Comparison of Greenhouse Gas Efficiency Metrics for Projects, Specific Plans, General Plans, and Climate Action Plans

Extended Abstract # 15

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INTRODUCTION

Based on the threats posed by climate change to the economy, public health, and natural resources, various governments have developed legislation and regulations to reduce greenhouse gas (GHG) emissions. For example, the State of California enacted The Global Warming Solutions Act of 2006 (AB 32), which establishes GHG reporting, regulations, and market mechanisms to achieve 1990 statewide emissions levels by 2020. Local governments are in need of guidance to determine whether their projects and plans are consistent with statewide reduction targets. In California, an important framework for assessing GHG emissions from projects and plans is the California Environmental Quality Act (CEQA). Modeled after the National Environmental Policy Act (NEPA), CEQA requires public agencies to analyze the environmental impacts of proposed projects. Recent amendments to the CEQA Guidelines include addressing GHG emissions, consistent with the Legislature's directive in Public Resources Code, Section 21083.05 (SB 97 [Chapter 185, Statutes 2007]).[1] CEQA lead agencies use thresholds of significance to differentiate between significant and less-than-significant impacts. However, neither the CEQA statutes nor guidelines provide specific advice that would allow local governments to easily determine whether or not individual projects and plans would contribute cumulatively considerable quantities of GHG emissions that could adversely impact the environment.[2] Some local governments and air districts in California are developing more definitive significance threshold guidance. One approach for determination of significance involves calculation of a GHG efficiency metric, the process of which is described in this paper, along with the proper application of the approach, and a survey of plan- and project-level GHG efficiency metrics.

METHODS

Quantified performance standards can help agencies determine whether projects and plans have contributed their "fair share" toward emissions reductions. The GHG efficiency metric allows agencies to compare projects of different types, locations, and sizes, and assess whether a project would accommodate population and/or employment growth in a way that supports or impedes overall emission reduction goals.

To develop an efficiency metric, annual "operational" GHG emissions at the time of project or plan build out need to be consistently and accurately estimated. Inventories, based on accepted protocols and professional judgment, are used to calculate baseline and forecasted GHG emissions for the following categories: transportation, energy (electricity and natural gas use), water and wastewater, and solid waste. Forecasting includes estimating emissions growth using sector-specific, land use plan-based, or population-based growth rates, as well as regulatory reductions (i.e., Pavley, Low Carbon Fuel Standard, Renewable Portfolio Standard) and local or project-specific mitigation (i.e., renewable energy, building efficiency, and water, waste, and vehicle miles traveled [VMT] reduction measures).The GHG efficiency metric is calculated by the following formula:

$GHG\ EM_x = GHG_x/SP_x$

Where:

$GHG\ EM_x$ = the GHG efficiency metric in year x, in MT CO_2e/SP/year;

GHG_x = operational GHG emissions in year x, in MT CO_2e/year; and

SP_x = service population (residents + employees) in year “x” (typically buildout).

VMT is a particularly important parameter in California, since on-road mobile sources account for a large proportion of GHG emissions. One-third of the California statewide GHG emissions inventory is attributable to on-road mobile sources and this value can approach 70% within community-level GHG inventories.[3] When developing trip and VMT estimates for plans, an origin-destination method should be used, in which all internal trips are counted (I-I), half of internal-external (I-X) and external-internal (X-I) trips are counted, and trips that begin and end outside the project area or jurisdiction (X-X) are not counted. For single land use projects, all trips originating within the regional transportation network are included.

Other emissions sources should be estimated using appropriate methods, including emissions associated combustion of natural gas and landscaping fuels, off-site water and wastewater related emissions, solid waste emissions from disposal and decomposition of waste, and indirect emissions from electricity generation at utility providers. There are many tools and models available for estimating construction and operational GHG emissions, and appropriate local assumptions should always be used for baseline and forecasted estimates, where data are available.

Nonresidential projects would use the level of employment at buildout for the SP estimate, while housing projects would use residential population only. Mixed-use projects can use population plus employment. Once GHG efficiency metric is calculated, it may be compared to a GHG efficiency standard to determine whether additional GHG reduction measures are needed.

RESULTS AND DISCUSSION

For land development projects, the use of an efficiency metric correlates with the activities that are accommodated by development: population growth and employment opportunities.

Agencies may wish to focus on "net emissions," considering both on-site and off-site emissions reductions. If offset or credit programs are used, it is important to ensure consistency between the metrics used in the offset or credit program and the efficiency metric.

This approach allows for consideration of the GHG reducing features of a project or plan, including location, design, density, mix of uses, surrounding land use context, and other elements, as well as modifications made to mitigate the project's operational emissions, as well as any credits or offsets taken. Proper application of the GHG efficiency metric would allow comparison of projects and plans to one another or to a performance standard, and would not create any undue "reward" for mixed-use projects since the GHG emissions for both the residential and non-residential components of mixed-use projects are included in the GHG emissions estimate, in balance with the inclusion of both population and employment SP estimate.

Local governments will play a role in achieving statewide GHG emission reduction goals by managing land uses and transportation planning (e.g. VMT and energy use reduction), providing public education and incentives (e.g., energy and water conservation), providing more GHG-efficient community services (e.g., recycling, waste management, and wastewater treatment), and implementing other GHG reduction strategies (e.g. urban forestry). Methods and tools for assessing GHG emissions and recommending reduction strategies are more useful to local governments if they: 1) are current with a constantly evolving regulatory environment; 2) address key emissions sources or sectors (i.e. transportation, energy, water, and waste, in that order); 3) allow comparison of different project types and sizes; and 4) address aspects of a project or plan over which the subject agency has some control.

A typical approach for calculating a GHG efficiency performance standard is to utilize the California Air Resources Board's (ARB's) land-use-related GHG emissions estimates for the year 1990 divided by the forecasted service population of California in 2020. Depending on the level of refinement in isolating land-use-related emissions and future population and employment, the GHG efficiency standard falls somewhere between 4.3 and 4.6 MT CO_2e/SP/year, consistent with AB 32 requirements.[4] Similar methods can be used to calculate efficiency metrics and performance standards outside California.

To support this paper, numerous environmental documents for projects and plans with GHG emissions estimates and numerous GHG emissions inventories for cities and counties were surveyed. Agency staff involved in similar efforts were also contacted, and various GHG performance standards were examined. Examples of GHG efficiency metrics are presented in Table 1. A range of GHG efficiencies exist for different types of projects and plans; however, variability in VMT estimates also exists. For certain projects, VMT was estimated using trip generation rates multiplied by area-wide or regional average trip length, and mode splits may not have been accurately characterized.

Table 1. Examples of GHG Efficiency Metrics for Projects and Plans

GHG Efficiency Metric (MT	**Type**	**Size**

CO_2e/SP/year)		
2.77	Redevelopment-focused, downtown Specific Plan	50 single-family units, 800 multi-family units, 300,000 square feet of commercial, and 90,000 square feet of office uses
3.5	Infill-oriented General Plan	3,500 dwelling units and 3 million square feet of mixed non-residential development
4.6	Transit-oriented, mixed-use Specific Plan with both greenfield and redevelopment elements	6,800 dwelling units, 50 acres of commercial development, 300 acres of light industrial development, parks, a school, and other complementary uses
7.1	Suburban greenfield Specific Plan with some mixed commercial/ retail use	4,700 dwelling units, 60 acres of commercial and office development, and a range of other uses
7.8	Large, greenfield, primarily suburban Specific Plan with some mixed commercial/retail use	Approximately 10,210 dwelling units, 60 acres of mixed use, 363 acres of commercial, 80 acres of industrial/office park, and a range of other land uses
13.4	"Business as usual" GHG efficiency for a southern California city (from Climate Action Plan analysis)	2020 GHG and service population projections based on general plan forecasts

Issues and Challenges

As noted previously, VMT estimates are critical for accurate GHG estimates. As more sophisticated travel demand models are used, the accuracy of emissions estimates will improve.

Another issue related to the GHG efficiency approach relates to future statewide population and employment estimates. Updates to these estimates would require an update to the GHG efficiency standard.

The use of post-2020 efficiency metrics poses a further challenge for projects and plans that have post-2020 build out or operational dates. The 2020 timeframe is important because it is tied to California's AB 32 goal (reduction of GHG emissions to 1990 levels by the year 2020). Executive Order S-3-05 establishes a more aggressive emissions reduction goal for 2050 (an 80% reduction in emissions below 1990 levels). Post-2020 GHG efficiency standards could be derived by interpolating between 2020 and 2050 targets for the year of interest. However, GHG efficiency standards beyond 2020 may be speculative due to uncertainties in GHG emissions projections, technological advances, and the effects of future statewide reductions.

SUMMARY

Standardized approaches to the calculation of GHG efficiency metrics (especially with respect to VMT and SP estimates) will enable more consistent comparisons of GHG efficiency across projects and plans of different types and sizes. The GHG efficiency approach is also applicable to the setting of CEQA significance thresholds and consistency of projects and plans with statewide GHG reduction targets.

Efficiency metrics are not appropriate for every situation, but there are certain circumstances that make them the best option for projects or jurisdictions. Continued work in this area will assist local governments in developing methods and tools to reduce GHG emissions associated with projects and plans within their purview for compliance with AB 32 and CEQA.

REFERENCES

1. California Code of Regulations CEQA Guidelines; Title 14, Sections 15000-15387.
2. Crockett, Alexander G. *Addressing the Significance of Greenhouse Gas Emissions under CEQA: California's Search for Regulatory Certainty in an Uncertain World*; Golden Gate University Environmental Law Journal; 2010; Volume 4, Issue 2: Pacific Region Edition; Article 3.
3. California Air Resources Board (ARB). California Greenhouse Gas Inventory for 2000-2008— by Category as Defined in the Scoping Plan. Available: < http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_00-08_2010-05-12.pdf>.
4. The Bay Area Air Quality Management District published a GHG efficiency threshold. See: BAAQMD. Environmental Quality Act Air Quality Guidelines. Available: <http://www.baaqmd.gov/Divisions/Planning-and-Research/CEQA-GUIDELINES.aspx>. Additional research has allowed more refined analysis. When emissions associated with industrial processing, mining, logging, agriculture, and other non land use related emissions are removed, the 1990 statewide inventory is approximately 264.1 MMT CO_2e or 4.3 to 4.4 MT CO_2e emissions per service population.