

Strategic Technology Market Assessment and Development Program

December, 1999

STMAD Program Objectives

- Develop Exports of Technology & Related Services -- Energy, Environmental, and Engineering
- Strengthen Economic Development -- Hawaii and U.S.
- Sustain Technical Proficiency Within the State
- Help Reduce Greenhouse Gas Emissions Where the Largest Need Exists -- The Asia-Pacific Region
- Compete and Succeed in the Global Economy
- Secure Lasting Role for Hawaii in Asia-Pacific

More On Hawaii's International Technology Export Initiative Objectives.

The State of Hawaii is deeply committed to facilitate increased exports of U.S. energy, environmental and other sustainable technologies and related services into Asia/Pacific markets. The Energy, Resources and Technology Division (SID) has developed a Strategic Technology Marketing and Development (STMAD) Program that focuses on Asia-Pacific markets due to their high growth history and future potential.

Many of the region's economies are showing very encouraging signs of recovery from the recent financial crisis. Further, not all Asian countries were as adversely affected as others; e.g., Philippines and China. And, there remains tremendous demand for basic infrastructure for these countries to succeed in their economic recovery and resume the explosive growth experienced until fairly recently. For example, the March 1999, *Far Eastern Economic Review* estimated that eight Asian economies -- China, Japan, South Korea, Singapore, Hong Kong, Taiwan, Thailand, and India - - would require **\$515.4 billion of basic infrastructure investments annually** for the next 3-5 years. Much of this

investment will be for energy and environmental projects (See [Appendix 1.](#)).

A key objective of STMAD is to facilitate sustainable, technology-related economic development for Hawaii, create higher valued jobs, and diversify and strengthen both Hawaii's and the Nation's economy. U.S. technologies and services lead the World, but the competition in Asia is stiff. According to U.S. Department of Commerce (USDOC), the U.S. lags behind Germany, Japan, Australia, and Canada in exports of environmental infrastructure technologies and services into the region.

In particular Hawaii is seeking to facilitate U.S. exports of technologies and related services, especially those related to:

- **Renewable energy;**
- **Energy efficiency;**
- **Advanced, highly efficient fossil energy;**
- **Recycling, reuse, and remanufacturing;**
- **Information Technologies;**
- **Health Care;**
- **Ocean Science & Technologies and**
- **Environmental management, control, protection, and remediation.**

The bottom line objective of Hawaii's program is economic development, diversity, and competitive success in global markets. The program has the added benefit of addressing some very serious social and environmental issues facing the Asia-Pacific region and the world.

Hawaii's Partnerships: A Unique Relationship-building Approach.

Competition for these projects in the region is fierce. Thus, genuine partnerships and cooperation between industry and the public sector is the backbone of Hawaii's program. Our teamwork is real, not rhetoric. Partnerships with industry by way of by-country market assessments; technical exchange and business opportunities missions; government-to-government contacts throughout Asia, often at the ministerial level; and, helping industry develop business leads through workshops and conferences in Hawaii are all important components of the Hawaii's technology export initiative.



Commerce Business Daily

U.S. Government Procurement
Opportunities Worldwide: The
Commerce Business Daily (CBD)
lists notices of proposed Federal

government procurement actions, contract awards, sales of federal government property, and other procurement information. CBDNet is the Federal Government's official FREE electronic version of CBD. A new edition is issued every business day. Each edition contains approximately 500-1,000 notices. Each notice appears in the CBD only once. The CBD databases online via GPO Access contain notices from December 2, 1996 forward. All Federal procurement offices are required to announce proposed procurement actions over \$25,000 and contract awards over \$25,000, that are likely to result in the award of any subcontracts, in the CBD. Link to CBDNet: cbdnet.access.gpo.gov.

Developing high level relationships has been instrumental to Hawaii's successes. For example, in early 1997, Governor Cayetano proposed to Philippine President Fidel Ramos that the Philippines and Hawaii collaborate on developing biomass-to-energy and biowaste management projects in the Philippines. As a result, in May 1997, an historic Memorandum of Understanding (MOU) was signed by Governor Cayetano and Philippine Energy Secretary Francisco Viray for a cooperative assessment of Philippine biomass-to-energy potential, with at least two commercial bio-energy projects included as case studies. In conjunction with the MOU, and at the request of the Philippine Department of Energy, Hawaii's Strategic Industries Division initiated a collaborative energy efficiency technology and policy exchange project.

These projects are now yielding tremendous results, and involve a large number of U.S. and Philippine companies, government agencies, NGOs, and research institutions, including our own University of Hawaii's Hawaii Natural Energy Institute. Clearly, these success stories are possible only because of the partners that have been strategically brought together to collaborate on these projects.

Here are some of Hawaii's partners in our broader technology export initiative:

Examples of Hawaii's Technology Export Initiative Partners

Industry

- AES China Generating Company
- Austin Tsutsumi & Associates
- Belt Collins
- First America Asia Fund I LP
- Hawaii Electric Light Company
- Hawaiian Electric Company
- HEI Power Corp
- Honeywell, Inc.
- Johnson Controls, Inc.
- Lyon Associates Engineering
- Milbank, Tweed, Hadley & McCloy
- MK Engineering
- Salomon Smith Barney
- Tangent Fund Management, LLC

Professional Organizations & Non-Governmental Organizations (NGOs)

- American Consulting Engineers Council
- Consulting Engineers Council of Hawaii
- Council of State Governments
- Export Council for Energy Efficiency
- Hawaii Bar Association
- National Association of Energy Service Companies
- National Association of State Energy Officials
- Utility Photovoltaic Group

U.S. Academic and Research Institutions

- East-West Center
- University of Hawaii:
 - Hawaii Natural Energy Institute
 - Social Science Research Institute

U.S. Govt. Agencies & Multilateral Bank

- U.S. Agency for International Development, U.S. - Asia Environmental Partnership
- U.S. Department of Agriculture
- U.S. Department of Commerce
- U.S. Department of Defense
- U.S. Department of Energy
- U.S. Environmental Protection Agency
- Asian Development Bank

Asian-Pacific Govts. and Agencies

- Asia-Pacific Economic Cooperation
- Indonesia
- Japan:
 - Japan International Cooperation Agency
 - Okinawa Prefecture, Governor's Office
- Malaysia, Prime Minister's Department, Economic Planning Unit, Energy Section
- Mongolia
- Pacific Basin Economic Council
- Peoples' Republic of China:
 - Guangdong Provincial Government
 - Hainan Provincial Government
 - Jiangsu Provincial Government
 - Guangxi Autonomous Region
 - Shanghai City/Pudong Region
- Philippines Department of Energy
- Thailand Ministry of Finance, and Trade Representative
- Vietnam Ministry of Science, Technology & Environment

Examples of Hawaii's Technology Export Initiative Partners

(continued)

Asian Academic and Research Institutions	
<ul style="list-style-type: none">• Asia Development Bank Institute• Bangladesh-Bangladesh Institute of Developmental Studies• China (Taiwan)-Chung-Hua Institute for Economics Research;• India-Indian Council for Research on International Economic Relations• Indonesia-Center for Strategic and International Studies• Japan-Japan Development Institute• Japan-International Development Center of Japan• Korea-Korean Development Institute	<ul style="list-style-type: none">• Malaysia-Institute for Strategic and International Studies• Nepal-Center for Integrated Economic Development• Pakistan-Pakistan Institute of Development Economics• Philippines-Philippine Institute for Development Studies• Singapore-Institute of Southeast Asian Studies• Sri Lanka-Marga Institute• Thailand-Thailand Development Research Institute• Vietnam-Central Institute for Economic Management

Exporting Technologies and Expertise.

Developing clean, efficient infrastructure in the Asia-Pacific region, clearly requires an interactive, collaborative approach involving a wide variety of private and public entities -- industry, financial institutions, government, NGOs, academe, and other research organizations. This is because clean energy and environmental technologies do not necessarily "sell" themselves.

For example, government policies and regulations and the enforcement thereof are the major drivers creating the markets for commercial deployment of clean energy and environmental technologies and related services. Thus, the importance of expertise and policy transfer as an exportable commodity is being recognized as nearly as important as exporting the technologies themselves. Grant opportunities for such activities are growing, and competent U.S. and Hawaii consultants should be helped to successfully compete for such opportunities. These services are

sought and funded by U.S. and Asia-Pacific governments, and multilateral financial institutions, such as the Asian Development Bank.

This type of government facilitation of U.S. exports, especially those related to energy and the environment, is also a key component of the U.S. Department of Energy's *Comprehensive National Energy Strategy*. It is expected that Hawaii's successful experiences in partnering with other U.S. and foreign government organizations, private companies, and non-governmental organizations will serve as a model of success for other states to emulate.

What does State "facilitation" and "public/private partnership" really mean?

Over the years, the State has supported Austin, Tsutsumi & Associates (ATA), a mid-sized, Hawaii-based environmental engineering company in its efforts to succeed in its business in Vietnam.

In 1997, Governor Cayetano signed a Governor's Message in support of ATA's initiative to form a joint venture partnership with the Dong Nai Provincial Government, and to secure a license to perform pollution abatement services and other engineering activities throughout Vietnam. Based on establishing that partnership, ATA now has an office and laboratory facilities in Dong Nai Province. ATA is now also under contract with the Nike shoe company to do environmental testing for five shoe factories in Vietnam.

The Strategic Industries Division of the Hawaii Department of Business, Economic Development & Tourism (DBEDT) has also helped ATA with its application and eventual registration as a qualified consulting firm with the Asian Development Bank (ADB).

Based on ATA registering with ADB it has been competing for various ADB project potential business opportunities.

ATA has reciprocated by assisting the State in its efforts in Vietnam. For example, in a May 1999 State-led business mission to Vietnam, ATA helped coordinate many aspects of the mission to enable other Hawaii companies to be introduced to opportunities in that country.

ATA also assisted with arrangements for the State of Hawaii's historic signing of an agreement with the Vietnam Ministry of Science Technology and Environment (MOSTE). This letter of intent is for Hawaii's DBEDT and Vietnam to pursue development of a cooperative environmental project. This agreement is truly significant because it was reported by MOSTE to be the first of its kind between Vietnam and a U.S. State.

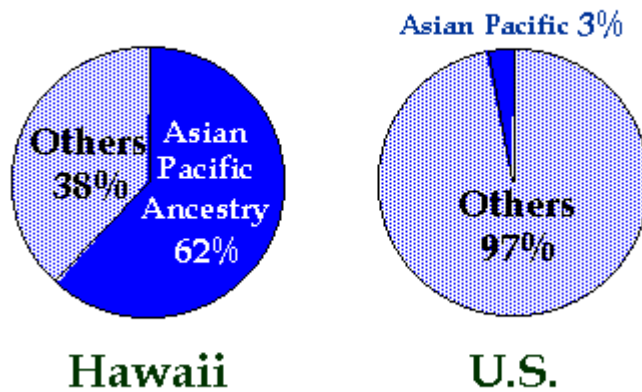
ATA's success in Vietnam is due primarily to its own hard work, but State efforts have eased their entry and helped to reduce business risks.

Hawaii is America's Gateway to Asia

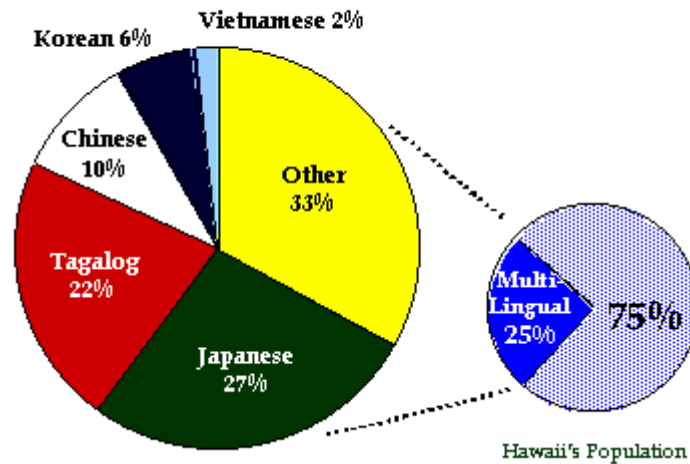
Hawaii has taken a strategic approach to interacting with Asian government and industry officials in educational and business development endeavors and in building close, personal relationships that are essential in business dealings in Asia. This approach is natural to Hawaii due to its close business relationships, in addition to academic, cultural, historical, linguistic, and in many cases, familial ties to the countries in the Asia-Pacific region. Asian executives indicate a strong preference for meetings in Hawaii to initiate contacts which can lead to closing deals.

Asia-Pacific industry and government officials simply feel more comfortable in Hawaii, due to the local culture and social ambiance. The majority (62%) of Hawaii's population is of Asian - Pacific ancestry, compared with only 3% of the total U.S. population. Hawaii's heritage is also reflected in the multi-lingual abilities of our well-educated population. One-fourth of Hawaii's population speak the Asian - Pacific languages, another major advantage when doing business in the Asia - Pacific (See Chart 1, next page). The University of Hawaii is third among all U.S. colleges and universities in graduating "minority" students, who while not in the numerical minority in Hawaii's multi-ethnic population, are students of Asian-Pacific ancestry.

Population Distribution by Ethnicity



Hawaii's Multi-lingual Distribution



The world-renowned East-West Center, a federally-funded academic and research institution, is located in Honolulu. In addition to Hawaii's natural personal contacts in Asia, tens of thousands of alumni of the East-West Center and other universities in Hawaii are in positions of influence in government and business throughout the Asia-Pacific region. These people can be and are tapped as resources to expand and improve key relationships to advance Hawaii's technology export initiative.

Hawaii is certainly well-positioned as a gateway to Asia, but, what about some examples of actual success from our technology export initiative? The next section provides some examples of Hawaii international program activities past and ongoing.

Projects For the Long- and Near-term

The overarching mission of the Center for Asia-Pacific Infrastructure Development (CAPID), a 2000-2002 State of Hawaii initiative, was to promote exports of U.S. energy, environmental, transportation-related and other infrastructure technologies and related services to facilitate sustainable economic development throughout the Asia-Pacific region, while helping to diversify and strengthen the American economy. The CAPID was intended to help open foreign markets to American goods and services.

Hawaii/Philippines Energy Efficiency Technology and Policy Transfer Project.

This Hawaii-Philippines Project on Energy Efficiency and Technology Transfer has had four primary objectives:

1. Introduce advanced Hawaii and U.S. energy efficiency technologies and policies to the Philippines;
2. Introduce Hawaii and U.S. energy service companies to business development and partnering opportunities in that country;
3. Provide policy advisory support on the refinement and enforcement of Philippine energy codes and standards; and
4. Provide policy and technical assistance on designing and implementing utility demand-side management (DSM) programs, as well as energy efficiency performance contracting.

The project has involved extensive collaboration among its participants ensuring only mutually beneficial and agreed upon activities are pursued. The Council of State Governments, through its State Environmental Initiative, provided U.S.-Asia Environmental Partnership funding (\$142,000), and have been active partners throughout the project.

The Hawaii-Philippines Project on Energy Efficiency and Technology Transfer to Improve Environmental Protection and Economic Efficiency will be completed on June 30, 1999, marking the end of its one-year duration. A report describing the project findings, results, and recommendations will be available in October 1999.

To achieve the project objectives, three workshops were conducted:

1. February 1 - 2, 1999 - [Workshop](#) in Honolulu on policy and technology transfer opportunities. Nearly 60 persons attended, including the Executive Director of the USAEP and several senior officials of the CSG. Private sector companies from Hawaii were showcased including HEI Power Corp., Honeywell, and Johnson Controls, Inc. Eleven Filipinos attended, led by Undersecretary of Energy Ben-Hur Salcedo, who also met with Lt. Governor Mazie Hirono;
2. February 2 - 5, 1999 - Co-organization and participation of a Philippine delegation in the Utility PhotoVoltaic Group's International Renewable Energy Business Opportunities [Workshop](#), Kona, Hawaii; and
3. May 31 - June 1, 1999 - [Workshop in Manila](#) on Hawaii energy technologies and services available for export. Nearly 100 persons attended. including the

Philippine Secretary and Undersecretary of Energy,
and the Senior Commercial Officer of the United
States Embassy.

The project has proven so successful that the USDOE has approved a grant for an additional \$50,000 to expand the work that will continue institutional capacity building in the Philippines and ideally result in an energy efficiency performance contracting demonstration project in that country. SID and Philippines DOE have also submitted a proposal for "bridge funding" from CSG/USAEP in the amount of \$40,000, to expand our efforts under that successful grant project, and we will continue to seek additional support for the following planned actions:

- Capacity building through training of Philippines personnel.
- Conduct audits of Philippine facilities for performance contracted retrofits and implement a performance contracting demonstration project.
- Philippines government to set energy efficiency leadership example.
- Consider and address the impacts of the electricity industry restructuring and deregulation on energy efficiency and renewable energy deployment in the Philippines.

The Hawaii/Philippines Biomass-to-Electricity Assessment and Commercial Case Study Project.

In partnership with Hawaii's Strategic Industries Division, and the Philippines Department of Energy, the Hawaii Natural Energy Institute of the University of Hawaii is conducting this project, which includes a complete inventory and future projections of the availability of Philippine biomass feedstocks for use as fuel for electricity generation. The project is developing recommendations for commercially applying the most economic, environmentally responsible energy conversion technologies to responsibly develop these biomass fuels. The database and networking that stem from this effort ultimately will help to identify opportunities and strategies for Hawaii companies to serve markets in the Philippines for commercial deployment of bio-energy technologies, products, and services.

UH-HNEI is also developing two case studies focusing on power generation at two sugar mills using sugarcane bagasse -- Victorias

Milling Company and First Farmers Holding Corporation. Significant opportunities for increased power generation and export have been found to exist, if these mills implement the engineering retrofits of their mills to sufficiently increase the efficiency of their facilities.

The UH-HNEI and SID project team is following-up with HEI Power Corp's Philippines representative, who has expressed interest in working with First Farmers to possibly serve as the contractor to retrofit this sugar mill according to the UH-HNEI analysis.

Technical and Market Assessments

Hainan Province, China, Energy and Environmental Infrastructure Assessment, March 1997.

This assessment consisted of a State of Hawaii SID and HEI Power Corp. scoping mission and preliminary survey of the energy infrastructure and opportunities for exporting Hawaii technology and services in Hainan Province, People's Republic of China. This mission resulted in the identification of an array of business opportunities for Hawaii companies covering coastal resource management, agriculture and ocean R&D, minerals development, and energy resource and technology development, including expansion of power generation facilities, and development of power transmission projects.

Assessment of Potential for Biomass Electricity in Philippines, Thailand, Malaysia, and Indonesia.

The UH-HNEI and SID conducted a broad-based assessment of the potential for electricity production from a variety of bioresidues in these four ASEAN countries. The purpose of the assessment, which has been used by local biomass co-generation developers in their preliminary market analyses, was to provide information on near-term opportunities for supplying more electricity from biomass, a particularly competitive and abundant fuel in Asia.

Hawaii's Asia-Pacific Infrastructure Demand Profiles on the World Wide Web.

Directly related to infrastructure development, Hawaii's Strategic Industries Division developed demand profiles for basic infrastructure in all Asia-Pacific countries, which are available on the Internet to the business community (www.hawaii.gov/dbedt/ert/cp). The profiles also list business and government contact information for each of the twenty countries

profiled. The U.S. Department of Energy, U.S. Energy Information Administration, found these country profiles to be useful enough to provide a "hot link" to our pages from the [DOE website](#).

Business Opportunities & Technical Exchange Missions

Business Mission to Hong Kong, May 31 - June 4, 1999.

Co-sponsored with the Hong Kong Business Association. Meetings with government decision-makers and potential joint venture partners allowed American firms to learn firsthand about infrastructure and other business opportunities.

Hawaii Trade Mission to Vietnam, May 18-30, 1999.

Seven representatives of U.S. firms participated on this [trade mission](#) to Hanoi, Haiphong, Hue, and Ho Chi Minh City. It was organized by the Vietnamese-American Chamber of Commerce and DBEDT. On May 21, 1999, the DBEDT Deputy Director signed an agreement with the Vietnam Ministry of Science Technology and Environment (MOSTE), to pursue development of a cooperative environmental project. This agreement is truly significant because it was reported by MOSTE to be the first of its kind between Vietnam and a U.S. State.

Trade & Sustainable Energy Technical Exchange Mission to Hainan Province, China, November 13-22, 1998.

Sixteen Hawaii delegates went on this [trade mission](#), which introduced Hawaii companies to business opportunities in Hainan. More than 70 key Chinese government officials and industry leaders participated in an introductory one-day seminar. The *Hainan-Hawaii Cooperation Committee* was formally established by execution of a proclamation by the Deputy Director-General, Hainan Province Department of Foreign affairs, and DBEDT Deputy Director; the ceremony was officiated by Hainan Governor Wang Xiaofeng.

The Hawaii Strategic Industries Division led a concurrent technical mission to assess commercial renewable energy and energy efficiency business opportunities for Hawaii companies in Hainan Province. This team included research engineers from the University of Hawaii (UH), Hawaii Natural Energy Institute, and the Biosystems Engineering Department, UH, College of Tropical Agricultural and Human Resources. Most important, three business

deals involving Hawaii and Chinese partners were consummated during the mission.

Thailand Business Opportunities Mission, April 25 - May 4, 1997.

Approximately twenty representatives from eighteen companies participated in this mission to Bangkok, Chiang Mai, and Phuket. Molokai Solar, a small, local solar energy company, signed a memorandum of understanding for business development with a Thai company, while in Bangkok.

Other Facilitative Activities

State of Hawaii & Malaysian National Energy Strategy Delegation Mini-Workshop, August 27, 1999.

The purpose of this workshop was to share and discuss the Malaysian National Energy Strategy Delegation's objectives of its technical visit to the United States and Europe. This delegation was directed personally by the Malaysian Prime Minister to develop a comprehensive national energy strategy, and included a senior representative of the Prime Minister's Department's Planning Unit. Hawaii was the first stop on the delegation's itinerary.

As requested, the State's SID, UH-HNEI, and Hawaiian Electric Company shared their experiences in development of a comprehensive Hawaii Energy Strategy, the State's international energy policy and technology outreach activities, with focused discussions with Hawaii's perspective on:

- Renewable energy, in particular solar and biomass;
- Energy efficiency policies and incentives, and their relationship to utility demand-side management programs; and
- Energy industry restructuring.

The Malaysian Delegation expressed enthusiastic interest in pursuing cooperative energy policy and technology transfer projects with Hawaii.

1998 Year of the Tiger: Opportunities for Trade and Investment in China, January 23, 1998.

Taking advantage of the Chinese Trade and Investment Delegation visit, this one-day conference showcased closer ties between

Hawaii and China. Vice Minister of Foreign Trade and Economic Cooperation, Long Yongtu, was the featured speaker. One panel included: Robert Lees, Secretary General of the Pacific Basin Economic Council; Professor David Yang, University of Hawaii at Manoa; and Richard Halloran, consultant. Trade and investment opportunities in China were presented by the Chinese delegation, and local firms shared their prospects for Hawaii firms in China's tourism market. Approximately 90 people attended this event.

Hong Kong Workshop: Infrastructure Projects worth US\$30 billion Planned, February 5, 1999.

This workshop showcased rail, road, housing, commercial, retail and recreational infrastructure projects scheduled for development in Hong Kong from 1999 to 2004. Patrick Chung, representing the Investment Promotion Unit at the Hong Kong Economic and Trade Office in San Francisco, described Hong Kong as a place of opportunity. Chief Assistant Secretary of Programme Management at the Works Bureau in Hong Kong, Albert Cheng, described the planned infrastructure projects. Approximately 100 people attended this forum sponsored by the Hong Kong Business Association of Hawaii, Hong Kong Economic and Trade Office in San Francisco, and DBEDT.

Business Opportunities in the Asia-Pacific, October 23, 1998.

Especially geared towards engineers and architects, a panel was assembled to discuss business opportunities in the Asia-Pacific. Speakers included: Hawaii Governor Cayetano; Gary Enright, USDOC Director of Export Promotion Coordination; Nikolai Sklaroff, Salomon Smith Barney Vice President of Public Finance Department; representatives from firms currently conducting business in southeast Asia, and DBEDT Director Seiji Naya. This forum was attended by approximately 130 people.

Regional Energy Emergency Seminar and Exercise, May 6-8, 1998.

This exercise and seminar was an integral component of the State of Hawaii's annual Civil Defense hurricane exercise, *Makani Pahili* 98. Regional dialogue between the U.S. Department of Energy (USDOE), the Federal Emergency Management Agency, other federal agencies, the National Association of State Energy Officials (NASEO), state government, county governments, and private industry was demonstrated on-line with direct Ethernet connection to the Pacific Disaster Center (located on Maui) to simulate

response capability during an energy emergency. Management information and decision-making processes required to support the multiple "Emergency Support Functions" which have been identified in federal and state disaster emergency plans were simulated. State and industry energy emergency preparedness was increased through this exercise.

This unique event also attracted international participants sponsored by the U.S. Department of Defense. High level military officials from the government of India participated in the exercise.

December 8-12, 1997 Infrastructure Project Finance Seminar.

In 1995, the Director of DBEDT led a small delegation of invited representatives from private companies as well as State of Hawaii officials to the People's Republic of China. As a result of this visit, Hawaii firms in particular were able to establish direct business contacts and began serious, detailed discussions with their Chinese counterparts. Due to the interest shown by the Chinese government officials and others in attendance at the State-sponsored investment seminar during this visit, DBEDT organized a seminar to disseminate information on innovative financing of infrastructure projects. The theme for this seminar, held December 8 - 12, 1997, was "Hawaii: China's Gateway to America. Approximately eighty-five high-level Chinese infrastructure project planning and development officials, financial and banking officials, judges and attorneys participated in the meeting. The areas of China represented included: Hainan, Guangdong, and Jiangsu provinces; and Beijing and Shanghai metropolitan areas.

Hawaii Energy, Environmental and Engineering Technology Export Directory in English, Chinese, and Japanese.

This [60-page directory](#) lists hundreds of Hawaii companies within the sectors named, and is used to promote Hawaii firms throughout the Asia-Pacific.

Asia's Energy & Environmental Infrastructure Needs: A Profile

The Asia-Pacific region has recently experienced the most serious financial crisis since World War II. Astonishingly, however, almost as quickly as the region's troubles began two years ago, most of affected countries are showing healthy signs of recovery. According to the USEIA's *East Asia: The Energy Situation* report of August 1999, all of the affected countries are now expected to show positive growth, with the unfortunate exceptions of Indonesia and Hong Kong. Further, China, Taiwan, Philippines, and Malaysia all weathered the crisis far better than their neighbors.

Infrastructure growth is tied directly to the economic vitality of a country. So, from Hawaii's perspective, it is very encouraging that the March 25, 1999, *Far Eastern Economic Review* estimated that eight Asian economies -- China, Japan, South Korea, Singapore, Hong Kong, Taiwan, Thailand, and India -- would require **\$515.4 billion of basic infrastructure investments annually** for the next 3-5 years (Chart 1). This should be good news to anyone interested in the health of the global economy.

Chart 1

Industrialized Countries	6,248	7,194	7,529	8,298	9,001	9,749	10,485	1.6
United States	2,713	3,243	3,333	3,585	3,843	4,113	4,345	1.2
EE/FSU	1,908	1,535	1,396	1,536	1,673	1,813	1,965	1.0
Developing Countries	2,274	3,324	3,895	5,033	6,282	7,695	9,422	4.4
Developing Asia	1,268	2,002	2,350	3,105	3,937	4,918	6,122	4.8
China	551	925	1,107	1,520	2,030	2,672	3,486	5.7
India	257	378	493	644	802	981	1,192	4.9
South Korea.	95	181	190	237	285	335	387	3.2
Other Developing Asia	365	519	560	704	819	930	1056	3.0
Central and South America	449	604	735	950	1,182	1,421	1,728	4.5
Total World	10,431	12,053	12,821	14,868	16,956	19,257	21,872	2.5

Note: EE/FSU = Eastern Europe and the former Soviet Union.

Sources: History: Energy Information Administration (EIA), International Energy Annual 1996, DOE/EIA-0219(96) (Washington, DC, February 1998). Projections: EIA, World Energy Projection System (1999).

Reproduced Table 17. International Energy Outlook 1999, USEIA, March 1999.

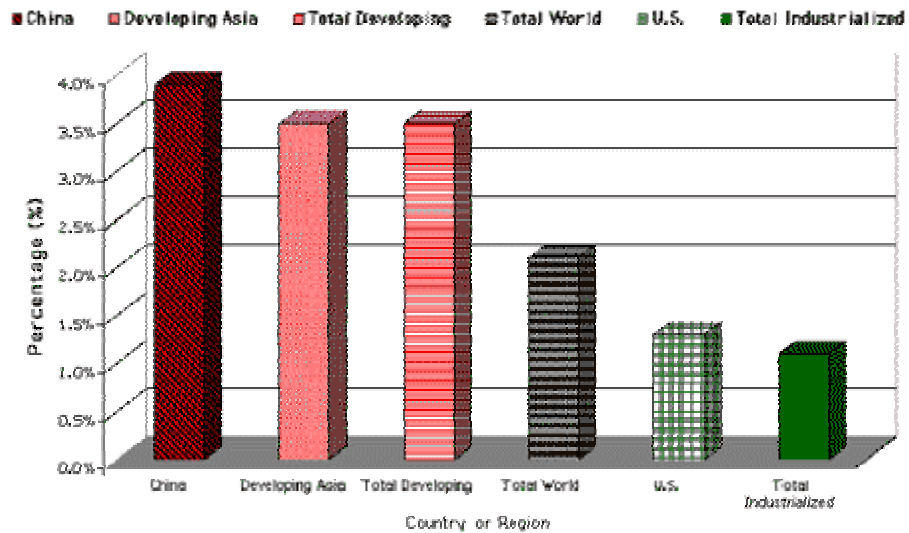
China's electricity consumption growth is forecast to be the highest in the world over the forecast period -- 5.7%! Just two years ago, 72 million people in China were without electricity, and over 1 billion people had no access to a telephone system. This incredible need for electricity and a projected GDP growth rate of 7.0% in 1999 demonstrates China's tremendous need for infrastructure. But, China's resources are incapable of handling this growth alone, and the government is actively seeking outside assistance to meet this demand.

To achieve the projected recoveries of the Asian economies and generate the electricity needed to support this growth, the region is turning to coal, the most carbon-intensive of the fossil fuels. IEO99 estimates that: "Coal use is expected to contribute about 44 percent of the 3.2 billion metric tons of emissions added in the developing countries between 1990 and 2020."

Chart 2 shows that China has the highest annual rate of growth (nearly 4%) of carbon emissions in the world. The Developing Asia and the rest of the developing world clearly outpace the industrialized world in carbon emission growth. These facts demonstrate a clear need and market for Western technologies and services -- energy efficiency, renewables, and high-efficiency fossil fuel supply-side technologies -- capable of curbing and reducing these rates of greenhouse gas emission growth

Chart 2

Carbon Emissions Rate of Growth, 1996-2020



China generates about 600 million tons of solid waste per year, most of which is landfilled or incinerated. The *Assessment of Potential for Biomass Electricity in Philippines, Thailand, Malaysia, and Indonesia*, which the University of Hawaii, Hawaii Natural Energy Institute and State of Hawaii Hawaii's Strategic Industries Division conducted in 1996-97 found that the disposal of wet biowaste is one of the greatest environmental problems facing these four countries. Developing Asia has similar needs. Among other issues, these solid wastes generate millions of tons of methane, a potent greenhouse gas.

Thus, these problems represent yet another type of lucrative environmental market for U.S. environmental firms. Just a few examples of the types of companies needed include those specializing in recycling and remanufacturing, and bioremediation. Bioremediation, especially advanced, efficient anaerobic digestion, offers tremendous promise to address Asia's wet biowaste problems, while capturing methane and using it for such uses as electricity production or other process energy.

This appendix is only a brief glimpse at the energy and environmental issues that face Asia. But, rather than view these issues as insurmountable problems, Hawaii chooses to view them as huge opportunities to diversify and grow our economy, while deepening our already close relationships with our Asia-Pacific neighbors.