



Desal: Energy Use & Climate Impacts

Informational Handout • December 2011



Energy Required for Desalination

In April 2011, **scwd²** released a white paper that describes the energy required to produce current water supplies for the City of Santa Cruz (SCWD) and Soquel Creek Water District (SqCWD) as well as the energy required to produce desalinated water. To provide context and perspective, it describes other energy requirements for typical households in the Santa Cruz/Soquel area.

Desalination requires 7 to 10 times more energy than traditional water treatment methods to produce drinking water, but the energy used to produce a typical household's water would only increase approximately 2 to 3 times because desalinated water will be contributing a small portion of the total water supply and supplement existing supplies.

During a typical year, the proposed desalination facility would require approximately 6,800 MWh per year to operate. It is important to note that under the conceptual operational scenarios, the

Energy Use in Our Community with Desalination



Current Drinking Water: Treatment and Distribution
SqCWD 2,800 MWh/year
SCWD 4,400 MWh/year



Mid-size Hospital
6,600 MWh/year



Amusement Park
1,500 MWh/year



Wastewater Treatment
12,000 MWh/year



Indoor Mid-size Mall
6,200 MWh/year



Supplemental Water Supply: Desalination
6,800 MWh/year
Typical use by SCWD during drought conditions or by SqCWD during non-drought conditions

SqCWD = Soquel Creek Water District SCWD = Santa Cruz Water Department

MWh = megawatt hour

The graphic above compares various energy uses in the community, including the energy used to treat and distribute water currently and the energy for a supplemental supply provided by desalination. For source and calculation information, visit www.scwd2desal.org/Page-Energy-Calcs.php

City would utilize the plant at 2.5 mgd in the summertime during drought years and SqCWD would utilize the plant at lesser capacity (~1.25 mgd) at all other times.

Water supply energy isn't typically considered in household energy consumption because that energy is associated with a

continued on page 2

Energy Study Analyzes Greenhouse Gas Reduction and Alternatives

As part of the ongoing review of the proposed Regional Seawater Desalination Project, the energy requirements and greenhouse gas emissions (GHGs) of desalination are being thoroughly studied



Solar panels at the City of Santa Cruz Graham Hill Water Treatment Plant.

and a list of potential projects to offset the energy demands and reduce GHGs is being developed.

An Energy Minimization and Greenhouse Gas Reduction Study (Energy Study) is currently under way that will evaluate the most advanced and energy efficient technologies and their incorporation into the project. The study will also evaluate alternative projects and programs to offset the project's energy requirements and thereby reduce GHGs.

continued on page 4

What is the scwd² Regional Seawater Desalination Project?

The City of Santa Cruz and Soquel Creek Water District are collaborating to conserve, protect, and create a reliable water supply portfolio. Together, as **scwd²**, they are evaluating a 2.5 million gallon per day (mgd) seawater desalination facility that would be shared to help meet water needs during drought periods, reduce groundwater withdrawals to prevent seawater intrusion, and provide system flexibility when

continued on page 4

Calculating Carbon Emissions from Desal's Energy Use

The desalination process does not directly emit greenhouse gases (GHGs) in the way that a power plant does. The emissions are attributed to the power that is purchased — similar to the way emissions are attributed to electricity used in a home or business. Based on the amount of energy used by the proposed project, the GHGs are calculated using PG&E's Emissions Factor.

Electricity on the California power grid comes from many different sources, including both fossil-fuel based and renewable energy sources. PG&E supplies electricity for the power grid in the Santa Cruz area. This energy emits a varying amount of greenhouse gases for every kilowatt-hour produced, depending on the mix of renewable and non-renewable (fossil-fuel) energy sources.

scwd² calculated the proposed project's GHG footprint using PG&E's most recent emission factors. Based on state regulations, it is anticipated that the emission factor will decrease over time as PG&E's energy portfolio shifts toward increased alternative and renewable energy sources that produce less carbon emissions to meet AB32.

The estimated annual indirect GHG emissions for the assumed operation of the scwd² Desalination Facility by

How much energy does it take...?



One Glass of Water
0.3 Wh



One Minute on Laptop Computer
0.8 Wh



One Cup of Coffee
88 Wh



Two Pieces of Toast
92 Wh



Dry Your Hair
128 Wh



One Glass of Water with Supplemental Desalination
0.7 Wh

Wh = watts per hour

The graphic above compares energy requirements for everyday activities, including the energy used to treat and distribute a glass of water currently and with a supplemental supply provided by desalination. For source and calculation information, visit www.scwd2desal.org/Page-Energy-Calcs.php

SCWD are equivalent to approximately 1,100-2,000 metric tons (MT) CO₂e/yr*. The estimated annual indirect GHG emissions for the projected operation of the scwd² Desalination Facility by SqCWD are equivalent to approximately 900-1,600 MT CO₂e/yr*.

*Assumes SCWD operates the project during summer months of a drought year and SqCWD operates the project at a lesser amount at all other times.

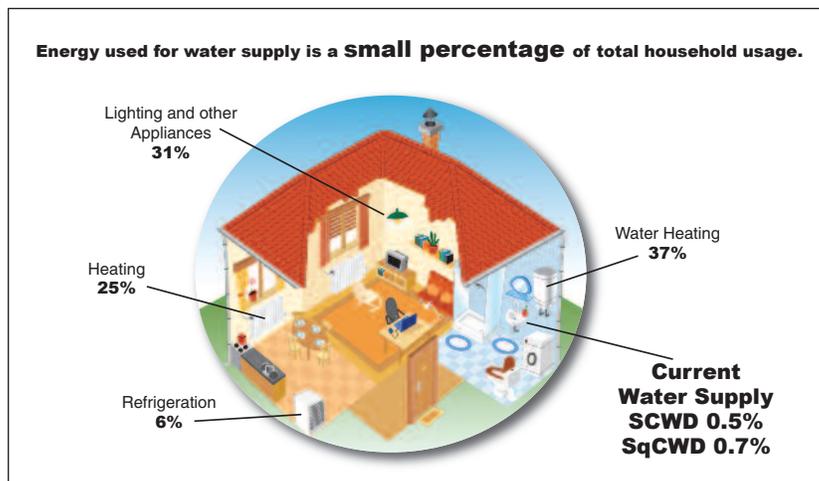
"Energy Required for Desalination" continued from page 1...

water utility's infrastructure, not a household's. But water used by a household requires energy to collect, treat and

distribute. Compared to the typical residential energy use in the Santa Cruz area, current water supply is a relatively small energy user — less than 1 percent of a household's energy total.

approximately 0.5 percent of a household's energy requirements. For the SqCWD, which currently relies solely on groundwater, the household energy equivalent is approximately 0.7 percent. This paper describes the additional energy that would be required to produce a supplemental water supply using desalination and how it would increase energy usage in a typical household. For SCWD, the percentage of energy to produce water would double to about 1 percent of a household's energy usage, while for SqCWD it would increase to 2.3 percent.

To view the Energy White Paper, *Perspectives on Water Supply Energy Use* on the project website, visit: http://www.scwd2desal.org/Page-Documents_FactSheets.php



For SCWD, the energy required for water production (which includes surface water and groundwater) makes up

Energy Study Evaluates New Technologies, Renewable Sources

Energy is one of the key issues in the evaluation of the proposed **scwd²** Desalination Project. **scwd²** is committed to thoroughly studying the potential energy use and indirect greenhouse gas emissions of the project and is conducting an Energy Minimization and Greenhouse Gas Reduction Study (Energy Study) to evaluate the most advanced and energy efficient technologies and their incorporation into the proposed project. The study also includes identifying renewable energy/GHG reduction projects that could offset the power requirements and reduce the carbon footprint of the proposed project.

A Technical Working Group, including local professionals, experts and practitioners in the water and energy fields, is providing guidance and input on the Energy Study. The group developed a list of nearly 50 potential Energy/GHG reduction projects and methods, narrowing it down to 11 potential projects.

In addition to its evaluation under CEQA, the Energy Study will further evaluate GHGs with respect to a number of other potential goals:

Assembly Bill 32 (AB32): Reduce total GHG emissions for treating and delivering water to 1990 levels.

No Increase (Net Carbon Neutral): A programmatic approach to evaluate energy impacts of the proposed project. Considers the fact that desalinated water is supplemental to existing sources and replaces others. There is no increase in energy/GHGs based on the net difference of existing and proposed water supplies.

How scwd² is Addressing and Minimizing Energy Use and Reducing Climate Impacts

Step 1: Commissioned Energy Study

1. Formed Technical Working Group (TWG) to advise Energy Analysis & Study
2. Assessed current and projected energy use
3. Calculated indirect GHGs from purchased energy

Step 2: Components of Energy Study

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| <ol style="list-style-type: none"> 1. Methods to Minimize Energy Requirements at the Desal Facility <ul style="list-style-type: none"> • Advanced RO Membranes Operating at Lower Pressure • Energy Efficient Pumps • Energy Recovery Devices | <ol style="list-style-type: none"> 2. Understand Greenhouse Gas Reduction Goals <p>Environmental Review/CEQA Process Identifies Threshold of Significance</p> <p>Additional goals to consider:</p> <ul style="list-style-type: none"> • Assembly Bill 32 • City Climate Action Plan • No Increase (Net Carbon Neutral) • Carbon Free | <ol style="list-style-type: none"> 3. Develop List of Energy/GHG Reduction Projects <p>TWG Reviewed 40+ Projects:</p> <ul style="list-style-type: none"> • Water & Energy Efficiency • Other Renewable Energy • GHG Offset <p>Created detailed assessment of 16 projects (including cost, local benefits, reliability, etc.)</p> <p>Developed list of 11 recommended projects to be used to reduce Energy/GHGs</p> |
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Next Steps

1. Complete the **scwd²** Energy Study and incorporate into the environmental review process
2. Should the project be approved, implement the Energy Study and its related projects

Carbon Free: A project-only approach to evaluate energy impacts. Considers just the proposed project when assessing energy and GHG implications and that all the energy/GHGs would be offset.

City's Climate Action Plan: City of

Santa Cruz has identified a GHG reduction goal of 30 percent below the AB32 goal for water-related emissions.

County Climate Action Strategy: The County of Santa Cruz is in the process of developing programs and goals for reducing GHG emissions.

Comparing the Project's Expected GHGs with Other GHG Emissions in the Santa Cruz area

City of Santa Cruz, 2008 Commercial/Industrial emissions: 93,000 MT CO₂e per year.*

City of Santa Cruz, 2008 Transportation emissions: 96,000 MT CO₂e per year.*

City of Santa Cruz, 2008 Residential emissions: 76,000 MT CO₂e per year.*

scwd² Desalination Facility by SCWD during drought conditions: ~1,100-2,000 MT CO₂e

scwd² Desalination Facility by SqCWD during non-drought conditions: ~900-1,600 MT CO₂e

2,000 metric tons CO₂e is equivalent to the emissions from approximately 400 typical automobiles travelling 12,000 miles a year.



*City of Santa Cruz Draft Climate Action Plan, 2010

"Energy Study" continued from page 1...

The City of Santa Cruz and the Soquel Creek Water District, in collaboration as **scwd²**, are committed to a thorough analysis of the energy needs of the proposed project and will utilize the Energy Study to inform the Environmental Impact Report (EIR). Once the EIR is certified, the Energy Study would be used as a guide to establishing GHG reduction goals and selecting projects to offset the energy requirements.

The analyses in the Energy Study will be part of the Draft EIR, which is anticipated to be complete in early 2012. This study includes a portfolio of GHG reduction projects that could be used to meet the GHG Reduction Goal and reduce the carbon footprint of the project.

"What is..." continued from page 1...

reductions in the use of surface water are required to maintain adequate stream flows to protect endangered species.

The project is currently in the evaluation phase. The Draft Environmental Impact Report is scheduled to be released in early 2012. For additional information, visit these websites:

scwd² Regional Seawater Desalination Project: www.scwd2desal.org

Proposed Project Schedule: www.scwd2desal.org/Page-schedule.php

Energy & Greenhouse Gas Emissions: www.scwd2desal.org/Page-Energy.php

Glossary of Terms

Power: measurement of electricity, usually in Watts (W), kilowatts (KW or 1000W) or megawatts (MW or 1,000,000W)

Energy: measurement of power over time, usually watt-hours (Wh) or kWh (1000Wh) or MWh (1,000 kWh)

GHGs: Greenhouse Gas Emissions. For desal project, this is primarily from indirect emissions from PG&E. Measured in Metric Tons of Carbon Dioxide equivalent per year (MTCO₂e/yr)

Technical Working Group Recommends 11 Projects to Offset Energy/GHG

The Technical Working Group (TWG) reviewed nearly 50 potential projects that included the categories of Energy Efficiency (such as programs to accelerate retrofits of efficient washing machines, pumps and motors), Renewable Energy (such as solar photovoltaics, wind, and hydropower), and GHG Reduction (such as fleet vehicles and GHG offsets).

The TWG was asked to:

- Consider which projects make the most sense for the **scwd²** Desalination Program and the Santa Cruz and Soquel communities
- Consider projects that offset GHGs and can be verified by an independent agency
- Select projects for the next step of detailed project evaluation

From the initial list of projects identified by the TWG, 11 were recommended to create the portfolio of Energy/GHG reduction projects that could be used to reduce the carbon footprint of the desali-



The Technical Working group evaluated 48 potential projects, including high-efficiency washing machines and wind power.

nation project. The list includes a diverse, feasible and flexible group of projects capable of meeting the current set of GHG reduction goals. These projects include:

Water and Energy Efficiency Projects	Estimated Annual GHG Reduction Potential
High-efficiency washing machine rebates (accelerated program)	453 MT CO ₂ e/yr
Commercial and residential solar rebates	246 MT CO ₂ e/yr
Implement advanced mixing technologies at SCWWTP*	266 MT CO ₂ e/yr
Implement additional energy savings at SCWWTP*	329 MT CO ₂ e/yr
Improve pump and motor efficiency (accelerated program)	29 MT CO ₂ e/yr
Renewable Energy Projects	
Program to convert food waste to energy at SCWWTP*	810 MT CO ₂ e/yr
Invest in renewable energy projects instead of purchasing power from PG&E	Variable (as required)
Install local solar projects	750 MT CO ₂ e/yr
Install micro-hydropower turbine at Graham Hill Water Treatment Plant	76 MT CO ₂ e/yr
GHG Reduction Projects	
Use recovered CO ₂ from local sources for desal process	70 MT CO ₂ e/yr
Purchase certified GHG offsets	Variable (as required)

*SCWWTP = Santa Cruz Wastewater Treatment Plant
 MT CO₂e/yr = equivalent of a metric ton per year of carbon dioxide emissions
 For more information on these projects, visit: <http://www.scwd2desal.org/Page-Energy-Project.php>



City of Santa Cruz & Soquel Creek Water District

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Esta información está disponible en español.
 Por favor llame al (831) 475-8500.