Co-Optimization of Water Security and Energy System GHG Emissions Performance

OVERVIEW

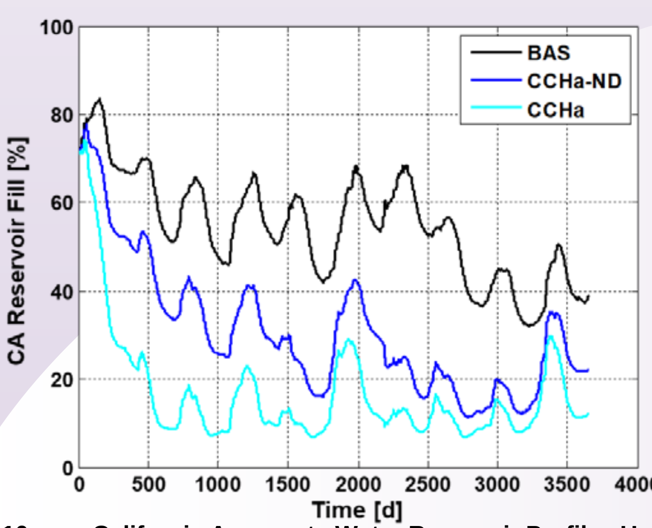
Motivated by the desire to build resilience into the water system against drought events, diversification of the water supply portfolio is taking place. New methods such as seawater desalination and water reclamation are increasingly becoming part of the water supply portfolio in arid regions such as California. These methods however, impose new energy demands on the energy system which itself is undergoing rapid transformation to meet renewable utilization and greenhouse gas reduction goals. This study focuses on how to best deploy water supply measures to achieve water security without upsetting the ability to meet energy sustainability goals.

GOALS

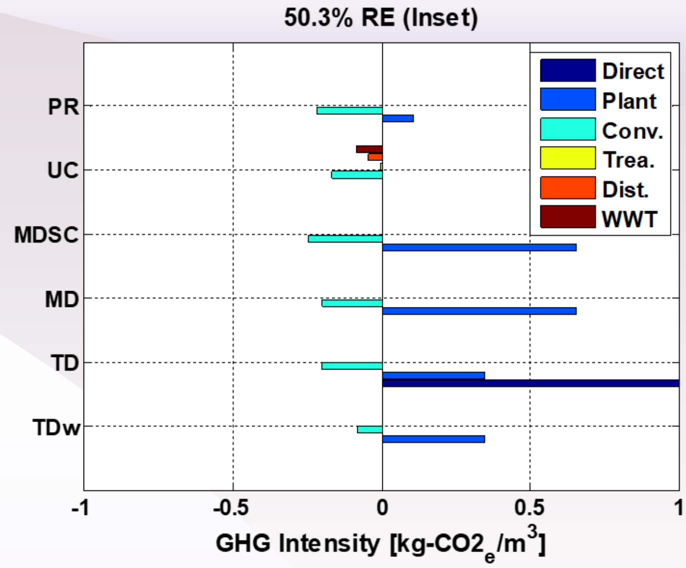
1. Determine and optimize the deployment of water resource measures to meet water demands while minimizing energy system impacts.

RESULTS

Water demands indicate that the scale of new water supply technologies needed are dependent on the strength of the impacts of climate change. Without climate change, water demands can be satisfied by deploying 38% of the state's overall water reclamation capacity. However considering the strongest impacts of climate change, realization of the full potential for conservation and water reclamation are needed in addition to seawater desalination. It was also determined that while water reclamation processes use energy, their spatial distribution of being sited closer to demand locations caused their deployment to actually decrease overall energy use by reducing the energy used for water conveyance in the state. This resulted in a net negative emissions impact for deploying water reclamation (PR) as well as for conservation (UC).



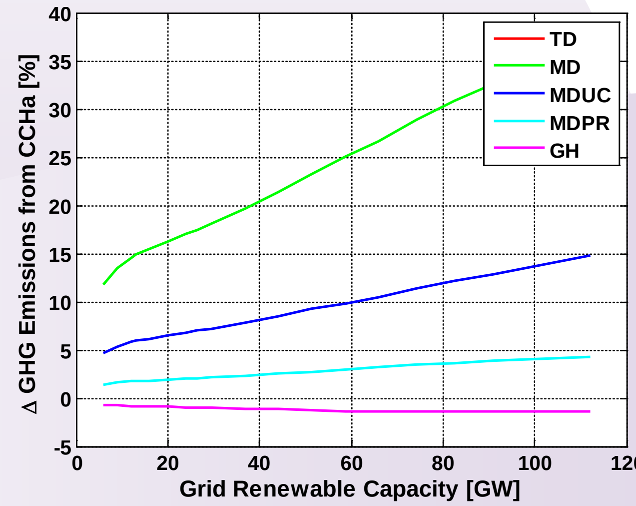
10-year California Aggregate Water Reservoir Profiles Under Historical (BAS), Climate Change with No Demand Change (CCHa-ND), and Climate Change with Demand Changes (CCHa).



Marginal GHG Emissions Intensity for Different Water Supply Measures by Process Component w/50% Renewable Electricity

RESULTS (continued)

By taking advantage of the benefits of reducing conveyance and other water infrastructure energy demands associated with water conservation and reclamation, it was discovered that future water demands could be satisfied with a resource portfolio that does not increase greenhouse gas emissions from the combined water and energy sectors. This configuration involves maximizing water conservation and reclamation to minimize the residual amount of energy intensive seawater membrane desalination needed.



Change in Greenhouse Gas Emissions Relative to the Case w/o Alternative Water Supplies for Different Water Supply Portfolios

PERSONNEL

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