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RESOURCE-EFFICIENT CITIES

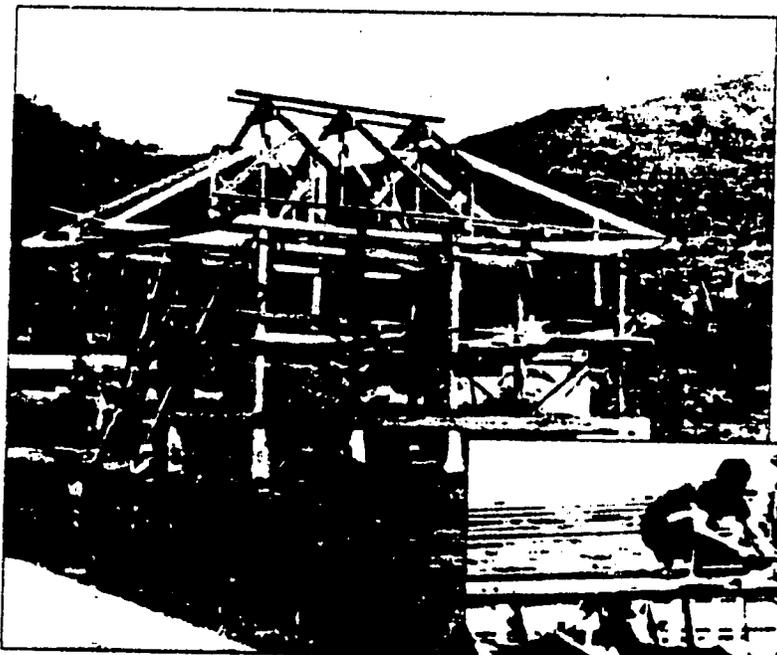
USAID IS UNDERTAKING A PROJECT TO IMPROVE ENERGY AND RESOURCE CONSERVATION IN SMALL AND MEDIUM-SIZED CITIES.

BY AVROM BENDAVID-VAL

Rapidly growing cities in developing countries take a heavy toll on scarce energy and natural resources. Not only are large amounts of fossil fuels needed for transportation, industry and to generate electricity, but urban areas are also rapidly consuming and depleting minerals, water, wood and other natural resources. In fact, present urbanization rates combined with increased resource use by urban dwellers and their businesses simply cannot be maintained.

Most efforts to address this problem have focused on metropolitan areas in the less developed countries (LDCs) because they are the largest, most intensive and most dependent consumers of energy and natural resources. But their infrastructure, economic and transport systems as well as the institutions that support them, are large and well-established. As a result, modifying their energy and resource use patterns is a monumental, costly and long-term task.

The urban structures of small and medium-sized cities, however, provide better opportunities to build energy and resource efficiency into emerging transportation systems, waste management methods, building designs, industrial technologies, land-use patterns, etc., and through relatively modest measures. This is largely because the institutional frameworks in small and medium-sized cities tend to be more accessible and



Cost-efficient housing is emphasized in the MEREC program.

flexible, making coordinated and timely responses to energy and resource concerns more easily attainable.

The United States Agency for International Development (USAID), with the assistance of the United States' Tennessee Valley Authority, USAID's contractor, has undertaken an action-research and demonstration project to improve energy and resource conservation in rapidly growing small and medium-sized cities. The projects, called Managing Energy and Resource-Efficient Cities (MEREC), brings together government, research institutions and the private sector to develop, implement and demonstrate solutions



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Mine reclamation in Thailand.

to current resource-related problems while also establishing long-term patterns for efficient energy and resource use.

A pilot project was begun in late 1981; by mid-1982 it was fully operational in Tacloban, Philippines; and during 1983, two more cities, Guarda, Portugal, and Phuket, Thailand, were added. The MEREC planning process, through its application in the three cities, demonstrates that efficient use of development resources provides a concrete, practical and measurable basis for effective planning and management.

The local MEREC process

Local leaders in MEREC cities form a task force to guide the MEREC process with the help and participation of national and municipal departments, special subcommittees and representatives of universities. Although a government official or city mayor heads the main task force, and local leaders are given the key responsibilities, care is taken to include in the process representatives of smaller public and private organizations whose cooperation is essential to achieve MEREC objectives.

First, the task force reviews the use of development resources, analyzes linkages between them and local development activities and determines new development opportunities and possible constraints. The results are prepared in the form of "Situation Reports" for each major urban resource.

Next, the MEREC task force formulates a strategy to foster efficient use of urban resources and promote local economic growth. The MEREC program sets out local policy objectives for the particular resources currently of greatest concern. These may include transport fuel, potable water, fuel wood, municipal waste, food, urban land and local construction materials. Resources are typically identified because they are in short supply and very expensive, or be-

cause they represent a significant opportunity for local economic development.

In order to implement the MEREC strategy, action plans are then devised for key urban sectors, such as electric power, land use, water supply, waste management and transportation. The action plans provide the basis for specific projects and other activities that will be undertaken in each sector with respect to the relevant resource and include budgets, implementation schedules and a list of responsible individuals or organizations. The task force coordinates these sector action plans, and together they constitute a broad program for the city as a whole.

The procedure described above extends over a period of about nine months and is marked by workshops that are conducted at three-month intervals. The first reviews the resource Situation Reports, the second reviews the MEREC strategy, and the third reviews the city's completed action plan. Thus, each workshop formally receives, considers and accepts the product of the preceding three-month period and develops a detailed workplan for the next three months. Following the final formal workshop, the focus shifts to refinement of detailed plans for specific projects and to the project's actual operation.

During a two-year implementation phase under USAID's sponsorship, the sector action plans are carried out. Specific projects and long-term planning activities are undertaken and associated energy/resource savings are monitored, evaluated and modified where necessary. Some projects are cancelled or delayed, and new projects may be added.

Tacloban, Philippines

Tacloban, the capital of Leyte province, is one of the primarily fastest growing cities in the Philippines. With 105,000 low-income residents and annual growth rate of 5.4 percent, Tacloban's size is outpacing its capacity to

provide services. The city has an inadequate sewer system, for instance, and the drainage system simply floods during heavy rains. Potable water delivery is reasonably good, but there are considerable system losses. There is also no public bus service within the city; fleets of motorized tricycles and jitneys provide fuel-inefficient public transport services, with no regular stops and relatively random routes.

The basic MEREC planning process described above was employed in Tacloban. Final formulation with the help of a matrix (see table) was developed by the local task force, which worked closely with local officials. The matrix, listing resources of major local concern along the top and the key urban sectors along the side, includes strategic objectives set out by the MEREC planners for each sector and resource. The same format was used to identify specific projects that would encourage resource conservation and pinpoint areas where intersectoral coordination was needed.

The following are projects in Tacloban's MEREC action plan that are currently being implemented, together with the funding method and a summary of their status at the close of 1984:

Development of a new land-use plan oriented to energy and resource efficiency. (Surveys funded by MEREC; plan preparation financed by the city.) This project is nearly complete. Because of public hearings held in connection with the plan's development, this project has served as a vehicle to introduce Tacloban's citizens and institutions to urban energy and resource efficiency concepts. The focus has now shifted to implementation.

Development of a fuel-efficiency-oriented traffic and transportation plan. (Transportation planning specialist funded by MEREC; implementation funded by the city, national government and the private sector.) Here, key elements are



In Tacloban, potable water leaks are being corrected throughout the city's water distribution system.



Local materials are being used in this Portuguese construction project (above). Left, close cooperation is encouraged between MEREK staff, government officials and the private sector.



small-scale improvements to roadways, walkways and traffic-control infrastructure; alterations in one-way street and parking patterns; and initiation of a carefully worked out bus route. The plan's implementation recently began.

An urban agriculture project designed to make maximum use of idle urban land for food and fuelwood production. (Initial demonstration funded by MEREK and the city; program continuation supported by the city.) This project is fully complete and will continue to operate as a self-sustaining activity out of the City Agriculturalist's office. The estimated value of the vegetables, livestock and fuelwood produced and sustained by the demonstration project in the first 16 months is about US\$200,000. However, the number of jobs created has not been determined.

Design and construction of eight demonstration housing units. (Initial funding by MEREK, with land and labor contributed by the city.) These are intended to maximize comfort and functionality with minimal use of public utilities. They are less expensive and utilize a higher proportion of local building materials than conventional units. The units are designed for the lower-middle-income market, where habits of energy and resource waste are thought to begin. The design and construction costs have been met. Some of the local building supplies used, such as tree bark, were formerly

considered waste products but are now being incorporated into roofing tiles and other construction materials. Onsite water collection and gas generation, as well as natural cooling features are included in the designs.

A program to reduce water loss in the city's water supply system. (Wholly supported by the local water district.) This program entails continuing rounds of leak detection and repair. At the end of the first year of activity, water system efficiency had been raised from 53.4 percent to 61.2 percent.

Centrally-placed waste containers in the main commercial areas to reduce waste-collection fuel costs. (10 containers funded by MEREK; 10 containers financed by the city.) In the first year of operation the 20 containers (only 17 are operational at any given time) have led to decreased fuel consumption by city trucks—12.4 percent per cubic meter of waste collected. The city is now manufacturing and installing additional containers at its own expense.

Human-powered pushcarts for waste collection. (Initial funding by MEREK; continuing funding by the city.) This is no longer a demonstration project, but is now part of Tacloban's regular waste management program. It not only accounts for a 17.4 percent decline in fuel consumption per cubic meter of waste collected by the city, but the program also has created 10 additional jobs. Using both pushcarts and the 20 containers, fuel consumption in waste collection has fallen by nearly 30 percent.

A biogas plant. (Construction financed by MEREK.) Built at the city slaughterhouse, the plant converts animal wastes

into methane gas for slaughterhouse process heating and lighting. Construction has been completed, and a debugging period is under way. Waste consumption and energy production data have not been calculated, however.

An oxidation pond. (Construction funded by MEREK.) Also located at the slaughterhouse, the pond will improve water quality in a bay near the city and will provide sludge for fertilizer. Construction has been completed, and a debugging and testing period is under way. Fertilizer production and water-quality data are not yet available.

A new landfill. (Component expenses assumed by MEREK, the city and the World Bank.) The landfill will replace an open dump and, in addition to improving sanitation, will create valuable urban land for future city growth, facilitate separation of waste for recycling and reduce fuel consumption in waste management. Plans for the new landfill have been completed and equipment has been ordered. Landfill operations should begin in 1986.

An electric meter calibration program to increase distribution efficiency of the electricity system. (Equipment funded by MEREK; program funded by a local electricity cooperative.) Results from calibrating the first 600 meters suggest that the program will increase overall system efficiency approximately 10 percent (see box).

An energy auditing and consultation program for institutions, businesses and industries. (Training supported by MEREK; program financed by a local electricity cooperative.) Audit equipment and training have been provided, and pilot audits conducted at a local university indicate substantial energy savings potentials. Energy efficiency data is expected soon. From the energy auditing and consultation program has come a related project establishing a revolving loan fund for the bulk purchase of energy-efficient light bulbs for use by city municipal offices, institutions and businesses.

In summary, with the help of a locally refined project monitoring handbook and a MEREK-provided microcomputer, the MEREK task force in Tacloban will be carefully tracking individual projects as well as citywide energy and resource efficiency in the years to come. Through 1986, a wealth of technical data will increasingly become available from Tacloban that will be useful to other cities in their own efforts to promote energy and resource-efficient urban development.

Guarda, Portugal

Guarda, population about 50,000, is in central Portugal, approximately 120 km from the country's western Atlantic coast. The mainstay of the economy is trade, augmented by light manufacturing and agriculture. The city has faced serious problems: Water supplies are often inadequate; heating fuel is expensive and used inefficiently; parts of the urban area were spread far beyond adjacent agricultural lands, which are now threatened with infill development; and, although Guarda is situated in an area with a cool climate and extensive forest and quarry reserves, the construction style is a traditional Mediterranean stucco that's more appropriate in the southern part of the country.

To date, the city's MEREC task force has completed the resource Situation Reports, MEREC strategy and the more specific action plan, and has begun implementation.

Like the program in the Philippines, MEREC staff members have worked closely with city officials. During the initial planning, for example, they cooperated with two nearby municipalities to create and operate a regional landfill and biogas project. The task force and technical support team also visited local factories, construction sites and farms to gather information and ensure that the private sector's concerns were reflected in the MEREC strategy. In addition, a number of government agencies have been closely following Guarda's MEREC effort, providing technical assistance and lending support to the implementation of selected projects.

Because Portugal is no longer a regular USAID-assisted country, Guarda's MEREC grant includes no "hardware" implementation funds. The initial round of energy and resource efficiency projects, to be implemented in 1985, are all planning, research and demonstration activities jointly funded by MEREC and city, regional or national sources. Those activities requiring construction or the purchase of equipment will follow and will be fully funded by domestic sources with assistance from the European Economic Community. Among the projects currently in Guarda's MEREC action plan are:

- a study of water demand and supply that will identify and evaluate alternative sources for meeting future potable water needs;
- an evaluation of the present water treatment system, and sewerage system recommendations for expansion and for improvement of efficiency and water quality;

There is a new appreciation of the benefits of cooperation among different government levels and the private sector.

- a recycling feasibility study, including assessment of quantity and makeup of solid waste, local markets for recovered resources and recommendations for a self-sustaining recycling program;
- feasibility studies for methane generation and a biogas generator;
- surveys and classification of agricultural lands for preservation;
- a study and plan for optimal irrigation systems;
- a plan to increase the efficiency of the local water distribution system through leak detection, repair and other measures;
- an energy and resource-efficient land-



Solid-waste collection projects in Tacloban have produced significant savings in energy consumption and gains in local employment.

use and urban management plan, which includes incorporation of relevant elements of the other studies and plans, assessment of existing land-use and management practices, a land-demand forecast, land suitability studies, and recommendations on future land-use patterns, urban management tools and programs for implementation;

- a program to update building codes and standards to promote energy efficiency;
- a project to promote the use of local building materials in construction;
- research and information dissemination on local renewable energy sources.

With these new MEREC projects, Guarda will be the only city in Portugal with modern and efficiency-based development, land-use and urban management plans. Owing to the unique municipal-national and municipal-regional cooperation that has come about through MEREC, the obvious development and modernization potential of the projects, and the fact that Guarda is now able to make immediate and effective use of any available EEC, national, regional, local and private investment funds, neighboring cities are investigating similar programs.

Phuket, Thailand

Phuket and its surrounding area have a population of about 135,000 and are situated on an island in southern Thailand. Cashew nut farming, raw rubber production, tin mining and fish processing are the major industries. There is also a growing tourist industry. The quantity and quality of water is a major problem for Phuket, however, that limits fishery and agricultural production and causes health problems. There is also a shortage of wood for finished goods and fuel. Siltation of drainage canals has long caused flooding of low-lying areas during the monsoon season, as well.

Staff members and students from Thailand's Prince of Songkla University's Center for Development Resources and Faculty of Management Sciences are providing technical support to the Phuket MEREC task force. This arrangement not only reinforces the MEREC effort but at the same time provides the university's faculty and students with field-based experiences. Much of what is learned will be incorporated into university programs, thereby building in-country dissemination of the Phuket MEREC demonstration.

Representatives of the central and provincial government, as well as the private sector, also are active partici-

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pants, together with local officials in the Phuket MEREC planning process. As a result, private-sector opportunities are being developed and there is a new appreciation of the benefits of cooperation among different government levels and the private sector.

The MEREC task force has completed the resource Situation Reports, MEREC strategy, the city's action plan, and has embarked on the implementation and continuation phase. All projects are being jointly financed by MEREC and the city; in most cases, additional cash or in-kind contributions are made by Prince of Songkla University, the provincial government, central government agencies,

other USAID programs and the private sector. The projects currently in Phuket's MEREC action plan include:

- inspection and calibration of water meters to improve the quality of water-consumption data;
- development of inexpensive, efficient and sanitary residential rainwater collection systems;
- construction of a biogas digester at the municipal slaughterhouse;
- construction of fermentation tanks to convert human waste to fertilizer;
- an energy-efficient transportation and traffic plan;

- research and development activities to expand the value added to locally produced raw rubber and to find commercial uses for currently discarded coconut and rubber trees, cashew nut shells, and other agricultural waste products.

- multiple-use reclamation of a 24.2 hectare, abandoned tin mining site that will include fish ponds; flower, cashew, rubber, coconut, and turf production; housing; water empoundment; and recreation areas.

- finally, construction of three housing units designed for energy and resource efficiency, utilizing local building materials and constructed at a lower cost than

Sectors	Resources					
	Urban Land	Transport Fuel	Electricity (and other energy)	Urban Waste	Local Bldg. Materials	Water
Land use	Achieve more efficient land use for all purposes	Reduce fuel consumption through better land-use patterns	Provide alternate energy sources through urban agriculture	Identify future sites for waste disposal	Produce local building materials and furniture through urban agriculture	
Housing and construction	.....	.....	Create housing designs that conserve and create energy	Use common biogas digesters	Employ local building materials and improved local building materials	Utilize rain water instead of city water
Water, sewerage, drainage	Increase usable urban land	Increase fuel efficiency through better road access and maintenance	.....	.....	.....	Reduce water losses Reduce bay water pollution
Waste management	Establish reclaimable landfill site Provide fertilizer for urban agriculture	Reduce fuel consumption via push carts, centralized containers, and new landfill	Convert waste to fuel	Increase the percentage of resources recovered	.....	Reduce water pollution (both ground and bay water)
Electricity (and other energy)	.....	.....	Increase efficiency of electricity distribution and consumption			
Transportation	Coordinate traffic patterns with desired land use	Conserve fuel through transportation planning Promote alternate transport fuels	Utilize local alternate energy sources			
Summary strategy for each resource	Achieve more efficient use for all purposes	Increase transportation fuel efficiency	Increase efficiency of existing sources and utilize alternate energy sources	Promote efficient utilization of urban waste for energy use and other purposes	Promote the efficient use of local building materials and designs	Conserve water and water sources

The planning process in Tacloban.

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counterpart conventional housing.

Although implementation is just beginning for many of these programs, they are attracting considerable attention from the provincial and central governments, the USAID mission and other Thai cities. Both the Royal Thai Government and USAID-Bangkok are considering expansion of MEREC to other cities and are examining the Phuket experience for lessons that can be applied to other program activity.

The global MEREC demonstration

An important factor in the successes of the three MEREC demonstrations, to date, has been the assistance provided by the Office of Natural Resources and Economic Development of the Tennessee Valley Authority (TVA). Specialists from the TVA MEREC team helped with the city selection process and provide technical assistance to the MEREC task forces throughout both planning and implementation. The TVA MEREC team plays important educational roles within MEREC cities and performs critical liaison functions among the central governments and USAID missions.

A TVA MEREC team member works with each MEREC city and coordinates the activities of other TVA experts who provide specialized technical assistance as needed. The team members also participate in all planning workshops and are experienced, small-city development practitioners; their ultimate mission is to transfer their skills to officials in the MEREC cities.

The TVA is also responsible for networking among the MEREC demonstration cities and for accumulating and disseminating the data generated by their energy- and resource-efficiency projects. All members of the TVA MEREC team are familiar with all three demonstrations and take pains to ensure that ideas are shared among them. In the spring of 1984, for instance, the TVA held a highly successful two-week seminar at its headquarters in Knoxville, Tennessee, USA, for members of the MEREC task forces from all three cities. The seminar gave MEREC city officials an opportunity to consult with a wide variety of TVA experts and exchange information.

The TVA MEREC team also assists with local project monitoring, and incorporates the resulting energy- and resource-efficiency data into a MEREC Information System located in Knoxville. This computer program accumulates and processes the data, and makes available regular special reports, case studies and responses to inquiries.

The MEREC projects have shown

Project specifics

Energy projects are an integral part of the MEREC program. And, in Tacloban, Leyeco II, an electricity cooperative serving 11,000 customers, is the focus of several projects which are detailed below.

Improvement of Leyeco's distribution efficiency. This project involves an assessment of Leyeco's distribution system and the preparation of a report that identifies ways to improve Leyeco's efficiency.

A field assessment of the co-op's distribution system was made in July 1984, and a report was prepared by a TVA co-op engineer on necessary improvements. The latter concluded that distribution efficiency has improved from 68 percent in January 1982, to 79 percent in August 1984—saving nearly US\$400,000. These figures prompted Leyeco II General Manager Manuel L. Sta Maria to credit MEREC for playing a major part in increasing the cooperative's distribution efficiency.

In addition, the report recommended that Leyeco:

- modify and use a new meter tester for all electric meters in Tacloban;
- begin an active program to identify and stop current diversion (theft);
- initiate programs to check and make changes to large customer meter connections;
- continue checking large customer meters for poor power factors;
- repair malfunctioning voltage regulators in substations.

In general, the investigation found Leyeco II's system to be sound, despite areas that need improvement.

Meter calibration. A phantom load and watt-hour meter is being used by Leyeco II to calibrate electric meters throughout the city. The purpose of this project is to

raise the efficiency level of the system. There are currently large, unaccounted-for electricity losses.

Meter calibration equipment was supplied by MEREC for this project. Approximately 2100 of the 14,000 local meters have been calibrated. (A total of 1500 can be calibrated during a quarter.) An adaptor for the equipment was provided by the manufacturer during 1984 so that it is now compatible with 100 percent of the local meters.

Energy audit program. An energy audit program for institutions, businesses and industries based on TVA experience has been started in Tacloban. Energy audits locate sources of energy loss and provide guidelines for reducing energy consumption.

The Leyeco co-op staff has been trained to conduct audits with equipment supplied by MEREC.

Additional energy projects. Two other projects supplement the MEREC activities conducted by Leyeco. One is the establishment of a light bulb revolving fund. The second is the instigation of an energy-efficient cookstove project.

The efficient light bulb revolving fund will provide US\$2000 to purchase light bulbs. The city and Leyeco II have been unable to implement recommendations from earlier energy audits because energy-efficient bulbs were not available in Tacloban. The bulbs must be purchased in bulk, and local agencies are unable to allocate the money. After the initial purchase, the city will replenish the fund as new bulbs are bought.

The cookstove project involves the demonstration and promotion of low-cost cookstoves. Leading this project are three local United States Peace Corps workers who have constructed two cookstoves and are now instructing others how to build them. □

that with an appropriate planning framework, a wide array of indigenous resources, expertise and operating agencies can be brought to bear to solve local development problems and to increase energy and resource conservation in small and medium-sized cities. In all three MEREC cities the planning process has served to develop new links among the local government, private sector, public institutions and central government agencies. MEREC has also changed attitudes about the benefits of a participatory and resource-focused urban development planning process. And in all three cities, MEREC is demonstrating how much can be accomplished with local initiative and resources.

But the most critical tests of the MEREC approach are still to come. What will be the long-term benefits of the three MEREC city demonstrations? To what extent will the MEREC process continue in each city once USAID support and TVA technical assistance terminate? How much of their own resources will central governments and other cities be willing to commit to MEREC-type efforts elsewhere? In light of competing demands for limited funds, will USAID missions be willing to promote and support MEREC projects in their host countries? The centrally funded MEREC action-research and demonstration project runs through 1986. By then, many of the answers will be in. □