

Ocean Desalination: A Problematic Response to Water Scarcity

As climate change accelerates and corporate misuse of water becomes more acute, some governments are turning to ocean desalination as a way to produce more water. However, desalination is expensive, energy intensive, and environmentally destructive, and it creates burdens that fall on communities that are already impacted by a host of other environmental injustices. Rather than flushing money away on costly industrial water fixes, governments should focus on reining in the biggest water abusers and investing in conservation and other sustainable water resilience strategies.

What is Ocean Desalination?

Ocean desalination (desalination) refers to a range of processes designed to remove salts from ocean water using various technologies. The most prominent process in the United States involves reverse osmosis, which relies on a semi-permeable membrane that permits water to pass through while blocking the salt (as well as other minerals and particles). The “separated materials,” also known as brine, are then “disposed of,” and the product water is moved into post-treatment and distribution.

While this may sound good in theory, it comes with a host of problems.

Hidden Costs of Ocean Desalination

Ocean desalination is extraordinarily costly

Despite years of deployment, ocean desalination remains much more costly and inefficient than other water options. The largest drivers of these costs are infrastructure, maintenance, and high energy expenditures. Desalination opponents estimate a cost range for multiple U.S. facilities of between \$2,500 and \$4,100 per acre-foot¹ (water needed to cover an acre with one foot of water², or enough water to supply around three U.S. households for a year³).

At the Southern California Carlsbad facility, the largest desalination plant in the U.S.⁴, untreated desalinated water is around \$2,725 per acre-foot.⁵ This is 73 percent higher than 2023 prices for San Diego’s current water supply, which comes primarily from Northern California and the Colorado River.⁶ The cost of the untreated desalinated water from the plant is expected to increase to \$3,736 by 2026.⁷

Costs also increase with decreasing facility sizes, so smaller facilities being considered will be even more expensive. In comparison, rainwater harvesting and processing, a more sustainable approach to obtaining water, costs around five times less than desalination.⁸ Conservation, another simpler and “cost-negative option,”⁹ was implemented in California towns along the Monterey Peninsula prior to the recently approved Marina desalination plant; households ended up cutting their water consumption to less than half of what most Californians use.¹⁰

High costs are borne by ratepayers

The high cost of desalination is shouldered by ratepayers, which is one reason communities reject desalination. Often these costs are not transparent and may leave residents uninformed about what part of their water bill is going toward desalination.¹¹ In Marin County, California, regulators rejected desalination in favor of more sustainable and affordable water supply options.¹² Southern California’s West Basin Water District opted against desalination in part because a proposed plant would have raised the community’s water rates by 10 percent per year for the next decade.¹³

Desalination costs are not shared equally

With desalination, low-income, disadvantaged households face disproportionate water rate hikes, as reflected in a 2022 drought study.¹⁴ Those projected, locked-in costs for utilities almost always reduce affordability for low-income households and were a primary reason for opposition to a recently approved desalination project in Marina, California. According to the mayor, “Marina gets none of the water, but all the harm.”¹⁵

From Public Resources to Private Profit

The privatization of ocean desalination exacerbates cost issues and interferes with the human right to water

Private involvement in desalination, often through public-private partnerships, drives up costs and perpetuates inequality. Low-income communities — such as those in the San Diego area impacted by Poseidon’s Carlsbad plant, which began operations in 2015 — are often left to deal with short-term, drastic increases in prices. Between 2015 and 2018, their water rates increased an estimated 17 percent,¹⁶ while a long-term comparison shows an increase of 60 percent from 2010 to 2018.¹⁷ As a result, in 2018, as much as 62 percent of low-income people in San Diego were living in areas where their water bills were unaffordable.¹⁸

In some cases, as in the city of Marina in Monterey County, these communities end up paying a high price (around \$8,000 per acre-foot)¹⁹ for desalinated water that they do not even receive or in some cases need. In Marina, the supply will be “allocated” to wealthier, whiter communities, while some Marina residents will be forced to choose between eating and buying water.²⁰

Ocean desalination leads to the loss of local control of water systems and ignores community needs

Desalination projects can have long contracts of 30-50 years,²¹ locking in disadvantaged communities to years of higher water rates, as was the case for a proposed Poseidon plant in Huntington Beach in Orange County, California,²² and for the existing Carlsbad plant in San Diego.²³ The effects of these contracts can be hidden through biased outreach efforts and misleading messaging that often facilitates community division and contains class bias.²⁴

Desalination is talked about as an investment — one that community members will not benefit from.²⁵ Meanwhile, it serves as a distraction from their need for affordable, sustainable water solutions. Furthermore, these contracts are made by local water wholesalers who, despite being aware of high costs and regulatory requirements, often force the project “on the backs of ratepayers” for the sake of a 30-year contract.²⁶

Environmental Health Risks

Desalination harms the ocean environment

One of the biggest problems with desalination is the widespread practice of pumping brine, or highly concentrated salt water, back into the local marine environment. In most seawater desalination processes, the recovery ratio for viable water is very low (0.42),²⁷ which results in 1.5 liters of brine being created for every liter of potable water produced.²⁸ This brine is often polluted with chlorine and copper and laced with different solvents, anticorrosion, and cleaning agents used during desalination.²⁹

Despite dilution efforts, these extremely salty concentrations can degrade aquatic ecosystems, create oxygen-deprived layers (hypoxia), and cause ocean acidification that is deadly for marine life.³⁰ Brine can also have a significantly higher temperature than ocean water, which can cause harm to the marine environment.³¹ In May 2022, the proposed Poseidon desalination plant in Huntington Beach was rejected in part because of the long-lasting environmental impacts on local marine life.³²

Plant construction can damage ecosystems

Construction of a desalination plant involves the installation of various equipment and infrastructure that subjects multiple ecosystems to different forms of air, noise, and water pollution from dust, fumes, and other emissions.³³ Heavy metal pollution in associated disposal sites may be further exacerbated by higher temperatures — primarily from plants using thermal technology — that increase the toxicity rate of chemicals found in brine.³⁴

Energy use increases air pollution

In addition to the direct impacts of ocean desalination plants, these plants are energy intensive — and nearly half of that energy comes from power plants that run on fossil fuels.³⁵ Fossil-based power plants contribute to air pollution, which is linked to a litany of diseases, including asthma and bronchitis, as well as premature deaths.³⁶

Climate Change and Desalination’s Thirst for Energy

Ocean desalination is incredibly energy intensive

Producing desalinated water using reverse osmosis requires significant energy — much of which is produced using fossil fuels. For this reason, the Intergovernmental Panel on Climate Change has called desalination “maladaptive” and warns that it could reduce our ability to adapt to climate change because of energy-related tradeoffs.³⁷

An average-sized desalination plant with reverse osmosis consumes between 2 and 7.5 kilowatt-hours³⁸ of electricity and emits 0.90 to 3.38 kilograms of carbon dioxide (CO₂) equivalent per cubic meter of product water. This means that the climate pollution created by the power needed to run desalination facilities is equivalent to driving around 2,500 to 52,000 cars for a year (see Table 1).³⁹

TABLE 1: Theoretical Energy Use and Emissions of Desalination Plants Running 24/7					
Plant Size	Total Water (in m ³ /Day)	MWh Daily (min/max)	MWh Annually (min/max)	CO ₂ Emissions (in Metric Tons/Year)	Equivalency in Cars Driven per Year
Large	190,000	380 – 1,425	138,700 – 520,125	62,488 – 234,332	13,905 – 52,146
Small	35,000	70 – 263	25,550 – 95,813	11,511 – 43,167	2,562 – 9,606

Source: U.S. EPA

According to the annual megawatt-hours reported by the California Coastal Commission in its report on the proposed Huntington Beach plant, an equivalent of 119,841 metric tons of CO₂ would be released during each initial year of operation — the same as driving 26,668 cars for one year.⁴⁰ The existing Carlsbad plant uses enough electricity to power 35 small towns, with annual emissions equivalent to 138,132 metric tons of CO₂.⁴¹

Desalination proponents greenwash their emissions with misleading emission reduction claims

Desalination corporations attempt to mask high energy requirements with misleading claims of reductions. The Poseidon Carlsbad plant proudly touts an annual reduction of 41,000 metric tons of CO₂ via the capture of hydraulic energy, but this accounts for only around 30 percent of the plant’s total estimated CO₂ emissions.⁴² While independent research efforts are undertaking the

challenge of integrating the use of renewable energy in desalination processes, they are still faced with the common tradeoff between energy necessities and the reliance on fossil fuels for gaps in service.

Environmental Injustice in Every Drop

Desalination projects often have significant environmental justice impacts, with lower-income communities and communities of color shouldering the burdens while the benefits go toward wealthier, whiter residents.

The Coastal Commission recently approved a California American Water Company (Cal Am) desalination facility in **Marina in Monterey County**, where a third of the population is low income and many people speak little English.⁴³ The community is already burdened by a regional landfill, a sewage plant, and a Superfund site, yet Marina residents will not benefit from the desalination plant.⁴⁴ The expensive water that residents will end up paying for would be distributed to other wealthier, whiter residents and businesses in Pacific Grove and Pebble Beach.⁴⁵

The proposed desalination plant in **Huntington Beach** would have created a similar health and human rights issue by being sited in a part of the city where poverty levels range drastically higher than in the luxury urban core.⁴⁶ Homes located in this “toxic triangle” are further impacted by numerous landfill sites and power plants, including multiple Applied Energy Service power plants.⁴⁷ Emissions generated from producing the energy needed to power desalination would further expose people living in the vicinity to health-related risks linked with air pollution over the decades specified in the proposed contract.

Interviews with community leaders also provide insight into the divisive discourses that Poseidon created during its proposal. These discourses were implemented through targeted canvassing efforts, mixed messaging and disconnect, scheduling inconvenient times for community feedback, and perpetuating the false narrative that the Latino community should support desalination as a “diversity” initiative.⁴⁸

In **Corpus Christi, Texas**, with the help of a nonprofit organization, residents of the Hillcrest neighborhood submitted a civil rights complaint to the U.S. Environmental Protection Agency, the Department of Housing and Urban Development, and the Department of Justice against the city for violations against Title VI of the Civil Rights Act, based on the city’s decision to locate the Inner Harbor Desalination plant in the historically African American area. This decision would result in dire health outcomes for Hillcrest residents, who suffer from disproportionately “high incidences of cancers, asthmas, and birth defects.”⁴⁹ The City’s official statement, given during two public permitting meetings, provides evidence that they do not aim to “interrupt people” in a

“neighborhood,” referencing its desire to avoid placing the facility in the wealthy neighborhood of Ocean Drive that is 87 percent white and only 2 percent African American/Black.⁵⁰

Better Options Are Available

Desalination is costly, inefficient, and environmentally harmful. The burdens of desalination often fall disproportionately on low-income communities and communities of color. Desalination is also unnecessary. Rather than moving forward with this costly, environmentally harmful, and unjust process for obtaining water, state and local governments should advance policies that take on wasteful water use by big agribusiness companies and fossil fuel corporations. Governments should also promote investments in water conservation, green infrastructure, and upgrading and reducing leaks in our aging pipe system and move forward in concert with impacted communities.

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