MITIGATING THE ENERGY IMPACTS FROM A DESALINATION PROJECT WITH RENEWABLE ENERGY – A REALISTIC SOLUTION?

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BACKGROUND

The City of Santa Cruz, located along the west coast of the United States, approximately 85 miles south of San Francisco, California, provides potable water to over 92,000 customers. On average, about 80% of its approximately 4.2 billion gallons (15.9 Mm^3) annual water supply comes from local streams and a river, while a reservoir supplies another 19%. This dependence on surface water sources creates serious problems during critical droughts.

The worst drought on record occurred in 1976-77, required severe water rationing, and caused considerable hardships. Since that time, the number of customers has increased substantially, but no major new water supply source has come on line. Fortunately, the City adopted an aggressive water conservation plan and its customers now have one of the lowest per capita water demand rates in the State. However, it is estimated that in a bad drought cutbacks in water use of over 35% would be required.

In addition, the City's streams and river are home to legally protected fish species. Federal and State regulators are demanding that the City significantly reduce its diversions from these sources. It is currently unclear how much of the City's supply may be lost.

The City has conducted numerous studies over decades seeking to identify feasible water supply projects. Finally, in 2005, the City Council adopted an Integrated Water Plan (IWP) containing a drought protection strategy of aggressive conservation, 15% curtailment during serious droughts, and a 2.5 million gallons per day (mgd) (9,500 m^3/d) desalination facility.

Since that time, the City in cooperation with a neighboring public water district experiencing serious overdraft of its groundwater acquifer, which provides almost all of its water, has actively been moving the proposed desalination project through the complex and detailed permit and environmental review process.

Desalination projects are a relatively new phenomenon in California. Few have been approved or constructed and they are almost always controversial, which is definitely the case in Santa Cruz. Opponents criticize their impacts on the ocean, costs, large energy demands, and climate change impacts. In addition, the regulatory requirements are intense. Permits are needed from numerous governmental agencies and rigorous environmental analysis mandated.

THE CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

The California Environmental Quality Act (CEQA) calls for the preparation of an Environmental Impact Report (EIR) for projects requiring discretionary approval from a State or local public agency that may have a potentially significant impact on the physical environment. Unlike environmental assessment systems in many other countries, CEQA does not identify specific project types subject to the EIR requirement. It focuses on a case by case determination of

significance. In addition, CEQA requires that every potentially significant impact of a project be mitigated to a less than significant level to the extent feasible.

The determination of significance is, therefore, a crucial feature of the law. Yet limited guidance is provided for determining significance thresholds (i.e. the point at which an impact goes from less than significant to significant).

In 2010, the State adopted mandatory CEQA Guideline amendments adding requirements for evaluating and mitigating a project's contribution to global climate change. However, it was left to the competent authorities (called lead agencies) to determine significance thresholds.

The EIR is also important because the lead agency's EIR must be used by any other State or local public agency that issues a permit for a particular project when evaluating that project's environmental impacts. The EIR focuses solely on environmental issues and must be certified prior to project approval, which is when other public policy issues are considered.

DESALINATION PROJECT, CLIMATE CHANGE AND ENERGY

One of the key concerns with the proposed desalination project is its potential effects on climate change. Much effort has gone into reducing these impacts.

However, it is important to distinguish between reducing GHG emissions and reducing fossil fuel energy use. Only with renewable energy projects can both GHG emissions and fossil fuel energy use potentially be reduced.

Because of the great public and regulatory concern with the potential climate change and energy impacts of the proposed desalination project, an Energy Technical Working Group, composed of recognized experts, was established to assist in evaluating and reducing the project's potential greenhouse gas (GHG) impacts. This effort eventually resulted in an initial recommendation of 16 projects/programs which, after additional analysis, was reduced to 11. Each project/program has the potential to reduce energy usage and GHG emissions with feasible capital and annual costs. A number of individual projects and combined portfolios could reduce the indirect GHG emissions to a net-carbon-neutral status.

DETERMINING THE SIGNIFICANCE OF THE PROJECT'S CLIMATE CHANGE IMPACTS

The preparation of the EIR on the desalination project overlapped the investigation of possible energy reduction projects. Since it was expected that the EIR document would ultimately face a legal challenge, the identification of a defensible threshold of significance for GHG emissions seemed essential.

Unfortunately, little guidance was available. The State Air Resources Board, which in many ways was leading the effort to reduce GHG emissions statewide, provided no thresholds. A number of regional air pollution control districts had begun to develop possible thresholds but none were relevant to the Santa Cruz project as the standards applied to facilities that directly emit GHGs. While the desalination project would use a relatively significant (to the region) amount of energy, its direct emissions would be negligible. The concern, then, was that there would be insufficient substantial evidence to justify any significance threshold proposed.

The solution was found with the completion of the Energy Technical Working Group's work. Since this effort determined that all the GHG emissions attributed to the desalination project could be offset by alternative energy, efficiency and other offset projects, proposing a carbon neutral approach seemed reasonable. In addition, supporting a net carbon neutral option is consistent with strongly held community values, which favor environmental protection. This approach has now been approved by the elected officials of the two water agencies.

GHG REDUCTION PROJECTS AND RENEWABLE ENERGY

For the desalination project to be carbon neutral, it must offset at least 650 tons (MT) of GHG emissions per year for typical operations and up to 3,200 tons under the worst-case conditions (full flow and highest emission factor).

To be included in the short term GHG emissions reducing portfolio for inclusion in the EIR, a project must provide immediately reliable, unduplicated and long term reductions. It must also be cost effective. Following is a brief description of the 11 projects recommended by the Technical Working Group and an explanation of why they were or weren't included in the desalination project's GHG reduction portfolio (See table below for GHG reductions and costs):

- **Water Conservation** – Would offer a USD$400 incentive to residential customers and $800 incentive to commercial customers for purchasing the most efficient clothes washers. Not included in the portfolio because the savings aren't reliable or verifiable.
- **Solar Rebates** – Would offer a USD$700 incentive to customers for installing solar power and a USD$200 incentive for installing solar hot water heaters. Not included in the portfolio because the savings aren't reliable.
- **Improved Digester Mixing System at the Santa Cruz Wastewater Treatment Plant (WWTP)** – Would include replacing the existing gas mixing system with a more energy efficient pump mixing system. Not included in the portfolio because the savings are needed by another City department.
- **Wastewater Treatment Plant (WWTP) Energy Improvements** – Would install major energy savings equipment at the WWTP – Again, the savings are needed by another City department.
- **Pump Efficiency Improvements** – Would estimate GHG reduction potential of an accelerated program to install cost-effective pump retrofits for the water system. Not included in the portfolio because the savings are too speculative.
- **Food Waste to Energy** – Would construct a facility to convert compost to energy. While the technology is proven, the project would be controversial in Santa Cruz due to concerns regarding possible toxic emissions, could have significant impacts, and is not feasible in the short term. Therefore, not included in the GHG reduction portfolio.
- **Renewable Energy Purchases** – Would invest in renewable energy projects in California and the U.S. Not included in the GHG reduction portfolio because the program is currently controversial and it isn't possible to assure that the savings will be non-duplicative.
- **Local Solar Projects** – Would install solar panels on facilities of the two cooperating agencies, including at the desalination facility itself. While expensive, this renewable energy project is local and meets the criteria.
- **Micro-hydro at Water Treatment Plant** – Would generate renewable energy from water flowing from the City's reservoir to the water treatment plant. Although savings are limited, this renewable energy project could be accomplished relatively simply and is without significant impacts.

- **GHG Offset Purchases** –Would entail purchasing GHG offset projects that would give the agencies the sole right to claim the GHG reductions from these projects. While controversial and with annual costs liable to increase substantially in future years if an entire project isn't purchased outright, offsets allow for flexibility and can fill the gap until additional local renewable projects are implemented.
- **CO2 Addition at the Desalination Plant** - Would use CO2 for post treatment and corrosion control at the desalination plant purchasing it from a facility that recovers it from waste streams where otherwise the CO2 would be released into the atmosphere. Not included because savings too speculative at this time.

Table 1
DESALINATION ENERGY PROJECTS – GHG REDUCTION SUMMARY

Project	Avg Annual Energy Saving (kWh/yr)	Avg Annual GHG Reduction (Metric Tons CO2e/yr)	Capital Cost	Annual Cost	Cost per MT Saved
Water Conservation	1 558 000	453	USD $4 200 000	USD $0	USD $1 519
Solar Rebates	584 000	170	USD $0	USD $64 714	USD $0.03
WWTP Digester	915 000	266	USD $1 400 000	-USD $19 000	- USD $45
WWTP Improvements	1 100 325	329	USD $801 000	- USD $66 000	- USD $215
Pump Efficiency	168 000	29	USD $366 000	USD $30 000	USD $980
Food Waste to Energy	0	810	USD $3 750 000	USD $280 000	USD $276
Renewable Energy Purchases	6 800 000	1 978	USD $100 000	USD $154 927	USD $32
Local Solar Projects	2 576 000	750	USD $14 300 000	USD $557 000	USD $2 900
Micro-hydro at WTP	260 610	76	USD $180 363	- USD $21 163	- USD $212
GHG Offsets	0 0	250 1 000	USD $62 000 USD $218 000	USD $8 213 USD $20 981	USD $27 USD $17
CO2 Addition at Desal	0	70	USD $500 000	USD $52 000	USD $472

While most of these 11 energy projects could be implemented over time, those selected for the GHG reduction portfolio for inclusion in the desalination project's EIR must be verifiable and, also, capable of implementation in the short term. The following projects appear to meet these criteria:

- **Local Solar Projects**
- **Micro-hydro at Water Treatment Plant**
- **GHG Offset Purchases**

- **Energy Recovery at the Desalination Plant**

Although it hasn't been possible to identify local renewable energy projects to fully offset initially the desalination project's GHG emissions, the agencies are committed to seeking additional ones. Work is underway on the remaining energy reduction projects and the City's Climate Action Coordinator is working with private and public entities to develop community renewable energy projects as part of the City's Climate Action Plan.

Politically, the approach outlined here for reducing GHG emissions is complicated because the City is committed to reducing its GHG emissions overall, yet the desalination project will increase these emissions. However, the water agencies have the financial resources to implement the GHG reduction portfolio and, in addition, can provide assistance not otherwise available for financing other longer term renewable energy projects.

CONCLUSION

While there is significant public concern regarding the potential climate change impacts of the proposed desalination project, the Santa Cruz community, through the EIR process, has made a commitment to assure that the project will be net carbon neutral. A variety of GHG emission reduction projects have been thoroughly evaluated to fulfill this commitment, both in the short and long term. Renewable energy projects are important components of this reduction approach and a serious effort is underway to increase renewable energy savings that can be attributable to this project. Preventing desalination projects from creating adverse climate change impacts is clearly a difficult challenge. However, if a developer and community's commitment is serious, strategies can be designed and incorporated into the project at least to significantly minimize these impacts.

ADDITIONAL INFORMATION

- Santa Cruz, City of – Integrated Water Plan, 2005 – http://scwd2desal.org/Page-Documents_Other.php

- Santa Cruz, City of and Soquel Creek County Water District – Energy Studies, 2011 - http://scwd2desal.org/Page-Energy.php

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