This presentation premiered at WaterSmart Innovations

watersmartinnovations.com
Where Do We Go From Here As A Region?

Case Study on Quantifying the Econometric Recovery and Future Conservation Strategy

October 10, 2014
Presentation Topics

1. How we got here – who BAWSCA is and why is understanding our demands critical for our planning?
2. How was this different than traditional methods?
   • Econometric modeling provided advantages and new answers
3. What did we find?
4. What did we learn?
5. What are we doing next?
What is BAWSCA?

*Bay Area Water Supply & Conservation Agency*

- 26 cities, water districts and water companies in San Mateo, Santa Clara, and Alameda Counties
- 1.7 million residents, over 30,000 businesses
- Significant diversity among member agencies in size, demographics, and water use profiles (single-family, multi-family, non-residential)
- All rely on the San Francisco Regional Water System
Conservation Program Is Key Element of BAWSCA’s Mission

- BAWSCA manages a variety of conservation programs regionally and on a subscription basis for its member agencies
- Current programs include:
  - Four rebate programs
    - Toilets, washing machines, turf removal, and rain barrels
  - Four public outreach program
  - Three school programs
  - Large landscape audit program
  - Home water use reports program
  - Water conservation database
Why Understanding Our Demands Is Critical for Planning

- Demand projections are a critical component for BAWSCA’s Long Term Reliable Water Supply Strategy
  - Goal is identify projects and programs to increase the water supply reliability
- During Strategy development, BAWSCA identified a need to update the water demand and conservation projections for BAWSCA member agencies
  - Actual demands since 2010 had been significantly different than Urban Water Management Plan projections for many agencies
  - Individual agency projections relied on different approaches and were not easily combined
  - Lack of understanding/quantification of the significant decrease in demands in recent years (so many variables could be responsible)
Demands Were Trending Much Lower than Previous Projections

Projected Demands from 2008 Study

Actual Demands

-Economy?

-Weather?

-Rates?

-Conservation?

Historical Demand (MGD)

Demand Since 2008 Study

2008 Study Projected Demands with Plumbing Code
Project Approach

Two Main Goals

1. Identify and quantify factors impacting water demands for BAWSCA member agencies, and

2. Incorporate the findings into developing water demand projections and conservation savings targets for each agency
Econometric Modeling Used to Identify Factors Impacting Demands

- Econometric modeling is a statistical approach used to determine the impact on water demands of factors such as:
  - Economic conditions
  - Weather
  - Rates
  - Conservation

- Analysis of historical data provides helpful information for answering questions such as:
  - How much and at what rate will demand rebound as the economy expands?
  - How much will future price increases continue to depress demand?
  - How does demand respond to weather?

- R-square: indicates the explanatory power of a statistical model. High R-square = greater explanatory power
Data Collection and Verification

- Data was collected for all individual BAWSCA agencies from 1995-2012, including:
  - Water Production
  - Consumption by Customer Class
  - Top 100 non-residential users
  - Pricing/Rates
  - Service Area Unemployment
  - Weather
  - Population / Employment
  - Conservation Data
  - Individual model for each agency
## Independent Variables Evaluated for the Econometric Analysis

<table>
<thead>
<tr>
<th>Variable Type</th>
<th>Variables</th>
<th>Units</th>
<th>Data Source</th>
<th>Comment</th>
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<tbody>
<tr>
<td>Weather</td>
<td>Precipitation</td>
<td>Inches per month</td>
<td>NOAA Weather Data</td>
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<tr>
<td>Weather</td>
<td>Avg Daily Max Air Temp</td>
<td>Fahrenheit</td>
<td>NOAA Weather Data</td>
<td>Max temp better</td>
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<tr>
<td>Weather</td>
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<td>NOAA Weather Data</td>
<td>Max temp better</td>
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<tr>
<td>Weather</td>
<td>Reference ETo</td>
<td>Inches</td>
<td>Not available</td>
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<td>Economy</td>
<td># of Jobs</td>
<td>Jobs per capita</td>
<td>ABAG</td>
<td>Unemployment better</td>
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<tr>
<td>Economy</td>
<td># of Jobs</td>
<td>Jobs</td>
<td>ABAG</td>
<td>Unemployment better</td>
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<tr>
<td>Economy</td>
<td>Unemployment</td>
<td>Unemployment rate</td>
<td>CA EDD / BLS</td>
<td></td>
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<tr>
<td>Service Area</td>
<td>SF Units</td>
<td>Dwelling units</td>
<td>DOF</td>
<td>Insufficient variation</td>
</tr>
<tr>
<td>Demographics</td>
<td>MF Units</td>
<td>Dwelling units</td>
<td>DOF</td>
<td>Insufficient variation</td>
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<tr>
<td>Service Area Data</td>
<td>Rates</td>
<td>$/HCF</td>
<td>Provided by Agencies</td>
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<tr>
<td>Service Area Data</td>
<td>Population</td>
<td>People</td>
<td>ABAG or other selected source</td>
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<tr>
<td>Service Area Data</td>
<td># Customers</td>
<td>Accounts</td>
<td>Agency billing data</td>
<td>Not favored, collinear with population</td>
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<tr>
<td>Conservation</td>
<td>Conservation</td>
<td>Conservation activity</td>
<td>BAWSCA WCDB</td>
<td>Used to convert actual GPCD to baseline GPCD</td>
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</table>
Forecasting Methodology – 3 Key Steps

**Econometric Analysis:**
Determine significant variables
Determine impact of economy

**Economic Recovery:**
Determine % demand increase and over what time period

**Service Area Changes:**
Add change in population/employment
Development patterns
Conservation efforts

- **Historical View**
  1995-2012
  (Large amount of data)

- **Short Term Future**
  6-7 years
  (Some near term predictive data available)

- **Long Term Future**
  Out to 2040
  (Limited predictive data available)
Econometric Models: BAWSCA Wide Historical Results

BAWSCA Service Area: Actual Versus Predicted

Demand Decrease from 2008-2011 BAWSCA-wide

- 28% due to weather
- 23% due to economy
- 50% due to rates / passive / active conservation and service area changes
Significant price increases in recent years (due to ~$3 billion capital improvement program) was a key driver in demands.
Econometric Models: Unemployment Rate w/ Recovery in 2020

Econometric modeling estimated the portion of water demand to rebound due to economy.

Economic Recovery assumes the unemployment rate will return to each individual agency’s "average of 1993-2000 unemployment rate" by the year 2020.
BAWSCA DSS Model Flow Diagram

Key Customer Categories
- Single Family Residential
- Multi-Family
- Commercial
- Industrial
- Institutional

Population / Employment Growth Projections

Continuing Conservation Programs

2020 Base Water Use

Projected Demand
- 2025
- 2030
- 2035
- 2040

New Planned Conservation

Forecasts by Customer Category

Forecasts by Indoor / Outdoor

DSS Model Forecast 2021 to 2040
DSS Water Demand & Conservation Model

Agency X

Service Area Information
- Model Setup
- Production
- Consumption Data
- Growth Projections
- Census Data

Demand Analysis
- Non-Revenue Water
- Regression Data
- Water Demand Scenarios

Conservation Analysis

Implementation Tracking

Results
- Reports and Graphs
Projected Demands are 20% Lower than 2008 Demand Study

Historical Demand (MGD)

- 2008 Study Demands with Passive Conservation
- 2014 Study Demands with Passive Conservation

Projected Demand with Plumbing Code Savings

Demand Since 2008 Study

- 2008 Study Projected Demands with Plumbing Code
1. Incorporate passive conservation savings (plumbing codes, CALGreen state building code)
2. Identify potential active conservation measures
3. Evaluate conservation programs
4. Select future conservation plan
BAWSCA’s 10 Step Process to Develop Conservation Strategies

1. Review BAWSCA Agency Historical Conservation
2. Prepare List of All Potential Measures
3. Measure Screening by Agencies via Survey Monkey
4. Establish Measure Parameters for DSS Model Evolution
5. Assign Avoided Costs for Conservation Benefits
6. Populate Agency DSS Models with Measures and Run Cost-Benefit Analysis
7. Agencies Select Preferred Program and Submit to BAWSCA
8. Agencies Evaluate Alternative Water Conservation Programs
9. Regional Roll-Up of Demands With Conservation Program
10. Deliver Water Conservation Workshop and DSS Model Training to Agencies

Publish Results in Final Report
Active Conservation Analysis

- Conservation Measures – Menu of 25 measures
- Individual Measure Parameters (individual measure budget, activity level, start date, etc.)
- Evaluated 3 Program options for each agency
  - Continue current conservation program
  - Optimized program based on costs & water savings
  - All 25 conservation measures analyzed
- Each agency made adjustments for its model and selected its final conservation savings plan
# Programs Identified for Potential BAWSCA Regional Implementation

<table>
<thead>
<tr>
<th>Program</th>
<th>Agencies Planning to Implement</th>
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<tbody>
<tr>
<td>Water Sense Fixtures Giveaway</td>
<td>23</td>
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<tr>
<td>Weather Based Irrigation Controllers (WBICs) Giveaway Program (and Classes) SF</td>
<td>9</td>
</tr>
<tr>
<td>Small Irrigation Hardware Incentives (Drip Irrigation and Rain Sensors)</td>
<td>11</td>
</tr>
<tr>
<td>Gray Water Retrofits SF Rebate</td>
<td>11</td>
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<tr>
<td>Water Conserving Landscape &amp; Codes (not including WBICs and turf removal) SF MF CII</td>
<td>13</td>
</tr>
<tr>
<td>HE Clothes Washer CII Rebate</td>
<td>13</td>
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<tr>
<td>HE Urinal CII Rebates</td>
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<tr>
<td>Focused School Retrofit Program</td>
<td>5</td>
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<tr>
<td>WBICs Incentive Program (more money) MF CII Large Landscape</td>
<td>10</td>
</tr>
<tr>
<td>Rotating Sprinkler Nozzle Incentive Program SF MF CII Large Landscape</td>
<td>12</td>
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</table>
Total Water Demand Projected to Reach 269 MGD in 2040

Additional Conservation Savings of 36 MGD by 2040
Projected 60% Population Increase with Only 8% Demand Increase (1986-2040)

32% decrease in per capita water use between 1986 and 2040
Summary and Conclusions

- Incorporating econometric modeling provided valuable insights into demand trends that influenced water supply planning efforts.
- BAWSCA is finalizing Long Term Reliable Water Supply Strategy based upon demand results.
- Conservation program changes are being implemented in FY 2015-16 based upon conservation analysis results.
  - Continuation of existing programs (large landscape, public outreach, turf removal).
  - “Phasing out” of programs where high saturation rates have been realized (e.g. toilets, washing machine rebates).
  - Incorporating new programs with high savings potential (e.g. CII programs, irrigation hardware incentives).
Questions?

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Final Report is available at: