

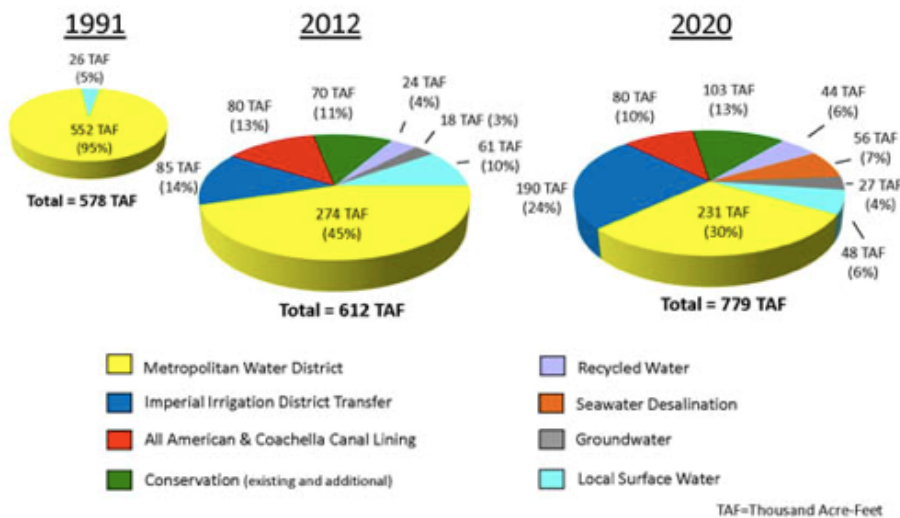
San Diego Water Consumption with Carlsbad Desalination Plant

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Abstract

Carlsbad is a desalination plant that is scheduled to be finished and running by summer of 2015. The plant will provide roughly ~6-7% of the water in the San Diego County (SDCWA). Desalination is the process of removing dissolved salts from ocean water or brackish water to produce fresh water (Cooley). How desalination works is through reverse osmosis in which the plant takes in large amounts of ocean water and passing it through fine pored membranes that separate salt and generate freshwater. Since rainfall varies and groundwater reservoirs decreases, desalination is a source of water that is reliable. The issues with the plant concerns its high energy demand since it requires more electricity than other water sources. Other issues involves impacts that it may have on marine organisms. Desalination plants need to be built on the highest standard to minimize ecological and biological impacts.

Increasing San Diego County's Water Supply Reliability through Supply Diversification



Introduction

When water supplies fall short and resources for water consumption becomes limited, many people turn to the ocean as the answer. One of the world's rapidly growing supplies of freshwater production is seawater desalination which is the process of filtering of water from the sea by reverse osmosis that involves the removal of dissolved salts from water. More recently, the desire for desalination increased in areas where freshwater supplies are limited. In California, the Carlsbad desalination project are aiming to use this method of water extraction to produce potable water for domestic and municipal uses and as a supplement to existing freshwater sources.

Approved construction of CARLSBAD desalination project by the coast of San Diego will provide reliable water and will serve as a response to the drought. The desalination plant will collect water from the ocean and the plant will treat it to remove salt and other compounds found. This project will focus on urban water demand which the desalination would supply 6% of (SDCWA). We will also address the benefits such as improving conservation and efficiency and concerns regarding desalination such as high economic and energy costs, environmental and social impacts and impacts on coastal developmental policies.

The problem to be investigated is the effectiveness of the proposed Carlsbad desalination plant in supplying water to San Diego County through the desalination of seawater. If it is found to be useful, it may provide a solution to increasing worries about drought, specifically in California. As freshwater resources are waning, turning to salt water may be the only solution. Once investigated in San Diego County, this model can be applied to other cities facing similar situations.

Objective

The problem to be investigated is the effectiveness of the proposed Carlsbad desalination plant in supplying water to San Diego County through the desalination of seawater. An analysis of various manipulated scenarios using real data from San Diego County will help us understand the effectiveness of the desalination plant. Results will be compiled in charts, with additional assessment of each. We will also address the benefits in terms of improving conservation and efficiency and concerns regarding desalination such as high economic and energy costs, environmental and social impacts and impacts on coastal developmental policies.

Data Sources

- San Diego County Water Authority: <http://www.sdcwa.org/carlsbad-desal>

Background information on San Diego County's water usage, as well as specific plans for the Carlsbad desalination project, were acquired from here. Overall financing costs and proposed dates for opening were also received from here. Other parts of SDCWA that we used were:

<http://www.sdcwa.org/water-use> and <http://www.sdcwa.org/734-million-carlsbad-desalination-project-financing-closes-0> and <http://www.sdcwa.org/water-authority-board-approves-landmark-seawater-desalination-project>

- California Department of Water Resources:

<http://www.water.ca.gov/desalination/2014DesalGrants.cfm>

Desalination projects can potentially receive grants from the state. Here, we were able to compare state funding for the Carlsbad project compared to other similar projects.

Overall, it was noted that the state does not provide much in the way of financing for these projects.

- Pacific Institute: http://pacinst.org/wp-content/uploads/sites/21/2013/02/financing_final_report3.pdf

The Pacific Institute gave us insight into environmental impacts and information about water usage in California.

Methods and Assumption

The method used is a cost-benefit analysis on the San Diego Region. The analysis will be done on a do nothing and Carlsbad scenarios. The assumption we make is that the annual consumer spending once Carlsbad is present is constant. The comparison between the two scenarios will focus only on the 7% of water that Carlsbad will be providing once it is running (SDCWA). The 7% of water is 50 million gallons a day, which will be converted to gallons per year and multiplied by the industrial cost of water. We are using the industrial cost of water because the distribution of the water is mostly going to commercial and urban areas. We will assume that Carlsbad will provide 7% of the water for 30 years. Within 30 year Carlsbad is mandated to undergo updates which can change the amount of water is provides for the San Diego County.

For the do nothing portion, the cost are related to current cost of providing San Diego County proportionate to the amount of water that Carlsbad plans on providing over the span of a year. Construction costs for this research is considered, but not applied as it was not funded by taxpayers. The plant is estimated to bring in 50 million dollars from consumer spending, while it has a 2.5 million cost for operational purposes. For this calculation we are only counting the direct benefits from the plant. As mentioned above, funding for the plant will not be counted towards the overall cost and benefit analysis since most of the investments are private investments.

Calculation/Results

Calculation used is the cost benefit analysis of the two date set. (SDCWA, pg.2) In order to a CBA analysis between the two scenarios, “Do nothing” Is computed by taking the amount of water Carlsbad is subjected to provide for a year and multiply it with the water rate to get a comparative amount to the cost of running the desalination plant throughout the year. Data was collected through the San Diego County Water Authority’s report and update on Carlsbad Desalination plant.

| Project | Do Nothing Water Cost (million \$/year) | Annual Maintenance (millions) | Average annual benefits (million \$ / year) |
|------------|---|-------------------------------|---|
| A (plant) | 50 | 2.5 | 47.5 |
| Do nothing | 113.44 | 113.44 | 0 |

Cost-Benefit-Analysis comparisons between the two scenarios

| Compare | Project | Benefit (B) (mln\$) | Cost (C) (mln\$) | ΔB (mln\$) | ΔC (mln\$) | $\Delta B/\Delta C$ (mln\$) | Decision |
|-------------|------------|---------------------|------------------|--------------------|--------------------|-----------------------------|--------------|
| | Do Nothing | - | - | | | | |
| Θ -A | | | | 47.5 | 2.50 | 19.00 | $A > \Theta$ |
| | A | 47.5 | 2.500 | | | | |

We also did a cost calculation of the entire plant

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$$47.7 \text{ million} + 2.5 \text{ million} = 50.2 \text{ million dollars in annual cost}$$

Compared to the annual cost without the plant

When the startup costs are considered, Carlsbad desalination is more expensive. Since most of the its funding has already been paid for, this analysis

Challenges

The difficulties that we encountered in analyzing this project and possible limitations to our results are: making comparisons for desalination costs can be difficult since desalination costs are influenced by many factors. Such factors are the amount of water the plant intends to supply, the number of people it is supplying, who they are going to supply and the water budget. Additional research is also necessary to determine the impacts of desalinated water on the distribution system. Currently, desalination is not a widely used technique and there is not an abundance of existing research on this idea. Desalination may also have unforeseen impact on the environment, especially marine life since marine organisms are killed on the intake screens (impingement) and smaller organisms such as planktons, fish eggs and larvae are killed during the processing of salt water (Cooley, 2013). Computing for the implementation of desalinating higher volumes of water is also a difficulty we faced since maintenance costs will change.

Conclusions

The data shows that the desalination plant will decrease the amount of money spent on the provision of water to the San Diego county. This is significant as the success in providing water through desalination provides an alternative way for counties to get water during droughts. The Carlsbad desalination project can be successful as long as it is efficient in the desalination and distribution of the water it treats and prevents any damages to the ecosystems. The desalination plant can become a good example and start for future desalination projects for counties that are vulnerable to droughts and fluctuating water supplies.

For now, we can firmly state that the plant will decrease the cost of water for only 6% of the water in San Diego's budget. The existence of Carlsbad desalination plant has various economic implications. One of those economic implication is the increase in the price of import water. This price varies each year, along with the interest rate of the different water resources.

Recommendation/Limitations

We recommend looking at funding and performance of other desalination plants that are already running and are established. The limitations of this project is due to the future increase of dependency on the desalination plant in the San Diego county; there was no way to determine how much the cost will change once the Carlsbad decides to desalinate more water [roughly about ~12% by 2020]. Therefore, research once the costs for these advancement are finalized should be conducted to see any further impacts the plant has for San Diego's water budget.

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