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Water-Energy Cost Effectiveness Analysis

PREVIEW Presentation of Work Plan

January 23, 2014

DISPUTES & INVESTIGATIONS • ECONOMICS • FINANCIAL ADVISORY • MANAGEMENT CONSULTING

Content of Report

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The goal of our research effort is to develop a method of valuing the monetary benefits of water savings via CPUC cost effectiveness tests.

- CPUC decision 12-05-01 stated it is “not prudent to spend significant amounts of ratepayer funds on expanded water-energy nexus programs until the cost-effectiveness of these programs, and particularly the net benefits that accrue to energy utility ratepayers, are better understood.”
- Past water-energy studies have focused on a “snapshot” of water infrastructure and its energy requirements today
- This analysis needs to look to the future: what future costs associated with water and energy infrastructure will be avoided as a result of water conservation?

California IOUs can already rebate high efficiency Clothes washers …

… does it benefit energy ratepayers for IOUs to rebate high efficiency toilets?

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Our core objective is to recommend modifications to existing Cost Effectiveness (CE) frameworks to include consideration of water.

- » Existing cost effectiveness frameworks value "Site Energy" savings using the avoided cost (AC) of energy.
- » Avoided cost of energy is based on the characteristics of California's marginal energy supply (a natural gas combined cycle power plant).

$$Benefit\ Cost\ Ratio = \frac{Site\ Energy\ AC}{Equipment\ Cost + Program\ Cost}$$

Where:

$$Site\ Energy\ AC = Site\ Energy\ Savings\ x\ Avoided\ Cost\ of\ Energy$$

- » Modifications to the benefits portion of the equation are needed to account for water savings.

$$Benefit\ Cost\ Ratio = \frac{Site\ Energy\ AC + Embedded\ Energy\ AC + Water\ Capacity\ AC + Environmental\ Benefits}{Equipment\ Cost + Program\ Cost}$$

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The study will develop the input values and methodology required to value the benefits of water savings.

$$Benefit\ Cost\ Ratio = \frac{Site\ Energy\ AC + \boxed{Embedded\ Energy\ AC} + \boxed{Water\ Capacity\ AC} + \boxed{Environmental\ Benefits}}{Costs}$$

Embedded Energy AC = Water Savings x **Marginal Energy Intensity** x Avoided Cost of Energy

Task 1.1: Avoided Embedded Energy Savings

Water Capacity AC = Water Savings x **Avoided Water Capacity Cost (Capital + O&M)**

Task 1.2: Avoided Water Capacity Cost and Environmental Benefits

Environmental Benefits = Water Savings x **Environmental Benefit Factor**

Task 1.2: Avoided Water Capacity Cost and Environmental Benefits

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Task 1.1 and 1.2 will determine the Avoided Embedded Energy and Water Capacity Costs respectively.

» Task 1.1: Avoided Embedded Energy Cost
  - Select marginal supply
  - Estimate energy intensity
  - Build Avoided Embedded Energy Cost calculator

» Task 1.2: Avoided Water Capacity Cost
  - Estimate Avoided Water Capacity Cost (Capital and O&M) by water system component
  - Research Environmental Benefits
  - Build Avoided Water Capacity Cost calculator

» Task 2: Integrating Water-Energy Considerations into Existing Cost Effectiveness Calculators for Demand Side Programs
  - Develop a comprehensive report
  - Integration with DEER
  - Educating program administrators
  - Presentation to stakeholders

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Task 1.1 will determine values for the Avoided Cost of Embedded Energy in water at the regional level.

Identify Geographic Regions	Determine Marginal Supply	Estimate Energy Intensity	Develop Calculator
• Determine regional breakdown • Identify the major water supply options (both current and future)	• Examine water supply planning processes and documentation • Indicate the regional marginal supply	• Estimate the energy intensity of water supplies including the marginal supply • Estimate the energy intensity of treatment, distribution, etc.	• Develop an embedded energy avoided cost calculator • Regional distinctions for regional analysis

» The marginal supply is meant to represent the supply which the region on aggregate will reduce (and avoid future investment in) when water is conserved in the region

» The Navigant team's goal is to develop a transparent framework that can be updated with new data and understanding as it becomes available (fully vetted with the CPUC).

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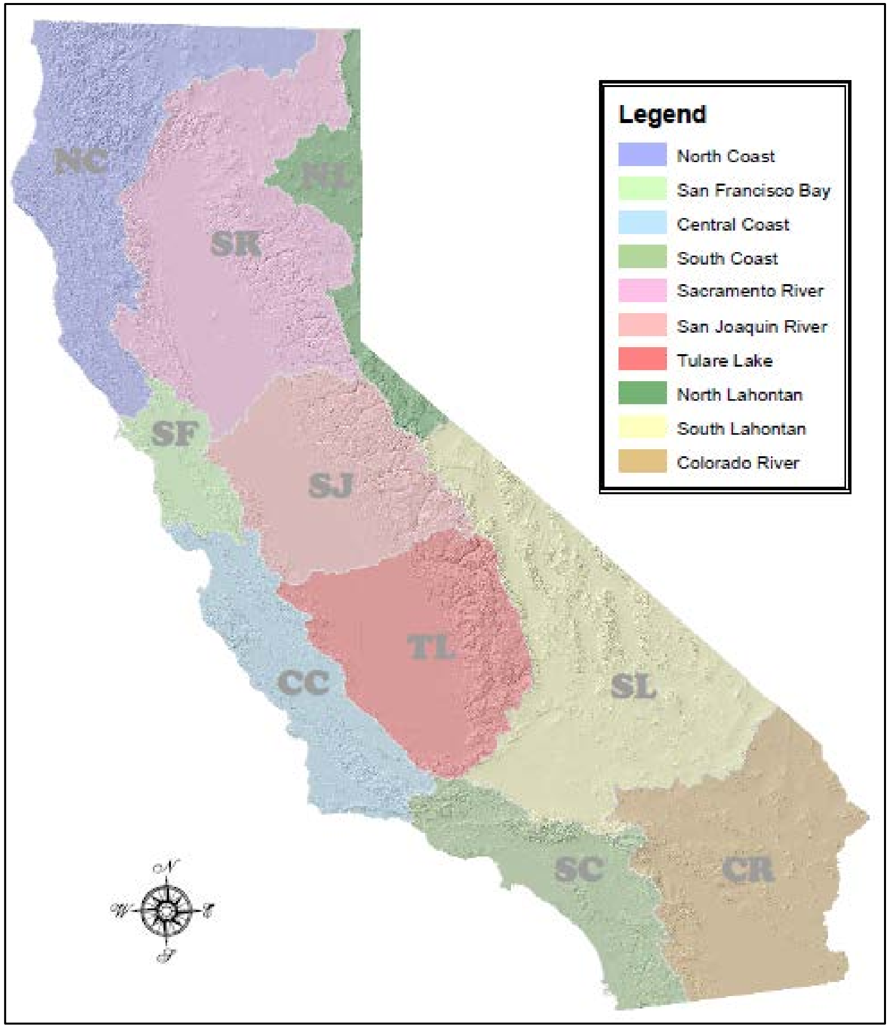
The team will conduct analysis at the CA Department of Water Resources Hydrologic Region level.

» Many water supply planning activities and data are available at this level; water supply options are relatively consistent within a hydrologic region.

» The Navigant team can leverage the multitude of existing studies and reports that already document water supplies and their energy intensities at the hydrologic region.

» The Navigant team will prepare GIS maps comparing hydrologic regions to IOU service territories, major water systems, and DEER climate zones.



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The team will determine the currently available water supplies as well as future water supply options at the regional level.

- Water supplies are varied across the state.
- "Conventional" supplies provide approximately 95% of the state's water and consist of:
  - Local surface supplies (local rivers, streams, lakes, and reservoirs),
  - Groundwater
  - Imported water (water from the State Water Project, Colorado River, or Central Valley Project).
- "Non-conventional" sources account for a small portion of existing supply but may see significant investment in the future. These include:
  - Recycled water
  - Seawater desalination
  - Brackish water desalination

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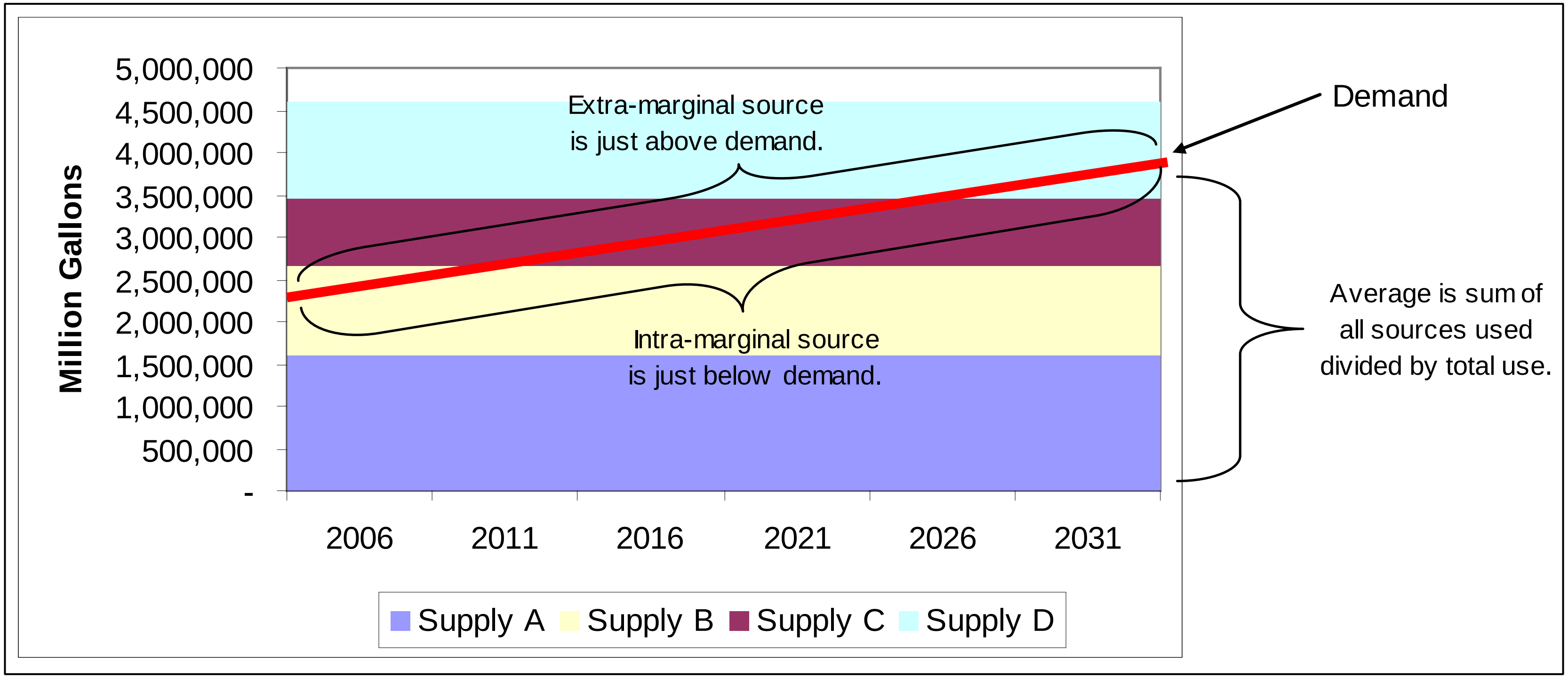
Research will determine the short term (< 10 years) and long term (> 10 Years) marginal water supply for each region.

- Like energy supplies, it takes time to develop additional water supplies
- Long term supplies are more uncertain; but determining these supplies is necessary because efficiency measures are expected to last >10yrs.

Illustrative Relationship of Demand and Supply Options



Navigant. *Refining Estimates of Water-Related Energy Use in California*, Prepared for the CEC. 2006

The Navigant team will refine and implement a methodology to determine the marginal water supply in each region.

1. Identify the supply options available in each region and time period leveraging DWR data sources, IRWMPs and UWMPs
2. Evaluate the economic and physical characteristics of each supply as well as legal and institutional issues
3. Using supply characteristics, determine short and long term marginal supply for each region
4. Vet marginal supply selections with the CPUC, PCG, and other experts such as DWR staff, regional water planners, and large wholesale and retail water agencies
5. Update the marginal supply selection based on feedback as needed

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The Navigant team will consider the operations of the State Water Project (SWP) during marginal supply selection.

» Many regions use SWP for a significant portion of their supplies, and look to the SWP for future supplies.

» The SWP is complex; subject to many legal requirements and restrictions that impact water availability and deliveries

» The Navigant team will consider the real world operations of the SWP

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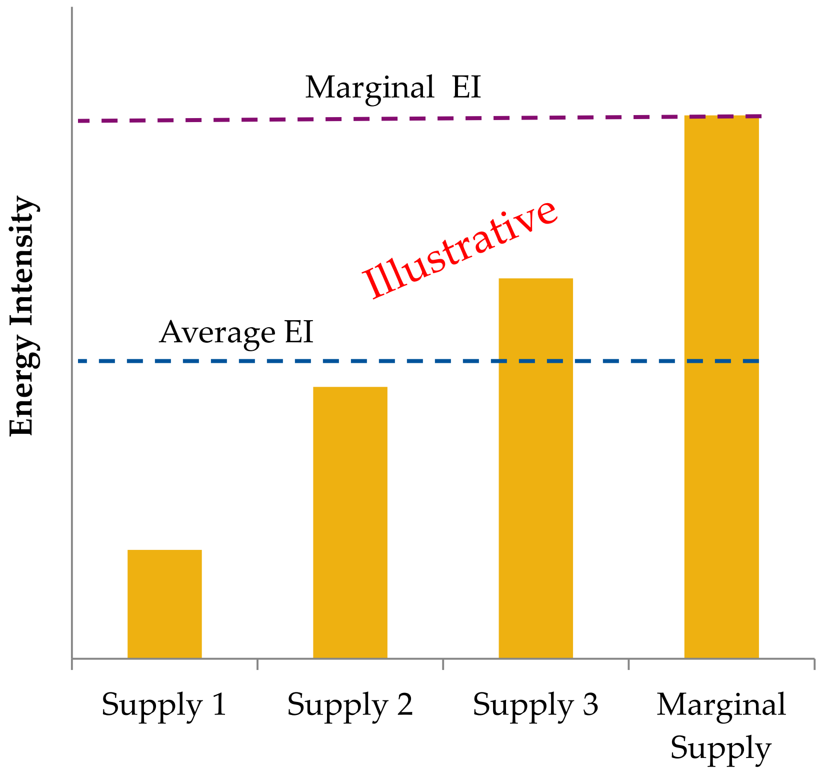
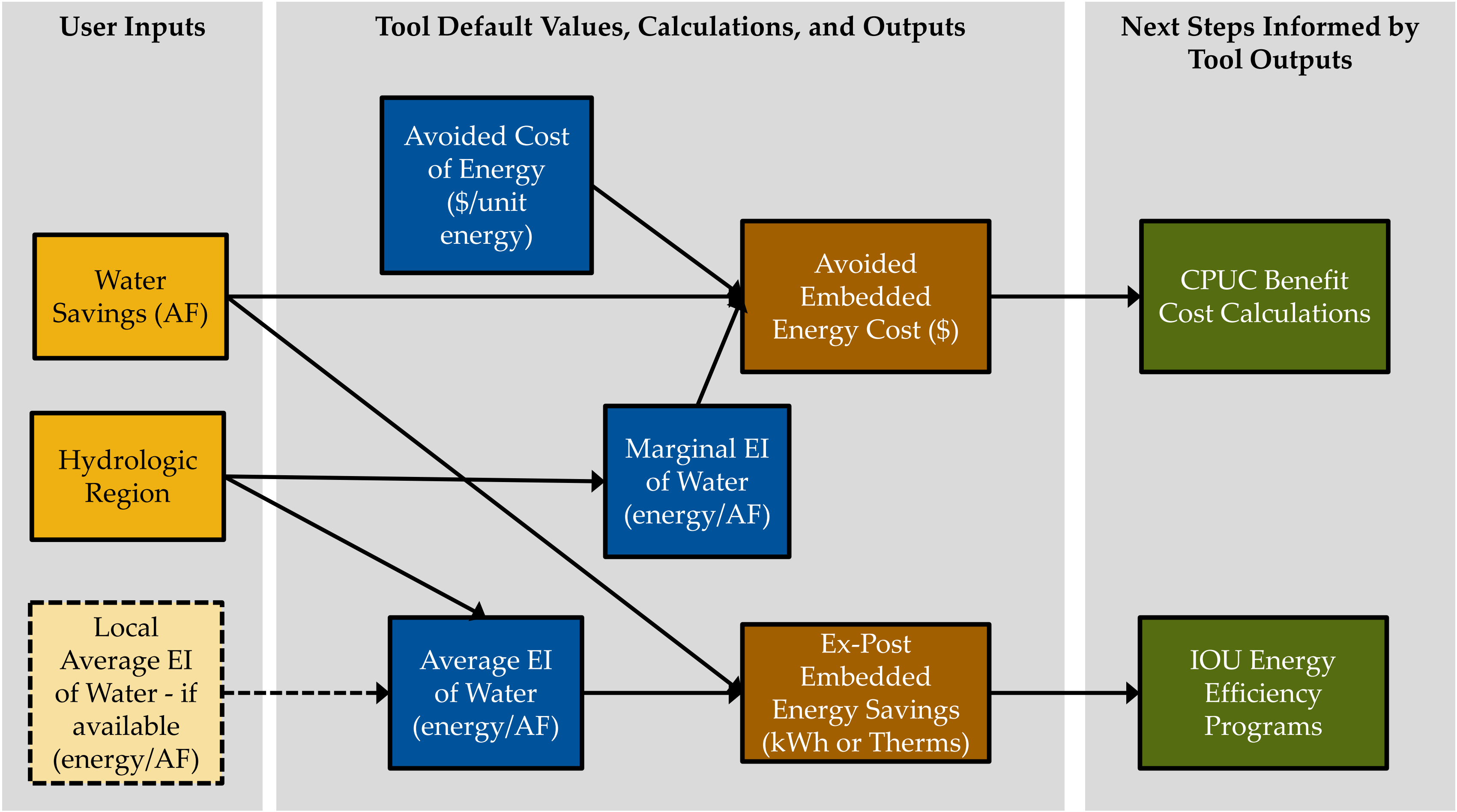
The Navigant team will determine the energy intensity (EI) of water for major water supplies in each region.

- **Marginal** EI will be fixed for each region.
- **Average** EI will serve as a regional default value for project evaluations, water utilities could substitute their own value if known.
- Average represents the present-day EI value of the regions' water
- Marginal represents the likely future EI value of the regions' water



Task 1.1 culminates by developing a tool to quantify the embedded energy savings and avoided cost of embedded energy savings.



Note: Image presents only major inputs and calculations for simplicity

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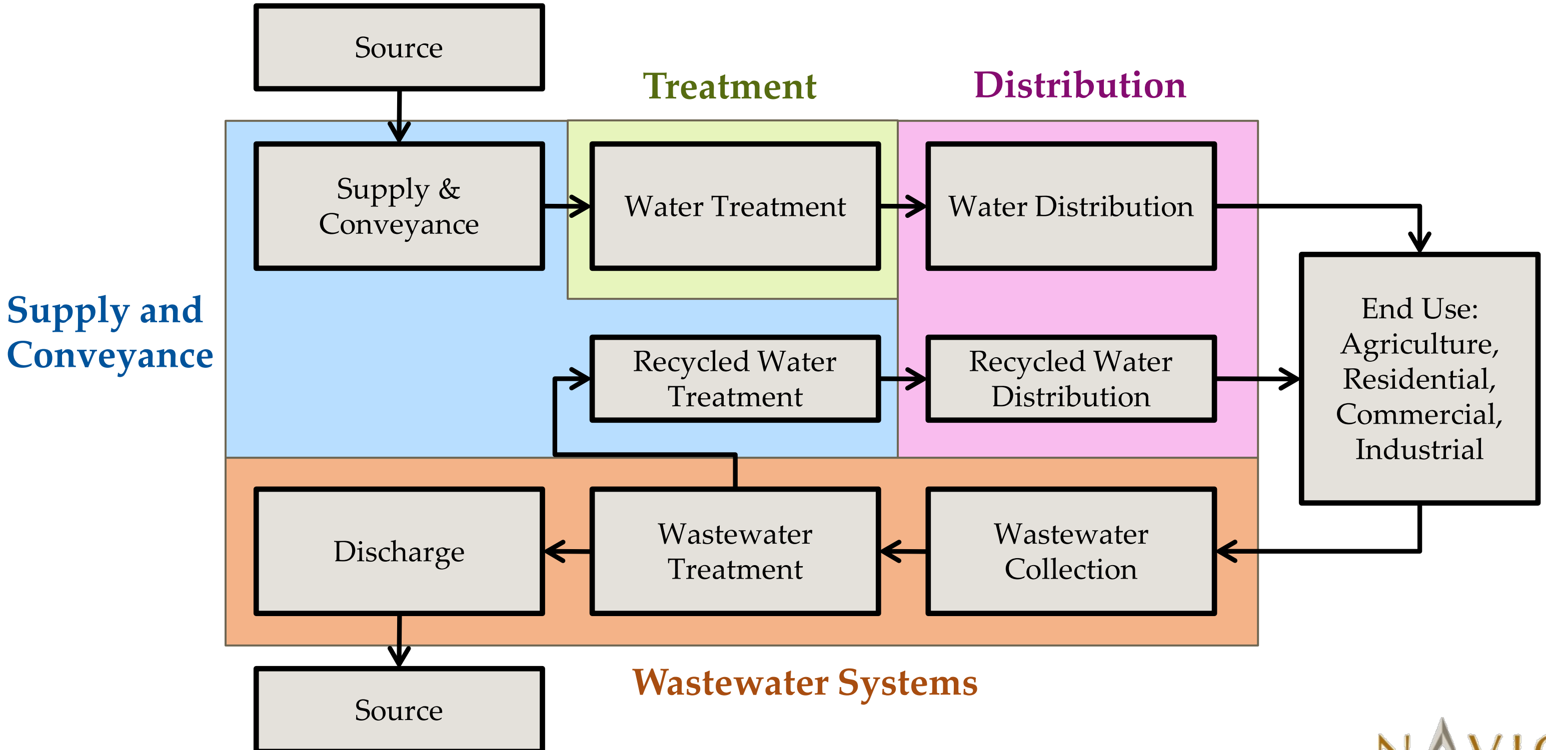
Task 1.2 will determine values for Avoided Water Capacity Costs

» Building upon the information developed in Task 1.1, the Navigant team will provide the CPUC with a methodology and calculator for the estimation of Avoided Water Capacity Costs (both Capital and O&M costs)

» Avoided costs will follow the same regional breakdown as Task 1.1.

» Avoided costs will be developed for each water system component



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Avoided Water Capacity Costs will be informed by existing secondary data.

- Capital Costs
  - Water infrastructure (i.e. pumps, pipes, treatment facilities, etc.)
  - Develop cost estimates for typical water system components appropriate for each region
  - Review planned water utility infrastructure spending in Capital Improvement Plans from representative water agencies.
  - Consider secondary data collected from recently constructed water treatment plants in California
- O&M Costs
  - Excludes any energy costs (already capture in the embedded energy avoided costs)
  - Consider cost such as chemicals and reduced maintenance requirements
- Capital costs will be levelized, O&M costs will be estimated on annual basis. Both will be reported on a volumetric basis ($/AF or $/MG)

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The Navigant team will investigate special considerations when estimating Water Supply Avoided Capacity Costs

» **Groundwater**
- California relies on groundwater for approximately 35% of its supply
- Water managers have increased groundwater banking
- Degraded water supplies (contaminated and brackish waters) may serve as alternative options for different end uses.

» **Water Imports and Large Scale Storage**
- High level of uncertainty in future storage projects
- This study will not examine large scale storage
- This study will examine distribution level storage

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Avoided Water Conveyance Costs may be minimal or zero.

- Conveyance costs are the costs to move water from a source to a different region in the state. Conveyance costs are analogous to the electric transmission grid or high pressure pipelines in the natural gas network.
- Like the electric transmission grid and natural gas network, large conveyance projects occur relatively infrequently.
- We expect our research may ultimately show:
  - No avoided conveyance capital cost
  - Some non-zero avoided O&M cost

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Avoided Water Distribution Costs analysis will draw best practices from Natural Gas avoided cost methods.

- Water distribution systems are analogous to natural gas distribution systems.
- Distribution costs could differ significantly based upon geography and density
- We expect the avoided cost of distribution to be minimal compared to other water system components; analysis will be conducted at a high level to focus team resources on other components.

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Task 1.2 will also research the environmental benefits resulting from water conservation.

» Ecosystems provide multiple goods and services including flood protection, water purification, wildlife habitat, and recreational opportunities. There is a growing recognition that these services have an economic value

» We will provide a qualitative assessment and reports values, where available.

Rivers/Lakes	Coastal/Estuarine	Groundwater
• Support fish populations, including their migration routes and spawning areas • Support marshland and riparian vegetation • Support wildlife and birds • Reduced salt water intrusion • Maintain recreational benefits of instream flows • Dilute pollutants • Avoid further regulatory actions • Maintenance of downstream water rights	• Maintain freshwater and nutrient inflows • Maintain marshland vegetation, eelgrass, mangroves • Support wildlife and birds • Support fish populations	• Maintain water table levels (fewer low tables) • Reduce land subsidence • Reduced contamination from salt water intrusion • Maintain baseflow to rivers and streams

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Task 2 provides guidance to the CPUC, IOUs and stakeholders on how to interpret results and use them to help design water-energy programs.

- Recommendations for integration into DEER and cost effectiveness calculators
- Support the CPUC on project related data considerations. Discuss best practices to assessing:
  - Incremental measure cost,
  - Expected useful life (EUL), and
  - Discount rates applicable to water projects.
- Recommendations for updates, important considerations include:
  - Frequency at which relevant data becomes available
  - Frequency at which major energy efficiency program planning decisions are made
- Development of users guides: how stakeholders can use tools developed by the team going forward
- Demonstration of the developed water-energy calculators with an example project (pending reliable project data in the necessary format)

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The Navigant team began research on Task 1.1, a public stakeholder meeting is planned for September.

		2013	2014											
Task	**Description**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1.1	Select regional boundaries and collecting regional historic data	■	■	■										
1.1	Determine supply options and marginal supply within each region		■	■	■									
1.1	Determine energy intensity for water within each region		■	■	■	■								
1.1	Develop an embedded energy avoided cost calculation tool				■	■	■							
1.2	Determine values for avoided water capacity costs			■	■	■	■							
1.2	Research Environmental Benefits					■	■							
1.2	Aggregate avoided capacity costs by region						■	■						
2.1	Draft comprehensive report on cost-effectiveness calculator updates								■					
2.2	Recommendations for integration with DEER								■					
2.3	Explanation for program administrators									■				
2.4	Presentation of recommended changes to stakeholders										■			
2.4	Final comprehensive report											■		

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