



# **2011 Renewable Energy Report**

**February 2011**

# **2011 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. A draft version of the 2011 report was reviewed by the Water & Light Advisory Board and the Environment and Energy Commission. After receiving input from both groups and a public hearing, the Columbia City Council approved the report.

### **Summary**

Columbia Water & Light has been pursuing renewable energy sources since the mandate was passed by voter approval in 2004. In 2010, Columbia had 5% 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.

### **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.

## 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%
<b>TOTAL</b>	<b>1,185,352</b>	<b>17,340</b>	<b>13,052</b>	<b>7,432</b>	<b>21,708</b>	<b>9</b>	<b>59,541</b>		

Columbia system load: 1,185,352 megawatt hours

Renewable energy total: 59,541 megawatt hours or 5%

- Bluegrass Ridge wind energy: 1.5% of electric system @ \$65.95/MWh
- Columbia landfill gas: 1.1% of electric system @ \$38.10/MWh
- Waste wood (fuel cost only): 0.6% of electric system @ \$56.22/MWh
- Jefferson City landfill gas: 1.8% of electric system @ \$53.05/MWh

### Costs of Renewable Energy

As outlined in Section 27-106(b) of the Renewable Energy Standard, 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 2010, the additional cost of renewable energy was \$598,640.71 and the limit was \$3,165,549.00, as outlined in the following tables. The extra money spent on renewable energy was 18.9% of what was allowed according to the ordinance.

## Cost of 2010 Renewable Energy Portfolio

Renewable Resource	Impact on Rates
Columbia Landfill	(\$121,775.16)
Jefferson City Landfill (Ameresco)	\$121,998.96
Associated Electric (Wind)	\$682,405.97
Local Power Plant (Wood)	(\$83,758.64)
<b>Total Impact on Rates</b>	<b>\$598,871.13</b>

## Maximum Renewable Portfolio Cost Calculations

Revenue Source	January – September (FY10)	October – December (FY11)
Residential	\$35,117,418	\$8,970,623
Commercial/Industrial	\$38,977,796	\$11,945,576
Street Lights	\$920,022	\$259,330
Public Authority	\$6,363,887	\$2,155,617
Inter-Departmental	\$608,555	\$199,470
Total Revenue During Calendar Year 2010		\$105,518,294
<b>3% Impact Limit on Rates</b>		<b>\$3,165,549.00</b>

## 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. Based 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.
  - 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 is \$47.43/MWh
    - i. Columbia landfill gas plant
      - Produced 13,052 megawatt hours
      - The average cost is \$38.10/MWh .
    - ii. Ameresco landfill gas plant
      - Produced 21,708 MWh.
      - The cost is \$53.05/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 2010, the average day-ahead LMP for the hours when the wind resource was producing energy was \$26.60 per megawatt hour.
    - i. Bluegrass Ridge wind
      - Produced 17,340 MWh
      - The cost is \$65.95/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 \$67.49/ MWh.
    - ii. Energy cost of wood
      - Produced 7,432 MWh
      - The cost is \$56.22/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.

## **2010 Portfolio Details**

### **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.

The amount of wind energy Columbia receives is variable, as is the cost. 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 March, the largest amount of wind energy was received and the cost was \$61.72 per megawatt hour. In July, the lowest producing month, the cost was \$74.66 per megawatt hour. The average cost for 2010 for wind power was \$65.95.

In 2008, the amount of wind energy Columbia received was low due to some of the turbine blades cracking. The estimated amount of energy lost was 5,557 megawatt hours. 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. Columbia also received additional wind energy under this agreement again in January, February and March 2010.

## Columbia Wind Energy Details

Month	System Monthly MWH's	MWH's of Wind Delivered	% of Total System Energy	Total Cost	Cost per MWH	Total Load Factor	MWH's @ 100% Load Factor
Jan 10	106,770	2,088*	2.0%	\$132,889	\$63.64	44.55%	4,687.2
Feb 10	92,910	2,132*	2.3%	\$135,474	\$63.54	50.36%	4,233.6
Mar 10	86,980	3,327*	3.8%	\$205,324	\$61.72	70.98%	4,687.2
Apr 10	80,544	1,798	2.2%	\$116,169	\$64.47	39.73%	4,536.0
May 10	90,412	1,018	1.1%	\$70,354	\$69.11	21.72%	4,687.2
Jun 10	114,129	746	0.7%	\$54,514	\$72.98	16.47%	4,536.0
Jul 10	123,263	523	0.5%	\$49,949	\$74.66	14.27%	4,687.2
Aug 10	128,815	688	0.5%	\$51,214	\$74.12	14.74%	4,687.2
Sep 10	95,840	1,154	1.2%	\$78,274	\$67.83	25.44%	4,536.0
Oct 10	83,554	1,107	1.3%	\$75,524	\$68.22	23.62%	4,687.2
Nov 10	81,674	1,691	2.1%	\$109,679	\$64.86	37.28%	4,536.0
Dec 10	100,461	1,068	1.1%	\$73,269	\$68.60	22.79%	4,687.2

\* Delivered wind energy to Columbia was for first 6.3 MW's produced by wind farm to make up for small production numbers during the previous year when the turbines had cracked blades.

Note: "MWH's @ 100% Load Factor" is calculated by multiplying 6.3 times 24 hours times the number of days in the month. "Total Load Factor" is calculated by dividing "MWH's Delivered" by "MWH's @ 100% Load Factor". Total load factor is also referred to as the capacity factor.

### 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 2010, the landfill gas plant produced 13,052 megawatt hours of energy which was 1.1% of Columbia's energy portfolio at a total cost of \$38.10 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 2010, the amount of energy each month was more steady. This amount of energy is expected to go up with the new bioreactor at the landfill. Electric production could be as much as 2.5% of Columbia's energy portfolio over the next five to ten years.

### **Wood Fuel at the Columbia Municipal Power Plant**

Columbia Water & Light started a pilot project in April 2008 to evaluate burning waste wood along with coal at the local power plant. 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 2010, the Columbia Power Plant produced 5.8% 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 7,432 megawatt hours which is 0.6% 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 \$56.22 while coal during that same time period was \$67.49. 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 generating unit and 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.

### **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 2010 was 21,708 megawatt hours which is 1.8% 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 Projects**

The current amount of solar energy is small enough that it does not impact the cost cap outlined in the renewable energy ordinance. However, Columbia Water & Light wanted to start developing this resource for the future. Solar One was started in November 2008 as a way for customers to have an affordable way to invest in local solar energy projects.

Solar One energy is generated through solar systems located on city-owned property or at Columbia businesses. By working with local businesses, Columbia Water & Light can provide more solar energy at a lower cost. Columbia's

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. Columbia Water & Light purchases the solar energy from businesses through a power purchase agreement. Solar energy is being generated at Quaker Oats, Bright City Lights and from solar systems located behind the West Ash Pumping Station on Bernadette Drive.

Columbia Water & Light sent out a Request for Proposals in 2009 and an additional project at Quaker Oats and a new installation at Bright City Lights were installed in 2010. A new solar shingle system, provided by Dow Chemical Company, was also installed on city-owned property. By the end of 2010, Solar One projects were rated at 33.8 kilowatts.

The extra cost of providing the solar energy to the Columbia system through these power purchase agreements with businesses is paid for by voluntary subscribers to Solar One. The cost of these new contracts is lower so the cost of Solar One subscription amount went down. Columbia Water & Light was purchasing energy from a 5 kilowatt system for \$0.41 per kilowatt hour. By adding 15 kilowatts from the new contracts, the net blended cost of the program is \$0.33 per kilowatt hour. This reduction allows the utility to collect less in monthly fees from all Solar One customers (both existing and new) and still maintain a positive balance of revenue and expenditures.

Currently, through the city's website, customers can purchase 100 kilowatt hours of electricity annually for \$3.35. A customer can purchase up to nine blocks. Participants in the Solar One program still pay the normal rate for the electricity they use. The Solar One charges show up as an additional line item on the monthly bill.

The development of solar energy could increase in 2011. The Columbia City Council approved a lease agreement for more local solar projects in December, 2010. As these new solar projects develop, the future of the Solar One program will be evaluated by the Water & Light Advisory Board and the City Council.

There is a video about the Solar One program available on the city's web site at: [http://gocolumbiamo.granicus.com/MediaPlayer.php?view\\_id=3&clip\\_id=281](http://gocolumbiamo.granicus.com/MediaPlayer.php?view_id=3&clip_id=281)

## **Renewable Energy Education**

### **Advancing Renewables in the Midwest**

On July 15, 2010, speakers from the Department of Energy, the Environmental Protection Agency, the Missouri Department of Natural Resources and other national agencies addressed 170 attendees about the state of renewable energy. Funding, legislative updates, economic impacts, new renewable projects and energy efficiency were all covered at the event. This fifth 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 2,861 kilowatt hours of electricity for the building in 2010. There were also six, 10-watt solar panels and one, 50-watt solar module installed. They provide information about the amount of solar radiation, temperature, wind speed and humidity. A link to the solar production amounts can be found on the City of Columbia's Web site at [www.GoColumbiaMo.com](http://www.GoColumbiaMo.com).

### **Anemometers**

The University of Missouri's Atmospheric Sciences Department collected wind speed data for the City of Columbia at the KOMU tower on Columbia's south side from 2008 through 2010. 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. The minimum wind speed for most utility scale wind projects is 12 miles per hour or 5.36 meters per second.

During the period that data has been collected at this site, the wind speeds have decreased. The mean annual wind speed has also been significantly lower than that estimated by the AWS Truewind wind map of Missouri. 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 mean wind as the observations take place at a single location while the map averages over an area.

The average wind speed at the KOMU site from August 2009 to July 2010 was:

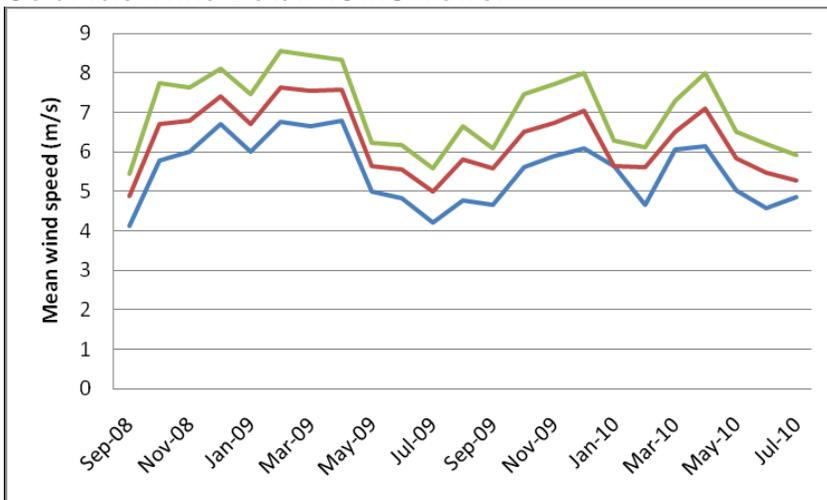
- 68 meters (223 feet): 5.31 meters per second
- 98 meters (321 feet): 6.25 meters per second
- 147 meters (482 feet): 7.04 meters per second.

Note: 1 meter per second = 2.237 miles per hour

### Columbia Wind Data: KOMU Tower

Month	68 m	98 m	147 m
September 2008	4.11	4.87	5.45
October 2008	5.78	6.69	7.73
November 2008	6.01	6.79	7.64
December 2008	6.70	7.41	8.10
January 2009	6.00	6.71	7.46
February 2009	6.76	7.62	8.56
March 2009	6.66	7.55	8.43
April 2009	6.78	7.57	8.33
May 2009	5.00	5.65	6.23
June 2009	4.82	5.56	6.16
July 2009	4.21	4.99	5.57
August 2009	4.77	5.8	6.64
September 2009	4.66	5.57	6.08
October 2009	5.62	6.51	7.45
November 2009	5.89	6.73	7.71
December 2009	6.09	7.04	7.99
January 2010	5.65	5.65	6.28
February 2010	4.66	5.60	6.12
March 2010	6.07	6.50	7.29
April 2010	6.13	7.10	7.98
May 2010	5.02	5.84	6.51
June 2010	4.56	5.47	6.20
July 2010	4.84	5.28	5.93

### Columbia Wind Data: KOMU Tower



Variation in mean monthly wind speed at each height on the Columbia tower. The green line represents observations at 147 m, the red line is for 98 m, and the blue line shows the measurements at 68 m.

## **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 four net metering customers; two of the solar projects are rated at 2 kilowatts, one solar system is rated at 1.5 kilowatts and the wind system is rated 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. To date, \$4,480 has been awarded in solar rebates by the utility, \$2,880 for photovoltaic systems and \$1,600 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**

Columbia Water & Light sent out a Request for Proposal (RFP) for renewable energy sources to meet the 2017 requirement of a 10% renewable energy portfolio. Staff received three responses in January, 2010 for wind energy. An evaluation committee was formed and they conducted interviews to evaluate the submitted proposals. The committee identified the two proposals with the best utility cost benefit. The cost ranged from \$65 to \$74 per megawatt hour. Based on the evaluated prices, the Midwest Independent System Operator's transmission and market cost issues, no proposals were accepted.

In December, 2010 the Columbia City Council signed a solar energy lease agreement with Free Power Company. The agreement states the City will pay Free Power Company based on the solar energy delivered by the systems. They will be supplying, installing and maintaining the photovoltaic system equipment. The city will be responsible for site selection, site preparation and electric service to the interconnection point. Staff members are currently working with the Free Power Company to select city sites for the photovoltaic systems.

The contract states that Columbia Water & Light will pay \$54 per megawatt hour 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 electric portfolio. 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.

### **2011 Estimated Renewable Portfolio**

It is estimated that in 2011, Columbia will receive around 5% of the electric portfolio from renewable resources. Columbia Water & Light is reviewing proposals that were solicited at the end of 2009 for an additional 5,000 megawatt hours of renewable energy. If there is renewable energy available this year and a contract can be finalized, the percentage of renewable energy could be 0.5% higher.

<b>Project</b>	<b>Location</b>	<b>Amount of Energy (Megawatt Hours)</b>	<b>Percentage of Columbia Energy Portfolio</b>	<b>Cost per Megawatt Hour</b>
Bluegrass Ridge wind energy	King City, MO	14,000	1.2%	\$67
Ameresco landfill gas	Jefferson City, MO	21,700	1.8%	\$53
Columbia landfill Gas	Columbia, MO	13,000	1.1%	\$38
waste wood	Columbia, MO	7,400	0.6%	\$56*
Solar (Free Power)	Columbia, MO	To be determined	To be determined	\$54

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

# 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%	
<b>TOTAL</b>	<b>378,095</b>	<b>3,744</b>				<b>3,744</b>		

## 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%
<b>TOTAL</b>	<b>1,146,543</b>	<b>8,128</b>	<b>7,282</b>	<b>3,902</b>	<b>0</b>	<b>1</b>	<b>19,313</b>		

\* 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%
<b>TOTAL</b>	<b>1,105,255</b>	<b>16,798</b>	<b>10,876</b>	<b>5,171</b>	<b>14,227</b>	<b>7</b>	<b>47,079</b>		

## 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 physically 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.**