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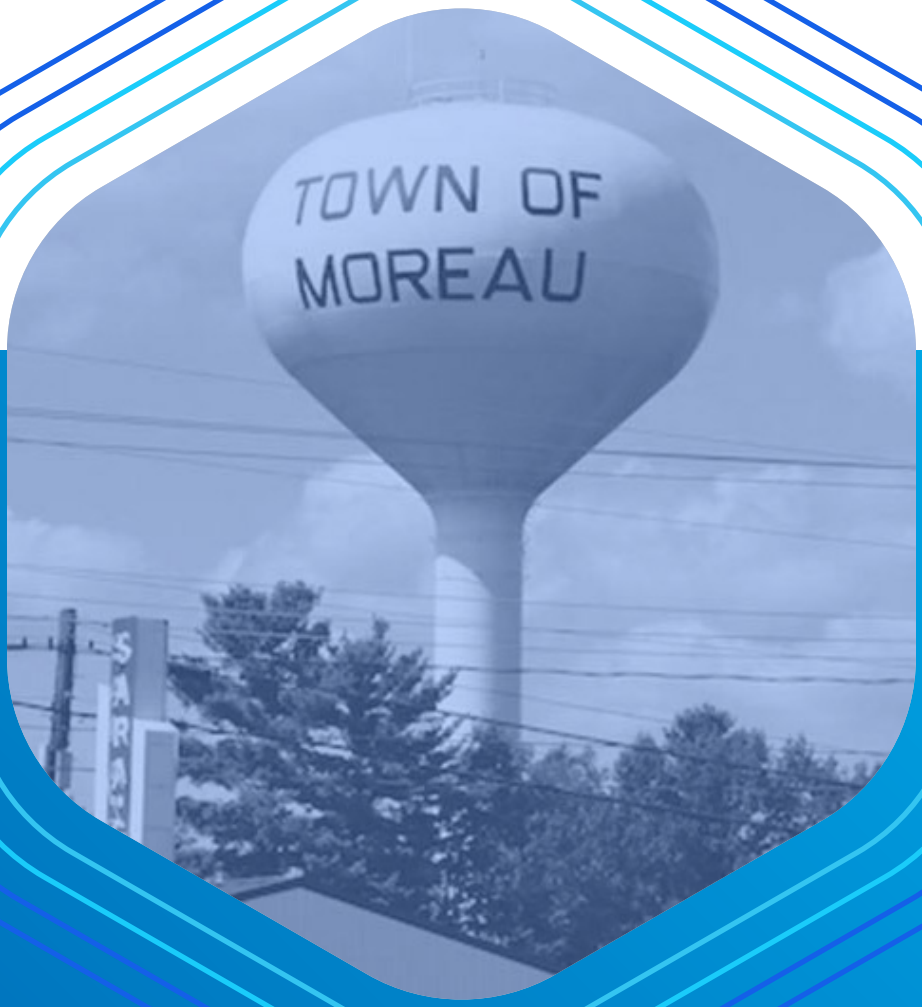

Outliers in Water Utility Consolidation:

A Visualization Tool for Understanding State-Level Drinking Water System Consolidation Opportunities

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Suggested citation:

Sridhar Vedachalam, William Nicholas, Claudia Flores, and Gregory Pierce. 2020. "Outliers in Water Utility Consolidation: A Visualization Tool for Understanding State-Level Drinking Water System Consolidation Opportunities"

Environmental Policy Innovation Center, Washington D.C. and UCLA Luskin Center for Innovation, Los Angeles, CA.

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Report Design by
Rachel Garofolo

Cover Image:
Town of Moreau, NY, whose water tower is seen here, is exploring the option to consolidate its six water districts to equitably distribute costs.

The Environmental Policy Innovation Center builds policies that deliver spectacular improvement in the speed and scale of environmental progress. A nonprofit start-up, EPIC is committed to finding and highlighting the best approaches to scaling up results quickly. EPIC focuses on clean water, endangered species, environmental markets and the use of data and technology in producing conservation outcomes. Our work in water focuses on innovative financing, outcomes-based stream and wetland restoration, water quality partnerships, utility consolidation, and the role of data technology in improving consumer trust.

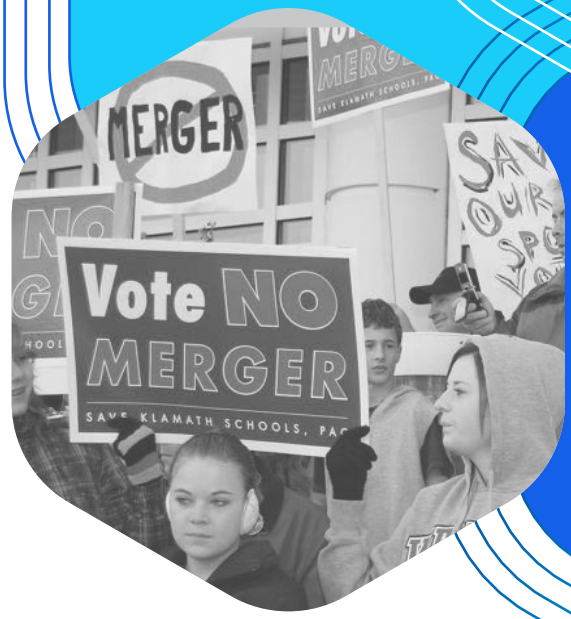
The UCLA Luskin Center for Innovation (LCI) unites UCLA scholars and students with forward-looking civic leaders to conduct rigorous research and timely outreach that informs environmental policies for the health of people and the planet. Our water program focuses on providing research leadership to inform the implementation of a Human Right to Water policy in California, as well as similar efforts across the United States.

Support for this report was provided by the Robert Wood Johnson Foundation and Spring Point Partners.

This project grew out of the initial data collected by EPIC intern, Sean McCarthy.

SUMMARY

AT CURRENT RATES, IT WILL TAKE APPROXIMATELY 110 YEARS FOR SUFFICIENT UTILITY CONSOLIDATION TO OCCUR THAT WILL ACHIEVE PUBLIC HEALTH GOALS.



The immense number of small drinking water systems in the U.S. exacerbates the water sector's challenges. Small utilities have a smaller customer base and are thus vulnerable to shocks such as population loss, changes in the local economy, or weather patterns. They also have trouble hiring and retaining qualified operators, have few resources to improve their overall infrastructure, and are more likely to experience water quality violations. At current rates, it will take approximately 110 years for sufficient utility consolidation to occur to reach our or other experts' recommended levels of consolidation to achieve public health goals. That is an unacceptably long wait for some communities currently served by small systems to seek sustainable water systems that provide reliable, safe, and affordable water services.

Given our cooperative federalist structure, state policies on consolidation and system governance may play a greater role than federal policies on the number of systems in an area and the reliability of their service. Using publicly-available EPA data, we created a new, interactive tool to visually analyze the structure of community water systems across states. This tool does not answer all the questions necessary to assess consolidation progress and potential at the state level, but does provide an easy to use first step.

Although only the case of Kentucky is prominently known, a number of southern states have consolidated water services compared to the rest of the U.S. On the other hand, demographically-similar states, such as Ohio and Pennsylvania, look a lot different in their water system governance structure likely due to state policies. We encourage policymakers and practitioners to use this tool to further understand state-level differences and inform planning efforts. We also encourage other researchers to develop similar, user-friendly tools to further democratize publicly-available, but often hard to access data on drinking water systems.

[1] *Pierce, G., Lai, L., & DeShazo, J. R. (2019). Identifying and addressing drinking water system sprawl, its consequences, and the opportunity for planners' intervention: evidence from Los Angeles County. Journal of Environmental Planning and Management, 62(12), 2080-2100.*

BACKGROUND

SMALL UTILITIES HAVE TROUBLE HIRING AND RETAINING QUALIFIED OPERATORS, HAVE FEW RESOURCES TO IMPROVE THEIR OVERALL INFRASTRUCTURE, AND ARE MORE LIKELY TO EXPERIENCE WATER QUALITY VIOLATIONS.

Roughly 87% of the U.S. residents receive piped water from a water utility and the rest rely on private water wells. The number of utilities that provide water services in the U.S. is dramatically different from other infrastructure sectors, due to a history of permissive policy regarding small water system formation, even in dense urban areas. There are more than 50,000 community water systems that supply water to the same people year-round.[2] By comparison, there are around 3,300 electric utilities, 2,600 internet service providers, and 54 state and territorial highway agencies.[3]

Nearly 90% of the water utility systems in the United States serve less than 10,000 people and more than half serve less than 500 people.[4] This exacerbates the water sector's challenges such as aging infrastructure, affordability, technical know-how to deal with contaminant pollution, and sustainability especially in light of climate change.[5] By contrast, large water utilities can exhibit strong economies of scale.[6] The per-volume cost of producing water goes down with increasing volumes, thus benefiting large utilities that produce several millions of gallons per day. Small utilities that produce only a few thousand gallons per day are disadvantaged by their size. They have a smaller user base to charge and are thus vulnerable to shocks such as population loss, changes in the local economy, or weather patterns. Additionally, small utilities have trouble hiring and retaining qualified operators, have few resources to improve their overall infrastructure, and are more likely to experience water quality violations.[7,8] They often lack resources to keep track of and apply for government grants that are specifically targeted for small utilities.

[2] *There are also an additional 103,000 small water systems that serve non-regular users or serve the same users seasonally, as well as about 13,000 wastewater utilities. These systems are not part of this analysis.*
[3] *Wang, T. 2019. Largest energy utility companies in the U.S. based on market value 2019. Statista. Accessed at https://www.statista.com/statistics/237773/the-largest-electric-utilities-in-the-us-based-on-market-value/; list of internet service providers: https://broadbandnow.com/All-Providers*
[4] *National Governors Association. 2018. State Level Policies to Promote Water Utility Consolidation.*
[5] *Ibid.*
[6] *Shih, J., W. Harrington, W. A. Pizer, and K. Gillingham. 2004. Economies of Scale and Technical Efficiency in Drinking Water Systems. Washington, DC: Resources for the Future.*
[7] *NRDC. 2019. Watered Down Justice. Accessed at https://www.nrdc.org/sites/default/files/watered-down-justice-report.pdf*
[8] *Teodoro, M.P., & Switzer, D. 2016. Drinking from the talent pool: A resource endowment theory of human capital and agency performance. Public Administration Review, 76(4), 564-575.*

CONSOLIDATION

To resolve many of these concerns, there is an effort across the country to take advantage of the process of physical (i.e., connecting pipes) or managerial (i.e., connecting functions) consolidation. Struggling utilities have consolidated to provide higher quality water and wastewater services, improve resilience, reduce costs to consumers, and modernize their water infrastructure. Importantly, system consolidation stands to promote health and financial equity because the smallest utilities disproportionately serve isolated, rural, and lower-income communities. There are few if any circumstances foreseeable in which a large fraction of these utilities which are currently underperforming can provide safe and sustainable water in the future. In an assessment conducted in 2017 by the EPA, more than 3,500 water systems were identified to have health-based violations in the past 12 months, and another 700 systems were deemed to be "persistently in violation."[9] Such systems would perhaps be the most likely candidates for any consolidation efforts to improve system performance and reliability.

SYSTEM CONSOLIDATION STANDS TO PROMOTE HEALTH AND FINANCIAL EQUITY.

[9] *USEPA. 2020. The Water System Restructuring Rule. Accessed on September 3 at https://www.epa.gov/dwcapacity/restructuring-rule*

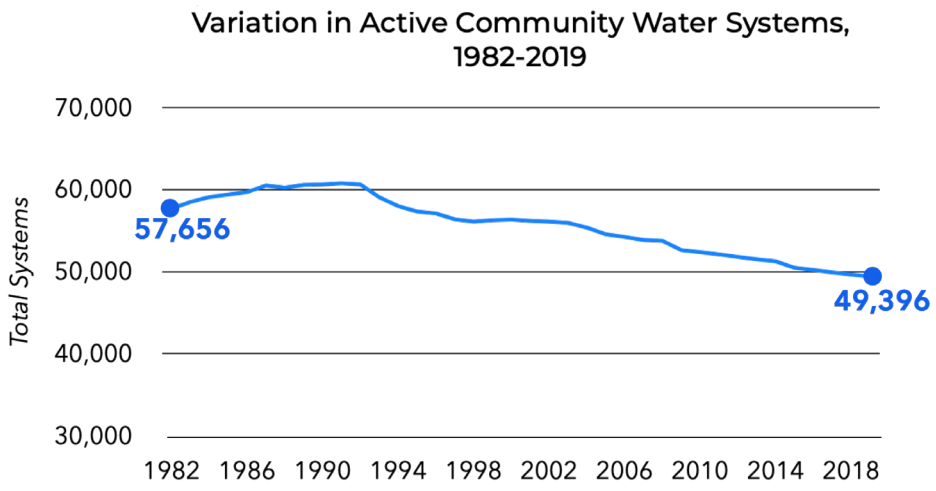


FIGURE 1

Active community water systems (CWS) have declined over time, but not enough to bring a meaningful reduction in the number of small systems.

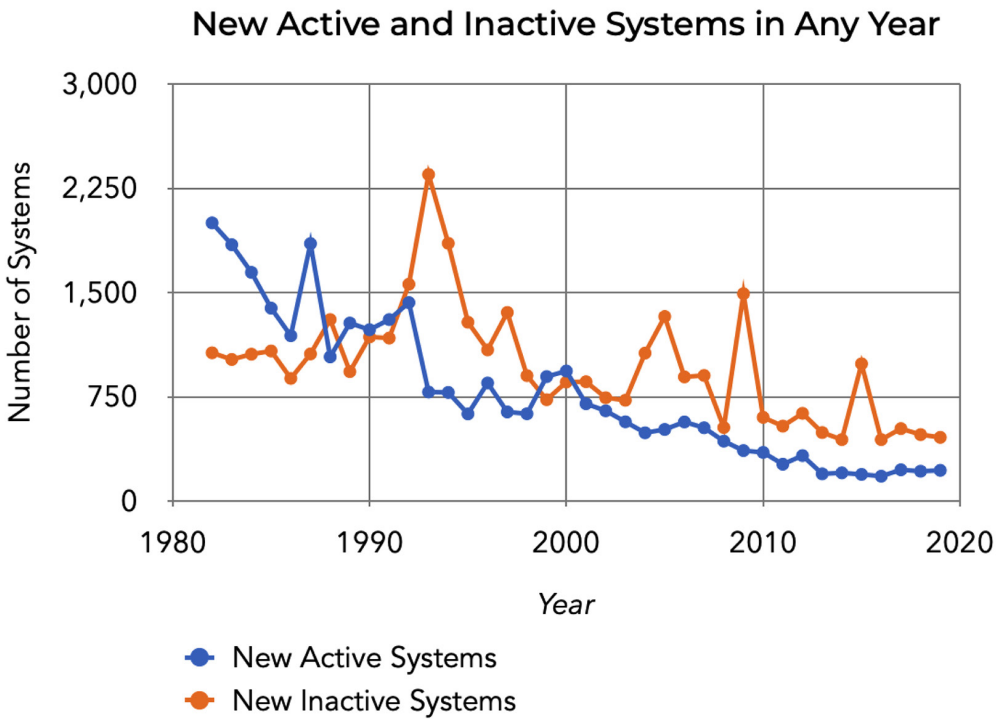
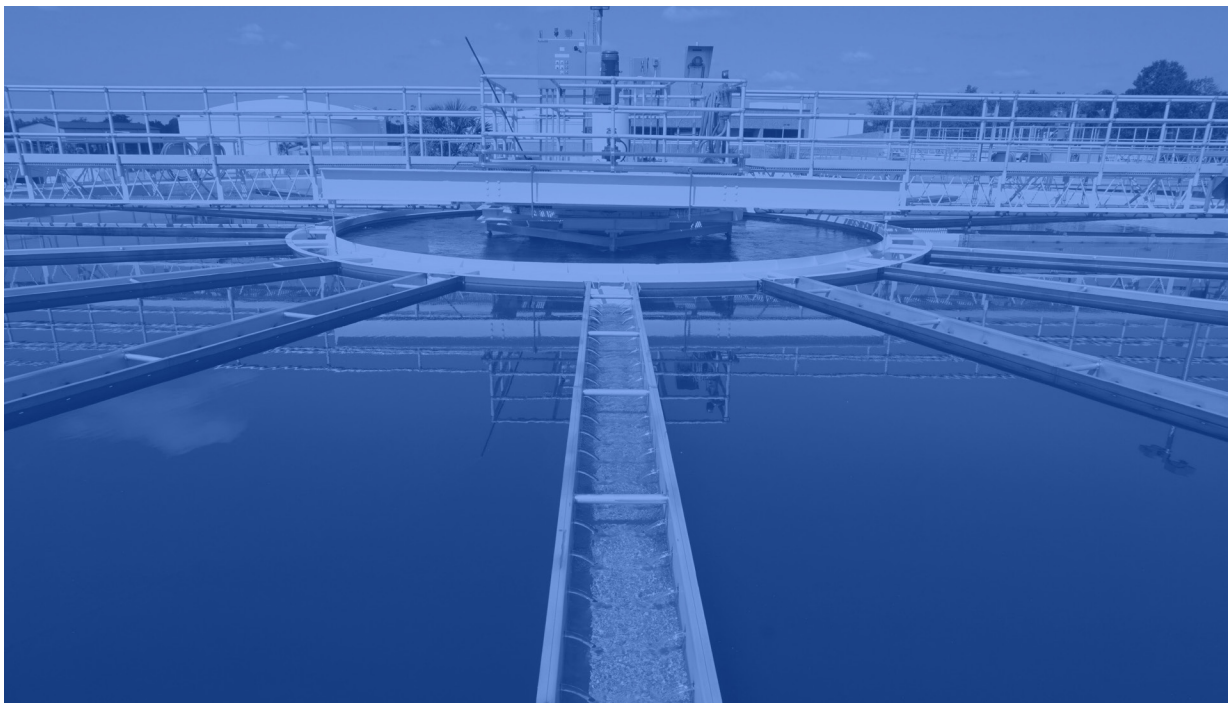


FIGURE 2

New utilities are still being created, even as their numbers are outmatched by inactivation of existing utilities likely as a result of consolidation.

The general need for consolidation among drinking water utilities has been recognized for some time, and there has been some progress.[10] Over the last few decades, the total number of community water systems has declined at a gradual rate, from a peak of 60,743 in 1991 to a current number of approximately 49,000 in 2019 **(Figure 1)**. There are also new utilities being created every year – approximately 400/year from 2000-2019, so this number reflects the net change in utility number. Since 2001, the number of inactive systems in any given year – likely attributed to mergers and consolidations – has outpaced new active systems, but the difference is often small **(Figure 2)**.

Currently, there is no consensus among experts on the ideal utility size or how many utilities should exist in a state or county, although several proposals have been made, and momentum is growing to reduce the number of utilities dramatically. Earlier this year, Environmental Policy Innovation Center recommended that the EPA set a national goal to bring down the number of utilities by 75% in the next 20 years to improve health outcomes for millions of rural residents.[11] Based on the historical rate of consolidation, the total number of systems would still be roughly 43,000 in twenty years, while reaching the goal of 75% reduction to 12,500 systems would only occur in the 2130s. It is clear that policy changes must be made in order to facilitate the volume of consolidation necessary to result in meaningful health outcomes.



[10] *Beecher, J. A., Higbee, J., Manzel, A., & Dooley, R. 1996. The regionalization of water utilities: Perspectives, literature review, and annotated bibliography.*

[11] *Vedachalam, S., Male, T., and Broaddus, L. 2020. "H2Equity: Rebuilding a Fair System of Water Services for America." Environmental Policy Innovation Center, Washington D.C.*

VISUALIZATION TOOL

Consolidation policies, including prioritization of State Revolving Fund monies, vary among states, as do urbanization levels which generally correlate with more consolidated utility arrangements. To compare and identify states with potentially promising policies, wedeveloped a tool for public use:

Water Systems Consolidation Opportunities Tool

CLICK TO EXPLORE THE VISUALIZATION TOOL

This tool is comprised of a series of Tableau dashboards, utilizing charts, maps, and filters to enable the identification of states that differ from national and regional trends based on data from EPA's Safe Drinking Water Information System (SDWIS), supplemented by urbanization data from the U.S. Census Bureau. Data from SDWIS and Census Bureau were collected in April 2020.

Understanding how states that are similar to others in population, density, and urbanization have achieved different levels of consolidation by pursuing different policies can help interested stakeholders, such as federal and state officials, better evaluate potential areas for further study and planning. Ultimately, policy and other variables, such as costs, prioritization by systems and other governing bodies and community acceptance, will help determine how feasible consolidation is across states and localities.[12]

[12] *Hansen, K., Mullin, M., and Riggs, E.K. 2020. Collaboration risk and the choice to consolidate local government services. Perspectives on Public Management and Governance, 3(3):223-238.*

FINDINGS & DISCUSSION

Overall, the largest category of utilities in most states serve 500 persons (54%) or less but represent the smallest share of the population served (2%) (Figure 3).[13] As we move to successively larger size utilities, they represent a greater share of the population but a diminished proportion of utilities, with the category of largest-size utilities (those serving 100,000+ persons) serving nearly half the population (47%) and having the fewest utilities (< 1%). Unless otherwise stated, the use of the term 'population' or 'population served' in this document refers to the population within a state that receives piped water service at their home or dwelling for most of the year. Below, we point out regional patterns for further study.

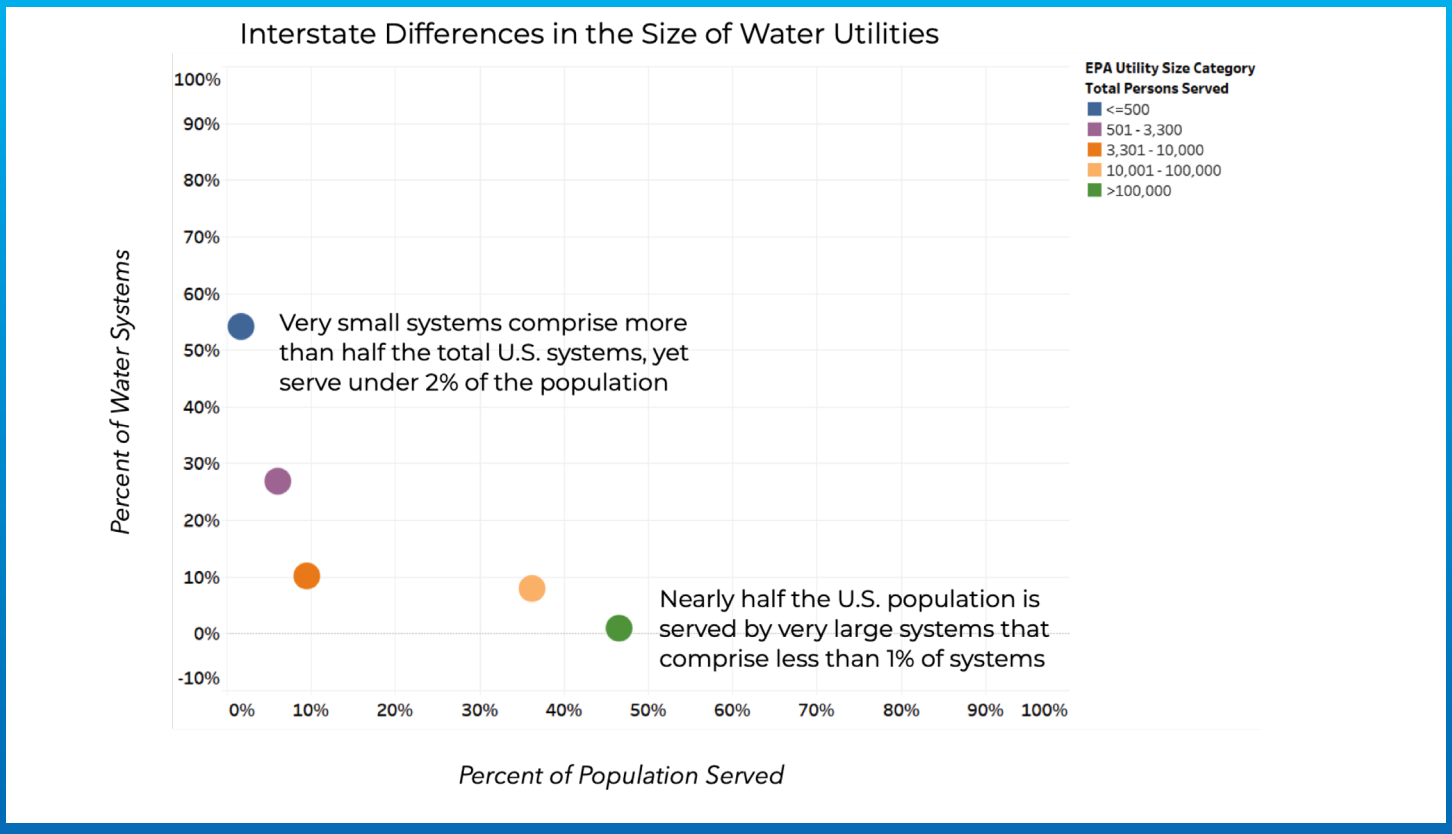


FIGURE 3

Distribution of water utilities in the U.S. across five size categories.

SOUTH REGION

Examples of state effectiveness in achieving consolidated utilities can most easily be identified in the South. Kentucky, Alabama, and Tennessee all stand out as states with an average of more than 10,000 persons per system despite state urbanization rates far below the 70%+ rates of other states with similar averages **(Figure 4)**. While neighboring states like Arkansas and South Carolina follow the national trend, both Kentucky and Tennessee have much larger shares of their population served by mid-size utilities, and the largest utilities do not serve a majority of the population.

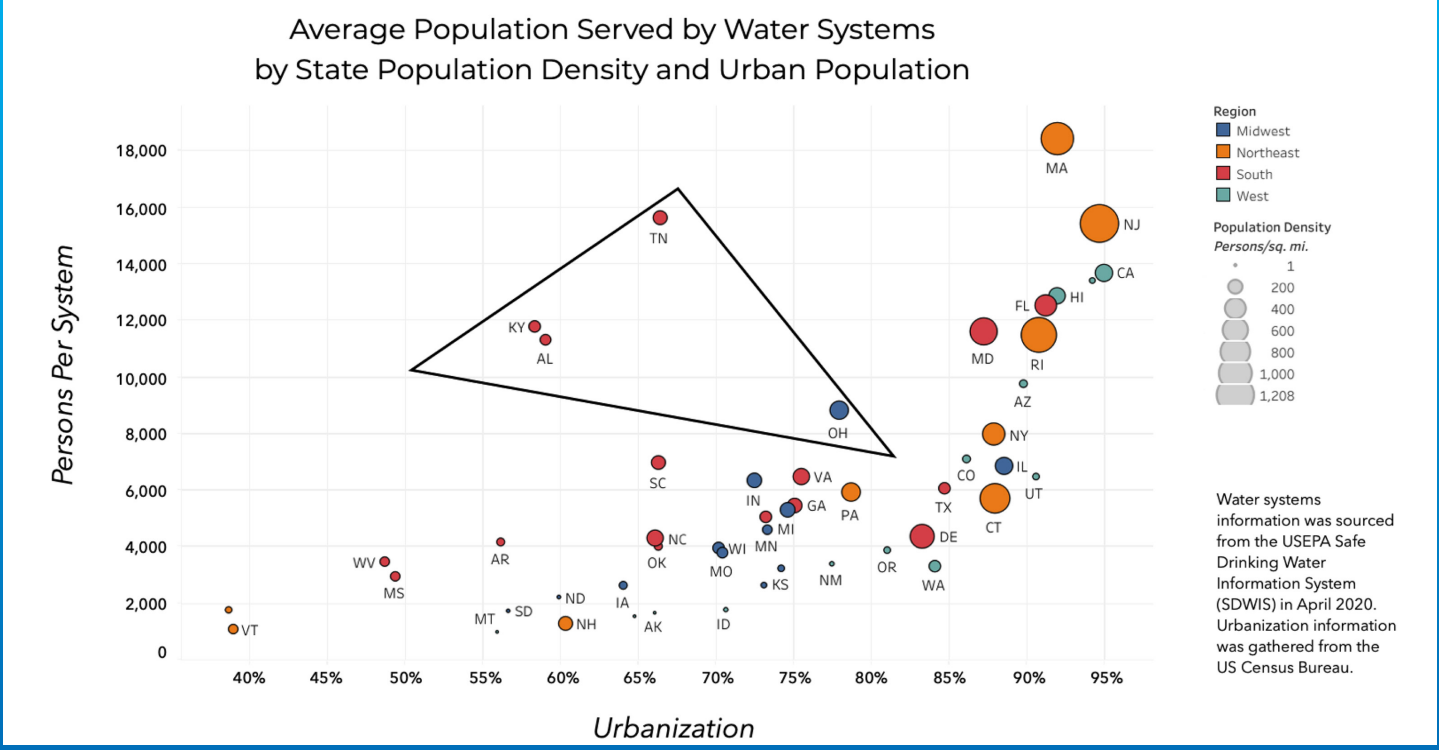
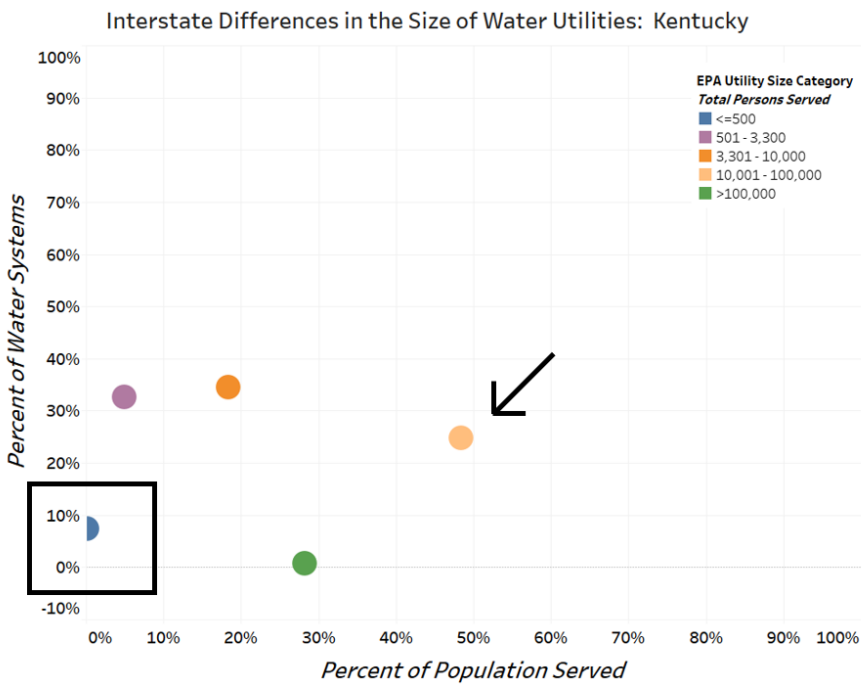


FIGURE 4

A plot of system density (persons per system) and urbanization identifies a pattern, singling out outlier states for further analysis.

Kentucky is known for pursuing aggressive consolidation by reorganizing its institutional structure, but neighboring Tennessee and Alabama have a similar composition of utilities. Kentucky, Tennessee, and Alabama have much larger shares of their population served by mid-size utilities and the smallest utilities (serving < 500 people) comprise a very small fraction of the total number of water utilities in the states – 7%, 11%, and 6%, respectively **(Figure 5)**. In contrast, more than half of the utilities fall in this category for the entire United States. Similar to Kentucky and Tennessee, 29% of Mississippi's served population and 55% of its utilities are those serving 500-3,000 persons, while neighboring Southern states follow a more traditional pattern. Texas, the region's largest state, largely follows the national pattern. To put this another way, Virginia – whose population is similar to Tennessee and is more urban – has twice the total number of utilities, 60% of which are small. As a result, Virginia has 600 more small utilities than Tennessee, a fact that has less to do with geography and more to do with governance and policy.

VIRGINIA HAS 600 MORE SMALL UTILITIES THAN TENNESSEE, A FACT THAT HAS MORE TO DO WITH GOVERNANCE AND POLICY AND LESS TO DO WITH GEOGRAPHY.



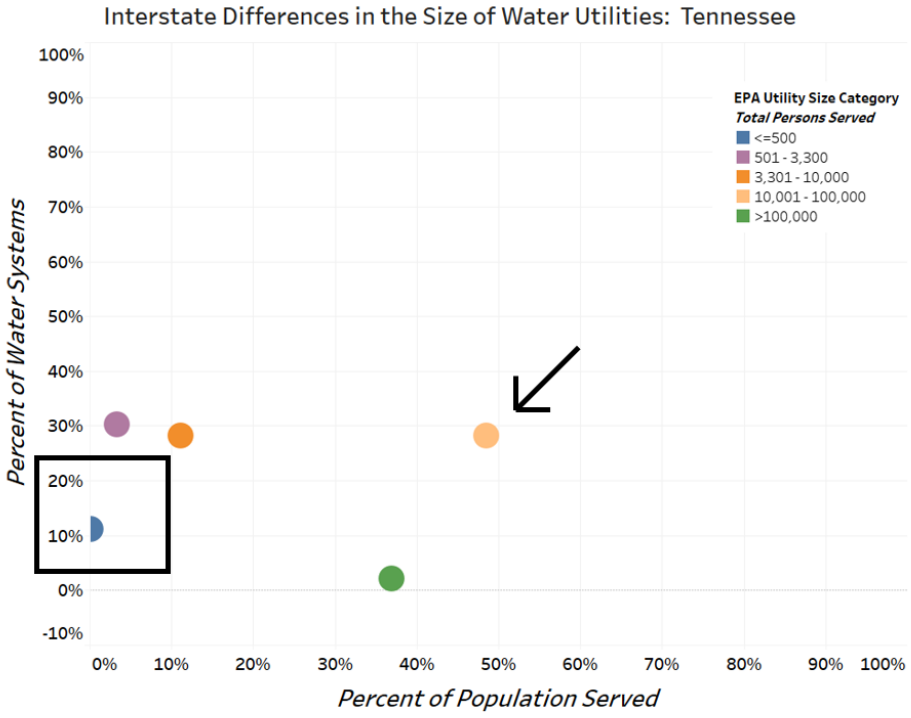


FIGURE 5

Medium-small utilities dominate in Kentucky and Tennessee. Distribution of water utilities across the five size categories in Kentucky **(top)** and Tennessee **(bottom)**. The arrows on the charts point to the 10,000-100,000 persons category that serves nearly 50% of the states' population and boxes represent the smallest size category (500 people or less).

NORTHEAST REGION

Moving away from the South, the Northeast region of the U.S. presents a different pattern. Highly urbanized, New England is served primarily by systems with 10,000-100,000 persons, however the state of Connecticut follows the national trend of 100,000+ person utilities serving most people. Despite this, Connecticut has a larger share of the smallest utilities than the national average, representing a wider divide and greater opportunities for consolidation. Massachusetts, meanwhile, has by far the highest system density in the country, at over 18,000 persons per system.

WEST REGION

The West follows a similar trend for urbanization and persons per system as the Northeast. In the West and out of all the states, Nevada has the highest percent of population served by 100,000+ person utilities, whereas Wyoming contains no very large utilities **(Figure 6).** California and Washington have a similar number of small water systems. However, given its several large urban areas, it is no surprise that California is the state with the second highest percent of population served by 100,000+ person utilities in the region.

MIDWEST REGION

Finally, in the Midwest, there is a wide degree of variation in system density in each state. At 72 percent urbanization, Indiana has a little more than 6,000 persons per system. While Nebraska, where urbanization is 73 percent and whose population density is lower than Indiana, has roughly 2,600 persons per system. However, Nebraska holds the highest percentage of state population served by 100,000+ person utilities in the country.

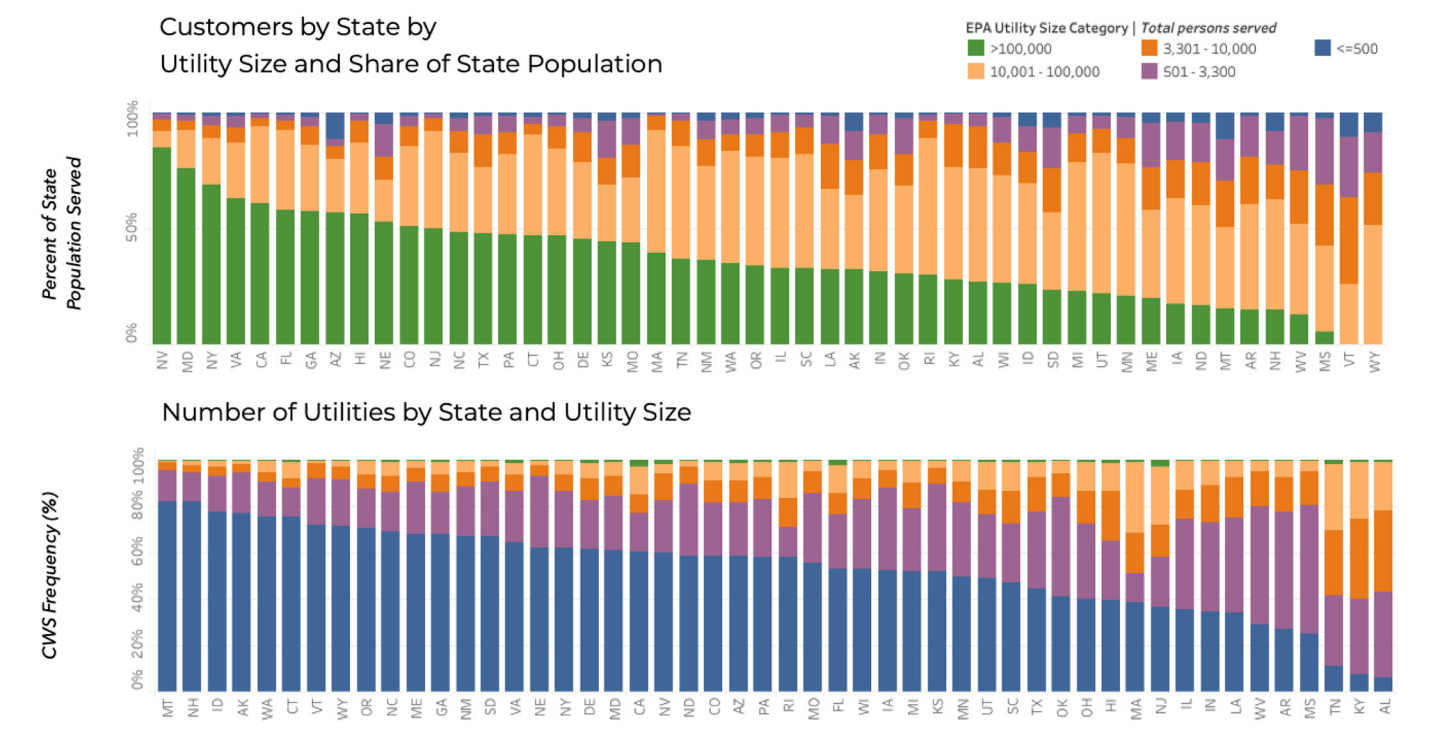


FIGURE 6

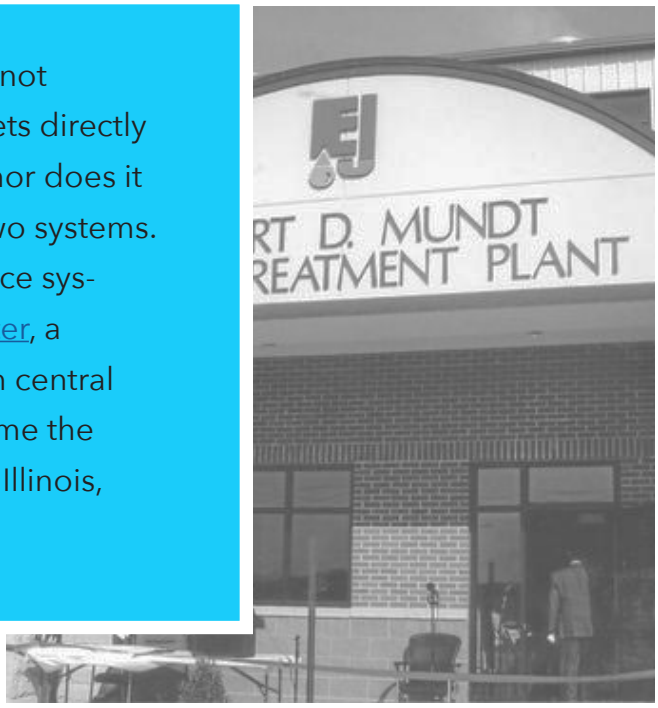
States ordered by utility size (top) and population served by the smallest utilities (bottom).

COMPARING ACROSS REGIONS

Pennsylvania and Ohio are politically and demographically similar states, while Pennsylvania and Georgia would initially appear to have less in common. Our tool, however, shows similar rates of urbanization across all three states (~75%), and a measurably-reduced spread of systems across size categories in Ohio as compared to Pennsylvania and Georgia. Both Pennsylvania and Georgia are far more comparable in terms of utility size distributions, presenting Ohio as a case for further study to policymakers in both states.

Nebraska and Nevada are among the 10 least-densely populated states in the country, at approximately 25 persons per sq mi. However, Nevada's population distribution around Las Vegas has allowed 85% of the state's population to be served by large systems.

Consolidation of utilities does not always mean a small system gets directly absorbed by a larger system, nor does it have to be restricted to only two systems. For alternative utility governance systems, see this profile of EJ Water, a nonprofit cooperative based in central Illinois that has grown to become the largest regional water utility in Illinois, serving over 75,000 people .



CLOSING THOUGHTS

Expanding consolidation efforts beyond a few states requires the identification of both national, state and local policies that help change the status quo pattern of utility distribution. The Water Systems Consolidation Opportunity tool helps us understand state-level opportunities. By considering the impact of state urbanization, persons per system, and population density across the five EPA categories of community water system sizes, we identify initial case examples that stand to provide methods and lessons for consolidation efforts in other states.

We encourage others to utilize the Water Systems Consolidation Opportunity tool to further identify state-level patterns and opportunities, as well as extend this analysis to sub-state levels such as regions and counties to get local perspectives. This is particularly useful as the EPA continues to consider initiatives such as the Water Systems Restructuring Rule (statutory deadline in October 2020) to authorize states (via their primacy agencies) to mandate consolidation of utilities that frequently violate health-based standards. For additional information and recommendations on water system governance, we encourage you to review our report, H_2Equity: Rebuilding a Fair System of Water Services for America.