WRF Webcast

Fostering Innovation Within Water Utilities

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Fostering Innovation Within Water Utilities - Project 4642

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City of San Diego
City of Tucson
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Cobb County-Marietta Water Authority
Coliban Water
Dallas Water Utilities
DC Water
Denver Water
East Bay Municipal Utilities Board
El Paso Department of Public Works
Great Lakes Water Authority
Greater Cincinnati Water Works
Hampton Roads Sanitation District
King County

Marin Municipal Water District
Metro Wastewater Reclamation District
Metropolitan Water District of Southern California
Metropolitan Water Reclamation District of Greater Chicago
Mohawk Valley Water Authority
Pittsburg Water & Sewer Authority
Queensland Urban Utilities
Rancho California Water District
Sacramento Regional Sanitation District
San Diego County Water Authority
Sanitation District 1
Santa Clara Valley Water District
Scottish Water
Seqwater
South Australian Water Corporation
Southern Nevada Water Authority
Spartanburg Water
Three Valleys Municipal Water District
Unitywater
Wannon Water
Washington Suburban Sanitary Commission
Water Corporation
Waternet
West Basin Municipal Water District
Yarra Valley Water Authority
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Water Environment & Reuse Foundation
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advancing the science of water
About WRF

- 501(c)(3) nonprofit research cooperative located in Denver, Colorado
- More than 1,000 subscribing organizations
- Governed by utilities
- WRF plans, manages, and delivers scientifically sound research solutions
- Over the last 50 years, WRF has sponsored nearly 1,500 research projects valued at $500 million.
- Advances the science of water to protect public health and the environment on the most critical challenges facing the water community in the areas of drinking water, wastewater, stormwater, and reuse.
- For more information, go to www.WaterRF.org
About WE&RF

- 501(c)(3) nonprofit located in Alexandria, Virginia
- >350 Subscribers (utilities, industries, consultants, technology providers, state agencies, NGOs, and others)
- Provide peer-reviewed research
  - research portfolio >$200 million on water, wastewater, recycled water, and stormwater
- Foster partnerships and collaborations
- Accelerate innovation and adoption of new technology

- [www.werf.org](http://www.werf.org) and [www.werf.org/lift](http://www.werf.org/lift)
Today’s presenters

- **Ed Means**
  - The Innovation Imperative and Key Attributes
- **Doug Owen**
  - Innovation Environment: Overcoming Barriers
- **Jason Carter**
  - Innovation Framework
- **Mark LeChevallier**
  - Lessons Learned: A Legacy of Innovation
- **Finish with viewer Q&A**
The Innovation Imperative and Key Attributes of Innovative Utilities

Ed Means
President
Means Consulting LLC
WRF 4642 Fostering Innovation within Water Utilities

1. Characterize innovation within water utilities
2. Define the value of innovation in utility sector
3. Develop an organizational framework for innovation
4. Assemble guidance resources for utility sector
Project Partners

- 31 Case Study Participants
  - Nearly 80 million customers
  - Over 23,000 employees
  - Over $50 million/yr in innovation investment

Global Surveys

- 82 utilities participated
- 423 utility professionals

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Develop scalable elements that can be used to augment current efforts or launch new programs.

- 30+ Water Utilities
- Private Companies

- Self Assessment
- Inhibitors & Catalysts
- Innovation Focus

- Foundations
- Operationalizing Disciplines
- Building a Program
- Global Perspectives

Project Approach

Defined Innovation

Global Surveys

Innovation Framework

Collaborative Workshops

Innovation Knowledge Base
Fostering Innovation within Water Utilities

Prepared by:
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The Water Works Board of the City of Birmingham. 3600 First Avenue North, Birmingham, AL 35223

Sponsored by:
Water Research Foundation
6666 West Quincy Avenue, Denver, CO 80235

and

Water Environment & Reuse Foundation
1199 North Fairfax Street, Suite 900, Alexandria, VA 22314
What is Innovation?

“Innovation” is the application of new ideas resulting in increased value to utility customers and/or increased utility productivity”
Innovation to Manage Risk

Social Factors
- Politics of water
- Complex decisions
- Financial limits
- Competing needs
- Info movement
- Workforce expectations
- Stakeholders

Rising Costs
- Energy
- Infrastructure
- Regs
- Chems/Labor
- Supply
- Decision making

Demand
- Infrastructure
- Population growth
- Climate change
- Regs
- Workforce
- Service
- Risks

Info movement
- Politics of water
- Complex decisions
- Financial limits
- Competing needs
- Info movement
- Workforce expectations
- Stakeholders

Politics of water
- Complex decisions
- Financial limits
- Competing needs
- Info movement
- Workforce expectations
- Stakeholders

Climate change
- Infrastructure
- Population growth
- Climate change
- Regs
- Workforce
- Service
- Risks
Financial Instability: Rising Rates

- Electricity, chemicals & natural gas costs
- Dropping GPCD & high fixed cost
- Pension & health care benefits
- Aging infrastructure

Source: 2013 B&V Survey
Integrated Planning

- Integrated Regional Water Management
- Water sustainability
- Watershed planning and management
- Climate change
- Green Cities / Infrastructure
- Energy / Water nexus
Supply Diversification

Example Utility

2014

- Imported Water: 77%
- Local Runoff: 10%
- Conservation: 11%

2035

- Imported Water: 40%
- Ocean Desalination: 30%
- Recycled Water: 30%
- Groundwater: 0.2%
- Surface Water: 9%
- Potable Reuse: 3%
- Conservation: 11%
EPA: ~$500 B gap in funding by 2020, in part due to aging infrastructure

With financing = ~$1,500 / citizen;
~$20/household /month

Source: USEPA
Technology Expanding

• Wireless & mobile provide continuous connectivity
• “Smart” systems monitor & control
• New treatment advances provide new options
• Integration & convergence
• “Data deluge”
Stakeholder Engagement, Media Influence

• Growing public sensitivity to water issues
• Greater sensitivity to cultural / ethnic shifts
• Public perceptions formed by mass / social media
• Water as a human right
Stakeholder Engagement, Media Influence

Seek to avoid these kinds of Board/Commission/Council Meetings
Efficiency Drivers, Resource Optimization

- Economic (local, nat’l, global) pressure on water rates & perception drive productivity
- Reduce inputs to lower resource use
- Meet GHG reduction goals
- Recover resources & energy
- Consolidation of small systems?
Efficiency Drivers, Resource Optimization

Ethic Shift from “Wastewater” to Resource Recovery

- Biogas Cogeneration
- De-icing Fluid Recycling
- Food Waste
- Beijing Train Station
- Sewer Heat Recovery
Climate Uncertainty

- GHG regulatory uncertainty
- Shift to alternative energy sources
- ↑ intensity, frequency & duration of extreme weather
- Rising mean sea levels
- Water-related ecosystems are stressed
Why Innovate?

- Sustainability
- Technical Solution
- Financial Impact
- Organizational Health
- Recognition
- Community Engagement
Utilities Launch Innovation Initiatives

Over half of programs began in last 5 years

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<td>60%</td>
<td>73%</td>
<td>93%</td>
<td>100%</td>
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Innovation Environment: Overcoming Barriers and Leveraging External Catalysts

Douglas M. Owen, PE, BCEE, ENV-SP
President
Owen Water Consulting LLC
Innovation Landscape

- Culture: % Yes
- Environment: % Yes
- Catalysts: % Yes
- Autonomy: % Yes
- Incentives: % Yes

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Culture: Social conditions regarding innovation and change
Environment: Conditions impacting operations

- Water Scarcity: 10% Yes, 50% Neutral, 40% No
- Water Quality: 70% Yes, 10% Neutral, 20% No
- Climate Change: 80% Yes, 10% Neutral, 10% No
- Rate Increase Resistance: 90% Yes, 5% Neutral, 5% No
- Infrastructure Repair and Replacement Needs: 100% Yes, 0% Neutral, 0% No
Autonomy: Responsibility and freedom to invest in innovation
Incentives: Effectiveness of potential rewards for innovation
Challenges to Change

- Cultural Inertia
- Resources
- "Tenured Employees"
- Facilitating Process
- Organizational Silos
- Executive Management
- Need
- Risk
- Incentive
Culture is Driven from the Top

• Driven by the Board’s vision
  – Partnerships inside and outside the organization
  – Incorporate sustainability into process/infrastructure

• Hiring practices with innovation in mind

• Collaborative and dedicated space

• Innovation “storytelling”
“A culture of innovation grows because everyone can play.”

Rosabeth Moss Kanter (2006)
Innovation Inhibitors

Top Ten Innovation Inhibitors

1. Infrastructure R&R Needs
2. Control of Rates
3. Regulatory Oversight
4. Procurement Laws
5. Climate Change
6. Rate Increase Resistance
7. Unified Framework for Innovation
8. Water Scarcity
9. Guidance for Innovation Activities
10. Workforce Level of Education
Innovation Inhibitors

Top Ten Innovation Inhibitors

1. Infrastructure R&R Needs
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6. Rate Increase Resistance
7. Unified Framework for Innovation
8. Water Scarcity
9. Guidance for Innovation Activities
10. Workforce Level of Education
Innovation Catalysts

Top Ten Innovation Catalysts

1. Technology
2. Peer Network
3. Research Programs (e.g., WRF, WE&RF)
4. Strategic Vision
5. Industry Experts (e.g., consultants)
6. Water Scarcity
7. Industry Expectation
8. Professional Recognition
9. Local Near and Long Term Goals
10. Control of Business Model
Catalysts: Access to enablers for innovation activities

% Yes  % Neutral  % No
What is WEF/WERF Initiative
Accelerating Innovation Into Practice
Program Components

1. Technology Evaluation Program
2. People and Policy
3. Informal Forum for R&D Managers
• Discover new technologies
• Connect with others with similar needs, technology interests, and desired expertise
• Collaborate on research and technology ideas, proposals, projects, demonstrations, and implementation
Test Bed Facility Network

60 Facilities

- Level 1 (bench lab)
- Level 2
- Level 3
- Level 4 (dedicated R&D facility)

www.werf.org/testbeddirectory
Go To The Website

www.werf.org/lift
jmoeller@werf.org
Innovation pipelines are often 85 to 90 percent “little i” concepts. “Big I” concepts are disruptive innovations. They generally represent higher risk investments with a greater number of unknowns.
What Innovations Succeed?

Probability of Failure

Product/technology

New to the company
Adjacent to current offerings
Same as current offerings

Same as present

Intended Market

New to the company
Priority Innovation Areas

- Process, 20%
- Technology, 70%
- Business Model, 4%
- Service, 5%
- Finance, 1%
Intentional Processes Manage Risk

- Stage/Gate process
- Idea management Project Charter
- Performance metrics
“More often than not, failure in innovation is rooted in not having asked an important question, rather than in having arrived at an incorrect answer.”

Christensen et al (2008)
The Innovation Framework: Fostering Innovation within Utilities

Jason Carter, PE
Vice President,
Delivery & Innovation Lead, North America
Arcadis
Moving to Center Stage
Value of Innovation

- Value
- Technical Solution
- Financial Impact
- Organizational Health
- Recognition
- Community Engagement
Facilitating Innovation

- Risk aversion is too simplistic
- Change is counter to culture
- Reliability and repeatability are not bad
- We must lead “ambidextrous organizations”
- We need a way to greenhouse ideas without distraction
Building a Framework

Key Disciplines of Proven Innovation Programs
The Utility Innovation Framework

Visualize
Focus
Develop
Engage
Reach
Communicate
Evolve
Evaluate

Impact
Capability
Engagement
Communication
The Utility Innovation Framework

**Results-oriented.** Tangible and intangible improvement aligned with leadership and organizational philosophy.
The Utility Innovation Framework

Ecosystem-oriented.
Environment encouraging growth and maturation of ideas.
The Utility Innovation Framework

People-oriented. Ideators, mentors, adopters leading initiation and application of innovation.
The Utility Innovation Framework

**Results-oriented.** Tangible and intangible improvement aligned with leadership and organizational philosophy.

**Ecosystem-oriented.** Environment encouraging growth and maturation of ideas.

**People-oriented.** Ideators, mentors, adopters leading initiation and application of innovation.
Eight Key Disciplines

**discipline** /ˈdɪ-sə-plən/ n. a practice that molds or perfects the mental faculties or character.

Adapted from Merriam-Webster.com
Eight Key Disciplines

1. **Visualize** - maintain a long view that empowers and inspires innovation
2. **Focus** - define challenges that guide investment
3. **Develop** - invest resources in new ideas
4. **Evaluate** - test concepts in scaled and relevant applications
5. **Engage** - motivate, enable and reward stakeholders
6. **Reach** - utilize resources outside of the organization
7. **Communicate** - capture and convey defining success stories
8. **Evolve** - implement concepts and measure impact
Key Disciplines in Action

- Self Assessment of over 80 utilities (423 water utility professionals)
- Over 90% believe innovation is critical to their utility’s future
- All disciplines scored below 50%
- Focus and Engage scored lowest.
- Trend consistent over global geographies
Framework Applied

- Combined disciplines into Innovation Framework Elements
- All elements scored below 50%
- Capability has highest score, providing a foundation for program
- Establishing goals and metrics around these elements helps guide program decisions and actions.
Phase 1 - Assessment

Phase 1: Assessing Innovation Environment

Phase 2: Program Development

Phase 3: Program Launch

Self-Assessment Survey

Broad Engagement

Identify Key Focus Areas

Dig for Details

Inhibitors

Ideas

Catalysts

Focus Areas:
- Revenue Opportunities
- Risk Reduction
- Industry Leadership
- Asset Planning
- Customer Service
- Energy Efficiency
- Quality of Life
- Resilience

Perception vs. Evidence

Percent Pos.

Chief Executive
Innovation
Finance & Administration
Engineering & Maintenance
Technical Services
Phase 2 - Program Development

Considerations for **Visualize**
- Vision and values
- Program outcomes
- Intellectual property
- Investment
- Leadership and structure
- Maturity levels
- Innovation plan

Considerations for **Focus**
- Program governance
- Staff engagement
- Value profile
- Selection criteria
- Financial analysis
- Submission requirements
- Communications
Leadership and Structure

Utility Innovation Plan

1. Assessment Results/Benchmark of Current Innovation Environment (can also be an Appendix)
   - Self-Assessment survey analysis
   - Assessment validation
   - Storylines (e.g., examples of successful innovation)
   - Challenges and catalysts

2. Expectation/Aspirations
   - Utility values
   - Aspirations for innovation culture
   - Key current and emerging challenges
   - Vision for innovation program

3. Innovation Strategic Framework
   - Mission, goals and objectives
   - ICE Utility Innovation Framework – levels of maturity

4. Innovation Program Elements
   - Program structure
   - Idea value profile (e.g., value dimensions)
   - Program elements (i.e., people, process, resources) for each ICE Framework element (Table D1)

5. Implementation
   - Near-term program activities, including people, process, resources and outcomes
   - Intermediate-term program activities
   - Long-term program activities

6. Success Criteria
   - ICE Utility Innovation Framework metrics
   - Idea metrics

Appendix
- Idea template
- Business case template
- Self-assessment results

- Executive leadership is key
- **Chief Innovation Officer (CINO)** - Single point of coordination is a powerful catalyst
- Reporting structure impacts program effectiveness
- Innovation plan provides a clear roadmap for program management and engagement
- Resources available in Guidance Manual
# Maturity Levels

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Supportive</th>
<th>Active</th>
<th>Networked</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Visualize</strong></td>
<td>Values defined and available to employees.</td>
<td>Innovation strategy or plan developed</td>
<td>Facilitated engagement of internal and external stakeholders in strategy development.</td>
</tr>
<tr>
<td><strong>Focus</strong></td>
<td>Ideas assessed on a case by case basis within each business unit or by supervisor</td>
<td>Value dimensions developed as framework for visible decision-making process at the executive level.</td>
<td>Cross-departmental (possibly external) engagement in decision making and program priorities. Defined portfolio of investments.</td>
</tr>
<tr>
<td><strong>Develop</strong></td>
<td>Ideas are developed and resources based on individual need.</td>
<td>Defined framework for idea development. Establish small business case budget and provide innovation time for staff.</td>
<td>Leverage external resources and programs for idea development. Define multi-channel “fit for purpose” phase-gate process. Establish partnerships through peer network.</td>
</tr>
<tr>
<td><strong>Evaluate</strong></td>
<td>Supervisor/manager-led evaluation of concepts.</td>
<td>Cross departmental engagement in evaluation. Gate evaluation requirements</td>
<td>Defined space for innovation evaluation together with repeatable processes that ensure stakeholder engagement in evaluation process, and defined metrics for success.</td>
</tr>
<tr>
<td><strong>Engage</strong></td>
<td>Largely internal and self-initiated. Award and recruited to multiple roles.</td>
<td>Open platform for collaboration. Involvement</td>
<td>\</td>
</tr>
</tbody>
</table>

- Allow utilities of different types, sizes and resource levels to choose targets
- Allows utilities to change targets over time
- Example in Guidance Manual
  - **Supportive**: reacts to need
  - **Active**: directs activities
  - **Networked**: broadly leverages relationships
Phase 2 - Program Development

Considerations for **Develop**
- Resource type and level
- External resources
- Program management
- Idea development process
- System support

Considerations for **Evaluate**
- Evaluation criteria
- Evaluation process
- Ideator guidance and resources
Idea Development Process

Source: Courtesy of Queensland Urban Utilities
Catalyst Funding ranged from $0 to $100,000
Phase 2 - Program Development

Considerations for Engage
- Roles
- Role description and resources
- Engagement events
- Recognition and rewards

Considerations for Reach
- Supply chain/network map
- Procurement
- Liabilities

Considerations for Communicate
- Internal and external needs
- Capturing legacy stories
- Channels
- Communications plan
# Defining “on ramps”

<table>
<thead>
<tr>
<th>Role</th>
<th>Responsibilities</th>
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<tbody>
<tr>
<td><strong>Executive</strong></td>
<td>Maintain visibility, vision, commitment, organizational accountability and resources for program</td>
</tr>
<tr>
<td><strong>Innovation Officer</strong></td>
<td>Lead initiative, manage program, speed development, bridge silos, augment teams and champion odd balls</td>
</tr>
<tr>
<td><strong>Ideator</strong></td>
<td>Idea generation, development, commercialization, and diffusion</td>
</tr>
<tr>
<td><strong>Subject Matter Expert</strong></td>
<td>Panel member, technical support for development and augmenting skillsets</td>
</tr>
<tr>
<td><strong>Mentor/Coach</strong></td>
<td>Program alumni and/or senior leader to encourage project team, provide resources and address barriers.</td>
</tr>
<tr>
<td><strong>Supporting Roles</strong></td>
<td>Human resources, communications, customer service, operations, legal, business liaisons, procurement, supervisor</td>
</tr>
</tbody>
</table>
Phase 2 - Program Development

Considerations for **Evolve**
- Articulate urgency
- Broad coalition of participants
- Alumni corps
- Key stories that reflect the ideal culture and values
- Performance reviews
- Employee orientation
- Pull together Innovation Framework
Engaging the Framework

Framework

Program Elements

Key Considerations

Desired Maturity Level

Discipline Assessment
Launching a Program

Phase 1
Assessing Innovation Environment

Phase 2
Program Development

Phase 3
Program Launch

- Focus on achievable ideas
- Recruit a team to refine program
- Benchmark and refine program
- Strong communications – internal/external
- Use framework and early metrics to guide program

<table>
<thead>
<tr>
<th>No.</th>
<th>Discipline</th>
<th>Used Selected Factor</th>
<th>Scoring</th>
<th>Weight</th>
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<td>1 2 3</td>
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<tr>
<td>1</td>
<td>Visualize</td>
<td>Executive leaders demonstrate a visible commitment to utility innovation.</td>
<td>•</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Visualize</td>
<td>Innovation is a critical component of our strategic plan.</td>
<td>•</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Focus</td>
<td>Innovation value dimensions are available to guide innovation.</td>
<td>•</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Focus</td>
<td>Our screening process is objective and consistently used.</td>
<td>•</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Evolve</td>
<td>Idea metrics achieved (e.g., Energy neutrality achieved).</td>
<td>•</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Evolve</td>
<td>Idea metrics achieved (e.g., Reduced lost time in repairs).</td>
<td>•</td>
<td>3</td>
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Impact Element Score 0.66

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<tr>
<th></th>
<th>Capability</th>
<th>Ecosystem-oriented metrics</th>
<th>Scoring</th>
<th>Weight</th>
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<tr>
<td>7</td>
<td>Develop</td>
<td>We have fully utilized our innovation budget.</td>
<td>•</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Develop</td>
<td>We are actively leveraging our staff innovation hours.</td>
<td>•</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Evaluate</td>
<td>Testing facilities and processes have been fully utilized.</td>
<td>•</td>
<td>3</td>
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Capability Element Score 0.66

<table>
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<th></th>
<th>Engagement</th>
<th>People-oriented metrics</th>
<th>Scoring</th>
<th>Weight</th>
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<tr>
<td>10</td>
<td>Engage</td>
<td>All departments have proposed concepts for consideration.</td>
<td>•</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>Engage</td>
<td>We have fully vetted concepts that are aligned with our focus areas for improvement.</td>
<td>•</td>
<td>1</td>
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<tr>
<td>12</td>
<td>Reach</td>
<td>We are leveraging our peer network.</td>
<td>•</td>
<td>3</td>
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<tr>
<td>13</td>
<td>Reach</td>
<td>We have engaged customers in innovation focus evaluations.</td>
<td>•</td>
<td>3</td>
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<td>14</td>
<td>Communicate</td>
<td>We host monthly updates to the Board.</td>
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<td>3</td>
</tr>
<tr>
<td>15</td>
<td>Communicate</td>
<td>We publish a quarterly newsletter highlighting innovation activities.</td>
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<td>2</td>
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Engagement Element Score 0.77

ICE Framework Measure 2.09
Value Proposition

General Quotes
• “…to better”
• “…found compliance strategy that works for us.”
• “…moved forward intelligently”

Financial Impact
• “Realized greater than $25MM in operational savings.”
• “…$4.2MM in operational savings since 2014.”
• Avoided $7MM in capital costs for traditional facility upgrade.
• “…saved the utility $1.4MM over a few years.”
Implementing Innovation Summary

- Utility sector is changing
- Ideas can be managed as critical resources to meet these changes
- Innovation has been a business discipline for decades and can be adopted by utility sector
- The Utility Innovation Framework provides a tool to utilities of all types and sizes to engage in shaping the water sector of tomorrow
American Water’s Innovation Development Program

Mark W. LeChevallier, Ph.D.
VP, Chief Science Advisor
American Water is the largest water and wastewater services provider in North America, headquartered in Voorhees, NJ.

American Water provide services to approximately 15 million people in more than 1,600 communities in more than 45 states and in Canada; and employs about 6,500 water professionals.

American Water owns or operates over 300 drinking water systems and 200 wastewater facilities.

We treat and deliver over a billion gallons of water daily

The company conducts over one million water quality tests each year for over 100 regulated parameters, and up to 50 types of water-related tests each day.
## Scope of American Water’s Operations

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<th>Owned Assets</th>
<th>Contract Ops</th>
<th>Total</th>
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<tr>
<td>Drinking water systems</td>
<td>264</td>
<td>64</td>
<td>328</td>
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<tr>
<td>Surface water plants</td>
<td>81</td>
<td>8</td>
<td>89</td>
</tr>
<tr>
<td>Ground water plants</td>
<td>520</td>
<td>62</td>
<td>582</td>
</tr>
<tr>
<td>Ground water sources (wells)</td>
<td>1037</td>
<td>148</td>
<td>1185</td>
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<tr>
<td>Wastewater Systems</td>
<td>131</td>
<td>66</td>
<td>197</td>
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<tr>
<td>Reclaimed Water Systems</td>
<td>20</td>
<td>15</td>
<td>35</td>
</tr>
<tr>
<td>Desalination</td>
<td>1</td>
<td>1</td>
<td>2</td>
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</tbody>
</table>

$1$ Opex savings $= \$6$ Capex investment
Challenges to the Water Industry

- Water scarcity
- Aging infrastructure
- Emerging contaminants
- Financially strapped municipalities
- Operational efficiency
- New environmental regulations
- Advanced treatment technologies
- Energy Efficiency / Climate change
- Environmental concerns/stewardship
- Security
- Customer satisfaction
- Automation
- & more

Need new innovations to address these challenges
What is the “Innovation Development Process”?

- A way to leverage American Water’s research and market position to build customer and shareholder value through innovation
- A mechanism to leverage our nationwide physical assets to test and develop new opportunities
- A process to differentiate American Water from the rest of the industry
- A way to drive efficiencies (e.g., capital investment to reduce opex) into American Water and grow the business
The “Innovation Development Process”

1. Uses a Stage Gate process to screen innovations
2. Execute non-disclosure agreements
3. Technical screen by internal experts
4. Initial financial screen
5. Validation Study
6. Business case development
7. Purchase agreement
8. Marketing agreement

Screening Questions
1. Does it address a pressing need?
2. Is the solution scalable?
3. Could it reduce cost?
4. Is it unique or competitive?
Smart Metering Systems

- Consolidation of data from 3.1 million water meters
- Commoditization of meters
- Reduction in acquisition costs
- Data analytics for stopped meters, continuous running meters, backflow
- Integrated customer service
- Improved customer interface
Smart Distribution Systems

- American Water with Israeli partner Stream Control was selected by the BIRD Foundation to validate a technology for pressure management.
- Turns “dumb” pressure reducing valves into “smart” devices.
- Pressure management reduces leakage, reduces main breaks, prolongs asset life.
- Automatically adjusts pressure with changes in flow.
- Evaluated at five locations in NJ, MO, WV, PA, and CA.
- Validated the technology and >20% non-revenue water savings.
Permanent Leak Detection

Echologics EchoShore -DX 11 leaks found in the first month and 45 leaks in the first 5 months of operation. Credited with 4.3 MGD of water loss reduction.
Satellite Imaging

- Utilis - Israeli company that detects leaks using spectral images from satellites
- Examines an area 50 x 70 km
- The microwave reflectometry algorithm searches for the dielectric constant spectral ‘signature’ - chlorine, fluoride, other signatures
- Six-fold increase in leaks detected over field inspection
- A California Energy Commission project will incorporate satellite imaging along with acoustic monitors and pressure management for water and energy reduction
- Trials initiated or planned in CA, TN, IN, MO, NJ
New Pipe Formulations

- Korean PPI PYUNGWHHA CO., LTD.
- Ductile Iron strength
- Corrosion resistance of PVC
- Installations: MO, NJ, CA

<table>
<thead>
<tr>
<th>Tests</th>
<th>AWWA Requirements</th>
<th>C-909 (JM Eagle)</th>
<th>iPVC</th>
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<tbody>
<tr>
<td>Impact Load (for 8” pipe)</td>
<td>100 foot-pounds</td>
<td>200 foot-pounds</td>
<td>1,200* foot-pounds</td>
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<tr>
<td>Tensile Strength at 73°F</td>
<td>7,000 psi</td>
<td>7,000 psi</td>
<td>7,930 psi</td>
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<tr>
<td>Modulus of Elasticity</td>
<td>400,000 psi</td>
<td>400,000 psi</td>
<td>461,000 psi</td>
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<td>Hydrostatic Burst test</td>
<td>755 psi</td>
<td>755 psi</td>
<td>1,033 psi</td>
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<tr>
<td>Stiffness Test at 73°F</td>
<td>364 psi</td>
<td>364 psi</td>
<td>479 psi</td>
</tr>
<tr>
<td>Empty Pipe Weight (pounds/foot) - 8” SDR 18</td>
<td>10.5 - 11.5</td>
<td>4.2</td>
<td>10.5</td>
</tr>
</tbody>
</table>
IOSight

Collects and analyzes multiple data streams (from multiple platforms/sources) to identify system efficiencies in customized reports to reduce OPEX costs

- Optimization of chemical feeds
- Pump efficiency
- Residuals management
- Proactive/preventative maintenance
Smart Reservoir Management

Installed four LG Sonic MPC buoys in Reservoir #1 May 2014
- Solar powered buoys have on-board monitors to measure algal pigments, DO, pH, Redox, turbidity
- Adjustable ultrasonic frequency to target different algae

- OPEX savings of $87,800.
- The Four LG buoys cost $160,000
- Simple payback of 1.8 years

Schneider et al.
JAWWA, Oct 2015
http://dx.doi.org/10.5942/jawwa.2015.107.0149
Smart Water Treatment

- WellToDo - Founded in 2012
- Licensed technology from the Technion Institute of Technology
- “Removal of Nitrate by Catalytic Reduction on Activated Carbon Cloth Supported Catalyst”

![Count of Utilities by State](image)

- Very Small (25-500)
- Small (501-3,300)
- Medium (3,301-10,000)
- Large (10,001-100,000)
- Very Large (100,001+)

![Risk of Groundwater Contamination](image)
Source Water Awareness

Zones of Critical Concern

Mapping of Potential Hazards

Federal

USGS
- National Hydrography Dataset (NHD)
- Landcover

EPA
- RCRA, TRI, NPDES, CERCLIS, OIL and PCS-ICIS
- Industrial pre-treatment dischargers

Census Bureau
- Administrative boundaries
- Demographics

DOI
- Federal lands and facilities

FEMA
- Floodplains and flood hazard areas

US DOT
- Airports
- Bridges

PHMSA
- Pipelines

State

BUSINESS
- Business License
- Transportation permits

State DEP
- Above ground storage tanks (partial)
- Water pollution control facilities
- Water resources
- Municipal waste operations
- Hazardous waste permits
- Oil and gas permits
- Mining permits
- Zone A description (no GIS files)

Local EMAs
- Tier II hazardous chemical storage

Water Suite

Source Water Monitors
Energy Efficient Wastewater Treatment

- NPXpress is a unique nitrogen and phosphorous removal wastewater treatment that has been patented by American Water

- Significantly reduces the energy requirements to treat wastewater

- Reduce/eliminate the amount of additional carbon required for denitrification

- Reduces chemical requirements for phosphorous removal

- Testing ongoing at 7 sites. Projected <2 year payback

- Initial 6 sites in NJ averaging 35% energy reduction, over $400,000 in accumulated savings over a three year period - $0.57/m³ operational cost savings
Efficient Small System Wastewater

- Small system septic plant unable to meet new ammonia discharge limits
- Ryan’s Lake Subdivision Wastewater Treatment Plant, New Bloomfield, MO serves <500 people
- The Bow Reactor (Rolla, Missouri) is simple, compact, and efficient for ammonia removal
- Low cost <$50,000
Granular Activated Carbon - Biofiltration

- AW has over 12 million pounds of GAC at 40 water treatment plants which is replaced on a 2-4 year schedule

- GAC is used to comply with specific water quality targets such as VOC’s, SOC’s and taste and odor compounds

- By encouraging bacteria to colonize the filters replacement schedules can be extended with no impact on performance

- Control of T&O, no impacts on turbidity, better filter production, manganese control

- Deferred replacement avoids replacement of GAC 2.7 million lbs./year

- Reduce greenhouse gas emissions by 2.4 million lbs./year

Innovation vs Invention

**Invention** is the *creation* of a new gadget, technology, or process

**Innovation** is the *application* of solutions, processes, or technologies better meet existing needs or new requirements

**Innovation** creates value
Wait! There’s More!

- Enbala: Grid balance software - pays for pump flexibility
- Fathom: Advanced metering solutions
- E-Sens: Mobile "lab on a chip“ - 16 parameters
- UV Pipe disinfection: Disinfecting new pipe with UV radiation
- Bilco: Grounding safety strap for water mains
- Citilogics: Real time distribution system modeling
- NPXpress: Low dissolved oxygen wastewater treatment
- Arvia: Contaminant adsorption/oxidation
About the Certified Innovation Partner (CIP) Program

American Water is proud of its reputation as a company that drives innovation and supports the development of new products. Our commitment to the early testing and adoption of new technologies is beneficial to our company, to the companies we work with and to the industry as a whole.

The Certified Innovation Partner program celebrates the collaborative partnerships between American Water and companies that develop innovative solutions valuable to the water/wastewater industry. American Water seeks out new technology companies that have developed innovations that can, if successful, add value to American Water through deployment across our asset base.

Companies that are interested in American Water’s CIP program have their technology vetted through validation testing at one of our sites. Once tested with positive results, American Water’s deployment of the technology begins.

By working with innovative companies, American Water creates value for its stakeholders and helps develop new technology throughout the water industry. The CIP designation is not meant to make any formal opinions of the innovation. Rather, it is meant to express that American Water has successfully tested and determined that an innovation has value when deployed across our asset base and is thought to be able to add value if deployed in other water/wastewater systems.

CIP members are change agents and leaders in their industries. If your company has innovative technology that has potential applications for the water/wastewater industry, contact Paul Gaagliardo to see how you can become a CIP partner.

Learn about our Current CIP Partners
WE CARE ABOUT WATER.
IT’S WHAT WE DO.

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