Nonstationary Water Planning

A Review of Several Promising New Methods

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Scope of Presentation

Climate change, once a taboo topic, is now challenging the way water utilities plan for the future. Observed warming and climate model projections now call into question the stability of future water quantity and quality. As water utilities grapple with preparing for the large range of possible climate change impacts, many are searching for new planning techniques to help them better prepare for a different, more uncertain, future. Several promising new methods are being tested in water utilities planning.

This presentation will discuss the need for new planning methods and describe several promising new planning techniques. Information from this presentation comes from a soon-to-be released white paper by the Water Utility Climate Alliance on decision support methods for climate adaptation. WUCA was formed to provide leadership and collaboration on climate change issues affecting the country's water agencies and is comprised of ten of the nation's largest water providers.

Principle Findings

Assuming stationarity, water utility planning tended to focus on the uncertainty surrounding future water use. Future demands were forecasted, and water utilities typically planned around a single future. Considering the significant range of possible impacts from climate change, planning for a single future condition is no longer an option.
To adapt to climate change, water utilities generally must complete four major steps:

1. Understand - understand climate science and climate model projections,
2. Assess - assess water system vulnerabilities to potential climate changes,
3. Plan - incorporate climate change into water utility planning, and
4. Implement - implement adaptation strategies.

The present range of climate projections for many regions is great and many agencies are not comfortable selecting one projection over another. Vulnerability assessments, consequently, tend to utilize a variety of different projections. While more sophisticated climate models and methods are in the development phase, it could be many years before the range of projections and the uncertainties about the projections are substantially narrowed (Barsugli et al., 2009).

In the meantime, many water utilities will have substantial decisions to make that may be affected by climate change. Therefore, many utilities are progressing or will move forward with the adaptation steps before considerable improvements to climate model projections are made. For many utilities, advancing to planning for climate change will require new methods to address the uncertainties of climate change.

New planning methods help utilities systematically characterize and comprehend uncertainties and prepare for multiple possible outcomes. Five methods have been evaluated for their use in water utility planning.

**Classic decision analysis** provides support for decision makers by systematically cataloging information and mathematically evaluating and ranking decision alternatives against multiple, potentially conflicting, decision objectives. **Traditional scenario planning** seeks to identify near-term actions that prepare a utility for several different, plausible and often provocative future scenarios. **Robust decision making** combines features of both decision analysis and scenario planning to provide develop adaptation strategies for a large number of plausible future conditions. **Real options** is a method to help water managers identify water supply strategies that adjust over time and balance risks. **Portfolio planning** is used in the financial world to select a portfolio containing a mix of assets or strategies that minimize financial exposure due to future market scenarios.

**Conclusions**

There is not a one-size-fits-all method. Every planning process must be tailored to the needs and capabilities of the utility. For utilities that are not interested in methods requiring sophisticated computing or modeling, scenario planning is fairly intuitive and can be accomplished with minimal external resources. On the other hand, utilities looking for, and confident in, a probabilistic assessment may look to classic decision analysis. Utilities that want to invest more resources and rigor into climate change adaptation strategy development may consider more advanced computational methods or hybrid methods such as robust decision making, real options, or portfolio planning.
Only a handful of applications of these planning methods to climate adaptation were identified. The Water Utility Climate Alliance is interested in promoting more research, evaluation and development of multi-outcome water planning methods. Encouraging more use of these methods by the water industry and the sharing of experiences through the development of case studies is also supported by the alliance.