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Water Needs for the Future

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Energy

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need to be answered: (1) Should there be additional federal and state aid for developing water for irrigation? And, (2) are we going to maintain or expand our present acreage of irrigated agriculture in this region through the protection of prime agricultural land, together with incentives to promote agriculture and open space utilization? Other questions that need to be answered are: What really is beneficial use? What is considered domestic use of our water? What do we do about condemnation rights as they concern irrigation water? What do we do about the outright purchase of water by municipalities? What do we do about mineral development and energy production: the coming of coal plants, coal gasification, and nuclear development? These questions all affect our water.

In closing, we in agriculture would like to remain an important part of the economy of this state. Irrigation does play a significant role in the economy of our entire region. However, if we do not consider the alternatives to water-use justly, we will return to a dry-land type of agriculture in this state.

Energy

T. W. TEN EYCK*

One of the most important facts of life this Nation must face is that it takes water to produce energy under the technology available to us now and for the rest of this century.

The United States, with 6 percent of the world's population, consumes about 30 percent of all of the energy used in the world. That same 6 percent of the world's population produces 31 percent of the gross national product of the world. There is a direct correlation between energy consumption and the GNP.

The only way we can hope to guarantee our high level of productivity in America is to produce as much energy as we can from sources within our own borders. I think we should be realistic. We are going to continue to need and want energy, and we know that dependence on foreign oil for 40 percent of our national needs is dangerous. Another embargo would be far

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more serious than the one three years ago. Further, whether we like it or not, oil and gas, oil shale, coal, and nuclear power are the sources we will have to use in the next several years. Increased conservation and use of renewable forms of energy such as solar power should be part of a national energy policy, if we ever get one. But, they will not contribute significant amounts of energy for many years to come.

The production of the kind of energy which is available to us now and will be in the next 20 to 25 years requires the use of water. Necessary water quality ranges from very low for such duties as water flooding of oil fields and moisturizing processed oil shale, to a very high quality water required for such jobs as high pressure boiler feed and production of hydrogen by reforming hydrocarbons with steam.

To give you some perspective on the use of water in the energy-producing industries, a few comparisons are in order. Here are some typical water requirements for various materials on a "per ton of material produced" basis: gasoline from the refining of petroleum requires 350 gallons of water per ton; shale oil by surface retorting, 1,000 gallons per ton; water flooding for secondary recovery of petroleum reserves, 7,000 gallons per ton; synthetic liquid fuel from coal may require from 1,000 to 7,000 gallons per ton; production of a ton of corn requires 10,000 gallons per ton; and wheat, 35,000 gallons of water per ton.

When push comes to shove, I believe it likely that powerful economic forces will exert a tremendous influence on the decision of who gets how much water for energy development and agriculture. The first test will likely take place here in the semiarid West before it does in the rest of the country.

A recent study by the U.S. Department of Agriculture and the Environmental Policy Institute shows that the dollar value of produced wheat is only about 4 percent of the dollar value of synthetic fuel produced from coal. This is based on each using the same amount of water. That is, if it takes 100 gallons of water to produce about one-half million B.t.u.'s of synthetic coal liquid worth one dollar, the same amount of water would produce about one-hundredth of a bushel of wheat worth four cents. These numbers could indicate that irrigated crops in the

West may be unable to compete economically with synthetic fuels for the use of water. There might be political constraints which would overcome some of the economic considerations in favor of increased agricultural use of water. Nevertheless, economic pressures are very likely to have an effect on future water-use decisions.

Now, I would like to be more specific about the use of water. The United States petroleum industry has pioneered the use of a zero discharge concept for use in petroleum refineries. In this concept, the total amount of water taken into the refinery, whether it be in the form of raw water required for cooling purposes or rainwater falling on the plant premises, is recycled and evaporated until it is totally consumed. There is no discharge of waste waters into surrounding streams with the concomitant problems of water quality and treatment required before discharge.

In the case of shale oil production, we find that the zero discharge concept fits in very nicely with the requirements of moisturizing the processed shale prior to discharge. The moisturizing serves the triple purpose of reducing the dust from the processed shale, providing a proper consistency for compaction, and avoiding the need for final evaporation. As I noted above, about 1,000 gallons of water are required per ton of shale oil produced. This is a total consumption of water. About one-half is used for moisturizing the processed shale and the other half is evaporated to the atmosphere, largely to take care of cooling certain process streams. There is not much potential for reduction of water consumed unless a way can be found to dispose of the processed shale without moisturizing. If water becomes too costly to be economical, the water cooling requirements could be partially reduced by substituting air cooling. However, there is only a limited potential because air cooling cannot completely replace water cooling.

The Rio Blanco Oil Shale Project proposes to kill two water birds with one stone. The saline groundwater, which must be pumped out in order to de-water the mine, is estimated to be capable of supplying all the water required for more than 50,000 barrels per day of production. Production at this level for us is probably more than 10 years into the future.

This means there will be no discharge of pumped saline water into the White River. As a matter of fact, our studies project a reduced natural flow of saline water into the White River as a result of our pumping. Another advantage is that we will not need to import more expensive water to our tract until our production increases. If and when our production does expand above 50,000 barrels per day to a potential ultimate of 300,000 barrels per day, we would import water from the White River through use of an existing industrial water right on which we have an option.

Our plans for use of water are more completely spelled out in our detailed development plan submitted to the U.S. Department of the Interior in March 1976. We stand ready to modify these plans if new information becomes available which would indicate a better solution.

In summary, the kinds of energy available to this country require the use of water. While there will probably be some competition for this valuable resource, it is probable that energy development will take much of it simply because we will not have that much of a choice in the next several years. In the case of the Rio Blanco Oil Shale Project, we can get by with underground water for production of some 50,000 barrels per day.

Industry

LYLE E. BUSH*

We as members of the water resource department of a large Eastern Slope industry in Colorado feel like a rare breed. It is unusual for manufacturers here to be self-sufficient to the extent that they provide their own water resource and water treatment systems. We appreciate the opportunity to present several ideas from that point of view.

Coors is the largest single brewing complex in the world. Our water diversions last year were a little over 40,000 acre-feet. Most of that water is used for cooling mechanical equip-

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