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THREE CASE STUDIES OF APPROPRIATE ENERGY TECHNOLOGY IN THE U.S. PACIFIC TERRITORIES

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January 1982

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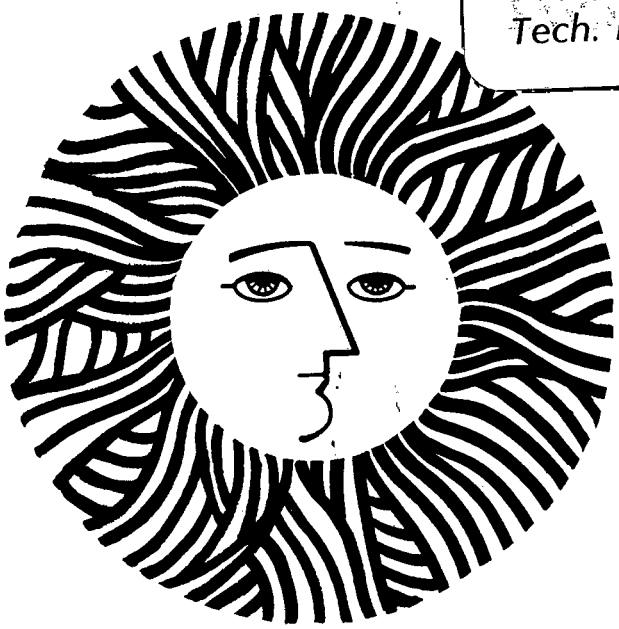

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THREE CASE STUDIES OF APPROPRIATE ENERGY TECHNOLOGY IN THE U.S. PACIFIC TERRITORIES

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ABSTRACT

For federally sponsored appropriate energy technology projects critical issues include transferring the technology to the community and minimizing adverse cultural effects. From 1978 to 1981 the Department of Energy has funded 33 small energy projects in the U.S. Pacific Territories through the Appropriate Energy Technology Grants Program. Average grant size is about $11,000. The projects attempt to be appropriate for developing Pacific island communities by using local labor and materials, using renewable resources, incorporating simple technologies, and being culturally sensitive. Most of the projects are completed now and are at the technology transfer stage. For a few it is possible to determine what the cultural effects are or might be.

During the last four years the authors have traveled throughout the Pacific monitoring the projects, offering technical assistance, and encouraging successful completion of the work. In the course of these travels we have noticed that there is a commonality between successful projects in which the technologies are more easily transferred and the cultural integrity is preserved. We have prepared three case studies which illustrate these common elements. These studies include a solar photovoltaic electric fence for controlling wild pigs on an outer island in American Samoa, a solar fish drying facility on an outer island in the Truk District of the Federated States of Micronesia, and a solar demonstration project on Guam. This paper presents the case studies and discusses the criteria and common elements for successful projects in these small, developing Pacific island communities.

INTRODUCTION

In 1977 the Energy Research and Development Administration (now the Department of Energy - DOE) instructed its San Francisco Operations Office (SAN) to establish a program for encouraging appropriate energy technology projects within Federal Region IX. This Region includes Arizona, California, Hawaii, Nevada, and the Pacific Territories - the Pacific Territories include American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, the Federated States of Micronesia, and the Independent States of Belau and the Marshall Islands. (Table 1 summarizes the political and geographical features of the Pacific Territories.)

SAN announced the Appropriate Energy Technology Program (AET Program) asking small businesses, individuals, nonprofit agencies, and public institutions to apply for grants for designing, constructing, and/or demonstrating appropriate energy technologies. These technologies were to conserve fossil fuel or use renewable energy resources, and were also to have community social or economic benefits.

For awarding grants SAN used a review process that transferred much of the decision making responsibilities to the states. Social, economic, technical, and innovative merits were equally stressed as selection criteria. In 1978, after three separate reviews involving state and university groups and committees, SAN awarded 108 grants. The average grant was for $12,000; the largest, for $43,000; and the smallest, for $500. The grants covered the complete spectrum of small-scale energy technologies, including solar active and passive systems, wind machines, biomass conversion systems,

energy conservation devices, recycling methods, aquaculture and agriculture systems, hydroelectric devices, geothermal systems, and hybrid systems.

In 1979 DOE expanded the program into all ten federal regions and offered funding cycles during 1979, 1980, and 1981. (DOE dropped the program in 1982.) They awarded about 600 grants each year, including 33 grants within the Pacific Territories. (Table 2 summerizes the program in these Territories.)

One program feature required regional monitors to visit each project. This task included offering technical assistance, assessing the direct and indirect energy impacts, looking for projects with commercial possibilities, and encouraging the completion of the projects on schedule. During the last four years the authors have traveled throughout the Pacific monitoring the 33 projects.

These trips have offered an unusual opportunity to become familiar with the problems of introducing, in a variety of situations, relatively simple energy producing technologies to remote, developing island communities. By closely following the progress of all 33 projects the authors have tried to identify certain elements common to the projects which appear to benefit their communities the most, are the most sensitive to cultural integrity, and are the most successful as judged by general criteria for appropriate technology. (Table 3 summarizes some of these criteria.)

This paper is the second in a series of case study papers presenting the authors' observations. Reference 1 is the first paper. Case II originally appeared in this paper and is presented here again, slightly altered, as a study of the problems of awarding a small grant to a village on a remote island.

CASE I

FERAL PIG CONTROL BY SOLAR POWERED ELECTRIC FENCES (Ta'u, American Samoa)

Background:

American Samoa, consisting of seven islands, is one of the principal Polynesian island groups. (See Figure 1 - Map of the Pacific Territory Islands.) Two of the islands are small coral atolls, the others are remains of extinct volcanos with central mountain ranges and limited coastal plains. Total land area is about 197 km^2 (Ref. 2, p.141). These islands are beautiful with secluded coves and beaches, lush vegetation, and rugged topography.

American Samoa became a U.S. territory in 1900 when a commission of Germany, Great Britian, and the U.S. agreed that the best way to provide a stable government for the politically turbulent Samoan Islands was to annex them. The U.S. acquired what is now the American Samoan Islands; Germany acquired the Western Samoan Islands; and Great Britian withdrew. Local government has now evolved to consist of executive, legislative, and judicial branches. The Governor, under the direction of the U.S. Department of Interior, is elected by popular vote.

American Samoa has a relatively strong economy based on a thriving fishing industry. Two U.S. corporations, Van Camp and Star-Kist, operate two large canneries, side-by-side, on Pago Pago Bay. 1978 tuna exports were about $97 million. These canneries are the largest employers in the private sector - the government is the largest overall employer with a 1974 payroll of 3,285 people. Tourism plays a minor role with 11,000 tourists visiting the islands in 1978 (Ref. 2).

This local economy plus the strong political affiliation with the U.S.

has encouraged rapid development during the 1970's, bringing about both benefits and problems. The Lyndon B. Johnson Hospital is one of the finest in the Pacific; Pago Pago has a good deep-water port facility; and there are fully developed communication, transportation, and educational facilities. On the other hand, U.S. Mainland corporations largely control the private industry; the economy still depends heavily on federal employment and subsidies; unemployment is high; and rapid and often insensitive development has affected traditional culture. Energy supply is 100% dependent on imported petroleum, although there appears to be excellent renewable resources including geothermal, solar, wind, and biomass (Ref. 3). These resources are largely unexplored.

Some of the original culture still remains, particularly in the outer villages and islands. The extended families with chiefs are the principal community social and economic units. Ninty-five percent of the land is communally owned. Traditional open-sided fales are the main housing outside of Pago Pago. Many of the rural villages on Tutuila and the outer islands are truly remote with little outside communication.

Project Description:

The Manua Island Group consists of three small islands; Ta'u, Ofu, and Olosega. The Group is 100 km east of Tutuila. Ta'u is the main island and has an area of about 39 km^2. Population is around 1,300. There is a small air strip and a harbor, but travel between Ta'u and Tutuila is infrequent and expensive. Much of the island is mountainous and difficult to travel through, and therefore only a portion of the land is suitable for agriculture.

One of the critical barriers to local farming has been crop damages

by feral (wild) pigs. Electric fences are an effective way to control domestic pigs and might be used for wild pigs except electricity does not service many rural areas. One solution used in Western Samoa and New Zealand for controlling domestic pigs is to power fences with solar photovoltaic units (Ref. 4).

In early 1980 Dr. David Sleep from the American Samoa Department of Agriculture applied for a small grant from DOE to construct a solar photovoltaic powered electric fence in a remote part of Ta'u. He wished to see if such a fence would be successful in controlling wild pigs, and if so, would local farmers try these fences. In the summer, 1980, DOE awarded Dr. Sleep $1,120 (Ref. 5).

Project Results:

Dr. Sleep selected 1 acre of fertile land located in a plateau above the village of Fitiuta, on Ta'u. Villagers had already planted taro, an important Samoan root plant, there, and the crop was just reaching maturity. The pigs have easy access to the plot with trails on three sides and a road on the fourth.

Villagers cut a 0.5 m wide fence line path around the plot perimeter. Two types of metal posts, spaced between 5 and 10 m apart, supported most of the fence. They also used trees and wooden posts around the perimeter, a common method for fencing. As the garden expanded, they moved the fence back. Surgical tubing was used for insulation.

Two lines of wire were used: one about 10 cm above ground level to prevent pig rooting and the other about 0.5 m above ground level. The wire consists of three copper wires interwoven around a polyethylene cord.

This is quite flexible and can be repaired by simply tying a knot.

The photovoltaic unit is a Waikato Sola Pak Fence Energiser, Model SP6, manufactured by Wallace Industries Ltd, Auckland, New Zealand. This is a 6v unit, especially designed for electric fences, producing 1000v with a 300 ohm load and 5700v with a 5000 ohm load. It will electrify fences up to 8 km long. Storage with lead batteries is up to 150 hours. Total equipment cost was $947 US (1980). They built a 3 m high tower inside the fence for observing the pigs. All construction was completed by the end of 1980, 3 months after receiving the grant.

Local farmers were quite enthusiastic about the project. During initial tests, the fence was effective keeping pigs away. Color of the wire, besides the electrical charge, may have helped. Storms made observation difficult though, and it was necessary to repair the fence often due to falling trees. In March, 1981, just after the fence was operating reliably, an extremely strong storm struck the Manua Group, creating widespread damage. Fallen coconut and breadfruit trees completely covered the plot, and the fence was destroyed. They salvaged the photovoltaic unit, which is now being stored.

Dr. Sleep has returned to the U.S. Mainland to do other work. The project, although completed according to the grant provisions, in a broad sense is at a critical stage now. Is there enough local interest to continue with what appeared to be a successful device now that the person initially responsible for the project is gone?

Analysis of Results:

There are a few imporant features of the project:

- This is a good example of project success due to individual effort and committment. It also illustrates just how important such a committment is for a successful project in a rural community. The project was well thought out and organized. Dr. Sleep was successful soliciting local help. He received the equipment quickly, something not easily done in remote areas. Work was completed despite storms, travel problems, and rough terrain.
- Dr. Sleep did a good job assessing the problem and finding a solution. The project demonstrates a device which works. Often alternative energy devices for developing countries are experimental, quickly failing, and difficult and expensive to repair or maintain. Photovoltaics are a reliable and important technology for developing countries, particularly where initial expense is not critical (Ref. 6 and 7).
- It is difficult to assess at this time what social, economic, and cultural effects the project might have. The budget was low and realistic, thereby not disrupting the local economy. This often is not the case with U.S. Pacific grants. Finding land, which is communally owned, was a problem as it often is with extended family cultures. Fencing previously unfenced land does not seem to be a problem although widespread fencing of communal land could be. There was considerable local help and interest, without which projects such as this usually fail.
- This is an interesting case regarding the fate of a project which must be rebuilt after the project leader leaves. Reconstruction can be done by local people, yet the photovoltaic unit has been in storage for nine months now. Much can be learned from such cases concerning the worth of government funded technology transfer projects.

- Once again the harshness of the Pacific environment is evident. So often this environment is the controlling element for these alternative energy projects. It is important that local people are able to repair and maintain these devices.

Conclusion:

In summary, one interpretation of the project is this. A Mainland expert working in a remote area analyzed a local problem and found a solution which uses a reliable and available technology. The project was completed on a low budget with local labor, and the result seems compatible with the culture. The fence can be repaired and maintained locally. However, is there enough local interest and impetus to reconstruct the fence? Are these photovoltaic units inexpensive enough so that villagers can afford them? Has a proven technology, used elsewhere in nearby and similar island situations, been transferred by a government project? If the fences are replicated, are the cultural effects minimal? The project seems appropriate, but now it is at the stage where these questions will be answered.

CASE II

FISHMEAL COOPERATIVE (Romanum Island, Truk District, Eastern Caroline Islands)

Background:

The Trust Territory of the Pacific Islands includes about 2,000 islands scattered across 8 million km^2 of Pacific Ocean between the equator and 22° N latitude and from 130° to 172° E longitude. After World War II a United Nations mandate placed these islands under the protectorate of the

U.S. For administrative purposes the U.S. divided the Trust Territory into six districts, now under the jurisdiction of the Department of Interior. According to the mandate the U.S. was to encourage these districts to become independent, and each district was to decide its own political fate by the early 1980's.

During the last decade there have been continuous negotiations between the U.S. and the districts culminating in four independent governments; the Commonwealth of the Northern Mariana Islands (the Northern Mariana Islands), the Federated States of Micronesia (Kosrae, Ponape, Truk, and Yap Districts), and the Independent States of Belau and the Marshall Islands. However, the Trust Agreement creating the original entity has not been terminated.

The Truk District consists of about 90 islands in the Eastern Caroline Islands. Fifty of these islands are on a great encircling reef that encloses a lagoon with a radius of 48 km. Within this lagoon are a number of high islands, including the district center, Moen. Truk is the most populated district with about 38,500 people (1980) (Ref. 2, p.441). There is a steady population migration to Moen, but many people still live in small villages scattered throughout the outer islands.

These people are isolated from Moen. There are no commercial air flights or telephone links, and travel by small boat is dangerous and expensive. Because of this isolation, the villagers have retained much of their original culture. However, they are slowly being exposed to new technical advances. Increasing populations place stresses on day-to-day subsistence living, and now there are critical energy demands, primarily

for refrigeration and communication systems and for better health facilities. Small diesel generating units are expensive to operate and difficult to repair, and fuel supplies are uncertain. Much of the living is still on a day-to-day basis. The islands have no cash economies - fishing and some farming are the main occupations. The islands are turning from this way of life, and a few are searching for ways to start economies through local businesses (Ref. 8).

Project Description:

Romanum Island is a typical outer island. It is about 5 km^2 and has a population of around 200. The island is approximately 30 km across the Truk Lagoon from Moen. There are no local businesses or cash economy. Because of their proximity to Moen and the contact with the people there, the people of Romanum are changing from their traditional ways of living.

In 1978 the Romanum chief and a Peace Corps volunteer applied for a grant to build some solar dryers and equipment for processing fish by-products for chicken feed. Because there is no electricity or refrigeration system on the island fish left over at the end of the day are usually thrown out. Chicken feed is expensive and requires a trip to Moen to purchase. This project would thus solve the problem of excess fish and expensive chicken feed. In addition, they planned to start a village cooperative business and sell the chicken feed to neighboring islands.

DOE awarded the cooperative $7,200 to build and experiment with a number of dryers and to purchase grinding equipment. Work was to start in summer, 1978, and finish a year later. This grant met all the criteria for a successful project: Starting a village business, training people to

build solar devices, and solving an energy problem with renewable resources.

Project Results:

Shortly after they submitted the application the Peace Corps worker was replaced by a new one who didn't arrive for a few months. Therefore DOE sent the money directly to the chief. During the last few decades Micronesians have received many federal grants, usually awarded without much awareness of how this money might affect local cultures. Often agencies do not check on the results of these grants, and the money appears as handouts (Ref. 8 and 9). Based on these experiences the chief took a broad definition of what the money could be used for. He was sure no one would check on the progress of such a small grant.

When he heard we planned to visit Romanum he wanted to show us some equipment, but he did not know how to build solar dryers, so he bought materials for some new fishing boats. We explained that the fishing boats may be necessary, but he must complete the project. The chief had good intentions, but he needed help. The new Peace Corps worker also had good intentions, but he had severe disagreements with the chief. Caught in the middle of local politics, his help was refused. After two years no work had been done so DOE terminated the grant.

Analysis of Results:

The chief and the original Peace Corps volunteer had a good idea. This is the type of project needed on these small islands, and they intended to do the work properly. Unfortunately the project failed, but DOE learned some lessons for awarding and monitoring other Pacific grants.

o For a project to succeed the person who thought of the idea and submitted

the application should be responsible for the project through its entirety. When there is a change in leadership the project has problems. The original impetus is lost; technical skills are different; and the purpose of the project changes. These are small, simple projects designed to be completed in a short period of time. There must be continuity, and this continuity is lost when leadership changes.

- The community must support the project. The villagers should have an interest in the project, either by providing material or volunteering labor.
- The Romanum grant was probably too large for the project. Project wages were much higher than wages on Moen. A grant such as this disrupts a culture not familiar with a cash economy and the ways of U.S. funding agencies.
- Funding agencies should be sensitive to cultural effects of grants. The U.S. funding structure is designed for the Mainland. Grant requirements may be reasonable in that context, but often they are not for developing countries. The practice of awarding money and then requiring people to follow schedules and submit written reports is strange to such cultures. Sensitivity is necessary to reach a balance between local ways of working and funding agency requirements.
- All projects should be monitored, preferably by knowledgeable people in the area. This is not easy for Micronesia as there are only a few Micronesian engineers, and travel is difficult and expensive. Still, contact must be maintained, and it must be more often than once a year. The more remote the project, the more important this contact.

Conclusion:

By DOE standards the $7,200 loss is small, but this loss follows a history of money poorly spent in the Trust Territory. DOE must use sensitivity in selecting which grants to award and in predicting both energy-producing consequences and cultural effects. The project itself is often a minor consequence of the grant. The indirect effects are far reaching in these fragile social and economic environments.

In this case, the money will not be returned, but the lessons may have been learned cheaply. Mistakes made on this grant have not been made again. Luckily, the long-range effects of this grant on Romanum will be few. They have two new fishing boats, which are expensive to fuel but which have also helped establish a fishing business. This business may eventually be more worthwhile than the chicken feed business. They are now realizing how expensive these boats are to run, and there is interest in returning to their old native sailing canoes and boats - another worthwhile indirect effect (Fig. 2).

CASE III

SOLAR HOT WATER DEMONSTRATION (Agana, Guam)

Background:

Guam is the largest (541 km^2) and southern most of the 17 islands in the Mariana Island chain. The U.S. acquired Guam as a possession in 1899 during the Spanish-American War and in 1950 made Guam a territory with local legislative authority. The government includes executive, judicial, and legislative branches. Popular vote elects the Governor. The Department of Interior provides general supervision (Ref. 2 and 10).

The island is the peak of a submerged mountain in the Mariana Trench. The northern part of the land is a relatively flat plateau, while the southern part is mountainous. Good agricultural land is at a premium, and there are a few fine beaches. The climate is generally tropical - hot and humid. Rainfall is heavy (about 200 cm/yr), and often there is heavy cloud cover. Typhoons do heavy damage almost yearly.

Guam is the most westernized of the U.S. Pacific Territories. It has been an important U.S. military base since World War II, and the military is the largest employer and ecnomic unit on the island. Both the Air Force and the Navy are stationed on Guam, and defense installations take up 35% of the land. In addition, Guam is a transportation and merchandising center for goods being shipped elsewhere in the Pacific and has a rapidly growing Japanese tourist business. Guam's population is about 109,000 (1978) of which approximately 92,000 live in urban areas. 20,000 of the population are U.S. military and dependents. The original natives of Guam, the Chamorros, currently constitute a small and decreasing portion of the population (Ref. 2).

Agana, the capital and principal city, has a population of about 50,000 and is similar to fast-growing U.S. towns of the same size. There are fully developed communication, transportation, and medical facilities. Features include beautiful beaches and rural areas, treacherous roads made of coral, which become very slippery when wet, the largest harbor in the Pacific, no mass transit system (resulting in large traffic jams), a good university and community college, and the remnants of heavy World War II action.

Energy production on Guam is entirely from imported petroleum products, mostly from the Philippines. Two oil-fired power plants, jointly operated

by the Navy and the Guam Power Authority (307 MW total capacity), produce the island's electricity (Ref. 2). Primary end users include the transportation and military sectors. Because of Guam's vulnerability to fuel shortages, the Guam Energy Office (GEO) has been trying to develop other sources. There has been strong local political support for developing Guam's ocean thermal energy resource, one of the best in the Pacific (Ref. 11). The GEO is also encouraging industrial and domestic conservation, assessing the solar, wind, and biomass resources, promoting small energy demonstration projects, and making energy audits.

Project Description:

Until recently little effort has been given to small decentralized systems or to domestic alternative energy production. There are not many energy producing devices using renewable resources. Materials and local expertise are hard to come by, and the environment is harsh.

Mr. Frank Jacquette, a mathematics professor at the University of Guam, asked DOE for a small grant to spend the summer, 1978, developing and demonstrating a domestic solar hot water system designed for tropical conditions. DOE awarded Mr. Jacquette $12,000 for a project with these objectives (Ref. 12):

- To build a solar hot water system that could be built and maintained locally and that would withstand the Pacific environment. Mr. Jacquette planned to build a simple system using "off-the-shelf" components. On Pacific islands "off-the-shelf" takes on a new definition as basic supplies such as lumber and glass may be difficult to find. Construction must be particularly durable and require only occasional maintenance. The system

must withstand typhoons and tropical storms, a highly corrosive atmosphere, termite damage, salt scaling, and unusually high tides or waves;

- To install and demonstrate these systems on various public buildings, including the Guam Penitentiary, a village firehouse, and a juvenile detention home;
- To teach people how to build these systems. This was to be done in two ways. The first was to solicit local help. The second was to publish a series of brochures describing the systems, and to make these brochures available to people on Guam and other Pacific islands.

Project Results:

The first project was to install a single collector system on the Talofofo village commissioner's office restroom. The collector was similar to one which Mr. Jacquette had built for a university workshop using galvanized pipe in a sinusoidal configuration. The absorber (34" x 92" x 3.5") is galvanized steel with polyurethane foam insulation. The inside is painted with black asphalt water-proofing paint. Glazing is a single sheet of tempered glass 1/8" thick (Ref. 12 and 13). He did not use a storage tank as the restroom is used just during the day on a regular basis. About ten young CETA workers built most of the system in one day. They were assigned to another project the next day so Mr. Jacquette finished the work himself. Performance data are not available, but the system appeared to operate satisfactorily. (Ambient water temperature is about 25°C so domestic systems only need to raise the temperature 10° or 15°C.)

The second project was to install a system during a workshop at the Mangilao village commissioner and youth center facility. The project was

not finished because: (1) Mr. Jacquette scheduled the work for early summer, and the grant money did not arrive until late summer. By that time the commissioner was not on the island, and interest had declined. (2) The ten people who participated stayed at the workshop for only a few hours - not enough time to complete the project.

The next project was for Boy Scouts to help install the partially completed Mangilao system on the Dededo village firehouse. The system, including two collectors, a pump, and storage tank, was completed, but the workshop was not totally successful. The Boy Scouts did not contribute much, and Mr. Jacquette did most of the work himself. The system worked well for awhile, but this and the Talofofo system are no longer in use for reasons unknown to the authors.

For the fourth project, 20 inmates of the Guam Penitentiary, under Mr. Jacquette's supervision, installed a ten panel collector system (including storage tank and heat exchanger) on a dormitory and cafeteria. Again, the system worked well for awhile but is no longer is use. This is a heavily guarded penitentiary with constant unrest, and Mr. Jacquette has had trouble checking the system. The inmates and prison administration are not interested in maintaining the system - electricity is easier, and cost is not a factor.

The last project is the most successful. Young adults at the Guam Youth Affairs Detention Home connected three of the sinusoidal collectors to a hot water storage system for their cafeteria. One of the authors inspected the system late in 1980, and it was operating well despite a total lack of maintenance - not even the pump had been oiled (Fig. 3).

After completing these five projects Mr. Jacquette wrote and privately published three brochures (Ref. 13, 14, and 15) describing three different systems. He has distributed about 100 copies of each. In addition to funding the projects the grant established him as an authority on solar matters. He has received two more small grants to develop domestic collectors. Through these grants he has acquired expertise which he has used to help others. Concerning his first objective, his one working system does appear durable, was simple to construct, and does not require much maintenance. All materials were easy to find, for Guam, except for the pumps and some fittings.

Analysis of Results:

While reviewing this project, one should consider these points:

- Three years after the grant the only evidence of the project is the solar system on the detention home. Indirectly though, the grant provided Guam with a solar expert. Mr. Jacquette is a clever person - a skilled craftsman - an old-fashioned, backyard tinkerer. Before the grant his experimenting with solar systems was mostly a hobby - something he did in his spare time. By receiving this and two other small grants from the same program Mr. Jacquette was able to spend more of his time acquiring a more sophisticated knowledge of solar systems. With the publicity and prestige of receiving the grants his work took on a new respectibility. People know of his work, and he is more qualified to help them.

This is an important part of a project. The project itself may not work out, but the grantee usually learns something. The community often

benefits indirectly from this knowledge. Simply put, DOE is paying someone to acquire expertise in a particular area. This expertise is especially valuable in the Pacific island where such local knowledge is uncommon.

- This is another project where the results depended entirely on one person's effort. Mr. Jacquette was familiar with solar collectors but did not have much experience running workshops. Technical knowledge is only one part of technology transfer - an effective workshop is vital.

Technology transfer from the workshops was only fair. The pamphlets, though, do a good job of explaining the systems and have an appealing style. DOE should have published these pamphlets and given them broader distribution. Every project seems to have a critical second stage after the work is completed. Publishing the pamphlets may have been that stage here.

- Public apathy towards renewable energy systems in rapidly developing areas such as Guam is a problem. People are willing to pay the high cost of electricity in order to have modern appliances. They often feel that installing renewable energy systems is a step backward. These people are not anxious to build or buy solar systems.
- Mr. Jacquette's solar system, although designed to be simple, may not be easily replicated on the more remote Pacific islands. Mr. Jacquette is clever with his hands and has a good technical background. Things which are easy for him may not be so easy for others without the same training. Also, "off-the-shelf" components on Guam may be scarce elsewhere.

Conclusion:

The DOE AET Pacific projects are mainly concerned with technology transfer. Except for unusual situations the energy device paid for by the

grant by itself will not greatly improve community life. The technology must be replicated willingly by others, ideally without additional government support. In this case the technology transfer is subtle. Only a handful of Jacquette collectors may appear on Guam, but hopefully others on Guam will benefit from his expertise. Technologies should be encouraged by local experts, not off-island consultants. This is particularly true for the Micronesian independent states with their quest for self-sufficiency. DOE and the federal government should do more to encourage islanders to acquire technical training.

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Table I

Summary of United States Pacific Territory Islands

Entity	Location	Political Status	Number of Islands	Land Area (Main Island in square km)	Administration Center	Population (1978)
American Samoa	In the Samoan group east of 171° W long.	Unincorporated U.S. territory	7 (Samoan group)	197	Pago Pago	30,600
Guam	13°26' N lat. 144°43' E long.	Unincorporated U.S. territory	1 (Mariana Islands)	549	Agana	102,000 (1975)
Commonwealth of the Mariana Islands	15°12' N lat. 145°43' E long.	U.S. Commonwealth (formerly Trust Territory)	16 (Mariana Islands)	471	Saipan	15,200 (1975)
Palau *	2° to 11° N lat. 130° to 136° E long.	Independent state (formerly Trust Territory) **	Approximately 200 for the main group (Western Caroline)	559	Koror	13,500
Yap	Equator to 11° N lat. 136° to 148° E long.	Federated state (formerly Trust Territory) ***	Approximately 20 for the main group (Western Caroline)	–	Colonia	8,500
Truk	Equator to 11° N lat. 148° to 154° E long.	Federated state (formerly Trust Territory)	Approximately 90 for the main group (Eastern Caroline)	–	Moen	35,200
Ponape	Equator to 11° N lat. 154° to 162° E long.	Federated state (formerly Trust Territory)	Approximately 25 for the main group (Eastern Caroline)	703	Kolonia	21,200
Kosrae	Equator to 8° N lat. 162° to 166° E long.	Federated state (formerly Trust Territory)	1 (Eastern Caroline)	110	Lele	4,500
Marshall Islands	5° to 15° N lat. 162° to 173° E long.	Independent state (formerly Trust Territory)	Approximately 34 for the main group (Marshall Islands)	171 (total for all islands)	Majuro	27,100

Principal Source: Pacific Islands Year Book, New York, N.Y., Pacific Publications, 1978.

* Palau has been renamed Belau.

** As of September 1981, the Trust Agrreement has not been terminated.

*** Federated States refers to the Federated States of Micronesia - both the Federated States and the Independent States are negotiating a compact agreement with the United States.

Table 2

Department of Energy Small Scale Grants Program
For the U.S. Pacific Territories

	1978	1979	1980	1981	Total
Number of Grants:	7	8	13	5	33
Amounts Awarded:	$55.5K	$51.3K	$166.8K	$91.9K	$365.5K
Average Grant Size:	$7.9K	$6.4K	$12.8K	$18.4K	$11.1K
Average Project Term:			- 2 years -		
Projects Completed: (January, 1982)	4	7	3	-	14
Projects in Progress: (January, 1982)	-	1	9	5	15
Projects Terminated: (January, 1982)	3	-	1	-	4
Territories Receiving Grants:					
American Samoa:	-	1	2	-	3
CMI:	-	3	2	-	5
FSM:	2	2	4	4	12
Guam	4	2	3	1	10
Marshall Islands	1	-	1	-	2
Palau (Belau)	-	-	1	-	1
Largest Grant:			- $45.0K -		
Smallest Grant:			- $0.6K -		

Table 3

CRITERIA FOR JUDGING CULTURAL EFFECTS OF APPROPRIATE TECHNOLOGIES FOR THE U.S. PACIFIC TERRITORIES

1) Is the project being replicated locally without additional government support? Does work on the project or device continue after off-island or federal support leaves?

2) Is the project or device reliable - a proven technology - or is it experimental? Is the device engineered for the elements and reliable over a period of time?

3) Is the project useful? Did the demand for the project originate locally?

4) Does the project meet a community need; does it improve village or individual standards of living; does it help the local economy?

5) Does the project use local labor and materials? Can the device be maintained locally?

6) Is the project environmentally compatible?

7) Does the project have an element of local leadership? Is there local political and people support?

8) Does the project have an educational element? Is this education useful locally?

9) Is the project or device compatible with local customs? Are there significant ramifications to overcoming local cultural barriers? Does it preserve local cultural integrity?

10) Is the project being demonstrated at a central or easily accessible location?

11) Is there a logical next step to the project and are there significant barriers to this next step?

Figures and Captions:

Figure 1 - Map of the Pacific.

Figure 2 - Romanum Island, Truk District.

Figure 3 - Youth Affairs Detention Home, Agana, Guam.

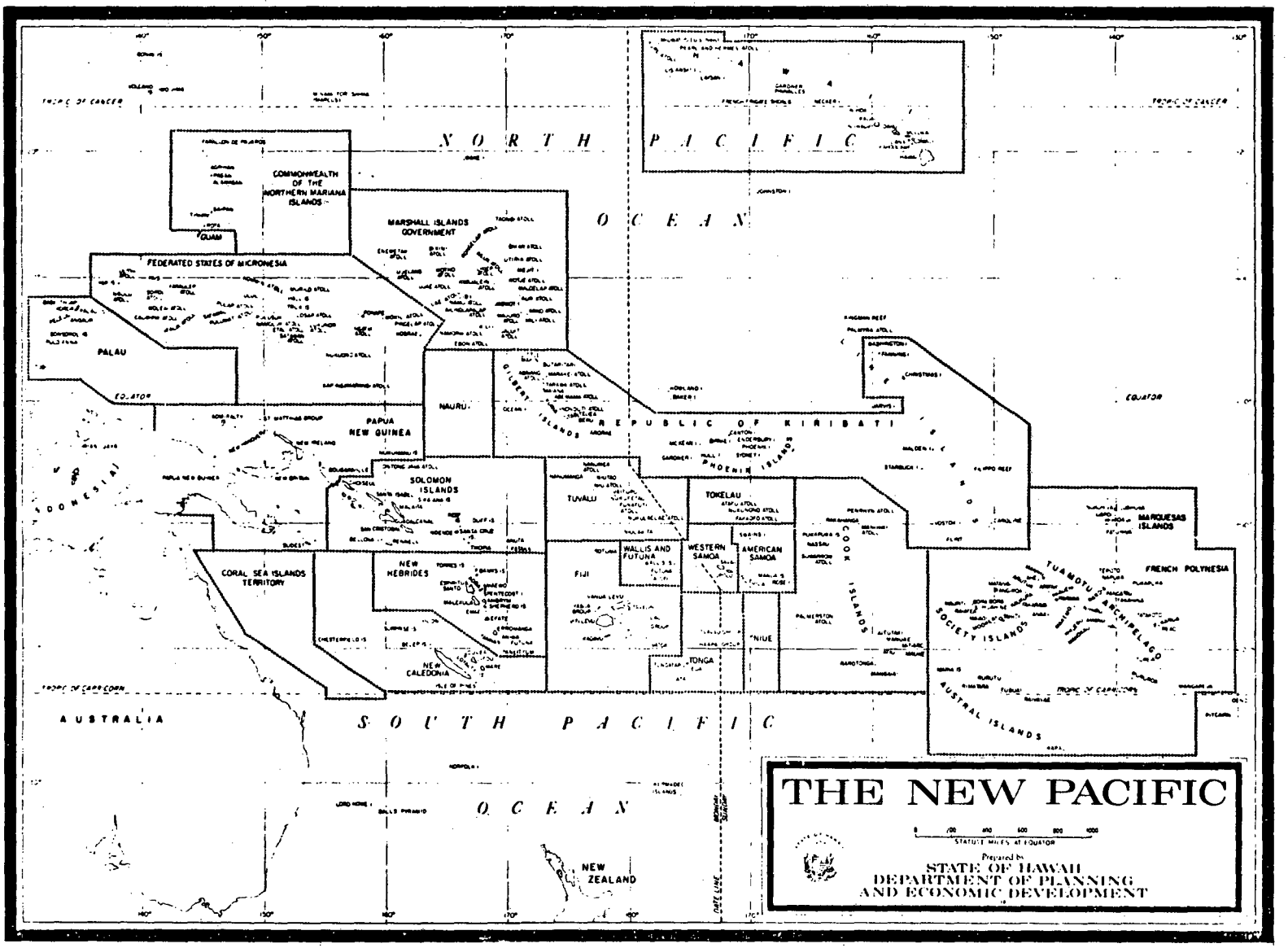

FIGURE 1 - MAP OF THE PACIFIC

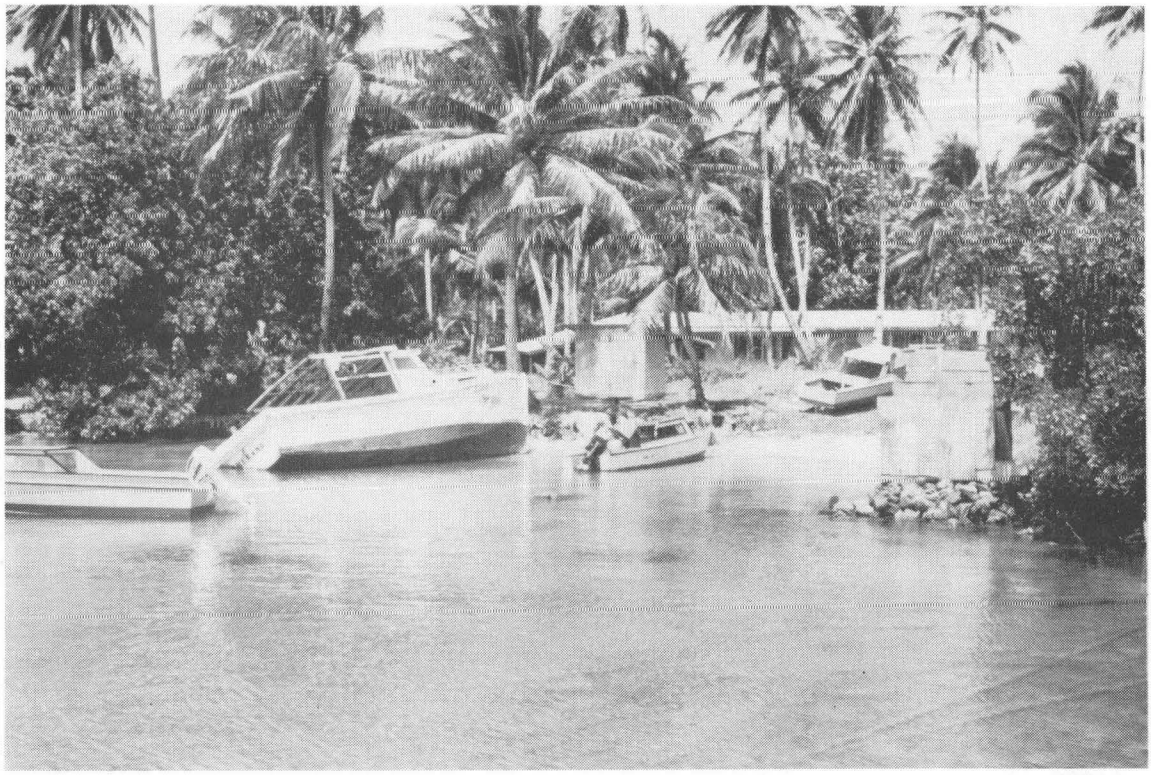

FIGURE 2 Romanum Island, Truk District CBB 809-10642

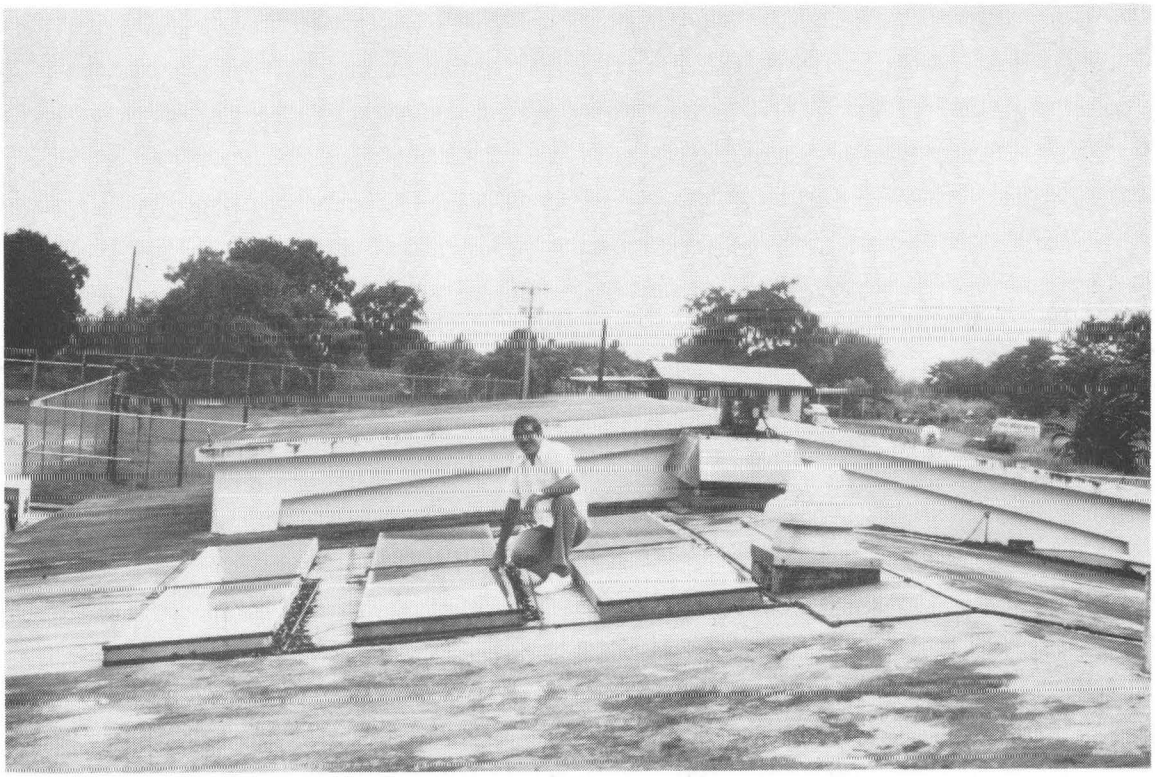

FIGURE 3 Youth Affairs Detention Home, Agana, Guam CBB 816-5372

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