

9/22/2017



Some Dam – Hydro News™ And Other Stuff



Quote of Note: *“The first day you think that you know everything there is to know about dam safety is the first day you’re in trouble” - whoever*

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“Good wine is a necessity of life.” - Thomas Jefferson
Ron’s wine pick of the week: 2015 Adegá Cachin Spanish Red “Peza do Rei Mencia”
“No nation was ever drunk when wine was cheap.” - Thomas Jefferson



Dams:

(Not a happy crowd.)

Oroville Dam: Frustration, friction flashed behind the scenes as emergency grew

By Ryan Sabalow and Dale Kasler Sacramento Bee | September 10, 2017, mercurynews.com

OROVILLE, CA — In the confusion and chaos of the emergency at Oroville Dam, as thousands of residents were being evacuated, public safety officials and others involved in managing the crisis found themselves clashing with the people operating the nation’s tallest dam. Butte County Sheriff Kory Honea questioned an assertion by the director of the state Department of Water Resources that the situation was stabilizing. He demanded to know whether the technical experts advising dam operators were properly credentialed. Honea and Cal Fire incident commander Kevin Lawson shot down suggestions that water could be allowed to flow once again



down the dam's emergency spillway – the structure whose near-failure prompted the evacuation in the first place. The frustrations and friction flared up in a series of meetings and conference calls between top officials in Gov. Jerry Brown's administration, local officials and others during the worst of the dam crisis on Feb. 12 and 13. Handwritten notes taken during the conversations, the contents of which were first reported Thursday by the Associated Press, shine a fresh light on the tense discussions between dam managers, public safety officials and others as they wrestled with enormous uncertainties and sometimes conflicting strategies for dealing with one of the gravest crises in California water history. Much of the ire was directed at DWR, which manages the dam. At one point, an unidentified official suggested that the agency wasn't grasping the severity of the situation, which threatened to unleash a torrent of water from the state's second largest reservoir on Oroville and other downstream communities.

"DWR brains work differently," the official said on a call the morning after the evacuation. "(They) don't weigh worst case (scenarios) as heavily." DWR has come under criticism from some elected officials, Oroville community leaders and others for its handling of the near disaster at Oroville Dam. But while the notes suggest friction arose between leaders of DWR and other agencies, current and former officials who attended the meetings said this week they were mostly in sync with each other as they kicked around multiple ideas for dealing with an emergency that threatened the lives of nearly 200,000 people. "There was lots of back and forth. Lots of discussions," said Bill Croyle, who was DWR's acting director at the time. "Lots of scenarios being run – lots of Plan A, Plan B, Plan C."

Last week, an independent team of experts investigating the disaster released a report that concluded that bad design and construction, along with inadequate state oversight, led to the collapse of Oroville's main spillway. The team said that water entering through cracks or repair seams in the main spillway may have triggered crumbling of the spillway. Its report cited a series of problems with the original construction of the spillway in the 1960s, including thin concrete, poorly placed drains and inadequate foundations. In an interview with the Sacramento Bee this past week, Honea said that DWR officials never once dismissed his concerns about public safety. He said the notes miss some of the nuance of the back and forth discussions. "It was just a matter of us trying to manage a complex problem," Honea said. "In that process, you've got to talk about things. You've got to weigh pros and cons. You've got to talk about what the worse-case scenarios might be and how that all plays out." But the notes reveal that some officials were second-guessing DWR's decisions, including its management of the dam after the crater formed in the main spillway on Feb. 7. Dam operators dialed back water releases the next four days to try to minimize the damage to the concrete spillway, even though it was raining heavily and water levels on Lake Oroville were quickly rising. According to an unidentified participant on one of the calls, the chief of DWR's Oroville field division, Pat Whitlock, wanted to increase the water releases down the main spillway but was overruled. "We lost time because of it," the person said. The decision proved critical. The reservoir filled to the point that water crested over the adjacent emergency spillway – a concrete lip resting atop an unlined hillside – for the first time in the dam's 48-year history.

Croyle assured the community the emergency spillway could handle the flows. But the next day, on Feb. 12, the hillside below the structure started eroding. In his interview with the Bee, Honea said he wasn't aware the erosion was so severe until that evening, when a concerned geologist arrived with a picture of the erosion and showed it to Whitlock. "I walked up to the table where Pat (Whitlock) was sitting because I was going to tell him good night and let him know that I was leaving ... and I heard him say, 'This isn't good.' I heard him say, 'Does the sheriff know about this?'" Honea said that a short time later, DWR estimated that the erosion would chew through the hillside in around an hour. Honea said there were close to 40 officials in a room discussing what to do. "It sounded to me that thousands of lives are at risk, so in a loud and a rather authoritative tone, I yelled for everybody to be quiet and listen to me. ... I said, 'It sounds to me that I need to order the evacuation of the southern part of Butte County. If there is anybody in this room who thinks that's the wrong move or has a better idea than you need to speak up now. Tell me now.' The room fell quiet, and everybody stayed quiet. So I said, 'I've got to do this.'"

In the notes, he's described as calling the decision to evacuate pulling "the big red handle." "If it wasn't for one geologist ... (Whitlock) is afraid we wouldn't have even caught the problem," the notes say.

The crisis eased a few hours later that evening, after DWR officials finally ramped up water releases from the main spillway, blasting apart the lower half. That lowered lake levels, relieved pressure on the emergency spillway and halted the erosion on the hillside below. The notes from the conference calls show DWR's top official struggling to balance competing concerns. Croyle wanted to minimize damage to the main spillway because he'd need to keep it functional enough to handle heavy spring runoff that was looming in the weeks ahead. And because of peculiarities in how the dam complex is set up, massive water releases from the fractured main spillway posed a threat to the adjacent power plant. The facility is the dam's primary outlet outside of flood season.

"We have been working hard to protect the plant," Croyle said the night of the evacuation. "It's important for us." At the same time, he recognized the importance of reducing lake levels as quickly as possible to tamp down the immediate threat to towns and cities along the Feather River. "Risk to public more important," he said that night, according to the notes. One additional problem loomed that evening: It was dark, and officials were having trouble verifying that the lake levels were falling and the spillways weren't dangerously eroding away. "Can't confirm. Dark," one meeting participant was quoted in the notes as saying. Six years earlier, the Federal Energy Regulatory Commission had urged DWR to install lighting and cameras around the dam and other measures to improve response times in case of a major problem, according to a memo obtained by the Associated Press. Croyle, however, said in the interview this month that officials were able to get a good read on the situation, thanks in part to a law enforcement helicopter that was able to conduct visual inspections. "We lit up the area with a helicopter," he said.

The notes reveal that some officials – it isn't clear who – were discussing that evening whether the evacuation order should be rescinded. The idea was dropped because Honea was insisting it needed to stay in place until the state could assure him the public wasn't in jeopardy. Residents were allowed to return home on Feb. 14, two days after the order. On a conference call the morning of Feb. 13, just hours after the hillside erosion had been stalled, one of the officials mused about the possibility of resuming the use of the emergency spillway. Honea and Lawson, the Cal Fire incident commander, forcefully shot down the suggestion. "Use of emergency spillway is off the table," Honea is quoted as saying. "Stay away from spillway water over emerg spill," Lawson adds, according to the notes. "Yesterday was scary," Honea says later that morning. "1,000s of people could have died. Let's not let that happen again."

During one discussion that morning, Honea asked Croyle why the public should trust the DWR's insistence that the main spillway was holding up, considering how wrong the state's assertions were about the stability of the emergency spillway. "Don't know," Croyle is quoted as saying. "Doing best we can (with) current monitoring. There could be an issue later, it appears stable now." Honea also questioned whether the experts DWR had on site were "competent" and "credentialed." He said that he wasn't necessarily second-guessing the DWR. Rather, he said, he was trying to get officials to speak clearly so that he could understand. He said he defaulted to a law enforcement officer's "interrogation mode." "Engineers and geologists and hydrologists, they speak their own language," Honea said. "It was a stressful situation. I went to my default comfort zone which was getting people to tell me the information I needed in terms that made sense to me so that I could make the decisions I needed to make."

(This could end up in a fist fight.)

Dam, disaster, dollars

Comprehensive dam forum to be held Saturday

09.14.17, newsreview.com

A free public forum on the past, present and future of Oroville Dam with an emphasis on its economic impacts is scheduled for Saturday (Sept. 16) at the Southside Oroville Community Center. Topics of discussion will include the dam's construction, maintenance, recreational and business connections, safety, ongoing repairs and potential. Representatives from the state's Department of Water Resources, Butte County and the Oroville Area Chamber of Commerce will give presentations during the first half, followed by a panel discussion focusing on economic factors. Attendees will have the opportunity to share questions and comments. The event is hosted by the League of Women Voters of Butte County and is scheduled for 9 a.m. to 1 p.m.

(What could have been?)

Engineer speaks out about 1996 study that predicted catastrophic flooding

By Click2Houston.com Staff, September 07, 2017

HOUSTON, TX - When massive amounts of rainwater were released from the Barker and Addicks dams, it flooded houses that hadn't been damaged until then. One of them belongs to Art Storey, who for 25 years directed billions of dollars worth of flood-prevention projects as Harris County's chief engineer and infrastructure director.

"I think it is a massive governmental and engineering failure," Storey said. In 1996, Storey ordered a study that found the Addicks and Barker reservoirs were inadequate to protect about 25,000 homes from the kind of flooding Harvey caused. The study proposed a \$400-million project to carry water from the reservoirs to the Houston Ship Channel through underground flumes beneath the Katy freeway, which was then being expanded. The project was never built. "Federal funding was absent, it was not so much they didn't have a willing or local partner. The county officials didn't refuse to do it," Storey said. County commissioner Steve Radack said the idea never got beyond the conceptual stage. "...and of course that was presented to TxDOT and TxDOT said, 'You got the money, you have approval, 'cause we are moving forward to building this freeway? Trying to do it on an expedited pace. And so basically, no, we didn't have the money."



Storey is also severely critical of the Corps of Engineers decision to release huge amounts of water at the height of the storm, while Buffalo Bayou was still over capacity. "I think it was a cruel and unnecessary decision to inundate this area where people had been assured for 20 years they'd be protected by the Addicks and Barker dams and could still have been," Storey said. The Corps of Engineers said the releases were necessary to ease flooding in neighborhoods behind the reservoirs, and to prevent failure of the 70-year-old earthen dams. Radack said the Corps was confronted with a tough balancing act. "It's a massive challenge, I think they're handling it well, but what it boils down to, more reservoir capacity is needed whether in the existing ones or new ones," Radack said. Storey contends the dams should have been rebuilt and strengthened years before. And new development prohibited around the reservoirs where much of the flooding happened. He blames himself and every level of government. "I failed to get the focus on the problem. Whatever it would have cost," Storey said.

(The dam some people don't want.)

Jack Sanchez: Nevada Irrigation District's Centennial Dam will negatively impact Placer County

Other Voices, Jack Sanchez, September 8, 2017, theunion.com

Many Placer County residents will definitely be negatively impacted by Nevada Irrigation District's Centennial Dam. The reasons for not building Centennial Dam are endless. How is NID steamrolling Placer County with Centennial Dam? NID staff is delaying its board's directive to remove Hemphill Dam so endangered steelhead and four runs of Chinook salmon can move six miles up Auburn Ravine to the next NID Dam Gold Hill Dam to spawn and reproduce. Staff is

delaying removal by misusing a \$177,000 grant of taxpayer monies from CDFW to perform studies on Auburn River which has already been done; salmon are fish on the verge of extinction. Centennial Dam will force a new bridge to be built over Bear River to accommodate the new traffic flow, which will be seriously impacted in the Weimar and Placer Hills Road areas of Placer County because this corridor will become the route of choice for commuters between Grass Valley/Nevada City and Sacramento.

Funds must be raised to build the new bridge in Placer County to pay for a dam residents almost universally reject and have no say in its building. The only current recreational tourism attraction in the Colfax area of the river, Bear River Campground, will be inundated by the dam, enfeebling the area's economy. Many Placer residents affected by Centennial Dam cannot even vote on the NID Board elections; they must find other means to make their feeling know by letters to the editor, op-eds, and attending NID board meetings, which are held in the morning during the week so anyone who is employed cannot attend a meeting to voice opinions without taking off work. One alternative to Centennial Dam that would benefit Placer County would be the raising of any one of the four existing dams on Bear River to increase water storage. Another alternative that would benefit Placer County residents is the removal of sediment behind the four dams. Anyone who has studied the implications of building Centennial Dam is staggered by NID's lack of vision, funding, team building and humanity ... staggered. *Jack Sanchez lives in Auburn, CA.*

(As always, there's a dam removal story.)

ROARING RIVER DAM REMOVAL PROVES TO BE SUCCESSFUL

The low-head dam, located in Jackson County, was removed in August.

Author: WBIR, 09/08/17, wbir.com

The Roaring River dam's removal has proven to be successful in creating a better place for fish. The low-head dam, located in Jackson County, Tenn., was removed in August. It was roughly 220 feet across and 15 feet tall. It was the largest dam of its kind to ever be removed for river or stream restorative purposes in Tennessee, according to the Tennessee Wildlife Resources Agency. Jack Swearengen has over 30 years of fisheries work under his belt and is a lifelong resident of the county. He says he knows what the river was like before the low-head dam was built and he knows what the removal will mean for fish populations. The failing dam was eroding and posed a safety hazard. Instead of rebuilding, TWRA along with several partnering agencies removed the structure, knowing the outcome would prove ecologically beneficial.



Swearengen was 16-years-old when construction on the dam was completed in 1976. "We used to go look at the construction progress every day, just for something to do," he said. According to the TWRA, the Cordell Hull Dam was completed prior to the building of the Roaring River low head dam, which was considered an extension of this larger dam project. We know better now. Suckers, chubs and other rough fish are an integral part of an ecosystem. Young fish and fish eggs are a food source for many other species. Older fish are not only fun to catch; they can be a food source for humans too," Swearengen said. The dam's removal will allow fish to move upstream. "A fish naturally wants to move upstream. The dam stopped them and concentrated them in one area. Anglers liked this. However, it wasn't always the best for fish. Now, fish will naturally move to other pockets along the shore providing better opportunities over a longer stretch of water." Swearengen continued, "I am more than confident the number of fish will increase upstream from the dam sight."

(Hoover Dam facts.)

DAM BIG

Where is the Hoover Dam, how many turbines are there, how much concrete was used to build it and how many deaths were there?

Rising 726 feet, it was the world's tallest dam when built in the Great Depression to provide work, power and curb floods

By Patrick Knox, 11th September 2017, thesun.co.uk

Where is the Hoover Dam?

It is situated on the Nevada-Arizona border and is 30 miles southeast of Las Vegas.

The dam is ginormous, stretching 1,244 feet across the Black Canyon.



Why was it built?

It was constructed to control flooding along the Colorado River and provides water and hydroelectric power for California and the Southwest. It helped fuel the development of such major cities as Los Angeles, Las Vegas and Phoenix in the 1930s and 1940s. And it was credited with helping to jump-start America's economy after the Great Depression. The mammoth project was spearheaded by the President of the time, Herbert Hoover. For that reason the dam was named after him.

How many turbines are there?

There are 17 main turbines in the Hoover Power Plant. Nine are on the Arizona wing and eight are on the Nevada wing. They generate on average about 4 billion kilowatt-hours of hydroelectric power each year for Nevada, Arizona, and California. Today that serves 1.3 million people.



Swimmers are banned from the reservoir because they risk being sucked under by the turbines. But in September a stag-do Brit cheated death as the first person to swim across it. He only escaped being dragged under during his 30-minute swim because nine of its ten hydroelectric turbines were switched off. British lad Arron Hughes cheated death after swimming across the Hoover Dam reservoir

How much concrete was used to build it?

It is estimated some 4.3 million cubic yards of concrete were used to build the dam, its power plant and other features. This was said to be enough concrete to pave a 16-foot-wide, 8-inch-thick road from San Francisco to New York City, according to the Bureau of Reclamation. But contrary to popular myth, no one was buried alive in the dam's concrete as it was poured.

How many deaths were there?

Officially the project had 96 construction-related deaths. This resulted from falling rocks or accidents involving heavy equipment. But it is thought the actual death toll was way in excess of 100.

(Another dam bites the dust.)

Mill Pond Dam removal gets underway near Sullivan Lake

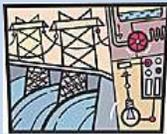
By Rich Landers, spokesman.com, Sept 12, 2017

DAMS -- A \$16 million project to remove century-old Mill Pond Dam and restore Sullivan Creek downstream from Sullivan Lake is slowly getting underway this month. Seattle City Light



has been preparing for the removal of the small dam in Pend Oreille County, WA for years. The dam no longer produces power and is being removed to improve stream processes, fish habitat and fish passage on Sullivan Creek. Additional benefits include improved safety and recreational amenities. The 64-acre pond behind the dam has been the site of primitive campground and hiking trails. The Mill Pond Historic Site to illustrate the history of the dam from which a large wooden flume once transported water 3.5 miles to a cement plant at Metaline Falls.

Removal of the dam -- 134 feet long and about 55 feet high -- should be completed in November. The campground and trails will be closed likely through 2018 during the stream restoration work. "The Mill Pond Dam removal is one of several habitat restoration projects City Light is performing in the Sullivan Creek watershed," said John Armstrong, Seattle City Light Boundary Licensing Manager. "Collectively these projects will help restore native salmonids in the Sullivan Creek and the Boundary reservoir."



Hydro:

(A classic.)

Haywood County's Hidden Historical Gem, The Francis Grist Mill

By Brad Nottingham, 9/2/17, themountaineer.com

Francis Mill, NC is an 'overshot grist mill' — the last one functioning of the original dozen or so water-powered mills that were humming away in Haywood County's coves by the late 1800s. Grist mills once used the region's ample tumbling streams to process (mill) corn and wheat grain on a daily basis. The original structure of the mill was built from wood located on the property, and in later years, from all over the county, such as Bald Creek. The reason the Francis mill has out-survived the others is partly due to the original timber frame construction. The mill was built by William Cotton Francis, and it carries on, 130 years later. Restoration of The Francis mill was begun



over a decade ago under the direction of William Francis descendants. They had the drive and foresight to constantly coordinate the many restoration stages with help from the Heritage Conservation Network, and the Bethel Rural Community Organization. The mill is now a Haywood County star, having taken hundreds of hours of cumulative volunteer labor so far to complete. Volunteers have come from as far away as Texas and even Switzerland to add their efforts and skills.

Tanna Timbes is one of the founding members of the non-profit Francis Mill Preservation Society, initiated in 2003. The lengthy and elaborate restoration, which Timbes has catalogued carefully in notes, articles and photos, was funded in part by a grant from the Blue Ridge National Heritage Area. All techniques were done as much as possible using period-correct tools and fastener techniques, resulting in the mill rightfully being listed on the National Register of Historic Places. Even though many of the mill's key mechanical components survived and are both visible and functional, the elevated flume as well as the structure's east side needed reconstruction. The flume is constructed of Locust logs from Bald Creek, and the mill employs a one-thousand pound hemlock beam for stability. The original mortise and tenon construction, both simple and strong, matches the era, and knee posts were built by hand, under the guidance of park service preservationists.

The last time the original gear-driven wood spoked wheel turned was back in our country's bicentennial year of 1976. The second wheel to be installed was a Fitz wheel with wood spokes and metal buckets. **The mill is now on its third wheel, a steel one with metal rim and assemblies created and powder-coated in Statesville.** By September 22, 2007, "the wheel was turning again!" This was a landmark date, as the wheel's huge diameter and 6,000 pound mass made the labor of its replacement a herculean effort in Francis Cove that year. Nobody was injured during the entire restoration process, but you can bet there were plenty of sore muscles and strained backs over the last decade. Effort was primarily voluntary service from people near and far, who heard the calling and wanted to give of their energy and equipment. For several years, people of all ages came to work on the mill for two weeks each summer. Thus, under the direction of the Francis Mill Preservation Society, the kinetics of hydropower are turning a massive millstone once again.

The original valued gear set is wooden. By being made of wood, these gear teeth will give the necessary play and shear-off protection to guard against damage to the millstone should something go awry. There is a home-built hopper, and a camshaft driven shaker/sifter apparatus that can separate the cornmeal from the grits and cracked corn or bran. In a demonstration, you can see it perform. **There are several kinds of grinders that can be substituted for different mill applications.** Wide leather drive belts and pulleys that are connected to other 130-year old genuine functioning parts complete the well-preserved mechanisms. If a belt ever needs replacement or major repair, a business in Knoxville is the source.

And the restoration efforts continue. As recently as 2014, a large crew teamed up to replace the old washed out footbridge that led across the stream to the mill site. No matter what repairs and maintenance are called for, the work gets done. It is all a labor of love in the classic sense. **Francis Mill is now an icon and a celebration spot to draw focus to the county's early innovative years of agribusiness utilizing the fast-running streams, a rare and impressive community gift, born of continuous effort and donations.** A number of school tours have woven their way inside amidst the mill workings. Several couples have enjoyed marriage ceremonies at this beautiful setting, creating an unforgettable backdrop that can be matched with custom personal touches. On May 20, the mill hosted a landmark 130th anniversary gathering, called "5th Annual Cars & Cornmeal." It was a warm and inviting celebration at the mill, with vendors, classic cars, prizes and an ongoing demo of the mill functions. **Positioned on the mill grounds were some rare old cars: A Rolls Royce Silver Cloud and a luxury 1953 Studebaker Skyliner.** A great contrast to those cars were a trio of muscular mid-1960s Ford Fairlanes featuring optional V8 engines built in the decade before insurance companies got wise to the power of these cars, and then began to reflect that in your rates! In a year or two, you just might just see something like a classic 1953 Chevrolet pick-up parked near the mill.

Glory days

What was it like hanging around a grist mill in our agricultural economy during its glory years? Over the last 15 years, **Timbes has curated the history, but if only those archive photos could speak.** Just like the social conversations we might share today in a line at our local post office, you can imagine the subjects brought up while awaiting the mill to process your grain at the Francis Mill, circa 1901. We can begin to imagine the rich oral history that circled around the Mill concerning community and the lives of its normally isolated farmers. That would include news of accidents, or the passing of residents young or old, the births of kin, the weddings, illnesses, flash floods, hot dry periods, fires, all amidst the general challenges of winnowing and threshing from year-to-year.

Tennessee-born William Cotton Francis, an ambitious man seeking his fortune in our county, fell in love with Mary Caroline "Polly" Almon at age 22, daughter of Gideon Almon, a wealthy Haywood County pioneer settler. Gideon gave to the couple one square mile of land in the upper reaches of Raccoon Creek, which was the beginning of the Francis Cove Community. **William was a sharp and quick learner, (today's multi-tasker?) who had excelled at many occupations of the day including repairing wagon wheels, blacksmithing, furniture making and carpentry.**

Beyond being known as a “mechanical fix-it man” of sorts, he learned the ways of farming by rebuilding, repairing and operating water-powered mills. He also dabbled in producing silk, followed by a more substantial business of beekeeping and selling different varieties of honey. A most unexpected part of the story was that William, after fathering five children with Polly, and a life of producing income from multiple services, had only just completed his Francis Grist Mill at age 76. But in a way, it makes sense. By that age, he had accumulated and refined all of his design, engineering and mechanical skills, and used arithmetic, geometry and blacksmithing skills to make components, and then rebuild parts to keep the mill a runnin’ and a grindin’.

With his years of milling and processing knowledge, along with the long-term respect of local farmers, William was able to direct the management of the Francis Mill winningly as a millwright. Over the years, he became an expert analyst of the density and content of each batch of grain, accurately monitoring the exact gap between the grinding stones for each process needed. Since corn has to remain in the field until November or early December, it was always “crunch time” for William’s operation in the middle of winter. For his work, a miller typically takes around 10 percent of the farmer’s grain for payment for his services. In the end, Mr. Francis probably felt comfortable that he had cared for his family for all these formative years, and toward his later life, would also leave them a durable income-generating mill plus the operating knowledge. As a senior citizen, William had over six more solid years as a miller and millwright at his own mill, maintaining and repairing as necessary, and probably demonstrating all these skills in the presence of his children, before he passed away at 84. His son, Monteville Francis, already 65, who had helped his father with the mill’s construction, inherited the mill, having learned first-hand most of the skills of his father, including carpentry skills; even beekeeping!

By 1914, Monteville saw the need to upgrade the waterwheel from poplar to a Fitz steel wheel with wooden spokes and metal buckets, in order to continue effectively processing local Haywood County corn and wheat. When Monteville passed away in 1924, his son, Dewey Francis (Tanna’s grandfather) next took ownership of the mill. During America’s march toward industrialization, the mill became more secondary. Dewey carried on the tradition of many trades, and before WW II, was maintaining telephone lines from Waynesville to Bethel. After returning from the Virginia shipyards during the war, Dewey restarted the mill again. The growing of wheat in Haywood County continued consistently right up until the period of the late 1950s and early 1960s. Dewey ran that mill right up until 1976, the year of his passing, although the mill had been in the legal ownership of his daughter Hester Ann Boone since 1965. In 1989, the mill was bequeathed from Hester to Timbes.

The mill is clearly visible from U.S. 276 South, just 2.5 miles from downtown Waynesville. From the dawn of the Francis Mill Preservation Society, we’ve now witnessed the completed solid beauty that is the Francis Mill today. I’ve learned that over the last 14 years there was an amazing alchemy of skills, services, and work camaraderie that blended together multiple times during the various stages and challenges of restoration. It truly all was an amazing adventure of preservation. What was long ago called ‘The Francis Old Mill’ just will not let its soul fade away as the generations move forward. Become a member or friend by starting with the Francis Mill Preservation Society website at www.francis-mill.org. Keep abreast of the various fun activities at the mill site via the website. One great way to get involved is to volunteer to help supervise and guide visiting school groups. The next event, ‘Music @ the Mill’ is September 9, from 10 to 4 p.m. (The very first music at the mill event was held in 2006, and featured members of the original group that soon afterwards formed the well loved “Balsam Range” musicians!) This year, you can help celebrate the 130th birthday of the mill by attending a fusion of barbecue and bluegrass. On the tree-sheltered deck to the right of the mill, your ears will be treated to the acoustic music of three skilled bands: The Hill Country Band, or Dirty Bathtub, and Possum on a Whale. In addition to getting your toes tappin’ you can transport yourself back a hundred years with a milling demonstration. There will be local crafters, and Mama Moody’s Fried Pies, just for starters. Things will be evolving as more details begin to gel. Advance tickets are \$8, \$12 at the gate.

(Does this make sense?)

Santee Cooper walking away from Greenwood County hydro power lease

By ADAM BENSON, indexjournal.com, 9/5/17

After pulling the plug on a planned nuclear generation facility in July, Santee Cooper is now ending a 10-year-old lease agreement with Greenwood County, SC to operate its Buzzard Roost hydroelectric plant. On Tuesday, county leaders said the Moncks Corner-based utility notified them two weeks ago that it would not renew the contract when it lapses in March 2020, leaving a possible \$600,000 budgetary shortfall if a new partner is not found. County Manager Toby Chappell and County Council Chairman Steve Brown said they were surprised by the news and were not provided with an explanation by the company for its Aug. 25 decision. "We have a five-year contract and their notification was made timely," Chappell said. In 2007, Santee Cooper got federal approval to operate the Buzzard Roost facility on Lake Greenwood. The 15-megawatt site is capable of producing enough energy to power 7,000 homes a year. In exchange for the lease, Santee Cooper paid the county \$600,000 a year.



Brown said losing Santee Cooper means the council will have "a lot of considerations to make." "It is very fresh to us, it is within two weeks and we are working diligently to find out what our options are," he said. Santee Cooper, the state's largest energy supplier, partnered with SCANA in 2008 to construct a pair of nuclear reactors at the V.C. Summer generating station in Jenkinsville. Both companies have been under scrutiny by lawmakers since they announced plans to scuttle the \$20 billion venture. A pair of bipartisan legislative committees were formed days after the project was abandoned. News of Santee Cooper's non-renewal with Greenwood County came the same day the utility's CEO, Lonnie Carter, announced his retirement, but will earn \$800,000 a year through state and company retirement plans. "We assume that a lot of this is a possible reaction to what has happened down at other sites in Columbia. We didn't fall off the truck yesterday and we know we have a lot of work ahead of us," Brown said. With a three-year window, Brown said the county wants to be diligent in exploring all options. "All we're doing now is trying to look at what our options are, what information we need," Brown said. "It certainly was a surprise. A big surprise."

[\(More pumped storage is better.\)](#)

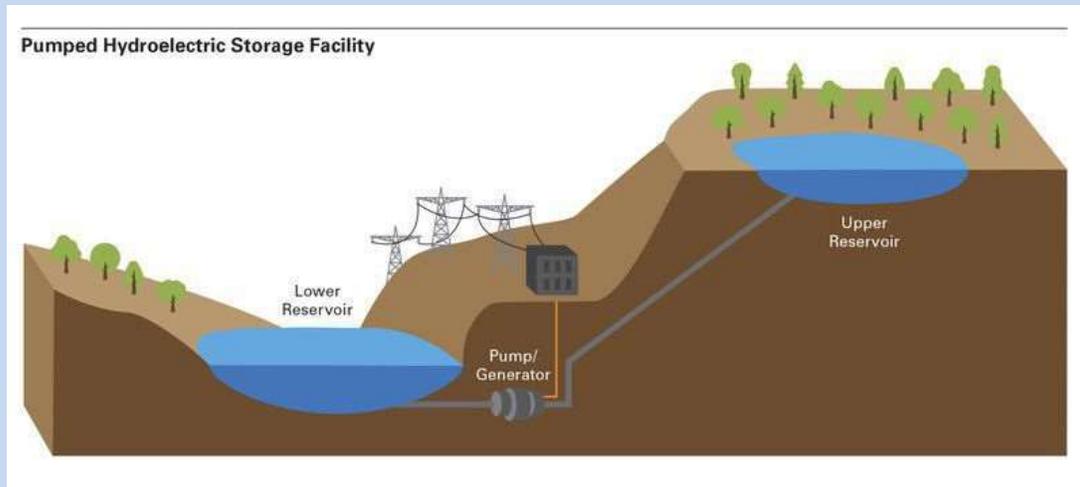
Dominion Energy Announces Plans to Pursue New Pumped Storage Hydroelectric Facility Virginia

energyonline.com

LCG, September 8, 2017--Dominion Energy Virginia announced yesterday that it will proceed with its plan to study the feasibility of a new pumped storage hydroelectric facility in the coalfield region of Southwest Virginia by conducting in-depth studies of two potential sites: a 4,100-acre site in Tazewell County and an abandoned mine in Wise County. The preliminary estimate for a single facility could be in the range of \$2 billion. Dominion Energy filed a preliminary permit with the Federal Energy Regulatory Commission (FERC) for the Tazewell location on Wednesday and has contracted with Virginia Tech to conduct the study of the former Bullitt Mine near Appalachia, Virginia. Dominion Energy's vice president-Generation Construction stated, "We are on parallel paths with performing studies on these two sites. The FERC application for the Tazewell site will allow us to proceed with the rigorous environmental, geological, archeological and technical studies, while further assessing the economics of the project. In addition, the detailed study on the mine site allows us to explore the feasibility of abandoned mine cavities for pumped hydroelectric storage. We expect to make a decision on which site to advance by mid-2018."

Conceptually, a pumped storage hydroelectric facility works by storing water in an upper reservoir. When demand for electricity is high and electricity prices rise, water is released to flow down to a lower reservoir water through turbines to produce electricity. When demand for electricity is low and prices are low, electricity is used to reverse the turbines and pump the water back from the lower reservoir to the upper reservoir, where the water is stored to be used again when needed. Pumped storage facilities typically act as a utility-scale energy storage system used daily. Water flows down to generate power during the peak demand hours of the day, and the water is pumped back up to the reservoir during the night to store energy for the next day.

Dominion Energy owns about 2,600 acres of the Tazewell site near East River Mountain, which it



purchased in 2009 when it was pursuing another electric generation project. Studies are underway by Virginia Tech that are expected to determine if the site is viable to proceed with a FERC license application later in 2018. With regards to the Bullitt Mine site, the Virginia Department of Mines, Minerals and Energy previously conducted research on the feasibility of using abandoned mines for pumped storage and looked at numerous sites in the coalfield region. The research identified the former Bullitt Mine as one of its top candidates. The mine was closed in 1997 and is currently flooded. A pumped storage facility could conceivably use the mine cavity as a lower reservoir. Dominion Energy elected to delay filing a preliminary permit application with FERC for the Bullitt Mine site pending the results of an on-going study. If the mine is selected for a pumped storage facility, Dominion Energy would file with FERC next year. Dominion Energy stated that it may also pursue other potential sites as the process continues.



Water:

(What if, It will.)

Alabama Voices: What if Harvey happened here?

By Cindy Lowry, Alabama Voices Published, Sept. 1, 2017 | montgomeryadvertiser.com

As I watched the devastating floods in Texas this week and saw desperate people standing in water, swimming to their rescuers or carrying their children through the water to get them to a safe place, I could not help but wonder what would happen if this happened in Alabama?



We are certainly not strangers to flooding or hurricanes. Most recently, in December 2015, our state experienced some of the deadliest floods in history and throughout this summer we have seen record rainfalls causing flash floods across the state. These floods are nothing compared to what is happening in Texas, but as a state that lies in a hurricane prone area, I want to know what we are doing to prepare. As someone who works in the area of protecting water, I think not only about the amount of water inundating the state during floods, but what might be in that water. All kinds of pollutants, from raw sewage to the chemicals that are on our roads and yards, end up in water all around us when floods happen. Then there are the toxic pollutants we cannot always see.

[\(This is bazaar.\)](#)

We May Soon Charge Devices by Harnessing Electricity from Our Bloodstream

futurism.com, 9/13/17

In Brief

Researchers from Fudan University in China have developed a way to harness electricity from your bloodstream. The process involves nanoscale carbon fibers and could lead to self-powered medical devices.

Inner Space Hydropower

It's a truly modern experience: losing battery power on your mobile device and searching desperately for a source of electricity. But what if that source was flowing through your veins? A team of researchers are looking to harness that power from within our own bodies, using power generators inside the bloodstream. The team from Fudan University in China has developed a lightweight power generator that can convert flowing blood in vessels into power. This is made possible by a fiber made of carbon nanotubes, which are electroactive. In tests, this thread of fibers, called a "fiber-shaped fluidic nanogenerator" (FFNG), is attached to electrodes and immersed in a solution to imitate the bloodstream. According to the researchers, "The electricity was derived from the relative movement between the FFNG and the solution." The researchers were inspired by the concept behind hydropower, which uses flowing water or steam to turn a turbine and generate electricity. Like hydropower, blood-based electricity would be a source of renewable electricity not dependent on the weather, as solar and wind energy are.

Blood Power

The researchers stated that their method was able to harness twenty percent of the energy generated from a test with a saline solution, a far more efficient result than previous models. The mechanical properties of the material will potentially allow it to have some interesting applications. For one, this could turn into an easy way to generate power for internal medical devices, like pacemakers. Additionally, according to the press release, "Other advantages are elasticity, tunability, lightweight, and one-dimensionality," which could allow the material to be woven into fabrics, allowing you to power wearable devices using yourself as an energy source. The device also has the upside of being stationary; proposed energy generators that floated in the blood raised concerns that they could lead to blood clots. It's understandable to question how much power could feasibly be generated by this technology when working with materials at this scale; so far, the method has only been successfully



tested in a living body by using frog's nerves. There will also have to be much more testing and a battery of regulatory approval before we could see this technology in use with humans. Still, even the medical applications alone leave plenty to be excited about. This single innovation could majorly revolutionize medicine and, more broadly, the way we generate and utilize energy.

Environment

(Troublesome little buggers.)

Zebra mussels causing problems at Gavins Point Dam

By NICK HYTREK, siouxcityjournal.com, 9/9/17

YANKTON, S.D. | An infestation of zebra mussels at Lewis and Clark Lake is causing maintenance headaches at Gavins Point Dam. The invasive species, first found in Lewis and Clark Lake behind the dam in fall 2014, attaches to grates over the two water intakes for the system that cools the dam's power-generating turbines. Those grates frequently become covered and clogged with mussels, and maintenance workers must now clean the 24 coolers every year, rather than the previous three-year cycle in which eight coolers were cleaned each year. The increased cleaning has led to a significant increase in maintenance costs, power plant superintendent Mike Welch said. "We have zebra mussels 3-4 inches deep on the intake grates," he said. The turbines themselves are not affected by the mussels, Welch said, but they must be shut down periodically when the coolers must be cleaned, cutting down on hydroelectric power production.



The pesky zebra mussels, which are about the size of a thumbnail, were found this summer in Lake Yankton, which sits north of the Missouri River below the dam. They've also been found in McCook Lake near North Sioux City and in the Iowa Great Lakes region at Okoboji. The zebra mussel, often transported on boats and in water that has not been drained from boats, competes with native fish and mussels, clogs pipes, cuts swimmers' feet and will pile up on rocks, docks, swimming platforms and anything else in the water. Karla Zeutenhorst, a U.S. Army Corps of Engineers park ranger at Gavins Point, said the zebra mussel was first spotted on the dam's spillway gates. Mussels also have been found inside and outside the power plant. The mussels have not caused any damage to the plant, she said. The mussel spreads rapidly, with a female capable of laying up to 1 million eggs a year, so they can multiply quickly. Zeutenhorst said the corps is evaluating potential options to combat the zebra mussel at the power plant. One possible solution is placing an ultraviolet lighting system where the raw water enters the power plant. The ultraviolet light is believed to kill zebra mussel larvae, though Welch said results at other dams with similar problems haven't been conclusive. Another option is replacing the two iron water intakes with copper, which adult zebra mussels won't attach to. Again, that's not a guaranteed fix. Welch said mussels have been found attached to copper pipes inside the coolers. For now, workers will continue the costly cleaning of mussels from the intake grates and coolers. Welch said boaters need to follow recommendations of various state natural resources agencies to rinse boats and drain their wet wells so that the pest isn't transported to other bodies of water not yet infested.

(Rocky Barker has a thing about these fish that the Idaho Statesman likes.)

Remove 4 dams, leave these fish alone, and they may be able to replenish themselves

By Rocky Barker, idahostatesman.com, September 10, 2017

STANLEY, Idaho - It's in places like Marsh Creek where the hope rests for spring chinook and other Northwest salmon. No hatchery-born fish have ever sullied the genetic stock of the chinook that run in the clean, clear waters of the 15-foot-wide tributary of the Middle Fork of the Salmon River, 10 miles west of Stanley and 870 miles from the ocean. The DNA of these salmon carries the imprint of 10,000 years of adapting to this watershed. Their range of traits and diversity allows them to survive incredible odds and obstacles as they migrate downstream, then return from the ocean to spawn in their native waters. Natural selection has equipped these fish to face the longest, highest migration of any salmon in the world.

These native fish in Central Idaho's pristine habitat are in the worst shape since 1995, when no chinook returned amid some of the worst recorded Pacific Ocean conditions for salmon, and 2015, when low river flows devastated their numbers. But the habitat of Marsh Creek is, if anything, better than it was in the 1960s, when nearly 2,000 wild fish returned to spawn annually. That's why the wide majority of fisheries biologists believe these salmon can rebound quickly if four dams on the Snake River — half of the eight that stand between Idaho and the Pacific — are removed. Their evidence: When Marsh Creek's chinook had ideal ocean conditions and high river flows that helped them cross the dams safely, they returned at levels like before the dams were built. When those conditions changed, the chinook returned to their current track to extinction.

Diverse life cycle

The Marsh Creek salmon quit eating when they begin running up the Columbia in March; only the strongest make the trip back to the very riffle where they emerged as fry two, three, four and even five years before. The female salmon spawn by beating their tails into the gravel to make a redd, or nest, for their eggs. Most newborn fish stay in the creek for a year before they quit swimming against the flow and allow it to carry them downstream during the spring runoff. Some do migrate early down into the Middle Fork and even the main Salmon River, giving them a head start and another survival advantage. Some stay in Marsh Creek for two years. By comparison, hatchery salmon are all released at once and have little of the diversity that natural selection provides.

The Middle Fork of the Salmon River has long been identified as a center of salmon production in the Columbia watershed. In the 1940s, when only one dam stood between the Pacific and Idaho, biologists counted 23,000 redds there. This year Idaho Department of Fish and Game biologists and volunteers counted only 52 redds — better than 1995, but far below historic and sustainable levels. Since 1995, about half of salmon leaving the Snake River Basin died as they migrated as smolts through the eight dams, according to the National Oceanic and Atmospheric Administration Fisheries Service. That has improved in recent years to about 40 percent due to improvements made at the dams.

- 5,000 eggs from each female
- 559 parr or small fish
- 40 to 50% survive through eight dams
- 0.2 to 11.6% survive the Pacific
- 63 to 70% survive upriver trip to Marsh
- 0.12 to 5.3 returning recruits per spawner

Variations in how long the chinook stay in Marsh Creek and roam the ocean give the population a buffer to survive back-to-back bad years. Some fish may leave Marsh Creek after one year, then return from the Pacific after two. They share the river with fish with the same life history, but that emerged from the gravel a year later, or chinook that spend two years in Marsh Creek and three in the ocean. Since a Marsh Creek spring chinook can lay 5,000 eggs, they can quickly rebound if conditions are right. These salmon have a high risk of going extinct if conditions downstream from the Middle Fork — the dams, predators like sea lions, the poor ocean conditions and climate change — don't improve, said Russ Thurow, a U.S. Forest Service Rocky Mountain Research Station scientist. But, he said, when river flows are high and ocean conditions are ideal — cool, nutrient-rich waters that provide salmon with abundant food and fewer predators — the salmon in Marsh Creek and throughout the Middle Fork demonstrate what their wild heritage can produce.

The Middle Fork of the Salmon possesses immense spawning areas for spring chinook which to my knowledge are not surpassed or even reached in quantity or quality any place else in the Columbia River drainage. William Chapman, federal fisheries biologist, in 1940

From 1996 to 2000, the Middle Fork chinook had these ideal conditions, and they responded. From 2001 to 2003, the Middle Fork redd count exceeded 1,600 annually and reached more than 2,200 at its peak. Extreme low river flows from 2001 on and less favorable conditions in the Pacific sent the trend downward, to where it is today.

The dam argument

That response shows what could happen if the four dams on the Snake River are removed, said Rick Williams, an independent fisheries biologist from Meridian. The American Fisheries Society's Western Division, the Nez Perce and biologists elsewhere make the same argument about the entire Snake Basin. Even if dam managers simply allow as much water as possible to spill over the dams rather than pass through hydroelectric turbines, these biologists believe Snake River Basin salmon returns will grow by 100 to 300 percent. The U.S. Army Corps of Engineers operates the eight Snake and Columbia dams. It has developed spillway devices that make salmon migration downstream easier, without spilling as much water away from hydroelectric turbines that produce power. Its experts believe these have made a major improvement in fish survival, and doubt that dramatic improvements are possible, especially with ocean conditions turning poor. "Personally, I don't see how the numbers add up," said Dan Feil, a fisheries biologist with the Army Corps. "I'm a skeptic."

Marsh Creek is not Williams' only example. When the devices were added and other changes were made in the Columbia dams over the last 15 years, sockeye salmon upstream in the Okanogon River in north-central Washington and British Columbia rebounded to runs of more than 600,000 fish at Bonneville Dam. More than 200,000 were counted in the river and on Osoyoos Lake in 2014. He also points to the high annual returns of wild fall chinook that spawn in the last free-flowing stretch of the Columbia River known as the Hanford Reach. Those wild salmon are responsible for the river's best fishery.

Other examples: Alaska's Bristol Bay, a huge natural fishery; and Russia's Kamchatka Peninsula, a California-sized region that was kept wild by the Cold War until the early 1990s. "We have so few examples of fish demonstrating their potential and fecundity and diversity in any kind of pristine habitats that people don't know what they can do," Williams said. "We've lost our faith in the fish and in nature to take care of themselves. "If we could start thinking about the concept of salmon and steelhead conservation areas, you don't have to do anything else but make sure you don't screw it up."

(Tracking fish.)

Beep. Beep. Beep. Knowledge helps survival of Columbia, Snake salmon

By Annette Cary, tricityherald.com, September 10, 2017

Tens of thousands of fish have migrated down the Columbia and Snake rivers over the last decade emitting a high-pitched beep every few seconds. Tiny acoustic tags developed by Pacific Northwest National Laboratory in Richland have become the go-to technology of the Army Corps of Engineers as it manages its eight dams on the lower Columbia and Snake rivers. The data collected has provided insight into why some fish survive the migration and others do not.

Each tag emits a tone assigned to a specific fish. The sound is picked up by receivers stationed wherever biologists want to know more about fish behavior. They might be placed at dams or along river banks or hung from buoys or carried in boats. "You get three-dimensional information about the fish so you can get very detailed fish swimming behavior," said PNNL chief scientist Zhiqun "Daniel" Deng. "With this kind of detailed fish behavior information, you can make management decisions of how you optimize operations of the dam for fish survival and, of course,

without loss of power generation.” Such detailed information was not available to the Corps in 2001, when a federal court biological opinion required an estimate of the survival of juvenile salmon downriver from the Bonneville Dam, the last Columbia River dam before the fish reach the Pacific Ocean, said Brad Eppard, a supervisory fishery biologist in the Corps Portland District. Acoustic tag technology then on the market was too large for juvenile salmon. PNNL researchers set to work creating a smaller acoustic tag — weighing less than half a gram and the size of a couple grains of rice — and have been improving the tags and developing more ways to use them since then. Funding has come from both the Corps and Department of Energy.

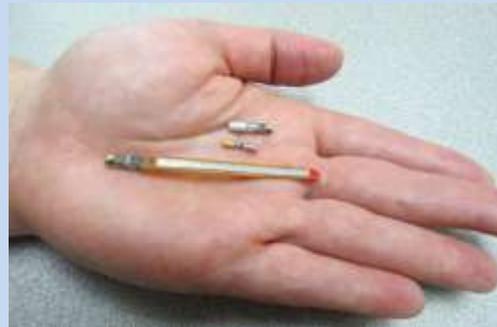
Acoustic fish tags developed at Pacific Northwest National Laboratory, from top to bottom, include an injectable acoustic tag, an eel and lamprey tag, and a self-powered acoustic tag. Smaller tags are needed for smaller fish, but smaller size means less power. The results have been used to learn about fish behavior and improve conditions for fish heading to both the Atlantic and Pacific oceans, and to improve fish survival at dams in Australia, Germany and Brazil. The initial use of the tags to estimate the survival of juvenile salmon downstream of the Bonneville Dam also provided new information about salmon behavior. Biologists had believed that young salmon take a right at the mouth of the Columbia River and immediately head north toward Canada. Instead, PNNL ecologists found that, especially in the early spring, the fish scatter in all directions as they reach the ocean. Its useful information, since the key weeks after salmon enter the ocean seem to set the tone for the strength of the annual class, including the success of the subsequent runs upriver to start the next generation of salmon. Information on fish behavior in the estuary can be used for decisions on when to release juvenile fish from hatcheries or to adjust plans for barging salmon downstream past dams based on optimal ocean conditions.

Another study using the tags collected data that helped the Corps decide the best place to install a spillway weir at John Day Dam on the Columbia River. The weir acts as a giant fish slide, allowing the fish to pass the dam near the surface of the water, where they prefer to swim. Data collected at the dam also provided more information on the number of fish that passed the dam only to provide a feast for gulls below it. Wires hung with fluttering ribbons were strung across the river downstream to haze away the gulls.

Not all the studies have involved juvenile salmon. The Corps has used acoustic tags to learn about the migration and survival of kelts, or steelhead that may spawn and then migrate one or two more times to the ocean before dying. Tagged kelts were monitored from Lower Granite Dam on the Snake River to McNary Dam on the Columbia River near Umatilla. To date, the Corps has been using acoustic tags that must be surgically implanted into fish in a process that requires fish to be anesthetized and handled for two to three minutes. A smaller acoustic tag developed by PNNL is “outpatient,” Deng said. It can be injected into the fish, requiring about 20 seconds of handling. “Fish tagged with this new tag, they have much higher survival rates,” he said. The result is a truer picture of fish survival, and the Corps plans to start using the injectable tags next year. They weigh less than .22 grams and are about six-tenths of an inch long. We used to joke about this. Our ideal scenario is to weigh nothing and last forever.

Researchers have since designed an even smaller tag, this one sized to be used in juvenile lamprey in the West or American eel in the East. The tag needed to be small enough to fit into a fish about the size and shape of a writing pen. Much of the research conducted using the tags in the West have been for salmon listed under the Endangered

Species Act. Even though lamprey are not a listed species, they are culturally important to the tribes. Their migratory behavior does not completely overlap with salmon, and there is opportunity to manage Northwest dams outside the listed salmon migration season to benefit lamprey, Deng said. PNNL plans a study — paid for by the Corps and in partnership with the tribes — in late



winter that will rely on the new tags to increase understanding of the migrating behavior of juvenile lamprey. A pilot study was conducted this year on the Columbia between the McNary and John Day dams to prove the feasibility of the technology. **The tags weigh just .08 grams and are just under a half inch long.** They have considerably less power than the injectable acoustic tags that can ping every three seconds for four months before losing battery power. **If the pings are extended to every five seconds, the smaller tags last for 20 to 30 days, just long enough for a lamprey to travel from the Snake River to the Pacific, Deng said.** The size of the tags is keyed to the size of the batteries they carry.

“Once you go smaller you sacrifice tech life,” Deng said. “We used to joke about this. Our ideal scenario is to weigh nothing and last forever.” PNNL researchers do have an idea on how to make the batteries last forever. They have developed a tag powered by the movement of the fish. **Along with the transmitter, the tag includes a strip of what’s called piezoelectric composite, a self-charging material.** Strips 3 to 4 inches long leave the tags much larger than those used in other juvenile fish, but that’s not a problem for studying large fish. Initially tags were inserted in a rainbow trout and a white sturgeon. As they swam around tanks at PNNL’s Aquatic Research Laboratory in Richland, microphones picked up the tell-tale beeps, and the tags did not appear to hinder the ability of either fish to swim. **The technology will be tested for the first time outside the lab in a pilot study using white sturgeon in either the Snake or Columbia rivers this year.** “Sturgeon are ancient fish and have been on the planet for millions of years,” Deng said. “This tag can help us mitigate the impacts of human activities, and help these fish survive many more years.”



Other Stuff:

(A dream that might come true.)

The world’s future energy system: cleaner, more efficient and less demand

By Bjørn Kj. Haugland, Chief Sustainability Officer, DNV GL, 09/11/2017, huffingtonpost.com

Global energy demand will plateau from 2030, oil demand will flatten from 2020 and continue to decline significantly thereafter, the shift to renewable energy will be quicker and more massive than most people realize, and yet the energy transition will not be difficult to finance.

These are some of the findings of DNV GL’s Energy Transition Outlook, a brand new study that charts the world’s energy future to the middle of the century.

- Energy efficiency will improve faster than global economic growth due to the rapid electrification of the world’s energy system, leading to a plateau in energy demand from 2030.
- Renewable energy sources will continue to rise, making up nearly half of global energy supply by 2050, cutting energy-related CO2 emissions in half by that time.
- Gas supply will peak in 2035, coal use has already peaked.
- Oil supply will flatten out in 2020 and then fall significantly to be surpassed by gas in 2034.
- The world will manage the shift to a renewable future without increasing overall annual energy expenditure, meaning that the future energy system will require a smaller share of GDP.
- Electricity consumption increases by 140% by 2050, becoming the largest energy carrier. Other energy carriers, such as coal and oil, experience significant reductions or only slight increases in consumption.
- 85% of global electricity production in 2050 comes from renewable sources – **Solar PV will provide around a third of the world’s electricity by 2050, followed by onshore wind, hydropower and offshore wind, in that order.**

Historically, energy demand and CO₂ emissions have moved broadly in line with GDP and population growth, but that relationship will unravel. Electrification, particularly with the uptake of renewables, will change the way in which energy is supplied and consumed. While the global economy and world population are set to grow modestly, energy demand will flatten out and CO₂ emissions will drop sharply.

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DNV GL

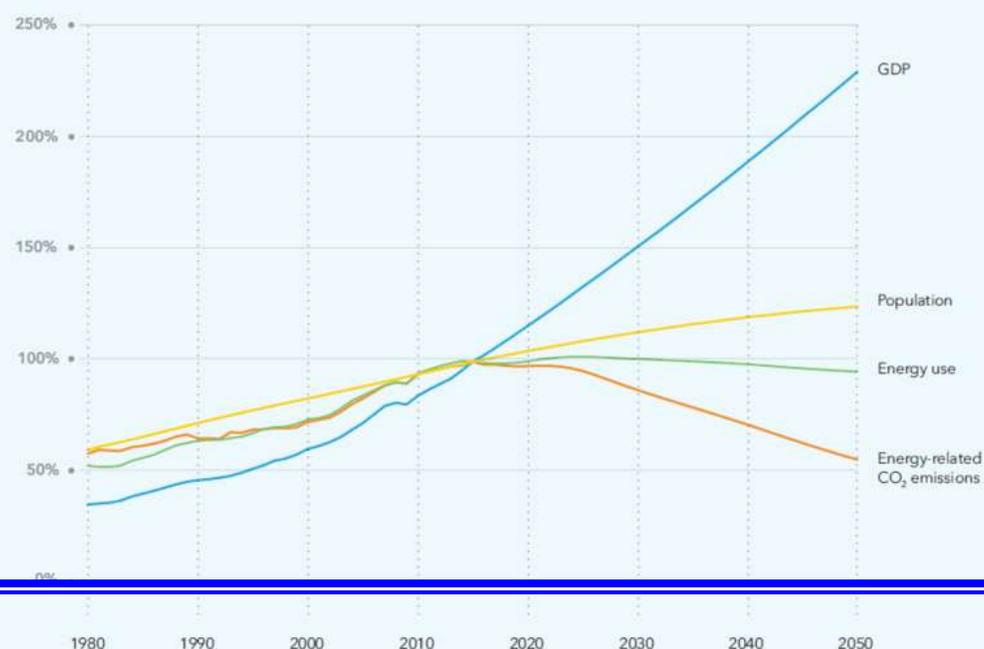
Not only will energy decouple from carbon in the coming decades, but, in our view, global energy use will peak and slowly decline in the context of continued (but slowing) population and economic growth. This is linked to accelerating energy efficiency on a global scale, driven in the main by the growing share of electricity in the energy mix, with losses reduced through the steady uptake of efficient renewable sources. Learn more at eto.dnvgl.com. We forecast that renewables and fossil fuels will have an almost equal share of the energy mix by 2050. Wind power and solar photovoltaics (PV) will drive the continued expansion of renewable energy, whilst gas is on course to surpass oil in 2034 as the single biggest energy source. Oil is losing ground as a source of heat and power, and is set to flatten from 2020 and fall significantly from that point as the penetration of electric vehicles gains momentum.

The global energy transition will occur without a significant increase in overall annual energy expenditure and on a straight comparison, the world's energy will cost less than 3% of global GDP compared to the current level of 5%. Solar PV and wind costs are set to decrease by 18% and 16% respectively per the doubling of capacity. Although the oil and gas industry has responded impressively to the present lower price environment, renewables will improve cost performance at a much faster rate, benefiting from the 'learning curve' effect. Electric vehicles will achieve cost parity with internal combustion vehicles in 2022 and, by 2033, half of new light vehicle sales globally will be electric. Despite greater efficiency and reduced reliance on fossil fuels, the Energy Transition Outlook indicates that the planet is set to warm by 2.5°C, failing to achieve the 2015 Paris Agreement target.

Even with energy demand flattening and emissions halving, our model still points to a significant overshoot of the 2°C carbon budget. This should be a wake-up call to governments and decision-makers within the energy industry. The industry has taken bold steps before, but now needs to take even bigger strides. To achieve the target of a low-carbon world, there is no single solution. Instead, multiple achievable actions must be taken both locally and globally, involving collaboration within the energy sector and across industries.

FIGURE 1. THE DECOUPLING OF ENERGY FROM KEY PARAMETERS

Units: Percentage of 2015 level



Action 1: Act on Paris agreement and the UN Sustainable Development Goals

- Nations, cities and companies must articulate how they respond to the main global challenges and explore the opportunities a low carbon world represents.
- R&D, education and society at large must use these global frameworks in order to build competence, capacity and to share and communicate good sustainable solutions, technology and best practice.

Action 2: Greater and earlier adoption of renewables is the single most important action to meet the world's 2030 agenda.

- Assist the growth of offshore wind
- Drive uptake of data analysis to optimize performance of wind, solar, grids, and energy use
- Invest in cyber security to ensure a robust electricity supply
- Provide flexibility, balanced and cost-effective integration solutions
- Optimize grids to facilitate growth of renewables

Action 3: Greater and earlier electrification of heat and transport

- Drive the uptake of de-carbonisation of heat
- Broader adoption of electric vehicles contributing to energy savings and emissions reductions

Action 4: Greater improvements in energy efficiency

- Invest in strategic energy management

Action 5: Change in personal behaviour

- Increase the level of public acceptance to shape consumer behaviour
- Availability of subsidies

Will the world achieve the United Nations Sustainable Development Goals (SDGs) by 2030? What can business do to lead the charge? DNV GL answered these two critical questions in the forecast examining the future of our 'Spaceship Earth'. The report launched at the United Nations in September 2016 concluded that, while many of the goals will make good progress across several world regions, action will not be fast enough or fair enough and will come at an unacceptable environmental cost. Lack of climate action is a showstopper. Lack of sufficient progress on climate action forms a barrier towards achieving most other global goals and it will be increasingly difficult to achieve most of the global goals in a world with increased climate change. A quick transition to a sustainable energy system is the single most important action to fight climate change and we hope that our new Energy Transition Outlook will contribute build more competence, capacity and fuel a fact based debate that can accelerate the global energy transition.

(They're against most things.)

Sierra Club opposes climate-friendly nuclear and hydroelectric energy

By David C. Hammel, Urbandale, Letter to the Editor Published, Sept. 12, 2017, desmoinesregister.com

In a letter in the Sept. 7 Register, a writer from the Sierra Club asks us to "Call the president and your legislators today." They want to enact legislation to move to cheap, climate-friendly energy. There have been two energy sources available for decades that produce zero greenhouse gases. Those are hydroelectric power and nuclear power. Both have been opposed by the Sierra Club the entire time. In fact, they constantly lobby for the dismantling of dams and nuclear plants. Opposition to nuclear power has been so severe that only two plants have been built since the 1970s. One in 1996 and one in 2016. The average age of our remaining plants is 36, with a commissioned age span of 40 years. When I ask people why they oppose nuclear energy, they ask me, "Didn't you hear about Fukushima?" I answer, yes, I did, but there is zero chance of plants being hit by a tsunami in 90 percent of the United States. So just avoid building plants along the coastline. Iowa is lucky in that we have sufficient wind to make wind power feasible. If you look at a wind power feasibility map you will see that Iowa is one of



eight states where there is sufficient wind to power turbines. Solar power is similar, with it only being feasible in some areas.

Without the opposition to nuclear power, the U.S. might have had greater reliance on this zero-emission source. Instead we have relied upon coal for the bulk of our power, while nuclear provides 19 percent. Other countries such as France get 74 percent of their power from nuclear energy. As such, they are a leader in keeping greenhouse gases out of the atmosphere. I urge people to push for climate-friendly nuclear power. — *David C. Hammel, Urbandale*

(The U.S. doesn't have a corner on the market.)

These Are the 10 Best Universities in the World

Oxford is No. 1, while top US schools are Caltech, Stanford in third place

By Newser Editors, Newser Staff, Sep 5, 2017, newser.com

(NEWSER) – The US is well represented on a new ranking of the world's best universities, but Britain has a hold on the top two spots. Education industry magazine Times Higher Education puts Oxford and Cambridge at the top of the pack for best overall university, though Forbes notes that uncertainty over Brexit could dry up research money and provide an opening for US universities in the near future. Here are the top 10:



1. University of Oxford, UK
2. University of Cambridge, UK
3. (tie) California Institute of Technology, US
4. (tie) Stanford University, US
5. Massachusetts Institute of Technology, US
6. Harvard University, US
7. Princeton University, US
8. Imperial College London, UK
9. University of Chicago, US
10. (tie) ETH Zurich–Swiss Federal Institute of Technology Zurich, Switzerland, and (tie) University of Pennsylvania, US

Click for the full rankings: https://www.timeshighereducation.com/world-university-rankings/2018/world-ranking#!/page/0/length/25/sort_by/rank/sort_order/asc/cols/stats



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