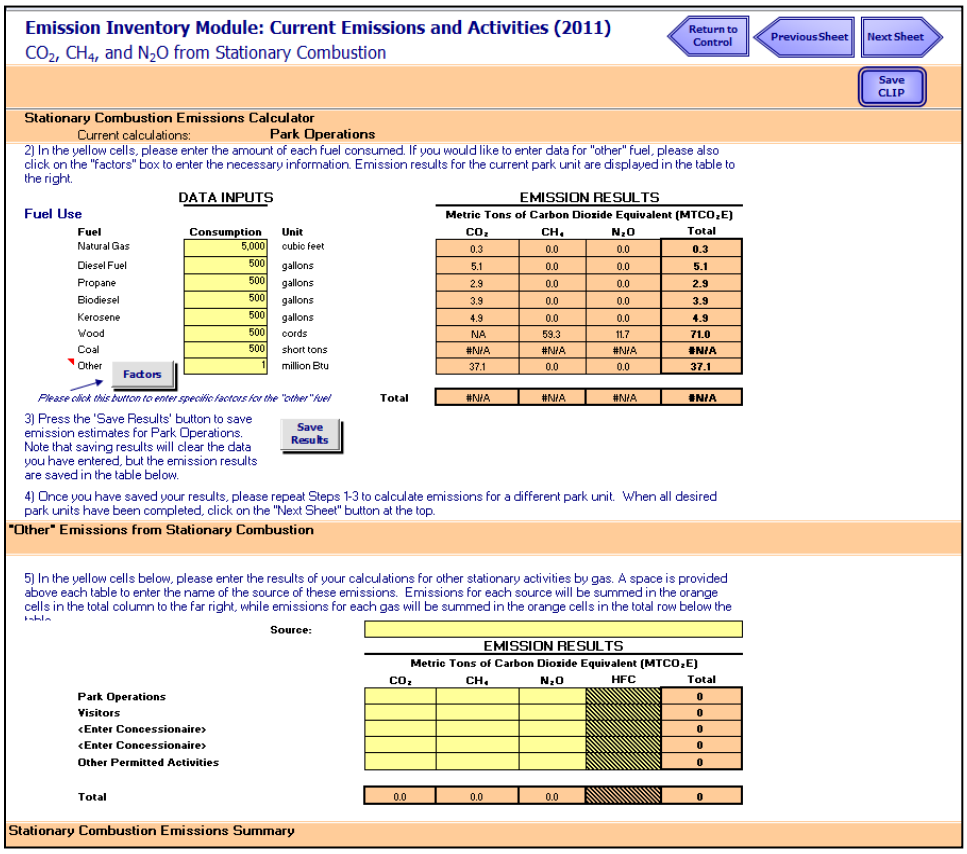

Figure 4. CLIP tool inventory—data entry page for stationary combustion.

Image from NPS

The CLIP tool support team was not responsive to inquiries from the pilot teams or from the NREL coordinators. The lack of technical assistance proved problematic as some of the issues were due to the tool not functioning correctly. In the long term, this can be a strong detractor to a tool and could indicate a lack of reliability and maintenance on the tool.

The ability to navigate efficiently through the data input portion of the tool is very important for reporting units. The quantity of data can be significant, and data input can be time consuming. The CLIP tool had a good navigation system for manual data entry; however, it did not offer any type of automated data-entry system, so all data had to be manually entered.

The transparency of the tool calculations is very important to enable users to track the types of calculations and assumptions being made, as well as to see what emissions factors are being used. This is important to know because the users are required to report in compliance with FEMP reporting requirements. The CLIP tool was designed prior to the federal reporting requirements being published and had the original intent of providing a tool for NPS units to assess their carbon footprint. It is not currently in strict alignment with the federal reporting requirements, but the developers are intending to modify the tool to meet those requirements. The CLIP tool hides and protects calculations so that users are not able to see what calculations or emissions factors are being used. This is being done to preserve the integrity of the tool from inadvertent changes, but it has the side effect of prohibiting the users from tracking how the calculations are being made. It is not clear what emissions factors the CLIP tool uses; thus, the ability to verify consistency with federal reporting requirements was restricted.

GSA Carbon Footprint Tool

The pilot team had different reactions to the GSA Carbon Footprint Tool. Some found the tool to be very user friendly, and others found it easy but not straightforward. The tool also did not function consistently in different Web browsers. The GSA Carbon Footprint Tool is Web based. The ability to access the tool online was occasionally challenging due to lack of either Internet connectivity or the tool site being down, which removed the users from more direct control of their data. Server problems and connectivity also made accessing the tool occasionally difficult. Online tools need to be extremely transparent; and the functionality needs to allow the users to maneuver around entering their data, accessing the data, connecting to what calculations are being made, and translating the data into reports as well as action planning.

The data entry section within the GSA Carbon Footprint Tool was well organized and followed the federal reporting requirements. See Figure 5. The tool also provides easy access to calculation assumptions. The organization of the tool is oriented towards agency-level reporting, which increases transparency. The tool allows different units within one agency to report separately, so the agency is able to discern the GHG impacts from each of the different units. However, the tool does not allow for reporting on a scale smaller than a unit, so an agency cannot report which facilities or which activities within the unit is contributing the most GHG emissions. This kind of detail would inform units as to which activities or facilities they should target for action planning.

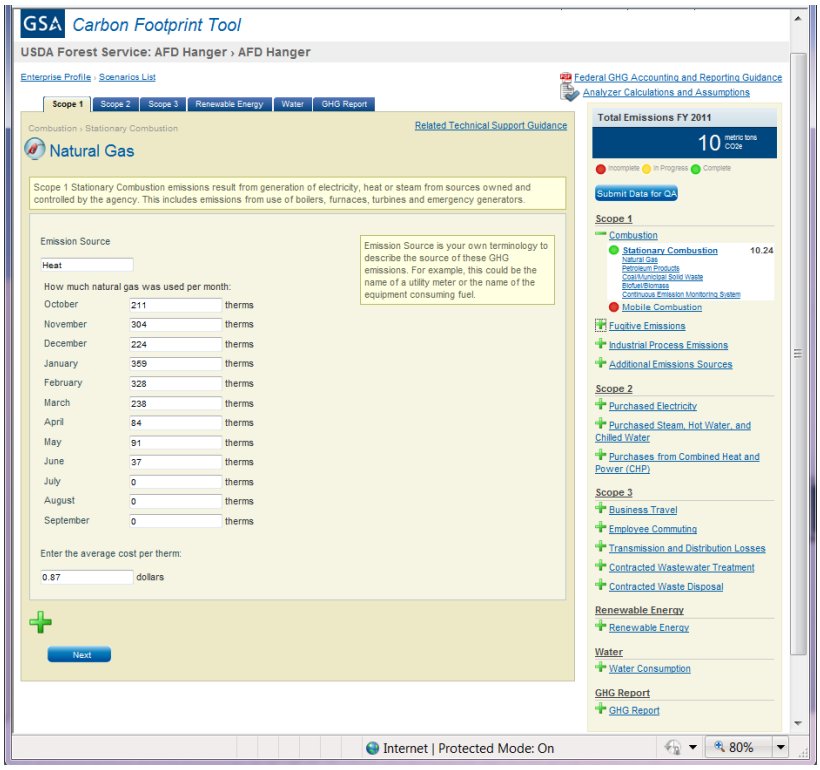

Figure 5. Screenshot of the GSA Carbon Footprint Tool inventory module.

Image from GSA

The GSA Carbon Footprint Tool could be set up to report for different districts or facilities within the forests or parks (see Figure 6).

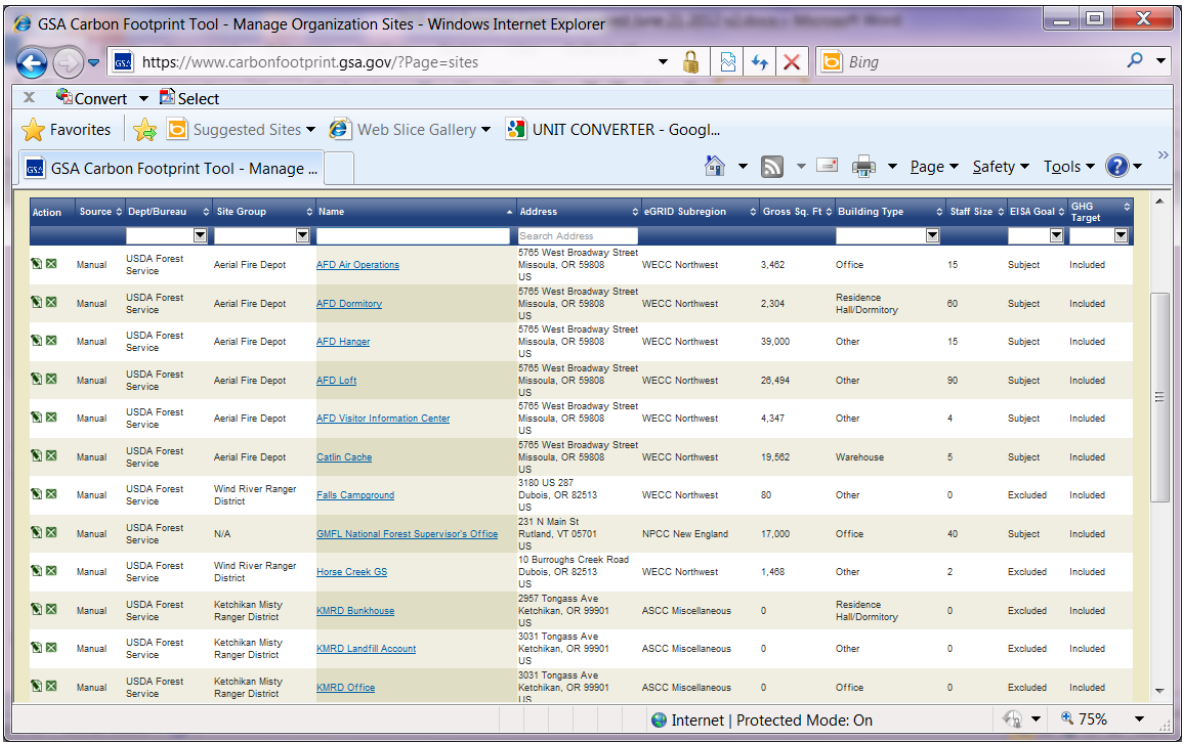

Figure 6. Screenshot of GSA Carbon Footprint Tool enterprise profile.

Image from GSA

Also relevant to the user-friendly aspect was the availability of technical assistance. The GSA Carbon Footprint Tool team was very responsive to questions and difficulties in navigating through the tool. Additionally, they were interested in any feedback from the teams on how to improve the tool.

The data entry aspect of any tool is important and potentially time and resource consuming. The ability to navigate efficiently through the data input portion of the tool is important for reporting units. Data entry in the GSA Carbon Footprint Tool can be semi-automated through a batch upload function; the batch upload function allows the users to upload all their data through formatted CSV (comma-separated values) files. The GSA Carbon Footprint Tool also described the data requirements and provided alternatives for how to collect and calculate certain data.

The GSA Carbon Footprint Tool provides links throughout the tool to a technical report that documents what assumptions were being made and what calculations were required for the different data points. This tool seems to provide the greatest transparency around the source data and aligns closely with federal reporting requirements and data sources.

One of the primary goals of the pilot project was to assess the tools' ability to aid in setting targets for and analyzing progress towards reducing carbon emissions. This goal was kept in mind while assessing both the inventory portion of the tool as well as the action planning portion. The pilot teams found the GSA Carbon Footprint Tool results to be somewhat useful and actionable, but limited to the prescribed action planning options the tool offers. Some of the

action planning/dashboard functionality also has some problems with the graphs not providing results. The ability to target the action planning to specific operations or activities within a unit would help to make the results more tangible.

ghgTrack Tool

The ghgTrack tool is also cloud based; consistent accessibility and control were found to be challenging for the cloud-based tools. Online tools need to be extremely transparent; and the functionality needs to allow the users to maneuver around, enter and access their data, connect to calculations, and translate the data into reports and action planning.

The teams found the ghgTrack tool somewhat difficult to navigate. The tool developers set up each team with baseline tool functionality, based on each team's data collection requirements. Some functionality was desired by the teams, to test, but was not included in the baseline set up, thus limiting the team's ability to fully test the tool. The ghgTrack dashboard provides quick visual results in terms of varying baselines, emissions classification, and facilities breakdown. Initial data entry for the tool was conducted through batch uploads. The batch upload template was predefined by the user for different data sources, and participants found this logical and easy to use. Figure 7 shows the features available in the ghgTrack tool, whereas Figure 8 shows the batch upload template.

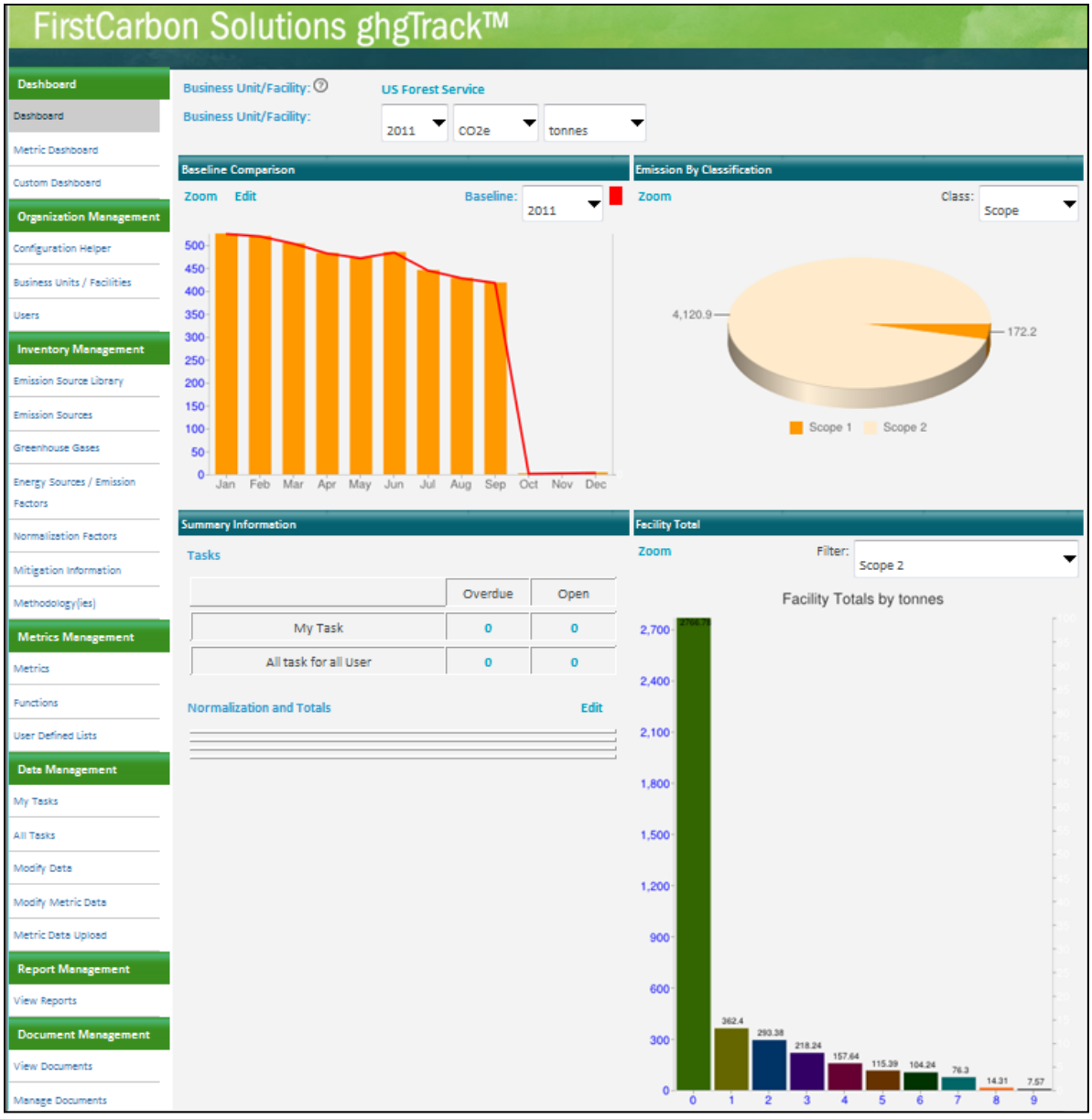

Figure 7. Screenshot of the ghgTrack dashboard.

Image from FirstCarbon Solutions

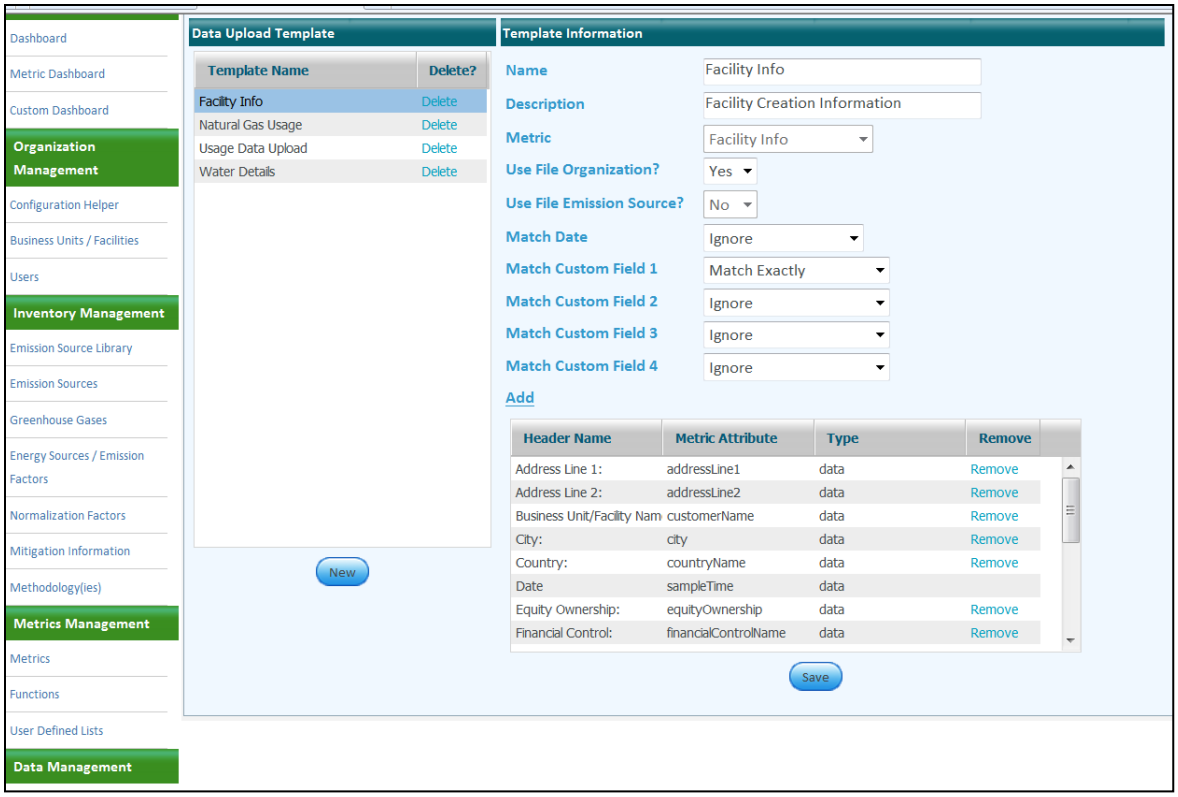

Figure 8. The ghgTrack data upload template.

Image from FirstCarbon Solutions

The organization of the tools varied and allowed for varying degrees of flexibility around how the units could report their emissions. The ability to report in a disaggregated manner provides information around where the emissions are originating and would facilitate action planning around specific buildings or activities. A customized ghgTrack tool could be set up for separate reporting for the different facilities and activities within the reporting unit.

The availability of technical assistance was an important factor and closely related to user friendliness. The ghgTrack team provided free access to the ghgTrack tool and technical assistance to the pilot project participants at no charge. The ghgTrack team provided either an on-site or webinar-based tool set up and training for the pilot teams specific to each team's needs within the constraints of the time and resources allocated. The ghgTrack team was very responsive, however, was not able to provide comprehensive functionality for the tool beyond the baseline, which limited a complete functionality review of the tool.

The ability to navigate efficiently through the data input portion of the tool is very important for reporting units. The quantity of data can be significant, and data input can be time consuming. The batch upload function allowed the users to upload their data from other sources. The ghgTrack tool offered the batch upload option from both formatted CSV files as well as other reports. Additionally, they provide a service to have data transcribed into the tool for the user. While this service can be convenient, it also removes quality control over the data entry.

ghgTrack does not offer the option for manual data entry; however, the data can be manually modified once it is in the tool.

The ghgTrack tool provided reasonably easy access to the different emissions factors that are used, which can also be easily modified. References and calculations were not available for understanding how the emissions factors were determined. The ghgTrack tool is an open form tool, so the developers can cater the tool to meet any requirements desired by the customer. Therefore, the ghgTrack tool could feasibly be set up to align with federal requirements in terms of both the types of calculations being made as well as the emissions factors being used.

With regards to results, the ghgTrack tool provides graphics to see which activities (as structured for data input) and which scopes are contributing the most to the carbon emissions. Feasibly, if the user is inputting the data in a more disaggregated manner—defining separate activities for all the different facilities and buildings and operations—then the results will allow them to see which are providing the highest emissions. There were no action planning tools within the ghgTrack available for the pilot teams to allow users to assess return on investment (ROI) or evaluate potential carbon reductions around different mitigation activities.

Action Planning Module

Federal agencies have been required to report GHG emissions data, however not many have taken action to prioritize and reduce emissions. Action planning tools or modules within inventory tools are essential to agencies that want and/or need to reduce their GHG emissions to meet targets established for their agencies. The action planning modules of the GSA Carbon Footprint Tool and the CLIP tool were evaluated based on criteria for the inventory modules with slight variances (see full results in Appendix A). The ghgTrack tool was not evaluated for action planning as the teams did not have access to full-tool set up, and thus, were not able to adequately evaluate the tool for action planning. The ghgTrack tool could be set up for some action planning with a contract in place; however, it was not available for the pilot project. The action planning criteria identified by the pilot team were:

- User friendliness
- Technical assistance
- Input and navigation / decision making
- Consistency with current action plans
- Tangible results
- Cost (discussed in inventory assessment section)
- Helpfulness with mitigation efforts.

Additional feedback was requested in terms of whether the teams would consider using the tool again, what they liked or disliked, what needed improvement, what functioned well, and any other additional comments they might have.

The users did not request technical assistance during the action planning assessment as often as during the inventory assessment.

CLIP Tool

The CLIP tool had the most diverse action planning module (Figures 9 and 10) that allowed users to evaluate different scenarios for carbon reduction. The scenarios are grouped into different sections: energy management, transportation management, waste management, other emissions sources, and education and outreach. The action planning could be based on setting a goal around a targeted reduction, as well as looking at specific activities.

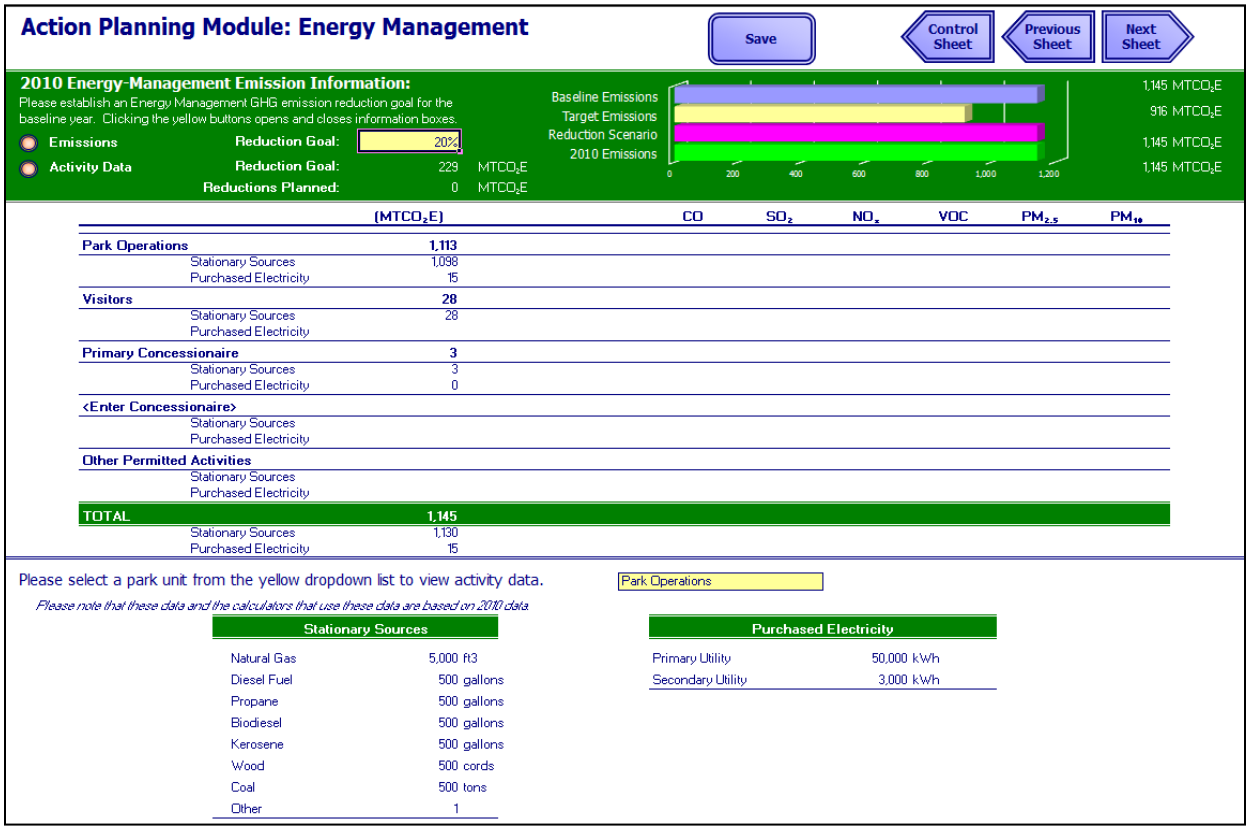

Figure 9. CLIP action planning module for energy management goal setting.

Image from NPS

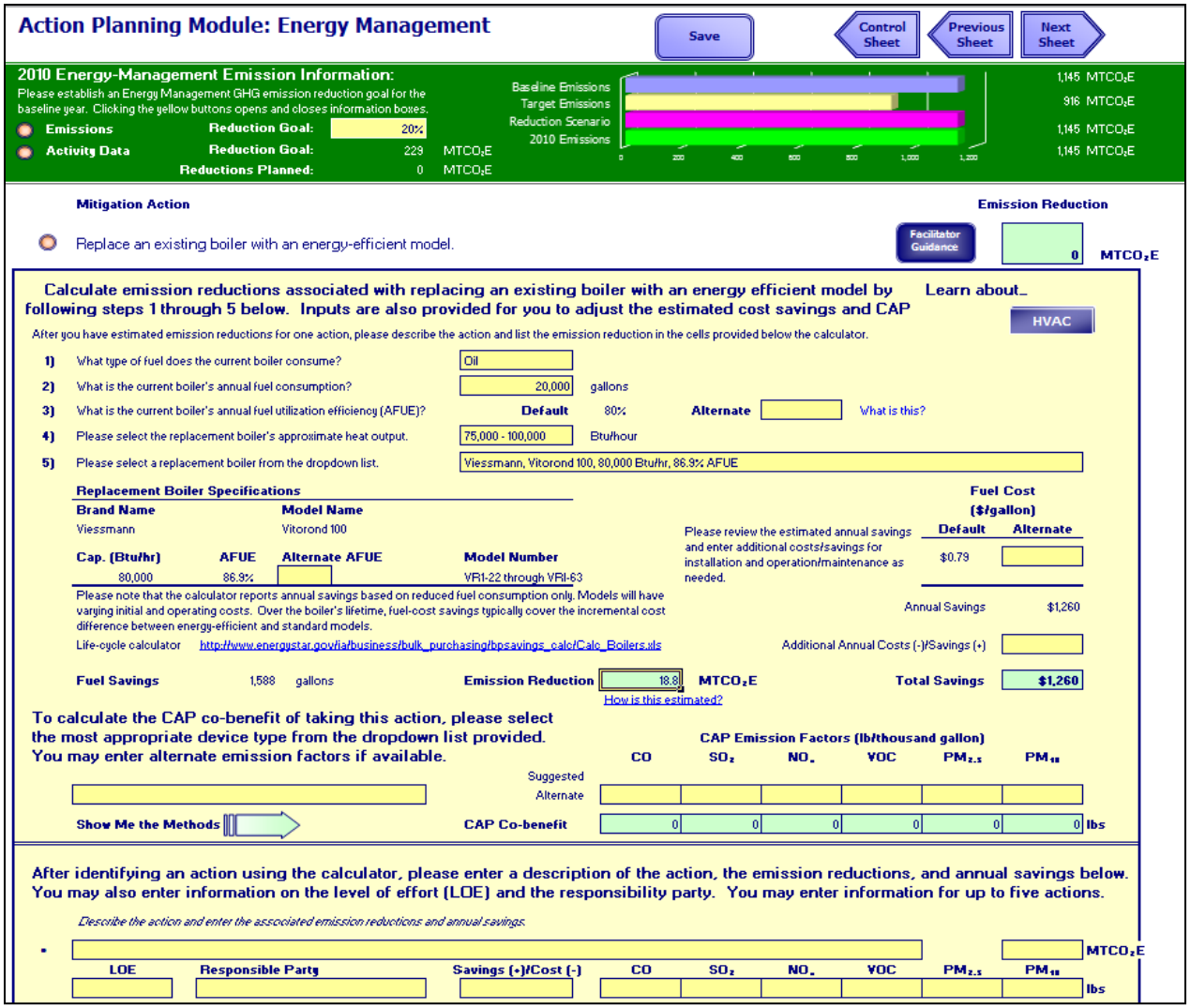

Figure 10. CLIP action planning module for energy management – assessment of specific mitigation action items.

Image from NPS

The different sections of the action planning module generate different scenarios or actions that the user can evaluate. The scenario evaluations offer some specific alternatives, calculate the potential cost savings and CO_2e reductions, and identify team members and the level of effort (see Figure 10). Some of the sections include emissions reduction calculators that allow the user to enter information about the current facility equipment and organization; and then select from various potential upgrades or modifications to determine the potential energy, cost, and emissions savings. Some of the calculators require that the user have in-depth knowledge, not only about the existing facility equipment, but also about the feasibility of the different upgrade options. There is a broad level of detail offered in the CLIP action planning tool that allows the users to assess very specific scenarios.

The pilot teams provided feedback on several different aspects of the action planning module. Despite the extensive scenarios offered, the tool was limited by shortcomings in the spreadsheet

functionality, where the macros would not always work, and the tool would not function at all without them. Additionally, the inventory module and the action planning modules are in two separate tools and are not accessible simultaneously. The ability to look back at the relevant inventory information while in the action planning module is useful, but not effectively done in any of the tools assessed.

For the action planning scenarios that do not have drop-down menus, the research needed is extensive and would deter their use; more drop-down options are desirable. The pilot participants would prefer that the selections available in the energy management section cover more than changing lightbulbs and upgrading furnaces and boilers; and that the fleet management section include a broader range of vehicle types. Users are time constrained, and the resources required to collect the inventory data alone are significant. Additional time and knowledge to research and understand other action planning options are not feasible for many agency units.

Otherwise, the tool had a "How to Use this Module" guide and smoothly connected data from the inventory to the action planning module. It also included a good Action Planning Summary with tables and graphics, and an Action Plan Document with a write up featuring summary tables and graphics as well as descriptions of all the mitigation strategies and activities the user selected.

The pilot teams had varying responses around the navigability of the action planning portion of the CLIP tool. Some found it very easy to navigate, and others found it to be not entirely straightforward.

With regards to consistency with current action planning, the pilot participants had mixed feedback on the CLIP tool with some finding it to be inconsistent, but adaptable, and others finding it consistent. The potential inconsistency with the CLIP tool action planning module might be due to the tool being targeted for NPS units and not for USFS units. The tool was able to provide some action planning results that were useful and actionable; however, the teams were unsure as to if it would be helpful with mitigation efforts.

GSA Carbon Footprint Tool

The GSA Carbon Footprint Tool's action planning sections include a dashboard, an ROI calculator, and a benchmarking tool. The dashboard assesses the potential carbon savings around different types of activities (e.g., video teleconferencing, mass transit participation, off-peak commuting, telecommuting participation, ENERGY STAR® monitor replacement, alternate work schedule, server virtualization, etc.). Sliding bars on the screen indicate the percentage increase in employee participation for an activity; the percentage is applied to the unit/agency to determine the potential GHG emissions savings for a specific activity. A screenshot of this feature is shown in Figure 11.

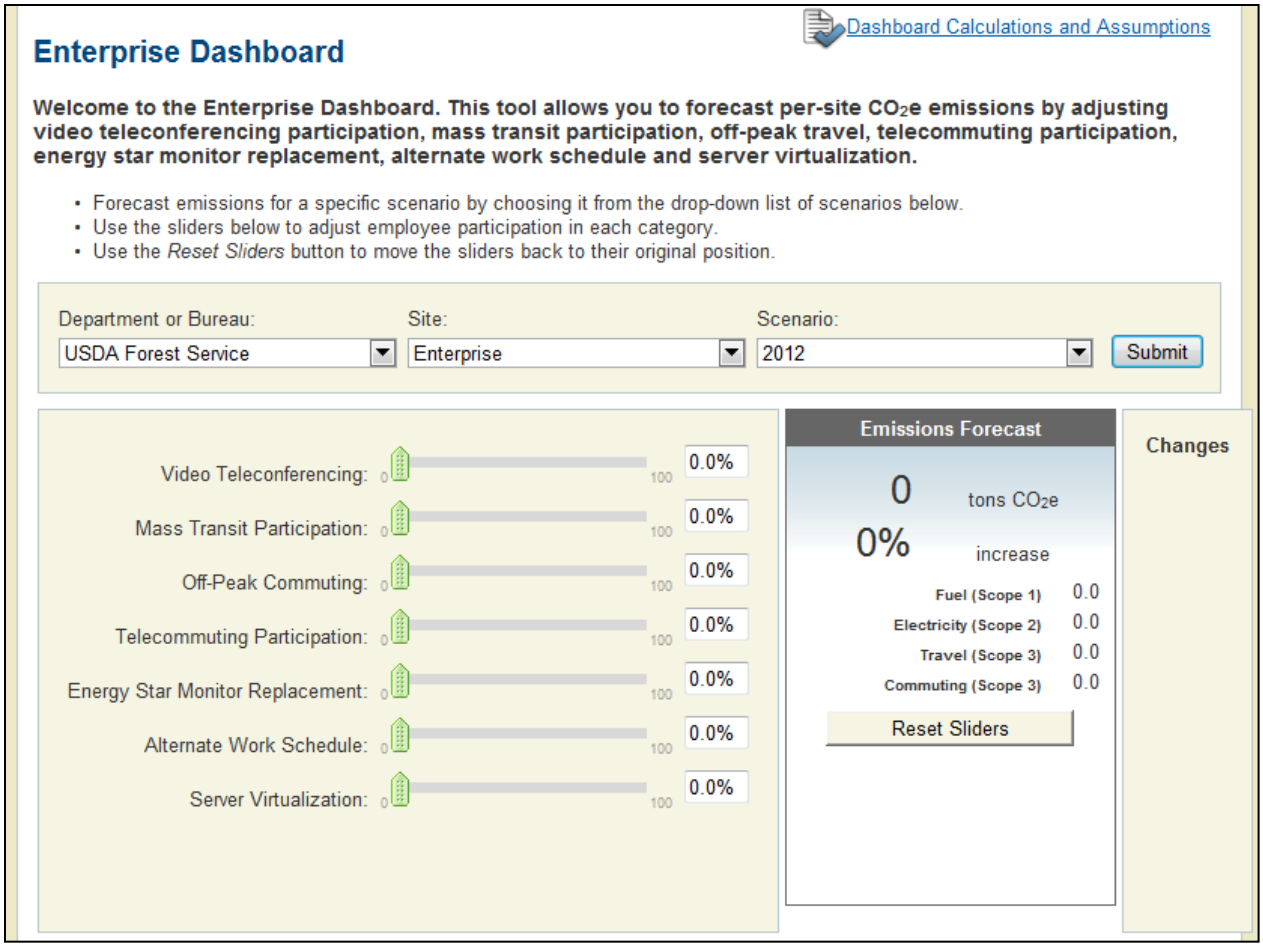

Figure 11. GSA Carbon Footprint Tool dashboard.

Image from GSA

The feedback from the pilot teams was that the overall functionality of the action planning sections was not ideal. It was difficult to find the action planning section, and the dashboard needs more subject areas to assess (e.g., lighting changes, low-energy equipment upgrades, fleet upgrades, etc.). Additionally, the dashboard needs to allow the user to select specific sites where actions should be implemented to evaluate the impact on emissions. Some of the dashboard sliders were disabled. The help link ("Some sliders require more information before they will be enabled") was very useful to help understand what information was needed.

The pilot teams found the ROI calculator useful. The ROI calculator covers interior and exterior lighting, solar power, and computer equipment investments. However, the pilot teams indicated that the scenarios are very general and do not allow for assessment upgrades in facilities nor assessment of specific scenarios and activities, so this calculator could be improved upon.

The benchmarking tool, shown in Figure 12, allows for comparisons using different filter and graph parameters. It is somewhat limited in functionality with limited data points. This tool can be very helpful for prioritzing types of buildings with higher GHG emissions and which

buildings to target for action planning. If a unit has a significant number of buildings to assess individually, the benchmarking tool may not be ideal for assessing the building portfolio.

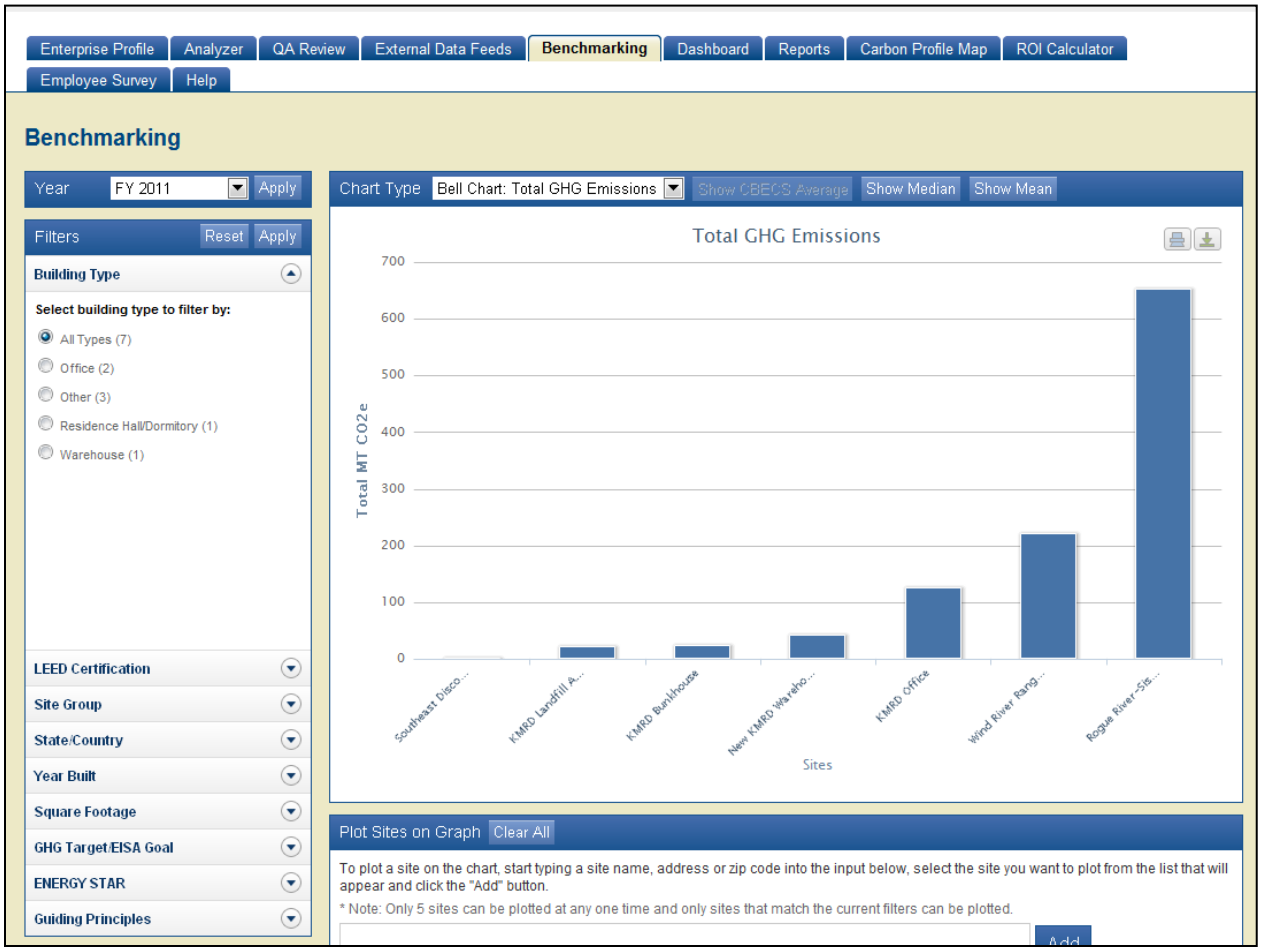

Figure 12. GSA Carbon Footprint Tool benchmarking feature.

Image from GSA

Feedback from the pilot teams on the tool's navigability for action planning indicated that the GSA Carbon Footprint Tool was challenging to navigate, but learnable. This tool did not appear to be consistent with the pilot teams' current action plans from previous years' inventories using the EPA Climate Leaders tool, which is no longer available. This might be because the GSA Carbon Footprint Tool is targeted for agency-level reporting and action planning that does not apply well to the unit level. As with the CLIP tool, the GSA Carbon Footprint Tool was able to provide some action planning results that were useful and actionable. However, it was unclear as to whether the tool would be helpful with mitigation efforts.

3.4 Post-Pilot Phase

During the post-pilot phase, NREL and the pilot participants reviewed the tools and assessed the functions and capabilities that would be ideal in a tool. It was determined that no tools met all of the criteria outlined in the pre-pilot phase. There was not any consensus amongst the pilot teams

about which tool met the needs of the pilot units; thus, there is no recommendation about a single tool that the GYA and Tongass units can use moving forward. The NPS and USFS agencies are currently using different tools that meet their individual needs better. The NPS has the CLIP tool that is specific for GHG accounting and action planning for parks. It is not an effective tool in its current configuration for non-park units. The USFS use the EPA Climate Leaders tool in its previous accounting. Its needs are mostly met through the GSA Carbon Footprint Tool. However, this tool is limited in that it is designed for reporting and action planning at the agency level and not for the unit level. This is due to the formatting that doesn't have room for disaggregating the unit-level data to a point that effective action planning can be done. NPS and USFS units are typically diffuse facilities covering large areas with some remote and/or stand-alone parts. With facilities composed of many different types of activities, it is necessary to be able to report the different activities within a unit separately and to be able to discern which activities have the best potential for GHG mitigation action planning. There were different aspects of the different tools that the pilot teams did find to be effective and certain tool characteristics that they felt were important to have, which are summarized in Table 4. An ideal tool would include many features, which are outlined in this section. These features were identified based on the experiences of the pilot team during the pilot of the three different GHG inventorying and action planning tools.

Technical support is needed for any tool, although the form in which the support is provided can vary. A user's guide, similar to that provided with the CLIP tool, proved useful. The GSA Carbon Footprint Tool provided notes about different data points, as well as a link to the TSD on the White House CEQ's website. Direct support for this tool was provided by the development team. A training session to understand how the tool operates is important to introduce the features and functionality of the tool. Responsive technical support teams, training sessions, guides, and notes that assist with using the tool all prove useful.

The desired **operating platform** may depend on the comfort levels of the users. The pilot project revealed that depending on their comfort level, some of the participants found using the CLIP tool easier because it was an Excel-based tool with which they were very familiar. The functionality of the GSA Carbon Footprint Tool and the ghgTrack tool, both of which were cloud based, was not as effective due to the difficulty in navigating around the tool sites. Having the ability to complete the inventory in an Excel file (with CSV batch files that can be uploaded to a Web-based tool) seems to offer the best of both platforms. The batch uploading functionality needs to be seamless and straightforward. The action planning modules seem to function better in a Web-based platform as this allows for easier access to inventory data, and is capable of providing more extensive assessment tools and visual aids. The navigation aspect in the action planning module must be straightforward and simple for effective usability.

The **inventorying and action planning** modules need to be included in any tool and should not be stand-alone, disconnected items. The inventory process can be very time consuming. Therefore, the ability to quickly translate accurate and granular data to the action planning module is critical.

The ability to understand the inventory data and translate information into specific emissions reduction activities is very important on both an agency and unit level. The CLIP and the GSA Carbon Footprint Tools set up their action planning components differently, both of which had

positive aspects. The CLIP tool provided very specific facility scenarios using drop-down menus that were relatively easy for the users to apply. Both tools could be improved by providing a broader range of specific scenarios that the user could develop for specific sites or facilities. The GSA Carbon Footprint Tool had several different action planning features that were useful. The ROI calculator was particularly good, but could benefit from more scenarios. The dashboard in the GSA Carbon Footprint tool allowed for forecasting based on a select number of activities, which was very useful, but again needs to include a broader range of activities. The benchmarking tool had the potential to be very useful, but seemed to require many data points in order for it to be fully functional. A combination of all these different types of action planning tools with a broad range of specific scenarios that can be assessed would be very beneficial. Ideally a tool would provide an agency at the headquarters level down to the unit-level with the ability to create an inventory, set goals, identify reduction measures, and track progress. None of the tools evaluated provided an effective means to accomplish all of these steps.

The teams also identified some functionality aspects during their reviews of the tools that they felt were important in the data collection process. **Reporting flexibility** is essential to the success of a tool. There are many different reports that can be required at different agency levels. Ideally, the tool should provide a variety of different reporting formats as well as being customizable to non-standard reporting. The reports should also allow the users to view results in both an aggregated format (for the agency level) as well as for very specific scenarios (for unit level action planning purposes).

The tools should be relatively **intuitive**, allowing users to quickly learn how to navigate through different sections, enter and analyze data, and create reports. At the unit level, resources are limited, and the time required to collect and process the data required for GHG reporting can easily overwhelm reporting staff. The structure of the tool should be as efficient and streamlined as possible, which can be done through a number of different methods (e.g., batch uploads, connections to travel data and utility data, etc.).

The data collection and entry processes require **tracking** of many data points that are collected from many different sources. Management of the data collection and entry requires keeping track of what data are required, where the data are coming from, how the data are being collected, and who is responsible for those data points. Incorporating a tracking system into the tool for not only the required data; but also tasks associated with collecting and entering the data are beneficial for the users to ensure that nothing is missed and the reporting is timely. With manual data entry for either batch uploads or individual data point entry, there is an opportunity to transcribe the data incorrectly.

An **error checking system** that can identify and highlight data entries that might not be correct can ensure that the reporting is accurate. This can be done through order of magnitude comparisons of data entry points to previous years, or regional or national averages. Identifying data points that have no data or have been left blank is also helpful. Some of the tools do allow for internal unit conversions; the users enter data in the units for which they are collected, minimizing opportunities for errors when converting to other units (e.g., cords to British thermal units, kilowatt-hours to CO_2e, etc.). This also ensures that the same unit conversion rates are being utilized because the conversion factors are then internal to the tool.

Compatibility with other tools and reporting requirements is critical to minimize the time demand in transcribing that information. The tool should allow for compatibility with the EPA Portfolio Manager, the FEMP GHG Data Report, commuter surveys, business travel systems being used by any agency, and any other regular reporting mechanism. Compatibility with GIS (geographic information systems) can also be helpful for units that cover large areas, as well as for agency staff at headquarters who are tracking emissions on a national level.

Compatibility with the existing commuter surveys were desired for the pilot project; however, the pilot participants found that the survey results were typically at the agency level and could not be applied to the individual parks and forests. This was also the case for some of the travel data (GSA TravelTrax, etc.), which were not granular enough to be used on a site or unit level. The ability to have the data at the unit level is not only useful for agency reporting, but also allows the units to use the data for their individual reporting and unit-level action planning. Because commuter surveys are only required every two years for federal reporting, and as a Scope 3 category, it may not be wise to track regularly due to the level of effort required to collect employee data; it is often difficult for unit-level staff to justify collecting data. The resources needed to collect data, offer incentives, and track progress are high compared to the benefits associated with a Scope 3 emissions source, over which the agency does not have direct control. A tool that provides an easier and faster tracking system would be ideal for both unit-level and agency-level reporting and mitigation efforts.

Data entry options would be helpful in a tool. The GSA Carbon Footprint Tool offers options for both individual manual data input, as well as template/batch uploads. The batch upload option, while potentially convenient, had some glitches that made it challenging to use for some of the pilot teams. However, providing multiple methods of data input is very desirable. The ghgTrack tool offered third-party data input, which could be desirable. One of the pilot team members was hesitant about this option as there was no information about the third-party, and thus the confidence level in that relationship was very low. With a data collection and input system firmly established and a strong relationship with a third-party provider, the time demand on the units would be minimized. However, there would likely be a fee associated with the use of a third-party provider, which the units would need to assess individually to determine the practicability of that option.

A successful tool will allow users to enter data on a regular basis, without adding extra burden to staff responsibilities. The data collected would ideally feed into a system that allows region-wide compilation and analysis of collected data; monitoring of progress towards GHG reduction targets; and enough granular information to inform decisions for reducing GHGs on a site-level, unit-level, and region-wide basis. The system, if an online tool, would allow changes and modification by authorized users so that updates could be posted online for sharing across sites. The data collected would serve two purposes: to inform decisions for making GHG reductions/tracking progress towards GHG reduction goals and to provide headquarters with data to meet annual GHG reporting requirements.

In order to provide a history behind the data and to allow for consistency in the data collection, the **ability to make notes** along with the data entries is important. The notes allow the users to provide points of contact, data sourcing, calculation assumptions, and other important comments that will allow the user or others to be able to repeat the data collection process using the same

methodology. Data points—from one year to the next—that are collected using different methodologies will not allow for consistent reporting. Without consistency between different years, comparisons will not provide any meaningful results, and the users will not have accurate information about whether their action planning has achieved real results.

Access control and accountability are essential in a successful tool. During the data collection and entry process, if multiple people are collecting and entering data, it is important to control who is entering what data. It is also helpful to have tiers of access, with the higher levels having full access and the lower levels having only access to the data they are responsible for reporting. This type of access was available in the GSA Carbon Footprint Tool and proved useful to the pilot participants.

A simple **navigation** system is beneficial to be able to move from one section of the data collection to another as well as to other parts of the tool. The naming convention for the different areas of the tools should also be self-evident. The CLIP tool had a simple naming convention; however, the other tools were not as straightforward in their naming.

The strengths and weaknesses of each tool are summarized in Table 4, below.

Table 4. Summary of Tool Strengths and Weaknesses

Tool	Inventory Module		Action Planning Module	
	Strengths	**Weaknesses**	**Strengths**	**Weaknesses**
GSA Carbon Footprint Tool	Capable of populating data fields with other federal reporting tools; data entry well-organized and follows federal reporting requirements; easy access to calculation assumptions. Tool allows different units in an agency to report separately. Responsive support team Automated, batch uploads	Connectivity issues with cloud-based platform; does not allow reporting on a scale smaller than a unit, which prevents seeing the largest contributors within a unit; glitches in batch uploads.	Helpful building benchmarking tool to help prioritize building retrofit candidates The feedback from the pilot team was that the action planning tool was challenging to navigate, but learnable.	Some of the action planning functionality has some problems with the graphs not providing results; no ability to target the action planning to specific operations or activities at a unit-level. Results limited to the prescribed action planning options the tool offers; overall functionality of the action planning sections was not ideal; ROI calculator useful, but doesn't allow detailed input for specific facilities, scenarios, or activities. Benchmarking tool has limited scope; not ideal for large portfolio of buildings.

Tool	Inventory Module		Action Planning Module	
	Strengths	**Weaknesses**	**Strengths**	**Weaknesses**
ghgTrack	Tool can be customized for the data reporting needs of each team and to meet federal reporting requirements; easy-to-use, automated batch upload of data; dashboard provides quick visual results in terms of varying baselines, emissions classification, and facilities breakdown; responsive development team; easy access to emissions factors.	Connectivity issues with Web-based platform in certain locations; considered somewhat challenging to use and navigate; there is a fee for use and customization.	Graphics allow clear visibility of emission sources.	Action planning functionality was not available for teams to test.
CLIP Tool	Baseline emission inventory specifically for NPS; Excel-based tool relatively easy to navigate.	Does not allow direct access to remote data; no automated data entry; drop-down menu options limited to specific parks; no easy way to track regions within a park separately; support team difficult to contact; no information on how calculations are made, and therefore, cannot verify consistency with federal requirements.	Allows users to assess different mitigation actions. Most diverse action planning module; broad level of detail offered to allow users to assess specific scenarios; good Action Planning Summary document.	Macros would not always work and the tool would not function at all without them; inventory module and action planning module not accessible simultaneously; detailed information needed for actions not located in the drop-down menu that may deter use. More drop-downs desirable, especially in fleet management and facility energy efficiency; action planning module might be due to the tool being targeted for NPS units and not for USFS units.

4 Summary

The land management agencies who participated in the GHG inventory and action planning tool pilot project have recognized the importance of compiling and understanding agency GHG emissions. Staff within these agencies' participating units voluntarily participated in this pilot in order to identify whether any currently available GHG inventorying and action planning tools met their needs. Staff determined that an ideal tool would feature:

- Comprehensive and readily available technical support, available in a variety of formats
- A familiar, transparent, and reliable operating platform
- Both inventorying and action planning modules, useable at a unit, regional, or agency-wide level
- A variety of standardized reporting formats and flexibility for creating non-standard reporting
- An intuitive, user-friendly design with simple navigation to facilitate turnover of tool users.
- A tracking system, with the ability to make notes, for capturing where the data came from, the data's relevant time period, and additional data points as well as points of contact and calculation assumptions
- An error-checking system for identifying and highlighting erroneous or missing data points
- Data entry options including manual data input and template/batch uploads
- Compatibility with other tools, and reporting requirements and mechanisms
- Access control and accountability to enable differing levels of access
- Low or no costs associated with tool use
- Direct data population into the FEMP GHG and Sustainability Reporting Workbook.

In an effort to identify a tool that aligned the most with the above requirements, the pilot team willingly tested three different tools available at the time of the pilot. While there were benefits to each tool that was piloted, no single tool met all of the needs of the participants.

Moving forward, existing tools could be modified or a new tool could be created. It is apparent that the developers of all three tools are actively working to improve the tools and, in the case of the two federal tools, to align them with federal reporting requirements. It is likely that the agencies involved in this pilot could work with these tool developers in an effort to influence the future development of these tools. Land management agencies are proactively attempting to quantify GHG emissions and identify reduction opportunities, and as such are seeking unifying principles, criteria, and approaches to the intensifying environmental management pressures on public lands. Hopefully, these agencies can work together to influence the revision or creation of

a tool that can effectively support these efforts at all levels, from an individual unit through the agency-level.

Appendix A – Inventory Module Evaluation Results and Comments

Table A-1. Inventory Module Evaluation Results

Criteria	GSA Carbon Footprint Tool	ghgTrack	CLIP
User friendliness	Very user friendly/easy to navigate (2); easy navigation, but not straightforward (2)	Difficult to navigate, recommend after significant modifications (2), challenging to navigate, but able to learn (1)	Very user friendly/easy to navigate (3), challenging to navigate, but able to learn (1)
Technical assistance	Yes (4)	Yes (4)	Unsure(2), no (1), yes
Data input navigation	Very user friendly (2); easy navigation, but not straight forward (1); challenging to navigate, but able to learn (1)	Easy navigation, but not straightforward (1), challenging to navigate, but able to learn (2), difficult to navigate, recommend after significant modifications (1)	Very user friendly (2); easy navigation, but not straightforward (1), difficult to navigate, recommend after significant modifications (1)
Data reference tracking	Enables users to enter either the source of the data or the year for all data points (4)	Enables user to enter both the source of the data and year of the data for all data points (2), enables user to enter both the source of the data and year of the data for all data points (2)	Enables users to enter either the source of the data or the year for all data points (3); tool does not enable user to input the source of the data or the year of the data (1)
Consistency of factors	Consistent with current reporting (3), not consistent, recommend this tool after significant modifications (1)	Consistent with current reporting needs / requirements (3), not consistent, recommend this tool after significant modifications (1)	Consistent with current reporting needs/requirements (4)
Tangible results	Some of results are useful and actionable (3)	Results are not in a useful format for implementation (3)	Useful results that can be put into action and monitored (2); some of the results are useful and actionable (1)
Cost	Free	Licensing fee applies	Free
Aligns with FEMP	Yes (3), no (1)	Unsure (4)	Yes (3), unsure (2)
Time requirement	See notes below	See notes below	See notes below
Feedback on using tool again	Average rankings shown below A scale of 1 to 5 was provided for ranking tools with 1 being "excellent" (i.e. would definitely use again) and 5 being "would not use again"		
User friendliness /navigation	**2.25**	**3.75**	**1.75**
Data input	**2.75**	**3**	**2.25**
Results	**2.6**	**4**	**1.6**

Note: numbers in parenthesis reflect the number of participants who had this feedback.

Synopsis of Inventory Evaluation Comments

Time Requirement

- **GSA Carbon Footprint Tool**

  Data input time estimates of one hour, two hours, four hours, and six hours were made. One comment mentions that data collection is the most time consuming part, especially when the software requires the data in a different format than they are collected in the park. Time requirements cover set-up to determine the process and group/site, and becoming familiar with tabs and navigation. Additionally, there is a time requirement to set up scenarios and sites, input data, review and understand the report, and edit for errors.

- **CLIP Tool**

  Data input time estimates of two hours, three hours, four hours, and five to seven hours per district, depending on the level of familiarity with the tool and how many of the tabs are utilized. Evaluators mentioned difficulty navigating the data input, enabling macros, and saving the data.

- **ghg Track Tool**

  Comments varied widely. One describes the software as very difficult to navigate. Another says it took three hours to type the data into spreadsheets for batch upload, and more time and help from the developer to troubleshoot uploading issues. One comment noted that the tool was not intuitive and lacked a help section for the software. Additional time estimates for data entry of four and five hours per district to complete the upload not including entering vehicle data, which would need to be one at a time.

What Was Not Liked

- **GSA Carbon Footprint Tool**

  Requests were made for a tutorial on the tool, an option to input total usage, the ability to print from the Enterprise Portfolio, an option to enter propane as an input for Scope 1 emissions, and making the action planning section easier to find. Issues included difficulty in estimating water usage, that the tool was not designed for a large national park with many buildings and meters, and lack of choices in the action planning section.

- **CLIP Tool**

  Glitches in the spreadsheet and issues finding the correct utility company were discussed. Two evaluators did not like the fact that data disappears once it is saved. The software would also need to be modified for a national forest. There were other comments noting there was no way to enter green power, difficulties entering wastewater data, difficulty saving data, the utility company options were not comprehensive, and unsuitable use of default data.

- **ghg Track Tool**

  Frustration was expressed with the data entry. Fleet usage, solid waste, and air travel were not included in the software. The software's ability to be customized was discussed by the developer, but could not be evaluated.

What Needed Improvement

- **GSA Carbon Footprint Tool**

  The action planning section needs improvement, including the ability to specific select sites for analysis, and the ability to analyze more improvements. The description of the tabs could be improved.

- **CLIP Tool**

  A troubleshooting guide, more guidance, increased variety of reports and more flexibility with the spreadsheet to accommodate data and requirements for different agencies were requested. Lack of clarity regarding the status of uploaded data, how to deal with in-park employee housing, and the "Age of Distribution" in the refrigerant worksheet were cited.

- **ghg Track Tool**

  More information on how to complete the set-up screens, and an improved layout were requested. The tool needed increased flexibility on the type of data that can be reported and better translation of site data by the company (data sent to the company for upload were incorrectly entered).

What Worked Well

- **GSA Carbon Footprint Tool**

  The ease of uploading data and getting results, the help section, the ability to break the parks into campuses, and the ability to analyze individual sites were appreciated. Two evaluators liked the ROI calculators; the easy-to-read charts, the reports and the survey potential were good.

- **CLIP Tool**

  The help and references, the options to upload data, the quick links on all the tabs, the ability to input data as a "lump sum" to save time, the criteria air pollutant (CAP) feature, the fact that it is not Web-based, the totals summary, and the software's simplicity were all cited as benefits to the software.

- **ghg Track Tool**

  Batch uploads and having the developer set up the sites ahead of time.

Additional Comments/Feedback

- **GSA Carbon Footprint Tool**

  The inventory tool works well, but the current action planning module is not very useful or functional.

- **CLIP Tool**

  Evaluators noted the tool is more appropriate for the NPS, it needs more "helper guides" throughout the tool, and the difficulty in following the logic of the spreadsheet.

- **ghg Track Tool**

  Custom reports were a nice feature. Evaluators were only able to look at parts of the tool that were made available. There seemed to be some false data in the system indicating results for sites where no data had been entered. The tool did not provide much detail.

Appendix B – Action Planning Module Evaluation Results and Comments

Table B-1. Action Planning Module Evaluation Results[a]

Criteria	GSA Carbon Footprint Tool	CLIP Tool
User friendliness	Challenging to navigate, but able to learn (1)	Very user friendly/easy to navigate (2)
Technical assistance	Yes (1)	Unsure (2)
Input and navigation / decision making	Challenging to navigate, but able to learn (1)	Easy navigation, but not straightforward (1), very user friendly/easy to navigate (1)
Consistency with current action plans	Not consistent, would not recommend (1)	Not consistent, but adaptable (1), consistent with current reporting needs/ requirements (1)
Tangible results	Some of the results are useful and actionable (1)	Some of the results are useful and actionable (1), Useful results that can be put into action and monitored (1)
Cost	Free (1)	Free (2)
Will help with mitigation efforts	Unsure (1)	Unsure (2)
Feedback on using tool again	1–excellent, 5–would not use again	
User friendliness/navigation	4	1, 2
Data input	4	1, 2
Results	4	1, 3
Action planning	4	3, 2

[a] The ghgTrack tool is not included as the teams did not have access to any action planning functionality for the tool, and thus, were not able to assess it.

Table B-2. Action Planning Evaluation Comments

Comments	GSA Carbon Footprint Tool	CLIP Tool
What Did You Not Like?	Hard to find action planning section. Not a lot to choose from. Apparently need to select sites in a different part of the tool in order to invoke the action planning part. Don't understand the carbon footprint map module.	The last time I pulled it up, it opened as a spreadsheet…. Not sure what happened there. Other actions (not covered by available Drop-downs) either need a lot of research to determine effects or people may have a tendency not to bother with them. Prefer a lot more drop-downs of potential actions that could be taken.
What Do You Feel Needs Improvement?	Needs functional action planning section. Select dashboard slider subjects for things that are more realistic or useful or where changes in the factor produce significant or tangible results—replace lighting with CFL or LED or other; install motion sensor light switches; replace different kinds of appliances with low-energy models; changes in fleet, for example. Select sites to be analyzed in the action planning module.	Would like to be able to go back and forth between the two different modules. Prefer to have the tabs in the upper right corner of the spreadsheet take the same place in each sheet. ("Next Sheet," "Previous Sheet," "Save" etc., be in same location, so when you flip from sheet to sheet you don't have to notice where your cursor is to keep clicking through.) Not enough drop-downs in most of the action planning modules to capture all the actions you might want to take. Need more options to choose from in the energy management module instead of just changing lightbulbs, furnaces, and boilers. Would like to see how changes in thermostat settings (using lockable thermostats) would affect power for heating and cooling; would like to see how changes from electric heat to renewable energy affect things. Need a greater range of selections to choose from in the fleet section. I selected a gas truck to replace with something else and could not find any trucks in the drop-down to choose from. Need to be able to choose a truck, 4WD, etc., rather than just cars. One always hopes that newer vehicles have better fuel economy.

Comments	GSA Carbon Footprint Tool	CLIP Tool
What Do You Think Functioned Well?	Liked the concept of the tab for answering more questions to complete information for some of the slider subjects. Like the ROI calculator. I like that individual buildings or sites can be analyzed.	I liked the "How to Use this Module" guide. The export of data from Module 1 and import to Module 2 was easy and effortless. The action planning input sheets were easy to use. I liked the summary and the action plan document.
Additional Comments	I like the inventory tool, but the current action planning module is not very useful or functional, really.	I have used this program when I wanted to see if proposed projects would be worthwhile. I like the spreadsheet aspect rather than the on-line aspect. It makes you feel this is your very own, and that it is easy and painless to complete and update. Because data are for the entire unit it does require a companion spreadsheet that holds all the individual site data and totals. A potential enhancement might have an option to input sites or districts individually, with the program compiling all the data and each district being able to manage their own data and do their own action planning. Though the data are compiled per unit (forest, park, etc.) individual actions can be site specific. I thought this action planning tool had a lot to offer. I did not personally try to contact the CLIP tool people with questions, so I do not have any comments on ease of receiving help.

Appendix C – Data Collection Forms

Table C-1. Automated Data Collection Spreadsheet

AUTOMATED DATA COLLECTION

Do you have access to your FAST data?		
Do you track business travel and have access to that dat		
Do you use the web based commuter survey?		
Do you have other automated data collection sources?		If, yes, please LIST

STATIONARY COMBUSTION

Stationary Combustion - Natural Gas

	Building/Facility Name	Zip	Energy Reporting	Monthly Usage (Therms) Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Annual Usage	$/therm	Data Source	DATA REQUIRED FOR: FEMP	GSA	CLIP	ghgTrack
1																			x	x	x	x
2																						
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						

Stationary Combustion - Petroleum Products

	Building/Facility Name	Zip	Reporting Category	Fuel Type (Units)	Monthly Usage (Units) Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Usage (units)	$/unit	Data Source	DATA REQUIRED FOR: FEMP	GSA	CLIP	ghgTrack
1																				x	x	x	x
2																							
3																							
4																							
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8																							
9																							
10																							

Stationary Combustion - Coal/MSW

	Building/Facility Name	Zip	Reporting Category	Fuel Type (Units)	Monthly Usage of Coal or MSW (Short Tons) Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Usage (short tons)	$/short ton	Data Source	DATA REQUIRED FOR: FEMP	GSA	CLIP	ghgTrack
1																				x	x	x	x
2																							
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							

Stationary Combustion - Biofuel/Biomass

	Building/Facility Name	Zip	Energy Reporting	Fuel Type (Units)	Monthly Usage of Biofuel or Biomass (Units)												Annual Usage	$/unit	Data Source	FEMP	GSA	CLIP	ghgTrack
					Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11							
1																				x	x	x	x
2																							
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Other (Geothermal, Solar, Ground-Source Heat Pump, Mechanical, Daylighting)

	Building/Facility Name	Zip	Energy Reporting	Fuel Type (Units)	Monthly Usage of Other Source (MMBtu)												Annual Usage	$/unit	Data Source	FEMP	GSA	CLIP	ghgTrack
					Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11							
1																				x			x
2																							
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							

Continuous Emission Monitoring System (CEMS)

	Building/Facility Name		Energy Reporting Category	Annual Fuel Consumption (Billion BTU)	Annual Fuel Cost ($K)	Total Annual Emissions (kg) CO_2 Biogenic	CO_2 Anthropogenic	CH_4	N_2O	Data Source	FEMP	GSA	CLIP	ghgTrack
1											x	x		x
2														
3														
4														
5														

MOBILE COMBUSTION

Mobile Combustion - Gasoline Vehicles

	Emissions Source	Vehicle Type	Emissions Control Technology	Miles Driven	Gallons Consumed	Avg $/gal	Data Source	FEMP	GSA	CLIP	ghgTrack
1								x	x	x	x
2											
3											
4											
5											
6											
7											
8											
9											
10											

add more as needed

Mobile Combustion - Diesel Vehicles

	Emissions Source	Vehicle Type		Miles Driven	Gallons Consumed	Avg $/gal	Data Source	FEMP	GSA	CLIP	ghgTrack
1								x	x	x	x
2											
3											
4											
5											
6											
7											
8											
9											
10											

add more as needed

Mobile Combustion - Motorcycle

	Emissions Source	Motorcycle Type	Emissions Control	Miles Driven	Gallons Consumed	Avg $/gal	Data Source	FEMP	GSA	CLIP	ghgTrack
1								x	x	x	x
2											
3											
4											
5											

add more as needed

Mobile Combustion - Alternative Fuel Vehicles

	Emissions Source	Vehicle Type	Emissions Control Technology	Alternative Fuel Type	Miles Driven	Gallons Consumed (Non-CNG)	Standard Cubic Feet (CNG Only)	Avg $/gal	Data Source	FEMP	GSA	CLIP	ghgTrack
1										x	x	x	x
2													
3													
4													
5													

add more as needed

Mobile Combustion - Biofuels (Ethanol Blend) Vehicles

	Emissions Source	Vehicle Type	Control Technology	% Ethanol in Blend	Miles Driven	Gallons Consumed	Avg $/gal	Data Source	FEMP	GSA	CLIP	ghgTrack
1									x	x		x
2												
3												
4												
5												

add more as needed

Mobile Combustion - Biofuels (Biodiesel Blend) Vehicles

	Emissions Source	Vehicle Type	Emissions Control	% Biodiesel in Blend	Miles Driven	Gallons Consumed	Avg $/gal	Data Source	FEMP	GSA	CLIP	ghgTrack
1									x	x	x	x
2												
3												
4												
5												

add more as needed

Mobile Combustion - Non-Road Equipment

		Operations Fuel Consumption	Visitors Fuel Consumption	Other Permitted Activities Fuel Consumption	SCOPE 3 <Consessionaire> Fuel Consumption	SCOPE 3 <Consessionaire> Fuel Consumption	add as needed	Data Source	FEMP	GSA	CLIP	ghgTrack
Agriculture	Motor Gasoline								x		x	x
	Diesel Fuel											
Construction and Industrial	Motor Gasoline								x		x	x
	Diesel Fuel											
Other (e.g., snowmobiles)	Motor Gasoline								x		x	x
	Diesel Fuel											

Mobile Combustion - Watercraft

	Operations Consumption (gal)	Visitors Consumption (gal)	Other Permitted Activities Consumption (gal)	SCOPE 3 <Consessionaire> Consumption (gal)	SCOPE 3 <Consessionaire> Consumption (gal)	add as needed	Data Source	FEMP	GSA	CLIP	ghgTrack
Motor Gasoline								x		x	x
Diesel Fuel											

Mobile Combustion - Other

SOURCES:	Operations Consumption (gal)	Visitors Consumption (gal)	Other Permitted Activities Consumption (gal)	SCOPE 3 <Consessionaire> Consumption (gal)	SCOPE 3 <Consessionaire> Consumption (gal)	add as needed	Data Source	FEMP	GSA	CLIP	ghgTrack
Aviation Gas								x			x
Jet Fuel											
Navy Special											
Other fuel											

Other Mobile Combustion Emission Not Already Covered
Metric Tons of Carbon Dioxide Equivalent ($MTCO_2E$)

Emission Source	Operations	Visitors	Other Permitted Activities	SCOPE 3 <Consessionaire>	SCOPE 3 <Consessionaire>	add as needed	Data Source	FEMP	GSA	CLIP	ghgTrack
CO_2								x	x		x
CH_4											
N_2O											

FUGITIVE EMISSIONS

*To convert gas from units of volume to lbs: Total mass of gas (lbs) = Volume of gas (ft^3) * 0.0283 (conversion for m^3/ft^3) * density of gas (lb/m^3). See the available material safety data sheet (MSDS) for density information.*

CLIP ONLY - Refrigerant Use (Stationary and Mobile)

Stationary Refrigeration & A/C Use

	NUMBER OF EACH UNIT	
	Coolant (CFCs such as CFC-12 and HCFC-22 do not need to be	
Refrigeration and A/C Type	HFC-134a	R-410
Refrigerated Appliances		
Air Conditioning		
Window Units		
Residential Unitary		
Small Commercial Unitary		
Large Commercial Unitary		
Packaged Terminal A/C		

Mobile A/C Use

- Enter the number of vehicles with air-conditioners for each vehicle type.
- If the vehicle breakdown is not known, you may alternately enter the total number of vehicles into the yellow cell and click on 'Calculate by Vehicle.' The tool will automatically fill in the yellow cells

	Optional Default Distribution	
Total Vehicles		vehicles
Vehicle Type		Units
Gasoline Cars		vehicles
Gasoline Trucks and SUVs		vehicles
Heavy Duty Gas Vehicles		vehicles
Diesel Cars		vehicles
Diesel Trucks and SUVs		vehicles
Heavy Duty Diesel Vehicles		vehicles
Motorcycles		vehicles (not included in emission calculations)

Data Source

FEMP	GSA	CLIP	ghgTrac
		x	

Flourinated Gases - Hydrofluorocarbons (HFCs)

Hydrofluorocarbons (HFCs) are one of the six primary GHGs primarily used as refrigerants. They consist of a class of gases containing hydrogen, fluorine, and carbon, and possess a range of global warming potential values from 120 to 12,000. HFCs are emitted as byproducts of industrial processes and are also used in manufacturing. They are a class of replacements for chlorofluorocarbons (CFCs) in refrigeration systems.

	Emissions (lbs)										
Emission Source Description	HFC-23	HFC-41	HFC-32	HFC-125	HFC-134	HFC-	HFC-143	HFC-	HFC-152	HFC-	HFC-161

HFC-227ca	HFC-227ea	HFC-236ca	HFC-236cb	HFC-236ea	HFC-236fa	HFC-245fa	HFC-43-10mee	HFC-365mfc	HFC-245ca	HFC-c-447ef	HFC-43-10mee

Data Source

FEMP	GSA	CLIP	ghgTrac
x	x	x	x

Flourinated Gases - Hydrochlorofluorocarbons (HCFCs)

Hydrochlorofluorocarbons (HCFCs) are fluorocarbons that are replacing chlorofluorocarbon as a refrigerant and propellant in aerosol cans. They are considered to be somewhat less destructive to the atmosphere.

Data Source

	Emissions (lbs)						
Emission Source Description	HCFC-22	HCFC-123	HCFC-124	HCFC-141b	HCFC-142b	HCFC-225ca	HCFC-225cb

FEMP	GSA	CLIP	ghgTrack
	x		x

Flourinated Gases - Chlorofluorocarbons (CFCs)

Chlorofluorocarbons (CFCs) are any of various gaseous compounds of carbon, hydrogen, chlorine, and fluorine, used as refrigerants, aerosol propellants, solvents, and in foam.

Data Source

	Emissions (lbs)					
Emission Source Description	CFC-11	CFC-12	CFC-13	CFC-113	CFC-114	CFC-115

FEMP	GSA	CLIP	ghgTrack
	x		x

Flourinated Gases - Perfluorocarbons (PFCs)

Perfluorocarbons (PFCs) are a group of human-made chemicals composed of carbon and fluorine only. PFCs and HFCs were introduced as alternatives to ozone depleting substances. PFCs are emitted as byproducts of industrial processes and are used in manufacturing. They are one of the six primary greenhouse gases and possess global warming potentials ranging from 5,700 to 11,900.

Data Source

	Emissions (lbs)										
Emission Source Description	Perfluoro cyclopropane	PFC-14	PFC-116	PFC-218	PFC-318 or -c318	PFC-3-1-10	PFC-4-1-12	PFC-5-1-14	PFC-6-1-16	PFC-7-1-18	PFC-9-1-18

FEMP	GSA	CLIP	ghgTrack
x	x		x

Flourinated Gases - Sulfur Hexafluoride (SF_6)

Sulfur Hexafluoride (SF_6) is one of the six primary GHGs, consisting of a single sulfur atom and six fluoride atoms. It possesses a GWP of 23,900 and is primarily used in electrical transmission and distribution systems.

Data Source

	Emissions (lbs)
Emission Source Description	SF_6

FEMP	GSA	CLIP	ghgTrack
x	x		x

Wastewater Treatment Plant (WWTP)

	Centralized WWTP with Anaerobic Digestion	Centralized WWTP with Nitrification / Denitrification	Centralized WWTP without Nitrification / Denitrification	Effluent Discharge to Rivers and Estuaries with Nitrification / Denitrification	Effluent Discharge to Rivers and Estuaries without Nitrification / Denitrification	Waste water Treatment Lagoons	Septic Systems	Data Source	FEMP	GSA	CLIP	ghgTrack
# people served by an Onsite:									x	x		x

Scope 1 and 3	Unit operations	Visitors	Scope 3 <Consessionaire>	Scope 3 <Consessionaire>	add as needed	Data Source	FEMP	GSA	CLIP	ghgTrack
Total wastewater sent to the WWTP							x		x	x
Does your unit own or operate the										
% Treated Aerobically										
% Treated Anaerobically	100%	100%	100%	100%						

Methane (CH_4) Recovery/Flaring

Helpful Hint							FEMP	GSA	CLIP	ghgTrack
	Amount CH_4 recovered at plant (ft^3)								x	x
	% attributable to your site									

Landfills and Solid Waste Facilities with Landfill Gas (LFG)

		Calculate OR Use Estimator Tool		Data Source	FEMP	GSA	CLIP	ghgTrack
Landfill Open Date		% Uncontrolled CO_2 Release			x	x		x
Landfill Close Date		% Uncontrolled CH_4						
MSW Disposed Onsite (Short Tons)		LFG Production Methotropic Bacteria Oxidation Factor						
		LFG Collection Efficiency						
		LFG Collection Loss Methotropic Bacteria						
Use EPA LandGEM to Calculate Total Emissions of:								
CO_2 biogenic (Metric Tons)		LFG Flaring CO_2 Combustion Oxidation Factor						
CH_4 (Metric Tons)		LFG flaring CH_4 venting loss						

Scope 1 and 3	Unit operations	Visitors	Scope 3 <Consessionaire>	Scope 3 <Consessionaire>	add as needed	Data Source	FEMP	GSA	CLIP	ghgTrack
How many short tons of waste did sent to a landfill in ye							x		x	x
Does your unit own or operate the landfill?										
Does the destination landfill practice methane flaring, use landfill gas to produce energy through a landfill gas to energy (LFGTE) project or have no methane flaring?										
How many short tons of waste were incinerated in year?										

Industrial Process Emissions

If any of these industrial processes is occuring at your site, then let us know and we will put together the data collection requirements for those processes.

	FEMP	GSA	CLIP	ghgTrack
	x	x		x

Adipic acid production
aluminum production
ammonia production
cement production
HCFC-22 production
iron and steel production
lime production
nitric acid production
particle accelerators
pulp and paper production
refrigeration and AC mfg
semiconductor mfg

Additional Emission Sources

	Methane		*Nitrous Oxide*		*User Defined Emissions Sources*					FEMP	GSA	CLIP	ghgTrack
	Emission Source	Total Emissions (lbs)	Emission Source	Total Emissions (lbs)	Emission Source	fugitive emission name	Total Emissions (lbs)	GWP (100 yr)	Data Source				
1										x	x		x
2													
3													
4													
5													

add more as needed

Forest Management/Burning

	FEMP	GSA	CLIP	ghgTrack
			x	x

GHG Flux and Forest Burning

Forest Type	Acres of Forest Type in Unit	Acres of Forest Type Burned
White-red-jack pine		
Spruce-fir		
Longleaf-slash pine (planted)		
Longleaf-slash pine (natural)		
Loblolly-shortleaf pine (planted)		
Loblolly-shortleaf pine (natural)		
Oak-pine		
Oak-hickory		
Oak-gum-cypress		
Elm-ash-cottonwood		
Maple-beech-birch		
Aspen-birch		
Other forest types 1		
Non-stocked 1		
TOTAL	0.0	0.0
		15

OR

Stock Change Method

Tree Type	Acres of Forest type in Unit in: previous year	Acres of Forest type in Unit in: current year	OPTIONAL: volume of merchantable wood (m^3/ha) select previous year	OPTIONAL: volume of merchantable wood (m^3/ha) current year
Firs (*Abies*)				
Maples (*Acer*)				
Alders (*Alnus*)				
Birches (*Betula*)				
Hornbeam (*Carpinus betulus*)				
Chestnut (*Castanea*)				
Beech (*Fagus*)				
Ashes (*Fraxinus*)				
Walnuts (*Juglans*)				
European Larch (*Larix decidua*)				
Spruce (*Picea*)				
Maritime Pine (*Pinus pinaster*)				
Eastern White Pine (*Pinus strobes*)				
Scots Pine (*Pinus sylvestris*)				
Poplars (*Populus*)				
Plums (*Prunus*)				
Douglas-Fir (*Pseudotsuga menziesii*)				
Oaks (*Quercus*)				
Willows (*Salix*)				
Cedar (*Thuja*)				
Lindens (*Tilia*)				
Hemlocks (*Tsuga*)				
Mangroves *(various)*				Helpful Hint

Grasslands Type		
Boreal		
Cold Temperate - Dry		
Cold Temperate -Wet		
Warm Temperate – Dry		
Warm Temperate –Wet		
Tropical - Dry		
Tropical - Moist & Wet		
TOTAL	0.0	0.0

Data Source