

Appendix O

Voluntary Reporting of Energy Intensity

This appendix provides guidance for voluntary reporting of the energy intensity associated with sources of water used by the urban water supplier as required by CWC §§10631.2(a). This section of the Urban Water Management Plan is optional, but urban water suppliers are encouraged to provide as much information as possible. If complete data are not available, estimates, informed judgements, and assumptions can be used to fill in missing information.

CWC 10631.2(a)

In addition to the requirements of Section 10631, an urban water management plan may, but is not required to, include any of the following information:

- (1) An estimate of the amount of energy used to extract or divert water supplies.*
- (2) An estimate of the amount of energy used to convey water supplies to the water treatment plants or distribution systems.*
- (3) An estimate of the amount of energy used to treat water supplies.*
- (4) An estimate of the amount of energy used to distribute water supplies through its distribution systems.*
- (5) An estimate of the amount of energy used for treated water supplies in comparison to the amount used for nontreated water supplies.*
- (6) An estimate of the amount of energy used to place water into or withdraw from storage.*
- (7) Any other energy-related information the urban water supplier deems appropriate.*

CWC 10631.2 (b)

The department shall include in its guidance for the preparation of urban water management plans a methodology for the voluntary calculation or estimation of the energy intensity of urban water systems. The department may consider studies and calculations conducted by the Public Utilities Commission in developing the methodology.

Energy intensity reporting has many benefits for water utilities and their customers including:

- Identifying energy saving opportunities as energy consumption is often a large portion of the cost of delivering water.
- Calculating energy savings and greenhouse gas (GHGs) emissions reductions associated with water conservation programs.
- Potential opportunities for receiving energy efficiency funding for water conservation programs.
- Informing climate change mitigation strategies
- Benchmarking of energy use at each water acquisition and delivery step and the ability to compare energy use among similar agencies.

Energy Intensity Defined

Energy intensity is a measure of the amount of total energy needed to take a unit volume of water from a starting location through all necessary steps to its point of use. Energy intensity is calculated by dividing the total quantity of energy consumed (kWh) by the volume of water entering the distribution system (AF).

For the purposes of voluntary water energy reporting for Urban Water Management Plans, urban water suppliers are only responsible for reporting *energy intensity* associated with *water management processes* within their *operational control*. This means that any energy embedded in water supplies by

an upstream water supplier (such as a water wholesaler) **should not be included** in the energy intensity information being provided.

Overview of Energy Intensity Guidance & Operational Control

This guidance is intended to cover reporting of the energy intensity of water supplies within an urban water supplier's operational control for extraction, diversion, conveyance, placement into storage, treatment, and distribution for a one year time period. Operational control in this context is defined as authority over normal business operations at the operational level. Thus, an urban water supplier would likely *not* have *operational control* over systems from which the urban water supplier purchases water e.g., the State Water Project and other wholesale water supplies, and would therefore not include energy intensity information for those systems.

Reporting Methods

The availability of water-related energy consumption data varies greatly across urban water management wholesalers and suppliers. This guidance is intended to accommodate a range of energy consumption detail. Three reporting options are provided; urban water suppliers should decide which level of reporting to provide based on the resolution of available energy consumption data. Using the more detailed reporting approach (A) will provide water managers with the best understanding of the energy intensity of their systems and how energy consumption of water management operations compares throughout the state.

Water Supply Process Approach (A): Report energy intensity by water management operation (aggregated across all supply sources). Enter amount of energy consumed for extraction, conveyance, placement into storage, treatment, and distribution (See Table O-1A on page 8).

Total Utility Approach (B): Report a single energy intensity for all water management operations. Enter total energy consumed by agency's water operations. The agency's energy intensity is automatically calculated as the ratio of energy consumption over volume of water delivered (See Table O-1B on page 9).

Multiple Water Delivery Products(C): Water Supply Process Approach (A) methodology with additional functionality for reporting energy intensity by water delivery product (Retail Potable, Retail Non-Potable, Wholesale Potable, Wholesale Non-Potable, Agricultural, Environmental, and Other deliveries.). (See Table O-1C on page 10).

Reporting Period

This guidance uses a one year reporting period. Ideally the reporting period will match the 2015 period selected by the urban water supplier for other sections for their UWMP. If energy consumption data is not available for the 2015 time period, urban water suppliers can select an alternate one year reporting period. As with other elements of the UWMP, only one year of data is being requested. Urban water suppliers wishing to report multiple years of energy intensity data can do so by filling out table O-1 for multiple one year periods.

Water Delivery Product

The type of water delivered by an urban water supplier can significantly impact the reported energy intensity. For the purposes of this guidance water delivery products include: Retail Potable, Retail Non-Potable, Wholesale Potable, Wholesale Non-Potable, Agricultural, Environmental, and Other deliveries. Tables O-1A and O-1B request the urban water suppliers to report a single type of water being delivered. Urban water suppliers delivering more than one type of water should use Table O-1C.

Volume of Water

Volume of Water Entering Water Management Process: Many urban water suppliers have multiple water supplies, each of these supplies may have different water management process characteristics e.g., some but not all supplies will pass through the extract and divert, place into storage, conveyance or treatment processes. For O1-A only, the volume of water is entered for each water management process to account for the differences in volume of water passing through each water management processes. The volume of water entered in the "Total" column should equal the volume of water entering the distribution system, in most cases this is the total volume calculated in UWMP Table 4-1: Demands for Potable and Raw Water in 2015. Recycled water should not be included in the water volumes (see discussion of recycled water on page 4).

Hydropower and other Electricity Generation within the Water System

Consequential Hydropower Generation: Consequential hydropower generation occurs where energy generation is a direct consequence of water delivery. All water passing through the energy generation devices is delivered to users and an interruption in water deliveries would result in an interruption in energy generation. An example of consequential hydropower generation is the State Water Project's Warne, Alamo, and Devils Canyon energy recovery power plants. Consequential hydropower generation should be netted from the total amount of energy consumed by each water delivery process. If consequential hydropower generation is greater than the amount of total energy consumed, energy intensity will be a negative value meaning that the water delivery is a net negative energy consumer or a net positive energy generator.

Non-Consequential Hydropower Generation (optional): Non-Consequential Hydropower Generation is defined as power generated by water systems where the generation of electricity is not directly connected to water deliveries i.e., energy could be generated even if no water were being delivered to water users. An example of non-consequential hydropower generation is the energy generated from the State Water Project by the Hyatt-Thermalito Powerplant at Oroville Dam. Water flowing out of Oroville Dam generates electricity, the water is then released to the Feather River channel where it could replenish groundwater, support environmental needs, flow out to sea or be delivered to SWP customers. There are many challenges in appropriating non-consequential hydropower generation; this guidance provides the option to include non-consequential hydropower generation, but does not provide a detailed methodology for partitioning hydropower production amongst multiple users or benefits. Urban water suppliers that wish to include non-consequential hydropower generated from facilities within their operational control can do so by entering the amount of energy produced by hydropower facilities as a negative value. The urban water supplier will also have to provide a volume of water passing through the hydropower generation process in order to calculate a per acre-foot energy intensity metric. The determination of how to quantify the amount of water passing through the hydropower generation process is left up to the urban water supplier and should be described in the narrative portion of the submission.

Self-Generated Energy Sources: Self-generated or other onsite energy generation should not be netted out from energy consumed. If self-generated energy (i.e. solar, wind, geothermal, Biomass, co-generation, diesel generator) is directly consumed by a water management process (generation “behind the meter”), add the estimated amount of energy produced by the self-generation source to the metered energy consumption for the appropriate water management process. While energy production from self-generated energy sources is not considered in these energy intensity calculations it should be included when considering GHG emissions associated with water management. Urban water suppliers that want to report self-generated renewable energy can do so in Table 0-1 and in the narrative section of this chapter.

Groundwater Banking

This guidance does not address how to incorporate the energy intensity from groundwater banking operations. It is possible to include the energy intensity from groundwater banking in the “Place into Storage” water management process. If groundwater banking operations occur within the urban water supplier’s operational control please include a brief discussion of how groundwater banking was addressed in energy intensity calculations or provide a general overview of how groundwater banking would impact the overall energy intensity of water supplies.

Place into Storage

This is the amount of energy consumed within an urban water supplier’s *operational control* to place water into a storage reservoir or groundwater bank less any *consequential hydropower generation*. Because only one year of data is being requested, the volume of water entering the Extract and Divert and Place into Storage processes may be substantially different from the volume of water entering the distribution system. If inter-annual storage occurs the total and net calculated energy intensities may not fully reflect the energy that was applied to the water prior to placement into multi-year storage. Urban water suppliers with inter-annual storage should address this issue by providing a qualitative discussion of how inter-annual storage operations would have impacted the Total and Net Energy Intensities.

Recycled Water Supplies

Recycled water supplies are not included in this reporting methodology. Recycled water systems are often operated as a separate water supply and distribution system. Additionally water conservation efforts typically do not focus on recycled water savings.

Report Narrative

Please provide a narrative for each water supply discussing water management processes in which energy is consumed or produced. Please also provide a narrative documenting data sources, assumptions and methods used to complete the energy intensity calculations.

This guidance and associated reporting tables do not capture all of the water-energy complexities or issues that may be of interest to the urban water supplier. Urban water suppliers are encouraged to include additional tables, charts, text and other additional water-energy information that are of interest.

Definitions (words within definitions that are italicized are also defined in this list):

Consequential Hydropower Generation (kWh): Amount of energy generated using turbines or other generation devices to generate electricity from falling water where the energy generation is a direct consequence of water delivery. Water passing through the energy generation devices is delivered to users.

Conveyance (kWh): Amount of energy consumed within an UWMP's *operational control* to transport water from point of diversion to point of treatment less any *consequential hydropower generation*. This does not include any energy expended by a water wholesaler e.g., DWR for the conveyance of State Water Project supplies. For wholesale water supplies, the conveyance energy to be reported by the urban water supplier is only the energy expended by the urban water supplier itself to transport the water from the point at which it receives the water from the wholesaler to the urban water supplier's treatment plant.

Data Quality: The urban water supplier is asked to make a subjective assessment of the quality of the data that is being provided in table O-1. DWR recognizes that energy intensity reporting for water supplies may be new for some urban water suppliers and that some processes may not be sub-metered to allow for precise quantification of energy use. Estimates and informed judgement by the water supplier should be used to fill in as much information as possible.

Distribution (kWh): Amount of energy expended within an urban water supplier's *operational control* to transport water from the treatment plant or wellhead disinfection point to the point of delivery. For treated wholesale water supplies, distribution starts at the point where the urban water supplier takes control of water. Reported distribution energy should include only energy expended by the urban water supplier to transport water from the point it receives the water to the point of delivery less any *consequential hydropower generation*.

Embedded Energy in Wholesale Water Supplies: Energy that has been applied to a water supply by all upstream wholesalers. Embedded energy in wholesale water supplies is not included in this voluntary reporting.

Energy Intensity (kWh/AF): Quantity of energy consumed divided by volume of water entering the water management process. A measure of the required amount of energy needed to take a unit volume of water from its starting location through all necessary steps to its point of use.

Extract and Divert (kWh): Amount of energy consumed within an urban water supplier's *operational control* to remove water from a channel, pipeline, stream, or aquifer less *consequential hydropower generation*.

Kilowatt-hour (kWh): A measure of electricity defined as a unit of work or energy, measured as 1 kilowatt (1,000 watts) of power expended for 1 hour. One kWh is equivalent to 3,412 Btu.

Net Energy Consumed (kWh): *Total Energy Consumed* less any *Non-Consequential Hydropower* production. [Net Energy Consumed = Total Energy Consumed + Hydropower]

Net Energy Intensity (kWh/AF): Total Energy Consumed less any Non-Consequential Hydropower production. [Net Energy Intensity = Net Energy Consumed / Total Volume of Water Entering Process]

Non-Consequential Hydropower Generation: Amount of energy generated using turbines or other generation devices to generate electricity from falling water where the energy generation is not a direct consequence of water delivery. If water that has generated electricity is released to natural channels and may or may not end up being delivered to an end user the generation should be considered *non-consequential hydropower generation*. [Enter as negative value in spreadsheet]

Operational Control: Authority over normal business operations at the operational level. This would not include other systems from which the urban water supplier purchases water.

Place into Storage (kWh): Amount of energy consumed within an urban water supplier's *operational control* to place water into a storage reservoir or groundwater bank less any *consequential hydropower generation*.

Production Volume (AF): Volume of water entering distribution system. If delivery occurs prior to distribution system use volume of water delivered.

Reporting Period: One year period for reporting *volume of water delivered* and quantity of energy consumed. When possible, use time period used to report 2015 data in other sections of UWMP.

Self-Generated Renewable Energy (kWh): Amount of renewable energy generated by facilities under urban water supplier's operational control not included in Consequential or Non-Consequential Hydropower Generation items (examples include solar, wind, geothermal, tidal).

Start Date: First day of one year *Reporting Period*.

Total Energy Consumed (kWh): Total energy consumed within an urban water supplier's *operational control* for all *water management processes*.

Total Energy Intensity (kWh/AF): Total *energy intensity* within an urban water supplier's *operational control*. [Total Energy Consumed / Total Volume of Water Entering Process]

Treatment (kWh): Amount of energy consumed within an urban water supplier's *operational control* to treat water to potable quality. Treatment of recycled water is not included in this guidance for calculating energy intensity of urban water supplies.

Water Delivery Product: Describes type of water delivered. Water delivery types include: Retail Potable, Retail Non-Potable, Wholesale Potable, Wholesale Non-Potable, Agricultural, Environmental, and Other deliveries.

Volume Entering Water Management Process (AF): Volume of water that entered given water management process in Acre-Feet for 2015 or selected reporting period. Volume of water entered for the "Total" column should equal the amount of water entering the distribution system, in most cases this is the total volume calculated in UWMP Table 4-1: Demands for Potable and Raw Water in 2015.

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Water Management Processes: For the purpose of Appendix O defined as *Extract and Divert, Place into Storage, Conveyance, Treatment, and Distribution.*

Instructions Table O-1A: Water Supply Process Approach

Water Delivery Product (If delivering more than one type of product use Table O-1C)

dropdown menu

Select type of water delivered.

Only report energy consumed or produced by water systems within the urban water suppliers operational control

Table O-1A: Voluntary Energy Intensity - Water Supply Process Approach

Enter Start Date for Reporting Period	10/1/2014	Urban Water Supplier Operational Control							
End Date	9/30/2015	Water Management Process					Non-Consequential Hydropower (if applicable)		
		Extract and Divert	Place into Storage	Conveyance	Treatment	Distribution	Total	Hydropower	Net
Volume of Water Entering Process (AF)		manual input	manual input	manual input	manual input	manual input	calculated	manual input	calculated
Energy Consumed (kWh)		manual input	manual input	manual input	manual input	manual input	calculated	manual input	calculated
Energy Intensity (kWh/AF)		calculated	calculated	calculated	calculated	calculated	calculated	calculated	calculated

Enter volume of water passing through each water management process.

Enter start date for reporting period.

Quantity of Self-Generated Renewable Energy

kWh

Enter non-hydropower renewable energy production

Enter amount of energy consumed by each water management process less any consequential energy generation.

Data Quality (Estimate, Metered Data, Combination of Estimates and Metered Data)

dropdown menu

Select quality of the data entered in Table O-1A

Data Quality Narrative:

Enter narrative for data quality.

Narrative:

Provide narrative describing general data sources, methodology, assumptions and process where energy is removed from the system by consequential hydropower generation.

Instructions Table O-1B: Total Utility Approach

Water Delivery Product (If delivering more than one type of product use Table O-1C)
dropdown menu

Select type of water delivered.

Table O-1B: Voluntary Energy Intensity - Total Utility Approach

Enter Start Date for Reporting Period Enter start date for reporting period.
 End Date

Urban Water Supplier Operational Control

Only report energy consumed or produced by water systems with in the urban water suppliers operational control

	Urban Water Supplier Operational Control		
	Sum of All Water Management Processes	Non-Consequential Hydropower	
	Total	Hydropower	Net
Enter Volume of water entering the distribution system			
<i>Volume of Water Entering Process (AF)</i>	<i>manual input</i>	<i>manual input</i>	<i>calculated</i>
<i>Energy Consumed (kWh)</i>	<i>manual input</i>	<i>manual input</i>	<i>calculated</i>
<i>Energy Intensity (kWh/AF)</i>	<i>calculated</i>	<i>calculated</i>	<i>calculated</i>

Enter amount of energy consumed by all water management processes minus any consequential energy generation.

Quantity of Self-Generated Renewable Energy
 kWh

Enter Non-Hydropower Renewable Energy

Data Quality (*Estimate, Metered Data, Combination of Estimates and Metered Data*)
dropdown menu

Select quality of the data entered in Table O-1A

Data Quality Narrative:

Narrative:

Instructions Table O-1C: Multiple Water Delivery Types

Table O-1C: Voluntary Energy Intensity - Multiple Water Delivery Products

Enter Start Date for Reporting Period <input type="text" value="10/1/2014"/>		Enter start date for reporting period.		Urban Water Supplier Operational Control					Only report energy consumed or produced by water systems with in the urban water suppliers operational control	
End Date <input type="text" value="9/30/2015"/>		Water Management Process					Non-Consequential Hydropower (if applicable)			
		Extract and Divert	Place into Storage	Conveyance	Treatment	Distribution	Total	Hydropower	Net	
<i>Total Volume of Water Entering Process (AF)</i>		<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>calculated</i>	<i>manual input</i>	<i>calculated</i>	
<i>Retail Potable Deliveries (%)</i>		<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>		<i>manual input</i>		
<i>Retail Non-Potable Deliveries (%)</i>		<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>		<i>manual input</i>		
<i>Wholesale Potable Deliveries (%)</i>		<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>		<i>manual input</i>		
<i>Wholesale Non-Potable Deliveries (%)</i>		<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>		<i>manual input</i>		
<i>Agricultural Deliveries (%)</i>										
<i>Environmental Deliveries (%)</i>		<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>		<i>manual input</i>		
<i>Other (%)</i>		<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>		<i>manual input</i>		
<i>Energy Consumed (kWh)</i>		<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>manual input</i>	<i>calculated</i>	<i>manual input</i>	<i>calculated</i>	
<i>Energy Intensity (kWh/AF)</i>		<i>calculated</i>	<i>calculated</i>	<i>calculated</i>	<i>calculated</i>	<i>calculated</i>	<i>calculated</i>	<i>calculated</i>	<i>calculated</i>	

Enter volume of water passing through each water management process.

Enter percentage of "Total Volume of Water Entering Process" contributed by each water product type. Total percentage in each column must equal 100%.

Enter amount of energy consumed by each water management process less any consequential energy generation.

Water Delivery Type	Production Volume (AF)	Total (kWh/AF)	Net (kWh/AF)
<i>Retail Potable Deliveries</i>	<i>manual input</i>	<i>calculated</i>	<i>calculated</i>
<i>Retail Non-Potable Deliveries</i>	<i>manual input</i>	<i>calculated</i>	<i>calculated</i>
<i>Wholesale Potable Deliveries</i>	<i>manual input</i>	<i>calculated</i>	<i>calculated</i>
<i>Wholesale Non-Potable Deliveries</i>	<i>manual input</i>	<i>calculated</i>	<i>calculated</i>
<i>Agricultural Deliveries</i>	<i>manual input</i>	<i>calculated</i>	<i>calculated</i>
<i>Environmental Deliveries</i>	<i>manual input</i>	<i>calculated</i>	<i>calculated</i>
<i>Other</i>	<i>manual input</i>	<i>calculated</i>	<i>calculated</i>
<i>All Water Delivery Types</i>	<i>calculated</i>	<i>calculated</i>	<i>calculated</i>

Quantity of Self-Generated Renewable Energy kWh
 Enter non-hydropower renewable energy production

Data Quality (Estimate, Metered Data, Combination of Estimates and Metered Data)

 Select quality of the data entered in Table O-1A

Data Quality Narrative:

Enter production volume for each water product type

Narrative:

End of Appendix O