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EDITOR: FRANK KOTASEK JR.

SURVIVING THE DINOSAURS: ADAPTIVE ENERGY SYSTEMS FOR NEW JERSEY

Conference held at the Woodrow Wilson School of Princeton University on February 5, 1977.

Reviewed by Aaron Ashkinazy, RCA Labs., Princeton, NJ.

Conservation and greater utilization of alternative energy sources (wind, solar) were the main topics of this conference, which was sponsored by Citizens for Responsible Power Policies (CRPP). The conference featured six speakers and a panel of New Jersey State legislators and officials. None of the speakers viewed nuclear power plants as a long-term solution to US energy demands. Rather, they emphasized the need for individual initiative to precipitate a movement to redirect government and industry toward conservation measures and increased utilization of solar energy.

Denis Hayes, a senior researcher at the Worldwatch Institute, projected a grim outlook over the next 50 years if energy sources are limited solely to conventional fuels and if energy growth is not checked. He contended that, since oil and gas would decline in significance, projected world energy demand in the year 2027 could be satisfied only by: (a) burning 30 billion tons of coal per year (and consequently increasing the atmospheric concentration of carbon dioxide by 5%* each year), or (b) 15,000 nuclear reactors of the largest size currently available. Allowing for replacement, at least one reactor would have to be put into operation every day for the next 50 years to reach that number! (These figures represent a 2% annual increase in world energy consumption, which is only half the current growth rate.) Mr. Hayes regards fusion reactors as speculative at present, and he has some reservations concerning their use. Thus, he sees no solution to our energy problems unless we conserve our resources.

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*[Ed. note: The 5% figure represents the total CO_2 that would be emitted each year from coal combustion. Currently two-thirds of this CO_2 is absorbed by oceans and land masses.]

On a more positive note Mr. Hayes advanced several examples of energy economy. First, solar energy is currently practical, especially for space heating. Second, better construction and insulation practices could result in 30% to 50% fuel savings in old buildings, and 50% to 80% for new buildings. Third, more waste materials could be recycled; for example, recycling aluminum requires only 5% of the energy needed to convert bauxite into aluminum. (The primary metals industry uses 20% of all industrial fuel.) Mr. Hayes also suggested locating industrial sites so as to reduce fuel consumption due to transportation, and a BTU tax rather than oil price deregulation. Finally, he noted that many solutions to national problems have arisen from popular movements (e.g., civil rights, Vietnam war, zero population growth) rather than from Congressional or Presidential action, and he therefore stressed individual commitment to energy conservation.

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SURVIVING THE DINOSAURS (Continued from page 1)

David Morris, Co-Director of the Institute for Local Self Reliance, also underscored the fact that the federal government has given little assistance to private industry to develop a viable wind-power technology or passive (solar) energy systems. Such development has been limited primarily to small companies. He stressed the need to move toward decentralized, renewable energy sources.

Doug Kelbaugh, an architect on the Trenton Planning Board, lives in a solar house of his own design. The house's southern exposure consists of a glass exterior face and a thick interior concrete wall, painted black. The wall serves both as a solar collector and as the energy storage medium. The system is passive; heat circulates primarily by thermal convection during the day, and by radiation from the wall at night. Solar heating is the primary heating system, and Mr. Kelbaugh relies on gas heating only when insolation is low. His heating bill last year was approximately $160, but he also noted that his hot water is not included in the solar system. Mr. Kelbaugh pointed out that one gallon of heating oil contains 130,000 BTU, and that one square foot of a good solar collector can supply the same amount of energy over a period of one year. He also emphasized the thermodynamic inefficiencies involved in burning oil at 1000°F to raise the temperature of air from 20°F to 70°F and, in the same vein, the absurdity of using nuclear energy for home heating.

Travis Price, architect and director of Energy Task Force in New York City, provided another example of individual initiative. He helped organize a group of tenants to renovate a tenement building on East 11th Street that had been abandoned by its former landlord, gutted, and subsequently taken over by the city. The tenant group obtained the building from the city, under provisions of the Sweat Equity Program, and set their rent level to pay for the mortgage and renovation materials. After insulating the building, the tenants erected solar collectors and a 2KW wind-driven generator on the roof. Mr. Price calls the project an example of 'sweat equity', since the tenants provided the labor themselves. He estimates that these modifications have resulted in a 70% savings in fuel bills over the last year.

David Morell (Princeton University Center for Environmental Studies) discussed the growing trend toward huge, centralized, capital-intensive (gigawatt) power plants separated from the cities they serve. He termed this tendency an 'edifice complex', and pointed out that, while the municipality in which such a plant is situated benefits from the ratable income, all communities within the area are exposed to essentially the same risk of potential accidents. Centralization has also resulted in greater control by the federal government over siting, and local municipalities have been virtually powerless in opposing such planning.

Mr. Morell suggested cogeneration (the generation of electricity as a byproduct of the production of industrial process steam) as one step toward decentralization and fuel conservation. Process steam is needed at temperatures of only a few hundred degrees Fahrenheit, while temperatures of over 3000°F are available in combustion. In cogeneration, this waste is avoided by first using the high-temperature energy to make electricity, and then using the lower-temperature 'waste heat' for the industrial process steam applications. The fuel required to make electricity by cogeneration, beyond what was needed to make the desired industrial process steam, amounts to only half the fuel required to produce the same amount of electricity at a conventional central-station power plant.

Economic incentives and/or state legislation may be necessary to encourage cogenerative power, since industrial management and the power utilities are wary of such an arrangement. (For example, who owns the generators? Why should a manufacturer enter the power business?) Also, present utility rate structures impede adoption of cogeneration by making it very expensive for the manufacturer to purchase back-up power, and uneconomical for the industry to sell excess electricity into the grid.

Bill Potter, a lawyer with the New Jersey Public Advocate's office, discussed implementation of the Dubin Report. This report suggests that, in contrast to the power utilities' projections of increasing power demands, essentially no growth in consumption of non-renewable energy supplies need occur between now and 1990 if conservation measures and solar energy utilization are seriously implemented. He suggested the need for prodding legislators to actualize this forecast.

The all-day conference concluded with an interchange between the audience (including speakers and press) and a panel of state officials and legislators. A number of pending bills which offer economic incentives to home-owners and builders for using solar heating systems were discussed. Also discussed were several pending bills which would limit--and/or impose stricter safety codes on--future nuclear reactors in NJ■

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THE DEFENSE OF PROFESSIONAL FREEDOM AND SOCIAL RESPONSIBILITY

Frank von Hippel
Center for Environmental Studies
Princeton University

[Invited Talk, Annual Meeting of the American Association for the Advancement of Science, February 21, 1977. Dr. von Hippel is Chairman of the AAAS Committee on Scientific Freedom and Responsibility's Subcommittee on Professional and Social Responsibility of the Scientist.]

The purpose of my talk is to discuss with you some of the ways in which the AAAS Committee on Scientific Freedom and Responsibility might help its affiliated professional associations to develop protections for the professional freedom and social responsibility of their members.

Today the activities of professional societies relate primarily to the advancement of the technical skills and economic status of their members. Most of the professional societies do recognize, however, that their members have larger responsibilities beyond the purely technical efforts which they undertake for their employers. Such responsibilities are mentioned explicitly in the codes of ethics and employment guidelines of many societies. Thus, for example, the "Engineer's Code" states that the engineer "Will use his knowledge and skill for the advancement of human welfare." The code also explicitly acknowledges the possibility that this duty may sometimes bring the engineer into conflict with the demands put on him by his employer. In such cases it instructs him to "regard his duty to the public welfare as paramount." [1]

These admonitions in fact seem to be directly relevant to the real world in which engineers work. In the August 1972 issue of the journal, Professional Engineer, for example, James Olson reported on the results of a survey of 1100 randomly selected members of the National Society of Professional Engineers. The purpose of the survey was "to determine engineers' attitudes toward professionalism, employment, and social responsibility." Of the approximately 800 respondents about 10 percent responded affirmatively in each case to questions asking them if "they were required to do things [in their jobs] which violated their sense of right and wrong or if they felt that their employers interfered with their personal rights," and about 40 percent responded affirmatively in each case when they were asked if they felt "restrained from writing a letter to the editor," or "restrained in taking part in political affairs" or "restrained from criticizing their employers' activities or products." A significant number also reported that they had tried to live up to their professional ethics "when asked to work on a product or project they believed not to be in the public interest." About seven percent responded affirmatively in each case to questions which asked them if they had sought a transfer within their organization or had resigned their jobs. About 20 percent responded affirmatively in each case to questions asking if they had refused to work on a project or on a client's commission or a job offer; and 60 percent had "expressed their disapproval of a project to their employer or client."

In the light of such statistics it would appear reasonable for the professional societies to make arrangements to help their members deal with ethical crises. Indeed most of the respondents to Olson's survey were in favor of professional societies "taking actions to keep firms from penalizing employees active in serving the public interest," "public condemnation of firms which violated the public interest," "recommending engineers not work for such firms," "finding new jobs for engineers fired because of socially responsive actions" and the "organization of engineers employed by a firm which makes unsafe products to stop it from doing so"; slightly under half even favored "having societies support public service engineering groups financially."

Almost five years later these proposals look very radical when compared to what the professional societies are actually doing. For example, the National Society of Professional Engineers, which published Olson's article, has a Board of Ethical Review which offers guidance to the society's members through the monthly publication of case studies in its journal. These cases are hypothetical, however, involving "engineers A and B" and "companies X and Y," and almost all of them deal with issues relating to the ethics of competition among professional engineers in private practice rather than issues of social responsibility. When actual cases involving social responsibility have been brought to professional societies, the societies have generally not become involved--and for relatively obvious reasons. Currently professional societies are just not organized to undertake substantial interventions in the relationships between professionals and their employers. Thus, for example, the leadership of most professional societies changes every year and generally is elected on the basis of "name recognition" within the profession for some scientific or technical achievement--or for the occupation of some high post in government or industry rather than because of any evidence of interest in the protection of the professional rights and responsibilities of the membership.

One would think that, if Olson's questionnaire still accurately reflects the feeling of the membership, a movement from within some of the professional societies to restructure them so as to deal more effectively with these issues might find considerable political support. Indeed the election of Dr. Alan Nixon to the Presidency of the American Chemical Society in 1973 represented a successful insurgency by a group within the ACS who felt that the society should be more involved with issues of job security.

The most highly developed arrangements which have been made by a professional society in this area appear to be those of the American Association of University Professors, which has used moral suasion rather effectively with university administrators when it feels that its members have been improperly treated. The relationships between academics and their employers tends to be more equal and therefore susceptible to such moral suasion, however, than is generally the rule--perhaps because of the tenure system.

Arrangements do exist for dealing with disputes over matters covered by labor contracts between organized labor and management. A rather sophisticated system of mediation and arbitration has been developed, using independent professional ar-

bitrators who are mutually agreed upon by the disagreeing employee and his management. [2] Such arbitration arrangements have evolved as an alternative to labor-management confrontations by strikes and lockouts. But they tend to deal with the "bread and butter" issues and not issues of social responsibility, and in any case do not cover most scientists and engineers.

For government employees, agency and civil service procedures offer grievance appeal mechanisms. Recent public disputes between management and employees at the Food and Drug Administration [3] and the Nuclear Regulatory Commission [4] have revealed important cases, however, in which these mechanisms have not adequately resolved issues which employees raised with regard to protection of the public health and safety.

What about legal protection of scientific freedom and social responsibility? The U.S. has no general law such as Great Britain's Trade Union and Labor Relations Act according to which appeals of unfair dismissal can be taken to various industrial tribunals [5], but our subcommittee has learned of provisions in particular pieces of legislation which do give some protection to employees who bring particular classes of occupational or environmental hazards to official attention. Thus, for example, the Occupational Health and Safety Act of 1970 contains the provision that:

> "No person shall discharge or in any manner discriminate against any employee because such employee has filed any complaint or instituted or caused to be instituted any proceeding under or related to this Act or has testified or is about to testify in any such proceeding or because of the exercise by such employee on behalf of himself or others of any right afforded by this Act." [6]

The section then goes on to specify how this protection will be enforced. In brief: If someone feels that he has been discriminated against because he has helped in the enforcement of the Act he may complain within 30 days to the Secretary of Labor; The Secretary has to investigate the complaint and make a finding within 90 days; If the Secretary determines that an employer or other party has violated this section of the Act, he must bring an action in a U.S. district court; Finally, the Court can order "all appropriate relief including rehiring or reinstatement of the employee to his former position with back pay."

In the case of this Act we have been able to obtain a report on how this provision has actually been carried out. [7] It appears that, as more workers have learned of this employee protection provision, numerous complaints have been filed: about 700 in fiscal year 1975 and 1600 in fiscal year 1976. In fiscal year 1976 OSHA had a staff of 39 full time investigators dealing with these complaints. Of the total number of complaints approximately 20 percent were determined to involve violations of the Act. Of these somewhat more than half, or a few hundred, were settled out of court--typically by offers of reinstatement, back pay, and the posting of a notice to employees by the employer describing the discrimination action and its settlement.

Two examples of complaints which were settled successfully in this way might help bring these rather dry statistics to life: 1) In a small town in South Dakota, an employee anonymously filed a safety and health complaint with OSHA, which triggered an inspection. In retaliation the employer suspended all of his employees without pay until the person who filed the complaint stepped forward. He was then fired and the rest of the employees were reinstated. The fired employee decided that he had been discriminated against and invoked the employee protection clause of the OSHA Act. Ultimately, as a result of OSHA's intervention, the employer backed off and offered the employee full reinstatement with back pay.
2) In New Mexico, a part-time school bus driver complained to his employer that some of the school bus brakes were deficient. His complaint was ignored, so he contacted the State Department of Transportation and the New Mexico State Police, which resulted in a safety inspection. He was thereupon fired. After complaining to OSHA, however, he was given back pay (he didn't want his job back), and the employer posted a notice to its other employees describing the case.

For cases where a settlement was not agreed upon and the case was taken to court, things have not worked out quite so well. At the time of the report about 60 cases had been taken to court: one had been won, eight had been lost, and 50 were pending. Because of the slowness of the legal system and to some extent because of lack of enthusiasm within the Labor Department about prosecuting employers, it appears that recourse to the courts has helped few people so far--except as a threat.

Protections such as those in the Occupational Health and Safety Act are important, but we still lack any general legal protection for the exercise of professional responsibility. A number of pieces of legislation have been proposed which would expand such protection, however. Thus, for example, in 1975 Senator Edward Kennedy introduced a bill (S.1210) which would protect the right of federal employees to disclose information which is required by the Freedom of Information Act to be available to the public. (It sounds like legislating against Catch-22.) Over the past few years, Nader groups (currently Congress Watch) have proposed improvements in the standards and procedures established under the Civil Service Act. The Institute for Policy Studies proposed in 1976 an "Administrative Oversight and Employee Disclosure Act," which would apply not only to federal employees but also to "any employees of any program, activity, or organization receiving Federal financial assistance by way of contract, grant, or loan." This Act would also establish an Office of Administrative Oversight, responsible to Congress, which would investigate complaints and initiate prosecutions under this law.

The Subcommittee of the AAAS Committee on Scientific Freedom and Responsibility which I chair has not yet developed a position on such legislation, but we hope to be able to do so over the next months. Then we will hopefully be able to propose to AAAS-affiliated professional societies that they support the passage of some legislation in this area.

Of course there are limitations to the kind of protection one can offer to a dissenting employee in an organization. Legislation might protect his livelihood, but in the long run, if the management really doesn't want him, he will probably find his position so frustrating that he will eventually decide to leave of his own accord--as in the school-bus-driver case. This doesn't mean that the employee-protection legislation is valueless, however. It can protect the employee from being rapidly "railroaded" out. It means that he can get an impartial hearing. And, if the outside investigator or hearing board finds in his favor, then he has some protection against being "blackballed" in his search for another job.

At least as important as the protection of the right to dissent is to make arrangements whereby the substance of the dissent is dealt with. After all, even if dissent is protected, it will be pointless if it does not give rise to a competent outside review of the issues in dispute between the employee and his

management and, if necessary, bring about outside intervention to rectify the situation. In fact, our institutional arrangements for holding organizations accountable in cases like this are ad hoc and generally ineffective. Typically, if the dispute receives enough public attention, the organization involved will set up an "independent blue ribbon panel of experts" or turn to an existing advisory panel and ask it to review the dispute. Usually, however, because of its special relationship with the management of the organization, even if such a panel finds that the employee has raised some valid issues, it will report its finding in such muted tones that the agency is not seriously embarrassed and is not forced to do anything as serious as reorganize its management personnel or basic approach. [8]

Therefore in addition to providing more adequate protection to dissenting employees, we need more independent mechanisms for reviewing the issues which they raise and for holding organizations accountable, even when the issues are highly technical and therefore intimidating to the public and to Congressmen. Elsewhere, Joel Primack and I have argued [9] that a greater involvement of the scientific community in independent policy analysis (or what we called "public interest science") is necessary if we are to make our institutions accountable by peer review of the way which they develop and regulate technology--just as the individual scientist is held accountable by peer review for the way in which he does his science.

There are of course some important recent initiatives in this area--notably the Congressional Science Fellowships which have been set up by several of the professional societies with leadership from the AAAS. In a few cases, also, professional societies have themselves sponsored in-depth reviews of scientific controversies. The AAAS did this in its review of the use of herbicides in South Vietnam, and the American Physical Society sponsored a review of the reactor safety controversy.

Of course what the scientific community can do is largely--although not exclusively--limited to what it can persuade the federal government to give it money to do. There seems, however, to be an increasing awareness within the government of the need for policy studies by independent technical people with a variety of perspectives on the issues of the day. This is evidenced by the establishment of the new Science for Citizens Program in the National Science Foundation. I hope that the AAAS Committee on Scientific Freedom and Responsibility will be able to propose additional institutional arrangements by which more of the scientific community can participate in such critical policy analysis.

In conclusion, I would like to remind you why it is important that scientists and engineers--particularly those in industry and government--be given more freedom of speech than they now possess. Technology has become so powerful that we can no longer afford to postpone improving our systems until the problems are evident to the man in the street. There are just too many dangers, and some of them may not reach this level of visibility until it is too late to avert a catastrophe. Furthermore, the longer we wait before we rectify our technological blunders, the more expensive and disruptive the corrective action will be and the greater will be the reluctance of industry and government to make the necessary changes. We will have to settle for expensive, patched-up solutions which we can live with, instead of the cheaper and more elegant technologies which would have designed the problems out. If we could surface and deal with our technological problems earlier, much of the tremendous amounts of intellectual energy which are now expended in the struggles over whether or not to change deployed technologies could be freed for other purposes.

What I have been talking about is the extension of freedoms which have been essential to the development of basic science to those professionals on whom we depend for the development and regulation of the technologies which science has spawned. The larger society must have free access to the knowledge and insights of these experts, who usually see the problems first and often see the solutions first.

We have the civil rights movements for racial minorities and the women's liberation movement for our sexual majority. Now we must add to these a movement for the liberation of professionals. Otherwise our society will increasingly be left at the mercy of special interests in a world which contains a rapidly-increasing number of roads to disaster.

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[1] The Engineers Code is that of the National Society of Professional Engineers. A selection of professional society Codes of Ethics are reprinted in Appendix B of Ralph Nader, Peter Petkas, and Kate Blackwell, Whistleblowing, (Grossman, New York, 1972). For an example of the employment guidelines which have recently been adopted by many large engineering and scientific societies, see the employment guidelines promulgated by the National Society of Professional Engineers (Professional Engineer, February, 1973, pp. 37-44).

[2] See, e.g., Frank and Edna Elkouri, How Arbitration Works (Third Edition, Bureau of National Affairs, Washington, DC, 1973); and Walter E. Baer, The Labor Arbitration Guide (Dow Jones-Irwin, Homewood, IL, 1974).

[3] Barbara J. Culliton, "FDA: Review Panel Faults Commissioner's Defense of Agency," Science, 192, p. 1084 (1976). See also the sequence of events focusing on FDA employee J. Anthony Morris, as reported in Science 175, articles beginning on pp. 861, 966, 1089, 1225 (1972), Science 176, p. 34 (1972), Science 193, p. 384 (1976); Science 194, p. 1021 (1976).

[4] For stories on dissent within the NRC see Nucleonics Week Jan. 29, p. 1; Feb. 5, p. 5; Feb. 12, p. 1; Feb. 19, p. 1; Oct. 28, p. 1; Nov. 25, p. 3, 5; Dec. 15, p. 4 (1976).

[5] Dudley Jackson, Unfair Dismissal (Cambridge Univ. Press, 1975).

[6] Public Law 91-596, Sec. 11C. Other laws with employee protection sections include the Federal Coal Mine Health and Safety Act of 1969 (P.L. 91-173, Sec. 110b); Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500, Sec. 507); Safe Drinking Water Act (P.L. 93-523, Sec. 1450); Toxic Substances Control Act of 1976 (P.L. 94-469, Sec. 23); Resource Conservation and Recovery Act of 1976 (P.L. 94-580, Sec. 7001); and the proposed Clean Air Act Amendments of 1976, S. 3219, Sec. 36.

[7] Morton Corn, Assistant Secretary of Labor, Memorandum for the National Advisory Committee on Occupational Safety and Health: Discussion of OSHA's Program for Discrimination Investigations (Nov. 15, 1976).

[8] This seems to be what happened in the FDA and NRC cases cited above.

[9] Advice and Dissent: Scientists in the Political Arena (Basic Books, 1974; New American Library, 1976). ■

BOOK REVIEW

A review of: Conference on Engineering Ethics (Baltimore, MD May 18-19, 1975), Edited by Jesse Mock. Published by ASCE, 345 East 47th Street, New York, NY 10017. 114 pages. $6.00 ($3.00 for IEEE members.)

Reviewed by Stephen H. Unger, Electrical Engineering and Computer Science Dept., Columbia University.

In recent years, there has been a widespread awakening to the importance of technology in our everyday lives. The fact that the work of engineers, generally beneficial when properly directed, can also, when misdirected, cause great harm is brought home to us almost daily in the press and other media. Perhaps one of the critical problems of our era is that of establishing effective institutions for maximizing the benefits and minimizing the bad effects of technology.

The mechanisms that, on the surface, might seem suitable for this purpose have proven to be inadequate. The free market, to the extent that it exists at all, fails mainly because of what may be an inevitable lack of information available even to the best-informed buyers.

Regulation by public agencies seems equally ineffectual. For a multiplicity of reasons, such bodies seem to become advocates of the industries they are supposed to regulate in the public interest. (The circumstances surrounding the DC-10 disaster[1] constitute a dramatic illustration.) It also seems evident that in nations where state-owned enterprises are the prevalent economic form, careerism and bureaucracy produce the same sort of health, safety and environmental abuses that concern Americans.

Instead of relying entirely on outside forces to pressure, or police, the behavior of technology-based organizations, it would be much more effective to have those actually engaged in the process regard themselves as guardians of the public interest. Ideally, engineers, in the course of their work, would be sensitive to the broader implications of what they and their colleagues are engaged in, and hence many abuses would be avoided at the origins. In other instances, the operations of regulatory agencies would be significantly facilitated by the support of such inside professionals.

Of course there are serious problems associated with this approach. First, there are certainly many cases where intelligent, conscientious people will disagree as to the consequences of key technological decisions. There is no magic solution to this sort of dilemma, only the approach that one would like to see in similar situations occurring in other realms: honest and open discussions followed by some reasonable decision-making process.

The principal practical problem is that of creating a working environment for engineers in which they are sufficiently independent of management pressures to be able to function as responsible professionals. Given a reasonable degree of success here, the expectation is that educational efforts by engineering societies and schools would contribute to the constructive use of this freedom by significant numbers of engineers. The beneficiaries would surely include the employers.

This then is the context in which the Conference on Engineering Ethics was held in Baltimore, May 18-19, 1975. Chaired by Victor Paschkis, it was jointly sponsored by the ACS, the AIChE, AIMMPE, ASCE, ASME, IEEE, and NSPE (the principal American engineering societies). Under review is a small paperbound volume consisting of a transcript of the proceedings edited from tapes (with some later revisions by speakers) by Jesse Mock and produced by William D. French of the ASCE.

A concrete basis for the deliberations was established by the presentation of three important cases. The BART case, familiar to readers of this periodical, [2,3,4] was discussed by Roy Anderson who, as chairman of the Transportation Safety Committee of the California Society of Professional Engineers, played a key role in validating the claims made by the three fired engineers and in attempts to help them directly. The second case involved the falsification of qualification test data for a military aircraft brake designed by the B.F. Goodrich Company. [5,6] We have here a classic example of decent people, under severe economic pressure, acquiescing in a gross violation of the most elementary concepts of engineering ethics, not to mention common honesty. In his later remarks, Richard K. Scharf underscores the "professional loneliness of the parties involved." There was no community of similarly-situated engineers to which they could turn for support.

The same applies to ASME member Carl Houston, who described his situation [7] when in 1970, as a newly-arrived welding superintendent employed by Stone & Webster, he found defective welds and extensive evidence of bad welding practice in the construction of a nuclear power plant for Virginia Electric & Power Co. At every level of management, his professional advice was brushed off and he was ordered to keep quiet. Within a short time he was fired and then, over an extended period of time, tried to bring the matter to the attention of various companies and officials involved. Finally, under pressure from two U.S. Senators, the AEC brought in an outside consulting organization, which validated Houston's charges. Special restrictions were then imposed on the plant. Houston,

however, suffered severe economic and career penalties. Without naming names, CSIT member Walter Elden sketched a similar case involving a licensed engineer doing quality-assurance work on a nuclear power plant for a power company.

An important part of the problem, according to participant J. J. Stilwell (formerly chief of the Navy's ship design division), is the transfer of engineering responsibility from the engineer on the job to "management experts." The latter, he says, are anxious to avoid disruptions of routines and will readily sacrifice good engineering practice in order to show "results."

What can engineering societies do about all this, and what are they doing? Their most active role to date has been in enforcing codes of ethics on their members. The ASCE, ASME and NSPE, for example, have been dealing with such cases for years. As indicated by remarks at the conference, it appears that the kinds of cases successfully dealt with generally involve such matters as bribery or other unethical business practices. The machinery set up for this purpose has little or no bearing on the dilemma of the employee-engineer. Neither, I believe, do proposals, also discussed at the conference, that all engineers be licensed.

As outlined by J. G. Bennett, the American Chemical Society (ACS) comes closer to the issue. They have a mechanism for investigating complaints by members of unprofessional treatment by their employers. Where appropriate, the facts are published and other forms of aid (such as loans) may be offered to the member. Apparently the principal application has been in cases where ACS guidelines on layoff procedures have been violated.

M. C. Ascher (ASME) related an interesting incident that shows how a number of provisions of some of the traditional engineering ethics codes can be given a reverse twist. In an attempt to stimulate discussion of problems of social responsibility, he circulated to a number of ASME sections a well formulated hypothetical case in which a chief engineer, despite protests by a conscientious engineering subordinate, ordered the improper disposal of a quantity of polluted liquid. Many of the responses quoted provisions such as "He will not injure...the reputation of another engineer...," "He will not disclose information concerning the business...of any...employer...," etc. as arguments for not dealing with the issue. (The first of these was similarly misused many years ago in a real case. [8])

Victor Paschkis further developed his proposal of an AAUP*-like procedure for supporting ethical engineers. He suggests a standing commission of five full-time members, appointed for long terms, who would investigate and rule on ethical conflicts between engineers and their employers. The commission would be funded jointly by the principal engineering societies. He calculates that the cost would be of the order of one dollar per year per society member.

Attorney A. Singer reviewed the legal machinery that might be brought into play in support of employee-engineers seeking to uphold the public interest. The basic picture he paints is a bleak one, in that the employer in the U.S. has an almost unqualified legal right to peremptorily discharge his employees. Singer does refer to some possibly useful exceptions, principally where the discharge is connected with an employee effort to report violations of law to a government agency. He feels that further developments of the law along these lines are desirable and possible, particularly if professional societies give active backing. He also considers it essential that the societies set up the sort of support machinery envisaged by Paschkis and others.

*American Association of University Professors.

The role of engineering unions was discussed by F. J. Kuchma of the Westinghouse Salaried Employee Association. Judging from his talk and his response to a specific question from Norman Balabanian, engineering unions--whatever other merits they may have--do not seem to be particularly well-suited to the task of supporting ethical behavior.

Various programs were described in which the teaching of ethics is incorporated in undergraduate engineering curricula. Among the suggestions made was one, by G. S. Rawling (NSPE), that practicing engineers be brought in to address student engineering societies on the subject. There was general agreement that early exposure to this aspect of the profession is of great importance.

In general, a wide variety of viewpoints was expressed at the conference and the proceedings constitute an excellent and concise introduction to engineering ethics (at a bargain price) as well as a source of new ideas and information for those already involved in the field.

For IEEE members, it may be worth noting here that the most significant ethics-related event in our organization since the Baltimore Conference has been the action of the Board of Directors last September in passing resolutions declaring that the Institute will set up machinery to enforce the code of ethics on its members and that it will, as appropriate, support those placed in jeopardy as a result of adherence to the code. The Working Group on Ethics and Employment Practices of CSIT has undertaken to investigate cases in the latter category (see announcement on page 13).

One such investigation is now under way. An IEEE member alleges that he was discharged primarily for refusing to sign papers, related to a patent matter, that included a false statement. An age discrimination element may also be present. The results of this investigation will be published, in appropriate form, in a subsequent issue of Technology and Society.

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PRESIDENT CARTER'S ENERGY PROGRAM

[Ed. note: The following summary of the energy program proposed to Congress by President Carter is based primarily on the President's nationally-televised speech at a joint session of Congress on April 20, 1977 and on the "fact sheet" issued by the White House Energy Staff on the same day.]

Goals for 1985:

1. Reduce the annual growth rate in U.S. energy consumption to less than 2% (from 4.6% currently).
2. Reduce gasoline consumption by 10%.
3. Reduce oil imports to six million barrels a day. (Current oil imports are eight million barrels a day, and extrapolation of current trends implies 16 million barrels of imported oil a day by 1985).
4. Establish a strategic petroleum reserve of at least one billion barrels (a six-month supply).
5. Increase coal production to at least one billion tons a year. (1976 production was 665 million tons.)
6. Insulate 90% of American homes and all new buildings.
7. Use solar energy in at least 2.5 million homes.

Energy Conservation

Existing federal mileage standards require the new automobile fleet to average 18 miles per gallon in 1978 and 27.5 m.p.g. in 1985. President Carter's energy program will impose a graduated excise tax on new cars that fail to meet these mileage standards. For example, this tax would amount to approximately:

$110 on a 1978 model getting 16 m.p.g.
$450 " " 1978 " " 11 m.p.g.
$1380 " " 1985 " " 16 m.p.g.
$2500 " " 1985 " " 11 m.p.g.

The revenue from the excise tax will be rebated to purchasers of cars that exceed the federal mileage standards. For example, a 1978 model getting 36 m.p.g. (the mileage rating for a 98-cubic-inch '77 Chevette) would carry a rebate of approximately $430. Electric cars will be eligible for the maximum rebate (approximately $473 in 1978 and $493 in 1985).

The energy program will set annual targets for total U.S. gasoline consumption. If gasoline consumption exceeds the amount targeted for 1978, a tax of five cents a gallon will be levied, effective January 15, 1979. From 1979 to 1988, the tax will be increased by five cents a gallon each year for which consumption exceeds the target, and will be reduced by five cents a gallon each year for which consumption falls within the targeted amount. The revenue from this tax will be distributed equally among all Americans.

Between now and 1985, those who weatherize their homes to reduce heating requirements will receive a tax credit of 25% on the first $800 invested and 15% on the next $1400. Thus the federal government will, in effect, pay a homeowner up to $410 to insulate his house. All regulated utility companies will be required to offer reasonable financing of weatherization costs to homeowners, to be repaid through the customer's monthly utility bill.

In addition the energy program will:

* Remove gasoline price controls in October 1977. This may cause the price to increase by one or two cents a gallon.
* Provide an additional 10% tax credit for business investments in energy conservation (including cogeneration of electricity and lower-temperature industrial process steam) and solar equipment.
* Provide incentives for district heating of buildings, using waste heat from electric power generation.
* Provide federal matching grants ($900 million over three years) for approved energy conservation measures in nonprofit school and hospital buildings.
* Weatherize state and local government buildings and low-income housing through public works programs and other jobs programs.
* Impose strict efficiency standards for household appliances by 1980.
* Phase out promotional natural gas and electricity pricing which provides artificially low rates to high-volume users.
* Offer homeowners the option of time-of-day metering, with lower electricity rates during off-peak hours.
* Require a separate meter for each new apartment.
* Remove the current 10% excise tax on intercity buses.
* Initiate a 6000-van pooling system for federal employees (to be financially self-sustaining).

Oil and Natural Gas

The President noted that oil and natural gas comprised 75% of current U.S. energy consumption, but only 8% of domestic energy reserves, and that U.S. demand for oil was increasing by 5% per year while domestic production was declining by 6% per year. He asserted that one of the principles of his energy program was that "the price of energy should reflect its true replacement cost, as a means of bringing supply and demand into balance over the long run." The energy program will:

* Allow the price of newly-discovered oil to rise, over a three-year period, to the 1977 world market price ($13 per barrel at the wellhead), adjusted for inflation. Gasoline prices may rise by seven cents a gallon by 1980 because of the rise in crude oil prices.
* Impose a wellhead tax on "old" domestic oil. This tax will increase each year until 1980, when it will equal the difference between the regulated price (which now averages $8.25 per barrel) and the prevailing world market price. The revenue from this tax will be used to reimburse homeowners for any increase in the price of home heating oil due to the tax. The surplus revenue will be distributed equally among all Americans.
* Allow oil produced from shale to sell at the prevailing world market price.
* Limit the wellhead price of newly-discovered interstate natural gas, which is currently regulated at $1.42 per thousand cubic feet (Mcf), to the price of its Btu equivalent in domestic oil ($1.75 per Mcf in 1978); impose the $1.75 price limit on new and old intrastate gas (currently unregulated and selling for $2 per Mcf). Existing contracts for delivery of gas are exempt from these changes.
* Retain the price limit on old interstate gas of $1.42 per Mcf plus adjustments for inflation.

(Continued on next page)

READER QUESTIONNAIRE ON ENERGY PROGRAM

Please circle the letter preceding the answer which most nearly represents your own views. If you wish, you may circle more than one choice, or none at all. Clearly, the questionnaire is far from exhaustive, and we welcome additional comments on the President's energy program itself, possible alternatives and additions to the President's program, and other issues related to energy policy (please use extra sheet of paper). Questionnaires will be tabulated and additional comments published (in full or in summary, as appropriate) in the September issue of Technology and Society. Please return questionnaire and comments, by August 1, to Frank Kotasek Jr., 73 Hedges Avenue, East Patchogue, NY 11772.

1. On balance, I
a. favor b. am neutral toward c. oppose
the President's energy program.

2. Compared with the magnitude of change needed, the energy program is
a. too bold. b. about right. c. too timid.

3. The energy program should have done relatively more to encourage
a. conservation.
b. oil production.
c. gas production.
d. coal production.
e. nuclear power.
f. solar heating.
g. R&D on solar energy.
h. R&D on breeder reactors.
i. R&D on fusion.
j. other:
k. (The energy program's priorities are satisfactory.)

4. We should rely primarily on
a. conservation
b. solar
c. breeder reactor
d. fusion
e. other:
to meet our long-term energy needs.

5. The energy program
a. does b. does not
entail needless federal bureaucracy and red tape.

6. The energy program should have relied more heavily on
a. deregulation of energy prices.
b. ending all forms of government intervention.
c. energy sales taxes.
d. tax credits.
e. mandatory measures (e.g., rationing, building codes, end-use restrictions, etc.).
f. other:
g. (The energy program's mix of methods is satisfactory.)

7 through 19: Circle the numbers corresponding to those provisions of the energy program which you favor. Draw an "X" through the numbers of those provisions you oppose.

7. Excise taxes or rebates on new automobiles according to m.p.g.

8. The standby 5-cent-a-year increase in the gasoline tax.

9. The 25%--15%--$410 tax credit to homeowners who weatherize their homes.

(Continued on next page)

ENERGY PROGRAM (Continued from page 8)

Conversion to Coal

As an incentive to conversion to coal, a gradually-increasing tax will be imposed on large industrial users of oil and natural gas, starting in 1979 (1983 for electric utilities) and reaching its final value in 1985. (Applications for which natural gas is essential will be exempt from the tax.) The taxes paid by electric utilities would be set aside to help them finance conversion to coal. An additional 10% tax credit will be allowed for investment in conversion. With limited temporary exceptions, no electric power plant will be permitted to burn natural gas after 1990. Clean-air standards will be maintained, and the best available pollution control technology (i.e., scrubbers) will be required in all new coal-fired plants. Strict strip-mining laws will be enacted. Funding of R&D on liquefaction, gasification, pollution control, and mine safety will be expanded.

Nuclear Energy

President Carter, who has a knowledge of nuclear engineering from his Navy career, asserted that there was "no need to enter the plutonium age by licensing or building a fast-breeder reactor such as the proposed demonstration plant at Clinch River." He observed that, even by the most conservative estimates, domestic uranium reserves were adequate to support the nuclear power capacity now on line or licensed for construction (roughly 120 gigawatts electrical) for at least 75 years. His energy program calls for:

* Increased capacity for producing enriched uranium fuel for light water reactors, using gas centrifuge technology.
* Stricter nuclear power plant safeguards and siting criteria.
* Faster, more streamlined licensing procedure for reactors of standardized design.

New Energy Sources

To stimulate the use of solar energy, the program will:

* Provide a tax credit of 40% of the first $1000 and 25% of the next $6400 invested in solar heating for homes. (The tax credit will be phased out in 1985.)
*Increase funding of R&D on solar energy, including photovoltaic systems, solar space cooling, small wind energy conversion systems, and wood-derived biomass.

Geothermal energy operations will be given the same tax deduction for intangible drilling costs as gas and oil drilling operations.

Other Measures

*Establish an Office of Small-Scale Technology within the new Department of Energy.
*Establish a Federal Energy Information System to monitor energy reserves, profits, and impending local shortages.
*Monitor (and ensure) competition in the energy industry.
*Provide emergency financial assistance to low income persons during energy shortages.■

Frank Kotasek Jr.

10. Mandate efficiency standards on household appliances beginning 1980.

11. Eliminate promotional gas and electric rate structures.

12. The energy program's crude oil pricing policies.

13. The energy program's natural gas pricing policies.

14. Tax on industrial use of oil and gas.

15. Stricter strip-mining reclamation laws.

16. Require scrubbers in all new coal-fired plants.

17. Cancel construction of Clinch River breeder reactor.

18. Speed up licensing of standardized reactors.

19. The 40%--25%--$2000 tax credit to homeowners who install solar equipment.

20. Compared with existing energy policy, the proposed energy program will have a substantial adverse impact on
a. inflation.
b. unemployment.
c. real gross national product.
d. quality of life.
e. environmental quality.
f. none of the above.
g. other:

21. The energy program is
a. basically fair to most Americans. b. unfair to:

22. The best approach to reducing unemployment and poverty in the U.S. is to
a. expand energy production.
b. develop a more labor-intensive economy.
c. redistribute wealth and income.
d. shorten the work week.
e. have the government provide jobs to the unemployed.
f. other:

23. Reducing unemployment and poverty
a. should be one of the main goals of U.S. energy policy.
b. should be done independently of energy policy.
c. should not be done by the federal government.

24. Continued growth in U.S. energy consumption
a. is necessary to provide an adequate quality of life.
b. will be beneficial to the American people.
c. entails social costs (e.g., degradation of environment) that would outweigh the benefits.
d. will no longer produce any real benefits; even neglecting pollution, we'd be better off if we adopted a gentler, less energy-intensive lifestyle.

25. The most promising means for improving the quality of life of our generation and of future generations is through
a. technology.
b. change in values and lifestyles.
c. change in social organization and decision-making (e.g., more centralization, less centralization, communes, etc.).
d. change in economic policy (e.g., laissez-faire, welfare state, etc.).
e. continuing existing policies.
f. other:

26. In the U.S. the quality of life will be highest if population
a. increases. b. remains the same. c. decreases.

ADDITIONAL COMMENTS ARE WELCOME! ■

CSIT POSITION PAPER ON THE APPLICATION OF SYSTEMS ENGINEERING TO SOCIETAL PROBLEMS

[Ed. note: The following position paper was approved unanimously by the IEEE Committee on Social Implications of Technology at its March 12, 1977 meeting. The position paper was drafted by Dr. Gerald Rabow.]

One of the skills that members of the Institute of Electrical and Electronics Engineers (IEEE), and others, have developed is called systems engineering. It includes the understanding of complex interacting assemblages and design or intervention so that they perform in some desired way. Projects such as landing a man on the moon would be impossible without systems engineering.

Societal problems also require understanding and purposeful intervention, and the question arises as to the possible role of systems engineering in the solution of societal problems. We believe that systems engineering can play an important part in the solution of societal problems. It may well be that the extrapolation of systems engineering to societal problems is the new ingredient that will permit their solution where solutions have not been obtained in the past.

We, therefore, outline in this position paper the characteristics of systems engineering which make it applicable to societal problems, some of the difficulties to be overcome, and what officers of IEEE, electrical engineers, related professionals, educators, government officials, and members of the public can do to help bring systems engineering to bear on societal problems. In view of the potential benefits, we recommend substantially increased research in societal systems engineering.

Definition of Systems Engineering:

Systems engineering is the relation of the goal for a system to the description of component portions of the system, so that the performance of the system can be predicted from the component descriptions (analysis), or that a set of components can be specified which together will yield a system with the desired performance (synthesis). The expression of these relations involves the language of mathematics.

In the case of complex systems, specialists from many different fields are involved. One of the tasks of systems engineering is to communicate with the various specialists and to translate the systems descriptions into terminology that the specialists understand. Another task is to take the specialized terminology and translate it into the mathematical language required for the system analysis or synthesis.

A system is an assemblage of interacting components. Although systems engineering has in the past been applied primarily to systems of physical and to some extent to biological components, the components may also be economic or social in nature.

A societal system is a system involving a large number of individuals, in which discretionary behavior of individuals has a significant effect on system performance. Examples of societal systems are transportation systems, criminal justice systems, health care delivery systems, and educational systems.

Systems Engineering of Societal vs. Physical Systems:

The following differences between societal and physical systems must be recognized when systems engineering is extended to societal systems:

1. The disciplines that must be interfaced will be extended to include social science, political science, psychology, law, etc, in addition to those encountered with purely physical systems such as various engineering specialties, physics, chemistry, and mathematics. Since the ability to interface diverse disciplines is one of the basic characteristics of systems engineering, the diversification of the disciplines to be interfaced is an extension that systems engineering should be readily able to make.

2. The components of societal systems and their interrelation are generally more subtle and less well understood than those of physical systems, and a better understanding of these components and their interrelation is necessary if we are to deal effectively with our societal problems.

3. With physical systems, the goal for the system is generally given. For societal systems, the goal may not be available explicitly but be imbedded in the system, and its explication is part of the systems engineering task.

Societal and physical systems have in common the need for systems engineering (or something akin to it), if predictable responses to intervention in the system are to be achieved. However, the lack of complete understanding of societal systems and societal goals will limit the predictability of the responses, and therefore a cautious, evolutionary approach to intervention in societal systems is indicated. We anticipate that further research in systems theory will provide added insight into the nature of societal systems and societal goals.

Electrical Engineering as a basis for Societal Systems Engineering:

At the present stage of development, there is not yet a recognized profession of societal systems engineering. The task of societal systems engineering must, therefore, be assumed by related disciplines. Electrical engineering is close to the discipline of societal systems engineering, because the following fields, which are useful in societal systems engineering, are encompassed by electrical engineering:

1. Systems engineering of electrical and other physical systems.
2. Control systems and feedback control theory.
3. Communications and information.
4. Computer design and applications.
5. The mathematical analysis of large-scale systems, including societal systems.

The relation of Systems Engineering to Management and Decision-Making:

Systems engineering is an activity that is both involved in and yet distinct from management and decision-making. As a part of management, which has overall responsibility for a project, systems engineering is held responsible for the completion of a project in that it must manage the various components to exact the required results. In contrast to management, which is not a field of engineering per se, systems engineering by its name implies direct involvement in the field of scientific processes. As a part of decision-making, where specific value judgements must be made, systems engineering gathers the various values attributable to differing aspects of a project which must be taken into consideration before a decision is made.

Systems engineers must utilize the values of the public whom they serve, and not substitute their own values. Where they believe that a system in accordance with their clients' values would be harmful to society, and a reconciliation of values cannot be achieved, they should withdraw from the project.

Special Ethics for Societal Systems Engineering:

As with all advances in civilization, the application of societal systems engineering can result in consequences which may not always be correctly foreseen. (The improved ability to foresee consequences of actions is, however, one of the distinguishing characteristics of systems engineering.) It is thus incumbent on societal systems engineers to make clear in every instance the extent to which a societal systems engineering project might fall short of the ideal. This includes any assumptions and uncertainties, all risks and by whom they are incurred, and to what extent any recommendations are experimental. Societal systems engineers should exercise great care to minimize any risks to society. They should evaluate interim results realistically and candidly, and they should ensure that the public is kept appropriately informed about any societal systems engineering project in which they participate.

The competent, responsible application of societal systems engineering will recognize the primacy of the "human element" and thus will be compatible with democracy, cultural development, diversity, and spontaneity.

Recommended Action:

IEEE officers should:

1. Bring the potential of societal systems engineering to the attention of government officials and other potential users, and the general public via the media.
2. Encourage the inclusion of papers and discussions relating to societal systems engineering in IEEE publications and at IEEE meetings.
3. Explore joint action on societal systems engineering with other interested societies.
4. Set up and support a committee to catalog all attempts to apply systems engineering to societal problems, and the outcome of those attempts.

Electrical engineers and related professionals should:

1. Be aware of and make use of systems engineering in their professional work.
2. Look at societal problems with a systems viewpoint, and communicate this viewpoint to others.
3. Seek and offer to apply their talents toward the solution of societal problems, at the local community level or wherever the opportunity presents itself.

Educators should be encouraged to:

1. Teach the systems approach and its applicability to societal problems to all students at all levels, as essential knowledge for a citizen in modern society.
2. Offer programs of study for careers including societal systems engineering.
3. Promote advanced research in systems theory.

Government officials should be encouraged to:

1. Make appropriate use of systems engineering in solving societal problems, through their personal understanding and/or the services of its practitioners.
2. Support research and education in societal systems engineering, so that we will be able to better solve our societal problems in the future.

Members of the public should be encouraged to:

1. Seek to understand the systems aspects of societal problems.
2. Insist that their representatives adequately use and support systems engineering for solving societal problems. ■

THE TECHNOLOGY THAT CAN ALIENATE

by Johan Galtung

[Johan Galtung is Professor of Conflict and Peace Research at the University of Oslo, Norway, and Director-General of the Inter-University Center in Dubrovinik, Yugoslavia. This article is reprinted from Development Forum, July-August 1976.]

For six months, I have had the pleasure, the challenge, and the job of being a United Nations consultant in Geneva. More precisely, there were two consultancies: one to the United Nations Conference on Trade and Development (UNCTAD) on the non-economic aspects of the transfer of technology, and one to the World Health Organization (WHO) on the effects on mind and spirit of "modern" Western technology, and industrialization in general.

At this point, permit me to introduce the hero of this little story: my scooter. It is a very simple little piece of modern technology, moderately polluting and depleting, not built for real collectivism, but comfortably seating two. The point about the scooter in this context, however, is neither its environmental impact nor the social structure associated with the scooter, but the simple fact that the scooter made it possible to move from UNCTAD to WHO--from one corridor of international civil servants and experts to another--in less than five minutes, including parking; from a building where technology is associated with economic growth and economic independence and autonomy to one where technology is associated with mental breakdown, with schizophrenia; in other words, from technological happiness to technological sadness. And it is some of that schizophrenia, built into the UN system, that I would like to share with you. Why? Because there was no other link between the UNCTAD and WHO corridors than my scooter.

I think that there are four or five distinct phases in the history of the transfer of technology--meaning Western technology directly or indirectly (for example, via Japan) to non-Western societies. The first two phases belong to the past and present. The last two or three belong to the history of the future.

The first is the old international technological order: technology is pumped through the pipelines of the imperial networks, more recently controlled by transnational corporations. In the colonial period, both sender and recipient belonged to the colonial power. In the neo-colonial period, the recipient is an independent country which is supposed to pay for the technology. In order for this to happen, a motivation has to be created through the propagation of Western development models (called "development theory") and by fostering a Westernized elite through scholarships and linkages of various kinds. If the capacity to pay for the technology is too low (or non-existent), gifts, grants, and loans enter the picture, together with the creation of an infra-structure that is meaningful only if Western technology is utilized--for instance apartment houses built of materials that make air-conditioning a necessity or highways that call for high-speed trucks and cars. We all know the result: endless debt formation to pay for the import of technology which is capital intensive, research intensive, and labour saving (in countries that are short on capital and research and long on labour), together with a tendency for that technology to increase even further the inequalities between a small elite and the masses.

The second phase, which we are now entering, is what we might call the new international technological order. Very basic criticism is leveled against the old order, but the questions raised are predominantly economic, or economistic, to underline the old order's one-sidedness. It is pointed out that a technology should be "factor compatible," meaning, for example, that it should be labour-generating rather than -saving. As for capital and research, the technology should be transferred free of charge--simply be made available--and there should be no research secrets. This of course adds up to a broadside attack against the patent system, so well analyzed in a number of important UNCTAD studies.

In a milder "code of conduct" version, the focus is on model contracts giving a more predictable, more uniform, and probably also less costly deal to the Third World countries. This model, however, is dependent both on the idea that the West will continue to supply the goods to the big world technology supermarket, and on the idea that the Third World will continue to go shopping in that supermarket (rather than becoming technologically much more self-reliant) and will continue to pay (rather than, say, by trying to obtain the innovations by other means, such as establishing direct links to Western innovators who are less than loyal to their private or state employers).

Then there is the third phase, where ecological--or sometimes ecologistic--questions are asked: What is the environmental impact of the transferred technology? To what extent can it be built into local ecological cycles to make use of locally-available, renewable raw materials? To what extent does it deplete local resources and pollute the environment? The problem is clear enough, but one kind of answer is entirely compatible with both the old and the new international orders: the Third World will simply wait for the West to develop a recycling and cleaning-up technology and then add it to the shopping list.

The fourth phase is self-reliance. At the regional and national levels, there are problems of autonomy, but the overall goal is Third World development of technology for local production and consumption, possibly also for export. At the local level, problems of local self-reliance are gradually emerging in rich countries as well as in poor. At all levels, the old transfer model can be seen for what it is: a way of solidifying the old teacher-pupil, master-disciple, professional-client relationship. To develop a local capacity for selecting appropriate technologies in the same Western supermarket changes little. There is no substitute for the stimulus derived from doing things oneself, even at the risk of re-inventing a couple of things on the way.

But then there is the individual level, at which the questions most critical of Western technology can be raised. If development is to develop human beings, not to develop things, then we must ask the profoundly disturbing question: "But does this really satisfy the basic needs of those most in need?" If the industrial geography of the world is to be changed so that 25 percent of industrial production takes place in the Third World by the year 2000, considerable transfer and creation of local technology has to occur. But technology for what? For making air-conditioners, passenger cars, armaments? Or for the satisfaction of basic needs for food, clothes, shelter, health, and education of those who have least of these essentials? The question, of course, can be put equally well to today's rich countries; their past and also their present are full of non-human--even anti-human--priorities. It is also well known that Western technology, especially the technology used by transnationals, is weak on basic needs satisfaction because it tends to price the product out of the reach of the masses.

This question, however, becomes even more disturbing when it is considered in relation to immaterial basic needs--such as the need for togetherness; for being creative; for having an identity, not being merely an object, a client, or a recipient; the need for happiness, for a meaningful life. Western technology of production and consumption seems sometimes to be like a diabolic plot aimed at counteracting human immaterial needs. Nobody denies that many goods are produced (together with a number of "bads", like armaments), but the way in which they are produced also matters. In a society where people are accustomed to producing together and love helping and chatting with each other, a noisy factory, with or without an assembly line, whether transferred on a grant or a loan basis, will create profound frustrations. This is not an abstract question of compatibility with social and cultural patterns, but a highly concrete question of human well-being. It shows up in low performance, in silent, senseless, even unconscious sabotage.

Foreign experts called in to study such phenomena will probably report in terms of clashes between "traditional" attitudes and behaviour on the one hand and "modern" production on the other, using those two loaded words to indicate which side has to yield. It rarely occurs to the experts that people may be right and technology wrong if its implication is an anti-human production pattern. And at this point, the WHO schizophrenia studies--indicating a relationship between level of industrialization and the incidence of schizophrenia--become interesting, to say the least. For the implication of those studies may be not only that Western-type technology can destroy the fine web of social relationships that seem to make some societies, less touched by Western technology, more able to cure and restore their mentally ill, but also that we in the West are already profoundly alienated because of our technology. And yet--or precisely for that reason--we nominate ourselves as world leaders and as development models.

To such reflections, the response is very often: "But let us focus on the material needs first; then we will have time for the immaterial needs." This is one of the basic fallacies, for in the meantime centralizing heavy industry will have settled in the society, broken down the autonomy of local communities, and turned much of the population into mutually-separated working robots.

In the top layers of such systems are usually various types of intellectuals--bureaucrats, finance people, researchers, technicians--the elites in countries rich or poor. The system is in their interest, since it provides them with top positions. But they might well mull over the following: what if an intellectual were ordered to publish exactly the same report or article each week, with not a word changed, in human co-operation with nobody? Mightn't he or she (usually a he) feel slightly alienated? And yet this is the work pattern to which "modern" technology condemns large parts of the working force.

From the universally-accepted idea that what was good for the West was good for the world, there is a transition to increasingly profound questioning. And there are answers to those questions. The Chinese People's Commune has a technological base that permits less hierarchical ways of orgainizing work, and is not so different from Indian sarvodaya villages, Tanzanian ujamaa villages, Israeli kibbutzim, and the countless experiments of the Western counterculture in recent years. By and large the formula of self-reliance covers them all, and this idea is incomprehensible in economistic and ecologistic terms alone. It goes deeper. These systems are also efforts, more or less successful, to pay much more respect to human needs and values as expressed in local social structures and cultures. No doubt they will spread to other countries or, rather, inspire other countries. If they are imitated uncritically, as Western technology was and still is, they will counteract self-reliance rather than build it.

And this is where the possible fifth phase comes in: the West becomes less arrogant, less bent upon its old missionary tradition ("Go ye forth and make all peoples my disciples...") and starts listening to these new signals. Of course, the signals are strongest from the country least Westernized (in spite of its strong exposure to Western ways of organizing production and consumption up till the 1960's)--China.

Maybe one day the UNCTAD Division on Transfer of Technology will be a two-way market where Western delegates can go shopping (for free, though) for the latest in ujamaa agricultural techniques and the latest in social organization in a Chinese People's Commune. And maybe that day is not too far away--for the movement is swift and the generation of new, radical technologies which are more compatible with the outer limits of nature and the inner limits of man (both material and immaterial) is very rapid. No doubt the process could be even quicker if the flow of information between the UN organizations, where the individual parts are often so much better than the organizations themselves, could be improved--especially when, as in Geneva, they are only a couple of kilometres apart. In fact, it might well be worth investing in a couple of dozen scooters.■

CSIT SPEAKERS BUREAU

Some CSIT members have given talks to groups of engineers and other interested citizens on aspects of the social impact of technology. We have found that this is an effective mechanism for promoting awareness and understanding of technology-society issues, and therefore CSIT has set up a SPEAKERS BUREAU.

Anyone wishing to arrange for a speaker or a discussion leader should write or phone:

Len Zimmerman
Bell Telephone Laboratories
Room 2C-414
Holmdel, NJ 07733
(201) 949-5737

At present, speakers are available to talk on: Solar Energy, Nuclear Energy, Ethics and the Engineer, and An Overview of the Social Impact of Technology.

Volunteers are needed to talk on these or other topics so that the load on any one speaker will be limited, the list of topics can be broadened, and a wider geographic area can be served efficiently. If you can give some of your time, please send your name, address, phone number, and topic or topics to Len Zimmerman at the above address.

HELP FOR THE ETHICAL ENGINEER IN TROUBLE

At its 9/11/76 meeting, CSIT decided to undertake the investigation of cases where engineers pursuing their professional work in accordance with the IEEE Code of Ethics have, as a result, been subjected to or threatened with unfair treatment. Where a careful study of the circumstances indicates that such a situation exists, efforts will be made to aid the engineer involved. For example, if legal action is being taken, the case might be brought to the attention of the IEEE Board of Directors with a recommendation that they instruct the Institute's attorneys to file an amicus curiae brief, as in the BART case.

It should be emphasized that only cases in which engineering ethics play a central role will be considered. CSIT is not volunteering as a shop steward for engineers dissatisfied with their last pay increases.

Readers acquainted with engineers in such predicaments are invited to inform them of this possible source of help. Initial contact should be made with the Chairman of CSIT's Working Group on Ethics and Employment Practices:

Stephen Unger
229 Cambridge Avenue
Englewood, NJ 07631
(201) 567-5923.

NEWS, NOTES, & COMMENT

ENERGY RESOLUTION OF BLACK SCIENTISTS AND ENGINEERS

We, as black scientists and engineers, have viewed with great concern the energy situation the U.S. faces today and the energy problems of the decades to come.

We strongly disagree with those who would capriciously eliminate nuclear power as an energy resource in this country. If this were allowed to happen, there would be a drastic economic impact on all Americans thru loss of jobs resulting from energy shortages and thru higher prices for other energy sources such as oil and coal. Any course of action which adversely affects our economy affects poor and black people in a disproportionate manner.

We strongly disagree with those who propose no-growth as an alternative to nuclear power. No-growth means no progress, and without progress the poor and disadvantaged will stand little chance of breaking the bonds of poverty and improving their position in this society.

We, by virtue of our education and training, understand the technical issues involved in the use of nuclear power and other energy resources; but our experience also makes us especially sensitive to the human issues involved in the severe limitation of energy resources. What is simply a matter of cutting back for some is a matter of survival for others.

We have looked at the energy options available to this country through the year 2000. Our options are limited to oil, coal, hydroelectric, geothermal, nuclear, and all of the conservation we can practice. None of these options will be sufficient by itself; we must use all. Although solar heating and cooling is now becoming economically feasible, it will not be technically feasible to generate large quantities of electricity by solar before the year 2000. Nuclear fusion shows great promise, but it will not be adequately developed before the year 2000.

We have carefully reviewed the issues concerning nuclear power technology and conclude the following:

1. Nuclear plants are safe by large margins.
2. The radioactive releases from nuclear power plants are insignificant when compared to the natural background radiation in which we live.
3. Technology exists today for the long-term storage of high level waste and the plans that are being developed will provide safe storage.
4. The methods now being developed will provide adequate safeguards to prevent the theft of nuclear materials.
5. Nuclear power plants have the least environmental and possible human health effects when compared to oil and coal.
6. The cost of electricity generated by nuclear power plants is less than that generated by oil and coal-fired plants.

In summary, we black scientists and engineers believe that nuclear power used to generate electricity is safe, economical, and environmentally acceptable. We urge the continued development of nuclear power and all other energy sources.

[Ed. note: The resolution was signed by 34 black scientists and engineers.]

IEEE ENERGY POSITION PAPERS

The IEEE Executive Committee issued three position papers on energy at its April 1977 meeting.

The "IEEE Position on Electricity in the U.S. Energy economy" calls for the formulation and implementation of "a sound national energy policy," by which it means "a commitment to uranium and coal as the only rational near- and medium-term alternatives" to oil and gas. The paper asserts that the generation of electricity is the best method of making this transition because of its flexibility and higher efficiency. It recommends continued development of the breeder reactor and expanded effort on conservation, environmental protection, plutonium safeguards, and advanced electrical energy technologies (e.g., fusion).

The "IEEE Position on Energy Conservation" is that "energy conservation programs should be given the highest national priority in energy planning." It warns that, although energy conservation should be recognized as an important supplement to any comprehensive energy program, it can only slow the rate of growth of energy requirements and thus can be no substitute for the expansion of coal and uranium applications and the development of alternative energy resources.

The "IEEE Position on Solar Energy" recommends:

"1. A vigorous research, development, and demonstration program aimed at improving the performance and reducing the cost of solar energy systems.
2. A public information program which addresses the question of how cost-competitive solar energy systems can be implemented by individuals and industries.
3. A program to investigate the institutional and economic problems of implementing solar energy systems on a large scale.
4. Provision of selective economic incentives or subsidies in order to promote early growth of solar energy systems."

F.K.

PRESIDENT DEFERS PLUTONIUM RECYCLE AND BREEDER

On April 7, 1977, President Carter announced that the U.S. would not use plutonium to fuel nuclear power reactors. The President said he hoped that, by this unilateral action, the U.S. could set a standard so that those countries that do not now have reprocessing plants, which extract plutonium from spent fuel, would not decide to build them in the future. Thus the U.S. government will not provide the $500 million subsidy needed to complete the commercial reprocessing plant at Barnwell, South Carolina.

In addition, President Carter's April 20, 1977 speech to Congress and subsequent statements by White House spokesmen confirm that construction of the Clinch River demonstration breeder reactor at Oak Ridge, Tennessee, which would have cost at least $2 billion, will be "deferred indefinitely." The government will complete the design phase of the project.

President Carter's nuclear power policy seems to be emerging along the lines suggested by the 1976 Ford Foundation/MITRE Corp. study, Nuclear Power, Issues and Choices. The study will be reviewed in the September issue of Technology and Society.

F.K.

(Continued on page 16)

LETTERS

[Readers are urged to comment freely, for publication, on any and all aspects of Technology and Society and on the full range of issues of social implications of technology. Short, concise letters are preferred. Letters should include writer's signature and mailing address. Please send letters to: Frank Kotasek Jr., 73 Hedges Avenue, East Patchogue, NY 11772. Affiliations of writers are given for identification purposes only.]

DEAR EDITOR,

Last fall, the then President of the IEEE circulated a letter to the membership that I think was a prejudicial and unfair attempt to influence the Institute's election of officers. I think that the IEEE Board of Directors should take action to insure that this kind of interference shall not be repeated. I urge the members of the Institute to write to their officers and directors to tell them to take such action.

Our IEEE ballots were accompanied by a letter from the incumbent President, Joseph K. Dillard. (A copy of that letter is included below.) The letter contains a 134-word description of the Board's nominating process, in which the Board's candidates are mentioned twice by name. This long paragraph implies that nomination by petition is somehow abnormal, and it extols the virtues of the Board's nominating process. In contrast, 50 words are devoted to the existence of rival candidates, whose names are not mentioned.

All this is in addition to biographical material supplied with the ballots and other material which has appeared in Spectrum and in some group and society newsletters and in some trade publications. But for the unaware or confused member who had not followed the campaign, a letter from the Institute president might be expected to give some guidance. Instead, I think that the letter is blatant electioneering, carried out with Institute funds in apparent violation of Institute procedure, and certainly not in the spirit of fair play for the opposition.

In the event, the Board's candidate for president was elected, although only by a plurality, while the Board's candidate for executive vice-president was defeated. However, the result of the election is not the issue I'm raising here; rather, it's the principle of an attempt by the Institute hierarchy to manipulate the result of an election which should determine the makeup of that hierarchy.

There are a lot of important things that the IEEE should be doing. We must continue and improve our technical work. We should be strengthening our "professional" activities, relating to both the economic concerns of members and to social and ethical matters which concern us as engineers and as members of society. To do this, we need more people working in the IEEE, not fewer, and we need to welcome and encourage suggestions from members, not to actively discourage them. We certainly need to have completely free and fair elections--Institute members who are concerned enough about Institute problems to campaign for office and who are prepared to take on the hard jobs that need to be done must have assurance of a hearing and a chance to convince their fellow members that their programs are good ones. Surely a professional society like IEEE can conduct a fairly-contested election--other societies can and do. If dissent via the electoral process is frustrated by tinkering with that process, why should we think that members with ideas will be content to work through other channels which they will perceive as having a large probability of being effectively closed. Freezing out dissenters is practically a guarantee of forcing out many of our most active and productive members.

I urge those members concerned with keeping the IEEE healthy, active, and working for the interests of all of its members to write and talk to your officers and directors, both of the Institute and its component societies, groups, sections, and chapters, about insuring that next year's election be kept free of such apparent prejudice. But please don't stop there; help in the ongoing work of the Institute.

Sincerely,
Alan Sobel
Zenith Radio Corporation
Chicago, IL

COPY OF THE LETTER REFERRED TO BY MR. SOBEL:

August 1976

Dear Member:

Please note that we again have more than one candidate running for the top IEEE offices. Therefore, it is important that you vote. Also, you should clearly understand our nominating procedures so that you know how these candidates got on the enclosed ballot.

The Board of Directors has nominated Dr. Robert M. Saunders and Mr. Robert D. Briskman as their candidates for President and Executive Vice President. They selected these two by a competitive election at the Board meeting last January. The Board was presented with two nominees for each office by the Institute's independent Nominations and Appointments Committee, composed of both Director and non-Director members. Also, the Board may exercise its privilege of adding nominations from the floor. Both the Board and the Nominations and Appointments Committee try to select the best candidates for these offices by criteria such as demonstrated leadership in Institute affairs, ability, and experience. This process is open and competitive. This is the normal process provided by the Institute's Bylaws, which resulted in the nomination of Dr. Saunders and Mr. Briskman.

The Institute's Bylaws also provide for candidates to be added to the ballot upon presentation of a petition having signatures of one percent of our active voting membership at year-end, this year requiring 1,448 signatures. Three candidates fulfilled this requirement. They are identified as petition candidates on the ballot.

The final selection is yours. All candidates on the ballot have provided platform statements which were published in the August issue of Spectrum. May I urge you to vote wisely and responsibly. If you have any further questions on this matter, I would be pleased to discuss them with you personally or by mail.

Sincerely,
Joseph K. Dillard

MEETINGS

CONFERENCE ON SOCIAL CONSEQUENCES OF TECHNOLOGY

POTTSTOWN, PA
OCTOBER 22-23, 1977

Engineering is at a crucial stage of development; while technology becomes more sophisticated and powerful, the awareness of unintended side-effects is growing. The need exists for new--or rather additional--evaluation criteria involving the social consequences of engineering (its goals and its unintended effects).

Engineers--and members of other relevant disciplines--are invited to participate in a weekend-long get-together to discuss this situation. The areas to be covered include definition of the problem, difficulties in dealing with it, and suggestions for how to proceed. The number of participants will be limited to about 20, so as to allow a real exchange of views.

The conference will be held on Fellowship Farm, located about 35 miles northwest of Philadelphia and 20 miles from Reading. The fee of $40 (plus sales tax, if any) covers two days' food and lodging (arrive Friday night). For further information, contact:

Dr. Victor Paschkis
Fellowship Farm
R.D. 3
Pottstown, PA 19464

J. Malvern Benjamin
Bionic Instruments, Inc.
221 Rock Hill Road
Bala Cynwyd, PA 19004
(215) 839-3250

SOUTHEASTERN CONFERENCE ON SAFE PRODUCT DESIGN AND FAILURE ANALYSIS

SCHOOL OF ENGINEERING, DUKE UNIVERSITY
DURHAM, NC
NOVEMBER 18, 1977

Topics include failure analysis, product design, and products liability. Papers on failure analysis and product design will emphasize minimizing failure and encouraging product safety. Papers relating to products liability will involve the legal aspects of specific products or product groups, plus broader political and economic issues concerning products liability. The registration fee is $25. For further information, contact the Conference Chairman:

Dr. Verne L. Roberts
Dept. Mechanical Eng. & Materials Science
Duke University
Durham, NC 27706
(919) 684-2832

NEWS, NOTES & COMMENT (Continued from page 14)

DISTRICT JUDGE STRIKES DOWN PRICE-ANDERSON ACT

In a March 31, 1977 decision, Federal District Judge James B. McMillan declared the limited liability provision of the Price-Anderson Act to be an unconstitutional deprivation of property without due process of law. The ruling involves a suit brought by the Carolina Environmental Study Group against the Nuclear Regulatory Commission (NRC) and the Duke Power Company, which is building two nuclear power plants near Charlotte, North Carolina. The suit contended that a serious nuclear power plant accident could cause damage well in excess of the $560 million limit on liability. It is likely that NRC and Duke Power Co. will appeal the ruling.

F.K.