AccelerateH2O
innovating water in Texas

Texas Water Technology Road Map

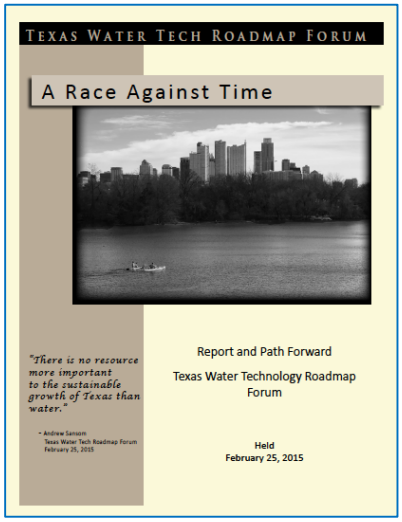
No. 2

Assessing Texas Water Technology Needs, Expectations, Opportunities and Market Scenarios for Innovation

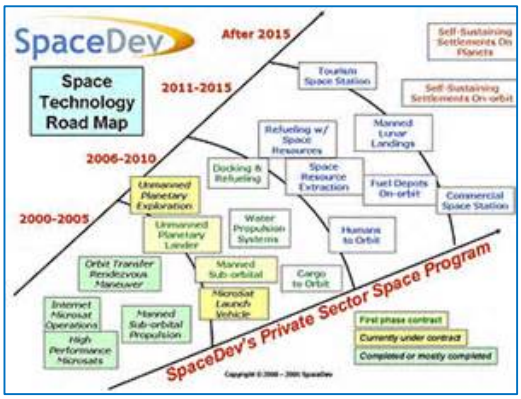
April 2016

Updating the Texas Water Technology Road Map

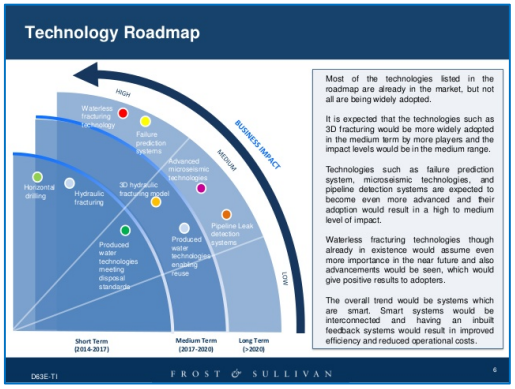
In February 2015, AccelerateH2O co-hosted the first-ever Texas Water Technology Road Map Forum in cooperation with Texas State University's Meadows Center for Water and the Environment, an NSF-funded Texas network of academic research teams, and the University of Texas San Antonio. Over 100 participant from corporate, industry, public utility, state agency, and academic institutions debated and prioritized several challenges facing state and regional water end-use, and the demands for future generation, treatment, transport, conservation, and management to meet expected population and industry growth, ebb and flow of droughts and floods, and loss of water from leaks in urban areas to depleted aquifers in rural communities.



The basis for organizing the Texas water technology road was on prior experiences in both water and non-water related technical, scientific, and engineering sectors such as recently held forums on desalination as well as historical gatherings on space, aeronautic programs for federal agencies (NASA, Defense, Intelligence) and myriad private sector product and solution providers.

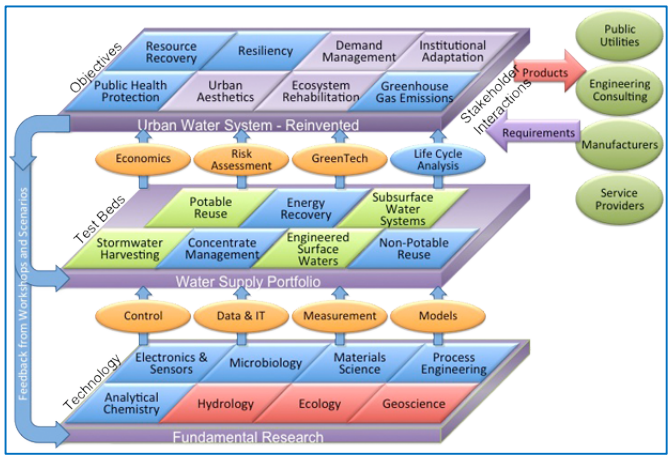


By referencing these existing road maps, attendees could identify outcome-oriented planning with market-driven technology gaps and needs in the water sector. The Technology Road No. 1 served as a baseline for identifying cross-sector challenges in desalination, reuse, conservation, and so-called 'smart water' of data and instrumentation.



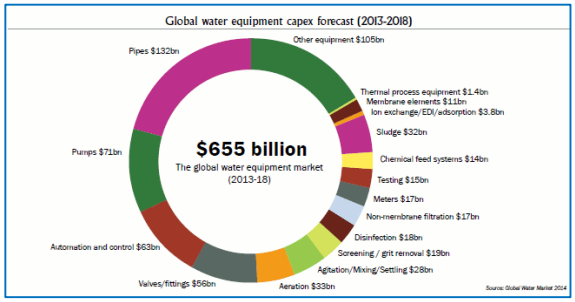
Participants encouraged state agencies, academic and non-profit research institutions, industry and commercial interests, and unique regional end-users to establish and strengthen collaborations for knowledge-sharing, engagement of problem-solvers, and unique test-beds for evaluating and deploying breakthrough technologies.

Further, participants identified the need to remove barriers and limitations to adopting emerging products and services, new innovative and operational practices, and multi-jurisdictional water-shed basin perspectives rather than maintain the current silos and artificial boundaries of 254 counties and sixteen regional planning districts for a statewide water plan. And most importantly, participants called for inclusion of technology alongside – or even in certain scenarios – above 'concrete and rebar' infrastructure – as a critical approach to solving our current and future water challenges.



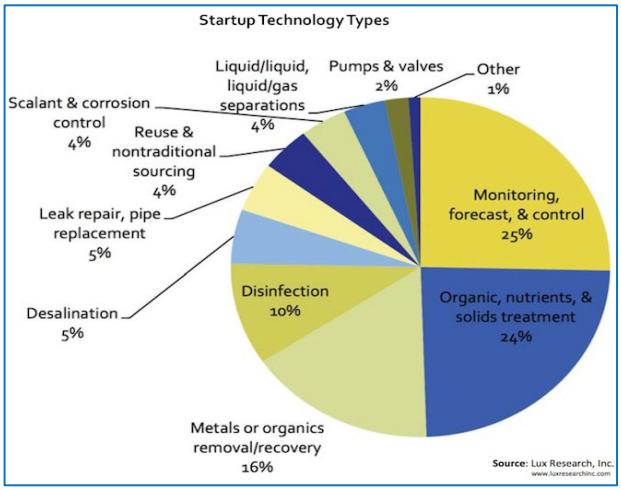
During and subsequent to the 2015 Road Map Forum, AccelerateH2O took a matrix-approach to assessing priorities for technology, engineered solutions, and innovative practices for public and private water management, in urban and rural locations, and across residential, agricultural, industrial, and utility end-users.

Our 4600+ water utilities – a majority of which serve small populations and diverse locations – represent a $9 billion marketplace that is fragmented, competitive, and often so mired in the politics of law, rules, and negative historical interactions as to limit alternatives to both practice and process for 'innovating water in Texas.' And yet the resources of the best minds, expertise, experience, and technical capabilities resides within the State's twenty-three academic research enterprises, non-profit organizations, and hundreds of Fortune 500 national and global companies with headquarter and/or operations across Texas.



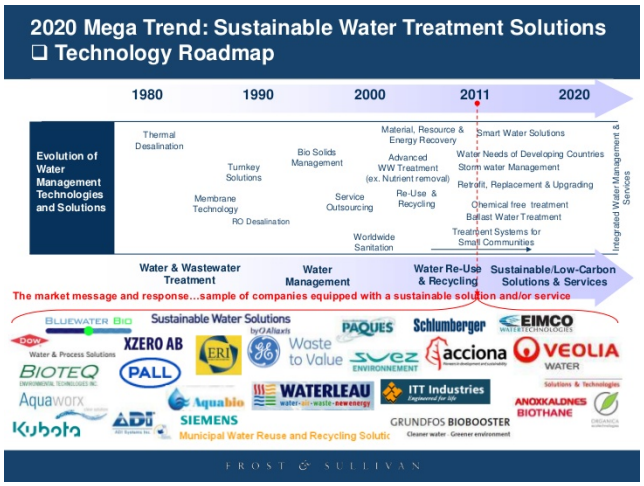
We could not assess the capacity for such innovation on the science and engineering alone, and therefore have had to determine what drives technology discovery, development, and deployment on a global and national basis, as well as within our own state. Nearly $700 billion is expected to be spent globally (approximately $78 billion in the U.S.) on upgrading, modernizing, replacing, or constructing anew the infrastructure that has supported economic competitiveness and continued expansion.

And yet such infrastructure investment has increasingly become integrated with significant technical and engineering improvements that over the last decade have been approved and permitted around drinking, waste, and overall water treatment and supply. What has had an impact on the adoption of new technologies, similar to the general challenge for increased public infrastructure investment, is the uncertainty of the US economy post the 2010 recession, the realization that the days are over of federal grants masking the true cost of capital expenditures, and need for attracting billions of dollars in private equity and finance to offset changes in funding at the national and state levels.



These and several other trends have led to the single most challenging issue for water technology: the actual (versus subsidized) price of water for citizens, consumers, industrial customers, and communities resulting from the adoption of products, services, practices, and policies over the past 50 years.

All the same, the investment sector – individuals, family offices, corporate and venture firms, private equity, even foundations – have explored 'placing bets' on water technology, first as a sub-sector of clean-/green tech, and now as its own sector. Following on the successful track record in Israel, Singapore, and Europe, US investors for the past five years increased their portfolio resources in areas that drive a technology road map as much as respond to it.



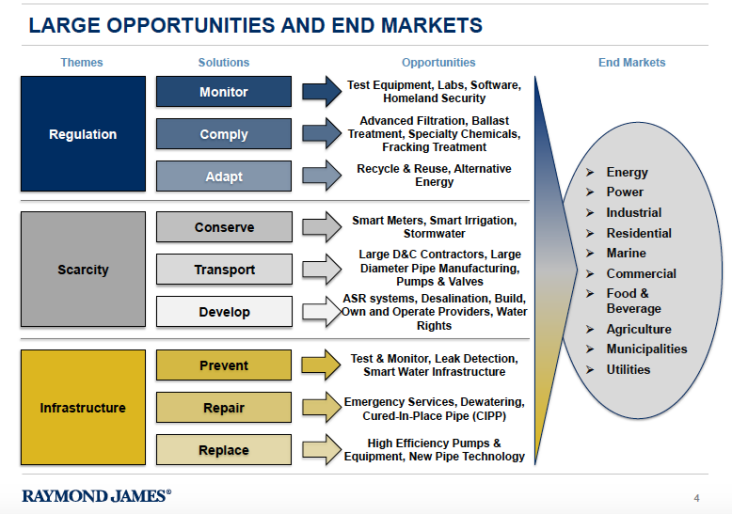
AccelerateH2O and our partners – including several national and regional research foundations, venture funds, incubators, and technology observers – have noted that additional trends emerged or clarity has reached a level that now support the need for the updated version of a Texas Water Technology Road Map for 2016 and 2017. These trends somewhat demand Texas' R&D, testing and evaluation, demonstration and deployment, investment and procurement representatives – in cooperation with the Texas Water Development, Texas Commission on Environmental Quality, the Texas Railroad Commission, the Texas Department of Agriculture, the Public Utility Commission and host of other agencies and program offices – to adopt a comprehensive action plan – a road map – to solve our 'grand challenges' and promote the State as a global water technology innovation hub.

Our current water planning process has increasingly recognized technology and innovation but does not prioritize nor incentivize broad adoption of alternative forms of water reuse, reclamation, repurposing by unleashing the entrepreneurs, inventors, innovators, investors, and industry to develop and deliver integrated, systemic, and cohesive strategies.

Trends observed since Texas Water Technology Road Map No.1:

Market Opportunities Broaden When Perspectives Expand

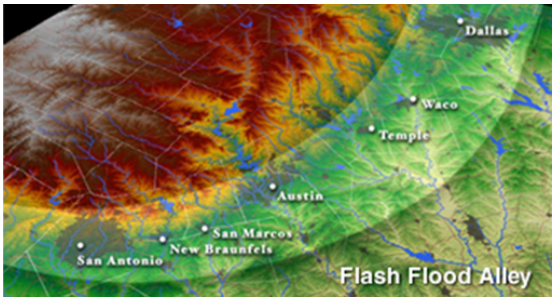
Four months after the2015 Road Map Forum, AccelerateH2O hosted the first-ever Texas Water Technology Investor Forum where 35 national and global investment experts provided insights and perspectives on the evolution of large opportunities and end-use markets. Presentations and panels broadened the awareness that investors could realize solid returns on investment beyond the current notion of owning millions of acre feet of water rights, or fighting over water in the courthouse rather than in the commercialization, industrialization, and marketplace of water beneficial use.



Over 200+ sub-markets, technology product and service, and integrated solutions were identified during the June 2015 investor forum and in subsequent gatherings across the State. Rather than perceiving "water" as a public infrastructure or public utility domain, of which it will always be a significant percentage, technology opportunities impacting Texas' energy, electronics, advanced manufacturing, food and beverage, and other private sector industries and interests are just as if not more robust drivers for a road map.

Additionally, the number of national and global Fortune 500 companies located in our state can serve as early adopters, merger and acquisition partners, and/or exporters of emerging and scalable water technologies, tested and proven in Texas.

From Drought to Storms and Flash Floods

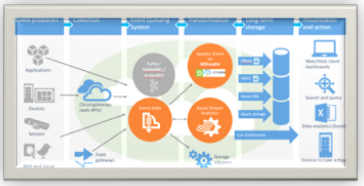


In late November 2015, AccelerateH20 organized on behalf of and co-hosted with the San Antonio River Authority and the University of Texas Center for Research in Water a one-day roundtable on Open-Water Data and Instrumentation. During the course of the panel presentations, the National Weather Services, National Oceanic and Atmospheric Administration, NASA, and the US Geological Survey combined shared new data and modeling that makes the area from Dallas-Fort Worth to Greater San Antonio known as "Flash Flood Alley" on the heels of the famous Memorial Day and Halloween Weekend storms of 2015.

The extensive work led by Dr. David Maidment and his team at the Center for Research in Water, coupled with his colleagues in geospatial, satellite imagery, analytics and modeling both at UT and other universities, identified that the constant and predicted storm-related flooding in Central Texas as well as along the Gulf Coast required an understanding and integrating of gages, sensors, instruments, geo-fenced and cellular, and a host of other sources that combine quantity AND quality data into real-time, actionable information. Data and instrument integration is a critical part of not just emergency response but anticipatory, long-term planning for corporate and industry infrastructure, utilities and operations to limit loss of life and property.

The message that Texas must focus on the effects of water-related drought and flooding suggests that a technology road map be inclusive of unique tools, techniques, and frankly innovative, fresh thinking about products and services to reduce risks, minimize costs, and respond to the economics of public agencies and authorities seeking immediate and lasting strategies for predicting, planning, and budgeting infrastructure, site locations, investment, and human capital.

The Internet of Things (IoT): Digitizing Water

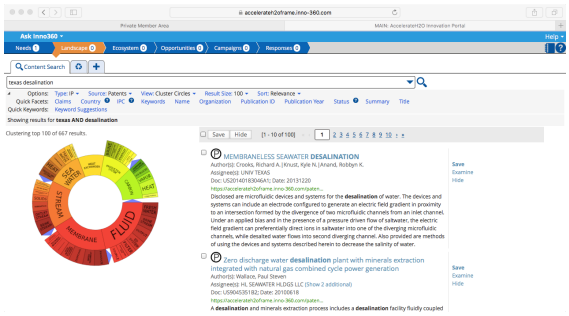


The Open-Data and Instrumentation Roundtable was followed by several meetings and discussions with sensor, instrumentation, data, and analytics firms such as Siemens, GE, Cisco Systems, Texas Instruments, Honeywell and other attendees of the 2015 WEFTEC annual gathering, a small-group discussion in North Texas' electronics corridor, and during the most recent gathering of South by Southwest Interactive.

The Internet of Things – whereby typical infrastructure, equipment, materials, and even humans are embedded with information-collection processes, and has reached a level that one of the last frontiers – water - is just now moving into the age of digitization. Coupled with the ability to analyze vast streams of unstructured data from multiple sources at one time into real-time decision-making and knowledge, the future of water technology will be "smart" enough to predict and self-regulate actions, responses, and pre-determine the effects on quality, treatment, management, and other characteristics of enhanced use or conservation of water sources.

The entire range of the Energy-Water Nexus, Food-Water Nexus – even Human-Water Nexus – is heavily reliant upon new information that disrupts traditional operations, infrastructure, and old-ways of managing utilities, authorities, agencies, and services. And such digitizing water is forming open-source innovations at a speed that the current water systems, regulators, and public elected officials cannot often maintain pace with or must determine how to leverage against prior resource allocation in legacy, quickly antiquated equipment, information systems, and other forms of data collection.

Summary of Findings: What We've Learned



Texas Water Innovation Clearinghouse: Maximizing Discovery-Development-Deployment Networks

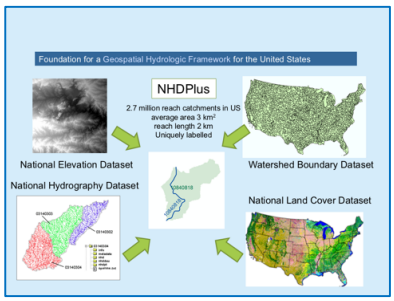
At the conclusion of the 2015 Road Map Forum, participants called for the creation of a clearinghouse that aggregated data, information, reports, research, and expertise into a platform that fostered collaboration, problem-solving and constant insight across sectors, institutions, organizations and regions. Over the past six months, we rolled out the initial versions of the Clearinghouse, and by customizing Proctor & Gamble's original platform to connect their internal technology demands with external partnership strategy, AccelerateH2O is able to engage thousands of Texas' and the world's best minds to collaboratively solve 'grand water challenges'. What we've learned from combing through over 300 million records, including sources of research grants and contracts, intellectual property and commercialization, papers and patents, and similar areas of insight is:

- Over 700 researchers, faculty, and senior staff on 23 academic campuses have been identified across a water technology taxonomy that ranges from desalination treatment to sensors, from data modeling to filtration – and every sub-category of technology related to residential, industrial, agricultural, and utility water management
- Approximately $400 million over a decade in federally-funded research has been conducted in water-related programs, including grants and contracts from the U.S. Departments of Agriculture, Commerce, Defense, Energy, Health and Human Services, Interior, NASA.
- Approximately $25 million in State of Texas resources has been provided in grants and contracts for similar research to academia, engineering firm, and non-profit research institutions
- Less than $5 million has been obtained by Texas interests for Small Business Innovation Research (SBIR) grants and contracts, leaving resources on the table that could assist early stage product development and company formation.
- Alarming is the minimal grants, contracts, and partnerships formed with key national and global initiatives in areas that Texas has competitive R&D, demonstration, and commercialization capacity – as compared to Milwaukee, Boston, San Francisco, as well as Toronto and Tel Aviv.

Field	Total
Aerospace Technology	$29,668,678
Biotechnology	81,095,765
Cancer Research	31,472,029
Energy	124,327,588
Manufacturing Technology	23,672,179
Materials Science	102,291,808
Microelectronics and Computer Technology	102,619,595
Water Resources	29,477,529
Total	**$524,625,171**

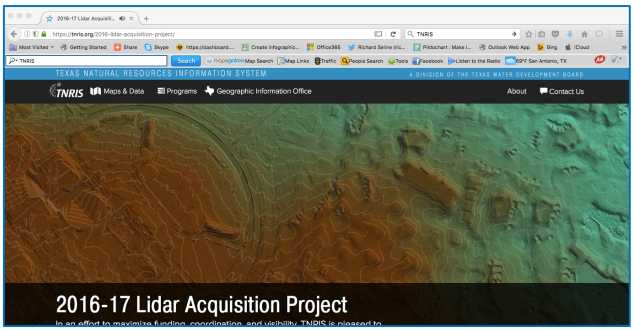
Source: Texas Higher Education Coordinating Board

Consortium on Data Modeling, Predictive Analytics, Smart Instrumentation



Since our Open-Data and Instrumentation Roundtable in late November 2015, and through participation in other forums and conferences across Texas and the US, the need for connecting public and private sector sources of data modeling, predictive analytics, and smart instrumentation continues to expand and reach a level of critical value. A Texas-focused consortium in a state with unique sources of modeling, instruments, computational engineering and sciences, massive computing power and servers, software and application designers, and cyber security expertise is reminiscent of the early formation of MCC and Sematech. Seizing the opportunity to be a global water-data leader requires a commitment on scale and with prior efforts to attract consortia of industry, government, and public sector interests.

Currently there is no such coordination of campuses, industries, end-use base, nor alignment of resources and incentives to form a consortium that would solve challenges in every aspect of water management through a technology road map approach to expediting the process for local, regional and statewide water planning interests. What has emerged are silos of state agency programs to use digital, web-based tools or worse an uneven utilization of digital tools among and within agencies for which the private sector and academia could collaborate to establish the first-ever statewide open-source data strategy.



The success of TNRIS ("Texas Natural Resources Information System) is a vital starting but not an end-point for further collaboration. What we've learned is that knowledge and information are not best driven by any one sector, organization, institution, nor end-user; Texas should become a global leader in the adoption of a framework that sparks the ingenuity and investment of entrepreneurs, innovators, inventors, and industries for a new generation of gages, sensors, instruments, and other technologies that will ensure better management and conservation of water, while also discovering new methods for finding and treating 'new' water sources.

Large-Scale Integrated Systems of Demonstration

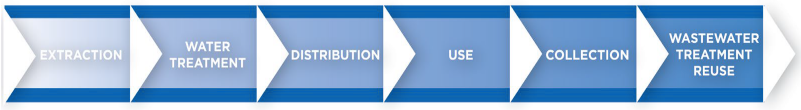
Currently the Texas water technology landscape has evolved faster than our competitor states and regions of the U.S. – we lead in direct potable reuse, aquifer storage and recharge, grey-water or so-called toilet to tap. The assessment, piloting, and adoption of innovations is a hallmark of the partnership among engineers, regulators, and utilities that other states envy the dynamics and speed by which Texas can research, evaluate and often permit through exemption and/or alternative approval.

Yet, we must scale these often one-off successes, find ways to bridge global technology capabilities into our market, and organize in-the-field sites for evaluating multiple technologies along an operational framework or value-chain. For these reasons, AccelerateH2O identified during the 2015 Technology Road Map Forum and in subsequent gatherings, the need for large-scale integrate systems of demonstration (e.g. "Innovative Water Technology Demonstration Hubs") and have begun to partner with

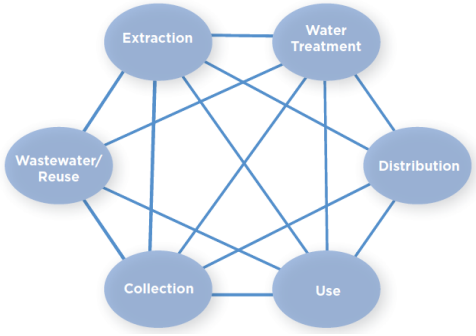
international, national and in-state technology firms to launch several 'demonstration hubs' for advancing the pace of technology development and deployment. What we've learned throughout this process relative to a technology road map is:

- **Regulators require precedence on which to construct rule-making and advise agency leadership**, legislators, and gubernatorial appointees for streamlining approvals and permitting of new products, services, and integrated solutions; however, the pace by which technology innovation is unfolding challenges the current oversight, processes, and procedures for regulatory bodies lacking the resources, in-house capabilities, and/or the timeframes by which the market, investors, and end-users seek answers.
- **Global and national firms with proven technologies and solutions must respond to the "show me, don't tell me" realities of decision-makers**, and therefore are caught in technology commercialization loop: to prove out the efficacy of their product, they need access to the water and infrastructure, but cannot gain such access as rarely does a public utility or industry wish to be the guinea pig or first-out proving ground.
- **Investors, acquisition partners, and procurement representatives want to view technology at real-world scale, not in a limited project conducted on minimum water, laboratory or research university site**, and without all the factors that impact efficiency and costs (i.e. energy use, harsh conditions, over a protracted period of time, etc.). Typically, a pilot is for a specific permit, geography, geology, and/or water characteristic – and again is a one-off that must be proven over and over at a significant cost to the technology firm, investment group, and corporate partner.
- **Utilities, river authorities, districts, and other operators are appropriately concerned with public safety and public health, and therefore must conservatively adopt new innovations and technologies**, relying upon consulting engineers, advisors, and staff experience. But unlike programs in Israel, Canada, even California and Ohio (e.g. East Bay Municipal Utility District and EPA Research Center, respectively), we have few and far between 'innovation centers' at a scale necessary to address prior observations on or adjacent to our largest urban utilities and aggregates of rural systems.

A Continuum of Water Innovation Strategy: Crossing Boundaries, Creating New Opportunities



Historically Texans have approached statewide and regional water strategies along a straight-line, sequential set of steps. Each step engaged different sources, relationships, infrastructure, rules and regulations, and funding, allowing for stovepipes of organizations and institutions to form within strong boundaries often overseen by federal and state regulators. Drinking, waste and general water operations were segmented according to the rules of oversight as well as the various professional certifications, associations and societies created in response to the requirements of a segment.

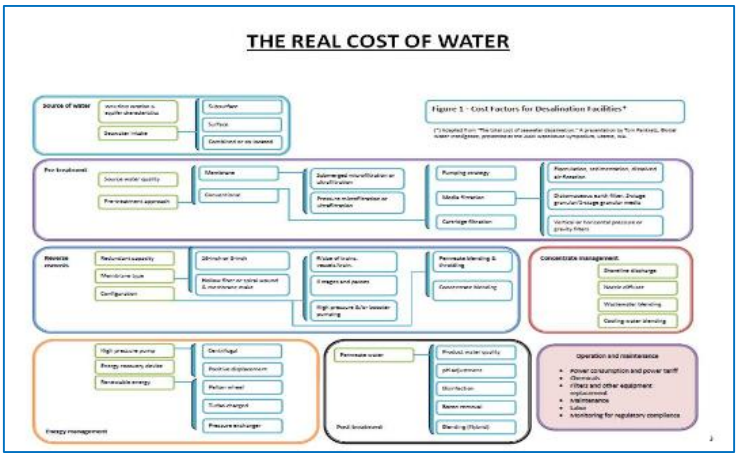


However, as innovation and technology have done in other sectors, boundaries have been broken and old lines of authority are being questioned. For instance, grey water, direct potable reuse, and new treatment methodologies challenge the lines between drinking and waste water regulations, oversight, management, and operations. Reusing sources of impaired water at a specific customer site rather than the treatment facility miles away challenge collection and treatment protocols. Therefore, a water technology road map must take into account the interactivity, the boundary crossing that science, engineering, information, and technology integration have spurred.

What we've learned is a simple reality of innovation: the relationships, networks, and new knowledge about water are transforming operations and management at fundamental levels for which the State of Texas must now modernize its own legislative, policy, practice, and resource allocation approach to 'next-level' planning, strategy and investment in 2016 and 2017. Such modernization will also encourage public and private water operators to seek new opportunities for optimizing operations, facilities, customer and consumer engagement, and the application of technology-breakthroughs. These new opportunities will drive the specifications, requirements, and conditions for advanced technologies that also reach across boundaries, and are highly integrative product and service development and deployment.

The Economic Impacts of Water Technology Innovation: Quality, Quantity, and Costs

While AccelerateH2O has avoided traditional debates on water rights and ownership as well as the price of water – and we will remain outside of contentious legal and legislative battles, the 'value of water' discussion and debate has a direct economic impact on technology innovation. By focusing all of our attention on innovations that respond to the levels of quality, quantity, and costs resulting from advanced technical, engineered, and market-oriented products and services, we seek to change the dialogue and perspective among public and private sector leaders.



The value of water is driven by myriad perspectives that often lead to the inescapable conclusion: water has been so inexpensive, perceived to be free, or miraculously and readily available that any change in future pricing will cause elected and appointed officials to abandon opportunities for deploying technology and innovative practices.

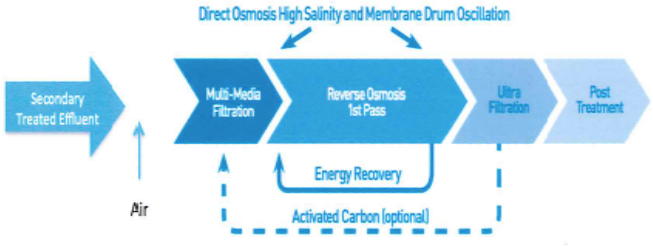
Therefore, an updated road map cannot be completed without recognizing the urgency to 'align the outcome with the methodology' – it is no longer about the technology, the expertise, the precedence for proven solutions, nor resources and capital – it's about the cost of the water resulting from the technological process, methodology, and practical application. We can clean the worse water into a potable or even drinkable resource, but not at $5,000+ a barrel!

One other aspect of technology and innovative practice adoption: any solution that impacts current offtake agreements and debt-management by public utilities will cause concern for senior officials, boards, and ultimately citizen approval. As was overcome in the deregulation, transformation, and/or new business models for the telecommunications, electricity, and other regulated industries, there must be an open discussion and evaluation of alternative financing tools to bridge the challenges of stranded infrastructure expense, bonded indebtedness, and related capital expenditures so that innovation will be a positive solution rather than a threat. Simply, public-private partnership frameworks and financial tools should be encouraged to provide the transitional resources between traditional, current scenarios and the future of water innovation in Texas

On the following pages, we introduce specific areas of technology demand that are already receiving attention in Texas but now must be scaled, obtain additional resources and investment, and become a part of new innovative-driven integrated systems. While only a sample of the 200+ portfolio of technological, scientific, and innovation-focused practices, these opportunities do require increased collaboration with investment expertise from public finance, private equity, venture, and corporate partnership or industry consortia that have significant understanding from years of national and global successful - and where applicable failed - business cases.

Specific Water Technology Areas of Interest

Reverse Osmosis in Desalination

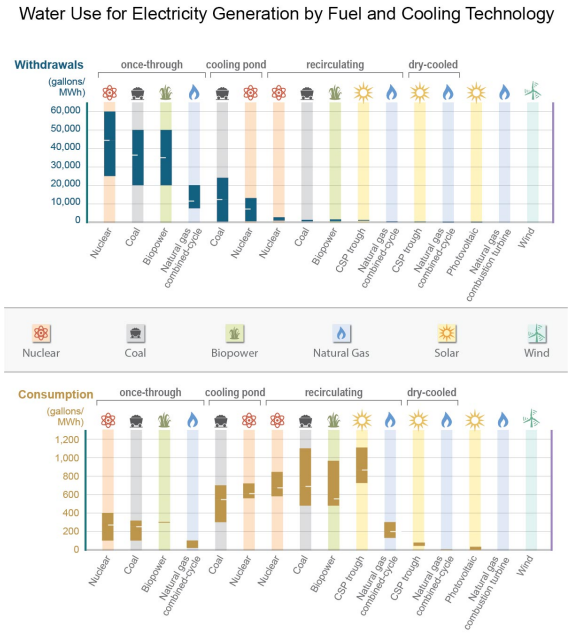


Desalination – both seawater and brackish – have received significant attention from elected and appointed leaders during the past two legislative sessions. While over 30 desalination facilities exist in the State, including the largest inland-brackish desalination facility in North America (El Paso's Kay Bailey Hutchison Plant), another ten to twenty are being proposed in recent state water plan reports and presentations. Though widely adopted in Israel, Asia, Australia, and other locations around the world, the construction and delivery of 100 mgd (million gallons per day) plants are only now being discussed. Such expansion in Texas and across the US has raised the awareness that there are only a handful of technology improvements to the current status of desalination projects:

- Reduce the energy demand caused by filtering significant amount of highly concentrated salt-water
- Pre-treat the salt-water before pushing on the energy and filtration load
- Change the filtration methodologies and standards
- Reuse of brine and post treatment waste stream for additional benefit

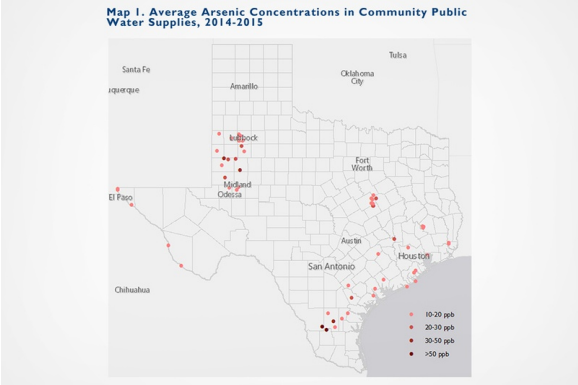
Reduction of Energy and Cooling Water-Related Costs

Research conducted by several Texas academic institutions, real-time data collected by water and power-generation utilities, and the overall economic analysis captured by associations and membership-based consortia have confirmed precise costs linked to the "energy-water nexus" – or simply the co-dependencies that must be addressed through alternative technologies, innovations, and integrated solutions.



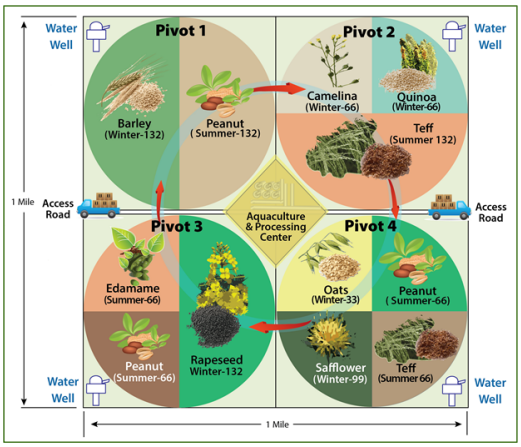
With increased population and industrial growth across Texas' highly urbanized communities, the demand for reducing costs in power-generation and water treatment coincide with recent technological and engineering discoveries, including use of alternative energy sources (wind, solar, flare-gas, thermal water).

Arsenic, Other Contaminants in Rural Groundwater Systems



Arsenic, and other organics found in over 2600 rural water systems threaten their future operations should EPA implement regulatory oversight to its fullest. As noted in a recent article in the Houston Chronicle: "Arsenic is a naturally occurring element present in rocks and can often make its way into groundwater. It is a known carcinogen and linked with a range of maladies, according to the U.S. Environmental Protection Agency. The federal Safe Drinking Water Act requires states to ensure that most water suppliers maintain running arsenic averages of 10 parts per billion or less. In Texas, the requirements apply to 5,523 water systems." The recent water quality issues in Flint Michigan have raised citizen and consumer concerns about their own local, regional groundwater supplies. The detection, reduction, and removal of a wide array of contaminants with lasting environmental and health affects has and will remain a priority of scientific and technical research, but increasingly under emergency and significant public scrutiny for immediate solutions.

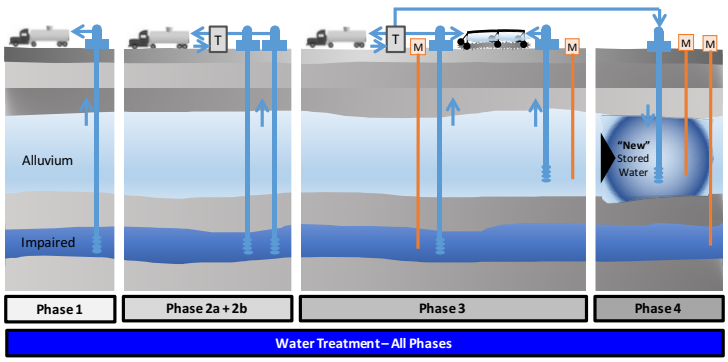
Smart Irrigation and Agriculture Water Management



Often the largest user of surface, ground and other water sources in a majority of Texas' counties, agriculture remains a vital economic and employment driver to the State's competitiveness. Farming and ranching interests have long been innovators in seed, soil, crop, animal husbandry, and resource management; the future of water demand has been the more recent beneficiary of Texas A&M, Texas Tech, San Angelo State, and other academic water research institutes. And yet some of the best sources of agriculture-related water management expertise and technologies come from global locations where water scarcity has dramatically changed the fortunes of national security – Israel and Singapore for instance.

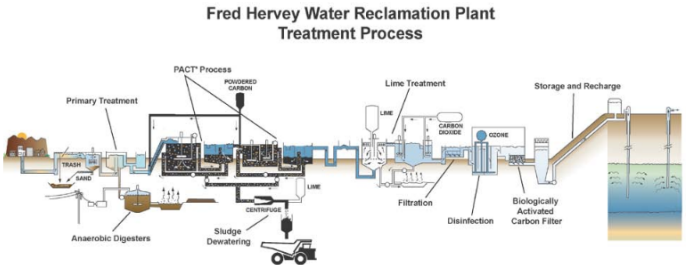
Aquifer Storage and Recovery

The depletion of US' largest aquifer – the Ogallala - has increased the pace for identifying practical and effective technical, environmental, and economically sound means for storing pre-treated water and using other sources for recharging streams and flows feeding into aquifers.



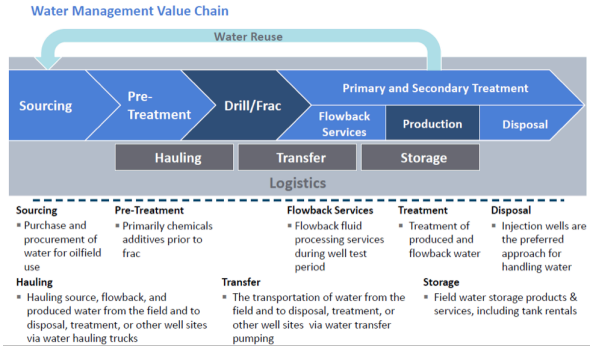
M - Monitor Well
T - Treatment Facility

The entire value-chain of technologies, and engineering design required to handle the movement and transfer of water along the value chain, has its basis in existing treatment processes that are being applied to aquifer recovery scenarios. Through use of the natural "storage" capacity of aquifers, and assuring their environmental integrity, requires significant pre-treatment, solids and sludge removal, mitigation of bacteria and other contaminants, and even the introduction of additional chemistry to support the protection of the entire system for transporting and recovering 'new water' into Texas' various aquifers. The Capitan Reef Complex in far West Texas represents a unique location and scenario for addressing the drought-caused water scarcity challenge, brackish desalination, smart-irrigation, produced water from oil and gas activities into a full-cycle of water management.

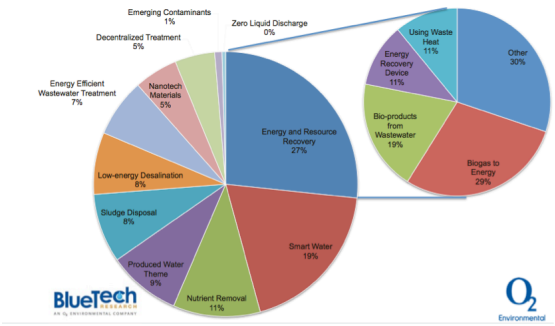


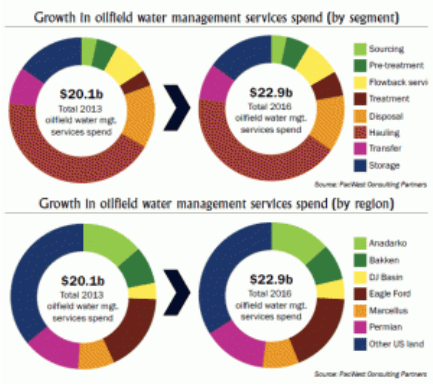
Produced Water from Oil and Gas Activities

Over 6 billion barrels of water from the conventional and unconventional oil and gas drilling sector have been discharged in some 4300 wells across Texas since 2007. Based on reports from the Texas Railroad Commission, DrillingInfo, and DigitalH2O, for every barrel of oil and gas produced, an additional 7-10 barrels of water emerge at the surface. With the decline in global prices from $100 to $32 per oil barrel, water has become an expense that many exploration and production companies are now seeking to address as a potential commodity for new revenue generation. Further changes that are sparking interest in the application of converting produced water to clean sources for agriculture and light manufacturing including operators of large-scale saltwater discharge sites (SWDs) that look to become water providers rather than disposal systems.



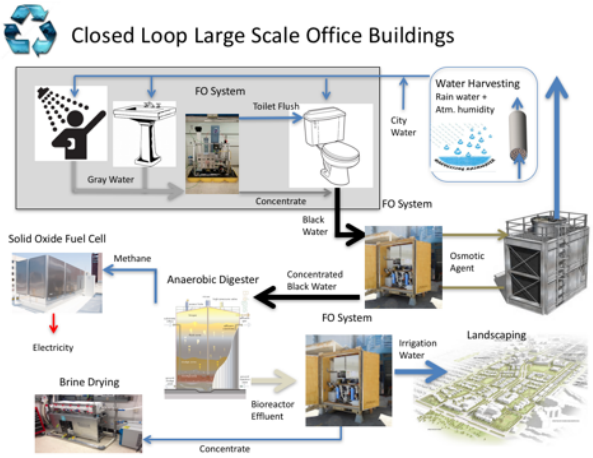
Recently analysis by BlueTech Research and Global Water Intelligence suggest that the growing markets for water recycling and reuse in the oil and gas sector has reached a significant potential as to spur R&D and commercialization in a nearly $22 billion international and national market.





Residential, Commercial Water Recycle/Zero Discharge

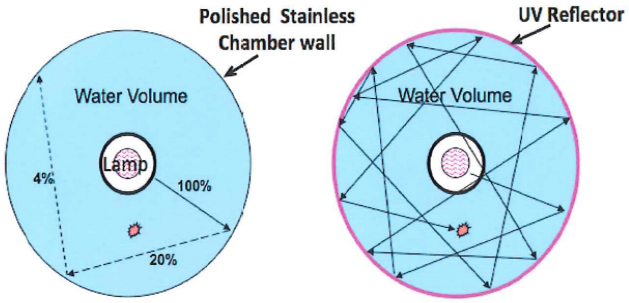
Conservation by residential and commercial building interests has remained an objective of public utilities and so-called corporate social responsibility campaigns around sustainability. However, the advancements in technologies that can be scaled to a residential (homes, multi-family residential, apartments, hotels) and commercial buildings (multi-story high rises, office parks, light industrial, retail) for recycling all forms of grey water, cooling towers, HVAC, and sprinkler systems have attracted attention of new sources of commercialization and deployment. NASA's capabilities to scale techniques and technologies from the International Space Station to small-footprint equipment has been tested and demonstrated to create a "closed loop" system for the capture, treatment, and recycle of millions of gallons to address California's current drought.



Additional technologies such as atmospheric water treatment – using traditional techniques in humidifying water conditions – are increasingly becoming available at price points for residential and commercial end-use. Rainwater capture, low-pressure bathroom fixtures, and upgrades to home equipment (washer-dryers, dishwashers) are a part of the Pecan Street (Austin) laboratory initiative.

UV and Other Alternative Treatment Processes

Improvements in ultra-violent light technologies – including the work of Dr. Mark Maizen (University of Texas' leading physicist) - suggest that changing the structures of light reflection, molecular responses, even isotope-level activity could result in profound changes in the treatment of water at a volume so significant as to create unexpected industrial opportunities. Other treatment protocols that leverage Texas' abundant solar, thermal, and related UV sources are being evaluated in a number of West Texas and urban water systems.

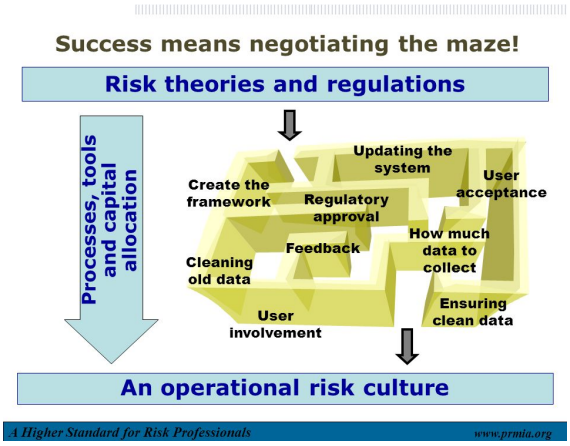


Additional Information and Knowledge-Sharing on Targets of Opportunity

In the weeks ahead, AccelerateH2O will be posting additional reports, findings, and materials on an entire portfolio of water technology "targets of opportunity" for R&D, commercialization, investment, procurement and deployment in Texas. We have already posted hundreds of reports in our various "communities" of the Texas Water Innovation Clearinghouse and Collaboratory.

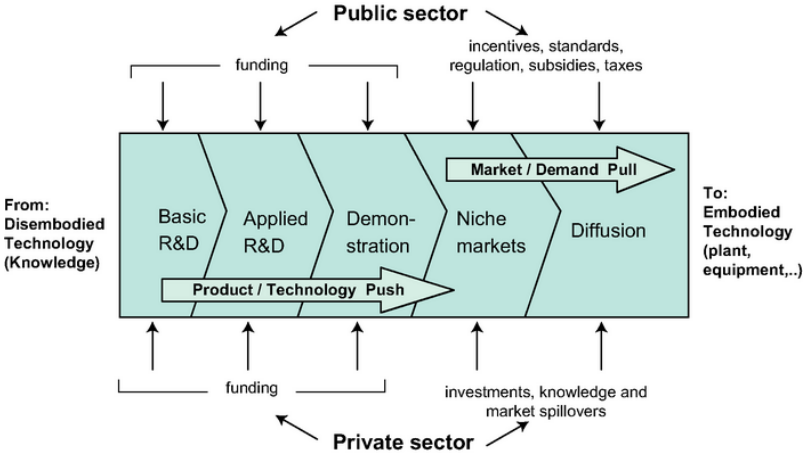
Challenges for Texas Water Technology

Charting the Regulatory, Rule-Making, and Approval Processes: Federal, State, Local



While seeking to streamline the approval and permitting process has been legislatively encouraged, TCEQ and the Railroad Commission are often at odds with federal directives, regulatory and rule-making, and policy interpretation. The maze by which early-, growth-, and even mature-stage technology companies must understand the steps for obtaining approval and permits is neither clear nor simply articulated. Each technology, each source water, each geography and geology are often considered so unique as to cause every new product or solution to go through the arcane and costly pathways. Recently Texas agencies have adopted "innovative" streamlining approvals, exceptions, and exemptions to address urgent scenarios. However, the pace by which innovation and technology development occur cannot be mutually met by state agencies overwhelmed with the demands for increased engineering, technical, and scientific evaluations. Risk mitigation in a risk-adverse culture does not add to the ability to support innovations, especially when such new technologies can often conflict with claims of efficacy, efficiency, and economics from one product to the next, one day to the next.

Aligning Private Sector Technology Development with Public Sector Deployment Timelines

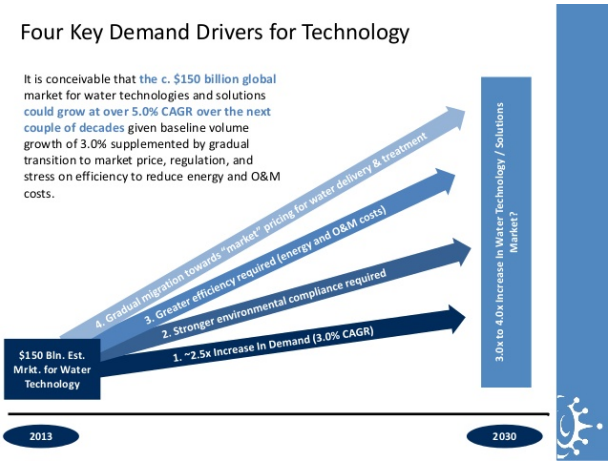


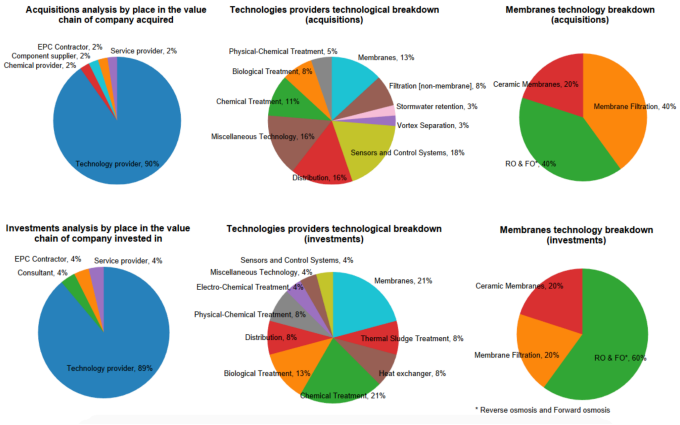
In addition to challenges relative to regulatory and rule-making approvals, water technologies and innovative practices compete for the attention of water operators in the public sector that must manage public trust and finances. Simply, upgrading or wholesale replacement of equipment and system integration comes at a time when the political setting for public expenditures are at a low point. The mismatch of demand, expectation, resource, and public sentiment for more bonding or financing of projects delays many important and critical infrastructure – and therefore technology – initiatives. Though Texas has one of the best public-private partnership (P3) frameworks for use by state, county, and municipal governments, such partnerships are slow in adoption as noted by the slow pace for desalination facilities as promoted in Corpus Christi and along the Gulf Coast.

While much better than the Carlsbad California approval and delivery of a large-scale desalination plant (fifteen years), Texas' current 24-36-month timeline has room for improvement. Overcoming the disconnect between industry and consumer demand for water security with the public sector concerns for financing and funding requires a new approach to partnership and resource allocation among technology firms, infrastructure developers, and private-equity/public-finance investment houses.

Increasing Awareness of Water Technology Investment Opportunities

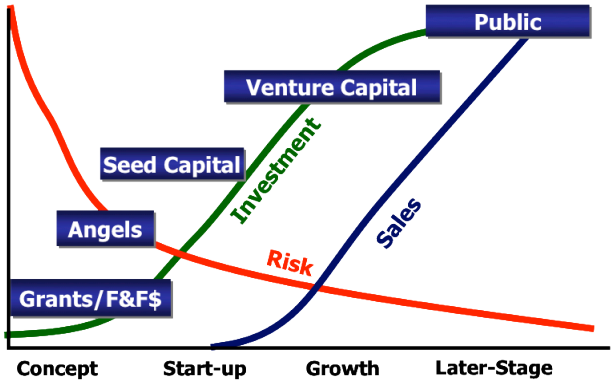
Though progress has been made towards changing perceptions that the only way to make a profit and return on investment in water is through ownership and management of millions in acre feet, Texans remain skeptical and conservative about alternative investments in new technology products, services, and solution. Consistent with the other sectors that required continuous education, awareness, and engagement, the water technology investment scenario is a recent-phenomena for individuals, family offices, corporate and venture capital firms, private equity and banking interests.





Convincing Texas investors to explore alternative opportunities requires overcoming several hurdles, including the perception that water is such a political, public-sector, and legally entangled risk. In recent statements by GE, XPV Capital, and a number of respected private finance and public equity firms, technology alone is not the most effective investment approach; rather, creating large-scale deployments through infrastructure, multiple site, and/or unique special purpose vehicles can structure risk mitigation with solid returns.

Texas' robust network of incubators, accelerators, early-stage commercialization and related outreach programs to investors, entrepreneurs, and innovators are now in alignment through AccelerateH2O's "Opportunity Triage Network" and partnership with ATI ("Austin Technology Incubator") Water Initiative to provide the vetting, evaluating, and professional advisory services to a broad spectrum of water technologies. In turn, InvestH2O: The Texas Water Technology Forum will continue to advance the knowledge-sharing, syndication, and investment information and data for family offices, venture capital firms, corporate venturing offices, private equity, and the banking sector.



Encouraging Actions for Texas' Water Technology Road Map

1. Incentivize and Strengthen Texas' R&D Collaboratory: Academic-Industry Partnered Problem Solvers

With over 23 different academic, research institutes, programs, and divisions across Texas' public and private universities, there are well over 550 individuals already identified that provide the underpinning for stronger industry, market-responsive 'problem solvers.' However, fragmentation within university systems and across campuses is a hurdle for inventors, innovators, entrepreneurs, investors and industry interests seeking to identify, engage, partner, and where applicable allocate resources for near- or market-ready technology products, services, and solutions. Though the National Science Foundation has funded certain collaborations, the focus on the "R" (research) and less on the "D" (development) plagues the connectivity for advancing scientific, technical, engineering and a host of other capabilities on and adjacent to the State's sources of intellectual property, commercialization, and unique facilities, incubation, and pilot infrastructure.

For these reasons, we have launched the Texas Water Innovation 'Collaboratory and Academic Partnership' vis-à-vis the Clearinghouse (http://www.AccelerateH2O.org) as a convening site, toolkit, and project management support for engaging leading academic expertise as "problem-solvers," technical advisors, evaluators, and partners to the Opportunity Triage Network, the Texas Water Innovation Network of Engineers, the Innovative Demonstration Hubs, and InvestH2O.

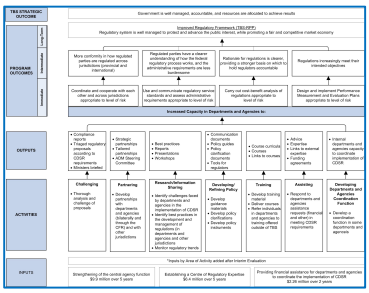
2. Infuse Private-Sector Innovation into Texas Water Development Board, State Water Plan Programs

While appropriately focused on responding to the critical infrastructure needs of the State's 4600+ water systems, and funding specific technology pilots (i.e. ASR, DPR, Desalination, etc.), after review of the 2016 draft regional water plans, opportunity remains to infuse additional private-sector innovation into the Water Development Board's planning process and to encourage greater engagement of innovative practices for alternative approaches. Simply, to achieve the Board's successful implementation of SWIFT and other programs, it must rely upon the ability to partner with private equity, public finance, and alternative resources to meet the need of a $30+ billion water plan. As home to some of the best expertise in global infrastructure, technology, financing, and project development, the State – and in turn counties and municipalities – could leverage the Texas Public-Private Partnership framework that has been used in other sectors and is the envy of 49 other states.

Restoring the funding to the Board's office of innovation and structuring it to leverage resources with entrepreneurs, innovators, inventors, and investors would rekindle the appropriate level of partnerships and resources necessary for public sector benefit and private sector pace. Piecemeal studies and reports, thought assistive in advancing innovation, will not scale the critical discovery-development-demonstration-deployment pathway to compete with other countries and states in identifying and utilizing next generation technology products, services, and solutions.

3. Streamline TCEQ, RRC Approvals and Permitting with Local Challenges, Interpretation

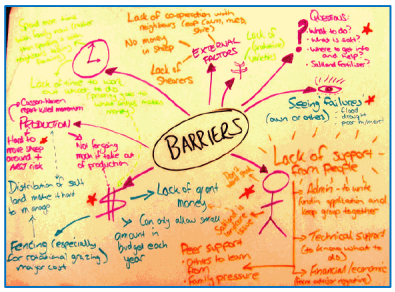
Over the past several years, state regulatory bodies have made strides to streamline their approval and permitting processes while federal regulatory agencies and initiatives change frequently with new interpretations, rules, and even court settlements or agreements when challenged. Yet, with the onslaught of technology and innovations occurring at a pace for which any agency would be stifled, there is the need to consider how best to continue streamlining procedures and aligning rule-making with public safety and health. However, even if streamlining could be achieved, many local and regional organizations and authorities seek to interpret rules and application of technology to the detriment of innovators, investors, and even their own citizens.



Currently there is NO graphic, diagram, nor easy chart to review on the steps from presenting a novel or even proven technology for approval and permitting. Stories are told and retold of the number of times a proven technology has to be demonstrated from one "unique" water, geology, geography to the next. Surely a state that has become a world-class location for life science and biotechnology clinical trials can take a page from increasing safety while also finding innovative technical approaches to obtaining the best technical, engineering, scientific, AND economic data without repeating the process over and over again.

4. Remove Unintended Barriers, Limitations to Innovative Practices

AccelerateH2O has identified a number of barriers and limitations – many unintentional – to innovative practices. For instance, a global Fortune 500 company that uses all means of industrial zero-discharge and reuse strategies is penalized when its 28% water reduction is offset by local and regional water authorities requiring a 100% monthly use in its offtake agreement. While industry seeks to reduce expenses, more efficiently and effectively use its resources, and create a sustainable footprint, it cannot resale or make a secondary market from its savings. Over time this will limit the economic benefit for industrial reuse.



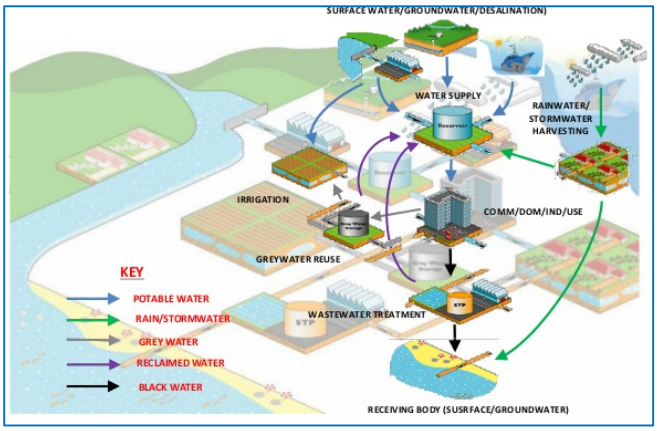
We are encouraged with the uptake of new technologies and innovative practices by a generation of engineers comfortable with alternatives to traditional solutions (including infrastructure) whom are emerging as practice leaders in their firms. Their insight to bridging the typical "we have always done it this way" to a consideration of additional and alternative engineering approaches in design and recommended planning strategies is refreshing. But still is not enough nor broadly accepted in certain utilities, authorities, and facility operations. The perspective that "not losing one's job by doing what has always been done" limits innovation, ingenuity, and effective application of newer technologies.

Previous generations of technology innovation and adoption have confronted similar issues, resulting in breakthroughs as well as new business and economic models for traditional sectors. State elected and appointed officials, legislative leadership, industry, and technology expertise should join with operators, managers, and water system project planning to identify steps for addressing the following barriers and limitations:

- Rules and Regulations in Review, Approval and Permitting of Technologies
- Incentives to Act, Procure, Deploy Technologies – Proven AND Emerging

- Culture and Perceptions Towards Technology Application and Innovation
- Economic and Business Models to Deploy, Implement Technology
- Implementation of Technology Approach in Regional and State Planning
- Leveraging Traditional Concrete and Rebar Infrastructure with Technological Innovations
- Federal, State, and Local Conflicts for Implementing Critical Technological Strategies

5. Spark New Market Dynamics for Basin-Oriented Water Solutions



Our current form of water planning leans more towards sixteen individual "systems" within artificial boundaries of the state process, and does not often encourage larger-scale, multiple jurisdiction scenarios for enhancing water management through basin-oriented approaches and solutions. West Texas is a perfect example for testing a new market dynamic across basins to address its recurring droughts and to stimulate economic growth and job creation. With multiple sources – from produced, impaired water during oil and gas exploration, desalination of brackish water, aquifer storage and recharge, effective irrigation practices, industrial reuse, and optimized utility operations – West Texas should be a center of water abundance. However, fragmentation of end-use, competing ownership and rights, geographic battles for jurisdictional oversight, and a host of similar challenges prevent a large-regional approach – a basin-focused – solution to becoming the "New American Oasis" where all sources contribute to a lifecycle of water generation, management, and innovation.

Implementing The Road Map

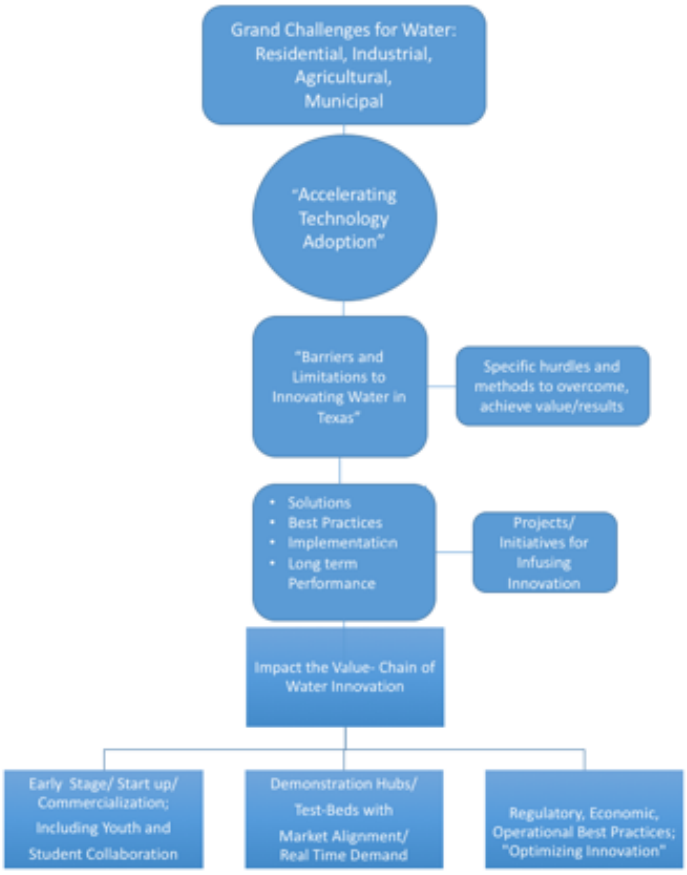
Performance-Based Technology Initiatives

AccelerateH2O has introduced several initiatives and programs to drive increased use of emerging and proven water technologies around "Grand Challenges", while also identifying barriers and limitations to innovating water that must be addressed to hasten and expedite the use of breakthroughs and globally-recognized products and services.

We have taken a performance-based approach – measurable actions and outcomes are built into each initiative, leading to specific strategies to overcome traditional perspectives, operating practices, and regulatory impediments.

Recently, AccelerateH2O has announced the following initiatives:

- Innovative Water Demonstration Hubs
- Texas Technology Approval Group with four of the largest urban water utilities
- The Texas Water Innovation Clearinghouse and Collaboratory
- WaterQuest Competitions

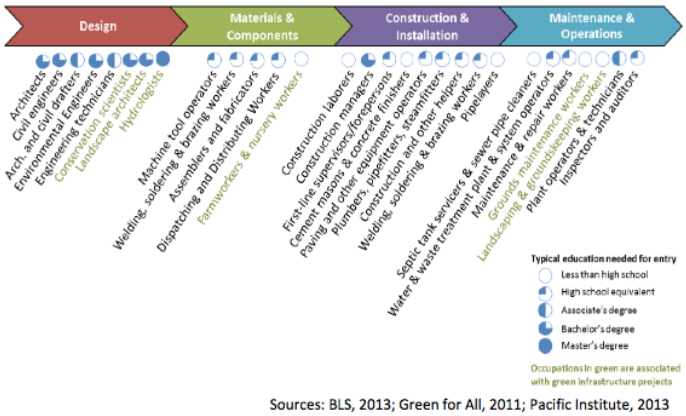


Engaging, Incentivizing, Promoting Water Innovators

There are more disincentives than incentives built into the current water practices and processes for Texas operators in both the public and private sectors. For instance, we are aware that as more industrial reuse and zero-discharge is adopted, large manufacturers are 'disincentivized' by the required monthly off-take agreements that demand the same level of water purchase regardless of savings and conservation. There is no secondary market for selling under-utilized amounts sparked by innovative practices. As Dick Evans, former Chairman of Frost Bank, has commented: "…we must unleash the private sector, entrepreneurs, innovators, inventors, and investors to solve Texas' greatest issues in water – and to really encourage the best minds and capital to push new ideas into what surely is a conservative market of public sector management and operations…"

"21st Century Water Technologist Skills Initiative"

With the introduction and adoption of each new water technology comes the necessary training, skills development, certification and degree program to meet the demands for operations, maintenance and repair on public and private systems, infrastructure, facilities, and sites. The typical process of recommending and approving new curricula to the TCEQ for certification can be 18-20 months, and is often considered reactive rather than proactive to the demands and pace for innovative practices and technologies. In addition, with over 30,000 retirements expected over the next 5-7 years in public water system and utility employment, Texas must adopt a strategy to consider the water technology workforce a priority. Some 344,000 Texans are directly employed in water and water technology across urban and rural communities, with another 1 million indirectly hired to manage, convey, treat, and transport water. There must be a corresponding statewide strategy to focus attention and interest in water technology as a future occupation for youth and students, retrain veterans, and otherwise promote water technology jobs as another part of the State's innovative capacity to globally compete.



Sources: BLS, 2013; Green for All, 2011; Pacific Institute, 2013

In AccelerateH2O's workforce, employment and skills assessment for the Texas Workforce Commission and the State of Texas, over 344000 Texans are directly employed in water-related positions. By 2020, retirements will leave a significant gap in the knowledge and understanding of legacy systems and existing technological approaches. However, there is a necessary and immediate opportunity to ensure future employment keeps pace with current technologies, applications, and innovation operations. By linking equipment design, evaluation and demonstration, manufacturing here in Texas – and even setting the standards for deployment and use of these technologies – there is a strong scenario for a 21st century water technologist implementing a 21st century water technology road map. And with Texas' highly regarded public and private university engineering, natural sciences, data and geospatial, and nearly 15 other vital disciplines, innovation can be successfully achieved along the road map!

Conclusions & Next Steps

AccelerateH2O will continue to work with the State's abundant academic, non-profit, industry, entrepreneur, and investor communities to advance market-demanded technology solutions and innovation practices into the $9+ billion water technology marketplace. To hasten a more efficient and effective eco-system for innovation, especially in an often risk adverse sector, a sense of urgency and opportunity has to be stabilized between newly reported droughts and sudden storm-caused flooding. And the price points and value of water must no longer be politically protected from the realities of the market and economic forces necessary to generate the investment, capital expenditure, and procurement of technology products and services for Texas to address its grand challenges AND fulfill the promise of the $9+ billion opportunity.

The 2nd Texas Water Technology Road Map sets in motion a specific need to organize state agency, legislative, industry, innovators, and investors into a partnership that works to overcome barriers and limitations to innovating water in Texas. Through Governor Abbott's leadership as 'chief executive officer', there is a unique moment to leverage his convening power and encouragement to position Texas as a global water innovation hub. The executive and advisory committee leadership of AccelerateH2O is prepared to support and work with the Governor and his staff in forming a Texas Water and Water Technology Innovation Working Group.

All the while, private sector capital, financial expertise, and market-making projects can infuse technology and innovation into the Texas scenario by challenging the status quo of traditional procurement by conducting a series of X-prize, open competitions to spark public sector imagination and partnership for mitigating risk about applying breakthroughs and new innovative practices for water security, management, reclamation, reuse, and repurposing. AccelerateH2O has the tools, information, and critical mass of networks within Texas and around the world to "run" competitions, prizes, and open-source problem solving through our Texas Water Innovation Clearinghouse and Collaboratory.

Finally, to stimulate technology and innovation across Texas' 4600 water systems and 5000 corporate campuses, there must be the resources, talent, and 'infrastructure' to combine public and private sector knowledge, expertise, and capital into partnerships that create regional water markets. For the moment, a series of 'jump-starts' may be required to move commercially viable, integrated systems of technology and innovation into the market through showcasing practical approaches and real-world solutions on a cost effective basis. AccelerateH2O proposes that the Innovative Water Demonstration Hubs could serve as regionally-aligned 'spark points' for connecting technology evaluation, approval, and deployment with broader understanding and acceptance on standards for quality, quantity, and the economics of generated water.

We look forward to collaborating with any and all parties across the State that seek to 'innovate water in Texas'. For more information, please send an email to info@accelerateH2O.org, join the Clearinghouse at www.accelerateH2O.org, or call us at 800-708-0478.

Founders, Underwriters and Sponsors

AccelerateH2O's Assessment and Opportunity Network

We have assembled an ever-expanding Texas-wide network among non-profit, academic, industry leaders, and highly regarded subject matter experts with specialization in the commercialization of water technologies. Our network includes:

AccelerateH2O Strategic Partnerships

AccelerateH2O has partnered with the following global and national organizations to deliver customized, specific market research. We deliver real time technology demand assessments, investment intelligence, and assistance in vetting, evaluating, and presenting emerging, growth and mature-stage solutions to residential, industrial, agricultural, and public utility interests.

AccelerateH2O Investment Advisors

AccelerateH2o has formed syndication and Investment network for opportunities to advise, syndicate, and/or co-invest in growth stage water technologies.