



2012 Renewable Energy Report

calendar year 2011 data & forecast for 2012

February 2012

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2012 Renewable Energy Report

Columbia Water & Light

In November 2004, Columbians approved a renewable energy ordinance for the city's power supply portfolio. The ordinance mandates Columbia Water & Light purchase increasing levels of energy from renewable resources. Each year, the utility is required to submit a plan outlining compliance with the ordinance. The Water & Light Advisory Board and the Environment and Energy Commission forwarded their approval of the report to the Columbia City Council. The Columbia City Council will vote to approve the report after holding a public hearing.

Summary

Columbia Water & Light has been pursuing renewable energy sources since the mandate was passed by voter approval in 2004. In 2011, Columbia had 5.4% of the electric portfolio generated from renewable sources. This amount exceeds the current requirement of 2%. The following is a summary of the renewable energy accomplishments:

- 2005: The first renewable energy was delivered to Columbia through a short-term contract for landfill gas energy from Illinois.
- 2007: Columbia started receiving wind energy.
- 2008: The landfill gas to energy project was completed in Columbia. The Columbia Power Plant started burning waste wood along with coal. The Solar One program was launched.
- 2009: Columbia started receiving landfill gas energy from Jefferson City.
- 2010: Three additional solar projects were added to the Solar One program.
- 2011: In December, Columbia started receiving solar energy through a long-term contract with the Free Power Company

Renewable Energy Ordinance

The city shall generate or purchase electricity generated from eligible renewable energy sources at the following levels:

1. 2% of electric retail sales by December 31, 2007
2. 5% of electric retail sales by December 31, 2012
3. 10% of electric retail sales by December 31, 2017
4. 15% of electric retail sales by December 31, 2022

The cost of the renewable energy mandated in the ordinance must not increase electric rates more than 3% higher than the electric rates that would be attributable to the cost of electricity generated from one hundred percent non-renewable sources. The full text of the Renewable Energy Standard and the approved list of renewable resources are listed in the appendix of this report.

2011 Renewable Energy Portfolio Overview

Month	System Total MWH	Bluegrass Wind MWH	Columbia Landfill MWH	Waste Wood MWH	Jeff City Landfill MWH	Solar MWH	Total Renew MWH	Monthly % of System	Annual % of System
1-11	104,370	1,050	1,255	950	2,018	0.7	5,274	5.1%	5.1%
2-11	89,644	1,369	1,043	1,305	1,931	1.2	5,649	6.3%	5.6%
3-11	88,683	1,358	1,269	1,380	2,220	1.9	6,229	7.0%	6.1%
4-11	79,860	1,646	1,187	985	1,685	2.4	5,505	6.9%	6.2%
5-11	88,794	1,363	1,301	0	2,099	2.8	4,766	5.4%	6.1%
6-11	111,595	1,312	771	814	1,510	3.2	4,410	4.0%	5.7%
7-11	137,604	631	1,133	1,389	1,632	3.3	4,788	3.5%	5.2%
8-11	124,170	531	1,116	1,929	1,956	3.0	5,535	4.5%	5.1%
9-11	90,389	874	604	1,350	1,679	2.7	4,510	5.0%	5.1%
10-11	84,257	1,260	1,344	497	1,870	2.4	4,973	5.9%	5.2%
11-11	81,591	1,968	1,299	37	2,033	1.1	5,338	6.5%	5.3%
12-11	92,894	1,407	1,362	1,182	2,215	3.0	6,170	6.6%	5.4%
TOTAL	1,173,851	14,769	13,684	11,818	22,848	28	63,148		

Columbia system load: 1,173,851 megawatt hours

Renewable energy total: 63,148 megawatt hours or 5.4%

- Bluegrass Ridge wind energy: 1.3% of electric system @ \$67.26/MWH
- Columbia landfill gas: 1.2% of electric system @ \$47.38/MWH
- Waste wood (fuel cost only): 1.0% of electric system @ \$56.37/MWH
- Jefferson City landfill gas: 1.9% of electric system @\$53.03/MWH
- Solar: the amount was a very small percentage of the entire supply

Costs of Renewable Energy

As outlined in Section 27-106(b) of the Renewable Energy Standard ordinance, renewable energy cannot cause electric rates to increase more than 3% above what rates would be with non-renewable energy. The City of Columbia has a fiscal year that does not match the calendar year outlined in the Renewable Energy Standard. The maximum dollar amount would be 3% times the total revenue from sources impacted by rate changes during the calendar year. Renewable energy costs for this report include information from the January through September period of the prior fiscal year along with the October through December information from the current fiscal year. For calendar year 2011, the additional cost of renewable energy was \$710,541.57 and the limit was \$3,274,668, as outlined in the following tables. The extra money spent on renewable energy was 21.7% of what was allowed according to the ordinance.

Cost of 2011 Renewable Energy Portfolio

Renewable Resource	Impact on Rates
Columbia Landfill	\$27,094.32
Jefferson City Landfill (Ameresco)	\$174,330.20
Associated Electric (Wind)	\$633,442.41
Local Power Plant (Wood)	(\$124,325.36)
Total Impact on Rates	\$710,541.57

Maximum Renewable Portfolio Cost Calculations

Revenue Source	January – September (FY11)	October – December (FY12)
Residential	\$37,971,219	\$7,795,489
Commercial/Industrial	\$42,155,077	\$10,922,365
Street Lights	\$759,074	\$121,146
Public Authority	\$6,534,052	\$1,891,081
Inter-Departmental	\$760,748	\$245,339
Total Revenue During Calendar Year 2011		\$109,155,590
3% Impact Limit on Rates		\$3,274,668

Calculating Renewable Energy Costs

Renewable and non-renewable energy prices are divided into resources with similar characteristics compared and evaluated according to these similar characteristics.

1. Base Load Resources
 - a. A dispatchable resource that provides capacity and energy at a high capacity factor, on a year-round basis.
 - b. Current non-renewable base load resources
 - i. Sikeston
 - ii. Nearman
 - iii. Ameren System Contract (ended May 31, 2011).
 - iv. Iatan II
 - c. Current renewable base load resources
 - i. Columbia landfill gas plant
 - ii. Ameresco landfill gas plant contract
 - d. All-in cost (capacity, energy and transmission) comparisons are calculated for a monthly average cost per megawatt hour. The cost per megawatt hour variance between each renewable resource and non-renewable resources are applied to the total monthly megawatt hour output of each renewable resource to determine the annual renewable cost variation. The average non-renewable cost in 2011 was \$45.40/MWH
 - i. Columbia landfill gas plant
 - Produced 13,684 megawatt hours
 - The average cost is \$47.38/MWH
 - ❖ Note: A periodic maintenance overhaul on the engines was completed in 2011. Costs were

allocated to all MWH production from the start of the plant through August 2011. This overhaul increased the average cost by \$9.69 per MWH.

- ii.* Ameresco landfill gas plant
 - Produced 22,848 megawatt hours
 - The cost is \$53.03/MWH

2. Intermittent Resources

- a.* A limited or non-dispatchable resource that may provide capacity and energy.
- b.* Current renewable intermittent resources
 - i.* Bluegrass Ridge wind
- c.* All-in cost (energy and transmission) for the renewable resources will be compared to the Midwest Independent System Operator's hourly day-ahead, Locational, Marginal Pricing (LMP) for energy at the Columbia pricing node for the megawatt hours of intermittent resource produced during the hour. The renewable cost per megawatt hour will include any additional fees invoiced under the contract, which are primarily transmission costs. The cost per megawatt hour variance between the renewable energy and the market energy will be applied to the total megawatt hour output of the renewable resources to determine the annual renewable cost variation. For calendar year 2011, the average day-ahead LMP for the hours when the wind resource was producing energy was \$24.37 per megawatt hour.
 - i.* Bluegrass Ridge wind
 - Produced 14,769 megawatt hours
 - The cost is \$67.26/MWH

3. Load Following and/or Ancillary Service Resources

- a.* The Columbia Power Plant is a resource that serves multiple functions. This resource does not provide energy production on a year round basis and should not be considered as a base load resource. For comparison of non-renewable and renewable energy costs, only the variation in the cost of fuel will be utilized for this resource. Adjustment will be made for BTU content of each fuel source to determine a cost per megawatt hour. The variance between the cost per megawatt hour of non-renewable fuel and cost per megawatt hour of renewable fuel will be applied to the total megawatt hour output attributed to the renewable fuel to determine the annual renewable cost variation.
 - i.* Energy cost of coal is \$66.89/MWH
 - ii.* Energy cost of wood
 - Produced 11,818 megawatt hours
 - The cost is \$56.37/MWH

4. Peaking Resources
 - a. All electric utilities are required to maintain resources to meet the megawatt system peak requirements plus a reserve requirement. This capacity requirement is typically met with the lowest cost resource available. The cost is calculated and/or paid on a per megawatt basis, not on a megawatt hour basis. These resources fulfill a specific requirement that typically does not include energy production. Non-renewable capacity resources are the Columbia Energy Center, two natural gas generators at the Columbia Power Plant and Columbia's distributed generation projects. There are not any renewable resources that are in place only for capacity purposes. For the purpose of evaluating non-renewable versus renewable energy costs, capacity resources are excluded from the calculations.
5. The total additional cost of renewable energy is the sum of the calculations described in section 1, 2 and 3 above.

2011 Renewable Energy Portfolio Details

Bluegrass Ridge Wind Energy

Columbia started receiving wind power from turbines near King City, Missouri on September 5, 2007. The Columbia contract is for one ninth of the electric output from the Bluegrass Ridge Wind Farm from Associated Electric Cooperative. At the maximum output, Columbia Water & Light could receive up to 6.3 megawatts. In 2011, Columbia received 14,769 megawatt hours of power from this contract or 1.3% of electric portfolio.

The amount of wind energy Columbia receives is variable. Due to this resource being highly variable, the Midwest Independent System Operator only allows the utility to use a 4.8% capacity factor for wind energy. There is a fixed transmission cost for this energy, so it is more expensive when less energy is received. For example in November, the largest amount of wind energy was received and the cost was \$63.95 per megawatt hour. In August, the lowest producing month, the cost was \$78.84 per megawatt hour. The average cost for 2011 for wind power was \$67.26.

Columbia Landfill Gas Energy Plant

The Columbia Landfill Gas Energy Plant was constructed within the \$3 million budgeted amount through the 2006 bond issue. Electricity is generated by using the gas created from decomposing waste at the landfill. It can currently generate 2.1 megawatts of renewable power. In 2011, the landfill gas plant produced 13,684 megawatt hours of energy which was 1.2% of Columbia's energy portfolio at a total cost of \$47.38 per megawatt hour.

The amount of energy received from the Columbia Landfill Gas Energy Plant is fairly consistent. In 2009, there were some problems with a water collection system at the landfill which lead to smaller amounts of landfill gas for a few

months. In 2011, there was a scheduled outage of the units to complete a periodic rebuild of the engines. There are plans to add another one megawatt generating unit at the landfill in 2012 since the amount of gas being generated has gone up with the addition of a bioreactor at the landfill. After this unit is added, there is still room for a fourth generator. With four generators, electric production could grow to approximately 2.5% of Columbia's energy portfolio over the next ten years.

Wood Fuel at the Columbia Municipal Power Plant

Columbia Water & Light started burning waste wood along with coal at the local power plant in 2008. The wood chips are purchased from a barrel production plant in Lebanon, Missouri. The wood is a by-product of creating the curved planks so they are considered a carbon neutral energy source. Using this form of biomass has allowed the utility to lower emissions and rate the effectiveness of a biomass fuel source.

In 2011, the Columbia Power Plant produced 7% of the city's electric portfolio. Of the electricity produced, the city has been using a 10% mixture of waste wood along with the coal. The energy produced by waste wood was 11,818 megawatt hours which is 1.0% of Columbia's electric portfolio. Moving to a higher percentage of waste wood would require changes to the existing coal handling equipment.

The fuel cost per megawatt hour of power produced for waste wood was \$56.37 while coal during that same time period was \$66.89. Determining the other related costs of producing energy from waste wood is complicated. The Columbia Power Plant is used as a capacity resource and provides a number of different functions. The plant does not have one dedicated function like the Columbia Landfill Gas Energy Plant. The operations and maintenance costs are not accounted for by the generating unit and the fuel type at the Columbia Power Plant. The operations and maintenance costs for wood and coal are similar. The fuel cost for waste wood is lower than coal so using a 10% wood mixture is a cost effective option for the utility at this time.

There are several older generating units at the Columbia Power Plant that will need to be upgraded, replaced or retired to meet future regulatory requirements. In order to determine the options available and the cost of the upgrades, Columbia Water & Light has been conducting research. The Biomass Combustion and Multi-Pollutant Emission Study was completed in 2011. It showed that the equipment could be updated to meet future regulations and to burn biomass. To further evaluate the effectiveness of burning more biomass at the plant, test burns will be conducted in 2012. Also underway is a condition assessment of the existing equipment at the plant. This research will help determine the cost of the upgrades and determine if it is feasible to change the generating units. All of this research will help formulate the best long-range plan

to meet capacity and energy requirements while being in compliance with new environmental regulations.

Ameresco Landfill Gas Plant

Columbia Water & Light has a 20-year power purchase agreement with Ameresco for 3.2 megawatts of energy from the landfill gas plant at the Jefferson City landfill. Columbia started receiving energy from the plant in April 2009. The total amount received in 2011 was 22,848 megawatt hours which is 1.9% of the electric portfolio. The utility pays \$53.05 per megawatt hour for the electricity. Both Columbia and Jefferson City are located within the Midwest Independent System Operator's territory so transmission fees do not substantially change the cost of the energy.

Solar One

Columbia Water & Light started the Solar One program in November 2008 as a way for customers to have an affordable way to invest in local solar energy projects. At the time the program was started the price of solar panels did not fall below the cost threshold in the renewable energy ordinance. This prohibited the utility from starting projects with rate payer funds so the voluntary program was established. Solar One helped the community start developing local projects which lead to Columbia receiving national attention for being a supporter of solar energy.

Solar One energy is generated through solar systems located on city-owned property or at Columbia businesses. Columbia Water & Light partners with local businesses since commercial buildings have large roof tops with good solar exposure. Businesses can also take advantage of incentives for installing solar panels that are not available to the utility. After installing a system, Columbia Water & Light purchases the solar energy from the businesses through a power purchase agreement. The cost of these power purchase agreements is paid for by customers who voluntarily pay an extra \$3.35 a month.

In fiscal year 2011 the installations at the West Ash Water Pumping Station, Quaker Oats and Bright City Lights were rated at 36.8 kilowatts and produced 40,324 kilowatt hours of electricity. Subscriptions to the Solar One program raised \$8,602.10 and the purchased power costs were \$7,931.19. The money raised by Solar One donations is kept within the Solar One account and is not used for other utility or city projects. Due to the addition of Free Power solar energy in 2012, Columbia Water & Light's staff is researching different options for customer based solar energy programs.

Free Power

The Columbia City Council approved a lease agreement with the Free Power Company, Inc. in December 2010. The contract stipulates that Free Power will purchase and install photovoltaic systems in Columbia. The city is responsible for

determining sites, preparing the sites and providing the electric system connection point.

The contract with the Free Power Company states that Columbia Water & Light will pay \$54 in per megawatt hour in 2011 with a 1.75% annual escalation rate. Since the amount of solar energy is only produced during the daytime hours when the energy consumption is high, it is estimated that the agreement will have a minimal impact on the cost of the Columbia's power supply. The rate of escalation built into the contract is less than the historical cost increases of the existing non-renewable resources. No significant fiscal impact is expected from this contract. The risks with this contract are minimal since the city is only financially responsible for site development and the energy delivered to the city.

The goal is to develop the Free Power Company's solar projects in stages. It is estimated that up to 12,000 megawatt hours annually could be delivered to Columbia. Based off the city's 2011 energy use, this solar energy contract would be around 1% of the city's electric portfolio. The estimated amount for 2012 is less than that to allow for the construction of projects throughout the year.

Developing solar projects with the Free Power Company involves many steps. A potential site is determined by identifying solar orientation and access, estimated solar output and other beneficial site characteristics. Once a site is agreed upon for development by Columbia Water & Light and Free Power, site plans are prepared, reviewed by various city departments and a cost analysis is determined for the electric interconnection. After a project has been approved to proceed, the site is prepared for the installation and the materials needed for the project are procured by both the utility and the Free Power Company.

Columbia Water & Light staff has been working with Free Power to potentially develop optimal solar installations at the following sites:

1. COLT Transload Phase I (roof mounted): approximately 360 kilowatts of panels are being installed
 - a. According to the Solar Electric Power Association this will be the largest solar roof installation in the eight contiguous states.
2. Columbia Energy Center
3. West Ash Water Pumping Station
4. COLT Transload Phase II (ground mounted)
5. Creasy Springs Road property
6. Waste Water Treatment Plant
7. Landfill Buffer area

Renewable Energy Education

Advancing Renewables in the Midwest

On March 30, 2011, speakers from the American Wind Energy Industry Association, the American Council for an Energy Efficient Economy, Missouri's

Public Service Commission and other national agencies addressed 180 attendees about the state of renewable energy. The theme of the conference was the economic development aspect of renewable energy and the topics ranged from attracting renewable energy manufacturing jobs to biomass energy development. This 6th annual conference was hosted by Columbia Water & Light, the University of Missouri's Department of Soil, Environmental and Atmospheric Sciences and the Missouri Department of Natural Resources.

Columbia Area Career Center

Energy from the sun is helping to power the Columbia Career Center and provide a learning opportunity for its students. In 2007, Columbia Water & Light purchased photovoltaic panels for the Columbia Area Career Center. Students are now using the solar data in their studies of science and technology.

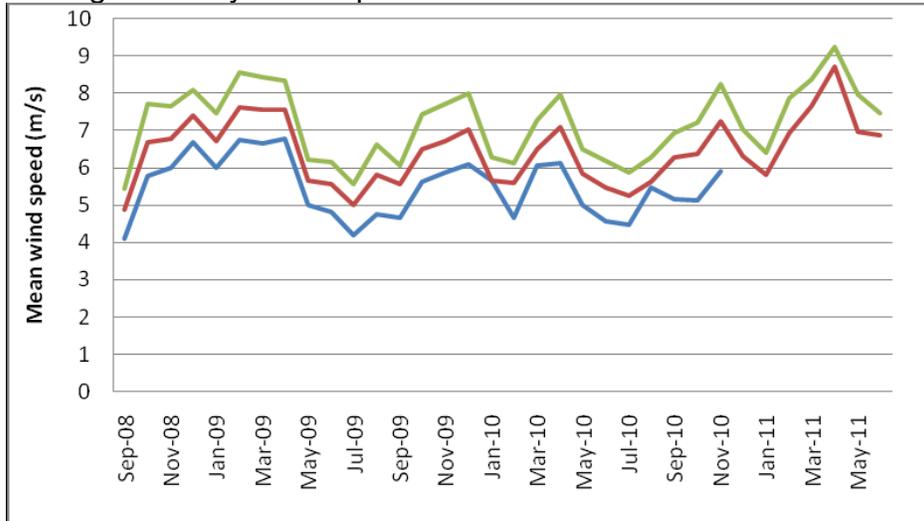
The 2 kilowatt photovoltaic system installed by Columbia Water & Light generated 2,775 kilowatt hours of electricity for the building in 2011. There are also six, 10-watt solar panels and one, 50-watt solar module at this site. Information about the amount of solar radiation, temperature, wind speed and humidity are all available to the students at the Columbia Career Center. A link to the solar production amounts can be found on the City of Columbia's Web site at www.GoColumbiaMo.com.

Anemometers

The University of Missouri's Atmospheric Sciences Department has collected wind speed data for the City of Columbia at the KOMU tower on Columbia's south side from 2008 through 2011. There is very little difference in the annual wind speed between the first and last 12 month period of observations. The site is in an open area of land with minimal obstructions. The data was collected to evaluate the wind speeds for utility scale wind generation in Columbia.

In each case it can be seen that the average annual wind speed observed at the tower sites is significantly lower than that estimated in the AWS Truewind map of Missouri. The difference is of the order of 0.7 meters per second at the 70 meter level and 0.4 meters per second at the 100 meter level. These differences are similar to those found at other sites around the state. It should be remembered that there are differences between these two estimates of average wind speed as the observations take place at a single location while the map averages the wind speed over an area.

Average Monthly Wind Speed at Each Anemometer



The green line represents observations at 147 meters, the red line is for 98 meters, and the blue line shows the measurements at 68 meters.

68 Meter Tower: As time goes on the instruments suffer declining performance and those operating at the 68 m height became too inconsistent to determine accurate observations in December 2010.

Note: One meter equals 3.28 feet, one meter per second equals 2.237 miles per hour

Customer Based Renewable Energy Projects

Columbia Water & Light has several new programs to encourage electric customers to invest in private renewable energy systems.

Net Metering

The Columbia City Council passed an ordinance in 2007 to allow customers to enter into a net metering agreement with Columbia Water & Light. There are currently six net metering sites;

1. Three solar systems at 2 kilowatts
2. One solar system at 1.6 kilowatts
3. One solar system at 3.9
4. One wind system at 11 kilowatts

A net metering arrangement keeps track of the amount of electricity being consumed or being produced for the Columbia system by the customer. At the end of the month, the customer is billed for the difference or the 'net' amount of electricity used over the month's time. Columbia Water & Light credits the net metering customer's account for the electricity provided to the Columbia system. Solar systems provide energy during peak summer conditions so the solar net metering rate customers are reimbursed at the corresponding residential electric rate. The wind net metering credit is two cents per kilowatt hour.

Solar Rebates

Columbia Water & Light offers a one-time \$500 per kilowatt rebate for qualifying photovoltaic systems up to ten kilowatts. If a customer is installing a larger system, they can appeal to the Columbia City Council to allow a larger rebate. Customers installing a solar water heating system can qualify for up to \$800 in rebates. Since 2007, \$16,630 has been awarded in solar rebates by the utility, \$5,830 for photovoltaic systems and \$10,800 for solar water heaters. Columbia Water & Light is expecting more customers to take advantage of these programs as solar technology improves and the cost of the systems go down.

Future Renewable Energy Projects

With over 7% of Columbia's electric portfolio coming from renewable resources in 2012, the 2013 renewable energy ordinance mandate of 5% will be surpassed. By securing extra resources now, the utility is locking in a low cost for future requirements. In 2012 the Free Power solar projects will continue to be developed throughout the year and an additional generator will be added at the Columbia landfill gas plant. A request for proposals sent out by Columbia Water & Light could also add more wind energy to the mix.

Columbia Water & Light has delivered a wind energy contract with NextEra Energy Resources, LLC to the Columbia City Council for consideration. The 20 year contract with NextEra Energy Resources is for 21 megawatts of wind generated power from Iowa. This long-term contract for wind energy allows the University of Missouri to purchase half of the wind power from the city through short-term agreements. The City Council will consider the wind energy provision with the University of Missouri at the same time they are deciding on the contract with NextEra Energy Resources.

NextEra Energy Resources responded to a Request for Proposals that Columbia Water & Light sent out in February 2011 in accordance with the city's purchasing regulations. The most favorable proposal came from NextEra Energy Resources. At their November meeting, the Water and Light Advisory Board unanimously decided to forward the contract to the City Council for approval. The 21 megawatt wind energy contract will produce around 60,000 kilowatt hours in one year. The wind energy will be generated for Columbia from the Crystal Lake III Wind Energy Center located in Hancock County, Iowa. If the power purchase agreement is approved by the City Council at the February 6, 2012 meeting, the delivery of energy will begin within a month.

According to the renewable energy ordinance, the cost of the energy can not raise the electric rates more than 3%. The fixed cost of the wind energy delivered to Columbia starts at \$42.50 per megawatt hour and then increases to \$43.50 in 2013, \$44.50 in 2014 and \$45.00 in 2015 for the remaining years of the contract. The estimated cost for the city's share of the energy in the first year will have a

0.75% impact on rates. The cost of energy from this intermittent wind resource is below the current energy and capacity cost of \$48 for new sources of fossil fuel generated energy.

2012 Estimated Renewable Portfolio

Project	Location	Amount of Energy	%of Portfolio	Cost
Associated Electric Bluegrass Ridge wind energy	King City, MO	14,500 MWH	1.2%	\$67/MWH
Ameresco landfill gas	Jefferson City, MO	22,500 MWH	1.8%	\$53/MWH
Columbia landfill gas	Columbia, MO	13,500 MWH *	1.1%	\$48/MWH
Municipal Power Plant waste wood	Columbia, MO	9,000 MWH	0.7%	\$56/MWH **
Free Power Solar	Columbia, MO	6,000 MWH ***	0.5%	\$55/MWH
NextEra's Crystal Lake wind energy	Hancock County, Iowa	24,000 MWH	2.0%	\$42.50/MWH

*The amount of energy generated at the Columbia landfill gas plant could increase slightly for 2012 depending on when the new generator is installed.

**Wood generated energy costs are only for the fuel source

***The Free Power contract states that they will install systems that will generate up to 12,000 megawatt hours in a year. The estimated amount for 2012 is less than that to allow for the construction of projects throughout the year.

Appendix

Historical Renewable Energy Data

2007 Renewable Energy Overview

Month	Total System MWH	Wind MWH	Columbia Landfill MWH	Waste Wood MWH	Jeff City Landfill MWH	Total Renew MWH	Monthly % of System	Annual % of System
9-07	104,618	592				592	0.6%	
10-07	91,357	1,030				1,030	1.1%	
11-07	84,135	1,153				1,153	1.4%	
12-07	97,985	969				969	1.0%	
TOTAL	378,095	3,744				3,744		

2008 Renewable Energy Overview

Month	System Total MWH	Wind MWH	Columbia Landfill MWH	Waste Wood MWH	Jeff City Landfill MWH	Solar MWH	Total Renew MWH	Monthly % of System	Annual % of System
1-08*	102,167	1,080					1,080	1.1%	1.1%
2-08*	95,852	671					671	0.7%	0.9%
3-08*	89,178	798					798	0.9%	0.9%
4-08*	83,215	782		158			940	1.1%	0.9%
5-08*	85,467	485		185			670	0.8%	0.9%
6-08*	104,001	321	672	802			1,795	1.7%	1.1%
7-08*	116,895	250	874	594			1,718	1.5%	1.1%
8-08*	111,956	229	1,279	821			2,329	2.1%	1.3%
9-08*	92,891	539	1,204	765			2,508	2.7%	1.4%
10-08	83,693	1,169	998	243		0.265	2,410	2.9%	1.5%
11-08	82,509	646	1,216	0		0.362	1,862	2.3%	1.6%
12-08	98,719	1,205	1,039	334		0.294	2,578	2.6%	1.7%
TOTAL	1,146,543	8,128	7,282	3,902	0	1	19,313		

* Starting in January 2008 there were cracked blades on the wind turbines which lowered production amounts by approximately 5,557 megawatt hours.

Note: Solar energy amounts were not included in the totals due to the small amount.

Historical Renewable Energy Data continued...

2009 Renewable Energy Overview

Month	System Total MWH	Wind MWH	Columbia Landfill MWH	Waste Wood MWH	Jeff City Landfill MWH	Solar MWH	Total Renew MWH	Monthly % of System	Annual % of System
1-09	101,445	979	1,167	853		0.369	2,999	3.0%	3.0%
2-09	83,491	933	1,043	670		0.459	2,646	3.2%	3.1%
3-09	84,038	2,807	1,236	146		0.643	4,189	5.0%	3.7%
4-09	80,857	3,208	1,216	0	1,220	0.610	5,644	7.0%	4.4%
5-09	84,508	2,696	1,083	379	1,427	0.807	5,585	6.6%	4.8%
6-09	104,689	761	1,181	75	1,711	0.831	3,728	3.6%	4.6%
7-09	106,500	480	1,145	175	1,583	0.812	3,383	3.2%	4.4%
8-09	107,081	691	1,113	102	1,729	0.746	3,635	3.4%	4.2%
9-09	89,941	533	402	576	1,590	0.606	3,101	3.4%	4.1%
10-09	83,335	1,279	44	854	1,769	0.373	3,946	4.7%	4.2%
11-09	79,725	1,439	695	76	1,849	0.356	4,059	5.1%	4.3%
12-09	99,645	992	551	1,265	1,352	0.221	4,160	4.2%	4.3%
TOTAL	1,105,255	16,798	10,876	5,171	14,227	7	47,079		

In 2008, the amount of wind energy Columbia received was low due to some of the turbine blades cracking. Due to this shortfall of energy, Associated Electric Cooperative provided the first 6.3 MW of energy produced from the wind farm for March, April and May of 2009 and again in January, February and March of 2010.

2010 Renewable Energy Overview

Month	System Total MWH	Wind MWH	Columbia Landfill MWH	Waste Wood MWH	Jeff City Landfill MWH	Solar MWH	Total Renew MWH	Monthly % of System	Annual % of System
1-10	106,770	2,088	1,090	1,119	982	0.233	5,279	4.9%	4.9%
2-10	92,910	2,132	1,112	734	1,656	0.352	5,634	6.1%	5.5%
3-10	86,980	3,327	1,219	623	2,002	0.539	7,172	8.2%	6.3%
4-10	80,544	1,798	1,151	368	1,914	0.694	5,232	6.5%	6.3%
5-10	90,412	1,018	1,135	0	2,212	0.735	4,366	4.8%	6.0%
6-10	114,129	746	1,253	367	1,846	0.781	4,213	3.7%	5.6%
7-10	123,263	523	1,127	495	1,556	0.741	3,702	3.0%	5.1%
8-10	128,815	688	911	773	1,890	0.819	4,263	3.3%	4.8%
9-10	95,840	1,154	832	804	1,744	1.372	4,535	4.7%	4.8%
10-10	83,554	1,107	966	690	2,037	1.335	4,801	5.7%	4.9%
11-10	81,674	1,691	1,196	866	2,058	1.262	5,812	7.1%	5.1%
12-10	100,461	1,068	1,060	593	1,811	0.541	4,533	4.5%	5.0%
TOTAL	1,185,352	17,340	13,052	7,432	21,708	9	59,541		

In 2008, the amount of wind energy Columbia received was low due to some of the turbine blades cracking. Due to this shortfall of energy, Associated Electric Cooperative provided the first 6.3 MW of energy produced from the wind farm for March, April and May of 2009 and again in January, February and March of 2010.

Approved Sources of Renewable Energy

The following sources of renewable energy were approved by the Columbia City Council in March 2006 as sources of compliance with the Renewable Energy Standard ordinance.

Wind Energy: All electricity generated through wind power would qualify as a renewable resource, including wind energy that is stored in any form for later use as electrical power.

Solar Energy: All active solar energy systems would qualify as a renewable resource, including solar photovoltaics, solar water heating, solar space heating, and any other method of using the sun that requires 'active' collection techniques. In this regard 'passive' solar heating, or systems which do not employ the use of mechanical equipment to move or distribute the heat, would not be considered as eligible items.

Biomass Energy: Biomass energy is typically considered to be derived from plants which have accumulated solar energy through photosynthesis. This definition, however, is somewhat open-ended as virtually all our current fossil fuels are derived from plants, even though their life span may have occurred in the geologic past. To create a definition of biomass that would correspond with its commonly understood meaning, biomass energy is considered to be energy derived from plant origin, considering only those plants that have been harvested within the recent past, certainly within the last 100 years.

Columbia Water & Light suggests that eligible biomass energy specifically include (but not be limited to) the following materials:

- Landfill Gas
- Paper based products, such as cardboard and newsprint
- Wood and wood wastes
- Cellulose based products that originate from trees or shrubbery
- Other materials that come directly from trees or plants.

In the event that an energy source would be derived from a mixture of biomass and other non-renewable materials Columbia Water & Light would make a rigorous assessment to determine what energy content of the fuel is biomass derived, and only claim that portion for compliance with the renewable energy ordinance.

Hydropower: By all definitions, hydropower fits the definition of renewable power in that it is renewed by the earth's water cycle.

Geothermal Power: Columbia Water & Light considers that geothermal power, or any energy that may be extracted from the earth, is eligible as a renewable resource. This would only be in reference to active mechanical systems that

extract the heat energy from the earth. Passive systems would not be eligible under this definition. It would be the utility's responsibility to provide details on what constitutes energy provided through geothermal power on a case-by-case basis.

Green Tags: The Green Tag system that has originated throughout the country allows a utility to make purchases of Green Tags and thus participate in the development of green, or renewable, energy without actually receiving that energy in the utility's system. In such situations the developer of the renewable resource is paid an agreed-to amount for the Green Tag for each Megawatt-hour sold; however, the electricity is not delivered to the utility. Thus Green Tags simply represent the value of the renewable portion of the project or the premium that is above the cost of conventional electricity project. Green Tags are commonly sold and traded across the US.

Although this works for other utilities, Columbia Water & Light has every intention of complying with the renewable energy ordinance by finding sources located close enough to Columbia that the power can be transmitted into our system. In the future, however, the higher compliance requirements may force the utility to look at Green Tags as an option. Columbia Water & Light would pursue this avenue only as a last resort and would seek approval before purchasing renewable energy in this manner.

Future Projects: The above list is not intended to be final because there may be new sources of power that could be a renewable resource in the future. Columbia Water & Light could come back to the city's governing bodies in the future should a new renewable resource come available.

Sec. 27-106. Renewable energy standard

(a) The city shall generate or purchase electricity generated from eligible renewable energy sources at the following levels:

- (1) Two (2) percent of electric retail sales (kWhs) by December 31, 2007;
- (2) Five (5) percent of electric retail sales (kWhs) by December 31, 2012;
- (3) Ten (10) percent of electric retail sales (kWhs) by December 31, 2017; and
- (4) Fifteen (15) percent of electric retail sales (kWhs) by December 31, 2022.

(b) This renewable energy shall be added up to these kilowatt hour levels only to the extent that it is possible without increasing electric rates more than three (3) percent higher than the electric rates that would otherwise be attributable to the cost of continuing to generate or purchase electricity generated from one hundred (100) percent non-renewable sources (including coal, natural gas, nuclear energy and other nonrenewable sources).

(c) Eligible renewable energy generation may be provided by wind power, solar energy, bio-energy sources or other renewable sources which meet the environmental criteria approved by the city council after review by the environment and energy commission and the water and light advisory board. Electricity purchased from on-site renewable energy systems owned by Columbia Water & Light customers ("net metering") may be included within the calculation of the levels required in subsection (a).

(d) Renewable energy generation sources located within Missouri may receive referential consideration in the selection process.

(e) Each year prior to February 1, the water and light department shall publicly release a renewable energy plan detailing a proposal for how the city would comply with this section during the following year. The plan will explain the city's due diligence in pursuing renewable energy opportunities and detail all cost assumptions and related utility rate calculations, except with regard to confidential information that may be withheld pursuant to state law. The plan will then be reviewed by the environment and energy commission and water and light advisory board and submitted to the city council for approval following a public hearing.

(Ord. No. 18196, § 1, 8-16-04)

Editors Note: Ord. No. 18196, passed by city council on Aug. 16, 2004, called for election; said ordinance was passed by the voters on Nov. 2, 2004.

Secs. 27-107--27-110. Reserved.