4/12/19 I AM GOING TO TOUCH ON SOME OF THE WEST’S WATER & POWER

ISSUES, AS SEEN THROUGH THE LENS OF A LADWP BRAT.

LET’S START EASY, WITH HISTORY: POWER PLANT 1, WHERE I GREW UP: San Francisquito Canyon, 40 miles N of L. A., PP1 came on line 1917. It’s electricity got to L.A. by a transmission line, providing LA municipal electric power for the 1st time.

* My parents, my brother and I moved to the Canyon in 1938. Because the plant was so remote, there was company housing close to the plant. Many times in my childhood, I would take Dad his lunch at the plant, sit with him and share his lunch box, the air rich with ozone. The control room isolated from the turbine roar. Don’t touch anything!
* PP1 is part of Owens Valley Aqueduct, getting water from the eastern Sierras.
* The aqueduct starts at Lee Vining (near Bridgeport), flows by gravity to L.A. L.A. bought 300,000 acres with water rights there and still takes approximately 200,000 ac-ft of water/year from there to L.A.
* The Owens Valley Aqueduct provides about half of LA’s needs. 41% from the Metropolitan Water District that provides State Water & Colorado River water; Wells;11%; Recycled:1%. L.A. recently announced that it will recycle all of it’s Hyperion Sewer Plant waste water by 2035. That is a big deal.
* DWPLA lost 80% of Mono Basin water in the Owens Valley after 20 years of litigation. DWP owned the land and water rights to this basin. This litigation loss occurred under a doctrine that stated “The State has a public Trust responsibility to revise water rights allocations in light of the currently prevailing values of ‘Society’”.
* SAN FRANCISQUITO CANYON IS FAMOUS FOR ONE THING:

THE SAINT FRANCIS DAM DISASTER occurred 10 years before we moved to the “Canyon”.

* Saint Francis Dam, 36 miles N of L.A., between PP1&PP2, was full to inches below spillway with Owens Valley water , about 182 feet deep at the dam.
* It was a concrete gravity arch dam—the latest technology, a conservative design.
* The dam failed March 12, 1928, minutes before midnite. Death toll a devastating 431 people.
* Power Plant 2 was located 2 mi downstream from the dam. 64 of the 67 residents and operators there perished. Ray Rising, one of the survivors, returned to a rebuilt PP2 & lived in a camp house on the same location that took his first family.
* Latest failure theory is that the dam eastern abutment failed, due to a landslide.
* William Mulholland, genius & legendary head of the aqueduct system, inspected the dam the day before it failed and though muddy water was leaking from the dam, endorsed it’s integrity.
* He retired 1 year later, died @ 77 in 1935.

OK, I GREW UP, WENT TO WORK FOR DWP, MARRIED A DWP GAL. GOT MY BSEE, MSEE, RE AND TOO MANY BUSINESS AND MANAGEMENT CLASSES FOR WHICH SEEMED TO TAKE FOREVER. MY FIRST BIG CAREER BREAK WAS BEING PART OF THE CASTAIC PUMPED STORAGE PLANT PROJECT, rated1247MW, DWP designed , built , maintained and operated.

* The CA Aqueduct is quite separate and distinct from the Owens River Aqueduct. In route to Southern CA, Edmunston Pumping Plant, South of Bakersfield, pumps water up the Tehachapis. The aqueduct splits E&W at the top of the mountains. The plant is on the West Branch, between Pyramid Lake (el:2579’) and Castaic Lake (el:1500’). Castaic Power Plant uses about 1000’ of the drop on the south side of the Tehachapis. The plant takes advantage of thru flow, but it primarily moves water back and forth between the two lakes with 6-250MW reversible units and1-55MW conventional unit.
* ??Surge Chamber120’ in diameter, 400’ high, only 160’ of it above grade, sits on top of the 30’ Angeles tunnel to Pyramid. It relieves water pressure on emergency shutdown of the turbine generators-----a race between over-reving the machines vs. destructive water hammer.
* For comparison, PG&E’s Helms Pumped Storage Plant, E of Fresno, is rated @ 1212MW, 35 MW less than Castaic.
* Project life is very stressful. People do strange things: Georgie, run over rabbit.

DWP is the largest municipal utility in U.S., serving 4M residents, has 9400 employees. DWP generating capacity is 7880MW, natural gas:34%, renewables:29%, coal:19%, neuc:9%, hydro:5%. DWP electricity rates are 15% below SCE’s, even after giving 7% REVENUES (NOT income or net income) to City’s general fund for in-lieu taxes (L.A.’s cash cow). DWP peak: 6502MW. DWP is committed to being carbon neutral by 2050 and has recently committed to shut down it’s 3 LA basin gas fired, ocean cooled steam plants by 2029.

FOR COMPARISON, California’s electrical energy peak is 50,270MW, about 8 times DWP.

* CALIFORNIA’S ENERGY GOALS are 50% renewables by 2030, 100% “CARBON NEUTRAL” by 2045. “Carbon neutral” means a net zero carbon footprint. Carbon released will be counterbalanced by an equivalent amount sequestered or offset, or buying enough carbon credits to make up the difference. Another CA goal: 5 million electric vehicles in CA by 2030. But! Question! Will the Feds continue the Electric Vehicle $7500 tax credit? AND, the Trump administration has cut CA out of its effort to craft new efficiency rules for cars and trucks. A controversial study by German think tank, IFO, compared output of CO2 output of a Tesla Model 3 versus a Mercedes C220d diesel sedan. It found, when considering manufacture of the Tesla battery and Germany’s increasing reliance on coal when the sun isn’t shining and the wind not blowing, that the Mercedes releases less CO2/kilometer driven. Guess who paid that Think Tank!!!!!!
* Now CA electricity use is about 300 Terawatt-hours/year (1Terawatt=1trillionwatts). To be “carbon neutral” by 2045, we must replace 127 Twhs of the 300Twhs because it is electricity generated by gas or nuclear. Then add another new 100 Twhs for the mandated 5 million electric vehicles, and water reclamation loves electricity. Presently, 70% of CA’s electricity is generated in CA, Will the remaining 30% out-of-state generation be required to conform to CA’s renewable criteria? I don’t think so.CA electric rates average 20cents/kwh, nearly twice the national average . At least 11 developers are trying to build literally hundreds of wind turbines off our local coast. As Warren Buffett has said, as long as it is subsidized, he will build it. California just passed a building code requiring solar panels on new homes, starting in year 2020. But the Trump administration applied a 30% tariff on photovoltaic panels imported from China and the federal tax credit for solar power systems will be reduced from 30% of cost to 26% in 2020.
* It is estimated that California needs a mind blowing 200 times more energy STORAGE to provide electricity when the sun isn’t shining and/or when the wind isn’t blowing. Ideas are popping up. For instance, DWP is proposing a $3 Billion project to make Hoover Dam Power Plant into a pump storage plant with a 20 mile underground pipe to return Colorado River water to Lake Mead, using wind and solar electricity to pump the water. Utah recently announced a 1000MW energy storage project. It will use a roster of exotic technologies: compressed air storage in a cavern, “flow” batteries that circulate liquid electrolytes, hydrogen synthesized with excess renewable generation, stored, and then used as a fuel source for gas turbines. All this would be rated to produce 1000 MW for 26 continuous hours.

There are several more ideas floating around. I see Time-Of-Use Metering also being a major player in mitigating this very real problem.

* THEN there is another very difficult hurdle for our renewable electric power grid to overcome. The grid requires second-by-second balancing between generated supply and consumer demand. In the case of a sudden imbalance—such as from the loss of a generator’s output—all the remaining generators on the grid instantaneously pool together and put their shoulder to the wheel. Each one pitches in a small part of the required power to make up for the lost generation fast enough to keep supply and demand balanced. You can hear them grunt. Wind and solar doesn’t grunt because you can’t spontaneously increase wind or sunshine. Reducing consumer demand isn’t fast enough and existing inverter technologies face serious software problems. More to come on this.
* LETS TALK ABOUT PG&E A MINUTE. PG&E IS HARD TO KEEP UP WITH…. BRIEFLY, WHAT I HAVE IS:

PG&E reported to the PUC that from 2013 through 2017, 16,000 sections of it’s 106,000 miles of distribution lines fell, about 30% of those 16,000 sections stayed energized after falling. STAY AWAY FROM FALLEN LINES!!!! CA investigators have determined the company’s equipment played a role in starting 18 blazes that killed 22 people in 2017 and the Camp Fire in 2018, the deadliest forest fire in CA history. PG&E filed for bankruptcy protection January 29, 2019 as it faces more than $30B in potential liability costs related to its role in sparking CA wildfires. PG&E has recently stated it could switch off power on purpose to as much as 1/8 of the state’s population for as long as 5 days when dangerously high winds arise and has recently tested this new policy. PG&E said in the bankruptcy filing that it wants the ability to end hundreds of long-term power contracts, including those with wind and solar farms.

PG&E has filed with FERC for16% return on equity (presently 11%) to attract capital for quote: “harden the grid, support the state’s clean energy goals and deal with fire risks”. This is estimated to raise the average customer bill 7%. PG&E posted a profit of $136 million for the first quarter of 2019. PG&E expects to spend $1.4 billion in legal, safety and bankruptcy costs this year. Goov. Newsom has just proposed a bailout fund—paid for by ratepayers.

Now get this. If you don’t anything else out of all this yammering up here: Alex Carlin, Nuclear Regulatory Commission Judge, member of the Diablo Canyon Decommissioning Engagement Panel and SLO County resident says that PG&E has decided to suspend the current spent radioactive fuel program and instead delay all off-loading from the Diablo 2 spent fuel cooling pools to casks until 2032. What do the pools require that the casks don’t? Water, pumps to circulate the water and electricity to run the pumps. Delaying the transfer of spent radioactive fuel from the pools to the casks is bad news for all of us. This would mean close to 2000 spent fuel pins in the pools at Diablo in year 2032. Carlin says off-loading from the pools to casks is the single best way to reduce the radiological risks of Diablo Canyon. PG&E may have a point, the casks that they have used up to now are not rated to be transported, so they couldn’t be sent to a permanent depository such as the much needed but politically dead Yucca Mountain in Nevada anyway. RFPs for transportable casks are being prepared. Just a gentle reminder while you are enjoying your lunch: Cesium 137, a principal component of the fuel pins, has a half life of 30 years. Southern California Edison powered down SONGS in 2012. Contractor Holtec began transferring plant radioactive waste from wet to dry storage last year, 6 years after the plant closed Moving right along, PG&E’s decision to allow the company’s CEO to announce her resignation prior to the bankruptcy filing and remain eligible for her estimated $5.4M golden parachute is not helping. Fees for PG&E’s first bankruptcy in 2001 was $400million. Fees for Weil, Gotshal & Manges—PG&E’s lead bankruptcy firm, now charge double they did in 2002. PG&E recently announced Bill Johnson as their new CEO and replaced most of their Board. Bill Johnson led TVA, the largest publicly owned utility in USA. Good luck, Bill. OK, enough.

THERE ARE SOME LOCAL ELECTRICITY OPTIONS AVAILABLE:

* Starting 1/2020, San Luis Obispo and Morro Bay will participate in the State’s “Community Choice Aggregator” program. Both cities joined with the Monterey Bay Community Power Authority. In your monthly bill there are two basic line items for electricity: Generation and Distribution. If you choose to participate in this VOLUNTARY program, just the Generation would change. PG&E will still charge customers for delivery of electricity regardless who generates it. This agreement will allow the Power Authority to buy generation for you from any source…say for instance, and I believe this to be the goal, those that don’t produce greenhouse gases---and charge you the same price as PG&E now charges + a minimum 3% rebate on your December bill. However, the PUC has ordained that departing customers must pay an exit fee from PG&E, about 15% of the average bill, and, the PUC again, has estimated that residential customers leaving PG&E would see an estimated INCREASE of at least 1.68% over 2018 bills. So read the fine print!!!!!!
* Another opportunity CA customers will have in the near future is Time-Of-Use rate options. CA will soon be taking on the biggest test yet by putting over 20 million customers on Time-Of-Use rates. This will allow customers to shift their electricity usage to lower cost time periods when solar and wind are abundant. Again. I recommend reading the fine print.

Utilities have already shifted the most expensive KWH usage time from 4PM to 9PM

* And of course, there is solar
* AFTER CASTAIC, I WENT TO SYLMAR CONV. STA., the south end of a HVDC transmission line to Bonneville Power Administration’s station @ The Dalles, OR. At the time I was at Sylmar, it was +-400KVDC , 1800 A, 1440MW
* It is jointly owned. DWP:40%., SCE:50%, SCPPA:10%. Sylmar and the transmission line to the Oregon border is operated and maintained by DWP . The North end by BPA.
* Commissioned November 1970. 3 months later, the Feb,’71 Sylmar Earthquake. Mercury, asbestos & pcbs heaped all over the place. You’d think we’d know better. The converter station was cleaned up and the Intertie was back operational within a year.
* 3/10 of a cent kwh power came down the line from BPA to LA during Spring surplus for many years. This was when the Northwest couldn’t use the power, Columbia River Basin spring runoff would otherwise go over the dam spillways. So instead, they directed the spill water through the power plants, selling the power to Southern California. The transmission line paid for itself in 2 years. The transmission line is now used as a system peaker, seasonal, daily and hourly as scheduled. DWP has even purchased Canadian power, wheeled through BPA to the HVDC and ultimately to Los Angeles.
* Lets take an example, a work day. As the day starts, little sun or wind. The pump storage plant is generating and hydro power is being generated in the Columbia River Basin, sent down the HVDC to Sylmar. The morning ticks to noon and the renewables take over and provide all the power. Then the afternoon, when the renewables have excessive power, the pump storage plants start pumping water up the hill and power goes north to BPA, allowing their hydro power to slow down. This delicate balance continues for the rest of the day.
* The transmission line has been upgraded to +-500KV, 3100MW, with solid state thyristors, hanging like a swing from the station ceiling. Who says we can’t learn from history?. DWPLA has over 19,840 miles of transmission lines (115KV and up) in the West. It owns over 25% of the entire California transmission system.
* HVDC power quantity and direction is pre-determined and dialed in, and makes the grid more resilient, helping minimize wild power fluctuations and blackouts.
* Although expensive, HVDC is still being built. The latest is where private investors are proceeding with a 349 mile HVDC underground extension cord to carry renewable energy from Iowa to the Chicago area. The project, scheduled to operational in 2024, is estimated to cost $2.5 billion, twice as much as it would cost overhead.
* ???How do you recognize overhead HVDC vs. HVAC? 2 lines on a tower vs. 3. HVDC transmission towers are smaller & cheaper, rights-of-way narrower, lower losses than HVAC, but the converter stations at both ends are much more expensive, so you need a LONG transmission line, to justify HVDC.
* AFTER SYLMAR, MY RESPONSIBILITIES INCLUDED HOOVER POWER PLANT: On 12/21/1928, Pres. Hoover authorized a dam @Black Canyon on the Colorado River.
* It was to be a massive concrete arch-gravity dam, convex facing the water, transmitting the water’s force into the abutments.....sound familiar? 726 feet high, 1244 feet across the arc, 660 feet@ the base, the top 45 feet wide.
* Boulder City, 30 miles east of Las Vegas, was created for dam construction, and later stayed for operation & maintenance. It exists to this day a very, very nice town.
* The dam design and construction was a monumental challenge. Such a large concrete structure had never been built before. For example, concrete heats and expands when curing. So the builders poured concrete in blocks w/1” cooling pipes, later filled with grout. Grooved, interlocking joints were filled with grout also. There are interesting tiled Navaho & Pueblo Indian designs in dam walkways and halls.
* There were 112 project deaths.
* Congress approved the Project after DWP and SCE committed to pay for it with a 50 year contract for the electricity from the Hoover Power Plant.
* The Power Plant started operating in 1936, 2 years ahead of schedule. It has recently been upgraded to 2080MW.
* Hoover power gets to LA by an overhead transmission line, 287KVAC. Highest transmission voltage in the world at the time in the early 1930s. You’ll see it on the way to Vegas
* For 50 years, DWP operated and maintained the west side power plant and SCE the east side. Fed Bureau of Rec took over power plant operation & maintenance in 1987, but DWP is still guaranteed 12% of plant output.
* Behind Hoover Dam is Lake Mead. Lake Mead full pool elevation is 1229’, total capacity: 28.5M ac-ft. In 1983, Lake Mead was full, requiring use of spillways. NOW is only 40% full @ 1085’, 144’ below full level. The drought restriction trigger is 1075’, only 3 more feet down. This would require a whole lot of water rationing . Bureau of Reclamation is scheduled to announce in August whether a shortage will be declared in January, 2020. Upstream Lake Powell is only 38% full. The Colorado River Basin, which comprises 7 Western states, was in drought for the last 19 years and was more arid than any time in the past 1200 years until last winter’s storms.. 2018 was the 3rd driest year ever recorded, 43% of historical average. A Fed Interior Secretary has NEVER declared a shortage on the Colorado. The Colorado isn’t a relatively huge river. For instance, the Mississippi is 1000 miles longer and carries the equivalent of the Colorado’s entire annual flow every 2 weeks. But the Colorado supplies water to about 40 million people and irrigates about 5 million acres of farmland.
* Historically, how has Colorado River water been shared? With great deal of yelling and screaming, most of it in court or Congress. And the yelling and screaming is getting louder. For instance, the Lower Colorado Basin rights to water are presently by “prior appropriation”. The first person to make beneficial use of water has the right to use that quantity forever. The law came from the California gold rush. This puts AZ & NV rights junior to CA. Very intense discussions on how to share delivery cuts, if they occur, are still ongoing….And these cuts must be approved by Congress. One of the big sticking points to the negotiations is what to do about the Salton Sea.. Should it be treated like Mono Lake? But rest easy. The upper Colorado Basin has snow levels of 140% of normal as we speak and the Feds predict a Lake Mead level of 1081’ by the end of summer, 6’ above the trigger point.
* So we know where California’s power comes from, how about its water? On the average, about 80% comes from captured water in reservoirs, including about 10% from the Colorado River, groundwater provides about 18%, the rest from recycled waste water and desal.

Well, then, how IS CA water USED? 50% environmental, 40% agricultural & 10% urban. Basically, 70% of CA’s water supply is found in its northern reaches; however, the best farmland and 70% of the population are located in the south.

In November, 2018, CA voters rejected Prop 3, $8.9B of water bonds. CA voters last rejected a water bond in 1990. Since 1990, 9 CA water bond measures have passed. Not much has been done with the bond money other than the $1billion Oroville Dam spillway repair & tentatively raising Shasta Dam 18.5’ for $1.4 billion. BUT! The Shasta salamanders are fighting back! This plan for the raising of Shasta Dam hasn’t been settled yet that I know of. California has only spent 14% of the voter approved bond money specifically slated for more or higher dams. Interestingly, it seems the most contentious issue of more California reservoir capacity is “Who would get the water and at what price???”In February, 2019, the Russian River overflowed and inundated more than 2000 structures. The last major reservoir in CA, the New Melones, was completed in 1979, with a capacity of more than 2 million ac-ft, back when CA’s population was around 23 million. Now our population is about 40 million and no new reservoir has been built in CA for 40 years. As we all know, as air warms, it holds more moisture and warmer air also melts our snow packs faster. So a lot of our precious rain we got this last season, went down the hill, and into the ocean. And so is our snow melt. California has some 1400 dams. The largest 200 have a combined capacity of 41 million acre-feet. For comparison, Lake Mead maximum capacity is around 28.5 million ac.-ft. Rest easy. Our wet winter ended California’s drought after 376 straight weeks. Sierra Nevada mountains snowpack is 178% of average. In early April, water went over the infamous but repaired Oroville Dam spillway. You and I know the drought is over and couldn’t ever happen again. Besides, we are conserving water, right?

By the way, I think the CA DWR is doing a very good job with our water considering their restraints . Their forecasting is state-of-the-art. These forecasts allow efficient management of water for our cities and farms, our environment and hydro generation.

THERE IS ONE LOCAL WATER ISSUE TO WATCH THAT SHOULD BE VERY INTERESTING:

In 2014, CA instituted sweeping legislation to prevent groundwater depletion, identifying 20 “critical” groundwater basins, including Paso Robles/Shandon. Plans must be in place by 2020 to limit groundwater drawdowns. Newer wells in the Paso Robles/Shandon region are going down 1500’ to get to water. Proof water can be turned into wine. BUT! Who owns that water down there? Will the gold rush precedent of ”first beneficial use” prevail? Is this why all the frenzied planting and drilling? We will find out soon.

WHAT HAPPENED NEXT TO DEAR OLD, OLD DAD WOODSON? I WAS ASSIGNED TO THE MANAGEMENT TEAM OF THE INTERMOUNTAIN POWER PLANT PROJECT

DWP WAS THE PROJECT MANAGER FOR THIS

* Coal fired power plant in Delta, Utah, 2 units @ 950MW each.
* Project partners are 23 Utah municipalities and 6 CA municipalities, including DWP.
* AE: Black & Veetch (KC), Construction Manager: Bechtel. We commissioned Unit 1 in 1986 and Unit 2 in 1987, ON TIME AND UNDER BUDGET. A key to our success was the extensive use of P2 schedule/$/commodities software on an IBM mainframe, State-of-the-art at the time.The overall Intermountain Project Cost:$4.5Billion, including interest, land, coal, railroad, water, transmission, training (including a Control Room simulator), community improvements, ELABORATE PLANT BACK END POLLUTION CONTROLS, and a commitment to train only Utah residents for plant personnel and management (which has turned out very well).
* Delta, Utah is a small town, some 100 miles SW of Salt Lake City and is known for growing alfalfa seed. Over the 6 years or so of the project, we got to know quite a few locals. 3 legged chicken and alfalfa farmer Lombardi joke.
* Southern California gets power from this plant by the project financed +-500KV HVDC transmission line from IPP to Adelanto, CA. You can see this line when going to Vegas on I-15, next to the old 287KV Boulder Line.
* IT WAS CLAIMED BY OUR SITE MANAGEMENT TEAM THAT WHEN THEY WENT FROM CA TO UT, BOTH STATE’S AVERAGE INTELLIGENCE WENT DOWN
* So now, L.A. City Council has recently decreed LA to become coal-free by 2025.
* IPP is scheduled to be converted to natural gas by 2025 at a cost of $500million
* 1 mile from IPP, a 300MW solar plant is being built. It will use the IPP 500KV HVDC to get its power to Southern California. The Utah 1000MW energy storage plant mentioned before will also use that transmission line.
* I end with some info that is interesting to think about: Coal’s’s share of global electric power generation is at about the same level as 20 years ago—37%; The battle over the future of coal is essentially being waged in Asia, Asia accounts for three-fourths of global coal consumption today. More important, it accounts for more than three-fourths of coal plants that are either under construction or in the planning stages—a mind boggling, unbelievable, whopping 1200 of them according to Urgewald, a group that tracks coal development. Indonesia is digging more coal. Vietnam is clearing ground for new coal-fired plants.. Japan, still recovering from the 2011 nuclear plant disaster, has resurrected coal. Even Germany is using more coal. The world’s juggernaut, though, is China. The country consumes half of the world’s coal. China has added 40% of the world’s coal plant capacity since 2002 AND Chinese companies are building coal plants in 17 countries. USA exports of coal doubled in 2017, and are increasing. USA carbon emissions from power generation have fallen by 30% since 2005, mostly due to the substitution of coal with natural gas. Coal is cheap and plentiful but is the most polluting of fossil fuels. Coal remains the single largest source of energy to generate electricity worldwide. After a three-year period in which global CO2 emissions remained relatively flat, emissions of CO2 grew 1.7% in 2017 and about 2.7% in 2018. 2018 USA CO2 emissions climbed 3.4% even though USA utilities retired about 14 gigawatts (1gigawatt= 1 million kw) of coal-fired generation in 2018. Overall coal consumption in China ticked up last year, for the first time since 2013.
* According to the United Nations Environment Program, the world total man-made emissions of carbon dioxide and other greenhouse gases were estimated 53.5 billion metric tons in 2017. If the U.S.A. went dark and magically stopped emitting CO2 today, the rest of the world would continue to emit on the order of 45 billion tons a year, 10 billion tons more than the Kyoto Protocol world goal of 35 billion tons/year.
* The world is burning more coal, oil and natural gas than ever.
* World-wide demand for energy grew 2.9% in 2018, its fastest rate since 2010.
* U.S. energy consumption rose by 3.5% in 2018, powering U.S. oil and gas production in 2018 to the largest increases ever recorded by any country.
* Where would a guy that has generation and transmission experience finish his career? In distribution, of course! But that is another story for another time.