PROCEEDINGS

Of The Hawaii Windpower Workshop

March 21 and 22, 1994   Honolulu, Hawai'i

Final Report
July 29, 1994

Prepared for:
U.S. Department of Energy (U.S. DOE) and
State of Hawaii Department of Business, Economic
Development and Tourism (DBEDT)-Energy Division

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Preface

The Hawaii Windpower Workshop was sponsored by the U.S. Department of Energy (U.S.DOE) and the State of Hawaii Department of Business, Economic Development and Tourism (DBEDT).

The Pacific International Center for High Technology Research (PICHTR) organized and conducted the workshop in cooperation with U.S.DOE, the National Renewable Energy Laboratory (NREL), DBEDT and the Hawaiian Electric Company (HECO). Participants in the workshop included representatives from the Electric Power Research Institute (EPRI), the Hawaii Public Utilities Commission (HPUC), the Hawaiian utilities, the National Congress of State Legislators (NCSL), Hawaii State legislators, county governments, the American Wind Industry Association (AWEA), wind manufacturers and developers, the National Resource Defense Council (NRDC), the Union of Concerned Scientists (UCS), the Green Party, the Hawaii Consumer Advocate (CA), and private citizens.

The workshop was jointly funded by DBEDT and NREL. The manager of the workshop was Warren S. Bollmeier, II, manager of wind/solar/hybrid projects at PICHTR. Special thanks are extended to:

- Ron Loose at U.S. DOE, Sue Hock and Blair Swezey at NREL, Maurice Kaya at DBEDT, and Art Seki at HECO for their assistance in coordinating the agenda and providing overall guidance;
- Each of the panel chairs for their efforts in preparing and delivering excellent presentations;
- Each of the panelists for their participation and lively comments during comment and question and answer periods; and
- Nancy Downes, Leonard Greer, Carol Hill, Ning Huang, Linda Ome, Milton Staackman, and Lyn Tong for their efforts in the preparation and implementation of the workshop. Finally, a special mahalo to Nancy for her diligence in helping to prepare and edit the proceedings.

Abstract

On March 21 - 22, 1994, approximately 80 key government, utility, industry and private representatives met in Honolulu, Hawaii, to discuss and learn from each other how additional wind power might be added to the supply mix for the Hawaiian utilities. A key outcome of the workshop was the consensus that the use of wind power should be increased in Hawaii. This consensus was consistent in all of the panel discussions, throughout the entire workshop. Furthermore, it is significant that the discussions were sometimes lively, but not heated; informative and accurate, but not biased; and proactive, but not reactionary.

Despite the consensus on the objective of using more wind power, it is also recognized that not everyone agrees on its implementation. But, what is significant and different from past meetings and discussions, is that there is a willingness on the part of the participants to continue the discussion. This willingness supports and reinforces the overall recommendation to form a wind collaborative as the vehicle for establishing and maintaining a cooperative and collaborative approach to enhancing the use of wind power to meet the electrical energy needs of the people of Hawaii.

The discussions, broken down into three separate sessions with a total of 10 panels, ranged from technology and wind resource status, to project development and implementation issues, and stakeholder perspectives.

Wind Technology and Resource Status. There have been problems with the commercialization of wind power in Hawaii, but industry has learned from the mistakes made in wind turbine design and siting, not only in Hawaii, but on the mainland as well. Some Hawaii-specific issues remain, including design refinements to meet Hawaii's environmental conditions, integration of advanced wind turbine technology and storage to meet utility integration needs, higher permitting and construction costs relative to other areas, and consideration of landowner concerns, such as competing uses and visual impact. There was a strong consensus among the participants that all interested parties should work together to address the issues.

Project Development and Implementation Issues. It was also recognized that there has been significant insight gained in project development and implementation, and that further improvements are possible and desirable. The utility business is rapidly changing across the country, which has led to alternative ownership and operation arrangements. While most wind power has been developed by independent power producers, some utilities are now considering utility or joint ownership and operation arrangements. Government has supported the development of new wind technology and is now advancing initiatives to assist the industry's commercialization activities. Wind power offers attractive economic and environmental benefits including increased employment and reduced supply risks. Utility planning has become more complex and difficult given uncertainties in forecasting and traditional supply sources, and environmental concerns. Utilities, in Hawaii along with many across the mainland, are now implementing

integrated resource planning (IRP) as a means to address traditional planning needs, as well as environmental and other public concerns. The need for cooperation and collaboration in project development and in IRP again was viewed as a high priority.

Stakeholder Perspectives. The stakeholders are the organizations and individuals impacted by wind power development and, in the broader context, by IRP. To date, too much emphasis has been placed on substance rather than process in utility planning, both at the PUCs across the nation and in the IRP process itself. IRP is a relatively new process and is evolving. Improvements are desirable in terms of seeking and utilizing input from all stakeholders. To date, the previous players have been the utilities, the PUC, industry and environmental and community action groups. In general, the public appears to support the use of wind power, but struggles to assert its views in the IRP process. There is a need to reexamine the role of public input and how it can be effectively mobilized. Recently, there have been initiatives by PUCs and state legislatures to support wind power, as well as other renewables. Specific initiatives discussed included green pricing, green solicitations, utility incentives and "risk-adjusted-rates" for evaluation of life cycle costs for renewables. The most successful initiatives were those which had the support of the key stakeholders, including the utility, PUC, legislature, industry and the public.

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1.0 Introduction

The Hawaii Windpower Workshop, held in Honolulu, Hawaii on March 21 to 22, 1994, was sponsored by the U.S. Department of Energy (DOE) and the State of Hawaii Department of Business, Economic Development and Tourism (DBEDT). The Pacific International Center for High Technology Research (PICHTR) organized and conducted the workshop in cooperation with U.S. DOE, the National Renewable Energy Laboratory (NREL), DBEDT and the Hawaiian Electric Company (HECO). About 80 key members from local and federal governments, the Hawaiian utilities, the wind industry, environmental and local community-action groups and the public attended the workshop. See appendix A for the list of participants.

There are two overall goals for this workshop:

- to support the integration of additional wind power into the Hawaiian utilities supply mix by providing up-to-date information and transfer of modern wind technology to the various stakeholders in Hawaii's energy arena, and
- to identify appropriate mechanisms for consideration of windpower within the IRP process.

The workshop was organized into a series of five sessions with a total of ten, one-hour panel discussions. See appendix B for the workshop agenda. Each of the panel discussions included a 3-minute presentation, followed by three, 5-minute panel member responses (panel 1 had 5 members), and a 15-minute general question and answer period. Each of the sessions and panel discussions are summarized in these proceedings as shown in the Table 1.1.

See appendices C through F for copies of the presentation charts/slides, and detailed notes on the panel member responses, and the general questions and answers.

Section	Session	Panel	Topic
1.2	1		History of Windpower in Hawaii
2	2		Technology and Resource Status
2.1	2	1	Technology and Industry
2.2	2	2	Resource Availability
2.3	2	3	Utility Interface Issues
3.0	3		Project Development and Implementation Issues
3.1	3	4	Project Development
3.2	3	5	Government Support
3.3	3	6	Benefits of Windpower to Hawaii
3.4	3	7	Integrated Resource Planning
4.0	4		Stakeholder Perspectives
4.1	4		Introductory Comments
4.2	4	8	Public Perspectives
4.3	4	9	Regulatory Perspectives
4.4	4	10	Legislative Perspectives
5.0	5		Wrap-Up, Conclusions and Recommendations

Table 1.1 Organization of the Proceedings

1.1 Opening Comments

Andrew Trenka, PICHTR vice president for engineering systems, started the Hawaii Windpower Workshop off by welcoming the participants on behalf of the sponsoring agencies, the U.S. DOE and the State of Hawaii DBEDT and acknowledged the contributions made by HECO and the Hawaii Natural Energy Institute of the University of Hawaii and NREL in the organization and coordination of the workshop. He expressed appreciation for the sponsors support and their interest in the topical areas of wind energy. He also extended his appreciation for the participants in sharing their perspectives on Hawaii's energy needs specifically wind power. Naming the various types of groups and organizations present, Mr. Trenka pointed out that the integration of all these groups is essential to putting together a viable plan for the implementation of wind energy in Hawaii:

- wind industry
- government agencies, both state and federal
- state legislators
- regulators
- utilities
- general public (including advocacy and consumer organizations)

He then went on to paraphrase the objectives of the workshop[1]:

1) Examine the viability of stimulating the integration of windpower into the Hawaiian energy mix.

2) Discuss the advances of wind technology while touching on the success stories and innovative approaches to the implementation of windpower on the mainland as well as worldwide.

3) Identify the appropriate and needed action for integrating windpower into the Hawaiian utilities via the integrated resource planning (IRP) process and other relevant innovative approaches. He pointed out that one of the reasons why PICHTR strove so mightily to hold the Windpower Workshop in March was because IRP planning activities were in process at that time and it was hoped that the deliberation from the workshop would help to impact that planning process. He emphasized that the IRP dockets and activities are critical for defining a pathway for the success of windpower in Hawaii.

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[1] Editorial comment: It is believed that this approach could be applied readily to workshops for other renewable technologies.

Mr. Trenka cautioned the workshop participants to focus on the lessons learned from the past uses of windpower in Hawaii and not to lay blame on any one group for its failures. He also reminded them that the workshop was not a marketing tool for wind manufacturers but rather an opportunity to provide current information on the advances in the technology.

The primary objective of the workshop, he said, was to stimulate a dialog to assess the success stories of windpower on the mainland and discuss how it can be implemented here in Hawaii.

In closing, Mr. Trenka asked every participant present to introduce themselves and identify the organizations that they represented. Taking time to invite the sponsoring agencies to share some of their thoughts on wind energy, he first introduced Mr. Ron Loose, director of the Wind\Hydro\Ocean Division of the Office of Utility Technologies of the assistant U.S. secretary from the Department of Energy Efficiency and Renewable Energy. In this capacity, Mr. Loose also serves as the director of the U.S. Department of Energy's Federal Wind Energy Program.

Ronald Loose, U.S. DOE

Mr. Loose greeted the audience and, as director of the Federal Wind Energy Program, acknowledged the support from the Office of Integrated Resource Planning (administered by Dr. Robert San Martin) under the U.S. DOE Office of Utilities Technologies as cosponsors of the Hawaii Windpower Workshop.

We are witnessing some exciting times and perhaps seeing a resurgence from the 1980's in wind energy development, Mr. Loose noted. There have been substantial improvements and a dramatic increase in the federal wind energy budget. He pointed out that when he took office, the federal wind energy budget was about $8.5M. Going into the appropriation budget process for 1995, the budget is at $51.5M.

Currently the U.S. DOE supports seven different turbine designs being developed for near term use. There are working prototypes for these designs currently being tested. All of these should be on the market during 1994-1995 and the DOE has played an active role in their development, he emphasized.

In addition, the department has instituted a unique 1.5¢ production incentive which is quite different from past tax incentives. It works quite simply, he said, if you don't produce, you don't get paid!

"We are also witnessing an increase use of the integrated resource planning process by utility planners along with expanding markets both domestically and internationally for wind energy. Currently, 2000 MW are being negotiated or are in use. The American Wind Energy Association announced a goal of 10,000 MW by the year A.D. 2000. This is an ambitious but achievable goal," Mr. Loose stated. Coinciding with this, the European Union announced its goal of 4,000 MW by the year A.D. 2,000.

"We are seeing an emerging market that will provide business stability as the technology matures," Mr. Loose said.

More importantly from his perspective, he said, the administration's recent announcement of a *Global Climate Change Action Plan* has allowed the federal programs to reestablish support to a commercialization effort.

The action plan calls for a market mobilization collaborative. Industry, utilities and other interested stakeholders are in the process of forming that collaborative. These are just some of the things that are coming together to bring a very bright future for wind energy.

In closing, Mr. Loose stated that given Hawaii's wind resources, he was confident wind power can make a contribution to Hawaii's energy mix. He thanked everyone for their participation and looked forward to a productive workshop.

Tak Yoshihara, State of Hawaii DBEDT

Next, Mr. Trenka introduced Dr. Tak Yoshihara, deputy director of the State of Hawaii DBEDT.

Dr. Yoshihara began by welcoming participants on behalf of DBEDT as a cosponsor of the Hawaii Windpower Workshop. The primary responsibility of the Department of Business, Economic Development and Tourism, he pointed out, is to formulate policy and programs to stimulate support and promote economic development.

Hawaii's economy has been suffering for three years, due in large measure to the downturns in tourism attributable to the economies nationally and internationally. A major barrier to Hawaii's economic growth is the high cost of living and doing business.

"Energy is but one component of that cost but one we feel is very important. Hawaii's cost for electricity is the highest in the nation, three times higher than parts of the Northwest. Gasoline in Hawaii is currently priced at $1.50 a gallon. In Washington D.C., I am told today, a gallon of regular unleaded gasoline costs about $1.00," Dr. Yoshihara said.

"If we are to compete economically, we must reduce the cost of energy!" he stated. Because of the strong link between the economy and energy, the director of DBEDT has also been designated as the state's Energy Resources Coordinator with following objective for the state:

"To insure a dependable, efficient and economical energy system capable of supporting Hawaii's needs while increasing the state's energy self sufficiency and energy security."

At the present time, Hawaii has neither an economical nor a reliable energy system and will not have one as long as the state is linked to petroleum coming out of the Middle East.

Dr. Yoshihara observed that twenty years have passed since the OPEC oil embargo and little progress has been made nationally towards reducing our vulnerability toward the source of our principle energy form. "Desert Storm has taught us how important that energy supply is to our national and environmental security."

He noted that Hawaii's energy and environmental problems are of a magnitude much worse than the rest of the country. Yearly we see a plethora of legislative bills indicating the legislature's interest in helping to solve this problem. This past year, thanks to Representative Duke Bainum and Senator Matt Matsunaga, energy in Hawaii became a focal point with the convening of the *Energy and Environmental Summit.* This summit was a good forum for all sectors of local society to get together in order to discuss the issues and chart our course for the future.

The *Energy and Environmental Summit,* confirmed a deep and widespread interest in the subject of energy especially in the support for renewable energy systems and development in Hawaii. However, despite a strong commitment over the past 15 years and the number of legislative measures put into statutes to encourage development of renewable energies, Hawaii has still fallen far short of its original expectations. In reviewing those past expectations, Dr. Yoshihara outlined the following findings in a 1980 study conducted by Lawrence Berkeley Laboratory for DBEDT to forecast the future of renewable energy in Hawaii.

- By 1995, oil prices would range from $47 to $129 a barrel. *The current price for a barrel of oil is $15.00.*
- By 1995, an underwater submarine cable would be in operation bringing geothermal energy from the Big Island to Oahu. *No cable exists nor are there any plans for one.*
- By 1995, there would be no need for large oil-fired plants on the island of Oahu except to be held in reserve.
- By 2005, 432 MW of wind power would be generated on Oahu. *Currently 11 MW of wind power is operational.*

Dr. Yoshihara next posed the question, "Why has Hawaii fallen so short of the mark?" Acknowledging that oil prices have not risen nearly as much as predicted as part of the reason, he pointed out that there were other factors as well. Recalling a quote from the past, he drew a strong correlation to emphasize the high cost of research and development.

"Things we don't understand, prove more difficult than we believe," he quoted.

"New technology always costs more and takes longer to mature than we anticipate," he said siting some personal examples of this ranging from fixing a leaky faucet to hanging wallpaper and learning how to swing a golf club.

Drawing a disposable razor out of his shirt pocket, Dr. Yoshihara made a further analogy of this concept.

"This gadget," he said, " is a Gillette Sensor Razor with a simple objective to provide you with a close, smooth shave. Simple, but it cost $200M in research and development to produce. It is very high tech!"

Today's society is complex and demanding. It demands perfection as accurate as a computer and as reliable as the motor on your refrigerator or the Seiko watch on your wrist. The Gillette razor story demonstrates how costly it is to achieve this level of perfection in our society, he said.

In the 1980's, the building of wind machines seemed to be a simpler process than it actually was. It took a generation of windmills to prove that wind machines, if they were to meet modern requirements, would be more difficult to build than initially thought.

"In the end, the wind industry realized, it had not paid the price to provide the performance required," he said. "What if Gillette had released its product after only spending $50M instead of $200M?"

"The wind industry has finally paid the price and windpower has finally come of age and I don't believe that we have to wait another 15 years to confirm this. DBEDT is bullish on wind power and its application to Hawaii. " he said.

With some of the finest wind resources in the country, the high cost of electricity and the state's vulnerability to fossil fuels, DBEDT strongly supports wind power and remains committed to its success in Hawaii.

"We have 11 years to go to fulfill the prediction made in 1980 to have 432 MW of wind power on-line by the year 2005. Let's not bet against this possibility," Dr. Yoshihara said in closing.

Andrew Trenka, PICHTR

Mr. Trenka thanked Dr. Yoshihara for his keynote speech and offered these reflections of Hawaii and wind energy.

"Hawaii has been in the business of renewable energy, supportive of renewable energy and in the forefront of the development of renewables since the late 1970's and the early 1980's. Many of you saw some of the results of that leadership when you visited the wind farm in Kahuku this morning."

Hawaii recognized its dependence on fossil fuels early on and set forth specific goals and attempted to implement legislative as well as regulatory actions to achieve the implementation of renewables in Hawaii. Reiterating what Tak Yoshihara said, Mr. Trenka noted that Hawaii is still nowhere close to the objectives it set forth in 1980.

"We can all get together now as we did in a similar workshop organized and conducted by HNEI in 1985 and identify solutions and approaches to the problem and realize no significant progress. We must focus on solutions that are implementable and set a clear path for implementation," said Mr. Trenka.

In summarizing the advances made in field of wind energy, Mr. Trenka cited some recent national statistics.

- More than 1500 MW of wind power are currently on-line in California.
- More than 3 billion kW/hr of power are generated in the United States by wind power on-line
- In other states, programs to integrate wind power are being implemented:
  1500 MW of wind power are being solicited in California
  300 MW in New York State, and
  100 MW in Minnesota (now increased to 425 MW).

Worldwide there has been a resurgence of interest in wind energy. The European community instituted a program for putting 4,000 MW of wind power on-line by the year 2000, a very ambitious goal. With some of the best wind resources available, Hawaii ought to be participating in some way.

- Capital costs are down from $3,000 to $950 per kW installed and some manufacturers say they can do it for less.
- O&M costs are down to 1¢ per kW/hr.
- Reliability is up to 85% to 95% or greater.
- A 50 MW wind farm can be developed, designed and implemented in 18 months or less according to some wind industry experts.

For those of us in Hawaii looking to implement the integration of wind energy, this is an encouraging message. Throughout the mainland, innovative legislative and utility actions and power purchase incentives are being targeted ranging from the concepts of green pricing, pilot wind projects funded by the state and standard power purchase contracts.

After providing a brief litany of some of the topics to be discussed over the next day and a half, Mr. Trenka introduced the first session presenter, Warren Bollmeier to lead off with the *History of Windpower in Hawaii*. Mr. Bollmeier has been involved in wind energy since 1977 on the Small Wind Systems Program at Rocky Flats, Colorado during the early days of the federal wind program. He is an active participant in the field having been awarded the AWEA award for "maintaining a strong and active working relationship with the wind industry" in 1986.

1.2 History of Wind Power in Hawaii—Warren Bollmeier, PICHTR

Early Uses of Wind Power in Hawaii. Early uses of wind power in Hawaii include the discovery and the settling first by Polynesians in sailing canoes and later by Europeans in the larger square-riggers. Water-pumpers were used on most islands from around the turn of the century. But most of these early turbines disappeared with the advent of the utilities.

Renaissance of Wind Power in Hawaii. In 1973, the nation learned that the low-cost, supply of oil could not be guaranteed, and this led to the investigation of the potential energy contributions from renewables. It led to a renaissance of wind power across the U. S. and especially in Hawaii.

There were several key players that contributed to the renaissance in Hawaii:

1) the state, which was among the early leaders in recognizing and valuing renewables;
2) government, both federal and state, which supported early research and development (R&D) and market conditioning activities in wind (these activities are discussed in *Panel 5: Government Support to Industry);*
3) the utilities, which supported the R&D activities, such as HECO's participation in the MOD-OA program with DOE, MECO's purchase of a Windane wind turbine and participation in the Zond/Wind-Diesel project with DBEDT, HELCO's integration of three wind farms on the Big Island, and, most importantly, Hawaiian Electric Industries' (HEI's) formation of Hawaiian Electric Renewable Systems (HERS) to become the first U.S. utility to own and operate a wind farm;
4) the University of Hawaii, which became heavily involved in wind resource assessment and R&D and public awareness activities; and
5) the wind industry, which moved out to set the stage for commercial activities in Hawaii.

Commercial Activities in Hawaii. For the workshop, PICHTR prepared a summary chart (Table 1.2) of the five major wind farms in Hawaii, which include three on the Big Island: Kahua Ranch, Lalamilo Wells, and Kamaoa and two on Oahu: Makani Moa'e and Makani Ho'Olapa. The first, Kahua Ranch, was installed in 1983, the last, Kamaoa in 1988. It is important to note that all of the wind turbines were first or second generation prototypes, with the exception of the MOD-5B, and the size of the wind turbines ranged from relatively small (Jacobs) to the world's largest wind turbine–the MOD-5B.

All of these wind turbines experienced design and operation problems, like others in California and at other locations. It is also important to note that the wind farms in Hawaii are small in capacity at less than 10 MW, compared to the wind farms on the mainland which are typically 25 to 50 MW or more (the total of the five wind farms in Hawaii is 27 MW). In general, the wind resource in Hawaii is stronger than most sites on the mainland, e.g., the wind site at Kahua Ranch is one of the best in the world.

Throughout 1992, the Hawaii wind farms have saved approximately 450,000 barrels of oil and approximately $9.0M.

Lessons Learned. The lessons learned, from a technical standpoint, can be broken down into two general areas–siting and wind turbine design and performance. Two important lessons were learned in siting:

1) the single-tower wind measurements, while representative of industry practice at the time, did **not** provide adequate data for the siting of the wind turbines–this generally led to overprediction of available wind speeds and energy outputs; and

2) the spacing in some of the wind farm arrays was too tight, resulting in reduced power outputs and higher-than-anticipated turbine dynamic loads. The latter tended to exacerbate wind turbine design problems. The good news is that industry has developed micrositing and analysis techniques which have solved the early siting problems and reduced the risk in estimating wind farm outputs.

There were two important lessons learned in wind turbine design and performance:

1) the wind turbines are representative of older technology, some of the wind turbines did not perform to their predicted power curves, most had higher-than-predicted operations and maintenance (O&M) costs, and some experienced power quality problems. The net results were losses in revenues; and

2) atmospheric and environmental conditions in Hawaii tended to exacerbate the wind turbine design process–specifically the ambient levels of turbulence were higher than anticipated and there were some component failures due to salt corrosion at some sites. The good news is that there have been major advances in wind turbine design which have resulted in dramatic improvements in performance and reliability and there have also been significant reductions in wind turbine and wind farm costs. The wind industry has maintained its interest in Hawaii by continuing to operate and improve the output of their wind farms and are seeking to enhance wind power's contribution to Hawaii's electric power supply. The industry is also seeking to meet growing market needs in the Asia-Pacific.

The Future Potential for Wind power in Hawaii. The performance of wind turbines has improved dramatically and costs have dropped significantly, the future potential in Hawaii would appear to be bright. The question put to workshop participants was: why is it that we aren't putting up more turbines in Hawaii? Most would agree that the answer is not a simple "we have got to do this or we have got to do that," in fact, that is one of the reasons everyone was at the workshop. Furthermore, the workshop was organized to address all of the key issues impacting further wind power development in Hawaii. Despite all of the potential reasons or issues impacting the development, there is one very compelling argument for further development–the wind resource in Hawaii is so great, we ought to be able to find a way to use it more effectively.

Wind farm	Kahua Ranch	Lalamilo Wells	Makani Moa'e	Makani Ho'olapa	Kamaoa
Owner/Operator	Kahua Ranch Limited	Lalamilo Ventures	Makani Uwila	Makani Uwila	Kamaoa Partners
Location	Kahua Ranch Island of Hawaii	Puako Island of Hawaii	Kahuku Point Island of Oahu	Kahuku Point Island of Oahu	South Point Island of Hawaii
Terrain	Mountain pass	Basically flat	Complex	Complex	Moderately complex
Wind speed	9.0 m/s (20 mph)	7.6 m/s (17 mph)	8.1 m/s (18 mph)	8.1 m/s (18 mph)	7.7 m/s (17 mph)
Installed Capacity	3.4 MW (2 phases)	2.3 MW	9 MW	3.2 MW	9.25 MW
Installed Cost	Not Available	Not Available	$25M	$15M	$11.7M
Operational Dates	1983 to Present	1985 to Present	1985 to Present	1987 to Present	1988 to Present
Turbines (Number)	Jacobs (198) Phase 1-17.5 kW (18) Phase 2-17.5 kW (180)	Jacobs (122) 17.5 kW (39) 20 kW (83)	Westinghouse 600 kW (15)	MOD-5B 3.2 MW (1)	Mitsubishi 250 kW (37)
Rotor Diameter	8.0 m (26')	8.0 m (26'):17.5 kW 8.6 m (29'):20 kW	43.3 m (142')	97.6 m (320')	21.9 m (72')
Current Capacity	300 kW (18 turbines)	1.7 MW (90 turbines)	7.8 MW (13 turbines)	3.2 MW	9.25 MW (37 turbines)
Capacity Factor	Not Available	Not Available	25%	20 to 22%	Not Available

Table 1.2 Hawaii Wind Farms (Commercial Projects)

2.0 Technology and Resource Status

2.1 Panel 1: Technology and Industry

Panel Chair

Sue Hock – National Renewable Energy Laboratory (NREL), Golden, Colorado.

Panel Members

Eric Miller – Kenetech Windpower
Robert Lynette – R. Lynette and Associates
Jeff Maurer – The New World Power Company
Edan Harel – TRM Advanced Wind Technologies, Ltd.
Robert H. Gates – Zond Systems, Inc.

Goals

The goals of this panel were to review the track record of the U.S. wind industry, including current industry structure and status, wind farm/turbine performance and costs, and suitability for application in Hawaii's market.

Summary

Wind Technology and Industry Growth. Wind technology, and the industry supporting it, have improved and grown dramatically over the past 10 to 15 years since the first wind farms were developed in California. The performance of wind turbines, measured in terms of energy captured and capacity factor, has improved dramatically. The cost of wind energy has dropped steadily during the 1980's and is now approaching 5 cents/kWh for some sites. At 5 cents/kWh, wind energy is considered competitive with fossil fuels for electric utility power generation. The overwhelming consensus of the panel was that wind turbine technology is here and now, it is ready for Hawaii and will be one of the cheapest sources for new electric power generation in Hawaii.

Future Projections. As the industry continues to mature, wind turbine designs are expected to improve further. With continued government assistance and the anticipated entrance of larger U.S. companies into the wind energy arena, the costs are expected to drop even further, perhaps to as low as 3.5 cents/kWh for some sites by the end of the decade.

Need for Government Support. There appears to be a growing consensus that the industry does not need the direct subsidies (i.e., tax credits) that fueled the initial development of the wind farms in California. At least one industry representative at the workshop stated that wind energy is "fully competitive with fossil fuels," as was the case in the recent competitive bidding process in California. However, in Hawaii, where construction and land costs and smaller wind farm or system capacities increase costs, some government incentives may be warranted. In addition, there is a need for continued government support in RD&D and market conditioning activities to reduce the risk of the introduction of wind technology in the utility marketplace throughout the U.S. and especially in Hawaii.

Recommendations

RD&D Support. Government support to the development of advanced wind turbine designs is viewed as a key factor to the further reduction of turbine costs and resolving other RD&D issues, such as utility interface issues, avian mortality and visual impact.

Market Conditioning Activities. Continued government assistance is needed to reduce the perceived barriers to the market. Raising public awareness is seen as one of the key roles that both the state, local and federal governments can play. Specific objectives would be to promote the environmental, economic and energy security benefits that wind power can offer. In addition, industry representatives felt that government can help by promoting appropriate consideration of wind power within the utility IRP/regulatory and legislative processes.

2.2 Panel 2: Resource Availability

Panel Chair

Karen Conover – R. Lynette & Associates, Redmond, Washington

Panel Members

Dick Cameron – Alexander & Baldwin, Hawaii Commercial & Sugar
Monty Richards – Kahua Ranch Limited
Mason Young – State of Hawaii Department of Land and Natural Resources

Goals

The goals of this panel were to provide information from a Hawaii State funded wind resource assessment, identify interested landowners and discuss land-availability issues.

Summary

Past Wind Resource Assessments. The State of Hawaii Department of Business, Economic Development and Tourism (DBEDT) with contracted support by R. Lynette & Associates (RLA) has performed an evaluation of Hawaii's Renewable Energy Resource Assessments (Ref. 1) as a precursor activity to the Hawaii Energy Strategy (HES). The results included an evaluation of potential wind sites based on wind data collected through state and federally-funded projects with the University of Hawaii (Meteorology Department), the Hawaii Natural Energy Institute (HNEI) and others. High potential sites were identified after screening based on land ownership, planned or competing uses, proximity to utility infrastructure, etc., for each of the major Hawaiian Islands.

Current Wind Resource Assessment Activity. Based on the results of the RLA study, DBEDT has funded additional work with RLA to install, operate and analyze the data from wind monitoring stations for one year at eight sites: two on Kauai, two on Oahu, two on Maui and two on the island of Hawaii. Karen illustrated with a series of maps the relative locations for land ownership and zoning for each of sites.

Potential Project Sizes and Characteristics. Karen discussed potential project sites on each of the inhabited islands (except Niihau). It is clear that the land is suitable for a number of projects in the 5 to 50 MW range. Most of the land is owned by either the state or private parties. Most of the land is currently zoned agriculture.

Landowner Issues and Concerns. A number of concerns and issues have been raised by landowners regarding the use of wind power in Hawaii. However, the primary concerns were visual impact, competing or conflicting land uses, potential difficulties in permitting projects, and overall public acceptance of wind power.

Recommendations

Joint Venture and Teaming. During this panel discussion, there was a strong consensus that everyone must work together as a team (or joint venture) to develop the wind power potential for the good of Hawaii. The team should consist of the landowner, utility, government, environmental groups, the manufacturer/developer of the wind technology and the public in general. It was felt that key issues could be identified, addressed and resolved through the early and committed involvement of each of the team members

Public Awareness. Again, as in panel 1, the consensus was that the public must be made aware of the benefits of wind power in general and merits of specific projects at an early stage. By public, the consensus is that it is not sufficient to include environmental, cultural or local-action groups, but also all non-affiliated individuals who wish to participate in the process.

State Agency Coordination. There was renewed support from the panel for an objective that the state has recognized for some time, i.e., that the permitting agencies could coordinate better to facilitate the permitting process. By facilitate, the consensus was that the process could be streamlined and shortened without short-circuiting the public's right to participate.

References

1) *Comprehensive Review and Evaluation of Hawaii's Renewable Energy Resource Assessments,* DBEDT, prepared by R. Lynette and Associates, Redmond, WA, April 27, 1992.

2) *Small System Performance Under High Wind Plant Penetration,* Research Project 2790-04, EPRI, Palo Alto, CA, prepared by Electrotek Concepts, Inc., Knoxville, TN March 1993.

2.3 Panel 3: Utility Integration Issues

Panel Chair

Charlie Smith – Electrotek Concepts, Inc., Arlington, Virginia.

Panel Members

Hamish Wong – Hawaiian Electric Company
Ed DeMeo – Electric Power Research Institute
Jonathan Lynch – Northern Power Systems

Goals

The goals of this panel were to discuss utility integration issues with an emphasis on the results of a study conducted by EPRI and Hawaii Electric Light Company (HELCO). The issues include power quality, operational characteristics, system reliability, system stability, load match, need for storage, and penetration levels.

Summary

Shortcomings of Conventional Technology Experience on the island of Hawaii. Charlie Smith reviewed the utility system voltage and frequency regulation problems encountered with DC machines with inverters and induction machines. These problems were magnified in Hawaii due to a weak, isolated system (i.e., non-grid intertied) with poor frequency regulation. He also discussed some bulk wind farm output data from Tehachapi and Hawaii. For example, these indicate that the power fluctuations are reduced as a function of 1/N where N is the number of wind turbines in the array and the reduction is based on the fluctuations from **one** wind turbine.

Recent EPRI/HELCO Study on Small System Performance. This study (Ref. 2) included analysis of six utility operational scenarios and considered the impacts of various events with and without the presence of wind turbines (both conventional and advanced designs) on the system. Mr. Smith noted that operation of the existing utility system presents a significant challenge and experiences significant problems. Conventional wind turbines only aggravate the situation. Advanced wind turbines, with variable-speed, constant-frequency output, present no problems to the operating system, and offer some potential benefits, through the capability of limiting outputs during increasing wind conditions.

Recommendations

Wind Technology. It was suggested that wind technology has advanced to the point where the wind turbines should not present operational problems to the utility. However, as the penetration of wind power increases on the utility system, overall power system planning is paramount.

Utility System Planning. Mr. Smith suggested that the key factor limiting the size of a wind farm is the size of the largest conventional unit on the island. Specifically, with the current generation mix, there is insufficient spinning reserve available during peak periods to cover the loss of the largest unit. He suggested that advanced wind turbines could also help the situation by "participating in spinning reserve."

Advanced wind turbines, either in isolation or as part of an automatic generation control (AGC) strategy with spinning reserve, offer the opportunity for increased amounts of wind generation and improved system operation.

Specific Topics for Consideration. From the overall utility operational perspective, it was recommended that: a spinning reserve policy be adopted, an AGC system be implemented, and benefits of storage, with or without renewables, be examined. With respect to increasing wind penetration, advanced wind turbines should be evaluated for any future installations.

3.0 Project Development and Implementation Issues

3.1 Panel 4: Project Development

Panel Chair

Jan Hamrin – Hansen, McQuat, Hamrin & Rohde, San Francisco, California

Panel Members

Dan Ching – HECO
Curt Maloy – New World Power
Keith Avery – Zond Systems

Goals

The goals of this panel were to discuss utility planning, alternative acquisition methods, resource contracting, alternative ownership arrangements and permitting issues.

Summary

The New Utility Paradigm. The utility business in the U.S. and around the world is changing rapidly due to a number of factors including: greater emphasis on the environment, greater concern over future risks (changing fuel costs, environmental regulation, utility structure), addressing consumer needs, greater use of market forces, and more emphasis on energy services. The movement is towards greater flexibility in contracting and investments and hedging strategies.

Acquisition Methods. Methods depend on the type of program, i.e., start-up, RD&D or basic resource acquisition, and the perception and management of the risks involved. The key risks are forecasting, environmental (including environmental regulation), economic (fuel-based versus resource-based) and technological.

Alternative Ownership Arrangements. Traditional utility ownership arrangements provide certain benefits to the shareholders, but there are risks which the utility assumes initially. These risks, however, are ultimately borne by the rate payers. In contrast, non-utility ownership arrangements transfer most of the risks to the developer, but remove benefits to the shareholder. Until recently, most wind projects have been developed under non-utility arrangements. But as utilities now weigh ownership decisions, there are also several "hybrid" arrangements that might be considered. For example, the risks can be shared as in the typical "turnkey" project, also referred to as the build-own-transfer (BOT). The utility can gain experience with new technologies at lower technology and cost risks, while obtaining shareholder benefits. Of course, once the utility accepts ownership, it bears the performance risk. A second option is the build-own-operate and transfer (BOOT), which is similar to the BOT but includes a transition or operation phase during which the developer assumes the initial O&M risk. However, it has the disadvantage of being more complex from a contractual standpoint.

Resource Contracting. There are several important issues to resolve during contract negotiations: financiability, pricing certainty, interconnection requirements, contract sanctity, curtailment and dispatchability issues, as-delivered capacity and length of the contract term. The use of standard contracts with standard terms and conditions are valuable in facilitating the negotiation process. Specifically, the standard contract can simplify negotiations, reduce uncertainty, create equity among the participants and speed the process.

Permitting Issues. Proposed wind projects in Hawaii have generally been for land zoned as agricultural or conservation. Use of agricultural land for wind projects has been authorized based on an application for a variance to 30' height restrictions in the current zoning laws. The request is subject to a public hearing and approval by appropriate state or county agencies. Use of conservation land is more involved and is initiated with a Conservation District Use Application (CDUA) requiring an environmental assessment, and, if necessary, an environmental impact statement. The process is subject to a series of public hearings at the discretion of the approving agency.

Recommendations

Ownership Arrangements. Alternative ownership arrangements should be considered for future wind developments in Hawaii.

Wind Technology Improvements. In addition to further reduction in the costs of wind power in Hawaii, new wind technology must improve the quality of the wind power currently delivered to the utility and address issues of visual impact and avian mortality.

Cooperation and Confidence-Building. Industry and the utility need to cooperate and build confidence in the application of wind technology in Hawaii. For example, a wind energy collaborative could provide an important role by identifying and facilitating project opportunities that would benefit the rate payers, utility shareholders, landowners and power producers.

3.2 Panel 5: Government Support to Industry

Panel Co-Chairs

Ron Loose *U.S. Department of Energy, Washington, D.C. (U.S. DOE)*
Maurice Kaya *State of Hawaii Department of Business, Economic Development and Tourism (DBEDT)*

Panel Members

Lawrence Mott – Northern Power Systems
Mike Boughton – Maui Economic Development Board
David Rezachek - DBEDT

Goals

The goals of this panel were to share experiences from federal and state of Hawaii perspectives.

Summary

Government Leadership. Government's role is to sense and lead the public's interest, in this case, that wind (and other renewables) should play a greater role in the U.S. energy mix. Government must provide the leadership necessary to create a level playing field for renewables, including wind.

Federal Role. The federal wind program is working closely with industry to increase utility use of wind energy, develop advanced wind turbine designs, increase productivity and industry competitiveness and upgrade the applied research base. The first phase of the advanced wind turbine program, including market enhancements of seven existing designs, are to bring the cost of energy down to 5 cents/kWh in 5.8 m/s (13 mph) wind sites by 1995. The second phase, just initiated, will consist of innovative, next-generation designs targeted for 4 cents/kWh by the year 2000.

To stimulate greater utility confidence in wind technology, DOE, in partnership with EPRI, has implemented the wind turbine verification program. The first phase has resulted in two new utility-owned wind farms to be installed in 1995: one in Vermont with Green Mountain Power and one in Texas with Central South West. Proposals for the second phase have just been solicited. In parallel, DOE is now planning a commercialization initiative in response to the Global Climate Change Plan. The initiative will expand commercialization of wind through the creation of new alliances between the existing wind manufacturers and larger (Fortune 500) corporations.

The federal government will continue to play a key role leading a newly-announced collaborative that will provide a U.S.-wide forum for coordination of wind activities.

DOE's funding profile is increasing and will allow a major emphasis on the utility- and industry-coordinated programs, while maintaining a strong research base.

State Role. The perspective of DBEDT Energy Division is to stimulate commercialization of wind energy as an element of the Hawaii Energy Strategy (HES). The Energy Division's current activities fall into four areas:

1) maintenance of an accurate resource data base for use by industry and for input to the IRP process--jointly funded by DOE;

2) overcoming Hawaii-specific technical barriers to wind energy. DBEDT has partnered with DOE and industry to address specific grid integration and storage problems, support evaluation of design solutions for the Westinghouse wind turbines at Kahuku, and is considering *tropic-specific* wind turbine designs for Hawaii;

3) overcoming institutional barriers (specifically to advocate coordination and streamlining of the permitting process, making state land available for wind turbine development, and increasing public outreach activities); and

4) providing appropriate incentives (including tax credits that are in place, consideration of *adders* as part of IRP, and appropriate legislation).

Recommendations

Government Leadership. Government leadership is necessary, both at the federal and state levels, to provide financial support for stimulation of higher risk wind technology development and deployment. Government can also foster information transfer and coordination with the key stakeholders. The DOE has just initiated the formation of a U.S.-wide wind collaborative; the state should support the formation of a state wind collaborative.

Technology Barriers. The federal (DOE) wind program is highly focused to meet industry's needs to develop and commercialize new wind turbine designs, while maintaining a solid research base. The state should follow DOE's lead by coordinating closely with industry to identify and address Hawaii-specific technology needs, such as utility-integration issues and tropical-turbine designs.

Institutional Barriers. Specific suggestions were made to improve the education of the public (starting from elementary school children to adults and members of the legislature) and to streamline the permitting process (also panel 1).

3.3 Panel 6: Benefits of Wind Power to Hawaii

Panel Chair

Tom Gray – American Wind Energy Association (AWEA)

Panel Members

Richard Joun – DBEDT
John Mapes – Division of Consumer Advocacy, Department of Commerce
Paul Brewbaker – Bank of Hawaii

Goals

The goals of this panel were to discuss the benefits to Hawaii's economy, environmental and energy security costs, and macroeconomic impacts.

Summary

Economic. The primary economic benefits are increased employment, reduced supply risk (or expressed as an energy security cost), reduced price risk, reduced environmental regulation risk and improved trade balance. Several economic studies have been completed recently which tend to incorporate local impacts. One of these conducted by the state of California indicated that 27,000 employee-years were required to install the 1700 MW of wind turbines in California; and approximately 400 permanent jobs resulted. Another study performed by the Union of Concerned Scientists *(Powering the Midwest)* concluded that wind power development created more jobs per MW than individual conventional technologies and other renewables with the exception of some biomass options (when feedstock cultivation is taken into account).

Wind power development reduces supply risk by adding diversity to the fuel supply mix and some flexibility to responding to particular problems. For example, unpredictable swings in oil prices are avoided.

Environmental. The primary environmental benefits are reduced greenhouse gas emissions, reduced risks of oil spills, and reduced toxic air emissions. Some might argue that investment in wind power is like buying insurance on the risks of the future, not the least of which now is the risk of environmental regulation.[2]

Valuing the Benefits. While there is general agreement on the potential benefits of wind power, there is less agreement on how to value those benefits. Consequently, there

[2] For example, the administration's *Global Climate Change Action Plan* could result in legislation of significant environmental emissions. This would place a burden on the utilities to reduce current use of fossil fuels significantly.

is a lack of agreement on how to best value the benefits of wind power in the pricing and regulatory processes. AWEA has just commissioned a new study to take a fresh look at the economic and environmental benefits of wind power. This study, subcontracted to Nathan and Associates, will examine *generic* costs and benefits for the economic and environmental benefits of wind power within the framework of the IRP process.

Recommendations

Economic and Environmental Risks. While public sentiment favors actions to protect Hawaii's economy and environment, the rate payers have no protection (and hence bear the risks) from the consequences of the volatility in the oil supply and costs for environmental regulation. One option would be to shift those risks via regulatory action to the utility and its shareholders. This shift, which is viewed as a positive process, would then place the responsibility on utility management to select those options (both on supply and demand-side) which best provide insurance against those risks[3]. It should be noted, however, that the decision to implement this option is, in part, political.

Valuing the Benefits of Wind Power. In parallel to the AWEA study, it was recommended that a Hawaii-specific analysis of the economic and environmental benefits be conducted. Such a study would provide data and information for valuation of externalities which would benefit renewables and especially wind power in Hawaii.

[3] Editor's note: Dr. Janice Hamrin pointed out in panel 4 that the name of the game is risk management, not risk avoidance, in the new utility paradigm.

3.4 Panel 7: Integrated Resource Planning

Panel Chair

David Moskovitz –Regulatory Assistance Project

Panel Members

Roy Uemura – HECO
Blair Swezey – NREL
Colette Gomoto – PUC

Goals

The goals of this panel were to identify and discuss IRP challenges and opportunities and to share experiences of IRP activities from other utilities.

Summary

Integrated Resource Planning (IRP). IRP was spawned when utilities found it increasingly difficult, using traditional planning approaches, to predict demand and estimate costs of new generation and to incorporate demand-side management options. There was also concern regarding environmental risks. IRP has become a new tool, a new process, to make the increasingly difficult decisions among diverse generation and demand-side management alternatives.

Two recent policy initiatives by the federal government have supported the implementation of IRP. First, the Energy Policy Act of 1992 (which amended PURPA), listed renewables as alternatives to be evaluated as part of IRP, as well as a number of risk factors, including reliability, diversity, and dispatchability. Secondly, activity in response to the *Global Climate Change Action Plan* has recommended implementation of IRP at the state level. The state of Hawaii implemented IRP in 1990 in advance of the Energy Policy Act and has resulted in submittal of four IRPs to date. These plans, submitted by HECO, HELCO and MECO, are currently under review by the PUC. Once approved, each will be evaluated annually and updated every three years. Each has a 20-year planning horizon, with a 5-year action plan. The action plans include lists of planned resource acquisitions and demand-side-management initiatives. It was noted that while each of the four IRPs considers wind power as a commercial technology over the 20 year planning horizon, none of the four IRPs has included wind as part of their 5-year action plan.

The Potential For Renewables. Across the U.S., approximately 8% of the electricity is currently generated by renewables (primarily hydro); estimates for the potential contribution of renewables by 2030 are as high as 35 to 51%. Three key attributes of renewables are sited as reasons for this rosy outlook: costs are dropping, system output and reliability are improving, and they can provide environmental and economic benefits. But the diversity of renewables complicates the IRP process.

The IRP Process. The IRP process provides a methodology for determining the worth (or value) of a resource. There are three important elements in establishing the *worth* of a resource: when will it be brought on line (timing), where will it go (location) and what are its key attributes (characteristics). Ideally, in IRP, once the resource values are established, those which *cost* less than they are *worth* will be selected. Hence, the more diverse the resource options, the more you need IRP and the more sophisticated the planning tools need to be.

Removing the Barriers. However, there are barriers which make it difficult to establish the worth of renewables, and especially wind, hence, cost-effective renewables may be overlooked. Some of these barriers relate to the resource-specific avoided cost, its distributed value, perceived reliability, risks and uncertainties in implementation and externalities. But there are no *magic* bullets to remove the barriers; the approach is part policy and judgment, and part analytic.

Risk Analysis. Risk analysis is an important tool, especially when two or more options appear to be equally attractive. However, the ultimate decision will be impacted by the specific risks (and the relative weighting that is applied) and from which perspective (utility or consumer) the risks are assessed. For example, the state of Maine reduced it's oil dependence from 40% to 5% over a 10 year period by utilizing renewables and energy efficiency. The objective was to hedge against oil price volatility. However, the utility rates increased by 35% over a 5 to 6 year period, which was a 4 to 12% higher increase than if conventional options had been employed. This was due, in part, to declining oil prices. The state of Maine, in fact, has paid a premium, for the reduction of its oil dependency. Was it a reasonable price to pay? While utility rates have increased, the state is currently avoiding $200M/year in oil purchases and environmental emissions.

Recommendations

Improving IRP. As a result of this panel discussion, it is clear that additional exchange of information and experience with the IRP process will be constructive. However, in order to better evaluate renewables, local (site-specific) information on resource strength and construction costs must be taken into account.

Valuing the Attributes of Wind Power. The attributes of wind power, as well as most renewables, are very site-specific. Additional data and information are needed to characterize the statistical contributions to capacity provided by wind. Within IRP, the valuation of capacity and other attributes of wind should then be compared with its cost.

4.0 Stakeholder Perspectives

4.1 Opening Comments

Presenter

Ron Lehr – Consultant

Panel Members

Tom Jezierny – Maui Electric Company (MECO)
Warren Lee – Hawaii Electric Light Company (HELCO)

Goals

The goals of this introductory session were to provide an overview of approaches to facilitate the proactive involvement of key stakeholders to enhance the use of wind power in the electric utility.

Summary

Who Are the Stakeholders? The definition of stakeholders is very broad, but generally includes anyone who is interested in a particular issue, e.g., meeting the electrical energy needs of the people of the state of Hawaii. The list of stakeholders includes the utility, the vendors or suppliers of energy technology (i.e., industry), the government (both legislative and executive), the utility regulators, the landowners, environmental or consumer advocacy groups, independent research organizations such as the university or PICHTR, the consumers and the public in general. Given the list of stakeholders, some will be key, i.e., without their support you do not move ahead, they hold decision power, make financial decisions and hold veto power. In this case, the key stakeholders (subject to some disagreement) are the utility, industry, the PUC, the landowners and consumers. Supporting stakeholders are those which have affected interests, can facilitate the key stakeholders, have a strong claimed interest and provide helpful, supportive roles. These would be government, research organizations, environmentalists.

What is the Process of Involving the Stakeholders? The formal legal due process employed by most Public Utility Commissions has five elements:

1) notice,

2) a hearing,

3) a fair decision-maker,

4) a record of the decision, and

5) appeal.

The process can be much more informal and still be fair to all concerned. Interested parties make themselves known or are identified by the key stakeholders. The informal process can consist of procedures to reach agreements with less cost and more effectiveness than formal legal due process. Informal procedures can be applied to the challenges of identifying, evaluating and selecting energy options for the electric utility. By working through information gathering, consensus building and negotiation, and finally, litigation when negotiations are unsuccessful, utility planners can reach conclusions about how to supply needed resources.

Why Commercialize Renewables? There are several key attributes of renewables that make them attractive to utilities:

1) environmental concerns: renewables generally offer attractive environmental benefits;
2) the costs and risks associated with fossil fuels—renewables can provide a hedge against fuel price volatility and reduce energy supply risks;
3) the productivity of new technology—costs of renewables are coming down, performance and reliability is going up, their diversity and modularity can offer utility integration advantages;
4) customer preferences—again renewables offer attractive alternatives; and
5) the utility competitive advantage—in many cases, utility-ownership arrangements will be the best for the utility and the rate payer.

Elements of a Successful Commercialization Strategy. There are many elements of a potentially successful commercialization strategy, but the most important are a shared vision of the future, a willingness to enter into partnering relationships and leadership based on a common agenda.

The Utility Perspective in Hawaii. The utilities in Hawaii are undertaking integrated resource plan (IRP) processes on each of the islands. IRP is viewed as the means to meet the goals of proactively involving key stakeholders to enhance the use of wind power in the electric utility. Stakeholders can become involved through intervention (the technical term for formal involvement in the IRP docket), membership on IRP Advisory Groups (a more informal forum), public meetings, etc. The current IRP elements include forecasting consumer demand, evaluation of demand-side management and supply-side options and an integration of the preferred options to meet the demand over a twenty year planning horizon. Within the IRP framework, the utility seeks to provide reliable, high-quality power to its customers at the lowest reasonable cost. Public concerns such as environmental impacts are to be addressed in the process. While it is believed that wind power has many positive attributes, the utility is still accountable for the quality and reliability of the power delivered to the customer. There are concerns, based on the utility's experience with wind power, regarding the quality and reliability of wind power. It is also recognized that the IRP provides a forum for exchange of information on the improvements in wind technology.

Recommendations

This panel discussion focused on how stakeholders, in general, might be involved, with some emphasis on the current IRP process in Hawaii. The discussion did not result in any specific recommendations. See sections 4.2 to 4.4 for additional discussion on stakeholder perspectives.

4.2 Panel 8: Public Perspectives

Panel Chair

Clyde Murley – Natural Resources Defense Council, Berkeley, California

Panel Members

Ira Rohter – Green Party
Scott Derrickson – Hawaii Energy Coalition
Michael Jones – Union of Concerned Scientists

Goals

The goals of this panel were to discuss key issues pertaining to public acceptance of wind power in Hawaii: environmental benefits, alternative land uses, aesthetics, noise and avian habitat.

Summary

Clyde Murley asserted that the public is a key, if not the ultimate, stakeholder, but one whose involvement to date has often been limited or overlooked. The public generally favors the use of renewables, and especially wind, but mobilizing this general acceptance into an impetus for action represents a formidable challenge, both on a global and local scale.

Global Public Perspectives. IRP, as the new planning standard, is designed to include externalities and other public concerns. But there are significant hurdles that the public must overcome in order to achieve meaningful involvement:

1) institutional inertia *(business as usual),*
2) difficulty in quantifying or analyzing externalities, and
3) organization (the public is dispersed, unorganized and with multiple interests and lack of resources to support full involvement or intervention).

As a consequence, the process now tilts the playing field significantly in favor of private over public interests. Two key elements must be addressed:

1) the quantification or monetization of externalities–while most externalities may be quantifiable, those that resist quantification should not be ignored; and
2) a bias in cost accounting practices towards local, as opposed to global, and especially near-term as opposed to far-term impacts. These patterns of bias can skew decision making away from the public interest, which, in this case, is to use more wind power in meeting our electrical energy needs.

Local Public Perspectives. For wind power development to be successful in Hawaii, there are several local (or site-specific) public acceptance issues which must be addressed:

1) land-use (referring back to the panel 2 discussion, the use of the land for wind power must be compatible with other uses and land owner interests),
2) avian habitat (a wind power plant should be sited to avoid, and all steps taken to mitigate, bird collisions with the wind turbines or their towers),
3) visual impact and noise (siting of wind turbines should be viewed and discussed with the public within a broad context of weighing the positive environmental and economic benefits against perceived negative impacts).

Advancing the Public Interest. The following conditions are felt to be necessary for advancing the public interest:

1) funding to support public involvement—the cost of intervention in the IRP process is high;
2) technical and subject matter expertise;
3) extensive involvement in the decision-making process;
4) a collaborative process to build consensus; and
5) creative approaches to improve the IRP process.

An assessment of the status of IRP in Hawaii indicates that the public interest is severely *out competed* by the private interest, most externality concerns are elevated in rhetoric but are inconsequential in actual decision-making, institutional support for wind power is lagging behind the public impetus and IRP currently is **not** a solution but a framework whose potential has not been realized.

Public Assessment of Wind Power in Hawaii. Generally, wind power is substantially superior to fossil-fuel-derived power from a public perspective. The regulatory and legislative infrastructure is lagging behind the public interest in providing the necessary and appropriate impetus for accelerating wind development.

Recommendations

The IRP is viewed as a framework whose potential might be improved if:

1. funding could be provided for public participation in planning, policy development, regulatory and legislative processes;
2. establishment of legislative and PUC public advisors to serve as focal points for advancing public interests;
3. a stronger role was created for the public in the IRP advisory processes;

4. there was increased use of public/private collaborative processes;
5. a strong public education effort was supported; and
6. analytical methodologies **and** decision processes were redesigned to be accountable to the new standards in energy planning.

4.3 Panel 9: Regulatory Perspectives

Panel Chair

David Moskovitz – Regulatory Assistance Project

Panel Members

Ron Lehr – Attorney
Collette Gomoto – Public Utility Commission
Gerald Sumida – Attorney

Goals

The goals of this panel were to discuss regulatory perspectives in the U.S. and applicability to Hawaii.

Summary

The regulatory process does vary from commission to commission. The ones that are highly litigious are the least productive and tend to *pit* utilities against the developers. There are some good models out there; there are also some good initiatives for treatment of renewables, and especially wind, within the context of the IRP process.

Initiatives. The initiatives or regulatory techniques essentially are attempts to improve the calculation of avoided cost. They include:

1) green pricing—the rate payer pays a premium for an environmentally-preferred service, the utility is obligated to acquire new renewables--a number of pilot programs are underway, but the question (yet unanswered) is whether the rate payers are **actually** willing to pay for the green option;

2) supply-side incentives—such as production incentives and allowing the utility to make a *profit* on purchased power;

3) green RFPs—viewed as a good option to hedge against tightening environmental requirements and global warming concerns--the initial attempt by the North East Energy System resulted in more, cost-effective options than was predicted;

4) Renewable Set Aside—a portion of the IRP is devoted to renewables with a focus on demonstration and commercialization (but additive to renewables R&D)—benefits accrue to all stakeholders; and

5) Safe Harbor Rules—provides for utility desire for certainty and regulators' desire to avoid pre-approval of cost recovery and removal of risk from the utility manager. However, the utility remains cautious to safeguard its need for prudent management.

Regulatory Climate in Hawaii. The Hawaii Public Utilities Commission (PUC) has required the Hawaiian utilities to implement IRP (reference discussion in panel 7). The PUC is supportive of the use of renewables and the consideration of externalities within the framework of IRP, but has not prescribed any specific measures or initiatives, such as those discussed above. During the panel discussion, several points were raised regarding the implementation of IRP:

1) the role of independent power producers (IPPs) in IRP - The IRPs in Hawaii assume that the utility will acquire new generation. Hence, IPPs are not included in the actual IRPs unless a power purchase contract is in effect, such as the case with Applied Energy Services, HPOWER, the sugar companies and others. In some cases IPPs have participated during the advisory and review periods. Finally, it was noted that a market test (competitive bidding) has proven to be useful as a supplement to IRP supply-side screening in about 25 states; and

2) a more equitable treatment of risk in cost analysis for wind—the present practice is to use the *weighted average cost of capital* or WACC for the discount rate. The WACC includes elements of fuel risk, which are not appropriate for wind and other renewables. An alternative, such as the *risk adjusted discount rate,* (RADR) provides capital-specific treatments.

Recommendations

The PUC should consider and evaluate further:

1) alternative initiatives for encouraging renewables,

2) treatment of risk in cost analysis for wind versus other supply-side options,

3) role of IPPs in the IRP process, and

4) cooperative and collaborative activities.

4.4 Panel 10: Legislative Perspectives

Panel Chair

Eric Sikkema – National Conference of State Legislatures

Panel Members

Matt Matsunaga – Hawaii State Senate
Duke Bainum – Hawaii State House of Representatives
Robert Herkes – Hawaii State House of Representatives

Goals

The goals of this panel were to discuss legislative perspectives in the U.S. and applicability to Hawaii.

Summary

There is a growing interest in wind at state legislatures in recognition of the energy, economic and environmental benefits. Many utilities have taken the lead in implementing wind power. However, in several states the legislature has taken the lead. The focus and force of this involvement varies from state to state. Wind legislation is successful when the state has abundant resources, aggressive implementation policies, quality information on wind technology, economics and benefits, and the PUCs and utilities work together.

Initiatives. State legislative initiatives include:

1) general encouragement of wind energy development,
2) stated preference or policy for renewables (where wind is included in the definition),
3) tax incentives,
4) production tax credits,
5) financing options,
6) integrated resource planning,
7) consideration of externalities, and
8) set-asides (especially when the PUC supports it) and adders.

Recent Legislation. A number of states have passed or are considering new legislation that will support wind:

1) California—50% of new generation, for the three major California utilities, is to be renewables by the year A.D. 2000 with a 300 MW wind power set-aside (1991 law);

2) Iowa—an avoided cost was set at 6.0 cents/kWh for alternate power producers (1993 law);

3) Oklahoma—a three year residential tax credit of 40% (up to $2500) and 30% for commercial systems (up to $150,000). All installed systems have to be certified (1992 law);

4) Minnesota—a preference for renewables (utilities must show that non-renewables are not in the interest of the people of Minnesota) and a requirement of 425 MW of wind power installed by the year A.D. 2000;

5) Several states including Iowa, Kansas, North Dakota, South Dakota, Massachusetts and Wisconsin have passed various forms of income tax credits, property tax exemptions or sales tax exemptions.

State Energy Plans. At least 20 states have a state energy plan or strategy. The plans, which generally compliment existing legislation, provide guidance and state goals and objectives, and encourage collaboration among legislators, state energy offices, utilities and public utility commissions. The 1992 New York plan is viewed as a good model. It set a goal of 300 MW of new electricity capacity from renewables by 1998. Although the state has excess capacity, it will encourage utilities to develop wind for future demand. And, as noted in panel 5, the state of Hawaii is implementing the Hawaii Energy Strategy program which will produce an integrated energy strategy for the state.

Legislative Environment in Hawaii. State Senator Matt Matsunaga and State Representative Duke Bainum convened and led the *Energy and Environmental Summit* in October 1993. The overall goal of the summit was to gain *consensus* on key issues and, where appropriate, coordinate and draft legislation. Within the Energy Committee to the summit, there was strong consensus that further use of renewables for the generation of electricity should be encouraged. Consequently, a number of bills were drafted and discussed within the Supply-Side Subcommittee. Most of these bills were forwarded to the legislature. The majority were not passed from legislative committee, in part, due to the lack of support by the utilities and the PUC, but also due to the tight budget constraints of this year's state legislature[4].

[4] Editor's note: At the time of the workshop, legislative hearings were still underway, so that the comments in the text above reflect the status as of that time. It should be noted that one important resolution was passed. The resolution (SCR No. 40) requires the PUC to open a renewables information docket. It is hoped that this docket will facilitate the informal exchange of information on renewables and the PUC's consideration of regulatory alternatives to improve the IRP.

Recommendations

Several recommendations were made:

1) consideration of stronger legislation during next year's session,

2) working with the utilities and the PUC to aggressively implement IRP,

3) building of consensus through the summit process,

4) establish a State Energy Commission to facilitate overall planning and coordination of energy issues.

5.0 Wrap-Up Discussions and Comments

Synopsis of the Panel Discussions.

Each of the presenters was asked to provide a brief synopsis and highlights from their respective panel discussions.

Session 2: Technology and Resource Status

Panel 1 (Technology and Industry: Ms. Sue Hock). The industry is now or on the verge of producing the 5 ¢/kWh wind turbine. The 4 ¢/kWh advanced wind turbines are on the drawings boards and are expected to be in the marketplace by 2000. In Hawaii, while there have been problems, the industry's experience has been particularly valuable, as problems with turbulence-induced loads and salt-corrosion were identified and are being resolved. The industry has matured and is no longer viewed as a cottage industry of *granola crunchers*.

Panel 2 (Resource Availability: Ms. Karen Conover). Hawaii has an excellent wind resource on each of its islands. The resource is well-documented and on-going wind measurements are supported by the state. Potentially, there are excellent wind sites on both state and private land available for development. But there are concerns voiced by some potential landowners about the use of their land for wind power development. These include visual impact, competition with existing or planned uses, avian mortality, cultural and native Hawaiian concerns.

Panel 3 (Utility Integration Issues: Mr. Charles Smith). This panel discussed the details of a study conducted on the Big Island's utility system and operating characteristics and experience with wind power. The study identified the need for spinning reserve, frequency regulation and automatic generation control to improve utility operation. The new generation of advanced wind turbines are expected to overcome all of the disadvantages seen with the first generation designs on the island. The new turbines will be able to provide both real and reactive power, and possibly participate in frequency regulation. A joint utility/developer collaborative was proposed to investigate strategies for increasing wind power penetration on the island.

Session 3: Project Development and Implementation Issues

Panel 4 (Project Development: Mr. Keith Avery, substituting for Dr. Jan Hamrin). Project development of wind power has been difficult in Hawaii. The utility's role is changing, and there are new opportunities in how contracts are designed, how wind power is integrated and how projects are developed, owned and operated. With respect to projects to be developed by independent power producers (IPPs), two recommendations were made:

1) an incentive should be created to provide a benefit to the utility and its shareholders, and

2) additional discussion is needed on the contract elements required for a financiable project. The process of project development can be enhanced through cooperation and confidence building between industry and the utility, but public input and responses are also needed.

Panel 5 (Government Support to Industry: Messrs. Ron Loose and Maurice Kaya). At the federal level, the appropriate roles are technology development and support to the industry to expand commercialization. However, the form of the support is changing. Tax credits are becoming obsolete, as the economics of wind power improves, but there are still technical and cost risks associated with project development. The federal government is seeking to share that risk with local stakeholders. At the state level in Hawaii, the key roles are support of resource assessment, overcoming technical impediments to wind power application in Hawaii, removal of institutional barriers and application of appropriate incentives. The state can provide an additional role by facilitating the formation of partnerships with the federal government and industry. One lesson that has been learned is that the state needs to not only talk to but also listen to the other stakeholders as well.

Panel 6 (Benefits of Wind Power to Hawaii: Mr. Tom Gray). Wind power has public support and can provide certain economic and environmental benefits both at the local and global levels, e.g., increased employment, reduced supply risks, etc. However, many of the benefits of wind power are not readily quantifiable, and there is disagreement on the best approach to valuation of these benefits. Consequently, there is a need for educating the public on the benefits of wind power.

Panel 7 (Integrated Resource Planning: Mr. David Moskovitz). Integrated Resource Planning (IRP) is an effective tool for obtaining *least cost* energy services. The basic approach is to determine the worth or value of energy alternatives and select those with costs lower than their value. Avoided costs are typically taken as the value of power provided to the utility by an alternative energy source. Improvements in the IRP process are generally focused on improvements or refinements in the avoided cost. Other key issues in IRP are risk and uncertainty, fuel diversity, and capacity value. Arguments have been made that wind power can reduce risks and uncertainty in the energy supply, can contribute favorably to fuel diversity, and possesses a non-zero capacity value. Overall, IRP can provide an effective tool in supporting sound judgment in the utility planning process.

Session 4: Stakeholder Perspectives

Opening Comments (Messrs. Ron Lehr, Tom Jezierny and Warren Lee). Overall, too much time is spent on substance, rather than the process in IRP. The process can be improved by better identification and inclusion of stakeholders in advisory groups. Utilities, in general, are showing a willingness to consider wind power. The catalyst for a more meaningful process would be the formation of a wind energy collaborative, consisting of the utilities, regulators, industry, government and the public. The utility perspective includes prime consideration of the quality and cost of electrical service. The utility has been *burned* by its early experiences with wind power. While IRP has created some attractive incentives for introduction of new technologies (such as DSM), the utility's commitment is to avoid an increase in its costs to the rate payer. IRP is the chief mechanism for renewed examination of wind power. The utilities support a collaborative approach in the development of action plans and public participation in the advisory groups.

Panel 8 (Public Perspectives: Mr. Clyde Murley). The advancing of the public perspective is a mighty struggle. The public views wind power as a sensible energy choice. However, the exclusion of externalities in the IRP process now stands as a barrier to this public will. But there are significant institutional barriers against public participation, one of which is the political process in Hawaii itself. A specific concern voiced by the panel is the current bias in IRP towards quantification, i.e., if a perceived benefit cannot be quantified, then it will not be included or will be inconsequential in the decision process.

Panel 9 (Regulatory Perspectives: Mr. David Moskovitz). The regulatory process works best if done collaboratively through information exchange and negotiation, but sometimes litigation is required. A number of new initiatives have been considered to encourage renewables, including green pricing, green RFPs, utility incentives, production incentives and *risk-adjusted-rates* for evaluation of life cycle costs for renewables.

Panel 10 (Legislative Perspectives: Mr. Eric Sikkema). States can learn from each other. Legislation supporting wind power (and other renewables) has been more effective when supported by the regulators, utilities and consumer advocacy groups. In Hawaii, this year's legislative efforts fell short of the consensus achieved during the *Energy and Environmental Summit*. However, it was noted that it is very difficult to pass legislation in Hawaii on the first year's attempt, when it normally takes up to three years. Cooperative and aggressive action might result in success sooner than three years.

Discussion

Education. The need for education was acknowledged and stressed again. The need to educate the public extends all the way from school-age children to legislators. This is an area where the state can show leadership.

Externalities. Businesses are already involved, or need to be, in IRP. The point was made that externalities should be used in pricing, not just in planning. It was suggested that a value be *assigned* as a place holder until a specific assignment can be made.

Incentives. Utilities need an incentive to go for wind power. The question is whether the industry still needs incentives? Ron Loose indicated that DOE is not looking at long-term incentives. However, to encourage further commercialization, the initial risk of market penetration needs to be overcome. Consequently, the government *buy-down* of that risk is viewed as a temporary measure to get industry *over the hump.*

Good Experience. Ed DeMeo (EPRI) pointed out that Hawaii's major problem with wind has been its own bad experience. What is needed is a way to *engineer* a good experience (rather than replicate it). Deployment assistance (viz.-a-viz. the joint EPRI/DOE wind turbine verification program) is a good example of a way to work together to engineer that good experience.

Legislative Activity. Dr. Rezachek (DBEDT) indicated that, while some of the summit bills were still alive, help was needed from those present to provide testimony. A list of the bills, with their status, was included as part of the panel 8 discussion.

6.0 Conclusions and Recommendations

Conclusions

The Hawaii Windpower Workshop brought together approximately 80 key government, utility, industry and private representatives in Honolulu, Hawaii, to discuss and learn from each other how additional windpower might be added to the supply mix for the Hawaiian utilities. A key outcome of the workshop was the overwhelming consensus that the use of windpower should be increased in Hawaii. This consensus was consistent in all of the panel discussions, and throughout the entire workshop. Furthermore, it is significant the discussions were sometimes lively, but not heated; informative and accurate, but not biased; and proactive, but not reactionary.

In 1984 a similar workshop was held, at which time many of the same issues were raised, and a similar vision of the future of windpower was painted. Since then much has been learned about the applicability of windpower in Hawaii. This vision of the future of windpower in Hawaii has been reinforced and renewed because of the:

1. progress that industry has made in improving wind turbine performance and reliability and in lowering costs, e.g. installed costs have dropped from $3,000/kW to $950/kW; cost of energy has similarly dropped from over 20¢/kWh to 5¢/kWh;
2. willingness of the Hawaiian utilities to examine the technology integration issues and to take a *fresh* look at the benefits of windpower; and
3. implementation of IRP which is leading to the proactive inclusion of more stakeholders in the process of determining the energy future of Hawaii.

Despite the consensus on the objective of using more windpower, it is also recognized that not everyone agrees on its implementation. However, there was general agreement and a willingness on the part of the participants to continue the discussion. This willingness is the basis for the recommendations which follow.

Overall Recommendation

The overall recommendation is to form a Hawaii wind collaborative. The collaborative will be the vehicle for establishing and maintaining a cooperative and collaborative approach to enhancing the use of wind power to meet the electrical energy needs of the people of Hawaii. The suggested key participants for the wind collaborative in Hawaii include: the state (legislature, DBEDT, DLNR, and others), county and federal (DOE) governments; the utilities and the PUC, industry, landowners, environmental and consumer advocacy groups, and the public at large. PICHTR will spearhead the activity to form the collaborative within the next three months. The collaborative is viewed as an informal process which can contribute positively as an adjunct to IRP, which is viewed as the more *formal* process.

Specific Recommendations

The wind collaborative will be the ongoing forum for addressing windpower implementation issues, establishing common agendas and promoting windpower in Hawaii. From the workshop, the following were identified as key issues with recommended actions:

1. *Public Awareness:* Implement public awareness programs regarding the potential impacts (benefits and costs) to the communities in Hawaii due to wind power development. The potential impacts include economic and environmental benefits, and concerns regarding visual compatibility, avian habitat and mortality, compatibility with existing or planned uses, and social and cultural values;

2. *IRP:* Investigate appropriate mechanisms for evaluating wind power within the IRP framework, including ways to increase and enhance public involvement, and recognition of economic and environmental benefits, capacity value, and other benefits which might not be readily quantifiable;

3. *Regulatory Process:* Encourage information exchange and negotiation in the regulatory process. Consider specific initiatives to encourage wind power, such as production incentives, utility incentives for independent power production, green pricing and green solicitations;

4. *Wind Technology:* Support refinements in wind power technology to meet Hawaii's combination of turbulent, humid and salt-corrosive wind conditions with possibility of periodic hurricane force winds;

5. *Utility Integration:* Conduct detailed power system studies to investigate the feasibility of increased penetration of wind power on each of the island grids, including the potential for wind power and energy storage to participate in frequency regulation, peak-shaving and spinning reserve; and

6. *Project Development:* Facilitate formation of partnerships to develop specific wind power projects.

Appendix A
Workshop Agenda

The Pacific International Center
for High Technology Research
Presents:

The Hawaii Windpower Workshop

March 21-22, 1994
Hilton Hawaiian Village

Sponsored by:

The U.S. Department of Energy (U.S. DOE)
State of Hawaii Department of Business, Economic Development & Tourism (DBED&T)

In Cooperation with:

U.S. DOE National Renewable Energy Laboratory
State of Hawaii DBED&T
Hawaiian Electric Company

THE PACIFIC INTERNATIONAL CENTER
FOR HIGH TECHNOLOGY RESEARCH

Hawaii Windpower Workshop

Welcome to the Hawaii Windpower Workshop at the Hilton Hawaiian Village Hotel on March 21 and 22.

Goals

- To support the integration of added windpower into the Hawaiian utilities supply mix and the transfer of modern wind technology to stakeholders in Hawaii's energy arena.
- To identify the appropriate mechanisms for consideration of windpower within the IRP process.

The attached agenda outlines the topics which will be discussed in a presentation / discussion format.

Wind Farm Tour

Through the courtesy of Makani Uwila Power Company, Oahu, PICHTR will conduct a wind farm tour for workshop participants on the morning of March 21. The tour will leave promptly at 8:00 a.m. from the Hilton Hawaiian Village Bus Depot located behind the Tapa Tower.

Registration

For registration and information, please see Linda Ome at the registration table located outside of Tapa Tower, Room I.

Parking for non-Hotel guests will be validated at the Hilton Hawaiian Village Hotel at a cost of $2.50 for each day of the workshop.

First Day: **March 21, 1994** (Tapa Tower, Rm. D)

12:30 p.m. **Opening Comments:**

Participants: Andrew Trenka, Ron Loose, Dr. Tak Yoshihara

Session 1: **Introduction: History of Windpower in Hawaii (1:00-1:30 p.m.)**

Presenter: Warren Bollmeier (PICHTR)

Content: An overview of government-sponsored and private developments, highlighting the "lessons learned." The overall goals and approach for the workshop will be presented and discussed.

Overall Goals:

1) Support the integration of additional windpower into the Hawaiian utilities supply mix by providing up-to-date information and transfer of modern wind technology to the various stakeholders in Hawaii's energy arena, and

2) identify appropriate mechanisms for consideration of windpower within the IRP process.

Overall Approach: The workshop will focus on how additional windpower can be integrated into the utility systems in Hawaii. Each of ten topics will be discussed in a panel format.

Session 2: **Technology and Resource Status (1:30 p.m. to 5:45 p.m.)**

Chairman: Warren Bollmeier (PICHTR)

Panel 1: **Technology and Industry (1:30 p.m. to 2:30 p.m.)**

Presenters: Sue Hock (NREL)

Panel Members: Eric Miller (KP), Bob Gates (Zond), Jeff Maurer (NWP), Robert Lynette (RLA), Edan Harel (TRM)

Goals: Review the track record of the U.S. wind industry: current industry structure and status, wind farm/turbine performance and costs, and suitability for application in Hawaii's market.

Panel 2:	**Resource Availability (2:30 p.m. to 3:30 p.m.)**
Presenter:	Karen Conover (R. Lynette & Associates)
Panel Members:	Monty Richards (KRL), Dick Cameron (HC&S), Mason Young (DLNR)
Goals:	Provide information from a SOH-funded wind resource assessment, identify interested landowners and discuss land-availability issues.

Break: 3:30 p.m. to 3:45 p.m.

Panel 3:	**Utility Integration Issues (3:45 p.m. to 4:45 p.m.)**
Presenter:	Charlie Smith (Electrotek)
Panel Members:	Alva Nakamura (HECO), Ed DeMeo (EPRI), Jonathan Lynch (NPS)
Goals:	Discuss power quality, operational characteristics, system reliability, system stability, load match, need for storage, and penetration levels.

Session 3:	**Planning and Implementation Issues (4:45 p.m. to 5:45 p.m., March 21; 8:30 a.m. to 11:45 a.m., March 22)**
Chairman:	Dr. Cary Bloyd (PICHTR)
Panel 4:	**Project Development (4:45 p.m. to 5:45 p.m.)**
Presenters:	Dr. Jan Hamrin, Hansen, McQuat, Hamrin & Rohde, Inc.
Panel Members:	Dan Ching (HECO), Curt Maloy (NWP), Keith Avery (Zond)
Goals:	Discuss utility planning, alternative acquisition methods, resource contracting alternative ownership arrangements and permitting issues.

Second Day:	**March 22, 1994** (Tapa Tower, Rm. I)
Panel 5:	**Government Support to Industry (8:30 a.m. to 9:30 a.m.)**
Presenters:	Ron Loose (DOE), Maurice Kaya (DBEDT)
Panel:	Lawrence Mott (NPS), Mike Boughton (MEDB), Dr. David Rezachek (DBEDT)
Goals:	Share experiences from federal and state of Hawaii perspectives.

Panel 6:	**Benefits of Windpower to Hawaii (9:30 a.m. to 10:30 a.m.)**
Presenter:	Tom Gray (AWEA)
Panel members:	Dr. Richard Joun (DBEDT), John Mapes (CA), Paul Brewbaker (BOH)
Goals:	Discuss the benefits to Hawaii's economy, environmental & energy security costs, and macroeconomic impacts.

Break: 10:30 a.m. to 10:45 a.m.

Panel 7:	**Integrated Resource Planning (10:45 a.m. to 11:45 a.m.)**
Presenter:	David Moskovitz (Consultant)
Panel:	Roy Uemura (HECO), Blair Swezey (NREL), Colette Gomoto (PUC)
Goals:	To identify and discuss IRP challenges and opportunities and to share experiences from IRP activities from other utilities.

LUNCH: 11:45 a.m. to 1:00 p.m.

Session 4:	**Stakeholder Perspectives (1:00 p.m. to 5:30p.m.)**
Chairman:	Andrew Trenka (PICHTR)
Presenters:	Ron Lehr (Consultant), Tom Jezierny (MECO), Warren Lee (HELCO)
Goals:	To provide an overview of approaches to facilitate the proactive involvement of the key stakeholders to enhance the use of windpower in the electric utility.
Panel 8:	**Public Perspectives (1:30 p.m. to 2:30 p.m.)**
Presenter:	Clyde Murley (NRDC)
Panel Members:	Dr. Ira Rohter (GP), Scott Derrickson (HEC), Dr. Michael Jones (UCS)
Goals:	Discuss key issues pertaining to public acceptance of windpower in Hawaii: environmental benefits, alternative land uses, aesthetics, noise, and avian habitat.

Panel 9:	**Regulatory Perspectives (2:30 p.m. to 3:30 p.m.)**
Presenter:	David Moskovitz (Consultant)
Panel:	Yukio Naito (PUC), Gerry Sumida (Carlsmith Ball), Ron Lehr (Consultant)
Goals:	Discuss regulative perspectives in the U.S. and applicability to Hawaii

Break: 3:30 p.m. to 3:45 p.m.

Panel 10:	**Legislative Perspectives (3:45 p.m. to 4:45 p.m.)**
Presenter:	Eric Sikkema (National Conference of Sstate Legislatures)
Panel:	Matt Matsunaga (Hawaii), Dr. Duke Bainum (Hawaii), Robert Herkes (Hawaii)
Goals:	Discuss legislative perspectives in the U.S. and applicability to Hawaii

Session 5:	**Summary, Wrap-Up and Closing Comments (4:45 to 5:30 p.m.)**
Chairman:	Andrew Trenka (PICHTR)
Presenter:	Andrew Trenka
Panel:	Workshop presenters
Goals:	To summarize the presentations and discussions, including key issues and conclusions.

Appendix B
List of Participants

Hawaii Windpower Workshop
March 21-22, 1994
Hilton Hawaiian Village
Honolulu, Hawaii

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Appendix C

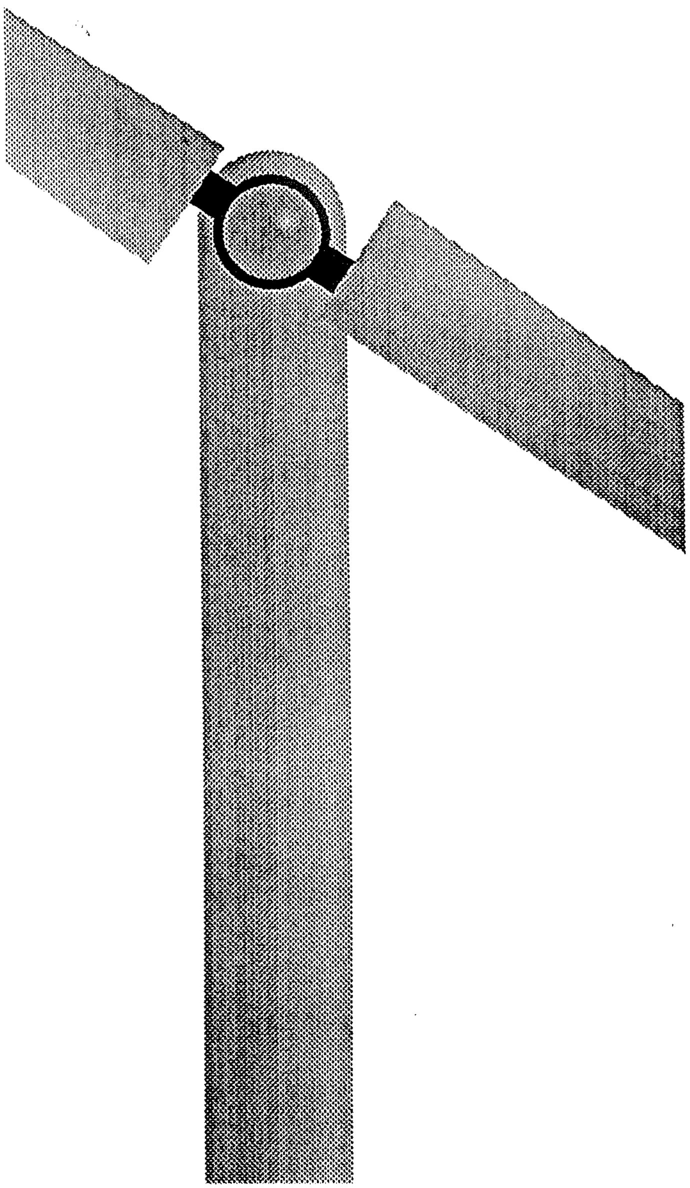
Session 1:
History of Wind Power

1.0 Introduction: History of Wind Power in Hawaii

1.1.1 Session 1 Presenter:

Warren Bollmeier, PICHTR

Presentation charts follow



Introduction

1. Early Uses of Windpower in Hawaii
2. Renaissance of Windpower
3. Commercial Activities
4. Future for Windpower in Hawaii
5. Workshop Objectives and Agenda

Renaissance of Windpower

1. State of Hawaii leadership

2. Government Support:

   - Research Development & Demonstration (RD&D)

   - market conditioning

Renaissance of Windpower

3. Utility Leadership: HECO:

- MOD-OA and MOD-5B programs
- MECO: Windane Wind Turbine and the DBEDT/Zond Wind-Diesel Hybrid Project
- HELCO: integration of windpower -- relatively high penetration
- HEI: formation of Hawaii Electric Renewable Systems

Renaissance of Windpower

4. University involvement:

- resource assessment: Meteorology Department and the Hawaii Natural Energy Institute (HNEI)
- RD&D: Wind Energy Battery Storage Test Facility at Kahua Ranch (HNEI)
- public awareness: windpower workshops and hosted Windpower '88

Renaissance of Windpower

5. Industry planning:

- encouraged by the Federal and State tax incentives
- drawing from the Federal wind program RD&D activities
- utilizing resource assessment activities in Hawaii
- investigation of windfarm sites

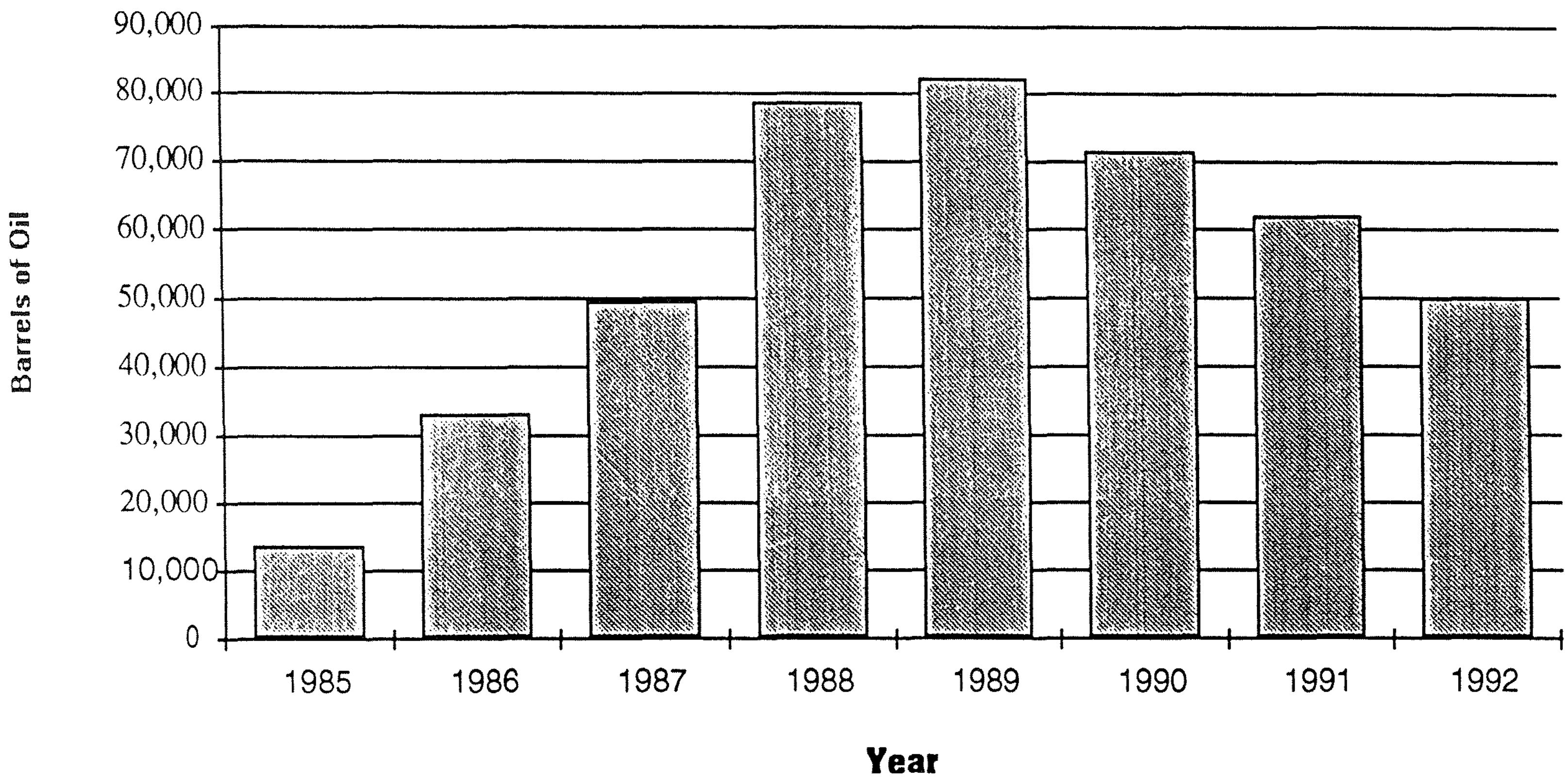
Hawaii Windpower Workshop

Commercial Windfarms

Project	Kahua Ranch	Lalamilo Wells	Makani Moa'e	Makani Ho'olapa	Kamaoa
Owner	Kahua Ranch Limited	Lalamilo Ventures	Makani Uwila Power Co.	Makani Uwila Power Co. Partners	Kamaoa
Location	Kahua Ranch	Puako, Hawaii	Kahuku, Oahu	Kahuku Point	South Point
Terrain	Mountain pass	Basically flat	Complex	Complex	Mod. Complex
Wind	9.0 m/s (20 mph)	7.6 m/s (17 mph)	8.1 m/s (18 mph)	8.1 m/s (18 mph)	7.7 m/s (17 mph)
Capacity	3.4 MW	2.3 MW	9 MW	3.2 MW	9.25 MW
Cost	N/A	N/A	$25M	$15M	$11.7M
O.D.	1983 to Present	1985 to Present	1985 to Present	1987 to Present	1988 to Present
Turbines	Jacobs (198)	Jacobs (120)	Westinghouse	MOD-5B	Mitsubishi
	1-17.5 kW (18) 2-17.5 kW (180)	20 kW (81) 17.5 kW (39)	600 kW (15)	3.2 MW (1)	250 kW (37)
Rotor	8.0 m (26')	8.0 m (26') 8.6 m (29')	43.3 m (142')	97.6 m (320')	21.9 m (72')
Status	300 kW (18))	1.7 MW (90)	7.8 MW (13)	3.2 MW (1)	9.25 MW (37)

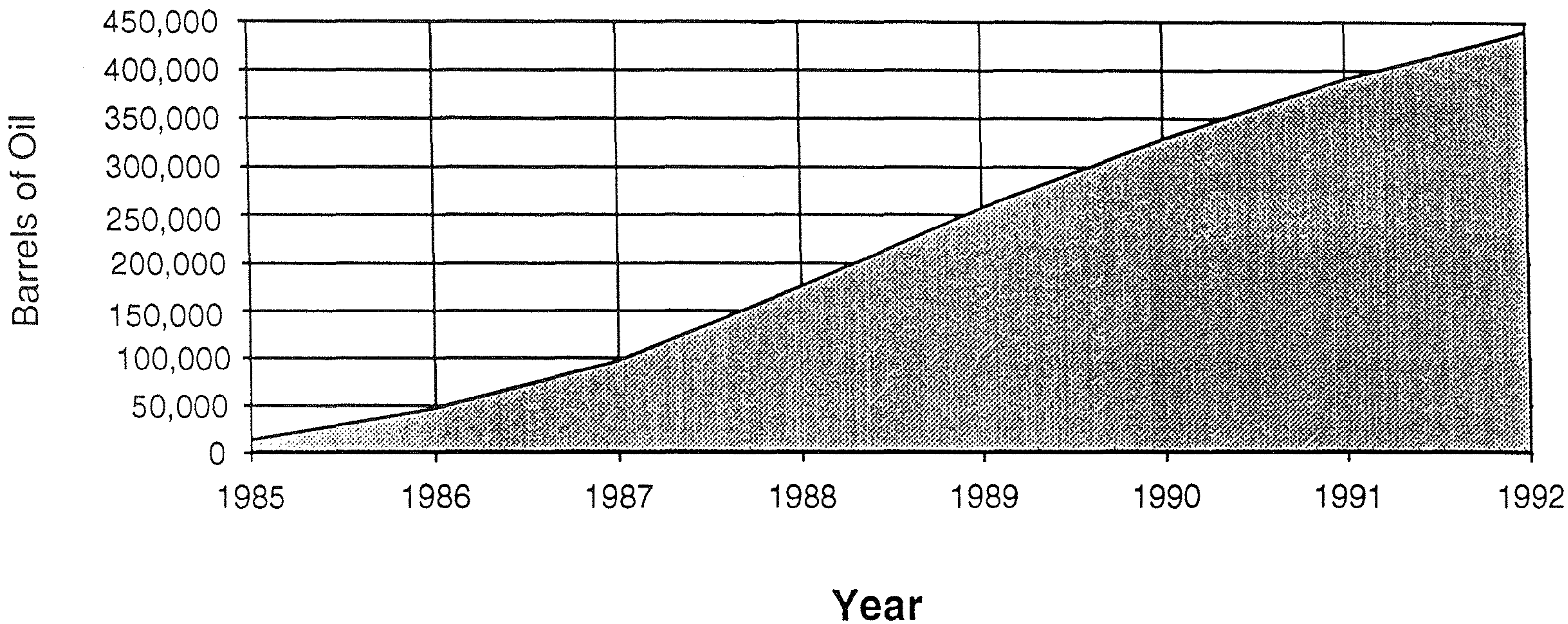
Barrels of Oil Saved by Hawaii's Windfarms

All barrel values consider the particular utility's yearly heat rates and average BTU contents per barrel.



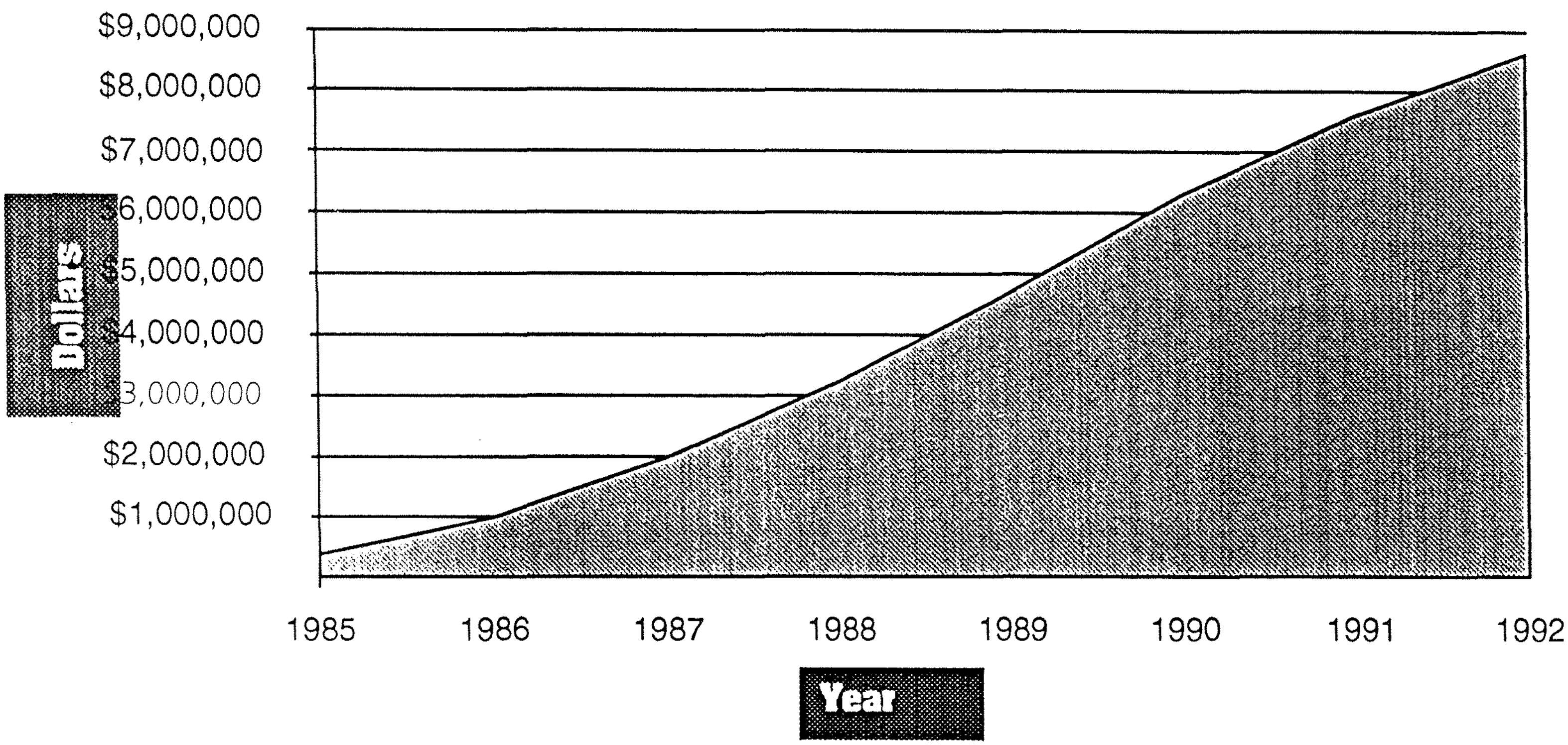
Cumulative Barrels of Oil Saved by Hawaii's Windfarms

All barrel values consider the particular utility's yearly heat rates and average BTU contents per barrel



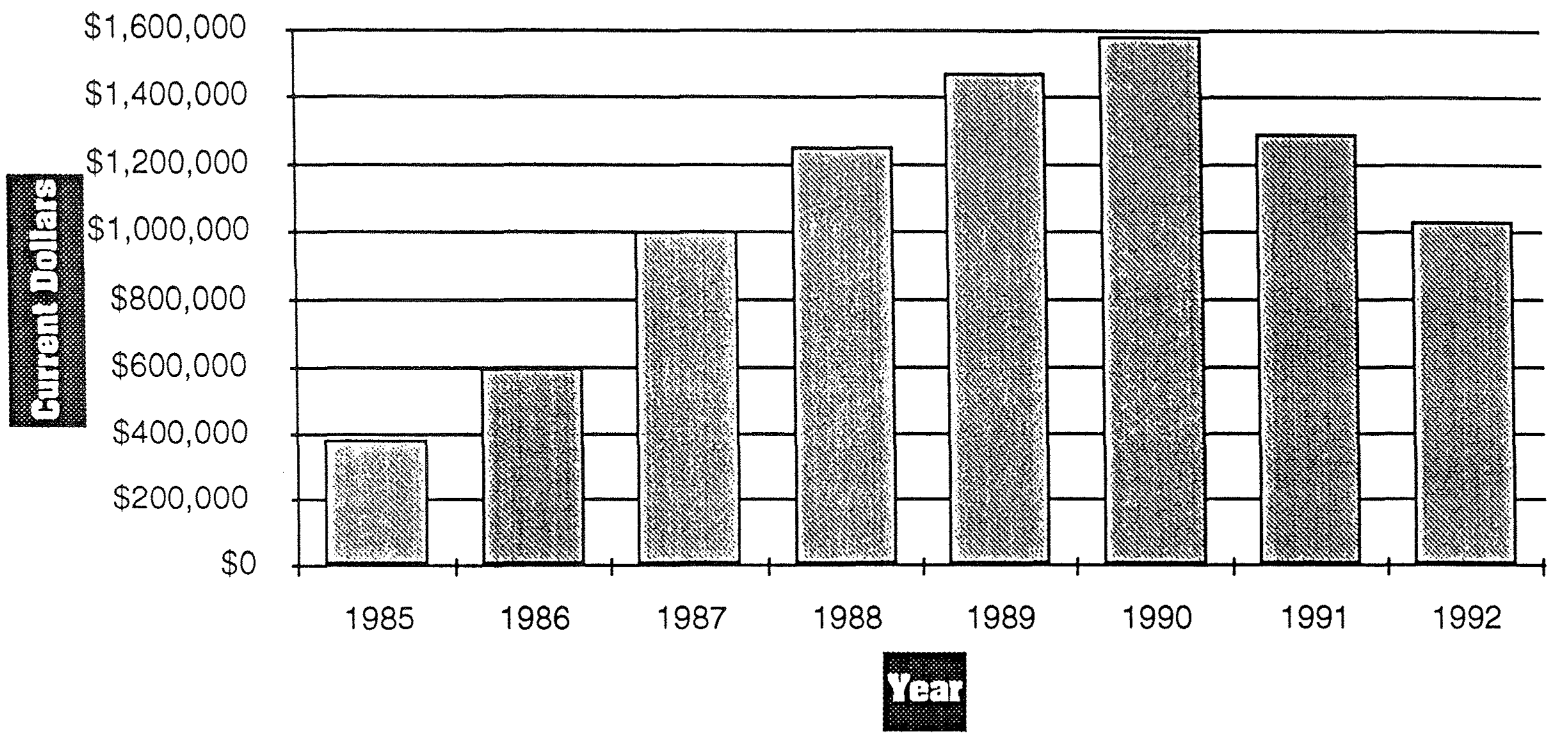
Hawaii Windpower Workshop

Cumulative Dollars Saved by Windfarms in Hawaii



Hawaii Windpower Workshop

Yearly Fuel Costs Savings by Hawaii Windfarms



Lessons Learned Siting

1. Single tower wind measurements, while representative of industry practice at the time, did not provide adequate data for siting the wind turbines:

   - the windspeeds, wind shear and turbulence at individual turbine site locations turned out to be highly variable, resulting in over prediction of energy output and also contributing to higher-than-predicted wind turbine failure rates, and
   - in some cases, the period of measurements was either too short, or otherwise not representative of the long term wind, regime at the sites, resulting in over-estimation of the average windspeed.

Lessons Learned Siting

2. In some cases where the wind turbines were installed in tightly-spaced arrays:

   - energy outputs were reduced in the second and succeeding rows, due to the lower windspeeds in the turbine wakes

   - higher dynamic loads were experienced by the turbines, due to the increased turbulence in the wakes

   - higher turbine maintenance costs resulted, due to the higher-than-expected turbine failure rates

Lessons Learned Siting

The Good News

The wind industry has developed "micrositing" and "analysis" techniques which:

- identify the variations in windspeed, shear and turbulence within a proposed windfarm site
- project more accurately the long-term or annual average windspeeds
- specify appropriate turbine array layout and spacing.

Lessons Learned: Wind Turbine Design and Performance

1. The wind turbines in Hawaii are representative of older technology - production prototypes, primarily first or second generation designs:

    - production shortfalls from the wind turbines that didn't meet their predicted power curves
    - higher-than-predicted O&M costs
    - power quality problems with those wind turbines that either used induction generators or line-commutated inverters without adequate reactive power support
    - losses in revenue due to the above.

Lessons Learned: Wind Turbine Design and Performance

2. In addition, several factors exacerbated the wind turbine design process:

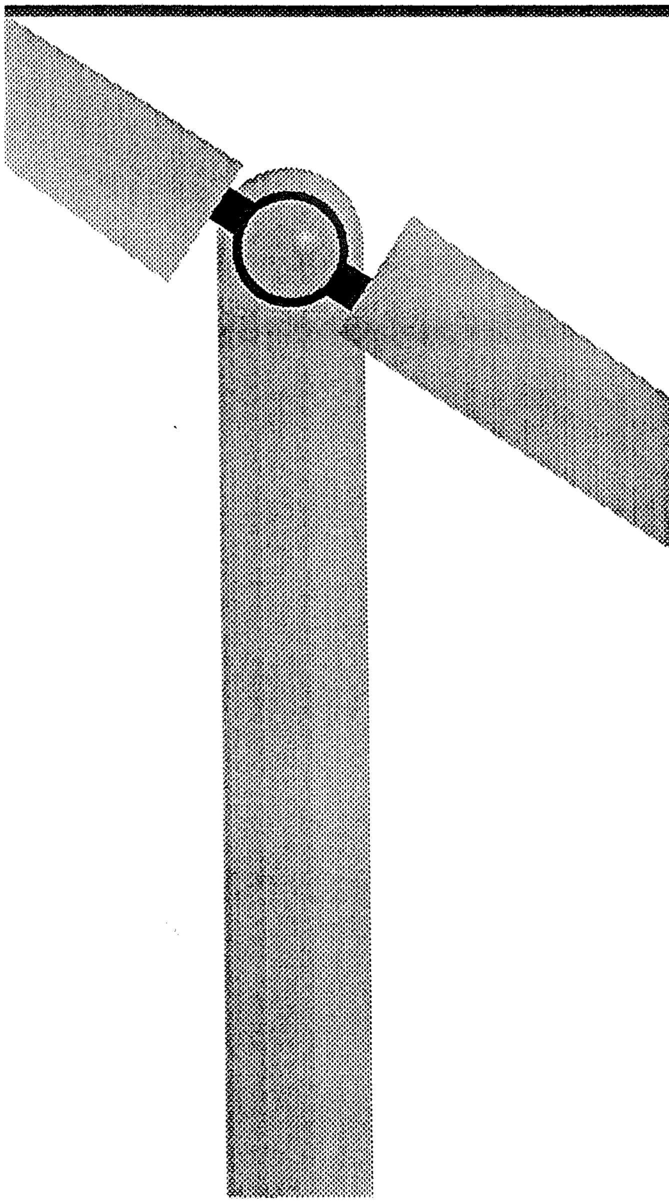
   - higher-than-expected "ambient" levels of turbulence combined with an initial lack of turbulence modeling capabilities
   - increases in turbulence due to wake effects
   - increase in component failures due to the salt corrosion at some sites

Wind Turbine Design and Performance

The Good News

1. Major advances have been made in wind turbine design:
   - dramatic improvements in performance and reliability
   - significant reductions in wind turbine costs
2. Progress and interest in Hawaii is growing due to:
   - efforts by existing operators to maintain and improve the output of their windfarms
   - industry interest in enhancing windpower's contribution to Hawaii's electric power supply and growing to meet market needs in the Asia-Pacific

Hawaii Windpower Workshop



Workshop Objectives

- support the integration of additional windpower into the Hawaiian utilities supply mix by providing up-to-date information and transfer of modern wind technology to the various stakeholders in Hawaii's energy arena and
- identify appropriate mechanisms for consideration of windpower within the IRP process

Hawaii Windpower Workshop

Workshop Agenda

Five Sessions - 10 Panel Discussions

1: Introduction: History of Windpower in Hawaii

2: Technology and Resource Status *(3 Panels)*

3: Planning and Implementation Issues *(4 Panels)*

4: Key Stakeholder Perspectives *(Introductory Comments + 3 Panels)*

5: Summary, Wrap-Up and Closing Comments

Modus Operandi
Each 1 hour Panel

- One 30-minute presentation
- Three 5-minute panel member responses
- One 15-minute general "Q&A"

Appendix D
Session 2

Presentation Charts, Panel Responses, and Questions and Answers

2.0 Technology and Resource Status

2.1 Panel 1: Technology and Industry

2.1.1 Panel Chair:

Sue Hock–National Renewable Energy Laboratory (NREL), Golden, CO

Presentation charts follow

Wind Energy Development: Technology Status and Commercialization

Susan M. Hock, Manager
Wind Energy Program
National Renewable Laboratory
Golden, Colorado

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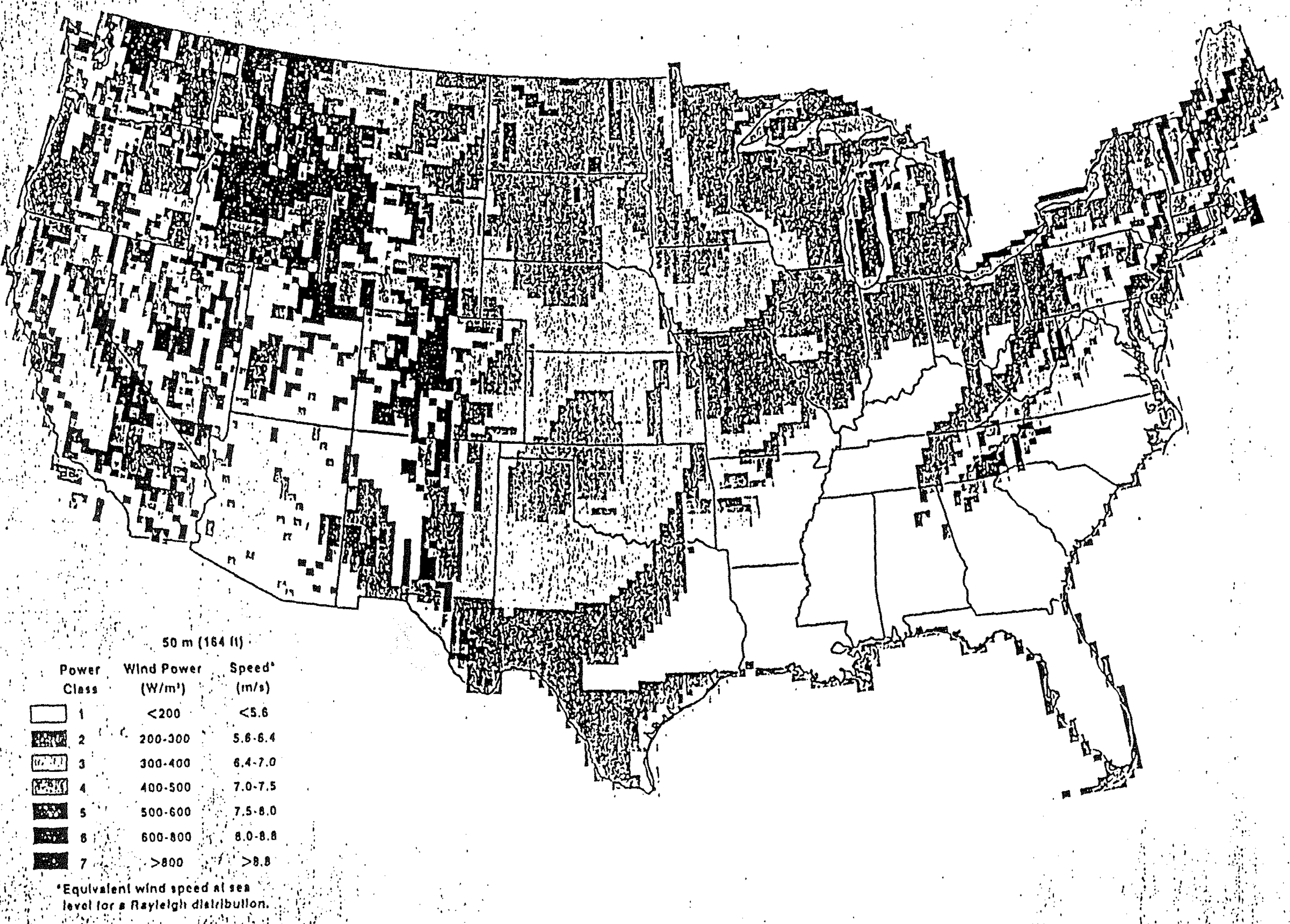
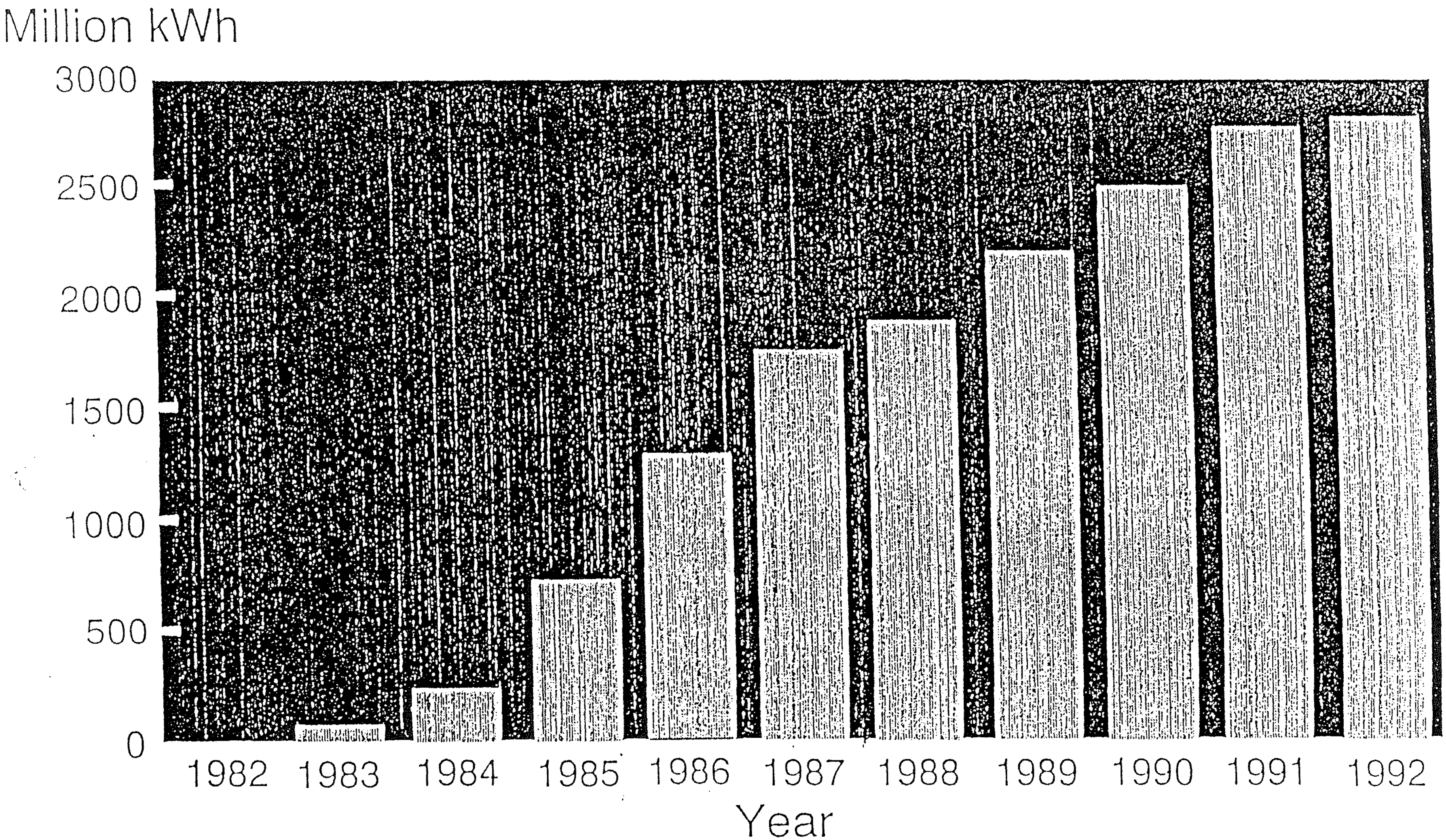


Map 2-6 Annual average wind resource estimates in the contiguous United States.

California Wind Power Plants Generation



Sources: CEC, CEC PRS, other 1990 Paul Gipe and Assoc.

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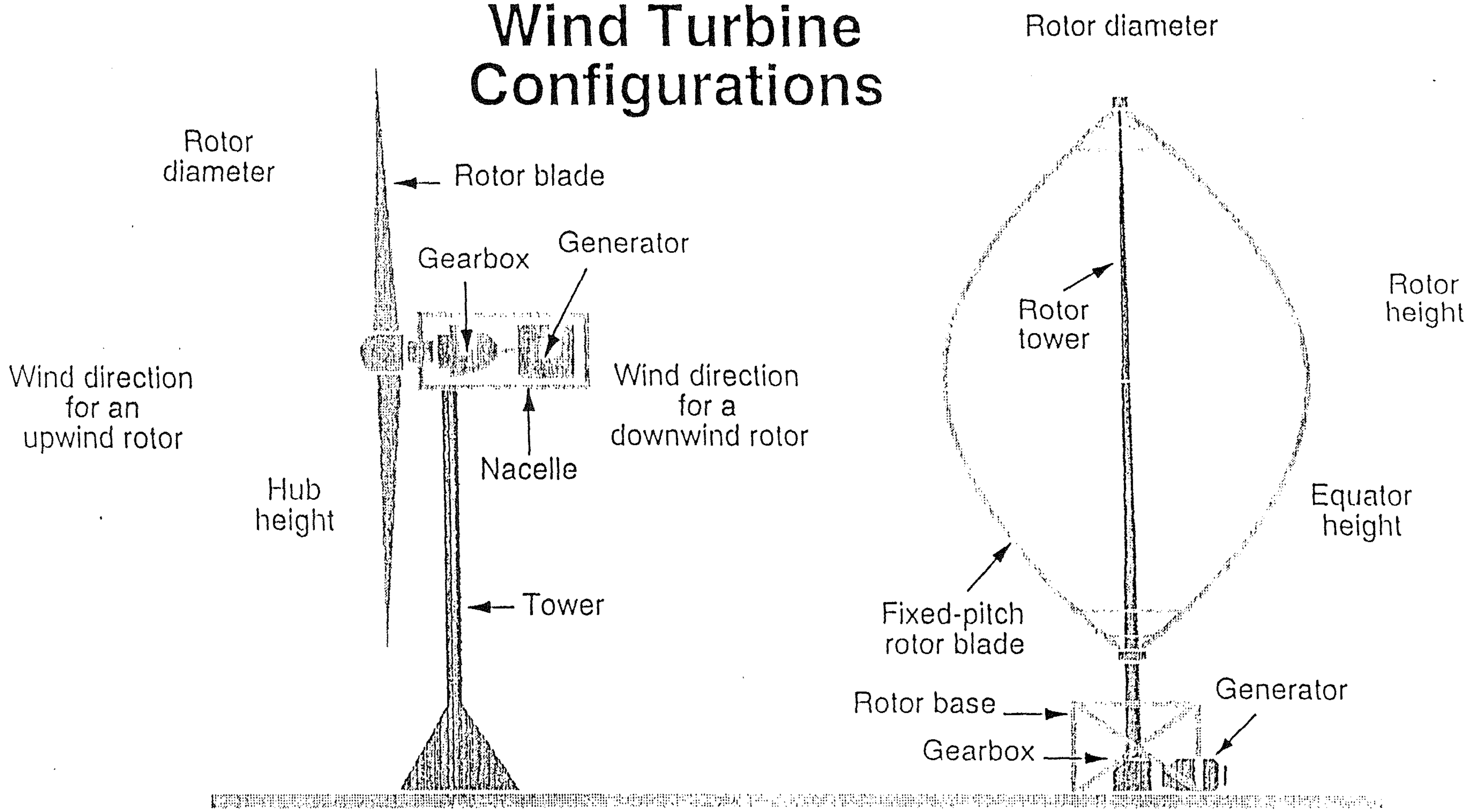
Wind Turbine Configurations



Horizontal-Axis Wind Turbine (HAWT) Vertical-Axis Wind Turbine (VAWT)

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Advanced Turbine Development Program

Current Technology – 1989 Baseline
- Commercial machines
- COE of 7-10¢/kWh
- Periodic fixes required

Matured Technology – 1995
- Optimized machines using best of current technology and recent results and analytical tools of the DOE Wind Energy Program
- COE of < 5¢/kWh
- Machines still designed for excellent wind sites

Advanced Technology – 2000
- New technology incorporating currently unexplored innovative concepts
- Broader markets/lesser wind sites
- Improve COE to < 4¢/kWh

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Levelized Cost of Electricity Is Calculated from Both Financial and Technical Performance Parameters

$$\text{Levelized COE (Constant Dollars)} = \frac{\text{Fixed Charge Rate x Initial Capital Cost}}{\text{Annual Energy}}$$

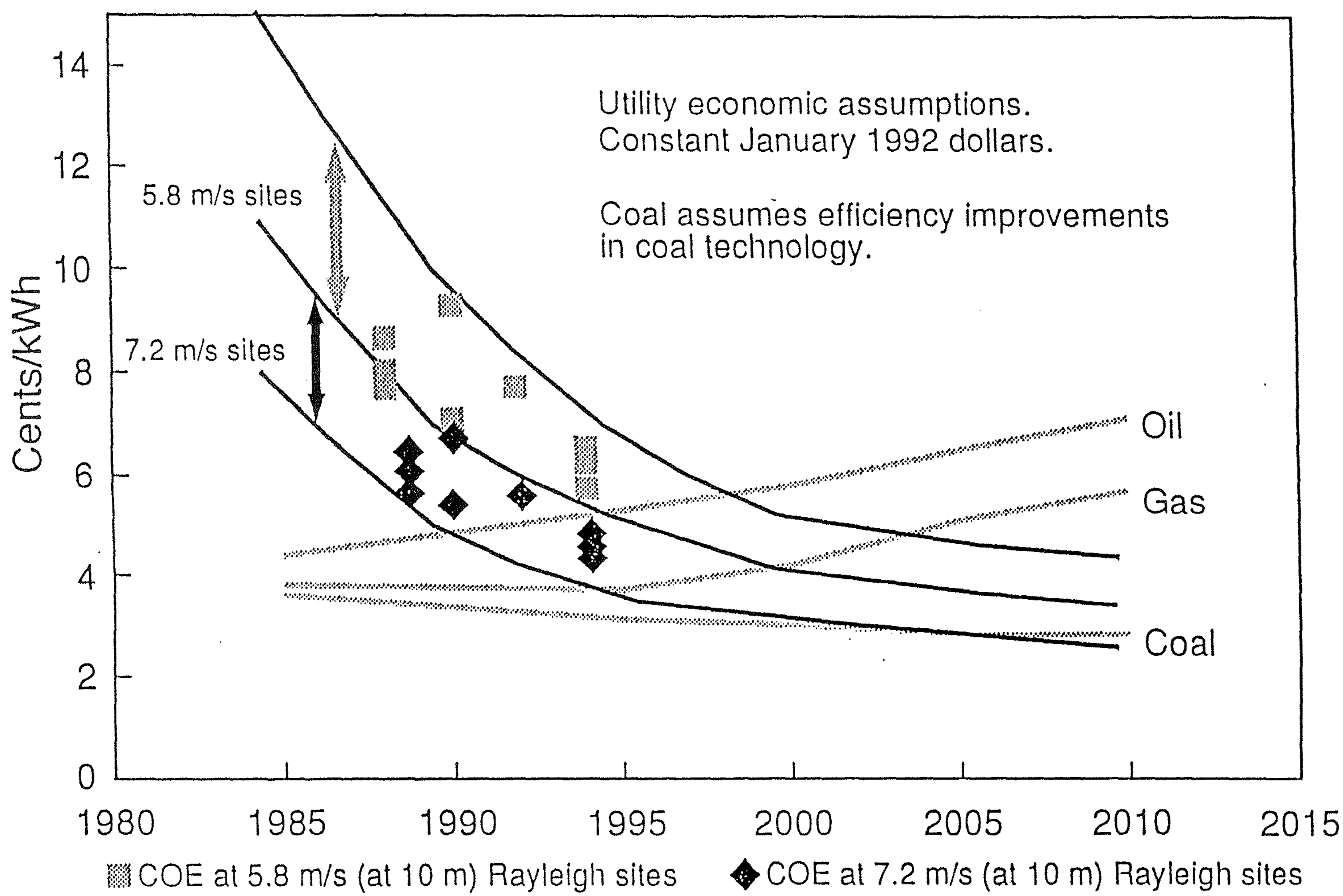
$$+ \frac{\text{Annual O\&M Expense}}{\text{Annual Energy}}$$

$$+ \frac{\text{Levelized Major Replacements/Overhauls}}{\text{Annual Energy}}$$

EPRI Tag Economic Assumptions

Discount rate	6.2%
Fixed charge rate	10.3%
Lifetime	30 years

COE Estimates for HAWTS



Source:"Technology Evolution for Wind Energy Technology (draft)", U.S. DOE, June 7, 1993

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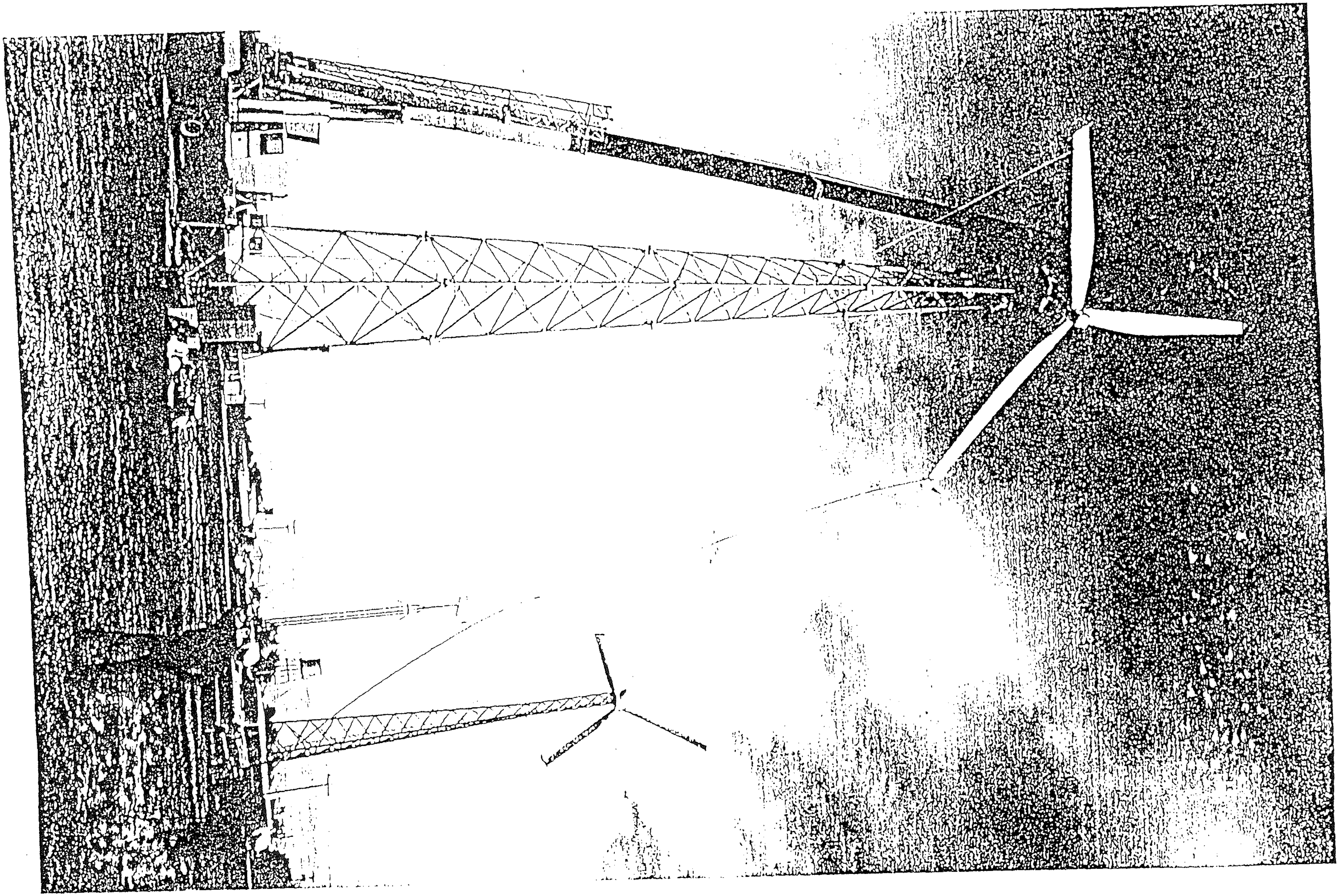

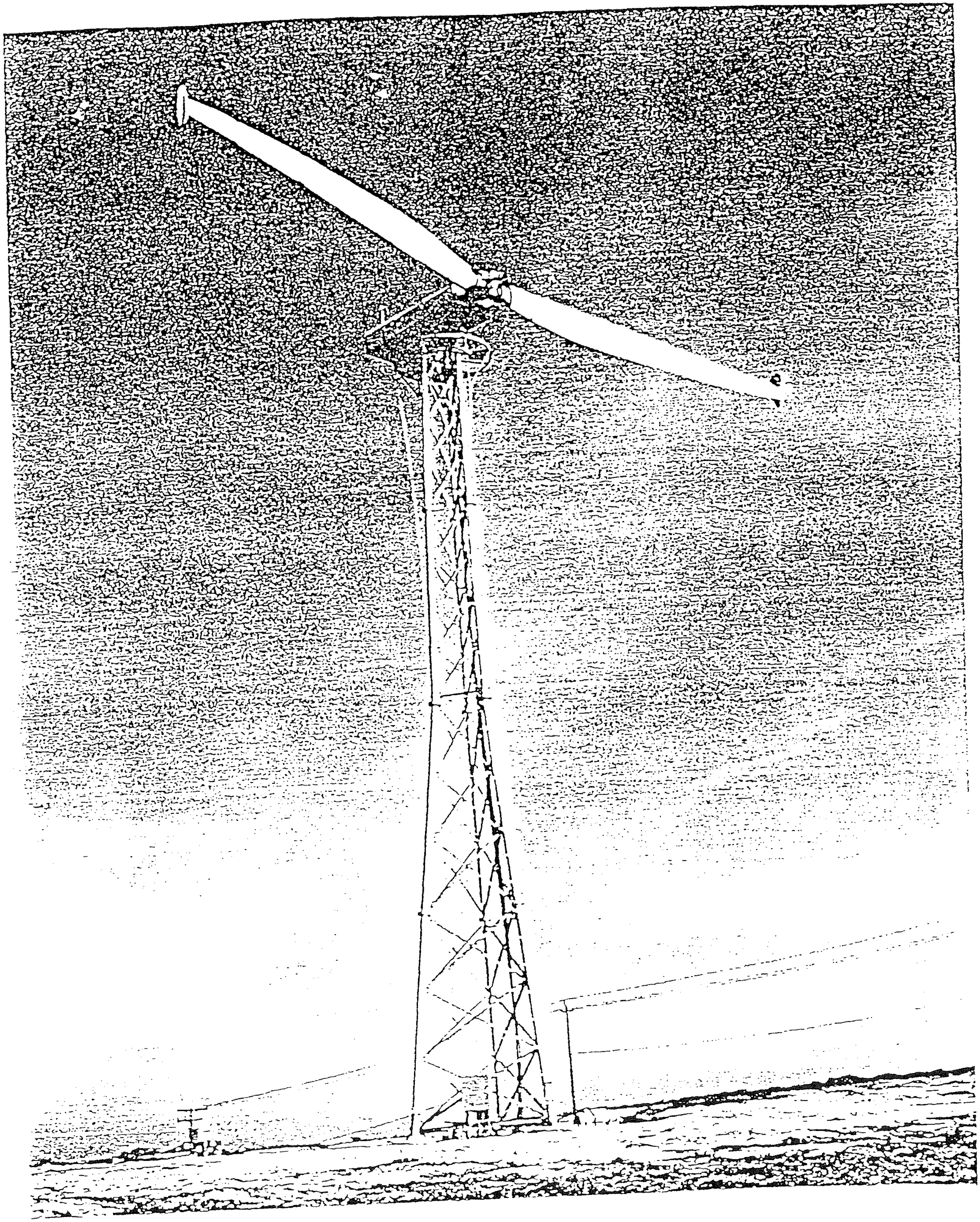

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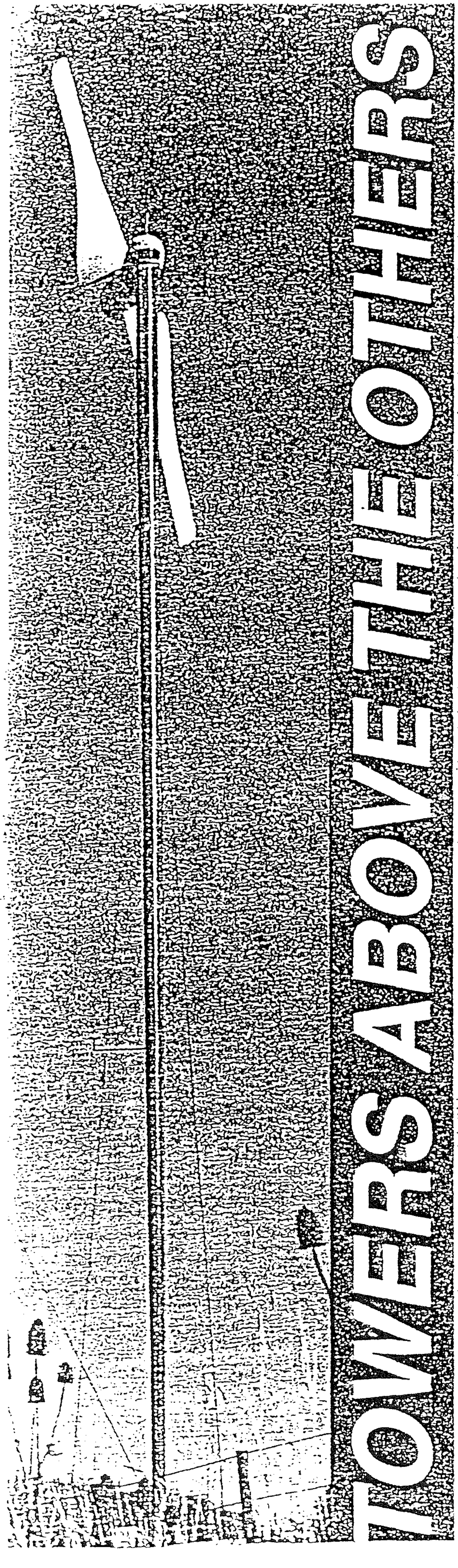

- In the May issue our claims for the Carter turbine are confirmed.
- Data from self-financed European wind farm.
- Independently verified power curve.
- Outstanding energy curve.
- Pricing policy achieves lowest cost per kwh.

CARTER WIND TURBINES

...for the generation to come

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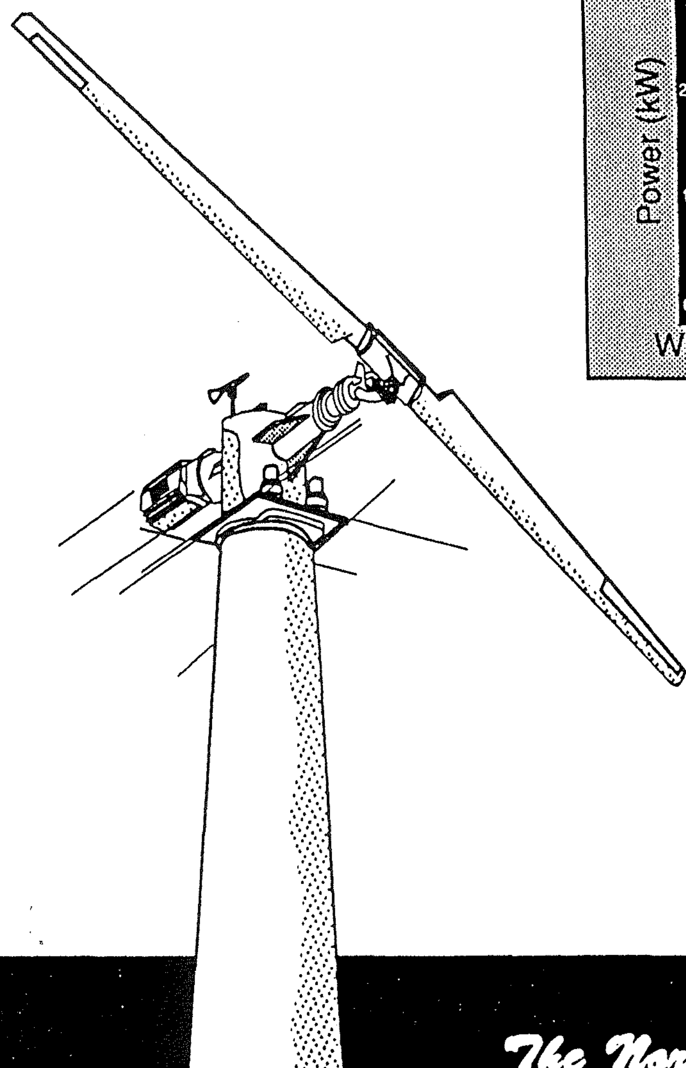
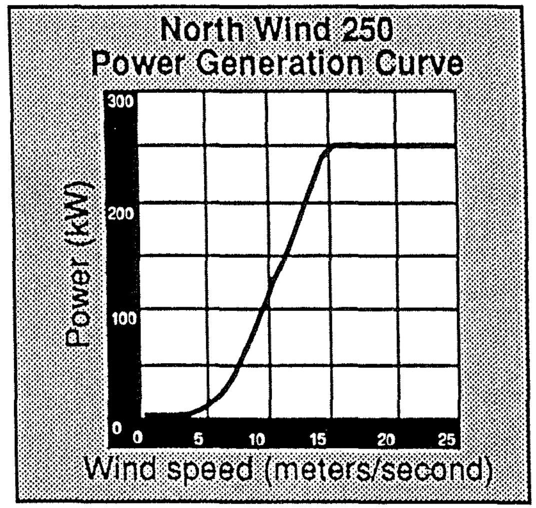




North Wind 250 Technical Data

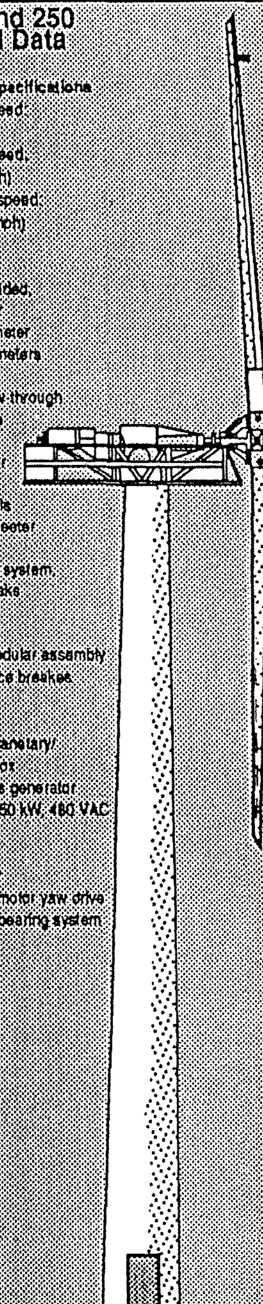
Performance Specifications
- Cut-in wind speed: 4m/s (9mph)
- Rated wind speed, 13m/s (29 mph)
- Survival wind speed: 54 m/s (120 mph)

Rotor
- Up-wind, 2-bladed, teetering rotor
- 25-meter diameter (490 square meters sweep area)
- 2° coning, flow-through rotor structure
- 60 RPM
- Composit rotor construction
- Aileron controls
- Elastomeric teeter bearings
- Teeter control system, dampers breaks

Drive Train
- Integrated modular assembly
- Parking/service breakes

Transmission
- Proprietary planetary/ helical gearbox
- Asynchronous generator 1800 RPM, 250 kW, 480 VAC

YAW System
- Active sensor
- Electric gearmotor yaw drive
- Friction yaw bearing system



The North Wind 250

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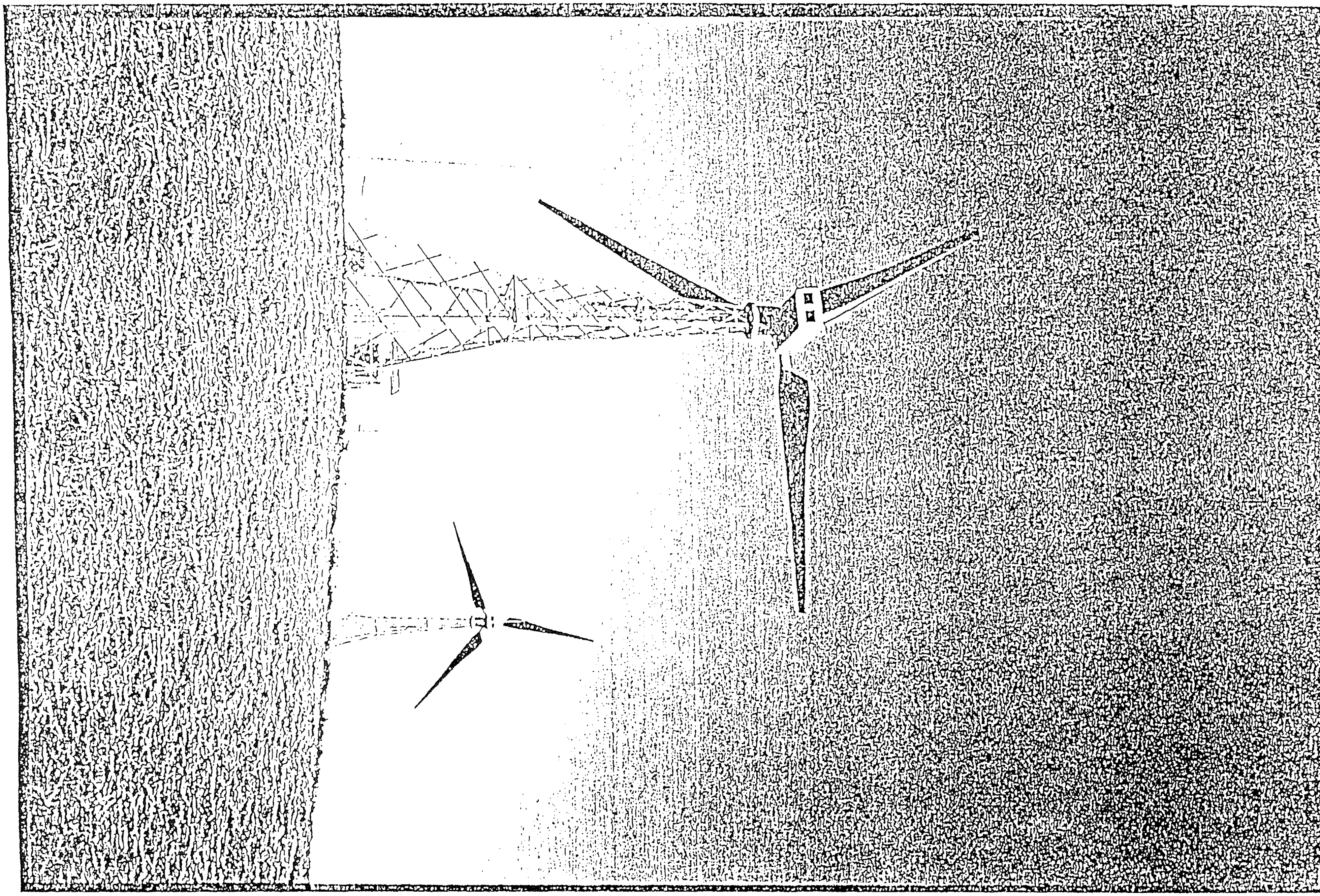
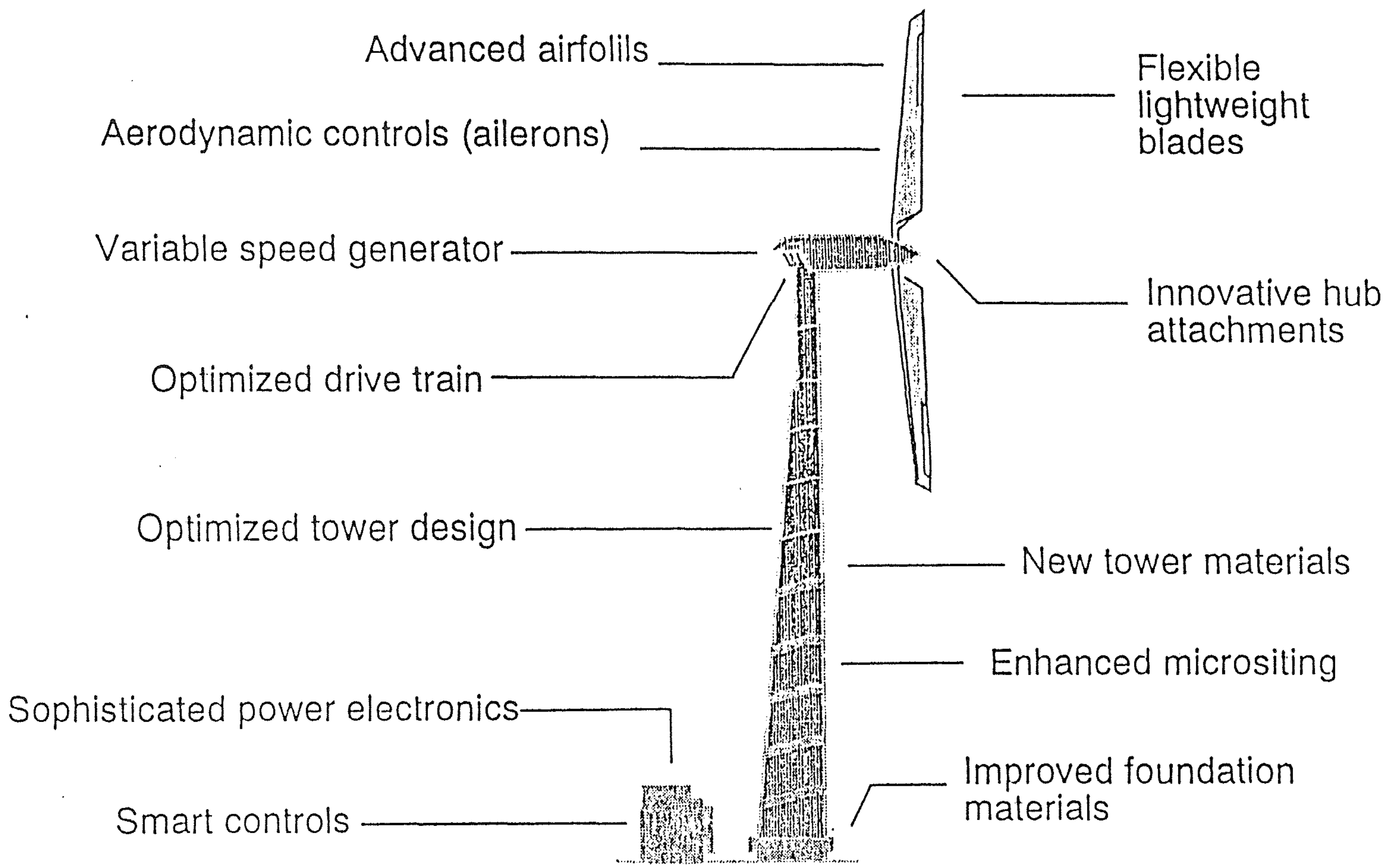


The Advanced Wind Turbine Concept
An artist's rendition of proposed turbine enhancements



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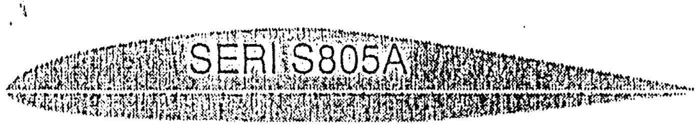
NREL

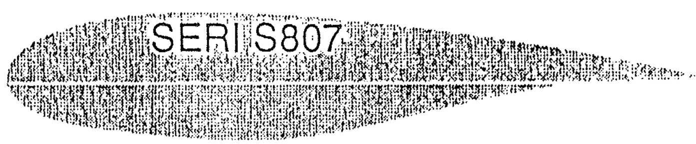
Special Purpose Thin and Thick Airfoil Family

Thin Airfoil Family for Medium Blades

Tip region airfoil (95% radius)

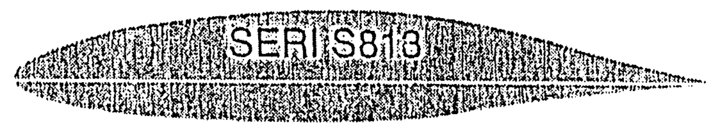


Primary outboard airfoil (75% radius)

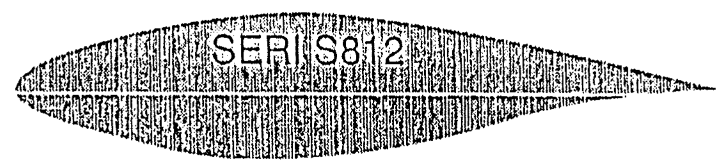


Root region airfoil (40% radius)

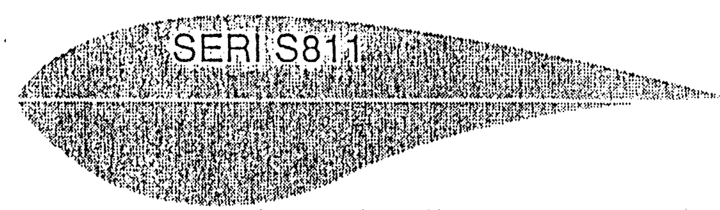
Thick Airfoil Family for Large Blades



Tip region airfoil (95% radius)



Primary outboard airfoil (75% radius)



Root region airfoil (40% radius)

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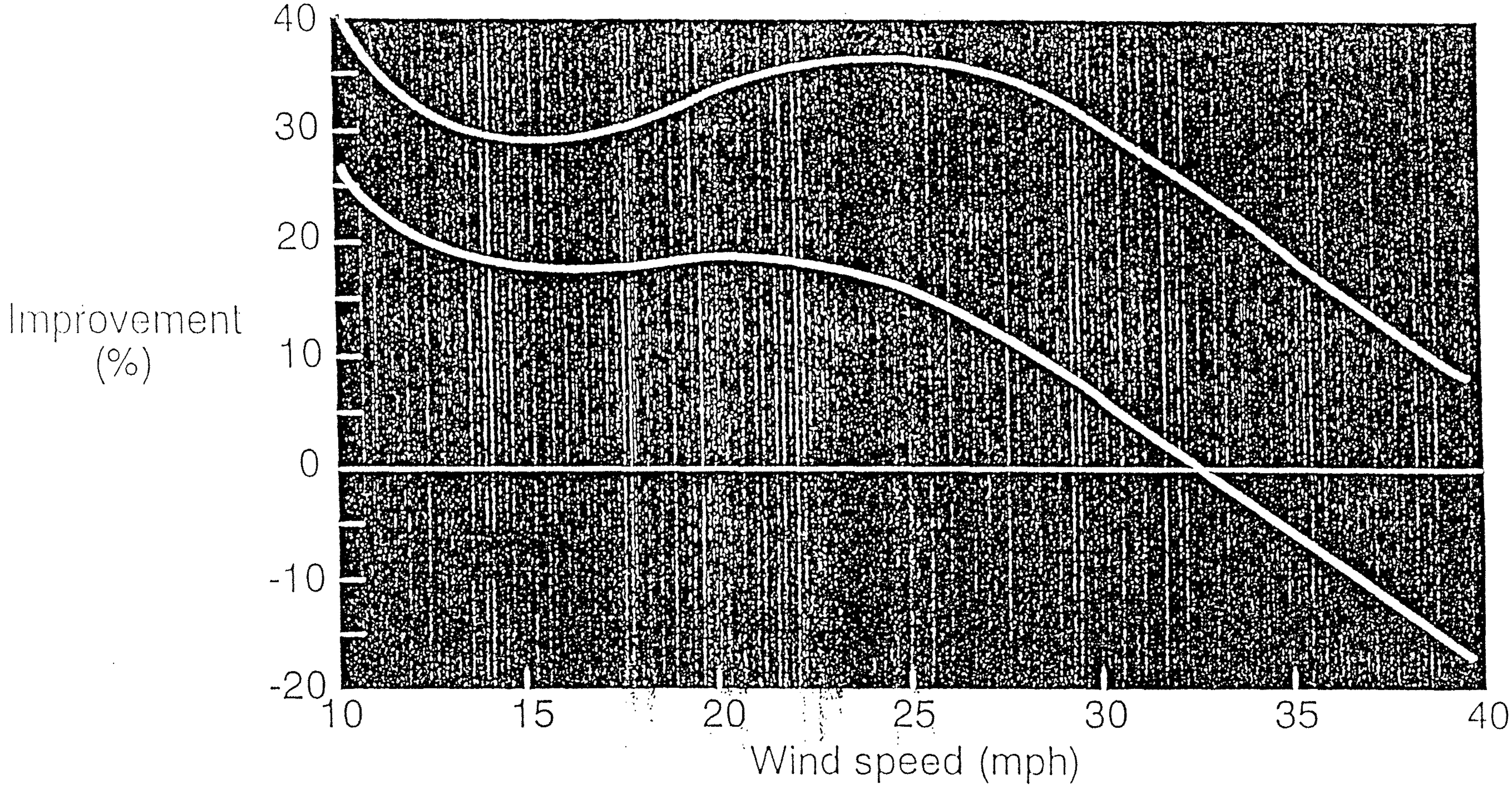
Generator Power Output Improvements
(SERI Blade over Aerostar Blade)



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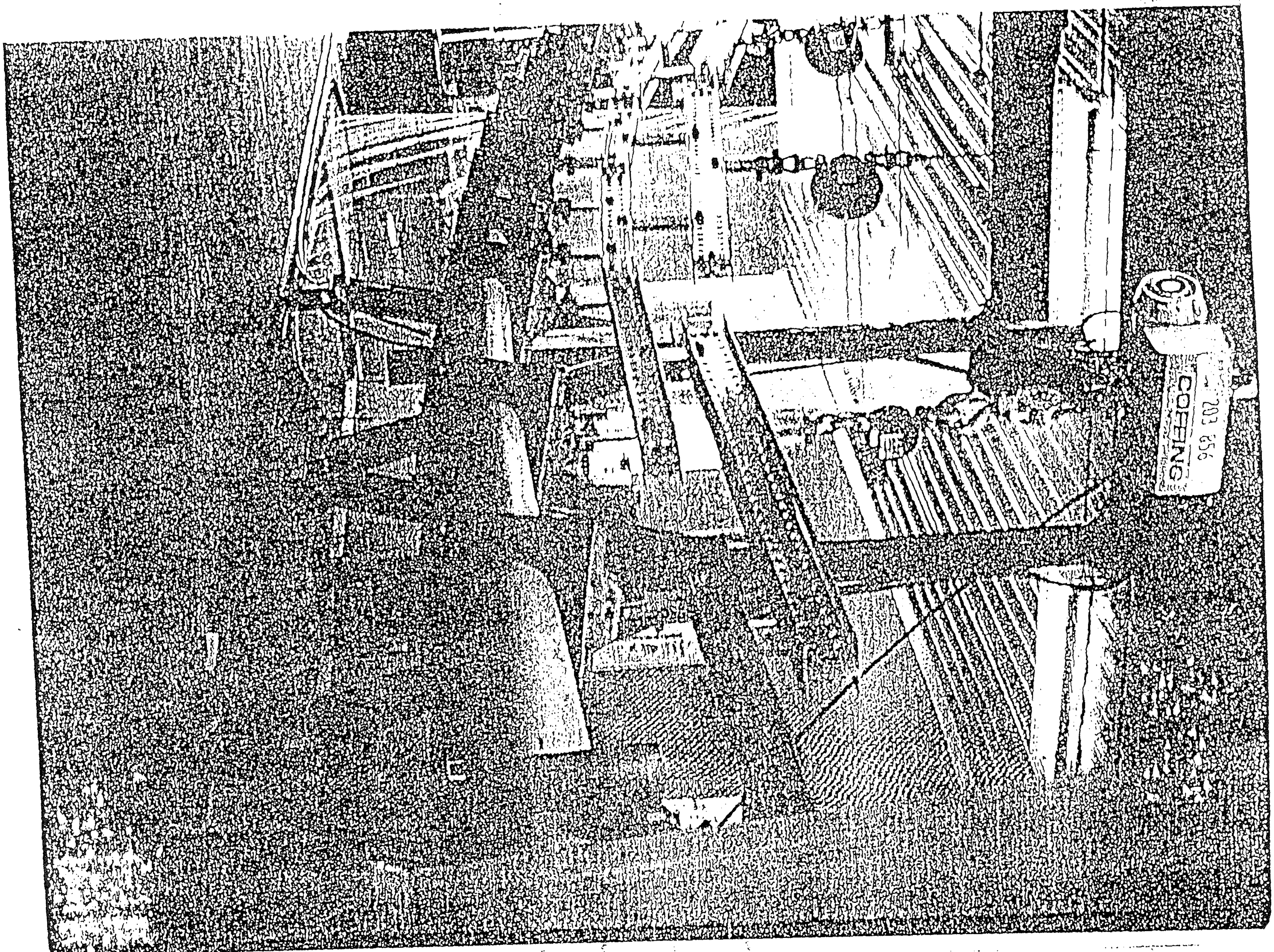
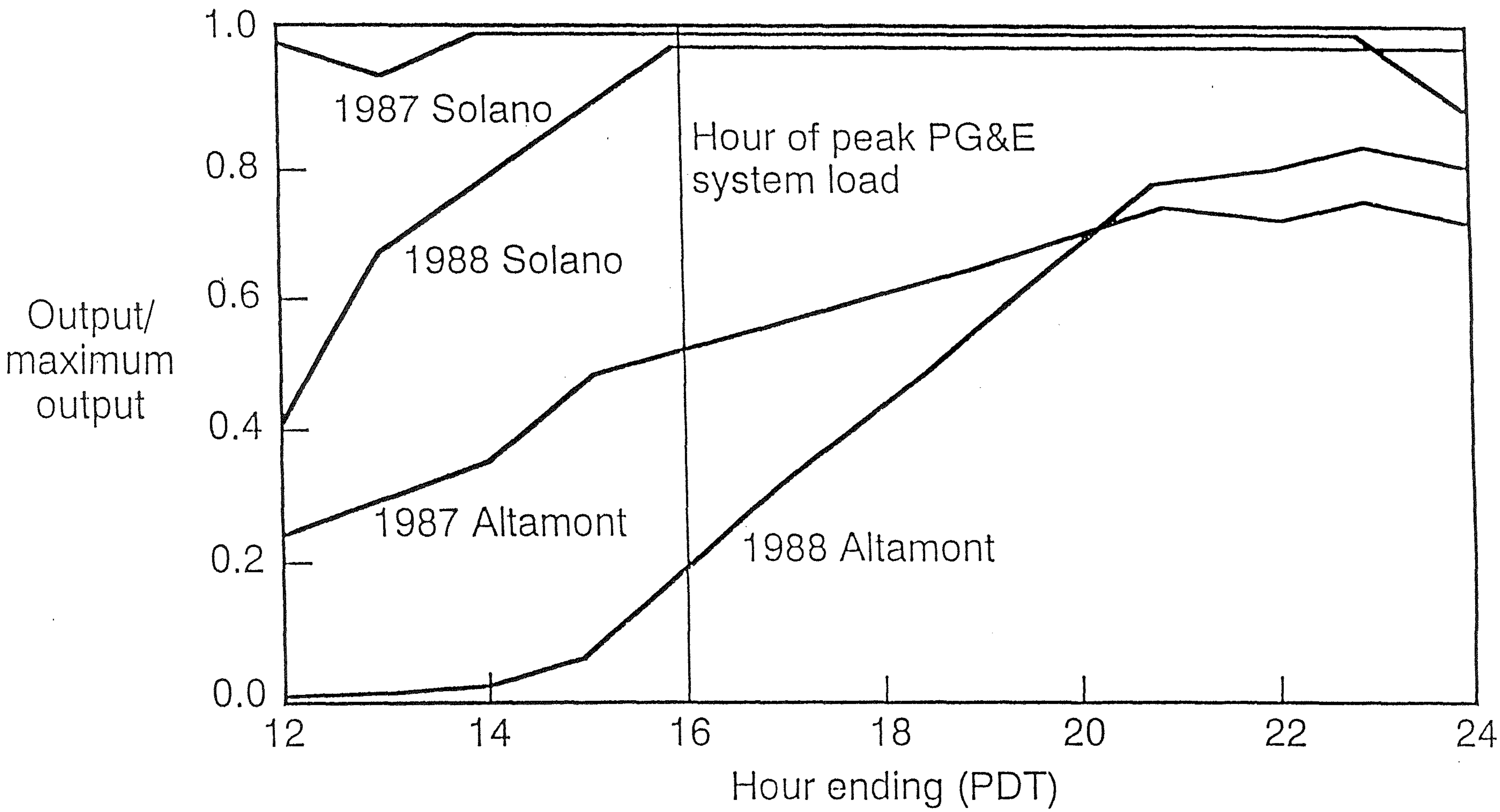

COFFING

Wind Plant Output During PG&E Peak Load Days



P96-G0977513

Environmental Issues

- Avian mortality

  - CEC study between November 1984 and April 1988 showed 108 raptor deaths in Altamont and Tehachapi

    - 67% due to collisions with wind turbines
    - 33% due to electrocutions

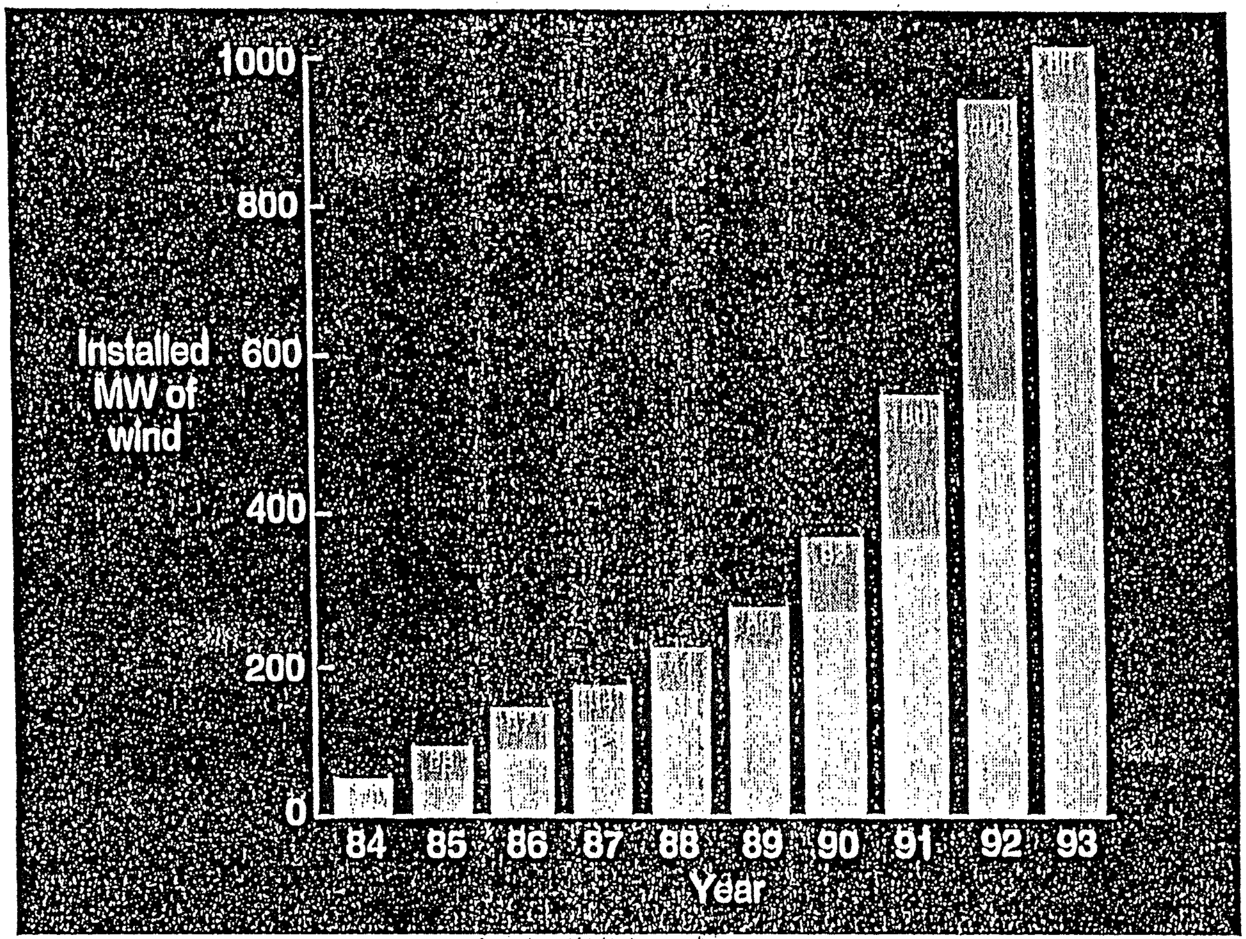
  - Bio Systems study in progress for Altamont and Solano areas

  - numerous avian studies being conducted in Europe

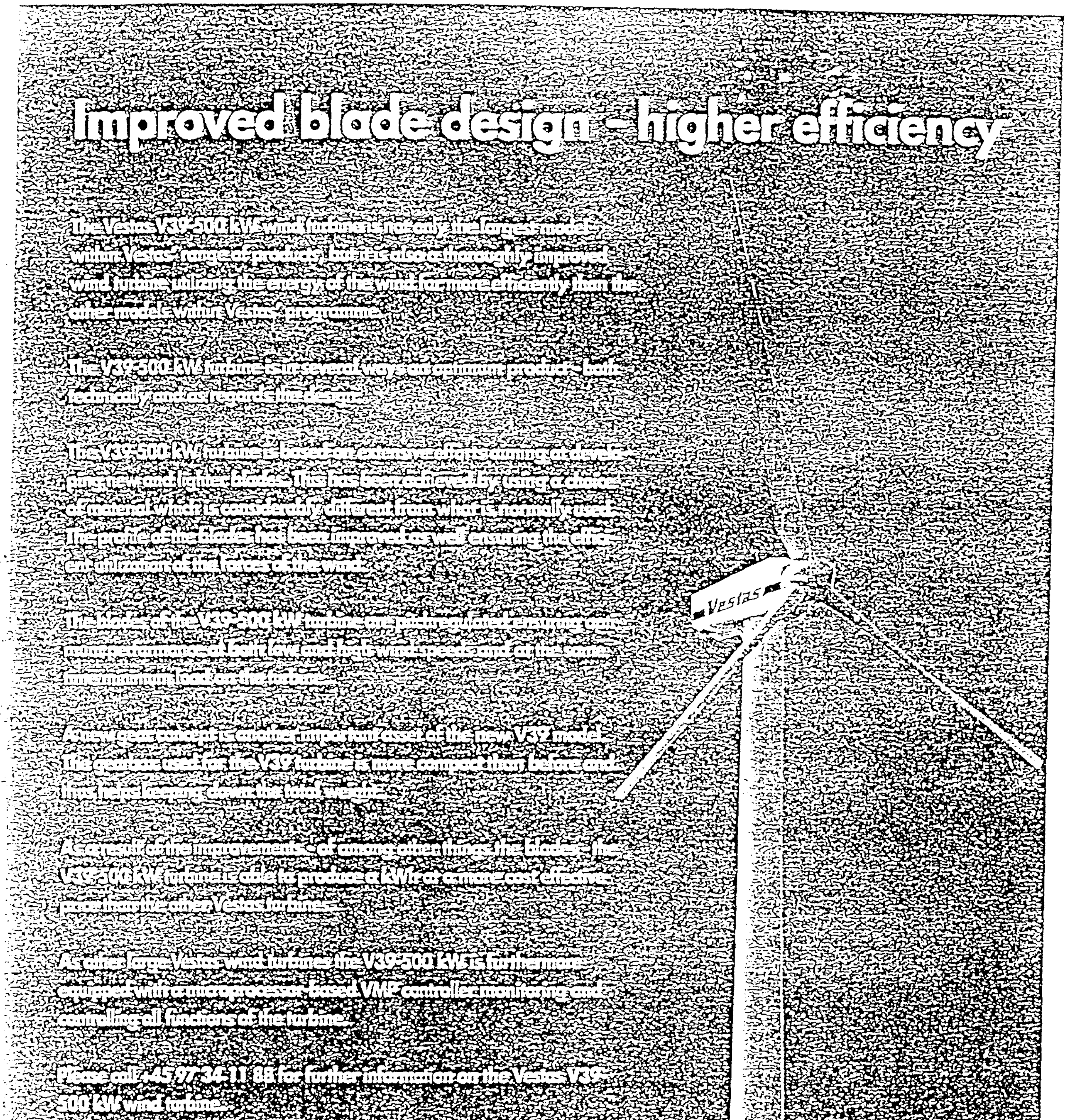
Environmental Issues (concluded)

- Noise
  - requirements vary by county (i.e., 45 to 60 dBA)
  - more serious as population density increases
- Visual
  - requirements vary by county (i.e., viewshed analysis)

Installed Wind Capacity in Europe

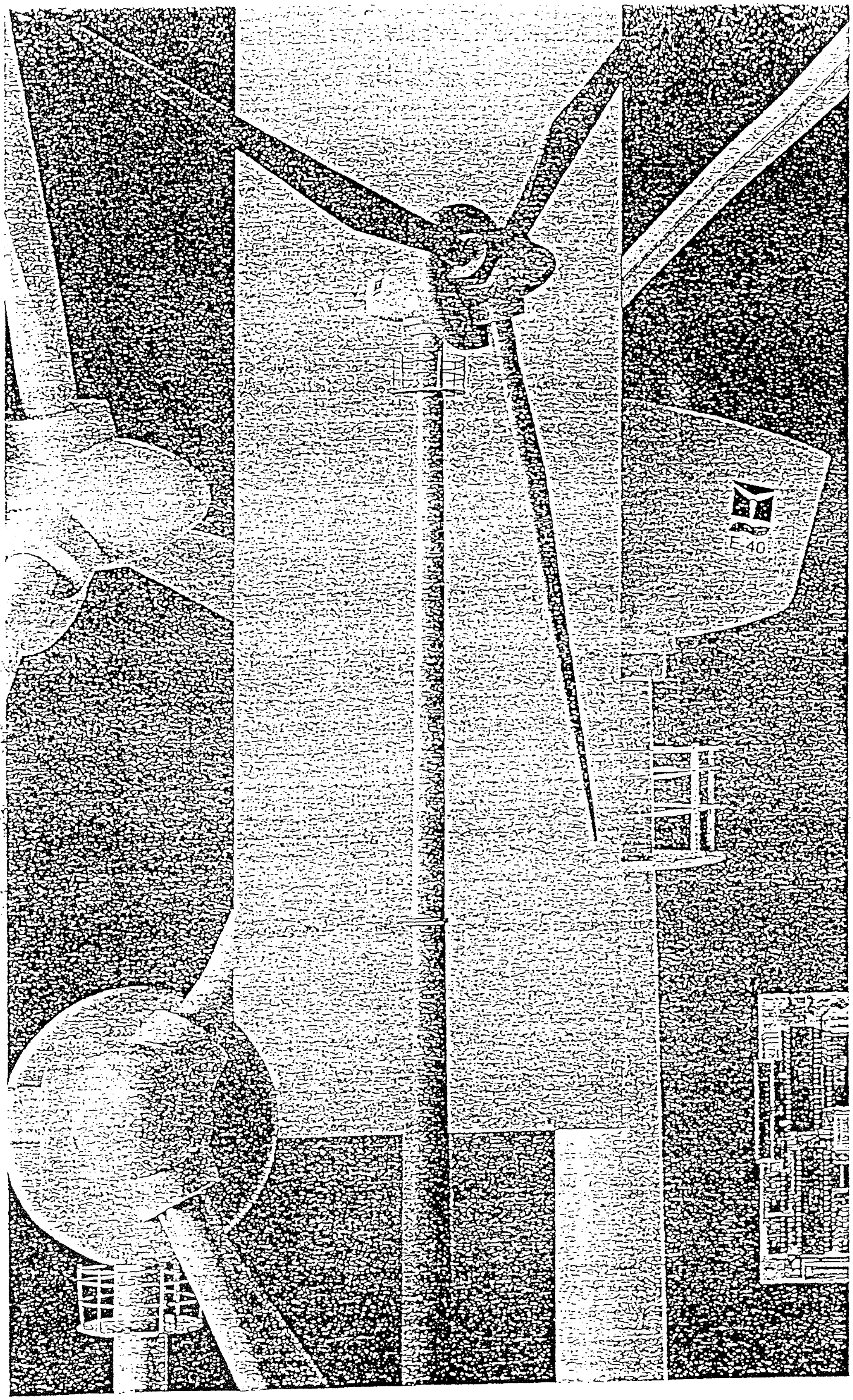


Reference source: Conference Reports by Windpower Monthly's Lyn Harrison, editor and Sara Knight, German correspondent



Vestas utilizes the natural forces of the wind. The manufacture of the Vestas wind turbines is based on years of experience. A carefully prepared and tested design is part of the qualities which have made Vestas the world's leading wind turbine manufacturer.

Vestas · Danish Wind Technology A/S



THE BEGINNING OF THE AGE OF WIND

ENERCON

Summary

Wind speed measurements at a proposed wind farm site will greatly improve energy capture estimates, and can be used to determine the capacity value of the energy.

There has been a significant improvement in wind turbine technical and economic performance over the past ten years:

Energy capture: 600 kWh/m² to 700 kWh/m²
Capacity factor: 17% to 23%
Cost of energy: \$.10 - \$.12/kWh to \$.05 - \$.07/kWh

Emerging design alternatives show the potential for continuing cost and performance improvements. New design options are under continuing development by the wind industry in the U.S. and Europe and should provide wind energy at \$.05/kWh by about 1995.

Design and development of the next generation of wind turbines for the year 2000 is only now beginning. These new designs are expected to have a cost of energy of about \$.04/kWh.

P131-G1154202

2.1.2 Panel Members:

Bob Gates–Zond Systems
Edan Harel–TRM Advanced Wind Technologies
Robert Lynette–R. Lynette and Associates
Jeff Maurer–The New World Power Company
Eric Miller–Kenetech Windpower

Panel Responses:

Bob Gates – Zond Systems

The perception that the wind industry requires government subsidies is incorrect. One half of the wind industry has been developed since tax credits expired in the early 1980s.

The goal that the industry set for a 5¢ /kWh by 1995 has been achieved. Proposals and bid solicitations are currently citing 5¢ /kWh for projects that will be coming on-line in the next year or so.

The cash cost per kWh for projects of independent power producers is higher than for utility ownership models because of inequity in the allocation of risks to the independents who sell their power to the utility. Utilities pay for the electricity delivered leaving all of the risk costs (legal infrastructure, technology risks, workmen compensation, etc.) to be borne by the independent power producers. Thus, some of that risk cost must be borne into the cost capital from an equity standpoint.

The increased costs per kWh for the independent developer who bears all of the risk costs is balanced by the fact that while costing less per kWh in capital costs, in the utility ownership model, all of the risks are borne by the rate payer.

The federal government's role in pushing wind turbine technology forward has been meaningful, according to Mr. Gates, especially in the case of advanced airfoil designs. He agreed that the industry is headed toward newer, larger turbine models of 500 kW or more. By increasing the size of the turbines, developers are able to lower their costs. The turbines are more efficient, thus fewer turbines are needed.

He emphasized the importance of maintaining a proper perspective on the avian issue. If one hundred bird deaths occur as a result of wind turbines, we must evaluate them in the context of the impact on the population of the birds overall or consider the alternative impact. What if we burn coal instead? What then is the impact on birds as well as other living things on earth?

Edan Harel – TRM Advanced Wind Technologies

Mr. Harel introduced himself as an international representative of the wind industry. In Israel, where he owns and operates a 6 MW wind farm installed with 600 kW wind turbines, Mr. Harel sells electricity for less than 5¢/ kWh. He emphasized that this was achievable without the need of government subsidy.

"I can tell you that the future is here and now," he said naming some of the criteria used in the manufacturing community when information is exchanged. Manufacturers strive to maintain standards set by the industry as closely as possible. Currently, there is a common understanding that *big is good* (i.e., 500 kW, 600 kW, 700 kW). Manufacturers are developing wind turbines with simpler designs and smart solutions to old problems such as the idea of moving to an operational regime of less loads and constant control of loads. Material engineering is much improved, however, power quality is still a problem.

Utilities and developers must keep in mind that the final product is not a machine or the services of the utility but a cooperative partnership, he said.

Jeff Maurer – New World Power

Mr. Maurer began by stating that the price of oil will go up in the not too distant future. For that reason in Hawaii, with its abundance of wind resources, it is imperative to act now with wind power.

He observed that the reason California developed wind power so effectively was because of the government subsidies and the purchase power contracts. "We had a lot of successes and a lot of failures, but we learned a lot."

Three billion kilowatts of wind power are produced in California annually representing three quarters of the total world production of electricity from wind power, enough to power the city of San Francisco, he said.

Problems with wind power include the lack of firm capacity power which can be successfully counteracted with hybrid systems. Micrositing[1] is another solution, he noted. "If your wind resource peaks at night and your power demand peaks during the day, micrositing turbines will allow you to match the peak with maximum generation of power."

[1]Editor's note: For example, siting the turbine in a wind regime that matches the utility load better.

Mr. Maurer believed the workshop to be a necessary step toward implementing wind power by enabling the participants to learn from each other in order to go forward with a plan to implement wind power in Hawaii.

"Wind is a solution for the long term energy needs in Hawaii," he said in closing.

Robert Lynette – R. Lynette and Associates

Mr. Lynette began by pointing out the strong resurgence in the interest in wind energy going on in the past few years.

"The dynamics of what's going on this time in the early 1990s is not based on the tax incentives and the government subsidies of the early 1980s," he noted. This time there is strong public support, strong government support, and strong support from the Electric Power Research Institute (EPRI).

Predicting a low cost of 3½¢/kWh for wind power within the next few years, Mr. Lynette stated that the price decrease will be due to three notable factors:

- the forming of new alliances with large players in big industry,
- technology innovations will lower costs 15% - 20%, and
- increased growth will allow the industry to produce decent quantities.

Given the current 1½% - 2% U.S. growth rate in electricity demand, if wind captures 10% of that growth (10% of 2%), that will result in a $5 billion a year industry. This is the major attraction for big industry.

With the involvement of big players, the wind industry will be able to do away with one of the principle fears utilities have, that of increased risks. Alliances with big industry will add solidity to the wind industry.

"I think within the next year or two you will see a very different look to the industry," he said in closing.

Eric Miller – Kenetech Windpower

The wind industry has moved out of California and into the global market. Wind energy is now fully competitive with fossil fuels. In the bidding process in California, renewables either won or came very closing to winning over fossil fuels in head to head competition, Mr. Miller said.

As an example of how technology has helped to bring costs down, Mr. Miller pointed out that variable speed drive technology has made a big difference in load control.

For Hawaii, one of the key elements which ought to be considered in moving wind energy forward is how power additions are acquired. That is, how do wind and fossil fuels compete politically and economically. When it comes to comparing resources, Mr. Miller deduced, it will come down to a question of values. Since wind is not dependent on fuel cost fluctuations and thus insulated from those risks, the value of wind power to price stability is less of a risk, he said.

"There is no question that the lowest cost, long term resource in Hawaii is wind," Mr. Miller said in closing. "The question is what is the framework to make it possible to capture those benefits here in Hawaii."

Question:

What are some of the installation costs of wind power?

Answer:

Bob Gates – Zond Systems

Installation costs vary depending as much on the project size as anything else including risk factors but a general overall estimate is about $1,000 per kW.

Sue Hock – NREL

While you can have a less expensive installation and higher O&M costs, you may not do as well with a more expensive installation that operates more efficiently. For this reason, a better measure of installation costs may be the cost of energy rather than the cost per kW.

Jeff Maurer – New World Power

Installation costs should not be considered as much as financing costs. The amount of cash flow you will have **after** you have financed the project if you can get low financing for your project, will make a great difference.

Edan Harel – TRM Advanced Wind Technologies

A good criteria for keeping installation costs down is to consider the amount of kWhs that can be produced annually per turbine. By upgrading his 36 m diameter blades to 45 m diameter blades on his turbines while still maintaining them as 600 kW turbines, Mr. Harel was able to produce many more kWh per year and drive the cost per kWh down to capture more energy for the same cost.

Question:

Are developers and utilities able to negotiate a contract with higher up front costs?

Answer:

Bob Gates – Zond Systems

Mr. Gates used the United Kingdom to illustrate how power contracts are negotiated with higher capital costs paid out during the early years of the project to reduce debt and the resulting debt load quickly. These types of contracts, much like comparing a 15 year mortgage loan to a 30 year one, result in a much lower total price paid out over the life of the project while maintaining lower O&M costs, a recognition of better overall economic efficiency.

Jeff Maurer – New World Power

Domestically, New World Power is responding to many utility RFPs on a price per kWh basis, and the bidding process is very competitive.

Eric Miller – Kenetech Windpower

A cost-effective contract for wind is one that is well matched to the higher capital costs over the long term. One of the great advantages of the wind technology is that ability to lock in at a fixed price over the long term, a key element common among all successful wind development projects.

Bob Gates –Zond Systems

The primary benefit of wind power to the utility or the power rate payer, is its hedge against future fuel costs and taxes. While fossil fuel costs are going up, wind prices will be going down.

Question:

In Hawaii where projects are built on a much smaller scale than on the mainland, what kind of help in terms of government assistance should be expected?

Answer:

Bob Gates – Zond Systems

In clarifying a statement made earlier in which he said government support was no longer needed, Mr. Gates emphasized that he was speaking in terms of tax credits and the government subsidies of the early 1980's. The government still plays a significant role in the renewable energy industry, particularly wind, he said.

One key role that government plays is by providing a stable regulatory environment. By ensuring a highly secure and reliable regulatory environment in which independent utility operators can operate, the risk premium charged by the financial community is lower, he said.

One area that Mr. Gates felt may be appropriate for government to look into, which is missing in today's regulatory environment, is an investment requirement to incentivize utilities to deal with the independent developers.

Edan Harel – TRM Advanced Wind Technologies

It is time for the wind industry to forget about the direct government subsidies of the past which were not economically effective, Mr. Harel said. Today's state of the art technology allows for the direct pricing of projects to be economical.

Jeff Maurer – New World Power

Government can help by providing a level playing field for wind developers to play on, Mr. Maurer stated. Currently, a utility is only required to buy power and thus avoid its risk costs.

Sue Hock – NREL

Ms. Hock said that she has been involved in discussions with several utilities that are reluctant to invest in wind power given its high risk environment. By reducing the up-front cost of technology to get the market rolling, government can play a significant role in supporting wind development, she said.

2.2 Panel 2: Resource Availability

2.2.1 Panel Chair:

Karen Conover – R. Lynette & Associates, Redmond, Washington

Presentation charts follow

WIND RESOURCE ASSESSMENT AND PROJECT DEVELOPMENT POTENTIAL IN HAWAII

presented at:

Hawaii Wind Power Workshop

March 21-22, 1994

presented by:

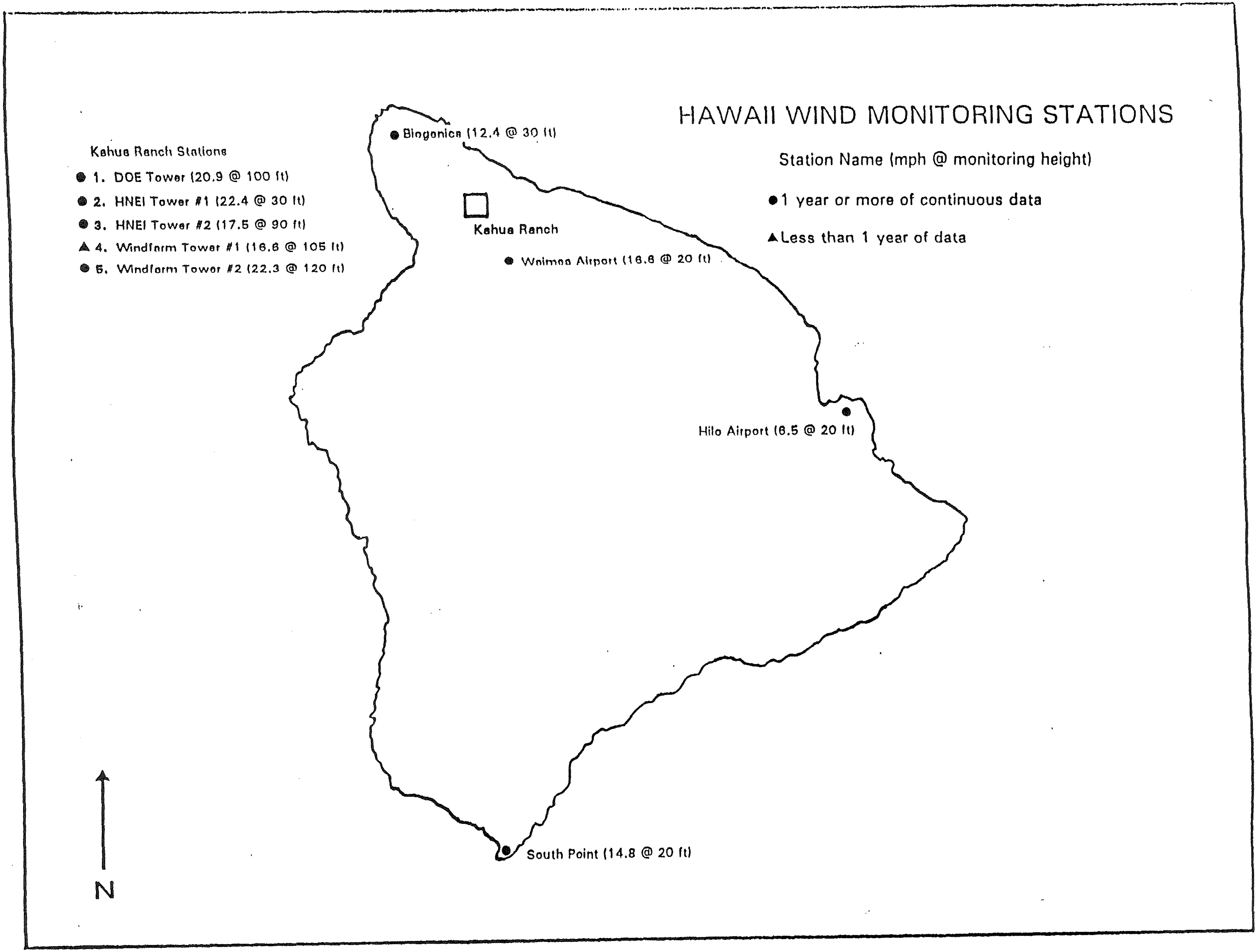
Karen Conover
R. Lynette & Associates, Inc.
15042 NE 40th Street, Suite 206
Redmond, Washington 98052-5353
Phone: (206) 885-0206
Fax: (206) 881-8468

SCOPE

- Past wind resource assessment work
- Existing projects
- Current wind resource assessment activities and preliminary results
- Potential project sites
- Land use issues

OVERVIEW OF PAST WIND RESOURCE ACTIVITIES

- Airports, military installations, and NWS
- University of Hawaii
  - Fixed stations
  - Mobile stations
- Wind Energy Resource Atlas
- U.S. DOE candidate sites
- Private developers and landowners
- Smaller assessments and/or single site measurements

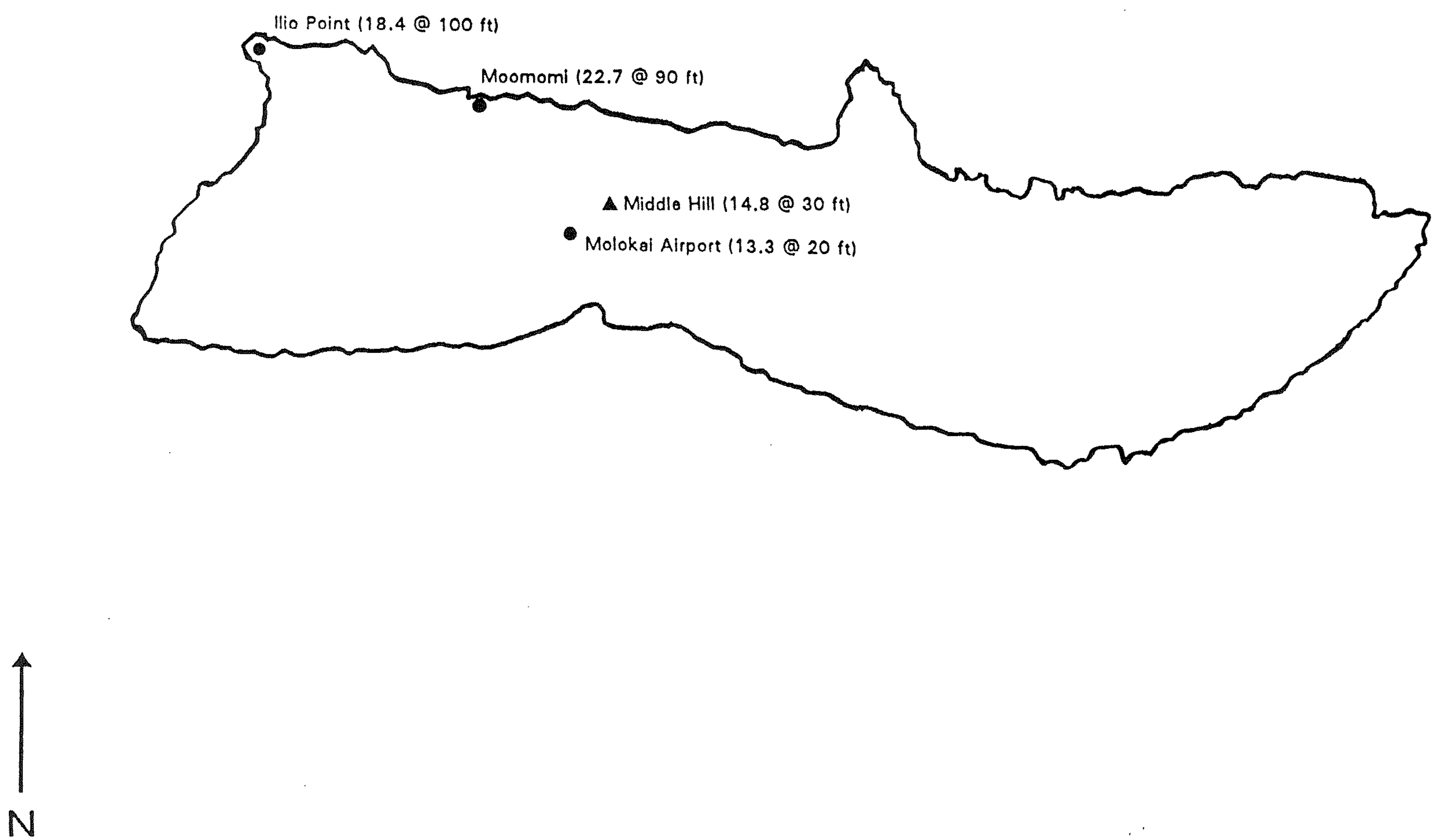

HAWAII WIND MONITORING STATIONS
Station Name (mph @ monitoring height)
● 1 year or more of continuous data
▲ Less than 1 year of data
Kahua Ranch Stations
● 1. DOE Tower (20.9 @ 100 ft)
● 2. HNEI Tower #1 (22.4 @ 30 ft)
● 3. HNEI Tower #2 (17.5 @ 90 ft)
▲ 4. Windfarm Tower #1 (16.6 @ 105 ft)
● 5. Windfarm Tower #2 (22.3 @ 120 ft)
Biogenics (12.4 @ 30 ft)
Kahua Ranch
Waimea Airport (16.6 @ 20 ft)
Hilo Airport (6.5 @ 20 ft)
South Point (14.8 @ 20 ft)
N

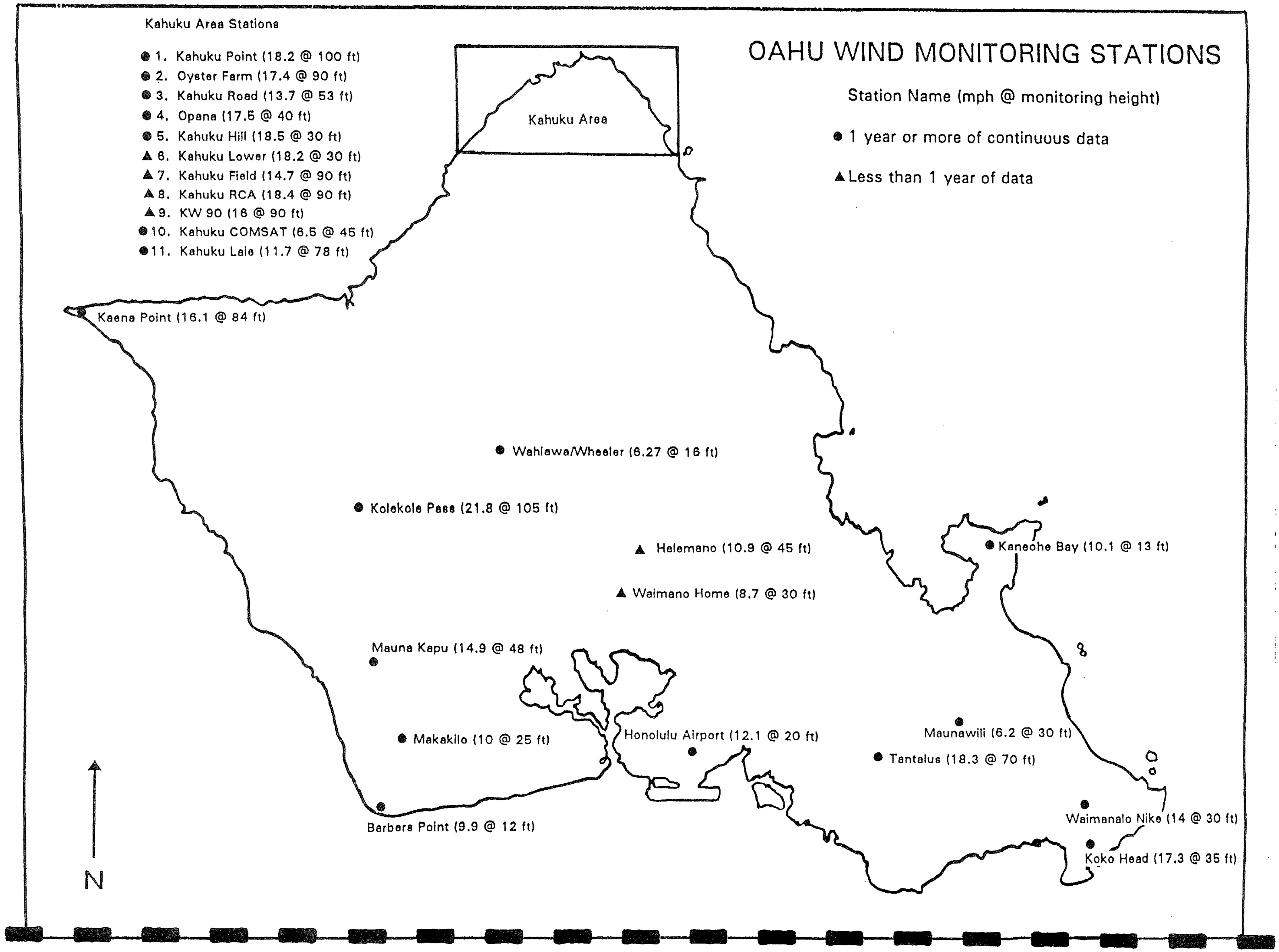
MOLOKAI WIND MONITORING STATIONS

Station Name (mph @ monitoring height)

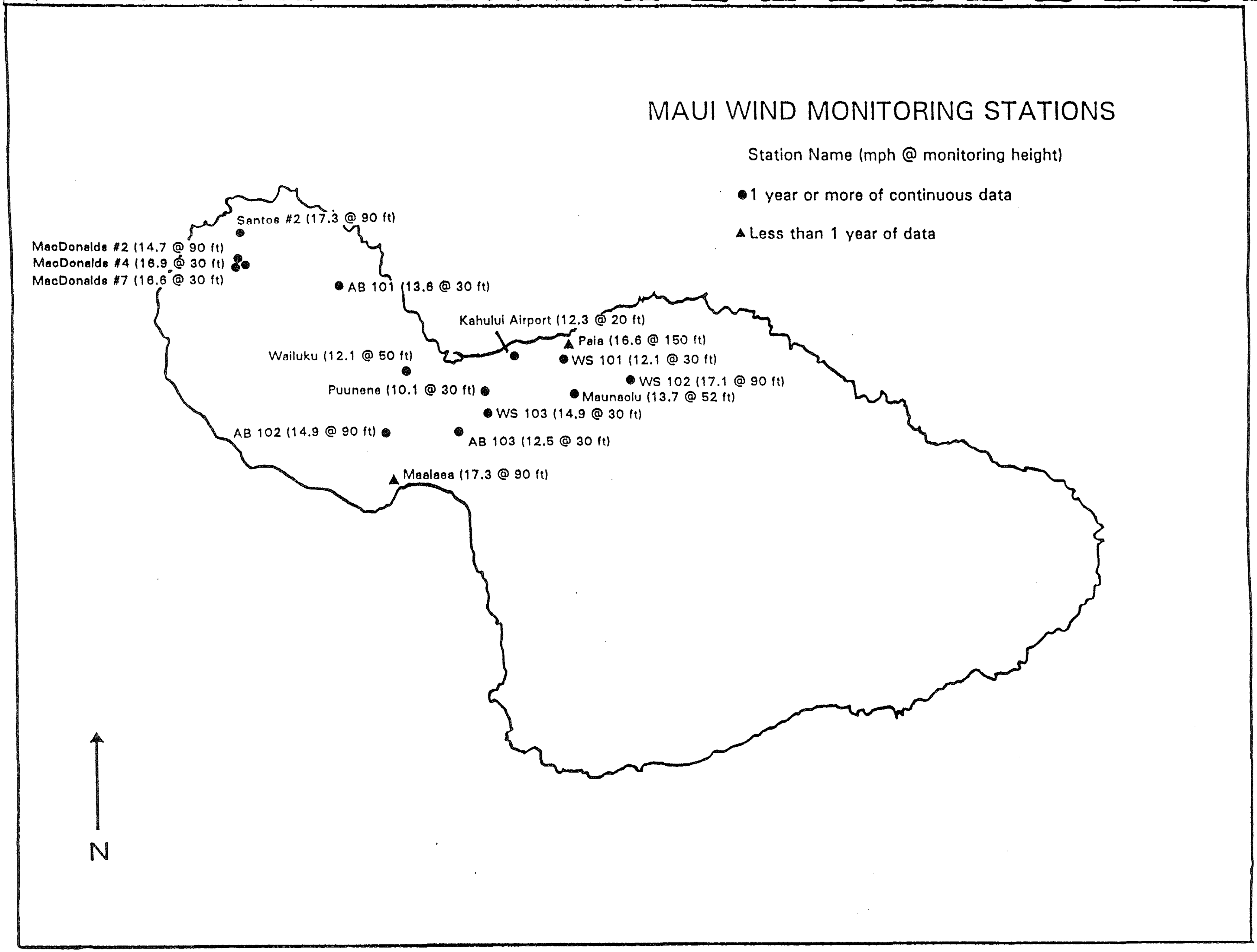
● 1 year or more of continuous data

▲ Less than 1 year of data

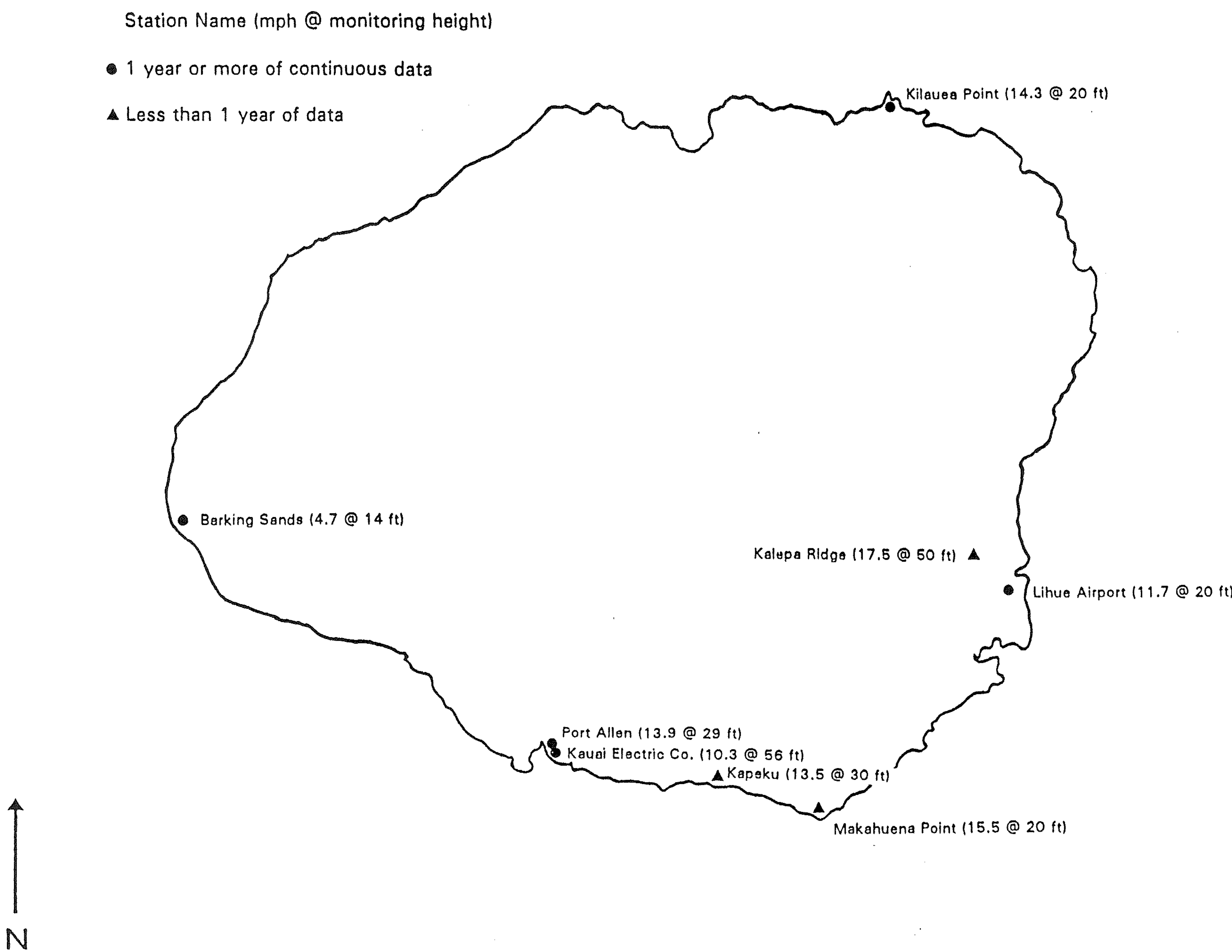




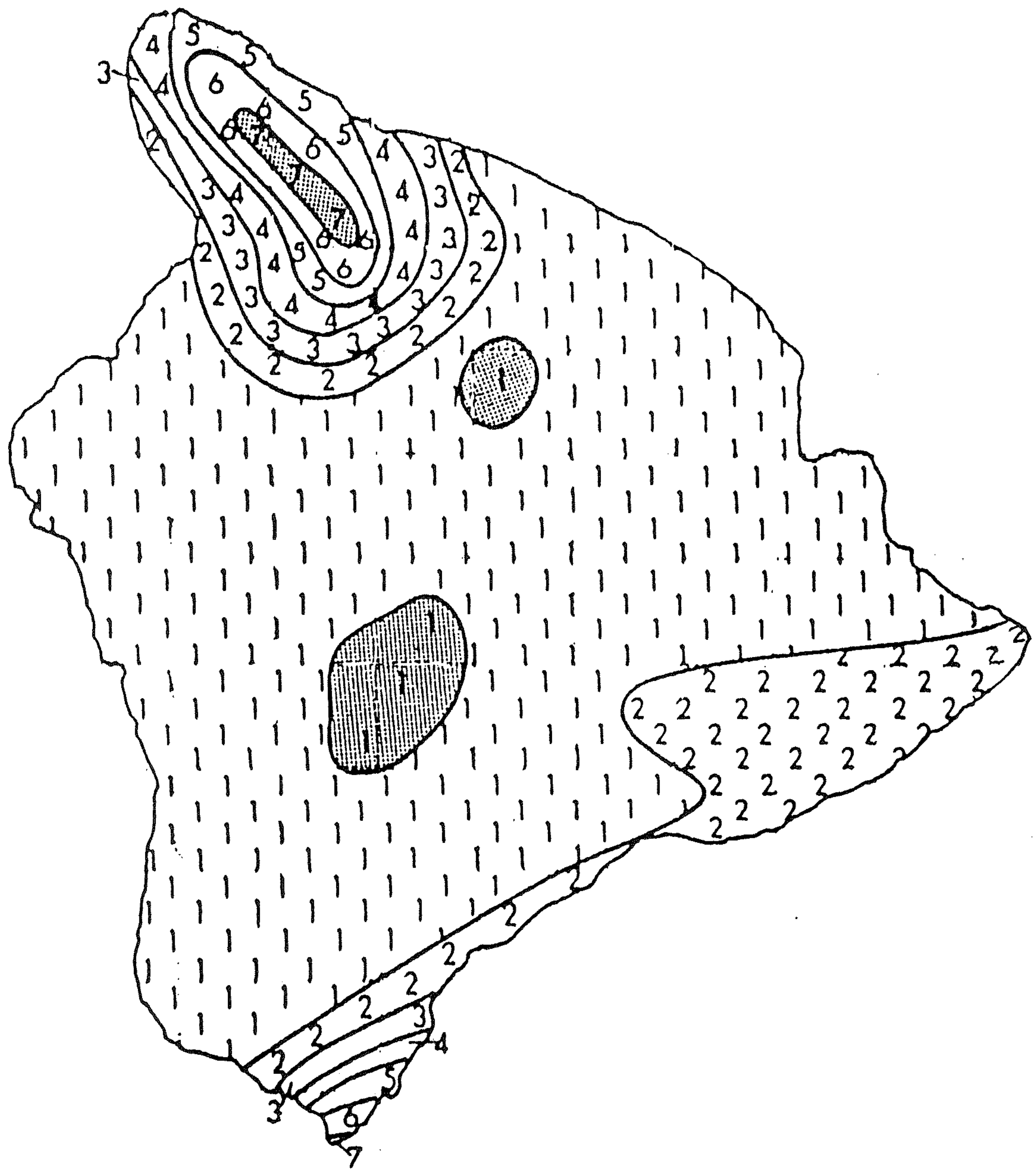
OAHU WIND MONITORING STATIONS
Station Name (mph @ monitoring height)
1 year or more of continuous data
Less than 1 year of data
Kahuku Area Stations
1. Kahuku Point (18.2 @ 100 ft)
2. Oyster Farm (17.4 @ 90 ft)
3. Kahuku Road (13.7 @ 53 ft)
4. Opana (17.5 @ 40 ft)
5. Kahuku Hill (18.5 @ 30 ft)
6. Kahuku Lower (18.2 @ 30 ft)
7. Kahuku Field (14.7 @ 90 ft)
8. Kahuku RCA (18.4 @ 90 ft)
9. KW 90 (16 @ 90 ft)
10. Kahuku COMSAT (6.5 @ 45 ft)
11. Kahuku Laie (11.7 @ 78 ft)
Kahuku Area
Kaena Point (16.1 @ 84 ft)
Wahiawa/Wheeler (6.27 @ 16 ft)
Kolekole Pass (21.8 @ 105 ft)
Helemano (10.9 @ 45 ft)
Waimano Home (8.7 @ 30 ft)
Kaneohe Bay (10.1 @ 13 ft)
Mauna Kapu (14.9 @ 48 ft)
Makakilo (10 @ 25 ft)
Honolulu Airport (12.1 @ 20 ft)
Maunawili (6.2 @ 30 ft)
Tantalus (18.3 @ 70 ft)
Barbers Point (9.9 @ 12 ft)
Waimanalo Nike (14 @ 30 ft)
Koko Head (17.3 @ 35 ft)
N


MAUI WIND MONITORING STATIONS
Station Name (mph @ monitoring height)
1 year or more of continuous data
Less than 1 year of data
Santos #2 (17.3 @ 90 ft)
MacDonalds #2 (14.7 @ 90 ft)
MacDonalds #4 (16.9 @ 30 ft)
MacDonalds #7 (16.6 @ 30 ft)
AB 101 (13.6 @ 30 ft)
Kahului Airport (12.3 @ 20 ft)
Paia (16.6 @ 150 ft)
Wailuku (12.1 @ 50 ft)
WS 101 (12.1 @ 30 ft)
WS 102 (17.1 @ 90 ft)
Puunene (10.1 @ 30 ft)
Maunaolu (13.7 @ 52 ft)
WS 103 (14.9 @ 30 ft)
AB 102 (14.9 @ 90 ft)
AB 103 (12.5 @ 30 ft)
Maalaea (17.3 @ 90 ft)
N

KAUAI WIND MONITORING STATIONS

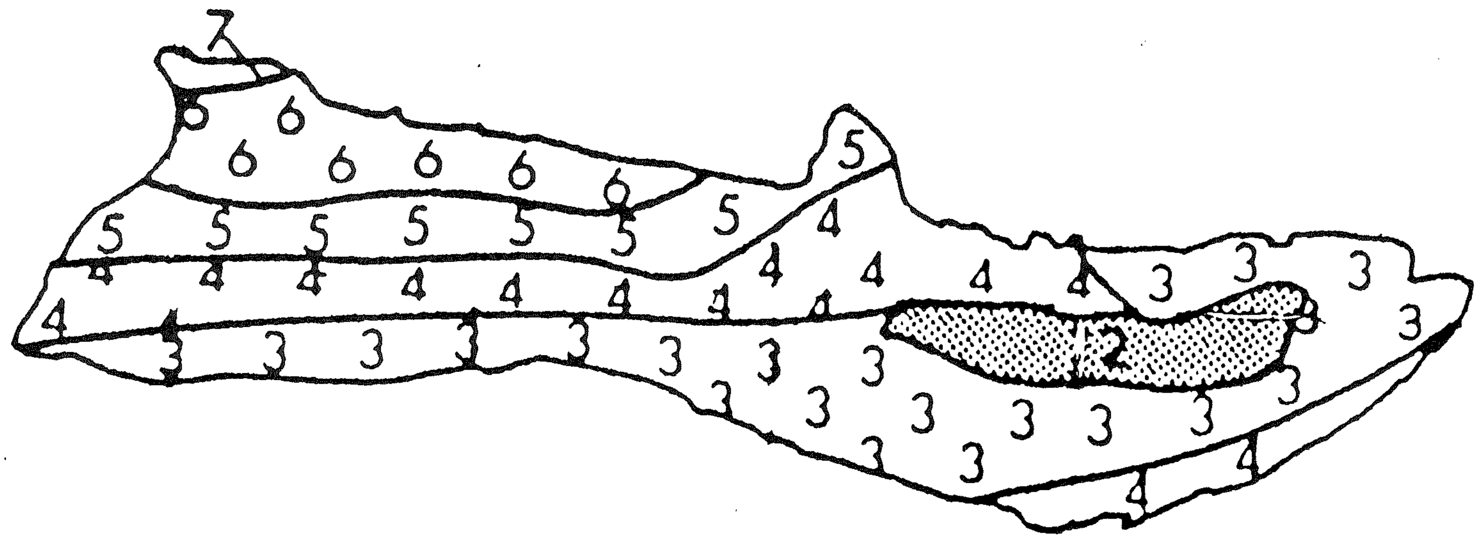


Hawaii Wind Resource Map



Source: *Wind Energy Resource Atlas: Volume 11 – Hawaii and Pacific Islands Region,* Battelle Pacific Northwest Laboratories, February 1981

Molokai Wind Resource Map



Source: *Wind Energy Resource Atlas: Volume 11 – Hawaii and Pacific Islands Region,*
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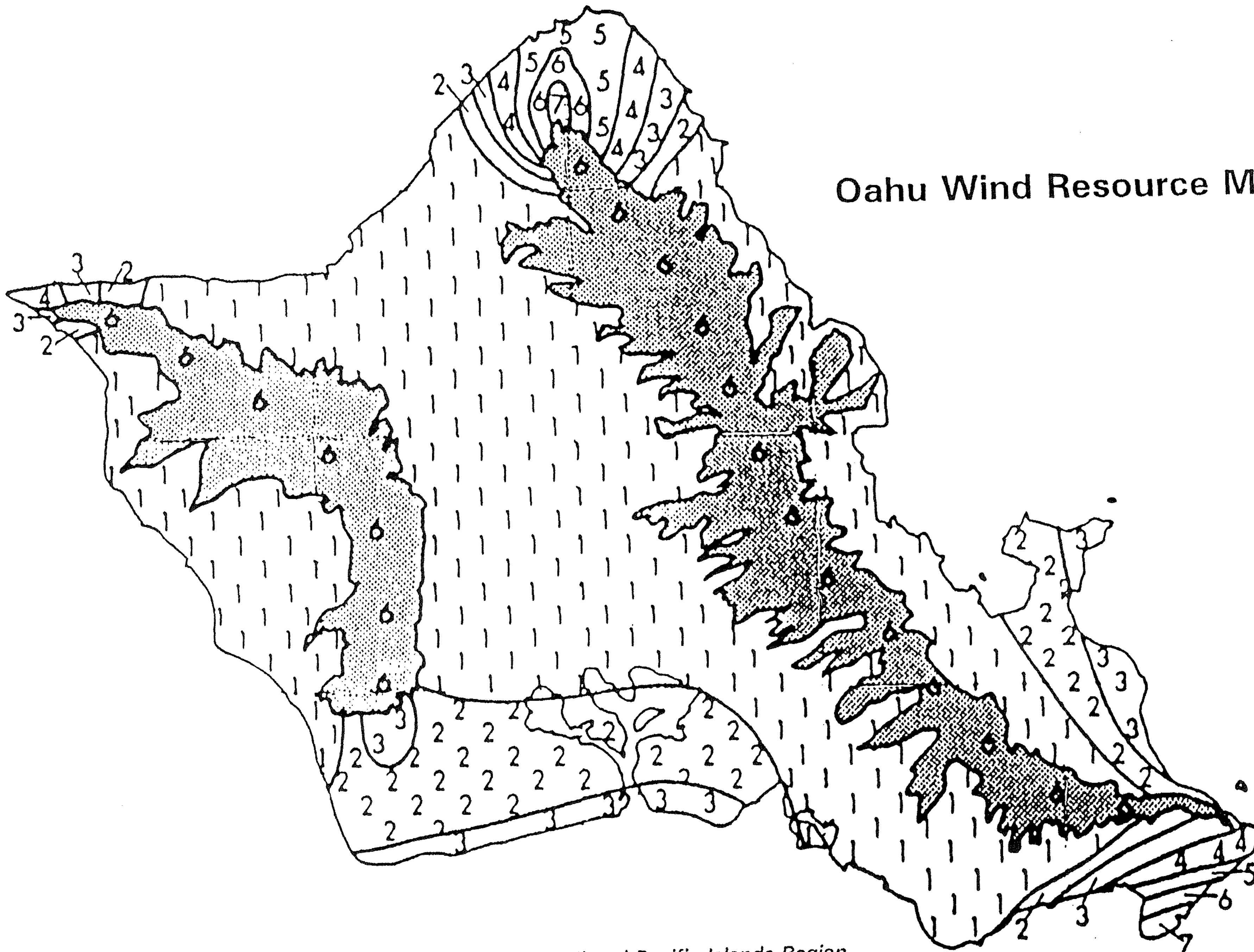
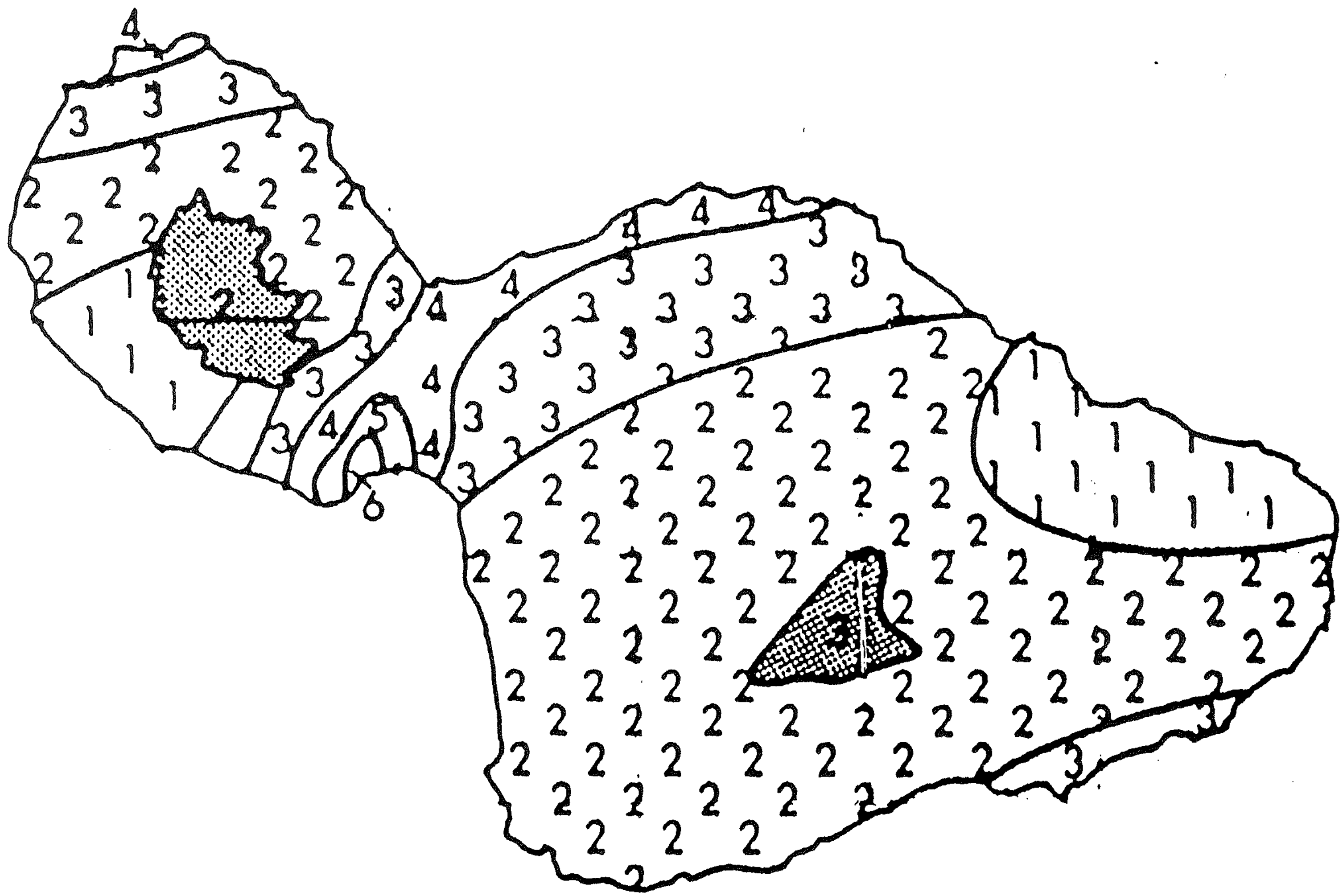
Oahu Wind Resource Map



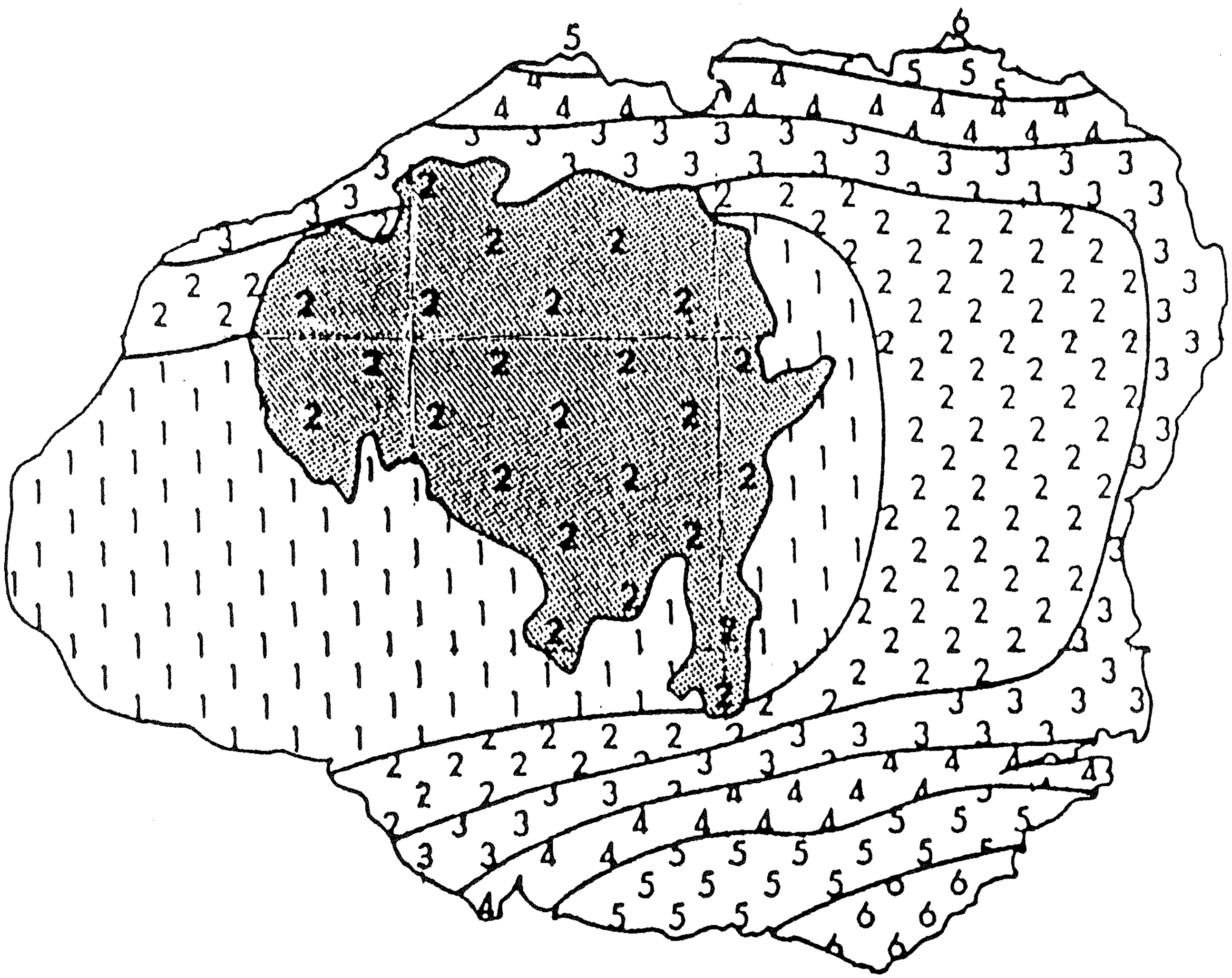
Source: *Wind Energy Resource Atlas: Volume 11 – Hawaii and Pacific Islands Region*, Battelle Pacific Northwest Laboratories, February 1981

Maui Wind Resource Map



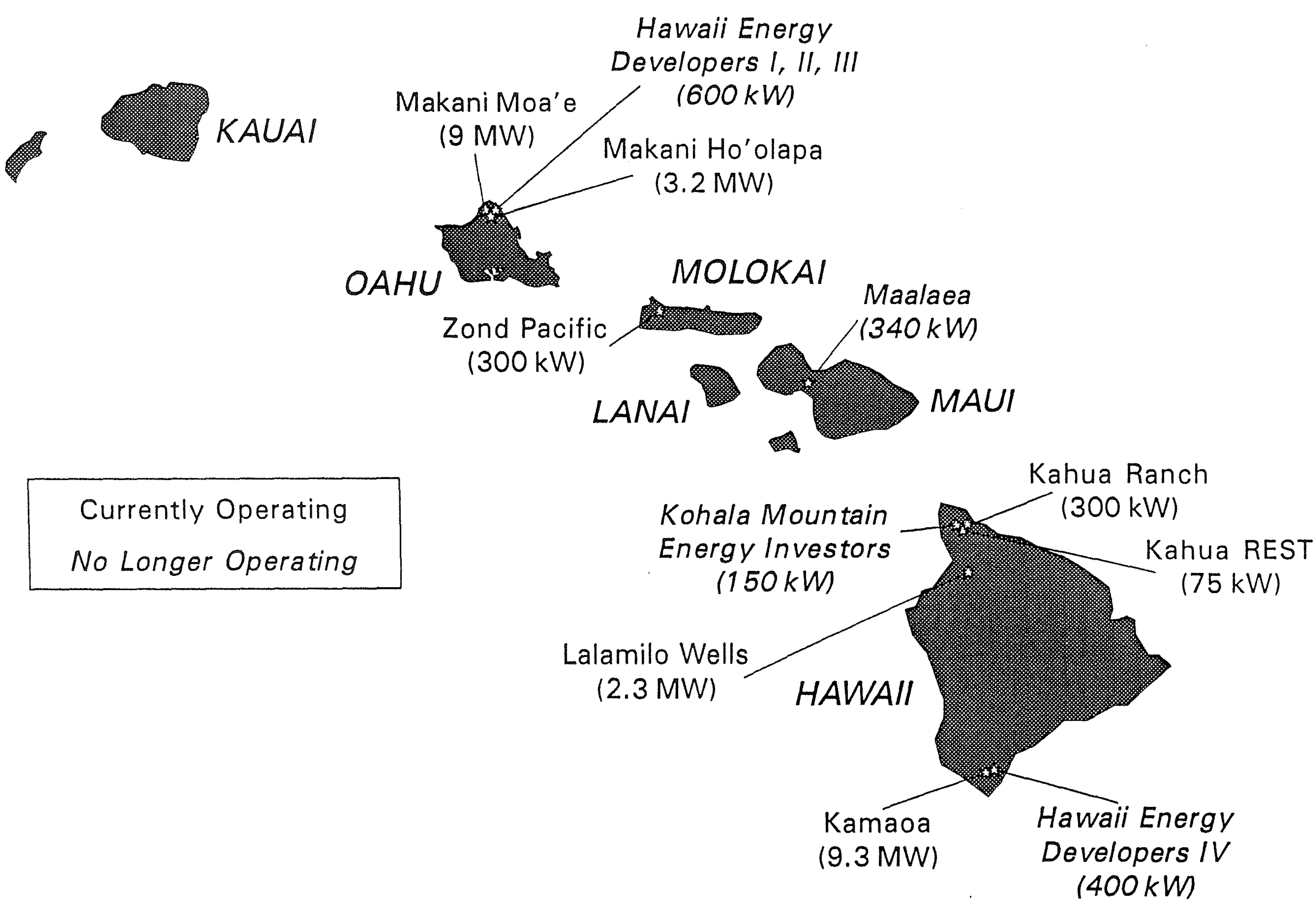
Source: *Wind Energy Resource Atlas: Volume 11 – Hawaii and Pacific Islands Region,* Battelle Pacific Northwest Laboratories, February 1981

Kauai Wind Resource Map



Source: *Wind Energy Resource Atlas: Volume 11 – Hawaii and Pacific Islands Region*, Battelle Pacific Northwest Laboratories, February 1981

Wind Power Stations in Hawaii



CURRENT ACTIVITIES

Hawaii Energy Strategy
Renewable Energy Resource and Development Program

- Phase 1: Renewable Energy Resource Assessment Plan

  Better define the viable locations for project development

- Phase 2: Renewable Energy Resource Supply Curves

  Develop cost and performance data

- Phase 3: Data Collection and Implementation Plan

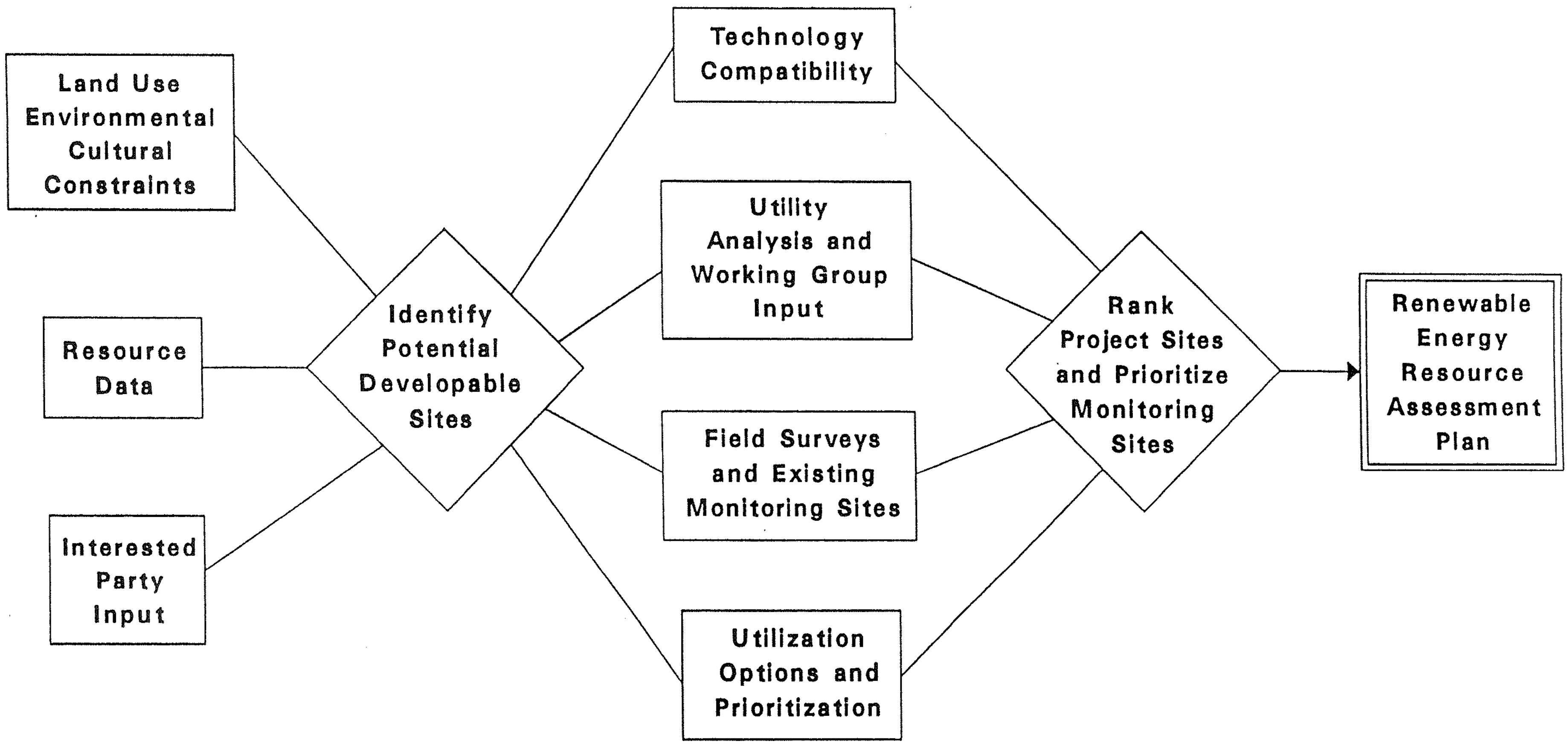
  Obtain additional wind and solar data and identify goals and methodologies for integrating renewables into the state's generation mix

- Technologies: wind, solar thermal, photovoltaics, biomass, hydro, wave, OTEC

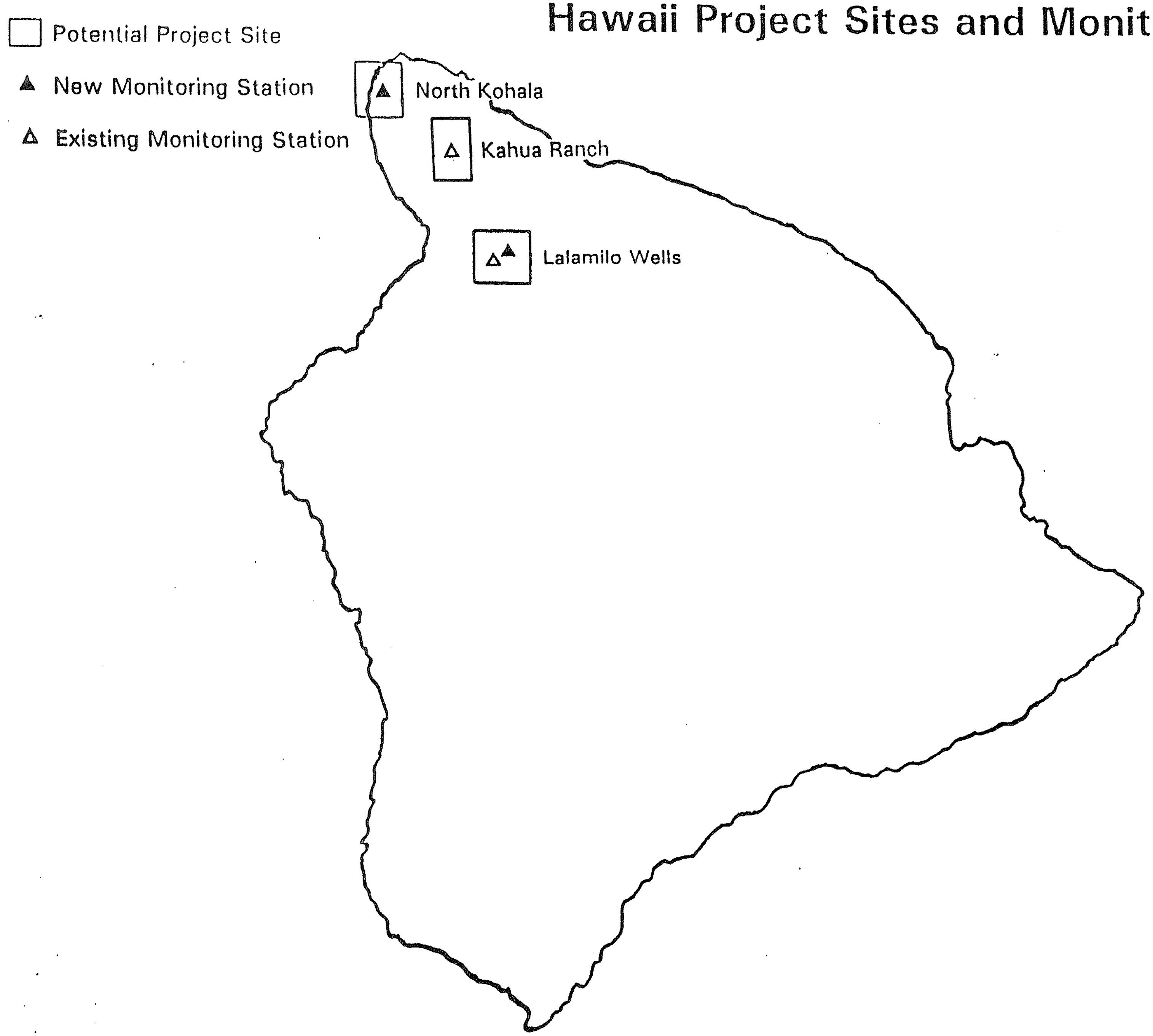
PHASE 1

- Identify constraints and requirements for renewable energy projects in Hawaii
- Apply screening process to identify most promising project locations
    - Resource intensity
    - Land zoning
    - Terrain suitability
    - Competing land uses
    - Owner acceptance
    - Utility access and impact
    - Environmental and cultural sensitivity
    - Public acceptance

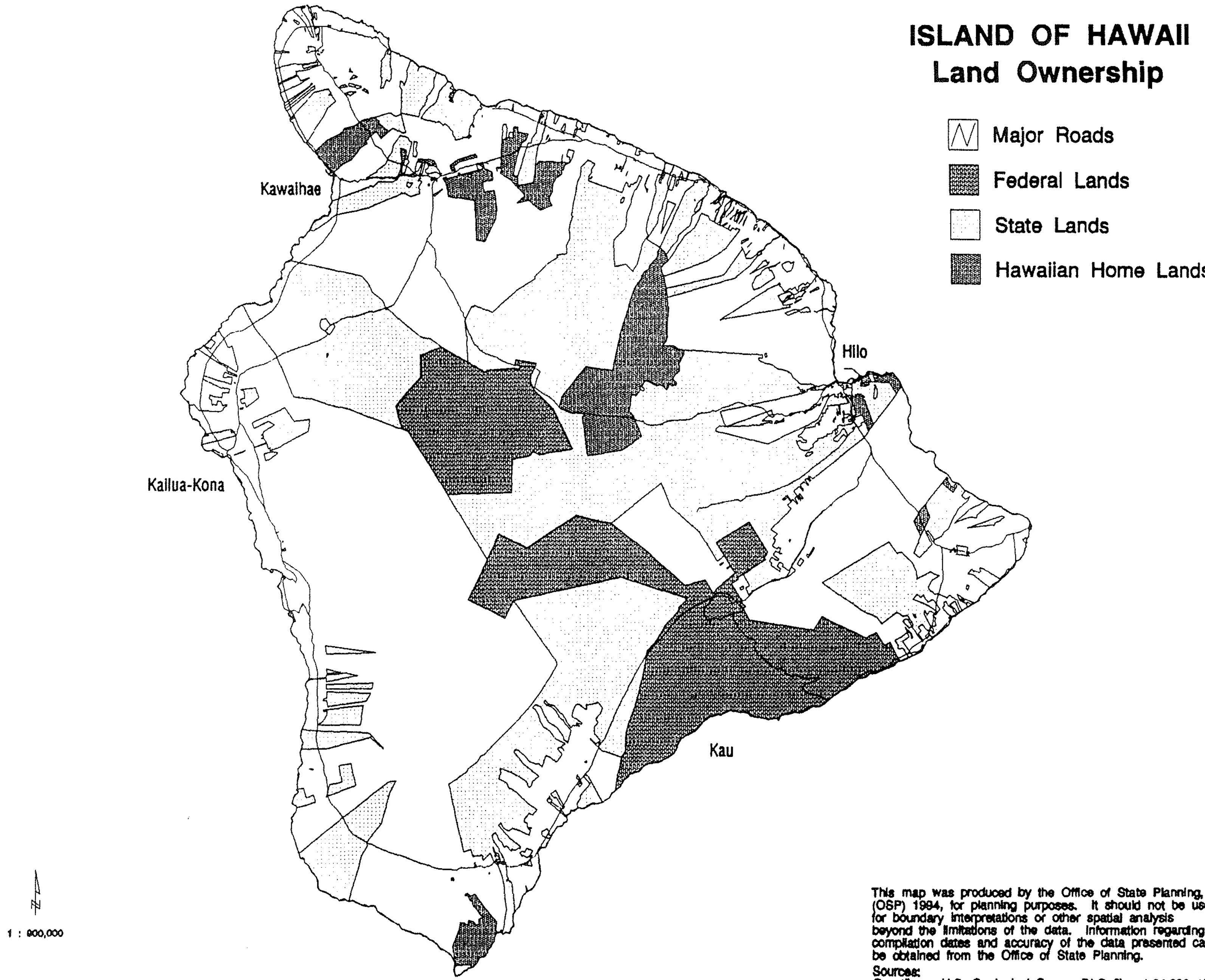
RENEWABLE ENERGY RESOURCE ASSESSMENT PLAN, PHASE 1



Hawaii Project Sites and Monitoring Locations



ISLAND OF HAWAII
Land Ownership



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Sources:
Coastline - U.S. Geological Survey DLG files 1:24,000 1983.
Land Ownership - U.S. Geological Survey digital GIRAS files 1:100,00 1976.
Roads - U.S. Geological Survey DLG files 1:24,000 1983.

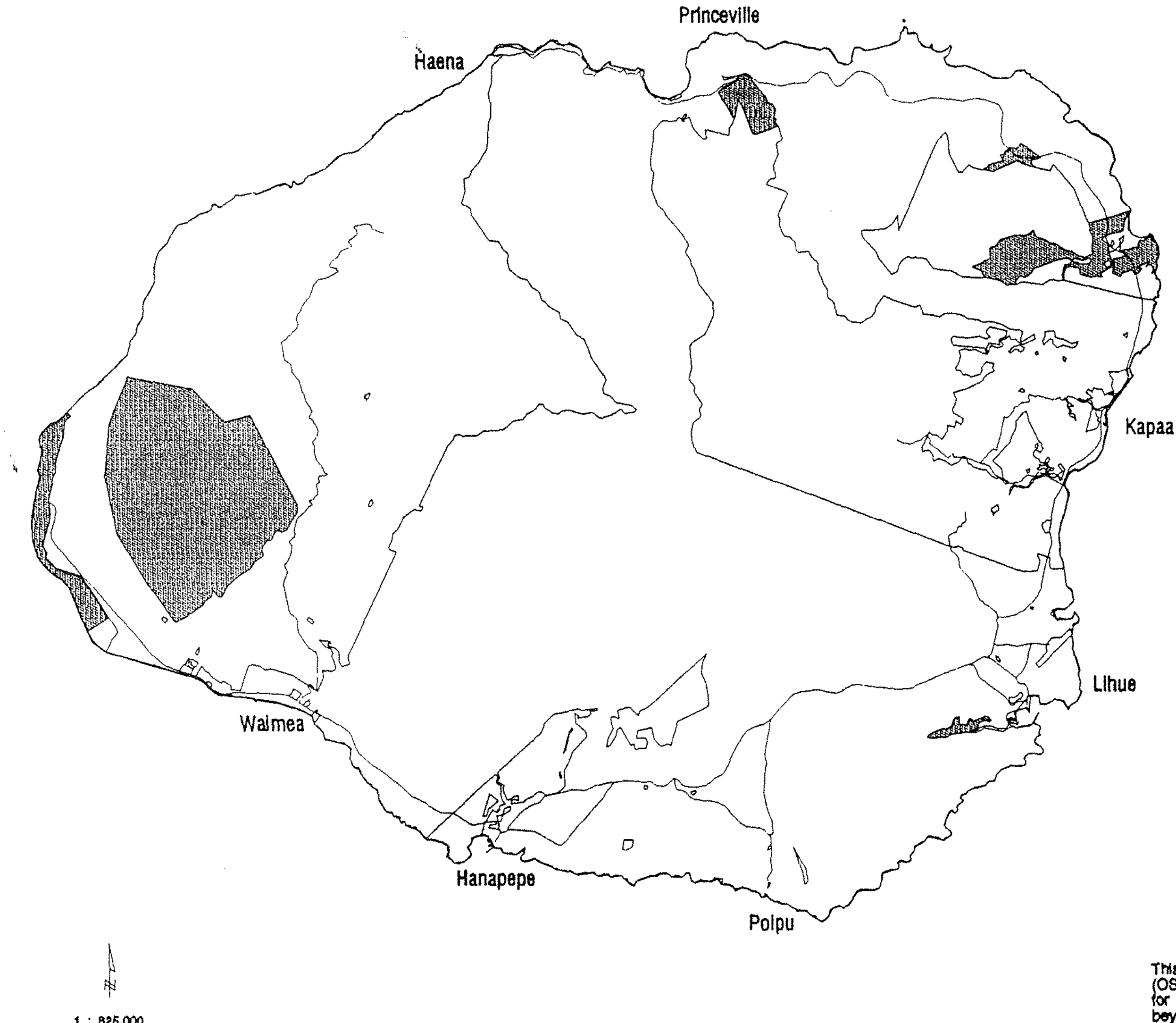
ISLAND OF KAUAI
Land Ownership

Major Roads

Federal Lands

State Lands

Hawaiian Home Lands



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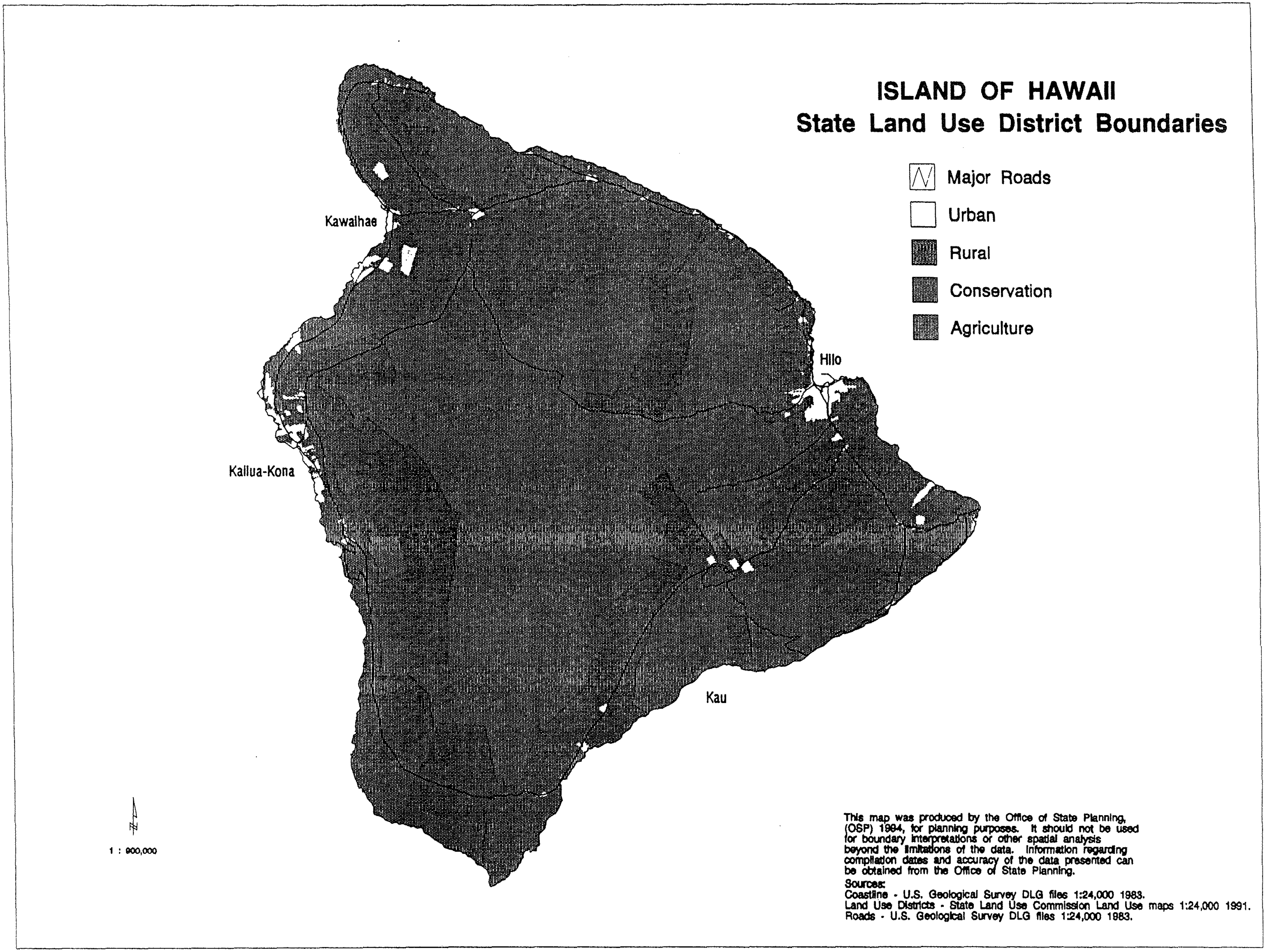
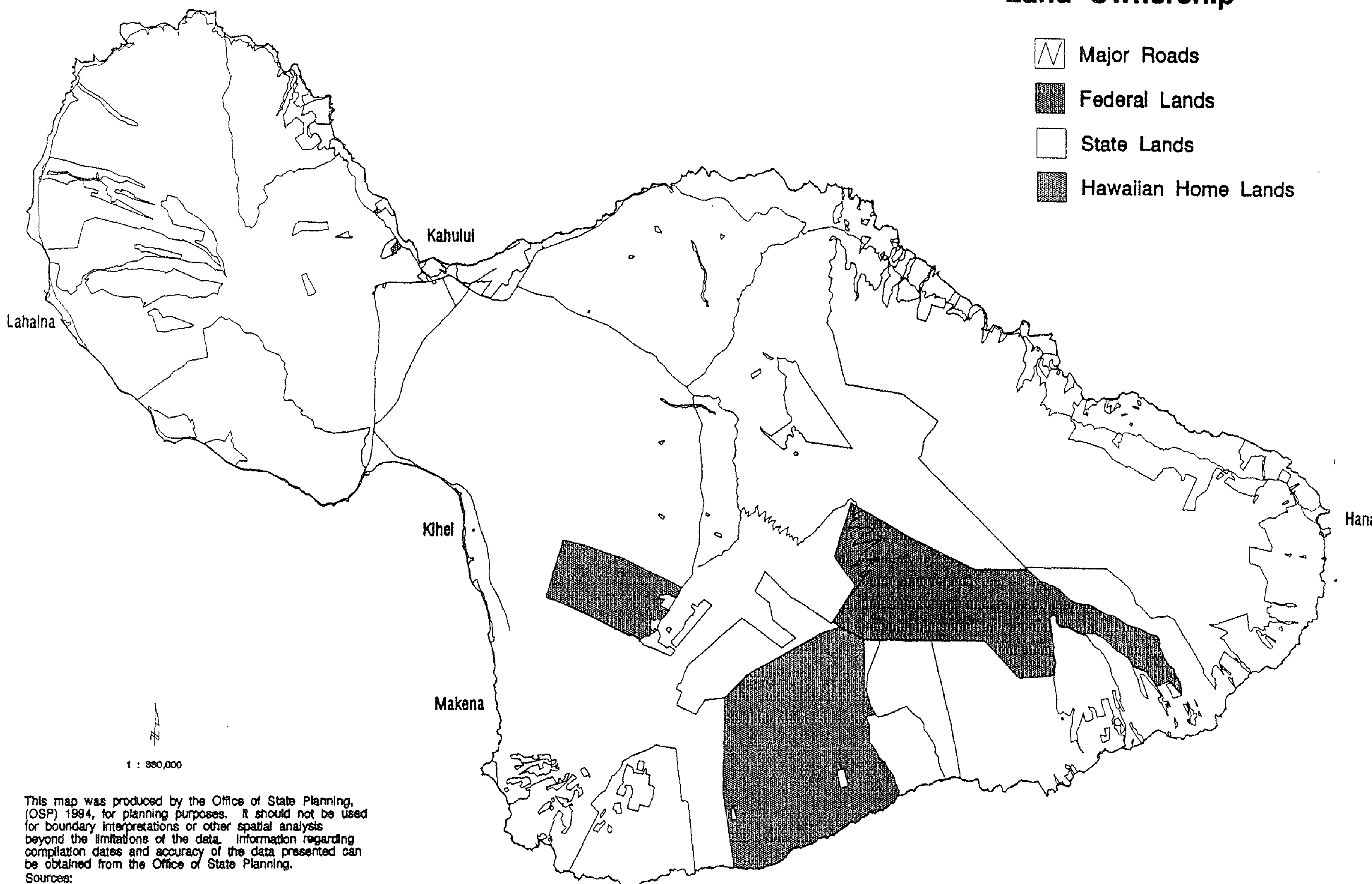

ISLAND OF HAWAII
State Land Use District Boundaries
Major Roads
Urban
Rural
Conservation
Agriculture
Kawaihae
Hilo
Kailua-Kona
Kau
1 : 900,000
This map was produced by the Office of State Planning, (OSP) 1994, for planning purposes. It should not be used for boundary interpretations or other spatial analysis beyond the limitations of the data. Information regarding compilation dates and accuracy of the data presented can be obtained from the Office of State Planning.
Sources:
Coastline - U.S. Geological Survey DLG files 1:24,000 1983.
Land Use Districts - State Land Use Commission Land Use maps 1:24,000 1991.
Roads - U.S. Geological Survey DLG files 1:24,000 1983.

ISLAND OF MAUI
Land Ownership



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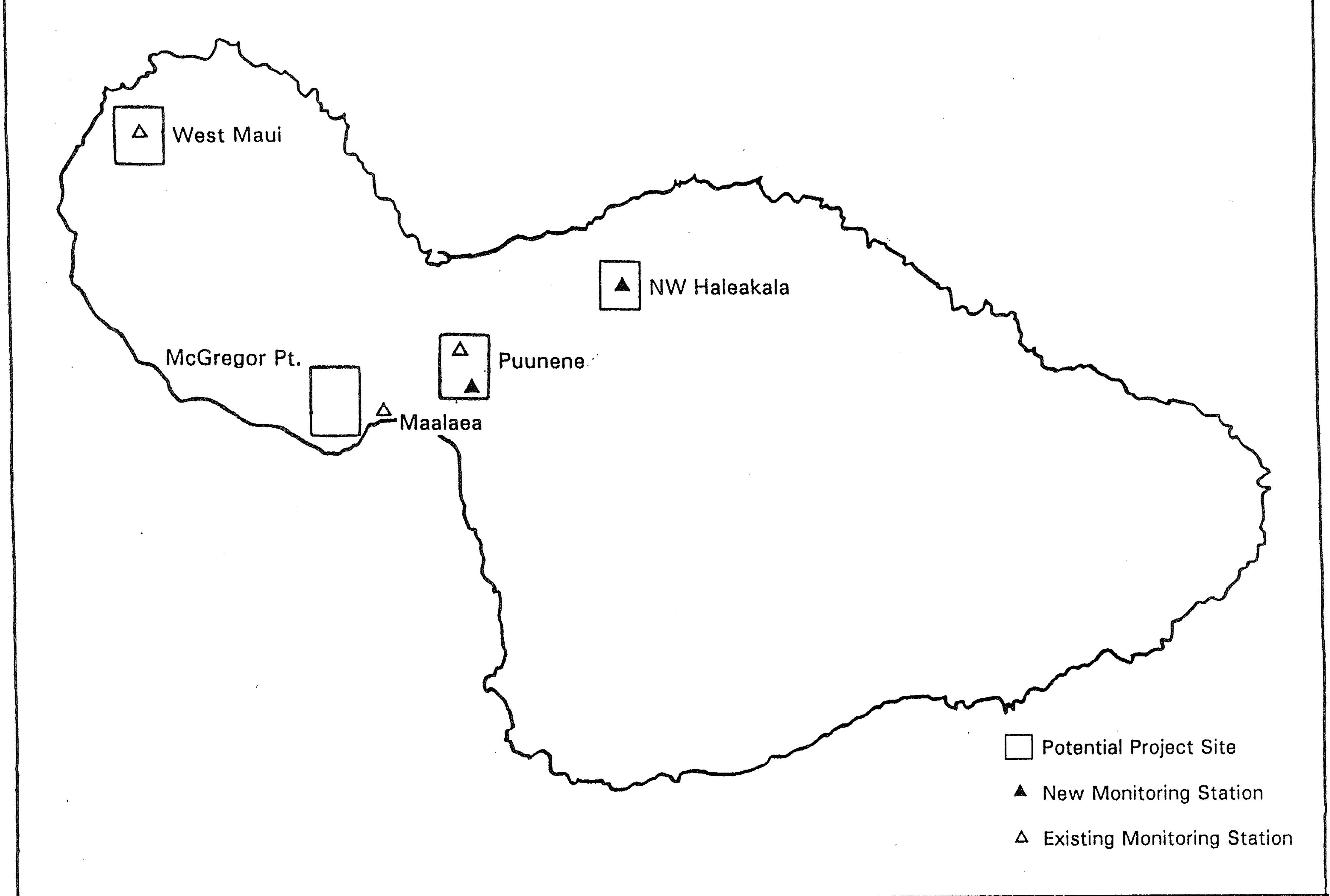
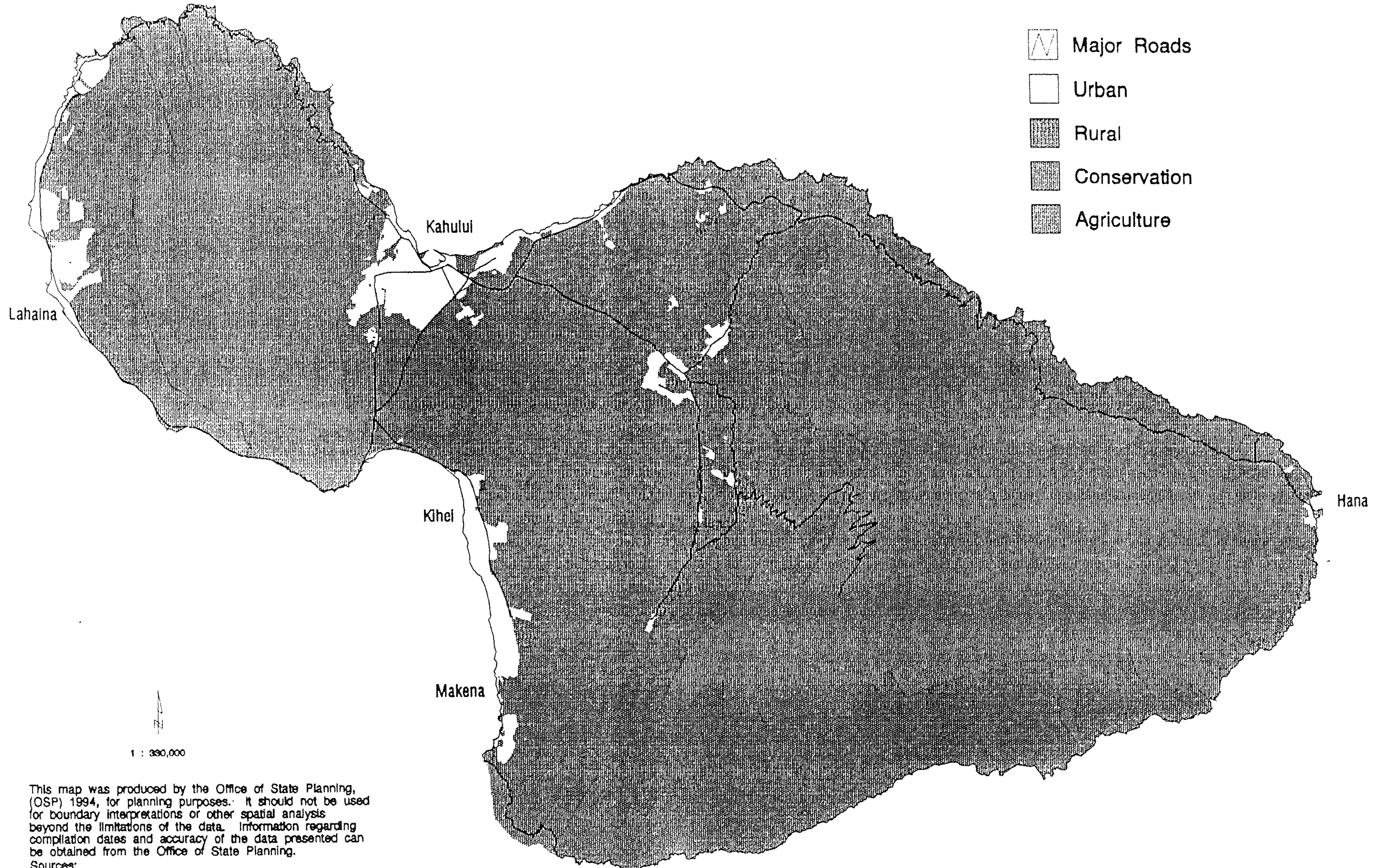
Roads - U.S. Geological Survey DLG files 1:24,000 1983.

Maui Project Sites and Monitoring Locations



ISLAND OF MAUI
State Land Use District Boundaries



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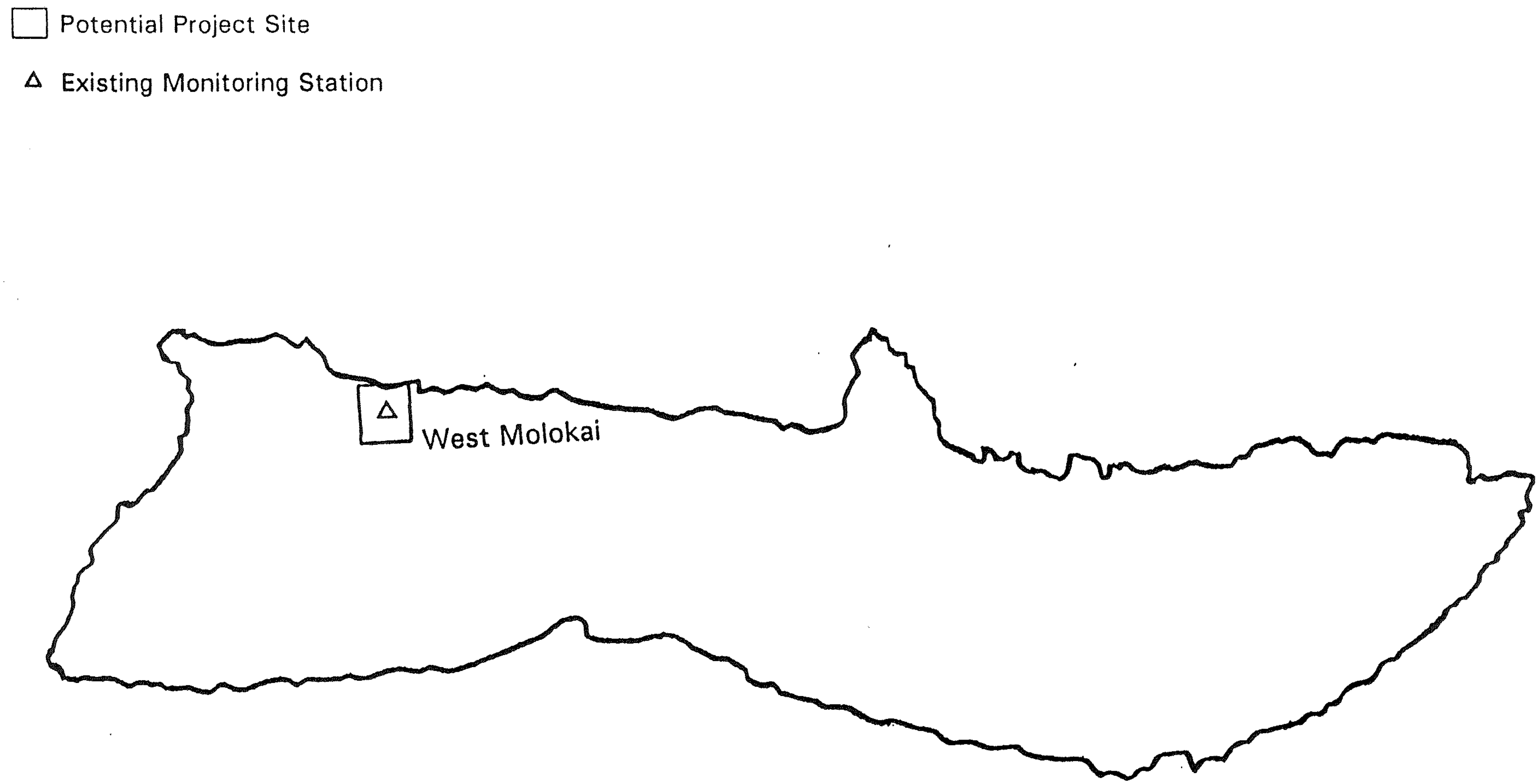
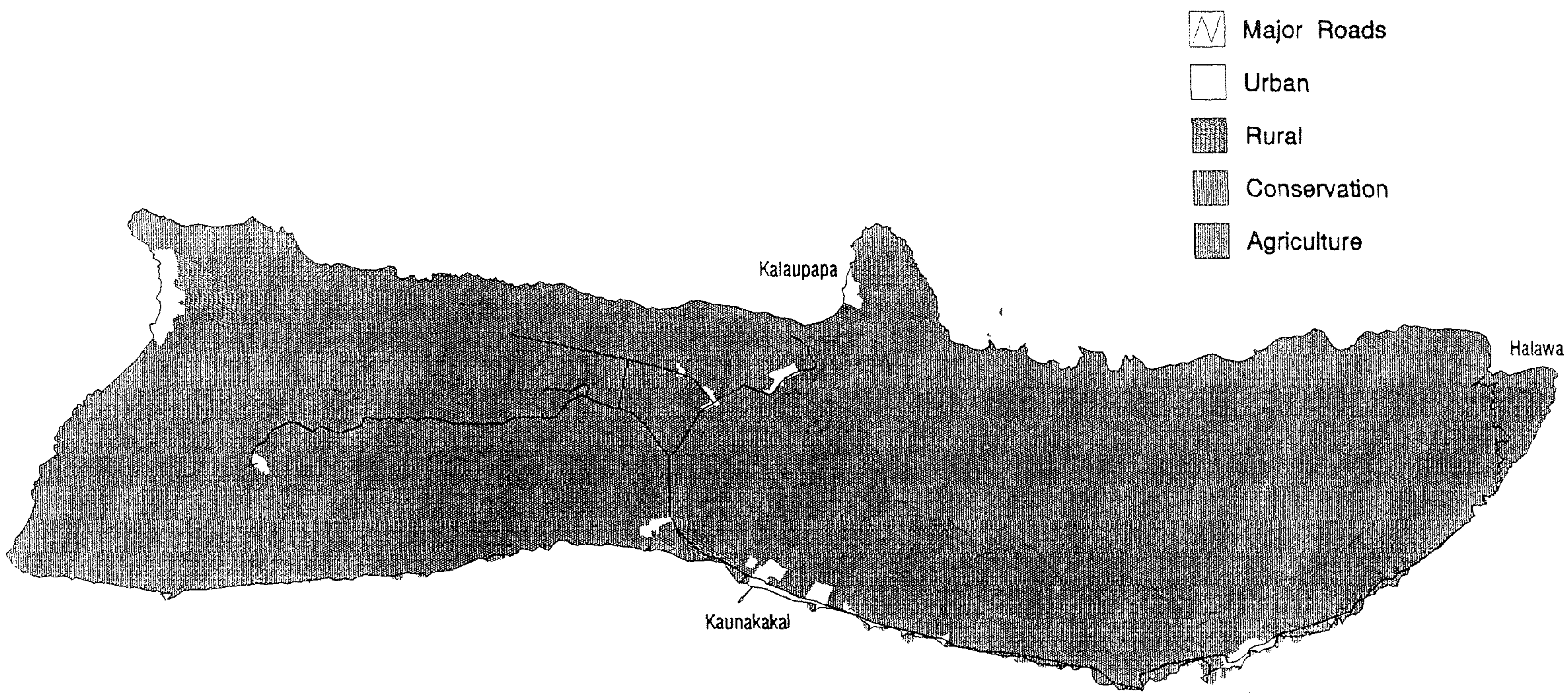
Roads - U.S. Geological Survey DLG files 1:24,000 1983.

Molokai Project Sites and Monitoring Locations



ISLAND OF MOLOKAI
State Land Use District Boundaries



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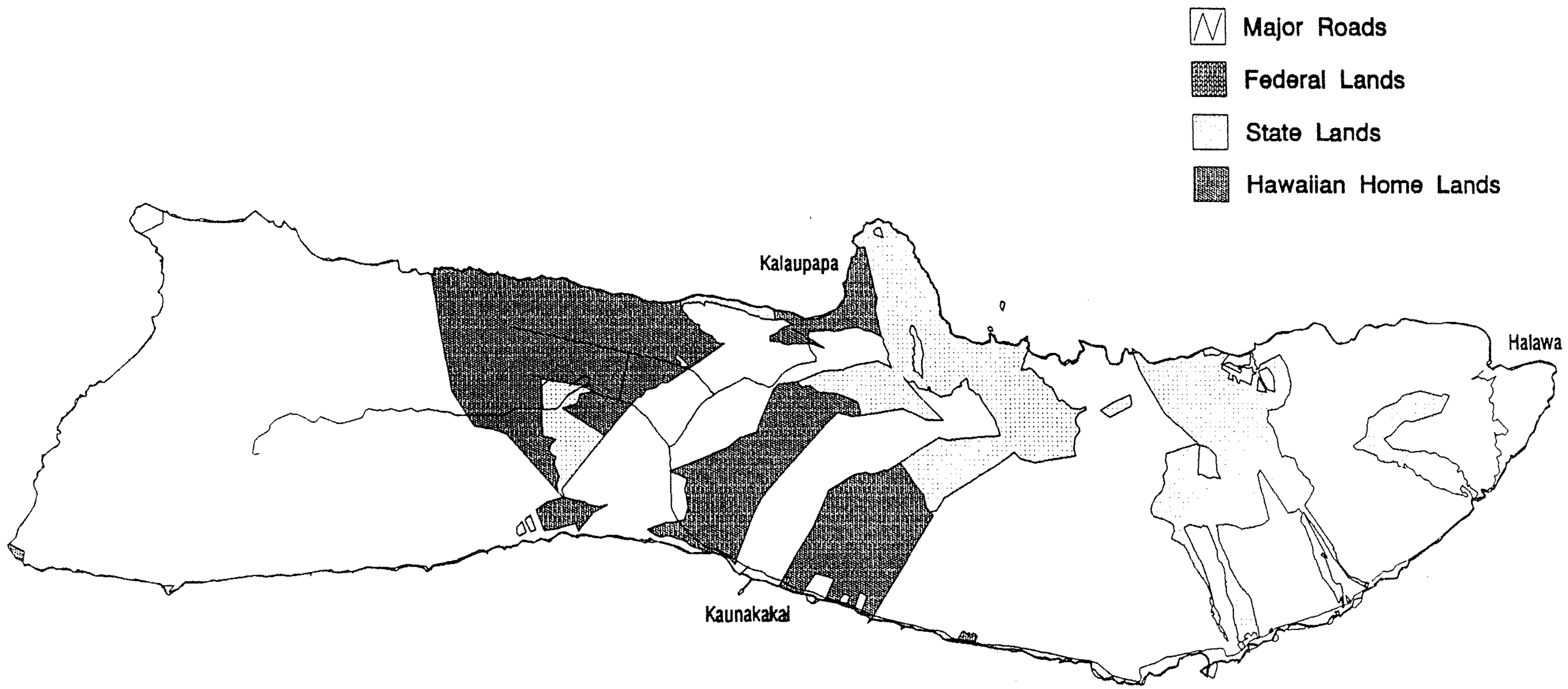
Land Use Districts - State Land Use Commission Land Use maps 1:24,000 1991.
Roads - U.S. Geological Survey DLG files 1:24,000 1983.

ISLAND OF MOLOKAI
Land Ownership



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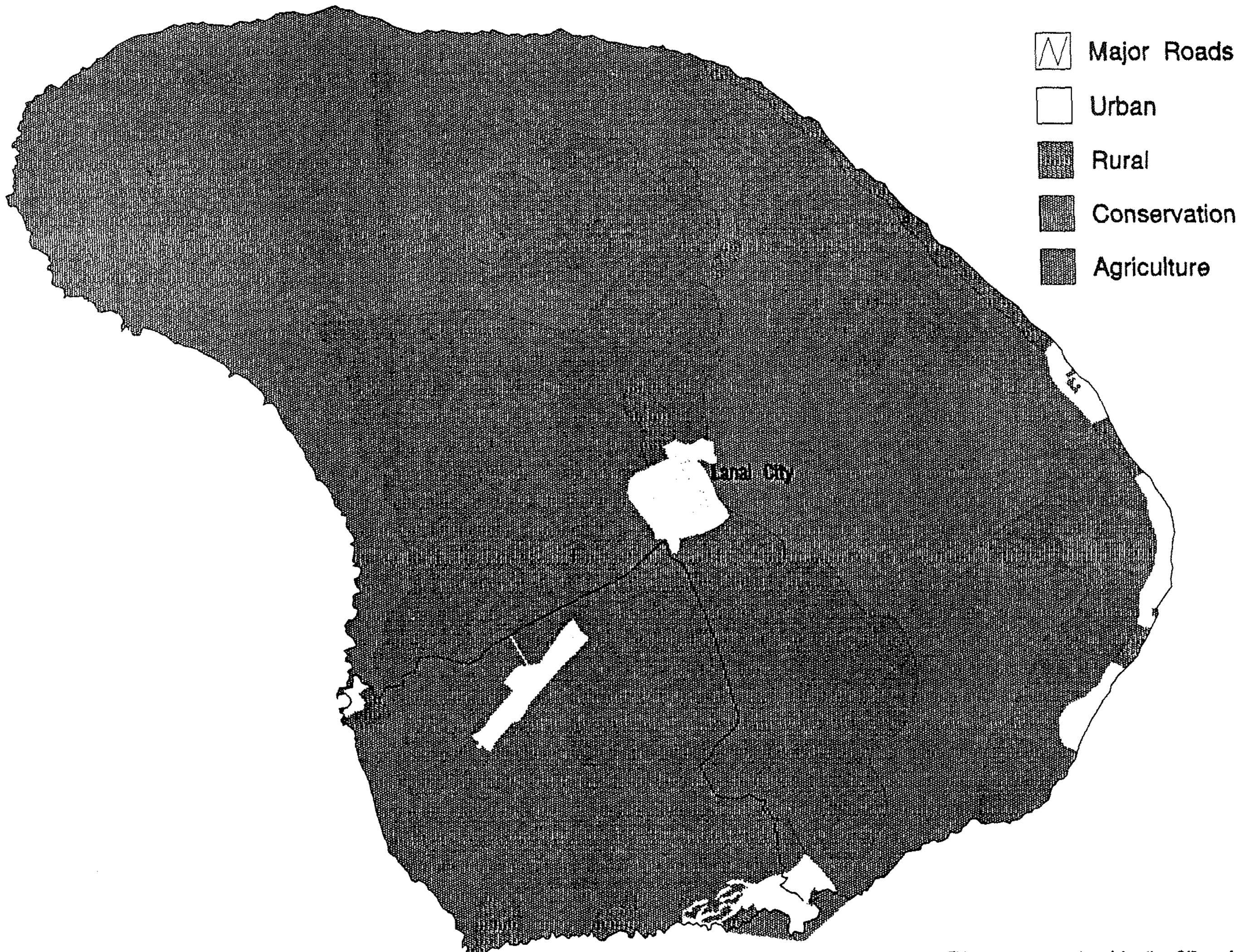
Land Ownership - U.S. Geological Survey digital GIRAS files 1:100,00 1976.
Roads - U.S. Geological Survey DLG files 1:24,000 1983.

ISLAND OF LANAI
State Land Use District Boundaries



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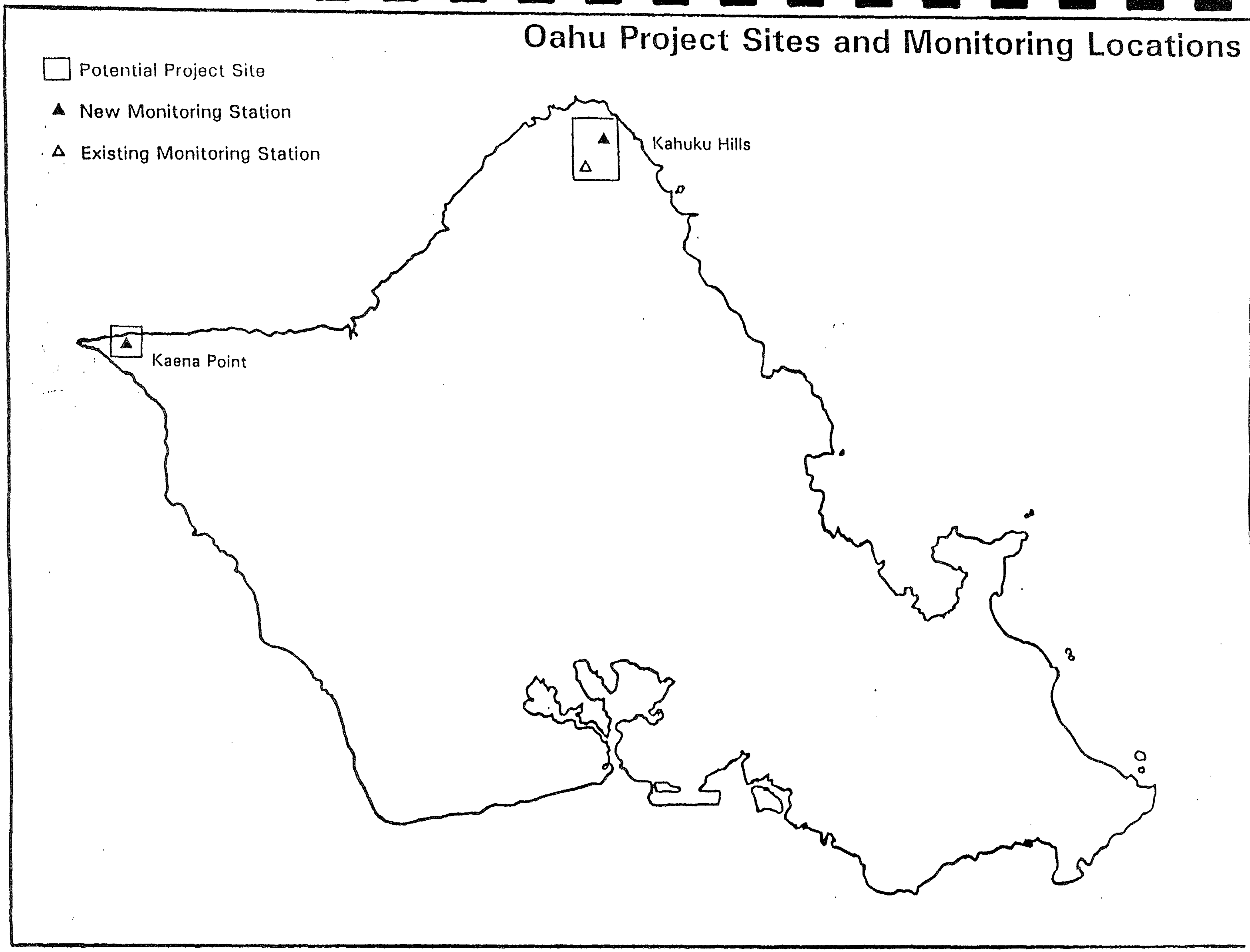
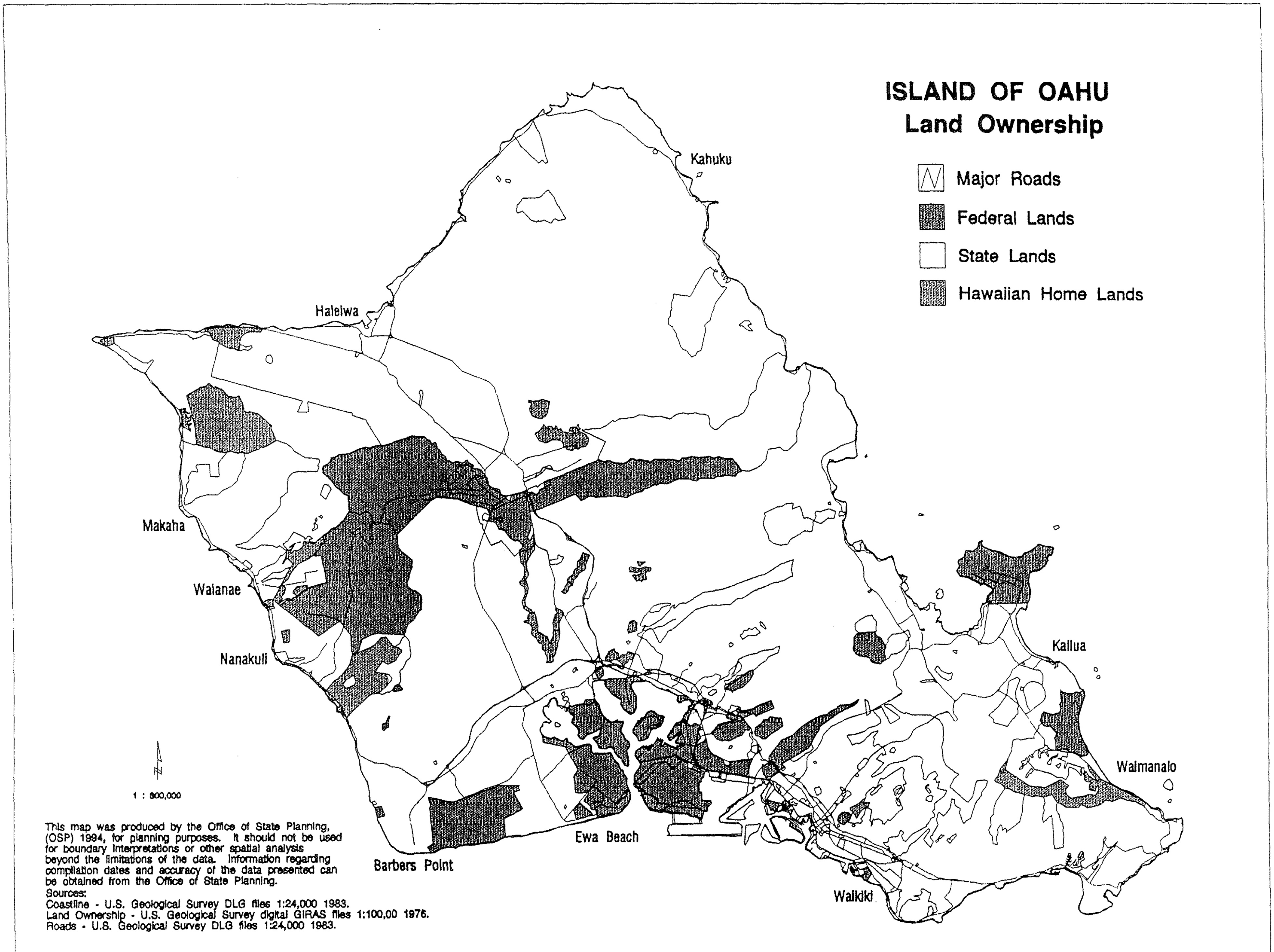
Roads - U.S. Geological Survey DLG files 1:24,000 1983.


Oahu Project Sites and Monitoring Locations
Potential Project Site
New Monitoring Station
Existing Monitoring Station
Kahuku Hills
Kaena Point



ISLAND OF OAHU
Land Ownership
Major Roads
Federal Lands
State Lands
Hawaiian Home Lands
Kahuku
Haleiwa
Makaha
Waianae
Nanakuli
Barbers Point
Ewa Beach
Waikiki
Kailua
Waimanalo
1 : 800,000
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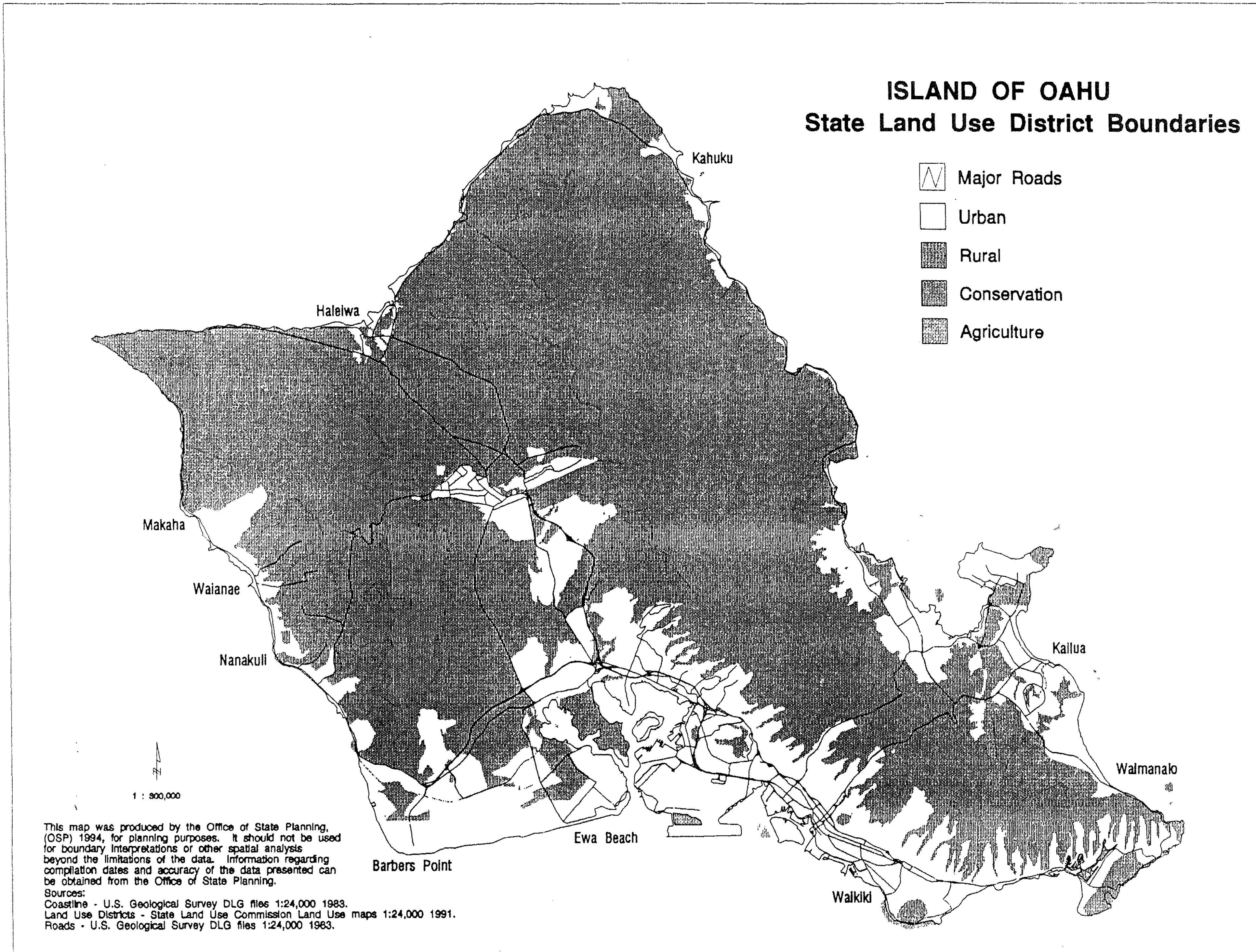
Land Ownership - U.S. Geological Survey digital GIRAS files 1:100,00 1976.
Roads - U.S. Geological Survey DLG files 1:24,000 1983.


ISLAND OF OAHU
State Land Use District Boundaries
Major Roads
Urban
Rural
Conservation
Agriculture
Kahuku
Haleiwa
Makaha
Waianae
Nanakuli
Kailua
Waimanalo
Ewa Beach
Barbers Point
Waikiki
1 : 300,000
This map was produced by the Office of State Planning, (OSP) 1994, for planning purposes. It should not be used for boundary interpretations or other spatial analysis beyond the limitations of the data. Information regarding compilation dates and accuracy of the data presented can be obtained from the Office of State Planning.
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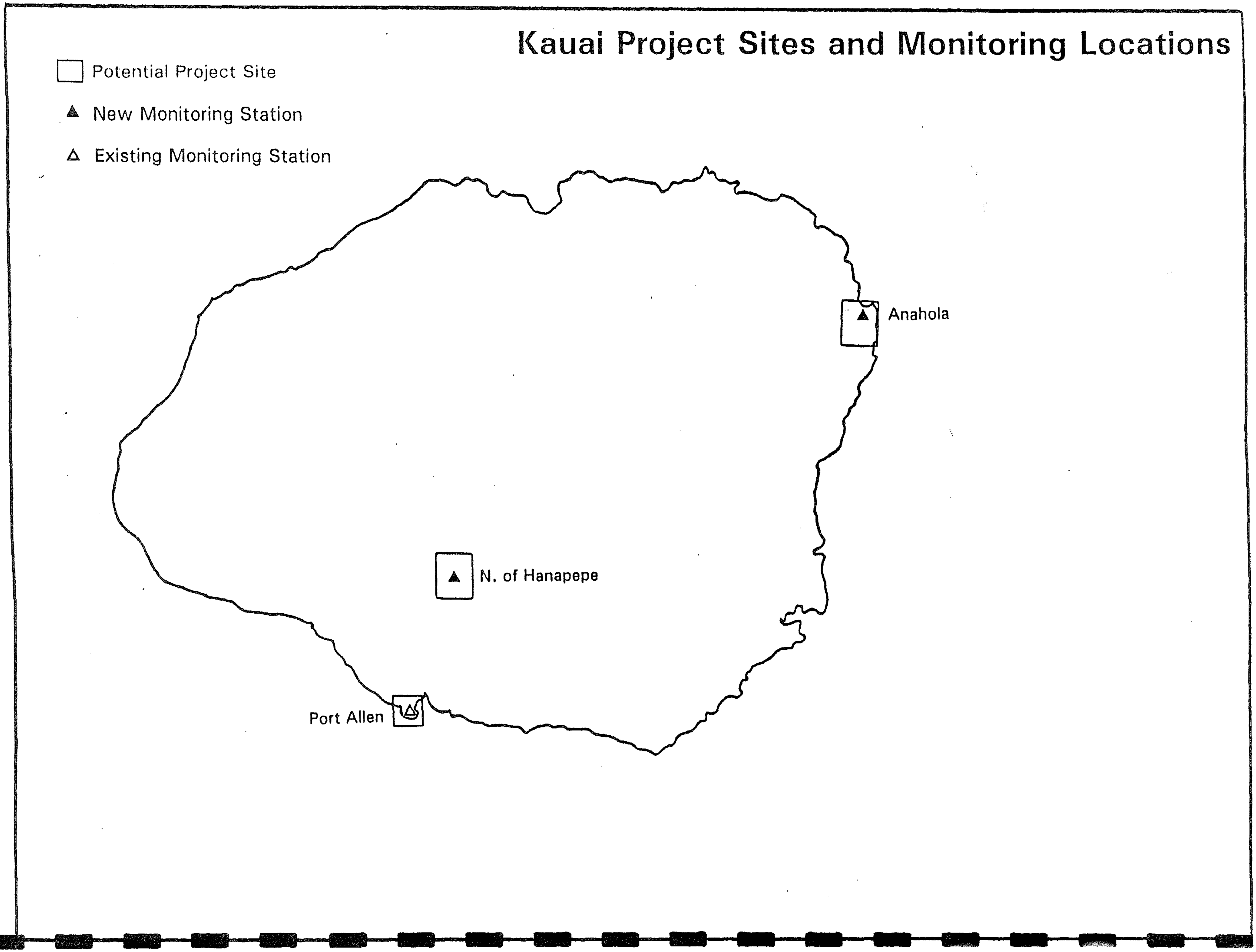
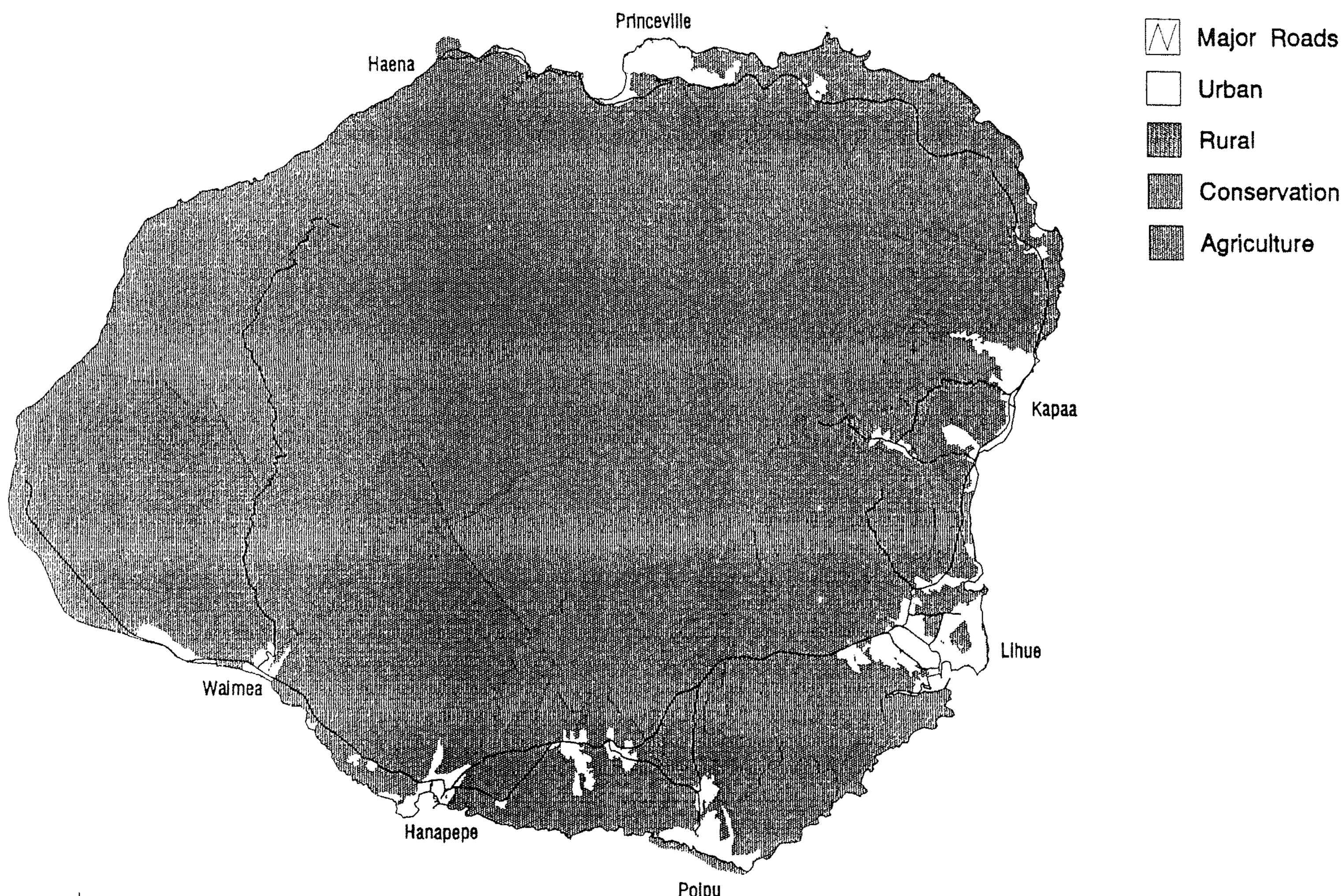

Kauai Project Sites and Monitoring Locations
Potential Project Site
New Monitoring Station
Existing Monitoring Station
Anahola
N. of Hanapepe
Port Allen

ISLAND OF KAUAI
State Land Use District Boundaries



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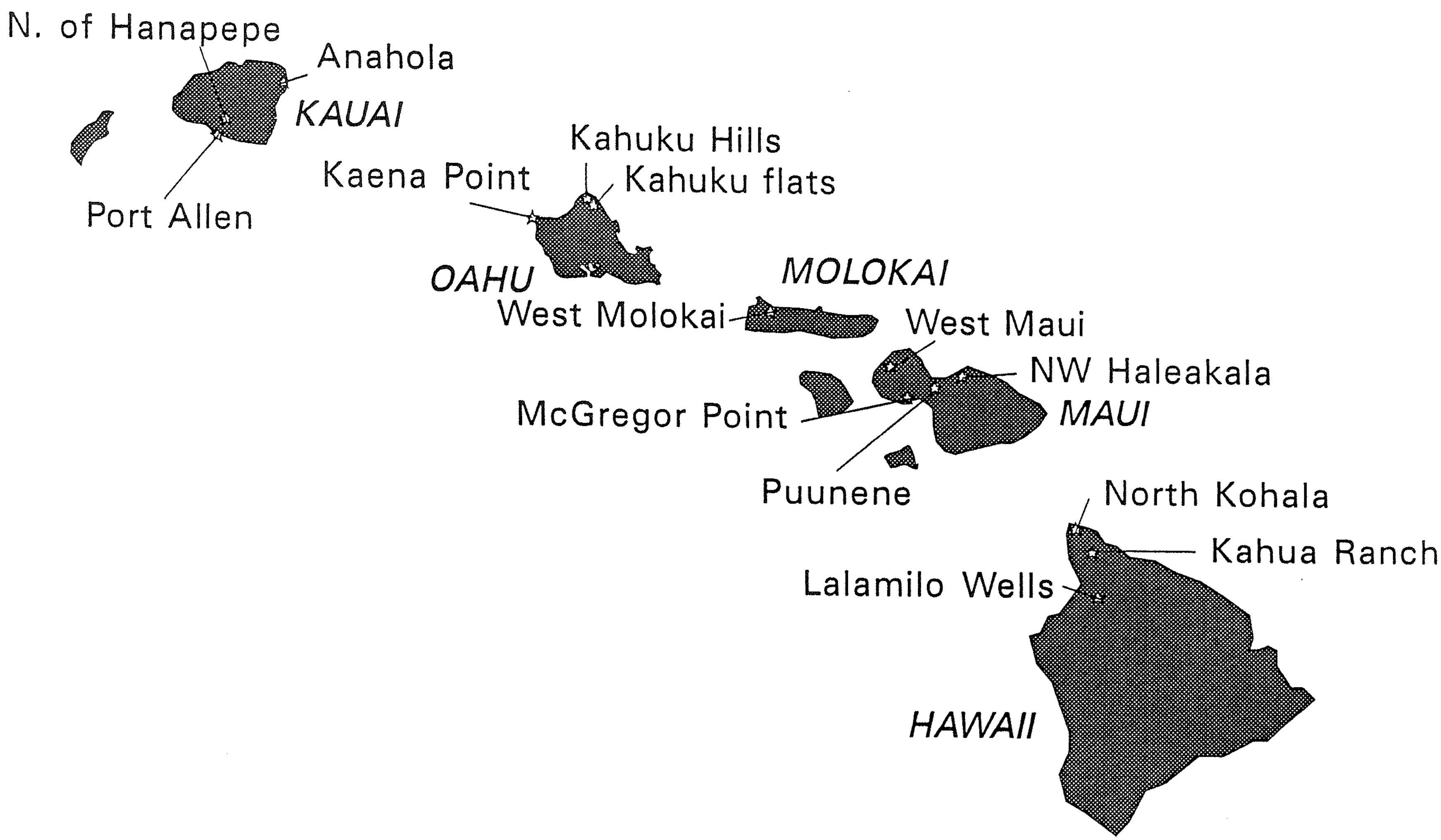
Sources:
Coastline - U.S. Geological Survey DLG files 1:24,000 1983.
Land Use Districts - State Land Use Commission Land Use maps 1:24,000 1991.
Roads - U.S. Geological Survey DLG files 1:24,000 1983.

Location of Potential Project Sites



LAND-USE CHARACTERISTICS OF POTENTIAL PROJECT SITES

	Sites	Owner	Zoning	Current/Planned Uses
Hawaii	Lalamilo	State	Agriculture	Grazing, Water Dept. wells
	N. Kohala	Chalon Int'l	Agriculture	Renewable energy, resort development, & residences
	Kahua Ranch	Kahua Ranch	Agriculture	Grazing, diversified agriculture wind energy
	Others	Bishop Estate Hawaiian Homes Parker Ranch		
Maui	W. Maui	Maui Land & Pineapple	Agriculture	Grazing, tourist activities
	McGregor Point	State	Resource & general conservation	Grazing
	Puunene	State, HC&S	Agriculture	Sugar
	NW Haleakala	HC&S	Agriculture	Sugar

LAND-USE CHARACTERISTICS OF POTENTIAL PROJECT SITES

	Sites	Owner	Zoning	Current/Planned Uses
Molokai	W. Molokai	Molokai Ranch	Agriculture	Grazing
Lanai	Shipwreck Beach	Castle & Cooke	Agriculture	Grazing
Oahu	Kahuku	Campbell Estate	Agriculture	Wind energy, aquaculture military training
	Kaena Pt.	State	Agriculture	Military communications
Kauai	Anahola	Hawaiian Homes, C. Brewer	Agriculture	Agriculture, some residences
	Port Allen	State	Urban	Recreation, aviation
	N. of Hanapepe	Gay & Robinson	Agriculture	Grazing

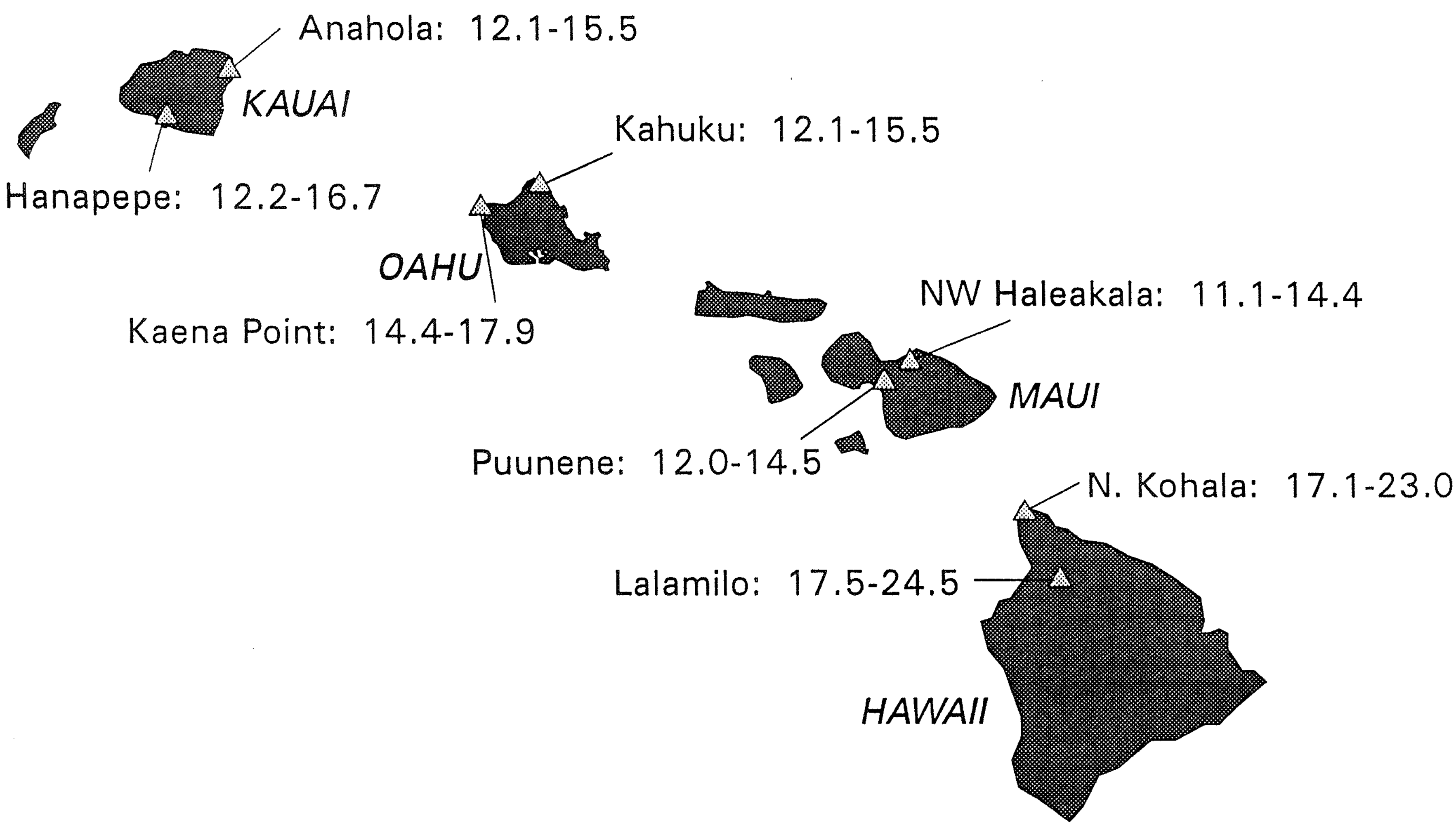
POTENTIAL PROJECT SIZES AND LIMITATIONS

Hawaii	Lalamilo	3 MW (existing transmission) 30 MW (utility) 50 MW (land)
	N. Kohala	5 MW (existing transmission) 15 MW (land)
	Kahua	5 MW (existing transmission) 15 MW (land)
Maui	W. Maui	10 MW (land) 30 MW (existing transmission)
	McGregor Point	10 MW (land)
	Puunene	10 MW (existing transmission) 30 MW (land + utility)
	NW Haleakala	10 MW (existing transmission) 30 MW (utility) 50 MW (land)

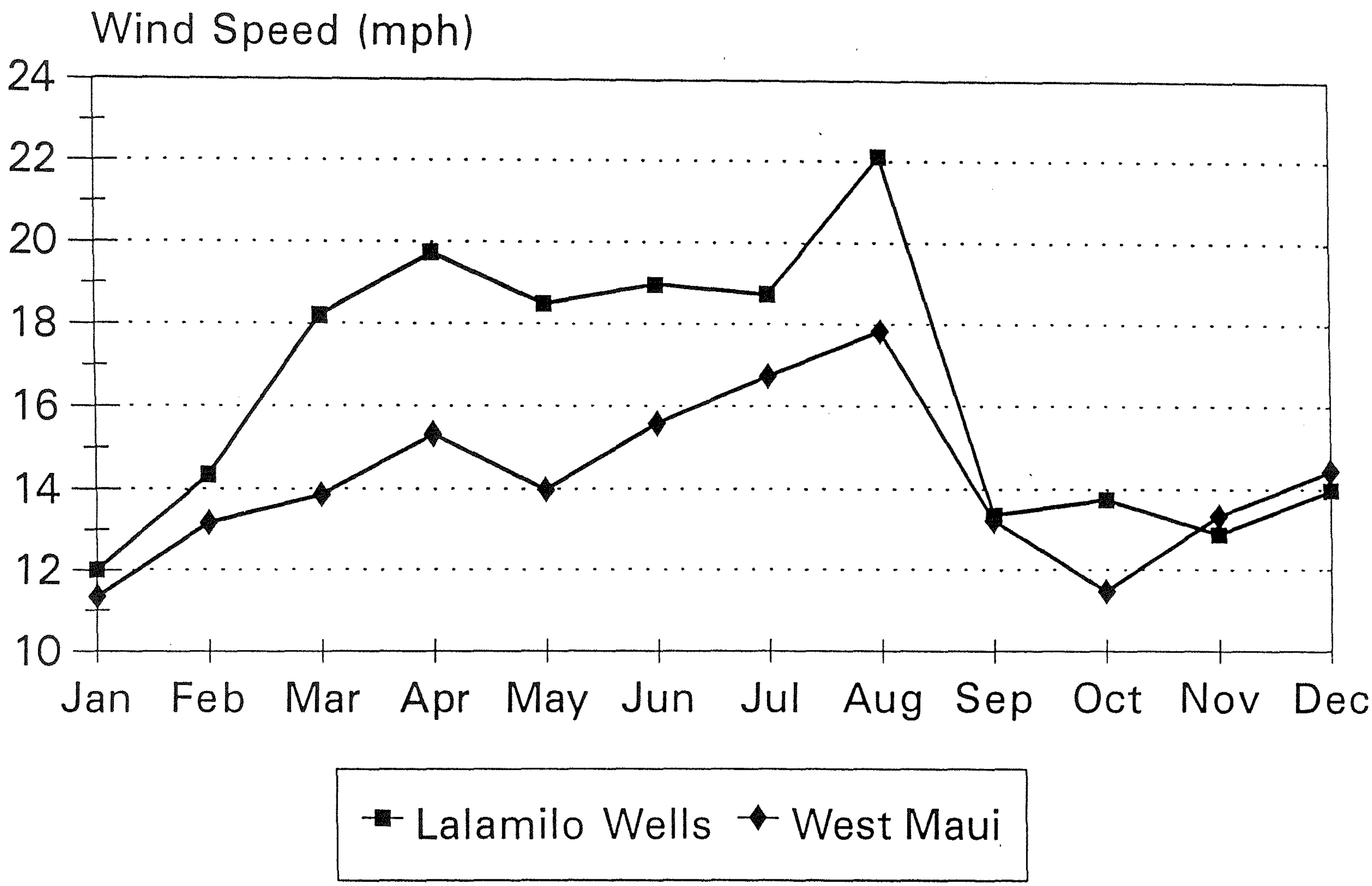
POTENTIAL PROJECT SIZES AND LIMITATIONS

Oahu	Kahuku	30 MW (existing transmission) 50 MW (utility)
	Kaena	2 MW (existing transmission) 15 MW (land)
Kauai	Anahola	7 MW (land & utility)
	N. of Hanapepe	10 MW (existing transmission)
	Port Allen	5 MW (land + existing transmission)

PRELIMINARY RESULTS FROM NEW MONITORING STATIONS
Range of Monthly Averages (Oct. '93 - Feb. '94 (mph)



SEASONAL VARIATION
7/92-6/93



LAND USE ISSUES

- Zoning
- Compatibility with existing or planned uses
- Impacts on land
- Impacts on wildlife
- Cultural/historical sensitivity
- Visual impacts
- Noise
- Uses of adjacent land
- Economics/competing uses

SUMMARY

- Good wind resources exist on all major Hawaiian islands
- Land use concerns limit potential development areas
- But -- potential wind energy development areas exist on all major islands on both state and private lands

2.2.2 Panel Members:

Dick Cameron–Alexander & Baldwin, Hawaiian Commercial & Sugar
Monty Richards–Kahua Ranch Limited
Mason Young–State of Hawaii Department of Land and Natural Resources

Panel Responses

Dick Cameron –Alexander & Baldwin, Hawaiian Commercial & Sugar (HC&S)

Mr. Cameron introduced himself as a representative of the agriculture industry participating in the workshop to share his perspective on the current usage of the land, particularly the central valley of Maui where HC&S currently occupies a primary portion of the land. He added that Alexander & Baldwin is open to the development of renewable resources citing the joint cooperative effort HC&S is involved in with the state and federal governments to build the biomass gasifier facility on HC&S land in Kahalui, Maui.

One of the key areas of concern in Hawaii, centers around the limited land resources available in Hawaii. A wind farm would be particularly visible in the central valley of Maui. The visibility impact from the general population is a major issue as HC&S experienced in the entitlement and gaining of permits for the biomass gasifier facility. The trauma suffered in erecting the BGF, put the project years behind schedule in construction.

Cost-effectiveness, long term reliability, predictable fuel sourcing, all pale in comparison to the visual impact issue, according to Mr. Cameron.

The value of the land and the installation of a wind farm leaves a very small footprint in comparison to the footprint of the land around it. The land impacted by the installation is a vast area, he emphasized, and it has a very, very large impact. It limits what you can do and needs to be put into perspective with other competing land uses.

In closing, Mr. Cameron predicted that it will be the visual environmental issues in Hawaii that will be the most difficult to combat in developing wind in the state.

Monty Richards – Kahua Ranch Limited

In Kahua, the wind always blows which is why Kahua Ranch got into the business of wind power, Mr. Richards stated. From an agricultural standpoint, wind is not an asset but a liability. As for ranching, Mr. Richards said in referencing Mr. Cameron's statements, wind was not an *either/or* competing land use but an *"and"* situation. However, due to the ravages of old technology and strong winds, the wind farm at Kahua Ranch is temporarily in demise with only a few Jacobs wind turbines still in operation.

Any diversification of business at Kahua Ranch would require power, Mr. Richards noted, adding another reason for the development of wind was to ease the requirement of power from the utility and thus lower their power costs.

"We are presently in the greenhouse business and if it was not for the few wind turbines we have left, we would not be in the greenhouse business," he said.

Echoing the words of Dick Cameron but from a different perspective, Mr. Richards emphasized that a team approach is needed in Hawaii to make the development of wind a success. The team players are as follows:

- Landowners - a substantial commitment is needed for a 20 to 30 year usage of land for wind development.
- Government - support is needed not only for research but for resolving zoning requirement disputes as well as providing legislative support. (Currently Mr. Richard's land in Kahua is being considered for a change in zoning from agriculture to conservation, therefore he has been forced to stop negotiations with Zond Systems until the issue can be resolved. Mr. Richards views the zoning change as a threat and countered by filing a request with the county to subdivide Kahua Ranch into 20 acre lots zoned agriculturally.)
- Environmental Groups - do they want wind to be developed or are they going to fight it?
- Public - support is currently strong.
- Manufacturers - need to produce a high performance machine.

"It's not going to be easy if you're going to have to fight your way, every step of the way. We have done battle and will continue to do battle but the old war horse is getting tired," he said noting that despite the hardships endured his spirit is not broken and Kahua Ranch will continue to support wind development in Hawaii.

In emphasizing the team approach, Mr. Richards outlined a few key points for all concerned to keep in mind:

- Approach a wind program from a long term perspective rather than a short term perspective.
- Make certain that the program implemented for wind is financially rewarding.
- Make certain that the development of wind in Hawaii is implemented for the good of the state as well as for private developers.

Mason Young – State of Hawaii Department of Land and Natural Resources

Mr. Young reiterated the need for a joint venture to implement wind in Hawaii. Without it, he added, it will never work.

With over 1.4 million acres in its possession, the state is the largest landowner in Hawaii, Mr. Young noted.

The state has many potential sites for wind development, he said and cited several wind project sites on the islands. However, the major problems for wind development in Hawaii are cultural and environmental opposition. Listing a variety of obstacles to establishing a wind farm ranging from cultural conflicts with sovereignty groups and OHA to legislative hurdles, Mr. Mason again emphasized the need for a joint venture with all the team players.

"We have the land for wind development but we have a battle in front of all of us. If we don't have team players, we don't have anything," he said.

The biggest player in the joint venture is the utility that buys the power and can readily provide purchase power agreements, according to Mr. Young.

In addition, he added that credibility is needed to show that the source is competitive and viable in the market. And finally, visual impact is a major issue as well.

"Let's be honest with each other," he said in closing, "a site location is only a dream until you figure out how you are going to reconcile it with all the parties concerned."

Questions and Answers

Question:

Is there data available on wind resources at site locations across the islands on short times, e.g. minute to minute.

Answer:

Karen Conover – R. Lynette & Associates

Because the winds in Hawaii are trade winds, sites have similar patterns across the islands. Ms. Conover added that data on shorter time scales is available should the interested party request copies.

Question:

What is the range in which wind correlates to load requirements in Hawaii?

Answer:

Karen Conover –R. Lynette & Associates

The wind is pretty consistent throughout the day except in the afternoon when it peaks.

Warren Bollmeier –PICHTR:

There is a significant problem, particularly on the Big Island, of excess loads at night from wind. There is a problem in that regard with hydro too, Mr. Bollmeier said, adding that the issue would be discussed in a subsequent session of the workshop.

Question:

What is the best way to engage the cultural interests in a wind project?

Answer:

Mason Young – State of Hawaii Department of Land and Natural Resources:

Involvement is key, according to Mr. Young. Go out to the affected community and neighborhood boards and sell your project. If you don't sell it, you don't get anywhere, he said. Be up front. Show how it benefits the community, and more importantly, work at a *win win* approach to show how the community will benefit. If they feel they are a part of the project and they are going to get something from it, you will have a much better chance of succeeding.

Dick Cameron –Alexander & Baldwin, HC&S

In echoing the thoughts of Mason Young, Mr. Cameron urged developers as they go out to market their project, to keep in mind that, in Hawaii, profit motivation does not sell a project.

This is a very difficult perspective to assume as suppliers and investors, according to Mr. Cameron. It becomes necessary to have tenacity as we look forward to projects that have as much community impact that wind farm projects will have on our very, very small island state.

Question:

Which is easier to site, a coal plant or a wind farm and why?

Answer:

Dick Cameron –Alexander & Baldwin, HC&S

Coal is easier to site because coal plants are:

- small, thus no visual impact,
- predictable as far as emissions are concerned,
- furnish power when you need it on a continuous basis, and
- coal is a known commodity.

When asked which would generate more public support, a coal plant or a wind farm, Mr. Cameron stated that there are coal plants on Maui but there are no wind farms.

Monty Richards – Kahua Ranch

"From my perspective," Mr. Richards said, "We could site a wind farm on my ranch easier than we could site a coal plant and I think the public would buy it."

2.3 Panel 3: Utility Integration Issues

2.3.1 Panel Chair:

Charlie Smith – Electrotek Concepts, Inc., Arlington, Virginia

Presentation charts follow

Utility Integration Issues

Hawaii Windpower Workshop
March 21-22, 1994
Honolulu, Hawaii

Prepared by:

J. Charles Smith

Electrotek Concepts, Inc.
2111 Wilson Boulevard, Suite 323
Arlington, VA 22201

Major Topics to be Addressed

- Shortcomings of Conventional Technology Experienced in Hawaii
- Recent EPRI/HELCO Study on Small System Performance
- Recommendations for the Future

Shortcomings of Conventional Technology Experienced in Hawaii

- Those related to DC Machines with Inverters
  - Poor power factor caused voltage problems
  - Inverters injected large harmonic currents

- Those related to Induction Machines
  - Poor power factor caused voltage problems
  - Wind gusts produce power fluctuations

- Problems were Magnified in Hawaii due to a Weak, Isolated System with Poor Frequency Regulation
  - Voltage regulation problem at Kamaoa
  - Capacitor failures at Kamaoa
  - Harmonic problem at Kealia Substation
  - Frequency regulation problem at Hill 6

the whole Tehachapi area at the same time.

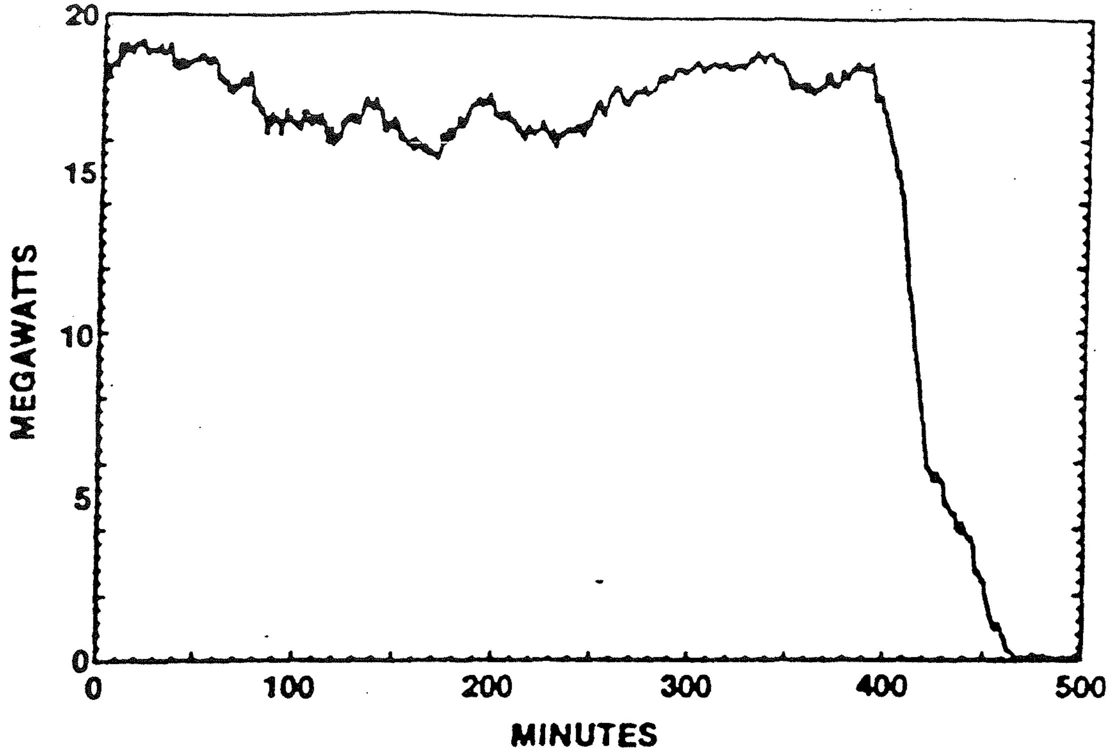


FIGURE 1
LONG PERIOD FLUCTUATIONS

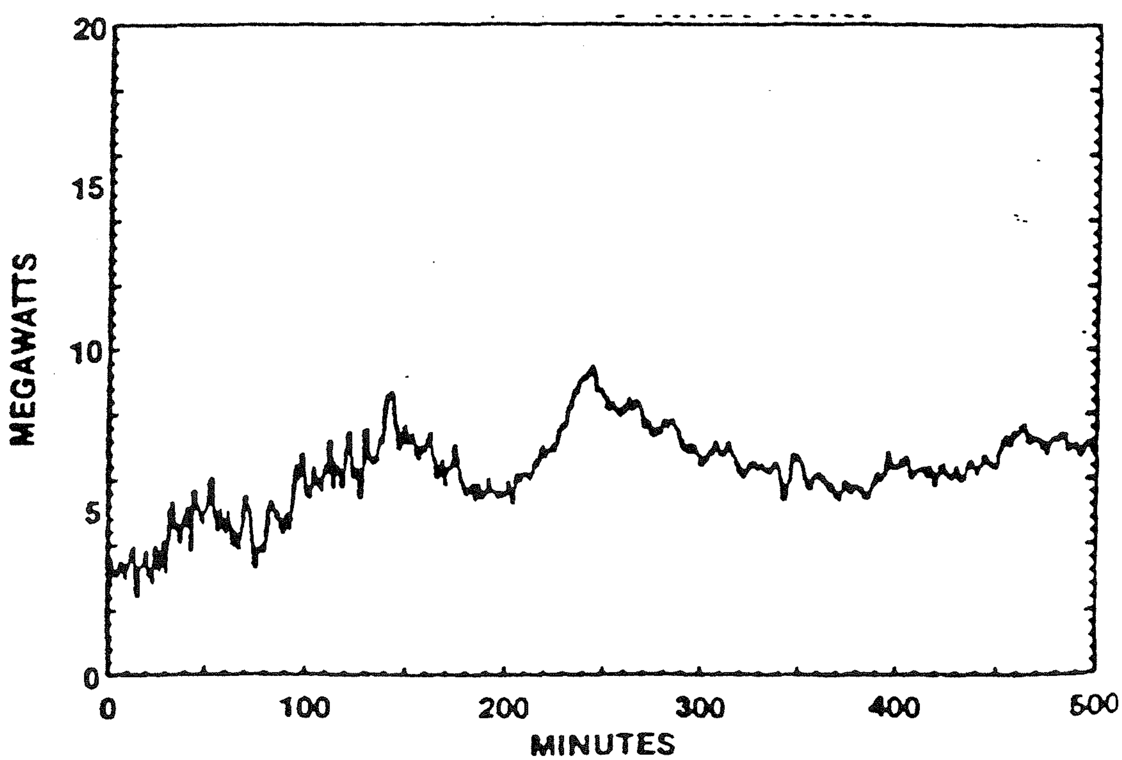


FIGURE 2
SHORT PERIOD FLUCTUATIONS

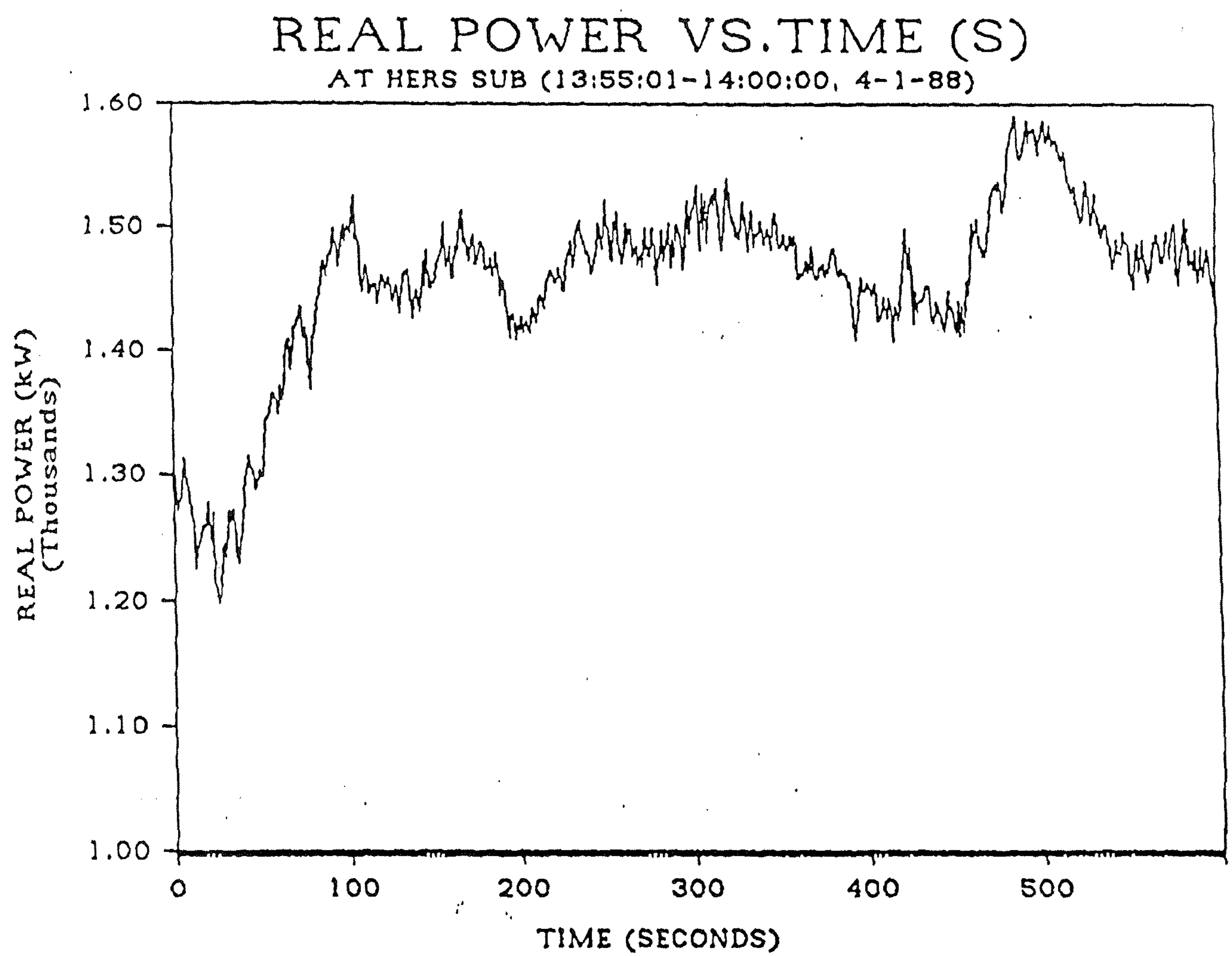


FIGURE 2

Close-up of Real Powers in Second-to-Second Time Frame

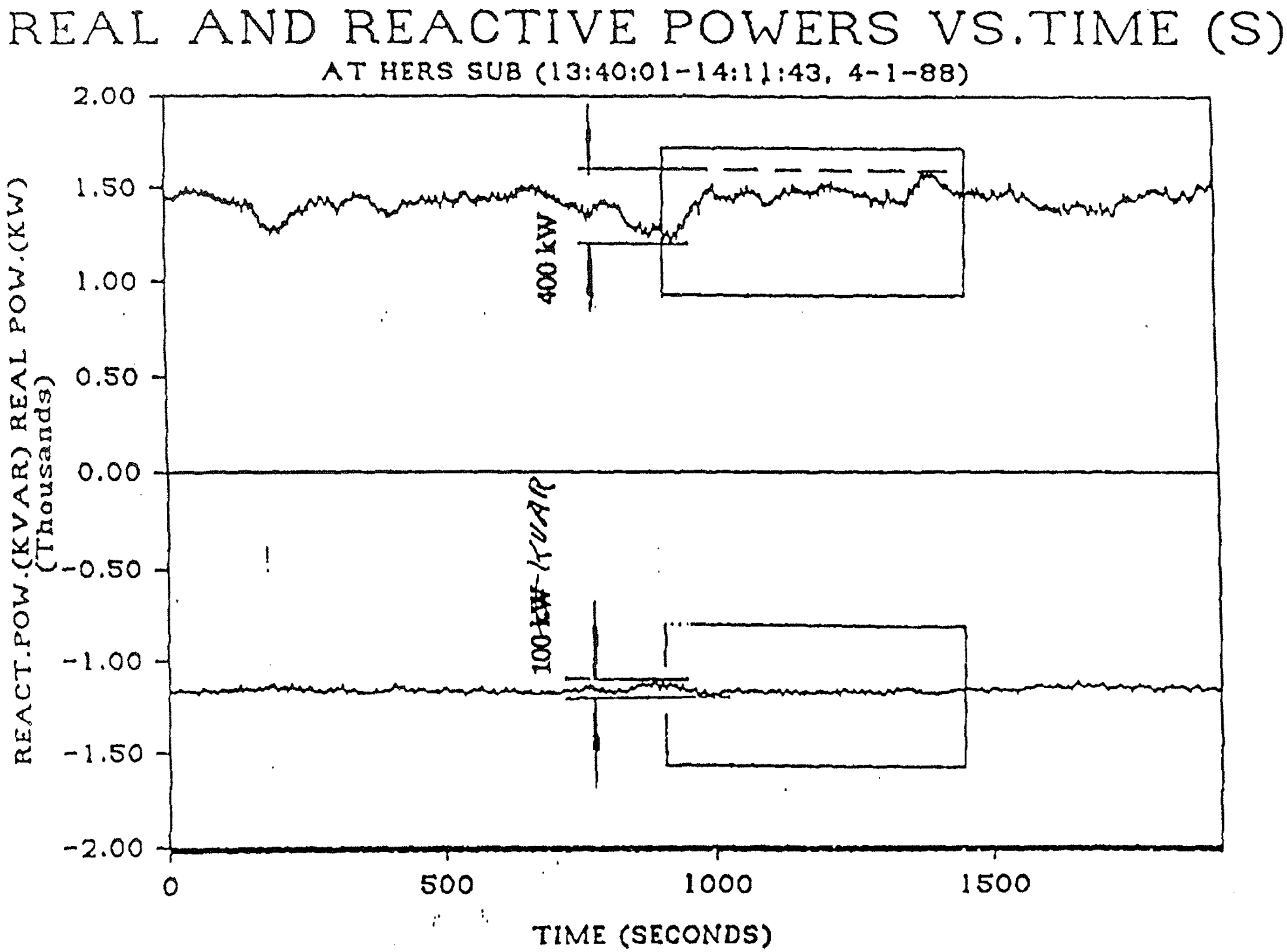
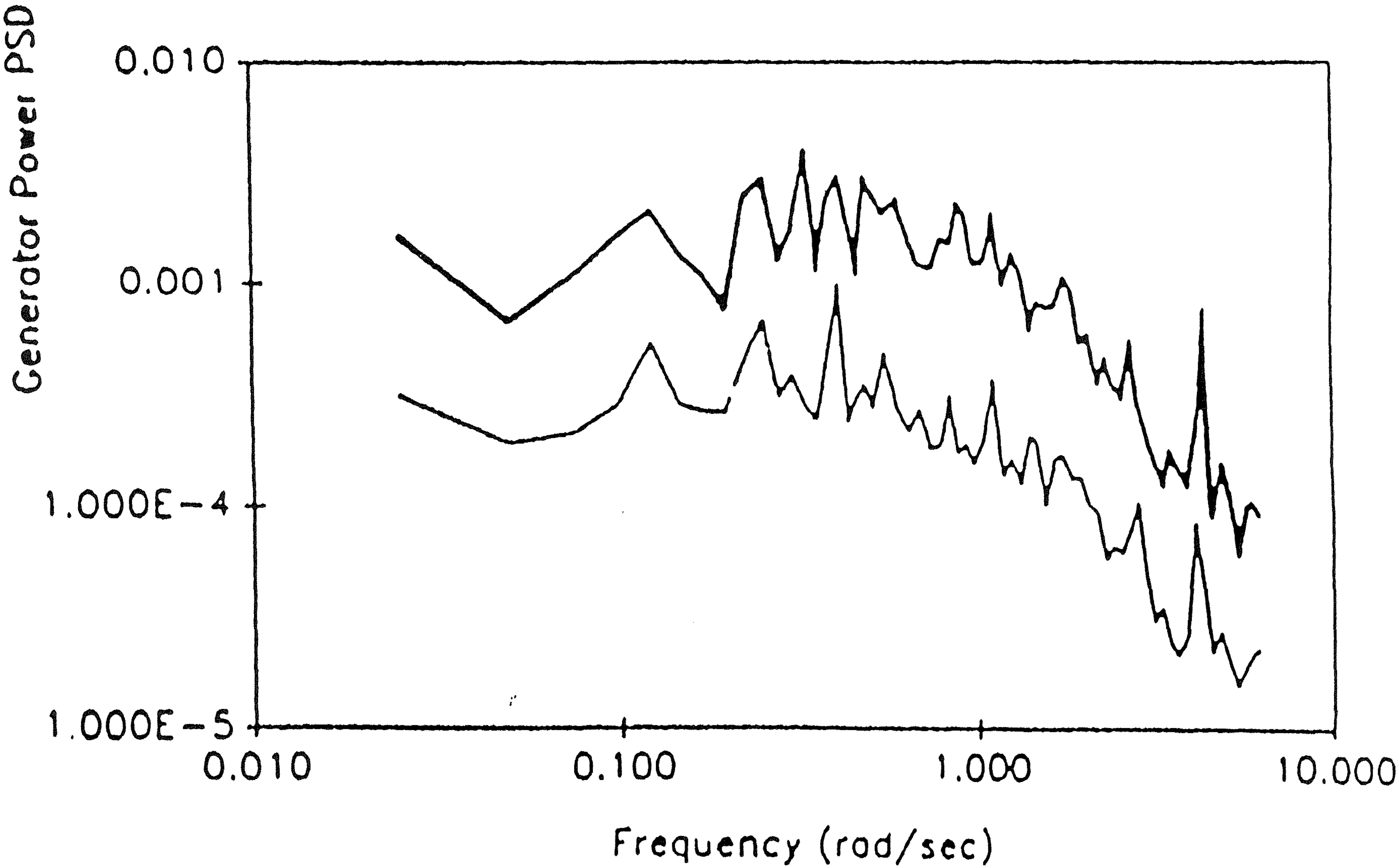


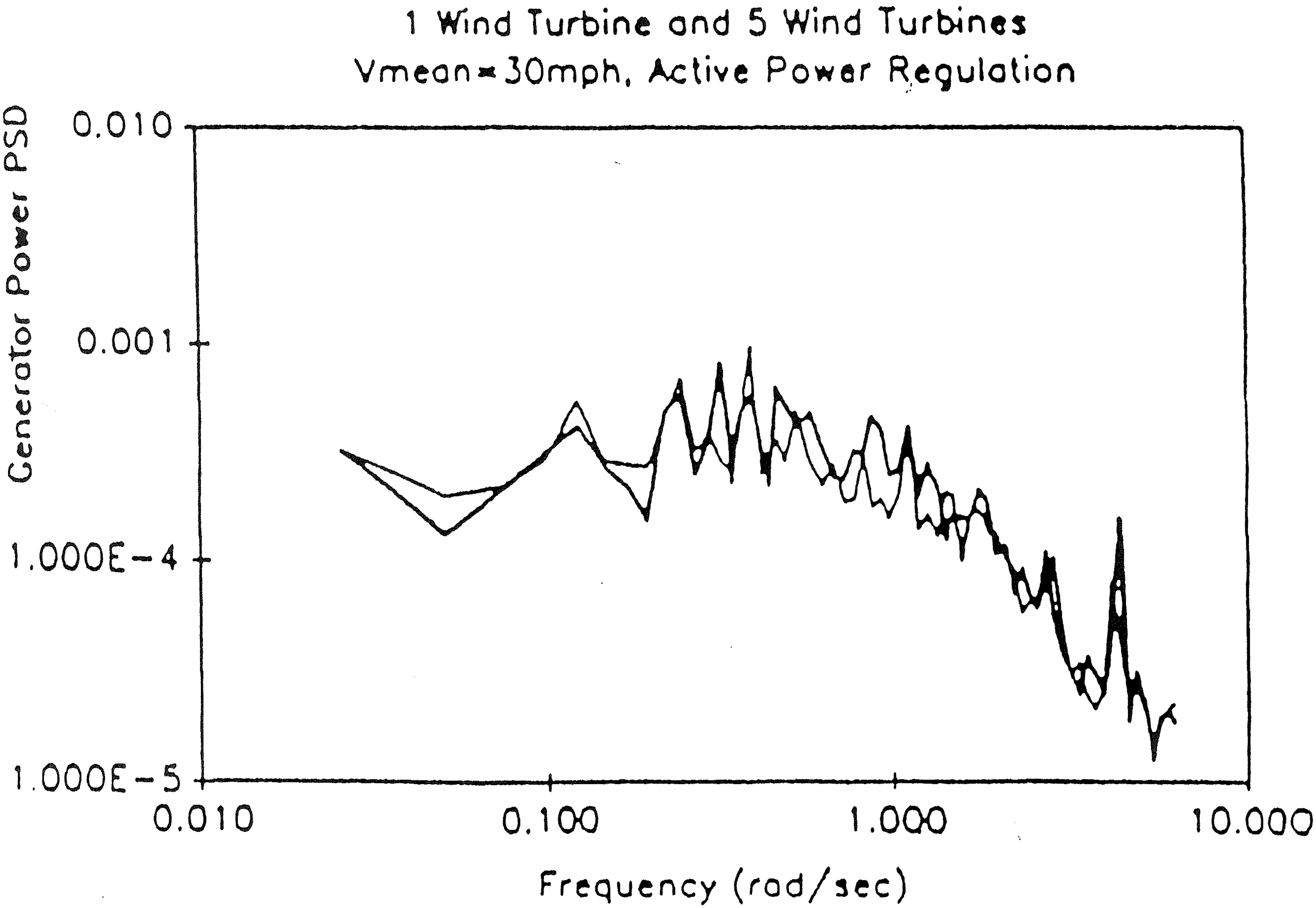
FIGURE 3

Real and Reactive Powers in Secodd-to-Second Time Frame

Normalized Spectra for One Wind Turbine and Five Wind Turbines

Vmean=30mph, Active Power Regulation





1 Wind Turbine and 5 Wind Turbines
Vmean=30mph, Active Power Regulation
Generator Power PSD
0.010
0.001
1.000E-4
1.000E-5
0.010
0.100
1.000
10.000
Frequency (rad/sec)

Hawaii Small System Performance Study

- Study Sponsored by EPRI and HELCO
- Scenario Analysis Approach
- Six Scenarios Identified (1991-1994)
- Study Initiated by PTI Assuming Conventional Wind Turbine Technology
- Study Completed by Electrotek Including Advanced Wind Turbines
- Data for HELCO System Provided by HECO an HELCO
- PTI PSS/E Programs Used for Analysis

Current Situation

- The existing HELCO System Presents a Significant Operating Challenge:
  - Operates isolated
  - Operates without spinning reserve
  - Operates with inadequate regulating capacity
  - Operates with primitive control system
  - Operates with severe transmission constraints
  - Operates with large distance between load and generation

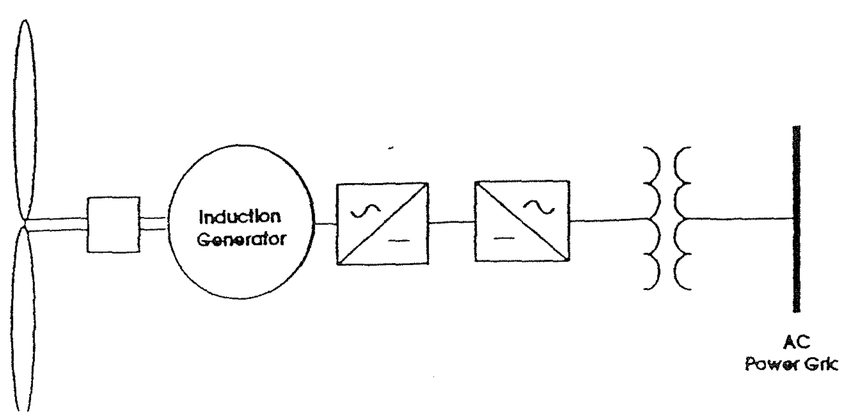
- The Existing HELCO System Experiences Significant Problems:
  - System frequency is difficult to control
  - System voltage is difficult to regulate
  - System reserve margins are low
  - Power outages are a problem
  - Load shedding is increasingly used
  - Rotating blackouts are occasionally necessary

- Conventional Wind Turbines Only Aggravate the Situation

Advanced Wind Turbine Characteristics

- Power Electronic Interface
  - IGBT Power Semiconductors
    - ◊ Increasing capability
    - ◊ Decreasing cost
    - ◊ Can upgrade to MCT
  - High Quality, Low Distortion, Output Waveform
    - ◊ Meets IEEE 519
    - ◊ Requires minimal filtering
  - Provides continuously variable reactive power

- Fast Control Response
  - Constant Output During Gusts
  - Spinning Reserve
  - Participate in System Frequency Control



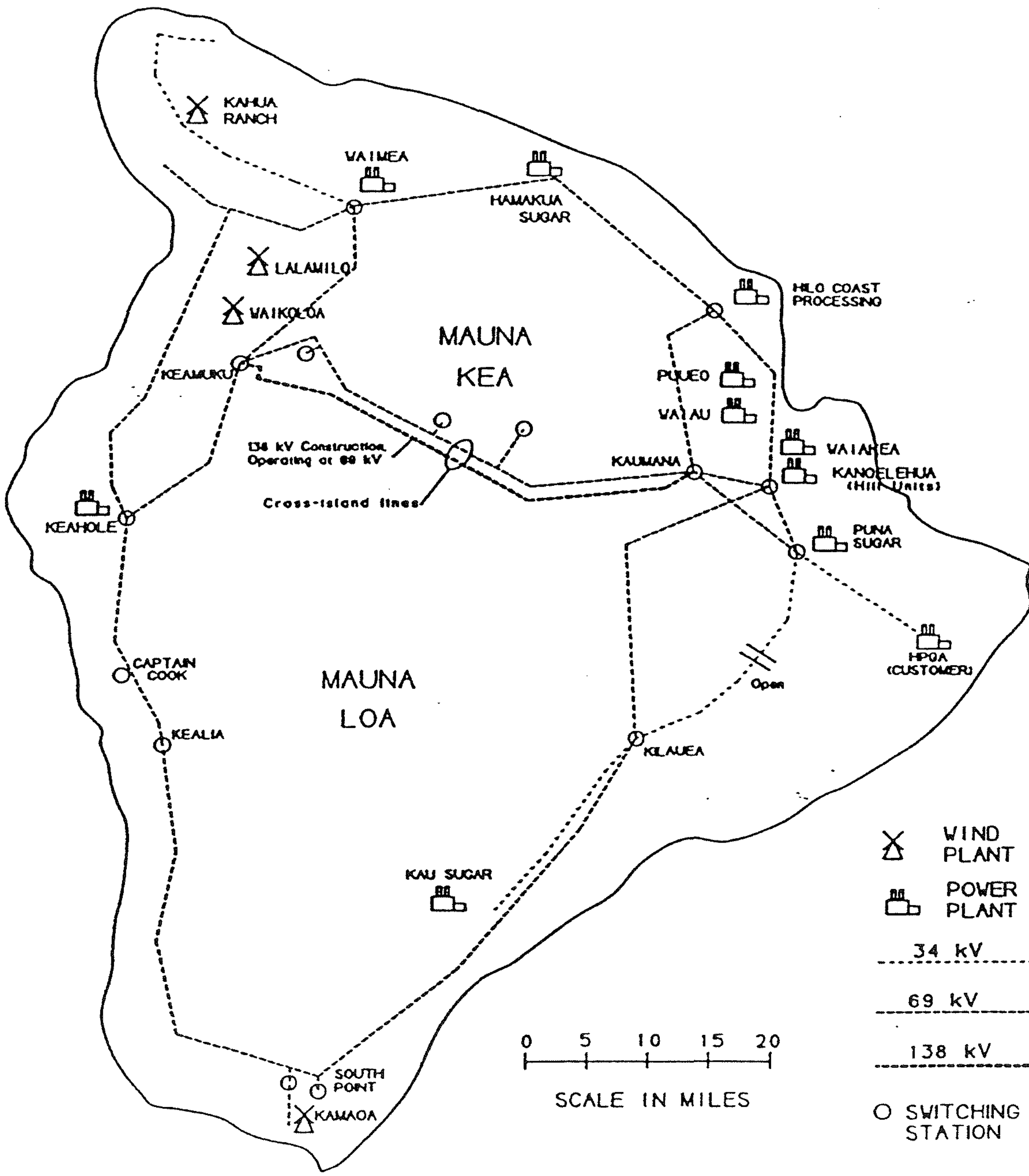


Figure 2-1
HELCO Power System

Power System Scenarios

- A: 1991 Maximum Load, 12.5 MW Conventional Wind Turbines
- B: 1991 Minimum Load, 12.5 MW Conventional Wind Turbines
- C: 1991 Maximum Load, No Wind
- D: 1991 Minimum Load, No Wind
- E: 1994 Maximum Load, 12.5 MW Conventional Wind Turbines,
  21 MW Advanced Wind Turbines
- F: 1994 Minimum Load, 0 Conventional Wind Turbines,
  21 MW Advanced Wind Turbines

Table 2-1: Description of Scenarios: Wind Power Plant Output and HELCO Dispatch
SCENARIOS

	A	B	C	D	E	F
Power System Load, MW	Peak	Minimum	Peak	Minimum	Peak	Minimum
On-Line Units	135	60.0	135.0	60.0	170.5	77.5
Existing WTs, MW	12.5	12.5	0.0	0.0	12.5	0.0
New WTs at Kamaoa, MW					10.0	10.0
New WTs at Waikoloa, MW					11.0	11.0
Hill 6, MW	19.7	11.8	19.4	19.4	20.0	12.0
Hill 5, MW	14.2	14.2	14.2	14.2	14.2	19.5
Shipman, MW	16.4	0.0	16.4	0.0	15.0	0.0
Puna, MW	11.6	0.0	11.6	0.0	13.2	0.0
Combustion Turbine CT2, MW	16.0	0.0	16.0	0.0	13.0	0.0
Combustion Turbine, CT3, MW					19.0	0.0
Geothermal, MW					25.0	25.0
Diesels, MW	15.0	0.0	27.0	0.0	9.0	0.0
Cogenerators, Hydros, MW	33.3	28.7	33.4	35.6	8.6	0.0
TOTAL	138.7	67.2	138.0	69.2	170.5	77.5

Study Objectives

- Examine Impact of Windplants on HELCO System

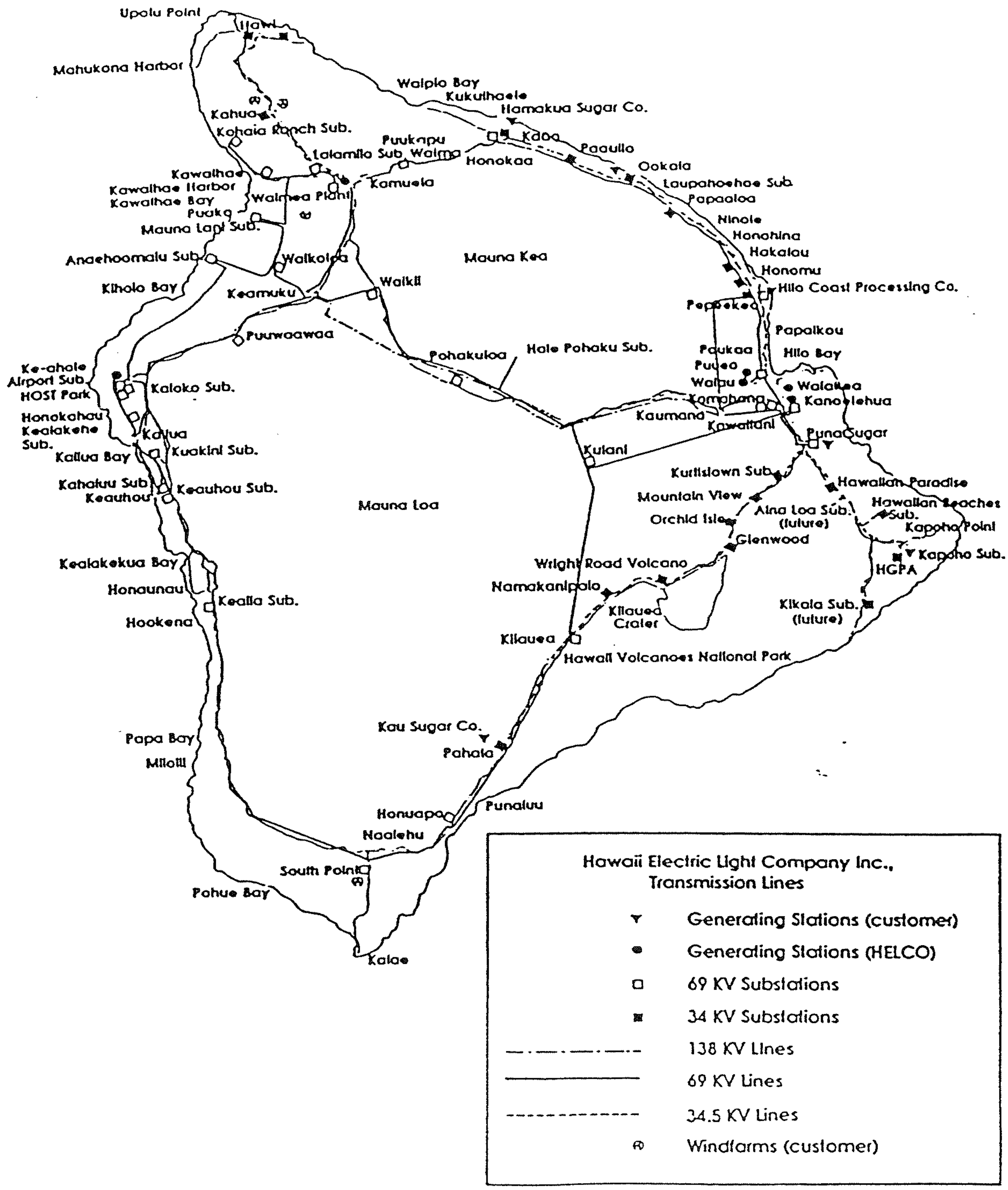
- Examine Alternatives for Controlling Voltage and Frequency Excursions

- Conduct Parametric Investigation to Understand Differences and Probe Limits

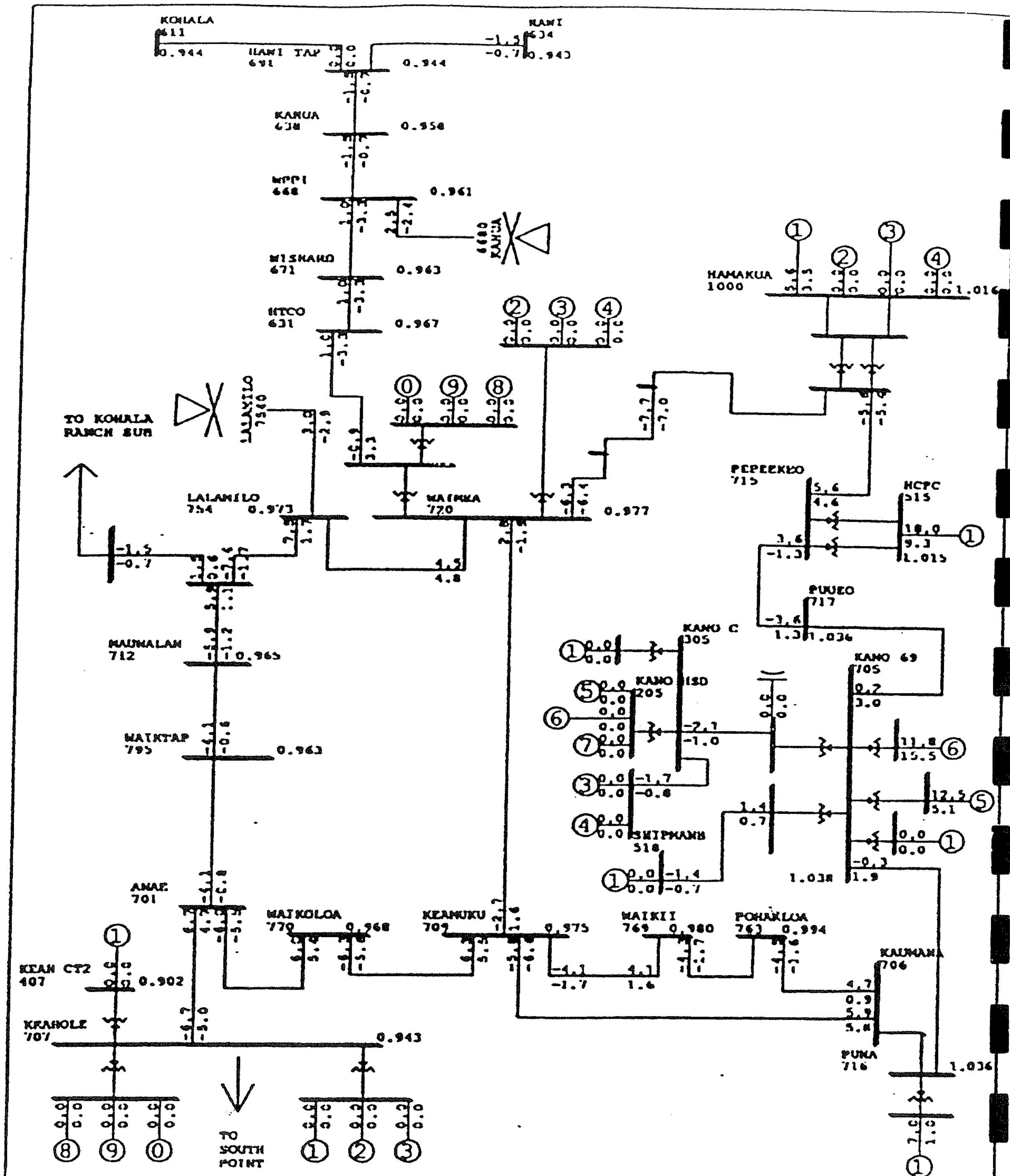
- Include Option of Wind Turbine with Advanced Power Electronic Interface

Reactive Power Considerations

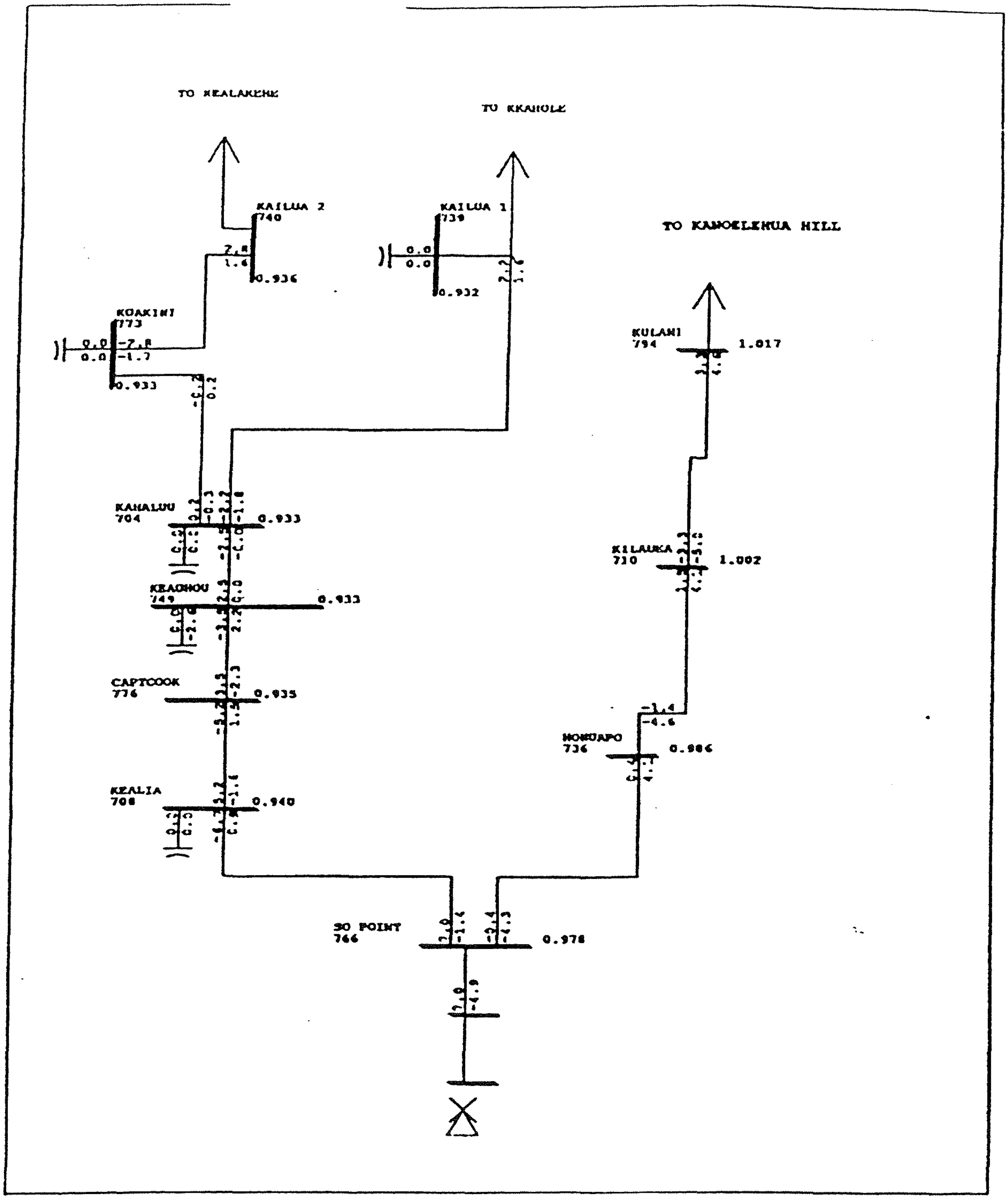
- 1991 System Conditions
  - Assume conventional windplant P.F. is .85
  - Only problem occurs at minimum load with maximum windplant output
  - Significant reactive flow in cross-island tie
  - 10 MVAr capacitor bank required at Captain Cook substation to maintain voltage



HELCO Transmission Line for the Island of Hawaii



Scenario B: Minimum Load with Wind Power Plants at Maximum Power Output



Scenario B: Minimum Load with Wind Power Plants at Maximum Power Output

Reactive Power Considerations

- 1994 System Conditions
  - Compare 21 MW of conventional wind turbines with 21 MW of advanced wind turbines
  - Conventional WTs require 7.5 MVAr more than the base case to meet voltage constraints
  - Advanced WTs require 7.5 MVAr less than the base case to meet voltage constraints
  - Local VAr source reduces system losses
  - 10 MVAr of reactive compensation requirement for convention WTs
- The Bottom Line
  - 25% reduction in system reactive compensation provided by advanced wind turbines

Table 3-1: Scenario E - Power Flow Cases

	Total Generation Output, MW	Capacitors added, MVAr	Output Keahole Combustion Turbine (CT2) MVAr	Total MVAr	System Losses (I^2X) MVAr	Cross-island Line out, System Losses MVAr
Base Case	181.7	46.1	3.5	49.6	35.9	43.0
21 MW -Induction Generator WTs	178.6	49.8	7.3	57.1	30.3	33.8
21 MW -Advanced Wind Turbine	178.3	37.4	4.7	42.1	28.7	32.0

All cases are for a peak load of 170.5 MW, corrected voltages in the transmission system are the same.

Power System Frequency Regulation

- Present Operating Strategy
  - Hill 6 regulates frequency
  - Other units operate with fixed set points with manual controls
  - System operates with no spinning reserve
  - System operates without Automatic Generation Control (AGC) system
  - Hill 6 has limited regulating range due to low fuel pressure trip

Other Operating Strategies

- DEFENSIVE DISPATCH STRATEGY
  - Position Hill 6 to Anticipate Load Changes
    - ◊ Hill 6 low when wind is high
    - ◊ Hill 6 high when wind is low
- MODIFY HILL 6 CONTROL STRATEGY
  - Remove Isochronus Control Below 18 MW Load and Share the Regulating Duty with Other Units
- AGC STRATEGY
  - Put All Units with Governors on AGC

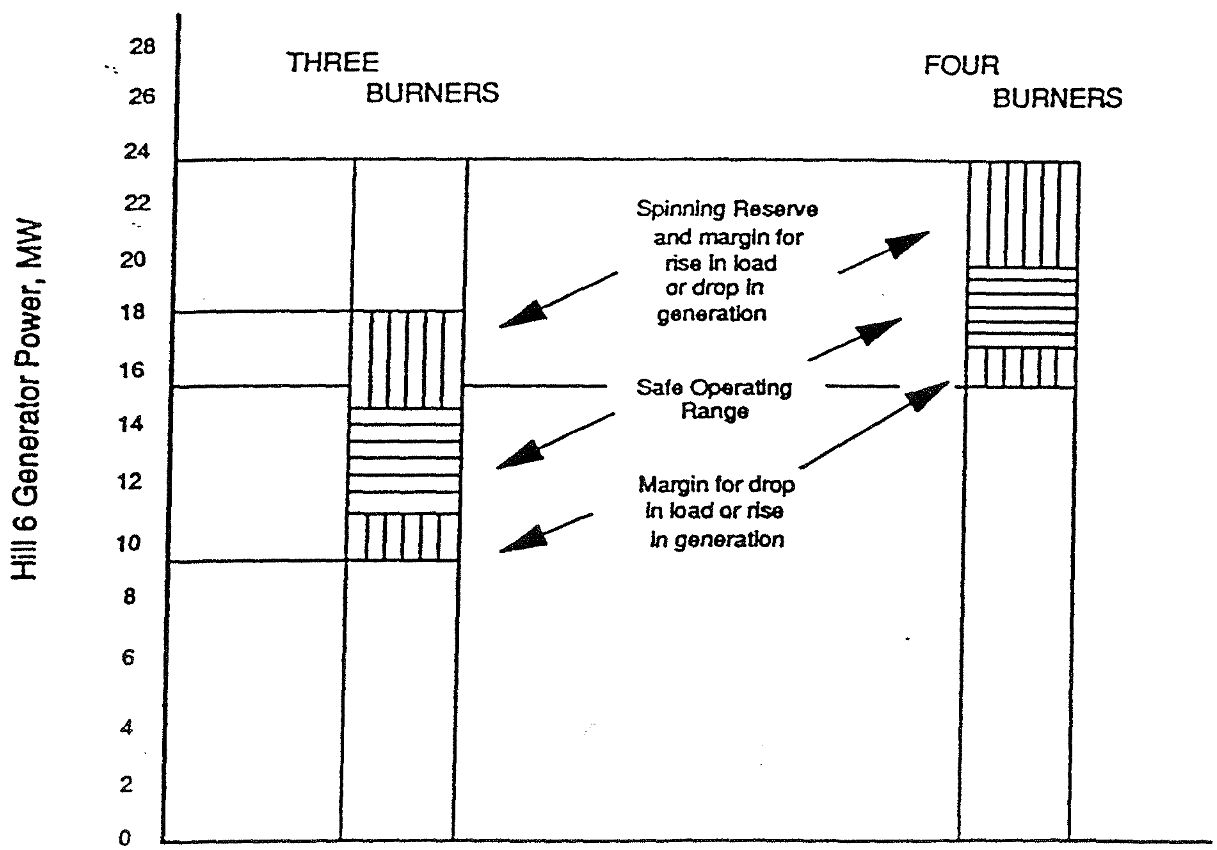
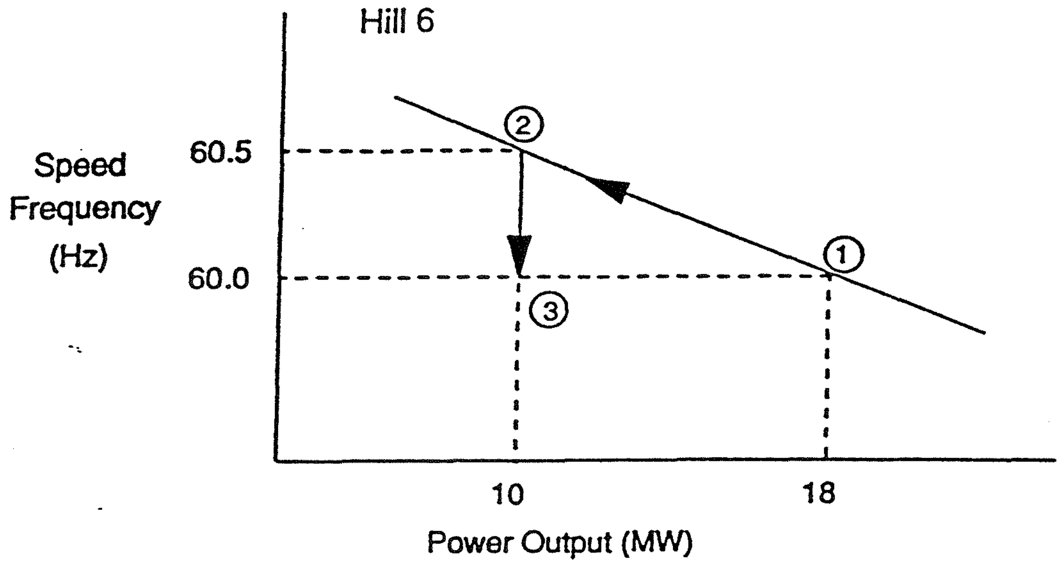
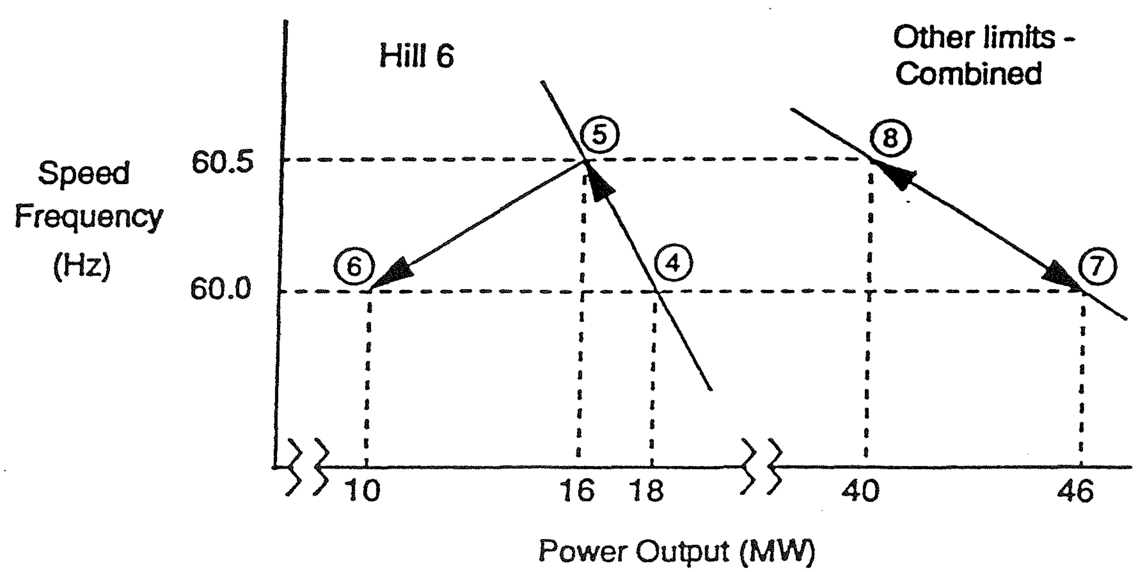


Figure 4-1
Operating Limits For Hill 6
for Three and Four Burners Operating



(a) Isolated Unit on a Single Load



(b) Load Sharing

Figure 4-2 Speed Droop Characteristic

Simulation Conditions Examined

- Peak Load
  - Loss of Generation
    - ◊ Hill 6
    - ◊ Kamaoa
    - ◊ Geothermal
  - Wind Gust
    - ◊ 10 MW increase over 1 minute
    - ◊ 10 MW decrease over 1 minute
  - Sinusoidal Variations of Wind
    - ◊ Low *f* variations (5 min) up to 15 MW
    - ◊ High *f* variations (30 sec) up to 5 MW
- Minimum Load
  - Same as above

Table 4-2: Scenario E - Peak Load Case

On-line Units	Scheduled MW	Maximum Power Output MW	Spinning Reserve MW
Existing Wind Power Plants	12.5	12.5	0.0
New Kamaoa WTs	10.0	10.0	0.0
New Waikoloa WTs	11.0	11.0	0.0
Hill 6	20.0	24.0	4.0
Geothermal	25.0	25.0	0.0
Combustion turbine 3, CT3	19	23.6	4.6
Keahole; CT2	13.0	16.0	3.0
Diesels	9.0	9.0	0.0
Other Units[1]	51.0	63.4	12.4
TOTALS	170.5	194.5	24.0

1 Other units include Puna, Shipman, HCPC, Hamakua, Hill 5 and the hydro units.

Table 4-4: Scenario F - Minimum Load Case

On-Line Units	Scheduled MW	Maximum Power Output MW	Spinning Reserve MW
New Kamaoa WTs	10.0	10.0	0.0
New Waikoloa WTs	11.0	11.0	0.0
Hill 6	12.0	14.0	2.0
Hill 5[1]	19.5	33.7	14.2
Geothermal	25.0	25.0	0
TOTALS	77.5	93.7	16.2

1 Hill 5 is a combination of Hill 5, HCPC, and Hamakua.

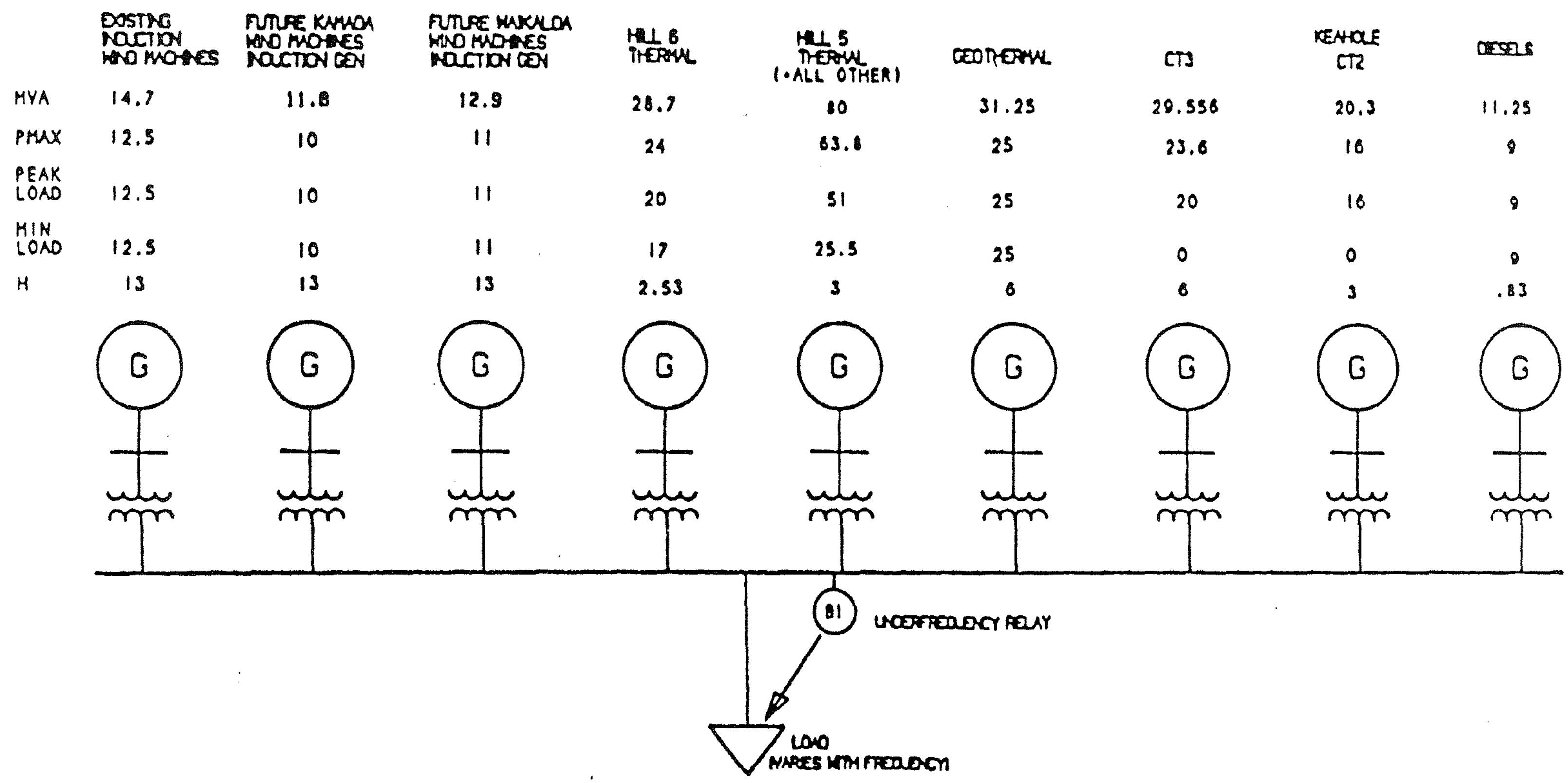


Figure C-1 Ten Bus Simulation Model
(see attached generator and governor parameters)

Major Observations

- Loss of Generation
  - Sufficient spinning reserve is available during peak load periods to cover the loss of the largest unit.
  - Wind turbines help arrest frequency decline.
  - Insufficient spinning reserve during minimum load conditions results in frequency decline >.7Hz and load shedding during the loss of the largest unit.
  - This is the limiting case and wind turbines are not a factor.
  - An alternative operating strategy with advanced wind turbines could help the situation, i.e. provide spinning reserve.

Major Observations

- Ramping and Sinusoidal Variations of Wind Generation
  - Decrease of 10 MW in 1 minute is not a problem in either the maximum or minimum load case, given the spinning reserve.
  - Increase of 10 MW in 1 minute creates problems with low load on Hill 6.
    - ◊ Present and defensive dispatch strategies cannot prevent Hill 6 trip during peak load or minimum load conditions.
    - ◊ Speed-droop control and AGC eliminate problems for maximum load condition, but cannot prevent Hill 6 tripping during minimum load conditions
    - ◊ Advanced wind turbines solve the problem by limiting turbine output during increasing wind conditions.

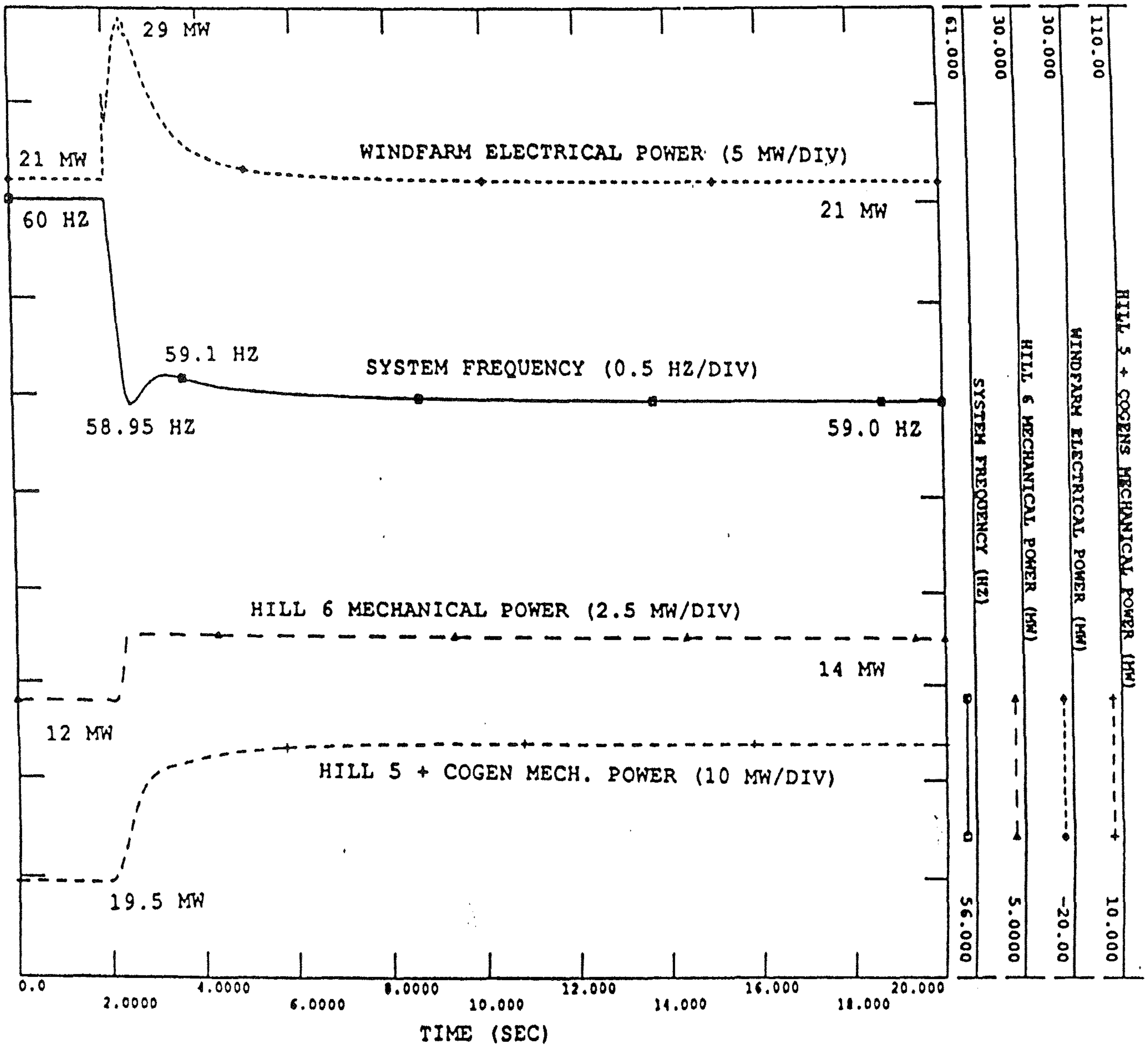
Table 4-5: Summary of Simulation Results with Conventional Wind Turbine Technology

Frequency Regulation	System Load	Loss of Generation	Ramp Up WTs 10 MW, 1 min.	Ramp Down WTs 10 MW, 1 min	Sinusoidal WT Output Variations
Present Dispatch Method	Peak Load	Frequency excursion	Hill 6 tripped+	Hill 6 to maximum output	Hill 6 tripped+
	Minimum Load	Frequency excursion, Load shedding	Hill 6 tripped+	Hill 6 to maximum output	Hill 6 tripped*+
Defensive Dispatch Method	Peak Load	Same as Present Dispatch Method*	Hill 6 tripped+	Hill 6 to maximum output	Hill 6 tripped*+
	Minimum Load	Same as Present Dispatch Method	Hill 6 tripped+	Hill 6 to maximum output*	Hill 6 tripped*+
Isochronous to Droop-Speed Control	Peak Load	Same as Present Dispatch Method* 1	Hill 6 backs down to minimum output	Hill 6 to maximum output*	Hill 6 backs down to minimum output
	Minimum Load	Same as Present Dispatch Method* 1	Hill 6 tripped+	Hill 6 to maximum output*	Hill 6 tripped*+
Automatic Generation Control	Peak Load	Same as Present Dispatch method* 1	Hill 6 backs down with other units*	Frequency excursion, restored to 60 Hz	Hill 6 backs down with other units*
	Minimum Load	Same as Present Dispatch Method* 1	Hill 6 tripped*+	Frequency excursion, restored to 60 Hz	Hill 6 tripped*+

1 These frequency regulation methods do not influence the amount of spinning reserve.

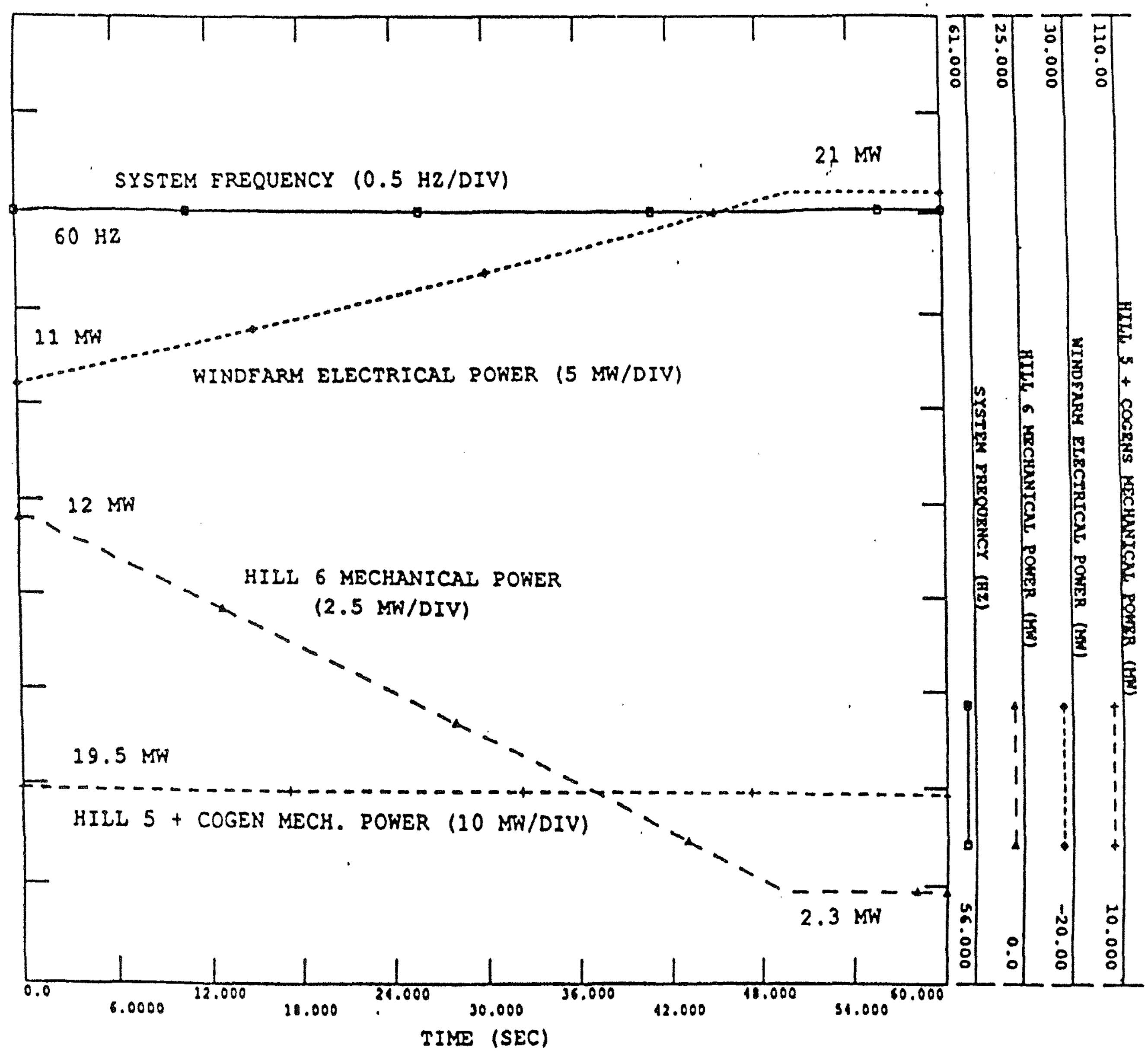
* Result was derived from other actual simulations

\+ Result can be avoided with advanced wind turbine technology

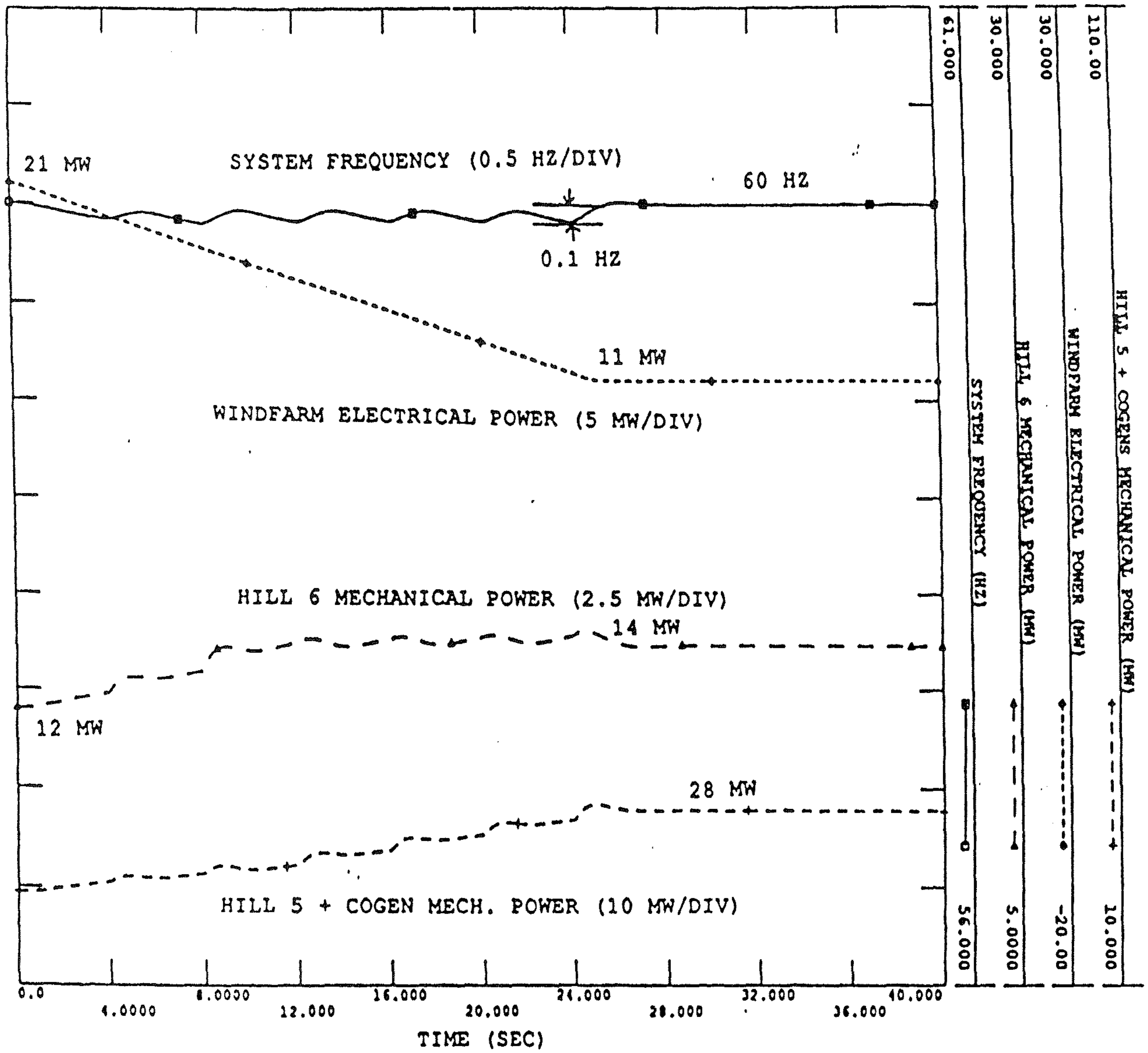


Case S14: Present Dispatch Method, Loss of Geothermal Plant

Scenario F: 1993-4, Minimum Load Condition



Scenario F: 1993-4, Minimum Load Condition
Case 16: Present Dispatch Method,
Wind Power Plants Ramp Up



Scenario F: 1993-4, Minimum Load Condition
Case S20: Automatic Generation Control,
Wind Power Plants Ramp Down

Final Conclusions

- From a system dynamics point of view, to a first approximation, the limiting factor for the size of the largest wind plant employing advanced wind turbine technology is the size of the largest conventional unit.

- Advanced wind turbines, either in isolation or as part of an AGC strategy with spinning reserve, offer the opportunity for increased amounts of wind generation and improved system operation.

Recommendations for the Future

- Adopt a spinning reserve policy
- Implement an AGC system
- Evaluate advanced wind turbines for any future installations
- Look at benefits of energy storage, with or without renewables
  - Batteries for short-term (1-3 hours) storage and system operating benefits
  - Pumped hydro for long-term (5-20 hours) storage and system reliability benefits
- Look at combined pumped hydro-water use project taking water from Hilo to Kona

Quit talking about wind penetration and start looking at power system planning, operating, and reliability issues.

2.3.2 Panel Members:

Hamish Wong–Hawaiian Electric Company (HECO)
Ed DeMeo–Electric Power Research Institute (EPRI)
Jonathan Lynch–Northern Power Systems (NPS)

Panel Responses

Ed DeMeo – Electric Power Research Institute (EPRI)

Mr. DeMeo took time to discuss the utility groups that have formed to support the realization of wind as a viable technology. Two of the principle organizations he discussed were the Utility Wind Interest Group and the Wind Users Support Group. An important role was played by members of the Hawaii utilities during the formative stages of these groups, Mr. DeMeo noted.

The Utility Wind Interest Group - formed in 1989, this group is comprised of 13 utility company members together with support from NREL, U.S. DOE and EPRI. The group functions by investigating current developments in the technology and communicating that understanding to the utility industry as well as other interested parties.

Wind Users Support Group - more recently formed, this group deals more with the *nitty-gritty* issues of how to integrate wind into the utility system. Currently, 25 utilities are active members and have formed a group of cost-shared projects each dealing with specific areas. Results from these projects are expected to offer insights into such issues as prediction capability, resource availability and other technical issues.

In addition, the group is supported by organizations from the wind community, such as R. Lynette & Associates, providing valuable input to utilities interested in getting started in developing wind and initiating the process properly.

An experience base the wind technology is developing within the utility sector, Mr. DeMeo said, and he encouraged the Hawaiian Islands to participate in these groups not only to gain knowledge from others but also to bring their own unique experiences to the group.

Hawaii has been a very good laboratory in areas such as the high penetration of wind and its impact on the utility system, he said.

In addition, these groups are currently experiencing a major expansion and, over time, will have an impact on the technology as it evolves, he said in closing.

[NOTE: Ed DeMeo's presentation charts follow this page.]

Utility Wind Interest Group (UWIG)

Formed by utilities mid 1989 with DOE and EPRI support

Current membership: 13 utilities

Mission: Expedite appropriate integration of wind power for utility applications

Strategy: Understand and communicate status and issues
- experience exchange
- wind industry interactions
- brochures and seminars

Six brochures published; several in process

EPRI Wind Users Support Group

- Formed by EPRI in 1993 with DOE/NREL cooperation
- Identify and address key integration issues
- Cost-shared projects
- In-depth experience exchange
- Initial membership: 22 utilities

Wind Users Support Group

<u>Initial Projects List</u>

1. Wind Energy for Utilities Primer
2. Wind Resource Planning Frameworks
3. Regional Reliability Council Accreditation
4. Short-term Hourly Energy Forecasts Methodologies
5. Interannual Variability Assessment Methodologies
6. Environmental Issues (Avian, Visual, Noise,etc.)
7. Electrical Interconnection Description

Hamish Wong – Hawaiian Electric Company (HECO)

February was a good for month for wind generation, according to Mr. Wong, with 6 -7 MW of wind power generated during peak hours at some wind sites and 2-3 MW generated during low times.

The intermittency of wind generation in Hawaii is such that you are faced with it from hour to hour. That kind of wide variation and the impact of how it appears on the customer's side remains to be seen, Mr. Wong said in referencing Charlie Smith's recommendation for utility system planning. This issue in Hawaii needs more careful study before we can conclude that the size of the wind farm should be limited to the size of the largest conventional unit available, he said.

With regards to evaluating 21 MW of advanced wind turbines mentioned in Mr. Smith's presentation, Mr. Wong stated that whether or not HECO can step up to the wind power capacity of 21 MW remains to be seen. Presently, HELCO uses turbines with 12 MW wind capacity for power generation on the Big Island and these turbines present system problems, he said acknowledging the fact that these units are conventional turbines.

As for installing an automatic generation control (AGC) system to help the system accept more power generation, Mr. Wong noted that HELCO is considering installing one on the Big Island in a couple of years.

In closing, Mr. Wong affirmed his belief in the an energy system as a promising concept for minimizing the impact of intermittent power variations on an operating system.

Jonathan Lynch – Northern Power Systems (NPS)

Speaking from the perspective of Northern Power Systems, a manufacturer of wind turbines and its parent company, New World Power, a developer of overall projects, Mr. Lynch said he viewed the work by EPRI and Electrotek to be extremely important and valuable in designing systems for wind power.

Whether or not it wanted to be, Hawaii is a pioneer in utility scale systems for wind turbines on soft grids, he said noting that his organization did not run into the same problems in developing systems at the same level on the mainland.

Presently Northern Power Systems and New World Power are bridging from isolated village systems of up to 50 -100 kW through small MW wind systems and up to fully integrated utility grid systems.

NPS is dealing with the same issues and the same analyses as EPRI and Electrotek in addition to the simulation programs going on now to work with these issues. Advanced wind turbines, separate from overall system analyses, offer frequency control and easily dispatchable power ratings with the ability to control the overall power level of the wind farm.

He added that Northern Power Systems is starting to add storage to its smaller systems (50 - 200 kW). For one to two hours of storage in a 50 to 100 kW size system, 100% wind penetration was obtained and frequency was held within ½ of a hertz with a fluctuating load level. When the economics and the technology improves, particularly as pump hydro storage becomes available, these full featured models may be available for larger systems.

In closing, he noted that the key lesson learned by the industry has been that wind turbines cannot be installed in isolation. The overall system must be considered. Molokai represents an interesting site because it is an island where a lot of ideas being perfected in other places can be applied. Due to its smaller scale size, solutions are easier.

Question:

Given that there are a number of modifications that could be made to improve the operation of the grid, which of these are benefits primarily for wind and which are beneficial for system operation?

Answer:

Charlie Smith –Electrotek Concepts

AGC system is the largest single item that would cause the improvement of the system's operation with or without wind.

Hamish Wong –Hawaiian Electric Co.

Solutions are primarily a function of the characteristic of the power source. There are various solutions to problems depending on the source of power and the solutions for one power source (i.e. photovoltaics) may not work for another (i.e. wind). Unfortunately, we are not at the point yet in Hawaii where we can modulize the system and handle each power source individually.

Charlie Smith – Electrotek

It is important to keep in mind that solutions to frequency control, spinning reserve and other problems cost money to implement and we are dealing with a situation where upgrading the system by implementing these solutions represents an investment that has to be measured against the rate impact to the power consumers. The ultimate question is, what is the rate impact pain level of the rate payers?

Question:

What about the addition of another 25 MW geothermal unit. What would the impact be on the spinning reserve with the loss of an additional 25 MW geothermal unit?

Answer:

Charlie Smith – Electrotek

If the units are independent and connected to different generators, step-up transformers and different buses, then the probability of any single event affecting both units is pretty small. If you can treat them as independent events, then the loss of the largest unit is still only 25 MW, or maybe only 12 MW, depending on how the existing system is connected, e.g. if both units are electrically and mechanically separate.

But if you look at the spinning reserve impact and you have a minimum load of 60 MW, you will have to pay a heavy penalty for that loss because of the need to keep enough units on-line operating at minimum load to be able to provide spinning reserve to cover the loss of the largest unit.

Question:

What would the impact have been if the power factor on conventional power systems started off at 95% versus 85% ? Is the 10 MW ramp rate criteria too severe?

Answer:

Charlie Smith – Electrotek

In response to the first question, the impact is that it just would not have required as much to keep the voltage within the bounds of capacitance. The range of voltage was 95% to 105% capacitance and we only added capacitors if the voltage range went out of the + or- 5% bounds. Instead of a situation where there is a 15 Mvar requirement being compared to the conventional turbines, you might have had a 7 Mvar requirement. Clearly, it would have reduced the Mvar requirement.

As to the severity in the assumption of the 10 MW ramp rate, the criteria is an extremely conservative design criteria, Mr. Smith said, based on wind data he has seen at other wind sites.

"By that I mean you don't normally expect 80% output changes over a one minute time span. The Tehachapi data is more typical but I don't have any similar wind data for Hawaii. I don't know what kind of variations you get or can expect here," he said emphasizing that it is a pretty stiff design criteria to meet.

Question:

What were the assumptions made about the 10 MW change from the wind turbines happening across the islands of Hawaii?

Answer:

Charlie Smith – Electrotek

It was just a MW change and no assumptions were made about what sites it was coming from. It was assumed that the advanced wind turbines were lumped together and it was assumed there was a 10 MW change from the wind turbines and we didn't look at any permanent spatial diversity. It was assumed that there was a 10 MW permanent change. However, if you experience the change simultaneously across the islands then you obviously lose that diversity factor and can no longer have a number of 10 MW wind plants. Instead, it starts to look like one 20 to 30 MW wind plant.

Question:

What criteria did you base your assumption on, that a wind farm should be limited by the size of the largest conventional unit on the island?

Answer:

Charlie Smith – Electrotek

The assumption was made using the normal standard planning criteria for power systems on the mainland. You should maintain sufficient spinning reserve and operating reserve to tolerate the loss of your largest unit on that system and maintain its operational integrity.

Hamish Wong – Hawaiian Electric Company

The situation in Hawaii is different, Mr. Wong said offering as a comparison, systems in Europe and on the west coast of the U.S. where 1000 MW is just a fraction of a percent of the available capacity. It may be an uncomfortable situation there but it is manageable.

However that situation is a little different in Hawaii where the existing amount of wind capacity is already 8% to 10% during peak load periods and is probably even higher than that during low load periods. Therefore, a loss of a large block of power in a short period of time would be very hard to handle from an operating perspective, he said.

Appendix E
Session 3

Presentation Charts, Panel Responses, and Questions and Answers

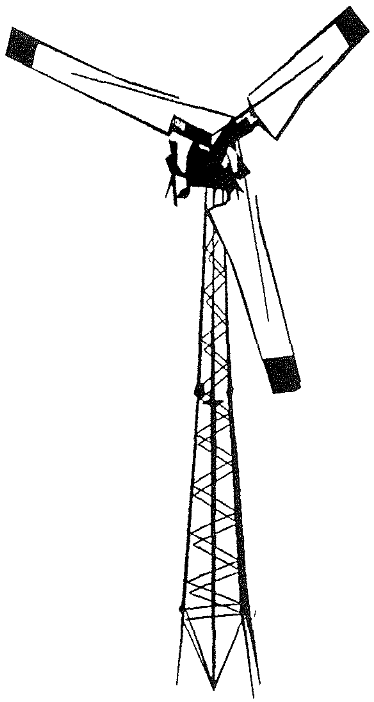
3.0 Project Development and Implementation Issues

3.1 Panel 4: Project Development

3.1.1 Panel Chair:

Jan Hamrin – Hansen, McQuat, Hamrin & Rohde, San Francisco, CA

Presentation charts follow



HAWAII WINDPOWER WORKSHOP

Planning & Implementation Issues

Honolulu, Hawaii

March 1994

Jan Hamrin

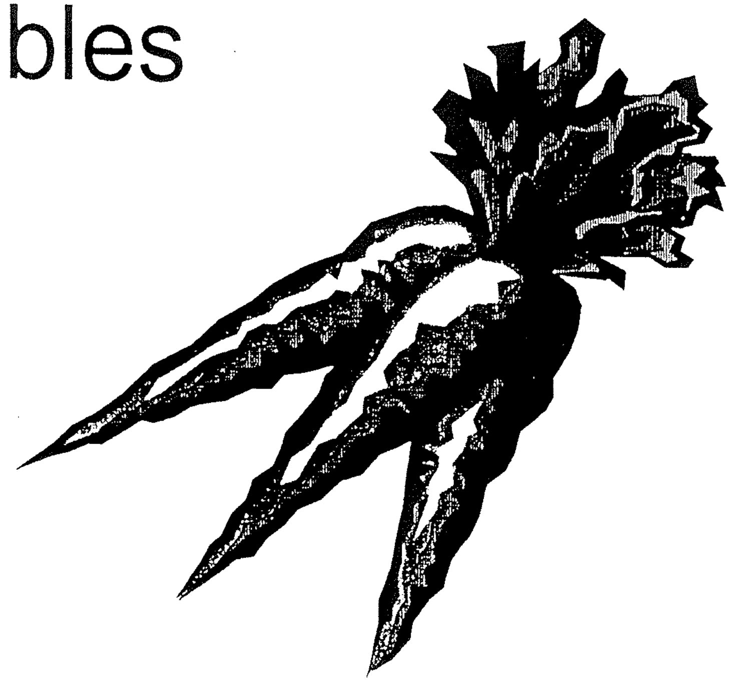
Hansen, McOuat, Hamrin & Rohde, Inc.

50 California, Suite 3005, San Francisco CA 94111 Phone 415/397-2210

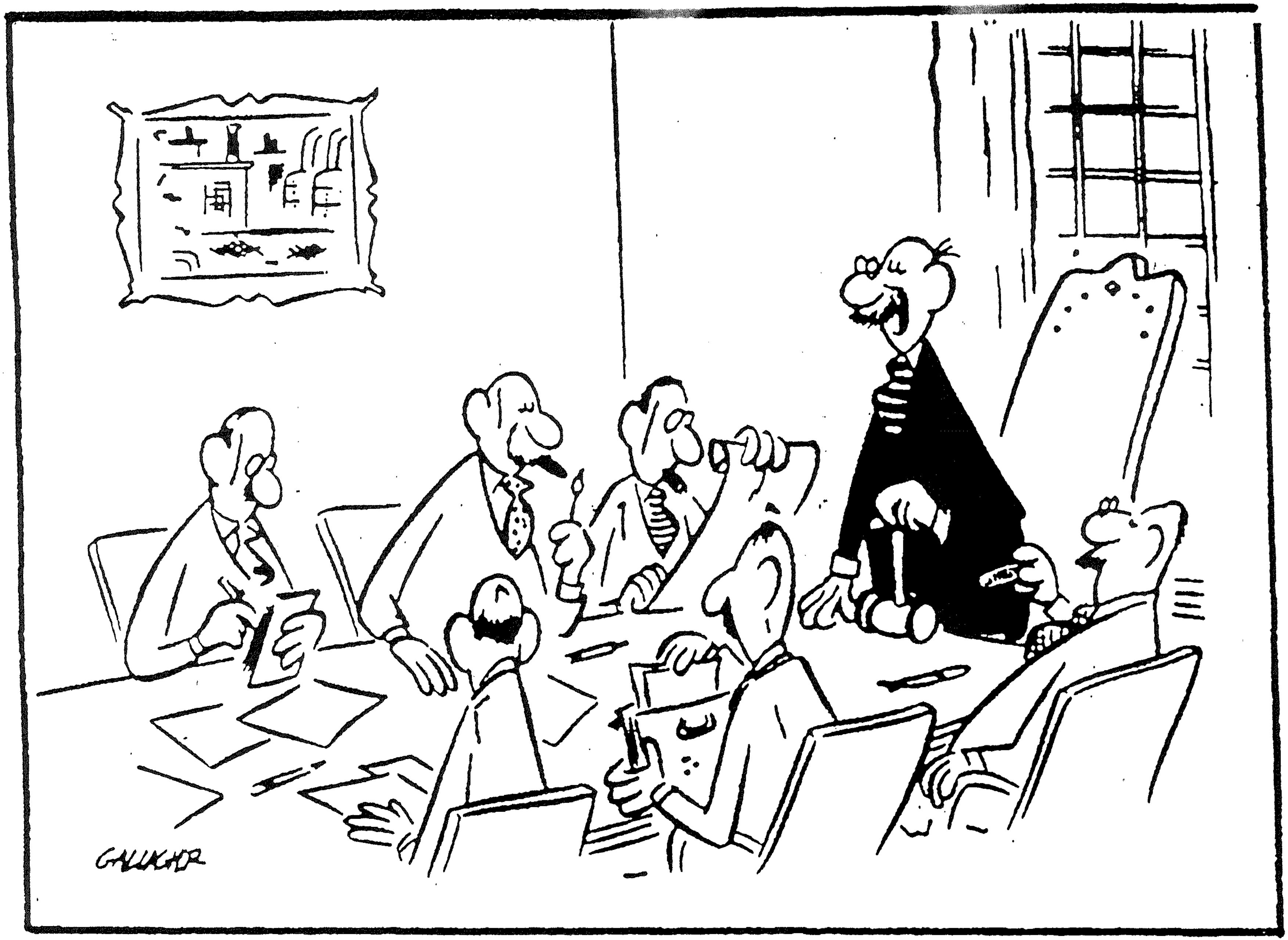
FAX 415/391-1329

Regulatory Treatment/ Utility Motivation

- Cost recovery issues
- Shareholder incentives
- Ownership structures
- Utility role in renewables



"Besides investing, merging, and expanding, does anyone know how we can make a few bucks?"



"Besides investing, merging, and expanding, does anyone know how we can make a few bucks?"

New Utility Paradigm

- Greater emphasis on the environment
- Greater concern over future risks:
  - Changing fuel costs
  - Changing environmental regulations
  - Changing utility structure
- More emphasis on what consumers want and need
- Greater use of market forces
- More emphasis on energy services

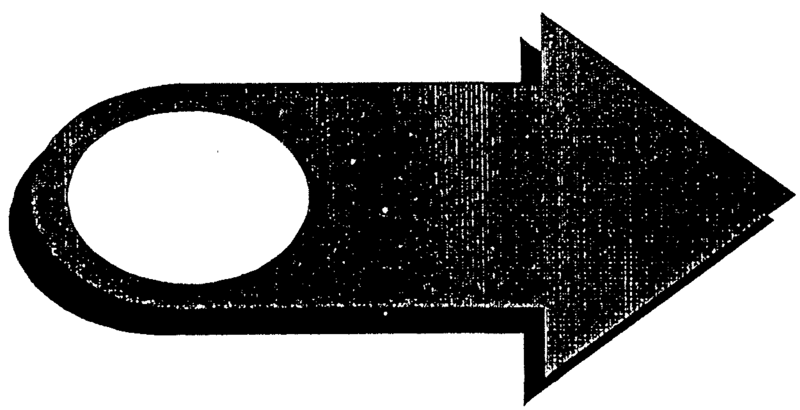
New Utility Paradigm

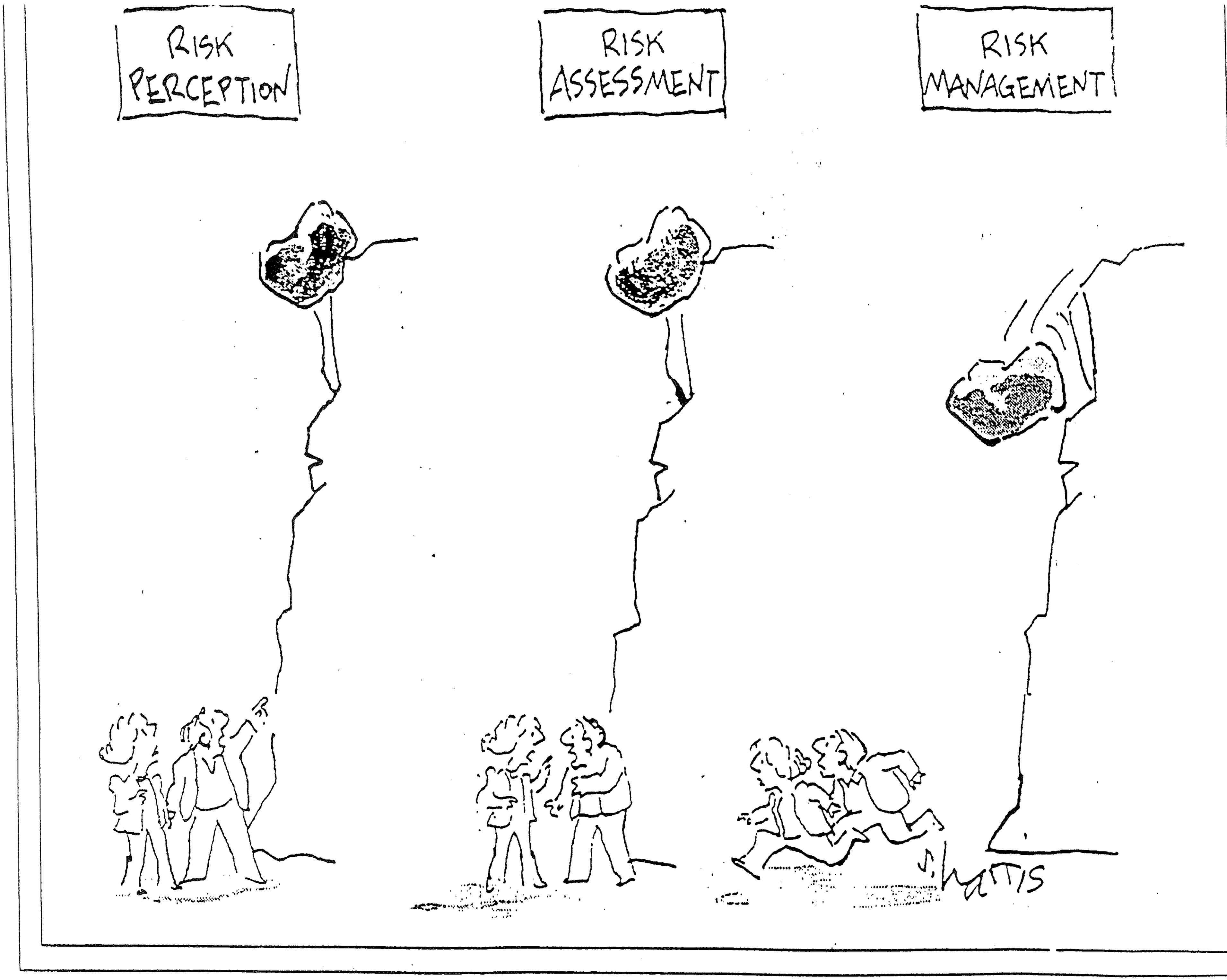
- GREATER FLEXIBILITY -
  CONTRACTING/INVESTMENTS

- HEDGING STRATEGIES -
  PORTFOLIOS

Acquisition Method

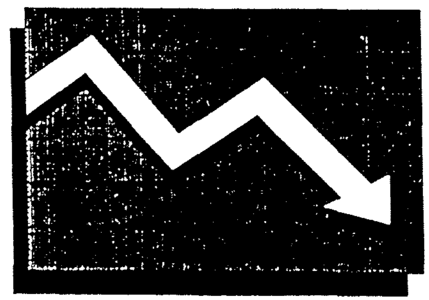
- Design to meet planning goals
- Start-up programs
- RD&D commercialization program
- Basic resource acquisition program

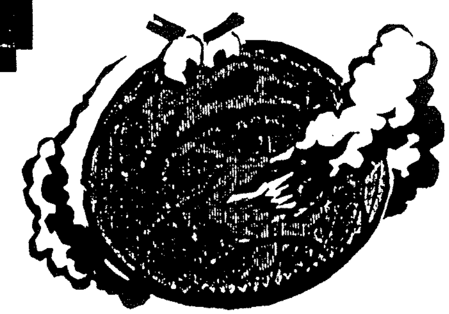


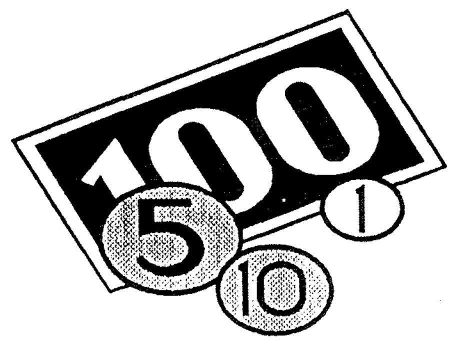

RISK PERCEPTION
RISK ASSESSMENT
RISK MANAGEMENT
J. WATIS

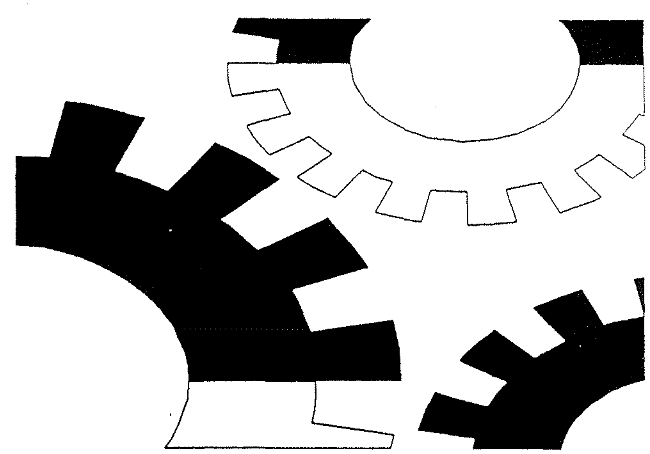
Allocation of Resource Acquisition Risks

- Forecasting
- Environmental
- Economic
- Technological









What are the advantages and disadvantages of different ownership arrangements?

ISSUES AFFECTED BY OWNERSHIP:

- ALLOCATION OF RISK
- UTILITY MOTIVATION TO ACQUIRE RRs
- RECOVERY OF COSTS BY UTILITY
- INTEGRATION OF FUTURE ROLE OF UTILITY
- ABUSE OF MONOPOLY POWER

Ownership Models

TRADITIONAL UTILITY OWNERSHIP

RISKS: Construction
Technology
Resource/Siting
O&M
Changed Envir. Regulation

Ratepayer

ADVANTAGES: Shareholder Benefits

DISADVANTAGES: Ratepayer/Shareholder
Financial Risk
Technology Risk
Cost-Plus Ratemaking

Ownership Models

NON-UTILITY OWNERSHIP

RISKS: Technology
Construction
Resource/Siting
O&M
Changed Envir. Regulation

Developer

ADVANTAGES: Risk of Performance Transferred To Developers

DISADVANTAGE: No Shareholder Benefits

Hybrid Ownership Models

TURNKEY PROJECTS - BUILD OWN TRANSFER (BOT)

RISKS: Technology

Resource-Siting

Initial Performance

O&M

Changed Envir. Regulation

Mixed

ADVANTAGES: Utility Gains Experience W/New Technology

Reduced Technology Risks

Reduced Project Cost

Shareholder Benefits

DISADVANTAGE: Higher Performance Risk Than NUG Projects

Hybrid Ownership Models

BUY, OWN, OPERATE, TRANSFER - BOOT

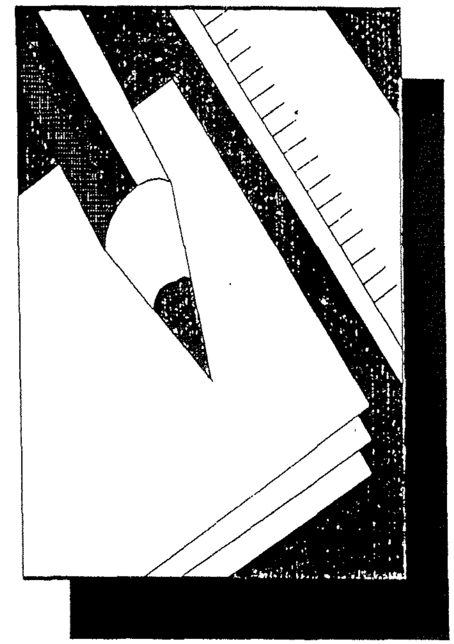
RISKS: Technology
Resource-Siting
Initial Performance
O&M
Changed Envir. Regulation

Developer/
Manufacturer

ADVANTAGES: Advantages of Non-Utility Contract
Shareholder Advantages

DISADVANTAGES: Terms/Conditions/Price Agreements
Complex
May Cost More

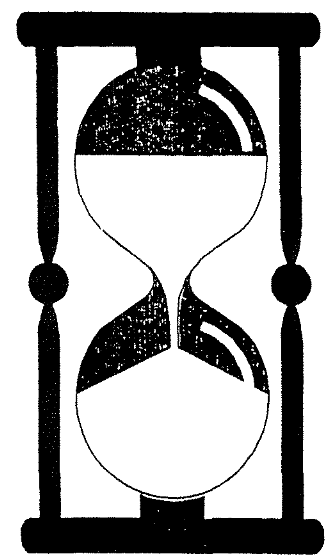
Important Contract Issues



- Financiability
- Pricing certainty
- Payment stream flexibility
- Interconnection issues
- Contract sanctity
- Curtailment/dispatchability issues
- As-delivered capacity
- Length of contract term

Resource Contracting

- Benefits of Standard Contract terms and conditions
  - Simplify negotiations
  - Reduce uncertainty; improve financing
  - Equity among participants
  - Better gauge of potential
  - Speed process



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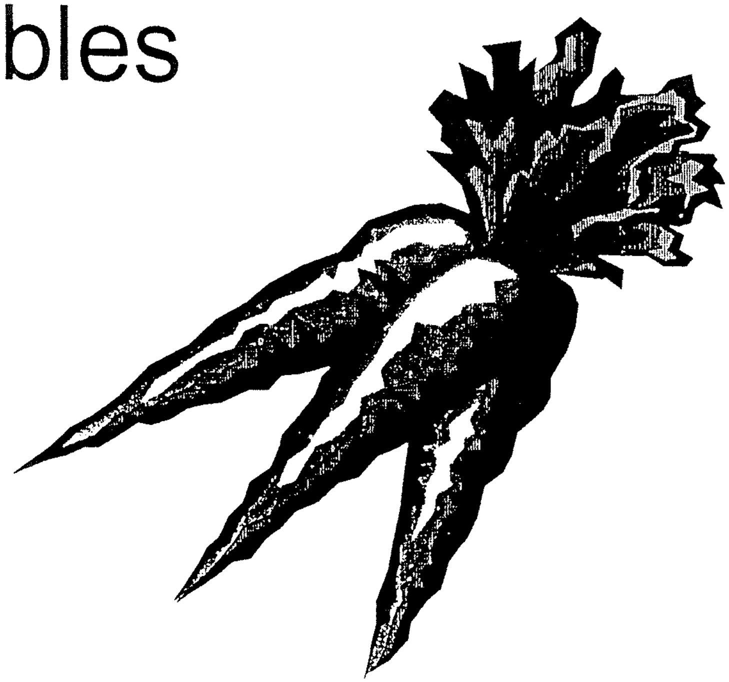

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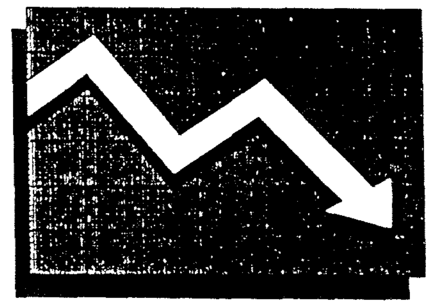

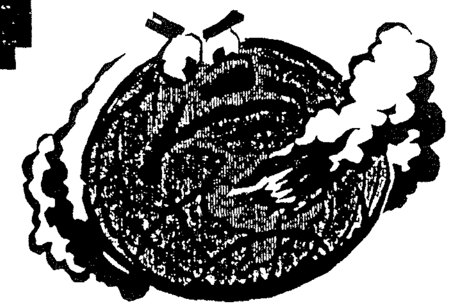

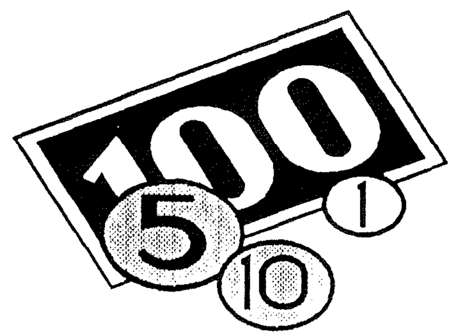

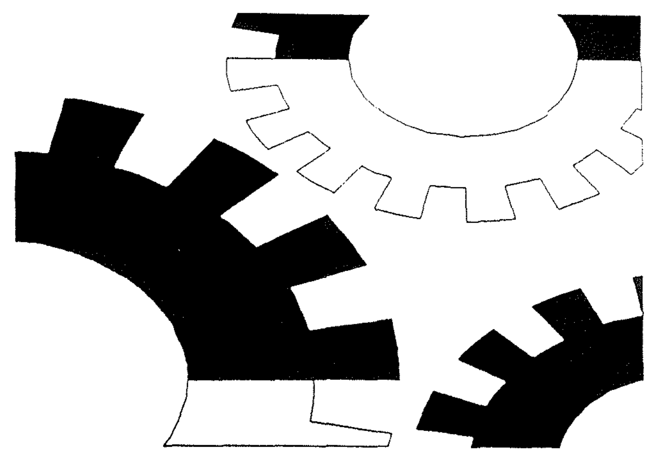

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Ratepayer

ADVANTAGES: Shareholder Benefits

DISADVANTAGES: Ratepayer/Shareholder
Financial Risk
Technology Risk
Cost-Plus Ratemaking

Ownership Models

NON-UTILITY OWNERSHIP

RISKS: Technology
Construction
Resource/Siting
O&M
Changed Envir. Regulation

Developer

ADVANTAGES: Risk of Performance Transferred To Developers

DISADVANTAGE: No Shareholder Benefits

Hybrid Ownership Models

TURNKEY PROJECTS - BUILD OWN TRANSFER (BOT)

RISKS: Technology
Resource-Siting
Initial Performance
O&M
Changed Envir. Regulation

Mixed

ADVANTAGES: Utility Gains Experience W/New Technology
Reduced Technology Risks
Reduced Project Cost
Shareholder Benefits

DISADVANTAGE: Higher Performance Risk Than NUG Projects

Hybrid Ownership Models

BUY, OWN, OPERATE, TRANSFER - BOOT

RISKS: Technology
Resource-Siting
Initial Performance
O&M
Changed Envir. Regulation

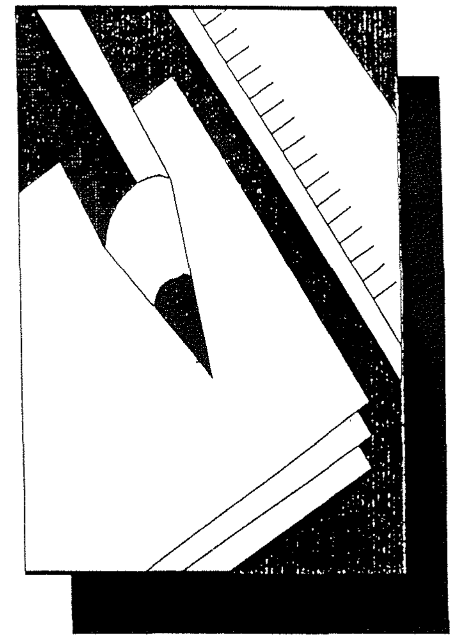
Developer/
Manufacturer

ADVANTAGES: Advantages of Non-Utility Contract
Shareholder Advantages

DISADVANTAGES: Terms/Conditions/Price Agreements
Complex
May Cost More

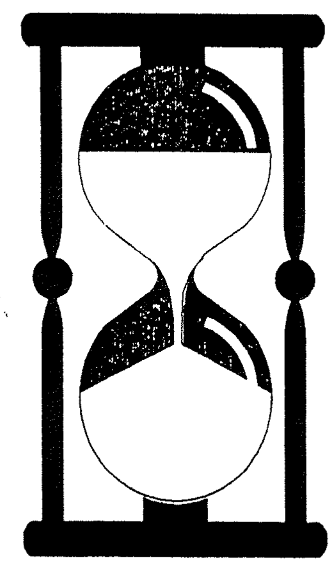
Important Contract Issues

- Financiability
- Pricing certainty
- Payment stream flexibility
- Interconnection issues
- Contract sanctity
- Curtailment/dispatchability issues
- As-delivered capacity
- Length of contract term



Resource Contracting

- Benefits of Standard Contract terms and conditions
  - Simplify negotiations
  - Reduce uncertainty; improve financing
  - Equity among participants
  - Better gauge of potential
  - Speed process



3.1.2 Panel Members:

Dan Ching–Hawaiian Electric Company (HECO)
Curt Maloy–New World Power (NWP)
Keith Avery–Zond Systems

Panel Responses

Keith Avery – Zond Systems

Mr. Avery reviewed the process of obtaining permits in Hawaii. Wind is allowed in agriculturally zoned land. It is, however, qualified by a 30' height limitation. Anything over 30' requires a public forum which basically involves a variance hearing.

For land zoned for conservation use, a developer must obtain a conservation district use permit which brings in the environmental concerns such as an environmental assessment and an environmental impact statement along with ample opportunity for public participation. In addition, if your project is located on land near the coast, this qualifies it as a special management area which brings in planning concerns and the Special Use Commission.

Participation of the public is critical and the majority of people in Hawaii are fond of wind energy and look forward to it, according to Mr. Avery. In Hawaii, there are many activists and interveners so it is beneficial to your project that you go out to the impacted community initially and speak with them. Get a sense of their concerns and try to adjust your project to fulfill their needs as best you can. If you do this, things will work easier and faster.

In closing Mr. Avery encouraged participants to consider exploring uses for wind energy separate from the utility interconnect, such as utilizing wind power for pumping water and the desalination of water for Oahu and in a futuristic sense, utilizing wind energy for charging electric cars.

Dan Ching – Hawaiian Electric Power

Hawaiian Electric Co., along with its subsidiaries, Maui Electric Co. and Hawaii Electric Light Co., recognizes the development of a new utility paradigm and is in the process of developing a new strategic plan that recognizes the forces developing in the market. The plan will focus on:

- customer needs,
- corporate excellence in providing quality service,
- new and changing technologies and their impact on the future, and
- energy services which will become a larger portion of the utilities' business.

Mr. Ching acknowledged the utilities recognition of the movement away from a purely regulatory environment into a market driven environment with regulatory oversight. Still, he noted, the utilities are concerned with:

- the rate payer's needs,
- competitive costs and keeping these costs at a reasonable level, and
- maintaining excellent service.

Likewise, in the power purchase agreements, the utilities are concerned with, not just the needs of the power purchase producers, but with the interests of the shareholders and the rate payers. The utilities are concerned with costs being kept in line with avoided costs and concerned with the reliability of service provided by the power producers, he said.

For firm capacity producers, the issue of reliability is especially important which is why, in power purchase agreements, the utilities have set stringent standards for performance, written in liquidated damages and sanctions for non-performance. While requirements in the power purchase agreements for as-available producers are not as stringent, the utility is still concerned with safety requirements because of the need to protect the utility systems from damages, he said.

Mr. Ching stated that the utilities in Hawaii have historically been supportive of non-utility generated power and continue to purchase as-available power from renewable energy sources, primarily power from bagasse energy from the operation of sugar plantations on all three islands (Oahu, Hawaii and Maui) as well as maintaining the firm capacity contract with the H-power plant, a renewable energy derived from the burning of municipal solid waste.

At the same time, he added, the utilities are concerned with prudent management from a regulatory perspective because all of our power purchase contracts must be approved by the PUC.

"The PUC has taken a very active role, especially in firm capacity contracts and have informed us that they will re-look at these contracts if they think we are not administering them as prudently as they think we should, " he said.

The regulatory treatment for non-fossil fuel producers has been encouraging, according to Mr. Ching. Through a legislative process, minimum purchase rates have been established for renewable technology sources. It works this way, if you are a renewable energy source producer and you come to the utility with a proposal, the utility will pay the purchase rates based on the avoided rates in effect at the time the contract was approved by the PUC.

"We view this as a definite incentive to renewable energy sources," he said in closing.

Curt Maloy – New World Power

Power quality, an issue touched on in session 2, is becoming increasingly important in the context of project development, according to Mr. Maloy.

"Our ability to affect smaller consumer grids is directly related to the quality of our product in the next generation of technology," he said. "There is no doubt about it, we have to solve this problem by designing better products to eliminate this key argument and make wind power more acceptable to the utilities."

Mr. Maloy added that the industry recognizes this and is taking steps in their designs to provide better products.

Visual impact is an issue, Mr. Maloy believes can be solved through a concerted education effort. Referencing a situation in Palm Springs in which New World Power was involved in the development of a wind power project, he illustrated how efforts at educating can successfully work toward eliminating opposition to wind power.

"We started with a small group, in the face of horrendous opposition, in Palm Springs. For two and a half years, we provided books to schools and made ourselves available to service groups and chamber meetings. We eliminated the opposition to such an extent that we ended up being fought over by three different communities to annex these areas to get a hold of the property tax revenues. They love us now," he said.

Dr. Hamrin added that in addition to education, careful siting and careful design can also help to eliminate opposition and improve the visual impact of wind turbines.

Question:

What is the panels reaction to some of the alternative ownership arrangements suggested in Jan Hamrin's presentation?

Answer:

Curt Maloy – New World Power

From New World Power's perspective, all of these alternatives have potential. The fact that there are a variety of alternatives available is simply going to make it more attractive for the utilities to select what type of projects they are going to want to provide for.

Keith Avery -Zond Systems

There will be more participation in these alternatives when the utility overcomes its fears resulting from being an early pioneer in wind energy, he said adding that the technology has advanced significantly since then.

"There are a lot of things we can do if both sides want to work together," he said.

Dan Ching –Hawaiian Electric Company

Speaking on behalf of the utilities, Mr. Ching added that they are always open to new proposals and will take a look at every one of them.

Question:

It looks as though some of these alternative ownership arrangements might present more complicated negotiations. Are there any examples of these kinds of arrangements that have been completed that utilities and developers might look to for guidance?

Answer:

Jan Hamrin - Hansen, McQuat, Hamrin & Rohde

Probably none that are available, Dr. Hamrin said noting that projects such as these have been completed but are probably not public.

The key is communication between willing partners who can clarify their needs in such a way that an agreement is designed to cover, as much as possible, the situations that need special consideration.

Dr. Hamrin depicted the standard contract as a fall back mechanism for situations where you want bring a lot of power on rapidly and you want to expedite it, and/or people don't have a lot of experience or need to have something to fall back on if negotiations fail.

With that in mind, you still have your basic contract and it is just some variations on some aspect in it. It is a matter of finding a deal that fits both parties.

Question:

What is your assessment of the type of projects being negotiated in which curtailment is an issue and the potential for financing these types of projects?

Answer:

Jan Hamrin - Hansen, McQuat, Hamrin & Rohde

A financeable contract is a contract in which a financial institution can anticipate the worst case scenario and still finance it, Dr. Hamrin explained. With that in mind, if you have an agreement that gives you the option to curtail at any time, then that kind of arrangement is not financeable.

However, if you have an agreement wherein you have an option that specifies the maximum amount of time eligible for curtailment (i.e. 600 hours) or if you have a good track record and have data to show how probable curtailment is and the frequency of curtailments, then you can determine the impact, she said.

The more specific the utility can be about the situation under which curtailment can be invoked, the more likely you will be able to finance such an agreement, better design your project and determine its economic feasibility. The issue is an open-ended liability versus something that is manageable and predictable.

Curt Maloy - New World Power

The bottom line according to Mr. Maloy, is if you cannot quantify the issue of curtailment then you will lose everybody's interest quickly.

Question:

What is the present price of avoided costs for Hawaiian Electric Company on Oahu?

Answer:

Dan Ching - Hawaiian Electric Company

This quarter, I believe it is about 3½¢ per kWh.

Question:

Under the new strategy plan being worked out by the local utilities, are avoided costs being redesigned to account for the externalities that are being discussed at the various IRP meetings in order to give a better economic picture of the actual price per kWh?

Answer:

Dan Ching - Hawaiian Electric Company

Currently, there is an avoided cost docket before the PUC. Perhaps some of the questions you are raising here may be brought up at these hearings but we will have to see.

Question:

In the "BOOT scenario" outlined in Dr. Hamrin's presentation, what kind of a time frame do you envision for the operational period before you turn it over to the utility?

Answer:

Jan Hamrin - Hansen, McQuat, Hamrin & Rohde

It depends upon the situation. It depends upon what the risk is that the utility perceives or that it is trying to mitigate by the original developer operating the project. It is a matter of agreement between the two parties to meet the needs of both, she explained.

In general, it is best to give enough time for the project to get through its initial shake down and to have some kind of a track record. Probably a minimum of two years of resource cycles is needed to give a better idea of resource availability and the O&M costs of operating. Beyond that, it depends. If it is too long a time period, you don't have as valuable an asset to transfer to the utility rate base. Whereas, if it is too short a time period, you may not have mitigated the risks of the technology or the resource that the utility is worried about.

3.2 Panel 5: Government Support to Industry

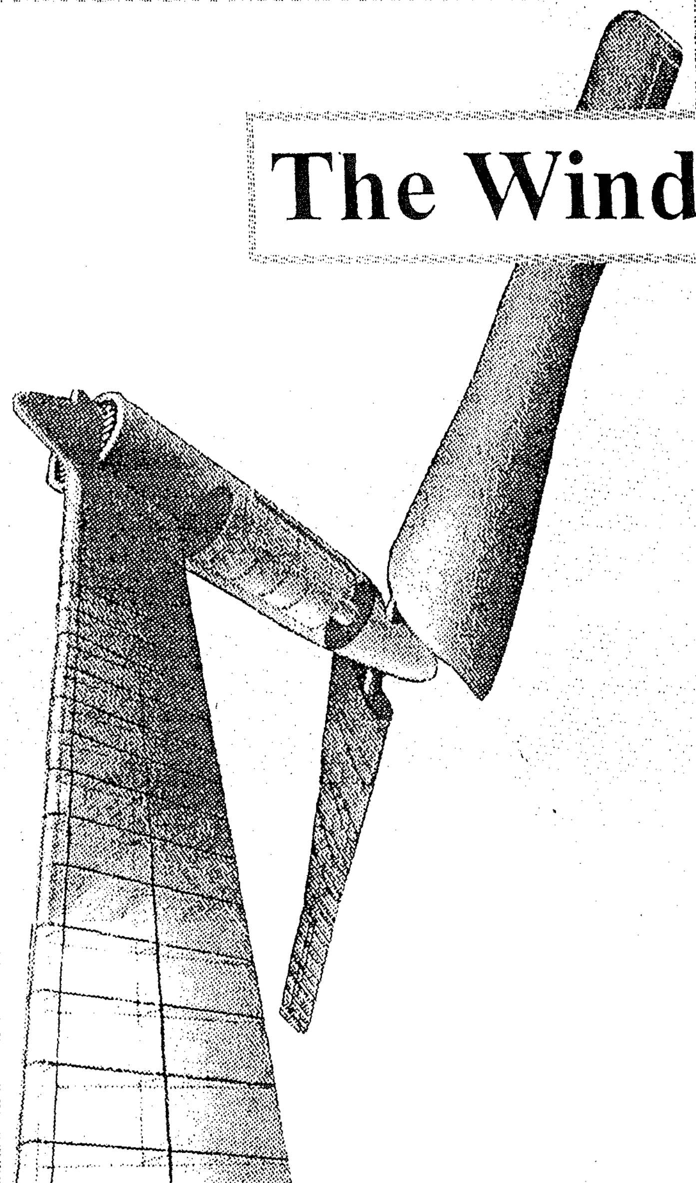
3.2.1 Panel Chairs:

Ron Loose – U.S. Department of Energy (DOE), Washington D.C.

Maurice Kaya - State of Hawaii Department of Business, Economic Development and Tourism (DBEDT)

Presentation charts follow

The Wind Energy Systems Program



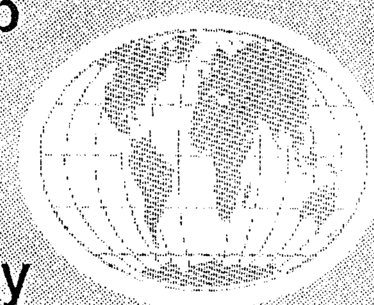
- Accelerating Commercialization
- Promoting Economic Development
- Enhancing the Environment
- Ensuring Technical Competitiveness

Ronald R. Loose, Director
Wind Energy Program, U.S. Department of Energy

Program Objectives

- Increase utility use of wind energy
- Develop advanced wind turbines
- Increase productivity and industry competitiveness
- Upgrade the applied research base

World leadership in wind turbine technology markets



Program Strategy

"Collaborate with key stakeholders to accelerate the widespread development and commercialization of wind technology, while achieving national objectives including increased economic development and reduced greenhouse gas emissions."

Recent Program Accomplishments

- Advanced wind turbines for the near-term market under development and test

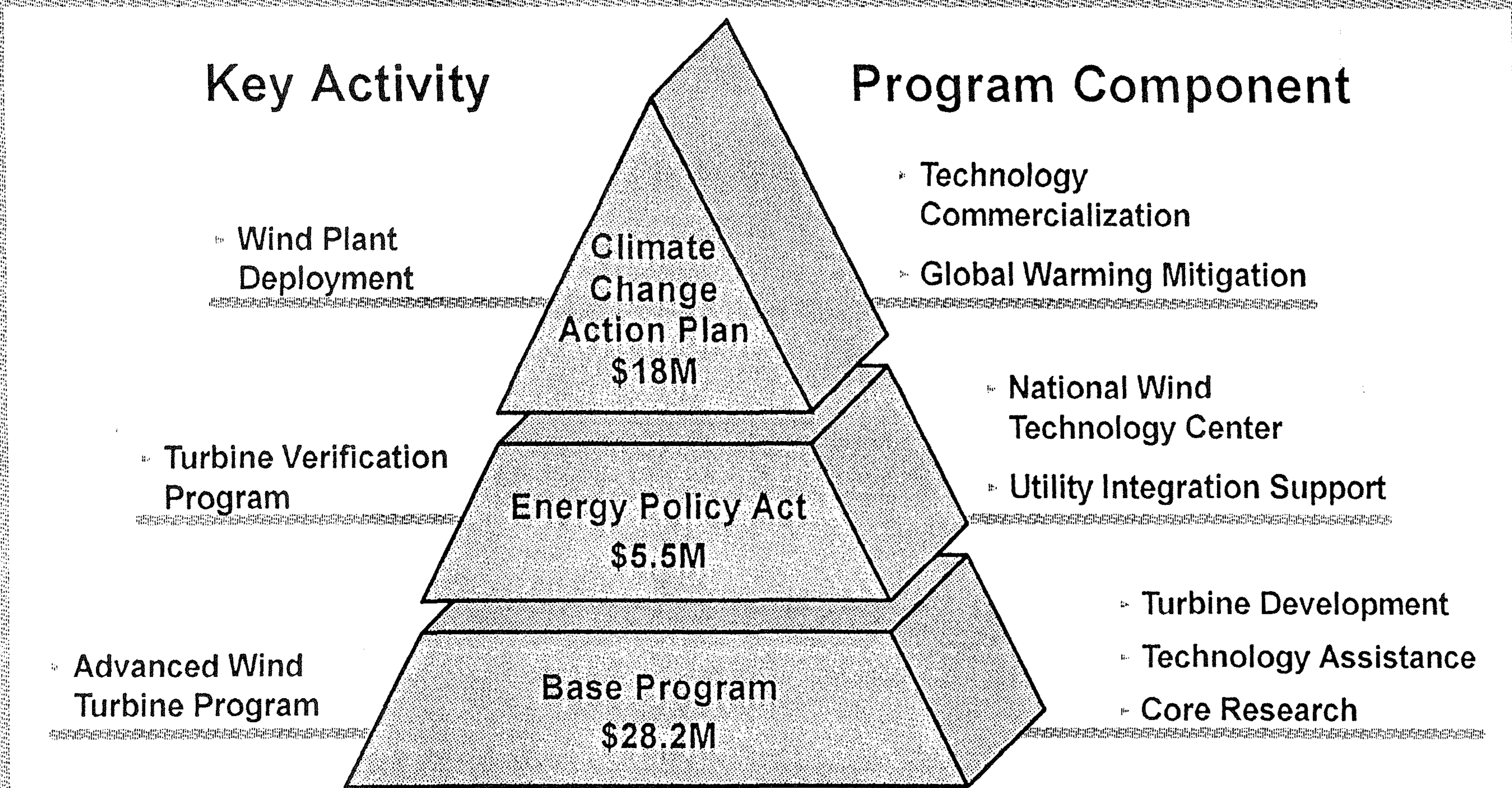
- Utility Wind Turbine Verification Program is establishing utility confidence in advanced technology

- Next generation innovative subsystems development initiated

FY 94/95 Plans

- Establish National Wind Technology Center
- Initiate full-scale next generation turbine development
- Establish a Market Mobilization Collaborative
- Continue ongoing core research activities

FY95 Wind Energy Program



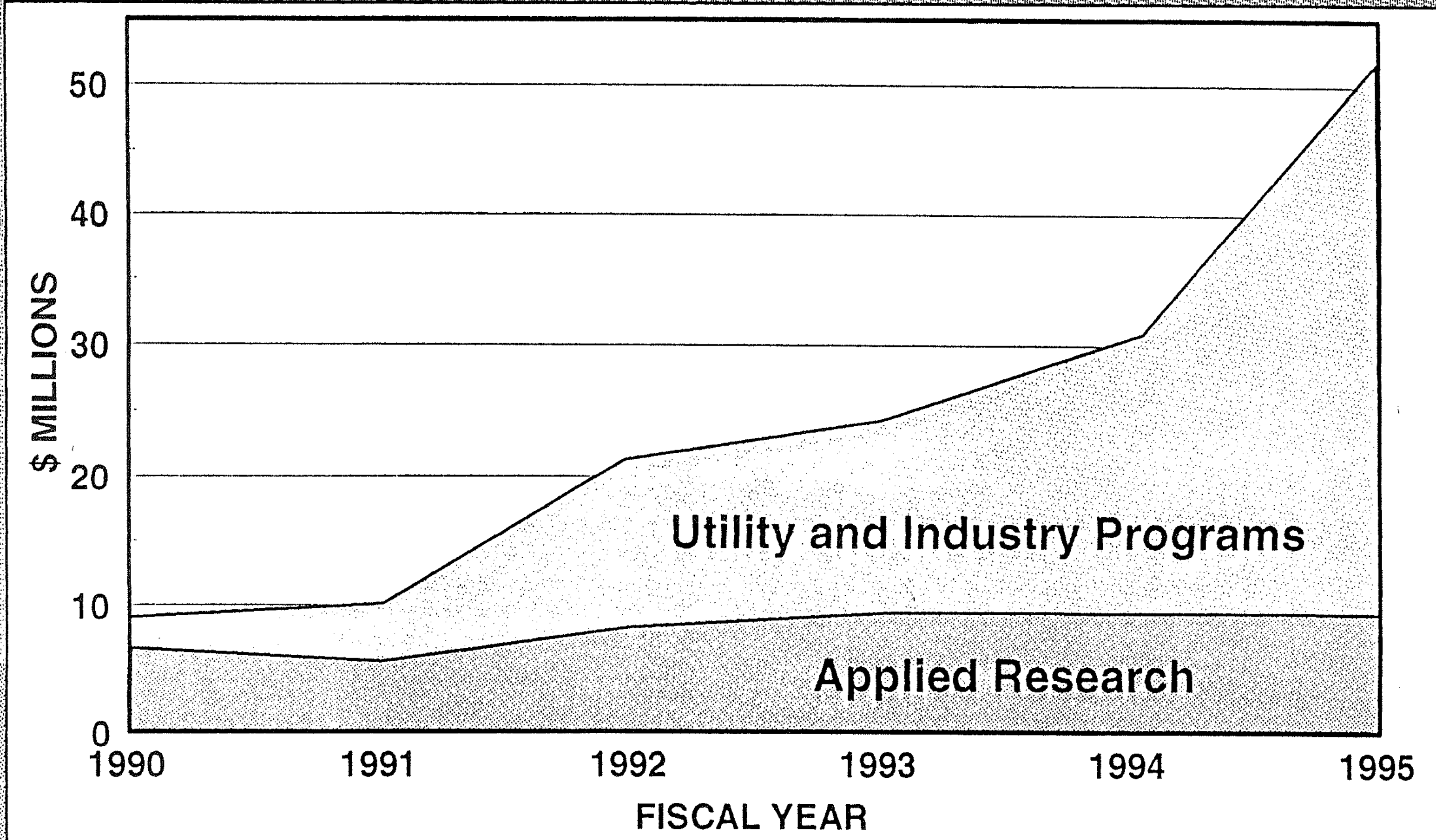
Collaborative Role

- Provide a forum for key stakeholder viewpoints on a market-driven, coordinated approach to accelerate the use of wind power
- Develop consensus on Collaborative activities that will stimulate follow-through by natural market forces
- Coordinate implementation of activities

Program Actions in Support of the Climate Change Action Plan

- Initiate windfarm deployment projects
- Expand the Turbine Verification Program
- Initiate avian research
- Initiate a Utility Wind Resource Assessment Program

Budget Perspective



Summary

- Program advancing on target
- Large wind resource exists
- Sizable markets emerging
- Technology continues to mature
- Utility interest expanding
- Next generation wind turbine development underway
- Commercial windfarm deployment projects underway

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
ENERGY DIVISION

PANEL 5

"GOVERNMENT SUPPORT TO INDUSTRY"

The Hawaii Windpower Workshop
March 21 - 22, 1994

STATE AND LOCAL GOVERNMENT SUPPORT

- DEVELOP ACCURATE RESOURCE DATA BASE
- OVERCOME TECHNICAL BARRIERS
- OVERCOME INSTITUTIONAL BARRIERS
- PROVIDE APPROPRIATE FINANCIAL INCENTIVES

DEVELOP ACCURATE RESOURCE DATA BASE

- HAWAII ENERGY STRATEGY
  - Assess Previous Resource Assessments
  - Collect, Publish Detailed Site Specific Data
  - Develop Resource Supply Curves
- INTEGRATED RESOURCE PLANNING
  - Ensure Supply-Side Plan Fairly Depicts Renewables

OVERCOME TECHNICAL BARRIERS

- PARTNERING WITH DOE AND INDUSTRY
- ADDRESS LIMITATIONS OF OLD TECHNOLOGY
- ADDRESS STORAGE, GRID INTEGRATION PROBLEMS
- DEMONSTRATE ADVANCED WIND TURBINES
- DEVELOP A PACIFIC WIND TURBINE

PROJECT DEVELOPMENT EXAMPLES

- KAHUA RANCH WIND-PUMPED HYDRO
- KAHUKU ZUTECK ROTOR PROJECT
- MOLOKAI WIND-DIESEL HYBRID PROGRAM

OVERCOME INSTITUTIONAL BARRIERS

- INTEGRATED RESOURCE PLANNING
  - Supply-Side Resource Plans
  - Wind Energy Acquisition Plan
  - Total Fuel Cycle Costing Analysis
- FACILITATE PERMITTING
  - Advocacy
  - Streamlining

PROVIDE APPROPRIATE FINANCIAL INCENTIVES

- STATE TAX CREDITS
- FEDERAL PRODUCTION INCENTIVE CREDIT
- OTHERS, ADDERS, EXTERNALITIES

3.2.2 Panel Members:

Lawrence Mott - Northern Power Systems
Mike Boughton - Maui Economic Development Board
David Rezachek - State of Hawaii DBEDT

Panel Responses

David Rezachek – State of Hawaii DBEDT

Dr. Rezachek outlined areas in which state government can provide support to renewable energy development in Hawaii. Given the limited funds, we need to leverage these funds with funds from other state and federal agencies as well as the county and the private sector in order to develop projects.

In furthering the development of renewable energy in Hawaii, state government can:

- conduct preliminary technical and economic feasibility studies in various areas of renewable energy;
- participate in cost sharing and risk sharing of promising renewable energy R&D and demonstration projects such as the Molokai Wind Diesel Hybrid Project and the Hawaii Zuteck Rotor Project; and,
- investigate other areas of technology to further the use and penetration of wind into the utility grid here in Hawaii including:
  - hybrid systems to increase the availability of wind through the use of a backup generator such as a diesel generator,
  - storage systems to increase the availability of wind through pumped hydro or battery systems.

Projects of these types are being developed at the Renewable Energy Storage Test Facility on the Big Island. The state government's principle interest in this type of technology, Dr. Rezachek explained, is to develop a control strategy to learn how to control other larger scale projects in a similar manner.

He outlined other approaches state government can take to further the development of renewable energy:

- make land available to developers for renewable energy projects,
- conduct statewide renewable energy assessments for a variety of renewable energy technologies, and

- facilitate the permitting process for renewable energy projects. In some cases, it has been determined that over 100 permits are needed to develop a project. In Hawaii, where projects are developed on a smaller scale than on the mainland, the permitting process represents a much higher cost of the total development of the project. Since many of the permits ask the same questions, opportunities arise to process some of these permits at the same time.

Permit facilitation is advantageous not only to the developer but to the public as well, Dr. Rezachek pointed out. Many of the environmental and public activist groups do not always have the resources to devote to a lengthy permitting process. By reducing the amount of resources that need to be devoted to permitting, it can actually increase the public's ability to participate and thus be a benefit to both groups.

In addition, state government can also:

- support various economic incentives for renewable energy development on both the residential scale as well as the utility scale particularly in isolated communities and remote areas;
- provide information to the PUC and the general public on renewable energy systems by serving as a secondary source of information; [State government can review the evaluations and analyses of utility studies conducted by other groups to ensure that they properly reflect accurate cost and performance figures as well as the status of the technology.]
- coordinate and assist in the coordination of efforts to various government and private agencies to avoid overlap and lack of coordination which causes fewer projects to be developed and money to be wasted;
- solicit public participation in policy making and incorporate some of that input into policy.
  [If developers solicit public participation early on in their project by addressing the public's concerns and soliciting public support, it will make the efforts easier, Dr. Rezachek said in referencing Mr. Avery's remarks in panel 3.1. The same argument also holds true for policy making.]
- develop legislative initiatives to implement policy and accelerate renewable energy development. [A direct result of the crisis in the sugar industry could be the conversion of biomass generated power plants to fossil fuel, illustrating the need for policy initiatives to stimulate renewable energy development, he said.]

Dr. Rezachek acknowledged state government's active role in the area of policy and planning in promoting renewable energy development and detailed some of these efforts:

- In 1989, the state held a workshop on enhancing renewable energy development in Hawaii. This was a public forum to determine where the impediments to renewable energy technology development are and how to overcome them.

Followed by:

- Hawaii Integration Energy Policy discussion and programs,
- Hawaii Energy Strategy and more recently,
- the Integrated Resource Planning (IRP) process.

In addition, last year the state held the *Energy and Environmental Summit* which brought together over 600 representatives of various energy and environmental groups to develop a consensus of what types of things can be done in the short term to enhance the renewable energy development and address the environmental concerns of the general public.

As a result of this summit, eight pieces of legislation were generated that focus on the acceptance of renewable energy in Hawaii. Dr. Rezachek detailed each legislative bill separately:

- A production incentive of 1½¢ per kWh for all renewables which would be financed by a surcharge on utility bills [According Dr. Rezachek's analysis if Hawaii increased it's use of renewable for fuel consumption from the current level of 10% to a level of 20% by the year 2014, a production incentive would increase utility rates by 1½% or an additional $1.00 per month for the average utility rate payer.]
- Net billing system to provide for an exchange of kW hours rather than the current system whereby you have to pay the retail cost for electricity used while you are paid at the avoided cost rate
- 75 day rule that allows independent power producers the opportunity to keep the negotiation process moving for avoided cost contracts
- HRS Chapter 226, A Permit Process Facilitation Act, incorporates externality concerns
- A 35% income tax credit for residential wind and PV systems which is an improvement on current residential income tax credits
- Nonutility generator guidelines for the utility requiring PUC approval
- Legislation to ensure that PV/Solar contractors can do all of the work (including electrical) on residential solar water heating systems

- Establishment of a Hawaii Energy Commission.

Most of these bills did not go very far during this year's legislative session primarily because of the lack of available funding resources this year, Dr. Rezachek explained. However, we hope to can keep this process going by taking some of the key issues out of some of these bills that did not make it and reintroducing them as concurrent resolutions in next year's legislative session. This will require the effort and cooperation of the various agencies and special interest organizations to look at how they can facilitate the implementation of these bills some of which require more money while others have unanswered questions that need to be worked out.

There are a number of things that state government can do, and workshop participants can do as well, to assist in this effort to keep the process going for the next legislative session, Dr. Rezachek said in closing.

Mike Boughton - Maui Economic Development Board

As a representative of the Planning and Economic Development Board for Maui County, Mr. Boughton stated his primary interest lies in the economic diversification of Maui.

"I have always believed in renewable energy, in all of its forms, as a natural form of economic diversification for this state because of the push/pull effect -- we need the alternative energy and we have a lot of resources," he said.

To summarize what government can do for the development of renewable energy, Mr. Boughton provided an outline of general functions of government:

- Provide technical information through R&D and demonstration programs as well as legal information to give a better understanding of the various processes such as permitting
- Set supportive procedures by putting competent individuals in the various processes
- Sense the public sentiment and lead it. Good state leadership can turn sentiment into action

Mr. Boughton observed that all of the workshop participants believed in the team effort approach with some sobering cautions.

"Various team members spoke of their willingness to play the game. I believe that an important function of government is to bring the team together. The objective of government should be to develop a legal and

"Various team members spoke of their willingness to play the game. I believe that an important function of government is to bring the team together. The objective of government should be to develop a legal and regulatory environment to allow and induce the team members to play together," he contended.

On the subject of financial matters, Mr. Boughton perceives there is still an apparent need for government subsidies in Hawaii.

"It is clear to investor owned utilities, particularly those in a regulatory environment, that any kind of direct subsidy is going to make a great deal of difference to speed up the projects and overcome conservative thinking that is a natural tendency, especially in Hawaii where conservatism is even more important because the consequences of a mistake is even more serious than in a non-grid situation," he said.

A secondary role that government can play in helping to develop renewable energy, particularly wind, Mr. Boughton noted, is in fostering an attitude that is supportive and stimulating of technology based industry. Funding for demonstration and R&D projects in collaboration with industry will go along way towards this goal, he said.

At the same time, government needs to view the Alternative Energy Development Program as a long term project, he emphasized in referencing his work with the Renewable Energy First National Plan for Energy Research Development Demonstration in 1974.

"The predictions made at that time, as to how rapidly renewable energy would develop, were optimistic primarily because of the assumption that oil would be priced at $100 a barrel by now," he said clearly illustrating how the planning process can be effected by the assumptions that are made.

And finally, education is an important function of the government's renewable energy development program. It is a generation long program. If we are to effect the transfer of information about alternative energy, education has to start in the first grade. More education of renewable energy needs to be carried out in the primary, secondary and high schools, he said in closing.

Lawrence Mott - Northern Power Systems

Representing the manufacturers perspective, Mr. Mott outlined the impact of government on helping to move technology forward. He illustrated this through examples of projects that government has impacted.

- A cost-shared program with SERI (now NREL) in the late-1970s with the U.S. Navy to develop a wind-turbine project. SERI/U.S. DOE gave Northern Power Systems, a relatively unknown small business, the credibility with the Navy to establish a successful project. The wind turbine is now a commercial machine and is installed internationally and works quite well, he added.

- Turbulence studies on 100 kW turbines were undertaken in the mid-1980s to understand the forces on rotors. Government funding and expertise were still needed to help move this technology forward.

- In Palm Springs today, turbines have been installed and are being tested as part of the Advanced Turbine Program using past experience with government and industry as a technical engineering group to move technology forward.

- Wind/PV hybrid systems for village power systems are packaged for off-grid situations to keep village economies going, Mr. Mott said in referencing a fishing village on the Big Island in need of a refrigeration and power generation system. This is an important example of the need to bring appropriate technology in while the market is not mature enough.

Such partnerships with government are an attraction to other team players as well, Mr. Mott added, "As a result of a village power system project developed in Alaska, we gained a utility partner as well as a large diesel manufacturer that signed on when they found out we had government support."

Government support for commercialization is needed in order for small companies to attract other team members through demonstration projects, he said in closing.

3.3 Panel 6: Benefits of Wind Power to Hawaii

3.3.1 Panel Chair:

Tom Gray – American Wind Energy Association (AWEA)

Presentation charts follow

BENEFITS OF WINDPOWER TO HAWAII

Hawaii Windpower Workshop
March 22, 1994

BENEFITS OF WINDPOWER TO HAWAII

- Economic
- Environmental
- Energy security

ECONOMIC BENEFITS

- Increased employment
- Reduced supply risk
- Reduced price risk
- Reduced CO2 reg. risk
- Favorable trade balance

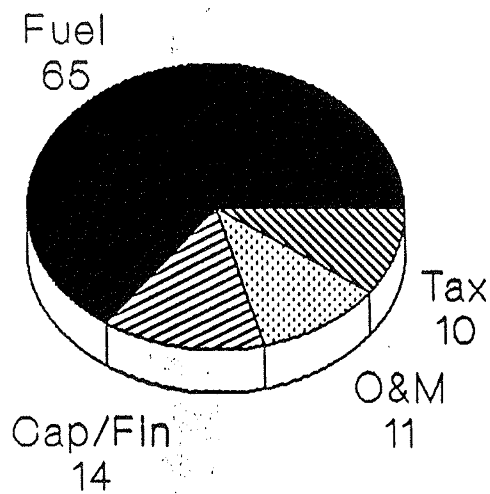
ECONOMIC BENEFITS
How to quantify?

- Few recent studies
- Findings positive, but variable
- AWEA plans national study
- Hawaii study probably needed
- Exports even more imponderable

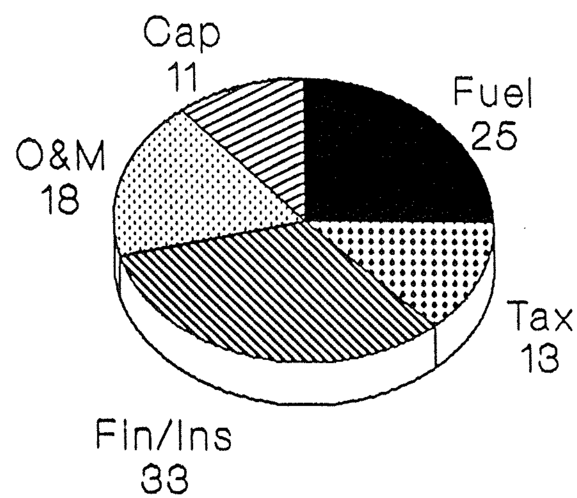
EMPLOYMENT STUDIES

- NYSEO
- UCS/Powering the Midwest
- Wisconsin
- California
- Hohmeyer

CONVENTIONAL ENERGY
Fuel, Not Jobs



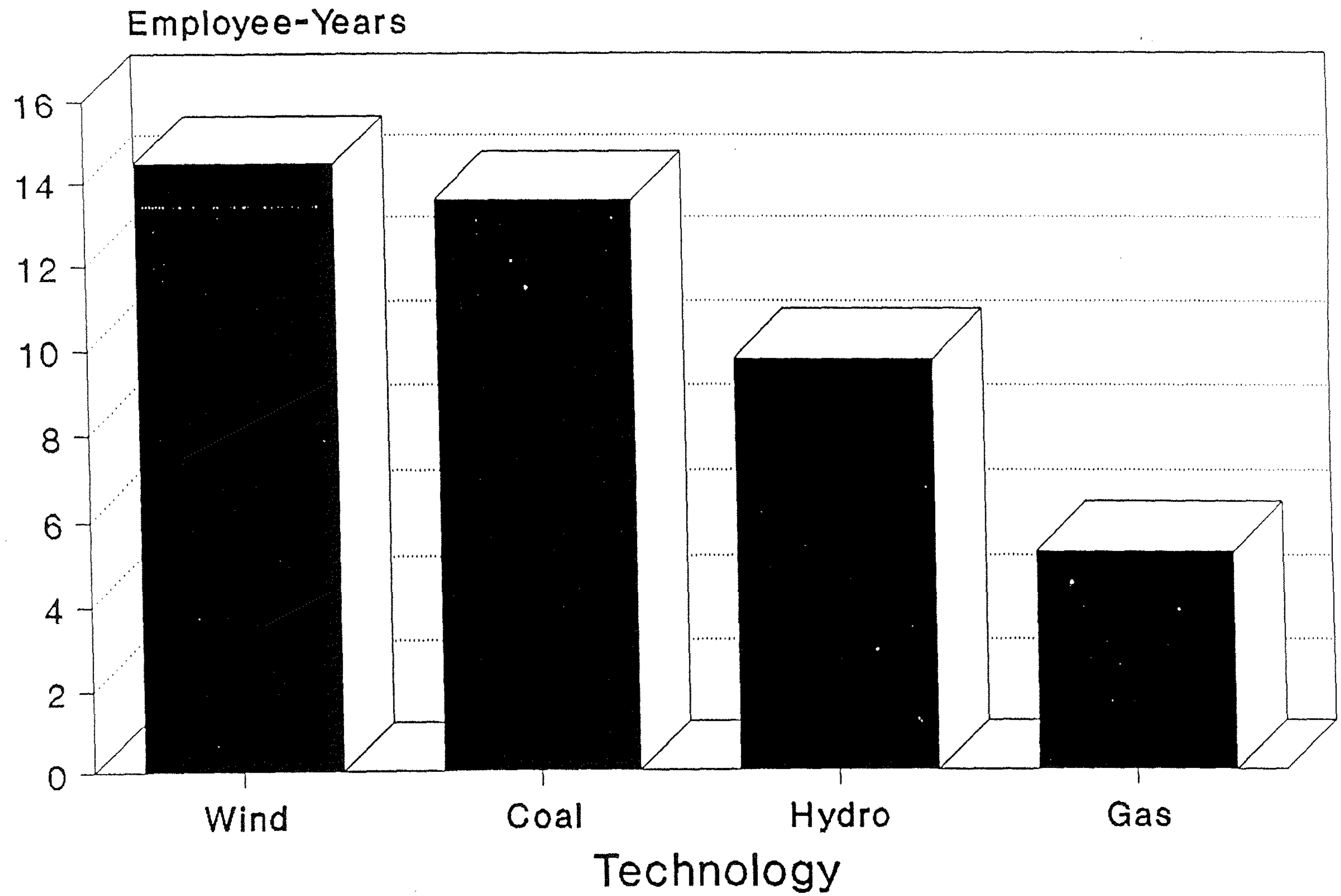
Gas



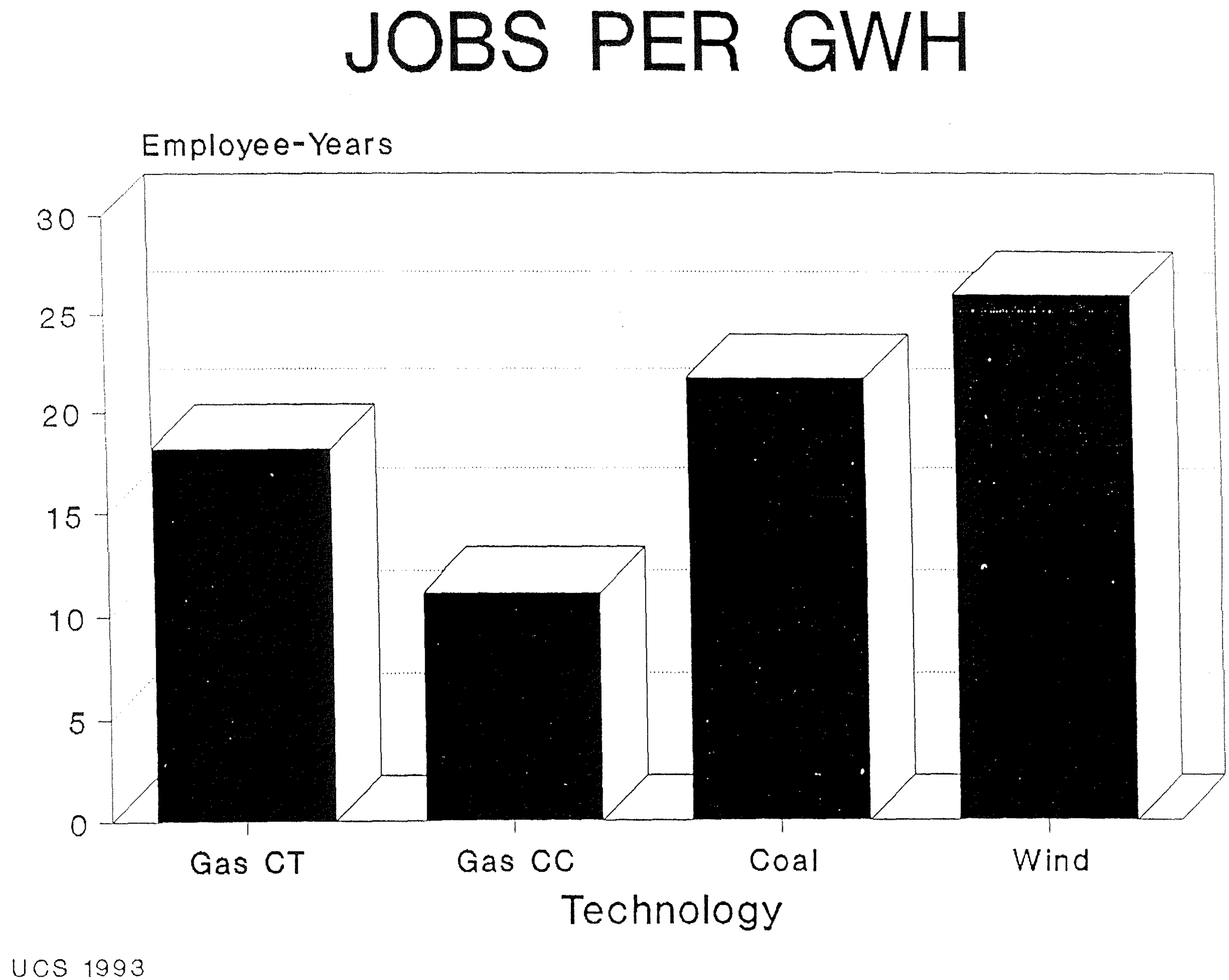
Coal

NYSEO 1992

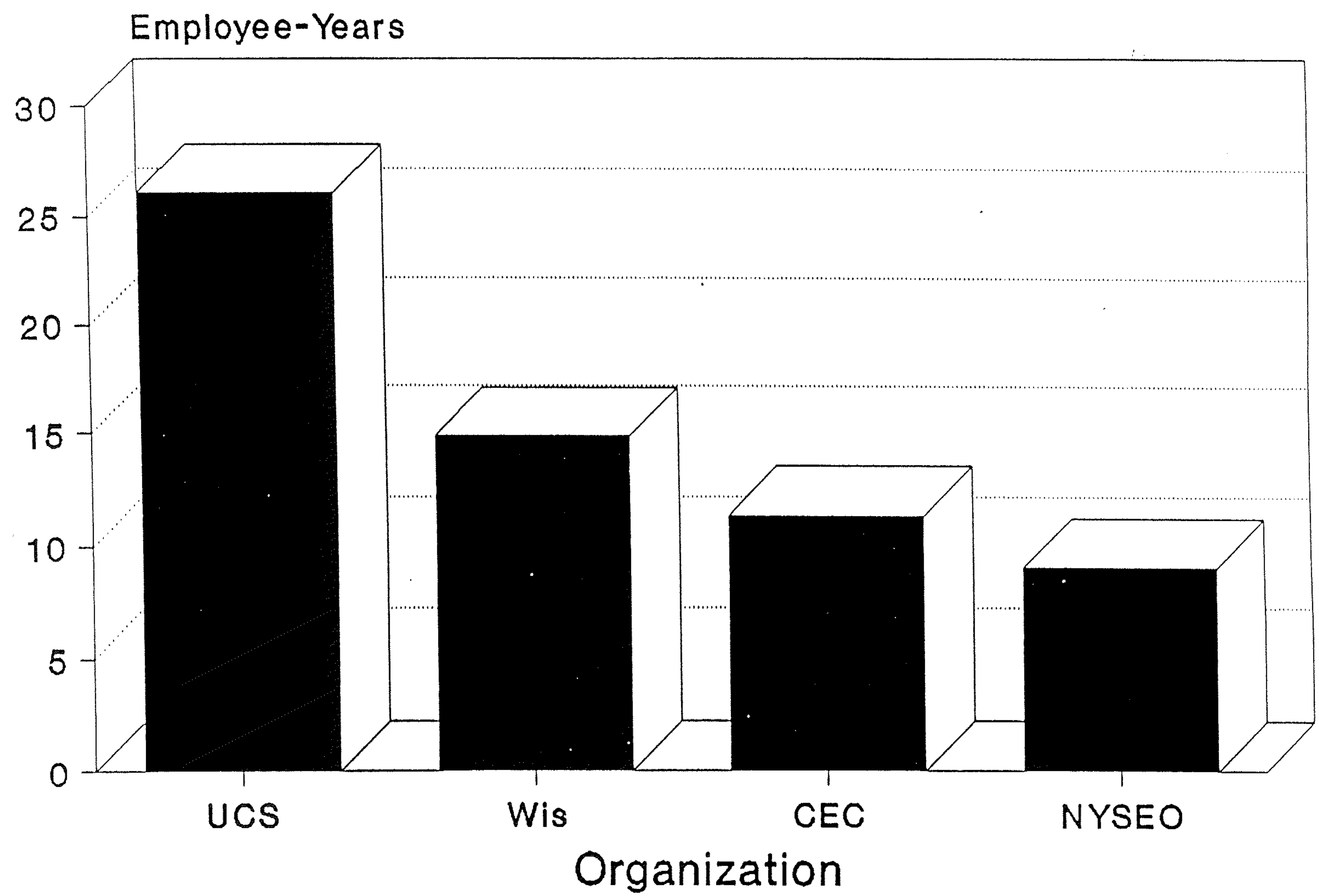
Jobs Per $Million



NYSEO 1992


JOBS PER GWH
Employee-Years
30
25
20
15
10
5
0
Gas CT
Gas CC
Coal
Wind
Technology
UCS 1993

JOBS PER GWH


Employee-Years
30
25
20
15
10
5
0
UCS
Wis
CEC
NYSEO
Organization

REDUCED SUPPLY RISK

- 90% dependence on oil
- 30 days reserve
- The sky isn't falling, BUT
- Fundamentals remain negative

OTHER ECONOMIC BENEFITS

- Reduced price risk
- Reduced CO2 regulatory risk
- Favorable balance of trade
- Export potential

ENVIRONMENTAL BENEFITS

- Reduced greenhouse gas emissions
- Reduced risk of oil spills
- Reduced air toxics emissions

TIMING ISSUES

- NZ begins wind development
- Clinton greenhouse policy
- Wind R&D funding boost
- Windpower 2000

3.3.2 Panel Members

Richard Joun–State of Hawaii DBEDT
John Mapes–Division of Consumer Advocacy, Dept. of Commerce
Paul Brewbaker– Bank of Hawaii

Panel Responses

Richard Joun - State of Hawaii DBEDT

Although Dr. Joun was in agreement with most of the points made by Tom Gray, he proposed that perhaps Hawaii and smaller states like it should develop their own perspective and should look at wind power more carefully to determine its benefits to Hawaii.

Referencing a study on the use of bagasse for electricity DBEDT conducted in 1970 to help the sugar industry survive while producing electricity from a renewable resource, he noted the irony in the sugar plant shut downs which represented the loss of a renewable energy source for Hawaii.

The predictions made in the 1980 *Integrated Energy Assessment* study carried out by DBEDT were overly optimistic, he acknowledged, particularly with regards to the energy self sufficiency of Molokai. Nevertheless, this was a good lesson to learn from in understanding how assumptions should be made in the planning process. The installation of the first wind turbines at Kahuku, generated great expectations and hope in Hawaii and obviously the reliability was lower and operational costs were higher than expected. So we should learn from past experiences not to get carried away by idealism and focus on the economic realities in the planning process, he explained.

According to data for energy costs available to DBEDT at this time, it appears that the costs of generating electricity are higher for wind power than for fossil fuels in Hawaii. Dr. Joun noted that this could change in the very near future with the technological breakthroughs taking place to reduce costs and increase the reliability of wind power.

While he agreed there are many economical benefits that should be and could be included in the computation of economic costs for wind power, more work has to be done in quantifying these externalities. Unfortunately, the actual costs of energy, or the external costs, are borne by society rather than the individual investor, he explained. So there has to be a recognition by government that there are these benefits that will not be accrued to the individual investor.

Besides the pecuniary costs or the external costs that can be measured, there are also non-pecuniary costs such as the greenhouse effect and air pollution for which there are no monetary quantifications. These are difficult to quantify or use to compare with different energy sources. Option value concepts is one approach to quantifying these non-pecuniary costs. The state's *Limited Resource Study* also attempted to quantify the social impacts of the environmental costs and benefits.

The real issue to be decided by society is, who is going to pay for these costs - the voters via a tax such as Clinton's btu tax or the government through subsidies, tax credits etc.?

There are, however, strong organized lobbying groups resistant to any efforts to quantify these costs. And there are strong competing needs for money in government so we need to decide how to allocate the resources of government, he said adding that he realized this was a quid pro process.

Furthermore, he added the government needs to decide what accounting system to use, whether it be the current monetary price system or an alternative environmental monetary system. The fundamental value system needs to be discussed, he said in closing.

John Mapes - Division of Consumer Advocacy, Department of Commerce

As a representative of the Division of Consumer Advocacy (DCA), Mr. Mapes presented the perspective of the DCA.

The mandate of the DCA is to advance the interests of Hawaii utility consumers before the PUC or in other words to oppose the excessive and unproductive charges being levied on Hawaii rate payers. As such, their concerns are essentially to determine how these benefits will be distributed and how they will be paid for.

The DCA's responsibility is to make sure that Hawaii rate payers will not pay more than their share while still receiving some of the benefits of wind power. The uncertainty of how this will work itself out is related to the interplay of three factors being:

- DCA's expectation that wind power improvements will be done by non-utility generators or independent power producers as opposed to the utilities,
- current avoided cost basis for payment to the non-utility generators, and
- current change which is being undertaken in integrated resource planning in the regulatory arena

Defined as the costs an electric utility would incur to generate power if it did not purchase that power from another source, avoided costs are generally a factor in determining how much the independent power producers get paid for their power. However, avoided costs are also used to select resources, not to determine which resources will be used, Mr. Mapes explained.

The selection of resources is expected to be done somewhat differently in the IRP movement. The DCA is optimistic about the IRP approach and views it as a progressive step that recognizes the long term better than previous approaches.

"We favor the total cost approach to combining the direct utility cost with the externality cost of a resource. However, IRP leaves us up in the air about how these resources are going to priced," he said outlining the situation currently faced by non-fossil resources.

Let us say, for example, that the utility avoided costs are calculated at 8¢/ kWh and the alternative option cost 9¢/kWh to implement. This situation would cause the alternative option not to be selected. However, if the alternative option cost 7¢/ kWh to implement, this resource would be selected since it can be implemented for less than the avoided cost. The power producer gets the benefit of being able to produce power at less than the avoided costs and the public benefits by the uncalculated externalities that may have been accrued to the utility option. Thus, there is a divergent benefit related to this kind of selection of payment procedure.

The emerging procedure in the IRP process is moving away from the traditional least cost resource selection to a situation where the total costs of options are considered in an attempt to rigorously compare resources. In this procedure, if for example, the utility option cost 12¢/ kWh and the alternative option cost 9¢/ kWh, the non-utility option should be selected because its total cost is lower than the utility's or the next best alternative. The question that follows is, how much should be paid to this option - 12¢/ kWh or 9¢ /kWh?

"My point is," said Mr. Mapes, "we don't know. There is no clear mechanism currently in place to tell us. Because we are assuming that this is non-utility generation, we don't really know what the height of that alternative option band is. This is the crux of our major problem related to the importance of alternative supply resources."

"During the course of this workshop we have heard of the willingness of Hawaii's people to pay for renewable technology. While this may be quite likely, at this point, a mechanism to provide an equitable way for them to do that has not yet been developed and it will be easier for the DCA to get on the team once that is in place," Mr. Mapes said in closing.

Paul Brewbaker – Bank of Hawaii

As an economist coming from a commercial bank, Mr. Brewbaker said he is acutely aware of the difference between commercial viability and economic viability. The reason wind power has not been commercially viable is because of its reliability and O&M costs.

"We're still a bit away from commercial viability here in Hawaii," Mr. Brewbaker contended. "The reality is that declining oil prices and the global economy we now have make it harder for proponents of wind energy to make a case."

Using oil prices of 5 year ago, Mr. Brewbaker ascertained that Hawaii imported $1.1B of crude oil. This year, at a price of $15/barrel, we will import less than $700M. That kind of savings makes it harder for wind power to make a case, he said.

A recent *Honolulu Advertiser* poll indicated that 75% of the general public supports alternative energy. However, an equally proportionate number of people would oppose paying a peak load pricing tax on their commuting to work even though in the abstract they support alternative energy.

We need to gauge what the premium might be that society is willing to pay until it is commercially viable, he said. This depends on three things:

- *External costs* - including the future liability risks that have not been quantifiable, such as supply destruction and price volubility. Society might be willing to pay a premium to preserve the option value that are subject to these yet unidentified risks until the price of oil goes up or such time that R&D brings the price of wind power down. This is a political question, Mr. Brewbaker said.

- *Education* - not only of our young people but adults, particularly legislators need to be educated on externatility theory and natural resource economics.

- *Economic viability* - The calculus undertaken to determine the social costs don't have a bottom line equivalent that the regulatory system can use to measure against. Until you can close that gap or convince policy makers that those costs need to be recognized and paid for, we will continue to have a problem, Mr. Brewbaker said in closing.

Question:

The state's consensus seems to be that wind is not economically viable. I'd like to challenge that. The perception that wind is not economically viable is not supported by the facts. In California since 1986, we have installed 10,000 windmills without any tax credits and public assistance. That experience indicates that the industry and the technology is viable. In addition, many proposals put forward by wind developers for 100 MW projects, are pricing wind power at 5¢ to 6¢ kWh which is extremely competitive with fossil fuels. Obviously the developers who are making these proposals would not be doing so if they didn't want to make money.

Answer:

Richard Joun - State of Hawaii DBEDT

I think that is quite right. However, all of the information that I have available to me does not indicate that. I think dissemination of information is lacking. Let me propose an example of how information, not properly disseminated, can give an incorrect assessment.

I made a personal investment by installing a solar panel for my residence which is now nearly paid off. I installed it for the tax benefits. At the time, I did not realize the rate of return because this information was not properly disseminated.

I believe wind might be viable especially in small isolated areas such as the fishing village on the Big Island (ref: panel 3.2-Lawrence Mott). Wind might be a better economical solution than any other option. This information is not properly disseminated.

I suggest that the state legislature provides us with the funds to study and disseminate this information from Hawaii's perspective and perhaps set a rule guarantee for implementing wind energy in areas where wind is a much better option.

Question:

On the mainland, wind energy systems are viable and cost-effective. Yesterday, we heard from a utility that they are paying 3½¢ kWh for avoided costs. Perhaps there is something on the mainland that allows for systems to be installed at higher avoided costs. There should be some mechanisms to allow the gap to be narrower on the mainland than in Hawaii. Perhaps certain things apply here that don't apply there.

Answer:

Tom Gray - American Wind Energy Association

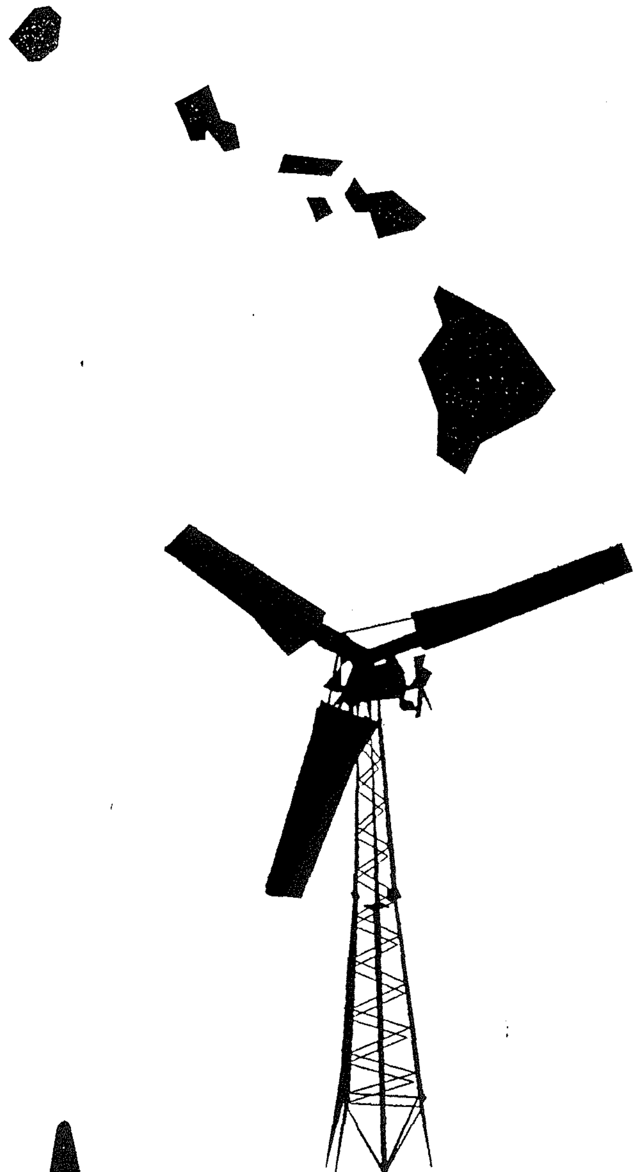
Part of the answer is that many of the systems which have been installed on the mainland were installed under utility contracts that are no longer being offered because the avoided costs applied at the time the contracts were negotiated are higher than the avoided costs for which systems are currently being installed under.

3.4 Panel 7: Integrated Resource Planning

3.4.1 Panel Chair:

David Moskovitz – Regulatory Assistance Project

Presentation charts follow



THE HAWAII WINDPOWER WORKSHOP

Integrated Resource Planning

David Moskovitz

The Regulatory Assistance Project

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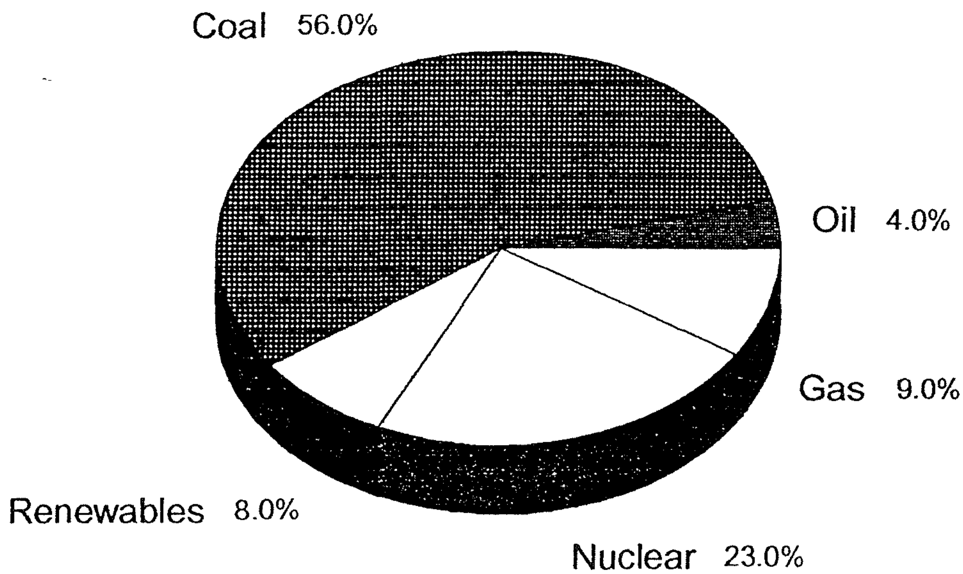
Phone (207) 582-1135 Fax (207) 582-1176

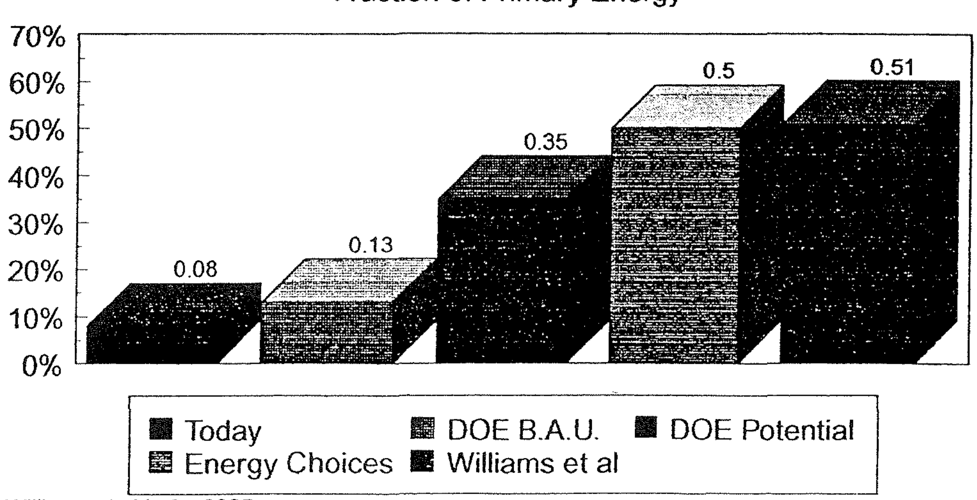
U.S. Electricity Generation



Possible Scenarios

Renewable Energy By 2030

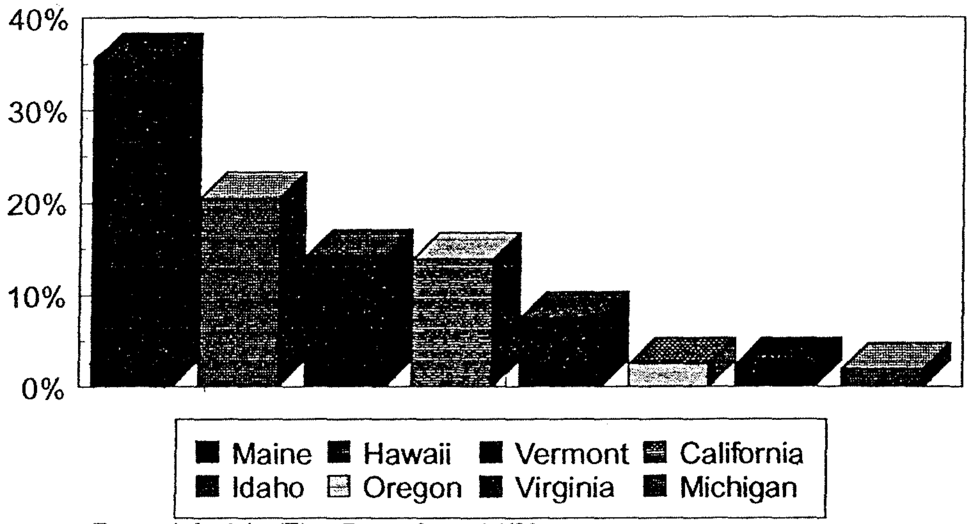
Fraction of Primary Energy



Williams et al is for 2025

State Status
% of Renewable Capacity

Grid-connected Only, Excluding Public & Utility Hydro



Source: Energy Info. Adm./Elec. Power Annual 1/92

Renewables

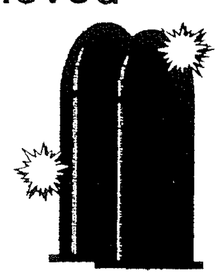
- Cost have come down
- Performance and reliability are up
- Renewables are very diverse so IR[illegible] is a must

IRP Framework

- LCP tells you what a resource is worth
  - The more competition increases the options and lowers prices
- The more diverse the resources (and renewables are very diverse)
  - The more you need LCP
  - The more sophisticated the tools must be

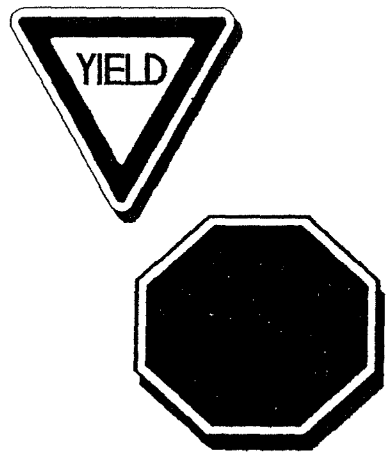
No Magic Bullets

- There are barriers to be removed
  - Planning
  - Acquisition
  - Regulation
- There are policies and program initiatives to be pursued

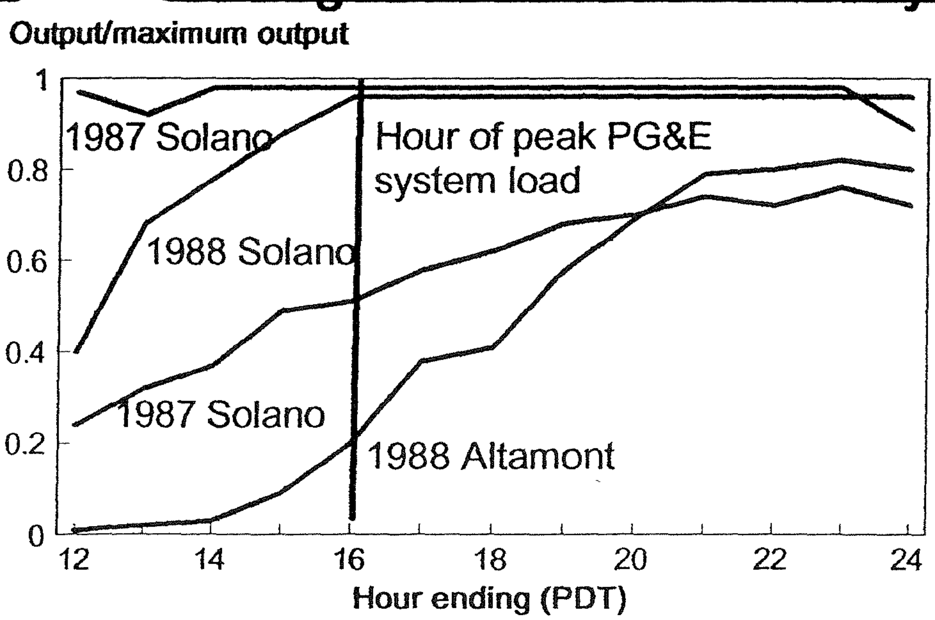


Planning Barriers

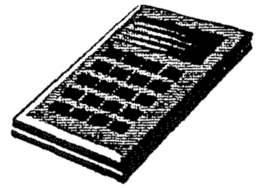
- Resource specific avoided cost
  - Dispatch
  - Intermittent
  - "Need"
- Distributed value
- Reliability
- *Risk/uncertainty*
- *Externalities*



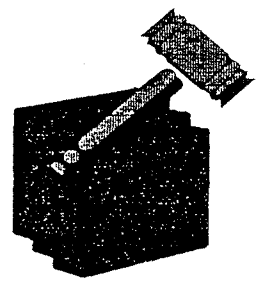
Wind Plant Output During PG&E Peak Load Days



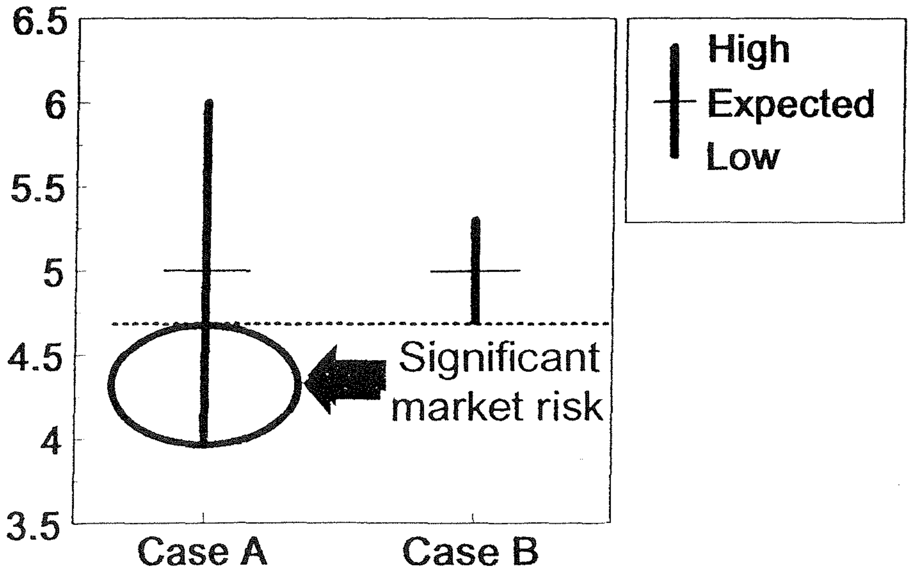
Elements



- Part policy and judgment, part analytics
- Policy and judgment elements are important because utility risk assessment may differ from consumer's perspective

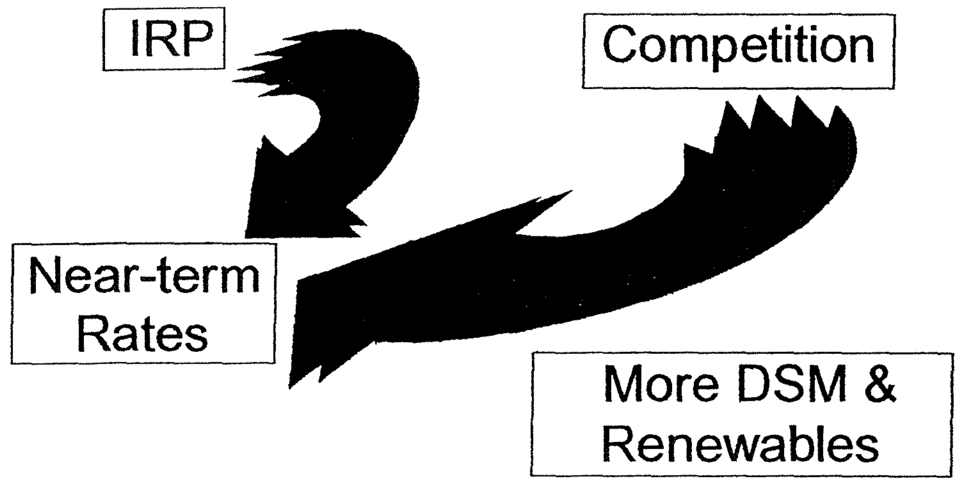


Risk Analysis



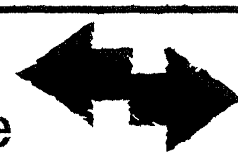
IRP & Competition

But ...



Implications for Regulators

- Diverging utility and customer interest, the greater the need for regulators

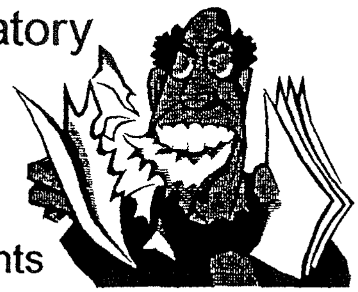


- But push for competition seeks to lessen regulator involvement

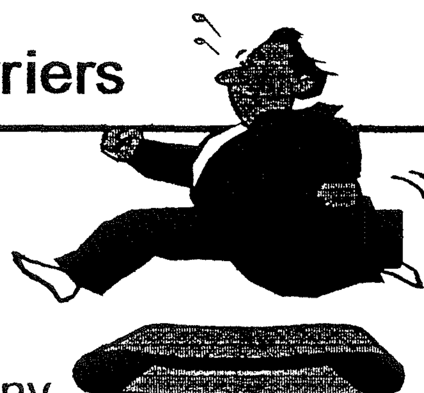
- Other option - increased customer input

Acquisition Barriers

- Unreasonable contract and pricing terms
- Apply planning and regulatory principles to acquisition
  - Payment patterns
    - Front-end loading
    - Capacity vs. energy payments
  - Security provisions
  - Contract reopeners
  - Termination of purchases



Process Barriers



- Inefficient process
- Developers are not regulatory experts
- There are not that many developers of renewables
- Commission credibility matters and is determined by consistent application of clearly articulated policies

3.4.2 Panel Members

Colette Gomoto–Public Utilities Commission (PUC)
Blair Swezey–National Renewable Energy Laboratory (NREL)
Roy Uemura–Hawaiian Electric Company (HECO)

Panel Responses

Blair Swezey – NREL

Mr. Swezey, the principle policy advisor for NREL, expanded on David Moskovitz's presentation by detailing two endorsements by the federal government on the need to perform IRP among all the utilities, in all of the states.

- *Energy Policy Act of 1992* - Congress endorsed the concept of IRP by amending PURPA to allow states to consider a standard for electric utilities to employ IRP.
  - Renewables are explicitly listed as one of the alternatives that should be evaluated in integrated resource planning.
  - A number of risk factors should be included in the deliberation process of the IRP plan, including diversity, reliability, dispatchability and others such as those outlined in Mr. Moskovitz's presentation.
- *Global Climate Change Action Plan* - a more recent federal endorsement that emphasizes the systematic consideration of all relevant options and uncertainties in the development of IRP at the state level.

In considering the value of each resource in the IRP process, Mr. Swezey concluded that the essential paradigm has to be changed from a system in which we look at the direct market cost of each resource, to a system that includes the value of each resource as well. Doing so, must include not only a consideration of direct economic costs of each resource, but a number of various attributes that each resource option brings to the resource mix. These attributes, both positive and negative, include:

- environmental impacts
- economic impacts
- diversity
- modularity
- location
- distributed benefits
- dispatchability

The most important issues to be considered in the evaluation of the IRP are the impact of these attributes on the utility system and how to quantify these attributes in terms that are comparable to the traditional monetary system of direct economic costs. Thus far, no universal method has been implemented for doing this.

In closing, Mr. Swezey said a joint venture with NREL and EPRI have recently initiated an IRP program to improve on existing IRP tools and methods in order to address some of these attributes in the IRP modeling system, particularly where renewables are concerned.

Collette Gomoto – PUC

Ms. Gomoto presented an up-to-date report of what the PUC has been doing in the area of IRP.

In 1990, the PUC instituted a proceeding to require the energy utilities to implement integrated resource planning. The PUC held meetings with utilities, other state agencies and interested parties.

The utilities on all the different islands formulated advisory groups made up of members of the community interested in the IRP process. Using input from these groups, the utilities developed their integrated resource plans and submitted them to the utility. Thus far, three utilities have submitted their plans and hearings have been held for two of them. The PUC is currently grappling with the issues of resource attributes in the IRP process, Ms. Gomoto noted.

The IRPs are intended to be evolving plans, she said. Every three years, the utilities are required to come back to the commission with evaluations of the plans that include proposals to modify the plans.

"We anticipate that the development of new technologies will impact the technology of these plans and will be included in these plans." she said.

"The commission has instituted the IRP program to encourage more efficient and innovative uses of our resources," she said. The PUC will analyze utility plans in the context of state and federal regulations and statutes and the IRP goals, one of which is to provide reliable power at the lowest reasonable costs.

While not one of the utilities has yet identified any wind power generation in their IRPs, in the HECO IRP docket, Makani Uwila has intervened and presented information to the PUC on wind power and other types of renewable resources.

"The commission has found the information very helpful in making its decision on the IRP process. Participation in these dockets is one of the best ways to get information to the commission about the different kind of technologies that are out there and the different ways of evaluating renewable resources," Ms. Gomoto said in closing.

Roy Uemura –HECO

Mr. Uemura, as a representative of the IRP Program for HECO, MECO and HELCO, emphasized that IRP is a broad band, very involved process of looking at different energy resources.

"You have to go through many steps. We look at objectives, provide scenarios and perform the planning functions in which we look at both sides of energy resources, the demand side as well as the supply side," he said.

On the supply side, he explained, HECO investigated all different types of technology for both the general technology and for the fuels available to Hawaii. There were many different options considered for Hawaii, one of which was wind power. Looking at the different options, we then integrated the demand side and supply side attributes of each to come up with a twenty year plan which included a detailed five year plan of action that was costed out.

The IRPs for each of the utilities were then submitted to the PUC for approval:

- HECO - submitted 7/1/93
- MECO - submitted 12/15/93
- HELCO - submitted 10/15/93

The PUC has just recently concluded hearings on the HECO IRP and is in the process of conducting hearings on the HELCO IRP.

The IRP is a dynamic process in that annual evaluations to the PUC are required for each utility. In the annual evaluations, the utility evaluates its forecast to see if assumptions have changed and to determine what the impact is on the five year action plan.

After three years, a major filing of the plan is required to update the technology which will include all new information with regards to wind power, Mr. Uemura said.

Currently, the big question with wind power is, what is the capital cost? he said. What is the O&M cost, what are the current costs, and are there any royalties? The IRP process is a balancing act to accommodate all the different perspectives:

- The corporate / financial perspective to minimize costs and minimize revenue requirements
- The customer perspective - to provide low, reliable service
- The state perspective - for which the viability of the economy affects pricing of these resources

Mr. Uemura outlined several areas of evaluation in the IRP process:

- Energy efficiency of all the different options [Wind is an available resource but we need to produce data and evaluate that data in order to integrate wind into the supply side of the IRP, he said.]
- Environmental and social impacts
- Current laws and regulations
- Current generation mix [Should we include oil, coal, biomass etc.?]
- Transmission costs
- Externalities [While not yet monetized, externalities are currently being addressed.]

Supply side options are categorized based on the current status of the technology:

- Commercially available, proven technology [Wind is categorized as such]
- Developing technology [i.e. photo voltaic]
- Other future alternatives

In closing, Mr. Uemura emphasized that the IRP process is a big balancing act for the utilities.

"We have to make sure we get enough oil for Hawaii's energy needs and at the same time try to use our natural resources to provide that energy while keeping costs as low as possible," he said.

Question:

When you say that the cost of oil is cheap, aren't you ignoring the externalities and the risks you have asserted add to the cost of oil?

Answer:

David Moskovitz – Regulatory Assistance Project

Yes. Oil is really more expensive if you consider all of its costs and a whole lot cheaper if you consider only its direct costs. Oil is perceived to be cheap. However, the low direct cost of oil has a powerful influence on resource decisions being made by the utilities right now.

Question:

It is difficult to quantify external costs. Is it so difficult that it is meaningless? Is real progress being made to quantify these costs?

Answer:

David Moskovitz –Regulatory Assistance Project

It is important not to lose sight of the importance of the direct cost benefits. Sophisticated analyses of the direct cost benefits had a big impact in Maine where they went from 2% to 35% renewable energy sources in just ten years. Maine does not consider environmental externalities nor the economic benefits in the externality calculation. All of its resource planning is based on direct cost benefits.

In addition to direct costs, it is good to look at consumer rate costs and all of the components that go into utility revenue requirements. That figure has a very wide range.

As far as externalities are concerned, it is difficult to quantify these. At the same time, there is a relatively narrow range of values you can come up with when looking at a broad range of options. Presently, there are nine states that put values on externalities. All of these states have developed figures in the same ball park.

Another group of states uses a *rule of thumb* consideration such as a 10% premium for non-fossil fuel based facilities.

As for other attributes like diversity, everyone knows that it is worth something extra to have a more diverse system.

In Colorado, a state that did not consider environmental externalities, the Public Service Co. boasted, rightfully so, that it went well beyond the regulations of the Clean Air Act to control polluting emissions from its energy plants. When you calculate how much extra they paid to go beyond the regulations, you come up with externality figures that are in the same order that the environmental groups were pushing and the utilities were opposing.

By presenting the utility with different Plan A and Plan B options, you can illustrate to them the surprisingly small investment required to pay for a more diverse system under different alternative scenarios.

Question:

What role will wind play in the HECO IRP?

Answer:

Roy Uemura –HECO

It is difficult to give a capacity credit for renewables since they are competing with demand side resources and other firm capacity resources.

David Moskovitz –Regulatory Assistance Project

The conclusion that intermittent resources have no capacity value is one of the mistakes that state/utilities make. The best way to think about this issue is in terms of customer loads which are intermittent and not dispatchable by the utility. Water heater demands on a utility system is a good way to illustrate this point (unless you have a direct load control device for your water heater).

Water heaters represent an intermittent demand because they have internal thermostats that determine demand. When that water heater is turned on, the instantaneous demand on the utility system (comparable to the nameplate rating on a wind turbine) is roughly 4 kW. The diversified demand on a typical utility system, or the demand that those water heaters place on the system (taking into account the probable distribution of those water heaters being on and off) is about 1 kW.

Thus, adding electric water heaters increases the requirement for firm capacity on a typical utility system by 1kW per water heater.

If adding intermittent demand increases firm capacity requirements; then adding intermittent supply, when you know something about supply characteristics, also adds a capacity value.

If intermittent supplies did not have capacity value, then intermittent demands would not have capacity costs. And everyone in this industry knows that intermittent demands also have capacity costs because the rate payers are billed every month for these.

What you need to know is the probability of an intermittent supply being available when your system's demand peaks. And every resource that is intermittent in nature will have some capacity value. If you arbitrarily say that intermittent supply has no capacity value, then you will miss the real value of these intermittent resources to the utility system.

Question:

The IRP process was expected to impact renewables positively. Why haven't renewables fared better in the IRP process?

Answer:

Roy Uemura –HECO

On Oahu, you need land and you need the technology. In the case of wind, we included 50 MW of wind power in our resource assessment. We consider that as a noncapacity benefit although it was an energy savings.

We also looked at cost trade offs and at other technologies. However, we did not have enough information on energy availability, and the costs of energy for renewable resources.

In Hawaii, we are competing for land with other developments, so land is not readily available. In addition, the direct cost of oil went down in January to $12/barrel.

David Moskovitz, Regulatory Assistance Project

The IRP process in Hawaii is not yet fully refined to give a true picture of benefits of renewables to a utility system.

Appendix F
Session 4

Presentation Charts, Panel Responses, and Questions and Answers

4.0 Stakeholder Perspectives

4.1 Opening Comments

Panel Chair: **Ron Lehr, Consultant**

Panel Members: **Warren Lee,** Hawaii Electric Light Co. (HELCO)
Tom Jezierny, Maui Electric Light Co. (MECO)

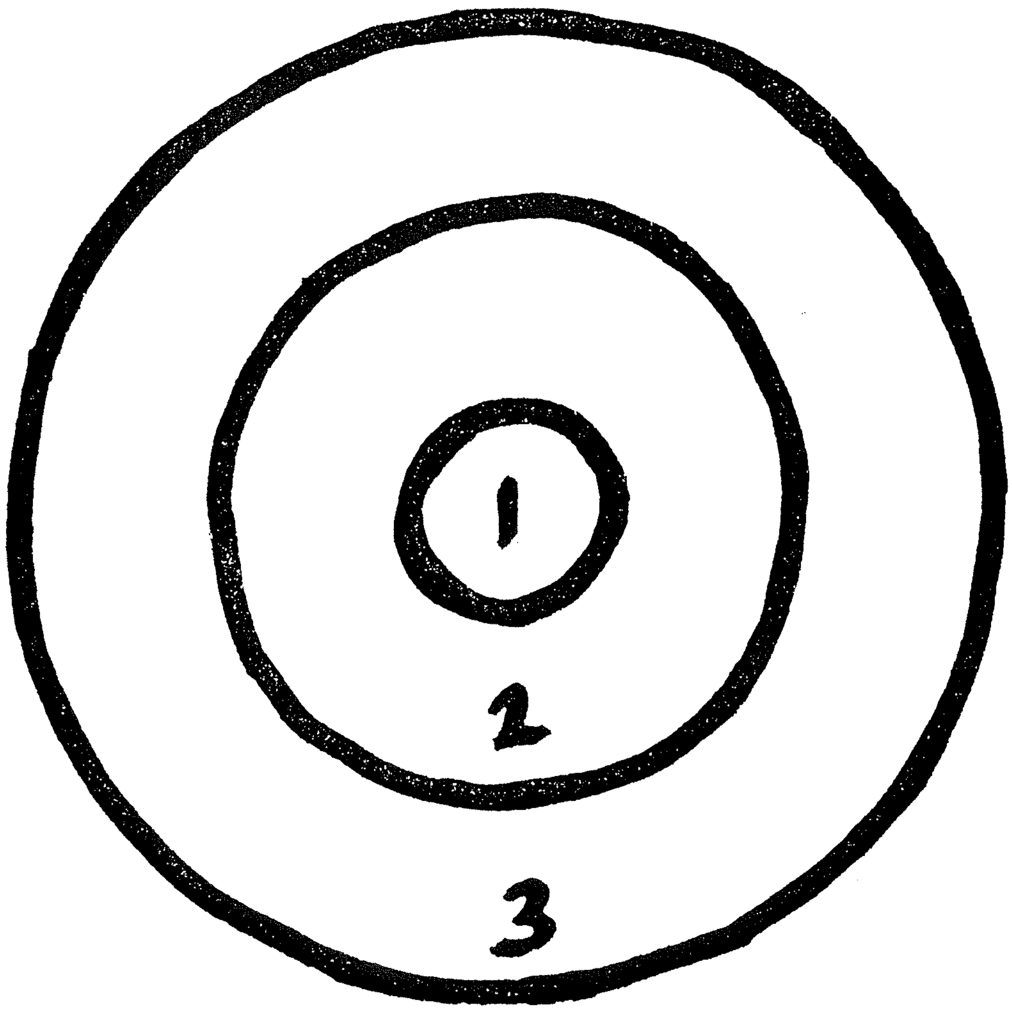
Presentation charts follow

STAKEHOLDER ANALYSIS

1. KEY STAKEHOLDERS
   "but for" their participation, no success
   hold decision power
   make financial decisions
   veto power

2. SUPPORTING STAKEHOLDERS
   affected interests
   facilitate key stakeholders
   strong claimed interest
   helpful, supporting roles

3. OTHER INTERESTS
   nice to have
   broader, related interests



Ron Lehr

INVOLVING STAKEHOLDERS

1. **GIVE NOTICE**
   interests will self-select
   work with informal due process

2. **LIST INTERESTED PARTIES**

3. **USE MULTIPLE APPROACHES**

build an information base and remember each area of technical expertise:

- engineering
- economics
- law
- finance
- accounting

move toward consensus building:

- agree on process
- agree on groundrules for participation
- agree on options
- work toward a consensus recommendations
- use single text negotiation

save litigation for remaining issues.

Ron Lehr

REASONS FOR UTILITIES AND COMMISSIONS TO COMMERCIALIZE RENEWABLES

1. ENVIRONMENTAL CONCERNS

2. COSTS AND RISKS OF FOSSIL FUELS

3. NEW TECHNOLOGY PRODUCTIVITY

4. CUSTOMER PREFERENCES

5. UTILITY COMPETITIVE ADVANTAGE

RENEWABLES COMMERCIALIZATION

1. 5 TO 10 YEAR COMMERCIALIZATION PERIOD
2. DECLINING COST TECHNOLOGIES
3. UTILITY INVESTMENT CREATES DEMAND
4. MANUFACTURING SCALE ECONOMIES
5. DECLINING COSTS, BROADER APPLICATIONS
6. NET COMMERCIALIZATION PERIOD BENEFITS

<u>NOT</u> NUCLEAR POWER

-MODULAR TECHNOLOGY

-VAST PUBLIC SUPPORT

ELEMENTS OF SUCCESSFUL COMMERCIALIZATION STRATEGY

1. SHARED VISION
2. PARTNERSHIPS BASED ON COMMON INTERESTS
3. LEADERSHIP
4. COLLABORATION
5. PLANNING
6. ORGANIZATION
7. COORDINATION
8. COMMITMENT

NRELSLID

Ron Lehr

PV-COMPACT

PhotoVoltaic - COllaborative Market Project to Accelerate Commercial Technology

TEAM-UP

(Technology Experience to Accelerate Markets in Utility Photovoltaics)

STEP PLAN

(STate Efforts for Photovoltaics)

RETA

(Renewable Energy Technology Analysis)

NASUCA PVEP

(National Association of State Utility Consumer Advocates PhotoVoltaic Education Project)

RECOMMENDATIONS:

1. **SET ASIDES FOR RENEWABLES IN IRP**

2. **RENEWABLES RFP**

3. **FUNDING MECHANISMS**

   utility cost recovery, incentives
   green pricing
   green bonding

4. **PROJECT DEVELOPMENT TEAMS**

HIWINDSL

Ron Lehr

Hawaii Windpower Workshop

Session 4: Stakeholder Perspectives

To provide an overview of approaches to facilitate the proactive involvement of the key stakeholders to enhance the use of windpower in the electric utility.

Utility Perspectives:

- IRP is the means to "facilitate the proactive involvement of the key stakeholders to enhance the use of wind power in the electric utility."
- Stakeholders can become involved through intervention, membership on IRP Advisory Groups, public meetings, etc. Stakeholders should become familiar with IRP filings, testimonies, hearings, decisions, action plans, etc.
  - Utility Action Plans proposed include:
  - Forecasting
  - Demand Side Management
  - Supply Side Resources: includes Renewable Energy Studies
  - Externalities
- The latter two items are opportunities to address the workshop goal of "identify appropriate mechanisms for consideration of wind power within the IRP process
- Integrated Resource Planning IS the ball game.

Tom Jezierny, MECO

Hawaii Windpower Workshop

Utility Perspectives

- **Regarding the session goals, developers can "enhance the use of wind power" by working with the electric utility regarding its concerns as a stakeholder:**

  1) New Utility Paradigm; Strategic Plan themes:

  – Customer Service: Energy Services (not just electricity) to retain/gain customers in light of competition.

  – Cost Containment: save money, keep product cost competitive with Purchase Power, Self-Generation, Energy Service Companies, etc.

  2) Provision of Wind Energy:

  – Quality and Reliability of power/energy supplied.

  – Customers and PUC/CA attention focus on the utility, not the wind energy developer.

  3) Costs:

  – Recovery impacted with too little wind (less than forecast in rate case decisions).

  – Financial impacts as a result of customer equipment damage claims.

  4) Ownership Alternatives:

  – Conservatism of Utilities

  – Conservatism of Isolated Utilities

  – Conservatism of Isolated Utilities with Unhappy Wind Experience

Tom Jezierny, MECO

4.2. Panel 8: Public Perspectives

4.2.1. Panel Chair:

Clyde Murley – Natural Resources Defense Council, Berkeley, CA

Presentation charts follow

WIND POWER'S NICHE IN HAWAII:

SOME THOUGHTS ABOUT ADVANCING

THE PUBLIC INTEREST

Clyde Murley
Natural Resources Defense Council

THE NEW ENERGY PLANNING STANDARD:

"EXTERNALITIES" JUST AS IMPORTANT TO ACCOUNT FOR AS "INTERNALITIES"

INTERPRETATION:

PUBLIC INTERESTS PUT ON A PAR WITH PRIVATE INTERESTS

OR

STOP HIDING THE REAL SOCIETAL COSTS OF ENERGY CHOICES

OUR CHALLENGE, VIS A VIS WIND, THEN:

APPLYING THE PROPER DEGREE OF PUBLIC IMPETUS TO THE ISSUE OF WIND DEVELOPMENT

KEY HURDLES :

- <u>institutional inertia</u> -- most of our expertise and experience is in weighing private costs; institutions have grown up with this focus

- <u>analytical/methodological</u> -- many important externalities are resistant to monetary quantification

- <u>organizational</u> -- the private sector is inherently well organized and motivated around a single issue--profitability--while the "public" is inherently dispersed, generally poorly funded, and to the extent organized, around multiple and diverse interests.

IN SUM: THE "PLAYING FIELD" IS SIGNIFICANTLY TILTED IN FAVOR OF REPRESENTING PRIVATE OVER PUBLIC INTERESTS.

THE QUANTIFICATION / MONETIZATION ISSUE

- o quantifiability is <u>NOT</u> a measure of importance
- o resistance to quantification is <u>NOT</u> grounds for ignoring or for relegating to secondary importance
- o "unmasking" the true social costs of energy options is only partially a task of quantification
- o tools of analysis and decisionmaking processes need to be able to meaningfully integrate quantitative and qualitative information.
- o we know what the <u>wrong</u> value is for important but quantification-resistant concerns: ZERO

TYPICAL COST COUNTING BIASES

toward impacts that are:	against those that are:
o local	o global
o present or near term	o further into the future
o direct	o indirect
o obvious, simple	o subtle, complex
o certain	o less than certain
o high probability	o low probability
o readily quantifiable	o resistant to quantification

THIS PATTERN OF BIAS CAN SKEW DECISION MAKING AWAY FROM THE PUBLIC INTEREST

SOME PITFALLS TO AVOID WHEN WEIGHING THE LOCAL/ACUTE ISSUES TOGETHER WITH THE BROAD/DEEP ISSUES

- overemphasis on the local/acute issues
- ignoring costs borne by those beyond Hawaii
- discounting costs borne by future public (Hawaiian or other)
- devaluing or ignoring low probability or uncertain events with high adverse consequences

LOCAL PUBLIC ACCEPTANCE ISSUES

LAND USE

- ~15-45 acres per MW.
- typically, only 5% of this dedicated to wind project
- leaves 95% available for compatible land uses (e.g., livestock grazing, some agriculture)
- no land used for fuel extraction, processing, transportation, disposal

LOCAL PUBLIC ACCEPTANCE ISSUES

AVIAN ISSUES

- currently most prominent environmental concern for windpower: birds colliding with turbines
- raptors affected disproportionately
- nature and magnitude of impacts highly site specific
- mitigation strategies for bird/turbine collisions being worked on
- placing wind machines outside important flyways is obvious preventive mitigation strategy

LOCAL PUBLIC ACCEPTANCE ISSUES

AESTHETICS

- visual
- aural
- contextual

BROAD/DEEP ISSUES

- o resource depletion
- o pollution, ecological degradation
- o public health impacts
- o coincidence of benefits with costs
- o mitigability of impacts
- o respect for the "future public"
- o integrating global and local concerns
- o prudence in face of uncertainty
- o mitigability and reversibility of risks and impacts

WHEN THESE ARE TAKEN INTO ACCOUNT ALONG WITH LOCAL/ACUTE ISSUES, WIND COMPARES VERY FAVORABLY TO FOSSIL-FUEL RESOURCES.

MONETARY ESTIMATION OF ENVIRONMENTAL IMPACTS BY RESOURCE: PRELIMINARY, BUT NEVERTHELESS INSTRUCTIVE......

RESOURCE	ENVIRONMENTAL "COST" ($ per Kwh)
COAL	$0.025 to 0.058
OIL	$0.027 to 0.067
SOLAR	$0 to 0.004
BIOMASS	$0 to 0.007
WIND	**$0 to 0.001**
ENERGY EFFICIENCY	$0

ADVANCING THE PUBLIC INTEREST

SOME NECESSARY CONDITIONS:

- o technical and subject matter expertise
- o prior existence of appropriate policy and decisionmaking forums
- o extensive involvement in decisionmaking processes
- o building consensus (w/ own group and with other stakeholders)
- o devise creative approaches
- o <u>resources to achieve all of the above</u>

PROBLEM: THESE CONDITIONS ARE SELDOM MET

"IN-STREAM" ASSESSMENT OF THE ADEQUACY OF REPRESENTATION OF THE PUBLIC INTEREST IN ADVANCING EXTERNALITIES DEBATE IN HAWAII ENERGY DECISION MAKING

- o severely "outcompeted" by the private interest

- o most externality concerns elevated in rhetoric, but largely inconsequential in actual decision making.

- o vis a vis wind power: institutional support is lagging behind public impetus

- o IRP is not a solution, but a framework whose potential has not yet been realized.

SOME AREAS IN NEED OF IMPROVEMENT

- o better public access and funding for participation in regulatory and legislative processes
- o legislative and PUC public advisors
- o stronger role for public in PUC's IRP advisory processes
- o increased use of public/private collaborative processes
- o strong public education effort
- o redesigning analytical methodologies <u>and</u> decision processes to be accountable to the new standards of energy planning, namely, reasonably comprehensive accounting of all costs and benefits in pursuit of true, least-cost provision of energy services.

IN CLOSING:

- o Advancing the public interest entails:

  - > "global" analysis of costs and benefits

  - > resolving global/local externality conflicts

  - > good-faith integration of both quantified and unquantified externalities with private costs and benefits

  - > overcoming institutional and organizational barriers faced by public advocates

- o Overall and generally, wind power is substantially superior to fossil-fuel-derived power from a public perspective.

- o The regulatory and legislative infrastructure is lagging behind the public interest in providing the necessary and appropriate impetus for accelerating wind development.

- o The utility perspective strongly influences whether the public interest in wind development will be served.

- o IRP is not wind's--or the public's--salvation, at least not yet.

4.2.2 Panel Members

Scott Derrickson–Hawaii Energy Coalition
Michael Jones–Union of Concerned Scientists (UCL)
Ira Rohter–Green Party

Panel Responses

Michael Jones – Union of Concerned Scientists (UCS)

As a representative of UCS, Dr. Jones noted UCS's strong support of renewable energy and cited the organization's recent study, *Powering the Midwest,* which details the use of wind power and other renewables as options in the Midwest. In addition, UCS publishes monthly briefing papers for the nonacademic public which provide overall summaries of their programs and activities in the field of renewable energy.

UCS is also working to support sustainable resources and has recently formed the group, *ACTION for Global Sustainability,* to deal with environmental issues on a global scale.

However, Dr. Jones believes much work lies ahead in overcoming the public's skepticism of government that has evolved over the years. Referencing work that his organization has been involved in recently in assessing the reliability of environmental impact statements (EIS), Dr. Jones illustrated the public's justifiable skepticism toward government.

The EIS for the refurbished Polaris missiles used in the launching of the Star Wars Program from Kauai, gave these missiles a reliability rating of 97%. After gaining access to the documents that the EIS was based on, and the particular study that was used to calculate the reliability, it was found that the reliability rating was obtained only by assuming 100% reliability for the first and second stage rocket motors, which are the most critical components of this missile, Dr. Jones said.

"This is an example of hiding details that are crucially important to discussions about reliability," he said. "If one is quoting reliability of a wind turbine, one needs to say under what conditions that reliability rating was obtained. If there is actual operating data, say what that is."

Another incidence of the public's interests not being served involved the actual significance of the impact on Kauai. One of the rocket launch pads for the *Star Wars Project* was located on a site adjacent to an ancient Hawaiian burial ground, Nahili Dune, a fact the EIS felt was not a problem while the Hawaiian community felt it was a very serious problem indeed.

Dr. Jones outlined another example of a questionable EIS involving the storage of radioactive waste material on Oahu. In this situation, the EIS presupposes what would happen if a large aircraft smashed into one of the two containers of radioactive wastes located at Pearl Harbor. According to the EIS evaluation, the risk of cancer would be increased by seven to eight cancer deaths as a result of the release of the radioactive matter. However, no actual statement was made of what the economic impact would be on the state of Hawaii as a result of the release of radioactive matter.

"It seems obvious to me that it would be pretty devastating," Dr. Jones said.

Cases like these, make it difficult for the public to maintain a trust in government. And for those who are trying to promote renewable energy, it is important to keep this in mind in dealing openly with the public.

"It is not a burden that you necessarily bring on yourself, but it is something that you will have to deal with," Dr. Jones said in closing. "It is sometimes said that nations do the right thing eventually but only after exhausting all other possibilities. I hope we can do better with wind power."

Scott Derrickson – Hawaii Energy Coalition

As a public advocate, Mr. Derrickson noted that he had to take time off from his gainful employment in order to participate in the Hawaii Windpower Workshop. He emphasized this to illustrate how difficult it is for the public to get involved in the policy decision making process.

In responding to what Clyde Murley had said, Mr. Derrickson urged the proponents of wind power to become proactive.

"You need to be on the front line pushing the development of tools to better address externalities because IRP requires it and because, wind energy has more positive externalities than the fossil fuels it is competing with to get on the grid," he said.

As Hawaii shifts toward an increase in the use of renewables, there is going to be a shift in the local impacts as well.

The state has been riding serendipitously because of its reliance on fossil fuels, and the impacts of that are not felt here locally. Biomass, a primary source of energy on the outer islands, is a byproduct of something that has a long-standing social acceptance here in Hawaii. As the sugar industry begins to phase out here, that source is also going to be phasing out. In shifting toward an increase in renewables, the general public will need to be educated about the impacts that will need to be taken locally, he said.

Although wind power only uses a small percentage of land area to generate electricity, there is still much room left for the development of compatible land uses. Proponents of wind power need to determine what those locally used compatible land uses might be and where they might be appropriate.

Mr. Derrickson disagreed with Mr. Murley's inference that the transmission corridor issues might be less of an issue here in Hawaii. The issue of whether transmission corridors should be located underground or not is becoming an increasingly debated concern here in Hawaii, he said.

The avoidance of sitings along flyways is a complex issue that needs to be addressed, hopefully through the Hawaii Energy Strategy. As far as noise impacts are concerned, technology is being developed and will soon be available that might mitigate this problem, he said.

Here in Hawaii, the issue of cultural impacts has increased with every single decision that involves large scale land use. Although wind power may occupy a small area of land, there is no way to avoid the cultural impact, he said. Wind power developments will tend to have a fence built up around large areas of land in order to keep the public out of the area. This is an especially important issue when it involves state lands that are part of the ceded land trust which will invoke considerable attention from the native Hawaiian population.

In the state government, there is a long history of noninvolvement or downright exclusion of public participation which is going to take a long time to overcome.

"For three or four years now, I've been involved in a number of workshops and forums that involved great effort on the part of government and the utilities to include the public in some meaningful way, but the public just does not come around too easily. It is going to take a long time to overcome this, partly because government does not have a whole lot of experience in meaningful public involvement. I think everyone is going to have to work hard to overcome this," he said.

In assessing the notion of a PUC intervener, Mr. Derrickson perceived this as a very good idea. An environmental ombudsman would serve both the general public's interests as well as government and the utilities interests by bringing a more focused public set of issues and concerns to the PUC and legislative processes.

Ira Rohter – Green Party

As an outsider observing the proceedings of the workshop, Dr. Rohter found the basic question implied in the actual subtext of what was being said was, *"How come so little has actually been done in implementing windpower if Hawaii is such an obvious place with its abundance of wind resources?"*

In addressing that question, Dr. Rohter provided some answers to this question and drew some hopeful signs. To start off, he addressed the issue of policy making in Hawaii which, he said, represents an area of enormous lack of trust between the government and the general public. Decisions about land involve developers interests, a great deal of wheeling and dealing, the infamous good old boy network entrenched in Hawaii, well organized self-interest groups and the big money always wins, he said.

The environmental impact statements are too often meaningless, superficial, and inaccurate examples of why people don't trust government.

Hawaii is a one party state, a statement evidenced by the narrow clique of people that have been in power over the past forty years with only a token representation of Republicans whose minority viewpoint is not taken seriously. The minority parties have in effect, no political clout, as such, no fresh ideas are injected into the governing system.

This legacy from the plantations days represents a colonialized mentality, where bosses make the rules and the peons simply obey, a practice deeply entrenched in the governing systems of this state. Decisions come down from the top and are passively accepted by the average person.

The *we know best* mentality permeates the thinking of top public officials in the state, city and county government. They reluctantly take citizen input and generally ignore major or important input from public interest groups. Government in Hawaii strongly resists the notion that the public and key stakeholders should be involved from the beginning of the project as equal partners, he contended.

"To be fair to the few progressive officials in this state, there is too much nihilism from the public side as well. In a society where private self interest prevails, people are quick to jump on the principle of my rights. Unfortunately, we have no good mechanisms for people to share responsibilities, as well as, consider the overall well-being of the community," he said.

"We need to create a new methodology for public involvement in policy making in the state of Hawaii. There are very few forums for policy making that directly involve local citizens and affected communities," he said outlining some principles for community planning:

- Participatory democracy - The involvement of many is a functional part of any planning process. The public will not overlook the important social and environmental impacts involved since they are the ones most affected.
- Citizens need to be vested with some sort of real authority in making planning decisions, not just confined to advisory roles.
- Support from the top is absolutely critical. Financial and staff resources for organizing, planning, informing and implementing of a community-based plan are required to implement and monitor the policy and adjust it under new circumstances.

- The biggest failure of leadership in the state of Hawaii has been to exclude the public from the planning and policy making processes.

  "The buck stops at the top, literally in many instances," he said adding that public planning needs to have a wide-based steering committee that represents a divergent group of people with different points of view. We need to educate the concerned citizens, stakeholders and officers alike in the issues that are being explored."

- Don't produce more studies and lists of recommendations.
- Do come up with specific actions and implement them.
- Lastly, it is tremendously important that we have enlightened leaders with respect for the public and the understanding of the need for citizen involvement, he said in closing.

As a representative of the Green Party, I find it sad that so many of our elected officials and candidates for the governor's office are still living in the past in terms of their understanding and their advocacy of the issues of renewable energy resources and conservation, he said.

Question:

Is there any proactive environmental organization that can represent the environmental concerns and intervene on behalf of the public in the IRP process?

Answer:

Clyde Murley–NRDC

There was an opportunity taken by the NRDC in the HECO IRP process to intervene and strongly support the development of wind and renewable energy in Hawaii. Going beyond that, there is no one comprehensive broad based environmental organization that represents the public interests. Different organizations have different mandates and agendas and are not all looking broadly. There is an opportunity for environmental groups to educate each other and integrate each other's viewpoint into a global platform.

Ira Rohter, Green Party

A stunning example of many people representing a wide spectrum of energy and environmental interests coming together to build a consensus was witnessed last year at the *Energy and Environmental Summit.* Unfortunately, many felt their efforts were thwarted at the legislature this past session by its failure to enact those bills resulting from discussions at the summit.

However, there are mechanisms in place and I think the challenge is to come up with positive economic programs to address public concerns. In other words, we need to get people at the top to start to pay attention and that is, I think, part of what has to happen here.

THE HAWAII WINDPOWER WORKSHOP

Regulatory Perspectives

David Moskovitz

The Regulatory Assistance Project

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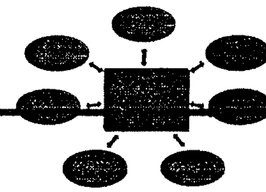
IRP



- Essential for accurate comparison of very different resources

- Do not confuse principles with a particular regulatory process

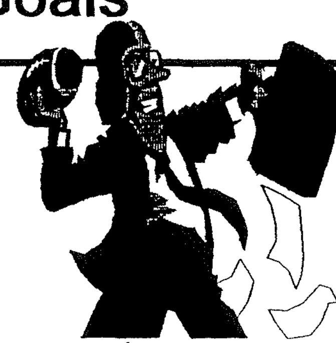
New Initiatives

- Green Pricing
- Supply-Side Incentives
- Green RFPs
- Set-asides
- Safe Harbor Rules

Green Pricing

- Optional electric utility service for customers who want to increase their utility's reliance on renewable resources
- When a customer elects the green pricing option, the utility obligates itself to acquire **new** renewables
- Price premium is intended to cover the incremental cost of the new renewable resource.

Green Pricing Goals



- Develop and test a market-based mechanism
- Test customer willingness to choose an environmentally preferred resource mix
- Assist in the sustained orderly development of renewables

Essential Elements

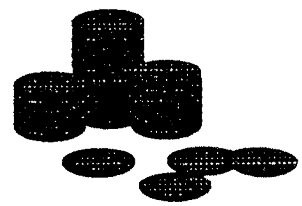
- Alternative utility product or service
- Customers get renewables over and above what an LCP would dictate, i.e. non cost effective 
  - Why not cost effective?
    - Technology
    - Timing
    - Low utility avoided costs
    - Site conditions

Supply-side Incentives

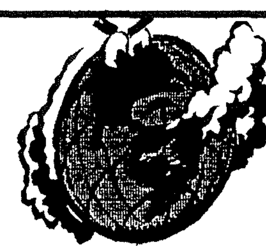
- An indirect way to begin removing contract and planning barriers
- Effective incentives could be very small
  - Compare 1 mil incentive to 15 mil tax credit
  - NEES Green RFP would be a $200,000 incentive per year

Supply-side Incentives (continued)

- Wisconsin is only state with incentives (May 93)
  - .75 cents/kWh for wind, PV, solar thermal
  - .25 cents/kWh for biomass, MSW
- Puget 's "1 mil provided that..." proposal rejected



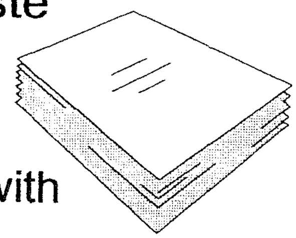
Green RFPs



- Objectives
  - Learning and resource planning benefits
    - Options to address tightening environmental requirements and global warming concerns
    - Possible "no regrets" strategy
  - Environmental benefits
    - Greenhouse gas emission reductions
    - Zero emission resources

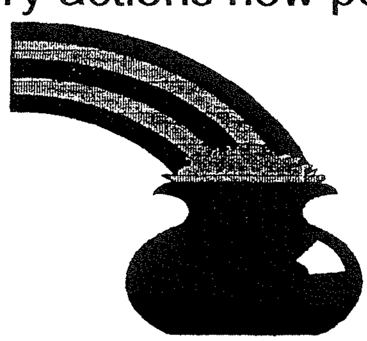
Green RFPs (Continued)

- Targeted solicitation for waste and renewable generation
- Preferred projects
  - Use fuels and technologies with strong resource potential
  - Not fully explored in New England
- Less preferred projects
  - Do not expand renewable knowledge base
  - Significant environmental impact
  - Significant cost



Bottom Line

- NEES got more options more cheaply than they thought
- Regulatory actions now pending

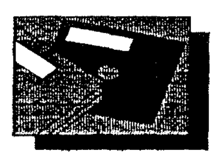


What is a Set Aside

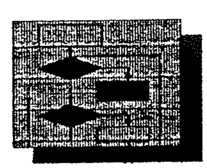
- A portion of an integrated resource plan devoted to learning about renewables
- Concentrates on demonstration and commercialization
- In addition to renewables R&D
- May involve innovative means of acquisition

Set Asides in IRP
Benefits

- Regulators
  - Planning information
  - Limit utility and customer risk
  - Insurance policy value



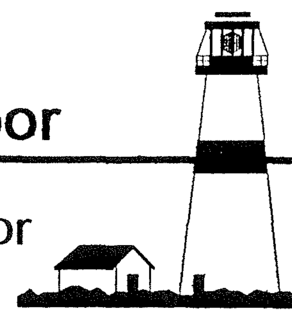
- Utilities
  - Gather planning information
  - Learn costs and benefits
  - Learn applications, technologies
  - Aggregate markets for demand pull



Set Asides in IRP Benefits (cont'd)

- Customers
  - Hedge fuel price and availability risks
  - Hedge environmental uncertainties
  - Diversity resource portfolios
    - Long-term least-cost resources
    - Natural gas bridge to renewables
- Renewable industry
  - Planning information for financing, expansion
  - Builds relationships with utility customers
  - Sell equipment, services

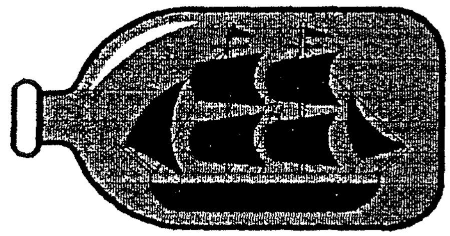
Safe Harbor



- Balances - utility desire for certainty and regulators desire to avoid pre-approval and removal of risk from managers
- The concept is simple and is used in other areas such as SEC
- By rule or decision regulators provide guidance and set forth limits within which cost recovery is more certain

Safe Harbor (continued)

- Differs from pre-approval by degree of specificity
- Examples:
  - Maine DSM rules
  - NY R&D 1% limit
  - IOWA DSM limit
- Utility remains at risk for prudent management



4.3.2 Panel Members

Collette Gomoto – Public Utilities Commission (PUC)
Ron Lehr –Attorney
Gerry Sumida –Attorney

Panel Responses

Ron Lehr –Attorney

In society, we pay investors to take risks. The tools that investors use to calculate risks and how they function have been fairly well developed by financial economics. In the IRP process, engineering economics compete with financial economics, Mr. Lehr asserted.

In utility planning, engineers generally oversee the planning process. Engineers tend to use shortcuts to get what they think of as value, according to Mr. Lehr.

In order to evaluate these long term projects in terms of today's dollars, utilities use a discounting technique to calculate the cost stream. The calculated cost stream is then multiplied by the discount rate in order to bring it back to present day value.

In calculating the cost stream, engineers borrow a term from the utility company's financial position, called the *weighted average costed capital* (WACC) to do the discounting. Engineers use that as the discounting rate.

This approach is wrong, Mr. Lehr contends because it understates the risk of fuel price and its availability risks.

WACC is what the investors have required to fund all of the facilities, including all of the oil fire and coal fire generators facilities, that the utility has in place to today. The cost in capital includes the risk of all these facilities.

If you are looking at a wind energy facilities or photovoltaic facilities, or any other alternative energy option, those technologies have their own risks. The big difference is in fuel risk. If you have to fuel a plant, then there will be a big cost stream of fuel that goes out into the future. If you look at that cost stream of fuel and apply a high discount rate such as WACC, within a few years, it looks like that fuel disappears.

Utilities can use a *risk adjusted discount rate* (RADR) in considering alternative resources. RADR is project specific and in particular, looks at the fuel cost stream over the long term future, he said. Given the fact that every fuel has different risks, those fuels that vary greatly using financial economics, would look riskier than fuels that do not vary as much. The process for calculating this discount rate is CAP M *(capital asset pricing model)* with the development of a *beta* for the fuel treated as an asset.

Colette Gomoto–PUC

The PUC considers any wind power proposal in the context of any utility's integrated resource program, Ms. Gomoto stated. It can be one of the utility's supply side reserve options. It can be submitted either as part of the utility's construction program or as a power purchase from an independent power producer for review and approval.

The PUC recognizes that renewable resources, such as wind power, are especially important to the people of Hawaii because of our vulnerability to petroleum shortages and our need to keep the environment and the skies free from pollution.

Wind power proposals must compete with other energy resources in order to be included in any kind of IRP program. These other energy resources include imported fuels, energy resources such as biomass, hydro, PV and demand-side energy resources also.

The PUC must determine that the wind power proposal is compatible with the preferred IRP in order to approve the proposal for implementation. Wind power generation with storage has not yet been identified in any of the utilities preferred plan in their initial IRPs. However, wind power resources have been considered in the utilities' screening process supply side options.

Initial IRPs are presently being reviewed by the commission and IRPs for GASCO and HEI have gone through evidentiary hearings, although no decisions have yet been made, she said.

The IRP framework does not include green pricing or set asides to foster the use of renewable resources. The benefits and costs of externalities are being considered in the ranking of resources. If the monetization of externalities is not practical than a qualitative analysis is done, she explained.

The IRP framework does not mandate air emission reductions for petroleum fuel generation over and above those required by federal and state regulations.

The broad environmental, social, cultural and public health benefits of wind power generation primarily accrue to society as a whole. In addition to consideration of these benefits with the IRP framework, the legislature could also consider incentives to foster the development of wind power resources. The cost of these benefits could then be charged, not just to rate payers, but to tax payers as a whole, she said in closing.

Gerry Sumida-Attorney

While acknowledging the importance of workshops in bringing key groups of people together to discuss the issues and advances in technology, Mr. Sumida said he was struck by the similarity in the Wind Energy Workshop held in 1984 at HNEI.

Some of the suggestions he made in addressing that workshop included the following:

• The PUC should move aggressively to implement the mini-PURPA standards to encourage development of renewable resources in the state of Hawaii.

• Hawaiian utilities should work very hard to dispel what is perceived to be an institutional attitude opposed to the development of renewable resource or obstructive of efforts of the independent power producer to obtain PURPA power purchase agreements.

• State and city agencies should work very carefully with alternative energy development and others to fashion a fast track permitting process and facilitate the development of renewable energy.

• State and counties, which have enacted alternative energy supportive legislation, should continue in that direction and should encourage regulatory agencies to facilitate that process as well.

All together, these observations represent the same themes of the current Windpower Workshop, Mr. Sumida noted with the exception of IRP and IRP issues.

By and large, Hawaii has a relatively supportive regulatory regime which is looked upon favorably and implemented by the PUC. Substantively, Hawaii does have a number of difficult issues concerning avoided costs and its concept, methodology and application. Because of the avoided cost issues, it is difficult in the state of Hawaii, for developers to get a good power purchase agreement, he explained.

It is very appropriate to discuss all of the means for developing wind power in Hawaii through various means, including permit facilitation, site assessment, data gathering, green pricing and favorable laws, externalities and IRP. However, the basic point is this, who does these kinds of projects, assuming we want these projects to be developed? Either the utilities do or private developers do because they expect to get a reasonable rate of return on their investment.

This very basic point is forgotten in the discussion of macro policy issues. But it seems obvious when it comes down to the question of wind energy development and wind power projects, you are not going to get any wind energy projects unless you have someone who is willing to buy that energy from you at a price that will support a reasonable rate of return. And the seller of energy could be a utility company, an unrecognized subsidiary of that utility or a private developer. The point is, you need that basic contract, either a negative contract with the utility or a PURPA type contract with the issue of avoided costs, he said.

The avoided costs issue in this state still represents an unclear issue in contracts as well as a major issue with respect to the PUC proceedings taking place right now.

IRP is a very good movement sweeping the country which draws vast elements of the public and other interested parties into a process, not only to assist the existing utility energy policy, but also to ensure that the policy reflects some other basic areas of concern.

The problem in this process is that there is essentially no integrated role for nonutility generational sources, including wind generational sources in the utility IRP. Is wind considered? Yes. Is wind mentioned? Yes. Is wind analyzed and assessed? Yes. Is wind considered over the long range? Yes. Is it part of the utility's plan, effectively integrated into its long range plan? No.

So, if you talk about the IRP process, if you talk about whether wind, utility or nonutility owned wind resources are effectively integrated into the IRP process, the answer is no. That is a fairly significant issue and it is not as open and shut and as clean a process as it has been made out to be during the course of this workshop. It is an issue that is being discussed in PUC hearings right now and we do not yet know what that utility IRP will look like when the PUC rules on it.

Mr. Sumida affirmed his believe in a joint collaborative process because it is better to have a total *win-win* situation than a *zero-sum* situation, even if everyone has to give a little. Nobody likes litigation since it generally has very little effect on this kind of situation.

Nonetheless, there does exist a rather unfortunate perspective in Hawaii whereby the utility considers any one involved in energy development as a competitor which promotes an *us vs. them* situation.

We all know the reason why Congress passed PURPA statutes and mandated the adoption of these statutes by all of the states, was to equalize the bargaining power between the utility or nonutility or qualifying facilities. Much has been accomplished because of PURPA.

Nonetheless, the *us vs. them* perspective is counterproductive. If there could be any effective change, it would have to be the implementation of a total cooperative agreement. Then much in terms of wind development could take place. However, it takes two to tango and so far, we do not quite have that, he said.

In the absence of that, the adversarial proceedings, taking place right now in the context of the IRP hearings with the PUC, will have to prevail even though we do prefer that alternative mode.

Question:

One area of concern for the utility is the effect of having too many sellers of power in its system and the negative impact on bond ratings and the ability of the utility to make money. Is this a problem? (Have the Wall Street analysts downgraded the bond rates of the companies with a lot of purchase power?)

Answer:

Ron Lehr – Attorney

Yes. The response has to be yes if you want the utility to involve the private power sector in their future. They have to have some upside. The utility is set up to invest money and to make a return on investment. That is the basic incentive that is in place now.

So the reform that is needed is a system that rewards the utility for it acquisitions. The utility that does a good job on acquisition, makes money; while the utility that does a bad job at acquisition and meeting its goals efficiently and on time, has a penalty. The PUC has to think of its role not only as a regulator of a monopoly, a single seller into a market, but it also has to become a regulator of a monoposony, a single buyer into a market. So now the PUC has to be concerned with things like: the content of the RFP, the evaluation process, the kind of notice to bid given, fair and open bidding, and the timeliness and effectiveness of negotiations.

Gerry Sumida–Attorney

I would like to supplement his answer in two ways:

1) The issue of power purchase and its impact on bond rating has been an issue raised at a number of PUC hearings.

   The California PUC dealt with the issue in a fairly extensive hearing. The net result was a careful dissection of the rating companies analyses, in this case Moody and S&P, which showed that the assumption that power purchases had an impact on bond rating was not well-based.

2) In Hawaii, one of the proceedings here dealt with the issue as well. Through an information request by the PUC, the utility was asked to produce material to support the impact on bond rating. The supporting material, received in the form of telexes and other issues from the rating companies, mentioned two things as impacting bond rating:

   - regulatory climate - the length of time it took to receive PUC decisions, and
   - construction costs.

   Purchase power was not mentioned as an impact on bond rating. So either it is a red herring or it is a little more complicated than it has been made out to be.

Question:

How do you include independent power producers in the IRP process when the IRP being processed by the PUC is essentially already planned and excludes proposals from independent power producers?

Answer:

David Moskovitz–Regulatory Assistance Project

Allowing independent power producers (IPP) to participate in the IRP process in the context of providing information and participating in workshops in going over the IRP, is very different from taking an actual IPP proposal and including it in the IRP. I would not recommend it. In addition to being very costly and foreign to the IRP process, it would set up a process that by its very nature, pits the supplier against the purchaser. The IRP is more a process than an implementation plan. And at the end of that process, when you have what you think is the best plan with the information that you have gotten which may or may not include all of the things that IPPs have to offer, that is when you turn it over to the competitive market.

Twenty-five states have supplemented the IRP process, essentially at the end, with competitive bidding. The purpose of that market test is to ask the independent power producers and other market players, the fundamental question: can you provide anything that lowers the cost of what I now show is my IRP. If you can lower the cost, that is another way of saying that you beat my avoided cost. Then you take it.

Providing that opportunity for competitive bidding at the end of the IRP has proven to be a workable solution to work the IPPs' input into the IRP process and minimize the standard adversarial approach and the necessity for litigation.

Ron Lehr–Attorney

The Texas Utility Electric Company, the largest utility company per kWh in the country, has issued bids for renewable energy power to use in their IRP.

Conceptually, I do not think there is a perfect way to solve this *chicken and egg* situation. The answer, I think, is for the PUC to come out and state that what you do first is only a problem the first time you do an IRP. But the second time, you would have always just done the other one, whether its bidding or planning. The second time you do it, it's not a problem.

4.4 Panel 10: Legislative Perspectives

4.4.1 Panel Chair:

Eric Sikkema – National Conference of State Legislatures (NCSL)

Presentation charts follow

LEGISLATIVE PERSPECTIVES ON WIND ENERGY

Hawaii Windpower Workshop

March 22, 1994

By
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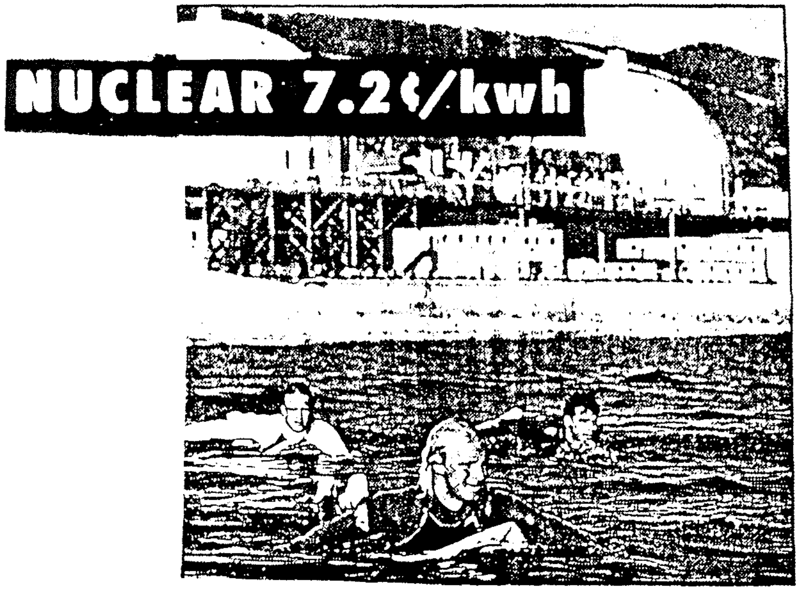
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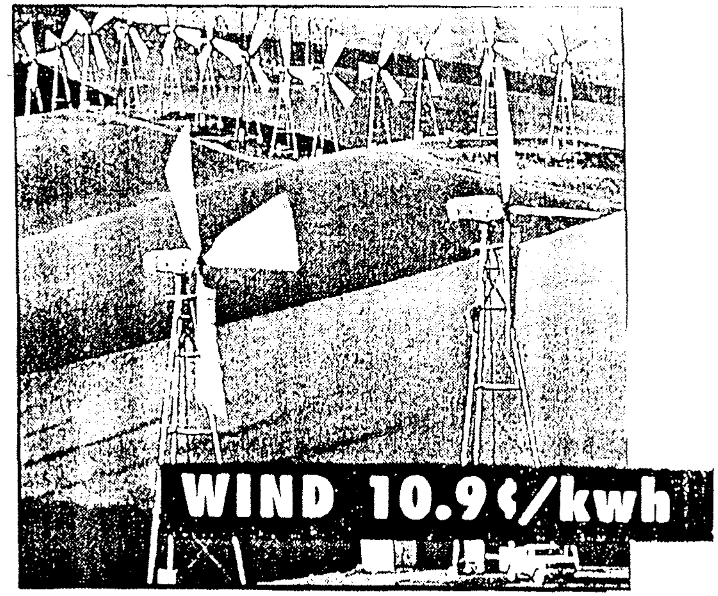
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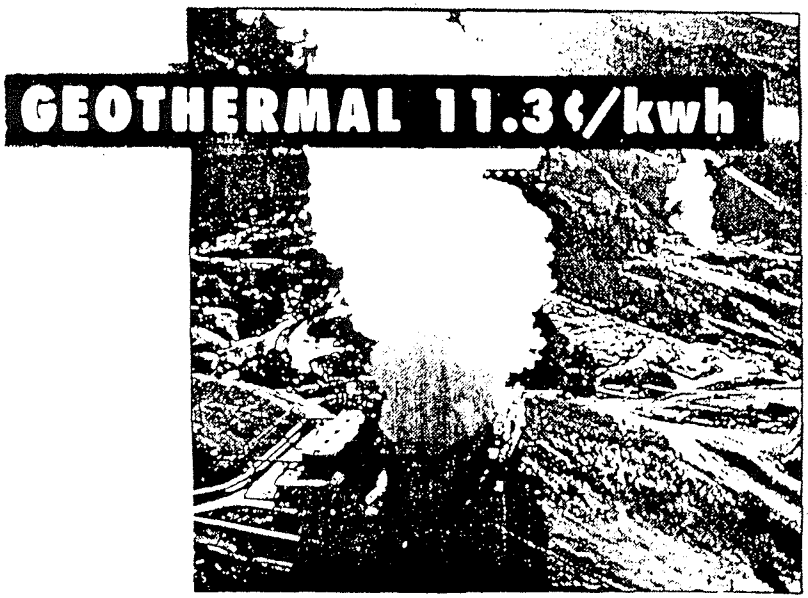
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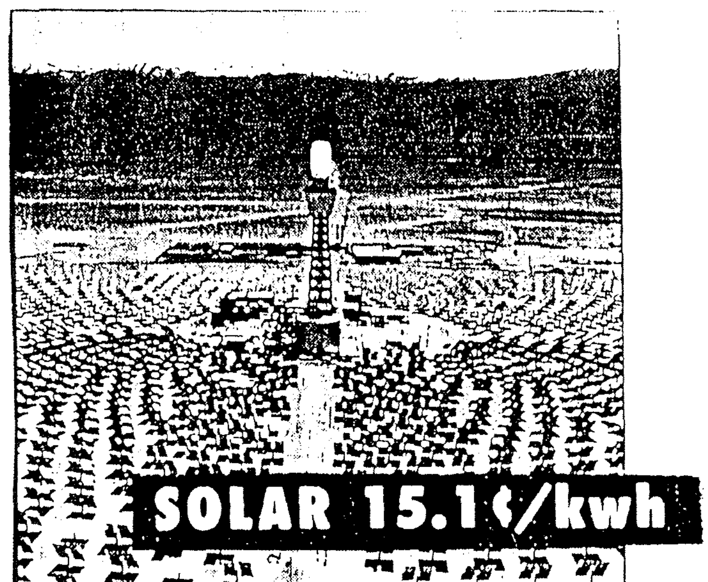
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GROWING INTEREST IN WIND

- REALIZING THE ENERGY, ECONOMIC AND ENVIRONMENTAL BENEFITS
- MANY UTILITIES ARE TAKING ACTION ON THEIR OWN
- INCENTIVES SHIFTING TOWARD COMMERCIAL AND UTILITY DEVELOPMENT
- STRONG COMMITMENT AND AGGRESSIVE PROGRAMS AT THE FEDERAL LEVEL
- FUTURE CARBON TAX ??

STATE LEGISLATION AND ENERGY PLANS ADVANCE WIND ENERGY

FOCUS AND FORCE VARIES FROM STATE TO STATE

- GENERAL "ENCOURAGEMENT" OF WIND ENERGY
- STATED PREFERENCE OR POLICY FOR RENEWABLES
- TAX INCENTIVES
- FINANCING OPTIONS
- INTEGRATED RESOURCE PLANNING
- CONSIDERATION OF EXTERNALITIES
- SET ASIDES

HIGHLIGHTS:

CALIFORNIA	NORTH DAKOTA
IOWA	SOUTH DAKOTA
OKLAHOMA	OREGON
MINNESOTA	MASSACHUSETTS
KANSAS	WISCONSIN

RECENT / CURRENT BILLS RELATING TO WIND ENERGY

TEXAS

MISSOURI

NEBRASKA

WISCONSIN

HAWAII

STATE ENERGY PLANS AND RENEWABLE ENERGY

AT LEAST 20 STATES HAVE SOME FORM OF STATE ENERGY PLAN OR STRATEGY

COMPLIMENTS EXISTING LEGISLATION

PROVIDES GUIDANCE AND STATE OBJECTIVES/GOALS

ENCOURAGES COLLABORATION AMONG:

- LEGISLATORS
- STATE ENERGY OFFICES
- UTILITIES
- PUBLIC UTILITY COMMISSIONS

WHEN WIND LEGISLATION WORKS

- ABUNDANT RESOURCES
- IMPLEMENTATION POLICIES
- QUALITY INFORMATION ON WIND TECHNOLOGY, ECONOMICS AND BENEFITS
- PUBLIC UTILITIES COMMISSION AND UTILITIES WORKING TOGETHER

STATE EXPERIENCES AND RELEVANCE TO HAWAII

1993 ENERGY AND ENVIRONMENT SUMMIT -- ENERGY SUPPLY RECOMMENDATIONS

STATE LEGISLATION CANNOT MAKE SIGNIFICANT IMPACT UNLESS IT HAS AN AGGRESSIVE FOCUS OR PUC AND UTILITIES TAKE THE INITIATIVE

WHERE DO WE GO FROM HERE ?

- STRONGER LEGISLATION
- AGGRESSIVE IRP
- FEELING SECURE WITH WIND AS AN ENERGY RESOURCE

4.4.2 Panel Members

Matt Matsunaga–Hawaii State Senate
Duke Bainum–Hawaii State House of Representatives
Chip Higgins for Robert Herkes–Hawaii State House of Representatives

Panel Responses

The Honorable Duke Bainum–Hawaii State House of Representatives

In reviewing the role of the state legislature in advancing the development of wind energy, Representative Bainum first looked at some of the legislature's early attempts to develop wind beginning in 1985. In 1985, 1989 and 1990, tax credits were the most successful attempts. Other than that most attempts were not very effective including revenue bonds for wind energy and other renewable energy ventures that were never utilized.

The legislature can play many roles in supporting wind energy development including:

- encouraging the PUC to push the acceptance of nonutility generators and the concept of externalities,
- take the lead in the development of wind energy and the recognition of its economic and environmental benefits,
- encourage the business sector by moving away from the bureaucracy that gets in the way, and
- encourage cooperation between the environmentalists and the legislature

Because these are not simple issues and there is always a natural resistance toward change, he noted that it takes time for change to occur.

The Honorable Matt Matsunaga–Hawaii State Senate

Senator Matsunaga reviewed some of the bills from the 1994 legislative session that came out of the *Energy and Environmental Summit* of 1993.

- SB2101–A bill to make an appropriation to implement the permit process facilitation act which is a companion bill to HB2634. The intent of this bill is to appropriate funds to implement an act that had previously been passed through the legislature for which no funds had been appropriated. This bill was held in committee.
- SB2106–A companion bill to HB2634 that raises the amount received from tax credits from 20% to 35% or $8,750 (whichever is less) for residential wind

and PV installations. This bill did not pass out of the Ways and Means Committee.

- SB2386–This bill directed the PUC to consider the conversion to renewable energy resources. It required that the PUC establish numeric quantities of the minimum amount of electricity which utilities must acquire from nonfossil fuel sources.

  Chip Higgins commented that the major thrust of this bill was to get quotas established rather than use other types of incentives. This represents a departure from the usual but is an approach, he believes we will see more of.

- SB2387–A similar bill that requires the PUC to establish a quota for the amount of energy to be purchased from nonfossil fuel sources.

- SB2388–Relating to nonfossil fuel generation, this bill directed the PUC to conduct a study of the environmental, economic, social and political advantages to the use of nonfossil fuels.

  Chip Higgins commented that this bill represents the ultimate result of discussions carried out at the Energy and Environmental Summit regarding the concept of externalities.

- SCR41–A resolution urging the Hawaiian utilities to explore and utilize wind systems to satisfy a greater proportion of Hawaii's electrical generation requirements. This resolution requests that the PUC and the electric utility companies examine the feasibility of wind and solar energy resources. It was heard by the Senate which ruled that it be held and incorporated into SCR 40.

The Honorable Duke Bainum–Hawaii House of Representatives

One of the things that participants of the workshop should recognize is that the *Energy and Environmental Summit* was the state's first attempt at developing a consensus agreement with the legislature, the public and the business community. It is very important for everyone who participated in the summit to realize that getting a bill through the legislature is a long process. As a rule of thumb, Representative Bainum said, it generally takes about three years for bills to pass through the legislature here in Hawaii.

Many times the process is even more important than the product, he said. The bills that died during the 1994 legislative session will be turned into resolutions. We are going to harness this momentum and turn these resolutions into legislation. In addition, there are some very important bills still alive. One of the bills concerning nonutility generation did make it through the House and was sent over to the Senate.

Chip Higgins, for Representative Robert Herkes–Hawaii State House of Representatives

One of the areas that Ira Rohter developed during the *Energy and Environmental Summit* was a plan for a government committee, with a true planning function, to raise the emphasis of energy in Hāwaii.

Having been involved in the Energy Planning Committee of the past, Mr. Higgins noted that when the administration changed hands, the long term aspect of planning halted. "Planning has got to be an ongoing process. You don't get anything out of one or two years of planning. We need to emphasize the long term range planning function."

Question:

What do you think is the future of the Energy and Environmental Summit process itself?

Answer:

The Honorable Duke Bainum, Hawaii House of Representatives

There seems to be a continuing interest in the summit process itself. If *Energy and Environmental Summit II* does take place, we need to discuss what form it will take and the parameters under which it will operate. There needs to be a fine tuning of the process itself in terms of how the committees are set up to get people, who have not historically sat down together, to work at building a consensus agreement. The agenda was originally set up loosely to ensure that proposals would not go too far if consensus could not be reached. I think that a layer of trust has been built up between the parties however, which will lead the way to a continuing summit process.

Question:

What is the fundamental reason that the legislative bills related to wind energy did not get passed out of the legislature, even when they did not represent additional moneys or tax increases but related to setting goals for instance?

Answer:

The Honorable Matt Matsunaga–Hawaii State Senate

From the Senate's standpoint, bills for tax credits and the like did not get passed through because of the financial impacts. When you are facing such an austere budget as the legislature was this past session, it is tough to get these kinds of bills passed. The Ways and Means Committee tries to scrape up money everywhere.

Other bills were probably held up because of such strong opposition by the regulators and other parties that came to testify.

The Honorable Duke Bainum–Hawaii State House of Representatives

Representative Bainum confirmed that similar reasoning was apparent in the House as well, in terms of the austerity of the budget.

In addition, much opposition was raised because of the IRP process itself touted by many legislators as an ongoing process. The prevailing attitude was one of, "Let's see if the process works itself out."

"I don't think the IRP is so sacrosanct that the legislature cannot get involved," he said. "I think the legislature needs to get more aggressive on these issues. I see the legislature as a policy maker. And I hope a message is being sent loud and clear to the PUC and the utilities that times are changing and we need to change with them. The legislature is keeping a close eye on what is happening with the PUC in reviewing the IRPs. Even if the outcome is conservative, we are still going to keep on plugging renewable energy bills. There is a whole host of bills before the legislature concerning these issues. There has to be a continual process with the PUC and the utilities that is in concert with the legislature."

Chip Higgins, for Robert Herkes–Hawaii House of Representatives

A handshake has developed between the PUC and the legislature involving a joint relationship. The problem is the PUC needs additional funding apart from the funding it requires for maintaining its normal operations. A bill has been submitted to provide funding for the PUC to use for planning purposes. I hope this bill will offer some planning dollars and provide the PUC with the ability to take on some contractors such that the PUC can respond adequately to the challenges of the IRP process.

The Honorable Duke Bainum–Hawaii House of Representatives

The PUC is trying to do so much with so little, in addition to the other areas it must regulate such as transportation. I think this issue will be revisited at next year's legislative session. In addition to providing the PUC with additional funds, we will see if the tasks they are charged with are necessarily something they need to be involved with.

The Honorable Matt Matsunaga–Hawaii State Senate

In addition, we need to urge the Governor to appoint qualified commissioners to the PUC, Senator Matsunaga said noting that two slots on the Commission will be vacated this year as a result of Dan Kochi's appointment to the state circuit court and the expiration in June 1994 of Yukio Naito's term of office.

Question:

If the Ways and Means Committee summarily discards any renewable energy legislation, perhaps you ought to attempt to change their attitude toward renewable energy?

Answer:

The Honorable Matt Matsunaga–Hawaii State Senate

The key is trying to convince the Ways and Means Committee chair that the benefits of these measures are certainly worth the costs. That is not easy. However, if we continue to tout the merits of our energy plan year after year and we have the same Ways and Means Committee members, eventually the message will get through.

The Honorable Duke Bainum–Hawaii House of Representatives

This is all part of the three year process of getting bills passed through the legislature. In other words, three years is the education curve on many of these complex bills. Even though the Ways and Means Committee may not have heard every bill, those same members sit on other committees and will hear these issues and proposals. Over time, these bills, along with the efforts of the participants from this workshop and the energy summit in reemphasizing the issues, will lead to a broader acceptance on the part of the legislators.

The Honorable Matt Matsunaga–Hawaii State Senate

In addition, we might have a better chance at getting some of these bills through if we can convince the tax director not to shoot them down when they get to the Ways and Means Committee.

Question:

Perhaps we could provide copies of studies to the legislature showing the economic benefits, in terms of job growth and revenue increases, to the development of wind energy?

Answer:

The Honorable Duke Bainum–Hawaii House of Representatives

Environmental energy industries, in particular the wind industry, are growth industries. I think if we have more of you helping during the course of the legislative process to emphasize that these bills are not just good for the environment and for society but are good for the state's economy and job growth as well, the message will get through.