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**THE HAWAII SCIENCE, ENGINEERING  
AND TECHNOLOGY PROJECT**

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**Prepared by**

**The Urban and Regional Planning Program  
University of Hawaii**

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**A Report to the Legislature of the State of Hawaii**

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**Submitted by the  
Legislative Auditor of the State of Hawaii**

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**May 1980**



## FOREWORD

At the initiation of its leadership, the Hawaii State Legislature applied for and received a grant from the National Science Foundation to develop a system whereby scientific, engineering, and technological resources can be effectively utilized in the legislative process.

The grant was administered by the Office of the Legislative Auditor, and the project was executed through the University of Hawaii's Urban and Regional Planning Program (URPP), an organization familiar with the scientific, engineering, and technological resources in the academic and business communities.

Research was conducted by Maureen Doughtie and Margaret Kimmerer of the Planning Program. Project coordination and review was conducted by Henry Tsuyemura, with assistance from Nancy Battaile, both on the staff of the Legislative Auditor. Project supervision and editing was conducted by Tom Dinell, with assistance from Kem Lowry, both faculty members in the Planning Program.

We express our appreciation to the members of the many SET organizations that participated in our survey. Their cooperation has resulted in the compilation of an initial SET resource directory, organized by specialty and firm or agency, as well as important data used in this study.

In addition, our special thanks to Dr. Doak C. Cox, Director of the Environmental Center, and Richard A. Carpenter, Research Associate at the East-West Environment and Policy Institute, the East-West Center, for sharing their knowledge about interchange between the legislative and scientific communities, assisting in the design of alternative SET mechanisms, and reviewing the draft of this report.



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## EXECUTIVE SUMMARY

The report on the Hawaii Science, Engineering, and Technology (SET) Project has been prepared by the Urban and Regional Planning Program, University of Hawaii, for and in consultation with the Office of the Legislative Auditor.

The purpose of the project has been to design a system which will facilitate the exchange of information between Hawaii state legislators and professional scientists, engineers, and technologists in the community. It is part of a national effort involving 42 states, spearheaded and funded by the National Science Foundation, to improve the capability of state legislatures to acquire and utilize SET information in making public policy.

Increasingly, the Hawaii State Legislature has been confronted with proposals and issues related to science, engineering, and technology, and it has sought to establish processes to utilize productively the SET resources of the State. One such effort began in 1972 when the Legislature enacted a law to establish the Legislative Scientific Advisory Committee. Through this project, it continues to seek effective ways to secure SET support for its policymaking functions.

Over 800 SET-related measures were introduced in the Hawaii State Legislature between 1973 and 1978, which gives some indication of the importance of scientific, engineering, and technological considerations in legislative decisionmaking. Interviews with selected Hawaii legislators and in-house legislative research staff and a survey of SET organizations in the State provided data on the current extent of interactions between Hawaii state legislators and SET experts in the community. The interviews and survey also indicated some of the shortcomings of the current information exchange process between legislators and SET experts.

Information on the types of SET mechanisms (i.e., SET information exchange mechanisms) operating elsewhere was obtained from legislative reference service agencies in other states, SET reports from other states, and a review of the literature on legislative SET information exchange processes.

The information collected revealed that Hawaii state legislators have at least three types of SET information needs: (1) responses to simple inquiries requiring only short-term research efforts; (2) provision of comprehensive analyses of SET issues previously prepared, usually by others; and (3) provision of comprehensive analyses of SET issues on which long-term research and analysis are conducted.

The range of activities which can provide these types of SET information includes the establishment of a phone inquiry service; arranging for experts to testify at legislative committee hearings; hiring consultants to write issue papers on current SET topics of concern; arranging education workshops, seminars, or panel discussions on SET subjects; providing technical review of SET-related bills and resolutions, assisting in the initial drafting of SET-related bills and resolutions; arranging field trips or site visits for legislators to research and development sites; monitoring the status of SET research and development projects in the State; publishing a newsletter for legislators to inform them of current SET activities; and publishing a directory of SET professionals.

Nine alternatives were designed as possible SET mechanisms for the Hawaii State Legislature: (1) reactivation of the Legislative Scientific Advisory Committee; (2) designation of a SET Task Force manager within the Legislative Reference Bureau; (3) location of the LEGITECH computer in an in-house legislative service agency; (4) expansion of the existing legislative intern program to include students with SET backgrounds; (5) appointment of a legislative science advisor; (6) establishment of a SET Legislative Committee; (7) creation of a SET division within the Legislative Reference Bureau; (8) appointment of University SET information brokers; and (9) establishment of the Hawaii Chapter of Sigma Xi (a scientific professional society) as a SET information broker.

Based on the information obtained from the interviews with legislators and in-house legislative service agency staff and the survey of SET organizations, eleven relevant criteria were developed under three major areas of concern: (1) content; (2) process; and (3) feasibility. Content criteria consisted of: (1) technical validity within the context of the Hawaiian environment; (2) adequate coverage of all perspectives; (3) policy relevant to legislators; (4) credibility of those providing SET information; and (5) clarity of information.

Process criteria consisted of: (6) complementary existing legislative information exchange systems; (7) accessibility by requestors; (8) response time; and (9) two-way information exchange between legislators and SET experts.

Feasibility criteria included: (10) cost of implementation and operation; and (11) political feasibility.

Each alternative was assessed in terms of the 11 relevant criteria. The SET mechanism receiving the highest rating is the establishment of Sigma Xi as a SET information broker. The second highest rating is the creation of a SET division within the Legislative Reference Bureau.

In order to implement a Sigma Xi mechanism, formal agreement needs to be entered into between the Legislature and the cooperating SET professional society. In addition, both those in the Legislature and in the professional society must share the same set of expectation as to how the mechanism will function and be willing to contribute to its continuing development.

## CHAPTER 1

### INTRODUCTION

Two related phenomena have led to Science, Engineering, and Technology (SET) playing an increasingly predominant role in state policymaking. The first is the increasingly important role of technology in society today. The second phenomenon is the growing reliance of the federal government on the states for policy development and implementation in areas of concern having a major scientific, engineering, and technological content. This has led to problems in how to obtain, translate, and deliver SET information to state policymakers, particularly state legislators. The question, then, becomes what kind of system best provides for the exchange of SET information needs and information between legislators and SET experts.

#### **The Changing Role of Technology and Its Impact on Public Policymaking**

The tremendous technological advances achieved in the years since World War II have truly been staggering. The new technologies have impacted every aspect of our lives from communication to reproduction, from military strategy to the processing of information, from relations among nations to health care, from the growing of food to social relations. It is hard now to imagine a world without television, computers, hydrogen bombs, contraceptive pills, microwave ovens, and 747's, but none of these technologies existed prior to World War II. Each of these developments is based in turn on some breakthrough in basic science. What has happened, of course, is the rather leisurely time lapse that once existed between a new discovery in science and its application in the marketplace has been vastly reduced. In fact, nowadays, it is sometimes hard to distinguish between basic science and its applied aspects which include technology and engineering. And if what has occurred in the last 30 to 40 years appears to constitute a technological revolution, it pales in comparison to what is predicted for the years ahead. The futurists have a field-day regaling their audiences with tales of what lies ahead. Their predictions are both heartening and fearful at the same time.

For years the predominant attitude toward technological development has been that it is good per se in and of its own right. It led to increased productivity, new opportunities, and greater material well-being. And while all this is often true, frequently it is not. Increasingly the inherent goodness of technology is being questioned. There is a new emphasis on technological assessment, on trying to identify and evaluate the impact and particularly the potential side effects of a new technology before committing vast resources to its development and implementation. There is concern about the impact of a new technology on the availability of natural resources, on the liability of the ozone layer, on

the existing culture in a particular area, on employment, and on foreign exchange and relations. There is concern about costs and benefits, particularly who is benefitting and who is paying, as exemplified in the health care field as each new high technology diagnostic and/or treatment system becomes available. There is increasing recognition that a decision about developing a particular technology relates to dozens and even hundreds of other activities, that letting the technological imperative rule is not an unmixed blessing. Perhaps Dennis Goulet expressed this best in titling his book on technology and the third world, *The Uncertain Promise*.<sup>1</sup> The promise of technology is indeed uncertain.

As the rate of technological development has quickened and the effects of technological advances have become more ubiquitous, technology itself has become a central concern for political decisionmakers.

The likelihood that the operation of supersonic airplanes will contribute to the destruction of the ozone layer, the potential impact if or when the Unagi eel escapes from confinement and the probability of this occurring, the sustainable yield of fresh water in the lens underneath the Oahu landmass and the consequences of exceeding this yield, the potential contribution of alternative energy sources not yet developed in meeting future energy demand, the means for controlling point and nonpoint sources of pollution, and the economic impact of doing so are simultaneously matters for the scientist, the engineer, the technologist, and the public policymakers. If the political actor is to make an informed decision, then he not only needs the input of the expert but he needs it in a form which lends itself to being utilized in the political decisionmaking process. And the decisions which are necessary are in fact political decisions, given our form of government. The major policy decisions cannot be made by the technocrats, no matter how highly qualified, unless this country is to become a technocracy. The technical experts, who sometimes disdain the political process, mistakenly believing that only technical considerations are involved in policy decisions involving scientific or technological matters, have to learn what policymakers need in the way of data and judgments in order to make informed decisions and in what form they need it. The experts have to recognize that even when experts agree on the technical aspects of a new technology, what constitutes desirable public policy is still an open question. Similarly, the policymaker cannot expect the experts to provide answers that go beyond their expertise. Furthermore, the policymakers need to recognize that science is not a matter of certainties but of probabilities, and that this is critically important in dealing with questions relating to the impact of new technologies.

The scientist, the engineer, and the technologist need to be able to speak to the policymakers and to listen to them. The concern is that the necessary common language and the needed medium of exchange or dialogue are lacking. In recent years, many measures have been implemented at the national level, both in the executive and legislative branches,<sup>2</sup> to close the gap, to provide the common language, and to create the needed medium. A new focus of concern is the state level, both executive and legislative. This concern has been given expression by the National Science Foundation.

<sup>1</sup>Dennis Goulet, *The Uncertain Promise*, (New York: IDOC/North America, 1977).

<sup>2</sup>The case can be made that attention also needs to be given to the judiciary, that scientific, engineering, and technical questions are just as crucial there as in the other two branches of government. This has not occurred yet to any extent. Primary reliance is still placed on the adversaries in a case to provide the judge and/or jury with the requisite technical education that may be required in a particular case.

## The Impact of Federal SET Measures on the States

In 1976 Congress authorized an appropriation of \$3,000,000 for the National Science Foundation to provide grants to state governments for improving their capability to incorporate SET information into their decisionmaking processes. The program provides up to \$25,000 each to the state executive and/or legislative branches or \$50,000 in the case of a joint effort for such a purpose. Forty-two states have been awarded grants to develop or improve SET information transfer systems for their legislatures, while 49 received grants to improve SET information flows among the executive agencies including four joint grants.<sup>3</sup>

In the early seventies national priorities for federal research and development (R & D), heavily emphasizing military and aerospace programs, were extended to include alleviation of domestic problems. This problem-oriented research included housing, land use, transportation, agriculture, health, education, welfare, and economic development. Much of it focuses on urban problems, the primary responsibilities of state and local governments.<sup>4</sup>

Two outcomes resulted from this modification of national focus: (1) an evolution in the nature of federal SET policy issues; and (2) an increased number of federal programs requiring states to utilize scientific, engineering, and technological expertise for their implementation.

Some of the recent "problem-oriented" federal R & D programs have resulted in public concern or controversy. The development of a U.S. supersonic transport (SST), for example, created much controversy leading to the cancelling of the program in 1971. More recently, the siting of nuclear power plants has stirred public concern throughout the nation. Controversies such as these have led to policy issues debated in terms of *technological fact*, where reputable SET experts differ in their views as to the outcomes or impacts of federal R & D efforts.<sup>5</sup>

Setting policy on federal SET programs is difficult for decisionmakers, as most of them do not have the academic background or experience to interpret highly technical information and evaluate its accuracy. Consequently, these decisionmakers place increasing reliance on professional scientists, engineers, and technologists to provide objective analysis and advice concerning SET issues even though the experts often disagree among themselves.

At the same time that the federal SET focus was changing, Congress enacted laws relating to scientific, engineering, and technological resources which delegate implementation responsibilities to the states. Table 1-1 lists several such SET-related laws. Frequently implementation actions of these laws require the setting of policy directions by

<sup>3</sup>James O. Gollub, et al., *Increasing the Capacity of State Governments to Access and Use Scientific, Engineering, and Technical Resources*, (Washington D.C.: SRI International, August 15, 1978), Report to National Science Foundation SRI Project 7563, pp. 1-2.

<sup>4</sup>Robert Crawford, "The Application of Science and Technology in Local Governments in the United States" in *Studies in Comparative Local Government* 7 (Winter), pp. 8-9.

<sup>5</sup>Ian D. Clark, "Expert Advice in the Controversy About Supersonic Transport in the United States," in *Minerva* 12, 4 (October 1974), p. 417.

Table 1-1

Examples of Federal Laws Delegating  
Implementation Responsibilities to the States

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National Traffic and Motor Vehicle Safety Act of 1966  
Highway Safety Act of 1966  
Natural Gas Pipeline Safety Act of 1968  
Radiation Control for Health and Safety Act of 1969  
Federal Coal Mine Health and Safety Act of 1970  
Federal Railroad Safety Act of 1970  
Occupational Safety and Health Act of 1970  
Federal Boat Safety Act of 1971  
Energy Policy and Conservation Act (EPCA)  
Energy Conservation and Production Act (ECPA)  
Coastal Zone Management Act of 1972  
Comprehensive Employment and Training Act (CETA)  
Resource Conservation and Recovery Act  
National Mass Transportation Assistance Act  
Water Quality Act of 1965  
Federal Environmental Pesticide Control Act of 1972  
Noise Control Act of 1972  
Federal Water Pollution Control Act of 1972  
Marine Mammal Protection Act of 1972  
Safe Drinking Water Act of 1974  
Marine Protection Research and Sanctuaries Act of 1972  
Emergency Highway Energy Conservation Act

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Source: *Increasing the Capacity of State Governments to Access and Use Scientific, Engineering and Technical Resources* by James O. Gollub, et.al., (Washington, D.C.: SRI International), prepared for International Programs, Applied Science and Research Applications Directorate National Science Foundation SRI Project 7563, August 15, 1978, p. 73.

the legislature and the executive. This in turn necessitates a basic understanding of the scientific, engineering, and technological issues inherent in these federal programs.<sup>6</sup>

One specific outcome of these federal trends on state legislatures has been an increase in the number of bills and resolutions entering the legislative arena which pertain to SET issues.<sup>7</sup> Hawaii is no exception to this trend. An inventory of bills and resolutions introduced into the Hawaii State Legislature over the past six years (1973–1978) suggests that between 10 and 20 percent of these measures pertained to SET issues. Specific subject areas range from biomedicine and health issues to manganese nodules, coral, and forestry matters. A complete description of the inventory is presented in Appendix A. Given the increasing number of SET issues entering the legislative arena, state legislators require greater inputs of scientific, engineering, and technological information in order to make informed decisions.

### The Problems of Obtaining, Translating, and Delivering SET Information

Getting SET information to state legislators when they need it and in a form they can use turns out to be a relatively complicated problem. Three separate tasks are included in the necessary information exchange process between legislators and SET professionals: (1) collection, (2) translation into laymen's language, and (3) delivery in a timely fashion. Putting these pieces together into a single process involves the creation and operation of a SET information exchange process.

A key factor in gathering SET information is knowing how to find the appropriate resources. With the steadily increasing volumes of scientific research papers, engineering reports and technical studies being produced, it is sometimes difficult to "filter out" specific pieces of SET information which pertain to legislative policy concerns. As Irwin Feller points out, the gap between that information which is available and that which is required for sound policies has widened.<sup>8</sup>

Some specific problems associated with collection of SET information are:

- . SET information sources are usually scattered throughout a state, frequently making access to a specific piece of SET data difficult.
- . There is no systematic mechanism for separating technically valid SET information from inaccurate data.

<sup>6</sup> Gollub, *Increasing the Capacity of State Governments*, p. 3.

<sup>7</sup> State of Wisconsin Legislative Reference Bureau, *Science, Technology and the Legislative Process*, Informational Bulletin 74-1B-9 (October 1974), p. 1.

<sup>8</sup> Irwin Feller, et al., *Diffusion and Utilization of Scientific and Technological Knowledge within State and Local Governments*, (Pennsylvania: University Park, February 1979), p. II-3.

Once the information is collected, it usually must be "translated" into language understandable to the nonscientist. This is probably the most difficult task, entailing much more than simple "re-wording." Experiences in other states and in Congress reveal that a communication barrier exists between legislators and SET experts, rooted in the differing frames of reference, vocabularies, and problem-solving techniques employed by scientists and by policymakers. Some specific problems which have been cited are:

- Scientists often perceive the technical aspects of legislative issues as distinct from the political aspects, while legislators consider the two inseparable. Consequently, scientists may not provide SET information to legislators which is applicable in the context of the political arena (e.g., information provided may be too "academic").
- The highly technical vocabulary of SET professionals is often unfamiliar to legislators.
- Findings of scientific research reports are often expressed in sophisticated statistical form which may be confusing to one who does not work with such figures regularly.
- Legislators sometimes perceive scientific research as being able to provide "100% correct" solutions to SET legislative issues. The discipline of science, however, deals in statistical probabilities and uncertainties.
- SET professionals often feel unduly burdened by the time constraints placed on them when providing information to legislators during session. Consequently, they may be reluctant to participate in the process. For example, when Hawaii SET organizations were surveyed to learn if they would be willing to supply requested information to legislators, some SET professionals replied, "Yes, if sufficient time is permitted."

Once the SET information has been collected and translated, it must be delivered to the legislators. Although delivery of SET data is probably the least "troublesome" aspect of a SET information exchange process, there are some problems associated with it:

- SET information may not be delivered in time for legislators to use when deciding on an issue.
- SET information is sometimes delivered in a manner which is confusing to nonscientists (e.g., a SET expert may use highly technical language when testifying at a legislative committee hearing).

The problems associated with SET information collection, translation, and delivery suggest the advisability of systematically reviewing the "SET information exchange mechanisms" used in Hawaii and elsewhere to determine if revisions in the existing system of brokerage between legislators and SET experts (hereafter referred to as "SET mechanism") is desirable.

Carpenter summarizes the tasks of a SET mechanism as follows:

“... to identify and select high-quality information and then bring it to the attention of the legislators in a timely manner.”<sup>9</sup>

Clark adds one pertinent factor to this description:

“Useful advice would be advice which answers the relevant technical questions *in a way which is understandable to persons who have to make a decision about policy.*”<sup>10</sup>

The Hawaii SET Project has developed alternative designs for a SET mechanism for the Hawaii State Legislature that will: (1) collect technically valid information that is applicable to the legislative decisionmaking arena, (2) translate technical data into language understandable to nonscientists, and (3) deliver the compiled information prior to any crucial legislative decisionmaking.

### Concluding Note on the Definition of “Scientific, Engineering, and Technological”

There are two possible ways to define “scientific, engineering, and technological.” In the broad sense, SET can include physical, biological and life sciences, engineering, technology, and disciplines from the social sciences as well. In the narrow sense, only the biological and physical sciences, engineering, and technology are considered to be SET topics. The Nevada SET Report states that it is important to explicitly define the bounds of what constitutes a SET issue:

“Science, engineering and technology can mean different things to different people, legislators included. This ambiguity has important ramifications for the kinds of information-gathering activities which legislators are likely to support and in which institutional investment will be made.”<sup>11</sup>

The Hawaii SET Project defines “SET” broadly and includes economics and social sciences, as well as physical and biological sciences, engineering, and technology. An indication of the range of these SET subjects may be found in Appendix A, which consists of an inventory of SET bills and resolutions introduced into the Hawaii State Legislature, and Appendix B, which consists of the subject headings used in the *Directory of Scientific, Engineering, and Technological Resource Personnel in the State of Hawaii* (a separate document compiled by the SET Project Team).

<sup>9</sup>Richard A. Carpenter, “Information for Decisions in Environmental Policy,” *Science* 160 (June 12, 1970), p. 1316.

<sup>10</sup>Clark, “Expert Advice,” p. 442.

<sup>11</sup>Robert B. Bradley, Ph.D., *State Science Engineering and Technology Project Report*, (Nevada: Legislative Counsel Bureau, October 1978), Bulletin No. 79-22, p. 5.

## CHAPTER 2

### DESCRIPTION OF METHODOLOGY

The methodology used for the Hawaii SET Project consists of two separate phases:

- (1) an information gathering phase, in which data were collected concerning SET mechanisms in other states, existing scientific, engineering, and technological resources in Hawaii, and current information exchange patterns between SET experts and legislators in the State; and
- (2) an analysis phase, in which alternative designs for a legislative SET mechanism were developed and assessed.

#### Information Gathering

Five tasks were conducted during the information-gathering phase:

- (1) an extensive review of the literature describing SET mechanisms proposed for or operating in other states;
- (2) an inventory of bills and resolutions introduced into the Hawaii State Legislature which pertained to SET issues;
- (3) a survey of organizations in Hawaii whose personnel possess scientific, engineering, or technological expertise;
- (4) interviews with Hawaii state legislators; and
- (5) interviews with staff members of Hawaii legislative service agencies.<sup>1</sup>

Each task is described in greater detail below.

#### Task 1: Literature Review

There is a fairly large volume of literature available concerning the flows of scientific, engineering, and technological information to and from state legislatures.

<sup>1</sup>*Legislative service agencies* are defined as in-house research offices, under direct supervision of the Legislature, that provide information to legislators.

This report draws primarily on SET project reports from other states, research reports concerning SET information flows in state legislatures, and journal articles and reports describing the acquisition of SET information by members of Congress. The literature review has provided several basic models of legislative SET mechanisms and indicated several variables to be considered in the design of these specialized information exchange systems.

### **Task 2: Inventory of Bills and Resolutions**

Bills and resolutions introduced into the Hawaii State Legislature between 1973 and 1978 were inventoried in order to determine the number and proportion of those measures having scientific, engineering, or technological aspects. The inventory also indicates the SET subject areas upon which Hawaii state legislators have recently been concentrating their attention.

### **Task 3: Survey of Existing SET Organizations in Hawaii**

Five hundred twenty-nine SET organizations in Hawaii were surveyed in order to learn what types of information resources are available to the Legislature. The survey was designed to: (1) identify specialized areas of expertise in those SET organizations surveyed; (2) learn what information exchange channels between legislators and SET organizations are presently being used and the extent of interaction; and (3) obtain data for a Resource Directory listing those organizations willing to provide SET information to legislators upon request.

### **Task 4: Interviews with Legislators**

Interviews with a limited number of Hawaii state legislators provided data on the SET information channels they currently utilize and their level of satisfaction (or dissatisfaction) with those channels. The following information was sought from the legislators:

- (a) their perceptions as to what constitutes a SET issue, and which of these issues they consider particularly pressing;
- (b) current information channels through which they obtain SET information;
- (c) their degree of satisfaction with existing information channels; and
- (d) suggestions for improving the existing SET information networks.

### **Task 5: Interviews with Staff Members of Hawaii Legislative Service Agencies**

The Hawaii State Legislature has six in-house information services which provide legislators with some SET data. Four of these offices are partisan (House and Senate Majority Research offices, House and Senate Minority Research offices) while two are non-partisan (Legislative Reference Bureau, Office of the Legislative Auditor). Personnel from each of these offices were interviewed, providing information on:

- (a) the types of services offered;
- (b) the approximate portion of information requests from legislators that pertain to SET topics;
- (c) the number of staff and their academic backgrounds;
- (d) the SET subject areas eliciting a particularly large number of information requests; and
- (e) the scientific, engineering, and technological resources in Hawaii utilized by these offices when seeking SET information.

### **Analysis**

The analysis phase consisted of four major tasks:

- (1) identification of those aspects essential to the design of a legislative SET information exchange system;
- (2) development of nine alternative SET mechanisms for the Hawaii State Legislature;
- (3) assessment of the nine design alternatives; and
- (4) presentation of one SET design for consideration by the Hawaii State Legislature.

### **Task 1: Identification of Essential Aspects of a SET Mechanism**

Seven aspects have been identified as essential when designing a SET mechanism:

- (a) operational responsibility – the organization responsible for overseeing activities of a SET mechanism;
- (b) nature of staffing – the number of staff members recruited (either paid or voluntary) and their level of scientific, engineering, or technological expertise;

- (c) type of activities – those specific actions through which scientific, engineering, and technological information is collected, translated, and delivered to legislators;
- (d) level of analysis – the detail and comprehensiveness of the SET information presented to legislators;
- (e) time perspective – focus on immediate or long-range SET concerns;
- (f) initiation of activities – whether SET information-gathering activities are initiated in response to requests from legislators or at the discretion of the SET brokers; and
- (g) implementation – the actions necessary to implement a particular SET mechanism.

### Task 2: Development of Nine Alternatives for a Hawaii SET Mechanism

Nine alternative legislative SET mechanisms have been designed as they might operate in Hawaii. Some are additions to existing in-house legislative service agencies while others are established in SET organizations which are not under direct supervision by the Legislature. Each alternative is described according to the seven aspects identified in Task One.<sup>2</sup>

### Task 3: Assessment of the Nine Design Alternatives

An assessment of each alternative was conducted to determine its utility to Hawaii legislators. The initial step in the assessment involved the development of three categories of relevant criteria:

- (a) content criteria – the quality of the SET information provided by each mechanism;
- (b) process criteria – the functioning of each mechanism; and
- (c) feasibility criteria – the likelihood of implementation of each alternative.

The nine alternatives and criteria were presented to a review panel comprised of four members of the SET community (two from “hard science” disciplines, two from the “soft sciences”) and two members of a legislative service agency.

<sup>2</sup>The design alternatives are based on a study by Irwin Feller, et al. *Sources of Scientific and Technological Information in State Legislatures*, (Pennsylvania: University Park, June 1975).

## CHAPTER 3

### EXISTING SCIENTIFIC, ENGINEERING, AND TECHNOLOGICAL RESOURCES IN THE STATE

Hawaii is unique among the states in that its state government offices, major university, and most private SET organizations are concentrated in the capital, Honolulu. This geographic characteristic facilitates information exchange activities between these sectors and the Legislature. It is, therefore, not surprising to learn that Hawaii's legislators obtain SET information from a wide variety of sources, some of which are directly controlled by the Legislature (in-house or internal sources), and others not under direct legislative supervision (external SET information sources).

Chapter 3 describes SET information sources available to Hawaii's legislators and attempts to trace the network of information exchange between these sources and the Legislature. It is divided into three parts. Part I discusses internal legislative information sources, Part II describes external SET information sources, and Part III briefly examines some past and present examples of SET information brokerage efforts in Hawaii.

#### PART I: IN-HOUSE LEGISLATIVE INFORMATION SOURCES

Interviews with Hawaii state legislators suggest that they utilize the available in-house legislative service agencies quite extensively to obtain information of all types. In general, these agencies are not considered ultimate sources for SET information (or any information, for that matter), but instead are perceived as information brokers between legislators and SET experts in the community.

Hawaii has six major legislative service agencies: the Legislative Reference Bureau, Senate Majority Research Office, Senate Minority Research Office, House Majority Research Office, House Minority Research Office, and Office of the Legislative Auditor. Each agency is individually described below and the common characteristics of SET information exchange patterns are discussed.

##### A. Legislative Reference Bureau

The Legislative Reference Bureau, a nonpartisan agency which serves all 76 legislators on a year-round basis, has a staff of eight attorneys (including the Director) and six researchers. Staff members represent a variety of professional disciplines, including one with a Ph.D. in chemistry.

Staff members are assigned to specific topical areas. Over a period of time they develop a level of expertise in those subjects through their continuous research efforts. The staff member with the Ph.D. in chemistry, for example, handles most information requests pertaining to energy. Specific duties of LRB staff vary, depending on whether or not the Legislature is in session. During session, much of their time is spent drafting bills, while in the interim they conduct in-depth studies (which have been requested by legislative resolution) and gather information on upcoming legislative issues. Throughout the year, LRB responds to legislative information requests.

#### **B. Senate Majority Research Office**

The Senate Majority Office serves the Democrats of the upper house. Staffing varies from seven researchers and three attorneys during session to five researchers and one attorney during the interim. Staff members are assigned to specific committees and, therefore, to specific topical areas. At the time of these interviews no staff person in the Senate Majority Office had a SET-related professional or academic background. Research efforts of Senate Majority Office staff concentrate on requests of committee chairpersons. They do not conduct independent, large-scale research projects.

#### **C. Senate Minority Research Office**

The Senate Minority Research Office, which serves the senators of the Republican Party, is staffed with four researchers and two attorneys during session and one less attorney during the interim. None of the researchers has a SET academic or professional background. Each researcher is assigned to several subject areas and monitors the Senate committees which deal with those topics. Thus, staff members are able to develop a measure of expertise in assigned areas through continuous research efforts. Duties in the office include responding to senatorial information requests, drafting bills, maintaining files on current issues of legislative interest, and initiating studies on anticipated future legislative issues.

#### **D. House Majority Research Office**

The House Majority Research Office staff includes one attorney and six researchers who serve the Democrats in the House of Representatives. During the legislative session, six attorneys are added. All researchers in this office have completed some graduate work (i.e., a Master's or Ph.D.). Although none of the researchers has a "hard science" or engineering background, one staff person has a Masters in Urban and Regional Planning, which this report defines as a SET (i.e., technological) area.

Office researchers are assigned to specific committees during session, gradually developing a measure of expertise in those areas through ongoing research efforts. During the interim, the office conducts seminars (if requested by legislators) and long-term research studies, provides staff support to legislative interim committees, and also prepares public issue papers on anticipated areas of future legislative concern. In addition, staff members do some speech writing and preparing of news releases for individual majority members.

## **E. House Minority Research Office**

The House Minority Research Office, which serves the House Republican members, consists of four researchers and two attorneys during session and two researchers during the interim. Although the office has no paid legal staff during the interim, an attorney volunteers his services as needed.

When hiring temporary researchers for the session, the Director anticipates upcoming legislative issues and attempts to recruit people whose professional or academic backgrounds coincide with those issues.

Staff duties include responding to legislative information requests and preparing speeches and testimony, if requested by House Republican members.

## **F. Office of the Legislative Auditor**

The Office of the Legislative Auditor serves the entire Legislature. Its principal functions are to conduct audits and long-range studies at the request of the Legislature. The office is staffed with 30 employees which include the Auditor, Deputy Auditor, 4 clerical workers, and 24 researchers. Members of the research staff possess a variety of professional backgrounds including law, accounting, business, economics, public administration, social work, public health, education, and library science. None of the present staff has a SET background, although several of the listed areas of expertise include scientific, engineering, or technological aspects.

Unlike the other legislative information services, the Auditor's office does not respond to direct requests from individual legislators. Rather, requests for audits or long-term studies are the result of resolutions or laws passed by the Legislature or joint requests from the President of the Senate and the Speaker of the House. Some audits are initiated by the Auditor himself; those requested by the Legislature, however, have the highest priority. The Auditor is occasionally asked to provide testimony during a legislative hearing or to assist in the drafting of a bill based on the information and recommendations contained in a published report.

## **G. Responses Common to All In-House Legislative Service Agencies**

The previous descriptions of in-house legislative service agencies reveal differences in each office regarding the number of their staffs and their specific duties. Results of interviews with legislative agency personnel suggest that similarities among the six offices are exhibited in two areas: utilization of external SET information sources and preference for office staffing.

### **1. Utilization of External SET Information Sources**

One of the questions asked in the in-house interviews pertained to the sources of SET information utilized by in-house legislative staff. Whenever possible, legislative researchers obtain information from files and libraries in their

own offices (or those of other in-house offices), knowledgeable committee staff personnel, and the State Archives.

Scientific, engineering, and technological information is so specialized, however, that frequently legislative staff must seek the requested data from SET personnel in the community. Sources used frequently are state agencies, the University of Hawaii, and trusted personal contacts who happen to be SET experts.

State agencies either provide requested information to legislative staff themselves, or (if they do not have it) refer the inquirer to an appropriate SET expert in the community. In addition, state agencies publish technical reports on governmental research and development efforts, copies of which are sent to in-house legislative research offices.

Information requests to the University of Hawaii are usually directed to faculty members recognized as experts in some particular field or who have previously testified at legislative committee hearings.

Because of Hawaii's concentrated urban character, it has been relatively easy for legislative service agencies to gradually develop a network of trusted personal contacts within the scientific, engineering, and technological disciplines. A substantial portion of needed SET information is acquired through these contacts.

The legislative research office staffs mentioned several attributes of external SET information sources which they consider to be important: speed of response, clarity of information to the non-scientist, credibility of source, and technical validity or accuracy of the data.

## 2. Staffing Preference

All legislative service agencies prefer that most of their staff members be "generalists" in terms of academic or professional backgrounds. Legislative information requests cover such a vast range of subject matter that it is not practical to hire specialists in any one field. There are exceptions, however. Some agencies, for example, hire temporary staff with expertise in a "hot" legislative issue due to be considered in the upcoming session.

## H. Types of Information Requested from In-House Offices

Interviews with Hawaii state legislators suggest that they make requests to different in-house service agencies depending on the type of information desired. The Auditor's Office and LRB are noted by legislators for their comprehensive studies of issues, while partisan research offices are said to provide specific data very quickly.

## PART II: EXTERNAL SET INFORMATION SOURCES

External SET information sources are organizations not under direct legislative supervision whose personnel possess scientific, engineering, and/or technological expertise. The types of SET organizations existing in Hawaii include government agencies, private firms, educational institutions, professional associations, community groups, and national organizations. These external sources are considered the ultimate providers of SET information, responding to requests from legislators, their personal staff, or personnel from in-house legislative service agencies.

In order to learn the extent of information exchange between external SET resources in Hawaii and state legislators or in-house legislative researchers, a mail-out survey was sent to 529 organizations believed to employ SET personnel. These organizations were selected from *Hawaii's Scientific Resource Directory, 1977*, (compiled by the Department of Planning and Economic Development) and from the *Hawaii Telephone Directory*. (The survey form, with summarized responses and frequency tabulations, is found in Appendix C).

The survey sought the following information:

- . how SET organizations learn about legislative issues;
- . the extent and methods of information exchange between legislators and SET professionals;
- . the willingness of SET organizations to provide requested information to Hawaii state legislators; and
- . the willingness of SET organizations to be included in a directory of SET organizations.<sup>1</sup>

A total of 387 responses (73 percent of those mailed out) was received. Fifty of the returned surveys were eliminated because the organizations did not fit the project's definition of "scientific, engineering and technological." Thus, results are summarized from the remaining 337 surveys (63 percent of those originally sent out).

For purposes of analysis, the 337 SET organizations have been clustered into four categories: government agencies, private firms, professional associations, and educational institutions. A breakdown of survey respondents by category is found in Table 3-1.

A brief analysis of the survey responses reveals:

80% of the organizations have engaged in some information exchange with legislators;

<sup>1</sup>One product of the Hawaii SET Project is a directory of SET organizations willing to provide information to legislators upon request.

86% answered that they would be willing to respond to legislative information requests; and

82% indicated that they would like to be included in a resource directory of SET organizations.

Table 3-1

Number of Survey Responses Received  
From SET Organizations Willing to Provide  
Information to Legislators (By Category)

| Type of Organization      | Number of Organizations | Percentage of Total |
|---------------------------|-------------------------|---------------------|
| Government Agencies       | 81                      | 24                  |
| Private Firms             | 179                     | 53                  |
| Professional Associations | 23                      | 7                   |
| Educational Institutions  | 54                      | 16                  |
| Total                     | 337                     | 100                 |

### Extent and Method of SET Information Exchange

External SET organizations provide information to legislators through several means, including presentation of testimony, participation in educational workshops, technical review of SET measures, and referral of previously written SET reports or studies. Table 3-2 illustrates the various methods of information exchange utilized by the four categories of SET organizations. From the table it is clear that governmental agencies, having the highest percentage of information exchange for every listed method, is the category that interacts most extensively with legislators. Educational agencies have the second highest level of SET information exchange, followed by private firms. Finally, SET professional associations exhibit slightly lower levels of legislative interaction than private firms.

Methods of interaction vary slightly with each category of organization. Although all methods are used to some extent, government agencies primarily rely on phone calls to legislative staff, participation in task forces, and phone calls to legislators. Private firms, on the other hand, interact more extensively through meetings with legislators and participation in task forces, panel discussions, or workshops. SET professional associations interact most extensively through letters to legislators and participation in task forces, panel discussions, or workshops. SET professional associations interact most extensively through letters to legislators and participation in task forces, panel discussions, or workshops.

Table 3-2

## Method of SET Information Exchange by Basic Category of Organization\*

| TYPE OF ORGANIZATION       | METHOD OF EXCHANGE |             |                       |                    |           |                |                    |              |               |             |              |               |
|----------------------------|--------------------|-------------|-----------------------|--------------------|-----------|----------------|--------------------|--------------|---------------|-------------|--------------|---------------|
|                            | Total Responses #  | Testimony % | Panels or Workshops % | Written Material % | Letters % | Review Bills % | Help Draft Bills % | Phone Leg. % | Phone Staff % | Meet Leg. % | Meet Staff % | Task Forces % |
| Government Agencies        | 81                 | 69          | 69                    | 74                 | 69        | 60             | 62                 | 75           | 78            | 72          | 72           | 77            |
| Private Firms              | 179                | 45          | 51                    | 40                 | 46        | 37             | 32                 | 48           | 46            | 58          | 46           | 51            |
| Professional Associations  | 23                 | 39          | 52                    | 35                 | 52        | 35             | 30                 | 35           | 48            | 48          | 39           | 52            |
| Educational Institutions   | 54                 | 76          | 61                    | 69                 | 66        | 50             | 46                 | 67           | 61            | 67          | 65           | 70            |
| Total of All Organizations | 337                | 55          | 57                    | 52                 | 55        | 45             | 41                 | 57           | 56            | 62          | 55           | 61            |

\*Each value listed indicates the percentage of positive responses (i.e., the combined values of "frequently," "occasionally," and "rarely" on the survey) for each method of exchange.

Finally, educational institutions interact more heavily through testimony at legislative committee hearings, presentation of written material (such as SET reports), and participation in task forces.

In addition to the methods listed on the survey form, 13 respondents indicated that they communicated with the Legislature through an intermediary organization and six respondents stated that they work through lobbyists.

#### **A. How SET Organizations Learn About Legislative SET Issues**

A major link in the information exchange network between legislators and SET organizations is the manner in which the latter learns about current or upcoming legislative issues. Table 3-3 illustrates that SET organizations learn about such issues in several ways. When comparing SET organizations by category, the table indicates that government agencies learn about legislative issues primarily from legislators or legislative staffs. Private firms, professional associations, and educational institutions depend primarily on the media to learn about legislative issues.

Less frequently mentioned means of learning about SET legislative issues are self-initiated efforts, affiliation with a professional association, state agencies, referral from another individual within the organization, legislative resolutions, referral by other non-SET organizations, federal sources, and site visits.

#### **B. Willingness to Respond to Legislative Information Requests**

Personnel from each organization surveyed were asked if they would be willing to respond to legislative information requests occasionally (three to five times per year) if contacted by a formal SET mechanism. Eighty-six percent indicated a willingness to participate, 9 percent stated that they would not, and 5 percent did not respond to the question.

Some organizations qualified their affirmative response, stating that they would respond to legislative information requests if:

- . the inquiry is pertinent to their area of expertise;
- . the inquiry is reasonable (does not require an excessive amount of time to compile the response);
- . the inquiry is cleared with a higher official in the organization;
- . there are available staff; and
- . the inquiry is not in conflict with the wishes of a client.

Organizations that did not wish to respond to requests from legislators indicated that:

- . they did not have the available staff; and

Table 3-3

Sources of Information About Pending SET Issues  
By Type of Organization\*

| Type of Organization       | Total Responses<br># | Receive Requests From        |            |                                 |             |
|----------------------------|----------------------|------------------------------|------------|---------------------------------|-------------|
|                            |                      | Legislators<br>or Staff<br>% | Media<br>% | Other SET<br>Organizations<br>% | Client<br>% |
| Government Agencies        | 81                   | 75                           | 55         | 57                              | 43          |
| Private Firms              | 179                  | 46                           | 61         | 56                              | 56          |
| Professional Associations  | 23                   | 43                           | 61         | 52                              | 30          |
| Educational Institutions   | 54                   | 61                           | 67         | 56                              | 37          |
| Total of all Organizations | 337                  | 55                           | 61         | 56                              | 48          |

\*Each value indicates the percentage of positive responses (i.e., combined values of "frequently," "occasionally," and "rarely" on the survey) for that source of information.

there was no need for SET information in their fields of expertise.

### C. Types of SET Information Provided by External Sources

Interviews with Hawaii legislators suggest that they refer to different SET organizations depending on the nature of the information they desire. State and county agencies, for instance, are said to provide SET information quickly, through either the compilation of short memos or reports containing specific SET data, or the referral of previously written comprehensive SET studies. University faculty are perceived as providing "SET expertise concerning state issues." SET personnel from private firms are considered useful for providing a "balance" to the information supplied by state agencies.

## PART III: EXAMPLES OF SET INFORMATION BROKERAGE EFFORTS IN HAWAII

All of the in-house and external SET information sources described previously are capable of providing scientific, engineering, and technological information to legislators. None, however, are designed specifically for that purpose. The organizations either include SET data provision as part of their function to supply *all* types of requested information to legislators (as in the case of legislative service agencies), or the organization itself exists for a completely different purpose, the provision of information to the Legislature being secondary (as in the case of most external SET information sources).

To a limited extent, Hawaii has instituted organizations or formal procedures whose primary functions are to provide SET information to legislators. Thus, they are given the term, "SET information brokers." Two of these SET information brokers have been instituted by the Hawaii State Legislature, while others have been (or are currently being) initiated by members of the SET community.

### A. Legislative Scientific Advisory Committee (LSAC)

In 1972, the Legislature passed Act 168 establishing the Legislative Scientific Advisory Committee (LSAC), whose purpose is to aid the Legislature in "evaluating and assessing the scientific and technical implications of proposed legislation." The law requires that LSAC members consist of 11 professional scientists and a chairman who is a non-scientist, and that the committee be assigned to the Office of the Legislative Auditor for administrative purposes.

The original committee was formed during the 1974-75 interim legislative session. Committee members were jointly appointed by the Senate President and Speaker of the House and represented a broad range of scientific, engineering, and technological fields.

In order to broaden the expertise of LSAC, *ad hoc* subcommittees were formed to work in seven major areas: agriculture, communications and transportation, energy, environment, health, human resources, and resource use and long-range planning. Each

subcommittee included members from the scientific community and was chaired by an LSAC member. During its short duration, LSAC reviewed and made recommendations on proposed legislation pertaining to mineral rights, energy resources, geothermal energy research, and waste recovery authority; reviewed 11 bills; and participated in public hearings relative to energy legislation <sup>2</sup>

LSAC did not prove to be an enduring endeavor. After a brief period, it became inactive. According to one member, the role of the committee was not clear. Members disagreed on whether they were to function as synthesizers of information or actually to make policy decisions.

Although the committee is presently not in operation, the enabling law has not been repealed; thus, LSAC could conceivably be reactivated.

## B. Environmental Center, University of Hawaii

The Legislature concurrently established the Environmental Center at the University of Hawaii, the State Office of Environmental Quality Control, and the Environmental Council to "stimulate, expand and coordinate efforts to determine and maintain the optimum quality of the environment of the State" (HRS, chapter 341). The functions of the center are to:

" . . . stimulate, expand, and coordinate education, research, and service efforts of the University related to ecological relationships, natural resources, and environmental quality, with special relation to human needs and social institutions, particularly with regard to the State."

As part of its service, the Environmental Center furnishes decisionmakers with environmental information obtained from university faculty members. A primary, year-round function of the Environmental Center is to review Environmental Impact Statements, incorporating comments from university faculty members into the consideration of these documents. During the legislative session, the Environmental Center monitors environmental legislation, selects bills and resolutions for review by faculty members, prepares a coordinated statement of the review comments, and testifies at committee hearings. The coordinated effort, however, is confined to environmental issues. It does not cover all SET topics. Occasionally the Environmental Center is asked to review specific proposals by members of the Legislature, but the majority of its involvement is self-initiated or initiated by faculty members through the Center.

## C. SET Professional Associations

The *American Chemical Society* (ACS), Hawaii Chapter, has indicated that it has had very little involvement with local lawmakers, but has established a liaison with Hawaii's

<sup>2</sup>Memo dated February 4, 1975, from Walter B. Lum, Interim Chairman, LSAC, to Honorable T. C. Yim, Chairman, Senate Committee on Energy/Natural Resources.

congressional delegation. Each member of Congress has a legislative counselor, a member of the local chapter of ACS, assigned to him to supply requested information regarding chemistry. The intent is to establish a personal working relationship between constituent and congressman but with no lobbying being conducted by the Legislative Counselor. ACS is considering establishing a similar relationship with the Hawaii State Legislature.

The *American Society of Civil Engineers* (ASCE), Hawaii Chapter, has publicized its willingness to participate in exchanging information with the Legislature. The Hawaii Chapter of ASCE distributes a directory of engineering resource personnel who voluntarily offer their services to legislators and their staffs. The directory contains a compilation of the resumes and particular specialities of its members. Legislators are encouraged to select one engineer and contact that individual directly.

The Hawaii Chapter of the *Society of Sigma Xi*, an interdisciplinary group of professional scientists, has discussed the possibility of establishing a mechanism by which that society, in cooperation with other scientific societies, might exchange information with the Legislature, if requested to do so. A transcript of the 1979 annual meeting of Sigma Xi, for which the Hawaii SET project was the topic of discussion, is included as Appendix D.

## CHAPTER 4

### PROBLEMS INHERENT IN THE EXCHANGE OF SET INFORMATION

Data from the interviews with legislators and in-house research staff as well as the survey of SET organizations provide an indication of the present network of information exchange between legislators and scientists, engineers, and technologists in the State. Although these channels appear fairly well developed, there are, nevertheless, several problems associated with the SET information exchange process in Hawaii. Chapter 4 describes these problems from the perspectives of the three parties involved in transferring requested SET information to the Legislature. First, the perspective of legislators is presented, followed by that of legislative service agency staff. Finally, shortcomings in the process as perceived by external organizations are described. For each perspective, the following specific points are discussed:

- . perceptions of what constitutes a SET issue;
- . perceived shortcomings of the present SET information exchange process between SET experts and legislators; and
- . suggested improvements for existing SET information exchange procedures.

#### PART I: PERSPECTIVE OF HAWAII'S LEGISLATORS

##### A. Perception of a SET Issue

Chapter 1 states that in order to develop a legislative SET mechanism there must be a relatively clear understanding as to what is defined as "scientific, engineering and technological." In order to arrive at a tentative agreement on the definition of "SET," a number of Hawaii legislators were presented with a list of scientific, engineering, and technological subject areas and asked if they agreed with this proposed "boundary" of a definition for "SET."

In general, the legislators interviewed agreed with the choice of SET topics in the list. Although additions to the list were suggested, deletions were not. One legislator, for instance, recommended that "judicially-oriented" health issues, such as patients' rights, be added to the definition of "SET." Thus, all suggested revisions broadened the definition of "Science, Engineering and Technology" rather than narrowing it.

## B. Perceived Shortcomings of SET Information Exchange Process

Legislators interviewed mentioned several problems associated with current SET information channels. Because of the limited number of legislative interviews conducted, no single overriding problem was made explicit. Instead, each legislator noted a slightly different aspect of SET information exchange with which he/she was dissatisfied. Specific shortcomings noted include:

- . SET information acquired is not always applicable to the legislative decision-making arenas (e.g., the information is too "academic");
- . potential biases are inherent in SET information provided by state executive agencies;
- . there is a lack of clarity of some SET information received (suggesting that some SET experts may be lacking the communication skills to convey technical data to laymen); and
- . there is limited access to some SET information, particularly information from executive agencies of the government if it conflicts with the administration's position.

## C. Suggestions to Improve SET Information Exchange to and from the Legislature

The legislators interviewed had several suggestions to improve the existing legislative SET information exchange process. By far, the most frequently mentioned idea was to increase the legislators' personal staff by either hiring additional persons during the session or maintaining at least one full-time employee for each legislator throughout the year. All legislators making these suggestions preferred to hire generalists who could later be trained in specific subject areas. Despite the predominance of this suggestion, a legislative staff increase was not considered politically feasible by the legislators interviewed due to cost factors.

Other suggestions made by legislators were:

- . increased information exchange activities between legislators and University of Hawaii faculty;
- . reactivation of the Legislative Scientific Advisory Committee or creation of a new SET "think tank" organization;
- . a centralized SET data source in the State; and
- . an in-house engineer who would be available to explain highly technical aspects of research and development projects.

## PART II: PERSPECTIVES OF IN-HOUSE LEGISLATIVE SERVICE AGENCIES

### A. Perceptions of Set Issues

As mentioned previously, it is important that all participants of a SET information exchange process be in general agreement concerning the definition of "SET." Thus the list of tentative SET subject areas which had been presented to Hawaii legislators was also presented to in-house legislative service agency personnel. Staff members interviewed generally agreed with the choice of SET topics, making additions to the list rather than deletions (thereby broadening the definition of "SET"). Some suggested additions, for example, were mariculture, water ownership, and computer technologies.

In-house staff were also asked to estimate the percentage of information requests received from legislators that pertain to SET topics, and the amount of effort undertaken when researching SET issues as compared with non-SET issues. One office estimates that at least 50 percent of its requests involved SET issues; other research offices estimate the percentage of requests concerning SET issues to range from 10 to 30 percent; the Legislative Auditor's Office responded that it rarely received requests for information pertaining to SET issues.

All respondents stated that the amount of time spent on any request depends on the particular issue. One researcher, however, specifically mentioned spending more time gathering information on SET issues because he does not have a sufficient background in any SET subject areas. Consequently, he is sometimes forced to "overresearch" SET information requests. These endeavors are not really wasted, however, since they permit the researcher to incrementally develop some expertise in SET areas.

### B. Perceived Problems with Legislative SET Information Exchange

In general, in-house legislative staff are pleased with the SET information they receive from external sources. A few problems were mentioned, however, which coincide with those expressed by state legislators:

- . acquisition of information which is too technical for laymen to comprehend;
- . potential bias inherent in SET information provided by external sources;
- . fragmentation of SET information sources throughout the State, making quick access to specific data difficult;
- . delivery of requested SET information too late for legislators to utilize in their decisionmaking (due in part to administrative constraints in some external SET organizations, an information response may have to be cleared with higher officials prior to delivery).

### C. Suggestions for Improved Flow of SET Information

In-house staff members did have a few suggestions for increasing their capacity to acquire SET information for legislators. As in the case of the legislators interviewed, the most frequently mentioned suggestion was an increase in staff. Other suggestions were to:

- . centralize SET information resources; and
- . link up to a national computerized information network.

## PART III: PERSPECTIVE OF EXTERNAL SET ORGANIZATIONS

### A. Perception of a SET Issue

Personnel in SET organizations surveyed received the same list of tentative SET topics that were presented to the legislators and in-house legislative staff, and were asked to make any revisions they deemed necessary. Survey results led to a major revision of the original topical listing.<sup>1</sup> For the most part, a greater number of "specialized" subject headings were suggested. The revised SET subject listing is found in the *Directory of Scientific, Engineering and Technological Resource Personnel in the State of Hawaii*, a separate document compiled by the Hawaii SET Project team. (See Appendix B for list of directory subject headings.)

### B. Perceived Problems with Legislative SET Information Exchange

In order to determine whether SET organizations perceived any problems in the exchange of information with legislators, the survey asked if respondents believe that legislators are presently receiving sufficient SET information to allow them to make informed decisions in these areas. Table 4-1 illustrates the variation in perceptions of SET organization personnel concerning this question. Within the four categories of SET organizations, 64 percent of the government agencies that responded to the survey believe that legislators are obtaining sufficient SET information, as compared with professional associations (57 percent), private firms (54 percent), and educational institutions (41 percent).

### C. Suggestions for Improving the Flow of SET Information

Survey respondents who stated that legislators are not presently receiving sufficient SET information were asked to suggest ways to remedy the situation. Some of the more frequently suggested ideas were:

<sup>1</sup>The survey requested SET organizations to check the subjects that best represented their areas of expertise. A copy of the survey, with summarized write-in comments, is found in Appendix C.

Table 4-1

Percentage of Organizations Surveyed that Think  
Legislature is Receiving Sufficient SET Information\*

| Number | Organization              | Percent |
|--------|---------------------------|---------|
| 81     | Government Agencies       | 64      |
| 179    | Private Firms             | 54      |
| 23     | Professional Associations | 57      |
| 54     | Educational Institutions  | 41      |
| <hr/>  |                           |         |
| 337    |                           |         |

\*Percentages of the 337 respondents who replied "yes" to question three of the SET organization survey (see Appendix C).

- . increased meetings between legislators and SET experts;
- . establishment of a group of SET experts to provide legislators with information;
- . compilation of a resource directory of SET experts;
- . coordination of site visits to SET research and development projects;
- . establishment of contact with SET professional associations; and
- . organization of a SET information clearinghouse.

### Concluding Comments

Comparing the three different perspectives, one can see that both the legislators interviewed and in-house legislative staff agreed with the broad "boundary" of SET issues delineated by the Hawaii SET Project team. External SET organizations broadened the definition even further, by adding additional subject areas, and increased the level of specialization of those identified topics. In general, however, there appears to be agreement among the three groups regarding the definition of "SET."

Of the problems identified in the transfer of SET information, comments from legislators and in-house staff coincided in two areas: (1) information is sometimes too technical; and (2) access to specific pieces of SET data is sometimes difficult due to the fragmentation of SET information sources in Hawaii.

When suggesting improvements to the present flow of SET information to and from the Legislature, responses of the legislators and in-house research staff coincide on two suggestions: (1) an increase in (generalist) staffing; and (2) a centralized SET information resource for Hawaii.

These identified problems and suggested solutions indicate the need for a legislative SET information broker in Hawaii who possesses, at minimum, two qualifications. First, the broker must have knowledge of all available SET information sources in the State and, second, the broker must be familiar with legislative decisionmaking procedures and legislative SET information needs. These two qualifications will enable a SET broker to interface the legislative and scientific spheres. The broker will function within a formal SET mechanism.

There are many variables to consider when designing a SET mechanism and determining the appropriate type of set broker for that mechanism. How many brokers should be involved in the SET information exchange process? Will the mechanism be located in an existing in-house legislative service agency or in an external SET organization? Chapter 5 examines some of these aspects and presents some alternative designs for a Hawaii SET mechanism.

## CHAPTER 5

### DESIGNING A SET INFORMATION SYSTEM FOR THE HAWAII STATE LEGISLATURE

How does the Hawaii State Legislature go about designing a SET information system for itself? What aspects or factors should it take into account in designing such a system? What might such a system look like? Chapter 5 addresses these questions. Part I identifies aspects to be considered in the design of any SET information transfer mechanism. Part II describes nine alternative designs for a SET mechanism, each one developed to accommodate at least a portion of the expressed SET information needs of Hawaii state legislators.

#### PART 1: ASPECTS TO BE CONSIDERED IN DESIGNING A SET MECHANISM

Seven aspects are identified as common to all SET mechanisms: (A) operational responsibility, (B) nature of staffing, (C) type of activities, (D) level of analysis, (E) time perspective, (F) initiation of activities, and (G) implementation. These are discussed below.

##### A. Operational Responsibility

Responsibility for establishing and overseeing the operation of a SET mechanism needs to be assigned to a permanent organization. Frequently, the establishment of such a mechanism by a state legislature entails the creation of an advisory committee, the appointment of a single advisor, or the organization of a paid SET research staff. Once established, the responsibility for oversight of information exchange activities is assigned to the director or chairman of this new organization.

Initial questions for consideration when organizing a SET mechanism are:

- Will the overseeing office be an existing in-house legislative service agency *or* an organization which is not under the direct supervision of the Hawaii State Legislature?
- What specific office or organization would best be able to oversee the activities of a SET mechanism?

## B. Nature of Staffing

The capacity of a SET mechanism to provide legislators with scientific, engineering, and technological information is partially dependent on the nature of its staffing. One major point to consider regarding staff is the “scale of operation” of the SET mechanism. For example, a mechanism which utilizes volunteers may produce different results from one that hires a full-time research staff. Similarly, the number of “staff positions” (either voluntary or paid) for a particular SET mechanism is likely to determine the manner in which information is provided to legislators.

A second point to consider when staffing a SET mechanism is the degree of specialization of the information brokers. Virtually all SET mechanisms, regardless of design, utilize brokers that possess at least basic knowledge of one scientific, engineering, or technological field. Some designs, however, utilize SET “specialists” (for example, Ph.D.’s in a SET-related area) while others tend to rely on “generalists” (for example, researchers who may have an undergraduate degree in a SET-related field, or researchers whose knowledge of SET areas has been acquired through on-the-job research activities).

Initial questions for consideration when staffing a SET mechanism are:

- . How many SET information broker positions should be created?
- . Will the brokers be paid or would they be volunteers?
- . If volunteers, how will the brokers be selected?
- . Will the SET mechanism rely primarily on generalists or specialists, or on some combination of both?

## C. Types of Activities

Activities are the “vehicle” through which SET information is provided to legislators. Some of the activities conducted by SET information services in other states are:

- . Establishing a phone inquiry service which legislators can use to obtain information concerning SET-related issues;
- . Hiring consultants to write issue papers or technical studies on SET-related legislative issues;
- . Organizing ad hoc educational seminars, panel discussions, workshops, or other events where dialogue between legislators and SET experts occurs;
- . Recruiting SET experts to testify at legislative committee hearings when SET-related issues are being considered;
- . Arranging field trips for legislators to scientific and technological research and development sites;

- . Consulting with legislative staffs in the drafting of SET-related bills and resolutions;
- . Providing technical review of SET-related measures;
- . Monitoring the status of SET research and development projects conducted in the State;
- . Publishing a newsletter to periodically inform legislators of available SET issue papers, upcoming seminars, or other educational activities; and
- . Publishing a directory of SET professionals willing to provide information to legislators upon request.

When choosing the type of activities for a SET mechanism, the following initial questions should be considered:

- . What types of activities will best meet the SET information needs of state legislators?
- . What amount of time can brokers reasonably be expected to devote to SET activities?
- . For those activities requiring extensive amounts of time, should a mechanism be established for setting priorities or limits on the number and type of projects to be undertaken?

#### D. Level of Analysis

Information provided by SET brokers may vary as to the level of analysis undertaken. Some activities, for example, supply legislators with comprehensive analyses of SET issues, while others focus on the provision of very specific data or on broad overviews which highlight major aspects of SET issues.

Results of interviews with Hawaii state legislators suggest that the level of analysis incorporated into any information they receive is partially dependent on two factors: first, the time constraints under which legislative researchers are operating; and second, their own desire for complete information pertaining to complex SET issues. Based on these two factors, three types of SET information have been identified, each requiring a different level of analysis for SET brokers:

- (1) Responses to simple inquiries requiring only short-term research efforts. "Short-term" projects take from a day or two to a month to prepare. These responses may provide specific SET data or brief overviews of comprehensive SET issues in which only the major highlights are presented.
- (2) Provision of comprehensive analyses of SET issues previously prepared, usually by others. This is essentially a "library" function of finding whether a particular SET report or study has already been compiled and obtaining the required materials.

- (3) Provision of comprehensive analyses of SET issues for which long-term research and analysis is conducted. "Long-term" is defined here as six months or longer.

These three types of information represent varying levels of analysis which may be achieved by a SET mechanism.

An initial question for consideration when determining the appropriate level of analysis to undertake in a SET mechanism is:

- . When making decisions on SET-related bills and resolutions, do legislators desire specific SET data provided quickly, comprehensive analyses of SET issues which take longer, or both?

#### E. Time Perspective

Time perspective is defined as the point at which a scientific, engineering, or technological issue or innovation becomes a matter of concern to state legislators. In general, SET mechanisms provide information concerning those issues for which bills have already entered the legislative decisionmaking arena or are expected to enter or recur within the next year or two. These issues are defined as being of immediate concern to legislators. Some state legislatures, however, are seeking to develop a capability for anticipating future SET issues in order to mitigate potentially adverse social, environmental, or economic impacts of technological innovations. This capacity has been termed "legislative foresight."<sup>1</sup>

Initial questions for consideration when determining the appropriate time perspectives for a SET mechanism are:

- . Do state legislators desire information pertaining to anticipated future SET issues?
- . If yes, are they willing to forgo receiving information on SET issues of immediate concern to obtain data on long-range issues or do they desire both?

#### F. Initiation of Activities

State legislatures vary in their preferences as to who should initiate information exchange activities undertaken by SET brokers. The standard procedure in all SET mechanisms is for the information brokers to undertake SET activities in response to requests from legislators. Some states, however, permit SET brokers to use their own discretion in initiating some activities in addition to providing requested information. Some SET mechanisms, for example, publish a "SET newsletter" and send copies to all state legislators.

<sup>1</sup>Clement Bezold, *Legislative Foresight Techniques*, a handbook prepared for the workshop on Legislative Foresight conducted for the Hawaii Legislature, June 19-20, 1979, sponsored by the Hawaii Commission on the Year 2000 and the National Conference of State Legislatures, pp. 3-4.

An initial question for consideration when determining the appropriate procedure for initiating SET activities is:

- Do the legislators wish a SET mechanism to provide information and undertake activities which they did not specifically request?

### G. Implementation

SET mechanisms differ in the actions which are necessary to implement them. If the SET mechanism is established within an organization not under direct legislative supervision, a formal agreement concerning SET information exchange is usually made between that entity and the State Legislature. If, on the other hand, a paid SET research staff is incorporated into an existing in-house legislative service agency, the Legislature simply needs to authorize new research positions and appropriate funds for salaries.

Initial questions to consider regarding the implementation of a SET mechanism are:

- What actions must be undertaken by the Hawaii State Legislature to implement a particular SET mechanism?
- What actions must be undertaken by members of the scientific, engineering, and technological community to implement a particular SET mechanism?

### Concluding Comments

The preceding seven aspects provide a conceptual framework with which to develop a SET mechanism for a state legislature. Some of these aspects may be considered independently of the rest, while others are highly interrelated. Specifically, "level of analysis," "time perspective," and "initiation of activities" are partially determined by the types of activities undertaken by a SET mechanism. Table 5-1 illustrates the relationship between "type of activities" and these three related aspects.

Several factors should be considered when "tailoring" the seven aspects for a specific SET mechanism. The primary consideration is the information needs of the state legislators. The number and type of existing scientific, engineering, and technological resources in a state should also be taken into account when designing a SET mechanism.

Table 5-1

Relationship Between Type of SET Activity and Level of Analysis,  
Time Perspective, and Initiation of Activity

| Type of Activities  | Level of Analysis  | Time Perspective                        | Initiation of Activities  |
|---|--|---|---|
| Phone inquiry service   | Provides specific SET data quickly                       | Immediate legislative concern           | Upon request by legislators   |
| SET issue papers  | Provides comprehensive analyses                          | Immediate or future legislative concern | Generally upon request by legislators but may be initiated by SET brokers |
| Educational seminars, panel discussions, workshops                | Provides comprehensive analyses or specific data quickly | Immediate or future legislative concern | Upon request by legislators or initiated by SET brokers                   |
| Testimony by SET experts at legislative committee hearings        | Provides specific SET data quickly                       | Immediate legislative concern           | Upon request by legislators or initiated by SET brokers                   |
| Field trips to SET research & development sites                   | Provides specific SET data quickly                       | Immediate legislative concern           | Upon request by legislators or initiated by SET brokers                   |
| Assistance in the drafting of SET-related bills and resolutions   | Provides specific SET data quickly                       | Immediate legislative concern           | Upon request by legislators or legislative staff                          |
| Technical review of SET-related measures                          | Provides specific SET data quickly                       | Immediate legislative concern           | Upon request by legislators   |
| Monitoring status of SET research & development projects in state | Provides specific SET data quickly                       | Immediate legislative concern           | Usually initiated by SET brokers  |
| Publish newsletter for legislators concerning SET activities      | Provides specific SET data quickly                       | Immediate legislative concern           | Initiated by SET brokers  |
| Publish directory of SET professionals                            | Provides specific SET data quickly                       | Immediate legislative concern           | Initiated by SET brokers  |

## PART II: NINE ALTERNATIVE DESIGNS FOR A LEGISLATIVE SET INFORMATION SERVICE

Based on material obtained from the legislative interviews, correspondence with other states, various journal articles and other publications, the survey of SET organizations in Hawaii and SET Reports from other states, nine design alternatives have been developed to improve the flow of SET information to and from the Hawaii State Legislature. Part II of Chapter 5 describes each design alternative according to the seven aspects presented in the previous section (i.e., operational responsibility, nature of staffing, type of activities, level of analysis, time perspective, initiation of activities, and implementation). Some of the nine alternatives are additions to in-house legislative service agencies while others are located in SET organizations in the community. These designs are not mutually exclusive; in fact, many states have incorporated several designs into their SET information exchange mechanisms<sup>2</sup>

The discussion of each SET design alternative begins with a brief description of how it operates and an example of the mechanism either proposed or operating in another state. This is followed by a description of *one* way in which the design might work in Hawaii.

### 1. Expert Consultation

The expert-consultation design is defined as a permanent advisory group of professional scientists, engineers, and technologists that studies the SET implications of immediate and/or future legislative issues. The Assembly Science and Technology Advisory Council (ASTAC), created in 1969 to serve the General Assembly of California, is an example of this approach. When requested by standing or interim assembly committees, ad hoc technical panels were formed from a subset of the general ASTAC membership to analyze specific legislative SET issues. Analyses and findings of the technical panels were summarized in final reports and submitted to the Assembly. When originally created ASTAC limited its considerations to future SET legislative issues. This focus shifted a few years later, and the Council began to consider issues of more immediate legislative concern. In 1976, ASTAC was abolished and replaced by the staff of the California Assembly Office of Research.

The Legislative Scientific Advisory Committee (LSAC), described in Chapter 3, is an example of an expert-consultation mechanism created for Hawaii. Since the enabling legislation for LSAC has not been repealed, it may be possible to reactivate the committee. There are, however, necessary procedural changes to overcome the shortcomings of the initial endeavor. For example, one problem identified is the lack of a clearly defined role for LSAC. Thus, a suggested initial implementation action is for newly appointed LSAC members and legislators to meet and arrive at a consensus concerning the committee's appropriate role.

A design for reactivating LSAC is presented in Table 5-2. Three aspects of this design not reflected in Table 5-2 need to be mentioned: selection of LSAC members, screening of information requests, and dialogue between LSAC members and legislators.

<sup>2</sup>A description of SET information exchange systems proposed for or operating in other states is found in Appendix E.

Table 5-2

Reactivation of the Legislative Scientific Advisory Committee (LSAC)  
Design Alternative

| Aspect                        | Description of How LSAC Might Work   |
|-------------------------------|--|
| A. Operational Responsibility | <ol style="list-style-type: none"> <li>1. Responsibility for overseeing LSAC operations rests with committee itself.</li> <li>2. Clerical and other support staff provided by auditor's office.</li> </ol>   |
| B. Nature of Staffing         | <ol style="list-style-type: none"> <li>1. Ten of eleven members required to be professional scientists.</li> <li>2. Committee chairman is not to be a scientist.</li> <li>3. Members selected jointly by Senate President and House Speaker from list compiled by Legislative Auditor, LRB Director, and Ombudsman.</li> </ol> |
| C. Type of Activities         | <ol style="list-style-type: none"> <li>1. Ad hoc technical panels for comprehensive analyses of SET issues.</li> <li>2. Seminars, workshops, or short-term reports to provide SET issue overviews or specific SET-related data.</li> </ol>   |
| D. Level of Analysis          | <ol style="list-style-type: none"> <li>1. Ad hoc technical panels prepare extensive analyses on SET issues.</li> <li>2. Seminars, workshops, and short reports provide moderate analysis.</li> </ol>   |
| E. Time Perspective           | <ol style="list-style-type: none"> <li>1. Primarily provides SET information on issues of immediate legislative concern.</li> <li>2. May undertake activities that anticipate future legislative issues and assess their potential impacts.<sup>1</sup></li> </ol>   |
| F. Initiation of Activities   | <ol style="list-style-type: none"> <li>1. "Long-term" technical panels should be formed only upon request from the Legislature.<sup>2</sup></li> <li>2. "Short-term" activities, seminars, workshops, short reports may be initiated without legislative requests.</li> </ol>  |
| G. Implementation             | <ol style="list-style-type: none"> <li>1. Initial step is to select new members.</li> <li>2. New committee should meet with Legislature to discuss role of LSAC and specific SET activities to undertake.</li> </ol>   |

<sup>1</sup> LSAC members would have knowledge of current scientific innovations and may anticipate when these innovations will become legislative policy issues.

<sup>2</sup> Since these activities require such great amounts of time and effort, it should be ascertained that the Legislature will be interested in the final product.

## Selection of LSAC Members

Some members of the SET community suggest that the legislative leadership appoint a "SET selection committee," comprised of professional scientists, to compile a listing of potential LSAC participants. Under this procedure, the leadership would make the final selection of committee members from a panel of professional scientists considered by their peers to be highly competent. Thus, peer evaluation would be incorporated into the appointment of LSAC members.

## Screening of Information Requests

Comprehensive analyses of SET issues in technical panels will require substantial amounts of committee members' time. If legislators request the formation of several panels in close succession, it may become difficult, if not impossible, for the LSAC to keep up with legislative demand. For this reason it may be desirable to institute a mechanism which establishes priorities or sets limits on the number of panels existing at any one time. One approach would be for the legislative leadership to screen requests from individual legislators or legislative committees for the formation of SET panels. The organization of simple seminars and workshops and the compilation of short reports do not require as much time, and therefore it may not be necessary to incorporate a screening mechanism for requests pertaining to these activities.

## Dialogue Between Legislators and LSAC Members

During the legislative interviews, one Hawaii legislator commented that researchers/authors of SET reports should make themselves available to answer questions concerning their documents once they have been read by the Legislature. If this comment represents a consensus opinion among Hawaii's legislators, it may be desirable for LSAC to schedule a question-and-answer session two to three weeks after the delivery of a major SET report.

It may also be advisable for LSAC members to meet with the legislative leadership and other interested legislators periodically, particularly when undertaking long-term research. This interaction will provide members with feedback from legislators and will help to ensure that LSAC studies are focusing on SET aspects pertinent to legislative policy issues.

### 2. Task Force

The task force design is similar to that of expert consultation, consisting of an advisory body which studies SET legislative issues. There are, however, two distinguishing factors which differentiate this SET mechanism from the previous one. First, each task force is only

a temporary entity established to examine a single SET legislative issue. Second, task force participants frequently include legislators, SET experts and occasionally lay citizens. The Legislative Services Office of the North Carolina General Assembly (the agency which conducted the SET Project in that state) recommends utilizing task forces to provide legislators with SET information. Analyses and findings of these task forces are compiled into written technical studies.

Currently, the Hawaii State Legislature organizes ad hoc task forces through either concurrent resolution or initiation by individual legislators (on an informal basis). The establishment of a "task force coordinator" in the Legislative Reference Bureau (LRB) may help to facilitate the organization of SET task forces. The task force manager position need not be a new staff position; instead, the responsibility of coordinating these ad hoc entities may be assigned to an existing LRB staff member.

Table 5-3 presents a design for a SET task force coordinator in the LRB. Three issues not reflected in the table are briefly discussed: selection of SET task force participants, screening of requests to establish SET task forces, and dialogue between task force members and legislators.

#### **Selection of Task Force Participants**

Some members of the SET community suggest that a permanent "SET selection committee," consisting of professional scientists, engineers, and technologists, be created to nominate competent SET professionals for inclusion in task forces. Legislative committees or the leadership could then select task force members from a list compiled by the SET selection committee.

#### **Screening Requests for SET Task Force**

Because task forces are fairly long-term projects, requiring large inputs of time and efforts by the members, this design alternative may need a "screening mechanism" which establishes priorities and sets limits on the number of task forces created at one time. The legislative leadership could provide such a mechanism.

#### **Dialogue Between Legislators and Task Force Participants**

It may be desirable for SET task forces to complement all written reports with a verbal presentation to the Legislature. It is suggested by members of the SET community that task forces meet periodically with legislators, throughout the life of the project, to ensure that the findings of the task force will be applicable to the legislative decisionmaking arena.

Table 5-3

Legislative Reference Bureau to Organize SET Task Force  
Design Alternative

| Aspect                        | Description of How SET Task Forces Might Work  |
|-------------------------------|--|
| A. Operational Responsibility | 1. SET task force coordinator responsible for formation and coordination of SET task forces.   |
| B. Nature of Staffing         | 1. Task force coordinator is member of LRB staff, most of whom are SET generalists. <sup>1</sup><br>2. Task force participants will be SET specialists.  |
| C. Type of Activities         | 1. "Long-term" comprehensive analysis of SET issues, compilation of findings in final reports.   |
| D. Level of Analysis          | 1. Extensive analyses of SET issues by task forces.  |
| E. Time Perspective           | 1. SET task force could provide information for immediate and future legislative issues.<br>2. "Think tank" approach is amenable to anticipation of future SET issues and their potential impacts. |
| F. Initiation of Activities   | 1. SET task forces formed only if requested by Legislature. <sup>2</sup>   |
| G. Implementation             | 1. Assign LRB staff member the responsibility of SET Task Force Coordinator.<br>2. Develop formal procedure for legislators to request creation of SET task force.                                 |

<sup>1</sup>One staff member has a Ph.D. in chemistry.

<sup>2</sup>SET task forces require large inputs of time and should only be initiated if it is certain that there is an interested audience.

### 3. National Information Clearinghouse

National information clearinghouses establish computerized communication networks in state legislatures throughout the U.S. for the purpose of information exchange. The central clearinghouse agency, through which information is disseminated to the states, is usually operated by a national organization such as the National Conference of State Legislatures. At least two national information clearinghouses currently provide information to state legislators.

#### (a) *The Model Interstate Scientific and Technical Information Clearinghouse (MISTIC)*

MISTIC, operated by the National Conference of State Legislatures, focuses primarily on disseminating SET information from the federal government to state legislatures. This computerized network has links with at least five federal agencies: the Department of Transportation, the Environmental Protection Agency, the National Aeronautics and Space Administration, the National Bureau of Standards, and the National Oceanic and Atmospheric Administration. MISTIC staff respond to specific information requests from legislators, prepare "tech briefs" which discuss issues of widespread concern to states, and distribute a monthly newsletter reviewing various legislative issues and selected federal and state reports.

#### (b) *LEGITECH*

LEGITECH is a specialized "subsystem" within a larger computer conferencing/messaging system known as the Electronic Information Exchange System (EIES), operated by the New Jersey Institute of Technology. LEGITECH is intended for use by legislative researchers, focusing exclusively on issues of legislative interest. By typing an entry into a LEGITECH computer terminal, a researcher can send information requests simultaneously to every unit which is linked up with the system. All responses to requests are sent and received through the LEGITECH terminals.

A LEGITECH computer terminal is presently located in the Department of Planning and Economic Development. Interviews with Hawaii state legislators indicated that few of them had heard of LEGITECH and, therefore, had not used the terminal. Similarly, staff from in-house legislative service agencies have rarely utilized this computerized information service.

If legislators and in-house support staff consider LEGITECH to be a useful information system, two actions can be suggested that may increase the level of use of the Hawaii terminal. First, a terminal could be established in an in-house legislative service agency. The most likely choice for the location of LEGITECH is the Legislative Reference Bureau, since it serves all Hawaii state legislators and is designated by statute to operate any legislative information system which might be established. Second, an LRB staff member could be designated as LEGITECH operator, responsible for sending information requests, evaluating the technical validity of incoming responses, and translating technical data into laymen's terms.

The LEGITECH operator would also be responsible for responding to information requests from other states. LEGITECH's success depends on the willingness of terminal operators to supply high quality information in a timely manner.

A design for locating LEGITECH is presented in Table 5-4.

Table 5-4

LEGITECH  
Design Alternative

| Aspect                        | Description of How LEGITECH Might Work   |
|-------------------------------|--|
| A. Operational Responsibility | 1. LEGITECH operator to be responsible for sending information requests, evaluating incoming responses for technical validity, translating technical data into laymen's terms.   |
| B. Nature of Staffing         | 1. LEGITECH utilizes existing LRB staff, most of whom are SET generalists (one staff member has a Ph.D. in chemistry).   |
| C. Type of Activities         | 1. Send information requests through LEGITECH terminal, receive responses, translate technical data, deliver to legislators in fact sheet, memo, or short report.<br>2. Respond to information requests from other states.     |
| D. Level of Analysis          | 1. LEGITECH system focuses primarily on providing quick responses to specific information requests.<br>2. Extensive analysis not undertaken.<br>3. LEGITECH can be used to locate SET reports or studies done by other states. |
| E. Time Perspective           | 1. Focuses exclusively on SET issues of immediate legislative concern.   |
| F. Initiation of Activities   | 1. Only used when SET information is specifically requested by legislators.  |
| G. Implementation             | 1. Establish LEGITECH terminal in LRB.<br>2. Assign one LRB staff member the function of LEGITECH operator.  |

#### 4. SET Legislative Interns

The SET legislative intern mechanism involves hiring graduate students with scientific, engineering, or technological backgrounds to work as temporary legislative researchers. The General Assembly of the New York State Legislature, for example, hires graduate students to serve in this capacity. The interns focus their efforts on a single SET legislative issue, devoting approximately 500 hours to the analysis or synthesis of available information concerning that issue. Students work under joint guidance from permanent legislative staff members and university professors, frequently being permitted to include their legislative work experience as part of their degree program.

The College of Continuing Education, University of Hawaii, coordinates an undergraduate legislative intern program during the spring semester (when the Legislature is in session), where students are assigned to individual legislators or to legislative committees. This program is generalist in nature, it does not have a scientific, engineering, or technological emphasis.

It may be possible for the College of Continuing Education to implement a few changes in its intern program and to provide a few SET intern positions. Possible changes for familiarizing students with the Legislature include:

- Expanding the intern program to cover a two-semester period, with a classroom session during the fall semester. Students could earn classroom credits while learning about legislative and political processes.

Possible changes for incorporating students majoring in SET subjects into the present intern program include:

- Setting aside a few existing undergraduate intern positions for students majoring in SET subjects.
- Establishing a separate intern program for graduate students with SET backgrounds. For example, a program could be established to recruit interested SET graduate students to work as temporary researchers for legislators. It may not be necessary to pay these graduate interns for their research efforts. Instead, they may be able to earn credits under a "directed readings" course, if their internship is supervised by an academic advisor.

A design for a SET intern program is presented in Table 5-5.

#### 5. Legislative Science Advisors

This design alternative involves the employment of a professional scientist to act as a permanent advisor to the Legislature. Science advisors communicate primarily with the legislative leadership but may brief members of standing committees as well. Ohio and Maryland are two examples of states whose legislatures utilize science advisors.

Table 5-5

Improvement of University of Hawaii Legislative Intern Program  
Design Alternative

| Aspect                        | Description of How Legislative Intern Program Might Work  |
|-------------------------------|---|
| A. Operational Responsibility | 1. College of Continuing Education responsible for UH intern program.   |
| B. Nature of Staffing         | 1. Staffed by university students majoring in SET subject.<br>2. Student interns are generalists.<br>3. Number of interns will vary.  |
| C. Type of Activities         | 1. Research tasks requiring a few weeks to a few months to complete.<br>2. Information usually delivered in written format.<br>3. SET interns' papers should be run through a technical review prior to delivery. |
| D. Level of Analysis          | 1. Interns focus on providing quick responses to simple information requests.<br>2. Extensive analyses of SET issues not undertaken.  |
| E. Time Perspective           | 1. Interns provide legislators with information on SET issues of immediate concern.   |
| F. Initiation of Activities   | 1. Interns undertake research tasks in response to requests from legislators.<br>2. Interns receive assignments from office supervisors.  |
| G. Implementation             | 1. Suggested changes in current intern program are noted in text.   |

The appointment of a science advisor for the Hawaii State Legislature may help to increase the exchange of SET information between legislators and professional scientists, engineers, and technologists.

A design for a Hawaii legislative science advisor is presented in Table 5-6.

Table 5-6  
Legislative Science Advisor  
Design Alternative

| Aspect                        | Description of How Science Advisor Might Work  |
|-------------------------------|--|
| A. Operational Responsibility | <ol style="list-style-type: none"> <li>1. Bring together legislators and SET experts for purpose of information exchange.</li> <li>2. Obtain requested SET information and deliver to Legislature.</li> </ol>  |
| B. Nature of Staffing         | <ol style="list-style-type: none"> <li>1. One SET specialist</li> <li>2. Hired as legislative staff person.</li> <li>3. Advisor could be placed in an existing legislative service agency and utilize their clerical and support staff as needed.</li> </ol>   |
| C. Type of Activities         | <ol style="list-style-type: none"> <li>1. Suggest SET experts to testify at committee hearings.</li> <li>2. Monitor progress of SET R&amp;D projects in state.</li> <li>3. Provide technical review of SET-related bills and resolutions.</li> <li>4. Arrange meetings between legislators and SET experts.</li> <li>5. Hire consultants to write SET issue papers.</li> </ol> |
| D. Level of Analysis          | <ol style="list-style-type: none"> <li>1. Provides SET information which does not require extensive analysis.<sup>1</sup></li> </ol>   |
| E. Time Perspective           | <ol style="list-style-type: none"> <li>1. Focuses on SET issues of immediate legislative concern.</li> </ol>   |
| F. Initiation of Activities   | <ol style="list-style-type: none"> <li>1. Primarily provide information only upon request by legislators.<sup>2</sup></li> </ol>   |
| G. Implementation             | <ol style="list-style-type: none"> <li>1. Create new legislative staff position.</li> <li>2. Appropriate funds for salary.</li> </ol>  |

<sup>1</sup>Comprehensive analysis is too time-consuming for a single staff person with several responsibilities.

<sup>2</sup>Some activities such as monitoring SET projects may be initiated by the advisor.

## 6. Legislative SET Committees

This design alternative consists of a legislative standing committee on science, engineering, and technology which reviews all measures having SET aspects. The New Hampshire SET Report has proposed the implementation of this mechanism for its state legislature. Under this proposal, the House Science and Technology Committee and the Senate Energy and Consumer Affairs Committee will monitor bills and resolutions during the legislative session and make comments or suggestions on those measures having a SET content.

The Hawaii State Senate currently has 17 standing committees and the House of Representatives has 22. Several of these committees in each house deal with SET-related topics. It would be possible to assign one committee in each house the responsibility for reviewing bills and resolutions containing SET aspects and attaching informative fact sheets to them prior to further circulation throughout the Legislature. The logistics of this monitoring and commenting procedure would need to be determined by the legislators themselves. There is some uncertainty as to when this monitoring and review process should begin. One possibility is to monitor those bills and resolutions immediately after they have been introduced.

Because this added responsibility would place an increased burden on legislative staff of the SET committee during session, it might be necessary to hire additional committee staff if this design alternative were implemented.

A design for a SET legislative committee is presented in Table 5-7.

## 7. SET Professional Staff

The employment of a permanent legislative research staff with scientific, engineering, or technological backgrounds is another mechanism state legislatures may use to increase their capacity to obtain and utilize SET information. New York, Wisconsin, Minnesota, Illinois, and Virginia are states which have SET professional research staffs serving at least one house of their legislatures. The SET staffs function in the same manner as any legislative service agency, but confine their attention to scientific, engineering, and technological issues.

One possible mechanism for increasing the flow of SET information to Hawaii's legislators is to create a specialized "SET Division" within the LRB to handle information requests pertaining to scientific, engineering, and technological subjects.<sup>3</sup> When initially created, it may be necessary for SET division staff to arrive at an agreement with LRB staff concerning "what constitutes a SET issue," since this concept can be defined in several different ways. A mutual agreement of this concept between the two staffs will facilitate the delegation of research tasks.

A design for a SET Division in LRB is presented in Table 5-8.

<sup>3</sup> An alternative, more "informal" approach to this design is to simply add two or three SET specialists to the existing LRB staff. (Aspects listed in Table 5-8 are still applicable, with minor modifications.)

Table 5-7

SET Legislative Committees  
Design Alternative

| Aspect                        | Description of How SET Committees Might Work   |
|-------------------------------|--|
| A. Operational Responsibility | 1. Monitor and review SET bills and resolutions.   |
| B. Nature of Staffing         | 1. Composed exclusively of state legislators.<br>2. Additional SET committee staff may have to be hired to handle increased workload.  |
| C. Type of Activities         | 1. Monitor legislation during legislative session.<br>2. Review important SET measures.<br>3. Attach SET "fact sheet" or committee report to measures for further circulation. |
| D. Level of Analysis          | 1. Extensive analysis not undertaken by SET committees during session.   |
| E. Time Perspective           | 1. Focus exclusively on SET issues of immediate legislative concern.   |
| F. Initiation of Activities   | 1. All activities initiated by SET committees.   |
| G. Implementation             | 1. Delegate SET responsibility to standing committees in each house.   |

Table 5-8

Creation of SET Division in Legislative Reference Bureau  
Design Alternative

| Aspect                        | Description of How SET Division Might Work  |
|-------------------------------|---|
| A. Operational Responsibility | 1. Provide legislators with SET information.  |
| B. Nature of Staffing         | 1. Two SET specialists and one clerical person with a SET generalist background.<br>2. All three are paid legislative staff positions. <sup>1</sup>                         |
| C. Type of Activities         | 1. All activities listed in Table 5-1 can be undertaken by SET division. <sup>2</sup>   |
| D. Level of Analysis          | 1. Provides responses to information requests which do not require extensive analysis.<br>2. Undertakes comprehensive analyses of SET issues, or hire consultants to do so. |
| E. Time Perspective           | 1. Provides information on SET issues of immediate legislative concern.<br>2. May arrange educational seminars, lectures, workshops on anticipated future SET issues.       |
| F. Initiation of Activities   | 1. Responds to legislative information requests.<br>2. Some activities may be initiated without legislative requests (see Table 5-1).                                       |
| G. Implementation             | 1. Create three new legislative staff positions.<br>2. Appropriate funds for salaries.  |

<sup>1</sup>If SET Division is located in LRB, it may utilize their support staff and office equipment as needed.

<sup>2</sup>Division chief, after consultation with Legislature, could decide which SET activities are appropriate.

## 8. Appointment of University SET Brokers

The appointment of SET information brokers at state universities and private colleges can increase legislators' access to scientific, engineering, or technological information resources. Several states have appointed university SET brokers and established formal information exchange channels between these institutions and the legislatures. Pennsylvania, for example, has established the Legislative Office of Research Liaison (LORL), which coordinates the exchange of SET information between the Pennsylvania House of Representatives and six universities in the state. A senior faculty administrator at each participating university is appointed to act as an information broker. Requests for information are sent by LORL to each broker, who reviews and refers them to an appropriate faculty member on campus. Responses to requests are sent back to LORL, which distributes them to the inquirers.

The University of Hawaii system and the private colleges in the State could become major legislative SET information resources through the development of formalized communication networks among these institutions and the Legislature. For each participating university campus a senior faculty administrator would be appointed to act as a SET broker, and be responsible for receiving legislative information requests, reviewing and distributing them to appropriate faculty members. Responses would be sent back to the senior administrator who would forward them to an in-house legislative service agency for integration and translation into laymen's terms.

A design for University SET information brokers is presented in Table 5-9.

## 9. Utilization of SET Professional Societies

Scientific, engineering, and technological professional societies are a potential source of SET information for legislators. These societies are organized around common scientific interest(s) or discipline(s). As a result, their members represent many different occupational sectors. Because of this diversity in membership, information obtained from these societies reflects a wide range of scientific perspectives. Moreover, since these societies are not linked with any particular political philosophy, the chances of their providing objective technical information to legislators are enhanced. New York utilizes scientific, engineering, and technological professional societies to obtain SET information for its state legislature.

Sigma Xi is a professional society whose members represent a wide range of scientific disciplines. Membership includes experts in fields of life and earth sciences (such as zoology and geology) and specialists from some social sciences (such as psychology).

The Hawaii Chapter of Sigma Xi indicated a possibility that, in cooperation with one or more other scientific, engineering and/or technological societies (such as the Hawaiian Academy of Science), it could operate and maintain a SET brokerage mechanism for the Hawaii State Legislature.<sup>4</sup> One approach would be for a "SET Brokerage Committee,"

<sup>4</sup> The Hawaii SET Project was the topic of discussion at the Sigma Xi annual dinner held on May 11, 1979. A summarized account of the presentations and group discussion which followed may be found in Appendix D.

Table 5.9

Appointment of University SET Broker  
Design Alternative

| Aspect                           | Description of How University<br>SET Brokers Might Work   |
|----------------------------------|---|
| A. Operational<br>Responsibility | <ol style="list-style-type: none"> <li>1. Distribute SET information requests to campus faculty.</li> <li>2. Collect and forward responses to Legislature.</li> </ol>   |
| B. Nature of Staffing            | <ol style="list-style-type: none"> <li>1. Comprised of university faculty members possessing SET expertise.</li> <li>2. Staffing is voluntary.</li> </ol>   |
| C. Type of Activities            | <ol style="list-style-type: none"> <li>1. Short-term research efforts, compilation of short memos or reports in response to requested SET information.</li> <li>2. Legislative service agencies will integrate and translate incoming responses from universities.</li> </ol> |
| D. Level of Analysis             | <ol style="list-style-type: none"> <li>1. Provides quick responses to simple information requests.</li> <li>2. Extensive analyses is not undertaken.</li> </ol>   |
| E. Time Perspective              | <ol style="list-style-type: none"> <li>1. Provides information only on legislative SET issues of immediate concern.</li> </ol>  |
| F. Initiation of<br>Activities   | <ol style="list-style-type: none"> <li>1. Information provided only in response to legislative requests.</li> </ol>   |
| G. Implementation                | <ol style="list-style-type: none"> <li>1. Formal agreements between the Legislature and the university chancellors required.</li> <li>2. Procedure established for transferring SET information requests, responses.</li> </ol>   |

drawn from the general membership of Sigma Xi and other interested professional societies, to oversee the operation of this mechanism. In particular it would be concerned with determining appropriate SET resources necessary for the collection, translation, and delivery of SET information to legislators and the referral of SET legislative information requests to appropriate experts in the community.

Depending upon the activities agreed to by Sigma Xi and the Legislature, it may be possible for this mechanism to supply legislators with quick responses to specific SET information requests as well as comprehensive analyses of SET issues. For the provision of quick responses, a direct, two-way communication channel between Sigma Xi and the Hawaii state legislators would need to be developed. One method would be to establish a phone inquiry service for use by legislators and in-house legislative researchers. To operate effectively, a member of Sigma Xi would be designated to act as "liaison" between inquirers of SET information and respondents. This liaison person would receive and/or review all incoming SET information requests and refer them to the appropriate experts identified in advance by the SET Brokerage Committee. In order to assure timely delivery of the information as well as making sure the question is clear and the response appropriate, there would need to be *direct* two-way communication between the inquiring legislator or in-house staff member and the responding SET expert(s).

When dealing with inquiries in controversial areas, it is important that the SET Brokerage Committee incorporate the responses of more than one SET expert, each representing a differing scientific view or perspective regarding that area. As mentioned previously in this report, science is a discipline which deals in statistical probabilities. Consequently, scientific or technical data may be subject to different interpretations by SET professionals. The Sigma Xi mechanism should not attempt to resolve conflicting perspectives regarding the interpretation of technical data, but rather should make explicit these differences in any presentations to the Legislature.

Comprehensive analyses of SET issues could be provided by the Sigma Xi SET mechanism by arranging for members of participating SET professional societies to write issue papers analyzing current or upcoming legislative SET policy concerns. Because the development of issue papers would require substantial inputs of time, it is presumed that the participating SET professionals would be appropriately compensated.

A potential shortcoming of this design is the fact that it consists exclusively of SET specialists, some of whom may be unaware of the information needs of Hawaii state legislators. To ensure that the Sigma Xi mechanism provides information pertinent to legislative decisionmaking, it may be desirable to establish links with one of the in-house legislative service agencies. A representative from an in-house service agency, for example, could be made a member of the SET Brokerage Committee. The Legislative Reference Bureau would be the likely agency with which to establish such links, since it serves the entire Hawaii State Legislature.

A design for a SET brokerage mechanism in Sigma Xi is presented in Table 5-10.

Table 5-10

Establish Sigma Xi as SET Information Broker  
Design Alternative

| Aspect                        | Description of How Sigma Xi Might Work   |
|-------------------------------|--|
| A. Operational Responsibility | 1. Sigma Xi will coordinate SET information exchange process for the Legislature.  |
| B. Nature of Staffing         | 1. SET experts working on a voluntary basis for simple requests, but for reasonable fee for extensive studies.   |
| C. Type of Activities         | <ol style="list-style-type: none"> <li>1. Compile short memos or reports in response to legislative requests.<sup>1</sup></li> <li>2. Recruit experts to testify at legislative committee hearings.</li> <li>3. Arrange educational seminars, workshops, lectures on SET topics.</li> <li>4. Undertake studies on SET issues.</li> <li>5. Create ad hoc technical panels to analyze SET issues.</li> </ol> |
| D. Level of Analysis          | <ol style="list-style-type: none"> <li>1. Provision of simple information requiring only short research efforts.</li> <li>2. Occasionally comprehensive analyses may be undertaken on SET issues.</li> </ol>   |
| E. Time Perspective           | <ol style="list-style-type: none"> <li>1. Provide information on SET issues of immediate and ongoing legislative concern.</li> <li>2. May anticipate future SET issues and their impacts and inform legislators of their findings.</li> </ol>  |
| F. Initiation of Activities   | <ol style="list-style-type: none"> <li>1. Primarily provide SET information in response to legislative requests.</li> <li>2. May initiate studies, analyses, or educational efforts if deemed necessary.</li> </ol>  |
| G. Implementation             | <ol style="list-style-type: none"> <li>1. Sigma Xi and Legislature would need to enter into a formal agreement on information exchange process.</li> <li>2. Sigma Xi should form SET brokerage committee to coordinate activities.</li> </ol>  |

<sup>1</sup>The activities undertaken will be partially a function of the time Sigma Xi members are willing to make available.

## CHAPTER 6

### ASSESSMENT OF SET DESIGN ALTERNATIVES

Chapter 6 assesses the nine SET mechanisms previously identified. It is divided into three sections. Part I describes the criteria used to assess the designs, Part II is the actual assessment, and Part III provides recommendations concerning appropriate designs for a SET information exchange mechanism in the Hawaii State Legislature.

#### PART I: EVALUATION CRITERIA

An initial step in any assessment is the identification of relevant criteria against which "effectiveness" of a program can be measured. For the Hawaii SET Project, 11 criteria are identified under three major classifications: content, process, and feasibility. These criteria are based on comments obtained from the interviews with legislators and in-house legislative staffs, and to some extent from the survey of the SET organizations.

##### A. Content Criteria

Content criteria pertain to the quality of the information supplied by the SET mechanism. They provide some indication of whether high quality information is being identified and selected for legislators. For purposes of assessing the SET mechanisms, five content criteria are identified:

1. **Technical validity of SET information within the context of the Hawaiian environment**

The information delivered to legislators should be technically valid in terms of its application to Hawaii. Many types of SET information which pertain to the continental U.S. (such as geologic and hydrologic data) may not apply to the unique environmental conditions found in Hawaii. When presenting information of this nature, care should be taken to make any necessary qualifications concerning applicability. It is presumed that Hawaii SET experts, because of their specialized training, will be better able to determine technical validity and applicability of information to Hawaii than SET generalists will. SET mechanisms which employ scientific, engineering, and technological specialists to obtain requested information receive a high rating for this criterion.

**2. Adequate coverage of all perspectives of SET issue**

This criterion consists of two interrelated components. First, it assesses the extent to which all pertinent facts for any SET legislative issue have been included in the information presented to the Legislature. Inclusion of all pertinent facts is partly a function of the amount of time available to study or analyze a legislative issue and the number of SET experts involved in the study.

As mentioned previously, scientific and technical data, being rooted in statistical probabilities, are subject to different interpretations depending on the perspective of the SET expert undertaking the analysis. It is important that these different perspectives be made explicit in the SET information provided to legislators or, at least, that they be incorporated into a "consensus" interpretation. Presumably, a large number of SET experts from a variety of backgrounds will incorporate different perspectives into the SET information provided to legislators. Thus, SET mechanisms utilizing a large number of SET specialists and permitting long-term analyses of legislative issues receive a high rating for this criterion.

**3. Provision of policy-relevant information to legislators**

Not all SET information can be usefully applied by legislators when deciding on issues. For example, the information may be too "academic" for purposes of legislative decisionmaking. This criterion attempts to assess the "utility" of the SET information for legislative policy issues. In-house legislative researchers probably have the best understanding of the types of information pertinent to legislative decisionmaking, and therefore SET mechanisms which incorporate these staff members are rated high.

**4. Credibility of those providing the information**

If legislators do not consider the information sources of a SET mechanism to be credible, it is doubtful that they will use it. Two qualities of credible SET experts are that: (a) they have established a reputation in Hawaii as being knowledgeable in a particular field; and (b) they are perceived to be free of political bias. SET mechanisms exhibiting these two characteristics are rated high for this criterion.

**5. Clarity of SET information to non-scientist**

Highly technical information provided by a SET mechanism should be presented in a manner that is comprehensible to non-scientists. It is sometimes difficult for professional scientists, engineers, or technologists to deliver information to legislators in laymen's terms, making the use of a "SET information translator" desirable. A SET mechanism that utilizes a generalist information translator, such as staff from in-house legislative service agencies, is rated high for "clarity of information."

## B. Process Criteria

In addition to quality of the information, it is desirable to assess the "effectiveness" of the manner in which a SET mechanism functions. Process criteria are concerned with whether the organization and operation of a SET mechanism will indeed supply legislators with useful SET information in a timely manner. Four process criteria have been identified for assessing SET mechanisms:

### 6. Complementary existing legislative information exchange systems

One factor in the successful implementation of a SET mechanism is the extent to which it links onto existing legislative information systems, particularly if the legislators are pleased with the performance of these in-house services. Results of interviews with Hawaii legislators reveal a high degree of satisfaction with the in-house service agencies. For this reason, "overlapping" with these existing information services is considered a desirable characteristic for a Hawaii SET mechanism.

### 7. Accessibility by requestors

Access by individual legislators or legislative committees to the SET brokers, or directly to external information sources, is a desirable aspect for any SET mechanism. To achieve this direct access, there should be no "screening" of legislative information requests and it should be fairly easy for legislators to contact the information brokers in a SET mechanism. It is recognized that some designs for SET information exchange systems focus on the provision of lengthy, comprehensive analyses of SET issues. Due to the amount of time involved in responding to each legislative request, some type of "screening device" is necessary. Nevertheless, such a device reduces accessibility.

### 8. Quick time

During the legislative session, the time required to supply requested information to legislators is a major consideration. The 60-day session of the Hawaii State Legislature is extremely fast-paced and generally demands that information be provided within a week of the date it is requested. Those SET mechanisms which can provide requested information within these time constraints are rated high for this criterion.

Quick response time is not an essential criterion for those design alternatives providing comprehensive analyses of SET issues. Since these activities require long periods of time (six months or longer) to complete, a quick response time is not only unnecessary, but counterproductive. Nevertheless, response time is considered for all nine SET mechanisms because it provides an indication of those designs which are most responsive and those which require more time for analysis.

## 9. Two-way information exchange between legislators and SET experts

All SET mechanisms allow for information delivery from scientists, engineers, and technologists to legislators. In addition, however, they should have a built-in procedure permitting information to flow from legislators to SET experts so that the latter gains an understanding of legislative needs and concerns, gains an appreciation of the political decisionmaking process, and receives feedback concerning the usefulness of the information they provide. A SET mechanism is rated high for this criterion if it builds in a two-way information exchange.

### C. Feasibility Criteria

Feasibility criteria are designed to determine the likelihood that a specific alternative will be acceptable to the Legislature. Two such criteria have been identified for assessing SET mechanisms.

#### 10. Cost

Interviews with Hawaii state legislators and with staff from in-house legislative service agencies indicate that the cost of implementation for any SET design alternative should be kept as low as possible, since legislators are reluctant to appropriate large sums of money for additional legislative support services. For this reason, a SET mechanism which is capable of operating at minimal cost is rated high for this criterion.

#### 11. Political feasibility

Some design alternatives are less desirable than others for political reasons. Some designs, for example, could conceivably result in undesirable changes to the legislative process or disturb traditional legislative prerogatives. Designs which would cause such effects would receive a low rating for political feasibility.

## PART II: ASSESSMENT OF THE NINE SET MECHANISMS

Assessment of the nine alternative SET mechanisms consists of comparing each design with the selected criteria, then making a judgment as to the level of attainment of each criterion for each mechanism. Based on this judgment a qualitative rating is assigned for each criterion as follows:

High – high level of attainment by SET mechanism expected in terms of criterion.

Medium – moderate level of attainment by SET mechanism expected in terms of criterion.

Low – low level or no attainment by SET mechanism expected in terms of criterion.

The ratings are, of course, based on the assumptions made about each mechanism contained in the previous chapters. Changes in any of these assumptions would result in variations in the ratings.

Summaries of the assessments are presented in Tables 6-1 through 6-9 of this chapter. In addition to the tables a brief discussion of each alternative, highlighting its strong and weak points, is presented below.

#### 1: Legislative Scientific Advisory Committee (Table 6-1)

Potential strong points of this design are that it provides comprehensive information concerning SET issues which has a high probability of being technically valid. In addition, the design obtains SET information from highly credible sources and minimal costs are involved in its operation.

Potential weak points for this design are a lack of clarity in the SET information presented, possibility that the SET data may not be applicable to the legislative decision-making arena, and a slow response time.

#### 2: Legislative Reference Bureau to Organize SET Task Forces (Table 6-2)

As in the case of LSAC, potential strong points for this design center around the provision of comprehensive analyses of SET issues which are likely to be technically valid. Task force participants will be credible sources of SET information, and the design will operate at minimum cost.

Task forces often take six months or longer to analyze a SET issue, thus a slow response is likely to be one weak point of this design. Moreover, final reports of these task forces may be written in technical terms which are incomprehensible to laymen since there is no SET translator incorporated into the design. (The task force manager acts as coordinator for the SET task forces, not as a translator.)

#### 3: LEGITECH (Table 6-3)

Potential strong points of LEGITECH are a fast response time, a high degree of accessibility, and a likelihood that the SET information will be understandable to non-scientists (since the LEGITECH operator will translate incoming responses if necessary). Furthermore, since LEGITECH is primarily used by legislative researchers, it is likely that SET information obtained through this system will be pertinent to legislative decision-making.

Potential weaknesses include a lack of comprehensive coverage of SET issues. Credibility of responses may be questioned since all information is obtained from other states and cannot easily be verified. Finally, the chances that information is not valid or applicable to Hawaii are greater than some other designs since there are no Hawaii SET experts involved in this SET mechanism.

#### **4: Legislative Intern Program (Table 6-4)**

Potential strong points in this design are quick response time and accessibility of the interns to legislators. Potential weak points are lack of adequate coverage of SET information and applicability of SET information to the legislative decisionmaking arena.

#### **5: Legislative Science Advisor (Table 6-5)**

A legislative science advisor could provide SET information quickly from reputable SET experts. Additional strong points are that the advisor will always be accessible to legislators and will arrange for direct information exchange activities between legislators and SET experts.

The primary weaknesses of the design are the high cost and the possibility that the advisor might aggressively seek to dominate legislative considerations on SET issues.

#### **6: SET Legislative Committees (Table 6-6)**

Potential strong points for this design are fast response time for receiving SET information and applicability of the information to the legislative decisionmaking arena.

The weakest point in this design is its political feasibility. A SET committee would rearrange the scope of responsibility of traditional standing committees.

#### **7: SET Division in the Legislative Reference Bureau (Table 6-7)**

There are several strong points to this particular SET mechanism. The SET division researchers will be able to provide requested information quickly and in a format that is understandable to non-scientists. In addition, this design is highly accessible to legislators, complements the existing in-house information services and incorporates a means for two-way information exchange between legislators and SET experts.

The major weak point for this design is its cost. Because it is such an expensive mechanism to implement, its political feasibility is also questionable.

#### **8: University SET Information Brokers (Table 6-8)**

The primary strong points of this design are the likelihood that all information provided will be clear and technically valid and the cost for implementation is minimal.

A major weak point to this design is its political feasibility. University-Legislature interactions are already quite extensive and there is no persuasive reason to formalize the process. Another weak point is the lack of two-way information exchange between legislators and the information providers or the SET brokers.

## 9: Sigma Xi as SET Information Broker (Table 6-9)

Major strong points of this mechanism are the credibility of the SET information sources and the likelihood that any data presented to the Legislature will be technically valid.

If implemented in the manner suggested in this report, the Sigma Xi mechanism appears to be the only design without a major weakness (based on an assessment which uses the 11 identified criteria).

## PART III: A POSSIBLE APPROACH FOR HAWAII

There are many possible approaches to obtaining, translating, and delivering SET information to Hawaii state legislators. Nine alternatives have been outlined in this report. Conceivably, any one of them could be implemented but the question is which approach at this time best provides for the exchange of SET information between legislators and professional scientists, engineers, and technologists, given existing possibilities and constraints. The two major current constraints concern money and power. In the absence of a recognized emergency situation directly attributable to a lack of SET information, the Legislature is unlikely, at this time of fiscal stringency, to invest extensive new funds in providing itself with additional new SET services. Secondly, legislators, while recognizing their need for additional access to SET information and experts, do not wish to create a system which eviscerates their own functioning as individual legislators dealing with SET issues. Given these constraints it is worthwhile to review briefly the design alternatives analyzed in Chapter 5 and assessed previously in this chapter. For an overview of the ratings assigned to each SET design alternative, refer to Table 6-10.

The primary weakness associated with the reactivation of LSAC (#1) is that it failed once. Furthermore, it is not at all certain that the changes suggested in this report would overcome the difficulties encountered in the operation of the original design. In addition, LSAC does not help meet the "short term" SET information needs of Hawaii's legislators. Finally, under certain circumstances, LSAC might seem to be usurping legislative decision-making. Organizing SET task forces with the LRB functioning as manager (#2), while low in cost of operation, does not provide legislators with short-term research and analysis. Another major weakness of both LSAC and the SET Task Force is the absence of an information translator to review final reports prior to their delivery to the Legislature.

Neither LEGITECH (#3) nor the Legislative Intern Program (#4) provide a sufficiently comprehensive approach to serve as adequate SET information mechanisms to meet Hawaii's needs though both could be useful supplements. SET legislative interns could be helpful in responding to requests of individual legislators for limited SET information. LEGITECH, if established in a legislative service agency, could prove to be of some use in obtaining responses to simple SET inquiries, but to expect much more at this time would be unduly optimistic. Neither approach, however results in creating separate power centers.

TABLE 6-1

Reactivation of the Legislative Scientific Advisory Committee  
DESIGN ALTERNATIVE

| CRITERIA  | ASSESSMENT  | RATING |
|---|---|--------|
| A. CONTENT CRITERIA   |   |        |
| 1. Technical validity within context of Hawaiian environment                | a. Hawaii's SET experts can determine technical validity of information and applicability to Hawaii<br>b. Eleven SET experts provide cross-section of disciplines                                 | High   |
| 2. Adequate coverage of all perspectives                                    | a. Adequate time to consider all pertinent facts<br>b. Variety of academic disciplines will help ensure all perspectives are considered   | High   |
| 3. Policy-relevant to legislators   | a. When first selected, LSAC members may not be familiar with legislative process<br>b. Three-year terms for members will allow them to develop an understanding of legislative information needs | Medium |
| 4. Credibility of those providing SET information                           | a. Members are well-established, reputable SET experts  | High   |
| 5. Clarity of information   | a. No SET information translator in design  | Low    |
| B. PROCESS CRITERIA   |   |        |
| 6. Complements existing legislative information exchange systems            | a. Virtually no "overlap" with existing legislative information services<br>b. Auditor's Office provides clerical support only  | Low    |
| 7. Accessibility by requestors  | a. Screening of requests for comprehensive studies  | Low    |
| 8. Response time  | a. Slow response time for extensive technical panels<br>b. Moderate response time for educational seminars, workshops   | Low    |
| 9. Permits two-way information exchange between legislators and SET experts | a. If question-and-answer period follows presentation of final written reports, there will be two-way exchange<br>b. Seminars, workshops will allow two-way exchange                              | High   |

TABLE 6-1 Continued

| CRITERIA                             | ASSESSMENT   | RATING |
|--------------------------------------|--|--------|
| <b>C. FEASIBILITY CRITERIA</b>       |  |        |
| 10. Cost of implementation operation | a. Staff is voluntary, reimbursed for expenses only<br>b. Clerical staff is in existing office                               | High   |
| 11. Political feasibility            | a. LSAC enabling law already on books; facilitates implementation<br>b. Mechanism did not succeed when previously instituted | Medium |

TABLE 6-2

## Legislative Reference Bureau to Organize SET Task Forces

## DESIGN ALTERNATIVE

| CRITERIA  | ASSESSMENT  | RATING |
|---|---|--------|
| A. CONTENT CRITERIA   |   |        |
| 1. Technical validity within context of Hawaiian environment                | a. Task force members are SET specialists; should be able to determine technical validity, applicability of SET information                           | High   |
| 2. Adequate coverage of all perspectives                                    | a. Adequate time to consider all aspects<br>b. Members selected to represent various aspects of issue under study                                     | High   |
| 3. Policy-relevant to legislators   | a. Members may not know the types of information that is useful to legislators<br>b. Could obtain feedback through periodic meetings with legislators | Medium |
| 4. Credibility of those providing SET information                           | a. Task force members are reputable SET experts   | High   |
| 5. Clarity of information   | a. SET Task Force Manager does not function as a translator<br>b. No SET information translator in design   | Low    |
| B. PROCESS CRITERIA   |   |        |
| 6. Complements existing legislative information exchange systems            | a. Slightly complementary; Task Force Manager is LRB staff member   | Medium |
| 7. Accessibility by requestors  | a. Information requests screened  | Low    |
| 8. Response time  | a. Slow response time   | Low    |
| 9. Permits two-way information exchange between legislators and SET experts | a. Periodic meetings with legislators<br>b. Question-and-answer session follows presentation of final report  | High   |
| C. FEASIBILITY CRITERIA   |   |        |
| 10. Cost of implementation operation  | a. Task force participants voluntary<br>b. Assumes Task Force Manager already on salary   | High   |
| 11. Political feasibility   | a. Might be considered to duplicate existing groups   | Medium |

TABLE 6-3

LEGITECH  
DESIGN ALTERNATIVE

| CRITERIA  | ASSESSMENT   | RATING |
|---|--|--------|
| A. CONTENT CRITERIA   |  |        |
| 1. Technical validity within context of Hawaiian environment                | a. Information obtained from other states; may not be applicable to Hawaii<br>b. LEGITECH operator (a generalist) may not be able to determine which SET information is valid and applicable to Hawaii | Low    |
| 2. Adequate coverage of all perspectives                                    | a. Limited information through LEGITECH<br>b. Extensive analysis not undertaken by LEGITECH operator due to lack of time in legislative session  | Low    |
| 3. Policy-relevant to legislators   | a. LEGITECH operator an experienced LRB staff person who will know what types of information are useful to legislators   | High   |
| 4. Credibility of those providing SET information                           | a. Out-of-state information sources; validity of SET data cannot easily be verified<br>b. LEGITECH operator a generalist, may not spot faulty information  | Low    |
| 5. Clarity of information   | a. LEGITECH operator acts as translator  | High   |
| B. PROCESS CRITERIA   |  |        |
| 6. Complements existing legislative information exchange systems            | a. Complements existing functions of LRB   | High   |
| 7. Accessibility by requestors  | a. Highly accessible to legislators who may simply phone in requests   | High   |
| 8. Response time  | a. LEGITECH designed for fast response   | High   |
| 9. Permits two-way information exchange between legislators and SET experts | a. No exchange between those providing information (i.e., other states) and Hawaii legislators<br>b. May be two-way exchange between legislators and LEGITECH operator                                 | Medium |

TABLE 6-3 Continued

| CRITERIA                             | ASSESSMENT   | RATING |
|--------------------------------------|--|--------|
| C. FEASIBILITY CRITERIA              |  |        |
| 10. Cost of implementation operation | a. LEGITECH is costly; costs increase with increased use | Low    |
| 11. Political feasibility            | a. Political feasibility uncertain                       | Medium |

TABLE 6-4

## Improvement of the University of Hawaii Legislative Intern Program

## DESIGN ALTERNATIVE

| CRITERIA  | ASSESSMENT  | RATING |
|---|---|--------|
| A. CONTENT CRITERIA   |   |        |
| 1. Technical validity within context of Hawaiian environment                | a. To a limited degree, SET interns will be able to assess technical validity of information (if they have academic backgrounds in a SET area)<br>b. Interns' papers are run through brief technical review | Medium |
| 2. Adequate coverage of all perspectives                                    | a. Interns work during session only; limited coverage due to time constraints   | Low    |
| 3. Policy-relevant to legislators   | a. Interns may be unfamiliar with legislative SET information needs   | Low    |
| 4. Credibility of those providing SET information                           | a. Interns may be able to seek high-quality SET information in their field of academic interest<br>b. Legislative supervisors will have interns' papers reviewed by SET experts                             | Medium |
| 5. Clarity of information   | a. If supervised by in-house staff, papers should be clear  | High   |
| B. PROCESS CRITERIA   |   |        |
| 6. Complements existing legislative information exchange systems            | a. Interns inexperienced; do not fit well with existing legislative information systems   | Low    |
| 7. Accessibility by requestors  | a. Interns work with in-house staff who are very accessible to legislators  | Medium |
| 8. Response time  | a. Interns work on short-term projects; fairly quick response time  | High   |
| 9. Permits two-way information exchange between legislators and SET experts | a. No mechanism for two-way exchange between SET experts and legislators  | Low    |

TABLE 6-4 Continued

| CRITERIA                             | ASSESSMENT   | RATING |
|--------------------------------------|--|--------|
| C. FEASIBILITY CRITERIA              |  |        |
| 10. Cost of implementation operation | a. Salaries for UH interns have already been appropriated<br>b. Additional positions, plus salaries may be desirable | Medium |
| 11. Political feasibility            | a. Program presently exists<br>b. Legislators have supported student intern programs                                 | High   |

TABLE 6-5

## Creation of Legislative Science Advisor

## DESIGN ALTERNATIVE

| CRITERIA  | ASSESSMENT  | RATING |
|---|---|--------|
| A. CONTENT CRITERIA   |   |        |
| 1. Technical validity within context of Hawaiian environment                | a. Advisor arranges for legislators and appropriate SET experts to meet directly  | High   |
| 2. Adequate coverage of all perspectives                                    | a. Most activities of advisor not intended for comprehensive consideration of SET issues<br>b. Consultants may be hired to write comprehensive issue papers | Medium |
| 3. Policy-relevant to legislators   | a. Advisor will be familiar with legislative process  | High   |
| 4. Credibility of those providing SET information                           | a. Advisory will seek information from reputable SET experts in the State   | High   |
| 5. Clarity of information   | a. Science advisor will act as translator for incoming SET information  | High   |
| B. PROCESS CRITERIA   |   |        |
| 6. Complements existing legislative information exchange systems            | a. Some overlap; advisor will be located in existing in-house legislative service agency  | Medium |
| 7. Accessibility by requestors  | a. Advisor is highly accessible since office is part of in-house legislative information service  | High   |
| 8. Response time  | a. Most activities of advisor provide information quickly (e.g., meetings, review of bills and resolutions)   | High   |
| 9. Permits two-way information exchange between legislators and SET experts | a. Meetings between legislators and SET experts assure a two-way exchange of information<br>b. Advisor accessible to both groups; can act as a "go between" | High   |

TABLE 6-5 Continued

| CRITERIA                             | ASSESSMENT   | RATING |
|--------------------------------------|--|--------|
| <b>C. FEASIBILITY CRITERIA</b>       |  |        |
| 10. Cost of implementation operation | a. Salary for advisor must be large enough to make position desirable to SET professionals | Low    |
| 11. Political feasibility            | a. Advisor might seek to dominate legislative consideration of SET issues                  | Low    |

TABLE 6-6

SET Legislative Committees  
DESIGN ALTERNATIVE

| CRITERIA  | ASSESSMENT  | RATING |
|---|---|--------|
| A. CONTENT CRITERIA   |   |        |
| 1. Technical validity within context of Hawaiian environment                | a. Time constraints; may not have time to check validity and applicability<br>b. Legislators and their staff are usually generalists; may not spot invalid data | Low    |
| 2. Adequate coverage of all perspectives                                    | a. Severe time constraints during session; therefore, limited information provided  | Low    |
| 3. Policy-relevant to legislators   | a. Legislators, legislative staff know what types of information are useful in legislative decisionmaking   | High   |
| 4. Credibility of those providing SET information                           | a. Sources may not be made explicit<br>b. Rest of Legislature may question the sources of the SET committee   | Low    |
| 5. Clarity of information   | a. Committee staff will act as translator<br>b. High turnover of legislators' staff; no development of "expertise" in translation                               | Medium |
| B. PROCESS CRITERIA   |   |        |
| 6. Complements existing legislative information exchange systems            | a. Complements existing legislative committee hearing process   | High   |
| 7. Accessibility by requestors  | a. SET committee members select measures for further consideration; this process not accessible to other legislators  | Low    |
| 8. Response time  | a. Fast response time<br>b. Design is intended to provide information very quickly during session   | High   |
| 9. Permits two-way information exchange between legislators and SET experts | a. No mechanism for two-way exchange  | Low    |

TABLE 6-6 Continued

| CRITERIA                             | ASSESSMENT  | RATING |
|--------------------------------------|---|--------|
| C. FEASIBILITY CRITERIA              |   |        |
| 10. Cost of implementation operation | a. No cost for delegation of responsibilities to SET committees<br>b. If additional staff needed, funds required for salaries | Medium |
| 11. Political feasibility            | a. SET committee would cause rearrangement of scope of responsibility of traditional standing committees                      | Low    |

TABLE 6-7

## Creation of a SET Division in Legislative Reference Bureau

## DESIGN ALTERNATIVE

| CRITERIA  | ASSESSMENT  | RATING |
|---|---|--------|
| A. CONTENT CRITERIA   |   |        |
| 1. Technical validity within context of Hawaiian environment                | a. SET specialists can evaluate information in their field of expertise<br>b. Will know the experts to go to for requests outside their field of interest       | High   |
| 2. Adequate coverage of all perspectives                                    | a. Most activities intended for quick response; therefore SET information may be limited<br>b. May hire consultants to conduct extensive analyses on SET issues | Medium |
| 3. Policy-relevant to legislators   | a. SET division may consult with LRB staff to learn what types of SET information are pertinent to legislators  | High   |
| 4. Credibility of those providing SET information                           | a. Division will obtain information from recognized SET experts in the State<br>b. Division researchers are reputable SET experts                               | High   |
| 5. Clarity of information   | a. SET division acts as translators   | High   |
| B. PROCESS CRITERIA   |   |        |
| 6. Complements existing legislative information exchange systems            | a. Fits into existing LRB system  | High   |
| 7. Accessibility by requestors  | a. In-house office highly accessible to legislators   | High   |
| 8. Response time  | a. Division intended to provide quick responses; two full-time researchers hired for this purpose   | High   |
| 9. Permits two-way information exchange between legislators and SET experts | a. Seminars, workshops, or lectures will permit two-way exchange of information   | High   |

TABLE 6-7 Continued

| CRITERIA                             | ASSESSMENT  | RATING |
|--------------------------------------|---|--------|
| C. FEASIBILITY CRITERIA              |   |        |
| 10. Cost of implementation operation | a. Very costly; funds must be appropriated for salaries for three positions     | Low    |
| 11. Political feasibility            | a. Would require legislators to spend more money on another legislative service | Low    |

TABLE 6-8

Appointment of University SET Information Broker  
DESIGN ALTERNATIVE

| CRITERIA   | ASSESSMENT  | RATING |
|--|---|--------|
| A. CONTENT CRITERIA  |   |        |
| 1. Technical validity within context of Hawaiian environment     | a. University SET experts will provide information  | High   |
| 2. Adequate coverage of all aspects of SET perspectives          | a. University SET broker could seek input from wide range of faculty members                                | Medium |
|  | b. Time constraints; intended to provide SET information quickly  |        |
| 3. Policy-relevant to legislators                                | a. University broker may not know what information is pertinent   | Medium |
|  | b. In-house offices will translate the SET information  |        |
| 4. Credibility of those providing SET information                | a. University faculty has well-established SET specialists  | Medium |
|  | b. There may be biases inherent in the responses provided   |        |
| 5. Clarity of information  | a. In-house legislative service agencies will translate incoming information into laymen's terms            | High   |
| B. PROCESS CRITERIA  |   |        |
| 6. Complements existing legislative information exchange systems | a. Slight overlap; in-house service agencies integrate and translate incoming information from universities | Medium |
| 7. Accessibility by requestors                                   | a. Fairly accessible to legislators who simply phone requests to in-house service agency                    | Medium |
|  | b. Not as accessible as in-house services   |        |
| 8. Response time   | a. Intended for quick response time   | Medium |
|  | b. Information requests and responses pass through several channels, which slows response time              |        |

TABLE 6-8 Continued

| CRITERIA  | ASSESSMENT   | RATING |
|---|--|--------|
| B. PROCESS CRITERIA (continued)   |  |        |
| 9. Permits two-way information exchange between legislators and SET experts | a. No mechanism for two-way exchange   | Low    |
| C. FEASIBILITY CRITERIA   |  |        |
| 10. Cost of implementation operation  | a. University SET brokers are voluntary positions<br>b. Faculty members provide SET information without charge   | High   |
| 11. Political feasibility   | a. Informal SET information exchange activities already occur between legislators and university faculty<br>b. Lack of perceived need to formalize process | Low    |

TABLE 6-9

Sigma Xi as SET Information Broker  
DESIGN ALTERNATIVE

| CRITERIA  | ASSESSMENT   | RATING |
|---|--|--------|
| A. CONTENT CRITERIA   |  |        |
| 1. Technical validity within context of Hawaiian environment                | a. SET experts are the brokers<br>b. Broad range of professional disciplines   | High   |
| 2. Adequate coverage of all perspectives                                    | a. Diverse membership could provide several perspectives on SET issues<br>b. Strong emphasis on providing all sides of issues                | High   |
| 3. Policy-relevant to legislators   | a. SET experts do not always know what information is pertinent<br>b. Linkage with LRB will help in determining policy-relevant information  | Medium |
| 4. Credibility of those providing set information                           | a. Members are reputable SET experts   | High   |
| 5. Clarity of information   | a. LRB staff may act as translators of SET information   | Medium |
| B. PROCESS CRITERIA   |  |        |
| 6. Complements existing legislative information exchange systems            | a. Slightly complementary <u>if</u> links are established with LRB   | Medium |
| 7. Accessibility by requestors  | a. If phone inquiry service is installed, design will be very accessible to legislators<br>b. Not as accessible as in-house services however | Medium |
| 8. Response time  | a. Members have indicated willingness to provide SET information quickly   | High   |
| 9. Permits two-way information exchange between legislators and SET experts | a. Will be direct dialogue between legislators and Sigma Xi members  | High   |

TABLE 6-9 Continued

| CRITERIA                             | ASSESSMENT   | RATING |
|--------------------------------------|--|--------|
| C. FEASIBILITY CRITERIA              |  |        |
| 10. Cost of implementation operation | a. Voluntary SET mechanism<br>b. Participants may be compensated for their efforts | Medium |
| 11. Political feasibility            | a. Does not disturb traditional legislative process or legislative prerogatives    | High   |

TABLE 6-10

Comparison of Ratings of Nine SET Design Alternatives

| Design Criteria             | LSAC   | TASK FORCE | LEGITECH | INTERN | SCIENCE ADVISOR | SET COMMITTEE | SET STAFF | UH BROKERS | SIGMA Xi |
|-----------------------------|--------|------------|----------|--------|-----------------|---------------|-----------|------------|----------|
| Technical validity          | High   | High       | Low      | Medium | High            | Low           | High      | High       | High     |
| Adequate coverage           | High   | High       | Low      | Low    | Medium          | Low           | Medium    | Medium     | High     |
| Policy-relevant             | Medium | Medium     | High     | Low    | High            | High          | High      | Medium     | Medium   |
| Credibility of sources      | High   | High       | Low      | Medium | High            | Low           | High      | Medium     | High     |
| Clarity                     | Low    | Low        | High     | High   | High            | Medium        | High      | High       | Medium   |
| Complements existing system | Low    | Medium     | High     | Low    | Medium          | High          | High      | Medium     | Medium   |
| Accessibility               | Low    | Low        | High     | Medium | High            | Low           | High      | Medium     | Medium   |
| Response time               | Low    | Low        | High     | High   | High            | High          | High      | Medium     | High     |
| Two-way exchange            | High   | High       | Medium   | Low    | High            | Low           | High      | Low        | High     |
| Cost                        | High   | High       | Low      | Medium | Low             | Medium        | Low       | High       | Medium   |
| Political feasibility       | Medium | Medium     | Medium   | High   | Low             | Low           | Low       | Low        | High     |

Not so with a Legislative Science Advisor (#5) who would arrange direct dialogue between legislators and appropriate SET experts (for example, through informal meetings or testimony). The advisor might be perceived by legislators as a gatekeeper who could potentially control access to SET experts. The geographic proximity of SET information sources and legislators, however, facilitates direct interaction between the two groups and obviates the need for contact persons.

The legislative SET committee (#6) centralizes responsibility for SET analysis of legislative measures in one entity. The committee might not have credibility with other legislators who would be hesitant to delegate what they believe to be their responsibility. Further, such a mechanism will not permit much time to be spent researching an issue. Consequently, the information it provides might be sketchy at best.

A very attractive approach to providing legislators with scientific, engineering, and technological information is the SET division consisting of professional staff (#7). The full-time SET staff would be able to respond to requests for information, translate technical data, and deliver responses to legislators in a timely manner. In addition to supplying requested information, the SET professional staff can undertake a variety of activities (such as organizing seminars, arranging field trips, and publishing newsletters) through which legislators may learn about SET aspects of issues. Legislative service agencies already perform most of these functions in Hawaii, though primarily in non-SET areas. The only major drawback to this design is the cost of implementation.

A major shortcoming of the university broker design (#8) is slow response time. Requests and responses usually go through a minimum of two "clearinghouses" — a legislative and a university one — prior to reaching their final destination. Hawaii legislators already have direct access to university SET experts, though not systematic or comprehensive (with the exception of the Environmental Center at the University of Hawaii). Formalizing the process would probably only increase response time without providing compensating benefits.

The Sigma Xi SET mechanism (#9) would result in direct provision of information by reputable SET experts. There would be sufficient analysis of information responses prior to delivery to legislators. Fast response would be possible when necessary. The approach could be implemented at a relatively low cost.

Sigma Xi could meet the various types of SET information requests. If a member is designated to serve as a liaison by the professional society, its members, as well as other SET experts in the community, could receive referrals of incoming requests and contact legislators or their personal staff directly to deliver the responses. This arrangement would permit a direct, two-way flow of information exchange between legislators and SET experts.

The Sigma Xi Brokerage Committee could also form ad hoc technical panels to conduct comprehensive analyses of SET issues, thus providing the second type of SET information identified in Chapter 5. In addition, Sigma Xi members would also have knowledge of current reports and studies pertaining to their specific disciplines, and it therefore may be possible for the professional society to provide a third type of SET information to legislators, the identification of previously written technical reports or studies (essentially a library function of locating available information resources). It is conceivable, then, that

Sigma Xi with cooperating societies could provide all three types of SET information identified in Chapter 5.

- (1) Responses to simple inquiries requiring only short-term research efforts;
- (2) Provision of comprehensive analyses of SET issues previously prepared, usually by others; and
- (3) Provision of comprehensive analyses of SET issues for which long-term research and analysis is conducted.

If the Sigma Xi mechanism is selected for implementation, it is important that a formal agreement between the Legislature and the professional society be entered into. Such an agreement should specify the manner in which the information exchange system will operate. Specifically, such an agreement would cover:

- (1) The type of SET information Sigma Xi will provide;
- (2) The channel for transmitting requests to Sigma Xi and delivering responses to the Legislature and/or legislators;
- (3) The process for screening requests and clarifying their content;
- (4) The nature of the review process within Sigma Xi preceding delivery of a report and the types of requests to which such a review process will apply;
- (5) The types of initiatives that can be taken by Sigma Xi within the framework of the agreement, if any;
- (6) The agreed-to expectations concerning the number of requests of different types to be processed and the appropriate response times;
- (7) The forum for informing Sigma Xi members of anticipated legislative information needs and legislators of SET developments that have public policy implications;
- (8) The reimbursement of Sigma Xi for costs incurred and any other financial arrangements;
- (9) Other activities to be undertaken by Sigma Xi for the Legislature in addition to responding to SET requests, if any; and
- (10) A Sigma Xi-legislative group to oversee and evaluate the working of the SET transfer process and the sufficiency of the agreement.

If the Sigma Xi SET mechanism is to function successfully, then both those in the Legislature and in the professional society must share the same set of expectations as to how the mechanism will function and be willing to contribute to its continuing nurturing and development.

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## APPENDIX A

### INVENTORY OF SCIENTIFIC, ENGINEERING AND TECHNICAL BILLS AND RESOLUTIONS CONSIDERED BY THE HAWAII STATE LEGISLATURE, 1973-1978

This inventory is intended to provide a broad overview of the scientific, engineering and technical bills and resolutions introduced for consideration in the Hawaii State Legislature during the past three bienniums.

Bills and resolutions are categorized along two general perspectives: First, by general subject matter (e.g., agriculture); and second, by major purpose of the measure (e.g., financial incentives). The subject matter classifications are further subdivided into specific categories. Three tables of information have been constructed.

Table 1 simply cross-references general subject matter with major purpose of the measures. The table is presented in a matrix for quick reference. The numbers in parentheses indicate the number of measures that were adopted.

Table 2 classifies the measures first by general subject matter, then by major purpose, and finally by specific subject matter.

Table 3 lists the measures first by general subject matter, then by specific subject matter, without considering major purpose of the measures.

Several cautions:

(1) Not all bills and resolutions are included. The inventory contains only those measures that could, in the opinion of this researcher, lead to requests to scientific, engineering or technical experts for advice prior to decision-making. For example, under the subject heading of "Energy," measures concerning research on new petroleum sources are listed, while measures pertaining to fuel taxes are not.

(2) Each measure has been listed only under one major subject matter heading, one specific subject heading, and one major purpose category, though some measures could be logically be placed under several headings. In each instance, where a choice was required, the most prominent category has been employed.

(3) It must be emphasized that this material is currently in draft form, and would require extensive revision before being presented in a formal paper.

## General Subject Headings

The general subject headings are as follows:

### Agriculture:

Contains all measures related to farming, including pest control and agricultural water rates. Measures that pertain to both agriculture and aquaculture are listed only once, under the heading of "Agriculture."

### Air Quality:

Includes measures relating to air pollution.

### Aquaculture:

Contains all measures concerned with the controlled breeding and growth of water-inhabiting animals.

### Coastal Zone Management:

Includes measures directly relating to the Coastal Zone Management Program, as well as some that are indirectly related; for example, a conference on coastal engineering, and the Shoreline Setback Law.

### Coral:

Contains those measures pertaining to coral harvesting and removal.

### Energy:

Includes measures relating to solar, wind, geothermal and ocean thermal energy, as well as energy conservation tactics. Some considerations of electrical energy and petroleum sources.

### Environmental Impact Statements:

Includes those measures pertaining to amendments of the Environmental Impact Statement process.

### Environmental Protection:

One of the more generic subject categories; contains measures relating to general environmental considerations, such as state environmental policies.

### Fisheries:

Contains all measures relating to fishing, including commercial fishing and regulatory aspects of recreational fishing (such as Fish and Game laws).

Forestry:

Includes measures on tree planting programs and the feasibility of a Hawaii timber industry.

Manganese Nodules:

Lists measures pertaining to the development of a manganese nodule industry in Hawaii.

Marine Resources:

Includes measures which specifically state "marine resources" in their titles, as well as general marine-related items (e.g., establishment of Marine Affairs Coordinator's Office).

Natural Resources:

Another generic category; includes environmentally-related measures which do not fit into any other category such as propagation of game birds, endangered plants and animals, and establishment of a state botanist.

Noise:

Contains measures relating to noise pollution.

Pollution:

Includes general measures relating to pollution control which cannot fit under the specific subject headings of air, water or land pollution (solid waste).

Radiation:

Includes measures concerning radiation safety and the establishment of nuclear fission plants.

Sand:

Includes measures pertaining to sand mining and sand removal.

Solid Waste:

Contains measures relating to resource recovery and recycling.

Transportation:

Includes those measures relating to mass transit and the rapid transit system.

Water Quality:

Contains measures relating to water pollution, wastewater reclamation.

Water Resources:

Includes measures pertaining to water conservation in the state.

Major Purpose of the Measures

The "major purpose" categorization is fairly straightforward:

Appropriations:

Includes measures which appropriate funds, or (in the case of resolutions) request that funds be appropriated.

Establishment of Governmental Organizations:

Contains measures which establish (or recommend the establishment of) new offices, agencies or positions in the State government.

Financial Incentives:

Includes measures relating to loan programs and revenue bonds.

General "Support":

Contains measures that offer statements of support for State, County or private activities.

Policies, Plans, Programs & Projects:

Contains measures which establish or recommend new policies, plans, programs, or projects.

Rules, Regulations, Statutes & Powers:

Includes measures which are regulatory in nature.

Studies, Reports, Reviews & Analyses:

Contains measures which request research and written results concerning specific subjects.

Tax Incentives:

Includes measures relating to tax exemptions and deductions.

One item must be noted, however. Under the subject heading of "agriculture," six measures were listed which established new research facilities. These did not appear to fit neatly into any of the "major purpose" categories. They were placed in the "establishment of government organizations" heading.

Measures with Multiple Purposes

Bills and resolutions which appropriated funds as well as mandated or recommended other activities are placed under headings of the latter. In other words, if a bill appropriates funds to conduct a feasibility study, it is placed under the major purpose category of "studies, reports, reviews & analyses," and not under "appropriations." With other multiple purpose measures, they have been categorized according to major purpose as indicated by the title of the bill or resolution. Each bill or resolution, as noted earlier, appears under only one purpose though it may be a multi-purpose measure.

Table 1  
 Number of Bills and Resolutions Relating to Scientific, Engineering and Technical Subjects  
 Considered by the Hawaii State Legislature,<sup>1</sup>  
 1973-1978

| General Subject Matter                             | Major Purpose of Bill or Resolution <sup>2</sup> |                |   |                         |                      |  |  |  |                   |
|--|--|----------------|---|-------------------------|----------------------|--|--|--|-------------------|
|  | TOTAL  | Appropriations | Establishment <sup>3</sup><br>of Government<br>Organization | Financial<br>Incentives | General<br>"Support" | Policies,<br>Plans,<br>Programs,<br>Projects | Rules<br>Regulations,<br>Statutes,<br>Powers | Studies,<br>Reports,<br>Reviews,<br>Analysis | Tax<br>Incentives |
| Agriculture ....                                   | 134 (14)   | 83             | 7 (2)   | 1 (1)                   | 11 (3)               | 16 (6)                                       | 2  | 11 (2)                                       | 3                 |
| Air Quality ....                                   | 9 (2)  | 0              | 0   | 0                       | 2                    | 0  | 1  | 4 (2)  | 2                 |
| Aquaculture ...                                    | 47 (10)  | 10             | 6 (1)   | 6 (1)                   | 6 (3)                | 2  | 12 (3)                                       | 0  | 5                 |
| Coastal Zone<br>Management ...                     | 22 (3)   | 3              | 0   | 0                       | 2                    | 6 (2)  | 10 (1)                                       | 1  | 0                 |
| Coral .....  | 5  | 1              | 0   | 0                       | 0                    | 0  | 4  | 0  | 0                 |
| Energy .....                                       | 148 (11)   | 32 (3)         | 16 (1)  | 3                       | 6                    | 15   | 34 (7)                                       | 10   | 32                |
| Environmental<br>Impact Statement<br>Process ..... | 33 (2)   | 0              | 0   | 0                       | 0                    | 0  | 32 (2)                                       | 1  | 0                 |
| Environmental<br>Protection ...                    | 61 (4)   | 1              | 0   | 0                       | 9 (2)                | 17 (1)                                       | 28 (1)                                       | 4  | 2                 |
| Fisheries .....                                    | 73 (14)  | 16             | 0   | 3                       | 3 (1)                | 11 (3)                                       | 29 (8)                                       | 10 (2)                                       | 1                 |
| Forestry .....                                     | 8 (2)  | 1              | 0   | 0                       | 0                    | 2 (1)  | 0  | 5 (1)  | 0                 |
| Manganese Nodules                                  | 18 (4)   | 4              | 2 (1)   | 0                       | 2 (1)                | 1  | 4 (1)  | 4 (1)  | 1                 |
| Marine Resources                                   | 26 (4)   | 14             | 3 (2)   | 0                       | 2                    | 3  | 2 (1)  | 2 (1)  | 0                 |
| Natural Resources                                  | 32 (5)   | 4              | 0   | 0                       | 4 (1)                | 3  | 15 (1)                                       | 6 (3)  | 0                 |

Table 1 (continued)

Number of Bills and Resolutions Relating to Scientific, Engineering and Technical Subjects  
Considered by the Hawaii State Legislature,<sup>1</sup>  
1973-1978

| General Subject Matter | Major Purpose of Bill or Resolution <sup>2</sup> |                |   |                         |                      |  |  |  |                   |
|------------------------|--|----------------|---|-------------------------|----------------------|--|--|--|-------------------|
|                        | TOTAL  | Appropriations | Establishment <sup>3</sup><br>of Government<br>Organization | Financial<br>Incentives | General<br>"Support" | Policies,<br>Plans,<br>Programs,<br>Projects | Rules<br>Regulations,<br>Statutes,<br>Powers | Studies,<br>Reports,<br>Reviews,<br>Analysis | Tax<br>Incentives |
| Noise .....            | 9 (1)  | 0              | 0   | 0                       | 1                    | 2  | 5 (1)  | 1  | 0                 |
| Pollution .....        | 17 (2)   | 0              | 0   | 7 (2)                   | 0                    | 1  | 5  | 2  | 2                 |
| Radiation .....        | 12 (2)   | 1              | 3   | 0                       | 2 (2)                | 4  | 1  | 1  | 0                 |
| Sand .....             | 7  | 0              | 0   | 0                       | 0                    | 3  | 2  | 2  | 0                 |
| Solid Waste ....       | 47 (1)   | 7              | 3   | 0                       | 6                    | 2 (1)  | 21   | 2  | 6                 |
| Transportation         | 25 (3)   | 2              | 3   | 0                       | 1                    | 11 (1)                                       | 3  | 5 (2)  | 0                 |
| Water Quality ..       | 34 (6)   | 1              | 0   | 1                       | 5 (2)                | 1  | 21 (4)                                       | 1  | 4                 |
| Water Resources        | 38 (4)   | 10             | 0   | 0                       | 3                    | 1  | 16 (2)                                       | 7 (2)  | 1                 |

<sup>1</sup>The number without parentheses is the total number of bills and resolutions considered including those adopted. The number within parentheses is the total number of bills and resolutions adopted.

<sup>2</sup>If a bill or resolution had more than one purpose, it has been classified by its primary purpose. Bills appropriating funds have been listed under that heading only when that was the sole purpose of the bill. It is recognized that funds have been listed under that heading only when that was the sole purpose of the bill. It is recognized that a bill or resolution might be classified differently by another compiler, but this compilation is considered sufficiently accurate in providing an overview.

<sup>3</sup>Includes establishment of research facilities. Six measures related to the establishment of research facilities for agriculture

Source: Status Table of Legislative Measures, 1973-1978; Legislative Reference Bureau Library

Table 2

INVENTORY OF SCIENTIFIC, ENGINEERING AND TECHNICAL  
BILLS AND RESOLUTIONS CONSIDERED

by Specific Subject Matter and Major Purpose  
1973-1978

|  | <u>Number of Bills<br/>and Resolutions</u> |
|--|--|
| <u>AGRICULTURE</u> .....                                 | TOTAL 134                                  |
| <u>Appropriations</u> .....                              | TOTAL (83)                                 |
| Avocado - research .....                                 | 4  |
| Floral industry research .....                           | 3  |
| Dairy cattle - reproduction problems .....               | 1  |
| Feed and forage research .....                           | 3  |
| Ginger root research .....                               | 1  |
| Pesticide research .....                                 | 3  |
| Papaya industry research .....                           | 4  |
| Vegetable research .....                                 | 9  |
| Corn research and development .....                      | 2  |
| Experimental stations .....                              | 8  |
| Hog slaughterhouse .....                                 | 1  |
| Vacuum cooling plant .....                               | 14   |
| Kona coffee research & development .....                 | 11   |
| Banana research .....                                    | 4  |
| Pineapple research .....                                 | 5  |
| Agricultural research facility .....                     | 2  |
| Hawaii Agricultural Experiment Station .....             | 1  |
| <u>Establishment of Governmental Organizations</u> ..... | TOTAL (7)                                  |
| Agricultural Cooperative Association .....               | 1  |
| Fruit fly eradication lab .....                          | 3  |
| Greenhouse vegetable culture facility .....              | 1  |
| Pilot papaya processing plant .....                      | 1  |
| Taro/native crop research center .....                   | 1  |
| <u>Financial Incentives</u> .....                        | TOTAL (1)                                  |
| Loan program for agriculture & aquaculture - expand ...  | 1  |

|  | <u>Number of Bills<br/>and Resolutions</u> |
|--|--|
| <u>General "Support".....</u> TOTAL  | (11)                                       |
| Papaya .....   | 4  |
| Floriculture industry .....  | 1  |
| Fruit fly research .....   | 2  |
| Agricultural development .....   | 1  |
| Agricultural growth .....  | 1  |
| Vocational education in agriculture & aquaculture .....  | 1  |
| Pacific basin agriculture workshop .....   | 1  |
| Pineapple industry .....   | 1  |
| <u>Policies, Plans, Programs, Projects .....</u> TOTAL   | (16)                                       |
| Pineapple .....  | 2  |
| Pesticide program .....  | 1  |
| Seed distribution program .....  | 1  |
| Feed/forage research program .....   | 1  |
| Diversified agriculture master plan .....  | 1  |
| Diversified agriculture state plan .....   | 1  |
| Agriculture water development project .....  | 1  |
| Agriculture - update policies .....  | 1  |
| Agriculture water policy .....   | 1  |
| Agricultural priority in water use .....   | 1  |
| Special agricultural water rates .....   | 3  |
| Development of state water supplies to support<br>agriculture .....                                  | 1  |
| Coffee farm research program .....   | 1  |
| <u>Rules, Regulations, Statutes, Powers .....</u> TOTAL  | (2)  |
| Classify "agricultural lands of importance<br>to the state".....                                     | 1  |
| Provision of adequate water resources in the State<br>Plan to support agricultural development ..... | 1  |
| <u>Studies, Reports, Reviews, Analyses .....</u> TOTAL   | (11)                                       |
| Pesticide analysis .....   | 2  |
| Study - souring beetle .....   | 2  |
| Study - pineapple uses .....   | 1  |
| Study - agricultural water rates .....   | 1  |
| Report - agricultural water rates .....  | 1  |
| Study - agricultural product development .....   | 1  |
| Foliage marketing study .....  | 1  |
| Study for an agricultural water policy .....   | 2  |
| Study - egg processing plant .....   | 1  |

|   | <u>Number of Bills<br/>and Resolutions</u> |
|---|--|
| <u>Tax Credits, Deductions, Incentives</u> .....                    | TOTAL (3)                                  |
| Agriculture/aquaculture products .....                              | 3  |
| <u>AIR QUALITY</u> .....  | TOTAL (9)                                  |
| <u>General "Support"</u> .....                                      | TOTAL (2)                                  |
| Abatement of air pollution .....                                    | 1  |
| Environmental effect of fluorocarbons .....                         | 1  |
| <u>Rules, Regulations, Statutes, Powers</u> .....                   | TOTAL (1)                                  |
| Aerosol sprays - prohibition of selling<br>certain containers ..... | 1  |
| <u>Studies, Reports, Reviews, Analysis</u> .....                    | TOTAL (4)                                  |
| Review of air pollution control regulations .....                   | 3  |
| Study on bus pollution .....  | 1  |
| <u>Tax Incentives</u> .....   | TOTAL (2)                                  |
| Tax deductions for pollution control devices .....                  | 2  |
| <u>AQUACULTURE</u> .....  | TOTAL (46)                                 |
| <u>Appropriations</u> .....   | TOTAL (10)                                 |
| Aquaculture development .....                                       | 2  |
| Prawns; eco-type testing .....                                      | 1  |
| Brine shrimp research & development .....                           | 1  |
| Opihi research .....  | 1  |
| Kahala fish research .....  | 1  |
| Fish propagation in inland waterways .....                          | 1  |
| Nehu farm .....   | 1  |
| Anuenue fisheries .....   | 1  |
| Eel importation .....   | 1  |

AQUACULTURE contd

Number of Bills  
and Resolutions

|   |       |      |
|---|-------|------|
| <u>Establishment of Governmental Organizations</u> .....  | TOTAL | (6)  |
| Establishment of lead agency .....  |       | 1    |
| Establishment of interim lead agency .....  |       | 1    |
| Establishment of mariculture office .....   |       | 1    |
| Establishment of aquaculture office in DPED .....   |       | 1    |
| Establishment of aquaculture program as a<br>division of Department of Agriculture .....        |       | 1    |
| Establishment of aquaculture development commission ...   |       | 1    |
| <u>Financial Incentives</u> .....   | TOTAL | (6)  |
| Aquaculture loan program .....  |       | 3    |
| Aquaculture revolving loan fund .....   |       | 3    |
| <u>General "Support"</u> .....  | TOTAL | (6)  |
| Development of aquaculture .....  |       | 2    |
| Kahala fish research .....  |       | 1    |
| Inland waterway fish propagation .....  |       | 1    |
| Support of research and testing of cultured and<br>nearshore baitfish .....                     |       | 2    |
| <u>Policies, Plans, Programs, Projects</u> .....  | TOTAL | (2)  |
| Aquaculture programs .....  |       | 2    |
| <u>Rules, Regulations, Statutes, Powers</u> .....   | TOTAL | (12) |
| Fishpond regulation .....   |       | 4    |
| Inclusion of "aquaculture" in the definition<br>of agriculture, relating to land use laws ..... |       | 1    |
| Leasing of public lands by aquaculturists<br>and mariculturists .....                           |       | 2    |
| Permit process .....  |       | 1    |
| Definition, rules, regulations .....  |       | 2    |
| Permission to import anquilliform eels .....  |       | 2    |
| <u>Tax Incentives</u> .....   | TOTAL | (5)  |
| Tax exemptions for aquaculture industry .....   |       | 2    |
| Tax credit for aquaculture research & development .....   |       | 2    |
| Property tax exemption for aquaculturists .....   |       | 1    |

|  |       | <u>Number of Bills<br/>and Resolutions</u> |
|--|-------|--|
| <u>COASTAL ZONE MANAGEMENT</u> .....                                 | TOTAL | (22)                                       |
| <u>Appropriations</u> .....  | TOTAL | (3)  |
| Coastal zone management expenditures .....                           |       | 1  |
| Conference on coastal engineering .....                              |       | 2  |
| <u>General "Support"</u> .....                                       | TOTAL | (2)  |
| Conservation of the coastal zone .....                               |       | 2  |
| <u>Policies, Plans, Programs, Projects</u> .....                     | TOTAL | (6)  |
| Coastal zone management policies .....                               |       | 3  |
| Coastal zone management program .....                                |       | 3  |
| <u>Rules, Regulations, Statutes, Powers</u> .....                    | TOTAL | (10)                                       |
| Coastal zone management resident exception .....                     |       | 1  |
| Consideration of coastal zone management<br>amendments by DPED ..... |       | 1  |
| Coastal zone management general amendments .....                     |       | 3  |
| Authorization of a state CZM program .....                           |       | 1  |
| Extension of land, sea boundaries .....                              |       | 1  |
| CZM State and county powers .....                                    |       | 1  |
| Shoreline setback .....  |       | 2  |
| <u>Studies, Reports, Reviews, Analysis</u> .....                     | TOTAL | (1)  |
| Review of CZM plan .....   |       | 1  |
| <u>CORAL</u> .....   | TOTAL | (5)  |
| <u>Appropriations</u> .....  | TOTAL | (1)  |
| Precious coral research & development .....                          |       | 1  |
| <u>Rules, Regulations, Statutes, Powers</u> .....                    | TOTAL | (4)  |
| Coral removal .....  |       | 4  |

|  | <u>Number of Bills<br/>and Resolutions</u> |
|--|--|
| <u>ENERGY</u> .....  | TOTAL (148)                                |
| <u>Appropriations</u> .....                                    | TOTAL (32)                                 |
| Alternate energy sources research .....                        | 8  |
| Energy conservation in buildings .....                         | 5  |
| Geothermal energy R & D .....                                  | 6  |
| Solar/wind energy .....  | 2  |
| Solar energy .....   | 2  |
| Biomass energy plantations .....                               | 1  |
| Oil recycling program .....                                    | 1  |
| Molasses-to-gasoline demo project .....                        | 1  |
| Energy conservation .....                                      | 1  |
| State energy trust fund .....                                  | 1  |
| Hawaii Natural Energy Lab .....                                | 4  |
| <u>Establishment of Governmental Organizations</u> .....       | TOTAL (16)                                 |
| Energy organization (agency, commission, etc) .....            | 5  |
| Energy "person" .....  | 6  |
| Petroleum control commission .....                             | 1  |
| Hawaii solar energy center .....                               | 1  |
| Establishment of Department of Energy .....                    | 1  |
| Energy conservation council .....                              | 1  |
| Energy resources coordinator .....                             | 1  |
| <u>Financial Incentives</u> .....                              | TOTAL (3)                                  |
| Surcharge based on total kilowatts of energy<br>consumed ..... | 1  |
| Revenue bonds for resource, energy recovery .....              | 1  |
| Revenue bonds for electric/gas energy .....                    | 1  |
| <u>General "Support"</u> .....                                 | TOTAL (6)                                  |
| Energy recovery facility .....                                 | 1  |
| Geothermal resources development .....                         | 1  |
| Energy conservation effort .....                               | 1  |
| Solar energy devices in government buildings .....             | 1  |
| Utilization of ocean wave energy .....                         | 1  |
| Energy measures .....  | 1  |

ENERGY contd

Number of Bills  
and Resolutions

Policies, Plans, Programs, Projects ..... TOTAL (15)

|  |   |
|--|---|
| Energy conservation program .....                        | 8 |
| Programs & policies update .....                         | 1 |
| Land re-districting - energy policy .....                | 1 |
| Energy management system .....                           | 1 |
| Energy extension service program .....                   | 1 |
| Government, private programs for energy research .....   | 1 |
| Early warning system for detecting energy shortage ..... | 1 |
| Policies and control .....                               | 1 |

Rules, Regulations, Statutes, Powers ..... TOTAL (34)

|   |   |
|---|---|
| Zoning ordinances .....   | 2 |
| Energy efficiency standards in lighting, buildings .....              | 7 |
| Adoption of rules concerning the energy problem .....                 | 1 |
| State ownership of geothermal resources .....                         | 2 |
| Limitation of speculation in geothermal lands .....                   | 1 |
| County powers .....   | 2 |
| Emergency powers .....  | 1 |
| Regulation of non-fossil fuels for electricity .....                  | 2 |
| Ban use of fossil fuels for heating pools .....                       | 3 |
| Ban pilot lites on gas appliances .....                               | 1 |
| Establishment of geothermal energy rates .....                        | 2 |
| Regulation of sales and installation of solar<br>energy systems ..... | 1 |
| Peak load utility pricing system .....                                | 2 |
| Energy conservation through procurement practices .....               | 3 |
| Solar energy devices for public buildings .....                       | 1 |
| Homeowners regulation of solar heating devices .....                  | 1 |
| Utilization of waste heat .....                                       | 1 |
| Easements for solar energy devices .....                              | 1 |

Studies, Reports, Reviews, Analysis ..... TOTAL (10)

|   |   |
|---|---|
| State energy problem .....  | 1 |
| Hawaii National Energy Institute & Lab - report .....                             | 1 |
| Energy impact analysis of government projects .....                               | 1 |
| Energy conservation development study .....                                       | 1 |
| Water desalinization/solar energy .....   | 1 |
| Feasibility of using electric motor vehicles<br>in Hawaii .....                   | 1 |
| Study of an underwater, interisland cable system<br>for energy transmission ..... | 1 |
| Hydrogen economy study .....  | 1 |
| Study of a Molokai hydroelectric system .....                                     | 1 |
| Sugarcane - fuel use study .....  | 1 |

Number of Bills  
and Resolutions

ENERGY contd

|   |       |      |
|---|-------|------|
| <u>Tax Incentives</u> .....                     | TOTAL | (32) |
| Alternate energy sources .....                  |       | 8    |
| Solar energy devices .....                      |       | 11   |
| Energy conservation (general) .....             |       | 5    |
| Solar/wind energy .....                         |       | 2    |
| Hot water heaters (energy saving devices) ..... |       | 2    |
| Geothermal well sites .....                     |       | 1    |
| Alcohol fuel .....                              |       | 1    |
| Hawaii State energy tax act .....               |       | 1    |
| Motor vehicle tax for energy research .....     |       | 1    |

ENVIRONMENTAL IMPACT STATEMENT PROCESS .....

TOTAL (33)

Rules, Regulations, Statutes, Powers .....

TOTAL (32)

|   |    |
|---|----|
| EIS process and general amendments .....                              | 21 |
| Amendment: consideration of certain PUC actions .....                 | 1  |
| Amendment: consideration of economic growth .....                     | 1  |
| Amendment: consideration of energy resources .....                    | 2  |
| Amendment: consideration of water resources .....                     | 4  |
| Amendment: consideration of agricultural lands .....                  | 1  |
| Amendment: consideration of effects from<br>neighboring actions ..... | 1  |
| Refinement of definitions, requirements .....                         | 1  |

Studies, Reports, Reviews, Analysis .....

TOTAL (1)

|   |   |
|---|---|
| State and county environmental review ..... | 1 |
|---|---|

ENVIRONMENTAL PROTECTION .....

TOTAL (60)

Appropriations .....

TOTAL (1)

|  |   |
|--|---|
| Environmental shoreline protection ..... | 1 |
|--|---|

General "Support" .....

TOTAL (9)

|  |   |
|--|---|
| Environmental shoreline protection .....   | 3 |
| Improvement of environmental quality .....   | 2 |
| Environmental protection .....   | 2 |
| Determination of optimum balance between economic<br>development & environmental quality ..... | 1 |
| Maintenance of ecology .....   | 1 |

| <u>ENVIRONMENTAL PROTECTION</u> contd   | <u>Number of Bills<br/>and Resolutions</u> |
|---|--|
| <u>Policies, Plans, Programs, Projects</u> .....  | TOTAL (17)                                 |
| The update and streamlining of programs and policies<br>relating to the environment ..... | 1  |
| State environmental policy .....  | 4  |
| Environmental programs .....  | 3  |
| Environmental health program .....  | 1  |
| State environmental policy .....  | 7  |
| Environmental quality control .....   | 1  |
| <u>Rules, Regulations, Statutes, Powers</u> .....   | TOTAL (28)                                 |
| Agency responsible for shoreline management .....   | 3  |
| Environmental quality, general amendments .....   | 16   |
| Limitations on environmental actions .....  | 2  |
| Enactment of laws related to Hawaii's environment .....                                   | 1  |
| Environmental protection; right to sue .....  | 1  |
| Authority of Environmental Quality Commission .....                                       | 2  |
| Environmental quality standards .....   | 1  |
| Remedy for environmental protection .....   | 1  |
| Environmental quality: declaratory relief .....   | 1  |
| <u>Studies, Reports, Reviews, Analysis</u> .....  | TOTAL (4)                                  |
| Annual report of the state of the environment .....                                       | 1  |
| Environmental council report .....  | 1  |
| Determination of environmental carrying capacity .....                                    | 1  |
| Review of shoreline protection ordinance .....  | 1  |
| <u>Tax Incentives</u> .....   | TOTAL (2)                                  |
| Tax incentives for environmental quality control .....                                    | 2  |
| <u>FISHERIES</u> .....  | TOTAL (73)                                 |
| <u>Appropriations</u> .....   | TOTAL (16)                                 |
| Hypobaric storage containers .....  | 3  |
| Fish freezing units .....   | 2  |
| Sonar detecting device .....  | 1  |
| Fishing vessels .....   | 5  |
| Research and testing of baitfish .....  | 1  |
| Research on ornamental fish industry .....  | 1  |
| Shark control and research .....  | 2  |
| Ocean fishing industry development .....  | 1  |

Number of Bills  
and Resolutions

FISHERIES contd

Financial Incentives ..... TOTAL (3)

    Shark control ..... 3

General "Support" ..... TOTAL (3)

    Promotion of the Hawaiian fishing industry ..... 3

Policies, Plans, Programs, Projects ..... TOTAL (11)

    State fisheries development master plan ..... 7

    Shark bounty program ..... 2

    Aerial spot for skipjack tuna ..... 2

Rules, Regulations, Statutes, Powers ..... TOTAL (29)

    Ban on inshore commercial fishing ..... 1

    Ban on fishing in certain Kauai bays ..... 2

    Prohibition of fishing with electrical devices ..... 1

    Protection, wise management of opihi ..... 5

    Regulation of mullet fishing ..... 4

    Definition of "commercial fishing" to include  
    plants and seaweed ..... 2

    Proper enforcement of 200 miles fisheries  
    conservation zone ..... 2

    Ban on taking nehu from Kaneohe Bay waters ..... 1

    Net restrictions ..... 2

    Wise management of ornamental fish ..... 1

    Female crab protection ..... 1

    Kona crab protection ..... 2

    Prohibition of spearing turtles ..... 1

    Fish management in the Hawaiian archipelago ..... 1

    Penalties on fishing rights ..... 1

    Permission to import marine mussels ..... 1

    Fishing reserves ..... 1

Studies, Reports, Reviews, Analysis ..... TOTAL (10)

    Study of use of haole koa as an ingredient of  
    fish diets ..... 1

    Green sea turtle study ..... 4

    Study on marketing Hawaiian fisheries products ..... 2

    Study on development of special sea containers ..... 2

    Study of the application of hypobaric fish  
    containers for commercial fisheries ..... 1

Number of Bills  
and Resolutions

FISHERIES contd

|   |       |     |
|---|-------|-----|
| <u>Tax Incentives</u> .....                         | TOTAL | (1) |
| Tax exemption for shark meat and its products ..... |       | 1   |

FORESTRY .....

Appropriations .....

|   |  |   |
|---|--|---|
| Timber industry - initial development ..... |  | 1 |
|---|--|---|

Policies, Plans, Programs, Projects .....

|                                    |  |   |
|------------------------------------|--|---|
| Forest demonstration project ..... |  | 1 |
| Koa planting program .....         |  | 1 |

Studies, Reports, Reviews, Analysis .....

|   |  |   |
|---|--|---|
| Timber industry - feasibility study ..... |  | 2 |
| Ohia decline study .....                  |  | 3 |

MANGANESE NODULES .....

Appropriations .....

|                                   |  |   |
|-----------------------------------|--|---|
| Development of the industry ..... |  | 4 |
|-----------------------------------|--|---|

Establishment of Governmental Organizations .....

|                                   |  |   |
|-----------------------------------|--|---|
| Manganese nodule task force ..... |  | 1 |
| Office in charge .....            |  | 1 |

General "Support" .....

|                                     |  |   |
|-------------------------------------|--|---|
| Encouragement of the industry ..... |  | 2 |
|-------------------------------------|--|---|

Policies, Plans, Programs, Projects .....

|                                |  |   |
|--------------------------------|--|---|
| Manganese nodule program ..... |  | 1 |
|--------------------------------|--|---|

Rules, Regulations, Statutes, Powers .....

|                                     |  |   |
|-------------------------------------|--|---|
| Government mineral rights .....     |  | 2 |
| Mining lease royalty payments ..... |  | 2 |

| <u>MANGANESE NODULES</u> contd  | <u>Number of Bills<br/>and Resolutions</u> |
|---|--|
| <u>Studies, Reports, Reviews, Analysis</u> .....  | TOTAL (4)                                  |
| Feasibility study - foreign trade zone on<br>Big Island .....                                 | 2  |
| Study - manganese nodule tailings disposal .....  | 1  |
| Mining study .....  | 1  |
| <u>Tax Incentives</u> .....   | TOTAL (1)                                  |
| Manganese processing - tax credit .....   | 1  |
| <br><u>MARINE RESOURCES</u> .....   | <br>TOTAL (27)                             |
| <u>Appropriations</u> .....   | TOTAL (14)                                 |
| Promotion, development of marine resources .....  | 6  |
| Ocean and marine education research .....   | 1  |
| Marine research .....   | 2  |
| Coordination of marine activities .....   | 2  |
| Conservation and restoration of marine resources .....  | 2  |
| Marine anti-pollution actions .....   | 1  |
| <u>Establishment of Governmental Orgnaizations</u> .....                                      | TOTAL (3)                                  |
| Marine exposition commission .....  | 1  |
| Marine Affairs Coordinator .....  | 2  |
| <u>General "Support"</u> .....  | TOTAL (2)                                  |
| Development of marine resources .....   | 1  |
| Expansion of marine culture industry .....  | 1  |
| <u>Policies, Plans, Programs, Projects</u> .....  | TOTAL (3)                                  |
| Marine resource management plans .....  | 2  |
| Marine resources development program .....  | 1  |
| <u>Rules, Regulations, Statutes, Powers</u> .....   | TOTAL (2)                                  |
| Establishment of marine resources division of<br>Department of Land & Natural Resources ..... | 1  |
| Marine resource conservation area .....   | 1  |

| <u>MARINE RESOURCES</u> contd  | <u>Number of Bills<br/>and Resolutions</u> |
|--|--|
| <u>Studies, Reports, Reviews, Analysis</u> .....   | TOTAL (2)                                  |
| Feasibility study for a separate Department of<br>Marine Resources and Aquaculture .....     | 1  |
| Leeward Islands marine survey .....  | 1  |
| <br><u>NATURAL RESOURCES</u> .....   | <br>TOTAL (32)                             |
| <u>Appropriations</u> .....  | TOTAL (4)                                  |
| Importation of game birds .....  | 3  |
| Establishment of state botanist .....  | 1  |
| <br><u>General "Support"</u> .....   | <br>TOTAL (4)                              |
| Conservation of natural resources .....  | 2  |
| Growth limits which harmonize with the supply and<br>distribution of natural resources ..... | 1  |
| Protection of Molokini environment .....   | 1  |
| <br><u>Policies, Plans, Programs, Projects</u> .....   | <br>TOTAL (3)                              |
| State-wide conservation program .....  | 1  |
| Land/water use commission .....  | 1  |
| Update and streamlining of policies, programs<br>relating to natural resources .....         | 1  |
| <br><u>Rules, Regulations, Statutes, Powers</u> .....  | <br>TOTAL (15)                             |
| Conservation of endangered, threatened species .....   | 8  |
| Protection of plant, animal life .....   | 1  |
| Exception to Endangered Species Act .....  | 1  |
| Establishment of conservation zones, districts .....   | 4  |
| Establishment of forest/water reserve zones .....  | 1  |
| <br><u>Studies, Reports, Reviews, Analysis</u> .....   | <br>TOTAL (6)                              |
| Study of Kawainui Marsh development .....  | 2  |
| Study of use of Kahoolawe .....  | 1  |
| Lava mining study .....  | 1  |
| Lava rock use study .....  | 1  |
| Archipelago baseline study .....   | 1  |
| <br><u>NOISE</u> .....   | <br>TOTAL (9)                              |
| <u>General "Support"</u> .....   | TOTAL (1)                                  |
| Reduce noise pollution .....   | 1  |

| <u>NOISE</u> contd                                      | <u>Number of Bills<br/>and Resolutions</u> |
|---|--|
| <u>Policies, Plans, Programs, Projects</u> ..... TOTAL  | (2)  |
| Public health noise control program .....               | 1  |
| Comprehensive design for noise control .....            | 1  |
| <u>Rules, Regulations, Statutes, Powers</u> ..... TOTAL | (5)  |
| Muffler noise level .....                               | 1  |
| Noise control regulations .....                         | 3  |
| General aviation noise elimination .....                | 1  |
| <u>Studies, Reports, Reviews, Analysis</u> ..... TOTAL  | (1)  |
| Study on highway noise abatement .....                  | 1  |
| <br><u>POLLUTION</u> ..... TOTAL                        | <br>(16)                                   |
| <u>Financial Incentives</u> ..... TOTAL                 | (7)  |
| Revenue bonds for anti-pollution projects .....         | 4  |
| Repeal of anti-pollution revenue bond .....             | 1  |
| Pollution control bonds .....                           | 1  |
| <u>Policies, Plans, Programs, Projects</u> ..... TOTAL  | (1)  |
| Liquid waste disposal program .....                     | 1  |
| <u>Rules, Regulations, Statutes, Powers</u> ..... TOTAL | (5)  |
| Litter control .....                                    | 1  |
| Pollution control requirements .....                    | 2  |
| Oil pollution .....                                     | 2  |
| <u>Studies, Reports, Reviews, Analysis</u> ..... TOTAL  | (2)  |
| Shoreline pollution study .....                         | 2  |
| <u>Tax incentives</u> ..... TOTAL                       | (2)  |
| Tax exemptions for pollution control facilities .....   | 1  |
| Tax deductions for pollution control facilities .....   | 1  |

|  | <u>Number of Bills<br/>and Resolutions</u> |
|--|--|
| <u>RADIATION</u> .....   | TOTAL (12)                                 |
| <u>Appropriations</u> .....  | TOTAL (1)                                  |
| Equipment for radiation safety program .....                       | 1  |
| <u>Establishment of Governmental Organizations</u> .....           | TOTAL (3)                                  |
| Radiation safety commission .....                                  | 1  |
| Nuclear power plant .....  | 2  |
| <u>General "Support"</u> .....                                     | TOTAL (2)                                  |
| Consideration of radioactive waste disposal .....                  | 2  |
| <u>Policies, Plans, Programs, Projects</u> .....                   | TOTAL (4)                                  |
| Department of Health radiation safety program .....                | 3  |
| Radiation monitor/survey program .....                             | 1  |
| <u>Rules, Regulations, Statutes, Powers</u> .....                  | TOTAL (1)                                  |
| Department of Health regulations for radiation<br>protection ..... | 1  |
| <u>Studies, Reports, Reviews, Analysis</u> .....                   | TOTAL (1)                                  |
| Department of Health radiation safety study .....                  | 1  |
| <u>SAND</u> .....  | TOTAL (7)                                  |
| <u>Policies, Plans, Programs, Projects</u> .....                   | TOTAL (3)                                  |
| Sand mining program .....  | 2  |
| Sand mining - re-evaluation of policy .....                        | 1  |
| <u>Rules, Regulations, Statutes, Powers</u> .....                  | TOTAL (2)                                  |
| Sand removal restrictions .....                                    | 1  |
| Sand removal - state/county powers .....                           | 1  |
| <u>Studies, Reports, Reviews, Analysis</u> .....                   | TOTAL (2)                                  |
| Sand, rock, lime study (DPED) .....                                | 2  |

|  | <u>Number of Bills<br/>and Resolutions</u> |
|--|--|
| <u>SOLID WASTE</u> .....                                 | TOTAL (46)                                 |
| <u>Appropriation</u> .....                               | TOTAL (7)                                  |
| Solid waste recycling facilities .....                   | 4  |
| Resource recovery .....                                  | 1  |
| Beverage containers - litter .....                       | 1  |
| Solid waste compaction plant .....                       | 1  |
| <u>Establishment of Governmental Organizations</u> ..... | TOTAL (3)                                  |
| Council of resource recovery .....                       | 1  |
| Paper recycling plant at Halawa .....                    | 1  |
| Hawaii waste recovery authority .....                    | 1  |
| <u>General "Support"</u> .....                           | TOTAL (6)                                  |
| Control of solid waste disposal .....                    | 3  |
| Litter and solid waste reduction .....                   | 1  |
| Recycling of litter and solid waste .....                | 2  |
| <u>Policies, Plans, Programs, Projects</u> .....         | TOTAL (2)                                  |
| State environmental policy - solid waste .....           | 1  |
| Solid waste management project .....                     | 1  |
| <u>Rules, Regulations, Statutes, Powers</u> .....        | TOTAL (21)                                 |
| Deposit-and-return legislation .....                     | 10   |
| Flip top cans .....                                      | 1  |
| Definition of "beverage containers" .....                | 1  |
| Ban on non-returnable beverage containers .....          | 1  |
| Plastic beverage containers .....                        | 1  |
| Solid waste ownership - declare .....                    | 1  |
| Resource recovery facility - P.U.C. regulations .....    | 1  |
| Contract negotiations - resource recovery facilities ..  | 2  |
| Issuance of pollution control bonds .....                | 1  |
| Beverage container regulation .....                      | 2  |
| <u>Studies, Reports, Reviews, Analysis</u> .....         | TOTAL (2)                                  |
| Paper recycling within corrections system .....          | 1  |
| Economic impact of "deposit-and-return" .....            | 1  |
| <u>Tax Incentives</u> .....                              | TOTAL (6)                                  |
| Recycling facilities .....                               | 4  |
| Waste facility .....                                     | 1  |
| Tax on soft drinks .....                                 | 1  |

|  | <u>Number of Bills<br/>and Resolutions</u> |
|--|--|
| <u>TRANSPORTATION</u> .....  | TOTAL (25)                                 |
| <u>Appropriations</u> .....  | (2)  |
| Rapid transit .....  | 1  |
| Repeal of mass transit .....   | 1  |
| <u>Establishment of Governmental Organizations</u> .....                       | TOTAL (3)                                  |
| Statewide transportation council .....   | 1  |
| Transportation control commission .....  | 1  |
| Mass transit authority .....   | 1  |
| <u>General "Support"</u> .....   | TOTAL (1)                                  |
| Withdrawal of House support of HART .....                                      | 1  |
| <u>Policies, Plans, Programs, Projects</u> .....                               | TOTAL (11)                                 |
| Statewide transportation council & planning program<br>program .....           | 3  |
| Statewide transportation plan .....  | 1  |
| Transportation master plan .....   | 1  |
| Surface transportation plan .....  | 1  |
| Fixed guideway system .....  | 1  |
| Water/air/land transit system .....  | 1  |
| Subway transit system .....  | 1  |
| Mass transit system .....  | 1  |
| Public information program regarding the mass<br>transit system .....          | 1  |
| <u>Rules, Regulations, Statutes, Powers</u> .....                              | TOTAL (3)                                  |
| State responsibilities concerning mass transit .....                           | 1  |
| County powers concerning mass transit .....                                    | 1  |
| Surface transportation .....   | 1  |
| <u>Studies, Reports, Reviews, Analysis</u> .....                               | TOTAL (5)                                  |
| Study on Hawaii belt highway problem .....                                     | 1  |
| Analysis of TH-3 guideway funds .....  | 1  |
| Review of fixed guideway underground realignment<br>along Waialae Avenue ..... | 1  |
| UH study to close Dole Street .....  | 1  |
| Review of rapid transit system concept .....                                   | 1  |

|  |       | <u>Number of Bills<br/>and Resolutions</u> |
|--|-------|--|
| <u>WATER QUALITY</u> .....   | TOTAL | ( 34 )                                     |
| <u>Appropriations</u> .....  | TOTAL | (1)  |
| Safe water act .....   |       | 1  |
| <u>Financial Incentives</u> .....  | TOTAL | (1)  |
| Grants-in-aid to state or counties for water<br>pollution control facilities ..... |       | 1  |
| <u>General "Support"</u> .....   | TOTAL | (5)  |
| Support for Department of Health in revising water<br>quality standards .....      |       | 2  |
| Maintain water quality .....   |       | 1  |
| Maintain water quality of the marine environment .....                             |       | 2  |
| <u>Polcies, Plans, Programs, Projects</u> .....                                    | TOTAL | (1)  |
| Sewage water reuse project .....   |       | 1  |
| <u>Rules, Regulations, Statutes, Powers</u> .....                                  | TOTAL | (21)                                       |
| Water pollution control - construction grants .....                                |       | 1  |
| Mandatory certification of wastewater treatment<br>personnel .....                 |       | 6  |
| Amendment of safe drinking water act .....   |       | 2  |
| Designation of DOH duties pertaining to water quality .....                        |       | 1  |
| Regulation for safe drinking water .....   |       | 2  |
| General prohibition of water pollution .....                                       |       | 2  |
| State implmentation of Federal Water Pollution<br>Control Act - amendment .....    |       | 1  |
| Remission of sewer use charges .....   |       | 1  |
| Requirements for private sewer disposal .....                                      |       | 1  |
| Wastewater reclamation/management .....  |       | 1  |
| Water pollution control permit .....   |       | 1  |
| Water flouridation .....   |       | 2  |
| <u>Studies, Reports, Reviews, Analysis</u> .....                                   | TOTAL | (1)  |
| Annual report on quality of state waters .....                                     |       | 1  |
| <u>Tax Incentives</u> .....  | TOTAL | (4)  |
| Tax credit on private sewer charge .....   |       | 2  |
| Tax remission on sewer use charge .....  |       | 2  |

|   | <u>Number of Bills<br/>and Resolutions</u> |
|---|--|
| <u>WATER RESOURCES</u> .....  | TOTAL ( 38 )                               |
| <u>Appropriations</u> .....   | TOTAL (10)                                 |
| Investigation of water resources .....                                    | 3  |
| Protection of water resources .....                                       | 1  |
| Development of water resources .....                                      | 2  |
| Development of aquatic resources .....                                    | 2  |
| Efficient use of water resources .....                                    | 1  |
| Conservation and utilization of surface and<br>ground water sources ..... | 1  |
| <u>General "Support"</u> .....  | TOTAL (3)                                  |
| Use of surface waters .....   | 1  |
| Enactment of laws relating to water .....                                 | 1  |
| Water use rights .....  | 1  |
| <u>Policies, Plans, Programs, Projects</u> .....                          | TOTAL (1)                                  |
| Water flow control device program .....                                   | 1  |
| <u>Rules, Regulations, Statutes, Powers</u> .....                         | TOTAL (16)                                 |
| Artesian well control .....   | 1  |
| Repeal of artesian well control .....                                     | 1  |
| Regulation of water conservation devices .....                            | 3  |
| Regulation of dams by counties .....                                      | 1  |
| Amend water resources statute .....                                       | 6  |
| Prerequisites for water development projects .....                        | 2  |
| Recirculating system for water cooled processes .....                     | 1  |
| Water conservation in cooling process equipment .....                     | 1  |
| <u>Studies, Reports, Reviews, Analysis</u> .....                          | TOTAL (7)                                  |
| Study on water rights .....   | 1  |
| Public annual report on state water resources .....                       | 4  |
| Exploration of South Kohala deep well .....                               | 2  |
| <u>Tax Incentives</u> .....   | TOTAL (1)                                  |
| Tax credit for water conservation devices .....                           | 1  |

Table 3

SCIENTIFIC, ENGINEERING & TECHNICAL BILLS AND RESOLUTIONS  
 CONSIDERED BY THE HAWAII STATE LEGISLATURE

by Specific Subject Matter

1973-1978

| <u>Agriculture</u>                     | <u>Number of Measures</u> |
|--|---------------------------|
| Avocados .....                         | 4                         |
| Agricultural water rates .....         | 11                        |
| Bananas .....                          | 4                         |
| Cattle .....                           | 1                         |
| Diversified agriculture .....          | 2                         |
| -----                                  |                           |
| Eggs .....                             | 1                         |
| Feed and forage .....                  | 6                         |
| Floral industry .....                  | 5                         |
| Fruit fly eradication .....            | 5                         |
| Ginger root .....                      | 1                         |
| -----                                  |                           |
| Green house facility .....             | 1                         |
| Hogs .....                             | 1                         |
| Kona coffee .....                      | 9                         |
| Loan programs .....                    | 1                         |
| Papayas .....                          | 9                         |
| -----                                  |                           |
| Pesticides .....                       | 6                         |
| Pineapples .....                       | 7                         |
| Policies .....                         | 4                         |
| Product development .....              | 2                         |
| Research facilities .....              | 11                        |
| -----                                  |                           |
| Seeds .....                            | 1                         |
| Souring beetle .....                   | 1                         |
| Tax incentives .....                   | 3                         |
| Vacuum cooling plant .....             | 13                        |
| Vegetables .....                       | 9                         |
| -----                                  |                           |
| Vocational education .....             | 1                         |
| Workshop .....                         | 1                         |
| -----                                  |                           |
| <u>Air Quality</u>                     |                           |
| Aerosol sprays .....                   | 2                         |
| Air pollution abatement .....          | 1                         |
| Air pollution control devices .....    | 2                         |
| Air pollution control regulation ..... | 3                         |
| Bus pollution .....                    | 1                         |

| <u>Aquaculture</u>                    | <u>Number of Measures</u> |
|---------------------------------------|---------------------------|
| Baitfish .....                        | 2                         |
| Brine shrimp .....                    | 1                         |
| Development .....                     | 5                         |
| Eels .....                            | 3                         |
| Fish ponds .....                      | 4                         |
| -----                                 |                           |
| Leasing of public lands .....         | 2                         |
| Lead agency .....                     | 7                         |
| Loans .....                           | 6                         |
| Nehu farm .....                       | 1                         |
| Opihi .....                           | 1                         |
| -----                                 |                           |
| Permits .....                         | 1                         |
| Prawns .....                          | 1                         |
| Programs .....                        | 2                         |
| Propagation in inland waterways ..... | 2                         |
| Research facilities .....             | 3                         |
| -----                                 |                           |
| Rules, regulations, statutes .....    | 3                         |
| Tax incentives .....                  | 5                         |

#### Coastal Zone Management

|   |   |
|---|---|
| Amendments .....  | 3 |
| Authorization of CZM program .....  | 1 |
| Conference on coastal engineering .....   | 3 |
| Conservation of the coastal zone .....  | 2 |
| Department of Planning & Economic Development to<br>consider CZM amendments ..... | 1 |
| -----   |   |
| Expenditures .....  | 1 |
| Extension of land, sea boundaries .....   | 1 |
| Policies .....  | 3 |
| Programs .....  | 3 |
| Resident exception .....  | 1 |
| -----   |   |
| Review of CZM plan .....  | 1 |
| Shoreline setback .....   | 2 |
| State and county powers .....   | 1 |

#### Coral

|                      |   |
|----------------------|---|
| Coral removal .....  | 4 |
| Precious coral ..... | 1 |

Energy

Number of Measures

|   |    |
|---|----|
| Alcohol fuel .....                                  | 2  |
| Alternate energy sources .....                      | 16 |
| Biomass energy .....                                | 1  |
| Electricity .....                                   | 2  |
| Electric motor vehicles .....                       | 1  |
| -----   |    |
| Energy conservation .....                           | 24 |
| Energy efficiency standards .....                   | 7  |
| Energy impact analysis .....                        | 1  |
| Energy office .....                                 | 7  |
| Energy measures .....                               | 2  |
| -----   |    |
| Energy "person" .....                               | 7  |
| Energy recovery .....                               | 2  |
| Energy transmission .....                           | 1  |
| Fossil fuels and non-fossil fuels .....             | 11 |
| Geothermal energy .....                             | 14 |
| -----   |    |
| Hot water heaters .....                             | 2  |
| Hydroelectric systems .....                         | 1  |
| Hydrogen economy study .....                        | 1  |
| Molasses-to-gasoline .....                          | 1  |
| Motor vehicle taxes .....                           | 1  |
| -----   |    |
| Ocean wave energy .....                             | 1  |
| Oil recycling program .....                         | 1  |
| Programs, policies .....                            | 5  |
| Rules concerning the energy problem .....           | 1  |
| Research facilities .....                           | 5  |
| -----   |    |
| Solar energy .....                                  | 21 |
| Solar/wind energy .....                             | 4  |
| State, county powers .....                          | 3  |
| State energy problem .....                          | 1  |
| State Energy Tax Act .....                          | 1  |
| -----   |    |
| State energy trust fund .....                       | 1  |
| Warning system for detecting energy shortages ..... | 1  |
| Waste heat .....                                    | 1  |
| Zoning .....  | 2  |

Environmental Impact Statement Process

|   |    |
|---|----|
| Consideration of agricultural lands .....               | 1  |
| Consideration of economic growth .....                  | 1  |
| Consideration of effects from neighboring actions ..... | 1  |
| Consideration of energy resources .....                 | 2  |
| Consideration of PUC actions .....                      | 1  |
| -----   |    |
| Consideration of water resources .....                  | 4  |
| General amendments .....                                | 21 |

| <u>Energy (contd.)</u>                        | <u>Number of Measures</u> |
|---|---------------------------|
| Refinement of definitions, requirements ..... | 1                         |
| State and county environmental review .....   | 1                         |

Environmental Protection

|  |    |
|--|----|
| Determination of environmental carrying capacity .....   | 1  |
| Enactment of laws relating to Hawaii's environment ..... | 1  |
| Environmental council .....                              | 1  |
| Environmental health program .....                       | 1  |
| Environmental policy .....                               | 7  |
| -----  |    |
| Environmental programs .....                             | 3  |
| Environmental protection .....                           | 4  |
| Environmental quality .....                              | 24 |
| Environmental quality commission .....                   | 2  |
| Limitations on environmental actions .....               | 2  |
| -----  |    |
| Maintenance of ecology .....                             | 1  |
| Report of the state of the environment .....             | 1  |
| Shoreline management .....                               | 4  |
| Taxation concerning environmental control .....          | 1  |

Fisheries

|   |   |
|---|---|
| Commercial fisheries master plan .....                        | 7 |
| Crab protection .....   | 3 |
| Definition of "commercial fishing" .....                      | 2 |
| Enforcement of the 200 mile fisheries conservation zone ..... | 2 |
| Fish diets .....  | 1 |
| -----   |   |
| Fish freezing units .....                                     | 2 |
| Fish management .....   | 4 |
| Fishing rights .....  | 1 |
| Fishing vessels .....   | 5 |
| Fishing with electrical devices .....                         | 1 |
| -----   |   |
| Green sea turtles .....                                       | 4 |
| Hypobaric containers .....                                    | 4 |
| Importation of marine mussels .....                           | 1 |
| Marketing of Hawaiian fisheries products .....                | 2 |
| Mullet .....  | 4 |
| -----   |   |
| Net restrictions .....  | 2 |
| Ocean fishing industry .....                                  | 1 |
| Opihi .....   | 5 |
| Fishing Reserves .....  | 1 |

| <u>Fisheries (contd.)</u>  | <u>Number of Measures</u> |
|--|---------------------------|
| Ornamental fish .....  | 3                         |
| Promotion of Hawaiian fishing industry .....                               | 3                         |
| Sea containers .....   | 2                         |
| Shark .....  | 8                         |
| Skipjack tuna .....  | 2                         |
| <hr/>  |                           |
| Sonar detecting device .....   | 1                         |
| <br>   |                           |
| <u>Forestry</u>  |                           |
| Forest demonstration project .....   | 1                         |
| Koa planting program .....   | 1                         |
| Ohia decline study .....   | 3                         |
| Timber industry .....  | 3                         |
| <br>   |                           |
| <u>Manganese Nodules</u>   |                           |
| Development of the industry .....  | 4                         |
| Encouragement of the industry .....  | 2                         |
| Foreign trade zone on the island of Hawaii .....                           | 2                         |
| Manganese nodule program .....   | 1                         |
| Manganese nodule tailings disposal .....                                   | 1                         |
| <hr/>  |                           |
| Mining and mineral rights .....  | 5                         |
| Manganese nodule task force .....  | 1                         |
| Office in charge .....   | 1                         |
| Tax credit for manganese processing .....                                  | 1                         |
| <br>   |                           |
| <u>Marine Resources</u>  |                           |
| Conservation of marine resources .....                                     | 2                         |
| Coordination of marine activities .....                                    | 2                         |
| Development of marine resources .....                                      | 8                         |
| Education research .....   | 1                         |
| Establishment of a Department of Marine Resources and<br>Aquaculture ..... | 1                         |
| <hr/>  |                           |
| Establishment of Marine Resources Division of DLNR .....                   | 1                         |
| Expansion of marine culture industry .....                                 | 1                         |
| Leeward Island marine survey .....   | 1                         |
| Marine Affairs Coordinator .....   | 2                         |
| Marine anti-pollution actions .....  | 1                         |
| <hr/>  |                           |
| Marine research .....  | 2                         |
| Marine resource conservation area .....                                    | 1                         |
| Marine resource management plan .....                                      | 2                         |

Natural Resources

Number of Measures

|  |   |
|--|---|
| Archipelago Baseline study .....                     | 1 |
| Conservation of endangered, threatened species ..... | 8 |
| Conservation of natural resources .....              | 3 |
| Establishment of conservation zones .....            | 4 |
| Establishment of forest/water reserve zones .....    | 1 |

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|   |   |
|---|---|
| Establishment of State Botanist .....         | 1 |
| Exception to the Endangered Species Act ..... | 1 |
| Growth limits .....                           | 1 |
| Kahoolawe .....                               | 1 |
| Kawainui marsh .....                          | 2 |

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|   |   |
|---|---|
| Land/water use commission .....                       | 1 |
| Lava .....  | 2 |
| Policies, programs concerning natural resources ..... | 1 |
| Protection of animal, plant life .....                | 1 |
| Protection of Molokini environment .....              | 1 |

Noise

|  |   |
|--|---|
| Aviation noise elimination .....             | 1 |
| Comprehensive design for noise control ..... | 1 |
| Highway noise abatement .....                | 1 |
| Muffler noise level.....                     | 1 |
| Noise control regulations .....              | 3 |

---

|   |   |
|---|---|
| Public health noise control program ..... | 1 |
| Reduction of noise pollution .....        | 1 |

Pollution

|                                      |   |
|--------------------------------------|---|
| Liquid waste .....                   | 1 |
| Litter control .....                 | 1 |
| Oil pollution .....                  | 2 |
| Pollution control facilities .....   | 2 |
| Pollution control requirements ..... | 2 |

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|                                       |   |
|---------------------------------------|---|
| Pollution control revenue bonds ..... | 7 |
| Shoreline pollution study .....       | 1 |

| <u>Radiation</u>                                | <u>Number of Measures</u> |
|---|---------------------------|
| Nuclear power plant .....                       | 2                         |
| Radiation monitor/survey program .....          | 1                         |
| Radiation safety commission .....               | 1                         |
| Radiation safety program .....                  | 4                         |
| Radiation safety study .....                    | 1                         |
| -----   |                           |
| Radioactive waste disposal .....                | 2                         |
| Regulations for radiation protection .....      | 1                         |
|   |                           |
| <u>Sand</u>                                     |                           |
| Sand mining .....                               | 3                         |
| Sand removal .....                              | 2                         |
| Sand, rock, lime study .....                    | 2                         |
|   |                           |
| <u>Solid Waste</u>                              |                           |
| Beverage containers .....                       | 19                        |
| Litter and solid waste recycling .....          | 2                         |
| Litter and solid waste reduction .....          | 1                         |
| Recycling facilities .....                      | 7                         |
| Resource recovery .....                         | 5                         |
| -----   |                           |
| Solid waste facilities .....                    | 4                         |
| Solid waste management project .....            | 1                         |
| State environmental policy on solid waste ..... | 1                         |
| Waste recovery authority .....                  | 1                         |
|   |                           |
| <u>Transportation</u>                           |                           |
| Fixed guideway system .....                     | 3                         |
| Hawaii belt highway .....                       | 1                         |
| Mass transit .....                              | 6                         |
| Rapid transit .....                             | 2                         |
| Subway transit systems .....                    | 2                         |
| -----   |                           |
| Surface transportation .....                    | 2                         |
| Transportation control commission .....         | 1                         |
| Transportation council .....                    | 1                         |
| Transportation plan .....                       | 2                         |
| Transportation program .....                    | 3                         |
| Water/air/land and transit system .....         | 1                         |

| <u>Water Quality</u>  | <u>Number of Measures</u> |
|---|---------------------------|
| Annual report on quality of state waters .....                    | 1                         |
| Certification of waste water treatment plant personnel ..         | 6                         |
| Safe Drinking Water Act .....                                     | 5                         |
| Sewers .....  | 4                         |
| State implementation of Federal Water Pollution Control Act ..... | 1                         |
| -----   |                           |
| Waste water reclamation/management .....                          | 2                         |
| Water floridation .....   | 2                         |
| Water pollution .....   | 2                         |
| Water pollution control facilities .....                          | 2                         |
| Water pollution control permit .....                              | 1                         |
| -----   |                           |
| Water quality .....   | 1                         |
| Water quality, Department of Health duties .....                  | 1                         |
| Water quality, marine environment .....                           | 2                         |
| Water quality standards .....                                     | 1                         |
| -----   |                           |
| <u>Water Resources</u>  |                           |
| Annual report on State water resources .....                      | 4                         |
| Development of water resources .....                              | 6                         |
| Efficient use of water resources .....                            | 1                         |
| Ground water sources .....  | 1                         |
| Investigation of water resources .....                            | 3                         |
| -----   |                           |
| Protection of water resources .....                               | 1                         |
| Regulation of dams .....  | 1                         |
| Surface waters .....  | 1                         |
| Water conservation .....  | 1                         |
| Water conservation devices .....                                  | 7                         |
| -----   |                           |
| Water resources statute .....                                     | 6                         |
| Water rights .....  | 1                         |
| Water use laws .....  | 1                         |
| Wells .....   | 4                         |

## APPENDIX B

### *Subject Listings from the Directory of Scientific, Engineering and Technological Personnel in Hawaii*

AGRICULTURAL LAND see also - CROP PRODUCTION, LAND USE,  
PESTICIDES, PLANT SCIENCE WEED SCIENCE

AIR QUALITY

AIR TRANSPORTATION

ANIMAL BEHAVIOR

ANIMAL DISEASES see also - DISEASE CONTROL

ANTHROPOLOGY

AQUACULTURE see also - FISHES, SEAWEED

ARCHAEOLOGY

ASTRONOMY see also - RADIATION, REMOTE SENSING

BIOMASS ENERGY

CARTOGRAPHY see also - REMOTE SENSING

CLIMATOLOGY see also - METEOROLOGY, RAINFALL

COASTAL ZONE MANAGEMENT

COMMUNICATIONS see also - TELECOMMUNICATIONS

COMPUTER CONFERENCING SYSTEMS see also - COMMUNICATIONS,  
TELECOMMUNICATIONS

CORAL

CROP PRODUCTION see also - AGRICULTURAL LAND, PESTICIDES, SEED  
RESEARCH, WEED SCIENCE

DESALINIZATION

DISEASE CONTROL see also - ANIMAL DISEASES, TROPICAL DISEASES

DRUGS see also - DISEASE CONTROL

EARTHQUAKES see also - TSUNAMIS

ECONOMIC ANALYSIS

ELECTRICAL ENERGY

ENERGY CONSERVATION

EROSION see also - SOIL SCIENCE, FLOODS

ETHNOBOTANY see also - PLANT SCIENCE

FIRE see also - FORESTRY

FISHES see also - AQUACULTURE

FLOODS see also - RAINFALL, EROSION

FORESTRY see also - FIRE

GASOHOL

GENETICS see also - MEDICAL RESEARCH

GEOHERMAL ENERGY

HEALTH & COMMUNITY SERVICES see also - MENTAL HEALTH, NUTRITION,  
TROPICAL DISEASES

HEALTH STATISTICS

HURRICANES/TYPHOONS see also - METEOROLOGY

HYDROELECTRIC POWER

INDUSTRIAL HYGIENE see also - OCCUPATIONAL HEALTH & SAFETY

LABOR STATISTICS

LAND USE see also - AGRICULTURAL LAND

MANGANESE NODULES see also - MINERAL RESOURCES

MARINE MAMMALS see also - ANIMAL BEHAVIOR, ANIMAL DISEASES

MARKETING RESEARCH see also - PUBLIC OPINION RESEARCH

MASS TRANSPORTATION

MEDICAL RESEARCH see also - DRUGS, GENETICS

MEDICAL TECHNOLOGY see also - HEALTH & COMMUNITY SERVICES

MENTAL HEALTH see also - HEALTH & COMMUNITY SERVICES

METALLURGY

METEROLOGY see also - CLIMATOLOGY, FLOODS,  
HURRICANES/TYPHOONS, RAINFALL

MINERAL RESOURCES see also - MANGANESE NODULES

NOISE POLLUTION

NUCLEAR ENERGY see also - RADIATION

NUTRITION see also - HEALTH & COMMUNITY SERVICES

OCCUPATIONAL HEALTH & SAFETY see also - HEALTH & COMMUNITY  
SERVICES, INDUSTRIAL HYGIENE

OCEAN THERMAL ENERGY

PESTICIDES see also - CROP PRODUCTION, WEED SCIENCE

PLANT SCIENCE see also - SEED RESEARCH, WEED SCIENCE

PROGRAM EVALUATION

PUBLIC OPINION RESEARCH see also - MARKETING RESEARCH

RADIATION see also - NUCLEAR ENERGY

RAINFALL see also - CLIMATOLOGY, METEROLOGY

REMOTE SENSING see also - CARTOGRAPHY

SAND see also - SOIL SCIENCE

SEABIRDS

SEAWEED see also - AQUACULTURE

SEED RESEARCH see also - CROP PRODUCTION, PLANT SCIENCE

SOIL SCIENCE see also - EROSION, SAND

SOLAR ENERGY

SOLID WASTE

SURFACE TRANSPORTATION (excluding Mass Transit)

TAX RESEARCH

TELECOMMUNICATIONS see also - COMMUNICATIONS, COMPUTER  
CONFERENCING SYSTEMS

TROPICAL DISEASES see also - DISEASE CONTROL, DRUGS, HEALTH &  
COMMUNITY SERVICES, HEALTH STATISTICS.

TSUNAMIS see also - EARTHQUAKES

VOLCANOES

WATER DISTRIBUTION

WATER QUALITY

WATER SUPPLY see also - CLIMATOLOGY, HYDROELECTRIC POWER

WATER TRANSPORTATION

WATER TREATMENT

WEED SCIENCE see also - AGRICULTURAL LAND, CROP PRODUCTION,  
PESTICIDES, PLANT SCIENCE

WIND ENERGY

APPENDIX C

SCIENCE, ENGINEERING AND TECHNOLOGY (SET) POLICY PROJECT:

SURVEY OF INFORMATION EXCHANGE BETWEEN LEGISLATORS

AND SET ORGANIZATIONS

Total Responses = 337

1. There are a number of ways in which scientific, engineering and technical (SET) information may have been exchanged between members of your organization and legislators. If your organization has been engaging in such exchanges, please indicate below the method(s) of interaction and the approximate number of exchanges per year. Please check one choice for each method of exchange listed.

Note: The numbers in parentheses are percentages of each response; the numbers below are frequencies of each response.

| Methods of Exchange  | (6+ times per year)<br>Frequently | (3-5 times per year)<br>Occasionally | (1-2 times per year)<br>Rarely | Never              | Did Not Answer  |
|--|-----------------------------------|--------------------------------------|--------------------------------|--------------------|-----------------|
| Provide testimony at legislative committee hearings.   | (17)<br><u>56</u>                 | (13)<br><u>45</u>                    | (25)<br><u>86</u>              | (43)<br><u>144</u> | (2)<br><u>6</u> |
| Participate in panel discussions or workshops attended by legislators at which scientific, engineering and technical issues have been debated. | ( 7)<br><u>24</u>                 | (18)<br><u>61</u>                    | (32)<br><u>108</u>             | (42)<br><u>140</u> | (1)<br><u>4</u> |

(Question 1 continues on next page.)

| Methods of Exchange   | (6+ times per year) Frequently | (3-5 times per year) Occasionally | (1-2 times per year) Rarely | Never              | Did Not Answer   |
|---|--------------------------------|-----------------------------------|-----------------------------|--------------------|------------------|
| Send written material to legislators such as annual reports and prepared publications (except for written testimony). | (11)<br><u>37</u>              | (16)<br><u>54</u>                 | (25)<br><u>85</u>           | (47)<br><u>157</u> | (1)<br><u>4</u>  |
| Write to legislators (letters or short 1-2 page reports).   | (10)<br><u>32</u>              | (17)<br><u>56</u>                 | (29)<br><u>99</u>           | (42)<br><u>143</u> | (2)<br><u>7</u>  |
| Review bills and resolutions for legislators.   | (12)<br><u>39</u>              | (11)<br><u>38</u>                 | (22)<br><u>73</u>           | (53)<br><u>179</u> | (2)<br><u>8</u>  |
| Consult with legislators in the initial drafting of bills and resolutions.  | (6)<br><u>23</u>               | (10)<br><u>33</u>                 | (25)<br><u>84</u>           | (57)<br><u>191</u> | (2)<br><u>6</u>  |
| Phone conversations with legislators in which SET information is exchanged.   | (11)<br><u>37</u>              | (12)<br><u>41</u>                 | (34)<br><u>113</u>          | (42)<br><u>141</u> | (1)<br><u>5</u>  |
| Phone conversations with legislative staff in which SET information is exchanged.                                     | (14)<br><u>47</u>              | (14)<br><u>47</u>                 | (28)<br><u>96</u>           | (41)<br><u>138</u> | (3)<br><u>9</u>  |
| Meet with legislators.  | (16)<br><u>55</u>              | (15)<br><u>50</u>                 | (31)<br><u>104</u>          | (37)<br><u>123</u> | (1)<br><u>5</u>  |
| Meet with legislative staff.  | (14)<br><u>46</u>              | (14)<br><u>47</u>                 | (27)<br><u>92</u>           | (43)<br><u>145</u> | (2)<br><u>7</u>  |
| Participate in task forces, advisory groups or similar <u>ad hoc</u> organizations.                                   | (18)<br><u>60</u>              | (16)<br><u>54</u>                 | (27)<br><u>92</u>           | (35)<br><u>119</u> | (4)<br><u>12</u> |
| Others (Please Specify):<br><u>Lobbyists</u>  | <u>6</u>                       |                                   |                             |                    |                  |
| <u>Intermediary Organization</u>  | <u>13</u>                      |                                   |                             |                    |                  |
|   | (3)                            | (2)                               | (1)                         | (0)                |                  |

2. Which of the following have prompted members of your organization to provide SET information to legislators (by any method listed in question 1)?

| Impetus for Acting   | (6+ times per year)<br>Frequently | (3-5 times per year)<br>Occasionally | (1-2 times per year)<br>Rarely | Never       | Did Not Answer |
|--|-----------------------------------|--------------------------------------|--------------------------------|-------------|----------------|
| Receive requests for SET information from legislators or legislative staff.                  | (13)<br>44                        | (15)<br>50                           | (28)<br>93                     | (39)<br>132 | (5)<br>18      |
| Learn about a legislative issue through the media.   | (16)<br>53                        | (18)<br>61                           | (27)<br>91                     | (31)<br>105 | (8)<br>27      |
| Learn about a legislative issue during conversation with member of another SET organization. | (10)<br>32                        | (18)<br>61                           | (28)<br>95                     | (36)<br>122 | (8)<br>27      |
| Learn about a legislative issue from a client.   | (5)<br>18                         | (12)<br>40                           | (31)<br>105                    | (42)<br>140 | (10)<br>34     |
| Others (please specify):   |                                   |                                      |                                |             |                |
| Self-initiated efforts   | 12                                |                                      |                                |             |                |
| Professional Assoc.  | 6                                 |                                      |                                |             |                |
| State Agency   | 4                                 |                                      |                                |             |                |
| Referral within organ.   | 4                                 |                                      |                                |             |                |
| Referral by other non-Set organizations  | 3                                 |                                      |                                |             |                |
| Federal sources  | 3                                 |                                      |                                |             |                |
| Site Visits  | 1                                 |                                      |                                |             |                |
| Legislative Resolutions  | 1                                 |                                      |                                |             |                |

3. Do you think legislators are receiving sufficient information in your areas of expertise to allow them to make informed decisions in these areas?

|         |        |              |
|---------|--------|--------------|
| (54)    | (43)   | (3)          |
| 181 Yes | 143 No | 13 Undecided |
| (1)     | (2)    | (3)          |

If no, what improvements can you suggest to improve the exchange of information between legislators and experts in your field?

|   |           |
|---|-----------|
| <u>Meetings between legislators &amp; SET experts</u>                                       | <u>22</u> |
| <u>Increase communication between SET experts &amp; legislators</u>                         | <u>16</u> |
| <u>Legislators &amp; their staff should make a greater effort to obtain SET information</u> | <u>15</u> |
| <u>Establish group of SET experts</u>   | <u>11</u> |
| <u>Compile a Resource Directory</u>   | <u>11</u> |
| <u>Contact Professional Associations</u>  | <u>10</u> |
| <u>Site visits</u>  | <u>10</u> |
| <u>Increase informal contacts between legislators &amp; SET experts</u>                     | <u>7</u>  |
| <u>SET experts should provide information before bills are drafted</u>                      | <u>6</u>  |
| <u>Hire better legislative staff</u>  | <u>4</u>  |
| <u>Establish a Clearinghouse operation</u>  | <u>3</u>  |
| <u>Assign SET topic to each legislator</u>  | <u>2</u>  |
| <u>Hire better staff in executive agencies</u>  | <u>2</u>  |
| <u>Conduct in-depth studies on SET issues</u>   | <u>2</u>  |
| <u>Improve quality of data provided to legislators</u>                                      | <u>2</u>  |
| <u>More private sector involvement</u>  | <u>2</u>  |
| <u>Assign SET expert to each legislator</u>   | <u>1</u>  |
| <u>Hire graduate students with SET backgrounds</u>  | <u>1</u>  |
| <u>Increase liaison between legislators &amp; University personnel</u>                      | <u>1</u>  |
| <u>Hire part-time University faculty during the legislative session</u>                     | <u>1</u>  |

4. We would like to know the science, engineering or technical subject areas in which your organization renders assistance. Please indicate those areas which are of major importance to your organization. If you mark more than six areas, please place an asterisk (\*) by the six areas of greatest importance to your organization.

ARCHAEOLOGY/ANTHROPOLOGY

|              |       |        |
|--------------|-------|--------|
| Archaeology  | _____ | 29 [ ] |
| Anthropology | _____ | 30 [ ] |
| Other _____  | _____ | 31 [ ] |

AGRICULTURE

|                       |       |        |
|-----------------------|-------|--------|
| Aquaculture           | _____ | 32 [ ] |
| Pesticides/Herbicides | _____ | 33 [ ] |
| Soil Sciences         | _____ | 34 [ ] |
| Other _____           | _____ | 35 [ ] |

## COMMUNICATIONS

|                |       |       |
|----------------|-------|-------|
| Communications | _____ | 36[ ] |
| Other _____    | _____ | 37[ ] |

## DISASTER PREVENTION & RELIEF

|             |       |       |
|-------------|-------|-------|
| Earthquakes | _____ | 38[ ] |
| Erosion     | _____ | 39[ ] |
| Floods      | _____ | 40[ ] |
| Tsunamis    | _____ | 41[ ] |
| Other _____ | _____ | 42[ ] |

## ENERGY

|               |       |       |
|---------------|-------|-------|
| Biomass       | _____ | 43[ ] |
| Geothermal    | _____ | 44[ ] |
| Nuclear       | _____ | 45[ ] |
| Ocean Thermal | _____ | 46[ ] |
| Solar         | _____ | 47[ ] |
| Wind          | _____ | 48[ ] |
| Other _____   | _____ | 49[ ] |

## ENVIRONMENTAL MANAGEMENT

|                         |       |       |
|-------------------------|-------|-------|
| Air Quality             | _____ | 50[ ] |
| Coastal Zone Management | _____ | 51[ ] |
| Forestry                | _____ | 52[ ] |
| Noise Pollution         | _____ | 53[ ] |
| Solid Waste             | _____ | 54[ ] |
| Water Quality           | _____ | 55[ ] |
| Other _____             | _____ | 56[ ] |

## HEALTH

|                    |       |       |
|--------------------|-------|-------|
| Drugs              | _____ | 57[ ] |
| Nutrition          | _____ | 58[ ] |
| Medical Technology | _____ | 59[ ] |
| Radiation          | _____ | 60[ ] |
| Other _____        | _____ | 61[ ] |

## MARINE RESOURCES

|                   |       |       |
|-------------------|-------|-------|
| Coral             | _____ | 62[ ] |
| Fish              | _____ | 63[ ] |
| Manganese Nodules | _____ | 64[ ] |
| Sand              | _____ | 65[ ] |
| Seaweed           | _____ | 66[ ] |
| Other _____       | _____ | 67[ ] |

TRANSPORTATION

|  |       |       |
|--|-------|-------|
| Air                                      | _____ | 68[ ] |
| Water                                    | _____ | 69[ ] |
| Surface Transit (excluding mass transit) | _____ | 70[ ] |
| Mass Transit                             | _____ | 71[ ] |
| Other _____                              | _____ | 72[ ] |

WATER RESOURCES

|              |       |       |
|--------------|-------|-------|
| Supply       | _____ | 73[ ] |
| Distribution | _____ | 74[ ] |
| Other _____  | _____ | 75[ ] |

ADDITIONAL SUBJECT AREAS

|       |       |       |
|-------|-------|-------|
| _____ | _____ | 76[ ] |
| _____ | _____ | 77[ ] |
| _____ | _____ | 78[ ] |

5. Would you or your organization be willing to respond to legislative information requests occasionally (3-5 times per year) if contacted by a formal SET organization? (An example of a formal SET organization might be a Science and Technology branch of a legislative information service or a formal system of information exchange between University SET experts and legislators.)

|                |              |                       |
|----------------|--------------|-----------------------|
| (86)           | (9)          | (5)                   |
| <u>290</u> Yes | <u>29</u> No | <u>18</u> (no answer) |
| (1)            | (2)          |                       |

Qualifying comment, if any:

|   |    |
|---|----|
| <u>Yes, if adequate time</u>                  | 9  |
| <u>Yes, if pertinent to area of expertise</u> | 16 |
| <u>Yes, if reasonable</u>                     | 11 |
| <u>Yes, if available staff</u>                | 8  |
| <u>Yes, if cleared with management</u>        | 9  |
| <u>Yes, if no conflict with client</u>        | 4  |
| <u>No, staff too small</u>                    | 5  |
| <u>No, no need for SET information</u>        | 3  |
| <u>Neutral, already do</u>                    | 5  |

If yes, who would be the person to contact in your organization?

\_\_\_\_\_  
Name

\_\_\_\_\_  
Phone Number

6. If a scientific, engineering and technical resource directory were compiled utilizing the information from questions 4 and 5, would you or your organization like to be included?

|                |              |                       |
|----------------|--------------|-----------------------|
| (82)           | (14)         | (4)                   |
| <u>277</u> Yes | <u>48</u> No | <u>12</u> (no answer) |

7. Please note below any additional comments you would like to make relating to exchange between Legislators and SET organizations (add an additional page if you wish).

Thank you on behalf of the Office of the Legislative Auditor and the Urban and Regional Planning Program for taking the time to respond to this questionnaire. The data you have provided will help to insure the success of our project.

Frequencies for Each Mode of Exchange by Class of Organization

| <u>Class of Organization</u> | <u>Provide Testimony at Legislative Committee Hearings</u> |    |       |
|------------------------------|--|----|-------|
|                              | Yes  | No | Blank |
| Government Agencies          | 56   | 24 | 1     |
| Private Firms                | 81   | 93 | 5     |
| Professional Associations    | 9  | 14 | 0     |
| Educational Institutions     | 41   | 13 | 0     |

|                           | <u>Participate in Panel Discussions on Workshops Attended by Legislators at which SET Issues have been Debated</u> |    |       |
|---------------------------|--|----|-------|
|                           | Yes  | No | Blank |
| Government Agencies       | 56   | 25 | 0     |
| Private Firms             | 92   | 83 | 4     |
| Professional Associations | 12   | 11 | 0     |
| Educational Institutions  | 33   | 21 | 0     |

|                           | <u>Send written material to Legislators such as Annual Reports &amp; Prepared Publications (except for written testimony)</u> |     |       |
|---------------------------|---|-----|-------|
|                           | Yes   | No  | Blank |
| Government Agencies       | 60  | 21  | 0     |
| Private Firms             | 71  | 104 | 4     |
| Professional Associations | 8   | 15  | 0     |
| Educational Institutions  | 37  | 17  | 0     |

| <u>Class of Organization</u> | <u>Write to Legislators (letters or short 1-2 page reports)</u> |    |       |
|------------------------------|---|----|-------|
|                              | Yes   | No | Blank |
| Government Agencies          | 56  | 24 | 1     |
| Private Firms                | 83  | 91 | 5     |
| Professional Associations    | 12  | 11 | 0     |
| Educational Institutions     | 36  | 17 | 1     |

|                           | <u>Review Bills &amp; Resolutions for Legislators</u> |     |       |
|---------------------------|---|-----|-------|
|                           | Yes   | No  | Blank |
| Government Agencies       | 49  | 32  | 0     |
| Private Firms             | 66  | 107 | 6     |
| Professional Associations | 8   | 14  | 1     |
| Educational Institutions  | 27  | 26  | 1     |

|                           | <u>Consult with Legislators in the Initial Drafting of Bills &amp; Resolutions</u> |     |       |
|---------------------------|--|-----|-------|
|                           | Yes  | No  | Blank |
| Government Agencies       | 50   | 31  | 0     |
| Private Firms             | 58   | 117 | 4     |
| Professional Associations | 7  | 15  | 1     |
| Educational Institutions  | 25   | 28  | 1     |

| <u>Class of Organization</u> | <u>Phone Conversations with Legislators<br/>in which SET Information is<br/>Exchanged</u> |    |       |
|------------------------------|---|----|-------|
|                              | Yes   | No | Blank |
| Government Agencies          | 61  | 20 | 0     |
| Private Firms                | 86  | 90 | 3     |
| Professional Associations    | 8   | 14 | 1     |
| Educational Institutions     | 36  | 17 | 1     |

|                           | <u>Phone Conversations with Legislative<br/>Staff in which SET Information is<br/>Exchanged</u> |    |       |
|---------------------------|---|----|-------|
|                           | Yes   | No | Blank |
| Government Agencies       | 63  | 18 | 0     |
| Private Firms             | 83  | 91 | 5     |
| Professional Associations | 11  | 11 | 1     |
| Educational Institutions  | 33  | 18 | 3     |

|                           | <u>Meet with Legislators</u> |    |       |
|---------------------------|------------------------------|----|-------|
|                           | Yes                          | No | Blank |
| Government Agencies       | 58                           | 23 | 0     |
| Private Firms             | 104                          | 72 | 3     |
| Professional Associations | 11                           | 11 | 1     |
| Educational Institutions  | 36                           | 17 | 1     |

| <u>Class of Organization</u> | <u>Meet with Legislative Staff</u> |    |       |
|------------------------------|------------------------------------|----|-------|
|                              | Yes                                | No | Blank |
| Government Agencies          | 58                                 | 23 | 0     |
| Private Firms                | 83                                 | 91 | 5     |
| Professional Associations    | 9                                  | 13 | 1     |
| Educational Institutions     | 35                                 | 18 | 1     |

| <u>Class of Organization</u> | <u>Participate in Task Forces, Advisory Groups or Similar Ad Hoc Organizations</u> |    |       |
|------------------------------|--|----|-------|
|                              | Yes  | No | Blank |
| Government Agencies          | 62   | 18 | 1     |
| Private Firms                | 94   | 76 | 9     |
| Professional Associations    | 12   | 10 | 1     |
| Educational Institutions     | 38   | 15 | 1     |

How Organizations Learn About a Legislative Issue:  
Frequencies by Class of Organization

| <u>Class of Organization</u> | <u>Receive Requests for SET Information<br/>from Legislators or Legislative Staff</u> |    |       |
|------------------------------|---|----|-------|
|                              | Yes   | No | Blank |
| Government Agencies          | 61  | 19 | 1     |
| Private Firms                | 83  | 82 | 14    |
| Professional Associations    | 10  | 12 | 1     |
| Educational Institutions     | 33  | 19 | 2     |

| <u>Class of Organization</u> | <u>Learn about a Legislative Issue<br/>through the Media</u> |    |       |
|------------------------------|--|----|-------|
|                              | Yes  | No | Blank |
| Government Agencies          | 45   | 30 | 6     |
| Private Firms                | 110  | 53 | 16    |
| Professional Associations    | 14   | 7  | 2     |
| Educational Institutions     | 36   | 15 | 3     |

| <u>Class of Organization</u> | <u>Learn about a Legislative Issue<br/>during a Conversation with a Member<br/>of Another SET Organization</u> |    |       |
|------------------------------|--|----|-------|
|                              | Yes  | No | Blank |
| Government Agencies          | 46   | 30 | 5     |
| Private Firms                | 100  | 63 | 16    |
| Professional Associations    | 12   | 9  | 2     |
| Educational Institutions     | 30   | 20 | 4     |

| <u>Class of Organization</u> | <u>Learn about a Legislative Issue<br/>from a Client</u> |    |       |
|------------------------------|--|----|-------|
|                              | Yes  | No | Blank |
| Government Agencies          | 35   | 38 | 8     |
| Private Firms                | 101  | 61 | 17    |
| Professional Associations    | 7  | 12 | 4     |
| Educational Institutions     | 20   | 29 | 5     |



## APPENDIX D

### Transcript of the 1979 Annual Meeting of Sigma Xi Hawaii SET Project

On May 11, 1979, the Society of Sigma Xi, Hawaii Chapter, an honorary scientific society, devoted the discussion at its annual meeting to the consideration of a mechanism by which the transfer of scientific and technical information to governmental bodies in Hawaii might be improved. Since the Office of the Legislative Auditor and the Urban and Regional Planning Program had been working together to design a formal information transfer mechanism, with funds provided by the National Science Foundation, Dr. Doak Cox, President of Sigma Xi thought it timely to present his idea for discussion to the membership, and invited Clinton Tanimura, the Legislative Auditor, and Tom Dinell, Director of the Urban and Regional Planning Program to participate in a panel discussion at the Sigma Xi annual meeting.

The following reports include the transcripts of the three principal speakers, and a summary of the audience discussion.

- 1) Page D2 Speech by Tom Dinell, Director, URPP
- 2) Page D5 Speech by Clinton Tanimura, Legislative Auditor
- 3) Page D8 Speech by Doak C. Cox, President, Sigma Xi
- 4) Page D13 Audience Discussion

## THE HAWAII SCIENCE, ENGINEERING & TECHNOLOGY PROJECT

Tom Dinell, Director  
Urban and Regional Planning Program  
University of Hawaii

In 1976 Congress appropriated three million dollars to the National Science Foundation to assist state governments in improving their ability to utilize science, engineering and technology resources in their decision-making processes. This appropriation was partially in response to the increasing technical and complex nature of issues which have confronted State governments in the past few years. The Hawaii State Legislature, for example, has considered bills and resolutions pertaining to commercial fisheries development, alternate energy sources, aquaculture, mass transit, pollution control, solid waste disposal, coral harvesting, biomedicine and manganese nodules. Grants from NSF have been awarded to approximately 30 states to create or improve science, engineering and technical information exchange systems for their legislators.

The Hawaii SET project is the result of a grant from NSF to the Office of the Legislative Auditor, which in turn is executing the project through the Urban and Regional Planning Program (URPP). We agreed to accept the project on condition that we be able to utilize resources of the Auditor's Office on an ongoing basis. So, essentially, the Hawaii SET project has become a joint effort between URPP and the Legislative Auditor.

During the project's initial phase, we contacted Dr. Doak Cox of the Environmental Center, who has some thoughts about how the scientific community can contribute to a SET information system. This evening, Clint Tanimura will discuss what he perceives to be the needs of legislators, and Dr. Cox will discuss how the scientific community can respond to those needs.

Very briefly, I would like to indicate what systems are being created in other states. First, I will describe some basic structures for SET information systems which have been developed; then I will discuss what specific states have recommended or already have in operation.

There have been at least three basic approaches to the structural development of a SET information service. A number of states have established a special legislative committee or subcommittee possessing special scientific, engineering or technological capabilities to monitor and comment on SET measures prior to their referral to the appropriate legislative committees. Both Washington and New Hampshire have moved in this direction. Other states have established formal information exchange links with their state universities. With this approach, legislative information requests are first referred to a senior faculty member at each school, who operates as a "clearinghouse." Once the request has been received by this senior administrator, it is then distributed to the appropriate SET person(s) on campus. Formal links with Universities have been established in Maryland. A third approach has been to add a professional SET staff to an existing legislative service agency. The SET people may act as resources themselves or they may function as links between legislators and SET experts in the community. This basic approach is being recommended in Nevada and North Carolina, and has already been developed in Wisconsin.

There are many variations on these basic SET structures. The state of Maryland, for example, has established a Science Division in the Department of Legislative Reference, General Assembly of Maryland, consisting of two full-time staff scientists. The Division functions as a link with the Maryland University system to obtain detailed SET information during the interim. When the General Assembly is in session, the Division hires two part-time University faculty members. With the additional manpower, the Division is able to answer information requests in-house, either through its own expertise in a subject area or by phoning the appropriate SET person in the community to obtain the relevant data. This in-house capability allows for a quick turnaround time on information requests and is therefore a more appropriate information service than University linkages during the fast-paced legislative session.

The State of Montana has recommended that the task of developing a legislative scientific and technical information network be assigned to the Environmental Quality Council, a special legislative council consisting of senators, representatives and members of the general public. Montana also proposes to establish formal information links with the University system and a computer hookup with other state legislatures (utilizing the EIES/LEGITECH computer conferencing network, which interconnects 25 legislative agencies, 20 federal agencies and the National Conference of State Legislatures).

New Hampshire has developed a rather elaborate SET information exchange system. A Science Advisor is selected jointly by the Senate President and Speaker of the House, who advises the Senate Energy Committee and House Science and Technology Committee. The members of these committees will monitor bills and resolutions introduced into the New Hampshire State Legislature for scientific, engineering or technical content. A New Hampshire Legislative Academy of Science will be created composed of selected SET experts in the community and under the direction of the science advisor. This organization will supply information to the members of the Senate Energy Committee and House Science and Technology Committee so that these legislators may make informed suggestions and comments on bills and resolutions pertaining to SET topics. The two committees will also brief the leadership of the House and Senate on potential SET issues which may be introduced.

The State of Washington has recommended that the House and Senate should each hire a SET staff. For each legislative session, all proposed bills will be screened to determine which have a significant scientific or technical content. From those identified, a limited number (based on importance and probability of action) will be assigned to the SET staff which will develop and attach a brief statement of impact or analysis, prior to the bill being sent to the appropriate legislative committees. This practice compares with that of attaching a fiscal note to bills requiring an appropriation. It was further recommended that the Washington SET staff consist of generalists with scientific or technical backgrounds rather than specialists in any one field.

Wisconsin has developed a Science and Technology staff in its State Legislative Council which offers a variety of services to legislators, including: (1) the compilation of informational memos, upon request, which summarize SET

comments from several sources, (2) technical evaluation of proposed bills and resolutions, (3) recruitment of experts to testify before legislative committee hearings, and (4) consultation in the drafting of bills and resolutions.

The Minnesota Science and Technology Project has been in operation for approximately two years, consisting of two professional scientists who work under the jurisdiction of the Joint Legislative Coordinating Commission. The Project staff compiles inquiry responses (one-to-two-pages), hires consultants to prepare comprehensive SET issue papers, arranges field trips and informal meetings between legislators and SET experts, and publishes newsletters periodically to inform legislators of current S & T publications and activities.

California has established the Assembly Science and Technology Council, consisting of between five and twenty members appointed by the Assembly Speaker. Information dissemination by the Council is conducted largely through ad hoc technical panels, created to undertake specific projects. The Assembly Speaker reviews all requests for Council assignments. The Council is able to initiate project proposals without waiting for requests from legislators, but this option is rarely used.

Based on the research we have conducted thus far, New York is the only state we know of where the SET organization utilizes the expertise found in scientific, engineering and technological associations on a regular basis. The scientific staff of the New York State Assembly have submitted bills to scientific and engineering professional societies for their review and comments. They have also arranged for dialogues between members of SET professional societies and legislative committees.

The development of legislative SET capabilities is currently generating a great deal of interest and concern throughout the nation because of the steadily increasing number of scientific, engineering and technical issues facing state legislatures. Hawaii is no exception to this trend. We conducted an inventory of bills and resolutions introduced into the Hawaii State Legislature which pertained to SET issues, and discovered that over the past six years more than 800 of these measures have confronted our legislators.

This is a policy issue that is currently on the agenda for Hawaii and one to which the Legislature is now directing its attention. In our opinion, it is fortunate that they have chosen to involve the University of Hawaii in the consideration of how communication can be improved between the scientific community and the Legislature. Whatever SET information system is developed for Hawaii, we think that a two-way flow of communication is essential between legislators and scientists. With two-way communication, scientists can provide concise, timely information to legislators and legislators will be better able to make their information needs known to the scientific community.

Now that I have provided the solution to the problem, I will turn it over to Clint to provide the questions. We always follow proper scientific procedure!

THE LEGISLATURE'S NEED  
FOR SCIENTIFIC AND TECHNOLOGICAL INFORMATION

Clinton T. Tanimura  
Legislative Auditor, State of Hawaii

May 11, 1979

INTRODUCTION

My portion of the discussion deals with the need of the State Legislature for scientific and technological information. But first, it might be useful to place my discussion in the context of what has been happening to state legislatures generally.

In recent years, state legislatures across the country have been retooling themselves to meet the demands of increasingly complex policy issues. They have also sought to assert themselves as co-equal branches of government.

The movement of legislatures to strengthen themselves is manifest in several trends. Most legislatures have increased both the quality and the number of their staffs to support legislative policymaking. They are also making increasing use of information resources. In addition, there appears to be a growing emphasis on policy analysis - the review of alternatives before policies are enacted - as well as policy assessment - the review of existing policies to determine whether they are still appropriate.

Hawaii's legislature seems to be in the mainstream of the national trend to shore up legislative capabilities. In recent years, both the Senate and the House of Representatives have set up offices of research. The more complex issues faced by the legislature are often deferred for extensive study during the interim period when a larger pool of information resources can be tapped. And, increasingly, the legislature has commissioned studies and analyses before making policy commitments.

THE RECOGNITION OF SCIENTIFIC  
AND TECHNOLOGICAL ISSUES

Even as this trend of legislative retooling can be discerned, there is another trend which has posed a demanding challenge to legislatures. More and more in recent years legislatures have had to face issues with complex scientific and technological implications. Much of this development is due to increased legislative and public awareness of such large issues as environmental quality and protection, energy conservation and the search for alternative forms of energy, and the application of science and technology to economic development.

Nationally, in a study done in 1975, over 80 percent of the state legislators who were surveyed reported that recent legislative agendas have contained an increasing number of issues which require scientific and technological information. In Hawaii, a recent survey conducted by the Pacific Affairs and Urban Studies Program showed that in the six legislative sessions between 1973 and 1978 a total of 805 bills and resolutions were introduced in the State Legislature relating to scientific, engineering, and technical subjects. Of these some 800 measures with significant scientific and technological implications, 94 were enacted into law or adopted as legislative resolutions.

The measures considered by the legislature ranged broadly from such general areas of emphasis as agriculture, aquaculture, and energy to the more specific issues of geothermal development, manganese nodules, noise and air pollution, and solid waste conversion and recovery.

In considering the broad range of scientific and technological issues, the legislature has labored under two serious constraints: the limitation of time and the limitation of knowledge. These limitations are generally to be found in any legislative process, but they weigh more heavily with scientific and technological issues, because such issues are likely to be more complex, and they are often without any clearcut solutions. The dilemma is that, increasingly, legislators have been required to make decisions on technical matters within the short and limited span of a 60-day session without any clearly defined and dominant solutions.

The Hawaii State Legislature has recognized this dilemma and the need to increase its capabilities to deal with the issues of science and technology. However, its efforts to date have not yielded the results intended.

In 1972, the Hawaii State Legislature passed legislation to establish a Legislative Scientific Advisory Committee. It was the intent of the legislature that legislative committees would be able to draw upon the Scientific Advisory Committee for advice on a broad range of issues.

The Scientific Advisory Committee was, in fact, established, but unfortunately the results fell short of legislative expectations. While the committee was composed of a number of prominent scientists representing a fairly broad range of experiences and disciplines, it lacked the immediate expertise to focus upon and render advice on specific legislative issues. It was perhaps unreasonable to expect the committee members representing the engineering sciences to have either the interest or the ability to deal with an issue involving the quality of health care or, conversely, to expect medical specialists to apply their backgrounds to water conservation.

Moreover, the role of the Scientific Advisory Committee and its relationship to the various standing committees of the legislature were not clearly defined. There was no mechanism by which legislative committee chairmen could identify issues, present them to the Scientific Advisory Committee, and secure the committee's advice in the timely manner which a tight legislative calendar requires.

Thus, however well intentioned was the purpose of the legislature in establishing the Scientific Advisory Committee, it was not too long before it fell into disuse.

The current state of affairs is that the scientific community has little formal or systematic involvement with the legislature. Some legislators do seek advice, but usually only informally on very short notice and, consequently, with limited results. Some scientists do render advice, but quite often their perspectives and their involvement are limited by the particular pet project which they support.

It seems reasonably clear that some new system must be designed if the legislature is to benefit from the potentially valuable contribution which science and technology can make to the legislative policymaking process.

### PROSPECTS FOR THE FUTURE

At the present time, our office and the Urban and Regional Planning Program are taking a fresh look at how science and technology can be brought to bear on some of the issues faced by the legislature. One would hope that if science can be marshalled to train and equip our athletes in preparation for the 1980 Olympic Games in Moscow, surely science and technology, here and elsewhere, can be enlisted to solve some of the problems which affect the well-being of people and the welfare of the State.

It is not certain at this time what specific form scientific and technological involvement should take. It would appear, however, that the scientists of our community could greatly advance legislative perspectives if we had a system by which the legislature could be informed of present and impending scientific developments which should be considered - a type of "early warning" system from science beamed to the legislature. Perhaps, a forum on scientific and technological developments could be convened with each new legislature to provide the means through which members of the scientific community can communicate with legislators. Perhaps, too, if scientists understand that legislators are not scientists but are merely lay consumers of scientific information, a way might be found by which scientists can communicate in lay person's terms and be involved in writing policy analysis of scientific issues which merit the attention of the legislature.

In any event, this much is clear: in the years ahead, the legislature will be faced with even more complex issues. The scientific community can help the legislature to understand these issues better and assist it in making the right decisions. The answer probably lies in a system which encourages the scientific community to help the legislature and a system which encourages the legislature to accept that help.

## SCIENTIFIC INFORMATION NEEDS IN GOVERNMENTAL DECISION MAKING

by Doak C. Cox, Director  
Environmental Center  
University of Hawaii

The need with which we are concerned is often referred to as relating to the transfer of scientific information to those who are elected or appointed to make decisions for the public as a whole. For reasons that will become apparent in a moment, I wish to express the concern more broadly as relating to the need for improvement in the complex process by which information is exchanged between the scientific community and the governmental decision-making community.

There is evidence of a growing anti-rational, anti-intellectual movement in our society, and specifically a growing distrust of science. From examination of the roots of this movement, I think we may learn something about the inadequacies of the mechanism for information exchange and even about the limitations of science as it applies to decision-making. However, in spite of the growth of the movement, it is clear that science has an increasingly important role in society.

Our concern is by no means a new one. The use of science in public decision making antedates the application of the term science to organized, objective information. Many of us have been concerned with the adequacy of the transfer process for a long time.

My entire professional career has been devoted to the combination of scientific research and application. Initially, my work was restricted to a variety of geophysical fields. However, for several years I have been involved in the organization and operation of the Environmental Center of the University, whose major function has been to pool competence in a broad array of scientific disciplines related to public problems and make the results available to public decision makers. The Center was established to contribute to the improvement which is our concern, but the coordinating efforts of the Center are restricted to the University community and to environmental problems, whereas the needs relate to a broader array of problems, and the scientific competence is by no means restricted to the University. Hence the Center's function only partially meets the need.

It will help, I think, if we recognize several more or less distinct dimensions of the transfer process or its components by examining the process from several different viewpoints.

### Directionality dimension

The first of these, I will refer to as the dimension of directionality of information flow. Identification of the need as pertaining to the transfer of scientific information implies a one-directional flow of such information from scientists to decision makers. I believe that a transfer in the reverse direction is of equal importance - the transfer of problem perception. I am not referring here just to problem identification - the process by which a problem recognized by decision makers is brought to the attention of potential advisors in the scientific community.

I am referring to the process by which the decision makers' understanding of the nature of the problem is transferred to the scientists. Scientists in different disciplines are likely to perceive a problem in different ways, none of them identical to the perceptions of the decision makers. Unless the problem is perceived in much the same way by those who must decide upon its solution and those who are advising on the decision, the solution is unlikely to be successful.

Achievement of mutual understanding is necessary to a successful solution and can generally be brought about only if there is a transfer of some of the non-technical understanding of the decision makers to their scientific advisors as well as a transfer of technical information from the advisors to the decision makers. In the case of a problem that is complex or demands a complex solution, optimal mutuality of understanding cannot be brought about by a single round of information transfers, but only through extensive dialogue. This requires considerable time; and the experience that our Environmental Center has had in the Legislature indicates that it is difficult to program such dialogue in the course of a legislative session. Our experience clearly indicates, however, the importance of information transfers in both directions. I expect that the distrust of science as a basis for public decisions stems to a considerable extent from the "quick fixes" that result from inadequate mutual understanding of scientists and decision makers.

#### The dimension of problem types

Another dimension of the transfer process relates to the range of problems in whose solution it is used. These problems are very diverse and, to the extent that the improvement of the process may involve formal institutionalization, it will probably be necessary to put some bounds on the range with which any particular institution will be expected to deal. This is especially probable in the case of a pilot endeavor.

For two reasons, I think it expectable that these bounds will be established primarily by the public decision makers. First, the decision makers control the public funding on which the institution may depend. Second, they represent the public in determining priorities of problem solution. I can offer no further suggestions as to defining the scope of the problems that might effectively be dealt with by a particular institution intended to improve the necessary information exchange between the scientific and decision-making community.

However, there are at least three reasons why the choice of problems on which scientific advice is offered to decision makers should not be made by the decision makers alone. First, public decision makers have an obligation to listen to the advice of the members of the public whom they are elected or appointed to represent, including those members who happen to be scientists. Second, scientists may have the foresight to spot important problems before their importance is realized by the public as a whole or by the decision makers, although not so often, I think, as scientists would like to think. Third, the insight of scientists should be involved in distinguishing between problems in whose solution scientific advice will be critical from those in whose solution such advice will be trivial. This last reason applies even in the case of information exchange sought through an institution intended to facilitate such exchange.

## Disciplinary dimension

Although decision-makers will see the need with which we are concerned in relation to the problem dimension, the need will be seen by scientists as related to the disciplines in which scientific information is organized.

Conventionally a distinction is made between the applied sciences and the so-called "pure" sciences. There is a significant correlation between types of problems and the scientific information that is applicable to their solution only in the case of the applied-science disciplines such as the medical sciences and engineering sciences. Each of these applied sciences incorporates information drawn from a number of basic-science disciplines. However, the information that should be used in the solution of a problem often includes disciplines that are not usually regarded as contributing to the applied-science discipline that is considered to apply most directly to the problem. Health problems for example are the particular concern of the medical sciences, and through them biology and to some extent chemistry and physics may be involved. We are now forced to recognize, however, that there are financial aspects of health problems that are not dealt with by the medical sciences, or their components, but by economics.

There is no doubt considerable room for improvement in the transfer of information between the community of decision makers and the communities of specialists in individual applied-science disciplines. The optimizational solutions to the most important problems, however, will require transfers of information that are not restricted in accordance with traditional or disciplinary lines. Some limitations as to disciplinary scope may be inescapable in a single institution intended to facilitate information transfers, but in my opinion such limitations should be avoided insofar as possible.

## Dimension of government organization

I wish to turn now to three institutional dimensions of the need. The first pertains to public decision-making responsibilities. These are divided among the three branches of government. The legislative branch is responsible for the establishment of public policy through the enactment of statutes; the executive branch for the implementation of the statutes; and the judicial branch for determining the constitutionality of the statutes, interpreting them in specific cases, and adjudicating issues arising among individuals and groups. Scientific information is significant in the decision making of all three branches.

The executive branch of government has relatively easy access to scientific information through the scientists on the staffs of its departments and through consultants. Although there are clear inadequacies in the quality of scientific information provided and in the extent to which such information is used, the need for improvement in information transfer seems to me not so great in the case of the executive branch as in the case of the other two branches.

The Legislature obtains scientific information in the form of testimony at public hearings, and can obtain additional advice through the Legislative Reference Bureau and from the executive departments. In the past it has also obtained some

information from a Legislative Scientific Advisory Council. There is, however, a need for improvement in the information exchange mechanism, and as indicated by Mr. Dinnel and Mr. Tanimura, this is a need recognized by the Legislature itself.

The judicial branch, too, is supplied with scientific information, but primarily information selected to bolster the cases of the adversaries in the cases before the courts. Even what are called "friends of the court" turn out usually to be friends of one adversary position or the other, and not the kinds of "friends" that could assist the courts with objective evaluations of the evidence introduced. Hence I see a particular need for improvement in the information exchange process used by the courts. Even if the primary objective of an investigation of means for improvement is related to the needs of the Legislature, I hope some thought will be given to identifying a mechanism that may serve the needs of the court as well.

#### Dimension of scientific institutionalization

There are really two more or less distinct sets of dimensions in the institutionalization of science. The first relates to the employment of scientists.

Some of us are employed by universities and colleges to teach as well as perform scientific research. Some are employed on the staffs of government agencies, non-profit research institutions such as the Bishop Museum, or research units in non-profit service institutions such as hospitals. Others are employed in institutions serving profit-making industries, such as the Experiment Station of the Hawaiian Sugar Planters Asssocation. Still others are employed in consulting firms or self-employed as consultants.

Some of the academicians among us are inclined to consider that, in general, our industrial and consulting counterparts have less competence than ourselves. Those engaged in consulting and industrial support are inclined to consider the academicians generally have little to offer to the solution of practical problems. Both of these generalizations are to some extent shared by non-scientists, including public decision makers. However, on the basis of personal experience at both ends of the spectrum of employment, I think neither of these generalities is valid.

Another shared generalization is that, in relation to public problems that are of concern to their employers, the advice of scientists in private employment is biased in favor of the economic advantage of their employers and that of scientists employed in government agencies is biased in favor of the policies of the agencies.

This generalization has considerable validity, at least to the extent that a scientist may be discouraged from testifying on an issue in which his employer has an economic or policy interest unless his scientific conclusions are compatible with his employer's interest. However, in an open information exchange process, there is a very strong curb on such bias in the desire of scientists to maintain their professional reputation in the scientific community.

The second institutional dimension is represented in institutions of science itself, the scientific societies.

There is a close correspondence between the organization of the scientific societies and the disciplinary organization of scientific information. The societies may be distinguished, by whether they represent science in general, as do Sigma Xi and the Hawaiian Academy of Science; they represent combinations of disciplines; or represent individual disciplines. The societies may also be distinguished by whether they relate to the applied sciences (or scientific professions) as does the Hawaii Medical Association, or to the pure sciences or combinations of pure and applied sciences as do the Botanical Society, Entomological Society, Chemical Society, and Society of Civil Engineers, for example. If they do not represent science in general, the societies may be distinguished further by the particular disciplines to which they relate. Another dimension that is of some importance in relation to the potential role of the societies in the transfer process with which we are concerned is the extent to which scientific competence is a criterion for membership in the societies. Nominees for membership in Sigma Xi, for example, are carefully screened for competence before admission by election, whereas membership in the Hawaii Academy of Science is open to all expressing an interest in the promotion of science.

As I have noted earlier, the applied sciences have the most direct pertinence to public problems, but in the possible use of the applied science societies there is a potential for a bias closely resembling the bias associated with employment, namely the bias associated with protecting a profession, for example, that of medicine or engineering. We should recognize, however, that bias is possible even in the case of the "purest" of the sciences--the kind of bias associated with "schools of thought" between which an objective choice cannot yet be made.

It has seemed to me that the community of scientists itself has a very distinct stake in the transfer process with which we are concerned and with the quality of the scientific information used in public decision making. For this reason, it has seemed to me that the community of scientists and the institutions representing this community may properly have a substantial role in the improvement of the process. Most scientists are both employed in scientific work and as members of one or more scientific societies. Hence the scientific community can be tapped either through its employing institutions or through its societies. If employing institutions were used, bias in the scientific information provided by the scientific community could be minimized by using only academic and non-profit institutions, but this would undesirably eliminate the important contribution that scientists employed in other institutions could make. Hence I believe that the scientific societies may have an important role in investigating methods for achieving the desired improvement and quite possibly in participating in the improved process. There are so many scientific societies, that it seems to me the responsibility lies most heavily on those with broad interests.

For these reasons, I have suggested to the Sigma Xi Council that our Society, together with other scientific societies yet to be selected, take the lead in investigating how the improvement may best be achieved, in parallel with and preferably in connection with the investigation now begun by the Urban & Regional Planning Program at the instigation of the Legislative Auditor.

Having made the suggestion only at the end of my term as Sigma Xi President, I must in good conscience, make myself available to assist in the investigation which the Council has recently approved.

SIGMA XI ANNUAL MEETING

May 11, 1979

AUDIENCE DISCUSSION

Comment from Audience

"Mr. Chairman, I am very pleased to hear these remarks tonight, and would like to respond to the comment that legislators are laymen and therefore need to communicate with scientists in lay terms. Specifically, I would like to comment on the problem of uncertainty in science, and how to communicate this notion to the non-scientist; and to suggest a format to be used when responding to requests for scientific advice, which appears to alleviate the problems associated with explaining the uncertainties of science to a layman.

The format provides four pieces of information:

- "What we know."
- "What we don't know."
- "What we could know."
- "What we should know."

Permit me to elaborate a bit. If we phrased our responses in these four perspectives, the first point, "what we know" will be expressed in probabilistic terms. We must take this statistical information and expand it into a narrative form, in layman's terms. The second point, "what we don't know," should be expressed in a similar manner, perhaps giving a reason for our limited knowledge (lack of an organizing theory, insufficient research conducted to date, etc.). "What we could know" can be expressed in terms of the additional resources and time currently available for further research into a particular area, and what product might result from the investment of these resources.

"What we should know" will emphasize the fact that scientists don't have to know everything. Many prudent decisions are made in society without full knowledge of any given area; and will be made in scientific matters without full knowledge. If we express our knowledge to legislators in these careful terms, we will be better understood and perhaps more valued. Thank you.

Tom Dinell

This strikes me as terribly reasonable advice. One of the most difficult undertakings is to convince a legislator that there is no definite answer to a particular issue, particularly when that legislator wants to hear a definite answer.

Doak Cox

I think there is a very distinct difference that occurs when somebody enters into a public decision-making position, whether by election or appointment. This gets back to the distinction I made between the objective questions, which are

amenable to scientific input, and the subjective questions, which are almost always embedded in any of the problems faced by the Legislature. When you are elected to Congress or to the Legislature, even if you are a scientist, you are charged to make the subjective decisions on the basis of the public as a whole. But a scientist as a scientist has no right to express the subjective value judgement except personally. He is not an expert; there are no experts in this field. In aesthetics and ethics nobody is an expert, although some people are delegated that responsibility; and the scientist as such is not. This means that there must be a considerable restraint on the scientific component of this information exchange process. The scientist who provides information to legislators should not feel that it is his or her place to make subjective value judgements; and he/she should not be offended if his/her advice is not used in the consideration of those subjective value judgements.

#### Comment from Audience

Several private industries in Hawaii do not wait to be asked for input during the consideration of bills. These industries have organized special committees to monitor bills and comment on those which are relevant to them. Perhaps a similar system could be designed to incorporate SET input into the legislative decision-making process. That is, a SET group could take the initiative by screening bills and resolutions of a scientific, engineering or technical nature, and referring these measures to the appropriate scientist(s) in the community.

#### Tom Dinell

I favor the idea of taking the initiative, although I wonder whether such efforts should be directed at introduced bills and resolutions, when the vast majority of them will never see the light of day. The efficiency of such an approach is a question that needs to be examined. You have raised the problem of foresight. How does the scientific community alert the Legislature to the changes and new developments which may require public policy decisions in the future? How do you define a potential "policy" area and begin the information exchange before that area has progressed to the "specific bill" stage? For example, there is no need to consider legislation for genetic engineering until genetic engineering is possible. Only then will it become a policy question. Ten years ago, Hawaii's decision-makers weren't considering questions relating to aquaculture in terms of public policy. Now, however, there are many aquaculture policy questions -- water rights, pollution and land use, to name a few.

#### Clinton Tanimura

I think that all legislators need to learn more about scientific and technological issues. The question is: How do we provide this information to the Legislature? I have seen a lot of technical documents presented to the Legislature in a form that is unintelligible to them. It would be beneficial if an "interpreter" could explain and summarize these documents in layman's terms.

(A suggestion was made that the legislators be requested to attend an introductory science class, which would teach them the basics about the Hawaiian environment).

### Comment from Audience

I don't think that an introductory science course is what the legislators need. I think that the arrogance with which many of us from the University present information to the Legislature is successful in turning them off. As you may remember, in 1972 David McClung initiated an effort to increase the interaction between scientists and legislators. A lot of mistakes were made in this attempt. University scientists received questions that were difficult or impossible to answer. It was also noted by legislators that the University professors were arrogant.

### Comment from Audience

I would strongly recommend that Sigma Xi make an effort to renew these information exchanges because I think some of the legislators are making the effort to obtain the best information possible -- and I think we have an obligation to provide it.

### Comment from Audience

Doak mentioned the National Academy of Science and the fact that they have been struggling with the problem of communication between decision-makers since Abraham Lincoln's time. This group usually does not try to tell the government anything. Instead, the decision-makers define a problem and seek out the scientist to obtain information dealing with that problem. It is the responsibility of the decision-makers to crystallize the crucial information that they want advice on. It is not for us to decide what SET information or issues the government should be aware of. This is how the scientist-Legislature information system operates at the national level; and I believe that it should operate in the same fashion at the Hawaii State level. A scientist has to be on call; he can't be aggressive and say, "Here is what you should be doing."

### Comment from Audience

I agree with that point. Scientists would be acting as lobbyists if they began trying to tell legislators what issues they should be considering.

### Doak Cox

I would like to comment further on this point. I agree, yet with an extent of disagreement. I think that the decision-maker should present his perception of a problem to the scientific community, because it is his responsibility to define that problem. However, if a legislator or other decision-maker says "I want only a certain type of scientific information which pertains to the problem," I would be reluctant to accept the notion because the decision-maker is not necessarily the best judge for determining which kind of scientific information is pertinent to that

problem. On the other hand, it is absurd for the scientist to force his information on the legislator, stating that in light of this information the legislator must advocate a particular stand on an issue. This would completely overlook the other values that the legislator must respect; specifically, those of his constituents.

#### Comment from Audience

Perhaps one area that we are focusing on is the question of how to differentiate between scientifically correct and incorrect testimony. Over a period of several hours in a day's session, there will be a number of people testifying to the Legislature, and the information they present may have a technical content for which they may have an incorrect interpretation. Possibly, the presence of a technical expert as an observer during such testimony might be of value to the legislators, who could periodically ask his opinion of certain facts which had been presented.

#### Tom Dinell

Here is one very important vehicle to consider. I think we need to recognize that a number of other interchanges occur in addition to public hearings.

#### Comment from Audience

Doak referred to one kind of filter that could be built into a SET system, which is that scientists could examine other scientists' work before it goes to the Legislature. I teach an introductory Zoology course and I consider myself another kind of filter. I review technical reports and research literature, then try to convert this information into layman's language to make it clear to the students in my course. This may be the type of filter we need here. Perhaps what is needed is a scientist to convert technical reports into layman's language and to serve in some capacity by which legislators will seek him out when they are confused about a particular scientific or technical report. This scientist could also supply requested background information on SET issues.

#### Doak Cox

There are really three functions involved in this transfer process. One is brokerage, another is the translation process Art just mentioned, and the third is the compilation of information from different sources which all pertain to the same topic or issue.

## APPENDIX E

### Examples of Scientific, Engineering, and Technological Information Exchange Mechanisms in Other States

The following examples serve to illustrate the diverse ways in which other states have developed or are presently developing SET information exchange mechanisms for their state legislatures.

The summaries in this appendix have been obtained from many sources. When the information was taken directly from a state's final SET report, a brief description of methods used in the study has also been included.

## ARIZONA

The Arizona SET Project was undertaken by selected faculty members from Arizona State University. The final report was completed in June 1979.

### Methodology

The following methods were utilized by the SET project staff:

1. Interviews with Arizona state legislators.
2. Examination of other states' experiences.
3. Development of a range of options for SET information exchange systems.
4. Evaluation of each option.

### Final Product

The Arizona SET Project produced a number of documents which could assist in acquiring scientific and technological information for legislators. The primary document was a resource catalogue which listed the names of individuals possessing SET expertise from industrial firms, state and federal agencies, professional associations, and state universities in Arizona. All individuals listed had agreed to provide requested SET information to legislators on a voluntary basis. The catalogue was accompanied by a set of indexes which permit access by subject area. Also accompanying the catalogue were instructions for

periodically updating the catalogue. It was noted that the catalogue should be updated at least once a year to be useful.

## CALIFORNIA

In 1969, the California Assembly created the Assembly Science and Technology Advisory Council (ASTAC) to provide scientific and technical input into the legislative decisionmaking process. The Council consisted of five to twenty members, each appointed by the Assembly Speaker to serve a three-year term. House Resolution 190, the enabling legislation for ASTAC, stipulated that council membership must exhibit a balance between life and earth sciences (i.e., "hard" sciences) and social sciences (i.e., "soft" sciences).

ASTAC's input was provided primarily through the formation of ad hoc technical panels from the general membership. Although committee members were not paid for attending regular (quarterly) meetings, they received an honorarium of \$100 a day plus expenses when participating on technical panels. The Council focused its attention on comprehensive SET issues requiring fairly long-term research and analysis. ASTAC was abolished in 1976.

## INDIANA

The Indiana S & T Project, undertaken by Holcomb Research Institute at Butler University, focused on the information needs of the General Assembly.

### Methodology

Methods utilized in the study included:

1. Examination of the general characteristics of the Indiana General Assembly.
2. Examination of the current methods through which Indiana legislators obtain S & T information.
3. Consideration of alternative means for providing S & T information to legislators.

### Final Recommendations

The report recommended that a resource directory of scientific and technological resource personnel be compiled as a means of meeting S & T information needs of the Indiana legislators.

## MARYLAND

In 1977, the General Assembly of Maryland created a Science Division in the Department of Legislative Reference. Staffing for this division consists of a Science and Technology Advisor, an Assistant Science Advisor, and a Division Secretary. The Science Division primarily responds to short-term information requests from legislators. It does not initiate any information exchange activities unless specifically requested by legislators, a legislative committee, or referred constituent.

The division has established information exchange links with state universities and and private colleges in Maryland. Information requests are sent to the participating educational institutions and responses are returned to the Science Division staff, who summarize the information in a one-to-two page memo and deliver it to the appropriate legislator(s).

## MINNESOTA

In January 1977, the State of Minnesota developed a non-partisan SET research office consisting of two professional scientists with expertise in physical and biological sciences. The office primarily serves legislators, but it also acts as a reference source for other legislative research offices.

The specific activities of the S & T Project include the preparation of:

1. *Inquiry responses* in the form of a brief (one-to-two page) memo, including background information, and a list of resource persons. Generally, these responses are supplied within one to five days after receiving the inquiry.
2. *Research reports* (issue papers) written by consultants or by S & T staff members. Generally they have taken one to five months to be completed.
3. The organization of *workshops (conferences or seminars)* on SET issues, such as energy, use of rock salt, and effects of air pollution.
4. *Expert testimony* for legislative committee hearings.
5. Arrangements for *field trips* to SET research and development sites.
6. Informal *committee briefings* to discuss SET aspects of particular bills.
7. *S & T newsletters* published periodically and sent to legislators.

## MONTANA

The Montana Science and Technology Project was undertaken by the State Environmental Quality Council, and the final report was completed in March 1979. The study focused on the provision of information to both houses of the Montana State Legislature.

### Methodology

The methods used in the Montana Project were as follows:

1. A mail-out questionnaire was sent to each state legislator to determine the information needs of the Legislature.
2. A study of other states that had completed SET Projects was conducted to learn how they had increased the science and technology capabilities for their legislatures.
3. Five alternative mechanisms were developed for Montana to increase the S & T capability for its Legislature:
  - a. hire two additional researchers with scientific backgrounds for the Legislative Council;
  - b. establish a separate agency to respond to all S & T information inquiries and conduct "mid-range interim projects";
  - c. establish a formal agreement with state universities whereby they will supply a faculty member on a rotating basis to provide legislators with S & T information;
  - d. establish a separate fund in each house of the Legislature to hire expert witnesses to testify at committee hearings; and
  - e. utilize the staff of the Environmental Quality Council to provide S & T information to legislators.

### Final Product

The Montana S & T Project recommended that the staff of the Environmental Quality Council be assigned to develop S & T information capabilities for the Montana State Legislature.

The recommendation included the suggestion of three specific actions to develop S & T capability:

1. compilation of a current listing of S & T resource personnel;
2. establishment of information exchange links with the Montana University system; and
3. utilization of LEGITECH.

## NEVADA

The Nevada SET Project was completed in October 1978.

### Methodology

The following methods were employed in the study:

1. Inventory of bills and resolutions introduced in the Nevada State Legislature containing scientific, engineering, and technological elements.
2. Interviews with Nevada legislators.
3. Examination of existing information resources which provide SET information to legislators.
4. Development of several options to increase the capability to acquire SET information.

### Final Product

The report of the Nevada SET Project contained eight recommendations to improve the flow of SET information to and from the Legislature. Seven of these are presented below:

*Recommendation One:* The addition of one or more legislative researchers with SET backgrounds to the Research Division of the Legislative Council Bureau.

*Recommendation Two:* Expansion of the legislative intern program within the Legislative Council Bureau to hire interns with SET backgrounds. It was noted that this was not sufficient to stand alone, but it should be implemented along with at least one other recommendation.

*Recommendation Three:* Development and maintenance of a Resource and Information Directory, listing sources of SET information from special libraries, government agencies, industrial laboratories, research centers, and persons with SET expertise.

The directory is for use by the staff of the Research Division and by personnel of the Legislative Council Bureau.

*Recommendation Four:* The organized research funds within the University of Nevada could be increased with some portion of the additional monies going to policy research on matters of legislative concern.

*Recommendation Five:* Publication and dissemination of a handbook for faculty in the University of Nevada faculty system to facilitate their understanding of and participation in the legislative process.

*Recommendation Six:* Creation of a fund in each legislative house for honoraria and expenses for SET experts to provide testimony at committee hearings. It was noted that, since Nevada has fewer scientists, engineers, and technical personnel than any other state, it may sometimes be necessary to seek SET expertise from other states.

*Recommendation Seven:* Development of a policy of faculty leave to permit members of the University of Nevada system to provide service to the Legislature during session.

## NEW HAMPSHIRE

New Hampshire established the position for a Legislative Science Advisor who advises the House Science and Technology Committee and the Senate Energy and Consumer Affairs Committee when they consider bills that pertain to SET issues. The advisor is also responsible to direct a Legislative Academy of Science, consisting of members from the academic, governmental, business, and industrial sectors. The primary functions of the advisor are to:

1. Establish a SET information exchange procedure between the legislative committees and the Academy of Science.
2. Periodically brief the legislative leadership concerning major SET issues.

## NEW YORK

New York was the first state to develop a permanent SET information exchange mechanism for its Legislature. Originally, the New York Assembly Scientific staff was created in 1971, an in-house information service consisting of three full-time professional scientists, an administrative assistant, and two secretaries. The staff respond to day-to-day requests and attempt to anticipate problems of long-term legislative interest.

During the 1979 legislative session, the assembly staff were incorporated into the newly created legislative Commission on Science and Technology, which serves both houses of the New York Legislature as an in-house source of SET information.

## VIRGINIA

The report of the Legislative Scientific and Technological Advisory Committee to the Governor and the General Assembly of Virginia was completed in 1979. The project focused only on the S & T needs of the General Assembly.

### Methodology

The methods utilized in the Virginia study are as follows:

1. Inventory of legislation enacted in 1976, 1977, and 1978 to determine the percentage having S & T elements.
2. Review of the legislation enacted during the 1978 session to determine whether the issues identified in the inventory of SET measures would continue to be areas of legislative interest for the next several years.
3. Survey of the members of the General Assembly to determine their perception of what constitutes a S & T issue.
4. Interviews with personnel in the Division of Legislative Services, an information office which serves the Virginia General Assembly.

### Final Recommendations

The Virginia S & T Project recommended that a Legislative Science Advisor be appointed as Director of Research in the Division of Legislative Services (an in-house legislative service agency).