Association of Environmental Professionals (AEP)

AEP Climate Change Committee's "The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Emissions Protocol"

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Abbreviations

ARB	Air Resources Board
AEP	Association of Environmental Professionals
BAAQMD	Bay Area Air Quality Management District
BMP	Best Management Practices
CDOC	California Department of Conservation
Caltrans	California Department of Transportation
CEC	California Energy Commission
CEQA	California Environmental Quality Act
OPR	California Office of Planning and Research
CAP	climate action plan
EMFAC	EMissions FACtors 2011
EPA	Environmental Protection Agency
GWP	global warming potential
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
kWh/MG	kilowatt hours per million gallons
LGOP	Local Government Operation Protocols
MGD	million gallons per day
NRCS	Natural Resource Conservation Service
RTAC	Regional Targets Advisory Committee
TDF	Transportation Demand Forecast
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
VMT	vehicle miles traveled

Executive Summary

In October 2012, ICLEI – Local Governments for Sustainability USA, issued the *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions Version 1.0* (2012 U.S. Community Protocol or Community Protocol). The California Office of Planning and Research (OPR), which develops the guidelines for California land use planning and the California Environmental Quality Act (CEQA), recommends the use of this protocol in local government planning efforts in California. The protocol provides guidance to communities to determine what emissions should be included or excluded in their greenhouse gas (GHG) emissions inventory and outlines recommended methodologies to estimating GHG emissions for the relevant activities to be included in the inventory.

In California, a large number of cities and counties have completed GHG inventories, and many jurisdictions have developed local climate action plans (CAPs) or GHG reduction strategies that identify local measures designed to reduce GHG emissions over time. In 2010, the CEQA guidelines, which provide guidance to lead agencies on complying with CEQA, were amended to encourage consistency in the analysis and mitigation of GHG emissions. The amendments also defined and added "plans for the reduction of greenhouse gas emissions" to the list of plans and regulations that may be considered in a cumulative impact analysis. This process allows a lead agency to determine that a project's contribution of GHG emissions is not cumulatively considerable, and minimize the need for additional analysis, provided it is consistent with the applicable "qualified" GHG reduction strategy per CEQA Guidelines Section 15183.5.[1] As a result, California jurisdictions engaged in climate action planning want to ensure that their local community inventories and local plans meet the new guidelines, so that future review of GHG issues can be streamlined at the project level.

The requirements for CEQA are defined both in California statute and in nearly 40 years of legal rulings determining the depth and breadth of analysis required in order to adequately define the law. As a general rule, CEQA does not readily allow the dismissal from consideration of small project impacts that contribute to cumulative impacts. As a result, GHG inventories in California that are done to comply with CEQA or to provide CEQA tiering or streamlining opportunities, may need to take a more comprehensive approach than the required or recommended components identified in the Community Protocol.

Preparing a GHG community inventory for CEQA purposes requires a lead agency to follow the tests for significance found in CEQA, which maintain from previous CEQA guidelines, that while there is no iron-clad definition of significance, "that lead agencies should quantify GHG emissions where quantification is possible and will assist in the determination of significance, or perform a qualitative analysis, or both as appropriate in the context of the particular project, in order to determine the amount, types and sources of GHG emissions resulting from the project." The decision about what is and is not "significant" under CEQA requires consideration of context, jurisdictional control/influence, precedent, and professional judgment and can be supported by the Community Protocol to provide a useful decision-making framework in its "Significant Influence" tests. However, due to California's regulatory requirements, the tools, data and methods available for preparing GHG inventories in California can diverge

[1] CEQA Guidelines Section 15183.5 allows for tiering of CEQA project GHG analysis from a qualified reduction strategy if it quantifies existing and projected GHG emissions; establishes a target for reducing GHG emissions to a less than considerable contribution level; contains GHG emission reduction actions; includes implementation steps for monitoring and ensuring the strategy meets its targets; and is adopted in a public process following environmental review.

substantially from those available for use in other parts of the U.S., as recommended by the Community Protocol.

In 2011, the Association of Environmental Professionals (AEP) Climate Change Committee, consisting of the leading practitioners in the preparation of GHG inventories and CAPs in California, issued a white paper, the *California Community-Wide Greenhouse Gas Baseline Inventory Protocol* (AEP Community Inventory White Paper) that provides advice on preparing community GHG inventories for California jurisdictions. The white paper provides recommended approaches to scoping a community GHG inventory as well as specific data sources, tools, and methods that can be employed in California to complete GHG inventories.

With the issuance of the Community Protocol, the AEP Climate Change Committee and the OPR recognized that California jurisdictions would benefit from a California Supplement to the Community Protocol that focuses on how to best apply the Community Protocol when preparing GHG inventories designed to meet CEQA requirements including recommendations about scoping, tools, and methodology.

This Supplement first provides an overview of CEQA requirements, scoping, sector choice, and documentation needs for GHG inventories in California and provides specific recommendations that deviate from the Community Protocol by individual emissions sectors. Overall, recommendations specific to scoping, sector choice, and documentation include the following:

- Jurisdictional Control and "Significant Influence"
  - Local jurisdictions in California preparing baseline community GHG inventories, particularly for the purpose of use in CEQA tiering, should include GHG emission that are under their jurisdictional control as well as those that may not be strictly under their jurisdictional control but for which the jurisdiction has a significant influence. CEQA has an expansive view of cumulative impacts and discourages dismissal of de minimis emissions based on prior case law and thus a more comprehensive approach to GHG inventories used for CEQA purposes is recommended. The Community Protocol supports this approach by recommending that local inventories include emissions over which a local government has significant influence and that inventory reports include a discussion of how the influence criteria (ownership, operational control, regulatory authority, enforcement, budgetary) were used to identify included and excluded emissions.
- Municipal Inventories
  - For community CAPs, segregating municipal inventories from the community-wide inventories is not required unless otherwise specified (such as a General Plan identifying a separate municipal target)
- Documentation and Transparency
  - If a GHG inventory is used for CEQA purposes, it is crucial to describe methods and data sources fully.
  - While use of the Community Protocol is not mandatory, given the OPR recommendation of its use for local planning efforts in California, it is recommended that inventories provide a rationale for using alternative protocols or guidelines or methodologies if those found in the Community Protocol are not used.
  - Documentation can become part of the administrative record under CEQA.

Table 1 below summarizes the key areas where jurisdictions may consider deviating from the Community Protocol, by emissions sector.

Table 1 Recommendations for Community GHG Inventories in California in light of the Community Protocol

Sector	Include[1]	Recommendation for California Community GHG Inventories
Built Environment		
Stationary Fuel Combustion	Partial	Include residential/commercial natural gas use. Exclude natural gas use for industries where state/federal regulatory oversight exists.
Electricity Use	Yes	Include as recommended in the Community Protocol.
Transmission and Distribution (T&D) Losses	Possibly, As Applicable	Include T&D losses as feasible with California Public Utilities Commission data to allow for full accounting of value of energy-efficiency or local renewable energy measures in CAPs.
Other Emissions	Varies	Include district heating and cooling. Exclude industrial process emissions where regional, state, or federal regulation exists. Exclude refrigerant leakage and fire suppressant emissions until local data are available. Exclude upstream energy use emissions due to lack of jurisdictional control and significant influence.
Transportation		
On-Road Transportation	Yes	Use origin-destination method for Senate Bill 375 consistency.
Freight/Intercity Passenger Rail	No	Exclude due to lack of jurisdictional control and significant influence.
Transit	Yes	Where data attributing passenger-miles to the jurisdiction is available, include on passenger-mile basis with similar concept as on-road transportation (e.g., split between origin and destination).
Marine Vessels	Unlikely	Exclude unless jurisdictional control/significant influence exists.
Off-Road	Yes	Include off-road emissions under local jurisdiction influence (construction, landscaping, etc.)
Lifecycle of Transportation Fuels	No	At present, lifecycle emissions are not a standard CEQA requirement for analysis. Jurisdictions may include at their discretion.
Solid Waste		
Community-Generated Waste	Yes	The "waste generation" method is acceptable, but data are available in California under most cases to do a "waste-in-place" analysis for communities wanting to know their current year "legacy" emissions.
Composting	Possibly, As Applicable	Should be included where data supports it to get better estimates of net benefits of additional composting.
Wastewater and Water		
Estimating Volumes	Yes	Use inflow measurement data wherever possible instead of default factors.
Fugitive Emissions	Yes	County health records of septic systems are preferable to defaults.
Energy-Related Emissions	Yes	Use water-system specific factors rather than broad regional factors, if feasible. Include diesel emissions for agricultural and private wells.
Agriculture		
Agricultural Emissions (not Livestock)	Possibly, As Applicable	Data available to assess fertilizer, pesticide application, and off-road equipment. In agricultural communities, emissions can be a major portion of inventory and should be included.
Livestock Emissions	Possibly, As Applicable	Include as applicable per Community Protocol.
Other Sectors		
Sequestration	Possibly	In areas with substantial natural land conversion, this sector can be a meaningful part of the inventory and jurisdiction may have control/influence through land use controls.
Lifecycle Emissions	No	Lifecycle emissions are not presently a standard CEQA requirement for requirement for analysis. Jurisdictions may include at their discretion.

[1] Presumes reasonably obtainable data if recommended for inclusion.

Introduction

ICLEI's *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* (Community Protocol) provides a solid foundation that jurisdictions in California can utilize when conducting a community-wide GHG emissions inventory. While the Community Protocol is generally consistent with the current practice in California, this Supplement outlines additional steps that are recommended if a California jurisdiction is preparing an inventory that will be used for a General Plan or a qualified GHG reduction strategy that satisfies the CEQA guidelines and provides CEQA streamlining opportunities to future projects that are consistent with a qualified GHG reduction strategy. The additional steps outlined in this Supplement are consistent with the land use sectors identified by the California Air Resources Board (ARB) in the 2008 Scoping Plan and recommendations from local Air Districts in California.

This Supplement is not intended to present every acceptable methodology, but rather to lay out a reasonable approach for considering GHG emissions sectors to include in a community-wide emissions inventory. California jurisdictions looking to take advantage of the streamlining provisions in CEQA Guidelines Section 15183.5 should consult the CEQA guidelines to ensure the inventory and plan elements meet the criteria outlined in this section. Plan elements identified in Section 15183.5 of the CEQA guidelines are:

1. Quantify greenhouse gas emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area;
2. Establish a level, based on substantial evidence, below which the contribution to greenhouse gas emissions from activities covered by the plan would not be cumulatively considerable;
3. Identify and analyze the greenhouse gas emissions resulting from specific actions or categories of actions anticipated within the geographic area;
4. Specify measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level;
5. Establish a mechanism to monitor the plan's progress toward achieving the level and to require amendment if the plan is not achieving specified levels;
6. Be adopted in a public process following environmental review.

The AEP Climate Change Committee has also drafted white papers on the preparation of community-wide GHG emissions inventories in California.

- California Community-Wide Greenhouse Gas Baseline Inventory Protocol (June 2011)
- Forecasting Community-Wide Greenhouse Gas Emissions and Setting Reduction Targets (May 2012).

These advisories are available at AEP's website: http://www.califaep.org/.

Community-Wide GHG Emissions Boundaries

The Community Protocol states that a community-wide inventory should include a quantified analysis of GHG emissions resulting from emissions 1) that are produced by community-based sources within the community boundary (in-boundary emissions or direct emissions), and 2) that are produced as a consequence of community activities (indirect emissions). The Community Protocol goes on to state that emissions sources should include "any physical process inside the jurisdictional boundary that releases GHG emissions into the atmosphere." As outlined in this Supplement, inventories conducted in California need not include every emissions source within their jurisdictional boundary because there is additional guidance available from ARB that can be used by jurisdictions to further define the jurisdictional boundaries that should be utilized in a community-wide GHG emissions inventory:

- **2008 Scoping Plan:**[2] Utilizes both a geographic boundary (emissions occurring within California) and a jurisdictional boundary (emissions that occur outside California but are directly related to California's emissions inventory)
- **Local Government Operation Protocols (LGOP):** Encourages local governments to utilize operational control when defining their organizational boundary

The boundary for a community-wide inventory falls somewhere between the broad scale of the statewide inventory and the narrow focus of a municipal inventory. While local agencies are encouraged to include GHG emissions based on the level of control or influence that the agency has over GHG-emitting activities, the community-wide inventory should encompass emissions within both the local agency's direct and indirect control and influence such as land use decisions and policies. A consumption-based approach is not recommended for estimating GHG emissions inventories prepared for General Plans or GHG reduction plans.[3] Inclusion of household consumption is not mandated. However, this supplement should not preclude a jurisdiction from considering emissions sources that are outside its land use authority at its own discretion.

Many baseline GHG emissions inventories are based on a combination of both geographic and jurisdictional control. The following should be considered when determining the appropriate boundaries for a community-wide inventory:

- The GHG emissions modeling tool or date source used to estimate GHG emissions may determine which method (operational control or geographic boundary) a jurisdiction is able to use.
- In most cases, a city's or county's land use authority is contiguous with its jurisdictional boundaries. However, there are exceptions:
  - Jurisdictions do not have land use authority over land that is owned by state-operated/owned institutions such as school districts, universities, and prisons.
  - Some jurisdictions encompass other lands (e.g., federal, tribal, airports), where land use jurisdiction is not in the sole authority of the local jurisdiction.

[2] ARB is in the process of updating the 2008 Scoping Plan.

[3] The Community Protocol identifies a separate accounting methodology for consumption-based inventories. Similar to the recommendations of this Supplement, neither ICLEI nor OPR mandate this approach. The Community Protocol provides an accounting methodology for those jurisdictions wishing to supplement the inventory with up-stream and down-stream emissions sectors (i.e., lifecycle emissions).

  - A planned expansion of geopolitical boundaries may support the inclusion of emissions from land outside of current jurisdictional boundaries such as land within a jurisdiction's, urban growth boundary, general plan area, or sphere of influence.
- A jurisdiction's land use authority typically applies to land use and policy decisions for new development (e.g., landscaping, building energy efficiency, infrastructure, design) and policy decisions and programs adopted for existing development within the jurisdiction.

It is recommended that a baseline GHG inventory include GHG emissions for sources that may not be in the jurisdiction's direct control, but for which the local agency has some degree of policy-land use control (e.g., indirect control) or influence. Factors that influence a local agency's consideration of appropriate emissions may vary by sector.

Community-Wide GHG Emissions Sectors

The sectors identified in this Supplement are consistent with those recommended in the Community Protocol, as shown in Table 2.

Table 2 Recommended California Community-Wide GHG Emission Sectors

Community Protocol	California Scoping Plan Inventory, Commonly Included In
Use of Electricity by the Community (Built Environment Activities and Sources)	■ Electric Power; Or ■ Residential and Commercial[1]
Use of Fuel in Residential and Commercial Stationary Combustion Equipment (Built Environment Activities and Sources)	■ Residential and Commercial ■ Industrial[1,2]
On-Road Passenger Vehicle and Freight Motor Travel	■ Transportation[3]
Use of Energy in Potable Water and Wastewater Treatment and Distribution	■ Water/Wastewater[4]
Generation of Solid Waste by the Community	■ Recycling and Waste

Notes: Agriculture emissions are included as a separate sector in the Scoping Plan and include livestock, crop growing and harvesting, and general fuel use (including fuel used in agricultural-related off-road vehicles). The Agriculture sector may be included in a California community-wide inventory, as applicable.

Carbon sequestration is included as a net benefit in the Forestry sector in the 2008 Scoping Plan inventory. Carbon Sequestration may be included in a Community-wide inventory, as applicable

1 Industrial emissions may be reported separately from the Commercial sector. ARB includes fugitive emissions from refrigerants loss and other high global warming potential (GWP) gases as a separate sector and these emissions are not commonly included in a California inventory.

2 Fuel used in industrial sources that are permitted by the Air District may be excluded because they may not be under jurisdictional control.

3 The Scoping Plan inventory includes fuel used for on-road transportation, ships and commercial boats, aviation, rail and unspecified fuel sources. Freight Motor Travel is not mandatory for California community-wide inventories. Ship, commercial boats, and aviation are also not mandatory California community-wide inventories. Unspecified sources of fuel include fuel used in off-road vehicles but exclude off-road fuel used in the Agricultural sector. Off-road fuel use may be reported separately from the Transportation sector in community-wide inventories.

4 Water and Wastewater may be reported separately from Electric Power and is not identified as a separate sector in the Scoping Plan Inventory. Wastewater may include fugitive emissions commonly included in the Industrial Sector.

The sector chapters in this Supplement detail where the methodology for inventories in California may diverge from the Community Protocol for the individual sectors. Additionally, the considerations relating to scoping, sector choice, and documentation needs for GHG inventories are listed below:

- **Aggregating Municipal and Community-Wide Inventories:** For community-wide GHG emissions inventories, separating municipal inventories from the community-wide inventories is not required unless otherwise specified (such as a plan identifying a separate municipal target).

- **Significant Influence Test:** GHG emissions may be generated within a jurisdiction that has some degree of either direct or indirect control but the emissions may represent a nominal contribution to a jurisdictions' community-wide GHG emissions inventory. In these instances, it is recommended that the Lead Agency/jurisdiction make an independent determination on whether to include these sources within the community-wide GHG emissions inventory. It is recommended that a jurisdiction should review its influence/control (in terms of ownership, operational control, regulatory authority, enforcement, budgetary or other influence) over emissions and include all of those over which it has significant influence. The Lead Agency/jurisdiction should substantiate the exclusion of sources not included in the inventory in terms of a lack of control/influence or lack of data or suitable methodology.

- **Documentation and Transparency in Modeling:** The Community Protocol outlines accounting and reporting principals including, accuracy, completeness, measurability, transparency, and consistency and comparability. Inventories conducted for California jurisdictions should follow these principals. Along these guidelines, inventories prepared for General Plans and GHG reduction plans should provide details on the modeling methodology (e.g., if a top-down methodology is used, identify what was used to apportion emissions to the community), including modeling tools used, changes to model defaults, model inputs, and citations for where data were obtained.[4] The level of detail necessary is identified in the individual sector chapters below.

[4] It should be noted that this detail may be required when preparing an inventory for a "project" under CEQA that would be part of the Administrative Record.

Built Environment Activities and Sources

Introduction

The Community Protocol describes methods and data sources that are appropriate and currently used in many California CAP emission inventories. The Community Protocol provides adequate flexibility to include or exclude sources where appropriate for California.

The Community Protocol identifies where local data may be available to provide more refined estimates. In many cases, California-specific or utility-specific source data are available that would provide the most accurate estimates. For example, most California utilities now provide aggregated community electricity and natural gas usage data for residential and commercial users.

The Community Protocol requires including the following GHG emission sources in community inventories:

- Fuel use in residential and commercial stationary combustion sources
- Indirect emissions from the consumption of electricity

In addition, the Community Protocol recommends including these in-boundary GHG emission sources:

- Industrial stationary source combustion sources
- District heating or cooling facilities
- Refrigerant leakage

Residential and Commercial

Fuel Use in Residential and Commercial Stationary Combustion Sources

The Community Protocol provides a methodology to use in including fuel use from residential and commercial stationary combustion sources which is compatible with California CAPs complying with CEQA. These sources include residential and commercial space and water heating, and cooking fuel. In addition, some small industrial combustion sources not regulated by the Clean Air Act should be included as well. Note that these small unregulated industrial sources are included here because they will be included in the natural gas utility data acquired to calculate GHG emissions from these sources. Large industrial sources regulated under the Clean Air Act are discussed separately below. We recommend acquiring community-wide natural gas usage data for residential, commercial, and small unregulated industrial users from the natural gas utility serving the local jurisdiction aggregated by land use or by meter type. These types of small unpermitted sources are often referred to as area sources because they are dispersed over a wide area.

Indirect Electricity Use

The Community Protocol for electricity consumption by the community is consistent with the methods and data sources used in most California CAPs. Data on the consumption of electricity within a community can be obtained from the local utility serving the community. The Community Protocol provides flexibility in calculating indirect GHG emissions associated with electrify consumption including using local emission factors and consumption data when

available. California utilities provide current emission factors and usage data on request by local government planning agencies.

Transmission and Distribution Losses

The Community Protocol addresses transmission losses from the utility to the end user. The transmission losses add a small but important amount of emissions to the inventory and more accurately portray the effects of distant generation on emissions. This is a relatively new addition to California community CAP inventories and should be included as a standard inventory component approach recommended in the Community Protocol is recommended for California-based estimates.

Industrial

Industrial Stationary Combustion Sources

The Community Protocol provides a methodology for industrial stationary combustion sources; however, these sources are typically regulated under the Federal and State Clean Air Acts, and not under the jurisdiction of the local government preparing the CAP. Therefore, industrial stationary sources outside the jurisdictional control of the local government are normally excluded from the CAP emission inventories. This is one of the primary differences between the Community Protocol, which requires inclusion of these industrial sources, and our recommendation that they are not included because of the lack of jurisdictional control. Stationary sources meeting specified size thresholds are required to report their emissions the ARB and the U.S. Environmental Protection Agency (EPA). Large stationary sources are required to participate in California's new Cap and Trade Program. Local governments have a responsibility for land use decisions related to siting stationary sources, but have limited authority over the operation of those sources, with the exception of health and nuisance impacts and other impacts not related to air emissions. California local and regional air pollution control districts have begun addressing stationary source GHG emissions through CEQA as part of the air quality permitting process. For example, when the San Joaquin Valley Air Pollution Control District is a Lead Agency it requires stationary source projects to implement Best Management Practices (BMP) to reduce GHG emissions to the extent needed to demonstrate consistency with applicable statewide plans to find that projects would result in less than significant impacts on climate change.

Industrial Process Emissions

Industrial process emissions are emissions produced as a byproduct of production and other processes. The Community Protocol recognizes that industrial process emissions are likely to be outside of the control of the local government or community and data are limited for these sources. Therefore, industrial process emissions are not normally included in community inventories except for informational purposes. However, if specific sources are under jurisdictional control, data can be obtained for large sources subject to EPA's Mandatory Reporting Rule using the EPA Greenhouse Gas Emissions from Large Facilities data publication tool. Data for small sources are not available.

Emissions from District Heating and Cooling Energy Use

District heating and cooling refers to facilities that provide steam or cooling for purchase by nearby customers. These facilities use fuels such as natural gas, electricity, and others and transform the energy in those fuels into useful heat (in the form of steam) or cooling (in the form of chilled water). At the community level, the GHG emissions associated with district heating and cooling is normally captured through the utility data for electricity and natural gas consumption unless the district heating and cooling system includes co-generation units. Co-generation, also

known as combined heat and power, is the use of a combustion turbine to produce electricity and the heat within the exhaust stream of the combustion turbine captured to provide useful heat in the form of steam. For California communities with district heating and cooling without co-generation, follow the Community Protocol for indirect electricity use described above and obtain natural gas consumption data from the natural gas utility serving the local jurisdiction in the same manner as described in fuel use in residential and commercial stationary combustion sources above. If the district heating and cooling facilities within the community have co-generation components, then natural gas, electrical consumption and electrical generation data needs to be included in order to accurately calculate GHG emissions associated with these types of district heating and cooling systems. In the case of co-generation, GHG emissions needs to be calculated using net electricity (either as net generation or net consumption) in order to avoid double counting emissions. California communities should use the Community Protocol methods for estimating emissions from district heating and cooling with co-generation, if data are available for sources within the community at a level of detail that includes both generation and electrical consumption in order to determine the net electrify associated with the district heating and cooling facilities.

Upstream Emissions from Energy Use

GHG emissions that result from the use of energy required to extract, process, and deliver the fuel to either an electricity generation facility or other points of combustion are considered upstream emissions. Upstream emissions are calculated for both fuels used directly inside the community, such as natural gas, propane, and heating oil, as well as for fuels used in the production of electricity purchased from outside the community. Upstream emissions are normally not included in California community inventories because of lack of jurisdictional control or influence over the upstream sources.

Emissions from Electrical Power Production

California community inventories are normally based on power consumption in the community. Electrical power providers are not under the jurisdiction control of the community. Electrical utilities in California are under state jurisdiction for addressing GHG emissions. State regulations include the Renewable Portfolio Standard that requires utilities to provide an increasing percentage of their electricity through renewable sources. Fossil fueled power plants are subject to California's Cap and Trade regulation.

Counting emissions for both consumption of electricity by the community and generation by the power provider would double count the emissions. Therefore, emissions from electrical power production are not normally included in the community inventories.

Refrigerant Leak and Fire Suppression Emissions

Chemicals used in refrigeration, fire suppression equipment, and some industrial processes can leak into the environment during use and disposal. Although the volume leaked is small, these chemicals have very high global warming potential and the amount used is increasing rapidly because they are being used as substitutes for ozone depleting substances that are being phased out. Accurate data needed to determine the amount of these chemical emissions leaking into the atmosphere can be very hard to obtain. Estimates can be used based upon surveys and tests of these types of systems. The Community Protocol refers to the *ARB Rulemaking to Consider the Adoption of a Proposed Regulation for the Management of High Global Warming Potential Refrigerants for Stationary Sources* as one source of information for estimating these emissions in community inventories. The data provided can be used to estimate a per capita emission rate for application in a community inventory.

Transportation and Other Mobile Emissions Activities and Sources

Introduction

The Community Protocol describes multiple methods and available data sources to estimate California GHG community inventory transportation emissions. This section summarizes the most appropriate methods and data sources to estimate on-road transportation GHG community emissions in California regarding the following:

- Estimate daily vehicle miles traveled (VMT)
- Estimate GHG emissions using daily VMT as an input into an air quality emissions model

The primary sources of GHG emissions for a community-wide GHG emissions inventory within a jurisdiction are on-road emissions with a focus on passenger vehicles and light duty-trucks. Other (i.e., heavy-duty trucks, trains, boats/ships, and airplanes) transportation-related GHG emissions are not typically included in community-wide GHG estimates because the community does not directly influence the activities of inter-regional travel and goods movements. Nothing prohibits a jurisdiction from including these other sources within their community-wide GHG emissions estimates. However, estimates of inter-city rail and air travel and goods movement are more appropriately conducted at the state and/or nation level given available data and state-of-practice modeling. GHG emissions data from rail, air, and goods movement is often modeled at the statewide or regional level and communities wishing to including information from these modes are encouraged to check with regional agencies such as Metropolitan Planning Organizations and state agencies such as the California Department of Transportation (Caltrans) to verify appropriate data sources, methodology, and consistency with previous studies.

Estimating Daily Vehicle Miles Traveled

In California, travel demand forecasts are generated using various forms of models that range from complex computer models that account for numerous factors that influence travel demand to simple spreadsheets based on historic traffic growth trends. Jurisdictions should follow state-of-the-practice or best practice methods for travel forecasting, which includes documentation of model inputs and technical analysis. A detailed discussion of the positive and negative aspects of potential analytical tools for inventories in the Mobile Sources chapter of the *California Community-Wide Greenhouse Gas Baseline Inventory Protocol White Paper* (AEP Community Inventory White Paper). As discussed in the *On-Road Transportation* chapter of the *Forecasting Community-wide Greenhouse Gas Emissions and Setting Reduction Targets* (AEP 2012), only a subset of inventory methods can be used to forecast future travel behavior.

Regardless of model selected (e.g., regional Transportation Demand Forecast [TDF] model, local TDF model, or non-model "accounting method"), to satisfy CEQA regulations and develop reasonable daily VMT estimates, the best-validated model should be applied for quantification of trip generation, internal/external distribution, trip length, and daily VMT within the study jurisdiction. When using a travel forecasting model, the following fundamental criteria should be met to ensure compliance with state-of-the-practice expectations (for additional detail see the *California 2010 Regional Transportation Plan Guidelines* [California Transportation Commission 2010]).

- The scale of the model should match that of the study area.
- The model should be calibrated and validated within the study area.

- The model validation should include static and dynamic tests.
- The model's land use or socioeconomic forecasts should be tested for reasonableness.

The origin destination method is recommended for calculating the daily VMT for a local jurisdiction (includes internal daily trips and one-half of daily trips that have either an origin or destination outside the local jurisdiction). This approach quantifies the jurisdiction-related daily VMT so that the jurisdiction's staff and decision-makers can develop policies to alter VMT and GHG emissions within their jurisdiction. The OD method is consistent with the Regional Targets Advisory Committee (RTAC) recommendation to the California Transportation Commission presented in the report *Recommendations of the Regional Targets Advisory Committee (RTAC) Pursuant to Senate Bill 375* (RTAC 2009). The OD method is described in the *On-Road Transportation* chapter of the *Forecasting Community-wide Greenhouse Gas Emissions and Setting Reduction Targets* (AEP 2012).

Estimating GHG Emissions

With travel activity statistics (i.e., VMT by speed range or "bin"), the chosen method of estimating the GHG emissions may affect the direction and magnitude of the results, as well as the level of accuracy. Daily VMT, including data by speed bin, is used as an input to California air quality emissions modeling software like EMissions FACtors 2011 (EMFAC) created by ARB to estimate GHG emissions for motor vehicles based on fleet mix, fuel type, and fuel consumption. Using air quality tools developed for areas outside of California is not recommended because EMFAC is specific to California and the use of more generalized tools may provide inconsistent results. However, under peak-period congested conditions a more complete understanding of GHG emissions can be developed using micro-simulation models or travel models with a dynamic traffic assignment. While macro-level daily GHG emissions factors by speed-bin can be used for off-peak uncongested time periods, the practice of estimating GHG emissions is evolving quickly, and better data and models will likely be available in the near future that are more sensitive to individual vehicle performance and traffic flow efficiency. Transportation GHG emissions estimates should be tested for reasonableness based on comparisons such as 1) proportion of transportation emissions relative to nearby or similar jurisdictions, and 2) VMT per service population (jobs plus residents) relative to the region or state. Other reasonable tests can be used by the jurisdiction as appropriate.

Solid Waste Emissions Activities and Sources

Introduction

For purposes of solid waste emissions, the Community Protocol will be acceptable for use in California GHG community inventories completed as part of deriving GHG reduction plans that can allow for tiering under CEQA. However, California GHG community inventories can use additional California-specific resources to meet Community Protocol guidance for solid waste and alternatives to waste-in-place calculations have been described. These resources are summarized below and addressed in additional detail in the AEP Community Inventory White Paper.

Solid Waste Facilities Located in the Community

For many community GHG inventories in California, it will generally be the case that solid waste generated inside the jurisdiction will be handled by facilities that are located outside the jurisdiction. Where all of a community's waste is handled inside the jurisdiction, the methods in the Community Protocol are appropriate to assess emissions from the following sources:

- Methane Emissions from Landfills
- Combustion of Municipal Solid Waste
- Composting

However, if the facilities inside the inventory boundary handle waste from multiple jurisdictions, the jurisdiction may take one of two appropriate approaches. If the local jurisdiction has control over the waste facility and can exert influence over the facility emissions, it could be appropriate to include all the emissions including those associated with waste from outside the inventory boundary. If the jurisdiction does not have substantial control over those emissions, it may exclude the emissions associated with other jurisdictions' waste contribution thus deferring potential mitigation to those jurisdictions.

Community–Generated Waste Emissions

Decomposition of waste in a landfill occurs over many years (i.e., the decompositional lifetime of the waste). The resulting methane emissions of a single year's waste do not occur in a single year, but over many years following deposition in the landfill. Thus, the jurisdiction has two options when looking at the GHG consequences of the community's waste generation:

- Quantify the GHG emissions that result from **waste generated in a single year** (i.e., the activity happens in the inventory year but the emissions happen over many years, are totaled and attributed to the inventory year). This approach is referred to as the "waste generation" or "future methane commitment" approach.
- Quantify the **emissions that physically occur in the year of interest** due to all waste generated by the community in the past and that is still actively decomposing and producing methane in various landfills (i.e., the emissions occur in the inventory year but the activity happened over many years in the past). This is referred to as the "waste in place" approach.[5]

[5] One could also choose to use both measures to disclose both aspects of waste emissions. However, if both are included in the jurisdictional total, this could inflate the jurisdiction's emissions relative to other

For community-generated waste sent to landfills, the Community Protocol only describes the use of the waste generation approach that includes future GHG emissions from waste generated in the inventory year in the current year inventory. While this approach is useful in gauging the "methane commitment" of today's waste generation patterns, it does not actually derive an estimate for current year emissions and it does not recognize responsibility for past waste generation that results in current year emissions.

In California, an alternative waste-in-place approach would also be acceptable for use in GHG inventories supporting GHG reduction plans for tiering under CEQA. Data are available in California for waste disposed by jurisdiction for at least the last 15 years and can be used to derive a reasonable estimate of legacy waste emissions from a jurisdiction's past waste generation for the current inventory year.

The *California Community-wide Greenhouse Gas Baseline Inventory Protocol White Paper* (AEP Community Inventory White Paper) describes methods and data needs for using either of the options described above and also provide additional resources for California inventories.

The Community Protocol also provides guidance for the following emissions associated with solid waste other than landfill emissions.

- **Process Emissions associated with Landfilling:** The Community Protocol provides guidance on estimating equipment emissions at landfills. It is common practice to use the ARB's OFFROAD software to estimate off-road equipment emissions including those at landfills. If a separate calculation of these emissions is done for a California community GHG inventory, then the emissions should be pro-rated to those associated with a particular jurisdiction's waste generation.
- **Collection and Transportation Emissions:** The Community Protocol provides guidance on estimating vehicle transport emissions associated with solid waste transport. These emissions are usually included in the traffic emissions analysis and thus may not need to be calculated separately. If a separate calculation of such emissions is performed for a California community GHG inventory, the emissions should be pro-rated for the emissions associated with a particular jurisdiction's waste generation.
- **Community-Generated Waste Sent to Combustion Facilities:** The Community Protocol provides guidance on emissions associated with combustion of waste. These emissions are often included in the stationary source section of an inventory using California or federal reporting data. If these emissions are included in a California community GHG inventory, they should be pro-rated for only that portion associated with a particular jurisdiction's waste generation. Biogenic carbon dioxide emissions, if included, should be reported separately from the rest of the inventory as a disclosure item as they do not result in a net increase in atmospheric carbon dioxide levels; this is consistent with state inventory practices. Alternatively they can be excluded from the inventory entirely with an explanatory note.

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jurisdictions that may only include emissions associated with one of the two methods. It is most common to only include emissions using one of these methods in a local community inventory total.

Wastewater and Water Emissions

Introduction

Given California's wide variety of climatic conditions, each community's water sources, supply, and treatment processes also vary. It is estimated that water-related infrastructure accounts for 20 percent of total electricity use in California (ARB 2010). While some communities rely on local sources, others may purchase water that must travel long distances, and increasingly, communities are looking to innovative water procurement techniques such as reclamation or desalination. All of these sources, and their subsequent treatment, distribution, conveyance, and disposal processes result in varying degrees of energy use and emissions, which must be considered in the estimation of GHG emissions from water and wastewater use in a community. Although in general the methods contained within the Community Protocol are acceptable, this Supplement includes specific calculation methods and data sources that can be used when completing a California GHG community wastewater and water inventory completed as part of deriving GHG reduction plans that can allow for tiering under CEQA. The methods and data sources are summarized below and addressed in greater detail in the AEP Community Inventory White Paper.

The Community Protocol identifies methods and data sources for communities to assess the emissions generated by water and wastewater uses and facilities in the community or operated by the local government. While the methods in the Community Protocol are applicable to communities throughout the U.S., additional resources and information exist in California that should be considered when preparing a GHG emissions inventory. In addition to the instructions and resources included in Appendix F of the Community Protocol, jurisdictions in California should consider the following methods and resources when preparing a GHG emissions inventory that includes water and wastewater activities.

- **Measurement-Based Method for Joint Facilities:** The Community Protocol recommends utilizing population as a method to attribute the emissions generated at a facility when the community is only partially responsible for the operation of the facility. In many California communities, wastewater treatment facilities are operated at the regional level or collect and process wastewater from multiple jurisdictions.

  California communities that are served by a regional plant should estimate emissions from a joint facility by the measurement of inflow (i.e., million gallons per day [MGD]) per jurisdiction, when available. Population-based estimates do not accurately reflect inflow from communities with higher employment or industrial users. An example of the inflow measurements assigned by jurisdiction is provided in Table 3.

Table 3 Wastewater Inflow by Jurisdiction

Jurisdiction	Palo Alto	Mountain View	Los Altos	Los Altos Hills
Inflow (MGD)	9.17	7.94	2.55	0.27
Population	64,403	74,066	28,976	7,922
Inflow per person (gallons per day)	142	107	88	34

Source: Palo Alto Regional Water Quality Control Plant

- **Stationary Emissions:** Methods identified in the Community Protocol are appropriate for California communities.

Process Emissions

- **Determining Contributions from Industrial Waste Discharges:** The Community Protocol recommends the use of direct measurement of nitrogen discharged per day (Total N-Load) as the preferred method. When direct measurements are not available, an alternative method utilizing population served should be used. In the alternative methods, the Community Protocol recommends that communities with "significant industrial users" according to the EPA's National Pretreatment Program, multiply the population by the default factor of 1.25. Communities in California vary widely in the industrial uses in their community and should determine whether the wastewater treatment plant serving the community has a specific industrial factor that can be used prior to relying on the default industrial factor of 1.25.

  For example, in the City of Tulare, a high rate of industrial users contributes to total wastewater inflow at a rate higher than the population. The Water Pollution Control Facility identifies an industrial adjustment factor of 9.3, or an equivalent population of 560,000 people, compared to the City's estimated resident population of approximately 60,000 people in 2006.

Fugitive Emissions

- **Effluent Discharge:** When direct measurement of nitrogen discharged is not available to calculate nitrous oxide emissions associated with effluent discharge and there are "significant industrial users," the method described above under process emissions should be utilized to determine fugitive emissions from effluent discharge.

- **Estimating the Number of On-Site Wastewater Treatment and Septic Systems:** The Community Protocol identifies two methods for estimating the population served by on site wastewater treatment or septic systems when a total number of septic systems are not readily available. In certain metropolitan areas, the estimated number of septic systems and average household size are provided in Appendix F of the Community Protocol in Box WW.11(alt).1. California communities not listed in Appendix F, including unincorporated communities where the presence of septic systems varies widely, should check with county records, often managed by environmental or public health departments, to confirm estimates or permits for on-site septic systems prior to utilizing the Community Protocol default urban/rural percent of septic systems users.

Energy Related Emissions Associated with Water Delivery and Treatment

- **Water Energy Intensity by Water Source/System:** California's water supply has a wide range in energy intensity depending on the water system and supply. For example, the Hetch Hetchy system is gravity fed and has an energy intensity of 0 kilowatt hours per million gallons of water delivery (kWh/MG) while the State Water Project uses more than 8,000 kWh/MG conveyed. To reflect the range in energy intensity associated with water delivery, communities in California should utilize the water system specific energy intensity factors estimated by the California Energy Commission (CEC) and presented in *California Community-Wide Greenhouse Gas Baseline Inventory Protocol* (AEP Community Inventory White Paper) rather than assuming energy intensity by geography (north/south) as recommended in the Community Protocol. The energy intensities by source and system are presented in Table 4 below.

Table 4 Water-related Energy Intensities by Source and Water System

Supply Source	kWh/MG
Surface Water	0
Groundwater	4.45/foot
Ocean Desalination	13,800
Brackish Water Desalination	1,240-5,220
Recycled Water	0

Conveyance Source	kWh/MG
SWP LA Basin	8,325
SWP Bay Area	3,150
SWP Central Coast	3,150
SWP San Joaquin Valley	1,510
CRA LA Basin	6,140
Hetch Hetchy - Bay Area	0
Mokelumne Aqueduct	160
Local/Intrabasin	120

Treatment Source	kWh/MG
EPRI Avg.	100
Distribution Source	**kWh/MG**
EPRI Avg.	1,200
Recycled Water	1,200-3,000

Source: CEC 2006

- **Wastewater Energy Intensity by Technology:** For municipally-operated wastewater treatment facilities, jurisdictions should follow the methodology outlined in the section of the AEP Community Inventory White Paper entitled "Municipal Water Treatment Facilities and Conveyance" to determine the energy attributed to the community. If wastewater treatment is out of the jurisdiction's control, the CEC has calculated general per-unit energy factors as shown in Table 5. The resulting energy can be converted to GHG emissions using utility-specific conversion factors.

Table 5 Range of Energy Intensities for Wastewater Use Cycle Segments

Wastewater Collection	
Source	kWh/MG
Aggregated within treatment	140

Wastewater Treatment	
Source	kWh/MG
Trickling Filter	955
Activated Sludge	1,322
Advanced	1,541
Advanced with Nitrification	1,911

Wastewater Disposal	
Source	kWh/MG
Gravity Discharge	0
Pump Discharge	400

Source: CEC 2006

- **Decentralized Agricultural Water Use:** In counties or communities with agriculture business, water for agriculture uses can account for 90 percent of total water use. The Community Protocol does not provide guidance on how to estimate emissions from agricultural water use and private wells that utilize diesel generators. Wells that operate using electricity would typically be accounted for in the community's electricity totals. In California, the use of diesel generators for agricultural purposes can be estimated using the ARB's OFFROAD software, which estimates emissions associated with various heavy-duty vehicles and equipment.

Agriculture

Introduction

For purposes of agricultural emissions, the Community Protocol will be acceptable for use in California GHG community inventories completed as part of deriving GHG reduction plans that can allow for tiering under CEQA. However, California GHG community inventories can use additional California-specific resources to meet Community Protocol guidance for agriculture. These resources are summarized below and addressed in additional detail in the AEP Community Inventory White Paper.

The Community Protocol provides a framework for conducting a GHG emissions inventory at the community scale and includes a chapter (Appendix G) on agricultural emissions. While the Community Protocol provides a useful framework for agricultural emissions for all U.S. communities, numerous sources and activities relevant to California farmers are excluded. In addition, California communities will often have access to local data and emission factors that will supersede the national and state level factors provided in the Community Protocol. Further, many California jurisdictions are preparing GHG inventories to respond to state and local guidance which recommends or requires inclusion of additional agricultural sources beyond those identified in the Community Protocol. Jurisdictions in California may access numerous resources not identified in the Community Protocol that are unavailable elsewhere in the nation, including those identified in the AEP Community Inventory White Paper.

Using the California-specific methods and emission factors described below will still meet Community Protocol requirements since 1) agriculture is not a required source by the Community Protocol and 2) the Community Protocol provides the flexibility to use local data and emission factors where available, provided these methods are described in reports and the Community Protocol Scoping and Reporting Tool.

Agriculture Emissions (other than Livestock)

Currently, the Community Protocol provides methods to calculate emissions from agricultural livestock management (enteric fermentation and manure management) only. While the Community Protocol suggests accounting for other agricultural activities as relevant to each community, the Community Protocol provides only general guidance for determining what type of agricultural activities warrant inclusion through a recommended scoping process. Specifically, the Community Protocol provides a "Significant Influence" test as one way to determine additional sectors for inclusion in an inventory but also suggests including sources and activities "of potential community interest, regardless of whether or not the local government has significant influence over them."

Many jurisdictions do not exert significant discretionary influence over agriculture but California precedents and some air district guidelines recommend that agriculture should consider these emissions comprehensively, accounting for additional sources and activities such as crop practices and off-road agricultural equipment. These additional activities and sources may be considered of potential community interest even though they are not explicitly recommended by the Community Protocol. In addition, both the state inventory and national inventories include agricultural emissions as standard practice. Table 6 highlights California-specific precedents and guidance that suggest expanding the sources and activities outlined in the Community Protocol. Determining whether agricultural activities are significant enough to analyze in a community-wide inventory will vary by setting and community, but agricultural

emissions can generally be expected in rural areas wherever larger-scale agricultural operations, such as commercial farms and crop fields, exist.

Table 6 California Precedents for Other Types of Agricultural Emissions

Precedents	Recommendations	Example Reference
Air district guidance for a qualified GHG reduction plan and/or inventory	■ Address recommended agricultural sectors of air districts as relevant, such as Bay Area Air Quality Management District recommendations to include fertilizer use and off-road agricultural equipment (as relevant) ■ Anticipate that other air districts may develop guidelines and review plans that assert consistency with CEQA Guidelines Section 15183.5 and comment on omissions of standard sectors	■ Bay Area Air Quality Management District (BAAQMD) GHG Plan Level Guidance (2012) referenced in BAAQMD's adopted CEQA Air Quality Guidelines.
California Environmental Quality Act	■ Evaluate environmental effects as appropriate for the context and setting, based on scientific and factual data (including agricultural data) ■ Determine appropriate local agricultural activities, considering standard practice of California inventories and reasonable evidence	■ California Environmental Quality Act Guidelines Section 15183.5, 15064
Common practice among inventories for California jurisdictions	■ Include appropriate agricultural sectors based on approach of other comparable local inventories ■ Provide a foundation for a comprehensive GHG reduction plan or CAP consistent with AB 32 and the CEQA guidelines by quantifying agricultural practices consistent with the state inventory prepared by ARB, including multiple agricultural sectors as relevant	■ Butte County Climate Action Plan (2013) ■ Napa County Climate Action Plan (2012) ■ San Luis Obispo EnergyWise Plan (2011) ■ City of Tulare Climate Action Plan (2011) ■ Yolo County Climate Action Plan ■ California Greenhouse Gas Emissions Inventory (2009)

For many agricultural communities in California, additional types of non-livestock agricultural activities may serve as major GHG emissions sources. The AEP Community Inventory White Paper provides additional context for a jurisdiction to understand the entire range of potential agricultural activities. Jurisdictions within California can use resources in this white paper to analyze these other agricultural emissions. Specifically, California jurisdictions can use the AEP Community Inventory White Paper to analyze the following additional agricultural activities and determine appropriate methods for emissions calculations:

- Crop practices, such as fertilizer use, pesticide application, rice farming, or residue burning.

- Other forms of livestock or large-scale confined animal facilities.
- Off-road agricultural equipment, including the operation of tractors and other equipment.

Livestock Emissions

Appendix G of the Community Protocol provides methods for emissions associated with enteric fermentation and manure management for livestock. Livestock includes cattle, sheep, goats, swine, and horses. Inventories should follow the general process to calculate livestock emissions outlined in the Community Protocol. However, ARB has calculated livestock activities at the state level, providing easy-to-use local emissions factors that more accurately reflect livestock characteristics in California. Through development of the state inventory, ARB calculated livestock emissions factors for California that are generally lower than the national emissions factors provided in the Community Protocol. The Community Protocol also provides several options for calculating manure management emissions, which involve detailed inputs that may be challenging for a jurisdiction to obtain. Relying on ARB's calculated manure management emissions factors may reduce the number of inputs that a jurisdiction must calculate to estimate emissions and still provide a more accurate estimate than the national approach described in the Community Protocol.

California jurisdictions should consider local adjustments to Community Protocol for three livestock variables, which are summarized in Table 7 and discussed in further detail below.

Table 7 Livestock Variables for California Jurisdictions

Topic	Recommended Actions or Refinements to Community Protocol Methods	Additional Resources
Livestock population	■ Account for seasonal rotations of livestock ■ Use County crop reports, air district reports, or other local records to estimate ■ Exclude calves less than 7 months from enteric emission calculations	■ AEP Community Inventory White Paper for additional links and reports
Enteric emissions factors	■ Use California Air Resources Board factors, which provide lower emissions rates for several livestock types (except bulls)	■ AEP Community Inventory White Paper California Air Resources Board (2007)
Manure management emissions factors	■ Use California Air Resources Board equations and factors, which generally provide simpler calculation methods	■ AEP Community Inventory White Paper California Air Resources Board (2007)

To calculate the number of livestock, jurisdictions should account for the seasonal variation of livestock and types of operations. This recommendation supplements the Community Protocol's guidance to calculate livestock population, recognizing that California jurisdictions generally can determine the fluctuation of seasonal livestock activity. For example, stocker cows and steers may graze in a temperate area for 6 months of the year before being transported to a feedlot. An inventory accounting for these cattle should scale the livestock population by 50 percent, the proportion of the year that cattle are present in the community. The age of local cattle will also affect calculations. Any calves younger than 7 months consume primarily milk,

resulting in no methane emissions (EPA 2010). Although the Community Protocol implies this approach with the emissions factors of Table A.1.1 of Appendix G, calves should be excluded from any enteric emissions calculations rather than calculated at an average emissions rate, consistent with the approach of the ARB and EPA.

Lastly, California jurisdictions should rely on California-specific livestock emissions factors developed by the ARB instead of the national defaults provided in the Community Protocol. The ARB has developed rigorous state-specific livestock emissions factors, using state data and methods developed by the EPA and the Intergovernmental Panel on Climate Change (IPCC). The resulting California-specific emissions factors provide several emissions rates that more accurately reflect the conditions in California than the national defaults in the Community Protocol. For purposes of manure management, the ARB has already accounted for many of the Community Protocol variables such as characterization of animal waste and typical animal mass. Relying on the manure management emissions factors developed by the ARB provides a simpler approach to calculate manure emissions, eliminating the burden of calculating many of the variables identified in the Community Protocol, while still ensuring an appropriate methodology.

Conclusion

The resources described above allow Californian jurisdictions to calculate agricultural emissions consistent with guidance from the Community Protocol but with local data and emissions factors that are more accurate for California. Developing an inventory consistent with the practices described above will also support consistency with common inventory practice in California. Additional resources are cited in the References section of this paper, in addition to the previous AEP Community Inventory White Paper.

Carbon Stocks and Sequestration

Introduction

The Community Protocol provides no guidance for accounting carbon stocks[6] or changes in carbon sequestration[7]. The AEP Community Inventory White Paper provides guidance and references on calculation of changes in carbon stocks and sequestration for local community GHG inventories, with a particular focus on California.

A community GHG inventory need not evaluate carbon stocks and sequestration to be consistent with the Community Protocol. However, evaluating stocks and sequestration can be useful for local communities in developing local GHG reduction plans and establishing the basis for crediting positive actions in avoiding losses in carbon sinks and/or increasing sequestration. Further, when changes in stocks and sequestration are a meaningful part of a local inventory, a local jurisdiction has substantial influence or control over activities that affect stocks and sequestration and the jurisdiction intends to use its GHG reduction plan as part of tiering under CEQA, then this sector should be included in the local inventory in order to provide a comprehensive assessment of cumulative local GHG emissions. As an example, In Napa County, ongoing vineyard development has resulted and will result in conversion of natural woodlands, forests, and other land covers to vineyard and the County decided to include changes in sink and sequestration in their GHG inventory and forecast to support their local climate action planning. Other jurisdictions, such as Sonoma County and Marin County are also planning on including sequestration in their local climate action planning. All of these jurisdictions have extensive agriculture sectors as well as extensive natural areas that can be affected by choices in land use planning.

For these reasons, carbon stocks and sequestration should be included in California inventories when:

- Changes in land use involving natural lands are substantial, in particular where urban development or agricultural expansion encroaches on woodlands, forests, and wetlands.
- Changes in future land use are expected to result in:
  - Substantial conversion of natural lands to urban land or agricultural land.
  - Substantial conversion of agricultural land to urban land.
  - Substantial changes in land covers, particularly woodlands, forests, and/or wetlands will occur due to restoration activities.
  - Substantial changes in agricultural soil management are planned as part of conservation efforts or GHG reduction plan.

Reporting Options for Community GHG inventories

Carbon sequestration is an optional item in the Community Protocol. Consequently, a local jurisdiction has some latitude in the manner of reporting and tracking such emissions. It is important to distinguish between total stock and total annual sequestration versus changes in

[6] Carbon stock is defined as the quantity (measured in tons of carbon) of standing, permanent carbon (in biomass or soils) on a specified area of land at the time of the inventory.

[7] Carbon sequestration is defined as the net annual increase in the carbon stock of a reservoir. In practical terms, it is the amount of permanent carbon added (or sequestered, or taken up) in a specified land area in a given year due to vegetative growth or soil processes.

stock and changes in annual sequestration when reporting emissions associated with this sector. Stocks that undergo no change during the inventory year will result in no change in GHG emissions; thus under no circumstances should unchanged stock values be combined with other sources of emissions during the inventory year.

Carbon stocks that increase during the inventory year are referred to as carbon *sinks*; carbon stocks that decrease during the inventory year are referred to as carbon *sources*. It is important to distinguish the cause of changes in carbon stocks. Increases or decreases carbon stocks in natural land covers due to natural causes (growth, wildfires, etc.) can be reported in a local GHG inventory. These increases are considered part of the natural biogenic carbon cycle and most inventory practitioners advise that negative or positive emissions associated with natural land covers should not be combined with anthropogenic emissions.[8] However, if increases in carbon stocks are due to man-made interventions such as forest restoration or changes in agricultural soil management, then such changes are not natural in origin and can be fairly combined with other anthropogenic emissions.

- **Reporting Changes in Carbon Stock and Annual Sequestration Separate from Other Emission Sources:** As described in the *California Community-wide Greenhouse Gas Baseline Inventory Protocol White Paper* (AEP Community Inventory White Paper), changes in carbon stock and annual sequestration in the baseline year should be reported separately from other source of emissions. This reporting approach is consistent with how sequestration is reported in both the California and national GHG inventories.

- **Report Changes in Carbon Stock and Sequestration Together with Other Emissions:** Changes in carbon stock and annual sequestration can be reported in the local inventory and included in local totals. As noted above, it is recommended that only man-made changes in stock/ sequestration be included in reporting that combines these emissions in local totals with anthropogenic emissions. This reporting scheme may be most useful in assessing the consequences of land use change and management patterns and practices and the benefits of altering those over time.

Urban and Suburban Communities

In urban or suburban communities where the land area is largely built out and truly natural areas that are large in size (10,000 – 100,000 acres per type) are rare, the majority of carbon stock in these communities will be in urban trees. The density, soil carbon content, and growth characteristics of trees of a select species in an urban environment are quite different than in a natural forest of the same species. Thus, tools and methods specific to urban forests (such as the U.S. Forest Service [USFS] Urban Forest Calculator, the I-Tree Tools for Community Forests and others) should be used when assessing an urban or sub-urban area. Urban forest carbon calculators and the Urban Forest Inventories prepared by the USFS are measurement based using selected sampling plots with scaling up to the jurisdictional level. If available, sampling based data should be used when establishing the carbon stock at the beginning of the baseline year and for establishing the typical carbon content and uptake capacity on a per-acre basis for a particular jurisdiction's urban forest.

[8] As part of the natural carbon cycle, carbon is sequestered during vegetative growth periods and then released back to the atmosphere when vegetation dies or decays or due to wildfire. In the end, this natural cycle does not result in a net long-term change in atmospheric carbon dioxide levels.

Rural Communities

In rural agricultural areas, the majority of the carbon stock will be associated with crops and agricultural soils. In rural natural areas, the majority of the carbon stock will be associated with the biomass of the predominant natural vegetation such as forests, shrub-lands, grasslands, or wetlands. Locally representative sample-based data sets with carbon content in natural and agricultural soils and vegetation would provide the most accurate assessment of local carbon stock. However, such data are rarely available unless a local community has made a specific effort to gather such data. As discussed in the AEP Community Inventory White Paper, default carbon stock and sequestration values for a variety of forest and other land cover types are available from the EPA, the CEC, the USFS, the Natural Resource Conservation Service (NRCS), and other sources. If local land cover data are not available, there are also sources of spatial land cover data available from the California Department of Conservation (CDOC), the U.S. Department of Agriculture (USDA), and others. In addition, there may be non-governmental and university research data sets that may be useful in estimating local carbon stocks and sequestration and land cover acreage.

LIfecycle Analysis

Introduction

The Community Protocol encourages but does not require analysis of lifecycle emissions. Lifecycle emissions, also called consumption-based emissions, are those that encompass a "cradle-to-grave" concept of understanding emissions. That is, a lifecycle-based inventory would include emissions associated with upstream aspects of goods and services consumed within the community. To some extent, upstream emissions are included in indirect emissions calculations because the emissions generated may not have been emitted within the boundary of the community. This is common, for example, when a community is estimating their emissions from electricity consumption. The Community Protocol acknowledges that lifecycle analysis is a relatively immature methodology at the community level, including unresolved issues of the boundary and how to handle double-counting.

The Pros and Cons of Conducting a Lifecycle Analysis

For CEQA reporting purposes, lifecycle analysis is not currently required. In fact, the data collection and analysis process are likely to be very labor-intensive and because there is not a general framework for calculating lifecycle emissions, one jurisdiction's emissions may not be comparable to another. In addition, providing lifecycle analysis of emissions can blur the boundaries of the community CAP from a CEQA perspective. CEQA requires lead agencies to review potential actions and determine if they are a "Project" under CEQA. That determination is normally made based upon whether or not the action taken by the agency is a "Discretionary Action." CAPs are considered a "Discretionary Action" under CEQA, and therefore, a "Project" under CEQA. Analyzing potential environmental impacts under CEQA requires clear "Project" boundaries.

However, for a community to truly understand the full ramifications of its choices on global GHG emissions, a jurisdiction would want to evaluate the total emissions generated by the goods and services consumed in the community, allowing policies and actions identify all sources of emissions and identify holistic reduction strategies. A jurisdiction may consume large quantities of energy-intensive goods, but if those goods are not manufactured in the jurisdiction, the community is not properly accounting for their contribution to global GHG emissions. If one presumes that production GHG emissions are similar between local and far away manufacture, locally-produced goods will result in fewer total GHG emissions because of lower transportation emissions. Caution should be exercised in presuming that local production is always more GHG efficient than production in other locations. Production emissions can be a dominant portion of life-cycle emissions and thus differences in production methods and inputs can have more influence on total emissions than differences in transportation emissions. Conducting a lifecycle analysis can help reveal the relative GHG intensity of local farms or other goods production vs. distant farms and manufacture. Where local production is more GHG efficient than distant production and a community moves toward local production and consumption, a traditional emissions inventory may penalize the community over the long term if the community moves from consumers to producers and consumers. Finally, a lifecycle analysis of emissions may prevent a community from demonstrating emissions reductions simply by moving energy-intensive practices outside of their boundary (known as "leakage").

If a local government in California chooses to include life-cycle emissions within the community inventories of the CAP, clear distinction should be made between the emission sources under the jurisdictional control of the CEQA Lead Agency and those emissions associated with life-

cycle of products outside of their control. One suggestion is to segregate life cycle emissions from the rest of the inventory to clearly differentiate emission sources within jurisdictional control and the CEQA "Project" boundaries, and those sources of emissions outside of the boundaries.

Ultimately, it will be up to the local jurisdiction to weigh the value of developing a comprehensive emissions inventory with the added time and analysis required. As communities move toward lifecycle analysis, it may be useful for jurisdictions to begin to assess lifecycle emissions as feasible.

Methodology and Reporting of Lifecycle Analysis

The Community Protocol provides a good summary of the current methodologies available to communities, as well as tools that allow simple lifecycle analysis to be calculated with few inputs. As with any emissions reported by a community, divulging the methodology used and all assumptions contained in the analysis will be critical to ensuring a transparent and replicable inventory. Currently, the Community Protocol does not require a scopes-based reporting framework, in which emissions are classified by Scope 1, 2, or 3 (see the LGOP for a full Scope Reporting Framework description); however, when conducting a lifecycle analysis, the scopes framework may be an appropriate accounting methodology so that double-counted emissions are easier to detect. In addition, this would allow the traditional emissions inventory to be pulled out and compared to other jurisdictions. Finally, the separation of emissions would allow a jurisdiction to set emissions reduction targets aligned with the state based on the traditional methodology. This may be beneficial to the jurisdiction seeking to use their analysis in a GHG reduction plan under CEQA for tiering purposes. Using an inventory based on lifecycle analysis will likely result in a much higher emissions inventory with less ability to affect those additional emissions. Therefore, demonstrating consistency with state-level emissions goals would most likely be much more difficult under a lifecycle analysis inventory.

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