

California's Water-Energy-Climate Nexus



Energy and Greenhouse Gas Emissions Embedded in Water

October 15, 2013

a joint project of:



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About Us

The Climate Registry

The Climate Registry (TCR) is a nonprofit collaboration between North American states, provinces, territories and Native Sovereign Nations. TCR empowers governments and businesses across the globe to operate more efficiently, sustainably and competitively by helping them measure and manage their carbon emissions consistently and with integrity.

TCR's General Reporting Protocol (GRP) is the gold standard for corporate GHG accounting in North America. TCR has also developed sector-specific reporting requirements for local government operations, the electric power sector, as well as for oil and gas exploration and production. Currently, almost 350 organizations across North America use TCR's GRP to calculate their GHG emissions, including 173 California-based organizations.

Water Energy Innovations

Water Energy Innovations (WEI) was established in 2012 to advance knowledge and understanding of the water-energy nexus. Through a diverse portfolio of activities, the firm is developing and implementing cross-cutting policies, programs, practices and tools to help realize the substantial resource, economic and environmental benefits that lie at the intersection of water, energy and the environment.

Achieving meaningful and enduring change requires proactively engaging the participation of all of the key stakeholders that have a significant role in implementation. To this end, WEI is working with policymakers, regulators, water and wastewater agencies, energy utilities, industry associations, research organizations, non governmental organizations, and a wide variety of other market participants to develop and promulgate a new body of leading best practices for comprehensive, integrated planning and management of water and energy.

Acknowledgements

This white paper is one of a series being written to facilitate the on-going dialogue among water and wastewater agencies, energy utilities, policymakers, regulators, customers, constituents, and other stakeholders as to the types of actions that can be taken to help achieve the state's aggressive resource efficiency, economic and environmental goals. Some of these actions are achievable now, under existing policies, rules and regulations; others will require policy changes, new technologies and new business models. Much of it will require funding.

Authors Laurie Park and Peggy Kellen thank the individuals and organizations that generously donated time and expertise to help the authors identify and remedy factual errors and/or inconsistencies, as well as to highlight areas in which additional information would help facilitate understanding of the concepts being presented. Conducting technical review does not constitute endorsement of the paper's findings and recommendations – those remain solely those of the authors.

Special thanks to our friends and colleagues who generously contributed time to conduct technical review within their respective areas of knowledge and experience.

- Ray Benett, Irvine Ranch Water District
- Martha Davis, Inland Empire Utilities Agency
- David Cohen and Jamie Ferro, The Energy Coalition
- Max Gomberg, State Water Resources Control Board
- David Jacot, Los Angeles Department of Water and Power
- Mark Martinez, Southern California Edison
- Cordel Stillman, Sonoma County Water Agency
- Dr. Cynthia Truelove, Visiting Scholar, Stanford Woods Institute for the Environment
- Ed Osann, Natural Resources Defense Council

Their support and keen insights enabled this paper to be written.

Foreword

Nearly twenty percent of California's electricity and more than thirty percent of non-power plant natural gas is used for water-related purposes: for collection, production, transport, treatment and delivery of water to end users; during the consumption and use of water; and for collection, treatment, and disposal or reuse of wastewater. Water is also critical to energy development: cooling, drilling, pump storage, hydropower, and bioenergy.

It is not a surprise that California's water sector uses substantial quantities of energy. Historically, Californians have routinely transported millions of gallons of water throughout the state, over hundreds of miles and thousands of feet of elevation, from point of origin to point of use. We have always known that our water systems use a lot of energy, but it was only after the Energy Commission quantified the magnitude of the energy intensity of the state's water supplies that we began to focus in earnest on a need to change our approach to management and use of water.

Metrics are important. Benchmarks help us to understand where we are, where we have been, and what we need to do to get to where we want to go. The ability to comprehensively assess the relationships among water, energy and greenhouse gas emissions will lead to more efficient investments, more effective programs, and more resilient markets.

Frances Spivy-Weber
Vice-Chair, State Water Resources Control Board
and Co-Chair, Water-Energy Team of the
Governor's Climate Action Team

Table of Contents

	<u>Page</u>
Executive Summary	1
I Introduction	3
II A Water-Energy-GHG Accounting and Reporting Program	9
III Policy Tools and Incentives	17
References	24

Executive Summary

In 2005, the California Energy Commission estimated that 19 percent of the state's electric requirements and 32 percent of non-power plant natural gas consumption are related in some way to water.

In 2010, studies conducted on behalf of the California Public Utilities Commission (CPUC) found that water and wastewater operations alone account for nearly eight percent of California's electricity requirements, a 60 percent increase over the Energy Commission's initial estimate.

The CPUC studies did not evaluate water-related energy use by water customers, so we cannot yet determine whether the 19 percent and 32 percent estimates for electricity and natural gas consumption should be adjusted. Nevertheless, there is considerable evidence that water-related energy consumption is substantial and deserves policy-level attention.

Understanding California's water-energy relationships – where, why, and how much energy is being used – helps to identify high potential strategies and actions that can be taken now to substantially reduce water-related energy consumption. That is particularly important today, as California faces not only water infrastructure challenges in the north, but electric resource constraints in the south due to the recent retirement of the San Onofre Nuclear Generating Station (SONGS) and anticipated retirements of old power plants.

The state's future is guided by a broad set of specific metrics that include benchmarks, targets, or aspirational goals. It is critical to track progress and gauge success moving forward.

*California @ 50 Million: California's Climate Future, The Governor's Environmental Goals and Policy Report, September 2013
Discussion Draft*

Hundreds of millions of dollars are invested every year by California's water and wastewater agencies in system repairs, replacements and improvements. Like all public utilities, there is never enough to do all the things that are needed. Of necessity, water sector investments must be prioritized. Identifying and quantifying multiple value streams can help to elevate energy opportunities in the water sector's funding queue.

One of California's highest environmental priorities today is the mitigation of climate change through the reduction of greenhouse gas (GHG) emissions. Quantifying and tracking a water agency's GHG emissions footprint aids in evaluating the effectiveness of resource and environmental policies, and the investments made to achieve them. It also enables access to additional sources of technical and funding assistance.

Some state programs already require reporting of energy and GHG emissions impacts from water management decisions. However, a statewide methodology has not yet been adopted. The data, too, are sometimes difficult to obtain – not because they don't exist, but because they are not presently collected and reported at a useful level of detail on a routine basis. Consequently, water-energy-GHG emissions data tend to be collected on an ad hoc basis for special purposes, when needed.

A Central Repository for Consistent and Transparent Reporting

As the state's water-energy and GHG emissions policies and programs mature, it will become increasingly important to collect and compile historical water, energy and GHG emissions data in the forms needed to plan, implement and track projects efficiently. A central repository of energy and GHG emissions footprints could both streamline data collection efforts and enable reports by individual water and wastewater agencies and electricity providers to be quickly compiled to automatically calculate the embedded energy and GHG emissions throughout the state's entire water use cycle. Structured properly, the data could be sorted and compiled easily at multiple levels: agency, regional, statewide, or any other demarcation (county, hydrologic region, energy utility service area, etc.) when needed for a particular purpose.

Regardless of the mechanism used to collect this energy and GHG emissions information, a standardized GHG accounting and reporting protocol for

State Policies and Programs Already Require Reporting of Water-Energy-GHG Impacts

- *State legislation requires that flood investments achieve multiple public benefits, including reducing energy consumption and GHG emissions.*
- *The Legislature directed the Department of Water Resources to include strategies to reduce GHG emissions in the California Water Plan.*
- *Integrated Regional Water Management (IRWM) Planning grants require that applicants address energy and GHG emissions impacts.*
- *The Air Resources Board has integrated reductions of water-related GHG emissions into its climate action plan.*
- *Projects that reduce water-related energy and GHG emissions are eligible for funding from carbon allowance revenues earned through the state's Cap & Trade auction.*
- *The California Environmental Quality Act (CEQA) requires analysis of GHG impacts for water projects with a large energy footprint.*

tracking energy and GHG emissions embedded in the state's water systems and supplies should be used by all state agencies to ensure that consistent criteria are applied when allocating funds to high priority public goals.

As we proceed down this track, market leaders that are already well along a path towards zero net carbon should not be disadvantaged when competing for public funds.

I Introduction

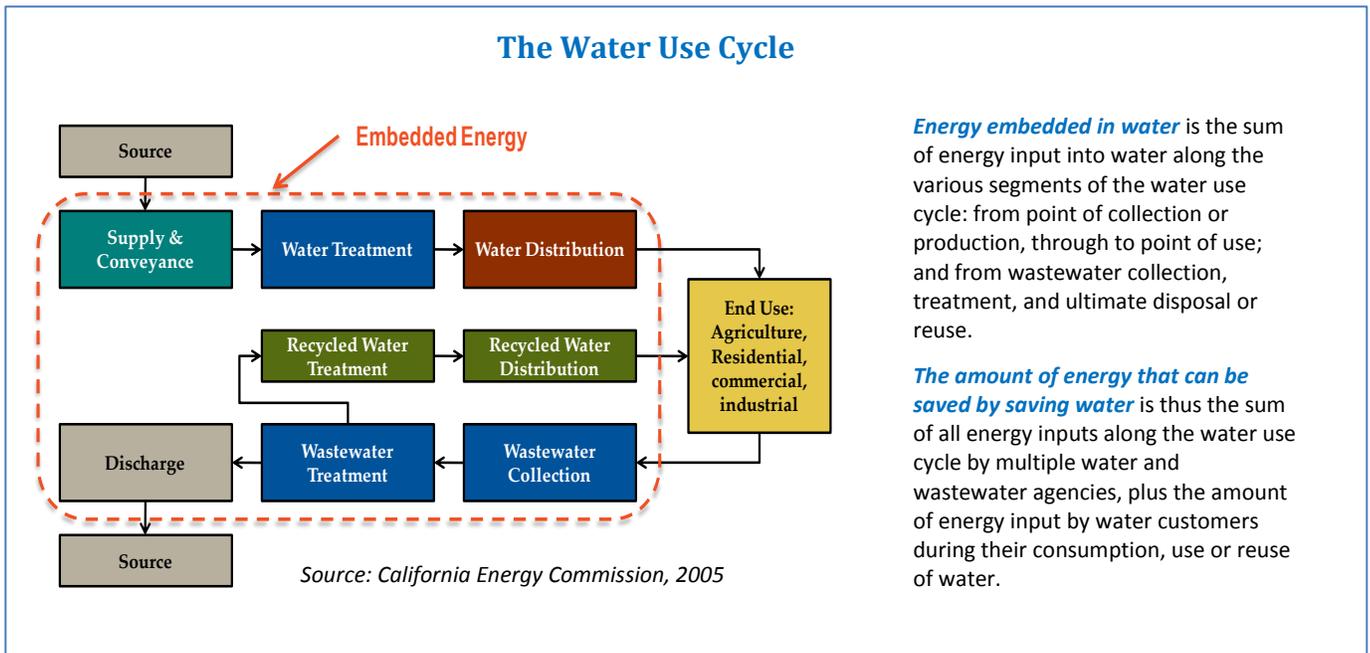
Background

The water use cycle is the aggregation of water management activities from point of collection or production, to point of use, and then to disposal or reuse. The water use cycle has three distinct components:

- **Upstream** of water consumption (the collection, production and transport of water to retail water agencies, and the treatment and distribution to water customers);
- **Use Phase** of water consumption (by end use customers); and
- **Downstream** of water consumption (the collection, treatment, and disposal or reuse of wastewater).

Water and energy decisions within the water use cycle have significant climate impacts. One of these impacts is the release of greenhouse gas (GHG) emissions attributable to the production of energy used during the water use cycle.

Studies conducted by the California Energy Commission, the California Public Utilities Commission (CPUC), and others have shown that some aspects of California’s water systems are very energy intensive. Water resources and operations that rely heavily upon fossil fuels to supply the energy needed are also high in GHG emissions.



Energy embedded in water is the sum of energy input into water along the various segments of the water use cycle: from point of collection or production, through to point of use; and from wastewater collection, treatment, and ultimate disposal or reuse.

The amount of energy that can be saved by saving water is thus the sum of all energy inputs along the water use cycle by multiple water and wastewater agencies, plus the amount of energy input by water customers during their consumption, use or reuse of water.

Some state programs already require or encourage water agencies to consider the energy and GHG emissions impacts of their water management decisions. Some also provide technical and funding assistance to help water agencies develop and implement projects that mitigate these impacts by reducing their use of energy and the GHG emissions related to that energy.

Tracking Energy and GHG Emissions

Energy is input into the water use cycle by multiple parties. This structure can complicate the tracking of energy and GHG emissions impacts in cases where:

- The agency that treats the water to potable standards is not the same agency that initially collected or produced it.
- The water agency that treats the water does not also deliver it to customers.
- After use, wastewater is collected or treated by multiple wastewater agencies. Some wastewater agencies only collect the wastewater and deliver it to a wastewater treatment plant.

To further complicate the comprehensive tracking of energy and GHG emissions inputs, energy is often purchased from multiple providers and some energy is provided by water agencies themselves.

The diagram on the next page illustrates the resources and functions that contribute to the build-up of energy within the water use cycle. The multi-party nature of energy and GHG emissions inputs to water presents challenges to some traditional programs, such as California's regulated energy efficiency programs that have historically targeted actions to reduce energy consumption by individual customers.

California's Regulated Energy Efficiency Programs

The CPUC authorizes regulated energy utilities to provide incentives to customers to help offset the costs of measures and actions that reduce energy consumption.

Historically, CPUC regulated energy programs provided energy efficiency incentives for that portion of energy use that the water agency itself could control. The water use cycle has presented a circumstance in which actions taken by one water agency can reduce energy consumption both upstream and downstream of the agency itself, and also upstream and downstream of the agency's water customers. This has presented the CPUC with a dilemma:

Should the CPUC allow incentives to be paid on the basis of all energy embedded in a unit of water that can be saved, or just on the amount of energy that the water or wastewater agency itself will save?

The ultimate resolution of this question will determine the level of energy efficiency incentives that will be available for water-energy projects; and thereby, the amount of water-related energy consumption that can be cost-effectively reduced by water and wastewater agencies, and their customers.

- In May 2012, the CPUC decided that *energy inputs by all regulated energy IOUs* should be included in the avoided energy cost calculation for energy embedded in water.
- In June 2013, CPUC staff proposed implementing a *societal cost test* that would enable increasing incentives to recognize the value of avoided GHG emissions and related health impacts.

Adopting these elements will require changes to the CPUC's energy efficiency program guidelines and protocols.

The Build-up of Energy in the Water Use Cycle



Calculating the energy embedded in water is not difficult – it is merely the sum of all energy inputs throughout the water use cycle. The CPUC’s challenge is therefore *not how* to calculate energy embedded in water – it is *whether and how* the various energy inputs should be recognized for the sole purpose of CPUC-regulated energy programs. Once the CPUC decides which water-related energy savings should be counted, it will then need to decide whether all avoided GHG emissions should be counted, or only those that are related to the energy savings that will be counted for CPUC-regulatory purposes.

The Water-Energy-GHG Benchmark is Comprehensive

The correct approach to calculating the energy and GHG emissions embedded in water is a comprehensive one: *all* of the energy and GHG emissions inputs throughout the water use cycle should be counted, irrespective of who put the energy into the water, or where. This includes GHG emissions related to energy that may have been input in other hydrologic regions, as well as energy provided by out-of-state generators.

Incorporating the GHG emissions embedded in water adds another important dimension to our understanding of water-energy nexus opportunities. Once the GHG and energy impacts and interdependencies in our water systems are understood, policymakers can determine whether and how to address the impacts to: (1) meet the goals and objectives of public purpose programs, and (2) comply with statutory requirements governing the allocation of public funds.

A comprehensive accounting enables understanding the true energy and GHG emissions impacts of the water use cycle. Calculating all of the energy and GHG emissions does not preclude the CPUC and other state agencies from specifying which energy and GHG emissions will be allowable for purposes of their programs.

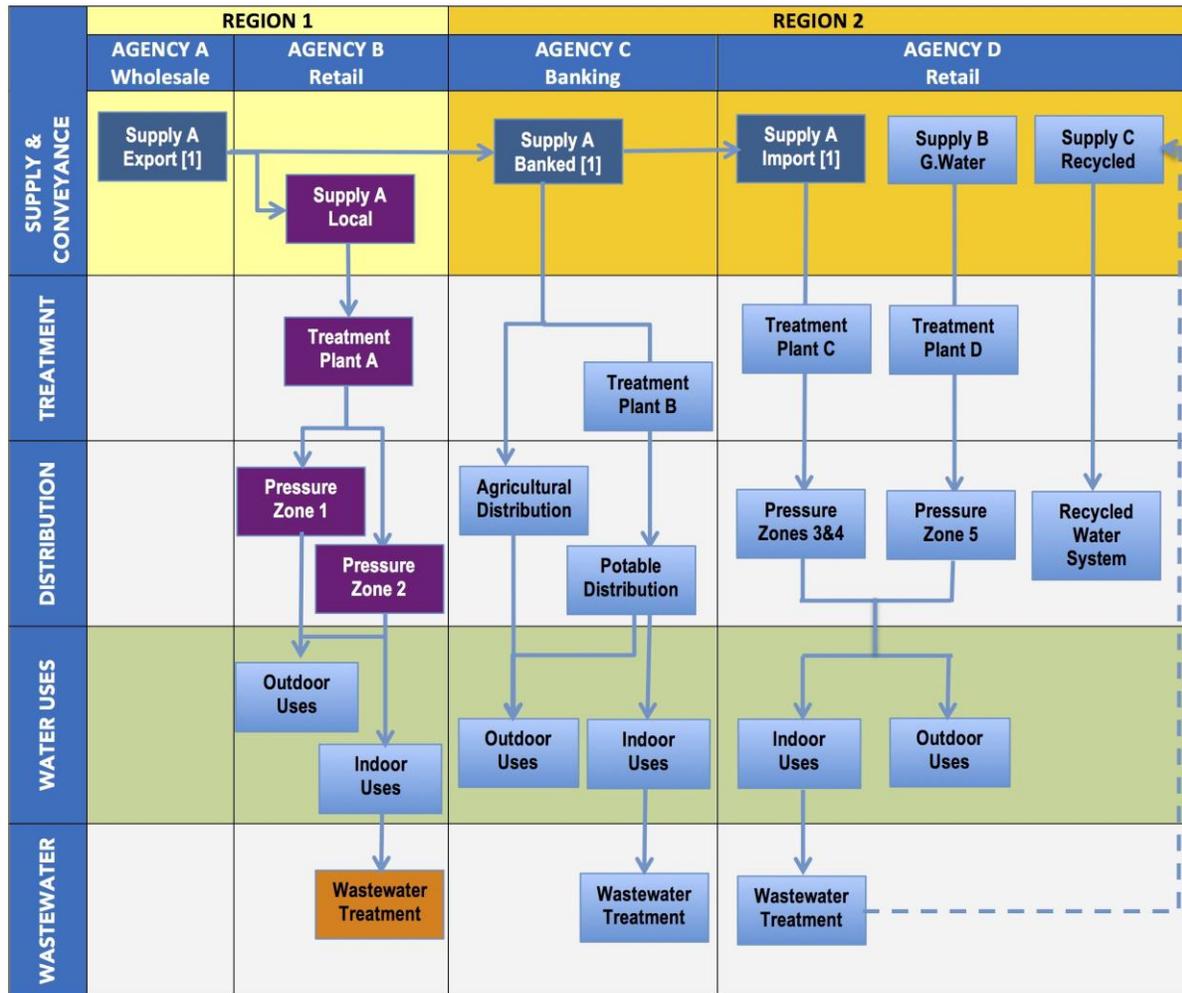
Calculating energy and GHG emissions embedded in water comprehensively enables the work to be done once, and then used by multiple agencies for multiple purposes. A single comprehensive statewide benchmark also enables consistent comparison of the costs and benefits of proposed water-energy-climate nexus projects and programs across multiple state agencies. This is beneficial for assuring prudent investment of public funds.

Applying the Comprehensive Water-Energy-GHG Benchmark

The figure on the following page illustrates how energy and GHG emissions along the various segments of the water use cycle can be aggregated or disaggregated as needed to meet the requirements of various public purpose programs:

- By water resource, water or wastewater system, or function or sub-function for a specific water or wastewater agency, or a group of water or wastewater agencies;
- For a water customer or group of customers;
- For indoor vs. outdoor water savings measures; and
- Within one or more hydrologic, investor-owned energy utility, climate zone, or other type of region.

ILLUSTRATION: Application of a Comprehensive Water-Energy-GHG Benchmark



The above diagram illustrates how a single comprehensive Water-Energy-GHG Benchmark can be applied to different types of public purpose programs and goals.

1. **Reduce the Energy and GHG Intensity of Water Supply Portfolios.** Incentives to reduce the energy and GHG emissions intensity of water supply portfolios can be provided to specific agencies or to entire regions. When determining the level of incentives for regional strategies, the net change in embedded energy and GHG emissions can be computed across multiple agencies' supply portfolios within a region, or across multiple regions. [Note that the embedded energy and GHG emissions accumulate as the water is passed from one entity to another (see Supply A)].
2. **Reduce a Water Agency's Energy and GHG Intensity.** Agency B purchases Supply A within the same hydrologic region, and then treats and distributes that water to its customers via two pressure zones.

All of the energy for potable water treatment and distribution is input by Agency B. Upstream energy is input by Agency A, and downstream energy is input by a wastewater treatment agency.

- Agency B should be able to earn energy efficiency incentives to reduce its own energy use for treatment and distribution.
 - Agency B may also be able to earn incentives to reduce energy inputs by Agency A (for example, if Agency B reduces leaks that enable reducing its purchases of Supply A).
3. **Design Incentives for Water Savings by End Use Customers.** Customers should be able to earn water efficiency incentives that recognize energy savings by all upstream water suppliers, and for energy saved by avoided treatment of wastewater from reduced indoor water consumption. (Outdoor water uses usually do not need treatment – they recharge groundwater or flow to storm drains.)

Benchmarking Tools

Since a statewide methodology has not yet been adopted, benchmarking tools are not available to help water and wastewater agencies accurately and consistently account for the complete climate impacts of their operations, the first step in understanding the energy and climate impacts of current operations and of future plans and projects.



Water pipeline

The few that do track GHG emissions tend to focus on those that occur within their direct scope of operations through energy generation and consumption of electricity and natural gas. Emissions associated with upstream water purchases and downstream processing and treatment are rarely estimated.

Should comprehensive GHG emissions accounting become a common practice, water agencies will require financial incentives to implement energy and GHG emissions reductions, because water sector savings often require substantial investments in reservoirs, pipelines, treatment plants, and sophisticated controls systems.

State support for water agencies through the entire process - from energy and GHG emissions accounting to investment and implementation of energy and GHG emissions reductions - will be necessary to realize the emissions reductions opportunity resulting from the water-energy-climate nexus. Incentives developed today should address all stages of the energy and GHG management cycle.

Leveraging the Water-Energy-Climate Nexus

By tying together water, energy and climate impacts, water and wastewater treatment agencies can consider all financial and environmental costs and make choices that will support future water and energy supplies while helping to achieve individual or statewide climate goals.

In order to enable water agencies in California to accurately and transparently integrate climate change mitigation and adaptation into their operations and long-term plans, it would be beneficial to develop the following resources:

- A Comprehensive Water-Energy-GHG Accounting and Reporting Protocol,
- A Combined Energy and GHG Benchmarking Registry,
- Training resources and support for California water agencies,
- A Voluntary Climate Leadership Recognition Program for the water sector,
- New financial incentives for GHG accounting and climate leadership, and
- Periodic regional and state-level analysis and reports.

II A Water-Energy-GHG Accounting and Reporting Program

Consistent accounting of the GHG emissions associated with the water use cycle will facilitate design of regional and agency-specific policies to reduce water consumption, energy use and GHG emissions. Addressing these issues concurrently as part of the water-energy-climate nexus will help to secure California's long-term water and energy supplies and meet regional climate goals at lower costs.

While some leading California water agencies are already accounting for GHG emissions from parts of the water use cycle, there is no detailed consensus-based guidance on estimating GHG emissions that addresses the unique operations of California water agencies, and no tool that can serve as a user-friendly resource to calculating complete water use cycle embedded energy and GHG emissions.

A New Protocol

A comprehensive GHG accounting and reporting protocol would enable water agencies to track the direct and indirect climate impacts of all of their operations throughout the water use cycle. Such a protocol should act as a collection of international best practice while also taking into account the unique geographic characteristics of California.

In developing a comprehensive protocol, it would be beneficial to convene a consensus-based stakeholder process with the participation of water agencies, wastewater treatment agencies, large water users, regulators, electric and gas utilities, and environmental non-profits.

Irvine Ranch Water District (IRWD) reports its carbon footprint to TCR. As part of that disclosure, IRWD voluntarily includes indirect GHG emissions associated with water imports from the Metropolitan Water District (MWD), and wastewater and biosolids treatment by other wastewater agencies. Including these sources in its GHG emissions inventory allows IRWD to track the impacts of projects, such as developing local supplies in lieu of importing additional water from MWD, and investing in its own biosolids treatment facility in the future.

A comprehensive Water-Energy-GHG Accounting and Reporting Protocol should include:

- A GHG emissions framework that will ensure the comparability of carbon footprints within the water sector,
- GHG accounting methodologies for all sources across the complete water use cycle,
- Metrics relevant to water agencies,
- Resources for high quality data that can be used to quantify emissions,
- Best practices and resources for projecting GHG emissions impacts for different water-sector projects and plans, and
- Guidance on verification for water agency emissions data.

Corporate Accounting “Scopes”

The emissions that make up corporate GHG emissions inventories (carbon footprints) are differentiated in the GHG Protocol Corporate Accounting and Reporting Standard and Corporate Value Chain (Scope 3) Accounting and Reporting Standard according to whether they result directly or indirectly from activities within an organization’s organizational boundary. The GHG Protocol and other standard-setting organizations like TCR, rely on the now internationally-accepted concept of scopes to communicate this breakdown as follows:

- **Scope 1:** All direct GHG emissions.
- **Scope 2:** Indirect GHG emissions from consumption of purchased electricity, heat or steam.
- **Scope 3:** Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. transmission and distribution losses) not covered in scope 2, outsourced activities, waste disposal, etc.

A water agency’s complete carbon footprint will include GHG emissions across all three scopes. A key source of scope 3 emissions will be the GHG emissions associated with the energy used to collect, produce, transport, treat and deliver water to customers, and to collect and safely dispose of, or reuse, wastewater.

Methods

Accurate estimation of GHG emissions embedded in water is largely dependent on the comprehensive estimation of the

energy embedded in water. However, it can be a complicated endeavor due to the complex nature of electric generation source ownership and electricity transactions. Factors that must be taken into account when calculating GHG emissions embedded in water include:

- The quality of the source water supplies and the level of treatment needed to prepare the water for its intended uses,
- The distance of water supplies from water demand,
- The elevations over which water must be transported to reach customers,
- The level of wastewater treatment required for safe disposal or reuse,
- The amount of water lost to leaks and evaporation, especially during storage and conveyance,
- The impacts of the wholesale management of water resources,
- The quantity of power generated by the water agency used for water-related activities,
- The GHG emissions characteristics of self-generated power used for water-related activities,
- The quantity and GHG emissions profile of each electricity purchase used to manage, transport or treat water,
- GHG emissions associated with electricity line losses during transmission and distribution,
- The impact of any market-based GHG mitigation tools on direct or indirect GHG emissions, and
- Direct GHG emissions resulting from water treatment activities.

The Water-Energy-GHG Accounting and Reporting Protocol should provide step-by-step methodologies that take into account these complex systems based on data that water agencies have available to them today.

Data

The activity data necessary to calculate GHG emissions are sometimes difficult to obtain – not because they don't exist, but because they are not presently being collected and reported at a useful level of detail on a routine basis.

The primary challenge to benchmarking energy and GHG emissions embedded in water is a need to trace energy inputs into any particular water resource: from point of origin, through point of use, to ultimate disposal or reuse.

Both water and wastewater agencies and their energy providers know how much energy is being used. What is not quite as simple is determining the GHG emissions intensity of any particular energy input, and how much energy was put into the water “upstream” (e.g., by wholesale water purveyors), and how much energy will be put into the water downstream (e.g., by wastewater treatment agencies).

Depending on any specific program's design, water and wastewater agencies may also need to be able to break energy and GHG data into finer levels of detail, such as the amount of energy and GHG emissions that were used for pumping and can thus be claimed to have been saved through pump efficiency measures. Other programs, such as regional water planning, may aggregate the data at higher levels to

enable better understanding of the regional and statewide impacts of any particular water resource strategy. This protocol should include an analysis of high-quality data sources that California water agencies can rely on for years to come.



Wastewater treatment plant

Metrics

Measuring and tracking changes in energy use and GHG emissions, whether for an individual water or wastewater agency, a region, or statewide can provide important information about the effectiveness of various resource management strategies in putting California on a path to long-term resource reliability and environmental sustainability. In addition to helping determine whether specific actions are effective in achieving policy and regulatory goals, metrics and benchmarks have an important role in helping to assure that investments of public funds are consistent with the policy goals and statutes that govern the disposition of those funds.

This protocol should include a series of metrics that can be used by water agencies to track overall GHG and energy impacts over time, plan for future projects and upgrades, contribute to regional water planning efforts, be combined to assess regional and statewide impacts of collective

USING METRICS TO TARGET PUBLIC INVESTMENTS

Given the geography of California's water resources, more than 80% of all energy inputs by California's water and wastewater agencies are accumulated during the collection, production and transport of wholesale water supplies across the state. The remaining water and wastewater functions (water treatment and distribution, wastewater collection, treatment and disposal) account for less than 20% of water sector energy consumption.

action, and communicate GHG savings potential to end use consumers.

For example, the metric in the previous text box helps to focus the state's attention on water resource strategies that can significantly change the water sector's energy and GHG emissions profile.

Another potential application of water use cycle metrics is a "Water Content Label" that discloses information about the energy intensity and GHG emissions impacts of water supplies (similar to the "Power Content Label" that retail electricity sellers are required to provide to customers that describes the energy resources within their respective portfolios). A Water Content Label would help water customers understand the linkages among water, energy and GHG emissions. Labeling could also help strengthen messaging about the benefits of proposed water resource and infrastructure projects, helping to obtain

funding support from elected officials, business leaders and residents. (See a mock-up of a Water Content Label on the following page.)

Metrics are also an excellent tool for communicating the impacts of water consumption to encourage water conservation. In summer 2013, the "Save Water and Energy" collaborative consumer information campaign led by the Governor's Office incorporated messages that specifically highlight these linkages. The messages and marketing collateral were jointly developed and delivered by the state's water and energy sectors. The campaign is being expanded for summer 2014.

SAVE WATER & ENERGY This Summer

Save Water and Energy This Summer

Water-related energy use accounts for more than 19% of the state's total electricity use, including treating, pumping and conveying water to your home, heating the water for your shower and washing machine, and treating the wastewater that leaves your home. This connection is especially strong in the summer when demands for energy and water are highest.

energy upgrade
Save Our WATER

Letting your faucet run for 5 minutes uses as much energy as leaving a 60-watt light bulb on for 14 hours

Turning off the faucet while you brush your teeth can save 8 gallons of water a day – that equals about 300 gallons of water saved per month

19% of electricity consumption in California goes to water-related activities

The carbon emissions embedded in California's water use are equal to
7.1 million cars

You can save **25** gallons of water by irrigating only in the early morning or late evening

Saving water can help your water and wastewater utilities reduce the amount of water they have to pump and treat—saving energy and money. Reducing the amount of water you use can reduce your energy usage.

Source: Governor's Office of Planning & Research

Illustration of a Potential Water Content Label

POWER CONTENT LABEL			WATER CONTENT LABEL			
ENERGY RESOURCES	2010 POWER MIX	2010 CA POWER MIX	WATER RESOURCES	YYYY WATER MIX	EMBEDDED ENERGY	EMBEDDED GHG EMISSIONS
Eligible Renewable	%	14%	Conservation	%	MWh	MTCO ₂ e
- Biomass & waste	%	2%	Surface Water	%	MWh	MTCO ₂ e
- Geothermal	%	5%	Groundwater	%	MWh	MTCO ₂ e
- Small Hydroelectric	%	2%	Recycled Water	%	MWh	MTCO ₂ e
- Solar	%	0%	Desalinated Water	%	MWh	MTCO ₂ e
- Wind	%	5%	Other	%	MWh	MTCO ₂ e
Coal	%	7%	Totals	%	MWh	MTCO ₂ e
Large Hydroelectric	%	11%	Energy & GHGs per MG		MWh	MTCO ₂ e
Natural Gas	%	42%	<i>MG = million gallons</i>			
Nuclear	%	14%				
Other	%	0%				
Unspecified sources of power	%	12%				
TOTAL	%	100%				

Source: California Energy Commission

Water agencies subject to California’s Urban Water Management Planning Act (Division 6 Part 2.6 of the Water Code, Sections 10610 - 10656) already report their past, current and future water resource portfolios every five years. The Department of Water Resources charged with administering the Act offers multiple sources of grants, incentives and low interest loans to help water agencies plan and manage their systems. Many of these provide bonus points for plans that incorporate energy and GHG impacts. For agencies that are already estimating the energy and GHG impacts of their water resources, a Water Content Label would be fairly simple to implement and to maintain. The ability to access a central water-energy-GHG data repository to obtain information about upstream and downstream energy and GHG emissions would further simplify the task.

Verification

GHG emissions can be challenging to accurately estimate and track due to their ubiquity and scale. When it is very important to have accurate estimates of GHG emissions, such as when GHG emissions information is used to satisfy a regulation or to qualify for funding, it is considered a best practice to seek third-party verification of emissions inventories and calculations.

Frameworks for third-party verification already exist and should be leveraged to support water-energy-climate programs and projects. Relying on existing infrastructure will keep costs down for program implementers and relying on experienced verifiers will streamline verification activities. Verified data may also simplify reporting on energy efficiency programs that require independent verification of installed energy efficiency measures.

A Water-Energy-GHG Registry

Creation and maintenance of a public repository for reporting water-related energy and GHG emissions can provide water and wastewater agencies with consistent data that help them understand the emissions impacts of their resources and operations management decisions. The repository can also support state programs by providing the ability for policymakers and regulators to aggregate energy and GHG impacts at different levels to understand the potential local, regional and statewide energy and GHG emissions benefits of various water resource and infrastructure strategies. The repository could also provide a mechanism for effectively targeting public programs and investments.

Ideally, a central calculation tool and repository for all of these data should be established. In that manner, the data reported by individual water and wastewater agencies can be quickly compiled to obtain the embedded energy in water throughout the entire water use cycle. Structured properly, the data can be sorted and computed expeditiously at multiple levels: agency, regional, statewide, or any other specific demarcation (county, hydrologic region, energy utility service area, etc.).

A customized calculation tool addressing GHG emissions from the complete the water use cycle will also serve as an educational resource for water agencies that may be new to the concept of GHG accounting. This tool should be user friendly and easily accessible and include user support addressing both the technical function of the tool and the content of the

Water-Energy-GHG Accounting and Reporting Protocol.

As the state's water-energy policies and programs mature, it will become increasingly important to collect and compile historical water, energy and GHG data in the forms needed to do these calculations efficiently on demand.

Training Resources and Support

Water and wastewater agencies will need technical and financial assistance to account for their GHG emissions. State agencies that require or encourage calculating water, energy and GHG emissions impacts should provide the technical and financial resources needed to help water and wastewater agencies collect, compile and measure these data. Assistance should also be provided to help water and wastewater agencies integrate this information into long term planning efforts and marketing, education and communications programs that encourage water conservation.

Financial Incentives

Like most public entities, water and wastewater agencies are already substantially resource-constrained. Every new public policy initiative, no matter how beneficial, creates a burden if it is not accompanied by sufficient funding. The logical solution is to link tracking of energy and GHG emissions embedded in water with incentives.

Some agencies are beginning to incentivize this disclosure. The California State Department of Water Resources (DWR) already includes consideration of energy and GHG impacts of water strategies in grant funding for integrated regional water

management plans. Projects that reduce water-related energy and GHG emissions are eligible for funding from California Carbon Allowances. The CPUC is also exploring provision of energy efficiency incentives for measures that save energy by saving water.

One Comprehensive Benchmark, But No Single Metric

It is important to note that no single metric yet exists that is wholly effective in optimizing investments across multiple resource, economic, environmental, and other policy goals. Computing energy and GHG emissions embedded in water is but one metric that can help to enhance understanding of the impacts of various water management options.

Used in conjunction with other indicators, it can, however, help to substantially improve the quality of policy and project management decisions. It is particularly well suited to targeting funding for water-related projects with discrete objectives, such as reducing energy consumption by the water sector or improving the long-term sustainability of California's water supplies.

Voluntary Climate Leadership Recognition Program

Awards, rewards and recognition for leadership have proven very effective in encouraging voluntary compliance with high priority environmental policy goals. TCR already recognizes water and wastewater agencies and large water users for tracking and reducing their direct and indirect energy use and GHG emissions through the *Cool Planet* energy efficiency and climate change mitigation program that

is funded by Southern California Edison ratepayers.



This program or others like it could be harnessed to recognize early action and encourage others to account for and reduce energy use and GHG emissions over time.

Periodic Reports

Raw data can sometimes be overwhelming when there is an absence of relevant analysis. To combat this, a series of reports should be released to evaluate the data for different purposes. Examples of levels of analysis are presented below.

Regional and State-Level Analyses and Reports

Periodic regional and state-level analysis reports should be prepared and reviewed by the state to enable evaluation of the impacts of voluntary action as well as policy impacts from grant and loan program criteria preferences or other future mandatory policies.

- ***Regional Purposes*** – Comprehensive water-energy-GHG metrics can be used to support applications for technical and financial assistance (grants, subsidies, incentives, low interest loans) available for projects that reduce water-related energy and associated GHGs within one or more regions.

- ***Strategic Planning & Policy Analyses*** – These data and metrics can also be used to help identify high potential water-energy policies, rules, programs and practices that can have a significant impact on statewide energy consumption and GHG emissions reductions. For example, these data and metrics would enable informed decisions about the tradeoffs among various water resource options, such as whether producing desalinated seawater within the South Coast region is more or less beneficial than continuing to import water via the California Aqueduct.

Agency-Level reports

Agency-specific water-energy-GHG benchmarks can be used for multiple purposes:

- Applying for energy efficiency incentives, California Carbon Allowances, water planning grants, State Revolving Funds, and other sources of grants, subsidies and incentives for reducing energy and/or GHG emissions within the water use cycle.
- Compliance reporting of estimated impacts of water management strategies to DWR and others.
- Reporting the projected changes in energy and GHG intensity of the agency's water supply portfolio to management, elected officials, customers and constituents.
- Building awareness by both internal and external stakeholders about the links among water, energy and GHGs emissions.

III Policy Tools and Incentives

Broadly, the water-energy-GHG nexus includes all activities and opportunities that occur at the intersection of water and energy.

- Reducing energy sector impacts on water and climate,
- Reducing water sector impacts on energy and climate, and
- Leveraging the collective resources, assets and relationships of both water and energy sector participants to improve cost-effective delivery of joint services.

Given the state’s high priority on reducing GHG emissions and specific legislative mandates for calculating and reporting water-related energy and associated GHG impacts, including GHGs in water-energy metrics is not just logical and useful – it is essential. It is through this broader metric that options such as displacing water sector consumption of fossil fuels with renewable and clean energy solutions is incorporated into the portfolio of options.

Several state initiatives already encourage or require evaluating the energy and GHG emissions impacts of water resources and systems. Some of these are described on the following pages.



POLICY TOOL: LEGISLATION

Integrated Regional Water Management Planning Act [2008]

State legislation created a new Division 33: Integrated Water Supply and Flood Protection Planning, Design, and Implementation in the California Water Code. Division 33 set forth the Legislature's findings with respect to statewide water management issues, and required "... the integration of flood protection and water systems to achieve multiple public benefits, including all of the following:

- (1) *Increasing water supply reliability in the least costly, most efficient, and most reliable manner to meet current and future state needs.*
- (2) *Increasing use of water use efficiency and water conservation measures to increase and extend existing water supplies.*
- (3) **Reducing energy consumption associated with water transport, thereby reducing state greenhouse gas emissions.** *[emphasis added]*
- (4) *Improving water management to protect and restore ecosystems and wildlife habitat."*

Chapter 4 directed the DWR to "... develop project solicitation and evaluation guidelines for the application of funds ...". Chapter 4 further stipulates that Integrated Regional Water Management Plans include "Consideration of greenhouse gas emissions of identified programs and projects."

Section 83002 also appropriated funds for specific purposes, including \$10 million to update the California Water Plan, including "... the identification of strategies to reduce greenhouse gas emissions related to the storage, conveyance, and distribution of water."



Colorado River Aqueduct system, photo by Larry Berger

POLICY TOOL: REGULATION

The California Global Warming Solutions Act [AB32, 2006]

AB32 required that the Air Resources Board (ARB) develop a Scoping Plan that describes the actions needed to reduce California's GHGs to 1990 levels by 2020. In its First Update to the Scoping Plan, ARB has acknowledged the role of reducing energy embedded in water to achieve the Plan goals.

"Water is a critical component of the State's economy and has implications for almost all sectors discussed in the Scoping Plan. [...] ... most of the water measures included in the Scoping Plan focused on the GHG emission benefits derived from reduced energy use, and the emission benefits are reflected in those sectors."

The First Update discusses progress by ten scoping plan sectors, of which water is one. Within the water sector, key strategies include water use efficiency, water recycling, water system energy efficiency, reuse urban runoff, renewable energy production, and a water public goods charge.



Recycled Water Pump

Water use efficiency, renewable energy production with water and by water agencies, and other water-related strategies are fully integrated into the other sectors where applicable. For example:

- *Water use efficiency is identified as an important strategy in the Buildings sector.*
- *Agricultural water use efficiency, increasing the efficiency of or electrifying agricultural water pumps, using biogas-based fuels, and increasing carbon sequestration on agricultural lands is identified as an important strategy for the agricultural sector.*

POLICY TOOL: INCENTIVES

California Carbon Allowance (CCA)

California's Cap and Trade Regulation [*Title 17, California Code of Regulations, section 95800 et seq.*] established limits (caps) on emissions from sources that account for 85 percent of the state's GHG emissions. Covered entities must surrender emissions credits to the Air Resources Board (ARB) in the amounts needed to comply with the regulatory cap – 1990 GHG emissions levels by 2020 - that is stipulated in AB32, The California Global Warming Solutions Act (2006).

Commencing 2013 and each year thereafter, ARB issues a limited number of tradable permits (California Carbon Allowances, or CCAs) equal to the cap that declines over time as needed to achieve the targeted level of emissions. Some of the CCAs are auctioned; others are placed into a cost containment reserve.

Each CCA entitles the owner to emit one metric ton of carbon dioxide equivalent (MTCO₂e). Organizations that are able to reduce their emissions below the AB32 cap can sell excess CCAs. Organizations that are unable to cost-effectively reduce their emissions to comply with AB32 can purchase CCAs. As the statewide GHG emissions cap declines, the CCAs are expected to increase substantially in value.

The proceeds from the CCA auctions are designated for certain *eligible purposes*. In May 2013, ARB issued its *Cap-and-Trade Auction Proceeds Investment Plan* for fiscal years 2013-14 through 2015-16. Reducing GHG emissions by reducing water-related energy consumption was specifically identified as a recommended priority for CCA investment in the Governor's 2013-14 Budget Proposal, as are other water sector strategies.

"... the water sector is one of the largest users of electricity..."

Examples of potential projects:

- *Reduce energy used for water supply, conveyance, treatment*

Public agencies will be able to apply for CCA funds for authorized purposes. Many types of water-related projects were included in the ARB's Investment Plan as eligible purposes.

- *Reduce GHG emissions associated with water use and supply*
- *Reduce energy used for water supply, conveyance, treatment*
- *Water conservation, capture and storage*
- *Water system and use efficiency, such as energy efficiency in water pumping/conveyance, and use of biogas from wastewater treatment plants to generate energy or fuels*
- *Advance renewable energy and energy efficiency technologies, including water efficiency*

POLICY TOOL: INCENTIVES

Integrated Regional Water Management Planning

Integrated Regional Water Management (IRWM) Plans are comprehensive, multi-stakeholder strategic plans created by state legislation [IRWM Planning Act, 2002 and 2008] that identify and prioritize actions and projects needed for long-term reliable water supplies, water quality, and flood protection within any particular region. The IRWM process crosses multiple regulatory jurisdictions and political boundaries with the aim of identifying solutions that meet multiple policy goals and objectives.

IRWM Plans are voluntary. To encourage these regional collaborations, the Legislature stipulated that a benefit should be provided for “qualified projects of programs” in IRWM Plans.

State agencies are motivated to work collaboratively on IRWM guidelines, because access to State funding can provide strong incentive for local agencies to comply with State laws and policies. Moreover, issuing State financial assistance through a coordinated IRWM program - as opposed to many single purpose grant programs - provides a single point of coordination for both local and state agencies and allows flexibility in using funding for the highest regional priorities.

Mark Cowin, Director of DWR, Testimony to the Little Hoover Commission (Sept. 2012)

In its Grant Program Guidelines (Nov. 2012), DWR established two overarching objectives for IRWM Plans:

- Adapting to Climate Change, and
- Reducing Emissions.

Reducing energy consumption, “... especially the energy embedded in water use, and ultimately reducing GHG emissions” was identified as an important strategy for mitigating the adverse impacts of climate change on water resources.

Statewide Priority: Climate Change Response Actions

Proposals that contain projects that reduce GHG emissions compared to alternate projects that achieve similar water management contributions toward IRWM objectives. Desirable proposals include those that:

- *Reduce energy consumption of water systems and uses*
- *Use cleaner sources to move and treat water*

Proposals that contain projects that reduce not only water demand but wastewater loads as well, and can reduce energy demand and GHG emissions. Desirable proposals include:

- *Water use efficiency*
- *Water recycling*
- *Water system energy efficiency*
- *Reuse runoff*

[Source: IRWM Grant Program Guidelines, November 2012]

POLICY TOOL: INCENTIVES

Energy Program Subsidies and Incentives

Both investor-owned (IOUs) and publicly-owned (POUs) energy utilities provide subsidies and incentives to their customers to reduce energy consumption and demand, and to develop customer-side “distributed” generation, especially “clean” (zero to low emissions) and/or renewable energy. Recently, subsidies have also been made available for energy storage.

To-date, however, such subsidies and incentives are only available to reduce a customer’s own energy consumption. No credit is provided towards so-called “embedded”, or “embodied” energy, that was input to water by other parties.

In May 2012, the CPUC decided that energy inputs by all regulated energy IOUs should be included in the avoided energy cost calculation for energy embedded in water.

Commission Staff’s evaluation of this program should report on energy savings, including embedded energy savings, avoided costs, and cost-effectiveness [that] ... include the embedded energy from all IOUs. [CPUC Decision 12-05-015, p.289]

In June 2013, staff of the CPUC’s Energy Division noted that although the CPUC’s Standard Practice Manual (SPM) provides the ability to include a Societal Test, such a test “... has never been applied in a CPUC proceeding.” [Draft Overview of Social Cost Test Proposal, CPUC Energy Division Staff, June 2013.]

CPUC staff proposed adding two non-energy benefits to the CPUC’s cost-effectiveness framework (1) avoided GHG emission costs, and (2) avoided environmental health costs.



If the comprehensive resource, economic and environmental benefits attributable to avoided energy consumption could be considered throughout the entire water use cycle, the level of energy efficiency incentives that could be made available for water projects would increase by 2-3 times or more, depending on whether avoided GHG emissions associated with ALL energy inputs to water are included.

The Price of Leadership



As more programs are established that provide preferential funding to projects that reduce energy and GHG emissions, it is important to not penalize market leaders such as Sonoma County Water Agency (SCWA), which is well along its path to *Zero Carbon Water*. Programs should be designed in a manner that do not disadvantage market leaders such as SCWA when competing for funds that award bonus points to water projects that reduce energy and GHG emissions.

Incremental Value Streams

The ability to comprehensively calculate the water, energy and GHG emissions impacts of our water management decisions increases access to new value streams that exist at the intersection of water, energy and climate.

No one metric is sufficient to optimize investments of public funds. While

Sonoma County's Carbon-Free Water

Sonoma County Water Agency (SCWA) has adopted a goal of operating a carbon free water system by 2015.

Through an aggressive clean energy program that includes efficiency and renewable energy production, the agency has reduced the GHG intensity of its energy portfolio 98 percent since 2008.

SCWA was awarded Climate Registered Platinum status by TCR, the highest level of achievement recognized by the nation's leading verifier of carbon emission inventories. SCWA is one of only three entities nationwide to receive this recognition.

mitigating GHG impacts is an important aspect of meeting the state's climate change goals, other key considerations include conserving water and energy, and minimizing adverse impacts on watersheds and ecosystems.

Nevertheless, accounting for water, energy and GHG emissions impacts enhance our ability to achieve multiple value streams through multi-resource, cross-cutting programs that were previously not accessible through traditional programs.

References

2012 Annual Report: A Year of Partnerships, Sonoma County Water Agency.

California @ 50 Million, California's Climate Future, The Governor's Environmental Goals and Policy Report (Discussion Draft), Governor's Office of Planning and Research, September 2013.

California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects, California Public Utilities Commission, October 2001.

California's Water-Energy Relationship, California Energy Commission, CEC-700-2005-011-SF, November 2005.

California Water Plan Highlights, Integrated Water Management Update 2009, Department of Water Resources.

Cap-and-Trade Auction Proceeds Investment Plan: Fiscal Years 2013-14 through 2015-16, Air Resources Board, May 14, 2013.

Climate Change and the Water-Energy Nexus: Statewide Opportunities to Reduce Greenhouse Gases and Adapt to a Changing Climate, WET-CAT Update 2011, The Water-Energy Team of the Governor's Climate Action Team.

Climate Change Scoping Plan, First Update (Discussion Draft), Air Resources Board, October 2013.

Decision 12-05-015, California Public Utilities Commission, May 18, 2012.

Draft Overview of Social Cost Test Proposal, CPUC Energy Division Staff, June 2013.

Embedded Energy in Water Studies, California Public Utilities Commission, August 31, 2010.

Integrated Regional Water Management Planning Act of 2008, Senate Bill SBX2-1 [Perata, Machado and Steinberg, 2008].

Integrated Regional Water Management (IRWM) Grant Program Guidelines – Propositions 84 and 1E, Department of Water Resources, November 2012.

Testimony of Mark W. Cowin to the Little Hoover Commission Public Hearing on Water Governance, September 24, 2009.

**California's Water-Energy-Climate Nexus:
Energy and Greenhouse Gas Emissions Embedded in Water**

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