

# ***A Remarkable Project: Combined Cogen/Wastewater/ Geothermal System***

***Developed by PacifiCorp, IMCO, and the City of Klamath Falls, this \$350 million project is one of the most innovative environmental/power concepts in the U.S.***

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## ***ABSTRACT***

What does a cogeneration plant, a wastewater treatment plant, a geothermal system and free compost have in common? The answer: the city of Klamath Falls, OR. This creative municipality has brought these elements together to develop one of the most innovative and aggressive environmental mitigation projects in the Northwest and in the nation. The \$350 million, 500 megawatt cogen plant is owned by the city and is being built, operated and maintained by PacifiCorp. IMCO General Construction, of Bellingham, WA, is giving the city-owned wastewater plant a major upgrade to supply the critically needed cooling water for the cogen plant.

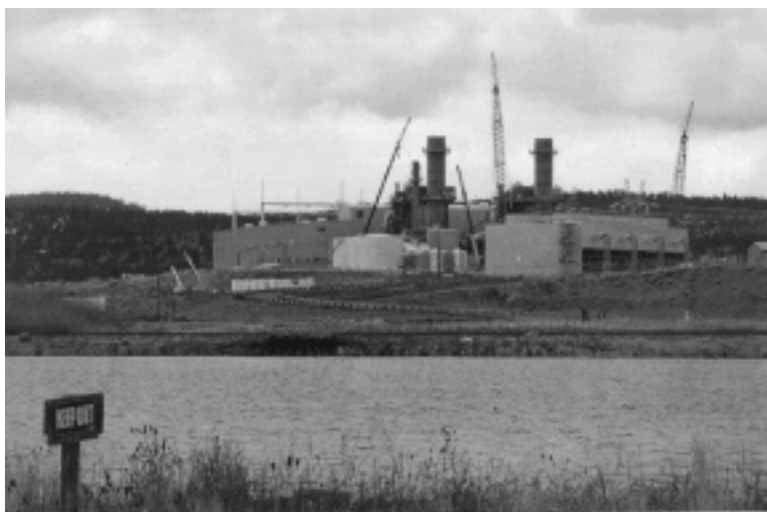
In addition, the City currently runs a geothermal system which provides many government buildings and local businesses heat. Included in this upgrade is extending the geothermal loop to include the WWTP. And the sludge from the wastewater treatment plant is being mixed into compost and then given away to local gardeners and farmers. The City of Klamath has hired IMCO to provide their construction expertise in bringing all these elements together and ensure that this collaborative effort is successful.

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## ***STATE-OF-THE-ART COGEN PLANT***

In August of 1996, the City of Klamath Falls Cogen Project was awarded an exemption to build a 500-MW cogen plant based on its comprehensive approach to reducing environmental impact and of providing the most energy efficient generation process available. The cogen plant is being financed by revenues from a \$300 million bond that was sponsored by the City. These bonds were then purchased primarily by institutional investors. This allowed the City to use private money to build a large public project that will provide opportunities for many private businesses while generating energy for local and West Coast businesses. The Klamath Falls Cogen Project is the first new major merchant plant built on the West Coast and will service energy-starved California and the Northwest.

The cogen plant uses a single source for fuel—in this case, natural gas—and generates two forms of energy: electricity and industrial steam. When in operation, the cogen plant will provide enough energy to service 400,000 homes, and will produce enough industrial steam for several local industries. This low cost steam will allow these businesses



**Construction of the 500 MW cogeneration plant is well underway. Owner is the City of Klamath Falls. Plant is designed/built/operated by PacifiCorp. Photo: Courtesy of IMCO General Construction.**

to remain competitive and reduce dependence on their own gas, oil or wood waste boilers.

## ***Wastewater Treatment Plant Reliability Improvements***

Integral to the success of the cogen project is its reliance on the City to deliver a consistent flow of low cost, high quality cooling water from the City's wastewater treatment plant. Mike Kuenzi, Director of the City's public works department, states, "Because the cogen plant is dependent on the cooling water from the treatment plant, we had to design and build a backup system for the plant's processes. This means more pumps, storage, chlorination capabilities and greater operational flexibility." The city chose IMCO General Construction to upgrade the treatment plant to meet the demands of the new cogen plant. IMCO's \$9.4 million contract includes:



**The base of the 110-ft. dia. secondary clarifier, under construction, at the Klamath Falls wastewater treatment plant. Photo: Courtesy IMCO General Construction**

- Construction of a 110-ft diameter secondary clarifier which adds another step in the process of refining the sewage and making it more suitable for cooling water.
- Construction of a sodium hypochlorite chemical feed facility that disinfects the effluent.
- Upgrading three existing aeration basins by dividing them into six basins and adding new mixers, pumps and gates. New air flow control valves, meters and dissolved oxygen probes are being included to enhance the existing diffusers.
- Construction of a 1,600-square-foot sludge thickening masonry building. The sludge has other composting materials added by the City before making it eventually available for residents to use as fertilizer.
- Construction of a 5.0 million gallon per day effluent pumping station to service the cogen cooling towers.

Some of the environmentally mitigating aspects of the Klamath Falls Wastewater Treatment Plant Modification and the Cogen Project are listed below:

***The WWTP will:***

- Provide 2.8 to 4.2 million gallons a day of effluent to use in the cooling towers, thus the cogen plant does not need to rely on fresh water for cooling. Over 60% of that water will be evaporated resulting in 1/3 of the usual amount being discharged into the river.
- Use the extension of the geothermal loop to heat the buildings and digesters.
- Add bulking agents (such as tree trimmings) to the sludge to make compost, thus providing free fertilizer for the community.

### ***The cogen plant will:***

- Provide inexpensive steam to local industries thus reducing their cost of business and reducing their reliance on their own boilers which use wood, oil or gas for fuel. This will also reduce these sources of pollution.
- Use advanced combustion technology contributing to the plant's overall fuel efficiency of 62% which is twice the efficiency of a coal-fired plant.

### ***A new generation of cogeneration:***

With significant shortages of energy on the West Coast, new solutions to old problems are needed. Cogeneration seems to be one of those solutions with its unique benefits.

#### ***Cogeneration:***

- Reduces the overall cost to the consumers since it heats water and produces electricity at the same time.
- Allows other facilities that are dependent on their own boilers, to take them off line.

Often times these boilers are less efficient and more polluting because they use wood, oil or diesel for fuel.

- Can be sized to fit the location or region it services and can be used as dedicated units for hospitals, universities and industrial facilities.
- Construction of a new 4,400 square foot control building which includes a reception area, offices, conference room, lunchroom and rest rooms.
- Installation of approximately 1,400 lf of concrete effluent piping with diameters ranging from 24" to 36." Some of this pipe is connected directly to part of the five miles of pipe going to the cogen

plant. There was an additional 8,000-ft of process piping installed that varied from double containment piping to stainless steel air piping.

IMCO Project Manager Todd Vasey says there have been several unique aspects to this project, One of the more unusual involved extending the City's geothermal heat loop. "The City uses the 180 degree natural geothermal water to heat many of its buildings, sidewalks and even some of the downtown businesses," says Vasey. "In this project, the City wanted to extend the geothermal loop to provide space heating to the WWTP's control, hypochlorite, and thickener buildings as well as provide a more reliable heat source to the digesters. The plan for routing the geothermal pipe even included a number of plant sidewalks to melt the snow. This has been a fascinating project in many ways."

While the wastewater treatment plant is gaining a number of innovative upgrades, the plan does not include increasing its capacity. "This project is about increasing reliability and operational flexibility so that the WWTP can provide cooling water to the cogen plant 100% of the



**The shell of the 110-ft. dia. secondary clarifier shell nears completion. Effluent from the wastewater treatment plant will be used for cooling water for the cogen plant. Photo: Courtesy of IMCO General Construction.**

time,” said Mike Kuenzi, Director of Public Works, City of Klamath Falls. “In addition to improved reliability, we have added the ability to ‘super-chlorinate’ our effluent to mitigate the potential of algae growth in the five mile long conveyance pipeline. We have also upgraded the plant to reduce the potential of scaling at the Cogen cooling towers through phosphorus removal at the WWTP.”

The WWTP will provide the cogen plant with an estimated 2.8 to 4.2 million gallons a day in cooling water, with over 60% of the water being evaporated in the cooling towers. The remainder of the water, called the blow-down, is returned to the WWTP where it is dechlorinated and reduced in temperature prior to its discharge into the Klamath River.

“This recycling of the WWTP effluent through the cogen does two things,” comments Vasey. “One, it alleviates the dependency of the cogen plant to use freshwater in its cooling process. And secondly, the evaporation process reduces the amount of discharge going into the river by approximately 2.3 million gallons per day.”

“Added to this,” mentions Kuenzi, “is the fact that reuse of the effluent is now essentially a revenue generator because profits from the power sales will come directly back to the City. In addition, profit from the steam sales will go to supporting the ongoing maintenance, operation and expansion of the City’s geothermal system.”

## ***A REVENUE-PRODUCING PROJECT***

Once the cogen plant is on-line, the City of Klamath will, also, be able to participate in revenues generated by the cogen plant. Depending on market price of the electricity and once the bonds are paid off, the City could financially benefit up to \$10-\$15 million dollars per year which is more than annual revenues generated from property taxes. Initially, these funds will go towards:

- Tax relief by paying off bonds used to purchase parks, and buying franchise fees on telephone lines and gas lines.
- Rebuilding the historical level of basic city service to the community.
- Provide funds for capital improvements.

- Provide seed money for economic initiatives for future development.
- Develop a community grant fund.

Frank Imhof, president of IMCO, summarized the attitude of the different groups working on the project by stating, “our company has really appreciated being part of this project and part of a team of people who embrace innovation and strive for quality workmanship. The entire project has so many unique, trend-setting aspects to it that it is a privilege to be able to provide our expertise. The

IMCO General Construction, located in Bellingham, WA, was founded in 1978 and has developed significant expertise in many areas of concrete construction with a forte for technically complex projects that require innovative solutions. They have constructed or upgraded more than 50 water/wastewater treatment plants in Washington and Oregon, making them one of the most experienced W/WWTP contractors in the Northwest. IMCO has provided construction services for major hydroelectric power plants and fish enhancement projects to the dams on the Snake and Columbia Rivers. In addition, IMCO has worked in regional refineries and pulp mills providing a variety of construction services. Corporations and organizations interested in contacting IMCO or viewing their track record for public and private projects can visit their website at [www.imco-inc.com](http://www.imco-inc.com).

team effort by the design engineer for the WWTP, Brown & Caldwell, the construction manager, URS/O’Brien Kreitzburg and the City of Klamath has made this project successful.”

The Klamath project incorporates many important environmental components and is setting a new standard of collaboration between private and public sectors. In providing efficient power generation while improving water quality and use, the project serves as a model to many communities who strive to provide the best available stewardship of their resources.

#### ABOUT THE AUTHORS

**Mike Kuenzi, P.E.**, is Director of Public Works for the City of Klamath Falls, Oregon. Mike has a Bachelors degree in Civil Engineering

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**Todd Vasey**, Project Manager for IMCO General Construction, Bellingham, WA. Todd has a Bachelors degree in Construction Engineering Technology from Montana State University. He has worked in both the consulting engineering and construction industries for the last 15 years. He joined IMCO in 1997 where he has managed over \$30 million in projects.

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