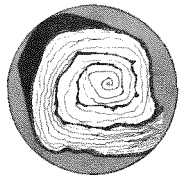
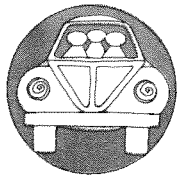
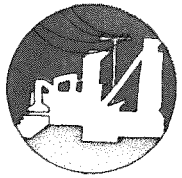
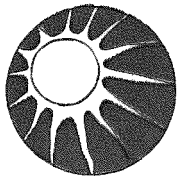
Draft Action Plan

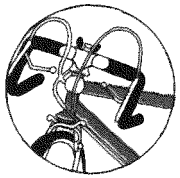
Report of the ENERGY, Ltd. Citizen Committee
October 1980



ENERGY, Ltd.

for a secure energy future

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This report was financed with funds from Argonne National Laboratory and the U.S. Department of Energy.

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To All Seattle Citizens:

Since the OPEC oil embargo of 1973, everybody has had a different explanation for our energy problem. Some people blame the oil industry or the utilities; others blame wasteful consumers; some blame government rules and regulations; and still others blame the OPEC countries. There are some people who are so fed up with the explanations that they don't believe there is a problem.

We believe that there is an energy problem, and that it will be with us for some time to come. The problem is complex and has many symptoms and causes--rising costs, uncertain supplies, increasing demand and questionable information. Placing the blame on someone else's doorstep won't help us solve the problem as it affects Seattle.

We represent the ENERGY, Ltd. Citizen Committee, 28 Seattle citizens who believe we can contribute to solving the energy problem right here at the local level. Over the past year and a half, we've worked many hours to develop a plan of action for Seattle.

The development of the action plan has been guided by a long-range goal: a secure and sustainable energy future. This goal can be achieved if we can marshal a long-term commitment on the part of elected officials and the public at large.

This action plan represents the Citizen Committee's draft recommendations. We offer them to you for public scrutiny over the next few months.

We hope you will review this draft action plan carefully. We will schedule public meetings in November, December, and January to solicit your comments. After digesting your comments and revising the action plan as necessary, we will prepare our final recommendations to the Mayor. Following consideration of our recommendations, the Mayor will propose a Final Action Plan to the City Council in early 1981.

Now is the your opportunity to get involved. You can be part of the solution!

Sincerely,

Paul Demitriades
Co-chairperson
ENERGY, Ltd. Citizen Committee

Beverly Smith
Co-chairperson
ENERGY, Ltd. Citizen Committee

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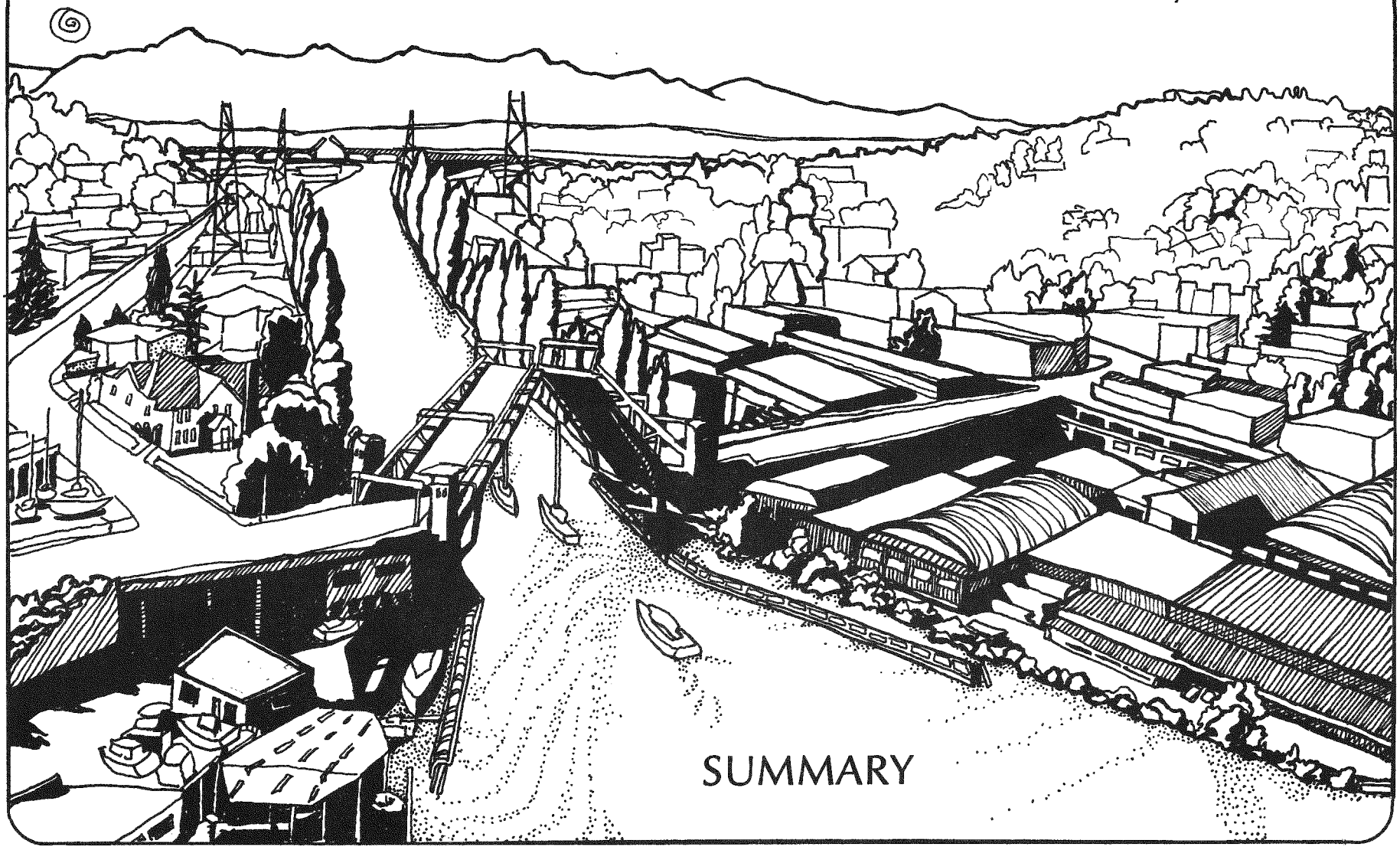
"Our task now is not to fix the blame for the past but to fix the course for the future."

John F. Kennedy

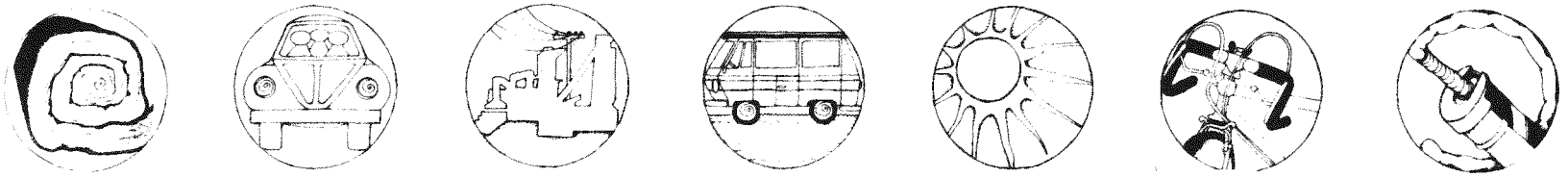
ENERGY
for a secure energy future

The trouble with our times is that the future is not what it used to be.

Paul Valéry



SUMMARY



SUMMARY

If we discovered oil in Seattle, would you say we should drill for it? Guess what? We have!
And we've also discovered natural gas. The resource we've found is potentially equal to about half of what we now consume in our buildings.

According to ENERGY, Ltd. estimates, we could reduce energy demand in our buildings and facilities by 84 percent for oil and 74 percent for natural gas, with only a modest 18 percent increase in demand for electricity. We could do this by "drilling" for the conservation and solar resource.

"Drilling" for this untapped conservation and solar potential is a way of viewing our buildings as part of the **solution** to our energy problem, not simply as part of the problem. For example:

- Residential energy use could be reduced by 58 percent (space heating alone by 81 percent).
- Commercial building energy use could be reduced by 40 percent, even allowing for a doubling in commercial space by the year 2000.
- Industrial energy use could be reduced by 25.7 percent.

These energy savings estimates are conservative. First, we have taken into account vigorous economic growth in some sectors. Second, we have not examined all the conservation technologies and we examined only those that are currently available, not accounting for innovations that will surely take place during the next 30 years. Third, we have determined that small scale, neighborhood heating systems are technically feasible and cost effective, but we haven't included their contribution because not enough is known about their potential distribution.

The ENERGY, Ltd. Citizen Committee has developed a comprehensive action plan for managing the energy resources used in transportation and buildings.

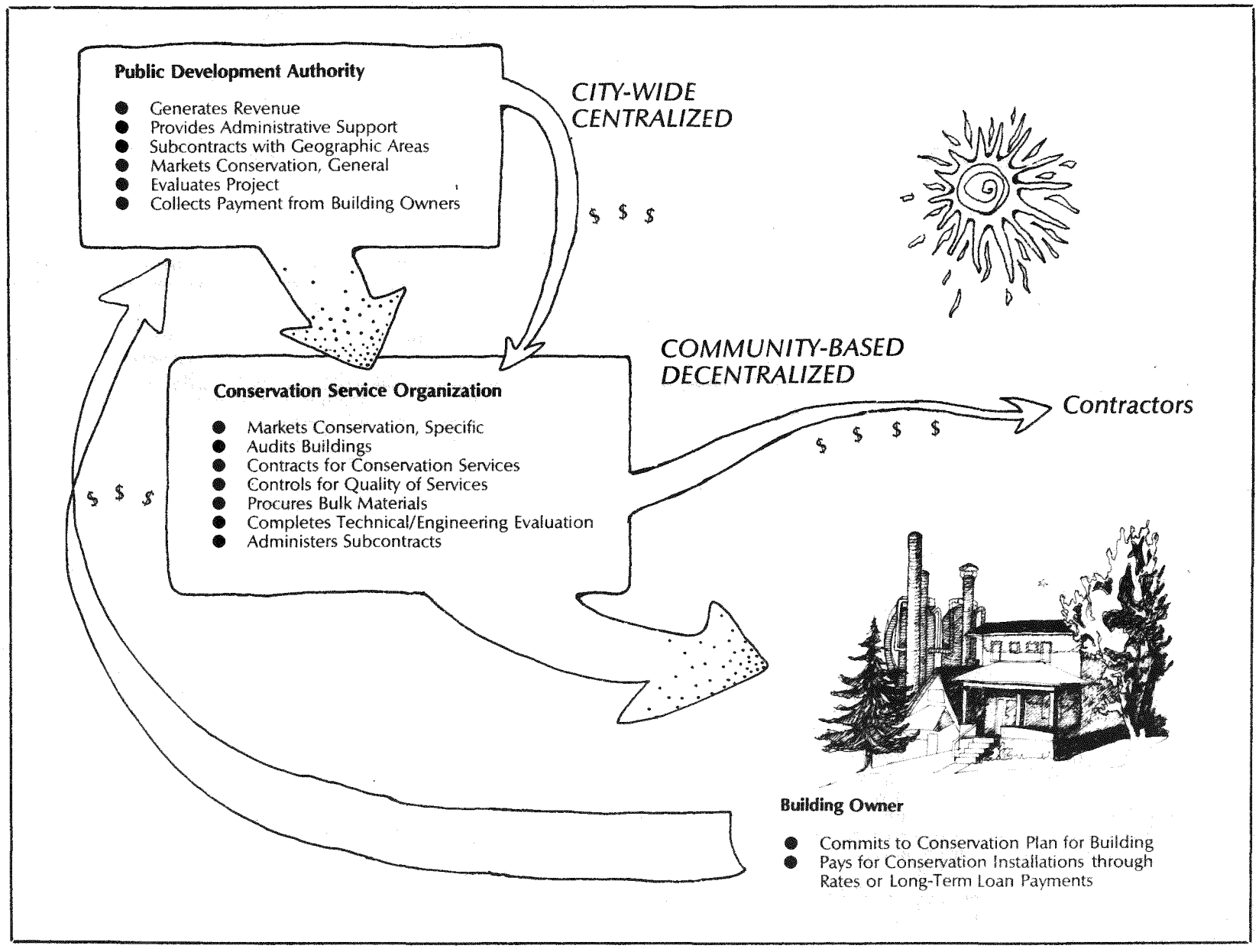
In transportation, a 10 percent energy savings can be achieved, and that's 10 percent of the 32 percent of Seattle's total energy consumption that was used for transportation in 1978.

The Citizen Committee has established a long-range goal of achieving maximum cost-effective conservation and use of renewable resources in **all** of Seattle's buildings. This would be accomplished through a Community Energy Redevelopment Plan. The plan would require that we make public investments in conservation and solar energy on the same terms by which we now invest in new electric generation facilities. Key elements of the plan include:

- Public financing to provide low-interest loans over the useful life of the investment.
- Maximum use of existing community organizations to market conservation services at the neighborhood level.
- Total retrofit or design packages determined by organizations with no vested interest in any particular technology. The organizations would assist the building owner with an energy audit, contractor selection, and quality control and would provide a single mechanism for repayment.
- Maximum private sector involvement in areas ranging from the purchasing of the bonds to contracting of energy conservation businesses for the actual retrofit work.
- Minimum requirements for all sectors of the built environment--residences, commercial buildings, industrial facilities, and municipal facilities.

Figure S-A illustrates how the Community Energy Redevelopment Plan would function.

FIGURE S-A
COMMUNITY ENERGY REDEVELOPMENT PLAN
ORGANIZATION AND FUNCTIONS



What will the Community Energy Redevelopment Plan accomplish?

- A 78 percent reduction in building and facility use of fossil fuels.
- A concomitant reduction in our vulnerability to energy supply interruptions and energy price increases
- Encouragement of the use of conservation and renewable energy resources
- More local jobs, and money recirculating in our own economy
- Lower energy bills.

What will it cost? Table S-1 shows annual cost comparisons for two typical buildings; these include the cost of paying for the conservation improvements. Table S-2 shows the energy demand for each of the buildings before and after retrofit, as well as the energy savings.

The conservation option would cost the average single family homeowner 27 percent less, on an annual basis, than oil heat, which is used in 53 percent of Seattle's single family homes. (Compare columns (1) and (2) in Table S-1.) In the most disadvantageous case--the single family home with electric baseboard heat--the conservation option would cost 48 percent more at today's energy prices, but this does not take into account either the escalating price of energy or any incentives that might be offered by the utility. Since it is very likely that energy prices will inflate faster than conservation prices, even in this case conservation is still an attractive option.

For the average office building, the conservation option would cost from 17 to 52 percent less, given the prices facing consumers today. However, it is important to compare the cost with the cost of public investments in new electricity. The cost of saving the energy is 74 percent less than the cost of new electricity for the office building, and 46 percent less for the single family residence. (Compare columns (4) and (5) in Table S-1.) In effect, column (5) shows the cost of **not** taking the conservation option. It's approximately equivalent to what we would pay for electricity from the Washington Public Power Supply System nuclear plants.

The capital cost of the Community Energy Redevelopment Plan would be approximately $150 per person per year over the next 30 years. This investment would pay instant dividends through reduced costs in nearly every case, and certainly through costs that would rise more slowly than any of the generation or production alternatives. The total cost is estimated at $2.3 billion over 30 years, including $1.2 billion for residential buildings, $830 million for commercial buildings and $240 million for industrial facilities. In addition, some incentives for meeting minimum requirements would be provided to building owners; these would be paid for through City Light rates.

Table S-3 summarizes the energy savings estimated for all the recommendations of the Citizen Committee. In the next few pages, each element is described in more detail, particularly the rationale for each and the implementation. Taken together, they constitute a plan of action for creating a secure and sustainable energy future.

TABLE S-1
COMPARISON OF ANNUAL ENERGY COSTS FOR TWO TYPICAL BUILDINGS BEFORE AND AFTER RETROFIT
(Dollars per Year)

	Before Retrofit[a]	After Retrofit[b]	Residual Purchased Energy	Cost of Energy Saved[c]	Cost of Saved Energy If New Electricity[d]
Office Building (28,657 ft.^{2})					
All Electric	$20,938	$17,379	$ 7,326	$10,063	$38,562
Gas Heat	29,664	18,773	8,710	10,063	38,562
Oil Heat	45,523	21,772	11,709	10,063	38,562
Single Family (1,450 ft.^{2})					
Electric Baseboard	384	568	221	347	474
Electric Central	465	598	251	347	637
Gas Heat	707	657	310	347	637
Oil Heat	1,000	730	383	347	637

[a] Based on October 1980 average energy prices.

[b] Includes cost of conservation plus residual purchased energy.

[c] Based on tax-exempt financing (9 percent) over the useful life of the conservation improvement.

[d] Based on new electricity costs of $15.37/MMBtu (space heating) and $11.30/MMBtu (other electricity).

TABLE S-2
COMPARISON OF ANNUAL ENERGY DEMAND FOR TWO TYPICAL BUILDINGS BEFORE AND AFTER RETROFIT
(Million Btu)

	Purchased Energy Before	Purchased Energy After	Total Energy Saved	Percent Savings
Office Building (28,657 ft.[a])				
All Electric	4,330	1,515	2,815	65
Gas Heat	6,380	1,846	4,534	71
Oil Heat	6,800	1,944	4,856	71
Single Family (1,450 ft.[2])				
Electric Baseboard	81	47 (41)	34 (40)	42 (49)
Electric Central	98	53 (44)	45 (54)	46 (55)
Gas Heat	135	61 (49)	74 (86)	55 (64)
Oil Heat	148	62 (50)	86 (98)	58 (66)

Note: [a]Numbers in parenthesis show the effects of solar retrofits, plus conservation.

BACKGROUND

What Is ENERGY, Ltd?

You'll find in no park or city
A monument to a comittee.

Victoria Pasternak

ENERGY, Ltd. is a federally financed demonstration project undertaken by an active Citizen Committee and the Seattle Energy Office. As one of sixteen national demonstration projects, formally called the Comprehensive Community Energy Management Program (CCEMP), it is designed to determine the roles local government can play in managing energy resources. King County has a project similar to ENERGY, Ltd. and the two have attempted to work closely together. The challenge presented to ENERGY, Ltd. is the development of a comprehensive energy management plan for Seattle.

ENERGY, Ltd. has an approximately two-year life under federal funding. The project has been following a general planning framework consisting of six tasks as shown in Figure S-B.

TABLE S-3
TOTAL ENERGY SAVINGS

	Energy Savings	Percent Savings
Buildings and Industry (1978 demand: 67,590[a] billion Btu)		
Residential	13,971 billion Btu	(58.5)
Commercial	10,926	(29.0)
Industrial	4,491	(27.5)
Community Energy Redevelopment Plan Total	29,388 billion Btu	43
Government[b] (1978 demand: 1,710 billion Btu)		
Municipal Facilities	217 billion Btu	12.7
Transportation (1978 demand: 34,122 Btu)		
Low-Power Vehicles	39 billion Btu	(0.1)
Ridesharing	625	1.8
Fuel Efficiency	16	(.05)
Alcohol Fuels[c]	2,720	(8.0)
Total	3,400 billion Btu	10.0

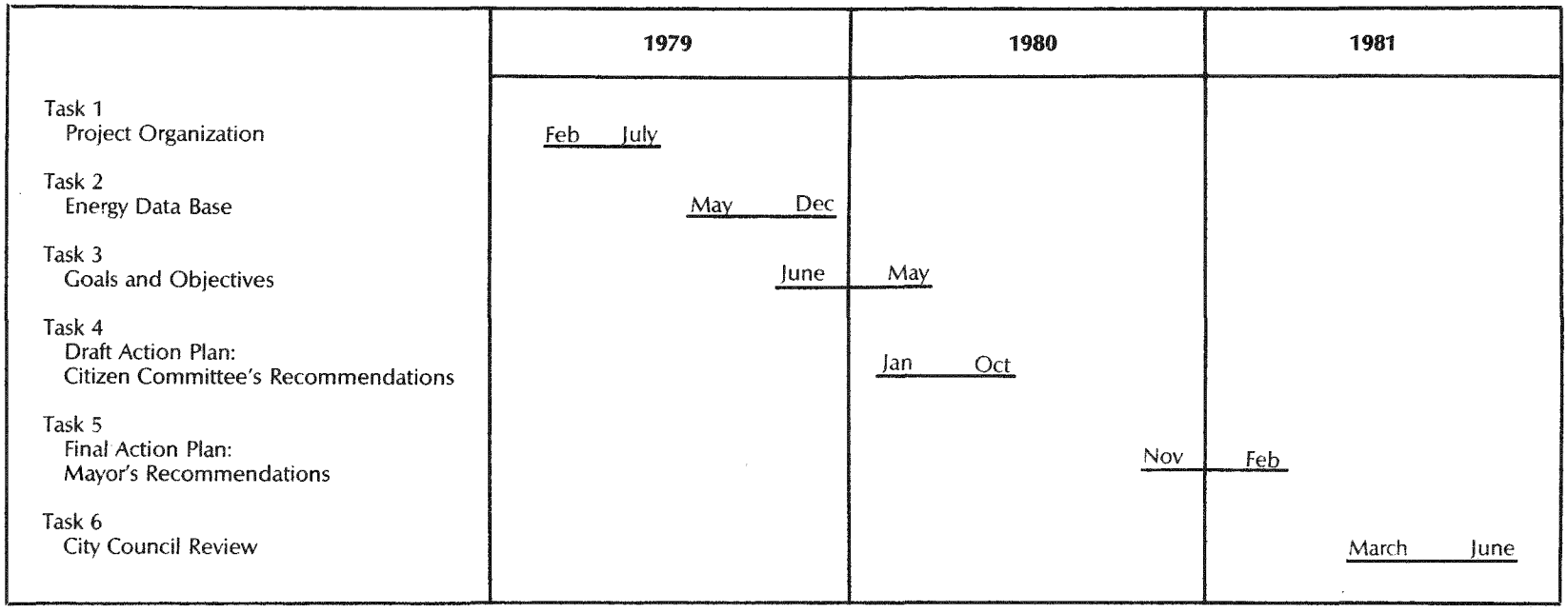
[a]This amount is 8 percent higher than what is shown in the ENERGY, Ltd. Data Base because of averaging the energy demand of only four commercial building prototypes.

[b]Governmental energy use includes non-City government. The municipal facilities conservation is estimated at 35 percent of municipal energy use alone.

[c]The impact of alcohol fuel displacement of petroleum is high because the savings estimates assume a near doubling in Metro's demand for fuel and because the estimate accounts for displacement of all of Metro's diesel fuel regardless of where in the county the fuel is consumed.

Members of the ENERGY, Ltd. Citizen Committee were appointed by the Mayor and confirmed by the City Council. The 28-member Citizen Committee has been operating since February 6, 1979, and has been meeting every two or three weeks since then. Additional members of the public have participated in the work of several subcommittees, so that approximately 60 citizens have been formally involved in ENERGY, Ltd.

FIGURE S-B
ENERGY, LTD. SCHEDULE



This major commitment of time and personal energy contributed by volunteers represents:

- A recognition that the energy problems facing our nation are real and must be addressed by public policy
- A belief that citizen volunteers can make a difference in the development of public policies
- A willingness to work with local government to ensure that energy management plans are sound and that they reflect the thinking of an informed community about the role of local planning in energy management.

Prior to the publication of this report, ENERGY, Ltd. has had three major accomplishments:

- The *Energy Data Base,* a report which provides the first comprehensive view of energy supply and demand in the city: what kind of energy we use, how much we use, where it comes from, and how we use it
- Approximately 30 community meetings to solicit ideas about Seattle's energy goals and the types of programs that should be encouraged
- City Council Resolution 26353, establishing tentative energy goals and policies for the City and a set of energy management tasks to which ENERGY, Ltd. would give priority attention.

A new world is only a new mind.

William Carlos Williams

What Is This Action Plan?

The Draft Action Plan is the tentative ENERGY, Ltd. response to a range of energy problems that are not likely to go away in the near future. The problems are described in more detail in our *Energy Data Base,* but the salient points are:

- Despite its relatively inexpensive electricity, Seattle is still heavily dependent--75 percent--on nonrenewable fossil fuels for the energy we use.
- Our energy supplies are vulnerable to politically motivated

disruptions because about half the oil and two-thirds of the natural gas we use come from foreign sources.

- Our energy supplies are vulnerable to system failure, either accidental or intentional, because of centralized production and delivery.

History repeats itself only if we let it.

Diane DiPrima

- Consumers are vulnerable to energy prices beyond their control, and the money spent on energy largely does not recirculate in the local economy.
- The significant price differential which has existed between fossil fuels and electricity means that there has been pressure for large conversions to electric resistance heating for space heating.

  Without any public policy to the contrary, this will continue and will place a substantial burden on electricity-generating capacities that are already straining to meet demand.

- We need to provide an alternative to high-cost fossil fuels and to electric resistance heating, particularly if Seattle City Light adopts strict conversion policies.

The *Energy Data Base* also found that large amounts of energy can be recovered from local renewable energy resources such as solar energy and biomass. Subsequent research shows that there is a large quantity of untapped conservation potential as well. These resources present us with an opportunity for solving some of the problems. ENERGY, Ltd. believes that any response to these problems and opportunities must be long range and multifaceted. There are no quick fixes and no single simple solutions.

The Draft Action Plan is also a response to our earlier work in developing energy goals and objectives. In Resolution 26353, the City Council recognized our work and adopted 11 general energy goals for the City, giving direction to this plan. The goals reflect the problems and opportunities identified in the *Energy Data Base*.

1. Assure a sufficient and reliable supply of energy to meet reasonable consumer needs.
2. Assure that all consumers use energy wisely.
3. Reduce local per capita energy consumption while maintaining a desirable living and working environment.
4. To the extent practical, make energy choices and use energy technologies which maintain or improve the quality of the environment.
5. Maximize opportunities to make energy decisions at the local level, and decrease reliance on energy supplies that are not subject to local controls.
6. Encourage the vigorous development of renewable energy resources, and reduce dependence on nonrenewable energy supplies.
7. Continue and expand energy conservation efforts and increase the use of energy-efficient technologies.
8. Encourage the development of an energy supply system that is resilient and diverse.
9. Make energy choices which match the type and heat quality of an energy supply to the appropriate needs of the consumer at the point of use.
10. Promote energy-efficient land use, transportation and economic development plans and policies.
11. Assure energy consumers an equitable and affordable supply of energy.

What Themes Run through This Plan?

There are several themes that are important to an understanding of the ENERGY, Ltd. recommendations. These include:

- Seattle can achieve a secure and sustainable energy future if an aggressive and comprehensive action plan is followed.
- A comprehensive program must address all forms of energy and must reach all classes of energy users.
- The maximum development of cost-effective conservation and renewable energy resources, when cost effectiveness is measured against the cost of building new central station thermal electric resources, will achieve far more reduction in energy demand than the programs currently underway in the City of Seattle.
- Maximum conservation and renewable resource development in buildings, when coupled with energy-efficient land use planning and alternatives to the private automobile, can bring us close to neighborhood or community self-sufficiency over the long term.
- Government must set an example to citizens and businesses by properly managing its own use of energy.
- Some governmental regulation is justified to achieve societal goals,

but it has its limitations. To achieve maximum conservation, financial incentives must be provided to attract private investment.

What is the Role of Local Government?

In analyzing the energy problems and developing a comprehensive energy plan, several basic questions have surfaced:

- What is the City's role with regard to the conservation of oil and natural gas?
- To what extent should the City regulate energy use, and to what degree should it rely on voluntary action?
- How can the City encourage the private sector to undertake energy-conserving activities?

The City's role in electric energy planning is obvious; it comes with ownership of the electric utility, Seattle City Light. The City's long involvement in electric energy policy sets a standard for energy planning in general. But does the City have the same level of responsibility to Seattle citizens who use oil and natural gas? There are certainly some equity issues involved. Some of our electric policies--for example, setting standards for conversion to electric resistance heat--limit choices for oil and gas users. Is that fair to them? Are we really saying that the City cares only about electricity because we own the electric utility? Or are conversion restrictions also justified when a broader context of total energy use is considered?

Is the operation of the municipally owned electric utility separate from the City's responsibility to represent all consumers equally? The utility traditionally operates as a business, albeit a nonprofit one. If we used our utility to provide nonelectric services to oil and gas users, would that be fair to electric rate payers? Is that our only option in meeting the needs of oil and natural gas consumers? No city policy is established for the management of oil and natural gas supply or demand, except for general statements encouraging conservation. The recommendations in the Draft Action Plan will, if implemented, help define city policy in this area.

Another role local government can play, particularly to influence the use of all energy types, is to exercise its police power to regulate, based on benefits to the general health, safety, and welfare of society. The advantage of regulation is that, in comparison to the ability of local government to offer incentives, from a legal perspective regulation is easier to understand and the powers are more clearly defined. The disadvantage of regulation is that it is restrictive, must be enforced, and is limited (properly) by political considerations.

The whole issue of mandatory versus voluntary approaches has been given serious, lengthy consideration by the Citizen Committee. Three general principles have emerged:

- All groups of consumers must be treated equitably. If conservation is mandated for residences, for example, then comparable actions must be mandated for commercial and industrial consumers.
- Mandatory programs must be aggressive enough to achieve real energy savings and to ensure that everyone takes at least minimum action.
- When at least minimum energy savings are assured by mandatory programs, then a voluntary, incentive-based approach to achieve optimal cost-effective savings can complement the mandatory measures.

The final role for local government that this report suggests is to stimulate actions by the private sector, small businesses and the community in carrying out an aggressive program of energy conservation and renewable resource development. The most powerful way is to provide public financing. Individuals trying to finance conservation must borrow money at 10 to 12 percent interest and pay it back over 5 to 10 years. On the other hand, utilities seeking capital to build new generation or transmission facilities can issue bonds at 6 to 8 percent interest, if they are tax exempt, and can pay off the bonds over a 30-year period. If local government can raise the necessary capital on comparable terms, then conservation can compete much more effectively with new generation. Once the capital is raised, then local government should use it to stimulate private sector efforts, either by contracting out the work or by making loans to energy users. As we shall see, this requires the removal of significant legal barriers to public sector flexibility.

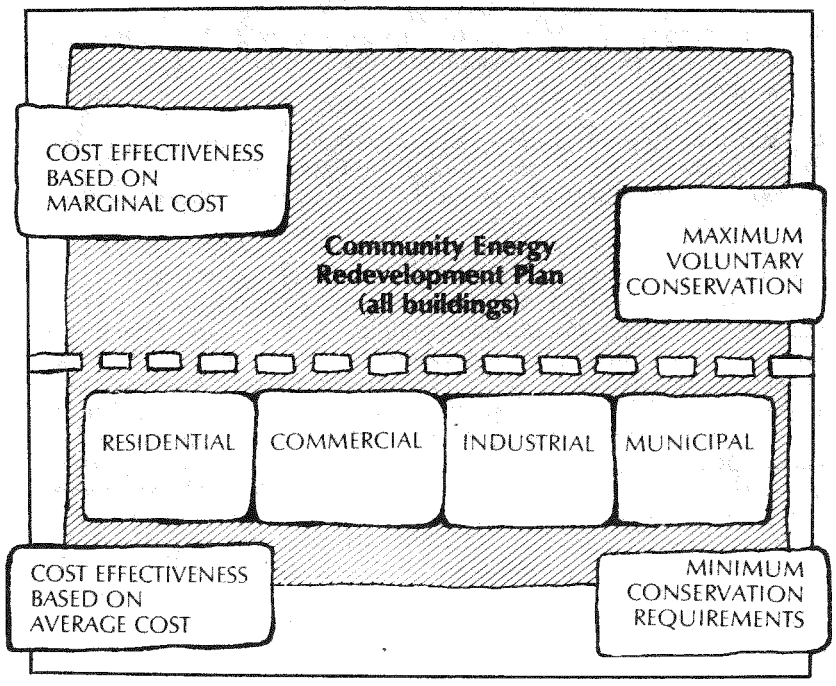
THE ACTION PLAN

What Are the Building Energy Strategies?

The ENERGY, Ltd. Citizen Committee is proposing a Community Energy Redevelopment Plan, a city-wide effort to achieve maximum conservation and use of renewable resources in **all** of Seattle's buildings. This long-range plan, clearly an ambitious undertaking, involves both regulatory and incentive elements, as shown in Figure S-C.

The regulatory elements set **minimum** requirements to achieve efficient energy use in all sectors--residential, commercial, industrial and municipal--applying the principal of equity across all sectors. These minimum requirements are viewed as a point of departure for the Community Energy Redevelopment Plan. The incentive elements of the plan are intended to achieve **maximum** cost-effective energy savings by providing attractive financing comparable to the terms at which the City would finance a new facility for energy production or generation.

FIGURE S-C
VOLUNTARY AND MANDATORY
ELEMENTS OF COMMUNITY ENERGY
REDEVELOPMENT PLAN



The requirement that all buildings meet minimum standards is based on a different criterion than the incentive-based maximum savings approach. For mandatory minimum requirements, the calculation of cost effectiveness uses the **average** price of electricity facing consumers (the cheapest energy available), so that the cost of compliance should not be at all burdensome. On the other hand, cost effectiveness for voluntary measures is evaluated against the **marginal** costs for new electricity and assumes public financing of the conservation measures over a 30-year period at tax-exempt bond rates, which is how City Light would raise capital. This results in much more cost-effective conservation, because conservation is much more competitive with the higher marginal electricity costs.

The goal of the Community Energy Redevelopment Plan is obviously an ambitious one, and in order to implement the ENERGY, Ltd. recommendations, some major changes will be required. These changes will be necessary because:

- The City has never before organized, as a matter of public policy, to conserve fossil fuels or to develop decentralized renewable resources.
- The energy problems identified will be with us for the next several decades, at least.
- The magnitude of the effort--increasing the energy efficiency of **all** 150,000 buildings and 1,400 manufacturing firms in the city--requires the concentration of human and financial resources on a comparable scale.
- The accompanying investment is very large, more than $2 billion over the next 30 years.
- Financing the investment requires the creation of new or significantly changed institutions.

What Are the Transportation Strategies?

Although one-third of the total energy we consume is used for transportation, it is difficult to find points of real leverage for public policy to encourage conservation in transportation. There are several reasons for this:

- Transportation issues are really regional issues, because travel, and especially commuter travel, occurs across jurisdictional boundaries.
- Mass transit, a popular response to travel demand, is already provided by Metro, a public agency which has its own ongoing responsibility for long-range planning.
- Seattle is not a large enough market to demand that new vehicles meet our own specifications for fuel efficiency.

However, there are several approaches we can take to reduce the amount of energy used in transportation:

- Increase the fuel efficiency of vehicles. This is mandated by federal standards, but better engine maintenance and vehicle inspections can also increase efficiency.
- Reduce the use of vehicles or the vehicle miles traveled. Ways to do this include mass transit, ridesharing (carpooling and vanpooling), and the use of bicycles and mopeds for utilitarian purposes.
- Provide or stimulate the production of alternative, renewable liquid fuels to power vehicles.

Many of these approaches are being followed already, but we can be more aggressive at the local level if we choose to be. The ENERGY, Ltd.

transportation recommendations are intended to encourage that choice.

What Are the Recommendations and Results?

COMMUNITY ENERGY REDEVELOPMENT PLAN

OBJECTIVES

- Produce the maximum amount of energy conservation possible from retrofitting all buildings in Seattle (residential and commercial buildings and industrial facilities).
- Place investments in conservation and renewable energy technologies on a par with investments in conventional energy supplies.
- Use all conservation and renewable technologies that deliver energy or offset demand at a price competitive in each year of the program with the cost of energy delivered to consumers from new central station thermal power plants.
- Install total energy systems (cogenerators) where economically and environmentally feasible.
- Construct district energy systems where economically and environmentally feasible, preferably using a renewable energy source.

APPROACH

- Carry out near-term pilot project to retrofit approximately 1,000 buildings in a selected geographic area. Seek federal or private foundation funding assistance.
- Develop a city-wide program based on the results of the pilot project. The comprehensive program will include both a centralized city-wide agency for central management and financing, and decentralized conservation service organizations to deliver the retrofit services.
- Investigate establishment of a Public Development Authority as the centralized city-wide organization.
- Solicit proposals for the community-level conservation service organization through a competitive process.
- Develop a financing strategy offering terms comparable to tax-exempt revenue bonding that allows repayment over the useful lifetime of the conservation or renewable energy measure.

COSTS

- The costs for the total retrofit program would be roughly $2.3 billion, repaid over the useful life of the conservation or renewable energy measures. This capital investment is necessary to place conservation and renewable energy systems on a par with conventional energy supplies. Tax-exempt revenue bonds issued by a Public Development Authority are recommended as the first avenue of financing to be explored.

BENEFITS

- A reduction of 58.5 percent in residential sector energy use.
- A reduction of 39.9 percent in commercial sector energy use, even if this sector doubles in size by the year 2000.
- A reduction of 25.7 percent in the energy use of the industrial sector.
- A 78 percent decrease in demand for fossil fuels.
- Increase in local employment opportunities.
- Development of community-focused organizations that will build community identity and awareness of energy problems and solutions.

MANAGEMENT

- Seattle Energy Office pursues funding for pilot project.
- Seattle City Light operates pilot project.
- Seattle Energy Office and Law Department, with cooperation of Office of Management and Budget, establish the Public Development Authority.
- Public Development Authority and decentralized energy conservation organizations manage the total retrofit program.

SCHEDULE

- 1981-86 Develop, operate, and evaluate pilot project.
- 1981-86 Define and establish central organization as a Public Development Authority.
- 1987-2010 Operate comprehensive retrofit program.

INCENTIVES TO ENERGY CONSERVATION

OBJECTIVES

- Encourage private sector investments in energy conservation and renewable resources by:
  - Extending existing investment incentives
  - Removing legal barriers to the extension of incentives.

APPROACH

- Pass city legislation defining conservation as a legitimate business consideration for the City.
- Lobby the state legislature to amend various state laws to:
  - Enumerate the right of utilities to finance conservation
  - Expand the City's authority to issue revenue bonds for conservation purposes.
- Request that Seattle City Light accelerate and expand its Home Energy Loan Program.
- Participate on behalf of Seattle citizens in Washington Natural Gas rate hearings before the Washington Utilities and Transportation Commission.
- Urge the state legislature to reserve a portion of the taxes collected from major oil suppliers in order to make conservation loans to oil heat users.
- Bring to the vote of the people an amendment to the state constitution to allow the City the authority to lend its credit to all classes of energy users and to consumers of all energy forms.
- Lobby for the amendment to the Federal Energy Tax Act of 1978 to expand the level and time frame of tax credits to businesses investing in conservation improvement.

COSTS

- Ratepayers bear the costs of financial incentives provided by their utilities.

BENEFITS

- Comparable financing opportunities and incentives for all energy users of all energy forms.
- Significant amounts of energy saved through conservation investments, resulting in public savings on the marginal cost of new thermal or hydro facilities.
- Reduced reliance on fossil fuels.

MANAGEMENT

- Intergovernmental Relations (City of Seattle) provides necessary coordination and development of strategies.

SCHEDULE

- 1982 Initiate lobbying efforts.

APARTMENT WEATHERIZATION REQUIREMENT

OBJECTIVES

- Extend provisions of the proposed Comprehensive Residential Weatherization Plan to include buildings with more than four residential units in order to:
  - Attain energy efficiency among all residential structures
  - Treat residential energy consumers equitably in the development and implementation of a weatherization program.
- Complete weatherization of apartment building stock by January 1994, using a time-of-sale requirement.

APPROACH

- Develop weatherization standards for apartment dwelling units.
- Require weatherization of all apartment buildings at time-of-sale, effective January 1, 1984 or by January 1994, whichever date comes first.
- Develop audit program and operations manual for apartment buildings.
- Develop an energy savings fact sheet, containing current information on financing and energy-efficient technologies for apartment buildings, for distribution through Seattle City Light billings.
- Require changeover of existing master-metered units with separate heating units to individual meters, where feasible.

COSTS

- Costs for installing cost-effective energy measures are to be included in the estimates of capital investment for the Community Energy Redevelopment Plan.

BENEFITS

- Consistency in applying minimum energy efficiency requirements to all structures.
- Reduction in energy use by 20-30 percent per building.

MANAGEMENT

- City Energy Office develops conservation standards.
- Seattle City Light develops apartment operations manual.
- Mesh program operation with single family Comprehensive Residential Weatherization Program.

SCHEDULE

- 1981 Develop weatherization standards.
- 1981 Develop apartment operations manual.
- 1982 Develop information fact sheets. Update these periodically.
- 1984 Begin mandatory inspections.

INDUSTRIAL CONSERVATION PROPOSAL

OBJECTIVES

- Institute an aggressive conservation program for all industries, regardless of size of firm, directed at saving all forms of energy.

APPROACH

- Establish educational and informational programs.
- Provide incentives to firms to encourage early conservation actions and to help finance the cost of audits and technical assistance.
- Require that all firms conduct a "walk-through" audit (1985) and determine engineering and economic feasibility of conservation actions (1989).
- Make renewal of a firm's business license contingent upon certification that an audit has been completed.
- Provide an appeals procedure for firms that need additional time to comply with program requirements.

COSTS

- Estimated cost of audits: $1.4 to $2 million, to be paid by City Light rates.
- Estimated cost of technical assistance: $10 to $20 million, to be subsidized by City Light rates on a scale proportionate to the savings in electric energy.
- Private firm covers expenses for cost-effective capital investments, under the financial arrangements included in the Community Energy Redevelopment Plan.

BENEFITS

- Estimated potential energy savings of 10 to 30 percent per industrial facility.

MANAGEMENT

- Seattle City Light sponsors educational/informational programs and provides or pays for audits conducted prior to January 1, 1984.
- Seattle City Light establishes qualification standards for audit and technical analysis consultants.
- City Council reviews audit program and technical analysis program.
- Private firms provide technical analysis under shared cost arrangement with Seattle City Light.

SCHEDULE

- 1985 Require walk-through audits. Make funding available for audits that are completed by January 1, 1984.
- 1989 Require detailed technical analysis. Costs of analyses that are completed prior to January 1, 1988,are shared by City Light and the firm.
- 1991 Require all firms to provide Licensing Department with written verification of progress toward or completion of cost-effective energy conservation measures prior to receiving business license.

ENERGY IMPROVEMENTS IN MUNICIPAL FACILITIES

OBJECTIVES

- Ensure that the City actively undertakes energy-related improvements and energy management activities in its internal facility operations.
- Set example for private sector energy consumers.

APPROACH

- Develop a municipal energy management program through the City Energy Office and an interdepartmental team.
- Conduct, through respective departments, walk-through audits and energy/economic analyses to identify cost-effective energy investments.
- Develop annual and five-year energy investment plans, through an interdepartmental team, for resource allocation requests.
- Set aside General Fund revenues to pay costs. Generate additional General Fund revenues through a two-tenths of one-percent increase in the Business and Occupation Tax for utilities and through the 1981 municipal bond issue.

COSTS

- Approximately $3 million in total investment capital (1980 dollars, based on estimates for Portland retrofit program). This is not quite double the cost of energy used to operate municipal facilities in 1979.

BENEFITS

- A reduction of 35 percent in energy use in municipal facilities is estimated. Assuming that this applies equally across all energy types, the following reductions from 1978 consumption levels would result:
  - Heating Oil 5,131 barrels
  - Natural Gas 674,660 therms
  - Electricity 34,326,110 kWh
  - Steam 2,431,000 lbs.

MANAGEMENT

- City Energy Office along with an interdepartmental team develops investment plans.
- Office of Management and Budget and Office of Policy and Evaluation incorporate the energy investment plans in the Capital Improvement Program planning and budget.

SCHEDULE

- 1982 Complete initial five-year investment plan.
- 1987 Complete the initially planned improvements.

ENERGY IMPACT ASSESSMENT IN THE ENVIRONMENTAL REVIEW PROCESS

OBJECTIVES

- Encourage environmentally sound development within Seattle by strengthening the analysis of impacts on energy resources.
- Provide specific authority and guidance for the mitigation or prevention of adverse impacts on energy resources.

APPROACH

- Amend Seattle's SEPA Policy Ordinance to provide explicit policies for disclosure, mitigation, or prevention of adverse energy impacts.
- Assign development of threshold standards for determining the significance of the energy impacts to City Energy Office and Seattle City Light.
- Give City Energy Office the responsibility for recommending amendments or additions to existing SEPA procedural or operational manuals in order to include energy-related provisions.
- Assign the development and adequate operation of a pre-EIS scoping procedure to the Department of Construction and Land Use.

COSTS

- Additional city administrative costs are not anticipated.
- Project proposers bear costs for preparation of an environmental impact statement; the costs will vary from as little as a few hundred dollars for simple analyses to as much as $15,000 for analysis of a complex industrial plant.

BENEFITS

- Development of environmentally sound and energy-efficient projects.
- Potential energy savings of as much as 70 percent for a given project.
- Development of end-use data for energy management planning.

MANAGEMENT

- Department of Construction and Land Use implements adopted amendments.
- Seattle City Light and City Energy Office propose changes to existing administrative documents to provide guidance in the SEPA process.

SCHEDULE

- 1981 Adopt amendment.
- 1982 Prepare amendments and additions to administrative manuals.

COMMERCIAL BUILDING EFFICIENCY

OBJECTIVES

- Encourage maximum energy savings in commercial buildings and facilities through a comprehensive program including education, financial incentives, minimum standards, and technical assistance.
- Establish minimum energy efficiency standards for commercial buildings that foster consistency with other classes of the built environment.

APPROACH

- Provide "walk-through" audits for commercial buildings. Seattle City Light pays for the audits performed or requested prior to 1984. Audits are performed by qualified private consultants. The City establishes the standards and maintains a listing of qualified consultants.
- Support the efforts of the Energy Office in developing minimum retrofit standards as requested by the City Council and recommend that the standards include:
  - -- Mandated minimum standards based on cost-effective conservation actions
  - -- Subsidized technical assistance scheduled on the basis of number of Btu used per square foot, with assistance going first to the most energy-intensive buildings
  - -- Shared responsibility between Seattle City Light and building owner for cost of technical assistance.

BENEFITS

- Consistent application of energy conservation requirements for built environment.

MANAGEMENT

- Seattle City Light provides for audits.
- City Energy Office develops minimum requirements.

SCHEDULE

- 1981 Begin development of financial incentives.
- 1981-84 Carry out subsidized walk-through audits.
- 1981-87 Carry out subsidized technical assistance.
- 1982 Complete minimum building retrofit standards.

SOLAR ACCESS/ZONING

OBJECTIVES

- Encourage efforts by local jurisdictions to remove the barriers to increased use of solar technologies.

APPROACH

- Recommend measures to consider in zoning amendments that would encourage widespread use of solar technologies.
- Recommend means by which solar access can be protected.

COSTS

- No additional costs.

BENEFITS

- Increased potential for use of solar technologies.

- Fewer variance procedures relating to solar system installations; consequent reduction in administrative burden for city officials.

MANAGEMENT

- Department of Community Development develops and recommends solar access and zoning amendments.
- Department of Construction and Land Use implements any adopted provisions.

SCHEDULE

- 1982 Adopt and implement amendment and new provisions.

SEATTLE CITY LIGHT HEAT PUMP PROPOSAL

OBJECTIVES

- Improve energy efficiency of heating systems in 10,000 residences that currently use central electric resistance space heating through installation of hybrid electric heat pumps.

APPROACH

- Propose a shared financing program, recognizing both utility and customer benefits, to encourage installation of hybrid heat pumps.
- Investigate potential for implementation as pilot project, as prelude to possible regional program under Bonneville Power Administration.

COSTS

- Installed cost: approximately $5,000 (1980 dollars) per unit.

BENEFITS

- Potential energy savings of 9,700 kWh per unit per year. For 10,000 residences, annual energy savings would total 97,000 million kWh per year.
- The energy savings would be contributed during daily and seasonal peak demand periods. Reductions in purchased power costs could exceed $3 million annually.
- Peak load requirements would be reduced by 58 megawatts, contributing to savings of over $15 million in capital costs for peaking turbines or over $100 million for new thermal generation.

MANAGEMENT

- Seattle City Light operates program.

LOW-POWER VEHICLE PROGRAM

OBJECTIVES

- Increase travel by low-power vehicles such as mopeds and bicycles to account for at least one percent of the utilitarian trips taken in Seattle by 1990.

APPROACH

- Expand, by a resolution, the responsibilities of the Seattle Engineering Department to include planning and program development for all low-power vehicles that are introduced as utilitarian transportation modes.
- Establish low-power vehicle planning section within Seattle Engineering Department.
- Identify and pursue project funds for safe parking and commuter routing for low-power vehicles.
- Affirm the goals and policies of the City relating to utilitarian travel by low-power vehicles.

COSTS

- Annual costs: $70,000 for each of the three years.
- Project costs: $85,000, includes capital investment for parking facilities, and costs for routing and training.

BENEFITS

- Reduction of 311,000 gallons per year in petroleum use.
- Considerable reduction in traffic congestion.
- Improvement in air quality.
- Improved health for many city residents.

MANAGEMENT

- Seattle Engineering Department continues to operate the low-power vehicle program as expanded by this proposal.

SCHEDULE

- 1982-85 Construct facilities and operate program on scale that will result in energy savings by 1990.

RIDESHARING

OBJECTIVES

- Support Seattle/King County Commuter Pool ridesharing programs that:
  - Promote ridesharing in King County
  - Increase ridesharing opportunities as a public transportation option
  - Establish operation of over 1,000 vanpool groups as part of a comprehensive ridesharing program.
- Support maximum use of paratransit operation for commuter travel as well as for use by noncommuter groups wherever possible.

APPROACH

- Provide ridesharing and paratransit programs as a basic part of the public transportation system.
- Draw financial support from all jurisdictions receiving services; use federal, state, and local funds allocated for transportation services.
- Seek support from Metro for vehicle purchase and program operation.
- Operate the program under an organization with a high level of public accountability and potential revenue-generating capability.

COSTS

- Approximate program operating costs: $500,000 annually.
- Capital costs for purchase of vans: $25.2 million. Fees collected under vanpool program repay investment capital.

BENEFITS

- Reduced congestion at peak periods; 8,500 fewer vehicles on roadway.
- Petroleum use reduced by more than 119,000 barrels per year by 1990.
- Significant reduction in air pollutants emitted by automobiles.

MANAGEMENT

- City of Seattle or Metro manages the ridesharing program.

SCHEDULE

- 1982-90 Purchase vans.
- 1982-90 Operate program.

FUEL EFFICIENCY THROUGH EMISSION INSPECTION

OBJECTIVES

- Improve the fuel efficiency of passenger vehicles.

APPROACH

- Develop and distribute jointly with King County a checklist for fuel-efficient measures for different classes of vehicles.
- Distribute checklist to all drivers of vehicles that undergo emission inspections in King County.
- Explore feasibility of conducting energy efficiency and emission inspections on public fleets. If feasible, institute a pilot program.
- Seek funding for classes on fuel-efficient vehicle maintenance, alternative transportation modes, and efficient driving skills to be conducted through the Washington Energy Extension Service.

COSTS

- Material for checklists on fuel-efficient maintenance: $20,700 annually.
- Pilot program for emission inspection: $55,000 annually.
- Transportation-related classes: $56,000 annually.

BENEFITS

- Savings of 125,000 gallons of oil per year.

MANAGEMENT

- City Energy Office and King County Executive Office develop the maintenance checklist. The Washington State Department of Ecology distributes the lists.

- Department of Administrative Services explores the feasibility for fuel efficiency emission inspections.
- City Energy Office and King County Executive Office seek funding for classes to be offered through the Washington Energy Extension Service.

SCHEDULE

- 1981 Determine the feasibility of testing for fuel efficiency through emission inspections. If feasible, carry out the pilot project and begin public inspections in 1983.
- 1982 Complete and distribute checklist for energy-efficient maintenance procedures.
- 1983 Begin classes in transportation alternatives and vehicle maintenance.

ALCOHOL FUELS DEMONSTRATION PROGRAM

OBJECTIVES

- Expand use of renewable fuels as displacement for petroleum fuels in public fleets.

APPROACH

- Conduct feasibility study of alcohol fuel production based on woody and other cellulosic resources of western Washington.
- Conduct vehicle testing program as part of this study.
- If feasible, encourage construction of alcohol production facilities to meet the liquid fuel demand for King County, City of Seattle, and Metro fleets by 1990.

COSTS

- Anticipated costs for the feasibility study, including the vehicle testing program, total $1.3 million.
- Estimates of production plant costs and vehicle conversion cost would be made as part of the feasibility study.

BENEFITS

- The conversion of 100 percent of the public vehicle fleet by 1990 would conserve 20 million gallons of petroleum fuel annually.
- Public sector would assume leadership role in incorporating new technology.

MANAGEMENT

- Feasibility study is conducted as joint venture by Metro, City of Seattle and King County.
- Management beyond the feasibility study to be determined during the study.

SCHEDULE

- 1981-83 Conduct feasibility study.
- 1984-85 Dependent on feasibility study, begin construction of production plant. Complete construction in 1985.
- 1985-90 Convert vehicles and purchase new vehicles to run on ethanol.

How Do These Recommendations Relate?

This Draft Action Plan incorporates different schedules and management and financing strategies for implementing the Citizen Committee recommendations. The differences in approach can be highlighted by juxtaposing the long-range, incentive-based approach of the Community Energy Redevelopment Plan and the regulatory approach of the Industrial Conservation Proposal or the Apartment Weatherization Requirement.

The regulatory approach provides for near-term implementation through existing agencies with a combination of public and private financing. The incentive-based approach will take longer to implement because it will require a significantly different organization and will use a more comprehensive financing strategy. The city-wide or centralized organization needed to administer the Community Energy Redevelopment Plan may, when it is operational, assume responsibility for the other building retrofit programs.

The different approaches do not appear to pose any inherent conflicts and the Citizen Committee believes the City Council should consider meshing the various programs with the Community Energy Redevelopment Plan as it is implemented.

DRAFT ACTION PLAN RESPONSE TO CITY COUNCIL RESOLUTION 26353

Resolution 26353, passed by the City Council and signed by the Mayor

on June 2, 1980, established tentative policies, many of which were recommended by ENERGY, Ltd. Of the five policies, several are very similar in intent. Table S-4 shows the relationship of the policies to the ENERGY, Ltd. proposals in matrix form.

Resolution 26353 also enumerated a number of energy management tasks which were recommended by ENERGY, Ltd. From these, the Citizen Committee established priority tasks that were assigned to ENERGY, Ltd. for completion. Table S-5 shows, again in matrix form, where each ENERGY, Ltd. task is addressed in the Draft Action Plan.

TABLE S-4
RESPONSE OF ENERGY, Ltd. PROPOSALS TO TENTATIVE POLICIES

TENTATIVE ENERGY MANAGEMENT POLICIES	ENERGY, Ltd. PROPOSALS												
	CERP	Incentives	Apartment Weatherization	Industrial Conservation	Municipal Facilities	Energy in EIS	Commercial Buildings	Solar Access	Heat Pump	Low-Power Vehicles	Ridesharing	Fuel Efficiency	Alcohol Fuels
1. Treat all energy-consuming sectors equitably in implementing energy management policies.	●	●	●	●	●	●	●						
2. Provide economic incentives to encourage energy conservation.	●	●		●			●						
3. Distribute burden of energy costs fairly.	●		●	●	●		●						
4. Support national, regional policies consistent with local policies.		●											
5. Express energy costs in terms of total life cycle costs, taking into consideration the replacement cost of energy resources.	●												
6. Give preference to indigenous energy resources.	●							●					●
7. Support private sector implementation.	●			●			●						
8. Give preference to supply technologies that minimize risk of disrupting a major element of the energy system.	●							●					●
9. Give preference to supply technologies that can be developed quickly.	●							●					●
10. Give preference to energy programs that increase local employment and promote a positive local balance of payments.	●		●	●			●		●				●
11. Encourage conservation, use of energy efficient-technologies and accelerated development of renewable energy resources.	●	●	●	●	●	●	●	●	●	●	●	●	●
12. Encourage reliance on appropriate mix of fuel types, supply sources, generation technologies and conservation strategies to minimize undue dependence on any one energy resource.	●		●	●	●		●	●	●	●	●	●	●
13. Use energy from nonrenewable sources where necessary in short term while providing growing reliance on renewable energy supplies in the future.	●										●	●	●
14. Make decisions leading to flexible, resilient energy systems and allow for timely response to unanticipated supply constraints or energy opportunities.	●		●	●	●	●	●			●	●		●
15. Implement energy-pricing policies and tariffs that encourage the efficient use of scarce energy resources.		●											
16. Make energy supply and use decisions which distribute the costs and benefits equitably to energy consumers.	●		●	●	●		●				●		
17. Make local governments the model of wise and efficient use of energy.					●								●
18. Mandate energy conservation where necessary and appropriate.			●	●	●		●						
19. Increase public awareness of possible impacts of future energy prices and energy supply constraints.	●		●	●	●	●	●				●	●	●

TABLE S-5
RESPONSE OF ENERGY Ltd. PROPOSALS TO PRIORITY ENERGY MANAGEMENT TASKS

ENERGY, Ltd. PROPOSALS

PRIORITY TASKS	CERP	Incentives	Apartment Weatherization	Industrial Conservation	Municipal Facilities	Energy in EIS	Commercial Bldgs.	Solar Access	Heat Pump	Low-Power Vehicles	Ridesharing	Fuel Efficiency	Alcohol Fuels
1. Propose strategies for developing and implementing weatherization and other conservation standards in buildings, especially apartments.	●		●				●						
2. Propose strategies for deploying renewable energy systems and conservation technologies in new and existing housing.	●							●	●				
3. Propose incentives for maximizing energy conservation, use of renewable resources and cogeneration in commercial buildings.	●	●											
4. Develop an industrial energy use reporting system for long-range planning and for identifying opportunities to improve energy efficiencies.				●									
5. Propose strategies for providing technical assistance to speed implementation of energy efficiency and renewable resource measures.				●			●						
6. Propose strategies for maximizing energy conservation, use of renewable resources, and cogeneration in manufacturing businesses.	●			●									
7. Propose strategies for incorporating stronger energy use criteria into the environmental review process through policy and regulatory reform.						●							
8. Propose methods for identifying, generating, and committing revenues for energy-related capital improvement projects.					●								
9. Review the energy impacts of the new town policy being considered by King County.													
10. Propose a demonstration project using nonpetroleum powered vehicles to meet local transportation needs.													●
11. Propose strategies promoting the use of fuel-efficient vehicles through measures such as changes in the determination of vehicle taxes and registration fees, the proceeds of which would be used for conservation programs in transportation.										●	●	●	
12. Determine the feasibility of and propose strategies for supplying major amounts of new energy from a diversified mix of renewable energy resources such as solar, wind, biomass (including municipal waste), small and intermediate scale hydroelectric, and geothermal resources.	●	●						●					●
13. Determine the feasibility of and propose strategies for supplying new energy from a diversified mix of energy-efficient technologies such as heat pumps, cogeneration and district heating.	●	●	●	●	●	●	●		●	●	●	●	
14. Review and comment on City efforts to develop and evaluate new sources of electric energy supply, especially the Energy Resources Report.													

The ENERGY, Ltd. Citizen Committee realizes that some of our recommendations are controversial; we know that we do not have all the answers. We welcome constructive comments from the general public and special interest groups. We know our recommendations can be improved; the more exposure they get, the better the chance that our Action Plan will be strengthened.

During the months of November, December, and January, we will be holding several community meetings to communicate our ideas more fully to the public and to solicit a thorough review.

On the basis of both the public review and additional work on our own, we will recommend changes to the Mayor. Based on the public response, our own recommendations, and the review by various city departments, the Mayor will propose a Final Action Plan to the City Council in February 1981.

In subsequent months, the City Council will review the Final Action Plan and decide what course the City should follow. During this time the public will again have an opportunity to influence Seattle's energy future.

My interest is in the future because I am going to spend the rest of my life there.

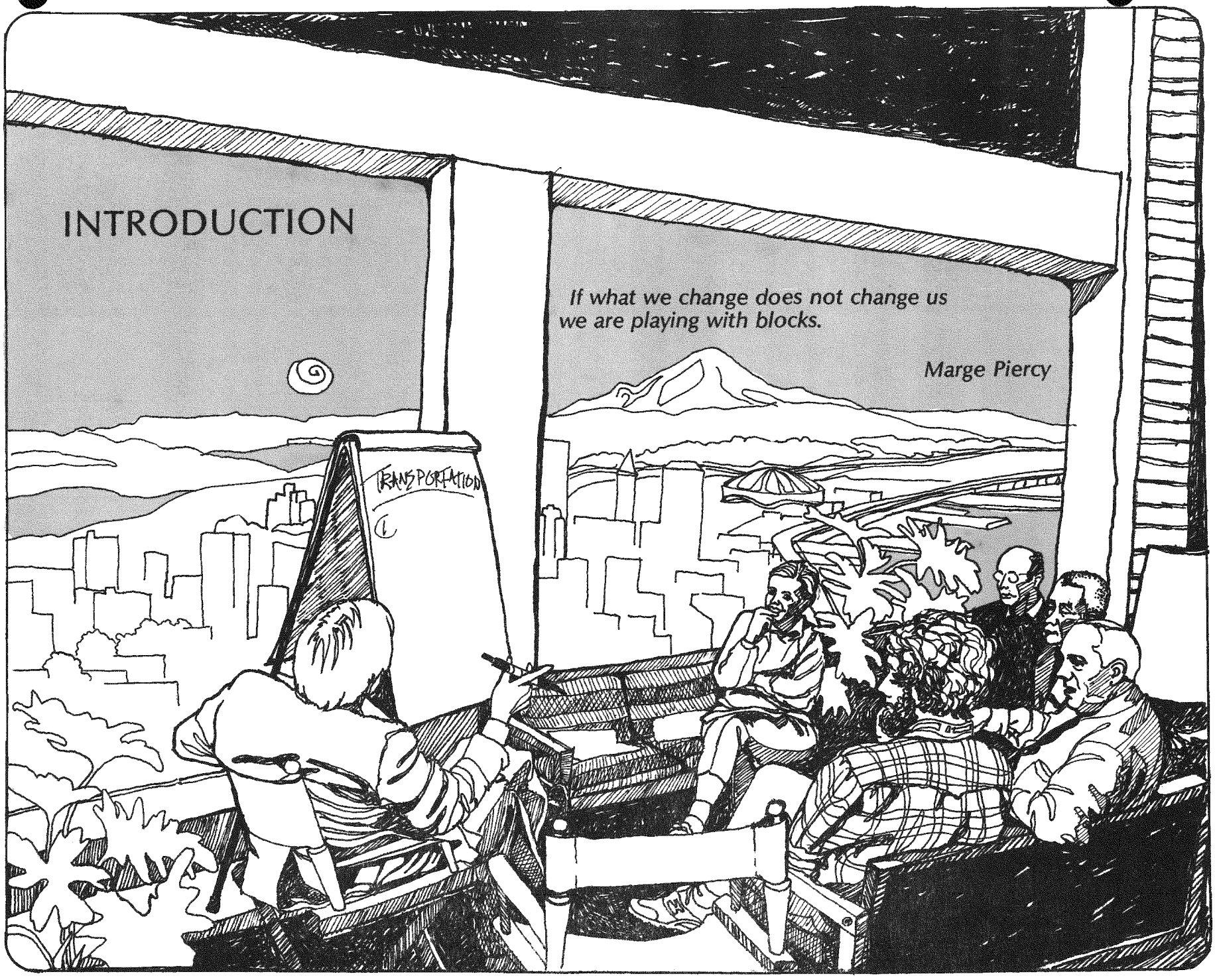
Charles Kettering

ENERGY
for a secure energy future

INTRODUCTION

If what we change does not change us
we are playing with blocks.

Marge Piercy



INTRODUCTION

WHAT IS ENERGY, LTD?

BACKGROUND

ENERGY, Ltd. is a federally financed demonstration project undertaken by an active Citizen Committee and the Seattle Energy Office. As one of sixteen national demonstration projects, formally called the Comprehensive Community Energy Management Program (CCEMP), it is designed to indicate the roles local governments can play in managing energy resources. King County has a project similar to ENERGY, Ltd. and the two have attempted to work closely together. The challenge presented to ENERGY, Ltd is the development of a comprehensive energy management plan for Seattle.

ENERGY, Ltd. has an approximately two-year life under federal funding. The project has been following a general planning framework consisting of the following tasks:

- Task 1. Project Organization: Appoint Citizen Committee, hire staff and prepare detailed work plan.
- Task 2. Community Energy Audit: Develop a data base that shows how energy is used in Seattle and identifies issues and policy areas to be addressed.
- Task 3. Goals and Objectives: Articulate general city goals and identify specific objectives for further work.
- Task 4. Alternatives and Strategies: Develop program proposals to achieve objectives, and evaluate them. In reality, this has become the development of a Draft Action Plan, which this report represents.
- Task 5. Action Plan: Develop implementation mechanism for presentation to City Council. This will become the Final Action Plan, the Mayor's proposal to the City Council.
- Task 6. Legislative Review.

Members of the ENERGY, Ltd. Citizen Committee are appointed by the Mayor and confirmed by the City Council. The 28-member Citizen Committee has been operating since February 6, 1979, and has been meeting every two or three weeks since then. In addition, the Citizen Committee has formed six standing subcommittees for residential, commercial, industrial, governmental, transportation, and supply energy issues. In all, there have been approximately 60 citizens formally involved in ENERGY, Ltd.

This major commitment of time and personal energy contributed by volunteers represents:

- A recognition that the energy problems facing our nation are real and must be addressed by public policy.
- A belief that citizen volunteers can make a difference in the development of public policies.
- A willingness to work with local government to ensure that energy management plans are sound and that they reflect the thinking of an informed community about the role of local planning in energy management.

What does not change is the will to change.

Charles Olson

MAJOR ACCOMPLISHMENTS

Prior to the publication of this report, ENERGY, Ltd. has achieved three major accomplishments:

- The *Energy Data Base*, a report by ENERGY, Ltd. which provides the first comprehensive view of energy supply and demand in the city: how much we use, what kind of energy we use, where it comes from, and how it is used (published January 1980).
- Approximately 30 community meetings to solicit ideas about Seattle's energy goals and the types of programs that should be encouraged (January-March 1980). These have included meetings with community councils and business representatives as well as general public meetings.
- City Council Resolution 26353, establishing tentative energy goals and policies for the city and a set of energy management tasks identifying efforts to which ENERGY, Ltd. would give priority attention (March-June 1980). This resolution is included in the appendixes of this report.

A more detailed chronology of all project activities, including interaction with the City Council and general public, is shown in Figure A.

FIGURE A
CHRONOLOGY OF ENERGY, LTD. EVENTS PAST AND FUTURE

	1978	1979	1980	1981
JAN.			Energy Data Base Report Slide/Tape Show.	Mayor's review; develop Final Action Plan
FEB.		Workplan reviewed by city departments and City Council. Approved in Resolution 26013.	30 Community Meetings; Citizen Committee Workshop: Goals and Objectives.	Mayor proposes Final Action Plan to Council.
MAR.		Citizen Committee appointed.	Goals and objectives submitted to City Council by Mayor.	Public hearings and City Council review.
APR.	City received Request for Proposal from Argonne National Laboratory.		City Council public hearing on goals.	
MAY		Council confirms Citizen Committee.	City Council review leads to City and Council developing identical goals.	
JUN.	Proposal approved by City Council. Resolution 25829 submitted.	Contingency planning recommendations.	Council Resolution 26353 adopts goals, policies, and energy management tasks.	
JUL.		Staff hired; Citizen Subcommittees formed.		
AUG.		Citizen Committee meets jointly with King County Steering Committee.	Citizen Committee Workshop: Program Direction.	
SEP.	Contract award announced.	Review of Mandatory Weatherization Standard.	Citizen Committee Workshop: Program Direction.	
OCT.			Draft Action Plan.	
NOV.	Beginning of staff hiring.	Citizen Committee Workshop: Energy Futures.	Public review; community meetings.	
DEC.			Revise recommendations to Mayor.	

WHAT IS THIS ACTION PLAN?

The Draft Action Plan is the tentative ENERGY, Ltd. response to a range of energy problems that are not likely to go away in the near future. The problems are described in more detail in our *Energy Data Base*, but the salient points are:

- Seattle is heavily dependent--75 percent--on nonrenewable fossil fuels for the energy we use.
- Our energy supply is vulnerable to politically motivated disruptions because much of it comes from foreign sources.
- Our energy supply is vulnerable to system failure, either accidental or intentional, because of centralized production and delivery.
- Consumers are vulnerable to energy prices beyond their control, and the money spent on energy largely does not recirculate in the local economy.
- The significant price differential between fossil fuels and electricity means that large conversions to electric resistance heating for space heating will be likely to occur. Without any public policy to the contrary, this will place a substantial burden on electricity-generating capacities that are already straining to meet demand.
- We need to provide an alternative to high-cost fossil fuels and to electric resistance heating, particularly if Seattle City Light adopts strict conversion policies.
- Large amounts of energy can be recovered from local renewable energy resources such as solar energy and biomass.

ENERGY, Ltd. believes that any response to these problems and opportunities must be long range and multifaceted. There are no quick fixes and no single, simple solutions. Our recommendations, therefore, cover a wide spectrum of concerns, and they are action oriented. Some proposals are ready to be implemented by the City Council, and others require City Council approval in concept before further development.

There are several themes that are important to an understanding of the ENERGY, Ltd. recommendations. These include:

- Seattle can achieve a secure and sustainable energy future if an agressive and comprehensive action plan is followed.
- The maximum development of cost-effective conservation and renewable energy resources, when cost effectiveness is measured against the cost of building new central station thermal electric resources, will achieve far more reduction in energy demand than the

programs currently underway in the City of Seattle.

- Maximum conservation and renewable resource development in buildings, when coupled with energy-efficient land use planning and alternatives to the private automobile, can bring us close to neighborhood or community self-sufficiency over the long term.

- Government must set an example to citizens and businesses in managing its own use of energy.

- Some government regulation is justified to achieve societal goals, but it has its limitations. To achieve maximum conservation, financial incentives must be provided to attract private investment.

- A comprehensive program must address all forms of energy and must reach all classes of energy users. We believe it is misleading to consider each different energy resource in isolation. Energy issues are complex, and policies affecting electric energy, for example, will have an effect on the use of oil and natural gas. Therefore, ENERGY, Ltd. has been studying ways to conserve all fuels and to provide alternative renewable energy resources.

PERSPECTIVES ON THE ROLE OF LOCAL GOVERNMENT

In analyzing the energy problems and developing a comprehensive energy plan, several basic questions have surfaced:

- What is the City's role with regard to the conservation of oil and natural gas?

- To what extent should the City regulate energy use, and to what degree should it rely on voluntary action?

- How can the City encourage the private sector to undertake energy-conserving activities?

To any casual observer, the fact that the City has a role in electric energy planning is obvious. That role comes with ownership of the electric utility. The City's long involvement in electric energy policy making sets a standard for energy planning in general. But does the City have the same level of responsibility to Seattle citizens who use oil and natural gas? There are certainly some equity issues involved. Some of our electric policies--for example, limiting conversions to electric resistance heat--create impacts on oil and gas users. Is that fair to them? Are we really saying that the City cares only about electricity because we own the electric utility, or are conversion restrictions simply an impact on oil and gas users that we have not yet considered in a broader context of total energy use?

Is the operation of the municipally owned electric utility separate from the City's responsibility to represent all consumers equally? The utility traditionally operates as a business, albeit a nonprofit one. Is the use of our utility to provide nonelectric services to oil and gas users fair to electric rate payers? Is that our only option in meeting the needs of oil and natural gas consumers?

No city policy has been established for the management of oil and natural gas supply or demand, except for general statements encouraging conservation. The recommendations in the Draft Action Plan will, if implemented, help define city policy in this area.

Another role local government can play, particularly to influence the use of all energy types, is to exercise its police power to regulate, based on benefits to the general health, safety, and welfare of society. The advantage of regulation is that, in comparison to the ability of local government to offer incentives, from a legal perspective regulation is easier to understand and the powers are more clearly defined. The disadvantage of regulation is that it restricts freedom and is limited (properly) by political considerations.

The whole issue of mandatory versus voluntary approaches has been given serious, lengthy consideration by the Citizen Committee. Three general principles have emerged:

- All classes of consumers must be treated equitably. If conservation is mandated for residences, for example, then comparable actions must be mandated for commercial and industrial consumers.

- Mandatory programs must be aggressive enough to achieve real energy savings and to ensure that everyone takes at least minimum action.

- When at least minimum energy savings are assured by mandatory programs, then a voluntary, incentive-based approach to achieve optimal cost-effective savings can complement the mandatory measures.

A final role for local government that this report suggests is to stimulate actions by the private sector, small businesses and the community in carrying out an aggressive program of energy conservation and renewable resource development. The most powerful way is to provide public financing. Individuals trying to finance conservation must borrow money at 10 to 12 percent interest and pay it back over 5 to 10 years. On the other hand, utilitites seeking capital to build new generation or transmission facilities can issue bonds at 6 to 8 percent interest, if they are tax exempt, and can pay off the bonds over a 30-year period. If local government can raise the necessary capital on comparable terms, then conservation can compete much more effectively with new generation. Once the capital is raised, then local government should use it to stimulate private sector efforts, either by contracting out the work or by

making loans to energy users. As we shall see, this requires removal of significant legal barriers to public sector flexibility.

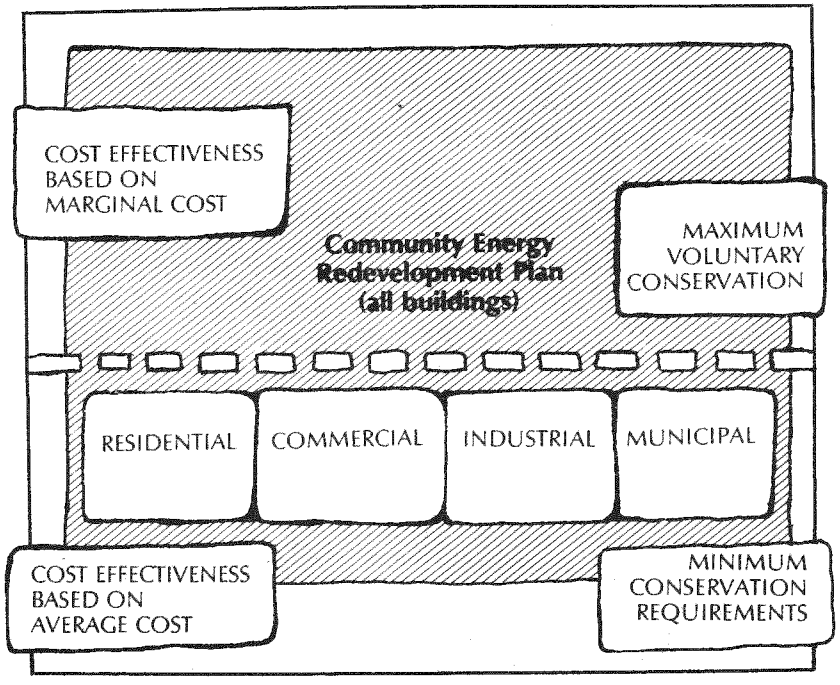
PERSPECTIVES ON THE ENERGY, LTD. RECOMMENDATIONS

The ENERGY, Ltd. recommendations cover energy use in buildings of all kinds and in transportation.

BUILDINGS

The ENERGY, Ltd. Citizen Committee is proposing a Community Energy Redevelopment Plan, a city-wide effort to achieve maximum conservation and use of renewable resources in all of Seattle's buildings. This long-range plan, clearly an ambitious undertaking, involves both voluntary and mandatory elements, as shown in Figure B.

FIGURE B
VOLUNTARY AND MANDATORY ELEMENTS OF COMMUNITY ENERGY REDEVELOPMENT PLAN



The mandatory elements set **minimum** requirements to achieve efficient energy use in all sectors--residential, commercial, industrial and municipal--applying the principal of equity across all sectors. These minimum requirements are viewed as a point of departure for the Community Energy Redevelopment Plan. The voluntary elements of the plan are intended to achieve **maximum** cost-effective energy savings by providing attractive financing comparable to the terms at which Seattle City Light would finance a new facility for generating electricity.

The requirement that all buildings meet minimum standards is based on a different criterion than the voluntary maximum savings approach. For mandatory minimum requirements, the calculation of cost effectiveness uses the **average** price of electricity facing consumers (the cheapest energy available), so that the cost of compliance should not be at all burdensome. On the other hand, cost effectiveness for voluntary measures is evaluated against the **marginal** costs for new electricity, and assumes public financing of the conservation measures over a 30-year period at tax-exempt bond rates, which is how City Light would raise capital. This results in much more cost-effective conservation, because conservation is much more competitive with the higher marginal electricity costs.

One question that is sure to arise is how the Community Energy Redevelopment Plan relates to the Mayor's proposed Comprehensive Residential Weatherization Plan, which includes the Home Weatherization Standard. The two plans differ in two ways:

- **Scope:** The Home Weatherization Standard is for residential structures containing one to four dwelling units, and focuses on low-income assistance and electric heat customers. The Community Energy Redevelopment Plan is for **all** structures--residential (including apartments), commercial, industrial and municipal--and has a much longer time frame for implementation.

- **Objective:** The Home Weatherization Standard mandates minimum standards. The Community Energy Redevelopment Program goal is to achieve all conservation that is cost effective from a societal benefit standpoint.

The objective of the Community Energy Redevelopment Plan is obviously much more ambitious, and, in order to implement the recommendations contained in the plan, some major changes will be required. These changes will be necessary because:

- The City has never before organized, as a matter of public policy, to conserve fossil fuels or to develop decentralized renewable resources.

- The energy problems identified will be with us for the next several decades, at least.

- The magnitude of the effort--increasing the energy efficiency of **all** 150,000 buildings and 1,400 manufacturing firms in the city--requires the concentration of resources on a comparable scale.
- The accompanying investment is very large, more than $2 billion over the next 30 years.
- Financing the investment will require new or significantly changed institutions.

TRANSPORTATION

Although one-third of our total energy consumed is used for transportation, it is difficult to find points of real leverage for public policy to encourage conservation in transportation. There are several reasons for this:

- Transportation issues are really regional issues, because travel, and especially commuter travel, occurs across jurisdictional boundaries.
- Mass transit, a popular response to travel demand, is already provided by Metro, a public agency which has its own ongoing responsibility for long-range planning.
- Seattle is not a large enough market to demand that new vehicles meet our own specifications for fuel efficiency.

However, there are several approaches we can take to reduce the amount of energy used in transportation:

- Increase the fuel efficiency of vehicles. This is mandated by federal standards, but better engine maintenance and vehicle inspections can also increase efficiency.
- Reduce the use of vehicles or the vehicle miles traveled. Ways to do this include mass transit, ridesharing (carpooling and vanpooling), and the use of bicycles and mopeds for utilitarian purposes.
- Provide or stimulate the production of alternative, renewable liquid fuels to power vehicles.

Many of these approaches are being followed already, but we can be more aggressive at the local level if we choose to be. The ENERGY, Ltd. transportation recommendations are intended to encourage that choice.

ORGANIZATION OF THIS REPORT

The Draft Action Plan is organized into two basic parts:

- Building Energy Strategies
- Transportation Energy Strategies

Under Building Energy Strategies, the maximum cost-effective conservation strategies focus on the long-range, incentive-based aspects of the Community Energy Redevelopment Plan: what it would accomplish, how it would be financed, and how it would be managed. These are presented first because it is essential to have a clear understanding of the goals of the Community Energy Redevelopment Plan before describing the associated building strategies.

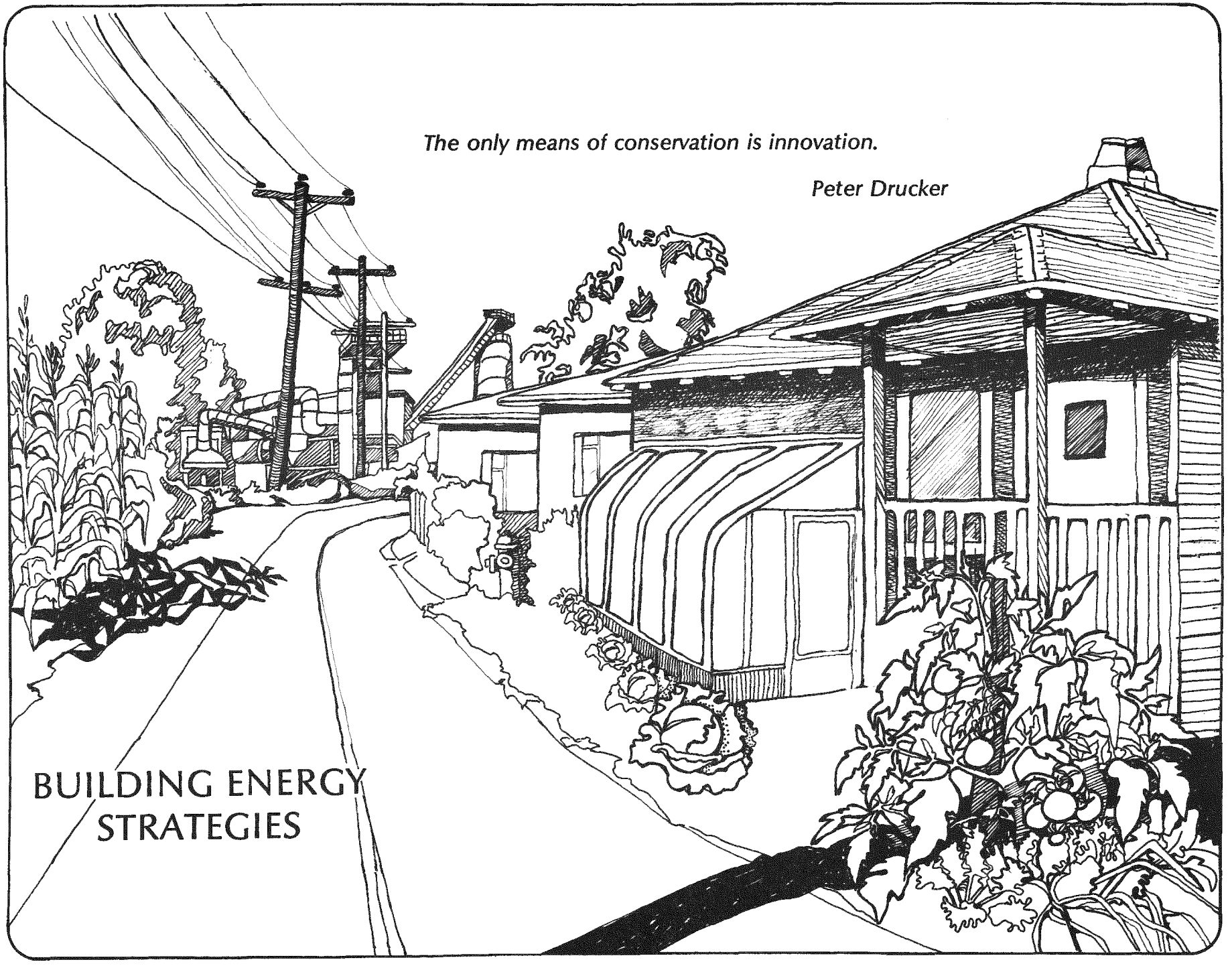
The Community Energy Redevelopment Plan is followed by a description of the minimum conservation actions required of all sectors. In some cases, there is overlap between the ENERGY, Ltd. recommendations and programs that have been proposed or are being developed by other city agencies. This is because the Citizen Committee wishes to recognize and encourage the ongoing work of others, and particularly to note where these related programs are complementary to the ENERGY, Ltd. recommendations. In some cases, a knowledge of these programs is necessary for an understanding of a comprehensive community energy management plan.

The last section on transportation energy strategies covers a variety of recommendations, from a bicycle/moped program to a demonstration program for producing alcohol from a renewable resource and converting publicly owned vehicle fleets to run on alcohol.

finite to fail, but infinite to venture.

Emily Dickinson

ENERGY, Ltd.
for a secure energy future


The only means of conservation is innovation.
Peter Drucker
BUILDING ENERGY
STRATEGIES

I. COMMUNITY ENERGY REDEVELOPMENT PLAN

Recommendations
Anticipated Results
Background
Energy and Cost Analysis
Implementation

Toto, I don't think we're in Kansas anymore.

Dorothy in The Wizard of Oz

COMMUNITY ENERGY REDEVELOPMENT PLAN

OBJECTIVES

- Produce the maximum amount of energy conservation possible from retrofitting all buildings in Seattle (residential and commercial buildings and industrial facilities).
- Place investments in conservation and renewable energy technologies on a par with investments in conventional energy supplies.
- Use all conservation and renewable technologies that deliver energy or offset demand at a price competitive in each year of the program with the cost of energy delivered to consumers from new central station thermal power plants.

APPROACH

- Carry out near-term pilot project to retrofit approximately 1,000 buildings in a selected geographic area. Seek federal or private foundation funding assistance.
- Develop a city-wide program based on the results of the pilot project. The comprehensive program will include both a centralized city-wide agency for central management and financing, and decentralized conservation service organizations to deliver the retrofit services.
- Investigate establishment of a Public Development Authority as the centralized city-wide organization.
- Develop a financing strategy offering terms comparable to tax-exempt revenue bonding that allows repayment over the useful lifetime of the conservation or renewable energy measure.

COSTS

- The costs for the total retrofit program would be roughly $2.3 billion, repaid over the useful life of the conservation or renewable energy measures.

BENEFITS

- A reduction of 58.5 percent in residential sector energy use.
- A reduction of 39.9 percent in commercial sector energy use, even if this sector doubles in size by the year 2000.
- A reduction of 25.7 percent in the energy use of the industrial sector.
- A 78 percent decrease in demand for fossil fuels.
- Increase in local employment opportunities.
- Development of community-focused organizations that will build community identity and awareness of energy problems and solutions.

MANAGEMENT

- Seattle Energy Office pursues funding for pilot project. Seattle City Light operates pilot project.
- Seattle Energy Office and Law Department establish the Public Development Authority.
- Public Development Authority and decentralized energy conservation organizations manage the total retrofit program.

SCHEDULE

- 1981-86 Develop, operate, and evaluate pilot project.
- 1981-86 Define and establish central organization as a Public Development Authority.
- 1987-2010 Operate comprehensive retrofit program.

COMMUNITY ENERGY REDEVELOPMENT PLAN

RECOMMENDATIONS

The ENERGY, Ltd. Citizen Committee recommends the following actions:

1. Retrofit all of Seattle's residential and commercial buildings and industrial facilities with the best available conservation and renewable energy technologies.

2. Retrofit strategies should include, but are not limited to, the following, if they prove to be economically and environmentally feasible:

   - Caulking, weatherstripping and other infiltration control measures
   - Insulation of walls, ceilings and floors
   - Insulation of hot water tanks, pipes and ductwork
   - Heat pumps for space and water heating
   - Active, passive and hybrid solar heating systems
   - Insulating shutters and shades
   - Efficient lighting systems
   - Waste heat recovery systems
   - Thermal storage and other load management systems
   - Flame retention burners, electronic ignition and flue dampers
   - Storm windows.

3. Utilize all the conservation and renewable energy technologies that deliver energy or offset demand at a price competitive in each year of the program with the cost of energy delivered to consumers from new central station thermal power plants.
4. Install total energy systems (cogenerators), if they prove to be economically and environmentally feasible, to serve individual buildings and/or clusters of buildings which have sufficiently large heating demands to be compatible with available cogenerators.
5. Construct district energy systems, if they prove to be economically and environmentally feasible, in those areas of the city which have sufficiently concentrated demand for heating energy. Preference should be given to district energy systems which utilize a renewable energy source.

6. Carry out in the near term a pilot project designed to retrofit approximately 1,000 buildings to:

   - Test the feasibility of marketing conservation services on a large scale
   - Test the effectiveness of marketing conservation services within geographically defined communities of the city
   - Test the effectiveness of comprehensive conservation and renewable energy retrofits on residential and commercial buildings and industrial facilities.

7. Develop a city-wide conservation and renewable energy financing mechanism. The mechanism should utilize tax-exempt public revenue bonding and should finance conservation and renewable energy measures over their useful lifetimes.

8. Create a city-wide agency which would be responsible for:

   - Issuing necessary revenue bonds to finance conservation and renewable energy investments
   - Handling centralized administrative functions such as billing, fiscal audits and program management
   - Providing publicity and technical support services.

9. A Public Development Authority should be investigated first to determine whether it is an appropriate organizational model for the city-wide agency.

The Community Energy Redevelopment Plan requires a two-stage implementation effort. First, a pilot retrofit project would be established which would carry out a large number of comprehensive energy retrofits on residential and commercial buildings and industrial facilities within a geographically defined Seattle community. The pilot project community would be selected through a city-wide competitive bidding process. The selecton process would be designed to encourage maximum participation by existing community and neighborhood organizations and by firms presently marketing energy services. The pilot project would get underway in early 1982 and would need to run two to three years in order to accumulate sufficient data on the effectiveness of the marketing approach and the conservation and renewable energy investments.

During the same period as the operation of the pilot project, efforts will also be directed at designing a city-wide agency which would be able to provide access to sufficient investment capital, through tax-exempt revenue bonds, to finance the Community Energy Redevelopment Plan. The agency will also be designed to provide other functions most efficiently performed by a city-wide entity. The organizational model to be investigated first will be a Public Development Authority.

The second stage in this implementation process should commence in the 1985-87 period. By this time the pilot retrofit program will have established the effectiveness of large scale conservation and renewable energy investments. In addition an organization will have been designed and chartered which can carry out the necessary city-wide financing and administrative functions. For the purpose of further discussion, it will be assumed that the organizational model chosen is the Public Development Authority (PDA). Shown in Figure I-A is the structure by which the PDA is linked with private building owners through the intermediary private conservation service organization. In this structure the PDA acts principally as a funding conduit providing sufficient capital for conservation investments and ensuring proper fiscal management. The conservation service organization is the backbone of this structure, aggressively marketing conservation to building owners, getting the work done and ensuring the quality of products and installation. The building owner participates by choosing the conservation options. In this case, choosing conservation options differs little from choosing natural gas, oil or any other energy form. To the extent that the conservation service organization can deliver conservation more cheaply than competing energy forms, the building owners will opt for conservation. The success of the conservation service organization will hinge on its technical capability, marketing expertise, and access to long-term, low-interest financing through the PDA.

ANTICIPATED RESULTS

If carried out by the year 2010, the Community Energy Redevelopment Plan is expected to result in:

- A reduction of 58.5 percent in the energy required by the residential sector
- The investment of $1.2 billion in conservation and renewable energy improvements to residential buildings
- A reduction of 39.9 percent in the energy required by the commercial sector even if this sector doubles in size by the year 2000
- The investment of $830 million in conservation improvements to commercial buildings
- A reduction of 25.7 percent in energy required by the industrial sector
- The investment of $240 million in conservation improvements to industrial facilities.

The Community Energy Redevelopment Plan would result in a 78 percent decrease in the city's demand for fossil fuels (including transportation uses). It would, however, require an 18 percent increase in the electric energy supplied to the city.

BACKGROUND

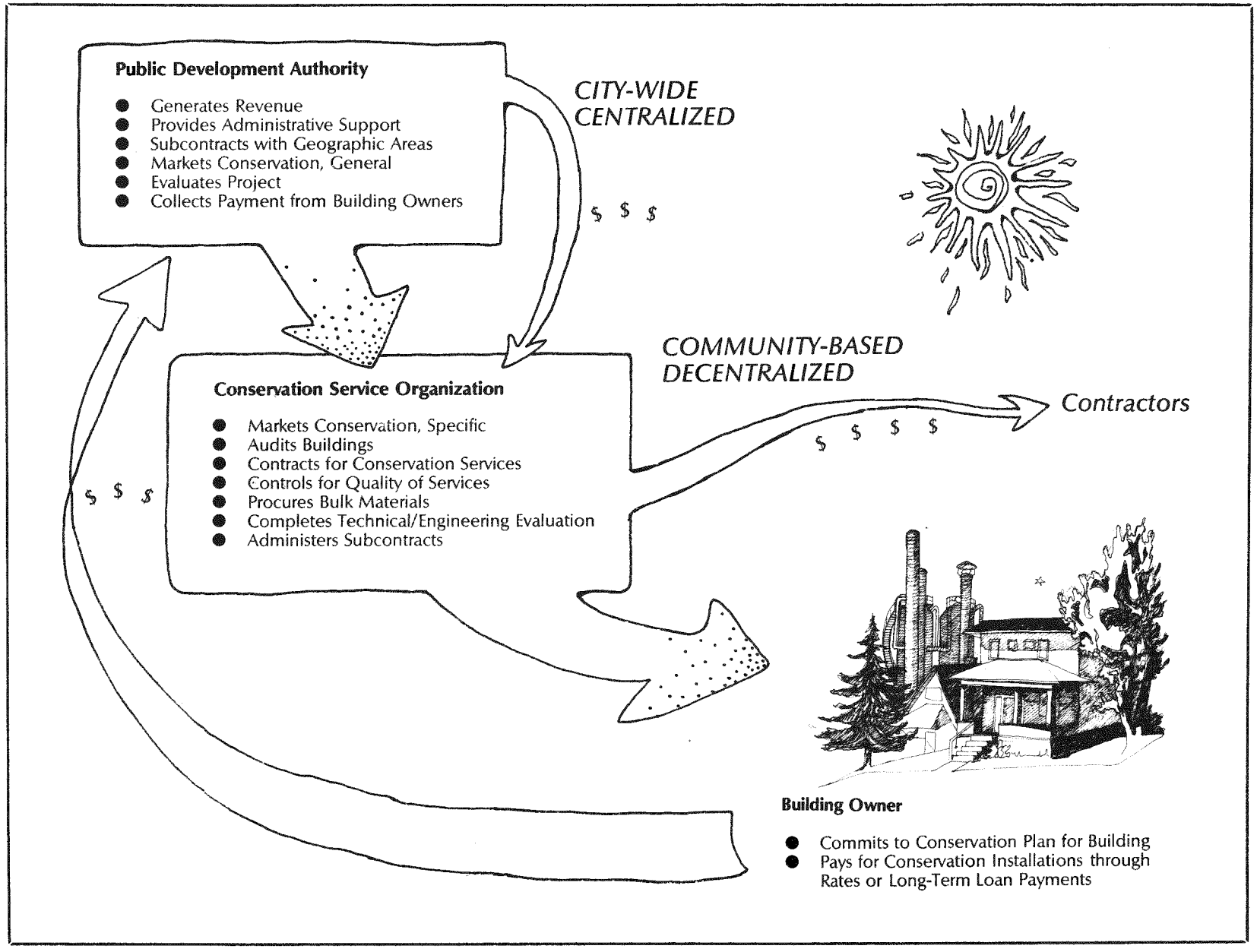
In 1978 Seattle's residential and commercial buildings and industrial facilities required 67.6 trillion Btu of energy to meet their various demands for hot water, space heating, lighting, process heating and other end uses. This amounted to 59.9 percent of all the energy consumed by the city. This enormous demand for energy may be seen as the greatest threat to the economic health and well-being of the city or it may be considered the city's greatest resource. The Community Energy Redevelopment Plan (CERP) is a means by which the city may convert the "energy problem" into the energy resource. The plan calls for all 150,000 residential and commercial buildings and 1,400 industrial facilities to be retrofit by the year 2010 with conservation and renewable energy technologies which will result in a 43 percent reduction in their demand for energy.

The CERP will cost, over the next 30 years, $2.3 billion, an enormous expenditure--although it is only slightly more than twice the city's present commitment to the Washington Public Power Supply System's nuclear plants 1, 2 and 3. Why make such an expenditure? Why take the risk? What is the driving motivation behind such an unprecedented proposal? The answers are deeply rooted in this century's transition toward an economy dependent on fossil fuels. However, the answers are more specifically illustrated by the events of the last decade.

In 1973, the energy economics of the world did an about-face. For decades energy prices had been declining in real terms, but with the Arab oil embargo and the emergency of OPEC as controller of world oil prices, the picture changed; prices began rising dramatically. Home-heating oil sold in Seattle in 1973 for 17 cents per gallon. By the winter of 1979-80, it was selling for one dollar per gallon, an increase in excess of 20 percent per year above the rate of inflation.

These price increases, although principally motivated by political forces, are only the first round in the world's transition to a fossil-fuel-scarce economy. In this new energy economy, real prices will rise precipitously as new oil becomes harder to find and the world powers jockey for control of the remaining supplies. There may be no physical shortage of oil yet, but oil has become such a vital commodity that even the hint of the future

FIGURE I-A
COMMUNITY ENERGY REDEVELOPMENT PLAN
ORGANIZATION AND FUNCTIONS



exhaustion of this resource is sufficient to drive the world to the brink of economic disaster and to the brink of war, as recent events in the Middle East have demonstrated.

Higher oil prices have many of Seattle's poor and elderly citizens who live on fixed incomes choosing between warmth and food. World oil prices have triggered natural gas price increases on the part of our Canadian neighbors; it is obvious that natural gas prices will track close behind oil in the coming years. These price increases have led to substantial conversions from oil to electricity, our only locally controllable energy supply. But switches to electricity are stretching the limited conventional hydroelectric resources, driving Seattle toward investment in high-priced nuclear and coal electric generation.

If Seattle does not change course, its future destination is clear: higher oil prices will drive the city's energy consumers toward electricity. Both the Seattle City Light Forecast 79/80 and ENERGY, Ltd. Data Base indicate a potential 75 percent market share for electricity in the year 2000. This shift would produce a 40-60 percent increase in electricity consumption, with the electricity being supplied by coal and nuclear facilities and, consequently, the price of electricity rising rapidly.

Another path toward the future is possible. Its driving tenet is simple and is based on the premise that considerable energy is wasted and that measures are available for recovering this wasted energy. Energy efficiency and the use of renewable resources in our buildings and industries could both help kick the oil habit and avoid the construction of more expensive nuclear and coal facilities. The trouble with this path is that energy consumers are so unaccustomed to being efficient. Not since the cliff dwellers in New Mexico have the people on this continent been pressed hard enough by the economics of energy that they were forced to use energy efficiently.

Many voices have been heard, especially in this city, raised in favor of conservation and renewable energy resources. Seattle led the nation in 1976 by deciding not to invest in two additional nuclear plants, and instead, to set a goal for recovering 230 megawatts of the conservation resource. Seattle has one of the most active solar constituencies in the nation. Many hundreds of do-it-yourselfers have remodeled their homes and businesses for greater energy efficiency, and a fledgling conservation and solar industry is struggling to make it in the market place.

That last phrase--struggling in the market place--bears some close attention and, in fact, is the key justification for the Community Energy Redevelopment Plan which has been proposed by the ENERGY, Ltd. Citizen Committee. Unless a program can be developed which removes the social, economic, legal and institutional barriers to the development of conservation and renewable energy resources, these resources will stay on the fringe and the city will continue down the other path. The barriers are many and pervasive, but the following three stand out as particularly important.

CAPITAL ACCESS

Raising capital for investment in conservation and renewable energy improvements, with a few exceptions, must be accomplished by building owners, dealing directly with local commercial lending institutions. In the case of a homeowner, typical circumstances might lead to a five-year home improvement loan at a 10-12 percent annual rate of interest. The loan might not be available at all for low-income home owners or for others whose credit was for any reason stretched to the limit. Even if loans were universally available in the amounts required for each building, the terms of repayment might constitute a significant disincentive and place conservation and renewable energy investments on an unequal footing with respect to investments in traditional energy supplies.

Seattle City Light, by comparison, investing in a new coal-fired electric plant, would raise capital by issuing 30-year revenue bonds and would pay interest rates somewhere in the range of six-eight percent. The investment would be paid back, roughly speaking, over the lifetime of the facility. Any organizational strategy for developing Seattle's conservation and renewable energy resources must lead to analogous conditions where capital is readily available to all building owners, and the investment is paid for over its useful life at a long-term interest rate.

SERVING ALL TYPES OF ENERGY USERS

The boldest recent step in the direction of motivating conservation and solar investments was the passage of SJR-120 which provides a special exemption from the state constitutional limitations on lending of public credit. SJR-120 allows the state's public utilities, including Seattle City Light, to make low-interest loans available to **residential electric heat** customers for conservation and renewable energy investments. However, residential building demand accounts for only 35 percent of the energy used in Seattle buildings and industries. In addition, only 36 percent of all residential units have electric space-heating systems. Any successful conservation and solar strategy will have to incorporate a method for delivering sufficient capital resources to all energy consumers regardless of the type of energy they are presently purchasing.

AVERAGE COST PRICING

When a building owner makes a conservation investment and succeeds in reducing the building's energy requirement, this is equivalent to a utility or an oil company developing the same amount of new energy generation capacity. However, the cost of energy seen by the building owner, and thus the saving due to conservation, is much less than the cost of new energy supplies. Seattle is a good case in point. Currently, electricity costs

a residential customer in Seattle about 1.6 cents per kilowatt-hour. Seattle City Light has concluded that the current marginal cost of electric energy is in the range of 4-5 cents per kilowatt-hour. From the perspective of a building owner trying to decide whether to invest in a conservation improvement, the real value of the investment is masked because the utility is marketing new energy to consumers at an **averaged** cost, combining the costs of the new energy with the costs of existing supplies.

The problem becomes worse when the value to society as a whole is considered, because even the price that the utility or oil company pays for new energy does not reflect all the social costs which are incurred in utilizing that new energy. In the case of a utility, the price of a new coal-fired generating plant does not include the costs of environmental damage done by the particulate emissions from the plant. In the case of an oil company, the cost of the next barrel of oil from the Middle East does not include the risks associated with increasing reliance on politically unstable energy supplies, nor the costs of further depleting a nonrenewable resource. The most significant recent steps to correct these "market imperfections" have been revisions in federal income tax regulations and various federal loan and grant programs. Unfortunately, these credits and subsidies do not apply equally to all types of conservation and renewable energy systems and are not available uniformly to all classes of customers.

The proposed Community Energy Redevelopment Plan is designed to overcome each of these three major obstacles. Tax-exempt revenue bonds issued by a city-wide Public Development Authority (PDA) would provide long-term, low-interest rate investment capital for conservation and renewabe energy investments. Because the PDA would be sustained by revenues from building owners who chose to participate, it should be exempt from any state constitutional limitations on the lending of public credit. This would allow the PDA to provide capital to all types of energy users. The obstacle of average cost pricing will be overcome by allowing the various conservation and solar measures to compete on the same terms--by averaging their costs together. There are many conservation techniques such as flame retention burners, attic insulation, and automatic temperature setback devices which provide relatively large savings at costs substantially less than current average energy prices, if they are paid for over their useful lifetimes. These very cheap conservation resources would be melded with more expensive conservation and renewable energy strategies. Other measures are more expensive than current average energy prices, but are still cheaper than the cost of new fossil and electric energy resources. By melding these costs, the conservation and renewable energy option can be marketed widely because it will be cheaper than the current average price of fossil fuel energy.

ENERGY AND COST ANALYSIS

METHODS

The estimation of costs and energy impacts associated with individual conservation or renewable energy technologies is rife with pitfalls. Information concerning the current status of energy end uses and their projected future status is based on a few well-substantiated statistics; a lot of guesswork; and, last but not least, layer upon layer of assumptions. The following are some of the things about which assumptions have been made:

- Future market shares
- Discount rate
- Interest rate
- Life expectancy of various products
- Price escalation rates for competing fuels
- Population growth rates
- Legal, regulatory and institutional behavior.

Amidst such an array of possible variation, it is a simple matter for value biases, misconceptions, miscalculations and bad judgment to slip in and shift the results. For the purpose of this analysis, three steps have been taken to provide a path through the confusion. First, wherever possible, assumptions have been made that are consistent with recent work and work in progress elsewhere in the city. At least, if we're wrong, we'll all be wrong together. Second, wherever possible, a simple assumption has been substituted where a complex one might have gone. Third, all assumptions were forced to reflect a systematic bias toward conditions required to implement the CERP successfully. For example, public bonding is required to provide sufficient access to capital, and, thus, the finance rate was assumed to be in a range typical of public tax-exempt revenue bonds.

The analysis of conservation and solar measures for residential and commercial buildings was based on computer simulations of prototype buildings. Seven types of buildings--three residential and four commercial--were tested in the simulations to determine the net effect of conservation and solar retrofits on their demand for space heating, water heating and other electric energy. A listing of the measures tested and detailed descriptions of each prototype are presented in Appendix A. The energy savings and life cycle costs of each measure were calculated individually. Those measures which were found to be less expensive than the cost of new electric energy were used to create comprehensive retrofit plans for each prototype. (See Appendix B for explanation of economic analysis methods.) The prototypes used were defined to correspond to the average characteristics of buildings found in areas of the city outside the Central Business District.

The principal method here is estimation by example. The prototype simulations constitute examples, albeit hypothetical, of building retrofits.

If, simplistically, it is assumed that all buildings similar to the prototypes will behave in a similar fashion, then the percent of savings shown by the prototypes can be applied to the consumption of all similar buildings. This is what has been done. Many other assumptions and procedures are involved in the estimations of present and future costs and energy savings that are presented in the rest of this section. (See Appendixes A, B, C and D for further details.)

ANALYSIS OF IMPACTS ON TWO SEATTLE COMMUNITIES

Forming the new society within the shell of the old.

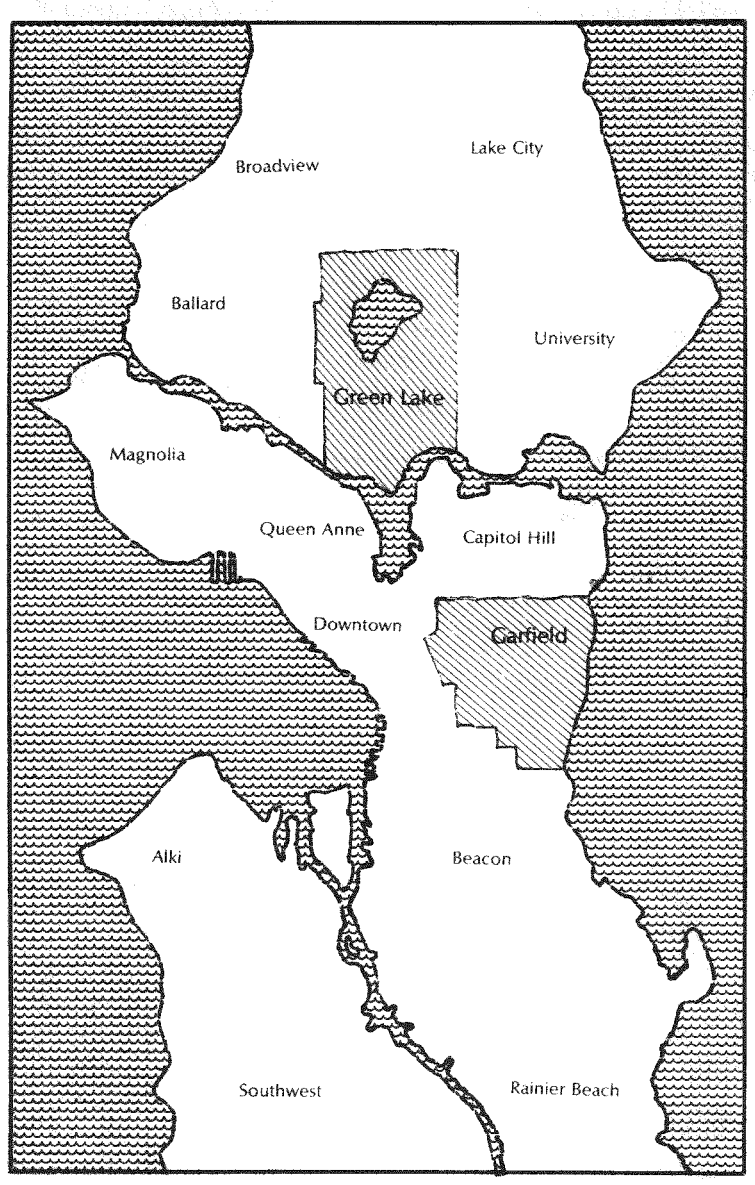
I.W.W.

The implementation strategy for the Community Energy Redevelopment Plan calls for a decentralized community-based approach. Geographically defined communities of the city will be mobilized to carry out their respective energy redevelopment plans in a fashion which is consistent with their varying social characteristics, community institutions, and built and natural environments. The number of communities and their particular boundaries have yet to be defined, but it is apparent that these communities need to be large enough to achieve economies of scale in training, materials purchase, installation and quality control. In addition, these communities should be defined so as to encompass existing organizations. It is important not to try to impose a wholly different infrastructure on the social fabric of the city's neighborhoods.

Two communities, Greenlake and Garfield, have been chosen to serve as examples in this analysis. (See map in Figure I-B.) The selection of these communities as examples is for the purpose of making the analysis more tangible, that is, for the purpose of illustration. Their selection does not in any way constitute an endorsement for serving these communities first. Further, the geographical bounds were established to conform to readily available data sources and thus do not reflect a rational approach based on the existing neighborhood politics of the city. Two communities are being shown as examples because the ENERGY, Ltd. Citizen Committee believes no single community can adequately represent the varying conditions of income, racial background and other characteristics found throughout the city. As will be shown below, these two communities have substantially different characteristics which may be important factors in how their redevelopment plans would be defined and carried out.

The built environments of these two communities are substantially different. In general, Garfield is characterized by a higher incidence of large structures, both residential and commercial, which is a reflection of its general zoning patterns. Four major hospitals are found within its boundaries, along with major commercial districts along Broadway, 15th Avenue, 23rd Avenue and Madison Street. These commercial areas tend to be linear in their development pattern, whereas the commercial activity in the Greenlake area appears as clusters in Fremont and adjacent to Greenlake, although there is one example of linear commercial development along 45th Street.

FIGURE I-B
EXAMPLES OF COMMUNITIES FOR COMMUNITY ENERGY REDEVELOPMENT PLAN



The residential building stock found within each community is described in Tables I-1 and I-2. Greenlake housing is dominated by single family residential buildings; 65 percent of its units are in this category as opposed to 31 percent in the Garfield community. Residential buildings are somewhat older in Garfield; they are also larger and in a somewhat more deteriorated physical condition. The constuction and demolition trends are markedly different; Garfield has shown a substantial decline over the past 10 years in the number of housing units, while Greenlake has remained relatively stable. Both rental occupancy rates and overall vacancy rates are substantially higher in Garfield than in Greenlake. Other detailed information on both residential and commercial buildings in these two communities has been assembled by ENERGY, Ltd. staff and others and is presented in Appendixes C and D.

Variations in the built environments would necessitate somewhat different approaches to the energy redevelopment work in these two communities. For example, buildings which have deteriorated structurally will require rehabilitation prior to being retrofit with conservation and solar measures. Because Garfield has a larger number of such structures, its redevelopment plan will have to reflect this additional work. Also, because Garfield has, in general, larger, more densely packed structures, it may offer more opportunities for neighborhood scale district energy systems. (These are described in more detail later in this chapter.) These kinds of variations need to be examined in detail as each Seattle community is organized to begin its energy redevelopment work.

Energy-relevant data on industrial firms operating in these two communities are not readily available. Therefore, no estimates of industrial energy consumption or conservation potential have been formulated for these two communities. Instead, these estimates have been deferred to the section that discusses city-wide impacts. The city-wide data base on industrial energy consumption is relatively well developed and provides a reasonable starting point for estimating gross industrial conservation potential.

POTENTIAL RESIDENTIAL ENERGY SAVINGS IN GREENLAKE AND GARFIELD

Recent work involving the retrofitting of existing residential buildings with conservation and solar measures has demonstrated the potential for large

TABLE I-1
GREENLAKE POPULATION AND HOUSING CHARACTERISTICS

Population	Number of Households	Average Number of Persons per Household	Density of Persons per Acre	
38,789	18,100	2.14	12.8	
		Single Family	**Multifamily (2-4 Units)**	**Apartment**	**Total**
Number of Units		11,534[a]	2,040[b]	4,256[c]	17,830
Rental Occupancy		32%[d]	77%		46%
Vacancy Rates		3.6%[d]	.3.3%		3.5%
Number of Buildings		11,534[a]	870[e]	448[e]	
Units per Building		1	2.3	9.5	
Exterior Condition[f] (city average)		1.42 (1.36)	1.25 (1.26)		1.36 (1.32)
Percent of Buildings over 50 Years Old		85%[g]	68%[h]	32%[i]	
Average Square Footage (per unit)		1,358[g]	856[h]	834[i]	
Units Added 1970-79[j]		122	1090		1,212
Units Deleted 1970-79[j]		245	115		360
Net Change 1970-79[j]		-123	+975		+852

[a] Estimate based on Kroll Map Count and Survey (2.34 units/bldg. x 870 bldgs. = 2,040 units).

[b] Estimate based on Kroll Map Count and Survey (9.50 units/bldg. x 448 bldgs. = 4,256 units).

[c] Office of Policy and Evaluation, "Greenlake Community, Polk Profile of Change," 1977.

[d] Department of Community Development Update of 1970 Census, 1979.

[e] Count from Office of Policy and Evaluation's Land Use Kroll Maps, 1980.

[f] On a scale of 1=sound, 2=basically sound, 3=deteriorated, and 4=dilapidated, as reported in "Housing Condition Trends, City of Seattle: 1974 and 1978," Office of Policy and Evaluation, January 1979.

[g] ENERGY, Ltd. survey of 378 single family buildings, Assessor's files.

[h] ENERGY, Ltd. survey of 86 multifamily buildings, Assessor's files.

[i] ENERGY, Ltd. survey of 83 apartment buildings, Assessor's files.

[j] Department of Community Development, "Housing Units Authorized," Current Planning Report, Bulletin Planning Report, Bulletin 41, April 1980.

TABLE I-2
GARFIELD POPULATION AND HOUSING CHARACTERISTICS

Population	Number of Households	Average Number of Persons per Household	Density of Persons per Acre	
43,267	22,198	1.95	16.3	
		Single Family	**Multifamily**	**Apartment**	**Total**
Number of Units		7,701[a]	2,726[b]	14,062[c]	24,289
Rental Occupancy		40.2%[d]	85.3%[d]		70.1%
Vacancy Rates		13.6[d]	7.3%[d]		
Number of Buildings		7,701[a]	1,201[e]	756[e]	
Units per Building		1	2.27	18.6	
Exterior Condition[f] (city average)		1.62 (1.36)	1.54 (1.26)		1.58 (1.32)
Percent of Buildings over 50 Years Old		87%[g]	78%[h]	75%[i]	
Average Square Footage		1,444[g]	919[h]	836[i]	
Units Added 1970-79[j]		273	1,255		1,528
Units Deleted 1970-79[j]		864	1,551		2,415
Net Change 1970-79[j]		-591	-296		-887

[a]Department of Community Development Update of 1970 Census, 1979.

[b]Estimate based on Kroll Map Count and Survey (2.27 units per bldg. x 1,201 bldgs. = 2,726 units).

[c]Estimate based on Kroll Map Count and Survey (18.6 units per bldg. x 756 bldgs. = 14,062)

[d]Office of Policy and Evaluation, "Polk Profiles of Change," 1977.

[e]Count from Office of Policy and Evaluation's Land Use Kroll Maps, 1980.

[f]On a scale of 1=sound, 2=basically sound, 3=deteriorated, and 4=dilapidated, as reported in "Housing Condition Trends, City of Seattle: 1974 and 1978" Office of Policy and Evaluation, January 1979.

[g]ENERGY, Ltd. survey of 381 residences.

[h]ENERGY, Ltd. survey of 90 multifamiy buildings.

[i]ENERGY, Ltd. survey of 62 apartment buildings.

[j]Department of Community Development, "Housing Units Authorized in Seattle, 1970-79."

energy savings.[1] This conclusion was confirmed through the analysis of the effects of 21 conservation and solar strategies on three prototype residential buildings. A detailed description of the conservation and solar strategies examined and the prototypes used appears in Appendix A. Many of the conservation and solar strategies were found to be less expensive than new electric energy supplies. Those shown to be cost effective are:

- Caulking, weatherstripping and other infiltration control measures
- Attic, wall and floor insulation
- Exterior storm windows
- Hot water temperature setback and tank insulation
- Hot water heat pumps
- Efficient bulbs
- Attached sunspace passive solar heating
- Thermosiphon wall passive solar heating
- Ground-source heat pumps[2]
- Automatic temperature setback for space heating
- Flame retention burners, automatic flue dampers and electronic ignition.

When applied in combination these various strategies resulted in the energy savings shown in Table I-3. The savings shown are relative to the current average demand of these three types of residential buildings in Seattle.

These retrofit strategies could be implemented throughout the Greenlake and Garfield communities as part of the Community Energy Redevelopment Plan. In certain cases, it may be difficult to implement one or more of these strategies in a particular building. However, it is also true that the analysis performed here does not cover all the potential conservation and solar strategies. For the purpose of illustrating the magnitude of savings which might result, it has been assumed that all

[1]"Special Section on Energy-Efficient Housing: An Overview and Outlook," *Soft Path Notes*, Vol. 3, No. 1, February 1980.

[2]In larger buildings, well-source heat pumps were also cost effective.

TABLE I-3
ENERGY SAVINGS DUE TO CONSERVATION AND SOLAR RETROFITS OF RESIDENTIAL BUILDINGS
(Percent)

	Space Heat with Conservation Only	Space Heat with Conservation & Solar	Water Heat	Lighting & Appliances[a]
Single Family	62.4	78.3	57.6	14.0
Multifamily	92.8	–	58.5	14.0
Apartment	87.9	95.4	60.6	14.0

[a]Appliance efficiency was assumed to increase by 15 percent as a result of federal appliance efficiency standards.

residential buildings can be retrofit with the conservation measures listed. If this were the case and if the retrofits were carried out over the next 30 years, then the residential energy demand in the Greenlake and Garfield communities would be as shown in Tables I-4 and I-5. This retrofit program would reduce the energy required by residential buildings in Greenlake by 60 percent, and in Garfield by 57 percent.

There are many assumptions that have been relied on in order to estimate these energy requirements. The methods used and assumptions made are described in Appendixes A and C.

TABLE I-4
GREENLAKE RESIDENTIAL ENERGY DEMAND
(Billion Btu)

	1978	1990	2000	2010
Single Family	1,556	1,212	859	585
Multifamily	212	163	113	74
Apartment	261	229	187	144
Total	2,029	1,604	1,159	803

TABLE I-5
GARFIELD RESIDENTIAL ENERGY DEMAND
(Billion Btu)

	1978	1990	2000	2010
Single Family	1,045	788	586	390
Multifamily	292	214	152	99
Apartment	864	758	616	478
Total	2,201	1,760	1,354	967

POTENTIAL COMMERCIAL ENERGY SAVINGS IN GREENLAKE AND GARFIELD

As in the case of residential buildings, substantial energy savings result when commercial buildings are retrofit with available conservation and solar measures. Specific estimates of savings were developed through the examination of four prototype commercial buildings. Most of the conservation strategies listed for residential buildings were found to be cost effective for small commercial buildings. The details of the commercial buildings analysis appear in Appendix A. If all the strategies found to be cost effective with respect to the cost of new electric energy supplies were implemented, the savings would be as shown in Table I-6.

TABLE I-6
ENERGY SAVINGS DUE TO CONSERVATION RETROFITS OF COMMERCIAL BUILDINGS
(Percent)

	Space Heat	Space Cooling	Water Heat	Lighting
Retail Buildings	84.1	28.2	38.4	39.2
Office Buildings	84.9	57.3	21.0	54.0
Warehouses	89.3	—	21.0	32.8
Other Buildings	85.6	37.9	29.7	41.3

These retrofits of commercial buildings could also be implemented as part of the energy redevelopment of the Greenlake and Garfield communities. In some cases, as with residential buildings, it will be difficult to apply certain measures to particular commercial buildings. There are, however, many conservation opportunities which it has not been possible to cover in this analysis. Assuming that all commercial buildings in Greenlake and Garfield were retrofit with the measures found to be cost effective, the buildings' energy requirements would be as shown in Tables I-7 and I-8. The retrofit program would result in a 63 percent reduction in the energy required by commercial buildings in Greenlake. Garfield would experience a 60 percent reduction. These reductions would occur even though the commercial sector in each of these communities is assumed to grow by 50 percent through the year 2000. This and other assumptions and projection methods used to estimate commercial building energy requirements are explained in Appendixes A and D.

TABLE I-7
GREENLAKE COMMERCIAL BUILDINGS
ENERGY DEMAND (Billion Btu)

	1978	1990	2000	2010
Electricity	215	238	250	229
Gas	285	211	106	2
Oil	126	92	47	0
Total	626	541	403	231

TABLE I-8
GARFIELD COMMERCIAL BUILDINGS
ENERGY DEMAND (Billion Btu)

	1978	1990	2000	2010
Electricity	407	450	473	432
Gas	477	355	177	2
Oil	212	157	79	1
Other	2	1	0	0
Total	1,098	963	729	435

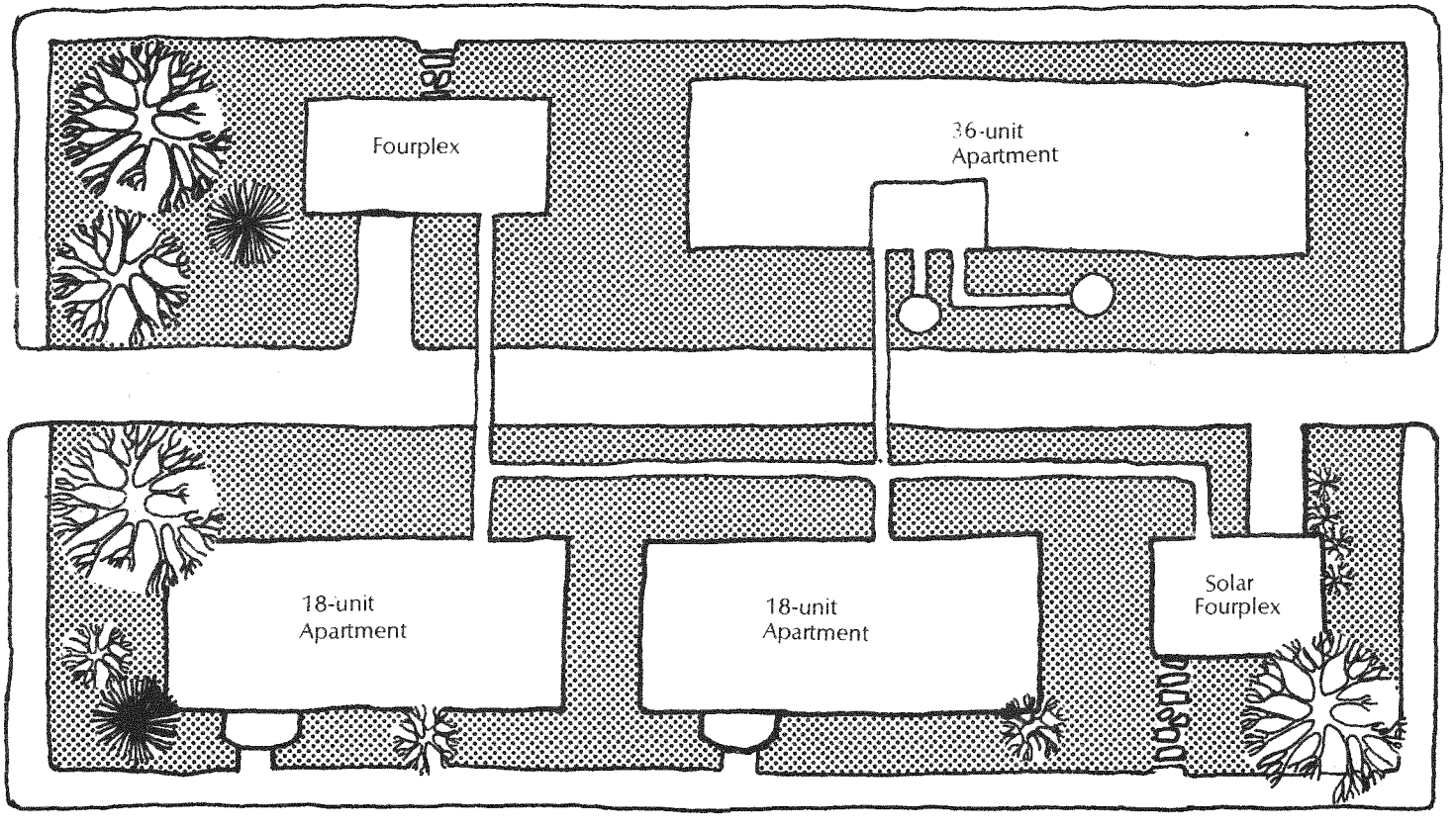
DISTRICT ENERGY SYSTEMS FOR GREENLAKE AND GARFIELD

Having carried out the cost-effective conservation and solar retrofits, these two communities would be faced with the question of how best to meet the relatively small residual demand for space and water heating. In many instances, when the buildings that need heating energy are sufficiently large and/or closely spaced, a district energy system may prove to be a viable option. For example, two single family dwellings which lie adjacent to each other could be served by a single ground-source heat pump. Either building alone would not have a sufficiently large demand to justify the expenditure for even the smallest available ground-source heat pump. The additional costs of the second hookup are outweighed by sharing the cost of the heat pump itself.

District energy systems which serve large numbers of buildings have been operating in European cities for many years. Seattle Steam is a local example of such a system. These large scale systems which require the transport of hot water or steam over long distances are economically viable only when the individual buildings served require large amounts of heating energy. The residential and commercial buildings in the Greenlake and Garfield communities, having been retrofit with all the available cost-effective solar and conservation measures, would no longer require enough heating energy to justify being hooked up to a large scale district energy system. It would, however, be economically feasible to serve these buildings with neighborhood scale district energy systems. Neighborhood scale systems, particularly those confined to a single block, can serve smaller loads because they avoid the high costs associated with large scale distribution networks which must cross major roadways and other physical barriers.

Figure I-C shows a hypothetical block containing four moderate-sized residential buildings, which are served by a district energy system. Combined, these buildings demand 1.5 billion Btu per year of heating energy, assuming that all cost-effective conservation measures have been implemented. This block could be served by a well-source heat pump system. District energy systems of this kind could reduce the heating energy requirement of residential and commercial buildings in Greenlake and Garfield by 20 to 30 percent more than the individual building retrofits alone. In addition, these systems may be feasible in cases where, due to insufficient uncovered ground area, ground-source heat pumps for single buildings are not feasible. There are, however, a variety of reasons why district energy systems might be physically difficult to install in some blocks. In addition, buildings which do not have central heating systems may be candidates only for water heating via these district energy systems.

FIGURE I-C
HYPOTHETICAL BLOCK SERVED BY A DISTRICT ENERGY SYSTEM



Million Btu per Year
Hot Water 1,174
Space Heat 325

Approx. scale — 1″ = 100′

The district energy systems concept can be taken one step further by using a natural-gas-fired cogenerator. The cogenerators, sometimes referred to as total energy systems, produce energy for space- and water-heating needs and electric energy for lighting, appliances and other electrical end uses. Why burn natural gas to generate electricity? In the case where only electricity is produced, as in a gas turbine peaking plant, this end use for gas is questionable because the conversion efficiency is only 30 percent with 70 percent of the fuel's heating value uselessly vented to the atmosphere. In the case of a total energy system, however, 27 percent is converted to electricity, but as much as 63 percent of the remaining 73 percent of the fuel's heating value can be channeled to meet the demand for space and water heating.

A 48 kW cogenerator might be located in the basement of a building in the hypothetical block; this could supply all the heating energy required by the block. In addition, it would supply to the City Light electrical grid 235 megawatt-hours of electric energy each year, which is 41.6 percent of the electric energy required by the block. Cogenerators can also be used to supply the heating energy required by a single building, such as a hospital or other large commercial building, if the building has a sufficiently large requirement for heating energy.

Another promising option is district energy systems which could utilize waste heat from commercial and industrial facilities. For example, the heat which is presently vented to the atmosphere by neighborhood laundromats could be recovered to meet the space- and water-heating needs of residential and commercial buildings in the Greenlake and Garfield communities.

POTENTIAL ENERGY SAVINGS FROM A CITY-WIDE COMMUNITY ENERGY REDEVELOPMENT PROGRAM

The Community Energy Redevelopment Plan, as proposed by the ENERGY, Ltd. Citizen Committee, would result in all communities of the city being retrofit through programs similar to those described for Greenlake and Garfield. By assuming that the prototype building retrofit analysis is applicable to all residential and commercial buildings, future city-wide energy requirements have been estimated. Detailed descriptions of assumptions and methods appear in Appendixes A, C, and D. In addition, data from the examination of two industrial firms have been used as a basis for estimating future industrial sector energy requirements.

If carried out over the next 30 years, the Community Energy Redevelopment Plan would result in a 58 percent reduction in the energy required by residential buidings. A further result, shown in Table I-9,is that the use of fossil fuels by residential buildings would be nearly eliminated. The rapid shift to electricity, however, would result in only a small reduction--12 percent--in the demand for electricity.

TABLE I-9
SEATTLE RESIDENTIAL ENERGY DEMAND (Billion Btu)

	1978	1990	2000	2010
Electricity	10,921	11,657	11,076	9,552
Gas	4,146	2,736	1,398	364
Oil	7,935	4,231	1,424	0
Other	885	422	52	0
Total	23,888	19,047	13,952	9,917

For commercial buildings, the overall pattern would be the same with a 40 percent reduction in the total energy required to serve these buildings by the year 2010. Again, the demand for fossil fuels would become very small by the year 2010. However, the demand for electric energy would increase by 38.7 percent. This is primarily due to the rapid shift to electric space heating combined with the vigorous growth assumed for the commercial sector. Table I-10 illustrates these results.

TABLE I-10
SEATTLE COMMERCIAL ENERGY DEMAND (billion Btu)

	1978[a]	1990	2000	2010
Electricity	10,365	13,567	15,556	14,382
Gas	5,155	4,605	3,479	1,929
Oil	6,053	4,534	2,348	133
Other	5,798	4,290	2,145	0
Total	27,370	26,996	23,528	16,444

[a]Results from the four commercial building prototypes could be used only to estimate the energy demand of retail, office, warehouse and "other" commercial buildings. This four-category approach leads to 1978 estimates that differ from those found in the ENERGY, Ltd. Data Base report. That report used a nine-category estimating procedure for commercial buildings.

The method used for estimating future industrial energy demands differs considerably from that applied to residential and commercial buildings and, unfortunately, contains a much coarser assumption. Two moderate-sized Seattle industrial firms were audited with the help of City Light's Commercial/Industrial Audit staff. The City Light auditors were asked to identify how energy-saving devices and methods could be incorporated in the operation of these two facilities. City Light's recommendations were analyzed by a consulting engineering firm which estimated the energy savings and costs associated with the implementation of each recommendation.

The audits of these two industrial firms revealed an average potential energy savings of 25.7 percent. Table I-11 shows the energy which could be saved city wide if all industrial firms could reduce their demand for energy by the same fraction found for the two audited firms. Clearly, these industrial estimates will be hard to defend until many more industrial audits and subsequent engineering analyses are carried out.

TABLE I-11
SEATTLE INDUSTRIAL ENERGY DEMAND (Billion Btu)

	1978	1990	2000	2010
Electricity	4,087	5,228	5,748	6,031
Gas	9,730	6,949	4,654	2,718
Oil	527	1,311	1,779	2,123
Other	1,988	1,752	1,505	1,262
Total	16,332	15,240	13,686	12,134

Tables I-12 and I-13 are summary comparisons of energy savings associated with the Community Energy Redevelopment Plan. Table I-12 shows the trends in energy demand by sector through the year 2010. Table I-13 shows these trends broken down by fuel type. The retrofit of all buildings and industries results in an energy demand in 2010 which is 43 percent less than the demand in 1978. The projections shows a 78 percent decrease in the demand for oil and natural gas. However, due to vigorous growth in the commercial sector and the massive switch to electric space-heating systems, these projections show a 18.1 percent increase in the demand for electricity. These projections do not assume the establishment of any district energy systems. If such systems were used wherever possible, it might be possible to achieve the same level of savings in oil, natural gas and other fuels without increasing the demand for electricity.

TABLE I-12
SEATTLE ENERGY DEMAND BY SECTOR (Billion Btu)

	1978	1990	2000	2010
Residential	23,888	19,047	13,952	9,917
Commercial	27,370	26,996	23,528	16,444
Industrial	16,332	15,240	13,686	12,134
Total	67,590	61,283	51,166	38,495

TABLE I-13
SEATLE ENERGY DEMAND BY FUEL TYPE (Billion Btu)

	1978	1990	2000	2010
Electricity	25,373	30,452	32,380	29,965
Gas	19,031	14,290	9,531	5,011
Oil	14,515	10,076	5,551	2,256
Other	8,671	6,464	3,702	1,262
Total	67,590	61,282	51,164	38,494

COST OF THE COMMUNITY ENERGY REDEVELOPMENT PLAN

The energy redevelopment effort described for Greenlake, Garfield and Seattle will result in large energy savings. However, these energy redevelopment programs will require a comparably large allocation of investment capital. The price will be less than the cost of the same amount of energy in the form of new electricity, but it will still be large. Like the energy savings estimates, the estimates of capital required for residential and commercial buildings are based on the analysis of seven prototype buildings. The detailed cost of each conservation and solar strategy found to be cost effective is presented in Appendix A. The industrial cost estimates are based on the examination of two moderate-sized industrial firms in Seattle.

Table I-14 shows the costs associated with the retrofit of the three residential prototype buildings. If it is assumed that all housing units in the sample communities are retrofit in a manner similar to the prototype retrofits, then the energy redevelopment of Greenlake would require $99.3 million and $110.9 million would be required for Garfield by the year 2010. To retrofit all Seattle residential structures would require $1.2 billion. It is important to keep in mind that the costs calculated for Table I-14 are based on assumptions consistent with the overall community-based, publicly financed redevelopment strategy. For instance, bulk purchase prices for various conservation and solar products are assumed. In some cases, substantial savings result from such bulk purchases. For a detailed description of how the life cycle costs were estimated, see Appendix B.

TABLE I-14
COST OF CONSERVATION AND SOLAR RETROFITS FOR RESIDENTIAL BUILDINGS

	Capital Costs ($/Unit)	Levelized Cost ($/Million Btu)	Net Present Value
Single Family			
Solar	7,667	3.83	22,928
Nonsolar	3,882	2.82	22,184
Multifamily			
Solar	3,854	3.82	12,856
Nonsolar	3,607	4.63	12,784
Apartment			
Solar	3,157	5.18	9,869
Nonsolar	2,703	4.47	10,079

The methods used to estimate the cost of commercial retrofits are similar to those used for residential retrofits. Again, the primary assumption is that all commercial buildings can be retrofit in a manner similar to the retrofit of the four commercial prototypes. Table I-15 shows the costs of retofitting each of the commercial prototypes. These costs were converted to cost per square foot of floor area and then multiplied by the floor area of commercial space in Greenlake, Garfield, and Seattle. The result is that the commercial building energy redevelopment would cost $12.2 million in the Greenlake community and $20.3 million in the Garfield community by the year 2010. The city as a whole would require $834 million.

TABLE I-15
COST OF RETROFITS FOR COMMERCIAL PROTOTYPES

	Capital Cost ($)	Levelized Cost ($/Million Btu)	Net Present Value
Small Office Building	13,538	3.26	54,433
Mixed Retail and Office	15,908	4.00	61,002
Warehouse	17,720	3.07	117,801
Supermarket	72,513	3.82	364,622

The costs of two district energy system options based on a hypothetical city block are shown in Table I-16. The levelized cost of the total energy system is very sensitive to the assumed price of natural gas. For these calculations, natural gas has been assumed to escalate at a real rate of 2.5 percent each year for the next 30 years. If added to the redevelopment plan, these district energy systems would increase the total capital requirement significantly, but they would also result in substantially larger energy savings.

TABLE I-16
COST OF DISTRICT ENERGY SYSTEMS FOR A HYPOTHETICAL CITY BLOCK

	Capital Cost ($)	Levelized Cost ($/Million Btu)	Net Present Value
Well-Source Heat Pump System	58,614	4.91	208,494
Natural-Gas-Fired Total Energy System	24,600	13.65	85,741

Rough estimates of the required capital for industrial energy redevelopment were made based on the examination of two moderate-sized industrial firms located in Seattle. Assuming that the average capital investment per Btu saved for all industrial firms is the same as that found for these two firms, then the total capital required for a city-wide industrial energy redevelopment program would be $240 million. Like the estimates of industrial energy savings, this cost estimate needs to be further refined through the examination of many more industrial firms.

IMPLEMENTATION

The discussion in the Management and Financing sections reflects an approach by stages for the Community Energy Redevelopment Program. In each section the management and financing issues for the pilot project are considered separately from the comprehensive long-range program with its centralized and decentralized organizations.

MANAGEMENT

Comprehensive Program

The comprehensive program for retrofitting Seattle's built environment has two levels of management: centralized management and decentralized management. These levels are addressed separately in this discussion.

Given the functions of the centralized organization, as previously outlined in Figure I-A, ENERGY, Ltd. suggests several criteria for the selection of this organization. These include:

- Ability to generate sufficient revenue at desirable terms for use as initial investment capital
- Ability to collect revenue to repay initial debt through payments for conservation
- Incorporation of public participation and/or public accountability
- Ease of implementation
- Minimal liability for municipal government
- Maximum private sector involvement
- Minimal impact on taxes in Seattle.

After weighing the advantages and disadvantages of eight prospective organizational models, ENERGY, Ltd. narrowed the in-depth consideration to six organizational choices. These six choices included a public utility district; a public development authority; a nonprofit corporation with public purpose; Seattle City Light, with an expansion of its current responsibilities; a conservation and solar utility; or a conservation and solar department. All six options had the ability to generate capital investment moneys through tax-exempt revenue bonding, which was considered to be the most critical of the selection criteria. All six also had the means for ensuring public participation and accountability.

The Public Development Authority (PDA) is recommended for initial investigation by the City as the organizational model for the centralized organization to implement the Comprehensive Energy Redevelopment Plan. The PDA has the following advantages:

- It is the least likely of the public organizations to require an amendment to the state constitution in order to carry out conservation installations.
- It will not affect municipal utility rates or taxes.
- It will not pose liability problems for the City.
- It will not require statutory changes for implementation.

In addition, the PDA offers a strong means for ensuring both public and private sector involvement, and it can accumulate assets as a public organization.

Under current statutory definitions, a Public Development Authority must utilize federal funds as part of its operational funds. This restriction would be a disadvantage if federal funding were not available; however, the use of federal funds is a strong and desirable possibility. Other disadvantages of a Public Development Authority relate more to the relative advantages of an existing utility such as Seattle City Light which has reserve revenues available to back the issuance of revenue bonds; a new organization established for the special purpose of conservation services would lack this backing. Therefore, the terms of bonding for a new organization, without revenue reserve backing, would likely be less advantageous than the terms of revenue bonds issued by Seattle City Light.

Let us not overlook vital things because of the bulk of trifles confronting us.

Emma Goldman

The power to establish a Public Development Authority is authorized in RCW 35.21.725. Under this authorization, a Public Development Authority can administer and execute federal grants and programs. A Public Development Authority cannot levy taxes or other such assessments. All liabilities incurred by a Public Development Authority must be satisfied exclusively from the assets and credit of the PDA. Therefore, a PDA can issue negotiable bonds for achieving a public purpose, but those bonds must be secured by the full faith and credit of the PDA or made payable solely out of certain revenues and receipts.

On dissolution, the assets of a Public Development Authority revert to the City. It is proposed that the PDA would lease installed removable energy systems to building owners. The PDA would retain title to equipment such as heat pumps and removable solar equipment. Considerable assets would be amassed under a leasing operation.

To ensure public accountability, the City is charged with the control and oversight of the Public Development Authority's operation and funds. In compliance with this charge, the appointments to the PDA's Board of Directors must be confirmed by the City Council. An annual financial report must be filed with th City Comptroller, containing an audited and certified statement of assets and liabilities. At any time, subject to adoption of a resolution with appropriate public hearings, the City may intervene and exercise control over the Public Development Authority to correct any deficiency or to ensure the accomplishment of public purposes. By resolution, the City may dissolve a Public Development Authority.

The responsibilities of a Public Development Authority in implementing the comprehensive Community Energy Redevelopment Plan, as detailed in Figure I-A and the accompanying description,are within the scope of the authority of a Public Development Authority, as understood by ENERGY, Ltd. at this time. Further investigation of this option is suggested as the first step necessary in moving toward a comprehensive Community Energy Redevelopment Plan.

The decentralized organization for managing the delivery of services, described in Figure I-A, will not be specified until proposals for service provision are requested. The decentralized organization could vary from one community to another. It may be.a private for-profit corporation, a private nonprofit corporation, a cooperative or any other organization with sufficient management capability and legal standing to be accountable for the provision of necessary services in a manner which maximizes community involvement and private sector service delivery.

Pilot Project

The pilot project should be planned through the City Energy Office. The Energy Office, with the cooperation of Seattle City Light, should secure the funds necessary for the pilot project and should specifically define the project's intent, procedures and timeline.

Once funding is secured, the City Energy Office will work with the Department of Community Development and Seattle City Light to develop the request for porposals, which will be published city wide. Technical assistance in developing the geographically based proposals will be provided by a team of staff from the Energy Office, the Department of Community Development and Seattle City Light. The Department of Community Development is most familiar with the characteristics of the respective geographic areas and with organizations and individuals whose interest in the project would aid in its success.

City Light may be the logical organization to implement the pilot project once the best proposal is selected, especially since an organization within the City which has the capability for collecting payments is needed. The City Energy office, as a staff office, does not have the capability to amass assets or to collect payments from building owners.

The organization in charge of the pilot project will have the following responsibilities: assume the title for installed removable energy systems; collect the payments for lease of equipment and installation of conservation elements which are permanently affixed; oversee project evaluation; provide support in the initial intensive marketing of conservation technologies in specific geographic areas; and carry out project administration. All activities should have the cooperation of the City Energy Office. Activities such as project evaluation can be carried out under contractual arrangements as necessary. ENERGY, Ltd. suggests that Seattle City Light designate a separate team to oversee the project and to work with other Seattle City Light divisions and other departments or agencies with energy interests.

The decentralized service delivery management cannot be specified at this time. The organization responsible for managing the service delivery operation will not be determined until responses to a request for proposal are considered and judged.

Alternative Centralized Organizations

ENERGY, Ltd's recommendation of the Public Development Authority as the organizational model for initial investigation resulted from a review of the advantages and disadvantages of six models, with an emphasis on the legal barriers and financial constraints of each. Because the Public Development Authority is recommended simply for initial investigation and is not necessarily recommended as the absolute answer, the advantages and disadvantages of the other options are also important to note. These are summarized in Table I-17. The option of a public utility district was removed from consideration and is not outlined here because early legal analysis suggested that the public utility district and Seattle City Light could not serve the same geographic area simultaneously. The conservation/solar utility and the conservation and solar department are described as one because their advantages and disadvantages are largely the same. As previously noted, all of the options presented appear to possess the ability to generate capital investment revenues through tax-exempt revenue bonding and all have a means for ensuring public accountability.

TABLE I-17
ADVANTAGES AND DISADVANTAGES OF OPTIONS FOR CENTRALIZED ORGANIZATION

ORGANIZATIONAL MODEL	ADVANTAGES	DISADVANTAGES
Public Development Authority (PDA)	1. Has potential for delivering service and generating revenue as a public organization without amending state constitution.	1. Will require at least partial federal funding for operation under provisions of RCW 35.21.725.
	2. Will not affect utility rates or taxes.	2. May need initial external subsidy to lower terms of bond issuance, because of lack of reserve revenue backing.
	3. Imposes no liability for City.	3. Broad interpretation of powers to provide conservation services and to generate revenues opens opportunity for litigation.
	4. Should not require additional authority for delivering services and generating revenue through federal or private means.	
	5. Includes public accountability through both community involvement and City of Seattle oversight functions.	
	6. Does not entail unreasonably involved enabling process.	
Seattle City Light (SCL)	1. Has reserve revenue backing which is favorable for bond issuance.	1. Increase in SCL rates across all classes may be unfair should this be chosen means for repayment of bond indebtedness.
	2. Can disperse costs to all ratepayers or to separate class of ratepayers, thus lowering the cost to individual building owners receiving conservation services.	2. Could affect SCL bond rating.
	3. Could build on administrative experience developed through Home Energy Loan Program to lower administrative costs.	3. Would compete with other SCL projects for revenue and for management attention.
	4. Organization is already established and functioning.	4. Needs amendment to state constition and state statutes to provide conservation retrofit services for all heating customers, including oil/gas heating fuel customers.
	5. Ensures accountability through oversight by Mayor and City Council.	5. Does not necessarily ensure public participation.

Table I-17 continued

ORGANIZATIONAL MODEL	ADVANTAGES	DISADVANTAGES
Conservation and Solar Utility or Department	1. Could merge with SCL for bonding purposes to receive most advantageous terms based on SCL rating and reserve revenue (as utility).	1. Needs amendment to state constitution and state statutes to provide conservation retrofit services to all fuel customers through public funds.
	2. Could be implemented without the extensive legal work necessary for organizing as an entity (as department).	2. Could affect city bond rating if capital raised through bond issuance (if department).
	3. Offers potential for better consolidation of existing efforts by City to conserve all fuels.	3. Could affect SCL's bond rating if the utility merged with SCL to issue revenue bonds.
	4. Ensures accountability through oversight by Mayor and City Council.	4. Does not necessarily ensure public participation or responsiveness.
Private Nonprofit, Public Purpose	1. Requires no legislative changes to provide services and generate revenue.	1. Assets accrued revert to municipality upon retirement of bonds unless IRS rulings are reinterpreted.
	2. Imposes no liability for City.	2. Has least assurance of adequate accountability.
	3. Does not entail extensive legislative work to establish.	3. Lacks revenue reserve for bond issuance. Terms of bond issuance may be higher.
		4. Requires city legislation to establish the specified public purpose.
		5. Broad interpretation of power to issue tax-exempt bonds opens opportunities for litigation.

FINANCING

Comprehensive Program

More than any other single proposal in this action plan, the financing necessary for the implementation of the Community Energy Redevelopment Plan must be able to meet the terms of "life cycle" financing in order to be successful. Investment capital must be available to building owners on repayment terms that offer sufficient incentive to action–and that put conservation investments on an equal footing with respect to investments in traditional energy supplies.

The key element necessary for placing conservation investments on a par with traditional energy investments is the life cycle repayment period. Traditional energy investments are amortized over periods of 20-30 years. Currently available capital for conservation or solar investments has short repayment periods, generally three-five years.

For this reason, ENERGY, Ltd. recommends that the City adopt a financing strategy for comprehensive retrofit investments which offers the building owner repayment terms over an extended period of time at the lowest possible interest rate. To accomplish this, it is anticipated that a centralized organization (for example, a Public Development Authority) will issue tax-exempt revenue bonds for phases of the comprehensive retrofit program. For example, the results of the pilot program may establish sufficient capital assets and revenue return records for the issuance of revenue bonds to provide capital for one geographic area. As experience in additional energy redevelopment efforts grows, future bond issues would generate capital at progressively more attractive rates of interest.

The bonds would be tax-exempt revenue bonds and would be issued by a public entity, but they would not rely upon City of Seattle bond ratings. Therefore, the interest rates for the bond retirement may be higher than Seattle municipal bonds, but the City of Seattle's debt ratio and bond ratings will not be affected.

The bonds would be retired through payments collected from building owners who have conservation systems installed. These would be either lease payments for removable equipment (the title of which would remain with the centralized organization) or payments for the service of installing permanent conservation systems.

Although the bond market mechanism itself emphasizes the private sector role in raising investment capital, further private sector involvement is desirable. Private financial institutions may be induced to participate in expanding the capital pool. From a policy standpoint, in soliciting the participation of the private lending institutions, a guarantee that the life cycle repayment period would be used is essential. Without that guarantee, equity with investments in traditional energy supplies and the incentive to building owners would be lost.

To date, public moneys have been used to leverage local private investment capital for conservation installations, but the terms have been comparable to conventional home improvement loans and not comparable to investments in traditional energy supplies. For example, the City of Seattle recently was awarded $319,000 from the Department of Housing and Urban Development's (HUD) Urban Development Action Grant (UDAG) program. Under the proposal, the $319,000 is used to leverage $850,000 in private lending institution financing, as shown below in the boxed description.

UDAG Program for Financing Home Weatherization

FUNDING:

$150,000--loan principal rebate to low-income client
$102,000--reserve loan guarantee fund

$ 29,600--UDAG share of City's administrative and publicity costs
$ 37,400--bank costs

$319,000--Total HUD Grant

$850,000--Total bank loan commitment (excluding servicing costs)

$200,989--City funds for administration

$1,369,989--Total Program

RESERVE FUND: A sum equal to 12% of each loan's principal will be deposited in an account at the lending institution as a "loan guarantee reserve fund." A partial lump sum deposit will be made at the program's initiation. The reserve account will be interest bearing, payable to the City of Seattle.

The use of the $319,000 in Housing and Urban Development (HUD) grant funds is combined with the lending institution's funds to create a loan pool of $1,000,000. The average loans are estimated to range between $850 and $1,000. Even with the guarantee provided by public funds and with the rebate of a portion of the princial to low-income households, the loan terms include an 11 percent interest rate and a repayment period of five years. This arrangement does not place conservation investments on an equal footing with traditional energy supply investments.

There are other potential revenue sources for financing parts of a comprehensive retrofit program. For example, the concept of "conservation purchase" or purchase of "electric load reduction" has been introduced under Section 562 of the Energy Security Act of 1980. This concept is discussed further in a legal memorandum from the firm of Wickwire, Lewis, Goldmark and Schorr; this memorandum is presented in Appendix E. ENERGY, Ltd. recommends that Seattle City Light explore this idea. Under this concept, Seattle City Light could contract with an entity to install conservation measures for reducing electric loads. The financial arrangement between Seattle City Light and the entity would be based on the specified price for a unit of saved energy (at the value of the unit to the utility).

Such purchasing of conservation could provide adequate financing for electrically heated buildings. As proposed under the federally subsidized pilot programs (regulations not yet issued), the arrangements are limited to residences and are available for commercial or industrial conservation financing. This residential focus could be expanded if the federal pilot project proves successful. For the purposes of the Community Energy Redevelopment Plan, the "conservation purchase" approach would provide a portion of the initial capital financing for the central organization, but it would be limited to electrically heated buildings.

If Seattle City Light pursues this federally sponsored pilot program for "conservation purchase," additional initial capital will still be necessary for retrofitting commercial and industrial buildings and gas- and oil-heated buildings.

Pilot Project

The financing for the pilot project will have to be developed from a number of sources. Tax-exempt revenue bonds are not a potential source because there will be no assets or revenue flow for the initiation of the

pilot project upon which a bond package could reasonably be based. If Seattle City Light moves in the direction of the "conservation purchase" and if that concept is actualized within the time period necessary for the pilot project, that source of funding would generate capital for retrofit investment for electrically heated residences. With or without this source, the City Energy Office should seek funding from various federal and private foundation sources such as the Bonneville Power Administration, the Department of Energy and the Ford Foundation.

SCHEDULING

You may delay, but time will not.

Benjamin Franklin

The presentation of scheduling for activities necessary to carry out the Community Energy Redevelopment Plan is divided into a developmental stage and an operational stage. The developmental stage includes activities necessary to plan for the larger comprehensive program. The operational stage relates primarily to the establishment of a centralized organization and to the identification of preliminary work necessary to develop financing for the operation of the comprehensive program. The operational stage includes the ongoing operation of both a centralized organization and of a decentralized service delivery system. Adequate financing and management are assumed.

TABLE I-18
SCHEDULE OF ACTIVITIES NECESSARY FOR DEVELOPING AND OPERATING THE COMMUNITY ENERGY REDEVELOPMENT PLAN

YEAR	PILOT PROJECT DEVELOPMENTAL PHASE	COMPREHENSIVE PROGRAM
1981-82	1. Clearly define parameters of pilot project: –Outline elements to be evaluated –Propose research design necessary for evaluating elements –Define operational parameters and outline issues which need resolution –Develop inter-departmental agreements.	1. Identify issues needing further work to establish an energy-conservation-focused Public Development Authority: –Legal issues with Law Department –Financing issues with bond attorney –Administrative issues with Department of Community Development and existing Public Development Authorities.
	2. Develop work program for pilot project. Introduce resolution detailing work program. 3. Draft proposal with clearly defined operational mechanism and anticipated results to be tested. 4. Examine conservation purchase concept in more detail.	2. Prepare detailed work program in resolution. Determine format for recommendations. 3. Identify issues which may require legislative action on state or federal levels.
1982-83	1. Secure funding for pilot project.	1. Carry out work program through Law Department, City Energy Office.
	2. Solidify interdepartmental agreements for performance of work during pilot project. 3. Develop and carry out Request for Proposal procedure for solicitation of proposals to provide comprehensive retrofit services in the geographic areas. 4. Select decentralized organization for conducting pilot project. 5. Establish administrative procedures necessary for operation of pilot. 6. Negotiate, execute agreement with contractor.	2. Present recommendations to Mayor, Council for action. 3. Prepare legislative action necessary for state or federal barrier removal.
1983-84	1. Begin service: –Intensive marketing –Begin audit, retrofit work.	1. Complete any further work identified by Mayor or Council.

Table 1-18 continued

	PILOT PROJECT	COMPREHENSIVE PROGRAM
	DEVELOPMENTAL PHASE	
	2. Begin evaluation system: --Data collection procedure in place.	2. Follow any necessary legislative actions.
1984-85	1. Continue operation of pilot: --Retrofit services --Project evaluation.	1. Clearly define work parameters: accountability, management structure of the centralized organization.
		2. Draft work program outlining specific tasks necessary to secure financing.
1985-85	1. Continue retrofit services.	1. Draft and introduce enabling legislation leading to the development of centralized organization.
	2. Begin wrap-up of pilot project. Compile evaluation results.	2. Identify funding prospects for ensuring administrative staff support until total operation capital is secured based on evaluation results.
1986-87	1. Complete report on evaluation results.	1. Establish centralized organization.
	2. Discontinue pilot phase of project.	2. Establish administrative procedures for initial work.
		3. Carry out tasks necessary for obtaining funds for initial capital investment.
		4. Refine selection procedure for geographically based organization, not to exclude completion of total retrofit of geographic area selected for pilot.
	OPERATIONAL PHASE	
1987-88		1. Solicit proposals for geographically based operation.
		2. Select proposal. Execute agreement.
1988-2010		1. Continue operation. Secure funding. Retrofit additional geographic areas. Evaluate energy results.

II. INCENTIVES TO ENERGY CONSERVATION

Recommendations
Anticipated Results
Background
Energy and Cost Analysis
Implementation

If the outcome is good, what's the difference between motives that sound good and good sound motives?

Laurence J. Peter

INCENTIVES TO ENERGY CONSERVATION

OBJECTIVES

- Encourage private sector investments in energy conservation and renewable resources by:
  - -- Extending existing investment incentives
  - -- Removing legal barriers to the extension of incentives.

APPROACH

- Pass city legislation defining conservation as a legitimate business consideration for the City.
- Lobby the state legislature to amend various state laws to:
  - -- Enumerate the right of utilities to finance conservation
  - -- Expand the City's authority to issue revenue bonds for conservation purposes.
- Request that Seattle City Light accelerate and expand its Home Energy Loan Program.
- Participate on behalf of Seattle citizens in Washington Natural Gas rate hearings before the Washington Utilities and Transportation Commission.
- Urge the state legislature to reserve a portion of the taxes collected from major oil suppliers in order to make conservation loans to oil heat users.
- Bring to the vote of the people an amendment to the state constitution to allow the City the authority to lend its credit to all classes of energy users and to consumers of all energy forms.
- Lobby for the amendment to the Federal Energy Tax Act of 1978 to expand the level and time frame of tax credits to businesses investing in conservation improvement.

COSTS

- Ratepayers bear the costs of financial incentives provided by their utilities.

BENEFITS

- Comparable financing opportunities and incentives for all energy users of all energy forms.
- Significant amounts of energy saved through conservation investments, resulting in public savings on the marginal cost of new thermal or hydro facilities.
- Reduced reliance on fossil fuels.

MANAGEMENT

- Intergovernmental Relations (City of Seattle) provides necessary coordination and development of strategies.

SCHEDULE

- 1982 Initiate lobbying efforts.

INCENTIVES TO ENERGY CONSERVATION

RECOMMENDATIONS

One of the ENERGY, Ltd. objectives is to encourage private investment in energy conservation and renewable resources. This involves both extending incentives for investments and removing the legal barriers to the extension of such incentives. The ENERGY, Ltd. Citizen Committee makes the following recommendations:

1. The City Council should pass an ordinance which defines conservation as a legitimate business consideration for the City. (This does not imply that additional energy supply is not a business consideration.)

2. The City should aggressively urge the Washington State Legislature to amend RCW 35.90.050, "Authority to acquire and operate utilities," to specifically enumerate the right of utilities to finance conservation measures.

3. The City should aggressively urge the Washington State Legislature to amend RCW 35.90.100, "Revenue bonds or warrants," to specifically expand the City's authority to issue revenue bonds for the purpose of financing cost-effective conservation measures (whether or not these measures constitute a physical asset to the utility).

4. The City should agressively urge the Washington State Legislature to bring to the vote of the people an amendment to the Washington State Constitution which would allow the City to loan money to finance cost-effective conservation by all consumers of all forms of energy.

5. The City should aggressively urge the amendment of federal legislation (e.g., the National Energy Conservation Policy Act) to specifically mandate public incentives in the form of audits and technical assistance for commercial buildings.

6. The City should aggressively urge the immediate amendment of the federal Energy Tax Act of 1978, to include:

   - A refundable tax credit for cost-effective investments by business in building improvements that conserve energy
   - An extension of the Act's closure from 1982 to 1987
   - An increase in the present Business Energy Investment tax credit of 10 percent.

7. The City should immediately begin to encourage and facilitate private sector participation in the federal loan subsidy program established in the Energy Security Act of 1980, entitled the "Solar Energy and Energy Conservation Bank."

8. Seattle City Light should extend its Home Energy Loan Program and accelerate its implementation.

9. The City should represent the interests of its citizens by participating in Washington Natural Gas Company rate hearings before the Washington Utilities and Transportation Commission.

10. The City should aggressively urge the Washington State Legislature to set aside a portion of the taxes collected from the state's major oil suppliers. The fund should be used to make conservation loans to oil heat users.

BACKGROUND

Why should we go to these lengths to offer incentives to energy conservation? There are several important reasons. Oil and gas prices have increased dramatically over the last six years. The OPEC price for a barrel of oil has risen ninefold since 1973 in current dollars. The growing demand for electricity is requiring the development of new resources, yet the marginal cost of these new supplies is 5-10 times higher than the existing average cost. But electricity consumers see only the lower average costs--they don't get the signal to conserve. These conditions have created a long list of **unexploited** conservation and demand offset activities that are economic and desirable **now.** The energy reality to which we must respond has changed, but changes in behavior lag behind. Cost-effective investments have not been made, skills have not been learned, and consumption patterns have not been altered.

PUBLIC VERSUS PRIVATE PERSPECTIVES

A government role in providing energy conservation is appropriate because there are flaws in the private market mechanism. The costs and benefits of energy conservation investments for the private investor diverge substantially from the costs and benefits deemed adequate from the public's point of view for three reasons:

- There are substantial public benefits.
- There are differences between the time preferences of private investors and those of the public.
- There are differences between public and private perceptions of risk.

Benefits

In the Pacific Northwest, the publicly owned electric utility has a mandate to supply electricity at the lowest reasonable cost (See Uhler v Olympia, 87 WA 1 [1915]). The provision of low-cost electricity, coupled with unstable supplies of oil and dramatic increases in the price of oil and natural gas, has increased the demand for electricity. While the average cost per unit of existing hydroelectric power ranges between three and six mills per kilowatt-hour, future planned thermal and hydro facilities have projected costs generally ranging between 20 and 50 mills per kilowatt-hour.[1] This more expensive power is still a small part of the overall energy supply, thus the customer pays a price (the averaged cost) far below the real present value of energy (the marginal cost).

Money costs too much.

Ross MacDonald

Private firms and individuals want the cost of conservation improvements to be quickly offset by reduced energy bills. Relatively low energy bills, based on average costs, mean that only relatively low-cost improvements will be attractive private investments. From the perspective of a private firm, energy is a small percentage of the total expenses, energy expenses are tax deductible as a business expense, and electricity prices are actually and relatively low. All these factors make a significant investment in energy conservation less profitable for the firm than they are for the public. In this case, a public policy--the provision of low-cost electrical energy--has created a disincentive to conserve. Further governmental intervention in the form of a subsidy or changes in utility rate structures may be justified in order to encourage firms to invest in energy conservation.

If significant amounts of energy were conserved, the public would save the marginal cost of new thermal or hydro facilities. Currently, the costs of conservation investments are borne by individual building owners, but the benefits are shared by all customers.

Time Preference

A profitable project may be rejected because the profits occur too far in the future for the firm's investment strategy. If firms prefer short-term profitability, even a project with both substantial long-term profits and long-term social benefits may not be undertaken.

Commercial enterprises favor investments in expanded sales or in new product development. David Morris, of the Institute for Local Self-Reliance, suggests that most industries will invest in product development or market expansion when a 15 percent return of investment is probable, "while they would be reluctant to invest in energy savings technology unless a 30 percent return on investment were likely, i.e. an investment which repays itself in less than three years."[2]

[1] Art T. Lane and Jeanette Pfotenhauer, informal Seattle City Light memorandum to June Appel regarding the New Large Load Policy, November 15, 1979, p.2.

[2] David Morris, "Energy Economics and Energy Financing," unpublished manuscript, Institute for Local Self-Reliance, 1979.

This stringent investment criterion is confirmed by the Department of Energy's Office of Industrial Programs which reports that for most industries economic requirements for discretionary investments in cost-cutting equipment (including energy conservation) are often one to three years, and in some cases, as low as six months for retrofitting existing plants.[1]

Perceptions of Risk

From the firm's perspective, the realization of the estimated rate of return may be too uncertain to make the project an attractive investment, while it may still be attractive from the public's viewpoint.

If, for example, the risks of a new technology are compared to the risks to society of an oil supply interruption, it may be that the comparison favors pursuing the risky technology. The divergence between the enterprise's perception of financial risk and society's perception develops because a part of the benefits which result from the private investment in the risky new technology are not captured by the firm. In addition, individual firms may be less able to bear the financial risk than society as a whole. Appropriate governmental intervention would reduce the risk to individual firms while ensuring that these financial risks were not substantial for any single taxpayer or ratepayer.

INCENTIVE STRATEGIES

There are a myriad of constraints hindering the City of Seattle's ability to accelerate energy conservation. These constraints are illustrated in Figure II-A, along with the general conservation incentive strategy.

[1] U.S. Department of Energy, Office of Industrial Programs, Division of Industrial Energy Conservation, "Development of the Strategic Plan for Industrial Energy Conservation;" DOE/TIC-1002.

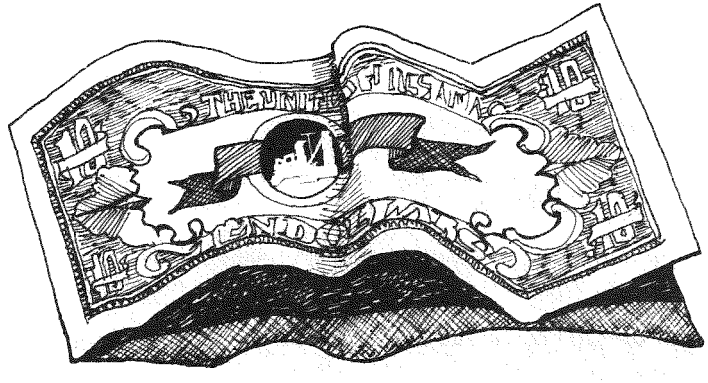


FIGURE II-A

TIME PERIODS: MAJOR CONSTRAINTS TO INCREASED ENERGY CONSERVATION

1978 Recent Past

KEY CONSTRAINTS ARE PSYCHOLOGICAL AND ECONOMIC

- many technologies are available and emerging
- for which economics are poor
- and conservation is not an accepted need

1980-85 Present/Near Future

KEY CONSTRAINTS ARE LEGAL AND ECONOMIC

- some technologies are emerging
- for which economics are marginal
- and capital is a limiting factor
- but in Washington State remedies are limited

1985-90 Mid-Future

KEY CONSTRAINTS ARE FINANCIAL

- some technologies are emerging
- for which economics are marginal
- and capital may be a key factor

TIME PERIODS: INCENTIVE STRATEGY

1978 Recent Past

KEY CONSTRAINTS ARE PSYCHOLOGICAL AND ECONOMIC

- federal demonstration projects
- information dissemination
- federal tax credits
- federal fuel conversion regulations
- Energy Code for new buildings
- changes in City Light rate structure

1980-85 Present/Near Future

KEY CONSTRAINTS ARE LEGAL AND ECONOMIC

- amend Washington State laws
- develop minimum requirements for existing structures
- subsidize audits/technical assistance
- expand tax credits
- disseminate information
- utilize federal loan subsidies

1985-90 Mid-Future

KEY CONSTRAINTS ARE FINANCIAL

- use rebate and purchase programs
- increase available capital

The ENERGY, Ltd. Citizen Committee considered the following groups of conservation incentive strategies, displayed in Table II-1:

- Statutory changes
- Subsidized technical assistance
- Tax structure changes
- Energy pricing
- Capital pool manipulations
- Rebates, purchases or leases.

The ENERGY, Ltd. recommendations fall within either the general category of statutory changes to eliminate instutitional barriers (or constitutional regulation to provide incentives) or the category of economic incentives to change market conditions. Both approaches can ease the circumstances which are impeding the adoption of energy conservation improvements. The recommendations selected were those deemed to be the most legally feasible, financially feasible, timely, equitable and effective. A discussion of each of the incentive strategies is presented below.

Statutory Changes

The City, as a municipal corporation, is a creature of the state. Its powers are enumerated and limited by Washington State laws and the Washington State Constitution. One constitutional provision appears to be a stumbling block to the use of public funds for encouraging energy conservation. That is Article VII, Section 7 of the state constitution, which reads:

> No county, city, town or other municipal corporation shall hereafter give any money, or property, or loan its money, or credit to or in aid of any individual, association, company or

TABLE II-1
POTENTIAL ENERGY CONSERVATION
INCENTIVE STRATEGIES

Given Current Conditions, Will the Proposal. . .	STATUTORY CHANGES	SUBSIDIZED TECH. ASST.	TAX STRUCTURE CHANGES	ENERGY PRICING	CAPITAL POOL MANIPULATION	REBATES, PURCHASES, OR LEASES
1. Be Legally Feasible?	Yes (statutes can be changed)	Yes	Yes (statutes can be changed)	Possibly	No (not City funds)	Possibly
2. Eliminate "Institutional" Obstacles?	Yes	–	None exist	–	–	–
3. Be Financially Feasible?	Yes	Yes	Possibly	Yes	Possibly (federal funds)	Possibly
4. Be Implemented within 24 Months?	Statutes, yes Constitution, no	Yes	Possibly	Possibly	Possibly (federal funds)	Possibly
5. Be a Significant Incentive to Conserve?	Not intrinsically	Not intrinsically	Possibly	Yes	Possibly	Possibly
6. Encourage Cost-Effective Conservation Techniques?	Possibly	Yes	Marginally	Yes	Possibly	Possibly

corporation, except for the necessary support of the poor and infirm, or become directly or indirectly the owner of any stock in or bonds of any association, company or corporation.

This provision against the lending of public credit to private entities has been construed very strictly by the Washington Supreme Court. Governmental conservation incentives in the form of grants, guaranteed loans, rebates, etc., for the private sector or for Washington residents (other than those who are poor and infirm) would, with a single exception,* be considered an unconstitutional lending of public credit. This is the reason fo the ENERGY, Ltd. recommendation for a constitutional amendment.

The Washington Supreme Court has ruled that no gift occurs when a payment by a municipal corporation is part of a "genuine exchange of concrete, specific, measurable consideration." *(Washington Natural Gas Company v PUD No. 1,* 77 Wn. 2nd 94, 104 [1969].) If the payments for reducing demand--or encouraging conservation--are less than the cost of meeting the demand, the use of the funds could be considered a sound management investment decision. But it is not clear that energy conservation would be considered a "concrete, specific, measurable consideration." If it were, then at least one barrier to the ability of a public utility to "buy" energy saved would be removed. This is the basis for the ENERGY, Ltd. recommendation that conservation be legally defined as a legitimate business consideration.

Appendix E of this report contains a memorandum that describes a federal pilot program, known as the Residential Energy Efficiency Program, involving the purchase of energy savings from utility customers. The memorandum discusses the central issue of the constitutionality of Seattle's participation in such a program. If this purchase of conserved energy from residential buildings proves to be legally acceptable, then the economic feasibility of extending it to commercial buildings and industrial facilities should be analyzed.

The state does empower municipal utilities to perform the following functions:

> 35.92.050 Authority to acquire and operate utilities. A city or town may also construct, condemn and purchase, acquire, add to, maintain and operate works, plants, facilities for the purpose of furnishing the city or town and its inhabitants, and any other persons, with gas, electricity, and other means of power and facilities for lighting, heating, fuel, and power purposes, public and private, with full authority to regulate and control the use, distribution, and price thereof, together with the right to handle and sell or lease, any meters, lamps, motors, transformers, and equipment or accessories of any kind, necessary and convenient for the use, distribution, and sale thereof: authorize the construction of such plant or plants by others for the same purpose, and purchase gas, electricity, or power from either within or without the city or town for its own use and for the purpose of selling to its inhabitants and to other persons doing business within the city or town and regulate and control the use and price thereof. (Formerly RCW 80.40.050.)

Note that "conserving energy" is not delineated as a right or power. This appears to be the crux of the King County Superior Court's ruling against the energy conservation programs ordered for Puget Sound Power and Light by the Washington Utilities and Transportation Commission. The *Seattle Tmes* of September 27, 1980, reported that:

> Judge Elston said no one could argue that the standards imposed by the commision would not be efficient and cost effective in the saving of energy, but the Legislature has not given that kind of authority to the commission.

It is probable that this ruling will be appealed to the state supreme court.

ENERGY, Ltd. has adopted the view that effective incentives to stimulate the conservation of all forms of energy cannot be implemented by the City of Seattle or Seattle City Light until these legal conditions have been clarified in the following ways:

- The use of public moneys for stimulating the conservation of energy must be exempted from the provisions of ArticleVIII, Section 7.
- The purchase of conservation must be a recognized power and a recognized business consideration of municipal corporations.
- Municipal corporations must be allowed to use revenue bonds for the purpose of financing cost-effective conservation measures.

These statutory changes do not directly affect energy use patterns, but they would clarify the authority of the City of Seattle to finance and implement conservation incentives.

What makes life dreary is the want of motive.

George Eliot

Subsidized Technical Assistance and Other Energy Supplier Incentives

Another approach to providing incentives is to require that all energy suppliers offer comparable conservation incentives and services to their customers, such as:

- Subsidized loans (low-interest, long-term) to electricity, oil, and natural gas consumers for conservation investments
- Subsidized energy audits and technical assistance to all classes of

*Amendment 70 of the Washington State Constitution, also known as SJR-120, permits publicly owned electric utilities such as Seattle City Light to make conservation loans to the owners of residential structures in order to conserve electricity. The loans require an appropriate charge back and a lien on the property.

customers

- Rate structures that encourage conservation.

In the case of electricity and natural gas, such incentives and services can be required through existing regulatory bodies. Seattle City Light, for example, is regulated by the Seattle City Council. The Washington Natural Gas Company, as a private, investor-owned utility, is regulated by the Washington Utilities and Transportation Commission. A different approach is required for oil companies, which are not regulated as private utilities.

As can be seen in Table II-2, these incentives are not offered uniformly.

TABLE II-2
INCENTIVES OFFERED BY ENERGY SUPPLIERS

Do they offer. . .	Seattle City Light	Washington Natural Gas	Oil Suppliers
1. Subsidized Audits to All Classes of Customers?	Residential, yes (apartments, weak) Commercial & Industrial, beginning	No (residential only beginning January 1981)	No
2. Subsidized Loans?	Yes (residential weatherization)	No (residential loans at market rates)	No
3. Conservation Rates?	Residential, yes Commercial & Industrial, rate structures changing	No	Not Applicable

The ENERGY, Ltd. Citizen Committee recommends that Seattle City Light accelerate the extension of its Home Energy Loan Program, which currently includes only weatherization measures (Phase I), to include solar hot water heaters, heat pumps, insulated and storm doors, fireplace doors and plugs, solar space heating, and heat storage systems. All of these items are proposed in Phase II of the Home Energy Loan Program. The cost of these programs should be included in City Light's rate base. It should be made clear that, because of the Washington State Constitution, Seattle City Light can loan money for these purposes only to electric heat customers.

Washington Natural Gas, through an affiliated company, provides some of the services suggested as examples. The affiliate, Thermal Efficiency, Inc., sells insulation, storm windows, solar panels and other conservation equipment to any energy consumer. It will make loans at market rates to purchasers of these services and equipment. In addition, Washington Natural Gas will begin offering residential audits in January 1981, as required by the National Energy Conservation Policy Act. A recent amendment to that federal law will require that audits be extended to small commercial buildings as well.

The ENERGY, Ltd. Citizen Committee recommends that the City represent its citizens who use natural gas by participating in Washington Natural Gas rate hearings before the Washington Utilities and Transportation Commission (WUTC). The purpose of the City's participation would be to encourage energy policies by Washington Natural Gas comparable to those followed by Seattle City Light and to ask the WUTC to evaluate and determine whatever is cost effective for the utility--whether it is drilling for new gas or attic insulation. The following are options that the WUTC might consider:

- Request that Washington Natural Gas apply rate structures that encourage conservation. Under the Public Utilities Regulatory Policies Act, the WUTC is required to examine different pricing policies that would encourage energy conservation. This request would be in line with federal law.

- Request that Washington Natural Gas offer audits and technical assistance to commercial and industrial customers.

- Request that Washington Natural Gas provide low-interest or long-term loans to customers to finance energy conservation.

The costs of the audits and subsidized loans should be included in the rate base. As an investor-owned utility, Washington Natural Gas should be allowed to make a profit on these services.

Providing similar services to oil heat customers is more difficult because there are no existing institutions that routinely influence oil company behavior. There are seven major oil suppliers that serve western Washington. They are not regulated by the WUTC since they are not, by statute, considered utilities. They generally sell their oil to smaller businesses (approximately 80 oil heat dealers in Seattle) that operate with a business license in Seattle.

ENERGY, Ltd. recommends that a trust fund be established from which to make loans to oil heat customers comparable to those suggested for electricity and natural gas customers. Two ways of generating a trust fund were discussed by the Citizen Committee:

- State legislation could require the major oil companies to earmark a portion of their revenues for a trust fund, established and operated by the oil companies. This would be a revolving fund to which the loans would be repaid, except for the cost of any loan subsidy. The major

concern with this approach is that the costs would simply be passed on to consumers in the form of higher prices.

- State revenues from the sales tax on oil have increased as a result of the inflated prices of oil. The ENERGY, Ltd. Citizen Committee believes this should be considered a revenue windfall, which should be earmarked for a state-operated trust fund. The disadvantage of this approach is that because these would be public funds, loans from the trust fund could not actually be made to consumers unless the state constitution were changed.

In later chapters of this Draft Action Plan, energy audits and more detailed technical assistance are recommended for commercial buildings and industrial facilities. The ENERGY, Ltd. Citizen Committee believes that these services should be subsidized by electric and gas utility rates. As mentioned earlier, audits will be provided to residential consumers as required by law. To strengthen this recommendation, the Citizen Committee recommends that Congress amend the National Energy Conservation Policy Act to provide public incentives in the form of shared-cost audits and technical assistance for commercial buildings.

Tax Structure Changes

In order for tax credits to be effective and to achieve results, several conditions must exist. The tax credit must be large enough to affect the decisions of a substantial number of firms. The percentage must be high enough to offset the high costs of the uncertainties associated with many new energy conservation technologies. ENERGY, Ltd. cannot recommend specific tax credit rules–but suggests that they be carefully designed to be compatible with the goals of equity and effectiveness.

Tax credits are a form of subsidy that directly increase the recipients' net income by canceling some part of their taxes. "Tax credits, like grants, are an appropriate subsidy for correcting. . . two types of market failure . . . external economies and private-public differences in time preferences. Tax credits raise the expected rate of return from an investment in order to encourage desired activity."[1] In this case, the desired activity is the accelerated use of energy conservation technologies for commercial buildings and industrial facilities.

The ENERGY, Ltd. Citizen Committee recommends the amendment of the Energy Tax Act of 1978 to expand refundable tax credits for investments by business. The credit is currently 10 percent and is available only through 1982. The amount of the credit should be increased and the date should be extended.

[1] Joseph Bowring, "Selected Federal Tax and Non-Tax Subsidies for Energy Use and Production," U.S. Department of Energy, Financial and Industries Study Division, Office of Economic Analysis, Washington, D.C., January 1980, p. 31.

To be effective, nonrefundable tax credits require that recipients have some current tax liability and, more specifically, tax liability in excess of the tax credit. As a result, nonrefundable tax subsidies are best suited to profitable ongoing firms. Thus, ENERGY, Ltd. recommends that some, or all, of the proposed tax credit be refundable; that is, act as a tax rebate if the firm does not have tax liabilities in excess of the credit.

ENERGY, Ltd. considered adopting a sales tax credit or sales tax exemption for the purchase of conservation materials, and/or adopting property tax credits or limiting property tax assessments for conservation improvements. To some extent, these are already available in Washington. But tax rebates significant enough to stimulate conservation would probably significantly reduce local revenues. Because local governmental units are considerably underfinanced, the committee rejected these incentives.

Energy Pricing

The Seattle City Council has directed Seattle City Light rate structures away from declining block rates (in which the more electricity the consumer uses, the lower the rate) and toward inverted block rates, which encourage conservation by charging a higher rate as the amount consumed increases. ENERGY, Ltd. believes this is a desirable incentive to energy conservation and should be continued. As noted earlier, the energy-pricing policies of the gas company will be examined by the Washington Utilities and Transportation Commission.

Capital Pool Manipulation

Capital pool manipulation involves the subsidized loans mentioned earlier or public financing; within these categories there are several variations:

- Interest subsidies include zero-interest or low-interest loans, similar to the Home Energy Loan Program being developed by Seattle City Light.
- Principal subsidies consist of outright grants.
- Loan guarantees include underwriting a loan guarantee reserve fund as a means of reducing the risk of nonpayment, as is being done for the Home Weatherization Standard by a federal Urban Development Action Grant to the City.
- Public financing includes raising capital by issuing public bonds, the proceeds from which would be used to make loans on tax-exempt, lifecycle terms for conservation purposes, as is proposed in the Community Energy Redevelopment Plan.

Somehow my finances will grow with the interest I show in the interest it gives me

John Sebastian

The intent of this chaper has been to focus attention on the need to

broaden the parameters of legitimate public actions in the state of Washington. Even before the legislature confirms that public funds can be used to foster private sector conservation, the City can facilitate participation in federal programs. Title V of the Energy Security Act of 1980 created a loan subsidy program known as the "Solar Energy and Energy Conservation Bank." The bank will be authorized to make payments to local "financial institutions" (a term used to denote any institution capable of handling financial transactions) that are willing to provide borrowers with below-market-rate loans or a principal reduction on loans for residential and commercial solar and conservation improvements. Assistance for improvements in commercial buildings will probably be calculated in these two ways:

- Energy conservation improvements will have a maximum subsidy rate of 20 percent of the cost up to $5,000.
- Solar energy projects will have a maximum subsidy of 40 percent or $100,000.

Commercial enterprises grossing over $1,000,000 are ineligible.

The Solar Bank's program provides only eligibility for financial assistance. The availability of Solar Bank subsidies to individual borrowers will depend on whether borrowers can arrange a loan at a financial institution and whether the financial institution has a commitment for subsidy funds from the Solar Bank. The program is a very weak incentive; it functions more as a subsidy for those commercial building owners already seeking capital. This subsidy, in the form of lowered interest or principal payments, will raise the expected rate of return on the desired investment.

The program is new and small. The first jurisdictions to capture a commitment for Solar Bank funds will have an excellent chance of "cornering the market" and acting as initial demonstration programs. Seattle is in a good position. This is why ENERGY, Ltd. recommends that the City immediately begin to encourage and facilitate the participation of commercial building owners and local lending institutions in the Solar Bank program.

Rebates, Purchases and Leases

To the extent that conservation alternatives are cheaper to a utility than new supplies of natural gas or new electricity generation, it should be in the utility's interest to undertake some or all of the following practices:

- Rebate to utility customers a percentage of the costs for conservation improvements or materials.
- Purchase measurable and permanent energy savings from consumers or pay for specific reductions in power use.
- Lease tangible and removable conservation equipment such as heat pumps, high-efficiency lamps, solar panels, cogenerators, etc.

Of these options, ENERGY, Ltd. looked most closely at the conservation purchase concept. Despite some significant legal barriers, it appears to be an idea worth pursuing further. It is described in detail in Appendix E.

COST ANALYSIS

I do want to get rich but I never want to do what there is to do to get rich.

Gertrude Stein

Incentives are not free. Since some of them are to be paid for out of utility rates, the impact on rates should be estimated. Over the coming months, ENERGY, Ltd. will try to estimate the effect on City Light's retail electrical rates.

IMPLEMENTATION

MANAGEMENT

Many of the recommendations made in this chapter require lobbying efforts in the state legislature and in Congress. Because of the growing importance of energy issues, additional issues to be lobbied will be likely to surface over the next few years. Therefore, the City's Office of Intergovernmental Relations should establish a specific energy legislative agenda coordinating the energy interests of City Light and the Energy Office, among others. This coordinated legislative effort should be better able to maintain an awareness of what issues other energy organizations are lobbying.

SCHEDULE

The state legislative agenda should be ready for introduction into the 1982 session of the state legislature. Because the federal agenda is shorter, the introduction of legislation into Congress might possibly begin in late 1981.

ENERG
for a secure energy future

III. APARTMENT WEATHERIZATION REQUIREMENT

Recommendations
Anticipated Results
Background
Energy and Cost Analysis
Implementation

i spent all winter in
carpet stores gathering
patches so i could make
a quilt
does this really sound
like a silly poem
i mean i want to keep you
warm

Nikki Giovanni

APARTMENT WEATHERIZATION REQUIREMENT

OBJECTIVES

- Extend provisions of the proposed Comprehensive Residential Weatherization Plan to include buildings with more than four residential units in order to:
  - Attain energy efficiency among all residential structures
  - Treat residential energy consumers equitably in the development and implementation of a weatherization program.
- Complete weatherization of apartment building stock by January 1994, using a time-of-sale requirement.

APPROACH

- Develop weatherization standards for apartment dwelling units.
- Require weatherization of all apartment buildings at time-of-sale, effective January 1, 1984 or by January 1994, whichever date comes first.
- Develop audit program and operations manual for apartment buildings.
- Develop an energy savings fact sheet, containing current information on financing and energy-efficient technologies for apartment buildings, for distribution through Seattle City Light billings.
- Require changeover of existing master-metered units with separate heating units to individual meters, where feasible.

COSTS

- Costs for installing cost-effective energy measures are to be included in the estimates of capital investment for the Community Energy Redevelopment Plan.

BENEFITS

- Consistency in applying minimum energy efficienc requirements to all structures.
- Reduction in energy use by 20-30 percent per building

MANAGEMENT

- City Energy Office develops conservation standards.
- Seattle City Light develops apartment operations manual.
- Mesh program operation with single family Comprehensive Residential Weatherization Program.

SCHEDULE

- 1981 Develop weatherization standards.
- 1981 Develop apartment operations manual.
- 1982 Develop information fact sheets. Update these periodically.
- 1984 Begin mandatory inspections.

APARTMENT WEATHERIZATION REQUIREMENT

RECOMMENDATIONS

ENERGY, Ltd. proposes an apartment weatherization plan to be included within the currently proposed Comprehensive Residential Weatherization Program (CRWP). This strategy was developed in response to a need to address the weatherization of structures containing five or more units. As the CRWP is presently proposed, only structures of four or fewer units will be required, at time of sale, to comply with minimum weatherization standards outlined in the program.

Given the Mayor's support for the Comprehensive Residential Weatherization Program and the objectives of the ENERGY, Ltd. Citizen Committee to attain energy efficiency among **all** residential structures, regardless of building size, complexity or ownership, and to treat all residential energy consumers equitably in the development and implementation of a residential energy program, a plan focusing on the weatherization of apartment buildings was developed. In this plan an "apartment building" is defined as any structure containing five or more units. The following specific recommendations are made:

1. Confirm Comprehensive Residential Weatherization Program (CRWP) policies and administrative strategy.

2. Develop an apartment component to the proposed CRWP: Effective January 1, 1984, all apartment buildings must be weatherized at time of sale or by January 1994, whichever date comes first.

3. Develop an audit program and an operational manual for apartment buildings by December 31, 1981.

4. Develop weatherization standards for apartment buildings by December 31, 1982.

5. Develop an "Apartment Building Energy Savings Fact Sheet" to be mailed in regular billings. Information will include case studies on savings realized from weatherization, information on available tax credits, financing, incentive programs and other similar items.

6. The City should explore and pursue options for financing of weatherization for all energy users and should coordinate financing arrangements with the Community Energy Redevelopment Plan.

7. Require changeover of existing electric master-metered units (with separate heating units) to individual meters, wherever feasible. Seattle City Light ratepayers to bear the cost of conversions.

ANTICIPATED RESULTS

Ninety percent of the apartment building stock would be weatherized by January 1994.

Energy use would be reduced by 20-30 percent per building through energy-efficient management of the building and its systems.

BACKGROUND

RELATED PROGRAMS

In July 1980, Mayor Royer proposed to the City Council a Comprehensive Residential Weatherization Program (CRWP). As proposed, the program would require all residences of four or fewer units to comply with minimum weatherization standards, at time of sale. These standards, which Seattle City Light has determined to be cost effective in no more than seven years, are:

Nothing modernizes a home so completely as an ad offering it for sale.

Laurence J. Peter

- R-19 attic insulation (with exemptions for structural barriers)
- Attic ventilation in accordance with the Seattle Building Code
- R-11 floor insulation over crawl spaces
- Vapor barrier on the ground in crawl spaces
- Insulation of accessible heating ducts in unheated spaces
- R-5 water jackets
- Water heater temperature setback to no higher than 130°F
- Caulking and weatherstripping in accordance with American Society of Heating, Refrigeration and Air Conditioning Engineers standards.

Major elements within the program are:

- A comprehensive residential weatherization policy which would allow the City to extend its weatherization assistance programs to:
  - All low-income households
  - All electrically heated households

- All other households as federal, regional and private funds become available

- A goal of weatherization of 4,400 residences for 1981 and future target goals as the availability of resources allow

- Identification of roles of participating departments involved in weatherization services and establishment of an administrative structure

- Uniform record keeping by Seattle City Light on residential weatherization

- Amendment of the Seattle Energy Code to incorporate weatherization standards and enforcement authority by Department of Construction and Land Use

- Authorization of acceptance of an Urban Development Action Grant (UDAG) to provide financial assistance for the program and its recipients.

The CRWP concept evolved during the Mayor's Reorganization Project--Phase II. During the course of the study, it was recognized that numerous residential energy programs are being implemented or proposed in various city departments without a common goal and objective. Specifically, over five existing and ten proposed residential energy programs are being administered by five departments. Sensing the potential for increased confusion and overlap in weatherization services, the reorganization staff recommended, in its final report, a consolidation of existing and proposed programs. The CRWP is the result of that recommendation.

THE PROBLEM

Prior to the consolidation of all residential energy programs under the CRWP, none dealt with apartment buildings. Under the CRWP strategy, these buildings continue to be excluded. Yet they comprise over 33 percent of the housing units and house 23 percent of the city's residents.

The reason cited in the CRWP for the exclusion of apartment buildings was the structural complexity of these buildings which would have necessitated different standards from those advocated for one- to four-unit structures. Also, because of lending of credit restrictions which prevent the City from providing financial assistance which might benefit landlords, no adequate financial strategy could be developed which would get around the restrictions. Rather than slow down the development of the CRWP while researching ways to broaden its focus, apartment buildings were left out of the proposal. This exclusion, however, was made with the intention that the Energy Code followup work would affect retrofits of existing buildings--including apartment buildings--and that standards would be developed in the near future.

Whether future energy programs will include apartment buildings is yet to be determined. It is likely that both Energy Code work and the expansion of Seattle City Light's Audit Program will concentrate on commercial buildings where potentially greater energy savings can be realized. If this is the case, the exclusion of apartments from weatherization efforts will leave some 112,500 apartment dwellers vulnerable to high energy costs with no foreseeable remedy.

The importance of decreasing energy costs through weatherization of apartment buildings becomes apparent when considering the city's present tight housing market, a vacancy rate which has been persistently low since 1977, the preponderance of unweatherized multifamily structures in comparison to single family structures and the average lower incomes ($5,000-$6,000 less) of multifamily households compared to those of single family households. However, there are still other problems which act against the weatherization of these buildings. They are:

- **Metering Systems**--The apartment building stock consists of master-metered buildings (23 percent) and individually metered buildings (61 percent). It is the metering system which measures the building's or unit's fuel consumption.

  - *Master-Metered Buildings:* The landlord pays the fuel bill under this system. This leaves the tenant with little incentive to conserve energy. Characteristically, when tenants do not receive the bimonthly feedback and economic incentive to conserve that a bill provides, their consumption of energy rises. This is demonstrated by the fact that master-metered buildings consume 33 percent more fuel than individually metered units consume.

    According to the *Energy Data Base* prepared by ENERGY, Ltd., master-metered apartment units account for approximately 17,000 units. Although Seattle City Light has banned the installation of and conversion to master metering for electrical service (Ordinance 108500), the existing number of units with this type of metering system remains large.

  - *Individually Metered Units:* Under this metering system the tenants pay the fuel bill. However, although the tenants have the incentive to conserve energy, they are reluctant to pay for the weatherization of units that they do not own. Thus federal tax credits which are available to "principal residents" are virtually wasted on residents who have no incentive to improve another individual's property. Another reason for tenants' reluctance to make weatherization improvements is that tenancy in one place of residence is often short. According to Seattle City Light's Customer Characteristics Survey, 30 percent of Seattle City Light's multifamily customers stay in their units less than one year. Any investment that tenants might make in

their units might not be recoverable if they later decided to move.

By and large, apartment owners of individually metered buildings do not have an incentive to weatherize their buildings because the benefits of a weatherized building will not accrue to them in the form of reduced energy bills.

- **Information Requirements**—Conflicting, inadequate or unavailable information on cost-effective conservation measures discourages decisions by apartment owners to optimize the energy efficiency of their buildings and building systems and to purchase efficient appliances. This problem is reinforced by the following circumstances:
  - Seattle City Light's energy checkers are not currently trained to audit larger residential buildings and assess system efficiencies adequately.
  - Current Seattle City Light audit results for apartment buildings come in the form of "tips" rather than in an investment analysis format, which would provide a greater stimulus to weatherization investments by owners.
  - No central source of information exists to tell apartment owners about applicable tax credits, available incentive programs or case studies on realized cost savings resulting from weatherization improvements. In addition no reliable information is available on safe, cost-effective weatherization measures.
  - Current City energy programs exclude apartment buildings; this contributes to the lack of data and of encouragement for energy conservation.
- **Rent/Cost Increases**—The reality that any improvements made to rental units may result in increased costs to owners and rent increases to tenants must be acknowledged. Related issues which may stymie apartment weatherization are:
  - The amount of increase in rents to be anticipated and the effect rent increases may have on low-income households
  - The effect increased costs to owners may have on the availability of low-income units
  - The effect increased costs may have on small apartment owners with limited capital and/or borrowing capacity.

It is expected that using a time-of-sale method for requiring weatherization would lessen the amount of rent increase each tenant may have to bear, compared to other methods which have been studied. This is because improvement costs would be spread out over the life of a long-term mortgage loan, thereby minimizing the impact of the expected rent increase. Also, rent increases would be somewhat offset by the reduced fuel bills that a majority of the apartment households would experience as a result of weatherization.

No assessment has been made as to the effect a weatherization requirement would have on marginal buildings which are "easier to abandon" than improve. However, it is anticipated that the Department of Community Development (DCD), through its rehabilitation programs, will reach those building owners who own marginal, yet livable, units. An Information and Referral System is already being worked out between offices within DCD to ensure that all requests for repair and rehabilitation will include weatherization.

- **Financing**—Due to the City's lending of credit restrictions, the City cannot financially assist landlords who do not qualify under the classifications of the poor, the infirmed, or electric heat customers. These limitations have imposed obstacles to apartment building weatherization. For example:
  - Because the majority of electrically heated apartment dwellings are individually metered, the incentive to weatherize and thus the need for financial assistance are greatest with the tenant--not with the landlord. Yet, whether it is practical for the City to lend its credit for weatherization to renters has not been established. In addition,federal tax credits are available only to the "principal resident" of a dwelling. Thus, even if owners installed weatherization throughout their buildings, the tax credits would be available only for the owner-occupied units.
  - Approximately 35 percent of the apartment units are fueled by oil or natural gas. Because SJR-120 is currently interpreted to include financial assistance only to electrically heated dwellings, no financing is available to owners of buildings fueled by natural gas or oil.
  - Some landlords may be interested in taking advantage of financing programs based on the low-income status of their tenants. However, complicated contractual arrangements required to ensure that only eligible tenants benefit from the improvements may put off many landlords from entering into any agreement. These agreements usually bind the owner from raising rents for a period of time.
  - Most apartment owners require short payback periods (usually two-three years) on investments, due to limited capital and/or average short ownership of the building (average is three-five years).

NEED

The City's resolution to promote the wise and efficient use of all forms of energy to meet present and future demand is well documented in a number of resolutions and ordinances passed by the City Council. In particular the City's desire to reduce electrical demand can be demonstrated by Seattle City Light's prohibition of master metering, new load policies and other conservation programs that are underway.

However, a quantitative assessment of the number of apartment buildings needing weatherization or the percentage of unweatherized apartments housing low-income families is not available. As explained earlier, this is due to the lack of program or data emphasis on these structures. Apartment buildings either have been left out of programming efforts altogether or have been lumped with other building categories such as multifamily or commercial buildings.

Because local data are not available to estimate the need for weatherization of these structures, national and regional data were relied upon for information. Several studies conducted in the Pacific Northwest indicate that multifamily structures, including apartments, are characteristically less well weatherized than are single family dwellings. Based on a Portland, Oregon study, *Residential Conservation Choices*, the following estimates provide a glimpse of the large number of existing apartments in need of weatherization:

MEASURE	PERCENT OF UNITS NEEDING MEASURE
Weatherstripping and caulking	90%
Ceiling insulation from R-6 to R-38	50%
Floor insulation from R-3 to R-19	50%
Wall insulation to R-19	44%
Glass or plastic storm windows	98%
Duct insulation	20%
Automatic thermostat setback	95-100%
Hot water heater jacket	98%
Shower head flow restrictor	95-100%
Lowered water temperature	80%
Efficient lighting	100%
Annual furnace servicing	65%

There are several important reasons why the City must pursue a program directed at requiring weatherization of these structures:

- The majority of apartment units (65 percent) are electrically heated, and the City has a vested interest in saving electricity.
- Tenants are, in effect, a "captive audience" who must await the weatherization of their dwellings by building owners and managers.
- The issue of equity is at play when one segment of the residential population is treated inconsistently with another segment of that same class.
- The incremental contribution to energy conservation by **all** energy users is a key step towards achieving the City's energy conservation goals.

ENERGY AND COST ANALYSIS

ENERGY

There are approximately 75,000 apartment units in some 4,000 buildings within the city. The total amount of energy used by each fuel type is:

	NUMBER OF UNITS	ENERGY USED (Million Btu/Unit)
Space Heating		
Electric Baseboard	45,735 (61%)	11
Electric Central	2,999 (4%)	23
Oil Central	7,498 (10%)	52
Gas Central	6,748 (9%)	47
Water Heating		
Electric	60,730 (81%)	15
Gas	8,247 (11%)	24
Other/Unknown	5,998 (8%)	24
Cooking		
Electric	73,476 (98%)	4
Gas	1,499 (2%)	4
Other Electric Uses		
Lighting	74,975 (100%)	5
Miscellaneous	74,975 (100%)	16

Because so little is known regarding the apartment building stock's contribution to energy conservation, four case studies conducted this year by Seattle City Light were relied upon for energy savings estimates. They are:

- Case 1: 16-Unit, Oil-Fired Boiler, 1926
  - Wall Insulation (blown in)
    Estimated cost: $1,200
    Savings: 29% of total yearly fuel bill
  - Double-Insulated Glass Windows
    Estimated cost: $9,400
    Savings: 15% of yearly fuel costs
  - Storm Windows
    Estimated cost: $4,700
    Savings: 15% of total fuel costs
  - Automatic Ignition Device to Replace Pilot Light
    Savings: 12% less fuel used

- Case 2: 24-Unit, 4-Story, Built in 1968
  - Crawl Space Floor Insulation (loosefill)
    Estimated cost: $ 975 (S)[a]
    $2,430 (C)[b]
    Savings: $ 170
  - Storm Windows
    Homemade 8-mil vinyl
    Estimated cost: $725 (S)
    Yearly savings: $165

    Homemade rigid plastic
    Estimated cost: $1,205 (S)
    Yearly savings: $ 165

    Aluminum and glass
    Estimated cost: $6,010 (C)
    Yearly savings: $ 165

    Insulated glass
    Estimated cost: $12,105 (S)
    Yearly savings: $ 165
  - Weatherstripping and Caulking
    Estimated cost: $460 (S)
    Yearly savings: $225

Estimated Heat Loss for Case 2:

Windows	47%	Ceilings	7%
Doors	0%	Floors	13%
Walls	9%	Infiltration	24%

- Case 3: 60-Unit Condominium, Electric Baseboard Heat
  - Thermostat Setback to 55°F, Installation of Automatic Setback
    Estimated cost: $25-$75 (S)
    Yearly savings: up to 5% per degree of setback
  - Double-Glazed Windows
    Estimated cost: $600-$1,500
    Yearly savings: 12-45%
  - Incandescent Lights Replaced with Fluorescent Lights
    Savings: 40% reduction

- Case 4: 6-Unit, Central System, Oil Heat and Hot Water, Built in 1920
  Consumption: 957 gallons/year
  Simulated bill: $ 976

  Simulation:
  - Attic Insulation, R-11
    Estimated savings: 4% (38 gallons)
    Estimated cost: $165-$240 (S)
    $255-$230 (C)
  - Wall Insulation
    Estimated savings: 35% (336 gallons)
    Estimated cost: $1,125-$1,250 (C)
  - Basement Floor Insulation (batts)
    Estimated savings: 4% (34 gallons)
    Estimated cost: $115 (S)
    $210 (C)
  - Storm Windows (all)
    Estimated savings: 25% (228 gallons)
    Estimated cost: $440-$645 (S)
    $4,365-$8,730 (C)
  - Weatherstripping and Caulking
    Estimated savings: 8% (74 gallons)
    Estimated cost: $160-$225 (S)

[a](S) = Cost based on self-installed materials.

[b](C) = Cost based on contractor installation.

According to a computer simulation conducted on a prototype three-story, 18-unit apartment building with an electric forced air heating system, the following savings are anticipated on selected weatherization measures:

Base Case (annual heating requirement prior to weatherization measures):
646.9 MM Btu/year
(35.9 per unit)

Simulated Weatherization Measures:

- Infiltration Measures (limited envelope leaks, .6 AC/hour)
  Estimated savings: 135 MM Btu/year
  20.9% savings over base case

- Attic Insulation, R-38
  Estimated savings: 48.4 MM Btu/year
  7.5% savings over base case

- Floor Insulation (fiberglass batt), R-19
  Estimated savings: 86.1 MM Btu/year
  13.3% savings over base case

- Hot Water Measures (temperature set back 20°F and tank insulation, R-5)
  Estimated savings: 64.8 MM BTu/year
  12.4% savings over base case

Using the estimates resulting from the computer simulation on the prototye 18-unit apartment building, a 30 percent savings for space heating and a 24 percent savings for hot water heating are anticipated. This would amount to an energy savings of approximately 648,000 million Btu per year. The breakdown of energy savings by fuel type is:

	NUMBER OF UNITS	SAVINGS/UNIT (Million Btu)	TOTAL SAVINGS (Billion Btu)
Space Heating			
Electric Baseboard	45,735	3.3	150.0
Electric Central	2,999	6.9	20.6
Gas Central	6,748	14.1	95.0
Oil Central	7,498	15.6	116.9
Water Heating			
Electric	60,730	3.6	218.6
Gas	8,247	5.7	47.5

For a more comprehensive analysis of all the possible measures which could be applied to a building of this size and these characteristics in order to gain maximum energy and cost savings, see Appendix A.

COSTS

The estimated capital and installation costs for selected measures applied to the prototype 18-unit apartment building are as follows:

	CAPITAL COST (MATERIALS)	CAPITAL COST (INSTALLATION)	CAPITAL COST (TOTAL)
Infiltration Measures	$ 300	$4,550	$4,850
Attic Insulation, R-19	1,344	540	1,884
Floor Insulation, R-11	1,261	961	2,222
Hot Water Measures	162	630	792
TOTAL			$9,748

Given that weatherization standards have not been developed for apartment buildings, it is difficult to assess, with any precision, the total energy savings possible and to estimate costs for weatherization measures. Within the Community Energy Redevelopment Plan (described in Chapter I) a range of energy conservation measures have been applied to a prototype 18-unit apartment building. Reference should be made to this section for a comprehensive analysis of potential energy savings as well as an analysis of the net present value (NPV) and the levelized cost of energy saved.

IMPLEMENTATION

MANAGEMENT

The apartment weatherization plan is expected to be administered by a multidepartmental delivery system, as proposed in the CRWP. The difference between the two programs will be in the timing by which apartment buildings which be required to comply with their specific weatherization requirement. In the CRWP strategy, key administering departments will be: Seattle City Light (SCL), the City Energy Office (CEO), the Department of Human Resources (DHR), the Department of Community Development (DCD) and the Department of Construction and Land Use (DCLU). The management strategy uses existing administration to support existing departmental roles, missions and weatherization service delivery experience. A more detailed description of the rationale for this management strategy, as well as a complete delineation of other responsibilities assigned to each of the departments, is contained within the CRWP. Key departments and their primary functions as they relate to apartment weatherization are described below:

- **City Energy Office (CEO)**

  A key task of the Energy Office proposed under the CRWP is to lobby the state legislature regarding time-of-sale **enforcement** of the home weatherization standards for one- to four-unit structures (and

eventually, for apartment buildings). A preliminary analysis conducted by staff counsel for the state senate's Energy and Utilities Committee indicates that legislation requiring sellers to submit an affidavit or certification of compliance with weatherization standards, in addition to their real estate excise tax affidavit, is a feasible enforcement mechanism. In addition, nonrecordation of the deed could be used as the sanction for failure to comply with the standards. This method would be an effective means of enforcement since banks require that deeds be recorded. Property sold by real estate contracts (which includes 50 percent of all apartment transactions) would also be subject to the enforcement mechanism because such contracts are subject to the real estate excise tax (RCW 82.45.010) and may also be recorded (RCW 65.08.060).

Other related tasks include:

- Develop standards for apartment buildings.
- Coordinate key administering departments (SCL, DHR, DCD, DCLU) to ensure timely and proper implementation of the apartment weatherization program.
- Develop apartment weatherization financing program in concert with SCL Apartment Pilot Study findings and DCD efforts.
- Develop an amendment to the Energy Code specifying apartment building standards.

- **Seattle City Light (SCL)**

City Light will have lead responsibility for marketing of the program, intake and referral of callers to the appropriate department for weatherization services, information dissemination and weatherization services to electrically heated households with income above 90 percent of the state median income. Other related tasks include:

- Develop apartment building audit program. Program will include promotion campaign to encourage audit requests.

  Note: Under the Energy Security Act (PL 96-294), all utilities will be required by January 1, 1982 to provide audits to all residential buildings greater than four units which do **not** have central heating and cooling systems. Rather than exclude centrally heated buildings from the audit program, greater emphasis should be given to assessing the practicality of converting these master-metered systems to systems with individual metering.

- Develop and distribute an operations manual for apartment buildings. Manual will be designed for easy use and will be provided at conclusion of audit. Staff assistance will be made available to apartment owners or managers who require assistance in using the manual.

- Develop "Apartment Building Energy Savings Fact Sheet" to be mailed in regular billings of apartment customers. Case studies will be used as examples of realized cost and energy savings. Whenever practical, investment analyses which use applicable tax credits, deductions, etc. and available financing should be presented as an example of the maximum dollar savings possible.

- Develop and implement program to convert existing electrically heated master-metered buildings with separate heating units to individual meters.

- Make program evaluation of apartment weatherization action.

- Design record system which monitors apartment weatherization, energy consumption and other pertinent information. Information will be a part of the overall Customer Information System of SCL.

- Develop financing program to serve apartment customers. Coordinate program with CEO financing program.

- **Department of Community Development (DCD)**

Under the CRWP, this department is given lead responsibility to develop a business and employment system. Tasks will include:

- Inventory existing energy and insulation firms to identify supply gaps and evaluate expansion opportunities.

- Provide Economic Development Administration, Small Business Administration, and Housing and Urban Development loan packaging assistance to eligible energy and insulation firms, with emphasis given to businesses owned by women and minorities.

- Evaluate opportunities for Consumer Co-op Bank assistance to insulation co-ops and especially encourage heating oil companies to diversify to include insulation work.

- Design a system to refer unemployed individuals to weatherization-related jobs and training programs.

Other related tasks include:

- Provide public relations/information assistance to real estate brokers and lenders to help them demonstrate energy and conservation options to prospective and current homeowners.

- -- Promote and provide information workshops to neighborhood-based groups on the benefits of weatherization.

- -- Develop and seek new private market funding sources for weatherization of gas- and oil-heated dwellings.

- -- Develop program to encourage private sector weatherization services for apartment buildings and condominium households whose incomes are above 90 percent of the state median income.

- -- Coordinate rehabilitation projects with apartment weatherization improvements wherever possible.

- **Department of Human Resources (DHR)**

  - -- Identify and solicit weatherization of apartment buildings that house low-income families.

  - -- Work with DCD to promote joint rehabilitation-weatherization improvement projects.

- **Department of Construction and Land Use (DCLU)**

  - -- Enforce apartment weatherization standards.

  - -- Provide inspections of weatherization improvements to ensure proper installation, quality and workmanship. Report to SCL any improper or shoddy workmanship.

  - -- Relay information to SCL on apartment improvement permit applications for possible arrangement of weatherization along with the intended improvements.

- **Office of Policy and Evaluation (OPE)**

  - -- Evaluate apartment weatherization program. Use SCL Customer Information System.

  - -- Provide quarterly reports to CEO describing CRWP progress.

FINANCING

If you would know the value of money, go and try to borrow some.

Benjamin Franklin

Because none of the financing options presented in the CRWP provide for apartment households, either an expansion of existing and proposed financing programs will be necessary or a separate program will be needed. Given that the majority of an apartment buildings are electrically heated, expansion of the Home Energy Loan Program (HELP) appears the most logical program to be expanded. Currently, SCL is conducting an Apartment Pilot Study to identify financial incentives for owners of apartments housing low-income residents. The study is designed to test the feasibility of providing weatherization services--based on the energy saved and the actual cost effectiveness of the weatherization measures installed. It may be necessary for SCL to go a step further to study the feasibility of providing financing to the 49,000 electrically heated apartment households, many of which are not low-income households. However, given the City's various limitations on lending of credit, the homeownership requirement may preclude financial assistance to renters of these dwellings.

Another option, of course, is to allow the apartment owner to seek financing through traditional channels in the private sector. Informational assistance could be provided to apartment owners about which banks are offering the lowest interest rates and best financial packages. (See preceding DCD tasks.)

Since weatherization will not be required until time of sale, it could be paid for through the proceeds from the sale, if the seller opts to pay for the work. If the buyer makes the improvements, weatherization costs could be attached to the mortgage loan. Given that apartment buildings are an investment property, the option of allowing apartment buyers, sellers or owners to seek their own financing may be a more prudent alternative.

In Chapter I, a financing strategy has been presented for the Community Energy Redevelopment Plan (CERP). If this strategy proves acceptable to the City Council, it could serve as a resource to finance apartment weatherization, without exceptions based on income level or the fuel type used.

SCHEDULE

The following schedule is provided as a guide to the essential tasks required of key administering departments and to their sequence of implementation.

TASK	LEAD RESPONSIBILITY	START
Gain City Council/Mayoral approval of Action Plan.	SCL	1981
Develop administrative rules and regulations for implementation of weatherization and audit programs.	CEO/SCL/DCLU	1981
Develop apartment data-processing program.	SCL	1981
Interview and hire auditors.	SCL/DHR	1981
Determine evaluation criteria and methodology.	CEO/SCL/DRH/DCD	1981

Develop apartment standards.	CEO	1981
Develop amendment to Energy Code.	CEO	1982
Train apartment auditors.	SCL	1981
Mail information on audit and weatherization programs to apartment owners, managers, and apartment management firms.	SCL	1981
Develop apartment operations manual.	SCL	1981
Conduct audits.	SCL/DHR	1982
Develop financing program package.	CEO/SCL	1982
Initiate program evaluation.	CEO/SCL/DHR/DCD	Ongoing
Begin comprehensive program evaluation.	OPE	1982/ongoing
Conduct voluntary inspections.	SCL/DHR/DCLU	1982/ongoing
Mail audit results to apartment owners and apartment management firms.	SCL	Ongoing
Develop Information Fact Sheet.	SCL	1982/ongoing
Make pre-inspection mailing to apartment owners.	SCL/DHR	1983
Implement weatherization requirement enforcement.	DCLU	1984
Conduct mandatory inspections.	DCLU	1984/ongoing

The number of staff needed to carry out the proposed apartment weatherization program would be dependent on the number of apartment buildings sold per year, as well as on the anticipated workload of the proposed and existing staff who will carry out the CRWP for one- to four-unit structures.

Estimates of apartment building turnover vary according to the source of information and method of count. A rule of thumb indicates that apartment buildings sell every three-five years. According to the *Real Estate Monitor-King County Edition,* an average of 73 apartment buildings is sold in Seattle during a month (two percent per month of Seattle's apartment building stock) or 876 buildings per year. According to the *Real Estate Research Report,* the average number of sales in King County is 30.3 per month or 363.6 per year. However, this last estimate excludes a number of transactions of apartment buildings valued at less than $250,000, as well as certain building age groups.

To be consistent with the source used in estimating the turnover of one- to four-unit structures, the estimates from the *Real Estate Monitor* have been used.

At most, from two to three additional auditors would be needed by Seattle City Light and the Department of Human Resources to supplement the workload of existing and proposed audit staff. Also, one additional Administrative Support Assistant and one Data Control Operator would be needed to process audit information. Other staff proposed under the current CRWP appear to be adequate to handle the workload created by the apartment program.

IV. INDUSTRIAL CONSERVATION PROPOSAL

Recommendations
Anticipated Results
Background
Energy and Cost Analysis
Implementation

Beware of little expenses: a small leak will sink a great ship.

Benjamin Franklin

INDUSTRIAL CONSERVATION PROPOSAL

OBJECTIVES

- *Institute an aggressive conservation program for all industries, regardless of size of firm, directed at saving all forms of energy.*

APPROACH

- *Establish educational and informational programs.*
- *Provide incentives to firms to encourage early conservation actions and to help finance the cost of audits and technical assistance.*
- *Require that all firms conduct a "walk-through" audit (1985) and determine engineering and economic feasibility of conservation actions (1989).*
- *Make renewal of a firm's business license contingent upon certification that an audit has been completed.*
- *Provide an appeals procedure for firms that need additional time to comply with program requirements.*

COSTS

- *Estimated cost of audits: $1.4 to $2 million, to be paid by City Light rates.*
- *Estimated cost of technical assistance: $10 to $20 million, to be subsidized by City Light rates on a scale proportionate to the savings in electric energy.*
- *Private firm covers expenses for cost-effective capital investments, under the financial arrangements included in the Community Energy Redevelopment Plan.*

BENEFITS

- *Estimated potential energy savings of 10 to 30 percent per industrial facility.*

MANAGEMENT

- *Seattle City Light sponsors educational/informational programs and provides or pays for audits conducted prior to January 1, 1984.*
- *Seattle City Light establishes qualification standards for audit and technical analysis consultants.*
- *City Council reviews audit program and technical analysis program.*
- *Private firms provide technical analysis under shared cost arrangement with Seattle City Light.*

SCHEDULE

- *1985* — *Require walk-through audits. Make funding available for audits that are completed by January 1, 1984.*
- *1989* — *Require detailed technical analysis. Costs of analyses that are completed prior to January 1, 1988, are shared by City Light and the firm.*
- *1991* — *Require all firms to provide Licensing Department with written verification of progress toward or completion of cost-effective energy conservation measures prior to receiving business license.*

INDUSTRIAL CONSERVATION PROPOSAL

RECOMMENDATIONS

ENERGY, Ltd. recognizes that the industrial sector, composed of 1,400 manufacturing firms, is profit motivated. Presumably, if these firms are aware of cost-effective conservation opportunities they will act to save energy. However, we believe there is a dichotomy between a few large energy consumers, who have their own internal energy managers, and the vast majority of small and medium-sized firms that may not be aware of their own conservation potential. The ENERGY, Ltd. recommendations would require firms to examine the possibilities for conservation and identify cost-effective investments. This requirement is combined with incentives to encourage early action.

The ENERGY, Ltd. Citizen Committee recommends the following program:

1. The City should institute a mandatory conservation program for all industrial firms, regardless of size, to achieve the most efficient use of energy.

2. The City should establish an information and education program to make industry more aware of conservation opportunities.

3. The conservation program shall require a "walk-through" audit to identify:

   - Energy consumption
   - Potential measures to reduce consumption
   - Ways of using wasted energy
   - Potential for producing energy on-site using renewable resources.

   The results of the audit shall be filed with the City prior to January 1, 1985, and shall constitute the firm's certification that the audit has been completed. After January 1, 1985, a firm must have certified that the audit has been performed, prior to renewal of its business license.

4. At the time of business license renewal or at subsequent points in the process, any industrial firm may appeal to the Seattle City Council (Energy Committee) for additional time, due to extenuating circumstances such as new or relocated operation, to comply with the requirement.

5. The walk-through audit shall be performed by City Light auditors, by qualified private consultants, or by the firm's own energy managers, at the option of the industrial firm. The City shall establish minimum qualifications for such auditors and maintain a listing of consultants who meet these minimum standards.

6. The City shall pay the cost of the walk-through audit for those audits taking place or requested before January 1, 1984. Beginning January 1, 1984, the firm shall pay the cost of the audit.

7. The City Council should conduct a general performance review of the audit phase of the industrial conservation program by December 31, 1984.

8. The industrial conservation program shall require all industrial firms to complete a detailed engineering feasibility and economic analysis of all potentially cost-effective energy conservation measures identified in the walk-through audit. This detailed technical analysis shall be performed by a qualified engineer selected by the firm.

9. The detailed technical analysis shall be completed prior to January 1, 1989, and after that date each industrial firm shall certify that a detailed technical analysis has been completed prior to renewal of any business license.

10. A firm shall be exempt from this and subsequent requirements provided that:

    (1) The walk-through audit does **not** identify any reasonable potential for cost-effective energy conservation measures, or

    (2) The firm can satisfactorily demonstrate that the potential energy conservation measures identified in the audit would significantly jeopardize the product quality of the firm.

    The definitions of "reasonable potential" and "significantly jeopardize" shall be determined by the auditor and the firm.

11. An industrial firm may appeal to the City Council (Energy Committee) any requirement for detailed analysis or subsequent implementation on the basis of cost effectiveness, impact on product quality, or insufficient capital resources.

12. The City shall share the cost of the detailed technical analysis for analyses completed before January 1, 1988, provided that the firm's executive officer or designated representative agrees, in writing, to:

    -- Hold a pre- and postanalysis conference with the analysis team.

    -- Designate a qualified representative of the firm to assist the analysis team.

    -- Commit to implementation of cost-effective conservation opportunities.

    -- Make a followup review within one year after the scheduled date for implementation of conservation measures.

    The cost shall be shared on the basis of electric system benefit. After January 1, 1988, the firm shall pay the total cost of the analysis. In the event that the engineering and economic analysis finds that the conservation measure for that firm is not cost effective, the firm will be allowed to credit the cost of the study against its Business and Occupation Tax for that year and subsequent years until the cost has been amortized.

13. The City Council should conduct a general performance review of the detailed analysis phase of the program by December 31, 1988.

14. Effective January 1, 1991, all industrial firms shall provide written verification that all cost-effective energy conservation measures have been completed or that substantial progress has been made toward completion prior to renewal of any business license. A firm shall be exempt from this implementation requirement provided that the owner can satisfactorily demonstrate that:

    (1) There are insufficient resources available to the firm for the capital costs of the energy conservation measures, or

    (2) The energy conservation measures analyzed would significantly jeopardize the firm's product quality.

15. It is the intent that all phases of the industrial conservation program may proceed faster than the schedule outlined here and may proceed simultaneously.

ANTICIPATED RESULTS

A number of studies, both regional and national, estimate a potential 10-30 percent energy savings.

Two case studies done for ENERGY, Ltd. show a possible 15 percent and 37 percent savings, based on average price, cost-effective criteria.

BACKGROUND

ENERGY DEMAND

Although Seattle's industry is not highly energy intensive, its total demand for energy is a significant part of the city's total energy needs. Seattle's manufacturing industry consumed about 16 trillion Btu of energy in 1978, or 15 percent of total demand (22 percent, excluding transportation). Natural gas supplied the greatest share of this energy, followed by electricity and coal. Oil and other fuels contributed relatively small amounts.

Three industrial groups--stone-clay-glass, primary metals, and transportation equipment--dominate the total energy demand. Together they consume approximately two-thirds of the total.

On an individual firm basis, total energy demand can be largely attributed to a small number of medium- to large-sized firms. In King County, 29 out of more than 2,000 firms account for almost 80 percent of the total energy demand. The same ratios are expected to be true for Seattle.

No substantial change in the city's total industrial energy demand is likely for the next 20 years. Industrial production will probably intensify on the limited industrial land available, but resulting increases in energy consumption will probably be offset by conservation. However, a trend is apparent which indicates that electrical energy, which is in short supply, will supply a larger proportion of the city's industrial energy needs. Whether this trend is the result of more intensive use or of the substitution of other fuels is not clear.

SURVEYS OF FIRMS

Recent consumer surveys indicate that an energy assessment program would particularly benefit the conservation efforts of small and medium-sized firms, and some of the largest firms that have not developed their own energy management programs.

A recent survey of the 10 largest firms in King County[1] indicated that some large firms, recognizing the rising cost of energy, will accept longer payback times for energy-conserving projects than for other plant modifications. Most maintain technical staff capable of analyzing energy-conserving concepts, or use the services of consulting engineering firms. As a result, most had made recent energy-conserving changes to their

[1] Rocket Research Company, *Industrial Electrical Cogeneration Potential in the Bonneville Power Administration Service Area.* Prepared for Bonneville Power Administration, January 1979.

process equipment, were actively investigating concepts for energy conservation, and were tracking energy consumption on a per unit of output basis. (Data from this survey were incorporated in the ENERGY, Ltd. Data Base.)

In contrast, a similar survey of 18 medium-sized firms conducted for ENERGY, Ltd. indicated that the degree to which the companies were addressing conservation opportunities varied dramatically.[1] Some firms had no projects planned or identified, while others were in the process of making major changes in operation in order to reduce energy use.

The love of economy is the root of all virtue.

George Bernard Shaw

The survey for ENERGY, Ltd. indicated a significant potential for conservation, especially through energy recovery from waste gas and liquid streams. However, firms interviewed tended to look for payback periods under two years. Several expressed an interest in investigating conservation options, but either did not have the necessary time or technical staff or did not know whom to ask for assistance.

A separate study commissioned by Seattle City Light and the U.S. Department of Energy[2] asked 19 medium-sized manufacturing firms in the City Light service area about the likelihood that they would participate in various utility-sponsored programs. Sixteen indicated that it was likely or very likely that they would participate in a program of energy use assessment resulting in recommendations for cost-effective conservation. Energy management seminars also appeared to be a potentially popular program. The firms' responses to questions on conservation programs are summarized in Table IV-1.

Although most of the firms rated their energy use as somewhat efficient or very efficient, and had taken steps to reduce energy consumption, none had conducted a study of their energy use and only three said they were monitoring energy use. The study concluded that few firms in the surveyed group had gone beyond the most obvious behavioral measures for conserving.

In January and February 1980, the ENERGY, Ltd. Citizen Committee conducted a survey of community opinion and found that 77 percent of the survey participants supported the idea of providing energy audits to industry to help identify conservation opportunities. Only four percent opposed this action. In addition, the Municipal League recommended to the City that greater emphasis be placed on energy conservation in the industrial sector, including "a strong program" of industrial audits and technical assistance.

PROGRAM CHARACTERISTICS

[1] ENERGY, Ltd., *Energy Data Base,* January 1980.

[2] Hall and Associates, *Energy Conservation Status and Needs: Medium-Sized Commercial/Industrial Firms.* Prepared for Seattle City Light and U.S. Department of Energy, October 1979.

In discussing energy conservation programs with its Industrial Subcommittee, the ENERGY, Ltd. Citizen Committee became aware of several points:

- There is little understanding of how industry as a group uses energy. Seattle City Light has to prepare demand forecasts and new load policies, yet not even the industries themselves have a thorough knowledge of industrial energy use overall.
- Industry has a need for more and better information about company-specific conservation potential.
- The diversity and complexity of industrial processes, where most industrial energy is used, make formulation of prescriptive conservation standards nearly impossible. Any program must take into account this variety.
- It is the belief of the subcommittee that because industrial firms are profit motivated, each firm will act in its own self-interest to use energy more efficiently.

The Citizen Committee believes that whether or not industrial firms are **required** to identify and assess cost-effective conservation opportunities is a question of equity. If residences are required to become more energy efficient, then all sectors should be required to contribute to an energy-efficient community. However, we recognize that the approach to minimum requirements must reflect the diversity of industry. Therefore, while residences may have to meet certain prescriptive standards, industry may have to identify and act on whatever conservation measures prove to be cost effective.

TABLE IV-1

LIKELIHOOD OF PARTICIPATION IN UTILITY-SPONSORED CONSERVATION PROGRAMS (Survey of 19 Medium-Sized Manufacturing Firms)

PROGRAM	PERCENT LIKELY	PERCENT UNLIKELY
Energy Management Seminar	72	28
Workshops on Systems	39	61
Energy Use Analysis	84	16
Consultant List	42	58
Energy Newsletter	58	42
Low-Interest Loans	53	47

Source: *Energy Conservation Status and Needs: Medium-Sized Commercial/Industrial Firms,* prepared for Seattle City Light and U.S. Department of Energy by Hall and Associates, Seattle, October 1979.

In the recommended program, there are three basic steps:

- The energy audit raises the firm's awareness of its conservation potential, and provides information on the industrial sector as a whole by which to evaluate the program's effectiveness.
- The detailed technical analysis identifies the cost effectiveness of specific actions for specific firms, thus showing the firm where investments would result in increased profits. This step also accommodates the diversity of industry.
- The implementation of cost-effective measures results in achieving the goal of energy efficiency.

Incentives are provided to achieve early, as opposed to tardy, actions. For the first several years of the audit phase, the audits would be provided at no direct cost to the firm. In the last year the firm would pay the cost. Similarly, the technical analysis would have an early stage of shared cost, followed by no shared cost. Costs would be shared on the basis of potential electricity savings.

A final aspect of the program is the City Council review of each phase before the next phase is implemented. This would enable the Council to evaluate the overall program effectiveness according to the following criteria:

- Continued appropriateness of schedule
- Participation by all firms
- Unexpected impacts of program
- Undue burdens of program on small firms
- Costs of program
- Readiness for next phase.

ENERGY AND COST ANALYSIS

ENERGY

The actual energy savings that can be expected to result from implementation of the recommended strategy depends on a number of factors: the unrealized conservation potential, the relative costs of energy and available conservation measures, and the availability of investment capital and economic incentives.

These factors assume that conservation investments, once identified, are simply economic decisions. However, other factors not related to economic considerations will play a strong role in determining whether a firm will participate in the program and undertake conservation measures. These include the perceived unreliability of energy supplies, federal restrictions on fuel use, and the attitude of management toward conservation as a social responsibility.

All of these factors will shape the decisions of individual firms. When combined, these decisions will determine the energy saved by all firms in the city.

Because these factors are numerous and complex, there is no direct way to estimate the energy savings resulting from the recommended strategy. We can, nevertheless, infer from other studies that the **potential** for conservation is large.

A recent study in Portland, Oregon,[1] concluded that 5-12 percent of industrial energy could be saved. The estimates of conservation potential were based on interviews with large manufacturers and a review of the literature on specific industrial processes. The interview approach allowed contact with conservation experts and yielded information on measures specific to Northwest plants. Savings for smaller industries were assumed to be equivalent to or greater than those for the largest.

A study conducted for Washington State University for the Northwest Energy Policy Project[2] estimated that housekeeping measures alone could reduce industrial consumption by 20 percent by the year 2000.

The findings of several national studies also suggest that the potential for conservation is significant. A Federal Energy Administration task force report for Project Independence concluded that improvements in process efficiency and changes in product mix could reduce 1971 projections of total industrial use by 20 percent in 1980 and 30 percent in 1990.[3] The Ford Foundation's energy study[4] sets the potential savings for short-term measures that involve little capital expense at 10-15 percent of the 1974 level of use. And the Electric Power Research Institute projected a 15-30 percent potential savings in the industrial use of electric energy between 1975 and 2000.[5]

An estimate of potential conservation may also be obtained by comparing

[1] Bureau of Planning, City of Portland, *Energy Conservation Choices for the City of Portland, Oregon,* September 1977.

[2] Northwest Energy Policy Project, *Final Report,* 1977.

[3] Federal Energy Administration, *Energy Conservation in the Manufacturing Center,* Project Independence Task Force Report, 1974.

[4] Energy Policy Project, *A Time to Choose,* Ford Foundation, 1974.

[5] C. B. Smith, *Efficient Electricity Use.* Prepared for Electric Power Research Institute, 1976.

U.S. energy use to that of countries of comparable industrial capacity and standards of living. The Stanford Research Institute made such a comparison between the U.S. and West Germany, countries which have comparable industrial bases and per capita incomes.[1] West Germany's industries, with more modern facilities, use 28 percent less energy than U.S. industries, per dollar value of shipments.

A more direct estimate of conservation potential could be obtained from documented conservation programs undertaken by local industry. However, only one well-documented energy conservation program within local industry has been identified. The largest energy user in King County, the Boeing Company, has cut its energy use by 30 percent since 1972, and has made its energy efficiency program an integral part of overall management.

As part of the ENERGY, Ltd. analysis for the Community Energy Redevelopment Plan, Seattle City Light audited two medium-sized industrial firms. While it is dangerous to generalize from such a small sample, one firm showed a potential savings of 15 percent and the other, 37 percent. These two examples are described in more detail in Chapter I on the Community Energy Redevelopment Plan.

COSTS

The City's costs may be separated into the costs of energy assessment, education and training, monitoring of program effectiveness, efforts to improve implementation incentives, and optional work such as analysis of data produced by the energy assessments. The costs to industry are those of assisting the assessment team, making detailed technical and economic analyses of conservation opportunities, and implementing selected opportunities.

Until the program is defined in more detail, the only costs which can be estimated with any certainty are those associated with the assessment. For the City, this will be the largest program cost.

On the basis of Seattle City Light experience (albeit limited) with industrial assessments, a reasonable amount of staff time to complete the walk-through audit and make a preliminary analysis of opportunities for the average-sized firm is one person-week.[2] Assuming an hourly rate of $25, this means that the average audit would cost about $1,000 in current dollars.

If all manufacturing firms took advantage of the program, the total cost to the City would be $1.4 to $2 million, depending on the number of firms served. This estimate is based on the number of Seattle manufacturing firms in SIC Groups 20-39 which were reporting to the Washington State Department of Employment Security in 1977. The total number of firms reporting was 1,975. Other estimates indicate that there are actually fewer firms in the city, perhaps as few as 1,400.[1] The Employment Security reports do include some firms that are outside the geographical limits of the city. The total cost would be somewhat larger if the program were offered to firms within the City Light service area, which extends beyond the city's north and south boundaries.

The direct costs to an average firm for the assessment should be minimal. A small amount of staff time would be required to assemble consumption data, to guide the assessment team through the facility, and to participate in the conferences before and after the assessment.

It is helpful to compare the cost of the program to Seattle's industrial energy bill. In 1979, City Light's industrial customers paid $11.6 million for electricity. The total bill for all forms of industrial energy was approximately $50 million.

The technical assistance phase of the program would be considerably more expensive than the audits, costing 5-10 times as much. This would mean that this phase could cost $10 to $20 million. If we assume that the conservation potential is in direct proportion to the use of each energy type, then 25 percent, or $2.5 to $5.0 million, would be the portion of the costs related to achieving savings in electricity.

The capital costs of implementing the cost-effective investments are undetermined at this time.

IMPLEMENTATION

MANAGEMENT

The industrial conservation program has at least two components requiring some organizational decisions:

- Energy audits: Who does them?
- Audit results: Who receives them?

Energy Audits

Seattle City Light has begun a program to conduct industrial energy audits, but it has few staff for this program and they are also responsible for commercial building audits. ENERGY, Ltd. believes that while City

[1] Stanford Research Institute, *Comparison of Energy Consumption between West Germany and the United States*. Prepared for U.S. Federal Energy Administration, 1975.

[2] No data are available on the size distribution of manufacturing firms in the city. However, a Seattle Chamber of Commerce survey indicated that 88 percent of all firms in King County have fewer than 100 employees.

[1] Seattle Chamber of Commerce and Dun & Bradstreet surveys, and Seattle City Light industrial customer sales records.

Light's program should be strengthened, it is neither likely nor desirable that all audits be conducted by city personnel. Industrial firms should be allowed to choose who will do the audit: City Light, a private consultant, or an internal staff person. City Light should develop a list of qualified engineers to conduct energy audits, and provide this list to all industrial firms.

A major disadvantage of this approach is that industries whose primary energy source is natural gas, which supplies 60 percent of Seattle's industrial energy, may not receive the best available technical advice on opportunities for process efficiency improvements. This assistance could be supplied by gas distributors who are familiar with the properties of this fuel and the process equipment in which it is burned.

Approximately 300-400 Seattle industries use gas as their chief energy source. At this time, the sole gas distributor, Washington Natural Gas Company, does not offer an industrial energy assessment to its industrial customers. Therefore, as part of implementing the Community Energy Redevelopment Plan, ENERGY, Ltd. recommends that the City participate in hearings before the Washington Utilities and Transportation Commission, which regulates Washington Natural Gas, to request that industrial energy use assessments be provided.

Audit Results

City Light should probably be the one to receive the audit results, as they have the greatest responsibility within the city for planning to meet new energy demands, and the audit information would be most useful for that purpose. In order to carry out the mandatory provisions, whatever agency receives the information will have to establish a check-off system with the Department of Licenses and Consumer Affairs.

FINANCING

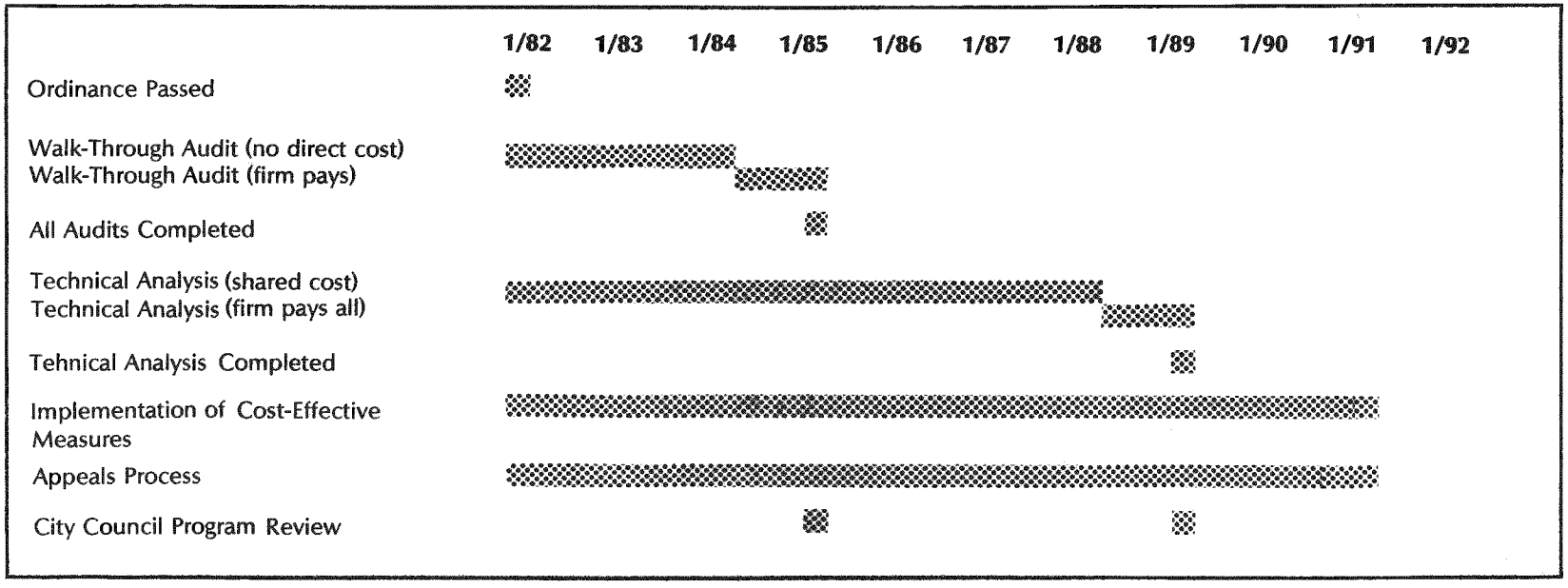
ENERGY, Ltd. recommends that the cost of the audits, $1.4 to $2.0 million, be included in the Seattle City Light rate base. The portion of the technical analysis that results in electricity savings should also be paid by City Light. This amount, estimated at $2.5 to $5.0 million, might be partly rate based and partly paid out of revenue bonds.

SCHEDULE

Figure IV-A shows the recommended schedule for implementation of the industrial conservation program.

FIGURE IV-A

INDUSTRIAL CONSERVATION PROGRAM SCHEDULE



V. ENERGY IMPROVEMENTS IN MUNICIPAL FACILITIES

Recommendations
Anticipated Results
Background
Energy and Cost Analysis
Implementation

Words but direct, example must allure.

Sir William Alexander

ENERGY IMPROVEMENTS IN MUNICIPAL FACILITIES

OBJECTIVES

- Ensure that the City actively undertakes energy-related improvements and energy management activities in its internal facility operations.
- Set example for private sector energy consumers.

APPROACH

- Develop a municipal energy management program through the City Energy Office and an interdepartmental team.
- Conduct, through respective departments, walk-through audits and energy/economic analyses to identify cost-effective energy investments.
- Develop annual and five-year energy investment plans, through an interdepartmental team, for resource allocation requests.
- Set aside General Fund revenues to pay costs. Generate additional General Fund revenues through a two-tenths of one-percent increase in the Business and Occupation Tax for utilities and through the 1981 municipal bond issue.

COSTS

- Approximately $3 million in total investment capital (1980 dollars, based on estimates for Portland retrofit program). This is not quite double the cost of energy used to operate municipal facilities in 1979.

BENEFITS

- A reduction of 35 percent in energy use in municipal facilities is estimated. Assuming that this applies equally across all energy types, the following reductions from 1978 consumption levels would result:
  - Heating Oil 5,131 barrels
  - Natural Gas 674,660 therms
  - Electricity 34,326,110 kWh
  - Steam 2,431,000 lbs.

MANAGEMENT

- City Energy Office along with an interdepartmental team develops investment plans.
- Office of Management and Budget and Office of Policy and Evaluation incorporate the energy investment plans in the Capital Improvement Program planning and budget.

SCHEDULE

- 1982 Complete initial five-year investment plan.
- 1987 Complete the initially planned improvements.

ENERGY IMPROVEMENTS IN MUNICIPAL FACILITIES

RECOMMENDATIONS

The ENERGY, Ltd. Citizen Committee recommends the following actions to ensure that the City of Seattle actively pursues energy management activities through internal facility operations and improvements:

1. Assign development of a municipal energy management program to the City Energy Office. The program, to be developed with an interdepartmental team, should include recommendations on:

   -- Improved systems for reporting municipal energy consumption and energy costs

   -- Energy conservation goals for service operations and municipal facility operations

   -- Accountability for goals attainment.

2. Identify significant, economical energy investments for selected municipal facilities. Develop five-year energy investment plan and annual energy investment packages for resource allocation requests.

3. Set aside general fund revenues annually to meet cost of energy investment package, as long as investments are economically viable.

4. Generate additional revenues for general fund to offset energy investment through a two-tenths of one percent increase in the Business and Occupation Tax for utilities and through the 1981 municipal bond issue.

ANTICIPATED RESULTS

It can be conservatively estimated that at least 35 percent of the energy consumed in municipal facility operations can be saved. Estimates of savings per year, using 1978 as a base year, are:

Heating Oil	5,131	barrels savings
Natural Gas	674,660	therms savings
Electricity	34,326,110	kWh savings

BACKGROUND

In 1973 the City of Seattle adopted the Seattle 2000 goals. Among the goals were explicit statements regarding the efficient use of energy. This direction was the first in a series of policies, adopted between 1978 and the present by the City, promoting energy conservation generally, while focusing on electricity use in residential and commercial buildings.

In 1976, energy conservation policy explicitly focused on managing energy use in buildings. Resolutions 25011 and 25257 established responsibilities for development of an energy code for new buildings. In August 1979, Ordinance 108500 was enacted, establishing the Seattle Energy Code with thermal standards for energy efficiency. Attention has now turned toward establishment of energy-efficient retrofit measures or standards for all existing buildings. The City has also begun examining means for removing barriers to the development of solar energy systems in new and existing buildings.

In spite of the policy direction adopted toward energy efficiency and use of renewable energy resources in buildings, the City has done little to examine its own physical plant. Little is known about the energy-saving potential of more than a few isolated facilities. While the City Energy Office has responsibilities for municipal conservation, assigned under Ordinance 106214 (as amended), it has few resources for carrying out these responsibilities. An inventory of physical improvements needed in municipally owned facilities is currently underway through the newly organized Department of Administrative Services. Unfortunately, the identification of energy-efficient measures will be a low-priority, tangential work item.

Leadership is action, not position.

Donald H. McGannon

If energy-efficient standards are developed and adopted for existing buildings, the City will have difficulty estimating the potential impact on its facilities--and it is the City's responsibility to set an example.

Why has so little tangible attention been paid to energy management in the municipal facilities? The reasons, justifiable or not, are various:

- Designated resources for energy improvements are not available. Capital improvement funds are largely encumbered. Less than five percent of the funds available for capital projects in any given time are discretionary.

- Energy-related improvements are viewed as a subset of maintenance improvements for municipal facilities. In spite of positive policy direction, such improvements are not in the category of basic city services. Resources allocated to identifying specific desirable energy-related improvements (let alone carrying out those improvements) are perceived as being diverted from basic services.

- Energy costs do not comprise a substantial portion of the General Fund budget. The $2.2 million expenditure of energy used in operating municipal facilities in 1979 approached only two percent

of the General Fund budget. For individual departments, the up-front costs of identifying, initiating, and carrying out projects may contribute to the inertia of the situation.

- In many cases, energy improvements require careful identification and economic analysis by knowledgeable staff. The staff resources to conduct the identification and analysis are not available as needed.

- Policy directions are not backed by accountability. There are no tangible "carrot" and no "stick" associated with energy conservation through municipal improvements. Staff and line departments have not viewed energy conservation in facilities operation as a priority.

The reasons for implementing energy-related improvemens are equally substantial:

- Energy costs are skyrocketing and continuing increases are projected. Electric rates for commercial customers, including specific municipal facilities, are scheduled to increase by as much as 50 percent in the next year. Electricity costs for operation of the Municipal Building alone are scheduled to increase from $31,000 to $47,000 in the next year. According to Washington Natural Gas representatives, natural gas prices will increase between 10-15 percent per year. Oil prices are hiked upwards at each meeting of OPEC and another increase is due in November. With relatively fixed revenues, the proportion of the City budget designated for energy costs will increase substantially.

- Clearly, there is policy actively promoting energy conservation. The City is in a position to provide leadership in identifying and implementing energy conservation improvements. Energy saved by municipal government is minor when compared to energy that could be saved in the commercial sector--but the example that can be set is invaluable. Investing in energy conservation can provide an opportunity to lead, not push, the private sector into making comparable investment.

- Expenditures for energy conservation improvements are investments. These investments provide an economically identifiable return. Few categories of expenditure in the annual municipal budget (operating and capital) can claim the classification of investment.

Assuming the reasons for acting on energy conservation improvements in municipal facilities are persuasive, the question becomes: How can the City accomplish these conservation actions?

Increasing energy prices to reflect marginal costs of new supply would highlight the problem and provide more of a stimulus to act--but would not necessarily provide the means for action. In order to stimulate action, ENERGY, Ltd. examined the barriers or impediments to carrying out energy conservation measures and arrived at four basic steps that are necessary to implement energy improvements in municipal facilities:

- Establish clearly defined administrative direction with assigned responsibilities, goals and accountability for planning for and completing energy improvements in municipal facilities.

- Assign resources necessary for identifying and prioritizing energy-related improvements in municipal facilities.

- Incorporate the plans for energy conservation in municipal improvements as a package in the fiscal planning and resource allocation process.

- Generate and appropriate sufficient revenue to carry out a reasonable number of projects annually until the prioritized projects are no longer cost effective.

The specific activities necessary to carry out the steps are described under the Management and Scheduling discussion in this section.

This proposal does not mean to imply that there are no current activities relating to energy efficiency in municipal facilities. Existing and proposed activities are outlined in the *Municipal Energy Management Report,* prepared by the City Energy Office in September 1980. The activities are scattered across various departments and do not present a comprehensive approach. The Department of Administrative Services (DAS) recently hired an Energy Conservation Coordinator, who, along with a "loaned" Air Force officer, will begin identifying efficiency measures for DAS facilities and operations. This will help DAS respond to energy issues in its facilities, but will not help other departments, such as the Seattle Public Library, improve the energy efficiency of their facilities. While recognizing that some departments will take the initiative, we feel that a comprehensive approach is needed.

ENERGY AND COST ANALYSIS

ENERGY

Lacking a detailed analysis of the condition of the existing City physical plant and of the nature of reasonable retrofit measures, it is not possible to estimate savings with any precision. A conservative goal for potential energy savings in municipal facilities should be approximately 25 percent, according to Public Technology, Inc.[1]

It is reasonable to assume that a 35 percent reduction in energy use for municipal facilities can be attained. Applications of combinations of

[1] *Energy Conservation Management Report for State and Local Governments,* 1975.

conservation measures to prototype buildings in computer simulations have produced ranges of savings from 30-60 percent. The prototype buildings analyzed included small office buildings and warehouse buildings, both of which are present in the municipal facility stock. See Appendix A for a description of the prototypes and the conservation analysis.

Setting a conservation goal of a 35 percent reduction in energy use is more meaningful in this proposal than attempting to estimate projected savings. Assuming the conservation goal would apply equally across all energy types, attainment of the energy savings goal would result in the following reductions from 1978 consumption levels:

	1978	Savings
Heating Oil	14,660 barrels	5,131 barrels
Natural Gas	1,927,600 therms	674,660 therms
Electricity	98,074,600 kWh	34,326,110 kWh
Steam	6,947,000 lbs.	2,431,000 lbs.

Examples of the retrofit potential are important. Because specific building samples cannot be outlined, examples must be drawn from prototype buildings.

Prototype: Warehouse

At least four of the facilities managed by the Department of Administrative Services appear to approximate the conditions of the warehouse prototype closely enough for the analysis on the prototype to be applicable. For the prototype, the following measures were defined as optimum with solar potential:

1. Limiting envelope leaks
2. Ceiling insulation (R-19)
3. Wall insulation (R-13)
4. Efficient bulbs
5. Task lighting
6. Ground-source heat pump

The energy savings resulting from these measures are shown in Table V-1.

Prototype: Small Office Building/Mixed Retail Office

More than 70 of the buildings managed by the Department of Administrative Services approximate the conditions of the small office or mixed retail/office building prototype closely enough for the conservation analysis to be applicable. The following are optimal conservation measures for these prototypes with solar potential:

1. Limiting envelope leaks
2. Ceiling insulation (R-30)
3. Wall insulation
4. Exterior storm windows
5. Water tank insulation
6. Hot water temperature setback
7. Efficient bulbs
8. Ground-source heat pump
9. Automatic night setback

The combined estimated energy savings for these optimal measures are noted in Table V-1.

TABLE V-1
ESTIMATED ENERGY SAVINGS
FOR MUNICIPAL FACILITIES
(Percent)

	SMALL OFFICE	MIXED RETAIL OFFICE	WAREHOUSE
Space Heating	85%	85%	89%
Space Cooling	57%	56%	0%
Electrical Uses	50%	31%	32%
Total	62%	50%	82%

Seattle City Light's experience can also serve as an example. In 1975, City Light contracted with KPFF Consulting Engineers for an analysis of energy conservation systems applicable to the City Light Building. The systems were in place in 1977. The total energy reduction achieved by all the techniques used is computed to be 76 percent of energy consumption when compared to energy consumption in the building in 1973. The major modifications include:

1. Conversion of chiller for heat pump operation
2. Installation of heat recovery systems from exhaust systems: toiler exhaust, water-to-water heat exchanger in basement
3. "Economizer Cycle" for automatic ventilation control
4. Water-to-water run-around recovery system for parking garage.

The annual estimated energy savings total 7,909,302 kWh. The total operating costs are roughly $43,700 and the capital cost for the systems was approximately $327,000.

COSTS

The capital and installation costs associated with the optimal conservation measures for the respective prototypes are outlined in Table V-2. For a more detailed cost breakdown, please refer to Appendix A. Investment analysis methods are discussed in Appendix B.

Nor is it less a virtue to take care of property than to acquire it. In the latter, there is chance; the former demands skill.

Ovid

TABLE V-2
TOTAL CAPITAL COSTS FOR CONSERVATION MEASURES PROTOTYPES (1980)

CONSERVATION	WAREHOUSE	SMALL OFFICE	MIXED
Limiting Envelope Leaks	96	562	662
Ceiling Insulation			
R-19	3,337		
R-30		940	1,410
Wall Insulation	2,734	1,000	1,594
Efficient Bulbs	11	41	98
Storm Windows		2,668	3,863
Water Tank Insulation		44	44
Hot Water Temperature Setback		0	0
Ground-Source Heat Pump	11,366	5,615	8,000
Automatic Night Setback	173	260	260
	$17,717	$11,130	15,931

The preceding prototypes provide examples of possible costs associated with retrofit activities in such structures. Without better information on the condition of municipal facilities, a detailed cost analysis with these figures is not productive.

Portland has instituted a retrofit program for its facilities. Using set-aside funds equal to one-half of one percent of the General Fund, Portland has scheduled 40 projects for FY1979-80 at an average cost of $4,500 per project. For 1979-80 approximately two projects are being undertaken per facility at an estimated cost of $9,000 per facility. Should Seattle's projects resemble Portland's experience, approximately $3 million (1980 dollars) would be necessary to carry out energy conservation measures in Seattle's municipal facilities. This is not quite double the cost of the energy to operate all municipal facilities in 1979.

It is anticipated that the City would schedule projects on a prioritized basis over a 10-year period.

IMPLEMENTATION

MANAGEMENT/SCHEDULING

The responsibilities for establishing clear objectives, identifying cos effective measures, designing a practical system of accountability f implementing improvements, and carrying out improvements are share by executive and operating departments alike. Because of th responsibilities for municipal conservation assigned under Ordinanc 106214 (as amended), the City Energy Office is to assume the lead rol for ensuring that energy improvements are adequately addressed.

Approaching this issue with a team of interdepartmental staff who hav responsibilities for facility operation will ensure that problems ar addressed in a practical manner. Also, their plans will be reviewed by th Energy Cabinet–a group composed of the Deputy Mayor and the head of several city departments whose purpose is to develop energy polic that affects numerous departments. Such a review will raise the visibilit of the issues and forge the commitment of affected departments. A pla developed by interdepartmental staff, acted upon by department head and by the Mayor, may suceed where others fail.

A more detailed description of the proposed plan is provided below:

1981 ● Develop an Energy Management Plan for Municipa Facilities.

- 1981 Lead responsibility for the development of the plan is assigned to City Energy Office.
- 1981 Interdepartmental team is formed to assist in the development of the plan, which will include goals reporting systems and an accountability process The plan will be reviewed and acted on by the Energy Cabinet.

1980-82 ● Identify Funds Necessary for Carrying Out Energy Improvements.

- 1980 Individuals with energy interests are nominated for participation on the Citizen Committee advising the City on 1981 bond issues. A general category of projects focusing on energy improvements should be included in the 1981 bond issues.
- 1982 Funds (in an amount equal to an increase of two-tenths of one percent of the Business and Occupation Tax for energy utilities) from the General Fund will be annually set aside in the Cumulative Reserve Fund. Authorization to expend the funds for projects approved in the annual investment package will be legislated as necessary.

  The amount of the annual set aside (not to exceed the amount of projected funds generated by an increase in the utility Business and Occupation Tax) will be determined by the amount of the

annual energy investment package. Legislation for the set aside will be prepared by the City Energy Office, the Office of Management and Budget, and the Law Department as appropriate.

1982 The Business and Occupation Tax for utilities (energy utilities only) will be increased by two-tenths of one percent.

1981-82 ● Identify Significant Energy Improvements for Municipal Facilities.

1981 Interdepartmental team selects the 100 most energy-consuming facilities for walk-through audits in the first year.

1981 City staff from departmental facility operations and trained by City Light conduct walk-through audits. Matching funds are sought.

1981 Results of walk-through audits are reviewed by the interdepartmental team.

1981 A maximum of 25 improvements are identified and ranked for detailed technical assistance in the first round. Operation/maintenance actions will be incorporated into a maintenance plan and schedule for each department.

1982 Prioritized projects are acted on by the Energy Cabinet. Federal funds for technical assistance are obtained.

1982 Technical assistance is enlisted to analyze projects, determine capital cost and estimated energy savings, and complete an investment analysis.

1982 ● Incorporate Improvements into Fiscal Planning/Resource Allocation Process.

1982 Prepare five-year energy investment plan of projects that are ranked according to the investment analysis completed as part of technical assistance. Only economically advantageous projects will be included. This energy investment plan will be the responsiblity of the inter-departmental team with the City Energy Office and Office of Management and Budget in the lead.

1982 The five-year energy investment plan is reviewed and acted on by the Energy Cabinet prior to inclusion in the Capital Improvement Plan.

The plan will be updated annually. New economically viable projects will be added to the last year of the investment plan (or added to the rankings as desirable). An annual energy investment package will be prepared to include projects scheduled for completion in the next fiscal year. The energy investment package, prepared by the interdepartmental team, will be reviewed and acted on by the Energy Cabinet prior to recommending its inclusion in the annual budget. Office of Management and Budget will be part of the preparation team.

FINANCING

Primary Considerations

In June of 1980, a resolution and ordinance relating to the development of a bond issue for 1981 were introduced in the City Council. Resolution 26354 established the General Purpose Bond Issue Citizen Committee to review the capital improvement needs of the City and recommend methods of financing and specific projects to be included in a 1981 bond measure. This resolution and the accompanying ordinance emphasized rehabilitating and preserving the municipal physical plant. Energy conservation was cited as a principal reason for pursuing the bond measure.

If the bond issue reaches the ballot box, it is important that energy conservation projects be included as a category of projects, not as enumerated, specific projects. Because this revenue source is the first priority for funding energy-related improvements in municipal facilities, it is important to pursue.

In considering ways to ensure funding for energy-related physical improvements, several questions arise. Apart from the question of whether funds should be set aside for categorical programs, the follow - ing issues surface:

- Assuming funds can be set aside for specific projects, should the funds be set aside on a City-wide or a department by department basis?
- Can funds reasonably be set aside without generation of additional revenue?
- Can any additional revenue be earmarked for specific purposes?

In response to these questions, the following corresponding set of answers has been formulated:

- Identifying categorical funds for energy-related improvements for all municipal facilities is preferable to a department by department identification of resources. Under a City-wide approach, funds for selected projects would be available from all departments that operate facilities and pay the energy costs for them. Projects to be funded in a given year would be those most beneficial (in terms of economics and energy) as established in a five-year energy investment plan. Departments not dependent on General Fund support would be excluded from funding under this proposal. Under a City-wide, rather than department-specific approach, no single department would be at a disadvantage because of its inability to free

resources for energy improvements from basic services.

- At present, the City of Seattle is facing a year of budget reductions. The 1981 fiscal year is not an exception; it indicates a trend which may continue in the foreseeable future. Introducing a set-aside measure at this time, without an accompanying revenue generation option, would be an unworkable strategy.

- ENERGY, Ltd. recommends that the City increase the Business and Occupation Tax for energy utilities by two-tenths of one percent. We further recommend that an amount equal to the revenues generated by this increase be set aside in the Cumulative Reserve Fund, in the subfund for repair and renovation of municipal buildings. The amount is to be set aside until economically viable projects are completed (approximately 10 years).

For fiscal year 1980, the projected revenues from energy utilities will exceed $15.4 million. These revenues are divided between General Fund (90 percent) and Parks (10 percent). The utility tax on City Light alone is expected to contribute over $6.9 million to the General Fund in 1980. The general rate of taxation is levied at eight percent of the gross income of the utilities, although income from City Light's Centralia operations is taxed at five percent in accordance with federal guidelines.

Assuming the income of the energy utilities remains at 1980 projected levels, the revenue generated by a two-tenths of one percent increase would equal approximately $385,000 ($346,000--General Fund; $39,000--Parks Fund). This revenue source would meet the revenues necessary to support the energy-related municipal improvements.

The Cumulative Reserve Fund, as amended through Ordinance 108549, includes a special subfund for the repair and renovation of municipal buildings. Among the reasons for establishing the subfund is "making an alteration to conserve energy or improve efficiency." Therefore, it is logical to appropriate funds from the General Fund to the Cumulative Reserve Fund. There are advantages and disadvantages to this approach:

Advantages

- The proposal effectively means that funds are set aside from additional revenues generated for this purpose. Existing funds presently used for city services would not be further strained under this proposal.

- Philosophically, the proposal could be seen as promoting active investment in municipal conservation by the energy utilities.

- This revenue generation/set-aside proposal ensures that all departments supported by the General Fund will have equal opportunity for accomplishing energy improvements.

Disadvantages

- Utility business and occupation taxes are passed through to customers in the rates. Depending on the means by which the utilities chose to pass through the proposed tax increase, it could pose a hardship to specific customers.

- Antirecessionary trends dictate decreases, not increase in taxes.

- Increasing revenues, setting specific moneys aside in a Cumulative Reserve Fund, and then appropriating funds from the Cumulative Reserve Fund may be too cumbersome.

- The Mayor and City Council are not prone to decrease the flexibility with which General Fund moneys are appropriated. Establishing a set-aside fund with a specific purpose limits the flexibility.

- At present, the Cumulative Reserve Fund, established nearly 30 years ago for purposes including major maintenance, is largely treated as a reserve general fund. Appropriations from this fund require Council action and the Council is reluctant to use it for other than emergency purposes within specific issue areas. This may pose a problem in the consideration of energy conservation projects, even though these are included as acceptable projects in the subfund.

Having weighed the advantages and disadvantages, we find that this means of generating revenue and setting aside funds is a reasonable option, if the bond revenues are not available, or are insufficient to sustain a comprehensive energy improvements program.

Alternative Options

Among options considered to ensure funding for completing energy-related municipal improvements were the following:

Option A: Departmental Approach--DAS Rental Surcharge

Should a City-wide approach not be feasible, it is reasonable to encourage pilot energy improvements in specific departments. The newly organized Department of Administrative Services (DAS), with its responsibilities for design, construction, maintenance and operation of roughly 40 percent of City facility space, is a likely candidate for carrying out pilot projects.

DAS collects rent through an intergovernmental transfer of funds from departments and agencies that occupy space under DAS management. The rent charges are collected for leased, as well as

owned and operated, space.

DAS could establish rental fees that include an additional surcharge for energy-related improvements to facilities. DAS is currently proposing a surcharge for major maintenance improvements. The square footage rate for the major maintenance improvements is projected to generate funds in the range of $500,000 annually. An additional square footage charge of 10-25 cents per square foot would provide funds for reasonable energy improvements to City-owned facilities under DAS management.

Under this proposal, the funds would be set aside in an energy and maintenance improvement fund within DAS. This would be a cumulative fund with two subfunds: energy and maintenance. The appropriation of funds from this cumulative fund would be subject to the annual budget cycle. The projects proposed would be a separate element of the capital improvement program proposal.

Under this option, the five-year plan and annual updates would originate with DAS. Funds from the first surcharge would be used to develop the five-year plan which would include a description of all measures in sufficient detail to determine costs and estimate the energy savings potential. Projects would be prioritized and outlined in a five-year improvements program. The Office of Management and Budget, the Office of Policy and Evaluation, the City Energy Office and the Energy Cabinet would be involved in developing the five-year improvement plan and proposing the annual energy investment package.

The surcharge would be imposed until all economically feasible projects are completed.

The advantages and disadvantages of this option are:

Advantages

- Provides funds for energy investments in selected municipal facilities. Performance of the improvements can be monitored as part of a pilot proposal.
- Expedites the development of projects by establishing a cumulative fund in the DAS fund subject to annual appropriation. The Cumulative Reserve Fund tends to be used for unusual or specific projects of large scale. The DAS fund provides the means for carrying out potentially mundane and small scale projects which have substantial conservation impacts.

Disadvantages

- Only facilities under DAS management (40 percent of City-owned space) are eligible for improvement under these funds.
- No new revenues are generated. Rental rates would strain already taut budgets.

Option B: Set Aside Existing Resources

The proposal entails setting aside one-half of one percent of the annual operating budget of those departments which operate and maintain facilities. These funds would be set aside annually in an energy improvements subfund of the Cumulative Reserve Fund. The funds would be set aside as long as economically feasible projects are identified.

Advantages

- This proposal ensures stable funds for use in energy-related improvements to municipal facilities. Funds would be available for use by all departments.

Disadvantages

- No additional revenues are generated. This set aside may reduce funds for basic services. The impact on any one department has not been assessed.
- It is difficult to appropriate funds from the Cumulative General Fund. If this fund continues to be viewed as an "Emergency General Fund" it would be difficult to exercise the use of a subfund.
- Departmental and OMB budget staff do not support this approach. In general, the attitude is that energy projects should be encouraged with technical assistance and that "good" projects woud be able to compete well for resources.

VI. ENERGY IMPACT ASSESSMENT IN THE ENVIRONMENTAL REVIEW PROCESS

Recommendations
Anticipated Results
Background
Energy and Cost Analysis
Implementation

Even when laws have been written down, they ought not always to remain unaltered.

Aristotle

ENERGY IMPACT ASSESSMENT IN THE ENVIRONMENTAL REVIEW PROCESS

OBJECTIVES

- Encourage environmentally sound development within Seattle by strengthening the analysis of impacts on energy resources.
- Provide specific authority and guidance for the mitigation or prevention of adverse impacts on energy resources.

APPROACH

- Amend Seattle's SEPA Policy Ordinance to provide explicit policies for disclosure, mitigation, or prevention of adverse energy impacts.
- Assign development of threshold standards for determining the significance of the energy impacts to City Energy Office and Seattle City Light.
- Give City Energy Office the responsibility for recommending amendments or additions to existing SEPA procedural or operational manuals in order to include energy-related provisions.
- Assign the development and adequate operation of a pre-EIS scoping procedure to the Department of Construction and Land Use.

COSTS

- Additional city administrative costs are not anticipated.
- Project proposers bear costs for preparation of an environmental impact statement; the costs will vary from as little as a few hundred dollars for simple analyses to as much as $15,000 for analysis of a complex industrial plant.

BENEFITS

- Development of environmentally sound and energy-efficient projects.
- Potential energy savings of as much as 70 percent for a given project.
- Development of end-use data for energy management planning.

MANAGEMENT

- Department of Construction and Land Use implements adopted amendments.
- Seattle City Light and City Energy Office propose changes to existing administrative documents to provide guidance in the SEPA process.

SCHEDULE

- 1981 Adopt amendment.
- 1982 Prepare amendments and additions to administrative manuals.

ENERGY IMPACT ASSESSMENT IN THE ENVIRONMENTAL REVIEW PROCESS

RECOMMENDATIONS

Accurate assessment of a proposed action's impact on energy resources is essential to responsible energy management and effective environmental protection. Although the State Environmental Policy Act (SEPA) requires disclosure of a proposal's energy impacts, the analysis provided in current environmental impact statements is often weak. One objective of ENERGY, Ltd., therefore, is to encourage environmentally sound projects by strengthening the analysis of adverse energy impacts and providing for their mitigation.

At least two positive side effects of this objective can be noted:

- Better-informed decisions regarding energy resources can be made, and programs relating to end uses of energy can be based on better information.
- Education of the public can take place through the introduction of these explicit policies and suggested mitigating measures. It is possible that municipally enforced measures would not have to come into play as project proposers begin to analyze energy impacts adequately and incorporate maximum energy conservation measures in the front end of project development.

In order to strengthen the analysis of adverse energy impacts and to provide for their mitigation or prevention, ENERGY, Ltd. offers the following recommendations:

1. Amend Seattle's SEPA Policy Ordinance (0.107678) to provide explicit policy for impact disclosure and to provide explicit authority for mitigating or preventing adverse energy impacts.
2. Assign development of threshold standards to City Energy Office with cooperation of Seattle City Light. Assignment includes ongoing review and comment for procedural and operational manuals.
3. Assign development of required scoping procedure as part of the SEPA standard operating procedures to the Department of Construction and Land Use. Energy interests are to be represented in the scoping.

ANTICIPATED RESULTS

In addition to the development of environmentally sound projects, this proposal would have other beneficial results:

- Energy savings per project may be as high as 70 percent of the energy load for a given project. Savings will vary from project to project.
- Better end-use data will be available for energy management planning.

BACKGROUND

The objective of the State Environmental Policy Act of 1971 (SEPA) is to achieve environmentally sound development through informed decisions by project proponents and government officials. The environmental impact statement (EIS) reports information about a project's impacts and possible proposal alternatives. Ordinance 107678, the City of Seattle's SEPA Policy Ordinance, directs a city official's decision to grant, to grant conditionally, or to deny the permits required for a proposal. Neither the informational function of an EIS nor the authority provided by 0.107678 to act on this information affords adequate energy resource protection.

In 1975, the State Council on Environmental Policy (now the Department of Ecology) adopted guidelines implementing SEPA. These guidelines specify that the contents of a draft EIS must describe the impact of a proposal on the environment, including:

- The known impacts resulting from the proposal within any element of the environment listed in WAC 197-10-444, the effects of which are either known to be, or may be significant ((whether beneficial or adverse), and impacts which are potential, but not certain to occur. Known impacts are to be discussed in detail and potential impacts are to be discussed within reason.
- Direct and indirect impacts of the total proposal (for example, cumulative and growth-inducing impacts).
- The possibility that effects upon different elements of the environment will interrelate to form significant impacts.[1]

Since energy is identified as an element of the environment,[2] this impact assessment must include an analysis of a proposal's energy impacts unless

[1] "Guidelines Interpreting and Implementing the State Environmental Policy," Chapter 197-10, Washington Administrative Code: WAC 197-10-440(8).

[2] WAC 197.10.444(3)(e).

it is determined that the proposal will not significantly affect energy resources. Ideally, this analysis would provide the information which is essential to responsible energy management. However, a review of recently written EISs reveals that energy impact assessment falls short of the guidelines presented in the preceding paragraph.

Most energy analyses provide gross estimates of the direct energy demands of a project, and note that the demand is within the current capacity of local energy utilities. The indirect impacts of the proposal's energy demand on other elements of the environment, the effect of the proposal on the cumulative demand for energy in Seattle, and estimates of the energy used in the construction of the project and for transportation induced by the project are all rarely discussed. Since incomplete assessment of a proposal's energy impacts constrains energy management decisions, some means of generating more thorough energy analyses is needed.

The American people think technology waves a wand and the game goes on....

Stewart L. Udall

Of particular significance in the Seattle SEPA Ordinance (0.105735, as amended) is a clause which provides the City with "the authority to deny or reasonably condition any proposal so as to mitigate or prevent adverse environmental impacts." Through this mechanism, a city official may condition or deny a building permit on the basis of adverse impacts disclosed in an EIS. However, as provided in RCW 43.21C.060, "such conditions or denials . . . shall also be based upon policies developed by the appropriate local governmental authority and incorporated into resolutions, regulations, ordinances, plans or codes." In response to this requirement, the City enacted 0.107678 which defines those policies to be used in conditioning or denying a proposal.

Relying on the authority provided in the Seattle SEPA Ordinance, and the policy direction afforded in 0.107678, Washington courts have ruled that adverse impacts disclosed in an EIS may be sufficient grounds to condition or deny a building permit application. In *Polygon v. City of Seattle,* 90 W2d59,56; P.2d 1309 (1978), the adverse impacts found to justify denial of a permit included view obstruction, excessive bulk and relative scale, and increased traffic, among others. Thus, the authority established through 0.105735 provides an effective means of protecting those elements of the environment emphasized in 0.107678.

Although the policies adopted in 0.107678 address view protection, light and glare mitigation, the preservation of housing opportunities and other issues, there are no policies which explicitly address energy resource protection. For this reason, the City is unable to condition or deny a proposal on the basis of adverse energy impacts. The ordinance does assert that Resolution 25259, "Energy Conservation Policies," and the energy goals established in R.24282, "Goals for Seattle 2000," may be used in assessing the environmental impacts of a proposal. However the policies presented in these two resolutions were not drafted to serve the intent of 0.105735, and do not adequately direct the City's responsibility to protect energy resources.

After examining several means of strengthening energy impact assessment in the environmental review process, ENERGY, Ltd. has elected to draft an amendment to Seattle's SEPA Policy Ordinance (0.107678). Amending 0.107678 with specific energy policies would explicitly define the City's commitment to protect energy resources, and direct the authority by which such protection may be enforced. The proposed amendment is included in Appendix G. The legislation is comprised of the following three main policy sections.

Policy One of the proposed legislation specifies those energy impacts which should be examined by a project proponent and city official. Policies Two and Three describe the means by which such impacts may be mitigated or prevented. Thus, the proposed legislation serves to explicitly define the City's commitment to protect energy resources, and directs the authority by which such protection may be enforced.

These policies can influence the environmental review at two different stages. At the beginning of the review process, a determination is made about the significance of a proposal's impact. If a Declaration of Significance (DS) is made, an EIS must be prepared. If a Declaration of Nonsignificance (DNS) is made, no EIS is required. However, it may be necessary to condition a DNS in order to mitigate a proposal's impacts. If conditions are imposed, the authority to do so must be provided by the policies stated in 0.107678. At the other end of the process, a document entitled "Findings and Decision" is drafted if no appeal is filed on the adequacy of an EIS. This document presents the decision of the Director of Construction and Land Use to grant conditionally or to deny the permits for the project. Once again, the decision to condition or deny the proposal's permit must be founded on the policy direction provided in 0.107678.

Amending the existing policy legislation does not complete the task. Standards or thresholds must be developed for triggering either a DS or DNS, or to justify imposing mitigative or preventive conditions..

Seattle City Light is currently developing electric standards for the threshold determination guidebook to be prepared by the Department of Construction and Land Use. The Energy Office should review the rationale for the electric standards and begin development of comparable nonelectric standards for inclusion in the guidebook for 1981. More refined criteria triggering mitigative or preventive actions should result from work on significance thresholds. These thresholds are likely to vary by fuel type (electricity, oil, natural gas) and type and size of project (residential: single family, multifamily; commercial: small retail, large office; etc.), and are therefore politically and technically difficult to draft.

The procedure for pre-environmental impact statement consultation is known as a "scoping" procedure. As described in the National Environmental Policy Act Regulations published by the Council on Environmental Quality, scoping is a "process for determining the scope of issues to be addressed (in an EIS) and for identifying the significant issues related to a proposed action." The process is also described in the SEPA guidelines as a "pre-draft consultation procedure."

The advantage of a scoping procedure is that before preparation of a draft EIS is begun the project proponent and government can reach agreement on the content of the document. Several issues can be resolved through the scoping, such as: how extensive the examination of a proposal's indirect impacts should be; what the cumulative effect of the proposal is; whether energy is a primary concern in a particular proposal, and if so, whether complete disclosure of impacts will be required and mitigation expected.

Although a scoping procedure will increase the City's administrative responsibilities under SEPA, the ENERGY, Ltd. staff and Citizen Committee strongly recommend implementation of such a procedure on a mandatory basis. Under the current SEPA Guidelines, pre-draft consultation is voluntary on the part of a project proponent. While a scoping meeting may not be necessary for all projects, some procedure for discriminating among projects should be developed.

ENERGY AND COST ANALYSIS

ENERGY

Amending 0.107678 will provide the City with substantial authority to protect energy resources. In this case, protecting energy resources means foregoing energy consumption entirely, reducing energy consumption through improved energy efficiency and/or displacing exhaustible resources with renewable, environmentally benign resources. The amendment provides protection through direct means--conditioning or denying projects--and indirect means--potential public education in the form of explicit policy for protecting energy resources.

Quantitatively, the energy savings and displacement potential associated with this proposal are difficult to measure. Absolute estimates are meaningless given the variety of project types and the variety of conservation measures and renewable energy technologies which can be applied.

The Seattle Energy Code (Ordinance No. 108500) has established energy efficiency standards for buildings, using three major energy calculation methodologies. The Code mandates minimal standards, while also accommodating the use of renewable systems or more stringent, but still cost-effective, conservation technologies. Through the SEPA Policy (as amended by this proposal) additional conservation measures or use of renewable energy systems can be required if appropriate, given a case by case energy assessment for each project.

It is assumed that structure-related projects reviewed under the SEPA procedures will primarily be new construction projects. Therefore, the energy load baseline from which savings must be estimated includes the Energy Code efficiency levels. Simulations of energy savings possible by applying conservation and renewable technologies beyond those covered by the Energy Code are not available except in isolated examples. These examples confirm the potential for additional savings, but do little to estimate cumulative savings for disparate projects.

The preliminary draft of *Residential Community Design,* prepared for the City of Seattle by Mathematical Sciences Northwest, Inc., presents data concluding that reasonable, economically sound conservation measures, exceeding those prescribed in the Seattle Energy Code, can reduce the heating load of one unit to as little as 20 percent of that reached under the Energy Code prescribed measures. The prototype units are 1,400 square-foot town houses in a fourplex configuration. The simulated energy use dropped from 32 million Btu per year per unit (Energy Code) to under 7 million Btu per year per unit (prototype).

COSTS

Two categories of costs are associated with the proposed amendment change:

- City-incurred expenses for administration and enforcement of the provisions
- Proposer-incurred costs for preparation of energy impact assessments.

City-incurred costs may not necessarily involve the hiring of **additional** staff, but staff with a specialized understanding of energy will be needed. As the Department of Construction and Land Use hires environmental analysts for staffing positions, energy assessment knowledge should be a required skill area. The enforcement of any special energy conditions which will exceed those required under the Energy Code can reasonably be done by the Energy Code inspectors. The nature of the measures relating to structures would be comparable to those inspected under the Energy Code. However, mitigation of transportation or industrial energy impacts may entail enforcement by inspectors with more specialized skills. Interdepartmental arrangements can be made for obtaining these skills, given the limited number of anticipated mitigations for projects in either area.

Costs incurred by project proposers--most frequently, private firms--vary considerably depending on the magnitude and type of project being proposed and the type of analysis being undertaken.

Recent projects requiring preparation of environmental impact statements ranged from 10-unit residential structures to 40-story commercial buildings. The sophistication of the energy assessment required for projects can differ significantly, with techniques ranging from simple assumptions and hand-held calculators through complex assumptions and computer modeling. Obviously the size and kind of project being assessed dictates the method of analysis--and that determines the additional cost increment. Based on a survey of 10 local consultants who prepare EISs for a variety of projects, a range of cost estimates has been established. At the low end, an energy analysis for a small project such as a 10,000 square-foot addition to a commercial building may cost a few hundred dollars. At the other end, a computer analysis of a large industrial plant may cost upwards of $15,000. Thus, depending on the complexity of the project and the sophistication of the analysis, the costs of preparing the energy impact assessment vary widely.

The proposer bears the cost of the energy impact assessment. Such assessment could be considered an investment if it leads to energy conservation or use of renewable resources which reduce operational energy costs.

IMPLEMENTATION

MANAGEMENT

Property has its duties as well as its rights.

Thomas Drummond

Implementation of Ordinance 107678, as amended, would be the responsibility of the environmental section of the Department of Construction and Land Use. In the near term, implementation of the ordinance poses no insurmountable difficulties. Since neither the intent of the ordinance nor the mechanism of conditioning or denial is a new issue in environmental impact review, the authority provided by the energy section should be familiar to both city departments and project proponents. The review of energy analyses will require specialized skills and an understanding of methods of calculating energy impacts, given various computer models.

SCHEDULE

Implementation of this proposal entails introduction and adoption of legislation, preparation for implementation and enforcement by the Department of Construction and Land Use, and completion of ongoing work in developing scoping procedures and standards. The schedule for implementation is as follows:

1980-81 Introduce and act on Amendment to 0.107678.

1981 Develop standard operating procedures for EIS preparation to include required scoping (Department of Construction and Land Use).

1981 Develop work program for determining threshold standards (City Energy Office).

CONSIDERATION OF OTHER ISSUES

CONSISTENCY IN ENERGY ASSESSMENT METHODOLOGY

Given the variety of proposals subject to the SEPA, and the number of methods which may be used in assessing energy impacts, consistency among the analyses becomes an issue. Is it necessary to ensure consistency in the analytical approach? Should specific methodologies be suggested? Recommended? Required?

It is recommended that criteria be set up in order to clarify expectations about the level of sophistication necessary for respective projects. Logically, the level of sophistication would be determined in a scoping procedure, but ground rules are necessary prior to that stage in the process.

TIMING OF ENERGY IMPACT ASSESSMENT

In drafting the proposed legislation, a conscious attempt was made to be as specific as possible in describing the kinds of impacts and mitigating measures examined in energy impact assessment. However, since the impact and alternatives analysis will occur early in the project development process, such detail may not always be useful. In many cases, details about a building's structural and HVAC design are not known when an EIS is being prepared, thus limiting the accuracy of the impact assessment and the examination of appropriate mitigating measures.

While the degree of detail in the amendment has sometimes been criticized as premature, there is adequate justification for the amendment's specificity. In the first place, some project proposals do have relatively detailed information about specifications which affect energy use. Secondly, the specificity of the amendment serves an educational purpose. Although most project proponents will not be certain of the energy-consuming features of their proposal, the information provided in the amendment focuses attention on impacts they should be concerned with and proposes several opportunities for conservation and renewable

resource use. Finally, as with most environmental impact assessments, over time the energy analyses will become less difficult to conduct and less dependent on guesswork. Although the detailed analysis described in the amendment asks for information which is not easily attainable now, methods for estimating this information are rapidly becoming more sophisticated and reliable.

ALTERNATIVE APPROACHES

Several means of improving energy impact assessment and authorizing protection of energy resources were considered by ENERGY, Ltd. as alternatives to the proposed amendment. The two most feasible alternatives are: amending the Seattle Energy Code, and developing an energy impact review procedure which is distinct from the environmental review process.

The Seattle Energy Code contributes significantly to energy resource protection. The possibility of amending the code to include provisions for energy-efficient site planning and construction practices was examined. There are important advantages to an Energy Code amendment. First, the specificity of a technical code minimizes discretionary application of legislation, thus affording more consistent and predictable regulation. Second, the enactment of a technical code provides project developers with design standards early in the development process, thereby minimizing costs of compliance. An important disadvantage is that an energy code cannot offer resource protection as comprehensively as environmental review can. Thus, site planning and transportation energy efficiency may not be as effectively achieved under an Energy Code amendment as through the proposed amendment.

Energy resource protection can also be achieved through an energy impact review process. The King County Energy Planning Project is currently examining such an alternative. Its greatest advantage is that it could provide the most thorough assessment of a proposal's energy impacts since it is unburdened by the SEPA legislative requirements. Conversely, however, a separate energy impact review procedure is likely to result in an additional administrative mechanism for implementation, and thus add another "hoop" to the permit-issuing process.

EVOLVING WORK

Over the long term, ENERGY, Ltd. expects 0.107678 to continue to evolve. Although the proposed amendment takes a much needed step toward protecting energy resources, the legislation can be made even more effective. Most significantly, Policy Two of the amendment can be made less discretionary by specifying quantitative thresholds for impacts which warrant mitigation or prevention. Such thresholds must be sensitive to the variety of fuels and projects which fall under SEPA. Thus, thresholds for electricity, oil, and natural gas uses in large and small residential, commercial, and industrial projects must be developed. Furthermore, thresholds must be established for projects other than buildings, such as bridges, highway extensions, and nonconstruction projects. This work is currently being initiated by Seattle City Light in coordination with ENERGY, Ltd. staff and can be considered in the realm of administrative actions, included in administrative manuals.

A second major improvement in the amendment will be achieved if the policies are revised in the future to more accurately reflect all kinds of proposals. The current language is oriented toward conventional buildings. Application to the construction of transportation facilities or to projects requiring programmatic EISs will be challenging. However, just as the ordinance will evolve through the proposed amendment, further improvements in the legislation will become necessary as our sophistication in environmental protection increases.

ENERGY, Ltd.
for a secure energy future

VII. RELATED PROGRAMS

- Commercial Building Efficiency
- Solar Access/Zoning
- Seattle City Light Heat Pump Proposal

Sad Soul, take comfort, nor forget
That sunrise never failed us yet.

Celia Thaxter

COMMERCIAL BUILDING EFFICIENCY

OBJECTIVES

- *Encourage maximum energy savings in commercial buildings and facilities through a comprehensive program including education, financial incentives, minimum standards, and technical assistance.*

- *Establish minimum energy efficiency standards for commercial buildings that foster consistency with other classes of the built environment.*

APPROACH

- *Provide "walk-through" audits for commercial buildings. Seattle City Light pays for the audits performed or requested prior to 1984. Audits are performed by qualified private consultants. The City establishes the standards and maintains a listing of qualified consultants.*

- *Support the efforts of the Energy Office in developing minimum retrofit standards as requested by the City Council and recommend that the standards include:*

  -- *Mandated minimum standards based on cost-effective conservation actions*

  -- *Subsidized technical assistance scheduled on the basis of number of Btu used per square foot, with assistance going first to the most energy-intensive buildings*

  -- *Shared responsibility between Seattle City Light and building owner for cost of technical assistance.*

BENEFITS

- *Consistent application of energy conservation requirements for built environment.*

MANAGEMENT

- *Seattle City Light provides for audits.*

- *City Energy Office develops minimum requirements.*

SCHEDULE

- *1981* *Begin development of financial incentives.*

- *1981-84* *Carry out subsidized walk-through audits.*

- *1981-87* *Carry out subsidized technical assistance.*

- *1982* *Complete minimum building retrofit standards.*

SOLAR ACCESS/ZONING

OBJECTIVES

Encourage efforts by local jurisdictions to remove the barriers to increased use of solar technologies.

APPROACH

Recommend measures to consider in zoning amendments that would encourage widespread use of solar technologies.

Recommend means by which solar access can be protected.

COSTS

No additional costs.

BENEFITS

Increased potential for use of solar technologies.

Fewer variance procedures relating to solar system installations; consequent reduction in administrative burden for city officials.

MANAGEMENT

Department of Community Development develops and recommends solar access and zoning amendments.

Department of Construction and Land Use implements any adopted provisions.

SCHEDULE

- *1982* Adopt and implement amendment and new provisions.

SEATTLE CITY LIGHT HEAT PUMP PROPOSAL

OBJECTIVES

- *Improve energy efficiency of heating systems in 10,000 residences that currently use central electric resistance space heating through installation of hybrid electric heat pumps.*

APPROACH

- *Propose a shared financing program, recognizing both utility and customer benefits, to encourage installation of hybrid heat pumps.*
- *Investigate potential for implementation as pilot project, as prelude to possible regional program under Bonneville Power Administration.*

COSTS

- *Installed cost: approximately $5,000 (1980 dollars) per unit.*

BENEFITS

- *Potential energy savings of 9,700 kWh per unit per year. For10,000 residences, annual energy savings would total 97,000 million kWh per year.*
- *The energy savings would be contributed during daily and seasonal peak demand periods. Reductions in purchased power costs could exceed $3 million annually.*
- *Peak load requirements would be reduced by 58 megawatts, contributing to savings of over $15 million in capital costs for peaking turbines or over $100 million for new thermal generation.*

MANAGEMENT

- *Seattle City Light operates program.*

RELATED PROGRAMS

COMMERCIAL BUILDING EFFICIENCY

RECOMMENDATIONS

To ensure that the City's approach to energy efficiency in buildings and facilities will be truly comprehensive, it is important to take note of work that is already going on with respect to commercial buildings. The ENERGY, Ltd. Citizen Committee recommendations promote equity among all sectors of the built environment by suggesting direction for the ongoing work. The intent is that the following recommendations will parallel the industrial conservation program proposal in Chapter IV:

1. The City should institute a comprehensive conservation program for commercial buildings and facilities, including mandatory minimum standards, audits, technical assistance, education and financial incentives.

2. The walk-through audits and technical assistance should be performed by qualified private consultants. The City should immediately establish minimum qualifications for such consultants and maintain a listing of consultants who meet these minimum standards.

3. The City should pay the cost of the walk-through audits for those audits taking place or requested prior to January 1, 1984. Beginning January 1, 1984, the firm should pay the cost of the audit.

4. The ENERGY, Ltd. Citizen Committee recognizes and supports the ongoing work of the City Energy Office in developing a retrofit standard for existing buildings, as directed by the City Council, and recognizes and supports the efforts of Seattle City Light to offer energy audits for commercial buildings and seminars to building owners.

5. The retrofit standards being developed for existing buildings shall include three elements:

   - Mandating of minimum standards based on cost-effective conservation actions
   - Scheduling of subsidized technical assistance based on the number of Btu used per square foot, with emphasis placed first on those buildings using the most energy per square foot
   - Sharing of responsibility for conducting and paying for the technical assistance by the City and the building owner.

6. The City should aggressively urge the amendment of federal legislation (e.g., the National Energy Conservation Policy Act) to specifically mandate public incentives in the form of audits and technical assistance for commercial buildings.

Because work on a retrofit code for existing buildings is already underway, detailed analysis of these recommendations has not been carried out.

BACKGROUND

In August, 1979, the City Council approved Ordinance 108500, setting standards for new construction and renovation of all buildings; this collection of standards is the Seattle Energy Code. In December 1979, the Mayor submitted to the City Council a proposed Home Conservation Requirement (now called the Home Weatherization Standard) which recommends energy conservation standards for existing residential structures. This proposal is currently being reviewed by the City Council.

Resolution 26258, passed by the City Council in January 1980, directs the Energy Office to "research and report on . . . appropriate energy conservation standards for those existing buildings which are not included in the Mayor's Home Conservation Requirement proposal"; these are referred to in the resolution as commercial buildings.

The ENERGY, Ltd. Citizen Committee supports this work, and, based on their experience in developing the industrial conservation program (Chapter IV), the Citizen Committee suggests that the commercial building efficiency program parallel the industrial program in concept and in schedule.

IMPLEMENTATION

In 1982 the City should provide a simple audit form to be used by building owners. The form would be similar to that used for the federal schools and hospitals audit program. The owners would complete and return the forms in 1983. One purpose of the audits will be to establish the present level of energy consumption. The philosophy in applying subsequent technical assistance will be the same as that of a hospital emergency room--the patient in the worst condition gets the speediest treatment. A possible schedule is shown in Table VII-1.

TABLE VII-1
APPLICATION OF TECHNICAL ASSISTANCE TO COMMERCIAL BUILDINGS

BUILDING ENERGY USE AUDIT RESULTS	DATE BY WHICH TECHNICAL ASSISTANCE PROVIDED
1. More than 100,000 Btu/ft^2/yr	January 1984
2. 80,000 to 100,000 Btu/ft^2/yr	January 1985
3. 50,000 to 80,000 Btu/ft^2/yr	January 1986
4. Less than 50,000 Btu/ft^2/yr	None will be provided

SOLAR ACCESS/ZONING

RECOMMENDATIONS

Recognizing that the City of Seattle and King County are currently developing or proposing to develop measures for protecting solar access and amendments to land use regulations and structure-related codes, the ENERGY, Ltd. Land Use Subcommittee recommends that the following points be considered in formulating these amendments or measures. We have divided the recommendations into zoning and access categories:

Solar Zoning Exemptions

1. Allow exemptions to height, yard, and setback requirements to permit installation of solar space- and water-heating systems without exercising a variance procedure.
   - For residential zones, language from *Solar Zoning Amendments*, Draft Report (Department of Community Development, August 1980) should be adopted for yard and setback requirements.
   - For residential zones, language from the proposed multifamily land use policies should be adopted for height exemptions.
   - Separate exemptions should be developed for commercial and industrial areas.
2. Review exemptions from height, yard and setback requirements periodically following adoption to ensure that the amendments keep pace with technology.
3. Allow exemptions only if such an exemption will not result in shading of a structure to the north.
4. Propose new zoning exemptions to be more flexible than the exemptions for existing structures. Such exemptions should allow for placement of structures on the northern lot line and orientation of houses on lots so that their south side is perpendicular to due south. This need for flexibility reaffirms the recommendation of the ENERGY, Ltd. Citizen Committee to reconsider the Single Family Land Use Policies which foster detached structures centrally placed on single lots.
5. Establish a design departure procedure for single family structures, similar to that proposed for multifamily structures.
6. Do not impose a minimum contribution standard on a solar system in order to qualify for a zoning amendment. Such a standard makes sense theoretically to ensure that the public benefit of the exemption is achieved (i.e., energy is saved). However, the administrative burden is not justifiable given the small number of property owners affected and the relatively insignificant magnitude of the exemption.

Solar Access Policy

1. Encourage private solar easements through an active education campaign.
2. Do not yet support the downzone in single family residences to 25 from 35 feet on the grounds of protecting solar access. Until the solar inventory is completed (January 1981), the extent to which the lower height restrictions protect solar access is not ascertainable.
3. Consider solar overlay zones if the inventory proves a 25-foot height restriction to be ineffective as a solar access control. If administratively feasible, such overlay zones should be adopted.
4. Exercise the public nuisance law as a control against shading by trees. A simplified administrative procedure for implementing the public nuisance provisions should be established. Existing vegetation should be grandfathered.

BACKGROUND

The City of Seattle has numerous regulatory measures in place which impede the widespread application of solar technologies. The regulatory measures include structure-related codes as well as land use regulations. Recognizing that these barriers must be removed, the City, through the Department of Community Development, Seattle City Light, and the City Energy Office, is examining means for protecting solar access and for amending current zoning regulations to accommodate and encourage

the installation of solar systems.

King County, through its Energy Planning Project, proposes to work with the City of Seattle to encourage the use of solar throughout the county. King County plans to develop solar system construction and installation guidelines, formulate solar and climatic design guidelines, and identify and amend those King County regulations that present barriers to solar. The efforts of the City and King County complement and supplement each other. For example, the development of guidelines will benefit both Seattle and King County residents.

Solar Access Study

The first step taken by the City has been an inventory of the solar access across the city. To date, two phases of a solar access study have been completed. A Phase I study, prepared for the Department of Community Development by Mike Bonoff and Thomas Brucker (December 1979), includes a review of solar technologies and an examination of legal issues and the costs of solar applications. It also offers initial recommendations on policy alternatives necessary for the active promotion of solar applications.

It's going to be the sunny side from now on.

Frank O'Hara

In general, this first study recommended that the City should promote "solar energy through regulation revision, new program and public investment opportunities."[1] In order to promote solar energy through regulatory revisions, several strategies were suggested:

- The City will protect solar access for individual use through a public ordinance modeled after the New Mexico Energy Institute's Ordinance.
- The City will require new construction of residential units to provide for a certain percentage of the requirements for space and/or domestic hot water heating to be met by the use of passive and/or active systems.
- The City will require the siting of new residential units to maximize solar exposure and natural light gain without restricting solar access to collector locations on adjoining property.
- The City will require an exchange of covenants to protect solar access for new construction of residential units that consist of more than one detached structure.
- The City will amend land use documents to incorporate solar policies in the Comprehensive Policy Plan Catalog in order to include solar considerations in a special issue--single and multiunit residential land use policies.
- For new construction, the City will provide exceptions to the bulk regulations of the zoning ordinance to allow flexibility in siting solar equipment without impairing solar access to collector locations on adjoining property.
- For existing construction, the City will provide exceptions for equipment from the bulk regulations of the zoning ordinance.
- The City will add definitions of solar terms and minimum design standards to the Building Code.

The Phase I study also suggested several methods for promoting solar energy through programming and public investment.

The City has already begun work on the regulatory actions necessary to promote the use of solar energy. Resolution 26258, adopted in January 1980, expresses the intent of the Mayor and City Council "to consider the application of solar features to new and existing buildings," and "to adopt a work program and schedule for establishing reasonable rights to solar access," in addition to other work items relating to the Energy Code. This resolution further states that the Energy Office, the Department of Community Development, and the Building Department shall review zoning- and structure-related codes to identify any existing legal impediments to the use of solar features in buildings. Amendments to these codes will be proposed.

The resolution also specifically directs the Department of Community Development to design, and the Mayor to propose, a work program and schedule to clarify, and, if possible, establish reasonable rights for solar access.

In response to this resolution, the Department of Community Development has completed a draft report on solar zoning amendments (August 15, 1980) and has had prepared under contract a Phase II study, *Solar Access Policy for Seattle* (Sally King and Ted Hunter, September 1980). These documents provide the background for the ENERGY, Ltd. recommendations.

Zoning

The major recommendations on zoning amendments to which ENERGY, Ltd. responded are those dealing with bulk requirements. Both the recommended height and setback amendments affect the residential zoning provisions. The height exemptions also affect the commercial zoning provisions. Because the bulk regulation exemptions apply only to

[1] Mike Bonoff and Thomas Brucker, *Solar Access Study*. Prepared for the Seattle Department of Community Development, December 1979, p. IV-4.

solar systems, the Department of Community Development proposes two methods for defining a solar system: a prescriptive standard and a performance standard.

Under the prescriptive standard, the specific orientation, tilt, thermal storage capacity, distribution ability and insulation would be prescribed. Under the performance standard, the solar system would have to meet a specified amount of the space-heating demand or of the water-heating demand. The draft report recommends 50 percent as the solar contribution to space heating.

The bulk requirement amendments recommended in the Department of Community Development draft report on solar zoning amendments are as follows:

- Height: Solar systems less than four feet in height are exempt. Systems between 4 and 10 feet are exempt if less than 50 percent of the roof area is covered.
- Front Yards: Solar systems attached to the principal structure would be allowed to encroach up to six feet or one-third of the required front yard depth.
- Side Yards: Solar systems attached to the principal structure would be allowed to encroach up to three feet of the property line. Currently, Section 22.42 allows up to three feet encroachment in side yards for cornices, eaves, and sunshades.
- Rear Yards: If the solar system is attached to the principal structure it can encroach within 12 feet of a rear property line or within 15 feet of the center line of the alley. If detached, the solar system would be permitted as an accessory structure.
- Lot Coverage: One-half the area of attached solar greenhouses and sunspaces could be counted in lot coverage; other solar systems would not be counted in lot coverage.
- Building Length: One-half the length of attached solar greenhouses and attached sunspaces along a side wall could be counted in building length. Other solar systems would not be counted in lot coverage.

Solar Access

The ENERGY, Ltd. recommendations address the solar access strategy suggested by the Phase II report, *Solar Access Policy for Seattle*. This strategy includes three levels of policy: 1) supportive official policy, but no direct regulation; 2) regulation of structures only; and 3) regulation of vegetation and structures.

To be effective and supportable, any regulation adopted must be based on solar inventory data and referenced to a solar development policy. Therefore, the *Solar Access Policy for Seattle* recommends that the policies noted below as Level One policy recommendations should be carried out immediately. It also recommends that some policies recommended under Levels Two and Three should be adopted immediately while other policies under these levels should not be implemented at the present time. Instead, these should be considered after the City has determined its level of commitment to solar development and has completed the data collection necessary to assess the extent to which shading would interfere with solar uses.

Level One: Supportive Official Policy, No Direct Regulation

1.1 Amend the Seattle Policy Catalog to include a general policy statement affirming that the development of solar energy is in the public interest, and that protection of solar access is necessary for the widespread use of solar systems. The policy statement should include general support for solar access protection in all zones, not just single family residential zones. Specific provisions of the solar access policy should then be incorporated in various sections of the Catalog dealing with energy and land use.

1.2 Adopt, by City Council resolution, a specific solar access strategy to be carried out over the next three to five years. The strategy should include: 1) an official public review mechanism, such as an advisory board or citizen task force, to ensure that the interests of solar professionals, neighborhoods, and developers are represented in the drafting of a solar access ordinance; 2) a directive to carry out any additional research which is needed on shading and solar potential in Seattle; and 3) periodic reconsideration of solar access to allow for updating based on new data.

1.3 Encourage private easements and covenants through public education and information dissemination.

Level Two: Direct Regulation Dealing with Structures Only

The *Solar Access Policy* study recommends the following policies for immediate adoption by the City:

1.1 Lower the zoning height restriction in all single family neighborhoods. Such a revision has already been adopted by the City Council in the new single family policies and will be implemented in 1981. While protecting solar access was not the reason behind adopting this revision, City policymakers and administrators should be aware that it effectively carries out such a policy.

1.2 Prohibit structures and objects which are exempt from zoning bulk

regulations (including solar system retrofits) from shading a certain portion of the lot to the north.

1.3 Amend zoning variance criteria so that shading a certain portion of the building to the north would be considered a material detriment. Variances could be denied when such shading would result.

1.4 Allow exemptions from zoning bulk regulations for new construction on single lots and short plats. Exemptions should go beyond those provided in the Department of Community Development's proposed exemptions for solar system retrofits. Only if the rate of new construction and the level of public support for solar development increase significantly in the future should a mandatory approach be considered for solar siting and legal protection of access for new homes.

If additional regulation proves necessary--after an inventory of solar access and potential is complete and after City policy toward solar is fully developed--the *Solar Access Policy for Seattle* recommends that the City:

2.5 Amend the zoning code to restrict the alteration and construction of houses so that they will not shade adjacent structures. This could be done by adopting a performance standard to control bulk, or a prescriptive envelope bulk regulation. Whether prescriptive, performance, or both types of standards are used, the solar access regulations should be applied through solar overlay zones.

2.6 Adopt recordation of solar systems on a lot by lot basis as an interim policy, should the 25-foot height restriction and variance amendments not provide sufficient solar protection. Recordation should be implemented through overlay zones, so that the ease with which a solar owner could obtain a permit would vary by the level of solar exposure in the owner's area. A recordation approach based only on neighbor's consent should not be adopted. A criteria approach, with some opportunity for input from the affected property owner(s) would be preferable from both legal and administrative perspectives. Because recordation of solar access permits would be voluntary, this would be a good measure of the level of public interest in regulation designed specifically to protect solar access.

Level Three: Direct Regulation of Vegetation

The City should not adopt a restriction on tree growth. In the near term, if research indicates that a vegetation control is justified, a lot by lot control is recommended due to the variation in tree height and type that occurs even within areas which have similar topography and density. This could be done through a nuisance or recordation approach, or through a mediation process.

SEATTLE CITY LIGHT HEAT PUMP PROPOSAL

PROPOSAL

City Light has a proposal to install hybrid electric heat pumps in the homes of 10,000 of their residential customers who currently use electric resistance space heating.

ANTICIPATED RESULTS

Some commercially available hybrid heat pumps are essentially solar devices that provide space heat and hot water to a home, using 30-40 percent the amount of energy used by existing electric resistance heat systems--without electric heat backup. Retrofitting 10,000 all-electric homes with these systems could save about 97,000 MWh per year and over 50 peak MW.

BACKGROUND

Pertinent Facts

Information gathered from James Bose, Director of the School of Technology, Oklahoma State University, shows that commercially available hybrid heat pumps have a number of desirable capabilities. In certain homes, they can use the existing ductwork. They can also be installed so that the cooling cycle is not available to cool the home without substantial extra expense. This feature is important in order not to encourage an increase in the use of home space cooling, and with it an increase in electric use. In addition, features can be included that will negate the need for an electric backup heating system; a fossil fuel system can remain in place, operating only during the coldest hours of the year.

Finally, these heat pumps can maintain a coefficient of performance of 2.5 or greater for residential uses. This means that they are at least two and one-half times as efficient as electric heating systems.

The "average" Seattle all-electric home uses 11,174 kWh per year for space heating and about 5,000 kWh for hot water.[1] A reasonably insulated 1,600 square-foot home would require a 2.5-ton heat pump for space heating and a 1-ton heat pump for hot water (assuming a 5 kW electrical peak, including all system components).

Assumptions

In addition to such factual information, the proposal is also based on

[1] Seattle City Light, "Finger-Tip Facts," Customer Service Division Reports.

several assumptions. These assumptions are:

- The use of 10,000 hybrid heat pumps would not pose serious environmental hazards.
- About 60 percent of potential heat pump electrical demand would be on line during winter peaks.[1]
- About 40 percent of potential electric heat demand would be on line during winter peaks.[2]
- Of the 40,000 homes in Seattle with electric heat, 10,000 have electric furnaces or boilers, plus solar exposure adaptable to the use of one or two solar panels.
- "Starting current" for heat pumps will not seriously affect an electrical distribution system.

Program Potential

A program on the scale proposed would "generate" permanent energy and peak savings. The program could:

- Be accomplished within a few years, meeting local needs years before other substantial options
- Pave the way for a program sponsored by the Bonneville Power Administration throughout the Northwest, from which the potential energy savings could be massive---the equivalent of several new thermal plants
- Pave the way for a similar local and regional commercial/industrial program that would save money, make energy available for load growth, create new jobs, make a shift from fossil fuels to renewable hydroelectric resources, and reduce the need for several of the different forms of energy.

[1] Alten Northwest, Inc.

[2] Julie Glidden, Load Research, Pacific Power and Light. City Light, Puget Power, and the Bonneville Power Administration did not have recent or similar research in this area.

ENERGY AND COST ANALYSIS

Energy

The potential energy savings, and accompanying dollar savings, from this program are significant. Each household in the program would save 9,704 kWh per year. In dollar terms this would amount to 60 percent of their costs for hot water and space heating--a savings of about $200 per year.

City Light would annually save 97,000 MWh, mostly during daily and seasonal peak demand periods. This could reduce purchased power costs by several million dollars each year since the marginal energy cost to the utility is currently as much as 100 mils per kWh greater than marginal residential revenue.

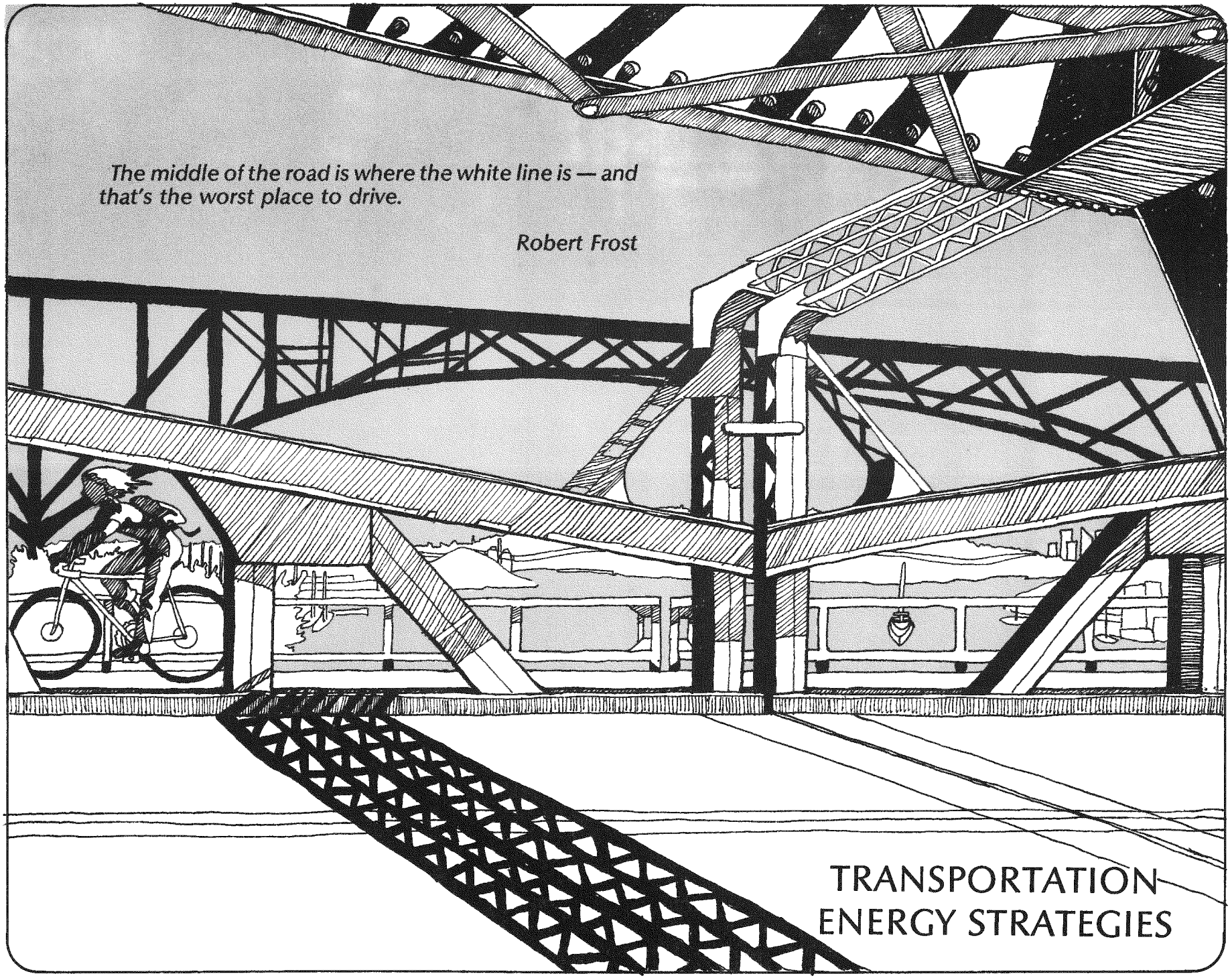
In addition, peak load would be reduced 58 MW, a savings worth about $100 million in capital costs for new thermal generating stations, or $15-20 million for peaking turbines.

Costs

Alten Northwest, Inc. estimates the installed costs for a self-contained retrofit system of this type to be about $5,000 (1980 dollars), given reasonable economies of scale for installation. Costs for the total program have not yet been fully determined.

IMPLEMENTATION

At this point implementation issues are largely in the recommendation stage. The assumptions listed in the Background section above must be confirmed and a shared financing program, recognizing utility and individual customer benefits,must be developed. In addition to pursuing this retrofit plan for homes, it has also been recommended that a similar proposal be developed for multifamily units, businesses, and industrial facilities.


The middle of the road is where the white line is — and that's the worst place to drive.
Robert Frost
TRANSPORTATION ENERGY STRATEGIES

VIII. LOW-POWER VEHICLE PROGRAM

Recommendations
Anticipated Results
Background
Energy and Cost Analysis
Implementation

Our national flower is the concrete cloverleaf.

Lewis Mumford

LOW-POWER VEHICLE PROGRAM

OBJECTIVES

- Increase travel by low-power vehicles such as mopeds and bicycles to account for at least one percent of the utilitarian trips taken in Seattle by 1990.

APPROACH

- Expand, by a resolution, the responsibilities of the Seattle Engineering Department to include planning and program development for all low-power vehicles that are introduced as utilitarian transportation modes.
- Establish low-power vehicle planning section within Seattle Engineering Department.
- Identify and pursue project funds for safe parking and commuter routing for low-power vehicles.
- Affirm the goals and policies of the City relating to utilitarian travel by low-power vehicles.

COSTS

- Annual costs: $70,000 for each of the three years.
- Project costs: $85,000, includes capital investment for parking facilities, and costs for routing and training.

BENEFITS

- Reduction of 311,000 gallons per year in petroleum use.
- Considerable reduction in traffic congestion.
- Improvement in air quality.
- Improved health for many city residents.

MANAGEMENT

- Seattle Engineering Department continues to operate the low-power vehicle program as expanded by this proposal.

SCHEDULE

- 1982-85 Construct facilities and operate program on scale that will result in energy savings by 1990.

LOW-POWER VEHICLE PROGRAM

RECOMMENDATIONS

Travel by bicycles, mopeds, and other low-power vehicles can accomplish several transportation goals. These include reducing roadway congestion, improving air quality and promoting energy conservation. To encourage increased travel by low-power modes of transportation, ENERGY, Ltd. recommends that the following actions be taken:

1. Introduce a resolution affirming goals and policies promoting travel by low-power vehicles. The resolution would affirm the responsibilities of the Seattle Bicycle Advisory Board, and commit the City of Seattle to careful planning for and promoting of utilitarian travel by low-power vehicles to attain a goal of 4,000 utilitarian trips per day by 1990.

2. Establish a section within the Seattle Engineering Department to consolidate low-power vehicle planning and program development to focus on utilitarian travel.

3. Target bicycle/moped parking facilities as priority construction tasks for 1982 Capital Improvement Plan for Engineering Department. Vigorously pursue funding through Federal Highway Administration bikeway program and through existing energy and transportation sources (Federal Aid to Urban Systems, state Energy Office grant programs, Washington Department of Transportation).

ANTICIPATED RESULTS

The amount of fuel used for transportation would be reduced by approximately 7,400 barrels per year by 1990, through increasing the utilitarian trips made by low-power vehicles to one percent.

BACKGROUND

Bicycles are not currently a significant mode of travel in Seattle, particularly for utilitarian purposes. Because mopeds and other low-power two-wheel vehicles have been only recently introduced, the statistics on usage of these vehicles are limited.

Nationally, approximately six-tenths of one percent of commuter travel is made by bicycle.[1] Seattle statistics are estimated to be roughly comparable due to a series of offsetting factors. The attitudes of the general population in the Northwest are generally favorable toward bicycling (and, potentially, the use of mopeds or other low-power vehicles) as a standard means of transportation. However, this positive attitude is offset by weather conditions that are perceived to be adverse, difficult topography, and lack of adequate facilities accommodating travel by low-power vehicles.

From an energy perspective, bicycles and low-power vehicles such as mopeds should be considered as a primary mode of transportation. Accommodating travel by low-power vehicles entails developing specific policy legislation, integrating bicycle and moped needs into the existing transportation system design and raising the priority of projects related to low-power vehicles.

You'll look sweet upon the seat of a bicycle built for two.

Harry Dacre

Raising existing bikeway projects to priority status is critical. Unless priority status is given to projects, sufficient staff resources to ensure rapid project completions are not assigned. Without staff attention, projects are subject to lengthy delays, diminishing funding and narrowed work scope.

The integration of bicycle/moped travel into the existing transportation system is a complicated but essential goal. It entails considering this travel mode in roadway design and surfacing, in intersection design, in traffic routing and in all transit interface. Low-power vehicles need to be introduced into the forefront of all phases of the transportation system, from policy planning through design and construction of projects and traffic flow decisions.

EXISTING EFFORTS

While little can be done to change the weather or level the hills of Seattle, the City of Seattle can be, and is, improving facilities for bicycle travel. To date, the City has used over $400,000 in federal and state funds to construct over 50 miles of bicycle trails and to implement spot improvements such as drain grate changes. Over $1.1 million is committed to bikeway projects in the 1980 Capital Improvement Plan. While the trails or designated bikeways are used for commuter or utilitarian travel, their principal use is recreational; this has also been the reason behind developing them.

The City also has policy legislation relating to the use of bicycles. Resolution 25534 created an 11-member Seattle Bicycle Advisory Board. The responsibilities and interdepartmental relationships of the Seattle Bicycle Advisory Board are ambiguous at present, but should be strengthened and defined. A constituency of well-informed users of a transportation mode can aid the City in planning for the future. The additional task of addressing other low-power travel needs requires consideration by a formal group such as the Bicycle Advisory Board.

[1] U.S. Department of Transportation, *Bicycle Transportation for Energy Consumption*, April 1980.

The Comprehensive Bikeway Plan developed and adopted by the City in 1972 contains a series of eight recommendations, several of which are particularly relevant to the concerns of ENERGY, Ltd. The recommendations most relevant are:

- The City should make a commitment to establish and promote bicycle routes within the city to serve not only a recreational function, but a transportation function as well.
  - One of the first steps would be a commitment in spirit to the concept that bicycles serve as a transportation mode and that it is the duty of city government to provide, to the fullest extent possible, opportunities for people who wish to exercise this option.
- The City should maintain a continuing effort to determine the magnitude of potential demand for bikeway routes.
  - New and innovative techniques should be developed to minimize the time and money required to sample current and future user demand. Constant citizen feedback during route operation, coupled with professional observation, will assist in determining the viability and success of these routes.
- The City should undertake a program of encouraging and helping to establish safe and convenient terminal facilities in key activity nodes within the city, paying particular regard to such areas as the Central Business District, Ballard, the University Area, West Seattle, Rainier Beach and the Capitol Hill-Madison Park business area.
  - There are only one or two known bicycle racks within the Central Business District and none in any other major activity area, with the exception of small portions of the University shopping area. However, it is readily apparent that these can also act as a stimulus for demand and should be used for such purposes. The City should undertake a program of helping to provide the installation of bike racks at all public buildings.

Restore human legs as a means of travel. Pedestrians rely on food for fuel and need no special parking facilities.

Lewis Mumford

Resolution 25899, passed in 1978, adopts transportation goals and interim policies. It specifically identifies alternative modes of travel, including bicycles, as desirable for the transportation system. The policy relating to bicycle travel references the need for a bicycle network and suggests inclusion of bicycle lanes on existing systems where feasible.

ENERGY, LTD. PROPOSAL

Resolution 25899 does not provide the tangible policy backing necessary to have a minimum of one percent of utilitarian trips traveled by low-power vehicles. Therefore ENERGY, Ltd. proposes to introduce legislation which would:

- Establish a goal for utilitarian travel by low-power vehicles.
- Identify an implementation strategy to attain the goal.

The implementation strategy includes the designation of a low-power vehicle section within the Transportation Planning Division of the Seattle Engineering Department. In addition to incorporating existing bicycle program activities, this section would be responsible for comprehensively addressing the following areas over a three-year period:

- Develop a plan for and pursue funding for parking facilities for bicycles and mopeds.
- Examine, and revise as necessary, locally controlled roadway specifications to provide for safe and efficient low-power vehicle traffic.
- Examine routing for utilitarian travel by low-power vehicles. Prepare and distribute public information on routing. Consider the issue of bicycle/moped mix in routing.
- Coordinate development of low-power vehicle parking requirements as part of land use policy development.
- Inventory spot improvements and intersection design changes necessary for safe, efficient low-power vehicle travel.
- Review Seattle Traffic Codes for bicycle/moped enforcement problems. Recommend changes necessary for safe utilitarian travel.
- Participate in long-term transportation planning.
- Develop and coordinate development of driver (both bicycle and automobile) skills safety programs through educational institutions, clubs, community centers and safety councils.
- Clarify departmental responsibilities of the City for integrating low-power vehicles into comprehensive transportation plans.
- Work with Metro to ensure provision of adequate, secure parking at major transit nodes and expanded "Bike and Ride" service.
- Compile data on potential for bicycle/moped travel and need for specific routing.

ENERGY AND COST ANALYSIS

ENERGY

The estimate of energy savings was established by setting a goal and delineating assumptions. The goal identified is: A minimum of one percent of the utilitarian trips in 1990 should be made by low-power vehicle.

Assumptions necessary for calculating energy savings to be accrued from attainment of this goal include:

- Bicycle/moped facility improvements in place.
- Utilitarian trips are defined as travel from home to work and home to school (for purposes of calculations in this section). Other utilitarian trips are not disaggregated in transportation statistics.
- Utilitarian trips for Seattle comprise 50 percent of these trips in King County.
- Eighty percent of utilitarian trips are made by automobiles with low occupancy.
- Average length of the utilitarian trips traveled by low-power vehicles is six miles (round trip).
- Automobile fuel efficiency for 1990 is 18.5 miles per gallon (adjusted for urban travel conditions, ENERGY, Ltd. Data Base). Moped/low-power vehicle fuel efficiency is estimated at 120 miles per gallon.
- Utilitarian trips traveled by low-power vehicles will be apportioned between bicycles (75 percent) and mopeds/low-power vehicles (25 percent).
- Utilitarian trips traveled by low-power vehicles in 1990 are assumed to reach 4,000 per average weekday. (Using data prepared for ENERGY, Ltd. by Puget Sound Council of Governments, November 1979).
- There are 250 average weekdays in a year.

Given these assumptions, an energy savings of 7,400 barrels of oil per year (1,600 due to increased use of low-power vehicles; 5,800 to bicycles) can be attained.

COSTS

The costs for the low-power vehicle proposal include the following estimated annual costs:

Personnel Services (2 staff)	$60,000
Administrative Overhead	$10,000
	$70,000 annually for 3 years

Project costs or one-time costs may include:

Vehicle Parking ($ 2,000--inventory, design $38,000--purchase $10,000--installation, site improvements)	$50,000
Routing Material ($ 5,000--signs $ 5,000--printing $ 3,000--installation)	$13,000
Safety, Skills Training	$ 7,000
User Survey, Potential Market	$ 5,000
Roadway Specification Review	$10,000
	$85,000

IMPLEMENTATION

MANAGEMENT

The low-power vehicle unit should be established within the Transportation Division of the Seattle Engineering Department. Planning and project construction should be as closely tied as possible to ensure proper completion of projects.

The Seattle Engineering Department currently coordinates bicycle-related activities within the City and with community groups. The bicycle coordinator for the City provides staff support to the Seattle Bicycle Advisory Board. Therefore, the low-power vehicle proposal is not a new direction for the Engineering Department; it is simply a more comprehensive direction.

FINANCING

At present, bicycle facility and roadway improvements are funded through combined state gasoline tax revenues (Arterial City Street Fund) and federal allocation via the Federal Aid to Urban Systems program. According to the U.S. Department of Transportation (DOT) publication, *Bicycle Transportation for Energy Conservation* (April 1980), all federal DOT major divisions will share responsibilities for financial assistance and program development to promote bicycling. Although these funds cannot be guaranteed, the prospect looks good.

State financing is dependent on gasoline tax revenues, revenues which

vary widely under circumstances of escalating prices and uncertain supply. However, this is an appropriate funding source. Because the first responsibility of the newly organized unit is to pursue funding, other sources of revenue may be located through energy-related grant sources.

SCHEDULE

The low-power vehicle proposal is scheduled to be phased in over a three-year period (depending on funding). The proposed schedule is as follows:

The modern idea of homes has been well expressed as the place one goes from the garage.

George W. Wickersham

1982-83 Low-power vehicle unit is established.

First Year: Pursue funding for parking facilities.

Examine routing needs for utilitarian travel.

Complete routing material for presentation and distribution.

Complete spot improvements.

Complete parking requirement analysis and recommend action.

1983-84 *Second Year:* Begin parking facility construction.

Begin analysis of roadway designs and specifications.

Prepare skills instruction program. Prepare material schedule.

1984-85 *Third Year:* Complete parking facility construction.

Begin analysis of traffic codes. Complete analysis. Recommend action.

Begin market survey of transportation needs of potential bicycle/moped users. Compile data.

IX. RIDESHARING

Recommendations
Anticipated Results
Background
Energy and Cost Analysis
Implementation

When the well's dry, we know the worth of water.

Benjamin Franklin

RIDESHARING

OBJECTIVES

- Support Seattle/King County Commuter Pool ridesharing programs that:
  - -- Promote ridesharing in King County
  - -- Increase ridesharing opportunities as a public transportation option
  - -- Establish operation of over 1,000 vanpool groups as part of a comprehensive ridesharing program.
- Support maximum use of paratransit operation for commuter travel as well as for use by noncommuter groups wherever possible.

APPROACH

- Provide ridesharing and paratransit programs as a basic part of the public transportation system.
- Draw financial support from all jurisdictions receiving services; use federal, state, and local funds allocated for transportation services.
- Seek support from Metro for vehicle purchase and program operation.
- Operate the program under an organization with a high level of public accountability and potential revenue-generating capability.

COSTS

- Approximate program operating costs: $500,000 annually.
- Capital costs for purchase of vans: $25.2 million. Fees collected under vanpool program repay investment capital.

BENEFITS

- Reduced congestion at peak periods; 8,500 fewer vehicles on roadway.
- Petroleum use reduced by more than 119,000 barrels per year by 1990.
- Significant reduction in air pollutants emitted by automobiles.

MANAGEMENT

- City of Seattle or Metro manages the ridesharing program.

SCHEDULE

- 1982-90 Purchase vans.
- 1982-90 Operate program.

RIDESHARING

RECOMMENDATIONS

ENERGY, Ltd. supports the current efforts of the Seattle/King County Commuter Pool in promoting ridesharing through carpools, vanpools and other energy-efficient modes of travel. The following recommendations are offered to ensure that ridesharing opportunities increase as a public transportation option in King County:

1. Ridesharing and paratransit programs should be provided as a basic part of the public transportation system. By 1990, over 1,000 vanpool groups should be operating as part of a comprehensive ridesharing program.

2. Financial support for ridesharing/paratransit programs should continue from all jurisdictions receiving or potentially receiving services. Revenues drawn from should include federal, state, and local funds allocated for transportation purposes. Support from Metro for both vehicle purchase and program operation should be pursued.

3. Ridesharing/paratransit programs should be operated under an organization with a high level of public accountability and potential revenue-generating capability. Reasonable options are the continued operation of Commuter Pool under the City of Seattle, with specific contracts for service with Metro or operation under Metro.

4. Paratransit operation should be fully utilized. Vehicles used for commuter travel should be available for noncommuter use by groups whenever possible.

ANTICIPATED RESULTS

Over six million person-trips in King County would be taken in vanpools by 1990. This would result in:

- Reduced congestion--8,500 fewer vehicles on the roadway at peak periods
- Reduction in petroleum use of over 119,000 barrels per year in 1990
- Significant reductions in air pollutants emitted by automobiles.

BACKGROUND

The Seattle/King County Commuter Pool provides comprehensive services to encourage ridesharing among commuters. The scope of services provided has expanded considerably since the Pool's inception as part of the Seattle Engineering Department in 1974. The primary services offered now include:

- Computerized rideshare matching
- Operation of vanpool program
- Development of incentives for private sector vanpooling/carpooling
- Promotion of flexible working hours
- Introduction of legislative initiatives including accomplishments such as:
  - Rideshare Act, 1979: Defines ridesharing, exempts rideshare vehicles from for-hire status, authorizes use of public fleets for public employee ridesharing
  - 1980 legislation exempts vans purchased for vanpool use from retail sales tax/use tax and from yearly motor vehicle excise tax
- Development of park and pool lots
- Development of parking management strategies to promote high occupant vehicle parking
- Operation of self-supporting buspool program from Tacoma to Seattle
- Rideshare marketing
- Dual use of vans for group use during noncommuting hours.

This comprehensive approach to ridesharing is effective in encouraging commuters to use a more efficient mode of travel. Three self-supporting buspools operate between Tacoma and Seattle. During the second quarter of 1980, 45 vanpools with 532 participants were in operation. The rideshare match file now has almost 18,000 participants. These statistics lend evidence to the public interest in ridesharing activities, an interest which is increasing with rising fuel costs and petroleum supply instability.

The need for comprehensive commuter services in encouraging ridesharing is not expected to decrease. Given current land use patterns, demographic shifts in resident population, and the housing scarcity in Seattle, residential growth is anticipated to be more rapid in King County and employment growth more rapid in Seattle. A growth in commuter travel will result. At present, over 30 percent of all trips are commuter trips.

According to the Metro Transition Phase IV Technical Report (August 1980) commuter trips in King County are expected to increase from 1.05 million trips per day to 1.104 million trips per day by 1990. Due to the scattered low-density termination points of most commuter trips, only 20 percent of these trips can be taken by bus. Without a ridesharing option, the remaining 80 percent would be taken in private automobiles.

All things are cheap to the saving, dear to the wasteful.

Benjamin Franklin

From an energy perspective alone, it is important that a ridesharing option be available for commuter travel. Vanpooling is a particularly desirable option. Compared with an average commuter trip by automobile, a trip by carpool can save up to 4,700 Btu per passenger mile and a trip by vanpool, up to 7,970 Btu per passenger mile. Bus travel conserves only 2,000 to 2,800 Btu per passenger mile. Ridesharing options also have positive side effects, including reduction in roadway congestion (leading to further energy savings from smoother traffic flow) and reductions in harmful air pollutants.

Prior to formalizing recommendations, ENERGY, Ltd. attempted to answer the following questions:

- Should commuter services, particularly vanpooling, be a public transportation service or can the private sector provide for itself?
- If commuter services are to be part of public service, where should the operation be housed, under which jurisdiction or organization?
- How should the funds for capital and operating costs be generated?

In answer to question number one: Vanpools are the most energy-efficient mode of commuter travel available locally for the short-term future; it is in the public's interest to promote the use of vanpools as a desirable commuter travel option until land use patterns change or modes of travel change. Providing for vanpool services as a part of public transportation involves two methods: actual purchase of vehicles and administrative operation of vanpools and/or marketing of vanpooling through private incentives and provision of technical assistance. To explain this issue, it is helpful to describe the current vanpool operation. Under the current program, as operated by the Commuter Pool, private sector involvement is encouraged in three primary ways:

- Providing "Do-It-Yourself" kits for individuals and employers interested in vanpooling. The kits explain vanpooling as legally defined and outline the incentives for vanpool operation by the private sector.
- Providing technical assistance to employers willing to sponsor a ridesharing option.
- Providing information to employers and their employees on the availability of publicly purchased vans for use as vanpool vehicles. Under this program, publicly owned vehicles are used for commuter travel.

  Volunteer drivers meeting specified requirements transport riders to employment areas. Riders pay monthly fares. Drivers do not pay a fare, but are charged for personal use of vans on a mileage basis. Participant fees pay all costs for purchase of vehicles, maintenance of vehicles, and insurance. Riders can be matched through a public rideshare match service.

All these methods are necessary for comprehensive ridesharing under a vanpool program. Once they are aware of the incentive options, larger firms can commit the resources for investment in vehicles and for operation of their own programs, but smaller firms frequently cannot. A publicly sponsored vanpool program is the only means of ensuring that employees of small firms have access to the vanpool option.

The considerations given to the organizational options and to the financing options raised in questions two and three above are discussed under the Implementation section.

Although ENERGY, Ltd.'s recommendations relate to the support of publicly provided commuter transportation, it is also recognized that the vehicles used should be available for noncommuter use whenever possible. For example, under current Commuter Pool services, the Norwest Day Center for Adults has midday access to two 15-passenger commuter vans used by Honeywell employees. The vans are used to transport elderly and handicapped adults and are returned for the evening commuter travel.

The present policy foundation for commuter ridesharing is limited. The Seattle 2000 goals include ridesharing encouragement. Resolution 25899, adopting transportation goals and interim policies, references car- and vanpooling as a low-cost alternative for reducing peak traffic volume. The ENERGY, Ltd. recommendations provide a basis for policy direction.

ENERGY AND COST ANALYSIS

ENERGY

Putting an average of 9-10 passengers into one vehicle for a daily trip averaging 45 miles in length would provide enormous savings. However, as a proportion of the total energy consumed in the transportation sector, the energy savings possible from a comprehensive ridesharing program, including an aggressive vanpool program, diminishes in scale. This points out the need for continued attention to transportation strategies.

From an energy perspective, measures such as the comprehensive

ridesharing programs are critical transition measures. They are necessary to reduce the consumption of depletable energy resources while we move toward renewable fuel types and progressive transportation modes. None of the ultimate changes, such as new technology or land use pattern changes, will happen in the immediate future. Interim or transition measures are critical--but must not be viewed as a total solution.

The estimation of the energy savings potential of ridesharing programs is based on three general assumptions:

- Energy savings, for purposes of this proposal, are limited to an estimation of energy saved from an aggressive vanpool program.
- The goal of the vanpool program is to have 1,000 of the commuter trips each day be traveled by vanpool in King County in 1990.
- Additional energy savings derived from the reduced roadway congestion, which allows smoother traffic flow, are not calculated.

Further specific assumptions are necessary before the energy savings estimate can be clearly made:

- The average vanpool passenger load is 10.
- The average occupancy of vehicles for commuter trips is 1.2 persons.
- By 1990, the fuel efficiency of a van will be 15 mpg and the fuel efficiency of an average passenger vehicle will be 18.5 mpg.
- There are 250 average weekdays in one year.
- The average vanpool trip is 35 miles.

Given the above assumptions, each vanpool vehicle would conserve approximately 3,400 gallons of petroleum fuel in 1990. For 1,000 vanpool groups, the resultant saving equals approximately 81,000 barrels of petroleum, or roughly six-tenths of one percent of the fuel estimated to be used for transportation in 1990.

COSTS

The costs for an expanded commuter pool operation can be roughly divided into ongoing program costs such as personnel and supplies, and overhead and capital costs for purchase of vehicles.

The annual costs, including personal services, program materials, and overhead for 11 staff, are estimated at approximately $500,000. In order to reach the goal of 1,000 vanpool groups by 1990, it will be necessary to include replacement vans as well as original-purchase vans in the calculations. It would be necessary to purchase 1,500 vans between 1982 and 1990 to ensure that 1,000 vehicles were operational.

		TOTAL COST
1982	200 vans	$2,400,000
1983	100 vans	1,200,000
1984	100 vans	1,200,000
1985	100 vans	1,200,000
1986	100 vans	1,200,000
1987	100 vans	1,200,000
1988	120 vans	1,440,000
1989	380 vans	4,560,000
1990	300 vans	3,600,000
		$25,200,000

In these calculations, a van is assumed to cost approximately $12,000 in 1980. In constant dollars, $25,200,000 is necessary in order to purchase 1,500 units. These figures do not include resale values.

IMPLEMENTATION

MANAGEMENT

Because ENERGY, Ltd. recommends that ridesharing services, particularly vanpool operation and services, be part of basic public transportation, it is necessary to recommend under which jurisdiction the services operation should be housed. At present, the Seattle King County Commuter Pool is a part of the Seattle Engineering Department. ENERGY, Ltd. recommends that the operation be under a jurisdiction with public accountability and with the ability to generate revenues for initial vehicle capital investment and ongoing administrative support. ENERGY, Ltd. recommends two options:

- *Continued operation under the City of Seattle with contractual ties to* Metro for funding
- Operation under Metro.

The advantages and disadvantages of the options are outlined below:

City of Seattle

Advantages

- Public accountability is provided through Mayoral and/or Council review.
- Revenue for vehicle purchase can be raised through short-term

financing, if necessary. More importantly, the City receives federal and state funds for transportation purposes. Commuter pool operation is a legitimate purpose.

- Under contractual relationship with Metro, service provisions and financial arrangements could be negotiated. Vanpooling is a suggested program under the Metro Transition Plan.

Disadvantages

- The City does not have a strong role in providing transportation services. Therefore Commuter Pool may not receive the full attention or support necessary for aggressively increasing the program.

Metro

Advantages

- Financing for paratransit option is more ensured with Metro. State transportation funding, as well as federal funding, can be used for paratransit. Local tax-based revenues are in place.

- Metro provides a full range of transportation services. The purposes of commuter programs are compatible with Metro in that sense.

Disadvantages

- Public accountability is provided through the Metro Council. Because this is comprised of elected officials with an already full slate of responsibilities, specific programs may not receive attention unless assigned to a subcommittee.

- Metro provides transportation services, but only fixed-route, fixed-schedule services. To include commuter services on a nonfixed route and nonfixed schedule would entail a departure from standard operations.

- Union conflicts may be encountered. If federal funds (e.g., from the Urban Mass Transportation Administration) were to be used for the purchase of vehicles or service operation, union agreement would be necessary. Paratransit operations are carried out primarily with unpaid drivers on no specific schedule. This may present a conflict.

FINANCING

ENERGY, Ltd. anticipates that state and federal funds will be available to support the continuing development of ridesharing services. Although these are limited at present, the Urban Mass Transportation Administration (UMTA) recently ruled that vanpool vehicles can be purchased under UMTA funding. Because vanpool programs are self-supporting with rider fares, either Metro or the City of Seattle should consider short-term financing.

The Metro Transition Plan includes the purchase of 1,500 vans (including replacement vans) between 1981 and 1990. While it is not explicitly stated that these vans will have a flexible schedule for vanpooling, it is assumed that they would operate in a vanpool under the Seattle/King County Commuter Pool. If Metro secures funds from the sales tax for implementation of the Transition Plan, this source could provide much of the funding. The bulk of the capital necessary for a comprehensive ridesharing program is used in vehicle purchase for a vanpool program.

SCHEDULE

Because the Seattle/King County Commuter Pool currently operates a full range of programs, and these recommendations relate merely to the need to support and expand those services, the scheduling discussion is applicable only to van purchases under an expanded vanpool program. This schedule is shown in the preceding discussion of costs.

X. FUEL EFFICIENCY THROUGH EMISSION INSPECTION

Recommendations
Anticipated Results
Background
Energy and Cost Analysis
Implementation

Pollution is nothing but the resources we are not harvesting.

Buckminster Fuller

FUEL EFFICIENCY THROUGH EMISSION INSPECTION

OBJECTIVES

- Improve the fuel efficiency of passenger vehicles.

APPROACH

- Develop and distribute jointly with King County a checklist for fuel-efficient measures for different classes of vehicles.
- Distribute checklist to all drivers of vehicles that undergo emission inspections in King County.
- Explore feasibility of conducting energy efficiency and emission inspections on public fleets. If feasible, institute a pilot program.
- Seek funding for classes on fuel-efficient vehicle maintenance, alternative transportation modes, and efficient driving skills to be conducted through the Washington Energy Extension Service.

COSTS

- Material for checklists on fuel-efficient maintenance: $20,700 annually.
- Pilot program for emission inspection: $55,000 annually.
- Transportation-related classes: $56,000 annually.

BENEFITS

- Savings of 125,000 gallons of oil per year.

MANAGEMENT

- City Energy Office and King County Executive Office develop the maintenance checklist. The Washington State Department of Ecology distributes the lists.
- Department of Administrative Services explores the feasibility for fuel efficiency emission inspections.
- City Energy Office and King County Executive Office seek funding for classes to be offered through the Washington Energy Extension Service.

SCHEDULE

- 1981 Determine the feasibility of testing for fuel efficiency through emission inspections. If feasible, carry out the pilot project and begin public inspections in 1983.
- 1982 Complete and distribute checklist for energy-efficient maintenance procedures.
- 1983 Begin classes in transportation alternatives and vehicle maintenance.

FUEL EFFICIENCY THROUGH EMISSION INSPECTION

RECOMMENDATIONS

To improve the fuel efficiency of the passenger vehicle fleet, ENERGY, Ltd. recommends the following:

1. Develop and distribute jointly with King County a checklist for fuel-efficient maintenance measures for different classes of vehicles. Distribute the checklist to all drivers of vehicles inspected for emission in King County. City of Seattle Energy Office should lead development of the checklist with funds from a demonstration grant.

2. Examine feasibility of conducting energy and emission inspections for public fleets, specifically, Seattle and King County fleets. The City of Seattle should lead examination of feasibility. Should the energy inspections prove feasible, the City should pursue a pilot program, under state or federal funding, for public fleet energy inspections. Voluntary inspections would be available, for a fee, for private vehicles.

3. Pursue funding for transportation-related classes to be conducted in King County under the Washington Energy Extension Service. City of Seattle and King County should urge incorporation of classes for fuel-efficient vehicle maintenance, alternative transportation modes and efficient driving skills in the Extension Service's class schedule through representation on the local government advisory committee to the Washington State Energy Office.

ANTICIPATED RESULTS

Savings of 2,970 barrels of oil per year would be achieved by 1983.

BACKGROUND

Surface modes of transporting goods and people require a large quantity of energy--over 32 percent of the energy used in Seattle, as reported in the ENERGY, Ltd. Data Base. Over 75 percent of that energy was estimated to be consumed by private vehicles. Only a trace of the energy used in transportation is renewable. Close to the entire block of energy used in transportation is petroleum derived--an exhaustible fuel.

Given that land use patterns and life styles change very gradually, it is anticipated that there will be only minimal changes in travel demand over the next 10 years. It may be possible to make technological advances in the modes of travel, but private petroleum-fueled vehicles will still remain the predominant mode of travel for the foreseeable future. Petroleum-fueled vehicles should be viewed as transitional vehicles. As such, it is necessary to keep them operating at maximum efficiency until other technologies become commercially available.

Maximizing the efficiency of the private passenger fleet is a formidable task. The Energy Policy and Conservation Act (EPCA) of 1975 established fuel efficiency standards for corporate new car fleets. With the establishment of these standards, new cars are produced with specific fuel efficiencies that are posted on the vehicles when distributed. The consumer has information on the fuel efficiency that the post-1975 vehicle is supposed to attain and can monitor the mileage and fuel consumption against a standard.

Seventy-two percent of the private vehicle fleet for 1979 in Washington was over five years old and was not subject to the EPCA fuel efficiency standards. The owners of these vehicles do not know when the vehicle is performing at top fuel efficiency.

Short of banning the operation of all pre-1975 vehicles, or of initiating state legislation instituting economic disincentives for ownership of fuel-inefficient vehicles, there is little local government can do to ensure the improvement of the fuel efficiency of private vehicles. Voluntary local educational programs are a solution, given the lack of control local government has over either the fuel or the vehicles. What sort of voluntary educational programs can be effective? How can an educational effort reach the maximum audience?

After purchase, the fuel efficiency of vehicles depends on several factors; the major ones are proper maintenance, weight of vehicle or load, driving patterns, and roadway conditions. The first three can be influenced by the driver/vehicle owner. Providing information on and demonstrating fuel-efficient means of addressing these criteria can affect the fuel efficiency of the private passenger fleet.

Under RCW 70.120 and WAC 173.422.040, vehicle owners will be a captive audience standing in line as vehicle emissions are tested against air quality standards. This mandatory inspection program (voluntary for six months prior to January 2, 1982) will be in place in King and Clark Counties by January 1982. The program of emission inspections and maintenance is required in areas which are not in compliance with air quality standards established in the Clean Air Act of 1977.

Under the mandatory emission inspection program, all private passenger vehicles under 15 years of age, except for new vehicles, must be tested for quality of exhaust emission. This entails a visit to an emission station where the exhaust is analyzed in approximately 30 seconds. If the

Remember when atmospheric contaminants were romantically called stardust?

Lane Olinghouse

exhaust meets the standard, a certificate is issued. If the exhaust does not meet the standard, the owner is required to perform or have performed maintenance measures, costing not more than $50.00, to improve the quality of emission. The vehicle exhaust must meet the standard or the vehicle owner must demonstrate that $50.00 was spent on maintenance measures before a certificate can be issued. The certificate is necessary for registration.

The emission inspections are to be conducted by a private contractor under the administration of the Washington State Department of Ecology. The inspections will take place with the engine on idle. A contract has been executed for the implementation of the inspections for four years, commencing in 1982. However, fleets of over 25 vehicles can be inspected independently as long as emission standards are complied with. Government fleets with one-time registration are exempt from emission-testing requirements.

How does this information on emission inspections relate to increasing fuel efficiency? Emission inspection programs can contribute to vehicle fuel efficiency in several direct and indirect ways.

- Maintenance measures necessary to pass the emission inspection test will be likely to contribute to the fuel-efficient operation of the engine.

- Vehicle owners whose vehicles do not pass inspection will be receptive to suggestions on specific maintenance. While information on maintenance to pass the emission inspection is most pertinent, information on fuel efficiency adjustments will also be effective at this point. WAC 173.422.040 states that relevant information will be distributed at test stations.

- While public fleets are exempt from the emission inspection requirement due to different vehicle registration requirements, emission inspections are voluntarily taking place. Under loaded conditions (using a dynamometer) an energy efficiency test can also be performed. Information from this test reveals how efficiently an engine is performing.

- Because maintenance will have to be performed on vehicles which do not pass emission inspections, self-help vehicle maintenance classes will become important. Vehicle maintenance classes can focus on fuel-efficient tune-ups as well as emission improvement procedures.

Movement toward an energy efficiency test, combined with an air quality emission test, is a possible direction. Before heading in that direction the City needs better information and a pilot stage project. There are several reasons for proceeding cautiously toward initiating a state legislative change to include energy efficiency inspection as a part of mandatory emission inspections:

- The fuel efficiency testing procedure is not yet commercialized. Hamilton Test Systems has developed a means for testing emissions through a computerized measurement of emission levels and mass, but it is not commercially available. Pilot projects would be appropriate at this stage, but not mass use of the test system.

- The statistics on the number of vehicles which would not pass the energy efficiency inspection are unknown.

- Information on the potential increase in fuel efficiency for vehicles tuned-up for energy efficiency, in addition to the tune-up for air quality emissions, is not available.

- Costs for the energy-efficient inspection, if done on a mass basis, would increase the cost of an air quality emission inspection by only 25-50 cents. However, small scale applications of the fuel efficiency test would be considerably more expensive than emission inspections because of the additional equipment needed.

- The City has equipment in place for completing air quality emission inspections for its fleet. Therefore, the cost of new equipment must be justified by the additional benefits. The City fleet is on a routine maintenance schedule. It is not known whether testing for fuel efficiency and resultant maintenance recommendations would make any significant differences in existing maintenance procedures. The City may already be performing maintenance necessary for fuel efficiency on a routine basis.

ENERGY AND COST ANALYSIS

ENERGY

In order to determine the energy savings to be accrued as a result of implementing these recommendations by 1990, several speculative assumptions must be entertained:

- A five percent increase in fuel efficiency can result from proper maintenance of a vehicle. (Hamilton Test Systems estimates an increase as high as 10 percent. The Environmental Protection Agency estimates five percent.)

- Vehicle registrations will increase at a rate of six percent annually.

- 1.42 million passenger vehicles will be registered in King County by 1983. Excluding 72,000 new vehicles (6 percent) and 198,000 vehicles over 15 years of age (14 percent), 1.28 million vehicles will be tested for emissions. (According to provisions of RCW 70.120 and

WAC 173.422.040 the vehicles designated above are excluded from consideration.)

- Of the vehicles tested, 384,000 (30 percent) will fail the emission test and will require maintenance. (30 percent is the proportion anticipated to fail under Department of Ecology rules.)
- An additional one percent of those passing the emission test will have maintenance done to improve fuel efficiency.
- Fuel efficiency of the passenger fleet in 1983 will be approximately 15 mpg.
- A passenger vehicle in King County is assumed to travel an average of 10,000 miles annually.
- The 5,000 vehicles in the public fleet are assumed to meet EPA established standards of 22 mpg.

Drawing upon all of these assumptions, a savings of 2,970 barrels of petroleum is possible through encouraging vehicle owners to practice energy-efficient maintenance. 2,970 barrels is a very small fraction of the over 14 million barrels of fuel consumed in 1977, as reported in the ENERGY, Ltd. Data Base.

COSTS

Costs for these recommendations are difficult to estimate. The Hamilton Test Systems mechanism and procedure for fuel efficiency testing of exhaust emissions is not available commercially. While they estimate that the cost of the system would increase normal emission inspection by 25-50 cents per inspection (current cost in Washington State is $8.75 per inspection), this estimate is based on a large inspection program and would not necessarily hold with small scale implementation.

Costs for developing material on energy-efficient inspection are not as difficult to estimate. The costs for developing and conducting classes will vary, but hands-on classes are much more expensive than lecture classes.

Estimates of costs are outlined below:

- **Material for Fuel-Efficient Maintenance**

Development of Checklist	$ 200
Graphics	500
Printing	20,000
	$20,700

- **Pilot Program: Emission Inspection of City Fleets**

Assume $9.25 cost per vehicle includes equipment, labor and overhead.

Total Cost: $55,000 for public fleets.

The cost to the public per inspection is $5.20, based on the following assumptions:

Assume 4,000 vehicles are inspected. Ten vehicles are inspected per hour.

Assume the inspection station is open to the public one day per week.

Assume $50.00/hour covers the labor, operations and overhead costs of the inspection.

- **Classes on Transportation**

Assuming there is one full-time resource person developing lecture-based classes, the following are the estimated costs:

Personal Services	$35,000
Material Supplies	5,000
Indirect (40%)	16,000
	$56,000

IMPLEMENTATION

MANAGEMENT

The implementation is presented by category of recommendation:

- **Material for Fuel-Efficient Maintenance**

The Seattle Energy Office, with King County, will be responsible for developing and reproducing checklists for energy-efficient maintenance procedures. The Department of Ecology will distribute the checklists through the emission test stations.

- **Energy Efficiency Emission Inspection**

The City of Seattle Department of Administrative Services (DAS) will determine whether energy emission inspections for public fleets are feasible. If they prove feasible, DAS would pursue funding for a pilot project. If funding is secured, the inspections will also be part of DAS responsibilities.

- **Transportation Classes**

  Both the Seattle Energy Office and the King County Executive Office will share the responsibility for advocating inclusion of transportation classes in the Energy Extension Service programming. The conduct of classes would be carried out through the Energy Extension Service based in King County.

SCHEDULING

The scheduling of these recommendations is as follows:

- **Fuel-Efficient Maintenance Checklist**

  1981 Develop proposal for funding.
  Submit proposal.
  1982 Develop checklist, complete graphics and printing.
  Distribute checklist.

- **Energy-Efficient Emission Inspection**

  1981 DAS explores feasibility.
  1982 If feasible, develop proposal for pilot project.
  Submit proposal to energy transportation sources.
  1983 If funding is available, purchase equipment, train staff, begin inspections.

- **Transportation Classes**

  1981 Advocate inclusion of transportation classes.
  1982 Develop work program for classes. Develop resources.
  1983 Begin classes.

There's just on thing to remember about driving any automotive apparatus and that is this: when the car begins to act as though it had the blind staggers it's time to get out and put a bullet through its head.

Henry Miller

XI. ALCOHOL FUEL DEMONSTRATION PROGRAM

Recommendations
Anticipated Results
Background
Energy and Cost Analysis
Implementation

An era can be said to end when its basic illusions are exhausted.

Arthur Miller

ALCOHOL FUELS DEMONSTRATION PROGRAM

OBJECTIVES

- Expand use of renewable fuels as displacement for petroleum fuels in public fleets.

APPROACH

- Conduct vehicle testing program as part of this study. based on woody and other cellulosic resources of western Washington.
- Conduct and alcohol vehicle testing program as part of this study.
- If feasible, encourage construction of alcohol production facilities to meet the liquid fuel demand for King County, City of Seattle, and Metro fleets by 1990.

COSTS

- Anticipated costs for the feasibility study, including the vehicle testing program, total $1.3 million.
- Estimates of production plant costs and vehicle conversion cost would be made as part of the feasibility study.

BENEFITS

- The conversion of 100 percent of the public vehicle fleet by 1990 would conserve 20 million gallons of petroleum fuel annually.
- Public sector would assume leadership role in incorporating new technology.

MANAGEMENT

- Feasibility study is conducted as joint venture by Metro, City of Seattle and King County.
- Management beyond the feasibility study to be determined during the study.

SCHEDULE

- 1981-83 Conduct feasibility study.
- 1984-85 Dependent on feasibility study, begin construction of production plant. Complete construction in 1985.
- 1985-90 Convert vehicles and purchase new vehicles to run on ethanol.

ALCOHOL FUELS DEMONSTRATION PROGRAM

RECOMMENDATIONS

The ENERGY, Ltd. Citizen Committee recommends the following:

1. Conduct a feasibility study of alcohol fuel production based on woody and other cellulosic resources of western Washington. Conduct an alcohol vehicle testing program, for both diesel buses and gasoline-powered cars and trucks, as part of feasibility study.

2. If technically, economically and environmentally feasible, construct alcohol production facilities to meet the need for liquid fuels of the City, County and Metro fleets. Alcohol fuels should be produced or otherwise procured in sufficient quantities to fuel 10 percent of the fleets by 1985 and 100 percent of these fleets by 1990.

ANTICIPATED RESULTS

Converting 100 percent of the vehicle fleets by 1990 would reduce the use of nonrenewable petroleum fuels by 20 million gallons per year.

The capital costs of a production facility would be $60-90 million. Perhaps as much as half of this could be covered by federal cost sharing.

Estimates of the cost of vehicle conversion range from $400 to convert a small four-cylinder engine to run on ethanol, to $1,450 to convert an eight-cylinder truck engine to run on methanol.

BACKGROUND

The largest single end use for fossil fuels is in the transportation sector. In Seattle, nearly 32 percent of the total energy used is consumed by our cars, trucks and buses burning gasoline and diesel fuels. Considerable progress is being made in improving the efficiency of these vehicles, thus substantially reducing the demand for petroleum fuels. Even so, these fuels are running out, their price is rising dramatically and there is a need to find replacements.

A number of possible replacement fuels have been examined by staff and consultants for the ENERGY, Ltd. project. Those examined in detail were hydrogen, methane, methanol and ethanol. The examination of these alternatives has made clear the reasons why petroleum fuels have been so widely adopted. Gasoline and diesel fuels have a number of physical properties which make them attractive transportation fuels. They are easily stored liquid fuels which have high heat content per gallon. Any alternative fuel would need to have similar properties. To date, analyses indicate that only the alcohol fuels have sufficiently desirable properties to be a viable short-term substitute for gasoline and diesel fuels.

Alcohol fuels are currently being produced in substantial quantities from natural gas and crop feedstocks. The former is obviously not a renewable alternative, and the latter may pose a threat to food prices and supply. However, alcohol fuels can also be produced from woody or other cellulosic feedstocks. In fact, these feedstocks represent the largest single renewable source of alcohol fuels.[1]

It appears possible to convert woody feedstocks, such as mill wastes, forest slash, noncommercial hardwood species and trimmings into either methanol or ethanol fuels with an overall conversion efficiency between 35 and 48 percent. These overall efficiencies are considerably degraded, however, if anhydrous alcohols (no water) are produced as opposed to 180 or 190 proof hydrous alcohols. Anhydrous alcohol is required only to make gasoline/alcohol mixtures, commonly referred to as gasohol (10 to 20 percent alcohol--the rest, gasoline). Gasohol seems to be an undesirable end use for alcohol because of the greater energy required to produce the anhydrous form of alcohol. In addition, because gasohol is intended for use in unmodified engines, the alcohol fraction of the fuel is not burned efficiently or cleanly.

Substantial woody and other cellulosic resources are available in western Washington for alcohol fuel production. The question is: How can the City stimulate the development of an alcohol fuels industry and promote the use of alcohol fuels in the transportation sector? The principal barriers to the production and use of alcohol fuels are the uncertainties regarding the cost of production from cellulosic feedstocks and the performance of vehicles run on hydrous alcohol. The City can take the lead in removing these uncertainties by developing a commercial alcohol plant and using the alcohol to fuel the municipal fleet and other public fleets. The existence of a plant producing reasonably priced alcohol, with a large number of vehicles being fueled by it, should remove most of the market's doubts.

To determine whether or not the technology is ready to produce competitively priced alcohol and adequate performance by alcohol-fueled vehicles, a feasibility study should be designed to answer the following questions:

- Can woody resources be recovered in sufficient quantity and at a low enough price to supply a commercial scale plant?

[1] ENERGY, Ltd., *Energy Data Base*, January 1980, pp. 102-105, 145-146.

- Can these resources be recovered without causing environmental damage?
- Are environmentally acceptable sites available for an alcohol plant?
- Can a plant be constructed using available technologies that will produce alcohol at a competitive life cycle cost?
- Can the vehicles in public fleets be run reliably on an alcohol fuel without significantly increasing the complexity of fleet operation?
- What would be the best financing and ownership arrangement for an alcohol fuel plant?

The first step is to determine how much alcohol fuel would be required by the City of Seattle, King County and Metro if they were to convert their fleets to run on alcohol. These fleets currently consume approximately three million gallons of gasoline and eight million gallons of diesel fuel. Almost all of the diesel fuel is consumed by Metro's bus fleet. Metro is currently expecting to double its diesel fuel consumption by 1990.

Assuming that all the vehicles in these fleets could be converted to run on alcohol, then by 1990 they would require either 31 million gallons of ethanol per year or 40 million gallons of methanol per year.[1] In order to achieve the Citizen Committee's stated goal to fuel, if feasible, these public fleets by 1990, a number of steps will have to be taken:

- Build a plant or series of plants to produce either ethanol or methanol from woody resources.
- Secure sufficient long-term supplies of woody feedstock for the plant.
- Convert the vehicles in the fleet to run on either ethanol or methanol.

ALCOHOL PRODUCTION TECHNIQUES

Habit is the easiest way to be wrong again.

Laurence J. Peter

It is possible to produce both methanol and ethanol (both alcohols) from woody or cellulosic feedstocks.The procedures and technology, however, are quite different. In the case of ethanol production, both enzyme hydrolysis and acid hydrolysis processes are available which convert the cellulose portion of woody feedstocks to sugars which then can be fermented to form ethanol. Acid hydrolysis is the traditional form of the technology which has been in use during much of this century. Traditional acid hydrolysis technology is not economically competitive, but new forms of the acid hydrolysis process utilizing steam explosion or extrusion techniques are being developed which will substantially reduce the price of the alcohol produced. Enzyme hydrolysis uses a strain of bacteria to accomplish the same task of converting cellulose to fermentable sugar. This technique may result in even less-expensive alcohol production than the advanced acid hydrolysis processes.

The technologies available for converting woody feedstocks to methanol are an outgrowth of technologies which have been developed to produce methane and methanol from coal. The procedure involves subjecting wood chips to high temperatures in an environment without oxygen to support combusion. The wood chips are converted to a mix of gases containing carbon dioxide, hydrogen, methane and others. This gas mixture is exposed to a series of catalysts which results in its conversion to liquid methanol.

At this point, it appears that ethanol production has some advantages over methanol production for serving the local public fleets. Methanol production requires a relatively large facility producing at least 15 million gallons per year and perhaps as many as 40 million gallons per year in order to achieve reasonable fuel production costs. An ethanol plant producing three-five million gallons per year could still produce ethanol at a reasonable price. The possibility of building a number of small ethanol facilities over the next 10 years offers two advantages. First, ethanol production could be increased slowly to match the rate at which vehicles in the public fleets are converted. Second, these smaller plants could be sited in a pattern which minimized the transportation distances for the woody feedstocks. It does, however, appear that methanol could be produced somewhat more cheaply than ethanol.[1] It is not clear whether the lower costs would outweigh the advantages of smaller scale ethanol plants. These competing technologies should be examined further prior to any final decision on building an alcohol plant.

SOURCES OF WOODY FEEDSTOCKS

The required amount of woody feedstocks will depend on the choice between ethanol and methanol technologies since these have substantially different conversion efficiencies. The energy content of the ethanol produced is approximately 35 percent of the energy content of the woody feedstock. Methanol can be produced with conversion efficiencies of approximately 48 percent. The woody feedstock required, if the fleets were completely converted by 1990, would be 475,000 oven-dry tons per year for ethanol production and 350,000 oven-dry tons per year for methanol production.

It is necessary to demonstrate that these quanitities of woody resources can be recovered, transported and delivered to a production facility at a reasonable price and without causing unacceptable environmental damage. There are a number of resources which might be used:

[1] Because methanol contains fewer Btu/gallon than ethanol, more gallons are required.

[1] Kramer, Chin and Mayo. *Renewable Fuels for Transportation*. Prepared for the Seattle Energy Office. September 1980.

- Forest slash which results from lumbering operations throughout the Puget Sound Region
- Noncommercial hardwood species such as alder and cottonwood growing on productive forest lands
- Waste wood from lumber mills, including sawdust, chips, and cut ends
- Portions of the solid waste stream, including tree trimmings and dead trees, logs removed from navigable waterways, yard wastes, pallets, and scrap wood from demolitions and other commercial wood wastes.

In a recent study, the Washington State Department of Natural Resources concluded that in King County alone 172,000 bone-dry tons of forest slash was on the ground in various lumbered areas of the county.[1] There may be more than 100,000 tons of woody wastes generated in Seattle each year from the combination of commercial wood wastes, yard wastes and logs removed from navigable waterways. Plantation growth of alder and cottonwood in the transmission corridors owned by Seattle City Light might produce 50,000 to 100,000 tons per year. The development of such plantations on other unproductive forest lands in King County could produce more, perhaps in the range of 100,000 to 500,000 tons per year.

VEHICLE CONVERSION

The final issue to address is whether the public fleet vehicles can be converted at a reasonable price. Recent analyses[2] indicate that spark ignition engines which currently run on gasoline can be converted to run on either methanol or ethanol. The conversion is somewhat more elaborate in the case of methanol because it is more corrosive than ethanol. Vehicle performance overall is comparable to that experienced with gasoline. Engine power is increased somewhat and emissions are generally reduced. Range with either of the alcohol fuels is less, due to the lower energy content per gallon. Mileage on a per gallon basis also decreases due to the lower energy content of alcohol fuels, but mileage on a per Btu basis increases because engines can be modified to burn more efficiently when run on alcohol fuels. Cold starting can be a problem, but there are methods available for achieving reasonable cold start behavior for alcohol-fueled engines.

The following modifications are required to convert engines to run efficiently on alcohol fuels:

- Replace seals and other engine parts which may be corroded by alcohol.
- Readjust carburetion and spark timing.
- Replace spark plugs with cooler plugs.
- Install cold start system.
- Increase compression ratio.

The case for conversion of diesel engines is not as clear cut. A number of conversion approaches are being tested. The Cummins Company is experimenting with a dual-fuel engine which involves the injection of alcohol into the combustion chamber along with diesel fuel in approximately a 50-50 ratio. Mercedes Benz is testing diesel engines run on a combination of ethanol and soybean oil. MAN of Germany is planning to test 12 methanol-powered buses in the fall of 1980. Diesel conversion needs to be examined further before a decision is made to build production facilities capable of fueling the local bus fleet.

ENERGY AND COST ANALYSIS

ENERGY

If the Seattle, King County and Metro public vehicle fleets were all converted to run on alcohol fuel, their use of nonrenewable petroleum fuel would be virtually elminated. The estimated yearly demand for petroleum fuel by these fleets in 1990 is approximately 20 million gallons. Thus, if all the fleets were converted by 1990, approximately 20 million gallons of petroleum fuels would be saved per year. This savings of nonrenewable energy would continue for the lifetime of the alcohol production facilities.

Things do change. The only question is that since things are deteriorating so quickly, will society and habits change quickly enough.

Isaac Asimov

COSTS

The federal government has begun to offer financial assistance for alternative fuel production facilities through the Energy Security Act of 1980 (also known as the Synfuels Bill). It is not clear at this time how much of the capital costs for production facilities might be shared. Assuming that a series of ethanol plants were built to meet the fleets' demand for alcohol, approximately $60-90 million would be required to cover construction costs. Perhaps half of this expense might be covered by federal cost sharing, but the estimate is purely speculative. The cost of fleet conversion will depend on how many vehicles designed to run on alcohol can be purchased over the next ten years. It will also depend on whether buses can be converted or whether it will be necessary to wait for bus engines which are designed to be run on alcohol.

Estimates of the cost of conversion range from $400 for a small four-cylinder engine to run on ethanol, to $1,450 for an eight-cylinder truck

[1] John Bergvall et al., *Wood Waste for Energy*, Washington State Department of Natural Resources, 1978.

[2] Kramer, Chin and Mayo, *Renewable Fuels for Transportation*. Prepared for the Seattle Energy Office, September 1980.

engine to run on methanol. It should be noted, however, that if autos and trucks were originally manufactured with the right characteristics, they could run on alcohol fuels with little or no additional costs for the engine. Some manufacturers are beginning to experiment with vehicles designed to run on alcohol.[1]

IMPLEMENTATION

MANAGEMENT

Metro should be given the lead for carrying out the proposed feasibility study. If buses can soon be run on alcohol, Metro would be the largest user. Metro needs to be closely tied to the work determining the feasibility of running buses on alcohol. In addition, Metro is a regional body providng a forum through which the other public fleets can collaborate on this effort. Decisions concerning who will manage construction of the plant--if built; who will own the plant; and who will operate it should be resolved as part of the feasibility study.

[1]Volkswagen is supplying the California Energy Commission with 25 Volkswagen Rabbits which are designed to run on methanol.

FINANCING

Expenses for the feasibility study, which include a vehicle testing program, should be covered by grant funds from the federal Department of Energy. The total expected budget is $1.3 million. Plant costs should be shared on a 50-50 basis with the Department of Energy through its cooperative agreements program. It is also possible that loan guarantees and price supports would be available from the federal Synthetic Fuels Corporation. The remaining capital costs and operating costs should be divided among the participating jurisdictions in proportion to the amount of fuel each uses.

SCHEDULE

The feasibility study should commence in the spring of 1981 and continue for approximately 24 months through the spring of 1983. A decision on whether to build the first alcohol plant would be made by the participating jurisdictions by the fall of 1983. Final plant design and plant construction should commence shortly thereafter, with the plant completed by the spring of 1985. A combination of vehicle retrofits and new vehicle purchases would prepare 10 percent of the public fleets to run on ethanol when the plant begins production. Fleet conversions and construction of additional production facilities would continue through 1990.

APPENDIX A -Analysis of Conservation and Solar Retrofit Strategies

Figures don't lie but liars figure.

Anon.

APPENDIX A
ANALYSIS OF CONSERVATION AND SOLAR RETROFIT STRATEGIES

A portion of the ENERGY, Ltd. work program has been devoted to the evaluation of 21 conservation and solar strategies which can be used to reduce the energy requirements of residential and commercial buildings. These 21 strategies were tested (as applicable) using computer simulation techniques* on three prototype residential buildings and four prototype commercial buildings. The technologies evaluated for each of the prototype buildings are listed below. It is important to note that the listing **does not** cover all the available conservation and solar technologies. A significant number of promising options have not been evaluated due to limitations on time and budget. In addition, the seven prototype buildings defined for this analysis cannot be expected to accurately reflect the enormous variety of residential and commerical buildings in Seattle. The analysis described in the appendix **must** be viewed as simply the first steps in a much larger work program devoted to evaluating the impact of all available conservation and solar technologies on Seattle's building stock. The technologies that have been evaluated are:

- Limiting of envelope leaks through weatherstripping and caulking of doors and windows
- Attic insulation: R-11 through R-38
- Wall insulation: R-13
- Floor insulation: R-11 and R-19
- Exterior storm windows
- Insulating shutters R-13
- Hot water pipe insulation
- Hot water tank insulation
- Hot water temperature setback, from 190° F to 120° F
- Hot water heat pumps (coefficient of performance [COP] of 1.8)
- Efficient bulbs, both incandescent and fluorescent
- Delamping
- Thermosiphon solar hot water heater
- Attached sunspace with concrete slab and rock bed storage
- Active solar space and water heaters, both air and liquid
- Ground-source heat pumps with and without solar assist (COP of 3.0)
- Well-source heat pumps (COP of 3.0)
- Flame retention burners
- Automatic flue dampers
- Electronic furnace ignition
- Automatic temperature setback (10° F during various periods depending on building type).

*Two computer simulation programs were used, SUNCAT and DOE-2.OA. SUNCAT is designed to evaluate passive solar and related technologies used in residential buildings. DOE-2.OA is designed to evaluate conservation technologies used in both residential and commercial buildings. In addition, the F-Chart technique was used to evaluate active solar space- and water-heating technologies.

SOLAR AND CONSERVATION PRODUCT REVIEW

The first step in this analysis was to accumulate information on the products and materials required to carry out the 21 conservation and solar strategies. Sixty-four products that are currently on the market were reviewed through contacts with local distributors and manufacturers. The following information was gathered for each:

- Price, both retail and wholesale or factory direct
- Performance data such as R value, collector efficiency or flow requirements
- Estimated lifetime and warranty period
- Maintenance requirements
- Installation costs
- Availability of large quantities.

For a complete listing of the products reviewed and the data on each, see *Residential and Commerical Building Retrofit Analysis,* a report prepared for the Seattle Energy Office by Mathematical Sciences Northwest, September 1980.

The 64 products reviewed are only a small fraction of the conservation and solar products which are currently available. It is possible that other products, not reviewed, might provide superior performance at a lower price. Further, many of these product lines are relatively new and rapidly evolving; substantial decreases in price and improvements in performance may materialize in the near future.

DEFINITION AND BASE CASE ANALYSIS OF THE BUILDING PROTOTYPES

The next step was to define the three residential and four commercial building prototypes. Figure A-A through A-G show the characteristics of the prototypes which were developed. These building types were chosen to

reflect the kinds of buildings found in the two example communities, Greenlake and Garfield. For example, the single family, woodframe structure of approximately 1,450 square feet with an unheated basement is the kind of residential building found in large numbers in these two communities and throughout the older neighborhoods of Seattle. Also shown in Figures A-A through A-G are the energy-relevant characteristics of these prototypes: heating and cooling system; levels of infiltration; internal loads, such as lights, hot water, and equipment which contribute to the heating of the buildings; electrical loads for hot water, lights and equipment; and the heat loss rates for various components of the building envelope.

Next, the base case heating, cooling and electrical requirements of each prototype were evaluated using the DOE-2.OA simulation package. The base case conditions in general represent a worst case for each prototype. For example, the single family prototype is assumed in the base case to have no insulation, except for two inches of old rock wool in the attic, and to have relatively high levels of infiltration. These conditions result in a total heating energy requirement of 90.3 millon Btu per year. By comparison, the average heating requirement of single family buildings in Seattle, (which have, on the average, the same square footage) is approximately 55 million Btu per year, as shown in the ENERGY, Ltd. Data Base. The DOE-2.OA stimulation package and the other simulation tools used predict building performance based on various approximations of Seattle climatic conditions: temperature, humidity, and solar radiation. Table A-1 summarizes the base case conditions of the seven prototype buildings.

In the table, the heating energy requirement refers to the amount of energy which must be supplied to the heated spaces within the building. The amount of purchased energy required by the building depends on the efficiency of the heating system. In the case of natural gas furnaces, for example, the efficiency would probably be 0.6 to 0.65 unless flue dampers or electronic ignition had been installed. The cooling energy listed in Table A-1 refers to the total electric energy supplied to the air conditioner. It has been assumed that current air conditioners have a coefficient of performance of two, which means that twice the energy listed is actually being withdrawn from the buildings. The hot water, lighting and equipment energy totals refer to the energy delivered to these various devices over the period of a year.

RETROFIT ANALYSIS OF BUILDING PROTOTYPES

The simulation tools were used in this step of the analysis to examine the effects of implementing each conservation and solar strategy. Once each has been tested individually, a preliminary economic assessment can be carried out to determine which of these strategies provides energy or offsets demand at a price competitive with new sources of electric energy. Those which pass this preliminary economic test can be used to form a combined conservation and solar retrofit strategy for each prototype building. Tables A-2 through A-8 show the results, in part, of this analysis. Listed in these tables are the strategies which met the economic criteria and the effects they had on each building's energy requirement. Also shown is the effect of the combined conservation and solar strategies on each building's energy requirements. A complete listing of all strategies tested can be found in *Residential and Commercial Building Retrofit Analysis* by Mathematical Sciences Northwest, Inc.

The costs shown come directly from the product review data and represent the expected cost of the best products found in the review. These capital costs also reflect the assumption that these strategies will be carried out on many buildings and thus the products and materials will be purchased wholesale or factory direct. The cost for each strategy does not include any operating and maintenance expense as it has been assumed that the conservation and solar improvements are no more expensive to operate and maintain than the original energy systems in each building. The life cycle costs, both levelized costs and net present value, are based on a series of assumptions which are explained in detail in Appendix B.

There are a number of aspects of this analysis which deserve detailed explanation. Some of the strategies, such as wall insulation and attic insulation, are approximately additive in their effects. Others, such as storm windows and insulating shutters, are not. The storm windows were found to have a lower life cycle cost and thus would be installed first. When the insulating shutters are added, the increment of energy saved is not large enough to result in desirable life cycle costs for the shutters. Thus, shutters were not included* even though their individual life cycle cost was attractive compared to the cost of new electric energy. A similar effect eliminated hot water pipe wraps from the combined retrofit strategies.

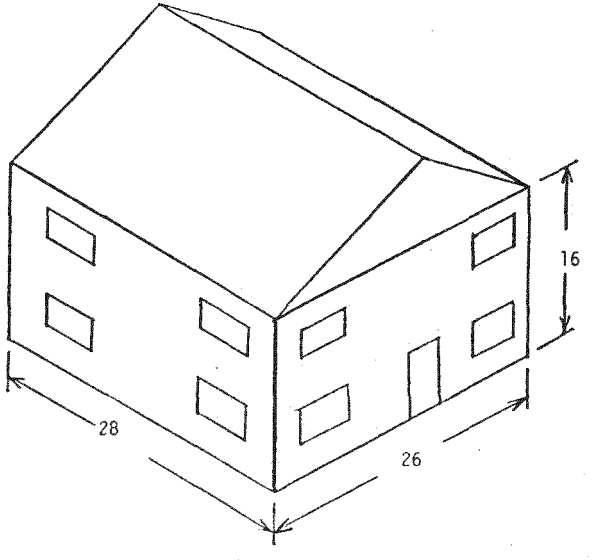
Thermosiphon solar hot water heaters were also a special case. The life cycle cost for this strategy was only slightly higher than the life cycle cost of new electricity. This conclusion is very sensitive to the assumed cost of new electrical generating capacity and to the assumed life expectancy of thermosiphon solar water heaters, which were assumed to last only 15 years. The case against the thermosiphon system is more clear cut when it is considered in combination with hot water heat pumps. When combined, the incremental energy savings of the thermosiphon system does not justify its life cycle cost unless new electrical rates are assumed to be much higher. Possible combination with heat pump hot water heaters does not, however, end the argument, because these heat pumps cannot be used when the water heater is located in a heated portion of the building, which is the case in many buildings. The conclusion is that where heat pump hot water heaters cannot be used, a thermosiphon may prove to be an attractive option if either its life expectancy is shown to be somewhat longer than 15 years or the cost of new electricity increases slightly over the levels assumed for this analysis.

*It should be noted that if a shutter system can be devised with a longer life expectancy, 30 years instead of 15, the shutters may prove less expensive than storm windows and the results would be reversed.

Two other solar strategies are conspicuous by their absence. Hybrid solar heat pump systems, particularly those with sufficient thermal storage to act as peak shaving devices, appear promising for residential applications. In addition, passive solar retrofits appear promising for commercial applications. Time and budget severely limited the scope of this analysis; as a result, these two strategies were not considered. In addition, the simulation tools used are not suited to the evaluation of passive solar strategies for commercial application. These two solar strategies should be given high priority in any further retrofit analysis that the City undertakes.

The analysis is also somewhat short sighted in that only "on the market" technologies are considered. In a number of instances, relatively minor changes in conservation and solar products would result in different conclusions concerning life cycle costs. One example is heat pump hot water heaters for small commercial buildings, which were found to have undesirable life cycle costs. Heat pumps which are currently available are too large for these applications, but could probably be downsized, in which case their life cycle cost might appear favorable. In general, the conclusion must be that an ongoing review of conservation and solar products is required. Product lines are changing rapdily and the potential for innovation in product design and applications has just barely been tapped.

Figure A-A
SINGLE FAMILY—RESIDENTIAL



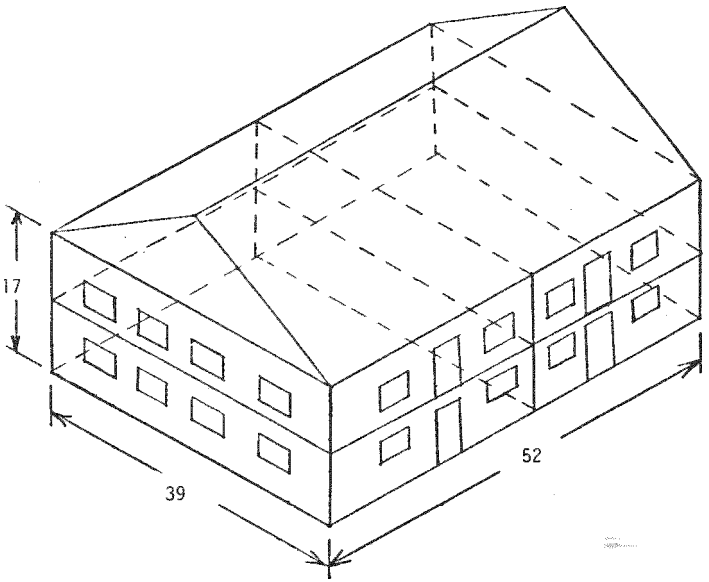
BASE CASE CONDITIONS

Description:	Detached, two-story, rectangular, woodframe house. 1,450 sq. ft. plus unheated basement and attic.	
Construction:	Roof/ceiling—roofing, plywood sheathing, 2 x 8 nominal joist, R-7 batt insulation, gypsum board	
	Exterior wall—wood shingle, plywood sheathing, 2 x 4 nominal studs, gypsum board (no insulation)	
	Floor—hardwood floor, plywood subfloor, 2 x 8 nominal joist (no insulation)	
	Window—clear single pane (⅛"), 15% of floor area, equally distributed	
Heating System:	Electric forced air, heated to 68°F, 24 hr. per day, 8 mo. per year (Oct.-May)	
Cooling System:	None	
Infiltration:	One air change per hour	
Internal Loads:	21 MMBtu/yr (people, lights, appliances)	
Base Electric Load: (Kwh/yr)	Hot water	4,980
	Lights	1,440
	Appliances	3,939
	Total	10,359 kWh/yr

HEAT LOSS FACTOR

Component	Area (ft^2)	U ($Btu/hr/ft^2/°F$)	Loss Factor
Roof	728	0.11	80.1
Walls	1,470	0.25	367.5
Windows	216	1.13	244.1
Doors	42	0.31	13.0
Floors	728	0.39	105.6
Infiltration	0.018 x 1 ac/hr x 11,648/ft^3		209.7
			1,020.0

Figure A-B
FOURPLEX—RESIDENTIAL



BASE CASE CONDITIONS

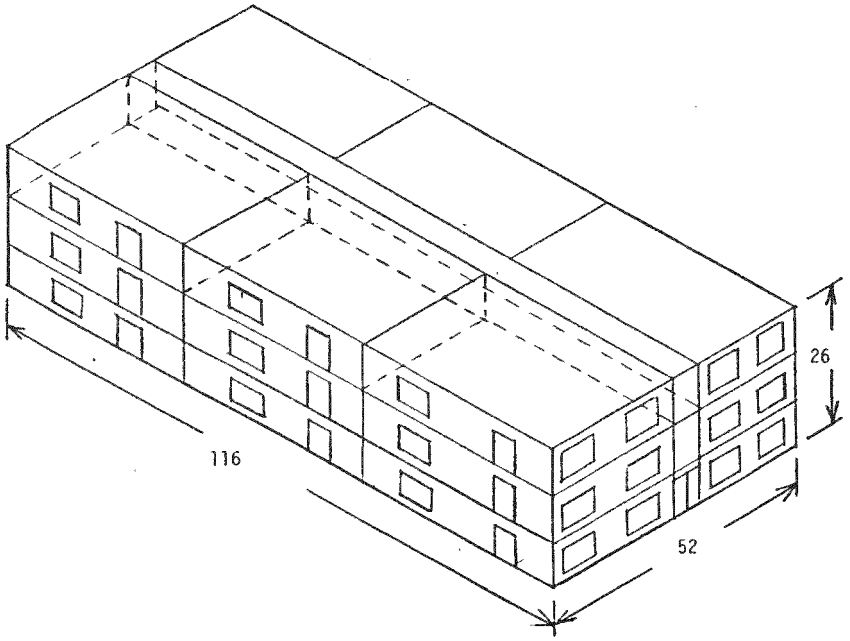
Description:	Detached, two-story, rectangular, woodframe fourplex. 1,000 sq. ft. per family plus unheated basement and attic.
Construction:	Roof/ceiling—roofing, plywood sheathing, 2 x 8 nominal joist, R-7 batt insulation, gypsum board
	Exterior wall—wood shingle, plywood sheathing, 2 x 4 nominal studs, gypsum board (no insulation)
	Floor—hardwood floor, plywood subfloor, 2 x 8 nominal joist (no insulation)
	Window—clear single pane (⅛"), 11% of floor area, equally distributed
Heating System:	Electric forced air, heated to 68°F, 24 hr. per day, 8 mo. per year (Oct-May)
Cooling System:	None

Infiltration:	One air change per hour	
Internal Loads:	17.8 MMBtu/yr (people, lights, appliances)	
Base Electric Load:	Hot water	4,700
	Lights	1,000
	Appliances	3,100
	Total	8,800 kWh/yr/unit

HEAT LOSS FACTOR

Component	Area (ft^2)	U ($Btu/hr/ft^2/°F$)	Loss Factor
Roof	2,002	0.105	210.2
Walls	2,553	0.242	617.8
Windows	440	1.13	497.2
Doors	84	0.31	26.0
Floors	2,002	0.39	290.5
Infiltration	$0.018 \times 1^{ac}/hr \times 34{,}034/ft^3$		612.6
			2,254.3

Figure A-C
18—UNIT APARTMENT BUILDING



BASE CASE CONDITIONS

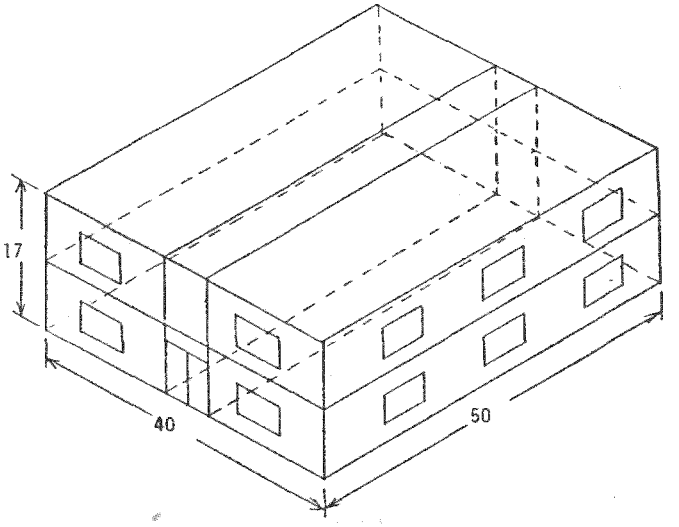
Description:	Detached, three-story, rectangular, woodframe apartment building. 1,000 sq. ft. per unit (18 units) plus unheated basement and attic.
Construction:	Roof/ceiling—builtup roofing, plywood sheathing, 2 x 8 nominal joist, R-7 batt insulation, gypsum board
	Exterior wall—brick veneer, plywood sheathing, 2 x 4 nominal studs, gypsum board (no insulation)
	Floor—hardwood floor, plywood subfloor, 2 x 8 nominal joist (no insulation)
	Window—clear single pane (⅛"), 8% of floor area, equally distributed with wall area
Heating System:	Electric forced air, heated to 68°F, 24 hr. per day, 8 mo. per year (Oct.-May)
Cooling System:	None
Infiltration:	One air change per hour
Internal Loads:	17.5 MMBtu/yr/unit (people, lights, appliances)

Base Electric Load:		
Hot water	4,400	
Lights	1,000	
Appliances	3,100	
Total	8,500	kWh/yr/unit

HEAT LOSS FACTOR

Component	Area (ft^2)	U (Btu/hr/ft^2/°F)	Loss Factor
Roof	6,006	0.093	558.6
Walls	7,186	0.268	1,925.8
Glass	1,440	1.13	1,627.2
Door	84	0.31	26.0
Floor	6,006	0.39	871.6
Infiltration	0.018 x 1 AC/hr x 156,156/ft^3		2,810.8
			7,820.0

Figure A-D
SMALL OFFICE BUILDING



BASE CASE CONDITIONS

Description:	Two-story, rectangular, woodframe with brick veneer, 4,000 sq. ft. office building.
Construction:	Roof/ceiling—builtup roofing, plywood sheathing, 2 x 8 nominal joist, suspended acoustic tile ceiling (no insulation)
	Exterior wall—brick veneer, plywood sheathing, 2 x 4 nominal studs, gypsum board (no insulation)
	Floor—concrete slab, pad and carpet
	Window—clear single pane (⅛"), 14% of floor area, equally distributed by wall area
Heating System:	Electric forced air, heated to 68°F, 24 hr. per day for entire building
Cooling System:	Window-mounted unit air conditioners, cooled to 68°F, 24 hr. per day from June through September only. No cooling in the hallway.
Infiltration:	Hallway—0.9 air changes per hour Offices—0.5 air changes per hour (0.6 air changes per hour overall)

Internal Loads: 207.2 MMBtu/yr

	Hall	Office
Lights (W/ft², peak)	2	4
Equipment (W/ft², peak)	0	0.6
People (number, peak)	0	40
Hot water	1 gallon/person/day	

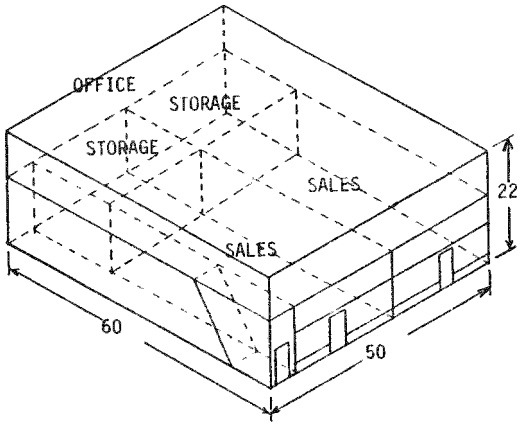
Base Electric Load:

Lights	50,324	
Equipment	4,371	
Hot water	2,285	
	56,980	kWh/yr

HEAT LOSS FACTOR

Component	Area (ft²)	U (Btu/hr/ft²/°F)	Loss Factor
Wall	2,500	0.30	750
Roof	2,500	0.23	460
Glass	560	1.13	633
Floor	2,000	0.073	146
Infiltration (Hall)	0.018 x 0.9 $^{ac}/_{hr}$ x 5,100 ft³		83
Infiltration (Offices)	0.018 x 0.5 $^{ac}/_{hr}$ x 28,900 ft³		260
			2,332.0

Figure A-E
MIXED RETAIL/OFFICE



BASE CASE CONDITIONS

Description: Small office building, 3,000 sq. ft., on top of two small retail stores, approximately 1,400 sq. ft. each. Rectangular, woodframe construction with brick veneer.

Construction: Roof/ceiling—Builtup roofing, plywood sheathing, 2 x 8 nominal joist, acoustic (no insulation)

Exterior wall—Brick veneer, plywood sheathing, 2 x 4 nominal studs, gypsum board (no insulation)

Floor—concrete slab, pad and carpet

Window—Office: Clear single pane (⅛"), 14% of floor area, equally distributed by wall area

Windows: Clear single pane (¼"), 330 sq. ft on the front of the store

Heating System: Office—Electric forced air, heated to 68°F, 24 hr. per day

Stores—Electric ceiling mounted unit heaters, with heating to 68°F 24 hr. per day

Cooling System: Office—Window-mounted unit air conditioners. Cooling to 68°F, 24 hr. per day from June through September only.

Stores—None

Infiltration: Office—0.5 air changes per hour
Stores—0.6 air changes per hour
(0.55 air changes per hour overall)

Internal Loads:

	Office	Stores
Total	199.6 MMBtu/yr	218.2 MMBtu/yr
Lights (W/ft², peak)	4	3.25
Equipment (W/ft², peak)	0.5	0.5
People (number, peak)	30	40
Hot water	1 gal/ person/day	½ gal/ person/day

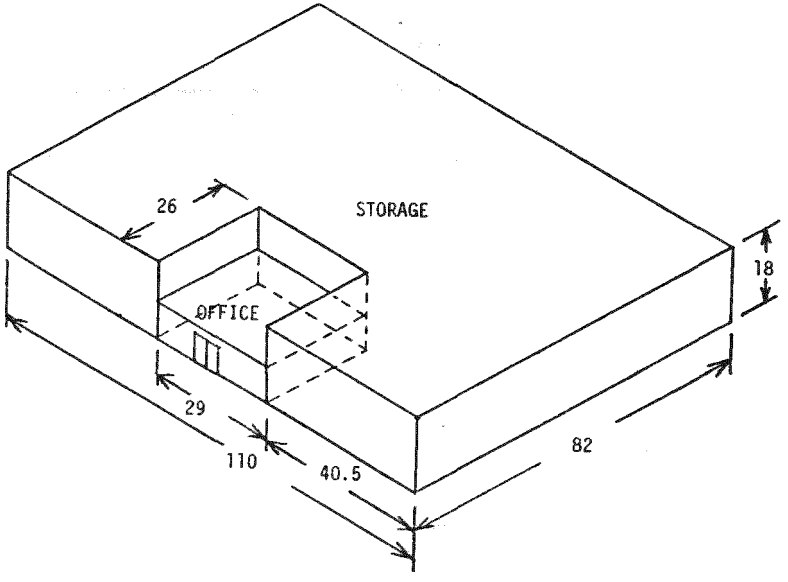
Base Electric Load:

Lights	81,310	
Equipment	9,205	
Hot water	2,660	
	93,175	kWh/yr

HEAT LOSS FACTOR

Component	Area (ft²)	U (Btu/hr/ft²/°F)	Loss Factor (Btu/hr/°F)
Roof	3,000	0.20	600
Wall	3,985	0.25	996
Door	42	0.31	13
Glass	813	1.13	919
Floor	3,000	0.059	177
Infiltration	0.018 x 0.55 ac/hr x 66,000 ft³		653
			3,358

Figure A-F
WAREHOUSE



BASE CASE CONDITIONS

Description: Rectangular, woodframe 8,270 sq. ft. warehouse with a 750 sq.-ft. office in the front.

Construction: Roof/ceiling—Builtup roofing, plywood sheathing, joists, acoustic tile (office only)

Exterior wall—Asphalt tile shingle, Plywood sheathing 2 x 4 studs, gypsum board (office only)

Floor—Concrete slab, pad and carpet (office only)

Window—Glass front door only

Heating System: Office—Roof-mounted unit heaters, heating to 68°F, 24 hr. per day

Warehouse—Roof-mounted unit heaters, heating to 55°F, 24 hr. per day

Cooling System: None

Infiltration: Office—0.2 air changes per hour
Warehouse—0.4 air changes per hour

Internal Loads: 67.8 MMBtu/yr

	Office	Warehouse
Lights (W/ft², peak)	4.0	0.5
Equipment (W/ft², peak)	0.5	0
People (number, peak)	5	5
Hot water	0.3 gal/ person/day	0 gal/ person/day

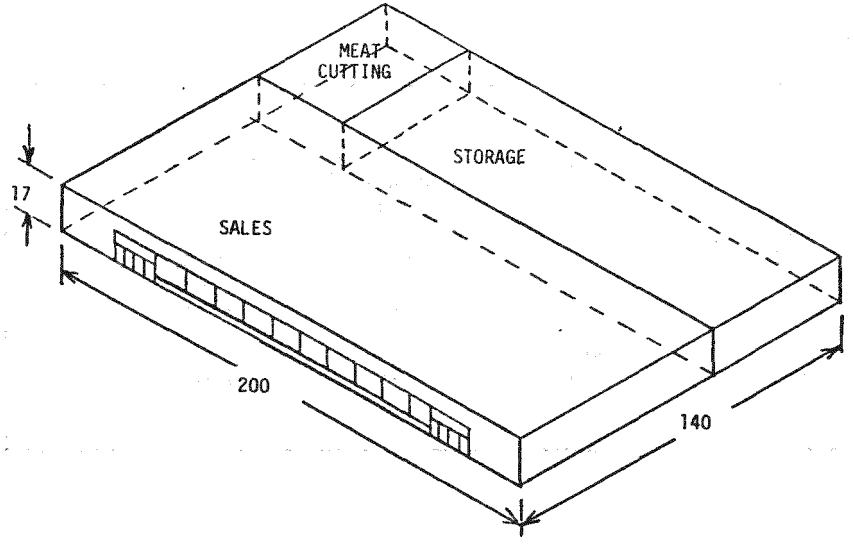
Base Electric Load:

Lights	17,610	
Equipment	940	
Hot water	180	
	18,730	kWh/yr

HEAT LOSS FACTOR

Component	Area (ft²)	U (Btu/hr/ft²/°F)	Loss Factor (Btu/hr/°F)
Roof	9,020	0.58	5,232
Wall	6,834	0.26	1,777
Door	504	3.00	1,512
Floor	9,020	0.30	2,706
Glass	42	1.13	47
Infiltration	0.018 x 0.2 ac/hr x 148,778 ft³		536
Infiltration	0.018 x 0.4 ac/hr x 6,786 ft³		43
			11,853

Figure A-G
SUPERMARKET



BASE CASE CONDITIONS

Description: Rectangular supermarket with 2,000 sq.-ft. meat-cutting room, 9,000 sq.-ft. storage room and 17,000 sq.-ft. of sales area, plenum, concrete block construction.

Construction: Roof/ceiling—Builtup roofing, plywood sheathing, joist suspended acoustic tile ceiling

External wall—Concrete block

Floor—Concrete slab

Window—Clear single pane (¼"), 1,320 sq. ft. on the front of the store plus swinging glass doors

Heating System: Sales/storage—Electric forced air, heated to 68°F, 24 hr. per day

Meat-Cutting—No heating

Cooling System: Sales—Electric forced air, cooled to 68°F, 24 hr. per day

Storage—None

Meat-Cutting—Electric forced air, cooled to 40°F, 24 hr. per day

Infiltration: Sales—0.15 air changes per hour (when fans are off)

Storage—0.5 air changes per hour (when fans are off)

Meat-Cutting—None

Internal Loads: 1912.9 MMBtu/yr

	Sales	Storage	Meat-Cutting
Lights (W/ft², peak)	4	1	4
People (number, peak)	100	6	4
Hot water (gallons/day)	0	20.5	0

Base Electric Load:

Lights	515,015	
Refrigeration	587,695	
Hot water	11,990	
Fans	97,906	
	1,212,606	kWh/yr

HEAT LOSS FACTOR

Component	Area (ft²)	U (Btu/hr/ft²/°F)	Loss Factor (Btu/hr/°F)
Roof	28,000	0.57	15,960
Floor	28,000	0.02	560
Walls (Reg)	8,501	0.51	4,336
Walls (Meat-Cutting)	1,097	0.07	77
Glass	1,740	1.13	1,966
Door (Metal)	42	0.57	24
Doors (Roll-up)	180	1.18	212
Infiltration			
(Meat-Cutting)	0.018 x 0 ^{ac}/hr x 24,024 ft³		0
(Storage)	0.018 x 0.5 ^{ac}/hr x 107,976 ft³		972
(Sales)	0.018 x 0.15 ^{ac}/hr x 204,000 ft³		551
			24,658

Table A-1

Summary of Base Case Energy Requirements for Seven Prototype Buildings (Million Btu/yr)

	Space Heating	Space Cooling	Hot Water	Lighting	Applicances and/or Equipment	Btu/ft²/yr
Single Family	90.3	—	17.0	5.0	13.4	86,690
Fourplex	191.5	—	64.2	13.6	42.3	77,910
Apartment	646.4	—	270.3	61.4	190.4	64,920
Small Office	127.6	50.3	7.8	171.8	14.9	93,100
Mixed Office & Retail	165.9	42.9	9.1	277.5	31.4	87,800
Warehouse	453.1	—	.6	60.1	3.2	57,450
Supermarket	992.1	512.5	40.9	1,758.0	2,340.0	201,600

Table A-2

Simulated Effects of Cost-Effective Conservation and Solar Strategies on Single Family Prototype

	Annual Heating Energy (MMBtu)	% Savings	Annual Cooling Energy (MMBtu)	% Savings	Annual Electric Energy (MMBtu)	% Savings	Capital Costs	Levelized Cost ($/MMBtu)	Net Present Value
Base Case	90.3	–	–	–	35.35	–	–	–	–
Shell Strategies									
Limiting Envelope Leaks (.6 ac/hr)	80.4	11.0	–	–	–	–	800	4.12	2,620
Attic Insulation R-38	83.6	7.4	–	–	–	–	229	1.74	2,084
Wall Insulation R-13	62.3	31.0	–	–	–	–	588	1.07	9,078
Floor Insulation R-19	80.0	11.4	–	–	–	–	269	1.33	3,287
Exterior Storm Windows	74.0	18.1	–	–	–	–	1,112	3.47	4,515
Hot Water Strategies									
Temperature Setback (10°F)	–	–	–	–	33.48	5.3	0	0	475
Tank Insulation R-5	–	–	–	–	33.14	6.2	44	1.67	489
Heat Pump (COP 1.8)	–	–	–	–	22.70	21.6	750	8.21	711
Lighting Strategies									
Efficient Bulbs	90.6	.3	–	–	49	1.4	3	5.54	28
Delamping	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heating System Strategies									
Attached Sunspace[a] (8'x24' w/concrete slab)	73.9	18.2	–	–	–	–	5,580	10.21	2,381
Thermosiphon Wall	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ground-Source Heat Pump[b]	30.1	66.6	–	–	–	–	4,600	6.40	13,230
Automatic Night Setback	77.9	13.7	–	–	–	–	87	36	4,194
Optimum Combinations									
Conservation + solar	11.7	87.0	–	–	25.38	28.2	7,667	3.83	22,928
Conservation Only	20.3	77.5	–	–	25.38	28.2	3,882	2.82	22,184

[a]Downsized to 8' x 12' for optimum case. This represents a guess as to the economic optimum size. Determining the actual economic optimum size is beyond the scope of this analysis. This 8' x 12' sunspace costs $3,785.

[b]Not included in optimum because heating load remaining after shell strategies is too small to be economically served by existing heat pump equipment.

Table A-3

Simulated Effects of Cost-Effective Conservation and Solar Strategies on Fourplex Prototype

	Annual Heating Energy (MMBtu)	% Savings	Annual Cooling Energy (MMBtu)	% Savings	Annual Electric Energy (MMBtu)	% Savings	Capital Costs	Levelized Cost ($/MMBtu)	Net Present Value
Base Case	191.5	–	–	–	120.35	–	–	–	–
Shell Strategies									
Limiting Envelope Leaks (.6 ac/hr)	162.1	15.4	–	–	–	–	1,650	2.86	8,500
Attic Insulation R-38	172.4	10.0	–	–	–	–	628	1.67	5,966
Wall Insulation R-13	142.6	25.5	–	–	–	–	1,021	1.06	15,861
Floor Insulation R-19	162.8	15.0	–	–	–	–	740	1.32	9,168
Exterior Storm Windows	165.9	13.4	–	–	–	–	2,266	4.51	6,572
Hot Water Strategies									
Temperature Setback (10°F)	–	–	–	–	113.31	5.9	0	0	1,787
Tank Insulation R-5	–	–	–	–	112.03	6.9	176	1.77	1,823
Heat Pump (COP 1.8)	–	–	–	–	92.19	23.4	3,000	8.92	2,224
Lighting Strategies									
Efficient Bulbs	192.3	-.5	–	–	119.0	1.1	9	5.79	96
Delamping	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heating System Strategies									
Attached Sunspace[a] (8'x48' w/concrete slab)	160.5	16.0	–	–	–	–	11,160	10.80	4,140
Thermosiphon Wall	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ground-Source Heat Pump[b]	63.8	66.6	–	–	–	–	7,769	5.10	31,330
Automatic Night Setback	166.4	13.1	–	–	–	–	347	71	8,792
Optimum Combinations									
Conservation + solar	24.7	87.1	–	–	83.24	30.8	15,417	3.82	51,426
Conservation Only	13.2	93.1	–	–	83.24	30.8	14,428	4.63	51,138

[a]Downsized in optimum to 8' x 24', costing $5,580

[b]Downsized in optimum to 5-ton unit costing $4,591

Table A-4

Simulated Effects of Cost-Effective Conservation and Solar Strategies on 18-Unit Apartment Prototype

	Annual Heating Energy (MMBtu)	% Savings	Annual Cooling Energy (MMBtu)	% Savings	Annual Electric Energy (MMBtu)	% Savings	Capital Costs	Levelized Cost ($/MMBtu)	Net Present Value
Base Case	646.4	—	—	—	523.57	—	—	—	—
Shell Strategies									
Limiting Envelope Leaks (.6 ac/hr)	511.4	20.9	—	—	—	—	4,850	1.83	41,755
Attic Insulation R-38	598.0	7.5	—	—	—	—	1,884	1.99	14,825
Wall Insulation R-13	482.5	25.4	—	—	—	—	3,000	93	53,583
Floor Insulation R-19	560.3	13.3	—	—	—	—	2,222	1.32	27,502
Exterior Storm Windows	562.7	12.9	—	—	—	—	7,416	4.52	21,480
Hot Water Strategies									
Temperature Setback (10°F)	—	—	—	—	493.87	5.7	0	0	7,540
Tank Insulation R-5	—	—	—	—	488.47	6.7	792	1.89	7,611
Heat Pump (COP 1.8)	—	—	—	—	404.77	22.7	13,500	9.52	7,997
Lighting Strategies									
Efficient Bulbs	651.1	-.7	—	—	517.56	1.1	21	1.24	1,380
Delamping	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heating System Strategies									
Attached Sunspace (w/concrete slab)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thermosiphon Wall	562.0	13.0	—	—	—	—	17,000	16.07	1,226
Ground-Source Heat Pump[a]	215.5	66.6	—	—	—	—	22,648	4.40	111,574
Automatic Night Setback	558.5	13.6	—	—	—	—	1,566	91	28,780
Optimum Combinations									
Conservation + solar	15.4	97.6	—	—	366.77	29.9	56,842	5.18	177,650
Conservation Only	43.4	93.3	—	—	366.77	29.9	48,651	4.47	181,432

[a]Ground-source heat pump is downsized to 15 ton in nonsolar optimum, costing $13,400, and 5 ton in solar optimum, costing $4,591

Table A-5

Simulated Effects of Cost-Effective Conservation Strategies on Small Office Prototype

	Annual Heating Energy (MMBtu)	% Savings	Annual Cooling Energy (MMBtu)	% Savings	Annual Electric Energy (MMBtu)	% Savings	Capital Costs	Levelized Cost ($/MMBtu)	Net Present Value
Base Case	127.6	–	50.3	–	331.00	–	–	–	–
Shell Strategies									
Limiting Envelope Leaks (3 ac/hr)	100.1	21.6	49.8	1.0	–	–	562	1.02	9,059
Attic Insulation R-30	86.4	32.3	48.2	4.2	–	–	940	1.11	13,817
Wall Insulation R-13	72.3	43.3	49.3	2.0	–	–	1,000	.91	18,345
Floor Insulation R-19	–	–	–	–	–	–	–	–	–
Exterior Storm Windows	98.7	22.6	51.6	-2.6	–	–	2,668	4.93	6,979
Hot Water Strategies									
Temperature Setback (10°F)	–	–	–	–	329.68	.4	0	0	336
Tank Insulation R-5	–	–	–	–	329.35	.5	44	2.23	347
Heat Pump (COP 1.8)	–	–	–	–	–	–	–	–	–
Lighting Strategies									
Efficient Bulbs	–	–	–	–	292.20	13.0	64	.58	9,407
Delamping	180.1	-41.1	37.1	26.2	252.10	23.8	0	0	–
Heating System Strategies									
Attached Sunspace (w/concrete slab)	–	–	–	–	–	–	–	–	–
Thermosiphon Wall	–	–	–	–	–	–	–	–	–
Ground-Source Heat Pump[a]	42.6	66.6	33.5	29.4	–	–	8,000	6.58	20,475
Automatic Night Setback	65.2	48.9	48.7	3.2	–	–	260	.34	22,755
Optimum Combinations									
Conservation + solar	–	–	–	–	–	–	–	–	–
Conservation Only	19.2	84.9	21.5	57.3	235.90	28.7	11,153	3.26	54,433

[a]Downsized in optimum to 5-ton heat pump costing $5,615.

Table A-6

Simulated Effects of Cost-Effective Conservation Strategies on Mixed Office/Retail Prototype

	Annual Heating Energy (MMBtu)	% Savings	Annual Cooling Energy (MMBtu)	% Savings	Annual Electric Energy (MMBtu)	% Savings	Capital Costs	Levelized Cost ($/MMBtu)	Net Present Value
Base Case	165.9	–	42.9	–	318.0	–	–	–	–
Shell Strategies									
Limiting Envelope Leaks (.3 ac/hr)	134.9	18.7	42.3	1.4	–	–	662	1.07	10,192
Attic Insulation R-30	109.9	33.8	40.4	5.8	–	–	1,410	1.28	17,928
Wall Insulation R-13	100.1	39.7	42.7	5	–	–	1,594	1.23	21,173
Floor Insulation R-19	–	–	–	–	–	–	–	–	–
Exterior Storm Windows	129.4	22.0	44.1	-2.8	–	–	3,863	5.58	8,433
Hot Water Strategies									
Temperature Setback (10°F)	–	–	–	–	317.0	3	0	0	254
Tank Insulation R-5	–	–	–	–	316.8	4	44	3.07	232
Heat Pump (COP 1.8)	–	–	–	–	–	–	–	–	–
Lighting Strategies									
Efficient Bulbs	–	–	–	–	276.4	13.1	75	64	10,042
Delamping	290.2	-26.1	32.1	25.2	253.1	20.4	0	0	4,271
Heating System Strategies									
Attached Sunspace (w/concrete slab)	–	–	–	–	–	–	–	–	–
Thermosiphon Wall	–	–	–	–	–	–	–	–	–
Ground-Source Heat Pump[a]	55.3	67.0	28.6	33.3	–	–	11,366	7.62	23,151
Automatic Night Setback	110.7	33.3	40.9	4.7	–	–	260	.23	19,304
Optimum Combinations									
Conservation + solar	–	–	–	–	–	–	–	–	–
Conservation Only	25.2	94.8	18.7	56.4	219.3	31.0	15,908	4.00	61,002

[a]Downsized for optimum to 8-ton heat pump costing $8,000.

Table A-7

Simulated Effects of Cost-Effective Conservation Strategies on Warehouse Prototype

	Annual Heating Energy (MMBtu)	% Savings	Annual Cooling Energy (MMBtu)	% Savings	Annual Electric Energy (MMBtu)	% Savings	Capital Costs	Levelized Cost ($/MMBtu)	Net Present Value
Base Case	453.1	–	–	–	62.29	–	–	–	–
Shell Strategies									
Limiting Envelope Leaks	440.9	2.7	–	–	–	–	96	40	4,116
Attic Insulation R-19	206.2	54.5	–	–	–	–	3,337	.69	81,900
Wall Insulation R-13	376.2	17.0	–	–	–	–	2,734	1.81	23,814
Lighting Strategies									
Efficient Bulbs	–	–	–	–	53.28	14.5	14	55	2,191
Delamping	461.5	-1.8	–	–	49.69	20.2	0	0	299
Heating System Strategies									
Attached Sunspace (w/concrete slab)	–	–	–	–	–	–	–	–	–
Thermosiphon Wall	–	–	–	–	–	–	–	–	–
Ground-Source Heat[a] Pump	151.0	67.0	–	–	–	–	20,313	5.63	70,942
Automatic Night Setback	209.4	53.8	–	–	–	–	173	.04	83,959
Optimum Combinations									
Conservation + solar	–	–	–	–	–	–	–	–	–
Conservation Only	48.5	89.3	–	–	42.56	31.7	17,720	3.07	117,801

[a]Downsized in optimum to a 12-ton heat pump costing $11,366

Table A-8

Simulated Effects of Cost-Effective Conservation Strategies on Supermarket Prototype

	Annual Heating Energy (MMBtu)	% Savings	Annual Cooling Energy (MMBtu)	% Savings	Annual Electric Energy (MMBtu)	% Savings	Capital Costs	Levelized Cost ($/MMBtu)	Net Present Value
Base Case	992.1	–	509.9	–	4,138.6	–	–	–	–
Shell Strategies									
Limiting Envelope Leaks	975.3	1.7	512.5	-.5	–	–	713	2.56	4,427
Attic Insulation R-19	262.6	73.5	665.1	-31.9	–	–	15,960	1.42	196,481
Wall Insulation R-13	727.0	26.7	546.1	-7.4	–	–	35,513	7.92	46,816
Floor Insulation R-19	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exterior Storm Windows	955.5	3.7	520.4	-2.2	*-	*-	6,798	13.29	3,172
Hot Water Strategies									
Temperature Setback (10°F)	–	–	–	–	4,134.1	.1	0	0	1,142
Tank Insulation R-5	–	–	–	–	4,133.3	.1	88	1.39	1,201
Heat Pump (COP 1.18)	–	–	–	–	4,115.9	.6	1,500	5.54	3,300
Lighting Strategies									
Efficient Bulbs	–	–	–	–	3,874.9	6.9	361	.48	64,448
Delamping	1,385.1	-39.6	411.7	19.3	3,549.2	15.5	0	0	38,897
Heating System Strategies									
Attached Sunspace (w/concrete slab)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thermosiphon Wall	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ground-Source Heat[a] Pump	330.7	66.7	339.7	33.3	–	–	46,248	4.66	135,199
Automatic Night Setback	948.1	4.4	–	–	–	–	260	.30	14,930
Optimum Combinations									
Conservation	164.6	85.4	656.4	-28.7	3,351.2	19.0	72,513	–	–
Conservation with/Waste Heat Recovery[a]	164.6	85.4	509.0	0	3,351.2	19.0	72,513	3.82	364,622

[a]Shell modification in this prototype had a detrimental effect on cooling load because of high internal heat gains due to lighting and refrigeration equipment. A more appropriate strategy which has been assumed for the optimum would be to increase ventilation and install waste heat recovery systems on lights and refrigeration. It is assumed that this can be accomplished for the same overall cost and that it would result in no increase in cooling load.

APPENDIX B - Methods Used to Evaluate Life Cycle Costs of Conservation and Solar Strategies

APPENDIX B

METHODS USED TO EVALUATE LIFE CYCLE COSTS OF CONSERVATION AND SOLAR STRATEGIES

The economic analysis methods described in this appendix are designed to compare, from the perspective of social costs and benefits, investments made in conservation and solar technologies with the cost of new sources of electric energy. This analysis relies on the capital cost, life expectancy, and performance data developed through the building prototype analysis described in Appendix A. Further, it relies on estimates, provided by Seattle City Light, of the current costs of new electric energy and the expected rate of growth in these costs. The economic analysis methods used require four major steps to carry out this comparison:

- Estimate the current and life cycle costs of energy used for space heating.
- Estimate the current and life cycle costs of energy required by other end uses.
- Estimate, individually, the life cycle costs of each conservation and solar strategy applied to each of the seven building prototypes.
- Estimate the life cycle costs of the combined retrofit strategies applied to each prototype building.

CURRENT AND LIFE CYCLE COSTS

SPACE HEATING

The price of new electricity has been chosen as a cost standard for this analysis. This choice is based primarily on the theory that the marginal value of energy corresponds to the cost of the next or most recently developed new source of energy. In the case of Seattle and, in fact, of the Pacific Northwest in general, the most recent investment choices have been for nuclear and coal-fired central station thermal electric plants and for gas turbine peaking plants. These are the largest energy resource investments being made and, for that reason alone, could be considered a reasonable guide to the marginal value of energy. In addition, these investments are being made largely by public agencies which view investment choices from the perspective of social costs and benefits. Since the question being asked is whether or not investments in conservation and solar technologies are socially desirable, it seems appropriate to answer by comparing such investments to the investments being made in nuclear and coal facilities. It is also appropriate to make the comparison using a set of assumptions consistent with the social cost and benefit perspective of public agencies.

Estimating the current marginal price of electricity requires a description of when the energy will be used. Seattle City Light has provided ENERGY, Ltd. with a set of marginal electric costs that indicates the different costs for additional energy that the utility would experience during three different periods of the year. During the 200 hours of greatest demand (peak energy), additional energy is estimated to cost $34.86 per million Btu. During the 1,000 hours which experience the next highest levels of demand (intermediate peak), the utility would have to pay $18.63 per million Btu for additional energy. During the periods of lowest demand (off-peak), the utility would have to pay $6.24 per million Btu.

When evaluating conservation and solar measures which reduce a building's need for externally supplied electric energy, it is necessary to determine at what period during the year the energy is offset. If the measures cause a uniform reduction in a building's demand for energy, then 2.3 percent of the energy offset would be valued at the peak rate, 11.4 percent at the intermediate rate, and 86.3 percent at the off-peak rate. These correspond to the fraction of the hours in the year which each class of electric energy occupies.

In the case of measures which offset space-heating requirements, the distribution is found to be substantially different from the uniform annual offset example. The number of heating hours — that is, the number of hours during which the heating system is operating — was found to be approximately 3,500 per year for most of the prototype buildings examined, using the base case condition. Both the peak and intermediate peak periods for the utility occur within this 3,500 hours. Therefore, 6 percent of the heating hours are valued at the peak rate; 28 percent at the intermediate peak; and 66 percent at the off-peak rate, resulting in a weighted average value of $11.43 per million Btu. However, when all the conservation and solar strategies are put in place, the number of heating hours declines dramatically into the range of 500 to 1,000 hours per year. The peak period is still completely within this heating time and the remainder of the time is intermediate peak. This puts the value for the energy displaced by the last conservation measure in the range of $21.88 to $25.12 per million Btu.

In a more extensive analysis of conservation investments, the incremental cost of each space-heating-related conservation measure would be compared to the marginal energy value based on the heating energy and heating hours actually displaced by that measure. For this analysis a simpler but less accurate approach is taken in which a single average value is assigned to space-heating energy. This average value corresponds to the assumption that 10 percent of heating energy is in the peak category, 40 percent in the intermediate category and 60 percent in the off-peak category, resulting in

an average value of $15.37 per million Btu.

In addition to the current value of space-heating energy, the analysis requires a life cycle value. For the purposes of this analysis, a 30-year period has been chosen over which to evaluate all costs and benefits. Thirty years was chosen because it roughly corresponds to the life expectancy of the coal and nuclear plants which are the basis of the marginal price standard. Seattle City Light has estimated that the cost of new electricity will escalate by one percent each year in constant dollars. Therefore the 30-year life cycle cost of new electricity is $17.61 per million Btu.*

OTHER END USES

The approach taken to assign a value to new electric energy used for water heating, lighting and other end uses is similar to the approach used for space heating. These end uses require energy in all seasons of the year but not during all the hours of any one day. For example, residential water-heating energy is generally required during the early morning hours, 6-8 A.M., and during the evening hours, 3-11 P.M. The demand for lighting also occurs in the early morning and the evening, but the number of hours per day is somewhat longer and varies with the seasons. For the purposes of this analysis, the differences among these various end uses have been ignored, **and a single new electric energy value adopted. It has been assumed that** for water heating, lighting and all other end uses, 40 percent of use occurs during the intermediate peak period and 60 percent occurs during the off-peak period. This results in a current average marginal price of $11.30 per million Btu. The levelized life cycle cost for this energy, again assuming the one percent escalation rate, is $12.95 per million Btu.

LIFE CYCLE COSTS: CONSERVATION AND SOLAR STRATEGIES

The next step in this analysis was to assess the life cycle costs of each conservation and solar strategy. All of these strategies were evaluated using two measures of life cycle costs: levelized cost and net present value. Both of these life cycle cost measures consider the discounted value of money over the 30-year evaluation period. In discounting the value of a dollar it is assumed that the person making an investment, in this case the public, would prefer having a 1980 dollar today to getting a 1980 dollar a year from now. The preference comes from the opportunity to invest that dollar and earn some rate of return in real dollars.

The discount rate assumed throughout this analysis is three percent. Therefore, the assumption is that the public would feel indifferent toward **the choice of receiving 1.03 1980 dollars next year and receiving one dollar to**day. This discount rate has been derived from consideration of the long-term cost of money to the City. In general, the City has had to pay a rate of interest for long-term borrowing which is approximately equal to the long-term inflation rate. Based purely on this interest rate a zero percent discount rate could be assumed. However, there are administrative costs associated with using the money borrowed. (This certainly would be the case when using the money for conservation and solar investment.) Therefore, a three percent discount rate has been assumed to account for these administrative costs.

LEVELIZED COST

Having assumed a discount rate and a 30-year evaluation period, it is now possible to calculate the levelized cost of each conservation and solar strategy. Levelized cost is the ratio of the discounted value of costs over a 30-year period to the discounted value of benefits over the same period. Benefits, however, are expressed in terms of the physical unit of energy, i.e. million Btu. The fact that levelized costs treat benefits in the form of physical units means that this measure is insensitive to the variation in the value of different kinds of energy. For example, the levelized cost of a device that costs one dollar and conserves one Btu of off-peak electricity would be the same as the levelized cost of a device that costs one dollar and conserves one Btu of peak energy. As has been shown earlier, the off-peak and peak Btu have very different values. However, levelized cost is a reasonable measure for comparison of strategies which conserve or produce the same kind of energy. In addition it has the advantage of presenting results in a familiar form, dollars per million Btu* or dollars per gallon.

The formula used to calculate the levelized cost of conservation and solar strategies which last 30 years is:

$$\text{Levelized cost} = \frac{\text{capital cost}}{19.6 \times \text{annual fuel savings}}$$

In this formula, 19.6 is the present worth factor, assuming a three percent discount rate. The present worth factor is a number which summarizes the effect of the discount rate over 30 years. Multiplying the present worth factor times the annual fuel savings yields the same quantity as summing the discounted saving in each year over the next 30 years. Capital cost is the total cost of installing the device in 1980 dollars. Generally, there would be interest payments added to the capital cost and the payments would be discounted. This does not appear in the equation because it has been assumed that the real interest rate that the public would pay is equal to the real discount rate. For strategies which last only 15 years the formula used is:

*This is a levelized cost which assumes a three percent real discount rate. The levelized cost concept is explained in greater detail later in this appendix.

*The levelized cost is not equivalent to the current price of energy which is also expressed in these units, i.e., dollars/million Btu, but which is not a life cycle cost.

$$\text{Levelized cost} = \frac{1.64 \times \text{capital cost}}{19.6 \times \text{fuel savings}}$$

The quantity 1.64 accounts for the discounted cost of replacing the improvement after 15 years.

Levelized costs for each of the conservation and solar strategies which were less expensive than new electric energy are presented in Appendix A. In calculating these levelized costs the following life expectancy assumptions were used along with the capital and energy savings given in Appendix A. All strategies were assumed to last 30 years except:

Solar thermosiphon wall	15 years
Hot water heat pump	15 years
Ground-source heat pumps	15 years
Efficient bulbs	3 years

All the conservation and solar strategies were assumed to have zero salvage value with the exception of the attached sunspace. Because these sunspaces add value to the building, they were assumed to have a salvage value equal to their initial cost. This value is discounted over 30 years and subtracted from the initial capital cost.

NET PRESENT VALUE

The conservation and solar strategies were also evaluated in terms of the net present value of the investment each required. Net present value is the difference between the discounted value of benefits and the discounted value of costs. In this case, benefits are the dollar value of energy saved. Because benefits are defined in terms of dollars, the net present value is sensitive to the differences between the value of various kinds of energy saved or produced. The net present value, therefore, is useful for determining whether it is desirable to invest in any particular conservation and solar strategy.

The net present value of each strategy was used in selecting those that would be included in the combined retrofit plan for each prototype building. Any strategy that had a positive net present value was included, with a few exceptions. Insulating shutters and water pipe insulation were excluded because they contributed less energy in combination with other less expensive strategies than they contributed when tested individually. Well-source heat pumps were excluded because they were redundant to the less expensive ground-source heat pump strategy.

The formula used to calculate net present value for each strategy lasting 30 years is as follows:

$$\text{Net present value} = CC - FS \times EC \times PWF$$

where CC = Capital cost in 1980 dollars
FS = Fuel savings in million Btu/year
EC = Marginal electric energy cost
— For space heating $15.37/million Btu
— For water heating, lights, and other uses $11.30/million Btu
PWF = Present worth factor for 30-year investment analysis assuming three percent discount rate and one percent escalation rate = 22.46

As in the levelized cost calculation, the capital costs are not modified by a discount rate or interest charges because these two are assumed to be equal and their effects cancel.

For strategies which last only 15 years the capital costs are multiplied by a factor of 1.64 to account for replacement costs after 15 years.

Both the net present value and levelized cost might in general contain an additional cost for operations and maintenance. However, it has been assumed that these conservation and solar strategies do not increase the total operating and maintenance costs of the energy systems in each of the prototype buildings.

LIFE CYCLE COSTS: COMBINED STRATEGIES

The final step in this analysis is to calculate the levelized cost of the combined solar and conservation strategies assumed to be applied to each prototype building. The calculation has been carried out in a manner similar to the individual strategy calculations. There are, however, a few modifications due to the interaction of various strategies. For example, all the strategies which modify the building envelope were grouped with the night setback strategy. All have a 30-year lifetime and their combined effects are not equal to the sum of their individual effects.

APPENDIX C -Methods Used to Estimate the Residential Conservation and Solar Resource

APPENDIX C

METHODS USED TO ESTIMATE THE RESIDENTIAL CONSERVATION AND SOLAR RESOURCE

This section describes an end-use projection procedure which was used to estimate the energy that could be saved by implementing conservation and solar strategies in all of Seattle's residential buildings. The procedure is designed to provide information on the future energy requirements of three classes of residential buildings: single family detached dwelling, multifamily dwelling (two through four units), and apartment buildings (more than four units). The energy requirement projections are further disaggregated within each class of building into the various energy end uses, such as space heating, water heating, cooking, lights and appliances.

There are four major steps in this projection procedure:

- Establish a baseline for the number of residential units and project the number of units which will exist in the years 1990, 2000, and 2010.
- Establish a baseline for market shares of each fuel type by end use and project future market shares for the years 1990, 2000, and 2010.
- Establish a baseline for energy use intensities and estimate the energy use intensities of each class of residential buildings after they have been retrofit with conservation and solar improvements.
- Estimate the number of buildings retrofit in each year of the projection, both those retrofit with conservation measures only and those retrofit with both conservation and solar measures.

Table C-1 shows the projection of housing units that has been adopted for the purpose of the analysis. The 1978 housing unit estimates for Seattle were taken from the ENERGY, Ltd. Data Base report. Estimates of units in Greenlake and Garfield were developed in part through a count of buildings shown on the Kroll maps maintained by the Department of Community Development and were supplemented by two other data sources.[1,2] Year 2000 estimates for Seattle were also taken from the Data Base report. All the remaining numbers are simple linear extrapolations. The average rate of growth estimated for Seattle has been imposed on Greenlake and Garfield and, further, that same rate of growth has been assumed to continue through the year 2010.

The approach used to develop market share projections closely parallels that used for housing units. Again, Seattle estimates for the years 1978 and 2000 come from the Data Base report. 1978 estimates for Greenlake and Garfield were derived from a random sampling of the King County Assessor's records for buildings in these two communities. The next step was to estimate Seattle market shares for the year 2010; this was done through linear extrapolation of year 2000 estimates. Seattle year 2010 estimates were then imposed on Greenlake and Garfield for the year 2010. Intermediate years for Greenlake, Garfield and Seattle were then estimated through linear interpolation. The market shares shown in Table C-2 are for buildings which **have not** been retrofit.

Retrofit single family units have the same market shares as the nonretrofit units in each year of the projection. Multifamily units are assumed to shift to electric central heating when retrofit, because a ground-source electric heat pump is part of the retrofit package. In the case of apartment units, it is assumed that, when retrofit, 61 percent remain electric baseboard heated and 39 percent are electric central heated via heat pumps. This corresponds to the 1978 apartment market shares for baseboard and central heating. Thus, by the year 2010 when all units have been retrofit, 100 percent of

Table C-1

Projection of Housing Units for Greenlake, Garfield and Seattle, 1978-2010

	1978	1990	2000	2010
Single Family				
Greenlake	11,534	12,012	12,413	12,812
Garfield	7,701	8,021	8,289	8,555
Seattle	132,423	137,924	142,508	147,092
Multifamily				
Greenlake	2,040	2,105	2,162	2,216
Garfield	2,726	2,813	2,888	2,961
Seattle	17,754	18,328	18,808	19,287
Apartment				
Greenlake	4,256	4,393	4,508	4,623
Garfield	14,062	14,517	14,897	15,276
Seattle	74,975	77,401	79,425	81,448

[1]Office of Policy and Evaluation, "Greenlake Community, Polk Profiles of Change," 1977.

[2]Department of Community Development Update of 1970 Census, 1979.

Table C-2

Market Shares (Percent) for Electricity, Gas, Oil and Other Fuels for Residential End Uses in Greenlake (GL), Garfield (GAR) and Seattle (SEA), 1978 and 2010

	1978 Single Family (SF)			1978 Multifamily (MF)			1978 Apartment (APT)			2010 All Units		
	GL	GAR	SEA	GL	GAR	SEA	GL	GAR	SEA	SF	MF[a]	APT[b]
Space Heat												
Electric Baseboard	11	8	13	24	11	50	61	61	61	65	65	65
Electric Central	3	4	5	3	2	2	4	4	4	25	25	25
Gas Central	27	27	25	17	39	23	9	9	9	10	10	10
Oil Central	54	47	53	52	37	18	10	10	10	0	0	0
Other	5	14	4	4	11	7	16	16	16	0	0	0
Water Heat												
Electric	92	92	92	88	88	88	81	81	81	98	98	98
Gas	8	8	8	10	10	10	11	11	11	2	2	2
Other	0	0	0	2	2	2	8	8	8	0	0	0
Cooking												
Electric	98	98	98	99.5	99.5	99.5	98	98	98	98	98	98
Gas	2	2	2	.5	.5	.5	2	2	2	2	2	2
Lighting and Appliances												
Electric	100	100	100	100	100	100	100	100	100	100	100	100

[a] All multifamily units would be converted to heat pump systems by 2010; thus, energy estimates assume 100 percent market penetration of electric central in 2010.

[b] The population of retrofit apartment buildings is assumed to be split 61 percent electric baseboard, 39 percent central heat throughout the retrofit program, a split corresponding to the 1978 market shares. If all buildings were retrofit by 2010, the market shares would be 61/39 as opposed to 65/25/10 as shown in this table. This assumes some reconversion to central heat.

multifamily units will use electric central heating, 61 percent of apartment units will use baseboard electric heating and 39 percent will use electric central.[1]

[1] If this retrofit plan were followed, some multifamily and apartment units which switched from electric central baseboard prior to being retrofit would have to reconvert to electric central when retrofit. This is probably not feasible for apartment buildings, although it might work for multifamily buildings.

The market shares for cooking in 1978 are: electric, 98 percent; gas, 2 percent for single family and apartment units; and electric, 99.5 percent, gas, .5 percent for multifamily units. These are assumed to remain constant through the year 2010. Lighting, appliances and other end uses are assumed to be 100 percent electric throughout the projection period.

Table C-3 shows energy use intensities for various energy end uses found in each of the three classes of residential buildings. The 1978 intensities were taken from the Data Base report, with the minor modification that space heating in single family buildings has been increased by four million Btu per year and in multifamily and apartment units by three million Btu per year. These increases reflect the use of small electric resistance heaters. The electrical demand of these heaters is part of the Other/Electric category in the Data Base report. These shifts are based solely on a rough guess of how many of these heaters are in use. The year 1990 and beyond estimates for nonretrofit units have been adjusted from 1978 levels to reflect the assumption that all appliances will be 15 percent more efficient by 1990. This assumption is based on the expected effects of federal appliance standards. Appliances, however, contribute to the internal heat gains of residential buildings, so that a portion of the energy saved has to be delivered by the building's space-heating system.[1] The space-heating intensities shown are for purchased energy. For example, in the case of gas-heated homes, the intensity shown is the heating value of the gas which enters the building's furnace during a one-year period.

The energy intensities, for the year 1990 and beyond, for retrofit units were derived from the results of prototype building simulations described in Appendix A. The conservation and solar strategies examined for these prototypes afffect only the energy intensities for space heating, water heating and lighting. Reductions in cooking and other uses are attributable to the assumption concerning increased appliance efficiencies. Space-heating intensities were estimated in the prototype analysis for buildings with electric central heating systems. For buildings which have gas, oil, and other heating systems, it has been assumed that when these buildings are retrofit the reduction in the requirement for heat delivered to the space will be proportionate to the reduction found for the electric-central-heated prototype.

Other assumptions used in calculating these intensities are as follows:

- Existing oil furnaces are 60 percent efficient and existing gas furnaces are 55 percent efficient.
- Addition of flue damper and flame retention burner increases oil furnace efficiency to 75 percent.
- Addition of the flue damper and electronic ignition increases gas furnace efficiency to 75 percent.

[1] It was estimated that 63 percent of the appliance savings would have to be supplied by the heating system in single family buildings. The estimate for multifamily and apartment buildings was 79 percent.

- Heat delivered to the space in electric-baseboard-heated apartments is 31.5 percent less than for electric-central-heated apartments both before and after retrofit.

Table C-3

Energy Use Intensities — Average Per Unit Consumption of Energy for Various End Uses (MMBtu/yr) for Single Family (SF) Multifamily (MF) and Apartment Units (APT)

	1978[a]			1990 & Beyond								
	SF	MF	APT	SF			MF			APT		
				NR[b]	RNS[c]	RS[d]	NR	RNS	RS	NR	RNS	RS
Space Heat												
Electric Baseboard	37	24	11	39	15.9	10.0	26.5	—	—	13.4	5.1	2.7
Electric Central	54	43	23	56	22.3	13.7	45.5	4.1	—	25.4	3.2	1.7
Gas Central	91	69	47	94.3	30.0	18.4	73.2	—	—	51.0	—	—
Oil Central	104	77	52	107.6	31.3	19.2	81.6	—	—	56.4	—	—
Other	89	46	17	92	36.1	21.9	49.5	—	—	20.0	—	—
Water Heat												
Electric	17	16	15	17	7.5	7.5	16	7.1	—	15.0	6.6	6.6
Gas	26	25	24	26	—	—	25	—	—	24	—	—
Cooking												
Electric	4	4	4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Gas	4	4	4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Lighting	5	5	5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Other	18	17	16	15.3	15.3	15.3	14.4	14.4	14.4	13.6	13.6	13.6

[a]1978 intensities from the ENERGY, Ltd. Data Base report, adjusted to reflect the use of small electric resistance heaters. The demand of these heaters appears under the Other/Electric category in the Data Base report.

[b]NR = Nonretrofit unit

[c]RNS = Retrofit nonsolar

[d]RS = Retrofit solar

The final aspect of Table C-3 which bears some explanation is the water-heating intensities. It has been assumed that all water heaters, when retrofit, are converted to electric air-source heat pumps, in addition to having the temperature set back to 120°F and the tank wrapped with insulation. In many instances this would also require that the hot water tank be shifted from a heated to an unheated space in the building. Such a shift in most cases would be prohibitively expensive. The assumption, however, can be justified by the following reasoning. In multifamily and apartment structures where the problem would be most common, the buildings, when retrofit, would have their space-heating needs served by a heat pump system. Ground-source heat pumps or well-source heat pumps could be designed to meet both the space- and water-heating load[1] of these buildings, thus providing a coefficient of performance of 3 for water heating as opposed to the coefficient of performance of 1.8 which has been assumed for the air-source hot water heat pumps.

The only information still required, at this point, for estimating the energy requirements in the years 1990, 2000 and 2010 is the number of solar and nonsolar retrofits in each of these years. The total number of retrofits is derived by assuming that the retrofit program begins in 1983 and is complete by 2010 and that the same number of retrofits are carried out in each year of the program. Thus, 26 percent of all residential units will have been retrofit by 1990, 63 percent by 2000, and 100 percent by 2010. It is assumed that 55 percent of the single family and apartment units are solar retrofits and that none of the multifamily units are solar retrofits.[2] The 55 percent solar market penetration potential is supported by recent field surveys of single family homes in the Greenlake and Garfield communities.[3]

The data in Tables C-1, C-2, and C-3 in combination with the retrofit rate and solar market penetration assumption can be used to replicate the energy requirement projections found in the Community Energy Redevelopment Plan. The following example should illustrate the procedure:

Estimate space heat energy required by single family, gas-heated homes in Seattle, year 1990.

Step 1 Number of single family homes is 137,924.

Step 2 Fraction gas-heated in 1990 is 0.19.

Step 3 35,860 are retrofit by 1990 — 26 percent of 137,524.

[1]This is possible only when the water-heating load becomes a large portion of the total heating load. This is the case when multifamily and apartment buildings are retrofit with all the available cost-effective conservation and solar strategies.

[2]This is assumed because the conservation-only option for the multifamily prototype required less energy for space heating than did the solar combination (see Appendix A). The conservation-only combination contained a ground-source heat pump which could not be added to the solar combination because the remaining heating load was too small.

[3]Survey conducted by the Department of Community Development and Sally King.

Step 4 Retrofit gas-heated homes (0.19 x 35,860) = 6,813.

Step 5 3,747 are solar retrofits (0.55 x 6,813).

Step 6 3,066 are nonsolar retrofits (6,813 - 3,747).

Step 7 Space-heating energy use intensity is 94.3 million Btu/year for nonretrofit homes, 30 million Btu/year for nonsolar retrofits and 18.4 million Btu/year for solar retrofits, from Table C-3.

Step 8 Total space heating is:

	(35,860 - 6,813)	x 94.3	=	2,739,132 MMBtu/yr
+	3,066	x 30	=	91,980 MMBtu/yr
+	3,747	x 18.4	=	68,945 MMBtu/yr
				?,900,057 MMBtu/yr

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APPENDIX D -Methods Used to Estimate the Commercial Conservation Resource

APPENDIX D

METHODS USED TO ESTIMATE THE COMMERCIAL CONSERVATION RESOURCE

This section describes an end-use projection procedure which was used to estimate the energy which could be saved by implementing conservation strategies in all of Seattle's commercial buildings. The procedure used closely parallels that described in Appendix C for estimating residential energy requirements. The procedure is designed to provide information on the future energy requirements of retail and office buildings and warehouses. In addition, by averaging the results for these three types of buildings, the procedure has been extended to project the energy requirements of all other types of commercial buildings. The projections are disaggregated within each class of commercial activity into various energy end uses, including space heating, space cooling, water heating, lighting and equipment.

As with the residential projection, there are four major steps:

- Establish a baseline for the floor area of commercial buildings and project the floor area which will exist in the years 1990, 2000, 2010.
- Estimate the commercial floor area which is retrofit in each year of the projection.
- Establish a baseline for market shares of each fuel type by end use and project future market shares for 1990, 2000, and 2010.
- Establish a baseline for energy use intensities and estimate the energy use intensities for each type of commercial building after they have been retrofit with conservation improvements.

Table D-1 shows the projection of commercial floor area which has been adopted for the purpose of this analysis. The 1978 floor area estimates for Seattle were taken from the ENERGY, Ltd. Data Base report. Estimates of floor area in Greenlake and Garfield have been developed by disaggregating portions of the commercial building survey which was conducted in support of the Data Base report. Year 2000 estimates for Seattle also come from the Data Base report and call for a doubling of commercial floor area. It did not, however, seem reasonable to assume this doubling for Greenlake and Garfield. It has been assumed that three-fourths of the total new floor area is developed in the Central Business District and that only one-fourth of the growth occurs in outlying communities, such as Greenlake and Garfield. Year 2010 estimates for Seattle, Greenlake and Garfield are based on the assumption that no floor area is added between 2000 and 2010. The estimates for 1990 are a linear interpolation between the years 1978 and 2000.

The estimation of retrofit floor area was handled somewhat differently for commercial buildings than it was for residential buildings. Of the buildings which existed in 1978, 26 percent will be retrofit by 1990, 63 percent by 2000 and 100 percent by 2010. To these are added all the new commercial buildings for which construction is completed by each of these years. The new commercial buildings are assumed to have the same energy characteristics as the retrofit commercial buildings. The total floor area shown in the retrofit column in Table D-1 reflects both of these assumptions.

Market shares shown for 1978 in Table D-2 were taken from the Data Base report. It has been assumed that these market shares do not change throughout the projection period except as a result of the retrofit program. This assumption was adopted because no projection of future market shares developed for the Data Base report was end use specific. This assumption, however, has a limited effect on the projection of future energy requirements because of two other assumptions which are at work in these projections. First, it has been assumed that all retrofit commercial buildings are served by electric heat pump heating systems. Further, it is assumed that all new commercial buildings are built with similar heating systems. These assumptions result in a market share for electricity in the year 2000 of 66.1 percent compared to a market share of 71.9 percent, which is shown for that year in the Data Base report projection. If the retrofit and new building heating systems were conventional electric as opposed to heat pump systems, the market share would be considerably higher. Given the rapid growth and retrofit rates, any shift in market share amongst the nonretrofit buildings in any year of the projection will have a relatively minor impact on total market shares for that year.

Table D-3 shows the energy use intensities which have been adopted for these projections. Intensities for 1978 were derived from estimates made by Jackson et al.[1] and are the same intensities used in the Data Base report. These intensities represent national average commercial energy use and are based on 1975 energy sales data. The year 1990 and beyond intensities reflect the percent reduction in energy requirements found for the four prototype commercial buildings described in Appendix A. The mixed retail/office and the supermarket prototype were used to represent retail commercial space. The small office prototype was applied to the office fraction. The warehouse prototype was applied to the warehouse category of commercial space. All four were averaged to represent the category for other

[1] Jerry Jackson et al., *Commercial Energy Use. A Disaggregation by Fuel, Building Type and End Use*, February 1978, ORNL/Con-14.

commercial space. For example, the space heat energy required by the two prototypes representing the retail category was reduced by an average of 84 percent. So the intensity for that category has fallen from 69,600 Btu/ft²/year to 11,100 Btu/ft²/year. These intensities refer to purchased energy.

There are a number of aspects of the intensities for 1990 and beyond which deserve further discussion. The assumption that new commercial buildings have the same energy use characteristics as retrofit buildings may understate the conservation resource. It can be expected that more effective and less expensive measures can be designed into a building than can be retrofit. Another general concern relates to the applicability of the four prototypes (which are all small commercial buildings) to other types of commercial buildings and to larger commercial buildings. Clearly, this analysis represents only a first attempt at approximating the energy characteristics of all commercial buildings. The development of perhaps a dozen additional prototypes will be necessary before the many varieties of commercial buildings are well represented. Along with the development of additional prototypes, other types of conservation strategies need to be examined, particularly those which relate to the more complex heating, ventilating and air conditioning (HVAC) systems of larger commercial buildings. Other strategies considered should include waste heat recovery techniques which have been only briefly examined in the analyses of the supermarket prototype. These techniques seem particularly promising for many larger commercial buildings which have large lighting or equipment loads.

Another area of concern is the lighting energy intensities. The lighting energy requirements of the prototype buildings described in Appendix A were substantially reduced by the use of efficient bulbs and by lowering, where possible, overall lighting intensity to two watts per square foot of floor area. The lighting energy requirements for the protytopes prior to retrofit are substantially higher than those estimated by Jackson and used in the Data Base report. The lighting levels prescribed for the prototypes do, however, correspond to the levels recommended by the American Society of Heating, Refrigeration and Air Conditioning Engineers in their load-estimating procedures. The procedure adopted in this analysis applies the percentage reduction experienced by the prototype to Jackson's intensity estimates. This would not seem reasonable if Jackson's estimates are correct because the lighting energy requirements of the prototypes, even with the retrofit measures, are nearly the same or slightly higher than Jackson's estimates. Unfortunately, it has been beyond the scope of this analysis to resolve this particular dilemma.

One final area of concern is the assumption that all commercial buildings will adopt heat-pump-based heating systems. This assumption appears particularly weak if the ground-source heat pump used in the commercial prototypes is assumed to be applied to all buildings. In many cases, commercial buildings do not have sufficient adjacent uncovered ground area to make such a system practical. However, well-source heat pumps were also found to have attractive life cycle costs for these commercial prototypes. Having the well-source option to fall back on somewhat strengthens the assumption that all commercial buildings will adopt heat pump technology.

The data presented in Tables D-1, D-2 and D-3 can be used to replicate the commercial energy requirement projections found in the Community Energy Redevelopment Plan. The following example illustrates the procedure.

Estimate the space heat energy required by retail buildings in Seattle in the year 2000.

Step 1 Total retail floor area in year 2000 is 57.66 million square feet, from Table D-1.

Step 2 Total retrofit floor area is 46.99 million square feet, from Table D-1.

Step 3 Total floor area not retrofit is 10.67 million square feet, from Table D-1.

Step 4 Market shares for nonretrofit floor area are 8.5 percent electricity, 27.4 percent gas, 28.5 percent oil and 35.6 percent other, from Table D-2.

Step 5 Energy intensities (in thousand Btu/ft²/yr) for nonretrofit floor area are 69.6 electricity, 140.7 gas, 154.7 oil and 154.7 other, from Table D-3.

Step 6 Energy intensities (in thousand Btu/ft²/yr) for retrofit floor area are 11.1 electricity.

Step 7 Calculate electricity consumption:

$$10.67 \times 10^6 \text{ ft}^2 \times 0.085 \times 69.6 \times 10^3 \text{ Btu/ft}^2\text{/yr} = 63 \times 10^9 \text{ Btu/yr}$$
$$+ 46.99 \times 10^6 \text{ ft}^2 \times 1 \times 11.1 \times 10^3 \text{ Btu/ft}^2\text{/yr} = 521 \times 10^9 \text{ Btu/yr}$$
$$584 \times 10^9 \text{ Btu/yr}$$

Step 8 Calculate gas, oil and other consumption:

Gas $10.67 \times 10^6 \text{ ft}^2 \times 0.274 \times 140.7 \times 10^3 \text{ Btu/ft}^2\text{/yr} = 411 \times 10^9 \text{ Btu/yr}$

Oil $10.67 \times 10^6 \text{ ft}^2 \times 0.285 \times 154.7 \times 10^3 \text{ Btu/ft}^2\text{/yr} = 470 \times 10^9 \text{ Btu/yr}$

Other $10.67 \times 10^6 \text{ ft}^2 \times 0.356 \times 154.7 \times 10^3 \text{ Btu/ft}^2\text{/yr} = 588 \times 10^9 \text{ Btu/yr}$

Table D-1

Projection of Commercial Floor Area for Greenlake, Garfield and Seattle, 1978-2010 (Million Square Feet)

	1978	1990		2000		2010	
		NR[a]	R[b]	NR	R	NR	R
Retail							
Greenlake	1.61	1.19	.84	.60	1.79	0	2.38
Garfield	2.55	1.88	1.32	.94	2.83	0	3.77
Seattle	28.83	21.33	23.64	10.67	46.99	0	57.66
Office							
Greenlake	.18	.13	.09	.06	.19	0	.26
Garfield	.42	.31	.22	.16	.47	0	.62
Seattle	32.12	23.77	26.34	11.88	52.35	0	64.24
Warehouse							
Greenlake	.75	.55	.39	.28	.83	0	1.10
Garfield	.14	.10	.07	.05	.15	0	.20
Seattle	34.39	25.45	28.20	12.72	56.06	0	68.79
Other							
Greenlake	.71	.52	.37	.26	.78	0	1.05
Garfield	1.97	1.46	1.02	.73	2.18	0	2.91
Seattle	61.55	45.55	50.47	22.77	100.32	0	123.10

[a]NR = Nonretrofit floor area
[b]R = Retrofit floor area

Table D-2

Market Shares (Percent) for Electricity, Gas, Oil and Other Fuels for Commercial End Uses in Greenlake (GL), Garfield (GAR) and Seattle (SEA), 1978

	Retail			Office			Warehouse			Other		
	GL	GAR	SEA	GL	GAR	SEA	GL	GAR	SEA	GL	GAR	SEA
Space Heat												
Electric	17.9	6.5	8.5	43.2	52.3	50.2	3.0	5.1	12.4	7.5	27.6	9.8
Gas	76.9	77.9	27.4	43.2	13.8	6.8	32.8	94.9	51.9	80.4	31.6	20.3
Oil	5.2	15.0	28.5	13.6	33.9	24.5	64.2	0	28.7	62.1	40.8	31.7
Other	0	6	35.6	0	0	18.5	0	0	7.0	0	0	38.2
Space Cool												
Electric[a]	61	61	61	61	61	61	0	0	0	61	61	61
Water Heat												
Electric	17.9	7.1	21.1	43.2	52.3	56.5	3.0	5.1	14.8	7.5	27.6	22.2
Gas	76.9	77.9	41.4	43.2	13.8	12.9	32.8	94.9	54.3	30.4	31.6	33.2
Oil	5.2	15.0	37.5	13.6	33.9	30.6	64.2	0	30.9	62.1	40.8	44.6
Lighting												
Electric	100	100	100	100	100	100	100	100	100	100	100	100
Other												
Electric	100	100	100	100	100	100	100	100	100	100	100	100
Gas	100	100	100	0	0	0	0	0	0	0	0	0

[a]All space cooling is assumed to be electric; however, only 61 percent of commercial floor area is assumed to be served by space cooling system (zero percent of floor area for warehouses).

Table D-3

Energy Use Intensities—Average Per Square Foot Consumption for Various End Uses (Thousand Btu/ft²/yr) for Retail, Office, Warehouse and Other Commercial Space

	1978				1990 & Beyond			
	Retail	Office	Warehouse	Other	Retail	Office	Warehouse	Other
Space Heat								
Electric	69.6	68.2	30.8	60.2	11.1	10.3	3.3	8.7
Gas	140.7	137.9	62.2	121.7	0	0	0	0
Oil	154.7	151.6	68.4	133.8	0	0	0	0
Other	154.7	151.6	68.4	133.8	0	0	0	0
Space Cool								
Electric	42.8	41.2	0	38.6	30.7	17.6	0	24.0
Water Heat								
Electric	2.4	4.8	.4	4.0	1.5	3.8	.3	2.8
Gas	3.0	6.2	.5	5.1	0	4.9	.4	0
Oil	3.9	7.9	.6	6.5	0	6.2	.5	0
Lighting								
Electric	32.3	29.9	10.3	31.7	19.6	20.1	6.9	18.6
Other								
Electric	18.5	7.4	2.8	5.6	18.5	7.4	2.8	5.6
Gas	32.5	0	0	0	32.5	0	0	0

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APPENDIX E - Memorandum on Residential Energy Efficiency Program (Conservation Purchase)

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MEMORANDUM

October 27, 1980

TO: ENERGY, Ltd.

RE: Application of Article VIII, § 7, to Seattle City Light Participation in a Residential Energy Efficiency Program (REEP)

Section 562 of the Energy Security Act of 1980, Pub. Law 96-294 (June 30, 1980), provides for the establishment of four pilot residential energy efficiency programs (REEPs) in the United States under which public utilities would purchase residential electric load reductions. The key elements required in a REEP are the following:

(1) A public utility must enter into a contract with one or more persons not under its control to install energy conservation measures in residential buildings located in the portion of the utility service area designated by the contract;

(2) Open and fair selection of the persons with whom the utility will contract;

(3) Payment by the public utility to the person or persons with whom it is contracted of a specified price for each unit of energy saved by the utility, which price is based on the value to the utility of the energy saved.

Pub. Law 96-294, § 562, 42 U.S.C. § 8235(a) (June 30, 1980). In addition to these requirements, a REEP must contain inspection procedures, warranties on installed conservation measures, and procedures for owner consent to and acceptance of installed conservation.

The Secretary of Energy has been authorized to approve not more than four pilot programs to test these procedures under regulations that will soon be issued by the Department of Energy. It appears that at least $2.5 million will be available to fund the administrative expenses of each of the four pilot programs.

Seattle City Light's participation in one of these pilot programs may be an important step toward achieving maximum energy conservation by its electric space heating customers. Preliminary data tends to show that even if 0% interest loans to finance residential weatherization were offered, no more than 30% of City Light's electric space heating customers would participate. Outright purchase of the load reduction that could be achieved by weatherizing residences, on the other hand, may offer an opportunity to reach a much higher percentage of City Light's electric space heating customers.

Discussion of load reduction purchase possibilities, however, appears to have been halted prematurely by a concern that such a program would violate Article VIII, § 7, of the Washington State Constitution. A judicial declaration that purchase of load reduction, as contemplated in a REEP, constitutes a gift or lending of credit seems most unlikely, however, because Seattle City Light would expect and would receive definite, concrete consideration for its funds just as if it had purchased comparable generating capacity. The Washington Supreme Court has ruled repeatedly that "receipt of valuable consideration assures that a transaction is not a gift." Lassila v. Wenatchee, 89 Wn.2d 804, 576 P.2d 54 (1978). Louthan v. King County, ____ Wn.2d ____ (Oct. 2, 1980) (slip op. at 8).

I.

DESCRIPTION OF LOAD REDUCTION PURCHASE TRANSACTION

As contemplated by Congress when it authorized residential energy efficiency pilot programs, load reduction or conservation purchase involves payments to persons for the delivery of reduced power that results in direct, measurable energy savings to a utility. See 42 U.S.C. § 8235a. For the purpose of this discussion, it is assumed that the load reduction or conservation to be purchased would meet the four criteria set forth by City Light in 1979 (Attachment 1), so that delivered load reductions would be determinable in amount, would be determinable as to when savings would be realized, would not be subject to manipulation by the electrical consumer, and would displace energy or capacity that would otherwise have to be provided by the utility.

Attachment 2 contains a general description of how a public utility would implement a REEP. Evaluation of the program's constitutionality from a gift or lending of credit perspective, however, requires only discussion of the basic economic transactions that would result. Those transactions are:

1. City Light contracts with an independent contractor for the purchase of load reduction from a designated class of residences. The contract specifies the price to be paid per unit of load reduction, the time period for which payments will be made, the method of measuring load reduction, and the standards, warranties, owner approvals, etc., that apply to installed conservation measures.

2. The contractor conducts a comprehensive energy audit of all residences in the designated class to determine the amount worth investing in each residence based on the dollar return to the contractor for delivered load reductions under its City Light contract.

3. The contractor installs the conservation improvements in each residence at no cost to the owner.*

4. City Light makes payments to the contractor based on measured load reductions resulting from the conservation improvements as delivered through customers' meters.**

5. City Light adds the cost of load reduction purchase to its rate base just as it would add the cost of an equivalent increase in generating capacity. If the price paid per unit of load reduction is less than or equal to the avoided cost of new

* How a program could work in which the contractor was allowed to bargain with the owner for partial payment of the cost of conservation measures is unclear.

** Various models have been developed to isolate the effects of conservation improvements from other simultaneously changing circumstances such as general changes in electric power consumption. These models appear sufficiently accurate to ensure an objective standard for load reduction purchases.

generating facilities, City Light customers as a whole should be indifferent between purchase of load reduction or purchase of new generation.***

II.

LOAD REDUCTION PURCHASE SHOULD NOT BE CONSIDERED A GIFT

The Washington Supreme Court has repeatedly stated that no gift within the meaning of Article VIII, § 7, occurs when a payment by a municipal corporation is part of a "genuine exchange of concrete, specific, measurable consideration." Washington Natural Gas Company v. PUD No. 1, 77 Wn.2d 94, 104 (1969); see Louthan v. King County, ___ Wn.2d ___ (Oct. 2, 1980) (slip op. at 8), quoting Lassila v. Wenatchee, 89 Wn.2d 804 (1978). In Washington Natural Gas Company v. PUD No. 1, the court approved a program under which a public utility district proposed to grant sizable credits to land developers and to loan them funds for installation of certain electrical facilities in exchange for (i) the developers' agreement to construct all electric homes that would purchase greater amounts of electricity from the PUD and (ii) the developers' agreement to pay in advance the electricity required for street lighting in the development. The court characterized the "concrete, specific, measurable consideration" that would result from this transaction as follows:

> In exchange for allowing the $150 credit to the developer and other consideration, the PUD will, as a measurable benefit, acquire a substantial number of total electric customers who will purchase from it greater amounts of

*** This statement ignores the decline in gross revenue to a utility that occurs when less energy is sold. How significant such a decrease would be would turn on the ratio of purchased load reduction to total power deliveries and on the price paid per unit of delivered load reduction.

The precise price to be paid by a utility under a REEP program appears to be a matter of negotiation between the contractor and the utility and could even, it appears, be fixed by public bidding. The REEP legislation requires only that the price paid per "unit of energy saved by such utility . . . [be] based on the value of the utility of the energy saved." 42 U.S.C. 8235a(3). The statute does not require equivalence of savings and value but only proportionality. A utility, for example, could pay its contractors 50% of the "value to the utility of the energy saved." A more likely possibility would be a payment to the contractor based on a per unit price equal to the difference between the utility's marginal and average costs.

> electrical energy than ordinary customers. It will be assured of paid-in-advance 5-year sales of electricity for street lighting and derive financial benefit from the developers' work and expenditures in helping install each secondary system and the street lights.

77 Wn.2d at 103.

State ex rel. O'Connell v. Port of Seattle, 65 Wn.2d 801 (1965) demonstrates what the court means by an absence of "concrete, specific, measurable consideration."

> In that case, we held that furnishing of meals and refreshments by a port district to private individuals who might possibly promote the shipping business or in the future transact business with the port district was in fact a gift of public money and property to private persons and, therefore, an unconstitutional expenditure of public funds. So-called "promotional hosting," that is, the spending of public money to supply food and entertainment for shippers, influential businessmen and other private individuals, amounted to gifts to them and was, we said, forbidden under Const. art. 8, § 7. The possible benefits accruing to the port district in the future seemed so illusory and doubtful that we concluded the guests delivered no adequate consideration in exchange for the port's bounty. Among the features which distinguish State ex rel. O'Connell v. Port of Seattle, supra, from this one was the lack of a contract or agreement binding recipients of the refreshments to do any business whatever with or render any specific service or benefit to the port district. The refreshments and entertainment were on the face gifts made with only the most illusory possibility of benefit to the port. The want of a beneficial contract and the lack of genuine mutuality between host and guest thus proved constitutionally fatal to the arrangements.

Washington Natural Gas Company, supra, at 101-2.

City Light's purchase of load reduction from a contractor under a REEP would involve "a genuine exchange of concrete, specific, measurable consideration." City Light would receive from such contractor the measured delivery of load reduction at a price based on the value to the utility of the energy saved. The market value of the consideration delivered to City Light could be demonstrated by allowing contractors to submit public bids for the delivery of load reduction and awarding the right to deliver such reduction to the lowest acceptable bidder. Where adequate consideration occurs, no unconstitutional gift results. E.g., Louthan, supra; Washington Natural Gas Company, supra; Scott Paper Company v. Anacortes, 90 Wn.2d 19, 32-33 (1978).

Moreover, no economic gift should result to a REEP contractor. To obtain the load reduction that it must deliver to City Light in order to obtain payment, a contractor must make substantial expenditures to audit homes and to purchase and install conservation materials. Indeed, the contractor obligated to deliver load reduction is in no different position than a contractor obligated to deliver generating capacity. Both must make substantial investments in labor and materials in order to deliver the agreed-upon consideration to the utility. Both, of course, expect to make a profit, but the expectation or actual realization of reasonable profit by private organizations dealing with public bodies has never been considered a gift within the meaning of Article VIII, § 7.*

Another possible objection to a load reduction purchase program as described above is that it would result in a gift to those City Light consumers whose residences were chosen by the contractor to receive installed conservation. As a preliminary matter, it should be noted that there do not appear to be any Article VIII, § 7, cases that discuss or invalidate transactions between public and private bodies on the grounds that some third party would receive a gift or lending of credit as a result of

* If, as is commonly estimated, conservation can be constructed/installed at a cost considerably below that of an equivalent amount of power generation, then it would seem that to avoid granting excessive profits -- a possible gift -- to the contractor, the utility should either solicit competitive bids or lower prices below the avoided cost of new generating capacity.

the transaction. So long as the exchange and consideration between the public and private body has been arms length and results in "concrete, specific, measurable consideration," Washington courts have not inquired further as to the tertiary effects of the transaction.

Nonetheless, it might be argued that because City Light could force its customers to install conservation measures through regulation, it cannot pay contractors to deliver the same load reduction that could be achieved by such regulation. There are several problems with this argument.

First, it is not at all clear that City Light has the power to force its customers to install extensive conservation improvements. See Seattle Master Builders Assoc. et al. v. Washington Utilities and Transportation Comm'n., King Cty. Sup. Ct. No. 80-2-11632-1, tr. of ct's op. at 15-21 (Sept. 26, 1980); but see RCW 35.22.280(15).

Second, it almost certainly can be demonstrated that even if City Light had such power, that power could not be exercised in a practical sense. Citizens cannot be ordered to spend money on conservation improvements that they plainly cannot afford. The scale of conservation improvements that would result from purchased residential load reduction is beyond the financial capabilities of many residential owners. With the proper legislative findings from the Seattle City Council as to the necessity for a load reduction purchase program, it could be shown that regulation is not a realistic alternative. In that posture, the argument that the City should regulate instead of purchase is really a policy argument that City Light ought to approach conservation with a stick (regulation) and not with a carrot (load reduction purchase). Assuming that the Seattle City Council has a reasonable basis for authorizing a load reduction purchase program by Seattle City Light, it is quite unlikely that Washington courts would assert the power to overturn the Council's program on the grounds that they believed some different strategy was preferable. See Louthan, supra, at 7-8 (rejecting argument that King County ordinance providing for purchase of development rights constituted a gift because development could have been prevented by regulation.)*

* The Washington Natural Gas case, supra, can also be viewed as standing for an analogous principle. In that case, the Washington Supreme Court approved direct subsidy payments and the lending of credit by a public utility to developers in order to encourage increased electrical usage by the developers' customers. Nothing was said there about the fact that the utility

Thus, so long as there is a reasonable factual basis for implementing a load reduction purchase program, there appears to be no basis in Washington law for concern that such a program would run afoul of Article VIII, § 7.** Still, in view of the

* continued
might have achieved the same increased electrical usage through regulation. If utilities have the power to require decreased electrical usage through regulation, they ought to have the corresponding power to require increased electrical usage through regulation. Instead of paying the developer in the Washington Natural Gas case to build all-electric homes that would use more electricity, the utility could simply have set a minimum electrical usage requirement for that development equal to that of a group of all-electric homes. No subsidy would have been required and the utility would have been guaranteed the same level of electric sales. It seems unlikely, however, that had such an argument been urged, the court would have accepted it.

** A possible challenge to a load reduction purchase program based on grounds other than Article VIII, § 7, could be that it discriminated against City Light customers who did not receive conservation improvements. This does not seem to be a particularly serious objection since the program would clearly be one of overall public benefit.

> Even though some property owners may be greatly benefited by a public improvement and others slightly or even negligibly so, the project does not thereby lose its public character if it is in essence one for the public's benefit and convenience. [Multiple citations omitted.] Indeed, scarcely a public improvement can be conceived that does not benefit some residents of a municipality more than others.

Steilacoom v. Thompson, 69 Wn.2d 704, 709-10 (1966).

At bottom, the discrimination argument may turn on the price paid to the contractor per unit of energy saved. If the contractor is paid the full marginal cost, then no direct monetary benefit is created for all rate-payers that could be characterized as a public benefit. If the contractor were paid the difference between marginal and average cost, then an overall public benefit would appear to result in the form of a rate decrease. So long as an overall public benefit is established, the fact that some rate-payers benefit more than others should not constitute unlawful discrimination. If it did, the legal basis of City Light's present and proposed weatherization loan programs might require re-examination.

doctrinal disarray created by the Washington Supreme Court in its Article VIII, § 7, cases, any question involving this article can never be wholly free from doubt, and answers can only be given with certainty in cases with identical factual patterns to those previously approved. In addition to the points made above, however, there are two additional factors that should make an adverse result unlikely in any litigation involving a load reduction purchase program.

First, the Washington State Legislature has given energy conservation the highest priority as a purpose of municipal governments.

> The conservation of energy in all forms and by every possible means is found and declared to be a public purpose of highest priority. The legislature further finds and declares that all municipal corporations, quasi-municipal corporations, and other political subdivisions of the state which are engaged in the generation, sale, or distribution of energy should be granted the authority to develop and carry out programs which will conserve resources, reduce waste, and encourage more efficient use by consumers.

Section 1, ch. 239, Laws of 1979, 1st. Ex. Sess. Thus, a load reduction purchase program would be thoroughly consistent with legislative policy at the state level.

Second, Washington Natural Gas Co., supra, stands, above all, for the principle that payments by a utility to encourage changes in electricity consumption (there, an increase) are not gifts. In the changed circumstances of the 1980's, payments by a utility to encourage a decrease in electricity consumption should not be considered gifts either.

Charles A. Goldmark

5/3/79

RECOMMENDED POLICY FOR EXPENDITURES

ON CONSERVATION PROGRAMS

Basic Objective

To establish and demonstrate the capability of the Lighting Department to develop and integrate cost effective conservation programs, which are equivalent to generation resources, into its power generation, transmission, and distribution program. This capability is needed because only conservation programs, which can be effectively integrated into the Lighting Department's generation, transmission, and distribution systems, can be counted on to alleviate the need for an equivalent amount of generation capability.

Definition

To be equivalent to generation resources, conservation programs must:

1. Be determinable in amount, e.g., kw-hr saved/°day. The confidence level for this, and other determinations referred to herein, should be comparable to those applied to generation resources available in the same time period.
2. Be determinable as to when the savings will be realized. This determination is needed to establish the equivalency with generation, e.g., savings that come only during the summer when secondary energy is being generated will not have the same value as firm savings that occur during the winter.
3. Not be at the mercy of the customer, once it has been installed, e.g., reduced thermostat settings under the control of the customer, etc.
4. Displace energy or capacity that would otherwise have to be provided by the Lighting Department. Note: Programs that could generate electricity at the point of use would also qualify as conservation programs under this definition.

Actions Needed to Achieve the Basic Objective

1. The amount, timing, and cost of the energy/capacity saved by specific conservation program elements must be determinable, which requires data acquisition, analysis, and retrieval capabilities.
2. Capital and incentives must be available to encourage the individual or entity to implement specific conservation programs.
3. Methods must be developed for the Lighting Department to buy conservation equivalent to generation resources, consistent with the imposed legal and financing constraints.

Excerpt from memorandum prepared
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DESCRIPTION

The following entities would participate directly in a Residential Energy Efficiency Program: 1) a private energy conservation company; 2) a natural gas utility and an electric utility; 3) a State or local governmental unit having jurisdiction over the gas and electric utility; 4) local suppliers and installers of energy conservation measures; and 5) individual homeowners or owners and renters of multi-family dwellings.

The Plan works as follows. An energy conservation company (ECCo) would undertake a preliminary assessment of a particular

3/ Pub. L. No. 96-294, §§561 et seq. (June 30, 1980).

geographical area. The ECCo would assess the conservation strategies for the various types of houses in the geographical area and determine the probable costs of obtaining various levels of energy savings in the various types of houses. The energy conservation company would then assess the costs utilities would incur in providing new electricity and natural gas in the particular service area. If the conservation company preliminarily concluded that the costs save energy in all residential buildings[4/] be produced, then the energy conservation company would approach the electric utility and the natural gas utility to discuss their willingness to enter into a contract whereby each would pay the conservation company a certain amount for each unit of energy that the conservation company saved. If the utilities expressed preliminary interest, the ECCo would approach the regulatory authority and discuss its willingness to approve the kind of price which the conservation company and the utility preliminarily thought was fair to the ECCo, the utility, and the customers.

Under REEP, there is no compulsion on the part of anyone to do anything. If the utilities oppose the conservation undertaking the conservation company must seek to do business elsewhere. If the State regulatory authority is concerned about possible rate

4/ The conservation costs would include retrofit of all residential buildings in the geographical area, including oil heated homes. Payments to the conservation company would only be for savings of natural gas or electricity. Thus, there would be oil savings but there would be no direct payment for that savings (unless a State determined otherwise).

increases or does not trust the conservation company to deliver projected savings, the conservation company does not proceed further.

However, if there is a general willingness to explore the possibility of the conservation company undertaking a residential energy efficiency program in a particular geographical area, the ECCo negotiates preliminary contracts with the utilities specifying the types of conservation measures that would be installed based upon sophisticated house-by-house audits and references in the contract the measurement plan which will be used to determine how much energy has been saved (and thus how much money the conservation company will be paid by the utilities). The energy conservation company then consults with the regulatory authority (or other public body) to determine if the measurement plan reflected in the contract meets public policy requirements.

If at this point it appears that the utilities are willing to sign the contracts and the State regulatory authority is willing to approve the signed contracts, the energy conservation company goes to a financial institution such as a bank, insurance company, or group of investors to obtain the monies necessary to undertake the audits, purchase the supplies, hire persons to install the designated measures, manage the entire undertaking, and insure quality control.

If a financial institution has enough confidence in the energy conservation company and believes that it can produce

sufficient revenues from its conservation undertaking to liquidate its incurred debt over the life of the contract (including the payment of an attractive interest rate), the financial institution will lend the conservation company the money. (It should be noted that not only does the State regulatory authority protect against fly-by-night operators who might want to become conservation companies; the financial institution also protects against such operators because it will not lend money without the expectation of being repaid, and repayment depends upon the ECCo being paid by the utility which, in turn, requires the ECCo to perform and to produce savings in the homes that it retrofits.)

If the ECCo is successful in obtaining financing, it will undertake marketing activities in the targeted geographical area and inform people of the fact that auditors will be coming into their homes to assess their conservation needs and that installers will be installing the measures free of charge. The conservation company then deploys its trained auditors who assess conservation needs in individual homes and make minor repairs or adjustments on the spot. The reports of the energy auditors are then compiled by the conservation management team and a supply and delivery strategy is developed.

Local suppliers and installers are used to the maximum extent possible. Based upon needs determined in the audits, supplies are purchased and assembled. Then installers move house-by-house and block-by-block under the supervision of an ECCo employee. The

energy conservation measures recommended by the auditor and accepted by the homeowner are installed systematically by qualified individuals under the supervision of the ECCo in which interest it is to save the greatest amount of energy at the lowest possible cost.

Upon completion of the work, an ECCo employee performs a quality assurance check. Any needed reinstallation or repair would be undertaken at that time.

In compliance with the measurement scheme adopted in the contract, the energy used in a given number of homes is measured prior to the retrofit and then measured over a period of time following the retrofit to ascertain the savings achieved by the conservation company. Based upon this measurement, the energy conservation company receives payments from the electric utility and the gas utility. These payments retire the debt incurred by the conservation company and hopefully provide profits for the company. The more efficient the conservation company is, the greater its profit. If it produced no savings it would receive no payment. In other words, market forces provide built-in incentives against poor performance and insulate against fraud and abuse.

The natural gas utility which receives the new supplies of gas through conservation could be authorized by the Federal Energy Regulatory Commission to resell the conservation gas without regard to certain provisions of the Natural Gas Act or

the Natural Gas Policy Act. Thus, persons who need natural gas and are willing to pay a price higher than the regulated price could purchase the gas at an unregulated price and help to pay for conservation in the gas utility's service area.[5/]

It should be emphasized that the State regulatory authority determines how payments from the electric or natural gas utilities to the conservation company are treated. That agency could treat payments as cost pass-throughs, ratebase them, impose conserver class charge-backs,[6/] or adopt any other regulatory approach.

The bottom line is this: If a REEP program is successful, individual homeowners end up saving 40% or more on their residential energy bills; electric and natural gas utilities receive

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5/ Suppose, for example, that a natural gas distribution company pays $2.00 per Mcf for natural gas from a transmission company and is authorized to sell that gas at $3.50 per Mcf. If that utility saves an Mcf of natural gas as a result of REEP and is authorized to sell the natural gas at $5.00 per Mcf and has a buyer at that price, then it is approximately $1.50 per Mcf ahead of where it would have been before the savings. If it then pays the conservation company $1.50 per Mcf of gas saved, it neither gains nor loses any money, its residential customers' bills are substantially reduced, and no per unit rate increases are required.

6/ A "conserver class charge-back" is a charge a regulatory authority might impose on residential customers who have received energy conservation measures through REEP. The charge would appear as an increase in the per unit cost of energy. Thus, if a customer used 50% less energy after REEP but his per unit cost went up 20%, the customer would end up with an overall net savings of 40% on the bill (20% x 50% = 10%; 50% (-) 10% = 40%). A regulatory authority might do this in order to avoid the need to raise rates to non-beneficiaries of the REEP program which might be occasioned if the difference between marginal costs and average costs is not greater than the payments the utility makes to the conservation company.

new domestic supplies of energy at a price equal to or below what they would otherwise have to pay (and pressure against needed rate increases is lessened because residential customers are paying less); the general economy in the community is improved because of the business and employment generated on behalf of local suppliers and installers and the savings to the homeowners; and the energy conservation company makes a profit while filling an important public policy need. However, if the Plan does not work, the utilities make few if any payments to the conservation company, the conservation does not produce a profit, and the only people hurt are the conservation company and its lenders.

LEGISLATION

1. Description

The basic Plan as outlined above is incorporated in Sections 561 through 563 of the Energy Security Act (which add new sections to the National Energy Conservation Policy Act (NECPA)). The legislation, however, establishes important parameters in law that might otherwise have been left to market regulation. For example, the REEP legislation requires that a public utility select an energy conservation company "in a fair, open, and non-discriminatory manner" (§262(a)(2)). The bill also requires that there be enforcement mechanisms in the contract (§262(a)(6)).

In Section 264 the Plan must be approved by the public utility, the State regulatory authority and the Governor. Such approval must be in writing.

APPENDIX F - Resolution 26353

RESOLUTION 26353

A RESOLUTION adopting tentative energy goals and policies for the City of Seattle; approving energy management tasks to implement those goals and policies; and authorizing the Seattle Energy Office and the ENERGY, Ltd. Citizens Committee to prepare an energy management action plan based on the goals and policies.

WHEREAS, Resolution 24283 (adopted by the Seattle City Council on September 4, 1973, the Mayor concurring) established the following goals for the City of Seattle for the year 2000:

(1) Reach a steady level of per capita energy consumption by the year 2000;

(2) Select energy sources which use the least of non-renewable resources, while taking into consideration other resources such as land and minerals;

(3) Use energy efficiently in providing for Seattle's demands, taking care to be aware of trade-offs between efficient energy use and environmental impact;

(4) Formulate an energy policy for the City. Such a policy would support regional, state and national efforts to formulate consistent policy. It should also encourage research, through direct city participation or funding, into techniques for more efficient energy production and utilization and methods to reduce associated environmental impacts; and

(5) Price energy so that it reflects all costs of supplying that energy to the consumer; and

WHEREAS, the Energy 1990 Study provided the basis for developing and adopting the following City energy policies emphasizing electricity:

(1) Resolution 25257 (adopted by the City Council on July 12, 1976, the Mayor concurring) declaring the intent of the Mayor and City Council to adopt an energy conservation code for new buildings, based on the ASHRAE Standard 90-75;

(2) Resolution 25258 (adopted by the City Council on July 12, 1976, the Mayor concurring) adopting a policy for forecasting electrical energy demand;

(3) Resolution 25259 (adopted by the City Council on July 12, 1976, the Mayor concurring) adopting energy conservation policies and an implementation schedule for the City of Seattle;

(4) Resolution 25260 (adopted by the City Council on July 12, 1976, the Mayor concurring) adopting electrical generation policies for the City of Seattle; and

(5) Resolution 25271 (adopted by the City Council on August 2, 1976, the Mayor concurring) adopting a contingency planning program to meet unanticipated electrical energy demand; and

WHEREAS, Resolution 26013 (adopted by the City Council on February 20, 1979, the Mayor concurring) approved a Work Plan for Seattle's Comprehensive Community Energy Management Program (called ENERGY, Ltd.), which provides for City Council review of the ENERGY, Ltd. goals and objectives; and

WHEREAS, ENERGY, Ltd. is intended to provide the basis for developing and adopting goals, policies, and an action plan for managing energy supply and use in Seattle; and

WHEREAS, the ENERGY, Ltd. Citizens Committee has spent hundreds of hours developing goals, policies, and tasks, has held more than two dozen community meetings, has developed a questionnaire used to solicit ideas and opinions from the general public, and has held numerous regular meetings, subcommittee meetings, and workshops; and

WHEREAS, King County is in the process of developing a Comprehensive Community Energy Management Program which will establish goals, policies, and an action plan for managing energy in King County; and

WHEREAS, King County and the City of Seattle have many mutual energy needs and concerns, and the King County Energy Planning Project Steering Committee and the ENERGY, Ltd. Citizens Committee have agreed to a common set of energy goals; Now, Therefore,

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF SEATTLE, THE MAYOR CONCURRING:

Section 1. The following eleven tentative energy goals are adopted for the City of Seattle:

(1) Assure a sufficient and reliable supply of energy to meet reasonable consumer needs.

(2) Assure that all consumers use energy wisely.

(3) Reduce local per capita energy consumption while maintaining a desirable living and working environment.

(4) To the extent practical, make energy choices and use energy technologies which maintain or improve the quality of the environment.

(5) Maximize opportunities to make energy decisions at the local level, and decrease reliance on energy supplies that are not subject to local controls.

(6) Encourage the vigorous development of renewable energy resources, and reduce dependence on non-renewable energy supplies.

(7) Continue and expand energy conservation efforts and increase the use of energy efficient technologies.

(8) Encourage the development of an energy supply system that is resilient and diverse.

(9) Make energy choices which match the type and heat quality of an energy supply to the appropriate needs of the consumer at the point of use.

(10) Promote energy efficient land use, transportation, and economic development plans and policies.

(11) Assure energy consumers an equitable and affordable supply of energy.

The foregoing tentative energy goals will be reviewed by the Mayor and City Council and adopted as currently written or amended after the ENERGY, Ltd. Citizens Committee recommends an energy management action plan for implementing the goals and the Mayor/City Council finish reviewing the recommended plan.

Section 2. The Mayor, the City Council, and the ENERGY, Ltd. Citizens Committee will continue to work with the King County Executive, the King County Council, and the King County Energy Planning Project Steering Committee to develop and adopt, where feasible and appropriate, joint energy goals/policies and energy management action plans.

Section 3. Attachment A to this Resolution 26353 sets forth nineteen tentative energy management policies to guide implementation of the tentative energy goals in Section 1.

Section 4. Attachment B to this Resolution 26353 sets forth 33 energy management tasks. These tasks were developed by the ENERGY, Ltd. Citizens Committee to help

implement the foregoing goals and policies. The Seattle Energy Office and the ENERGY, Ltd. Citizens Committee will work to develop an energy management action plan for carrying out the ENERGY, Ltd. Tasks. Other City Tasks considered to be important by the Citizens Committee, but for which the Committee does not have adequate resources to complete, are recommended to be undertaken by City departments.

Section 5. The Mayor and City Council authorize the Seattle Energy Office and the ENERGY, Ltd. Citizens Committee to develop an energy management action plan based on the foregoing goals and policies. The ENERGY, Ltd. Citizens Committee will develop, the Mayor propose, and the City Council review and adopt an energy management action plan. The Mayor will propose an energy management action plan in January, 1981, and the City Council will review and act on the plan by April, 1981.

ADOPTED by the Seattle City Council this 2 day of June, 1980, and signed by me in open session in authentication of its adoption this 2 day of June, 1980.

President of the City Council

Filed by me this 2 day of June, 1980.

ATTEST: Jim Hill
City Comptroller and City Clerk

BY: G.C. Geisert
Deputy

THE MAYOR CONCURRING:

Charles Royer, Mayor

ATTACHMENT A TO RESOLUTION 26353

Tentative Energy Management Policies

(1) Treat the residential, commercial, industrial, and governmental sectors equitably in implementing energy management policies.

(2) Provide economic incentives to encourage energy conservation.

(3) Distribute the burden of energy costs fairly.

(4) Vigorously support national and regional decisions that are consistent with local energy goals and policies.

(5) Express energy costs in terms of total life cycle costs, taking into consideration the replacement cost of energy resources.

(6) Give preference to energy resources that are indigenous to our region.

(7) Give preference to strategies that support the private sector implementation of energy programs.

(8) Give preference to energy supply technologies that minimize the risk of disrupting a major element of the energy system.

(9) Give preference to energy supply technologies that can be developed and produce results quickly.

(10) Give preference to energy programs that increase local employment and promote a positive local balance of payments.

(11) Encourage energy conservation, the use of energy efficient technologies, and the accelerated development of renewable energy resources.

(12) Encourage local reliance on an appropriate mix of fuel types, supply sources, generation technologies, and energy conservation strategies to minimize undue dependence on any one energy resource.

(13) Use energy from non-renewable sources where necessary in the short term, while providing for growing reliance on renewable energy supplies in the future.

(14) Make energy decisions which lead to flexible and resilient energy systems and allow for timely response to unanticipated supply constraints or energy opportunities.

(15) Implement energy pricing policies and tariffs that encourage the efficient use of scarce energy resources.

(16) Make energy supply and use decisions which distribute the costs and benefits equitably to energy consumers.

(17) Make local governments the model of the wise and efficient use of energy.

(18) Mandate energy conservation where necessary and appropriate.

(19) Increase public awareness of the possible impacts of future energy prices and energy supply constraints.

ATTACHMENT B TO RESOLUTION 26353

Energy Management Tasks

A. RESIDENTIAL TASKS

Energy, Ltd. Tasks

(1) Propose strategies for developing and implementing weatherization and other conservation standards in buildings, especially apartments.

(2) Propose strategies for deploying renewable energy systems and conservation technologies in new and existing housing.

Other City Tasks

(3) Propose strategies for educating energy consumers and protecting them from illegal, unsafe, and unfair practices in providing residential energy technologies and services.

(4) Propose strategies for responding to requests for new or enlarged electric service in residential buildings.

B. COMMERCIAL TASKS

Energy, Ltd. Tasks

(1) Propose incentives for maximizing energy conservation, use of renewable resources, and cogeneration in commercial buildings.

Other City Tasks

(2) Propose strategies for maximizing conservation, use of renewable resources, and cogeneration in institutional buildings.

(3) Propose energy conservation standards for existing commercial buildings.

(4) Propose strategies for responding to requests for new or enlarged electric service in commercial buildings.

C. INDUSTRIAL TASKS

Energy, Ltd. Tasks

(1) Develop an industrial energy use reporting system for long-range planning and for identifying opportunities to improve energy efficiencies.

(2) Propose strategies for providing technical assistance to speed implementation of energy efficiency and renewable resource measures.

(3) Propose strategies for maximizing energy conservation, use of renewable resources, and cogeneration in manufacturing businesses.

Other City Tasks

(4) Propose strategies for improving public and private sector cooperation in developing new energy resources and in increasing the efficiency of energy use.

(5) Propose strategies for responding to requests for new or enlarged electric service in industrial buildings and processes.

(6) Propose strategies for developing and implementing energy efficiency standards for industries.

D. GOVERNMENTAL TASKS

Energy, Ltd. Tasks

(1) Propose strategies for incorporating stronger energy use criteria into the environmental review process through policy and regulatory reform.

(2) Propose methods for identifying, generating, and committing revenues for energy-related capital improvement projects.

(3) Review the energy impacts of the new town policy being considered by King County.

Other City Tasks

(4) Propose strategies for requiring the consideration of energy in the development and review of municipal capital improvement projects.

(5) Propose energy conservation standards for existing government buildings.

(6) Propose strategies for respnoding to requests for new or enlarged electric service in government buildings.

(7) Propose strategies for including energy criteria in the development and adoption of land use and zoning policies.

(8) Propose an appropriate City administrative structure for effectively implementing City energy management goals, policies, and programs.

E. TRANSPORTATION TASKS

Energy, Ltd. Tasks

(1) Propose a demonstration project using non-petroleum powered vehicles to meet local transportation needs.

(2) Propose strategies promoting the use of fuel-efficient vehicles through measures such as changes in the determination of vehicle taxes and registration fees, the proceeds of which would be used for conservation programs in transportation.

Other City Tasks

(3) Propose strategies leading to neighborhood self-sufficiency as a means of reducing automobile trip frequency and length through measures such as the development of pedestrian and transit malls.

(4) Propose parking management strategies discouraging the use of energy inefficient and low occupancy vehicles.

(5) Propose strategies for using employer/employee incentives to encourage the use of high occupancy vehicles for commuter trips.

(6) Propose strategies for expanding systems of bicycle and pedestrian facilities and accessways.

(7) Propose strategies for conducting a coordinated energy analysis of regional transportation plans affecting Seattle.

F. SUPPLY TASKS

Energy, Ltd. Tasks

(1) Determine the feasibility of and propose strategies for supplying major amounts of new energy from a diversified mix of renewable energy resources such as solar, wind, biomass (including municipal waste), small and intermediate scale hydroelectric, and geothermal resources.

(2) Determine the feasibility of and propose strategies for supplying new energy from a diversified mix of energy efficient technologies such as heat pumps, cogeneration, and district heating.

(3) Review and comment on City efforts to develop and evaluate new sources of electric energy supply, especially the Energy Resources Report.

Other City Tasks

(4) Propose strategies for enhancing the reliability and availability of existing energy supplies, including the development of local fuel resources.

APPENDIX G -Proposed Legislative Amendment to SEPA Policy Ordinance

APPENDIX G
PROPOSED
LEGISLATIVE AMENDMENT

(a) Policy Intent

Recognizing that

1. Under the Seattle 2000 Commission and the Energy 1990 study, the City adopted goals and policies to guide the conservation of energy and development of renewable energy resources; and

2. Energy production and consumption can have direct and indirect, as well as cumulative impacts on the environment; and

3. Increases in Seattle's production and consumption of energy are constrained by both energy resource and natural resource limitations which particularly limit expansions of capacity to meet new demands; and

4. Responsible energy management requires that a full range of technological, economic, and energy resource alternatives be considered in making energy production and consumption decisions; that adverse environmental impacts from energy production and consumption be avoided as far as possible; and that unavoidable adverse environmental impacts from energy production and consumption be subject to mitigation,

it is the intent of the City to evaluate the environmental impacts of and alternatives to proposed actions which involve energy production and/or consumption, in keeping with the following policies.

(b) Policies

1. The city official or authorizing agency shall assess the extent of the proposed action's impact on energy resources, giving particular attention to:

   - the energy consumed during the proposal's operation, including, but not limited to: heating, ventilation, air conditioning, domestic water heating, lighting, and equipment appliance energy use; and energy used for building maintenance, rehabilitation and/or demolition;

   - the transportation energy consumption caused directly and induced by the proposal, including but not limited to: increases in existing transportation energy use caused by any congestion and increased trip lengths resulting from the project;

   - the construction energy consumption caused by the proposal, including, but not limited to: energy used at the job site during construction and in work force commuting; and energy embodied in manufacturing and transporting construction materials;

   - the cumulative effect of the proposal on energy resources, including the effect of large incremental proposals as well as the effect of multiple, small incremental proposals;

   - the indirect impact of the proposal's incremental increase in energy use on elements of the physical and human environment, including, but not limited to: fish and wildlife, and air and water quality.

2. The city official or authorizing agency shall assess the significance of the proposal's impact on Seattle's energy resource base. In determining the significance of a proposal's energy impacts, the city official or authorizing agency may refer to the policy, guideline, and regulatory documents identified in Attachment A. Based on this determination of significance, and pursuant to Section 19 of Ordinance 105735, the city official or authorizing agency may condition or deny a proposal in order to:

   - encourage the energy-efficient production and consumption of energy;

   - promote the efficient use of renewable resources in minimizing dependence on nonrenewable resources;

   - mitigate or prevent the adverse environmental impacts of energy production and consumption to the greatest extent practicable, giving consideration to measures which reduce or control peak energy demand.

3. The city official or authorizing agency may mitigate adverse energy impacts by conditioning project approval upon the implementation of various measures, including, but not limited to:

   - Site planning for energy efficiency and renewable resource use, for example:

     - orienting the structure to take advantage of summer wind cooling and ventilation

     - orienting the structure to optimize winter sun heating

- landscaping to provide summer sun shading and winter windbreaks
- orienting the structure to optimize access to insolation for space conditioning, water heating and lighting
- minimizing the structure's interference with the flow of sunlight and wind to nearby property.

- Energy-efficient construction practices, for example:
  - using minimally energy-intensive construction materials
  - minimizing site preparation (grading, drainage, landscaping) by adapting to existing topography, natural drainage swales, and existing vegetation
  - maximizing construction materials recycling.

- Designing an energy-efficient building envelope which complements renewable resource use, for example:
  - minimizing exposed surface areas, particularly on the north side of the building, by manipulating structural geometry or configuration, constructing common walls, and using unconditioned spaces (garages, equipment rooms, etc.) as buffer zones
  - insulating exterior walls, roof, and floor
  - controlling infiltration by: minimizing crackage area around doors, windows, etc.; weatherstripping and caulking windows and exterior doors; using vestibules or revolving doors; providing operable windows with gaskets; sealing vertical shafts
  - controlling heat loss or gain through windows by: minimizing the ratio of window to wall area, particularly on the north side of structures; installing storm windows, double, or triple glazing in insulated window frames; using operable thermal shutters; and using solar control devices, e.g. external sun screens, tinted or reflective glass, internal shades, fins along the sides of windows, and roof overhangs or eyebrows over windows
  - minimizing thermal bridging through exterior surfaces
  - using thermal mass (e.g. insulated concrete slab floors) to store solar energy
  - using operable windows to take advantage of natural ventilation.

- Designing energy-efficient heating, ventilating, air conditioning, domestic water heating, and lighting systems which complement renewable resource use, for example:
  - installing automatic timers to adjust heating, ventilating, air conditioning, water heating, lighting, and irrigating operations during low occupancy or unoccupied periods
  - insulating pipe and duct work to minimize thermal losses in air, water and steam distribution systems
  - designing air and water distribution systems for a minimum volume of flow
  - installing an economizer cycle with enthalpy control to optimize the use of outside air for cooling
  - installing an automated power management system controling all building operations
  - installing modular boilers with automatic staging control
  - installing flue gas analyzers and automatic flue dampers
  - installing load management or load levelling devices
  - installing electric spark ignition in water heaters, boilers, and furnaces
  - designing for a minimum temperature in domestic hot water systems
  - installing both master and independent light switching systems
  - maximizing waste heat utilization through such heat recovery devices as thermal wheels, run-around coil systems, heat pipe systems, air-to-air heat exchangers, heat pumps, shell and tube heat exchangers, and "heat-of-light" systems
  - using energy-efficient lamps, fixtures, and ballasts
  - using natural daylighting through skylights, windows,

and reflective surfaces (e.g. reflectors at windows, light-colored surfaces)

- reducing illumination levels by: restricting decorative lighting; using task lighting; and installing multilevel ballasts, multilevel fluorescent fixtures, and dimmers to meet variable lighting demands.

- Transportation planning for energy efficiency, for example:
  - maximizing accessibility to transit and paratransit (vanpools and carpools) services by providing shelters or waiting areas, bus turnoffs, paratransit parking, etc.
  - maximizing use of most fuel-efficient modes of travel by providing for exclusive lanes or preferential routing for high occupant vehicles and two-wheel vehicles
  - providing preferential parking opportunities and facilities for carpools and vanpools, short-term parking, fuel-efficient vehicles, and bicycles
  - requiring "in lieu of" investments in bus pass subsidization, subscription bus service, company vans, bicycle racks, or transit shelters as a substitute for automobile parking requirements
  - setting a ceiling on the ratio of parking spaces per building occupants
  - providing bicycle and pedestrian paths and right of way zones.
- The energy-efficient use of renewable resources, for example:
  - relying on such energy resources as solar energy, wind energy, biomass energy, and small and intermediate scale hydropower
  - using such unconventional energy technologies and systems as cogeneration, heat pumps, district scale heating systems, and on-site energy generation (e.g. passive and active solar systems).
- Utilizing energy-efficient industrial processes and equipment, for example:
  - using renewables-fueled preheating systems in industrial process flow
  - sizing equipment and motors appropriately for load and power requirements
  - using automatic load monitoring devices and automatic shut down devices
  - recovering waste material for use as fuel when appropriate
  - insulating heat process equipment, ducts, lines, and storage tanks for reduction of heat loss
  - insulating chilled water lines and refrigerated units
  - installing waste heat recovery systems, giving careful consideration to process furnace stacks
  - installing steam traps where appropriate.

ATTACHMENT A

The following policy, guideline, and regulatory documents may be used by the city official or authorizing agency in identifying characteristics which define a reasonably or moderately energy-efficient proposal:

1) Seattle Energy Office, City of Seattle. Ordinance 108500, "Seattle Code for Energy Conservation in New Building Construction." Adopted August 1979; effective February 20, 1980.

2) State Building Code Advisory Council, State of Washington. *Washington State Energy Code*. Adopted May 1980: effective June 30, 1980.

3) U.S. Department of Energy, Office of Conservation and Solar Energy. "Energy Performance Standards for New Buildings." Proposed Rule. Vol. 44, No. 230 *Federal Register* 68120. November 28, 1979.

4) Seattle City Light, City of Seattle. *New Load Policies*. Preliminary Draft, July 18, 1980.

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Committees have become so important nowadays that subcommittees have to be appointed to do the work.

Laurence J. Peter