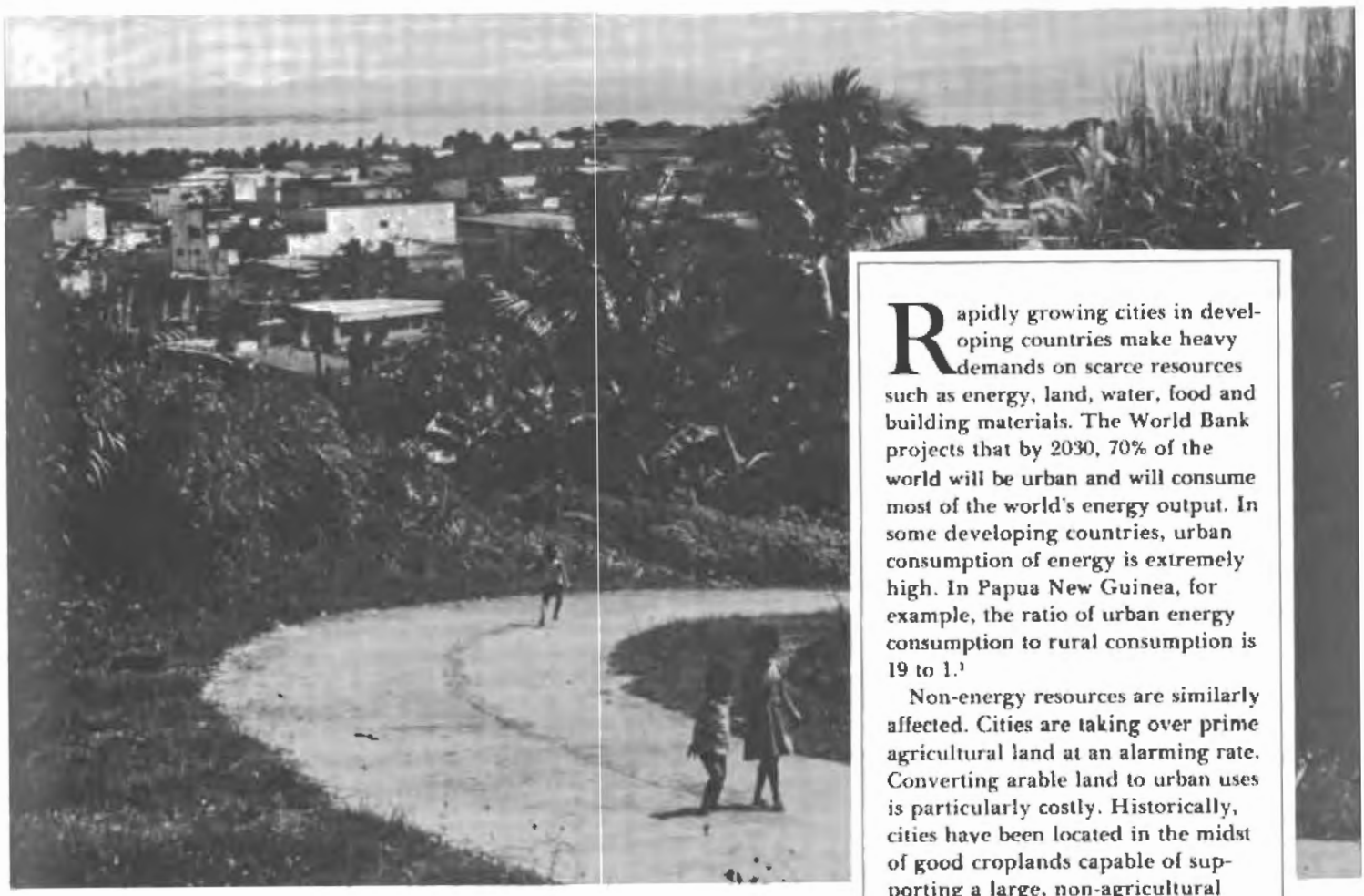


by Eric Chetwynd Jr. and Alan Carroll

EFFICIENT ENERGY AND RESOURCE MANAGEMENT FOR CITIES

Applied research and demonstration project zeros in on resource conservation.

Rapidly growing cities in developing countries make heavy demands on scarce resources such as energy, land, water, food and building materials. The World Bank projects that by 2030, 70% of the world will be urban and will consume most of the world's energy output. In some developing countries, urban consumption of energy is extremely high. In Papua New Guinea, for example, the ratio of urban energy consumption to rural consumption is 19 to 1.[1]

Non-energy resources are similarly affected. Cities are taking over prime agricultural land at an alarming rate. Converting arable land to urban uses is particularly costly. Historically, cities have been located in the midst of good croplands capable of supporting a large, non-agricultural population. In some countries, the process places extreme pressure on marginal agricultural lands to produce yet more food. Often, woodlands near expanding cities are depleted rapidly to meet increasing urban demand for fuelwood and building materials.

Cities can consume these resources more efficiently. Conservation, the World Bank estimates, could contribute significantly to a proposed 25% reduction in petroleum imports in developing countries by 1990. A U.S. government report states that "increased efficiency has the potential to provide major energy and financial benefits to the Third World and world markets," and yet, the report

1. Kenneth Newcomb, based on studies carried out in Papua New Guinea, in the late 1970s.

concedes, this approach largely is "ignored by international aid agencies."[2]

Fortunately, the situation is beginning to change. The World Bank, the United Nations, AID and others are moving, albeit tentatively, into conservation-oriented programs. One AID activity, "Managing Energy and Resource-Efficient Cities" (MEREC), is helping improve efficiency in the use of energy and other key resources in small and intermediate-sized cities—for purposes of this project, those with populations of 50,000-150,000.

The Case for Small and Intermediate-Sized Cities

Some experts argue that resource conservation should begin in the major cities where most of the urban resources are consumed, rather than in the small and intermediate-sized cities on which the MEREC project is focused. There is no question that resource conservation in major cities is of great importance, but it is a complex and costly proposition. Physical layout and design, growth trends and patterns, building styles, infrastructure systems and life styles already are well established. In the larger cities, significant resource conservation involves expensive retrofitting of buildings and homes, difficult changes in infrastructure systems and complex and politically costly social engineering to change attitudes and practices.

On the other hand, the number and population of small and intermediate-sized cities are growing rapidly. Between 1950 and 1980 in Africa, Asia and Latin America, their number has tripled. In almost all of those cases, their growth rate exceeded that of the national populations.[3] This means that the share of urban population living in small or intermediate-sized cities is increasing.

Tacloban's port offers a study in contrast as traditional boats dock near modern commercial vessels.

Moreover, with limited financial resources, AID can make a greater contribution by concentrating on those cities in which basic growth patterns are emerging, in which transportation, waste disposal, water and electric power systems are in early stages of development and in which it is not too late to influence the design, layout and material content of houses, buildings and other structures.

Developing countries are giving increased attention to decentralized urbanization. Stimulating growth in smaller urban centers opens many opportunities to work on resource conservation problems at this level. As smaller cities more and more assume important roles in national economic development, their need to exercise efficient energy and resource management becomes more compelling. Energy and resource conservation may make an even greater impact at the local level where it is carried out as a strategy encompassing the complementary development of an urban center and its surrounding rural region. For example, urban waste products and waste water can be used for compost, fertilizer, soil conditioning and irrigation in the surrounding countryside.

Developing MEREC

MEREC is an applied research and demonstration project. Host-country public officials and private sector representatives in local demonstration areas develop an action plan that includes a strategy for resource and energy-efficient development of a variety of sectors. The plan contains

2. *The Global 2000 Report to the President.* A report prepared by the Council on Environmental Quality and the Department of State. Vol. 1, Washington, DC, 1980.

3. Dennis A. Rondinelli, *Developing and Managing Middle-Sized Cities in Less Developed Countries*, a monograph prepared for the Office of Urban Development, Bureau for Science and Technology, AID, Washington, DC, 1981.

"MEREC has created an awareness in Tacloban that a great deal can be done to foster energy and resource efficiency at the local level with local initiative."

a coordinated package of sectoral investment projects, studies, education and training efforts, routine information collection and analysis and evaluation.

The MEREC approach was developed through a "pre-test" in Tacloban, Philippines, a small but growing city of about 103,000 people. The Philippines was selected because the national government places a relatively high priority on energy and resource problems. Tacloban met several criteria for participation—rapid growth, energy and resource constraints, adequate local technical and administrative capacity and dynamic leadership.

Prior to adopting the conventional sectoral approach, other approaches were considered. The first would have involved the quantification of cities' energy and resource flows to determine the magnitude of problems, and to assess the potential costs and savings of addressing them. This approach, though conceptually satisfying, would have been complex, cumbersome and inaccurate if applied to small and intermediate-sized cities in developing countries. Data would be difficult to locate, incomplete and unreliable in most cases. The effort could be interpreted locally as just another study, raising suspicions and stretching patience rather than stimulating local interest, initiative and support. Suitable methods to quantify the resource flows would be difficult to develop, as would translating the analyses' results into meaningful programs.

A second approach, the "urban ecosystems" model originally adapted for contemporary application by Richard Meier in the early 1970s, is a useful conceptual framework for understanding cities as resource-consuming systems and helped guide initial development of the MEREC project.[4] However, the model lacks specificity and rigor, making it difficult to teach to others and apply in the field.

AID opted for a sectoral approach keyed to the handful of urban sectors likely to be energy and resource intensive or wasteful. AID experts felt that the land use, transportation, electric power, water and sewer, solid waste and housing sectors could be examined by local officials for resource consumption patterns and waste with minimal orientation and technical guidance from outside. The resulting information would be pulled together into a multisectoral energy and resource conserving strategy for the city. The approach's participatory nature would provide local personnel with a sense of control over and "ownership" of the project.

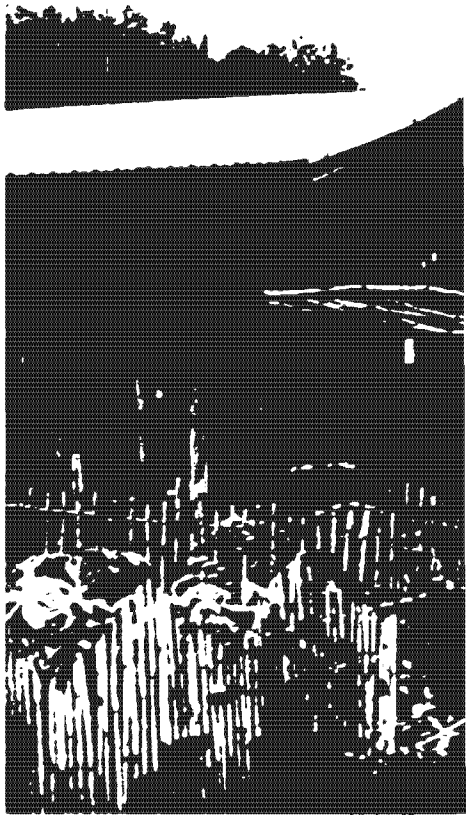
Profile of Tacloban

Tacloban is one of the fastest growing cities in the Philippines, with an annual population growth rate (1975-80) of 5.6%. The capital of Leyte province, Tacloban is a port city and serves as the principal commercial and educational center of the Eastern Visayan region. Of the city's total land area of 10,855 hectares, 18.9% is urban. The rural area includes arable land, land under permanent crops, pasture land, barren land and forest or woodlands. The climate is tropical; annual rainfall is heavy.

Tacloban is growing faster than its capacity to provide adequate services.

4. R.L. Meier et al., *The Urban Ecosystem and Resource-Conserving Urbanism in Third World Cities*, a report prepared for the Office of Urban Development, Bureau for Science and Technology, AID, Washington, DC, March 1981. Also, Richard L. Meier, *Planning for an Urban World: The Design of Resource-Conserving Cities*, MIT Press, Cambridge, MA, 1974.

"The MEREC data base on land use, transportation, urban waste and other sectoral activities will be useful well beyond the life of the project."



About 70% of its population is low-income, according to unofficial estimates. There is no sewer system; the drainage system is overwhelmed during frequent heavy rains. Potable water delivery is reasonably good but fees are high by Philippine standards. Heavy rains incapacitate the system for short periods while sand filters are cleaned. Until recently, the city experienced chronic brownouts due to inadequate output by the two local power cooperatives. There is no public bus service, but extensive private fleets of tricycles and jeepneys provide adequate, though very fuel-inefficient, public transport service with no regular stops and somewhat random routes. Traffic jams during peak hours are becoming a serious problem.

The region exports large quantities of rice, but most of its fruits and vegetables are imported, despite excellent growing conditions. Most building materials are imported.

The city is governed by an elected mayor, vice mayor and city council. Principal government officers include a treasurer, assessor, engineer, health specialist, agriculturalist and city development coordinator. Regional offices of national organizations are responsible for transportation, water and sewer, electric power and the police. The mayor does not have direct authority over the regional offices, although the offices must coordinate their Tacloban operations with city officials.[5]

Institutional Setting for the Project

In August 1981, shortly after Tacloban agreed to be the pre-test site, the mayor set up a MEREC task force, led by the city administrator, to act as a steering committee for the project. The task force was divided into sectoral subcommittees.

At the national level, the project was sponsored by the National Economic and Development Authority (NEDA), which played a monitoring and facilitating role. The Ministries of Energy and Human Settlements provided technical advice to the project.

The pre-test approach was developed during early meetings in Tacloban between the task force, AID officers and consultants. It centered on three workshops. The first workshop included the task force, its subcommittees plus Philippine energy and resource conservation consultants. The second, held in Washington, was attended by the mayor and several task force representatives as well as U.S. technical specialists. The final workshop produced the city's energy and resource strategy.

To prepare for the first workshop, the subcommittees produced reports describing conditions in Tacloban, identifying energy and resource consumption problems and proposing strategies to deal with them. Proposals ranged from an energy-conscious integrated transport and traffic plan drawn up by the transportation working group to a composting pilot plant and methane gas recovery program devised by the working group for water and sewers.

The land use working group recommended resource-efficient guidelines to influence future land use planning and conversion of unused land and nearby rice lands to fruit and vegetable production. The latter would help reduce heavy local import of fruits and vegetables from Cebu and Manila. It also would make produc-

5. Tacloban, Philippines, *Situation Report: Managing Energy and Resource Efficient Cities*, prepared by Tacloban for AID, Washington, DC Workshop, December 1981.

Housing in Tacloban reflects a Western influence, with little regard to meeting local needs. Roofs retain heat, there is little ventilation or shade from trees.

tive use of organic waste generated by the city, take advantage of local technical and marketing expertise and help absorb the city's surplus labor.

The land use working group recommended consolidating planned industrial sites into one well-serviced site located near a major bus route on the city's outskirts. Earlier planned sites were far-flung with poor access, inadequate services and weak drawing power.

The energy working group recommended household and business surveys along with educational campaigns to identify specific conservation opportunities and encourage their exploitation. The water and sewerage working group recommended initiatives to increase efficiency of solid waste collection, disposal and recycling.

A preliminary state-of-the-art paper on energy and resource conservation was prepared by AID. U.S. sectoral experts responded to the proposed strategies at the second workshop and recommended a refined set of strategies along with criteria to be applied to their further development. It was agreed that the strategy elements should be:

- cost-effective in terms of resource conservation and improved community welfare measured against life cycle costs;
- proven approaches and appropriately small-scale;
- replicable in other cities and capable of becoming self-sustaining;
- learning-based—capable of increasing local knowledge and understanding;
- manageable by the city; and
- reflective of a healthy interaction between the public and private sectors.[6]

6. Coopers and Lybrand, "Pre-test for Managing Energy and Resource Efficient Cities: Results of Washington, DC Workshop," December 10-11, 1981. Also, Development Analysis and Programming, Inc., "Managing Energy and Resource Efficient Cities: Project Design," January 1982.

Workshop participants agreed no action should be taken on strategy elements in the absence of adequate planning and design information and without community participation. Furthermore, it was agreed that certain "don'ts" should be observed during the initial phase: don't do anything that requires heavy capital investment, that will result in major physical change, that will require major social change or be politically risky. These criteria and general guidelines, along with the revised proposed strategy elements, set the stage for and the tone of the third workshop and prepared action plans for each sector.

Strategy Synthesis and Summary

The final step was to write a brief synthesis and summary of the strategy. The strategy covered general support, land use, transportation, solid waste, building design and materials, sewage, water and energy and electric power, in order of rank reflecting the relative impact a sector was thought to have on other sectors. For example, the "general support" plan contained two cross-cutting elements—a citywide resource conservation information and education campaign and a demonstration community illustrating elements of the overall strategy. The transportation sector was perceived as a web that binds and links other sectors of the city and which becomes a major tool for land use planning and implementation. It also was viewed as a sector that very inefficiently consumes large quantities of petroenergy and time, adding to price inflation.

Other strategy elements were less cross-cutting but represented areas with significant opportunities to conserve resources important to the city. Heading the list was solid waste disposal. Experts felt the community can play a significant role in improving sanitation as well as recovering and recycling waste. The key to this sector strategy was the need to increase information on current disposal practices and waste content and to convert this knowledge into specif-

Colorful jeepneys and tricycles in downtown Tacloban aggravate an already inefficient transportation system. AID will help set up an effective system that will save time and fuel without displacing traditional vehicles.

ic opportunities for improving waste management and recycling. A series of studies, pilot demonstrations and public education programs were planned.

The energy and electric power sector deserves special mention because of its position at the bottom of the list. Frequent brownouts constrain modernization, development and the creation of new employment opportunities in Tacloban. The problem will be alleviated later this year, when Leyte's first geothermal plant is anticipated to be ready. Nonetheless, transmission system improvements and energy audits to be introduced under MEREC will cut waste and consumer costs, and provide good examples for less fortunate towns and cities.

Lessons of the Pre-Test

The pre-test's approach proved viable in addressing the problem of resource conservation in small and intermediate-sized cities where it is possible to begin at the local level. The approach will be refined and improved through further application. In the meantime, the key lessons of the planning process include:

1. The approach never went beyond the capacity of local sectoral practitioners to comprehend it and to play a key role in it.
2. The group process immeasurably contributed to the acceptance of the strategy that was developed, the continued political support it achieved and the prospect that it may be explained convincingly to the general public.
3. The group process also assured continued integration of strategy sectors and elements and highlighted intersectoral linkages, requirements and opportunities for interagency cooperation.

The Global MEREC Project

Based on the success of the pre-test, a global MEREC project was approved in July 1982. The project provides grant funds and technical assistance for planning efforts similar to the Tacloban one and for local implementation of energy and resource pilot and demonstration projects. Technical assistance is provided by the Tennessee Valley Authority, which has extensive experience in working on local-level economic and resource development. MEREC has an initial life of four years with the implementation phase of the Tacloban project as the first field activity. A MEREC project in Thailand is being discussed and a third project is under consideration in Portugal.

Implementation of Tacloban's MEREC plan began with AID and the Philippines government signing a project agreement in September 1982. Implementation is the responsibility of the sectoral agencies that participated in the pre-test. The task force oversees the project.

The city's first step was to finalize the sectoral action plans and to prepare a detailed budget and implementation plan. AID is providing a $275,000 grant plus technical support by the Tennessee Valley Authority and the global MEREC project. The city and national governments are providing additional funds and in-kind support.

Some subprojects began even before the first disbursement of MEREC funds in early 1983 (see box). Each subproject is designed to take advantage of opportunities and overcome constraints particular to Tacloban. For example, a key question for the land use plan is to what extent should agricultural lands surrounding the city proper be preserved against urbanization. The city hired a consulting firm to analyze soils and topography in the city's outlying areas, to prepare a land capability analysis and to conduct an aerial and field topographic survey of the city to serve as the basis for the land use plan, drainage works and future development projects. City personnel will participate in the surveys and will receive on-the-job training in interpreting them.

Project Institutionalization

The MEREC project in Tacloban deliberately avoided creating new

institutions. Nonetheless, MEREC is being institutionalized as a basis for continued coordination among local agencies. The MEREC data base on land use, transportation, urban waste and other sectoral activities will be useful well beyond the life of the project. Finally, MEREC has created a greater awareness in Tacloban that energy and resource efficiency can promote economic development, that new technologies and approaches are available and adaptable to the local context and that a great deal can be done to foster energy and resource efficiency at the local level with local initiative. For example, the mayor has launched a media-oriented public education campaign and is introducing MEREC ideas into the school system.

Evaluation

A special evaluation procedure is being established for the MEREC project in Tacloban. A U.S. minority firm, Socio-Economic Systems Corp., is preparing an impact evaluation handbook for local officials and staff in Tacloban. TVA will help the city continuously monitor project impact. The handbook will establish procedures for measuring the impact of subprojects during and after implementation and will provide guidelines for comparing these measurements with baseline data and the project's original targets. It also will include procedures for calculating the cost-effectiveness of each subproject.

There is much to be said in favor of the MEREC approach on the basis of its timeliness, relevance to global energy and resource shortages and adaptability to planning and development at the local level. The results of the impact evaluations, however, will be the final factor in determining whether it is a conservation approach worthy of widescale promotion. ■

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The authors are indebted to those who have helped make the MEREC project possible. Among them are Robert Ichord, division chief in AID's Asia Bureau's Technical Resources Office, who directed the project team to opportunities in Asia; Lawrence Ervin, senior energy adviser, and his assistant, Concita Silva, in AID's Philippines mission, who guided and administered the project; Avrom Bendavid-Val, TVA subcontractor, who provided technical support to the project; Greg Haladay, who worked on the project as a Peace Corps volunteer and is now assistant project coordinator under the mayor; Steven Hadley of the Asia Bureau for his editorial assistance; and the officials and people of Tacloban, who have been key to progress achieved to date.

TACLOBAN SUBPROJECTS

Land Use

- A new land use plan to identify the most productive uses for urban land and the most resource-efficient patterns of development.
- A new land use data and monitoring system.
- Promotion of urban agriculture.

Housing

- Construction of energy-efficient, low-cost demonstration housing units designed with local materials.

Water/Drainage

- New drainage pipes, catch basins and an oxidation pond to control runoff in the city.
- Water line testing and repair to reduce leakage.

Waste Management

- A sanitary landfill to replace the existing open dump and create new developable land.
- Centralized containers and push carts to collect waste in an energy-efficient way.
- A biogas digester at the municipal slaughterhouse producing energy from animal and human waste.

Electricity

- Calibration of electricity meters to reduce losses.
- Energy audits of major consumers to pinpoint electricity waste.

Other Energy

- Research and development of a more fuel-efficient cookstove suited to local needs.

Transportation

- A new energy/fuel efficient transportation master plan coordinated with the land use plan.
- Education campaign on energy-efficient traffic and transportation.

Information and Education

- City-wide program of workshops, school activities, publicity and promotional campaigns on energy and resource efficiency.