We regret any erroneous implication that Chapman was advocating the abandoning of chemical farming.

The point raised by Schoning is an important one. Even the proposed "distant" fishing for Antarctic krill is still coastal fishing (although off an unoccupied coast). Sometimes such fishing is in underexploited areas—as the Antarctic case would be—but, all too frequently, fishing distant shores is the first step in overexploitation and leads to political difficulties (as in Iceland), economic difficulties, and overfishing (as in Peru).

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Geothermal Resources: Prospects for Development

May I offer a footnote to Geoffrey R. Robson's fine review "Geothermal electricity production" (19 Apr., p. 371).

On 12 July 1973, Pacific Energy Corporation (the geothermal operating arm of Hughes Aircraft Company) entered into an agreement with Pacific Gas and Electric Company (PG & E) under which it agreed to sell PG & E its established geothermal steam reserves (149 hectares) and to develop additional reserves (1304 hectares), and PG & E agreed to buy all the steam produced in that area, located within The Geysers geothermal field in Sonoma County, California. An initial 55-megawatt power plant will be installed by PG & E by 1977; additional power plants will be installed as additional geothermal reserves are established. PG & E is presently paying geothermal steam suppliers 3.73 mills per kilowatt-hour for steam supply and effluent disposal services. The Pacific Energy Corporation also holds additional leases within The Geysers (about 6000 hectares) that are uncommitted and has applied for federal geothermal leases in Oregon, Washington, Idaho, and Utah.

Barbier and Fanelli (*1*) report that the installed capacity at Larderello-Travalle in Italy is 405.6 megawatts. The installed capacity at The Geysers will be 516 gigawatts by November 1974 (*2*). The 20-megawatt geothermal power plant at Matsukawa, Japan, is owned and operated by the Japan Metals and Chemicals Company; a 10-megawatt plant has recently been installed there by Mitsubishi Mining Company.

While "dry (superheated) steam" field operation is relatively simple, as Robson notes, the work under way to demonstrate binary cycle systems is thought by several major companies to offer a more economical and efficient conversion process (*3*).

The dry steam produced at The Geysers is not only the result of encountering a vapor dominated reservoir. Superheating may also be a function of the thermodynamic process occurring in the well bore and the pipeline system.

One of the major obstacles to geothermal development in the United States is the fact that the federal tax laws do not refer to "geothermal resources" or provide any explicit tax treatment for exploration and drilling expenses.

Congress is aware of this oversight, but the current political situation regarding the tax treatment of oil and gas companies has apparently prevented any consideration of the plight of the geothermal developer at this time. Until geothermal exploration costs can be confidently treated as current business deductions, it is unlikely that the rate of geothermal exploration will increase dramatically.

Some 100 companies, partnerships, and individuals have applied for federal geothermal leases (about 3.2 million hectares) since 1 January 1974, when the Federal Leasing Program began. It is hoped that the federal government will change the focus of its political attention and enact remedial legislation that will encourage the development of these lands.

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References

1. E. Barbier and M. Fanelli, *Overview of Geothermal Exploration and Development in the World* (Istituto Internazionale per le Ricerche Geothermica, Pisa, Italy, 1973), p. 3.
2. *PG & E Environmental Data Statement for Geysers Unit 15* (Pacific Gas and Electric Co., San Francisco, 1974).
3. D. H. Cortez, B. Holt, A. J. L. Hutchinson, *Energy Sourc. J.* 1, 1 (1974); a contrary opinion is held that "theoretically a refrigerant can promise more [electrical] output than does water in the single flash process . . . [but] it appears that double flash can about match anything that refrigerants can hope to attain and is eminently more practical" [B. Wood, in *Geothermal Energy*, N. C. H. Armstead, Ed. (Unesco, Paris, 1973), p. 121].