Energy Management Workbook for Local Governments

Workbook 1: Electrical Energy

MASTER

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Prepared by Puget Sound Council of Governments
and the Bonneville Power Administration

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Workbook 1: Electrical Energy

Prepared by Puget Sound Council of Governments ✓
and the Bonneville Power Administration 951 2400

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Foreword

The increasing involvement of local government in areas of energy management, especially in energy conservation and renewable resource generation, is one of the most heartening developments I have seen on the energy front.

In saying that, I don't want to pass the buck to local governments. Each of us has a role to play – elected and appointed officials at all levels of government, the energy suppliers and distributors and, ultimately, each and every consumer.

Each of us can do some things that others simply cannot, and there are some things some of us are better equipped to do than other things. Local governments, for example, have the authority and means to adopt and enforce policies that are aimed at promoting conservation and new energy sources through public services and regulations. They also can focus long-term planning to reduce energy consumption through land use, housing, transportation, and economic development. Energy affects practically all aspects of local government services, development plans, and activities. Many citizens also look to their local governments to lead by example in wise energy use.

So, while recognizing that others must do their share, I am greatly encouraged by what local governments are doing to stretch our region's and our nation's energy supply.

The Bonneville Power Administration is grateful for the opportunity to cooperate with the Puget Sound Council of Governments in the preparation and production of this workbook intended for use by local governments throughout the region.

Sterling Munro
Administrator
Bonneville Power Administration

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Preface

This workbook is intended to help local governments meet the challenge of an uncertain electrical energy future through better management of current energy usage and development of new, small-scale energy sources.

The workbook consists of a text and a separate appendices to the workbook, referenced throughout the text.

Development of the workbook was a joint effort of the Puget Sound Council of Governments and the Bonneville Power Administration. Hayden Street, director of energy planning for the Council of Governments, was project director. Contributing in the research and writing were Burr Stewart, Kelly Robinson, John Jarstad and Dennis Michaels. Editing and production assistance were provided by Anita Hill and Donna Barnes. Policy guidance was provided by the council of government's Standard Committee On Regional Energy.

The contributions of the state associations of cities and counties, various offices of state government and a number of Pacific Northwest communities were essential to completion and usefulness of this workbook. Several communities in Idaho, Montana, Oregon and Washington provided examples and technical information and materials for the appendices. Others tested the workbook in workshop sessions and reviewed the draft. These contributions are gratefully acknowledged.

Local government officials who participated in the workshop testing of this workbook found it very useful. The authors hope others will find it helpful in initiating energy management in your community. The need is critical.

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Introduction

1

This workbook describes twenty major categories of energy actions, ranging from simple, immediate actions to those that are complex and long term. It is intended to be used by a variety of professions, government levels and sizes of communities. It will provide you with background information needed to identify and evaluate potential energy actions suitable for your community and assist you in implementing them, explaining where financial and technical help may be available.

Chapter 1 provides background on the energy problem, discusses federal, state and local roles, and outlines the planning process. Chapter 2, probably the key part of the workbook, is a list of 20 questions to help you identify a range of potential actions that could become part of your energy management plan.

Chapter 3 will help you evaluate each of the twenty potential activities, and chapter 4 and 5 discuss implementing and monitoring your energy management plan.

The workbook is set up so that you need to read only those sections that are relevant to your own community, using chapter 2 as a guide. If you are already implementing an energy management plan, you may be familiar with some of the material, but the twenty questions could help you identify potential actions you may have overlooked.

The workbook is designed to develop a comprehensive energy strategy for your local community. However, it is not necessary that a comprehensive energy planning process be followed to utilize this workbook. If your community is interested in a specific action, that can be easily found in the table of contents (most actions will be found in chapter 3), and reading that specific section will tell the reader where to get information and how to begin. You can also use the Bibliography to select texts that are specific for one or more energy management actions. While an action-by-action approach can work, it is our recommendation that you go through the entire process, identify what types of energy management actions can work in your community and then set priorities and approach their implementation on an action-by-action, or step-by-step, basis.

To begin the process, elected officials and department heads should meet in a workshop session to answer the questions in chapter 2. They will come up with a list of actions in three categories – immediate, short term and long term. Once this has been done, the community can begin to develop strategies to implement the immediate actions and to evaluate short and long term actions.

The Energy Problem

Since 1973 sporadic shortfalls in oil availability have caused waiting lines at gas stations. With the volatile political situation in the Middle East, temporary acute shortages, chronic problems, or a crippling, complete cutoff are all possible. Electric power supply failures (brownouts) are occurring in increasing numbers. In the Pacific Northwest, public and private utilities forecast electricity shortfalls for at least the next 11 years. Only above average rainfalls will change the picture. Energy shortages will become a way of life for Northwest residents in the 1980's.

Nuclear power plant construction has been delayed. High interest rates and inflated construction costs are blunting new starts of energy-generating plants. It takes up to ten years to get a new coal generating plant on line.

Alternative sources of energy, such as wind, solar and geothermal, although promising in the long run, are largely in the research or development stage today. For example, large scale state-of-the-art wind generators soon to be tested along the Columbia River show promise but it would take 300 of them to equal the capacity of one nuclear generator.

Local energy management appears to be the first step toward easing energy problems. Energy management planning has been done at the federal and state levels and by some large cities. All conclude that there is a large role to be played at the local level, where implementation is accomplished.

To date little has been accomplished. Recently, a local government energy coordinator pointed to apathy as the greatest barrier to energy conservation in his area: "Apathy first that there is an energy problem. Second, each person feels he or she is such an insignificant part of the problem that they don't count. And apathy third, until the other guy does something about it, don't talk to me."

In a recent survey, local government officials were asked to identify barriers to local energy management. A consensus indicated:

1. Local governments tend to let other agencies worry about energy problems: "Let DOE, WSEO, HUD, DOT, BPA, City Light, the PUD's, private utilities, Congress, state legislatures worry about it. The problem's too big for us."

2. Energy management efforts are splintered in so many ways and through so many private and public agencies that it is difficult for a community to determine what is going on, or should be going on.

3. Most local governments are facing dwindling financial resources as the demand for services increases and inflation erodes a static revenue base. With strong competition for budget funds, establishing a new program such as energy conservation may mean cutting back on existing services. As a result, new energy programs often get placed on hold.

Federal, State and Local Roles

Every governmental level has an essential role to play in energy management. It is especially important that each county, city and town effectively participate in a way that complements the effort of other governmental units.

Federal Role

Energy policy is a complex issue, and a comprehensive national energy program has yet to be completed. But it is clear that the federal policy will include conservation, promotion of renewable resources and the development of any conventional energy resources to assist the country in becoming more energy independent.

Congress has and will continue to promulgate programs that will assist state and local governments. Energy management, power planning, financial incentives, grants, loans, energy studies, alternative resource development and energy conservation are types of programs financed and administered by the federal government.

State Role

While the federal government establishes energy guidelines and goals, the state plays an essential role in implementing these policies. To promote or discourage energy usage, the state can use measures such as incentives, building codes, gasoline taxes, utility regulations, and other similar tools.

The state must be made aware of and then disseminate information on federal and state energy programs to cities and counties throughout the state. This will help assure that constructive energy programs are being communicated to local governments in an effort to meet federal and state energy objectives.

State government can also provide current energy data and information to energy suppliers, consumers and policy makers. Such data should include: price, supply and use of coal, petroleum, natural gas and electricity; trends in energy development; analysis of alternative energy resources available in the state; and statistical analysis of energy use by the residential, commercial, industrial, agricultural and transportation sectors. When made available to both private and public sector officials, the data will assist in sound decision-making.

Local Role

Local government's role in the energy picture is key.

The local community should not expect the federal government to dictate specific policies or programs to be implemented in a community. It is the role of local government to assess local energy needs and to develop specific programs that are necessary to satisfy these needs. There is a myriad of energy programs available to local communities (see appendix 4, "Index to Federal and State Energy Programs"). Local governments must evaluate and decide what programs would be appropriate for their communities.

It is the involvement of the local constituent, and the local utility along with the local government, that will be necessary in implementing any effective energy project. The use of energy now, or any changes in this usage, could involve substantial lifestyle changes, thus citizens must be actively involved in this process. So local government, having the best access to local citizens, must play a key role in energy policy decision making.

There is a substantial reservoir of technical expertise within local governments which can be put to work on local government energy management. These technically trained individuals include engineers, surveyors, draftsmen, planners, transportation specialists, attorneys, appraisers, economists, and more. There is a need to organize and provide local government energy management tasks for this latent energy work force.

Areas of possible energy management action for local governments include conservation of energy use in public buildings, building codes, utility hookup requirements, community information and assistance programs, local development of renewable resources, imaginative land use planning measures that encourage efficient energy use, taxes on inefficient uses of energy, property tax moratoriums for efficient uses, issuance of local development bonds to finance energy efficiency equipment and facilities, and incentives for private development of energy facilities which utilize local resources.

The Planning Process

The planning process described in this workbook is built around five progressive steps:

1. *Identify possible local government energy management actions* appropriate to your community.
2. *Evaluate the possible actions.*
3. Combine selected actions into a "*local energy management plan.*"
4. *Implement the plan.*
5. *Monitor the results* and make adjustments as necessary.

Like most planning processes, the emphasis here is on improving the results by repeating the five steps several times. Don't expect the first draft of the energy management plan to be a complete or wholly effective document. Go through all five steps relatively quickly – say in two or three months – and then after some of the actions are working, go back and improve the total plan. This approach is preferable for several reasons. First of all, there are some immediate actions, such as setting up an advisory committee and hiring an energy coordinator that can be done no matter what other actions the plan may end up recommending. Secondly, among those remaining actions, some you can evaluate yourself while others will require outside help. It's not necessary to wait for all the evidence on each action before implementing others. New actions will be occurring to you even after the plan is well underway. The idea is to implement some actions, evaluate the results, make adjustments, and then add more actions, and so on through the steps as the plan gets stronger and more effective.

To understand this process better, let's discuss each of the steps in order:

Identify Possible Energy Management Actions

One way to approach this task – and the way this workbook approaches it – is to begin with a long list of possible actions, fitting them to your community's circumstances, gathering data along the way, to evaluate their likelihood of success. This approach allows you to implement some obvious steps immediately and to build on other communities' experience in studying or using these actions.

To build the list of possible actions, a series of approximately twenty questions are given in the next chapter. The questions in chapter 2 can be answered in approximately thirty to forty minutes. By answering the questions, you will select a list of possible energy management actions relevant to your community.

In chapter 3, you need to read only these materials identified in chapter 2 as relevant to your community. For example, if you are a rural county and you don't operate streetlights, you won't read a section on how to conserve energy by converting to sodium vapor units.

Another way to identify energy management actions is to complete an "end use survey" of energy in your community. This results in a table that shows how much of which kinds of energy are consumed by different "end use" activities. Typically, the results are summarized by "sector," such as residential, commercial, industrial, government, transportation, and so on; and for different activities within each sector, such as heating buildings, running machinery, etc.

This kind of information helps put the different energy uses into perspective. For example, energy management actions that attack large blocks of energy (like space heating or a small hydro) have more potential energy than those that focus on relatively minor amounts (like electronic equipment).

End use surveys, however, consume much time and effort to make complete and accurate. Also the big energy blocks may not necessarily be more effectively reduced by energy management actions. Average end use data from other surveys prepared by comparable cities may be just as useful

FIGURE 1
Sample Energy End Use Survey Data

as doing your own. Roughly check your community's end use against the averages, shown in figure 1, using sector data from your local utility. If the fit seems reasonable, we don't recommend spending further effort on an end use table until you need the information to evaluate a specific conservation action later in the workbook.

Evaluate Possible Energy Management Actions

At the end of step one you will have a master list of possible energy management actions for your community. Some of the items on your list will be things you can do right away. At the end of step two you will have identified some additional measures that are probably cost effective, rejected some actions as not appropriate, and selected some for further evaluation, perhaps with the help of outside consultants. (Chapter 3 includes more information on each of the possible actions to help you in this evaluating process.)

This evaluation step is really the heart of the planning process. It's here that you become committed to some initial strategies that will become the plan in step three. Here your citizen and technical advisory committees will be the most active in sorting out what the different alternatives may mean for their constituents.

A discussion of implementation alternatives for each of the actions is included in the evaluation chapter so the implications of actually carrying out these actions in your community can be considered at this early step in the process, rather than waiting until the implementation. Too often plans are formulated without attention to implementation questions, such as voluntary vs. mandatory regulations, resulting in frustration at the end of the process.

Many of the costs and benefits of candidate actions cannot be measured quantitatively and will have to be evaluated in the advisory committee discussions using qualitative judgments. For example, some believe that energy independence for a community has a philosophical appeal or value that cannot be measured in dollars and cents. Other measures may be appealing economically but inconsistent with the community's values.

No set of numbers, however well conceived, can ever substitute for people's attitudes about these matters, and it's important that these attitudes be taken into account early in the process. Do not assume that because an action is logical from an economic or cost-benefit standpoint that it will necessarily be embraced by the community.

There are some other limitations in the evaluation step that should be noted. Since this workbook deals only with electrical energy management, we have not included advice on how to do so-called "net energy budgeting" in which potential savings in the use of one form of energy, such as electricity, are balanced against possible increases in the use of other forms, such as oil. For example, if the community undertakes a program to discourage the use of electric space heating, obviously other forms of space heating will be substituted. These other forms have their own costs which may or may not justify the electrical energy saving alone.

Even solar heating systems have an energy cost embodied in specialized materials required for their construction. Energy audits of residential buildings in a rural area will require gasoline to get the auditor around. In nearly all cases these costs will not be significant enough to affect the community's judgment of the cost effectiveness of an alternative, but the decision maker should be aware of these costs, and they probably should be discussed by the advisory committee.

Assembling Selected Actions Into a "Local Energy Management Plan"

Once a set of actions is selected it is relatively easy to assemble them into a plan. Gather together the selected actions, set priorities among them, prepare explanatory text, and publish them as a plan. The size, scope, and content of your own community's plans will vary widely depending upon the actions that have been selected and the resources available for implementation. (These are discussed in some detail in Chapter IV.)

A recommended five part outline includes:

1. Statement of the Problem
(Why are we doing this plan?)

2. Goals, Objectives, and Policies
(What do we expect the plan to accomplish? Statements about both ends and means)
3. Recommended Actions
 - a. Actions we are taking now
 - b. Actions we expect to take soon
 - c. Long range actions being studied
4. Timing and Cost of Implementation
(When we expect to take what action, and how much it will cost)
5. Implementation Responsibilities
 - Council's role
 - Energy coordinator's role
 - Department head's role
 - Role of boards and commissions
 - Local utility role
 - Businessmen's role
 - Industry's role
 - Citizens' role
 - Other responsibilities implementation

One of the ways to give the plan momentum is to assure that by the time a formal plan is written, some of the energy management actions have already been taken and may be showing results that can be discussed in Section 3 of the plan. Another is by including two sections (4 and 5) specifically devoted to implementation.

Many plans over-emphasize the problem statement, tend to have unfocused goal and policy statements, and are weak in coverage of implementation. Don't dwell on how the planners got to the recommended action but rather on how the actions will be carried out. This is why we include separate implementation responsibilities. Everyone in your government and community should be able to read in your Section 5 exactly how they can make the plan a success.

Implement the Plan

To reiterate, the keys to successful implementation are (1) take some immediate energy management actions even before the plan is adopted; and (2) include detailed information about implementation in the plan itself. Implementation is a lot harder than planning and it's easy to lose momentum after the plan is adopted (especially if the adoption process has been contested) unless you've got some action working for you.

The cost discussion in section 4 should include figures that can be readily translated into budget requests, including money for further study of possible actions, as well as for actions you have already decided to carry out.

Monitor the Results and Make Necessary Adjustments

This leads the community back to steps one and two to begin another planning cycle that improves and strengthens the plan. When evaluating possible actions, ask: "How will we be able to tell if this action is bringing results?" If you can't answer this question, then that particular action probably shouldn't be one of the earlier actions you take. Monitoring is important not only to improve the plan, but also to help the community and decision makers to feel good about the plan. Publicizing progress toward established objectives will help to rally the community behind energy management planning.

Twenty Questions Identifying Energy Management Actions for your Community

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Twenty Questions Identifying Energy Management Actions for Your Community

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Following is a set of twenty questions about your community that will help you select a list of candidate energy management actions. The questions can take from five to forty-five minutes to complete depending on the extent of your present energy program and your commitment to local energy management.

Each answer directs you to another question, or to a short section of text on the facing page. After reading through the text, you will be asked to check a box if you think a particular energy management action is appropriate to your community. All the questions require yes or no answers; if you don't know or are unsure of the answer, always check "no."

As you go through the questions, you will accumulate a number of boxes representing actions your community could take. After you've completed the questions, transfer these checks to the boxes with the same numbers in the "Master Action List", page 26-27

Go all the way through the exercise in one sitting. If you don't know the answer to a question, check "no" and proceed.

Try to resist the temptation to read additional materials about a proposed action somewhere else in the manual. There will be plenty of opportunity to weed out inappropriate actions later in the planning process. This is just the first rough cut to give you a set of prospective energy management actions, reasonably matched to your community's circumstances.

Q-1.

Has your local government adopted a resolution expressing support for local energy management and planning?

Yes ☐ Go to question Q-2

No ☐ Read Section 1

Section 1

Official recognition of the energy problem is a first essential step in any local planning process. Regardless of the community's size, no serious attention is likely to be given to the problem without some measure of leadership from the local government.

A simple, inexpensive, and visible way to do this is to adopt a resolution similar to the one described in chapter 3. For governments that expect to carry their energy planning activities further, this is a vital first step; for those that don't, it symbolizes an important commitment to cooperate with other Northwest communities in solving our common energy problems.

If you agree, check box 1. If you're not convinced that a local government resolution is a good idea, please read on.

Action 1. Adopt a resolution supporting energy conservation and planning.

☐ 1

Now go to Question Q-2

Local officials are sometimes reluctant to assume leadership on energy issues, usually because they feel powerless to find solutions. Many have become comfortable with the idea that electrical energy problems are really problems for the utilities who generate and sell electricity, or for state and federal agencies that have knowledgeable experts and resources to deal with the problems. There are no specific enabling laws that give local governments "energy powers" like those authorizing a police force or land use control. Many governments, especially small ones, feel they are doing very well just to provide the primary services that people have come to expect from them.

But our growing electrical energy problems are *everybody's* problem. Less electrical energy at higher prices is a reality that touches virtually every aspect of our daily lives. Local governments already influence the way we live by the decisions local government officials make every day in carrying out their traditional functions. These actions have a powerful, and perhaps decisive, effect on energy use: whether as simple as purchasing a new office copier, or as complex as the adoption of a comprehensive land use plan, they have important energy use implications.

Another reason for the resolution is that local government should support the conservation efforts of the local electric utility. Utilities are chartered to provide a service and are legally obligated to meet the growing electrical demand whether that demand is an efficient use of the resource or not. Utilities do have some discretion in negotiating terms of interruptible load contracts with larger users, but for the most part they have no authority to regulate or influence demand. Since local government has many of the authorities that the utility lacks, it can be an effective partner with the utility in the energy management planning process.

Finally, many citizens expect local governments to set a positive example. If governments waste energy in their operations, citizens will be reluctant to change their own habits. If government shows a concern for energy management actions by adopting a resolution setting a general conservation policy, and later by specific actions as part of a plan, then local officials can ask citizens to cooperate in a community-wide effort to use energy more wisely.

If you agree that your local government should adopt a resolution, check box 1.

Action 1. Adopt a resolution supporting energy conservation and planning. ☐ 1
Now go to Question Q-2

If you don't agree, then this manual may not be for you.

Q-2.

Does your community have a person specifically designated to deal with energy matters?

Yes ☐ *Is the person a full time energy coordinator or does he/she have other duties?*

Full time ☐ *Go to question Q-3*

Other duties ☐ *Read Section 2*

No ☐ *Read Section 2*

Section 2

Each community needs to have one person responsible for overseeing and carrying out its energy planning program. Usually that person is called an energy coordinator. Small cities and towns may do all right with a part-time coordinator (usually a city employee who shares his or her coordinating functions with other city responsibilities). But larger communities will want a full time energy coordinator. Many well intentioned local energy programs have failed for lack of continuous long term attention to the problem — the kind of attention that can only come from a full time staff member. If you agree that you need a full time staff member attending to energy issues, check box 2A and proceed to question 3.

Action 2A. Hire or appoint a full time energy coordinator. ☐ 2A
Now go to Question Q-3

If you don't think you need a full time coordinator, read on:

If due to costs or other considerations you favor a part time staff person, sharing an energy coordinator with another nearby city or county is preferable to hiring someone who must divide his or her attention between your energy problems and an unrelated job.

Two or more adjacent communities with common or interrelated energy problems can pool their resources to hire a coordinator and perhaps additional staff to develop and implement a joint planning program. If you belong to a council of governments, consider hiring an energy coordination staff for the entire council membership.

The Bonneville Power Administration service area includes many rural counties with single central cities in which a joint city/county energy planning program could be easily managed by a shared coordinator. If these options seem appropriate to your community, check either or both boxes 2B and 2C.

Action 2B. Hire or appoint a part-time energy coordinator.

☐ 2B

Action 2C. Explore joint energy planning with neighboring communities or your Council of Governments.

☐ 2C

Now go to Question Q-3

Q-3.

Does your community have an advisory committee appointed to deal with energy matters?

No ☐ Read Section 3A

Yes ☐ Do you also have a technical advisory group?

Yes ☐ Go to question Q-4

No ☐ Read Section 3B

Section 3A

As soon as an energy coordinator has been hired, the city, county, or council should immediately appoint an Energy Advisory Committee. This committee serves several important functions. First, it provides direct and continuous liaison among all of the various individuals and groups in the community participating in the process, the coordinator, and the government. Second, it serves as both a source and sounding board for ideas on how to save energy. Third, it provides a forum for resolving inevitable differences among the various groups as the plan progresses. Finally, it performs a formal advisory function to the legislative body of local government during key decision points in the planning process.

To do all these things well, the committee must have wide representation in the community. Both public and private agencies must be represented, and it must be able to speak for both professional and non-professional segments of the population.

If you are serious about energy management planning, you will need to establish such an advisory committee. Check box 3A if you agree.

Action 3A. Appoint an energy advisory committee from the community at large.

☐ 3A

Go to Question Q-4

Section 3B

If you are a council of governments, a county or a larger city, you may want to assemble a group of technical experts from both inside and outside the government. If these kinds of people are already on the advisory committee along with citizens and other "lay" representatives, consider organizing them into a separate technical body. Staff people can tend to dominate broadly based policy-oriented advisory committees and are often more useful if they meet separately and then report to the larger advisory committee.

Technical committees can be very useful in evaluating policy and program alternatives, identifying economic, social and environmental implications, and in providing cost evaluations of policies, programs and projects. Consultants can also provide expertise in some cases. However, local technical staff can have specific insight into local problems and conditions.

If you think you want to add a technical advisory committee, check box 3B.

Action 3B. Establish an energy technical advisory committee.

☐ **3B**

Go to Question Q-4

Q-4.

Is there a plan to keep your city or county running in the event of an emergency shortage of energy?

No ☐ *Read Section 4A*

Yes ☐ *Does your plan include contingencies for electric energy curtailment, either voltage reductions, selective area blackouts, or total blackouts?*

No ☐ *Read Section 4B*

Yes ☐ *Do you have a plan of action to carry out your local government's responsibilities as specified in the curtailment plan?*

No ☐ *Read Section 4C*

Yes ☐ *Go to question Q-5*

Section 4A

Shortages of electricity, oil, gasoline, and natural gas are being forecast for the 1980's. How long the shortages will last, and how extensive they will be, is not known, but it is likely that they will happen. Local government will be under intense pressure from affected citizens to do something about the problems created by energy shortages. Creating and putting into place an energy contingency plan can help to ensure that the effects of energy shortages will be minimized.

The state energy office or the electric utility in your area may have a plan for allocating power in a regional electricity shortage. If your utility has a plan, your local government should know its role in the plan, in order to react quickly and effectively to an electric energy shortfall contingency. Contact your public utilities and the state energy office to find out if an energy contingency plan exists and what it does.

If an adequate plan does not exist for each major type of utility, the local government has the responsibility and authority to develop it. Even if you feel that the state or some other agency should be responsible for energy contingency planning, remember that local government will have to face its constituents during an energy shortage whether or not the state or anyone else has an effective energy contingency plan.

An energy contingency plan should address more than electricity shortages. A simultaneous shortage of imported oil and natural gas, and a low water year, would create a grave situation for any community in the Pacific Northwest.

Check box 4A if you feel that your area is not prepared for an energy shortage of gasoline, oil, coal, natural gas, or electricity.

Action 4A. Prepare a contingency plan to meet an emergency shortage of energy (all forms) in your community.

☐ **4A**

Go to Question Q-5

Section 4B

The BPA is now forecasting a 98 percent probability of an electricity shortage some time in the 1980s. The ways that your local electric utility can deal with a shortage of electricity include reducing the voltage (brownouts), curtailing service to certain neighborhoods (blackouts), and

intense media campaigns to temporarily and voluntarily reduce the demand for electricity. The customers of the electric utility are the constituents of local government, and all will be adversely affected by electricity shortages. In addition, shortages of electricity can cause temporary and permanent increases in the use of other energy fuels which may also be in short supply. A complete energy emergency contingency plan must include not only gasoline, oil, natural gas and coal, but electricity as well. If your energy contingency plan does not include electricity and you agree that it should, check box 4B.

Action 4B. Expand your contingency plan by adding an electrical curtailment element. ☐ 4B

Go to Question Q-5

Section 4C

Readiness for an electrical shortage is dependent on all sectors knowing and understanding their roles as described in the contingency plan. Many contingency plan efforts fall short because the planning process does not include extensive publicity and a clear definition of who will be in charge during the electricity shortage. All parties to an electrical contingency plan must make a major effort to educate and prepare their people for the roles they will play in the event of electric power reductions. If you have reason to believe that your electrical contingency plan is not widely known and understood, check box 4C.

Action 4C. Conduct a public relations campaign to ensure that everyone involved with the electrical contingency plan knows their role before the plan has to be used. ☐ 4C

Go to Question Q-5

Q-5.

Do you pay the energy costs for public buildings that you own or operate?

No ☐ Read question Q-6

Yes ☐ Have your buildings had any kind of energy audit since 1974?

No ☐ Read Section 5A

Yes ☐ Were these audits carried out under NECPA?

No ☐ Read Section 5B

Yes ☐ Go to question Q-5a

Section 5A

Conducting an energy audit will lead you to discover your building's energy costs: (1) the mechanical systems, such as heating, lighting, and elevators, (2) the building itself, with its windows, doors, insulation, and orientation, and (3) the people in the building and the way they use it.

Usually an energy audit begins by examining the records of utility payments, and building design, orientation, and use to discover the potential for energy savings. In a second phase, a detailed walking inspection of the building is made to uncover specific operational and maintenance changes which could be made by building management. In an optional third phase, a professional engineer would be called in to design physical changes to be made to the structure or to energy-using systems. These changes, called "energy management measures" (EMM's) would probably be more than the annual operating budget would allow, and might therefore require capital financing.

Some operational and maintenance changes, such as light bulb removal, improved boiler maintenance, or lower hot water temperature settings often save enough money to pay for the minimal cost of the energy audit in just a few months. If you are interested in saving money in your government buildings by performing an energy audit, check box 5A.

Action 5A. Arrange to audit each government building used by your jurisdiction.

☐ 5A

The "National Energy Conservation Policy Act of 1978" (NECPA) provided money to help fund energy audits for local government buildings, public care institutions, schools, and hospitals. Under NECPA, half of the costs of energy audits are paid by the federal government. For schools and hospitals, NECPA may also award grants for part of the costs of energy management measures (EMM's), those energy-saving projects which require major capital investment.

If you want to start auditing your public buildings, contact your state energy office. They will send you the forms you need and will tell you more about how to participate in the NECPA energy audits. Check box 5B if you want more information on the NECPA.

Action 5B. Contact your State Energy Office and arrange an energy audit under NECPA for your schools, hospitals, public care institutions, or government buildings.

☐ 5B

Go to Question Q-6

Section 5B

The "National Energy Conservation Policy Act of 1978" (NECPA) provided money to help fund energy audits for local government buildings, public care institutions, schools, and hospitals. Under NECPA, half of the costs of energy audits are paid by the federal government. For schools and hospitals, NECPA may also award grants for part of the costs of energy management measures (EMM's), those energy-saving projects which require major capital investment.

If you want to start auditing your public buildings, contact your State Energy Office. They will send you the forms you need and will tell you more about how to participate in the NECPA energy audits. Check box 5B if you want more information on the NECPA.

Action 5B. Contact your State Energy Office and arrange an energy audit under NECPA for your schools, hospitals, public care institutions, or government buildings.

☐ 5B

Go to Question Q-5a

Q-5a.

Have you successfully implemented all of the audit's recommendations and have you evaluated new building techniques such as heat pumps and solar units?

Yes ☐ Go to question 6

No ☐ Read Section 5C

Section 5C

If your energy audit recommended energy management measures (EMM's) but your building is not an eligible school or hospital, federal funds are not available for financing under NECPA. However, many EMM's result in enough energy savings to pay back their cost in just a few years. Also, direct credits from your electric utility may be available to pay for the energy which an EMM will save. Ask your utility if it can help.

If no energy management measures were recommended in your building energy audit, then you probably have a modern building designed for energy efficiency. But you should not overlook alternative energy sources such as solar space and water heaters, greenhouse foyers, heat pumps, and the like. Investments in these technologies may be cost effective in the long run, particularly if they become eligible for a direct credit from your electric utility.

Check box 5C if you feel that the action would help your energy conservation effort.

Action 5C. Finance the energy conservation measures recommended in your building audit(s).

☐ 5C

If you have had difficulty implementing the operational and maintenance recommendations of an energy audit, you may need a public relations effort to reach your community and your staff. To be eligible for the U.S. government's program to share the costs of energy management capital improvements to schools and hospitals (NECPA), you will need to show that you have already implemented the operation and maintenance recommendations in the NECPA audit.

Check box 5D if you feel that a public relations effort on behalf of energy conservation would help.

Action 5D. Conduct a public relations program to implement people-related conservation measures. ☐ 5D

Go to Question Q-6

Q-6.

Is the local electric utility conducting energy audits and conservation programs for commercial and/or residential buildings in your community?

Yes ☐ Go to question Q-7

No ☐ Is your local government conducting energy audits and conservation programs for commercial and residential buildings in your community?

Yes ☐ Go to question Q-7

No ☐ Read Section 6

Section 6

Auditing private residences and commercial buildings for energy management potential can accomplish several important energy objectives:

1. It encourages building owners to save energy.
2. It helps them decide how to save energy most effectively.
3. It shows the public that local government is serious about the need for energy management and is willing to commit resources to fulfill the need.

If you have access to trained energy auditors, you may be able to start a building auditing program. Otherwise, work with the energy utilities in your area to set up a local program for energy audits. The most immediate concern is electric resistance space heating, but buildings which use other forms of energy for space heating are also potential targets for an energy management auditing program. If you are interested in establishing an audit program in your area, check box 6.

Action 6. Consider establishing a program to conduct home and business energy audits. ☐ 6

Go to Question Q-7

Q-7.

Does your community have a public information program to help citizens save energy?

Yes ☐ Go to question Q-8

No ☐ Read Section 7

Section 7

As energy costs rise, the public will look to local government for help in solving their own household-level energy problems. There should be a phone number that citizens can call to get straightforward advice on such subjects as weatherization, insulation, alternative space heating methods, and so on. If the local electric utility has already taken the lead in providing this kind of

service, the local government's own program should support and expand the utility's effort, such as explaining city and county regulations. The utility can't do it all, and every community needs a public energy information program that includes both utility and local government participation.

If you want to learn more about establishing your own program, check box 7.

Action 7. Establish, in cooperation with your local electric utility, a public energy information program. ☐ 7

Go to Question Q-8

Q-8.

Do you own and operate a public water system?

No ☐ Go to question Q-9

Yes ☐ Do you also own the water source?

No ☐ Go to question Q-9

Yes ☐ Is it a surface water source?

No ☐ Go to question 9

Yes ☐ Read Section 8

Section 8

Water held by a public water supply dam can represent considerable energy that might be converted to electricity. Small scale hydro generation is a well tested technology that is often cost-effective with minimum environmental impacts. The Corps of Engineers has identified 108 existing water supply dams in the four Northwest states that show some promise for small scale hydroelectric development. The shaded portion of the map¹ shows all counties where one or more such dams have been identified. If you are located in one of these counties, check box 8.

Action 8. Investigate the feasibility of developing small scale hydro generation at an existing water supply dam. ☐ 8

Go to Question Q-9

MAP 1

Counties with Water Supply Dams Possessing Small Scale Hydroelectric Potential

Q-9.**Do you operate a public solid waste utility?**No ☐ Go to question 10Yes ☐ Did you collect more than 250,000 tons of solid waste last year?No ☐ Read Section 9AYes ☐ To your knowledge, is there an industry or institution in your community that uses a boiler with bottom ash handling capacity and particulate emission equipment?Yes ☐ Read Section 9BNo ☐ Read Section 9C**Section 9A**

Some experts believe that a minimum of 600 tons of solid waste a day must be available to economically convert it to steam or electricity. But some plants have been successfully operated at a lower capacity, especially if the heat or steam produced by burning the waste is to be used directly in industrial processes, rather than being converted to electricity. Much depends on the makeup of your particular wastes, and on the market opportunities to use the waste fuel. Combining your wastes with those of nearby communities may be enough to make a waste recovery system feasible.

The availability of an existing boiler (with bottom ash handling capability and electrostatic precipitation devices) that could burn processed solid waste along with the fuel it is now using (such as gas or coal) would greatly enhance the economics of this alternative.

If you want to explore further whether this option is appropriate to your community, check box 9.

Action 9. Investigate the feasibility of converting solid waste to energy.☐ 9**Go to Question Q-10****Section 9B**

If you collect a quarter of a million tons or more of solid wastes a year and have available a suitable existing boiler, you are a prime candidate for a resource recovery program that burns solid waste for electrical energy. The boiler is important because it may provide a ready market for the fuel, probably the single most critical factor in judging system feasibility. Other factors include estimates of existing and probable future costs of disposing of a growing waste stream at conventional landfill sites. As these costs rise, alternative schemes for converting waste to energy become more attractive.

After sorting out metals and other non-organic materials, the remaining wastes can be burned directly to produce heat or steam, part or all of which may in turn be used to generate electricity.

It is not easy to decide whether this alternative will be cost-effective for your community. But if you want to explore the possibility of burning solid waste for energy, check box 9.

Action 9. Investigate the feasibility of converting solid waste to energy.☐ 9**Go to Question Q-10****Section 9C**

The reason we asked about the boiler is because the feasibility of burning solid waste for energy is heavily dependent on a ready, *existing* market for the fuel. Most of the successful schemes now operating in this country sell their processed garbage to an industry or utility that can use it to replace or supplement fuel (usually coal) that they now are burning. This doesn't mean that a boiler couldn't be built specifically to burn waste, just that it might be harder to make an economic case for it. Other prominent factors in the cost-benefit formula include the cost (both existing and probable future) of disposing of your growing waste stream using conventional landfill methods. As these costs rise (many communities have found it virtually impossible to locate new landfill sites), various burning schemes become more attractive. Your answer to the question shows you are already generating

significant amounts of solid waste. If you want to explore the possibility of converting these wastes to energy, check box 9.

Action 9. Investigate the feasibility of converting solid waste to energy.

☐ 9

Go to Question Q-10

Q-10.

Do you impose any special requirements on new "all-electric" building construction?

No ☐ Read Section 10

Yes ☐ Go to question Q-11

Section 10

Local government can significantly reduce the overall electrical load by imposing special requirements on new "all electric" construction. Electric space heating has become very popular in the Pacific Northwest, especially in commercial apartments due to the convenience of metering all units in the absence of a centralized boiler and duct system. Anxiety about the future availability and cost of heating oil has lead increasing numbers of private homeowners to abandon their central heating system and "retrofit" with baseboard electric.

Electricity is an economically attractive way to heat space in the short run only because the cost of electricity has remained so low in the Pacific Northwest. As our electric bills increase dramatically over the next five to ten years, electrically heated buildings will become as rare here as they are in the rest of the country.

Local governments can require that all new electrically heated construction be built to very high thermal standards to get the most out of the energy utilized.

If you are not already enforcing such standards and would like to consider doing so, check box 10A.

Action 10A. Consider requiring strict thermal standards for new "all-electric" construction.

☐ 10A

Another way to reduce the burden of new all-electric space heated building construction is to require that these buildings take maximum advantage of alternative energy fuel forms where available. For example if a gas line is available to the property, the city could require that the home or building connect to the gas line whether it is used or not. This may encourage the use of gas for space or hot water heating, or for cooking, thus reducing the total electrical load. It would also facilitate conversion to gas heat at some time in the future when electric space heat is no longer economical.

If you don't already have such requirements, and if natural gas is available in your community, check box 10B.

Action 10B. Consider requiring mandatory non-electric fuel hookup where available.

☐ 10B

Go to Question Q-11

Q-11.

Do you operate streetlights?

No ☐ Go to question Q-12

Yes ☐ Do you use, or are you converting to, sodium vapor units?

No ☐ Read Section 11

Yes ☐ Go to question Q-12

Section 11

The Puget Sound Council of Governments' survey of local conservation programs in the Pacific Northwest shows that street lighting programs are among the most popular, effective, and least costly ways for a local government to save money on its electric bill. Replacing burned out units with modern energy efficient sodium vapor lamps provides an immediate payoff. There are also more efficient ways to use street lighting to get the same amount of benefit out of fewer units at lower cost. If you don't already have such a program in effect and want to learn more, check box 11.

Action 11. Replace existing streetlights with sodium vapor units and investigate other streetlighting conservation measures. ☐ 11

Go to Question Q-12

Q-12.

Do you enforce a local or state building code?

No ☐ *Go to question Q-13*

Yes ☐ *Does your local code require modern* thermal insulation standards for new construction?*

No ☐ *Read Section 12A*

Yes ☐ *Does the code encourage innovative solar construction?*

No ☐ *Read Section 12B*

Yes ☐ *Go to question Q-13*

**At least R-30 in ceiling, R-19 in floors.*

Section 12A

On a household basis Northwest residents consume twice as much electric power as the national average. We have the least thermal efficient housing stock of any part of the country. We could easily be in the same situation as some people in the Northeast, whose utility bills are higher than their mortgage payments. Multiply a typical Northwest monthly electrical bill by a factor of three (a reasonable expectation within the next 10 years).

A first essential step is to increase the energy efficiency of new construction through building code amendments. Local governments generally look to the states to set building standards, and all the Northwest states have taken the lead by adopting amended energy conscious codes within the past few years. Many local governments are enforcing those codes and others have adopted even tougher standards. To find out whether your locally enforced building code is adequate for the high cost energy future, check box 12A.

Action 12A. Amend the building code to include tougher thermal standards for all new construction. ☐ 12A

Go to Question Q-13

Section 12B

Most locally enforced building codes were designed to regulate traditional type construction. To make codes easier to enforce, they are usually written with strict numerical standards; e.g., so many inches of foundation, or so many square feet of window area, and so on. Most of these numerical "rules of thumb" were originally based on less specific "performance standards," but because the broader standard required more judgment to interpret and enforce, the tendency has been to rely on the numbers.

These strict building codes may present obstacles to builders who want to use innovative construction, such as active or passive solar energy systems. These buildings may meet or exceed the original performance standards (or "spirit") of the code, but because they differ from traditional construction practices, may violate the "letter" of the code. Solar buildings are a proven, effective,

and energy saving alternative which can be used to advantage anywhere in our region.

If you suspect your building code may not be flexible enough to allow an innovative solar building, check box 12B.

Action 12B. Expand the building code to accommodate innovative solar construction. ☐ 12B

Go to Question Q-13

Q-13.

Do you enforce a subdivision ordinance?

No ☐ *Go to question Q-14*

Yes ☐ *Does it provide for the special orientation and other siting needs of passive solar buildings?*

No ☐ *Read Section 13A*

Yes ☐ *Does it provide for the protection of solar access for both passive and active solar structure?*

No ☐ *Read Section 13B*

Yes ☐ *Does it include provisions to permit zero lot line common wall construction under some conditions?*

No ☐ *Read Section 13C*

Yes ☐ *Go to question Q-15*

Section 13A

Most subdivision ordinances are based on models that were drafted years before energy efficiency was considered in the siting of residential structures. Modern ordinances take into account the passive solar benefits of orienting homes with their windows facing the sun. Builders who want to construct passive solar houses that require certain site conditions are often discouraged by the traditional subdivision ordinance with its emphasis on rigid setbacks and height restrictions. If you think your subdivision ordinance may be putting institutional obstacles in the way of innovative energy efficient building, check box 13A.

Action 13A. Expand the subdivision code to accommodate passive solar siting needs.

☐ 13A

Please read Section 13B

Section 13B

Innovative building designs that take advantage of the sun for space or water heating can be very successful in the Pacific Northwest, but they need to have certain guarantees that surrounding buildings and landscaping won't block out their access to the sun. If your community is serious about encouraging solar energy systems to save electricity, you will have to make those systems feasible at conventional subdivision residential densities. In many cases this will require amending the subdivision ordinance to make it sensitive to the special need of solar houses to have the sun always available to them. If you want to bring your subdivision ordinance up to date, check box 13B.

Action 13B. Expand or amend the subdivision code to protect solar access.

☐ 13B

Please read Section 13C

Section 13C

In an energy scarce future, we should be building more attached housing, which is more energy efficient than larger detached structures. Unfortunately, in many communities this translates to a choice between traditional single family homes and commercial apartments. While grudgingly

granting their greater energy efficiency, many neighborhood groups object to more commercial apartments on the grounds that they disrupt established single family neighborhoods by their inappropriately large design scale, and because they are perceived to be less suitable for families.

It is true that traditional commercial apartment designs frequently seem out of place in many single family neighborhoods and, except for in very large cities, apartments have traditionally not been designed for families with children.

However, there are compromise attached housing options such as single or two-story town or row-houses or cluster-type configurations. These take advantage of the energy efficiency offered by attached walls and the more efficient use of land without violating the design standards of established neighborhoods. To accommodate the compromise housing styles may require administrative action in the form of amendments to your subdivision and zoning codes to both permit these uses and to set conditions regulating their siting and location. If you want to explore ways to do this in your community, check box 13C.

Action 13C. Amend the subdivision and zoning codes to permit more energy efficient attached housing styles. ☐ 13C

Go to Question Q-14

Q-14.

Do you enforce a zoning ordinance?

No ☐ *Go to question Q-15*

Yes ☐ *Read Section 14*

Section 14

Traditional zoning ordinances have emphasized the separation of uses – commercial, industrial, residential – into their own respective “zones.” Today communities need to consider the energy implications likely to result from the enforcement of their zoning codes.

Over the past two decades cheap gasoline and an expanding federal highway system have encouraged people to separate their working, living and shopping activities across a regional landscape. Higher fuel costs will mean that in the future more people will want to bring these activities closer to home. A greater mixing of residential, commercial and office uses is one way to accommodate this trend. The principle energy savings are, of course, in gasoline due to a reduced need to travel, and in shorter trip lengths. There are, however, some electrical energy savings to be gained by carrying on a mix of activities in a single building or approximate location. If you want to explore these further, check box 14.

Action 14. Amend the zoning code to permit more mixed uses in single structures. ☐ 14

Go to Question Q-15

Q-15.

Were a significant number of homes in your community built before World War II?

Yes ☐ *Read Section 15*

No ☐ *Are most existing homes in your community insulated to modern levels*?*

Yes ☐ *Go to question Q-16*

No ☐ *Read Section 15*

**At least R-30 in ceiling, R-19 in floors.*

Section 15

Most people would agree that we ought to enforce stricter thermal standards for new construction, especially for buildings using electricity to heat space or water. But what about all those

existing homes and businesses? The benefits of retrofitting existing buildings are more difficult to assess. Building audits for both homes and businesses, discussed in another part of the workbook, are part of that assessment process. Because the benefits of retrofitting vary for each building, a local comprehensive retrofit program should be broad enough to fit the particular conditions in your community. If you would like to work to develop such a program, check box 15.

Action 15. Consider establishing programs to retrofit existing homes and other buildings to make them more energy efficient. ☐ 15

Go to Question Q-16

Q-16.

Are any of the following located in or near your community?

Saw mill

Pulp mill

Paper mill

Plywood mill

No ☐ *Go to question Q-17*

Yes ☐ *Read Section 16*

Section 16

Co-generation is the process of creating steam for industry and for generating electricity at the same time, in the same plant. Conventional single purpose steam turbine electrical generating plants use only about 35% of the heat available in the source fuel – the rest is lost as waste heat, mostly in large condensers. At the same time many industries operate boilers built just to produce steam necessary for their operations. In co-generation, these two processes are combined into one facility resulting in the use of nearly 80% of the available energy in the fuel.

In the Pacific Northwest, the potential for co-generation exists principally in the forest products industry, where paper, saw, pulp and plywood mills are already generating large amounts of steam for their own operations. A recent study for the Bonneville Power Administration identified significant potential using these existing boilers to drive electrical generators.

So far only the technical feasibility of co-generation has been estimated. Important questions relating to economic feasibility are still being studied. Generally the larger the plant the more likely that co-generation will be cost-effective. Because pulp and paper plants tend to be larger than saw or plywood mills, they seem to have greater potential.

Co-generation is not a new idea and your own local plant manager may tell you that it has already been considered and found to be not economically feasible. Previous studies, however, probably didn't consider the rising cost of electricity nor the cost of alternative generation, now that we've exhausted our hydroelectric potential.

From an energy conservation standpoint, co-generation could allow the forest products industry, which utilizes a renewable resource, to add capacity without increasing electrical demand. It also offers an alternative source of electrical energy to the industry in the event of curtailment. If you think co-generation might be an option to be explored by your community, check box 16.

Action 16. Investigate the feasibility of co-generation at a local industrial boiler. ☐ 16

Go to Question Q-17

Q-17.

Is your community located in one of the counties identified on the map below as having potential industrial waste heat resources?

No ☐ Go to question Q-18

Yes ☐ Read Section 17

Section 17

The shaded counties on the map are those with large energy consuming industries demanding over 200 billion BTU's per year in total energy. These industries use processes that are likely to generate a great deal of "waste heat" which might be utilized by the community. If this heat could be used to generate additional electricity ("co-generation"), or as a substitute for electricity, it represents a significant source of potential conservation. For example, it might be a source of peak electrical energy for the local utility, provide baseload energy for the industry itself, or be used to heat homes or businesses ("district heating"). It all depends on the characteristics of the heat available and of the community it might serve.

The Bonneville Power Administration is investigating ways of utilizing waste heat within its Northwest service area. If you are in one of the shaded counties on the map and want to learn more about the potential in your own community, check box 17.

Action 17. Investigate the feasibility of district heating with waste heat from local industry. ☐ 17

Go to Question Q-18

MAP 2**Counties with Potential Industrial Waste Heat Resources**

Q-18.

Is your community located in or near any identified potential geothermal resource area shown on the map below?

No ☐ Go to question Q-19

Yes ☐ Read Section 18

MAP 3

Potential Geothermal Resource Areas in the Northwest

Section 18

Geothermal energy is the natural heat from the earth's crust – available everywhere, but in most places too diffuse to be economically recoverable. The Pacific Northwest includes a number of sites where geological conditions have concentrated this heat energy so that it can be recovered as steam or hot water. These in turn can be used directly for district heating or other uses, or they might be converted to electricity. The City of Boise, Idaho has utilized geothermal hot water for heating homes and other purposes since before the turn of the century and other sites have been developed around the Northwest. If your community is located near such an identified geothermal resource and you would like to investigate the possibility of its economic recovery, check box 18.

Action 18. Investigate the feasibility of developing local geothermal resources for district heating or other uses. ☐ 18

Go to Question Q-19

Q-19.

Is your community located in one of the darkly shaded areas shown in the map below to have high winds?

No ☐ Go to question Q-20

Yes ☐ Read Section 19

MAP 4**Wind Energy Potential in the Northwest** **Section 19**

Wind energy is already a technologically feasible and cost-effective renewable source of electricity. Several companies are developing and marketing equipment for small scale electricity generation. The darkly shaded areas of the map are the areas of highest wind energy potential. If your community is included in the shaded area, you should encourage the development of wind power resources in your community. There are many actions you can take to develop wind resources, from modification to building and zoning codes to establishment of a locally owned wind energy utility. Check box 19 if you want to explore wind energy further.

Action 19. Take action to develop wind power in your community.

☐ 19

Go to question Q-20

Q-20.

Does your local government now offer financial incentives to the private sector for conserving energy?

Yes ☐ Please turn to the next page for further instructions

No ☐ Read Section 20

Section 20

There is a tendency for local government to look upon its role in energy management as being largely one of regulation and perhaps providing public information. It's true that some regulatory authority will probably need to be exercised in the management plan – and public information is always important – but perhaps a better way to change people's energy behavior is through the use of financial incentives to the private sector. In this country the market has a way of providing both short and long term solutions to many of our problems and must not be overlooked by the local government in preparing its comprehensive energy management plan. If you agree, check box 20.

Action 20. Explore alternative ways of offering financial incentives to the private sector for saving energy. ☐ 20

Master Action List

When you have completed the exercise, transfer the check marks from the boxes at the end of each section to the boxes in the master list and read the instructions on the page following the master list.

Immediate Actions – Things to do Now

- ☐ 1 Adopt a resolution supporting energy conservation and planning. (page 35-36)
- ☐ 2A Hire or appoint a full time energy coordinator. (page 36-37)
- ☐ 2B Hire or appoint a part time energy coordinator. (page 36-37)
- ☐ 2C Explore joint planning with your Council of Governments or neighboring communities. (page 37)
- ☐ 3A Appoint an energy advisory committee from the community at large. (page 37-38)
- ☐ 3B Establish an energy technical advisory committee (page 38)
- ☐ 5A Arrange to audit each government building used by your jurisdiction. (page 40-46)
- ☐ 5B Contact your state energy office and arrange energy audits under NECPA for your schools, hospitals, public care institutions, or government buildings. (page 41)

Short Term Actions – Options You can Evaluate Yourself

- ☐ 4A Prepare a contingency plan to meet an emergency shortage of energy (all forms) in your community. (page 38-40)
- ☐ 4B Expand your contingency plan by adding an electrical curtailment element. (page 39)
- ☐ 4C Conduct a public relations campaign to ensure that everyone involved with the electrical contingency plan knows their role before the plan has to be used. (page 40)
- ☐ 5C Finance the energy conservation measures recommended by your building audit(s). (page 45)
- ☐ 5D Conduct a public relations program to implement “people-related” conservation measures. (page 40)
- ☐ 6 Consider establishing a program to conduct home and business energy audits. (page 45)
- ☐ 7 Establish, in cooperation with your local utility, a public energy information program. (page 45)
- ☐ 11 Replace existing streetlights with sodium vapor units and investigate other streetlighting conservation measures. (page 46)
- ☐ 12A Amend building code to include tougher thermal standards for all new construction. (page 51-55)
- ☐ 13C Amend the subdivision and zoning codes to permit more energy efficient attached housing styles. (page 59-61)
- ☐ 14 Amend the zoning code to permit more mixed uses in single structures. (page 60-61)
- ☐ 20 Explore alternative ways of offering financial incentives to the private sector for saving energy. (page 47-48)

Long Range Actions – Strategies That Require Further Study

- ☐ 8 Investigate the feasibility of developing hydroelectric generation at an existing water supply system. (page 48-50)
- ☐ 9 Investigate the feasibility of converting solid waste to energy. (page 50-51)
- ☐ 10A Consider requiring strict thermal standards for new “all-electric” construction. (page 56-57)
- ☐ 10B Consider requiring mandatory non-electrical fuel hookup where available. (page 56)
- ☐ 12B Expand the building code to accommodate innovative solar construction. (page 57-59)
- ☐ 13A Expand the subdivision code to accommodate passive solar siting needs. (page 57-58)
- ☐ 13B Expand or amend the subdivision code to protect solar access. (page 58-59)
- ☐ 15 Consider establishing programs to retrofit existing homes and other buildings to make them more energy efficient. (page 46-47)
- ☐ 16 Investigate the feasibility of co-generation at a local industry boiler. (page 61-62)
- ☐ 17 Investigate the feasibility of district heating with waste heat from local industry. (page 62-63)
- ☐ 18 Investigate the feasibility of developing local geothermal resources for district heating or other uses. (pages 62)
- ☐ 19 Take action to develop wind power in your community. (page 62-63)

Now that you have transferred the checks from the questionnaire to the “Master Action List”, you have started an energy conservation plan for your community! Type the “Master Action List” up yourself, leaving out the items you didn’t check. Use the list as a work plan. Start right away to do the immediate actions. As soon as your advisory committees are in place, use the list to generate your first meeting agenda.

Chapter 3 is meant to be a resource for you or your energy coordinator. It explains the fundamentals of each conservation action and offers suggestions for specific steps, gives examples, and suggests additional source materials. The page numbers following each numbered action on the Master Action List refer to a section in chapter 3 which describes how to evaluate that action.

The next step is to first read the introduction, and “The Evaluation Process”, in chapter 3. After you have read how chapter 3 functions and are familiar with the evaluation process used, return to your “Master Action List” and refer to the page numbers in chapter 3 following each of your proposed actions.

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Evaluating Energy Management Actions

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Evaluating Energy Management Actions

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Now that the first screening of possible energy management actions has been completed, this chapter will guide you through a more detailed evaluation. This process helps you determine if the actions you chose are feasible and cost effective for your community.

The chapter is divided into two main sections: First, the "Evaluation Process," covers evaluating economic benefits, getting technical assistance and financing energy management actions. Second, "Evaluating Specific Energy Management Actions" describes each of the prospective actions according to their timing of implementation: immediate actions – things to do now; short term actions – options you can evaluate yourself; and long range actions – strategies that require further study and specific types of expertise.

Read the material appropriate to your own "Master Action List" and ignore the sections which describe actions not on your list. Next, your energy advisory committee should recommend what sources of technical expertise are best utilized in making these evaluations for investigating short term and long term options. Your energy coordinator should locate all sources of expertise, either within or outside of your local government staff. After completing the evaluation, the energy advisory committee should review the actions and forward its recommendation to your legislative body.

Public information programs are vital to the implementation of most energy actions. A section dealing solely with public information programs is not a part of this workbook. However, public information programs specific to each energy management action are discussed as part of the section describing each alternative action, where appropriate.

The Evaluation Process

Estimating Economic Benefit – Is it Worth Doing?

Before deciding whether a particular prospective energy management action should be included in your community's energy plan, a number of factors must be considered. The most important of these is economic benefit. City councils and county commissions will want to know if the benefits of a proposed action will be greater than its costs – often before they want to hear anything else about the proposal.

Broadly speaking, there are four different situations in which the benefits of a proposed action can be said to exceed its costs:

1. The action requires no money costs and shows results *immediately*, or as soon as the next utility bill arrives.
2. The initial cost of the action is greater than the initial benefit but *over the life of the action* the benefits exceed the costs.
3. The benefits of an action exceed its costs over its lifetime, but *only with an outside subsidy*.

4. Benefits don't exceed costs over the life cycle, even with a subsidy, but there is a *net economic benefit to the community*.

Immediate Benefits

Reducing the courthouse thermostat a few degrees costs nothing, and the benefits in lower heating bills are immediate. Many, but unfortunately not all, energy management actions are of this type.

Life-of-the-Action Benefits

Cost accounting methods consider the entire cost of a program or piece of equipment over its entire life, rather than just its initial "purchase" or "start-up" costs.

For example: Consider the choice between two new copy machines for city hall. Both machines appear to meet your needs equally well, but one costs \$800 and the other only \$500. Considering the purchase price alone, the second machine is preferable. But operating and maintenance costs for the life of the machine must also be considered. Investigation shows the following:

	Machine A	Machine B	Life-Cycle Cost* Over Five Years	
			Machine A	Machine B
Purchase price	800	500	800	500
Operating cost	200/year	300/year	1000	1500
Maintenance cost	40/year	50/year	200	250
			\$2000	\$2250

*This example assumes constant dollars.

Machine A costs less to operate because it uses cheaper paper and less electricity. It's also a better built machine (the maintenance contract is cheaper). Assuming both machines will last five years, and ignoring their salvage values, Machine B will cost you \$250 more over the five year period.

This example illustrates how energy savings are often hidden behind the initial cost of energy management actions. In this example, we assumed energy costs would remain constant over the five-year life of the machine. Actually, this is unlikely. Electrical energy costs will certainly increase. In addition, we have not made adjustments to account for the time value of money – something you will want to take into account, especially for long-term actions.

Some city and state laws requiring that the government accept the lowest bid for equipment and services may hinder or prevent cost accounting methods that take into account the life of the action. Try to get these laws changed in your area in favor of a policy requiring local government to consider the same range of benefits and costs a business would in making an investment decision. (For a detailed technical discussion of cost-benefit arithmetic, see Appendix 3.)

Subsidized Benefits

Some energy management actions may qualify for grants or loans, or require other forms of outside subsidy to show an economic return. The state or federal government may provide funding to help defray the cost of some required actions, as in the case of grants to improve sewage systems.

If you're considering local electrical generation (smaller scale hydro, cogeneration, etc.), a cooperative arrangement with your local utility might be possible.

For example, you and your consultants may find that it is technically feasible to convert your community's solid waste to electricity. However a cost/benefit analysis shows that even considering the future cost of conventional land fill disposal, purchasing electricity will be less costly than solid waste conversion.

The electricity your project generates would in effect save the electric utility from providing it. Thus the electric utility might be interested in the "opportunity cost" of having your proposed plant on-line and generating electricity. This is the cost they would have to pay to add that same amount of electrical capacity. Comparing the opportunity cost with the deficit for your project, the utility may

consider paying you the difference as a direct credit on your electric bill, in exchange for the electricity your plant generates.

The utility can then adjust its wholesale rate to "meld," or spread out over the whole service area, the higher cost of the power they buy from you. This is similar to BPA helping pay for nuclear power construction plants by guaranteeing a region-wide market for the electricity the plants eventually will produce.

With large scale hydroelectric potential virtually exhausted in the Northwest, the cost to the utility of generating additional electricity using alternative thermal plants may be on the order of ten times their current costs. Since most Northwest electric utilities buy some or all their electricity from the Bonneville Power Administration, it's the BPA that is most likely to get into this kind of subsidy program with local governments, if authorized by the Congress.

Extending this principle, BPA could help to pay for significant energy management measures that don't involve the addition of any generating capacity, but still represent a significant opportunity for BPA to avoid the need to add capacity.

Obviously, while the principles are relatively straightforward, the actual arithmetic is fraught with uncertainties and complications. No one knows what electricity will cost 20 years from now, or even how much electricity we will need. The point is: don't reject an energy management action that doesn't immediately appear to be cost effective to the community. Rather, monitor energy supply and cost situations to see if your project becomes cost effective in the future.

Community Benefits

Finally, there are some kinds of energy management actions that won't directly profit the local government budget even over the long run, but which still may result in a measurable gain to the community. An example is a public relations program aimed at household-level conservation. The program will cost the government money, but virtually all the benefits will go to the individual homeowners and to the electric utility. Local governments already provide many services that, in effect, transfer economic benefit from one group of people (all taxpayers) to another group (citizens benefiting from the government's advice), without consideration of profit to the government. Therefore, some energy management actions should be evaluated from a broader perspective than direct economic benefit.

Two excellent references for further reading on measuring economic benefits are: American Institute of Architects, *Life Cycle Costing Analysis; a guide for architects*, Vol. 1, Washington, D.C., 1977, Vol. 2, Washington, D.C., 1978. And National Bureau of Standards, *Life Cycle Costing: a guide for selecting energy conservation projects for public buildings*, BSS 113, Washington, D.C., Sept. 1978.

Financial Assistance: Where to Get Money

The different types of actions will require different financing methods. Immediate actions usually cost little and can be accommodated in a normal operating budget.

The same is true for short term actions if funds are available from existing revenues. Your local utility may share the costs and/or provide technical assistance in some cases. In others, such as contingency plans or insulation programs, which provide a service to the utility, you may want to contract your services to the utility on a fee basis.

There are several alternatives for financing long range actions. The cost of studies may be shared with your local utility, other cities or counties, and in some cases, the federal government. The Bonneville Power Administration has technical assistance programs and also can advise you where loans and other forms of financing may be available. (Other agencies conducting energy assistance programs are listed in Appendix 4.)

In financing generation projects such as solid waste facilities, district heating, small scale hydro and wind energy, traditional forms of public financing – including general obligation bonds, revenue bonds, and other forms of loans – are as applicable for energy as for any other municipal project.

Cooperative financing arrangements between local government and the utility can significantly increase the profitability of many long term actions.

Government revenue bonds have a much lower interest rate than do financing alternatives available to private utilities. For example, Portland, Oregon, which is served by a private utility, has undertaken a large public energy conservation financing program using government revenue bonds.

Using public financing and maintaining public ownership of energy utilities is often a very important factor in the total cost, and, therefore, cost effectiveness of energy projects. For example, if energy from a small hydro project is used by a city or county, a federal license is not required, resulting in considerable savings. Advantages of lower interest rates through public financing can also apply in this case.

The community and its local utilities should investigate a power purchase contract to underwrite the financing for the project. Power purchase contracts can be long term or short term. In some cases, once the project has been paid for, the contract terminates and the local government continues to operate its municipally owned energy facility for its own use.

A more common method, especially in California, is for the local government and utility to negotiate a contract that guarantees the payback and operation cost of the facility plus a guaranteed profit every year to the local government. Guaranteed profits usually range from 0.5 mills to 5 mills per kilowatt hour. Profits greater than 5 mills per kilowatt hour are commonly shared jointly by the utility and the local government, usually on a 50/50 basis. The advantage of this type of contract is that local governments are guaranteed a profit and the utility is encouraged to use cost effective management so it can also make a profit.

Once the cost of financing or, in the case of purchase agreements, the net revenues to the city, are determined, these factors should be used in completing the cost effective analysis described in the preceding section.

Energy generation projects should not be undertaken unless you can execute a contract, as described above, that guarantees a market for the power over a reasonable financing or payback period.

Technical Assistance: Where to Get Help

Local Experts

Local technical talent for energy planning is frequently available but not always apparent. Large urban communities may already have staff technicians available to help develop the energy plan. But even in small communities a building maintenance person could become the "energy building auditor." Someone who understands the basic workings of a large building's heating and cooling systems and knows something about the structural components of the building can become your energy auditor expert with little additional reading or training.

Similarly, local contractors, architects, engineers and bankers can collectively possess all of the essential knowledge to help write the most sophisticated building code amendments, solar access ordinances, and other technical elements of the plan. One of the energy coordinator's most important tasks will be to find these people and apply their existing knowledge to the newer context of the energy plan. (See discussion in section below titled "Advisory Committees").

Local Utility

The local electrical utility is also a primary source of readily accessible technical assistance, especially for information on energy end uses and forecasts of future demand. Utilities have insights and data on local consumption patterns and potential for energy savings that are not always shared with local governments or the public. Seek them out and get them directly involved early in the planning process.

State Energy Offices

Each of the four Northwest states has a working energy office (see addresses in Appendix 4) that will help local governments prepare energy management plans. One of the first contacts the

energy coordinator should make is with his state energy office. Tell them about what you plan to do, how much money you have, and how much time, and ask them to send you any written materials that might help. Also invite a representative of the state energy office to attend an early advisory committee meeting to inform the committee on the state's energy planning programs and how they relate to local community plans.

Regional Planning Agencies

Several regional planning agencies can provide information on existing local energy planning efforts. They are an especially good source of information on state and federal regulations and grant assistance programs. (See Appendix 4 for a listing of regional planning agencies in the four Northwest states.)

Bonneville Power Administration

The Energy Conservation Section of BPA is an excellent resource for local governments on a wide range of technical subjects. The BPA phone number is (503) 234-3361.

State and Local Government Associations

State associations of counties and cities also serve as a link between local member governments and state and federal programs. State energy offices frequently use these local associations to help inform cities and counties about state energy actions, guidelines and requirements. (See Appendix 4 for the association that serves your community.)

Energy Consultants

Consultants are probably not necessary for general energy management planning or implementation, but if your community is considering developing alternative local energy sources such as geothermal, small scale hydro, or burning solid waste, you will likely need the help of private experts who have had experience with these kinds of projects. Probably the best source of information about consultants is other local governments who have hired them for their own projects. To find out which local governments are involved in energy conservation projects that require consultant help, see *Energy Actions by Local Governments of the Pacific Northwest, A Compendium*.

Evaluating Specific Conservation Actions

Immediate Actions

Immediate actions are things local governments can do right away to improve energy management. They don't require detailed study or significant shifts of local resources, and they are aimed at getting relatively quick results. The three immediate actions discussed in this section are: 1) adopting a resolution committing the local government to energy management process; 2) appointing or hiring an energy coordinator; and 3) recruit technical help.

Adopting an Energy Resolution

The energy planning process has to begin somewhere, and the formal adoption of an energy resolution is a good place to start. To make your own resolution more than routine, it should include:

1. Among the "whereases"; specific reference to the local energy problem. (General statements about national energy management concerns are useful, but they don't catch and hold local attention.)
2. Among the "be it resolveds": a tangible list of beginning actions including
 - a commitment to "life-cycle" costing as part of the government's procurement policy. (If the government is already committed, a reaffirmation would be appropriate here.)
 - Reference to the energy coordinator (to be hired, shared, appointed from existing staff, whatever).

- *Directives to the staff* regarding their own energy behavior (thermostats maintained, use of private space heating prohibited, etc.).
- *Suggestions for citizen energy management actions.*

For maximum effect the resolution should be well publicized, perhaps by holding a public hearing prior to its adoption, and by distributing copies to the media. Some communities have held energy fairs or declared an energy conservation week to kick off their energy planning process. A draft model resolution is included as document 1. Use it as an inspiration and outline to prepare your own.

DOCUMENT 1.

Sample Energy Resolution

RESOLUTION ESTABLISHING A COMMITMENT TO ENERGY CONSERVATION AND PLANNING FOR _____

WHEREAS, it has become apparent that the nation is faced with a future of decreasing energy supply and increasing energy costs; and

WHEREAS, the (City/County) of _____ has felt the impact of the energy problem in (*bring the problem home with reference to local impact*); and

WHEREAS, said energy problems have been recognized by federal, state and local leaders; and

WHEREAS, the _____ County/City has acknowledged the need to develop a policy committing the City/County to energy conservation and planning.

NOW, THEREFORE, BE IT RESOLVED, by the Board of Commissioners/City Council of _____ that the following steps shall be taken by all offices and employees of _____ to preserve energy, to-wit:

1. The use of electric lights and appliances shall be curtailed to a minimum consistent with safety requirements.
2. Thermostats shall be maintained at a maximum of 68° in all offices and facilities controlled by the County/City.
3. County/City owned vehicles shall be restricted to a maximum of 50 miles per hour, except for vehicles operating under emergency conditions.
4. Carpools of employees commuting to and from work are encouraged.

BE IT FURTHER RESOLVED THAT it shall be the policy (or it is the policy) of the City/County to take into account the energy implication of its major purchases by using life-cycle techniques in evaluating alternative investments;

BE IT FURTHER RESOLVED THAT the City/County urges its citizens to practice the conservation of energy in their daily lives by:

(list specific suggestions appropriate to your community)

BE IT FURTHER RESOLVED that _____ of the Office of _____ be and hereby is designated as the County/City Energy Coordinator (or an energy coordinator be hired, or whatever other provision has been made) with the charge that he/she shall develop, coordinate and administer a County/City Energy Plan at the earliest practicable date, consistent with federal and state guidelines, for review and approval of the County Board/City Council.

Energy Coordinator

You are reading this section because you have decided in chapter 2 that you may need either a part-time or full time energy coordinator.

He or she may be a planner, an engineer, or maybe just someone who is interested in the energy problem and willing to make an intensive effort to do something about it. A technical understanding of energy is helpful but not necessary. Unless you are a large city or urban county, don't spend too much time trying to find an "energy expert" to manage your local program. Energy is such a broad field that most "energy experts" tend to have a specific focus. However, you should choose someone who is experienced in working in technical areas. Technical information necessary to carry out a successful program is readily available from utilities, in books or from consultants.

More important are the person's coordinating skills. "Coordinator" is a much abused job title, but in the case of local energy planning, it aptly describes what this person will do. Because successful local energy planning programs require the full cooperation of all city departments and of all private, as well as public, agencies in the community, the energy coordinator must be someone who can relate well to elected officials, bureaucrats, technicians, businesspersons and private citizens, keeping these diverse actors working toward common objectives. Find someone who knows your community, has the respect of the diverse individuals and groups whose cooperation is necessary, and is committed to the importance of the energy planning process for the future well being of your community.

The specific duties performed by your energy coordinator will depend very much on local circumstances. The kinds of tasks he or she will probably be responsible for include:

1. *Serving as the contact person* in the government for all matters relating to energy.
2. *Leading the government's own program* to save energy in its day-to-day operations.
3. *Serving as staff to the energy advisory committee* by preparing meeting agendas and notices; gathering, analyzing and redistributing written materials; seeking out necessary experts; and researching and drafting all plan elements.
4. *Initiating efforts to find additional money* (grants, loans, etc.) to finance the local energy plan.
5. *Advising the staff and council* on energy matters.
6. *Promoting the adopted energy plan* in public forums and with the press.
7. *Monitoring plan implementation* both by insuring that actions are carried out, and by measuring results against expectations.

Advisory Committees

Advisory committees are necessary to the local energy planning process both because they are a valuable resource for new ideas and fresh thinking about energy problems, and because they provide a focus for community support and involvement in the plan. You could probably write the plan without them, but it won't be as good, or as well received, as one in which an advisory committee has been involved from the start.

Begin by making a list of the groups and interests in your community that will likely be affected by the energy plan. Remember that the committee represents the local government's primary source of contact with the community on energy related matters. No significant group should be surprised by any actions taken by the government as part of the energy management planning process because it wasn't represented on the advisory committee.

Generally speaking, 15 members is an optimum size. If a larger committee seems necessary, you may have to divide the group into a steering committee, which meets frequently and carries out the day-to-day advisory functions, and a larger general committee, which meets less frequently to hear from and respond to the work of the steering group.

When extending invitations to join the advisory committee, the city or county council should make it clear that this will be a working committee in which the members will be expected to devote time outside formal meetings, especially in smaller cities and counties. This will include making telephone calls, reading and reporting on materials for other committee members, and other work not usually expected of blue ribbon advisory committees.

Members also must be willing to make a long term commitment to the committee. Local energy management programs take at least a year to see results and more often two or three years. Changing

committee members every few months can be very disruptive to the consensus-building function of the group.

One final word of advice: don't include too many technical people on the advisory committee itself, as they have a tendency to divert the discussion away from important policy issues toward technical considerations. Instead, bring them into the process as ad hoc advisers to the committee at points where their knowledge is useful and relevant. This is not to disparage the value of technical information to the process but to emphasize the greater importance of focusing the committee's time and attention to the larger policy issues.

In larger cities or counties where many local government and utility staff members could provide an excellent technical resource to the committee, a separate technical advisory committee might be formed. Technical issues could be referred to them by the advisory committee for special study and advice before advisory committee action. If there are only a few experts available, then include them in the general advisory committee rather than establish a separate layer of bureaucracy.

Appointments to all committees should be made by formal letters of invitation from the mayor or other chief elected official. The letter should include information about what the committee is expected to accomplish and about how much time the committee work will take.

Once the committee is in place and has held a get-acquainted meeting, a second organization meeting should be held to elect a chairperson. Thereafter the committee may choose to adopt bylaws or other working rules, but usually this can wait until it has had a chance to become more familiar with its role and subject matter.

What will the committee do? The advisory committee's primary role is to advise; that is, to recommend specific actions to be taken by the local government. In almost all cases this recommendation will be to the city or county council, which will then act on the recommendation by adopting a resolution, policy or ordinance as part of the energy plan. The committee also has several important secondary roles, each closely related to its advisory function:

1. It will both initiate and respond to ideas about the content of the plan.
2. It will build consensus by resolving conflicts among members representing divergent interests; or where no consensus seems possible, by defining alternatives for council action.
3. It will provide policy guidance to the energy planning work by evaluating alternative actions against goals and policies developed early in the process.

An example of a policy issue that needs early discussion by the advisory committee is the question of how the economic benefits of alternative energy management actions will be measured. To initiate this discussion, the energy coordinator should distribute the first section of chapter 3 to all committee members and put the issue on the agenda for an early meeting.

Use the final "Master Action List" you generated in chapter 2 as the meeting agenda for the first working meeting of the committee. Ask the committee to work with staff to set timetables, work assignments, and to define the resources necessary for completing the feasibility analyses discussed in chapter 3 for each of the actions on your final "Master Action List."

Short Term Actions

Short term actions consist of actions that can normally be done by existing county or city staff. In some cases it may be necessary to bring in outside expertise from your utility, some other agency, or a consultant. Most of these actions require investigation and analysis by your staff. The agency or department most likely to have implementation authority should be the department to take the lead, and your energy coordinator should see that all projects are kept on schedule. All work should be completed under the general direction of your energy advisory committee.

Contingency Planning

Electrical contingency planning is a process whereby local government, private business, and utilities work together in developing a specific plan of action to deal with a severe cutback of electrical energy. This process helps minimize the environmental, economic and social effects of a severe electrical shortage.

When electricity must be curtailed, some customers will receive electricity and others will have to do without. This public policy decision must be made with the support of all sectors in the local community. The selection of high priority electrical users such as emergency services, essential government offices, foodsuppliers, and other key users should be established in standby readiness in anticipation of an electrical emergency.

In the Pacific Northwest region, a serious electrical shortage can easily occur because of our dependence on unpredictable hydropower and the tremendous population growth that is occurring. Recent studies indicate a 50% chance of electrical curtailment of firm power could occur in any one year. There is a 99% probability that a curtailment of firm electrical power may develop within the 1980s. A moderate or severe drought, an unplanned shutdown of a large energy plant, or a severe cold snap could cause a serious electricity shortage.

Structuring

State governments in the Bonneville Power Administration region, through the Pacific Northwest Regional Commission, have developed electrical curtailment plans. In general, these plans are an outline of desired cutbacks (curtailments) in energy use during an electrical shortage. The strategy is to maximize available supplies and reduce demand, initially by voluntary means and then through mandatory action. State curtailment plans should be used as guidelines for local governments in developing local contingency plans.

First, contact your state energy office to obtain their curtailment plans since any local contingency plan should complement existing state plans. Most electrical emergency actions will be triggered by the governor, so it is important that strong communication channels are developed with state energy officials.

Next, inventory other curtailment plans which may exist. Contact the local utility leadership, the sheriff's office, office of emergency services, the fire department or any other appropriate governmental agency which may have some form of contingency planning. Determine what these plans cover and identify any additional needs.

Organize a committee on contingency planning consisting of industry, utilities, local government, business, the news media, and private citizens. This committee could be your energy committee or a subcommittee of that group. It could include members not on the energy committee. This contingency planning committee should develop a specific plan of action addressing the following problems associated with a severe electrical shortage:

1. A discussion of the five stages in the state curtailment plan: Stage 1 Voluntary, Stage 2 Voluntary, Stage 1 Mandatory, Stage 2 Mandatory, Stage 3 Mandatory.
2. Establish specific priority users of electricity which will receive allocation of 100% of current requirements, i.e., hospitals, police, essential government offices, etc.
3. Identify or develop, as necessary, the legal authority for local governments or utilities to effectively monitor and enforce mandatory curtailment. When cutbacks of electrical signs, building temperature, industrial power, etc., are announced, specific monetary penalties, enforcement powers or special authority should exist to enhance the effectiveness of curtailment controls.
4. Identify specific conservation and curtailment actions to be taken by each major user and energy use sector in your community.

Select an office or individual to coordinate curtailment activity between the suppliers and users of electricity, and make all announcements regarding the status of the electrical energy emergency. There should be close contact between this office and the state energy office.

During an electrical emergency, keep the media briefed on the seriousness of the shortage and how private citizens and businesses can assist in minimizing the negative effects of a power shortage. Curtailment of firm power can be prevented if the users of electricity cooperate voluntarily in substantially reducing energy use during peak hours of demand.

Determine what specific actions need to be implemented in order to obtain a certain level of

electricity curtailment. For example, if a 25% reduction of power is needed, the following actions might be undertaken:

- All energy intensive industries must curtail electricity use by 40%.
- All outdoor lighting (parking lots, streetlights, advertisements, etc.) must be heavily curtailed.
- Voluntary reduction in home heating to a 65° temperature level is urged, with mandatory heat reductions to a 65° level in all commercial and industrial centers.

A comprehensive study should be initiated in order to ascertain the social, environmental and economic effects of any curtailment action. For example, a decision to reduce only large industrial loads during a curtailment period could have severe economic consequences to the local economy. Any curtailment action must consider job loss, personal security, social acceptance, and other environmental and social effects.

It is essential that contingency plans for electrical curtailment be widely known among all sectors of the local community. It is almost certain that all local communities will be experiencing severe shortages in electricity in the near future. Since in most cases this electricity shortage scenario is a new experience, the ability of local communities to quickly adapt to such an emergency could prevent severe adverse economic and social impacts.

To prepare a plan, local government, along with utilities, should organize a series of public meetings with major and essential users of electricity. Hold separate meetings for the key groups – industry, commercial (retailers, large service companies), and public institutions (schools, hospitals, libraries, government buildings). Those groups that are highly dependent on reliable electricity should develop their own contingency operations plans.

Encourage these groups to determine what actions they must undertake in order to obtain specified levels of electricity reduction. Inform the groups about the potential problem and discuss details of a contingency plan. With customer preparation, a reduction of electricity ordered by the utilities will result in a minimum of economic loss.

Prepare a brochure to educate consumers on the status of probable electricity deficiencies in the near future. Include ideal curtailment measurements which individuals could initiate in their own homes. Distribute these brochures via monthly utility bills several times a year, during and before seasonal peak demand periods.

A working media group with at least one representative from each newspaper, radio or television outlet should be a part of the contingency planning committee. They can assist in developing ways to reach and persuade the public to cooperate. Reporters and editors who are included in development of a plan will be much more receptive and helpful when the emergency arrives. They can be especially helpful by monitoring the successful electrical savings of the implemented plan, and prominently reporting that success to their audiences.

A public information program should include: informational newsletters to key community persons involved in development and implementation of the plan; press releases describing the plan and the need for it; an availability of key contingency plan leaders for newspaper interviews; radio and TV information developed to serve formats of local broadcasters.

Building Energy Audits

Introduction

An energy audit will help you discover ways to conserve energy and money in the operation of buildings. It normally takes only a few hours and will give you a list of conservation actions which can be undertaken immediately, plus a number of capital improvements to analyze for feasibility and cost effectiveness. All of the materials needed to perform the audits are included in this workbook.

Two activities are part of an energy audit. First, study past utility bills to learn the building's energy history. Second, walk through and around the building, following an audit checklist such as the one in Appendix 2. The building manager, who will be responsible for implementing the audit's recommendations, could participate, as should others who are knowledgeable in building systems and can recognize possible sources of wasted energy.

Contact your local electric utility before you begin your audit and ask for technical help. They can often provide experts and sometimes will help you train your own auditors.

Any building which is heated during the winter should be audited. Space heating is by far the largest consumer of energy in most government buildings. Low or no-cost options which can be performed easily, such as lowering thermostats for space and water heating, and reducing lighting levels, can save considerable amounts of energy.

Even a relatively new building should be audited for energy conservation. Before the 1973-74 Arab oil embargo, building architecture reflected cheap, plentiful energy supplies. The transition to energy-efficient building design is still underway, and even very modern buildings contain opportunities for major energy conservation measures.

The Energy Use Inventory

Finding out how much energy of what types your building uses during the year can guide you in looking for actions to save energy during the audit.

Later, as you implement energy management measures, these records will highlight your energy money savings. The best sources of energy use information are your utility bills and meters. This section will explain how to interpret your utility bills and how to organize the information so that it is useful.

Document 2 illustrates how to record data from your electric utility bill on energy data sheets. This information will be used later to estimate your energy savings. In the sample, one month's energy bill information is recorded. The next time period's data should be recorded on the next line. A blank data sheet (document 3) is supplied at the end of this section so that you may begin your own energy data collection. If you have utility bills from several past years, select a baseline year such as 1978 or 1979 so that you can compare your present usage to it. The same type of information can be recorded for other types of fuel sources on separate data sheets.

After recording your final month's fuel consumption, add the twelve-monthly fuel consumptions to record the total annual consumption.

Please note on the form that two conversion factors are used for both electricity and steam consumption. The larger figures, important if you are involved in the NECPA program, indicate the values to be used in reporting in compliance with the April 2, 1979, *Federal Register*, Part VI, Department of Energy, "Energy Measures and Energy Audits Grant Programs for Schools and Hospitals and Buildings owned by Units of Local Government and Public Care Institutions," Section 450.42(a)(11). These larger figures represent point of generation values and include transmission losses and production inefficiencies.

The smaller of the conversion factors for electricity and steam are to be used for institutional record keeping since these reflect on-site consumption. Remember, these factors are standard conversions and are not adjusted for altitude.

Although the format of your utility bill may be different, the contents are the same. If you have a question, call your local utility for an explanation.

Building Systems

Before conducting the energy audit, it is important to understand the seven basic support systems used in a building. As a tool in diagnosing major problem areas, the energy audit checklist is organized according to these seven building systems:

- Administrative
- Lighting
- Envelope
- Ventilation
- Heating
- Cooling
- Water

Following are brief discussions of each of the seven systems.

DOCUMENT 2.

Filling Out an Energy Data Form.

Month	Reading Date		KWH Used		Measured Demand KW		\$ Cost		(FCA) Fuel Cost Adjustment (\$)	Total Cost (D + E = F)		\$/KWH (F ÷ B = C)	
	FROM	TO	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	BASE	CURRENT	BASE	CURRENT	BASE
Jan													
Feb													
Mar		3-17	111000		N/A		1553.70		NA		1553.70		.014
Apr													
May													
Jun													
Jul													
Aug													
Sep													
Oct													
Nov													
Dec													
Column B Totals													
On-Site BTU Conversion Factor			x	x									
			3,413	3,413									
Total BTU's													
Column B Totals													
Point of Generation BTU Conversion Factor			x	x									
			11,600	11,600									
Total BTU's													

ELECTRICITY _____ KWH/YR.

Electricity Rate No. _____

Building _____

NOTES: This form is intended to be a working document. If it is kept monthly, you will see how effective your Energy Conservation Programs are.

CURRENT Means current month.
BASE means the corresponding month of your base year.

SNOWHOMISH COUNTY
PUD
PUBLIC UTILITY DISTRICT No. 1

ACCOUNT NUMBER
8162 115431 017

NAME **XYZ School District No. 5**
SERVICE ADDRESS **24620 Elm Avenue, Edmonds**

WHEN PAYING IN PERSON PRESENT ENTIRE STATEMENT FOR RECEIPT

CODE LEGEND
M - MINIMUM C - CORRECTION
P - PARTIAL PERIOD S - SCHEDULE CHANGE
E - ESTIMATE A - MISC CHARGE
I - METER EXCHANGE IN O - METER EXCHANGE OUT

TOTAL AMOUNT DUE
1553 70

METER NUMBER	METER READING	METER MULTIPLIER	PERIOD ENDING	DAYS OF USE	RATE SCH	CODE	KWH / CU FT / WATER	AVERAGE KWH PER DAY LAST YR	AVERAGE KWH PER DAY THIS YR	AMOUNT
108887	6212	600	17 Mar 80	32	20		111000	3216	3469	1553.70

KEEP THIS PORTION FOR YOUR RECORDS

Administrative System.

Perhaps the most important of all, the administrative system includes the human element – the people who have an important impact on how much and when energy is consumed. A facility's energy systems are designed to maintain a comfortable working environment for its occupants. Establishing energy management procedures can make these same systems more energy efficient. Effective communication and cooperative effort among all concerned are vital.

Lighting System.

Since the lighting systems of many buildings were designed within the restrictions of initial cost economies, without knowledge about final space use or the benefit of relatively recent developments and research findings in the field, significant potential for lighting system modification exists. These modifications can substantially reduce energy consumption (and associated costs) while still providing occupants with the quality and quantity of illumination required.

A lighting system is just that – a system. Its many elements are interrelated, just as the lighting system is interrelated with other systems in the building. While energy can be conserved by proper lamp removal, such action should be taken only after the entire system has been analyzed and all options evaluated. Conservation of energy is important, but it must be achieved in a manner consistent with other requirements, including productivity and visual comfort, aesthetics, federal, state and local codes and ordinances.

Envelope System.

The building envelope contains elements which, although they do not consume energy directly, do affect the amount of energy which must be supplied to the building to maintain comfort. Two main factors – infiltration and transmission – greatly affect heat gain in the summer and heat loss in the winter.

Infiltration refers to the passage of outside air into a building through apertures such as cracks around windows and door jambs, doors and windows left open, or outside air dampers which do not close tightly. In winter, infiltration causes heat loss. The cool outside air which enters the building must be heated to maintain desired indoor conditions. During summer, infiltration causes heat gain. The warm outside air which enters the building must be cooled to meet desired conditions. In many cases, additional energy is used to further treat the outside air by humidification, dehumidification, or filtering.

Although the amount of air infiltrated depends primarily on air leaks, the human element is also important. When doors or windows are left open to offset interior temperatures which are too hot or too cool, the waste involved is magnified even more.

Transmission refers to heat passing into or from a building through the various components of the building envelope, primarily exterior walls, windows, doors, skylights, roofs and floors. Heat always is conducted from an area of higher temperature to an area of lower temperature. Accordingly, during winter, heat flows from the interior, through the building envelope, to the exterior, causing heat loss. During summer, the process reverses: heat is transmitted from outside to inside, causing heat gain.

The rate of transmission depends on the composition and thickness of the various materials utilized in construction of the building envelope, the difference between indoor and outdoor temperature and the surface area. Adding insulation or storm windows and modifying the indoor temperature can slow the transmission rate.

Ventilation System.

Ventilation contributes to heat gain or heat loss (and humidification/dehumidification) depending upon the season. The ventilation system provides a building with fresh air by exchanging inside air for outside air. The rate of ventilation is expressed in cubic feet per minute (CFM) or in air changes per hour. The greater the rate of air exchange, the more unconditioned air is brought into the building. In many instances, the single most dramatic area of energy conservation – and one achieved with virtually no expense – involves reducing the ventilation rate which may be higher than actual requirements.

Heating and Cooling Systems.

These are the largest energy users in most buildings. Your facility's total heat loss is equivalent to the amount of heat which the heating system must add to the space (in a given time) to maintain a given temperature. Infiltration imposes a significant load on the heating and cooling systems which increases total energy consumption.

Your facility's total heat gain is the amount of heat which the cooling system must remove from the space (in a given time) to maintain a given temperature.

In most cases, those factors which contribute to heat loss and heat gain can be modified.

Four subcategories of heating and cooling affect each system and its efficiency. They are (1) operating practices, (2) maintenance modifications, (3) systems modifications, and (4) control adjustments.

1. Operating Practices.

Minor deviations from accepted standards of comfort or operating practices will generate savings. Some deviations, such as higher humidity with lower temperatures, may be more acceptable than others, such as drastic temperature and lighting reductions.

2. Maintenance Modifications.

The importance of routine equipment maintenance to your energy management program cannot be over emphasized. Regular maintenance will extend the useful life of equipment, save you energy dollars and provide better service.

3. Systems Modifications.

Each system interacts with the others in a building. Although modifications of inefficient systems are encouraged, a careful analysis by a trained engineer should precede any actual system changes.

4. Control Adjustments.

Your building's original controls probably were chosen more on a cost basis than on an energy conserving basis. Lack of proper maintenance can result in a decrease in sensitivity.

Water System.

Domestic hot water may account for 2-4% or more of the total energy consumed in your facility. Chilled water provided in drinking fountains also is a factor in total energy consumption. In many buildings where restrooms are the only place hot water is needed, hot water temperatures can be reduced significantly without a noticeable change in user comfort. In cases where hot water is needed for dishwashing, it may be more efficient (and less expensive in the long run) to keep the system hot water temperature low and use a booster unit right at the dishwasher to achieve the higher temperatures.

The Audit

After completing the energy use inventory and gaining a basic understanding of the building systems, your team is ready to schedule a walking tour of the building. Conduct the audit during normal operating hours, covering outside areas as well as the main buildings.

The checklist in Appendix 2 is organized according to building systems. Trouble spots are indicated by appropriate symptoms or conditions, each capable of being observed by individuals with non-technical backgrounds in energy management. No elaborate equipment is required; however, it is recommended that, if available, a standard dry bulb thermometer, a light meter and the building plans be used to facilitate data collection. Corresponding to each condition are appropriate operational and maintenance procedures (O&M) and conservation measures (retrofit options) which can rectify the problem.

Operational and maintenance options include the reset or readjustment of existing systems to achieve increased efficiency and generally involve no-cost or low-cost procedures. Only when all possible operational and maintenance options have been employed should the more capital intensive energy measures (retrofit and redesign options) be considered. Keep a record of your progress by indicating the dates of implementation of O&M options, initials of implementors and whether applicable. Energy measures should be checked if they are to be considered or if they do not apply.

Community Audit Programs

Once you are auditing your local government buildings and demonstrating energy savings, you can explore ways to encourage energy management in your community's commercial, industrial, and residential buildings. The principles of building energy auditing are basically the same for all these buildings, but incentives to reward building owners for energy management are helpful.

In complex buildings, professional engineering expertise is needed to make the highest return from each dollar spent on energy management planning. In private homes, expertise is helpful but not essential. Most homeowners understand the basics of home insulation and many can even do the required work themselves.

Even before you finish auditing your government buildings, you can start a public education campaign to stimulate homeowners to insulate. An excellent workbook on energy auditing and insulating a private home titled "In the Bank... or Up the Chimney?: A Dollars and Cents Guide to Energy-Saving Home Improvements" is available from your state energy office or HUD. Publicize the book's availability and encourage people to use it.

Find out if your electric utility already has a program to audit commercial, industrial, or residential buildings. If they don't, encourage them to start one.

The utility has several advantages over a local government in conducting energy management audits. A utility probably has an engineering department with knowledge of building systems and energy management. Also, it may have more flexibility in financing the program than a typical local government. A small rate increase to pay for energy conservation is better than a large rate increase to pay for increased generation capacity. Utility regulatory commissions in the Pacific Northwest are increasingly favorable to energy management programs funded by utility rate increases. Even so, a utility-sponsored residential audit program is a massive undertaking. Utilities in the Puget Sound region, for example, are finding that residential audits require staffs of about one hundred people and budgets in the millions.

DOCUMENT 3

Sample Energy Data Form

Month	A Reading Date		B KWH Used		C Measured Demand KW		D \$ Cost		E (FCA) Fuel Cost Adjustment (\$)		F Total Cost (D + E = F)		G \$/KWH (F ÷ B = C)	
	FROM	TO	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
Jan														
Feb														
Mar														
Apr														
May														
Jun														
Jul														
Aug														
Sep														
Oct														
Nov														
Dec														
Column B Totals														
On-Site BTU Conversion Factor			x	x										
			3,413	3,413										
Total BTU's														
Column B Totals														
Point of Generation BTU Conversion Factor			x	x										
			11,600	11,600										
Total BTU's														

ELECTRICITY _____ KWH/YR.

Electricity Rate No. _____

Building _____

NOTES: This form is intended to be a working document. If it is kept monthly, you will see how effective your Energy Conservation Programs are.

CURRENT Means current month.
BASE means the corresponding month of your base year.

But, most of all, start developing community energy management programs immediately. Every day without energy management is a day of wasted energy. The sooner that energy management – particularly electrical energy management – is achieved, the less risk of major electrical curtailment and its ensuing economic and social costs.

For details on building energy audits we recommend the following:

- National Electrical Contractors Association and National Electrical Manufacturers Association, *Total Energy Management – A Practical Handbook on Energy Conservation and Management*, 1976.
- Modern Power and Engineering, July 1979, Energy Conservation Case Book.
- American Management Association, *The Systematic Energy Conservation Management Guide*, 11 volumes, 1978.
- *Energy Management Guide for Light Industry and Commerce*, NBS Handbook 120 – sponsored by the Office of Energy Policy and Programs – U.S. Department of Commerce, by W. J. Kelnhofer and L. A. Wood, 1976.
- *Oregon Energy Auditor Training Notebook*, 1979 ODOE.
- *ASHRAE Handbooks* – 1977 Fundamentals; 1978 Applications.
- *ASHRAE Stand: 90-75* – Energy Conservation in New Buildings Design – Section 12.

Street Lighting

Up to 20% of a municipal energy budget may be devoted to street lighting, primarily on arterial and residential streets. Selecting the most energy efficient light fixtures can produce a substantial savings in both money and energy. Most existing lighting systems use mercury vapor fixtures or other less efficient fixtures such as incandescent lamps.

High pressure sodium fixtures, which produce a yellow-orange light, are significantly more energy efficient than mercury fixtures. The new high pressure sodium vapor lights generate approximately twice as much light per watt as mercury vapor light, and up to eight times as much as incandescent light.

Inventory present streetlights in your local community to determine the type of lighting being used and the corresponding drain on electricity. Also assess present lighting systems to determine which street lighting is essential and which is not. This comprehensive light management study would establish the minimum amount of lighting that is required, yet maintain safety and security for the local residents.

Contact a contractor/manufacture of the high pressure sodium vapor lights to determine the cost of converting and the potential savings. In most cases the payback period for such a conversion will be short. Financing for this project could be obtained through existing federal, state, or local funding sources or possibly through the local utility.

Bellingham, Washington conducted a study in 1977 on ways to make its municipal streetlight system more energy efficient. The city could save over one million kwh per year, (a dollar savings of \$30,000) by converting all units to high pressure sodium. This conversion project would have a payback period of 2.74 years. For more details on the Bellingham study, see the Compendium, (Vol. II). Two other excellent references on energy efficient street lighting are:

- Skidmore, Owings & Merrill, *Bonneville Power Administration Electric Energy Conservation Study*, pp. 136, 137, 139, 143, 172, 176. July 1976.
- Loan Management and Research Branch, Load Planning Department, Portland General Electric, *Conservation/Load Management Scoping Analysis*, February 1980.

Mandatory Building Retrofit

A community audit program may provide assistance and incentives for some homes and businesses in your community. You might also consider a mandatory weatherization program requiring existing buildings to be insulated to a particular standard.

Portland, Oregon recently started a mandatory weatherization program which requires a building to be brought up to the energy code before resale. Consequently, a building not up to code would have less value than one which is weatherized. Many diverse groups in Portland support the program because it creates jobs, saves energy, and raises the value of the housing stock.

To be politically possible, such a program has to be accepted by both homeowners and businesses, and the real estate industry. It might be better to start the program with the commercial or industrial sector before tackling the more independent minded and politically difficult homeowners/taxpayers/voters. Because mandatory programs are so politically sensitive, wait until you have a well respected and established energy conservation program before trying this strategy. But, at some point, it may be necessary to consider it as energy shortages become more severe.

Financial Incentives

A local government decision to use mandatory energy management measures will usually precipitate strong opposition from the private sector. Sometimes these mandatory requirements are the only quick and effective means to restrict excess and inefficient use of energy.

But when at all possible, financial incentives should be promoted as an effective and equitable means of encouraging energy management. There are numerous federal, state and local energy credit programs of which the private sector can take advantage.

Local government should be a central source of information regarding energy credits, which do vary from state to state. These programs can contribute to conserving energy only if they are used. Local government must be aggressive in getting this up-to-date information to citizens so they can take advantage of these incentives.

The following are types of grant/loan or tax incentives that are available at all levels of government and at the local utilities.

Property Tax Incentives (State and Local)

Usually when improvements are made in a residential or commercial/industrial building, including installation of energy saving devices, the property is revalued upward, which means an increase in taxes for the property owner. With an energy property tax incentive, any home improvements (insulation, storm windows, active solar units, etc.) will not mean an increase in taxes.

Low Interest Rate Financing of Weatherization (Utilities)

A no-interest or low interest loan for weatherization can sometimes be obtained from your local utility. Individuals may contact their utilities for an energy audit in order to determine which weatherization actions will be cost effective. Actions – insulation, caulking, storm windows, etc. – approved by the audit will thus be eligible for these special interest loans. Most states still have legal barriers that restrict utility loan programs. Some efforts are being made to reduce or eliminate these barriers. If successful, these programs will expand in the future.

Grants or Subsidized Weatherization for Low Income People (Federal, State, Local)

These special subsidies are grants or loans which are directed to the poor who cannot afford to finance weatherization on their own. Paying higher energy costs and unable to afford energy conservation improvements, low income groups are in a difficult predicament. These special grants or loans assist the low income group to weatherize their homes.

Sales Tax Credits/Exemptions (State/Local)

This incentive involves exemptions from state/local sales tax when an individual purchases energy-saving devices or materials (insulation, storm windows, etc.)

Income Tax Exemptions (Federal, State)

Tax credits (subtracted from taxes due) are granted for installing energy-saving materials in homes. Income tax exemptions could be approved for the following energy-saving projects: storm or thermal doors, all types of home insulation, caulking, weatherstripping, automatic energy-saving setback thermostats, furnace replacement burners, flue-opening modifications, solar, wind-powered or geothermal devices.

Local governments' energy office coordinators should contact state and federal officials to determine the specific and up-to-date financial incentives that are available to the private sector. Once this information is collected, a public relations program should be instituted to inform people of these numerous programs. For example, the local newspaper might commit a permanent page to be used exclusively for energy information. With constant energy information directed to the general public, there should be substantial progress toward efficient energy use.

Long Range Actions

Long range strategies are energy management actions that require feasibility studies, detailed economic analyses, and complicated implementation arrangements. These actions will involve all levels of your community and in most cases will require special expertise from your utility or from consultants. This section describes the general technology and economics of the long range action, lists who you should work with on the project, and, wherever possible, identifies a reference document which can be used to get you started.

Hydro Power

Forty years of cheap, abundant electrical energy for Pacific Northwesterners is testimony to the remarkable efficiency of large scale hydroelectric generation. The principal reason for our present electrical energy crisis is that we have run out of large scale hydroelectric capacity and must now turn to much more costly thermal generation from nuclear and fossil-fuel sources.

There are, however, a great many smaller scale hydro sites that could be developed. The most feasible are dams that already impound water for other purposes to which electrical generating equipment could be added at relatively low cost (as compared with thermal plants, whose current generating costs are about 10 times those of large scale hydro).

The U.S. Army Corps of Engineers has identified 451 existing dams in the four Northwest states to which generating capacity could be added (see table 1). Some of these are already generating electricity but could generate more if they were raised or otherwise improved. Most, however, are dams without generating equipment that do have the technical potential for adding it. You may contact the U.S. Army Corps of Engineers to obtain a copy of table 1, "National Hydroelectric Power Resources Study, Preliminary Inventory of Hydropower Resources," and read which sites in your community were identified in the study.

This section focuses on evaluating the feasibility of developing hydroelectric generating capacity at existing water supply dams in the region. The corps' survey identified 108 of the 451 such dams in the four Northwest states that show some potential for this action. Continue reading this section if one or more of those dams is located in your county, as shown in the map on page 17.

Technology

Commercially successful hydroelectric generation dates from the early 1890s and many small scale systems continued in operation until about 40 years ago, when the Federal Columbia River Power System in the Northwest, and centralized fossil-fueled fired steam generators elsewhere in the country, replaced virtually all the smaller systems.

Hydro systems are basically of two types: low head (less than 60 feet), and the more common high head. The low head systems (also known as "run-of-the-river" systems) are more popular in the East, while high head systems predominate in the Northwest because of the mountains.

The theoretical power available from an existing dam is a function of "head," or the height the water will fall before it passes through the turbine, and "flow," expressed in cubic feet of water per second (cfs). Simply stated: the higher the dam and the more water flowing over it, the more power can be generated. The formula for kilowatt hours (kwh) is as follows:

$$\text{Power in kwh} = \frac{\text{Flow (cfs)} \times \text{Head (feet)}}{11.8}$$

For example, if your dam is 90 feet above the generator and the minimum flow is 400 cfs, the theoretical power available is:

$$\frac{400 \times 90}{11.8} \text{ or } 3,051 \text{ kwh}$$

This is a theoretical figure. Actual power depends on a number of other factors, principally the efficiency of the turbine and the generator. All together we could expect to generate about 2,200 kwh from our example.

A single power figure like the one just calculated assumes the continuous availability of 400 cfs of water falling 90 feet, day in and day out, all year. If your dam does not have year-round dependability, because of seasonal low flows on the river or other factors, you will want to compute separate power figures for high and low flow conditions. One of the problems with hydroelectric power is that the highest river flows tend to be in the spring, and low flows in the summer and winter.

Seasonal electrical demand is just the opposite. Peak demand comes with electric heating in the winter and air conditioning in the summer. This is especially a problem with low head systems whose output tends to rise and fall with the river. High head systems, like your water supply dam, are less vulnerable to variations in flow because they can hold back water during earlier months and release it in the summer, thereby acting as a kind of giant storage battery. For Northwest rivers, high mountain snow pack is an additional source of stored fuel for hydro generation in the summer.

Another important consideration in evaluating the conversion of an existing dam is the flow requirements of its existing uses. Many Northwest dams are used for more than one purpose – water supply, flood control, irrigation, recreation, etc. – with which seasonal flow requirements may be at odds. For example, heavy spring rains might increase the turbidity of the water behind the dam so much that water supply officials might want to drain the reservoir and replace it with cleaner water. But to the electric utility, this turbid water is money in the bank against a dry summer.

TABLE 1
Estimate of Hydropower Potential at Dams in the Northwest

State	Hydropower Now Developed		Potential Additional Hydropower	
	# of Sites	Total Energy*	# of Sites	Total Energy*
Idaho	40	12,089	109	6,152
Montana	20	9,722	88	5,195
Oregon	60	36,875	130	10,095
Washington	180	84,538	124	20,631
Four State Total	300	143,224	451	42,073

*annual gigawatt hours

Adapted from: National Hydroelectric Power Resources Study,
Preliminary Inventory of Hydropower Resources,
U.S. Army Corps of Engineers, July 1979.

Evaluation Methodology

The feasibility of adding hydroelectric generating capacity to an existing water supply dam depends on the answers to a number of questions, including the following:

- How old is the dam? Does it need rehabilitation?
- Are water rights secure?

- How much power can be generated?
- Is there a market for the electricity?
- What are the natural flow characteristics?
- Do existing uses conflict with electrical generation?
- How far is the dam from where the electricity is needed?
- Are there any environmental factors that prohibit using the reservoir for power generation?

Some of these questions are discussed briefly below.

The age and condition of your existing dam are important because rehabilitation can be very expensive. Plans to rebuild or raise an existing dam to increase its life or capacity for another purpose, however, might provide the opportunity to consider adding hydroelectric generation at the same time.

Other important factors include the storage capacity of the area behind the dam, the location of the powerhouse, the length of the penstock or conduit needed to carry the water from behind the dam to the powerhouse, flow conditions in the "tail water" at the bottom of the dam, and the particular design of turbine and generating equipment you decide to use. Use the formula on page 48 to calculate the amount of power that can be generated by your dam, but remember that this gives only a theoretical figure and that you will need expert outside help to estimate the amount of electricity you can actually produce.

The most obvious market for the electricity is the existing local electric utility, but the city or county might decide to use the electricity directly for its own purposes.

Economics

If you need to rebuild or raise your water supply dam to make it suitable for hydro generation, the capital costs are likely to be quite high. Recent estimates for new hydropower construction suggest a range of \$500 to \$2,000 per kilowatt hour of installed capacity. For the example cited above, this would mean an initial capital investment of about \$4.5 million. The resulting electricity would likely cost 20-30 mills per kilowatt hour. If you only need to add generating capacity to an existing dam, your costs would, of course, be considerably less.

If you wish to further investigate the feasibility of this action, a good place to start is your local electric utility. If they agree that the idea merits further investigation, a jointly funded feasibility study using your utility's staff or outside consultants is a logical next step. An excellent reference for getting started is available from the U.S. Department of Energy, Idaho Operations Office, *Micro-Hydro Power - Reviewing an Old Concept*, by the National Center for Appropriate Technology, P.O. Box 3838, Butte, Montana 59701.

Converting Solid Waste to Energy

Solid waste is one of this country's few growing energy resources. Ironically, the best way to capture the energy available in solid waste would be to *reduce* the amount of solid waste. There are actions local governments can and should do to attack the waste problem at its source, principally by coordinating local collection franchises. The following section, however, is about how communities can make better use of the waste they do collect.

Technology

The half dozen or so known technical processes for converting solid waste to energy generally fall under two categories: those which burn the waste directly to generate heat or steam, and those which first convert the waste to a fuel such as oil or gas, which is then burned for heat or steam. The first category describes the technology most appropriate to local governments and will be the focus of this discussion.

Direct burning of waste is the simplest and cheapest way for a community to use its solid waste for power generation. Raw wastes are first processed by shredding and removing metal and other non-combustibles, then fed to a boiler which generates steam, which may be used directly or to drive an electrical generator.

Because processed wastes have a lower heat value than conventional fuels, a supplementary fuel

such as gas or coal is usually burned with the waste to achieve complete combustion. This is important both to get all the energy out of the waste and to reduce particulate emissions from the stack. All of this can be achieved by applying existing proven technologies, using equipment that is already commercially available.

If an industry or utility already operates a boiler in your community, your best option would probably be to sell them your municipal waste for use as an auxiliary fuel. Existing boilers must have an ash handling capability, some kind of particulate emission control system, and be within economical transport range of the city. Many of these boilers will produce steam for direct use by the industry while others will cogenerate electricity. If they are not cogenerating electricity now, see the section on cogeneration.

The other option is for the public solid waste utility to build and operate its own boiler and generator. Several manufacturers make incinerators specifically designed for this purpose. They utilize a two-stage controlled-air process that is far more efficient than conventional boilers for burning solid wastes. The waste is burned "as received" in a primary combustion chamber with insufficient oxygen for complete combustion. The effluent gas is then burned in a secondary chamber with an excess of oxygen. These two steps result in more complete combustion and fewer particulates. Natural gas is used as an auxiliary fuel to assist in the secondary combustion process.

To accommodate smaller waste loads, these incinerators operate on a batch feed basis rather than continuously. The usual procedure is to feed the boiler for seven to eight hours during the working day, then burn down the contents, using the auxiliary fuel, for approximately three more hours. The boiler is then allowed to cool overnight and the ashes removed each morning before the beginning of the next cycle.

The boiler efficiency for recovery waste heat in the form of steam on these systems is remarkably high, around 70%.

Financing

If the community decides to sell its solid waste to an existing utility or industry for use as an auxiliary fuel, then both capital and operating costs of the system will depend entirely on the nature of the existing boiler and the internal economics of its owner. We can offer no rules of thumb to substitute for discussions with the potential buyer.

If the solid waste utility decides to build its own plant, the capital costs per ton of capacity will be around \$15,000 to \$20,000. Operating costs per ton processed will depend on the cost of labor, auxiliary fuel, and monies recovered from the sale of recycled metal and electricity. Plants already in operation report figures ranging from \$2 to \$9 per ton. Labor is the largest operating cost for most facilities and auxiliary fuel can also be significant.

In your own cost benefit analysis, be sure to consider the increasing costs of disposing of solid wastes at conventional landfill sites. As available sites become scarce, and the cost of land disposal increases, the feasibility of converting solid waste to energy will likely improve. Remember, too, that the energy management potential includes both energy saved from recovering recyclable products as well as any electricity generated.

Two excellent references on the subject of converting solid waste to energy are: *Evaluation of Small Modular Incinerators in Municipal Plants*, U.S. Environmental Protection Agency (EPA Publication SW-113c), 1976; *Decision-makers Workbook, Resource Recovery from Solid Waste*, Department of Ecology, State of Washington, May 1975.

Amending the Building Code

An energy conscious building code is an essential centerpiece of any community's energy plan. More than any other region in the country, the Pacific Northwest needs to upgrade the thermal efficiency standards for new construction.

To get an idea of how a tougher building code can make a difference, let's compare the benefits of thermal efficiency in two hypothetical houses as shown in table 2. In the left hand column are the characteristics of a conventional home, typical of those built in many communities in the Northwest without any special attention to energy savings. The middle column shows the characteristics of an

TABLE 2
Comparison of Conventional and Energy Efficient Homes

Attribute	"A" Conventional Home	"B" "Energy Efficient" Home	"C" Difference
Structure			
Living Room	1100 sq. ft.	1100 sq. ft.	None
Glass area (% living area)	15%	10% w/metal windows 8.7% w/wood windows	Reduce window area
Windows	1/8" single pane	1/8" double pane	Use double pane windows
Basement or crawl space	None or unheated	None or with 4" insulation, R-11	Add 4" of insulation
Ceiling	6" insulation R-19	10" insulation R-32	Add 4" of insulation
Walls	Frame construction w/sheetrock, 4" insulation R-11	Frame construction w/sheetrock, 6" insulation R-19	Add 2" of insulation
Floors	Open joists 3" insulation R-9	Open joists 6" insulation R-19	Add 3" of insulation
Doors (exterior)	1 1/2" solid wood R-2.04	1 3/4" metal faced w/polyurethane cores R-11	Use metal instead of wood exterior doors
Equipment			
Heating	20,000 watt resistive or electric forced air, ducts in <i>unheated</i> spaces	5,000 watt resistive or electric forced air, ducts in <i>heated</i> spaces	No ducts in unheated spaces; reduce furnace size 75%
Hot water	Electric heater w/1 1/2" tank insulation, 52 gal. capacity; temperature 150°F. Flow 6-8 gpm	Electric heater w/ 4" tank insulation, 52 gal. capacity. Temperature 120°F. Flow 1.5-3 gpm	Add 2 1/2" insula- tion; reduce hot water temp 30°; restrict hot water flow by 75%
Lighting	Incandescent bulbs	Fluorescent bulbs in kitchen, lower incandescent wattage	Reduce incan- descent wattage; substitute fluorescent in kitchen

Adapted from: "Energy Efficient Residential Development" CRAG
Region Energy Analysis: Work-in-Progress Report 3,
for CRAG by Michael N. Weinstein and Associates,
November 1977.

energy efficient house. Both are 1100 square feet and of standard design, but with the internal differences summarized in the third column. The window area has been reduced from 15% to 10%, and double-pane windows instead of the usual single-pane were used. Insulation has been increased in the ceilings, walls and floors, and metal, polyurethane-core, external doors are used in place of traditional wood. Two and a half inches home, typical of those built in many communities in the Northwest without any special attention to energy savings. The middle column shows the characteristics of an "energy efficient" house. Both are 1100 square feet and of standard design, but with the internal differences summarized in the third column. The window area has been reduced from 15% to 10%, and double-pane windows instead of the usual single pane were used. Insulation has been increased in the ceilings, walls and floors, and metal, polyurethane-core external doors are used in place of traditional wood. Two and a half inches of insulation have been added to the hot water heater, the thermostat turned down to 120° and a flow regulator added to the shower. Finally, we have reduced the incandescent wattage and substituted some fluorescent lighting in the kitchen.

To heat the conventional structure described in column A with an electric furnace would require a 20,000 kilowatt unit. The energy efficient home in column B, however, needs only a 5,000 kilowatt unit. This results in about a 75% drop in the electric heat bill. Add a 40% savings in the cost of heating hot water plus other efficiencies, and you have a total reduction in electrical energy use of nearly 50%.

But doesn't the energy efficient house cost more money to build? Yes, but not that much more. Most of the additional costs of insulation and other improvements are offset by the significantly smaller furnace size. A 1976 estimate put the cost difference between the two houses at about \$750 – an amount quickly recovered in reduced electrical bills. The State of Idaho has estimated that their energy-conscious building code will add about a penny per square foot to the cost of single family construction, and that it will actually result in a net *savings* of 36 cents a square foot for low-rise multi-family buildings, again principally due to the smaller heating, ventilating and air conditioning systems needed for more energy efficient structures.

A study conducted by Arthur D. Little for the U.S. Department of Energy calculated the average change in cost per square foot of floor area for each of the energy efficient building's components as shown in table 3.

TABLE 3
Cost Changes for Installing Energy Efficient Building Components
(An Average of 20 Different Building Types)

Building Components	Change in Cents Per Square Foot of Floor Area
Exterior walls	+ 33 cents
Exterior glass	+ 24 cents
Roof	+ 15 cents
HVA/C* equipment	– 39 cents
HVA/C distribution	– 48 cents
HVA/C controls	+ 12 cents
Lighting	– 04 cents
Electrical distribution	– 28 cents
Domestic water heating	+ 02 cents
Hot water distribution	+ 04 cents
Net change	– 29 cents

*Heating, ventilating and airconditioning.

Keep in mind that these figures are for an average of 20 different building types, including high rise office buildings, where net savings of 93 cents per square foot are estimated. Savings for single family homes will not be as large, and in fact may be closer to the break-even point estimated by the State of Idaho. The point for local officials is that the added cost of building energy efficient structures should not be a deterrent to toughening building codes.

Before you amend your own code, two questions need to be answered: First, should the new requirements apply just to residential construction or to all construction; and second, do you want a "prescriptive" or a "performance standard" type ordinance.

Many communities choose to target their new standards toward only residential construction, usually because they fear it may be too complicated to regulate large commercial buildings. However, we recommend that all new construction come under your energy code. Tenants of commercial structures are entitled to the same protection that the code offers home owners. Large commercial buildings may actually be easier to regulate than homes because usually an architect and HVAC engineers will be involved in their design.

The other question relates to the kind of ordinance that you want to develop. "Prescriptive" ordinances are the simplest. They "prescribe" minimum standards for the kinds of materials to be used in various parts of the structure: the ratio of the window area to the outside of the building, how much and what type of insulation is needed in different parts, and so on. Prescriptive ordinances work well for conventional housing, where design and materials are fairly standard. They are easy to enforce because they require a minimum amount of judgment in comparing the code's requirements against the actual building.

The "performance standard" kind of code sets general standards to be met by the building as a whole (usually in terms of a maximum heat gain or loss of a building expressed in BTU's per square foot of floor area) but leaves it up to the building designer to show how he is going to meet these standards. These are more complex, both for the builder and the building inspector because they require an extensive dialogue between the two on just exactly how the building meets the standards. The performance standard itself is usually very simple to understand. The problem comes in deciding what constitutes evidence of having met the standard.

The disadvantage of prescriptive codes is that they tend to discourage innovative design solutions to energy problems. A builder who claims that his design can either meet or beat the "spirit" of a prescriptive ordinance – that is, his house will be as good or better in terms of thermal efficiency as the one described in the ordinance – may be turned down by the building inspector because the design doesn't meet the "letter" of the code.

Conventional builders won't be bothered by this, and in fact will probably appreciate the simplicity of the prescriptive code and the fact that all the rules are clearly set down. The innovative builder will prefer the challenge of meeting the performance standards in the most efficient way possible.

To accommodate the needs of all builders, many modern energy codes include both prescriptive and performance standard options. Under this arrangement, applicants are asked to choose which path they wish to follow, and then they must stick with it throughout the approval process.

To illustrate different approaches to building codes, we have included four contemporary examples in the Compendium.

The Boise, Idaho, code is the simplest of the four and seems ideally suited to the many small communities in the Bonneville service area. After describing procedures and defining terms, the code sets a maximum allowable heat loss of 24 BTU's per hour per square foot for all new residential construction in the city. Heat loss is calculated using a handy work sheet provided in the ordinance in conjunction with a table of precalculated multipliers for typical combinations of construction materials. These data have been extracted from standard engineering design manuals.

The code is prescriptive in the sense that it sets down both the numbers to be used in the calculations and the format for applying them. The conventional builder need only select the numbers corresponding to the design of the various components of his building from the table, transfer them to the work sheet, and carry out the necessary arithmetic.

At the same time, the code explicitly welcomes non-conventional building designs provided they meet the overall performance standards, requiring only that "each system of construction or

component to be used shall admit of a rational analysis in accordance with well established principles." This leaves the door open for an innovative designer/builder who doesn't want to be constrained by the conventional materials described in the code's table.

A slightly different approach is taken by Woodburn, Oregon, which requires that all structures be designed so as not to use more than four BTU's per degree day per square foot of heated area. A degree day is an average temperature difference of one degree between the inside and the outside of the building for one day. In the Woodburn code, degree days are calculated for the entire heating season from September through May, and the inside temperature is assumed to be 65°. (Note the difference between this and the Boise, Idaho standards which, instead of using seasonal degree days, simply assume a worst case of 0° outside and 70° inside and builds numbers into the table to assure that on this bitter cold winter day, the structure would not lose more than 24 BTU's per hour.)

The Woodburn ordinance also includes a provision that allows the builder to reduce the total energy requirement of the building by any amount of heating contributed by a solar device.

Our third example is the code adopted by Clark County, Washington, which is a detailed prescriptive code that sets down "C" "R" and "U" values for all components of the building design – exterior walls, windows, roofs, floors, etc. It also sets standards for insulation around heating ducts and water pipes. The code leaves it up to the builder to decide how he will meet these minimum standards.

"C," "R" and "U" values are all just different ways of expressing heat gain and loss through materials. "C" stands for thermal conductance, or the amount of heat measured in BTU's that is transferred through a square foot of building material of a given thickness within an hour when there is one degree of temperature difference between the surfaces. "R" stands for thermal resistance and is used to describe insulation. "U" stands for heat flow, which is the inverse of resistance.

Our last example is the King County, Washington energy code. King County's code is a technical code specifically tailored for an urban county. If you are not an urbanized area, some portions of this code may not be suitable for your needs, but you probably will find some ideas you can use by reading it. The code offers three different paths for prospective builders – a straightforward prescriptive requirements approach, a design by component performance approach, and a third systems analysis approach for buildings using "non-depletable energy sources" such as solar, wind, tides, etc.

The "Rolls Royce" of energy conscious building codes is the one adopted by Davis, California in 1975. We have not included a copy here but it is widely available for those who want to see how a code can be specifically tailored to a local community's unique climatological characteristics. The City of Davis has been a pioneer in energy code development partly because it is fortunate enough to be the home of a campus of the University of California, where a number of scholars have taken an active interest in energy problems. The performance standards of the Davis code are not appropriate to the Pacific Northwest, but the philosophy and the spirit of the ordinance, and especially the thoroughness with which it has been developed, have universal application.

Many local officials look to the state as the proper government to take the lead in reforming building codes. The states do have an important role in establishing minimum standards and promoting uniformity among local codes, and each of the four Northwest states had adopted energy related code revisions in recent years.*

*— Washington – Under the new energy section of the Washington State Building Code. Local jurisdictions have the option of exempting certain classes of buildings.

— Oregon – Chapter 53 of the Oregon Structural Specialty Code includes mandatory energy efficiency standards for new buildings. They are available from the Building Code Division of the Oregon Department of Commerce, Labor and Industries Building, Salem, Oregon 97310.

— Idaho – Chapter 53 of the Uniform Building Code in Idaho recommends energy efficiency standards for buildings. However, adoption of the building code, including Chapter 53, by county and local governments is optional.

— Montana – Model Energy-Saving Code includes requirements for insulation and other energy conservation resources for new construction. Their Uniform Building Code establishes minimum/maximum efficiency standards which local jurisdictions must follow.

— B.E.P.S. – For information on the status of the Federal Building Energy Performance Standards (B.E.P.S.) contact the State Energy Office.

It's the local government, however, that must enforce the code, and because no two communities are the same, it would be a mistake to depend wholly on state-drafted provisions to meet local needs. Make the state-mandated language part of your code and borrow heavily from the work and experience of other local governments – but make it your own code.

All-Electric Standards

In communities where electricity is used extensively for residential space and water heating, the local government should seriously consider establishing strict thermal standards for so-called all-electric service.

Several Northwest electric utilities have established energy efficiency standards for all-electric homes, but more of the state building codes reflect these standards. There are two actions that local governments could take to help utilities enforce these standards:

1. Adopt an ordinance requiring that wherever available natural gas or oil be used in place of electricity for space or water heating in new construction (a variation might be to require a non-electric hook up, but not require that it be used).
2. Adopt separate, more strict, thermal requirements for "all-electric" new construction.

A requirement to use oil or gas heat may be strongly opposed by some in the home building industry, since the installation of electric heating is significantly cheaper than oil or natural gas.

TABLE 4
Solar Radiation and Heating Degree Day Comparisons for Selected Locations

Location	(A) Average Daily Solar Radiation Received During the Heating Season*	(B) Average Monthly Heating Degree – Days During the Heating Season**	(C=A/B) Ratio of Solar Energy Received to Heating Degree – Days During the Heating Season***
Richland, WA	720	690	1.04
Seattle, WA	520	660	0.79
Spokane, WA	660	920	0.72
Astoria, OR	560	610	0.92
Corvallis, OR	530	610	0.88
Klamath Falls, OR	810	840	0.96
Medford, OR	750	700	1.07
Boise, ID	810	820	0.99
Twin Falls, ID	840	860	0.98
Great Falls, MT	770	1,000	0.77
Boston, MA	680	800	0.85
Schenectady, NY	640	950	0.67
Chicago, IL	530	880	0.60
Madison, WI	710	1,100	0.64

*Average daily solar radiation (Btu/ft²) rounded to two significant digits, for the months of October through March.

**Heating degree-days (base 65°F) rounded to two significant digits, for the months of October through March. Heating degree-days are a measure of temperature as it affects energy demand for space heating. For any one day, it is equivalent to the difference between the mean temperature for the day and 65°F. The greater the number of degree-days, the greater the heating demand.

***This ratio is calculated by dividing the amount of solar radiation received, column (A), by the heating degree days, column (B). For Richland, Washington, for example, $C=A/B=1.04$. The higher the number, the better the location for solar heating.

Source: Solar Energy for Pacific Northwest Residential Heating-Executive Summary Report, U.S.D.O.E. and U.S.E.P.A., Region X, May 1978.

Also, it is easier and more economical to install individual electrical heating units in multi-family units than one central, oil-fired boiler. Another problem is that in some areas, electric rates are still cheaper at the retail level than either oil or natural gas.

First step in considering new "all-electric" ordinances is to contact your local electric utility to gain its support and advice.

Solar Construction

Passive Systems

Passive solar buildings are designed to take maximum advantage of the sun's natural energy for space heating. Many people believe these kinds of buildings are only cost-effective where the sun shines much of the time, like Arizona or maybe Boise, Idaho. The amount of available sunshine tells only half the story, however. The other half depends on how severe the winters are or, expressed in technical terms, how many "heating degree days" there are during the winter months.

Considering both factors, a place like Seattle, with a well deserved national reputation for cloudy, wet winters, can still rank favorably for passive solar because Seattle's winters are also very mild. This principle is illustrated in table 4 which compares the relative attractiveness of several Northwest cities and selected cities elsewhere in the country for solar heating. The index in the right hand column is the ratio of solar energy received (average daily radiation of BTU's per square foot) to heating degree days for the period October through March. The higher the number, the better the location for solar heating.

The table shows that, based on climatic factors alone, the attractiveness of solar space heating is relatively uniform across the Northwest. West of the Cascades the winters are cloudier but more temperate; while east of the Cascades the sun shines more but the winters are colder. The table also shows that the Northwest as a region is relatively more attractive than other northern cities, mostly because Northwest winters are milder.

Technology

The basic principles of passive solar heating are quite simple. Because the south side of a building at 40° latitude receives about three times as much winter sun as the east or west sides, passive solar structures usually have a large window wall facing south, with small or no windows on the other three sides. On the inside of the window is a large thermal mass or "heat sink" to store daytime heat for use at night. This might take the form of a large masonry fireplace wall or perhaps even the floor itself as a darkly painted concrete slab. Living areas are generally organized to take advantage of the warmer south side of the house, while bedrooms and other spaces are arranged on the north side. To prevent overheating in the summer, shading is provided in the form of eaves, overhangs, deciduous trees, or removable shutters. Successful solar buildings are well insulated (R-19 in the walls and floors and R-38 in the ceiling) to take maximum advantage of the stored heat.

Passive solar buildings are cost-effective nearly everywhere in the Pacific Northwest because good designs can provide between 60 and 70% of the total heating needs of the building.

The Department of Energy has used a computer model to simulate the performance of a well insulated passive solar house in five Northwest cities. The model house has a 12-inch thick concrete thermal storage wall equal in area to half the floor area of the house. The results are displayed in table 5.

Methodology

Because space heating accounts for such a large share of electrical energy in the region, the potential for future electrical savings using passive solar heated buildings is very large.

The local government's first responsibility in helping realize this potential is to remove any obstacles to innovative passive construction that may be present in locally enforced building, subdivision, and zoning ordinances.

We have already talked about the building code in another section of this manual. The important feature of amending the code for solar structures is that the amount of energy provided by the sun is credited in the heating calculations. Methods for calculating the solar heating "fraction" of the total energy requirements for a particular structure can be found in the following publications:

TABLE 5
Space Heating Potential of Passive Solar Structures in Five Northwest Cities

City	Percent
Eugene, Oregon	59%
Medford, Oregon	71%
Seattle, Washington	60%
Spokane, Washington	61%
Boise, Idaho	71%

Source: *Solar Energy and Pacific Northwest Residential Heating*, U.S. Department of Energy, Region X, Office of the Regional Representative, May 1978.

- *Solar Workshops for the Financial Community*, Workshop Manual, U.S. DOE, 1979.
- *Application of Solar Technology to Today's Needs*, Office of Technology Assessment, 1978.
- *Domestic Potential of Solar and Other Renewable Energy Resources*, National Academy of Sciences, 1979.

Two other possible obstacles to look for in your subdivision code are:

1. Does the code take into account the unique siting needs of passive structures?
2. Does the code protect solar access?

To take advantage of the sun, solar homes need a large southern exposure, usually accomplished by facing the long side of the structure toward the south. Depending on the orientation of a particular parcel of land, it may not be possible to subdivide the lots in such a way to do this and still meet the setback, lot coverage and other typical code requirements. For example, in the parcel illustrated in figure 2, a uniform front yard setback from both streets will not allow a southern exposure for each structure at typical subdivision densities. But, alternating the setbacks would, as in figure 3. Will your subdivision code permit this kind of platting?

FIGURE 2.
**Restriction of Solar Access
 by Platting Uniform Setbacks**

FIGURE 3.
**Maximization of Solar Access
 by Alternating Setbacks**

↑
 NORTH

Protecting solar access is a closely related problem. A solar building must be guaranteed long term, unobstructed exposure to the sun. This means preventing future buildings from encroaching into its sky space, the segment of the sky between the building's southern exposure and the sun. Solar access ordinances must be defined in terms of distances between buildings in relation to their height and bulk, and not to the lot line, taking into account the shadow of surrounding buildings.

A good example of a simple solar access ordinance is included in the Woodburn, Oregon code, found in the Compendium. Note that the code also provides a table for considering the effect of slope on the shadow of buildings. Communities located in flat areas may not need this elaboration.

An excellent reference book on solar access is *Protecting Solar Access for Residential Development: A guidebook for Planning Officials*, prepared by American Planning Association for HUD and USDOE, May 1979.

Active Systems

Active solar systems use collectors, pumps, piping, fans or other mechanical equipment to move the collected heat, usually from sophisticated collectors located on the roof of the building to a heat storage area involving rocks or water in the basement of the structure, where it can be recovered at night or during periods of no sunshine. Active systems are still quite expensive and some research suggests that they may not be any more effective than passive systems for the Northwest.

The same siting and access considerations discussed for passive systems, above, apply to active systems. However, the cost effectiveness of retrofitting a particular building will depend on both the cost of the system and the household's present and probable future fuel bills for space heating.

For more information on solar construction we recommend the following:

- *Sunset Homeowner's Guide to Solar Heating*, Lane Publishing Company, 1979.
- *HUD Intermediate Minimum Property Standards Supplement*, 1977 Edition, Solar Heating and Domestic Hot Water Systems.
- *Fundamentals of Solar Heating*, U.S. DOE, 1978.
- Mazria, Edward, *The Passive Solar Energy Book*, Rodale Press, 1979.
- *California Passive Solar Design Competition*, California Office of Appropriate Technology, 1979.
- *Passive Solar Design Handbook* (two volumes), U.S. DOE, 1980.
- ECCLI, Eugene, *Low-Cost, Energy-Efficient Shelter*, Rodale Press, 1976.
- *Solar Workshops for the Financial Community*, Workshop Manual, U.S. DOE, 1979.
- *Domestic Potential for Solar and Other Renewable Resources*, National Academy of Science, 1979.
- *Introduction to Solar Heating and Cooling Design and Sizing*, U.S. DOE, 1978.
- *Application of Solar Technology to Today's Energy Needs*, Office of Technology Assessment, 1978.
- *Domestic Policy Review of Solar Energy*, a Response Memorandum to the President of the United States, 1979.

Zoning Code Amendments

Zoning regulations guide the location and density of housing, businesses and jobs in the community. Local zoning codes have a major effect on the general pattern of development in the community. Because some development patterns are more energy efficient than others, all cities and counties should review their codes to see what kind of development pattern they are encouraging.

Here are four general questions to guide the examination of your own code:

1. Does the code encourage multi-family housing, especially near the center of the city?
2. Does the code encourage "mixed uses" such as residential/commercial and residential/office?

3. Does the code encourage a tight, high-density development pattern that makes maximum use of lands near jobs and services?
4. Does the code encourage strong neighborhoods with local service centers?

Let's look at each of these issues in turn.

More Multi-Family Housing

There's a direct relationship between the proportion of multi-family or "common wall" housing in your community and energy consumption. This is illustrated in figure 4, which compares total electrical energy consumption for different ratios of multi-family and single-family housing. Because multi-family housing permits more people to live closer to work and shopping, there is an obvious savings in gasoline because of the reduced need to travel. But there are also significant electrical energy savings for space and water heating because multi-family construction uses electrical energy more efficiently than single-family houses.

FIGURE 4

Electrical Energy Consumption for Different Housing Mixes

Assumes 25,000 new housing units built to existing code, without conservation.

From: *CRA Region Energy Analysis*, Work in Progress Report 1, April 1977.

Many local zoning codes don't have enough land set aside for multi-family housing. Established single family neighborhoods may object to apartments in general and to large-scale, commercial apartments in particular as an encroachment on their neighborhood. Perhaps a better way to introduce multi-family into existing single-family neighborhoods is to permit newer, more modest scale duplexes and triplexes on one or more adjacent single-family lots. With proper attention to design, these units can blend easily into established neighborhoods.

If your community has many large homes, another option is to encourage the development of apartments in these larger, existing, single-family homes. Both of these strategies can be very effective, in providing more housing for the community and in saving energy.

More Mixed Uses

Traditional zoning codes are aimed at producing a development pattern that separates living, working and shopping space in the urban landscape. A more energy conscious zoning code would encourage mixing these activities where appropriate. For example, your code should permit home occupations to be carried out in all single-family residences, and allow low key businesses in neighborhoods.

For the greatest energy savings of all, you might even consider breaking down the traditional barrier between industrial and residential uses by permitting industry that can meet certain good neighbor performance standards, including campus-like design and landscaping, to locate in or near residential neighborhoods. This puts jobs within walking distance of people's homes and also opens up the possibility for the utilization of waste heat from some industries for residential space heating. (See the section on district heating elsewhere in this workbook.)

Tighter, More Dense, Development Patterns

All of the strategies discussed above will tend to tighten the community's development pattern, thereby making it more energy efficient. Other actions the community could take include reducing the amount of land zoned for large lot (more than one-quarter acre) residential construction, particularly near the center of the city, and increasing the amount of land with smaller minimum lot sizes, say as small as 5,000 square feet.

The increasing cost of land makes large lot zoning more and more exclusionary in today's housing market. The kind of housing that is built on these large suburban lots is also the least energy efficient. These facts should provide incentives for your community to reduce the amount of land in large-lot zoning categories and to increase the amount of land available for smaller lot subdivisions. With careful attention to design, attractive, energy efficient single-family detached housing at competitive prices can be built on 5,000 square foot lots.

A further incentive to utilizing many close-in odd shaped parcels that have been passed over might be a zoning amendment that permit variances from strict setback and other standards. All these actions can make your community's development pattern tighter and more energy efficient without detracting from its livability or forcing any significant changes in lifestyle.

Local Neighborhood Service Centers

Both existing and new neighborhoods can be strengthened by providing a neighborhood service center that includes convenience commercial activities like neighborhood grocery store, a gas station, a laundry, a beauty parlor, and perhaps some office space as well. The center might be developed in conjunction with a neighborhood park or school.

The primary energy implication of the neighborhood is, again, a reduction in travel demand. But the center has an important secondary impact of improving the attractiveness of the neighborhood for existing and future residents, thereby encouraging investment that assures its preservation, renewal and health. Strong urban neighborhoods can reduce the demand for less energy-efficient development at the edge of the city and in rural areas.

The underlying energy-saving principle behind all of these actions is the enforcement of a zoning code that encourages a balanced pattern of mixed development where as many people as possible can live, work, shop and play within comfortable distances – ideally, within the same neighborhood or community. Examples of planning policies and ordinances drafted in the spirit of this principle are included in the Compendium: Eagle Point, Oregon; Hubbard, Oregon; and Monmouth, Oregon.

Cogeneration

If your county was shaded in the map on page 23 in chapter 2, it means that there is at least one industry present with an annual energy use in excess of 200 billion BTU. The first step is to identify the company and evaluate its potential for cogeneration.

The Bonneville Power Administration (BPA) along with the Rocket Research Corporation in Redmond, Washington has developed a survey of potential cogeneration facilities in the BPA region. The following industries have the highest potential for cogeneration: paper, miscellaneous paper, wood pulp, sawmill, plywood, and miscellaneous food.

Once specific industries have been identified, a meeting or seminar should be organized to provide these industries with the latest technical and financial information that is available on cogeneration. This seminar should include the local utility, a U.S. Department of Energy official, a state energy officer, local government administrators, and probably most important, an official from

an industry currently utilizing cogeneration. Cogeneration has an excellent potential if industry officials are aware of the benefits this resource may offer.

A technical and financial study must be completed to determine the feasibility of a cogeneration facility. Financing for such a study is the responsibility of the individual business, but some outside funds may be available, such as a federal demonstration grant, a grant or loan from the local utility, or other arrangements which may be available from another level of government. New legislation is under consideration that could allow tax credits, low interest construction loans, accelerated depreciation allowances, and other financial incentives for any cogeneration project that a private industry may undertake. Any company considering cogeneration should stay in contact with government energy officials on changing legislation.

If you have an industry where cogeneration may be feasible, one or all of the following may be able to assist you: (1) your local utility; (2) the Bonneville Power Administration; and (3) a consultant specializing in cogeneration projects.

Geothermal Power

Geothermal energy is the natural heat of the earth contained in the upper portions of the crust. In most areas this heat is so diffuse that it cannot be economically recovered. However, due to favorable geological factors, there are areas of high heat flow where the geothermal energy is concentrated and can be recovered as steam or hot water. These products can then be utilized to generate electricity or be used directly for space heating and cooling or for industrial and agricultural purposes.

The Pacific Northwest may have some of the nation's most promising geothermal resource areas. At present, there are 695,222 acres of potential geothermal areas in the Pacific Northwest. As of November 30, 1978, there were 323 active geothermal leases in Oregon and Idaho.

The costs of geothermal energy development vary greatly with the physical characteristics of the particular resource. Total cost has been estimated at between 10 and 46 mills per kilowatt hour (kwh). Pacific Gas and Electric Co. of Oregon reported their actual operating cost at the Geysers geothermal field at 17 mills per kwh, compared to 23 mills for nuclear, 29 mills for coal, and 45 mills for oil.*

In FY-78, the federal government appropriated \$106.2 million for geothermal energy development. In 1979, a total of \$153.2 million was appropriated.

If your local community is near a potential geothermal area, it may be feasible to use this thermal energy source to produce electricity or commercial heat. The technical and economic feasibility study for this type of project should be done by outside consultants with financing from federal and/or state government agencies. If this geothermal source is to be used in the production of electricity, the local utility may want to help finance the project.

If you are interested in exploring a geothermal site in your area, one or more of the following may be of further assistance: (1) your local utility; (2) the Bonneville Power Administration; (3) the Idaho Office of Energy; (4) City of Boise Geothermal Project; and (5) the City of Klamath Falls, Oregon.

Wind Power

Wind power can be utilized to supply direct mechanical power (such as to pump water) or to generate electricity. The Pacific Northwest has more potential for large scale windmills than most of the nation, since the region generally has brisk and steady winds and a well developed hydroelectric capacity which offers an energy storage system. Sites along the Oregon coast, on the Washington coast, by the Columbia Gorge, and in open areas of eastern Oregon, Washington, and southern Idaho, have significant potential. The potential for generating electricity from wind is affected by the following three variables: the distribution of wind directions, and mean wind speed.

The basic configuration of windmills has remained unchanged for centuries. The ideal wind machine should be able to capture about 59% of the kinetic energy of the wind that passes through the sweep of its blades. Actually, blade inefficiency and mechanical losses reduce practical efficiencies to about 35%.

*Los Angeles Times, August 13, 1978, Part VII, p. 1, 2.

Commercially available small-scale wind machines (up to 100 kw) now generate electricity at costs ranging from 10 to 25 cents per kilowatt hour. Experimental larger scale machines (more than 100 kw) show comparable cost ranges, although some experts believe design and other refinements of existing technologies might reduce these figures to as low as two cents per kwh. These costs are only tentative estimates, however, and are for systems *without storage*; that is, the wind machine is connected directly to the electrical grid as a supplemental power source.

Your own estimates must be based on local conditions and will require help from outside consultants.

The federal government has significantly increased its budget for wind energy research. You will probably need help from a consultant to determine the potential for a wind energy project in your area and the costs.

Contact your state energy office to find out what funding sources are available for an initial wind survey. Wind measurements taken at a local airport are inadequate because these instruments are normally mounted close to the ground and give no indication of winds present at windgenerator heights.

The Bonneville Power Administration and the National Oceanic and Atmospheric Administration may also be able to assist you.

Once an area has demonstrated its feasibility, the local utility, along with state and federal energy programs, may be able to assist in the construction of a wind energy facility. At the present time many state and federal programs are being developed to give further financial incentives to promote wind energy. Wind energy has a potential of offering clean, renewable energy to a local community if local government and utility officials are aggressive in developing this local energy resource.

Two good references to get you started are the wind chapter XVII in *The Fact Book on Unconventional Energy Technologies*, Report No. 79-47 SPR, Congressional Research Service, February 1979, and *Energy Alternatives for Idaho*, Idaho Office of Energy, December 1979, pp. 21-25.

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Putting it all Together: Writing the Plan

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Putting It All Together: Writing The Plan

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Chapter I described the five step local energy planning process. The first two steps – identifying and evaluating candidate energy management planning actions – were the subject of chapters 2 and 3, respectively. This chapter describes the third step, which is to prepare the local energy plan. This is the point in the process where the selected energy management actions are formally documented, along with other essential plan elements, for public review and local government adoption.

An overview of an energy management plan, its scope, purpose and products, is presented in document 4 at the end of this chapter. A general outline of the contents of the plan was presented in chapter 1 and is repeated below:

1. Statement of the problem (why are we doing this plan?)
2. Goals, objectives and policies (what do we expect the plan to accomplish and how, in general terms, do we expect to get results?)
3. Recommended actions
 - A. The actions we are taking now
 - B. The actions we expect to take soon
 - C. The longer range actions under study
4. The timing and cost of implementation (when do we expect to take what action and how much will it cost?)
5. Implementation responsibilities (who is responsible for what to see that the plan gets carried out?)

The following discussion is organized around this outline, treating each of the major plan elements in turn.

Statement of the Problem

By this point in the planning process you are undoubtedly well aware of what the energy problem means for your own community. Use the resolution adopted at the start of the process as a general outline for your problem statement. Write this chapter of the plan document for the citizens of the community rather than for other planners or technicians. Key points to consider are:

- Cheap abundant energy is a thing of the past
- Energy management planning actions will require some sacrifices and changing of habits, but shouldn't seriously affect overall standard of living or lifestyle
- Northwesterners use far too much electricity and will have to find substitutes, especially for space and water heating.

In the plan document itself you may want to illustrate major points using charts, tables or other appropriate graphics.

Use local examples wherever possible and express numbers in terms of individual households so people can translate the problem to their own circumstances. For example, you might include a chart showing the history of local electric rates, on a household basis, along with projected rates.

Goals, Policies, and Objectives

Because the terms “goals,” “policies” and “objectives” are often misunderstood, this section will first describe how they relate to one another and to the total planning process. In this manual a goal means a general statement about a long term condition describing what we want to achieve at some time in the indefinite future. For example, you might adopt a goals statement that says:

“The City/County of _____ will use its available energy resources in the most efficient manner possible.”

This statement sets a general direction and spirit for our actions. But it doesn’t indicate when we expect to achieve this or what level of achievement we are looking for.

Objective statements are more specific than goal statements. If you say:

“The County/City of _____ will reduce its energy consumption by 25% over the next three years”

you have defined your goal so that your progress can actually be measured. Now it is an objective. A single goal might have several objective statements supporting it, each specifying levels of achievement over certain time periods for different kinds of activities.

Policies, on the other hand, state how goals and objectives will be achieved. An example of a policy that fits the goal and objective statements above might state:

“The City/County of _____ will require that new construction be more energy efficient.”

This tells us one way in which the county or city expects to achieve a 25% reduction in energy consumption. A whole series of policies might be written to support a single objective, each spelling out another strategy the local government can take to achieve that particular objective.

Note that our policy example isn’t very detailed. It doesn’t say whether the regulations will apply to commercial or residential construction, or both; and it doesn’t say how much more efficient we expect the buildings to be. These details should be spelled out in the plan’s implementation chapters, where specific standards, criteria, and ordinances are drafted to carry out the policies.

Policies should, however, be specific enough to aid the local elected officials in making decisions. Our policy example does say that the local government will “require” more efficient buildings, clearly ruling out a voluntary ordinance. It also says that buildings must be more efficient than they presently are, thus calling for strengthening the existing ordinances and regulations.

In short, a policy is a written mandate which, once adopted by the council, points directly to some implementing actions. If your policy statements don’t do that – that is, if they don’t assist the decision makers in carrying out the objectives of the plan – then there may be misunderstandings later about what the purpose of the policies was. If you have adopted our example policy, then you don’t want anyone in the community to be surprised when your elected officials begin debating proposed building code amendments.

Why not simply combine goals, objectives and policies into a single general purpose statement? Using separate statements helps to build consensus about what should be done about a problem. Begin with a very general goal statement (about which nearly everyone will agree). Progress to the slightly more refined objective statement (where differences about how much can be done how soon will be ironed out), and then to policy statements (where considerable discussion about different ways to accomplish the same ends must be resolved). The policies in turn should point to specific implementing ordinances, regulations, standards and other actions. The value of the process is that it provides a series of distinct plateaus through which many diverse ideas and interests can be incrementally focused toward consensus about specific actions to solve a problem.

An example of the use of this format is the City of Portland’s Energy Conservation Policy Ordinance contained in *Energy Actions by Local Governments of the Pacific Northwest, A Compendium*. The Portland example cites a general policy statement, followed by a series of specific objectives.

Another common approach is to list goals supported by objectives followed by policies. (See, for example, the energy conservation element of the Detroit, Oregon plan in *Energy Actions by Local Governments of the Pacific Northwest, A Compendium*.) Either format is appropriate. Just remember that goals and objectives are statements of ends, while policies are statements of means.

Even though you should begin thinking about goals and policies early in the planning process, a realistic set of statements can't be finalized until your advisory committees have studied the alternatives, predicted the energy management planning results, and talked about specific implementing actions. At the same time, the alternatives selected will partly depend on what goals they want to set for the community.

Don't be too concerned about which of these steps comes first – in practice there will be considerable overlap. The important thing is that at the end of the process, the committee has agreed on goals, policies and objectives.

Recommended Actions

This section will document the results of evaluating prospective local government energy management actions described in chapter II. Organize your presentation using the same three major headings in the "Master Action List":

1. Actions we are taking now
2. Actions we expect to take soon
3. Long range actions under study

It's important to have some actions already working for you to report under section one. This gives momentum to the planning process and credibility to local government's commitment. In presenting the recommended actions, separate those which local government will implement to reduce its own energy consumption from those aimed at reducing consumption in the community as a whole.

This distinction is useful for two reasons. First, government has control over the energy it uses, while private consumption can only be influenced by less direct methods, such as regulation or incentives. Secondly, most governments will want to show how they are using energy efficiently before going to the private sector to ask for similar sacrifices. Nearly all successful local energy management plans we have seen began with some kind of action by the government to reduce its own energy usage.

In describing the recommended actions, try to link the actions to policies or objectives they support. This helps assure that the actions chosen are consistent with adopted policy and highlight policies for which you have not proposed implementing actions. Every policy needs to have an action attached to it, even if it is only to recommend further study of alternatives.

If the actions don't fit the goals and policies, then something will have to be adjusted to make it all tie together. Because the actions are the heart of the plan, it is easy to ignore the goals and policies and to justify the actions on their own merits. This tends to depreciate the consensus that you built in developing the policies in the first place. Use that consensus to support your actions by showing that they follow logically from the policy statements.

Finally, somewhere in your discussion of the actions you should summarize the total expected costs and potential benefits of each action. Use the four different kinds of net economic benefit described in chapter 3.

Implementation Costs and Timing

Rather than develop an independent budget for implementing your energy management plan, integrate the cost figures into your local government budget. Separate those costs associated with increases in the level of service reflected in individual department line items from costs to be included in the capital improvements program.

For example, you will need more building inspectors to enforce proposed building code amendments. That has budgetary implications which should be spelled out for the department involved. If you want to do a demonstration cogeneration project, that should be reflected in the capital improvements program.

The timing of costs should be shown for the following year's budget and for the next five years. Show any expected net economic benefits, such as fuel savings, as "opportunity costs" on the revenue side of the ledger. It's also helpful to show the dollar amounts you're proposing alongside the total budgeted amount for each line item you are affecting. This helps the local elected officials and citizens to put your proposals into the context of the total budget.

Implementation Roles

The success of an energy plan will depend on the cooperative efforts of many different individuals and groups in the community. Begin by defining roles inside the government – the city or county council, the energy coordinator, individual department heads, and various boards and commissions. Spell out what is expected of each for any of the recommended actions.

For example, if an action requires that coordinated efforts of more than one department, make it clear whether or not the energy coordinator will take the lead, whether the work will be carried out individually in the departments, or whether one department has the responsibility for coordinating the action of others. If the plan describes these responsibilities explicitly, potential misunderstanding can be avoided.

Next, describe the plan's expectations of different groups in the community, such as businessmen, the local utility, industries, and so on. If the cooperation of a group is critical to the success of a particular action, detail the resources or other sacrifices involved. In most cases such groups will not have assigned responsibility, but their cooperation is encouraged.

Finally, say something about the citizens' contributions to the plan's success. If you propose major savings in the residential sector, for example, include assumptions about changes in people's living habits using voluntary incentives. Paint as accurate a picture as possible of what these expectations mean for the average community household.

DOCUMENT 4

Sample Energy Management Plan

1. *Scope:* Community based plan for the entire electrical utility service area.
2. *Purpose:* Identify and develop energy management goals and prepare specific programs to achieve the goals.
3. *Plan Products:*
 - (a) A definition of conservation and small source potential in the service area;
 - (1) Residential, commercial and industrial energy audits;
 - (2) Inventory of potential locations for direct application of renewable resources, waste recovery, and cogeneration.
 - (b) Feasibility studies of potential programs and projects.
 - (c) Cost-effective analysis of potential programs and projects.
 - (d) Energy demand forecast.
 - (e) Priority listing of potential projects and programs.
 - (f) Definition of energy management and small source development goals.
 - (g) Development of energy conservation standards.
 - (h) Listing of procedures to monitor goal attainment.
 - (i) Development of a process or program for administering surcharges and credits.
 - (j) Definition of roles and responsibilities of each member on the energy management team, including responsibilities for program implementation.
 - (k) Electrical contingency or curtailment plan.
 - (l) Documentation of the citizen and public involvement program.
 - (m) An environmental impact assessment of the plan.

Implementation Strategies

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Implementation Strategies

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Implementation has already been discussed in chapter 3 on evaluating the energy management actions and in chapter 4, where the importance of building implementation elements into the plan document was emphasized.

This chapter will provide a concise overview of the range of implementing strategies available to local government and briefly discuss these strategies as they apply to energy management actions in general.

In thinking about implementation strategies, perhaps the first choice is between voluntary and mandatory approaches. Voluntary strategies are of two types: those which attempt to influence the market by changing the cost of something, and those aimed at changing attitudes or ideas through education. Market strategies can be further divided into actions aimed at making the cost of energy more expensive, and those designed to make energy management cheaper. There is a great variety of mandatory strategies which have the same basic approach.

These fundamental distinctions, which are illustrated in table 6, provide a useful framework for measuring potential implementation strategies for any of the actions discussed in this plan.

Traditionally, local government has tried to change behavior first with educational programs, then through the market approaches and finally regulation to bring about the desired result. This is why strict energy management actions, like requiring evidence of retrofit as a condition for the resale of single-family homes, will almost always be preceded by a period – perhaps of several years – of voluntary compliance.

There is little evidence that educational appeals alone have any significant effect on people's behavior. Information and publicity campaigns are, however, an essential part of either the market or regulatory approach. The market can't function without a free flow of information, and changes in the law won't be effective unless people are told about them.

This means that whatever implementation strategies comprise your community plan, you will almost certainly need some kind of ongoing public information program to accompany it. Citizens often complain that local government doesn't adequately explain its actions to the public. The mere opportunity to participate in public hearings and invitational workshops seldom satisfy many citizens' concept of government's responsibilities to keep people informed. Most citizens believe that they should be able to ignore government completely until it begins to contemplate an action that will affect their lives directly, at which time they expect to be informed of the action and its probable effect. This is why so many citizens groups plead lack of information about a proposed local government action as an excuse to oppose it. This is why it's important that your advisory committees represent all significant interest groups in the community. It also explains why several of the energy management actions are themselves public relations programs.

Strategies that involve adjustments in the marketplace are popular because of this country's faith in market solutions to problems in general, tempered by the belief that when the market is obviously failing, the government has a right – indeed a responsibility – to intervene.

TABLE 6
Implementation Strategies for Changing Energy Use Behavior

Voluntary Approaches		Mandatory
EDUCATION	MARKET ADJUSTMENTS	REGULATION
Change attitudes and ideas about energy	Change the cost	Change the law
<ul style="list-style-type: none"> • information • publicity • workshops • advisory committees 	Make energy more expensive <ul style="list-style-type: none"> • tax big users 	<ul style="list-style-type: none"> • Tougher codes • Prohibitions • Requirements
	Make conservation cheaper <ul style="list-style-type: none"> Indirect Subsidies <ul style="list-style-type: none"> • Public works • Changes in service levels Direct Subsidies <ul style="list-style-type: none"> • Grants • Loans • Tax relief 	

One way to do this is through its taxing power. Local government can make energy more expensive, thereby presumably reducing demand, by taxing big energy users like gas guzzling automobiles or electrically-heated swimming pools. On the other side of the market, tax relief can also make energy management cheaper, such as the federal tax credit on storm windows and insulation.

A second market tool is the direct subsidy, either in the form of a grant or a loan, to carry out an energy management action. A good example is the federal Department of Energy's appropriate technologies grant program. This is a popular strategy for the federal and state governments, especially in combination with a mandatory regulation, such as when the federal government requires audits of public buildings along with the money to carry them out.

Direct subsidies are less popular among local governments because they usually don't have sufficient funds available to make them work. Cities and counties can, however, provide loan guarantees backed by the full faith and credit of their general taxing powers. In states where the constitution permits it, this can be a very effective way of carrying out joint public/private energy conservation projects. Tax increment financing, which has gained popularity in California, is a good example of this.

Perhaps the greatest potential for local government market intervention is in the form of indirect subsidies that make energy cheaper. A commuter bikeway that encourages people to bicycle to work, is an example. Improvements to local building, subdivision and zoning codes that make it easier to build passive solar housing are also a kind of indirect subsidy. Any action that reduces the processing time for a building permit is an indirect subsidy to the builder who pays heavy interest on front-end construction loans.

Finally, and some would say inevitably, there is the power to regulate. No local energy management plan is likely to succeed without it. Obvious examples are tougher building codes, mandatory gas hookup for all-electric homes, and emergency curtailment powers associated with the community's contingency plan.

An aggressive and comprehensive local government energy plan will certainly include all three types of implementation strategies, including combinations. The secret is to find a balanced program suited to achieving necessary results with the minimum resistance from the community. Experimentation is as important here as it is in selecting the energy management actions.

Monitoring Results

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Monitoring Results

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Monitoring is the step in the process that directs the community back to earlier planning steps for refinement and improvement. There are two parts to monitoring, both the responsibility of the energy coordinator.

The first is to see that the adopted energy management actions are carried out. For example, if the plan calls for a community weatherization program, the coordinator must see that the program gets funded, that people are hired, and that homes are actually weatherized. Although the actual carrying out of the program is part of implementation, the important overview function – seeing that the program is actually the one called for in the plan – is a monitoring responsibility.

Sometimes persons responsible for implementing the plan were not involved directly in its development. They may have ideas about program design not necessarily consistent with the plans, policies and objectives. It is the responsibility of the energy coordinator to see that the resulting program is in fact consistent with the plan and that beneficial new ideas are integrated into the plan's implementation.

The second part of monitoring involves measuring program performance and results and comparing them with program expectations. The energy plan's objectives statement, drafted during implementation, should include enough detail about expectations to be used as a yardstick in monitoring the performance of individual energy management actions. If your objectives aren't detailed enough to do this, they probably should be rewritten. Otherwise you may get caught in the uncomfortable situation of having to set your standards after the programs are operating.

Besides good, concise objectives, the other factor that makes monitoring successful is a recordkeeping system that measures action performance. The results of some actions will be easy to measure, such as savings in the city's electric bill. But others, like savings in residential heating costs resulting from weatherization, are more difficult to determine. This is why it is helpful to think about how savings will be measured while you are still working on the design details of a particular action so that you can build convenient yardsticks into the program itself. This will often include the need to gather initial baseline data against which to measure program performance.

Another monitoring pitfall is the so-called external variable. Sometimes measured energy savings may have little to do with energy management actions, but rather result from outside variables such as the weather or energy prices. Some of these factors can be discounted from your figures, others cannot. For example, when measuring savings in space heating electricity, it is very important to standardize comparisons over time periods to account for differences in the weather.

The simplest way to do this is to use heating degree day data. The number of heating degrees in the day is simply the difference between the average daily temperature and 65°. To get the average, add the daily high temperature to the daily low temperature and divide by two. These degree days can be accumulated for weeks, months and seasons for comparison. Electrical space heating consumption should always be expressed in so many kilowatt hours per heating day. If you are measuring air conditioning savings, you can use cooling degree days, comparing the average daily temperature to 85°.

Most local energy plans will include a number of separate energy management actions that together are expected to conserve or produce so much energy over a certain period of time. In the beginning, most of the actions should be treated like pilot programs – that is, they should be considered somewhat experimental for the first six to twelve months until you can assess the impact they are having on overall savings. After results of the first trial period have been evaluated, the more successful actions should be emphasized while marginal actions can be amended, scaled down, or dropped all together, depending on their showing. In this way the total package of planned actions can be fine tuned to fit the community over a period of 18 months to two years.

If your monitoring activities produce significant changes in the content of the community's energy plan, review the revised program to see if it still matches your adopted goals and policies. Policy statements are especially susceptible to major shifts in implementation strategies. If necessary, you may need to revise some policies, requiring advisory committee discussion and recommendations followed by a council action.

This is more than a housekeeping formality. Policy guidance can only be effective and trustworthy if all elements of the community's energy plan – from goals to policies to objectives to specific implementing actions – are consistent with one another. The danger of isolating the policy-making aspects of the planning process from the implementation stages is that you may lose all the hard-earned community consensus built early in the process. This could produce a backlash against the plan from segments of the community that perceive a breach of trust in the revised set of implementing actions. Remember, a real breach is not the issue. The appearance of a breach is all that is necessary to damage or destroy critical public support for the plan.

In *Energy Actions by Local Governments of the Pacific Northwest, A Compendium*, we have included an example of an excellent in-house monitoring process used by the City of Great Falls, Montana to measure progress in reducing the city's own energy consumption. Note that the plan spells out in great detail energy management actions and expected savings for each city department. Department heads are made responsible for achieving results which they calculate monthly, using degree day and other data supplied by the city. This is the kind of energy management plan and monitoring process that department heads like because it is simple and unambiguous.

We don't have a good documented example of monitoring programs for actions taken outside the government, but we will be looking for good examples to include in later editions of this workbook.

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