Chapter 11

Overview

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Chapter 11

Overview

Introduction

The treatment of the case studies in the preceding chapters derives less from an interest in any one specific technology than from an interest in the process by which the technologies were identified and adopted by particular communities, their impact on the communities, and the factors that might have an influence on their wider adoption and diffusion. The case studies focus on three substantive areas:

- energy conservation, particularly methods for increasing the energy efficiency of private housing;
- agriculture, particularly the survival of the small family farm; and
- the delivery of community services, including health care and social services as well as waste management.

It should be noted that the cases do not include examples in the industrial or manufacturing sector. Nonetheless, these three areas include some of the most important and intractable problems facing the Nation.

Each chapter also includes an analysis of relevant Federal policy and programs, but this should not be taken to mean that expanded Federal involvement is necessary or even desirable for the local development of these technologies. In several cases, notably energy-efficient housing and farmers' markets, local adoption seems to be going forward without direct Federal involvement; in other cases, existing Federal programs have been quite effective and appear to need no major alteration. Federal policy has been a focus for analysis, rather, because this report is designed for Congress, one of whose responsibilities is the evaluation and improvement of Federal programs that encourage and assist community development.

Because of this Federal interest, it has been necessary to consider not only the local impact of these projects but also the likely effects of widespread replication by communities throughout the Nation. The projects are of interest precisely because they tailor technology to local needs and resources, and most of them have been relatively successful in achieving local goals. In some cases, however, the local resources are sufficiently unique that it is uncertain whether the projects could be replicated elsewhere. Nevertheless, enough similarity exists across the cases to draw several general lessons about the factors that aid or impede the process of community adoption.

This overview chapter will present thumbnail profiles of the case studies and then comment on their significance, first from the local perspective and then from the national. This will be followed by a summary of the critical factors affecting the success of these projects, and steps that might be taken to promote similar projects elsewhere.

Profiles of the Case Studies

Resource= Efficient Residential Architecture (ch. 3)

These projects, developed in communities as diverse as an Eskimo village in Alaska and the middle-class exurbs of Connecticut, involve the application of a wide spectrum of technologies that make considerable energy savings possible for individual families. The technologies range from well-known solar designs to new, highly efficient heat-retentive houses that hold great promise for the future.

Local and National Significance.–The striking diversity of the applications—in cost and complexity, as well as performance—is both a strength and a problem. On the one hand, they represent solutions to the problem of energy conservation that can be adapted to every region of the United States. On the other hand, because

such a large variety of approaches have been developed in so many locations, no "preferred" solutions have yet gained nationwide acceptance from financial institutions, homebuilders, and the general public. Low-cost retrofits, notably the attached solar heating greenhouse, are being built by individual homeowners, and local initiatives have been effective in encouraging these individual efforts, the community workshop appears to be a particularly effective mechanism for promoting more widespread adoption of this technology. The higher initial costs of the passive solar and double-envelope houses, however, are such that they are being built primarily by middle- and high-income families. From a national perspective, this may mean that lower cost options, like the Bethel and Conserver Homes, will be more appropriate for energy-saving tract houses and low-income housing.

Critical Factors.—In several of the case studies, large numbers of people have turned out to inspect the houses, but thus far there has been less acceptance from financial institutions than from the general public. One housing developer commented that his first solar development "would never have happened if we had not been able to do the design, the financing, the land development, and the construction ourselves. " From these case studies it would appear that one of the most significant barriers to the widespread transfer of these technologies from the custom housing market to the mass housing market is the lack of reliable data on the cost and performance of the various energy-efficient designs. The Bethel house, which was developed in part to influence the design of low-income housing in rural Alaska, has had some local success in this regard.

Federal Policy.–Federal programs could assist the diffusion of these technologies by making data gathering a required part of sponsored projects and by making detailed local microclimate data available to prospective developers and owner-builders. Increased Federal encouragement of "networking," community workshops, and other locally based dissemination mechanisms could also be useful; these approaches have proven to be successful in several of the projects described in this and other chapters.

Food= Producing Solar Greenhouse (ch. 4)

The Cheyenne Community Solar Greenhouse appears to be an effective mechanism for delivering social services, such as productive activities for the elderly and youth offenders. It also seems to have contributed to a local program to encourage residential energy conservation. It has not, however, been cost effective in its role as a food-producing greenhouse, and since it cannot be operated as a research facility, it has been unable to collect sufficient performance data to establish its economic feasibility.

Local and National Significance.–The project is notable for the extent of public participation in the construction, operation, and management of the greenhouse. It offers activities for the elderly and the handicapped, job training and work experience for the unskilled, alternative service for youth offenders, and educational activities for children. In addition, this highly visible demonstration may have contributed to the widespread adoption of smaller attached solar heating greenhouses in Wyoming, which now has more such retrofits relative to its population than any other State. However, the capital and operating costs of the greenhouse are rather high, and as presently used it may not be the most cost-effective mechanism for delivering social services. Neither is it an effective means of demonstratin$_g$ the feasibility of large-scale solar greenhouse horticulture, Crop yields have been low b$_y$ commercial standards, but the project has neither the staff nor the resources to carry out scientific research on plant varieties and production techniques for solar greenhouses.

Critical Factors.—The technical problems encountered in Cheyenne point out the need for expert advice on solar greenhouse design and construction. More reliable information on costs, energy savings, production methods, and crop yields will also be required if the technolog$_y$ is to be adopted by communities, cooperatives, or commercial growers on a widespread basis.

Federal Policy.—Existing Federal programs include construction grants for community food production projects and a few monitoring projects

that should produce needed information on greenhouse performance. Additional Federal efforts to promote the technology might include programs to disseminate this new information, as well as selective tax credits to individuals or subsidies to community groups.

Small Farm Systems (ch. 5)

The New Life Farm (NLF) in Missouri and the Small Farm Energy Project (SFEP) in Nebraska are community-based attempts to improve the economic viability of small-scale farming in their regions. NLF is a local initiative by young farmers to develop a promising new renewable energy technology—manure and phytomass digesters that produce methane from farm wastes. SFEP has established a particularly successful program of technical assistance and cost sharing that has encouraged local farmers to apply proven technologies to the energy needs of their own farms.

Local and National Significance.–Of the two projects, SFEP seems to have had a broader impact on local farmers, largely because the farmers were allowed to select and build their own projects. But although self-selection has led to a variety of innovative solar applications, it has not always led to maximum energy savings, since the farmers often failed to pick the most promising combination of technologies or installations. NLF's concept of an integrated "system" of farming techniques shows more potential in this regard, but the technologies themselves are still in the development stage. Both projects, however, demonstrate that farmers and other local groups are capable of developing and installing low-cost, energy-saving technologies that are appropriate to the needs and resources of their particular farming operations. Widespread replication of these projects might make a significant contribution to the related national goals of conserving energy, making more efficient use of available resources, and aiding the survival of the small family farm,

Critical Factors.–The local success of SFEP results from its project design, which encourages public participation through self-selection and a comprehensive program of workshops, seminars, and individual technical assistance. Cost sharing also appears to be an effective form of financial assistance, but a number of local farmers (participants and nonparticipants alike) undertook projects on their own. NLF has also held workshops, but its primary efforts have been in developing the biogas digester; its inability to involve large numbers of local residents may pose a problem for the local dissemination of this technology in the future.

Federal Policy.–Widespread dissemination of the results of these and similar projects through the Agricultural Extension Service would promote the spread of these technologies, as would the encouragement of networking among local and regional groups with related interests and activities. Further research is needed on the effectiveness of integrated farm systems, the performance characteristics of biogas digesters, and the nutrient value of digester sludge. Federal funds for establishing model farms at State agricultural centers might contribute to this type of research, as well as providing local demonstrations that could increase interest in these systems among the Nation's small-scale farmers.

Farmers' Markets (ch. 6)

Farmers' markets and other direct marketing strategies represent the revitalization of a food distribution system that, having fallen into disuse after World War 11, has become attractive again due to rising energy costs. They can benefit farmers and consumers alike, and by encouraging local agriculture they can contribute to the conservation of energy and the security of local food supplies.

Local and National Significance.–The case studies include farmers' markets established through the initiatives of a variety of local groups—farmers, consumers, businessmen, and municipal governments. By creating a local market where none had existed before, these markets improve the economic viability of small-scale agriculture and encourage local farmers to diversify their crops and keep their land in production. All of the farmers' markets appear to have promoted local development, although the redevelopment of the Pike Place Market in Seattle seems to have had a negative impact on the availability of low-income housing and low-cost produce. Widespread development of farmers' markets throughout the United States could result in considerable

energy savings and should contribute significantly to the survival of the small family farm and the retention of agricultural land near urban areas.

Critical Factors.–All of the markets depend vitally on the participation of the local producers and consumers. In Morehouse Parish, La., the market was established and managed by the farmers themselves, but a network of interest groups in Boston proved to be an equally effective way of organizing markets. Where the markets were part of a larger educational and technical assistance program, like the one initiated by the county extension agent in Morehouse Parish, the benefits to the local farmer have been further increased. The financing required for the markets is minimal and most of them are self-supporting. Large-scale urban redevelopment projects like the Pike Place Market may not be the most cost-effective means of encouraging local agriculture or making low-cost produce available to local consumers.

Federal Policy.–The success of the comprehensive program in Morehouse Parish suggests that similar efforts elsewhere by the Agricultural Extension Service could be useful in promoting the widespread development of farmers' markets. Reenactment of the Farmer-to-Consumer Direct Marketing Act of 1976, which expired in 1980, would also allow the U.S. Department of Agriculture to complete its State-by-State surveys of current farm marketing programs and to expand its existing programs of technical and financial assistance to farmers' markets and marketing cooperatives throughout the Nation.

Resource Recovery From Municipal Solid Waste (ch. 7)

These two case studies of alternative technologies for waste management and resource recovery illustrate not only the contribution they can make to the redevelopment of deteriorating urban areas, but also the crucial problems and constraints posed by the size and quality of the "waste stream."

Local and National Significance.–The Recycle Energy System (RES), which uses combustible wastes as fuel to produce steam for space heating and industrial uses, has made an important contribution to the revitalization of downtown Akron, Ohio. Replicated on a nationwide basis, this technology could produce almost 2 percent of annual U.S. energy consumption, in addition to recovering significant amounts of glass, aluminum, iron, and steel. The Bronx Frontier Development Corp. (BFDC) converts vegetable wastes from a large produce market into compost for parks and community gardens in the South Bronx, and this technology may also have potential for comporting sludge from sewage treatment plants. Both technologies could, if widely adopted, contribute to the national effort to recycle materials, conserve energy and other resources, and reduce the environmental problems caused by waste disposal.

Critical Factors.–The Akron RES was almost totally an undertaking of the municipal government and its consultants; greater public participation might have made a difference in the size and/or development of the project. BFDC, on the other hand, has experienced some opposition from the traditional political leaders of the community, and it is not clear that local residents have had an effective voice in the project. The "consortium financing" developed by BFDC freed it from some of the constraints imposed by the grants economy, but the project could improve its finances considerably by charging competitive tipping fees to haulers or by increasing its income from the commercial sale of compost. The principal constraint on the feasibility of both these projects is the quantity and quality of the waste stream. To assure itself of an adequate supply of combustible waste, and thereby reduce financial risks, Akron was forced to pass an ordinance (since challenged in court) requiring private haulers to dump at the RES facility. The BFDC operation, on the other hand, requires a relatively uncontaminated supply of organic wastes, and its organizers too feel that it may be necessary to require source separation by means of legislation. The institutional problem of overlapping jurisdictions further complicates the issue of control over the waste stream.

Federal Policy.—Existing Federal programs provide funds for research, development, and technical and financial assistance for waste management and resource recovery. Federal policy has not yet addressed the overarching issue of control

over the waste stream. If the Supreme Court decides against the city of Akron in their pending case, Congress may wish to investigate the desirability of permitting municipal control over the waste stream, including passage of enabling legislation if necessary.

Community Wastewater Treatment (ch. 8)

The General Accounting Office has recently concluded that, due to the scope and enormous costs of upgrading the Nation's sewage treatment system, it is imperative that lower cost approaches be found for providing this municipal service. The Solar AquaCell system is one of a number of alternatives that have the potential for reducing the operating costs of secondary treatment, as well as for reducing both the capital and the operating costs for more advanced wastewater treatment.

Local and National Significance.–From the local perspective, an important benefit of this wastewater treatment facility is that local control of the technology has also given the town control over its future growth by freeing it from the constraints of regional sewage planning. From the national perspective, such local treatment plants may serve to remove one of the few effective means of regional planning. At the same time, however, this and other new treatment technologies offer a badly needed, lower cost approach to expanding and upgrading of the Nation's sewage treatment facilities.

Critical Factors.–The Hercules AquaCell facility was a municipal undertaking, and like some of the other projects examined in this report it has involved relatively little participation by local residents. General acceptance of this technology by the engineering profession will require reliable data from a full-scale facility like the one at Hercules, and widespread adoption by other communities will be contingent on its proven reliability and competitive costs. At present, the AquaCell system involves sufficient risks that it might not have been adopted even in Hercules were it not for the town's large revenue base and its desire for greater control over its future population growth.

Federal Policy.–Federal policy has promoted the adoption of alternative wastewater treatment technologies since the establishment of the Environmental Protection Agency's Innovative and Alternative Technology (1/A) Program in 1978. Congress may wish to extend this program, which is due to expire at the end of fiscal year 1981, or to expand the financial incentives it has made available to municipalities and regional sewage agencies. In particular, only $15 million has been earmarked for R&D under the I/A Program; increased research, full-scale demonstrations, and information dissemination would be desirable features of an expanded I/A Program.

Community Energy Generation (ch. 9)

Small-scale hydroelectric projects can make a potentially significant contribution to the Nation's energy supply. The U.S. Army Corps of Engineers estimates that U.S. hydroelectric capacity could be increased almost threefold simply by installing additional capacity at existing sites and installing new generating equipment at dams that currently produce no electricity.

Local and National Significance.–Locally developed energy sources, like the recommissioned damsites in Wareham and Woonsocket, represent the revitalization of local resources that have fallen into disuse. The electricity generated by these projects can be applied to local energy needs, either for cutting the costs of municipal services (such as streetlights, schools, and sewage treatment), for attracting industry to the area, or for sale to local utility companies. In Woonsocket, the nearby Tupperware plant has also begun plans to renovate their own dam for industrial purposes.

Critical Factors.—Public participation does not seem to have been a critical factor in either of the case studies, although the Woonsocket project required local voters to approve a bond issue. Both projects have general support from local residents, but misconceptions about the size and potential uses of the projects have been widespread in both communities. Both towns had existing damsites, which gave the projects a sizeable capital cost advantage. Woonsocket also made effective use of Federal grants as seed money for attracting conventional financing. Wareham, on the other hand, has held out for almost total grant financing, and this has held up the completion of the

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project. The economics of local hydroelectric projects, in these communities and elsewhere, will also be affected by the rates paid by local utility companies for the power they produce. Recent Federal legislation will help to assure equitable rates.

Federal Policy .–Existing Federal programs of technical and financial assistance for feasibility studies, planning, and construction seem to be working effectively, particularly when the grants are used as seed money to reduce risks and attract conventional financing. The Corps of Engineers has conducted an extensive survey to identify damsites that might be converted or recommissioned; it has also issued a manual to assist communities in performing preliminary feasibility studies. The Public Utilities Regulatory Policies Act of 1978 requires public utilities to buy or wheel power from these projects, but the economic viability of the projects will be vitally affected by the wheeling and purchase rates that are to be established by State utility commissions by February 1981. In addition, current Federal policy favors the development of hydroelectric sites by municipalities and cooperatives. This may constitute a disincentive to the development of some sites by industry and investor-owned utilities, although they too are eligible for Federal grants and considerable private development has been taking place.

Health Care Systems (ch. 10)

Local health centers, prepaid health plans, and well-care programs may be able to reduce the costs and increase the effectiveness of health care delivery in communities throughout the Nation.

Local and National Significance.–The organizers in Hyde Park-Kenwood wanted to develop a community-controlled health care center as an alternative to the fragmented and inadequate health services on Chicago's South Side. Although the issue of community control is still unresolved, they have achieved some of their objectives—notably those of increasing the availability of primary health care and reducing its costs. In addition, their programs of preventive medicine and health education could help to improve the general health of the community. Widespread creation of health maintenance organizations in other communities could have a significant impact on the enormous cost of health care in the United States. The resources available in Hyde Park-Kenwood would not be available in most inner-city areas, however, and entirely different approaches will probably be required in rural areas.

Critical Factors.—Public participation was important to the development of the center, particularly in its financing: the organizers were able to raise $110,000 through the sale of debentures to community residents. The center is now operating in the black, largely due to the cost-cutting incentives offered by prepaid health care plans. There remains some conflict over community versus medical governance of the center, and there are problems in this and some other locations due to State medical practice laws that discourage community control of health care organizations.

Federal Policy.—Existing Federal programs have effectively encouraged the establishment of health maintenance organizations in a large number of communities. However, there has as yet been no review of the impact of the public participation requirements of the Health Maintenance Organizations Act of 1973, Congress may also wish to investigate means of addressing the barrier posed by State medical practice laws.

The Technologies From a Local Perspective

The preceding profiles show that the projects had widely varying objectives and suggest that their significance can be quite different when viewed from the national perspective instead of the local. Thus, no simple judgment of "success" or "failure" can be applied: each case must be examined from both points of view.

Viewed broadly, local development is not always simply a question of economic growth as conventionally measured. Efficient and cost-effective municipal services—the goal of several of the projects—are a necessary underpinning to local development, as is the availability of health care and a healthful, pleasant environment. Similarly, it is

not sufficient to ask whether the projects created *new* employment. In one case study, jobs have been saved that otherwise would have been lost–certainly as important as the creation of new jobs. Other projects have aided the continued operation of existing enterprises—the small family farm.

Creating employment and new industry was not the principal objective of the projects examined. Nevertheless, some of the projects provided help in severely depressed areas by creating jobs and by providing training or retraining for the unemployed. Often, however, these jobs and training programs were limited to the construction phase of the projects and did not represent permanent employment opportunities. Some of the projects did improve the viability of existing enterprises (small farms). Others could create significant opportunities for small business—the home-improvement and construction sector is notable in this connection.

One real significance of these projects from a local perspective is their potential for reducing—or at least stabilizing—the real costs of community services. The following are some examples taken from the case studies:

1. *Waste management and resource recovery.*—
   - *reduce* the operating costs of secondary wastewater treatment;
   - use municipal solid waste as a fuel to generate steam for use in the downtown area;
   - recover materials from municipal wastes, including compost and water as well as aluminum, glass, iron, and steel;
   - reduce the volume of sludge and other residues that must be disposed of; and
   - reduce the air, water, and land pollution associated with waste management.

2. *Energy.*–
   - *reduce the energy* consumption of wastewater treatment facilities;
   - develop new sources of energy for municipal services and local industrial use; and
   - recommission abandoned or underutilized energy-generating facilities for local use.

3. Health *care and social services.*—
   - increase the availability of primary health care;
   - reduce the cost of medical services; and
   - provide community activities for the elderly and the handicapped.

The technologies for residential housing address the energy efficiency of the local housing stock, thereby reducing the costs of owning or renting a home. The technologies for small-scale agriculture address the variable costs—energy for machinery and farm buildings—that farmers have the most control over. By stabilizing or reducing the farmer's production costs, these technologies might make the difference in helping to keep him in business. The farmers' market and other direct-marketing strategies, by creating or expanding local markets, likewise improve the farmer's return on investment and thereby improve the economic viability of the small family farm.

The Technologies From a National Perspective

Perhaps the most important aspect of these technologies from a national perspective is their transferability–the degree to which a technology that was successfully developed in one community can be replicated in other communities throughout the Nation. This preliminary study includes only a few case studies, and for this reason it is difficult to draw any firm conclusions on this subject. Several of the case studies suggest that the success of some development projects was due to unique local resources; but even in those cases it is possible to learn valuable lessons about the factors that might be important to the success or failure of similar projects elsewhere. These critical factors will be addressed in the next section.

If the development projects examined in the case studies were replicated by a large number of communities throughout the Nation, their combined effects could make a significant contribution to achieving national goals in the following three sectors:

- *Community services.* —The correction, upgrading, and expansion of the Nation's waste-

water treatment facilities through conventional approaches may be beyond the resources currently available to the Federal, State, and local governments. Alternatives such as the Solar AquaCell may provide more cost-effective solutions. Similarly, the contribution of hydroelectric power to the Nation's energy supplies could be substantially increased by installing additional capacity at existing small-scale damsites like Woonsocket's that are currently unused or underutilized. The staggering costs of health care, which may soon consume 15 percent of the gross national product, might also be cut by prepaid health care plans and the diffusion of community health care centers such as Hyde Park-Kenwood.

- *Residential energy conservation.—The* residential sector accounts for over 20 percent of annual U.S. energy consumption. Americans have already responded to the changing energy situation by reducing the direct consumption of energy in their homes, but dramatic further savings are possible: conservation measures that are cost effective against current energy prices could save the energy equivalent of the total production rate of Alaska's North Slope. This potential energy savings is particularly important in view of the number of new houses that must be built in the next 20 years, but considerable savings are also possible for existing housing stock through energy-saving retrofits such as attached solar heating greenhouses. By reducing the demand for energy in this important sector, technologies like those examined in this study could, on a national level, not only help to stem the rise in the total costs of housing but also reduce the need to develop costly new sources of energy.
- *Small-scale agriculture.*–By reducing energy and other production costs, and by increasing the prices that farmers receive for their produce, these production technologies and marketing approaches can improve the economic viability of the small family farm. They can also help to promote agricultural land retention and hel$_p$ to ensure local food supplies in the event of an oil embargo, natural disaster, or war.

From a national perspective, the potential bill for some of the services examined, such as wastewater treatment, is so high that any reduction in their cost might free up significant resources for other national needs. In several other cases, the technologies represent an updating of approaches that were in use before the era of cheap and plentiful energy supplies. While they are unlikely to become more than a partial alternative to centralized or large-scale technology, they can help to broaden and diversify the Nation's "technology mix."

Critical Factors

The relative uniqueness of some of the projects, which might limit their transferability, is largely a result of special conditions or community resources. In some instances the resources were financial: passive solar houses, for instance, are being built primarily in the custom housing market for middle- and high-income families; similarly, the Solar AquaCell wastewater technology involves substantial risks, and might not have been built had it not been for the city's revenue base. In other cases the special resources were human: the Hyde Park-Kenwood organizers, for instance, could draw on the considerable resources available through the University of Chicago community and the local tradition of cooperative action; in the case of the New Life Farm, the success of the project depended in large part on the special contributions made by a charismatic leader. In still other communities, the special resources were material: Wareham and Woonsocket both had existing damsites at which to install hydroelectric generators, and Akron had an existing distribution system for the steam created by burning refuse.

Despite the unique elements found in some of the projects, however, a number of common factors seems to be important in the success or failure

of each case, as well as in their likely transferability to other communities.

Public Perception and Participation

In municipal undertakings, such as the Akron RES, the low-head hydroelectric projects in Wareham and Woonsocket, and the Hercules AquaCell facility, public participation was not a major factor. Greater participation by local residents in the planning of the projects, however, might have encouraged consideration of alternative approaches; for example, Akron might have decided on a turnkey development rather than assuming the risk itself. Public participation seemed to be important to the success of such community undertakings as the health care center in Hyde Park-Kenwood and the various farmers' markets. In the case of individual undertakings, such as the solar applications in the Small Farm Energy Project, the passive solar houses, and the attached solar greenhouse retrofits, a high degree of public interest and participation was—almost by definition—essential to the success of the projects.

Technical Information and Expertise

Availability of technical information and expertise was found to be crucial to the successful planning, construction, and operation of all the projects. The Cheyenne Community Solar Greenhouse offered an example of the difficulties that can arise when this information and expertise is lacking.

In the larger projects, city planners and consulting engineers demanded reliable data on the capital costs and technical performance of the technologies. Where such detailed information is not yet available, as was the case with the AquaCell, high contingency fees and difficulties in securing financing must be expected. For less complicated community projects, on the other hand, the needs for information are simpler and can often be met through "networking," as was the case in the organization of the farmers' markets in the Boston area, In the case of individual undertakings, the greatest need is for personal, hands-on experience in the design and construction skills needed to build the installation. This experience was provided effectively by community workshops in the case studies of solar heating greenhouses in New Mexico and farm energy systems in Nebraska. Comprehensive programs of instruction, practical experience, and individual technical assistance—used in Morehouse Parish, La., as well as Cedar County, Nebr.–appear to be the most effective mechanism for transferring technical information about the simpler technologies.

Essential Resources

The availability of essential resources—material and human, tools and labor—was found to be the most unique factor in these projects. For this reason, it is also likely to affect their transferability to other communities. The apparent lack of resources in a community, however, is less of a barrier to the development of these projects than it might at first seem. The unpromising resources in Morehouse Parish (almost total reliance on cotton) and Rutland (very little local vegetable production) were eventually overcome through the efforts of determined and imaginative organizers. This is not quite a case of pulling a rabbit out of a hat, however; only an outsider would conclude that necessary resources are not available. The lesson seems to be that a great deal can be done if resources are developed and managed from within the community, and in some cases—the manure digester, for example–a promising technology can be based on what might seem the least promising resource base (hog manure and depleted farmland).

Financing

The forms of financing used in the projects were as varied as the financial needs involved. Grant-financed projects appear to work best where initial seed money is required, either to attract more conventional financing (as in the case of Woonsocket) or to allow the project to become self-supporting (as in the case of the farmers' markets). The projects were less successful, or encountered a new set of problems, when they became dependent on total or continued grant financing. For one thing, they have a continuing need to attract new grants, which may require the staff to invest its time in fundraising instead of project management; for another, grant funding is frequently tied to specific

projects rather than being available for general and administrative expenses. The latter may cause the project staff to become involved with a number of disparate efforts, instead of concentrating its time and attention on the success of a central program. The Bronx comporting project encountered both of these problems, but the organizers were able to overcome them (to some degree) through "consortium funding''-by seeking smaller grants from a large number of donors, they avoided becoming too dependent on a single source. In Wareham, on the other hand, the organizers' insistence on financing their whole project through grants has led to delays in the completion of the hydroelectric project.

In the smaller scale projects, the success of the Small Farm Energy Project shows that cost-sharing funds can be very effective in encouraging the adoption of some technologies. This and other projects also demonstrate that grant funding for community workshops can be highly cost effective, because of the high leverage they achieve in disseminating information and practical skills and in encouraging independent efforts within the community. Many of the residential projects were financed out-of-pocket by individuals, and tax credits and low-cost loans (including loans from utility companies) can effectively encourage these investments.

The development of larger scale technologies, like the Solar AquaCell, can be impeded considerably by the current state of the venture capital market. In large municipal projects, such as centralized resource recovery or small-scale hydropower or wastewater treatment, intervention may also be required to reduce financial risk in order to attract conventional financing. These, too, are cases where Federal and other grants can be productively used as seed money.

Some of the projects became self-supporting in a fairly short time; the farmers' markets are the best example of this, but they also have much smaller capital requirements than most of the other projects. Other projects—notably the Bronx Frontier Development Corp.–have the potential to support themselves in time, although in the case of the Bronx this probably will require raising tipping fees to competitive levels. Some projects, on the other hand, are not profit-oriented and are unable to become self-supporting. Community service projects like the Cheyenne solar greenhouse are the best example of the latter, and their cost effectiveness must be evaluated in comparison with alternative mechanisms for delivering the same social services.

Institutional Factors

Some of the projects were opposed, at least initially, by professional and commercial interests; others encountered difficulties due to institutional resistance or outright opposition. Professional resistance seemed to derive from a demand for better and more reliable performance data; the reluctance of the engineering profession to accept the AquaCell technology is a good example, as is the building industry's reluctance to accept new housing designs. In other cases, local commerical interests opposed a project that they thought might become a competitor (as in the case of a greenhouse operator in Cheyenne) or might be detrimental to local business (as in the case of the Rutland farmers' market); these fears usually proved unfounded, however, and in other cases (notably Ravinia) the business community was an important promoter of a project. Financial institutions were hesitant about financing some of the projects, particularly resource-efficient housing. Some of the projects also experienced opposition (or at any rate insensitivity) from regulatory and other government agencies; building codes and waste-management guidelines are a particular source of difficulty for some technologies.

One institutional arrangement that can promote the adoption and diffusion of these technologies is networking—establishing links between existing delivery systems and public interest groups—which was used successfully by city and State agencies in Boston and Baltimore. In most cases, the assistance of the Federal Government was effective, although in some cases it could have been improved, as will be discussed below.

Federal Policy

A wide variety of Federal policies and programs have contributed, directly or indirectly, to the development and adoption of these technologies; the individual chapters contain extended discussions of these programs. Criticisms of these Federal programs concern the extent, coordination, and management of these programs, rather than their formal objectives. These criticisms, and proposals for addressing them, are also discussed in the individual chapters.

The pattern that emerges from the case studies suggests that there are four principal areas in which Federal programs for local development might be modified and improved:

- data gathering and analysis;
- information dissemination;
- technical assistance; and
- financial assistance.

Data Gathering

The technologies examined in the case studies were found to be at varying stages or development, but they all seemed likely to profit from a more concentrated effort to gather reliable data on the design, cost, performance, and/or reliability of the technology itself, as well as on the particular community's experience in applying it. In the case of technologies that are still in the experimental stage, this information is vital to their further development; the gathering of such data was seen to be the central objective of several of the projects, including the Solsearch Conserver Home and the New Life Farm biogas digesters. Other case studies involved technologies that had been successful in laboratory- or pilot-scale demonstrations, but were being applied for the first time in a full commercial- or municipal-scale facility; in these cases—which included the food-producing solar greenhouse, Recycle Energy System, large-scale composting, and Solar AquaCell wastewater treatment—the acceptance of the technology by other communities will depend on the demonstrated reliability and cost-effectiveness of the pioneer installations. In still other cases, the local development project involved the innovative application of a proven technology, as in the onfarm solar applications. Finally, some of the projects involve variations on technologies that have been in use for some time, and which could productively be subjected to a comprehensive comparison with one another and with more conventional approaches; the future dissemination of this category of technologies, which includes several varieties of passive solar houses, farmers' markets, and health maintenance organizations, could be assisted by this kind of evaluation and comparison.

It should be noted, however, that most of the local development projects that were examined in this study were not designed with the specific purpose of providing technical demonstrations of the technologies involved or gathering technical and other data on those technologies. In addition, there are special difficulties involved in the gathering of reliable data at facilities that are currently in use by the community or, in the case of projects undertaken by individuals, currently occupied. The behavior of the occupants has a considerable influence on the performance of energy-efficient houses, for instance; similarly, the staff of the Cheyenne greenhouse, like the busy farmers in Cedar County, Nebr., have had neither the time nor the equipment to conduct detailed monitoring of their solar installations.

Options.–There are a number of steps that can be taken by Federal agencies and local project organizers to ensure that adequate data gathering and analysis is in fact carried out. These steps include, but are not limited to, the following:

- *Modify project* design. -Federal agencies can encourage grant applicants to include a strong data-gathering component in the design of their projects, where possible. In some cases this may require additional funding or the earmarking of a portion of the project's funds specifically for data-gathering.
- *Redirect existing* research.–In some cases what is needed is not *more* data but a different *kind* of data, particularly social science data. Human behavior is a significant but uncontrolled variable in some projects. Occupants of solar-heated houses, for instance, may have to open and close vents or tolerate wide tem-

perature swings. Similarly, Federal research has traditionally been oriented toward the science and engineering underlying resource recovery; future efforts might productively investigate the human aspect, such as incentives that would promote source separation by individual households.

- *Support and expand Federal monitoring projects.*—The National Center for Appropriate Technology has begun two projects to monitor the performance of different solar greenhouse designs. Similar projects might be undertaken by other Federal agencies to provide assistance for monitoring the performance of other projects, including direct-marketing strategies and energy technologies for small-scale farmers.

Information Dissemination

Even when a technology is fairly well developed and data have been gathered by one developer, its diffusion can be impeded if other potential developers are unaware of the project or unable to obtain detailed information on design, costs, and performance. In some cases this will cause communities to overlook a promising alternative or to waste time and money in an unnecessary duplication of efforts that have already been carried out elsewhere. In other cases it will result in resistance from engineers and financial sources who, in the absence of reliable technical and economic information, consider the project too risky. In a few cases this might cause the failure of a project because its organizers were unaware of the problems, and solutions, that have been discovered in similar projects elsewhere.

Options.–The problem of information dissemination can be addressed through a number of measures—local, regional, and national—including but not limited to the following:

- *Encourage networking.*–The establishment of networks, through which local and regional groups with related interests are able to share information and expertise, has been effective in organizing farmers' markets in the Boston area and for disseminating information on small farm systems in Nebraska. Federal agencies, particularly those like the Agricultural Extension Service and Community Services Administration that have extensive local representation, are in a good position to encourage the establishment of similar networks to spread information and share experience among local groups, State agencies, and Federal programs throughout the Nation.
- *Establish regional demonstration* Projects.—The case studies have shown that local demonstration projects are particularly effective in stimulating a community's interest in innovative technologies and, more significantly, in promoting the adoption of those technologies by other local residents. This was particularly true in the case of the Small Farm Energy Project in Nebraska, but could also be seen in the interest stimulated by several of the resource-efficient houses. The creation of regional research and demonstration centers, such as model energy-efficient farms at State experimental stations, could also help to generate information on the effectiveness of integrated systems of farming techniques and farm energy technologies.
- *Encourage information* exchange.-The Federal Home Loan Bank Board has conducted four workshops on energy-efficient housing as part of its efforts to encourage local savings and loan associations to include conservation requirements in their home loan programs; this program, however, had no legislative mandate. The Resource Recovery and Conservation Act of 1976 called on the Environmental Protection Agency to organize a similar program of information exchange between different levels of government, and between government and private industry, on the performance of available resource recovery systems; however, sufficient funds were not appropriated to implement this program. The Federal Government could contribute to the diffusion of a number of these technologies by creating and funding a more extensive program of regional panels and seminars at which local bankers, homebuilders, engineers, urban planners, and other interested parties could be exposed to recent developments in their fields. By disseminating the necessary information on design, reliability, and costs, this approach could be useful in overcoming institutional

and financial barriers to the adoption of the technologies by other communities.

Technical Assistance

Even when reliable design and performance data are available, the development of a particular project will not be possible unless and adequate skill base exists, or can be developed, in the local community. This can be a problem even with the simplest of projects, although the skills needed for planning and building an attached solar greenhouse, for instance, can be taught rather easily. Often, however, these skills are relatively complex, and difficulty of acquiring them can be a barrier to the success of the project. In the case of the larger municipal projects, even the expertise needed for planning the project or determining its feasibility are beyond the means of a given community.

Options.—There are two basic approaches to this problem: technical assistance and skill transfer. The former usually involves greater Federal involvement and greater expense; the latter usually costs less and benefits the community more, since the skill base will remain in the community after the completion of the project. The following represent a range of options for technical assistance:

- Workshops.—For the simplest of the projects, particularly those that are to be built by individual homeowners or farmers, the community workshop approach is highly effective. This was the case with the attached solar greenhouse in both New Mexico and Wyoming, where small groups of neighbors can together to learn by doing: they planned and built a greenhouse on the home of one of the group members, thereby learning the skills that they would need to plan and build their own greenhouses later. This approach was also successful in demonstrating the technology in the local community, and it was often the stimulus for additional installations.
- *Training programs and seminars.--The* Small Farm Energy Project in Nebraska demonstrated the effectiveness of programs of lectures, seminars, and discussion groups in exposing local residents to a wide variety of potential applications for their farms. The training programs conducted by the organizers of the Cheyenne greenhouse allowed local residents to plan and build their own facility; it also provided marketable skills and work experience for local high school students. A similar program in Bethel, Alaska, was part of the curriculum of Kuskokwim Community College.
- *One-on-one technical* assistance.—Personalized, individual attention from organizers and outside experts was useful in providing specific help to farmers both in building solar installations in Nebraska and in organizing a farmers' market and ancillary projects in Morehouse Parish, La. The existing extension program of the Departments of Energy and Agriculture could be used as a mechanism for this form of assistance.
- *Computer models and other planning aids.*– Some communities lack the expertise for planning large municipal projects, and for other communities the expense of detailed feasibility studies may be prohibitive. Technical assistance in these cases might include manpower for conducting site evaluation and other preliminary studies of the local resource base. However, the same assistance can be provided in the form of handbooks showing how local groups and municipal governments can conduct a low-cost, "quick and dirty" feasibility study. In some cases, notably that of small-scale hydropower projects, computer models have been developed for this purpose; Federal agencies have also prepared feasibility and planning manuals for farmers' markets and community health care centers. Local groups could be assisted greatly by the development of similar technical and organizational guides for energy-efficient housing and farm systems, resource-recovery systems, and wastewater treatment facilities. These aids would allow local communities to conduct their own evaluations and planning, without the need for extensive Federal involvement or funding.
- *Expert assistance* panels.—The Resource Recovery and Conservation Act of 1976 directed the Environmental Protection Agency (EPA) to provide State and local governments with teams of technical, financial, marketing, and institutional specialists to assist them in

developing comprehensive plans for waste management and resource recovery. EPA's Technical Assistance Panels Program provided staff and consultant expertise in these areas to over 160 communities in 1978 and 1979. A similar program has been planned for DOE's Energy Extension Service. The establishment of similar assistance programs by other agencies might be useful in promoting the consideration, adoption, and construction of local projects for wastewater treatment, energy generation, and health care.

Financial Assistance

Some of the technologies had the virtue of low cost, which allowed them to be developed by local communities without major Federal assistance. In several of the case studies the costs of the project were minimal and the project rapidly became self-supporting. This was particularly true of the farmers' markets and some of the energy-saving retrofits for residential and farm buildings. Other projects, although they promise to cut total costs over the life of the installation, required initial investments that might be beyond the resources of some communities or involved technical and economic risks that could make conventional financing difficult or impossible to obtain. This was found to be true in the case of the larger municipal projects, such as resource recovery, wastewater, and hydroelectric installations. Given the potential expense of these municipal services on a national level, and the potential benefits of developing innovative methods of delivering them, it might be appropriate that the Federal Government intervene to reduce the financial risks and burdens they might impose on local communities. At issue is the form that this intervention should take.

Options.–Several of the local development projects examined in the case studies could be replicated by other communities without Federal financial assistance. But even in cases where Federal assistance is necessary, there are several ways in which the degree or amount of this assistance can be held down. These measures include, but are not limited to, the following:

- *Technical risk* reduction.—Federal efforts to gather and disseminate reliable information on the technologies (see above) can also reduce the financial risks of the projects and prevent costly planning errors. Data-gathering efforts might include programs to determine the capital and operating costs of existing installations; this information could then be disseminated to financial institutions through regional workshops like those conducted by the Federal Home Loan Bank Board. Particular attention—and where necessary, expert assistance—should be given to the collection of cost-benefit and lifecycle cost information.
- *Financial risk reduction.*–Current Federal programs for innovative and alternative wastewater systems include risk guarantees for the correction or modification of facilities that do not work properly, at no cost to the local government. Similar guarantees might encourage the consideration of other alternative technologies. Tax-free bonding would also improve the financial profiles of some municipal undertakings.
- *Earmarked and set-aside* funds.-Federal appropriations for research, development, demonstration, and construction of municipal facilities might set aside a certain portion of the funds specifically for the adoption of innovative and alternative technologies.
- *Subsidized loans.*—The Solar and Conservation Bank, recently established within the Department of Housing and Urban Development, provides low-cost loans for conservation retrofits and solar features in new housing. The Farmers' Home Administration provides similar loans for rural housing, and the Federal Home Loan Bank Board encourages local savings and loan associations to include energy-efficiency requirements in their home loan programs. These efforts might be expanded and/or extended to include other technologies.
- *Tax credits and other incentives.*–Eligibility for Federal tax credits, such as the Residential Energy Credit, might encourage the adoption of several of the smaller technologies. Current Internal Revenue Service guidelines do not allow credits for attached solar greenhouses, for instance, and extension of the credits to include farm installations might also promote

the more rapid adoption of biogas digesters and onfarm solar installations like those developed in the Small Farm Energy Project.

- *Stimulate* markets.-Federal procurement guidelines, such as those promulgated for recycled steel, might ensure a market for locally grown produce or for materials recovered from municipal waste.