

Transforming How Water Utilities Do Business

By Newsha Ajami, Ph.D.

AS THE WESTERN UNITED STATES GRAPPLES with water scarcity made worse by recurring droughts and dry periods, the time has come for water managers to look beyond conventional water infrastructure networks that were built under the assumption of abundance. These once-through systems deliver clean water to end-users while treating wastewater and stormwater as nuisances to be captured and removed as quickly as possible without reuse.

While this model has worked for most of the past century, our water infrastructure systems are now facing increasing pressures due to intensified climatic variability, aging and degradation, population growth, and shifting societal and economic priorities.

Water recycling and reuse, green infrastructure, groundwater banking, smart water solutions, and demand management measures are being tested across the U.S. to address some of these challenges while also introducing more flexibility and resilience to both local and regional water systems. These alternative, decentralized, and multi-benefit water management solutions enable water agencies to harness every drop of water that moves through the human water cycle.

This paradigm shift, moving us toward a more hybrid infrastructure model that includes gray, green, centralized, and decentralized infrastructure systems while embracing the concept of One Water, considers all waters — drinking water, wastewater, storm water, and more — as a resource to be managed holistically and in a sustainable manner.

Nonetheless, the widespread integration of these alternative solutions has been slow. The rigidity and complexity of our current governance system hampers progress, as does the fragmented and often outdated regulatory, institutional, and financial structures that administer this complex web of infrastructure without considering inherent interlinks. Traditional federal and state government funds are limited, and local utilities are often too cash-strapped to meet existing operations and maintenance obligations let alone fund innovative water projects. Additionally, private investors shy away from certain water projects due to the potentially high risks that are associated with novel technologies and management approaches, including limited track records, slow or small rates of return, and/or lack of appropriate performance metrics and standards to holistically measure the success of these solutions.

Can We Learn from the Electricity Sector?

Over the past three decades, the electricity sector has been undergoing a paradigm shift similar to the one just now being

experienced by the water sector. While established as top-down, utility-driven with heavy reliance on centralized and capital-intensive infrastructure, the electricity sector has been disrupted by the introduction of distributed, multi-scale solutions, such as renewable energy (e.g. solar and wind) and demand side management (DSM) strategies. The movement to include decentralized systems has also been partially driven by the ability of these small-scale systems to be built with less capital and less risk than typical electricity projects like large power plants and transmission lines. Looking closer at the electricity sector's path to a hybrid infrastructure model reveals a valuable set of lessons that can inform the water sector's paradigm shift.

An Alternative Financing Framework for the Water Sector

Four elements have proven to be critical in enabling the electricity sector's transition toward a clean energy era and the uptake of distributed solutions. These elements stand out in evaluating

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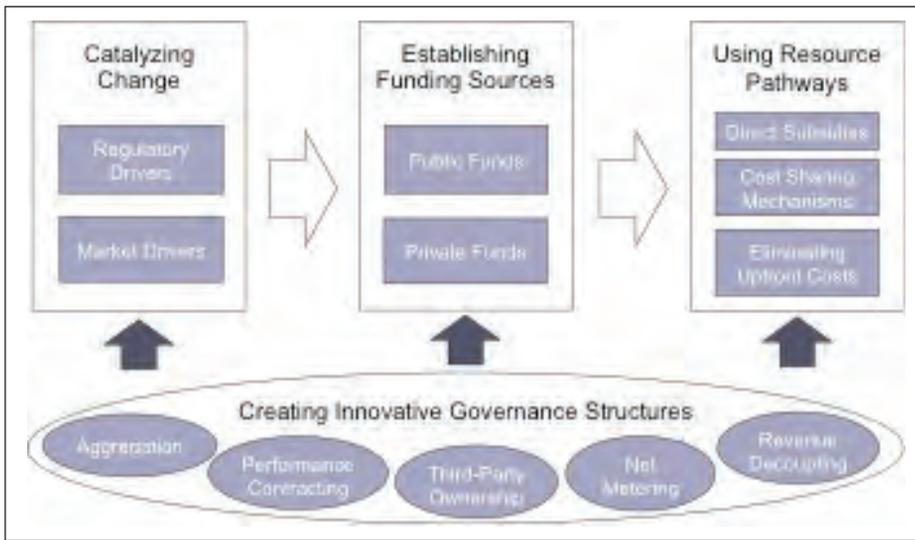


Figure 1: Comprehensive Financing Framework for the Water Sector. Source: Quesnel, et al. (2016)

case studies of successfully implemented distributed electricity projects — renewable energy and DSM — and together they establish a comprehensive financing framework presented in Figure 1.

1. **A catalyzer:** A change in policy and regulations or market forces and economic incentives can stimulate a shift and expedite uptake of unconventional solutions. For example, establishment of California’s Renewable Portfolio Standards in 2002 has led to the proliferation of renewable energy across the state as can be seen in Figure 2. Currently, California is aiming to move toward 100 percent renewable and clean power by 2045, which can

further expedite uptake of distributed clean energy solutions. The water sector can learn from this effort and implement a strategy, such as Regional Water Diversification Portfolio targets (Gonzales, et al., 2017) to further spur the paradigm shift in the water sector.

2. **Portfolio of new and reliable funding sources:** Water utilities often do not have the financial capacity to efficiently operate and maintain their existing infrastructure, let alone invest in new and innovative solutions that might require additional technical and human capacity in addition to upfront capital. As water utilities consider introducing distributed solutions into

their infrastructure mix, they also need to establish a set of steady and reliable sources of funding to implement, operate, and maintain these projects. Some possible mechanisms include taxes, end-user fees, revolving funds, and private capital (Figure 3). Public benefit funds are another mechanism that could help the water sector finance and, thus, integrate more distribution solutions into existing systems (Quesnel and Ajami, 2018).

3. **New distribution pathways:** There must be new ways to facilitate the flow of financial and technical resources among stakeholders. Many pathways engage customers and end users by incentivizing them through cost-sharing opportunities or eliminating upfront costs of project implementation. Some popular mechanisms used in the electricity sector are low-interest or revolving loans, grants, rebates, tax credits, and on-bill initiatives. An example is the Solar Investment Tax Credit, which incentivizes residential and commercial customers to purchase and install distributed solar systems.

4. **A series of innovative governance structures and models:** New governance structures can help expedite project implementation by facilitating transactions, encouraging collaborations, engaging new funders and actors, and enabling project construction that might not be possible in a traditional project delivery and management schemes. Examples of these mechanisms include project or financial aggregation, alternative investment structures, end-to-end service companies, and net metering.



Figure 2: Electricity capacity generated by renewable energy sources since the inception of California’s RPS in 2002. Source: Quesnel et al., 2016. Data source: California Public Utilities Commission, 2015.

Reformed Water Governance to Enable Change

In addition to adopting a set of new financing and governance mechanisms, the water sector must reform its current business model. Some of these reforms are sparked from what the energy sector has been grappling with in the past decade as it has been transitioning to a hybrid infrastructure model. A collection of new strategies are required to be consid-

ered by the water sectors as it is going through this transformation including:

- Redefining the boundaries of water infrastructure:** As utilities consider a more holistic approach to meet their future water demand through the One Water movement, the boundaries of water infrastructure are blurring. While the human water cycle was once divided into the different components of drinking water, wastewater, and stormwater infrastructure types, utilities now realize the importance of managing their systems holistically and recovering resources from all points in the cycle. This transition is also bridging infrastructure boundaries across various sectors. Water, transportation, energy, and land use are increasingly interconnected, offering significant opportunities for cross-sector infrastructure planning. This new approach stretches the limits of current governance models, demanding new definitions for water systems that include gray, green, centralized, decentralized, demand management,

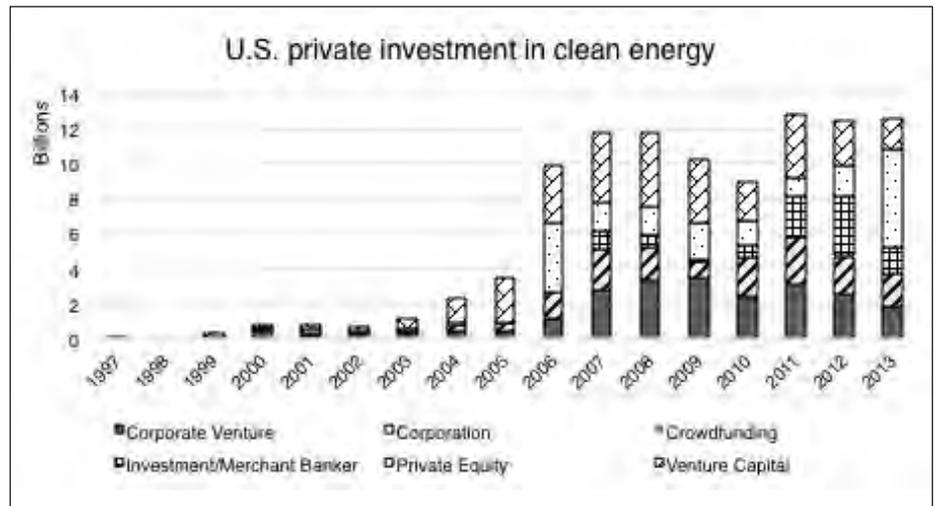


Figure 3: U.S private sector investment in clean energy. Source: Quesnel et al. 2016. Data source: Cleantech Group 2014

Note: Clean energy = biomass generation + energy efficiency + energy storage + solar + wind + geothermal + nuclear + hydro & marine + smart grid. Non-private categories of investment not shown here are debt funds, public sector funding, and other. Crowdfunding is a small percentage of the total investments and while shown, is not visible on this chart.

road, building, and other infrastructure. Bridging these gaps will further enable uptake of multi-purpose

projects and unleash new opportunities to share resources within and across sectors.

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- Establishing new assessment strategies and performance targets:** With new water systems and technologies comes the need for a reform in the way we assess the success and performance of various infrastructure types. Implementation of novel and multi-benefit infrastructure solutions, such as natural systems, suffer from the outdated assessment structures currently used in the water sector. In addition, due to unproven track records and the lack of appropriate methods to holistically measure the success of these solutions across various sectors and dimensions, it can be challenging to secure affordable and reliable financing options. An established and holistic set of performance metrics can promote cross sector collaboration and a higher degree of investor confidence in the monitoring and measuring of success of the new infrastructure model (Gordon et al., 2018). Such tools and platforms can also engage a broader set of actors and beneficia-

ries (Figure 3). As the water sector transitions into a new era, there are more opportunities to access a more diverse set of financial resources such as social impact bonds and sustainability investors, who are eager to spread social and environmental good while also receiving returns on investment.

- Working with different stakeholders and introducing new engagement strategies:** The role of customers is slowly changing. Utilities have to engage more actively with their customers, recognizing that they are an integral part of water system's transition. New smart, localized data gathering devices, such as automated home devices and smart meters, are now more actively engaging customers and can ultimately impact demand patterns across various sectors. In addition, as more cities and communities are embracing on-site reuse, gray water systems, and rain and stormwater capture, they are

offering the chance for customers to shift from end-users to generators/producers. These changes can also affect demand patterns locally, regionally, and statewide. New financial, planning and operational uncertainties need to be considered as part of the new business model water utilities and the sector as a whole need to embrace during the infrastructure transition process.

Era of Collaboration and Partnerships

The 21st century water paradigm will look very different from our conventional model. The water sector must consider new financing models that enable access to a broader set of funding sources while engaging a more diverse set of stakeholders and beneficiaries and institute new revenue sources that are suitable for their changing infrastructure model. Alongside these changes, utilities must embrace new infrastructure choices and governance regimes (i.e., siting, permitting, data and tools, and management) that more

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effectively and smoothly incorporate these novel solutions in their existing human water use systems (Ulibarri et al., 2018). There is a need to revisit the definition of water infrastructure and develop new ways to manage forthcoming system uncertainty due to changing demand patterns and increasingly local water production.

While all of the above solutions are

important in holistically reimagining our water systems, these changes will happen slowly if utilities operate in silos. Exploring regional solutions, partnerships, and collaborations as part of integrated regional planning can help water agencies in the West more efficiently manage scarce water resources and accelerate this process. Partnerships can help bridge

institutional silos, aggregate financial resources, distribute risk, minimize operational and maintenance costs, and take advantage of opportunities throughout the region. By utilizing a suite of 21st century strategies, the water sector can establish a new precedent in sustainable water resource management under our changing social and climatic realities. 💧

FURTHER READING

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