billion of the $10 billion program "could have its initial impact" by 1980, Smith said, but even that is felt to depend critically on finding the right answers to some thorny policy issues. Among these are the pace of oil shale leasing in the West; pricing policies on energy that can make or break the economic attractions of new technology; government's role in subsidizing such things as coal gasification or liquefaction plants, or otherwise softening the economic risks of pioneering plants; and problems of siting and licensing energy plants.

The most immediate policy issue, however, concerns the management of energy R & D. With a herd of federal agencies—from the AEC to Interior to the NSF—all heading off along traditional and potentially conflicting or duplicative paths, the overview panel's most emphatic conclusion, Smith said, was that the grand plan is "not going to work unless someone is put in charge. . . . Somebody has to drive this train."

—ROBERT GILLETTE

Astronomy in Britain: Fogged Up by Cloudy Skies and Schisms

The British astronomical establishment has been shaken by its second top-level resignation in 18 months, a sign at best of failure to resolve internal differences. The latest departure is that of observational astronomer Margaret Burbidge, who last month resigned as director of the Royal Greenwich Observatory to return to the University of California at San Diego. In May last year, for somewhat different reasons, theoretical astronomer Sir Fred Hoyle gave his notice as director of the Cambridge Institute of Theoretical Astronomy (*Science*, 2 June 1972).

The basic reasons for her resignation, Burbidge said in a statement issued last month, were "lack of support for my vision of the way in which optical observational astronomy in the United Kingdom could be revitalized, and an environment in which I have felt it increasingly frustrating to work." Just what has gone wrong in British astronomical politics is hard to figure out from across the Atlantic, but part of the trouble seems to have been the emergence of two camps, based to some extent on earlier animosities but which have quarreled most recently over the future development of British optical astronomy. The camp that is easier to identity, because it has been more willing to go public with its version of events, is that associated with Hoyle and his colleagues, including several whom cloudy skies have driven to work overseas, such as Margaret Burbidge and her husband Geoffrey.

Friendly relations between the two camps were not assisted when Geoffrey Burbidge decided recently to "share a few home truths" with the readers of *Nature*. "Optical astronomy as it is currently being practiced in Britain is only third-rate," Burbidge stated. The primary reason was that the British astronomical establishment "has consistently, over the period since the war, refused to face the real world or accept that anything was the matter, and when important decisions were made, they were either hopelessly wrong, or too late or both." Citing eight "key mistakes" that flowed from this attitude, Burbidge alluded to the pettiness of English astronomical politics and the "never-ending consultations" involved in the planning committee system operated by the Science Research Council (the British equivalent of the National Science Foundation); this kind of situation, he noted, was what had led up to Hoyle's resignation. Hoyle, Burbidge said, had "attempted to reverse the trend from almost complete to absolute mediocrity. Some of us have tried, peripherally, to help. We have so far failed."

Burbidge's support of Hoyle against the British astronomical establishment was also an expression of his own troubles with that establishment. At the time his letter appeared in *Nature* (8 September 1972), it was already clear that the SRC was not able to offer him an acceptable post in England from which he could continue his partnership with his wife.

Another difficulty between the Burbidges and the SRC arose over plans for a new British observatory in the Northern Hemisphere. Several years ago, the SRC appointed a committee to advise on the feasibility of building a Northern Hemisphere observatory in a site suitable for modern observing, and therefore outside Britain. The committee was chaired by Hoyle and included as members Geoffrey Burbidge; another expatriate, Wallace Sargent of Caltech; and the astronomers royal of England and Scotland. The SRC, whose commitment to keep the public informed on important issues of science policy is less than passionate, suppressed the committee's report and with it any outside debate of the issues raised. The report is believed to have recommended that a national center be set up, financed by the council, but managed, after the model of the national centers in the United States, by an independent consortium of universities. Implicit in the report was that the two royal observatories should be closed down or otherwise reduced in scope.

The last suggestion, whatever its merits, was a tactical error. It antagonized the many astronomers working at the royal observatories and particularly the Astronomer Royal, then Sir Richard Woolley.

Woolley, the most vocal critic of the national center plan, retired last year, renewing the hopes of the proponents that they could persuade the SRC to act. Hoyle at that time still held the chairmanship of a critical SRC committee, the Astronomy Policy and Grants Committee, and seems to have persuaded some of the British expatriates in the United States to return to England if the plans for the national center should move ahead. The inducement seems to have been the amount of money the SRC was prepared to put up—enough for one 150-inch telescope and a smaller instrument. And the favored site for the new observatory, after the Spanish refused to let it be built on the Canary Islands because of the dispute with Britain over Gibraltar, was Hawaii.

At first, things went well. Margaret Burbidge was appointed to succeed Woolley as director of the Royal Greenwich Observatory (though not as astronomer royal), and the SRC apparently agreed to find a place for her husband and make available other senior positions for the appointment

of expatriates. Hoyle and his colleagues were under the impression that the SRC was committed to a reorganization along the lines they had proposed. But somehow the plan failed in its execution. Sir Brian Flowers, who had persuaded Margaret Burbidge to accept the Greenwich directorship, retired as chairman of the SRC; Hoyle rotated off the crucial SRC astronomy committee; and SRC's support of the national center scheme seemed suddenly to evaporate at about the time Margaret Burbidge arrived from San Diego to assume the directorship of the Royal Greenwich Observatory.

When she resigned in frustration 15 months later, Burbidge complained that she had not been given the support to carry through an essential "pruning and reorganization and concentration of effort for overseas telescopes." She found herself in charge of a "highly traditional observatory . . . situated in a castle and grounds whose upkeep becomes an end in itself." She was, she concluded, the wrong person in the wrong job. Geoffrey Burbidge was equally disappointed at the failure of the SRC to embrace reform. "I've thrown all the bricks I can, and they've all hit home, but the beast is still alive," he told *Science*.

The SRC's version of these events can only be surmised because the council refuses to discuss the issue. M. O. Robins, the SRC's director for astronomy, said this month from London that he could not comment on Burbidge's resignation, that he did not know what mandate she had been given, and was not aware of the proposed national center. A possible reason for the SRC's withdrawal of support may have been simply that the Hoyle-Burbidge proposals, whatever their merits, did not have the backing of other astronomers. The view of an eminent British theoretical astronomer is that the committee which proposed the national center was unrepresentative in the first place, and unrealistic in its proposals to run down the royal observatories. "The leadership provided by Hoyle and Burbidge has not proved any more effective than that before," he says. Other British astronomers agree with some of the ideas proposed by the Hoyle-Burbidge group but consider they were too impatient with the British committee system and too unwilling to persuade others of the merits of their case. An American astronomer acquainted with the politics of British astronomy suggests that the SRC would have moved ahead with establishing a national center if the groundwork had been better laid. "It's wrong to castigate [former SRC chairman] Flowers and the establishment just because they were not given a good game plan," he says.

Margaret Burbidge

It is easy to criticize the Hoyle group for not working within the system and for their propensity to resign when things don't go their way. On the other hand, they have at least tried to apply their considerable talents to reforming the system from within, and by their own account have endured years of bumbledom from the SRC and parts of the British astronomical establishment. The decision to site Britain's largest optical instrument, the 100-inch Isaac Newton telescope, in Herstmonceux castle in Sussex is no great tribute to the establishment's conduct of affairs.* Hoyle and Geoffrey Burbidge have come to the conclusion that optical astronomy in Britain can only be saved by a radical restructuring and that the time is past for relying on self-correcting processes. "The SRC gets pretty good advice from most of its scientific committees," says Burbidge. "But British astronomy is third-rate or worse. You cannot improve the situation if you continue to take advice from these people." Hoyle, who resigned when his Cambridge institute was stripped of its international character, said this month from Rice University, Houston, that both his resignation and Margaret Burbidge's stemmed from the same bad situation—the fact that there are many people living on British astronomy who can do very comfortably provided standards are low; such people resist any reform that would lead to an improvement of standards, Hoyle observes.

(A straw poll taken to ascertain the strength of this view indicated that British optical astronomy does have a low reputation, particularly in comparison with the excellence of British radio and theoretical astronomy. One expatriate, asked if he agreed that optical astronomy in Britain was third-rate, replied: "With certain individual exceptions, that is too high an estimate." Others praised highly the traditional observing programs carried out by the Royal Observatory under Woolley. Most people agreed that leaden skies, not people, were to blame for the lack of success.)

The Hoyle group is unhappy about the management of the SRC, as well as the state of optical astronomy. Mandarins with firsts in Greats (the equivalent of a *summa cum laude* in ancient languages), zero interest in the science, and a total interest in building empires for their own sakes is how one British astronomer describes the officials of the SRC. Hoyle found during his stint as chairman of the SRC astronomy committee that the permanent officials held all the effective power and that there was no possibility of their being overridden by the scientists. (SRC director Robins described this view as "a complete misunderstanding of the system—all decisions are taken by the council or by committees which are also composed of eminent scientists.") But Hoyle also expressed sympathy for some of the problems of the SRC; it has no mandate, for example, to correct a bad situation in the universities (which are, in theory, independent of the government), and the royal observatories, with their own particular problems, were forced upon the SRC, which has to invest large sums in keeping them going.

The present state of affairs is unfortunate chiefly in that the SRC has missed the opportunity, maybe permanently, to enlist expatriate astronomers in the revitalization of British optical astronomy. The Hoyle camp may be in part to blame for having run out of patience with the system, but it is equally evident that the SRC, although it had the opportunity, has failed to create the conditions under which everyone could work in harmony.—NICHOLAS WADE

* According to Geoffrey Burbidge, the telescope is "almost completely useless" in its present position. Standing 5 miles from the sea and a bare 100 feet above sea level, the instrument is restricted by cloud cover and sea mists to a maximum of 800 observing hours a year, compared with 2500 for the large telescopes in California. It cannot pick up very faint or distant objects at all, so cosmological investigations are largely ruled out. Defenders of the telescope's position say that it is useful for training students and developing instrumentation.