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SOURCE magazine is a publication of the California-Nevada Section, American Water Works Association that acts as a clearinghouse of information for water works professionals. Its goal is to heighten awareness and encourage communication in the water industry.

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ERRATA • Winter 2012 • Volume 26, Number 1
The Winter 2012 issue of SOURCE contained editing errors that resulted in incorrect sentences that did not make sense.

Page 14, the call-out box and the first sentence in the second column as printed reads: “Pilot testing of the six treatment technologies followed the seven scale study to assess treatability under flow-through conditions.” The sentence should read: “Pilot testing of seven treatment technologies followed the bench scale study to assess treatability under flow-through conditions.”

Page 15, beginning with the last sentence of the center column, the sentence reads: “However, SBA can be an attractive alternative if other anion compounds such as nitrate, arsenic, perchlorate require co-contaminant treatment.” The sentence should read: “However, SBA can be an attractive alternative if other anionic compounds such as nitrate, arsenic, perchlorate require co-contaminant treatment.”

The California-Nevada Section of AWWA and the publisher regret the errors.
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"How’s it going?” I would bet that at least once per day, in or around our workplace, someone we know asks each and every one of us this very question. I would also argue that the majority of us have become so used to hearing this casual question that many of us default to a standard answer of: “Good, how about you?” We rarely stop to reflect or comment on what’s really going on in our lives.

For me, this year has been different. Serving as Chair of the Section, I am engaged each day in an effort to think about and explore new ways in which we might better meet the mission of the Section through the offering of new opportunities to serve our members. As a result, I now find myself expanding the standard answer to something like: “It’s going great. How about you?” Then I usually include some conversation on what’s going on with CA-NV AWWA and why it’s such an exciting and rewarding time for me during my year of service as Chair.

Regardless of what the Mayan calendar might say, the year 2012 is truly a year of new beginnings, and the Section is really making the most of it. If there were ever a great time for you to capitalize on your AWWA membership and realize the great value that your active participation in the Section offers, 2012 is the year. At the risk of dating myself, comedian Milton Berle once said, “If opportunity doesn’t knock, build yourself a door.”

This year, through the innovative and dedicated work of many CA-NV Section volunteer leaders, and with the support of all of our Section staff, we have built many new doors of opportunity for you. Whether it’s participating as a Charter Member on with CA-NV AWWA and why it’s such an exciting and rewarding time for me during my year of service as Chair. Regardless of what the Mayan calendar might say, the year 2012 is truly a year of new beginnings, and the Section is really making the most of it. If there were ever a great time for you to capitalize on your AWWA membership and realize the great value that your active participation in the Section offers, 2012 is the year. At the risk of dating myself, comedian Milton Berle once said, “If opportunity doesn’t knock, build yourself a door.”

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What Does an Engaged Member Look Like?

By Charles W. (Bill) Wulff, Jr., Association Director, AWWA, CW Wulff Associates

As any reader of SOURCE knows, the American Water Works Association (AWWA) has experienced a reduction in membership during recent years. Additionally, various Sections of the association, including the CA-NV Section, have also seen similar reductions in memberships. While the reasons are varied, this membership reduction is not unique to our organization, but is being experienced by many other nonprofit organizations.

It is not just total membership numbers that are of interest to AWWA and its Sections. Equally important, and in many ways even more so, is the type of involvement—including volunteerism—our members participate at within our organization. It is not just the numbers of members that should be of concern to the Association and their value to our organization, but also the value to the members that their individual participation brings. Recently, a workshop was facilitated at the AWWA Winter Board Meeting in San Juan, Puerto Rico, where a special session was held to address the question: “What does an engaged member of AWWA look like?”

The matrix below is a benchmark used to illustrate the various levels and types of individual engagement as an AWWA member.

The lifeblood of any organization is not only a healthy membership roster, but the type of engagement that the membership brings to the association. Our organization at the national and Section levels seeks more participant involvement at the more fully engaged levels (reliable, fully engaged, and committed leaders). Not only does this make the AWWA a much more diverse and talented body, but also provides an extremely powerful means of developing individual capability, professional enrichment, and value. In short, as valuable as enhanced membership engagement is to the Association, it can be even more so to the individual. I can think of no better means of self-investment and professional cultivation.

Speaking of which, kudos go out to two CA-NV Section committed leaders. During the previously mentioned winter board meeting, Rosemary Burbulis Smud (Senior Sales Engineer with ACIPCO in Sacramento, CA), who is currently an Association Service Provider Director-at-Large, was

<table>
<thead>
<tr>
<th>Engagement Designation</th>
<th>Example(s) of Member Engagement (Partial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoppers</td>
<td>Web site visitors, publication readers, extremely rare if involved in any volunteer capacity</td>
</tr>
<tr>
<td>Episodic</td>
<td>Education, infrequent conference, or workshop attendees, and rarely involved in volunteer capacities</td>
</tr>
<tr>
<td>Short term</td>
<td>Transient involvement usually associated with individual, well defined needs</td>
</tr>
<tr>
<td>Reliable</td>
<td>Regular conference or workshop attendees and specialized or unique volunteer participation</td>
</tr>
<tr>
<td>Fully engaged</td>
<td>Committed participation in committees, projects, and advocating Association value to others</td>
</tr>
<tr>
<td>Committed Leaders</td>
<td>Actively and reliably seeks and participates in officer, volunteer, and related leadership role(s)</td>
</tr>
</tbody>
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As I outlined in the Winter 2012 SOURCE, I would like to reiterate the opportunity that comes through the mentoring of a new Student member, Young Professional, or existing Operator who may not be familiar with the value and benefits of AWWA membership and Section participation. I am again urging you to consider sponsoring a new member. For as little as $28, you can sponsor a new student member. Your sponsorship, and if possible, your efforts to provide some direct mentorship to a new member will effectively give back some of the value you have enjoyed through your membership in this great organization. With my Chair’s Challenge, I have set a goal of gaining at least 200 new members through this effort. Based on my own experience, I can honestly say that the personal reward realized through the sponsorship of a new AWWA member makes this one of the greatest value propositions available. Information on this program and a count of where we are in achieving the goal of at least 200 new members is also available on the CA-NV Section website.

In closing, I will ask you to keep one key message in mind whenever considering your AWWA membership and your participation in the CA-NV AWWA activities. Our success relies on your success. This is a truly a unique year in that it presents many new beginnings and a host of exciting new ways for you to be successful in gaining much value through your membership. I look forward to your participation and exploitation of these opportunities.
Many readers will be familiar with the parable of the six blind men experiencing an elephant for the first time, and describing it according to the different part of the animal each man was feeling. Touching the leg, one said an elephant is like a pillar; to another feeling the tail, an elephant was like a rope; the animal’s side was thought to be like a wall; and so forth.

I just had never thought of AWWA in the same way, until recently. At the Membership Matters Summit in January, AWWA Executive Director David LaFrance recalled the blind men-and-elephant story, which I thought was especially relevant and worth further exploration.

Many members of AWWA interact primarily with just one facet of the association. Many experience AWWA only through its publications, such as the Journal or OpFlow—or SOURCE, at the California-Nevada Section level. Some are active on a committee at the Section, others just on an AWWA committee. Some members will think of AWWA primarily in terms of ACE, or perhaps another specialty conference. Some value the association for the standards it sets on dozens of vital products for the water industry. Some members think of the training and continuing education AWWA provides to ensure safe practices in water treatment and water distribution; others for the advocacy on drinking water regulations and other policy matters.

The point is that all of these viewpoints are partly right, but in a limited way and woefully incomplete. The American Water Works Association is an entity unto itself, yet also comprised of 43 Sections. The Sections would not be the same without the overarching association. AWWA serves virtually every occupation and touches about every issue within the North American drinking water community—from the trenches (literally) to the executive suite, and from coagulation to climate change.

David’s comment was that people who understand the broad scope of the organization may still draw different meanings from it. Some feel that in trying to be all things to all people, AWWA is so diffuse that it stands for nothing. Others have told him that they find its greatest strength is in its very comprehensive scope. Even at a high level, people see the elephant very differently.

There is no doubt that the landscape of water-related organizations has changed considerably in the past generation, which could be a cause for great concern to a mature association like AWWA. Think of the narrowly focused groups that have sprung up around water conservation, water recycling, desalination, membranes or other technologies, and on, and on. Each single-focus organization brings together those with a common interest in a subject. These organizations attract their own members, field their own conferences, websites, even research projects, training classes, and the occasional publication in some cases.

Some observers would view this development as the death knell for a broad and all-encompassing organization like AWWA, but there are at least two very important reasons why it is not. First, silos in a company or agency create barriers to the free flow of information and hinder cross-disciplinary learning and collaboration. Of course, this can be limiting, or at its worst, severely damaging to the organization. Within the community of water professionals, single focus organizations act in much the same way as silos in a single business. These organizations can be highly effective for learning and collaboration within a specific subject area, but are more constrained when it comes to sharing information outside their narrow boundaries.

Consider an example of how such sharing across departments, or across an organization, is important. AWWA volunteers developed a very useful (and free, by the way) water audit software tool for monitoring system water losses. If this tool were only known to water conservation professionals but never entered the awareness of distribution system managers or general managers of a utility, its use would remain very rare, and it would be of little value. Spreading the awareness of this tool would be possible without AWWA, but is so much easier and more effective when it can be done within a single organization that touches all parts of the water utility.

A second reason AWWA has a bright future is that the association is continually renewing itself, which is essential for new growth. AWWA is adapting to the desire for special interest sectors to communicate...
seamlessly, for example, by creating on-line communities—the first was launched for conservation, and a second recently added for customer service. New communities are planned and will be rolled out gradually in coming months. At the CA-NV AWWA Section, many changes are taking place—some more visible than others—to renew the organization and ensure its relevance to all parts of the community of drinking water professionals. The revamped website launched in January offers much better access to the information one needs to find on-line. New committees were approved by the Governing Board and launched at the spring conference to address operator issues, asset management, and engineering and construction topics. Recognizing that some of our members attend the AWWA Annual Conference (ACE) but have relatively little interaction with the Section, a reception will be held at ACE12 in Dallas to reacquaint those folks to what the Section offers.

This story is not to put down or minimize the contributions of narrowly focused organizations. Many individuals and companies hold membership and actively contribute their time, money, and expertise to multiple organizations. The focus, like a highly trained spotlight, can lead to clarity of vision and new insights. But just as one does not truly comprehend an elephant by only feeling a tusk, or its trunk, or tail, the unity of the whole drinking water community is found only in AWWA. That is why your membership in AWWA, which includes membership in the California-Nevada Section, is important to the entire community and extremely valuable to you.

Also, elephants are extremely compassionate and smart! 🐘
On January 4, 2006, the U.S. EPA promulgated the Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) as required by the Safe Drinking Water Act Amendments of 1996 (SDWAA), which provides increased public health protection by reducing the potential risk of adverse health effects associated with Total Trihalomethanes (TTHM) and five Haloacetic Acids (HAA5) throughout the distribution system. The Stage 2 DBPR applies to community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) using a primary or residual disinfectant other than ultraviolet light or delivering water that has been treated with a primary or residual disinfectant other than ultraviolet light.

At the time of the promulgation of Stage 2 DBPR, compliance dates seemed far away. But, time flies! The compliance monitoring for large water systems and consecutive systems start the second quarter of this year. Compliance deadlines are based on the sizes of the public water systems (PWSs). Wholesale and consecutive systems of any size must comply with the requirements of the Stage 2 DBPR on the same schedule as required for the largest system in the combined distribution system (defined as the interconnected distribution system consisting of wholesale systems and consecutive systems that receive finished water). Compliance activities are outlined in the table above.

Your water system(s) may have already received letter(s) from your state drinking water regulators regarding the compliance monitoring starting date and forms to report compliance results. It is time to review the regulations and get ready for this new rule.

Since compliance of the Stage 2 DBPR is based on local running annual average of each sample site, if you have hot spots in your system, you probably should look into how to modify your treatment process or operations to reduce DBP levels at those hot spots.

Hydraulic Fracturing
EPA is working with states and other key stakeholders to help ensure that natural gas extraction does not come at the expense of public health and the environment. EPA is investing in improving scientific understanding of hydraulic fracturing, providing regulatory clarity with respect to existing laws, and using existing authorities where appropriate to enhance health and environmental safeguards.

If you are interested in knowing more about hydraulic fracturing or the fracking process, there is a presentation by EPA staff in the SDWA Committee Technical Session #3 at the Spring Conference in Santa Clara on April 3. Hope to see you there!
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California-Nevada Section
American Water Works Association
I was hired as an engineering assistant the summer before my senior year of college at the firm where I still work. At the time, I was fairly undecided about my future in engineering. I wanted to give engineering a try since I was going to school for that purpose, but I wanted to see it in a real-world setting. Working as an Engineering Assistant provided the opportunity to see what a career as a Civil Engineer really looked like. I had already completed a geotechnical emphasis, and I needed only one class to finish a second emphasis in either water resources or transportation. The office where I worked was primarily a water office, so I chose water as my second emphasis. It seemed like a small decision at the time, but it was one of many that led me to where I am today.

After graduation I was hired full-time as an Assistant Engineer. I had passed my Engineer-in-Training exam during my last year of college, and when combined with my work experience, I believed that I had a pretty good handle on what was coming my way. I actually remember thinking that after working and going to school how much easier it would be to only work 40 hours a week. Time has proven this to be yet another example of me not realizing I was completely wrong, but I am getting ahead of myself.

In the fall of 2007, I was asked to help write a section of a pre-design report for the T-3 Water Storage and Treatment Facility for the City of Fresno. A pre-design report did not sound like the most exciting project at the time when, as a recently graduated engineer, I knew that I was capable of designing an entire treatment plant by myself in no longer than three months. After all, I had just designed a plant as a part of my senior project and how much different could it be?

As the design phase began, I started working for the Project Manager by getting realistic footprints for equipment on the site, laying out site piping, and working on the raw water and filtration facilities. Within two weeks, I realized I was in trouble. I had already completed more design than I had on my senior project—which looking back at I now realize was a preliminary level at most. It was at this point I realized how little I knew about everything. I now know that this was the most important lesson I learned in my early career. I immediately began bringing books home from the office on everything from pump stations to chemical feed systems. My goal was to try and outline a chapter a night and, hopefully, in the next two weeks I would know what I was doing. To this day I still have those notes in my desk; needless to say, I had again overestimated my success.

I joined AWWA in the summer of 2009 shortly after I realized that AWWA did not actually make C900 PVC pipe but wrote standards for industry equipment. The Project Manager for the T-3 project was a member, and it seemed like a great opportunity to gain some knowledge. I first attended the Fall Conference in 2009, and I was not disappointed. The technical sessions were very interesting and the exhibit hall was worth every minute I spent looking at pipes, valves, couplings, and mixers. That evening I walked into the Young Professionals (YP) Committee meeting to network with others my age and walked out as the new Committee Secretary.

Today I am the Chair of the YP Committee writing an article for an industry publication that will hopefully encourage other young professionals out there to get involved in what has been an incredible learning experience for me.

That same fall, I sat for and passed the Professional Engineering exam and by the time the T-3 Plant went out to bid in October 2010, I was the Deputy Project Manager responsible for the design of nearly every process on the site and helping to coordinate with our structural, electrical, and instrumentation engineers—yet another thing left out of my student plant design.

The project is currently in construction and is scheduled for completion by July. It is incredible to see something that I worked on for so long actually being built. It’s almost as if you don’t believe that anyone is really going to build something you design until you see it for the first time.

Also amazing, although harder to notice, are the changes in your own life. Sometimes we need a life equivalent of a 60 percent submittal to stop and reflect on how much we have learned and more importantly how much we have yet to learn. Thankfully, I have learned that it takes much longer than three months to design a water treatment plant. 

Working as an Engineering Assistant provided the opportunity to see what a career as a Civil Engineer really looked like.
The intense economic realities of the new normal of today’s business environment are driving both private- and public-sector entities to make significant changes to their organizations and to enhance their focus on efficiently meeting their current and future challenges. The management framework of Effective Utility Management (EUM) has gained momentum and acceptance by the water utility industry as a pathway to respond to the need of continuously improving organizational performance.

EUM is proving to be an excellent organizational framework to help utility executives, governance boards, policy makers, and regulators focus on ways to improve utility performance across the board. As an organizing framework, EUM provides utility organizations a method to plan, implement, measure, and monitor organizational performance enhancements against 10 specific attributes of Effectively Managed Utilities. These 10 attributes describe a series of outcomes that all water-sector utilities, regardless of size, should strive to achieve. They include:

- Product quality;
- Customer satisfaction;
- Employee and leadership development;
- Operational optimization (efficiency);
- Financial viability;
- Infrastructure stability (management of assets);
- Operational resiliency (safety and security);
- Community sustainability (environmental sensitivity);
- Water resource adequacy; and
- Stakeholder understanding and support.

In addition to the 10 attributes, the EUM framework also defines the five keys to management success that impact the overall performance of a utility organization, including:

- Leadership;
- Strategic business planning;
- Organizational approaches;
- Measurement; and
- Continual improvement management framework.

The Past: How EUM Came to Be

The origin of the EUM program can be traced back to a July 2005 meeting hosted by the EPA. The original intent of the meeting was to convene a cross section of utility leaders and leading organizations to discuss perspectives, observations, and the critical needs of the industry as it faces a growing list of challenges. During this meeting, it became apparent that the challenges facing our country’s utilities were all very similar. As the discussions unfolded, the group began to focus on the idea that our industry would benefit from the development of a strategic management framework focused on providing guidance to utilities as they address their organization’s key challenges. The group realized that a coalition of leading industry associations, with support from EPA, was needed to develop a common utility management framework that could help utilities of all sizes address their management and performance challenges.

In May 2006, AWWA, NACWA, APWA, AMWA, WEF, NAWC, and the EPA entered into a Statement of Intent to “formalize a collaborative effort among the signatory organizations in order to promote effective utility management.” These collaborating organizations chartered the Effective Utility Management Steering Committee to advise them on a proposed joint water utility sector management strategy that would be applicable to water-sector utilities across the country. Members of the Steering Committee were nominated by these associations and represented a wide range of utilities. The charter of the Steering Committee was to establish a framework that would allow for industry collaboration for the advancement of the principles and practices of effective utility management, and to encourage and promote their wide application.
In March 2007, the Steering Committee released its findings and recommendations, which became the basis for continued development of the EUM initiative. The Steering Committee’s findings and recommendations included:

1. Establishing and adopting 10 attributes and five keys that best frame the industry’s key focus areas for management attention for improved performance;

2. Promoting and advocating performance measurement. The Steering Committee believed strongly that improved performance happens most successfully when organizations monitor and measure their performance over time;

3. Providing the industry with a resource tool kit that would include both immediately useful tools and guidance on where management related resources could easily be located; and

4. Ensuring sector promotion and advocacy of the program and available resources by the collaborating organizations and other stakeholders. The Steering Committee indicated that to help create incentives for management focus on improved performance, the industry’s leading organizations would need to lead in the advocacy of the EUM program through active promotion, community outreach, recognition of commitment to management excellence, and promotion of financial incentives from sector financial sources.

**The Present: What is the Current State of EUM?**

In June 2008, the Collaborating Organizations released the EUM Primer, which contains the majority of the EUM framework resources and serves as EUM’s unifying document. Additionally, the establishment of the EUM website (www.watereum.org) was completed.

For the past three years, numerous utility organizations have utilized the EUM Primer to help guide them to assess, audit, plan, and implement sustained organizational improvement across the 10 attributes and the five keys in their utilities. A number of successful case studies now exist that serve to demonstrate the benefits of adoption of the EUM framework. The Collaborating Organizations continue to administer and promote this sector strategy for improved industry performance, and an ongoing effort exists to enhance and improve the EUM initiative to ensure that its utilization results in sustained performance improvements for the industry. For example:

- Conferences and industry awards are now using the EUM framework as a way to organize technical programs and make achievement awards that recognize management excellence;

- Bond rating agencies are starting to consider EUM concepts as a mechanism Continued on page 18
Initiative, Continued from page 17

to assess the strength of a utility’s management team to arrive at bond ratings;

• Management audits of utilities are being organized around the EUM framework;
• Individual utility strategic plans are being developed to address the Ten Attributes;
• Utility managers are being trained in EUM; and
• EPA is working with utilities to describe how the Attributes can also support other management approaches like Lean and Six Sigma.

All of the above are resulting in a growing sector interest in the EUM initiative.

How Can Utilities Best Use the EUM Framework?

EUM provides a simple, replicable way for any utility to assess its strengths and areas for improvement and then chart a course for improvement. The most important step any utility can take is to perform an assessment using the simple steps described in the EUM primer. Where feasible, utilities should seek to involve persons with various responsibilities in the assessment, chart the results, and identify a simple plan for improving performance in key areas. Hard copies as well as an interactive version of the EUM primer can be found at www.wateruem.org.

The Future: Where is EUM Heading?

EUM is, by design, a simple, replicable framework that allows individual utilities to assess their strengths and opportunities for improvement, and chart a measurable course for improvement. Building on the EUM Primer, the Water Research Foundation (WRF) is now leading an effort to develop a benchmarking tool based on the attributes and associated best practices. Once completed, this tool will allow a utility to benchmark its own performance and gauge its efforts with other similar utilities. The pressures associated with the new normal of today’s economy require a departure from the status quo of yesterday. Many of the key pieces are now in place within the EUM framework that can be used today to help water and wastewater utilities enhance overall utility performance.

Jim Horne has been with the Office of Water at EPA since 1988. He was instrumental in finalizing an agreement between EPA and six national water-sector associations to promote effective utility management based on a series of Attributes of Effectively Managed Utilities and Keys to Management Success. Mr. Horne is the Co-Chair of the WEF Management Systems Subcommittee. He received a Bachelors Degree from the University of Texas and a Masters Degree in Public Administration from the University of Washington.

Darin Thomas serves as the Director of Raftelis Financial Consultants, Inc.’s management consulting division, SUNESIS. For more than 25 years, he has been a significant contributor to many of the industry’s emerging technologies and services. Mr. Thomas received a Bachelors of Science Degree in Mechanical Engineering from Michigan Technological University.
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Robustness: Strategies for Utility Management in Conditions of Uncertainty

By Xavier Irias, East Bay Municipal Utilities District

"Prediction is hard, especially about the future." These words, attributed to the sage Yogi Berra, sum up a major challenge we face as utility managers, and why it makes sense for us to seek "robust solutions."

Predicting the future can be difficult to impossible, but we still need to somehow formulate a strategy for that future. Climate change strategy is a premiere example of such a circumstance. We choose a coat in the morning without perfect information about the day’s weather. Examples closer to the heart of a water utility person might be our lack of information on the extent and depth of the next drought, which pipe among thousands is likely to leak next, and exactly what future demand patterns will be throughout our service area. Despite these major information gaps we still need to move forward every day, allocating finite resources as best we can with our limited information.

Robustness methods are tools for selecting a strategy or action in the face of significant uncertainty. Robust decision-making seeks to identify actions that will work reasonably well no matter what the future holds, even if not optimally for any one future. This is distinctly different than classical decision-making, which seeks to identify an action that optimizes, e.g., maximizes expected utility, against either a single specific future or a suite of probability-weighted futures.

The first hurdle to discussing robustness is that people don’t all agree on what it is. One researcher (Jen, 2001) defines robustness as a sort of feature persistence in the face of perturbations. Defining exactly what features and which perturbations is however easier said than done. For example, a clock’s pendulum if perturbed will eventually return to its at-rest state, but we don’t think of it as robust, merely stable. Despite our still-vague definitions, it is worth surveying available tools for robustness even as we acknowledge that it may be hard to define and measure robustness.

There are at least two major robustness methodologies in use today—Robust Decision Making (RDM) and Info-Gap Decision Theory. Each is discussed separately below.

RDM

RDM was developed by the RAND Corporation for "a wide range of other challenges of decision-making under conditions of deep uncertainty" (Lempert et al., 2003). Deep uncertainty means not only that the future is uncertain, but also that we lack or can’t agree on even conceptual models to predict that future. We are in the dark about the various unknowns; we don’t know what the average rainfall will be in the future, nor do we know the probability distribution about that average. Finally, we don’t know or can’t agree on the relative merits of different outcomes; for example, I might rate a strategy highest based on financial outcomes, while you might rate that same strategy very low based on aesthetics.

RDM has been used to attempt identification of robust strategies for climate change. One group applied RDM by following this series of steps (WUCA, 2010).

1. Frame the analysis and assign performance metrics.
2. Develop models to evaluate system performance.
3. Develop ensembles of plausible scenarios and some preliminary strategies.
4. Model each strategy’s performance against all of the scenarios.
5. Identify common elements of the various scenarios that tend to result in poor scoring of a strategy.
7. Develop hedges to key vulnerabilities.
8. Choose a final strategy based on hedges and on decision-makers’ judgment about which scenarios for the future are most likely.
Looking at the eight steps above, it is striking that we appear to be violating our initial assumptions. For example the first step requires us to assign performance metrics, and step six requires us to calculate performance tradeoffs, even though RDM applies to cases for which we don’t know or can’t agree on the merits of different outcomes. If we can’t agree on the merits, how can we even rank different outcomes, much less calculate their performance? This is a fundamental problem, not just with RDM and other robustness methods, but with classical methods too. Performance measurement is difficult anytime we need to measure multiple attributes, e.g. cost along with one or more environmental impacts, or trade off attributes that are not coincident in time and space.

The challenges with RDM do not stop at measurement, however. Steps two and four require us to develop and use system models, a notion that seems at odds with our starting assumption that we lack a consensus on even conceptual models. Step eight requires us to decide which scenarios are more important than others; how can we do that when we said up front that we lacked information about the relative likelihood of the various scenarios?

The short answer to these apparent contradictions is that no methodology can create information out of thin air, nor can it obviate the need for human judgment. At its best, RDM can flush out key patterns, building on points of consensus among stakeholders and illuminating the impact of areas of disagreement, and identifying which areas of disagreement can be safely ignored without compromising the ultimate solution. RAND suggests that the process ought to be interactive and iterative between the stakeholders and the modelers, and that visualization tools be used to help the stakeholders understand the most important uncertainties and their impacts on strategy performance.

Info-Gap

Info-gap, like RDM, was developed to deal head-on with the problem of severe uncertainty (Ben-Haim, 2006). Specifically, info-gap proposes to address situations for which the relative probabilities of various futures cannot be assigned, a type of uncertainty termed “Knightian” after the University of Chicago economist Frank Knight.

The theory—to confront severe uncertainties—is based on three elements.

A model of the uncertainty, i.e., some way to quantify the uncertainty; the uncertainty could be one or more values, or an unknown system behavior. These unknowns are taken to be of unknown distribution and unbounded. This is in contrast to RDM, in that RDM considers “credible” scenarios and thus implicitly puts bounds on the unknowns, e.g., on the temperature rise by the year 2100; info-gap requires no such bounds.

Continued on page 22
A model of the system; this model may in turn have its own info-gaps.

Performance requirements. These are usually satisfying requirements, i.e., a statement of exactly what kind of performance is good enough, rather than focusing on a metric whose value ought to be maximized.

The three elements listed previously are combined to create two decision functions: a robustness function that characterizes a candidate solution’s robustness as how wrong we can be in our assumptions and still meet performance requirements, and an opportuneness function that measures how wrong we must be to reap windfall benefits.

The decision functions of info-gap are performance measurement functions and, thus, are subject to the fundamental performance measurement problem discussed earlier. Info-gap, consistent with its goal of robust solutions, frames this performance measurement in terms of how wrong the assumptions can be while still meeting some stipulated baseline performance.

Like RDM, info-gap relies on human judgment and cannot create information out of thin air. Two key differences are the order in which the various judgments and calculations are made, and the way in which the key questions are framed (Hall, 2011). For example, RDM defers its judgments on how important a scenario is until after it’s been analyzed, in the hope that many scenarios turn out to be benign and thus don’t need to be judged by humans. Info-gap, by contrast, might frame the needed human judgments as part of the modeling, without knowing which of the various judgments might turn out to have far-reaching consequences. Each approach has its possible benefits and downsides, in terms of the ways the needed judgments might be biased more or less.

Conclusions
In choosing which model to use for situations of deep uncertainty, we should recall the proverbial hiker, lost in the Alps, who would rather rely on a map of the Pyrenees than admit he is lost. Like that proverbial hiker, we may find that admitting the depth of our ignorance does not come easily. Even when we acknowledge uncertainty, we tend to underestimate both its magnitude and its potential consequences (Kahneman et al., 1983; Taleb, 2010). As a result, we may tend to draw false comfort from approaches that eliminate uncertainty by either ignoring its existence altogether, or by making unjustified simplifying assumptions so classical methods can deliver an optimized solution.

Robustness methods take a different approach and explicitly acknowledge the depths of our ignorance. At their best, the robustness-centered methods don’t seek to eliminate uncertainties, but rather to help the analyst zero in on key uncertainties and explore their significance. Instead of optimizing our strategy based on a single future scenario that is unlikely to occur, robustness methods drive at solutions that make sense even if our models, and our predictions, turn out to be imperfect. Along the way, they may improve the understanding on the part of the stakeholders on what the key uncertainties are, and their consequences. For these reasons, robustness methods should be part of our toolkit even as they continue to mature.

References


Xavier Irias is Director of Engineering and Construction at East Bay Municipal Utilities District, based in Oakland, California.
The Effective Utility Management (EUM) framework has provided a standardized model for water and wastewater utilities to use for strategic planning, driving improvement, and providing a definitive set of reference points to help gauge actual performance. The EUM model is a potent tool for today’s managers to help them quickly and precisely get to the core elements that are important to their business and help them build a smarter water utility. One of the most valuable features of the model is the set of Key Performance Indicators (KPIs) that are directly integrated into the 10 attributes and their associated components (see Figure 1 below).

Admittedly, that volume of over 150 of the specific KPIs can be a little daunting, but with a little thought and the proper selection as to where to start, these metrics can provide powerful insight into performance of the utility (both current and desired).

EUM’s five keys to management success (leadership, strategic planning, organizational approach, measurement, and continuous improvement) are all essential. However, this article focuses on the latter two (measurement and continuous improvement), as they are specifically relevant to the effective use of data and performance metrics. For utilities to achieve their goals really boils down to three fundamental questions they must ask themselves:

- Where are you now?
- Where are you going?
- How do you get there?

These seem to be simple questions, yet they require very specific information and thought to fully answer. This is not the same as data. That is because data is only a component—a very important component, but still only a component. How an organization collects, uses, analyzes, and presents data is crucial to delivering meaningful information and efficiently placing it in the hands of leadership to make key business decisions. Organizations need to understand the imperative to make informed business decisions that are not only data driven but defensible. In order to make those key decisions, an entire organization requires global information drawn from the various business areas (i.e. finance, operations, customer service, human resources, etc.) and the various systems that support them. This leads us to Business Intelligence (BI).

How does one define BI? It is an umbrella, or overarching system or process, that refers to a variety of software applications/information systems that an agency uses to analyze their raw data. Most utilities have a mix of disparate systems. So they may use their BI solution specifically to help them in extracting and analyzing business data as well as querying and reporting from their multiple system landscape. A BI solution can be a useful tool to help monitor and manage performance metrics, and can also be an important source for answering those three crucial questions mentioned earlier.

To answer those three questions really represents a journey. Actually, it is similar to planning a trip and following a map.

**Where Are You Now?**

Any journey one embarks on has a definite starting place, which can be identified as a point on the road map that one goes forward from. Even if one has not planned the ultimate destination, at least one can...
look around and see where one is starting. Performance management is no different. Most likely the organization has set some strategic goals to pursue and has some business objectives it would like to achieve. For example, the agency may want to better its financial standing, reduce operating costs, and improve customer satisfaction. Those are pretty general in nature and in order to manage will require more specificity. An effective option to drill down to a meaningful level and determine where you are, is to use the relevant KPIs associated with the EUM model that was highlighted earlier. For example, if we were to pick a specific metric to illustrate the financial goal it might look like Figure 2.

A recommended approach is to start slowly with a manageable amount of KPIs, and to select the ones that will truly drive the organizational behavior and improvement desired. It is important to remember that organizations will respond to what they are being measured on, and normally find ways to meet the goals. Consequently it is important to select the right set that provides the correct balance of indicators to give a complete picture.

**Where Are You Going?**
Where is the point on that map that you want to go, or where you want to be? The EUM leadership success element of “Measurement” is an integral element at this point. The old adage that you can’t improve what you don’t measure is true. The management team needs to establish a clear goal. They need to identify an ambitious, but realistic, target to hit (in our example we identified the Bond Rating KPI). Ideally the KPIs should be calculated timely and routinely, analyzed regularly, and visible to the leadership of the organization. Many utilities today use dashboards or shared reporting to accomplish this.

It is also important to regularly review the KPIs the organization has been monitoring in order to appropriately adjust to the changing business dynamics of the utilities industry.

**How Do You Get There?**
Continuing the analogy of taking a trip, one will typically decide whether to fly to a location on the map, or drive, or maybe even both. Answering this question and

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### Effective Utility Management (EUM)

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*Figure 2*
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managing the performance metrics for improvement is similar and is very action oriented. This area involves the EUM success element of continuous improvement, and determining the strategy and specific tactics for success and a plan for actual execution. Benchmarking can be a valuable tool to assist a utility at this juncture. By using benchmarking the utility can compare its performance to a relevant peer who has been successful in the area targeted for improvement, or even a best-in-class utility. It is easier to get a jumpstart on improvement by modeling success.

Results are the key to success. Naturally, they are not guaranteed. However, a long-term strategic plan that’s built around the EUM framework and utilizes meaningful KPIs to measure and monitor continuous improvement are key to building a smarter water utility that sustains a results oriented culture.

Kirk Kuzirian has more than 25 years of management experience in the U.S. utilities industry. He spent 16 years with the Pacific Gas & Electric Company in California in various leadership roles in several areas of operations and services. For the past twelve years he has worked in a management capacity consulting with water utilities in helping them implement Enterprise, Customer Information, and Business Intelligence Solutions. Kirk is a managing partner for UtilityWorks, Inc. and can be reached by email at kirk.kuzirian@utilityworks.com.
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