MEMORANDUM

TO: Columbia City Council

FROM: Water & Light Advisory Board John T. Conway, Chairman

DATE: August 18, 2014

SUBJECT: Review of Columbia Water & Lights Existing Electric Energy Portfolio

Summary:

At the April 21, 2014 Council Meeting, a motion was approved for the Water & Light Advisory Board to "review, clarify, comment on, and make recommendations regarding the City's electric utilities energy portfolio". This memo provides the results of this review.

A balanced blend of cost-effective supply side and demand side resources are of critical importance in providing for a utilities electric energy needs. For the supply side there are two primary aspects in the ability to provide electric service, capacity and energy balance.

- Capacity balance is the ability to provide electricity at the rate of usage demanded
- Energy balance is the ability to provide electricity in the quantity to meet consumption.

Based on current capacity balance plans, Columbia Water & Light will need to have addition capacity resource by 2017. Columbia Integrated Resource Plan (IRP) projects these capacity resources will come from market activity until cost or size of deficit justified a long term arrangement.

Current energy balance plans have Columbia Water & Light producing approximately 85% of our annual electric energy consumption from baseload resources and buying approximately 15% from the energy market and using peaking resources to limit financial exposure.

The IRP anticipates the need to additional baseload energy production by 2019. Columbia's baseload energy needs are currently met with three power plant unit participation contracts; Sikeston, Iatan II and Prairie State. Due to the age of the facility, the Sikeston Power Station is viewed to have the greatest future cost impact risk, while Iatan II and Prairie State Power Stations are viewed to have a much lower and similar future cost impact risk for the utility.

Renewable energy has and should continue to be pursued to meet future capacity and energy needs. In addition to renewable production resources, technology development that can allow energy storage and load shifting resources to be developed should also be monitored.

Discussion:

Resource planning for an electric utility is the process of matching resources to meet forecasted annual peak (KW) and energy demands (KWh's). IRP's can be thought of as the process of planning to meet users' needs for electricity services in a way that satisfies multiple objectives for resource use. On a regular basis, Columbia Water & Light performs an IRP for the electric utility. These plans evaluate the current supply side resources and future options to meet current and future load requirements. For planning and evaluation purposes, future load serving requirements are divided into capacity balance and energy balance. Columbia Water & Light performed an update and issued the last Integrated Resource Plan in 2013.

Capacity balance review:

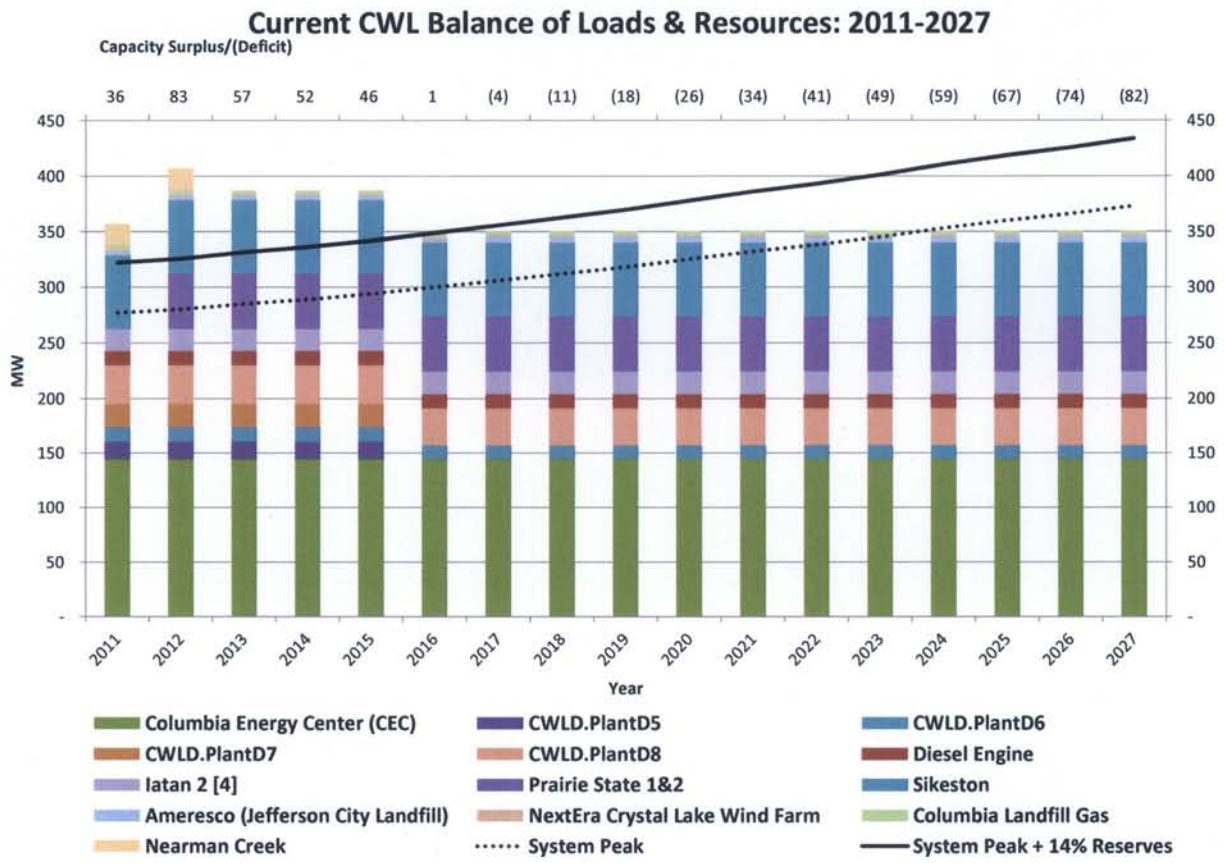
Below is Columbia Water & Lights' projected electric capacity balance from the 2013 IRP.

Table A

Existing Columbia Water & Light Generation Resources

Unit	Description	Net Unit Nameplate Capacity (MW)	Planning Capacity Credit (MW)
Bluegrass Ridge	Wind	6.3	0.8
NextEra Crystal Lake 3	Wind	10.5	1.4
Columbia & Ameresco	Landfill Gas	6.0	6.0
Distributed Generators	Diesel Generation	12.5	12.5
Columbia Energy Center	Combustion Turbine	144.0	144.0
CWL Turbine 5	Coal-Fired Steam	16.5	16.5
CWL Turbine 6	Combustion Turbine	12.5	12.5
CWL Turbine 7	Coal-Fired Steam	22.0	22.0
CWL Turbine 8	Gas-Fired Steam	35.0	35.0
Iatan II	Coal-Fired Steam	20.0	20.0
Prairie State	Coal-Fired Steam	50.0	50.0
Sikeston	Coal-Fired Steam	66.0	66.0

Chart A



As this chart shows, based on the future operation of Municipal Power Plant Units 6 & 7, we will need to be looking for capacity additions in the 2017-18 time frame.

Energy Balance Review:
Electric energy production units can be divided into to four different types of resources. The first three resource types are classified as dispatchable types of resources. Dispatchable generation refers to sources of energy that can be dispatched at the request of power grid operators; that is, generating plants that can be turned on or off, or can adjust their power output on demand. Typically dispatchable types of resources include: base Load, load following or intermediate and peaking. The fourth resources type is classified as intermittent types of resources. Intermittent generation refers to source of energy that is not continuously available due to some factor outside direct control. The intermittent source may be predictable, but cannot be dispatched.

- Base load power plants typically operate at or near maximum output. They shut down or reduce power only to perform maintenance or repair. These plants produce electricity at the lowest cost of any type of power plant, and so are most economically used at maximum capacity. Base load power plants typically include coal, fuel oil, nuclear, geothermal, hydroelectric, biomass and combined cycle natural gas plants.
- Intermediate power plants run during the day and early evening. They either shut down or greatly curtail output during the night and early morning, when the demand for electricity is the lowest. The exact hours of operation depend on numerous factors. One of the most important factors for a particular plant is how efficiently it can convert fuel into electricity. The most efficient plants, which are almost invariably the least costly to run per kilowatt-hour produced, are brought online first. As demand increases, the next most efficient plants are brought online and so on. The status of the electrical grid in that region, especially how much base load generating capacity it has, and the variation in demand are also very important.
- Peaking power plants operate during times of peak demand or for system support. Typically a peaking power plant would start up a couple of hours before peaking loading conditions and shut down a couple of hours after. However, the duration of operation for peaking plants can vary from a good portion of the waking day to only a couple dozen hours per year. Peaking power plants typically include hydroelectric and gas turbine power plants.
- Intermittent power plants operate when fuel is available but are non-dispatchable due to its variable nature of the fuel supply, like wind, solar and hydro.

Below is a table listing Water & Lights' Generation Units with their associated energy production characteristics.

Table B

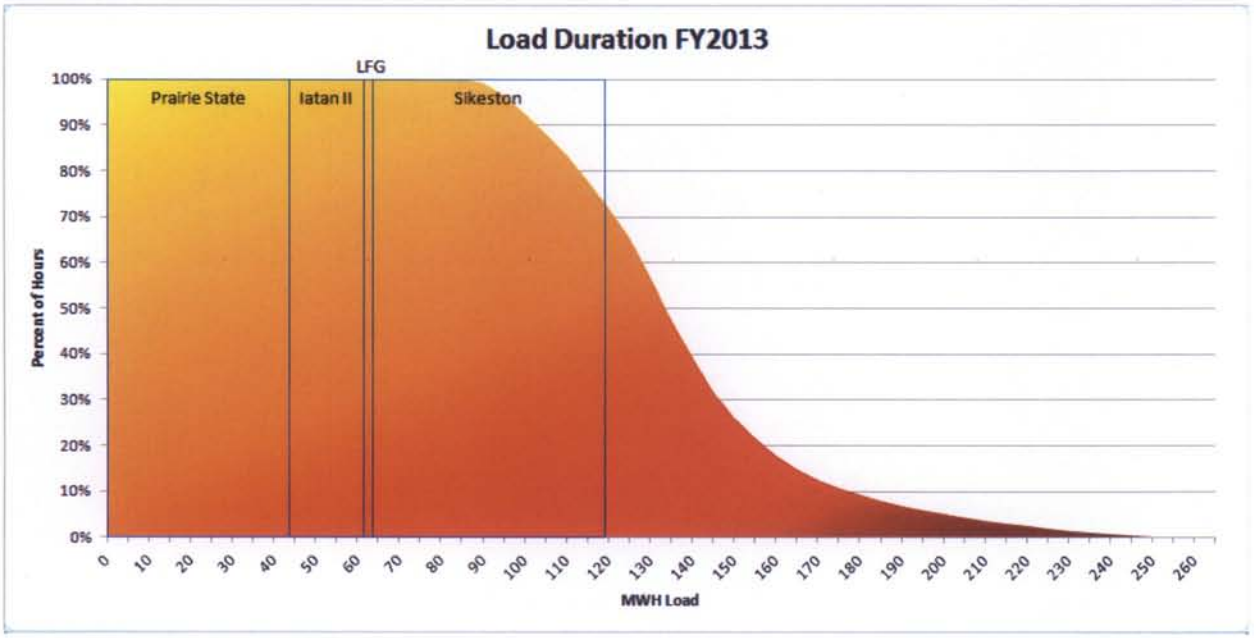
Generation Unit	Description	Resource Type	Cap. (MW)	Dispatchable CWL | RTO		Variable	Predictable	CF (%)	Future Risk
Bluegrass Ridge	Wind	Intermittant	6.3	No	No	High	Low	25%	Low
Crystal Lake 3	Wind	Intermittant	10.5	Dwn	Dwn	High	Low	25%	Low
Ameresco LFG	Landfill Gas	BaseLoad	3	No	No	Med	Med	75%	Low
Columbia LFG	Landfill Gas	BaseLoad	3	Yes	No	Med	Med	75%	Low
RICE Generators	Diesel	Peaking	12.5	Yes	No	Low	High	0%	High
Col. Energy Ctr.	Natural Gas	Peaking	144	Yes	Yes	Low	High	10%	Med
CWL Turbine 5	Coal	Intermediate	16.5	Yes	Yes	Low	High	20%	High
CWL Turbine 6	Natural Gas	Peaking	12.5	Yes	Yes	Low	High	5%	High
CWL Turbine 7	Coal	Intermediate	22	Yes	Yes	Low	High	20%	High
CWL Turbine 8	Natural Gas	Intermediate	35	Yes	Yes	Low	High	10%	High
Iatan II	Coal	BaseLoad	20	No	Yes	Low	High	85%	Low
Prairie State	Coal	BaseLoad	50	No	Yes	Low	High	85%	Low
Sikeston	Coal	BaseLoad	66	Yes	Yes	Low	High	85%	Med

- Bluegrass Ridge – Wind resource located in Northwest Missouri. This resource requires fixed transmission cost to get into the MISO system.
    - Resource Cost = Energy Based Contract + Fixed Transmission
- Crystal Lake 3 – Wind resource located in Northern Iowa. The resource is in MISO and production is sold into the MISO market at point of connection.
    - Dispatch rights and settlement prices passed through the contract
    - Resource Cost = Energy Based Contract + Deemed Energy Contract – MISO Settlement Price
    - Resource Managed by W&Ls' Market Participant
- Ameresco – Landfill Methane Gas fueled Reciprocating Internal Combustion Engines (RICE) located in Jefferson City Missouri. This resource is connected to the Ameren distribution system and is pseudo tied or balanced out with an Ameren connection. This is a Combined Heat and Power (CHP) facility with Columbia Water & Light contracting for the Power output.
    - Resource Cost = Energy Based Contract + Distribution Losses
- Columbia - Landfill Methane Gas fueled Reciprocating Internal Combustion Engines (RICE) in Columbia, Missouri. This resource is located at the Columbia Public Works solid waste landfill and connected directly to Water & Lights' distribution system.
    - Water & Light Owned and Operated Facility
    - Resource Cost = Facility + O&M + Landfill Methane Fuel
- Distributed RICE Generators - Diesel generation sites located in Columbia, MO. 1to 2MW resources located at customer installations to provide on-site backup power support for the customer and peaking generation for Water & Light.
    - Water & Light Owned and Operated Facilities
    - Resource Cost = O&M + Diesel Fuel
    - Regulation Risk High
- Columbia Energy Center – Natural gas resource located in Columbia, MO. This resource is a 4 X 36MW single cycle combustion turbine.
    - Water & Light Owned and Contract Operated Facility

    - Resource Cost = Debt Service + Operations Contract + O&M + Natural Gas Fuel
    - Resource Managed by W&Ls' Market Participant
    - Fuel Risk Medium
- CWL Turbine 5 – Coal resource located at the Columbia Municipal Power Plant. This resource is a 1956 stoker fired steam boiler/turbine.
    - Water and Light Owned and Operated Facility
    - Resource Cost = O&M + Coal Fuel
    - Resource Managed by W&Ls' Market Participant
    - Fuel Risk and Regulation Risk High
- CWL Turbine 6 – Natural gas resource located at the Columbia Municipal Power Plant. This resource is a 1963 single cycle combustion turbine.
    - Water and Light Owned and Operated Facility
    - Resource Cost = O&M + Natural Gas Fuel
    - Resource Managed by W&Ls' Market Participant
    - Fuel Risk Medium
- CWL Turbine 7 – Coal Resource located at the Columbia Municipal Power Plant. This resource is a 1965 stoker fired steam boiler/turbine.
    - Water and Light Owned and Operated Facility
    - Resource Cost = O&M + Coal Fuel
    - Resource Managed by W&Ls' Market Participant
    - Fuel Risk and Regulation Risk High
- CWL Turbine 8 – Natural gas resource located at the Columbia Municipal Power Plant. This resource is a 1970 wall fired steam boiler/turbine.
    - Water and Light Owned and Operated Facility
    - Resource Cost = O&M + Natural Gas Fuel
    - Resource Managed by W&Ls' Market Participant
    - Fuel Risk Medium
- Iatan II – Coal resource located in Kansas City, MO. This resource is a life of the unit participation contract administered through the Missouri Utility Pooling Commission.
    - Resource Cost = Capacity and Energy Based Contract + Fixed Transmission
    - Resource Managed by W&Ls' Market Participant
    - Fuel Risk Low
- Prairie State – Coal resource located in Marissa, IL. This resource is a life of the unit participation contract administered through the Missouri Utility Pooling Commission.
    - Resource Cost = Capacity and Energy Based Contract + Fixed Transmission
    - Resource Managed by W&Ls' Market Participant
    - Capacity Factor Risk Low
- Sikeston – Coal resource located in Sikeston, MO. This resource is a life of the unit participation contract with the Sikeston Board of Public Utilites.
    - Limited dispatch rights passed through the contract, no settlement prices passed through contract
    - Resource Cost = Capacity and Energy Based Contract + Fixed Transmission
    - Resource Managed by W&Ls' Market Participant
    - Regulation Risk Medium

The below load duration curve has the projected energy production from our base load generation units shown.

Chart B



Energy above the Sikeston block will need to be supplied by either intermediate/peaking resources or energy market purchases if the market price is below intermediate/peaking generation costs. The risk of exposure to energy market is capped by cost of intermediate/peaking generation.

The cost of providing electric energy from these three base load resources comes from a separate capacity and energy charge. The table below shows capacity and energy cost for these base load resources:

Table C

BaseLoad Unit	Capacity Cost ($/KW)	Energy Cost ($/MWh)
Sikeston	$18.00	$22.00
Iatan II	$21.00	$21.00
Prairie State	$30.50	$9.00

The arrangement with Sikeston Power Plant is a unit participation contract. The Sikeston Power Station came online in 1981. The Sikeston Power Plant was built with an Electrostatic Precipitator for particulate control and a wet scrubber for SO2 control. With the switch to powder river basin coal the wet scrubber was removed from service. The Sikeston Power Plant had been previously served by two rail providers. A few years ago rail service was reduced to one provider. The risk affect of these items are an older unit will require increased capital repair and replacement investment with age, future environmental regulations will likely require capital expenses to restart the scrubber in the near future, and reduced competition for rail services can have an adverse impact on delivered cost of coal.

The arrangement with the Iatan II Power Plant is a unit participation contract that is administered through the Missouri Joint Municipal Electric Utility Commission. With this arrangement, the commission pools municipal needs to meet them through as a single unit participation contract with the power plant developer. In a pooled arrangement the benefits of the single larger commission contract are passed through the individual utility contracts. In addition to the benefits the individual utilities get from this pooled arrangement, the pools performance is dependent on each utility performance. The Iatan II Power Station come online in 2010 and uses Selective Catalytic Reduction for NOx control, was built with an baghouse for particulate and mercury control and uses a wet scrubber for SO2 control. With this plant all known major risks have been addressed and future costs for fuel and carbon emissions are in line with other modern power plants.

The arrangement with the Prairie State also operates under a unit participation contract administered through the Missouri Joint Municipal Electric Utility Commission. The Prairie State Power Station come online in 2012 and uses Selective Catalytic Reduction for NOx control Dry Electrostatic Precipitator for particulate control, wet scrubber for SO2 control and finally a wet Electrostatic Precipitator for particulate control. This power station was developed as a mine mouth power plant, which means the mine and the electric production facility operate as the power plant. With this plant all known major risk has been addressed and the future costs for carbon emissions are in line with other modern power plant. While the fuel risk has been mitigated with the mine mouth design of the plant, this design transfers some of the operational cost of fuel to a capital cost for the mine. With this approach the reduced cost fuel risk is offset by the bigger capacity factor risk for this facility.

Table D below shows past and expected cost performance for our base load energy resources. The Prairie State Plant has significantly more air emission control equipment in service and this equipment has been a sourch of operational reliability in the early years of operation.

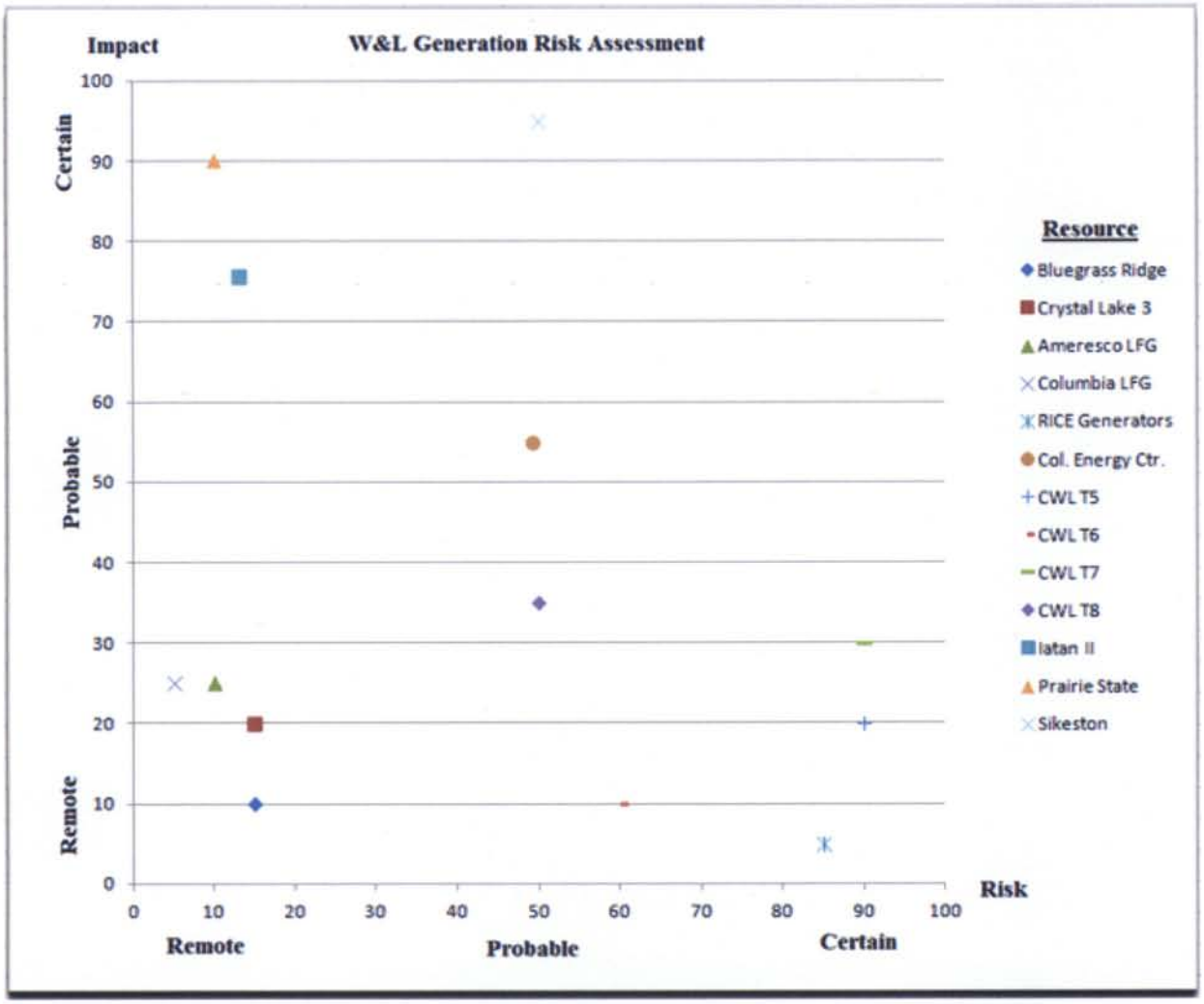
Table D

	Startup Year		First Full Year of Operation		Projected	
BaseLoad Unit	Capacity Factor	Total Cost ($/MWh)	Capacity Factor	Total Cost ($/MWh)	Capacity Factor	Total Cost ($/MWh)
Sikeston	77%**	NA	83%**	NA	85%	$51*
Iatan II	71%	$68	88%	$56	85%	$55
Prairie State 1	60%	$78	58%	$81	85%	$58
Prairie State 2	71%	$67	66%	$72	85%	$58

* Project Total Cost for Sikeston does not include any future emission control expenses.
** Numbers are Averages from a Navigant Survey, not Sikeston specific data.

Chart C Using this information the below Risk Assessment Chart is shown to demonstrate risk vs. impact for W&L Generation Resources.

Chart C



As this table shows, at this time it is the Water & Light Advisory Boards determination that is no high risk and high impact resource issues that need to be addressed at this time. While the electric utility industry will certainly face challenges in the future, Columbia Water & Light is well positioned at this time.

In May of 2014 Standard and Poors conducted a credit rating evaluation for the utility. This evaluation resulted in Standard & Poor's Ratings Services to raise its rating on Columbia, Mo.'s water and electric system revenue bonds one notch to 'AA' from 'AA-' with a stable outlook. This upgrade was based on rating agencies opinion that the system will be able to sustain a solid debt service coverage (DSC) and strong working capital as it has updated its power supply portfolio in recent years and fully integrated those resources into its rates. Additional factors supporting this upgrade include the system's:

- Economically stable and diverse service territory, with higher education and regional health care anchoring the employment base; and

- A modest 10-year capital improvement program, with only about $170 million in identified projects, funded with an equal mix of additional debt and internally-generated revenues.

The stable outlook reflects Standard & Poor's expectation that CW&L's financial performance should continue to exceed conservative forecasts and reflect strong debt service coverage over and beyond our two-year horizon, precluding any downward pressure on the rating. Enhancing credit stability is the fact that the utility is now moving past the most costly phase of its new-generation investment.