



## Case Study – Tucson, AZ

### **Embrace Climate Uncertainty and Implement No-Regrets Solutions with Scenario Planning**

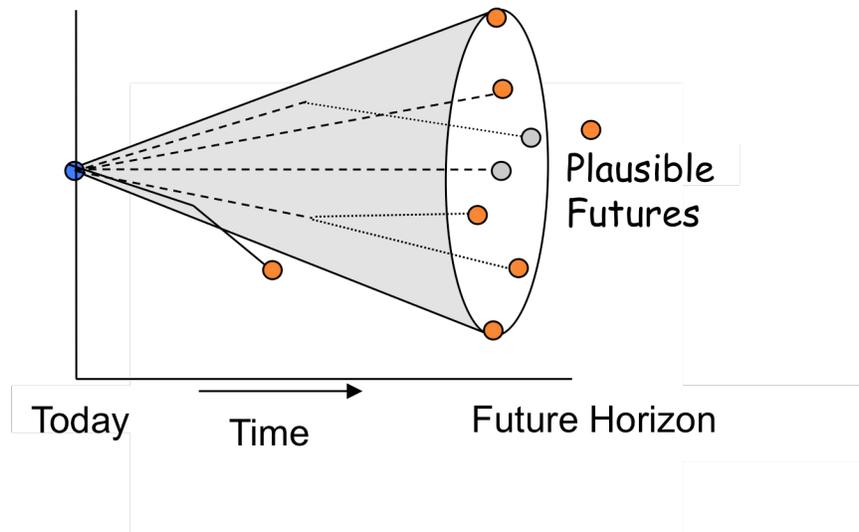
While downscaled projections have their place in preparing for climate change, some significant climate uncertainties will not be reduced before decisions need to be made, such as those related to future emissions. Other forces that can affect water resources can be as important and uncertain as climate change, such as regulations, regional development, and costs. How can water managers make decisions in the face of such large levels of uncertainty?

Scenario planning is a great place to start if you are facing high uncertainty about forces over which you have little control because scenarios encompass greater complexity and uncertainty than predictions, forecasts, or even projections.

In the Academy's January 31, 2012 webinar we discussed scenario planning with our guests Armin Munevar, Global Technology Leader, CH2MHill and Wally Wilson, Lead Hydrologist, Tucson Water. Scenario planning provides a framework for thinking about climate and impacts information in a different way – not trying to reduce or precisely quantify uncertainty, but ensuring that decisions can succeed in spite of great uncertainty. Scenario planning methods are ideal for helping to rapidly scope problems, identify the importance and consequences of major uncertainties, assess and prioritize feasible decision options, and identify key decision points. Scenario planning also provides flexibility to consider non-climatic concerns.

### **Scenario Planning in Water Resources Management**

The standard approach for dealing with our water problems, from infrastructure choices to ecosystem management, is based on historical information. But what if the future is different from anything we've experienced in the past? Many of our planning problems ask us to look forward 25 to 50 years. We can look at the past for some perspective about what future conditions might be, but 50 years ago, who would have projected the expansive population growth in the Southwest, the recent economic downturn, the level of regulatory changes, or the changes in the social values that have produced the growing water conservation ethic? Scenario planning allows us to take a broader view of the future by considering alternative futures and developing solutions that are robust across the range of possible futures.



Planning typically takes a deterministic view of the future, whether it's the “best” future we can envision, the “most likely” future to occur, or an extension of “business as usual.” The emphasis of scenario planning is to consider several different plausible futures and trajectories for how the future might unfold. *Adapted from Timpe and Scheepers, 2003.*

Climate change is one of the major external drivers and critical uncertainties for water resources in the coming decades, whether related to agriculture, ecosystems, flood management, water quality, energy, infrastructure, or coastal regions. However, in planning for water resources, other driving forces may be equally pressing – and uncertain – in the future, including population growth, regulations, changing environmental values, and energy needs. In scenario planning, we simply bring climate change into the arena with these other key uncertainties; we don't need a completely different process.

The major elements of scenario planning are:

1. Frame the question: identify the main question or focal issue to be addressed.
2. Identify and rank the key driving forces that relate to your question. For example, you might focus on system reliability and identify the external forces that will potentially affect your system reliability over time.
3. Prioritize and select critical forces that are both highly important and highly uncertain.
4. Create storylines. Many of these uncertain forces can be grouped and woven together to create compelling narrative descriptions about how the future might evolve. The goal is to develop storylines that are different from each other.
5. Create scenarios. These are the quantitative aspects of the storylines that relate to your focal issue. In our example, this step would develop each of the different storylines into scenarios that relate to system reliability.

For the scenario building process to be robust, it must include input from a variety of stakeholders that have different perspectives. By asking key stakeholders to rank critical uncertainties, through surveys or other means, you can take advantage of the experience and knowledge of experts outside of your organization to identify uncertainties you may have overlooked. Once you've identified the major uncertainties, you can group them into different categories such as, natural systems, demographics and land use, technology and economics, and social- and governance-related elements. Then, create the storylines for different possible futures by combining uncertain forces and considering their interactions.

Remember, though, that the goal isn't simply to create the scenarios as ends in themselves, but to use them in a decision process, like that in the Academy's Iterative Risk Management Roadmap. That means that for each scenario, vulnerabilities can be assessed and then response options can be assessed, including evaluation of the robustness of the "no regrets" options, which are effective across all scenarios. Also look for options that are unique to specific scenarios, and identify the trigger points and monitoring that would need to be used to determine when to invest in that particular option.

### **Tucson Water: Scenarios for Long Range Planning**

Tucson Water has integrated scenario planning as a standard element in their overall planning method, conducting multiple scenario planning studies over the past decade and integrating the results into their on-going decision making processes. Tucson Water first used scenario planning to address their long-range plans, as a supplement to shorter-term tactical plans. They have implemented choices from their scenario planning process and then dealt with incorporating new critical uncertainties after their initial process was completed in 2004. This experience drives home that planning is a continual process.

Tucson Water's scenario planning questions were framed around three objectives:

1. Fully use currently available water resources – "Use what we've got"
2. Increase water-use efficiencies through aggressive demand management and conservation – "Save what we've got"
3. Possibly acquire additional resources to reinforce vulnerable supplies and for future growth – "Get more"

Tucson Water's 2004 study emphasized the first objective going out to 2050. Key uncertainties related to the use of Colorado River water supplies and to the reuse of treated wastewater effluent. Each of these uncertainties had different possibilities, which were combined to craft storylines and scenarios, and to create and assess options. The results that were presented to their leadership and the public included timelines and sets of decision points that would have to be addressed under different scenarios. Key decision points occurred when Tucson Water

would fail to comply with assured water supply requirements. One decision point, for example, was whether to treat the Colorado River water through recharge or directly treat and deliver the water, and in both cases what level of mineral content would they be aiming for. Considering the lead time to put into place some of the Colorado River water options, Tucson Water identified that they would have to make a decision about how to treat and deliver that water in 2006. That decision was made and implemented.



The Southern Avra Valley Storage and Recovery Project is one of several groundwater recharge projects that allow Tucson Water to efficiently use Colorado River water to recharge local groundwater supplies. *Photo: Tucson Water*

Tucson Water then conducted a 2008 update to their 2004 study. They evaluated all their water sources, including the new Colorado River water supplies, and considered demands based on population projections and per capita water use. It looked like demands could exceed supply starting in 2036. But considering how climate change could produce shortages in Colorado River deliveries, Tucson Water considered an earlier shortfall, possibly in 2030, and made it larger over time. This means that, depending on the level of water conservation that Tucson Water users achieve, the utility will eventually reach another decision point when they will have to consider how they will use wastewater effluent.

This required Tucson Water to address their second decision point from the 2004 study, which related to different ways that wastewater effluent could be used to increase supplies, such as through landscape watering that ultimately leaves the region, full treatment and integration into the potable water supply, or partial treatment for something other than potable use. This required another set of scenarios that focused on key uncertainties related to the type of wastewater use and the level of water quality treatment that Tucson Water could implement to deliver additional supplies. Those scenarios were considered as another update to their long-range plan, through their recycled water master plan.

Tucson Water has conducted three scenario planning studies within a decade. They started the process as soon as they had made a choice to approach long-range planning using strategic planning as opposed to tactical planning. They don't consider their subsequent studies as having to redo prior work, but as additions to the original effort, that should be expected as the future unfolds to reveal new uncertainties or to meet those decision points identified by earlier studies.

### **The Bottom Line**

Water utilities and other resource managers are facing a variety of critical uncertainties over the coming decades. Climate change is just one of many. Scenario planning is a good process for developing robust "no regrets" decisions that work across a variety of futures, identifying unique decisions that may be required under certain conditions, and determining when those decisions must be made.

### **Tools**

Reports:

[Incorporating Climate Changes into Water Planning](#), 2010. This report was developed by the Water Utilities Climate Alliance (WUCA), a group of large utilities, many in the West, working on climate change adaptation. In particular, look at chapters 2.2 and 3.2, which cover traditional scenario planning and case studies, respectively. URL:

[http://www.wucaonline.org/assets/pdf/actions\\_whitepaper\\_012110.pdf](http://www.wucaonline.org/assets/pdf/actions_whitepaper_012110.pdf)

[Water Plan: 2000-2050 by the City of Tucson Water Department](#). This 2004 report describes the first of three scenario planning processes used by Tucson Water. Chapter 6 succinctly explains the scenario planning process and Appendix D describes their methods in detail sufficient for technical staff to implement.

**Citation**

Timpe, C. and M. Scheepers, 2003. A Look into the Future: Scenarios for Distributed Generation in Europe. Energy Research Center of the Netherlands, Petten, The Netherlands.