"As we think and argue about water, land, air, energy, open spaces, and other resources separately, and I hope wisely, we can never forget that man, including urban man, must always move and live and have his being in his total environment, not separately in each of the neat cubbyholes which the experts have laid out to facilitate technical analysis."--Luther Gulick in PERSPECTIVES ON CONSERVATION.

Nuclear power ... it's directly related to Colorado water problems.

An atomic power breakthrough, teamed with low-cost salt water conversion, would help relieve Southern California pressures on the Colorado River.

Cheap A-power would revolutionize water project planning concepts. Pumped-storage would reach unforeseen feasibility heights. Overlooked off-channel dam and reservoir sites would become economically attractive. Reversible pump-turbines would be used to shuttle water back and forth by off-peak pumping and on-peak generation, with close to 100% load factor. Hydropower capacity would be provided at sites where no natural flow exists. Municipal water distribution system planning would undergo basic changes.

But cheap power could have a dampening effect upon Colorado's participating irrigation projects. Hydropower revenues from the Colorado River Storage Project are their financial life-blood.

A-power breakthrough! Is it imminent? Most power authorities say No. But the cost gap may be closed in some parts of the U.S. by 1970.

A-power development started out like cloud seeding in its early days. Success predictions over-reached the advance of solid scientific knowledge. Current status: Disillusionment, uncertainty, downgrading of availability timing, shifting of A-power research gears.
A-power's high-speed passing gear was supposed to overtake conventional generation methods rather quickly. Atomic Energy Commission forecast in 1955: 2 million kilowatts of atomic energy capacity by 1960. Probable atomic capability by the end of 1960: 470,000 KW.

Now—a shifting back into the typical low gear of difficult scientific research. It's a slow hacking away at endless flies in the power cost ointment.

Basic difficulties: Unexpectedly high costs. New A-power plants are costing much more than anticipated. Also: Tougher-than-expected cost competition from conventional steam plants using coal, oil or gas as fuel. There's much confusion over a choice of A-power generation methods. A noticeable relaxation of federal efforts is attributed to a slackening of competition from Russia.

Russia appears to have been soured on A-power by high costs. She seems to have shifted towards quick expansion of coal, oil and hydroelectric energy sources.

Cost breakthrough point: About 7 mills per kilowatt-hour generally in the U.S. Cost average for all U.S. steam plants is about 8.5 mills. Newer steam plants usually average about 7 mills. Hydroplant average: Generally about 4 mills.

Present A-power costs: 40 to 60 mills at the 60,000 KW federal plant at Shippingport, Pa. . . the only commercial-size plant now in operation in the U.S. This price is non-competitive, except in isolated remote areas having very high delivery costs for fossil fuel.

Narrowing of the cost gap to between one and two mills appears to be almost within reach. A utilities combine anticipates 8 mill energy at its recently completed 180,000 KW Dresden, Illinois plant. The Dresden reactor, now undergoing tests, is the world's largest single unit, all-nuclear powerplant.

Reactor? It's an atomic furnace. It produces heat through controlled fission (atom splitting) of uranium or plutonium. In a sense it burns these metals as atomic fuel. This burning runs wild in an atom bomb. In a reactor it is held in check to produce heat and power, providing the controls function properly.
Sterns-Roger Mfg. Co. of Denver has prepared detailed designs for a spectacular $4 million atomic "runaway" reactor which is built to work safely while delivering violent surges of atomic power.

A 62,000 KW reactor is being constructed by a utilities group at Sioux Falls, S. Dak., to try out a process which AEC estimates will eventually produce 6.7 mill power. AEC also predicts that a small A-plant being constructed at Piqua, Ohio will eventually produce 6.7 mill power.

The Los Angeles Dep't. of Water and Power and the City of Pasadena are considering construction of two 300,000 KW atomic powerplants. Private firms say they can build these plants to produce 8 mill power . . . almost down to the 7 mill rate generally considered competitive in California.

Theoretically, the A-power cost gap seems to be almost closed. But practically the gap is far from closed. It's like an all-out goal line stand by a rugged cost defense, with an offensive AEC team that is not too aggressive.

AEC recently unveiled a 10-year program aimed at reducing the cost of nuclear power in commercial-size units to 7 mills by 1968. AEC's planned expenditures: $230 million a year for 10 years, with $108 million research and development and $122 million construction. AEC's 1961 request: $171 million, with only $24 million for a new reactor.

There's grumbling about AEC's program. Some call it "nothing new 'til '62". Careful reading of AEC's reports indicates that 7 mill A-power by 1968 is probably unrealistic. Reason: AEC says current technology can produce 9.56 mill power "after the period of time required for plant construction and fuel cycle equilibrium."

James Grahl, Director, Atomic Energy Service, American Public Power Association: "Allowing 1 year for design, 3 years for construction and 3-4 years for fuel cycle equilibrium, this indicates a 300 megawatt PWR (pressurized water reactor) started now would produce 9.56 mill power by 1968."

Another complaint: AEC seems to be waiting for changes in attitudes of private utilities' top management.
AEC (in 10-year program statement): "Competitive power will have been achieved when utility executives can decide to build nuclear stations based on economic considerations."

Private utilities have already spent or committed half a billion dollars on nuclear development. They have given the A-power cost bronco a hard ride, with two spurs discernible. One is fear of government domination if they lose the initiative. The other: Lure of unlimited cheap energy.

AEC (Semi-annual report 7/58): "Assuming that someday a fusion reactor fueled with heavy hydrogen can be operated successfully, it may be expected to have the following advantages:

"(a) The fuel costs would be extremely low. At present, deuterium (heavy hydrogen) costs about $140 a pound to produce. If its nuclear energy content could be converted into electrical energy, a pound of deuterium could yield 40,000,000 KW of electricity. The gross fuel cost would be 0.0035 mills per kilowatt-hour. This figure does not, of course, consider the capital costs of the reactor which may be considerable.

"(b) The fuel supply would be virtually unlimited. Heavy hydrogen exists in all surface waters of the world - the total of this deuterium is estimated at one hundred thousand million, million pounds. Complete fusion of this quantity of deuterium would produce one thousand million, million, million kilowatt years of electricity. At present, the United States use is at a rate of 72 million kilowatt years."

Meanwhile, power realists are hard-put to keep up with load growth. During the last quarter-century electric utility generation has increased over 700%, or more than 2-1/2 times as fast as the increase in real (stable dollar) gross national product. Electric load growth is doubling every ten years. The U.S., with 1/16 of the world's population, generates about 40% of the world's electrical energy. During the next 20 years U.S. energy requirements are expected to increase more than twice as fast as population. Needed by 1980: 300 million KW additional generating capacity . . . in addition to today's 160 Mkw.

There's room for all in the power market . . . steam power, hydro power, thermal power . . . even public and private power.

George Lof, Denver Consulting Engineer: "A Texas oil well on a quarter section of land would have to produce crude oil at a perpetual rate of 2500 barrels per day to have an energy output equal to the sunshine falling on that piece of ground."
Lof points out that because solar energy lacks government research subsidies, it probably won't furnish more than one percent of the nation's energy needs by the year 2000. Present solar energy generation cost: Over $50,000 per kilowatt, compared with fuel-operated plant costs below $200.

Colorado has vast energy reserves . . . falling water, coal, oil shale. The Denver lab of the U.S. Bureau of Mines has been experimenting with use of low grade Rocky Mountain coal for steam power purposes.

Warling J. Ankeny, Bureau of Mines director: "These coals are abundant in the West and we believe that their major future market is the production of thermal power (electrically generated by steam)."

Colorado oil shale may become a commercial source of energy within 20 years, possibly with the help of underground nuclear explosions. From a long-range standpoint, one of the most interesting developments in recent years is research indicating that oil shale is a good raw material for production of high-Btu fuel gas.

M. A. Elliott, Director, Gas Institute of Technology: "If Colorado oil shale deposits were used for gas production instead of oil, 6,000 trillion cubic feet could be produced therefrom."

There may be some by-product electrical energy produced from oil shale operations. Experts differ on this. Some say none. Others say maybe 4 million KW can be produced from low grade gas as a by-product of a 1-million ton per day oil shale industry. Then there's by-product uranium . . .

Russell J. Cameron, President, Cameron & Jones, Inc., Denver: "Uranium as a by-product of oil shale processing is of the greatest significance in considering long-term future resources of energy."

Western slope oil shale development means people. People use water . . . lots of it! Oil shale processing, as such, will use little water. It's the related municipal and industrial development that is expected to put new pressures on the dwindling Colorado River water supply.

Water rich, energy rich Colorado . . . what a combination. What a potential!

Colorado's vast energy reserves are sidelined by cost competition. But they are staying put. In contrast, Colorado's once vast water reserves are slipping away
to permanent downstream commitments.

Why? There are reasons, some good, some inexcusable. Much of the trouble can be boiled down into one word ... attitudes. Example: Colorado's leave-it-to-uncle attitude. This results in endless delays and unnecessary interstate water give-aways ... concessions to California here, New Mexico or Arizona there. It's the price that has to be paid for congressional authorization and project appropriations in a give and take political situation.

Another source of Colorado's water troubles has been her attitude of extreme preoccupation with water law and a lack of aggressive water development leadership based upon imaginative, sound engineering planning. Intra-state court battles over water have been fascinating treadmills to participants and observers alike. But they don't develop much water.

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Russian power development ... there's a difference of opinion on its status.

On the US-is-far-ahead side: Private power utilities. One the USSR-is-catching-up-foot side: Public power interests. Representatives of both sides have toured Russia and have issued reports.

Public power-private power differences in general viewpoint erupt in unpredictable spots. Latest eruption: Opposition to Curecanti by Earl G. Armstrong, secretary-treasurer of Englewood-based Colorado Central Power Co. Armstrong sent letters to congressional delegations on Capitol Hill "as a taxpayer and private citizen" urging them "to do all within your power to prevent any appropriations for the Colorado Curecanti Dam Project."

CCP Co. has not taken an official stand against Curecanti. Armstrong explains that his letter was written with complete unawareness of the importance of Curecanti to Colorado's water development program. He says that had he known the full facts he never would have written the letters.

This experience emphasizes the importance of getting water information out to the people of Colorado.
Investor-owned private utilities and public REA's are pulling together on one matter... a strong push for federal funds for a USBR construction start on backbone power transmission lines from Glen Canyon to Curecanti and to Poncha Springs, near Salida... and from Flaming Gorge to Oak Creek. This is sparsely settled country that's unattractive to private utilities.

Beyond this... unsettled disagreement territory. Privates want to build backbone lines from Oak Creek and Poncha on into major load centers. Publics want the USBR to build all of the backbone lines.

General principles on storage project power market have been proposed to Interior by the Upper Colorado River Commission. Primary market area: Upper division states (Colo-NM-Utah-Wyo). Secondary market area: 1-Arizona 2-Parts of California and Nevada within the Colorado River basin. Priority order: 1-Primary preference users (REA's, municipalities) 2-Secondary preferencers 3-Primary private utilities. Approval by the Secretary of Interior is expected.

Still unsettled: Permanent allocation of storage project power among basin states. Colorado wants 535 megawatts of Flaming Gorge-Glen Canyon-Curecanti power for her markets, in three steps: 170 mw by 1960... 375 mw by 1975... 535 mw by 1980. That's an ultimate 46.72% of total capability... about the same as Colorado's share of the storage project power revenue pot. But other states have different ideas. Hot-seat decider... Secretary of the Interior.

New Mexico-Colorado differences over water have reached a new intensity. They've been simmering for some time. New Mexico is ready to use her share of Colorado River water... if she can get authorization for her Navajo and San Juan-Chama irrigation projects. Consequently NM has shown less than adequate enthusiasm for Colorado's concern about lower basin water grabs.

But the trouble goes much deeper. USBR's project reports on San Juan-Chama and Navajo were completed in 1955. Authorizing legislation has been repeatedly introduced in Congress, without results. Colorado hasn't gotten around to formulating a policy on these NM projects until now. This delay is regarded as inexcusable
and it has deeply irked New Mexico.

Now Colorado has a policy . . . but it is unacceptable to New Mexico. Controversial point: New Mexico's proposed project legislation would put a heavy burden on Colorado's Animas and La Plata rivers, which enter the San Juan below Navajo Reservoir. Colorado needs this water for her proposed Animas-La Plata Project. There isn't enough water to do both jobs.

The Southwestern Water Conservation District, located in Colorado's San Juan basin, demanded an amendment to the authorizing legislation which would place the burden of downstream rights on Navajo Reservoir, rather than on Animas-La Plata Project water. Probably about 10,000 acre feet of water a year is at stake.

Both sides have appeared adamant. Both sides have talked rough. At one point SWWCD threatened that NM may not be allowed any uses at all out of Navajo Reservoir. Then came a Colorado claim for the first 42,000 acre feet out of Navajo. New Mexico refused to even discuss it.

Navajo Reservoir is an interesting Colorado River upper basin compact offspring.

CWCB Director Sparks: "The Navajo Reservoir was built as a mainstem project although no benefit accrues whatsoever to the other states by virtue of its construction. Nevertheless, New Mexico was given about two full years of the storage project revenues to build this Navajo Dam. Actually it is strictly a 100% New Mexico project. In it New Mexico can utilize holdover storage. But under the terms of the Upper Colorado River Compact, for some reason unknown to us at the present time, we are required to make annual deliveries into the State of New Mexico for its allocation based upon the flow of the entire Colorado River . . . That, in some years, requires the entire flow of the San Juan basin to make up the 11⅔% allocated to the State of New Mexico . . . If we deliver to New Mexico twice as much water as they need or are entitled to in any year, we get no credit for it. If we have a shortage the next year, we have to make up the full water supply. Yet they have a reservoir which we have helped build in which they can get holdover storage."

The Colorado Water Conservation Board is attempting to work out a compromise solution that will be consistent with Colorado's prime objective . . . assurance that the Animas-La Plata project will be built if feasible. Director Sparks has obtained speed-up assurances from USBR on the A-LP feasibility report. It was scheduled for completion in late 1963. Now it may be completed within a year.
USBR officials are also trying to help resolve the Colorado-New Mexico controversy.

Looking over CWCB's shoulder . . . Fry-Ark and Curecanti project pushers.

New Mexico says she won't support Colorado projects before Congress unless she has her way on San Juan-Chama and Navajo. NM's hard-hitting delegation to water talks with Colorado is headed by Governor John Burroughs.

Congressional appropriations hearings open on Capitol Hill on April 11th.

Colorado's governor and congressional delegation will support all upper basin projects, including New Mexico's. But New Mexico may choose to flex her congressional muscles against Colorado. Even if Colorado and New Mexico agree, there's no assurance that Congress will agree to the language in New Mexico's amended project bill.

No action has been taken on Interior's proposed filling criteria for Glen Canyon. Upper and lower basin engineers met on March 21-22 to talk it over.

The House has approved a contract between the United States and Colorado's Conejos Water Conservancy District, located in the San Luis Valley. It provides for a variable repayment plan based upon availability of water for use on project lands within the district.

A two-mile deep well in Denver's backyard . . . It's being proposed as partial solution to a serious well water contamination problem at the Rocky Mountain Arsenal. Chemical wastes would be pumped down through the well under pressure into a porous sandstone bed. Estimated cost: $500,000.

National attention is being focused upon water pollution problems. The situation is serious. Pollution in America's rivers is symbolic of an era of exploding metropolitan population and inability to raise funds to cope with resultant problems.

Warnings are being sounded. Colorado's Health Department has published an interesting booklet, "We Can Clear Up the South Platte River". It notes that 72 communities and 45 industries discharge wastes into the South Platte Valley where two-thirds of the population of Colorado resides. Inadequately treated waste water is used to irrigate vegetable crops.
Colorado Health Department: "Anything eaten raw, such as celery, lettuce, onions, berries can carry disease germs if irrigated with polluted water, which also can infect stock with parasites that endanger both cattle and people in the area."

The Colorado River also needs a scrubbing, according to Arthur S. "Cranberries" Fleming, U.S. Secretary of Health, Education and Welfare. He called a 7-state conference in Phoenix last January to consider inter-state aspects of pollution problems in the Colorado River and its tributaries . . . particularly radioactive contamination from uranium milling operations.

Teaming up with health department experts . . . state game and fish people. Also the Atomic Energy Commission. Incentive for the proposed basin-wide cleanup apparently came from the highly successful program to rid the Animas River of pollution resulting from uranium milling operations at Durango.

Secretary Fleming has warned that water pollution could "jeopardize the further growth and development of many areas of the country and even the health of millions of people". But the President appears less concerned. Presidential veto of the $900 million water pollution bill has sparked much controversy. The bill would have increased federal grants for construction of sewage treatment works.

Pollution control is an important election year issue. It spotlights basic differences in opposing political philosophies.

President Eisenhower: "Because water pollution is a uniquely local blight, primary responsibility for solving the problem lies not with the Federal Government but rather must be assumed and exercised, as it has been, by state and local governments."

National Rivers and Harbors Congress: "The control and abatement of pollution is, primarily, a state or local responsibility. A heroic effort has been made throughout the country to stem the tide of pollution, but despite these efforts the problem continues to grow until today it has reached national proportions requiring a nation wide effort. In this the Federal Government can and must take the lead. Rivers and streams, after all, know no artificial boundaries but flow from town to town and state to state on their way to the sea. The Federal Government's responsibility is clear".

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