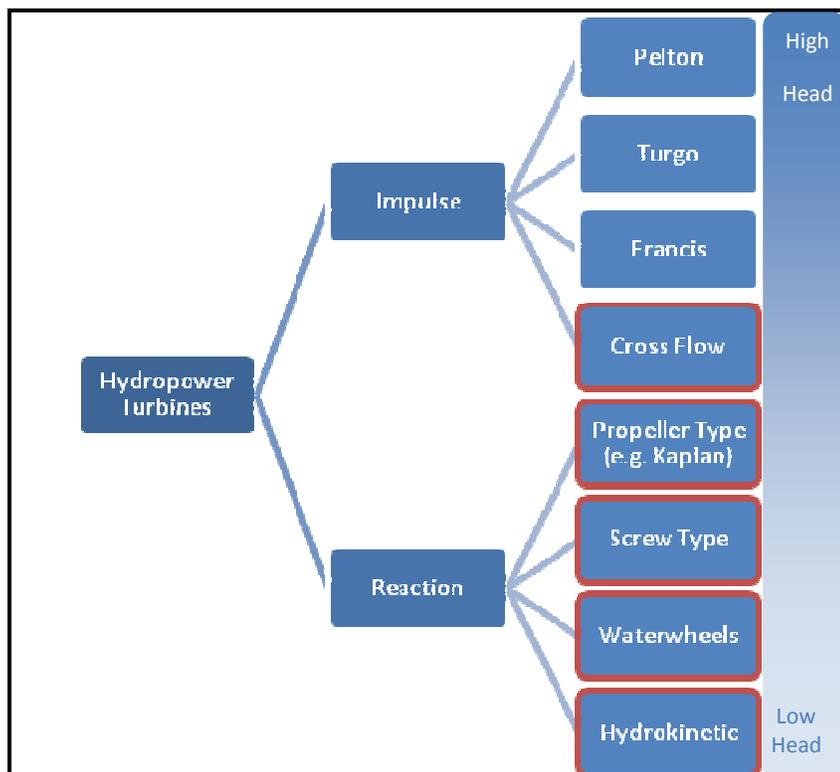


Water Review

A Perspective on Western Water Issues Prepared by the Family Farm Alliance and Its Members

COLORADO

Colorado Firm Takes the High Road and Pursues Low-Head Hydro Opportunities



Types of Hydropower Turbines Source: Applegate Group

“As the single largest owner of hydropower generation in the United States, it is important for the federal government to tap this valuable asset so it can continue to contribute to our clean energy portfolio and energy security.”

Steven Chu, U.S. Energy Secretary

Several Western water users are currently pursuing the concept of inexpensive low-head power generation that can be utilized in water service areas across the country. Farmers, ranchers, irrigation managers and engineers have identified potential sites for many small hydropower units that could be built along control structures in existing water delivery pipelines and canals to generate green energy.

Applegate Group, Inc. in partnership with Colorado State University has been awarded a grant from the Colorado Department of Agriculture to study the potential that Colorado’s irrigation canals hold to produce hydropower. Specifically, the study will investigate low head hydropower, with elevation drops of less than 30 feet. Emerging technologies are currently in development to make these low head sites economically viable. Innovative turbines that require very little change in elevation can be utilized by irrigation companies and ranchers to produce power in their canals and ditches and provide an additional revenue stream to the organization. **This issue is the topic of this month’s “Water Review”.**

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RENEWED NATIONAL FOCUS ON LOW HEAD HYDRO POTENTIAL

Clean, renewable energy is one of our nation's most important goals in today's society. The federal government, aware of these needs, has recently implemented aggressive measures aimed at weaning our dependence on foreign fossil fuels and focusing instead on U.S. hydropower development.

The U.S. Interior and Energy departments and the Army Corps of Engineers earlier this year agreed to create a new strategy for promoting hydropower development while reducing environmental impacts and streamlining regulations. Under a new memorandum of understanding (MOU), the Obama administration will evaluate new hydropower technologies and their potential impact on U.S. renewable energy supplies. The MOU directs the agencies to formulate a resource assessment of current federal facilities as well as identify ways to upgrade and modernize those facilities and install hydropower technologies at new sites. The Federal Energy Regulatory Commission (FERC) will also be involved in the process.

Hydropower accounted for 7 percent of last year's electrical generation, according to the Energy Department. The Interior Department and the US Army Corps of Engineers already operate federal water projects that represent about half of US hydro-power capacity, or close to 34,000 megawatts.

One megawatt of small hydro could supply the power equivalent to the electricity needs of 500 to 750 homes.

"While hydro-power is the largest source of renewable electricity in the nation, hydro-power capacity has not increased significantly in decades," said Energy Secretary Steven Chu. "As the



This very low head turbine is in the pilot project stage of development and has been installed at a site in France. This turbine is intended to be installed in an open channel, and a head differential will be created across the turbine. It would probably be best suited for the larger canals in Colorado, and in an existing structure to reduce the infrastructure costs.

Source: www.vlh-turbine.com

single largest owner of hydropower generation in the United States, it is important for the federal government to tap this valuable asset so it can continue to contribute to our clean energy portfolio and energy security."

Secretary Chu estimates that up to 60,000 megawatts of additional electricity capacity could come from hydro-power.

"With better coordination among federal agencies, a common-sense approach, and a focus on low-impact hydro-power projects, we can supply more clean power for our economy," said Interior Secretary Ken Salazar.

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LOW HEAD HYDRO POTENTIAL IN COLORADO

Low head hydro has historically been utilized in the state of Colorado, as early as the 1800s, but had not been implemented in recent years. Surveys have found that Colorado has several hundred sites with a potential of 5 megawatts or less, with a combined generating capacity of more than 1,400 megawatts.

Small hydro projects typically take advantage of existing dams, ditches, canals and pipelines to make the projects more practical. Such projects also avoid additional diversions from Colorado streams, as they use water flows already designated for crops or municipal supplies.

The gravitational water vortex power plant was invented by an Austrian engineer, Franz Zotlöterer. The power plant below uses the rotational energy at the center of a vortex to turn a paddle type turbine. An installation is currently in progress in Colorado. The plant requires a very small head difference, and the configuration is very unique. The turbine is set in the center of the vortex with the axis of rotation vertical, and the generator is mounted above the water. This plant can produce 7.5 kW of electricity.

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Source: www.zotloeterer.com

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According to Lindsay George, water resources engineer for Applegate Group, new technologies have been developed streamlining the infrastructure and equipment required to develop a low head hydro site.

“These new technologies have potential at sites previously considered unfeasible for hydro development because of a lack of significant elevation drop,” George said. “Irrigation canal drop and check structures, as well as existing diversion dams and outflows, may provide the drop necessary to implement these new low head hydro technologies.”

Gov. Bill Ritter in August elevated the importance of low head hydro further when he announced that Colorado has signed a significant agreement with the federal government that will make it far easier to develop small hydropower projects. The MOU between the Federal Energy Regulatory Commission (FERC) and Colorado will considerably streamline the permitting process, reducing the time and money required to develop a project and opening the door to derive more clean energy from small hydropower sites while maintaining high levels of environmental protections.

“This agreement moves our New Energy Economy another important step forward,” Gov. Ritter said. “Colorado has enormous potential to produce more clean energy from small-scale hydroelectric power. These projects can create local jobs, diversify our energy supplies, reduce emissions and further bolster our energy security.”

In the recent past, lengthy permitting processes associated with even the simplest of hydro proposals have prevented many projects from moving forward. In the past 30 years, only 24 small hydropower projects in Colorado have received an exemption permit from FERC.

To alleviate this barrier, the Governor’s Energy Office has worked closely with FERC to find ways to not only shorten, but to simplify the process to

obtain a permit so that it’s cost-effective for smaller projects to advance.

“I am proud that Colorado continues to be a leader in the clean energy economy. This agreement will not only create more jobs, but will generate a new source of renewable energy to power our state that will ultimately limit our reliance on foreign oil,” U.S. Senator Mark Udall said. “The cooperation between our state and federal government demonstrates what a powerful team we can be when we join forces.”

SCOPE OF STUDY

Applegate Group, Inc. was awarded a Colorado Department of Agriculture ACRE grant to perform a research study entitled “Exploring the Viability of Low Head Hydro in Colorado’s Irrigation Infrastructure”. The study will be performed by taking a state-wide look at existing infrastructure and current technologies.

The main goals of this study are to research low head hydro turbine technologies, explore interconnection issues, and to quantify the potential of Colorado’s irrigation infrastructure to produce low head hydroelectricity. To complete these goals five tasks were identified:

- Research low head hydropower technologies
- Inventory the infrastructure available in Colorado for low head hydro generation
- Investigate interconnection issues
- Compare the technologies to the hydraulic structures
- Estimate a statewide potential

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“The study began in May of 2010 and to date we have put together a list of available technologies, and we have begun to match these technologies with the typical canal structures,” said George. “We recently sent surveys out to all organizations that own ditches with a decreed capacity over 100 cubic feet per second (cfs). The results of the surveys will outline the possible locations that turbines could be installed in Colorado, and we will summarize a state wide potential.”

Two ditches will be chosen from all of the surveys for further investigation. These ditches will be visited and the structures considered in more detail for low head hydropower development.

The study will result in a quantification of the potential to produce low head hydropower in Colorado, as well as a guidance document that can be used by ditch owners to evaluate the potential of their canals. A final report is anticipated in Spring 2011.

Challenges

Under current regulations, anyone who wants to develop hydropower less than 5 megawatts (which would apply to virtually every single potential location within irrigation canals) can get an exemption from FERC licensing requirements. However, the process required to get that exemption can cost

\$100,000 and 18-36 months just to satisfy National Environmental Policy Act (NEPA) compliance requirements. The costs and time associated with the environmental compliance issues



The staff of the Elephant Butte Irrigation District (NEW MEXICO) designed, manufactured and installed a turbine in a drain off of their canal with 8 feet of head and about 20 cfs of flow. EBID has identified over 100 sites on their delivery system where this type of turbine could be installed. By designing and manufacturing their own turbines, they can significantly reduce costs. Source: EBID

(noticing, public meetings, etc) can make projects that only cost \$20,000 in materials suddenly become infeasible. Meanwhile, new solar and wind projects can move full-steam ahead without these stifling licensing impediments. More and more policy makers are beginning to believe the process for installing in-canal low-head hydro facilities should be the same.

Lindsay George and Brad Wind (Northern Colorado Water Conservancy District) are members of the Family Farm Alliance Low-Head Hydropower Committee, which has played a key role in helping committee staff in

both houses of Congress craft legislation intended to streamline the approval process associated with developing low-head hydropower projects within existing canal systems - without weakening environmental laws.

“The Hydropower Improvement Act of 2010”, introduced in the Senate earlier this year, provides important, incremental progress towards facilitating the development of low-head hydroelectric generation facilities within existing conduits, canals, flumes and similar man-made conveyance

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systems. These provisions include: 1) the development of a competitive grant program; 2) a new conduit pilot project program; and 3) public workshops intended to improve coordination and achieve a common understanding of documented challenges associated with known regulatory barriers.

In the House of Representatives, the “Small-Scale Hydropower Enhancement Act of 2010” intends to exempt any conduit-type hydropower project generating less than 1.5 megawatts from FERC jurisdiction. This limited exemption would promote the development of small-scale hydropower while still protecting the environment. This bill also would require the Bureau of Reclamation to examine its facilities for more conduit generation using existing funding.

Next Steps

Applegate Group is still busy working on its report, but is also preparing to take its final study to a larger audience.

Lindsay George and other Applegate Group representatives will be featured speakers at a February 16, 2011 workshop hosted by the Northern Colorado Water Conservancy District in Berthoud. The Low Head Hydro workshop is the pre-convention workshop before the 9th Annual Ditch and Reservoir Company Alliance Convention in Loveland, CO on February 17-19, 2011.

The workshop will begin with a brief overview of low head hydro and assessing a site for feasibility and potential. Conditions that create a good low head hydro site and common obstacles for development will be highlighted. Low head hydro turbines will be introduced and each turbine’s strength and limitations will be discussed. A representative from the Governor’s Energy Office will explain the two MOUs introduced earlier this year by the federal government and the Governor of Colorado (*see above discussion*). Other topics will include financ-

ing low head hydro projects, developing a project on a Bureau of Reclamation canal or reservoir, and utility interconnection issues.

“Currently we are collecting survey results from ditch companies. The responses are slowly, but steadily coming in,” said George. “We plan to choose the “project sites” within the next two months, and complete the evaluations before the end of the year.”

Applegate Group will be presenting the results of those evaluations in a paper at the United States Committee on Irrigation and Drainage conference in Albuquerque (NEW MEXICO) in April 2011.

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