DOW SUSTAINABILITY FELLOWS
UNIVERSITY OF MICHIGAN

Connecting Water and Energy in Michigan With the Michigan Department of Environment, Great Lakes, and Energy

2021

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Executive Summary

The 2021 Michigan Water and Energy Conservation Dow Sustainability Team is working with the Michigan Department of Environment, Great Lakes, and Energy (EGLE) to bring water and energy conservation efforts together as one. The objective of this project is to marry the two conservation efforts in order to lower energy and water bills, reduce water waste, and positively impact underserved Michigan communities. In addition to this, addressing water quality concerns in energy conservation will have numerous public health benefits. To achieve these outcomes, we will be completing an extensive national scan of efforts in other states, a predictive water leak data model, and interviews of water utility professionals to understand best practices for community engagement. The findings in this research will inform next steps to be taken by the State of Michigan in order to implement these conservation efforts. This final report provides suggestions to the state, policy recommendations, resources, and steps to implement this into communities.

The energy and water nexus describes the strong interdependence of present-day water and energy systems. Water is used throughout all aspects of energy production and energy is used for extracting, treating, and delivering water for human activities or for return to the environment. The weakness that comes with this interdependence is often exposed during extreme weather events. Droughts can reduce water availability, affecting power plants. Hurricanes and storms can cause power outages, affecting treatment and pumping of water. As these extreme weather events and water scarcity becomes more prominent with climate change, states are beginning to recognize the need to address the energy and water nexus and how the interdependency can be turned into a strength, as reduction in one often leads to reductions in the other. Unfortunately, the landscape of the nexus is vast and complex, leaving states unaware of where to start.

This project began when EGLE introduced the landscape of the water and energy nexus in Michigan. From this, the project was divided into three elements. The first element was to conduct a national scan of current water and energy conservation policies and initiatives being taken in states across the country; with the goal of discovering “best-practice” strategies. The second element was to develop a water variance tool in Tableau by combining a community’s residential data from an online database, such as Zillow, with community water consumption data. The tool provides a geographic representation of each home’s age, value and water consumption per square foot; ultimately showing which homes in a community are using far more water than their neighbors, indicating a likely source of water leakage. After validating the tool’s accuracy using residential and water consumption data from Highland Park before and after the Water Leak Pilot, EGLE has a new method to more effectively target water repair efforts within communities across Michigan. The third element of the project was to interview public water utilities in Michigan to understand the state guidelines they are required to meet, how water loss is quantified, and how potential water leakages are communicated to residents. After completing each phase of the project, these three elements were blended together in the final report provided to EGLE.

The national scan was divided into five different categories: Funding and Financing, Education and Technical Assistance, Structural Changes, Communication and Data, and Climate. Within Funding and Financing, it was found that states often provide financial incentives through grants and loans. In addition, they use Property Assessed Clean Energy (PACE) programs which finance energy and water efficiency measures. States focus on small utilities through Energy Saving Performance Contracting (ESPC), which helps them implement efficiency practices that help utilities save millions of dollars. States provide Education and Technical Assistance through workshops, databases of best practices, and aid in training and workforce development. Structural Changes often involve the state requiring water audits of each utility and planning to address areas of need. Communication and Data is often addressed by sharing a database of best practices and funding data collection efforts to improve water efficiency. Lastly, Climate strategies involve quantifying and reporting emissions related to water use and reductions related to efficiency.

The water variance tool developed for this project found a strong correlation between water savings and annual water usage of the communities studied. The tool found that home size, age, and value had no significant impact on water savings. However, larger water users were able to see greater utility savings after water leaks and efficiency measures were addressed in the house.

Interviews with public water utilities in Michigan on community outreach best practices provided insight on how to best address making improvements at the energy and water nexus at the residential level. It suggested having transparency in the level of community engagement and using clear language that residents are familiar with. Results also suggested having utilities work with other utilities with similar objectives. In addition, interviews found that utilities are already attempting to integrate water and energy efficiency practices into their communities, as they are starting to recognize the need to do so on their own.

The impacts of addressing this area can already be seen in Highland Park. With efforts undertaken to increase water efficiency within the community, they are projected to see water savings well over three million gallons per year. The associated carbon reduction of saving that much water is around 13,000 pounds. Not only are these reductions helping to meet environmental targets and mitigate climate change, but it also helps the residents too. The efficiency measures are expected to provide each household with average savings of $30 per month.

Aside from these quantitative measures, there are also qualitative values to implementing these practices. It addresses social justice measures as underserved communities are acknowledged through the opportunity to reduce the economic burden of high utility bills. In addition, the results from this project provide community benefits as they now should know how to make the most of their available resources. The national scan also resulted in an encyclopedia of policies and actions states have taken to address the nexus. With these compiled findings, Michigan now has a place to start when it comes to tackling the complex landscape of the energy and water nexus and creating change within both communities and the effort of mitigating climate change.

Introduction & Background

Motivation: In 2021, EGLE started the first Michigan Fix a Leak Week to start the conversation on how to bridge water and energy conservation efforts for a greater impact and policy and funding needed to sustain water and energy conservation efforts in disadvantaged communities. Fix a Leak Week is an initiative in the U.S. Environmental Protection Agency's (EPA) WaterSense Program. During Fix a Leak Week, which ran in mid-March 2021, residents were provided with the resources necessary to identify and repair leaks within their homes. EGLE recently launched a Water Leak Pilot in two disadvantaged communities with aging water infrastructures and homes, in which they piloted home repairs. These compounding factors lead to significant water leaks, wasted water, and the associated wasted energy. As part of the Water Leak Pilot, 100 homes in Benton Harbor, located in southwestern Michigan, and 100 homes in Highland Park, a city in metro Detroit, were provided with the funds and educational material needed to conduct a water leak audit of their home as well as connected with a local organization and plumber to help complete any necessary repairs. With the average US family losing approximately 10,000 gallons of water to leaks each year, finding ways to reduce leakages is crucial.[1]

Energy & Water Nexus: Energy and water systems are often seen as two separate entities when in reality, the two are tightly intertwined within present-day practices. Water is used all throughout energy production and electricity generation and energy is used when extracting, conveying, treating, and delivering water for human uses and returning it to the environment (*The Water-Energy Nexus*, 2014). This specific interdependency is addressed within the Fourth National Climate Assessment saying:

> "Given the interdependencies, resilience actions taken by other sectors to address climate change and extreme weather can have implications for the energy sector. For example, reductions in urban water consumption can result in reductions in electricity use to treat and convey both water and wastewater. California's mandate to reduce urban water consumption to address drought conditions in 2015 resulted in significant reductions in both water use and associated electricity use. Exploring the resilience nexus between sectors can identify the co-benefits of resilience solutions and inform cost-effective resilience strategies."

The impacts of the strong interdependency at the energy and water nexus are seen during numerous different severe weather events. In 2012, when severe drought affected over a third of the United States, limited water availability affected operations of some power plants. When Hurricane Sandy caused severe power outages, vital water infrastructure became impaired (*The Water-Energy Nexus*, 2014). Most recently in February 2021, Texas experienced a winter storm that was challenging for its infrastructure. Power outages prevented water treatment plants from properly treating water for days, leaving residents without clean drinking water. Lack of energy also caused water pump failures when water demand was increasing due to frozen

[1] US EPA, O. of W. M. (2017, February 3). *Fix a Leak Week* [Overviews and Factsheets]. US EPA. https://www.epa.gov/watersense/fix-leak-week

water pipes that burst. The low water pressure led to harmful bacteria growth within the water, exacerbating the water treatment issue (*State Insights on the Water-Energy Nexus*, 2021).

These issues are expected to become more frequent along with extreme weather events due to climate change. Climate change has already begun to affect temperature patterns and precipitation, causing impacts on water availability. Lower water availability for energy production will only be exacerbated by increased energy demand for cooling purposes as temperatures rise. These issues make addressing the energy and water nexus now crucial for future resiliency. The landscape around the nexus is complex and changing, with decision-making shaped by available technologies as well as environmental, political, economic, regulatory, and social factors (*The Water-Energy Nexus*, 2014). Luckily, utilities, governors, and state policymakers are becoming increasingly aware of this nexus and the need to conserve both resources to meet environmental and economic goals.

Methods

Literature Review: A national scan was conducted through an extensive literature and policy review of eighteen states known to be actively engaging in efficiency practices at the energy and water nexus. Much of the information deemed useful to the scan was found on state government websites that covered their policies and programs that contribute to their efficiencies. Following the practices of the National Governors Association, findings were then divided into five different categories: Funding and Financing, Education and Technical Assistance, Structural Changes, Communications and Data, and Climate. The Results and Recommendations section of this report provides a summary of findings and a reference point to the appendices where specific details and links to the information page are provided.

Water Usage Data Analysis: Household residential water consumption from the city of Highland Park was analyzed to support or disprove proposed hypotheses about what factors would be most beneficial in identifying candidate homes for Fix a Leak type events. The data were provided by EGLE and showed household consumption for all homes in the city before the repairs and consumption data for the homes that participated in the program following the plumbing repairs. The home repairs began in June and continued through the end of September so there is only one month of data (October 2021) that includes all of the homes post-repair. Data about the age, size (measured in finished square feet), assessed tax value, and estimated market value (Zestimate) for each home in Highland Park was collected from Zillow's API using Python Code. While an analysis of both Benton Harbor and Highland Park would have been more beneficial, EGLE at this time did not have accurate data on the pre- and post-repair water consumption at the household level. All statistical analysis was conducted using Microsoft Excel. Map visualizations were created using Tableau Data Visualization software.

Interviews & Community Engagement: In addition to a national scan of water and energy conservation initiatives, it was apparent that it would be useful to gather information about how utility managers can engage with communities in order to address the impact of water loss on consumers. To do this, we reviewed resources on best practices for community engagement for

public utilities as well as summaries of previous Fix a Leak programs. This content informed the final set of recommendations for community engagement. Along with literature reviews, we interviewed the Environmental Services Manager for the City of Grand Rapids to better understand their needs when it comes to identifying the need for leak reduction programs in their community and also understand how they engage with high use customers. While the interview was fruitful and informed the recommendations, it would be useful to speak with employees of other water departments across Michigan as well as with individuals with different job responsibilities within the water resource management sector to better understand the perspective of utilities and their desire to engage customers in conservation efforts.

Results and Recommendations

National Scan*[2]

Funding and Financing: Financial incentives are often provided by the state in the form of grants and/or loans. Many of these grants and loans are designated for projects that look to increase water efficiency or conservation which in turn saves energy and greenhouse gas emissions. Multiple states also have PACE (Property Assessed Clean Energy) and/or C-PACE (Commercial Property Assessed Clean Energy) programs that fund water and energy efficiency measures. States also make sure to provide a specific focus on smaller, rural utilities. Many of these measures come within Energy Saving Performance Contracting (ESPC) that help these smaller utilities implement energy reducing practices that allow them to save millions of dollars each year. Some states have even gone so far as to implement laws that focus on water and energy efficiency to strengthen water resources and provide assistance to low income communities.

Education and Technical Assistance: Many states look to provide education to utilities through workshops or by creating one shared space of best practices and suggestions that utilities in the state can go to when looking to enhance their knowledge of water and energy conservation practices. Some states create programs that hold workshops and create best practices manuals. Others look to create standards of water and energy efficiency and provide information to utilities on how to meet those standards. These workshops and best practices suggestions look to make people and utilities aware of the impact their water consumption has and the changes they can make to decrease that impact. States also look to focus on rural utilities by providing training and workforce development for these facilities. This can come in the form of providing free training and software to utilities or creating a webpage for small utilities to go to that provides them with information on finances, technical/operating, and managerial help. Technical assistance is often provided along with financial assistance, such as when ESPCs are used.

Structural Changes: One of the most common practices for enforcing structural changes involve states implementing required water audits at water utilities. They use the information from the audits to find leaky infrastructure and measure efficiency improvements. Other states

[2] Refer to Appendix E for specific details and sources.

have implemented water conservation councils that develop plans that guide industries on structural changes that address water and energy efficiency. One area a couple of states have specifically focused on is agriculture. States enact policies that use water wisely, strengthen drought resistance, eliminate water waste, and incentivize efficiency technologies. A few other states have rules that require water usage be taken into account when permitting new energy structures.

Communications and Data: One of the best ways for communicating information on the water and energy nexus practices involves creating a centralized location utilities in the state can go to find information on best practices. This goes hand-in-hand with Education and Technical Assistance. The location of these practices should be easy to find and often provided as a point of reference to utilities. In addition, it should be clear on the best way to implement these practices, essentially guiding the utilities through the process in a way that best suits their needs. In addition, some states use data collected either from water audits or water measuring and tracking to clearly identify opportunities for improvement. For example, Wisconsin has an annual reporting program that creates data-informed partnerships between local government and utilities. In terms of communication, Michigan already has established the Office of Clean Water Public Advocate which connects the Governor's office with utilities to ensure effective communication exists.

Climate: Many states look to address the climate by quantifying the greenhouse gas emission reductions that occur from water conservation practices. For example, the state of New York was able to develop a tool that specifically measures greenhouse gas emissions for water sustainability emissions. In addition, states often create climate goals that involve a reduction in greenhouse gas emissions and involve the ways they plan to address those emission cuts. A good practice when doing this is to hold the state accountable by releasing annual reports that provide progress updates on these goals. Rhode Island, for example, created a climate council that sets reduction targets and requires member agencies to consider their climate change impacts.

Water Variance Tool

Findings: The analysis of the water usage data before and after repairs in Highland Park provided several important findings. The first was that homes that consumed the most water before repairs had the greatest water savings following repairs. While this is intuitive, it has major implications for any leak-fixing program and was reaffirming. This correlation is shown in Appendix A. This reduction in water usage resulted in the greatest utility savings for the homes that had previously used the most water. The payback period for repair work is shown in Appendix B. Finally, homes that received repairs on average used 14% more water than the average home in Highland Park.

Major Considerations: Highland Park was easy to analyze because most homes are similar sizes and major uses of water such as swimming pools or irrigation systems are not common. There was no correlation found between the age of the home, square footage, or estimated home value and the water savings from repair work. This could be attributed to Highland Park

having a somewhat homogenous housing stock that is generally from the same era and has not been as well maintained. In communities with more diverse houses with regards to age, size, and value, correlations between water savings and these factors may be found. One major shortcoming of this form of data analysis is the difficulty in accounting for the number of residents. A home with a serious leak with a single resident may have the same water consumption as an identical home with no leaks but a family of four living there. While these data would be useful, gaining access could prove difficult and lead to privacy concerns. **Implications:** If the goal of the program is to reduce system water consumption and associated energy usage, then the program should focus on the top consumers of water. If the objective is to alleviate the financial burden on residents, then focusing on the top consumers will also be the most beneficial. However, if community goals include assisting certain population segments (extreme poverty, disabilities, elderly), then water consumption should be paired with demographic information to prioritize repairs based on water consumption and homes with at-risk residents. Finally, some of the savings were quite significant. This could be extremely beneficial in alleviating pressure on the water utility if they are near capacity. A municipal water utility could finance a fix-leak-program using a payment structure similar to Energy Performance Savings Contracts where residents pay for repairs over time with savings on their utility bills.

Engagement Best Practices: Every day, 6 billion gallons of treated water is lost within the United States (*The Case for Fixing the Leaks*, 2013). This apparent loss of water or treated water that is lost to leakages within the water distribution system is concerning because it contributes to a waste of both potable water and the energy that was used during the water treatment and distribution process. While all drinking water systems have apparent losses, if customers have leakages within their homes, they bear the costs for water that is measured by their meter but never used. The following examples highlight strategies utility managers and municipalities have taken to engage community members in efficiency programs focused on the water-energy nexus.

The American Water Works Association (AWWA), an organization focused on connecting and providing resources to water supply professionals, provides two recommendations for engaging residents in water management initiatives that are particularly applicable in Michigan. First, they recommend pairing waste reduction programs with other community benefits such as workforce development or environmental education. Reviewing previous Fix a Leak campaigns, a common activity used to encourage participation in identifying household leaks is hosting a water conservation education program for elementary and middle-school-aged children and encouraging them to be “leak detectives” within their own homes (*Fix a Leak Week 2016: Campaign Summary*, 2016). Engaging students in water and energy conservation efforts is a low-cost method for investigating potential leakages within water utilities that do not utilize advanced water metering technology. Furthermore, a study of a student water conservation education program in Dallas, Texas found a significant decrease in water use within single-family homes in the year following the program (Serna, 2014). While this is not a direct identification of the effectiveness of grade school environmental education programs, it does highlight the value of bringing the youngest members of the community into conservation efforts.

Along with pairing interventions with larger community benefits, engaging the community throughout the process of developing and implementing efficiency programs is central to building trust and ensuring the needs of residents are being met. The AWWA points to the five levels of engagement derived by the International Association of Public Participation (IAP2) which detail to what level a utility may be interested in resident participation (*A Water Utility Manager's Guide to Community Stewardship*, 2019). These different stages include informing the public which focuses on providing information, consulting, which involves gathering resident feedback, involving, which encompasses consistent inclusion of public concerns into considerations, collaboration, which champions partnering with the public and including as much of their perspective as possible in decision making and lastly, empowerment, which involves allowing the public to make the final decision on how an initiative would be implemented. Clearly defining the desired outcome from community participation during the planning stages of a waste reduction program is crucial for managing both utility and community expectations (*IAP2 Spectrum of Public Participation*, 2018).

Along with these guidelines for clearly defining the level of public participation desired in a program, it is also necessary to budget and plan for the resources needed during public engagement events. The US Environmental Protection Agency (EPA) recommends a few key practices to keep in mind after the desired level of public engagement has been defined. These recommendations include outlining base-level programs needs, such as staff time required for planning and following up on community engagement efforts. Equally important, utilities should plan for technical assistance needed to reach residents and potential schedule delays that could impact public involvement such as inclement weather or public health concerns (*Plan and Budget for Public Involvement*, 2003). Lastly, using language residents understand throughout the engagement process should be a high priority. Patrick Gubry, the Conservation Manager at Wayne Metro Community Action Agency, recommends describing savings from water efficiency and repair programs as a "dollar amount" to provide residents with a more meaningful metric of savings as opposed to the total volume of water saved (Michigan EGLE, 2021). To address language access differently, Fort Worth, Texas' water utility worked with the WaterSense program to create Spanish language material and leak identification kits to better serve their Latino community (*Fix a Leak Week 2017: Campaign Summary*, 2017). This effort allowed the utility to meet its outreach goals and increase equity in access to repair and education materials. These materials are now publicly available and tools like EPA's EJSCREEN can allow utility managers to locate linguistically isolated communities within their jurisdiction and develop materials that are relevant to the languages their residents are most familiar with (United States Environmental Protection Agency, 2014).

One final tip for effective community engagement is to focus on partnerships. Many energy utility companies have programs in place to support disadvantaged residents. Collaborating with these organizations can support the capacity for water utilities to distribute information about water efficiency programs. For example, working with energy utilities that already have information about residents who qualify for efficiency programs can lighten the burden on residents looking to apply for water leak repair assistance (EPA WaterSense, 2021). Thanks to funds from the American Rescue Plan Act, the Minnesota Department of Commerce now makes

it possible for residents to apply for water and energy bill assistance with a single application (*Minnesota's Energy Assistance Program Expands to Offer More Benefits, Cold Weather Rule Protections Start Earlier*, 2021).

To complement building partnerships among utilities, building utility managers should also consider creating partnerships across existing local organizations. Working with trusted local leaders provides an avenue for utility staff to build new relationships with residents and begin working to understand the priorities of community members (Michigan EGLE, 2021). Such initiatives have already been undertaken in Benton Harbor for the Fix a Leak pilot by collaborating with organizations like the Michigan Welfare Rights Association and The Highland Park Human Rights Coalition to connect residents with household leak repair opportunities (Terranealla, 2021). Smaller utility companies could follow a similar model by engaging with after-school programs, churches, or community groups to understand the key stakeholders utility staff should engage with. Before establishing partnerships, however, it is important that utilities and organizations are working to fulfill the mission of both institutions and clearly define what each partner is willing to commit to the initiative, whether it be financial assistance or volunteer time (EPA WaterSense, 2021).

All in all, building trust, sharing and receiving knowledge, and being open and honest about project goals are fundamental aspects of engaging communities with water and energy efficiency initiatives. The success of previous Fix a Leak campaigns and water utility projects has shown the potential that can come from partnerships between utilities, non-profits, and across communities to help underserved communities address water loss while also limiting the waste of valuable natural resources.

Project Impact

Reduced Water Consumption: Based on the initial data from EGLE, the Fix a Leak program in Highland Park saved approximately 314,000 gallons of water in October 2021 compared to October 2020 for the 106 homes in the program. This is almost 3,000 gallons per home. If these savings are annualized, it results in the program saving over 3.7 million gallons each year for the city. Since most of the indoor plumbing issues were leaks that filtered back into the sewer system, this reduction benefits both the upfront water pumping and treatment as well as the wastewater treatment.

Reduced carbon emissions: A major task of this team was evaluating the energy impact of water waste and the associated emissions impact. Highland Park uses surface water from the Detroit River and Lake Huron. The embodied water energy to treat, use, and dispose of 1,000 gallons of surface water is 2.16 kWh. (Energy-Water Nexus Report). That means the water savings will reduce energy consumption for the water utility by approximately 8,100 kWh each year. This is about 80% of the energy used in an average American home in a year. DTE is the utility provider for southeast Michigan. Based on their average emissions, this program reduced carbon emissions for the Highland Park Water Department by 13,000 lbs. This does not account

for potential savings in hot water leaks since the initial data from EGLE did not indicate which, if any repairs targeted heated water versus tap water issues.

Cost savings: Based on Highland Park's water rates, this program resulted in customer savings of $3,000 in the month of October 2021. On their monthly bill, about one-third of program participants saved less than $20, another third saved between $20 and $40, and the remaining third saved over $40. These savings were on water and sewer only. Any hot water savings from repairs would be reflected in lower electric or gas bills. These savings were not identified in this analysis as the data was not available.

It's difficult to identify the savings for the Highland Park Water Department. The city does not have its own water treatment or sewer services and instead relies on the Great Lakes Water Authority to provide these services. While it is not known exactly what rate Highland Park pays to GLWA, the lease agreement states that rates are based on a 24 month average. That means savings from the Fix a Leak program will take time to lower costs for the City of Highland Park. Additionally, a large portion of the fees paid to GLWA are fixed which means reducing water consumption will have an even smaller impact on Highland Park's costs.

Social Justice: Addressing water leaks provides the opportunity to reduce the economic burden high water bills may place on low or fixed income households. Further, by specifically targeting individuals who may not have the resources or physical ability to implement water efficient appliances or repair leaks around their home, this project supports households that would otherwise face high water and energy costs.

Community Impacted by project: Primarily, our project aims to impact low-income communities in Michigan. By demonstrating more effective methods to improve water efficiency in low income areas, our project could improve the implementation of future water-leak initiatives. Furthermore, by presenting a variety of policies that other states have adopted to fund water + energy efficiency, it could also serve as a springboard for EGLE to implement water + energy nexus policies in Michigan. Generally, these policies benefit low-income communities more directly than high income communities by distributing financial resources from the State Government to low-income areas.

Additionally, our project benefits higher-income communities in the state. While the solutions we've identified tend to provide extra benefits to communities that lack sufficient resources, they also benefit all other communities in the state. For instance, high-income communities can implement the more efficient water-leak program methods we have identified, just as in low-income communities. Utilities in these communities can also benefit from programs created by the state, such as technical assistance programs.

Community benefits: As discussed above, our project aims to provide two buckets of benefits to impacted communities. First, we hope that our data analysis shows EGLE a more efficient manner by which to implement water leak programs. This will increase the benefits these projects provide by making the most of the available resources. Second, by creating an

encyclopedia of policies used by other states, our project could enable the State to implement some of these here in Michigan. This would likely involve increasing the resources available to low-income communities.

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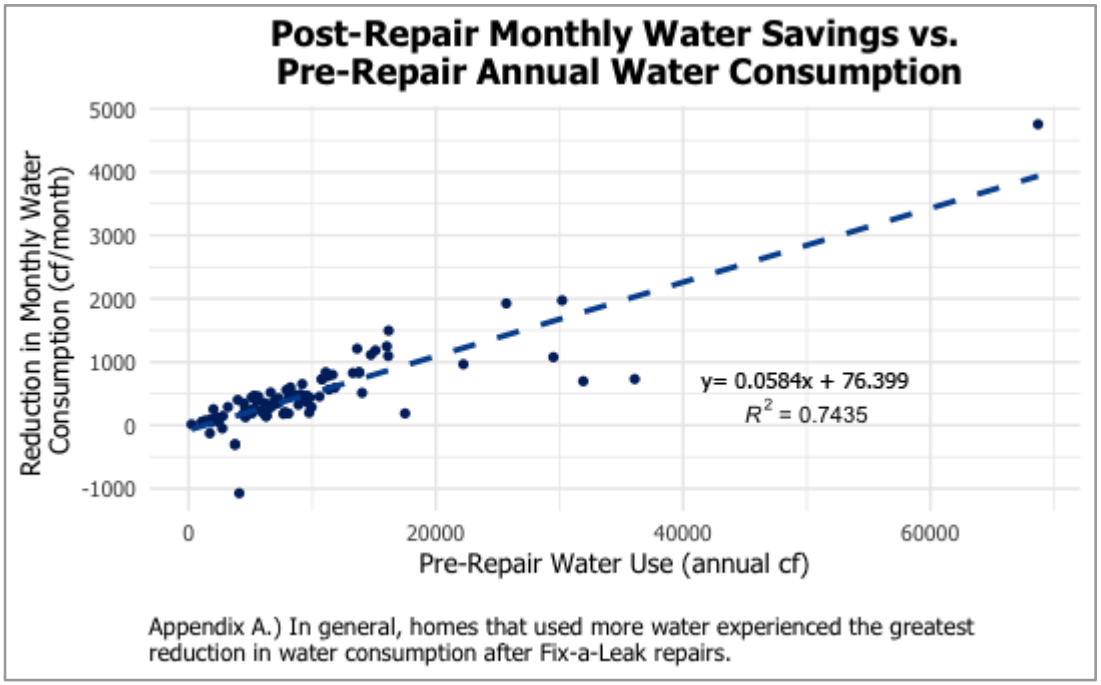
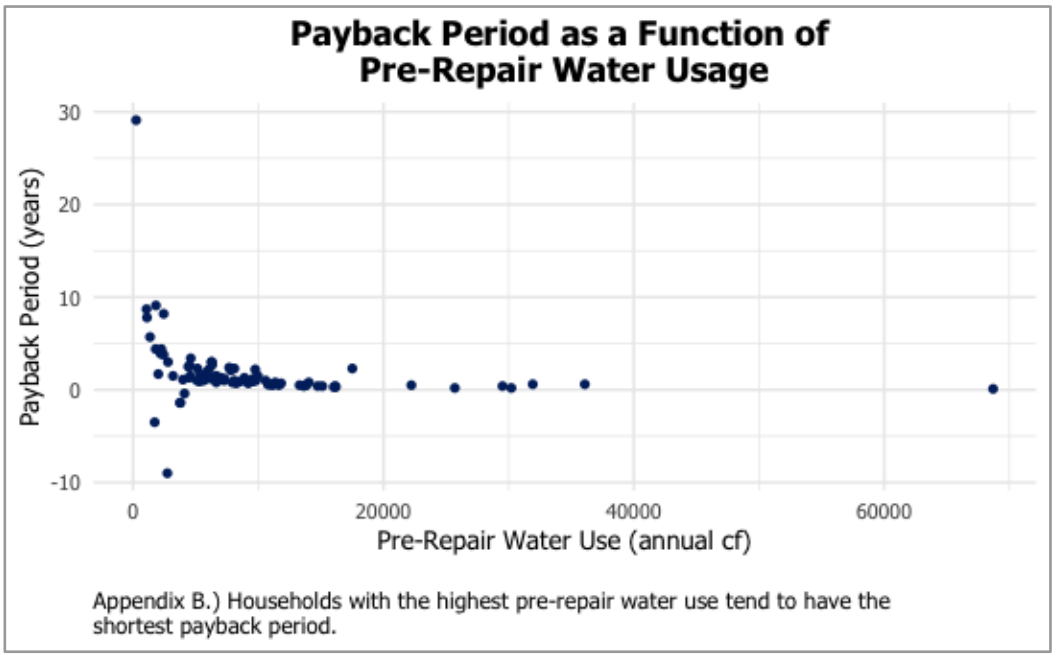
Appendices

Appendix A



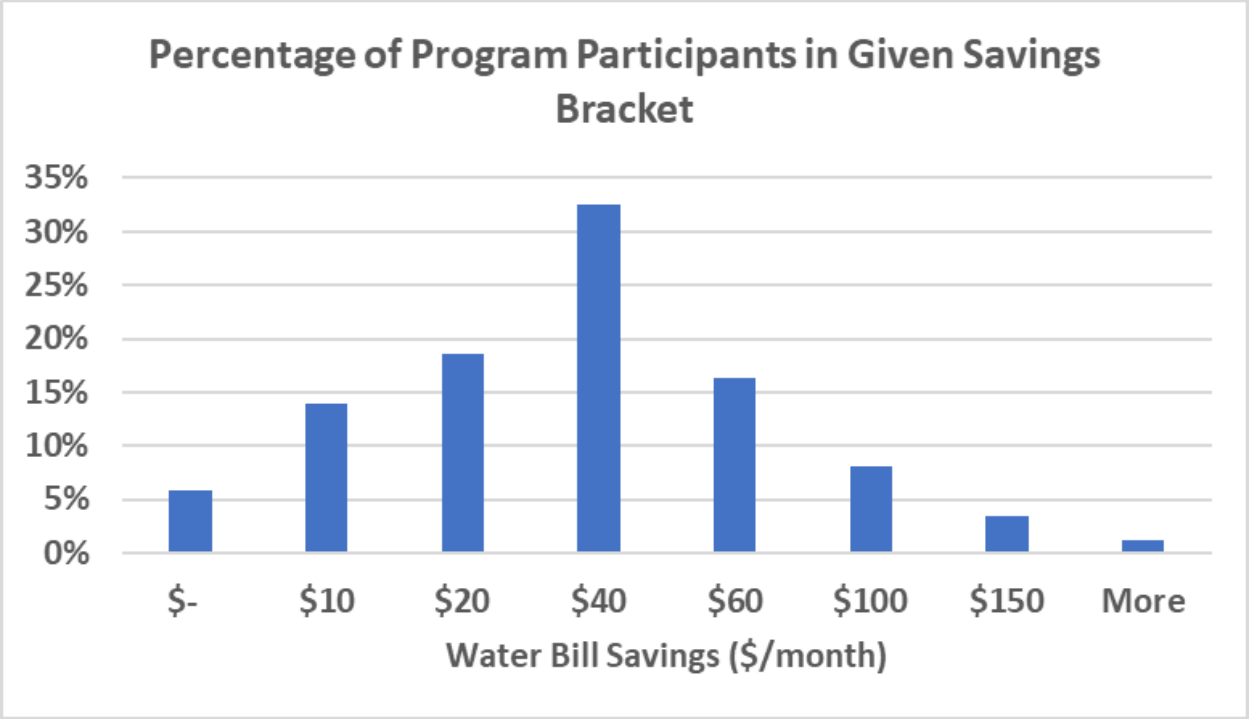
Appendix A.) In general, homes that used more water experienced the greatest reduction in water consumption after Fix-a-Leak repairs.

Appendix B



Appendix B.) Households with the highest pre-repair water use tend to have the shortest payback period.

Appendix C



Appendix D
DTE Emissions Associated with Power Production

Fossil Plant Emission or Nuclear Plant Waste in Pounds per MWh Jan. - Dec. 2020	DTE Electric Average per Megawatt-Hour (MWh)	Regional Average (per MWh) for Fossil/Nuclear Generation (MI, IL, IN, OH and WI)
Sulfur Dioxide	1.86 lb/MWh	1.92 lb/MWh
Carbon Dioxide	1,643.1 lb/MWh	1,927 lb/MWh
Nitrogen Oxides	0.88 lb/MWh	1.19 lb/MWh
High-Level Nuclear Waste	0.00588 lb/MWh	0.006 lb/MWh

Appendix E - National Policy Scan Comprehensive Findings

Funding and Financing

- *Financial incentives*
    - Arizona - The State has a Water Protection Fund that invests primarily in protecting riparian water resources. However, it also invests in projects that improve water efficiency for end users.

    - California - Water Energy Grant Program. Established by CA Department of Water Resources. Grant program that funds water efficiency programs and projects that reduce water and energy consumption. In 2014 and 2016, the grant funded commercial and institutional water efficiency programs, residential water efficiency programs benefiting disadvantaged communities, and projects reducing greenhouse gas emissions as well as water and energy consumption.

    - Colorado - The State has a Water Efficiency Grant Program that gives out loans and grants to communities to improve their water efficiency. The fund has an appropriation of $550,000 annually. The state also operates a fund for water provider infrastructure improvements that has an annual appropriation of $20m.
    - Massachusetts - Statewide Water Management Act Grant. Provides funds for planning assistance, demand management and withdrawal impact mitigation projects for eligible public water suppliers and municipalities with Water Management Act Permits. (Water Management Act requires permits to be obtained by anyone planning to withdraw water from ground or surface sources at an annual average rate above 100,000 gallons per day or 9 million gallons in any three month period).

    - Massachusetts - Gap Funding Grant Program. Established by the Massachusetts Department of Environmental Protection. Under the Clean Energy Results Program, Massachusetts DEP partnered with Massachusetts Clean Energy Center to offer a grant program designed to leverage the funding from other available programs. Provides grant assistance (up to $200,000 per community) for implementing energy efficiency and clean energy projects at water and wastewater plants.

    - Maryland - The Maryland Energy Administration provides grants and loans to homeowners to install energy and water efficiency-improving technologies. The State also finances water reuse technologies for water infrastructure improvements for water utilities and homes.

    - New Hampshire - New Hampshire has a Clean Water State Revolving Fund that provides loans for wastewater infrastructure improvements. The State also has a Drinking Water State Revolving Fund that funds improvements to water

infrastructure for public water systems. It also provides loans to disadvantaged communities to improve their water efficiency.

- Oklahoma - The State created a grant program for water conservation efforts. It provides grants to municipalities, schools, water districts, and not for profits for projects that reduce their water use or improve water conservation.

- Rhode Island - Water Facilities Assistance Program. Established by Rhode Island Water Resources Board. Grant program to finance up to 50% of design and construction costs for new public water supply facilities.

- Tennessee - Tennessee's State Revolving Fund Loan Program is administered by the Division of Water Resources at TDEC and provides low-interest loans and some loan forgiveness for water and wastewater infrastructure and improvements.

- Virginia - The state has sales tax holidays for Energy Star and WaterSense appliances. It also supports cost sharing for water retention technologies including rainwater harvesting and removal of impermeable surfaces.
- Wisconsin - Focus on Energy program provides funding for energy efficiency and renewable energy projects. It is funded by utilities that each pay 1.2% of their gross revenues to fund the program.

- *PACE for water efficiency*
    - Colorado - Water efficiency projects included in the State's PACE program. This allows residents and businesses to finance improvements to their water infrastructure through their property tax bill.

    - Maryland - Maryland includes water efficiency measures in the PACE and CPACE program.

    - Virginia - Virginia includes water efficiency improvements in the scope of its C-PACE program.
    - Michigan - Use Property Assessed Clean Energy (PACE) programs to fund water and energy efficiency measures in projects
        - Additional PACE information and a good figure at: https://leanandgreenmi.com/how_pace_works
    - Utah - Uses C-PACE (Commercial Property Assessed Clean Energy) funding for water and energy conservation projects
        - Additional Utah Specific C-PACE Website: https://utahcpace.com

- *Financial assistance to small utilities for efficiency*

- Arizona - Several agencies in the State provide funding to rural utilities and municipalities to improve their water efficiency and develop their water infrastructure. They provide this funding through both grants and loans for water and environmental conservation projects.

- Georgia - Georgia Environmental Finance Authority (GEFA) - Financing Water Efficiency and Conservation Projects. Provides low-interest financing through Georgia Conservation Fund to local governments for a wide range of water conservation projects in the areas of water loss and end-use water efficiency. Projects include installing or retrofitting water efficient devices, implementing incentive programs to conserve water (such as rebates for water efficient fixtures), installing water meters in previously unmetered areas, replacing broken or malfunctioning water meters or upgrading existing water meters with automatic meter reading (AMR) systems, recycling end water use projects, and replacing or rehabilitating distribution pipe to reduce water loss and prevent water main breaks.

- Massachusetts - State Revolving Fund (SRF). Loan program that offers affordable loan options to cities and towns to help protect their clean water and drinking water.

- Maryland - The State set up Energy Saving Performance Contracting for small utilities that want to install energy or water saving technology. The contracts pay for themselves through the financial returns on energy/water cost savings.

- Oklahoma - enables utilities, commercial buildings, and residential buildings to use energy saving performance contracting to finance energy and water efficiency improvements
- New Mexico - The state has Guaranteed Energy Savings Performance Contracts (GESPC) that have allowed utilities to make energy efficiency upgrades that will save millions of dollars per year. Current projects in the GESPC program are projected to save over a million therms of gas, 80.6 kWh of electricity, and 32.5 million gallons of water annually
- New Mexico - With the help of federal DOE SEP Funding, the state launched LEEP (Local Energy Efficiency Performance). LEEP helps local governments increase the use of energy savings performance contracts (ESPCs), which help reduce financial barriers associated with making energy efficiency upgrades. By executing ESPCs, there are no upfront costs required because building owners use future energy or operating cost savings to pay for the new energy-efficient equipment and services. This is done by guaranteeing that cost savings will meet or exceed payments for equipment and services over the contract period.
- New Mexico - The New Mexico State Energy Office was awarded a SEP grant titled “Financial Resiliency Through Energy Efficiency” (FREE). The objective of it

is to develop and deploy statewide energy practices that reduce energy use while generating new revenue for the state.
    - Minnesota - Uses Energy Savings Performance Contracting (ESPCs) to provide financial assistance to small, rural wastewater utilities
    - New York - Uses ESPCs to provide financial assistance to small, rural wastewater utilities

- *Energy savings in clean water state revolving fund criteria*

- *Water rate design reform*
    - California - Low Income Water Assistance Act (Chapter 662, Assembly Bill 401 - In Recess?). Bill required state board to develop a plan for funding and implementation of a Low Income Water Rate Assistance Program by 2018. Final report published in February 2020 outlines three-component program design: 1st component: direct water bill credits. 2nd component: renter's water bill credits. 3rd component: water crisis assistance.

    - Rhode Island - Rhode Island Water Use and Efficiency Act. Aimed to help assure reasonable, needed and adequate future water supplies by managing demand, reinvesting in water supply infrastructure and water supply sources, and protecting + preserving the health and ecological functioning of the water resources of the state. Aimed to strengthen water resources and supply planning by efficiently implementing water rates and supply system management plans that are designed to achieve appropriate infrastructure reinvestment.
- *Other*
    - Rhode Island - Clean Water State Revolving Fund. Established by Executive Climate Change Coordinating Council (EC4). Co-managed by Rhode Island Office of Water Resources and Rhode Island Infrastructure Bank. Provides below market rate financing for a wide array of water pollution abatement projects. Alternative energy and water efficiency projects that benefit a water pollution treatment facility are eligible.

    - Oklahoma - The State has a goal of using no more freshwater in 2060 than it did in 2012. This involves lots of future planning and likely more efficiency programs in the future.

Education and Technical Assistance
- *Training and workforce development for rural facilities*
    - Arizona - The ADWR supports several water groups and committees that provide information and technical assistance to rural utilities, municipalities, and businesses to improve water efficiency and environmental conservation.

    - California - Urban Water Use Efficiency. Established by CA Department of Water Resources. Provides information and assistance to water suppliers, agencies

and the public in several areas: Urban water management planning and other water supplier management and reporting requirements. Leak detection information and resources to reduce water waste. Understanding and implementing the Model Water Efficient Landscape Ordinance (MWELO). Commercial, Institutional and industrial water efficient practices. Tips on what individuals can do to save water.

- New Hampshire - The State provides free training and software to utilities to conduct water audits.
- Indiana - Indiana's Utility Regulatory Commission has a webpage for small utilities that provides educational resources. The website provides resources on finances, technical/operating, and managerial help.

- *State agency technical assistance*
  - Maryland - Maryland provides financial and technical assistance to homeowners, businesses, and water utilities looking to save energy and water.
  - New Hampshire - The State Department of Environmental Services offers regular workshops providing technical assistance to wastewater utilities and operators. It also provides information to the public on how to improve water efficiency measures.
  - New Mexico - The state implemented a "Waste-Not" program that looks to help low-income communities advance the energy management of their wastewater facilities by implementing Energy Audits that assess energy consumption and savings opportunities. In addition, they assessed developing and implementing renewable energy and energy conservation plans, measuring progress, and sharing lessons learned statewide. Their audits found they would be able to save approximately 700,000 kWh per year.
  - Minnesota - Commerce Department has a Guaranteed Energy Savings Program (GESP) does a myriad of things. It promotes awareness and implementation of energy efficient and renewable energy measures in public facilities by state and local governments that "result in millions of dollars of annual energy savings while creating jobs, reducing energy consumption, improving facility infrastructure, and reducing carbon emissions." In addition, they provide technical, financial, and contractual assistance to public entities looking to leverage the state's GESP Master Contract to implement these projects. They also assist public entities with evaluating facilities for potential energy efficiency opportunities, analyzing financing options, soliticitating proposals to perform ESPCs, negotiating and awarding contracts, project management oversight, and technical assistance.

  -
- *Workshops and continuing education*

- Massachusetts - 2018 Massachusetts Water Conservation Standards. Established by Massachusetts Executive Office of Energy and Environmental Affairs, and Massachusetts Water Resources Commission. Sets statewide goals for water conservation and water use efficiency and provides guidance on effective conservation measures. Provides a vehicle to educate Massachusetts' citizens about the importance of water conservation, its crucial link to our natural resources, and how all consumers can use water more efficiently. The Standards aim to reduce utility costs by a) reducing water waste and associated energy and treatment costs b) prolonging the natural life of system components and equipment, and c) postponing or eliminating the need to develop additional water supply sources.

- Georgia - WaterFirst. Established by Georgia Environmental Finance Authority (GEFA). Program that recognizes local governments for achieving excellence in water resources management (must apply and pass on-site review). WaterFirst communities receive 1% interest rate reduction on GEFA loans. WaterFirst also conducts a webinar series that includes lessons learned, best practices for water conservation, minimum environmental requirements of the state.
- Georgia - Septic to Sewer Program. Established by Georgia Environmental Finance Authority (GEFA). Assists local governments and authorities with constructing viable wastewater treatment systems to enhance public health and prevent groundwater contamination. May award up to $3 million per applicant. Assists communities with educating residents on their role in protecting new infrastructure.
- Tennessee - implemented the Tennessee Plant Optimization Program to provide support to water and wastewater operators for reducing energy use and optimizing nutrient removal using low- and no-cost measures. Members of this free program benefit from technical assistance, flexible and informed regulatory oversight, and cost savings.
- Indiana - Bloomington has taken it upon themselves to attempt to teach their community about the impacts of water consumption in terms of energy, infrastructure costs, economic growth, a changing climate, and resource competition.
- New Mexico - Has a Weatherization and Intergovernmental Programs Office has a project map for New Mexico that provides information on energy efficiency programs that can be used to make water utilities more efficient. They also frequently hold workshops, webinars trainings, and outreach events that have allowed almost 30k people to experience savings from energy efficiency installations
- Wisconsin - The Focus on Energy program looks to provide training opportunities on energy efficiency improvements in wastewater facilities

- *Other*
  - Wisconsin - The Focus on Energy program created a best practice manual called *Water and Wastewater Industry Energy Efficiency Best Practices Guidebook*. It

was created for local governments to use to save money and drive efficiency. Other states can use it as a successful case study for their programs.

Structural Changes

- *Agricultural process improvement incentives*
    - Arizona - Arizona's Active Management Zones and their related management organizations allot water to farms in the State. Through this oversight, they can also incentivize the use of efficiency technologies.

    - California - Executive Order B-37-16: Making Water Conservation a California Way of Life. Sets forth actions to use water more wisely, eliminate water waste, strengthen local drought resilience, and improve agricultural water use efficiency and drought planning.
    -
- *Include water minimization criteria in electricity generation permits*
    - Arizona - The State requires utilities to consider water usage in their IRPs. It also requires analysis of water use in applications and approvals for energy projects.

    - Colorado - Colorado considers water usage when permitting power infrastructure – See Rule 3604(h).

- *Required water audits for water utilities*
    - Arizona - The AZ Department of Water Resources conducts water audits according to the M36 Methodology. The program utilizes audits to find and replace leaky infrastructure.

    - California - Water Conservation and Drought Planning. Establishes water use objectives and long term standards for efficient water use that apply to urban retail water suppliers; comprised of indoor residential water use, outdoor residential water use, commercial, industrial and institutional (CII) irrigation with dedicated meters, water loss and other unique local uses. Requires both urban and agricultural water suppliers to set annual water budgets and drought preparations.

    - Massachusetts - American Water Works Association (AWWA) M36 Water Audit Training. Established by Massachusetts Water Management Act. Water Management Act registrants and permit holders may receive a free AWWA M36 "top down" audit from a private consulting firm.

    - Georgia - Georgia Environmental Finance Authority (GEFA) - Financing Water Efficiency and Conservation Projects. (See Funding and Financing). Water

auditing assistance may be financed through Georgia Conservation Fund and Drinking Water State Revolving Fund.

- Rhode Island - Water Supply System Management Plans (WSSMP). Established by Rhode Island Water Resources Board. Water supply system management plans are submitted by water suppliers that produce over 50 million gallons of water per year. The Water Use and Efficiency Rule for Major Public Water Suppliers, passed in 2011, established the requirement for WSSMP's to include water production and use data.

- Tennessee - The state does not require water audits, but provides water utilities with a host of resources to conduct them more accurately and efficiently as part of the TPOP.

- *Create a water conservation council*
  - Arizona - Arizona has a version of this called the Governor's Water Augmentation, Innovation and Conservation Council. The council is made up of representatives from local government, state government, industry, and utilities. The group studies water use and develops plans to guide the state's use of water.

  - Maryland - The State created a Statewide Water Conservation Advisory Committee. The Committee focused primarily on statewide infrastructure improvements and responding to droughts, but also developed outreach and educational materials for residential users.

  - Oklahoma - Oklahoma has a 15-member advisory council which is charged with creating educational programs, financial incentives, and enabling improved agricultural techniques. It recently published a pilot study on reuse of water.
- *Other*
  - Arizona - Arizona benefits from the Groundwater Management Act of 1980 – it created regulatory zones with specific oversight plans in high population areas. Those plans aim to achieve safe levels of ground water extraction by 2025. They are updated consistently. There are also a number of water utilities that have installed energy saving technologies and partnered with energy utilities to reduce the emissions intensity of their emissions.

  - Colorado - Colorado passed regulation 86 in 2013 to coordinate across the state on the reuse of "graywater."

Communications and Data

- *Repository of best practices*

    - Arizona - The ADWR has a wealth of information for stakeholders at all levels of water use – including best practices.

    - Massachusetts - 2018 Massachusetts Water Conservation Standards (See Education and Technical Assistance)

    - Georgia - WaterFirst. Established by Georgia Environmental Finance Authority (GEFA). (See Education and Technical Assistance).

- *Utilize data to identify opportunities for improvement*
    - California - Water Energy Nexus Registry. Established by California EPA and The Climate Registry. Free program for participants (water agencies, local governments, and high water-consuming sectors such as higher education, food and beverage, hospitality, and health care) to measure, track and mitigate GHG emissions associated with California's water system. No minimum participation requirement, and participants get access to Climate Registry Information System (CRIS) to calculate, report and verify GHG emission data.

    - Massachusetts - American Water Works Association M36 Water Audit Training - Water Management Act. (See Structural Changes).

    - Rhode Island - Water Supply System Management Plans (WSSMP). (See Structural Changes).
- *Other*
    - Michigan - The Governor created the Office of the Clean Water Public Advocate which operates within EGLE and connects with the Governor's office to ensure there are communication strategies between public utilities and energy and water concerns with the Governor's office
    - Wisconsin - Created the Compliance Maintenance Annual Reporting (CMAR) program that creates "data-informed" partnerships between utilities and local units of government

Climate

- *Establish multi-agency working group*
    - Rhode Island - Resilient Rhode Island Act, establishes Executive Climate Change Coordinating Council (EC4). Council is responsible for setting GHG reduction targets and requires all member agencies to consider their climate change impacts. Created EC4 Advisory Board and EC4 Science and Technical Advisory Board
    -
- *Quantify GHG reductions from water savings*
    - Massachusetts - Gap Funding Grant Program (See Funding and Financing).
    - Minnesota - Released a "Climate Change Trends and Action Plans" that discusses GHG reductions through water conservation

- In addition, they hold themselves accountable by publishing an annual report to the Governor on their Climate Change Executive Order
- New York - Developed a A Tool to Measure Greenhouse Gas Emissions for Water Sustainability Emission
- California - Water Energy Nexus Registry (See Communications and Data)

- California - Executive Order B-37-16: Making Water Conservation a California Way of Life (See Structural Changes)

- California - California Water Action Plan. Established by California Natural Resources Agency, California Department of Food and Agriculture, and California EPA. Developed to meet three broad objectives - more reliable water supplies, the restoration of important species and habitat, and a more resilient, sustainably managed water resources system (water supply, water quality, flood protection and environment).

Appendix F
Diagram of Interconnected Water and Energy Flows

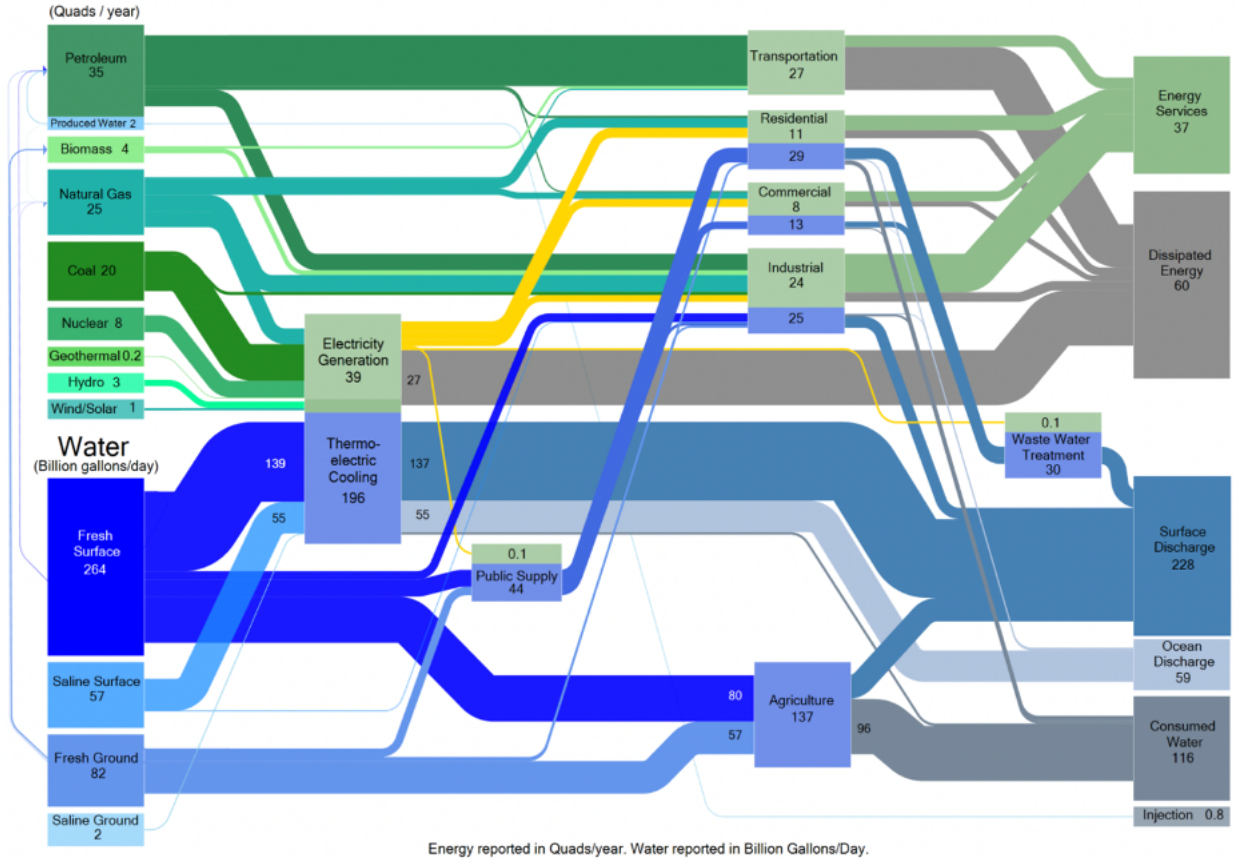


Figure ES.1. Hybrid Sankey diagram of 2011 U.S. interconnected water and energy flows.

Appendix G

Graph of Area States Invested in to Address the Nexus