WASHINGTON, DC, Jan. 30, 2015 -- According to new information from American Rivers (AR) -- an organization that aims to protect wild rivers, restore damaged rivers and conserve clean water for people and nature -- communities in 19 states, working in partnership with non-profit organizations and state and federal agencies, removed 72 dams in 2014, restoring more than 730 miles of streams for the benefit of fish, wildlife and people. States that were represented on the list were California, Colorado, Connecticut, Delaware, Iowa, Idaho, Illinois, Maine, Massachusetts, Michigan, New Hampshire, New Jersey, Ohio, Oregon, Pennsylvania, Tennessee, Vermont, Virginia, and Wisconsin. Pennsylvania topped the list for the 12th year in a row with 17 dams removed, while California had 12 dams removed and Michigan had six dams removed. Ohio, Massachusetts and Iowa each had five dams removed. **Looking ahead to this year, AR is setting a goal of 75 dam removals.** Scheduled dam removals include the West Britannia Dam on the Mill River in Massachusetts and the Fielder and Wimer dams on Evans Creek, a tributary to the
Rogue River in Oregon. Removal of the Plymco Dam on Town Creek in Plymouth, Mass., began just last week. AR will add the information on the 72 dam removals in 2014 to its database of more than 1,185 dams that have been removed across the country since 1912. Most of those dams (971) were removed in the past 20 years. AR is the only organization maintaining a record of dam removals in the U.S. and uses the information to communicate the benefits of dam removal, which includes restoring river health and clean water, revitalizing fish and wildlife, improving public safety and recreation, and enhancing local economies. AR updated its interactive river restoration map to include the 2014 dam removals. The map includes all known dam removals in the U.S. as far back as 1936. The map features the name of the dam and river, location and year the dam was removed, as well as other interesting facts. Explore the map at www.AmericanRivers.org/DamRemovalsMap.

(You can't build a dam with non-dam materials. Never liked mine tailings dams!)

**UPDATE 2—Canada investigation finds flawed design led to mine dam spill**

By Julie Gordon and Susan Taylor, Jan 30, 2015, reuters.com

Jan 30 (Reuters) - A massive spill from a dam containing mine waste in British Columbia last year was caused by a flawed design for the embankment, which did not account for the presence of a glacial lake deposit at the foundation, an independent panel said on Friday. The probe found that the breach at Imperial Metal's Mount Polley mine, which sent billions of gallons of wastewater and sludge into waterways, happened because the dam's weight was too much for the foundation to bear. "We concluded the dominant contribution to the failure resides in the design," the panel's chair, Norbert Morgenstern, said after the 5-1/2-month investigation. "The design did not take into account the complexity of the sub-glacial and pre-glacial geological environment associated with the perimeter embankment foundation." The panel, appointed by the provincial government with the backing of two Aboriginal bands from the Mount Polley area, also found the collapse was triggered by the construction of a downstream rockfill zone at an overly steep slope. They concluded that had the slope been flattened, work that was under way when the accident happened, the failure could have been averted.

Morgenstern said design flaws created a "loaded gun" and the construction of the steep slope "pulled the trigger." Knight Piesold Consulting designed the tailings pond, but ended its service as "engineer of record" for the facility in early 2011. The firm was not immediately available for comment on Friday. Vancouver-based Imperial Metals' shares closed up 6 percent at C$8.95 on the Toronto Stock Exchange. The stock, which plunged more than 46 percent the day after the Aug. 4, spill, hit a near five-year low of C$7.30 in December. The 147-page report had seven recommendations for industry and government, including stronger regulatory overview and emphasis on safety over economics in the feasibility stage of mining projects. British Columbia's energy and mines minister said all mines operating in the province will be immediately required to report on whether their tailings dams are built on glacial material. The massive spill had called into question provincial government inspections of tailings dams and could delay or even derail other energy and mining projects planned in the famously "green" province. However, the panel found that additional inspections of the tailings facility would not have prevented the failure.

The Mount Polley copper and gold mine is near the city of Williams Lake, some 550 km (340 miles) northeast of Vancouver. (Additional reporting by Nicole Mordant in Vancouver; Editing by G Crosse and Jonathan Oatis)

(A complete disaster!)

**Canada's worst mine disaster grew from a dam built in the wrong place**

By Ron Meador | 02/05/15, REUTERS, minnpost.com

The history of trouble in tailings and water storage at the Mount Polley mine is a very old story. Maybe you saw the news about the expert review panel's conclusion that undetected weakness in glacial deposits beneath a tailings dam caused the disastrous breach and waste release at the Mount Polley copper mine in British Columbia last August. If so, you were perhaps reading the
Duluth paper, which carried a brief Reuters story under the headline, “Investigation finds design flaw caused Canada mine dam spill.”

Amazingly, you still have to squint to find coverage in U.S. media of what is now generally described in the Canadian press as the greatest mining disaster in the country’s extensive history, with cleanup costs projected at more than $200 million.

This is so even in a media market like ours, at a time when the prospect of new copper mines at the edge of the Boundary Waters is at the core of so much consternation, conflict and debate.

When legislators are holding hearings to get updated on those projects, as they did Tuesday afternoon in a cursory, heavily pro-industry “informational hearing” by the House’s new committee on mining and outdoor recreation. When a key architect of the failed B.C. dam has also had significant involvement with the PolyMet project that’s first in line for a Minnesota mining permit.

An editor at Duluth’s News Tribune helpfully added that context to the Reuters piece published Saturday – and hats off to her or him for doing so:

"The company that designed, engineered and oversaw the construction of the Mount Polley tailings dam — Knight Piésold — also provided the Minnesota Department of Natural Resources and PolyMet with input on the current proposal for the proposed PolyMet copper mine project near Hoyt Lakes.

Two Knight Piésold employees are listed in the Supplemental Draft Environmental Impact Statement as contributors. And, in a 2013 corporate overview, PolyMet officials described the relationship as "the State of Minnesota has engaged Environmental Resource Management and Knight Piésold to assist in the completion of the EIS."

Investigations continue

This is not to say that the Canadian panel blames Knight Piésold for the dam's construction flaws or ultimate failure. It doesn't really blame anyone – not the designers, not the operators, not the owners, not the regulators or inspectors. The picture it paints is of a design that was flawed from the outset, because of subsurface conditions that weren't sufficiently investigated or understood, and went undetected over its 20-year lifespan. Which is not to say there weren't other, obvious problems with tailings storage at Mount Polley. The ever-rising pond was in and out of trouble for years as a result of unsound management practices, some of them noted by the expert reviewers. It may be that their full findings will have more to say in the way of fixing responsibility: The version of the report released on Friday was heavily redacted by B.C. officials, perhaps to protect ongoing inquiries, perhaps to protect some backsides. (A Vancouver activist group has counted 113 supporting documents held back.) And the investigations are far from finished. On Tuesday afternoon, as spokesmen for PolyMet and other Minnesota mining projects were assuring Minnesota lawmakers that state and federal regulators would guarantee the environmental safety of their operations, Canadian cops were serving new search warrants at the Mount Polley mine and the downtown Vancouver offices of its owner, Imperial Metals. The document seizure, according to CBC, lasted long into the evening.

A history of problems

I think it is important to remember that while the review panel's conclusions are both new and significant, the history of trouble in tailings and water storage at the Mount Polley mine is a very old story. Within a week of the breach last Aug. 4, Canadian journalists had combed through documents and dug out the basic narrative: Imperial Metals opened the mine in 1997, when copper prices were high, then shut it down four years later when they were low. In 2005, rising
prices moved Imperial Metals to put the mine back online; in 2009, it proposed to expand production – and tailings storage – beyond its original permits. One way to do that was to just keep adding height to the dam, an “earth-rockfill” structure formed by piling up dirt, crushed rock and tailings to specified heights and slopes, under the guidance of engineers. Another was to “dewater” the storage pond by pumping some its contents into natural waterways. The B.C. government signed off on both solutions; had it declined, the pond would have filled to overflowing. The papers also documented a sharp decline in mine inspections throughout the province since the Liberals won control of the government from the New Democrats in 2001. And plenty of whistleblowers came forth to tell of warnings that went unheeded. (Among those sounding alarms may have been Knight Piésold, which resigned as the engineer of record at the Mount Polley operation in 2010; after the collapse, it released a letter in which it warned Imperial Metals that the dam was being raised too high, and in a way that meant “it can no longer be considered a Knight Piésold design.”) Some 15 million cubic meters of water and solids let loose when the dam breached, and because of past concerns about exceeding the pond’s design capacity, the initial suspicion was that the upper portions of the dam had given way. But the expert reviewers found no evidence of that, nor any that the dam had gone soft in the middle from “piping” of water laterally through its core – perhaps the most common way these dams are known to fail. They found that the pond was very near, but still below, its authorized height at the moment of collapse. Because the safety margin had grown slight, its condition near the rim was being watched closely; the report includes a somewhat unnerving table of all the checks made on Aug. 1, 2, 3 and 4 that failed to detect any trouble until just before it all gave way. A question the experts don’t answer, and perhaps can’t, is whether the dam might not have failed anyway, from some other cause, even if its foundation had been placed on a sufficiently solid footing.

A near-disaster last May
On that point I’ll close by quoting a passage, lightly compressed, from Vancouver Sun columnist Vaughn Palmer, who has been covering the story for a long time and providing, in my opinion, an especially clear perspective. Zeroing in on a near-failure last May that is documented in the report, he writes:

The spur was a heavy run-off from an abnormally high winter snow pack, followed by torrential rains. With the rising waters in the tailings pond threatening to over-top the dam itself, the mine operator put out a call on the 25th to AMEC, its engineering firm of record. After arriving on the scene the following day, geotechnical engineer Dmitri Ostritchenko found plenty of cause for concern: wet spots on the embankment, seepage here and there, and a pond almost level with the core of the dam.

Two days later he reported by email to the company’s senior geotechnical engineer, Andrew Witte, that the situation had not much improved. “At the end of the day, the freeboard level is basically zero,” wrote the on-site engineer, referring to the gap between the water level and the crest of the dam.

Despite some effort to reduce the amount of water behind the dam, tailings were still being added to the pond because the mine was continuing to operate. This was too much for Witte. The safe operating standard was nine-tenths of a metre of freeboard at bare minimum. Mining operations had to take a back seat until that was restored. He directed Ostritchenko to remind the company of its obligations.

“That is a dangerous game to play and we need to make sure that our ass is covered by telling them to pump water out of the tailings storage facility. We cannot support the ‘just keep operating in the danger zone attitude.’ Remember, if they lose the dam, the mine can’t operate anyways.”

They didn’t lose the dam — not then, anyway. That wouldn’t happen for another 10 weeks.

The full report, with supplemental material, can be read or downloaded here: https://www.mountpolleyreviewpanel.ca/final-report

Copy obtained from the National Performance of Dams Program: http://npdp.stanford.edu
March 14: Annual St. Francis Dam Talk & Tour

The Santa Clarita Valley Historical Society, CA will present a tour of the St. Francis Dam site on Saturday, March 14, 2015. The failure of the St. Francis Dam on March 12, 1928, the second-worst disaster in the history of California, and America’s biggest civil engineering failure of the 20th Century, killed an estimated 431 people from Saugus to the sea. The break and subsequent flood leveled farms and homesteads, destroyed property and livestock and changed the way dam safety was addressed forevermore. The tour will begin with a short presentation about the disaster at 11 a.m. The talk will be held at the Saugus Train Station at Heritage Junction within William S. Hart Park, a unit of the County of Los Angeles Department of Parks and Recreation System, 24101 Newhall Avenue, in Newhall, California. At noon, ticketed passengers will board a motor coach at Heritage Junction for a trip up to the dam site in San Francisquito Canyon and a hike to the dam ruins. St. Francis Dam expert Frank Rock, who has been featured on the History Channel, the Discovery Channel and local television, will conduct the lecture and tour. Tickets are $35 per person for all ages and include snacks and bus transportation. Funds raised will benefit programs of the Santa Clarita Valley Historical Society. Participants should wear long pants and comfortable hiking shoes. Water will be provided. Tickets may be reserved by calling 661-254-1275 with credit card and contact information or by mailing your ticket order to P.O. Box 221925, Newhall, CA 91322-1925. Mail orders must be received no later than March 7. Because this tour is a popular fund-raiser, it is impossible to guarantee that seats will be available for purchase on the day of the tour. Order tickets today.

Tosches: A serious dam threat at Cherry Creek Reservoir?

I'd been putting off writing at the start of last week as the sun and ridiculously warm temperatures beckoned me outdoors. But finally, it was time to write my dam column. Today's topic is a recent Post story about Cherry Creek Reservoir and the possibility of its dam overflowing or even failing, inundating "the heart of the Denver area." (Some water would flood the retirement-friendly, adult community of Windsor Gardens, known as "the enlarged prostate of the Denver area.") Luckily, the Army Corps of Engineers is studying the potential danger. These engineers, as you know, are a bunch of dam experts. From the story: "On Saturday, the Army Corps of Engineers will take its Dam Safety Modification Study for Cherry Creek Dam to the public to get more feedback ... ." If you ask me, it's about dam time.

The 140-foot high earthen structure is 65 years old and — unlike many of the residents of the Cherry Creek area — has not undergone a facelift. Its failure in a massive storm would, the engineers say, be catastrophic, putting some 280,000 people in danger. That should make us pretty dam concerned. John Palensky is the manager of the new dam study— not just part of the study, but the whole dam thing. He says the risk is inherent because the dam sits over a heavily populated urban corridor, not because of any known structural problems with it. It was, apparently, built pretty dam well. "If this dam was out in the middle of nowhere, we wouldn't care about it,"
Palensky told The Denver Post. Which, if you take the feelings of rural country folk into account, was a pretty dam insensitive thing to say. The Corps of Engineers has about 700 such reservoir-creating structures across the country. As you would imagine, inspecting them takes a lot of dam work. The Cherry Creek Dam has, since it began working in 1950, never even come close to overflowing. Which should make us breathe a dam sigh of relief. It would, engineers say, take a storm with twice as much rain as the monstrous Boulder County monsoon of 2013 to cause water to spill over the top of the Cherry Creek structure — a chance they've listed as one in 58,800 in any given year. I do not know how they arrived at that figure, but I assume it involved using a lot of dam math. Anyway, such an overflow could, experts say, send 143,900 cubic feet of water per second surging over Interstate 225 and the nearby Kennedy Golf Course. Such a torrent would, as you'd imagine, make the golfers miss a lot of dam putts. To keep us from panicking, Scott Field, the head of the Denver Office of Emergency Management and Homeland Security, said any real problems at Cherry Creek Reservoir are unlikely and that his office deals "in the world of worst-case scenarios." Despite Field's calming words, I think you know what we'd be if we didn't take the threat seriously. That's right: a bunch of dam fools.

(A moving dam is NOT a good thing! Drawdown now!)

Ritschard Dam moving slightly, but steadily
Brent Gardner-Smith, Aspen Journalism, February 1, 2015, aspentimes.com

GLENWOOD SPRINGS, CO — The Colorado River District board of directors was told last week it is time to address the steady settling and movement occurring in Ritschard Dam, which holds back 66,000 acre-feet of water to form Wolford Mountain Reservoir, 5 miles upstream of Kremmling. “The continued movement of the dam at Wolford Mountain Reservoir is the most important issue currently facing the River District,” states a Jan. 8 memo from John Currier, the chief engineer at the district. The board discussed the situation at the dam Wednesday during a regular quarterly meeting in Glenwood Springs. “We see this continued downward movement of about an inch a year, unabated, with no evidence that it is really going to slow down,” Currier told the River District board. “It is a significant concern and is something we need to address.”

Ritschard Dam is 122 feet tall and 1,910 feet wide and sits across Muddy Creek, which flows into the Colorado River east of Gore Canyon. It was built for the River District in 1995 at a cost of $42 million by D.H. Blattner and Sons, of Minnesota. The dam has an impermeable clay core that is covered on both the upstream and downstream sides with rockfill, including shale rock excavated on site during construction. In 2008, engineers working for the River District noticed the dam had settled downward by 11/2 feet instead of the expected normal settling of 1 foot. They decided to install monitoring equipment, including inclinometers, which measure slope angles. Engineers for the River District have since gone on to install an increasingly sophisticated array of monitoring devices. And they've verified that the dam has now settled more than 2 feet downward.

On the move
The dam also has moved horizontally by 8 inches at a location about 40 to 50 feet from the top of the dam. Mike May, an engineer with AECOM, told the River District board that because of "poorly compacted rockfill" the dam's rocky, outer shells are still moving, especially the downstream shell, and that the clay core of the dam, which is somewhat elastic, is also moving.

Copy obtained from the National Performance of Dams Program: http://npdp.stanford.edu
While the dam does not have “a global stability problem,” May said the concern is that if enough movement occurs, it could cause cracks in the clay core. Water could then find its way into those cracks and start transporting material and widening the cracks, and then the dam could eventually be at risk of failing. “If we lose the integrity of that core, at that point, the threat we’re under is essentially having the dam completely fail,” Dan Birch, the deputy general manager of the River District, told board of directors. “And the scenario that happens when the dam fails is a lot worse than any flood that Mother Nature could create, and we’re talking just tremendous amounts of devastation and tremendous potential for loss of life.”

**Serious situation**

If the dam failed with a full reservoir behind it, there is the potential for 600,000 cubic feet per second to run down Muddy Creek toward Kremmling, said Jim Pokrandt, communications manager for the District. Eighteen hours later, the massive surge of water would reach Glenwood Springs. “It is a very serious situation (that) as an organization we are, have been and will continue to take very seriously,” Birch said. Bill McCormick, chief of dam safety for Colorado, was briefed on the dam’s situation Jan. 14. “Everyone involved (including the downstream public and the emergency management community) are now more aware of the dam and its operation than they ever have been before,” McCormick said via email Jan. 22. “The extensive investigations and analysis to date show that the dam remains strong and stable but that if left unabated, the movements could ultimately (in decades) create greater damage to the dam structure,” McCormick said. “The safety of the dam is being managed through the River District’s changes in normal operations, which include maintaining a reduced reservoir level and increased surveillance including real-time monitoring.” The dam was last inspected by the state in November, and there are no restrictions yet in place from the state that would force the River District to lower the water level in the reservoir. The district did, however, voluntarily lower the water level by 10 feet in 2014 to take pressure off the dam. Dick Davidson, a senior engineer and dam expert with AECOM, told the River Board on Tuesday it was his professional opinion that it was time to move toward a solution. “We are not in an emergency by any stretch, but we have definitely stressed our core beyond where we like it to be,” Davidson said. “So, let’s figure out what we need to do. Let’s look at our options.” One option is to spend up to $30 million rebuilding the dam. Another potential option is to store significantly less water in Wolford Reservoir, which is about two-thirds the size of Ruedi Reservoir, in order to take pressure off the dam. However, that may buy the River District some time, but not solve the problem. A refined set of options is now expected to be brought back to the River District board at both its April and July board meetings.

(Choose folks just don’t like it!)

**Proposed Susitna dam an outdated option, would set salmon back**

Rand Hagenstein, Corinne Smith, February 1, 2015, adn.com

The recent withdrawal of funding for the Susitna dam project from Gov. Bill Walker’s budget recommendations may have clouded the future of the proposal for now. While it’s too soon to know the project’s ultimate fate, it’s not too early to assess what the proposed dam would mean for Alaska salmon. The Susitna River is home to Alaska’s fourth-largest run of Chinook salmon. In a single summer you could catch all five species of salmon in its waters. The river supports subsistence traditions, sportfishing and commercial fisheries, and as such, its contributions to the people of Alaska are tremendous. At the same time, the facts show that Alaska has plenty to gain from hydropower. It’s a clean energy source. It can be relatively inexpensive. Many communities in Alaska -- Sitka, Kodiak and Cordova are among

Copy obtained from the National Performance of Dams Program: [http://npdp.stanford.edu](http://npdp.stanford.edu)
them – rely on small-scale hydropower for an alternative to municipal diesel generators. And of course, in the year 2015, we cannot deny the value of carbon-neutral energy. That’s plus, plus and another plus for hydropower.

This is why The Nature Conservancy works with communities, governments and power utilities around the world to help make sure that hydropower is developed and managed in a way that doesn’t harm fish and wildlife. This includes working hand in hand with the U.S. Army Corps of Engineers in the Lower 48 to reduce impacts to fish from existing dams. Just last spring, the conservancy joined the U.S. Bureau of Reclamation in a historic effort to restore Colorado River fish habitat with a rejuvenating pulse of water. The conservancy also helps lead the innovative Low Impact Hydropower Institute, a nonprofit led by a diverse array of companies and organizations committed to sustaining hydropower’s contributions to the nation’s energy grid while reducing its impacts on our nation’s rivers. As Alaskans, we want to know that when hydropower gets developed, it’s done in the right way. While we’ve neither opposed nor supported the Susitna project, we have applied our organization’s global hydropower expertise to address an important question for Alaska: How does the Susitna supply what salmon need, and how would a hydropower project as proposed affect the river’s ability to provide it? To answer questions such as these, we’ve recently published the “Ecological Risk Assessment of Large-Scale Hydropower on Braided Rivers in Alaska.” Risk assessments like this gauge how planned megaprojects could affect people and natural resources. In this case, we’ve specifically addressed how hydropower proposed for the Susitna would affect salmon. We know, for instance, that dams like the one currently proposed for the Susitna do more than block spawning salmon on their upstream migration. Even though relatively few salmon spawn and rear above the proposed dam site (records confirm some chinook salmon in these waters) it’s important to understand that a dam would change the 184 river miles downstream from the dam too.

The Susitna River -- with its mix of side channels, sloughs and deep pools -- provides plenty of spawning habitat. Perhaps more important, the Susitna provides nurseries for developing salmon -- eggs, alevins, fry and smolts. Before salmon can migrate to the sea, they need safe places to grow.

The risk assessment tells us that building and operating a Susitna dam as proposed would mean some immediate changes for salmon. Summer flows would fall below historically recorded levels and could limit the ability of salmon to reach spawning grounds. Winter flows may reach volumes of up to five times higher than historic conditions. Some river sections may no longer freeze, while ice may threaten salmon eggs and young fish by scouring the river bottom in other stretches. We also know that many changes to the river wouldn’t affect salmon immediately. But over time, changes to water quality, water temperature and the river’s ability to naturally transport wood and sediments will all impose risk on salmon. Hydropower will continue to have a place in a clean, carbon-neutral energy portfolio for Alaska. But to be clear, the new era of low-impact hydropower doesn’t look like the dams of the past. The proposed Susitna dam, as currently designed, would be an outdated option. Let’s think creatively, tap our ingenuity and work together to find Alaska’s best hydropower solutions. Alaska’s future generations are counting on us to do just that. Rand Hagenstein is Alaska state director for The Nature Conservancy. Corinne Smith is the organization’s Mat-Su program director. The “Ecological Risk Assessment of Large-Scale Hydropower on Braided Rivers in Alaska” is available at http://nature.ly/SusitnaHydroERA.

Hydro:
(A small step for mankind!)
Tiny hydro plant plays big role on big stage
Federal licensing rules eased around growing industry

Copy obtained from the National Performance of Dams Program: http://npdp.stanford.edu
SILVERTON, CO – The water from Arrastra Creek, unused industrially since it served to process precious metals at the Mayflower Mill north of here 60 years ago, has been harnessed again. This time it is powering a generator and turbine to produce electricity – part of a growing small-hydro industry. The power will light the way for tourists visiting the well-preserved mill, now a National Historical Landmark. The water, under an estimated 1,500-foot head, powers its way through an 8-inch pipe to the mill, where the pipe forks, supplying the power plant and the town water-treatment plant behind the mill. In the turbine – a device of few parts – the water flows across blades mounted on a shaft, making it turn. The energy produced by the rotation is collected by the generator and converted to electrical energy by means of a magnetic field. Excess power will be sold to the San Miguel Power Association through net metering. The 9 kilowatt power plant was the battering ram that opened the door for economic small hydro. The San Juan County Historical Society, which had inherited the Mayflower Mill and the water rights on Arrastra Creek, 12 years ago began to think about putting the water to work at the mill. But projects downtown took precedent, said Bev Rich, who chairs the San Juan County Historical Society. Finally, three years ago, the society tackled licensing from the Federal Energy Regulatory Commission where the bureaucracy can be as cumbersome and lengthy as getting a Hoover Dam-sized project approved. Licensing can cost small-hydro applicants fees in excess of what they pay for power plant hardware. Kurt Johnson, a Telluride hydropower consultant and president of the Colorado Small Hydro Association, took the Silverton case to Washington to win legislation that streamlined the process to license small hydro plants, Rich said. A $90,000 grant from the Colorado Historical Fund covered the bulk of expenses, Rich said. The 25 percent local match came from a U.S. Department of Agriculture program and other sources, including the Colorado Water Resources and Power Development Authority. “We’ve made history,” Rich said. The Mayflower Mill is connected to another historic first, Rich said. In its heyday, mill operations were among the first powered by alternating current from the Ames Hydroelectric Generating Plant near Ophir. Alternating current never had been harnessed before for industrial use. The power output for the Mayflower Mill is dwarfed by the 5,800 kW plant at Vallecito Reservoir that produces power for Tri-State Generation and Transmission and the 8,000 kW capacity plant at Tacoma on the Animas River north of Durango operated by Xcel Energy. Even the 120 kW generating plant on Lemon Reservoir that produces power for La Plata Electric Association is many times larger. (Oh well, nice try.)

Feds reject hydroelectric plan on Upper St. Anthony Falls
February 5, 2015 - startribune.com

Federal energy regulators on Thursday rejected a plan to install a hydroelectric generator in the Upper St. Anthony Falls Lock on the Mississippi River. The Federal Energy Regulatory Commission (FERC) denied the permit application of Symphony Hydro LLC to install twin generators in the lock. The boat passage through the upper falls will close by June 1 to halt the spread of invasive carp. The lock is upstream of the historic Stone Arch Bridge in Minneapolis. The FERC order said the U.S. Army Corps of Engineers, which owns and operates the lock and dam, “explicitly finds the proposed project to be incompatible” with the lock and therefore “no purpose would be served by issuing a permit.” The Minneapolis Park Board, the Minnesota Department of Natural Resources and a citizen group called the Friends of the Riverfront also had raised concerns about the project. Symphony Hydro may request a hearing. Company executives could not be reached immediately to comment. The project is one of three hydro generators proposed on the upper falls. Xcel Energy, the Minneapolis-based electric utility, already operates a hydropower generator there. (Except that the photo, which is nice, is from Tenn. – looks like Pigeon Forge mill.)
Meetings explore small hydropower possibilities
torringtontelegram.com, Jan 30th, 2015, UW Extension

TORRINGTON, WY – Opportunities for agricultural producers, irrigation districts and other water users to develop small hydropower at existing water infrastructures will be covered in a Torrington roundtable and Wheatland workshop Tuesday, Feb. 17.

The Wyoming Business Council and State Energy Office partnered with University of Wyoming (UW) Extension and the UW School of Energy Resources to develop the Wyoming Small Hydropower Handbook, which is the foundation of the discussion, said Milt Geiger, UW Extension energy coordinator.

Water:
(They need snow and rain!)
Analysis: California drought bites deeper
30 Jan 2015, argusmedia.com

Washington, 30 January (Argus) — Dry weather in January spells trouble for California hydropower plants and farmers as water reservoirs in the state remain depleted after a multi-year drought. January normally is California's wettest month but the state Department of Water Resources recorded little precipitation in the past four weeks. A manual snow survey on 28 January showed that the statewide snowpack was only 25pc of the historical average. The snowpack normally supplies about 30pc of California's water needs, the state agency says. Meager precipitation this month means California likely will encounter drought conditions for the fourth straight year, the agency said. Water levels at Lake Oroville, Shasta Lake and San Luis Reservoir — major reservoirs in northern California — are at 62pc, 65pc and 68pc of historical averages. California's precipitation has to exceed normal levels by 150pc for the rest of the current water year that ends in September to make up for the water deficit, which is unlikely, state climatologist Michael Anderson says. The growth of solar and wind generation is partly making up for lower hydro generation. But gas-fired plants have to run more often in peak load hours both to replace hydropower output and to support renewables. Hydro generation on the California Independent System Operator system last year fell by 29pc from 2013. The resulting change in the supply mix is adding to wholesale price volatility in real time markets. It also is lifting natural gas prices in California, located far from the fastest-growing US production regions. Northern California depends more on hydropower so power prices there are affected more. NP-15 summer 2015 round-the-clock assessments are $34/MWh, gaining 11pc by summer 2016. The summer 2015 values at SP-15 are $35/MWh and are up by 9pc for the following summer.

(Interview about new NASA satellite. Maybe technology can help! It's been 165 years since the last time there was no rain in San Francisco in January.)

Sunday Science: Soil Satellite Launches
Jan 30, 2015, wcax.com

Copy obtained from the National Performance of Dams Program: http://npdp.stanford.edu
SOUTH BURLINGTON, Vt. -
Cat: Good morning and thanks for joining us. This week, NASA launched a new satellite to study soil. And joining us to talk about what they're looking for this morning is Dr. John Bolten from NASA. Thank you so much for being here.
Bolten: Thanks for having me.

Cat: So what exactly are you looking for with this satellite?
Bolten: Well the NASA SMAP mission that was launched earlier this week measures global soil moisture observations. And it will monitor soil moisture every two to three days. And this is actually a critical variable in climate studies and weather forecasting.

Cat: So how will that data actually help you with that weather forecasting?
Bolten: Well it turns out that the water that's held in the top one to two inches of soil is critical for estimating the amount of water and temperature. So think about the perspiration on your skin, how it regulates your body temperature. The same thing happens on the land surface. And the amount of water held in the soil can drive the temperature changes of the surface, as well as the humidity in the atmosphere. So from this NASA SMAP satellite, we'll have direct, continuous observations of soil moisture for the first time ever. And this really is sort of a game-changer for weather forecasting and climate forecasting.

Cat: So a lot of Vermonters here rely on their land for farming and recreation. How will this study then help them?
Bolten: Well in fact, the applications from SMAP are very broad for science and society, including agricultural yield. So the amount of water that's available to the roots of plants is essential for estimating potential yield. In fact, so agriculture is really a global enterprise. So the commodity pricing for crops in the U.S. is driven by the health of plants in Central Asia or South America. So if we have a global estimate for the health of these plants by assessing the amount of water available to the roots, we'll really improve our targeting of humanitarian assistance for global crops and yields.

Cat: We often think of NASA as being all about space exploration -- why do you focus on Earth science too?
Bolten: That's a good question. In fact, the best way to study the Earth because it's so complex and so vast is not actually from the ground, but from space. And in fact NASA has over 18 Earth-observing satellites studying different components of the energy, water and carbon cycles. And from this we're able to have a more complete picture of in fact how the Earth system works as a whole.

Cat: So why is this particular mission important? Why did you launch?
Bolten: Well this mission is a groundbreaking mission. It's NASA's first mission that has ever been devoted to soil moisture observations. In addition, it's groundbreaking from a technological standpoint because it's the largest rotating aperture ever released into space. So the antenna of the NASA space instrument is actually 20 feet in diameter. And the satellite itself is about the size of a minivan. And so from this, they'll have global estimates every two to three hours. And it's really a game-changer for earth science and weather forecasting.

Cat: Wow. So you said every two to three hours -- when are you expecting the first data to come in?
Bolten: We expect the first data from SMAP to be available about 90 days after launch.
Cat: Wow, so we can look forward to that. Dr. John Bolten from NASA, thank you so much for joining us this morning, we appreciate it.
Bolten: Thank you for having me.

Environment:
(Getting back to normal, we hope.)

Wanapum Reservoir to reopen at noon on Jan. 7

EPHRATA, Wash.—After Grant PUD raised the Wanapum reservoir by 17 feet in December, the utility, the Washington Department of Fish & Wildlife and Washington State Parks have determined that the reservoir can reopen to the public at noon on Wednesday, Jan. 7. Working in conjunction with other hydroelectric operators on the Columbia River, Grant PUD began raising the reservoir on Nov. 25 and finished on Dec. 1. After a thorough evaluation, the utility will restore public access to most of the shoreline. Two boat launches are operational at the current river level – Grant PUD’s Wanapum Upper Boat Launch and the watercraft launch at Wanapum State Park just south of Vantage. With the reopening of the reservoir, Washington State Parks will open the Wanapum State Park launch for daily access from 8 a.m. to dusk. Camping at the park remains on its regular winter schedule, open for camping only on weekends and holidays until March 1. The park will resume a daily operating schedule for campground and day use facilities after March 1, for the 2015 season. The following recreation-site locations on the reservoir remain closed because of inoperable boat launches, unstable shorelines or ongoing recreation site improvements:

- Sand Hollow Recreation Area
- Vantage Boat Launch and Day-Use Area
- Frenchman Coulee Boat Launch
- Sunland Boat Launch
- Yo Yo Rock Boat Launch and Recreation Area
- Quilomene Dune and Bay
- West Bar
- Crescent Bar Boat Launch and portions of Crescent Bar Island
- Grant PUD property in the Tarpiscan Creek area
- Grant PUD property off Columbia Siding Road

Closed shoreline areas are marked with no trespassing signs. To ensure public safety, Grant PUD personnel and law enforcement officials will continue to patrol and enforce trespassing laws in these locations. Those visiting the shoreline and reservoir are cautioned to be aware that sections of the shoreline may still be unstable. Boaters should be mindful of shallow-water hazards and heed all warning signs and barriers near the dam. Grant PUD continues to monitor and evaluate conditions on the shoreline and will notify the public if the situation changes.

The entire shoreline and access points were closed to the public last March after Grant PUD had to draw down the reservoir by 26 feet in response to a fracture discovered on the Wanapum Dam Spillway. After completing enough work to stabilize and re-enforce the spillway, the utility received permission from the Federal Energy Regulatory Commission to raise the reservoir. Work continues on the Wanapum Dam spillway, and Grant PUD expects to have enough repairs finished to return the reservoir to normal operations by the start of the 2015 recreation season.

(Ugly bugger, huh!)

Advocates: Dams Put Dinosaur-Like River Fish at Risk
BILLINGS, Mont. — Feb 2, 2015, By MATTHEW BROWN Associated Press, abcnews.go.com

Copy obtained from the National Performance of Dams Program: http://npdp.stanford.edu
Wildlife advocates claimed in a federal lawsuit filed Monday that the dinosaur-like pallid sturgeon could be wiped out in stretches of rivers in Montana and North Dakota if the federal government doesn't deal with dams that disrupt spawning.

Pallid sturgeon are known for their distinctive shovel-shaped snout and can live 50 years, reaching 6 feet in length.

Believed to date to the days when Tyrannosaurus Rex walked the Earth, the species has declined sharply over the past century as dams were built along the Missouri River system.

In a lawsuit, attorneys for Defenders of Wildlife and the Natural Resources Defense Council asked a judge to order new steps to protect the last 125 pallid sturgeon downstream of Fort Peck Dam in Montana to Lake Sakakawea in North Dakota. That includes fish on the lower Yellowstone River. The groups say Fort Peck Dam and a smaller dam on the Yellowstone River near Glendive prevent sturgeon from successfully breeding. The three defendants named in the lawsuit — the U.S. Army Corps of Engineers, Bureau of Reclamation and Fish and Wildlife Service — are considering modifications to the Yellowstone River dam to allow sturgeon to pass around it. Army Corps spokeswoman Michael Coffey said an environmental study of the proposed Yellowstone dam modifications was close to being finalized.

Federal officials have said the $59 million upgrade to the dam would allow sturgeon access to an additional 165 miles of the river for migration and spawning. The lawsuit, however, claims the agencies’ plans would result in a larger dam and creation of an artificial side channel that sturgeon won't necessarily use.

"It's one of those twisted tales of some good intentions but in the end the outcome is this monster project that a lot of the experts we are talking to have serious concerns about," said Steve Forrest with Defenders of Wildlife. Without the channel, sturgeon on the Yellowstone have been left to wait for high waters to form a natural passage that lets them get around the dam. Most years that passage is not available.

Federal officials have said rebuilding the dam and constructing a side channel offers the best chance for fish to get further up the Yellowstone. But they still are uncertain how well it will actually work, due to limited information on whether pallid sturgeon are willing to use such routes. The intake dam was built beginning in 1905 to provide irrigation water for almost 400 farms covering more than 54,000 acres of land in eastern Montana and western North Dakota. The lawsuit also claims water releases from Fort Peck dam are killing off young sturgeon in the Missouri River. Pallid sturgeon was listed as an endangered species in 1990. Its numbers have since increased, according to federal scientists, but the precise size of the population remains unknown.

**FERC blames Ellsworth dam owner for autumn fish kills**

February 3, 2015 by Steve Rappaport on News, News-Featured, ellsworthamerican.com

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Copy obtained from the National Performance of Dams Program: [http://npdp.stanford.edu](http://npdp.stanford.edu)
ELLSWORTH, Maine — The Federal Energy Regulatory Commission (FERC) is holding the owner of the Ellsworth hydropower dam responsible for a number of significant fish kills in the Union River last fall. FERC also reported a “failure to show due diligence” in providing adequate downstream passage for alewives and adult eels on their return to the sea from the Union River watershed. In an eight-page Jan. 27 letter, FERC charged that Black Bear Hydro Partners, LLC violated its federal dam operating license by failing to operate the fish passage facility at the dam “in such a way that the needs of migrating fish were addressed.” It also charged that the company took advantage of a license requirement that it “evaluate upstream and downstream fish passage needs” at the dam by essentially doing nothing.

Black Bear is in the early stages of renewing its operating license for the Ellsworth hydroelectric dam. The license expires in 2017. The fish passage issue at the dam is nothing new. According to FERC and the U.S. Fish & Wildlife Service, “nearly two decades have passed and the downstream fishway still has not been evaluated” to determine whether it works. “The evaluation process is not intended to allow you to fail to provide passage,” Thomas J. LoVullo, chief of FERC’s Aquatic Resources Branch, wrote last month. “We expect no fish mortality during the 2015 fish passage season,” LoVullo said, and warned that the fall fish kills and the Black Bear’s response would become a part of the company compliance history “and taken into consideration should similar incidents recur.” The strong tone of LoVullo’s letter came as a pleasant surprise to Dewayne Shaw, executive director of the Downeast Salmon Federation. “It was very encouraging,” Shaw said in phone call last week. “It surprised the natural resource agencies as well.” Last fall, both the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) filed comments about the fish kills with the commission. While Black Bear is the nominal license holder, Toronto-based Brookfield Renewable Energy Partners purchased the Ellsworth dam, along with eight other Maine hydropower generating facilities, in 2013. FERC’s displeasure was directed largely toward Brookfield’s response last November to the commission’s request for information about the cause of the fish kills and a description of any “corrective actions” or repairs the company made “to ensure downstream migrating fish…were protected.”

Brookfield blamed the alewife fish kill primarily on a temporary failure of a pump that creates an “attraction flow” so that alewives will be drawn toward collection weirs and pipes that allow them to pass through the dam to the river below. With the pump inoperative, Brookfield said, fish were drawn into a pipe that provides “auxiliary cooling water” to the turbines.

In its letter, the commission also cited the comments from NMFS and FWS last fall regarding both the cause and frequency of the fish kills around the dam. The fisheries service “noted that the injuries on the fish were consistent with turbine entrainment, and does not believe the fish kill is an isolated event,” FERC said. The federal fish and wildlife agency (FWS) found that “the condition of the fish downstream of the project indicates turbine-induced mortality.” According to FERC, the service also found that the “fishway was not operating properly” and that it “doubts whether it has been operated properly in the past.” FERC agreed with Brookfield’s contention that pump failure likely contributed to the fish kill. But it faulted the company for not addressing the faulty pump promptly and concluded that both alewives and eels were drawn directly into the
generating turbines rather than passing through the auxiliary cooling system and killed by the turbines' spinning blades. Brookfield’s letter also completely ignored the dead eels. “Your letter should have acknowledged or responded to the eel mortalities downstream of the project (dam) as requested,” LoVullo wrote. FERC, he said, would “expect” that the company’s annual comprehensive fisheries management plan progress report “will address the need for eel passage…to help avoid this type of incident in the future.” In its letter, the commission asked Brookfield to describe in detail, before the start of the spring downstream passage season but no later than March 31, how it planned to prevent fish from being sucked into the auxiliary cooling water intake. In response to an email requesting comment last week, Brookfield spokesman Vanessa Pilotte said the company was reviewing the letter from FERC and would provide “a more detailed response” by Tuesday, Feb. 3. No comments from Brookfield were received by The Ellsworth American’s deadline.

**Other Stuff:**
(Interesting data! It doesn’t take rocket science to know the U.S. hydro output is down because of the drought.)

6 New Charts That Show US Renewable Energy Progress
By PETE DANKO on February 05, 2015, breakingenergy.com

Capacity is the amount of total power that the various renewable sources could put out if operating at 100 percent. That's indicated in the above chart in megawatts (MW). The amount of actual energy generated each year is indicated in gigawatt-hours (GWh). You're probably familiar with kilowatt-hours, the unit of measure for monthly electricity use on your utility bill. The average U.S. residence uses 900 kilowatt-hours a month, and a gigawatt-hour is 1,000,000 kilowatt-hours.

The numbers are still pretty small, but the latest data compilation from the National Renewable Energy Laboratory shows renewable electricity generation rising steadily in the United States. Here’s a key chart from NREL’s just-released Renewable Energy Data Book, which includes data through the end of 2013.

Copy obtained from the National Performance of Dams Program: [http://npdp.stanford.edu](http://npdp.stanford.edu)
There are five main sources of renewable electricity: hydropower, solar, wind, geothermal and biomass. This is how they break down:

U.S. Renewable Electricity Generation as a Percentage of Total Generation

<table>
<thead>
<tr>
<th></th>
<th>Hydropower</th>
<th>Solar</th>
<th>Wind</th>
<th>Geothermal</th>
<th>Biomass</th>
<th>Total Renewables</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>7.2%</td>
<td>0.0%</td>
<td>0.1%</td>
<td>0.4%</td>
<td>1.6%</td>
<td>9.4%</td>
</tr>
<tr>
<td>2001</td>
<td>5.8%</td>
<td>0.0%</td>
<td>0.2%</td>
<td>0.4%</td>
<td>1.3%</td>
<td>7.7%</td>
</tr>
<tr>
<td>2002</td>
<td>6.8%</td>
<td>0.0%</td>
<td>0.3%</td>
<td>0.4%</td>
<td>1.4%</td>
<td>8.9%</td>
</tr>
<tr>
<td>2003</td>
<td>7.1%</td>
<td>0.0%</td>
<td>0.3%</td>
<td>0.4%</td>
<td>1.4%</td>
<td>9.1%</td>
</tr>
<tr>
<td>2004</td>
<td>6.7%</td>
<td>0.0%</td>
<td>0.4%</td>
<td>0.4%</td>
<td>1.3%</td>
<td>8.8%</td>
</tr>
<tr>
<td>2005</td>
<td>6.7%</td>
<td>0.0%</td>
<td>0.4%</td>
<td>0.4%</td>
<td>1.3%</td>
<td>8.8%</td>
</tr>
<tr>
<td>2006</td>
<td>7.1%</td>
<td>0.0%</td>
<td>0.7%</td>
<td>0.4%</td>
<td>1.3%</td>
<td>9.5%</td>
</tr>
<tr>
<td>2007</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.8%</td>
<td>0.4%</td>
<td>1.3%</td>
<td>8.5%</td>
</tr>
<tr>
<td>2008</td>
<td>6.2%</td>
<td>0.1%</td>
<td>1.3%</td>
<td>0.4%</td>
<td>1.3%</td>
<td>9.3%</td>
</tr>
<tr>
<td>2009</td>
<td>6.9%</td>
<td>0.1%</td>
<td>1.9%</td>
<td>0.4%</td>
<td>1.4%</td>
<td>10.6%</td>
</tr>
<tr>
<td>2010</td>
<td>6.3%</td>
<td>0.1%</td>
<td>2.3%</td>
<td>0.4%</td>
<td>1.4%</td>
<td>10.4%</td>
</tr>
<tr>
<td>2011</td>
<td>7.8%</td>
<td>0.2%</td>
<td>2.9%</td>
<td>0.4%</td>
<td>1.4%</td>
<td>12.6%</td>
</tr>
<tr>
<td>2012</td>
<td>6.8%</td>
<td>0.3%</td>
<td>3.4%</td>
<td>0.4%</td>
<td>1.4%</td>
<td>12.4%</td>
</tr>
<tr>
<td>2013</td>
<td>6.6%</td>
<td>0.5%</td>
<td>4.1%</td>
<td>0.4%</td>
<td>1.5%</td>
<td>13.1%</td>
</tr>
</tbody>
</table>

Copy obtained from the National Performance of Dams Program: http://npdp.stanford.edu
So if 13.1 percent of U.S. electricity comes from renewable sources, how do we generate the rest of it? Fossil fuels and nukes, mostly.

### U.S. Electricity Generation by Source

<table>
<thead>
<tr>
<th>Year</th>
<th>Coal</th>
<th>Petroleum Liquids</th>
<th>Petroleum Coke</th>
<th>Natural Gas</th>
<th>Other Gases</th>
<th>Nuclear</th>
<th>Renewables</th>
<th>Other</th>
<th>Total Generation (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>51.6%</td>
<td>2.7%</td>
<td>0.2%</td>
<td>15.8%</td>
<td>0.4%</td>
<td>19.8%</td>
<td>9.4%</td>
<td>0.1%</td>
<td>3,807,985</td>
</tr>
<tr>
<td>2001</td>
<td>50.8%</td>
<td>3.1%</td>
<td>0.3%</td>
<td>17.1%</td>
<td>0.2%</td>
<td>20.5%</td>
<td>7.7%</td>
<td>0.3%</td>
<td>3,745,745</td>
</tr>
<tr>
<td>2002</td>
<td>50.0%</td>
<td>2.0%</td>
<td>0.4%</td>
<td>17.9%</td>
<td>0.3%</td>
<td>20.2%</td>
<td>8.9%</td>
<td>0.3%</td>
<td>3,867,498</td>
</tr>
<tr>
<td>2003</td>
<td>50.7%</td>
<td>2.6%</td>
<td>0.4%</td>
<td>16.7%</td>
<td>0.4%</td>
<td>19.6%</td>
<td>9.1%</td>
<td>0.4%</td>
<td>3,892,115</td>
</tr>
<tr>
<td>2004</td>
<td>49.7%</td>
<td>2.5%</td>
<td>0.5%</td>
<td>17.8%</td>
<td>0.4%</td>
<td>19.6%</td>
<td>8.8%</td>
<td>0.4%</td>
<td>3,979,023</td>
</tr>
<tr>
<td>2005</td>
<td>49.5%</td>
<td>2.5%</td>
<td>0.6%</td>
<td>18.7%</td>
<td>0.3%</td>
<td>19.2%</td>
<td>8.8%</td>
<td>0.3%</td>
<td>4,062,458</td>
</tr>
<tr>
<td>2006</td>
<td>49.8%</td>
<td>1.1%</td>
<td>0.5%</td>
<td>20.1%</td>
<td>0.3%</td>
<td>19.3%</td>
<td>9.5%</td>
<td>0.3%</td>
<td>4,071,962</td>
</tr>
<tr>
<td>2007</td>
<td>48.4%</td>
<td>1.2%</td>
<td>0.4%</td>
<td>21.5%</td>
<td>0.3%</td>
<td>19.4%</td>
<td>8.5%</td>
<td>0.3%</td>
<td>4,164,748</td>
</tr>
<tr>
<td>2008</td>
<td>48.1%</td>
<td>0.8%</td>
<td>0.3%</td>
<td>21.4%</td>
<td>0.3%</td>
<td>19.5%</td>
<td>9.3%</td>
<td>0.3%</td>
<td>4,127,019</td>
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<tr>
<td>2009</td>
<td>44.4%</td>
<td>0.7%</td>
<td>0.3%</td>
<td>23.3%</td>
<td>0.3%</td>
<td>20.2%</td>
<td>10.6%</td>
<td>0.3%</td>
<td>3,956,990</td>
</tr>
<tr>
<td>2010</td>
<td>44.7%</td>
<td>0.6%</td>
<td>0.3%</td>
<td>23.9%</td>
<td>0.3%</td>
<td>19.5%</td>
<td>10.4%</td>
<td>0.3%</td>
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<td>2011</td>
<td>42.2%</td>
<td>0.4%</td>
<td>0.3%</td>
<td>24.7%</td>
<td>0.3%</td>
<td>19.2%</td>
<td>12.6%</td>
<td>0.3%</td>
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<tr>
<td>2012</td>
<td>37.3%</td>
<td>0.3%</td>
<td>0.2%</td>
<td>30.3%</td>
<td>0.3%</td>
<td>18.9%</td>
<td>12.4%</td>
<td>0.3%</td>
<td>4,067,551</td>
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<tr>
<td>2013</td>
<td>38.9%</td>
<td>0.3%</td>
<td>0.3%</td>
<td>27.3%</td>
<td>0.3%</td>
<td>19.4%</td>
<td>13.1%</td>
<td>0.3%</td>
<td>4,074,457</td>
</tr>
</tbody>
</table>

You can see that the most important shift since 2000 has been the steady move out of coal and into natural gas. In the renewables category, wind has been responsible for most of the increased generation. Here’s a closer look at how wind has grown over the past decade-plus:
As the chart indicates, wind capacity additions more or less paused in 2013, but new data shows wind bounced back well in 2014, so we should see the trend line continue to rise. How quickly will depend a lot on policy decisions in Washington, D.C., as well as in state capitals, but at this point, wind looks to be on a trajectory to overtake hydropower as the leading source of U.S. renewable electricity, perhaps by 2020. (There is some work being done to improve the efficiency of existing hydropower, but with no big capacity additions planned, hydropower generation will likely continue to fluctuate in its recent range depending on water supply.)

What about solar? Solar has overtaken wind as the fastest growing source of electricity in the country—but remember, it started from practically nothing in 2000, and it’s really just been in the past six or seven years that solar has begun to show up in the larger picture. Here’s the solar chart for 2000 through 2013:

Those are the main story lines on U.S. renewable electricity generation—but you might be wondering how it compares to the rest of the world. As you can see below, we’re lagging, although mainly that’s because our proportion of electricity from hydropower is much lower than the rest of the world (6.6 percent in 2013 for the U.S. vs. 15.9 percent globally).

Copy obtained from the National Performance of Dams Program: http://npdp.stanford.edu
### Global Renewable Electricity Generation as a Percentage of Total Generation

<table>
<thead>
<tr>
<th>Year</th>
<th>Hydropower</th>
<th>Solar (PV and CSP)</th>
<th>Biomass</th>
<th>Wind</th>
<th>Geothermal</th>
<th>All Renewables</th>
<th>Renewable Generation (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>16.8%</td>
<td>0.0%</td>
<td>1.2%</td>
<td>0.3%</td>
<td>0.3%</td>
<td>18.7%</td>
<td>2,727,082</td>
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<tr>
<td>2001</td>
<td>17.3%</td>
<td>0.0%</td>
<td>1.3%</td>
<td>0.4%</td>
<td>0.3%</td>
<td>19.3%</td>
<td>2,872,463</td>
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<tr>
<td>2002</td>
<td>17.1%</td>
<td>0.0%</td>
<td>1.2%</td>
<td>0.5%</td>
<td>0.3%</td>
<td>19.2%</td>
<td>2,953,979</td>
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<td>2003</td>
<td>18.0%</td>
<td>0.0%</td>
<td>1.2%</td>
<td>0.7%</td>
<td>0.3%</td>
<td>20.2%</td>
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<td>17.3%</td>
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<td>1.1%</td>
<td>0.8%</td>
<td>0.3%</td>
<td>19.5%</td>
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<td>1.2%</td>
<td>0.9%</td>
<td>0.3%</td>
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<td>0.1%</td>
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<td>0.3%</td>
<td>19.4%</td>
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<td>2007</td>
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<td>1.3%</td>
<td>1.3%</td>
<td>0.3%</td>
<td>19.3%</td>
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<td>0.1%</td>
<td>1.3%</td>
<td>1.7%</td>
<td>0.3%</td>
<td>20.0%</td>
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