Side-By-Side Comparison of Conservation-Based Water Rate Models*

Disclaimer: The Santa Ana Watershed Project Authority (SAWPA) does not necessarily endorse or oppose any of the following vendors who provided details on their rate models. This side-by-side comparison is strictly for information sharing purposes only. It is provided to benefit retail water agencies by assisting them in making informed decisions as they analyze conservation-based water rates (also known as budget-based water rates). The comparison documents were developed by an independent consultant, Dr. Kenneth Baerenklau, Associate Professor in the School of Public Policy and Associate Provost at the University of California, Riverside, who has extensive experience in analyzing the effects of conservation-based water rates on water demand. The summary documents and analyses were reviewed by SAWPA staff and staff from the SAWPA member agencies, but remain independent of the vendors.

For Dr. Baerenklau's CV see: http://provost.ucr.edu/staff/baerenklau.html. For the SAWPA member agencies see: http://www.sawpa.org/resources/.

***Background:** As part of the Emergency Drought Grant Program, SAWPA released a Request for Qualifications (RFQ) where a range of vendors were asked to explain their rate models for conservation based-water rates. What they provided to SAWPA is reflected in the summary documents and related information. **SAWPA encourages retail water agencies to further analyze the information provided by the vendors, and ask follow-up questions of the vendors, as SAWPA is reporting on only what was provided by the vendors.**

Rate models are the major part of any rate study. The vendors that are included in this summary document and related information are not a complete list of all the firms that can provide rate modeling services as some vendors chose not to respond to the SAWPA RFQ.

Vendors Who Responded:

1. A&N Technical Services (ANTS)
2. Robert D. Niehaus, Inc. (RDN)
3. Raftelis Financial Consultants, Inc. (RFC)
4. Valor Water Analytics (Valor)

Summary of RFQ Submissions for Retail Water Agency Conservation Rate Modeling

	Vendors			
	ANTS	RDN	RFC	Valor
Does this vendor currently model budget-based rates?	• Does not currently model budget-based rates, but this would be added for retail water agencies, for up to 3 customer classes.	• Yes	• Yes	• Yes
What does a retail agency need to provide in order to use this tool?	• 1 year of customer bill tabulations for each customer class and season per AWWA M1 standards. • Current rate structure parameters for both fixed and variable components. • Price elasticity of demand data, if available. • Drought rates and drought stage information, if applicable. • Local weather data (available online from NOAA). • Estimates of anticipated future system growth. • ½ to 1 day of training is recommended. • 3-4 days to 5-6 weeks to produce a validated model, depending on data cleaning and structuring needs. • MS Excel for Windows.	• Up to 5 years of customer bill tabulations and rate data for each customer class. • Demographic characteristics, property characteristics (lot size or irrigated area, household size), weather – i.e. evapotranspiration (ET), conservation policies (announced/ adopted restrictions). • Most recent budget and financial information, including projected revenues and expenses for 5 years, and supply costs. • Previous rate studies and rate schedules. • 1 day training session. • 5 weeks to run the model for 1 agency after receipt of all data.	• 1-4 years of customer bill tabulations for each customer class. • Current year financial data including capital expenditures, O&M cost data, debt service, reserve funding, transfers, conservation and water supply costs. • Asset data showing year of installation. • Water supply availability by source. • Peaking data. • Current rate schedule. • Irrigated/landscaped area or lot size. • ET data and household size, if available. • 4-6 hours of training. • Completed model within 4-6 weeks of data delivery. • MS Excel or Access	• 4 years of customer bill tabulations for each customer class. • Current and historic rate schedules and rate code glossary*. • Weather (ET) data, census demographics, and property characteristics (lot size or irrigated area, household size). • 3 years of revenue and cost data. • Bulk purchase and special user agreements. • Fiscal/budget data, capital and operating cost data (if applicable). • ½ day training session for each module; kickoff meeting with finance, billing, IT staff. • Completed model within 4 weeks of receiving all

	Vendors			
	ANTS	RDN	RFC	Valor
		• ASCII, text, MS Excel or Access, or other common formats.	format.	agency data. • Text or CSV format.
Can the model be accessed online?	Yes, at www.financing sustainablewater.org.	No.	No.	Yes.
What are the notable unique features of this model?	• Addresses customer affordability of rates. • Does not currently model budget-based rates, but this would be added for retail water agencies, for up to 3 customer classes. • Includes a library of pre-defined conservation activities. • Use of the ANTS model to meet Prop 218 standards requires additional analyses.	• State-of-the-art discrete-continuous choice (DCC) model of demand under block pricing. • Model has performed well in tests where some other agency data is substituted for missing data.	• Widely used. • Predicted demand within 3% of observed demand for two southern California water districts.	• Dynamic: models incorporate new billing and ET data each month for revenue monitoring, risk assessment, model updating, and shadow rate monitoring.
Cost estimate.	• Model is open source and available online. Updates available to agencies if they are Alliance for Water Efficiency members ($0.01 per connection). No other cost data provided. • Costs would cover 3-4 days of setup and 1-2 months of support. • Multi-agency training workshops would reduce	• Small to medium agency (15-50K connections) with good data would be about $35-45K. • Cost depends on the number of customer classes, number of accounts in each class, and availability of sufficient agency data. • Model is available as a perpetual in-house license with a limited	• Approximate cost for average retail agency is $35-50K, and closer to the lower end per agency if several are involved. • Cost is more dependent on number of customer classes than number of accounts. • Cost also dependent on data quality. • Willing to discuss group	• $12-36K for 10-40K connections plus $10K annual license fee for the Water Rate Simulator. • Costs can be reduced 10% if multiple agencies participate in training workshops. • Unspecified cost to set-up and customize the EFG financial tools, but no subsequent annual

	Vendors			
	ANTS	RDN	RFC	Valor
	the cost per agency.	period of technical support, at additional cost. • Group discount is available. **	rates. **	licensing fee.
What are the notable advantages of each model?	• Affordability analysis good for disadvantaged communities. • Conservation activity library facilitates scenario analysis for agencies considering significant changes to programs.	• Model is consistent with economic theory of demand under block rate pricing.	• Likely that some retail water agencies are already familiar with, or even using, this model.	• Dynamic capability good for maintaining currency of estimates and forecasts.
Agencies that have used the model previously to analyze budget-based rates. *** (For reference contact information, please contact SAWPA at iachimore@sawpa.org).	• City of Los Angeles DWP • Elsinore Valley MWD • California Water Services Company • Coachella Valley WD • Padre Dam MWD • California American	• Las Virgenes MWD (used for budgeting water efficient customers) • Carpinteria Valley WD (utilizing a hybrid budget based structure for M&I customers since 2008; the first tiered rate is based on the account's winter use)	• Santa Margarita WD • El Toro WD • Las Virgenes MWD • Huntington Beach • San Clemente • San Juan Capistrano • City of Santa Cruz • Western MWD • Eastern MWD • Rancho California WD • Elsinore Valley MWD • City of Corona • City of South Pasadena • City of Glendora	• Beaufort Jasper Water and Sewer Authority • Clayton County Water Agency
Agencies in California that are implementing budget-based rates that are on the above list. ***	• Elsinore Valley MWD • Coachella Valley WD	• Las Virgenes MWD (adopted, not yet implemented)	• City of Corona • Western MWD • Eastern MWD • Rancho California MWD	

	Vendors			
	ANTS	**RDN**	**RFC**	**Valor**
			• Elsinore Valley MWD • El Toro WD • Las Virgenes WD (adopted, not yet implemented)	
Vendor Contact Information	http://antechserv.com/ info@antechserv.com	www.rdniehaus.com Daniel@rdniehaus.com	www.raftelis.com info@raftelis.com	https://valorwater.com/ info@valorwater.com

*Rate code glossary: A type of decoder used for translating alphanumeric rate codes into prices.

**Through the RFQ, SAWPA asked whether vendors would provide their models at a "group rate" if multiple agencies in the Santa Ana River Watershed through the Emergency Drought Grant Program wanted to use the same model.

***These listed agencies may have just used the vendor's model to *assess* rate structures, even just generally, but not used the model to adopt and implement budget-based rate structures.

A&N Technical Services

Detailed Summary of RFQ Submission

A&N Technical Services (ANTS) has partnered with the Alliance for Water Efficiency (AWE) and M.Cubed in submitting its response to the SAWPA RFQ.

The ANTS model is named the AWE Sales Forecasting and Rates Model and is divided into two modules:

- Rate Design Module
- Revenue Simulation Module

The model is available online at www.financingsustainablewater.org. It is open source and Excel-based. Model updates are available at no cost to agencies that are members of AWE. Note that membership costs $0.01 per service connection. Model set-up appears relatively straightforward, requiring 3-4 days assuming good data quality. Set-up may take as long as 5-6 weeks if significant data cleaning is needed. Data that must be provided by the agency include one year of customer bill tabulations for each customer class; current rate schedules; drought rates and drought stage information; price elasticities, if available; and historical weather data which are available from public sources such as NOAA, CIMIS or Daymet. It is recommended to use at least 15 years of historical weather data. ANTS is able to provide technical support for obtaining, cleaning and inputting weather data.

In addition, AWE members have access to the Water Conservation Tracking Tool which facilitates estimates of water savings from conservation programs and related benefits and costs. This tool also is Excel-based and available online. Conservation program data must be provided by the agency. A full list of data needs is here: http://www.allianceforwaterefficiency.org/uploadedFiles/Tool/Tracking-Tool-User-Inputs-Version2.0.pdf.

ANTS also has developed two related tools that complement the AWE Sales Forecasting and Rate Model:

- Drought Response Tool
- Water Efficiency Calculator

These tools do not appear to be available to AWE members but instead could be provided on an additional cost basis by ANTS to interested retail water agencies in the Santa Ana River Watershed. Costs estimates are not provided in the response to the RFQ. Both tools appear to be Excel-based.

Notable Advantages

1. The ANTS model appears to be relatively cost-effective compared to other submissions. The cost for an AWE membership for an agency with 100,000 service connections is only $1,000 per year. However there may be additional set-up costs if the available data is not of high quality. Also the costs for the Drought Response Tool and Water Efficiency Calculator are not reported.
2. The ANTS model addresses affordability of rates, which should be appealing to agencies with high variances in household income across customers and/or large disadvantaged populations.
3. The ANTS model implements Monte Carlo analysis for simulating the effects of external shocks including weather on model outputs.
4. The ANTS model (specifically the AWE Water Conservation Tracking Tool) includes a library of pre-defined conservation activities which should be appealing to agencies considering implementing new and significant conservation programs or those considering significant changes to existing programs.

Other Considerations

1. Although the ANTS model can work with standard block rates, it does not currently model conservation-based rates (i.e. water budget) rates. However ANTS proposes to add this component for water agencies, for up to three customer classes, presumably for an additional cost.
2. The state-of-the-art method for modeling demand under any type of block rate schedule is the discrete-continuous choice (DCC) model developed by Hewitt and Hanemann. The ANTS model does not currently use the DCC approach.
3. The ANTS model does not conduct an incremental cost of service analysis and thus offers limited capabilities in terms of helping agencies to ensure compliance with Proposition 218. However ANTS has other experience with cost-of-service analyses.
4. The ANTS model does not utilize demographic data that can be useful for examining the effects of rate changes on segments of the customer base (such as senior or minority populations).
5. The drought rate adjustment calculation assumes that a curtailment will cause the demand curve to shift and that subsequent price increases of any magnitude will reduce consumption according to the new demand curve. Economic theory predicts that a curtailment will not cause the demand curve to shift and therefore subsequent price increases will not reduce consumption unless the price change is so large that the customer would have consumed less under the price increase than under the curtailment. Which of these methodologies is more accurate is an empirical question.

Robert D. Niehaus, Inc.

Detailed Summary of RFQ Submission

The Robert D. Niehaus, Inc. (RDN) model is named the WaterEcon model and is comprised of four main components:

1. Demand Analysis
2. Revenue Requirements
3. Cost of Service
4. Rate Setting

The model is Excel-based and utilizes parameter estimates derived from the commercially available Stata statistical software package. The model is not available online but rather can be made available to agencies as a perpetual in-house license after the initial contract expires, at an additional unspecified cost. The cost to initially set up the model for a small to medium agency with 15,000 to 50,000 connections with good data is estimated to be around $35,000 to $45,000. Cost depends on the number of customer classes, number of accounts, and data quality. Initial set-up requires about five weeks for one agency after receipt of all data. Data that must be provided by the agency include: up to five years of customer billing data and rate data for each customer class; property characteristics, and conservation policies; most recent budget and financial information including five-year projections; and previous rate studies. The model also uses census demographic characteristics. RDN will acquire all publicly available data; the remaining data may be provided to RDN in ASCII, text, MS Excel, MS Access or other common formats.

Notable Advantages

1. The RDN model uses state-of-the-art methods (i.e. the discrete-continuous choice framework) for modeling demand under both standard block and allocation-based block rates.
2. RDN states that the model has performed well in tests where data from a second agency is substituted for missing data from the agency under analysis.
3. Set-up of the RDN model is priced similarly to the other models, with the exception of the ANTS model.
4. The RDN model includes what appears to be a robust cost-of-service component for assessing compliance with Proposition 218.
5. The RDN model can run scenario analyses as well as Monte Carlo simulations for sensitivity analyses.
6. The RDN model incorporates census demographic data that can be useful for examining the effects of rate changes on segments of the customer base (such as senior or minority populations).

Other Considerations

- The method for simulating/predicting demand under block rates relies on calculating the expected marginal price that each household would face under a proposed rate structure. This differs from the method that is implied by the structure of the discrete-continuous choice framework. Which of these approaches is more accurate is an empirical question.

Raftelis Financial Consultants, Inc.

Detailed Summary of RFQ Submission

The Raftelis Financial Consultants, Inc. (Raftelis) model is available in both Microsoft Excel and Microsoft Access versions. The Raftelis model is not available online but will be made available to agencies after the initial contract period without a licensing charge. The approximate cost to set up the model for an "average" retail agency is $35,000 to $50,000. Cost is more dependent on the number of customer classes than on the number of accounts, and also depends on data quality.

Set-up for the Raftelis model requires about 4-6 weeks after receipt of data from the agency. Data that must be provided by the agency include: 1-4 years of customer bill tabulations for each customer class; irrigated (landscaped) area or lot size for each customer; current year financial data including capital and operating cost data, debt service, reserve funding, transfers, conservation, and water supply costs and availabilities by source; the current rate schedule; and peaking data. ET data and household size estimates also may be provided by the agency, or else calculated by Raftelis. These data may be provided in formats compatible with Microsoft Excel or Access.

Notable Advantages

1. The Raftelis model is widely used. It is likely that some retail water agencies in the Santa Ana River Watershed are already familiar with, or even using, this model.
2. The Raftelis model has achieved high levels of predictive accuracy (within 3% of observed demand) for two southern California water districts.
3. While set-up of the Raftelis model is priced similarly to the other models, with the exception of the ANTS model, the Raftelis model has no licensing fee which reduces its long-run total cost.
4. The Raftelis model includes what appears to be a robust cost-of-service component for assessing compliance with Proposition 218.
5. The Raftelis model can run scenario analyses as well as Monte Carlo simulations for sensitivity analyses.

Other Considerations

1. The Raftelis model does not utilize household-level socio-demographic data that can be useful for examining the effects of rate changes on segments of the customer base (such as senior or minority populations such as low-income).
2. The state-of-the-art method for modeling demand under any type of block rate schedule is the discrete-continuous choice (DCC) model developed by Hewitt and Hanemann. The Raftelis model does not currently use the DCC approach.

Valor Water Analytics

Detailed Summary of RFQ Submission

Valor Water Analytics, Inc. (Valor) has partnered with Environmental Financial Group, Inc. (EFG) in submitting its response to the SAWPA RFQ.

The Valor model is named the Valor Water Rate Simulator and is integrated with cost of service analysis tools provided by EFG. The Valor model is built with the Python and R computer programming languages and utilizes Tableau Software for its user interface. The EFG tools are Excel-based and can link to a variety of commonly used databases and statistical software packages.

The Valor model is entirely online and is made available to agencies during and after the initial contract period on a licensing fee basis. The cost to initially set up the model for an agency with 10,000 to 40,000 connections is estimated to be between $12,000 and $36,000 plus a $10,000 annual license fee during each year of the contract. Cost depends on the number of meters but not the number of customer classes. An estimate of the cost to set-up the EFG tools is not provided but subsequent use of the tools after customization does not require an annual licensing fee.

Initial set-up for the Valor model requires about four weeks after all data is received from the agency. Data that must be provided by the agency include: four years of customer bill tabulations for each customer class; current and historic rate schedules and rate code glossary; three years of revenue and cost data; budgeting data, and capital and operating cost data. Weather (ET) data, census demographics, and property characteristics also are integrated into the model. These data may be provided by the agency in text or CSV format. A half-day session typically is needed to train agency staff.

Notable Advantages

1. The Valor model is dynamic: it automatically incorporates new billing and ET data each month for revenue monitoring, risk assessment, model updating and shadow rate monitoring. This is helpful for maintaining currency of model estimates and forecasts.
2. The Valor model allows an agency to monitor the performance of hypothetical “shadow” rates that differ from the actual rates currently implemented.
3. Set-up of the Valor model is priced similarly to the other models, with the exception of the ANTS model.
4. The Valor model includes what appears to be a robust cost-of-service component for assessing compliance with Proposition 218.
5. The Valor model can run scenario analyses as well as Monte Carlo simulations for sensitivity analyses.
6. The Valor model incorporates census demographic data that can be useful for examining the effects of rate changes on segments of the customer base (such as senior or minority populations).

Other Considerations

- The state-of-the-art method for modeling demand under any type of block rate schedule is the discrete-continuous choice (DCC) model developed by Hewitt and Hanemann. The Valor model does not currently use the DCC approach.