

California to tackle water scarcity by converting seawater

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In this April 25, 2014, photo, Joshua Haggmark, interim resources manager for Santa Barbara, California, stands next to a desalination plant, which removes salt from ocean water, in Santa Barbara. The city is considering restarting the plant as California withers in a drought. Photo: AP Photo/Alicia Chang

CARLSBAD, Calif. — Along this patch of the Pacific Ocean, construction crews nearly outnumber the surfers and sunbathers. As waves crash, the laborers are busy assembling what some hope will make water scarcity a thing of the past.

They are building the Carlsbad Desalination Project, which will convert as many as 56 million gallons of seawater each day into drinking water for San Diego County. The project is expected to cost \$1 billion to complete.

The desalination plant is being built by Poseidon Water, a private company. Customers in the city of San Diego will help pay for the plant through their water bills, which could increase as much as \$5 a month.

The building will house more than 16,000 reverse-osmosis membranes — salt filters, essentially. They will convert the Pacific Ocean into drinking water suitable for making coffee and watering lawns.

Thirsty State's Eager Anticipation

Reverse-osmosis desalination was invented in California in the 1950s, but since then it has mostly been used outside the United States. When the Carlsbad plant begins operating in 2016, it will be the largest desalination project ever built in the Americas.

The eyes of a thirsty state are on this project: It is an all-important test for an industry eager to expand in California, where residents are famously protective of their coastline and are accustomed to cheap water.

"This plant can't come online fast enough," said Bob Yamada, water resources manager at the San Diego County Water Authority, which serves 3.1 million people and is buying all of the plant's freshwater production. "It's drought-proof," he said. "It will be the most reliable water source we have."

Promise Of Water Is Not Cheap

The water authority's 30-year contract with Poseidon illustrates both the promise and peril of this water source. San Diego County agreed to pay for 48,000 acre-feet of water from the plant every year — whether it needs the water or not — to ensure a guaranteed supply. The water will cost \$2,257 per acre-foot, about double the price of the authority's most expensive supply now.

One acre-foot is enough to serve two average homes for a year. At a total output of 56,000 acre-feet, the plant would meet 7 percent of San Diego County's annual water demand.

Many conservation groups are critical of desalination. They argue that it comes not only with high costs, but with a lot of environmental risks as well.

"If you look at our choices based on costs and (environmental) impacts," desalination "should always be at the bottom of that list," environmentalist Conner Everts said. "It's kind of an engineer's dream, but there's a lot of challenges to it."

One of the big challenges is energy demand. Desalination requires more electricity than nearly any other water source, because water must be forced through reverse-osmosis membranes by high-pressure pumps. The amount of electricity needed drives up the cost of the water steeply. However, the San Diego County Water Authority expects the cost of imported water to rise over time, to a level where there would no longer be a price difference.

Potential Harm To Marine Life

Desalination involves two basic stages: seawater intakes and outfalls.

Desalination plants operate by drawing in seawater. Unless that intake is carefully designed, it can harm marine life. Reverse-osmosis filters are so fine that they allow only water molecules to pass — everything else entering the desalination plant is killed.

One solution is fish screens, similar to those widely used at water-treatment plants along California rivers. Carlsbad, for example, will use fish screens with openings just 1 mm wide — about the thickness of a credit card. These will strain out at least 95 percent of juvenile fish, but only 20 percent of all organisms, said Poseidon Vice President Peter MacLaggan. The remaining 80 percent — including tiny zooplankton and fish eggs — will be sucked into the desalination plant and killed.

“Those small things form the basis of the food web,” said Victoria Whitney, deputy director for water quality at the state water board.

The desalination industry worldwide largely favors screened intakes, because they are cheaper to build than the subsurface intakes favored by the water board.

With subsurface intakes, ocean water is drawn through pipes buried in the seafloor. Mud and sand act as a fine filter to screen out nearly all lifeforms. However, such intakes are far more expensive to build.

How To Deal With Leftover Water

The second major environmental concern with desalination is discharge water. Most desalination plants take in two times more seawater than the fresh water they produce. To produce 50 million gallons per day of fresh water, Carlsbad will draw in 100 million gallons of seawater. The leftover water is returned to the ocean as discharge water, but with its salinity — its salt level — doubled.

The discharge water is so salty that it does not dissolve well in the ocean.

“It’s like oil and vinegar — they stay separate,” Whitney said. “You end up with these very large dead zones ... where you have really salty water just sitting on the ocean bottom.”

Carlsbad will deal with this problem by mixing the salty water with cooling water discharged from a nearby power plant. As a result, the discharge water will be only about 20 percent saltier than the ocean.

Another approach is to use spray nozzles to spread the discharge water under the ocean surface. This helps the salty discharge mix with the ocean water. The water board currently recommends this approach. MacLaggan from Poseidon says, however, that the force of such sprayers is so great that it can kill some sea life.

Other Water Programs Discussed

Some cities in California are taking an entirely different approach to the water crisis.

Los Angeles Mayor Eric Garcetti last month announced an aggressive program to expand water conservation. He also ordered the city to cut its use of imported water in half by 2024. He named almost every potential option to reach that goal, including stormwater capture, water recycling, groundwater treatment and even new storage facilities. Desalination was missing from the list.

“We believe in being innovative and open-minded when it comes to tackling the water crisis,” mayoral spokeswoman Marie Lloyd said. “At the same time, we do understand that desalination is quite expensive today.”

Quiz

- 1 Read the sentence from the article:

Unless that intake is carefully designed, it can harm marine life.

Which of the following sentences BEST supports the above sentence?

- (A) Desalination plants operate by drawing in seawater.
 - (B) The remaining 80 percent - including tiny zooplankton and fish eggs - will be sucked into the desalination plant and killed.
 - (C) The desalination industry worldwide largely favors screened intakes, because they are cheaper to build than the subsurface intakes favored by the water board.
 - (D) With subsurface intakes, ocean water is drawn through pipes buried in the seafloor.
- 2 Select the paragraph from the section "Promise Of Water Is Not Cheap" that discusses how the costs associated with desalination will not be a problem in the long run.
- 3 Read the sentence from the article.

It is an all-important test for an industry eager to expand in California, where residents are famously protective of their coastline and are accustomed to cheap water.

Which of the following words BEST replaces the word "expand" in the sentence above?

- (A) elaborate
- (B) enlarge
- (C) flourish
- (D) increase

4 Select the sentence that contains a word that means the same thing as "judgmental."

- (A) It is an all-important test for an industry eager to expand in California, where residents are famously protective of their coastline and are accustomed to cheap water.
- (B) The water authority's 30-year contract with Poseidon illustrates both the promise and peril of this water source.
- (C) Many conservation groups are critical of desalination.
- (D) Some cities in California are taking an entirely different approach to the water crisis.