Renewable Projects

Electric

Since May 23, 1885, when Aspen became the first municipality in the United States west of the Mississippi, to harness hydroelectric power for lighting homes, businesses and streets, Aspen has been progressive and innovative in supplying power to it residential and commercial customers. Aspen was not only put on the map for the silver ore that poured from its mines, but for its role as a leader in the applied technology of mining. In keeping up with Aspen's reputation as being progressive and innovative reputation, the City of Aspen purchased 640,000 kW of wind power from Holy Cross Energy. In 1999, it began paying for 2.4 million kW from Platte River Power Authority and currently it purchases 18,550 MWh from the Municipal Energy Agency of Nebraska which constitutes 26% of the COA Electric System energy supplied by wind. The other renewables energy supply is 45% hydro which includes the Ruedi Dam Hydro facility (29.3%), Maroon Creek hydro (2.3%) and 13.8% from WAPA and MEAN. This makes the COA Electric system a total of 71.5% renewable source. The City of Aspen electric system serves 1,993 residential customers, 834 small commercial customers and 41 large commercial customers. In November, 2000, the Aspen/Pitkin County Building Department worked with Aspen City Council to create REMP (Renewable Energy Mitigation Program). The REMP program gives two choices to owners of new homes over 5,000 square feet: Either the home must include a renewable energy system, like solar heating or photovoltaic electric generation or the owner must pay a special mitigation fee that increases with each energy using amenity. In 2009, The City of Aspen's City Council approved the program of tiered Electrical rates which by design encourage electric conservation by making your electric rate proportionally go up as you use more power based on a base load calculation.

a. Hydroelectric (WAPA, Ruedi< and Maroon Creek)

   The COA renewable energy supply is 45% hydro which includes the Ruedi Dam Hydro facility (20,910 Mwh-29.3%of total energy mix), Maroon Creek hydro (1,647 MWh-2.3%) and the remaining percentage from WAPA and MEAN (9,882 MWh-13.8% based on year 2008 figures.)

b. Wind Energy (MEAN)

The COA currently receives 18,550 MWh of wind with 18,075 MWh coming from an Aspen contract with MEAN and another 475 MWh from MEAN in their total mix. This wind accounts for 26% of the COA total renewable portfolio. The City is looking into possible more wind purchases in the future.

c. Coal-fired (MEAN)

In the MEAN overall mix, their coal-fired usage is 21.8% of Aspen's total power mix.

d. Natural Gas Turbines (MEAN)
   In the MEAN overall mix, their gas-fired usage is 1.4% of Aspen's total power mix.
e. Nuclear (MEAN)
f. In the MEAN overall mix, their nuclear usage is 5.3% of Aspen's total power mix.

g. Agricultural methane (MEAN)
h. Program goals and summary of future emissions reductions

The City's long term goal is to be at 100% by 2020 by implementing many different renewable technologies. Our goal, lofty that it is, is to use geo-thermal heat exchange, hydroelectric power, photovoltaic power, wind power, solar thermal collection, hydrogen generation, micro turbines on our water lines, and fuel cell technology to obtain total green energy dependence at our facility. We plan on extending this concept throughout our municipality starting with city-owned facilities and housing and eventually extending it to all residents. Once the city of Aspen has proven that the integration of all these technologies is not only possible, but economically viable, then we hope this model will be used world-wide.

In the area of Utility programs, the city of Aspen currently has an annual energy efficiency budget of $150,000 to promote green solutions and energy conservation within our electric service area. Current efficiency programs include: appliance rebate programs for Energy Star rated appliances; Photovoltaic (PV) installation incentives; a geothermal installation assistance program; and, energy audit rebates. Additionally, in conjunction with the Federal Economic Stimulus package, which will be giving taxpayers money back starting in May 2008, the city began offering extra incentives in all its efficiency programs—doubling the appliance rebates, as well as increasing the PV rebates from $2/watt to $3/watt; offering geothermal installation incentives of matching customer funds for the installation plus an extra $4,000 rather than only a $4,000 incentive; and, increasing our 50 percent rebate on energy audit costs from a ceiling of $200.00 to a ceiling of $500.00.

We have ordered a complete energy analysis/audit for replacement of pumps and lighting loads and energy efficiency programs to reduce our energy consumption at all City facilities.

1. Solar PV
   The Water Department has completed the installation of Phase 1 of their Solar Voltaic Project which encompassed the installation of a 20,740 watt advanced solar energy system. It includes the education web site which will make show on the internet in real time, the electricity generated by the system. Phase II and III will be the completion of installation of the PV system which will meet our goal of meeting all the electric needs of the campus and any unused power

will be placed on the City of Aspen Electric grid. This would eventually tie into our other renewable energy systems. By converting sunlight directly into energy through the use of photovoltaic cells, we reduce our carbon footprint, as well as eliminating our exposure to energy price volatility. This direct process results in a reduced amount of carbon being emitted by approximately 2,303,750 lbs. of carbon over the lifetime of the PV system for Phase I alone. Phase II will reduce the carbon being admitted by the same amount, bringing the total reduction over the life of the PV system to 4,607,500 lbs of carbon. By the completion of all three phases, we will have reduced our carbon footprint by approximately 9,215,000 lbs.

We have pursued perhaps forming solar districts to promote the application and installation of solar panels on roof tops in the City using a "Feed-in Tariff" or promoting solar installation companies to lease roof tops for solar installation.

2. Solar Thermal

   We are incorporating solar Thermal panel systems to meet our domestic hot water and supplementing GSHP technology for heating needs on any applicable facilities.

3. Ground Source Heat Pumps

   The design, retrofit and incorporation of the existing floor heating system and air exchange units with solar thermal panels and heat exchange unit for Water Campus buildings has been initiated and will use a geo-exchange system to extract heat and cooling out of our water that is stored under the building. This will eliminate our need to burn natural gas for heating and cooling. Our Admin building is slated for an addition to be added on to it this summer as well as PV system. We are incorporating heat exchange systems for the East Treatment Plant Building, West Treatment Plant Building and Distribution/Electric Building.

   The programs we are initiating and/or doing feasibility studies on are: a community-wide geothermal heat exchange utility using existing stored water in the surrounding mine shafts; heat exchange off of our new hydroelectric facility and recreation center swimming pool; geo-exchange off of our local sanitation plant to offset heating and cooling loads at our new employee housing subdivision.

4. Hydrogen Fuel Cell

   We have performed feasibility studies to replace battery backup systems for cell sites and communication centers and the replacement of our diesel generator with fuel cells powered by our own hydrogen

production as well as possibly provides emergency backup power for the hospital.

i. Renewable Energy Utilities

1. Castle Creek Hydro

A system and building design for the proposed New Castle Creek hydroelectric plant has been completed. This conceptual design identifies the potential amount of power that would be generated, anticipated facility requirements, and estimated costs for the proposed facility, which would increase the City's electric utility's renewable energy supplies by 8 percent over its current level of approximately 75 percent. This project would utilize existing water rights, head gates, and water storage components of the original Castle Creek hydroelectric plant that met all of Aspen's electric power needs from 1892 through 1958, when the plant was decommissioned. Restoring this capacity will require construction of a new powerhouse and penstock. When completed, the 1.05 MW facilities are expected to increase electric production by 5.5 million kWh annually. Switching from primarily coal-fired energy purchases from MEAN to the hydroelectric power production of the proposed Castle Creek hydroelectric plant would eliminate an estimated 5,167 tons of CO_2 emissions, (5,500,000 kWh @ 1.879 lbs CO2/kWh), annually. This represents a 0.6 percent community-wide reduction in carbon emissions based on the 2004 Greenhouse Gas Emission Inventory.

2. Micro hydro Electric Plants

We are in the design phase of installing three micro turbines for production of electricity to offset some City of Aspen facility power use. One is to be placed on a water main near our Parks Department facilities and will offset some of their power needed off of the grid. The other two are being designed to utilize our minimum stream flow required to be left in Castle and Maroon Creek to maintain fisheries and the health of the stream. These will not affect the MSF and the power will be placed back into the grid or used in nearby facilities. We are also pursuing the possibility of using our raw water lines for potential power generation.

3. Geothermal Heating District

The City of Aspen intends to develop geothermal resources within and near the City in order to provide heat to businesses, residences and sidewalks within the City. The geothermal resources will be obtained through a closed-loop system of deep aquifer production and

reinjection wells, resulting in no consumptive use of water. The estimated heating demand for selected hotels and lodges in the City is approximately 231 billion BTU per year. Much or all of the heating demands for these hotels and lodges is expected to be met through heat exchange with the bedrock ground-water system using the Aspen Geothermal Wells. The first test well is expected to be drilled spring of 2009.

4. Hydrogen Generation (electrolizer)

   The plan is to use electricity off of the new Castle Creek hydro to power electrolyzers and generate hydrogen for potentially fueling the hospital's fuel cells and constructing a hydrogen filler station for new autos and RFTA buses. Searches are being made currently for other possible uses of the hydrogen and possibly oxygen. We have received proposal and a study is being prepared. We have been in communication with the Denver Clean Cities Coalition to identify others who have developed hydrogen fueling stations.

a. Energy Storage Options

   The city's plans for the potential storage of energy can be interpreted many different ways. We have one hydro with the designs of a second hydro that will have reservoirs behind them with potential water storage for electric production. The second potential is the production of hydrogen through using an electrolizer and electricity from the proposed new Castle Creek Hydro facility and storing the hydrogen to power fuel cells and possibly power a hydrogen fuel generator to shave peaks off of our electrical demand. The third potential is the development of the geothermal reserves. If we were to find water that is hot enough, we could potentially generate electricity off of the hot water and use it as an energy storage possibility depending on the source's temperature and availability. We have also looked into the feasibility of powering an air compressor and storing compressed air to run an air powered generator to shave peak demand.