April 22, 2009

Mike Chrisman, Chair and Members
California Ocean Protection Council
1416 Ninth Street, Suite 1311
Sacramento, CA 95814

Re: Ocean Protection Council guidance on eliminating marine life impacts from open seawater intake structures.

VIA EMAIL: COPCpublic@resources.ca.gov

Dear Chair Chrisman and Members of the Council:

The California Coastkeeper Alliance and the Surfrider Foundation commend the Ocean Protection Council ("Council") for taking a leadership role in the development of a clear and consistent state policy to protect coastal, estuarine, and marine ecosystems from the devastating impacts of once-through cooling ("OTC"). The OTC resolution you passed in April of 2006 and the draft feasibility and grid reliability studies that you funded provide important guidance and support to the State Water Resources Control Board ("State Board") as it implements state and federal requirements through developing state policy on OTC.[1] It is also critical that the state protect our marine ecosystems from unnecessary entrainment and impingement of marine life from <u>all industrial withdrawals</u> of seawater using open seawater intakes – as mandated in the Porter-Cologne Act.[2] **We respectfully submit the following comments and ask that you continue to lead the agencies tasked with addressing once-through cooling issues to a prompt and timely phase-out of this environmentally devastating technology and ensure that the impacts are not simply replaced by new industrial coastal developments – including ocean desalination.**

<u>California Should Phase Out Once-Through Cooling</u>

It has been three years since the Council passed a resolution on once-through cooling, and yet California still does not have a clear statewide policy on this issue. While we wait for the

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[1] *E.g.*, the Resolution "encourages the State to implement the most protective controls to achieve a 90-95 percent reduction in impacts."
[2] California Water Code § 13142.5(b).

State Board to finalize a policy, the daily assault on our delicate marine and estuarine ecosystems continues. State Board staff recently testified at a joint hearing of the California Assembly on Natural Resources and Utilities and Commerce Committees that it intends to release the revised policy in June, with public hearings in July/August and a hearing in front of the Board for possible adoption in November.[3]

Earlier this month, the U.S. Supreme Court ruled in *Entergy v. Riverkeeper*, 556 U.S. __(2009) that cost-benefit analysis *may* be used as a factor in mandating the use of "best technology available" as defined by the Clean Water Act Section 316(b), which governs cooling water intake structures.[4] The Court left it to the Environmental Protection Agency ("EPA") to decide whether and how to compare costs to benefits when it issues new regulations for existing power plants. Importantly, the Court did not require that cost-benefit analysis be used, nor did the Court determine how or in which circumstances cost-benefit analysis may be used. The Court also stated that CCKA's, Surfrider Foundation's, and the other co-plaintiffs' view that cost-benefit analysis is not to be used at all, with which the Second Circuit Court of Appeals agreed, is also a reasonable interpretation of the law, and would pass legal muster if EPA adopted it.

Further, the U.S. Supreme Court left stand the other issues decided by the Second Circuit Court of Appeals in *Riverkeeper I* and *Riverkeeper II,* including the prohibition on "after the fact" restoration as a substitute for employing the best technology available to avoid adverse impacts in the first place.[5] The current Administration will now issue new regulations that conform to the lower court decision, as possibly modified in one limited respect by the Supreme Court ruling regarding the option to use cost-benefit analysis, if EPA chooses.

California has the right and responsibility to go beyond whatever federal minimum standard the EPA regulation creates. As the attached analysis from lawyers representing the regulated industry concludes, "[t]he Supreme Court's ruling does not mandate application of the cost-benefit test anywhere, much less in California."[6] The studies funded by the Council show that phasing out once-through cooling in California can be done feasibly and without negative impacts on energy reliability.

The Supreme Court decision did not result in any legal constraints that would limit California's authority to set strict standards and feasible timelines for phasing out once-through cooling. We strongly encourage the Council to urge the State Board to stay on course to finalize its policy by November 2009 to phase out once-through cooling.

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[3] Jonathan Bishop, Chief Deputy Director, California State Water Resources Control Board, *Testimony before the California Assembly Joint Informational Hearing Utilities and Commerce and Natural Resources Committees*, March 2, 2009.
[4] Supreme Court Decision available at http://www.cacoastkeeper.org/images/pdf/07-588.pdf.
[5] *See*: *Riverkeeper, Inc. v. EPA*, 358 F.3d 174, 184 (2d Cir. 2004) ("*Riverkeeper I*"); see also: *Riverkeeper, Inc. v. United States EPA*, 475 F.3d 83, 97 (2d Cir. 2007) (*Riverkeeper II*)
[6] Elizabeth Lake & Peter Landreth, "*U.S. Supreme Court Rules Cost-Benefit Analysis Permitted Under the Clean Water Act – But Will it Matter in California*?" Holland & Knight. Available at: http://www.hklaw.com/id24660/publicationid2613/returnid31/contentid54040/

Marine Life Impacts of Open Seawater Desalination

In order to fully protect marine life from the impacts the Council sought to address in its OTC resolution, the state must also implement concise standards on the withdrawal of seawater for all industrial uses. Private industry and water agencies are planning over 20 open seawater desalination facilities statewide without guidance on minimizing the intake and mortality of marine life. **Left unchecked, the cumulative impacts of multiple open seawater desalination facilities could effectively undermine the gains to the marine environment from implementing the Council's resolution on OTC and your efforts to find adaptation strategies for imminent climate change and sea level rise.**

Many of these proposals are planned to utilize the discharge from OTC systems as the desalination facility "source water."[7] Others are relying on the use of new or currently abandoned open seawater intakes. For example, in Carlsbad there is a desalination plant in the final stages of consideration for the continued use of an OTC system as a "stand alone" ocean desalination facility – that is, when the co-located generator is not withdrawing seawater for cooling purposes. This proposal, will withdraw 304 million gallons of estuarine water every day, an annual average of approximately 11% ***more*** seawater than the co-located Encina Power Station (EPS) currently withdraws.[8] Whether the water is used for cooling a plant or for ocean desalination, the impacts on the marine life sucked in through these intake structures is devastating. **If the ocean desalination facility is permitted as planned, the gains of implementing your resolution to *reduce* marine life mortality from OTC by 90 to 95% will have been completely undermined. In fact, the ocean desalination facility will *increase* the intake and mortality of marine by approximately 11% under current operating averages at EPS[9]. It follows that future operations of a "stand alone" desalination facility, once the EPS re-powers, will approximate 111% of current intake and mortality annually.**

Fortunately, there are alternative technologies for desalination that protect marine life. There are more progressive desalination proposals designed to use sub-seafloor intakes that eliminate entrainment and impingement while simultaneously reducing the energy demand of the final product water.[10] We believe these successful ocean desalination pilot projects set the standard for compliance with the Porter-Cologne Act's mandate to locate and design ocean desalination facilities in a manner to minimize the intake and mortality of marine life.[11] **We respectfully ask that the Council direct its staff to investigate and report back on alternative methods for desalination technology at the Council's next meeting.**

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[7] The life expectancy of proposed ocean desalination facilities is a minimum of 30 years – well beyond the acceptable life expectancy of OTC.

[8] See: Flow, Entrainment and Impingement Minimization Plan at: http://www.swrcb.ca.gov/rwqcb9/press_room/announcements/carlsbad_desalination/carslbad_desalination.shtml

[9] There is still on-going controversy over the exact level of impingement that will result from the desalination intake. See: "Statement of Peter Raimondi, PhD" (April 1, 2009) – and associated follow-up comments at: http://www.swrcb.ca.gov/rwqcb9/press_room/announcements/carlsbad_desalination/carslbad_desalination.shtml

[10] See e.g., Long Beach Water Department at; http://www.lbwater.org/desalination/desalination.html ; see also Municipal Water District of Orange County at: http://www.mwdoc.com/Ocean_Desalination.htm

[11] California Water Code § 13142.5(b)

Energy Demand of Open Seawater Desalination

Open seawater desalination is the highest energy user of any water supply strategy.[12] In regard to new ocean desalination facility planning, the Council should take notice of the significant energy demand of these facilities and the potential for undermining the Council's efforts to recommend adaptation strategies for inevitable climate change, sea level rise, and other impacts on future water supply management. First, our current water management system is extremely energy demanding. It is an accepted estimate that the delivery and treatment of water accounts for nearly 20% of the cumulative energy demand in California.[13] If we are serious about reducing greenhouse gas emissions, we should be looking at reducing the "embedded energy" in our current water management as a primary target to meet the goals of the Global Warming Solutions Act of 2006 – not water projects that are more energy intensive.

Open seawater desalination is counter-productive to meeting both the goals of reducing greenhouse gas emissions and adapting to the consequences of inevitable climate change and sea level rise. For example, the Carlsbad-Poseidon Desalination proposal mentioned above will consume approximately 40% more energy than the most energy-intensive available component of the region's water supply portfolio – imported water from the State Water Project.[14] If ocean desalination proposals are constructed closer to the source of State Water Project imports – the Sacramento Delta – that increased energy demand comparison only gets more dramatic. **And, once again, the cumulative impacts of numerous ocean desalination facilities on greenhouse gas emissions has never been thoroughly documented or regulated.**

In addition, much of the southern California region is reliant on local groundwater for a significant portion of the local water supply portfolios. Already these areas are combating seawater intrusion and contamination of coastal freshwater aquifers. Advancing the use of energy-intensive ocean desalination as a response to purported limits on available water supplies, and consequently exacerbating climate change and sea level rise, will only serve to heighten the threat to local groundwater supplies. It would be ironic, if not tragic, to allow the development of one energy-intensive water supply option (ocean desalination) to contribute to the contamination of a local renewable water supply with a relatively low energy demand (groundwater). This would turn sound public policy on its head.

While the ocean desalination proponents in Carlsbad argue that the product water is "replacement water" and will eliminate the need for current State Water Project imported supplies, thereby offsetting much of the energy demand and lowering the "net energy" consumption – there is no enforceable mechanism to ensure that offset. Further, while this one project proponent has promised a new and controversial plan to mitigate the greenhouse gas emissions created by this

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[12] *See* Gregory Freemen, *et al*. "Where Will We Get the Water? Assessing Southern California's Future Water Strategies" Los Angeles County Economic Development Corporation, August 14, 2008. Available at: http://www.laedc.org/sclc/studies/SCLC_SoCalWaterStrategies.pdf; and *see*: Martha Davis "Climate Change Scoping Plan Implementation Workshop Measure W-2 Water Recycling" March 4, 2009 presentation to the California State Water Resources Control Board, Public Utilities Commission, and Water Energy Climate Action Team. Available at: http://www.waterboards.ca.gov/water_issues/programs/climate/docs/ieua_030409.pdf.

[13] *See*: "Energy Down the Drain: the Hidden Costs of California's Water Supply"; NRDC, at: http://www.nrdc.org/water/conservation/edrain/contents.asp.

[14] *See* attached: Powers Engineering report on Carlsbad-Poseidon Desalination Report.

extremely energy-intensive project, there are also no enforceable mechanism to ensure others will follow suit – nor that the carbon offset opportunities are readily available for the cumulative pollutant load.

No After-the-Fact Restoration as Mitigation

The San Diego Regional Water Quality Control Board is considering a proposed "restoration project" as mitigation for the continued marine life mortality. But, as we noted above, the federal Second Circuit Court of Appeals decisions (*Riverkeeper I and II*) made it clear that "after the fact restoration" is not a legal substitute for the mandate to employ the best technology available to avoid the impacts in the first place. Because the mandates of the Porter-Cologne Act make no distinction between cooling water intakes and any other withdrawal of seawater for industrial purposes, it follows that "after the fact restoration" is not allowable mitigation for any new industrial facility in California.

Open Seawater Desalination Conclusion

We are not opposed to ocean desalination per se. There may be circumstances where ocean desalination fills an important niche in a local water supply portfolio. We respectfully request that the Council take note of and inform relevant agencies that:

1) the cumulative impacts of the potential for 20 or more ocean desalination facilities in the State, including energy demand, indirect greenhouse gas emissions and cumulative marine ecosystem impacts, should be immediately documented and made available to the public;
2) readily available alternative ocean desalination intake technology (sub-seafloor intakes) can eliminate the intake and mortality of marine life and should be the statewide regulatory standard for new proposals – consistent with CA Water Code § 13142.5(b);
3) new ocean desalination facilities should be located and designed with a production capacity that is compatible with the use of sub-seafloor intakes – consistent with CA Water Code § 13142.5(b);
4) local, reliable and less energy intensive alternative supply alternatives in every local water supply management plan should be fully implemented before ocean desalination is permitted.

We request that these recommendations be adopted into a new Ocean Protection Council resolution on seawater intakes for industrial purposes.

* * *

It has been over thirty years since the Clean Water Act and the Porter-Cologne Act first laid out the requirements for power plant cooling technology and the use of seawater for all industrial purposes respectively, and three years since the Ocean Protection Council's and the State Lands Commission's resolutions on once-through cooling. We are long overdue for a clear, consistent statewide policy that protects our coastal, marine and estuarine ecosystems and helps to move California towards a future with cleaner, more efficient and more sustainable energy production and water supply management. In addition, the state's laws mandating the reduction of greenhouse gas emissions, and the several resource agencies' efforts to draft guidance on responding to the irreversible and inevitable impacts of climate change and sea level rise, demand immediate action.

The Council has the authority to coordinate "activities of state agencies, that are related to the protection and conservation of coastal waters and ocean ecosystems, to improve the effectiveness of state efforts to protect ocean resources…."[15] We respectfully ask that you exercise your authority and continue to lead the way to stopping this needless assault on our resources. We encourage the Council to follow through with your strong resolution to ensure that the State Board moves to expeditiously phase out OTC, which is ravaging our coastal, marine, and estuarine ecosystems and marine life. We also strongly urge you to advise the State Board and other relevant agencies to apply the strictest interpretation of the Porter-Cologne Act to minimize the intake and mortality of marine life when considering current applications for ocean desalination intake permits, and develop clear guidance on acceptable ocean desalination facility design, location and intake technology that, in combination, minimizes the intake and mortality of marine life.

Thank you for consideration of our requests.

Sincerely,

Angela Haren
California Coastkeeper Alliance

Joe Geever
Surfrider Foundation

cc: Charles Hoppin, Chair, State Water Resources Control Board
John Garamendi, State Controller and Chair, State Lands Commission
Bonnie Neely, Chair, California Coastal Commission
Peter Douglas, Executive Director, California Coastal Commission
Sam Schuchat, Executive Officer, California Coastal Conservancy
Karen Douglas, Chair, California Energy Commission
Melissa Jones, Executive Director, California Energy Commission
Michael Peevey, President, Public Utilities Commission
Yakout Mansour, CEO, California ISO

Attachments

[15] California Public Resources Code § 35615 (a)(1).

ATTACHMENT 1:
ASSESSING SOUTHERN CALIFORNIA WATER STRATIES TABLE
EXCERPTED FROM "WHERE WE WILL GET THE WATER? ASSESSING SOUTHERN CALIFORNIA'S FUTURE WATER STRATEGIES" LOS ANGELES ECONOMIC DEVELOPMENT CORPORATION, AUGUST 14, 2008.

Assessing Southern California Water Strategies

Strategy	2025 Regional Potential (TAF*)	Typical Project Characteristics							
		Timeframe (years)	Drought-Proof (Reliability)	Risk (Project Aborted)	Enviro Opinion	GHG	Initial Cap. Cost ($millions)	Annual Oper. Cost ($millions)	30-yr cost Treated ($/AF)
Strategies to Replace or Augment Imported Water									
Urban Water Conservation	1,100+	0-2	Favorable	Favorable	Favorable	Favorable	$0	$0.5	$210
Local Stormwater Capture	150+	3-5	Unfavorable	Favorable	Favorable	Favorable	$40-$63	$1-$3.5	$350+
Recycling	450+	6-10	Favorable	Neutral	Favorable	Neutral	$480	$30	$1,000
Ocean Desalination	150+	6-10	Favorable	Neutral	Unfavorable	Unfavorable	$300	$37	$1,000+
Groundwater Desalination	TBD	6-10	Favorable	Neutral	Neutral	Neutral	$24	$0.7	$750-$1,200
Strategies to Increase Imported Water									
Transfers-Ag to Urban	200+	1-5	Neutral	Unfavorable	Neutral	Favorable	n/a	n/a	$700+
Strategies to Increase Reliability									
Inter-agency Cooperation	**	0-5	Favorable	Neutral	Favorable	Favorable	low	low	n/a
Groundwater Storage	1,500+	3-5	Neutral	Neutral	Favorable	Neutral	$68-$135	$13	$580
Surface Storage	0	10+	Unfavorable	Unfavorable	Unfavorable	Neutral	$2,500+	$7.5-$15.5	$760-$1,400

*TAF-Thousand Acre-Feet
** Improves reliability and efficiency of existing supplies
Source: LAEDC

● Favorable ● Neutral ● Unfavorable

ATTACHMENT 2:
POWERS ENGINEERING REPORT ON
CARLSBAD-POSEIDON DESALINATION REPORT, OCTOBER 12, 2007.

Assessment of Energy Intensity and CO_2 Emissions Associated with Water Supply Options for San Diego County

Prepared for: Surfrider Foundation

Prepared by: Bill Powers, P.E., Powers Engineering

Date: October 12, 2007

Surfrider Foundation contracted Powers Engineering to provide a technical assessment of the energy intensity, in terms of kilowatt-hours per acre-foot of water, and associated carbon dioxide (CO_2) emissions associated with a range of water supply options for San Diego County. These water supply options evaluated include:

- Conservation
- Reuse (non-potable)
- Reuse (potable)
- Desalination (linked to existing once-through cooled power plant)
- Desalination (no linkage to existing power plant)
- Colorado River water transfers
- State Water Project water transfers

Citations for the energy intensity values and CO_2 emission factors for each water source option are provided in this analysis. The CO_2 emission rate calculation for each source option is also provided. Table 1 summarizes the energy intensity and CO_2 emissions associated with the supply and transport of water from each source option.

State Water Project (SWP) water imports are used as the baseline for comparison purposes in this analysis. San Diego County imports a significant amount of its water supply from the SWP. In 2006, SWP imports reached 232,000 acre-feet (AF).[1] This is one-third of the total 2006 water usage of approximately 690,000 (AF). Colorado River water imports reached 347,000 AF in 2006. A recent judicial ruling has called into doubt whether SWP imports will continue to be available in the quantities that San Diego County has historically imported.[2] As a result, in addition to addressing natural growth in water demand, San Diego County must also consider sources of water that can substitute for any reductions in the county's allotment of SWP imports. For this reason, the energy intensity and CO_2 emissions associated with SWP imports are appropriate baseline values to compare the energy intensity and CO_2 emissions of potential options.

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[1] E-mail communication from Debbie Discar-Espe, senior water resources specialist - San Diego County Water Authority, to B. Powers, October 12, 2007.

[2] See **Attachment A**, San Diego County Authority Press Release, *SWP may cut-off supplies*, August 31, 2007.

A. Calculation of CO_2 Emission Rate for Reuse and Water Transfer Scenarios

The following energy intensity assumptions are used for calculation of CO_2 emission rates:

- Reuse, non-potable: 400 kWh per AF
- Reuse, potable: 2,246 kWh per AF
- Colorado River water transfers: 2,000 kWh per AF
- State Water Project water transfers: 3,200 kWh per AF
- The source will produce 56,000 AF per year (equal to 50 million gallons per day - Mgd) of water.

Energy intensity estimates for non-potable reuse, Colorado River water transfers, and SWP water transfers are from the August 2004 NRDC report, *Energy Down the Drain – The Hidden Costs of California's Water Supply,* Table 8, p. 34. The energy intensity estimate for potable reuse is from an October 10, 2007 e-mail communication from Jim Burror, engineering supervisor, Orange County Sanitation District (OCSD) to Bill Powers of Powers Engineering. OCSD estimates that the micro-filtration/reverse osmosis process being employed at OCSD to produce potable recycled water has an average energy demand of 20 MW to produce 78,000 AF-year of potable water. This converts to an energy intensity of 2,246 kWh per AF.[3] OCSD produces very high grade potable water that exceeds the quality of many current potable water sources in Southern California. As a result, the energy intensity of OCSD potable recycled water should be considered a conservative, upper-end estimate for potable recycled water. An article describing in detail the OCSD potable recycling process is provided as **Attachment B**. OCSD cites a typical energy intensity range for recycling water to potable grade of 800 to 2,000 kWh per AF in the article.

1. Calculate annual CO_2 emission rate for reuse, non-potable source:

$$\frac{400 \text{ kWh per AF} \times 56{,}000 \text{ AF} \times 0.915 \text{ lb per kWh}}{2{,}000 \text{ lb per ton}} = \mathbf{10{,}248 \text{ tons } CO_2 \text{ per year}}$$

2. Calculate annual CO_2 emission rate for reuse, potable source, per October 10, 2007 OCSD estimate of 20 MW continuous energy demand to produce 78,000 AF per year:

$$\frac{2{,}246 \text{ kWh per AF} \times 56{,}000 \text{ AF} \times 0.915 \text{ lb per kWh}}{2{,}000 \text{ lb per ton}} = \mathbf{57{,}543 \text{ tons } CO_2 \text{ per year}}$$

3. Calculate annual CO_2 emission rate for Colorado River water transfers:

$$\frac{2{,}000 \text{ kWh per AF} \times 56{,}000 \text{ AF} \times 0.915 \text{ lb per kWh}}{2{,}000 \text{ lb per ton}} = \mathbf{51{,}240 \text{ tons } CO_2 \text{ per year}}$$

4. Calculate annual CO_2 emission rate for State Water Project water transfers:

$$\frac{3{,}200 \text{ kWh per AF} \times 56{,}000 \text{ AF} \times 0.915 \text{ lb per kWh}}{2{,}000 \text{ lb per ton}} = \mathbf{81{,}984 \text{ tons } CO_2 \text{ per year}}$$

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[3] OCSD potable reuse energy intensity: $\frac{20 \text{ MW} \times 8{,}760 \text{ hr/yr} \times 1{,}000 \text{ kW/MW}}{78{,}000 \text{ AF/yr}} = 2{,}246 \text{ kWh/AF}$

B. Calculation of Energy Intensity and Associated CO_2 Emission Rate for Desalination at Encina Power Plant With and Without Use of the Once-Through Cooling System

Assumptions:

- The EIR prepared by Poseidon Resources LLC for the 50 Mgd desalination project at Encina estimates a peak power demand of 35 MW and an average demand of 29.8 MW. An additional 0.5 MW of power would be required by the Oceanside booster pump station as well. Total average energy demand would be 30.3 MW. For this reason, the desalination plant is assumed to have a continuous energy demand of 30 MW for the purposes of calculating energy intensity.[4]
- The CO_2 emission rate for natural gas is 117 lb per million Btu. The heat rate of the two largest and newest units at Encina, Units 4 and 5, is approximately 10,000 Btu/kWh. These are the two primary operational units at Encina. The three older units, Units 1-3, rarely operate. As a result, the CO_2 emission rate is 1,170 lb CO_2 per MWh (or 1.17 lb per kWh) of power generated at Encina.[5]
- If the desalination project is not linked to the existing once through cooling system at Encina and the developer is not buying power directly from Encina, then a gerenic "market power purchase" CO_2 emission factor must be used. SDG&E assumes a market power purchase CO_2 emission factor of 915 lb CO_2 per MWh.
- The desalination plant will produce 50 Mgd of desalinated water.
- The April 2007 Dana Point cold water desalination feasibility study estimates an average energy demand of 7 MW to produce 16,000 AF per year of desalinated water.

1. Calculate desalination plant energy intensity (average) linked to Encina OTC:

$$\frac{30 \text{ MW} \times 1{,}000 \text{ kW/MW} \times 24 \text{ hours/day} \times 365 \text{ days/yr}}{56{,}000 \text{ AF/yr}} = \mathbf{4{,}693 \text{ kWh per AF}}$$

2. Calculate CO_2 emissions per year assuming desal plant has power contract with Encina and power is produced from Units 4 and 5 at Encina:

$$\frac{4{,}693 \text{ kWh per AF} \times 56{,}000 \text{ AF} \times 1.17 \text{ lb per kWh}}{2{,}000 \text{ lb per ton}} = \mathbf{153{,}742 \text{ tons } CO_2 \text{ per year}}$$

3. Calculate CO_2 emissions per year assuming the desalination plant is utilizing the once through cooling facilities of the Encina power plant but is buying power directly from the utility or a third party from unidentified sources:

$$\frac{4{,}693 \text{ kWh per AF} \times 56{,}000 \text{ AF} \times 0.915 \text{ lb per kWh}}{2{,}000 \text{ lb per ton}} = \mathbf{120{,}235 \text{ tons } CO_2 \text{ per year}}$$

4. Desalination, non-OTC case. Calculate CO_2 emissions per year assuming the Encina boilers are retired, the desalination plant has no once-through cooling host. Assume that 7 MW is

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[4] City of Carlsbad, *Precise Development Plan and Desalination Plant Project Final Environmental Impact Report*, December 2005.

[5] Encina power plant CO_2 emission rate: (117 lb CO_2/million Btu)(10,000 Btu/kWh) = 1.17 lb CO_2 per kWh

required to produce 16,000 AF per year of desalinated water per the April 2007 Dana Point cold water desalination feasibility study. Also assume the desalination plant is buying power directly from the utility or a third party from unidentified sources:

a. Calculate desalination plant energy intensity for cold water desalination with no linkage to OTC:

$$\frac{7\text{ MW} \times 1{,}000\text{ kW/MW} \times 24\text{ hours/day} \times 365\text{ days/yr}}{16{,}000\text{ AF/yr}} = \mathbf{3{,}833\text{ kWh per AF}}$$

b. Calculate CO_2 emissions per year assuming cold water desalination with no linkage to OTC discharge from Encina power plant:

$$\frac{3{,}833\text{ kWh per AF} \times 56{,}000\text{ AF} \times 0.915\text{ lb per kWh}}{2{,}000\text{ lb per ton}} = \mathbf{98{,}201\text{ tons } CO_2\text{ per year}}$$

Table 1. Energy Impacts of Water Supply and Transport Options for San Diego County

Option	Energy intensity (kWh/AF)	Energy intensity compared to State Water Project imports (%)	CO_2 emitted to produce and transport 56,000 acre-feet, equal to 50 Mgd (tons/year)
1. Conservation	0	- 100	0
2. Reuse, non-potable	400	- 88	10,000
3. Reuse, potable	2,200	- 31	58,000
4. Colorado River Water Transfers	2,000	- 38	51,000
5. State Water Project Transfers	3,200	baseline	82,000
6a. Desalination (linked to OTC), power purchased from Encina	4,700	+ 47	154,000
6b. Desalination (linked to OTC), open market power purchase	4,700	+ 47	120,000
7. Desalination (non-OTC), sub-seafloor intakes, open market power purchase	3,800	+ 19	98,000

Footnotes to Table 1, source of energy intensity and CO_2 emission estimates:

1. The relative energy intensity compared to the SWP baseline is calculated in the following manner: (option – SWP baseline) ÷ SWP baseline. For desalination with linkage to OTC the result is: (4,700 – 3,200) ÷ 3,200 = + 47 percent.
2. Conservation energy intensity. Assumed to be zero.
3. Non-potable reuse energy intensitycitation: Natural Resources Defense Council, *Energy Down the Drain – The Hidden Costs of California's Water Supply*, August 2004. San Diego County - Energy and Urban Water (case study), Table 8, p. 34.
4. Potable reuse energy intensity citation: The energy intensity for potable reuse provided by OCSD includes pumping the product water to percolation ponds for groundwater re-charge. A draft report by Wilkinson, Bren School - UC Santa Barbara, estimates water reuse with reverse osmosis at 1,280 kWh per AF. The more energy intensive OCSD figure is used in this analysis as a conservative estimate for potable reuse in San Diego County.
5. Colorado River Water Transfers energy intensity citation. Natural Resources Defense Council, *Energy Down the Drain – The Hidden Costs of California's Water Supply*, August 2004. San Diego County - Energy and Urban Water (case study), Table 8, p. 34.
6. State Water Project Transfers energy intensity citation: Natural Resources Defense Council, *Energy Down the Drain – The Hidden Costs of California's Water Supply*, August 2004. San
7. Energy intensity of desalination linked to NRG Encina plant OTC: See desalination calculations in text.
8. Energy intensity of desalination without OTC: See desalination calculations in text. There are variables that can increase or decrease the energy demand of "cold water" desalination relative to OTC desalination. These include the energy impacts of sub-seafloor intakes compared to using the heated discharge water from OTC. Cold water desalination issues are discussed in: *Engineering Feasibility Report: Dana Point Ocean Desalination Project* April, 2007, Chapter 4, p. 4-4. See: www.mwdoc.com. The executive summary of the engineering report with graphics of the sub-seafloor intakes is available at: http://www.mwdoc.com/documents/ProjectOverviewDanaPointOceanDesalinationProject-ExecutiveSummary.pdf. The assumptions used in Table 1 for the energy intensity of desalination without linkage to an OTC are taken from the Dana Point desalination feasibility study. The estimate for Dana Point is an average of 7 MW continuous energy demand to produce 16,000 AF per year of desalinated water. See p. 5, executive summary: *"The project site is located in Dana Point, California on property owned by South Coast Water District. The project capacity is estimated at 15 MGD or about 16,000 AFY. Electrical energy service provider is San Diego Gas & Electric Company and plant load will be 6 to 8 MW at 12 KV service."* This equates to an energy intensity of 3,830 kWh per AF if an average continuous energy demand of 7 MW is assumed to produce 16,000 AF per year.
9. SDG&E assigns a CO_2 emission rate of 915 lb per MW-hr (or 0.915 lb per kWh) for unidentified power purchased for use in SDG&E service territory.
10. The CO_2 emission rate for natural gas is 117 lb per million Btu. The heat rate of the two largest and newest units at Encina, Units 4 and 5, is approximately 10,000 Btu/kWh. These are the two primary operational units at Encina. The three older units, Units 1-3, rarely operate. As a result, the CO_2 emission rate is 1,170 lb CO_2 per MW-hr (or 1.17 lb per kWh) of power generated at Encina.