Book Reviews

Social and Technological Choices

Energy and American Values. IAN BARBOUR, HARVEY BROOKS, SANFORD LAKOFF, and JOHN OPIE. Praeger, New York, 1982. xvi, 240 pp. Cloth, $26.95; paper, $12.95.

This is not an ideal moment to publish a book on energy policy. A glut of petroleum on world markets, falling oil and gasoline prices, the Reagan administration's disdain for energy planning, the public's apparent boredom with the "moral equivalent of war"—all have combined to undermine interest in this once fashionable topic. No doubt present apathy about the matter will be short-lived. When energy prices begin skyrocketing again, we may rue the day when careful thinking about energy went out of style. In the meantime the lively, useful analyses offered in *Energy and American Values* could well be overlooked.

The study is a collaborative project of four scholars gathered at the National Humanities Center in North Carolina: Ian Barbour, a physicist and professor of religion and philosophy; Harvey Brooks, a professor of technology and public policy; Sanford Lakoff, a political scientist; and John Opie, a historian of technology and the environment. Though each of the participants wrote drafts of the chapters in his area of expertise, the book avoids problems of scatter that often afflict collections by several authors. Beginning from different standpoints on energy and social values, the writers worked to achieve consensus and offer their findings as a unified whole.

Almost all of the energy studies written during the past decade set out to weigh important alternatives—oil, coal, solar, nuclear, and so on—from the exclusive (perhaps obsessive) standpoint of economic and engineering efficiency. The implicit notion seemed to be that people who disagree on everything else might nevertheless endorse a good recipe for efficient energy. An important strength of *Energy and American Values* is to transcend such narrowness to examine a very wide range of human needs, ideals, commitments, and conflicts involved in energy choices.

The first two chapters present a colorful overview of patterns of energy use in the nation's history. "As late as 1850 wood supplied more than 90 percent of the fuel used for energy in America, mostly for heating" (p. 5). Through a rapid process of development, the increasing use of coal, petroleum, and hydroelectric power helped transform an agrarian society into a thoroughly industrial one. In the popular imagination, material "abundance" fueled by expanding energy resources came to be seen as a boon synonymous with democracy itself.

During the past decade, however, Americans' traditional optimism about energy and the common good has experienced a series of shocks. Oil shortages, environmental pollution, the accident at Three Mile Island, and other such problems have sparked a series of heated controversies in social philosophy and public policy. The book examines these issues in detail, drawing upon a wealth of theoretical and practical sources. What ought to be the role of government as compared to business firms and consumers in making choices about energy? When risks are involved in particular forms of energy production, how can we make equitable judgments about the distribution of those risks? Should our society reject certain kinds of energy systems as threats to individual freedom while embracing other systems on the grounds that they realize the democratic promise? As they approach questions of this kind, the authors acknowledge the challenge posed in the work of Amory Lovins. Renewing the split between Jeffersonian and Hamiltonian ideas of American life, Lovins has sharpened the political and cultural dimensions of our energy problems.

The volume's primary contribution is to clarify matters seriously debated during the past decade, giving the most important viewpoints their due. In its even-handed approach to such issues as conservation, nuclear proliferation, renewable versus nonrenewable resources, and the obligations of this generation to future ones, the book would make an excellent college textbook. Though the writers avoid imposing their viewpoint on the reader, their arguments convey a number of strong opinions, ones that are, to use the book's own metaphor, distinctly Hamiltonian. Thus, several chapters diligently investigate a host of dangers and social problems that might arise were society to adopt energy decentralization and the "soft energy" path. For example, the writers anticipate "an erosion of centralized energy networks as decentralized sources are phased in, which will degrade the energy services available to the poor and to central city residents and increase costs" (p. 133). The underlying message is that, though Lovins and other critics have raised some interesting questions, their proposals are neither practicable nor politically sound.

At the same time, the book seeks to bolster confidence in nuclear power, economic growth, and the ability of scientific and technical progress to solve social problems. Environmentalists will be interested to learn that "from a strictly ecological viewpoint nuclear power is almost certainly the most benign of all the main available or prospective energy supply technologies" (p. 138). Those worried about risks to health and safety from coal and nuclear power are asked to remember the great improvements in material welfare that stem from the expansion of our technological civilization. Though the writers favor steps toward conservation and an increasing use of sustainable resources, they see no particular need for social reform. What is important now is to develop a "mix of supply technologies," to "diversify risks" and "keep our options open" (p. 113). Toward this end, Barbour, Brooks, Lakoff, and Opie advise, existing institutions in our society, public and private, will serve us well.

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An Arena of Applied Research

Agricultural Research Policy. VERNON W. RUTTAN. University of Minnesota Press, Minneapolis, 1982. xiv, 370 pp. Cloth, $32.50; paper, $13.95.

The subject this volume promises to address is a complex one of major importance to both rich and poor countries. The book, moreover, promises to focus on its institutional dimensions, a task not frequently attempted by economists, and it is written by an individual whose record as scholar, researcher, research administrator, and adviser to govern-

ments, foundations, and other organizations seems to almost uniquely qualify him to tackle so complicated and nontraditional a subject.

Most readers will, in fact, benefit substantially from Ruttan's irrepressible good sense and judgment on almost every portion of the vast landscape he has chosen to work on. Nevertheless, as a whole the volume falls short of its promise, mainly because it tries to discuss agricultural research policy without continuous appeal to what we actually know about the moving agricultural research frontier itself. Though one can well understand a reluctance to resurvey so vast a literature in both the natural and social sciences, one has the uncomfortable feeling that Ruttan has instead decided simply to empty out his files, resorting to partial summaries of much of his and his associates' earlier work, plus some rather hurried ruminations on interesting dimensions of the landscape not previously analyzed. What is known and relevant is thus not adequately summarized and what is new is not sufficiently spelled out or integrated with the rest.

One illustration is the discussion of the alternative political, administrative, and budgetary systems that underlie the choice of a national research system. Ruttan (in chapter 2) indicates that he intends to concentrate on the organizational or institutional environment conducive to technical change in agriculture and to downplay what we have learned about the biological and economic ingredients of such change. The bases of differences in agricultural performance among developing countries have received a good deal of professional attention, especially the relative roles of R & D and extension services and the extraordinary high rates of return attaching to them (as high as 90 percent annually in one estimate) relative to other possible investments in agriculture (for example 18 percent to capital). Explaining the persistence of such large disparities in the rate of return should have high priority and may well require a new, broadened conception of "rationality" that would take into account institutional options—and constraints—embodied in national research systems. Unfortunately we are not permitted more than a distant view of this promised land.

This is not to say that Ruttan does not present a useful discussion of national agricultural research systems and the national agricultural research institutes that are a key component of those systems. In chapters 3 and 4 he provides instructive sketches of the contrasting British, German, U.S., Japanese, and Malaysian cases plus valuable insights from his own experience. He makes the point that in developing countries the choice of research system may be more related to colonial antecedents and postcolonial foreign assistance efforts than to indigenous initial conditions (physical as well as human) and objectives. This is highly suggestive and undoubtedly correct; all the more pity that little effort is made to extract some general principles from the fascinating materials presented. The volume also includes a chapter (chapter 10) that ostensibly reviews the economic benefits of agricultural research. But the review contains little beyond a rather uncritical summary of the residual and multiple regression analysis results that have been accumulating in the profession and does not take up the non-traditional theme announced earlier by considering such questions as how the size of the residual might be affected by institutional factors or how alternative organizational environments can be meaningfully compared by regression techniques.

Ruttan does rummage about in one corner of the institutional arena by means of a selective review of the literature on allocation of research resources (chapter 11). But the emphasis here is less on the interaction between R & D inputs, physical inputs, and institutional modes in increasing productivity than on the difficulties, technical as well as political, of determining what the relevant outputs and objectives are. Ruttan makes explicit what we all know implicitly, that is, that one's prior assumptions often determine one's methodology as well as one's findings; to wit, the commodity selected, the input focused on, the level of aggregation of the production process, even the scientific discipline brought to bear do not represent value-free choices. It is perhaps not shocking to be told that the allocation of research funds is a substantially political act; but Ruttan also exposes in a very instructive fashion the distributional issue of who, producers or consumers, exporters or domestic market suppliers, are benefited by maximization of agricultural productivity in a world of imperfect fiscal redistribution capabilities. He also makes us aware of the "free rider" problem, with each region anxious to piggyback on others' research, and he exposes the weaknesses of the so-called "parity model" approach, which, in its naïve version, holds that technological opportunities are about equal in every commodity and the benefits of research likely to be proportional to the expenditures on it. All of this is good common sense but brought together here with clarity and style.

The rapidly growing international network of specialized agricultural research institutes has received much attention as a key element in the "Green Revolution" of the '60's and '70's. Ruttan's treatment here steers effectively between the exaggerated enthusiasms of the "seeds of change" literature and the harsh skepticism of the old national extension service fraternity. He rightly emphasizes the need to innovate continuously so that gains that have been made will not be negated by such second-generation problems as reduced resistance to disease and pests, and he underlines the importance of the national system's choice of plant varieties and agricultural practices; but, once again, given the national systems as the main actors, there is little attempt to relate this to the theme of institutional policy options.

Ruttan cites the importance of friction between the personal research agendas of international institute scholars and the assigned public service commodity missions of these institutes. But what about the relationship between the latter and basic national system constraints and objectives? Given the increasing number of functions gradually being assumed by international institutes—from maintaining genetic material banks and carrying out research on farming and cropping systems to choosing between mechanical and biological technologies and serving as full-fledged agricultural development centers—he would opt for greater concentration and avoidance of overextension in accommodating to financial donors' escalating demands. However, the policies that militate most strongly against a given society's national employment-cum-growth objectives are usually not primarily internal to its agricultural research system but are imposed upon it from the outside, usually on behalf of powerful urban and industry-oriented pressure groups. Unless the agricultural research system is analyzed within that broader context it is difficult to see how one can determine either the extent of the gap between general social and particular private objectives or the best way of closing it.

The volume ends with chapters on the role of the social sciences in agricultural research and on social responsibility and agricultural research. The former constitutes a somewhat plaintive discussion of the relatively small role social scientists have played and the difficulties in the

way of fruitful collaboration between natural and social scientists. The latter takes us back to well-traveled ground: the author's favorite induced institutional innovation hypothesis; the possible relationship between research and productivity, equity, health, and even esthetics; and the alleged standoffishness of the basic sciences community vis-à-vis both agricultural and, of course, social scientists.

In sum, the reader would have benefited from having research policy options related to the variable but often very high observed rates of return to agricultural research; from an analysis of why the institutional and economic environment for the R & D industry continues to be suboptimal; from more discussion of private versus public sector R & D activity, formal and informal; from some reference to the matter of appropriate technology; and, finally, from a more consistent comparative treatment of rich and poor country settings.

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Molecular Neurobiology

Molecular Approaches to Neurobiology. IAN R. BROWN, Ed. Academic Press, New York, 1982. xii, 422 pp., illus. $49.50. Cell Biology.

This book captures the excitement of certain applications of molecular and cell biology to the study of the nervous system. At the same time, it reveals the awesome challenge of relating biochemical findings to functional parameters and underlying developmental mechanisms.

Nervous systems develop tremendous morphological, biochemical, and functional specialization, and it is logical to investigate whether synaptic membranes contain proteins with specific functions. Isolated synaptic junctional complexes and postsynaptic membrane densities do contain a major protein, postsynaptic density (PSD) protein, distinct from actin, tubulin, neurofilament protein, and calmodulin (which are also present), plus glycoproteins not found on other types of cellular membranes. Marked increases in PSD protein, Thy-1 antigen, and protein kinases accompany morphological maturation of synapses (Gurd). Another critical feature of neurons is axonal transport of proteins synthesized in the cell body and of neurotrophic viruses, toxins, nerve growth factor (NGF), and, probably, neurotransmitters into the cell body (Karlsson). Little is known yet of the underlying mechanisms or their regulation, however.

Several powerful genetic techniques can be applied to the study of the mammalian nervous system (Breakefield *et al.*). The use of complementary DNA probes reveals that tubulins are a family of eight to 20 proteins and that six distinct messenger RNA species (one possibly for NGF) hybridize with a cDNA probe for the human insulin gene. Genes are mapped on specific chromosomes, and genotypically altered cells can be used in cultures or to construct mosaic animals. Many mutant behavioral phenotypes are being investigated; a structural defect in β-NGF or its precursor polypeptide may be the primary lesion in familial dysautonomia.

An unusually short DNA repeat length appears postnatally in chromatin only from neurons of the cerebral cortex (Brown and Greenwood). RNA-DNA hybridization shows that the number of different types of brain mRNA sequences is manyfold greater than that of other tissues, corresponding to more than 100,000 different brain polypeptides (Kaplan and Finch). This subject is ripe for investigation with specific cDNA probes, restriction enzymes, and other tools of the recombinant DNA era. Our knowledge of transposons and of gene translocations in the immune system should stimulate searches for molecular means of enhancing informational capacity in the nervous system.

Hemoglobin and immunoglobins have proved to be crucial molecular markers in their respective systems. What might be their counterparts in the nervous system? Several brain-specific proteins have been identified, but results have been limited. In this context, NGF is emerging as an especially attractive probe for certain developmental processes in the nervous system.

NGF was detected serendipitously in sarcomas that evoked outgrowth from dorsal root ganglia of chick embryos into which the tumors had been explanted. Classic studies depended upon measurements of neurite outgrowth from sympathetic and dorsal root ganglionic neurons. Recently a transplantable rat pheochromocytoma cell line (PC12) has been exploited as a target cell with receptors for NGF (Burstein and Greene). Without NGF, PC12 cells display features of adrenal chromaffin cells, bearing catecholamines. NGF reversibly converts the cells in four to seven days to ganglion-like clusters with slowly extending electrically excitable neurites. Priming (with accumulation of transcription-dependent macromolecules) and neurite outgrowth are separable processes requiring NGF. On two-dimensional gels, three of about 1000 protein spots show striking increases in relative abundance during the priming phase; one has been localized as a cell surface glycoprotein on sympathetic neurons.

The chick embryonic neural retina is a well-characterized system (Linser and Moscona). Maturation of the retina and dissociation and reassociation of the component cells occur in vitro. The glial cells manifest a transcription-dependent, cortisol-induced 100-fold increase in glutamine synthetase; contact between neurons and glia is required for full expression of cytosol receptors for cortisol. Mediators and mechanisms of the cell-cell contact might be elucidated in this system. Other hormones have major effects on brain differentiation and function. Genetic lesions causing insensitivity to androgen in rats and humans have permitted crucial insights into developmental targets of gonadal hormones in brain (McEwen). Structure-activity studies suggest that the effects of ACTH, MSH, β-LPH, and their fragments on active avoidance behavior, grooming behavior, and opiate-like analgesia are mediated through changes in phosphoinositide metabolism in neuronal membranes, inhibiting calcium influx and hyperpolarizing membranes (Jolles *et al.*). The remaining papers examine opioid peptides, substance P, cholecystokinin, and vasoactive intestinal peptide as neurotransmitter candidates, hyperthermia and LSD as perturbants of protein synthesis, macromolecules as mediators of learning and memory, and bulk isolation of neurons and glia.

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Organelles

The Eukaryotic Ribosome. HEINZ BIELKA, Ed. Springer-Verlag, New York, 1982. 338 pp., illus. $35.

Ribosomes, the complex ribonucleoprotein particles that mediate cellular protein synthesis, have proved a rich source of information on the architectural and functional attributes of supramolecular structures that enable such structures to carry out intricate tasks like the