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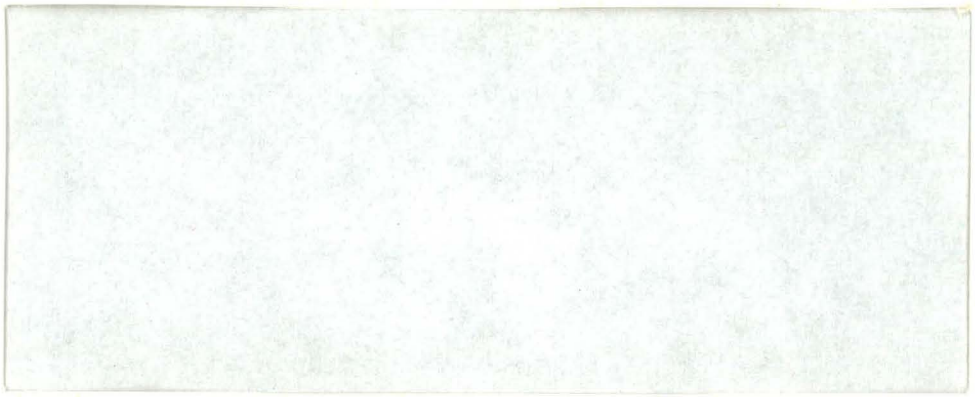

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COMMUNITY ENERGY AUDITING: EXPERIENCE WITH THE COMPREHENSIVE COMMUNITY ENERGY MANAGEMENT PROGRAM

prepared by

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COMMUNITY ENERGY AUDITING: EXPERIENCE WITH THE COMPREHENSIVE COMMUNITY ENERGY MANAGEMENT PROGRAM

I. INTRODUCTION

This report is the second in a series of preliminary evaluations of the first phase of the Comprehensive Community Energy Management Program (CCEMP). CCEMP is a 16-community pilot program designed to test the role of local government in energy management.* The program is funded by the U.S. Department of Energy (DOE) and managed by Argonne National Laboratory (ANL).

The pilot program is designed to develop, test, and demonstrate comprehensive community energy management planning techniques. Experience of the 16 communities will result in useful information on organizational arrangements, on planning/implementation approaches, and on methodologies for doing local energy management planning. The results of the pilot program will be disseminated to other communities starting energy planning through publication of a guidebook and other means. This information also will help determine future federal policy on local energy planning.

The planning method provided by DOE to the pilot communities is farily traditional. It involves the following planning process.

- Establishing a planning organizational structure and project work plan
- Estimating or "auditing" the community energy demand and supply patterns
- Establishing community energy management objectives
- Identifying and evaluating alternatives and strategies for meeting energy management objectives
- Preparing and adopting a community energy management plan.

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* The contract with a seventeenth community, Tulsa, Oklahoma, was terminated in early 1980.

Figure 1 on the next page depicts the logic of the planning method provided to the communities. The methodology provided by DOE consists of three volumes. The first volume contains the main body of the workbook and procedures for analyzing energy alternatives. In the first volume, frequent reference is made to both appendices and worksheets. The second volume of the report presents the referenced appendices which provides backup information for the procedures discussed in the main body of the workbook. The third volume is the methodology for a community energy audit and contains the worksheets which are used to record the data as it is being collected or calculated as indicated in the main body of the workbook.

Communities began the program in October 1978 with most completing required work plans by Spring of 1979. A preliminary assessment* of the organizational phase was prepared by the Academy for Contemporary Problems, which is monitoring and evaluating the CCEMP under a contract to Argonne National Laboratory. The organizing report presented background on the various community approaches for establishing local energy management planning capability. The purpose of this second monitoring and evaluation report by the Academy for Contemporary Problems is to document and assess progress on CCEMP since completion of the organizational phase. The first two Academy reports along with future reports on other phases of the CCEMP will provide the basis for the Academy's final report to Argonne and DOE on the overall CCEMP experience.

This report focuses primarily on the communities' process and technical experiences with the auditing and projection phase of CCEMP. Because the communities

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* The first report is entitled Organizing for Comprehensive Community Energy Management Planning: Some Preliminary Observations. ANL/CNSV-TM-27, Argonne, Illinois. December 1979. It is available through the National Technical Information Service.

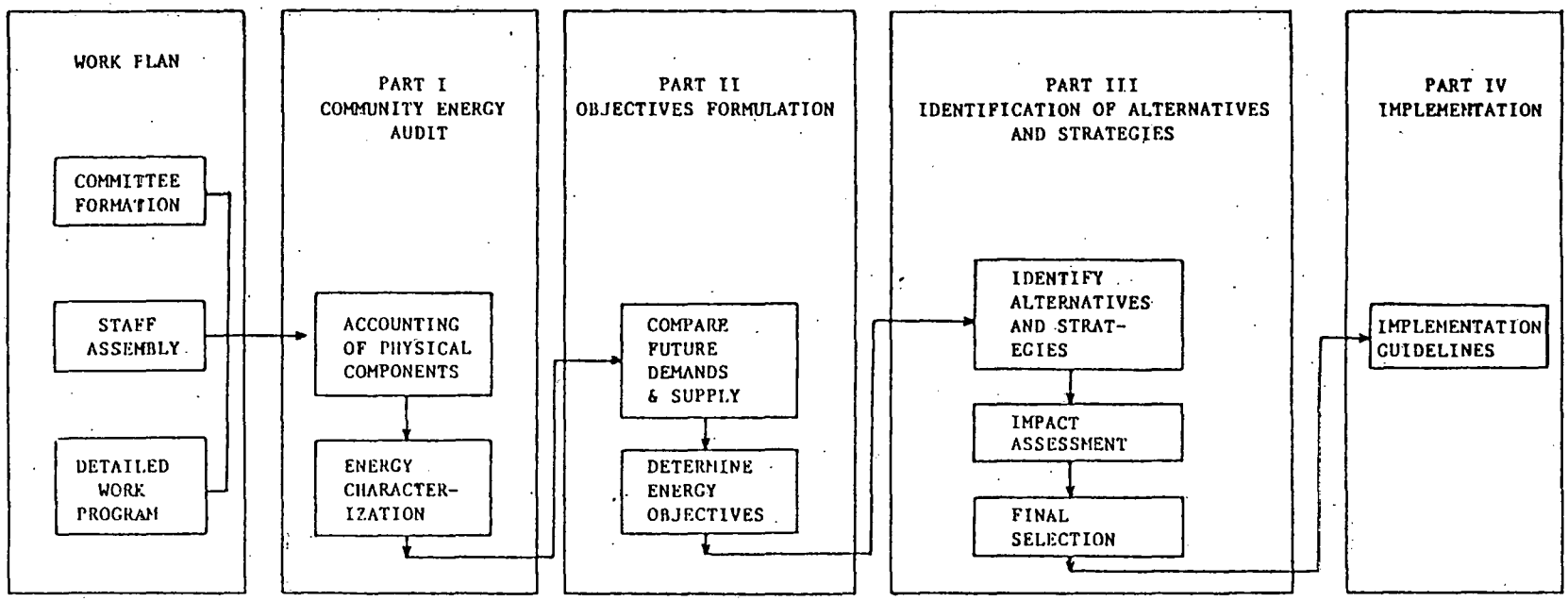

FIGURE 1. COMPREHENSIVE COMMUNITY ENERGY PLANNING METHODOLOGY

are at various stages in the development of their energy plans, and because some of the communities are working concurrently on auditing, and establishment of objectives and specific energy management alternatives, the report necessarily goes beyond the audit phase of the CCEMP.

Specific objectives of the report are:

- To provide local officials and staff with information on lessons from the audit, projection and general planning experiences of the CCEMP communities.
- To provide Argonne National Laboratory and the Department of Energy with information useful to the further development of local energy management planning methods.

The report is based on community planning documents, personal interviews by Academy staff with key individuals involved in the planning process, and reports by local monitors* working with the Academy.

In keeping with the objectives, the report is organized into the following sections:

- Section II presents the evaluation issues and key findings based on the communities' experiences from Spring of 1979 to approximately March of 1980.
- Section III gives an organized review of experience of communities in applying the detailed audit methodology for estimating current community energy consumption and projecting future consumption and supply.
- Section IV provides a preliminary assessment of how audit information is being used in other CCEMP tasks.
- Section V presents an organized review of preliminary lessons from development of the community planning processes.
- Section VI provides preliminary conclusions on the audit and planning methodology.

As with any assessment of a program not yet completed, a note of caution is in order. First, the basis for the assessment is observations and planning

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* On-site monitors under contract with the Academy who serve as passive observers of the community process.

documents from 16 highly diverse communities. The wide range of community backgrounds, approaches, and project timing limits the potential for generalizing from these individual cases. This "information" base must be used cautiously in developing preliminary conclusions on the functioning of the CCEMP experiment. Second, the units of observation are planning processes still at their formative stages. The serious questions about the value of the audit and its role in local comprehensive energy planning can only be addressed at the conclusion of the planning process in each community.

Within these limitations, this report attempts to present relevant examples and preliminary lessons from the community experiences. The report also attempts to make educated guesses on the implications of other outcomes which are not yet clear. Such observations may be helpful to other communities starting local energy planning programs.

II. EVALUATION ISSUES AND SUMMARY OF FINDINGS

Introduction

Preparing base year audit and consumption projections has occupied the better part of a year for most of the CCEMP communities. Although all but four communities applied the general audit methodology, several modified various parts. More than half of the communities also made key changes in their committee structures during this period.

Table 1 gives an overview of each community's organization arrangements, key changes that occurred during the audit phase, and some highlights on the audit exercise.

- Nine of the 16 communities altered their initial committee structure, including four of the five small cities. Changes included the expansion or reconstitution of policy advisory committees and the establishment or deletion of subcommittees.

- Half of the communities modified the detailed audit methodology procedures by (1) performing multiple small area energy audits (common to multi-jurisdictional programs), (2) conducting supplemental audits (for the agricultural sector and business districts or particular building types), or by (3) adopting other methods for specific sectors (notably, the industrial sector).

- In lieu of the detailed audit methodology, three communities completed the audit by apportioning aggregate utility data between various sectors and one utilized a state-developed econometric model. Both large cities departed from the suggested methodology.

This report is concerned with (1) the community experiences with the planning methodology, of which the audit methodology is an important part; and (2) the development of the general planning process. The interim evaluation presented deals with four questions.

1. How well did the specific audit methodology provided to communities work?

2. Given community adaptations to the audit methodology, what lessons are there for community energy auditing in general?

TABLE 1. OVERVIEW OF COMMUNITIES

Community	Lead Agency	Committee Structure	Committee Changes	Audit Approach	Adaptations/ Innovations	Base/ Projection Year
Small Cities						
Boulder, CO	City Planning Department	13 member Task Force (policy) 6 subcommittees (advisory) - Solar - Residential conservation - Industrial/commercial - Building code - Land use regulation - Transportation	Expansion of Task Force Activation of subcommittees	Planning methodology	- Building audits for commercial and industrial sectors, unsuccessful for residential, followed by residential survey	1978/1990
Greenville, NC	Energy Conservation and Management Office-Greenville Utilities Commission	9 member Energy Management Commission (policy) Technical Advisory Group Citizens Task Force	Reconstituted Energy Management Commission following municipal election Deletion of Citizen Task Force subcommittees	Planning methodology	- Industrial sector survey - Disaggregated utility data for residential and commercial sectors	1978/2000
Janesville, WI	Public Works Division	No committees	N/A	Apportioning aggregate utility data	- Only residential and municipal sector audits were conducted - Time series data	1970-1979/1985
Portland, ME	Office of Energy Conservation - City Manager's Office	27 member Portland Energy Reduction Team (policy) 2 subcommittees (advisory) - Public awareness - Conservation and alternative energy	Deletion of four subcommittees - Municipal operations - Demand - Supply - Economics and finance	Planning methodology	- Disaggregated utility data for residential sector - 100% survey of industrial sector	1978/1985
Richmond, IN	CCEMP Department	7 member Executive Committee (policy) Resource Inventory Council (existing entity for citizen input)	Expansion of Executive Committee Abandonment of case study group formations and, instead, use of existing community organizations as advisors	Planning methodology	- Disaggregated utility data for residential, commercial, industrial, and municipal sectors - Supplemental audits: 1) Local building types 2) District audits - CBD and shopping center	1978/1985
Intermediate Cities						
Dayton, OH	Central Services Department	20 member Steering Committee (policy) Action Plan Team (technical resource organizations)	None	Planning methodology	- Sample surveys of residential, commercial and industrial sectors - Addition of two office, construction, and communications parcels to commercial sector	1978/1985& 2000
Knoxville, TN	Metropolitan Planning Commission	11 member Steering Committee (policy) Executive Management Committee (review) 5 subcommittees (advisory) - Land use - Buildings and structures - Transportation - Emergency contingencies - Alternative energy resources	Expansion of Steering Committee Reorientation and activation of subcommittees, originally conceived as - Inner-city residential - Suburban residential - Commercial/industrial - Municipal/institutional - Technical review	Planning methodology	- Based primarily upon secondary source information	1978/1982
Seattle, WA	City Energy Office	25 member Energy Ltd. Citizens Committee (policy) 6 subcommittees (advisory) - Transportation - Governmental - Supply - Industrial - Commercial - Residential Municipal Support Group (review/ coordination) Technical Resource Group (coordination)	Contingency Planning Subcommittee (ad hoc) disbanded upon completing recommendations	Planning methodology	- Extensive survey of commercial sector and addition of two other parcels--construction and fishing - Industrial process audits (jointly with King County CCEMP) - Joint-county-scale transportation sector audit with King County	1978/2000

TABLE 1. OVERVIEW OF COMMUNITIES (Continued)

Large Cities						
Los Angeles, CA	Energy Coordinator-Mayor's Office	27 member Energy Management Advisory Board (Policy) Technical Advisory Consortium (advisory)	None	Econometric model	- California Energy Commission. "California Energy Demand 1978-2000" model for Los Angeles utility service area - Use of planning methodology for street lighting parcel	1978/2000
Philadelphia, PA	Office of the City Representative and Director of Commerce	7 member Energy Policy Task Force (policy)	Abandoned elaborate policy and task force committee structure following the completion of audit and objectives	Apportioning aggregate utility data	- Approach adopted in lieu of detailed sector stratified sampling and audits which proved unsuccessful - Use of secondary source information and utility records to complete "citywide audit" at sector-level detail	1977/1988
Counties						
Allegheny County, PA	Energy Division County Planning Department	50 member Advisory Committee (policy) 6 subcommittees (advisory) - Supply network - Industrial - Residential - Municipal - Commercial/civic/institutional - Transportation	Consolidation of technical Advisory Committee (TAC) and Policy Advisory Committee (PAC) into a single advisory committee (Policy and Technical Advisory Committee)	Planning methodology	- Based primarily upon secondary source information	1976-77/1985
King County, WA	Energy Planning Project, Office of the County Executive	16 member Steering Committee (policy) 7 Task Forces (advisory) - Commercial/institutional - Government operations - Industrial - Land use - Renewable resources - Residential - Transportation	Creation of 90 member task forces	Planning methodology	- Residential sector survey - Industrial Progress audits (jointly with Seattle CCEMP) - Joint transportation sector audit with Seattle CCEMP	1978/1990-2000
Wayne County, MI	Intergovernmental Affairs And Management Office-Wayne County	18 member Energy Management Council (policy) Community Energy Planning Task Force (Advisory) Communications Task Force (advisory) Operating Group (municipal liaison)	None	Planning methodology	- Based exclusively upon secondary source information and planning methodology default values Individual audits prepared for each of the 42 municipalities excepting municipal and transportation sectors	1975/NA
Areawides						
Greater Bridgeport, CT.	Greater Bridgeport Regional Planning Agency	6 member Energy Steering Committee (policy) 7 Advisory committees - Public policy - Commerce and industry - Energy suppliers - Environmental - Planning and development - Transportation - Citizens/consumers	Creation of task force on cogeneration	Apportioning aggregate utility data	- Based exclusively on utility data and secondary source information - Time series data for three periods (1971, 1975, and 1978) - Disaggregation of regional totals to six municipalities	1971, 1975, 1978/2000
South Florida, FL	South Florida Regional Planning Council	Regional Planning Council (policy) Energy Working Group (technical advisory) Energy Review Group (review and coordination)	None	Planning methodology	- Development of regional-specific basic energy factors (BEF's) - Sample surveys conducted for commercial and industrial sectors	/1985
Toledo Area, OH	Toledo Metropolitan Area Council of Governments	20 member Energy Guidance Group (policy) 5 subcommittees - Community energy audit - Crisis contingency planning - Communications - Reading - Energy conservation	Originally planned 4 subcommittees - Community energy audit - Crisis contingency planning - Management strategies - Supplemental energy systems	Planning methodology	- Residential/commercial, and municipal sector individual audits for 144 small geographic data cells - Sample surveys and interviews conducted for commercial and industrial sectors - Addition of an agricultural sector	1978/2000 by 5-year increments

3. How does the audit information relate to the other phases of the CCEMP planning methodology and to local energy planning in general?

4. How have community organizational arrangements developed and functioned during the audit phase?

This section is organized around these four questions. For each question, the section gives relevant background on what was expected of the communities, the issues used in examining the audit phase, study findings, and preliminary conclusions derived from the community experiences to date. The period of interest is the process up to the completion of the audit, or April 1980, if the audit was not completed at that point. This date is approximately a year and a half after the two-year community projects started.

In order to give perspective to the sequence of activities communities are to do, Table 2 explains the planning methodology steps in Figure 1 (Introduction, page 3). The DOE/ANL work program, based on the methodology, calls for using the audit data to develop local energy management plans through the indicated steps.

The three-volume planning methodology presented to the communities, as is suggested by the table, is a highly detailed, far-reaching set of procedures, background technical information, and "cookbook" steps for conducting a traditional requirements-based analysis of energy management or conservation measures.* It was initially expected that communities would use at least the general framework of the methodology, if not the detailed procedure. The rest of this section and the report examine the degree to which communities did use the methods during the audit phase and identify some early lessons from their experience.

How Well Did the Audit Methodology Work?

A large part of the planning methodology supplied to the communities

*Comprehensive Community Energy Planning, Final Report, Volume I - Workbook, Volume II - Appendices, Volume III - Worksheets, HIT-703-3. April 1978. Prepared under U.S. Department of Energy Contract No. EC-77-C-0023. Hittman Associates, Inc., Columbia, Maryland.

TABLE 2. THE PLANNING METHODOLOGY DETAILS

Part I: Community Energy Audit

- Estimation of base year energy consumption by sector (residential, commercial, municipal, industrial, and transportation) by fuel type by activity for subcategories (parcels) of each sector, e.g., residential is subdivided into six separate parcels--single-family detached, single-family attached, etc. By estimating energy consumption for each parcel/activity/fuel use combination and adding across all fuels, activities, and sectors a detailed estimate of total community energy consumption for a base year is obtained.

Part II: Objectives Formulation

- Projection of consumption for a future year based on projections of change in the parcels (i.e., growth in single-family detached housing), again by each parcel/activity/fuel, adjusting for changes in energy efficiency where necessary.

- Estimation of fuel supplies for a future year that may be uncertain or in short supply and identification of potential shortages based on the projected community fuel requirements.

- Identification of community energy objectives by attempting to quantify the energy shortage for each fuel type related to each type of land use.

Part III: Identification of Alternatives and Strategies

- Identification of energy management alternatives with significant potential to accomplish energy objectives. This is based on use of the detailed audit information to show how various alternatives with associated costs and dollar energy savings affect energy conservation in land use/fuel types identified as community objectives.

- Identification of strategies for implementing alternatives and assessment of the impacts on the community of the various strategies.

Part IV: Implementation

- Incorporation of the objectives, alternatives, and strategies with legal authority, public support, and institutional arrangements to form an energy management plan.

- Establishment of periodic review and acquisition of funding.

deals with energy auditing. Communities have spent as much as a year on preparation of the audit and some have spent as much as 50 percent of their budgets on it. The critical question is how well did this "cookbook" approach work.

The Cookbook Approach

Two of the three premises underlying the planning methodology deal with the audit phase, namely: (1) to perform local energy planning it is necessary to have detailed knowledge of current and future energy consumption, and (2) if community physical characteristics, activities, and weather conditions are determined it is possible to estimate energy use patterns.

While the auditing method in the extreme is a highly detailed, data intensive exercise, the underlying concepts are straightforward.

The audit methodology for the residential, commercial, municipal, and industrial sectors consists of two parts: accounting of physical components and energy characterization as depicted in Figure 1 in the Introduction. An accounting of physical components will identify and tabulate all energy users for a base year and a future year. The physical accounting translates the community into categories and subcategories of land use with specific energy use characteristics (such as building square footage, number and type of street lights, etc.). These estimates are to be made for a base and future year. Figure 2 shows the steps used in the audit methodology.

The energy characterization involves correlating the detailed land use categories with energy consuming activities by fuel type (e.g., single-family residential space heating using natural gas). The first step in this correlation is an identification of the number of parcels (land use subcategories) using each fuel type for each activity. The product of this exercise is an estimate of the total square feet of given parcel type using a given fuel for a given activity.

The second step involves computation of energy use for each parcel/activity/fuel type combination. This is accomplished in one of two ways. Basic energy factors (typical annual Btu consumption per square foot) times heating/cooling degree days is used where no primary data are available.

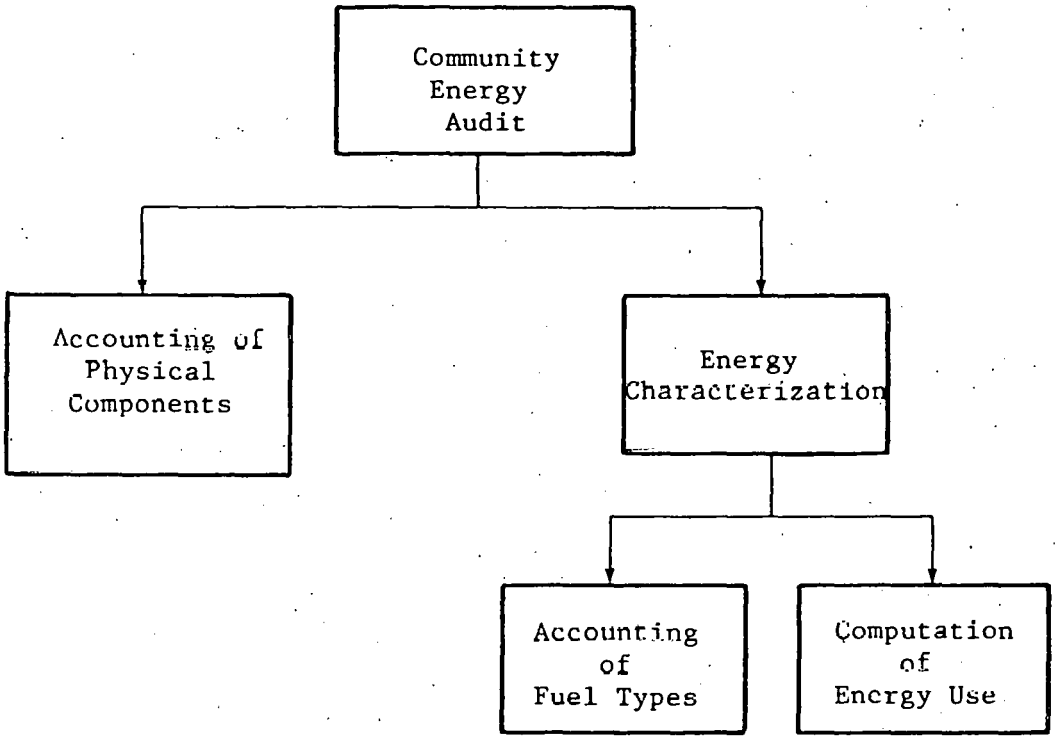

FIGURE 2: COMPONENTS OF THE COMMUNITY ENERGY AUDIT METHODOLOGY

Where primary data (energy intensity factors in Btu's/square foot) are available, these are used directly. Either of these values multiplied by the square footage gives the estimated annual energy consumption for each parcel/activity/fuel type. Aggregated, these give total annual energy consumption for the residential, commercial, and municipal sectors.

For the industrial sector, the method calls for surveys of local industrial fuel use or obtaining data from other secondary sources. These estimates are divided by number of employees in each of several SIC groupings to produce "energy intensity factors" for industrial sectors. These can then be used to "forecast" future industrial energy consumption based on employment forecasts.

The transportation audit involves estimates of vehicle miles traveled by various classes of vehicles, by fuel type. These data are multiplied by respective Btu's/mile to give total estimated energy transportation use.

Variations were expected in special data sources, level of detail, and other special analyses. Geographic variations also resulted in different planned approaches, since energy consumption data in the audit methodology were developed based on building characteristics of Baltimore, Maryland. While some of the larger, more energy experienced communities planned extensive primary data collection within the general audit methodology, many of the communities indicated in their work plans that they would use energy consumption data contained in the audit methods.

Evaluation Issues

The major concern for this part of the evaluation was the way in which communities applied the prescribed audit methodology. Specific questions

underlying assessment of how the audit methodology worked include:

- Did the communities find the audit methodology straightforward and practical to apply?
- Was the audit methodology used consistently in the detail that was suggested? If not, why?
- Were there differences among the sectors in the application of the audit methodology, particularly in data quality and availability?

Findings

Did the Communities Find the Audit Methodology Straightforward? All of the communities made slower progress on the audit than initially anticipated in their work plans. Most took an additional two to six months to complete drafts of the audit. As of April, 1980, some were still completing or refining the audit drafts.

Several reasons for extension of the audit period were given by communities. These include:

- Slow staff hiring (in part related to the sponsor's contractual process), staff turnover, and general staff inexperience in local energy analysis
- Unexpected problems in obtaining data, disappointment in sampling response rates for specific sectors, and discrepancies and non-comparability which required experimentation and approximations
- Delay in receiving utility send-out data from which to validate estimates
- Difficulties in reconciling estimates produced from "default" values in the audit methodology with aggregate sector data from utilities, requiring modifications to specific sector estimates
- Additional unplanned effort in coordinating and applying consultant products.

A number of communities also expressed concern that scientifically based stratified sampling and a much longer preparation period would be needed if consistent statistically reliable local energy consumption profiles are to be developed.

Was the Audit Methodology Used Consistently in the Detail That Was Suggested? The communities adapted the audit methodology in several different ways. While most stayed within the general framework,* there is considerable variation in methods of data collection and level of detail for the land use and activity/fuel estimates for the various sectors. The only significant departures from the general approach have been Los Angeles, Greater Bridgeport, Philadelphia, and Janesville. Los Angeles used a detailed state-developed econometric model for its base year and future year consumption estimates and Greater Bridgeport and Philadelphia used secondary source information consisting of sector level utility send-out data. Janesville is only doing the residential and municipal sectors using time series data.

Were There Differences Among the Sectors in the Application of the Audit Methodology? Within the five sectors of the audit (residential, commercial, municipal, industrial, and transportation), communities generally found the residential, municipal, and transportation sectors easier to deal with analytically than either the commercial or industrial sectors. There are several reasons for this result:

- The residential sector has detailed housing characteristic data available from the Census, square footage data (usually from the county property tax records), and the potential for relatively easy coordination of utility fuel data with specific housing stock. Exceptions include fuel oil data and the inclusion often of multi-unit apartments in the commercial sector of utility's billing classification systems.

- The municipal sector, in many communities, has already had some building-specific auditing performed under Title III of the National Energy Conservation Policy Act. Access to local

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* Land use-specific built-up sector estimates of base year energy consumption with detailed projections of future year consumption.

government fuel bill records also facilitates estimates of total municipal fuel consumption.

- The audit methodology for the transportation sector is comparable to data and projections made by communities' areawide planning agencies, thus facilitating regional transportation fuel use estimates.

- In contrast, the heterogeneous character of the commercial sector, the lack of systematic data on square footage, and the difficulty in obtaining establishment level utility data (buildings are often master-metered even when occupied by more than one type of establishment) presented communities with many information gaps in attempting a detailed audit. In several cases, the planning methodology "default" values were used for the commercial sector. Total sector consumption from the "default" values underestimated commercial sector estimates from utility or other sources by significant percentages. In some cases, the audit methodology fuel consumption percentages by subcategory (land use parcel) were simply multiplied by total commercial sector data from utilities to arrive at parcel estimates.

- Similarly, the planning methodology was of limited value in estimating industrial sector consumption. In smaller communities, some direct industry surveys were made. In others, industrial process models were used. Again, the wide variance in energy use, even within four-digit SIC code industries, limits fuel consumption estimates to only the most general level, if standard secondary sources are to be used. Also, industries are reluctant to release proprietary data for competitive reasons.

Conclusions

It is still too early to identify the types of benefits that may result from attempting a detailed built-up audit. Information that seems unrelated to the planning process at the conclusion of the audit may prove useful later. It is clear, with one or two exceptions, that the kind of detail actually achieved by the communities is less than envisioned in the audit methodology. While making a good faith effort to follow the workbook, many CCEMP communities eventually departed from it to get the job done within the time, money, and data constraints. This may suggest a less ambitious audit exercise with a larger fraction of resources focused on other phases of the planning process, particularly evaluation of alternatives. Conversely, more money and

time might profitably be invested in auditing if a statistically reliable detailed profile of community energy consumption is desired.

For many of the communities, the audit methodology, as applied, may have resulted in information that is too detailed for overview and general educational purposes, but not the type necessary to conduct the kind of initial feasibility studies envisioned in the planning methodology.

Strict application of the detailed audit methodology also probably would benefit from computerization as has been done in Dayton, Wayne County, TMACOG, South Florida, and Richmond. If the audit is to serve as a tool for analyzing specific alternatives, the capability to manipulate a variety of the energy determining variables is desirable. Dayton and TMACOG conducted audits sufficiently detailed to warrant computer-assisted manipulation. Both contracted at the outset large portions of the work to local universities. How this analytical capability serves the remainder of the planning process remains to be seen, since (as of April 1980) neither of these communities had begun work on subsequent phases of the project.

What Lessons Are There for Community Energy Auditing?

The audit methodology provided to the communities--namely, a built-up single year estimate of community energy consumption projected to a specified future year--is one alternative for developing local energy information. This section examines the broader question of auditing as it relates to local energy planning and policy development, drawing on the audit experiences in the CCEMP communities.

Alternate Purposes for Energy Consumption Data

A recent National Academy of Sciences report presents a useful classification of alternate purposes of energy consumption data.* The report classifies energy consumption data according to three possible uses with varying degrees of relevance to public policy development as follows:

- Describing and monitoring energy consumption
- Modeling energy consumption
- Assessment of energy policy.

Observations made in the National Academy of Sciences report help to give perspective to the CCEMP audit methodology and its application to date:

1) "Monitoring energy consumption provides information about the total amount of energy consumed, the forms in which energy is consumed, and the end uses served. . . . The limitations of monitoring for purposes of policy making are inherent in its all-inclusiveness: monitoring data reflect all the factors that influence energy consumption. . . .

2) Policy makers must be aware of changes in consumption, but they require a more complex kind of information as well--information that helps to explain the cause of such changes. The purpose of explanation, in contrast to description, is accomplished by the various analytic procedures called modeling. . . . Models of energy use are devices . . . such as statements of statistical relationships, mathematical functions, physical or engineering relationships and the like. . . for explaining the factors that have affected energy consumption in the past and may determine future consumption under various possible circumstances. . . .

   Empirical models of energy consumption can provide explanations and even estimates of the effects of public policies, but models are always simplified versions of reality and . . . their estimates are subject to error. . . . Policy outcomes typically remain problematic to some degree, even when a model has apparently predicted or explained them.

3) Responsible policy assessment requires knowing not only how and why patterns of energy consumption change, but also how those changes

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* Energy Consumption Measurement: Data Needs for Public Policy, National Academy of Sciences, Washington, D.C. 1977, pp. 8-9.

> may affect other economic, social, and institutional aspects of national life. Not all assessment activities require the collection of data different from those needed for monitoring and modeling. . . .However, some assessment activities require collecting different kinds of data, both experimental and non-experimental.
>
> The costs of implementing some proposed policies, the almost inevitable uncertainties and disagreements about their effectiveness, and the difficulty of identifying their specific effects contribute to the importance of controlled and randomized field experiments as a tool for policy assessment."

Evaluation Issues

This overview translates into a number of logical questions concerning the potential of the CCEMP audit methodology in serving the three uses--monitoring, modeling, and policy assessment. Questions include:

- As currently constructed, can the CCEMP audit methodology efficiently serve as a means for monitoring local energy consumption? If not, what are the alternatives?
- Similarly, does the audit methodology provide a cost effective modeling technique. If not, what are the alternatives?
- Does the audit methodology adequately serve policy assessment purposes? If not, what are the alternatives?

Findings

Use of the methodology involved a wide range of data sources, approximations and assumptions. There is a wide range in the reliability of information between sectors and within sectors. Generally, the audits produced insufficient detail within types of land uses to allow general analysis of alternatives. This community experience with the audit methodology gives some guidance on the above questions. Comments and observations by community staff also provide useful insights on the role of auditing in local energy planning.

Can the CCEMP Audit Methodology Efficiently Serve as a Means for Monitoring Local Energy Consumption? The audit methodology has certain weaknesses and

strengths for continuous monitoring of community energy consumption. While the framework is useful, one still must obtain direct sampling data for monitoring. Since many forms of energy delivered and used within a community are not centrally accounted for--e.g., fuel oil, diesel fuel, gasoline, and propane--the estimation methods included in the methodology are particularly useful for determining the level of reliance upon these fuels. Conversely, built-up single year energy consumption estimates are particularly unsuited for the continuous monitoring of community energy consumption. In order to update the initial "snapshot" of community energy use obtained from the audit, the entire methodology must be replicated involving new data inputs for sectors or subsectors of interest. Primary data collection is both time consuming and expensive while reliance upon secondary source data is likely to involve too long a time lag between reporting periods to be of value for monitoring purposes. A more cost-effective monitoring approach would use utility supply data for gas and electricity and sampling for decentralized sources.

Can the Audit Methodology Provide a Cost Effective Modeling Technique?

As designed, the audit methodology could be used to model community energy consumption, if the effects of changing fuel prices on consumption levels are assumed to be insignificant (prices will change but it's their effects on consumption that's important to the audit). The potential as a modeling tool, however, requires extensive financial, analytical, and managerial resources including, probably, computerization of audit components. The high costs and the exclusion of price variables raises two questions. First, if the local energy economy is to be modeled, what level of government should handle it? The California Energy Commission utility service district econometric model is an example of state developed models for local areas. Given the resources required, locally developed comprehensive models would appear impractical in most communities. Second, is the CCEMP audit methodology the best approach? This question cannot

be answered here, but the exclusion of economic variables from the method limits the model to a physical requirements or "needs" approach.

Does the Audit Methodology Adequately Serve Policy Assessment Purposes?

It is too early to judge if the audit methodology is useful in policy assessment since many communities were working on that part as of this report. From the community experiences, it is clear that additional analysis outside the audit framework will be needed if energy management alternatives are to be fully evaluated.

Conclusions

The various purposes for making community energy consumption estimates lead to the following conclusions, focused on community experience to date with the CCEMP audit methodology.

- For purposes of monitoring general community energy consumption, or for evaluating the effectiveness of specific programs, utility billing data would provide a much more cost-effective source than information generated from the audit methodology if billing categories can be easily modified to reflect land use sectors. Limited geographical and billing category modifications of most utility management information systems could provide accurate, timely information for any community monitoring activities. The cost to utilities and their willingness to provide such information, however, are important considerations in relying on this alternative for monitoring. An additional limitation would be relatively heavy reliance on decentralized sources, certainly in the transportation sector, but also in places relying on fuel oil, e.g., for space heating.

- The audit methodology does have potential for use in local energy modeling and policy analysis, given its emphasis on quantifying subsector energy consumption based on the physical characteristics of building and appliance stock, weather, and average use characteristics. A larger problem is the resources that would be required to produce statistically valid consumption estimates. In particular, stratified sampling within each subsector is necessary for accurate consumption estimates. Unfortunately, the audit methodology does not include the influence of price on energy consumption, which limits the use to simulation of physical changes in which price effects are implicitly assumed in the consumption characteristics.

- If comprehensive auditing is undertaken, alternatives to an expensive detailed built-up audit would include accessing utility data on a disaggregated geographical and sectoral basis. Again, the potential

for this varies from community to community. Correlation of building specific consumption data with sample surveys of building characteristics would provide decision-making information useful in evaluating alternatives and strategies.

- In spite of the shortcomings of the audit methodology, a simplified cookbook approach does seem to be useful for most communities. Sector level analysis of time trends in centrally distributed fuels and sampling and secondary information for decentralized sources would provide sufficient background information for starting the planning process. Detailed analyses of energy use should probably be done only for specific subsectors where there are known problems and for specific alternatives and strategies that seem likely to be implemented.

How Does the Audit Information Relate to the Other Phases of the CCEMP Planning Methodology?

The planning methodology provided to the communities builds sequentially from a detailed comprehensive audit to a series of other related planning tasks. The length of time required for the audit and the tendency for policy advisory committeees to want to deal with issues and alternatives rather than preliminary audit data have led many communities to alter their application and timing of the suggested planning methodology.

The Planning Methodology

Figure 1 (page 3) outlined the major elements of the planning methodology. The methodology calls for using the audit data to support the other phases of the planning process, as was shown in Table 2. The planning methodology instructs communities to set quantified energy reduction targets for each fuel type anticipated to be in short supply as determined by projections of future demand and supply. Objectives are then to be established by relating percentage reduction targets to land use categories most affected by shortages and which have the greatest potential for demand reduction. The energy audit is essential to this procedure, as future demand/supply projections for the various fuel types must incorporate base year energy demand levels.

Issues

The issues associated with the use of the audit in subsequent stages as distinct from how the audit was prepared can only be partially assessed at this stage of the pilot projects. These are:

- Have the communities used the audit results and demand/supply projections to establish energy management objectives as suggested in the planning methodology? If not, what alternative approaches have they used?

- Are the planning activities proceeding on a sequential or linear basis, as suggested in the planning methodology. If not, how are the communities proceeding with the other phases of the planning methodology?

Findings

Have the Communities Used the Audit and Projections to Establish Objectives?

- Most communities started the objectives setting process or other tasks before audit results were available. Consequently, the objectives formulation phase was done concurrently with the base year energy audit rather than as a result of the audit.

- Communities did not use the planning methodology as an aid for setting objectives, i.e., adding projected demand to the audit results and comparing these requirements to forecasted supplies to quantify projected fuel shortages by land use categories. Some communities simply rejected the shortage concept without attempting demand and supply projections. Instead, these communities chose to incorporate a broader array of concerns into the objectives setting process. Others, later in the process, did attempt demand and supply forecasts. However, the inherent weakness of small area supply forecasts required the extrapolation of utility service area, state, or national estimates. When compared to demand projections, the forecasts did not disclose future shortages. The lack of confidence in supply projection methods and results made communities reluctant to base objectives on any findings.

- As a result, expected supply shortages, or the gap between demand and available supplies, was not found to be a useful basis for setting local energy objectives. Communities typically used group process techniques to identify fuel specific problems. Problems included rising prices, potential supply interruptions or capacity limitations, or the relation of fuels to other resource management problems such

as air quality. The detailed energy audit results conditioned the final selection of objectives--by providing a basis for adding or deleting particular objectives and provided empirical support for objectives selected.

- Some communities have reordered the objectives formulation phase. They will derive quantitative sector objectives from baseline projections of future fuel consumption and the reduction in fuel consumption resulting from specific energy management alternatives.

Is a Sequential Planning Process Being Used?

- Several of the communities (particularly the larger ones with more previous experience in energy) identified specific energy management alternatives before completing the audit. Many communities already have a variety of energy related projects and programs underway. Although a "comprehensive" energy planning exercise could be developed independently of other current programs, these communities have attempted to use CCEMP as an integrating force, building around existing efforts.

Conclusions

These various departures from the planning methodology suggest the need for a more flexible community energy planning approach. Flexibility is needed to:

- Permit the use of more simplified and expedient methods for the base year energy audit
- Accommodate a wider range of community energy issues in the objectives formulation phase
- Allow for variation in the ordering of tasks and/or timing of their performance.

The time, effort, and cost of producing a comprehensive energy audit does not appear to be worthwhile when measured against its usefulness to setting community energy objectives. A more simplified and expedient audit procedure is needed; one that would permit communities to derive reasonable estimates of total fuel use by various land use sectors. Detailed analysis of individual sector consumption patterns and activities could then be performed on an "as needed" basis to support decisions about objectives and energy

management approaches. The potential for a more simplified procedure already exists in utility billing records (for centralized energy forms) and the default procedures supplied in the methodology for non-centrally reported fuel types.

Experience with the objectives setting phase has indicated that the "gap" approach is technically impossible and further, unrealistic. Potential energy shortages are but one of several critical issues perceived as being relevant to local energy management planning. Consequently, the planning methodology for the objectives setting phase appears to be flawed based on community experience to date.

The strict ordering of planning tasks has also been altered by more than half of the CCEMP communities. Several communities reordered the sequence of tasks or began other tasks not specified in the planning methodology following completion of the audit. Others have found that later tasks are not discrete, but rather blend into one another. Hence, in these communities the planning process has become more iterative than consecutive.

These tendencies suggest the need for greater flexibility in the arrangement and timing of planning tasks. For some communities, particularly smaller inexperienced communities, an ordered sequence of steps may prove useful. However, others may require flexibility in order to adapt the process to established planning approaches or to accommodate previous and present energy activities.

How Have Community Organizational Arrangements Developed and Functioned During the Audit Phase?

How the communities have organized to conduct their planning processes and how these organizational structures are functioning provide useful information to other communities engaging in local energy planning. For this

report, the concern is largely the functioning of the planning process during the audit phase.

Community Organizational Structures

The CCEMP pilot project called for certain minimum organizational or management structures including advisory committees and public access. Within that mandate communities have chosen a wide range of organizational structures.

Regardless of which local government agency has responsibility for the planning process,* all of the communities are characterized to varying degrees by the following management forms:

- A full or part time project director and core staff, sometimes student interns and in some cases staff on loan from other departments. The CCEMP staff generally has major responsibility for advisory committee coordination, for technical products, intragovernmental coordination, and in some cases public outreach.

- Technical work performed either directly by staff, with the assistance of consultants, or in some cases completely by consultants.

- Policy advisory committees with representatives of various community interests, utilities, and department personnel. These committees in their various forms are intended to serve a range of functions depending on the specific community. The various community advisory committees are expected to assist in product review, provide technical direction, secure planning resources, facilitate public outreach, promote coordination between government and the private sector, and facilitate implementation through the political process. These expectations vary by community and by the stage of the planning process. They are often assisted by subcommittees, technical committees, or task forces with more limited jurisdiction.

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* Of the general purpose governments (excluding three areawide planning agencies) all but three located the function in agencies with some form of implementing authority or in coordinating offices reporting directly to the chief executive.

- Integration of the plan with traditional community functions through the process of plan development and by presentation to and/or formal adoption by the local political body. The integration process is expected to become most critical as the process approaches consideration of specific energy management alternatives and faces the plan adoption process.

- Public participation through means such as workshops, public hearings, interest group representation on advisory committees, and the news media. Sustained public participation in the planning process is important in achieving support for energy management alternatives and plan adoption.

Evaluation Issues

The concern in assessing community planning processes is to identify any general lessons that may be useful to management of audit activities in other communities. Concerns guiding assessment of community experiences during the audit phase included:

- What role did advisory committees play during the audit?
- How have staffing and consultant arrangements worked?
- What role have public utilities played in assisting with the audit?
- Have elected officials participated during the audit phase? In what ways?
- Has the CCEMP planning process resulted in early implementation and spinoffs?
- How has the public been involved during the audit phase?

Findings

The above questions are covered in some detail in Section V. Key findings include:

- For a number of communities, there has been a tendency for advisory committees to lose interest in the process during conduct of the audit. Reasons given for this difficulty include the long period associated with the audit, the technical nature of the audit exercise, and concerns with the validity and policy relevance of the

information produced. But some have used the period to focus on education and training of committees by sharing and discussing preliminary audit results, writing issue papers, and bringing in guest speakers.

- In some communities initial committees had to be repopulated with individuals with more direct experience or interest in energy or the sectors being examined.

- In many cases, changing composition of policy committees has been a natural process of moving from the organizational phase to a phase requiring more specialized backgrounds. By plan or by necessity, committees have been expanded to task forces or subcommittees for dealing with the audit sectors. In communities where advisory committees serve broader roles than CCEMP, special task forces have been established. Establishment of task forces for contingency plans in response to the 1979 regional gasoline shortages is an example.

- The use and management of consultants' work has been another area of challenge. The major issue is integration of consultant work with the community planning process. Knowing precisely how to use the information developed by consultants has presented some communities with a gap between analysis and policy evaluation. This has been particularly true of some of the smaller communities.

- Revision of initial scope and focus of consultant contracts has also been a challenge as communities gained greater understanding of the nature of the audit and planning requirements. In some cases, consultants helped write the original responses to the Program RFP. In at least one case, major revisions and reordering were done to bring consultant work products in line with revised analytical approaches.

- On the other hand, two communities have delegated the entire audit (and subsequent analytical work) to consultants. The results for the planning process are not yet apparent, but more likely will depend more on the quality of personnel and the nature of working relationships than any specific division of responsibility among consultants and staff.

- Although use of outside consulting assistance is a matter of community operating procedures and in-house capabilities, timing of consultant assistance appears to be important in how effective their products are to local planning efforts. Waiting until the community has a clear idea of what products will support their planning objectives appears to be essential in effective use of consulting assistance.

- Although some projects have been affected by normal staff turnover, a more common issue has been slow progress or lack of staff experience with energy analysis affecting the start-up time on the audit, particularly for those communities doing work in-house. Development and training of staff is anticipated as one of the program benefits.

- Information and assistance from investor owned and municipal utilities have been essential in preparing community energy audits. All the

communities received data assistance from their utilities. Utility compliance with data requests, however, has sometimes required special efforts or went beyond their automated information capabilities.

- For the most part, elected officials have not played an active role during the audit phase. This is hardly surprising, since many of the communities also had trouble keeping up attendance at their policy advisory committee meetings.

- Political events have also influenced the pilot projects to varying degrees. Since CCEMP is an experiment, with untested processes and often high visibility, it has been vulnerable in some communities to redirection as a result of political leadership changes. It is too soon to judge the effect of specific redirections, but in one case they have acted to reduce the breadth of the project, focusing efforts more narrowly on government operations or more readily implementable activities.

- A number of communities have proceeded with energy management actions, concurrent with the planning process. Directly or indirectly, CCEMP project staff and advisory committees have helped in the implementation of several community energy activities. Many of the early implementation actions were planned by communities at the outset of the program, with CCEMP serving in part as a coordinating mechanism. In other places, early project spinoffs are more directly related to activities of CCEMP committees and staff. While CCEMP is an exercise in energy planning, there is a natural and strong tendency for communities to follow lines of opportunity at the time they occur, using these projects later as part of the community energy plan.

- Citizen and community organization representation on CCEMP committees continues to be the principal means for public involvement in the planning process. Efforts to broaden public involvement during the objective setting phase, beyond committee membership, are limited to only four communities. Hence, for most communities, the extent of consensus and commitment achieved during the objectives setting phase extends to only those interests represented within the CCEMP committees. Public awareness activities have been emphasized by all CCEMP communities. However, expanded efforts in a few communities suggest that public awareness will emerge as a primary strategy for implementing energy actions.

Many of the preliminary conclusions presented in this summary section will be reconsidered after the communities conclude their pilot projects. The subsequent sections of this report present examples and detailed findings in support of these preliminary conclusions.

III. THE AUDIT AND PROJECTION METHODOLOGY: HOW WELL DOES THE COOKBOOK APPROACH WORK?

This section considers the questions of how well the audit methods worked and the lessons to be learned. Since community projections of future energy requirements and probable supplies are closely tied to the audit, these activities are also examined. Topics covered include:

- An overview of alternate methods used in conducting the base year audit and demand/supply projections
- Sector level review of community audits
- Summary of lessons for other communities.

Because each community's experience with the audit methodology tends to be unique, the number of general conclusions that can be drawn is limited. Community examples show the numerous ways auditing was approached and suggest a number of patterns. With few exceptions, these patterns are common to all the communities with little distinction between type of community (government form, size, geographic location, economic base, etc.).

There are two purposes served by a review of experience with the audit and projection methods.

- Other communities may learn from the experience
- Specific changes, if necessary, can be made in the methods.

Alternate Methods Used

For all but four communities the audit methodology served as a general framework within which communities made changes to accommodate data limitations and local conditions. Based on comments by community staff, the audit framework worked better in some cases than others because:

- The more important communities thought it was, the more careful job they did. Some communities wanted detailed energy consumption data based on earlier experience with energy management where only general data could be obtained.

- The more previous local energy studies and analyses available, the easier it was for communities to conduct the audit. The ready availability of other energy studies (utility appliance saturation surveys, state level sector consumption estimates or forecasts, individual building audits, etc.) made application of the audit methodology more practical for many communities. Less reliance was placed on methodology "default" values, thus improving the credibility of audit findings.

- The more experience communities had, the more they knew what they wanted the audit to do, and the more variations they made in its application. Prior local energy experience has made a difference in how communities have approached the audit. Those without prior experience have more typically followed the cookbook approach. On the other hand, the physical and political complexity of two larger energy experienced communities resulted in dropping the audit methodology in favor of other approaches.

- Most communities attempted to follow the detailed methods required by the program sponsor. Because CCEMP is an experimental program, DOE and Argonne contract expectations called for a detailed built-up audit. Communities were initially committed to this concept, but the outcome has varied widely within the general spirit of the required method. A number of communities, toward the conclusion of the audit exercise, increasingly viewed the detailed audit more as a contractual requirement than as information useful to energy decision making at the local level.

Greater variation occurred with respect to methods selected to complete projections than to do the base year energy audit. However, this pattern might be expected given (1) the diversity of time horizons selected by communities, (2) the two components of the projection task--demand and supply, and (3) comparative lack of prescription in the planning methodology for the projection exercise.

Key questions governing this part of the audit review include:

- What alternatives to the audit framework were applied and why?

- How were primary data generated for use in the audit methodology?

- Are there any distinguishing differences among types of communities in the application of the audit and projection methodology?

Base Year Audits

Three approaches were used to complete the base year energy audit. These included use of:

1. Audit Methodology--Detailed sector-specific primary data and/or use of audit methodology coefficients to produce parcel (land use) activity/fuel type consumption estimates, usually validated by aggregate utility consumption data. There were also a number of specific variations to this approach.

2. Sector-Level Estimates--Aggregate sector consumption data apportioned between parcels (land use) and/or end uses from sampling, audit methodology coefficients, or other secondary source proportions.

3. Econometric modeling.

Audit Methodology. Most communities, 12 of 16, completed the base year energy audit using the general framework specified by the audit methodology (No. 1 listed above). Primary data, when assembled for the physical accounting and energy characterization, were usually obtained by one of four techniques:

- Sample surveys--mailed surveys to building owners requesting building characteristics and energy use from utility records
- On site audits--Class A (or B)* audits of sample buildings
- Utility billing statements--correlated with general land use categories
- Disaggregating utility supply data.

These techniques were most often used in connection with the major parcel/activity/fuel type combinations of the residential, commercial, industrial, and municipal sectors. Other parcel/activity/fuel type combinations within these sectors were usually estimated by applying audit methodology default values and energy factors. Transportation was the only sector for which secondary data

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* Class A: On-site accounting of energy use and performance.
  Class B: Use of averages and computer algorithms to estimate typical energy use and performance.

in the form of vehicle miles traveled by mode were the principal data source for most communities.

One advantage provided by sample surveys was the opportunity to obtain additional information beyond that required to generate consumption estimates. Supplemental information obtained through sample surveys was thought to be useful or necessary for the alternatives/strategies phase. Such information often included items such as insulation levels, past conservation efforts, structure/operation characteristics, future plans, and opportunities for co-generation.

Interestingly, no community was successful in completing stratified sampling for individual parcels. Reasons for this varied, but primarily involved poor response rates to mailed surveys within subcategories of the various parcels. Hence, estimates of variables called for in the audit methodology, such as average square feet, were computed as simple averages for all structures within a particular parcel, regardless of the diversity of building types within the parcel.

Variations to the Audit Methodology. While 12 communities complied with the general audit methods, some within this group either supplemented the methodology or made specific adaptations as shown in Table 3. Three types of changes are particularly noteworthy:

- Development of multiple base year energy audits based on small areas
- Supplemental energy audits
- Modified approaches to specific sectors, notably the industrial sector.

Small Area Audits. Two communities, both having many political jurisdictions within their planning areas, prepared multiple base year energy audits at small area scales. The units selected by the Toledo Metropolitan Area Council of Governments (TMACOG) were 144 Census Tracts.

TABLE 3

VARIATIONS TO METHODOLOGY

Small Area Audits	
TMACOG	- for residential, commercial, and municipal
Wayne County	- all but transportation
Supplemental Audits	
Richmond	- building type and small area
TMACOG	- agricultural
Sector Specific Audits	
Boulder	- commercial and industrial Class A audits
Seattle	- industrial Class A audits
King County	- industrial Class A audits
Allegheny County	- commercial as residual from total county consumption
Other	
S. Florida	- region-specific basic energy factors

Enumeration Districts, and Minor Civil Divisions. Initially, all sectors except transportation were to have been developed at this scale to permit aggregation by political jurisdictions and to provide more sensitivity in the assessment of strategies by examining their applicability to a variety of areas with different structural and energy-using activities. Subsequently, the industrial sector audit was lifted to the total planning area scale, to avoid the disclosure of individual industries, and the transportation audit was conducted at the level of 39 traffic districts, the smallest geographic level of data availability. This approach also entailed other liabilities. Working at such a small scale necessitated the use of sample surveys to obtain critical physical accounting and energy characterization variables for the residential, commercial, and industrial parcels, and utility supply data organized by meter reading districts to validate estimates. Obtaining valid sample responses for all parcels within 144 areas proved difficult and delayed the receipt of utility supply data.

The second community to develop multiple base year energy audits was Wayne County, Michigan. Unlike TMACOG, the units of analysis selected for these audits were the 42 suburban political jurisdictions comprising the balance of Wayne County outside Detroit. The decision to develop individual audits for each of the communities was tied to the overall program objective of developing policy options for incorporation in local community

energy plans. Individual community audits were prepared entirely from secondary information for all sectors except municipal and transportation.

Supplemental Audits. Audits not specified in the planning methodology were undertaken by two of the communities, TMACOG and Richmond, Indiana. The TMACOG base year energy audit incorporates an agricultural sector, examining operational (all energy used directly) and invested (energy embodied in fertilizers, herbicides and pesticides) energy for different crops and livestock. This sector was added because 63 percent of the land use acreage within the planning area is devoted to agricultural production. Two supplemental audits were performed as part of the Richmond, Indiana base year energy audit. The first set includes audits of local building types, studying patterns of use, equipment types and age, and building condition and age. These audits were conducted on 12 commercial/civic buildings, 16 municipal buildings, and 40 residences. Two district audits were also performed, one in the central business district and another within a high-density suburban commercial district, to determine the potential for Integrated Community Energy Systems (ICES) districts. Results from both sets of audits are anticipated to provide information to aid in the selection and assessment of alternatives/strategies.

Sector Specific Modifications. A majority of communities that followed the planning methodology for the base year energy audit abandoned the prescribed classification scheme and Btu/employee per year energy intensity factor for the industrial sector. Instead, most simply obtained the fuel amounts consumed by industries based on two-digit Standard Industrial Classification (SIC) classes. This method was usually selected after attempting to use the suggested approach, which often yielded inaccurate estimates. More radical departures were undertaken in Boulder, Seattle, and King County. Boulder conducted 45 Class A audits of commercial and industrial buildings to identify viable conservation measures. Building upon previous audits, Seattle and King County conducted Class A audits of an additional 29 firms to determine fuel use by various industrial process end uses. This method of auditing was perceived as superior to use of the SIC classification scheme because it provides the type of information necessary to determine the opportunity for cogeneration and the substitution of fuel types.

Allegheny County estimated commercial energy use by subtracting all other sectors from total County consumption. This procedure was followed after estimating consumption via the methodology, which yielded estimates at least 50 percent below the residual totals for all fuel types.

Other. South Florida developed region-specific basic energy factors for all parcel/activity/fuel type combinations. Such region-specific indexes were thought necessary because of the unique climatic, construction materials, and energy using practices in the Miami area.

Sector-Level Estimates. Three communities departed from the supplied methodology and developed sector-level estimates from utility energy supply

data. The communities were Philadelphia, the Greater Bridgeport Regional Planning Agency, and Janesville. Philadelphia and Greater Bridgeport developed base year energy audits by apportioning aggregate community energy supply data between consuming sectors. Other communities used this approach for individual sectors when the built-up audit estimates proved highly inaccurate. Janesville, which audited only the municipal and residential sectors, disaggregated utility data for electricity and gas residential usage for each year from 1970 to 1979. Both Philadelphia and Greater Bridgeport used local and national sampling data and other secondary sources to distribute energy supply totals between the five major audit sectors. Although similar in approach, the rationale for selecting this method was different in each community:

> Philadelphia's initial approach to the base year energy audit involved stratified sampling of the four structure-based sectors. Detailed local data were thought necessary to support sector-based task forces to develop objectives and assess alternatives appropriate to the scale and diversity of the city. However, consultant efforts to complete stratified sampling in the residential, commercial, and industrial sectors proved unsuccessful: Too few households volunteered for free energy audits; most industries had incomplete data due to their small size; and a low response rate was encountered in the commercial sector mail survey. This approach ultimately had to be abandoned and a much quicker method adopted to complete the audit. Consequently, a "citywide audit" was conducted based on a compilation of available secondary source data from the electric and gas utilities, the Air Management Services Department, and from published surveys. City-specific data were available from each source but not always organized according to the CCEMP energy use sectors. Therefore, both local and national survey data were used to allocate fuel types between sectors and among parcels within the sectors.
>
> Adoption of this approach by the Greater Bridgeport Regional Planning Agency was motivated by different circumstances. Because the region is heavily dependent upon imported oil, the audit was used to assess changes in energy use resulting from the embargo and escalating petroleum prices. Accordingly, three different years were examined: 1971 (pre-OPEC embargo), 1975 (after the embargo), and 1978 (last year of reliable data). The most convenient and least costly method of completing these three time series audits was to utilize available secondary data, estimating use by fuel type for each sector from aggregate supply totals for each year. For each sector, descriptive physical profiles were developed and energy consumption was presented by fuel type and cost. Regional totals were then disaggregated to each of the municipalities within the planning area.

Econometric Model. The third method of completing the base year energy audit and demand projections was through the use of an econometric model. Only one community, Los Angeles, followed this approach. The city started out using the audit methodology, but finishing the energy audit was impeded by staff turnover and local data sources that were not compatible with the methodology. The discovery of such difficulties coincided with the publication of the California State Energy Commission forecasts of electricity and natural gas consumption by major utility service territories for 1978 and 2000, one of which was the City of Los Angeles. The Commission's data and forecasts were based on locally derived information with clearly stated assumptions and models for estimating sector-by-sector consumption for a variety of end uses within most of the major sectors. A comparison of preliminary audit methodology results with the Energy Commission base year estimates suggested that the Commission estimates were both more reliable and more useful. Subsequently, the Commission model was used in lieu of the audit methodology for all sectors and subsectors except street lighting, where the audit methodology was judged to produce more accurate results.

Demand Forecasts

The methods used to forecast energy demand vary most according to the time horizon selected by communities. Those adopting short-term horizons, of up to ten years, most commonly forecasted the change in physical components by extrapolating past growth trends within individual sectors. Variations to this procedure included ratio techniques, projecting change in sector physical components on the basis of per capita ratios multiplied by the total change in population (Greenville, North Carolina), by adding or deleting physical components to the base year on the basis of known commitments (Dayton, Ohio), or by modifying utility forecasts for individual sectors (Portland, Maine).

Long-term forecasts, greater than ten years, were typically accomplished by using economic base models developed for local jurisdictions. Key forecasting variables obtained from these models included total population and employment by two-digit SIC classifications that were converted to net additions or deletions from the base year count of physical components by sector.

Although different in approach, both short- and long-term forecasting methods were alike in that they produced only projected additional units--housing units, commercial establishments, or industrial employment. Most communities did not modify other factors included in the demand estimation methodology such as average square feet per parcel, fuel splits for activities, or energy intensity factors. Instead, these were generally held constant to project a "Base Case", or present conditions, scenario into the future. When modifications to these factors were made, they commonly included the following assumptions:

- Lower than projected housing and industrial components to account for physical limitations (land availability) in mature jurisdictions with relatively fixed boundaries
- Higher energy efficiency standards in new commercial structures, reflecting new federal standards
- Improved auto and truck fuel efficiencies from values supplied with the audit methodology.

Supply Forecasts

Only half of the communities developed energy supply forecasts, as called for by the planning methodology. These communities were evenly split in their use of Department of Energy and local utility forecasts of future energy supplies. Department of Energy forecasts were excerpted from the Annual Report to Congress and localized according to a constant per capita share on the basis of current ratios. Utility forecasts were often limited to electricity and natural gas and were seldom available for a particular jurisdiction, but

rather, for the utility service area. Advantages cited for the U.S. Department of Energy forecasts were the coverage of all conventional fuel types and the development of alternative supply scenarios. Disadvantages noted were that the long-term price scenario for gasoline has already been exceeded in certain areas.

Communities electing not to develop energy supply forecasts frequently characterized the exercise as irrelevant. Reasons cited for this perception included:

- Territorial discrepancies between the planning jurisdiction and the utility service areas, such that supply/demand gaps would be of a regional scale
- Greater concern over energy pricing than availability
- Greater concern over supply interruptions and temporary shortfalls than long-term availability
- Lack of local control or influence upon the availability of centralized energy forms and petroleum
- Uncertainties associated with the amount and form of future energy supplies.

Adaptations to the energy supply forecast task were undertaken by several communities. Seattle and King County, Washington, did not prepare energy supply forecasts. Instead, both used an econometric model to simulate the effects of different energy type price scenarios. These simulations produced estimates of the relative proportions of fuels used in the residential, commercial, and industrial sectors for the projection year demand estimates. This adaptation was made in response to local concern over a likely price-induced shift to greater electrical energy use due to electricity's comparatively cheaper cost in the northwestern United States. Another adaptation, investigated by Seattle, Washington, and Richmond, Indiana, was the potential supply contribution from renewable energy sources.

Sector Audits

This part discusses community experiences in developing base year energy consumption estimates (audits) for each of the five major sectors. The main purpose is to present the range of approaches used and problems encountered in attempting to apply a detailed comprehensive audit methodology. Observations pertain only to those communities which generally followed the audit methodology to complete the base year energy audit (12 of the CCEMP communities). Organized by sector, the discussion focuses on the application of the audit methodology, types of problems encountered and modifications made, community assessments of the validity of results obtained, and sector-specific data sources and methods. Three general conclusions regarding the technical merits of the audit methodology for the base year energy audits are clear from the community experiences:

- The audit methodology can produce reasonably valid estimates of energy consumption for the residential, transportation, and municipal sectors and sufficient detail to support policy development;
- The methodology does not work well for the commercial-civic-institutional or the industrial sector in terms of producing reasonably accurate energy consumption estimates or specific detail for policy development purposes; and,
- Only electrical and natural gas energy consumption estimates are capable of being easily validated. All other fuel forms included in the methodology lack centrally reported data, making validation difficult and expensive.

Residential Sector

Most communities expressed satisfaction with use of the audit methodology for the residential sector. Total sector electrical and natural gas consumption estimates most often compared favorably with actual use data provided by utilities, regardless of whether primary data or secondary source information was used. One consultant commented that, "The methodology for calculating energy

usage for the residential land-use activity appear to be the most highly developed and also the most accurate in predicting results."

Communities were evenly divided in their use of primary and secondary data sources to complete the residential base year energy audit. Comparatively few modifications to the audit methodology were made. These usually involved the adoption of fewer parcel (subsector) categories than outlined in the methodology. Local-specific data requirements for parcels in the residential sector included total occupied dwelling units by type, total residential population, average square feet per dwelling type, and fuel fractions for each of the five residential activities by dwelling type. In contrast to most other sectors, these data could be obtained from secondary source information. The use of primary data collection techniques was usually motivated by the early recognition of this sector as a major consumer of energy and as having the most potential for conservation. Primary data were collected by two methods, sample surveys of households and detailed analysis of utility records and surveys.

Table 4 identifies the various secondary sources used to obtain specific data for the base year residential energy audit. While a multitude of alternative sources exist for estimating total occupied housing units by type, the range of sources for the other data requirements is quite limited. Residential population was most often determined from U.S. Census Reports. The most common method of determining average square feet by dwelling type was to sample county tax records--usually a laborious time-consuming exercise due to the manually recorded format of the data. Although the U.S. Census of Housing, Detailed Housing Characteristics, does provide fuel fractions and appliance saturations* for four of the five residential subsectors, the data are for total occupied

* Percentage of a potential market owning a given appliance.

TABLE 4. RESIDENTIAL BASE YEAR ENERGY AUDIT SECONDARY SOURCES

	LOCAL-SPECIFIC DATA	SOURCES
I.	Total Occupied Dwellings, by type	1970 U.S. Census of Housing, Detailed Housing Characteristics Local building permit and demolition records Utility Residential Accounts Water Bill Mailing Lists County Tax Records Planning Department planimetric maps R.L. Polk Co.-Profiles of Change U.S. Postal Vacancy Surveys HUD Housing Market Surveys U.S. Annual Housing Survey (Bureau of the Census)
II.	Residential Population	U.S. Census of Population Current Population Series Reports
III.	Average Square Feet	County Tax Records Boards of Realtors Apartment Association/Boards
IV.	Fuel Splits	1970 U.S. Census of Housing, Detailed Housing Characteristics U.S. Annual Housing Survey Utility appliance saturation surveys

housing units and they are 10 years old. Consequently, limitations of this source are: (1) the inability to derive fuel fractions and appliance saturations specific to each dwelling and type; and (2) the age of the data base.

Of the eight communities using primary data collection methods, three obtained utility records and surveys to satisfy local residential data requirements. This method was only common to smaller communities, those with 100,000 or less population, two of which operate their own gas and/or electric utility.

The method involved the development of discrete parcel or parcel/activity fuel consumption from total residential sector billing account data. Utility appliance saturation survey data were particularly useful in developing the parcel/activity fuel amounts. The principal advantage of this method is that, instead of estimates, actual fuel amounts consumed by parcel and/or parcel/activity combinations can be developed. However, actual consumption data are usually limited to only natural gas and electrical energy forms, as centralized accounting records are not kept for other fuels.

One community within each of five community groups in Table 1 conducted sample surveys of households. Three distinct types of information were commonly requested through mailed survey questionnaires:

- Structural (dwelling type and square feet) and energy using (equipment and corresponding fuel source) characteristics of the dwelling and households to satisfy local-specific data requirements of the methodology
- Annual fuel consumption by fuel types--usually requested by having the respondents return signed utility billing statement release forms, enabling the calculation of local basic energy factors
- Supplemental information regarding energy sensitive characteristics of the dwelling--insulation levels, existence of double glazed windows, etc., desired for the alternatives/strategies assessment phase.

While the sample survey approach held forth the promise of producing a broad range of information, low return rates often diminished the usefulness of data obtained. Statistically valid returns, as measured by the number of respondents, were often limited to only the predominant parcel type (single family detached) and the major fuel types (electricity and natural gas). Moreover, even when fuel oil billing statement release forms were returned, suppliers often did not have annual billing/supply data on hand. Consequently, many of the parcel/activity combinations within the residential sector were

often completed using secondary source information. Under such conditions, stratified sampling within particular parcels was not attempted.

Of additional note is that two communities initially attempted to use individual residential audits as the basis for the residential sector audit. Both communities, Boulder and Philadelphia, abandoned this method after low response rates were encountered. The Boulder effort was linked to the Public Service Company--Home Audit Program. The slow start of the program coupled with the requirement that results would be provided to the city only via signed releases diminished the number of household audits obtained by the city. The Philadelphia Free Energy Analysis program was operated through the City Department of Licenses and Inspections using CETA workers. Homeowner fears of code violation citations and the inexperience of CETA workers combined with the timing of the program in the summer--when fuel bills are normally less--resulted in an extremely low response rate to the program.

Commercial Sector

Numerous problems were encountered by communities in the development of the commercial-civic-institutional sector base year energy audit. As a consequence, energy demand estimates generated for the various parcel/activity combinations within this sector are acknowledged by most communities to be of questionable accuracy. Reasons for difficulties with the sector energy audit include:

- A wide diversity of structural and operational characteristics between parcels within the sector, ranging from warehousing to nursing homes, raising doubts as to the validity of estimating energy use through similar activity measures for all parcels
- Considerable variation within parcels, in terms of the scale and age of structures or types of establishments (the retail parcel includes five establishment categories), which make the

development and use of parcel averages in the physical accounting both difficult and of questionable validity

- Multiple use buildings containing establishments classified within several of the sector parcels or perhaps in other sectors, often contributing to physical accounting errors and validation problems due to the use of master meters

- Limited secondary source information for parcels included in this sector, often necessitating the estimation of parcel square feet averages from surrogate employee ratios

- Non-discrete utility billing data for this sector, often containing residential multi-family and governmental sector accounts as well, thereby diminishing its usefulness for deriving fuel splits and for validating total consumption estimates for the sector.

Energy use estimates were developed from a mix of primary and secondary data techniques and sources. Those communities using primary data collection techniques often modified the recommended parcel classifications by adding or deleting certain parcels. The additions often represented parcels not explicitly identified in the audit methodology, such as construction, communications, and (in the case of Seattle), fishing. Dayton divided the single office parcel into two categories, one of high-rise office and the second for other office types, to distinguish the substantially different physical and energy use characteristics for high-rise structures. Deletions often resulted from a shift of institutional parcels from the commercial sector to the municipal sector, such as municipal parking structures and auditoriums. In contrast, communities utilizing secondary source data often adopted alternative parcel classification schemes to achieve compatibility with the format of available secondary data. Apart from these adaptations, no further modifications were made to the demand estimation methods outlined in the audit methodology for this sector.

Table 5 identifies the secondary data sources used by communities in developing the commercial-civic-institutional sector base year energy audit. The

TABLE 5. COMMERCIAL-CIVIC-INSTITUTIONAL BASE YEAR ENERGY AUDIT SECONDARY SOURCES

LOCAL-SPECIFIC DATA	SOURCES
1. Number of Establishments by Parcel	County Business Patterns (Bureau of the Census) City Directories
2. Average Square Feet by Parcel	County Tax Records (direct) County Business Patterns State Employment Security (indirect) data
3. Energy Intensity Factors	Oak Ridge National Laboratory

base year count of establishments by parcel was most often compiled from County Business Patterns or the local city directory publications. The most widespread source of parcel square feet data was county tax records. A unique source for square feet and other energy characterization data was identified in Seattle and King County, Washington, in the Washington Surveying and Rating Bureau. This organization maintains records on commercial establishments required to class structures for fire insurance ratings which are similar to the data requirements for the energy audit (such as building square feet, type of heating system, space heating fuel type, and building activity). When local-specific square feet data were not obtained, parcel estimates from employment ratios were often developed. Secondary sources of employment data by parcel included the County Business Patterns and State Employment Security publications. While no secondary source was disclosed for determining activity fuel splits by parcel, the Oak Ridge National Laboratory publication, Commercial Energy Use:

A Disaggregation by Fuel, Building Type and End Use, provided the energy intensity factors used by several communities for certain parcel/activity combinations.

Three types of primary data collection techniques were used to develop the commercial-civic-institutional sector base year energy audit: sample surveys; building audits; and the disaggregation of utility data. All three communities using the mailed survey instrument approach encountered low return rates, with usable results obtained for only a few parcel/activity/fuel type combinations comprising the sector. Actual building audits for representative commercial establishments were conducted by Boulder, Colorado, with satisfactory results obtained. Three communities were able to obtain local commercial utility billing data, organized by two-digit SIC codes, which enabled them to record actual fuel use by parcel for electrical and natural gas energy forms.

Industrial Sector

The industrial sector base year energy audit was distinguished by substantial deviations from the audit methodology. Only two of the CCEMP communities followed the prescribed methodology for generating industrial sector energy consumption estimates. Virtually every component of the suggested methodology was altered by the other communities. Instead of grouping industries by similar energy intensiveness, most communities organized industries into two-digit SIC parcel classifications. While the methodology stipulated the use of annual Btu per employee energy intensity factors, most communities simply recorded estimated fuel use by fuel type--omitting the development of energy intensity factors. Other communities chose to depict total sector energy demand by fuel types according to industrial

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* Jerry Jackson, et al. Commercial Energy Use: A Disaggregation by Fuel, Building Type, and End Use. Oak Ridge National Laboratory, Oak Ridge, Tennessee. February 1978.

end use processes. These modifications stem from an assumption made by most communities that no single measure is appropriate or valid for characterizing industrial energy use.

In contrast to other sectors, comparatively few of the communities relied solely upon secondary source information for the industrial sector base year energy audit--only five of the communities. The necessary physical accounting data, establishments and employees by industry type, were usually obtained from one of three sources: County Business Patterns; U.S. Census of Manufactures; or State Manufacturing Directories. Energy characterization data, fuel splits and fuel amounts, were obtained from the U.S. Census of Manufactures "Quantity and Cost of Fuels Used" in the absence of state or other local survey data.

More than half of the communities used primary data to derive energy use estimates for the various industrial parcels. Those using primary data were typically smaller and medium sized communities with smaller numbers of industrial establishments. The most frequently used technique was surveying, whereby plant operating personnel were interviewed (most commonly larger industries) or received mailed surveys (smaller industries). In addition to requesting fuel use data, these surveys often sought to obtain additional information on past conservation efforts, waste heat volumes, industrial processes, and opportunities for cogeneration.

Three communities--Seattle, King County, and Boulder--conducted in-plant energy audits. While the small number of industries in Boulder made such an approach feasible, the Seattle and King County joint effort was motivated by the prior existence of industrial audits performed for ten of the County's largest industrial energy users. Additional audits were targeted toward firms of somewhat smaller size, spread across the remaining manufacturing sectors

in the County. This approach provided detailed information from which energy use could be portrayed in terms of industrial end use processes, according to thermal requirements, and the opportunities for fuel substitution, waste heat recovery, and cogeneration.

Apart from difficulties posed by the planning methodology, other problems were also encountered by communities in completing the industrial sector base year energy audit that are unique to this sector. They include:

- Potential unrepresentativeness of sample surveys. Because of the uniqueness of individual industrial firm processes, extrapolations from sample data are not likely to produce accurate total use estimates.

- Disclosure. In order to account for all industries, it was often necessary to establish an industrial two-digit SIC parcel for a single industry. Publishing such parcel-specific data and/or requesting utility supply information for the SIC category would result in the disclosure of proprietary information.

- Lack of end-use specific data. Completion of the industrial sector base year energy audit did not yield information perceived as useful to the alternatives/strategy assessment phase because of the absence of end-use measures.

Transportation Sector

Community approaches to the transportation sector base year energy audit were marked by substantial uniformity. Local-specific data required to estimate total fuel consumption (annual vehicle-miles-traveled (VMT) by all modes except mass transit) were acquired or derived from data supplied by the metropolitan planning organization responsible for transportation planning, or from state transportation agencies. Local transit VMT and actual fuel use were often supplied by the transit operating agency. Total fuel consumption by mode was then calculated by dividing annual VMT by energy intensity factors (miles per gallon) assumptions supplied with the audit methodology. A few communities adjusted the

miles per gallon assumptions to reflect lowered efficiencies due to congestion or more or less efficiency resulting from the composition of the local fleet. The only apparent shortcoming of the transportation audit methodology is the inability to validate energy consumption estimates. No community was able to obtain control data for delivered gasoline and diesel fuels consumed in the base year.

Municipal Sector

The municipal sector base year energy audit was completed with comparative ease by most communities by obtaining actual use data or by using the estimation methods outlined in the audit methodology. Few substantive modifications to the planning methodology were attempted. The single acknowledged shortcoming within this sector, identified by some communities, is whether complete coverage can be achieved, particularly with respect to county, state, and federal installations. Geographical differences relating to street lighting were also a problem.

A variety of data sources and methods was used to complete consumption estimates for the five municipal parcels. Actual use data, obtained from local records or utility billing statements, were used by most communities to complete the outdoor lighting and municipal waste and water parcels. Local school districts, colleges, and universities were often able to provide actual use data for all operations and buildings, and when not, previous Class A audits of individual facilities were often available from which average square feet, space cooling saturation, and fuel splits could be determined. Public administration activity/fuel type consumption estimates were often derived from a variety of sources including previous Class A building audits, actual use data for municipal buildings, and the General Services Administration for federal facilities. The "other"

municipal parcel was often an amalgam of unrelated activities or buildings with consumption calculated as the residual of electrical and natural gas use by subtracting the other four parcel use estimates from total government utility supply data or by adding known consumption for the various activities or buildings assigned to the parcel.

In summary, the community experience with the audit and projection methods defies any concise overview because of the variety of approaches. Review of each of the communities reveals that the audit methodology is characterized by:

- Use of a wide range of data sources, approximations and assumptions to produce the comprehensive base year audit
- Wide variability in the reliability of information between sectors and within sectors in terms of fuel/activity estimates by specific land use categories
- Sector level consumption data and fuel/activity splits serving as background information for staff and for policy advisory committees
- Insufficient detail within types of land use to allow general analysis of specific alternatives from the audit data base alone
- Little or no attempt to extend the base year detail in projecting future year consumption
- Intended use of consumption projections (regardless of method) as a baseline against which to measure fuel saving potential of proposed alternatives/strategies. The projection exercise was often conducted independently from the detailed built-up audit. Projections were more often derived from extrapolations of past consumption trends or population and employment forecasts than by adding future units to the base year audit.

Lessons for Other Communities

Ignoring the question of whether detailed comprehensive auditing is necessary for local energy planning, what general lessons can be drawn from the 16 audit experiences? The preceding review provides some guidance in the following areas:

- Use of a detailed comprehensive approach
- Data collection methods
- Projections

Use of a Detailed Comprehensive Approach

The fact that the two largest communities abandoned the detailed audit methodology for other approaches is an indicator of the methodology's practicality for large metropolitan areas. The reasons for using other approaches vary between the two communities, but the lessons appear to be the same:

- The complexity of large urban areas greatly complicates developing comprehensive energy consumption estimates that are reliable and consistent. A much larger investment of time and money is probably required to adequately implement the suggested audit methodology
- If a comprehensive overview is needed, sector level utility billing data plus sampling of non-centrally reported energy sources may be sufficient. Detailed energy consumption analysis would then be conducted when specific alternatives are under consideration.
- Community use of econometric approaches would probably only be practical where local-specific models have been developed on a statewide or perhaps regional basis, such as in California.

Use of the audit framework was more practical in medium and smaller sized communities. There is a more homogeneous building stock, fewer institutions to deal with and less complex intra- and intergovernmental relations. Again, how much should be invested in detailed comprehensive energy consumption information prior to analysis of specific alternatives is unclear. The perception by most of the communities suggests less effort be placed on the audit. This issue will be reexamined after the communities have assessed alternatives and strategies.

Data Collection

Experience from the communities in collecting primary data suggests a number of lessons:

- Mailed surveys probably will not produce acceptable response rates in all categories unless follow-up efforts are made.

- Home audits programs did not work as well as hoped, due to low response rates and limited training of audit personnel. This technique may be more appropriate for small scale studies rather than comprehensive energy auditing.

- Use of utility billing records correlated with specific buildings or classes of customers is the most cost effective way of generating gas and electricity consumption information. Cooperation of utilities in providing information is critical.

Projections

While projecting future energy consumption can be done through a variety of approaches, formal quantitative supply projection at the community level is not especially meaningful. In particular, forecasting alternate fuel availability in other than qualitative terms beyond a few years is not possible.

Under these circumstances, it is probably better for communities to make only very general consumption projections and to deal with supply on the basis of known or probable problem areas. Most of these areas would be easily identified and would relate to price increases, supply constraints or moratoria and potential for disruption. Environmental problems also play a role in setting objectives.

While considerable resources and time have been spent by the communities in dealing with the energy audit and projection exercises, the question remains as to how this information serves local energy planning. The next section attempts to explore the role of the audit in setting community energy management objectives. Full assessment of the usefulness of the planning methodology and audit methods, however, will require completion of the pilot projects.

IV. OTHER PLANNING PHASES: DOES THE AUDIT HELP?

Introduction

The "cookbook" approach prescribed for the energy audit also extends to procedures outlined for the objectives formulation phase. The planning methodolody instructs communities to set quantified energy reduction targets for each fuel type anticipated to be in short supply based on projections of future demand and supply. Objectives are to be established by relating percentage reduction targets to those land use categories most affected by shortages and which have the greatest potential for demand reduction. The energy audit is essential to this procedure, as future demand/supply projections for the various fuel types must incorporate base year energy demand levels.

Since the planning methodology directly links the base year energy audit and the setting of community energy objectives, and subsequent activities as well, this linkage is explored here through two sets of questions:

1. How did communities actually set objectives? If they did not set objectives, what are they doing?

2. Are the audit and planning methodology helpful in setting objectives and is the sequential process being used?

How communities set objectives is important because of the influence these energy objectives are anticipated to have on later phases of the planning process. Specifically, objectives are expected to provide the necessary direction for the planning effort and a framework within which alternative plans can be developed and evaluated. Of interest in the community approaches is the character of the consensus building process and the commitment secured for community energy management objectives. The second question applies to the planning methodology suggested for this phase. Two key issues associated with the use of the planning methodology are: (1) Have the communities used the audit results and demand/

supply projections to establish energy management objectives? and (2) Are planning activities proceeding on a sequential, or consecutive, basis?

How Did Communities Actually Set Objectives?

Only nine of the 16 CCEMP communities had made substantial progress on the objectives formulation phase and/or were proceeding with other tasks at the time Academy site visits were conducted for this report. (The remaining seven communities were completing base year energy audits.) Hence, only tentative observations and conclusions regarding the objectives formulation phase may be drawn from the practices of these nine communities.

Among the nine communities, an almost equal division emerged between those that proceeded to establish energy objectives and those that did not. Five of the nine communities followed the outline procedure by setting energy objectives--Boulder, Seattle, Los Angeles, Philadelphia, and Allegheny County. These communities got a head start in objectives setting by starting the work before they had completed the audit. The remaining four communities chose not to develop energy objectives as the second phase of the planning process--Richmond, Knoxville, King County, and Wayne County.. Instead, these communities started later phases of the planning methodology or embarked on alternative planning approaches.

How Objectives Were Developed

Three preliminary objective setting approaches emerge from the five communities which had completed or made substantial progress on this phase, as summarized in the accompanying table. Although different approaches were taken, all five communities started the objectives setting phase concurrently with the base year audit development and none derived objectives from demand/supply projections. The three approaches are:

TABLE 6. COMMUNITY OBJECTIVE-SETTING APPROACHES

COMMUNITY	TIMING	PROCESS STEPS	PARTICIPANTS	PROCESS AIDS	OUTCOMES
STAFF-INITIATED OBJECTIVES					
Los Angeles, CA	-Begun in April, 1979, 7th project month, at midpoint in energy audit -Concluded in September of 1979, 12th project month	1. Draft discussion papers Energy Management Objectives and Issues prepared by staff and presented to Energy Management Advisory Board 2. Review and comment by Energy Management Advisory Board 3. Staff response to comments made by Energy Management Advisory Board 4. Staff revision to CCEMP Goals and Objectives, adopted by Energy Management Advisory Board	-Energy Management Advisory Board	-Concept Los Angeles General Plan	-Goals and Objectives Statement with four energy goals, in order of priority, and three objectives. Goals reflect major energy values while objectives have criteria for the selection and implementation of energy management options.
ITERATIVE APPROACH					
Allegheny County, PA	-Begun in February, 1979, 5th project month, shortly after initiation of energy audit -Not completed at time of site visits, Spring of 1980	1. Sector-based working groups draft general sets of issues and objectives 2. Series of working group meetings reviewing and refining objectives 3. Consolidation of issues and objectives into a single draft for consideration by Technical and Policy Advisory Committee 4. Review by County Planning Commission	-Technical and Policy Advisory Committee and working groups thereof -County Planning Commission	-Staff redrafts of issues and objectives	-Critical issue statements and objectives organized by sector
Philadelphia, PA	-Begun in September, 1979, 12th project month, near completion of energy audit -Not yet completed due to change in committee structure	1. Establishment of sector-based task forces with charge to develop objectives for energy conservation and supply expansion in respective sectors 2. Series of meetings between September and December of 1979 to draft issue statements and objectives 3. Draft issue and objective statements completed by January of 1980	-Task Force Members	-Individual staff detailed to task forces -Consultants for technical support	-Critical issue statements and objectives organized by sector
MULTI-PHASE APPROACH					
Boulder, CO	-Begun in October of 1979, 13th project month, near completion of energy audit -Concluded in February, of 1980, 17th project month	1. Town meeting (about 300 attendees) identifying energy issues and to receive suggestions 2. Draft statements of Goals and Principles prepared by project director and Chair of Energy Task Force 3. Review and comment by Energy Task Force followed by adoption 4. Submission to Council followed by approval	-General Public -Energy Task Force -City Council	-Preliminary audit results	-Goals and Principles Statement with three goals and five principles which are to apply to programs developed or endorsed by the Energy Task Force
Seattle, WA	-Begun in November, 1979, 14th project month, near completion of energy audit -Concluded in May of 1980, 20th project month	1. One-day Futures/Goal Setting Workshop of Energy Ltd. Citizen Committee 2. Two-dozen neighborhood and community organization meetings to communicate initial audit findings and obtain citizen viewpoints regarding energy issues 3. One-day Objectives Setting Workshop for Energy Ltd. Citizen Committee to review initial staff-prepared goals and objectives and develop a process and structure for objectives phase 4. Subcommittee refinement of sectoral objectives with integration by an Ad Hoc Working Committee comprised of Citizen Committee and subcommittee chairs 5. Adoption of preliminary goals and objectives by Energy Ltd. Citizen Committee 6. City department and agency reviews of preliminary goals and objectives 7. Transmittal to Mayor for submission to Council, referred to Council Energy Committee for review 8. Modifications suggested by Energy Committee accepted by Energy Ltd. Citizen Committee followed by Council endorsement	-Energy Ltd. Citizen Committee and subcommittees thereof -Neighborhood and community organizations -City departments and agencies -City Council	-Individual staff detailed to subcommittees -Preliminary audit results -Professional facilitators for Futures/Goal Setting Workshop and community meetings	-City Council Resolution adopting tentative energy goals, management policies, and management tasks. Energy management tasks, by sector, divided between Energy Ltd. Citizen Committee and other City departments.

1. Staff-Initiated Objectives (Los Angeles)

2. Iterative (Allegheny County, Philadelphia)

3. Multi-Phase (Boulder, Seattle)

1. Staff-Initiated Objectives. This approach, undertaken by Los Angeles, is characterized by staff-developed energy objectives submitted to a policy advisory committee for review and comment. The process was initiated with the presentation of a staff-developed discussion paper to the Los Angeles Energy Management Advisory Board. Preliminary audit results and demand/supply projections were not used to support or derive objectives. Rather, tentative goals--reflecting energy values--and general objectives--embodying criteria for the development of energy management options--were proposed. Board comments to proposed goals and objectives were responded to in writing by the Energy LA staff and later incorporated into revised goals and objectives.

2. Iterative Approach. Two communities adopted an iterative approach, with objectives resulting from a series of meetings involving staff and committee interaction. Both communities, Allegheny County and Philadelphia, started this approach through their multiple sector-based working groups and task forces with preliminary audit results becoming available mid-way through the process. In each case, audit results provided a basis for refining objective statements. The process of staff-committee interaction began with the identification of sector-specific energy issues and objectives by the working groups, followed by a series of additional meetings to refine the objective statements.

In Allegheny County, this process has been conducted over a long time span, with the refinement of objectives occurring simultaneously with the initial development of alternatives and strategies. Much of the refinement has

resulted from staff effort between meetings, followed by working group reviews. Tentative objectives were later transmitted to the County Planning Commission for review.

In contrast, Philadelphia's task forces were charged with the responsibility of drafting objectives with staff and consulting resources made available to them for this purpose. Further, the process was completed within a comparatively shorter time span of approximately five months. Task forces experienced difficulties with the assignment, particularly with the directive to orient objectives to fuel types anticipated to be in short supply and in distinguishing between objectives and strategy statements.

The final products of these communities include sector-based issue statements accompanied by objective statements. Neither community had completed the process at the time Academy site visits were conducted.

3. Multi-Phase. The Multi-Phase approach is distinguished by a number of different process steps incorporating citizen input and a review by the local legislative body. Both Boulder and Seattle followed this approach to the objective setting phase.

Boulder started the objective setting process with a town meeting attracting about 300 participants, including the Boulder City Council and the Energy Task Force. Energy concerns and priorities expressed in this meeting were next incorporated into a draft statement of Goals and Principles for review by the Energy Task Force. Although preliminary audit results were available at this time, they were not viewed as being useful to the development of goals and principles by either staff or the Task Force. Goals reflect underlying energy values while the principles set forth criteria for the development or endorsement of energy management options to be considered by the Energy Task Force in subsequent

phases of the planning process. Following Task Force approval, the Goals and Principles were transmitted to Boulder City Council for adoption.

Seattle's objective setting process was started near the completion of the base year energy audit through the Energy Ltd. Citizen Committee and its sector-based subcommittees. Process steps followed by the Citizen Committee, in order of sequence, included a one-day Futures/Goal Setting Workshop, an Objectives Setting Workshop, and subcommittee refinement of goals and objectives. At the beginning of this process some two dozen neighborhood and community organization meetings were conducted to communicate initial audit findings and obtain citizen viewpoints regarding community energy issues. Results of these meetings and the Futures/Goal Setting Workshop were incorporated into the initial staff-prepared goal and objective statements first considered at the Citizen Committee Objectives Setting Workshop. The use of audit information and projections in this process is best described in the staff document for the Workshop which noted that the audit ". . . provided a factual basis for many of the problems and opportunities already perceived."

The process of review and adoption also included several steps. Immediately prior to the Citizen Committee final approval, preliminary goals and objectives were transmitted to city departments for review and comment. Responses were received and considered by the Citizen Committee before submitting the goals and objectives to City Council via the Mayor. While under review by the City Council Energy Committee, a number of specific changes were requested, including: additional goal statements; changing objectives to energy management tasks and assigning responsibility for their development to the Citizen Committee or other city departments; and, a charge to develop a set of joint city/county goals and policies. Each request was acted upon by the Citizen Committee and accomplished prior to Council endorsement.

Findings. Although different objective setting approaches were followed, several patterns emerge from the experiences of this limited number of communities. These preliminary findings are listed below with a note of caution. They are based upon the experiences of less than one-third of the CCEMP communities and, therefore, may be subject to revision after the practices of other communities are known. Final conclusions will be included in the next Academy interim report.

- None of the five communities used the suggested planning methodology as an aid to setting objectives. Further, the scope of the objectives setting exercise was broadened to include more than anticipated energy shortages.
- Most communities limited participation in the objectives setting phase to CCEMP committees. Only two of the five communities incorporated citizen input and legislative body review into the objective setting process. Two also included review by other established governmental committees or departments.
- Communities with multiple committee structures achieved a greater degree of committee participation in the objective setting process.
- All communities expanded the scope of this task to include additional elements--critical issues, goals, and/or principles.

Alternatives to the Planning Methodology Sequence

Instead of developing objectives, four communities reordered the sequence of tasks during or near the completion of the base year energy audit. Of the four communities, only Wayne County did not include the objectives formulation task in its CCEMP Work Plan. Instead, the audit was followed by the selection of program areas for alternatives/strategy development. In the other three communities, a decision to alter the sequence of planning tasks was made after the audit was underway and committees were functioning. The reasons for these decisions and approaches followed in conducting other tasks are described in this part.

Communities altering the sequence of planning steps included Richmond, Knoxville, and King County. In each of these communities, the decision to re-order the sequencing of tasks was made independently by the project director. Although the reasons accounting for this decision vary between communities, two themes are common to all three. First, the project directors cited misgivings with the planning methodology for the objectives setting phase. Specifically, all were unwilling to direct the planning process toward quantified energy savings targets for various sectors based upon fuel types projected to be in short supply. The second common element was a major expansion of committee structures or change in the planning process during the preparation of the base year energy audit.

A decision to alter the planning process coincided with the expansion of committee structures in Knoxville and King County. In both communities, a large number of new participants were brought into the planning process through the establishment of subcommittees in Knoxville and task forces in King County. Prior to activating these new entities, both project directors decided to reorder the objectives setting phase near the conclusion of the planning process so that the basis for quantified objectives would be the energy savings anticipated from recommended alternatives and strategies.

Instead of objectives, each of Knoxville's subcommittees started the alternatives and strategies development phase. This task began with each subcommittee developing a "shopping list" of possible alternatives. The CCEMP staff then expanded these lists with other options and organized the list according to policy areas (general plan, public services and facilities, public fiscal policies, etc.) At subsequent meetings, staff requested subcommittees to rank the options according to potential effectiveness and feasibility criteria. The highest ranked options were then evaluated by staff for savings potential and time required for implementation prior to the final selection.

King County altered the objectives formulation task to one of developing critical issue statements, goals, and policies through their newly established task force committee structure. Each task force first drafted critical issue statements relative to various sectors and other concerns, such as land use and alternative energy sources. With staff assistance, the task forces then developed general and sectoral goals. Shortly after submitting these products to the County Council for endorsement, Seattle's City Council Energy Committee requested that a joint set of energy goals and policies be prepared for the City and County. Through joint efforts of the City and County CCEMP staffs, the chairs of the respective policy advisory committees, and City and County Councilpersons, the previously developed task force goals were integrated with those of the City and adopted by the County.

The absence of an objective formulation phase in the Richmond planning process to date is more the result of the abandonment of a sequential approach to energy planning than disenchantment with the suggested methodology. Midway through the base year energy audit, a host of activities were begun under the heading of CCEMP. Among the activities were public information and education programs, supplemental energy audits, energy demonstration programs, and alternatives/strategies development. With respect to the latter, action proposals are anticipated to result from various committees and organizations both inside and outside the CCEMP committee structure. These action proposals will be made at any time during the planning process and will proceed to implementation if feasible.

Wayne County has deleted the objectives formulation phase from its planning process. The major reason for this is that a countywide plan will not be developed. Instead, implementation options (alternatives/strategies) will be developed for adoption by the County and the 42 suburban governments.

Can the Methodology Prescribed for Setting Objectives Work?

A preliminary answer to this question is derived from the limited base of community experience in later phases of the planning process. Of interest is whether the methodology is workable under some conditions, or, do community experiences indicate that it is basically flawed.

Community experience is examined in light of the methodology's basic requirements for the objective setting exercise. Issues include:

- Timing/Sequencing: Is the objective setting phase begun after audit results are available?
- Quantified Shortages: Is the audit used to develop demand/supply projections, were shortages disclosed, and do communities have confidence in the projections?
- Objectives: Are objectives narrowly defined on the basis of supply gaps?

Timing/Sequencing

More than half of the CCEMP communities have departed from the sequential planning process suggested by the methodology. Four communities reordered the sequencing of planning phases during the audit while the five which made substantial progress on the objective setting phase started this phase while the energy audit was under preparation. These latter communities did not think that audit results were needed to work on objectives.

Quantified Shortages

Four of the five communities did produce preliminary audit results and demand/supply projections before completing the objectives setting phase. However, these products did not lead to an explicit quantification of projected fuel shortages with corresponding energy management objectives for different land use categories. Rather, if potential shortages were disclosed, they were often one of several fuel-specific concerns guiding the objective setting process.

The energy audit was not used as a framework for calculating future energy demand increments--deriving "built-up" estimates from future additions or deletions to the base year accounting. Instead, more expedient approaches were usually taken. Changes to base year energy demand were either forecasted on the basis of past energy consumption trends or base year consumption ratios of fuel consumption by population and employment variables.

Supply projections proved more difficult. Especially troublesome was the lack of small area supply forecasts. Consequently, supply forecasts were extrapolated from state and/or national projections of fuel availability. In three of the four communities which adopted this method, projected demand levels did not exceed the forecasts of fuel availability for the projection year.

Given the technical difficulties of deriving demand/supply projections and the results achieved, most communities discounted the importance of these findings in the objective setting process. Specifically, the lack of confidence in results obtained made communities reluctant to base objectives on their findings.

Objectives

All communities broadened the objectives formulation phase to include the consideration of multiple energy objectives in contrast to the narrow shortage-based emphasis of the methodology. In addition to shortage issues, these multiple objectives also reflected concerns related to rising prices, potential supply interruption, capacity limitations, or the relation of particular fuel types to other resource management problems, such as air quality.

Departures from the formal quantitative methods and shortage approach to setting energy objectives resulted from either an advance decision not to use the methodology or from experience with the projection exercise. Only one

community, Los Angeles, elected not to pursue supply projections at the outset of the objectives setting process. Both experience and results from the demand/supply projection exercise led the other four communities to discount the importance of these findings in the objectives setting process. Abandonment of the shortage approach was also due to a common perception, among CCEMP staff and committees: energy objectives should be responsive to multiple, instead of single, energy issues. For example, although Los Angeles did not use the planning methodology for preparing the energy audit or projections, this was not advanced as the major reason for departing from the shortage approach. Instead, the preface to the adopted Goals and Objectives statement declares:

> If energy management goals and objectives are defined solely as a process of advance identification of shortages of conventional energy sources and appropriate planning to deal with them, this implies that the present ways in which community energy needs are met are optimal. That is, we should go on supplying as much of our energy needs as we can with our present conventional energy sources, but when we discover we cannot at some time in the future, then we must search among energy management alternatives for a second best solution.

Conclusions

These initial tendencies indicate that the planning methodology for the objectives formulation phase needs major modification. The objectives formulation or other tasks were started prior to completing the energy audit. Technical procedures for deriving demand and supply projections proved difficult and, in most cases, did not disclose future shortages--thus diminishing confidence in the procedure and result obtained. Moreover, communities preferred to broaden the objectives setting exercise beyond the narrow consideration of supply gaps.

The planning methodology's weaknesses are evident both in its underlying assumption and technical procedures for the objectives formulation phase, at least on the basis of the preliminary experience. At issue is the exclusive focus upon supply shortages. In the long run, an equilibrium between energy demand and supply will result from the effects of pricing and fuel substitution. Yet, the technical procedures outlined for the projection exercise exclude both of these considerations. While supply interruptions are likely in the short run, the methodology is geared to long-term planning and not contingency planning. Apart from these methodological shortcomings, supply shortage concerns are but one of several energy issues dominating local energy management planning.

These conclusions suggest the need for a more flexible energy planning approach. Such an approach would place less precise technical requirements on the energy audit, permitting further information development and analysis of issues to be performed on an "as needed" basis as energy objectives and potential management actions are formulated. A more flexible approach is also needed to accommodate variations in the manner in which communities may desire to start the policy planning process--through objectives setting, goal setting, critical issues development, or policy development.

These issues will be addressed more directly as more of the communities proceed toward completing their management plans. At that time, the shape of a more flexible approach to a planning methodology will probably emerge more clearly.

V. THE CCEMP PLANNING PROCESS: HOW HAVE ORGANIZATIONAL ARRANGEMENTS DEVELOPED AND FUNCTIONED?

Introduction

Local government adoption of effective energy management action plans is the desired result of the CCEMP pilot projects. Because energy management has generally not been a local government function, how the 16 pilot communities manage their planning processes should provide useful information to other communities.

The goal of implementation and the untried nature of comprehensive energy management provide the context for evaluation of community planning processes during the audit phase. Ideally, conduct of the planning process would produce two overlapping results necessary for adoption of effective local energy management plans:

- Information useful to local energy management decision making
- Commitment to consensus alternatives by the public and private sector for inclusion in an energy management action plan.

As Section III attempted to demonstrate, reliable detailed information for local energy management planning is not always easy to obtain or to use. Participation of a number of public and private sector institutions is needed to get the most out of information that is available. The planning process must also obtain access to other types of information, namely, judgments and perceptions of individuals knowledgeable about energy. Finally, there is a necessary exchange of information between the public and the planners, involving public education, access, and participation.

Commitment to effective actions requires involvement of key individuals in public and private sector institutions, if local energy management

planning is to result in more than just another plan. Commitment can be achieved in a variety of ways, but will probably require either sustained participation or close coordination during the plan development phase. The current number of independent activities potentially affecting local energy consumption (and supply) is large,* indicating the complexity of achieving commitment, particularly in the larger metropolitan areas. The more ambitious the local plan, the more critical extensive and early commitment of various interests will be.

The audit phase was to produce some of the information useful for energy management decision making. The process by which different communities developed their audits may contain lessons for other communities. The long duration of the audit phase also raises questions on how commitment is being developed and maintained. As of this report, one cannot generally identify commitment to specific actions in the various communities.

The themes of information or development of commitment underlie the topics covered in this section. These topics cover the various aspects of community management structure and planning processes, as outlined in Section II. Topics include:

- Changes in advisory committee structure and functioning
- Staff role in the overall process and other community energy activities
- The role of consultants

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* These include various federal and state demonstration programs (solar, cogeneration, etc.), the federal weatherization program, housing rehab programs, the Residential Conservation Service, utility rate reform, local building code ordinances, to name a few.

- The role of public utilities
- Elected official involvement
- Early implementation and project spinoff
- The role of public involvement and awareness
- Coordination.

Advisory Committee Functioning

The role of the advisory committee is of primary importance to the planning process. The committees provide coordination, technical expertise, and political access, as well as serve as a prime public involvement vehicle, thereby improving chances of success. Community advisory committees generally have been populated with individuals with the power to make decisions (or their representatives) and with individuals with technical backgrounds. The time taken to do the audit and the technical nature of the results affected the participation of advisory committees during the audit phase. Issues of concern include:

- How have communities adapted their initial advisory committee structures to accommodate conduct of the audit?
- How have committee structures been modified to accommodate other functions such as coordination and public outreach?

Specific changes in advisory committee structures are instructive of the challenges faced in keeping the participation of busy important people. Without their involvement, at least at key points in the process, it is unlikely that commitment to meaningful local energy management actions can be achieved. How important participation is during a long audit period remains to be seen.

Findings

During the audit phase, 9 of the 16 communities either expanded, repopulated, or reduced their policy advisory committees. Nine of the communities modified their subcommittee structures, involving either expansions, reductions, or reorganizations. Tables 7 and 8 show these changes for the 16 communities and the general reasons given for making changes. Key findings include:

- The most common reason for expanding or repopulating policy advisory committees was to increase participation. Several of the communities found that initial members of advisory committees lost interest and had to be replaced.

- The least change in policy advisory committee structure occurred among counties and areawide planning agencies (four of six). Those that did make changes added or shifted a few members.

- Only four communities that planned to use subcommittees during the audit phase did not make some major modifications. Seven communities either reduced the number of subcommittees or reorganized them. In the latter case, the major reason was to improve the topical focus or functional structure of subcommittees (three of the seven communities). Lack of participation appeared to be a major reason for reducing the number of subcommittees.

- All of the communities (three) expanding their subcommittees (numbers of people or committees) were either counties or areawide planning agencies. Reasons were to increase participation, increase access to information and policy making, or to improve subcommittee functional structure.

Policy Advisory Committee Modifications. Five communities expanded the membership of their initial advisory committees and three replaced inactive members with more interested individuals. For example:

- In Boulder, four individuals representing business, neighborhood, and citizen interests were added to the nine-member Energy Task Force. This helped increase attendance. The original Task Force consisted primarily of city officials, university professors, and federal or private sector energy experts. Knoxville, whose seven-member Steering

TABLE 7. POLICY ADVISORY COMMITTEE CHANGES DURING THE AUDIT PHASE

	Changes				Reasons			
	Expansion	Repopulation	Reduction	No Significant Change	Participation[1]	Representation[2]	Coordination Policy Access[3]	Public Access
Small Cities								
Boulder	X				X	X		
Greenville		X	X				X	
Janesville								
Portland		X			X			
Richmond	X						X	
Intermediate Cities								
Dayton				X				
Knoxville	X					X		
Seattle		X			X			
Large Cities								
Los Angeles				X				
Philadelphia			X		X		X	
Counties								
Allegheny				X[5]				
King				X				
Wayne	X[4]				X		X	
Areawides								
Greater Bridgeport				X				
South Florida				X				
Toledo		X			X			

[1] Participation = attendance.

[2] Representation = breadth of interests

[3] Coordination Policy Access = involvement of key individuals/ institutions

[4] Change of role with substantive decisions made at subcommittee level.

[5] Combined technical and policy committees after completion of the audit.

TABLE 8. SUBCOMMITTEE CHANGES DURING THE AUDIT PHASE

	Changes				Reasons				
				No Significant	Participation		Access to:		Improve Functional
	Expansion	Reduction	Reorganization	Change	To Increase	Lack of	Information	Policy	Structure
Small Cities									
Boulder		X[1]				X			
Greenville		X	X						X
Janesville				N.A.					
Portland		X				X			
Richmond				X					
Intermediate Cities									
Dayton				N.A.					
Knoxville			X						X
Seattle				X					
Large Cities									
Los Angeles				N.A.					
Philadelphia			X		X		X	X	
Counties									
Allegheny				X					
King			X		X[2]				
Wayne				X					
Areawides									
Greater Bridgeport	X						X	X	
South Florida		X[3]				X			
Toledo	X		X[4]						X

1 Elimination of Industrial/Commercial and Use Conservation Group.

2 To achieve broad public participation.

3 Subc tees did not meet.

4 Expa n of number of subcommittees but not total participants. Also, establishment of a public awareness committee.

Committee consisted exclusively of elected or appointed public officials, added four new members in September 1979. These included representatives from industry, the building trades, and the local Chamber of Commerce. The reason was a desire on the part of the Knoxville Mayor and CCEMP Project Director to broaden representation on the policy advisory committee to include the private sector. Richmond, whose Executive Committee consists solely of elected and appointed public officials including the Mayor, added four more city officials including a representative of Richmond Power and Light, the city-owned utility. The reason cited for the addition of these members was to increase coordination with the respective organizations or agencies represented.

- Seattle, Portland (Maine), and the Toledo Metropolitan Council of Governments replaced members of their policy advisory bodies. In Seattle, several members of the Energy Ltd. Citizens Committee resigned because they could not make bi-weekly early morning meetings of the Committee. Replacements were found by placing ads in the local paper, with screening and selection by staff and committee cochairpersons. In Portland new members were added to replace inactive members of the Portland Energy Reduction Team. For the 20-member Toledo Metropolitan Area Council of Governments - Energy Guidance Group, inactive members have been replaced by new members, generally from the same interest groups.

On the other hand, two communities reduced the size of their policy advisory committees in order to more effectively manage the planning process.

- In Greenville, the Energy Management Commission, the key directive committee for CCEMP, was originally appointed by the Greenville City Council in December of 1978. Its 12 members were later increased by three. While this 15-person Commission represented a broad range of community interests, it did not function effectively as a decision-making group for CCEMP. The staff as well as Commission members recognized its ineffectiveness in late 1979 and efforts were made since to streamline and rejuvenate the Commission. Last fall, a local election had resulted in a new mayor as well as three new members of a six-person City Council. Consequently, many forces favored reconstituting the Commission. The new Commission consists of nine persons, eight of whom were appointed as voting members and the ninth, a city councilor, is a nonvoting liaison person. With the new membership, a new chairperson, and the backing of the City Council, the new Commission is expected to take a more active role, providing leadership and policy guidance to CCEMP and city staff concerned with energy matters. One of the major differences between the old and the new Commission is that appointments were made to the former based on achieving representation of key elements of the community while those to the latter were made based on expressions of interest in the subject of energy and CCEMP. The staff expects the new Commission will perform different activities and show a different pattern of operation. They expect that the Commission, as a formally empowered city-council appointed Commission, will be more than just an advisory committee.

- Of all the communities, Philadelphia committee structures have undergone the greatest change. These changes are instructive for other large cities dealing with energy management. Briefly, an Energy Management Committee open to membership from neighborhood, consumer, labor, university, and business sectors was formed at the outset of the project. This committee was to consider the CCEMP products and then influence the policies of constituent members. Because of the unwieldy size of this group (approximately 50) a 13-member Executive Steering Committee representative of the interest groups in Philadelphia was established to organize and oversee the Philadelphia program. An Urban Strategy Committee on Energy and the Environment consisting of government officials was to consider CCEMP products and develop relevant city policies. Subcommittees consisting of Energy Management Committee members and CCEMP staff were to oversee development of the various planning products along with the assistance of various consultants. Evolution of this structure included reconstituting and populating the subcommittees as sector task forces, eventual loss of attendance by the Energy Management Committee, and development of the task force chairpersons as the leadership focus. Disillusionment with the audit and change in administrations created a hiatus in the program until early 1980 when a new Energy Policy Task Force consisting entirely of subcabinet officials was formed and the program began moving forward again. To date, the extensive public outreach structure has not been reconstituted.

Changes in Sector Level Subcommittees and Task Forces. As in Philadelphia, most communities planned for subcommittees or task forces to provide guidance in the development of the CCEMP planning products (audit, objectives, alternatives/strategies). These subcommittees typically are oriented around the five audit sectors, supply, and other functional aspects of the planning process such as public relations or coordination. As noted later in this section, several of the communities used their advisory committees and special subcommittees or task forces as a vehicle for dealing with other community issues such as the 1979 gasoline shortages.

Two types of developments in subcommittee structure are of interest: unplanned expansion or reorganization of sector or functionally oriented subcommittees and the collapse or reduction of planning subcommittees.

- In Portland, of the six subcommittees that were formed in the Spring of 1979, four were abolished in January 1980 because of lack of activity (these included municipal operations, demand, supply, and economics and finance). Left in place were the Public Awareness Committee and the Conservation and Alternative Energy Committee.

- In Greenville, after reconstitution of the Energy Management Commission (see above), changes were made in the subcommittees. As part of the original work plan, a Technical Advisory Group consisting of local residents with energy-related expertise, and a Citizen Task Force Committee and its subcommittees were to provide a broad range of community input. In the Fall of 1979 it was acknowledged that the effectiveness of the subcommittees was questionable--members were unsure of their roles and attendance at meetings was poor, eventually ceasing altogether. They were to be reconstituted and rejuvenated as soon as the Commission specified the mission and expectations for the subcommittees.

- In Toledo, a total of four subcommittees were planned (Community Energy Audit, Crisis Contingency Plan, Management Strategies, and Supplementary Energy Systems). Only the Community Energy Audit and the Crisis Contingency Planning subcommittees were actually formed. The former was established at the outset of the audit, although it was never officially convened. Rather, members were contacted individually for information and cooperation as the audit was developed. The Crisis Contingency Planning subcommittee was not established until January of 1980. Two subcommittees, not anticipated in the Work Plan, were established midway through the audit. The first, the Communications Subcommittee, was established to develop public awareness about energy matters in general and activities of the Energy Guidance Group (EGG). The second, the Reading Subcommittee, was established in reaction to staff-developed technical papers (some of which were subject to intense quality criticism by EGG members) for the purpose of editing previous and future papers in terms of technical and policy content. The remaining two subcommittees, Crisis Contingency Planning and Energy Conservation Planning, were established at the January 1980 EGG meeting. Their activation was initiated by the CCEMP Project Director to "increase the efficiency of EGG by freeing the entire group from functions that could be as easily achieved by a sub-group." Subcommittees were populated by EGG volunteers.

- Knoxville is an example of changing subcommittee structure as a result of initial experience with the CCEMP project. As initially planned, five subcommittees were to be organized around the topics of inner-city residential, suburban city-county residential, commercial-industrial, and municipal-institutional. Their general responsibilities were to include the identification of issues, the drafting of objectives and the development of strategies. These subcommittees were never populated or activated. A substitute structure was outlined in September 1979 and five working subcommittees were established:

land use; building and structures; transportation; emergency contingencies; and alternative energy resources. The general responsibility of each is to provide suggestions to staff for the development of energy management objectives and implementation options. The membership of each subcommittee reflects a mix of public (local government, Metropolitan Planning Commission, TVA, state government), private commercial and industrial representatives, academic (University of Tennessee), and citizen groups. The CCEMP Project Director stated that the revised scheme minimized confusion in dealing with functional areas. The original sector-based groupings were anticipated to have each subcommittee simultaneously considering land use, transportation, and structural strategies. It is also likely that a number of other factors influenced this shift, including:

- The revised groupings offer a more convenient subdivision of strategy alternatives, thus accelerating their development
- Delays and difficulties encountered in the audit made staff reluctant to activate subcommittees
- The opportunity arose to participate with the State of Tennessee in the design of a local organizational and administrative structure for energy emergency contingency management.

- King County offers another variation in the use of subcommittees for accomplishing various functions of the planning process. The King County Steering Committee (policy advisory group) was originally to have had a community involvement element called the Community Energy Management Council. This body was to have had broad representation, general oversight and policy responsibilities for the project, with the smaller Steering Committee responsible for directing the staff effort. However, the Steering Committee was formed first, leaving the issue of citizen participation in CCEMP unresolved.

  Several options were examined by staff and presented to the Steering Committee identifying various community involvement approaches: a citizens' task force; public information; workshops; public meetings; and public opinion surveys. The staff paper also delineated purposes and objectives for citizen participation, the relationship of different CCEMP task elements to citizen participation, and a detailed description of the task force approach.

  The process of activating task forces began in July of 1979 with solicitations for membership. Over 1,000 letters under the Steering Committee Chairman's signature were mailed to individuals, community and civic organizations, and special interest groups.

  The Energy Planning Project Staff selected membership from the respondents on the basis of (1) community connections and (2) particular expertise or perspectives, then assigned individuals to the various

task forces. Chairpersons for respective task forces were also selected by staff, although the Steering Committee Chairman personally interviewed nominated chairpersons prior to their appointment. Task forces included transportation, land use, government operations, residential, renewable resources, industrial, and commercial. The task forces were to terminate in June of 1980 after conducting a series of 12 meetings. Products anticipated to result from staff, subcommittee and Steering Committee interaction over this period include:

1. Listing of Critical Issues by Sector
2. General and Sectoral Goals
3. Policies
4. Strategies and Programs

While there has been considerable change in most communities' policy advisory structures, Los Angeles and Dayton both have operated as envisioned. The Los Angeles Energy Management Advisory Board meets on a monthly basis to consider both CCEMP and other community energy issues. Dayton's Steering Committee and Action Plan Development Team (responsible for producing planning products) have operated as scheduled, with the exception of delay in completion of the audit. Although the South Florida Regional Planning Council has not changed its committee structures, the Working Group (composed of representatives from utilities, business, planning organizations, and local governments) stopped meeting in January 1980. It will be reconvened later for the strategies/alternatives phase.

Conclusions

The change in advisory committee and subcommittee structures has generally been in response to two needs:

- Maintaining interest during the audit phase or bringing in people with backgrounds more suited to development of the audit
- Reorganizing subcommittees to deal more effectively with formulation of issues and objectives and development of alternatives and strategies.

One key lesson is apparent from this diverse set of experiences. Once policy advisory committees are established it is important that they be given substantive policy-related work if participation is to be maintained. This suggests that formal policy level committees be convened as soon as audit information is available or that they work concurrently on issues and strategies.

Staff Role and Conduct of Technical Work

The CCEMP pilot projects presented unusual staffing demands for many of the communities. The technical nature of the projects called for special skills. To meet these needs, many communities chose to hire consultants, rather than hire permanent or temporary staff. Energy management may affect many different community agencies, businesses, and people. Under these conditions, developing policy information to satisfy these different interests is not easy.

Issues of concern for this phase of the monitoring and evaluation include:

- How well have consultants worked and how have unexpected outcomes been handled?
- What problems have developed in staffing and how have they been resolved?
- What is the role of staff in the process, particularly the relation to policy and technical advisory committees?

Table 9 presents an overview to these three questions for the 16 communities.

TABLE 9. DEVELOPMENT OF TECHNICAL INFORMATION

	Consultants' Role in Audit and Later Phases			Turnover in Project Manager	Involvement of Advisory Committees in Audit Preparation		Involvement of Advisory Committees on Other CCEMP Tasks	
	All/Most	None	Selected Parts		Active	Inactive	Active	Inactive
Small Cities								
Boulder			X	X	X		X	
Greenville			X			X		X
Janesville		X		X		X		X
Portland		X				X	X	
Richmond		X				X	X	
Intermediate Cities								
Dayton	X				X		X	
Knoxville			X	X		X		X
Seattle			X		X		X	
Large Cities								
Los Angeles		X				X	X	
Philadelphia			X	X	X		X	
Counties								
Allegheny	X				X		X	
King			X			X	X	
Wayne	X					X	X	
Areawides								
Greater Bridgeport	X			X		X		X
South Florida			X			X		X
Toledo	X					X	X	

Findings

The experimental nature of CCEMP and the expected cut-off of funding at the end of two years create unusual conditions for project staffing. Communities have responded to these conditions in a variety of ways, usually involving flexible arrangements not typical of grant programs. These staffing arrangements have been described previously in the Academy's report on the organizing phase of CCEMP. General types of arrangements for staffing the community programs or energy offices differ largely in the amount of outside work performed by consultants. These arrangements include the following general types:

- All or most of technical work (audit and later phases) performed by consultants. A program director and staff assistants review consultant materials and provide liaison with policy advisory committees. Examples include Dayton, Greater Bridgeport, TMACOG and, to a large extent, Wayne County.

- All or most of technical work performed by staff. Typically, staff from other departments or permanent energy coordinating offices are used. Some advisory committees play active roles. Examples include Los Angeles, Richmond, Portland, and Janesville.

- Selected sections of the audit and other phases conducted by consultants. Permanent and temporary staff (often student interns) have worked with consultants in producing audit materials for advisory committee review. Some of these communities have drawn heavily on advisory committee assistance. Communities in this group include Allegheny County, Boulder, Greenville, Knoxville, Seattle, Philadelphia, King County, and South Florida.

The Role of Consultants. Only four communities (Janesville, Los Angeles, Portland, and Richmond) did not use consultants in preparing the community energy audit. In one of these cases, the project manager felt the audit work could have been done easier and completed earlier if some of the work had been contracted out. Two of the other communities experienced major delays in

completing the audit, one due to computer difficulties. Utility assistance in the fourth facilitated development of the audit.

The communities using consultants include five who relied on university departments or university research institutes for all or part of the work. The rest used a variety of independent or small specialized consulting firms, generally for portions of the audit (e.g., specific sectors).

The effective use of consultants for the audit seems to depend on two things: communities knowing precisely what they wanted; and the closeness of individual working relationships. What type of institution was used seems less important. However, two of the communities going into the most sector detail contracted their audits to universities. It remains to be seen how the attempted thoroughness of these two audits affects the subsequent planning process.

At least three communities expressed dissatisfaction with how the consultants' role had evolved. Receipt of technical audit materials in two cases left the community staffs with little or no direction as to how the information should be used. Further analysis using the audit information would have been desirable. In the third community, consultants played a major role in developing the initial response to the Argonne request for proposal. In retrospect, the CCEMP staff believed that it would have been better to contract with smaller research groups and to plan greater reliance on in-house work.

Staffing of Programs. Community CCEMP staffing, as laid out in the organizing phases, has undergone various changes and has had to deal with a variety of challenges. Some of the developments are not unique to CCEMP, while others are due to the experimental nature of the program. Communities have had to deal with contractual delays, staff inexperience in energy analysis, and some leadership turnover.

Contractual Delays. Final approval of program work plans in some communities took several months longer than was anticipated at the outset of CCEMP. Because communities received initial funding appropriations only for the work plan and organizational development phase, these delays impeded timely hiring of support staff. This in turn delayed the audit phase. Reasons for contractual delays vary. Generally, they involved differences of opinion between communities and Argonne National Laboratory over (1) the level of detail in project fiscal management and (2) the degree to which communities specified how they were going to conduct the technical portions of the planning methodology.

Development of Staff Capabilities. The timeliness of energy issues has generally allowed communities to attract a high calibre of both management and support staff. Regardless of how communities have chosen to staff preparation of the audit (in-house staff, university assistance, not-for-profit contract research organizations, private consultants), the attempt to use the audit method required a long learning period. This is particularly true for those communities which attempted to develop detailed local data for use within the audit framework (Dayton, TMACOG, and South Florida). Staff (or consultants) have had difficulties in:

- Deciding quickly whether the data they had were any good and in getting data from utility companies
- Dealing with the limitations of direct surveys, some of which did not function as planned
- Fitting together diverse kinds of data from different sources
- Attempting to develop reasonable approximations where data were deficient
- Dealing with consultant work which did not always meet initial expectations.

These kinds of problems are not surprising. Experienced judgment is limited in the local energy field. Even in communities with experienced energy coordinators, application of the audit methods required considerable adjustment and experimentation by staff before audit drafts compatible with the data limitations were completed.

Staff Turnover. Five of the CCEMP communities had changed project managers as of April 1980, a rate not as surprising as it might appear. Individuals with energy management background are particularly in demand; the future of local energy offices after completion of CCEMP is uncertain in some communities; and the political exposure of the programs has been frustrating as have the problems with applying the audit and planning methods.

Staff turnover has been much less of a problem than the loss of project managers. In two communities, however, rapid staff turnover delayed the audit. Both of these cases were due to departmental or interdepartmental management problems.

Staff Relations to Policy Advisory Committees. Community experiences suggest that most policy advisory committees have only been peripherally involved in the development of the audit. The common pattern among most communities was to restrict advisory committee participation to the receipt of progress reports, conveying difficulties and findings, and upon completion of the audit, to seek their review and approval.

With the exception of five communities, staff have played the major role in managing the audit work. In these five, active subcommittees worked closely with CCEMP staff in developing audit assumptions, obtaining data, and reviewing drafts. Overall, it proved very difficult to maintain committee interest and activity given contractual requirements to prepare a detailed comprehensive audit.

In some cases, advisory committees have reacted negatively to the type and quality of information generated from the audit exercise. Concerns were raised about the accuracy and usefulness of audit information, quality of draft reports, and the concern that most energy problems were self-evident.

Two general patterns of staff/committee relations are apparent so far in the planning process:

1. Limited committee roles, reacting to interim staff products, with agendas for meetings set by staff--typical of some of the smaller communities and those proceeding sequentially with the planning methodology.

2. Significant staff/committee interaction with staff assisting subcommittees working on development of issues and alternatives or technical committee reviewing the products generated by staff or

> consultants--typical of the larger and more energy experienced communities. It is these situations where frustration over the length of audit time and the relevance of information has resulted.

Although not many advisory committees played a direct role in the development of the audit, several did participate in other community energy activities and other phases of CCEMP. Other activities included guest speakers, review and input to issue papers, goals, or objectives, and advice on other community energy projects, as discussed later in this section.

In a few situations, staff have worked closely with policy advisory committees as part of ad hoc task forces looking at alternatives for early implementation or have worked on other non-CCEMP energy related projects such as municipal conservation. Examples are described later in this section.

Conclusions

Preliminary conclusions from the community experiences include the following:

Consultants' Role. From the experience of the communities, one lesson does seem clear. It is probably better for communities to conduct some preliminary energy analysis before hiring outside assistance. Preliminary auditing using utility billing data would allow communities to fit technical assistance more precisely to actual needs. The effect on the final planning process of complete delegation to consultants remains to be seen.

Staff Development. Levels of staff capability and particularly energy experience can be expected to change as more college and university courses are developed around energy planning and management and as programs such as CCEMP

diffuse energy management experience. The lesson from staff experience with the CCEMP program does suggest the need for refinement of audit guidelines to reflect the limitations of locally available data and the capacity of local analysts to make legitimate use of various data sources.

Staff/Advisory Committee Relations. It would be expected that in all but a few communities, staff would tend to dominate the process simply because (1) most of the policy or technical advisory committee members are volunteers whose time is quite limited, (2) staff controls the technical information; and (3) the process to date has not reached the politically difficult point of decision (i.e., what is the community actually going to do in energy management?). Where policy level individuals have participated actively during the audit phase, there have been understandable differences. Advisory committees have not wanted to depend on the audit information for development of sectoral issues, objectives, policies, and specific alternatives. Again, this raises the issue of when policy level advisory committees should be convened. It would appear that background information on energy consumption should be available before formally convening high level advisory committees.

The Role of Public Utilities

Participation of utilities is important to local energy management planning for two reasons.

1. Utilities provide the only source of data for validating audit method estimates of gas and electricity use. More important, utility data can be used directly in monitoring project results and for purposes of program development or evaluation.

2. Utilities are increasingly involved in energy management actions. Rate changes and the Residential Conservation Service are the two major utility efforts. In some circumstances, utilities may also participate in integrated community energy systems. Coordination with these activities will be important for effective community energy management planning.

Findings

Information and assistance from investor owned and municipal utilities have been essential in preparing community energy audits.

- All the communities received data assistance from their utilities. Utility compliance with data requests, however, has sometimes required special efforts or went beyond their automated information capabilities. In Toledo, data on utility fuel deliveries for the 144 small geographic areas did not arrive until April 1980. By requesting small area data, the request was made more difficult to comply with--since summary data for rate book districts had to be retrieved.

- In Philadelphia, CCEMP staff encountered a number of utility data problems. Although the data supplied were very good, they were not always in a form useful for energy management planning.*

In several of the communities, utilities were actively involved in the audit effort.

- In Allegheny County, utility research executives have been among the more active members of the Technical Advisory Committee, providing review and comment on drafts of the building audit sectors.

- In Janesville, Wisconsin, Wisconsin Power and Light has worked with the city in conducting the energy audit. Wisconsin Power and Light provided residential electrical and gas consumption data from 1970 through 1979. The city is particularly interested in the residential audit to determine the energy savings of homes that have been retrofitted through city-sponsored programs or by Wisconsin Power and Light.

- In Seattle, Seattle City Light was able to provide CCEMP staff with the majority of the necessary information on energy users and a profile of energy consumption through a survey of their residential customers conducted in 1978-79. Washington Natural Gas, through a

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* Philadelphia Gas Works (public) commercial and industrial customers are not coded by SIC and interruptible customers are not classified by end-use sector. Philadelphia Gas Works had no real computer data base, and billing tapes had routinely been destroyed at the end of the year. Philadelphia Electric Company's (private) large industrial commercial customers are SIC coded but small industrial users are not. Until recently, there were significant errors and inconsistencies in PECO's coding. Although these have been corrected, historical files have not been regenerated with the new codes. This produces potential inaccuracies in consumption trends by SIC industrial groups. The CCEMP staff reports that to develop an efficient, current routinely maintainable information system for local energy management, some changes in the way utilities maintain their present sales records are necessary.

rate analysis, provided the average amount of natural gas consumed annually by single family and multifamily attached units for space heating, water heating, and cooking.

- Similarly, the King County residential survey was conducted with Puget Sound Power and Light by enclosing survey forms in the monthly billing statement.

Conclusions

Utility data provide the best information for surveying some fuel uses. It appears that slight modification of billing systems can also provide much of the necessary data for monitoring of gas and electricity consumption. Development of model information formats for consideration by other utilities would be valuable for future community energy planning efforts. The next phase of the Academy's monitoring and evaluation effort will explore these possibilities in more detail.

The Role of Elected Officials

Commitment of elected officials to proposed community energy plans is obviously important. Without that commitment, meaningful actions seem unlikely. The current national focus on energy issues should increase elected official interest in CCEMP. Because of the nature of CCEMP, community pilot projects also may be more vulnerable to political level changes.

Findings

For the most part, elected officials have not played an active role during the audit phase. This is hardly surprising, since many of the communities also had trouble keeping up attendance at their policy advisory committee meetings.

Elected officials serve on a number of the policy advisory committees. For example:

- In Los Angeles, a City Council member actively serves as vice chairperson for the Energy Management Advisory Board. She also chairs the Council's Energy and Natural Resources Committee.
- A Greenville City Councilor serves as a non-voting liaison between Council and the Energy Management Commission.
- In Richmond, the Mayor is actively interested in the project, is briefed regularly on progress, and attends the CCEMP Executive Committee meetings. A council member has also been in regular attendance.
- Dayton's regular Steering Committee meetings are chaired by a City Commissioner.
- In Wayne County, a Commissioner chairs the Energy Management Council.

As discussed in the section on objectives setting, the legislative bodies in three communities--Boulder, Seattle, and King County--have reviewed and approved issues and objective statements; others are expected to, as well.

Election year changes have directly or indirectly affected three community projects, as indicated at previous points in this report. The effects by community can be summarized in the three cases as follows:

- Little effect on project design but temporary hiring freezes and loss of internal administration as a result of departmental reorganization
- Restructuring of the policy advisory committee and significant revamping or cutback in planned subcommittee roles with the objective of increasing participation in the project
- Reduction of the advisory committee functions to current departmental participation, loss of staff, and a hiatus in further development of the project.

Conclusions

Elected officials, with one or two exceptions, have not played a major role in the development of the audit. Where they have been active, they have chaired policy advisory committees which met on a regular basis.

It is anticipated that elected officials will be increasingly involved as communities begin to select energy management actions. Review of planning products by legislative bodies and participation in debate on actions should occur toward the completion of the planning process.

Early Implementation and Project Spinoff

The planning method proposes a linear planning process. Auditing was to produce information for setting quantitative objectives. Alternatives and strategies were to be devised for meeting objectives.

Findings

A number of communities have proceeded with energy management actions, concurrent with the planning process. Directly or indirectly, CCEMP project staff and advisory committees have helped in the implementation of several community energy activities. Many of the early implementation actions were planned by communities at the outset of the program, with CCEMP serving in part as a coordinating mechanism. In other places, early project spinoffs are more directly related to activities of CCEMP committees and staff. While CCEMP is an exercise in energy planning, there is a natural and strong tendency for communities to follow lines of opportunity at the time they occur, using these projects later as part of the community energy plan.

Several examples illustrate this process:

- Toledo Metropolitan Area Council of Governments--CCEMP Technical Team and University of Toledo installed a pyranometer for daily solar index readings for use by local media weather programs.
- Wayne County--CCEMP lead agency (County Office of Intergovernmental Affairs and Management) has made small ($2,500) energy planning grants from Community Development Block Grant funds to local communities for comprehensive plan revisions. Also, the County is pushing for the merger of a model residential retrofit ordinance with the State Residential Conservation Service Program.

- Los Angeles--CCEMP staff assisted in the evaluation of an ordinance calling for solar water heaters in new residential construction.

- King County staff was called on for a variety of activities including: assistance on Title III County building audits; assistance to the County Executive to address statewide electrical curtailment planning; assistance to the County Executive in intervention hearings before the state utility commission on electric resistance heating moratorium; and economic analysis of a County building code requiring 100 percent double glazing.

- Richmond--Midway through the base year energy audit, a host of activities were begun. Among these were public information and education programs, supplemental energy audits, energy demonstration programs, and alternative/strategies development.

- Seattle--The policy advisory committee (Energy Ltd. Citizen Committee) reviewed the city's proposed residential retrofit ordinance.

In Philadelphia, energy management planning has been picked up outside of CCEMP activities. Concurrent with CCEMP, a citizen based energy initiative has emerged (Community Coalition for Energy Efficiency--C2E2) and an 11-county private sector Regional Energy Council is currently in the formative stage.

With minor exceptions, community staffs view these activities as serving an important and useful role for local energy management planning. In several cases, these actions have been started outside of the CCEMP process. Staff analytical skills have been used in support of the actions.

Conclusions

Given the current level of activity in energy policy and technology, it seems inevitable that most local energy planning programs will be drawn to early actions. Under these circumstances it would seem that local energy planning methods need to account for and support early implementation opportunities. The goal of "comprehensive" planning may serve as a convenient means for organizing the planning process. What appears necessary is a planning method that encourages phased implementation.

Public Involvement and Awareness

Given the highly technical orientation of the audit, few community involvement and awareness efforts were anticipated during the first stage of the planning process. With the initiation of the objectives formulation phase--when choices regarding the direction of the planning process are made--there is a need to develop consensus on community energy issues and secure early commitment to the planning process. One means of obtaining both is through public involvement and awareness activities.

Many communities planned for sustained citizen involvement through advisory committee membership. Only a few work plans, however, identified mechanisms or actions external to committee membership for public involvement and awareness. Of interest in the objectives formulation phase is whether and how communities broaden participation in and awareness of the planning process through opportunities for public input and public awareness activities.

Citizen Input Mechanisms. Only four communities have used, or plan to use, external citizen input mechanisms as part of the objectives formulation process. Three of the four are small cities--Boulder, Janesville, and Portland. The fourth is Seattle, a medium-sized city. Also significant is that Janesville has no committee structure.

Three of the four communities started the objectives setting process with community meetings. The meetings helped identify energy values and priorities as viewed by citizens and community groups. Boulder started the objectives setting process with a town meeting attracting about 300 participants. This forum allowed citizens and community groups to express energy concerns and priorities to both the Boulder City Council and the Energy Task Force.

In Seattle, citizen input was obtained through two dozen community organization and neighborhood-based meetings conducted by University of Washington facilitators. Following opening remarks by Energy Ltd. Citizen Committee members and a slide show presenting key audit findings, attendees were requested to fill out opinion questionnaires. General themes emerging from the responses were then used by staff and the Committee as guideposts for developing objectives. The Janesville CCEMP staff will identify citizen perceptions of energy issues and problems through the use of the "Delphi Technique" involving a preliminary list of issues and solutions to be ranked according to importance by selected participants.

Portland is the only community to date affording citizens the opportunity to react to proposed energy objectives. A major public meeting--sponsored by the Portland Energy Reduction Team, and cosponsored by the Chamber of Commerce and the University of Southern Maine--was held in the spring of 1980. This meeting allowed for public discussion of both audit results and preliminary objectives established for the energy planning process.

Public Awareness Efforts. Most communities have established public awareness programs and/or subcommittees to publicize CCEMP activities and sponsor public education functions. The most common public awareness technique in use is the publication of newsletters, charting the progress of CCEMP and other national, state, and local energy developments, or the preparation of articles for incorporation in other local publications. Popular summaries of the energy audit have also been prepared, or are planned, by a number of communities for distribution to the public. Other means of public awareness have included the development of project description brochures which were often disseminated via mailed survey questionnaires during the energy audit phase.

A few communities have broadened public awareness efforts to include additional activities. Three notable examples are Richmond, the Toledo Metropolitan Area Council of Governments, and Wayne County.

The Richmond CCEMP project has served as a catalyst for the formation of other community groups or to broaden the agenda of previously established groups to include public education efforts. In cooperation with the Organization Planning for Energy Concerns (OPEC), which is the technical advisory group to the CCEMP, and the local Chamber of Commerce, a seminar series for business and industry personnel has been initiated. The CCEMP staff was also instrumental in the formation of two other groups having public education as part of their missions. The Energy Development Assistance Program was established as a subset of OPEC to identify practical applications of energy conservation measures and projects. The Solar Interest Group (SIG) was formed to advance interest in local solar applications through demonstrations and public education. Finally, steps have been taken by the City to incorporate a non-profit educational organization, yet to be named, to administer and implement community energy projects.

The Toledo Metropolitan Area Council of Governments (TMACOG) CCEMP effort has included two public education initiatives. The first is a series of four staff-developed information papers which were reviewed by the policy advisory committee during the audit phase. Topics addressed by these papers included: Ethyl Alcohol from Biomass (gasohol)--A Review; Life-Cycle Costing for Energy Conservation in Buildings; Groundwater Heat Pumps; and Toledo Area Solar Index. Although intended to assist in the alternatives/strategy selection phase, upon acceptance by the policy advisory committee, these papers have been published in final form for distribution to the public. As previously mentioned, the Solar Index paper subsequently led to the installation of a pyranometer at the University of Toledo, providing daily solar index readings for the local media. The second activity involved a workshop for church operating personnel, focusing upon energy auditing methods and conservation techniques.

Public education is one of seven program areas established for the Wayne County--Energy Action Plan. During the initial phases of the CCEMP planning process a number of public education efforts were undertaken by the CCEMP staff, including:

- A two-day workshop, co-sponsored by the State Energy Administration, to train municipal and County staff in procedures for public building audits--40 attended;
- Two, two-day CCEMP/Wayne County CBDG/Detroit Edison-sponsored workshops conducted for community grant coordinators and building inspectors outlining procedures to be followed in determining the most efficient and cost-effective weatherization measures to be supported by County CDBG rehabilitation/retrofit grants;

- Assistance to the City of Trenton in establishing a $25,000 energy public awareness program including an energy fair, public school programs, and workshops; and,

- Newspaper articles covering energy issues and conservation methods prepared by the two CCEMP consultants and disseminated by the County Information Office.

Findings

Key findings regarding public involvement and awareness efforts during the audit and objectives formulation phases include:

- Public involvement was minimal during the energy audit phase.

- External public involvement has not been a common feature of community objective setting processes. Only one quarter of the CCEMP communities structured citizen input into their process of setting objectives; most of these were small cities.

- Where public involvement was a part of the objective setting process, it has often preceded the drafting of objectives. Results have conditioned the selection of objectives by staff and committees. Only one community afforded citizens the opportunity to react to proposed objectives. In this case, public involvement was used to check the acceptability of objectives.

- Public awareness efforts are nearly universal among the communities, beginning during the energy audit and continuing to the present.

Conclusions

Citizen and community organization representation on CCEMP committees continues to be the principal means for public involvement in the planning process. Efforts to broaden public involvement during the objective setting phase, beyond committee membership, are limited to only four communities. Hence, for most communities, the extent of consensus and commitment achieved during the objectives setting phase extends to only those interests represented and participating within the CCEMP committees.

Public awareness activities have been emphasized by all CCEMP communities. However, expanded efforts in a few communities suggest that public awareness will emerge as a primary strategy for implementing energy actions.

Coordination

The pervasive influence of energy across all community functions places a broad coordination requirement upon the conduct of all phases of the energy planning process if recommendations are to be credible and implemented. Initial coordination requirements corresponding to the audit and objectives formulation phases are two-fold. First, staff (or consultants) must have access to timely information on important categories of community energy consumption, trends in consumption, and general supply conditions in order to conduct the energy audit. Secondly, participation of key public/private actors and organizations must be secured so that a commitment to recommendations results from the planning process.

Gaining access to, formating, and interpreting the diverse information required to conduct the energy audit was a formidable task for most communities. Having only limited information and knowledge about community energy use and supply, most CCEMP staffs were obliged to seek information and advice from other public agencies and private organizations. Anticipating this need, many communities established coordination mechanisms at the outset of the planning process. Of interest is whether these mechanisms, or other techniques, were helpful in obtaining information or resolving technical dilemmas in the conduct of the energy audit.

Almost all CCEMP communities activated policy advisory committees prior to or during the conduct of the energy audit. Most communities included a cross-

section of representation on these committees with membership drawn from the ranks of public officials, private organizations and citizens. Coordination with the varied activities and interests represented by the membership was anticipated to result as a by-product of their interaction and participation over the term of the planning process. Therefore, the operation of these committees during the conduct of the audit is of interest to note the level of participation and initial commitment achieved.

Gaining Access to Information. A variety of formal coordination mechanisms were proposed or established by communities during the CCEMP organizing phase. Although most were not limited in purpose to the energy audit, they were anticipated to assist in gaining access to needed information and in resolving technical problems. These mechanisms included: delegation of work tasks to other public agencies; committees with explicit coordination responsibilities, and technical advisory bodies. Experience with the operation of these mechanisms within a cross-section of communities is noted below.

Los Angeles. Responsibility for the conduct of the Los Angeles energy audit was originally delegated to the Planning Department, with the lead residing with the Energy LA Office within the Mayor's Office. Staff turnover within the Planning Department and time spent in negotiating an acceptable work program impeded conduct of the audit. Ultimately, responsibility for the audit and staff from various City departments were assigned and physically housed within the Energy LA Office to complete the audit and support the development of other tasks. In this community, the delegation of work tasks to other departments worked better when staff were detailed to one central location.

Knoxville. Coordination and review functions were assigned to the Executive Management Committee, composed of policy-level representatives from public and private organizations and interest groups. Yet, up to the completion of the audit, the Committee had no formal organization nor were interim products or requests for information made through the Committee.

Seattle. Two coordinating committees were established as part of the CCEMP committee structure, the Municipal Support Group and the Technical Resource Group. The Municipal Support Group is the mechanism for involving City departments and agencies in the CCEMP effort while the Technical Resource Group was established to provide an interface between the Seattle and King County CCEMP projects relative to technical issues and jointly conducted tasks. The Municipal Support Group was not activated during either the audit or objectives formulation tasks. Rather, informal contact was maintained between the Energy Office staff and various agencies and the interim draft of goals and objectives was formally transmitted to each agency for review and comment. Although the Technical Resource Group has met on several occasions, informal contact between the two project directors and staff has proven to be a more frequently used means for coordination.

Toledo COG. A Community Energy Audit Subcommittee was established by the Toledo Metropoitan Area Council of Governments--Energy Guidance Group to assist in the identification, assembly, and coordination of data required for the energy audit. Membership of the subcommittee consisted of energy suppliers and state regulatory agency personnel. Yet, the full subcommittee was never convened. Rather, direct contact between project staff and the individuals appointed to the subcommittee was used as the means for obtaining needed data.

Dayton. The Action Plan Development Team serves as the technical review and coordination arm of the CCEMP management structure. Membership of the Action Plan Development Team is fluid, depending upon the agenda, and has included University of Dayton project personnel, various City department representatives, areawide planning agencies, and the private utility. This mechanism has worked well, but informal contact served as the principal means of obtaining information from other sources.

The early functioning of the planning process indicates that these formal mechanisms were generally of limited value in gaining access to information and technical knowledge about community energy use and supply. Instead, informal coordination methods, such as staff consultations with other departments and energy suppliers, proved to be the norm.

Reliance upon informal methods of coordination during conduct of the audit was largely a result of the type of work being performed--a massive data gathering exercise. Consequently, much of the staff effort involved direct contact with both public and private sources having information of possible use in the audit--city planning department, the County Tax Assessor, areawide planning agencies, state energy offices and energy suppliers. There

was usually too little data, seldom too much. When multiple sources existed, the question of which source to use could often be answered objectively based on compatibility with the format of the planning methodology. Another factor accounting for the limited use of formal coordination mechanisms was the output of the audit--a profile of energy use in the community--which does not directly impinge upon the interests of committee members.

Securing Participation and Commitment. Sustaining the interest and participation of policy advisory committee members over the long time period required to conduct the energy audit was a major challenge to most communities. During this period, meeting agendas seldom required the active participation of committee members and few decisions were needed. Typical agendas included progress reports on the energy audit, speakers on energy issues, demonstrations of energy saving or generating devices, and discussion papers on various topics.

The lull introduced by the conduct of the audit, shortly after policy advisory committees were formed, exacted a price in most communities. The general result of not having substantive discussions or decisions to make was that the interest of key individuals on these committees often waned. Some members either stopped attending meetings or sent alternates in their stead. In more than half of the communities (See Section IV. Other Planning Phases: Does the Audit Help?), a desire to engage in substantive actions led to the early initiation of other planning phases before audit results were available. In others, the lack of interest and participation led to a reformulation of policy advisory committees--Greenville, or altered committee structures--Portland and Knoxville.

Findings

Three general findings relative to coordination are apparent in the experiences of communities during the energy audit phase:

1. Formal coordination mechanisms were not generally active nor helpful in obtaining information required for the energy audit.

2. Informal coordination methods, principally staff contact and interaction with other agencies and energy suppliers, proved to be the most common means of obtaining information required for the energy audit.

3. Early formation of policy advisory committees frequently resulted in a loss of interest and participation over the long time period required to conduct the energy audit. The diminution of interest and participation has been partly responsible for altering the sequential phasing of the planning methodology and committee restructuring.

Conclusions

These findings raise doubts as to the need for formal coordination mechanisms and active policy advisory committees during the conduct of the energy audit. Access to information needed for the energy audit was primarily obtained through staff contact with other departments and private energy suppliers, with little need to involve coordinating committees or technical advisory groups in securing or interpreting data. The activation of policy advisory committees at the outset of the energy audit poses a real risk of loss of interest and participation. Lacking substantive matters for policy advisory committee deliberation, the preliminary evidence suggests that their activation ought to await the near completion of the audit.

VI. GENERAL CONCLUSION

Much remains to be learned as communities complete the CCEMP planning process and governing bodies consider adopting the plans. The experience to date, however, already suggests the need for flexible approaches to local energy management planning. Most needed are flexible approaches for:

1. A simpler audit method.
2. Simultaneous performance of planning phases.
3. Improved ties between technical work and committee operations.

1. A Simpler Audit Method. A simpler audit method is necessary to accommodate variations in data availability, objectives for energy planning, and the state of community energy experience. Efforts to produce highly detailed energy audits proved extremely time consuming and costly, both in terms of expended project resources and diminished policy advisory committee interest in the process. Moreover, final results were often acknowledged to have large margins of error.

Only a limited amount of information is required to start the planning process--a profile of community energy use by major sectors and fuel types. The potential to effectively "audit" electricity and natural gas consumption already exists through most utility billing records. Modification to billing codes and manipulation capacity would appear to significantly reduce the information costs of developing community energy profiles, including time series information for monitoring energy consumption. Use estimates of other non-centrally reported fuels for various sectors could be developed by using the default values supplied with the planning methodology or by limited sampling.

2. Simultaneous Performance of Planning Phases. The link between the suggested audit and projection methods and the way communities are actually

setting objectives is particularly weak. Further, many communities are conducting later phases simultaneously, departing from the consecutive process suggested by the planning methodology. These tendencies (coupled with the recommendation for a simpler audit method) suggest changes in the planning methodology. What is needed is an iterative planning process more suited to local energy management planning. This would involve more audit detail--subsector end use/fuel type information--developed for specific actions under consideration in the policy making process.

3. Improved Ties Between Technical Work and Committee Operations. Policy advisory committees probably should not be fully developed until a general audit has been completed. Sustaining policy advisory committee interest in the planning process proved to be a difficult challenge for many communities because of the time needed to complete the energy audit. Committee inaction was difficult to justify given their general perception that the detailed audit had limited direct relation to the policy process. Unless committees can work on other phases of plan development or serve other community energy roles, their activation should await the completion of the audit.

These observations will be developed more fully in the subsequent Academy reports.