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The Environmental Bi-Weekly

# High Country News



Vol. 6 No. 7 35¢

Lander, Wyoming

Friday, March 29, 1974

## Heat and Power from the Sun Harnessing Limitless Energy

by Joan Nice

Denver inventor Jerry Plunkett won't work on anything that is environmentally unsound. "That's as stupid as working on something that's economically unsound," he says. Lately Plunkett has been attracted to the possibilities of solar heating systems.

Plunkett earned a Ph.D. at MIT in 1961. He "gave up science seven years ago to become an inventor." His firm, Materials Consultants, Inc. hopes to have solar heating kits for homes this summer.

Plunkett says that the potential for solar energy systems in the Denver area is colossal. "More heat falls upon the roof of the typical well-insulated house than is needed to heat it during the winter season," he says. "The great need is for low-cost practical systems that builders and developers can install."

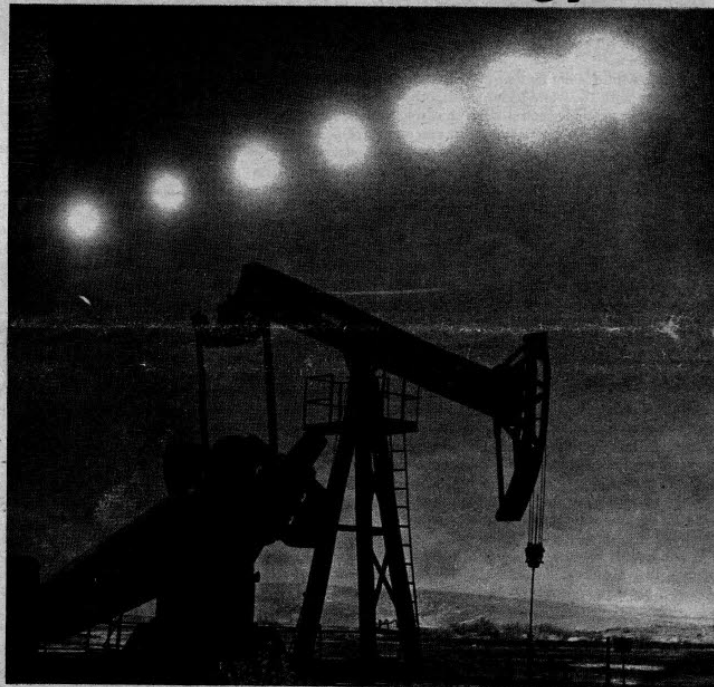
Plunkett's "beer can collector" is not his best model, he says, but it certainly is within the reach of the average do-it-yourselfer. Collector construction requires plywood, 2 x 4 studs, aluminum beer cans, plastic, glue and black paint. At a cost of about 50 cents a square foot, the assemblage can deliver about 60% of the solar energy which falls upon the collector, Plunkett says.

The aluminum cans are cut in half and glued to the plywood at half-inch intervals. The plywood is edged by the 2 x 4's. Then the whole honeycomb assemblage is sprayed with black paint and covered with plastic. In the same way that a greenhouse is warmed, air flowing across the collector is heated by the sun and trapped in the collecting box.

In Denver a well-insulated house needs about one-half its floor area in collector space. That is, a 1,200 sq. ft. house would require a 600 sq. ft. collector. At 50 cents a square foot, a beer can system would cost about \$300. As a supplement to electrically supplied heat, the collector could save the homeowner around \$600 to \$900 per year, Plunkett calculates.

Under a U.S. Navy contract, Plunkett designed and built a \$15,000 solar heating system for two homes in Hawthorne, Nev. (see centerspread photo). For these houses he used a wire mesh instead of aluminum cans as the absorbing layer. Each collector is a shallow 15 x 45-foot plastic-covered box. Air heated in the collectors passes through a heat exchange system. Excess heat is stored in a 2,100 gallon water storage tank. Plunkett used the existing forced air system to distribute the solar-heated air.

When the house temperature falls below a pre-set point, in the Nevada dwellings, a ther-



"Little wonder then that our attention ought to be drawn to the sun. In that fiery star we have a source of energy virtually without limit; a source of energy that poses no ecological problem for the earth; a source of energy that can free our fossil fuels for more important uses in the future, such as conversion of oil to protein to feed the hungry peoples of our world."

Photo by Lynne Bama

—Dr. Peter E. Glaser

mostat switches on, calling for hot water to be circulated between a heat exchanger and the hot water storage tank. When the heat exchanger reaches 100 degrees Fahrenheit, the blower is activated. Air drawn through the heat exchanger is heated and transported to various outlets in the duct system.

A number of other solar home-heating schemes have been proven in the Rocky Mountain West. For the past 15 years Dr. George O.G. Lof, a professor of engineering and director of the Solar Energy Research Lab at Colorado State University in Fort Collins, has been living in the solar heated house he designed. Lof's system consists of two black metal boxes with

glass lids on the roof of his home. Air heated in the boxes is piped to a 12 ton bin of rocks which heats the air for his home.

Rocks, water and salt have all been tried for storage of the solar-collected heat. In Lof's view the proper storage medium "depends entirely upon what you're picking up the heat in."

"If you're picking up the heat in water in your collector, you store it in water," Lof says. "That's the logical, cheapest way to do it. If you're picking it up in air, then you store it in rock."

Which should you use — air or water — to pick up the heat? "I don't think that's clear yet,"

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## HIGH COUNTRY

By Tom Bell

Hints abound. The signs of spring are in the air. From the distance comes the wick-wick-wick of the flicker, and across the way, male redwing blackbirds call their onk-a-ree, onk-a-ree. The mysterious whistle of wings floats down the evening breeze as pintails pursue their ageless journeys into God knows where. Last Saturday, 16 whistling swan preened and swam and fed on the lake south of town.

Winter gives way begrudgingly, of course. What seems full-bloom spring one day leads to the sudden quiet of snow gently falling the next. But the sun bears down warmer each day as it rises toward the summer solstice. Green grasses and gentle zephyrs can't be far away.

Spring is that time when the living feels rebirth and renewed hope. If it were not so, the buds would not swell on cottonwood, nor catkins appear on the willow. The bulbs and shoots and rhizomes all feel the inner stirrings. So, too, the restless nature of Man.

Somehow, the gloom of winter seems to lift from body and soul. And though the worries of the world are still there, they seem easier to bear. It is as if God knew we needed respite.

But the respite is not for long. While some would make their peace with the world about them, others gear up for the struggle to conquer and subdue that world. Make hay while the sun shines is an adage that can as well be pursued by strip miners as by farmers. It is much easier to launch some vast new project in the summer than when winter blizzards are blowing.

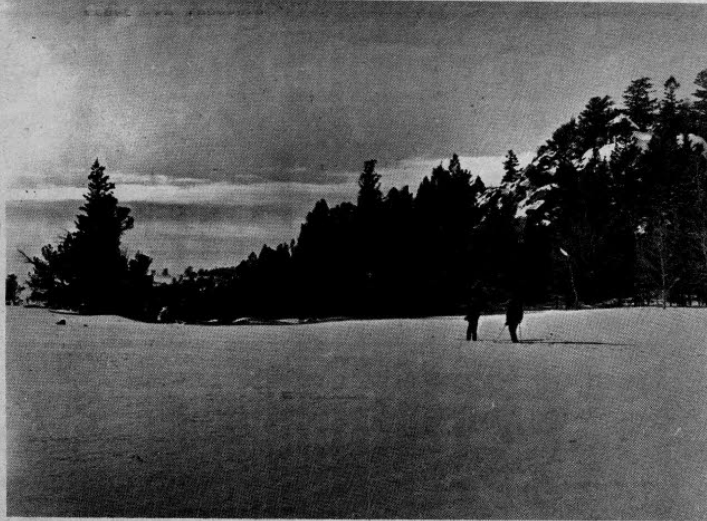
And so the West can brace itself against the onslaught of the developers. With actual gas rationing receding to a more distant horizon, the land scalpers will be back in force. And with the threat of gas rationing present, even though distant, will come the energy hawkers. Ambitious plans to gut our land become more ominous with each new day of spring.

What makes the coming summer — and the coming years — even more sobering is the attitude of people. Always willing to be blindly optimistic, they are prone to take their share today and gamble that tomorrow they can do the same. The trouble with Americans is that their take is far beyond what an average citizen of the world gets to take — and getting larger. And Americans suffer the delusion that our system is self-perpetuating of that situation. Warnings of an energy crisis raises the cry of 'hoax!' Equally serious warnings of food shortages, material shortages, or serious environmental problems receive a similar reaction.

We have only begun to grapple with the real problems of keeping our air clean enough to breathe. But at the first sign of a personal problem in getting enough gasoline, or having enough electricity for the air conditioner, the average American cuts and runs. It makes no difference that the president of the American Health Association warns that respiratory diseases — and resulting deaths — are going to escalate astronomically if we relax air standards. A down-grading of our national air quality comes at a time when it was finally beginning to show some slight improvement. Now, the Nixon White House staff proposes to cut the heart out of the 1970 Clean Air Act.

The attitude of people can clearly be seen in the results of polls. Two are reported in this issue of High Country News. The one from Utah is particularly dismaying. In that survey, a little over two-thirds of the people polled would favor construction of the giant Kaiparowits plant even if it meant relaxation of environmental standards. The entire output of the plant would go to southern California where those people have already destroyed a clean air resource.

New Mexico enacted its own environmental policy act three years ago. When it began to be burdensome to some state agencies, amendments were sought. But opponents wouldn't accept amendments. This year the legislature repealed the act and the governor refused to veto the repealer. New Mexico is left without protection.



## Letters



Tom,

The nation's appetite for fuel resources has caused serious problems in Wyoming. Energy development projects have created a phenomenon reminiscent of the Gold Rush Days — the "Boom Town." Gillette, Rock Springs, Green River and Kemmerer have already been directly affected. In addition, Sheridan, Buffalo, Douglas and Wheatland are destined to grow dramatically in the near future.

What can be done to insure orderly development and growth in Wyoming? One approach is to coordinate federal mineral leasing policy with the ability of individual communities to assimilate growth. Let's take a hypothetical example to illustrate this idea. Before federal mineral leases are opened for bids in the Powder River Basin, the ability of City "A" to provide needed services is determined by the appropriate state agencies. This information is then fed by computer to the Department of the Interior and carefully noted. In the case of City "A", adequate sewer and water systems are lacking. Housing is in short supply and the existing school system is also inadequate. A sudden influx of 5,000 additional people would overwhelm these facilities and create tremendous problems. As a result, mineral leases in the area of Community "A" are delayed for 18 months so that the appropriate state agencies can prepare the community for the impending growth.

Similar data collected for Community "B" indicates that this City employs a professional

### High Country . . .

A poll in Idaho showed an overwhelming desire of the people to protect its streams. Three years ago, the legislature passed the Stream Channel Protection Act. Last year, the legislature voted to repeal the act. It was vetoed by Idaho Governor Cecil Andrus. This year the Idaho Senate has before it a bill identical to the one vetoed last year.

Where does hope begin and despair end? Will it indeed have to come to a "Silent Spring" before Man awakens to the self-induced danger to his own survival? Or will there come a year when there will be no Man to greet a Spring?

planner, has adequate sewer, water and educational facilities and a strong land use ordinance. Mineral leases are therefore open for bids in the area surrounding Community "B".

It would not be an exaggeration to say that a lack of planning has resulted in the creation of tremendous problems in southwest Wyoming. This blunder need not be repeated again. Cooperation between the affected federal and state agencies and the "impact communities," can insure orderly development and growth in Wyoming.

Sincerely,  
Gregory Paul Capito  
Concerned Citizen  
Laramie, Wyoming

Dear Editors:

Just received your March 1st issue of High Country News yesterday. You are to be commended on the very educational and informative newspaper you publish. I do not want to miss a single issue so am sending in my subscription right away.

As a farmer, I feel very close to the land and deplore what has and is going to be done to it. As stewards of God's earth, I don't think we can take our responsibility to care for the land lightly.

For political and economic gain, people and the land are thrust aside. We are aware of how the Bureau of Reclamation has ruined the land and lack of concern of the people in the Garrison Diversion Project.

Sincerely,  
Albert Klain  
Turtle Lake, N.D.

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# Editorial



## Playing With Fire in the Grand Tetons

The National Park Service's latest plan to reintroduce fire into Grand Teton National Park (see story page 6) is backed up by good intentions and sound biology, but it is bad policy none the less.

Through man-initiated and machine-controlled fires the Park Service hopes to re-create an ecological condition which they refuse to let nature initiate and control. The Service is disturbed at the buildup of fuel on the forest floor, and want to set a fire to remove it "naturally." It seems that if the conditions are ripe for fire, nature will discover the situation without man's help.

The researchers have made tree ring studies and historical searches to determine the fire frequency in various areas of the park. When nature is not on schedule or has been turned away by Smoky Bear, the Service feels it is their duty to step in with a match and a shovel.

The Service bases its authority on the principle put forth by the Leopold Committee (1963) on wildlife management in the national parks which said, "A national park should represent a vignette of primitive America." To accomplish this end, the committee proposed, "As a primary goal, we would recommend that the biotic associations within each park be maintained, or where necessary recreated as nearly as possible in the condition that prevailed when the area was first visited by white men."

This principle is fine at first reading, but, as it was pointed out by early critics of the report, "There is a danger that these phrases might be misrepresented as meaning . . . maintained as static museum pieces." The Wilderness Society feared at that time that the Park Service might turn into a force of "gardeners" instead of "guardians." Their fears may be coming true today.

Adolph Murie, a noted wildlife authority, naturalist and a year-round resident of Grand Teton National Park, is opposed to the park burning program. He says "the new proposed policy of 'gardening' our park forests, may result in a patchwork of small burns, curbed by spaced firebreaks or breaks made by a blade. I suppose the policy has its inception from the controlled burns practiced in the redwoods in Sequoia-Kings Canyon National Park where the actual reproduction of the redwoods has been curbed by over-enthusiastic fire suppression in past years. Burning may have been justified there, but I do not see the justification for the practice in Teton Park."

Human life should be protected from wildfire, and we should not allow fires to endanger developments within and around the park, but the park's management proposal carries the safety issue to the extreme. The zone where the Service plans to allow lightning fires to run their course is confined to the mountainous western portion of the park where "topography is rough and firebreaks are numerous." In most of the valley floor, the region which has suffered the most from the park's old total fire suppression policy, natural fires will continue to be doused on sight. Here man's fires or forest clean up will "approximate" nature's hand.

This approximation will vary from small fires contained by firebreaks to "manipulation of vegetation" on land within 1/4 mile of developed areas" by "mechanical fuel reduction, logging, planting etc." Clearcutting of small strips or patches around developments may be used

since there will be "no attempt made here to create any semblance of natural conditions."

The burning will not be limited to a few small areas either. Like a long-lost child, fire is so important to the park managers that future forests have only one way to die and be reborn — fire. In the aspen forest the researchers have determined nature meant to have a fire every 50-100 years. To make sure no tree is allowed to grow old, the Service is recommending that "approximately 10% of the aspen type in Grand Teton National Park should be allowed to burn or burned through prescribed use of fire during each decade."

Why should the public stand for an approximation of nature's work in the National Park System? We already find nature's work compromised in every other portion of our lives. We are told we can't let natural fires run their course in most of the park to protect the lodges, campgrounds, ranches and private homes within the park. Do we value overprotecting these developments more than the natural environment of the Grand Tetons which the park was established to preserve in the first place?

In the name of visitor safety we have driven

wolves and grizzly bears from the parks that were to be their last refuges. Proclaiming that "parks are for people" we filled Yosemite with smog, put a curio store on Rocky Mountain Park's fragile tundra and backed the waters of Lake Powell under the Rainbow Bridge. Is there any place on earth that is inviolate? Where shall man turn to to experience his insignificance in the natural world if his handiwork is carved into every landscape?

Naturally occurring fire is a crucial part of the ecology of all our national parks. To eliminate fire from the park system was folly, and the Park Service should be commended for ending the era of total wildfire suppression. But just as it took us 75 years to realize the importance of fire in Grand Teton Park, we must recognize that most of the workings of nature are poorly understood and so misrepresented, underappreciated and poorly imitated. All the tree ring studies you may want to do cannot tell you when the next lightning fire will naturally occur in a forest.

Let's experiment in the National Forests. Let's observe and learn from nature in the National Parks.

—BH



"UH, HOUSTON (chuckle) THAT SOLAR HEATING EXPERIMENT GOT AWAY FROM US FOR A MINUTE..HOUSTON? HOUSTON?"

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## Limitless Energy . . .

(Continued from page 1)

Lof says. "If I were to predict today, I'd say they both would be used in the future."

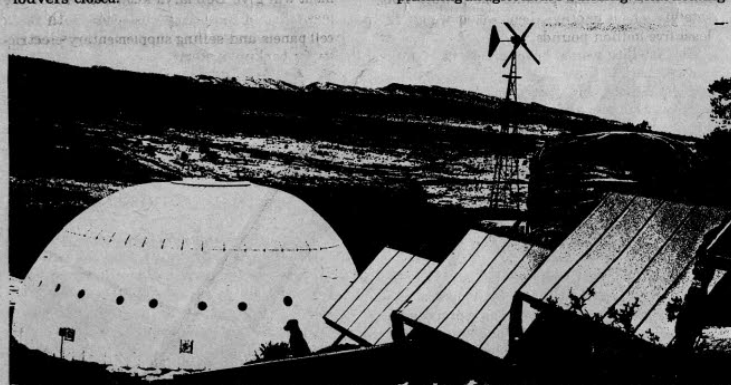
Another thing to consider in making the choice between rocks and water is that rocks take about three times more space, Lof says. And a water tank costs more than a container for the rocks.

### AN ENERGETIC MAVERICK

Steve Baer, a solar inventor in New Mexico, has been experimenting with salts as a medium for heat storage. Although they may have potential, they aren't dependable yet. After several cycles of melting and refreezing, the salts sometimes won't refreeze — and then they can only store the amount of heat that an equal amount of water could.

Baer is an energetic, dedicated maverick in the solar world (see HCN centerspread, Jan. 1, 1974). He heats his home with south-facing walls made of 55 gallon oil drums filled with water. The system uses 6,000 gallons of water in all. At night the drums are shielded and their heat is held in by pulling outside wall panels up with ropes.

This system operates in concert with "skylids," insulated louvers which open automatically when the sun is shining. They are activated by inside and outside canisters containing freon. When the outside canister is receiving more heat, it pushes the freon into the inside canister, tipping open the louvers. When the internal canister is warmer, the gas moves back outside and the added weight tips the louvers closed.



Eileen and Bob Reines' solar-heated, wind-powered home near Tijeras, N.M. The boxes on the hill above their dome-shaped house are solar collectors. Heat is stored in the large water tank behind the collectors. In their next house, they'll put the collectors right in the "skin" of the dome, they say.

Five years ago Baer started a company called Zomeworks. Today, the firm researches, manufactures, develops and consults — mainly in the field of solar energy. The company is building solar heating units for houses in Virginia, Maine and California.

Businessman Baer's style is unique. He prides himself in buildings — not paperwork. And he tosses all profits back into the research kitty.

A couple of Baer's New Mexican neighbors, Eileen and Bob Reine have built themselves a combination wind-solar home. They take electricity from the wind and heat from the sun. They hope that the idea will serve as a model for other energy self-sufficient dwellings.

Their house is a 31-foot diameter dome. Solar collectors and a water storage tank dot the hill above it. The company they've set up, Integrated Life Support Systems Laboratories, soon plans to build improved hemispherical houses with solar collectors built into the "skin" of the structures. Ultimately, they'd like to offer wind-solar home kits, which could be built by amateurs and would cost no more than mobile homes.

The Reines' ILS Labs is what Bob calls "free of the usual bureaucratic encumbrances of the conventional corporate form." Like Zomeworks, this "laboratory" has no time or money for much paperwork.

### BEYOND IDEALISTIC INVENTORS

While independent inventors are proving that solar houses work, traditional institutions and business interests are taking cautious steps in the same direction.

To prove its support for the technology, the Colorado Springs City Council waived \$1,400 in sewer and water tap fees for a solar home in the Vista Grande residential area northeast of town. Solar equipment will add a cost of \$15,350 to the \$45,000 home. The house's annual heating bill will be only \$60 per year, however. A local contractor estimates that natural gas heat would cost \$182 and electric heat \$756 per year in the area.

Two colleges in the Rocky Mountain West, Community College of Denver and New Mexico State University, plan to use solar power to heat and cool new facilities. New Mexico State is planning an agriculture building. Solar heating

most parts of the country — both technically and economically.

For house heating and cooling "solar energy isn't coming. It's here," Kula says.

### SOLAR POWER PLANTS

Heating and cooling applications are particularly suitable for the sun's rays. The rays are diffuse and of a low temperature, which is all that heating and cooling require. The production of electricity from the sun, however, takes more technical magic. Various techniques are receiving attention. Heat engines are built by focusing the sun's rays on a boiler and using the steam produced to turn turbines to generate electricity. Direct conversion of sunlight to electricity is achieved by solar cells, a process called "photovoltaics."

A large amount of land space is taken up by most heat engine systems. A plan conceived by Dr. Aden Meinel of the optical sciences center of the University of Arizona and his wife, Marjorie, would need 13 square miles of collectors for each 1,000 megawatt solar plant.

"(If we converted 10% of the solar radiation which falls on the earth to power) . . . the 3.2 million acres that we have laid waste by strip mining could produce 10 billion kilowatts . . . , or equivalent to about 600 very large power plants we will need to build over the next 30 or 40 years."

Dr. Peter E. Glaser  
Arthur D. Little, Inc.

If collectors are far flung, as in the Meinel's plan, efficient transfers of heat become a problem. Modern steam turbines require temperatures from 300 to 600 degrees centigrade. Once this temperature requirement is met, solar engineers must solve the problem of storing intermittent sun power.

The Meinels, who admit that they are astronomers and "not part of the solar energy establishment," say that solar specialists have had narrow goals.

"If you start fresh and read the journals dealing with solar energy to see what has happened during these past disappointing years, you sense immediately that, aside from the silicon solar cell and the space race, the vision of solar energy was myopic," Marjorie says.

The Meinels' approach to the solar heat engine is awesome. They envision 1,000 "solar farms" covering 13,000 square miles of desert in Arizona, Nevada, and California. The collectors on each farm would produce 1,000 megawatts. The entire complex, a "National Solar Power Facility," could supply most of the United State's electrical needs in 2076, as well as those of northern Mexico, they say. When the sun did not shine on the Meinels' collectors, heat stored in tanks of molten salt would be used to drive the steam turbines.

At this National Solar Power Facility, 50 billion gallons of water per day would be used for cooling in the power plants. The Meinels would pump salt water from the Gulf of California for this purpose. The cooling process would produce an attractive by-product — desalinated water. The entire system would produce enough fresh water to supply 120 million people, the research team estimates.

The Meinels see deserts as exploitable resources. "When you see the immensity of deserts in comparison to human energy needs, we hope that you, too, sense that a century from now we may consider these deserts as God's greatest gift in natural resources to mankind," they say.

and cooling the building would use only 21% of the energy required by a conventional system, planners say.

Bob Kula, director of planning at Community College, has similar high hopes for the "solar silo" student center he's building. It will cost him 10% more to use solar systems. "But you get back the extra costs in fuel savings in just ten years," he says. "After that savings from solar energy could amount to \$60,000 a year."

As the costs of fuels go up, the number of solar heating and-cooling projects will go up. Even at 1970 prices George Lof and Dr. Richard A. Tybout, an Ohio State University economics professor, established that solar house heating compared favorably with all-electric heating in

### WORKING WITH HYDRO POWER

A more modest approach to the heat engine concept is being explored by a team of scientists at Martin Marietta Aerospace in Denver. The manager of solar power programs there, Floyd A. Blake, sees two generations of solar power plants ahead. In the first generation, Blake believes, the problems of storage can be avoided by using solar power to add to the output of a more stable energy source. The solar plant might stand alone only in a second solar generation, when sophisticated storage techniques have been developed.

A first generation solar power plant could work in conjunction with existing hydroelectric plants, for instance. At hydro plants where a lack of water kept the facility from running at capacity around the clock, water could be held back during sunny days. While the sun shone, a solar plant would provide power. Later in the afternoon, the reservoir replenished, hydroelectric turbines could operate at full power.

In January, Blake and his Martin Marietta team were awarded a \$229,500 National Science Foundation grant to refine their heat engine design. The group will use two banks of heliostats, mirrors that follow the sun's motion, to concentrate sunlight on a boiler. A 100 megawatt system would require about 500 acres of land, the group estimates.

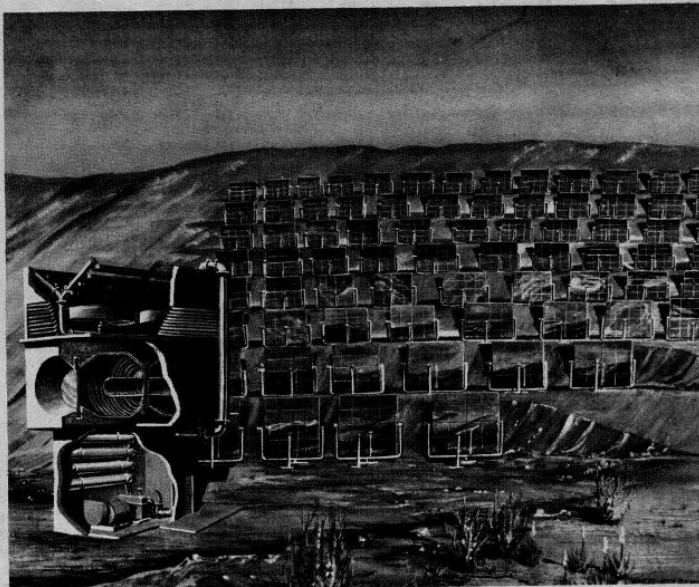
NSF is also funding preliminary studies of four other heat engine schemes around the country. Right now these power plants look to be at least 10 times more costly than their fossil fuel competitors. In the future, fuel costs of other energy sources may rise to meet the high costs of solar energy, heat engine advocates say.

### SOLAR CELLS AND SATELLITES

Another method of producing electrical power from the sun, photovoltaics, has received scant attention outside the space race. In the photovoltaic process sunlight hitting a solar cell is directly converted to electricity. Unfortunately, almost no one outside the space program has been able to afford the cells. The National Aeronautics and Space Administration (NASA) spends about \$200,000 per kilowatt of electrical capacity to power big satellites. Fossil fuel and nuclear plants cost \$200 to \$550 per kilowatt.

Peter Glaser, head of engineering sciences at the Massachusetts consulting firm Arthur D. Little, Inc., believes that further research and automated manufacturing techniques would bring solar cell costs down dramatically. When they do come down, Glaser believes that we will look to orbiting satellite stations for our power.

Glaser's scheme would have two advantages over earthly solar power plants. For one thing, in space the sun is a continuous source of energy. Storage of power is unnecessary. For another, the collectors in space would safely reach temperatures which, in the presence of oxygen, would burn the collecting apparatus up on earth.



The sketch above shows part of the Martin Marietta plan for a solar power plant. A bank of heliostats, mirrors that follow the sun's motion, concentrate sunlight on a boiler. This bank of mirrors on the north side work together with a second bank of mirrors (not pictured) on the south side. Together they produce enough heat to generate 1,000 kilowatts.  
Martin Marietta Photo

One solar power station in orbit 22,300 miles above the earth could supply the U.S. with 10 million kilowatts of electrical power, Glaser says. Solar cells spread out over a 25 square mile collector would produce the power. The satellite which carried them would weigh at least five million pounds.

The satellite would beam a current of microwaves back to the earth. Then, at a 36 square mile land-based collecting station, an antenna grid and a microwave rectifier would transform the microwave signal to DC power. This large receiving area would scatter the incoming power enough so that "for example, cattle could graze safely within the area enclosed," Glaser says.

### CELLS ON EARTH

Two University of Denver scientists, Jack E. Rink and Jack G. Hewitt, Jr., would like to use solar cells down on earth. They have proposed a large solar cell power plant for southwestern Arizona. Their system could provide power during the night and on cloudy days by using pumped storage. Electricity from the solar array would pump water into high reservoirs during periods of low demand. The water would be released to fall and turn electrical generators when the sun was down.

Some scientists have even suggested using solar cell arrays on individual homes. The experiment would not be economically attractive now. The average house using 23 kilowatt-hours of electricity per day would need about 2,000 solar cells on the roof. At current prices an array of that size would cost \$7,000 to \$10,000.

The University of Delaware has produced electricity with solar cells for a house called Solar One since July 1973. Cells made of cadmium sulphide convert sunlight into electricity and operate the home's fans, lights and range. Batteries store excess power for use on cloudy days.

The technology for Solar One was available. But Karl Boer, director of the university's Institute of Energy Conservation, had to invent a

new way to finance it. Offering a way to sell the sun, Boer attracted the attention of the Delmarva Power and Light Co. The utility is paying for 30% of the \$125,000 project. The investment will give Delmarva knowledge about the feasibility of supplying customers with solar cell panels and selling supplementary electricity for backup systems.

Two private firms manufacture solar cells in the U.S. The president of one company, Heliotek, says that he expects to cut the cost of solar cells to 10-25 cents apiece through mass production. He hopes to be able to compete with nuclear power by 1985.

### GOING COMMERCIAL

Obviously, solar technology exists. And projects in the Rocky Mountain region and all over the country are proving that the theories work. Then why aren't we all using solar power? Up until recently perhaps we've gotten the power we needed too cheaply to tempt us to look elsewhere.

Erich Farber, director of the University of Florida's solar energy laboratory says, "Ignorance is the major reason solar heating systems aren't on the market. Most manufacturers don't know it can be done."

Despite what Farber says, a few manufacturers are finding out about solar energy. Forty large industries have joined Arthur D. Little, Inc., to study solar energy's business potential. The companies include such giants as Corning Glass, Du Pont, Ashland Oil and Honeywell. Nine are Japanese and German firms. The businesses have invested about \$600,000 in the study.

"This is no research project," says Peter Glaser, of Arthur D. Little, "but a program to develop a new industry."

Honeywell scientists have expressed optimism about solar power plants as well as solar heating and cooling potentials. Last summer Roger N. Schmidt, manager of Honeywell's solar energy programs, told the House Subcommittee on Energy that solar power plants

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## Smoky Bear Era Ends Rangers to Restore Fire in the Tetons

Editor's note: The National Park Service is preparing a Fire-Vegetation Management Plan to "restore pristine ecological conditions to ecosystems of Grand Teton National Park." Their proposal calls for the use of "safe" wildfires, prescribed man-initiated burns and mechanical removal of built up fire fuel to approximate a "near-natural fire regime."

The Park Service reasons that fire has historically played a major role in shaping the plant and animal distribution patterns of Grand Teton National Park. Rallying behind Smoky Bear, the government taught the public that fires were dangerous and wasteful and a policy of all out fire suppression was instituted. This policy has been used in Grand Teton for the last 75 years, but the elimination of fire has introduced problems fully as serious as those Smoky warned us about. Unnatural changes are occurring in the park which are detrimental to the native plants and animals.

Fire suppression has led to a deterioration of aspen stands, an unnatural buildup of dead wood on the forest floor and a marked increase in sagebrush and other shrubs. Since vegetation and wildlife are so interdependent, these changes have had a corresponding detrimental effect on some forms of animals — notably the elk.

The Park Service feels that "the trend is toward a decrease in biological diversity. Action must be taken in the near future or the ecological consequences of these changes may become irreversible and Grand Teton National Park will lose much of its aesthetic and scientific value."

To reverse the current trend, the Park Service is proposing setting up four fire management zones within the park. These zones are based on "past fire history, fuel continuity, danger of spread to other areas (and) presence of human developments."

In the remote areas of the park, natural (lightning-caused) fires will generally be allowed to burn. All man-caused fires will be extinguished. On the valley floor, where human activity and private property are more prevalent, a few natural fires may burn under control conditions, but the general rule will be to use prescribed fires to approximate natural fire frequency. In the developed areas mechanical manipulation (logging, planting etc.) are being considered to remove the natural fire hazard and "approximate the effects of fire."

Park researchers maintain that this plan, "provides for the perpetuation and diversity of wildlife habitat with attendant aesthetic and scientific benefits. Reduction of forest fuels will reduce the hazard of future catastrophic, uncontrollable fire. The only significant unavoidable adverse effects of the project are the remote possibility of escape of fires and periodic reduced visibility due to smoke."

The Fire-Vegetation Management Plan is to be released in the near future. Two experimental prescribed burns are scheduled for later this year.

The following article by Lloyd Loope gives the Park Service's reasoning for initiating the Fire-Vegetation Management Plan. A *High Country News* comment and criticism of the program may be found on the editorial page.

by Lloyd L. Loope,  
Grand Teton National Park  
Research Biologist

The National Park Service is generally regarded as a people-managing agency but national parks are often thought of as being more than simply "pleasuring grounds for the people."

Many Americans give considerable importance to the aesthetic and scientific values of natural ecosystems which are thought to be preserved in national parks. One justification often given for establishment of national parks is that it is desirable to preserve "natural" or "pristine" ecosystems both for the enjoyment of present and future generations and so that scientists will have a permanent standard against which changes occurring in "disturbed" ecosystems can be measured.

In Grand Teton National Park, it is becoming painfully obvious that the goal of preserving "natural" ecosystems is not so simple as was once thought. Problems arise from the fact that lightning-ignited fire, a major force shaping the ecosystems of northwestern Wyoming for millennia, has been excluded from park ecosystems for about 75 years — and must continue to be suppressed in much of the park in the future. With fire exclusion, most ecosystems of Grand Teton are changing drastically — away from a situation with a highly diverse mosaic of post-fire stands of vegetation from 0 to 150 years old — toward a "climax" situation with relatively low diversity which is undoubtedly unprecedented in the vegetational history of northwestern Wyoming.

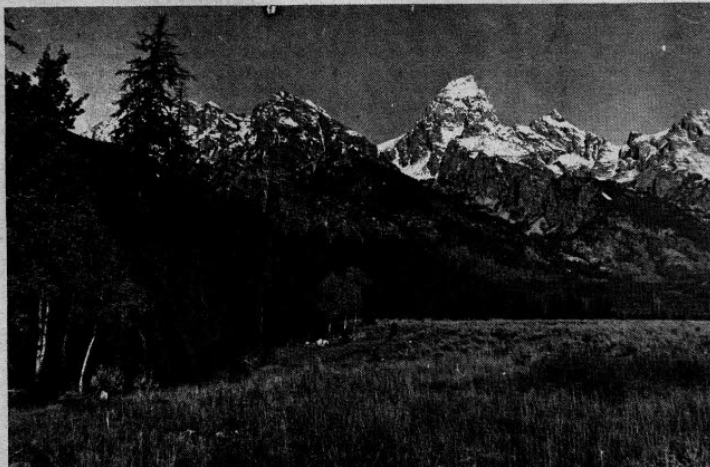
Most ecosystem types of Grand Teton Park are fire-influenced or fire-dependent. Within most of the Teton Range, large fires have been infrequent because of rugged topography and natural firebreaks, but numerous small lightning fires have occurred there. In the valley of Jackson Hole, tree-ring evidence indicates that few extensive areas have escaped fire for the past 200 years and that most areas last burned in the interval between 85 and 120 years ago. Tree-rings of fire-scarred 300 to 400 year old Douglas-firs document the occurrence of

numerous fires in the 1600s and 1700s — well before the influence of white man in this area. Since 1910, less than 300 acres of 310,000 in Grand Teton have burned. An average of three to four lightning fires have been extinguished each year.

Lodgepole pine seedlings generally become established rapidly after fire and form dense stands. When these stands reach an age of about 80 years, they become highly vulnerable to attack by a native insect — the mountain pine beetle. Under a normal fire regime, only a relatively small percentage of lodgepole stands would be vulnerable to mountain pine beetle attack at one time. But due to successful fire suppression during the past 50-75 years, all lodgepole stands in the park were at a susceptible stage simultaneously in the 1960s when a buildup of mountain pine beetle populations occurred. As many as 45% of the trees in many areas of the park were killed. The beetle populations are declining now in the park, but we are left with very hazardous forest fuel accumulations in the lodgepole forests because of the many dead trees. For any particular locality, such a fuel accumulation is probably in no way unnatural. However, the occurrence of this situation throughout the lodgepole forest of the park is probably unprecedented and clearly threatens developments — many of which are located within the lodgepole ecosystem.

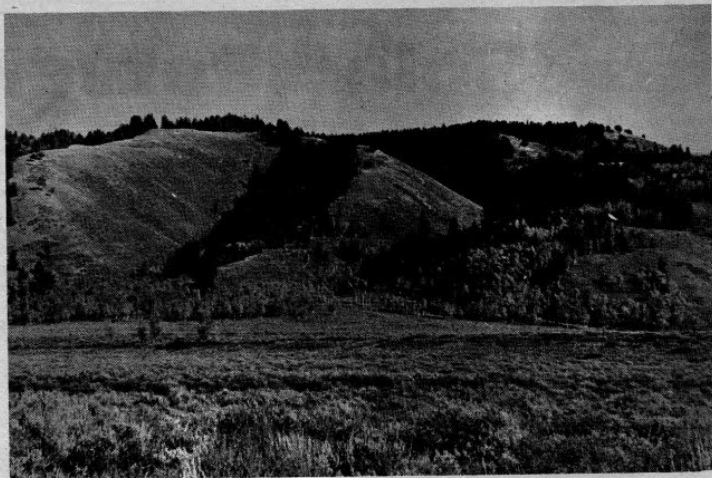
Aspen is a species which appears to be fire dependent in Jackson Hole. Virtually all existing stands in the valley regenerated following fires of the late 1800s. Without fire and with current levels of browsing by elk and moose, aspen is not reproducing in most of Jackson Hole. When aspen stands reach an age of 80 to 100 years, they deteriorate rapidly. Some stands have already been essentially lost. Many stands could still be saved through returning the stands to early succession with fire, but without fire most stands will either be lost or reduced to a shrub community. When an aspen stand is lost, its characteristic assemblage of plants and animals goes with it.

Pure Douglas-fir stands are not common in the park except on the northfacing slopes of Blacktail Butte, an isolated prominence near



Mountain pine beetle killed these lodgepole pines in Grand Teton National Park. What action is appropriate when wildfire fuel hazards like this occur in close proximity to developments?  
Photo by Lloyd Loope





West slope of Blacktail Butte in Grand Teton National Park, showing 20-acre stand of Douglas-fir (left of center) where prescribed burning is planned.

the center of the valley. Tree-ring evidence shows that these stands burned in the past at intervals of 25-75 years. Since buildup of forest fuels was periodically reduced by fires, many thick-barked trees from 100 to 400 years old have survived these fires. The last great fire burned most of the Butte's forest in 1879, leaving only these old monarchs. Since the 1879 fire, a very dense growth of young Douglas-fir has developed and dead material is accumulating. Aspens and willows, which thrived following past fires, are being outcompeted.

Other park ecosystems, including sagebrush, were greatly influenced by fire in the past. Even spruce-fir forests are shaped by fire's influence.

The past National Park Service policy in Grand Teton of attempted suppression of all fires is understandable since the important natural role of fire was not appreciated. Now that we have a moderately good understanding of fire's natural role, what management action is appropriate? Our present very tentative, long-range plans call for the eventual reintroduction of fire as an essential environmental factor (essential if any semblance of natural ecosystems is to be preserved) in most park ecosystems.

To achieve this goal, there would be no need for elaborate planning or for any artificial manipulation if we could address ourselves solely to ecological concerns — a park-wide "let the lightning fires burn" policy could be relied on to restore a natural vegetation mosaic. However, any plan for fire management in this or any other national park must assure visitor safety, protection of structures and developments within the park and protection of lands outside the park. Numerous developments and private lands exist within the valley areas of the park. Thus, if fire is going to play an ecological role in most valley areas, it is going to be prescribed fire — used under safe burning conditions with careful planning and preparation. In the Teton Range, however, and in some valleys areas (i.e., most sagebrush flats west of the Snake River) lightning fires can be allowed to initiate new stands of vegetation.

In the summer of 1972, a policy of allowing lightning fires to burn in much of the Teton Range was initiated. This summer a lightning fire in a spruce stand west of Jackson Lake was allowed to burn. It burned from July 12 to mid-September, but covered only a few acres because of the moist conditions characteristic of spruce stands.

Current plans call for carrying out two pre-

scribed burns — one in a sagebrush and aspen area of 100 acres on Uhl Hill and another in a 20-acre Douglas-fir stand on Blacktail Butte. An attempt was made to carry out the Uhl Hill burn on August 28, 1973. Although conditions were dry enough for a successful burn in the 30 acres of sagebrush vegetation, the aspen understory was too moist to burn. Much experience was gained from this initial prescribed burn and it is to be completed when weather and fuel moisture conditions permit. Dry enough conditions were not attained in 1973 for either this or the Blacktail Butte burn.

It is difficult to assess public reaction to our announced plans for limited restoration of fire to park ecosystems. There have been very few formal complaints and about an equal number of formal endorsements. The experience has been that most people, when presented with the facts, feel that restoration of fire to park ecosystems is a good idea — with the reservation that it will have to be handled carefully if the general public is going to understand and accept it.

In order to gain public acceptance for lightning fires and prescribed burning, the National Park Service needs demonstration areas which are accessible to the public. The Uhl Hill and Blacktail Butte sites will serve this purpose well, as well as providing excellent documentation of the actual biological changes which occur following fire. John McGee, a graduate student in the Zoology Department at Laramie, did intensive preburn sampling of small mammal and bird populations on the planned Blacktail Butte burn site this summer. Preburn studies of vegetation have been carried out on both Uhl Hill and Blacktail Butte.

In addition to these two burns, a prescribed burn of 50 to 100 acres in lodgepole pine forest and several small prescribed burns in sagebrush vegetation are planned within the next few years. Having demonstration areas in each of the major fire-influenced ecosystem types of Grand Teton, park naturalists would guide visitors through the burned areas to judge for themselves whether prescribed burning is an appropriate management tool in a national park. Following a period of several years to evaluate the effects of these initial burns, the National Park Service will propose and implement a comprehensive plan for fire and vegetation management, taking into account the views of interested visitors, conservation organizations and others.

Prescribed burning must be used in certain areas of Grand Teton and some other national

Photo by Lloyd Loope High Country News-7  
Friday, Mar. 29, 1974

parks if any semblance of natural ecosystems is to be maintained for future generations. There is some question as to whether large-scale use of prescribed and or lightning fires will be socially acceptable. Perhaps the general public does not rate preservation of natural ecosystems as a high-priority item. Perhaps many people will feel that prescribed burning is not aesthetically desirable in a national park. The National Park Service would greatly appreciate hearing from anyone who will take the time to let us know his or her views on what is a crucial issue in the management of national parks. (Write: Superintendent, Grand Teton National Park, Box 67, Moose, Wyoming 83012.)

## Limitless Energy...

(Continued from page 5)

will compete with nuclear plants by the late 1980s. "An experimental solar steam power system can be operating successfully in the 1970s and can be matured during the 1980s to the point where the American power industry can begin to consider it as a technically and economically practical and attractive alternative for supplemental operations," Schmidt said.

### A NUDGE FROM THE GOVERNMENT

The subject of government support of solar energy stirs up controversy among some solar enthusiasts. The National Science Foundation's \$13.2 million solar energy budget for 1974 is a dramatic improvement over past years' funding. But many people believe it is still sorely inadequate. Even the Atomic Energy Commission has recommended that the amount be more than doubled (raised to \$32 million) in next year's research budget. Early in February, the House passed a bill to authorize \$50 million over the next five years to support research and development of solar heating and cooling systems. Congressional support for the bill was overwhelming: 253 for and only 2 opposed.

George Lof believes that the money available today is adequate. Lof, who is engaged in one building project and two study projects funded by the National Science Foundation (NSF), says that at present levels of funding "any sound proposal will get support."

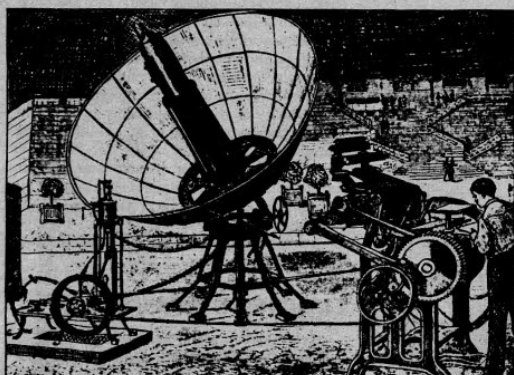
Others claim that despite an increase in funds, the NSF can only find money for paperwork. The government is in a "philosophical marshland of funding optimization studies, computer models and the like," Aden and Marjorie Meinel say.

Many of the solar inventors who can't attract government money are moving ahead anyway. Many of them, because of their readiness to produce, have earned private support. However leaden the government's pace, these people remind us that if we're looking for solar energy, it is here — today.

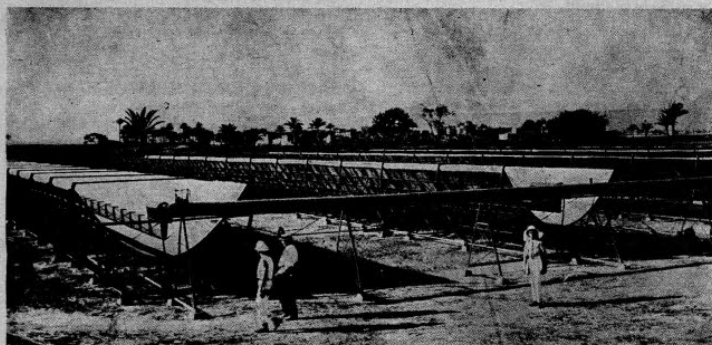
That other group, which independent inventors call the solar establishment, is moving ahead as well, but slowly. They have taken on the painstaking task of perfecting the solar package. As a result of their studies, they hope we'll soon sell solar power in forms which suit the tastes and the pocketbooks of the masses.

**"What is needed is a big push. President Nixon's \$12 million for solar energy research, sad to say, sounds more like a perfunctory nudge."**

—James J. Kilpatrick  
Washington Star



1878



1913

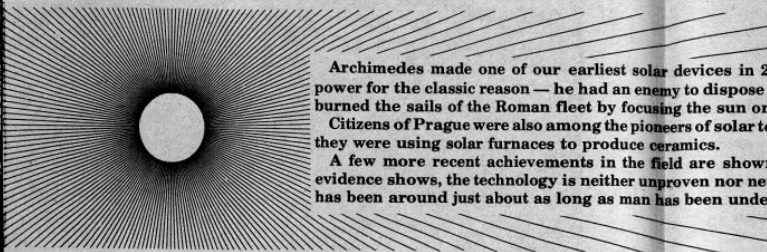
Smithsonian Institute Photo

A solar-powered steam engine (upper left) was a central attraction of the Paris exposition of 1878. A large paraboloidal reflector concentrated sunlight on a steam boiler. The steam ran an engine for the printing press of a newspaper appropriately named *The Sun*.

The solar collector above produced more mechanical energy (55 horsepower) than any collector has since. Its creators, Frank Shuman and C. V. Boys, built it in Meadi, Egypt for the same reason many Americans head for the Southwest — intense sun power. The solar power they generated was used to pump water.

The collectors at right are heating two houses on a Navy facility in Hawthorne, Nev. Inhabitants live in conventional modern houses, set their thermostats, and receive warm air through vents when the temperature drops below the limit they've set. This system was designed and built by Materials Consultants, Inc. of Denver.

## Solar Powered



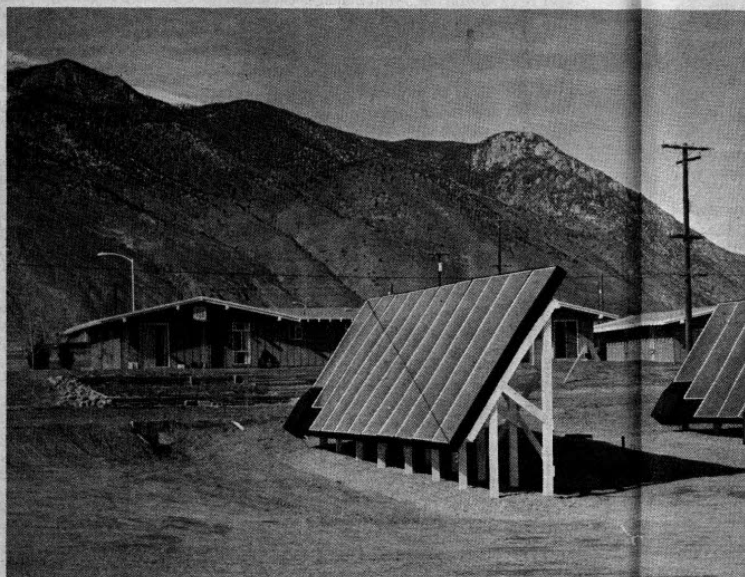
Archimedes made one of our earliest solar devices in 212 B.C. He used a solar power for the classic reason — he had an enemy to dispose of. He burned the sails of the Roman fleet by focusing the sun on them. Citizens of Prague were also among the pioneers of solar power. They were using solar furnaces to produce ceramics.

A few more recent achievements in the field are shown. The evidence shows, the technology is neither unproven nor new. It has been around just about as long as man has been under the sun.

With the space program came a surge of interest in solar power. The model of the Mariner 71 spacecraft's solar cell arrays, which were made of silicon, which converts the sun's rays directly into electricity. On earth — clouds, nighttime, oxygen and economics have held up the promise.

The sketch in the lower right corner of the page shows how a solar collector might look. This particular one is the dream of Floyd A. Blakely. He is working on programs at the Martin Marietta Aerospace plant in Denver. A solar collector on a boiler. A conventional steam turbine would convert the electricity.

Instead of storing the solar power, the sun system could be used as a hydroelectric plant. While the sun shone, solar power could be used. In the meantime the hydro plant would stock up potential energy in the form of water.



1974



# ered History

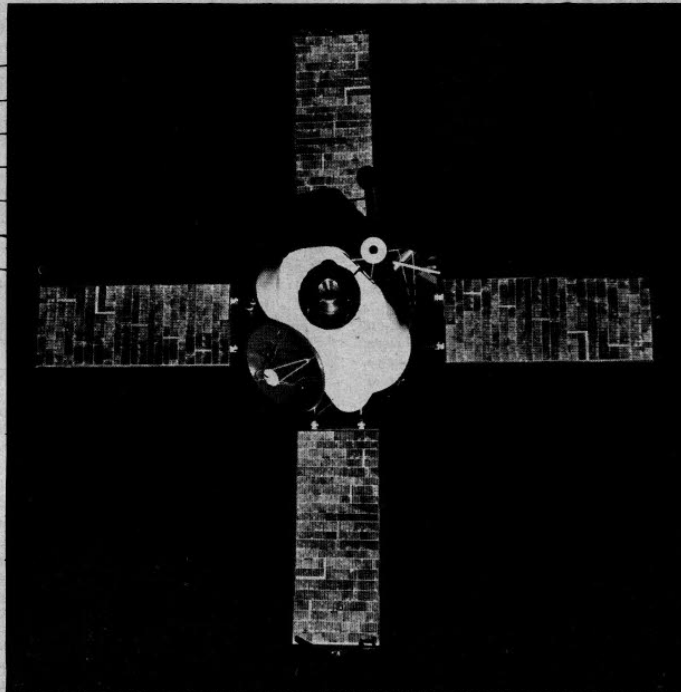
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he had an enemy to dispose of. According to legend he  
fleet by focusing the sun on them with mirrors.  
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corner of the page shows how a solar power plant of the future  
is the dream of Floyd A. Blake, who manages solar power  
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stock up potential energy in the water filling behind the dam.

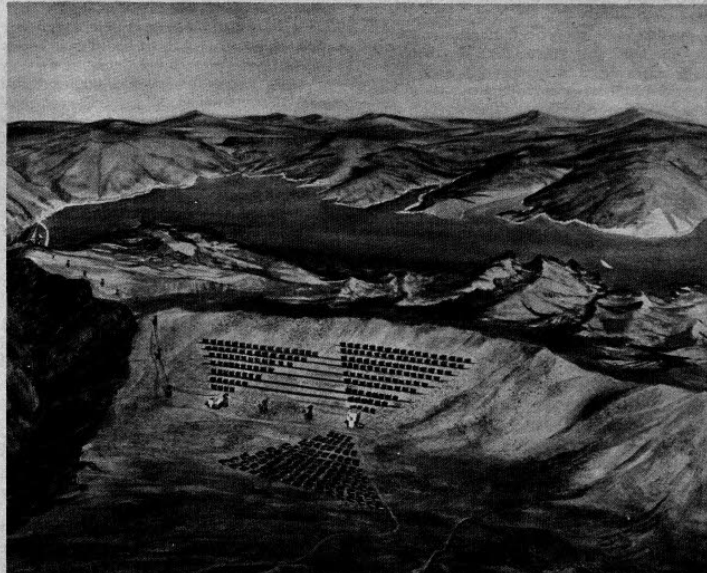


1971

Martin Marietta Photo



U.S. Navy Photo



Martin Marietta Photo

## The Future...

10-High Country News  
Friday, Mar. 29, 1974

## Reckoning from Washington

by Lee Catterall

The federal government is approaching its final rush to judgment on the matter of coal development in Wyoming, acknowledging that many things won't be known about its impact on the area even after the judgment has been made.

Asst. Interior Sec. Jack Horton told a Senate committee last week that "continuing study" will be needed to determine how massive coal development will affect air and water quality and local communities in the Powder River Basin. Horton owns a dude ranch only a stone's throw away from a huge coal deposit in that very area.

An official from the Environmental Protection Agency went even further, saying "a great deal more data" needs to be assembled about air and water quality, that agency's concerns. A full year of weather-watching in the basin will allow the agency to make better predictions, he said.

Here's the timetable the government wants to keep, a timetable Horton describes as "tight but adequate."

April — The Bureau of Land Management will propose a mineral leasing program for the different beds of coal in the basin. About the same time, seven research groups will submit a report to the Interior Department predicting environmental effects of development in the area.

June — Several federal agencies will issue a report assessing the environmental impact that existing coal activity already has had on the area.

July — The government will issue what is expected to be a voluminous, detailed and probably controversial statement on the environmental impact of the development. Most of the information will be drawn from the April reports of the seven research groups, Horton said.

September — If the July environmental statement is found acceptable, the Interior Department will begin issuing new coal leases — something it hasn't been doing — and Wyoming will enter a new era of industrial development.

"There will be no single point of full-scale commitment" to mine the coal, Horton said. However, he added, the government has been postponing decisions "which entail major new commitments" until September. He didn't describe the difference between the two terms.



The Senate Interior Committee asked Horton a series of questions about what plans are being made, and what predictions can be made about the development. Horton outlined the bureaucracy and the timetable, but told committee members less than they wanted to hear. One committee staffer complained afterward that Horton had been much too vague.

Sen. Lee Metcalf (D-Mont.) pressed government witnesses about "who's the boss" when it comes to making decisions about Powder River Basin coal — the Interior Department or the Federal Energy Office. He failed to get an answer.

Horton did not give assurance that the answers would be available by the end of the summer on some important environmental concerns, including those surrounding coal-related industries like electrification and gasification plants. EPA, in broad language, expects those plants to produce severe effects.

Further hearings before the Senate Interior Committee are scheduled in Washington in early April, in Casper April 18, and in Billings two days later.

## 'Net Energy' - A Concept

"Only when our leadership is able to grasp the unity of energy, ecology, and economics will we be able to guide our country in the desired direction. Today, instead, we hear adversary arguments coming out of these three disciplines, and this is dangerous to the welfare of our nation and to the role of man as custodian of the earth," said Sen. Mark Hatfield, a former Republican governor of Oregon.

Speaking before the Northwest Regional Conference on the Energy Crisis in Portland, Hatfield said that if we fail to recognize this unity, "we will continue reacting only to immediate crises while we rush blindly toward a future that threatens us with energy scarcity, ecological deterioration, and economic disaster."

Hatfield's main point was that "it takes energy to extract energy . . . (which) is a crucial consideration to which our energy planners and economic advisors have not paid attention." He said, "We should be asking — and finding out — just how many Btu's (British thermal units) are burned up in making 10 Btu's of energy available to produce the goods and services we demand. Obviously, if we begin to exploit energy resources that take 11 Btu's in order to make just 10 Btu's available, we are going to lose the energy battle. We need to assess the President's 'Project Independence' immediately in terms of what we're going to expend for what we intend to get."

To accomplish this end, Hatfield introduced to his audience the concept of "net energy." He said, "the true value of energy to society is not the gross amount that exists in the world. The true value is the net energy — the amount remaining after you subtract the energy costs of getting and concentrating that energy."

"We're getting a phony picture today," said Hatfield. "The net reserves of fossil fuels are mainly unknown, but they are much smaller than the gross reserves which have been the basis of public discussions and decisions that have implied that our present growth can continue unabated."

"Suppose that for every 10 energy units of some deposit of oil shale proposed as an energy source, there were required nine units of energy to mine, process, concentrate, transport, and meet the environmental requirements," said Hatfield. "Such a shale reserve would deliver only one-tenth as much net energy and last one-tenth as long as was calculated using the gross figures."

Hatfield said new energy technologies — coal gasification, oil shale extraction and nuclear fission — are inefficient from the standpoint of net energy production. "With regard to our nuclear energy resource," said Hatfield, "I would estimate that right now it is just barely a yielder of net energy." Using solar energy for anything but space heating and cooling "is prohibitive, from a net energy standpoint," said Hatfield.

"We can soon expect this phenomenon of declining net energy percentage to become the principal cause of inflation, eclipsing all the other inflationary pressures which already are seriously unsettling the U.S. economy," he said. "An inappropriate energy policy, one that does not take net energy into account, will be felt in terms of a general 'economic crisis' rather than in terms of the 'energy crisis' that lies at its base."

Hatfield blamed our per-capita consumption of energy for the crisis we face. He said energy consumption has far outstripped our population increases due to "the technological choices we have been making." "We have been displacing lower polluting, lower energy-consuming processes with higher polluting, higher energy-consuming processes," Hatfield said.

"When population or economic growth becomes so concentrated that such energy-consuming technologies as tertiary sewage treatment or automobile pollution control devices start to be employed, then growth needs to be arrested, or it will arrest itself, through an energy-caused economic depression," he said. "Man must break out of his expansive ways, which now have him mesmerized, so that his total society can settle into a steady state," said Hatfield.



The president of Montana-Dakota Utilities Co. says he wants to see more use of electricity. David Heskett says his company has no shortage of electricity, "so we say go ahead and use natural gas and electricity." Heskett is dismayed at the cutbacks being made. "There was only a 2.5% increase in 1973 as compared to an average increase of 7%. This does hurt. We certainly think its deplorable," said Heskett.

Wyoming's director of the Department of Economic Planning and Development says that as many as 50 unit trains a day may haul coal from just Wyoming's part of the Powder River Basin. Each unit train is made up of 100 cars each. Don Brunk says, "We think one of the biggest problems down the line — after the socio-economic problems — is going to be the traffic generated by unit coal trains." The Burlington Northern and Chicago Northwestern Railroads are planning a joint 120-mile section of new railroad from Douglas to Gillette. Numerous spurs would run off the mainline to a number of different coal mines.

Bechtel Corporation, Union Carbide, and Westinghouse Electric are considering North Dakota as one of six possible sites for a uranium enrichment plant, according to the Northern Plains Resource Council. The plant would require 2500 megawatts of power — 10 times the generating capacity of Montana-Dakota Utilities Co. and twice the present generating capacity of the entire state.

A spokesman for Bechtel said he liked North Dakota's attitude. He said Montana was not being considered because "they've written us out of the picture with their laws." He specifically referred to Montana's tough Utility Siting Act of 1973.

## System Proposed

Wisconsin Sen. Gaylord Nelson has proposed creation of a National Resource Information System. It would monitor, analyze and forecast supplies of and demand for important world resources, and the implications for the U.S. economy.

Sen. Nelson says, "The energy crisis is a distant early warning signal that, if heeded, will help the U.S. — and other countries — soften the impact of shortages impending in a variety of important materials."

He adds, "The energy crisis is telling us that we must abandon our assumption that there always will be an abundance of materials needed by a complex industrial society to maintain a high standard of living."





The stream above is Piney Creek. It originates on the east slope of Wyoming's Bighorn Mts. It meanders out into the broken hills between Buffalo and Sheridan — hills beneath which lie billions of tons of coal. This stream, and many others in the West face an uncertain future. Those which are not consumed in their entirety for use in developing coal will probably be dammed, diverted and literally destroyed.

Last week, Wyoming Rep. Teno Roncalio delivered the final coup. He offered an amendment which struck out Section 208 (d) (5) of HR 11500, the surface mining and reclamation bill. The language which he struck out would have required the mine operator, in obtaining a permit, to show that no lake, river, stream, creek or watercourse would be moved, interrupted or destroyed during mining or reclamation. It would also have forbidden any mining or reclamation within 100 feet of such bodies of water. His constituents should hear from him.

## Emphasis ENERGY

in the Northern Rockies and Great Plains

Over two-thirds of Utah's citizens favor construction of the massive Kaiparowits coal-fired power plant even if it requires relaxation of environmental standards. In a poll conducted for the *Deseret News* by Dan Jones Associates, 69.3% favored the plant. Kaiparowits is scheduled to be located near Lake Powell in south-central Utah. The plant has been held up by Interior Sec. Rogers C.B. Morton for environmental reasons. Interior is now considering alternative sites in the same general area.

In another Dan Jones poll for the *Deseret News* 72.8% of the Utahans interviewed favored relaxation of environmental standards to allow for oil shale development in their state. This figure jumped to 81.1% in the eastern portion of Utah where development is expected to occur. Both polls were conducted before it was announced that the Arab embargo had been lifted.

Natural gas trapped in formations below Pinedale, Wyo. will be the target of hydraulic fracturing experiments starting later this year, says the El Paso Natural Gas Co. El Paso had been part of a plan for nuclear stimulation of the gas, Project Wagon Wheel, which has been postponed by the Atomic Energy Commission. "We're pursuing every possible method we can," says John McFall, a company spokesman.

"Let's hope that this decision will put in abeyance any further industry participation in nuclear stimulation of natural gas fields," says Wyoming Rep. Teno Roncalio. "I'm confident that El Paso will find that hydraulic fracturing will prove more economically feasible than nuclear stimulation."

Gary Glass, of Wyoming's Geological Survey, says industry figures indicate that a possible 86 million tons of coal could be mined in Wyoming by 1980. In a presentation to the Murie Audubon Society at Casper, Glass says nine new surface mines are projected. Companies anticipating mines are Amax, Atlantic Richfield, Carter Oil (a subsidiary of Exxon), Kerr-McGee, Peabody Coal, Sun Oil, Medicine Bow Coal Co. and Pacific Power & Light Co. Wyoming's total coal production in 1973 was about 13 million tons.

The Old West Regional Commission will spend \$50,000 in North Dakota to study the impact of coal gasification. The study will serve as a pilot plan for development in the states under their jurisdiction — North and South Dakota, Montana, Wyoming, and Nebraska.

The Utah Sierra Club "strongly protested" an Environmental Protection Agency (EPA) proposal to exempt the Huntington Canyon coal-fired power plant from controlling sulfur oxide emissions. Marga Raskin, the Club's spokeswoman, pointed out that the first unit at Huntington Canyon will emit 33 to 45 tons of sulfur oxides every day. Los Angeles plants are not allowed to emit more than two tons a day.

EPA and industry studies have determined that controls would not be needed on the first unit to meet air quality standards, but EPA sources admitted that their study was restricted due to pressure of time and resource limitations. Raskin said, "Someone will be paying for the cost of that pollution — if not in health effects, then in a degraded and less productive environment."

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## The Hot Line

across the country

Two officials of companies which manufacture heavy equipment told Federal Energy Administrator William Simon that orders for coal mining equipment cannot be met without a substantial increase in the production of steel plate. Putnam B. McDowell, chairman of the board of Marion Power Shovel Co., and Eugene Berg, president of Bucyrus Erie, said the need for steel is a critical bottleneck to increased coal production. Carl Bagge, president of the National Coal Association also told Simon that increased supplies of steel must go into additional railroad cars and barges for hauling coal.

Energy Chief William Simon has joined the National Coal Association and other opponents of strong strip mining legislation. Simon told a House Appropriations subcommittee, "If Congress passes unnecessarily restrictive strip mining environmental legislation, they will also discourage coal produced at the surface."

A 125 foot tall windmill designed to generate 100 kilowatts of power will be constructed by the Lewis Research Center through a grant from the National Science Foundation (NSF). NSF spokesmen said this windmill is a step toward future windmills capable of producing 1,000 to 2,000 kilowatts. It will be the first large wind energy system constructed in the U.S. in 30 years. It is to be located at Plum Brook Test Area, Sandusky, Ohio.

Millions of acres of federally-protected wilderness may be opened up to geothermal steam development as a result of the federal governments' new leasing program. A little-noticed provision of the 1970 Geothermal Steam Act grants protection from development to national parks and wildlife refuges but does not exempt wilderness areas.

"There's nothing I can see in the regulations to stop their being leased," said Fred Ferguson, assistant solicitor for the Department of the Interior. "Geothermal energy is perfectly desirable, but in no way is it compatible with wilderness," said Doug Scott, Sierra Club Northwestern Representative.

The Nixon administration is mobilizing a task force to boost U.S. coal production until it supplies 45% of our national energy needs. Presently coal provides 17.7% of the national energy base. Thomas V. Falkie, the new director of the Bureau of Mines, will be the "top sergeant" of the task force, according to Rogers C.B. Morton, Sec. of the Department of the Interior.

Dr. Priscilla Laws, a physicist at Dickinson College in Pennsylvania, sat down with her slide rule and came up with her own plan to help out Project Independence. She discovered that: 1) If all the beverages in the U.S. were sold in returnable containers we would save enough electricity to serve 11 million people for one year. 2) If all food and beverages in the U.S. were sold in returnable containers we would save enough electricity to serve 25 million people for one year.

Amoco Productions Co. is exploring 606,000 acres of lake bed under Utah's Great Salt Lake for oil. Amoco leases the land for \$1 an acre per year.



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Friday, Mar. 29, 1974

## Wyoming Views Development

How does a state react to the news that it is soon to be heavily industrialized? Especially if that state has never had significant industry?

That question is of more than academic interest to Wyoming. With a total population of approximately a third of a million, the state faces not only an undetermined influx of new people but a direct assault on air, water and land resources. The magnitude of development is only now becoming apparent to both state officials and a growing body of the citizenry.

John Jenkins, a Wyoming son in environmental studies at Princeton University, wanted to know how Wyoming people were reacting to this situation. A native of Buffalo, his hometown of approximately 4,000 people at the foot of the towering Bighorn Mountains may be one of the worst impacted.

Describing his trips across the state to get a firsthand reaction, he says, "I discovered that high school classmates, ranchers, businessmen, and other townspeople thought I was just a little bit crazy when I began to ask about tripled population, sprawling industrial complexes and the possibility that the very way of life people in Wyoming have enjoyed for decades might be fundamentally altered in the not-so-distant future."

Jenkins devised a questionnaire to test Wyoming people's reaction to large-scale development and imminent change. The questionnaire was mailed to 945 residents, drawn from a computer selection of licensed drivers. He received 282 replies, enough to be a highly reliable, statistical sampling.

In devising his questionnaire, Jenkins said he wanted to determine: How intensely do residents value our unique combination of relatively uncrowded recreational opportunities, low population densities, clean air and water, and the absence of many problems which plague more urbanized communities?

And he adds, "Foremost in my mind while this study was being designed was the following questions: Is the average citizen aware of the coal-energy boom we stand on the brink of today? And if so, what kind of mental pictures are Wyomingites carrying of that development? What do 50,000 megawatts; 800,000 acre feet of water, or 'intensive gasification efforts' look like to the typical resident?"

Jenkins found that Wyoming people were not fully aware of all the implications of large-scale development. He says, "I believe that due to a peculiar combination of old political affiliations that are no longer relevant, incorrect beliefs that screen out challenges to their validity, and confidence that the existing way of life will continue to endure regardless of external influences and new trends, our citizenry has overlooked the challenge to what it claims to value highly."

Some 71% of the respondents say they think Wyoming's large coal reserves "place us on the verge of an enormous expansion of the energy industry here." Only 29% say the talk is "exaggerated."

Some 59% think the boom would be good for Wyoming. The other 41% think otherwise. 52% think Wyoming's strip-mining reclamation act will protect the state; 45% think it isn't strong enough, and 3% say it is too strong.

Surprisingly, conservationists are not directly blamed for job losses or obstructing "progress." Some 40% think conservationists "could have a lot to do with a scarcity of jobs for Wyoming's young people in the future." 60% think it would be lack of opportunity.

Only 36% think "environmentalists" (such as Sierra Club suit against Jim Bridger plant) "are obstructing sensible development." 64% think

"court actions like the Jim Bridger case serve as informed and valuable checks on industry and are in the public interest."

The 1973 Legislature passed congressional resolutions requesting no more additions to the wilderness system in Wyoming. That does not square with results of the poll. Only 31% said, "No more Wyoming public land should be included in the Wilderness System because it deprives the state of the productive resources in those areas." 69% said "Wilderness is a scarce and valuable resource so Wyoming should preserve its remaining wild areas." Some 76% of the respondents said they spent "some" or "quite a bit" of time every year in a wilderness or primitive area.

Some 43% think a state economy based on recreation and agriculture could provide a healthy economy. 45% say no, and 13% say they are not really sure. A preponderant 74% say it is possible to have both industrial growth and a "quality environment." Only 17% say it is not possible. A strong 77% say there has been no significant change in air quality in the past few years (66%) or the air has gotten better (11%). 23% say it has become worse.

Land planning seems to be a controversial subject in Wyoming and most other western states. But 81% of the respondents say that "Wyoming needs land use planning to cope with any large growth." Only 10% disagree, and of those only 4%, strongly. 73% say, "Industrial development should be an important concern for the future of Wyoming." Only 18% disagree. 42% say, "The population of Wyoming could double without affecting the quality of life," but 52% disagree.

To the question, "How much of your present family income would you be willing to give up in higher taxes or reduced income in order to live in an unpolluted area ten years from now?" 35% said none at all, 30% said 5%, and 19% said 10%. Only 4% said they would give up 50% or more.



To the question, "If your job required you to move to Denver would you . . . 65% say they would refuse to move, 27% would require an increase in income, 8% would move and 0.2% would take a cut in pay to move.

Some 65% say, "technological advances can solve pollution problems in Wyoming without slowing growth." Only 21% say not, and 14% are uncertain. 70% say they think agriculture can continue to be an "influential force" in Wyoming's economy and society "in the face of greatly expanded industry."

Wyomingites think of themselves politically as being quite conservative (15%), somewhat conservative (39%), or middle of the road (34%). Only 12% consider themselves liberal to any degree. A surprising 36% consider themselves independent of either party. Democrats and Republicans are split evenly at 32%. Only 75% of the respondents voted in the last general election.

A surprising 54% said they thought "State officials should be more concerned about the quality of the environment than about economic growth." 31% disagreed with that statement and 16% were uncertain. Some 41% said they thought "state government is pretty much run by a few big interests looking out for themselves." 46% said they were uncertain, it

depends, and only 13% said "for the benefit of all."

Some 30% said they thought they had some influence over state and local government, 17% thought "quite a bit," but 39% felt they didn't have much, and 14% felt they had almost none. On the national level, 78% felt they had little or no influence.

In view of the answers to environmental or energy questions, it is surprising that 29% said they had seen no news articles, or heard news broadcasts or programs in the three months before answering. 8% said they had heard or seen one, 44% had seen or heard two or three, and 19% four or more.

Jenkins draws the conclusion that Wyoming citizens are ill-informed and ill-equipped to deal with large-scale industrialization. He comments, "When four out of every five citizens indicated that they hadn't even seen or read four items directly relating to the consequences of coal industrialization, you can begin to realize how much in the dark most really had to be!" And he adds, "The public seems to be believing what it wants to believe and refusing to face what it doesn't want to contend with."

In the face of widespread ignorance of the consequences, or naive acceptance that it will all be worked out for the good, Jenkins says, "Public officials and other leaders cannot, in good conscience, proceed with policies (and non-policies) which encourage development of massive industrial facilities in Wyoming . . . There is no genuine majority support for the idea, only unknowing incomprehension of its meaning. A new development like this, unique in its size and implications for life in Wyoming, demands active popular approval . . . Yet, it is clear from the results of this opinion research that the average Wyoming citizen is unaware of the nature of development and its consequences."

Jenkins concludes by saying, "If no other fact gleaned from this data impresses the reader, I hope this one will: 'The people of Wyoming don't know what they are getting into.' And in light of that, he says, "It is up to the opinion leaders of our political community to sharply define the trade-offs, and then search for the popular mandate."

### Billion Dollars Lost On Oil Shale Leases

Congressman Charles A. Vanik (D-Ohio) has revealed the fact that if the Federal Treasury had received the same per barrel bonus bid on the January and February Colorado oil shale leases as it did on the first Utah lease, the public would be a billion dollars richer. Because the Department of the Interior has failed to establish a better leasing and bid procedure, the Treasury has "lost" that money.

Interior leased 5,120 acres of Utah land for \$75 million — approximately 30 cents per barrel. The first Colorado lease, on the other hand, brought in a bonus bid of only about a nickel a barrel. The second Colorado lease, given out a month ago, brought in 16 cents per barrel. The Utah lease resulted in a return to the public of six times the first lease and twice the second lease.

Vanik points out that because of the nature of oil shale, bidders are fairly certain of the amount of oil they can recover. They are bidding on a much more certain quantity than offshore, underwater drillers are bidding on.

Vanik has called for establishing a system of renegotiation to ensure that this public treasure is not given away at needlessly low prices.

# Western Roundup

## Dam Plans for Grand Canyon Revived

Damming the Grand Canyon, the issue that rallied many citizens to the cause of conservation in the 1960s, is being revived in the name of the energy crisis. The Los Angeles Department of Water and Power and the Arizona Power Authority are planning a 400-foot-high power generating dam on the Colorado River in the Grand Canyon.

The dam is proposed for the Hualapai Indian Reservation near Bridge Canyon in the lower Grand Canyon. If built, the reservoir would inundate 54 miles of canyon and river right up to the boundary of the existing Grand Canyon National Monument.

Robert V. Phillips, general manager and chief engineer of the Los Angeles Department of Water and Power, said the power generated by such a dam could save five million barrels of oil a year and reduce air pollution from the burning of fossil fuels in the Los Angeles Basin. He said the dam could satisfy "peak power demands."

Reservoirs used for "peaking" power are characterized by huge daily fluctuations of water level due to large discharges during power production and rapid refilling after peak demands have been met.

Michael McCloskey, executive director of the Sierra Club, said, "There is no chance whatsoever that this project will get authorized. There is a greater need to cut peaks rather than encourage them by building additional capacity."

## Teton Jet Runway Extension Nixed

The Grand Teton Jetport final environmental impact statement has been released by the National Park Service. As predicted, the document "recommends against runway extension from 6,305 feet to 8,000 feet since it would allow the use of regularly scheduled jet aircraft, resulting in increased noise and air pollution levels." The statement recommended that all other airport improvements be undertaken. These improvements include widening and strengthening the runway, constructing a parallel taxiway, installing a medium approach light system, and building an air traffic control tower.

The impact statement also recommends that a regional transportation study be undertaken "prior to any long range commitments" which would include an analysis of alternate airport sites and alternate modes of ground transportation.

Before the official record was closed on Oct. 11, 1973, the Park Service received 1285 letters about the airport. Only 142 of the letters favored runway expansion and improvement. The others were either opposed to expansion or opposed to the airport in the park and recommended relocation. Several petitions were also received by the Park Service. Over 5,700 petition signers opposed expansion while only 79 signers were for expansion of the airport.

## Montanans Act to Protect River

"The Yellowstone is under a severe threat of total dewatering by the energy industry," says Jim Posewitz, director of the information and environment division of the Montana Fish and Game Department.

To protect wildlife values in this embattled river the Department hopes to reserve water at a base flow level. New water users would not be allowed to dip into the reserved minimum flow. The Department's pending reservation "in no way will affect existing water rights on the lower Yellowstone," says Posewitz.

When asked why the Department was making this application just after the state legislature had approved a three-year moratorium on future Yellowstone appropriations, Posewitz responded that it was a precautionary measure. Posewitz said the moratorium may be challenged and not stand up in court. "The legislation is exactly what is needed and we support it, but we need this as a backup," he said.

Also on the Yellowstone, the state legislature is considering a resolution to the Secretary of Interior asking him to recommend to Congress not to appropriate money for the proposed Allenspur Dam. The resolution, already passed by the Senate, declares that the dam "would be particularly detrimental to the recreational, economic and environmental needs of the residents of the Yellowstone Valley."

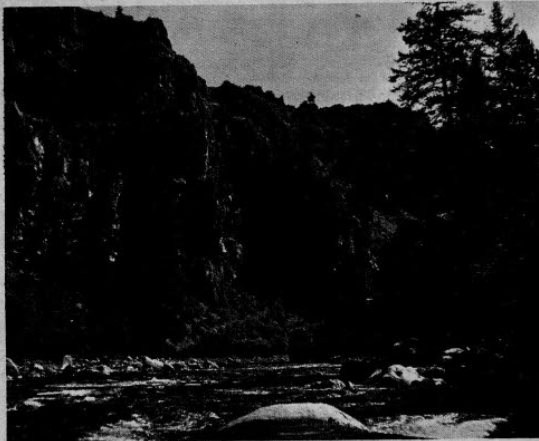
State Rep. William Warfield, who represents the region that would be inundated, says his county is united behind the resolution. He said the latest surge of opposition comes because of rumors that the dam would supply coal development water.

## Briefly noted . . .

The three Northwest governors, Dan Evans of Washington, Tom McCall of Oregon, and Cecil Andrus of Idaho, have called for a strict monitoring of DDT applications for the tussock moth on national forests. The U.S. Forest Service proposes to apply DDT on about 500,000 acres of national forests in the three states.

Photo by Ernie Day

High Country News-13  
Friday, Mar. 29, 1974



The Idaho Legislature passed a bill directing the lieutenant governor to seek "just compensation" from the federal government for state river beds classified as a part of the National Wild and Scenic River System. The bill would affect such streams as the Lower Middle Fork of the Salmon, shown above. Gov. Cecil Andrus vetoed the bill, but the House overrode the veto.

## Wyoming Sues to Bring Back Poisons

Wyoming is attempting to force the federal government to control predators on federal, state and private lands. In a suit filed in U.S. District Court the state contends that under federal statutes, the Secretary of Interior is required to control predators and calls for a declaratory judgment to that effect.

The suit charges that predator control in Wyoming is impossible without chemical toxicants. It asks for a judgment to allow federal employees to actively participate in conducting predator control programs or to allow state employees to control predators on federal lands with chemical toxicants.

Also sought is a court order invalidating an Environmental Protection Agency (EPA) denial of a state request for state registration of predator poisons. The state also filed a petition to force EPA to hold hearings on the issue.

Co-plaintiffs in Wyoming's suit include the Wyoming Wool Growers Association, Wyoming Farm Bureau Federation, and several predator animal districts and individual ranchers around the state.

Departments of Agriculture in 17 other western states have indicated they may either join Wyoming in its suit or initiate similar actions of their own, according to Wyoming Asst. Atty. Gen. George Andrews.



## Briefly noted . . .

The newly-formed Environmental Defense Fund's Denver office has joined the Committee to Save North Dakota in their fight against the Garrison Diversion (see HCN, March 1, 1974, page 10 for details). This move will give the Committee a new pool of legal and scientific manpower to combat the mammoth pork barrel irrigation project, said Committee chairman Richard Madson.

The two organizations will work together on a federal lawsuit which is seeking a moratorium on Garrison Diversion work. The joint complaint is now being amended to include alleged inadequacies in the Bureau of Reclamation's environmental impact statement.

\* \* \*

A controlled burning program in Northern Idaho is flickering. The program was designed to restore big game winter range, says Thomas A. Legge, a biologist for the Idaho Fish and Game Commission. Plans are being held back this year by wet weather, lack of funding and new demands for more comprehensive environmental impact statements. The program began in 1965. The state's environmental impact statement was rejected by the U.S. Environmental Protection Agency last year. As a result, only 4,000 acres of the 17,000 acres scheduled were actually burned. Legge says fire increases the amount of high protein browse available to wintering elk herds.

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Friday, Mar. 29, 1974

## Thoughts from the Distaff Corner

by Marge Higley

In this day of modern technology, the word "myth" has come to mean an untruth, or an old wife's tale. Yet the origin of myths goes back to the beginning of mankind, long before science had made any attempt to explain the mysteries of natural phenomena, such as sun, wind, moon, etc.

Myths were passed by word of mouth from one generation to another in all ancient civilizations. While the legends differ from one primitive culture to another, all are peopled with gods and goddesses of varying degrees of importance.

When we consider the constancy of the sun, it is not surprising that in all the myths that have come down to us through the ages, the sun-god, by whatever name, is ranked as one of the most important gods. (Note to womens' libbers: the job was apparently too substantial for a female — I find no reference whatever to any sun-goddess!)

Ancient man didn't know that the sun was a mass of burning, exploding gas around which the earth revolves. To him, the earth was a stationary, plate-like object, and the sun was a golden ball which soared across the sky each day, shedding its light and warmth. Although he was ignorant of its substance, he was aware of its importance and its power.

One well-known Greek myth tells of Phaethon, the earthly child of the sun-god Apollo. Apollo's daily task was to journey across the heavens in the chariot of the Sun, driving four beautiful, untamed horses. Phaethon, wishing to prove his kinship with the sun-god, traveled to the place of the Sun, where he was recognized and welcomed by Apollo.

"Indeed thou art my son," said the sun-god. "Ask any gift of me, and it shall be thine, I swear by the river Styx."

Present-day parents of teenagers can almost guess what that boy asked for.

"Ah," cried Phaethon rapturously, "Let me drive thy chariot for one day!"

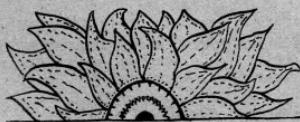
Well, Apollo wasn't very happy about it, but he couldn't talk Phaethon out of the idea, nor could he break his oath, so the boy took his place in the chariot.

Those four wild, immortal steeds soon realized that the hands holding the reins were unfamiliar and inexperienced. With reckless abandon the horses left their regular route and plunged erratically across the heavens. At times they pranced far too high, and the earth below was assailed by bitter frost. Then they drew down so close that the earth was scorched, rivers disappeared into the ground, and seas dried up.

All mankind implored Zeus, the greatest of all the gods, to save the earth. Reluctantly, Zeus hurled a thunderbolt and Phaethon fell headlong to earth, and to his death. The steeds of the Sun returned to their stables, and the Sun has traveled in its regular path ever since.

The remedy was a radical one, but the chariot of the Sun had to resume its proper and eternal place in the sky, since myths were ancient man's way of explaining the phenomena of nature. Even those long-ago myth makers were aware of the power and the unfailling presence of the sun.

In a way, it's odd that modern man, in his search for energy, has dug into the bowels of the earth for finite coal and oil and uranium — and, almost as a last resort, is finally looking toward the sun!



## Bulletin Board

The Minerals, Materials and Fuels Subcommittee of the Senate Interior Committee is scheduling public hearings in Casper, Wyoming, and Billings, Montana, to hear opinions on the Department of Interior's coal leasing program in the Northern Great Plains. The hearings will be chaired by Sen. Lee Metcalf.

Metcalf says the subcommittee is "... concerned about the possibility that the current energy situation will lead to premature decisions to proceed with large scale coal leasing when the impacts of such action are not fully understood. We are particularly concerned that the issuance of leases would, for all practical purposes, commit the land, water and air resources of the area to development of surface mines, coal gasification plants, water impoundments and new communities without adequate consideration of other energy alternatives and environmental, social, and economic impacts."

Metcalf says the subcommittee wants to know the views of the people who will be most directly affected. Persons wishing to testify at the hearings may write the Interior and Insular Affairs Committee, U.S. Senate, 3106 Dirksen Senate Office Bldg., Washington, D.C. 20510. The hearings will be April 18 in Casper and April 20 in Billings.

Sulphur dioxide, fluorides, and ozone are the major tree despoilers, according to a publication just released by the Forest Service.

The 12-page booklet lists various pollutants and contaminants occurring in the air around industrialized communities. Then it names the trees which are "tolerant," "intermediately tolerant," and "sensitive" to each of the air-borne pollutants. According to the booklet, home and professional gardeners should look out for nearby sources of pollution, and then plant only vegetation known to tolerate local pollutants. Copies of the booklet are available from Pub-

lications Clerk, USDA Forest Service, Federal Building, Missoula, Mont. 59801. Ask for "Trees For Polluted Air," (Miscellaneous Publication No. 1230).

The Wyoming Conservation and Land Use Study Commission will hold public hearings on draft land use legislation. The hearings will be May 20 in Cheyenne, May 21 in Casper, May 22 in Gillette, May 23 in Worland and May 25 in Rock Springs.

The U.S. Section of The International Solar Energy Society will hold its annual meeting at Colorado State University, Fort Collins, on Aug. 21-23, 1974. Three sessions covering technical areas, general areas, and commercial and industrial uses of solar energy will be held.



The National Motorsports Committee has released a report on energy consumption as it relates to leisure time activities, and the report contains a few surprises.

Naturally, most of the energy consumed by leisure activity is spent by traveling to the site of the action. In that regard, vacation travel consumes far more energy than any other form of leisure — fully 129 million barrels of fuel, or 66% of the total amount attributed to leisure activity.

Non-scheduled aviation — meaning pleasure flying — accounts for the second most expensive activity in terms of energy consumption, followed by motion picture attendance, football, basketball, horse racing, auto racing, rodeos, bowling and, way down the list, major league baseball. Wrestling and golf came in last. : EARTH NEWS

## A WESTERN PORTRAIT: George Lof, Solar Scientist

"There's more misinformation about solar energy than I think any other subject except rattlesnakes and a few other areas of mystique," says Dr. George Lof.

Lof ought to know. He has researched the concept, through thick and thin funding, ever since the early 1940s. He has built two solar-heated homes for his own use and is working on a third — the first house in the world with an integrated solar heating and cooling system.

Lof earned a B.S. at the University of Denver and a doctorate in chemical engineering at MIT. He is now professor of engineering and director of the Solar Energy Applications Laboratory at Colorado State University in Fort Collins, Colo. He is also president of the International Solar Society.

Now that sun power is becoming respectable, Lof has moved into public prominence as a leader of the solar establishment. Dr. Jerome Weingart of Caltech's Environmental Quality Lab has called him "one of the few real experts in the field of solar energy."

Among solar advocates, the "misinformation" or controversy to which Lof refers seems to revolve around money. Everyone agrees that the technology to produce power from the sun is here now. But which solar scheme, if any, will be able to make it in the marketplace? Which scheme deserves the most research money? Who should get the money?

In the following interview with **High Country News**, Lof talks about his work and how he feels about some of these solar controversies.

**HCN** — How soon will it be before solar energy could begin to supply some of the power needs of the American people?

**Lof** — We can move ahead and get solar heating and cooling in buildings underway — certainly within a year or two — and still do a reasonably sound engineering job.

They might not be the best solar energy units that we can conceive of. They probably won't be the same ones that will be built 10 years from now. But they certainly will not be failures, nor will they be things that we won't learn from.

**HCN** — What would you tell someone who wanted to build a solar-heated house this year?

**Lof** — I would advise them, if they weren't technically inclined, to work with an architect and design a house so that a solar energy system could be applied to it without much effort in the way of remodeling in a year or two.

**HCN** — Will the costs go down soon?

**Lof** — Oh certainly. Because today you have to have a custom built installation. In a couple of years, it should be factory made. It'd be like buying a Ford if only one car had been made this year — it'd cost you millions of dollars.

**HCN** — Several large companies like General Electric and Westinghouse that have expressed interest in solar energy are also producing the hardware for the nuclear industry. Is this a conflict of interest?

**Lof** — There can be no conflict between those two energy sources whatever. Nuclear is for power and solar is for heating and cooling. And in the 20th century there'll be no overlap.

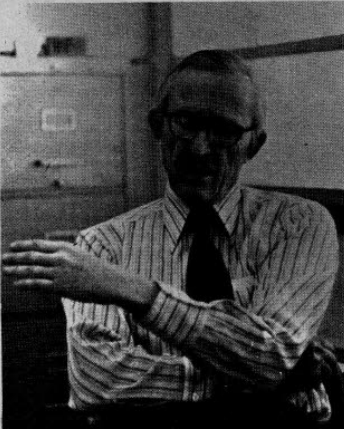
You probably want me to follow that up with reasons. The costs of generating electricity with solar energy exceed any commercial capacity to pay for them. Those costs are at least 10 times the costs of nuclear power. And so we're looking down a long road that leads to the production of electricity with solar energy. But heating and cooling with solar power is this year.

**HCN** — Why is solar production of electricity so costly?

**Lof** — The direct conversion of solar energy to electricity ("photovoltaics") with silicon cells costs over 100 times the cost of developing power with fuel oil. Manufacturing silicon is a complicated process using electric furnaces to reduce sand to silicon metal. Then you have to crystallize the metal from a melt — a slow process.

There are attempts being made to develop fast-growing silicon, but the technology is expensive. We just can't see any major breakthroughs.

Great economies could be made in the production of silicon cells with mass production. The



costs, I am told by enthusiasts, could conceivably come down by factors of 10 to 100. But I am also told by other experts that they would never come down by as much as 100. So you take your choice.

Now there are other materials for cells, such as cadmium sulfide, which is basically a cheaper material. But cadmium sulfide has some technical problems. It isn't as stable and it can't take as high a temperature. It can't even go to 200 degrees Fahrenheit.

Anyway, photovoltaics are a long hope. At present we don't know how to make these things compete.

**HCN** — Could heat engines, which use solar energy to make steam which turns a turbine, come closer to competing with other sources of electricity?

**Lof** — We don't know yet. We have a large investigation going on here into that process: comparing various methods, types of solar collectors and types of engines. Our preliminary indications are that heat engine costs are going to be about 10 times what ordinary power plant costs are.

(Continued on page 16)

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**HIGH COUNTRY NEWS**

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High Country News-15  
Friday, Mar. 29, 1974

## Eavesdropper

LOONEY LIMERICKS

by Zane E. Cology

Some think solar power is fantasy stuff —  
That "value received" is not great enough.

But consider, a minute,  
The power that's in it —  
(A bright red sunburn can be pretty tough!)

The billing for the dedication ceremony at White Sands Missile Range called for the sun to shine and burn through a ribbon. But the sun couldn't muster enough energy. A heavy overcast didn't allow it to cooperate. The occasion was the dedication of the world's second largest solar furnace. It will be used to test thermal effects on missiles.

Solar energy technology is being used to aid in tracking wild animals. The **Journal of Wildlife Management** tells how solar energy is used to power transmitters attached to animals for radio tracking. Solar power may overcome the problem of short-lived batteries used in most current research.

Horse sales rings in the Northwest report a thriving business. The horses are being slaughtered and shipped to foreign meat markets. The horses are selling for 25 cents per pound, much less than for other types of meat animals. Packers also point out that horses produce some 10-15 per cent more meat per carcass than cattle.

Use of The Pill is attributed to declining hospital income and cutbacks in some maternity facilities. Other factors enter in but most hospitals believe more effective contraceptives are most responsible.

Recent studies indicate that one or the other married partner has had a sterilization operation in one of every six in the prime child-bearing ages. The trend is also reported to be continuing upwards.

Herbicides dropped on South Vietnam by American planes not only caused deaths of children directly but caused ecological damage which may take at least 100 years to repair. That is the conclusion of a 17-man panel of the National Academy of Sciences. More than 100 million pounds of concentrated herbicide were sprayed on 5.7 million acres, or about one-seventh of the country's total land area. The scientific report, carried out in secrecy for the Defense Department, has been submitted to Congress.

**YOU'RE THE SOLUTION  
TO WATER POLLUTION**

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Friday, Mar. 29, 1974

## George Lof...

(Continued from page 15)

Right now the heat engine is much cheaper than photovoltaics, but it (the heat engine) probably can't get as cheap. (A paradox: With study, Lof says, we can probably bring the cost of photovoltaics down to meet and go below the cost of heat engines.) You pretty much know what your limits are in making heat engines. It's like making steel. You know that steel is going to take iron ore and coke and limestone furnaces. But photovoltaics is an area in which some magic might be worked. You might put it this way: when you know a lot about a project and it's too expensive then the prospects don't look very good. But when you don't know much about a process and it's expensive, the prospects look better.

But I'm sorry we got off on the subject in this way because electric power is only a part of the nation's energy requirement. . . . (Building heating and cooling and water heating) that's nearly a fourth of the total energy used in the U.S. So if solar fits well into that use, let's concentrate on that and let the nuclear boys or the coal boys have the power — at least for the future we are now looking at.

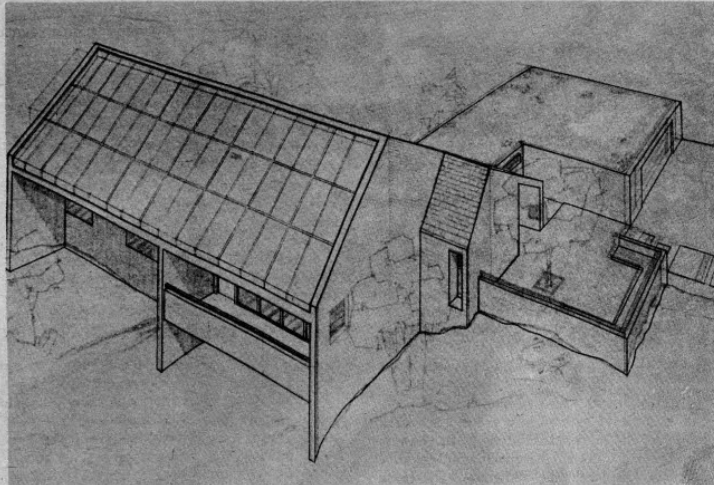
Solar radiation is a very diffuse source of energy. It's a very weak source. But with ordinary non-concentrating solar collectors of good design you can get 100 to 200 degrees with good efficiency somewhere ranging from 35% to 55%. That's all house heating and cooling requires.

HCN — Do you think that government funding for research in solar energy is adequate?

Lof — I think that under the present funding that the National Science Foundation now has that any sound proposal will get support. I'd say that the limit is the capability and the capacity to engage in the work.

HCN — How are those funds divided between power projects and heating and cooling projects?

Lof — Up to now I'd say that it has been approximately equally divided. NSF started out to give a little more funding to power — but that was because there wasn't much pressure for work on heating and cooling. I think the trend is



The sketch above shows what the first house ever heated and cooled by solar power will look like. The project is part of the work of Colorado State University's Solar Energy Applications Lab, directed by Dr. George Lof. The house should be ready to begin a season of solar cooling this spring. Monitoring instruments will automatically record some 100 different pieces of data: temperatures, flow rates, solar radiation and natural gas consumption.

Lof expects the solar system to supply three-fourths of the house's heating and cooling needs. Aluminum collectors at an angle of 45 degrees will heat water in an antifreeze solution. The heat will be stored in a tank containing 1,200 gallons of water. The project is being funded by a National Science Foundation grant to CSU.

definitely to increase the funds for house heating and cooling. It's cheaper research to do. And it is the early payoff.

HCN — If there is enough money around to support solar research, why is it that some of the independent solar inventors go unfunded?

Lof — Some of them are very energetic and dedicated people, but I think their impact on solar energy needs of the country is going to be small. That is because they think in terms of the do-it-yourselfer rather than in terms of big commercial production. Nobody's going to go out and use ropes to raise and lower the walls of the house everyday. And they're not going to have cans of water in their living room. And they aren't going to tolerate temperatures down to 55 degrees and put on a coat.

We're too spoiled for this kind of thing. Even though you might and I might, the average public user isn't going to. He's got to have his heat so that it's just the same as the heat that he's used to. So that whenever he moves that thermostat up he's going to get heat and when he moves it down he's going to get cool.

And if you don't make it cheap (\$2,000-\$3,000 per unit), it's still going to be cheaper to burn gas or oil.

HCN — What solar projects are you and your colleagues at Colorado State University working on now?

Lof — We have three active projects (all NSF funded) and quite a number of others in the early planning stage. One is a power systems analysis that we're doing in cooperation with Westinghouse. This is an 18-month examination of the methods for generating power with solar energy using heat engines. The objective is to advise the government on what systems have the best prospects for being useful — and what general levels of costs could be expected for them.

Our second project is the design and production and testing of a solar heated and cooled house, which actually will be the first completely integrated solar heating and cooling

system in the world (see artist's conception, page 16).

The third project is called a Phase O effort on the heating and cooling of homes. Westinghouse is the prime contractor and CSU is the supporting contractor. This is a very broad multi-disciplinary examination of the potential of solar heating and cooling in buildings of all kinds. We're engaged in the technical study. Then the plans call for a second phase which is hardware development. Whether the university will be involved in this I don't know. Then the third step is the construction and testing of systems in buildings. Westinghouse is one of three contractors on this. TRW and General Electric are the other two. All of them are going down somewhat parallel lines to push solar heating and cooling as expeditiously as possible.

HCN — What are your hopes for solar in the more distant future?

Lof — There's one other field in which I think tremendous effort ought to be made, in addition to the photovoltaics. I think that in photochemistry there could be tremendously important experiments if they were successful. By photochemistry I mean the high efficiency conversion of solar energy to chemical products by direct photochemical reaction — in other words the duplicating of the process in which chlorophyll converts solar energy into carbohydrates, which is our basic biological process.

And there have been some slight, very slight, successes in directly converting sunlight into non-living things — chemical products. Hydrogen would be one product that could be very useful. If you could convert sunlight directly to hydrogen and do it economically, then you might say our problems would be solved. —JN



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