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Greenhouse Gas Mitigation Planning: A Guide for Small Municipal Utilities

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Problem Statement and Project Goals

California's electric power generators are increasingly aware of the problem of climate change and the necessity of mitigating greenhouse gas (GHG) emissions. Utilities anticipate a carbon-constrained future and want to prepare for this operational constraint by acting in an environmentally responsible, economically feasible and politically strategic manner through mitigating their GHG emissions. Information on the steps involved in, and the resources available for, GHG mitigation options have yet to be synthesized into a format that will help utilities to make informed choices.

To address this need, we have developed this GHG mitigation planning guide (Guide) for a sub-sector of California's power generators: small municipal utilities. The Guide helps small municipal utilities navigate the decision-making process involved in selecting economically and environmentally beneficial mitigation options. Burbank Water and Power (BWP) in Los Angeles County, California serves as a case study to illustrate the decision points necessary for forming a GHG mitigation plan. The specific objectives of the Guide are to:

- Inform utilities about the biophysical aspects of climate change, GHG policy, and their roles in contributing to, and addressing, climate change
- Provide a format for evaluating GHG mitigation options based on key environmental, economic and other criteria
- Describe the menu of available GHG mitigation options and implementation measures
- Describe the steps that a utility must conduct to develop its mitigation plan and demonstrate this planning process using BWP as a case study
- Provide a list of key resources for information and for implementing GHG mitigation options

Background

Burbank Water and Power (BWP)

As of 2004, BWP supplied 1,800 million kWh of electricity annually to >50,000 customers. Ten percent of this electricity is generated on-site via natural gas and hydroelectric production, resulting in direct annual GHG emissions of ~25,085 metric tons of carbon equivalent (MTCE). BWP's annual indirect emissions (137,640 MTCE) are higher due to purchases of ~70% of supplied power from fossil fuel-based off-site generation projects. Remaining off-site generation (20% of total supply) is from hydroelectric, nuclear and renewable production. BWP expects power demand to grow by 2.5-5%/yr. Concurrent increases in GHG emissions are likely.

Figure 1. Burbank Water and Power facilities

GHGs in the Atmosphere and Climate Change Effects

The greenhouse effect is a natural process that heats the Earth's surface and atmosphere. An enhanced greenhouse effect – global warming – is caused by anthropogenically-produced GHGs (e.g. CO_2 from fossil fuel combustion) above natural concentrations of GHG. According to the Intergovernmental Panel on Climate Change, our present rates of GHG emissions will result in an *average* global temperature increase of 6°C by 2100.[1] Already, warming in Arctic regions is melting glaciers, reducing summer sea-ice cover and leading to sea level rise.[2] Regional climate modeling of impacts to California suggests that, among other effects, snow pack in the Sierra Nevada will decline by 30-70% and areas such as Los Angeles can expect more summer heat waves and extreme heat events.[3]

GHG Emissions and California's Utilities

Annual net GHG emissions for California in 1999 were 108.6 million MTCE and are expected to increase by ~14% by 2010. Unlike other states, the electricity sector contributes a relatively small portion (16%) of emissions.[4] This is partly caused by California's high transportation emissions, but it is also due to (1) utilities' relatively low GHG emissions from on-site generation; (2) their proactive efforts to reduce emissions voluntarily; and (3) because emissions from imported power are *not counted* in the state's estimates. Out-of-state, coal-fired power plants supply >20% of electricity. As a result, utilities are still responsible for significant emissions, and efforts to further mitigate emissions will require a creative mix of approaches.

Climate Change Policy

At the international level, the Kyoto Protocol agreement mandates mitigation of climate change. The U.S. has not ratified this treaty and GHG emissions are not federally regulated. However, proposed legislation at the state level is creating the impetus to mitigate. Examples include GHG emission cap-and-trade programs (NY); GHG mobile emission standards for vehicles (CA); CO_2 emission standards and offset measures for new power plants (OR and WA). California's energy policy could also motivate municipal utilities to reduce GHG emissions if they become subject to its Renewable Portfolio Standards.

The Mitigation Options

Utilities face a wide variety of mitigation options. Figures 2-4 depict the types of mitigation that are described and evaluated in the Guide.

Figure 2. Reduction of GHG emissions

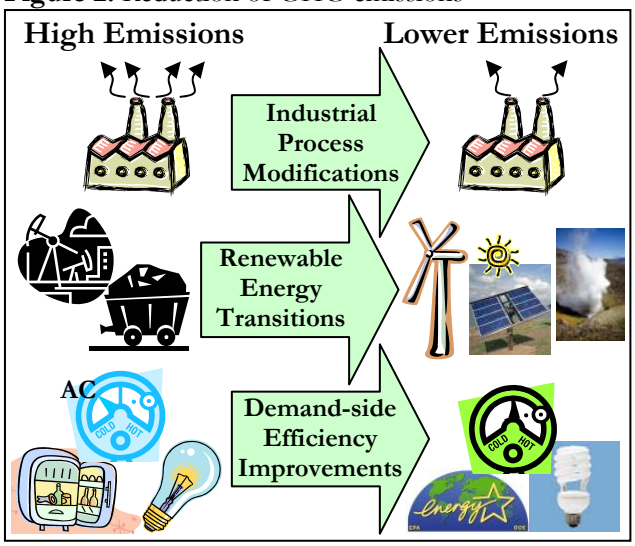


Figure 3. Capture and use of GHGs

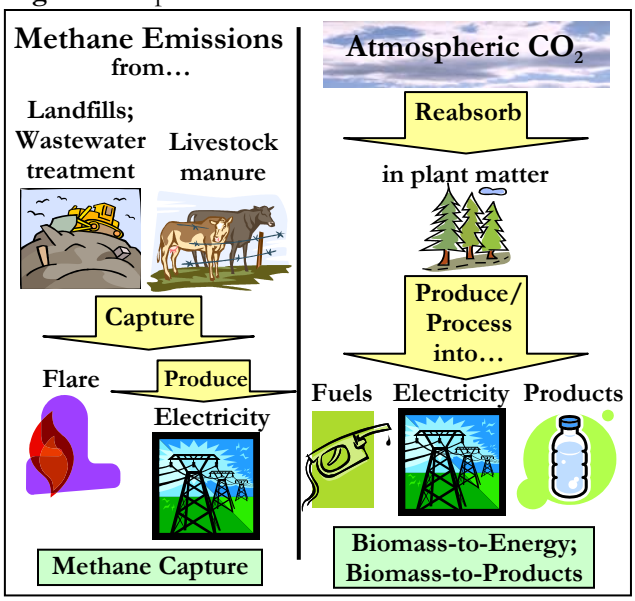
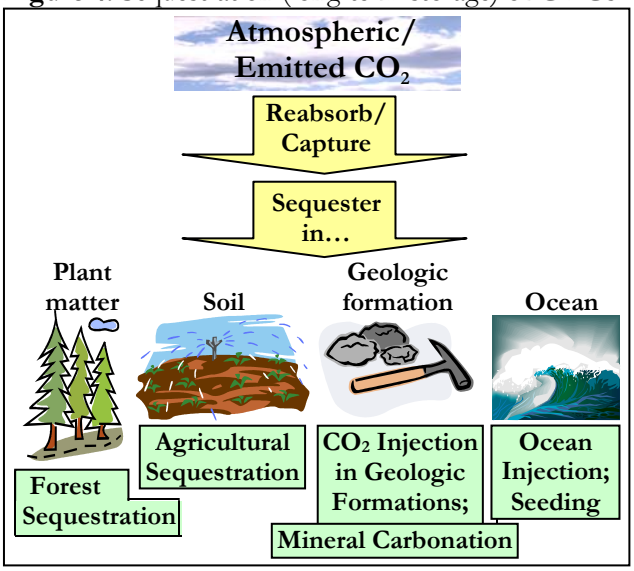


Figure 4. Sequestration (long-term storage) of GHGs



The Mitigation Planning Process

The Guide presents a process for GHG mitigation planning for the target audience of small municipal utilities. The six planning steps follow the order and progression of the material presented in the Guide. Steps 1-4 are straightforward for a utility to perform on their own. For the remaining planning steps and subsequent implementation, utilities will benefit from outside expertise. Specialized consultants can help gather preliminary data (including cost estimates) for mitigation options to ensure that utilities are well-informed and can effectively evaluate and select the best strategy for mitigating GHGs (Step 6).

The Mitigation Planning Process

Step 1: Establish the organization's desire to, and motivations for, mitigating GHGs

Step 2: Create an inventory of the organization's baseline GHG emissions

Step 3: Set the organization's goals (target amounts) for GHG mitigation

Step 4: Identify relationships with other utilities and businesses for collaborative activities

Step 5: Delineate and categorize a list of GHG mitigation alternatives

Step 6: Evaluate the mitigation alternatives and select one or a set alternatives

Step 1: *Establish the organization's desire and motivation(s) for mitigating GHGs*

A clear understanding of motivations facilitates setting goals, thinking of project ideas, and evaluating mitigation alternatives. Managers and environmental staff will find it helpful to become knowledgeable about:

- GHG emissions and the climate change problem
- Roles of utilities in causing/addressing problem
- Other utilities' mitigation activities
- Regulations and policy

This information (provided in the Guide) assists in pinpointing the organization's specific motivations.

Step 2: *Create an inventory of the organization's baseline GHG emissions*

The emissions baseline is essential information for the remaining planning steps. The Guide provides information about protocols for calculating GHG emissions inventories. Key suggestions are:

- Use a stringent enough protocol to satisfy future regulations (e.g. from the California Climate Action Registry or GHG Protocol Initiative)
- If the inventory is time-consuming, make a rough emissions estimate to facilitate next planning steps

Step 3: *Set the organization's goals for GHG mitigation*

Certain considerations are helpful in deciding upon a mitigation goal:

- GHG targets set under existing climate change policies and programs
- Targets set by other organizations
- The utility's motivation for mitigating GHGs
- Information from the inventory process (Step 2)

Utilities have a great deal of freedom in setting their targets, so the Guide recommends selecting a goal that has significance for the utility and its stakeholders.

Step 4: *Identify relationships with other utilities and businesses for collaborative activities*

Opportunities to collaborate on mitigation projects increase the options available to a small municipal utility. Projects that are too large for independent, direct implementation potentially become feasible with multiple investors. If collaborations are identified, the utility should coordinate with these other organizations early in the planning process.

Step 5: *Delineate and categorize a list of GHG mitigation alternatives*

To discover better-performing options, a utility should develop a comprehensive list of alternatives. To do this, we recommend a (series of) structured brainstorming session(s) involving managers who are broadly familiar with the organization's facilities and operations, and a consultant that specializes in GHG mitigation for the business community. Participants need to know the basics of climate change, greenhouse gas mitigation options, potential roles for utilities in solving the problem and climate change policy setting. They also need to clearly understand the utility's motivation(s) for mitigating. Information sources for idea generation that should be compiled and reviewed prior to creating the list of alternatives include:

- The utility's major direct and indirect emissions (Taken from the inventory process in Step 2)
- Existing energy conservation/efficiency programs that have the potential for expansion
- California's Renewable Portfolio Standards
- Information about major GHG sources
- Examples of mitigation activities by other organizations with similar profiles

In the process of generating mitigation alternatives, the utility should prioritize idea-generation by: first, considering options within the organization to reduce direct emissions; next, examining the potential for reducing the organization's indirect emissions sources; and finally, considering options that are more removed from the organization. (This prioritization process is elaborated in the Guide.) The focus should be on high-performing mitigation approaches (e.g. efficiency improvements). This does not mean that other, potentially riskier options should not be included in

the list, but it helps utilities avoid overlooking any high-performing possibilities. Utilities should also:

- Consider only options that meet the preliminary screening criteria described in the Guide
- Understand how each alternative abates GHGs and categorize it by mitigation type (Figures. 2-4)
- Describe how alternatives would be implemented (e.g. independent project, collaborative project, investment opportunity, or credit purchase).

Step 6: *Evaluate the mitigation alternatives and select one, or a set of, alternatives*

In comparing mitigation alternatives, costs will most likely be the primary decision criteria for utilities. However, characteristics of GHG emissions and the climate change problem require incorporation of four key attributes for environmentally successful projects (Figure 5). Inclusion of these attributes also helps to ensure future regulatory acceptance.

Figure 5. Key attributes of a mitigation alternative

The mitigation alternative…

Has additionality
It would *not* have been done in the absence of the utility's action, and it results in a *surplus* of reductions of atmospheric GHGs beyond what would have occurred in absence of the action.

Can be quantified, monitored & verified (QMV)
QMV methods exist for this type of mitigation for empirically determining the amount of GHG abatement accurately, robustly & cost-effectively.

Maximizes permanence
It reduces or avoids emissions; or, for sequestration alternatives, the degree to which mitigation permanently removes atmospheric GHGs is maximized.

Minimizes leakage
The alternative does not lead to GHG emissions outside of the project.

The Guide provides more attributes to be considered: amount of GHGs mitigated, timing of the mitigation, ancillary effects, likely regulatory acceptance issues, leveraging existing business relationships, stakeholder preferences, and public perception issues. Utilities will need to decide how important these latter attributes are and weight them accordingly.

The evaluation process involves making estimates of:

- Costs (e.g. project design, capital equip., QMV)
- Project baseline emissions, leakage, permanence
- Project amount, and timing of mitigation

Utilities are urged to use a matrix format (described in the Guide) to organize information and rank alternatives. They should choose the alternatives that meet mitigation targets and perform best.

Recommendations for BWP

As fully as possible, the Guide takes the reader through the mitigation planning process for BWP.

Example Planning Process for BWP

Step 1: Potential motivations:
- Continue to be an environmental leader/innovator
- Prepare for future carbon constraints on business
- Generate revenues and reducing costs.

Step 2: Emissions estimate: 162,731 MTCE/yr (BWP is in the process of creating an emissions inventory with the CA Climate Action Registry)

Step 3: Suggested minimum target is 7% reduction from 1990 emissions (Kyoto Protocol) as an environmentally and socially meaningful target.

Step 4: Existing relationships for collaborations:
- Southern CA Power Producers Authority (SCPPA)
- L.A. Dept. of Water & Power (LADWP)
- Intermountain Power Project (IPP)

Step 5: Potential alternatives:
- Switch from less efficient steam boilers to meet peak demand, to BWP's new, efficient gas turbines
- Collaborate with IPP to upgrade its boilers for integrated gasification combined cycle technology
- Invest in methane capture at a CA dairy farm
- Collaborate with SCPPA on a wind power project
- Collaborate with IPP, SCPPA, or other group for geologic sequestration of IPP's emissions
- Purchase credits from Chicago Climate Exchange to offset indirect emissions from power purchases

Acknowledgements

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[1] Intergovernmental Panel on Climate (2001). *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the IPCC.* NY, NY: Cambridge University Press.
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[3] Hayhoe, K, et al. (2004). Emissions pathways, climate change, and impacts on California. *PNAS.* 101(34)12422-12427.
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