

U.S. EPA Water Technology Innovation Cluster Leaders Meeting

The Role of Water Utilities

Meeting Summary Report

Sunday, September 25, 2016

Ernest N. Morial Convention Center

New Orleans, Louisiana

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EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA) hosted a meeting of Water Technology Innovation Cluster Leaders on September 25, 2016, ahead of the Water Environment Federation's Annual Technical Exhibition and Conference (WEFTEC) at the Morial Convention Center in New Orleans, Louisiana. There were approximately 100 individuals who attended and represented the water clusters, government agencies, national water associations, and water utilities. The meeting was organized to bring together various stakeholders who have a dedicated interest in water technology innovation and implementation. These groups shared an interest in a meeting on the topic of the role that water utilities play in water technology innovation clusters. The focus of the meeting was to identify best practices and showcase examples, as well as to encourage the water cluster leaders and utility representatives to begin collaborating to strengthen the water industry and regional assets.

The meeting had three major goals: (1) to foster closer collaboration between the water clusters and water utilities; (2) to showcase leadership, programs, and actions of innovative water utilities, water clusters, and other organizations both here in the United States and abroad; and (3) to capture ideas, successful models, and best practices for development of a guide on how water utilities and water clusters can work together effectively.

The audience heard presentations and panel discussions from water cluster leaders, utility managers, water technology companies, and various water research and support organizations. Each speaker and panelist shared experiences and insight into how their organizations operate. Water cluster leaders and utility managers heard about the challenges of working together, but they also heard about the benefits. The panels were conversational; and therefore, PowerPoint presentations were not used. The following individual speakers presented slides during their talks: Biju George, Angela Koh, Booky Oren, Jonathan Clement, and Hein Molenkamp. The presentations were distributed to the registered meeting participants in advance of the meeting. To request a copy of the presentations, please email epawatertech@epa.gov.

ABBREVIATIONS AND ACRONYMS

AWWA	American Water Works Association
CSO	Combined sewer overflow
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ETICP	U.S. EPA Environmental Technology Innovation Clusters Program
FEMA	Federal Emergency Management Agency
GCWW	Greater Cincinnati Water Works
IP	Intellectual property
LADWP	Los Angeles Department of Water and Power
LIFT	Leaders Innovation Forum for Technology
MMSD	Milwaukee Metropolitan Sewerage District
MOU	Memorandum of understanding
MSDGC	Metropolitan Sewer District of Greater Cincinnati
NACWA	National Association of Clean Water Agencies
NEWIN	New England Water Innovation Network
NGO	Non-governmental organization
NSF	National Science Foundation
ORD	U.S. EPA Office of Research and Development
OW	U.S. EPA Office of Water
PUB	Singapore Public Utilities Board
R&D	Research and Development
RUN	Confluence Regional Utility Network
SWBNO	Sewerage & Water Board of New Orleans
TAG	Isle Utilities Technology Approval Group
WEF	Water Environment Federation
WEFTEC	Water Environment Federation's Annual Technical Exhibition and Conference
WE&RF	Water Environment & Reuse Foundation
WRF	Water Research Foundation

INTRODUCTION AND OVERVIEW

The U.S. Environmental Protection Agency (EPA) Water Technology Innovation Cluster Leaders Meeting was held Sunday, September 25, 2016 in New Orleans, Louisiana. The meeting had three major goals: (1) to foster closer collaboration between the water clusters and water utilities; (2) to showcase leadership, programs, and actions of innovative water utilities, water clusters, and other organizations both here in the United States and abroad; and (3) to capture ideas, successful models, and best practices for development of a guide on how water utilities and water clusters can work together effectively. There were approximately 100 individuals in attendance from nine different countries.

WELCOME TO WEFTEC AND MEETING OBJECTIVES

Speakers

DR. BARRY LINER, Director, Water Science and Engineering Center, Water Environment Federation

STEVE PICOU & GRASSHOPPER MENDOZA, Louisiana Water Economy Network

CHRISTOPHER ROBBINS, Associate Assistant Administrator for Management, U.S. EPA Office of Research and Development

Dr. Barry Liner welcomed everyone to the meeting. Steve Picou and Grasshopper Mendoza followed up with a welcome to New Orleans.

Christopher Robbins stated that this was the largest and most diverse set of water cluster leaders that has ever assembled at a EPA water cluster leader meeting since the program started in 2010. In this short time, the water cluster initiatives in the U.S. have grown from three to 18, which includes the newest clusters: Water-TIE in Philadelphia, Current in Chicago, and the Los Angeles Cleantech Incubator Water Cluster. He expressed gratitude for everyone's attendance, especially the international participants. Mr. Robbins mentioned several of the direct water challenges faced by EPA this year. All of these problems require innovative technologies to better monitor our water supplies, improve water efficiency, and better treat and control contaminants. Lastly, Mr. Robbins commented that when we work together, we have a unique opportunity to bring solutions to bear with clear outcomes to improve the sustainability of our water supplies and the health of those we serve while simultaneously supporting the growth and development of our water industry.

PERSPECTIVES FROM LARGE U.S. UTILITIES AS PRIMARY ACTORS IN WATER CLUSTERS AND WATER INNOVATION

Speakers

BOB MILLER, Chief Financial Officer, Sewerage & Water Board of New Orleans

BIJU GEORGE, Chief Operating Officer, DC Water and former Board Member of Confluence

Introduction

DR. BYRON CLAYTON, President & CEO, NexusLA

BOB MILLER

Dr. Byron Clayton introduced Bob Miller, who spoke on behalf of Cedric Grant, the Deputy Mayor and Director of the Sewerage & Water Board of New Orleans (SWBNO).

He opened with a challenge to the audience, particularly the utility representatives, to think about the legislation that created their utility. He said that there is a good chance that many utility representatives have never read that legislation. He described that it is likely prescriptive, telling you what you can and cannot do. Utility folks are very mission-driven. While the utility may have a mission statement, all of the authority goes back to the enabling legislation.

Next, Mr. Miller explained how SWBNO got from the enabling legislation to where it is today. He said that it is safe to say that the words “water cluster,” “collaboration,” or “innovation” are not included in the enabling legislation. In New Orleans, folks started about 100 years ago to define the mission, which they did so well that it allowed their communities to thrive and their businesses to grow. But all of those utilities have a life cycle, and within it, many of them are in the fourth quarter of that life cycle.

Similar to other major American cities, New Orleans has experienced significant demographic changes over time. When the demographic changed and reached a certain tipping point, those demographic changes caused a significant population shift. This happened in 1980, when about one third of the New Orleans population moved out of Parish County. The population went from 660,000 to 440,000. This drove funding shortages, which drove them out of compliance with the Clean Water Act, which drove a federal consent decree. This drove a privatization battle that involved significant staff cuts.

Eight percent of the city was damaged or destroyed from the flooding devastation of Hurricane Katrina. This caused the makings for a full-scale utility disaster. With the Federal Emergency Management Agency’s (FEMA) assistance, they were able to get the utility back up and going, allowing the population to return. But, they were on a crash trajectory.

Mr. Miller told a story about a meeting where he gave a testimony on the need for rate increases. The chair of the meeting asked, “How long and how far can you go without a rate increase?” Mr. Miller responded, “We can go all the way to the scene of the crash.” He explained to the chair that this meant, “When this utility fails and we can’t get it restarted and you have to evacuate the city because we cannot provide the necessary water services.” Mr. Miller considers that to be a pivot point. It provided the justification for full funding and the community was able to understand what had been happening for the past 30 years. At that point, SWBNO was about half a billion cumulatively in under funding. With

that, they got a program with water and sewer rate increases over eight years, 10% a year, and more than doubling the rates for that period. The utility is about halfway through that now. He said that there is a price to pay for a rate increase program like that, typically involving governance changes. In this case, the board of directors changed to an entirely qualifications-based board. This was essential so that the board could switch from an operating entity to a strategic entity. As they became more strategically focused and because they had imposed such a financial demand on the community, there was the expectation that they would turn outward. SWBNO considered itself a self-enclosed monolith that always took care of its own business. That myth was shattered, and because of this new financial demand, there was the expectation that it would engage with the city, which meant it had to engage stakeholders.

Mr. Miller met Grasshopper Mendoza of the Louisiana Water Economy Network shortly after he started at SWBNO. He asked her about which organizations he needed to know, but she said that “it’s not which organizations you need to know, but which people you need to know and engage. Engagement can only take place at the personal level.”

SWBNO looked at its revenues and quickly realized that even with the full funding, it would never be able to fulfill its mission. In order to survive, it had to engage the other participants in the water economy. New Orleans has an Urban Water Plan, which is a 50-year plan for re-envisioning living with water in the city. It is a well-developed plan; however, it was developed – for all intents and purposes – without meaningful participation. While evaluating that plan, SWBNO concluded that it could not afford the traditional way and the continued infrastructure investments without engaging innovative ideas.

Although the utilities represented at this meeting have systematized the innovation process, many utilities are not prepared to systematize innovation or collaboration. Rather, they are prepared for business as usual until they can pass the responsibility on to someone else. A bold step is needed to convince a utility to build a conceptual plan if it is not already positioned to do so. It requires the executive leadership of the utility to have the courage to turn many of the operational responsibilities over to a senior management team so that that executive leadership can spend more time turning outward and engaging stakeholders. SWBNO still struggles with this balance. As Chief Financial Officer, Mr. Miller has a saying: “It’s not love that makes the world go ‘round – it’s cash flow.” To find out if a utility is truly engaging in collaboration, then follow the money, he said. If a utility is spending money on innovation and collaboration, then it is probably doing it. And if there is not money being spent on it, then it is probably not.

Fundamental change cannot be bolted on to a utility. It requires a transformation, and frequently, the transformation cannot be led by the old guard. Current SWBNO Director Cedric Grant began after Marcia St. Martin retired. Ms. St. Martin was responsible for restoring SWBNO after Hurricane Katrina. Mr. Grant’s primary responsibility was to unite SWBNO with the Department of Public Works, two major deliverers of infrastructure. This new guard brought a new approach. Mr. Miller’s last secret to success is creating the freedom to act and the freedom to redesign your mission. To solve that problem, sometimes you have to step back and redefine the problem as actually bigger than it was. He said that we are taught that if we cannot solve a problem, then we should break it into pieces and solve the

pieces. But, this sometimes leads to partial solutions. When you are redefining the problem, you need to redefine the opportunity that comes with it – water, sewer, and stormwater – but also groundwater stabilization, subsidence control, job creation, and water as a community amenity. Mr. Miller closed with a challenge to the audience: “Don’t just bolt the strategy for innovation and collaboration on to your utility, but work to make fundamental changes in the DNA of your organization by looking outward, redefining your mission, and going big.”

BIJU GEORGE

Dr. Byron Clayton introduced the next speaker on this topic, Biju George, who presented on “Utilities as Primary Actors in Water Clusters and Water Innovation.” Mr. George formerly served as a board member of Confluence, the water technology innovation cluster in Cincinnati, OH. One thing that distinguishes DC Water from other agencies is the level of collaboration among the regional utilities throughout DC, Maryland, and Virginia. Before a utility jumps in to innovation, it has to have a very clear definition – a flag peak in the mission – of what innovation entails. DC Water follows this definition of innovation: development, implementation, and marketing of fresh ideas, which brings value to ratepayers, employees, and the water industry as a whole. It allocates about \$3 million per year for innovation research in the Blue Plains and is planning to further grow that to other programs. Innovation is well-funded rather than an aspiration. In order for this to happen, DC Water had to have a well-defined mission for innovation.

Other aspects of the organization, such as performance evaluations and the business model itself, also aligned with innovation. For example, the organization has a maturity model, where every business process is ranked from one to five. Processes labeled four or five are considered to be innovative, otherwise they are working towards that. Innovation is not the solution for every part of a problem, so issues must be solved in other ways. If you are performing well, then you will incorporate innovation into part of the equation. In addition to the maturity model, DC Water is also developing a business reference model. It has an end-to-end estimating system for processes, so it knows the costs and opportunities that innovation can provide. Innovation should be about finding the economic benefit.

Mr. George gave credit to Dr. Sudhir Murthy, Chief Innovation Officer at DC Water, for the next topic. Dr. Murthy explains that innovation is different depending on what is being innovated, and he relates it to the gestation period of different mammals. Mr. George presented the specific examples that Dr. Murthy uses. The rabbit has a lifespan of 2-3 years and has a gestation period of about 33 days. A horse has a lifespan of 20 years and a gestation period of 340 days. And, an elephant with a 70-year lifespan has a 640-day gestation period. When assessing innovative ideas at DC Water, they are evaluated based on the lifespan of the project. For example, if it is an infrastructure asset that is going to last 70 years, then it must be viewed differently than an innovative idea for analytics that can be evaluated fairly quickly. A \$19 million product or process that has a 10-15-year lifespan will also be viewed differently. There is a system of recognizing the innovation program based on the lifespan or value of the asset.

Adding to Mr. Miller’s comments, Mr. George emphasized that innovation is not something that gets bolted on just for the sake of collaboration, but rather, to be implemented as a true business driver. When he was working to establish an innovation program at Greater Cincinnati Water Works (GCWW),

the utility was negotiating a consent decree with EPA. He and his team found that the only way to follow through was to establish an innovation program and come up with solutions to support their part of the negotiation. Similarly in DC, they are developing business goals to drive business strategies to drive innovation strategies. Further down the road, they apply the strategy and identify innovation opportunities. Clusters truly have an innovation strategy integrated with a business goal. For example, one of DC Water's business goals is finding alternate revenue by using water as a service. One strategy involves providing services on the other side of the meter. DC Water is collaborating with Xylem to develop a solution that it can offer to customers. He summed up by saying business goals drive business strategy, and that drives innovation strategy. Then, he presented a graphic on DC Water's innovation model. There are three kinds of innovation strategies that each relate to an animal gestation period: quick-win shared ideas program (rabbit), products and services (horse), and engineering (elephant).

Water clusters play the role of a facilitator, and DC Water looks forward to participating in one. It works with utilities, universities, manufacturers, and consulting firms. This is a true model for a cluster, as clusters connect universities, consultants, other companies, and utilities – as long as the utilities have a model to collaborate.

Last year, DC Water's board requested that it use innovation as a strategy to pursue alternative revenue. The strategy consists of three parts: (1) Maximizing revenue by leveraging existing capital assets; (2) Developing alternative revenue by leveraging intellectual capital (commercializing intellectual property); and (3) Building "Blue Drop" (non-profit arm of DC Water) as a vehicle to implement alternative revenue strategies. The second strategy is working well and it has acquired a lot of intellectual property (IP). Finally, once a system to operationalize innovation as a systems process is established, hiring staff is the next step. DC Water has a Chief Innovation Officer and a Chief Marketing Officer.

In closing, Mr. George encouraged utilities to play as a leading actor in an innovation cluster. He shared his Guiding Principles for Innovation:

- Define innovation for internal mission clarity
- Adopt innovation as a business process
- Identify long-term opportunities and themes
- Prioritize opportunities based on value creation
- Assess internal capabilities and collaborate for competencies
- Focus on the most renewable internal resources – people
- Execute flawlessly

Question & Answer Session

Are you allowed to make a profit as a public utility?

It depends on the legislation.

Innovation does not always fit in to the traditional procurement process boundaries, but to some degree, it does. But sometimes you want folks to come forward that may not fit in these boundaries. How do you handle that?

In DC, thinking about doing procurement for innovation, they need to be careful about procurement and contracts. They have a procurement chief who is a lawyer. In Cincinnati when working with a consulting firm, they set up an agreement early on saying that there was no guarantee that they would get the job. At the end of the day, they got a better bid and the initial firm did not get the job. You have to make sure you are fair and that your commercial partners get the benefit of working with you.

LEADING SINGAPORE TO A SAFE AND SUSTAINABLE WATER FUTURE THROUGH INNOVATION: THE ROLE OF THE SINGAPORE PUBLIC UTILITY BOARD

Speaker

ANGELA KOH, Director, Singapore Water Academy, Singapore Public Utility Board

Introduction and Moderator

PAUL O'CALLAGHAN, Founder & CEO, BlueTech Research

PAUL O'CALLAGHAN

Paul O'Callaghan preceded Angela Koh's talk with a brief overview of the water challenges and successes that Singapore has encountered. "Singapore is a glimpse into the future. If you want to see the cities of tomorrow, it is a great case study." There are some emerging water technology startups going to Singapore to innovate and address the needs of the Singapore PUB. Singapore is arguably one of the best places to prove a technology, Mr. O'Callaghan said.

ANGELA KOH

Ms. Koh began with the key takeaways addressed in her presentation: (1) We always keep our mission in mind of achieving water sustainability for Singapore. Industry is a key partner to help us achieve this mission; (2) From vulnerability to opportunities: The water sector created jobs and contributed economic growth for Singapore; and (3) We continue to grow our water industry. We will explore new areas by looking at providing solutions for the world and building further on our industry capabilities.

Singapore is a city, state, and country in Southeast Asia and is one of the world's most densely populated countries. Ms. Koh showed the structure of the Singapore Public Utility Board (PUB). It is part of Singapore's Ministry of the Environment and Water Resources, which is comparable to the EPA in the United States. PUB is responsible for everything water-related in Singapore and manages the entire water loop as the national water agency. It gets water from four different sources: local catchment from 17 reservoirs, water imported from Malaysia, NEWater (high-grade reclaimed water), and desalination. PUB owns and manages almost all of the water infrastructure in Singapore. Over the years, it has brought in industry partners to own, operate, and design its desalination and NEWater plants. But overall, PUB manages the entire responsibility. The private industry treats/processes the water and then sells it back to PUB for distribution.

Because Singapore is a vulnerable country, it creates long-term plans, including a masterplan to achieve water sustainability within the next 50 years. This plan addresses three ideas: (1) To make as much of Singapore a water catchment area, so they can collect every drop of rain that falls in Singapore; (2) To collect as much used water and adopt technologies that allow them to increase the recycling rate efficiently; and (3) To desalinate as much seawater at the lowest cost possible.

Water supply is very important to PUB, and it recognized that water demand management on the other side of the grid is equally important. For that reason, it has a plan to work with community partners in managing water demand. It wants the pricing of water to reflect strategic importance and scarcity. It also does mandatory increases for industry and voluntary public programs and community engagement in an effort to reduce daily water demand from 150 liters per day to 140 liters per day by 2030.

PUB views industry as necessary for achieving its mission. It has three objectives for engaging industry: (1) Build an ecosystem to support the co-creation of innovative water solutions; (2) Support Singapore's economic development and create jobs in the water sector; and (3) Create a mindshare and enhance Singapore's international relations and reputation around the world.

Ms. Koh presented statistics showing how Singapore's water industry has changed since 2006. From 2006 to 2016, Singapore has increased jobs two fold and economic value has increased almost four times. All of the metrics presented (number of companies, research and development (R&D) centers, master's/Ph.D. engineers, projects), have significantly increased in the time period. She shared two of PUB's approaches for attaining these results and growing the water industry over the last 10 years: (1) the way it looked to industry to provide solutions and (2) how it looked at ways to provide more jobs and add value to the economy.

PUB recognized the importance of growing the water industry and co-creating solutions with industry as essential to its mission. The Singapore water industry comprises a wide spectrum of solution providers. PUB is involved across the entire engineering value chain. This presence gives PUB the choices to get the best solutions at the best value. As mentioned previously, industry partners also own and operate some of the plants. PUB's heavy investments in R&D provide a platform for collaboration with industry partners on many R&D projects, which is also a key driver for it to develop solutions. Since it started the R&D program in 2002, it has undertaken close to 500 projects with partners and companies from Singapore and around the world, including many in the United States. PUB has set aside about \$15 million since 2010 for R&D, in addition to funds allocated by the government.

Ms. Koh explained PUB's value proposition as a national water utility. It is a small agency that is responsible for the whole country. It has the skills and laboratories/facilities for testing new technologies. PUB remains receptive and willing to try new technologies. Collaborating on projects with PUB serves as a starting point for the industry. It also leverages its strong government-to-government relationships and is always seeking opportunities for companies.

Ms. Koh then described how PUB grows the industry for jobs and economic development. As she mentioned earlier, this is more of an incidental goal. It did not start out as a mission goal, but the opportunity was recognized as PUB was developing an industry to solve the water challenges in Singapore. Ten years ago, Singapore assembled a multi-agency outfit to achieve this. It is comprised of economic agencies, research institutions, manpower, and the urban, water, and environmental agencies. PUB was tasked as the lead agency and has collectively administered \$330 million of R&D funding during the past decade. This development is guided by three strategic thrusts: cluster development, technology development and internationalization, and industry growth.

For PUB, cluster development means trying to attract international companies to bring their R&D operations, engineering, manufacturing, and operations to Singapore. PUB works with economic development agencies to link overseas partners with local companies so they can work together to develop their services. In terms of technology development, PUB looked at everything from research, especially applied research, all the way to commercialization. Under the various parts of the innovation value chain, there are initiators that PUB looks at to help the companies (academia, startups, small companies), and it has teams to help the companies with technology development. To date, more than 150 test-bedding projects have been completed at PUB facilities. In terms of internationalization, PUB helps connect Singapore-based companies to overseas opportunities. It works very closely with the

trade and export development agency and introduces companies to other agencies and utilities through government-to-government relationships. PUB Consultants (PUB C), the private arm of PUB, leverages internal PUB expertise to provide technical advisory services to the companies that request for PUB to be a part of their bid, which makes the bids of the Singapore-based companies more competitive. PUB uses Singapore International Water Week to attract international players to Singapore, which allows its water industry to be profiled to a global audience.

Next, Ms. Koh discussed PUB's future growth areas. She referenced a recent news article about the Prime Minister's announcement for another \$150 million USD of R&D funding. PUB believes that this is a sign of the way things are moving and it is where innovation is going to happen. It is going to continue building on the foundation that it has built over the last 10 years. It will also focus on three additional actions: (1) Develop water solutions not only for Singapore, but for the world, particularly the regions nearby that require help and knowledge sharing; (2) From experience, PUB understands how difficult it is to get from research to commercialization, so it is looking at how to accelerate this and export technologies; and (3) Build a range of capabilities and talent for the future. Tomorrow's jobs require tomorrow's capabilities.

At this year's Singapore International Water Week, PUB announced the Singapore Water Academy, its plan for developing its capability. It strives to be an institution that does not only do training, but training that is practitioner-based for PUB, based on the experience it has accumulated over the last 50 years and gained from industry partners. It also allows water professionals to constantly refresh and update their knowledge and skills, and it creates international mindshare with developing countries.

Question & Answer Session

Referencing Mr. Miller's advice from earlier in the meeting, "Change the DNA of your organization, look outward, and go big." Singapore has done all of those things. Perhaps you can talk about the challenges you have faced over the last 10 years while doing these things.

This is not unique to PUB, but there are two things: First, it is working across many different agencies with different agendas, so there are challenges in working together. Even in Singapore, which is known for operating on a national level, there are many challenges. They overcome them by focusing on the national agenda and the country. Also internally, there are various people looking at industry development in terms of innovation with different perspectives. There are about 3,000 of them in the organization working across different segments. When this began 10 years ago, industry development was new to the organization, so getting the engineers to look beyond their everyday responsibilities and allow industry partners in to their plants was a challenge. There was a lot of collaboration and engagement that PUB's engineers were not used to – they had to overcome the challenge of internal buy-in. The former CEO's leadership motivated the organization and pushed this along.

Do you think that the leadership goes through the DNA and is permeated throughout PUB? You brought everyone along with you, which has been fantastic. The metrics that you shared (job creation, number of R&D centers, etc.) are a good way for any water cluster to track success. Were there throttles to that? For example, you often hear that talent, human capital, can hold back growth?

She recalled that within the organization, there were obstacles. PUB's Chief Technology Officer, Harry, always talks about the challenges of all these new technologies coming in and how the internal capability must be able to keep up while also being willing to try and learn new things. PUB is quite

famous for bringing in external support and help. It brings in a lot of international experts to help, which is a way to fill the gaps. It is honest in recognizing that it does not have everything in terms of human capability, but it is always willing to learn.

An audience member asked Ms. Koh to talk about PUB's test-bedding process, including structure and criteria for adopting technologies after they have gone through the process.

Ms. Koh was not able to provide all the criteria, and began by saying that PUB's process is "technology-neutral." It looks at the available technologies that would be useful for the organization. PUB is very mission-oriented. It engages a panel of experts in the evaluation process. The panel regularly meets to help PUB evaluate technologies from all over the world. PUB also looks at the capability of its facilities. There are many projects happening simultaneously, so it must evaluate and determine availability. Then, it looks for useful technologies. These are some of the factors PUB considers. If it is possible to commercialize a technology that has been tested there, PUB puts it to market, which increases competitiveness and adds value.

The next question referenced Mr. George's earlier discussion of DC Water's goals for alternative revenue sources and how it is developing, leveraging, and monetizing IP. You work with a lot of technology companies from R&D to commercialization, so can you comment on PUB's position on IP development, equity positions, and how you might be monetizing it?

Shengwei Yeo from PUB responded that PUB does not make any IP private. First and foremost, PUB wants to be the client for all the solutions it develops. PUB's facilities are supported for test bedding. A conflict of interest may arise if PUB said "I want to develop this technology with you, but if it is successful, I also want to have a part in the commercial success of it." PUB tries to facilitate the commercialization process, but if the technology is successful, it is not a given that PUB will purchase that particular technology.

Mr. O'Callaghan asked how PUB will continue to drive the engine for growth in the next 10 years, perhaps once it has solved all of Singapore's water problems, including solving problems outside of Singapore.

PUB's CEO believes strongly in the human capability, which is the reason for establishing the Singapore Water Academy. It is a place to consolidate the learning and experience it has accumulated over the last 50 years. Currently, the expertise is scattered around the different organizations and the industry, but PUB hopes to coordinate these in this role – to look at today's capabilities and move forward. Also, the topic of data information and actually knowing what is out there is a big area that PUB is working on. It is not just looking at all the different information, but also how PUB should be using it to grow.

Do you have any advice for the water clusters here?

She replied, "Singapore is a very small country, and we work hard because we really have no choice." Ms. Koh shared some of the things she has learned in her nearly 20 years working for PUB: Continue to learn from others, collaborate, and create collective wisdom, and then bring back what you think is suitable for your environment.

PANEL DISCUSSION: THE EMERGING TREND OF WATER UTILITY INNOVATION MANAGERS AND PROGRAMS

Panel Leader

JON GRANT, Research Manager, WaterTAP

Panelists

JOHN ARENA, Business Outreach Section Manager, Metropolitan Water District of Southern California

SHANNON DUNNE, Assistant Director for Wastewater, City of Houston

SAUL KINTER, Business Development Program Manager, DC Water

JIM MCQUARRIE, Chief Innovation Officer, Metro Wastewater Reclamation District

DAN MURRAY, Metropolitan Sewer District of Greater Cincinnati

JON GRANT

Jon Grant opened the panel discussion with a brief overview of WaterTAP. Located in Ontario, Canada, it was created by a piece of provincial legislation called the Water Opportunities Act of 2010. The province realized that there were great assets, a history of success among multiple water companies, and it was developing new infrastructure for testing and demonstration, like the Southern Ontario Water Consortium and innovative stormwater testing labs. The province wanted to bring all of this together into one group to connect the dots. WaterTAP's role has been to connect, accelerate, and celebrate. It connects businesses to the right resources at the right time (funding, international partners), and it helps businesses enter the Ontario market. It also started a new initiative upon a recent mandate called the "Better Best Practices Initiative" where it is looking at best practices from around the world in terms of regulatory hurdles that slow down adoption of innovation in its municipalities. It is there to help drive innovation through adopting de-risked technologies.

JOHN ARENA

John Arena was the first panelist to speak about his utility. The Metropolitan Water District of Southern California is the world's largest wholesaler of drinking water. It serves roughly half of the drinking water needs in southern California, about 20 million people. When Mr. Arena started 20 years ago, 80% of southern California's supply was imported from the north and the Colorado River Basin. He always asks, "What's the catalyst for change or innovation?" It was not until 2008 or 2009 that AB32 [*Assembly Bill 32 – California Global Warming Solutions Act*] came out and the world noticed that California was examining greenhouse gas emissions and introduced AB32 to address that. As a result, all of the focus turned toward energy and the cleantech centers were focused on energy, but there was no conversation about water. Mr. Arena touched on Mr. Miller's earlier note about why utilities are created and how innovation is not in their mission statements. He said that there is a huge change happening as public water utilities start to address innovation in their vision statements. For example, San Diego County Water Authority recognized that its mission statement was great 40-50 years ago, but it needed to change, so it has actually put innovation into its core principles. At Metropolitan, Mr. Arena works in external affairs where he plays the role of a business development officer for technology. The utility has about 900 technologies and 27 partners and has always worked on developing partnerships. His next goal is to go internal, take a deeper dive into the organization, and determine out what is on its "wish list," or the troubling issues departments are facing, so that he can match the technology firms and solutions.

SAUL KINTER

Next, Saul Kinter spoke about DC Water, the water and wastewater utility for the city of Washington, DC. It does direct retail water sales and retail wastewater services for about 650,000 people in DC and wholesale wastewater treatment for the surrounding suburbs, extending its reach to over 2 million people. It has had an innovation program for about two years now. The focus has changed during that time as it has learned more about what its capabilities are and what it is good at doing. Advancing research and technology is one of the parts of the innovation program. There is an extensive research lab at DC Water, which was developed to support internal capital improvement projects and to assess various technologies while major upgrades are made to its wastewater treatment plant. The lab is run by Sudhir Murthy, who has been successful on the research side while guiding the DC Water plant upgrades over the last decade. A little less than two years ago, DC Water received a request from a consulting group asking if its lab could do a test for the group. The short answer was no, because the lab was funded by ratepayer money, and it could not be done unless the ratepayers benefited from it. Considering its lab and the universities it works with, this group said that no other place could do a test like DC Water could. This external trigger urged DC Water to think about how to provide a service without costing the ratepayers money. The answer to this was yes, it could. Top management was supportive of this effort, and the board was spectacular in encouraging DC Water to find a way to do this. They talked through the regulations and wrote new ones that said DC Water could sell its services to third parties as long as it follows certain conflict of interest rules. The rules are critical because it could potentially be buying and selling from somebody at the same time, and it must be careful whenever money is flowing. There were also rules and procedures for how it would make a sale, and an invoice to a private party had to be created for the first time. At the end of the day, they set up a system, and after a few months, DC Water's lab was open for business. Higher difficulty tests were a market niche that made a lot of sense for the lab. Rather than the basic characterization common in a commercial lab, it would do high complexity tests: treatability, toxicity, kinetics, stoichiometric testing. This program has been up and running for just over a year and has been very successful. In the first fiscal year of operation, DC Water has done just over \$100,000 in sales, and it is currently thinking of ways to expand. During this process, it has uncovered challenges in the budgeting processes. DC Water collects the money, but it is difficult to send it back to cover the expenses due to rules over the budget. In DC, the budget has to be approved by Congress. This is an example of an unanticipated challenge. Mr. Kinter said that by and large, it has been successful. In general, it is one of the things that the innovation program has developed the most since it began.

SHANNON DUNNE

Shannon Dunne then discussed the City of Houston's technology plans. The City is just short of 700 square miles, has 40 sewer plants, and has nearly 400 lift stations. The City of Houston is currently working on the Y-Max system, which is a cellular system built for the city. It is moving towards smart water, where it can have constant data streaming from manhole monitoring lift stations and constant water pressure. The problem is that it is a lot of constant data, and decisions must be made very quickly. One of Houston's big initiatives is on big data, and it is about halfway through this initiative. The City of Houston has 23,000 employees, and everyone has different equipment for retrieving data. A big challenge is converting all of that information, so it is looking at going to the cloud. The City knows that the computer engineers could find opportunities with higher salaries elsewhere. Therefore, it cannot continue to have large data rooms because it does not have the people to maintain them, so figuring out

how to “do more with less” is the only option. In order to do that, Mr. Dunne said that you have to rely on technology. It gives you the ability to have your eyes and ears somewhere where you cannot have personnel. Additionally, the City is training operators on new technology and trying to keep things simple. In terms of personnel, the utilities cannot get the people they need. They have job fairs and spend a lot of time training. They also try to promote within and set up programs with some of the high schools to educate about being an operator.

JIM McQUARRIE

Next, Jim McQuarrie from the Metro Water Reclamation District in Denver, Colorado spoke about the innovation program there. The 10-year capital programs for the utility is about \$1-1.5 million. The general manager has a background in finance and infrastructure planning and understands the importance of rates and rate changes. A few years ago, the general manager sat on the board of WE&RF (Water Environment & Reuse Foundation), and in that experience, she came to appreciate that innovation is a key tool that can be implemented to keep service reliable and rates reasonable. This helped her understand that innovation is something that they needed to integrate into their day jobs. Mr. McQuarrie said that it is not extra credit; but rather, something that a utility should do when presented with significant challenges to execute its mission statement. Metro’s mission statement is to provide reliable service, to do it efficiently, and to keep rates reasonable. Its program is about a year old and has had some success stories.

DAN MURRAY

Dan Murray, who represented the Metropolitan Sewer District of Greater Cincinnati (MSDGC) at the meeting, but is actually an EPA employee on loan to MSDGC, spoke last. There is a long history of partnership and research in Cincinnati between MSDGC and EPA, including decades of collaboration on wastewater. EPA has a large research facility in Cincinnati, and one of its high-bay research facilities is on the property of the MSDGC wastewater treatment plant. Recently, EPA and MSDGC collaborated to join the national test bed network in the LIFT (Leaders Innovation Forum for Technology) program. Part of Mr. Murray’s job at MSDGC is to identify opportunities to continue those collaborations. Those collaborations have led to many projects with researchers from each organization. His role at MSDGC is in a new division called the Watershed Operations Division. Cincinnati is under a large consent decree to address wet weather problems, largely combined sewer overflows (CSO). There are about 200 overflows in Cincinnati, some sanitary sewer overflows, and peak wet weather flow issues at treatment plants. The Watershed Operations Division was created to manage the wet weather facilities that are being constructed under that consent decree – many standalone treatment plants to deal with CSO treatment and real-time control facilities. The Division does not see the need to build additional capital facilities if it can manage its current system wisely. The two major drivers in that division are: (1) optimization of current infrastructure; and (2) identification of innovative technologies to help build new facilities more cost effectively. Over the past several years, it has had efforts to identify areas in the wet weather treatment and management program to focus on innovation. MSDGC has looked globally to identify technologies to bring to the U.S. and evaluate for its own use. Currently, it is very active in three areas: (1) the use of alternative disinfection technologies outside of chlorine; (2) filtering technologies; and (3) technologies for in-line management of first flush in the combined system. Mr. Murray shared a quote that is taken to heart at MSDGC: “Innovation is creativity with a job to do.” First, he and his team have a job to do. They can do that with innovative technologies to save the ratepayers money, and do it more effectively in a greener, more sustainable way. As they are looking at the technologies, the consent

decree schedule is moving. In addition, as they identify things that make sense for application and implementation to the consent decree, they have to try to integrate what they find into the planning process. It is a challenge, but Mr. Murray is hopeful that they will see successes as they move to phase two of the consent decree.

Question & Answer Session

How did you choose your partners, and can clusters be partners?

Mr. Murray discussed the Confluence reverse pitch, where utilities in the region described their problems to the technology developers in the room. He thought it was a unique way to flip things around and begin that connection to find the solutions they need.

Mr. Dunne said they use conferences like this one. The City of Houston is also going through LIFT, TAG (Technology Approval Group), and AccelerateH2O. It has partnered with universities to vet technologies. The technologies go through a long process before they are implemented because the City does not want to be the first to try new technologies.

Mr. McQuarrie commented that his wastewater utility was chartered in the same year as Singapore PUB. The Denver region gets about 300 millimeters of rain per year. But jurisdictionally in the way it has been set up as a government agency, 50 years into its future, it has built infrastructure so far that has not done a good job addressing the water cycle. It is very “you do the water, we’ll do the wastewater.” It probably varies by region, but in Mr. McQuarrie’s region, a successful water cluster would be that group of technologists, agencies, etc. that help all the utilities in the area forget who they work for and enter a common space where they can focus on water and the benefit of society.

Mr. Arena said that he was at this meeting to learn about what others are doing around the world, especially the water clusters. Five years ago, the Metropolitan Water District of Southern California looked into innovation clusters and found the WET program at Fresno State, which is the only one it could find in California. The driving force was the \$250 billion agriculture industry. The community encouraged companies to bring their technologies to California because of the lack of water in the state. Ninety percent of the fruits and vegetables in the world come from central California, so it is a huge issue. But there is no water cluster for drinking water for people to come together to talk about it. There are cleantech centers, but no water clusters. Water is not sexy to investors or for innovators to come to California – there is too much red tape and too many regulations. When a conference starts with comments like, “We are risk averse,” and “What are the top 10 barriers to doing business in California?”, it is clear that people would rather make their investments in other sectors. Mr. Arena’s former boss, Dr. Roy Wolfe, who was also the chair of WRF, went to Singapore about five years ago, and said that what they are doing and talking about there is what southern California needed. This really showed them the importance of learning from others.

Innovation is about culture and how we are going to shift the culture. How, as utilities across the world, are we going to breed that culture of innovation so that we can attract people to utilities? No one really wants to work for a utility.

Mr. Dunne suggested that it is important to show prospective hires that you are using high technology. He understands how hard it is to attract people. Many people do not understand why cities are so slow to adopt technologies and all of the red tape that is involved. Moreover, when you say,

“Why Houston?” to the people who come there, they say, “power.” However, we make the power in Houston, so it is cheap, and those technologies are not needed here because the City cannot afford them. Therefore, you have to look at where you are putting the technology and make sure to bring it to the right ears. It is not so much about saving money, but rather, you have to understand that there is going to be red tape when you bring technologies to a city. In addition, part of the business is recognizing that it is going to take a while. You are not going to be able to change City Hall. It is just the way it is; it is politics.

Mr. McQuarrie has seen examples that work well. “It starts out with people,” he noted. He does not think you can outline a plan to develop an innovation program unless you have some of those people in your organization. In terms of personnel, he feels that the central ingredients are those people within an organization who – whether they are allowed to have the space or not – start thinking creatively. They start thinking about what could be, and then there is somebody at the management level who hears that message and understands its value. That seems to be the one-two punch that launches these innovation programs. A technical subject matter expert sees the opportunity, and then somebody at the management level hears that and recognizes the value to the ratepayers. That is the essential ingredient. He followed this with a story: there is a test-bedding project currently going on at the utility. After discussing the very technical technology, the Board of Directors saw the cost avoidance, return on investment, etc., and they started nodding their heads and liked what they were hearing. Mr. McQuarrie felt like this was the beginning of the innovation initiative for Metro, which is starting to make progress.

Mr. Kinter agreed with Mr. McQuarrie on the idea of fostering and encouraging the folks that are naturally innovative within the workforce, finding them, and making sure they are heard. In addition, it is important to give them a leash that is long enough to allow success. It means not pulling the plug immediately after something goes wrong. It also means giving them some freedom to fail. Therefore, if something does go wrong, you are acknowledging that it did not work and stop spending more money on it. Also, that does not mean that you just say no to the next idea. You have to evaluate each as it comes along on its merits and potential. To give an example on this point, there is a foreman at DC Water, who has since been promoted, who was a champion of getting the utility to look into trenchless lateral replacement. There was not a lot of initial traction, but he pushed it internally and managed to gain support from the top to purchase the equipment and start running it. It really did not go well. For the initial installations, he assembled an inexperienced crew that had not done this before, and their failure rate on installs was over 50% for the first couple of months. However, there was enough time awarded by the folks in charge to allow them to improve and spend time on making it work. After a year, their failure rate is down in the single digits, and they calculated that the trenchless program over the last two years has saved DC Water about \$6 million versus what it would have spent to replace the same number of laterals with standard digging. Giving the leash to that foreman and his crew was what led to a successful trenchless program and what allowed them to make an investment to buy more trucks and train more crews. The training process is much easier now because they have in-house expertise. This has worked out really well for them. Having that long leash and the freedom to fail is crucial for the internal creative minds to shine and make improvements to your processes.

PANEL DISCUSSION: PERSPECTIVES ON THE ROLE OF WATER UTILITIES IN CLUSTERS

Panel Leader

BRYAN STUBBS, Executive Director, Cleveland Water Alliance

Panelists

NATE ALLEN, Executive Director, WaterStart

DEAN AMHAUS, President & CEO, The Water Council

MARCUS GAY, Executive Director, New England Water Innovation Network

RICHARD SELINE, Executive Director, AccelerateH2O

BRYAN STUBBS

Bryan Stubbs introduced the topic of the panel discussion, which is to gain perspective from water cluster leaders on the role of water utilities in clusters. He provided a brief introduction of each panelist and asked them to give their perspective on how they do or do not work with utilities in their cluster, including the successes and challenges they have faced.

DEAN AMHAUS

Dean Amhaus from The Water Council, based in Milwaukee, Wisconsin, spoke first. He highlighted how utilities are a key partner of The Water Council and how the council perceives the cluster as an opportunity for industry, academia, utilities, and non-governmental organizations (NGO) to work closely and collaborate in a partnership. The location of the Water Center is only a block away from the Milwaukee Metropolitan Sewerage District's (MMSD) headquarters and the executive director of MMSD is on the board of directors, allowing for regular communication between the two groups. Another active member of the board of directors for The Water Council is the Mayor of Milwaukee. Having the ability to communicate with the CEO of the City and the CEO of the wastewater and drinking water facilities as well as other members of the surrounding communities is essential to the way the council operates. For example, the wastewater treatment facility is starting to become more involved with innovations and partnerships of the Water Council. In conjunction with Wells Fargo, MMSD has provided funding for pilots for another two years. The Water Council works day in and day out with utilities in order to find new innovations and new solutions. If the utilities are successful, then the Water Council is successful as well.

NATE ALLEN

Next, Mr. Stubbs introduced Nate Allen of WaterStart. WaterStart is a fairly new water cluster that was formed as a response to a demand from the local Las Vegas utility. Three years ago, WaterStart was formed through a partnership between the Southern Nevada Water Authority, the Desert Research Institute, and the Nevada Governor's Office of Economic Development. Nevada is not known as a large technology hub, but rather as a hub for gaming and hospitality. Mr. Allen explained that this lack of perception of Nevada as a technology hub is a great indicator of the need for an organization like WaterStart in Nevada, the driest state in the country. The dryness of this region has created a cluster of first adopters of water technologies that extends beyond the utility sector. This is a key component of

WaterStart's strategy – not simply to work with Southern Nevada Water Authority and other authorities, but also to look into sectors like mining, agriculture, commercial, and industrial water consumption.

Since there is such a clear demand for water technology in Nevada, WaterStart primarily focuses on prototype-to-market technologies. The process began two years ago with Southern Nevada Water Authority identifying 15 technology priorities for the cluster and working with international partners to help recruit companies with technology that fit the priorities. This model is also implemented at the Truckee Meadows Water Authority, a utility serving the Reno area. Together, those two utilities serve about 80% of Nevada's population. The next target will be smaller, rural areas that need a tremendous amount of support in managing their water resources. MGM Resorts, which runs approximately one third of the Las Vegas strip and is Nevada's single largest employer, was recently added as a partner. This partnership opens doors to not only impact water usage in MGM's facilities, but also employees' usage at home. WaterStart is focusing on two new areas due to the potential for new technologies: a farm, that was the largest potato producer in the United States before the drought, and the mining sector. These are both critical opportunities for technology companies looking to enter the United States to test and prove their technologies in new markets. This is all entirely driven by the list of technology priorities WaterStart's partners have identified, which has grown from 15 to more than 40 in two years.

MARCUS GAY

Next, Marcus Gay from the New England Water Innovation Network (NEWIN) began by explaining his background training as an environmental chemist with experience working with wastewater technology. Since his time here in the United States, he has held a variety of positions including entrepreneur, Executive Director of NEWIN, and working at both water technology startups and large corporations. These experiences allow him to understand the internal and external challenges for water innovation. Next, he described the history of NEWIN's involvement in the water utility space. The northeastern U.S. faces the challenge of having hundreds of water utilities in a very diverse region. NEWIN focuses on community collaboration and engagement to support innovation. Mr. Gay broke down innovation into different buckets:

- 1) Market-driven research: Applied, basic research
- 2) Research-to-innovation: Translation of basic research into an actual solution
- 3) Innovation-to-market: The ability to take that innovation, develop it into a business case, and get it into a customer for a demonstration
- 4) Market-to-scale

NEWIN recognizes water innovation as being both the solution development and market engagement between critical pieces, and it has a suite of products and services it offers to utilities and innovators to help them guide solutions through the different stages of innovation.

RICHARD SELINE

Richard Seline from AccelerateH2O began by discussing how AccelerateH2O has identified a set of challenges in Texas, which has 4,600 water utilities, the majority of which are smaller water systems. He has learned the following takeaways in the past year and a half:

- 1) Innovation threatens utility business models in the rate structures, the public perception of “who owns my water” in a public/private partnership, and the longevity of management.
- 2) Collaboration suggests “One of us is going to do all of the work and it’s not me. There is \$100 on the table and you only get \$20, and if it fails, it’s your fault.”

Mr. Seline also shared some reality checks that he found among the utility, the technology, the investor, and the cluster:

- 1) There is never enough money to solve and pay for the demand in Texas, especially because the state has switched from grants to loans.
- 2) The economics of water: AccelerateH2O is no longer about the technology and it is no longer about the money – it is about the economics of the water, which translates to rate changes.
- 3) The technology *can* provide offsets of costs, resource use, and time. Often, those in the technology community do not effectively position their technology in a way that explains what the technology will do to offset something else for a utility in order to have other resources for other needs.
- 4) Public assets are the public platform for sustainability, efficiency, and economic development. Sometimes it is necessary to speak with utilities about how they are a part of the economic development of communities and regions, and inform them of the opportunity to actually grow companies and employment.
- 5) The water sector is the next sector for disruption.

Next, Mr. Seline addressed the technology companies both at the conference and involved in the clusters. He advocated to stop selling the dazzle and start understanding the integration, economics, and value proposition for utility customers. Procurement decision makers are not likely to buy based off a pilot scale or an R&D plant. Utility companies have four potential customers: the citizens and residents, the industry, agriculture, and other services. It is important to understand exactly who the utilities’ customers are when talking to them about technologies. Lastly, there are going to be 30,000 retirements over the next five years in public utilities in Texas. He does not think there is enough outreach to younger generations informing them how technology and innovation drives the future of water, and there is a unique opportunity to engage with the utilities and the innovators.

Question & Answer Session

How can clusters go about pitching to the utility, and what is the model they pitch to the utility about working with a cluster?

Mr. Gay responded that he thinks the key to talking with any stakeholder, including a utility, is to try to ensure that the work happening within the innovation pipeline and work happening within your cluster’s water innovation ecosystem is aligned with the utility’s needs. He uses the words “market-driven research” for that reason – the activities that are happening within the water cluster are addressing the right issues and concerns. The bottom line has to impact either a technical, environmental, or societal metric that the utility cares about.

Mr. Allen said that when talking to new partners about bringing them on, he talks primarily about solving three challenges for them. All of these challenges fall under one primary role of trying to de-risk the innovation process for the utility. He described the three risks/problems:

- 1) Sometimes, multiple companies call a utility in the same day about new technology that they believe is going to singlehandedly save the utility. Trying to figure out how to receive those calls, direct those calls, manage those calls, and figure out if any are actually worth the time is overwhelming to the utility's workload. This is a key role WaterStart helps its partners with.
- 2) Similarly, WaterStart helps its partners evaluate technologies. WaterStart brings in independent, third parties to evaluate its partners' needs from both a technical and economic/business standpoint. This evaluation is another part of WaterStart's pitch.
- 3) WaterStart also brings outside funding to help with piloting, testing, or demonstrations. They get economic development funds from the state, which their partners match in order to do projects that specifically solve one of its problems. This reduces the risk for partners financially and helps WaterStart avoid wasting allocated funds from the state.

Mr. Seline said that at AccelerateH2O, they do not pitch; they listen. He talked with all 26 of the major engineering firms that complete 98% of the work for public utilities and tried to stress the importance of not only selling reservoirs, concrete, and rebar as the only solutions to solve the water problem in Texas. These are only part of the solution. There is a lot of innovation to be placed on the infrastructure, inside the infrastructure, and outside the infrastructure. One of the reasons why they brought in the utilities and the TAG process was to allow the utilities to have ongoing meetings where engineering firms were not present to tell them what they could and could not do. He also brought up the importance of making it easier for the utilities and general managers to step out and do the things they have wanted to do. It is a good sign when general managers begin to be more open to stepping out and addressing these issues of innovation.

Mr. Amhaus said that The Water Council works intimately and closely with its utilities on a daily basis. This really is a partnership and collaboration with the utilities to find solutions. He agreed with Mr. Seline that it is important for those at the top level of utilities to be open to new ideas and suggestions. The utilities are looking to companies and academia for solutions as well as the talent available there. He views The Water Council as a broker, connecting people with other people. No one on the staff has a water background, but the organization's role is to make matches and connections. It is about listening, but taking action as well. The Water Council works with its wastewater facility to do pilot testing. However, a few months prior, the Commissioner for Public Works contacted them wondering why there were not more pilots happening. He was taking a proactive step towards tapping into The Water Council's entrepreneurs. It is this kind of connection and relationship where it is not a task to communicate with the utilities, but rather a daily occurrence.

Mr. Seline added that sometimes those with no water background can serve as neutral third parties and periodically see connection points that can be presented to utilities in a way that they might not have had time to consider. He wanted to emphasize that there is sometimes a role for clusters to identify integration opportunities. This is becoming more relevant as utilities and industries begin to

understand how well different technologies work, but hesitate because integrating new technologies will affect something up or down the value chain. This is an opportunity for clusters to help combine pieces of five or six different technologies.

Are you collaborating, and who coordinates what the clusters are doing? Are you overlapping with each other?

Mr. Seline explained how AccelerateH2O is collaborating in a working group with five clusters located in the gulf coast states. In addition, AccelerateH2O is partnering with Technology Ventures Corporation in New Mexico and is going to begin bringing the southwest region together. He also noted that this emphasizes what many of the clusters desire to do: find ways to solve a problem in their region with a technology that may be currently implemented in The Water Council's region, but is needed in Texas. He concludes that technologies and clusters are ripe for networking.

Mr. Amhaus went beyond that and discussed how The Water Council is working across the world in France and South Korea. It really looks at the technologies and approaches that are developing across the world.

An audience member brought up the point that new innovation can often be threatening to a variety of companies.

Mr. Gay agreed that innovation creates risk and change, which can be painful. However, to not innovate is probably a larger problem. The Massachusetts Water Resources Authority recently published a report detailing the capital and operating costs forecasted through 2020. There is a \$14 billion deficit between what we need to invest and what we get in revenues. That is a story replicated in New England and all of the U.S. If we do not invest in lower-cost and more efficient technical solutions, there is going to be a major problem in the future.

It seems that clusters are going to flip the innovation model from a technology push to a demand pull. All four of the clusters that spoke are about understanding the real problems that innovators are going to be addressing. Is there a way to begin to aggregate across the planet what these problems are and be able to communicate to industry, entrepreneurs, innovators, the universities, etc.?

Mr. Gay started with the story of how NEWIN was created. Back in 2011, the Massachusetts governor went on a trade mission to the leading water clusters around the world to better understand how water innovation should be executed and what the global problems were. NEWIN's focus since then has been to enable its local innovators to have an impact in global markets – exporting ideas, innovations, and talent. With regards to bringing everything together, Mr. Gay discussed his early career as a climate change scientist, where he observed that people can understand these problems technically, but it is hard to earn community buy-in when discussing problems on a global scale. Instead, it really does require a local or hyper-regional focus to mobilize people. He is also seeing that as the Executive Director of NEWIN, he has to sell a local story in order to engage local stakeholders, and he believes everyone will need to do that individually to have a global impact.

LUNCH AND KEYNOTE: THE JOURNEY OF MEKOROT IN LEADING WATER INNOVATION IN ISRAEL AND THE GLOBE

Speaker

BOOKY OREN, Chairman & CEO, Booky Oren Global Water Technologies

Introduction

JEFF LAPE, Deputy Director, Office of Science and Technology, U.S. EPA Office of Water

BOOKY OREN

Booky Oren noted the importance of being optimistic on the water journey. He stated, “In principle, I was not born in water, but water was there for me half of my life.” Mr. Oren is a businessman who worked in a variety of businesses in the high-tech industry before joining the water industry 16 years ago. He was working at the largest communications company in the world when he left and made a commitment to working in water. He became the Executive Chairman of Mekorot, the Israel National Water Company, where he established the program called WaTech. From there, he initiated an event called WATEC and another organization called Miya. Six years ago, he started his own business to facilitate activities of implementing the vision around water.

Mekorot is a company owned by the Israeli government. It is a large utility that treats 60% of the wastewater in Israel and provides 85% of the drinking water and 70% of all the water. There are \$350 million in investments every year, and it generates a revenue of \$1.3 billion. Mekorot deals with activities from water treatment, desalination, water quality, watershed management, hydraulic control, etc. In 2004, it dealt with tariff and financial problems, and the government requested that it improve efficiency by 1.5% per year. Ninety-four percent of Mekorot’s expenses were fixed, so this was a huge challenge. Innovation needed to be implemented.

There were nearly no experiences to learn from when Mekorot started WaTech, Mekorot’s entrepreneurship and partnership center for water technologies, in 2004. Everything it did was oriented towards the wants of Mekorot’s engineer, which was to improve the way it did business. After two years, Mr. Oren left the company and returned to the private sector. Mekorot continued operating WaTech and has received over 1,000 applications for collaboration since 2004. The applications have been mostly in water quality, desalination, water resources, and engineering services. Interestingly, many of them have been rejected because they were not relevant. Over the last decade, Mekorot has implemented 42 new technologies. Implementation is not easy to overcome in a large public utility. There are many challenges: bureaucracy, labor unions, operational aspects, working with start-ups, regulatory issues, and legal aspects. Additionally, there are challenges with strategy and tactics, buy-in processes, budget, public relations, equity investments, and internal communications. It made mistakes, but currently, Mekorot’s achievement is the increase in industry it has created. There is a lot to learn from this example, and he expressed that we can save years of mistakes by learning from his. WaTech’s achievements are beyond Mekorot as lessons learned are implemented through adaptations by water utilities and technology clusters worldwide.

Mr. Oren proceeded to discuss the structure of the innovation to implementation process, or “i2i.” He began with the first rule: “We don’t speak, we listen.” When dealing with a utility, try to listen to it and hear its needs. Create your shopping list of needs and priorities and then begin looking globally. First, we listen to the utility, then we bring them a relevant solution, and then we begin the internal validation.

Mr. Oren provided several examples of the “i2i” process used by Mekorot. Mekorot first implemented it in PUB to bring solutions, not just ideas. Mekorot has supported implementation of this process over the last three years. This process is also running at the Los Angeles Department of Water and Power (LADWP), the largest drinking water utility in California. Recently, there was an augmented reality technology implementation there that captures all the know-how in pumping stations. The supervisor can give the technician in the pumping station instructions remotely and all of the information is recorded. Mr. Oren’s next example came from the Southern Nevada Water Authority. Several solutions are currently in the process of being employed there. This was also done in Cincinnati, Finland, Austria, and Italy. Next, he talked about the process at Mei Netanya, a mid-sized utility in Israel that has about 300,000 customers. Mei Netanya began to implement big data in 2011. It had an idea for integrating GIS business data, water quality data, asset management, leak detection, etc. The CEO and chief engineer understood that collaboration with another utility was needed to accomplish this. They searched for a mid-sized utility in the U.S. and found Akron, Ohio. It has taken a few years to implement an asset management solution, but there are currently several solutions being employed there. This collaboration is crucial in a small country like Israel.

Booky Oren Global Water Technologies uses a “Blue Ocean” approach that focuses on relevant long-term support. It has accumulated experience in managing utilities, it understands technology, and it has global coverage with a global business perspective. This small team created something significant, and they are optimistic about the future and all of the opportunities for collaboration.

Question & Answer Session

Of the 42 collaborations at Mekorot, are there opportunities to bring those in partnership to the U.S.?

Mr. Oren thinks that people are concerned about the word “innovation” because it is not a part of the DNA of the water sector. He uses the phrase “proven innovation.” Proven innovation is an innovative solution that a utility somewhere in the world has already used. Specifically, in all of the places mentioned in the presentation, they identified solutions that were already being used somewhere else. There is no need to reinvent the wheel.

In regards to non-technology solutions such as issues of public policy regulation, financing, public education, stakeholder management, and conflict resolution, technology is not the issue – it is all the non-technical things. What are your thoughts on developing an innovation supply chain for those issues?

Mr. Oren responded that he rarely uses the word “technologies,” but rather “solutions.” Even when talking about water technologies, it is not only about water technologies. To him, a water technology can mean a cyber security solution, a solution for securing entities, predictive maintenance, or solutions for monitoring facilities that are not necessarily about water. On policies, Mr. Oren said that when dealing with water conservation, there are a lot of utilities that have the same charges, so first, listen to them, but also participate in knowledge sharing. He encouraged everyone to define their shopping list of wants/needs and look around the world for someone who has the same problem. Maybe neither of you have solved it, but you can develop the solution together.

This meeting is about water clusters and the role they play. You stated that 949 proposals were rejected. What happens to those ideas or technologies? Do you have a cluster or a pathway for them to go? What happens next?

When we reject a technology, we try to send an encouraging “no” to those that are rejected, explaining the reasons for rejection and why that technology did not meet the needs of the solution being sought out. We explain what the requirements were.

You mentioned WaTech invested in some of these startups. Can you tell us a little more about that? How much money and at what stage are these companies?

It is a governmental company, so it is small money because there is limited funding to give to companies. But there is one technology – it was almost bulletproof to invest in this company – that WaTech made a few hundred-thousand-dollar investment in because it really needed it. They were very happy with how they developed the solution, and it is now piloted in PUB. Part of the reason for the investment is that it was on Mekorot’s shopping list. The other is that they opened the facilities and there was a lot of support and guidance.

CLUSTER SHOWCASE: CONFLUENCE REGIONAL UTILITY NETWORK (RUN)

Panel Leader

REESE JOHNSON, CH2M and Chair of Confluence Board

Panelists

VERNA ARNETTE, Deputy Director of Operations, Greater Cincinnati Water Works

MELINDA KRUYER, Executive Director, Confluence

RYAN WELSH, Principal Engineer, Metropolitan Sewer District of Greater Cincinnati

REESE JOHNSON

Reese Johnson, the Chair of the Confluence Board, opened with a brief description of Confluence.

Confluence is the water technology cluster for the Ohio Valley region. Its mission is to connect people to solve water challenges with an awareness to their specific challenges and particular strengths. From the beginning, the utilities in the region have been at the center of Confluence because they are the customers of water innovation. They are leveraging the technology, whether it is old or new, for the benefit of their ratepayers. And like any successful business, you have to know your customer.

Confluence puts the regional utilities in a central role, and Mr. Johnson considers them to be the nucleus of the cluster. Confluence formalized this by sponsoring a group within Confluence called the Regional Utility Network (RUN) to enable utilities to maximize their contributions and benefits from Confluence.

The panel members saw the value of RUN, developed the idea for RUN, and now participate in RUN.

MELINDA KRUYER

Melinda Kruyer explained the development of the RUN. After the microcystin event in Toledo, Ohio, caused the water system to shut down, algal toxins became a huge issue. Following this event, Confluence held an Algal Toxin Summit, which included the experts from the local area. At the summit, there was a report out from the utilities, Ohio EPA, universities, and others who came together to answer this issue. A big part of that was the utilities. They shared their experiences from when the water system was shut down. As they were preparing to report out, they said that they were not comfortable reporting out individually as utilities because of the regulators in the room; but rather, preferred to speak as a group. They went to a conference room to discuss, and when it was time to present, they did not want to finish because of the great conversation that was happening. This is when Confluence realized that the utilities needed a place to talk and share ideas. Therefore, a core group of utilities met to discuss the idea of a platform for doing it. They all agreed that they wanted one, which was the start of RUN. In this first meeting, the utilities identified 21 challenges they face. Verna Arnette from Greater Cincinnati Water Works (GCWW) was at that meeting.

VERNA ARNETTE

Ms. Arnette said it felt like “misery loves company.” She echoed Ms. Kruyer’s comment on the importance of the utilities being able to talk amongst themselves at the Algal Toxin Summit. There was a meeting of local utilities in June 2015, and it was “like the flood gates opened,” as Ms. Arnette described. There were no prepared presentations or an agenda. They used the list of 21 challenges they identified as the foundation to move forward. With that information, Confluence hosted a reverse pitch in July 2016. It was born out of that group of local utilities who had discussed their challenges. Part of the idea for that came from Booky Oren. Ms. Arnette was impressed by the model he presented during

a previous visit to Cincinnati about recognizing your utility's needs and asking for the technologies to address those needs. She had wondered why they were not telling the vendors and the innovators what they needed. She said that she felt like they often over-purchase because they either buy things that are not really what they need, they buy more than what they need, or nobody has exactly what they need. This results in purchases that they simply have to make work, and oftentimes have to spend quite a bit of money customizing those purchases to do the job. This is when Ms. Arnette asked why this process was not reversed.

RYAN WELSH

Ryan Welsh from MSDGC was a speaker at the first meeting of local utilities. Rather than going to shows like WEFTEC and seeing technologies for sale, the reverse pitch flips this around so that the utilities say what they need. MSDGC has already received interest from the University of Cincinnati (UC). One of the issues MSDGC raised was incinerator ash, which has to be landfilled at its expense every couple years, and it is looking for a way to bring it to market. No one has found the solution yet, but it has collaborated with UC to create three student capstone projects.

Ms. Kruyer added that there are approximately 90 utilities within a 100-mile radius of Cincinnati, some of which are one-man operations with small budgets and limited access to training. Each has its challenges, and many are innovating on the spot. Confluence learned that a market is created by aggregating all the tiny utilities in the region. When developing the RUN, Confluence looked at the whole utility system. Everyone from the utilities was invited, including accounting and IT, and representatives in the reclamation, drinking water, and waste water sectors. After they identified those 21 challenges, they held another meeting in December. Each utility provided updates on various issues like lead and microcystin, for example. Particularly, utilities presented their responses to the 600-mile algal bloom that came down the Ohio River for the first time.

Mr. Welsh said that the cluster provides benefits to the utilities, but the vendors also see benefits. Confluence has brought together a lot of the small utilities that are not typically represented, especially at shows like WEFTEC. The cluster brings everyone together, including the vendors, which is beneficial for them because they do not have to travel and everyone can meet in one place.

Ms. Arnette noted two significant events: the shutdown of the Toledo water plant in 2014 and the 2015 algal bloom that came down the Ohio River. There are no records of anything like the 2015 algal bloom ever happening before. Last year, there was the algae and microcystin issue, and this year, GCWW was greatly impacted by the events in Flint, Michigan. GCWW is dealing with problems it never thought it would, and it has almost become reactionary. Another value of Confluence is the ability to effectively pull people together, especially because most have limited time and resources. These challenges require everybody working together to find solutions. Ms. Arnette added another benefit of the reverse pitch. A City of Cincinnati councilman attended and was so impressed that she and her director from GCWW received an email that same day inviting them to City Hall to further discuss the event and how the city could help with barriers to innovation. In working with the councilman, it has become apparent to her that the City does not understand the boundaries that the utilities face. The reverse pitch was a

platform for them to tell their story to the vendors and others such as the councilman, and it was positively received by many of the attendees.

The next step is to have the vendors present at the Confluence Technology Showcase on December 6 in Cincinnati. With the showcase, the vendors who have the solutions presented by the utilities will be submitting abstracts online that will be reviewed by a technical committee. The relationships and the utility-to-utility connections have been created, and they can continue their conversations outside of these events. This communication speaks to the importance of regionalism. They have different source waters, but that adds a commonality among all the utilities.

Question & Answer Session

Regarding the role of the existing associations that the panelists are members of, is the cluster another layer? Or could it exist in one of these environments?

Ms. Arnette said that this question has been brought up before. When looking to join Confluence, one of the utilities asked how it is different from WEF or AWWA (American Water Works Association) when they were looking to join. It is different because it really addresses the entire watershed. For example, AWWA is focused on drinking water and WEF has more of a strong environmental focus. We are starting to see the impacts from all of the different water challenges, and this lets us address that as a group. This group bridges the gaps between wastewater, drinking water, stormwater, etc.

Mr. Welsh added that the organizations are so separate, but this group brings everyone, including all the stakeholders, together. Also, it is good to get the small utilities talking about their problems and how they are related.

As clusters, we are not all the same. We need to take a look at our asset base in our clusters and determine what differentiates us. We are going to have common issues. The best thing we can do as clusters is start to identify the things going on in the other clusters around the country. If we are all trying to become the same types of clusters, we are going to fail. We need to find our commonalities, but then use our differences to our advantage.

Ms. Kruyer agreed and explained that there is no specific checklist or toolkit for what makes a successful cluster. It requires looking at a region's assets and issues and developing the connections to solve those issues.

PANEL DISCUSSION: SUPPORTING THE PARTICIPATION OF WATER UTILITIES IN INNOVATION

Panel Leader

LOUANN DECOURSEY, Chief Executive Officer, Open Water Foundation

Panelists

CRISTINA AHMADPOUR, North American President, Isle Utilities

DR. BARRY LINER, Director, Water Science and Engineering Center, Water Environment Federation

JEFF MOELLER, Director of Water Technologies, LIFT Program, Water Environment & Reuse Foundation

BEATE WRIGHT, Executive Director, DC Office, Water Research Foundation

LOUANN DECOURSEY

Louann DeCoursey from the Open Water Foundation began by discussing the fact that the water sector is not very efficient, transparent, or collaborative, and cluster leaders struggle with that and try to overcome it. In terms of support groups for clusters, there are economic development groups, chambers of commerce, innovation and entrepreneurship institutes, universities, investors, government entities, utilities, and non-profits. These panelists represent a number of support groups that support utilities.

DR. BARRY LINER

Dr. Barry Liner described one of WEF's strategic plans to drive innovation in the water sector. He mentioned the Innovation Pavilion at WEFTEC that highlighted the 12 startups that have won awards through Imagine H2O or BlueTech Research. WEF is focused on its collaboration with WE&RF and its LIFT program. WE&RF also recently began a new program, called LIFT for Management, adding that it is not only about technology, but the management aspect that is involved. WEF partners with organizations like Imagine H2O and BlueTech, and it will be having an innovation event next year in conjunction with Imagine H2O to discuss putting innovation into practice and implementing the winning startups at utilities. Dr. Liner and his colleagues often participate in water innovation events, and through their research and innovation committee and other activities, innovation is ingrained into their work at WEF.

JEFF MOELLER

Jeff Moeller is the WE&RF manager for the WEF/WE&RF LIFT program. LIFT is a program to help accelerate innovation in the water quality industry. It has a strong utility emphasis – over 350 municipal and industrial facility owners participate as part of the LIFT working group. He shared some of the tools and resources available through the LIFT program to help water clusters collaborate with utilities. At the research level, WE&RF has a program to better connect universities and utilities. In many regions, universities are developing solutions and looking for problems, and utilities with problems are looking for solutions – but they are not necessarily connected. These resources need to be better aligned. WE&RF is developing a guidance manual for universities and utilities that includes case studies for doing this. WE&RF also has research funding available for partnerships between universities and utilities to work on R&D together, move technologies into practice, and develop homegrown innovation. Additionally, LIFT Link (liftlink.werf.org) is a platform that serves as a clearinghouse for new technologies and innovation, which might be a good resource for clusters looking for new technologies to attract to their regions. There is also a Needs Forum in LIFT Link, so utilities can post specific needs and other

utilities can indicate that they have the same need. If there is a problem posted and 10 utilities indicate that they have the same need, this will hopefully send a signal to the market. WE&RF views this as a potential market opportunity. It could serve as a resource for identifying high-priority regional needs. The LIFT program is also working on a National Test Bed Network in collaboration with EPA, NSF (National Science Foundation), and DOE (U.S. Department of Energy). There were two recent workshops with 100 stakeholders to develop recommendations on moving it forward. Additionally, LIFT hosts a test bed directory that has over 60 facilities, including many utilities. That serves as a better way to connect innovators with test bed facilities appropriate for their needs. WE&RF also has a program called "See It." Utilities have expressed that the best way to learn about new technologies is to be able to go and see them in person and talk to peer utilities about them. But, a lot of utilities have limited travel budgets or restrictions, so together with WEF and NACWA (National Association of Clean Water Agencies), WE&RF launched a travel scholarship for utilities to travel to other utilities around the world to see their innovations. Lastly, Mr. Moeller noted that his team is working with the Water Research Foundation (WRF) on a project to foster innovation in water utilities that will provide guidance to utilities on developing an innovation program.

CRISTINA AHMADPOUR

Next, Cristina Ahmadpour spoke about Isle Utilities. It is a global innovation and consultancy firm with a team of 46 people that includes scientists, engineers, entrepreneurs, tech geeks, etc. The team tracks, vets, and qualifies the emerging technologies entering into the water field. Isle Utilities serves about 150 clients globally, that are primarily water and wastewater agencies and water utilities. It is in seven countries, and the U.S. is its biggest market, where there is still the most opportunity for growth. Isle has been active in the U.S. for four years, and it most known for its TAG forum, which was introduced in 2005. The forum engages water utilities with qualified, vetted technologies that meet their needs. Some utilities that are part of this TAG forum go through a needs assessment with an Isle consultant to look at technology needs and best practices. The information can be cross-shared regionally and globally within the TAG network. In the U.S., there are seven regional groups. Isle hosts TAG meetings frequently and new technologies are constantly introduced. A list of the best available technologies is presented at the TAG forum, and the end users vote on the ones they want to see. The technologies that receive the most votes make it to the room. This platform ultimately creates a market pull. Although there are barriers to innovation, Mrs. Ahmadpour sees a lot of leadership in the water utility space through TAG. Through the TAG forum, there is a lot of collaboration with water clusters and the research organizations. TAG is also a feedback loop because every utility fills out a feedback form about the technology. This is essentially a SWOT analysis, and the technology company receives that analysis, which allows it to develop the product and a commercial strategy. Whether it is a small agency or a large one with a full R&D department, the forum fosters regional collaboration. The small utilities learn from the large ones and there are opportunities to collaborate and share funding resources.

BEATE WRIGHT

Finally, Beate Wright spoke about utility innovation at the Water Research Foundation. Innovation is fundamental in the applied research WRF does. It funds and manages research, and its board and research agenda is all utility driven. It also holds frequent workshops, where participants listen and list

their drivers, and then they are able to craft a research and scope engine. WRF has a lot of partners, so it is able to connect the dots for the utilities, and in addition, uses reverse pitching and its partnership with TAG to meet the utilities' needs. It has over 1,000 subscribers, 900 of which are utilities all over the world, and it has the ability to work with a large amount of stakeholders. The flexibility in its research program is appealing to promote innovation. There is neither a problem nor research gap that WRF is not interested or willing to figure out how to address. It leverages the experts in the field – utility experts, consultants, manufacturers, and vendors – and facilitates to address the needs. Working with partnerships is critical to using subscribers' dollars in the most efficient and optimal way. Mrs. Wright encouraged the audience: "We should be always innovating. When we listen to forums like today and we get ideas and want to make connections, we should always keep growing." The water sector is critical to WRF's work, and with all the current environmental challenges, innovation is not a fleeting thing.

Mrs. Wright provided examples of research WRF has done over the last 50 years. The clusters can leverage WRF's research, and it can leverage the clusters. WRF has been doing research in "One Water," but has made a renewed commitment to expanding that. It is a finite resource, and we all need to be thinking big, with a watershed approach. She touched on the joint project with WE&RF, which includes important partners outside of WE&RF to foster innovation in utilities. This project could answer many questions about what it takes to characterize research and innovative activities within water and wastewater utilities. There are nearly 40 utilities already actively sharing what works and what does not, and much of it is related to culture. WRF is developing a framework to help utilities, as well as clusters, researchers, and technologists, understand what drives utilities to be innovative and the associated challenges and solutions. As part of this project, WRF did a global survey with help from its partners. There were roughly 400 respondents from 78 utilities. Mrs. Wright presented the results:

- 91% believe innovation is critical
- 20% of innovation programs were in existence 10 years ago
- 39% have identified clear objectives
- 36% have a facilitating structure and process
- 25% consider innovation characteristics/responsibilities in hiring

Then, she described the seven innovation attributes that resulted from this project:

- Vision: Articulated long view that inspires innovation activities
- Focus: Defined challenges that guide innovation investments
- Develop: Commitment to investing resources in innovation
- Test: Commitment to scaled application of the innovation
- Extend: Utilization of resources outside of the utility
- Engage: Ability to motivate, enable, and reward staff and broader stakeholders
- Evolve: Ability to adopt innovation and measure impact

Through subscriber feedback, WRF has found communication to be valuable in the effective dissemination of information. For example, it uses webcasts and succinct, published reports that explain exactly what utilities can do. It is critical to be able to communicate and share knowledge.

Question & Answer Session

What are the opportunities and gaps you see in addressing innovation in collaborations between utilities and clusters?

Ms. Ahmadpour said that it begins with understanding the assets and competitive advantages in the region that can be leveraged outwards. This is the first thing that utilities and clusters need to do when coming together to see how they can bring in the universities, the utilities themselves, the research organizations, and the other service providers in the industry. Some of the success she has seen with water clusters specifically is when the utilities are a big part of it – whether they are funding the initial start of the cluster or they are on the Board of Directors in an advisory role. The other opportunity is addressing the complete water cycle in your region. If you look at the water cycle, you know who is discharging the wastewater, who is delivering the water, and who the biggest water users are, and you can incorporate that into that overall vision of the cluster. She thinks it will enhance regional collaboration on the economic development side.

Mr. Moeller thinks a huge opportunity for utilities and clusters is addressing the utilities' pain points. There is a real opportunity, and utilities need to see what is in it for them and the value they can gain. In particular, at the university and utility collaborations, there is a huge opportunity to do homegrown innovation. Mr. Moeller mentioned how Sudhir Murthy, the DC Water Innovations Chief, who is chair of the LIFT program, talks about when he went Beijing to tour a utility. He saw many students there working on all these different projects, including demonstrations, small pilots, etc. This was an example of the opportunity to embed universities in utilities and help solve problems. In the utilities, students get real-world training, patent opportunities, and an understanding of end-user R&D needs. For the utilities, this is workforce training for the future, as well as low-cost and proactive problem solving.

Dr. Liner said that from a more practical, lower-level viewpoint, a cluster and a utility is not a one-to-one relationship, because a cluster is not one thing. It is a many-to-many relationship of many utilities with multiple actors in the cluster. In fact, the utility should be part of the cluster. Therefore, it really is not an interaction between a cluster and the utilities; it is simply interaction within the cluster. Dr. Liner believes that this mindset needs to occur. In terms of workforce development, we need to drive students into the water sector. This is important because we need people from all backgrounds in this sector, and this is a great opportunity to show the career paths in the water space.

PERSPECTIVES ON THE ROLE OF WATER UTILITIES IN THE NETHERLANDS

WATER CLUSTER

Speaker

HEIN MOLENKAMP, Managing Director, Water Alliance

Introduction

JONATHAN CLEMENT, Chief Executive Officer, PWN Technologies

JONATHAN CLEMENT

Jonathan Clement began by noting that he was born in America, but has lived in the Netherlands for the past 16 years. He has worked in the water industry in the U.S. and in the Netherlands, which has given him a modest perspective on both industries. Mr. Clement briefly described the Netherlands as a small country with 16 million people and a river delta that includes the Rhine. The Rhine goes through the most heavily industrialized area in the world, which presents a challenge for PWN, the Netherlands utility, located in the northwest corner of the country. The utility serves about two million people, and while much of the Netherlands can use groundwater, PWN has to use Rhine River water. This water source is highly polluted with pesticides, has high risk from cargo shipping, incomplete watershed control, and a complex, unnatural, and manmade lake with unique water quality characteristics. These challenges have forced PWN to innovate, which has led to specialized treatment.

While PWN is a public utility, Mr. Clement explained that the government is not involved. PWN makes the decisions about what it thinks is right for public health and the system, which is a very evolved utility model. For example, if PWN wants to build a treatment plant, it is able to do so with relatively no problems from the public, who trust in the utility's decisions. The money for projects also comes from the ratepayers. In one year, PWN spends \$2.5 million in its own research facility. This allows it to determine the best solutions for quality and reliability without needing to seek a consultant. PWN's highly educated and qualified team of engineers and Ph.D.'s design the utility's systems and recognize that innovation is necessary within a highly polluted and contaminated water source. It was a strange experience for Mr. Clement to come from America where he helped a utility get around a filtration waiver, to then go to the Netherlands where the utility not only wants to have standards, but also aims to be even better than the standards if it is feasible.

In 1988, a salt treaty with France to reduce the salt content of the Rhine was cancelled, resulting in elevated salt levels. This led to the need for reverse osmosis, and in response, PWN developed the first large-scale integrated UFRO membrane plant in the world – an effort involving both private companies and a public utility. In addition to elevated levels of salt, elevated levels of pesticides were also found in the Rhine River, and after evaluating multiple treatment technologies, PWN decided to employ a never-before-used technology. Additionally, together with the University of Waterloo and Trojan Technologies, PWN developed a process called UV hydrogen peroxide. The success of these two technologies in combination with many other technologies spurred the creation of a daughter company, PWN Technologies. Unlike the public utility, PWN Technologies can earn money, which then goes back into the utility to create new innovation.

This innovative model allows for PWN and PWN Technologies to work with companies all over the world because companies are not threatened by a sales talk from a public utility. Also, PWN does not develop technologies for the market, it only provides technologies it has already created for its own needs.

Internationally, it ran a successful test plant in Singapore for two years. This success opened up work in California and Australia.

Finally, Mr. Clement said they have been doing water reuse and recycling for 90 years. For most of that time, the Rhine River was worse than secondary wastewater effluence. PWN uses ion exchange, ceramic membranes, advanced oxidation, and GAC filtration. After it does all that, the water is pumped into sand dunes and filtered for 40 days with no addition of chlorine. This well-filtered and high-quality drinking water has led to the lowest water bottle consumption rate in the world.

HEIN MOLENKAMP

Hein Molenkamp opened with an explanation of how the Netherlands has an innovative ecosystem for water technology. Companies like PWN Technologies are quick-moving, which is great for innovation. Since the Netherlands is a small country, there is a small market and a lot of export for innovations. Mr. Molenkamp is the managing director of a water cluster in the Netherlands called Water Alliance. He describes it as a smart ecosystem or network of organizations bound together through innovations.

The Netherlands has a large, complicated watershed stemming from multiple rivers. Without dikes, 60% of the Netherlands would be under water. Water utilities in the Netherlands are very different from water utilities in the United States or Canada. Mainly, the drinking water utilities are separate organizations from the wastewater treatment organizations. In addition, there are separate municipalities that maintain the pipes and sewers, so there are three different organizations performing water treatment in the Netherlands.

Through the years, many companies have become active in the water technology field, including clean water technologies, sensor technologies, and wastewater technologies – both in the municipal and industrial sectors. As an example, Mr. Molenkamp described the recent wave of new companies entering into the sensor technology field. One company wanted a solution for rapidly detecting bacteria without having to wait days for lab results. This led to the discovery of a method of rapid detection based on DNA profiling that can identify the bacteria in any fluid in 10-20 minutes. This technology resulted in the creation of a water technology business. While commercial companies develop water technology in the Netherlands, it is not always possible for them to do it alone. Water Alliance has set up an ecosystem where the goal is to help these entities, which are often small, to develop technologies without having to invest heavily in facilities or laboratories. The Netherlands' utilities are also heavily involved in this effort.

The first stage of the technology innovation chain is research. Companies and universities need a research institute to work together on new technology development. In the Netherlands, this is done by an organization called the Wetsus Research Institute. This institute is a cooperation of 21 different universities, where Ph.D.'s from those universities work together in the laboratories at Water Alliance's Water Campus. This collaboration inspires breakthrough-type technology developments. After the initial research phase, significant applied research is necessary before entering into the market, and this is often completed by individual companies. At Water Alliance's Water Campus, there are over 100 different companies working alongside the researchers from the Wetsus Research Institute to study market-driven research. The Water Campus also has five different test and demonstration sites that companies can rent to test and demonstrate their technologies. This is the stage where utilities play an important role. For instance, one of the demonstration sites is located at a municipal wastewater

treatment facility. This allows companies to conduct pilots at an actual treatment facility while also allowing the utility to learn about new technology that might benefit its operations. Another example Mr. Molenkamp mentioned is a Netherlands drinking water utility that operates its entire distribution line as an open innovation spot for new sensor technology.

Water Alliance also has a demonstration site located at a hospital. Mr. Molenkamp believes that there will be a lot of future interest in wastewater from hospitals, which is often highly polluted. These pollutants flow into the central sewer where they are diluted by rainwater and are difficult to remove. Having a test site at a hospital encourages the development of new technologies that can treat the water at the source. The Water Alliance demonstration sites are under an umbrella permit in the Netherlands, allowing companies in the water cluster to test and pilot their technologies without having to wait months for permit approval.

Most of these water innovations are on the border of multiple sectors, including energy, industry, and agriculture. Mr. Molenkamp believes it is important to gather as a global water technology cluster to find new ways to solve challenges. Clusters are too small to solve these challenges on their own, so it is necessary for clusters to come together to tackle them.

Question & Answer Session

With regards to the hospital wastewater site, your presentation indicated that internal medicines are removed. Are all pharmaceuticals removed?

Mr. Molenkamp explained that this site is a demonstration and test site that is set up with multiple streams available for technology pilots. Therefore, it depends on the type of water stream and the type of technology being tested.

From my perspective, there seems to be more leadership and progress associated with longer life cycle type projects in the Netherlands than there is from agencies in the United States. What do you think drives this difference? Culture? Regulation?

Mr. Clement responded that he believes it is based on culture. He participated in a round table discussion with water ministers from Australia, Singapore, the U.S., and the Netherlands. At the end of a long discussion, they all asked why the Netherlands was so far ahead. Mr. Clement attributes it to culture and how the Dutch revere water from their history of being below sea level, struggling both with the sea and water quality. Also, the position as a director of a water utility is considered a very serious, powerful, and well-respected position. This leadership and culture drives decisions to be made that do not focus on cost, but rather, focus on the environment and the best solution for the next 30 or 40 years. The culture in the Netherlands is to do the best and right thing.

As a follow up, what are the key performance indicators that need to be achieved?

Mr. Clement expressed that sustainability is a main driver for his utility. His utility looks not so much at the money, but rather the value to the environment and the value proposition to the water quality, the consumers, and the customers. In most utilities around the world, cost is 70% or 80% of the factor; however, in the Netherlands, 90% of the decision accounts for environmental quality and sustainability.

To be more specific, is there a carbon footprint that needs to be justified directly or indirectly? Or do you look at it holistically?

Mr. Clement replied that they look at it holistically.

Where does a company like Royal Dutch Shell fit into your Water Alliance? Royal Dutch has a fairly significant play on water sustainability.

Mr. Molenkamp said that it does not have much involvement in the Water Alliance. But, if you look at the Water Campus level, it is a company partner within Wetsus Research Institute. Shell also has an interesting water technology department, so it is quite knowledgeable and experienced. Thus, it is involved, and he thinks that is important.

Mr. Clement said that his water treatment utility is rather small. However, 50 people from Shell met with their water technology group to discuss how our water treatment systems and their water treatment systems could interplay.

BREAKOUT SESSIONS: DISCUSSION FOR INPUT INTO WATER CLUSTER-WATER UTILITY HANDBOOK

Moderators

KEN PANTUCK, U.S. EPA Region 3

MAGGIE THEROUX, U.S. EPA Office of Research and Development

The main points discussed during the breakout sessions are summarized below.

GROUP 1: MODERATED BY MAGGIE THEROUX

Involve EPA region: It might help utilities if the clusters collaborated by EPA region. Utilities could have a better sense of the regulations when wanting to do a trial for a technology. Additionally, it could possibly add value to have an EPA Regional Office representative provide assistance and join the cluster representative when approaching utilities, as long as EPA does not directly regulate the utility.

Finding unique capability: Each cluster is unique in its composition and strengths.

Utility-only meetings are a safe space: Providing a safe space for the utilities to talk encourages them to speak honestly and openly with each other about their needs and share their experiences. Utilities can hear about the challenges that others near them face and discuss their common issues.

Vet the technology and act as a trusted connector between companies and utilities: The cluster can serve as a facilitator to hear the needs and challenges of both the technology companies and the utilities. Based on those needs and challenges, the cluster can connect the company or utility to the right people, companies, agencies, etc.

Economic development funds: Nevada has a fund that supports academic institutions doing applied innovation/R&D in collaboration with private industry. WaterStart received economic development funds by submitting a grant to that program.

What are the successful ROI models?: Sharing the ROI models of utilities with successful innovation programs, like Cincinnati and DC Water, could be a way to provide justification for innovative projects and build a foundation for making the case at your utility.

Check legislation: Earlier in the day, a couple speakers discussed the need for the utility representatives to at the enabling legislation of their utilities.

What is the cost model?: If the technologies will lower costs, then reluctant utilities will be more willing to adopt them. A reference model, including the cost to the utility, would be helpful when discussing with the utilities that are hesitant to adopt technologies. It is important to establish the business case for innovation.

What is the clusters' role?: When it comes to facilitating clusters, there cannot be a single manual for all of them to operate because each one has its own mandates, missions, and objectives.

Leverage from other clusters – sharing resources and cross-collaboration: WaterTAP provided examples of how it collaborates with other clusters. If it does not have the services, it might approach another cluster and leverage its services and vice versa. For instance, MassCEC and NEWIN are doing pilot testing and they went to Ontario to see some of their test sites. They can see what each organization is doing or not doing and then fill in those gaps by sending companies back and forth and leveraging some bilateral trade funds.

Develop comprehensive inventory: An all-encompassing inventory could include problems, solutions, physical assets, IP assets, resources, funding, etc. Other clusters could do this with their constituencies, including utilities. Clusters could share their inventories with each other and utilities.

Commercialize lab and technology testing: DC Water has a research lab where researchers can develop processes and work with the utility to scale-up and test processes to help commercialize the product. It is considered a service of DC Water, which they are allowed to operate because of the changes they made to their legislation. It is called ART: Advancing Research and Technology. If anybody has a new technology, and they cannot scale it up unless they have access to a university, they can bring it to DC Water for testing services. It costs about \$5,000/week to support those services.

Utilities to collaborate with one another: Clusters can help utilities collaborate. Different utilities bring different skill sets to the market. Connecting the right companies to the right utilities is a service that clusters can provide.

Go towards the pull, do not push, and listen to the utilities: WaterStart has seen success when it has been pulled in certain directions by its partners and constituents rather than trying to push them in some direction. It is not a best practice to start a cluster for the sole purpose of trying to get the utilities to improve. The clusters need to listen to their utilities rather than telling them how to operate better.

Cluster-to-cluster collaboration: Clusters can unify around big data to create value for industry and utilities.

Developing a document on fostering innovation in utilities: WE&RF is developing a guidance manual for fostering innovation in utilities. The document will explain how to establish an innovation program. It will include small things around open innovation.

Collaboration with universities: Biju George explained that DC Water receives requests from utilities to help set up a research lab and get students from universities. Clusters can help utilities do this.

Assess needs of utilities in region: Clusters can bring their utilities together in order to facilitate the process for accessing needs. Confluence has been asked to give training credits to the utility representatives who attend meetings. Their attendance is important and training credits may help. Confluence also has a MOU between the three states in its region that asserts that they will be more open to innovative technologies. If one state vets it, the others will be more open to it.

Financial innovation: Clusters can assist in other areas of innovation, specifically financial innovation, by pooling funds from private investors. DC Water uses several instruments such as the green bond and the environmental impact bond, which is tied to the performance of technologies.

Forum that brings together stakeholders: Clusters can act as a bridge to bring politicians together. They can have a forum to bring various stakeholders together to discuss needs, such as the Reverse Pitch, which the city councilman attended. It is important because the city controls the utility's budget.

GROUP 2: MODERATED BY KEN PANTUCK

Utilities needs assessments: Clusters could offer needs assessments as a service to utilities. The Confluence reverse pitch was a good way to hear about utilities' needs.

Directory of cluster strengths: It is a challenge for clusters to identify water companies.

Marketing and personal relationships: Clusters need to better market themselves to utilities. There was a suggestion that the AWWA section regions and the Chamber of Commerce could assist with this. A strong website would also help market clusters. Additionally, developing personal relationships is critical.

Include utilities in the governance structure of clusters: This approach is currently used in several clusters. This ensures the utilities are engaged in the conversation.

Advantages to collaboration, but how to do this?: Everyone is learning that there are more advantages to collaboration than competing. There was a suggestion for a communications piece authored by the clusters. MOUs are another option for collaboration. All of the clusters could develop a white paper to explain the benefits of the network to the nation and inform the nation of our water crisis. It can be solved by using the power of the clusters as a problem-solving platform. Another suggestion was to have an organization, like AWWA, WRF, WE&RF, etc., be the center of the clusters. The power of this network could be amazing if it collaborates.

Local leadership and governance needed: There is a need to redefine the role of water in the community as not just about solving a pollution or treatment problem. It is about redefining water as fundamental to the economic future of the community. This is important for both industry and the citizens. This is a part of the marketing and rebranding of water as a pillar of the economy as opposed to just clean water. Local leadership and governance make clusters work – not a grant writer or a university-based cluster initiative since it is about research there and not economic competitiveness and innovation.

More documentation of the clusters needed: It is important to identify what each cluster is doing, conduct social network mapping to figure out the assets, opportunities, and gaps, and then determine who is going to fill those gaps. This could be achieved in a workgroup of cluster leaders and by physically visiting other clusters.

Prioritize problems and identify assets: What are the solutions that clusters can provide? Are they well-suited to solve these problems? Focus on three or four and put the collective cluster brain to work on solution(s) for those problems. Some of this is based on current problems, some of this is about anticipating them. Over the next decade, water problems and associated public health, food, drought,

flooding, acidification, rising sea levels, and climate change issues are going to emerge all over the world. But what are the three or four that clusters are well-suited to solve?

Clusters perform a screening function (serve as an intermediary) for the utilities and companies: Richard Seline described how AccelerateH2O does this. If a company comes to them, AccelerateH2O does an initial vetting to determine if the company is ready to go out into the marketplace, and they talk to the specific community to see what they really need. AccelerateH2O either pushes the technology or tries to listen to who is pulling the technology. Their role is to listen to what the community wants and help the companies really understand that. They are a filter or intermediary for looking at technologies.

The need to de-risk: The Denver area is at the early stages of beginning to form a cluster, so they are going to be interested in their own challenges, and it would be great to look at the other clusters to find common issues. That would help them to further de-risk innovation for their utilities, so their leadership can look at what they are spending their money on, but if they could show them how other clusters are also working on the same problem, then they could leverage that and it would de-risk innovation.

Everyone wants a piece of the action: What is in it for the utilities? They would want equity, but can they be a business partner? How else can the utility gain value other than increasing efficiency? Richard Seline provided an example. In his experience, he has seen that if a full-scale demonstration installation at the utility is successful, then then utility will want to buy it or license it. The technology is already on site, so they offer the utility a 20%-30% cost reduction because of how valuable word-of-mouth will be to spread the word to the other 4,600 utilities in Texas. Some of the companies may not want to give up the equity, but they want 100 procurement packages.

Managing IP and the procurement process: Dr. Rominder Suri brought up the topic of how clusters handle IP. He said it seems that the major objective is match-making rather than developing IP. We need to have a good conversation about the IP process and the procurement of innovation. There are some models that exist in other sectors, but if we cannot get the procurement process opened up, we are going to be back in the same type of RFP process. How do you as an innovator bring your IP to the utility, and is the utility going to have a piece of that?

Business perspective added: The OptiRTC and Veolia model as mentioned by The Water Council is an example for handling IP. In that case, you have an emerging company partnering with a company that the utilities feel comfortable with, instead of the utility handling the IP relationship, the big company handles it. There was a suggestion for building business around the IP.

Following the breakout sessions, representatives from each group reported an overview of their discussions.

INPUT FOR FUTURE MEETINGS

After both groups reported out, the participants discussed future meetings. Many agreed that these meetings work well when held at large industry conferences or meetings. Other than WEFTEC, AWWA's annual meeting and WaterVent were suggested, and Egils Milbergs invited everyone for a meeting in Washington state. A few topics for the next meeting were suggested: communication and interaction, finance, and developing a long-term handbook that includes chapters on finance, universities, etc. An additional suggestion was made for discussing the definition of a cluster.

CLOSING REMARKS

Speakers

MATTHEW QUIGLEY, U.S. Department of Commerce

SALLY GUTIERREZ, U.S. EPA Office of Research and Development

Matthew Quigley from the U.S. Commercial Service at the U.S. Department of Commerce offered a few closing remarks. He invited the cluster leaders to reach out and work with the Department of Commerce for export assistance.

Sally Gutierrez thanked the audience for their participation and the Gulf Coast Cluster Leaders for sponsoring the reception.

APPENDIX A: AGENDA

- 8:30 AM **Informal Networking**
- 9:00 **Welcome to WEFTEC and to New Orleans**
DR. BARRY LINER, Director, Water Science and Engineering Center, Water Environment Federation
STEVE PICOU & GRASSHOPPER MENDOZA, Louisiana Water Economy Network
CHRISTOPHER ROBBINS, Associate Assistant Administrator for Management, U.S. EPA Office of Research and Development
- 9:15 **Meeting Goals and Objectives**
SALLY GUTIERREZ, Director, Environmental Technology Innovation Clusters Program, U.S. EPA Office of Research and Development
- 9:20 **Perspectives from Large U.S. Utilities as Primary Actors in Water Clusters and Water Innovation**
Speakers
MR. CEDRIC GRANT, Deputy Mayor and Director, Sewerage & Water Board of New Orleans
MR. BIJU GEORGE, Chief Operating Officer, DC Water and former Board Member of Confluence
Introduction
DR. BYRON CLAYTON, President & CEO, NexusLA
- 9:50 **Leading Singapore to a Safe and Secure Water Future Through Innovation: The Role of the Singapore Public Utility Board**
Speaker
MS. ANGELA KOH, Director, Singapore Water Academy, Singapore Public Utility Board
Introduction and Moderator
PAUL O'CALLAGHAN, Founder & CEO, BlueTech Research
- 10:30 **Break**
- 10:45 **Panel Discussion: The Emerging Trend of Water Utility Innovation Managers and Programs**
Panel Leader
JON GRANT, Research Manager, WaterTAP, Ontario, Canada
Panelists
JOHN ARENA, Business Outreach Section Manager, Metropolitan Water District of Southern California, Los Angeles, CA
SHANNON DUNNE, Assistant Director for Wastewater, City of Houston, TX
SAUL KINTER, Business Development Program Manager, DC Water, Washington, DC
JIM MCQUARRIE, Chief Innovation Officer, Metro Wastewater Reclamation District, Denver, CO
DAN MURRAY, Metropolitan Sewer District of Greater Cincinnati, Cincinnati, OH
- 11:30 **Panel Discussion: Perspectives on the Role of Water Utilities in Water Clusters**
Panel Leader
BRYAN STUBBS, Executive Director, Cleveland Water Alliance
Panelists
NATE ALLEN, Executive Director, WaterStart, Las Vegas, NV
DEAN AMHAUS, President and CEO, The Water Council, Milwaukee, WI
MARCUS GAY, Executive Director, New England Water Innovation Network, Boston, MA
RICHARD SELINE, Executive Director, AccelerateH2O, San Antonio, TX

- 12:15 PM **Lunch and Keynote: The Journey of Mekorot in Leading Water Innovation in Israel and the Globe**
Speaker
 MR. BOOKY OREN, Chairman & CEO, Booky Oren Global Water Technologies, Israel
Introduction
 MR. JEFF LAPE, Deputy Director, Office of Science and Technology, U.S. EPA Office of Water
LUNCH SPONSORED BY THE CLEVELAND WATER ALLIANCE – PROVIDING SPONSOR REMARKS
- 1:15 **Cluster Showcase: The Confluence Regional Utility Network (RUN)**
Panel Leader
 REESE JOHNSON, CH2M and Chair of Confluence Board
Panelists
 VERNA ARNETTE, Deputy Director of Operations, Greater Cincinnati Water Works
 MELINDA KRUYER, Executive Director, Confluence
 RYAN WELSH, Principal Engineer, Metropolitan Sewer District of Greater Cincinnati
- 1:45 **Panel Discussion: Supporting the Participation of Water Utilities in Innovation**
Panel Leader
 LOUANN DECOURSEY, Chief Executive Officer, Open Water Foundation, Colorado
Panelists
 CRISTINA AHMADPOUR, North American President, Isle Utilities
 DR. BARRY LINER, Director, Water Science and Engineering Center, Water Environment Federation
 JEFF MOELLER, Director of Water Technologies, LIFT, Water Environment & Reuse Foundation
 BEATE WRIGHT, Executive Director, DC Office, Water Research Foundation
- 2:15 **Break**
- 2:45 **Perspectives on the Role of Water Utilities in the Netherlands Water Cluster**
Speaker
 HEIN MOLENKAMP, Managing Director, Water Alliance, The Netherlands
Introduction
 JONATHAN CLEMENT, Chief Executive Officer, PWN Technologies, The Netherlands
- 3:15 **Breakout Sessions: Discussion for Input into Water Cluster-Water Utility Handbook**
Moderators
 KEN PANTUCK, Senior Environmental Scientist, U.S. EPA Region 3, Philadelphia
 MAGGIE THEROUX, Senior Cluster Development Specialist, U.S. EPA Office of Research and Development
- 4:40 **Share Results**
- 4:50 **Input for Future Meetings**
- 5:15 **Closing Remarks**
 MATTHEW QUIGLEY, Foreign Commercial Service Officer, U.S. Commercial Service, U.S. Department of Commerce
- 5:20 **Adjourn**
- 5:30 PM **Reception**
 Tommy's Wine Bar: 752 Tchoupitoulas Street, New Orleans, LA 70130
RECEPTION SPONSORED BY THE GULF COAST CLUSTER LEADERS

APPENDIX B: REGISTERED ATTENDEES

First Name	Last Name	Organization
Jacob	Adler	U.S. Environmental Protection Agency
Cristina	Ahmadpour	Isle Utilities
Nathan	Allen	WaterStart
Dean	Amhaus	The Water Council
John	Arena	Metropolitan Water District of Southern California
Verna	Arnette	Greater Cincinnati Water Works
Philip	Ashcroft	New England Water Innovation Network
Mark	Barker	WEX Global
Alex	Berhиту	Water Alliance (The Netherlands)
Bryan	Bjorndal	Assure Controls
Charles	Bott	Hampton Roads Sanitation District
Marc	Bracken	Echologics
Zeke	Campbell	Denver Water
Jean-Loic	Carré	POLE EAU (France)
Victor	Chew	Singapore Economic Development Board
Byron	Clayton	NexusLA
Jonathan	Clement	PWN Technologies (The Netherlands)
Ken	Crisp	City of Akron, Ohio
Erin	Dalius	Temple University
Todd	Danielson	Avon Lake Regional Water
Wouter	de Buck	Netherlands Water Partnership
Louann	DeCoursey	Open Water Foundation
Shannon	Dunne	City of Houston, Texas Wastewater
Aaron	Fisher	Water Environment & Reuse Foundation
Greg	Fisher	Denver Water
Kerry	Freek	WaterTAP (Ontario)
Karen	Frost	The Water Council
Peter	Gallant	WaterTAP (Ontario)
Marcus	Gay	New England Water Innovation Network
Biju	George	DC Water
Ken	Glotzbach	City of Roseville, California Wastewater
Angela	Godwin	Pennwell Corporation
Cedric	Grant	Sewerage and Water Board of New Orleans
Jon	Grant	WaterTAP (Ontario)
Jeff	Guild	BlueTech Research
Sally	Gutierrez	U.S. Environmental Protection Agency
Ted	Henifin	Hampton Roads Sanitation District
Shahar	Hilawi	Mei Netanya (Israel)
Alan	Hinchman	Gray Matter Systems

Jocelyn	Hittle	Colorado State University
Cody	Holcomb	City of Ada, Oklahoma
Claus	Homann	Aarhus Water Ltd. (Denmark)
Erik	Hromadka	Global Water Technologies
PARK	jAEHYUN	Korea Ministry of Environment
Reese	Johnson	CH2M
Rahim	Kanji	Southern Ontario Water Consortium
Fidan	Karimova	Water Environment & Reuse Foundation
Sami	Khalil	Jefferson Parish Department of Environmental Affairs
Huishan	Khong	Singapore Public Utility Board
Sungpyo	Kim	Korea Water Partnership
Saul	Kinter	DC Water
Adriane	Koenig	U.S. Environmental Protection Agency
Angela	Koh	Singapore Public Utility Board
Melinda	Kruyer	Confluence
Vishnu	Lakdawala	Hampton Roads Sanitation District
Cynthia	Lane	American Water Works Association
Jeff	Lape	U.S. Environmental Protection Agency
Barry	Liner	Water Environment Federation
Jim	McQuarrie	Metro Wastewater Reclamation District
Grasshopper	Mendoza	Louisiana Water Economy Network
Egils	Milbergs	Center for Accelerating Innovation
Bob	Miller	Sewerage and Water Board of New Orleans
Leanne	Miller	Water Research Foundation
Amelia	Mioranza	U.S. Environmental Protection Agency
Jeff	Moeller	Water Environment & Reuse Foundation
Hein	Molenkamp	Water Alliance (The Netherlands)
Dan	Murray	Metropolitan Sewer District of Greater Cincinnati
Pam	Neal	Portland Development Commission
Edward	Norris, III	South Central Connecticut Regional Water Authority
Paul	O'Callaghan	BlueTech Research
Tze Haung	Ong	Singapore Economic Development Board
Booky	Oren	Booky Oren Global Water Technologies (Israel)
Dan	Page	Gray Matter Systems
Kenneth	Pantuck	U.S. Environmental Protection Agency
Steve	Picou	Louisiana Water Economy Network
Viktoriya	Plotkin	U.S. Environmental Protection Agency
Dr. Michael	Prange	German Water Partnership
Matthew	Quigley	U.S. Department of Commerce
Chris	Robbins	U.S. Environmental Protection Agency
Richard	Seline	AccelerateH2O

Yuseop	SHIM	Korea Water and Wastewater Works Association
Shay	Siboni	Mei Netanya (Israel)
Geoffrey	Smyth	City of Tacoma Center for Urban Waters
Tanya	Spano	Metropolitan Washington Council of Governments
Matan	Strul	Booky Oren Global Water Technologies (Israel)
Bryan	Stubbs	Cleveland Water Alliance
Rominder	Suri	Temple University
Elizabeth	Thelen	The Water Council
Maggie	Theroux	U.S. Environmental Protection Agency
Marisa	Tricas	Water Environment Federation
Ryan	Vogel	Pure Blue
Ryan	Welsh	Metropolitan Sewer District of Greater Cincinnati
Joe	Williams	U.S. Environmental Protection Agency
Lisa	Willis	Gwinnett County, Georgia
YANG	WOO KEUN	Korea Ministry of Environment
Beate	Wright	Water Research Foundation
Shengwei	Yeo	Singapore Public Utility Board