Irrigation Leader

Volume 2 Issue 4

April 2011

Gary Esslinger: District Develops In-House Hydropower Turbine Design, Hopes To Offset Aging Infrastructure Costs

Temples in the Desert

Russell Patras is a great tour guide for the Metropolitan Water District (MWD) of Southern California. Recently, I had the opportunity to participate in the MWD Colorado River Aqueduct Inspection Trip, sponsored by the Desert Water Agency (DWA) of Palm Springs. With Russell as our guide, our tour began at the DWA offices in Palm Springs. For the next three days, we visited many of MWD's facilities along the 242-mile Colorado River Aqueduct between its intake at Lake Havasu and its termination at Lake Mathews. The concrete-lined canal is an impressive feat of engineering, with the capacity to move more than a billion gallons of water a day through desert and mountain terrain. Five MWD pumping plants along the canal elevate the water a total of 1,617 feet. Ninety-two miles of tunnels ranging in length from 338 feet to 18.3 miles move the water through solid rock. Remarkably, it only takes about 72 hours for water to make the 242-mile journey.

Along our tour, we visited Diamond Valley Lake, built by MWD in the late 1990s to provide an additional 810,000 acre-feet of off-stream storage for its member agencies. The lake is unique in that three dams were used to close in a valley for storage. Although no river existed in the valley, the reservoir is gravity fed through the Inland Feeder pipeline from Lake Silverwood. Additionally, we visited with Ed Smith, general manager of the Palo Verde Irrigation District. Ed talked about the successful water sharing program his district and MWD have developed to pay farmers to temporarily fallow their lands. We also had a presentation by Tom Kieley, a DWA board member, on DWA's aquifer storage program for Colorado River water delivered by MWD. The aquifer is managed by agreement between DWA and the Coachella Valley Water District, and has an estimated storage capacity in the millions of acre-feet.

A consistent observation of the MWD facilities is the architectural effort and detail. The pumping and hydrogeneration plants could have simply been large, utilitarian concrete structures; however, they are beautiful, well-designed buildings with clay tile roofs and terrazzo floors. Attention to detail and design around doorways and light fixtures is everywhere. The quality of craftsmanship is impressive. As an example, members of our party noticed the perfection of the copper tubing joints at the Hinds pumping plant. Not the smallest hint of solder was visible. The maintenance of the facilities is impressive as well. Surfaces are exceptionally clean and tool and work areas are very organized; even the oil rags are neatly folded. Great pride is taken in the smallest of maintenance tasks. To the interested observer, these structures are designed and maintained more like churches or temples than as part of utility infrastructure.

Throughout the MWD tour, one is struck by the enormity of the engineering, the harsh natural conditions endured by the workers over the eight-year construction period, and the indivisible relationship of water and power. The project underscores the tremendous importance of a reliable source of water and the power to move it. Built mostly in the late 1930s, the canal and the many MWD facilities stand as a great example of what can be done to solve a problem. That engineering and problem-solving spirit lives on at MWD with Diamond Lake, the Palo Verde Water Sharing program, and the DWA/Cochella Valley Water District aquifer storage project of more recent years.

It is that same creative thinking that must now be employed to develop the next generation of hydropower generation for irrigation districts and municipal water suppliers, to capture the energy within our existing dams, canals, and pipeworks. This issue of *Irrigation Leader* magazine is dedicated to the efforts and ideas of irrigation district and municipal water managers, Members of Congress, and federal agencies to make the next generation of hydropower a reality.

Kris Polly is editor-in-chief of Irrigation Leader *magazine and president of Water Strategies, LLC, a government relations firm he began in February 2009 for the purpose representing and guiding water, power, and agricultural entities in their dealings with Congress, the Bureau of Reclamation, and other federal government agencies. He may be contacted by e-mailing Kris.Polly@waterstrategies.com.*

APRIL 2011

Irrigation Leader

VOLUME 2 ISSUE 4

Irrigation Leader is published 10 times a year with combined issues for November-December and July-August by:
Water Strategies, LLC
P.O. Box 100576
Arlington, VA 22210

STAFF:
Kris Polly, *Editor-in-Chief*
John Chisholm, *Senior Writer*
Robin Pursley, *Graphic Designer*
Capital Copyediting, LLC, *Copy Editor*

SUBMISSIONS:
Irrigation Leader welcomes manuscript, photography, and art submissions. However, the right to edit or deny publishing submissions is reserved. Submissions are returned only upon request.

ADVERTISING:
Irrigation Leader accepts one-quarter, half-page, and full-page ads. For more information on rates and placement, please contact our office by e-mailing Irrigation.Leader@waterstrategies.com.

CIRCULATION:
Irrigation Leader is distributed to irrigation district managers and boards of directors in the 17 western states, Bureau of Reclamation officials, Members of Congress and committee staff, and advertising sponsors. For address corrections or additions, please contact our office by e-mailing Irrigation.Leader@waterstrategies.com.

COVER PHOTO: Drop 8 Station of the Elephant Butte Irrigation District and site of the district's experimental bypass hydro turbine. The 300 CFS canal returns water from fields in the 90,000 acre project to the Rio Grande River.

CONTENTS

District Develops In-House Hydropower Turbine Design, Hopes to Offset Aging Infrastructure Costs

When Elephant Butte Irrigation District (EBID) in southern New Mexico decided to explore the development of low-head hydropower on drops throughout its over 300 miles of canals and laterals, district management was taken aback by the costs of commercial solutions. EBID resolved to explore the use of its own resources to develop a design in-house at what it hoped would be a fraction of the cost.

EBID has since constructed a pilot project on a single check structure that could be replicated throughout the district and beyond. Once connected to the local power grid, EBID hopes its hydropower capability will provide an alternative revenue stream to pay for aging infrastructure costs and keep farmers' water assessments low.

Irrigation Leader's *editor-in-chief, Kris Polly, discussed the development of low-head hydropower with Gary Esslinger, EBID's treasurer-manager, on April 11. Esslinger's presentations about EBID's low-head hydropower initiative have helped to spark interest in the development of projects by irrigation districts across the western United States. The enthusiasm and showmanship he displays during the presentations have helped to draw larger crowds and garner support for this renewable power source.*

Kris Polly: What was your motivation for developing your own water turbine for generating electricity?

Gary Esslinger: My motivation came while I was flying back from Las Vegas where I had attended a water conference on the energy-water nexus issue and, while thinking about the problem, I dozed off. I had a dream about Drop 8, an irrigation structure on the Westside Canal behind my house. I had watched water falling from this drop my entire life, since it was used to check up water behind our farm. The light bulb sort of turned on in my head. I saw this wasted energy of irrigation water flowing through this structure in this canal and I wondered why I could not generate electricity from it. It was so clear to me what was occurring that I had to drive to the site after getting off the plane to verify for sure that this wasted energy could somehow be harnessed.

My grandfather once told me, "If it ain't broke, don't fix it; if it breaks, fix it yourself." I guess that pioneer spirit of ingenuity and innovation was sort of like a pilot light burning inside of me through the years, and all of a sudden, the flame was turned up. I was inspired to try and do something everybody else in the country was on

the bandwagon trying to do, and that was come up with a renewable, alternative, green energy supply for our nation. What better motivation than to try and build a good old farmer shade tree design, southern engineered, low-cost, low-head turbine made from scratch? The good Lord must have been smiling down on me, because it worked. I was able to produce 6.5 kilowatt-hours, not much, but enough to know we could produce more.

Kris Polly: What is the potential for turbine placement throughout your irrigation district?

Gary Esslinger: There are over 300 miles of canals and laterals in our irrigation district, so the potential for a renewable energy supply is great, maybe over 150 sites. We estimate that perhaps a megawatt and a half could be produced simply by capturing this kinetic energy that is totally off the river, away from any diversion dam, and flowing in a canal system that has been around for 80 some-odd years. These particular canals have been through every federal and state acronym I can think of, from EIS to SHPO, when our facilities were transferred from Reclamation. They have been here so long, I can't imagine what environmental impact they would have on anyone, but think of the footprint you leave when you clear 40 acres for a wind or solar farm; I bet a few furry critters will be upset by that.

Kris Polly: Other than size, how is your hydro generation development different from more traditional hydro projects?

Gary Esslinger: Our turbine project is totally southern engineered; in other words, we used local vendors to acquire the materials, our in-house talent to build, and parts from the local NAPA dealer. When I saw the cost of the traditional hydro turbines, I don't think I would have ever begun to develop this project if I hadn't tried first to get our district engineer, maintenance director, fabricator, and employees to build it ourselves. Our irrigation district success comes from within; I have very talented employees who are willing to take on any challenge. I often kid my engineer that my dreams become his nightmares. My board of directors has given me the flexibility to hire my own consultants, engineers, and talented employees. I also have a great relationship with New Mexico State University, where I have tapped into the graduate student program, a low-cost, talented resource. In return, I offer our district as a gigantic field lab for them to experiment in.

Kris Polly: You have talked about your efforts at many different meetings and speaking venues. What has the general reaction been to your presentation?

Gary Esslinger: I really had no idea how my dream would ever become reality, and that I would be able to tell my story to hundreds of people. What surprised me was their reaction to what our district did and the results we got. I think what gets people excited about what our district did was the fact that we just went out and did it

to prove to ourselves we could do it. It's something about American ingenuity that my grandfather and my father instilled in me years ago. I guess it's that pioneer spirit that is in all of us to go and try to do something to see if it works. I just turned it up a notch and bam! My Walmart fan turned on.

If I had known about the Federal Energy Regulatory Commission (FERC) licensing process, I probably would never have tried what I did. I'm all for protecting our environment; farmers are stewards of the land and developing a renewable energy supply is the call from our nation's capital, yet all I see is a big red light that tells me to stop what I'm doing. I can't afford the FERC license and the time it will take to produce what is so needed in our nation at this time.

Kris Polly: Congressmen Adrian Smith (R-NE) and Jim Costa (D-CA) introduced H.R. 795 to assist in the development of low-head hydro power. How would that legislation help you, and what would the cost be to taxpayers?

Gary Esslinger: This legislation provides for a new pigeon hole, other than the conduit exemption, to single out low-head power generation on a small scale. In my opinion, it is a perfect opportunity that FERC should take advantage of creating. When any type of hydropower is mentioned, it triggers FERC to respond under their regulatory protocol. Immediately, FERC requires an application and the process begins. It is expensive and time consuming. It defeats the purpose of what our district is trying to accomplish for irrigation districts all over the West. H.R. 795, which now has a total of six co-sponsors with representatives from both parties, could open the door for other districts to produce this same kinetic energy and tap this resource in their own canal systems.

The local electric utility, El Paso Electric, is very much in favor of our idea and would gladly accept the green energy into its grid. The beauty of this is that it would not cost the taxpayers anything. However, it would enable our district to bring a new revenue stream into our business, which in turn could be used to improve our aging infrastructure and perhaps reduce the assessments to our constituents. It would allow me to create new jobs, keep my employees employed, purchase materials from local vendors, and keep our communities clean with a locally developed renewable energy supply.

Kris Polly: You are also pursuing a conduit exemption for your project from FERC. How would you describe that process, and what is the status of your application?

Gary Esslinger: I was invited to attend the hydropower workshop at the U.S. Department of the Interior and witnessed the signing of the memorandum of understanding between Interior, the U.S. Department of Energy, and the U. S. Army Corps of Engineers on March 24, 2010. During my brief testimony, I mentioned that my project was moving along and was generating electricity for a dusk-to-dawn light that I had installed, but it turned into a red light. The chairman of FERC, Jon Wellinghoff, asked what the red light was, and I responded that it was FERC. He looked down at his attorney in the audience and told him that he wanted the light to turn green for me. The FERC folks told me that they would begin working on a streamlined system to the application process.

I later testified in front of the House Water and Power Subcommittee on small-scale hydroelectricity power and stated that with an easy-to-navigate regulatory process, our efforts could be replicated on a wider scale and would free districts to invest revenues in the aging infrastructure across the West. Senator Jeff Bingaman (D-NM) visited my low-head turbine site and was impressed with the minimal environmental footprint and the simplicity of the turbines. He asked me if I would go ahead and submit an application for a license, and I told him I would. On Valentine's Day of this year, I submitted my application online, which I believe to be FERC's streamlined process,

EBID completes construction of experimental bypass turbine box at Station 8.

but have not heard from them as of this day. The light is still red in my case. FERC folks have been very cooperative over the phone, but I wish a FERC representative would just come out and visit the site and witness that my turbines are not even in a conduit. My project is not creating a new hydropower dam, is not on a river, is miles away from a diversion dam, and sits off-site of a canal that has been in place for 80 years.

Kris Polly: Has EBID been discouraged by not yet being able to connect your pilot project to the electric grid?

Gary Esslinger: On the contrary, it's motivated me to look at developing electricity in front of the meter so FERC won't apply. There are applications for my low-cost, fabricated, low-head turbines at selected canal drop sites where farmers are using fossil fuel to run their drip irrigation filtration units on a variety of crops such as alfalfa, chili, and onions. If I can't provide the electricity, I will provide pressurized water to the filtration units. EBID was awarded a New Mexico Small Business Assistance Program (NMSBA) through the Los Alamos National Lab (LANL), along with five farmers in the Hatch Valley, the Chili Capital of the World.

During 2011, EBID, the five farmers, and LANL are jointly conducting a detailed assessment of five low-head hydropower sites in this area. The project is sponsored by NMSBA, which offers laboratory staff technical support to enhance innovative business solutions throughout the state. LANL will assess EBID's prototype hydro turbine for its efficiency and analyze the potential sales of excess energy via a utility backflow metering contract. Up to 50 percent of yearly irrigation costs can be reduced by subsidy and total savings for the five participating EBID farmers could equal or exceed $100,000 per year. My goal is to get the credibility of LANL acknowledging my efforts and perhaps put more pressure on the Department of Energy to look closer at this kind of project across the irrigated West, or wherever the potential is available to use low-head turbines in canals. Perhaps a little more pressure on FERC to respond to the need is required.

Kris Polly: Members of your congressional delegation have expressed interest in participating in a tour of your turbine facility with representatives of irrigation districts throughout the West invited to attend. What is the likely timing of the event?

Gary Esslinger: We are working with a couple of our House members' schedulers to find some dates that will work. Once we have the event scheduled, we will let people know. Any irrigation district manager or their board members will be welcome to join us. We hope *Irrigation Leader* will help get the word out and cover the event.

Kris Polly: What advice or message do you have for other irrigation districts considering developing low-head hydro generation?

Gary Esslinger: I urge any irrigation district in the country to continue to apply pressure on FERC. Congressman Smith's bill, H.R. 795, needs national attention and needs to move forward. The conduit exemption that FERC believes handles my type of project is still very expensive and time consuming. FERC needs to develop, as I call it, a new pigeon hole for projects such as mine and allow for some other sort of oversight process other than what is now in place. I am getting calls from all over the country asking me for help with FERC because people are stymied by the expense and time-consuming process they are encountering.

I credit both the Family Farm Alliance and National Water Resources Association with helping to move this legislation forward. This issue deserves support on a national scale, and these two organizations are helping to provide that.

Bypass turbine inflow gates.

Encourage All Forms of Hydropower as Part of Our Nation's Clean Energy Solution

By Senator Lisa Murkowski

Coming from Alaska, I've long been a strong proponent of hydropower. I consider hydropower to be our hardest-working renewable resource—and one that often gets overlooked in the clean energy debate. Hydropower is the largest source of renewable electricity in the United States. The 100,000 megawatts of hydroelectric capacity we have today provide about 7 percent of the nation's electricity needs. Hydroelectric generation is carbon-free baseload power that allows us to avoid approximately 200 million metric tons of carbon emissions each year. Hydropower is clean, efficient, and inexpensive. And yet, despite its tremendous benefits, I'm constantly amazed at how some undervalue this important resource. To me, there is no question that all forms of hydropower are, and must continue to be, part of our energy solution.

Contrary to popular belief, the hydropower resource is not tapped out. At a recent Energy Committee hearing, the Department of Energy testified that we have the potential to realize an astounding 300 gigawatts of additional hydroelectric energy—three times what we receive today. We certainly understand that in my home state, where hydro already supplies 24 percent of the state's electricity needs, and over 200 promising sites that have the potential to produce thousands of megawatts of power have been identified. Importantly, every state has the ability to develop this resource. According to the Department of Energy, the overwhelming majority of this potential can be derived from small hydropower projects, including in-conduit hydropower.

To that end, I've introduced S. 629, the Hydropower Improvement Act of 2011, and was pleased to be joined by an impressive group of bipartisan cosponsors—Senators Bingaman, Risch, Cantwell, Crapo, Wyden, Murray, Begich, and Whitehouse. The Hydropower Improvement Act aims to spur on the development of a wide range of conventional projects to increase hydropower production—everything from efficiency improvements and capacity additions at existing facilities, to electrifying nonpowered dams, to conduits at irrigation districts, to small hydro projects, to large pumped storage facilities. The bill establishes a competitive grants program for additional production, increases support for research and development, and calls for better interagency coordination.

One area that has been overlooked until recently is the capacity we can derive from in-conduit hydro projects—those man-made conveyances such as tunnels, canals, or pipelines that are operated for water distribution and not electricity generation. There are countless opportunities throughout the West to develop these low-head hydro projects. These types of projects really are a win-win for everyone involved. Irrigation water deliveries can continue while utilizing flows to generate renewable power. The sale of this energy can lower costs to farmers. And, because the irrigation infrastructure is already in place, these projects should have no adverse environmental impacts.

The Hydropower Improvement Act seeks to expedite the implementation of in-conduit projects on both federal and nonfederal lands. The bill directs the Federal Energy Regulatory Commission and the relevant federal agencies to develop a coordinated and more efficient environmental approach to these types of projects. Additionally, the legislation calls for the Bureau of Reclamation and the Federal Energy Regulatory Commission to conduct regional public workshops and pilot projects to identify and address barriers to in-conduit approval. This includes the development of a category of microhydro conduit projects, such as those involving the pressurization of existing irrigation conveyances and municipal pressure reduction valves, that may be approved through a simple application process. Finally, under S. 629, the secretary of energy is to conduct a study of the potential quantity of hydropower that may be derived from existing conduits.

Given the bipartisan and stakeholder support for the Hydropower Improvement Act, I expect to move it quickly out of committee. It is my hope that as the Senate considers our nation's long-term energy policy, we can finally recognize the important contribution the renewable resource of hydropower makes, and will continue to make, to our clean energy goals.

Senator Lisa Murkowski (R-AK) is the ranking member of the Senate Energy and Natural Resources Committee.

Common-Sense Solutions *for American Hydropower*

By Congressman Jim Costa

Solving our nation's biggest challenges sometimes just takes a little common sense. Take our nation's energy policy for example. With the Middle East in turmoil and energy prices rising across all sectors, it is clear we can no longer continue sending our dollars to unstable regions of the world. We can and should develop our energy right here in America.

One critical tool in our energy toolbox is hydropower. Hydropower is the largest source of non-carbon-emitting energy in the world, and it accounts for 67 percent of the total renewable electricity generation in America. We currently harness the power of moving water at large infrastructure projects scattered across the country. The Hoover Dam, which powers significant portions of California, Arizona, and Nevada, is a perfect example. But, we cannot ignore the potential of hydropower on a much smaller scale.

California's enormously complex water system is a marvel of human achievement on par with the interstate highway system and the transcontinental railroad. Think of it: every minute of every day, water flows through thousands of miles of canals, pipes, and ditches, and this water could be used to produce low-cost, renewable energy through hydropower. Using this power on a smaller scale and in man-made water delivery systems does not disrupt the delivery of water or the habitat of species that call this system home.

But employing this power is more easily said than done. The agency charged with regulating the licensing and inspection of hydroelectric projects, the Federal Energy Regulatory Commission (FERC), applies the same permitting rules to the Hoover Dam as it does to smaller scale projects, like those located within California's water system. As a member of the Subcommittee on Water and Power, I've heard folks across the country say that these one-size-fits-all regulations are too costly and complex to navigate. In some cases, obtaining an exception from FERC permitting rules can take up to six months and $50,000—money and time that our local water agencies can't afford. Simply put, these regulations just aren't common sense.

That's why I introduced the Small Scale Hydropower Act of 2011 (H.R. 795) with Representative Adrian Smith (R-NE) in this session of Congress. This bill would exempt hydropower projects generating less than 1½ megawatts from FERC permitting rules. By empowering local irrigation districts and water agencies to develop this clean, renewable resource, we will stimulate the economy of rural America and help farmers and local communities receive this power at no cost to taxpayers. Water agencies across California could harness the power of water to generate energy and revenue. The bill is endorsed by the Family Farm Alliance, the Association of California Water Agencies, and the National Water Resources Association, among others.

Imagine if we were able to generate new electricity through small-scale hydropower in irrigation canals across the country. Some estimate that doing so would power 85,000 households, create 1,200 good-paying jobs, and significantly broaden our energy portfolio. We can do it. It just takes a little common sense.

Congressman Jim Costa (D-CA) is a member of the House Natural Resources Subcommittee on Water and Power.

Small Hydro a Priority for FERC

By Ann Miles

The Federal Energy Regulatory Commission (FERC) is working to facilitate the development of small hydro projects in recognition of the growing potential for hydropower in the United States. These actions are part of the Commission's larger effort to manage the transition to a smart energy future by integrating all energy resources onto the power grid.

Distributed generation, which is the generation of electricity from groups of small energy resources, is an important aspect of integrating all energy resources onto the grid, along with demand response, energy storage, and smart grid. And small hydro is a key player in distributed generation: conservative estimates peg the amount of developable electricity from hydropower at 60,000 megawatts (MW). While 38,000 MW of that is found in projects ranging from 2 to 60 MW, the remaining 22,000 MW of that developable hydropower is in the range of 2 MW and lower—down to smaller than 200 kilowatts in size.

Add to that the increased interest in small hydro through the growing number of state and industry renewable energy initiatives, and it is easy to see why FERC has seen a rise in small hydro interest over the past three years. In 2008, FERC had issued 21 small hydro permits with 39 pending development applications. By 2010, FERC had issued 102 permits and had 57 pending development applications.

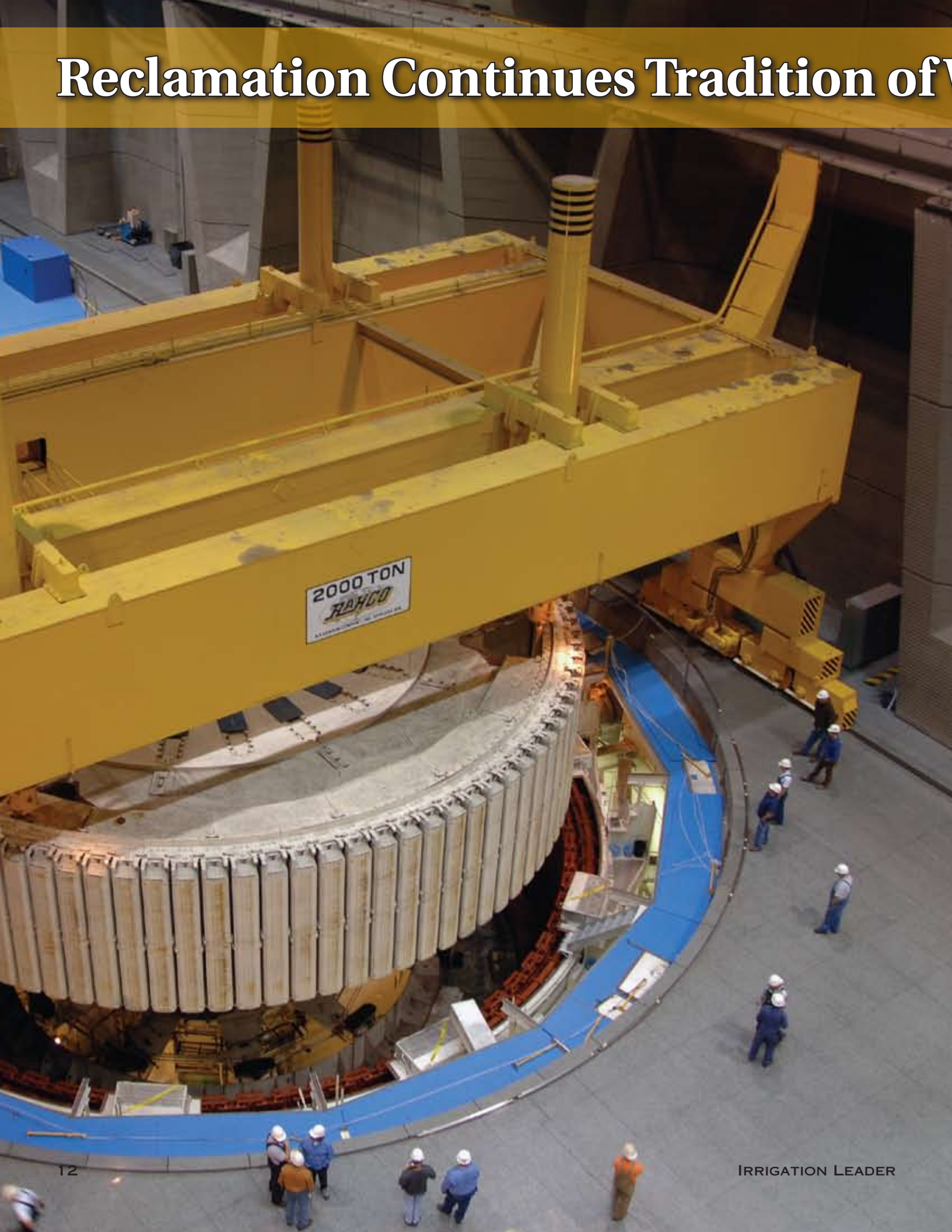
FERC's small hydro initiative, begun in December 2009, has led to development of a series of Web-based tools that will help developers understand the FERC licensing process, help improve coordination with other agencies, and help applicants complete the process more quickly and efficiently. The new resources, available at the FERC website (http://www.ferc.gov), provide a roadmap that walks applicants through the process of selecting a project site, determining whether a project is jurisdictional, selecting a FERC licensing process, consulting with stakeholders, and preparing a license or exemption application.

Commission staff also have streamlined some of the standards for exhibits and drawings for licenses, 5 MW exemptions, and conduit applications. So, for those applicants that have filed complete and adequate applications and for which the Commission has determined that the impacts are minimal, FERC's goal is to take final action in less than one year—and in some cases, as quickly as two months. FERC also has reduced the public notice period from 60 to 30 days and the reply period from 45 to 15 days for these applications.

We also continue to conduct outreach efforts via webinars and by participating in small hydro workshops around the country. We signed a memorandum of understanding (MOU), or agreement, with Colorado, and we participated in small hydro workshops in Oregon, Massachusetts, and New Hampshire. Upcoming outreach efforts include participating in small hydro workshops in Washington, DC; Vancouver, B.C.; New Mexico; and California. We Will conduct another webinar this summer. We have also completed an update on our MOU with the U.S. Army Corps of Engineers. Finally, we continue to provide access to our small hydro hotline (1-866-914-2849) and e-mail inquiry service (smallhydro@ferc.gov) to answer applicants' questions.

Ann Miles is the director of the Division of Hydropower Licensing in the Office of Energy Projects at the Federal Energy Regulatory Commission. The views expressed in this column are those of Ann Miles and do not necessarily represent the views of the Federal Energy Regulatory Commission.

Reclamation Continues Tradition of



Western Hydropower Development

As support for the development of hydroelectric power resources continues to rise, Reclamation is taking steps to continue its tradition as a leading supplier of hydroelectric power. Historically the second largest hydropower producer in the United States, Reclamation operates 196 units with 14,639 megawatts of installed capacity, enough energy to meet the needs of 9 million people. This renewable energy source annually offsets 27 million tons of carbon dioxide and saves 20 million tons of coal or 67 million barrels of oil that would otherwise be used to generate an equivalent amount of electricity.

In 2010, the agency, in partnership with the Idaho National Laboratory, undertook a comprehensive assessment of 530 existing federal dams and other sites—including some irrigation canal drops—with the potential for hydropower development. This initial assessment was a component of a memorandum of understanding among the U.S. Departments of the Interior and Energy, and the U.S. Army Corps of Engineers, to promote hydropower nationwide.

"The study came up with an additional 225 megawatts of capacity, but that did not get all of the canal drops at Reclamation facilities," said Kerry McCalman, manager of Reclamation's power resources office, about the potential for further capacity to be developed at low-head sites.

To that end, Reclamation recently began a new resource assessment of the hydropower potential at the remaining canal drops in systems throughout the western United States. Prompted by irrigation districts hoping to capitalize on this prospective source of renewable energy that could be sold to local electric utilities, the study aims to catalog low-head resources across the West.

Reclamation is also encouraging districts to independently take stock of their available resources by implementing publicly available assessment tools. "One of the neat factors of the assessments we are doing is that they have a resource assessment tool built into them," McCalman said. "We're making that tool available to the public so individuals can put the parameters of any site they want into that program."

However, Reclamation's efforts to promote the development of low-head hydropower resources extend beyond the assessments it is working to perform. The agency is also exploring available technologies and recently announced the launch of a pilot grant program to demonstrate the efficacy of available solutions.

"We're looking to find out what is going on in the marketplace that can make small developments more economical," McCalman said of a request for information Reclamation issued to explore available low-head hydropower technologies.

The upcoming grant program aims to provide a 50 percent cost share for two or three small pilot projects that show less expensive ways to develop small hydropower. To be eligible, the site of the development must be a Reclamation project. However, operators teaming with others can apply. "It's not limited to who can apply," said McCalman. "A lot of irrigation districts may be interested, but there may be teaming between irrigation districts, municipalities, and private developers."

Concurrent with these efforts, Reclamation is working to standardize its falling water charges across regions. Currently, charges are set separately in each of Reclamation's five regions, but the agency plans to implement a standard system across the agency.

"We want to do it and we want to make it easy for the developer," McCalman said. "What we're doing right now, especially for small, low-impact developments, is working to try to streamline the process as much as possible.

For more information on Reclamation's hydroelectric power initiatives, visit its website at http://www.usbr.gov/power.

Diamond Plastics PVC Pipe

Helping Irrigation Districts Save Water

Gasketed PVC Pipe:

- 2" Diameters thru 60" Diameters
- Bottle Tight Joints
- Easy Push Together Installation
- Large Internal Diameter
- Smooth High Flow Rate Interior
- Practically Maintenance Free
- Corrosion Free PVC = Long Life
- The Sustainable Solution

For more information on Diamond Plastics Corporation's PVC pipe offerings, please contact a representative at **1-800-PVC-PIPE**
or visit our website at **www.dpcpipe.com**

DIAMOND PLASTICS®
CORPORATION

Corporate Headquarters • 1212 Johnstown Road • P.O. Box 1608 • Grand Island, NE 68802-1608

PVC PIPE FOR THE 21st CENTURY

H.R. 872

Reducing Regulatory Burdens Act of 2011

By Congressman Bob Gibbs

The $1.75 trillion federal regulatory burden is mostly made up from costs that come from complying with red tape requirements that are not specified in the laws passed by Congress. Redundant and unnecessary costs of these administrative and compliance mandates are major contributors to higher prices for businesses and consumers, weakened American competitiveness, and jobs being sent abroad.

Regardless of one's party, everyone can agree that duplicative and costly red-tape requirements that provide no additional health or environmental benefits do not make sense. However, a number of lawsuits have resulted in the Clean Water Act being added as a new and redundant layer of federal regulation over the use of pesticides. As a result, an additional set of permits will be required for their use and application.

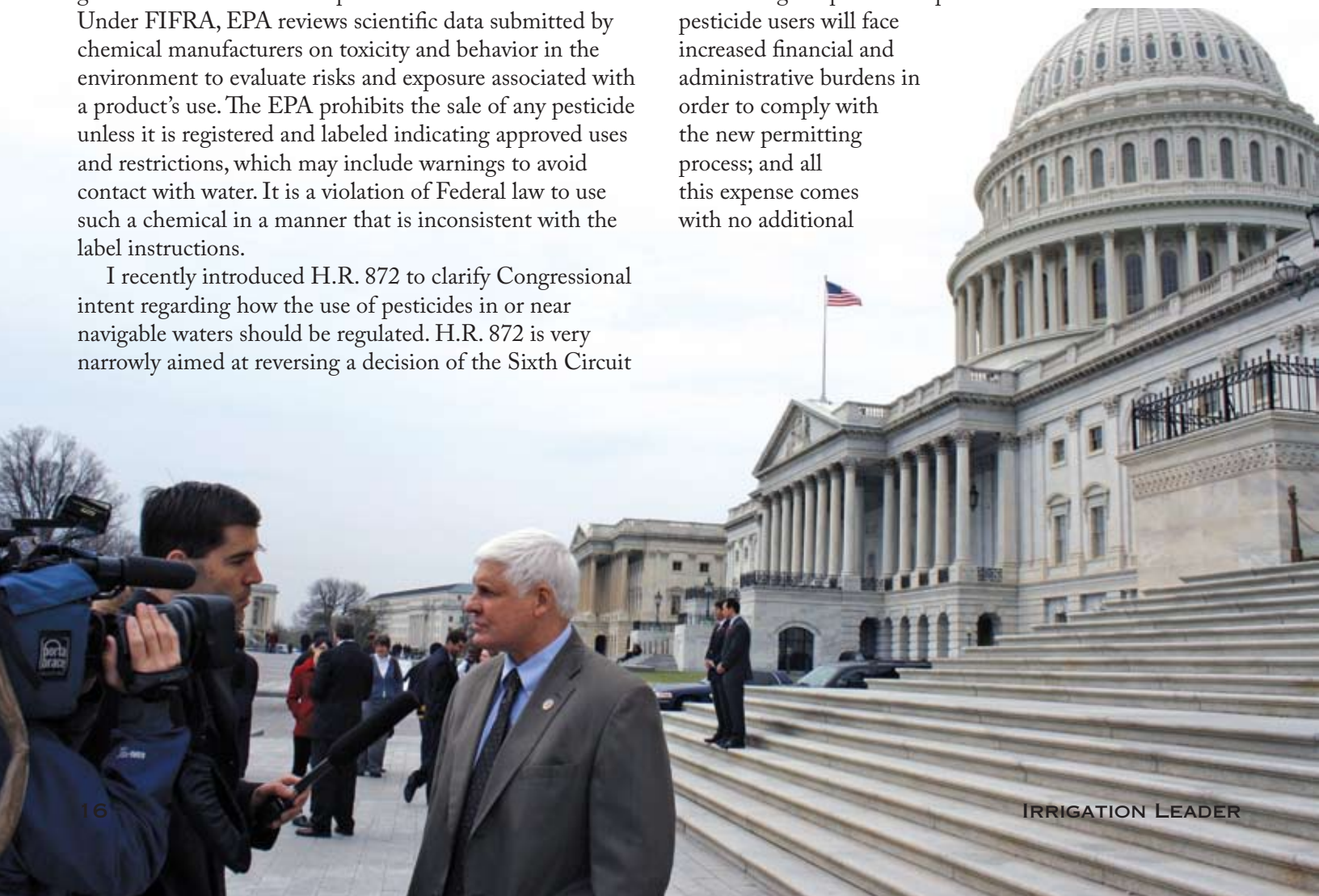
The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) has long been the federal regulatory statute that governs the sale and use of pesticides in the United States. Under FIFRA, EPA reviews scientific data submitted by chemical manufacturers on toxicity and behavior in the environment to evaluate risks and exposure associated with a product's use. The EPA prohibits the sale of any pesticide unless it is registered and labeled indicating approved uses and restrictions, which may include warnings to avoid contact with water. It is a violation of Federal law to use such a chemical in a manner that is inconsistent with the label instructions.

I recently introduced H.R. 872 to clarify Congressional intent regarding how the use of pesticides in or near navigable waters should be regulated. H.R. 872 is very narrowly aimed at reversing a decision of the Sixth Circuit Court of Appeals in National Cotton Council v. EPA. In this ruling, the Sixth Circuit substituted a judge's policy preferences for reasonable agency interpretations of the law.

In the process, the court undermined the traditional understanding of how the Clean Water Act interacts with other environmental statutes, and judicially expanded the scope of Clean Water Act regulation further into areas and activities not originally intended by Congress.

EPA has estimated that approximately 365,000 pesticide users, including state agencies, cities, counties, mosquito control districts, water districts, pesticide applicators, farmers, ranchers, forest managers, scientists, and even every day citizens, that perform some 5.6 million pesticide applications annually, will be affected by the court's ruling. This will virtually double the number of entities currently subject to NPDES permitting under the Clean Water Act.

With this ill-advised court decision, the states and a wide range of public and private pesticide users will face increased financial and administrative burdens in order to comply with the new permitting process; and all this expense comes with no additional



environmental protection.

The court-ruled permitting process was set to take effect on April 9, 2011, but on March 28th, the night before this bill came to the floor for a vote, the U.S. Sixth Circuit Court of Appeals issued a stay on the mandate until October 31st, 2011. However, the court-issued stay only temporarily postpones the need for an NPDES permit for pesticide use and does not mean that resolving this issue is no longer a priority. This issue will not be resolved until Congress passes legislation, and a failure to do so would result in a disastrous, unnecessary expansion of government.

H.R. 872 fixes the problem. It exempts, from the NPDES permitting process, a discharge to waters involving the application of a pesticide authorized for sale, distribution, or use under FIFRA, where the pesticide is used for its intended purpose and the use is in compliance with FIFRA pesticide label requirements.

This bill passed unanimously out of the Agriculture Committee and passed the Transportation and Infrastructure Committee on a strong bipartisan vote of 46-8. On March 31, 2011, H.R. 872 received broad bipartisan support and passed the House of Representatives with over 2/3 vote.

Now the Senate must introduce and act on this legislation quickly to avoid another six months of uncertainty. At a time when job creation is paramount to economic recovery, businesses and farming operations are being forced to postpone decisions on hiring and expansion because they do not know what to expect.

The House acted decisively to remove a costly, lengthy, and duplicative regulatory process that would prove to be a huge barrier to job creation, and I am already working with Senators who have been engaged on this issue to ensure that the Senate quickly takes up the cause. I am optimistic about its passage as H.R. 872 had over 30 Democratic co-sponsors and 57 Democrat "yea" votes.

Together, we can enact this common sense legislative effort to reduce the regulatory burden that weighs down our economy and stifles job creation. Then, not only will we continue to have a safe environment, but also a better environment for economic growth.

Congressman Bob Gibbs (R-OH) is the chairman of the House Water Resources and Environment Subcommittee.

PROMOTING THE NEXT GENERATION OF hydro power

By Linda Church Ciocci

Today, our nation faces energy challenges that will set the course for our future. Hydropower stands ready to contribute to the solution as a renewable, affordable, reliable, and sustainable energy source. In the United States, hydropower currently generates 65.9 percent of renewable, domestic electricity, and is poised to grow through a variety of avenues including efficiency updates, nonpowered dams conversions, and in-stream hydrokinetic additions. With only 3 percent of the country's 80,000 dams currently generating power, and hydropower offering the lowest levelized cost of electricity across all major energy sources (approximately 2–3 cents/kilowatt-hour), the opportunity for growth of this affordable, clean resource is exciting, and one we cannot ignore.

Recently, Senator Lisa Murkowski (R-AK), along with eight cosponsors from both sides of the aisle, introduced the Hydropower Improvement Act of 2011. This bipartisan bill seeks to increase hydropower capacity in the United States significantly while creating new family-supporting jobs and economic opportunities. This holistic bill addresses all types of hydropower growth, from new research and development to pumped storage opportunities to improving the process for the development of conduit projects in the hundreds of miles of man-made channels throughout the country

According to a recent study from Navigant Consulting, with the right policies hydropower can contribute 60,000 additional megawatts to our country's electricity resources and add 1.4 million jobs to the U.S. economy. Because every state benefits from hydropower generation, these jobs and generation would be distributed across the nation, allowing communities to meet their clean energy goals and providing local economic growth. Some irrigation districts like the Portland Water Bureau and the Central Nebraska Public Power and Irrigation District are already embracing these opportunities by conducting feasibility studies or adding generation capacity to their facilities.

Hydropower's benefits go beyond lower electricity bills and new jobs. Hydropower's reliability means it plays a key role in supporting the electric grid, stabilizing the network, and storing electricity for later use so that other renewable power sources can be effectively integrated into the nation's energy mix. There are also environmental benefits: in 2009, using hydropower avoided approximately 196 million metric tons of carbon pollution in the United States, equal to the annual emissions from approximately 38 million cars.

The National Hydropower Association (NHA) is a nonprofit national association that encourages hydropower growth in the United States to support our new clean energy economy. With the goal of securing hydropower's place as a clean, renewable resource, NHA represents the North American hydropower industry before Congress, the federal agencies, and the administration.

Focusing on policy, communications, education, and regulatory issues, NHA seeks to maximize hydropower's contribution to the U.S. electricity grid in all areas. We currently have nine committees and councils dedicated to advancing the industry's agenda and promoting research in all of the hydro sectors, from small hydro to conduit and hydrokinecs to pumped storage. With over 180 member companies ranging from small family-owned business to Fortune 500 companies, we focus on a wide variety of issues. Our members include both public - and investor-owned utilities; irrigation districts; independent power producers; developers; manufacturers; environmental and engineering consultants; attorneys; and public policy, outreach, and education professionals.

To learn more about the hydropower agenda and NHA, check out our website at http://www.hydro.org; if you have joined the social media world, follow us on Twitter (@natlhydroassoc) and Facebook. There has never been a better time to promote our nation's original, renewable hydropower. NHA looks forward to working with irrigation districts around the country to encourage a greater appreciation for the value of this important resource we steward.

Linda Church Ciocci is the executive director of the National Hydropower Association in Washington, DC. She previously served as an official at the American Public Power Association. Church Ciocci can be reached by phone at (202) 682-1700, or by e-mail at linda@hydro.org. More information on the National Hydropower Association can be found on its website at http://www.hydro.org.

Small Hydro Projects:

10 Questions Every Developer Should Ask

By Mike Swiger and Chuck Sensiba

There has been a resurgence of interest recently in the development of hydroelectric power, particularly low-impact hydropower that could be developed at existing infrastructure of many western irrigation and water districts. Chairman Jon Wellinghoff of the Federal Energy Regulatory Commission (FERC), the federal agency with licensing jurisdiction over hydroelectric projects not owned and operated by the federal government, has said, "The intensified interest in developing renewable energy in this country has made hydropower an increasingly important player in the game. . . . Small hydropower development has become a highly desirable option." Over the past couple of years, applications to develop new hydroelectric projects filed with FERC have increased significantly. In fact, FERC-issued preliminary permits (study permits) have increased from 75 in 2007 to 160 in 2010. FERC-issued licenses and exemptions for new project development have increased from a single project in 2007 to 23 projects in 2010. The vast majority of these new projects fall into the smaller-scale, low-impact hydro category.

There are many ways to define low-impact hydropower, but the term typically refers to adding hydroelectric capacity at existing dams and water conduits. Of 80,000 dams on existing impoundments in the United States, only about 3 percent currently have hydroelectric generation. Many of these nonhydropower dams are water supply dams, serving irrigation needs or municipal water supply. In addition, there are untold numbers of existing water conduits that may have potential for adding hydroelectric turbines. Many water agencies that have not considered hydroelectric development in the past are now thinking hard about whether the investment in developing a low-impact hydroelectric project would be positive, either as a source of power for their own system needs or as a source of revenue through the sale of this renewable power to an electric utility.

Potential developers should consider several key issues when deciding whether a new hydroelectric project is a feasible solution to their specific water and power objectives. The following 10 questions, developed through interviews with some of our clients that have developed small, low-impact hydroelectric projects, as well as our own experience in this area, are designed to assist in this decision-making process.

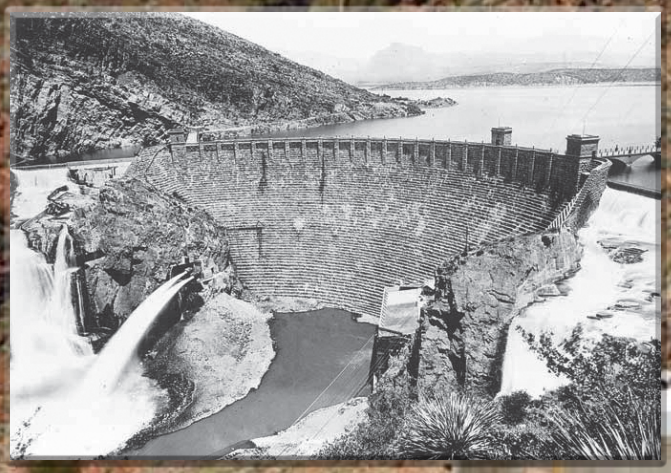
1. Is there hydroelectric potential at the dam or water conduit? This is an engineering question, the answer to which would depend on such factors as available hydraulic "head," water flow and duration, and other site characteristics.
2. Would the project be economic? This also is an engineering question, at least initially, although there may be tax or other incentives available (as discussed below) that could improve the economic prospects of a project.
3. Would the hydroelectric project be located on the stream, at or below a dam, or would it be located on a municipal

or industrial water supply or irrigation conduit? Conduit projects may qualify for a FERC exemption from licensing. Certain small projects at existing dams also may qualify. Obtaining an exemption, which is somewhat of a misnomer because an application still must be filed with FERC, is generally faster and less expensive than obtaining an actual license from FERC. Projects at new dams require licenses and are generally more complex and controversial than projects at existing dams or conduits.

4. Who owns the land on which the project would be located? Having site ownership or control is important and greatly simplifies the permitting process. Projects on federal lands can be more complicated, depending on the federal land management agency and its management plan for the area.
5. Would there be significant environmental issues associated with the project? Again, new dam projects, particularly on streams inhabited by anadromous fish or on federal lands, generally are more difficult and expensive to license. The fewer environmental issues, the easier and less costly the licensing process. Projects on existing conduits rarely have environmental issues or opposition.
6. Can water rights be obtained to develop the project? Water rights systems vary from state to state. Water rights authorizing use for hydroelectric generation may be different from rights that authorize a consumptive use.
7. Is there a potential buyer of power or renewable energy credits from the project, and is the project in that buyer's service area? Even if an irrigation or water district plans to consume the power itself for pumping or other uses, there may be surplus power that can be sold to the local utility or wheeled across the local utility to a purchasing utility.
8. Is there a nearby transmission interconnection? The distance of the project from a utility transmission line and the voltage of that line are important factors in the cost feasibility of a project. Developers generally are responsible for interconnection and project-specific system upgrade costs.
9. Does the project qualify as a Qualifying Facility (QF) under the 1978 Public Utility Regulatory Policies Act (PURPA)? Certain small hydro projects may qualify as QFs under the PURPA, which Congress enacted to encourage domestic, alternative energy development. Although some of the incentives of the 1978 law have since been eliminated, small hydro QFs may still be eligible for exemption from FERC's rate regulation and some state rate and siting regulations.
10. Does the project qualify for federal energy tax incentives or a state renewable energy credit? Congress has enacted federal tax credits and grants in lieu of credits for certain small hydro projects, including conduit projects. Such incentives may make the difference between a viable project and one that the developer cannot afford to build. The tax incentives are subject to expiration and may require that a project begin construction and be placed in service by certain dates. Although Congress has not enacted a Renewable Portfolio Standard concerning the sources of electricity for a utility, many states have adopted such standards and the project or purchasing utility may be able to claim a renewable energy credit for qualifying power, making the project power even more valuable.

The law firm of Van Ness Feldman represents water districts, river authorities, and municipal utilities throughout the West and nationwide on legal and policy issues associated with development of water and power resources, including all aspects of FERC hydroelectric project licensing and approval. Mike Swiger heads the firm's hydroelectric practice and is a nationally recognized leader in the hydroelectric industry with substantial experience on the full range of issues associated with energy and water projects. Chuck Sensiba is the chair of the American Bar Association's Hydro Committee, and his practice focuses on the regulation of hydroelectric facilities under the Federal Power Act and federal environmental statutes affecting energy and water development.

For more information regarding Van Ness Feldman's hydroelectric practice, please see the firm's advertisement on page 9 of this issue or visit the firm's website at http://www.vnf.com.



From Cornerstone to Milestone

Commemorating the 100th Birthday of Theodore Roosevelt Dam

Framed by a brilliant March sky and spectacular canyon vistas, Arizona dignitaries past and present, plus pioneering families and Salt River Project (SRP) employees, gathered atop Theodore Roosevelt Dam to recognize one of the state's signature structures.

An intimate crowd of some 200 guests had come to honor the elegant crescent of stone and concrete that has quietly served the thriving downstream communities of the Salt River Valley for scores of years. Just as Roosevelt Dam is the cornerstone of water reclamation in central Arizona, "Together We Celebrate," the tribute to the dam, was a touchstone for SRP's water conservation campaign, "Together We Conserve."

The ceremony on the crest above the dam's north spillway was emceed by John Sullivan, associate general manager, Water Group, and featured lunch and talks by SRP President David Rousseau and Vice President John Hoopes. Both men recounted how Roosevelt Dam and SRP played a major role in their lives and the lives of their families.

U.S. Bureau of Reclamation Deputy Commissioner Kira Finkler spoke about the Bureau's past accomplishments and future direction, noting the importance of Roosevelt Dam and SRP in this context.

Gov. Jan Brewer explained how the dam and the state's centennial were inextricably linked.

"The Theodore Roosevelt Dam was built at a place the early pioneers called 'The Crossing,'" Brewer said. "I think that is a fitting name as Arizona crosses between two centuries—our first and second, paying tribute to the courage and labors of those who settled this great land—and built great monuments for us to celebrate 100 years later."

Brewer then presented Rousseau with a framed copy of a state proclamation marking March 18, 2011, as Theodore Roosevelt Dam Centennial Day.

Humanities scholar, author, and social commentator Clay Jenkinson paid homage to the 26th U.S. president, entertaining the crowd at the dam with a voluble impression of Colonel Roosevelt that provided a unique insight and snapshot of that era.

After the reenactment, Finkler and Rousseau opened the time capsule inserted into the dam during the Golden Jubilee in 1961. One of the items in the capsule was a telegram from then newly elected President John Kennedy.

However, it was Kennedy's secretary of interior, former Arizona Congressman Stewart Udall, who captured the essence of the dam at the Golden Jubilee when he said, "The true worth of this resource development cannot be measured in dollars and cents . . . but should take into account its service to man."

Gov. Jan Brewer presenting David Rousseau with a framed copy of a state proclamation marking March 18, 2011, as Theodore Roosevelt Dam Centennial Day.

Back in the Valley, Roosevelt Dam's 100th birthday was celebrated simultaneously at a number of venues in metropolitan Phoenix. At SRP's recreational complex in Tempe, Dick Silverman, general manager and Mark Bonsall, associate general manager and chief financial executive, hosted about 400 invited guests, including members of Arizona's congressional delegation.

The luncheon included a video simulcast of the Roosevelt Dam event, the premier showing of "The Water Legacy," a video history about the dam, and a recorded video address from Senator Jon Kyl. The ceremony from the dam also was broadcast for employees to view at various SRP administrative facilities.

Salt River Project is one of the nation's largest public power utilities and a major water supplier to metropolitan Phoenix. SRP is named for the major river that provides water to central Arizona—the Salt River—and is among the oldest and most successful multipurpose reclamation enterprises in the United States. SRP was created in 1903 as a territorial corporation through provisions of the National Reclamation Act.

Did you know?

- Roosevelt Dam construction began in earnest in early 1905. Engineers designed a rubble-masonry dam that contained about 342,000 cubic yards of masonry and stone. The faces had hand-cut stone hewn by Italian stonemasons hired by the contractor. In between its faces, the dam was filled with large boulders and mortar. It was strengthened by a "keystone" effect—the fuller the reservoir, the tighter the rocks fit.
- Raw materials for the dam included timber from the Sierra Ancha wilderness, stone from canyon walls, and cement using local deposits of sand and clay. Two 1,200-foot cableways that moved horizontally and vertically were erected to deliver sandstone and dolomite from site quarries.
- When complete in 1911, Roosevelt Dam was 280 feet high, 184 feet thick at the base narrowing to 16 feet at the top, and 1,170 feet long at the crest.
- In 1959, the dam and lake were officially named after Theodore Roosevelt to avoid confusion. There is a Franklin D. Roosevelt Lake in Washington, created in 1941 by the impoundment of the Columbia River by the Grand Coulee Dam.
- From 1989 to 1996, Roosevelt Dam underwent extensive renovation to address water storage and flood control issues. The "facelift" raised the dam's height 77 feet, increasing conservation storage capacity by 20 percent, adding flood control space to the reservoir and addressing safety issues for Roosevelt and the downstream Salt River dams. Also, two new spillways were added, new outlet works installed, and Roosevelt's hydroelectric generation system was upgraded.
- On April 12, 1996, SRP and federal and state officials gathered at the base of the dam for its rededication, pushing the same button as did Colonel Roosevelt in 1911 to release water from the reservoir. Water impounded by the additional conservation space is shared by metropolitan Phoenix cities.
- The dam's original stonework is still visible on the upstream side, lake level permitting.

U.S. Senator Barry Goldwater was one of the featured speakers at Roosevelt Dam's Golden Jubilee, held on the crest of the dam in 1961. Several years before, Goldwater introduced a bill in Congress to officially name the facilities Theodore Roosevelt Dam and Lake. Among the highlights of the Golden Jubilee celebration was Senator Goldwater's unveiling of a new bronze plaque commemorating Theodore Roosevelt and his contributions to the development of the West.

Salt River Valley community leaders and family members observe a proposed site for a new dam and reservoir circa 1905; construction of Theodore Roosevelt Dam would begin later that year. The area was about 80 miles east of Phoenix, near the confluence of Tonto Creek and the Salt River, nestled among the Superstition, Sierra Anchas, and Four Peaks wilderness areas.

Essential Building Blocks for Hydro Development

By Stan Schweissing

As irrigation districts face growing operating expenses and the costs associated with needed improvements, they are trying to use their existing resources wisely and avoid user fee increases in the face of current economic realities. Many are now considering hydropower facilities as a way to create a new revenue stream that could help offset these rising costs. However, the success of hydropower development often lies in how well those responsible for the project understand the key technical drivers, and how well the project is planned and managed.

Considering hydropower

Hydropower has been employed by many irrigation districts throughout the West, having been either included in the original project construction or added at a later date. This renewable energy resource can be a good match for irrigation districts' existing capabilities because the two basic elements of any hydropower project are water and a drop in elevation. Many irrigation districts have locations where water flows through a drop, such as structures on a main canal, wasteways, diversions into lateral canals, or even check structures.

Ridgeway Dam, Colorado: Proposed site for 7 megawatt hydropower plant.

Where districts maintain existing hydropower projects, the irrigation district can often increase its benefit by replacing existing equipment with higher-efficiency equipment, or even by implementing minor changes in the project configuration. In locations where hydropower has not been developed, there may be an opportunity for a hydropower project that gives the district a new revenue source to fund other needed improvements. In any case, hydropower is often a capital investment that will pay for itself and provide benefit to future generations of water users when developed properly.

Ensuring that irrigation districts derive the full benefit from improving existing facilities or developing new hydropower facilities can be a challenge. Beyond the obvious tasks of assessing and prioritizing locations within the district that have the most efficient physical configuration and where hydropower development can be done reasonably, there are other project elements to consider, including:

- Identifying the level of financial investment the district is willing to make.
- Determining the market value of the power produced.
- Developing partnering agreements, agreeing on the method for project design and construction (e.g., traditional design-bid-build vs. design-build).
- Identifying regulatory and permitting strategies.
- Evaluating the district's ability or willingness to provide long-term operation and maintenance for the facility.
- Determining the level of risk the district is willing to accept.

Often, the difference between successful hydropower development and frustration over a missed opportunity is determined by how well the technical considerations, financial evaluation, and administrative requirements are planned and combined throughout the project.

The foundation for many of the decisions involved in hydropower development is the basic analysis of available flow and head. Irrigation districts often have good information regarding the flow that could be passed through a turbine, and measuring the amount of fall is easily done. When combined, these two pieces of information are used to obtain a quick estimate of how much capacity there is for power production at a particular site.

However, it can be difficult to assess a project's overall potential because other engineering considerations that may have a greater level of risk and uncertainty. The reliability of the flow data for estimating future power revenues, in light of potential cropping changes or implementation of water conservation measures, may need to be evaluated. In Washington State, irrigation districts have seen wasteways that historically had a fair amount of water flowing in them dry up when water conservation projects have been constructed, thereby eliminating some potential sites for hydropower development. Additionally, subsurface soil conditions may not be well understood at a particular location and can cause the cost of the project to increase due to issues such as the removal of unsuitable foundation materials, buoyancy, or groundwater.

Financing Options

Options for different types of turbines should be evaluated carefully in light of capital cost of equipment, the impact of differing efficiencies on power revenue, and the cost of construction for elements such as building foundations. Early integration of equipment vendor information by the design engineer can facilitate good overall project decisions and identify a reliable project cost as early as possible.

Additionally, transmission line routes and configurations should be integrated with the design process as early as possible. The cost of transmission can be the difference between financial viability and deciding against pursuing the project. However the use of existing, nearby distribution lines can often be a viable option for many smaller projects. Although many other technical considerations come into play, an engineer who has completed other similar hydropower projects would be able to define other considerations applicable to a specific district.

Importantly, there are new hydropower technologies for low-head applications that could turn some projects not considered economically viable into winners. Integrating these new technologies within the existing infrastructure of a canal drop, while maintaining the irrigation flow commitments, is the key to the project's success.

Financing for the project can present a substantial obstacle and may be the greatest challenge to a successful project. Once the engineering, administration, and

Scroll Case being set and connected to penstock for Francis turbine.

construction costs have been developed, it is appropriate to begin evaluating the financial viability of the project. This evaluation will include identifying probable buyers for the power and establishing the value of the power in different markets. Districts should assess the difficulty of developing a sales contract and the cost of wheeling charges (if they are applicable). Many of these things can be included in a market analysis and should provide the district with a strong understanding of its options for selling power, as well as the advantages or disadvantages of any particular site. The assessment of the potential to sell power will likely include an interconnection and transmission deliverability study. This effort may need to be combined with some assessment of the administrative requirements for the project to identify the long-term operation and maintenance costs. Clean renewable energy bonds may be available for the project and are a low-interest mechanism for financing hydropower development. Applicable tax and renewable energy credits should also be identified and evaluated. A partner or other third party may present financing opportunities that would relieve the district of responsibility for financing construction of the project. Such scenarios can result in some small payments to the district from the outset of the project as consideration for use of district resources, but will likely require that the majority of the revenue for the project be applied to financing payments and profit for the partner or third party. Alternatively, if the district accepts some portion of the burden of financing the project, the revenues from project power production can bring larger payments to the district.

Markets are appearing that change the landscape for evaluating the revenues that hydropower development can produce. Many states are passing laws that require that substantial percentages of a utility district's power be from a renewable source. California has recently reached as far north as Washington State to purchase power from renewable energy facilities, and the value of

energy can be as much as $0.12 per kilowatt-hour. While these opportunities should be carefully evaluated, they do represent a potential revenue environment that should be included in the financial evaluation of a proposed project.

Administering the Project

Project administration should not be overlooked and can represent a significant responsibility for the district. Administrative functions range from contracts to public relations. Developing a regulatory compliance strategy that includes required environmental permitting and agency coordination is also critical. The district should decide early on whether the project qualifies for development under Reclamation's Lease of Power Privilege (LOPP) or whether the project will require Federal Energy Regulatory Commission licensing. The LOPP may represent a shorter time frame and will keep the project discussions within the more familiar framework of relationships between irrigation districts and Reclamation. Developing a public relations plan early on can streamline the relevant regulatory processes as stakeholders generally appreciate upfront involvement and opportunity to comment.

There will probably be a number of federal and state agencies involved in permitting and evaluating the project's impact. The district (and its technical support team) will likely be responsible for coordinating with these agencies, and such coordination will represent a significant investment. Contracts for design and construction will need to be developed and should be carefully reviewed to control the extent of liability and to make sure that work being done is focused on benefits for the irrigation district. Land use and real estate issues and purchases will become one of the many administrative tasks for almost any project. Transmission lines may also require purchase of rights of way and the project may require negotiations with Reclamation or a third party for leases sufficient to allow construction and eventual operation of the project.

Selecting a Partner

Selecting a partner can be one of the most difficult aspects of any project. The district will have to objectively evaluate the resources a partner can provide and the extent to which the district will be able to work effectively with a partner through the many stages of the project.

Such a partnership will require a legal agreement. Developing an agreement can be frustrating for both entities, but a third party familiar with these types of agreements can help keep the focus on creating an arrangement for a project that will benefit all of the parties involved.

Developing a Roadmap

All of these pieces can often be difficult to track and control and can make the undertaking of a small hydropower project seem overwhelming. However, successfully managing the various studies, costs, permits, discussions, and decisions is the difference between a project that provides long-term benefits to the irrigation district and a project that is remembered as a missed opportunity. For this reason, we typically recommend that a district establish a technical resource team, as well as develop and maintain a roadmap throughout the life of the project.

The roadmap should be treated as a living document and revised as frequently as necessary, as well as identify critical decision points and the information required to support that decision. It should define project expectations and acceptable levels of performance. For example, if the district is uncertain as to whether it needs a partner, the roadmap should identify when that decision should be made to avoid a project delay. The roadmap should also define the district's expectations for a partner: Is the partner the main source of funding? Can the partner maintain and operate the plant? Can the partner provide some of the equipment?

The roadmap provides a means to tie the project together and give the district a single document that can be used to identify next steps. The roadmap also helps the district to control its risk within acceptable levels when a change occurs. It will often be used by the board of directors to assess progress on the project, identify opportunities to improve project benefits or reduce the time required for completion, and intercept issues before they become problems.

Seizing the Opportunity

Hydropower represents a real opportunity for districts to develop a revenue stream that can help them overcome the issues they face. Districts are likely to be successful with hydropower if they employ resources that help them assess opportunities and create a plan to develop those opportunities. Districts should also be familiar with the broad range of issues and concerns that come with development of a hydropower project. Putting together the right combination of resources can result in a project that will limit the district's risk during project development and keep the focus on its needs.

Stan Schweissing is a civil engineering manager at HDR in Issaquah, Washington. He can be reached by phone at (425) 391-0523, or by e-mail at Stan.Schweissing@hdrinc.com.

Water Agency Builds Stakeholder Relationships to Streamline FERC Relicensing

As Placer County Water Agency's (PCWA's) 50-year Federal Energy Regulatory Commission (FERC) license to operate Middle Fork American River Project hydroelectric facilities nears its expiration in March 2013, no time has been wasted in moving forward with the relicensing process.

"You've got a heck of a lot of money at risk in a license application and we laid out a program that would get us ahead of the curve," said Einar Maisch, PCWA's director for strategic affairs, noting that the project, completed in 1966, generates 1 million megawatt hours on average each year.

Instead of waiting to file what is known as the preapplication document, or PAD, five years before license expiration, PCWA thought proactively and began engaging stakeholders more than two years prior to submitting this initial document. While the PAD generally serves as the basis for negotiations with interest groups, PCWA believed starting the process early would ultimately allow it to streamline its efforts and minimize unforeseen costs.

"We made a conscious decision to engage our stakeholders long before beginning the formal relicensing process with FERC," said Dave Breninger, PCWA's general manager. "We simply could not afford unexpected delays when dealing with our stakeholders and knew proactively engaging them would promote cooperation on both sides."

While PCWA budgeted $30 million for the relicensing process, operators of comparable projects have nearly doubled that cost when unexpected setbacks in stakeholder outreach emerged. "Our observation was those companies that didn't invest in doing it up front had to pay more to do it later," said Maisch.

As a result of its extensive engagement with various stakeholders before the formal licensing process began, when PCWA ultimately submitted its PAD it included a list of study plans already agreed to by all parties involved. "You need to be collaborative," Breninger said. "Some of our neighbors completing relicensing have ended up in adversarial relationships with their stakeholders, and we did not want that to be the story of our relicensing process."

Maisch indicated it was important that PCWA viewed its measure of success as getting all stakeholders to agree to the study plan, even if it differed from an initial straw man proposal. While the agency provided guidance regarding the reasons its plan would meet all stakeholder needs, the ultimate recommendations included with PCWA's submission to FERC were the result of a collective process.

"The first edition is always the hardest; it helped people focus on what the objectives were," Maisch said. "Success was measured on whether or not we could get everybody on the plan."

PCWA submitted its draft license application on September 28, 2010, and its formal application for a new, 50-year license on February 23, 2011. FERC is reviewing the application to make a determination as to whether it is complete and will then issue a ready for environmental analysis notice.

In the remaining two years before license expiration in March 2013, FERC will issue a draft and final environmental impact statement or environmental assessment. The final license will ultimately include terms and conditions from mandatory resource agencies, including Clean Water Act Section 401 certification.

For more information on the Placer County Water Agency's relicensing process for Middle Fork American River Project, visit its website at http://www.relicensing.pcwa.net.

Eyeing Municipal Growth, Northern Water Aims to Protect Ag Water Use in Coming Decades

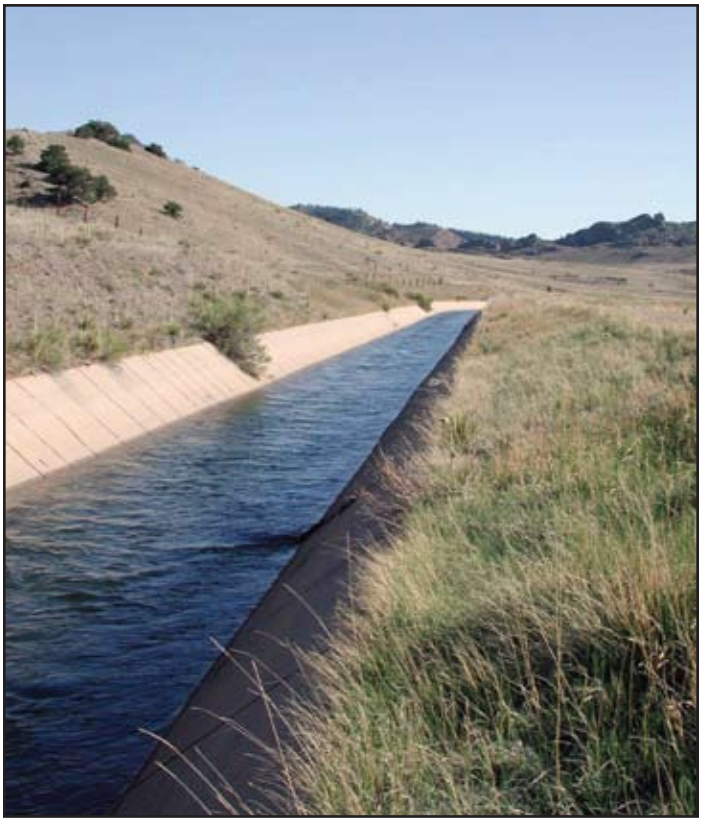
By Eric Wilkinson

Since its founding in 1937 to partner with Reclamation to build and manage the Colorado-Big Thompson (C-BT) Project, the Northern Colorado Water Conservancy District has served irrigated agriculture. However, as new residents continue to relocate to Colorado's Northern Front Range, growing municipal water demands have increasingly strained available water supplies. Northern Water seeks to meet this challenge by implementing innovative measures to ensure that regional agriculture remains vibrant while providing water for new residents.

Northern Water was formed as drought and depression gripped the nation. Though rooted in studies completed in the 1880s, another 50 years passed before the technology and political willpower were available to push development of C-BT forward. When completed in 1957, the project became the largest transmountain water diversion project in Colorado, and its water is now used help irrigate approximately 650,000 acres of farmland and provide water supplies for about 50 cities, towns, and domestic water districts.

C-BT supplements native water supplies from the South Platte River Basin via the 13.1-mile Alva B. Adams Tunnel, which transports upper Colorado River water from west to east under the Continental Divide. The project supplies an average of about 215,000 acre-feet annually, in addition to generating hydropower as it drops through five power plants on its way to Colorado's Front Range.

As many estimates indicate that Northern Colorado's population will double in the coming four decades, Northern Water faces new challenges to maintain water supply for irrigators while also meeting the growing urban needs. Northern Water is working to meet these challenges by increasing water supplies



through the development of the Northern Integrated Supply Project (NISP).

The NISP aims to add storage capability by constructing Glade Reservoir, with a 170,000 acre-foot capacity, and Galeton Reservoir, with a 45,000 acre-foot capacity. The intent of NISP is to ensure that Northeastern Colorado municipalities are not forced to buy large amounts of irrigated agricultural land to obtain water rights and associated water supplies as their populations continue to grow in the coming decades.

A component of NISP, the South Platte Water Conservation Project is a cooperative effort with irrigated water users in the region. Pipelines will be constructed to link Galeton Reservoir to canals serving irrigated agriculture in the South Platte Basin. By helping irrigators to modernize their infrastructure, the project will not only shore up agricultural water supply, but will also promote water conservation through a more efficient delivery system.

Similarly, the Windy Gap Firming Project, proposed by Northern Water's Municipal Subdistrict, will construct an additional 90,000 acre-feet of storage east of the Continental Divide to "firm" the water supply diverted by the Windy Gap Project from the Colorado River and transported to Northeastern Colorado through C-BT. The Windy Gap and Windy Gap Firming Projects will divert water from the Colorado River allotted through water rights filings in the 1960s and 1970s.

Both NISP and Windy Gap Firming Projects require federal environmental approval to move forward. Northern Water continues to work with Reclamation and the U.S. Army Corps of Engineers to ensure that these important projects are built.

Even as Northern Water looks to shore up available water supplies, it keeps an eye on aging infrastructure. C-BT was completed in 1957, with many components constructed in the two decades prior. Northern Water continues to modernize its facilities to ensure that it can keep pace with the demands of Northern Colorado's burgeoning population.

Eric Wilkinson is the general manager of the Northern Colorado Water Conservancy District in Berthoud, Colorado.
He can be reached by phone at (970) 532-7700. For more information on Northern Water, visit http://www.northernwater.org.

Overview of Western Water Adjudications: A Judge's Perspective

By Gregory J. Hobbs, Jr.

West of the 100th meridian, irrigation development in the 19th century, followed by municipal development in the 20th century, has placed its marker on the available water supply in many river basins. Undoubtedly, as the population of the West has continuously increased and the customs and values of the people have widened to include environmental and recreational uses, the 21st century is the era of limits made applicable to water decision-making. Due to natural western water scarcity, we are no longer developing a resource. Instead, we are learning how to share a developed resource.

In this context, western water adjudications provide a vital function. The term adjudication generally refers to the process by which state or federal courts of law decide a case. Typically, the ordinary court case involves only one or several parties. Hearing a civil or criminal matter, the trial court determines what the facts are and then applies the appropriate constitutional, statutory, or case law principles. For example, has one party breached a contract agreed to by both parties? If so, how much money does the breaching party get to collect? What did the defendant do and is she or he guilty of a crime? If so, what shall the sentence be?

State and federal courts of appeal and supreme courts are ultimately responsible for enunciating the law to be followed by trial courts. But the trial courts resolve disputed issues of fact that the appellate courts must base their legal opinions on, if the evidence in the record supports the trial court's findings of fact. A final judicial opinion that is no longer subject to appeal becomes binding on the parties.

In many cases, individuals, companies, and governmental entities settle disputes among themselves rather than testing the proposition that divides them in court. When parties cannot agree, courts are available to make final, enforceable decisions about the rights and duties of citizens, companies, and governmental entities under the law of the community.

So what does water have to do with courts? And what do courts have to do with water? A basic law of nature is that all living beings need water, and that water is a scarce resource. Water is a public resource; its ownership always remains with the public.

Of course, the public's business is the business of individuals who have need of water to make a product, grow a crop, turn a turbine, wet a fishing line, play a kayak wave, or brew ice tea for sipping on the back porch on a hot summer's day.

Individuals, companies, and governmental entities may obtain water use rights in accordance with applicable state and federal laws. The adjudication court determines the relative priority of water use rights that depend on the same river system for their supply. So stream adjudications inevitably involve many parties making many claims. They include Native American tribes; state, local, and federal agencies; farmers and cities; and individual persons and businesses.

The tribes and federal agencies can claim water use rights created under state law. In addition, they may claim federally created water rights. In contrast, individuals, companies, and nonfederal public entities are typically restricted to claiming state-created water use rights only.

Subject to the exercise of previously created water rights, federally created water rights operate to reserve a portion of the available unappropriated water for present or future use. For example, when Congress created each Indian reservation, it impliedly reserved a sufficient amount of water as of the date of the reservation's creation to make the reservation productive, regardless of when the tribe might actually use the water.

In contrast, state-created water rights are perfected only by actual beneficial use. Those who perfect their water rights in the public's water resource earlier by actual beneficial use have a preferred right to those who put the water to actual beneficial use later in time.

Under the McCarran Amendment of 1952, Congress permits state courts to exercise jurisdiction over all federal agencies and tribal water claims in stream adjudications involving water rights priorities. Of course, the state court must apply the law of federal reserved water rights when determining those claims.

Once determined, the water officials employ the court-decreed priorities to distribute the available

water to the federally created and state-created water rights. They shut down junior water rights whose exercise would diminish the water that would otherwise be available to the senior water rights.

Water sharing occurs by judicial and administrative decisions that limit all water uses to their actual beneficial need in two ways: by requiring reasonably efficient means of diversion and carriage to the place of use, and by voluntary market mechanisms that allow willing sellers and willing buyers to transfer senior priorities to new points of diversion, new uses, and/or new places of use.

The most valuable water rights in the marketplace are the senior priorities that will receive water in drought years. Reservoir storage is indispensable because water taken in priority in the good water years can be held and released in the water-short years.

During a drought year, a river system may produce only one-fourth of its average water supply. Truly, the early 21st century multiyear drought in the West teaches once again that smart water conservation in all its forms is a necessity of western life.

Every generation learns this lesson. Our most memorable disagreements are founded on the common goal of extending water benefits to as many useful purposes as customs and recognized cultural values permit.

In the late 19th century, irrigation expert Elwood Mead packed up from Colorado to Wyoming with a derogatory parting salvo about the waste Colorado's water adjudication system was causing. His telling 1903 book, *Irrigation Institutions*, brims with scorn for water judges who rewarded speculation by issuing decrees that bore no basis in available water. This made these decrees a mandate for outright theft of someone else's water use right.

As we continue to examine our western water law and institutions in the face of incredible population growth since the 1950s, it's worth taking a fresh look at Mead's criticism of a court-based water rights determination system:

> In the early adjudications the amounts of appropriations were based on the estimated capacities of ditches and canals. Sometimes the amount was fixed by the measurement of the ditch, and sometimes by what the appropriator claimed. With rare exceptions it does not seem that the acreage of land which had actually been irrigated exercised any influence. The real issue was the amount of water diverted or proposed to be diverted. . . . [A]ppropriators were encouraged to make extravagant claims. All of the conditions, therefore, contributed to favor the granting of water rights in excess of the actual uses or necessities (Mead 1907).

It drove Mead mad that a public resource could be manipulated for selfish monopolistic and fraudulent practices that included the sale of excess diversions whose use would deprive other appropriators of the stream's supply:

> In every instance investigated the real purpose has been to make money out of excess appropriations. The parties who have acquired surplus rights are unable to use the water themselves, and seek to sell to some one who can. . . . The usual result is to take as much water away from one user as is supplied to another (Mead 1907).

Mead mostly blamed Colorado water lawyers, judges, and the adjudication system they controlled. In its 1879 Adjudication Act, the Colorado General Assembly assigned the state's judiciary to decree water rights priorities, and the state and division engineers and the local water commissioners to enforce them (Hobbs, Jr. 1997). This decision was prompted in part by upstream/downstream junior/senior disputes caused by water scarcity (Colorado Constitution article XVI 1876; Act of Feb. 19, 1879). The Union Colony—downstream at the confluence of the Cache la Poudre and South Platte Rivers—built and began to operate their irrigation canals, only to find in 1874 that diversions by a new upstream ditch near present-day Fort Collins had reduced the Cache la Poudre's flow to a trickle (Dunbar 1983). Clearly, the priority system and its enforcement—prior reliance on turning the water to beneficial use and protecting that use—had to be institutionalized within the three branches of Colorado government for the benefit of the citizens.

The "better way" he envisioned (and took to Wyoming as its first state engineer upon leaving his post with the school we now call Colorado State University) was enlightened expert decision-making through careful investigation of the facts of water supply and water use administered through a permit system:

> This situation deserves careful consideration, not only from irrigators in Colorado, but in the other States. It raises the question as to whether the evil of excess decrees is wholly due to lack of experience or is the result of a defective method of establishing rights. The latter is believed to be the truth. It is believed that if the determination of water rights was entrusted to a body of trained irrigation experts, who had a practical knowledge of the subject and who would familiarize themselves by personal

> investigation with the use of water on every stream where rights are to be established, the results would be far superior to anything which is possible under the present plan (Mead 1907).

Another irrigation expert, F.H. Newell, reported in 1894 the phenomenon of excess ditch-building and land cultivation in the South Platte Basin that had no real hope of realizing water, even in average years:

> The earliest large enterprise conducted by English speaking farmers was probably the irrigation system at Greeley built by the Union Colony, work being begun about 1870. As the population of the state has increased and the demand for agricultural products has become greater, farmers have gradually brought under cultivation strips or patches of arable land wherever water can be diverted to cover it at moderate expense. Thus all the easily available sources of water have been utilized, and with increase in the number of farmers still more land had been cultivated until the area far exceeds that which can be irrigated in ordinary seasons (Newell 1894).

Even as Mead and Newell were leveling their criticisms, Colorado courts were at work leveling the playing field, due to the overappropriated status of the South Platte and the Arkansas by the 1890s. For example, late 19th and early 20th century Colorado Supreme Court cases consistently reiterated that seepage water from ditches and reservoirs and return flows from field irrigation belonged to the stream to supply other water rights established in reliance on them.

I use Colorado and Wyoming examples because they are the paradigm adjudication and permit states. Many other western states followed Wyoming's permit lead for recognizing new water rights, but all of the states have found that some form of court adjudication is necessary to settle the relative priorities of all users in particular stream systems. The advent of the McCarran Amendment necessitated water adjudications to establish tribal and federal agency priorities to water vis-à-vis state-created water rights.

Some of the states start with state agency determinations leading to judicial adjudication proceedings; other states allow a state agency or private party to initiate the adjudication. All the states have found that they must depend on the expertise of state water officials and private engineers and hydrologists to present the facts of water supply and water use in agency and court proceedings. The fact finder (an administrative board, master, referee, district court judge, or water judge, depending on the state or federal court forum having jurisdiction) determines the facts and makes the required legal conclusions. A trial court enters the adjudication decree, which is subject to appellate review. The water officials administer the decrees and make the day-to-day water distribution decisions with the sound discretion the law accords to them.

Throughout the West, state courts of appeal and supreme courts have defined the parameters of state-created water use rights. Without being exhaustive, I list the dozen most fundamental principles of western state water law as including the following:

1. An appropriation of the public's natural stream water resource is only for actual beneficial use.
2. Actual beneficial use is the basis, measure, and limit of every appropriation.
3. The "natural stream" governed by the doctrine of prior appropriation includes ground water that is tributary to a surface stream (this is recognized by the vast majority but not all of the western states).
4. To be recognized, water rights to use of natural stream supply must be adjudicated to ascertain their priority and extent.
5. Every decree recognizing a water right to waters of the natural stream contains an implied limitation restricting diversions to those needed for actual beneficial use, regardless of the diversion rate stated on the face of the decree.
6. Every appropriator is entitled to maintenance of the stream conditions, subject to natural fluctuations, as they existed at the time of the appropriation.
7. Appropriators must employ an efficient means of diversion and conveyance to the place of use.
8. In times of short supply, the water officials must administer water rights in the order of their decreed priority.
9. Junior water rights, including rights to use ground water that is tributary to a natural stream, must be curtailed to the call of seniors, unless out-of-priority diversions are accompanied by adequate replacement water under a court-approved augmentation plan or state-engineer-approved substitute supply plan.
10. New water rights (also called conditional rights) cannot be decreed in the absence of available unappropriated water, taking into account the historic exercise of senior water rights.
11. Changes of water rights, whose purpose is to continue an appropriation in effect under its

priority date for another type or at a place of use, or through a different point of diversion, are limited to their historic beneficial consumptive use measured over a representative period of time and cannot be decreed if they will cause injury to other water rights.

12. A state must comply with the interstate compacts and United States Supreme Court equitable apportionment decrees that define the allocation of interstate-apportioned waters.

Mead would be amazed! Adjudications now operate under a set of procedural and substantive laws intended to optimize the beneficial use of water on a watershed basis.

Mead placed great faith in the integrity and fact-finding ability of state water officials. In the western states, departments of water resources and state engineers are assigned a wide variety of data gathering and regulatory authority. Fair, enlightened, and common sense administration of water rights is important to sharing the water resource while protecting the established water use rights. Mead would be chagrined to learn that Colorado, the adjudication state he so criticized, now grants its state engineer considerable permit authority that extends to every form of ground water—tributary, designated, nontributary, and Denver Basin ground water—all of which are recognized as constituting a public resource, though the latter three are allocated and administered differently from waters of the natural stream. The Colorado State Engineer's Office, with adequate conditions to protect against injury to water rights, can approve temporary changes of water rights, substitute supply plans, stored water banks, and loans of water rights by farmers to cities without the need for water court adjudication.

Mead, who resisted the separation of water rights from irrigated land to other uses, would, I think, grudgingly admit that temporary and permanent water transfers to municipalities and other public water supply entities are in the public interest, due to the western population growth he and the other agriculturists of his day did not foresee.

Finally, Mead would be surprised to learn that all the western permit states, including Wyoming, have resorted to court adjudications to establish the relative priorities of Native American water rights, federal agency express and implied reserved water rights, and state-created water rights, so that they can be administered fairly in times of short supply. The West's population continues to grow. Public officials at all levels have a responsibility to make principled and common-sense water decisions for the good of humans and this magnificent western environment we enjoy.

Water lawyers and engineers bear particular responsibility for the integrity of water decisions, whether made by the legislatures, water officials, water judges, city councils, county commissioners, boards of special water districts, or private persons.

Water judges bear particular responsibility to listen carefully to factual, sometimes highly technical, presentations, and then render decisions that are legally sound, intelligible, and consistent with ever-evolving understandings.

We live in community. Water is our common and most valuable resource. Water disputes often seem to divide us. But the Great Divide constantly informs the direction we must take—to the higher ground—so we may see the vista.

References:

- Act of Feb. 19, 1879, 1879 Colo. Sess. Laws 94.
- Colorado Constitution art. XVI 1876.
- Dunbar, R., 1983. Forging New Rights in Western Waters 88–89.
- Hobbs, Jr., G., 1997. Colorado Water Law: An Historical Overview. University of Denver Water Law Review 9, 10.
- Mead, E., 1907 (reprint). Irrigation Institutions. The Macmillan Company 148–49.
- Newell, F.H., 1894. Report on Agriculture by Irrigation in the Western Part of the United States at the Eleventh Census: 1890, 91.

Gregory J. Hobbs, Jr. serves as a justice on the Colorado Supreme Court, a position he has held since 1996. Hobbs previously practiced law for 25 years, focusing on water, environment, land use, and transportation issues.

This article is reprinted with permission from Justice Hobbs's book, The Public's Water Resource: Articles on Water Law, History, and Culture, *as published by Continuing Legal Education in Colorado, Inc., in 2007. Justice Hobbs holds the copyright to this material.*

Powering Up Irrigation Districts: *The Water-Energy Future*

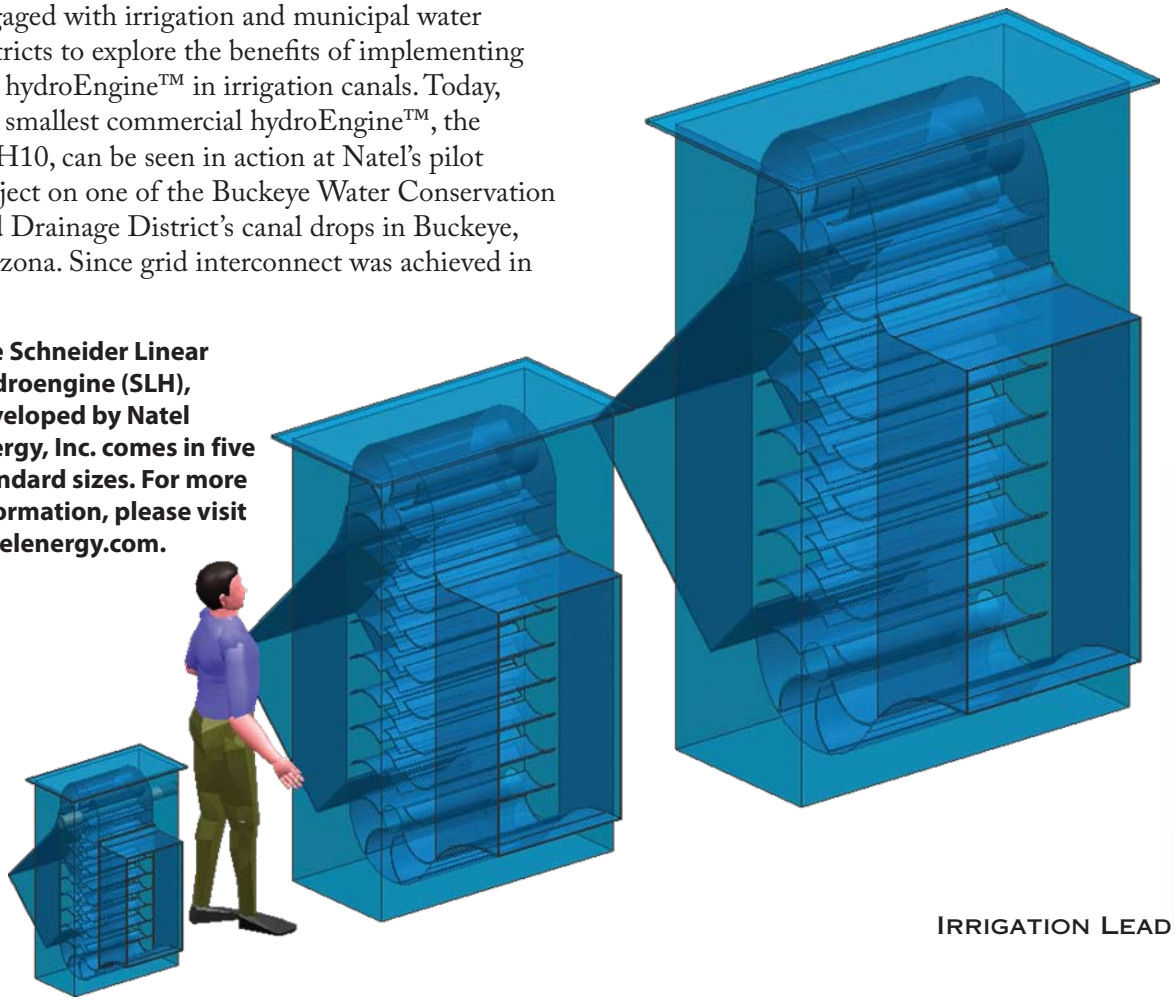
By Laila Winner

Turbines for developing low-head hydropower resources have existed for over a century, but they have historically been too expensive to cost-effectively generate energy at heads under 20 feet in height. The introduction of an innovative new technology, however, along with an increasingly supportive legislative environment for renewable energy projects, is inspiring some irrigation and municipal water districts to reconsider the economics of low-head hydro.

The hydroEngine™, developed by California-based Natel Energy, Inc., is a scalable, turbine-like machine designed for heads as low as 5 feet. Unlike Francis and Kaplan turbines, which are characterized by complex geometries and high manufacturing cost, the hydroEngine™ features a simple, symmetrical design in which water flows across curved blades mounted on a pair of parallel belts. Once installed, water enters a penstock, passes through the hydroEngine™, and exits a draft tube at the velocity of the incoming water.

Over the past few years, Natel has strongly engaged with irrigation and municipal water districts to explore the benefits of implementing the hydroEngine™ in irrigation canals. Today, the smallest commercial hydroEngine™, the SLH10, can be seen in action at Natel's pilot project on one of the Buckeye Water Conservation and Drainage District's canal drops in Buckeye, Arizona. Since grid interconnect was achieved in April 2010, General Manager Ed Gerak feels that the project has added substantial value beyond the 2500 kilowatt-hours generated. "It's proved that these units can go in relatively simply and easily, assuming they can get past the FERC small conduit exemption hurdle, and that there's huge potential for small hydro in the West. With sufficient flow, a 10- or 15-foot drop would pencil out."

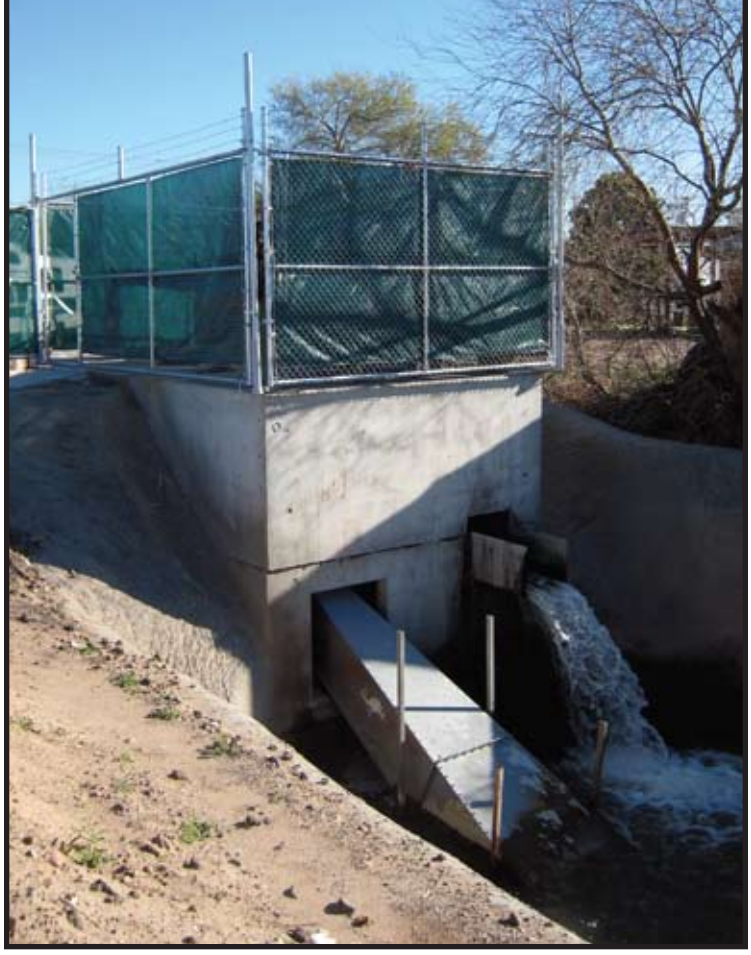
In addition to innovations on the technical side, increasing support for renewable energy initiatives and awareness of the potential of small-scale hydropower have combined to create a legislative environment in which projects such as hydroEngine™ installations are viewed favorably. Streamlining the FERC licensing process for hydropower installations on existing dam structures is one of the key items in the recently proposed Hydropower Improvement Act, reflecting the increased awareness that a number of such sites can be developed with a minimum of environmental impact. Many states have adopted policies that encourage the production and



The Schneider Linear Hydroengine (SLH), developed by Natel Energy, Inc. comes in five standard sizes. For more information, please visit natelenergy.com.

purchase of renewable energy: feed-in tariffs require utilities to pay a fixed, premium rate for renewable energy for a set period of time, while renewable portfolio standards require that suppliers of electricity produce a minimum quantity of renewable energy by a set date.

As irrigation and municipal water districts struggle to meet the challenges associated with budget cuts and aging infrastructure, opportunities to turn infrastructure upgrades into revenue-generating, local, and clean energy assets are especially compelling. Central Oregon Irrigation District (COID) in Bend, Oregon, completed its second 5-megawatt hydropower project in October 2010 and is currently in talks with Natel to partner on a hydroEngine™ installation in 2012. General Manager Steve Johnson says that revenue generated from the two existing plants helps to offset costs, pay for capital and water conservation projects, and keep patrons' assessment rates lower. He attributes COID's interest in Natel's product to the comparative ease and simplicity of the licensing, installation and interconnect process. "Instead of spending $20 million on a 5-megawatt project, why not do four or five or six of these $1–$1.5 million projects and end up with same amount of power generation?" The primary economic benefit of the hydroEngine™, in Johnson's view, is that it features "the same efficiency as a Kaplan, lower construction costs, and better return.



Energy Beets:

Refueling North Dakota's Rural Economy

By Angela Magstadt

North Dakota is on the cutting edge of a project that could bring major development to its small communities, energy independence to the state, and another high-value crop for farmers to add to their rotations. Growing sugar beets for ethanol production has been successful in Europe, and studies and field trials in North Dakota have shown that this crop can be successfully grown across the state.

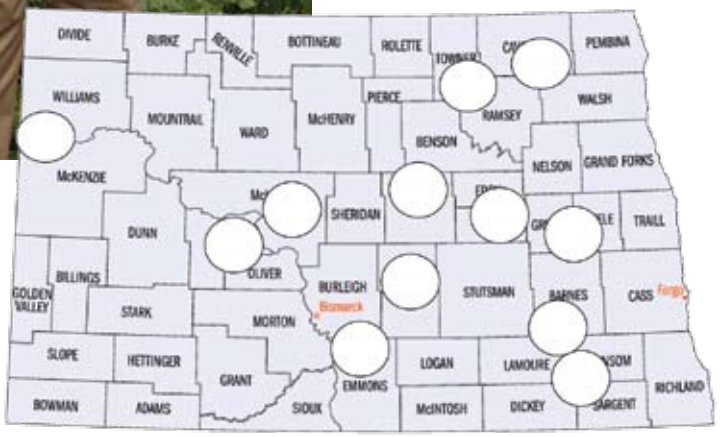
In 2007, what is now the Green Vision Group began to study the use of sugar beets as an alternative feedstock for biofuels. Numerous agencies and organizations, including the North Dakota Irrigation Association, have funded this project, and funding was matched by the North Dakota Renewable Energy Council. Much of the research is being carried out by North Dakota State University, Beta Seeds, Syngenta Seed Company, and Heartland Renewable Energy of Muscatine, Iowa.

Just as irrigation plays a significant role in growing sugar beets in dry western North Dakota, it also will play an important role in energy beet production in central and western North Dakota. Field trials have shown yields from 28 tons per acre in dryland plots to 41 tons per acre in irrigated plots. "Energy beets respond very well to irrigation," says Maynard Helgaas, president of the Green Vision Group. "It is especially important to have adequate moisture during crop emergence and establishment of the stand." Helgaas says that the use of irrigation in the production of energy beets will vary by area: 2 of the 12 proposed locations have limited irrigation potential, other areas will be about half irrigated and half dryland, and the Missouri River corridor is 100 percent irrigated. "This area has a lot of underdeveloped land that could be two or three times more productive with irrigation and high-value crops."

Corn for ethanol production has, in recent years, been considered a high-value crop, benefiting farmers and the state for several years. Even with the increasing prices corn has been bringing, Helgaas says energy beets have many advantages over corn:

- Energy beets do well across the state. Growing corn, by contrast, has limitations in North Dakota, especially in the northern part of the state. Field trials in five locations over the past two years have shown high yields and good sugar content. This research will continue this spring in nine locations across North Dakota.
- Energy beets can provide additional income for farmers. According to North Dakota State University studies, the economic return of energy beets has a net margin over direct expenses more than twice that of corn under normal circumstances.

Green Vision Group founders Rod Holth, Rudy Radke, and Maynard Helgaas. Not pictured is Lloyd Anderson.



North Dakota energy beet production and processing targeted areas.

- Energy beets benefit the soils. Energy beets require considerably less nitrogen, are tolerant to saline soils, are drought resistant, and have deep tap roots (up to 8–12 feet deep) that will open the soil and mop up nutrients that escape shallow-rooted crops grown in traditional crop rotations.
- Energy beets have a lower carbon footprint. Energy beets require one less processing step. While corn needs to be converted from starch to sugar, the juice from energy beets is already sugar, so it can go directly to fermentation. This decreases production time and cost. And, initial tests show that burning the stillage from the beets (the waste byproduct) will produce 70 percent of the energy required to power the processing plant. Furthermore, the ash left after the burning process is 33 percent potash, which can be applied to the beet fields as fertilizer, reducing the plant's waste to almost nothing.
- Energy beets require less water for processing. Because 70 percent of an energy beet is water, only 1½ gallons of water are needed to make 1 gallon of ethanol, compared to corn, which takes 2½ gallons of water to make 1 gallon of ethanol.
- Energy beets produce more ethanol. Energy beets produce twice as much ethanol per acre than corn.

The Green Vision Group's long-term vision is to have 12 20-million-gallon-per-year processing plants in various locations across the state, with the goal of keeping transportation costs and petroleum used to a minimum. The plants will be strategically located so that producers will not have to travel more than 20 miles to transport their beets, which will keep carbon emissions low. This will further reduce the plant's carbon footprint and allow petroleum companies to buy the plant's carbon credits.

Plans are currently in the works to construct a pilot plant, which Helgaas says he hopes will be operational in 2012. While the size and location are still being considered, construction and start-up costs are estimated at $54 million and will be funded by state and federal loans and private investors. The plant would use technologies from similar facilities in Germany and Brazil, and be the first of its kind in North America. Helgaas expects that once the pilot plant is built, the others will not be far behind, and that 12 plants is a conservative number. "In Germany, 50 plants quickly became 5,000 small digester plants, and energy from the plants is distributed throughout the country via pipelines and transmission lines. This is a great opportunity for us to become more energy independent."

Reprinted with permission from the North Dakota Water *magazine.*

Irrigation Leader

2011 CALENDAR

Apr. 4–6	National Water Resources Assn., Federal Water Seminar, Washington, DC
Apr. 26–27	Water Resources Research Center, Annual Conference, Yuma, AZ
May 10–13	Assn. of California Water Agencies, Spring Conference & Exhibition, Sacramento, CA
June 1–3	Groundwater Management Districts Assn., Summer Session, Estes Park, CO
June 15–17	Texas Water Conservation Assn., Mid–Year Conference, Galveston, TX
June 22–24	Western Coalition of Arid States, Annual Conference, San Diego, CA
June 27–28	Idaho Water Users Assn., Summer Water Law Seminar & Workshop, Sun Valley, ID
July 21–22	Irrigation Assn., Water Conference, Broomfield, CO
July 25–27	National Water Resources Assn., Western Water Seminar, Colorado Springs, CO
Aug. 23–25	Colorado Water Congress, Summer Conference, Steamboat Springs, CO

For more information on advertising in *Irrigation Leader* magazine,
or if you would like a water event listed here, please phone (703) 517-3962,
or e-mail Irrigation.Leader@waterstrategies.com.
Submissions are due the first of each month preceding the next issue.