Bodega Bay Nuclear Plant

The editorial "Civilian nuclear power" in the 14 December issue (*1*) very appropriately brings attention to the recent Atomic Energy Commission report which documents U.S. achievement in reactor technology. Although the quotation from this report cites the remarkable reduction in cost of fission-generated electricity to an "estimated 5.5 to 6 mills [per kilowatt-hour] for a large plant to be built in the near future at Bodega Bay, California," the editorial fails to point out that such economical operation of the proposed plant would be possible primarily because of the site. Were the plant to be situated in a more remote place where cooling water, transportation facilities, and other features of construction and operation are less readily available, the electricity could not be sold at so low a price—that is, nearly in the range of cost of electricity generated by fossil fuels.

The Bodega Bay reactor, would be the largest nuclear plant for generating electricity in the world. Water wastes would be discharged into the ocean, with resulting thermal changes and deposition of radionuclides similar to those in the discharge from the Hanford reactors into the Columbia River. Low-level gaseous wastes would be discharged at a point windward of a highly productive agricultural area which supports a 70-million-dollar-a-year dairy industry in the San Francisco milkshed. The plant would conform to AEC regulations regarding safety measures; nevertheless, the proximity of the reactor site to populated areas and areas of agricultural production would create special problems which should be taken into consideration. The site is just *under* ¼ mile from the San Andreas fault (previous regulations regarding the location of reactors stated that "no facilities should be located closer than ¼ to ½ mile to a known active earthquake fault," but the regulations were altered in April 1962 to read only "¼ mile"). Thus the hazard of possible natural catastrophe is added to the hazard of possible man-made catastrophe. Normal operating conditions would add detectable radiation to the local biosphere.

The site has long been considered a unique natural preserve; for this reason Bodega Head had been selected by the University of California as the location for a marine biological laboratory. A

faculty committee of the university has so far failed to find an alternative laboratory site which would be as suitable, quite apart from considerations of accessibility. The propriety of the political maneuvers by which the Pacific Gas and Electric Company acquired land rights has been questioned; moreover, alterations in federal and local regulations have facilitated the development of the project, although none of this help can be classed as subsidy.

The implications of the AEC report might well have been examined in the editorial from the viewpoint of the AAAS Committee on Science in the Promotion of Human Welfare: What is the impact of science on society as exemplified by nuclear technology at Bodega Bay? The AEC report states that over half the electricity in the United States may be generated by nuclear reactors by the year 2000. While such reactor development can be beneficial, is it not fitting to ask whether those who are affected by such growth are participating in the decisions which make such economic developments feasible? Are consumers of electricity willing to buy the product for 5.5 mills per kilowatt-hour and take an admitted but as yet unmeasured health risk (*2*) and sacrifice the ecological and scenic assets of Bodega Bay? Where will the public have an opportunity to register its opinion? The AEC has not yet held hearings for granting the license for the Bodega Bay reactor. (Recent legislation has reduced the number of mandatory public hearings for reactor licensing. The AEC report suggests that further simplification and streamlining of licensing procedures will encourage utilities to develop more nuclear power stations. Would it not be in the public interest to hold hearings regarding site selection before the utilities present a *fait accompli*?) Will the development of nuclear power demand that Bodega Bay be selected, as the only suitable location? Will all who are affected participate in that decision?

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References

1. *Science* **138**, 1231 (1962).
2. "Background Material for the Development of Radiation Protection Standards," *Federal Radiation Protection Standards Rept. No. 1* (Government Printing Office, Washington, D.C., 1960).

The proposed Bodega Bay Atomic Park of the Pacific Gas and Electric Company is cited in a recent editorial as a breakthrough in nuclear power economics. The editorial quotes excerpts from AEC chairman Seaborg's recent report to the President and asserts that the power rate figure "does not involve a subsidy."

It happens that this particular power plant will be built on a scenic headland, about 50 miles north of San Francisco, which was included in the 1955–56 California State Park master plan. For some reason the state master plan did not receive open and public consideration by the Sonoma Planning Commission, and this apparent pocket veto made it possible for Pacific Gas and Electric to purchase the initial site on Bodega Head and to acquire an additional 67 acres for an exclusion zone through exercise of its rights of eminent domain. Further, Sonoma County has granted an easement for three lines of high-tension wires along the entire length of its only coastal park, Doran Beach County Park.

Bodega Head had been selected by the University of California as the site for its future Marine Biological Laboratory. Through construction of an access road and the emission of 250,000 —perhaps eventually 1 million—gallons of hot water per minute, the power station will transform the area from a unique class A site to a class B site for a marine facility. The history of this somewhat controversial matter is documented in the booklet "A Visit to the Atomic Park," published and circulated under the auspices of the Sierra Club in San Francisco.

The power economics of the Bodega Bay reactor are discussed in an article by Dresner and Weinberg in *Reviews of Modern Physics* [**34**, 747 (1962)]. These authors point out that the price of fossil fuel at Bodega Bay is much higher than the average for the rest of the United States. They go on to say that the exact method of calculating the fixed plant cost, the initial outlay for fuel, the plutonium buy-back arrangement, the lease charge for U^{235} hold-up, and the assessment for spent-fuel reprocessing will all be instrumental in dictating the ultimate cost of mills per kilowatt-hour at the Pacific Gas and Electric facility. The authors state: "These prices are set largely by government fiat; the current prices represent a substantial government subsidy for the Bodega Bay plant."

Assuming that the radioactive waste

problem can eventually be solved, Dresner and Weinberg conclude that the development of "breeder" reactors which can utilize abundant low-grade uranium and thorium ores is "one of mankind's most important ultimate tasks." Reactors of the Bodega design will decimate the national reservoir of high-grade uranium ore without making any substantial contribution to technology. Nonetheless, convertors of this type are fostered by the AEC, probably because, as Chairman Seaborg has said, the intensely competitive nuclear equipment industry is "over-capitalized and under-used at the present time" and it is thought necessary to keep the uranium industry "viable" during the period of transition to breeder reactors.

Finally, the Price-Anderson Act of 1957 provides a federal liability indemnity of $500 million for each catastrophic accident in a nuclear installation. Through this subsidy, ethical standards of safety may have been bypassed and ultimate liability transferred to the taxpayer [A. Ackermann, *Proc. Am. Soc. Civil Engrs.* **87**, No. PP2 (1962)]. This point is especially relevant to the Pacific Gas and Electric reactor in view of the proximity to the San Andreas fault and the meteorological instability of the Bodega area.

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In my editorial I cited the proposed Bodega Bay plant with its estimated cost of 5.5 to 6 mills per kilowatt-hour merely as an example of a continuing trend toward lower costs of nuclear power. I was unaware of the controversy over the site of the proposed installation. On that matter I have little knowledge. With respect to estimating future trends in costs of nuclear power I do have a special basis for the opinion that figures considerably lower than those cited for Bodega Bay are in sight. Indeed, Alvin Weinberg has recently spoken of costs as low as 1.5 mills per kilowatt-hour for a very large installation.

As for the matter of subsidy, the monetary value of the government insurance is small. The utilities are re-

quired to obtain a substantial amount of insurance with private companies. This covers most of the accidents which might occur. The government insurance in effect amounts to a $60 million deductible policy. The utilities pay AEC a fee of $30 per thousand kilowatts of thermal energy as a premium to obtain the additional coverage up to $500 million.

It is difficult to establish what the true competitive position of oil and nuclear energy would be in the absence of federal action. The government has set an artificially high price for natural uranium. In a free market its price might be half what it is at present. The 27½-percent depletion allowance for oil is worth about a billion dollars a year to the petroleum industry. If this allowance were removed, the competitive situation with respect to energy in California would be considerably changed.—P.H.A.

Activists and Nonactivists

The article "Divergent reactions to the threat of war" [*Science* **139**, 88 (11 Jan. 1963)] raised a number of important issues, mainly in the realm of group perception. For instance, the restudy seemed to suggest that both groups had been attentive to those arguments and points of view presented publicly that were most closely in accord with their previous thinking. After intensive public propaganda by opponents of Medicare, as well as by its supporters, the OASIS group was more against it, and the People for Peace group were more in favor of it.

In their conclusion the authors express surprise at the "similarity between the two groups" and suggest that this may have been due to the "particular community studied." May I suggest another alternative, which evidently was not considered by the authors? It is significant that out of a community of 8000 people (3500 adults?) only 54 sought concrete community action of any kind during the Berlin crisis (unless there was other activity which the authors do not tell us about). Perhaps the two groups are relatively similar in a number of ways because they represent the activists in the community. They are probably the best-informed members of the community and those who tend to respond to emergency conditions with some kind of concrete ac-