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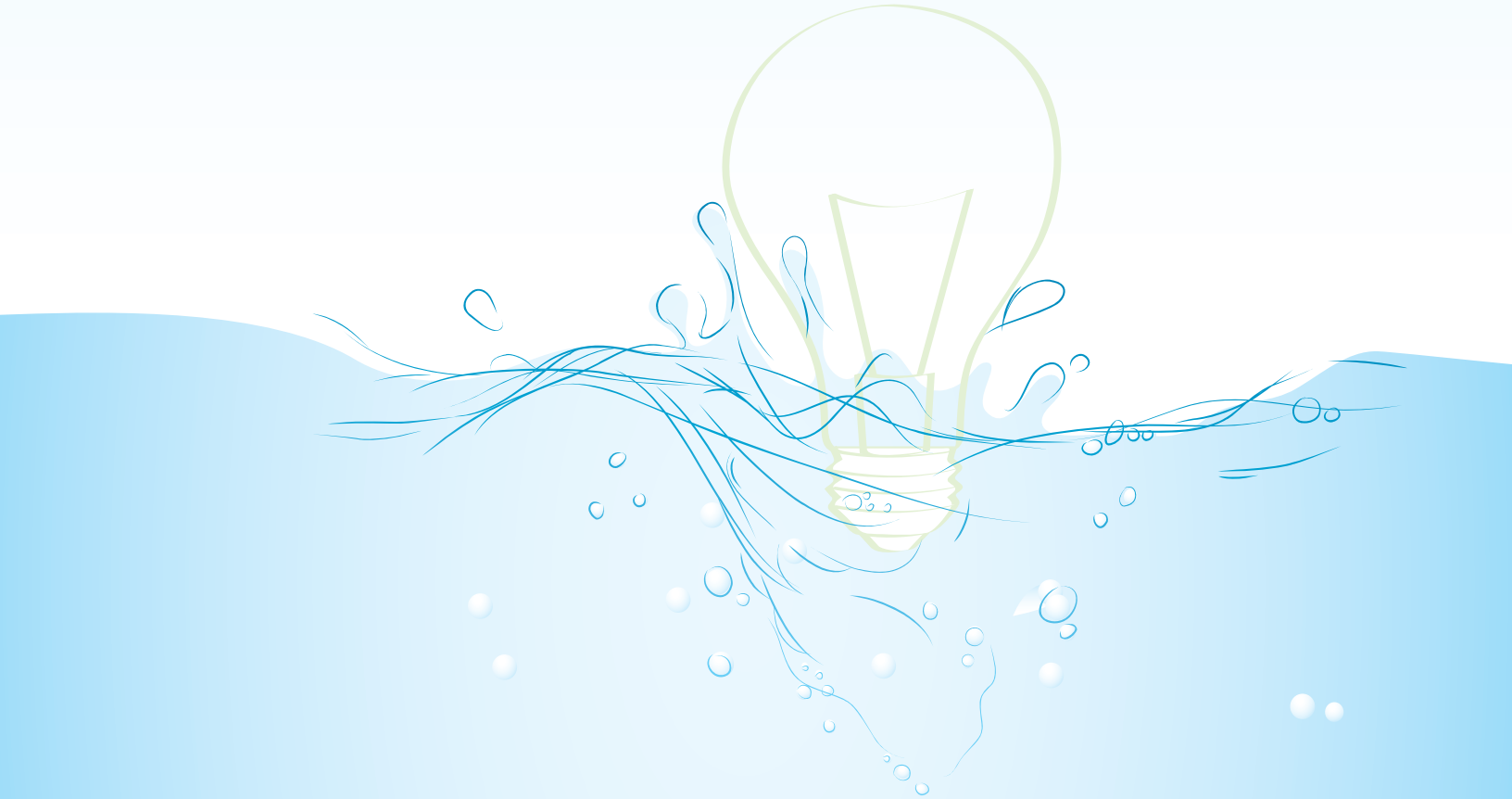
Project 4469

# Water and Electric Utility Integrated Planning:

## *Joint Utility Planning Tournament*



# *Summary Report*

**October 16-17, 2014** Water Research Foundation 6666 W. Quincy Ave., Denver CO 80235

Project 4469

# Water and Electric Utility Integrated Planning:

*Joint Utility Planning Tournament*

**May 2015**

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Additional information about this tournament is available online at
http://www.rem.sfu.ca/water/research/waterrf-4469-tournament/

Additional information about Water Research Foundation Project 4469 – Water and Electric Utility Integrated Planning is available online at http://www.waterrf.org/Pages/Projects.aspx?PID=4469



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## Acknowledgements

We would like to thank all collaborators for their support, and exercise participants for their time and thoughtful insights. Many thanks also to the members of the Water Research Foundation project advisory committee for their constructive feedback and guidance.

*Tournament Committee:*

Steve Conrad, *Simon Fraser University*
Steven Kenway, *University of Queensland*
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Linda Reekie, *Water Research Foundation*
Valerie Roundy, *Water Research Foundation*

*Special Thanks:*

Jon Kardon, Travel Coordinator
Jason Turgeon, Jim McMahon, Mary Ann Dickinson, Jeff Carmichael, Eric Fitzer (Context presentations)
Anthony Fiore, Carol Howe, Eric Fitzer, Kelly Twomey Sanders, Paul Fesko (Judges)
Commissioner Catherine J. K. Sandoval, California Public Utilities Commission (Keynote)
Minister Mark Francis McArdle, Queensland's Minister for Energy and Water Supply (Special introduction)
Suzan Lapp, Urban Systems (Tournament agenda review)
Adam Carpenter, Delon Kwan, Mike Hotaling, Kathleen O'Connor, Robert Goldstein (Project advisory committee, scenario review and comment)
Students of Simon Fraser University and University of Queensland (Tournament process testing)

This tournament is possible due the previous work by Harvey Hill, Monica Hadarits, and Nancy Lee, *Agriculture and Agri-Food Canada*.

*Tournament Sponsors*

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## Executive Summary

This report summarizes the Water and Electric Utility Integrated Planning: Joint Utility Planning Tournament (Joint Planning Tournament), which took place October 16-17 2014 in Denver Colorado. Thirty two people from the United States, Canada, and Australia and representing water and electric utilities, water and energy sector professionals, federal and state regulators, and academic institutions took part in a simulated planning tournament in order to identify opportunities and barriers to water and electric utility integrated planning.

Five teams developed long-term integrated plans as they played through two management scenarios in the fictitious city of Meadowlands. Teams were given a list of potential planning options from which they could select to meet the goals of each scenario. Teams could also develop their own innovative option. At the end of each round, teams presented and defended their integrated plan to the other teams. Following each presentation, participants scored each team's plan on its ability to incorporate options that met a variety of sectors' needs, addressed the vulnerabilities and conflicts presented in the scenario, improved regional water and electric system reliability and security, improved the region's ability to adapt to future conditions, and improved customer service delivery. At the end of scenario presentations, five Judges composed of subject-matter experts ranked the teams. A final winner was selected based on the Judge's ranking and overall scoring by tournament attendees. At the conclusion of the tournament, a world café was hosted to provide an opportunity for participants to share their thoughts and observations as a group.

Throughout the tournament teams actively discussed the opportunities and barriers to water and electric utility integrated planning. Participants noted that the tournament format enhanced discussion and appreciation of unique sector viewpoints. Participants commented about the distinct language and terminology used between water and electric utilities and that water and electric utilities often face differing service delivery goals. Political and regulatory barriers to integrated planning were most often discussed including that water and electric utilities often operate in incompatible regulatory environments. Differing viewpoints on how stakeholders view water and electric resources was also mentioned noting that water is more closely linked with environmental values and public sense of rights than electricity. Participants agreed that public awareness of the water-energy link was not present and that the water and electric sectors lacked awareness of the overall benefit of integrated planning.

Participants found it challenging to articulate specific benefits for joint utility planning often noting a strong history of "silo'ed" operations and attitudes between water and electric utilities. The benefits identified tended to focus on technical opportunities noting that improvements in water and electricity efficiency provided a strong impetus to consider joint planning efforts. Teams also identified watershed management, hydroelectric generation, and water demand management as areas where water and electric utilities would benefit from collaboration. Additional benefits identified included cost savings, broader consumer awareness of water and energy linkages, better capacity to respond to future events, and greater opportunity for developing innovative options and sustainable solutions that address cross sector problems.

## Introduction

The Joint Planning Tournament is a concept based on the Invitational Drought Tournament developed at the Science and Technology Branch of Agriculture and Agri-Food Canada[1]. Using a simulation gaming concept, a tournament helps actors discuss opportunities for future planning efforts. More specifically, it supports "the improved assessment of policies, programs and management strategies at a range of spatial scales".

In the Joint Planning Tournament, multiple water and electric power sector actors formed teams consisting of approximately five players. The teams were guided through two integrated planning scenarios (see Appendix D and E) set in a fictitious city and region. The scenario included information about the city and its biophysical, political, and social environment (e.g. demographics, temperature, precipitation, water and energy demand projections). Teams were provided a technical memo and guided through each scenario round. Through discussion, teams worked together to develop an integrated water and electric utility plan consisting of several planning alternatives. Teams scored each other based on their integrated plan's abilities to ***meet the goals of the scenario, minimize economic impact and maximize system resiliency*** in both the short and long term. The team with the highest score at the end of the second scenario won the tournament.

### *Tournament Background*

The Joint Planning Tournament was an event hosted by the Water Research Foundation on October 16 and 17, 2014 in Denver Colorado at its corporate headquarters. Included as part of the Water Research Foundation project 4469: Water and Electric Utility Planning, its objectives were:

1. To develop a Joint Utility Tournament framework and apply it to hypothetical but realistic water and electric utility integrated planning (WEUIP) scenarios
2. To encourage active conversations between water and electric utilities with specific attention to identifying the opportunities and barriers for WEUIP
3. To create an enjoyable environment for sharing of ideas and challenges through gaming and to explore the constructs of WEUIP

[1] Hill, H., Hadarits, M., Rieger, R., Strickert, G., Davies, E.G.R., Strobbe, K.M., 2014. The Invitational Drought Tournament: What is it and why is it a useful tool for drought preparedness and adaptation? High Level Meeting on National Drought Policy 3, 107–116.

Thirty two people from the United States, Canada, and Australia and representing water and electric utilities, water and energy sector professionals, federal and state regulators, and academic institutions were in attendance (see Appendix A – Participant List). Participants were invited from various disciplines to create a distributed but equal representation of water and electric utility viewpoints. Participants were grouped into five teams of five. A panel of five judges with one member of each team comprising 2 water utilities, 1 energy regulator, 1 industry representative, and 1 academic was selected to collectively rank team results. The research team provided technical and referee oversight of the process.


**Figure 1 - (Left) Team 5 and (Right) Team 1 deliberating options to include in their water and electric integrated plan**

### *Process*

The tournament opened on October 16 with a half day of context presentations by the organizers, research team and selected speakers. Rules and process were covered and teams were invited to ask questions about the previously provided information background and scoring process. Tournament roles were explained and judges introduced. After opening presentations teams were given the task of naming their teams and identifying a long-term management goal that would guide their consideration of planning options on the following day. Attendees were then invited to an informal dinner for networking and team building.

Gaming opened on October 17 and ran from 8:00 am until 3:45 pm with a hosted lunch and keynote lunch speaker. At the start of the tournament, teams presented their selected names and long-term management goal. The day consisted of two scenario games and a world café discussion (see Appendix B – Agenda).

In a tournament game or round (see Figure 4), teams were responsible for managing the long-term viability of a fictitious city (Meadowlands) based on real data. A fictitious city was created to provide appropriate context for all participants from differing geographical areas and to reduce bias or constraints that might apply to real cities. At the beginning, the tournament facilitator distributed a technical briefing and presented the objectives of the scenario. Teams considered strategic options about their water and electric power resources and selected planning options from a list provided to them (see Appendix C – List of Planning Options), or proposed new innovations (i.e. new planning strategies not on the

list) for which they were instructed to assign a realistic cost and benefits accepted by the tournament referees.

**Figure 2 - (Left) Team 4 deliberating planning options; (Right) tournament referees conferring with Team 3**

At the end of the gaming round, teams provided their initial selection of options to the tournament referees and prepared and presented a short (4-5 minute) summary of their integrated plan. All individuals in the room scored each team's presentation (excluding their own team). The tournament continued for an additional round, ending with judges conferring to rank the team's overall integrated plan's performance and prizes awarded to the wining team.

**Figure 3 - Team 2 preparing to present selected options**

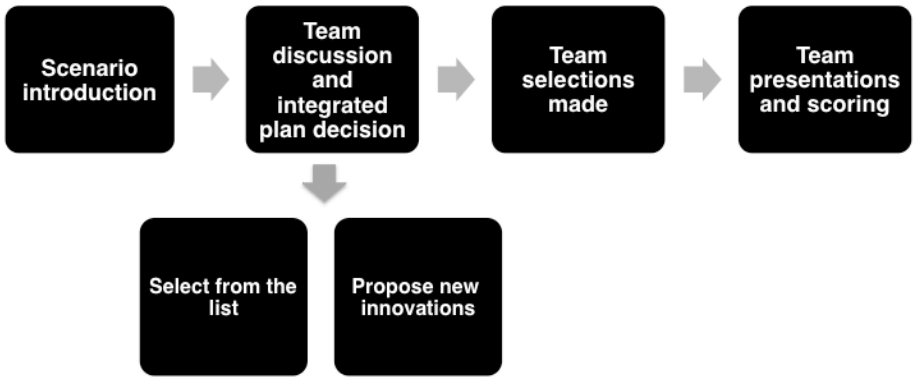


**Figure 4 - Tournament round process**

### *Scoring and Voting*

At the end of each round, teams presented their final integrated plan, justifying any change made to their plan after submitting decisions to referees. Teams were scored on how well their plan supported the team's long term management goal, met the goals of the scenario, minimized economic impact and maximized system resiliency (capacity to deliver service efficiently and reliably while maintaining system security) in both the short and long term. Other players, observers, referees, and judges assigned a score of 1 to 7 based on the criteria shown in Box 1. The sum of scores represented the total score of the team in that round. Final team scores were based on the cumulative averages from each round (75%) and judge's rankings (25%).

Box 1: Tournament scorecard.

Team: _____ Budget: _____ Spent: _____

When filling out the sheet, ask yourself three questions.

- 1) How effective is their overall integrated plan in reducing environmental impacts in the region? (reducing impact is more effective than avoiding environmental impacts)
- 2) How effective is their overall integrated plan in addressing societal impacts in the region? Are there expected gains for society?
- 3) How effective is their overall integrated plan in addressing economic impacts in the region? Are there expected gains, economically?

Please provide a score from 1 (very ineffective) to 7 (very effective) for the following criteria.

| Criteria | Score (1 to 7) |
|---|---|
| The plan is comprehensive and incorporates options that meet a variety of sectors' needs | |
| The plan addresses the ***Goals*** of the scenario | |
| The plan addresses the vulnerabilities and conflicts presented in the scenario | |
| The plan improves customer service delivery | |
| The plan improves regional water and electric system reliability and security | |
| The plan improves the region's ability to adapt to future conditions | |
| TOTAL | |

## Summary of Key Findings

The joint planning tournament was successful in encouraging conversation and exchange of knowledge between diverse sector representatives, and in addressing a challenge of terminology often noted in literature when considering joint collaborations between water and electric utilities. Teams worked aggressively to a) develop integrated plans across both scenarios (including introducing new innovations) and b) come to consensus on the most opportunistic areas for integration. The following presents the results from each round.

### *Tournament results*

For long-term management goals, teams focused on achieving regional water and energy sustainability, improving system resiliency, minimizing risk and cost, and promoting innovation.

#### Round 1 - Securing water supply futures

For round 1, teams considered a scenario that presented declining water supplies affecting drinking water, hydroelectric generation, and coal generation cooling. Teams were required to address the looming water conflict and ***prepare a strategy for sustainable management of water over the next 20 years.*** In this round all team plans selected to undertake leak identification and repair programs and pursue alternatives to potable water (see Table 1). Four of the five teams implemented a regional water and electric conservation program and funded municipal rebate programs for water and energy efficient fixtures and appliances. Three of the five teams implemented a watering restriction program and set wholesale water rates and water rate structures to reflect the full cost of regional water supplies. Two teams opted to expand wind generation facilities. Team 4 implemented a combined real-time metering and customer reporting program and a joint watershed management program to improve water quality. Team 2 opted to expand solar generation facilities and team 4 opted to develop a three-tiered water rate structure. Team 4 also proposed a series of innovation options for improving building codes and introducing a program for agricultural water leasing. Team 3 proposed a development offset charge.

#### Round 2 - Clean energy regulations ($CO_2$ emission limits)

For round 2, teams considered a scenario where the federal government was proposing to regulate carbon dioxide (CO2) emissions from coal-fired and gas-fired generation facilities reducing electric generation capacity from 10% to 25%. Teams were required to prepare for the pending regulation and ***prepare an integrated water and energy transformation plan for the next 10 years.*** Teams were given the option to start from their existing plans or develop a new plan. All teams opted to build from their earlier plan (see Table 2). Team 1 did not modify their existing plan, feeling the options selected served to meet the goals of scenario 2. Team 2 and Team 3 added a combined real-time metering and customer reporting program to their integrated plan. Team 3 also set wholesale water rates and water rate structures to reflect the full cost of regional water supplies. Team 4 eliminated the choice to implement a joint watershed management to improve water quality from their previous plan. Team 5 opted to add a region-wide water and electric conservation program,

complete a joint water use plan to manage hydropower at the Lake 1 (one of the region's water supply sources), and expand wind generation facilities. Team 3 eliminated their proposal for development offset and instead proposed an innovation option for improving building codes to ready the region for solar power.

**Table 1 - In game selected options round 1**

| Code | Strategy | Team 1 | Team 2 | Team 3 | Team 4 | Team 5 |
|---|---|---|---|---|---|---|
| D1 | Implement a region wide water and electric conservation program. Program elements include water and energy audits, informative resources and case studies. | X | X | X | X | |
| D2 | Implement watering restriction program | X | | | X | X |
| M1 | Implement combined real-time metering and customer reporting program | | | | X | |
| E3 | Undertake a leak identification and repair program | X | X | X | X | X |
| Q2 | Develop a joint watershed management program to reduce the risk from microbiological or chemical contamination by restriction access to the source watersheds | | | | X | |
| S5 | Implement alternatives to potable water for specific purposes, including:<br>• rainwater harvesting for irrigation;<br>• greywater and reclaimed wastewater for residential, commercial, institutional, and agricultural use;<br>• groundwater for irrigation;<br>• river and sea water for waterfront businesses. | X | X | X | X | X |
| P1 | Set wholesale water rates and water rate structures to reflect the full cost of regional water supply | | X | | X | X |
| P2 | Developed a three tiered water rate structure | | | | X | |
| P3 | Develop a municipal rebate programs for water and energy efficient fixtures and appliances | X | X | | X | X |
| S6 | Complete a joint water use plan to manage hydropower at the Lake 1 | | X | | | |
| G1 | Expand solar generation facilities | | X | | | |
| G2 | Expand wind generation facilities | X | | | X | |

**Table 2 - In game selected options round 2**

| Code | Strategy | Team 1 | Team 2 | Team 3 | Team 4 | Team 5 |
|---|---|---|---|---|---|---|
| D1 | Implement a region wide water and electric conservation program. Program elements include water and energy audits, informative resources and case studies. | X | X | X | X | X |
| D2 | Implement watering restriction program | X | | | X | X |
| M1 | Implement combined real-time metering and customer reporting program | | X | X | X | |
| E3 | Undertake a leak identification and repair program | X | X | X | X | X |
| S5 | Implement alternatives to potable water for specific purposes, including:<br>• rainwater harvesting for irrigation;<br>• greywater and reclaimed wastewater for residential, commercial, institutional, and agricultural use;<br>• groundwater for irrigation;<br>• river and sea water for waterfront businesses. | X | X | X | X | X |
| P1 | Set wholesale water rates and water rate structures to reflect the full cost of regional water supply | | X | X | X | X |
| P2 | Developed a three tiered water rate structure | | | | X | |
| P3 | Develop a municipal rebate programs for water and energy efficient fixtures and appliances | X | X | | X | X |
| S6 | Complete a joint water use plan to manage hydropower at the Lake 1 | | X | | | X |
| G1 | Expand solar generation facilities | | X | | | |
| G2 | Expand wind generation facilities | X | | | X | X |

### Expenditure overview

Teams were not required to meet a given budget, yet were required to defend their selection of options and expenditures. Participants were initially concerned that not being held to a budget would encourage teams to include every option, however this was not observed. It is felt that while a budget was not provided, teams prioritized their selections and choose options that would address the scenario at an optimal cost. Overall the integrated plan expenditures ranged from $11 million to $119 million in round 1 and $67 million to $133 million in round 2. Table 3 presents expenditures for each round.

Table 3 - Integrated plan budgets for round 1 and 2

| Round | Team 1 | Team 2 | Team 3 | Team 4 | Team 5 |
|---|---|---|---|---|---|
| 1 | $79,580,300 | $87,880,300 | $58,830,300 | $119,080,600 | $11,080,300 |
| 2 | $79,580,300 | $132,880,300 | $109,330,300 | $117,580,600 | $67,330,300 |

### *Water and Electric Integration Themes*

Participants felt reducing waste and improving efficiency were the highest priorities followed by reducing water use by residential customers. The most frequently selected and discussed options focused on the following themes:

1. End use efficiencies through joint water and electric utility conservation programs and rebate programs
2. Internal waste reduction through leak management
3. Investing in alternatives to potable water supply for irrigation, industrial uses, and electric power cooling
4. Water restrictions
5. Alternative water pricing strategies
6. Solar and wind generation

While some teams selected wind and solar generation planning options, overall teams were hesitant to invest in capital projects. Table 4 lists the options that were not selected during round 1 or round 2, all of which include a capital infrastructure project.

Table 4 - Planning options not selected by teams during tournament

| Code | Strategy |
|---|---|
| A1 | Construction of Aquifer Storage and Recovery (ASR) facilities |
| A2 | Construction of desalination plant in Port Bay |
| A3 | Construction of Alpine lake (not currently used to supply water) transmission pipeline |
| E1 | Construct a deep water lake cooling supply |
| E2 | Convert 25% of existing cooling towers to dry cooling technologies |
| S1 | Construct a waste heat recovering facility for hot water supply to the Meadowlands industrial park |

| Code | Strategy |
|---|---|
| S2 | Construct a co-generation facility at Meadowlands' south wastewater plant |
| S3 | Construct additional hydro electric generation facility on Thatch River |
| S4 | Construct additional diversion tunnel at Lake 2 to Meadowlands |
| Q1 | Improve the water quality of Lake 1 by adding a UV disinfection system |

### Decision Factors

Teams considered a number of issues throughout each round. The following items were highlighted as key influences, questions raised, or other factors affecting team selection of planning options.

1. How would rate changes impact customers?
2. How can the city lead by example?
3. Are there influences between groundwater and surface water that should be considered?
4. Can federal funds support implementation of planning options?
5. How does climate change influence the viability of options?
6. What are the potentials to control growth through development charges?
7. Are metering programs effective in reducing water and electric power use?
8. Impact of mandated water restrictions and political viability of implementing such programs (participants felt mandated restrictions should be held in reserve to manage significant droughts)
9. Participants believed that implementing conservation programs in water and electric utilities would have immediate impact and benefit
10. Participants felt real-time metering may provide for reductions in water use but raised security concerns by customers
11. Leak management programs were immediately agreed upon by all participants
12. Participants felt that the conversion of wet cooling towers to dry towers would provide opportunity to reduce consumption, but questioned the cost viability of this option (this option was not selected by participants)
13. Demand response programs (or load shedding) were considered in that they can help meet peak electric power demand and possibly reduce carbon emissions
14. Cost analysis was important and informally considered
15. Participants believed that setting wholesale rates to reflect the full cost of water would provide an immediate payback but would be challenging to implement in reality
16. Water restrictions and drought affect power generation so integrated plans must consider how to support the power industry
17. Hydro generation may be more resilient than solar and wind power generation, but not viable in water scarce environments

18. Wind and solar power generation cannot contribute to peak capacity without storage capacity

### Selection priorities

Teams identified their criteria for selection of strategies, ranging from minimizing cost to deferring capital investments. These are listed below:

1. Provides synergistic water/energy savings
2. Reduces demand (efficiency, alternative supplies – greywater, rainwater, etc.)
3. Upgrades systems (leak detection)
4. Defers new capital projects (fixing leaks, decreasing peak demands)
5. Meets growth (increased supplies of energy and water)
6. Provides reliability, resilience, environmental sustainability, affordability, regional economic advantage
7. Enhances longer term sustainability with diversified energy supply, minimal new infrastructure, optimising existing sources
8. Reduces water and energy demands significantly, while allowing utilities to recover costs (e.g. tiered-rate pricing structure, system improvement benefit charges)
9. Provides opportunity to focus on non- or low carbon generation with no increase in water demand
10. Provides opportunities for education and public outreach and efficiency & conservation
11. Provides the most "bang for buck"

### Opposing viewpoints and challenges

Teams identified a number of opposing viewpoints that might challenge the preparation of water and electric utility integrated plans in real world applications, including:

1. Regional perspectives vs. city perspectives
2. Water use conflicts (e.g. conflicts between potable water for drinking water vs. potable water use in industry and agriculture)
3. Cost overrides or cost limitations that prevent the consideration of fully integrated planning options
4. Community acceptance and support of integrated options
5. Priority of water use for power generation vs. drinking water

Challenges noted by teams include:

1. Communication and enforcement of integrated plan options
2. Interpretation of and understanding of generation capacity to meet $CO_2$ regulations
3. Gathering support by customers and community will be key to meeting stretch goals (and getting buy-in on costs)

### Missing options and representation at the Tournament

During discourse, teams identified a number of missing options from the list of prepared planning strategies, namely:

1. Options that identify and encourage behavioural changes to water and electric power use
2. District or distributed energy systems
3. Options for utilizing adaptive management and a phased approach
4. Options that focus on social and environmental considerations
5. Options that factor in climate change variability
6. More wastewater options
7. Land use planning alternatives

In addition, participants shared that several groups should be included in real world tournaments including:

1. Customers
2. Elected officials
3. Legal representatives

## *Participant Feedback*

Participants shared feedback throughout the tournament, during the tournament debrief, and during post tournament interviews. The following are aspects about the process that participants liked and recommendations for improvement.

### What participants liked

1. Participants enjoyed the game style meeting and energy of the day. Several participants commented that the time passed quickly and that they were still energized at the end of the tournament.
2. Participants noted the benefit of the game format for forcing exchanges between water and electric utilities.
3. Participants liked the process of solving problems (meeting scenario goals) as an extension to open-ended discussions.
4. Participants appreciated the opportunity to network and learn from cross-sector experts (i.e. water to electric or electric to water).
5. Participants noted considerable learning of water and electric utility terminology and an expanded appreciation of cross-sector concerns and goals.
6. Participants liked how the scenarios could build off each other throughout both rounds.
7. Participants liked the ability to consider options without being held financially accountable, yet participants realized that real world plans must be evaluated for costs and benefits.

Suggestions for improvement

1. Participants suggested that the tournament would be more successful if applied to a real world scenario or in a regional context
2. Participants suggested that more time be given to discussing the scenarios and selecting planning options
3. Participants suggested utilizing a rulebook or holding teams to a minimal standard for developing integrated plans

## World Café – answering key questions

As a component of the tournament, an open-ended process was used to elicit feedback from the participants on selected key questions of interest to the research team, focused on integrated management of water and electric utilities. The adopted process was the World Café method used previously by the research team[2], but modified for the Tournament along the following lines.

### *Methodology and process*

1. We commenced tables based on the team groups assigned earlier in the tournament.
2. The following questions were put to the entire tournament participants:
    1. *What are the benefits, or desirable outcomes of integrated water and electric utility planning (what will be "lost" for utilities, cities, regions without integrated planning)?*
    2. *Under what circumstances is integrated water and electric planning of higher value? Under what circumstances is it better to plan separately?*
    3. *Where and why is it necessary to invest (adopt, support, promote, create) in integrated planning for water and energy systems?*
    4. *What are key barriers to be overcome to enable integrated water and electric utility planning?*

The participants decided to focus on questions 4 (barriers) and 1 (benefits). (Noting that the organizers were encouraging the participants to focus on question 1).

3. For each table, a table "host" was identified. This was generally someone who had not previously had a role such as a tournament presenter or judge. The role of the table host, like in a good café situation, was to make sure people have been introduced and heard. They also chaired and recorded the discussion on butcher's paper. Toward the end, the host facilitated agreement on major points where that was possible.
4. After approximately 20 minutes, everyone except the host had to leave the table and go to another table at the café (i.e. table memberships were swapped in a random, organic manner.)
5. When the new table guests arrived, the host briefly explained where the earlier discussion had landed, along with major points. New guests to the table described

[2] Kenway, S., McMahon, J., Elmer, V., Conrad, S., Rosenblum, J., 2013. Managing water-related energy in future cities–a research and policy roadmap. Journal of Water and Climate Change.

what they had found important at their previous table discussions along with any new insights they had. The host continued to record the new information readjust priority points if needed for the table.

6. The process was repeated (i.e. steps 4 and 5 were repeated).
7. Finally the café was "closed", with each table host briefly presenting (2-3 minutes) the main points arrived at by the table. The summary below is an amalgamation of the points made by each team.

### *Results*

Key barriers

***Question 1: What are key barriers to be overcome to enable integrated water and electric utility planning?***

A number of barriers were identified including current fragmentation of water systems vs. energy systems. There are currently many quite small water systems and utilities. This makes it difficult for the (generally larger) electric utilities to coordinate with them. There is also a difference in public vs. private goals, drivers, and management between water and electric utility systems. Water systems are often municipal systems whereas electric utilities are typically privately operated. The different operational jurisdictions, the degree of utility centralization/decentralization, and the lack of consistent spatial boundaries of operation (of water and energy utilities) were all seen as barriers to integration..

As most mechanisms for funding water and energy assets are separate, this also creates barriers. Integrated funding – i.e. government funding mechanisms which encourage integrated water and energy solutions could break silos and foster collaboration.

One New York City utility noted that revenue decoupling had helped enable stronger collaboration across water and energy. Decoupling had involved separating financial returns to utilities from volumetric sales (i.e., sales of kWh/ML). In contrast, "decoupled" utilities received increased payments for meeting conservation targets. It was noted however that "decoupling" was individually insufficient to incentivize joint planning efforts and is not common across the United States.

Lack of integrated approaches to data collection, storage and analysis was seen as important. Integrated or improved coordination was viewed as essential to quantifying some of the impacts (e.g., of water or energy) and consequently would be of strong value in designing water-energy systems in ways that are mutually-beneficial (perhaps as opposed to problem-shifting). A key research need was identified – "quantify benefits of integrated water-energy planning". However, it was also noted that such quantifying benefits can be partially dependent on integrated water-energy data, i.e., being able to actually access mutually compatible water and energy data (of similar spatial, temporal pattern) such that impacts of water on energy, or vice versa, could be quantified.

Other groups of barriers identified in the café are summarized below (with minimal edits made to the original notes from each café table for clarity).

- There are often competing stakeholder interests such as environmental versus electric or water system needs.
- Consumer Awareness / Education on water-energy needs to be improved.
- A general barrier was that "we have not done it that way before" and "the same language is not used across the water and energy sectors".
- The current "silo mentality" is a barrier. Silos were also identified as potentially including institutional, industrial, technological, momentum, cultural (customer acceptance), and planning factors across electric and water sectors.
- There are often historical reasons, which have put water and energy systems on particular trajectories. There are conflicts in goals, priorities and budgets. There is also a lack of communication across the sectors, as well as legal and liability barriers.

Regulatory / Political barriers:

- Lack of allocation/accounting methodology for receiving credit or recognition for implementing actions that results in be external benefits (e.g., implementing water initiatives which have energy sector benefits such as reducing peak demand).
- Rate of return decisions not recognizing ROI (return on investment) (e.g., from water investments on energy assets or vice versa).
- Water and energy goals are not linked
- There is a changing political landscape which influences water (which is typically publically owned and State-managed) versus energy (which is more privately owned and Federally-regulated).
- Water does not get full and fair billing
- There is a lack of political continuity leading to undeveloped or unimplemented plans

Institutional issues were identified as key barriers including:

- Different management and different bottom lines between water and energy
- Data sharing between utilities
- Lack of common goals (noting that California is different, thanks to the Californian Public Utilities Commission leadership).
- Regulatory drivers are different between utilities
- Regional differences
- Lack of organizational buy-in to integrated planning

Financial barriers:

- Differences in budgets for integrated planning (water budgets = millions, energy budgets = billions)
- Need to share water/energy costs/benefits. Harvesting these benefits can be a challenge as spread across a number of systems (or even households/sites), individual benefits can be small, but collectively they can be significant.. This needs to be considered in rebates and demand management programs.
- Operational and maintenance costs limits investments
- Existing capital investment requirements
- Different investment timelines
- Overlapping NPV's (Net Present Values)

Geographic barriers:

- Physical
- Political and jurisdictional boundaries
- Regulatory boundaries
- Co-locations of facilities in different geographic boundaries

Ownership barriers:

- Public vs Private
- Proprietary

Physical barriers:

- Smart metering
- Markets, different timing of supplies and demand
- Virtual water connections / physical electricity connections
- Water utilities often do not represent a significant customer for some electricity utilities in term of infrastructure connections
- Risk and cost shifting recovery
- Automation within operations
- Water footprinting

Structural (Institutional and organisational) barriers:

- Regulations keep utilities from taking initiative
- Mandates
- Goals
- Resources
- Collectively these influence tools
- Organisations, agencies, commissions, multi-stakeholders

Perspective / World View:

- Differences between industries
- Timescales

A number of possible strategies were put forward for overcoming barriers:

- Strategies and technologies/methods including multi-State, and multi-region approaches
- Implementing a coordinating body and process
- Focusing on an overall outcome and identifying best practice including: cost reductions, profits or rate stability, identifying cross-subsidies or cross-incentives, and net metering
- Broader regulations
- Capitalizing on a crisis (having response plans in place)

### Benefits of integrated planning

***What are the benefits, or desirable outcomes of integrated water and electric utility planning (what will be "lost" for utilities, cities, regions without integrated planning)?***

A major benefit was identified as joint goal setting and joint evaluation of results. There are common goals to increase system solutions that are greater than the sum of the separate (water and electric) parts. It is likely that more sustainable solutions will be identified that address problems across both the water and energy issue-sets.

There is a significant opportunity for joint water-electric planning noting:

- There is a need to identify specific areas where there is overlap of jurisdiction and interest.
- There are different opportunities in retrofits and new growth (including siting, city planning and land use). Water and electric utilities need to present a joint agenda here.
- It is necessary to also consider wastewater – energy – heat – connections, as there is a strong resource link between wastewater and energy generation (wastewater is recognized as a component of integrated planning, but was not central focus in scenarios for the tournament).
- Need to avoid financial risks – how to influence/expose/plan for unexpected expenditures.
- Need to recognize wastewater generated electricity as renewable
- Incentivize the relationship between water and electric utilities (perhaps through regulations)
- Water sector benefits were perceived to be greater than the benefits to the electric utility.
- A substantial opportunity lies in jointly planning storage for drinking water or electricity.
- Urban planning and capacity can lead the progress toward integrated planning

- Expand and revise political dimensions
- Support formal joint trade association relationships (e.g., American Water Works Association and Electric Power Research Institute)
    - The National Association of Regulatory Utility Commissioners (NARUC) was noted as an opportunity to explore benefits through:
        - Water and electric utility coordination
        - Hosting joint sessions
        - Learning among Public Utility Commissions for example if California and Los Angeles share their progress

Cost savings to both sectors can be realized through:

- Joint planning
- Joint implementation of efficiency programs
- Common metering strategies in the new smart grid
- Shared infrastructure costs (digesters etc.)
- Multiple innovative opportunities and synergies

Better consumer awareness of linkage in water and electric (energy) systems could be achieved:

- One marketing campaign
- One audit/visit
- One-stop rebate shop
- Shortage strategies in water and electric systems that are truly joint messages
- Greater customer satisfaction
- Better joint messaging to consumers (e. g. hot water heater temperatures vs. Legionella disease).

Better information could be made available to customers:

- Integrated billing information
    - kWh used (related to water use)
    - Gallons consumed (related to energy use)
    - Compare to utility standards
- Point of use information
    - Real time water/electric usage and cost
    - Savings/efficiency opportunities
- Home "GreenSheet" data for new home sales
- Market Efficiency Improvement Credits to offset upgrades and in-turn reduce capital expenditure for utilities
- Performance based incentives for utilities rate-based assets

Improved system resiliency and response could be realized through:

- System optimization modelling and joint operation
- Cross training of staff in joint operations

- Driver for electric sector is renewable. (Identify mutually beneficial opportunities, sharing waste products).
- Sustainability and resiliency including risk mitigation
- Improves environmental management through a total system view of the environment and its resources

***What is lost if integrated planning is not done? (these are the benefits if done well)***

- Opportunities for synergies and mutual efficiencies
- Opportunities to reward good behaviour
- Business opportunities
- Opportunity for resiliency and diversity
- Prices / Rates reflect the true cost of resources
- Opportunities to eliminate single point of failures
- Awareness, and customer knowledge

## Conclusions

The joint planning tournament has provided the opportunity for water and electric utility sector participants to share knowledge and experiences, learn terminology, and collaborate in developing realistic water and electric integrated plans to respond to possible scenarios affecting communities. The joint planning tournament builds on the work of International Drought Tournament and is an innovation in the field of planning and simulation gaming. The tournament process provides opportunities for social learning and allows players to holistically consider the impact of scenarios affecting water and energy resources. It supports players' consideration of planning options and facilitates communications between diverse stakeholders, in an environment that is fun for participants.

The joint planning tournament has proven to be an effective means for providing data for the larger research project and provides a possible mechanism to support integrated planning in real world applications. Information collected in this tournament is being truth tested in a national sector survey. As well, interest in holding regional joint planning tournaments is forming in Brisbane (Australia), Boston (Massachusetts), New York City (NY), and Vancouver (Canada).

## Appendix A – Participant List

| Name | Organization | Role |
|---|---|---|
| Adam Carpenter | American Water Works Association | Player |
| Alfred Picardi | Exelon Corporation | Player |
| Amelia Nuding | Western Resource Advocates | Player |
| Anthony Fiore | NY Department of Environmental Protection | Player - Judge |
| Brett Gracely | Colorado Springs Utilities | Player |
| Carol Howe | ForEvaSolutions | Player - Judge |
| Cmmr. Catherine J. K. Sandoval | California Public Utilities Commission | Observer – Key Note Speaker |
| Delon Kwan | LA Department of Water and Power | Player - Judge |
| Eric Fitzer | AZ Governor's Office of Energy Policy | Player - Context Presenter |
| Jamie Brennan | DG Con Edison of New York | Player |
| Jason Turgeon | US Environmental Protection Agency | Player - Context Presenter |
| Jeff Carmichael | Metro Vancouver | Player - Context Presenter |
| Jim McMahon | Better Climate Research and Policy Analysis | Player - Context Presenter |
| Joe Casola | Center for Climate and Energy Solutions | Player |
| John Whitler | Water Research Foundation | Observer |
| Kelly Twomey Sanders | University of Southern California | Player - Judge |
| Kristen Averyt | University of Colorado Boulder | Player |
| Linda Reekie | Water Research Foundation | Organizer & Observer |
| Lindsey Geiger | American Water Works Association | Observer and roaming player |
| Maria Brusher | University of Queensland | Organizer & Observer |
| Mary Ann Dickinson | Alliance for Water Efficiency | Player - Context Presenter |
| Michael Dirks | Water Research Foundation | Observer |
| Michael McDonald | American Water | Player |
| Mike Hotaling | Newport News Waterworks | Player |
| Mohammad Badruzzaman | MWH Global | Player |
| Noah Mundt | DNV GL, Consultant Arizona Power Services | Player |
| Paul Fesko | The City of Calgary | Player - Judge |
| Robin Newmark | National Renewable Energy Laboratory | Player |
| Seth Nowak | American Council for an Energy-Efficient Economy | Player |
| Steve A Conrad | Simon Fraser University | Facilitator, Referee, Context Presenter |
| Steven Kenway | University of Queensland | Facilitator, Referee, Context Presenter |

| Name | Organization | Role |
|---|---|---|
| Valerie Roundy | Water Research Foundation | Organizer & Observer |
| Vincent Tidwell | Sandia National Laboratories | Player |
| Wendy Anderson | Metro Wastewater Reclamation District | Player |

### Team Roster

| Team 1 "Kill a Watt" |
|---|
| • Michael McDonald |
| • Wendy Anderson |
| • Vincent Tidwell |
| • Noah Mundt |
| • Carol Howe |
| Team 2 "RC[3]"[3] |
| • Anthony Fiore |
| • Jamie Brennan |
| • Mohammad Badruzzaman |
| • Robin Newmark |
| • Joe Casola |
| Team 3 "The Team Formerly Known as Desal or Die" |
| • Delon Kwan |
| • Jason Turgeon |
| • Mary Ann Dickinson |
| • Paul Fesko |
| • Kristen Averyt |
| Team 4 "O' Water Where Art Thou" |
| • Mike Hotaling |
| • Brett Gracely |
| • Eric Fitzer |
| • Amelia Nuding |
| • Jim McMahon |
| Team 5 "Excellence" |
| • Jeff Carmichael |
| • Alfred Picardi |
| • Adam Carpenter |
| • Kelly Twomey Sanders |
| • Seth Novak |

[3] Resilient, Cost effect, Clean, Community Involvement

## Appendix B – Agenda

| Day 1 | |
|---|---|
| 13:00 | • **Coffee/tea, arrival, registration** |
| 13:30 | • **Welcome**<br>o Introduce tournament process & purpose<br>o Introductions<br>▪ ***Consider the question*:** Where do see yourself or your organization the scale of the implementation of water and electric utility integrated planning? |
| 13:45 | • **Why water and electric utility integrated planning…**<br>o **Steve Conrad**, Simon Fraser University<br>o Message by Minister Mark McArdle, Minister for Water and Energy Supply<br>o **Steven Kenway**, University of Queensland<br>o **Mary Ann Dickinson**, Alliance for Water Efficiency<br>o **Jason Turgeon**, US EPA<br>o **Jim McMahon**, Better Climate Research and Policy Analysis<br>o **Jeff Carmichael,** Metro Vancouver<br>o **Eric Fitzer,** AZ Governor's Office of Energy |
| 15:45 | • **BREAK** |
| 16:00 | • **Process and Agenda Review**<br>o How we will work together, introductions, "rules" of the game, review scoring process<br>o Introduce Meadowlands<br>• **Team organization**<br>o Review team assignments and clarify |
| 16:30 | • **Preparing for the Scenarios (Plenary)**<br>o Frame the challenge<br>▪ *Present Scenario Topics*<br>o Reference the scoring and score board<br>o Name the Judges |
| 16:40 | • **Team Discussion and Decision (Table Discussion – Break-outs)**<br>o Continued introductions for team members at their tables<br>o Development of overall Management goal<br>▪ ***Discuss***: What is the team's long-term management goal?<br>▪ Teams will develop different management goals to guide their consideration of planning options |
| 17:15 | • **Closing Comments and Preparing for Tournament on Day 2**<br>o Return to Holiday Inn, shuttle to dinner |
| 18:30 | • **Networking Dinner (hosted)**<br>o Hacienda Colorado at Wadsworth and Belleview |

| Day 2 | |
|---|---|
| 07:30 | • **Coffee/tea, arrival** |
| 08:00 | • **Welcome and brief review of days agenda**<br>o Review of tournament process |
| 08:05 | • **Teams return to group discussion and reflect on Management goals**<br>o Record management goals on white boards |

| Day 2 | |
|---|---|
| 08:15 | • **Morning Tournament**<br>• **Round #1 – Overview**<br>  o Present Scenario #1 |
| 08:25 | • **Team Discussion and Decision**<br>  o Appointment time, spokesperson, documenters, and recorders for the round<br>  o Consider options and development of Integrated plan to meet the goals of scenario #1<br>  o Record discussion points<br>  ▪ Template for recording discussion provided<br>• **Provide decisions to referees by 9:10 am** |
| 09:10 | • **Team Discussion and Decision**<br>  o Finalize recording discussion points<br>  ▪ Template for recording discussion provided<br>  o What are the implications of system interactions for our integrated plan overall<br>  o Team's Prepare short 5 minute presentation<br>  ▪ Template for short presentation is provided |
| 09:30 | • **Debrief – Round #1**<br>  o Team Presentations (5 minutes each) – What strategies/approaches did you chose? Why?<br>  o After each presentation, judges, observers, and individuals in the room given 1 minute to score the team<br>  o Total score recorded on score board |
| 10:00 | • **Begin Round #2 – Overview**<br>  o Present Scenario #2 |
| 10:05 | • **Team Discussion and Decision**<br>  o Appointment time, spokesperson, documenters, and recorders for the round<br>  o Consider options and development of Integrated Plan to meet the goals of scenario #2<br>  o Record discussion points<br>  ▪ Template for recording discussion provided<br>• **Provide decisions to referees by 10:50 am** |
| 10:50 | • **Team Discussion and Decision continued**<br>  o Finalize recording discussion points<br>  ▪ Template for recording discussion provided<br>  o Team's Prepare short 5 minute presentation<br>  ▪ Template for short presentation is provided |
| 11:10 | • **Debrief – Round #2**<br>  o Team Presentations (5 minutes each) – What strategies/approaches did you chose? Why?<br>  o After each presentation, judges, observers, and individuals in the room given 1 minute to score the team<br>  o Total score recorded on score board |
| 12:00 | • Lunch (Hosted)<br>Keynote: Commissioner Catherine J. K. Sandoval, California Pubic Utilities Commission |
| 13:00 | • **World Café Discussion**<br>  o Introduction, process, roll of table hosts<br>  o Consider the questions:<br>  ▪ *What are the benefits or desirable outcomes of integrated water and electric planning & management?*<br>  ▪ *Under what circumstances is integrated water and electric planning of high value and enabled? Under what circumstances is it better to separately plan for water and energy?* |
| 13:15 | • **Table group discussions**<br>  o Rotating table discussions (2 of 3 rounds of 20-25 minutes)<br>  ▪ Breaks as needed during discussions |

| Day 2 | |
|---|---|
| 14:30 | • **Group Presentations**<br>  ○ Groups present table discussions (5 minutes each) |
| 15:00 | • **Final Plenary Debrief – Key Lessons Learned and Overall Exercise**<br>  ○ Given the overall objectives of the Tournament<br>  ▪ From a process perspective...What was useful? Key lessons learned?<br>  ▪ What are the implications of the exercise for integrated planning in your organization/region?<br>  ▪ How would this type of tournament/exercise apply or add value in in promoting WEUIP efforts? |
| 15:30 | • Closing Comments and Next Steps (Organizer(s))<br>  ○ Announce winner<br>  ○ Award Prizes |
| 15:45 | ○ Organize transportation return to Airport |

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## Tournament Roles

| Players | Facilitator/Organizers |
|---|---|
| • Actively participate in the WEUIP Tournament<br>• Consist of players from electric and water utilities, government, industry, and academia/NGO<br>• Within the team – time keepers, spokespersons and recorders are selected for each round | • Facilitate the process overall<br>• Work together to adjust as necessary<br>• Answer question regarding process, technical options |

| Observers or "Fans" | Judges |
|---|---|
| • Observing the process for potential planning tournament application and feedback – on process, organization etc.<br>• Scoring Team presentations/choices | • Evaluate the cost and benefits of innovative adaptation options<br>• Engage in the scoring process along with the individual players and teams |

| Referees |
|---|
| • "Content" experts that can be consulted by teams<br>• Evaluate the cost and benefits of innovative options |

## Appendix C – List of Planning Options

| Code | Management Strategy | Cost | Water Supply (Δ annual average) | Water Demand (Δ annual average) | Electric Supply (Δ annual average) | Electric Demand (Δ annual average) |
|---|---|---|---|---|---|---|
| D1 | Implement a region wide water and electric conservation program. Program elements include water and energy audits, informative resources and case studies. | $42,000,000 | | -5% to -25% | | -5% to -25% |
| D2 | Implement watering restriction program | $1,750,000 | | -30% | | -1% to -3% |
| A1 | Construction of Aquifer Storage and Recovery (ASR) facilities | $34,000,000 | +5% to +10% | | 0 to +1% | |
| A2 | Construction of desalination plant in Port Bay | $45,000,000 | +5% to +10% | | +3% to +4% | |
| A3 | Construction of Alpine lake (not currently used to supply water) transmission pipeline | $19,300,000 | +5% to +10% | | +1% | |
| M1 | Implement combined real-time metering and customer reporting program | $45,000,000 | | -5% to -10% | | -5% to -10% |
| E1 | Construct a deep water lake cooling supply | $22,000,000 | | | | -2.5% |
| E2 | Convert 25% of existing cooling towers to dry cooling technologies | $45,000,000 | | -7.5% to -12.5% | | |
| S1 | Construct a waste heat recovering facility for hot water supply to the Meadowlands industrial park | $45,000,000 | | | | -1% to -2% |
| S2 | Construct a co-generation facility at Meadowlands south wastewater plant | $34,000,000 | | | +1% to +2% | |
| S3 | Construct additional hydro electric generation facility on Thatch River | $45,500,000 | +.1% | | +5% to +10% | |
| S4 | Construct additional diversion tunnel at Lake 2 to Meadowlands | $24,000,500 | +2% to +5% | | | 0 to -1% |

| Code | Management Strategy | Cost | Water Supply (Δ annual average) | Water Demand (Δ annual average) | Electric Supply (Δ annual average) | Electric Demand (Δ annual average) |
|---|---|---|---|---|---|---|
| E3 | Undertake a leak identification and repair program | $12,330,000 | | -10% to -25% | | -1% to -4% |
| Q1 | Improve the water quality of Lake 1 by adding a UV disinfection system | $23,000,000 | +2% to +5% | | | +1% to +3% |
| Q2 | Develop a joint watershed management program to reduce the risk from microbiological or chemical contamination by restriction access to the source watersheds | $1,500,000 | +1% to +2% | | | |
| S5 | Implement alternatives to potable water for specific purposes, including:<br>• rainwater harvesting for irrigation;<br>• greywater and reclaimed wastewater for residential, commercial, institutional, and agricultural use;<br>• groundwater for irrigation;<br>• river and sea water for waterfront businesses. | $4,500,300 | | -5% to -7% | | +1% to +2% |
| P1 | Set wholesale water rates and water rate structure to reflect the true cost of regional water supply | ($12,500,000) | | -1% to -2% | | |
| P2 | Developed a three tiered water rate structure | $5,500,300 | | -5% to -15% | | 0 to -1% |
| P3 | Develop a municipal rebate programs for water and energy efficient fixtures and appliances | $5,000,000 | | -5% to -15% | | -2.5% to -6% |
| S6 | Complete a joint water use plan to manage hydropower at the Lake 1 | $250,000 | -0.50% | | | +1% |
| G1 | Expand solar generation facilities | $36,300,000 | | -1% to -5% | +4.5% | |
| G2 | Expand wind generation facilities | $14,000,000 | | -1% to -5% | +4% | |

## Appendix D – 4469 Tournament Scenario 1 Technical Brief

To: Joint Water Electric Planning Group

From: Technical Staff, Meadowlands

Subject: Securing water supply futures

Recent flows in the Thatch River have been dropping and historically low rainfall has been recorded in the catchment over the last 5 years. Low flows have reduced water quality and quantity, making it difficult to provide water to meet drinking water and electric power generation needs during the summer months. Lower water quality has also increased water treatment costs.

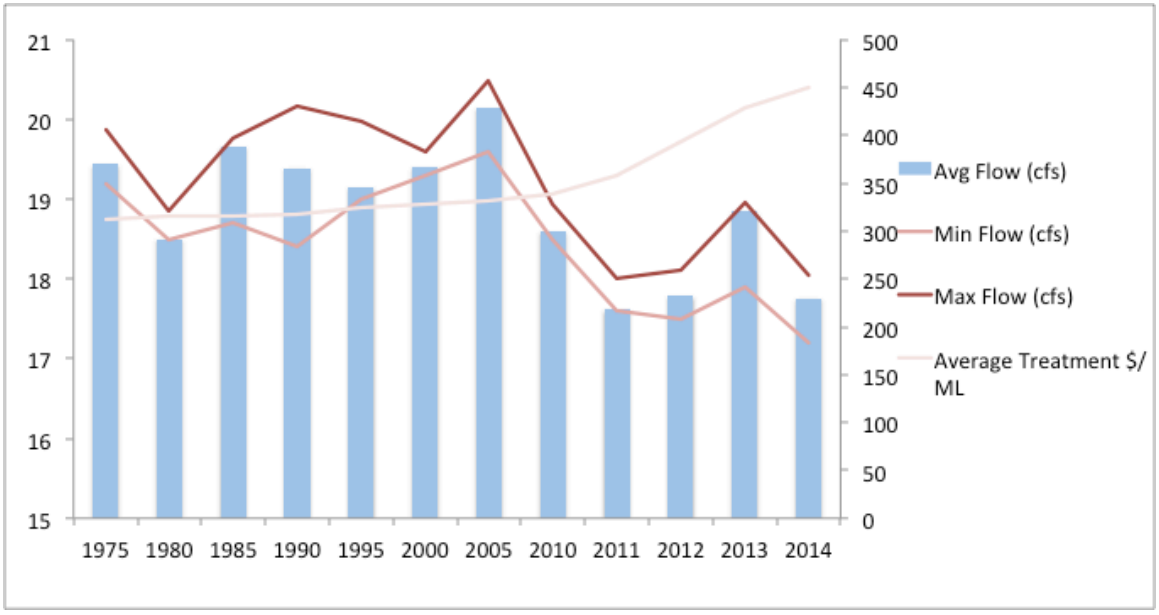


**Figure 5 - Thatch River Historical Flow and Treatment costs**

Over the past few years, Meadowlands' water utility has been drawing more water from groundwater resources during periods of low flow when allocations are reduced, resulting in a noticeable drop in groundwater aquifer levels. A study has recently provided data on the sustainable yield of the groundwater aquifer, suggesting that a minimum 10% reduction in ground water withdrawals are needed to maintain current groundwater levels. Moreover, the region's Independent System Operator Corporation recently commissioned a report that details an appreciable reduction in available water to the region's generation facilities.

Compounding this situation is the fact that much of the City's infrastructure was built in the post war boon (1950-1970) to support growth in the region. Water main breaks are becoming more frequent and electric transmission lines are at capacity. Maintenance and

incident response costs are increasingly affecting water and electric utility rates. Increased spending has driven electric rates higher with 30% of annual utility (on average for the regional electric and water utilities) budgets spent on infrastructure issues.

### *Aging Infrastructure*

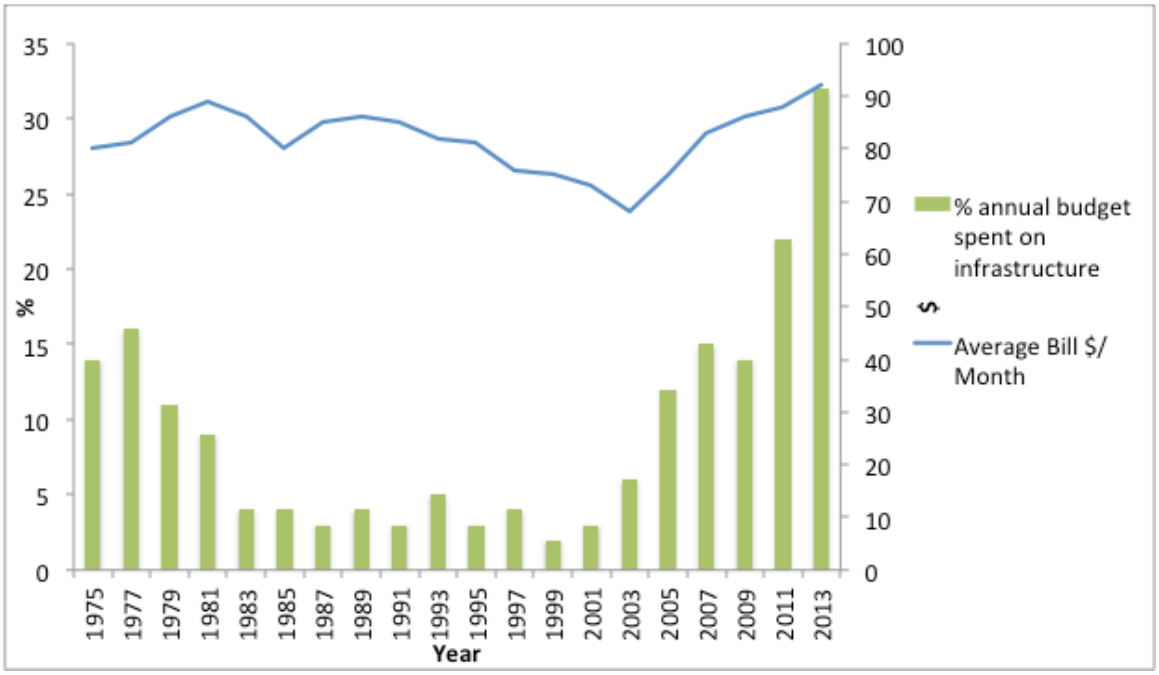


**Figure 6 - Average home electric bill and % spent on infrastructure**

As is, the region will soon experience increased conflict for existing water resources and your planning team has been asked by the region's water and electric governing board to ***prepare a strategy for sustainable management of water over the next 20 years.*** This strategy will be presented to the board, regional utilities, and community.

## Appendix E – 4469 Tournament Scenario 2 Technical Brief

To: Joint Water Electric Planning Group

From: Technical Staff, Meadowlands

Subject: Energy transformations

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The region's electric power supply has been relatively secure over the preceding decades with a mix of hydroelectric, coal-fired, gas-fired, and cogeneration.

**Table 5 – Generation (peak + reserve margin) capacity by fuel type (MW)**

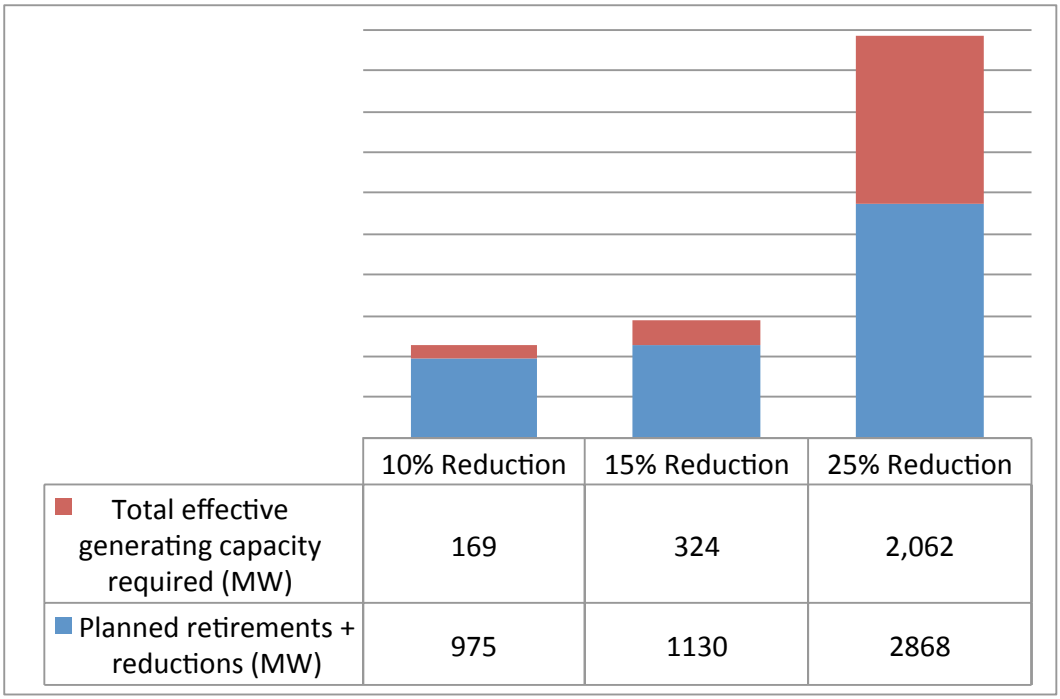
| Year | Coal-fired | Cogeneration | Gas-fired | Hydro | Wind | Solar | TOTAL |
|---|---|---|---|---|---|---|---|
| **2013** | 6,271 | 1,234 | 1,643 | 3,894 | 1,088 | 438 | 14,568 |

However, in June, 2014 the federal government proposed a *Clean Energy Plan* proposing to reduce carbon dioxide ($CO_2$) emissions from the country's coal-fired and gas-fired generation facilities.

In August 2014, the region's Independent System Operator Corporation commissioned a report detailing future generation requirements along with the retirement of current regional facilities required to meet different levels of $CO_2$ emission reduction targets. Table 6 and Figure 7 illustrate the outcomes of this work.

**Table 6 - 2024 Generation Forecast (MW)**

| | 2030 | |
|---|---|---|
| Forecast Meadowlands' Regional annual peak demand | 12,470 | **Forecast Requirements** |
| Effective generation capacity required to meet peak demand + reserve margin | 14,340 - 15,588 | |
| Existing generation capacity (end of 2013) | 14,568 | |
| Effective existing generation capacity (end of 2013) | 13,276 | **Current Capacity** |



| | 10% Reduction | 15% Reduction | 25% Reduction |
|---|---|---|---|
| Total effective generating capacity required (MW) | 169 | 324 | 2,062 |
| Planned retirements + reductions (MW) | 975 | 1130 | 2868 |

**Figure 7 - 2030 forecasted reduction in current generation to meet CO2 reduction requirements**

Next year, the Federal government will set a reduction requirement for the region. It is unclear what level of reduction will be required. To prepare for the pending requirement, your planning team has been asked by the region's water and electric governing board to ***prepare an integrated water and energy transformation plan for the next 10 years.*** In developing the plan, your team must consider the impact of generation facilities on existing hydrological resources.

Your team's plan will be presented to the board, regional utilities, and community.